US-75 ICM System Design Document

Dallas Integrated Corridor Management (ICM) Demonstration Project

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16. Abstract
This System Design document for the US-75 Integrated Corridor Management (ICM) Program has been developed as part of the US Department of Transportation Integrated Corridor Management Initiative. The basic premise behind the ICM initiative is that independent, individual network-based transportation management systems, and their cross-network linkages, can be operated in a more coordinated and integrated manner, thereby increasing overall corridor throughput and enhancing the mobility of the corridor users.

This document is intended as System Design for the US-75 Corridor in Dallas consisting of freeway, arterial, bus and rail networks, and serving a central business district. The System Design provides a detailed description of the three subsystems: the Decision Support Subsystem, the SmartNET Subsystem, and the SmartFusion Subsystem.

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1 Executive Summary

The US-75 Integrated Corridor Management System Demonstration Project is a multi-agency, de-centralized operation which will utilize a set of regional systems to integrate the operations of the US-75 corridor. The purpose of the Dallas ICM System is to implement a multi-modal operations decision support tool enabled by real-time data pertaining to the operation of freeways, arterials, and public transit. The system will be shared between information systems and people involved in transportation operations and emergency response in the US-75 Corridor. The Dallas ICM System is intended to provide improved integration of operation procedures, including procedures that take advantage of the data sharing capabilities of the Dallas ICM System and facilitate improved emergency response, and traveler information.

A team headed by the Dallas Area Rapid Transit agency is providing technical and management services in support of the Dallas Integrated Corridor Management Demonstration Project.

2 Introduction

This document contains the System Design for the US-75 Integrated Corridor Management Demonstration Project, further down called the ICMS.

The Integrated Corridor Management System (ICMS) is a component based system which supports corridor management by sharing internal and external incident, construction, special event, transit, and traffic flow data, and utilizes this data to provide operational planning and evaluation through decision support.

Keeping in mind the vision of the ICM project, “Operate the US-75 Corridor in a true multimodal, integrated, efficient, and safe fashion where the focus is on the transportation customer”, the management and operations of the corridor and the ICM will be a joint effort involving all the stakeholders. The management and operations of the corridor and the ICM will be a joint effort involving all the stakeholders. To effectively manage and operate the ICM concept as described in the Con Ops document, the US-75 Steering Committee recommended the creation of a central corridor decision-making body. This body – designated as the US 75 ICM Subcommittee – will consist of leadership level representatives from each of the stakeholders in the US-75 Corridor. Due to the number of agencies involved in ITS and traffic operations in the Dallas – Fort Worth Region, the subcommittee is envisioned to be a subcommittee of the Regional ITS Steering Committee. The membership will consist of members from each of the corridor agencies; however, membership will be on a rotational basis so that the size doesn’t become too large.

The daily operation of the corridor will be coordinated through the existing arrangements and information will be exchanged through the center-to-center project, along with a Decision Support system which will distribute response plan requests and utilize the center-to-center interface to communicate to the various agency systems. The central point of coordination for the corridor will be the DalTrans facility, with TxDOT, Dallas County, and DART co-located at the facility.

All operations among corridor networks and agencies (e.g., activation of specific ICM strategies) will be coordinated via the Decision Support system. The US 75 ICM Subcommittee will also investigate and prepare corridor response plans for various scenarios that can be expected to occur within the US-75 Corridor. The chairman of the committee will be responsible, with the other agency/service operations officers, for configuring the subcommittee with respect to its functions and staffing for all hours of operations. Staff will be assigned by the corridor stakeholders to support daily operations, develop response plans, analyze system deficiencies and needs, and general administration. Performance measurement and monitoring will be the responsibility of the US 75 ICM Subcommittee. The agency/service members, led by the chief chairman, will be accountable to the centralized decision-making body and make reports as the decision-making body designates.

Communications, systems, and system networks will be integrated to support the virtual corridor command center. Voice, data, video, information, and control will be provided to all agencies based on the adopted protocols and standards for the sharing of information and the distribution of responsibilities. The ICM will support the virtual nature of the corridor by connecting the member agency staff on a real-time basis via communications and other ITS technologies. While all the ICM operational strategies will be available for use, it is envisioned that only a subset of these strategies will be activated at any one time, depending on the operational conditions and events within the corridor.

2.1 System Overview

The ICMS consists of the following Subsystems:
- SmartNET – Information Exchange Network User Interface
- SmartFusion – Information Exchange Network Data Layer
- Decision Support System (DSS) - Decision Support Engine

The stakeholders for the Project include:
- Dallas Area Rapid Transit
- City of Dallas
- City of Richardson
- City of Plano
- Town of Highland Park
- City of University Park
- North Central Texas Council of Governments
- North Texas Tollway Authority
- Texas Department of Transportation – Dallas District

2.2 Purpose

This document provides a detailed description of the selected system and the design for the systems to be implemented for the US-75 Integrated Corridor Management Demonstration Project. This architecture and design document is based on the system and subsystem requirements defined in the US-75 ICM System Requirements document, version 7.8 dated January 1, 2011.

The architecture and design incorporates those elements that must be used to provide a solution that fulfills the system and subsystem requirements, and the Stage 3 proposal to USDOT. The architecture is presented both graphically in diagrams and in text. The relationships and interfaces between the system and external systems are shown. This design process also defines the division of the ICMS into several subsystems and subsubsystems.

2.3 System Concept

The US-75 corridor will be an integrated transportation system – managed and operated collectively – in order to maximize its efficiency to corridor travelers. All corridor assets will be attuned to obtain the goals and objectives of the corridor, as well as the goals of each individual traveler as their preferences prescribe. The corridor users will recognize the US-75 Corridor as a multimodal, integrated, efficient, and safe transportation system that provides them with multiple viable alternatives that they can select based on their specific travel circumstances and needs.

Figure 1 is a high-level framework on how the system will interface to the various information systems and users. The system will utilize an existing Center-to-Center standards based communication infrastructure. It will also be able to have direct connections to agencies not on the Center-to-Center network, via a web-based interface. The existing systems of each member agency will share ITS data within the corridor, and the decision support subsystem will recommend responses for all affected agencies.

The SmartNET subsystem will provide the main graphical user interface for the ICM Stakeholders to use to create, edit, and view events in the corridor and region; view current conditions of field devices and congestion on the roadway network; and coordinate responses to incidents within the corridor. The decision support subsystem and SmartFusion subsystem also have some graphical user interfaces for administrative functions.

The SmartFusion subsystem will provide the data integration and fusion needed for the operation of the ICM corridor. The SmartFusion subsystem will collect data from several sources, such as the regional center-to- center system, transit data from DART, and weather and traffic information from 3rd parties, and fuse this data to provide the ICM stakeholders with a view of the network via the SmartNET subsystem. The SmartFusion subsystem will also provide fused data to other external systems such as the regional 511 systems, the media, and 3rd parties. The specific types of data being provided are described in this system design document, and in the data dictionary. In addition, as part of the operations of the 511 ICMS, the stakeholders will develop messages for their Dynamic Message Signs (DMS), Light Rail Transit (LRT) message boards, and other enroute traveler information strategies.

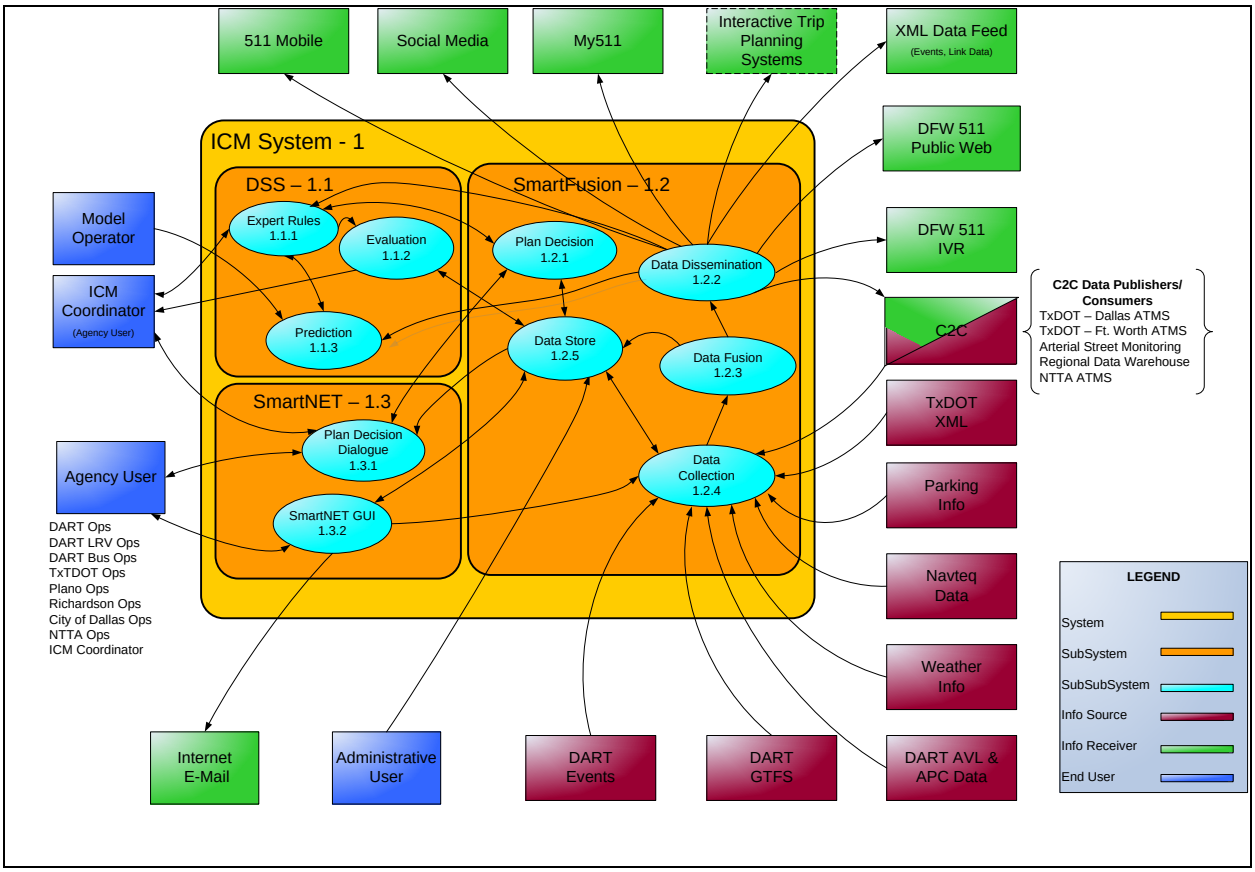

Figure 1: High-Level ICMS Conceptual Diagram

The decision support subsystem (DSS) recommends a response plan to the ICM coordinator based on conditions provided by the SmartFusion subsystem. After approval from the ICM coordinator the SmartNET subsystem will send response plan requests via the plan decision dialogue to communicate to the various agency operators. For instance, if TxDOT has an incident on the US-75 freeway, when the operator at the Daltrans facility inputs data in their ATMS incident management subsystem, the information from this system will send basic information on the incident (such as location, number of lanes, severity) to the SmartFusion subsystem via the regional Center-to-Center system. The DSS will receive the information from the SmartFusion subsystem and will use specific criteria (location, time of day, network conditions) to query its database, and select pre-approved response plans. The DSS sends the recommended plan to the ICM coordinator who then sends a recommendation to the agencies. If the agencies are able to implement the recommendation, the ICM coordinator then sends a "go live" request to the agencies. The DSS always has an ICM coordinator in the loop that assesses the DSS recommendation and the agency readiness before issuing an implementation request.

When an ICM user receives a request to implement a response plan, they will have the capability to accept, reject, or request a modification of the recommended response plan. As the conditions of the incident change, and the SmartFusion subsystem is updated, the DSS is updated and could provide a new recommended response plan to the ICM coordinator. In addition, the DSS will send

out updated responses based on other criteria; for instance, if an incident was occurring during the peak hours, and extended beyond.

2.4 System Context

The system context diagram below shows a high level conceptual framework of the data inputs to the ICMS subsystems and outputs to external systems.

Data Interfaces, as discussed in the sections below, include both data providers and data consumers. Each data interface has been identified as providing an important service to the ICMS. A summary of each data interface that will be developed for the ICMS is provided below:

- Regional Center-to-Center (C2C) –This data interface will allow the ICMS to publish event data to the C2C for agencies utilizing the ICMS, but not connected to the C2C.
- DART AVL & APC Data – this data interface provides transit data from DART into the ICMS. This interface may only be a temporary interface until the DART data is published directly to the Regional C2C.
- DART Event - this is a new data interface that DART is developing a system for, so the final data provided and content will be defined during the deployment phase.
- DART GTFS – this data interface provides the transit schedule and route information from DART via the GTFS format.
- Parking Management – this data interface will provide data via the DART Data Portal.
- Navteq Data – this data interface will provide freeway and arterial traffic information (speed, travel times) for the Dallas – Fort Worth region.

The other data interfaces on the context diagram are interfaces that currently exist or will exist in the near future based on the current deployment of the SmartNET™ software or for the 511-system deployment in 2013.

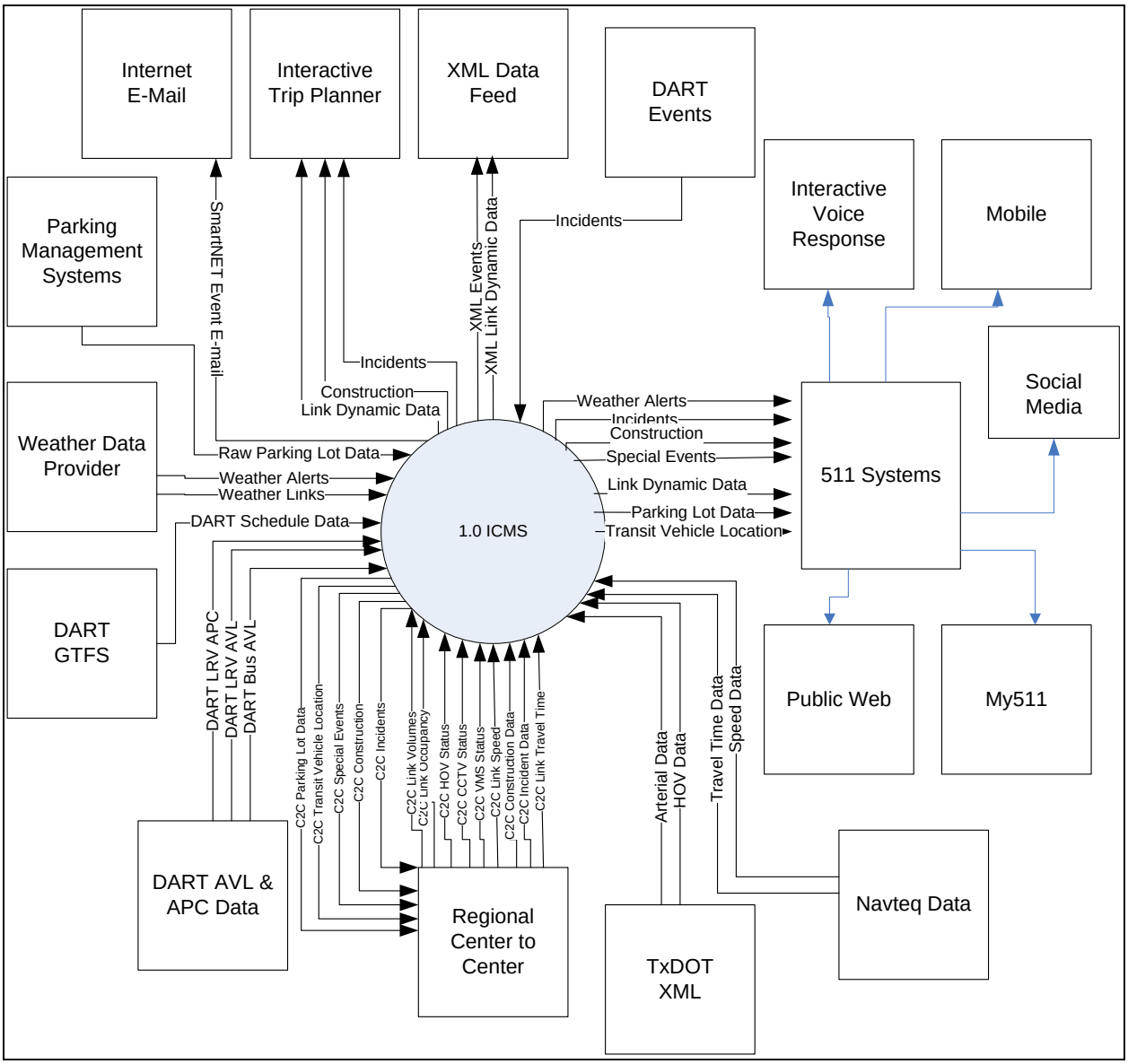

Figure 2: High-Level Integrated Corridor Management System Concept

3 Design Considerations

3.1 Reusability of Components

All components (hardware, COTS software, custom code) have been analyzed for re-use. The existing deployment of the SmartNET™ software (SmartNET and SmartFusion Subsystems) will be utilized for the ICMS, with any functionality modifications designed as part of this system design document. The SmartNET™ software will be used to exchange data between stakeholder agencies within the ICM corridor, which are not connected directly to the center-to-center infrastructure.

The existing center-to-center infrastructure will be used to exchange data between connected stakeholder agencies in the region impacted by the ICMS, and to receive data from agencies not using the SmartNET subsystem directly.

The DIRECT model developed for the Stage 2 Analysis, Modeling, and Simulation (AMS) stage of the project will be used for the prediction subsubsystem. The DIRECT model is a macroscopic simulation model developed by Southern Methodist University, which was developed as part of Stage 2. The model is used to predict conditions in the corridor and was previously calibrated for the AM peak during the Stage 2 effort, and the validation will be expanded to include the PM peak during the Stage 3 effort.

3.2 Use of Standards

The ICMS will utilize information technology, Intelligent Transportation Systems, and transport protocol standards for publication of data to external subscribers as well as reception or request of data from external publishers and subscribers.

3.2.1 ITS Standards

- Traffic Management Data Dictionary (TMDD) – SmartNET utilizes TMDD version 2.1 as the basis of its data dictionary. The Dallas Regional Center-to-Center system is based on TMDD version 2.1, with some localization.
- Message Sets for External TMC to TMC Communication (MS/ETMCC) - SmartNET and the Dallas Regional Center-to-Center system utilize the Message Sets for External TMC to TMC Communication.
- Transit Communication Interface Protocol (TCIP) – The DART Data Portal is envisioned to utilize the Transit Communication Interface Profile for some of its data elements.

3.2.2 Transport Protocol and Content Standards

- eXtensible Markup Language (XML) – eXtensible Markup Language is used by the ICMS to provide data feeds to external systems

- Java Messaging Service (JMS) – Java Messaging Service is used by the SmartNET and SmartFusion Subsystems
- Simple Messaging Transport Protocol (SMTP) – E-mail messaging will be generated utilizing the Simple Messaging Transport Protocol
- Hypertext Transfer Protocol (HTTP) – networking protocol for distributed, collaborative, hypermedia information systems utilized by web based applications.
- File Transfer Protocol (FTP) - standard network protocol used to transfer files from one host to another host over a Transmission Control Protocol (TCP) - based network, such as the Internet.
- Hypertext Transfer Protocol Secure (HTTPS) - Hypertext Transfer Protocol Secure (HTTPS) is a combination of the Hypertext Transfer Protocol (HTTP) with Secure Sockets Layer (SSL)/ Transport Layer Security (TLS) protocol to provide encrypted communication and identification of a secure network web server.

3.3 Assumptions and Constraints

This section describes the assumptions and constraints used in the development of this design for the ICMS. The following assumptions and constraints were used:

- The existing implementation of the SmartNET™ software and its 511 configuration will be used and modified for any additional functionality needed for the ICMS, and additional data configuration will be performed, as identified in the requirements there are requirements fulfilled by the existing SmartNET software, by the enhancements for the 511 system, by the enhancements for the ICMS integration, and finally for future functionality.
- The decision support subsystem will interface to the SmartFusion subsystem for requests and responses for pre-approved response plans, for dynamic data, and to store historical data;
- The existing regional center-to-center system will be used for agencies that have implemented connections to their ATMS systems. The SmartNET interface will provide connections for incident notification and system monitoring for agencies not connected through the center-to-center interface; and
- The Daltrans facility will host the ICMS hardware.

3.4 Development Methodologies

The SmartNET and SmartFusion Subsystems are being developed using component based object oriented methodologies to allow related functions to be insulated within their own respective objects in order to achieve performance measures required by the ICM effort. The development methodologies and processes are further described in the Systems Engineering Management Plan.

3.5 Development Environment

Software developed for the ICMS will use a consistent development platform environment and development tools. The following describes this environment.

The Telvent ICM development team uses the Visual Studio 2008 .NET IDE (Integrated Development Environment) for Microsoft based application development as well as the MyEclipse 9.1 IDE for java based development.

GUI based applications will be compiled using Visual Studio. Data interfaces will use MyEclipse or Visual Studio based on platform needs.

Applications are developed, compiled and unit tested in a development environment. The applications are then integrated on a test bed.

The Telvent ICM development team uses Telelogic CM Synergy to generate the directory structure for the development and installation environments. All code is checked in to the development directory structure and version stamped after successful unit test. Requirements and issues are entered into the Change Synergy tool for tracking purposes.

All installation scripts are stored in Synergy and software builds are done using the Synergy file structure which ensures the correct software release version. For some Java applications the Apache Ant utility (version 1.8.2) is used to conduct builds. Configuration files associated with Ant are also maintained in Synergy.

To maintain consistency a single version of Java (version Java 1.6.0_x) will be used for compiling all java applications. Although there is a more current version of Java, this version will be used unless there are specific issues found with backward compatibility given that existing COTS or libraries are going to be used for the ICMS.

The TTI ICM development team uses the Visual Studio 2010 .NET IDE (Integrated Development Environment) for Microsoft based application development, using Microsoft .NET 4.0.

The TTI ICM development team uses Subversion, hosted by Assemblia.com for Source Code management and repository. All code is checked in to the development file structure and version stamped after successful unit test.

3.6 Common Libraries

The following common libraries will be used for custom software development on the ICM project:

Log4j – used for data and error logging in Java applications which will limit the size of a log file based on configuration.

3.7 Integration and Test Environment

The integration test bed environment includes a web server, application server, data collection server, and database server, at a minimum, as required for testing all software functions. Performance, security and other system functions will be tested in a controlled pre-production environment during the system test phase which will mirror the production environment.

3.8 ICM System Physical Architecture

The architecture represents software processes and functions, data flows and associated interactions. The following diagram represents a physical view of the logical ICMS and includes some of the physical hardware associated with the three major subsystem components. The operational user's view of the system is through the SmartNET GUI subsubsystem. The SmartNET GUI subsubsystem provides the user privileged data retrieved through the SmartFusion subsystem and decision support subsystem. The Storage Area Network (SAN) includes a SQL Server database, which is central to all components and stores current and historical data.

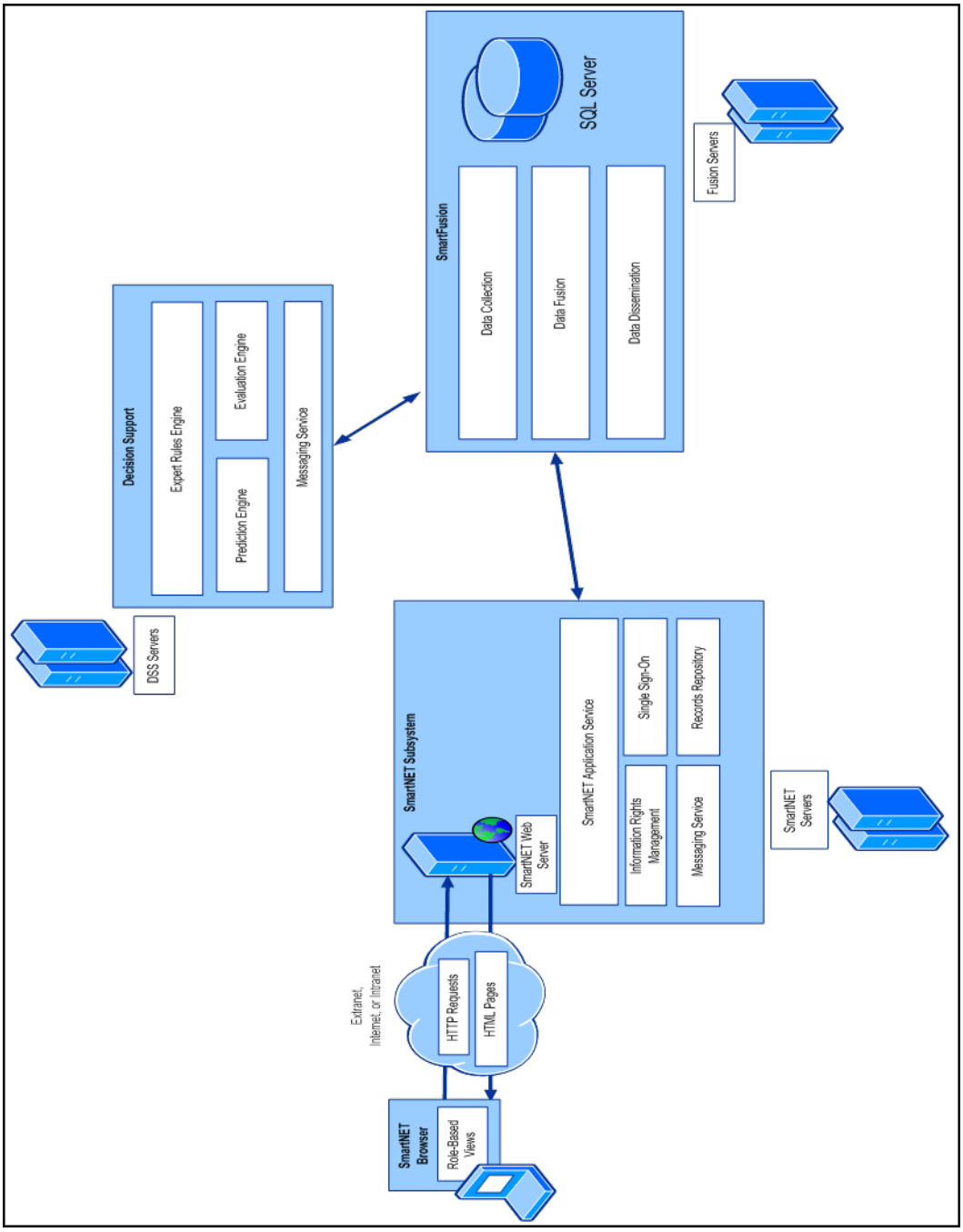

Figure 3: ICMS High-Level Physical Architecture

The high-level system functions (business requirements) of the ICMS developed during the requirements phase and approved by the stakeholders include functionality that already exists and new functionality required to be developed for the ICMS:

- Provide interactive communication among agencies;
- Send current status of ITS devices in the corridor to the corridor agencies;
- Store inventory of ITS devices within the corridor;
- Store ownership of ITS devices within the corridor;

- Provide current performance of the corridor transportation network to corridor agencies;
- Analyze stored event data to evaluate the effectiveness of the corridor strategies and response plans;
- Analyze stored ITS device status data to evaluate the effectiveness of the corridor strategies and response plans;
- Store pre-agreed incident response plans ;
- Send to agency users incident response plans to ensure that conflicting responses are not enacted ;
- Send agency users incident response plans to ensure prompt response to incidents ;
- Store history of enacted response plans;
- Evaluate the impact of enacted response plans on the corridor;
- Provide agency users the capability to update incident response plans;
- Store updated pre-approved response plans.

The system interfaces and external systems will provide the following system functionalities:

- Receive current status of ITS devices in the corridor;
- Receive current status of the transportation network in the corridor;
- Provide current performance of the corridor transportation network to travelers;
- Provide travel time information to travelers;
- Provide roadway event information to travelers;
- Provide transit event information to travelers;
- Provide travelers alternate route option information;
- Provide travelers detour route information;
- Provide travelers information on alternate modes of transportation.

The main performance functionality of the ICMS developed during the requirements phase and approved by the stakeholders are:

- Provide 98% availability
- Provide data latency of less than or equal to 10 minutes from a data source where a change is received
- Provide automated monitoring capabilities to alert operators of outages of the ICMS hardware, software, or network
- Provide failover capabilities within 45 minutes of a hardware component failure.

The design in this document will far exceed these requirements; for instance, the SmartNET and SmartFusion Subsystems will have failover capability with the use of VMWare software. If a physical server hosting the SmartNET subsystem or SmartFusion subsystem fails, another server within the network will be used.

3.8.1 Data Flow Diagrams

The data flow diagrams represent inputs and outputs between subsystems and subsubsystems that make up the ICMS. In order to further understand the process flow and data flows of the ICMS, the basic flow of information for the ICMS is:

1. Agencies collect current network information
2. Agencies store and process the information for their own systems,

3. The agency's electronic information is then sent to the ICMS via the Regional Center-to-Center. The agency can also manually enter event information into the SmartNET Subsystem. The format and content of this data is required to meet the Regional Center-to-Center ICD, which is based on the TMDD and MS/ETMC standards as defined within the TxDOT Center-to-Center documents.
4. The SmartFusion subsystem is the first receiving component of the ICMS. The SmartFusion subsystem is a combination of short-term storage used by the other ICMS subsystems and long-term storage used for modeling, data validation, mining and archiving.
5. The decision support subsystem (DSS) processes this data utilizing a mesoscopic model to calculate both current conditions and prediction conditions of the network for 30 minutes into the future. Based on these two time horizons, the DSS compares results against the set of pre-planned scenarios. The decision support subsystem then sends a response plan request, if it calculates one is needed.
6. In order to evaluate the performance of the ICMS, the decision support subsystem will be used on a regular basis to calculate the performance measures utilizing models and collected data. The data used in the model is received from the SmartFusion subsystem.
7. The last component of the ICMS is the SmartNET Subsystem. The SmartNET subsystem allows both agency users and external users to view the data within the ICMS. The SmartNET subsystem allows authorized users to view, edit, query and update data within the data store.

The following data flow diagram illustrates the data required to flow between the subsystems, and the internal interfaces required for the ICMS, additional Data Flow Diagrams can be found in the Data Flow Diagram document.

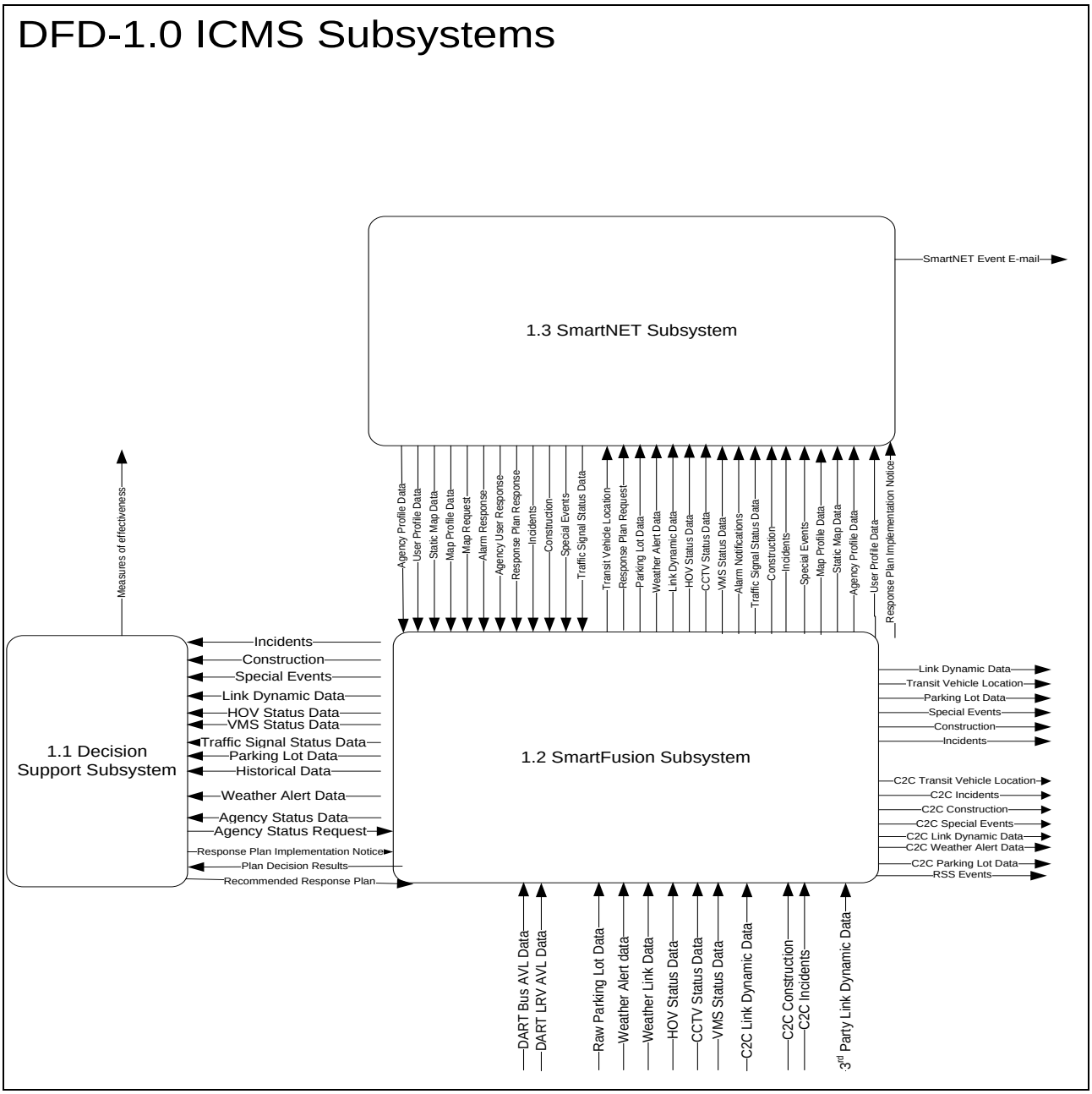

Figure 4: ICMS Level 0 Data Flow Diagram

3.8.2 External Interfaces

External Interfaces represent external software components and their respective interaction within the ICMS. As shown in the Figure 1 above, the ICMS Context Diagram, there are several external interfaces required for the ICMS. These interfaces are divided into three types of interfaces the ICMS supports:

1. Data Providers: Provides data to the ICMS; these data interfaces are dictated by the provider and the ICMS must develop the interface to meet the process, protocols, and formats of the provider. The provider must have an associated schema or data definition for the ICMS to follow.
2. Data Subscribers: Receives data from the ICMS; these data interfaces are dictated by the ICMS and the provider must develop their interface to meet the process, protocols, and formats developed by the ICMS. The ICMS must provide the subscriber an associated schema or data definition.
3. Data Providers/ Subscribers (bi-directional): Receives data and provides data to the ICMS; the only interface planned for this is the Regional Center-to-Center, which has already defined process, protocols, and formats for data subscriber and data publishing.

The following sections describe the new interfaces for the ICMS; there are several existing data interfaces.

3.8.2.1 IVR Interface (Data Subscriber)

The IVR Interface is the data interface needed by the Interactive Voice Response system to generate concatenated speech and text to speech messages for events, roadway conditions (speed, travel times), transit information, weather conditions, and parking information.

This interface has already been developed and deployed by Telvent in similar 511 system deployments, and minimal development effort is required. The current IVR system is database driven and utilizes JMS to receive real-time speed and travel time data.

3.8.2.2 Public Web Interface (Data Subscriber)

The public web interface is the data interface needed by the public web site (www.511dfw.com) to generate web page information to provide traveler information on the web. The web site will use a map based system, similar to the map in the SmartNET subsystem to provide the public with up to date traveler information.

This interface has already been developed and deployed by Telvent in similar 511 system deployments, and minimal development effort is required.

The public web interface will extract real-time data from the central or replicated version of the ICMS data store database. The connection will be read-only to ensure data is not compromised. The public web includes its own underlying database to handle content, configuration or statistical usage information.

3.8.2.3 511 Social Media Interface (Data Subscriber)

The 511 Social Media interface is the data interface needed by the 511 Social Media system to generate the event and link dynamic data information to provide traveler information on Facebook and Twitter. The events and link dynamic data are converted to a format for publishing to the social media sites.

This interface has already been developed and deployed by Telvent in similar 511 system deployments, and minimal development effort is required. The Social Media interface will utilize an XML feed from the SmartFusion subsystem for events and link dynamic data.

3.8.2.4 My511 Data Interface (Data Subscriber)

The My511 Data Interface is the data interface needed by the My511 public web site to generate web page information to provide traveler information on the web. The web site will use a map based system, similar to the map in the SmartNET subsystem to provide the public with up to date traveler information.

All alert messages from the SmartFusion subsystem will be distributed via Extensible Markup Language (XML) files available at a URL. The Alerts will be published to a web server, most likely to a VPN tunnel over the internet which will be employed to move the data across. The alert XML file will be superseded with an index file that contains the references to alerts and their URL's at which detailed information can be found. Each alert XML will contain information for only one event. The transactions for the alerts will be categorized into new alerts (New), updated alerts (Updated) and closed alerts (Closed).

At a configurable period of time the alert data Interface application will check the system database to gather information for events that need to be published. For now, only incident related events will be published. The application will process and write the current alerts in an XML file that can be accessed remotely. It will publish one index XML file that lists all of the alerts available at the URL. Each alert will be in its own XML file and will have the required expiration date listed.

This interface has already been developed and deployed by Telvent in similar 511 system deployments, and minimal development effort is required. The My511 Data Interface will utilize a replicated database of the data store subsubsystem.

3.8.2.5 Internet E-mail Interface (Data Subscriber)

The Internet E-mail interface is the data interface used by the SmartNET subsystem to generate e-mail alerts to any designated recipient, the SmartNET subsystem interfaces to an Exchange Server to generate an e-mail with event information and sends that information to designated recipients. This interface will use Simple Mail Transfer Protocol (SMTP), which is an internet standard for electronic mail (e-mail) transmission across Internet Protocol (IP) networks.
Users will have the ability to create alert profiles to receive email based or SMS incident and planned event information for specific roadways as well as weather alerts and transit disruptions.

This interface will also be used by the network monitoring tools to send alerts when issues are detected within the system.

3.8.2.6 Trip Planning Interface (Data Subscriber) - Future

This interface is a future enhancement to the ICMS, and is not planned for the ICMS demonstration project. Currently, DART utilizes their Trapeze™ system to generate transit trip plans for the public, however, this version of the Trapeze™ software does not allow direct interfacing due to the current license agreement. There is currently no traffic trip planner provided by the stakeholder agencies within the region.

In the future, it is desired by the stakeholder agencies to provide a regional trip planner which combines both traffic and transit, but the timing and potential solutions for this will exceed the timeframe for the design-build phases of the ICM demonstration project.

3.8.2.7 XML Data Feed Interface (Data Subscriber)

The XML Data Feed interface is the data interface used by the SmartFusion Subsystem to generate XML based text messages to provide the messages to subscribers of the feed, including the media; the SmartFusion subsystem generates the XML formatted feed.

The ICMS XML Data Feed content will be provided to authenticated users in W3C standard XML format. The data will be provided for the various source data types made available by the ICM system. This source data includes Event Data, as made available by the various external providers of the Event Data, Link Dynamic Data, VMS Status Data as made available by the various external providers of the Link Data, as well as CCTV Status Data, as made available by the various external providers of the CCTV Data. All necessary information needed for development purposes will be provided to the Data Consumers in a Wiki, which will be available via the Internet.

3.8.2.7.1 Data Consumers:

Data consumers are defined as the group of users that will access the ICMSs Data Feed system to query for the different data types that are available. Data consumers are broken down into two main groups: Public Consumers and Trusted Partners. Public Consumers will have access to a limited dataset and filters will be set up to exclude data that is deemed not suitable for public consumption. Filters will also be available to filter in information that will only be suitable for Trusted Partner consumption. These filter rules will be set up in configuration files in the ICM XML Data Feed source code and will be customizable in order to ensure that changes can be made to the system without interrupting service.

3.8.2.7.2 Data Content:

The ICM XML Data Feed will provide real-time traffic event data as made available in the ICM system from the various ICM subsystems external sources, based on the public web filtering rules developed during the 511 detailed design. These sources include Regional Center-to-Center, DART Data Portal, and 3rd Party Information Providers. Only active, open event data will be provided via the XML Data Feed.

3.8.2.8 Parking Management Interface (Data Provider)

This interface will eventually be provided through the DART Data Portal interface to the Regional Center-to-Center. For the purpose of the ICMS demonstration project, this interface will be provided by a third party provider into the DART Data Portal, which will then be polled by the ICMS from the Regional Center-to-Center interface.

The type of information that will be received will include the items identified in the data dictionary to include: Parking Lot ID, Utilization, and Availability information.

The Parking Information Interface will be implemented as part of the ICMS demonstration project.

3.8.2.9 Weather Information Interface (Data Provider)

The Weather Information Interface is the data interface needed by the ICMS to receive weather data to include radar maps, weather forecasts, weather links, and weather alerts. Weather and pavement information gathered from the Clarus system, NEXRAD radar, storm corridors, surface observations, and National Weather Service bulletins are continuously, geospatially monitored and analyzed against road segments. When severe weather is identified for any road segment, an alert

is generated and full information on the weather condition and its exact location is provided to the ICMS.

The following information is continuously, geospatially analyzed to create the severe weather road segment alerts:

- Clarus Data—Information from Road Weather Information Systems (RWIS), including both pavement and atmospheric weather conditions.
- NEXRAD Radar—Precipitation types and intensities, including rain, mixed precipitation (e.g., ice, sleet) and snow.
- Storm Corridors—Represent the projected path of a thunderstorm, possible tornado or hail storm over the next 30 minutes.
- Surface Observations—Temperature, wind and gust speeds, fog, precipitation, etc.
- National Weather Service Bulletins (Watches, Warnings and Advisories)—Winter weather (snow, blizzard, ice), severe thunderstorms, tornados, floods, hurricanes etc.

Severe weather road segment alerts are updated every 5 minutes, and represent the current time period as well as a NowCast forecast time period of 30 minutes. Road segments affected by a National Weather Service bulletin can provide information up to 48 hours in advance of a severe weather situation. Only weather conditions considered to affect traffic and safety within the transportation network create alerts along road segments, so that ICM users can clearly identify those road segments that have weather issues. Severe weather categories and the colors used to represent them are simplified to clearly indicate the level of severity along each roadway, with more detail available to the 511 user when the mouse is hovered over the road segment.

This interface has already been developed and deployed by Telvent and minimal development effort is required. The interface uses an XML feed from the Telvent-DTN servers into the ICMS.

3.8.2.10 DART Data Portal Interface (Data Provider)

The DART Data Portal interface is the data interface needed by the ICMS to receive transit related data from DART. This interface will provide transit route, schedule adherence information, current location of DART buses and light rail vehicles, and transit incidents, construction and special event information. The DART Data Portal has not been completely defined; however, the current DART systems publish data to a central database within DART. This database will be opened to the SmartFusion subsystem via a Web Service, and will allow integration of the transit data into the SmartFusion subsystem.

In the future, the DART Data Portal will publish data to the Regional Center-to-Center and this interface will no longer be needed.

3.8.2.11 Regional Center-to-Center Interface (Data Subscriber)

The Regional Center-to-Center Interface is the data interface needed by the ICMS to generate and receive TxDOT traffic information to include incidents, construction, and roadway conditions (speed, travel times). In addition, this interface will publish ICMS information to the center-to-center system including incidents, construction, special events, weather conditions, transit vehicle information, and parking lot information from non-TxDOT agencies. The information is geo-coded to display on a map based system.

This interface has already been developed and deployed to receive TxDOT information (version 3.2 plug-in) by Telvent as part of the initial SmartNET™ software implementation, however, an updated version of the TxDOT Center-to-center protocol has been deployed by TxDOT and the interface (version 4.1 plug-in) will need to be updated. The interface will also be expanded to include the publishing of ICMS information to the center-to-center system.

This current interface (version 3.2 plug-in) is a Web Services utilizing XML and SOAP. For the updated version of TxDOT Center-to-Center protocol (version 4.1 plug-in.), a Web Services utilizing XML and SOAP will also be used.

The 4.1 plug-in for publishing data to the center-to-center interface will be deployed as part of the ICMS demonstration project.

3.8.3 Internal Interfaces

Internal Interfaces represent internal software components and their respective interaction within the ICMS.

3.8.3.1 SmartFusion – Decision Support System Interface

This internal interface will consist of data exchange, and messaging for the incident response plans. This interface will be discussed in more detail as part of the detailed design section below. This interface will use an XML data feed. The DSS will pull data from the SmartFusion Subsystem via XML utilizing an FTP protocol for network data, and exchange data with the SmartFusion Subsystem via XML utilizing an HTTP protocol for the publishing and receipt of response plan selection requests.

Data elements will include:

- Incident Events – Both Traffic and Transit events will be provided;
- Construction or Planned Events – Future events including schedules;
- Link Dynamic Data – Speed, Volume, and Travel Time data as available;
- Traffic Signal Status Data – Operational status of the traffic signal as updated in SmartNET;
- Weather Alerts – National Weather Service alert types included affected counties;
- VMS Status Data – Operational Status of a sign and text representation as available;
- HOV Speed Data – Speed, Volume, and Travel Time data for HOV as available.

Response Plan Selection data will be exchanged and includes:

- The Incident Response Plan Data – Response Plan Identifier and Plan Description;
- The Incident Response Plan Dialogue Data – Response Plan Request Identifier, Agency Identifier, Decision;
- The Plan Decision Results Data – Response Plan Identifier, Decision.

3.8.3.2 SmartFusion – SmartNET System Interface

This internal interface will consist of data exchange, and web page content creation. This interface will be discussed in more detail as part of the detailed design section below. This interface will use the Data Store Subsubsystem, and the Data Collection Subsubsystem to exchange data between the two subsystems.

Data elements will include:

- Incident Events – Both Traffic and Transit events will be provided;
- Construction or Planned Events – Future events including schedules;

- Link Dynamic Data – Speed, Volume, and Travel Time data as available;
- Traffic Signal Status Data – Operational status of the traffic signal as updated in SmartNET;
- Weather Alerts – National Weather Service alert types included affected counties;
- VMS Status Data – Operational Status of a sign and text representation as available;
- HOV Speed Data – Speed, Volume, and Travel Time data for HOV as available.

Response Plan Selection data will be exchanged and includes:

- The Incident Response Plan Data – Response Plan Identifier and Plan Description;
- The Incident Response Plan Dialogue Data – Response Plan Request Identifier, Agency Identifier, Decision;
- The Plan Decision Results Data – Response Plan Identifier, Decision.

User interface data will be exchanged and includes:

- Agency Setup information – administration, agency user management;
- User Information – account information, login authentication and authorization;
- Map Display information – display of Google based map with geo-location of objects, and events within the network;
- Alarm information – display of alarms and alerts.

3.9 SmartNET Subsystem

The purpose of the SmartNET Subsystem is to provide the Graphical User Interfaces (GUIS) needed for the web-based information exchange tool for the Stakeholder agencies to share information and manage incidents, construction, and special event information. The basic system is currently in operation and provides the majority of the functionality needed for the ICMS. The SmartNET Subsystem is the presentation layer for the ICMS in simplest terms; the other two subsystems do have user interfaces for administrative functions, such as model updates and data store administration.

The main functionality of the SmartNET Subsystem needed for the ICMS is to display data that is provided by the SmartFusion Subsystem to include:

- Display data regarding incidents, construction, and special events in an interactive manner;
- Display the current status of devices and roadway and transit networks within the corridor;
- Display the current status of devices and performance of roadway and transit network within the corridor;
- Provide incident response plan information to corridor stakeholders;

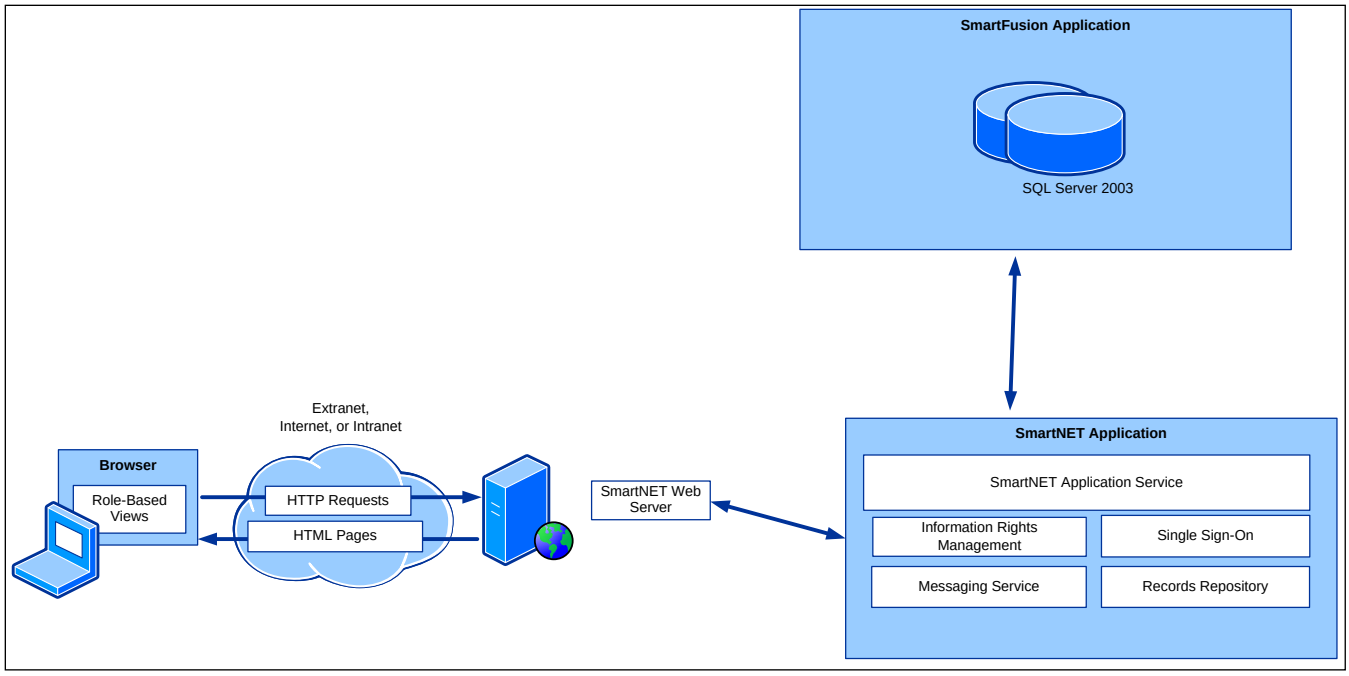

Figure 5: High-Level Physical Architecture for the SmartNET Subsystem

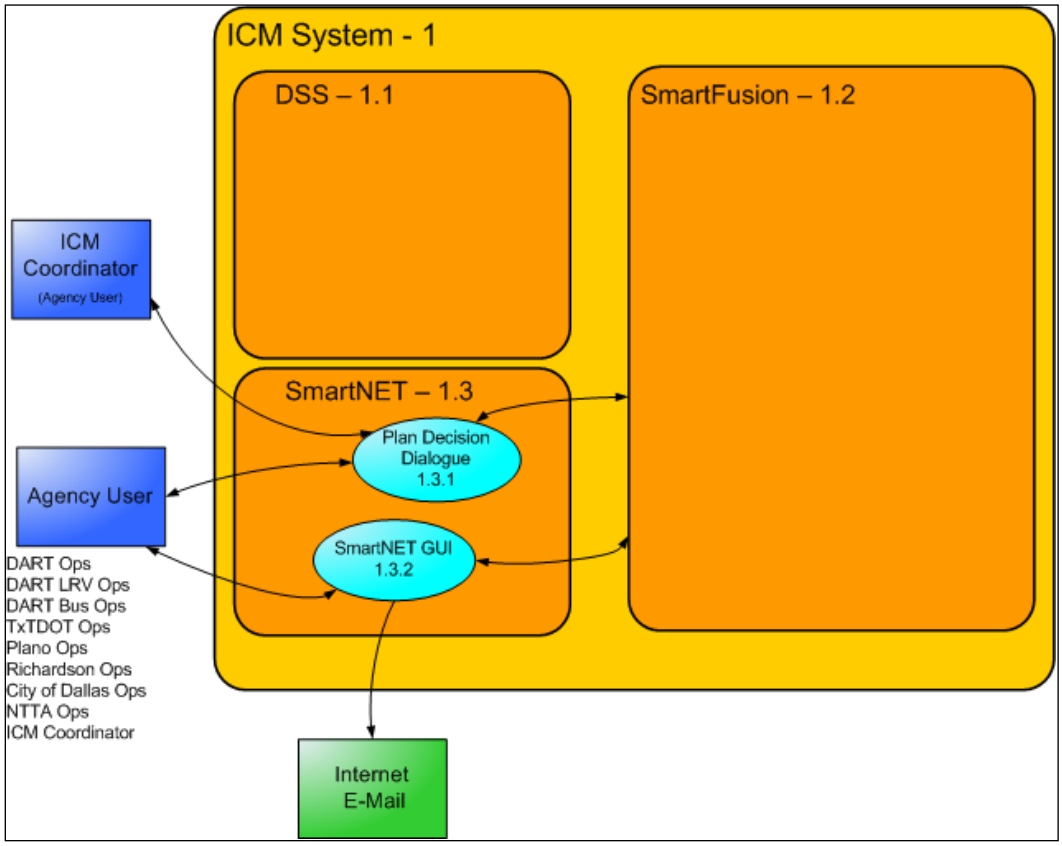

Figure 6: High-Level Logical Architecture for the SmartNET Subsystem

3.9.1 Subsystem Interfaces

The interfaces to the SmartNET subsystem include the data defined in the System Requirements Document, and further defined in the Data Dictionary. The diagrams below show the data elements received and sent by the SmartNET Subsystems.

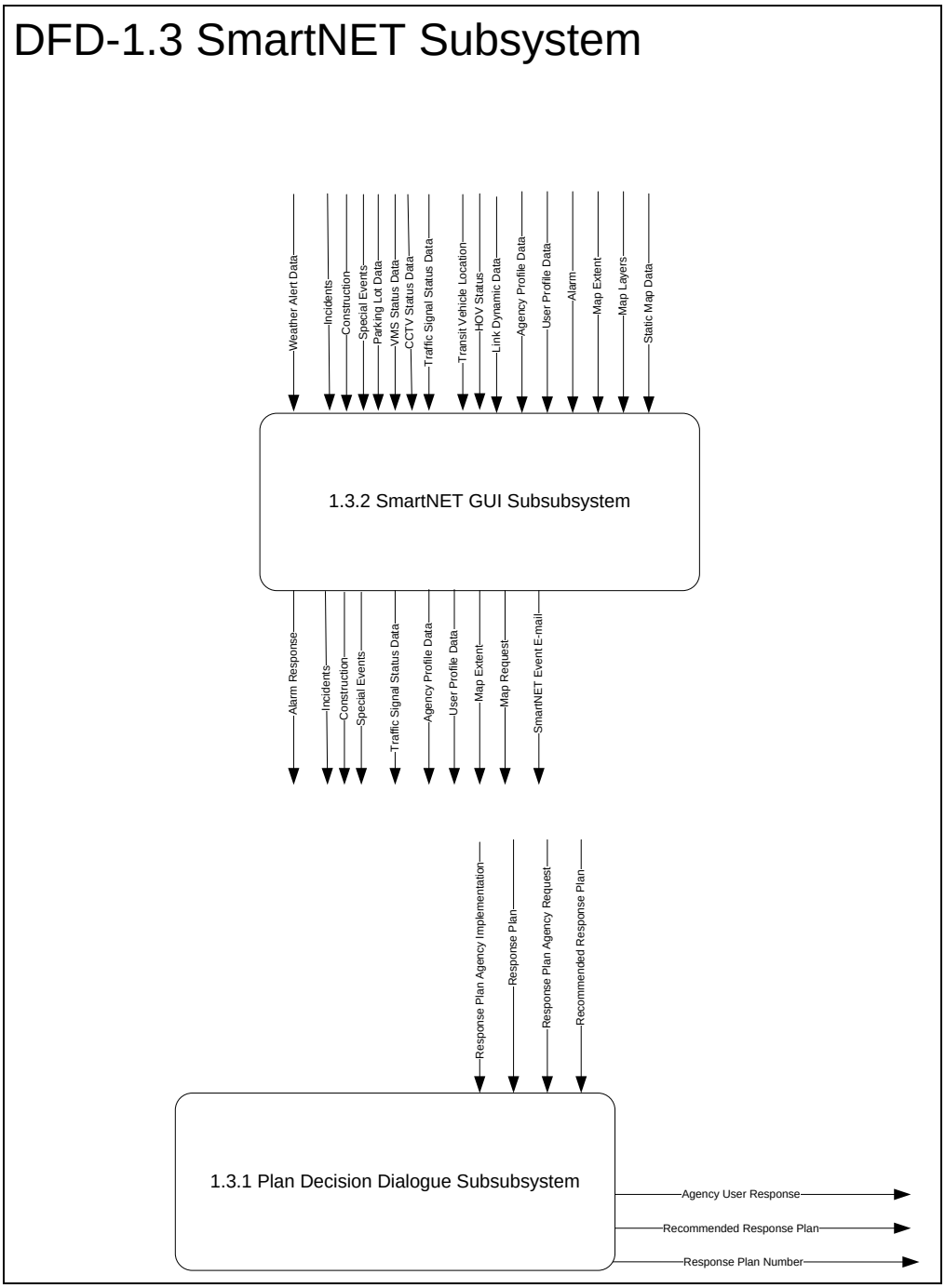

Figure 7: Data Interfaces of the SmartNET Subsystem

3.10 SmartFusion Subsystem

The purpose of the SmartFusion subsystem is to provide the data processing, fusion, and data dissemination functions for the ICMS. The SmartFusion subsystem receives data from and provides data to the SmartNET subsystem. The SmartFusion subsystem also receives data from external interfaces described in this document. The basic SmartFusion Subsystem already exists and provides the majority of the functionality needed for the ICMS demonstration project. The SmartFusion Subsystem is the data layer for the ICMS in simplest terms.

The main functionality of the SmartFusion Subsystem needed for the ICMS is:

- Receive the current status of devices and roadway and transit network within the corridor;
- Provide roadway link information to external systems to include link speeds, volumes, travel times, and weather conditions;
- Provide event, construction, and special event information to stakeholder agencies and to external systems;
- Store inventory of ITS devices, network data, and device ownership for the corridor network;
- Store pre-agreed incident response plans developed and approved by corridor stakeholders;
- Store history of implementation of pre-agreed incident response plans;
- Provide roadway link information to external systems to include link speeds, volumes, travel times, and weather conditions for the calculation of alternate routes and modes;
- Provide transit information to external systems to include routes, schedules, current location of transit vehicles for the calculation of alternate routes and modes;

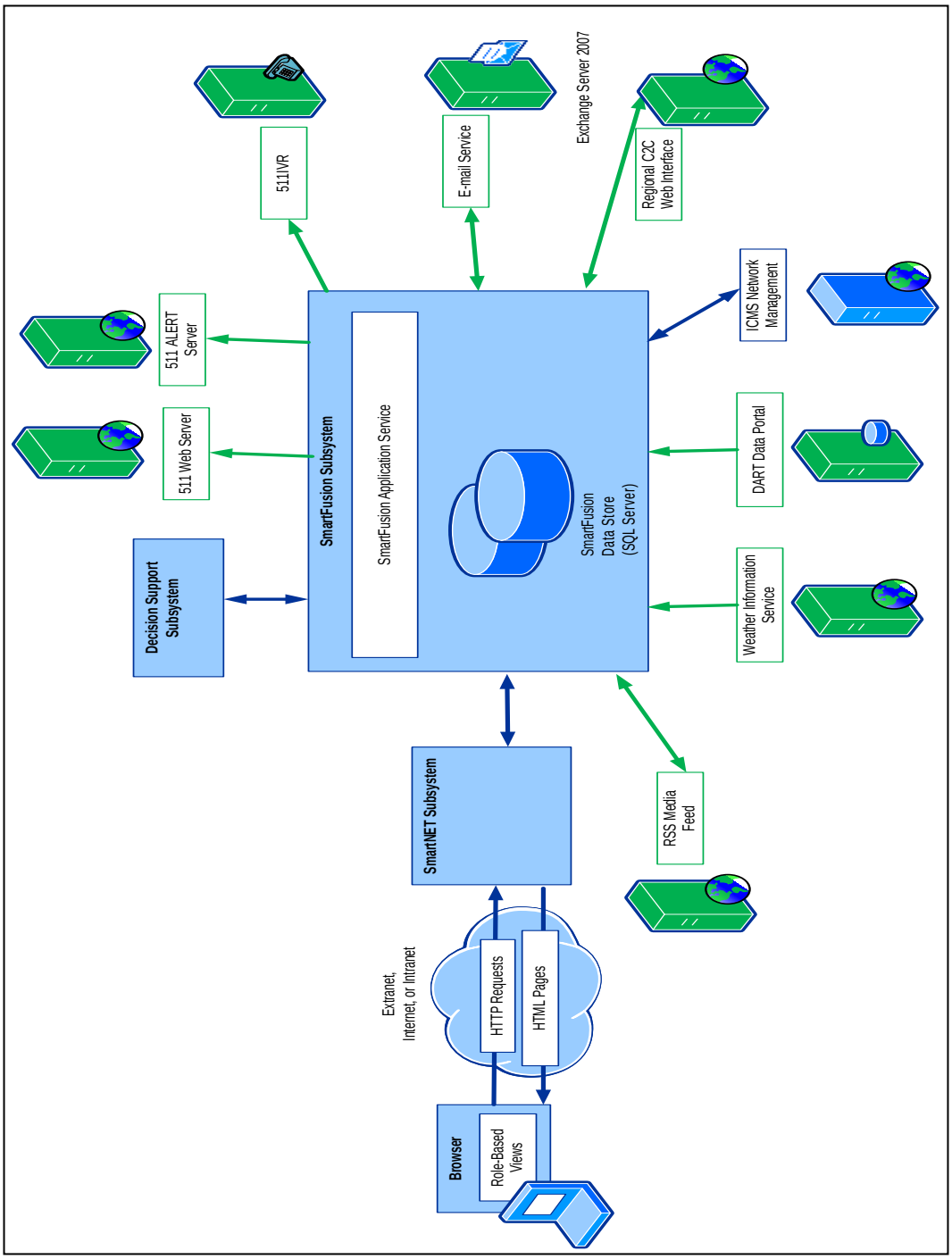

Figure 8: High-Level Physical Architecture and Interfaces for the SmartFusion Subsystems

3.10.1 SmartFusion Static Roadway Network Data Merge Process

Telvent reviewed the various data sources provided for the roadway network data covering the ICMS project. A spatial data analysis was performed on the data supplied from Richardson, TxDOT (Dallas), Plano and NCTCOG to identify the most comprehensive source(s) of static roadway network data. The results of the analysis helped Telvent locate the best fit data sources for the DFW511 project. After reviewing the various data sources, the recommended approach is to fuse static data in the following manner:

DFW511 Roadway Network Data = TxDOT Dallas Highway + City of Richardson identified arterials (NCTCOG) + City of Dallas identified arterials (NCTCOG) + City of Plano identified arterials

TxDOT Dallas Highway data including HOV:
TxDOT(Dallas) data was received on August 1st 2011 and was provided in an XML format containing 1929 objects. The data received contained most of the needed data attributes to build the roadway network. Geographical coverage is presented in the diagram below:

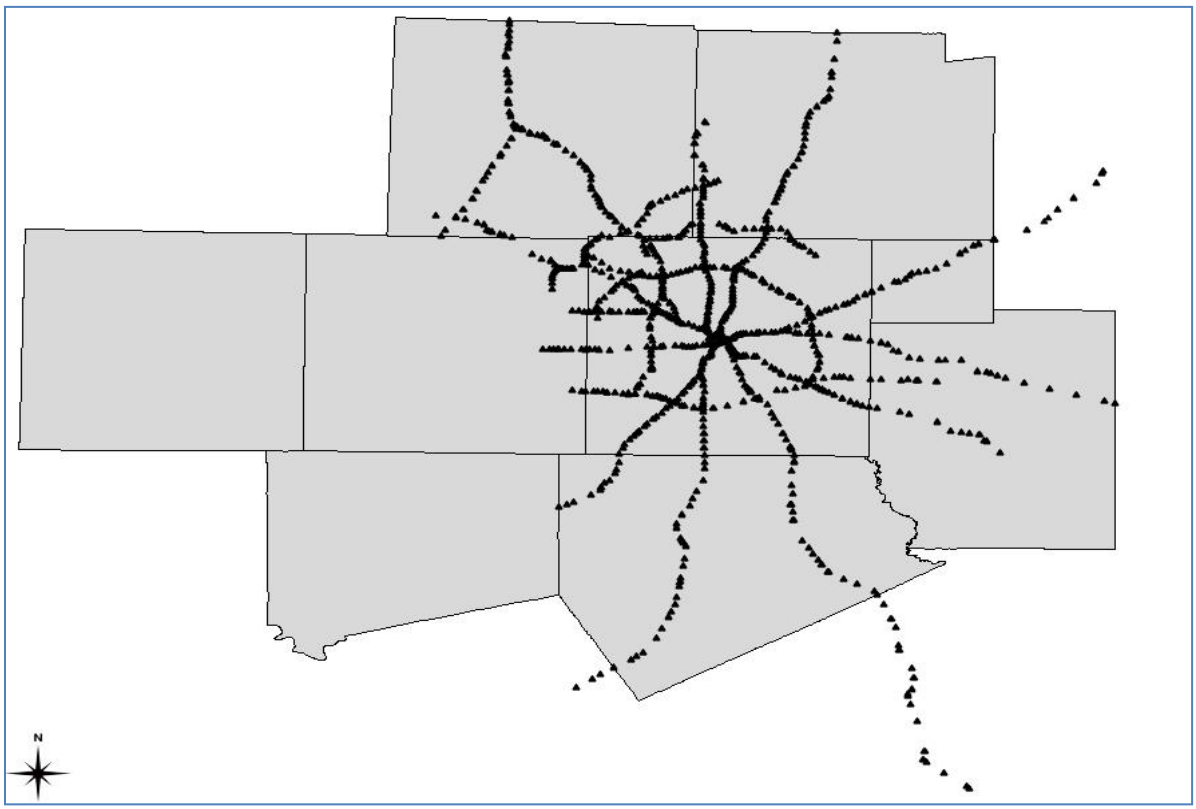

Figure 9: TxDOT Dallas Highway Data Diagram (Source: Texas Department of Transportation)

1. **City of Richardson identified arterials:**
   Both the City of Richardson and NCTCOG provided roadway network data covering the City of Richardson area. Both data sets were compared and the recommendation will be to use the NCTCOG dataset in order to provide a consistent approach for merging data from the remaining cities. However, missing data attributes were identified in the NCTCOG data and

were discussed with NCTCOG on 09/28/2011.Telvent was tasked to coordinate with the City of Richardson to compile the list of all the needed facilities in the NCTCOG data sets.

2. **City of Dallas identified arterials:**
   The major arterial data for the City of Dallas was extracted from the NCTCOG data set. Telvent was tasked to coordinate with the City of Dallas to compile the list of all the needed arterial facilities in the NCTCOG data sets.
3. **City of Plano identified arterials:**
   The major arterial data for the City of Plano was extracted from the NCTCOG data set. Telvent was tasked to coordinate with the City of Plano to compile the list of all the needed arterial facilities in the NCTCOG data sets.

3.10.2 Subsystem Interfaces

The Interfaces to the SmartFusion subsystem include the data defined in the System Requirements Document, and further defined in the Data Dictionary. The diagram below shows the data elements received and sent by the SmartFusion Subsystem.

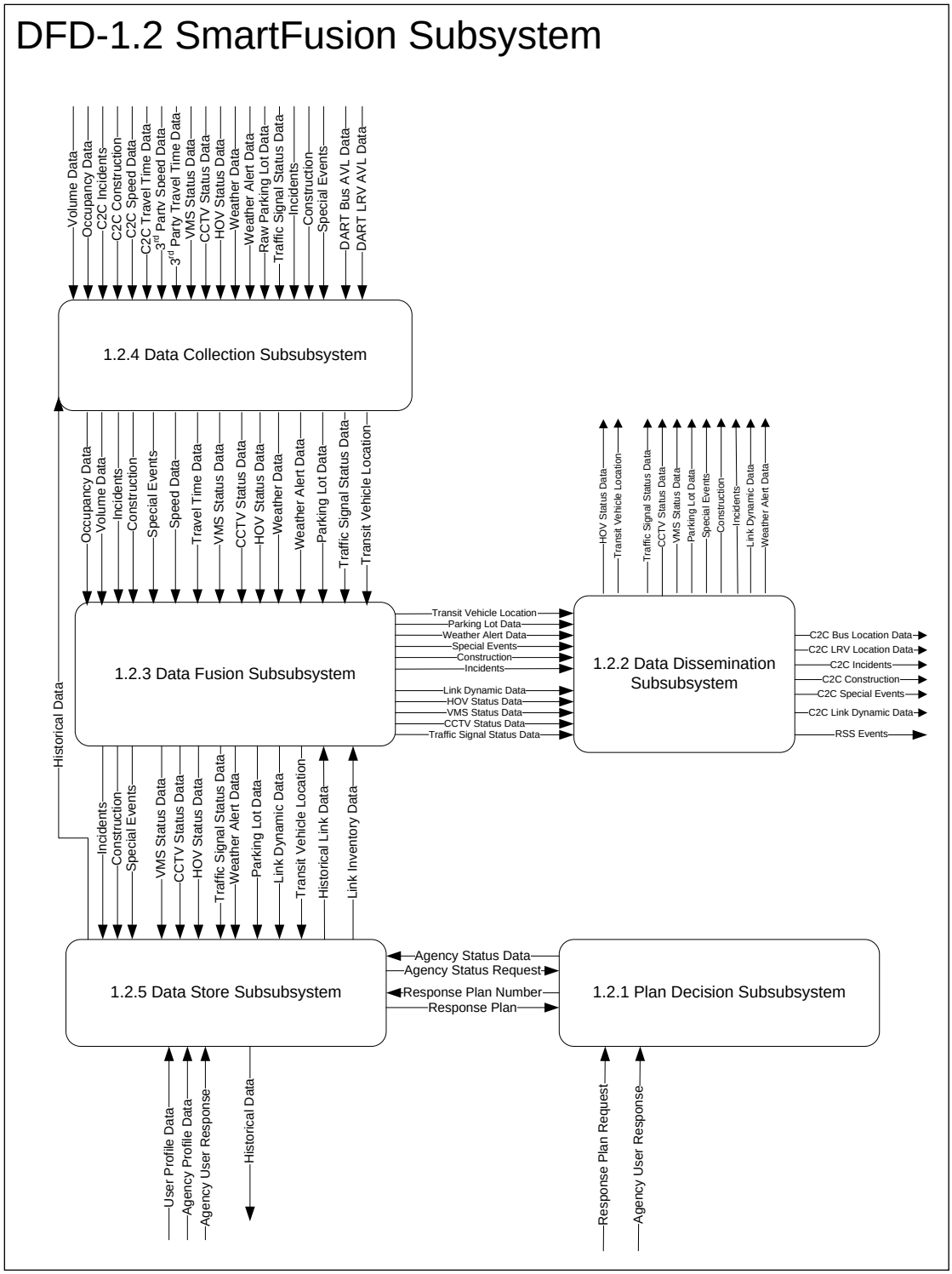

Figure 10: Data Interfaces of the SmartFusion Subsystem

3.11 Decision Support Subsystem

The Decision Support Subsystem (DSS) is an essential component for the ICM operating agencies to implement the ICM strategies. The Decision Support Subsystem will become the collective knowledge resource to select appropriate response plans and determine potential corridor benefits of proposed response plans. The decision support system is comprised of three main subsubsystems: 1) the expert rules subsubsystem, 2) the prediction subsubsystem, and 3) the evaluation subsubsystem. The expert rules subsubsystem uses real-time traffic and transit data, incident data (incident location, estimated incident duration, affected traffic lanes), and weather conditions to assess changing conditions. When an event occurs that may reduce the mobility of the corridor, the expert rules subsubsystem makes initial recommendations on the high-level ICM strategies (i.e., type of route diversion or mode diversion) and identifies predetermined response plans (i.e., specific actions to be taken by individual operating agencies) that are appropriate for that event.

The expert rules subsubsystem passes the recommended ICM response plan on to the ICM Coordinator via the plan decision dialogue subsubsystem. When events such as significant changes in demand, incidents (planned or not planned), or inclement weather occur, the expert rules subsubsystem or the ICM coordinator will initiate an analysis of the ICM strategy through simulation in the prediction subsubsystem. The prediction subsubsystem results will be sent back to the expert rules subsubsystem for the incorporation into the recommendation process. The selection of operational strategies is planned to include a prediction of future conditions under some conditions. The prediction subsubsystem is envisioned to have at least three instances of the DIRECT model running: 1. Current conditions of the network; 2. Future conditions of the network, 30 minutes into the future, without response plans enabled; 3. Future conditions of the network, 30 minutes into the future, with response plans enabled.

The evaluation subsubsystem provides the ICM coordinator and the operating agencies a critique of how a response plan performed for a given event. The evaluation subsubsystem uses the corridor data from the SmartFusion subsystem to calculate corridor performance metrics. These performance measures will allow the operating agencies to refine strategies and response plans in attempts to continually improve how the ICMS improves corridor operation.

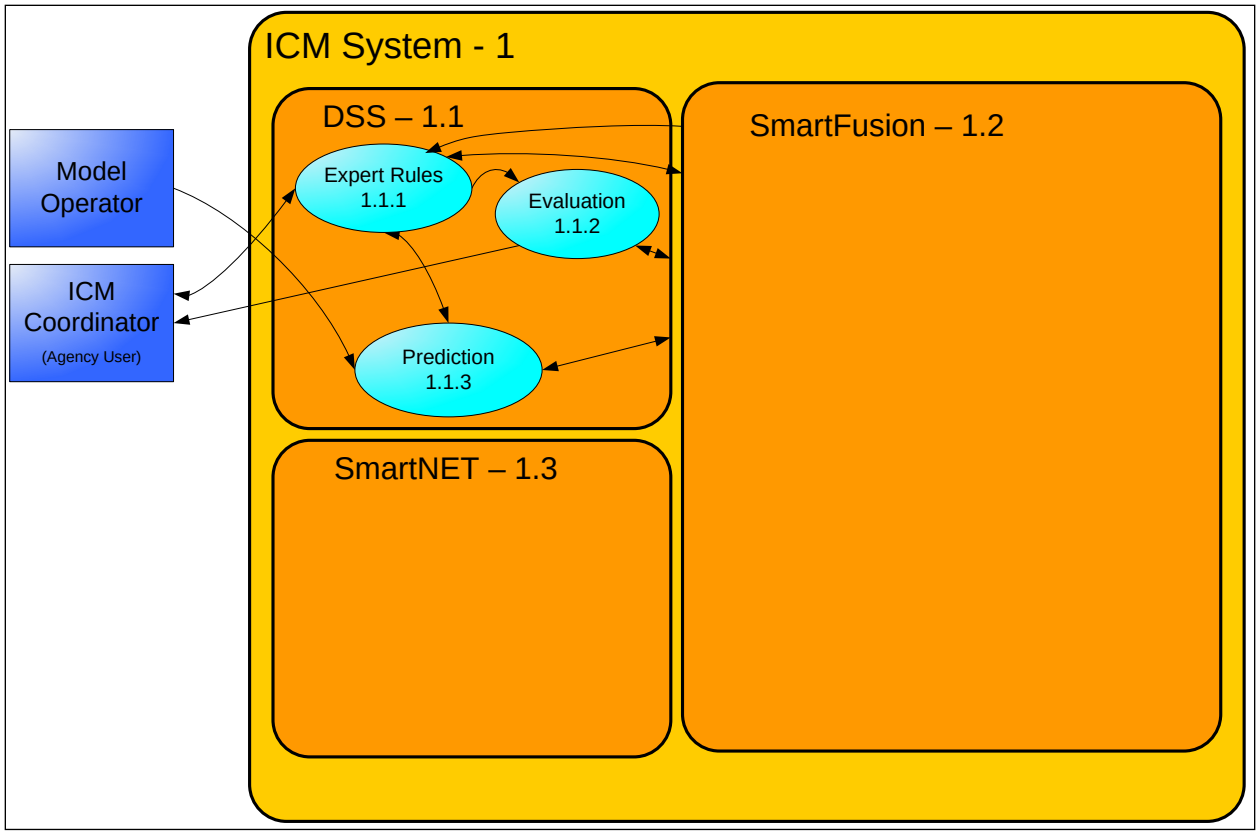

Figure 11: Logical Architecture for Decision Support Subsystem

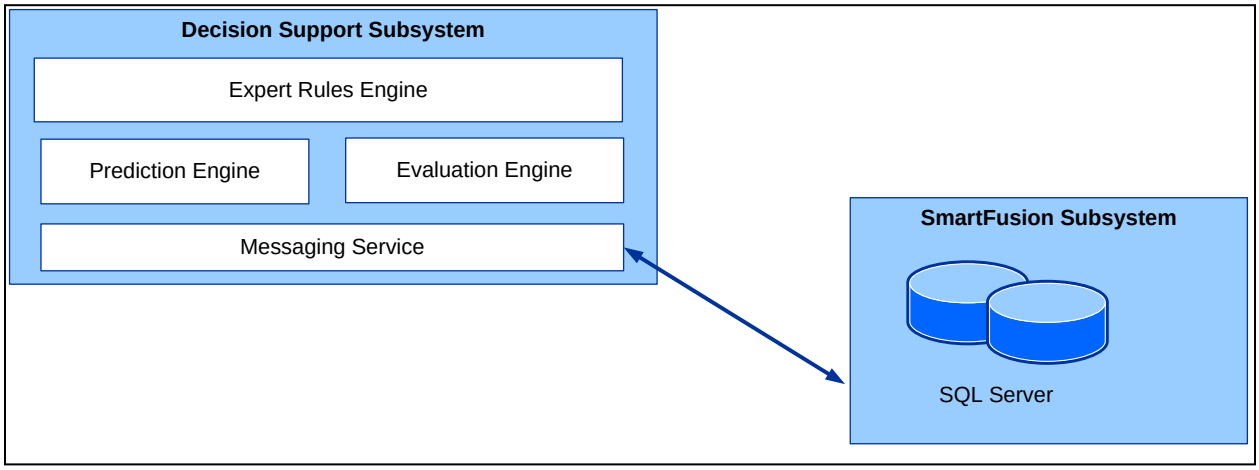

Figure 12: Physical Interfaces for Decision Support Subsystem

The main functionality of the decision support subsystem for the ICMS demonstration is:

- Analyze stored event data to determine appropriate corridor strategies and response plans;
- Analyze stored ITS device status data to determine the availability in the corridor;
- Analyze events, network conditions, and status of devices to select appropriate response plans;

- Predict the potential benefit of implementing an ICM strategy and associated response plan; and
- Evaluate the impact of enacted response plans on the corridor.

3.11.1 Subsystem Interfaces

The decision support system has the following interfaces:

- Data Interface to SmartFusion – the DSS will receive data from the SmartFusion Subsystem, using XML via an ftp protocol.
- Recommended Response Plan Generation Interface to SmartFusion – Once the expert rules subsubsystem calculates a response is needed based on conditions and events within the ICM network a response plan request is generated. The DSS will interface to the SmartFusion Subsystem so that Agency Users receive alerts from SmartNET through the plan decision dialogue to implement the calculated response plan.

The interfaces to the decision support subsystem include the data defined in the System Requirements document version 7.8, and further defined in the data dictionary. The diagrams below show the data elements received and sent by the decision support subsystem.

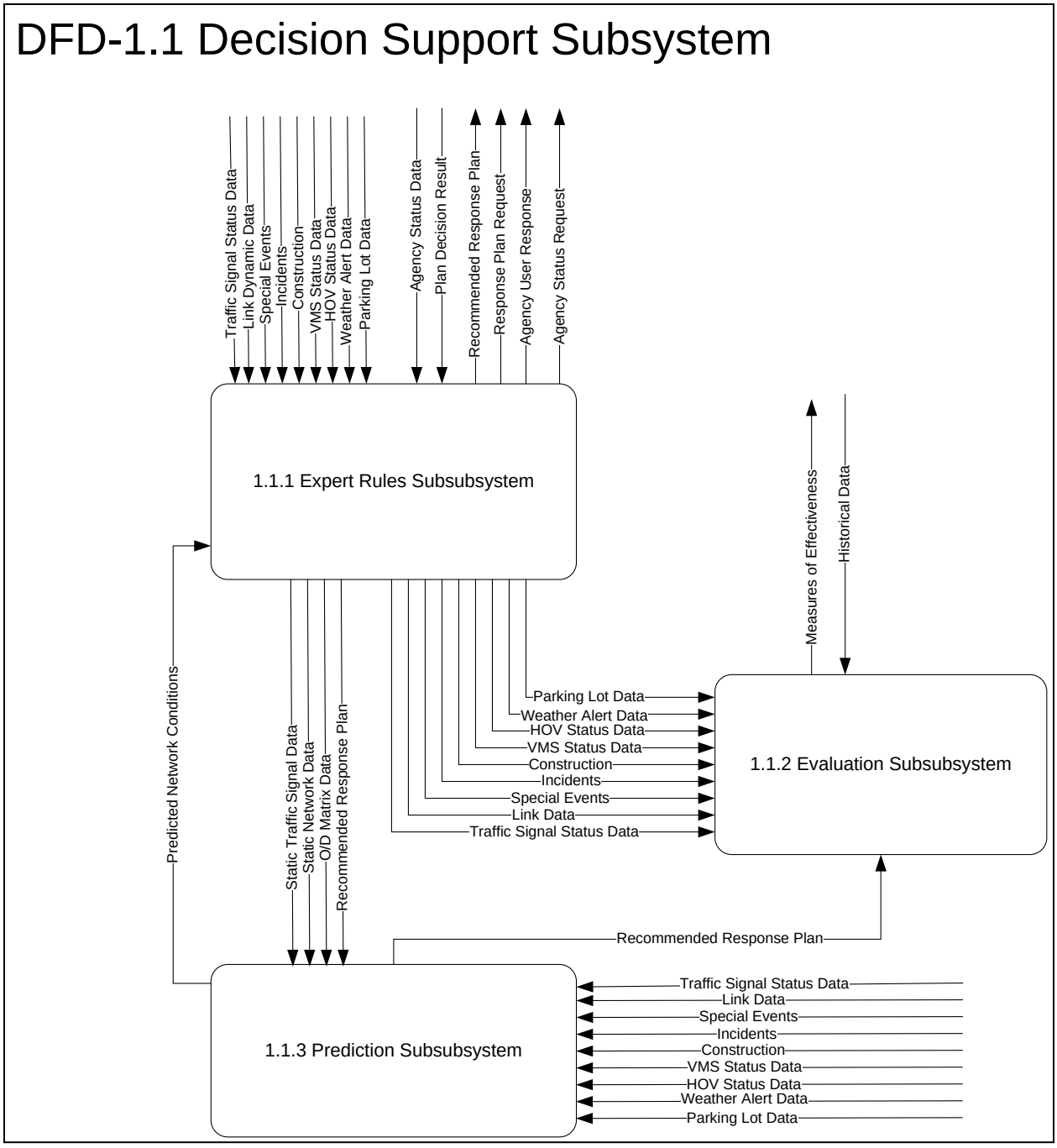

Figure 13: Data Interfaces of the Decision Support Subsystem

3.12 Physical Architecture

The physical architecture represents actual software, hardware and networking components, where they will reside, the relationship between each component and how they will be integrated. For this Detailed Design, a physical architecture is provided, which includes both the physical architecture and a "virtual" physical architecture.

3.12.1 Network and Hardware

The network and hardware diagram below represents the physical components for the ICMS.

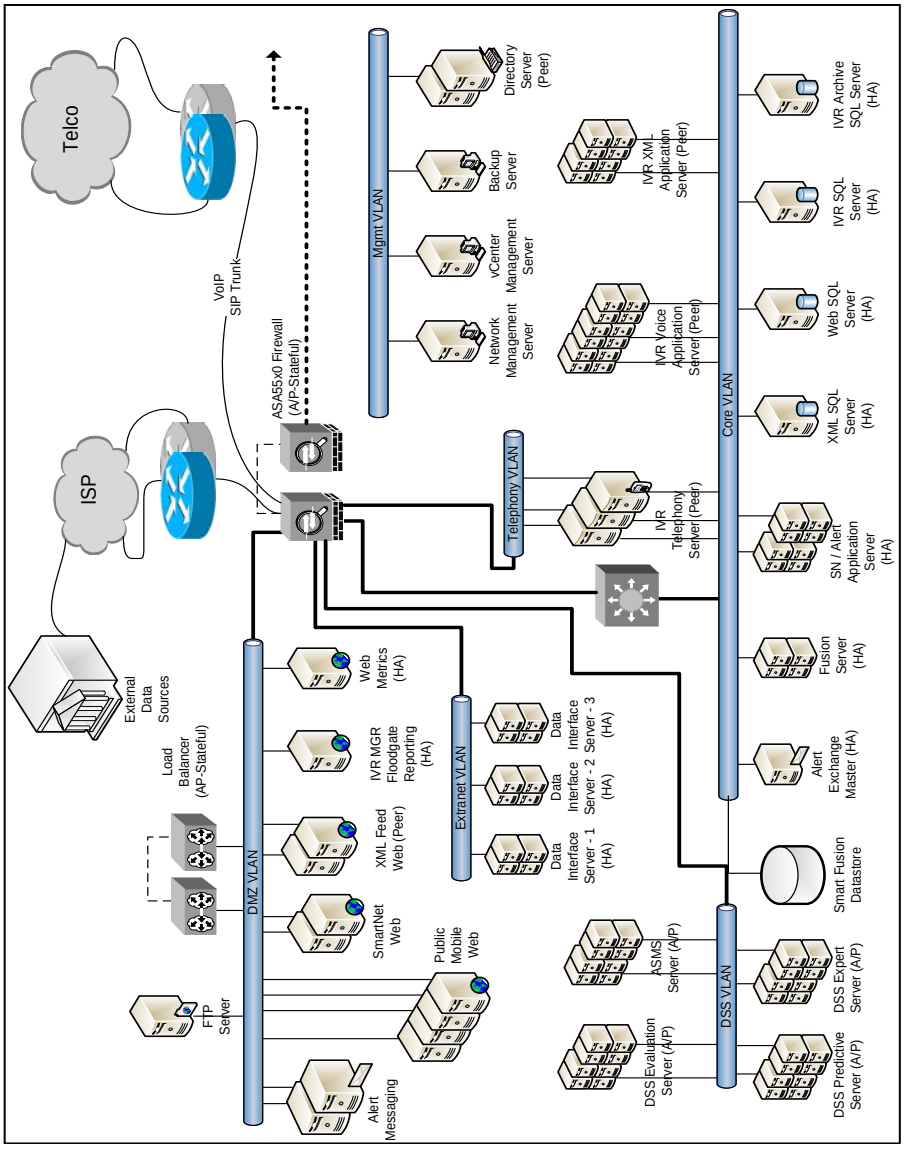

Figure 14: Conceptual Physical Architecture (Physical and Virtual Servers)

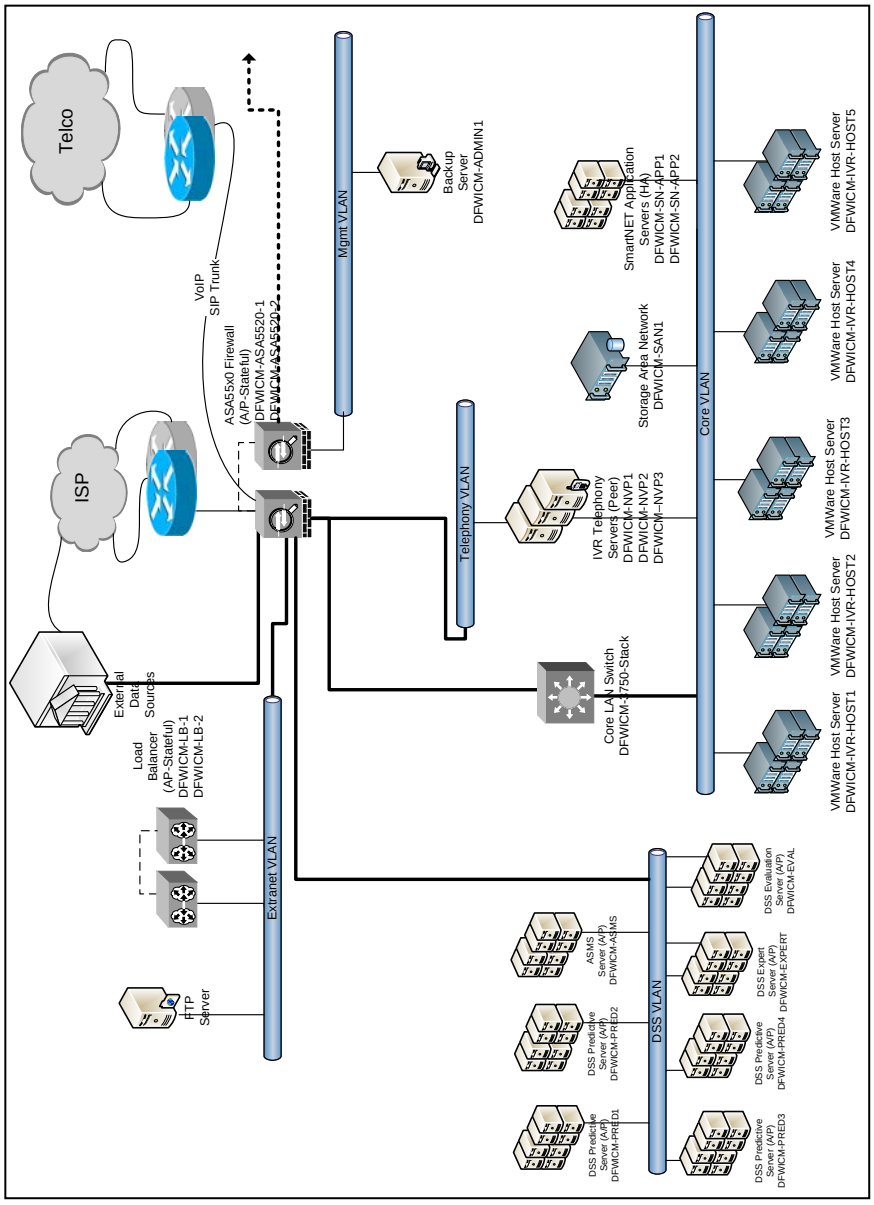

Figure 15: ICM Physical Architecture

3.12.2 COTS Software and Hardware

The ICMS uses many COTS software and hardware products as part of the underlying physical architecture.

3.12.2.1 Decision Support Subsystem

The Decision Support Subsystem will utilize the following COTS products:

- Windows Server Operating Systems – Server Operating System;
- Windows Workflow Foundation – Rules Engine;
- SQLite – Provide Database for the DSS.

3.12.2.2 SmartNET/ SmartFusion Subsystem

The SmartNET/ SmartFusion subsystems utilize the following COTS products:

- SmartNET™ – Web-based information exchange and management tool;
- Windows Server Operating Systems – Server operating system;
- Windows SQL Server – Database software;
- Microsoft IIS – Web server software;
- Oracle Weblogic – JMS application software;
- Geoserver – GIS mapping engine;
- Apache – SmartNET GUI webserver software.

3.12.2.3 Network Management

The ICMS Network Management and Administration Servers utilize the following COTS products:

- BackupExec – Provides back-up and restore capabilities for all servers;
- Symantec Endpoint AV – Provides anti-virus capabilities for all servers;
- WhatsUpGold – Provides network and application monitoring software;
- VMWare – Provides virtualization of hardware servers.

3.12.2.4 Maintenance Management

Remote access to the system is provided through use of Cisco IPSec VPN client sessions and typically uses RealVNC Enterprise Edition that provides encryption and Windows integrated authentication as the remote access application. The ICMS Maintenance Management will utilize the following COTS products:

- RealVNC Enterprise Edition – Provides remote control and access of servers.

3.12.2.5 Security Management

Security implementation is achieved with Windows Active Directory being utilized for server authentication, and SQL authentication for SQL client access. In addition, encryption is provided via HTTPS protocols and a single login and password can only be logged into the system once. The ICMS security management utilizes the following COTS products:

- Windows Active Directory – Provides domain control authentication and authorization for system.

3.12.3 Hardware Components

The hardware components provided for the ICMS hosting facility are listed in the following table.

Table 1: ICMS Hardware Physical Components

Device Number	System Name	System Function	COTS	Description
30001	DFWICM-3750-Stack	Core LAN Switch	N/A	Cisco 3750G
30003	DFWICM -ASA5520-1	Firewall	N/A	Cisco ASA5520
30004	DFWICM -ASA5520-2	Firewall	N/A	Cisco ASA5520
30005	DFWICM -LB-1	Load Balancer	N/A	Barracuda
30006	DFWICM -LB-2	Load Balancer	N/A	Barracuda
30008	DFWICM -M8024-1	iSCIS Storage Switch	N/A	PowerConnect 8024F, 24 10 GbE SFP+ Ports, Four Combo Ports
30009	DFWICM -M8024-2	iSCIS Storage Switch	N/A	PowerConnect 8024F, 24 10 GbE SFP+ Ports, Four Combo Ports
100003	DFWICM -ADMIN1	Backup Server	Windows 2008 server R2 Symantec Antivirus RealVNC Symantec BackupExec	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100019	DFWICM -SN-APP1	SmartNET Application Server	Windows 2008 server R2 Symantec Antivirus RealVNC WebLogic	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100020	DFWICM -SN-APP2	SmartNET Application Server	Windows 2008 server R2 Symantec Antivirus RealVNC WebLogic	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100028	DFWICM -IVR-NVP1	Nuance NVP Server	Windows 2008 server R2 Symantec Antivirus RealVNC Nuance NVP	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100029	DFWICM -IVR-NVP2	Nuance NVP Server	Windows 2008 server R2 Symantec Antivirus RealVNC Nuance NVP	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem

Device Number	System Name	System Function	COTS	Description
100030	DFWICM -IVR-NVP3	Nuance NVP Server	Windows 2008 server R2 Symantec Antivirus RealVNC Nuance NVP	R710 Intel Xeon X5660, 2.8Ghz, 24 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100061	DFWICM -VM-HOST1	VMWare Host Server	VMware ESX5	R710 Intel Xeon X5660, 2.8Ghz, 96 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100062	DFWICM -VM-HOST2	VMWare Host Server	VMware ESX5	R710 Intel Xeon X5660, 2.8Ghz, 96 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100063	DFWICM -VM-HOST3	VMWare Host Server	VMware ESX5	R710 Intel Xeon X5660, 2.8Ghz, 96 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100064	DFWICM -VM-HOST4	VMWare Host Server	VMware ESX5	R710 Intel Xeon X5660, 2.8Ghz, 96 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
100065	DFWICM -VM-HOST5	VMWare Host Server	VMware ESX5	R710 Intel Xeon X5660, 2.8Ghz, 96 GB RAM 12M Cache, Turbo, HT, 1333MHz Max Mem
30007	DFWICM -SAN1	Storage Area Network		Dell EqualLogic PS6010XV, 10Gbe, High Performance, 15K SAS Drives (224-7558) 16x600GB
10052	DFWICM – PRED1	Prediction Server	Windows 2008 server R2 Microsoft SQL Server DIRECT	
10053	DFWICM – PRED2	Prediction Server	Windows 2008 server R2 Microsoft SQL Server DIRECT	
10054	DFWICM – PRED3	Prediction Server	Windows 2008 server R2 Microsoft SQL Server DIRECT	
10055	DFWICM – PRED4	Prediction Server	Windows 2008 server R2 Microsoft SQL Server	

Device Number	System Name	System Function	COTS	Description
			DIRECT	
10056	DFWICM - EXPERT	Expert Rules	Windows 2008 server R2 Microsoft SQL Server Windows Workflow Foundation	
10057	DFWICM - EVAL	Evaluation Server	Windows 2008 server R2 Microsoft SQL Server	
10058	DFWICM - ASMS	Arterial Street Monitoring	Windows 2008 server R2 Microsoft SQL Server	

Table 2: ICMS Hardware Virtual Components – VMWare Servers

Device Number	System Name	System Function	COTS
100001	DFW511-ADC1	Windows Domain Controller	Windows 2008 server R2 Symantec Antivirus RealVNC
100002	DFW511-ADC2	Windows Domain Controller	Windows 2008 server R2 Symantec Antivirus RealVNC
100004	DFW511-VCENTER	VMware vCenter Manager	Windows 2008 server R2 Symantec Antivirus RealVNC
100005	DFW511-NET-MON	SNMP Management Server	Windows 2008 server R2 Symantec Antivirus RealVNC WhatsUp Gold
100006	DFW511-MGMT-MON	Network Management Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100007	DFW511-DI1	Data Interface Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100008	DFW511-DI2	Data Interface Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100009	DFW511-DI3	Data Interface Server	Windows 2008 server R2 Symantec Antivirus RealVNC

Device Number	System Name	System Function	COTS
100010	DFW511-PW1	Public Web, Mobile Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100011	DFW511-PW2	Public Web, Mobile Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100012	DFW511-PW3	Public Web, Mobile Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100013	DFW511-PW4	Public Web, Mobile Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100014	DFW511-XML-WEB1	XML Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100015	DFW511-XML-WEB2	XML Web	Windows 2008 server R2 Symantec Antivirus RealVNC
100016	DFW511-SN-WEB1	SmartNET Web	Windows 2008 server R2 Symantec Antivirus RealVNC Apache
100017	DFW511-SN-WEB2	SmartNET Web	Windows 2008 server R2 Symantec Antivirus RealVNC Apache
100018	DFW511-WEB-MON	Web Metrics	Windows 2008 server R2 Symantec Antivirus RealVNC
100021	DFW511-FUSION	Data Fusion Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100022	DFW511-FUSION-DATA	Data Fusion Archive Repository	Windows 2008 server R2 Symantec Antivirus RealVNC
100023	DFW511-XML-SQL	XML SQL Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS SQL

Device Number	System Name	System Function	COTS
100024	DFW511-WEB-SQL	Web SQL Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS SQL
100025	DFW-ALERT-EXCH	My511 Alert Messaging Master Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS Exchange
100026	DFW511-ALERT-EDGE1	My511 Alert Messaging Edge Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS Exchange
100027	DFW511-ALERT-EDGE2	My511 Alert Messaging Edge Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS Exchange
100031	DFW511-IVR-VS1	IVR Voice Server	Windows 2008 server R2 Symantec Antivirus RealVNC Apache TomCat
100032	DFW511-IVR-VS2	IVR Voice Server	Windows 2008 server R2 Symantec Antivirus RealVNC Apache TomCat
100033	DFW511-IVR-VS3	IVR Voice Server	Windows 2008 server R2 Symantec Antivirus RealVNC Apache TomCat
100034	DFW511-IVR-XML1	IVR XML Server	Windows 2008 server R2 Symantec Antivirus RealVNC Apache TomCat
100035	DFW511-IVR-XML2	IVR XML Server	Windows 2008 server R2 Symantec Antivirus RealVNC Apache TomCat

Device Number	System Name	System Function	COTS
100036	DFW511-IVR-SQL	IVR SQL Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS SQL
100037	DFW511-IVR-ARCH	IVR Archive SQL Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS SQL
100039	DFW511-DI-P	Pre-Production Data Interface Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100040	DFW511-PW-P	Pre-Production Public Web Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100041	DFW511-XML-WEB-P	Pre-Production XML Web Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100042	DFW511-SN-WEB-P	Pre-Production SmartNET Web Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100043	DFW511-SN-APP-P	Pre-Production SmartNET Application Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100044	DFW511-FUSION-P	Pre-Production Fusion Application Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100045	DFW511-SQL-P	Pre-Production SQL Server	Windows 2008 server R2 Symantec Antivirus RealVNC MS SQL
100046	DFW-ALERT-EXCH-P	Pre-Production My511 Alert Master Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100047	DFW511-ALERT-EDGE-P	Pre-Production My511 Alert Edge Server	Windows 2008 server R2 Symantec Antivirus RealVNC

Device Number	System Name	System Function	COTS
100048	DFW511-IVR-NVP-P	Pre-Production NVP Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100049	DFW511-IVR-VS-P	Pre-Production Voice Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100050	DFW511-IVR-XML-P	Pre-Production XML Server	Windows 2008 server R2 Symantec Antivirus RealVNC
100051	DFW511-IVR-MGR	IVR Floodgate / Reporting Manager	Windows 2008 server R2 Symantec Antivirus RealVNC
100052	DFW511--OM-EXCH	O&M Exchange Server	Windows 2008 server R2 Symantec Antivirus RealVNC

3.12.4 Software Components

The software components provided for the ICMS hosting facility are listed in the following table.

Table 3: ICMS Software Components

Name	Functions	Capabilities	Source (manufacturer)
HTTP Server Software	Open-source HTTP server	Provide web interface function for ICMS	Apache Tomcat
Java Application Server Software	Open-source Java application server	Provide Java based application support	Red Hat JBoss
Monitoring Software	Monitoring and Alarms	Provide monitoring of system health and operation of the ICMS	Ipswitch WhatsUp Gold
E-mail server software	E-mail server	Provide E-mail function for sending alerts e-mails to users	Microsoft Exchange Server
Database software	Database	Provide database function for ICMS	Microsoft SQL Server
C2C Adapter Software	C2C Adapter	Provide JMS Capabilities for SmartNET	Apache ActiveMQ

Name	Functions	Capabilities	Source (manufacturer)
Webserver Software	WebServer	Provide web interface function for ICMS	Oracle Weblogic
Fail-over software	Automated Fail-over	Provide Fail-over for servers between primary and back-up servers	VMWare
Disaster Recovery Software	High Availability and Disaster Recovery	Provide high availability software and disaster recovery software for any Windows-based application	VMWare
Back-up and Recovery software	File Backup and Recovery	Provide Backup and Recovery for all files on the ICMS servers	Symantec BackupExec Agent
Anti-Virus software	Anti-Virus	Provide Anti-Virus protection of all servers	Symantec Norton AV
Information Exchange Software – SmartNET	Information Exchange Interface/ GUI	Provide Information Exchange, monitoring and management of incidents, construction and special events	Telvent SmartNET
Expert System Software	Decision Support Rules Engine	Provide Decision Support Rules Engine for selection or response plans based on conditions system and criteria of stakeholders	Microsoft Workflow Foundation
Server Operating System	Server Operating System	Provide Operating System for all ICMS related servers	Microsoft Windows Server
GIS based layer software	Display of layers on GIS map	Provide geo-coded display of layers onto the Google map	Geoserver
Prediction Software	Prediction Software	Provide prediction of ICMS traffic network condition for 30 minutes into the future	DIRECT

3.12.5 Security

User authentication and authorization is done at multiple levels within the ICMS, a single sign-on is not being used. For the SmartNET interface, the user authentication and authorization is done within the program through the use of the database.

For system administration functions, Windows Directory Services are used to provide server authentication and authorization for system maintenance and configuration.

XML Feeds will use software based security (login and password) compared to a database table of accepted logins and passwords.

4 Detailed System Design

This system design provides a description of the ICMS subsystem components, subsubsystem components, and processes within those components in a hierarchical representation. It describes system functions and interactions using unified modeling language use case diagrams, sequence diagrams, and class diagrams as necessary to understand the requirements of the ICMS.

Use case diagrams are used to describe both the functional needs from an external user or external system perspective and the functional needs of an internal system component. The use of use cases in the system design is to the extent of the need for the design and development team to understand system needs.
While use cases depict system needs, sequence diagrams depict the order in which a system need is carried out. Sequence diagrams can be illustrated at a high level where components may already exist and need to be integrated, or at a more detailed level where new components must be developed and therefore low level functions need to be understood.

In cases where new development is necessary, the design and development team uses class diagrams to show class or object level relationships and the methods and attributes they contain.

Subsystem level components including DSS, SmartFusion, and SmartNET are described at a higher level with subsubsystem level components being described at a lower level.

The U.S. National ITS Architecture document describes services in market package representations. Examples of market packages include transit signal priority, transit vehicle tracking, broadcast traveler information, dynamic route guidance, network surveillance, regional traffic management, and others. These market packages are organized into service areas. Using the concept of “use cases” these services areas could be depicted as shown below.

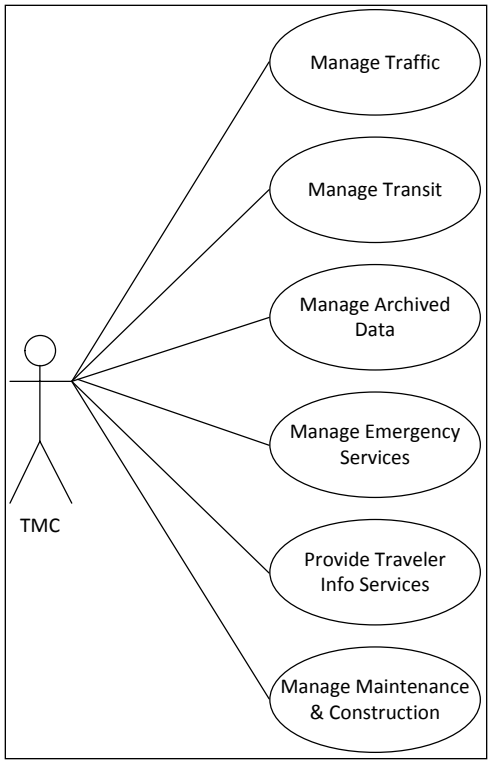

Figure 16: ITS Use Case Overview

Within the service area of traffic management there is a market package for "Traffic Decision Support and Demand Management" labeled ATMS09. The National ITS Architecture states the following:

"This market package recommends courses of action to traffic operations personnel based on an assessment of current and forecast road network performance. Recommendations may include predefined incident response plans and regional surface street and freeway control strategies that correct network imbalances. "

The US-75 ICM Corridor concept of operations, requirements, and design documents take this same approach.

4.1 Subsystem Components

The subsystem components as referenced in the High-Level ICMS Conceptual Diagram, Figure 1, represent the highest level processes in the ICMS which include the decision support, SmartFusion, and SmartNET subsystems.

The following sections detail each ICMS subsystem component and each associated subsubsystem component.

4.2 Decision Support Subsystem

The decision support subsystem (DSS) provides candidate response plans to the SmartFusion subsystem based on network conditions received from the SmartFusion subsystem, prediction analysis, and on a rule-based assessment of the recommended response plans. The subsystem consists of three major components:

- Expert rules subsubsystem;
- Prediction subsubsystem; and
- Evaluation subsubsystem.

4.2.1 Inputs/Outputs

Current network conditions data such as highway link speeds and volumes, arterial speeds, and event data will be provided by the data dissemination subsubsystem.

Recommended response plans will be provided to the plan decision subsubsystem for distribution to agency users.

4.2.1.1 Data Stores

The DSS data store include the Evaluation data store. This is short term storage used by the software during the exchange of data, the Data Store Subsubsystem will store all of this information for longer term storage.

4.2.1.2 Dependencies/Constraints

- All current network data for the transportation system performance and operations will be provided by the SmartFusion Subsystem;
- Static data for network representation, rules, and other parameters will be updated periodically in the DSS.

4.2.1.3 Use Case Diagram

The use case below illustrates the basic high level activities of the DSS Subsystem.

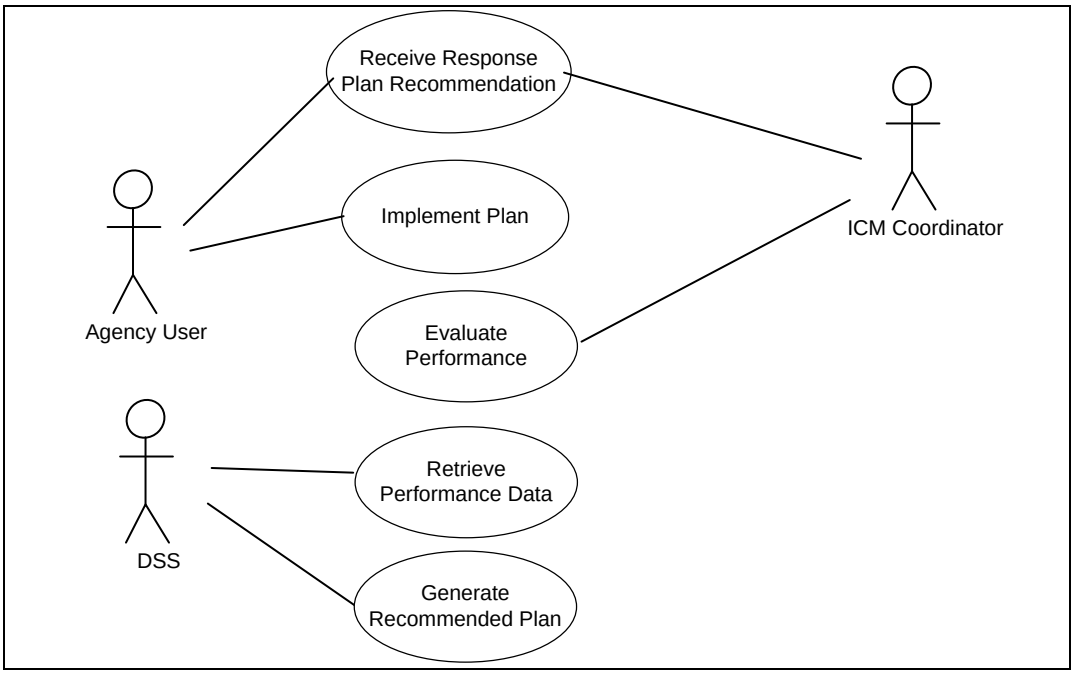

Figure 17: DSS Subsystem Use Case Diagram

This use case includes the following activities:

- Receive response plan recommendation – Response plan is generated by the DSS and provided to the ICM coordinator and agency users through the SmartNET subsystem, and more specifically the plan decision dialogue subsubsystem.
- Implement plan – The agency user will be notified to implement a recommended plan once the ICM Coordinator approves the plan. The Agency User will utilize their own systems to implement the plan, and will use the ICM System to document the actions taken.
- Evaluate performance – The DSS develops metrics that represent the performance of the ICM system and provides it to the ICM coordinator.
- Retrieve performance data – The DSS will retrieve performance data including current network conditions from the SmartFusion subsubsystem.
- Generate recommended plan – The DSS will generate recommended response plans based on performance data and prediction analysis.

Table 4: Decision Support Subsystem Use Case Description

Use Case ID	1.1.1.01
Description	The Decision Support Subsystem produces candidate recommended response plans for the ICM Coordinator based on existing and predicted roadway network conditions.
Actors	ICM Coordinator and Agency Users
Preconditions	ICM Coordinator and Agency Users are authenticated users. The SmartNET system is collecting and fusing roadway data.
Post Conditions	Recommended response plan is generated and provided to TMC operators for implementation.
Normal Course of Events	1. Expert Rules Subsubsystem receives roadway network conditions data from SmartFusion. 2. Prediction Subsubsystem uses roadway conditions data to assess existing roadway conditions and predict the impact of candidate response plans. 3. Expert Rules Subsubsystem generates a recommended response plan 4. Expert Rules Subsubsystem DSS distributes recommended response plan to the Plan Decision Dialogue Subsubsystem for distribution to the Agency operators via the SmartNET Subsystem.

4.2.1.4 Sequence Diagram

The following sequence diagram describes the exchange of information between the Decision Support Subsystem and the SmartFusion and SmartNET Subsystems.

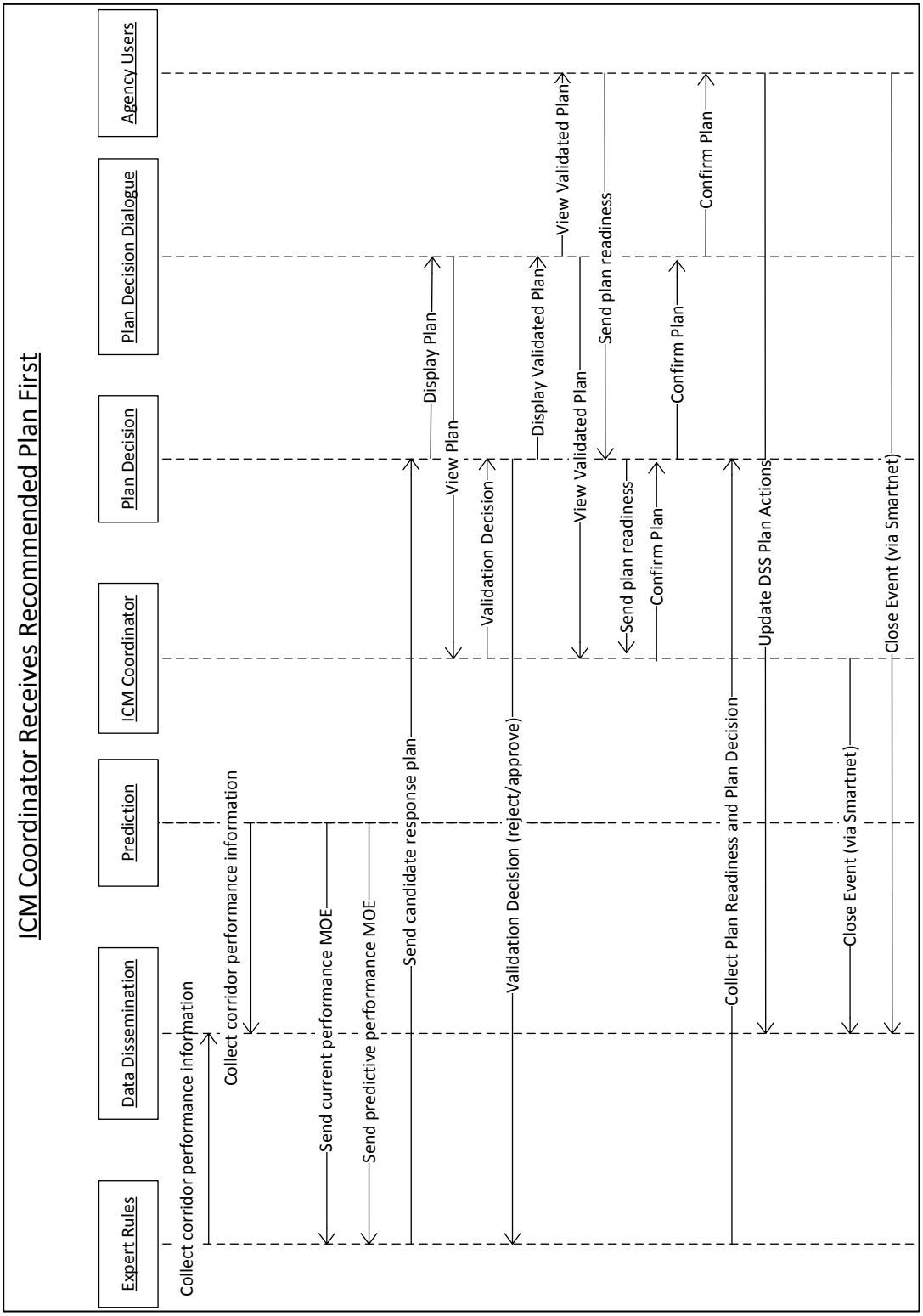

Figure 18: DSS Sequence Diagram

In response to an incident the process begins with the expert rules and the prediction subsubsystems collecting information on corridor performance and incidents from the data dissemination subsubsystem. This is fused data collected from many sources.

Since the prediction subsubsystem's model and analysis techniques use a network representation that is different from the fused data stored in the data dissemination subsubsystem, the prediction subsubsystem transforms some elements of the data.

The prediction subsubsystem develops an assessment of the current roadway operations based on the data received from the data dissemination subsubsystem. In addition, the prediction subsubsystem periodically forecasts the current and predicted performance of the network based on the current conditions and sends them to the expert rules subsubsystem.

Given the information about the current conditions of the network and the predicted performance of the network, the expert rules subsubsystem develops candidate response plans that are delivered to the ICM coordinator via the plan decision. The Plan decision subsubsystem assigns a SmartNET ID to the candidate response plan. These candidate response plans are generated based on expert knowledge provided by local traffic engineers.

The ICM coordinator approves or rejects the candidate response plan from the recommendation of the expert rules subsubsystem. This validation decision is sent to the expert rules subsubsystem via the plan decision subsubsystem.

If the validation decision is approved by the ICM coordinator, then the plan decision subsubsystem pushes candidate response plan information to the plan decision dialogue subsubsystem.

The plan decision dialogue subsubsystem displays the validated response plan to the involved agency users.

The plan decision subsubsystem collects plan readiness from each agency user.

The ICM coordinator receives the plan readiness information and confirms the plan decision via the plan decision dialogue subsubsystem.

The plan decision dialogue subsubsystem sends the plan decision confirmation to each of the agency users for plan implementation.

The Expert Rules Subsubsystem collects the users plan readiness status and plan decision from the plan decision subsubsystem.
After implementing the ICM coordinator’s plan decision, each agency user confirms the plan’s operational status.

The plan is terminated once the event owner agency user or the ICM coordinator close the event in SmartNET.

4.2.1.5 Process View

The following diagram provides a process flow view of the DSS. This view provides a high-level overview of the process utilized by the DSS in determining a response plan, the steps and actions by the ICM Coordinator, and Agency Users during the entire workflow from beginning of an incident to the closure of the incident.

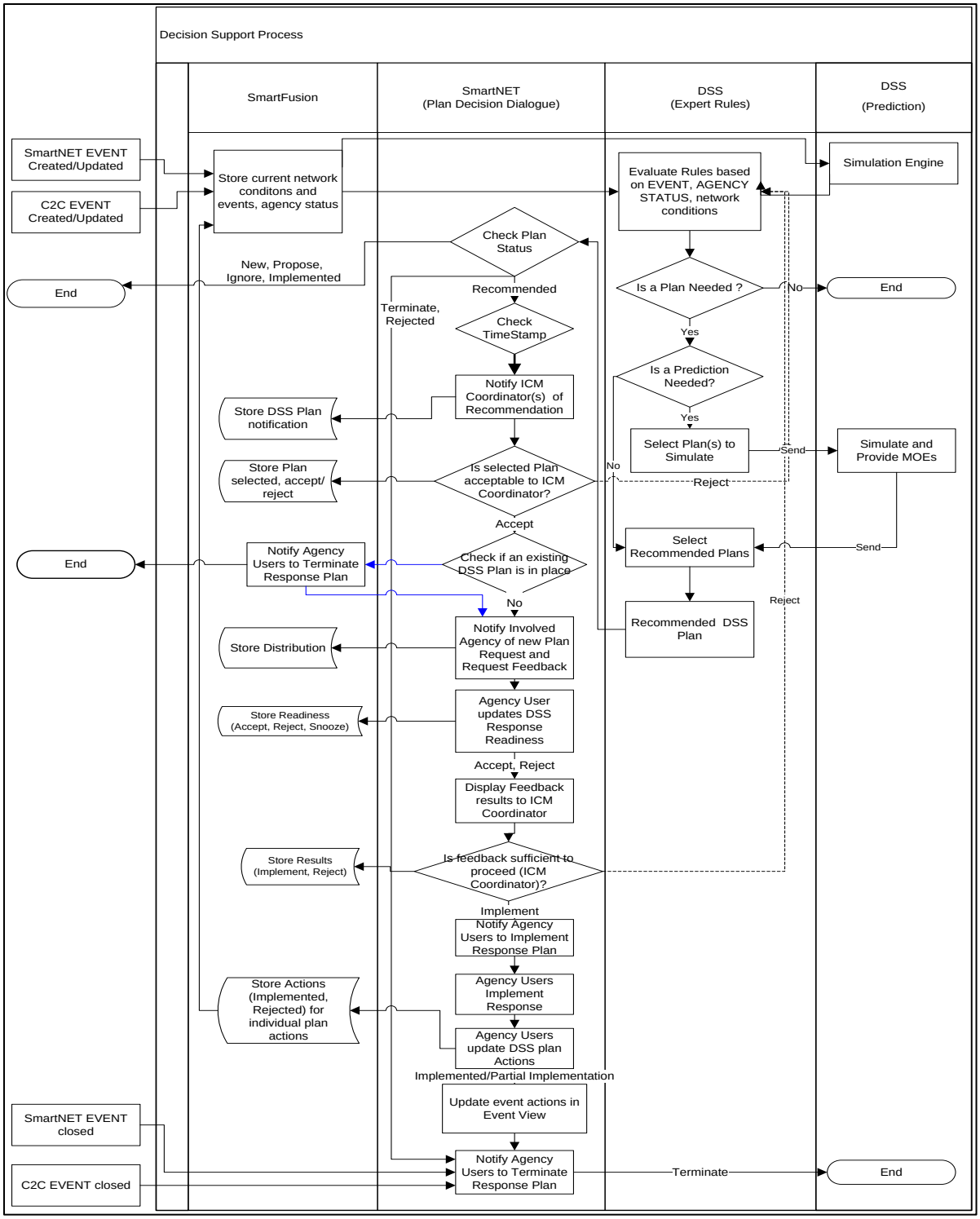

Figure 19: Decision Support Process View

4.3 Expert Rules Subsubsystem

The expert rules subsubsystem provides the logical engine of rules selection for the decision support subsystem (DSS). The primary software component of the expert rules subsubsystem is the DSS manager. The DSS manager is essentially the liaison between the data dissemination subsubsystem, the prediction subsubsystem, and the rules engine software component. The expert rules subsubsystem provides recommended response plans based on network conditions, predicted conditions, and a defined set of rules.

The expert rules subsubsystem begins with an assessment of existing roadway conditions. It develops that assessment based on monitoring of incidents through the SmartFusion subsystem and through monitoring of roadway conditions (such as speeds). This assessment of roadway conditions is also used by the prediction subsubsystem running the DIRECT software. The DIRECT software is continually developing estimates of current system performance. It is also predicting future performance of the system based on continued operation of the current operational strategies. Candidate response plans may also be evaluated using the DIRECT software. The expert rules subsubsystem selects the recommended response plans based on existing roadway conditions, predicted future system performance, and potentially the predicted performance of candidate response plans.

Once a recommended candidate response plan has been developed and authorized by the ICM coordinator that decision is communicated to agency users through the plan decision dialogue subsubsystem via the plan decision subsubsystem.

4.3.1 Inputs/Outputs

Current network conditions data such as highway link speeds and volumes, arterial speeds, and event data will be provided by the data dissemination subsubsystem.

Recommended response plans will be provided to the plan decision subsubsystem for distribution to agency users.

4.3.1.1 Data Stores

Expert rules data store – contain the rules, static plan information, and static network data.

4.3.1.2 Dependencies/Constraints

All current network data for transportation system performance and operations will be provided by the SmartFusion subsystem.

Static data for the network representation, rules, and other parameters will be updated periodically in the decision support subsystem.

4.3.1.3 Use Case Diagram

The use case below illustrates the basic high level activities of the expert rules subsubsystem.

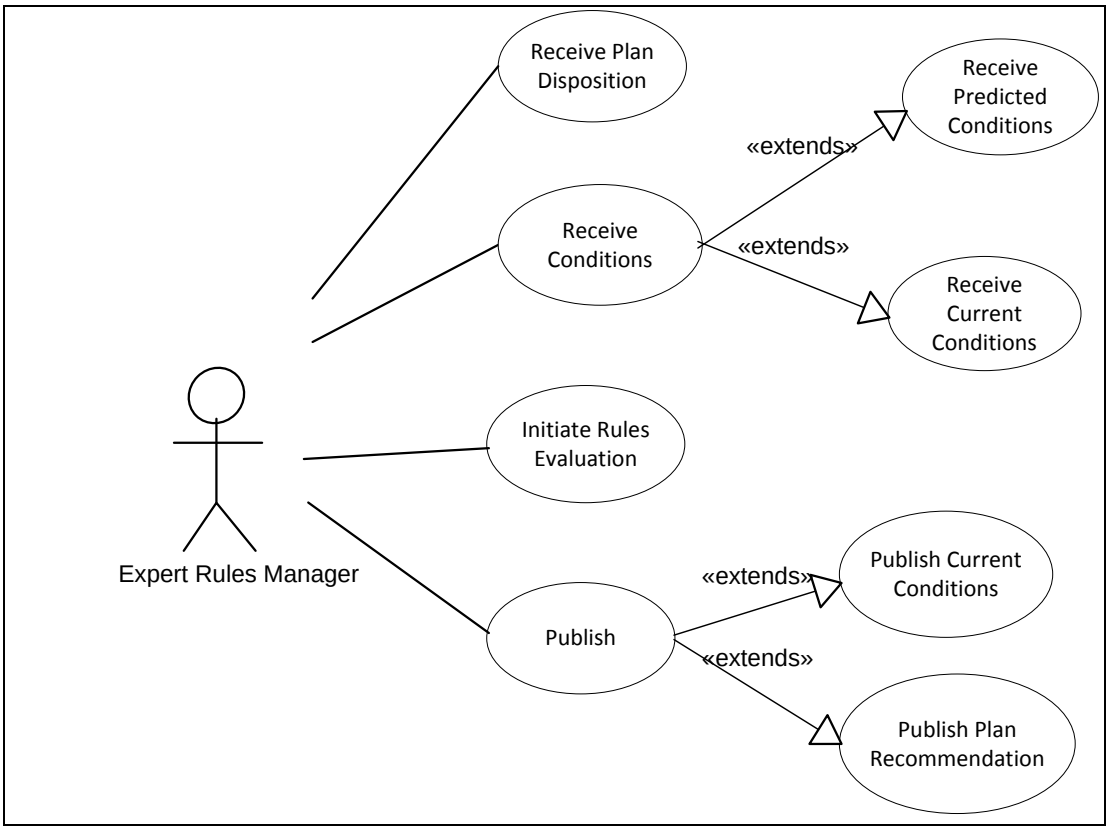

Figure 20: Expert Rules Subsubsystem Use Case Diagram

- Receive Current Conditions – the expert rules manager software component receives current conditions published by the data dissemination subsubsystem. The receipt of new data initiates evaluation of the rules which may then result in the recommendation of a response plan.
- Publish Supplemental Data – Upon receiving current conditions from the data dissemination subsystem, the expert rules manager software component will publish supplemental data needed for the prediction subsubsystem such as direction on how model parameters are to be applied for the rules that are being evaluated.
- Receive Predicted Conditions – the expert rules manager software component periodically receives predicted conditions from the prediction subsubsystem. The receipt of predicted conditions initiates evaluation of the DSS rules which may then result in the recommendation of a response plan. Predicted conditions are stored for later consumption by the evaluation subsubsystem.
- Initiate Rules Evaluation – having received new data or new predicted conditions, the expert rules manager software component initiates the rules engine which evaluates pertinent rules. The rules evaluation may, or may not, result in a plan recommendation.
- Publish Plan Recommendation – when a response plan recommendation is generated by the rules engine, the plan is published to the plan decision subsubsystem by the expert rules manager software component.

- Receive Plan Disposition – the expert rules manager software component receives information from the data dissemination subsubsystem which indicates whether or not the response plans recommended by the DSS were implemented or rejected.

4.3.1.4 Sequence Diagram

The following sequence diagram provides the sequences of steps that demonstrate a typical response plan initiation and recommendation based on the current conditions of the network, pre-defined rules, and pre-agreed response plans.

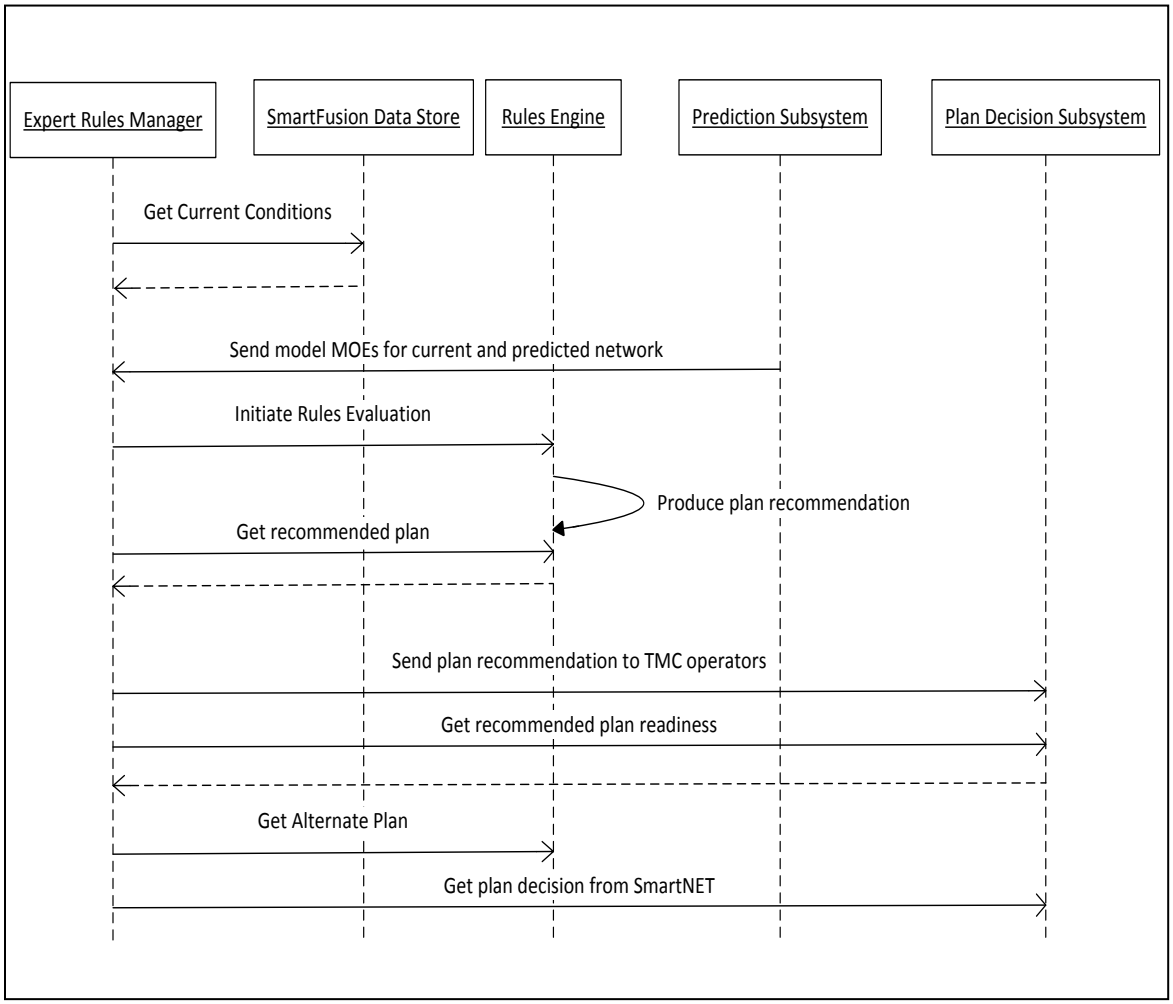

Figure 21: Expert Rules Sequence Diagram

4.4 Prediction Subsubsystem

The prediction subsubsystem provides prediction of the transportation network within the US-75 corridor and influence area. The prediction subsubsystem will utilize the DIRECT model software component to predict the conditions of the transportation network. Three instances of the DIRECT

model software component are planned including a model of the current conditions, a model of the future conditions (30 minutes) without any strategies implemented, and finally a model of the future conditions (30 minutes) with response strategies.

4.4.1 Inputs/Outputs

Inputs include static data from the DIRECT model and static data from the data store subsubsystem.

Outputs include direct model runs that are provided to the expert rules subsubsystem.

4.4.1.1 Data Stores

Prediction data store consists of the DIRECT model which contains static network data, behavioral data including driver diversions.

4.4.1.2 Dependencies/Constraints

The prediction subsubsystem will use the DIRECT model validated during Stage 3 of the ICMS project.

4.4.1.3 Use Case Diagram

The following use case diagram illustrates the major activities of the prediction subsubsystem.

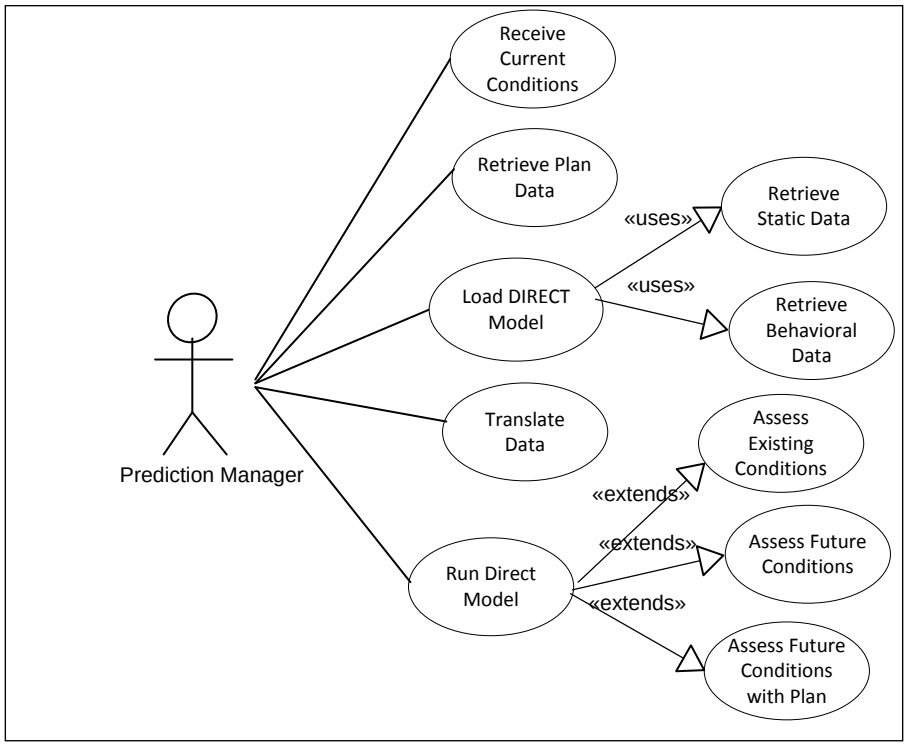

Figure 22: Prediction Subsubsystem Use Case Diagram

- Receive Current Conditions – The prediction subsubsystem receives dynamic data such as link speeds and incident data from the fused data in the SmartFusion subsystem using the data dissemination subsubsystem.
- Retrieve Plan Data – The prediction subsubsystem receives additional model parameters (such as recommended response plan and traffic signal plan the schedule) from the expert rules subsubsystem.
- Load DIRECT Model – The DIRECT model requires static data (such as a model specific network description), behavioral data (for instance to represent the amount of driver diversion based on reading a DMS sign), and current roadway conditions data. This function populates the DIRECT model with static, behavioral, and roadway conditions information.
- Retrieve Static Data – The DIRECT model-specific static data (such as the model network description) is retrieved from a data store within the prediction subsubsystem.
- Retrieve Behavioral Data – The DIRECT model-specific behavioral data (such as driver diversion based on traveler information) is retrieved from a data store within the prediction subsubsystem.
- Translate Data – Current conditions data (such as link speeds and incident data from the fused data in the SmartFusion subsystem) is translated to the specific network description and attribute configuration used by the DIRECT model.
- Run DIRECT Model – The prediction manager software component calls the DIRECT model to assess current and future conditions and future conditions if plan is enacted.
- Assess Existing Conditions – The DIRECT model is run to assess current conditions
- Assess Future Conditions – The DIRECT model is run to assess future conditions and using no additional response plans.
- Assess Future Conditions with Plan – The DIRECT model is run to assess future conditions and using the response plan provided by the expert rules subsubsystem.

Table 5: Prediction Subsubsystem Use Case Description

Use Case ID	1.1.3.01
Description	The prediction subsubsystem develops assessments of the existing travel corridor performance, the predicted travel corridor performance with no changes in system operations, and the predicted travel corridor performance with an implemented response plan.
Actors	Prediction Manager
Preconditions	1. The SmartFusion subsystem provides fused current roadway conditions data. 2. Model-specific static and behavioral data is stored within the prediction subsubsystem. 3. The expert rules subsubsystem develops response plan recommendations.
Post Conditions	The expert rules subsubsystem is provided an assessment of the existing and predicted travel corridor performance for use in response plan selection.
Normal Course of Events	1. Existing conditions data is collected from the data dissemination subsubsystem. 2. Additional data is collected from the expert rules subsubsystem. 3. The DIRECT model is populated with data. 4. The DIRECT model is run. 5. Results of the DIRECT model runs are provided to the expert rules subsubsystem.

4.4.1.4 Sequence Diagram

The following sequence diagram describes a high level sequence of activities performed by the prediction subsubsystem.

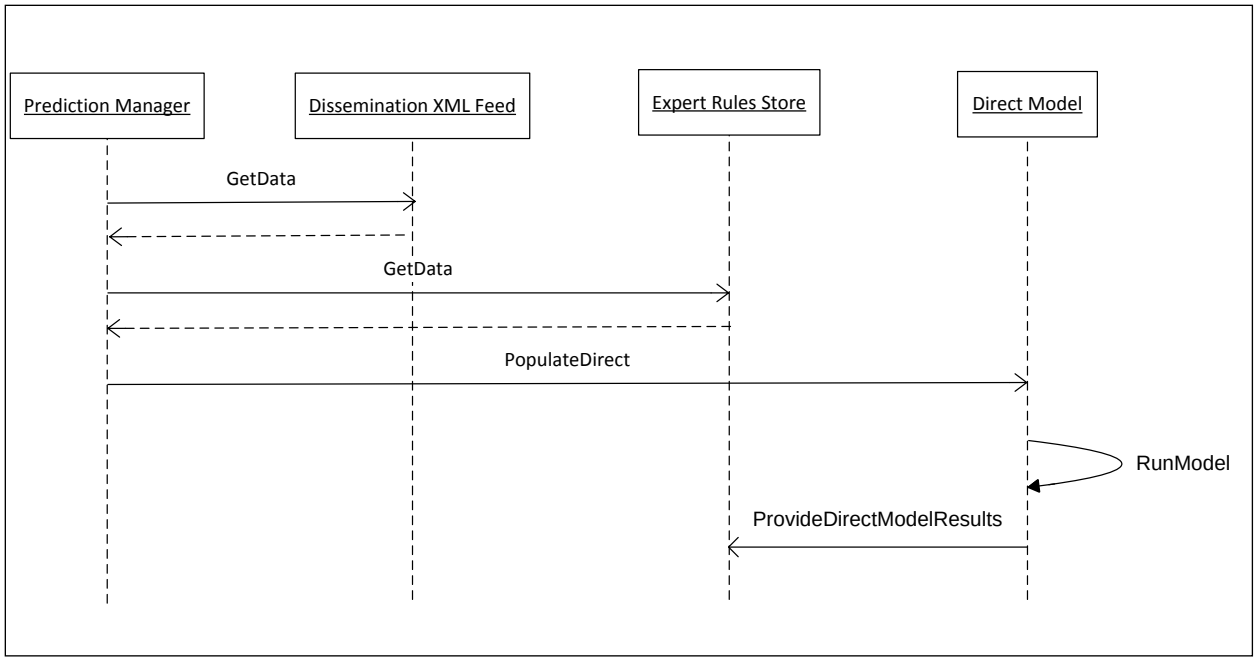

Figure 23: Prediction Subsubsystem Sequence Diagram

The following sequence of activities is performed to provide predicted information to the Expert Rules data store for use by the expert rules subsubsystem for plan recommendation.

1. The prediction manager software component retrieves data from the data dissemination subsubsystem (XML Feed.)
2. The prediction manger software component retrieves data from the expert rules data store.
3. The prediction manager software component sends a request to the DIRECT model in order to provide predicted, and rules data to the DIRECT model.
4. The DIRECT model is run based on predicted and rules data.
5. The model data is provided to the expert rules engine.

4.5 Evaluation Subsubsystem

The evaluation subsubsystem uses historical data, static network data, and real-time data to calculate the various measures of effectiveness that are used to evaluate the performance of the ICMS. Algorithms developed for the Stage 2 AMS will be utilized to evaluate the ICMS transportation network.

4.5.1 Data Stores

Evaluation data store – contains the past, current, and predicted network conditions, and plan decisions.

4.5.1.1 Use Case Diagram

The use case below illustrates the basic high level activities of the evaluation subsubsystem.

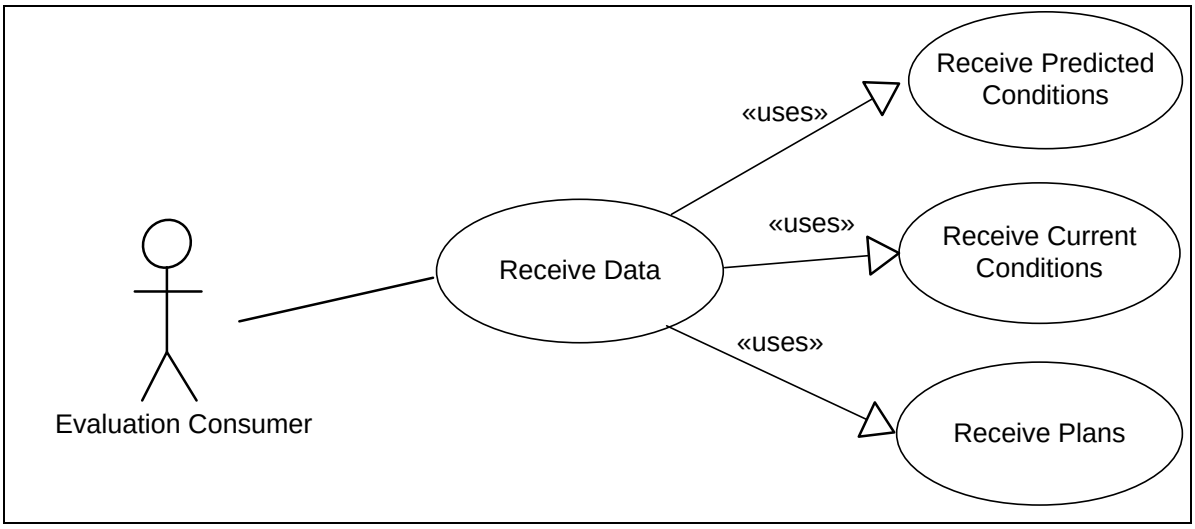

Figure 24: Evaluation Use Case

The Evaluation Subsubsystem retrieves historical data from several sources and makes it available to others for analysis.

- Receive Data - the evaluation subsubsystem provides a unified interface to evaluation consumers to receive data.
- Receive Predicted Conditions - at the request of an evaluation consumer, the evaluation subsubsystem retrieves stored prediction data
- Receive Current Conditions - at the request of an evaluation consumer, the evaluation subsubsystem retrieves current condition data from the data dissemination subsubsystem.
- Receive Plans - at the request of an evaluation consumer, the evaluation subsubsystem requests the disposition of response plans from the data store subsubsystem.

4.5.1.2 Sequence Diagram

The following sequence diagram describes a high level sequence of activities performed by the evaluation subsubsystem.

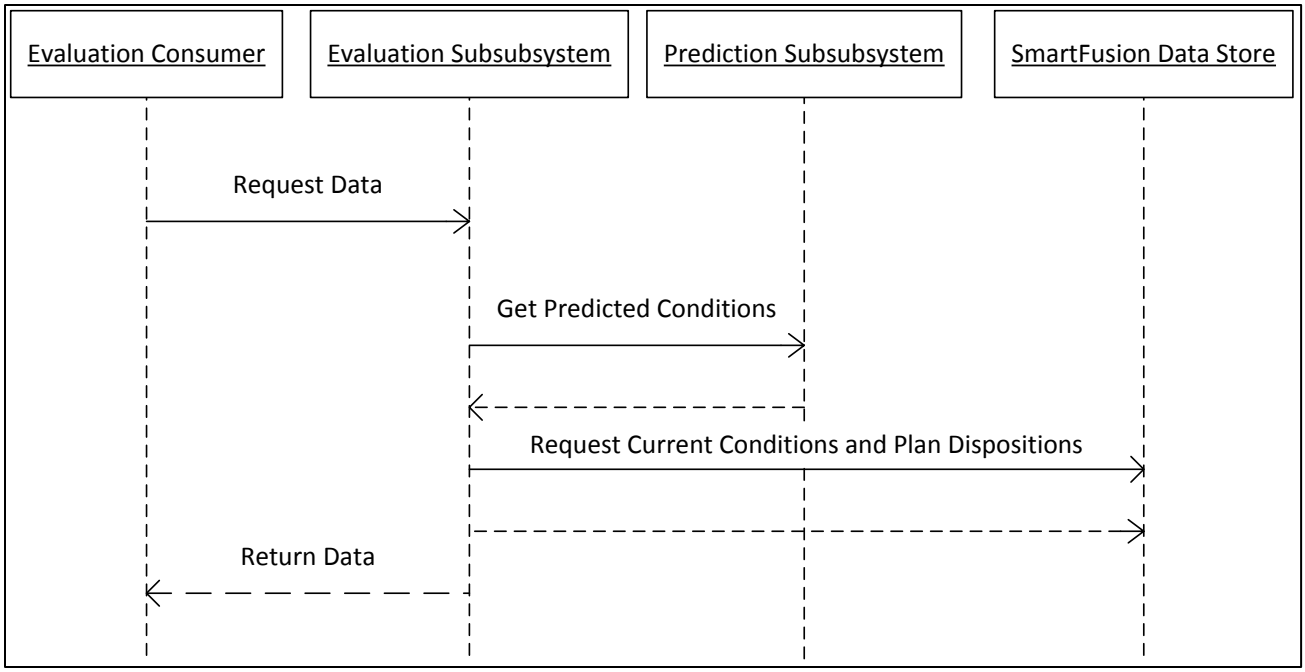

Figure 25: Evaluation Subsubsystem Sequence Diagram

The following sequence of activities is performed by the evaluation subsubsystem to evaluate plan response to existing conditions:

1. The evaluation software component (evaluation consumer) requests data from the evaluation subsubsystem .
2. The evaluation subsubsystem requests predicted conditions from the prediction subsubsystem .
3. The evaluation subsubsystem requests network conditions and plan dispositions from the SmartFusion data store subsubsystem.
4. The evaluation subsubsystem provides the evaluation consumer the results of the data requested.

4.6 SmartFusion Subsystem

The SmartFusion subsystem includes the underlying subsubsystems for collecting, fusing, disseminating, and storing data as well as relaying response plan recommendations and approvals. The following sections describe each of the components.

- Plan decision subsubsystem;
- Data dissemination subsubsystem;
- Data fusion subsubsystem;
- Data collection subsubsystem;
- Data store subsubsystem.

4.6.1 Use Case Diagram

The following use case diagram describes at a high level, the main activities performed by the SmartFusion subsystem.

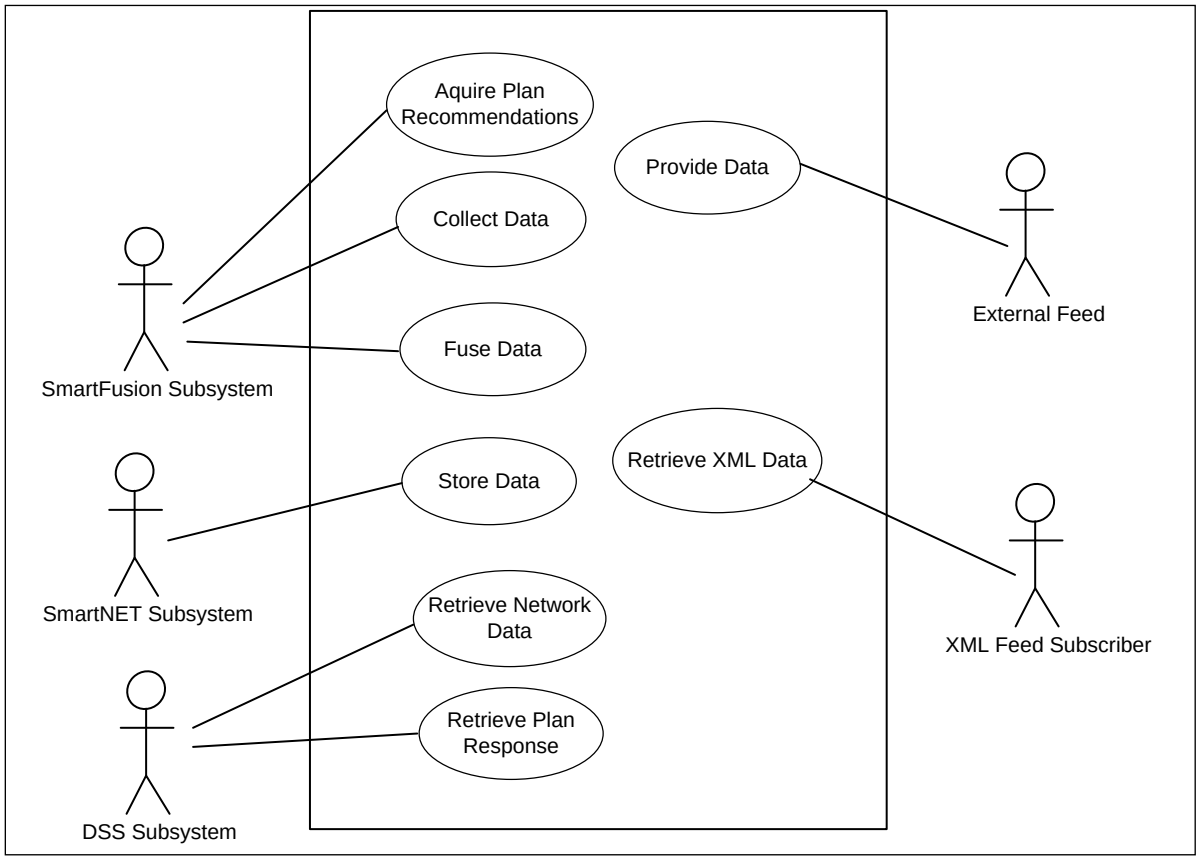

Figure 26: SmartFusion Subsystem Use Case Diagram

The following actors will utilize the SmartFusion subsystem:

- The SmartFusion subsystem itself is an actor since these functions are performed by the system being described.
- The SmartNET subsystem actors are the SmartNET GUI subsubsystem and plan decision dialogue subsubsystem interfaces that will store data and write data to the data fusion subsubsystem.
- The DSS subsystem actor retrieves current network data and retrieves response plan decisions from the SmartFusion subsystem.
- External feed actors provide data to the SmartFusion subsystem data collection interfaces.
- The XML feed subscriber retrieves XML data including events from the data dissemination subsubsystem.

The use case illustrated above represents basic functions of the SmartFusion subsystem which are described in more detail in the sections that follow.

4.6.2 Plan Decision Subsubsystem

The plan decision subsubsystem is the broker which supports creating events, alarms, and actions associated with response plan recommendations retrieved from the expert rules subsubsystem.

When the expert rules subsubsystem provides a plan recommendation via XML feed, based on network conditions, the plan decision subsubsystem is responsible for generating a SmartNET event which contains a reference to the plan recommendation based on a DSS transaction identifier. Agency users will have the ability to accept or reject plan recommendations and action records will be generated and provided to the expert rules subsubsystem.

Once conditions return to normal the plan will be removed from the expert rules subsubsystem plan recommendation list and the event will be subsequently removed from the data store subsubsystem database.

4.6.2.1 Inputs/Outputs

Inputs – Recommended response plan including a DSS transaction identifier, removal of DSS transaction identifier and associated plan once conditions return to normal.

Outputs –SmartNET event associated with the recommended response plan, plan responses (accept or reject from operators), and plan approval.

4.6.2.1.1 Data Stores

SmartNET Data Store – db_Event Object tblIncidentResponsePlan, tblevent and other associated tables.

4.6.2.1.2 Dependencies/Constraints

XML feed must be available to the plan decision subsubsystem from the expert rules subsubsystem. The plan decision subsubsystem must be authenticated.

4.6.2.1.3 Use Cases

The following use case illustrates the activities of the plan decision subsubsystem.

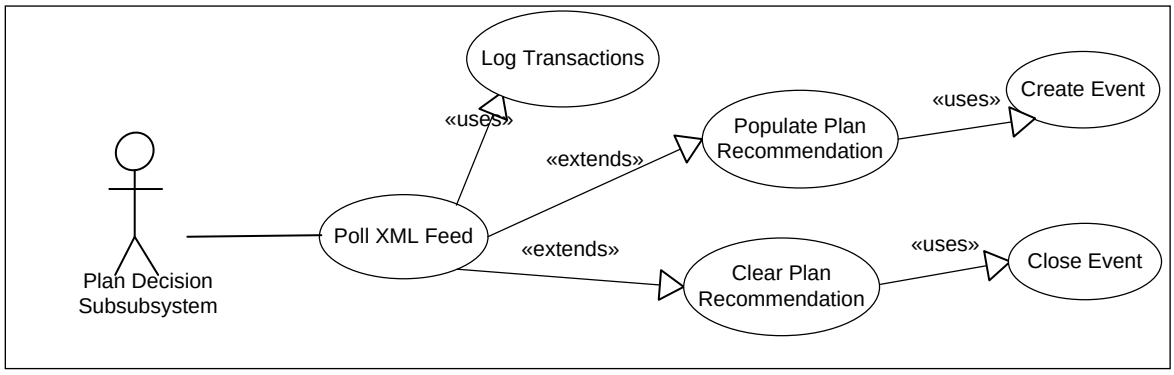

Figure 27: Plan Decision Subsubsystem Use Case Diagram

The plan decision subsubsystem polls the expert rules subsubsystem XML feed and creates or removes events associated with response plan recommendations.

- Poll XML Feed – The Plan Decision Subsubsystem polls the Expert Rules XML Feed to get an inventory of recommended response plans (response plan list).
- Log Transactions – All Plan recommendations added and removed are logged to a flat file.
- Populate Plan Recommendation – A Plan recommendation event is generated.
- Clear Plan Recommendation – A Plan recommendation event is cleared.
- Create Event – An event record is generated in the SmartNET database.
- Close Event – An event record is marked as closed in the SmartNET database.

Table 6: Plan Decision Use Case

Use Case ID	1.2.1.01
Description	The Plan Decision Subsubsystem retrieves response plan recommendations from the Expert Rules Subsubsystem based on existing and predicted roadway network conditions, and creates an associated event and alarm which it populates in the SmartNET database
Actors	Plan Decision Subsubsystem
Preconditions	The Plan Decision Subsubsystem is authenticated with the Expert Rules XML feed.
Post Conditions	Recommended response plans are available to SmartNET operators through the SmartNET GUI.
Normal Course of Events	1. The Plan Decision Subsubsystem retrieves the latest recommended response plan list from the Expert Rules Subsubsystem. 2. The Plan Decision Subsubsystem populates an event and alarm associated with the response plan. 3. The event is made available to SmartNET GUI operators.
Alternative Courses	1. The Plan Decision Subsubsystem retrieves the latest recommended response plan list from the Expert Rules Subsubsystem. 2. The Plan Decision Subsubsystem removes a recommended response plan which is no longer in the plan list.

4.6.2.1.4 Sequence Diagram

The Plan Decision sequence diagram illustrates the associated objects and ordered set of functions associated with receiving plan recommendations, creating incidents, and receiving responses and plan approval.

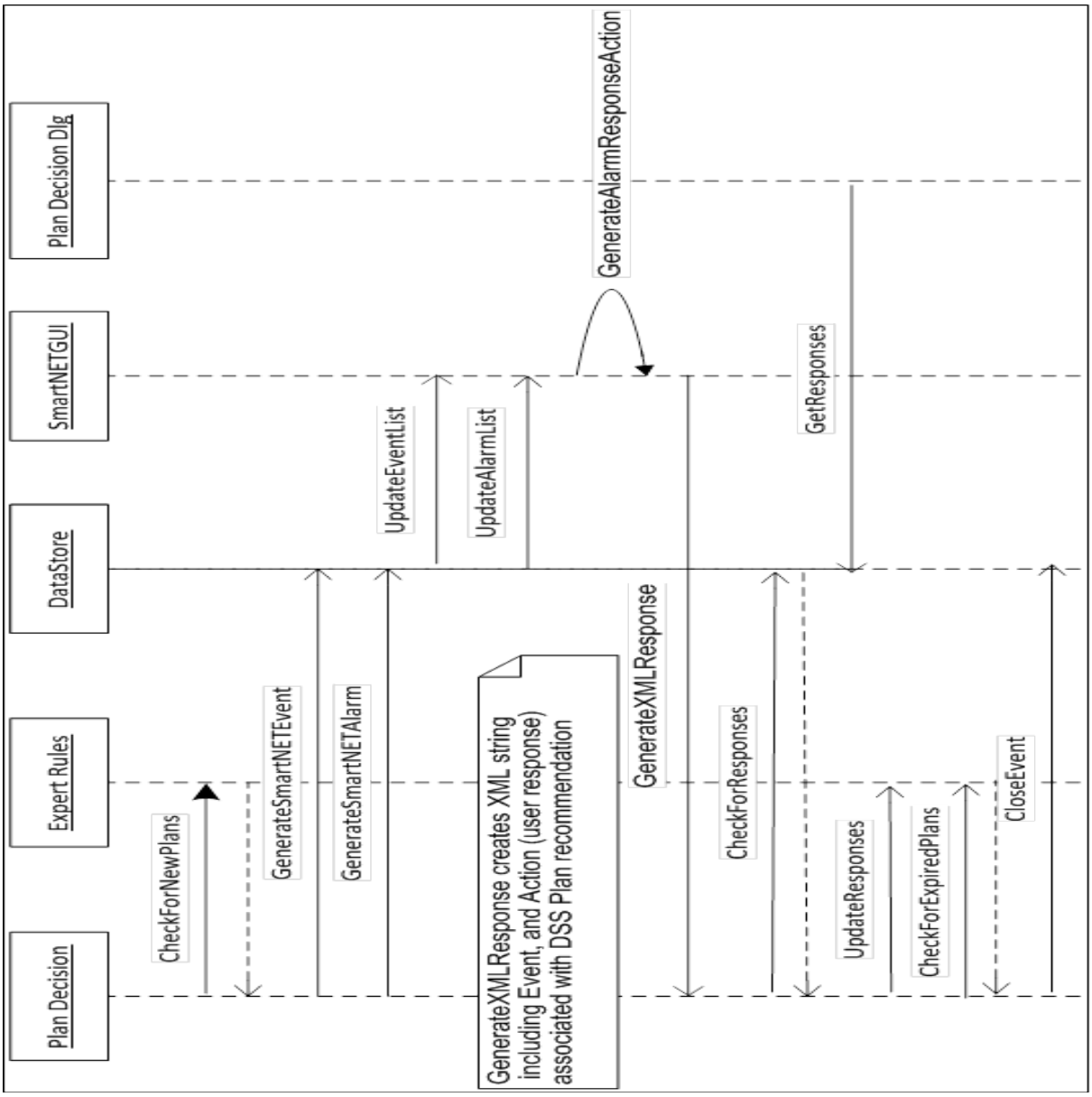

Figure 28: Plan Decision Subsubsystem Sequence Diagram

The Plan Decision Subsubsystem represents the actor in this scenario. It performs the following functions.

- Plan Decision Subsubsystem periodically checks the Expert Rules XML feed for changes to the recommended response plan list.

- If new plans are found, a SmartNET event and alarm are generated. Subsequently the SmartNET GUI subsubsystem will display new plans upon database refresh.
- The SmartNET GUI subsubsystem displays an alarm which a privileged operator will accept or reject, which generates an action response record.
- The plan decision subsubsystem periodically checks for responses and will generate an XML string which includes the event, and user response actions.
- The XML string is provided to the expert rules subsubsystem.
- The plan decision subsubsystem periodically checks for expired plans (removed from the plan list) and subsequently marks the event as closed in the data store subsubsystem database software component.

4.6.2.1.5 Error handling

If the expert rules XML feed is unavailable, the plan decision subsubsystem will attempt to reconnect and re-authenticate. There are SNMP traps setup that will notify the O&M team if errors occur.,

4.6.2.1.6 Logging capabilities (debug/error handling)

All XML feed connections and data retrieved will be logged in a date based log file.

4.6.3 Data Dissemination Subsubsystem

The data dissemination subsubsystem will consist of a secure XML feed for both public and operational users. Credentials will determine the types of users and what types of data are made available. This information will be database driven for scalability.

The data dissemination subsystems comprise an XML Web service and a C2C publisher.

The C2C Publisher will publish the following dynamic data into the C2C:

- C2C AVL Bus Location Data
- C2C AVL LRV Location Data
- C2C Construction and special event Data
- C2C Link Dynamic Data

4.6.3.1 DFW511 XML Web Services Overview

The DFW511 XML Web Services content will be provided to authenticated users in W3C standard XML format. The data will be provided for the various source data types made available by the DFW511. This source data includes Event Data, as made available by the various external providers of the Event Data, Link Data, as made available by the various external providers of the Link Data, DMS Data as made available by the various external providers of the DMS Data, CCTV Data, as made available by the various external providers of the CCTV Data, Detector Data, as made available by the various external providers of the Detector Data, and User Profile Data. All necessary information needed for development purposes will be provided to the Data Consumers in the XSD and WSDL documentation, which will be available via the Internet.

4.6.3.2 Data Consumers

Data consumers are defined as the group of users that will access the DFW511 XML Web Services system to query for the different data types that are available. Data consumers are broken down into two main groups: Public consumers and trusted partners. Public consumers will have access to a limited dataset and filters will be set up to exclude data that is deemed not suitable for public

consumption. Filters will also be available to filter in information that will only be suitable for trusted partner consumption. These filter rules will be set up in configuration files in the DFW511 XML Web Services source code and will be customizable in order to ensure that changes can be made to the system without interrupting service. A username, password, and valid IP address will be required in order for a user to authenticate with the DFW511 XML Web Services.

4.6.3.2.1 Data Elements

The static and dynamic data elements stored within the SmartFusion data stores will be made available to other ICMS subsystems through an XML web service. The XML Web Service will contain the following dynamic and static data records:

- DMS status and messages
- Detectors status
- CCTV status
- Traffic Signal Status
- Parking Lot Data
- Passenger Count Data
- Weather Alert Data
- AVL Data
- Link Inventory Data
- Link Dynamic Data
- Event Data
- Incidents
- Construction
- Special Events
- Schedules (For Construction and Special Events)
- Actions
- Agency Profile
- User Management (logged in users)
- User Profile/User Privilege
- SmartNET Ticker Message

4.6.3.2.2 Data Archiving

Dynamic data is periodically stored into an archive database to optimize the performance of the database of origin. Archive data will be used in mining procedures that are fed to reporting functions and to historical data calculations. The following dynamic data elements will be stored in the SmartFusion sub system:

- Closed Event Data
- Closed Incident Data
- Closed Construction Data
- Link Dynamic Data: Historical data representing infrastructure performance is stored. All periodic storing of historical data is done by copying the data and storing it every fifteen minutes. All records stored have a time stamp pre-pended to the pertinent fields of the record. The time stamp is of the form Year + OrdinalDay + Period. Where year is the year of the data capture; Ordinal day is the day number of the year. January 1st is 1, January 2nd is 2, up to 365, or 366 on leap years; and Period is the fifteen minute period of the day, 1 first period of the day at midnight, 96 is the last period of the day 11:45 PM
- Parking Lot Data

- Passenger Count Data
- Weather Alert Data

4.6.4 Public Secure XML Feed

The XML data feed web service will be a scalable travel information service providing quality, timely, and reliable real-time traffic and transit event, link, and CCTV data. Service is available to public consumers and trusted partners via XML data.

XML data will be made available to privileged users in W3C standard XML format through a secure sockets layer (SSL) connection. Public users will have the ability to request a connection after supplying a user name, password, and a static IP address, if desired.
Data sources to be provided in the XML feed include event data, and link dynamic data for public consumption. Configurable filter rules will determine what data is provided to the public user.

4.6.4.1 Trusted Consumer Secure XML Feed

XML data will be also made available to privileged users through a secure sockets layer (SSL) connection. This data will include additional information that would not be provided to public consumers.

Access to the XML data feed will be provided strictly through an SSL connection. Because this data is requested over a secure connection, the user information, as well as the data from the XML data feed will be encrypted, and therefore protected.

When data requests are received, user credentials are compared against an access list to validate authentication and determine public and trusted users. The dissemination database will contain the user's assigned username and password, in addition to the IP address or addresses supplied in the user access request form. Following valid authentication, the user will then have access to the XML data feed content. Authenticated users will be limited to one connection attempt every ten seconds. If a user does not authenticate properly, an error message will be returned by the service, indicating "Failure to Authenticate. Invalid Username or Password." Subsequent requests can be made to the system to correct the previously supplied username and/or password. If misuse of the system is detected, XML data feed registration will be revoked. Misuse of the system will be defined in the terms of service agreement that the user must agree to before access to the system is granted.

4.6.4.2 Inputs/Outputs

- Inputs – username, password, IP address
- Outputs – XML feed data

4.6.4.3 Data Stores

XMLfeed data store includes all users (public and trusted) that will access the XML feed. It also includes data that is available to the data dissemination subsubsystem XML feed.

4.6.4.4 Dependencies/Constraints

Constraint – User and user type must be registered in the XML feed database user tables in order to connect, authenticate, and receive data.
Constraint – Users will only receive current data. Data is only published once.

4.6.4.5 Use Case

The XML feed use case represents functions required by the XML feed in order to provide data to public and trusted users. The XML feed actor represents the system function that will occur as new data is populated in the XML feed database from the data store subsubsystem through stored procedure.

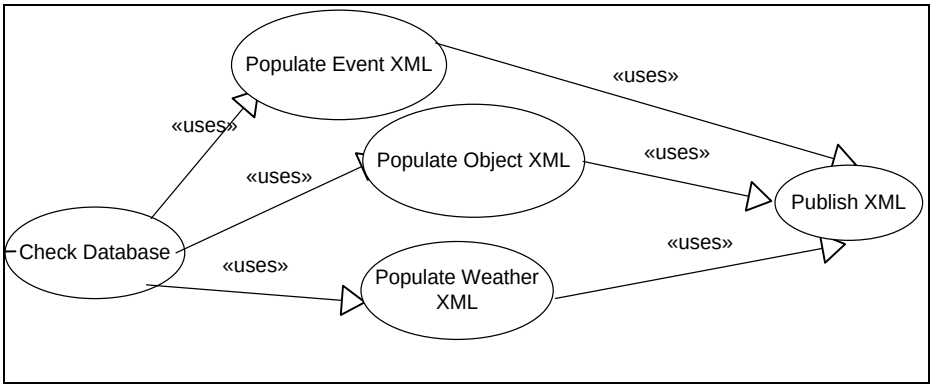

Figure 29: XML Feed Use Case Diagram

The XML feed provides subscribers with updated XML content.

- Check Database – The XML feed checks the data store subsubsystem database for changes to event and object status information.
- Populate Event XML – XML content is generated for event changes.
- Populate Object XML – XML content is generated for object changes.
- Populate Weather XML – XML content is generated for weather data changes.
- Publish XML – XML data is published to each subscriber based on the type of access.

Table 7: XML Use Case Description

Use Case ID	1.2.2.1
Description	The XML Feed provides event, object, and weather data to subscribers.
Actors	XMLFeed
Preconditions	db_EventObject is populated with new events or event changes.
Post Conditions	None
Normal Course of Events	1. XML Feed checks db_EventObject database. 2. XML Feed populates Event, Object, or Weather data in which data has changed. 3. XML Feed publishes the XML content based on user access list.

4.6.4.6 Logging capabilities (debug/error handling)

All attempts to access the system through the XML feed will be documented including successful connections and failures and data provided to subscribers.

4.7 Data Fusion Subsubsystem

The data fusion subsystem consists of the link data fusion (LDF) and event data fusion (EDF) components which will handle fusing data as well as a pass through for data that is unique and does not require fusion. This is based on an existing architecture that is currently part of the Dallas SmartNET™ software system. It is database driven, meaning as the data collection subsubsystem writes to the collection repository the data fusion subsubsystem retrieves the data and fuses and passes through as appropriate, and then stores this data in the data store subsubsystem database and this data is made available for the data dissemination subsubsystem.

4.7.1 Link Data Fusion

The link data fusion (LDF) will independently process two types of data (C2C link data and arterial data), and will produce output for each on a configurable interval (currently planned as 60 seconds).

C2C link data will be associated with specific links in the ICMS roadway network. The data is directly derived from the C2C feed source, and will be supplemented by data from historical records as well as simple algorithmic extrapolations. Information is output for equivalent links in the ICMS roadway network.
The second data type, arterial data is based on Bluetooth sensor based travel time for which speed is derived. This information is processed in the same way as the C2C data and is associated with equivalent links in the ICMS roadway network.

The LDF system will poll the data collection dataset for the latest link speed and sensor based derived speed information. It will internally load this data and use historical data from the system database. The LDF process consists of a number of modules that either run continuously, or on a cycle. This set of modules is run independently for each managed data type (speed, travel time, and volume/occupancy). The modules include:

- Input processing;
- Historical data management;
- Data accumulation;
- Data averaging;
- Winner selection;
- Data aging.

4.7.1.1 Input Processing

The primary data processing performed by LDF uses the traffic status information it receives on a regular basis in combination with the setup parameters to generate its output. There are three categories of data used in this process. These data reports will minimally contain link travel time, link speed, link volume/occupancy, or some combination of these values. As each report is received, it is assigned a score based on the quality assigned to the source. Based on other settings, the reports might be:

- Accumulated in memory for the current cycle. At the end of the cycle the average is calculated and used as the current input to the process;
- Averaged with old reports from the same source. A weighing scheme is used to ensure the most recent data is more significant. See the Data Averaging section below for details on the weighing scheme;

- Accumulated and averaged;
- Replacing the old value.

The traffic status is always accepted, and new data is factored into the outputs during the next cycle. The types of sources are discussed in the following sections.

4.7.1.2 Historical Data Management

Historical data will be stored for speed and optionally travel time. This data is actually read (and updated) directly by the LDF process from the system database for its use. This data is further subdivided into two subcategories – Historical and Predicted.

4.7.1.2.1 Historical Sub-category

This data is loaded from the database, and is from a link where there have been recent updates to the data based on reports from 'live' data sources.

4.7.1.2.2 Predicted Sub-category

This data is loaded from the database, and is from a link where there have not been recent updates to the data based on reports from 'live' data sources.

4.7.1.2.3 Field Data

Reports from field devices that directly measure the roadway conditions are also accepted by the LDF process. These reports can contain any of the acceptable information types.

4.7.1.3 Historical Data Management

The Historical Data Management module is responsible for determining the appropriate data set to load, loading it, and saving changed data when it is no longer being used. The data is stored based on a combination of factors, including the location (link ID), time of day (15 minute blocks), and type of day (plan ID). It is loaded prior to the time it is needed, swapped into the active data set at the start of its interval, swapped out at the end, and then is saved back to the database. The system supports a minimum of 10,000 links, 15-minute time of day intervals, and 32 plan ID's. Historical data is used by the system in one of two forms. The first is based on data that has been recently modified via live data reports from a physical source. The second is data that has not been modified. These types are submitted to the system independently so they can be treated differently.

4.7.1.4 Data Accumulation

Some data input sources can provide multiple reports for a link during the defined cycle. Based on the system setup, the input processing module can overwrite old reports with subsequent data, or it can accumulate all reports received during the cycle in memory, and generate an average of the values to act as the final input for that cycle. When accumulated, the final output is a straight average of all accumulated reports. This mode would be used for data sources that either provided multiple reports per cycle, where there were multiple data sources for the source on the link, or both.

4.7.1.5 Data Averaging (Smoothing)

Some data sources have data that is volatile. In these cases, it is sometimes beneficial to reduce the volatility of the final input to the process for each cycle. This is implemented by storing the value used for each cycle (the last report, or the accumulated average) in memory for its entire defined duration, and calculating a weighted average of the associated data each cycle. The weighing scheme favors the most recent data, by calculating the total of the scores of all stored values, and then weighing each value based on its score versus the total of the scores. These values are used

as the input to the selection process. This mode can be combined with the Accumulation mode if desired. An example of this follows – assuming the data received and stored from the source looks like:

Speed Value	Current Score
100	100
105	80
100	40
110	20

The system would average this by calculating the sum of the stored scores (240 = 100 + 80 + 40 + 20), then calculating the weighted value that would be used during this cycle.

Speed Value	Current Score	Weighted Score	Speed Adder
100	100	41.6% (100/240)	41.66 (100 * .416)
105	80	33.3% (80/240)	35.00 (105 * .333)
100	40	16.6% (40/240)	16.66 (100 * .166)
110	20	08.3% (20/240)	9.16 (110 * .083)

The sum of the 'Speed Adder' values (102.48) would be used that cycle.

4.7.1.6 Winner Selection

At the end of each cycle, a winner selection module is used to choose the best data input for each link. This selection is based on the currently calculated score as well as the setup parameters. If there are multiple data reports with the same score, the quality for the sources is used as a tie-breaker. If the selection is still tied, the source with the lowest name (dictionary order) is selected (except the Historical and Predicted data sources that are prioritized in that order and are lower quality than all sources specified in the database).

4.7.1.7 Data Aging

After the winner selection process is complete, the reports are aged. This is done by deducting the aging factor (base quality divided by duration cycle length) from each score, and deleting any reports where the score falls at or below zero. For sources that use Averaging, this is done for each stored report.

4.7.2 Event Data Fusion

The EDF will handle pass through for all data received from the data collection subsubsystem with the exception of instrumented link and sensor data which will be handled by the LDF. The EDF will have an associated configurable rules data store to handle any aggregation that would be necessary for overlapping data including incidents occurring at the same location at the same time.

4.7.2.1 Inputs/Outputs

Inputs – Event data, ITS device data
Outputs – Event data, ITS device data

4.7.2.2 Data Stores

- Data store subsubsystem stores rule criteria used in fusing data;

- The data store subsubsystem will store all current event data for the SmartNET subsystem. The data fusion subsubsystem will provide data to the data store subsubsystem.

4.7.2.3 Dependencies/Constraints

Rules must be added to data fusion subsubsystem data store rules table in order to handle overlapped data.

4.8 Data Collection Subsubsystem

The data collection subsubsystem represents multiple data interfaces which receive data from multiple external interfaces. The data that is received is translated and stored in a database which the data fusion subsubsystem will retrieve and fuse before making the data available to the SmartNET subsystem and the decision support subsystem.

Each data collection software component makes reuse of an existing secure XML web services architecture which can either request data and wait for response, or retrieve at a configurable interval. The data interfaces are as follows:

- C2C event interface;
- C2C link interface;
- Telvent DTN Weather interface;
- A parking data interface is to be determined and has not yet been defined.

4.8.1 Architecture

The C2C DI will be installed on the DFW511 Link Data Fusion servers and will run as a Windows .NET console application. The installation of Microsoft.NET Framework 3.5, at a minimum, will be required to run the DI. This application will be responsible for collecting and analyzing various data messages from the DalTrans and TxDOT C2C web services via Internet connection. The DI has been developed to listen on a configurable TCP port to which C2C TCP messages are sent by the C2C web services from the agencies. All messages sent by the C2C web services at the agencies that are successfully received by the DI will be handled based on the data type included in the C2C message after initial authentication and establishment of a TCP/IP socket connection. For detailed information about the content of the messages sent by the C2C system, please see the *C2C Message Content* section below.
DalTrans and TxDOT data has been made available via web services hosted by each agency. Data will be collected from the C2C by the C2C DI and will be used to populate the existing DFW511 dynamic data tables. For detailed information on specific data content received from each agency, see the *Data Content* section below.

DFW511 data will be updated by the C2C DI based when the specific data type messages are received by the DI. When made available in the C2C message, if the last update in the message is more recent than the DFW511 data stored locally in the DFW511 database, the DFW511 dataset will be updated. Otherwise, the DFW511 database will be updated regardless of whether any changes were made on the DalTrans/ TxDOT C2C side. New and removed static objects, including link, DMS, and CCTV objects, in accordance with the DFW511 Database Maintenance quarterly

updates schedule, will be added to and removed from the DFW511 dataset during the data processing period established in the schedule. It is assumed that all static data will be provided prior to the commencement of the development phase and any changes to the static data will be processed during the agreed upon DFW511 quarterly data updates processing period. If a C2C message received from the C2C contains static data objects that do not currently exist in the DFW511 dataset the static data object ID will be logged in the Missing*(static data object*)_mmddyyyy.log file for review and can be added during the next scheduled quarterly update.

When the Data Interface is launched, the C2C DI will initially read in the application configuration parameters as described in the *Configuration File Parameters* section below. This read will also occur only once, and only on startup. If a change is made to the application configuration file, the DI must be restarted. This restart will not impact the production environment as the C2C DI will simply reconcile any differences that may exist between the source and destination datasets on startup. On initial subscription to the C2C web services, a full status message containing all available data for each subscribed to data type is sent by the C2C in order to facilitate in the reconciliation of C2C and DFW511 dynamic data. The types of data that are sent by the C2C web services are specified in the SubscriptionDataTypes parameter.

For version 4 of the C2C web services, if desired, data can be reconciled by collecting on configurable time intervals as specified in the PeriodicRequestRefreshRateInSeconds parameter listed in the *Configuration File Parameters* section below. Therefore, a subscription to the C2C web services is not required, but is desired to maintain real-time dataset in the DFW511 system. Data types that are made available to the C2C DI for periodic refreshing are specified in the PeriodicRequestDataTypes parameter. For C2C version 3 and version 4, data will be collected as subscription messages are received. If the C2C web services become unavailable for any reason, the DI will log a failure, send an SNMP trap message, and attempt to logout and re-connect after the LoginRetryWaitTimeInSeconds interval has elapsed. For more details on the SNMP trap messages sent by the C2C DI, see section *SNMP Error Trapping*.

When a C2C message is processed, the C2C DI will attempt to validate the XML against an XSD schema file that corresponds to the dataType received from the C2C service. Schema file location and file names are defined in the application configuration file. If the C2C message does not contain valid schema as expected by the DI, the C2C content will not be processed. The corresponding C2C message data will be logged in the InvalidXML_mmddyyyy.log file. This will allow the DFW511 Operations and Maintenance team to easily detect and report the issue as needed based on the results of system troubleshooting. This error will be sent via SNMP as a trap message, alerting the O&M team. For more information on the types of SNMP traps the C2C DI will send, please see section: *SNMP Error Trapping*.

The TCP connection will be monitored for the last update received. If data is not received within a configurable period of time as specified in the NoMessagesReceivedTimeoutInMinutes parameter, the data interface will attempt to logout and reconnect with the C2C feed. Connection retries will be attempted until the C2C DI is successfully able to subscribe to the C2C web services. An SNMP trap will be invoked and the disconnect and reconnection attempt will be logged.

4.8.2 Event Data

Initially, the types of event data that are handled by the C2C DI include incidentData and laneClosureData. The event data is processed in real-time as messages are received from the C2C

web services. New event records received by the DI will be inserted, existing records will be updated, and closed records will be closed and removed accordingly.

Where periodic refresh on a non-subscription type basis is available (C2C Version 4), data will be updated by the C2C DI based on the last update field provided in the source dataset where available. If the last update in the C2C feed is more recent than the existing event data stored locally in the Database, the local event data will be updated. The C2C Event DI will treat the absence of an existing event as a close transaction and will close the event on the SmartNET system.

Where periodic refresh on a non-subscription basis is not available (C2C Version 3), data messages will be processed by the C2C DI as they are received. Therefore, even if no changes are made to the data on the C2C side, the event message will be processed by the C2C as it is received.

The following rules will be applied to each event received:

- If an event type is not available as part of the event type dataset, the event will still be processed by the DI, but the event type will be changed to "other." However, the missing event type will be logged in the *MissingEventTypes_mmddyyyy.log* file on the server.
- If an event facility does not exist in the facility tables (tblFacility, tblTransitFacility), the DI will continue to process the event, but the event will be flagged in the *MissingFacility_mmddyyyy.log* file on the server and a warning will be logged.
- If an event point location does not exist in the point location tables (tblPointLocation, tblTransitPointLocation), the DI will continue to process the event, but the event will be flagged in the *MissingPointLocation_mmddyyyy.log* file on the server and a warning will be logged.

4.8.3 Link Data

Initially, the types of link data that are handled by the C2C DI include tvtStatusData and trafficCondData. The link data is processed in real-time as messages are received from the C2C web services.

Where periodic refresh on a non-subscription type basis is available (C2C Version 4), data will be updated by the C2C DI based on the last update field provided in the source dataset where available. If the last update in the C2C feed is more recent than the existing link data stored locally in the Database, the local link data will be updated.

Where periodic refresh on a non-subscription basis is not available (C2C Version 3), data messages will be processed by the C2C DI as they are received. Therefore, even if no changes are made to the data on the C2C side, the link message will be processed by the C2C as it is received.

Links that are received from the C2C are mapped to links on the DFW511 system. Therefore, there could potentially be more than one link segment on the DFW511 system that is mapped to a corresponding link or links on the C2C system. The C2C DI will calculate and store the average speed and travel time for a C2C link using the following algorithm:

Average Speed = (percentage of link 1 * link 1 mph + percentage of link 2 * link 2 mph + percentage of link 3 * link 3 mph) / (percentage of link 1 + percentage of link 2 + percentage of link 3)

Average Travel Time = (percentage of link 1 * link 1 travel time seconds + percentage of link 2 * link 2 travel time seconds + percentage of link 3 * link 3 travel time seconds) / (percentage of link 1 + percentage of link 2 + percentage of link 3).

4.8.4 DMS Data

DMS data that is handled by the C2C DI includes dmsData. The DMS data is processed in real-time as messages are received from the C2C web services.

In order to detect updates to the DMS dataset, the DI will attempt to compare the existing DMS message and DMS status in the DFW511 system. If no changes are detected to the message or status, the DMS message is skipped. If either status or DMS message is different on the C2C side from what is in the DFW511 system, the DMS data message will be processed.

DMS data objects that are received from the C2C are mapped to DMS's on the DFW511 system.

4.8.5 CCTV Data

CCTV data that is handled by the C2C DI includes cctvStatusData. The CCTV status data is processed in real-time as messages are received from the C2C web services.

In order to detect updates to the CCTV status dataset, the DI will attempt to timestamp in the C2C message. If either the timestamp is more current on the C2C side from what is in the DFW511 system, the CCTV status data message will be processed.

CCTV data objects that are received from the C2C are mapped to CCTV's on the DFW511 system.

4.8.6 C2C Message Content

This section describes the socket interface that is used by the C2CExtractor to transmit XML data to the C2C DI. Messages are sent by the C2C web services in the following format:

Byte	1	2	3	4	5	6	7	8	9-N
Content	Message ID				Data Length				Data

Message ID = 4-byte integer. This field identifies the type of message to follow.

ID	Message Type
2001	Current Status Data
2002	Status Update
2003	Status Deletion
2004	Network Deletion

Data Length = 4-byte integer. This field indicates the number of bytes contained in the data portion of the message. This value will be 0 for a shutdown message, because there is no data sent on shutdown.
Data = variable length. This field is the XML formatted ICD message. It is empty when the message type is 'Shutdown'.

4.8.7 Data Logging

The C2C DI will generate extensive log files to log information about all activity performed by the DI. The log files will be stored in a log directory as defined in the “LogPath” key in the application configuration file. These files will be stored as flat text files, named in the format Log_mmddyyyy.log. New files will be created each day. Old log files will be zipped and archived to reduce the size on disk. All log files will be backed up to external storage for future analysis, if necessary.

All dataType updates will be stored in the updateLog_mmddyyyy.log file found in the *dataType* subdirectory of the log file location (for example, if the data type received is “incidentData”, the updateLog_mmddyyyy.log file will be written to in “LogPath”/incidentData/”. Sub-directories for different dataTypes are created dynamically, as the DI processes the different types of data that are being subscribed to. The file will contain a listing of the object ID along with the action performed by the VMS DI.

Objects that do not exist in the DFW511 data set, as mentioned above, will be logged to the Missing(*object*)_mmddyyyy.log file for DFW511 data team review where *object* is the type of missing object being logged.

4.8.8 Error Logging

If the application experiences an application error during runtime, the error will be clearly logged in the errorLog_mmddyyyy.log file. This error log file only includes application errors where normal processing was interrupted due to a bug in the code, an issue connecting to the C2C feeds, a server error, etc. These errors do not include errors other than application exception errors. The error logs will contain a description of the exception, along with the procedure that contained the code that threw the application exception and the line number where the exception occurred in the code.

4.8.9 Process View

The following diagram provides a process flow view of the SmartNET Subsystem. This view provides a high-level overview of the process utilized by the SmartNET Subsystem for managing events.

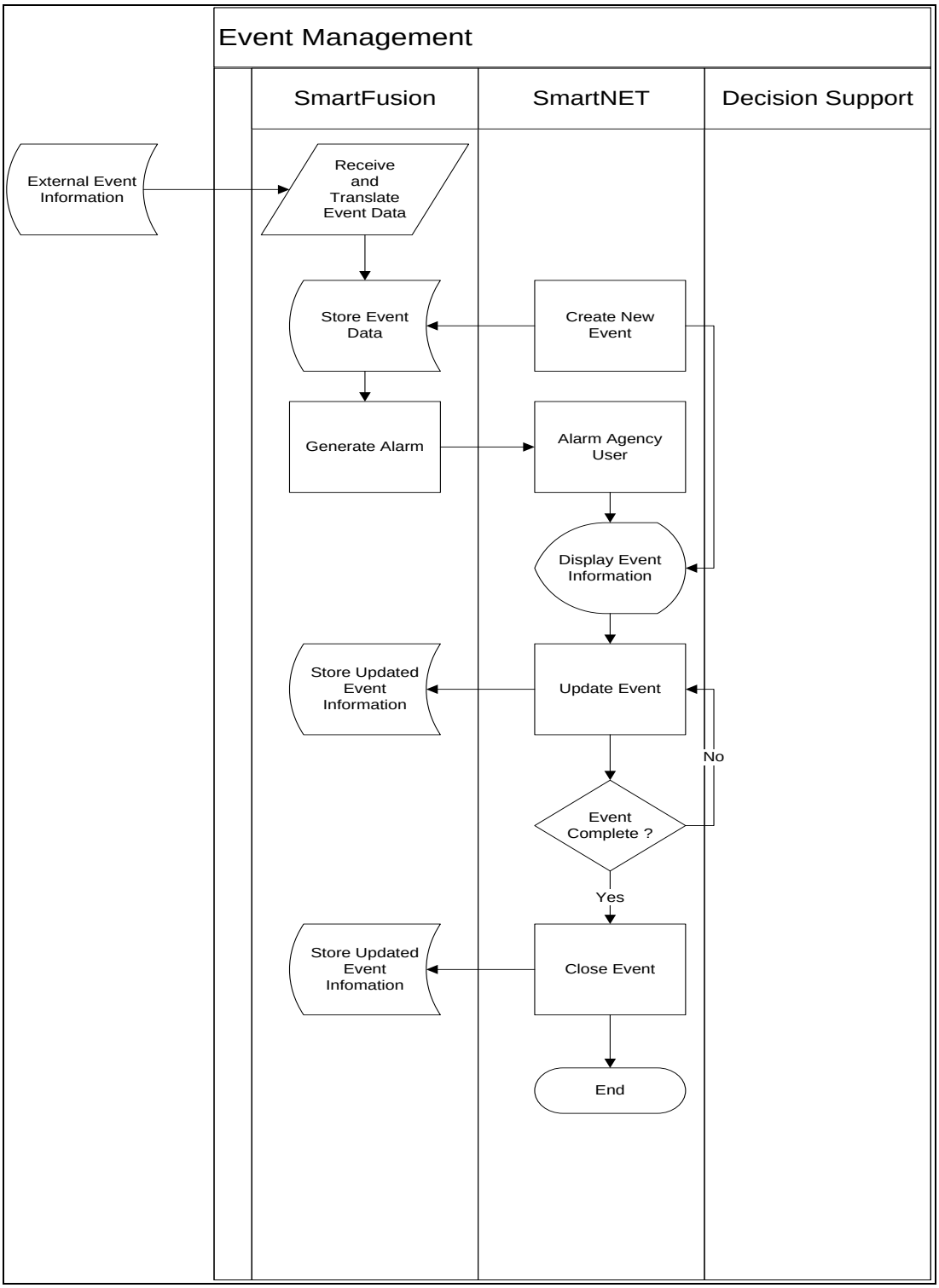

Figure 30: Process View of Event Management

4.8.9.1 Arterial Blue Tooth Link Data Interface

The Arterial Blue Tooth Link Data Interface uses SOAP/WSDL architecture. Data from the Arterial Blue Tooth link feed will be periodically polled after initial authentication and establishment of a TCP/IP socket connection.
Sensor data will be compared with the last update and written to a hash table. If it's determined that the sensor data is more current in the XML feed, it is marked for update.

Sensor data updates are handled in memory, and sensor data will be translated and paired with the appropriate SmartNET network link end points. The Travel Time data associated with the SmartNET network link will be used to compute speed using the calculated distance between each Blue Tooth sensor

4.8.9.2 Inputs/Outputs

The following inputs will be provided to the various data interfaces that make up the Data Collection Subsubsystem.

Table 8: Data Sources

Data Type	Component	Source
Link Speed Data	Link Data Interface	TxDOT C2C
Arterial Speed Data	Arterial Blue Tooth Link Data Interface	ASMS
Weather Alerts	Telvent DTN	Telvent DTN
Link Weather Data	Telvent DTN	Telvent DTN
Precipitation Overlays	Telvent DTN	Telvent DTN
Event Data	Event Data Interface	TxDOT C2C

4.8.9.3 Data Stores

Data Collection data store will contain a view to the SmartNET database to link static data including roadway network and ITS object inventory as well as real time data collected by Data Collection Subsubsystem data interface components. The data store will also include a translation rules table.

SmartNET data store will include static tables accessible by a read only view. The source of this data will be maintained in a central location in order to avoid duplication of data and potential discrepancies.

4.8.9.4 Dependencies/Constraints

Data Interfaces must run continuously and have the ability to detect updates. The FireDaemon utility will be responsible for ensuring continuous execution of applications. SNMP traps will alert operations and maintenance staff via email when an issue is detected.

4.8.9.5 Use Case Diagrams

The C2C DI will be responsible for requesting and receiving events from the TxDOT C2C feed and publishing the data to make it available to the SmartFusion Subsubsystem and subsequently in the SmartNET GUI. The use case diagram below illustrates the basic functionality carried out by the C2C Data Interface (DI) to process event data.

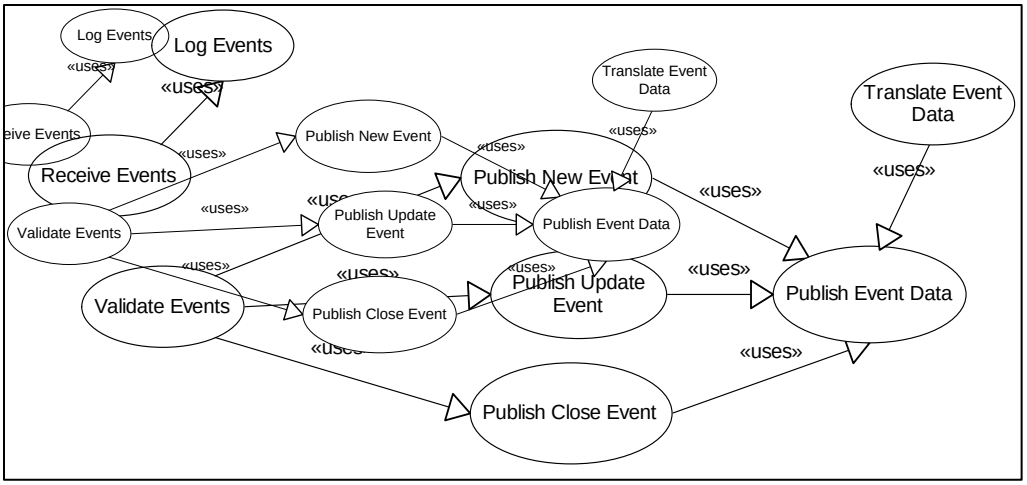

Figure 31: C2C DI Use Case Diagram

The C2C DI receives, validates, translates, and publishes event data.

- Receive Events – The C2C DI receives events.
- Log Events – All events added and removed are logged to a flat file.
- Publish New Event – A new event record is generated.
- Publish Update Event – An update event record is generated.
- Publish Close Event – A close event record is generated.
- Publish Event Data – The event record is published.
- Validate Event – The event record is checked for format and consistency.
- Translate Event Data – The event data will be translated to the SmartNET format before being published.

Table 9: C2C Data Interface Use Case

Use Case ID	1.2.4.01
Description	The C2C Data Interface will receive events from the TxDOT C2C feed and publish the events
Actors	C2C DI
Preconditions	C2C DI is authenticated with the TxDOT C2C feed
Post Conditions	Data is made available to the Event Data Fusion component
Normal Course of Events	1. The C2C DI receives events from the TxDOT feed based on request and log the data. 2. The C2C DI validates events received. 3. The C2C DI translates a new event record from TMDD to SmartNET format. 4. The C2C DI publishes the new event record.
Alternative Courses	The C2C DI translates an update event record from TMDD to SmartNET format Or The C2C DI publishes a close event record.

4.9 Data Store Subsubsystem

The data store Subsystem consists of the SQL Server Relational Database Management System (RDBMS) software and associated stored procedures, and archival process.

The SQL Server RDBMS will include stored procedures to consolidate database activity (reads and writes) for the SmartNET subsystem and the SmartFusion subsystem to enhance performance and improve transaction handling.

4.9.1 Inputs/Outputs

Inputs represent event data, object status and inventory updates, plan recommendations and approvals. Outputs represent the same data as inputs. All data received in the data store subsubsystem is made available to the DSS Subsystem and SmartNET Subsystem.

4.9.1.1 Data Stores

The SmartNET data store subsubsystem stores current network data and archives the data. It includes the following databases:

- db_EventObject - Database stores all current event and static data as well as inventory data;
- db_EventArchive – stores all purged data based on a configurable time period;
- db_Public Database – stores all data translation information for the ICMS system including SmartNET lookup values and TMDD to SmartNET data translation tables.

The data dissemination subsubsystem data store stores all data to be disseminated to external users as well as user information. The db_TX511 database is the primary database to be used for the 511 IVR system.

- db_TX511 – stores all data for the IVR phone system including call flows, IVR network including points of interest, and current events.

4.10 SmartNET Subsystem

The SmartNET subsystem is a system operator interface for management of incident, construction, planned events, ITS object inventory and status, and incident response plan recommendations. The SmartNET subsystem includes multiple levels of access rights and privileges to allow administrators to determine rights for specific levels of users.

In addition to providing an interface to maintain status and incident management, it also provides a multi-modal view of operations along the US-75 corridor and includes participating agencies beyond the corridor as well as event and ITS object status retrieved from the TxDOT C2C plug-in.

4.10.1 Inputs/Outputs

Inputs represent event data, object status and inventory updates, plan recommendations and approvals. Outputs represent the same data as inputs. All data received in the data store subsubsystem is made available to the SmartFusion Subsystem and includes:

- Operational user input of incidents, construction, and special events;
- Inputs received from the data store subsubsystem including incidents, construction, special events;
- Inputs received from the plan decision subsubsystem associated with recommended response plans.

4.10.1.1 Data Stores

The data stores are described below under the SmartNET GUI subsubsystem. The plan decision subsubsystem uses the same databases as the SmartNET subsystem.

4.10.1.2 Use Case Diagram

The following use case diagram describes at a high level, the main activities performed by the SmartNET subsystem.

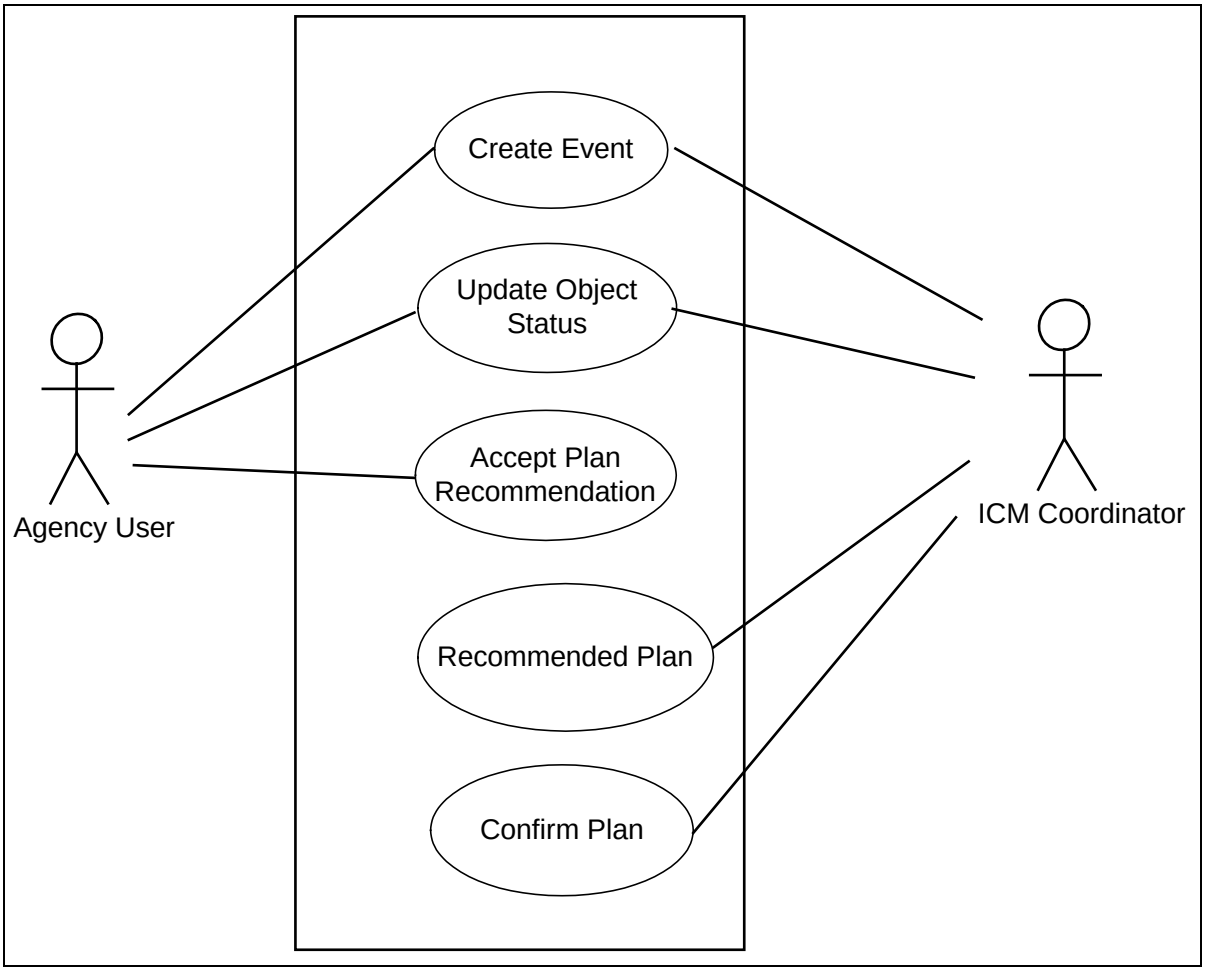

Figure 32: SmartNET Use Case Diagram

The following actors will utilize the SmartNET subsystem:

- The agency user creates and updates events and object statuses, as well as accepting response plan recommendations;

- The ICM coordinator creates and updates events and objects statuses, recommends response plans, and confirms response plans.

The use case illustrated above represents the basic functions of the SmartNET subsystem which are described in more detail in the sections that follow.

4.11 SmartNET GUI Subsubsystem

The SmartNET graphical user interface (GUI) subsubsystem provides a graphical user interface for the management of corridor events and changes to status of the corridor infrastructure. This includes entering and updating events, viewing events, updating and viewing ITS object status, and responding to response plan recommendations.

4.11.1 Inputs/Outputs

Inputs and outputs are represented by updates to the data store subsubsystem based on information entered into the SmartNET GUI subsubsystem and information received from the SmartFusion subsystem.

4.11.1.1 Data Stores

The data store subsubsystem includes the following databases:

- db_EventObject Database – stores all events, objects and associated status, and alarms;
- db_Public – stores all SmartNET GUI lookup tables;
- db_Org – stores all organization settings;
- db_User – stores all user settings including login and password information;
- SmartNET data store – Includes all event, object, and static network data for the ICMS system.

4.11.1.2 Use Case Diagram

The SmartNET GUI subsubsystem will be the operator interface for the ICMS providing event data, object data, and alarm notifications to privileged users. The use case below illustrates the internal basic activities of the SmartNET GUI subsubsystem to the extent of receiving information from the ICMS system.

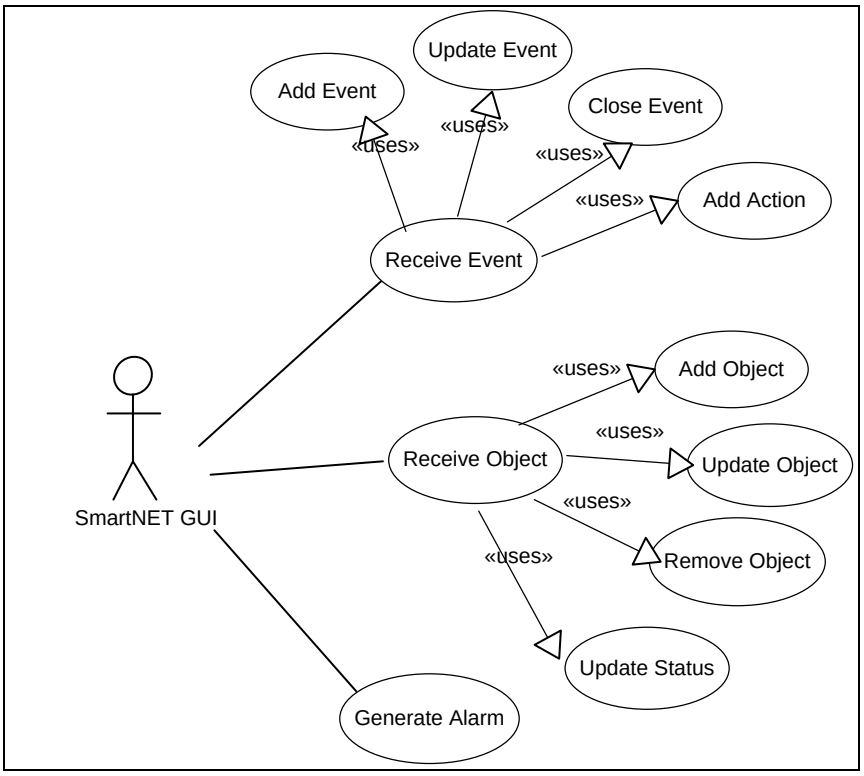

Figure 33: SmartNET GUI Subsubsystem Use Case Diagram

The SmartNET GUI subsubsystem receives events, receives object data, and generates alarms.

- Receive Event – The SmartNET GUI subsubsystem will receive notification of an event;
- Add Event – An event is added to SmartNET GUI subsubsystem;
- Update Event – An event is updated in SmartNET GUI subsubsystem;
- Close Event – An event no longer displays in SmartNET GUI subsubsystem;
- Add Action – An action is added to SmartNET GUI subsubsystem;
- Receive Object – the SmartNET GUI subsubsystem will receive notification of an object;
- Add Object – An object is added to SmartNET GUI subsubsystem;
- Update Object – An object is updated in SmartNET GUI subsubsystem;
- Remove Object – An object no longer displays in SmartNET GUI subsubsystem;
- Update Status – An object's status is updated in SmartNET GUI subsubsystem;
- Generate Alarm – An Alarm is generated based on a new event, an updated event, or a closed event.

Table 10: SmartNET GUI Use Case

Use Case ID	1.3.2.01
Description	The SmartNET GUI subsubsystem displays event data and provides an interface for data entry.
Actors	SmartNET GUI
Preconditions	db_EventObject database is populated with events and objects
Post Conditions	Operators can view and edit populated events and alarms
Normal Course of Events	4. SmartNET GUI subsubsystem checks db_EventObject database 5. SmartNET GUI subsubsystem updates user interface with changes 6. SmartNET GUI subsubsystem generates an alarm

4.11.1.3 Sequence Diagram

The SmartNET GUI subsubsystem sequence diagram illustrates the reception of events and objects in the following order.

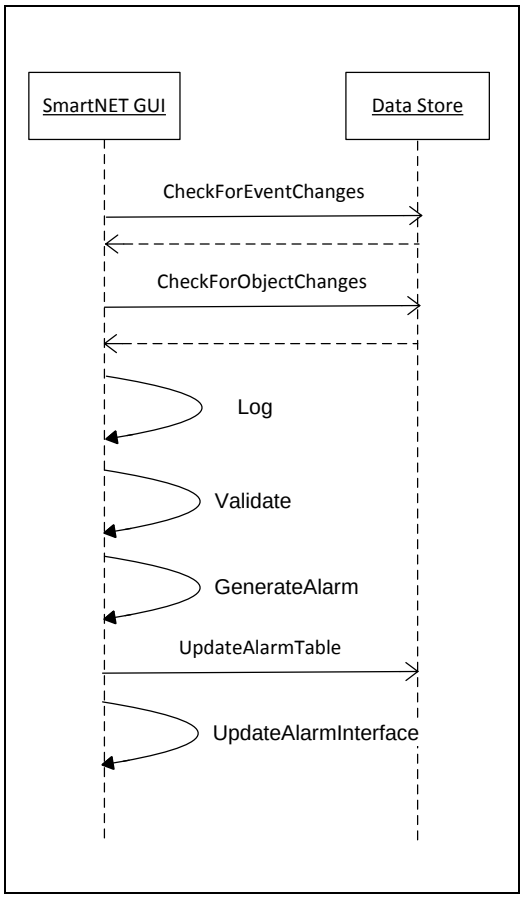

Figure 34: SmartNET GUI Subsubsystem sequence Diagram

The SmartNET GUI subsubsystem represents the actor in the scenario. It performs the following functions.

1. SmartNET GUI subsubsystem periodically makes calls to the data store to detect any new event or changes to events. It also checks for new objects or changes to objects.
2. SmartNET GUI subsubsystem will log and validates the changes. An alarm is generated based on the new event or event change. An alarm is only generated for certain data changes in the system.

4.11.1.4 Error handling

When SmartNET GUI subsubsystem receives an invalid event, the information is logged.

4.11.1.5 Logging capabilities (debug/error handling)

SmartNET GUI subsubsystem uses the Log4j library for logging all system errors, data errors and data transactions. When the log exceeds a configurable size a new log is generated. Log4j configuration also includes configuration to turn off debug logging.

4.12 Plan Decision Dialogue Subsubsystem

The plan decision dialogue subsubsystem is a web based interface that allows the ICM coordinator to view recommended incident response plans and the associated accept or reject decisions provided by agencies based on readiness. Agency feedback will assist the ICM coordinator's decision to accept or reject the incident response plan.

4.12.1 Inputs/Outputs

Inputs include updates to the data store subsystem database associated with recommended response plans. Outputs include user decisions on response plan readiness.

4.12.1.1 Data Stores

The data store subsubsystem stores all response plan recommendations, agency user readiness decisions, and plan approvals.

4.12.1.2 Use Case Diagram

The plan decision dialogue subsubsystem use case illustrates the major activities performed by the ICM coordinator and agency users.

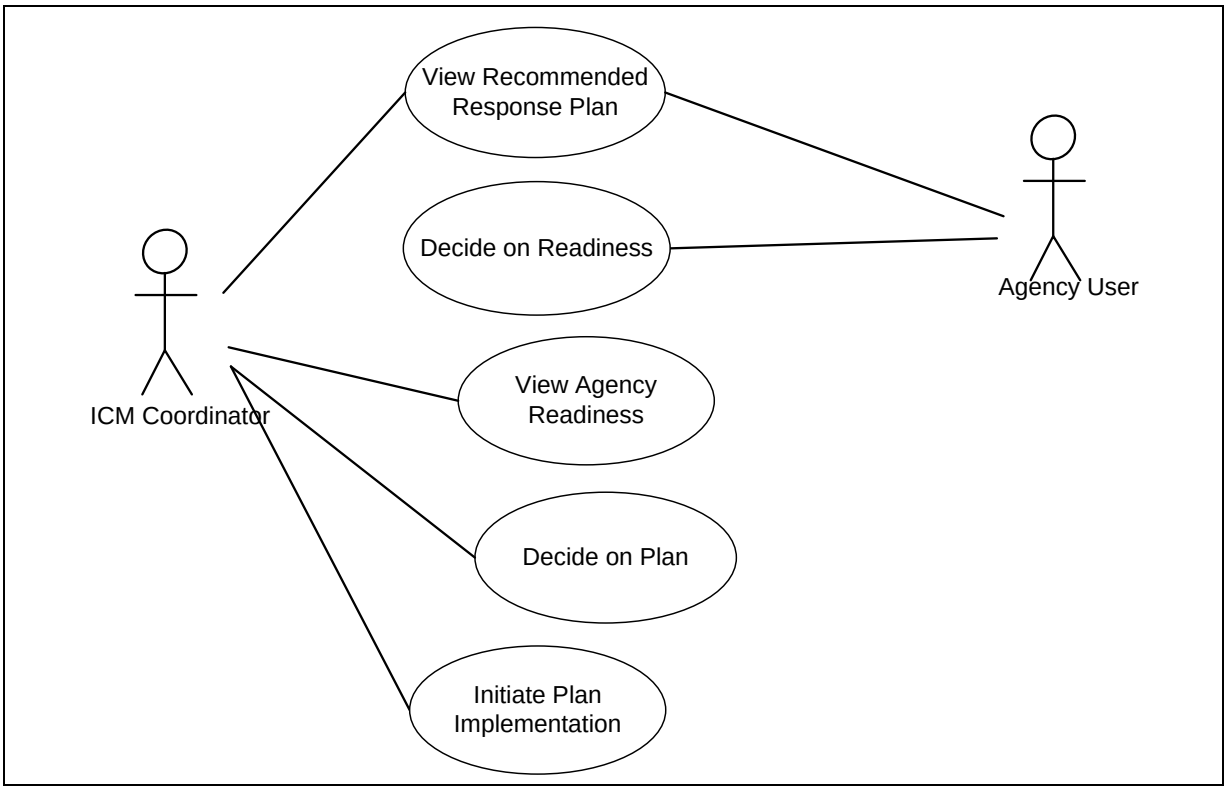

Figure 35: Plan Decision Dialogue Use Case

This plan decision dialogue includes two actors, the ICM coordinator and agency user. The ICM coordinator views agency user readiness decisions and decides on plan implementation. The agency user views recommended response plans and responds to readiness request alarms.

- View Recommended Response Plan – The ICM coordinator and agency user views response plan information in the Plan Decision Dialogue;
- Decide on Readiness – The agency user determines if they are ready to implement a response plan;
- View Agency Readiness – The ICM coordinator determines agency readiness by viewing agency user decisions;
- Decide on Plan – The ICM coordinator decides on plan based on performance and agency readiness;
- Initiate Plan Implementation – The ICM coordinator initiates a plan implementation.

Table 11: Plan Decision Dialogue Use Case Description

Use Case ID	1.3.1.01
Description	The plan decision dialogue subsubsystem will allow the ICM coordinator and agency user to view recommended response plans and decide on readiness to implement a plan which has been approved by the ICM coordinator
Actors	ICM coordinator, agency user
Preconditions	db_EventObject database is populated with plan recommendations
Post Conditions	Agency users can implement response plans
Normal Course of Events	1. ICM coordinator and agency user review recommended response plans. 2. Agency users decide on readiness to implement plan. 3. ICM coordinator views agency readiness. 4. ICM coordinator decides to implement plan based on agency readiness.

4.12.1.3 Sequence Diagram

The plan decision sequence diagram describes the sequence of activities performed by the plan decision dialogue subsubsystem.

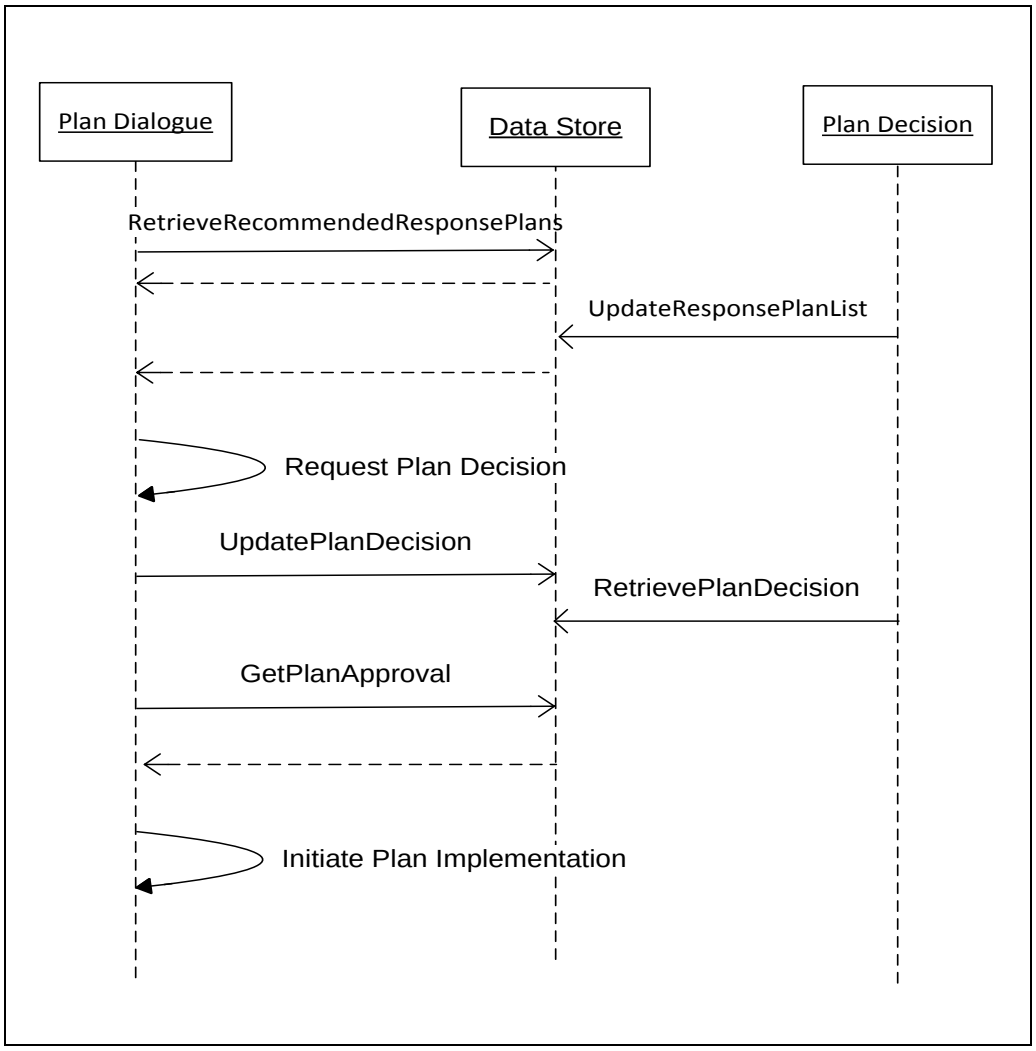

Figure 36: Plan Decision Dialogue Sequence Diagram

The plan decision dialogue subsubsystem represents the actor in the scenario based on user input. It performs the following functions.

- Plan decision dialogue subsubsystem retrieves recommended response plans from the data store subsubsystem;
- Plan decision subsubsystem updates the data store subsubsystem with current response plan recommendations;
- Plan decision dialogue subsubsystem requests plan readiness from agency users;
- Plan decision dialogue subsubsystem updates the data store subsubsystem with plan readiness decisions;
- Plan decision dialogue subsubsystem checks the data store subsubsystem to determine if the ICM coordinator has approved the plan;
- Agency users are notified to initiate the plan.

4.12.1.4 Error handling

When the planned decision dialogue subsubsystem receives an invalid event, the information is logged in a dated flat file.

4.12.1.5 Logging capabilities (debug/error handling)

Plan decision dialogue GUI application logs all system errors, data errors and data transactions. The log is generated based on date.

4.13Data Model

The ICMS data model captures all underlying data of the ICMS to support the requirements. The ICMS data model described within includes data storage, a high level representation of all data stores and their respective relationships, database schemas, as well as references to interface control documents (ICD) and external data references.

4.14Data Storage

The ICMS data store will use the SQL Server RDBMS to maintain, and preserve data for the ICMS. The data store subsubsystem will consist of five logical databases: The SmartNET database; the Data Collection database; the IVR database; the dissemination database; and the DSS database.

- The SmartNET database will support the SmartNET subsystem interfaces as well as the external public web and mobile web interfaces that are outside of the scope of the ICM design;
- The data collection database will include all translation tables and holding tables for incoming dynamic and static data received by data interfaces to external feeds including the TxDOT C2C feed and the Telvent DTN weather system feed. The data collection subsubsystem and data fusion subsubsystem will utilize the data collection database for data acquisition, translation and fusion purposes;
- The IVR database will support the 511 telephone interface which is outside the scope of the ICM design. It will contain call flow and IVR roadway network data;
- The dissemination database will support the XML feed which will provide XML formatted data event, link status, and device status data to public and trusted users. This database will include XML fed subscriber credentials;
- The decision support subsystem will have a separate database which contains the network model and response plan information.

4.15 High Level Entity Relationship Data Model

The high level data model is a generic representation of all data that is required in the ICMS. This top down methodology allows the design and development teams to start at a high level and break down data concepts to generate the actual databases which are represented in the Databases section below.

The high level entity relationship data model below provides an overview of internal data structures required by the ICMS. Crow's feet notation depicts the general relationships between data concepts there are five conceptual databases that make up the ICMS. They are as follows:

- DSS – Decision support subsystem includes the recommended response plans, network conditions received from the SmartFusion subsystem, response plan inventory, and the underlying network model used for Prediction analysis.

- SmartNET – SmartNET subsystem includes the current and historical event, ITS device, and organization and user privileges.
- Data Fusion – includes the rules for fusing event, ITS device, and link data as necessary.
- Data Collection – includes the events, ITS device data, and weather data received from external feeds, and the underlying network translation and TMDD to ICMS translation.
- Data Dissemination – includes the events, ITS device data, and weather data staged for external consumption through the XML feed.

The high level model diagram below depicts these five data concepts.

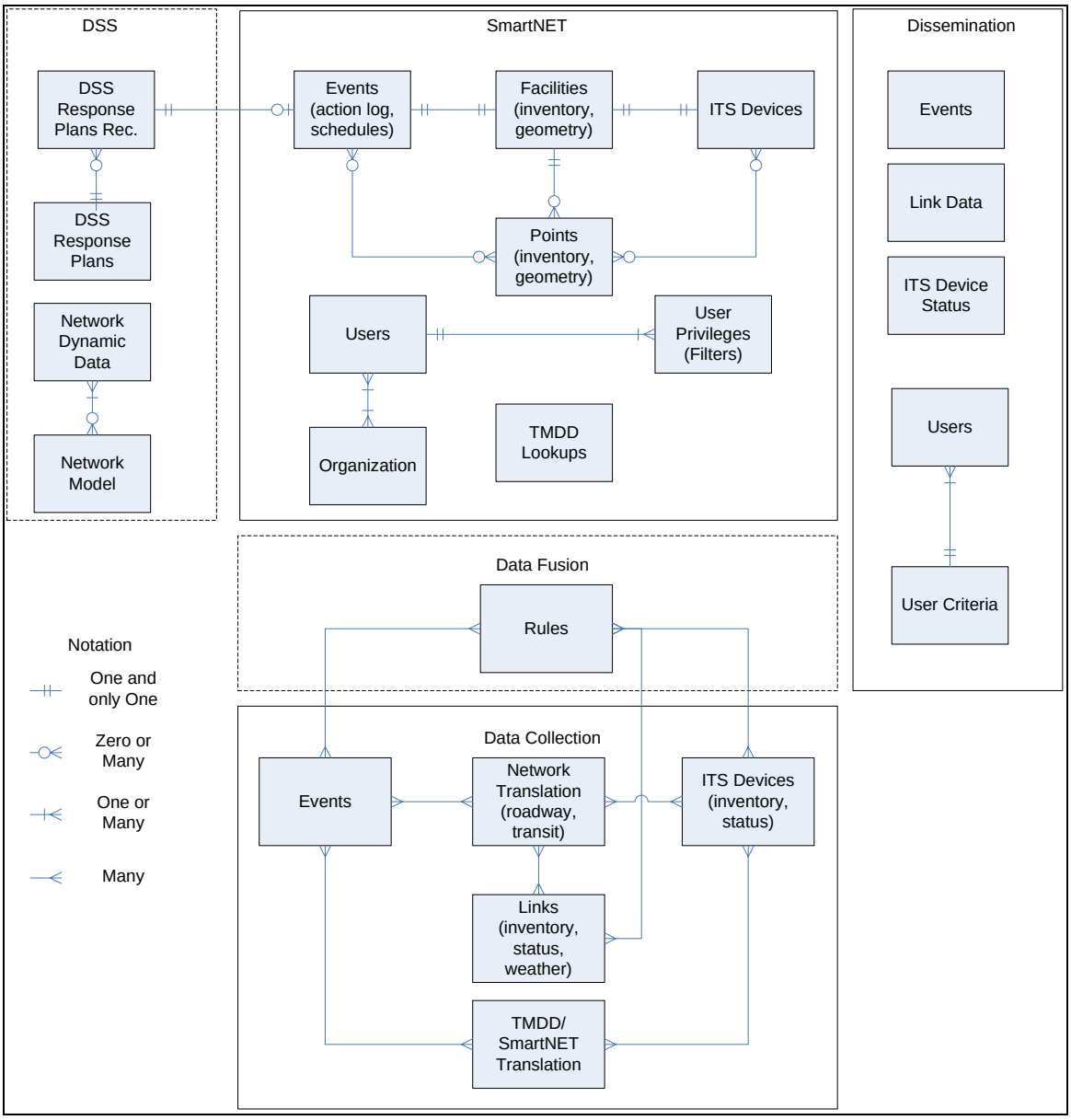

Figure 37: High Level Data Model Diagram

4.16 Databases

The following section describes the databases which will be utilized by the ICMS and discusses the relationship between the database elements.

4.17 Entity Relationship Diagrams

The entity relationship diagrams (ERDs) describe the table structure and table relationships within each of the five key ICMS databases. Each table includes field name, data type, and primary key and foreign key designations which create associations between tables.

ERDs represented below are key tables within each database and are not inclusive of all tables that will make up the ICMS.

The db_EventObject database, shown below, includes tables that contain current data for the SmartNET GUI Subsubsystem interface including events, inventory and status, and the roadway and transit networks. These tables and associated ERDs are described below.

- tblEvent – Contains incident, construction, special events, response plan recommendation events;
- tblAction – Contains transaction history for each event and user responses to recommended response plans;
- tblSchedule – Contains schedules associated with construction events and special events;
- tblAlarm – Contains messages that display in the SmartNET subsystem Alarm GUI for operators to respond to;.
- tblDSS_Incident_Response_Plan – Contains response plan recommendation received from the DSS;
- The tblEvent, tblAction, and tblSchedule tables are also part of the db_DataCollection databases which contain identical schemas for these tables.

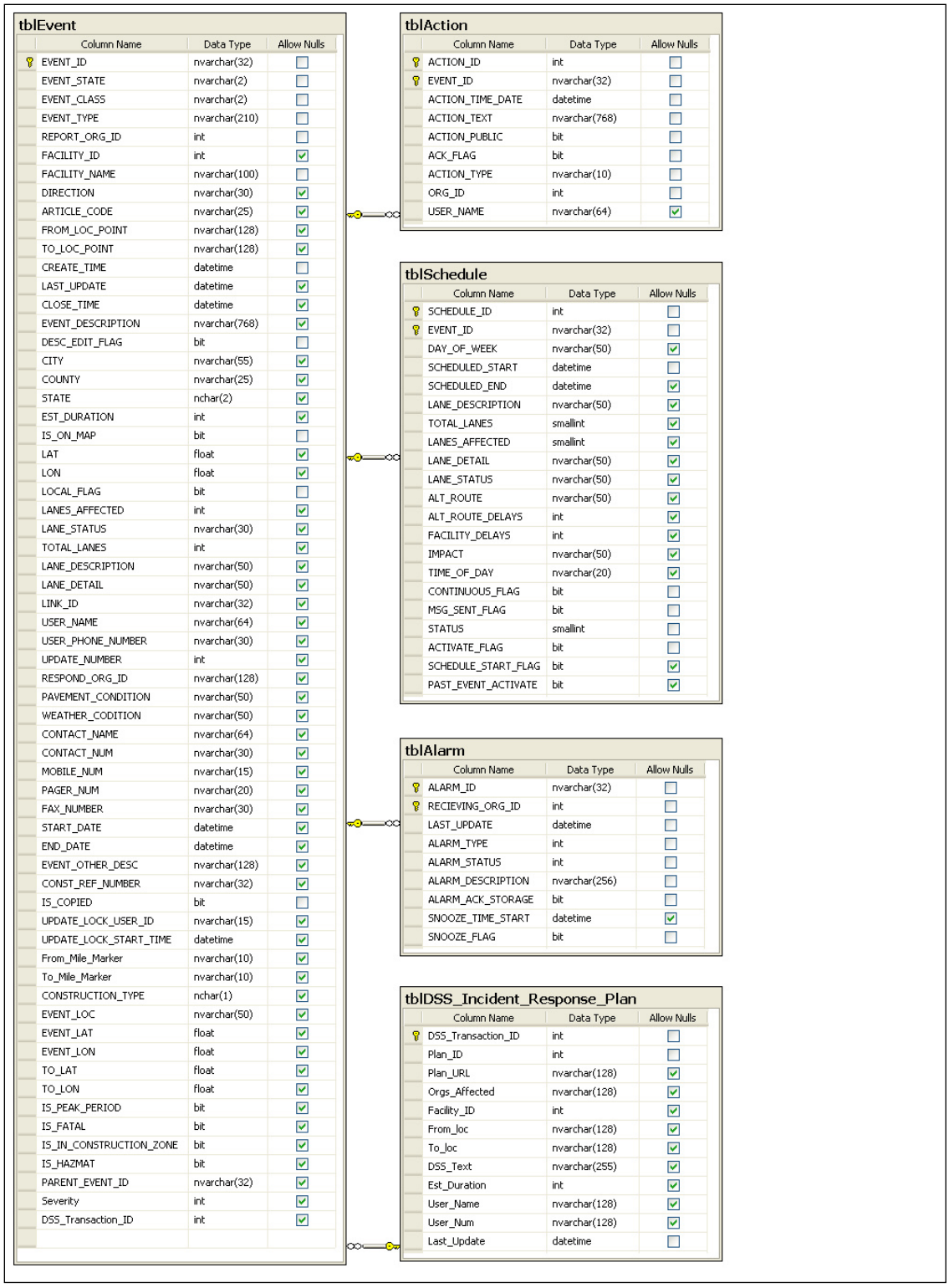

Figure 38: Events ERD

The ITS object status and inventory tables are described in the ERD below and are also included in the db_DataCollection database which contain the same schemas for these tables.

- tblVMS – Contains Dynamic Message Sign inventory and status;
- tblVMSModel – Contains Dynamic Message Sign model information;
- tblCCTV – Contains CCTV camera inventory and status;
- tblDetector – Contains detector inventory and status. This can include Blue Tooth readers and other types of detection devices;
- tblLink – Contains roadway network link inventory;
- tblLinkDynamic – Contains roadway network link status;
- tblHAR – Contains Highway Advisory Radio inventory and status;
- tblTrafficSignalStatus – Contains traffic signal inventory and status;
- tblWeatherAlert – Contains NWS weather alerts;
- tblParkingLot – Contains parking lot inventory and status.

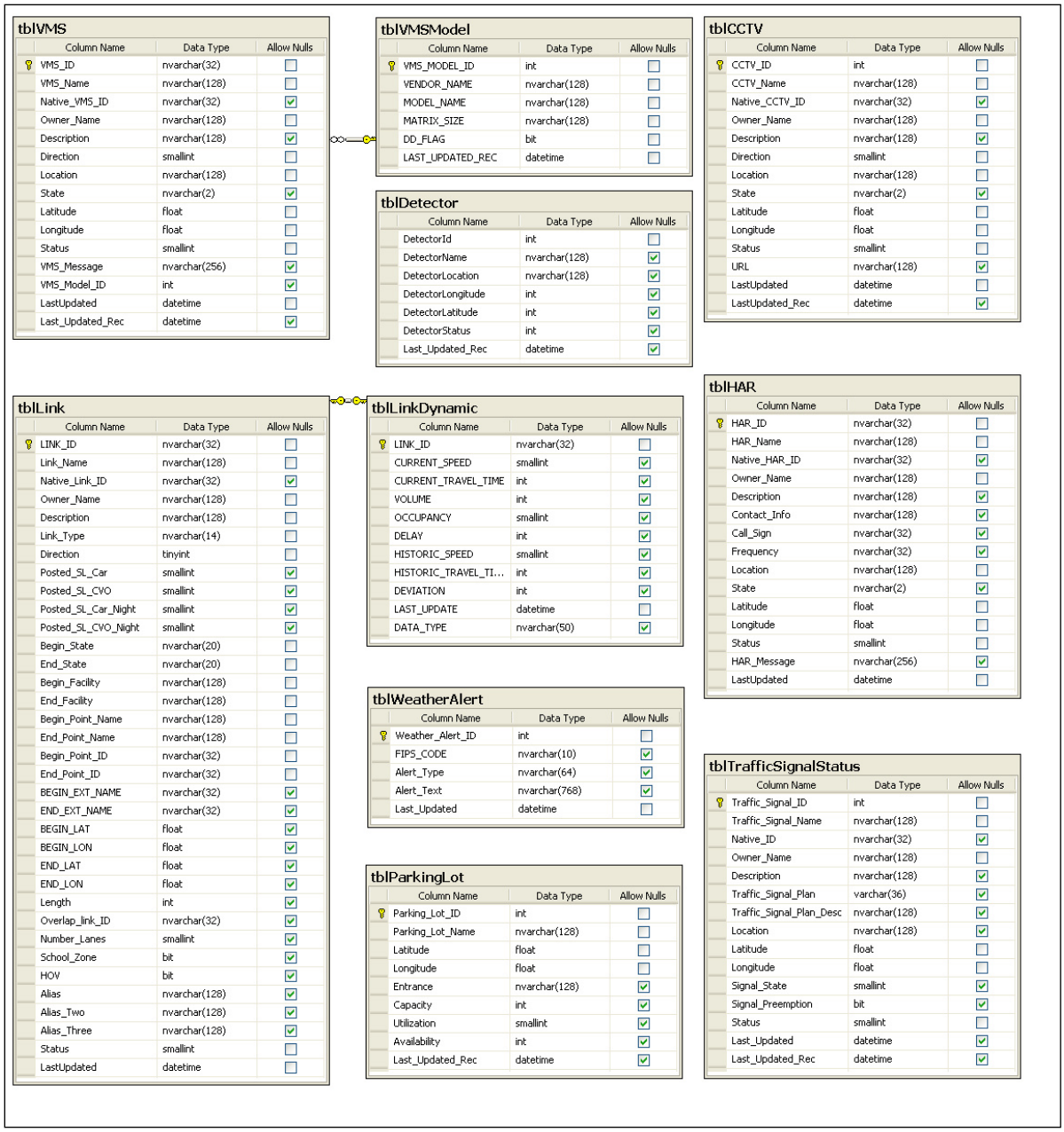

Figure 39: ITS Status and Inventory ERD

The highway and transit network tables are described in the ERD that follows and are also included in the db_DataCollection database which contains the same schemas for these tables.

- tblFacility – Contains inventory of roadways supported by the ICMS;
- tblPointLocation – Contains intersecting points associated with roadways supported by the ICMS;
- tblFacilityOrg – Contains jurisdictional ownership of roadways supported by the ICMS;
- tblTransitFacility – Contains inventory of transit lines and routes supported by the ICMS;
- tblTransitPointLocation – Contains points (including stops and stations) associated with lines and routes supported by the ICMS;

- tblTransitFacilityOrg – Contains transit agency ownership of lines and routes supported by the ICMS;
- tblTransitVehicleLocation – Contains inventory and status (including location) of transit vehicles.

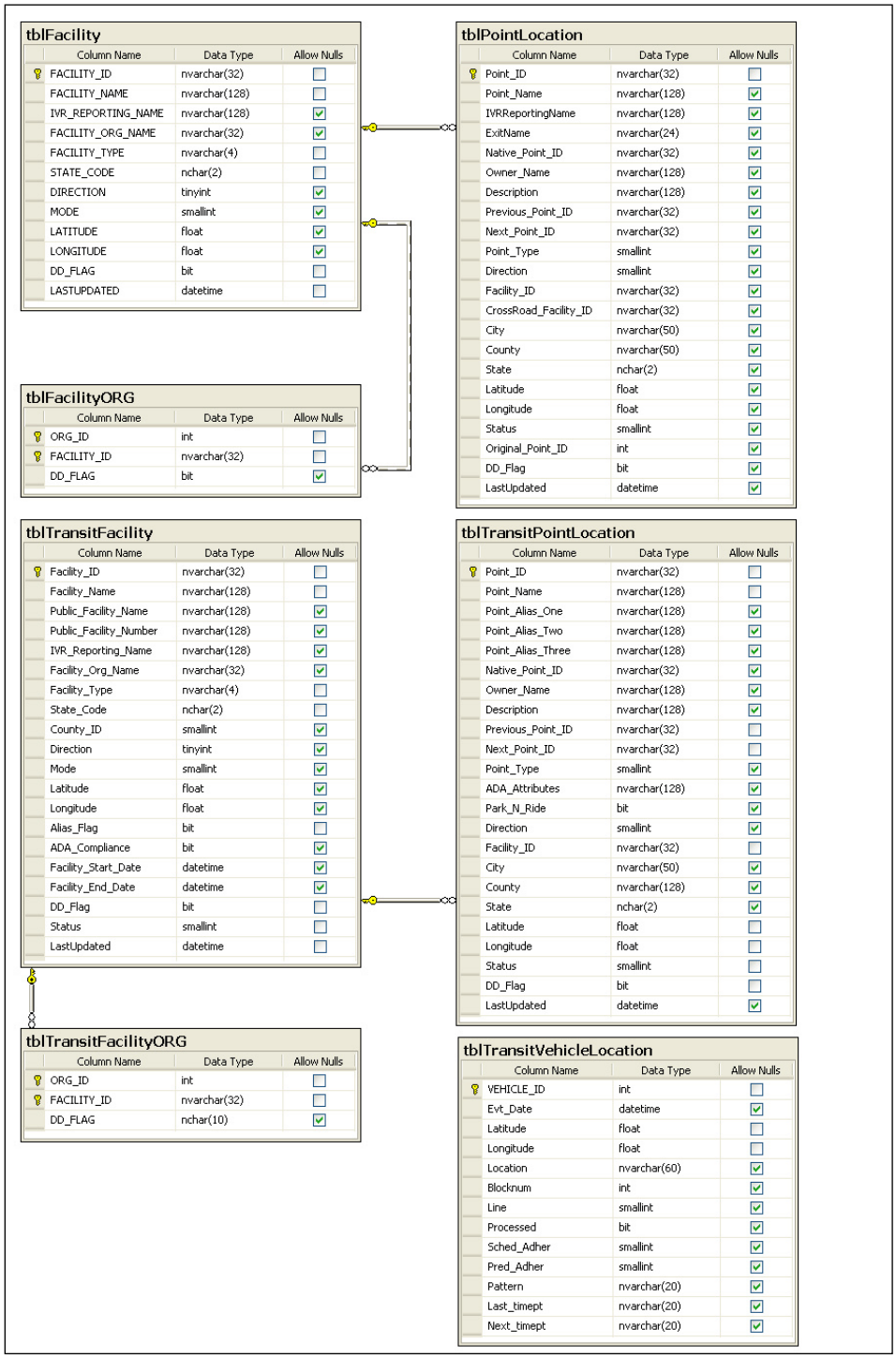

Figure 40: Highway and Transit Network ERD

db_DataFusion

The db_DataFusion database includes a data rules table to support rules necessary to fuse overlapping external data such as instrumented roadway data that overlaps a specific section or link on the roadway network.

db_DataCollection

The db_DataCollection database includes translation tables and event, object status, and network inventory tables to support Data Collection Subsubsystem translation of data received from external systems.

db_DataDissemination

The db_Datadissemination database includes XMLFeed format, and user criteria that will support providing event, and object status data to public and external trusted users.

5 Software Component Design

The logical subsubsystems described in the sections above were decomposed into the physical software components that are being used for this project. The software components described below are physical pieces of software or software code which makes up a larger overall product, or is a self contained piece of software. The components are shown in three colors: green for new components, orange for existing components which do not require changes, and green/orange components are existing components which do require changes.

5.1 Expert Rules Subsubsystem

The expert rules subsubsystem provides the logical engine of rules selection for the DSS and interfaces to the SmartFusion subsystem and the prediction and evaluation subsubsystems. The following diagram shows the physical components of the subsubsystem and the text below describes each of these software components.

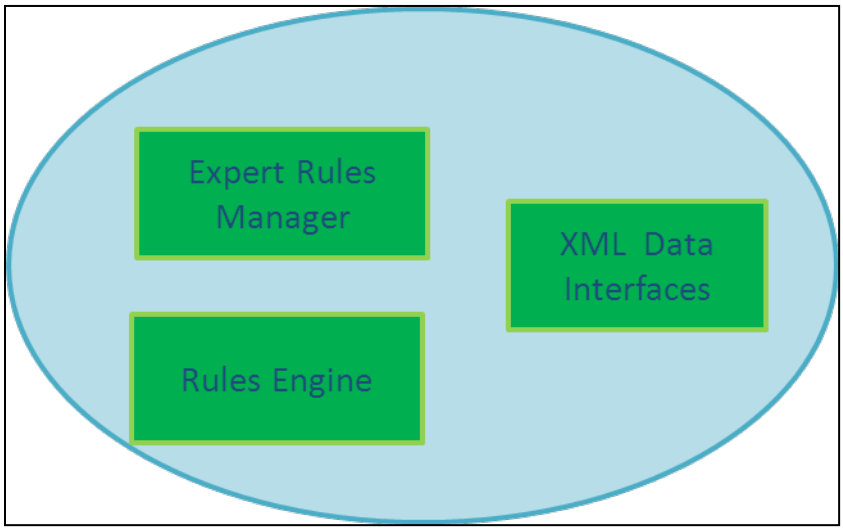

Figure 41: Expert Rules Subsubsystem Software Components

5.1.1 Expert Rules Manager

The expert rules software component provides a user interface for the expert rules subsubsystem to run pre-defined queries, view/edit/delete response plans, and manually trigger a particular response plan.

5.1.2 Rules Engine

The rules engine software component evaluates pertinent rules based on incident information, corridor performance information, expert knowledge-based rules, and simulation based measures of effectiveness (MOE) and selects response plans if needed.

5.1.3 XML Data Interfaces

This software component provides the interface between the expert rules subsubsystem and the evaluation, prediction, SmartNET decision plan, and SmartNET data dissemination subsubsystems using an XML format.

5.2 Prediction Subsubsystem

The prediction subsubsystem provides simulation and prediction of the transportation network and generates the MOEs needed by the expert rules and evaluation subsubsystems. The following diagram shows the physical components of the subsubsystem and the text below describes each of these software components.

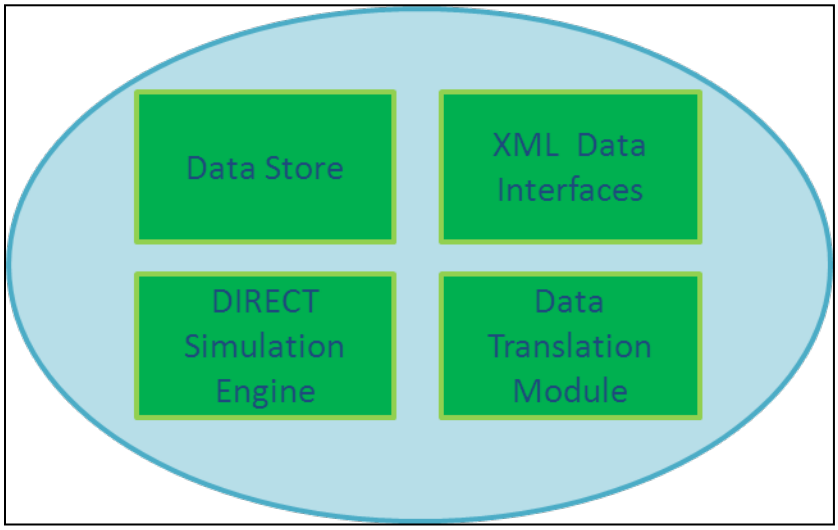

Figure 42: Prediction Subsubsystem Software Components

5.2.1 Data Store

This software component provides the database within the prediction subsubsystem. The data store component stores all dynamic and static data received from external sources and generated within the prediction subsubsystem.

5.2.2 DIRECT Simulation Engine

This software component consists of the DIRECT model software that is used to simulate and predict the conditions of the transportation network. The DIRECT simulation engine is comprised of a GUI, dynamic data broker, and static data broker.

5.2.3 XML Data Interfaces

This software component provides the interface between the prediction subsubsystem and the evaluation, expert rules, and SmartNET data dissemination subsubsystem using an XML format.

5.2.4 Data Translation Module

This software component provides the necessary translation of the dynamic data, provided by the data dissemination subsubsystem, into the format required by the DIRECT simulation engine component.

5.3 Evaluation Subsubsystem

The evaluation subsubsystem consists of database tables and software which stores and provides data to the expert rules subsubsystem and users to evaluate the performance of the ICMS. The following diagram shows the physical components of the subsubsystem and the text below describes each of these software components.

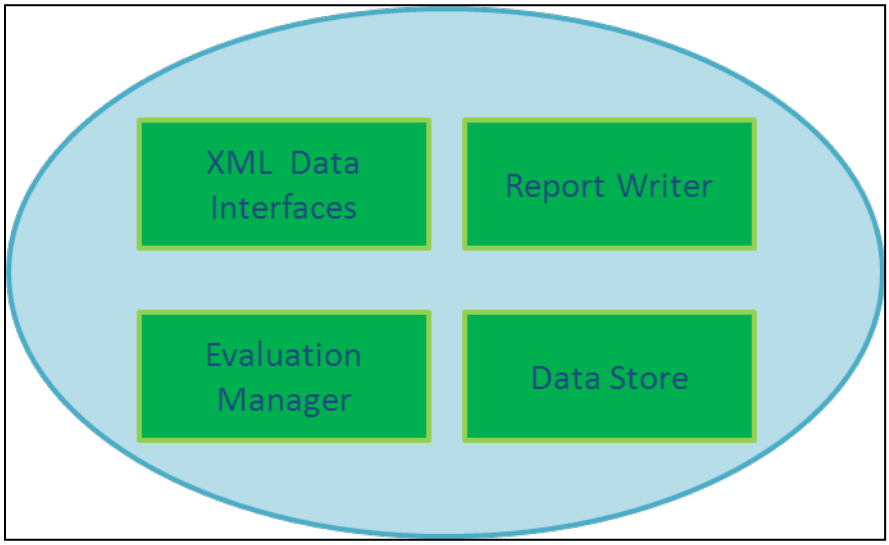

Figure 43: Evaluation Subsubsystem Software Components

5.3.1 XML Data Interfaces

This software component provides the interface between the evaluation subsubsystem and the expert rules and prediction subsubsystems using an XML format.

5.3.2 Report Writer

This software component provides the reporting functionality within the evaluation subsubsystem. The report writer allows authorized users to create various customizable and pre-defined reports within the evaluation subsubsystem. This reporting functionality is provided by the Microsoft SQL Server software.

5.3.3 Evaluation Manager

The evaluation manager tool component provides the evaluation subsubsystem with the ability to run pre-defined queries against the evaluation data store.

5.3.4 Data Store

This software component provides the data database, Microsoft SQL Server, within the evaluation subsubsystem. The data store component stores all new data, edited data, and static data within the expert rules and evaluation subsubsystems.

5.4 Data Collection Subsubsystem/ Data Fusion Subsubsystem

Data collection and data fusion subsubsystems are logically separated in the logical architecture, however, from a physical architecture point of view they occur as part of a single physical grouping of software code. The following diagram shows the physical components of the subsubsystems and the text below describes each of these software components.

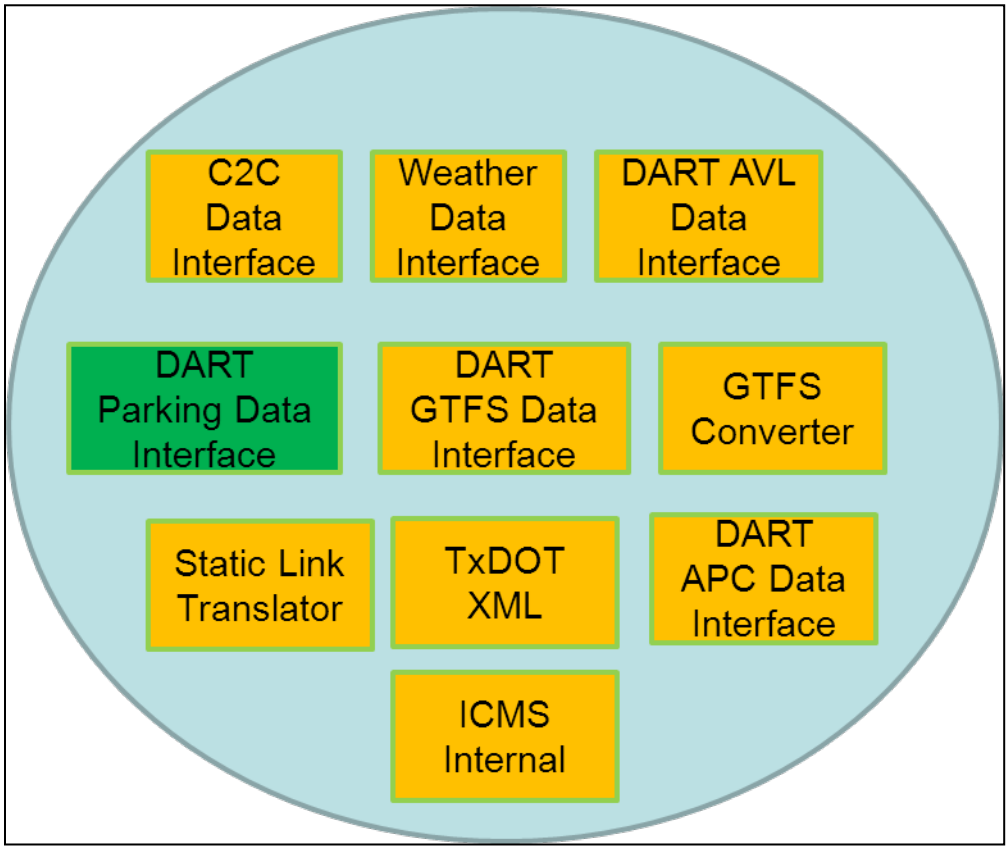

Figure 44: Data Collection Subsubsystem Software Components

5.4.1 C2C Data Interface

This software component provides the interface between the data collection subsubsystem and the TxDOT Regional Center-to-Center system. This interface provides link data, equipment status, and incident and construction data as described in section 4.10 above.

5.4.2 Weather Data Interface

This software component provides the interface between the data collection subsubsystem and the Telvent-DTN weather information system. This interface provides weather link data, weather radar overlays, and forecast data as described in section 3.9.2.9 above.

5.4.3 DART AVL Data Interface

This software component provides the interface between the data collection subsubsystem and the DART AVL data feed. This web service is a temporary connection that will eventually be replaced by the DART Data Portal, once it is publishing data to the Regional Center-to-Center interface. This interface is described in section 3.9.2.10.

5.4.4 DART Parking Data Interface

This software component provides the interface between the data collection subsubsystem and the DART Parking data feed. This interface provides parking availability information for the five light rail transit stations along the northern part of the red line within the US-75 corridor as described in section 3.9.2.8 above.

5.4.5 DART GTFS Data Interface

This software component provides the interface between the data collection subsubsystem and the DART GTFS data. This interface provides the routes, and schedule information for DART's bus and light rail systems.

5.4.6 GTFS Converter

This software component converts the data feed received from the DART GTFS Data Interface, and converts the data into the ICMS format for use by the SmartFusion subsystem.

5.4.7 Static Link Translator

This software component provides the translation of links from the various data feeds into the ICMS network defined within the data store subsubsystem. Once link data is received from an external provider, the link data is mapped to the links within the ICMS and the link data is translated to the mapping.

5.4.8 TxDOT XML

This software component provides the interface between the data collection subsubsystem and the TxDOT XML feed. Since the level of granularity of the TxDOT Regional Center-to-Center (C2C) is not sufficient in some cases, the XML feed is provided for more detailed information that the C2C does not provide.

5.4.9 DART APC Data Interface

This software component provides the interface between the data collection subsubsystem and the DART APC system. As part of additional funding, the APC data interface will either be separate, or combined with the existing DART web services data feed. This information, along with the schedule and routes provided from the GTFS, the location provided in the DART AVL feed will provide all necessary data for the transit component of the ICMS.

5.4.10 ICMS Internal

This software component provides the interface between the data collection subsubsystem and the SmartNET GUI subsystem. This interface processes the events (incident, construction, special events) entered into the SmartNET GUI by the agency users, as described in section 3.9.3.2 above.

5.5 Data Dissemination Subsubsystem

The data dissemination subsubsystem consists of interfaces to external and internal data users, this includes the traveler information systems (DFW 511), the regional center-to-center, and the other subsystems within the ICMS. The following diagram shows the physical components of the subsubsystem and the text below describes each of these software components.

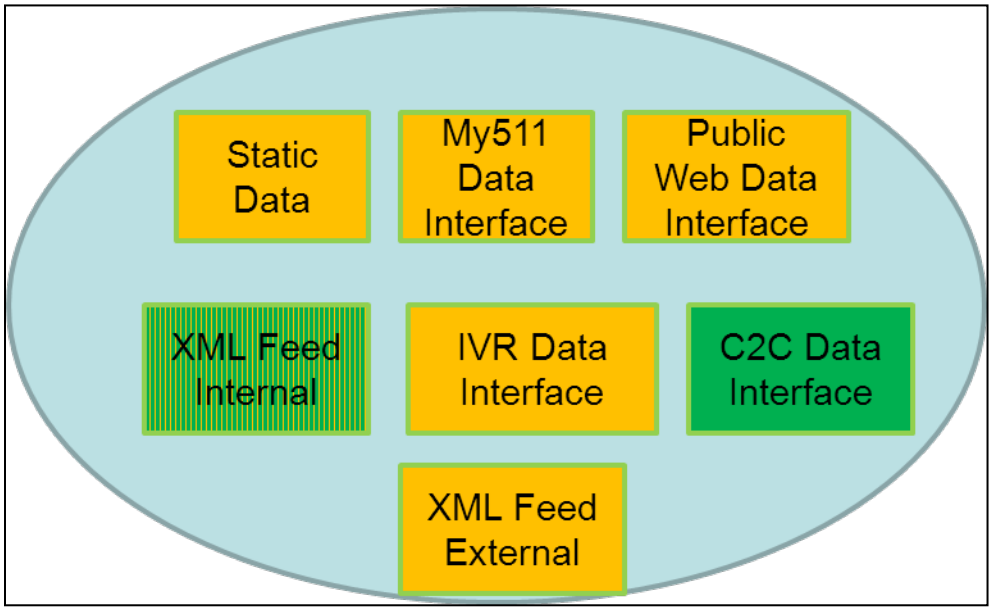

Figure 45: Data Dissemination Subsubsystem Software Components

5.5.1 Static Data

The static data component provides external and internal systems a baseline data set of the static data within the ICMS. This includes an inventory of all devices, locations, links, nodes, and map shape files.

5.5.2 My511 Data Interface

This software component provides the interface between the data dissemination subsubsystem and the My511 system, as described in section 3.9.2.4 above. This data provides the personalized traveler information for the DFW 511 system.

5.5.3 Public Web Data Interface

This software component provides the interface between the data dissemination subsubsystem and the DFW 511 Website, as described in section 3.9.2.2 above. This data provides the web-based traveler information for the DFW 511 system.

5.5.4 XML Feed Internal

This software component provides the interface between the data dissemination subsubsystem and the internal ICMS users (such as the expert rules subsubsystem and the prediction subsubsystem) using an XML format, as described in sections 4.8.3 and 3.9.2.7 above.

5.5.5 IVR Data Interface

This software component provides the interface between the data dissemination subsubsystem and the DFW 511 interactive voice response system, as described in section 3.9.2.1 above. This data provides the voice-based traveler information for the DFW 511 system.

5.5.6 C2C Data Interface

This software component provides the interface between the data collection subsubsystem and the TxDOT regional center-to-center system, and allows the ICMS to publish data to the TxDOT regional center-to-center system. This interface provides the incident and construction data as described in section 3.9.2.11 above.

5.5.7 XML Feed External

This software component provides the interface between the data dissemination subsubsystem and any approved external users using an XML format, as described in sections 4.8.3 and 3.9.2.7 above.

5.6 Data Store Subsubsystem

The data store subsubsystem consists of database tables and software which stores and provides data to ICMS, this data consists of static network data, dynamic data, a data archive, and report tools to query the database for specific information. The following diagram shows the physical components of the subsubsystem and the text below describes each of these software components.

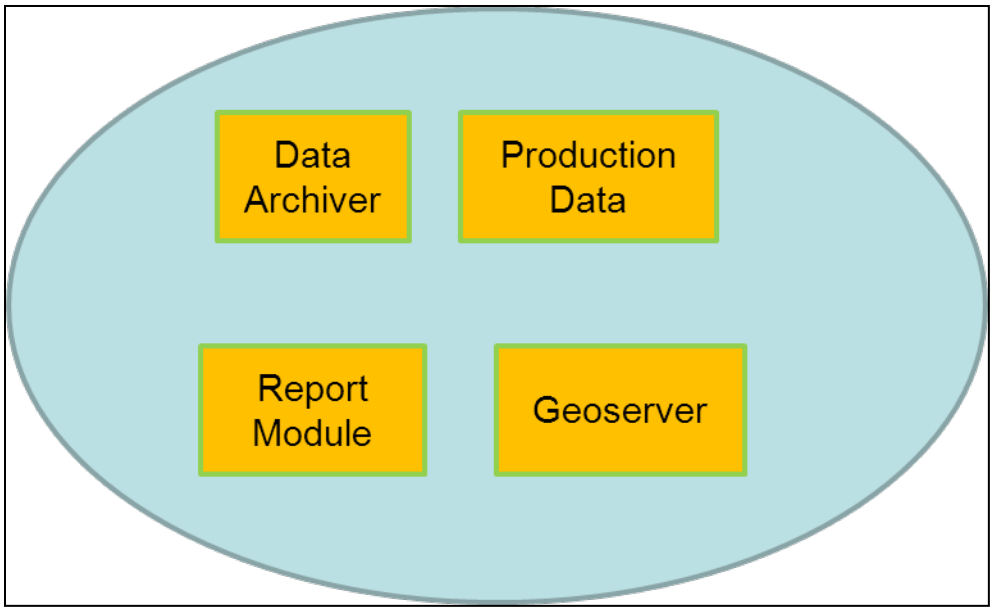

Figure 46: Data Store Subsubsystem Software Components

5.6.1 Data Archiver

This software component provides the data archiving functionality within the data store subsubsystem. The data archiver moves data from the production database into an archive database based on a configurable setting within the SmartNET™ software, as described in section 4.11.1.1 above. This functionality is provided as part of the Microsoft SQL Server product.

5.6.2 Production Data

This software component provides the production data database, Microsoft SQL Server, within the data store subsubsystem. The production data stores all new data, edited data, and static data within the ICMS, as described in section 4.11.1.1 above.

5.6.3 Report Module

This software component provides the reporting functionality within the data store subsubsystem. The report module allows authorized users to create various customizable and pre-defined reports within the SmartNET™ software. This reporting functionality is provided by the Microsoft SQL Server software, as defined in section 3.13.4 above.

5.6.4 GeoServer

This software component provides the mapping functionality for the SmartNET™ software, and more specifically for the SmartNET GUI subsubsystem. The Geo Server software is an open source software server written in Java that allows users to share and edit geospatial data.

5.7 Plan Decision Subsubsystem

The plan decision subsubsystem consists of a workflow tool that interacts with the DSS and the SmartNET subsystems to manage the interaction and workflow for managing response plans for the ICMS. The following text describes each of the software components.

5.7.1 Plan Coordination Workflow

This software component provides the interface between the three subsubsystems and workflow tools needed to manage the response plan process. This software uses an open-source Java based workflow tool to develop and manage the workflow process, as described in section 4.7 above.

5.8 SmartNET GUI Subsubsystem

The SmartNET GUI subsubsystem consists of user interface and software which allows users to view, edit, and create the data for the ICMS, this data consists of static network data and dynamic data. The following diagram shows the physical software components of the subsubsystem and the text below describes each of these components.

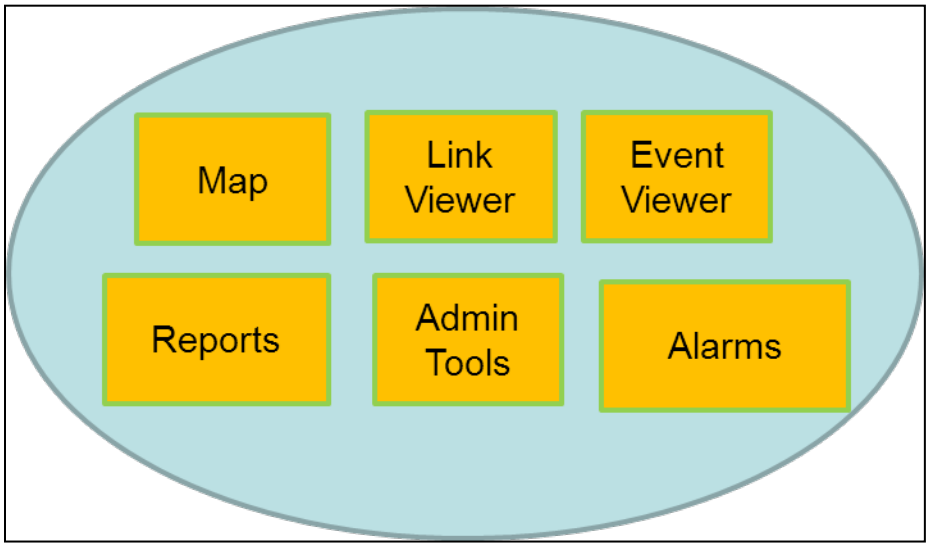

Figure 47: SmartNET GUI Subsubsystem Software Components

5.8.1 Map

The map software component provides the SmartNET GUI subsubsystem users with the map and uses the Geoserver component in the data store subsubsystem to generate the view and extents of the map displayed to the individual users.

5.8.2 Link Viewer

The link viewer component provides the SmartNET GUI subsubsystem users with the ability to view data on a group of links within the network, create new links within the network, and to view and edit individual devices within the network. This software component is a part of the existing SmartNET™ software.

5.8.3 Event Viewer

The event viewer component provides the SmartNET GUI subsubsystem users with the ability to create, view, edit, and close events within the network. This software component is a part of the existing SmartNET™ software.

5.8.4 Reports

The reports software component provides the SmartNET GUI subsubsystem users with the ability to create and view reports on data within the data store, this component interfaces with the reports module within the data store subsubsystem.

5.8.5 Admin Tools

The admin tools component provides the SmartNET GUI subsubsystem users with the ability to login, create, edit and delete user and agency profiles, and send e-mails. This software component is a part of the existing SmartNET™ software.

5.8.6 Alarms

The alarms component provides the SmartNET GUI subsubsystem users with the ability to view, acknowledge, and close alarms created by the ICMS when action or acknowledgement is needed. This software component is a part of the existing SmartNET™ software.

5.9 Plan Decision Dialogue Subsubsystem

The plan decision dialogue subsubsystem consists of the graphical user interface for the workflow tool that interacts with the DSS and the SmartNET software to manage the interaction and workflow for managing response plans for the ICMS. The following text describes each of the software components.

5.9.1 Plan Coordination

This plan coordination software component provides the interface between the SmartNET and SmartFusion subsubsystems and provides the workflow tools needed to manage the response plan process. This software uses an open-source Java based workflow tool to develop and manage the workflow process, as described in section 4.7 above.

6 Deployment Phasing

The ICMS is a multi-stage deployment which uses existing software, deployment of off-the-shelf solutions, and creation of some custom software. The ICMS is planned to be deployed in three phases.

6.1 Phase 1

The first phase was completed during the Analysis, Modeling, and Simulation phase of the ICM program. During this phase the SmartNET™ software was deployed on a single set of hardware in the Daltrans facility, with a connect to the regional center-to-center (C2C) which allows the SmartNET™ software to receive incidents events, construction events, dynamic link information, and field device information.

6.2 Phase 2

The second phase of the ICMS deployment is to add the deployment of off-the-shelf solutions for traveler information (e.g. the DFW 511 system), add transit data into the SmartNET™ software, add weather data into the SmartNET™ software, and upgrade the hardware deployed at Daltrans.

6.3 Phase 3

The third phase of the ICMS deployment is to add the decision support subsystem and its supporting data and graphical interfaces to the SmartNET™ software. In addition, an updated interface to a new version of the regional center-to-center will be deployed which allows both receiving and publishing of traffic data. Lastly, the SmartFusion subsystem will be updated to support all new and updated data sources and data feed requirements.

6.4 Future Enhancements

Since funding for the ICMS was limited, several interfaces and functionality identified during the Stage 1 work will be added in the future, assuming funding becomes available. These items include:

- Provide Trip Planning Interface
- Receive and integrate 3rd Party Traffic Information
- Traffic Signal Data
- Digital Video Integration
- DART Data Portal – fed through Regional Center-to-Center and ICMS connections to DART data removed.

7 Requirements Traceability

The requirements to design traceability matrix provides a cross reference between requirements and specific sections of the design document which apply to each requirement. There are requirements that do not have a direct correlation to specific sections of the design document and a higher level section reference or explanation will be provided. The following table includes the high level business requirements and detailed requirements.

7.1 ICMS High-Level "Business" Requirements

The ICM Steering Committee developed the User Needs, Goals, and Vision for the corridor. These were then translated into applicable use cases, and high-level requirements for the ICM System as a whole. These requirements are fulfilled by existing and new systems, and are the basis for the High-Level Design.

Table 12: ICMS High-Level Requirements Traceability Matrix

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.10	The ICMS System shall provide interactive communication among agencies	Functional	1	Con Ops §4.2	High	Demonstrate	SmartNET, SmartFusion	1	Section 5.2
1.0.0.20	The ICMS System shall receive current status of ITS devices in the corridor	Interface	2	Con Ops §4.2	High	Demonstrate	SmartFusion	1	Section 5.2

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.25	The ICMS System shall receive current status of the transportation network in the corridor	Interface	2	Con Ops §4.2	High	Demonstrate	SmartFusion	1	Section 5.2
1.0.0.30	The ICMS System shall send current status of ITS devices in the corridor to the corridor agencies	Interface	3	Con Ops §4.2	High	Demonstrate	SmartFusion , SmartNET	1	Section 5.2
1.0.0.40	The ICMS System shall provide current performance of the corridor transportation network to corridor agencies	Data	4	Con Ops §4.2	Medium	Demonstrate	SmartFusion , SmartNET	3	Section 5.2
1.0.0.50	The ICMS System shall provide current performance of the corridor transportation network to travelers	Functional	5	Con Ops §4.2	High	Demonstrate	SmartFusion	2	Section 5.1.2.2
1.0.0.60	The ICMS System shall provide information for corridor interactive trip planning to travelers	Interface	6	Con Ops §4.2	Medium	Demonstrate	Outside of ICM System - existing DART system	Future	N/A
1.0.0.70	The ICMS System shall provide travel time information to travelers	Interface	7	Con Ops §4.2	Medium	Demonstrate	SmartFusion	2	Section 5.1.2.2 Section 5.1.2.1

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.80	The ICMS System shall provide roadway event information to travelers	Interface	8	Con Ops §4.2	High	Demonstrate	SmartFusion	2	Section 5.1.2.2 Section 5.1.2.1
1.0.0.90	The ICMS System shall provide transit event information to travelers	Interface	9	Con Ops §4.2	High	Demonstrate	SmartFusion	2	Section 5.1.2.2 Section 5.1.2.1
1.0.0.100	The ICMS System shall store inventory of ITS devices within the corridor	Functional	10	Con Ops §4.2	Medium	Demonstrate	SmartFusion	1	Section 5.2
1.0.0.110	The ICMS System shall store ownership of ITS devices within the corridor	Functional	11	Con Ops §4.2	Medium	Demonstrate	SmartFusion	1	Section 5.2
1.0.0.120	The ICMS System shall analyze stored event data to evaluate the effectiveness of the corridor strategies and response plans	Functional	12	Con Ops §4.2	High	Demonstrate	DSS	3	Section 5.3

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.130	The ICMS System shall analyze stored ITS device status data to evaluate the effectiveness of the corridor strategies and response plans	Functional	13	Con Ops §4.2	Medium	Demonstrate	DSS	3	Section 5.3
1.0.0.140	The ICMS System shall store pre-agreed incident response plans	Functional	14	Cons Ops 4.2	Medium	Demonstrate	SmartFusion , DSS	3	Section 5.2 Section 5.3
1.0.0.150	The ICMS System shall send to agency users incident response plans to ensure that conflicting responses are not enacted	Interface	15	Con Ops §4.2	High	Demonstrate	SmartFusion , DSS	3	Section 5.2 Section 5.3
1.0.0.160	The ICMS System shall send agency users incident response plans to ensure prompt response to incidents	Interface	16	Con Ops §4.2	Medium	Demonstrate	SmartFusion , SmartNET, DSS	3	Section 5.2 Section 5.3
1.0.0.170	The ICMS System shall provide travelers alternate route option information	Functional	17	Con Ops §4.2	Low	Demonstrate	SmartFusion	2	511 Systems Interface
1.0.0.180	The ICMS System shall provide travelers detour route information	Functional	18	Con Ops §4.2	Low	Demonstrate	SmartFusion	2	511 Systems Interface

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.190	The ICMS System shall provide travelers information on alternate modes of transportation	Functional	19	Con Ops §4.2	Medium	Demonstrate	SmartFusion	2	511 Systems Interface
1.0.0.200	The ICMS System shall store history of enacted response plans	Functional	20	Con Ops §4.2	Medium	Demonstrate	SmartFusion	3	Section 5.2 Section 5.3
1.0.0.210	The ICMS System shall evaluate the impact of enacted response plans on the corridor	Functional	21	Con Ops §4.2	Medium	Demonstrate	DSS	3	Section 5.3
1.0.0.220	The ICMS System shall provide agency users the capability to update incident response plans	Interface	22	Con Ops §4.2	Medium	Demonstrate	DSS	3	Section 5.3
1.0.0.230	The ICMS System shall store updated pre-approved response plans	Functional	23	Con Ops §4.2	Medium	Demonstrate	SmartFusion, DSS	3	Section 5.2 Section 5.3
1.0.0.240	The ICMS System shall provide 98 percent availability	Perform	24	Con Ops §4.2	Low	Demonstrate	SmartFusion, SmartNET, DSS	3	Section 5.1 Preliminary Software Components
1.0.0.250	The ICMS System shall provide data latency of less than or equal to 10 minutes from a data source where a change is received	Perform	24	Con Ops §4.2	Low	Demonstrate	SmartFusion, SmartNET, DSS	3	Section 5.1

Requirement ID	Requirement Description	Type	User Needs	Source	Criticality	Verification Method	Subsystem Allocation	Phase	High-Level Design Section Allocation
1.0.0.260	The ICMS System shall provide automated monitoring capabilities to alert operators of outages	Perform	24	Con Ops §4.2	Low	Demonstrate	SmartFusion, SmartNET, DSS	3	Preliminary Software Components
1.0.0.270	The ICMS System shall provide failover capabilities within 45 minutes	Perform	24	Con Ops §4.2	Low	Demonstrate	SmartFusion, SmartNET, DSS	3	Section 5.1 Preliminary Software Components

7.2 ICMS Detailed Requirements

The requirements to design traceability matrix below provides a cross reference between requirements and specific sections of the system design document which apply to each subsystem and subsubsystem requirement. There are requirements that do not have a direct correlation to specific sections of the design document, because they are either already implemented (Phase 1), will be implemented during the 511 deployment (Phase 2), or Future enhancement that is currently unfunded (Future). The following table includes the detailed subsystem and Subsubsystem requirements.

7.2.1 Decision Support Subsystem Detailed Requirements

The decision support subsystem requirements provide the functions and data interfaces required for the DSS to operate the ICMS. The following table allocates the requirements to the sections above which decompose the requirements. Since the DSS will be done as part of Phase 3, the Phase column has been removed from this table.

Table 13: Decision Support System Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation
1.1.0.10	The Decision Support Subsystem shall receive from the Data Store Subsubsystem pre-agreed incident response plans as defined in data dictionary table 2.9.1	Functional	1.0.0.140	14	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.20	The Decision Support Subsystem shall provide the ICM Coordinator the capability to add pre-agreed incident response plans for a specified incident to the Data Store Sub-subsystem	Functional	1.0.0.230	23	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.30	The Decision Support Subsystem shall provide the ICM Coordinator the capability to query pre-agreed incident response plans	Functional	1.0.0.140	14	M	Demo	Con Ops §4.3	4.2	Expert Rules

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation
1.1.0.40	The Decision Support Subsystem shall provide the ICM Coordinator the capability to edit pre-agreed incident response plans for a specified incident	Functional	1.0.0.230	23	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.50	The Decision Support Subsystem shall provide the ICM Coordinator the capability to delete pre-agreed incident response plans for specified events	Functional	1.0.0.230	23	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.60	The Decision Support Subsystem shall receive from the SmartFusion Subsystem Incidents as defined in data dictionary table 2.5.1	Data	1.0.0.25	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.70	The Decision Support Subsystem shall receive from the SmartFusion Subsystem Construction as defined in data dictionary table 2.5.2	Data	1.0.0.25	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.80	The Decision Support Subsystem shall receive from the SmartFusion Subsystem Special events as defined in data dictionary table 2.5.3	Data	1.0.0.25	2	M	Demo	Con Ops §4.3	4.2	Expert Rules

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation
1.1.0.90	The Decision Support Subsystem shall receive from the SmartFusion Subsystem Link dynamic data as defined in data dictionary table 2.4.4	Data	1.0.0.25	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.100	The Decision Support Subsystem shall receive from the SmartFusion Subsystem HOV Status data as defined in data dictionary table 2.4.4	Data	1.0.0.20	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.110	The Decision Support Subsystem shall receive from the SmartFusion Subsystem VMS Status Data as defined in data dictionary table 2.1.1	Data	1.0.0.20	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.120	The Decision Support Subsystem shall receive from the SmartFusion Subsystem Traffic signal status data as defined in data dictionary table 2.1.3	Data	1.0.0.20	2	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.130	The Decision Support Subsystem shall receive from the SmartFusion Subsystem parking lot data as defined in data dictionary table 2.4.1	Data	1.0.0.20	2	M	Demo	Con Ops §4.3	4.2	Expert Rules

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation
1.1.0.170	The Decision Support Subsystem shall receive from the SmartFusion Subsystem the response plan decision result as defined in data dictionary table 2.9.3	Data	1.0.0.10	1	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.180	The Decision Support Subsystem shall receive from the SmartFusion Subsystem agency status as defined in data dictionary table 2.7.1	Data	1.0.0.10	1	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.190	The Decision Support Subsystem shall receive from the SmartFusion Subsystem historical data as defined in data dictionary table section 2.10	Data	1.0.0.130	20	M	Demo	Con Ops §4.3	4.2	Evaluation
1.1.0.200	The Decision Support Subsystem shall send the SmartFusion Subsystem agency status requests	Data	1.0.0.10	1	M	Demo	Con Ops §4.3	4.2	Expert Rules

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation
1.1.0.210	The Decision Support Subsystem shall send the SmartFusion Subsystem a response plan recommendation within fifteen minutes of incident conditions that trigger a response plan recommendation arriving at the SmartFusion XML feed	Perform	1.0.0.160	15, 16	M	Demo	Con Ops §4.3	4.2	Expert Rules
1.1.0.220	The Decision Support Subsystem shall receive from the SmartFusion Subsystem weather alert data	Data	1.0.0.120	12	M	Demo	Con Ops §4.3	4.2	Expert Rules

7.2.1.1 Expert Rules Subsubsystem Detailed Requirements

The expert rules subsubsystem requirements provide the functions and data interfaces required for the expert rules subsubsystem within the DSS subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 14: Expert Rules Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.10	The Expert Rules Subsubsystem Shall generate a response plan recommendation based on existing network conditions in the ICM corridor	Function	1.1.0.210	15, 16	Low	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.30	The Expert Rules Subsubsystem Shall send to the Plan Decision Subsubsystem a response plan recommendation	Function	1.1.0.210	15, 16	Low	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.40	The Expert Rules Subsubsystem shall provide the Evaluation Subsubsystem the response plan recommendation after the ICM Coordinator confirms the response plan	Function	1.1.0.210	15, 16	Low	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.60	The Expert Rules Subsubsystem shall receive from the Plan Decision Subsubsystem a plan decision result	Function	1.1.0.210	15, 16	Low	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.80	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem VMS status data	Data	1.1.0.110	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.90	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem Traffic Signal status data	Data	1.1.0.120	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.100	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem HOV status data	Data	1.1.0.100	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.110	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem link dynamic data	Data	1.1.0.90	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.150	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem parking lot data	Data	1.1.0.130	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.160	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem weather alert data	Data	1.1.0.220	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.190	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem incident data	Data	1.1.0.60	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.200	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem construction data	Data	1.1.0.70	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.210	The Expert Rules Subsubsystem shall receive from the Data Dissemination Subsubsystem special event data	Data	1.1.0.80	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.240	The Expert Rules Subsubsystem shall receive from the Plan Decision Subsubsystem agency status	Data	1.1.0.180	1	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.340	The Expert Rules Subsubsystem shall receive from the Prediction Subsubsystem predicted network conditions	Data	1.0.0.120	12, 13	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.350	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem link dynamic data	Data	1.1.0.90	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.360	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem incidents	Data	1.1.0.60	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.370	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem construction	Data	1.1.0.70	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.380	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem special events	Data	1.1.0.80	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.390	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem traffic signal status data	Data	1.1.0.120	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.400	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem VMS status data	Data	1.1.0.110	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.410	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem HOV status data	Data	1.1.0.100	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.420	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem weather alert data	Data	1.1.0.220	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.430	The Expert Rules Subsubsystem shall send to the Evaluation Subsubsystem parking lot data	Data	1.1.0.130	2	Medium	Demo	Con Ops §4.3	4.3	XML Data Interfaces	3
1.1.1.440	The Expert Rules Subsubsystem shall calculate measures of effectiveness	Data	1.0.0.120	12	Medium	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.450	The Expert Rules Subsubsystem shall send the Evaluation Subsubsystem agency status	Data	1.1.0.180	1	Medium	Demo	Con Ops §4.3	4.3	Rules Engine	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.460	The Expert Rules Subsubsystem shall send the Plan Decision Subsubsystem agency status request	Data	1.1.0.200	15, 16	Low	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.470	The Expert Rules Subsubsystem shall send the Evaluation Subsubsystem a summary of the predicted network conditions	Data	1.0.0.120, 1.0.0.130	12, 13	Medium	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.490	The Expert Rules Subsubsystem shall select a response plan recommendation based on the response plan list	Function	1.1.0.210	15	High	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.500	The Expert Rules Subsubsystem shall coordinate with the Plan Decision Subsubsystem the response plan recommendation	Function	1.1.0.210	15	High	Demo	Con Ops §4.3	4.3	Rules Engine	3
1.1.1.510	The Expert Rules Subsubsystem shall retrieve from the Data Store Subsubsystem pre-agreed incident response plans as defined in data dictionary table 2.9.1	Data	1.1.0.210	15,16, 20	Medium	Demo	Con Ops §4.3	4.3	Rules Engine	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.520	The Expert Rules Subsubsystem shall provide the DSS Administrator the capability to add pre-agreed incident response plans for a specified incident to the data store subsubsystem	Data	1.1.0.210	15,16, 20	Medium	Demo	Con Ops §4.3	4.3	Expert Rules Manager	3
1.1.1.530	The Expert Rules Subsubsystem shall provide the DSS Administrator the capability to query pre-agreed incident response plans	Function	1.1.0.210	15,16, 20	Medium	Demo	Con Ops §4.3	4.3	Expert Rules Manager	3
1.1.1.540	The Expert Rules Subsubsystem shall provide the DSS Administrator the capability to edit pre-agreed incident response plans for a specified incident	Function	1.1.0.210	15,16, 20	Medium	Demo	Con Ops §4.3	4.3	Expert Rules Manager	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.1.550	The Expert Rules Subsubsystem shall provide the DSS Administrator the capability to delete pre-agreed incident response plans for specified events	Function	1.1.0.210	15,16, 20	Medium	Demo	Con Ops §4.3	4.3	Expert Rules Manager	3

7.2.1.2 Evaluation Subsubsystem Detailed Requirements

The evaluation subsubsystem requirements provide the functions and data interfaces required for the evaluation subsubsystem within the DSS subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 15: Evaluation Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.2.10	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem agency status	Data	1.1.0.180	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.20	The Evaluation Subsubsystem shall accept from the Expert Rules Subsubsystem the recommended incident response plan within two minutes after the ICM Coordinator confirms the response plan and confirmation is posted in the SmartFusion XML feed	Function	1.1.0.210	15, 16	Medium	Demo	Con Ops §4.3	4.5	Evaluation Data Store	3
1.1.2.40	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem link dynamic data	Data	1.1.0.90	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.50	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem incidents	Data	1.1.0.60	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.2.60	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem construction	Data	1.1.0.70	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.70	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem special events	Data	1.1.0.80	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.80	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem traffic signal status data	Data	1.1.0.120	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.90	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem VMS status data	Data	1.1.0.110	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.100	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem HOV status data	Data	1.1.0.100	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.110	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem weather alert data	Data	1.1.0.220	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.2.120	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem parking lot data	Data	1.1.0.130	2	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.130	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem a summary of the predicted network conditions	Data	1.0.0.120, 1.0.0.130	12, 13	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.140	The Evaluation Subsubsystem shall receive from the Expert Rules Subsubsystem a response plan recommendation	Data	1.0.0.120, 1.0.0.130	12, 13	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3
1.1.2.150	The Evaluation Subsubsystem shall evaluate the ICM network to calculate measures of effectiveness of the corridor	Functional	1.0.0.120, 1.0.0.130	12, 13	Medium	Demo	Con Ops §4.3	4.5	Evaluation Manager	3
1.1.2.160	The Evaluation Subsubsystem shall receive from the Data Store Subsubsystem historical data	Data	1.0.0.120, 1.0.0.130	12, 13	Medium	Demo	Con Ops §4.3	4.5	XML Data Interfaces	3

7.2.1.3 Prediction Subsubsystem Detailed Requirements

The prediction subsubsystem requirements provide the functions and data interfaces required for the prediction subsubsystem within the DSS subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 16: Prediction Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.3.10	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem link dynamic data	Data	1.1.0.90	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.20	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem traffic signal data	Data	1.1.0.120	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.30	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem incidents	Data	1.1.0.60	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.40	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem construction	Data	1.1.0.70	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.3.50	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem special events	Data	1.1.0.80	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.60	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem VMS status data	Data	1.1.0.110	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.70	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem HOV status data	Data	1.1.0.100	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.80	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem weather alert data	Data	1,1,0.220	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.90	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem parking lot data	Data	1.1.0.130	2	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.3.100	The Prediction Subsubsystem shall receive from the Data Dissemination Subsubsystem response plan	Data	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.4	XML Data Interfaces	3
1.1.3.110	The Prediction Subsubsystem shall compute predicted network conditions	Functional	1.0.0.120	12, 13	Medium	Demo	Con Ops §4.3	4.4	DIRECT Simulation Engine	3
1.1.3.120	The Prediction Subsubsystem shall send to the Expert Rules Subsubsystem predicted network conditions	Data	1.0.0.120	12, 13	Medium	Demo	Con Ops §4.3	4.4	DIRECT Simulation Engine	3
1.1.3.130	The Prediction Subsubsystem shall accept from the Data Dissemination Subsubsystem the recommended incident response plan within two minutes after the ICM Coordinator confirms the response plan and confirmation is posted in the SmartFusion XML feed	Data	1.1.0.210	15, 16	Medium	Demo	Con Ops §4.3	4.4	DIRECT Simulation Engine	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.1.3.160	The Prediction Subsubsystem shall evaluate the ICM network conditions to compute the performance measures	Function			Medium	Demo	Con Ops §4.3	4.4	DIRECT Simulation Engine	3

7.2.2 SmartFusion Subsystem Detailed Requirements

For the following requirements, several have already been allocated to the existing SmartNET™ software deployment (Phase 1), or the 511 system deployment (Phase 2). In addition, several requirements are future enhancements that have been identified by the stakeholders, but will not be a part of the ICMS demonstration.

Table 17: SmartFusion Subsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.10	The SmartFusion Subsystem shall receive from the Regional Center to Center interface CCTV status in the corridor as defined in C2C-SICD-4.3.0	Interface	1.0.0.20	2	H	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.15	The SmartFusion Subsystem shall receive from the Regional Center to Center interface VMS Status in the corridor as defined in C2C-SICD-4.3.0	Interface	1.0.0.20	2	H	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.18	The SmartFusion Subsystem shall receive from the Regional Center to Center interface HOV Status in the corridor as defined in C2C-SICD-4.3.0	Interface	1.0.0.20	2	H	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.20	The SmartFusion Subsystem shall receive from the DART Network bus AVL data in the corridor	Interface	1.0.0.25	2	M	Demo	Con Ops §4.3	4.6	Data Collection	2

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.25	The SmartFusion Subsystem shall receive from the DART Network light rail vehicle AVL data in the corridor	Interface	1.0.0.25	2	M	Demo	Con Ops §4.3	4.6	Data Collection	2
1.2.0.30	The SmartFusion Subsystem shall receive from the weather data interface weather link data in the corridor	Interface	1.0.0.25	2	Medium	Demo	Con Ops §4.3	4.6	Data Collection	2
1.2.0.35	The SmartFusion Subsystem shall receive from the weather data interface weather alert data in the corridor	Interface	1.0.0.20	2	Medium	Demo	Con Ops §4.3	4.6	Data Collection	2
1.2.0.40	The SmartFusion Subsystem shall receive from the Parking Management System Interface parking lot data in the corridor as defined in data dictionary table 2.4.1	Interface	1.0.0.20	2	Medium	Demo	Con Ops §4.3	4.6	Data Collection	3
1.2.0.50	The SmartFusion Subsystem shall receive current link dynamic data in the corridor from the Regional Center to Center interface as defined in C2C-SICD-4.3.0	Interface	1.0.0.20	2	Medium	Demo	Con Ops §4.3	4.6	Data Collection	1

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.70	The SmartFusion Subsystem shall receive from 3rd Party information providers link dynamic data in the corridor	Interface	1.0.0.20	2	Medium	Demo	Con Ops §4.3	4.6	Data Collection	Future
1.2.0.90	The SmartFusion Subsystem shall receive from the Regional Center to Center interface incident data as defined in C2C-SICD-4.3.0	Interface	1.0.0.25	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.95	The SmartFusion Subsystem shall receive from the Regional Center to Center interface construction data as defined in C2C-SICD-4.3.0	Interface	1.0.0.25	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.100	The SmartFusion Subsystem shall receive from the SmartNET Subsystem incident data	Data	1.0.0.25	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.105	The SmartFusion Subsystem shall receive from the SmartNET Subsystem construction data	Data	1.0.0.25	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.108	The SmartFusion Subsystem shall receive from the SmartNET Subsystem special event data	Data	1.0.0.25	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.110	The SmartFusion Subsystem shall send to the Regional Center to Center interface parking lot data as defined in C2C-SICD-4.3.0	Interface	1.0.0.50	5	High	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.115	The SmartFusion Subsystem shall send to the Regional Center to Center interface transit vehicle location data as defined in C2C-SICD-4.3.0	Interface	1.0.0.50	5	High	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.120	The SmartFusion Subsystem shall send to the Regional Center to Center interface link dynamic data as defined in C2C-SICD-4.3.0	Interface	1.0.0.70	7	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.125	The SmartFusion Subsystem shall send to the Regional Center to Center interface transit vehicle location data as defined in C2C-SICD-4.3.0	Interface	1.0.0.70	7	Medium	Demo	Con Ops 4.3	4.6	Data Dissemination	3
1.2.0.130	The SmartFusion Subsystem shall send to the Regional Center to Center interface incident data as defined in C2C-SICD-4.3.0	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.135	The SmartFusion Subsystem shall send to the Regional Center to Center interface construction data as defined in C2C-SICD-4.3.0	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.138	The SmartFusion Subsystem shall send to the Regional Center to Center interface special event data as defined in C2C-SICD-4.3.0	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.140	The SmartFusion Subsystem shall send to the Public Web weather alert data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.150	The SmartFusion Subsystem shall send to the Public Web incident data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.155	The SmartFusion Subsystem shall send to the Public Web construction data	Interface	1.0.0.90	8, 9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.158	The SmartFusion Subsystem shall send to the Public Web special event data	Interface	1.0.0.90	8, 9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.160	The SmartFusion Subsystem shall send to the Public Web link dynamic data	Interface	1.0.0.70	7	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.165	The SmartFusion Subsystem shall send to the Public Web parking lot data	Interface	1.0.0.70	7	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.170	The SmartFusion Subsystem shall send to the Interactive Voice Response Telephone system link dynamic data	Interface	1.0.0.70	7	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.180	The SmartFusion Subsystem shall send to the Interactive Voice Response Telephone system incident data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.200	The SmartFusion Subsystem shall send to the Interactive Voice Response Telephone system weather alert data	Interface	1.0.0.50	5	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.210	The SmartFusion Subsystem shall send to the XML feed Events	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.220	The SmartFusion Subsystem shall send to the interactive trip planner incident data	Interface	1.0.0.60	6	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	Future
1.2.0.240	The SmartFusion Subsystem shall send to the interactive trip planner link dynamic data	Interface	1.0.0.60	6	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	Future

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.250	The SmartFusion Subsystem shall send to My511 system, link dynamic data	Interface	1.0.0.50	5	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.290	The SmartFusion Subsystem shall receive from the SmartNET Subsystem traffic signal status data	Data	1.0.0.20	2	High	Demo	Con Ops §4.3	4.6	Data Collection	1
1.2.0.270	The SmartFusion Subsystem shall send to My511 system, parking lot data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.280	The SmartFusion Subsystem shall send to My511 system, weather alert data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.300	The SmartFusion Subsystem shall send to the Public Web, parking lot data	Interface	1.0.0.90	8	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.310	The SmartFusion Subsystem shall send to the Public Web, transit vehicle location data	Interface	1.0.0.70	7	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2
1.2.0.320	The SmartFusion Subsystem shall send to Interactive Voice Response Telephone system, parking lot data	Interface	1.0.0.90	9	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	2

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.330	The SmartFusion Subsystem shall store incident data	Functional	1.0.0.120	12	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.340	The SmartFusion Subsystem shall store construction data	Functional	1.0.0.120	12	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.350	The SmartFusion Subsystem shall store special event data	Functional	1.0.0.120	12	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.360	The SmartFusion Subsystem shall store CCTV status data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.370	The SmartFusion Subsystem shall store VMS Status data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.380	The SmartFusion Subsystem shall store HOV Status data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.390	The SmartFusion Subsystem shall store link dynamic data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.400	The SmartFusion Subsystem shall store parking lot data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	3
1.2.0.410	The SmartFusion Subsystem shall store transit vehicle location data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	3
1.2.0.420	The SmartFusion Subsystem shall store weather alert data	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	2

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.430	The SmartFusion Subsystem shall aggregate incident data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.440	The SmartFusion Subsystem shall aggregate construction data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.450	The SmartFusion Subsystem shall aggregate special event data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.460	The SmartFusion Subsystem shall aggregate CCTV status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.470	The SmartFusion Subsystem shall aggregate VMS Status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.480	The SmartFusion Subsystem shall aggregate HOV Status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.490	The SmartFusion Subsystem shall aggregate link dynamic data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	1
1.2.0.500	The SmartFusion Subsystem shall aggregate parking lot data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	3
1.2.0.510	The SmartFusion Subsystem shall aggregate transit vehicle location data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	2
1.2.0.520	The SmartFusion Subsystem shall aggregate weather alert data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	2

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.530	The SmartFusion Subsystem shall store pre-agreed incident response plans	Functional	1.0.0.140	14	Medium	Demo	Con Ops §4.3	4.6	Data Store	3
1.2.0.540	The SmartFusion Subsystem shall store history of enacted response plans	Functional	1.0.0.200	20	Medium	Demo	Con Ops §4.3	4.6	Data Store	3
1.2.0.550	The SmartFusion Subsystem shall aggregate traffic signal status data	Functional	1.0.0.20	2	Medium	Demo	Con Ops §4.3	4.6	Data Fusion	3
1.2.0.560	The SmartFusion Subsystem shall send to the Decision Support Subsystem VMS status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.570	The SmartFusion Subsystem shall send to the Decision Support Subsystem CCTV status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.580	The SmartFusion Subsystem shall send to the Decision Support Subsystem HOV status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.590	The SmartFusion Subsystem shall send to the Decision Support Subsystem incident data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.600	The SmartFusion Subsystem shall send to the Decision Support Subsystem link dynamic data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.610	The SmartFusion Subsystem shall send to the Decision Support Subsystem parking lot data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.620	The SmartFusion Subsystem shall send to the Decision Support Subsystem weather alert data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.630	The SmartFusion Subsystem shall send to the Decision Support Subsystem traffic signal status data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.640	The SmartFusion Subsystem shall send to the Decision Support Subsystem transit vehicle location data	Functional	1.0.0.40	4	Medium	Demo	Con Ops §4.3	4.6	Data Dissemination	3
1.2.0.650	The SmartFusion Subsystem shall send to the SmartNET Subsystem static map data	Data	1.0.0.100	10	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.660	The SmartFusion Subsystem shall receive from the SmartNET Subsystem static map data	Data	1.0.0.100	10	Medium	Demo	Con Ops §4.3	4.6	Data Collection	1

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Subsubsystem Allocation	Phase
1.2.0.670	The SmartFusion Subsystem shall store static map data	Functional	1.0.0.100	10	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.680	The SmartFusion Subsystem shall store traffic signal status	Functional	1.0.0.130	13	Medium	Demo	Con Ops §4.3	4.6	Data Store	3
1.2.0.690	The SmartFusion Subsystem shall store map profile data	Functional	1.0.0.10	1	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.700	The SmartFusion Subsystem shall store agency profile data	Functional	1.0.0.220	22	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.710	The SmartFusion Subsystem shall store user profile data	Functional	1.0.0.220	22	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.720	The SmartFusion Subsystem shall store alarm notifications	Functional	1.0.0.10	1	Medium	Demo	Con Ops §4.3	4.6	Data Store	1
1.2.0.730	The SmartFusion Subsystem shall receive from the SmartNET Subsystem a map request	Data	1.0.0.100	10	Medium	Demo	Con Ops §4.3	4.6	Data Store	1

7.2.2.1 Data Collection Subsubsystem Requirements

The data collection subsubsystem requirements provide the functions and data interfaces required for the data collection subsubsystem within the SmartFusion subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 18: Data Collection Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.10	The Data Collection Subsubsystem shall receive from the regional center to center interface VMS status data as defined in C2C-SICD-4.3.0	Interface	1.2.0.15	2	Medium	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.20	The Data Collection Subsubsystem shall receive from the regional center to center interface CCTV status data as defined in C2C-SICD-4.3.0	Interface	1.2.0.10	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.30	The Data Collection Subsubsystem shall receive from the regional center to center interface HOV status data as defined in C2C-SICD-4.3.0	Interface	1.2.0.18	2	High	Demo	Con Ops §4.3	4.10	TxDOT XML	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.40	The Data Collection Subsubsystem shall receive from the regional center to center interface incident data as defined in C2C-SICD-4.3.0	Interface	1.2.0.90	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.50	The Data Collection Subsubsystem shall receive from the regional center to center interface construction data as defined in C2C-SICD-4.3.0	Interface	1.2.0.100	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.60	The Data Collection Subsubsystem shall receive from the regional center to center interface link dynamic data as defined in C2C-SICD-4.3.0	Interface	1.2.0.50	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.100	The Data Collection Subsubsystem shall receive from the SmartNET GUI Subsubsystem incident data	Interface	1.2.0.100	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.110	The Data Collection Subsubsystem shall receive from the SmartNET GUI Subsubsystem construction data	Interface	1.2.0.110	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.120	The Data Collection Subsubsystem shall receive from the SmartNET GUI Subsubsystem special event data	Interface	1.2.0.120	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.130	The Data Collection Subsubsystem shall receive from the SmartNET GUI Subsubsystem traffic signal status data	Interface	1.2.0.290	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	3
1.2.4.140	The Data Collection Subsubsystem shall receive from the DART Network Interface DART Bus AVL data	Interface	1.2.0.20	2	High	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.150	The Data Collection Subsubsystem shall receive from the DART Network Interface DART LRV AVL data	Interface	1.2.0.25	2	High	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.160	The Data Collection Subsubsystem shall receive from the weather provider interface weather alert data	Interface	1.2.0.35	2	High	Demo	Con Ops §4.3	4.10	Weather Data Interface	2
1.2.4.170	The Data Collection Subsubsystem shall receive from the weather provider interface weather link data	Interface	1.2.0.30	2	High	Demo	Con Ops §4.3	4.10	Weather Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.180	The Data Collection Subsubsystem shall receive from third party information provider link dynamic data	Interface	1.2.0.70	2	High	Demo	Con Ops §4.3	4.10	Future	Future
1.2.4.200	The Data Collection Subsubsystem shall receive from the Parking Management System Interface parking lot data	Interface	1.2.0.40	2	High	Demo	Con Ops §4.3	4.10	DART Parking Data Interface	3
1.2.4.220	The Data Collection Subsubsystem shall validate link volume data using historical data and expected values	Functional	1.2.0.50	2	Medium	Demo	Con Ops §4.3	4.10	Static Link Translator	1
1.2.4.230	The Data Collection Subsubsystem shall validate weather alert data using historical data and expected values	Functional	1.2.0.35	2	Medium	Demo	Con Ops §4.3	4.10	Weather Data Interface	3
1.2.4.260	The Data Collection Subsubsystem shall validate incident data using historical data and expected values	Functional	1.2.0.90	2	Medium	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.270	The Data Collection Subsubsystem shall validate special event data using historical data and expected values	Functional	1.2.0.120	2	Medium	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.275	The Data Collection Subsubsystem shall validate construction data using historical data and expected values	Functional	1.2.0.100	2	Medium	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.280	The Data Collection Subsubsystem shall validate parking lot data using historical data and expected values	Functional	1.2.0.40	2	Medium	Demo	Con Ops §4.3	4.10	DART Parking Data Interface	3
1.2.4.290	The Data Collection Subsubsystem shall validate weather link data using historical data and expected values	Functional	1.2.0.35	2	Medium	Demo	Con Ops §4.3	4.10	Weather Data Interface	2
1.2.4.300	The Data Collection Subsubsystem shall validate VMS status data using historical data and expected values	Functional	1.2.0.15	2	Medium	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.310	The Data Collection Subsubsystem shall validate CCTV status data using historical data and expected values	Functional	1.2.0.10	2	Medium	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.320	The Data Collection Subsubsystem shall validate traffic signal status data using historical data and expected values	Functional	1.2.0.290	2	Medium	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	3

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.330	The Data Collection Subsubsystem shall validate HOV status data using historical data and expected values	Functional	1.2.0.18	2	Medium	Demo	Con Ops §4.3	4.10	TxDOT XML	1
1.2.4.340	The Data Collection Subsubsystem shall confirm DART Bus AVL data using historical data and expected values	Functional	1.2.0.20	2	Medium	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.350	The Data Collection Subsubsystem shall confirm DART LRV AVL data using historical data and expected values	Functional	1.2.0.25	2	Medium	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.360	The Data Collection Subsubsystem shall translate link dynamic data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.50	2	High	Demo	Con Ops §4.3	4.10	Static Link Translator	1
1.2.4.380	The Data Collection Subsubsystem shall translate HOV Status data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.18	2	High	Demo	Con Ops §4.3	4.10	TxDOT XML	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.390	The Data Collection Subsubsystem shall translate CCTV Status data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.10	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.400	The Data Collection Subsubsystem shall translate VMS Status data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.15	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.410	The Data Collection Subsubsystem shall translate Incident data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.90	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.420	The Data Collection Subsubsystem shall translate Construction data received from the Regional Center to Center into the ICMS data format	Functional	1.2.0.95	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.450	The Data Collection Subsubsystem shall remove redundant Incident data received from SmartNET GUI when same incident was received from the Regional Center to Center interface	Functional	1.2.0.90	2	Medium	Demo	Con Ops §4.3	4.10	C2C Data Interface	3
1.2.4.460	The Data Collection Subsubsystem shall remove redundant construction data received from SmartNET GUI when same construction was received from the Regional Center to Center interface	Functional	1.2.0.95	2	Medium	Demo	Con Ops §4.3	4.10	C2C Data Interface	3
1.2.4.480	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem incident data	Data	1.2.0.90	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.490	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem construction data	Data	1.2.0.95	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.500	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem special events data	Data	1.2.0.108	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	1
1.2.4.510	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem CCTV status data	Data	1.2.0.10	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.520	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem VMS Status data	Data	1.2.0.15	2	High	Demo	Con Ops §4.3	4.10	C2C Data Interface	1
1.2.4.530	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem HOV status data	Data	1.2.0.18	2	High	Demo	Con Ops §4.3	4.10	TxDOT XML	1
1.2.4.540	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem traffic signal status data	Data	1.2.0.290	2	High	Demo	Con Ops §4.3	4.10	ICMS Internal Interface	3
1.2.4.550	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem weather link data	Data	1.2.0.30	2	High	Demo	Con Ops §4.3	4.10	Weather Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.560	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem parking lot data	Data	1.2.0.40	2	High	Demo	Con Ops §4.3	4.10	DART Parking Data Interface	3
1.2.4.570	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem link dynamic data	Data	1.2.0.50	2	High	Demo	Con Ops §4.3	4.10	Static Link Translator	1
1.2.4.580	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem weather alert data	Data	1.2.0.35	2	High	Demo	Con Ops §4.3	4.10	Weather Data Interface	2
1.2.4.590	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem DART LRV AVL data	Data	1.2.0.25	2	High	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.600	The Data Collection Subsubsystem shall send the Data Fusion Subsubsystem DART Bus AVL data	Data	1.2.0.20	2	High	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.640	The Data Collection Subsubsystem shall translate link dynamic data received from third party information providers into the ICMS data format	Functional	1.2.0.70	2	High	Demo	Con Ops §4.3	4.10	Future	Future

Req No	Requirement Text	Type	Parent Req	User Need	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.4.660	The Data Collection Subsubsystem shall translate DART LRV AVL Data received from the DART Network interface into ICMS format	Functional	1.2.0.25	2	Medium	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.670	The Data Collection Subsubsystem shall translate DART Bus AVL Data received from the DART Network interface into ICMS format	Functional	1.2.0.20	2	Medium	Demo	Con Ops §4.3	4.10	DART AVL Data Interface	2
1.2.4.680	The Data Collection Subsubsystem shall translate weather link data received from weather information provider into ICMS format	Functional	1.2.0.30	3	Medium	Demo	Con Ops §4.3	4.10	Weather Data Interface	2
1.2.4.690	The Data Collection Subsubsystem shall translate weather alert data from weather information provider into ICMS format	Functional	1.2.0.35	3	Medium	Demo	Con Ops §4.3	4.10	Weather Data Interface	2
1.2.4.700	The Data Collection Subsubsystem shall translate parking lot data received from Parking Management System into ICMS format	Functional	1.2.0.40	2	Medium	Demo	Con Ops §4.3	4.10	DART Parking Data Interface	3

7.2.2.2 Data Fusion Subsubsystem Requirements

The data fusion subsubsystem requirements provide the functions and data interfaces required for the data fusion subsubsystem within the SmartFusion subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 19: Data Fusion Subsubsystem Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.340	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem VMS Status data	Data	1.2.0.470	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.370	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem CCTV Status data	Data	1.2.0.460	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.380	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem Traffic Signal Status data	Data	1.2.0.550	3	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	3
1.2.3.390	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem DART Bus AVL data	Data	1.2.0.510	3	Low	Test	Con Ops §4.3	4.9	DART AVL Data Interface	2
1.2.3.400	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem DART LRV AVL data	Data	1.2.0.510	3	Low	Test	Con Ops §4.3	4.9	DART AVL Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.410	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem link dynamic data	Data	1.2.0.490	4	Low	Test	Con Ops §4.3	4.9	Static Link Translator	1
1.2.3.450	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem incidents	Data	1.2.0.430	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.460	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem construction	Data	1.2.0.440	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.470	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem special events	Data	1.2.0.450	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.480	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem weather alert data	Data	1.2.0.520	4	Low	Test	Con Ops §4.3	4.9	Weather Data Interface	2
1.2.3.490	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem weather link data	Data	1.2.0.490	4	Low	Test	Con Ops §4.3	4.9	Weather Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.500	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem HOV status data	Data	1.2.0.480	3	Low	Test	Con Ops §4.3	4.9	TxDOT XML	1
1.2.3.510	The Data Fusion Subsubsystem shall receive from the Data Collection Subsubsystem parking lot data	Data	1.2.0.500	3	Low	Test	Con Ops §4.3	4.9	DART Parking Data Interface	3
1.2.3.520	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem parking lot data	Data	1.2.0.500	3	Low	Test	Con Ops §4.3	4.9	DART Parking Data Interface	3
1.2.3.530	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem parking lot data	Data	1.2.0.500	5, 19	Low	Test	Con Ops §4.3	4.9	DART Parking Data Interface	3
1.2.3.540	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem transit vehicle location	Data	1.2.0.510	5, 19	Low	Test	Con Ops §4.3	4.9	DART AVL Data Interface	2
1.2.3.550	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem transit vehicle location	Data	1.2.0.510	4	Low	Test	Con Ops §4.3	4.9	DART AVL Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.580	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem incidents	Data	1.2.0.430	8, 9	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.590	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem incidents	Data	1.2.0.430	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.600	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem construction	Data	1.2.0.440	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.610	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem construction	Data	1.2.0.440	8, 9	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.620	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem special events	Data	1.2.0.450	8, 9	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1
1.2.3.630	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem special events	Data	1.2.0.450	4	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.640	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem VMS Status data	Data	1.2.0.470	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.650	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem VMS Status data	Data	1.2.0.470	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.660	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem CCTV Status data	Data	1.2.0.460	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.670	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem CCTV Status data	Data	1.2.0.460	3	Low	Test	Con Ops §4.3	4.9	C2C Data Interface	1
1.2.3.680	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem traffic signal status data	Data	1.2.0.550	3	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.690	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem traffic signal status data	Data	1.2.0.550	3	Low	Test	Con Ops §4.3	4.9	ICMS Internal Interface	3
1.2.3.700	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem HOV status data	Data	1.2.0.480	3	Low	Test	Con Ops §4.3	4.9	TxDOT XML	1
1.2.3.710	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem HOV status data	Data	1.2.0.480	3	Low	Test	Con Ops §4.3	4.9	TxDOT XML	1
1.2.3.720	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem weather alert data	Data	1.2.0.520	3	Low	Test	Con Ops §4.3	4.9	Weather Data Interface	2
1.2.3.730	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem weather alert data	Data	1.2.0.520	3	Low	Test	Con Ops §4.3	4.9	Weather Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.3.740	The Data Fusion Subsubsystem shall send the Data Dissemination Subsubsystem link dynamic data	Data	1.2.0.490	4, 6, 7	Low	Test	Con Ops §4.3	4.9	Static Link Translator	1
1.2.3.750	The Data Fusion Subsubsystem shall send the Data Store Subsubsystem link dynamic data	Data	1.2.0.490	4	Low	Test	Con Ops §4.3	4.9	Static Link Translator	1
1.2.3.890	The Data Fusion Subsubsystem shall receive from the Data Store Subsubsystem historic link dynamic data	Data	1.2.0.490	4	Low	Test	Con Ops §4.3	4.9	Static Link Translator	3
1.2.3.910	The Data Fusion Subsubsystem shall merge Weather link data into link dynamic data	Functional	1.2.0.490	4	Low	Test	Con Ops §4.3	4.9	Static Link Translator	2

7.2.2.3 Data Dissemination Subsubsystem Requirements

The data dissemination subsubsystem requirements provide the functions and data interfaces required for the data dissemination subsubsystem within the SmartFusion subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 20: Data Dissemination Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.10	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem weather alert data	Data	1.2.0.140	4	Medium	Demo	Con Ops §4.3	4.8	All	2
1.2.2.20	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem link dynamic data	Data	1.2.0.120	7, 4	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.30	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem incidents	Data	1.2.0.130	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.40	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem construction	Data	1.2.0.135	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.50	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem special events	Data	1.2.0.138	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.60	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem parking lot data	Data	1.2.0.110	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.70	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem VMS status data	Data	1.2.0.560	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.80	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem CCTV status data	Data	1.2.0.630	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.90	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem traffic signal status data	Data	1.2.0.640	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	3
1.2.2.100	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem Transit Vehicle Location	Data	1.2.0.580	4, 8, 9	Medium	Demo	Con Ops §4.3	4.8	All	2
1.2.2.120	The Data Dissemination Subsubsystem shall receive from the Data Fusion Subsubsystem HOV status data	Data	1.2.0.580	4	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.130	The Data Dissemination Subsubsystem shall remove incidents received from the Regional Center to Center interface	Functional	1.2.0.130	4	Medium	Demo	Con Ops §4.3	4.8	All	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.140	The Data Dissemination Subsubsystem shall remove construction received from the Regional Center to Center interface	Functional	1.2.0.135	4	Medium	Demo	Con Ops §4.3	4.8	All	1
1.2.2.160	The Data Dissemination Subsubsystem shall translate Transit Vehicle Location into the Regional Center to Center format as defined in C2C-SICD-4.3.0	Functional	1.2.0.125	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.180	The Data Dissemination Subsubsystem shall translate link dynamic data into the Regional Center to Center format as defined in C2C-SICD-4.3.0	Functional	1.2.0.120	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.190	The Data Dissemination Subsubsystem shall translate incidents into the Regional Center to Center format as defined in C2C-SICD-4.3.0	Functional	1.2.0.130	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.200	The Data Dissemination Subsubsystem shall translate construction into the Regional Center to Center format as defined in C2C-SICD-4.3.0	Functional	1.2.0.135	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.210	The Data Dissemination Subsubsystem shall translate special events to the Regional Center to Center format as defined in C2C-SICD-4.3.0	Functional	1.2.0.138	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.220	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface Transit Vehicle Location as defined in C2C-SICD-4.3.0	Interface	1.2.0.125	4	Low	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.240	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface Incidents as defined in C2C-SICD-4.3.0	Interface	1.2.0.130	4	Medium	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.250	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface construction as defined in C2C-SICD-4.3.0	Interface	1.2.0.135	4	Medium	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.260	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface special events as defined in C2C-SICD-4.3.0	Interface	1.2.0.138	4	Medium	Demo	Con Ops §4.3	4.8	C2C Data Interface	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.270	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface link dynamic data as defined in C2C-SICD-4.3.0	Interface	1.2.0.120	4	Medium	Demo	Con Ops §4.3	4.8	C2C Data Interface	3
1.2.2.280	The Data Dissemination Subsubsystem shall publish to the Interactive Voice Response telephone system incidents	Interface	1.2.0.180	8, 9	Medium	Demo	Con Ops §4.3	4.8	IVR Data Interface	2
1.2.2.300	The Data Dissemination Subsubsystem shall publish to the Interactive Voice Response telephone system link dynamic data	Interface	1.2.0.170	5, 7, 17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	IVR Data Interface	2
1.2.2.310	The Data Dissemination Subsubsystem shall publish to the Interactive Voice Response telephone system weather alert data	Interface	1.2.0.200	17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	IVR Data Interface	2
1.2.2.320	The Data Dissemination Subsubsystem shall publish to the public web interface weather alert data	Interface	1.2.0.140	17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.330	The Data Dissemination Subsubsystem shall publish to the public web interface incidents	Interface	1.2.0.150	8, 9	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	2
1.2.2.340	The Data Dissemination Subsubsystem shall publish to the public web interface construction	Interface	1.2.0.155	8, 9	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	2
1.2.2.350	The Data Dissemination Subsubsystem shall publish to the public web interface special events	Interface	1.2.0.158	8, 9	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	2
1.2.2.360	The Data Dissemination Subsubsystem shall publish to the public web interface link dynamic data	Interface	1.2.0.160	5, 7, 17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	2
1.2.2.370	The Data Dissemination Subsubsystem shall publish to the public web interface parking lot data	Interface	1.2.0.165	17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	Public Web Data Interface	3
1.2.2.400	The Data Dissemination Subsubsystem shall publish to the My511 system incident data	Interface	1.2.0.260	8, 9	Medium	Demo	Con Ops §4.3	4.8	My511 Data Interface	2

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.410	The Data Dissemination Subsubsystem shall publish to the My511 system link dynamic data	Interface	1.2.0.250	5, 7, 18, 19	Medium	Demo	Con Ops §4.3	4.8	My511 Data Interface	2
1.2.2.420	The Data Dissemination Subsubsystem shall publish to the My511 system parking lot data	Interface	1.2.0.270	17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	My511 Data Interface	2
1.2.2.430	The Data Dissemination Subsubsystem shall publish to the My511 system weather alert data	Interface	1.2.0.280	17, 18, 19	Medium	Demo	Con Ops §4.3	4.8	My511 Data Interface	2
1.2.2.450	The Data Dissemination Subsubsystem shall publish to the XML feed incident data	Interface	1.2.0.210	8, 9	Medium	Demo	Con Ops §4.3	4.8	XML Feed External, XML Feed Internal	2
1.2.2.460	The Data Dissemination Subsubsystem shall publish to the interactive trip planner interface incidents	Interface	1.2.0.220	6	Medium	Demo	Con Ops §4.3	4.8	Future	Future
1.2.2.480	The Data Dissemination Subsubsystem shall publish to the interactive trip planner interface link dynamic data	Interface	1.2.0.240	6	Medium	Demo	Con Ops §4.3	4.8	Future	Future

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.490	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem traffic signal status data	Data	1.2.0.630	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.500	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem link dynamic data	Data	1.2.0.600	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.520	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem incidents	Data	1.2.0.590	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.540	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem VMS status data	Data	1.2.0.560	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.550	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem HOV status data	Data	1.2.0.580	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.560	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem weather alert data	Data	1.2.0.620	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.2.570	The Data Dissemination Subsubsystem shall send to the Expert Rules Subsubsystem parking lot data	Data	1.2.0.610	12, 13	Medium	Demo	Con Ops §4.3	4.8	XML Feed Internal	3
1.2.2.580	The Data Dissemination Subsubsystem shall publish to the Regional Center to Center interface parking lot data as defined in C2C-SICD-4.3.0	Data	1.2.0.110	12, 13	Medium	Demo	Con Ops §4.3	4.8	C2C Data Interface	3

7.2.2.4 Data Store Subsubsystem Requirements

The data store subsubsystem requirements provide the functions and data interfaces required for the data store subsubsystem within the SmartFusion subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 21: Data Store Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.10	The Data Store Subsubsystem shall receive VMS status data from the Data Fusion Subsubsystem	Data	1.2.0.370	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.20	The Data Store Subsubsystem shall receive CCTV status data from the Data Fusion Subsubsystem	Data	1.2.0.360	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.30	The Data Store Subsubsystem shall receive HOV status data from the Data Fusion Subsubsystem	Data	1.2.0.380	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.40	The Data Store Subsubsystem shall receive Transit Vehicle Location from the Data Fusion Subsubsystem	Data	1.2.0.410	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	2
1.2.5.50	The Data Store Subsubsystem shall receive Static Map Data from the Data Fusion Subsubsystem	Data	1.2.0.670	10	Medium	Demo	Con Ops §4.3	4.11	Geoserver	1
1.2.5.60	The Data Store Subsubsystem shall receive link dynamic data from the Data Fusion Subsubsystem	Data	1.2.0.390	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.70	The Data Store Subsubsystem shall receive Parking Lot Data from the Data Fusion Subsubsystem	Data	1.2.0.400	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3
1.2.5.80	The Data Store Subsubsystem shall receive Traffic Signal Status Data from the Data Fusion Subsubsystem	Data	1.2.0.680	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.90	The Data Store Subsubsystem shall receive Map Profile Data from the SmartNET GUI Subsubsystem	Data	1.2.0.690	1	Medium	Inspect	Con Ops §4.3	4.11	Geoserver	1
1.2.5.100	The Data Store Subsubsystem shall store HOV status data from the corridor	Functional	1.2.0.380	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.120	The Data Store Subsubsystem shall receive Request Map from the SmartNET GUI Subsubsystem	Data	1.2.0.730	10	Medium	Inspect	Con Ops §4.3	4.11	Geoserver	1
1.2.5.130	The Data Store Subsubsystem shall store parking lot data from the corridor	Functional	1.2.0.400	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3
1.2.5.140	The Data Store Subsubsystem shall receive Agency Profile Data from the SmartNET GUI Subsubsystem	Data	1.2.0.700	22	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.150	The Data Store Subsubsystem shall store Agency Profile Data	Functional	1.2.0.700	22	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.170	The Data Store Subsubsystem shall receive Incidents from the Data Fusion Subsubsystem	Data	1.2.0.330	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.180	The Data Store Subsubsystem shall receive construction from the Data Fusion Subsubsystem	Data	1.2.0.340	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.190	The Data Store Subsubsystem shall receive special events from the Data Fusion Subsubsystem	Data	1.2.0.350	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.200	The Data Store Subsubsystem shall send construction to the SmartNET GUI Subsubsystem	Data	1.2.0.340	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.210	The Data Store Subsubsystem shall send special events to the SmartNET GUI Subsubsystem	Data	1.2.0.350	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.220	The Data Store Subsubsystem shall send CCTV status to the SmartNET GUI Subsubsystem	Data	1.2.0.360	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.230	The Data Store Subsubsystem shall send VMS status data received from the regional center to center interface to the SmartNET GUI Subsubsystem	Data	1.2.0.370	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.240	The Data Store Subsubsystem shall send HOV status data received from the regional center to center interface to the SmartNET GUI Subsubsystem	Data	1.2.0.380	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.250	The Data Store Subsubsystem shall send Transit Vehicle Location to the SmartNET GUI Subsubsystem	Data	1.2.0.410	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	2
1.2.5.260	The Data Store Subsubsystem shall send Static Map Data to the SmartNET GUI Subsubsystem	Data	1.2.0.670	10	Medium	Demo	Con Ops §4.3	4.11	Geoserver	1
1.2.5.270	The Data Store Subsubsystem shall send weather alert data to the SmartNET GUI Subsubsystem	Data	1.2.0.420	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	2
1.2.5.280	The Data Store Subsubsystem shall send incidents to the SmartNET GUI Subsubsystem	Data	1.2.0.330	12	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.290	The Data Store Subsubsystem shall send parking lot data to the SmartNET GUI Subsubsystem	Data	1.2.0.400	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.310	The Data Store Subsubsystem shall send link dynamic data to the SmartNET GUI Subsubsystem	Data	1.2.0.390	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.320	The Data Store Subsubsystem shall send map profile data to the SmartNET GUI Subsubsystem	Data	1.2.0.690	1	Medium	Demo	Con Ops §4.3	4.11	Geoserver	1
1.2.5.330	The Data Store Subsubsystem shall send traffic signal status data to the SmartNET GUI Subsubsystem	Data	1.2.0.680	13	Medium	Demo	Con Ops §4.3	4.11	Production Data	3
1.2.5.340	The Data Store Subsubsystem shall store VMS inventory as defined in data dictionary table 2.1.1	Function	1.2.0.670	10	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.350	The Data Store Subsubsystem shall store VMS status as defined in data dictionary table 2.1.1	Function	1.2.0.370	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.360	The Data Store Subsubsystem shall store CCTV inventory as defined in data dictionary table 2.1.2	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.370	The Data Store Subsubsystem shall store CCTV status data as defined in data dictionary table 2.1.2	Function	1.2.0.360	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.380	The Data Store Subsubsystem shall store traffic signal inventory as defined in data dictionary table 2.1.3	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3
1.2.5.390	The Data Store Subsubsystem shall store traffic signal status data as defined in data dictionary table 2.1.3	Function	1.2.0.680	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3
1.2.5.400	The Data Store Subsubsystem shall store the facility inventory as defined in data dictionary table 2.2.1	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.410	The Data Store Subsubsystem shall store the roadway point data inventory as defined in data dictionary table 2.2.2	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.420	The Data Store Subsubsystem shall store the transit facility inventory as defined in data dictionary table 2.3.1	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.430	The Data Store Subsubsystem shall store the transit point data inventory as defined in data dictionary table 2.3.2	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	2
1.2.5.440	The Data Store Subsubsystem shall store transit vehicle location as defined in data dictionary table 2.3.3	Function	1.2.0.410	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	2
1.2.5.450	The Data Store Subsubsystem shall store parking lot inventory as defined in data dictionary table 2.4.1	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	3
1.2.5.460	The Data Store Subsubsystem shall store Weather alert data as defined in data dictionary table 2.4.2	Function	1.2.0.420	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	2
1.2.5.470	The Data Store Subsubsystem shall store Link Inventory Data as defined in data dictionary table 2.4.3	Function	1.2.0.670	10	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.480	The Data Store Subsubsystem shall store Link Dynamic Data as defined in data dictionary table 2.4.4	Function	1.2.0.390	13	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.490	The Data Store Subsubsystem shall store Incidents as defined in data dictionary table 2.5.1	Function	1.2.0.330	12	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.500	The Data Store Subsubsystem shall store construction as defined in data dictionary table 2.5.2	Function	1.2.0.340	12	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.510	The Data Store Subsubsystem shall store Special Events as defined in data dictionary table 2.5.3	Function	1.2.0.350	12	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1
1.2.5.580	The Data Store Subsubsystem shall store Alarm Notifications as defined in data dictionary table 2.6.3	Function	1.2.0.720	1	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.590	The Data Store Subsubsystem shall store User Profiles as defined in data dictionary table 2.7.1	Function	1.2.0.710	22	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.610	The Data Store Subsubsystem shall store Map Profile Data as defined in data dictionary table 2.7.3	Function	1.2.0.690	1	Low	Demo	Con Ops §4.3	4.11	Geoserver	1
1.2.5.640	The Data Store Subsubsystem shall store Ticker Message as defined in data dictionary table 2.7.6	Function	1.0.0.10	1	Low	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.650	The Data Store Subsubsystem shall store Incident Response Plans as defined in data dictionary table 2.9.1	Function	1.2.0.530	14	Low	Demo	Con Ops §4.3	4.11	Production Data	3
1.2.5.680	The Data Store Subsubsystem shall receive from the Plan Decision Dialogue Subsubsystem a request for agency status	Data	1.2.0.700	22	Low	Demo	Con Ops §4.3	4.11	Production Data	3
1.2.5.690	The Data Store Subsubsystem shall send to the Plan Decision Dialogue Subsubsystem agency status as defined in data dictionary table 2.7.1	Function	1.2.0.700	22	Low	Demo	Con Ops §4.3	4.11	Production Data	3
1.2.5.720	The Data Store Subsubsystem shall send the SmartNET GUI Subsubsystem alarm notifications	Function	1.2.0.720	1	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.730	The Data Store Subsubsystem shall determine for a special event the Start Time for conversion to an incident	Function	1.2.0.450	4	Low	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.740	The Data Store Subsubsystem shall determine for a construction event the start time for conversion to an incident	Function	1.2.0.440	4	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.750	The Data Store Subsubsystem shall generate for a special event an activation alarm based on a configurable time interval	Function	1.2.0.450	4	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.760	The Data Store Subsubsystem shall generate for a construction an activation alarm based on a configurable time interval	Function	1.2.0.440	4	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.860	The Data Store Subsubsystem shall allow the SmartNET GUI Subsubsystem the capability to create a user profile	Function	1.2.0.710	22	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.870	The Data Store Subsubsystem shall allow the SmartNET GUI Subsubsystem the capability to modify a user profile	Function	1.2.0.710	22	Low	Demo	Con Ops §4.3	4.11	Production Data	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.5.880	The Data Store Subsubsystem shall allow the SmartNET GUI Subsubsystem the capability to delete a user profile	Function	1.2.0.710	22	Low	Demo	Con Ops §4.3	4.11	Production Data	1
1.2.5.950	The Data Store Subsubsystem shall send the Plan Decision Dialogue Subsubsystem agency status	Data	1.2.0.700	22	Low	Demo	Con Ops §4.3	4.11	Production Data	3
1.2.5.1160	The Data Store Subsubsystem shall receive from the Data Fusion Subsubsystem weather alert data	Data	1.2.0.420	13	Low	Demo	Con Ops §4.3	4.11	Production Data	2
1.2.5.1180	The Data Store Subsubsystem shall send Agency Profile Data to the SmartNET GUI subsubsystem	Data	1.2.0.700	22	Medium	Inspect	Con Ops §4.3	4.11	Production Data	1

7.2.2.5 Plan Decision Subsubsystem Requirements

The plan decision subsubsystem requirements provide the functions and data interfaces required for the plan decision subsubsystem within the SmartFusion subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 22: Plan Decision Subsubsystem Requirements Traceability

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.1.10	The Plan Decision Subsubsystem shall receive from the Expert Rules Subsubsystem a response plan recommendation	Data	1.1.0.210	15, 16	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.20	The Plan Decision Subsubsystem shall receive from the Data Store Subsubsystem agency status	Data	1.1.0.180	15, 16	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.40	The Plan Decision Subsubsystem shall send the Plan Decision Dialogue Subsubsystem a response plan recommendation.	Data	1.1.0.210	15, 16	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.60	The Plan Decision Subsubsystem Shall receive from the Plan Decision Dialogue Subsubsystem response plan recommendation decision	Data	1.0.0.150, 1.0.0.160	15, 16	Low	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.1.90	The Plan Decision Subsubsystem Shall generate for the Plan Decision Dialogue Subsubsystem the agency contact list	Function	1.1.0.210	15, 16	Low	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.120	The Plan Decision Subsubsystem Shall receive from the Plan Decision Dialogue Subsubsystem a plan decision dialogue request	Data	1.1.0.210	15, 16	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.130	The Plan Decision Subsubsystem Shall receive from the Plan Decision Dialogue Subsubsystem a plan decision dialogue response	Data	1.1.0.210	15, 16	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.140	The Plan Decision Subsubsystem Shall send to the Data Store Subsubsystem a plan decision dialogue request	Data	1.1.0.210	15, 16, 20	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.150	The Plan Decision Subsubsystem Shall send to the Data Store Subsubsystem a plan decision dialogue response	Data	1.1.0.210	15, 16, 20	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3

Req No	Requirement Text	Type	Parent Req	User Needs	Critical	Verify	Source	Section Allocation	Component Allocation	Phase
1.2.1.190	The Plan Decision Subsubsystem Shall send to the Expert Rules Subsubsystem a plan decision result	Data	1.1.0.210	15, 16, 20	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.200	The Plan Decision Subsubsystem shall receive from the Plan Decision Dialogue Subsubsystem a plan decision result	Data	1.1.0.210	15, 16, 20	Medium	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.210	The Plan Decision Subsubsystem shall receive from the Plan Decision Dialogue Subsubsystem a response plan implementation notice	Data	1.1.0.210	15, 16, 20	Low	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3
1.2.1.220	The Plan Decision Subsubsystem shall send the Expert Rules Subsubsystem a response plan implementation notice	Data	1.1.0.210	15,16 ,20	Low	Demo	Con Ops §5	4.7	Plan Coordination Workflow	3

7.2.3 SmartNET Subsystem Detailed Requirements

The SmartNET requirements provide the functions and data interfaces required for the SmartNET subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 23: SmartNET Subsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.10	The SmartNET Subsystem shall provide Agency Users the capability to view current status of ITS devices in the corridor	Function	1.0.0.30	3	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.20	The SmartNET Subsystem shall provide Agency Users the capability to view current conditions in the corridor	Function	1.0.0.40	4	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.30	The SmartNET Subsystem shall send to internet E-mail SmartNET E-mail alerts	Interface	1.0.0.10	1	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.40	The SmartNET Subsystem shall receive from the SmartFusion Subsystem incidents	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.50	The SmartNET Subsystem shall receive from the SmartFusion Subsystem construction	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.60	The SmartNET Subsystem shall receive from the SmartFusion Subsystem special events	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.70	The SmartNET Subsystem shall receive from the SmartFusion Subsystem parking lot data	Data	1.0.0.10	1	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	3
1.3.0.80	The SmartNET Subsystem shall receive from the SmartFusion Subsystem weather alert data	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	2
1.3.0.90	The SmartNET Subsystem shall receive from the SmartFusion Subsystem link dynamic data	Data	1.0.0.10	1	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.100	The SmartNET Subsystem shall receive from the SmartFusion Subsystem HOV status data	Data	1.0.0.30	3	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.110	The SmartNET Subsystem shall receive from the SmartFusion Subsystem CCTV status data	Data	1.0.0.30	3	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.120	The SmartNET Subsystem shall receive from the SmartFusion Subsystem VMS status data	Data	1.0.0.30	3	Medium	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.130	The SmartNET Subsystem shall receive from the SmartFusion Subsystem traffic signal status data	Data	1.0.0.30	3	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	3
1.3.0.140	The SmartNET Subsystem shall receive from the SmartFusion Subsystem a response plan recommendation	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	Plan Decision Dialogue	3
1.3.0.150	The SmartNET Subsystem shall send to the SmartFusion Subsystem incidents	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.160	The SmartNET Subsystem shall send to the SmartFusion Subsystem construction	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.170	The SmartNET Subsystem shall send to the SmartFusion Subsystem special events	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.180	The SmartNET Subsystem shall send to the SmartFusion Subsystem response plan responses	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	Plan Decision Dialogue	3
1.3.0.190	The SmartNET Subsystem shall receive from the SmartFusion Subsystem transit vehicle location data	Data	1.0.0.30	3	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	2
1.3.0.200	The SmartNET Subsystem shall send to the SmartFusion Subsystem agency profile data	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.210	The SmartNET Subsystem shall send to the SmartFusion Subsystem user profile data	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.220	The SmartNET Subsystem shall receive from the SmartFusion Subsystem agency profile data	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.230	The SmartNET Subsystem shall receive from the SmartFusion Subsystem user profile data	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.240	The SmartNET Subsystem shall receive from the SmartFusion Subsystem an alarm notification	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.250	The SmartNET Subsystem shall receive from the SmartFusion Subsystem map profile data	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.260	The SmartNET Subsystem shall receive from the SmartFusion Subsystem static map data	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.270	The SmartNET Subsystem shall send to the SmartFusion Subsystem map profile data	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.280	The SmartNET Subsystem shall send to the SmartFusion Subsystem a static map request	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1
1.3.0.290	The SmartNET Subsystem shall send to the SmartFusion Subsystem an alarm response	Data	1.0.0.10	1	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Subsystem Allocation	Phase
1.3.0.300	The SmartNET Subsystem shall receive from the SmartFusion Subsystem a response plan request	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	Plan Decision Dialogue	3
1.3.0.310	The SmartNET Subsystem shall send to the SmartFusion Subsystem an agency user response	Data	1.0.0.220	22	High	Demo	Con Ops §4.3	4.12	Plan Decision Dialogue	3
1.3.0.320	The SmartNET Subsystem shall send to the SmartFusion Subsystem traffic signal status data	Data	1.0.0.30	3	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	3
1.3.0.330	The SmartNET Subsystem shall send to the SmartFusion Subsystem static map data	Data	1.0.0.100	10	High	Demo	Con Ops §4.3	4.12	SmartNET GUI	1

7.2.3.1 SmartNET GUI Subsubsystem Requirements

The SmartNET GUI subsubsystem requirements provide the functions and data interfaces required for the SmartNET GUI subsubsystem within the SmartNET subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 24: SmartNET GUI Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.10	The SmartNET GUI Subsubsystem shall refresh the SmartNET Event Form based on a time interval defined in minutes	Perform	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.20	The SmartNET GUI Subsubsystem shall refresh the SmartNET Map based on a time interval defined in minutes	Perform	1.3.0.10	4	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.30	The SmartNET GUI Subsubsystem shall refresh the Alarm Form based on a configurable time interval defined in minutes	Perform	1.3.0.240	1	Medium	Demo	Con Ops §4.3	4.13	Alarms	1
1.3.2.40	The SmartNET GUI Subsubsystem shall provide an administrative user the capability to create an agency user profile in the Data Store	Function	1.3.0.210	22	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.50	The SmartNET GUI Subsubsystem shall provide an agency user the capability to modify an agency user profile in the Data Store	Function	1.3.0.230	22	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.60	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a construction	Function	1.3.0.160	1	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.70	The SmartNET GUI Subsubsystem shall provide an agency user the capability to modify a construction	Function	1.3.0.160	1	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.80	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view information layers on a map as defined in data dictionary table 2.7.5	Function	1.3.0.260	1	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.90	The SmartNET GUI Subsubsystem shall provide an agency user the capability to send via email the incident description as defined in data dictionary table 2.5.1	Function	1.3.0.30	1	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.100	The SmartNET GUI Subsubsystem shall receive VMS status data from the Data Store Subsubsystem	Function	1.3.0.120	3	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.110	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view current status of VMS in the corridor	Interface	1.3.0.10	1,	Low	Demo	Con Ops §4.3	4.13	Map, Link Viewer, Reports	1
1.3.2.120	The SmartNET GUI Subsubsystem shall receive CCTV status data from the Data Store Subsubsystem	Function	1.3.0.110	3	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.130	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view current status of CCTV in the corridor	Function	1.3.0.10	3	Low	Demo	Con Ops §4.3	4.13	Map, Link Viewer, Reports	1
1.3.2.140	The SmartNET GUI Subsubsystem shall receive HOV status data from the Data Store Subsubsystem	Function	1.3.0.100	3	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.150	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view current status of HOV facilities in the corridor	Function	1.3.0.10	3	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer, Reports	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.160	The SmartNET GUI Subsubsystem shall receive Transit Vehicle Location from the Data Store Subsubsystem	Function	1.3.0.190	3	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	2
1.3.2.170	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view Transit Vehicle Location in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer, Reports	2
1.3.2.210	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view link based weather link data in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer, Reports	2
1.3.2.220	The SmartNET GUI Subsubsystem shall receive from the Data Store Subsubsystem incidents	Function	1.3.0.40	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.230	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view incidents in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Event Viewer, Map	1
1.3.2.240	The SmartNET GUI Subsubsystem shall receive from the Data Store Subsubsystem parking lot data	Function	1.3.0.70	1	Medium	Demo	Con Ops §4.3	4.13	Event Viewer, Link Viewer	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.250	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view parking lot data in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Event Viewer, Link Viewer	3
1.3.2.260	The SmartNET GUI Subsubsystem shall receive from the Data Store Subsubsystem Link dynamic data	Function	1.3.0.90	1	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.270	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view link dynamic data on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer	1
1.3.2.300	The SmartNET GUI Subsubsystem shall provide an administrative user the capability to make inactive a agency user profile in the Data Store Subsubsystem	Function	1.3.0.230	22	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.310	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view Freeway Travel Time link dynamic data on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.330	The SmartNET GUI Subsubsystem shall provide Agency Users the capability to view Arterial Travel Time link dynamic data on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map, Link Viewer	3
1.3.2.340	The SmartNET GUI Subsubsystem shall receive from the Data Store Subsubsystem construction	Function	1.3.0.50	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.350	The SmartNET GUI Subsubsystem shall receive from the Data Store Subsubsystem special events	Function	1.3.0.60	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.360	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create an incident	Function	1.3.0.150	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.370	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a special event	Function	1.3.0.170	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.380	The SmartNET GUI Subsubsystem shall provide an agency user the capability to modify an incident	Function	1.3.0.150	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.390	The SmartNET GUI Subsubsystem shall provide an agency user the capability to modify a special event	Function	1.3.0.170	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.400	The SmartNET GUI Subsubsystem shall provide an agency user the capability to close an incident	Function	1.3.0.150	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.410	The SmartNET GUI Subsubsystem shall provide an agency user the capability to close a construction	Function	1.3.0.160	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.420	The SmartNET GUI Subsubsystem shall provide an agency user the capability to close a special event	Function	1.3.0.170	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.460	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a link	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.470	The SmartNET GUI Subsubsystem shall provide an agency user the capability to modify a link	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.480	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a link	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.500	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a map profile	Function	1.3.0.270	1	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.510	The SmartNET GUI Subsubsystem shall provide an agency user the capability to update a map profile	Function	1.3.0.270	1	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.520	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a map profile	Function	1.3.0.270	1	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.530	The SmartNET GUI Subsubsystem shall provide an agency user the capability to select layers on a map by toggling on and off	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.540	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a facility point	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.550	The SmartNET GUI Subsubsystem shall provide an agency user the capability to update a facility point	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.560	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a facility point	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.570	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a VMS object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.580	The SmartNET GUI Subsubsystem shall provide an agency user the capability to update a VMS object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.590	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a VMS object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.600	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a CCTV object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.610	The SmartNET GUI Subsubsystem shall provide an agency user the capability to update a CCTV object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.620	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a CCTV object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.630	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create a traffic signal object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	3
1.3.2.640	The SmartNET GUI Subsubsystem shall provide an agency user the capability to update a traffic signal object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	3
1.3.2.650	The SmartNET GUI Subsubsystem shall provide an agency user the capability to delete a traffic signal object	Function	1.3.0.330	10	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.660	The SmartNET GUI Subsubsystem shall provide an agency user the capability to send via email the construction description as defined in the data dictionary table 2.5.2	Function	1.3.0.30	1	Medium	Demo	Con Ops §4.3	4.13	Reports	1
1.3.2.670	The SmartNET GUI Subsubsystem shall provide an agency user the capability to send via email the special event description as defined in the data dictionary table 2.5.3	Interface	1.3.0.30	1	Medium	Demo	Con Ops §4.3	4.13	Reports	1
1.3.2.680	The SmartNET GUI Subsubsystem shall provide an agency user the capability to create reports	Function	1.3.0.20,	4	Medium	Demo	Con Ops §4.3	4.13	Reports	1
1.3.2.690	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view construction in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.700	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view special events in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.710	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view incidents on a map in the corridor	Function	1.3.0.20.	4	Medium	Demo	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.720	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view construction on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.730	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view special events on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Map	1
1.3.2.740	The SmartNET GUI Subsubsystem shall provide an agency user the capability to edit current status of VMS in the corridor	Interface	1.3.0.330,	10	Low	Demo	Con Ops §4.3	4.13	Link Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.750	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view Traffic signal device status information on a map in the corridor	Function	1.3.0.10,	3	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	3
1.3.2.770	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view link speed information on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.780	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view link weather information on a map in the corridor	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.790	The SmartNET GUI Subsubsystem shall provide an agency user the capability to view an alarm	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Alarms	1
1.3.2.800	The SmartNET GUI Subsubsystem shall provide an agency user the capability to confirm an alarm	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Alarms	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.810	The SmartNET GUI Subsubsystem shall provide an agency user the capability to ignore an alarm	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Alarms	1
1.3.2.820	The SmartNET GUI Subsubsystem shall provide an agency user the capability to acknowledge an alarm	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Alarms	1
1.3.2.830	The SmartNET GUI Subsubsystem shall provide an agency user the capability to login to the SmartNET GUI	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.840	The SmartNET GUI Subsubsystem shall validate an agency user login	Function	1.3.0.20	4	Medium	Demo	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.850	The SmartNET GUI Subsubsystem shall authorize an agency user based on user profile	Function	1.3.0.20	4	Low	Test	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.860	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem incidents	Function	1.3.0.150	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.870	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem construction	Function	1.3.0.160	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.880	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem special events	Function	1.3.0.170	1	Low	Test	Con Ops §4.3	4.13	Event Viewer	1
1.3.2.900	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem VMS inventory	Function	1.3.0.330	10	Low	Test	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.910	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem VMS status data	Function	1.3.0.330	10	Low	Test	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.920	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem CCTV inventory	Function	1.3.0.330	10	Low	Test	Con Ops §4.3	4.13	Link Viewer	1
1.3.2.930	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem Traffic Signal inventory	Function	1.3.0.330	10	Low	Test	Con Ops §4.3	4.13	Link Viewer	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.2.940	The SmartNET GUI Subsubsystem shall send to the Data Collection Subsubsystem Traffic Signal status data	Function	1.3.0.330	10	Low	Test	Con Ops §4.3	4.13	Link Viewer	3
1.3.2.950	The SmartNET GUI Subsubsystem shall send to internet email an incident description	Function	1.3.0.30	1	Low	Test	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.960	The SmartNET GUI Subsubsystem shall send to internet email a construction description	Function	1.3.0.380	1	Low	Test	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.970	The SmartNET GUI Subsubsystem shall send to internet email a special event description	Function	1.3.0.30	1	Low	Test	Con Ops §4.3	4.13	Admin Tools	1
1.3.2.980	The SmartNET GUI Subsubsystem shall send to the Data Store Subsubsystem an updated user profile	Function	1.3.0.220	22	Low	Test	Con Ops §4.3	4.13	Admin Tools	1

7.2.3.2 Plan Decision Dialogue GUI Subsubsystem Requirements

The Plan Decision Dialogue subsubsystem requirements provide the functions and data interfaces required for the Plan Decision Dialogue subsubsystem within the SmartNET subsystem of the ICMS. The following table allocates the requirements to the sections above which and the subsubsystems which decompose the requirements.

Table 25: Plan Decision Dialogue Subsubsystem Requirements Traceability Matrix

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.1.10	The Plan Decision Dialogue Subsubsystem shall receive from the Plan Decision Subsubsystem a response plan recommendation	Data	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.20	The Plan Decision Dialogue Subsubsystem shall receive from the Decision Support Subsystem a response plan recommendation	Data	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.40	The Plan Decision Dialogue Subsubsystem Shall display to the ICM Coordinator a response plan recommendation	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.50	The Plan Decision Dialogue Subsubsystem shall provide the ICM Coordinator the capability to accept or reject a response plan recommendation	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.1.60	The Plan Decision Dialogue Subsubsystem Shall receive from the ICM Coordinator a decision on whether to use a response plan recommendation	Data	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.70	The Plan Decision Dialogue Subsubsystem shall display to an agency user a response plan recommendation	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.80	The Plan Decision Dialogue Subsubsystem Shall provide to an agency user the capability to accept or reject a response plan recommendation	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.90	The Plan Decision Dialogue Subsubsystem shall receive agency accept or reject responses to response plan recommendation	Data	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.100	The Plan Decision Dialogue Subsubsystem shall display to ICM Coordinator agency accept or reject responses to response plan recommendation	Data	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3

Req No	Requirement Text	Type	Parent Req	User Needs	Criticality	Verify	Source	Section Allocation	Component Allocation	Phase
1.3.1.110	The Plan Decision Dialogue Subsubsystem shall provide the ICM Coordinator the capability to implement a response plan recommendation	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.120	The Plan Decision Dialogue Subsubsystem shall display to the agency users a response plan implementation notice	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3
1.3.1.130	The Plan Decision Dialogue Subsubsystem shall send the Plan Decision Subsubsystem a response plan implementation notice	Function	1.1.0.210	15,16, 20	Low	Demo	Con Ops §5	4.14	Plan Coordination	3

8 References

The following references were used in developing the Requirements for the US-75 Integrated Corridor Management System.

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9 Appendix A - List of Acronyms and Glossary

ACRONYMS

- ATIS – Advanced Traveler Information System
- ATMS – Advanced Transportation Management System
- ARDT – Arterial Detection Subsystem
- AVL – Automatic Vehicle Location
- C2C – Center-to-Center
- CAD – Computer Aided Dispatch
- CCTV – Closed Circuit Television
- Con Ops – Concept of Operations
- DalTrans – Dallas Transportation Management Center
- DART – Dallas Area Rapid Transit
- DMS – Dynamic Message Sign
- DNT – Dallas North Tollway
- DSS – Decision Support Subsystem
- ERD – Entity Relationship Diagram
- ETC – Electronic Toll Collection
- FHWA – Federal Highway Administration
- FTA – Federal Transit Administration
- FTP – File Transfer Protocol
- GIS – Geographic Information System
- HOV – High Occupancy Vehicle
- HTTP – Hypertext Transfer Protocol
- HTTPS – Hypertext Transfer Protocol Secure
- ICD – Interface Control Document
- ICM – Integrated Corridor Management
- ICMS – Integrated Corridor Management System
- IEEE – Institute of Electrical and Electronics Engineers
- INCOSE – INternational Council On System Engineering
- INFR – Infrastructure
- ISP – Information Service Provider
- ITS – Intelligent Transportation System
- IVR – Interactive Voice Response
- JMS – Java Messaging System
- LBJ – Lyndon Bayne Johnson
- LRT – Light Rail Transit
- LRV – Light Rail Vehicle
- MS/ETMC – Message Set for External TMC to TMC Communication
- MOD – ICM Model Subsystem

- NCTCOG – North Central Texas Council of Government
- NTTA – North Texas Tollway Authority
- P&R – Park & Ride
- PARK – Parking Management
- PDA – Personal Data Assistant
- PGBT – President George Bush Turnpike
- RITA – Research and Innovative Technology Administration
- RTC – Regional Transportation Council
- SAN – Storage Area Network
- SOAP – Simple Object Access Protocol
- SNMP – Simple Network Management Protocol
- SMS – Short Message Service
- SMTP – Simple Messaging Transport Protocol
- SRS – System Requirement Specification
- SSL – Secure Sockets Layer
- TCIP – Transit Communication Interface Protocol
- TCP – Transmission Control Protocol
- TLS – Transport Layer Security
- TMDD – Traffic Management Data Dictionary
- TRE – Trinity Railway Express
- TxDOT – Texas Department of Transportation
- USDOT – United States Department of Transportation
- VXML – Voice eXtensible Mark-up Language
- W3C – World Wide Web Consortium
- WDMS – Web-based Database Management System
- WSDL - Web Services Description Language
- XML – eXtensible Mark-up Language

GLOSSARY OF TERMS

	DEFINITION
Accept	To receive (e.g. data feed from another system)
Activate	To make active; cause to function or act (e.g. to make a planned event an active incident)
Add	To add (e.g. add a timestamp to a record)
Aggregate	to bring together; collect into one
Allow	to give permission to or for
Authorize	to give authority or official power to (associated with security authentication requirement)
Collect	to get from source; assemble
Compare	to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences
Compute	to determine or ascertain by mathematical or logical means
Confirm	to make valid or binding by some formal or legal act; sanction; ratify
Determine	to settle or decide (a dispute, question, etc.) by an authoritative or conclusive decision
Display	to output (data) on a monitor or other screen
Evaluate	to judge or determine the significance, worth, or quality of; assess
Execute	to run (a program or routine) or to carry out (an instruction in a program)
Filter	to remove by the action of a filter
Generate	to bring into existence; cause to be; produce (e.g. generate a log file)
Import	to bring (documents, data, etc.) into one software program from another, implies translate
Manage	to handle, direct, govern, or control in action or use (e.g. manage the add, change, delete of an object)
Monitor	to watch closely for purposes of control, surveillance, etc.; keep track of; check continually
Notify	to inform (someone) or give notice to
Parse	to analyze (a string of characters) in order to associate groups of characters with the syntactic units of the underlying grammar
Predict	to declare or tell in advance; prophesy; foretell
Provide	to make available (e.g. provide a function to a user)
Publish	to make generally known (e.g. publish to C2C)
Receive	to get or be informed of
Recommend	to advise, as an alternative; suggest (a choice, course of action, etc.)
Refresh	to read and write (the contents of dynamic storage) at intervals in order to avoid loss of data
Remove	to get rid of; do away with (e.g. remove from User Interface display)
Reside	- Hardware constraint - e.g. reside in a controller cabinet
Restore	to bring back to a former, original, or normal condition
Restrict	to confine or keep within limits, as of space, action, choice, intensity, or quantity
Retrieve	to locate and read (data) from storage, as for display on a monitor
Save	to copy (a file) from RAM onto a disk or other storage medium
Search	to examine (one or more files, as databases or texts) electronically, to locate specified items
Select	to make a choice; pick
Send	to cause to be transmitted to a destination

Simulate	to create a simulation, likeness, or model of (a situation, system, or the like)
Sort	to arrange according to sort, kind, or class; separate into sorts; classify
Start	to set in operation
State	the condition of a person or thing, as with respect to circumstances or attributes
Status	As defined in the Traffic Management Data Dictionary, status of field devices and transportation network, various attributes of the device include condition, state, current display of information, etc.
Store	to put or retain (data) in a memory unit
Translate	to convert (a program, data, code, etc.) from one form to another
Update	to incorporate new or more accurate information in (a database, program, procedure, etc.)
Use	- Constraint Only - to utilize a specific technology

This section defines the terms and definitions used in this document.

Real-time – receipt or calculation of conditions within 2 minutes of occurrence
Near real-time - receipt or calculation of conditions more than 2 minutes of occurrence, but within 30 minutes of occurrence
Status – condition of infrastructure
Active - not marked as out-of-order or in-maintenance
Link - the portion of a model connecting two nodes. The link is defined within the model as:

- facility type
- number of lanes
- capacity per lane
- speed limit
- average jam density

Node – point of branching of physical connections, or terminating a physical connection within a simulation model
Average Jam Density - the maximum number of vehicles per unit length of the highway link
Intermodal network conditions – current status and state of modes of travel within the network
Consistency – the system's estimation error will fall within a pre-determined range
Real-world conditions – model capabilities to match conditions of actual network

- The system's estimation error of the traffic speed, density and volume on every highway link in the network should not exceed 15% (plus or minus).
- The system's estimation error of the location of every transit vehicle in the network should not exceed 10% (plus or minus).
- The system's estimation error of the occupancy of every park-and-ride facility in the network should not exceed 20% (plus or minus).

Corridor management strategy – management plan for an event or incident within the corridor. These strategies include:

- pre-trip and en-route traveler information provision
- congestion pricing
- signal timing modification
- transit service modification
- transit signal priority
- parking management and pricing
- combinations of the above

Traffic Management Scheme – A traffic management scheme consists of the different actions that will be implemented by all agencies to manage the corridor. These actions are:

- List of Dynamic Message Signs (DMS) to be activated along with their messages
- Transit vehicle service pattern including any route and headway modifications
- Timing plan of all signalized intersections

Environment-oriented – factor relating to the environment of the system

Activities - major task that must take place in order to fulfill an operation contract

Actor - specifies a role played by a user or any other system that interacts with the subject

Object - particular instance of a class

Class - construct that is used to define a distinct type.

Type - identifying one of various types of data, such as real-valued, integer or Boolean, that determines the possible values for that type; the operations that can be done on values of that type; the meaning of the data; and the way values of that type can be stored.

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