Electronic Credentialing for Commercial Vehicle Operations

A Cross-cutting Analysis

Final Draft—6/10/99

This report is being prepared for printing. Printed copies of the published version are anticipated to be available in August 1999. Electronic copies will be available in the FHWA Electronic Documents Library.

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Economic Analysis Division
Volpe National Transportation Systems Center
U.S. Department of Transportation

Purpose: (For cover inset)

This is one of seven studies exploring processes for developing ITS architectures for regional, statewide, or commercial vehicle applications. Four case studies examine metropolitan corridor sites: the New York, New Jersey, and Connecticut region; the Gary-Chicago-Milwaukee Corridor; Southern California; and Houston. The fifth case study details Arizona's process for developing a rural/statewide ITS architecture. A cross-cutting study highlights the findings and perspectives of the five case studies. This particular study (the seventh in the series) is a cross-cutting examination of electronic credentialing for commercial vehicle operations in Kentucky, Maryland, and Virginia.

Six of the studies were conducted by U.S. DOT's Volpe National Transportation Systems Center under the sponsorship of U.S. DOT's ITS Joint Program Office, with guidance from the Federal Highway Administration and Federal Transit Administration. The Houston case study was conducted by Mitretek Systems, with support by the Volpe Center.

This study was prepared for a broad-based, non-technical audience. Readership is anticipated to include mid-level managers of transportation planning and operations organizations who have an interest in learning from the experiences of others currently working through ITS architecture development issues.

Overview

This case study examines how Maryland, Virginia, and Kentucky have used the Commercial Vehicle Information Systems & Networks (CVISN) Architecture to develop state CVISN systems designs for electronic credentialing. It focuses on the CVISN Project Plan and Top-Level System Design phases with lessons learned from these CVISN states. Sequences of activities based on the three sites' deployments frame the technical and institutional issues addressed. The purpose of the case study is to assist those who are planning or currently deploying electronic credentialing systems to understand the activities and challenges that might be encountered when developing state systems designs using the CVISN Architecture.

Background

National ITS and CVISN Architectures

The National ITS Architecture is a tool for states to develop their own systems architecture by defining the functions performed by different Intelligent Transportation Systems (ITS) components and ways in which they should be interconnected. The CVISN Architecture is the ITS/commercial vehicle operations (CVO) information systems and networks portion of the National ITS Architecture. The CVISN Architecture documentation begins with the National ITS Architecture and adds more detail in some areas such as operational concepts and message requirements to facilitate further development. It thus serves as guidance for stakeholders in the CVO community to develop systems and interfaces to support identified user services. These user services were based upon stakeholder needs and requirements and were an outgrowth of analyzing operational scenarios within the commercial motor vehicle environment.

"The CVISN Architecture is the ITS/CVO information systems and networks portion of the National ITS Architecture and adds more detail in areas such as operational scenarios and message requirements."--Johns Hopkins University, Applied Physics Laboratory CVISN Program.

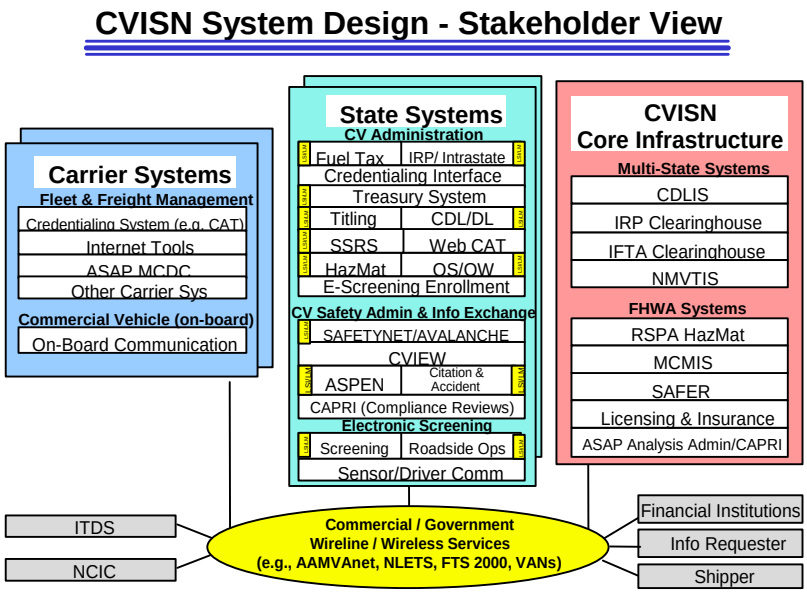
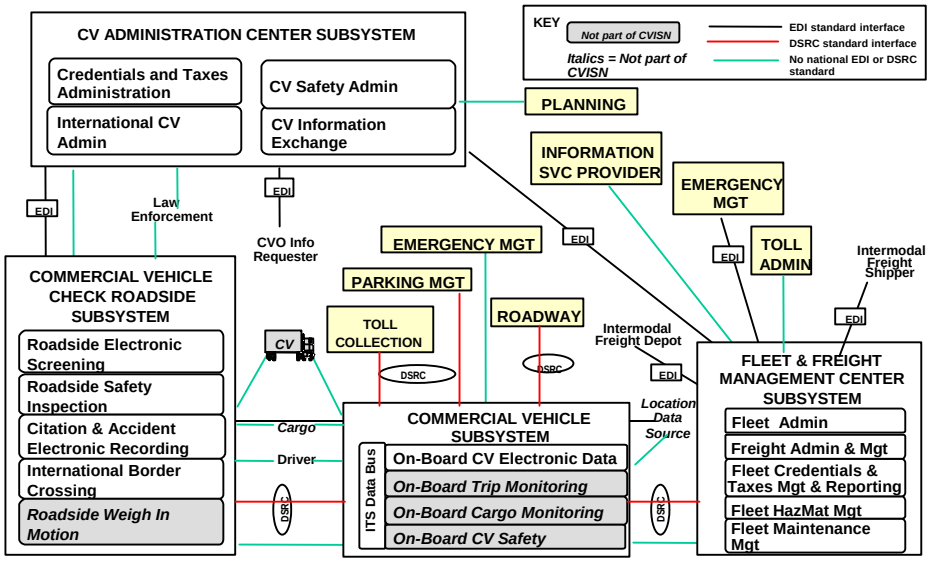


Diagram courtesy of Johns Hopkins University Applied Physics Laboratory

In sum, the CVISN Architecture defines:

- The functions associated with ITS/CVO user services,
- The physical entities or subsystems within which such functions reside,
- The data interfaces and information flows between physical subsystems,
- The communications requirements associated with information flows.

The CVISN architecture includes the information systems and networks in the ITS/CVO architecture



The CVISN Architecture states who should be connected to whom and what types of things they need to be telling each other."--CVISN Statement of Direction. FHWA Office of Motor Carriers.

Thus, the CVISN Architecture states who should be connected to whom and what types of things they need to be telling each other (Statement of Direction, FHWA Office of Motor Carriers). To assure interoperability, the CVISN architecture requires the use of electronic data interchange (EDI) standards for communications technologies. Details regarding the deployment of CVISN projects remain in state hands, including decisions regarding institutional arrangements and specific technologies.

CVISN & Credentialing Administration

The CVISN program provides a framework that enables government agencies, the motor carrier industry, and other parties engaged in CVO safety assurance and regulation to exchange information and conduct business transactions electronically. CVISN Level 1 is comprised of three elements—credentialing administration, electronic screening, and safety information and exchange. To give focused depth to this case study, one topic has been chosen--electronic credentialing. (Further information regarding the other elements can be found on the FHWA Office of Motor Carrier web page noted in the References & Additional Resources Section.)

The goal of electronic credentialing is to offer motor carriers the ability to apply and pay for credentials, registration and fuel taxes electronically.

The goal of electronic credentialing is to offer motor carriers the ability to apply and pay for credentials electronically. This includes state registration, fuel taxes and base state (International Registration Program--IRP and International Fuel Tax Agreement—IFTA) registration and taxes. Carriers would then receive electronic notification of credentials status and an invoice of payments due. Electronic payments for credentials and taxes may be an option. As well, there could be electronic distribution of credentials or an in-house inventory at large carriers' offices much like what is done with passenger vehicle registration at car dealerships. Some states are also looking at electronic application of hazardous materials and oversize/overweight permits. Information collected from these processes can be shared with roadside inspectors and law enforcement officials to enforce up-to-date registration and tax payments.

Electronic payments for credentials and taxes may be an option. As well, there could be electronic distribution of credentials or an in-house inventory at large carriers' offices much like what is done with passenger vehicle registration at car dealerships. Some states are also looking at electronic application of hazardous materials and oversize/overweight permits. Information collected from these processes can be shared with roadside inspectors and law enforcement officials to enforce up-to-date registration and tax payments.

To achieve CVISN Level 1 capabilities in electronic credentialing, specific activities must be completed:

CVISN Level 1 Capabilities in Electronic Credentialing

- Automated processing (i.e. carrier application, state application processing, tax filing, credentialing issuance) of at least IRP & IFTA credentials and ready to extend to other credentials (intrastate, titling, oversize/overweight, carrier registration, hazardous materials). Processing does not include electronic payment.
- State system connection to IRP & IFTA Clearinghouses.
- At least 10% of the transaction volume is handled electronically and the system is ready to bring on more carriers as carriers sign up and to extend to branch offices where applicable.

Expected benefits resulting from credentials administration capabilities are more efficient and responsive administrative processes for carriers and government agencies.

Electronic Credentialing Benefits

Expected benefits resulting from the credentials administration capabilities are more efficient and responsive administrative processes for carriers and government agencies. Since data interchange among states, carriers, and other stakeholders will be electronic, it will be more timely, accurate and less expensive. Credentials issuance, tax filing, interstate reconciliation, and audits will be automated to proceed more effectively and efficiently. Both administrators and enforcement personnel will have rapid, electronic access to required data. All this will result in better enforcement of registration, licensing, and tax regulations and better customer service to safe and legal motor carriers and drivers.

A case study involving eight states estimated that the deployment of ITS/CVO technologies for electronic credentialing would have up to a 6:1 benefit cost ratio. Labor costs for administrative compliance would be reduced significantly for medium and large-sized carriers using EDI, showing a benefit/cost ratio of 4.2:1 and 19.8:1, respectively. Deterred tax evasion could save an estimated $500,000 to $1.8 million per state. ("What Benefits are Expected from CVISN?")

The State CVISN Architecture Development Process includes the completion of a CVISN Project Plan and Top-Level Design. The Project Plan spells out program goals, objectives and priorities. The Top-Level Design charts the system architecture.

State CVISN Architecture Development Process: Electronic Credentialing

The state CVISN architecture development process includes the completion of a CVISN Project Plan and Top-Level Design. The Project Plan spells out program goals, objectives, and priorities. The Top-Level Design charts the state's system design. The following is a cross-cutting composite of three states' experiences in deploying electronic credentialing focused on the CVISN Project Plan and Top-Level Design activities. The planning section starts by looking at why states choose to deploy electronic credentialing, and then follows through a sequence of planning and organizing activities that culminate in the final

product of a CVISN Project Plan. The Top-Level Design section focuses on how these states developed their state system design, which technologies they chose and why, and what have been some technical challenges they have faced along the way. Suggestions from interviewees of what to do and what to look out for are included.

PLANNING

"CVISN is not a project, not a deliverable. It's a different way of looking at things and a means to broaden customer services." Judy Vesely

Why Deploy Electronic Credentialing?

There are many reasons states choose to deploy electronic credentialing. Among them are the goals to offer better customer service to motor carriers while increasing efficiency in agency operations. As Judy Vesely, Virginia's Credentials Administration Lead says, "CVISN is not a project, not a deliverable. It's a different way of looking at how you do business and a means to broaden customer services." Given the importance of the motor carrier industry in many states in which most everything is transported by truck except water and electricity, and state governments' goal to "do more with less", streamlining and automating administrative processes can be a solution. Benefits include decreased administration expenses, increased tax collection, and increased targeting of non-compliant carriers. Often times, these objectives are boosted by governor-led statewide initiatives to provide "one-stop shop" services and the offering of electronic ways to do business with the state.

This was the case in Kentucky with the Empower Kentucky program begun in 1996. Championed by the governor who promised large, recurring cost savings, the Empower Kentucky program's goal was to simplify and automate processes within all government agencies. For the Transportation Cabinet, this meant a "one-stop shop" where motor carriers can register, pay fees, and taxes at one location. Given Empower Kentucky's goals, CVISN is an integral part of the state's transportation technical solution. As a result, many of the tasks associated with CVISN system development, for example, system definition and requirements analysis, were addressed by the Empower Kentucky initiative. A similar "one-stop shop" concept is found in Virginia's Virtual Customer Service Centers begun in 1996. Passenger and commercial vehicle customers can go to one of 80 Customer Service Centers throughout the state to do all their transportation-related transactions.

Governor-led statewide initiatives have also focused on establishing a web presence to offer the public the option to do business with the state electronically. In Virginia, customers can do driver's license renewals, vehicle renewals, and address changes over the web. In Maryland, applications for commercial driver's licenses and certificates of titling can be downloaded and on-line vehicle registration renewals can be done on the web. Maryland's primary impetus to deploy electronic credentialing, however, came from the desire to extend the same electronic registration options offered to passenger vehicle dealers to commercial vehicle operators.

Which Agencies are Involved in Electronic Credentialing?

The state departments of transportation motor carriers divisions are often the lead agencies that deploy electronic credentialing. Other agencies are sometimes in charge of tax collection and permit issuance. Maryland's Department of Transportation Motor Vehicle Administration was the lead

agency for electronic credentialing and IRP while the Comptroller of the Treasury was in charge of IFTA. The Department of the Environment issues hazardous materials permits and the State Highway Administration issues oversize/overweight permits.

In Virginia, the Department of Motor Vehicles is charged with electronic credentialing, IRP, IFTA, and some oversize/overweight permits. The Department of Transportation does larger oversize/overweight permits. Unlike many states, Kentucky's transportation functions are organized and co-located under one entity, the Transportation Cabinet's Department of Vehicle Regulation, that is charged with all credentials administration. As noted in interviews, a single centralized agency greatly enhances planning and day-to-day operations, however, a strong champion and cooperative interagency working group can also facilitate smooth implementation.

How to Start an Electronic Credentialing Program?

For states deploying electronic credentialing, interviewees recommended that CVISN participants follow these steps.

Designate A Champion. Often noted in interviews was the important role of a champion. This person, generally the project manager, has the authority to make decisions and establish a core working committee. The champion will ensure that all stakeholders are kept "on the same page" as the program moves forward. It was recommended that a champion be appointed by the Secretary of Transportation or state legislature to ensure that he/she has the decision-making power to do such activities. This person also manages legislators' expectations and secures financing.

Establish a Credentials Administration Working Committee. Interviewees recommended that all agencies affected by the program be involved from the beginning to formulate business and project plans collectively. It is then easier to acquire approvals and implement plans. This is especially important for states that have multiple agency participants. Maryland, which has ten agencies involved in all CVISN elements, formed the Inter-Agency Coordinating Group (IACG). This group is comprised of operations managers who routinely meet to discuss deployment issues. Any issue that cannot be resolved on the operations level, for example budget allocations, is brought to the advisory board composed of administrators. The IACG is then divided into sub-committees based on functions which do the actual deployment work. States that have centralized motor carrier operations, such as Kentucky, still benefit from working committees. Kentucky's Motor Carrier Task Force also includes members from the University of Kentucky Transportation Center and the motor carrier industry.

Follow a Methodology. In order to keep all parties on the same track, interviewees noted the importance of following a methodology. Having this is crucial especially with personnel turnover since it quickly brings new participants up-to-speed on the project. The following is a sample methodology:

"The worst thing you can do is automate a bad credentialing process." Commissioner Ed Logsdon

The key to a good system design is to focus on solving people's actual problems.

List key goals and objectives. The working committee should decide which goals and objectives the agencies collectively want to achieve. For example, the goal is electronic credentialing and the objective is to offer small, medium and large carriers an alternative method of registration. Then an action plan should be written for each goal and objective. For example, for medium sized carriers, the Personal Computer Carrier Automated Transaction (PC CAT) is a good option. Large carriers can enhance their fleet management software packages to handle the new commercial vehicle credentials transaction set and integrate electronic credentialing processes with other existing business functions. The action plan should document how the program's business and technical requirements satisfy these goals and objectives.

Baseline Business Requirements. First the working committee should look at what the business demands and assess what is currently being done and what agencies want to do. Then they should determine what CVISN Level 1 capabilities will give in terms of an operable functional system and how these match the state's needs for an operable system. Finally, the committee should document the differences and decide on priorities. Often electronic credentialing programs require a reengineering of business transactions to simplify forms and processes. "The worst thing you can do is automate a bad credentialing process, " says Commissioner Ed Logsdon, Kentucky's CVISN Project Manager. In Kentucky, eleven forms were consolidated into one before they were available electronically. It is good at this stage to look at other states' electronic credentialing programs and apply lessons learned that are relevant to one's own state.

Baseline Technical Requirements. With business requirements in hand, the working committee should have a thorough examination of existing information technology infrastructure done. Questions such as, "Which connections currently exist between systems and agencies and how are they conducive to what the state wants to do as documented in the business requirements?" should be asked and answered. For example, with the Internet, analysis should be done to see if there is sufficient infrastructure to support web transactions. If not, how much modification is needed to make the system compatible for such activities? It is also important to think about the future. For example, should hooks be built in now for possible expansion later? As several interviewees noted, the key to a good system design is to focus on solving people's actual problems as noted in the business requirements. Once system changes are documented, they should be assessed on how they are compatible with the CVISN Architecture.

Lastly, business and technical requirements that meet goals and objectives must be prioritized. For example, the state may choose to implement a PC CAT first to let medium carriers submit electronic credential applications using EDI since EDI capability is required for CVISN architecture conformance. The system design then should be approved by the CVISN working committee, state senior executives, and the state's Conformance Assessment Team.

Get Senior Executive Support. Statewide initiatives such as Kentucky's Empower Kentucky and Virginia's Virtual Customer Service Centers made getting governor and commissioner approval for electronic credentialing

simpler. Such programs also assist in acquiring state resources, information technology department staff support in assessment and system architecture enhancements, computer training for staff personnel, and changes in laws to allow for electronic commerce and payments. Interviewees noted that high level decision-makers must view electronic credentialing as a value-added effort that takes priority over other projects. To do this, it was recommended to have the Chairs of the Transportation Committees of both the state House and Senate attend the first couple of CVISN meetings. Here, officials could explain the program's objectives. Managing senior executives' expectations throughout the project can be a challenge. Nonetheless, by setting realistic goals, for example, a year-and-a-half to reengineer business processes and another year to implement the technology and showing small successes quickly, senior executive support can be more easily maintained.

Get Motor Carrier Buy-In Early On. Interviewees noted the importance of bringing motor carriers on board from the start, such as on working committees. This was primarily to make them feel like partners in the project as well as for cheerleading to other carriers, lobbying to legislature for program funds, and testing of products. Generally speaking, larger carriers are eager to try electronic credentialing systems given the great benefits of saved time and effort. Carriers like the fact that they don't have to calculate taxes and can pay fees and taxes electronically. It was noted in one interview, that some carriers may not like the program because it makes avoiding taxes and surcharges more difficult.

Secure Resources. It is important to acquire enough financial and human resources to address all priorities in all phases of the project. For example, sufficient funding is needed to provide staff training and information technology support once the electronic credentialing system is operational. Competing project priorities, such as Y2K, can create delays by diverting information technology staff efforts.

Look at Legislation. Electronic credentialing might require changes in statutes to allow for electronic commerce and electronic funds transfers. To assess if this is needed, registration laws and the appropriate section of the regulations should be referenced. In Maryland, since they already had electronic registration with passenger car dealers, no changes in laws and regulations were needed. On the other hand, some states like Kentucky had to make a regulation to allow for electronic payments. For electronic payments such as credit cards, there is also an issue of who pays the credit card surcharge--the state or the customer. It was recommended in interviews that the legislature give the state department of transportation authority to do electronic registration and titling by regulation to make such changes easier.

Assess What Staff Will Be Needed. A core electronic credentialing team includes a project manager, system architect, and credentials administration managers. Given the myriad of elements and tasks associated with CVISN, a full-time project manager is needed and often comes from the lead agency. Regarding system architects, one interviewee noted the importance of hiring a non-commercial system architect since it is easy to misrepresent technical issues as political especially with procurements. Another interviewee

recommended that for states with multiple agencies, a planner who can juggle different schedules with agencies, vendors, and contractors is also helpful. Credentials administration managers continue in their roles but now must learn about new systems. As one interviewee noted, although it is ultimately the project manager who is responsible for the success of the project, middle managers ensure that steps to that success are achieved. Therefore, it is very important to have their input at the early stages of project planning.

In addition to this core CVISN team are support staff. Information technology staff members play a major role in writing requirements and specifications. Depending on the state's in-house resources, system design may be done in-house or contracted out. In either case, in-house information technology staffers ensure that the system design meets the state's business requirements. They will also most likely maintain the system. Operational users of the systems have a significant role in the business and technical requirements stage. They are asked what they need to do to complete transactions. Some staff members initially may not be amenable to electronic credentialing fearing that technology might replace their jobs. Actually, what has happened in one state is something quite different. Since new skills were required to do the work, clerical positions have become professional ones as level of responsibilities have increased. For example, instead of employees completing transactions themselves, employees guide customers in filling out applications electronically, resolve banking issues, and do preliminary audits. Training on the systems as well as courses on basic computer operations and letter writing, will help staff with the new tasks.

Schedule Deployment Activities. With both business and technical requirements completed and priorities agreed upon, agency responsibilities and work orders are easy to set. Often schedule priorities are driven by what is required to attain CVISN Level 1 capabilities. Usually, states first do electronic credentialing then they connect to the IFTA and IRP Clearinghouses. Once these CVISN Level 1 capabilities are met, states often do intrastate registration and oversize/overweight permits. Oversize/overweight permits are a priority because of the volume of permits issued daily and consequent cost savings. Several interviewees noted the importance of showing successes early on to manage legislators' expectations and maintain funding. Therefore, focusing on small segments of one function, for example, connecting to the IFTA Clearinghouse, is recommended. The use of Gantt charts can aid in scheduling.

Assemble All into a Project Plan

The Project Plan will be the document that CVISN working committee members can reference to ensure that original goals and objectives are being met. In conjunction with the Top-Level Design, a work breakdown and responsibility chart, a schedule of deliverables, and required resources will emerge. A list of possible institutional and technical difficulties and contingency plans is very important. Often, local universities assist in the production of CVISN Project Plans. The University of Kentucky helped with Kentucky's Project Plan and Johns Hopkins University Applied Physics Laboratory helped with Maryland's Project Plan.

TOP LEVEL-DESIGN

The Top-Level Design explains new transaction operational flows, what existing state systems will be modified, what computers and networks will be upgraded, and what new computers or network segments and other products will be added. The Top-Level Design also identifies where open standards will be used to support new or modified interfaces.

To explain the steps taken in developing a Top-Level Design, it is helpful to view how a transaction is processed through a system. (See the IRP Renewal Operational Scenario Generic diagram below.) Starting from the left, an applicant enters information via a Carrier System such as a CAT. From here, the information can be transferred to a Credentialing Interface (CI) and then passed on to the state's legacy system where data is checked and a response is sent back to the CAT via the CI. Information then goes to the Commercial Vehicle Information Exchange Window (CVIEW) and on to the SAFER data mailbox for roadside inspections. Based on the technical requirements, changes to current systems known as modifications to legacy systems, must be done. As well, new technologies must be bought such as a CI and CAT.

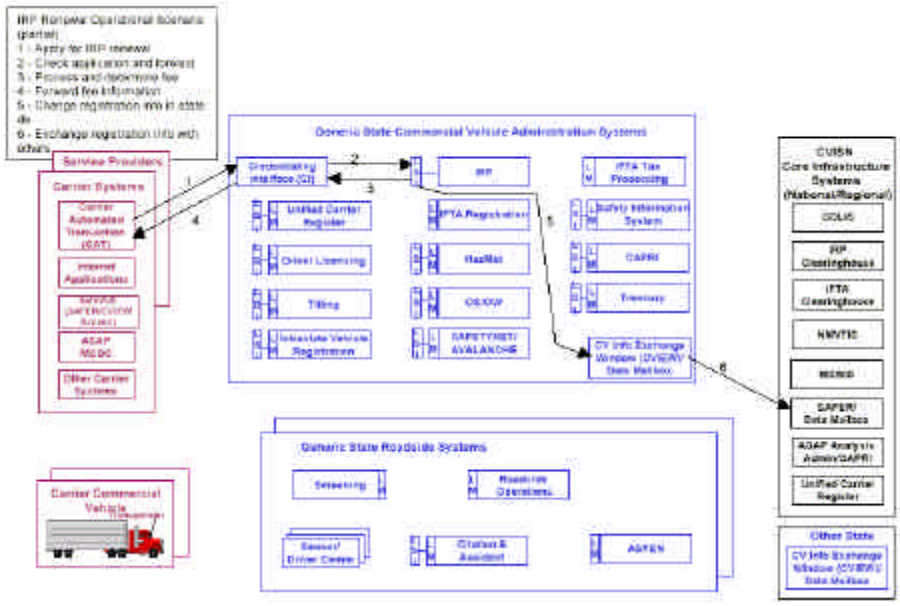


Diagram courtesy of Johns Hopkins University Applied Physics Laboratory

There are several requirements for a good systems design among them are uniformity, accessibility, flexibility and expandability.

It was recommended by a system architect to build small to start with, connect to things that already work, then extend the reach and replace things as needed. "Like petrified wood, it crystallizes throughout the structure and after awhile all the wood has been replaced by stone. Now it has a new structure but it will always carry the traces of the original structure," says D.J. Waddell, Maryland's System Architect.

State Technology Options

Technology decisions are based on the state's computing environment and accepted communications protocols. There are several requirements for a good systems design: uniformity, accessibility, flexibility, and expandability.

Several electronic credentialing options are being explored by CVISN States. Since the use of open standards is a key CVISN architectural concept, at least one option must support EDI transactions.

Uniformity can be accomplished with a common platform and standards. In Maryland, a common platform was achieved by purchasing personal computers and software that were given to the state's ten participating agencies. Communications protocols that allow data to be sent and interpreted by various parts of the system must be used. EDI open standards are required by the CVISN Architecture and are common standards used by carriers to transmit data. According to the "Technology in Trucking Operations" study conducted by the American Trucking Associations Foundation, between 1996 and 1998, EDI had a 47% increase in motor carrier usage. Multiple motor carrier access points to the systems could be offered to increase electronic credentialing accessibility and usage. Quoting the same study, eight out of ten large fleets are EDI capable and three quarters have Internet access. As well, one in three small to mid-sized fleets are EDI capable and/or have Internet access. Lastly, the system architecture must be flexible enough so that it can have manual supplements with the ability to expand later for more automation. For example, Legacy System Interfaces (LSI) can be built into the CI to accomplish this. In all technology choices, assessments of the technology as "leading edge" versus nearing obsolescence must be made.

Several electronic credentialing options are being explored by CVISN states and many of them are planning to try more than one option. Since the use of open standards is a key CVISN architectural concept, at least one electronic credentialing option must support EDI transactions.

Carrier Credentialing Systems
For carriers, the three most common choices are the Personal Computer (PC) CAT, World Wide Web (the Web), and Fleet Management Systems. Descriptions of each choice include requirements needed to conform to the CVISN Architecture.

1) PC CAT: An applicant (motor carrier or independent service provider) uses stand-alone software that provides a user interface to enter application information and transmit/receive state responses via a personal computer using EDI standards. Such an example is InterCAT produced by a private company.

Advantages
- It is a simple software package that is installed on a personal computer.
- PC CAT software is commercially available.

Disadvantages
- Software must be installed on each personal computer.
- PC Cat software needs to be updated with new legislation and tax changes.

2) World Wide Web: An applicant (motor carrier or independent service provider) uses commercial web browser software for access to a state or service provider's WWW site that accepts application information and forwards information to state systems. The CVISN Architecture recommends that if a state offers Web-CAT, the state should consider using EDI for the interface between the Web site and CI.

Advantages

- Information is under the control of the state and can be changed anytime to reflect new legislation, taxes, and requirements.
- It is easily accessible especially for small and medium-sized carriers.

Disadvantages

- No Web-CAT software is commercially available now.
- There is a slow processing time to complete a transaction.
- There is no storage capability for information on the web page. Therefore there is an issue of who will maintain carrier databases--the state or carrier?
- It isn't known if the web can support high volume transactions which is especially bad for large fleets who send their applications in large batches.
- There is an issue of disencryption of data. Security of information transmitted over the web is not assured.
- Standards are changing quickly. HTML is currently the web standard but will likely switch over to the richer XML. HTML is not rich enough to describe EDI syntax.
- To conform to the CVISN Architecture, an EDI option must also be provided. If the Web CAT-CI interface is not EDI, then the state must maintain two interfaces--state-specific & EDI.

When choosing off-the-shelf software, assess how much modification would be needed to satisfy business requirements.

3) Fleet Management Systems: Using EDI, motor carriers can send messages from their fleet management systems to a CI.

Advantages

- Motor carriers continue using their own systems that use EDI.

Disadvantages

- System software will have to be modified to interact with the CI. Choices will have to made regarding whether to embed CAT software within an existing fleet management system or make an interface with other CAT options.

What Should a Good CAT Software Program Have?

In choosing CAT software for any of the above options, the first decision must be whether to buy off-the-shelf software and modify it to fit the state's needs or develop software from scratch. When making this decision, it is important to review off-the-shelf software closely and assess how much modification would be needed to satisfy business requirements. Every modification could entail another modification and depending on the program design--if it is modular or not--making modifications may be very difficult. Virginia had difficulties with a software product that was designed for another jurisdiction and was not modular. Attempts were made to modify the software to accommodate Virginia's business processes and regulations, but given its non-modular design, the modification process was fraught with difficulties and a fully operational product was never delivered.

A state developing its own software has its own basket of concerns as well. The ability of in-house information technology staff to write the software or

oversee vendor software development must be taken into account. The associated costs can also be dramatic. Whether a state decides to develop its own software or buy it off-the-shelf and modify it, it is crucial that potential users of the systems be asked what they need from the system at the early stage of a functional requirements assessment.

Based on interviews with operational managers and users, the following considerations were suggested for inclusion in CAT software programs:

CAT Software User Recommendations

- Once an U.S. DOT number is entered, the operational user should be able to go from one program to another in order to access information needed to address carrier needs. For example, one should be able to go between IRP and IFTA files to access common information to avoid entering information twice.
- Carriers should not have to enter their own tax rate. If a carrier does an IFTA transaction, the tax rate for that quarter should be supplied. If they do an IRP transaction, the fee should be there too. The carrier should not have to look it up on a piece of paper and enter it. Tax rates should also be automatically calculated for the carrier and be linked to a mainframe so that they can be easily changed when legislation requires.
- Instructions should be available on screen. Users should also be able to go back to the last screen and make immediate changes and be able to double check entire applications before sending them.
- The program should have open-ended tables built into the source code so application developers don't have to rewrite the code when changes are made. Thus, changes to tables could be done by adjusting parameters.

Finally, interviewees noted that if modifying software, it is recommended to see a sample vendor demonstration of the product using state data before hiring vendor services.

"EDI and the web are like the telephone and Internet. We use the telephone to get on the Internet or use the telephone over the Internet. They interweave."--D.J. Waddell

EDI and the Web

There is a debate among system architects whether to use EDI or the web to access state legacy systems. As D.J. Waddell, Maryland's System Architect, states and Valerie Barnes, CVISN System Architecture Project Lead at Johns Hopkins University Applied Physics Laboratory concurs, there is no dichotomy between the two. "EDI and the web are like the telephone and Internet. We use the telephone to get on the Internet or use the telephone over the Internet. They interweave. Currently we are using Internet email to transfer EDI files." In other words, the choice is not between using EDI or the web. EDI is the language in which the data is recorded. The web is a mode in how that data is transferred. The web says little about structuring or interpreting the data.

Credentialing Interface (CI)

Once CAT options are chosen and legacy modifications determined, the next step is to choose how these systems will interface with state legacy systems. Most states have chosen to do a CI that acts as an interpreter of data between the CAT and state legacy credentialing systems. In this case, applicants use a CAT of their choosing and, via EDI, transmit to a single computer address

located on the CI. From the CI, data is transferred to the state's legacy credentialing system. The advantage is the state makes minimal modifications to its legacy systems.

Modifications to Legacy Systems
The next step is to decide which modifications are needed to state legacy systems. Legacy Modifications (LM) represent changes to the legacy systems or new functionality built into systems when they are redesigned. Once the modifications are made, they become a part of the legacy system and are no longer separate interfaces. A Legacy System Interface (LSI) provides an interim interface between the CI and legacy systems. LSIs are implemented when the state chooses not to modify the legacy system to handle the open standard interfaces.

A common approach is to modify legacy systems to handle electronic applications, but use a CI to interact with the applicant's systems via EDI.

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Connections to IRP and IFTA Clearinghouses
Connections between the state and IRP and IFTA Clearinghouses are CVISN Level 1 requirements. The IFTA is an agreement among states, Canadian provinces, and Mexico that allows carriers to register and pay motor fuel taxes in the carriers' home or base jurisdictions. The base jurisdiction is responsible for disbursing the appropriate fuel taxes to other jurisdictions where the carriers operate. The IRP is a registration reciprocity agreement among states, Canadian provinces, and Mexico providing for the payment of license fees based on the number of fleet miles operated in participating jurisdictions.

Commercial Vehicle Information Exchange Window (CVIEW)
To enable credentialing information to be accessed by roadside inspectors and law enforcers, "snapshot segments" are sent from the CI or state legacy systems to CVIEW using EDI. These segments consist of safety and credentials data. Carriers that have bad safety records can be accessed by state credentialing systems; thus, renewals of credentials to these carriers can be suspended. EDI is required between CVIEW and Safety and Fitness Electronic Records System (SAFER), an interstate safety data exchange system. EDI is recommended, but not required, for the interactions between CVIEW and other state systems.

Maryland, Virginia, and Kentucky System Design Comparison
The CI is the hub of the transactions that correspond with the CAT, the Clearinghouses and state legacy systems. All three states interviewed use the CI. Both Kentucky and Maryland use the PC CAT product InterCAT. Kentucky plans to have PC CAT accessibility at a weigh station, library, and county clerk's office located in various parts of the state. Kentucky is also working on providing a Web-CAT. After many software development difficulties with a PC CAT, Virginia has decided to halt this development and develop a Web-CAT using EDI.

For Maryland and Virginia, the Vehicle Information System for Tax Apportionment/Registration Services (VISTA/RS) system sends IRP data to the IRP Clearinghouse. The Vehicle Information System for Tax

Apportionment/Tax Services (VISTA/TS) sends financial data for Virginia to the IFTA Clearinghouse. Maryland connects to the IFTA Clearinghouse via a Regional Processing Center. Kentucky's legacy system connects to the IRP Clearinghouse and the state will connect to the IFTA Clearinghouse via a Regional Processing Center in the future.

A key difference between Maryland and Virginia's designs is that in Virginia, the IRP processing system generates updates directly to CVIEW. In Maryland, the CI is the only system that communicates with back-end systems including CVIEW. Maryland is also one of a few states that has the data from the IRP database incorporated into its mainframe database. Other states keep intrastate and IRP databases separate. In this way, Maryland has policy control over the database to do "flag and conditions" checks. So, for example, if officials want to revoke a carrier's plates, they can do so directly through their mainframe.

System Interoperability

After CAT and CI options have been selected and an assessment of legacy modifications done, the question becomes "How will these systems interact?" Architecturally, this means that various pieces that were developed over time that then met certain business needs and were developed by different vendors must be able to talk to each other to process a transaction. System interoperability lessons learned include the following.

Data Requirements between the CAT and CI. During the life cycle of an application, that is, how the application flows through a system from one point to another and returns, certain business processes are invoked. These business processes, in return, require certain data requirements. Most of the states' processes, regulations, weight rules, and taxes must be embedded in the CAT and match with the CI. The majority of state regulations and rules should be in the CI and not in the PC CAT so that any software company could develop PC CAT software. However, since different vendors are going to develop PC CAT software and CI (except one private company that is currently developing both), data requirements may not match. This has proved a challenge for some states.

Data Validation Checks Throughout the System. There are various checkpoints in different systems during the life cycle of an application to validate that data is correct. For example, verifying to see if a carrier is in good standing could involve checking if the carrier is a title bearer, has paid IRP fees, and IFTA taxes. Architecturally, it is best to put validation checks as close to data entry points as possible so the system and customers' time is not wasted. Nonetheless, these checkpoints must also be embedded at different parts of the life cycle especially since many different systems that are developed by different vendors are used. When hiring a vendor to build a CAT, CI, or modify legacy systems, one must ensure that data uses the appropriate logic at the appropriate place with periodic system data checkpoints.

The CVISN Architecture will be periodically updated to keep up with technology innovations.

CVISN ARCHITECTURE EVOLUTION

Changing Technology

Given public agencies' constrained finances, the life cycle of technology procurements is generally five years or more. This can be a difficult challenge

for agencies when assessing technology options. In the credentials administration arena, technology changes are taking place in computers, open standards, and network communications options. The CVISN Architecture will be periodically updated to keep up with technology innovations. For example, as new technologies such as the web standard XML are proven for CVO applications, they will be incorporated into the CVISN Architecture.

Architecture Maintenance

Once the system architecture has been modified to allow for electronic credentialing, measures to maintain that system must be established. This is especially important if the system was modified by contractors and in-house information technology staff members will be in charge of maintenance. Furthermore, assistance plans for operational users should be clearly spelled out. For example, in the case of production problems while walk-in customers are waiting, users can contact an "on call" program analyst who can fix the problem.

CONCLUSION

Electronic credentialing broadens motor carrier customer services while streamlining and automating administrative processes. The CVISN Architecture has been used as a framework to develop state system architectures to allow for these new services. To facilitate program deployment, institutional and technical changes must occur. Such changes have also been catalysts for other transportation projects. Interagency working groups can be forums to discuss extensions of electronic credentialing to passenger vehicles or tracking of mandatory insurance compliance. Inter-state relations are also deepened, for example, regional oversize/overweight permitting may be done in the Southeast. Finally, CVISN can be a catalyst for systems integration work, in particular, remote client server communications structures. In sum, developing state architectures in conformance with the CVISN Architecture have resulted in benefits specific to electronic credentialing and to other transportation projects.

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