

Accelerated Information Sharing for Law Enforcement (AISLE) Using Web Services

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Abstract

Information sharing is the defining principle for public safety and Web Services is the technology best positioned to facilitate sharing and lower costs. The National Law Enforcement Telecommunication System (NLETS) provides a network for criminal justice information exchange throughout North America. NLETS is defining new standards based upon XML and Web Services under the Accelerated Information Sharing for Law Enforcement (AISLE) Project. AISLE deployed an XML Message Router (XMR) which provides operational Web Services capabilities. The AISLE Project developed and published detailed specifications based upon a broader Justice XML Data Dictionary. Initial Web Services provided partner agencies with guaranteed message services functionality and interoperability with existing systems by providing bi-directional legacy transaction transformation capabilities. AISLE uses a self-defining XML transaction with Web Services Attachments to support legacy image transfer. Future efforts will focus on more distributed Web Services as well as Web Services Security.

Keywords: public safety, integrated justice, security, attachments, XML Message Router.

1.0 Industry Challenges

Information sharing is the defining principle for effective homeland security. To help defend against terrorism and protect the lives of all Americans, criminal justice and law enforcement organizations must be able to efficiently and accurately share data and exchange intelligence across jurisdictional boundaries.

1.1 Sharing Information

To support the increased demands of information sharing in the post September 11th era, the national public safety and criminal justice technology infrastructure needs massive overhaul. Law enforcement officers and intelligence agents must be able to determine if terrorist information is maintained in the databases of the Federal Bureau of Investigation (FBI) or the United States Secret Service, or in the tens of thousands of local police record systems.

1.2 Lowering Costs

Further impetus for a criminal justice technology infrastructure overhaul is the obvious cost savings associated with Internet-based technologies during a time of budget shortfalls. Tens of thousands of municipal, state, and federal systems are already linked by a vast, private telecommunication infrastructure built on Internet protocols for law enforcement use. Leveraging this existing infrastructure will create economies of scale that will benefit the law enforcement community and, as a result, the entire country.

1.3 Streamlining Justice Processes

The nation's renewed focus on homeland security highlights the need for seamless integration of and distributed access to disparate law enforcement information systems. Already, criminal justice integrated justice systems that streamline complex, duplicative justice processes (from enforcement through parole and probation).

1.4 Providing Mission Critical Service

Most law enforcement interactions are based on unpredictable and, in many cases, uncooperative encounters. There is a need for highly accurate and timely information because of potential risks to officers during a very short encounter.

1.5 Improving Security

Security concerns are critical issues to all law enforcement agencies. The current system largely relies on a private network for security and established procedures and relationships. New security standards offer the potential for greatly improved security on the private network and the potential to leverage lower cost public networks. The implementation of an automated security framework must address the laws associated with the release of law enforcement information which vary considerably from state to state. New technology must provide safeguards for privacy which often applies to information such as criminal history and juvenile offenses.

1.6 Supporting a Diverse Community

Individual federal, state, county, city, and tribal law enforcement organizations must be able to communicate in a very timely and accurate manner despite the variations in technology and modernization cycles. This situation presents a dramatically different set of problems than might be seen in a more highly controlled environment, such as the interactions that might occur in a large

multinational corporation that has strong control over internal operations and subcontractors.

2.0 Role of XML and Web Services

The technologies best positioned to enable information sharing throughout law enforcement are XML and Web Services. The broad adoption of these standards-based technologies will allow pervasive and efficient communications and lower the cost of maintaining the current communications infrastructure.

2.1 Adopting XML and Web Services

Like many organizations, National Law Enforcement Telecommunication System (NLETS) adopted XML several years ago as the basis for future transactions but has only recently begun operational deployment. NLETS delayed implementation of XML transactions until it identified a more effective transport for XML transactions. Historically, NLETS had used an asynchronous guaranteed delivery data exchange model with specialized TCP/IP socket level communications (or legacy binary synchronous data link communications) and text-based transactions with data formatted as field value pairs reminiscent of older synchronous terminal transactions (See Figure 1). Now, NLETS is using Web Services to provide an open framework for standardized transport consistent with the loosely coupled nature of the law enforcement community.

OSI Layer	NLETS		AISLE Web Services
Application	NLETS Applications		NLETS Applications
Presentation	NLETS Native Messages		XML,WSDL, MIME
Session	NLETS TCP/IP Protocol		Web Services (SOAP)
Transport	Bisync	TCP	TCP
Network	Bisync	IP	IP
Data Link	Frame Relay		Frame Relay
Physical	Frame Relay		Frame Relay

Figure 1. NLETS and AISLE Web Services Protocol Profile

2.2 Realizing Web Services Benefits

With XML and Web Services, law enforcement communications will likely evolve from a proprietary “switch-centric” communications model to a more distributed standards-based system. At the state level, the adoption of XML and Web Services will allow public safety organizations to fully and effectively participate among the increasing number of automated, integrated criminal justice systems. Furthermore, the adoption of industry standards will enable the law enforcement community to leverage the benefits, advancements and investments of industry leading technology companies. Advancements in the areas of Web Services Security and Web Services Attachments will be especially useful to the law enforcement community in the future.

3.0 Background

Law enforcement networks evolved using two very different models. As the national “carrier” for law enforcement online transaction processing, NLETS reaches more than 500,000 law enforcement communications devices in North America. NLETS is a consortium of the states and, consequently, uses a distributed data model. The National Crime Information Center (NCIC), in contrast, is federally operated and uses a central repository model. With the central repository model, data is standardized, and there are synchronous online transactions.

3.1 NLETS Distributed Access Model

The distributed data model has resulted in inconsistent data formats and response content. Limitations of early technology, lack of standardization, and insufficient control over data values contributed to data inconsistencies in early law enforcement networks like NLETS. At the time, transactions were often operator-to-operator, rather than machine-to-machine, in a manner similar to “telex” transactions. Since a person was involved, it was acceptable to have variations in the responses as long as the operator could provide a consistent answer to the requesting officer. As machine-to-machine operations became the norm, inquiry formats were standardized. Eventually, the intervening

operator was eliminated, and the task of interpreting response data was pushed to the officer on the street. This resulted in difficult situations as officers were trying to interpret increasingly complex transactions while engaged in potentially dangerous encounters that demanded their full attention.

3.2 Law Enforcement Information Needs

To complicate matters, the law enforcement community has two distinct sets of users with very different needs. The primary users are police forces. Police require very timely, accurate, and simple information. During a citizen law enforcement encounter, the level of information required is the equivalent to that provided by a traffic signal – go, caution, stop. Access to photo images and wireless access are highly desirable. In contrast, investigators need as much information as possible, even if it is less accurate or less timely. The investigative model most resembles a conventional Internet search. Even partial information can be useful, and public source information is of great value. Web Services provides the ideal framework for both communities.

3.3 NLETS Today

Unlike thirty years ago, today's networks and systems used by the law enforcement community are faster, more reliable, and more consistent. Internet technologies have made it easier for law enforcement organizations to operate in a loosely coupled environment, eliminating the need for the old message switching model. Today, XML and Web Services are the ideal technologies to exchange law enforcement data transactions, and standardization efforts are underway. NLETS has published a complete XML specification for the inquiry formats and is working to develop standardized response formats. The ability to regulate data content by schema, and the ability to view data through a common style sheet, will be of tremendous value to law enforcement personnel who may need access to data from 50 different states.

4.0 Technical Approach

To develop and deploy Web Services technology, NLETS established a pilot Web Services Project called Accelerated Information Sharing for Law Enforcement (AISLE) in conjunction with the Wisconsin Crime Information Bureau and with the support of the National Institute of Justice. Prior to AISLE, Wisconsin had created a new architecture for intrastate law enforcement information sharing with Internet technologies. Wisconsin's plan was to make more information available without forcing centralized warehousing. During this project, it quickly became obvious that Web Services was an ideal standard for linking a distributed network of data sources. In addition to its intra-state Web Services network, Wisconsin needed a Web Service interface to the national network, NLETS.

4.1 Message Oriented Web Services

The initial phase of the Web Services deployment consisted of the implementation of a simple symmetric "send message" Web Services. The AISLE Web Service Description Language (WSDL) was defined, and corresponding Web Services were deployed for each leg of the switching infrastructure. Web Services eliminated the need for proprietary socket level communications and provided an operational framework. Future efforts will take full advantage of the Web Services infrastructure to provide direct access to new services and provide Web Services discovery capabilities.

4.2 XML Message Router

While the AISLE project successfully introduced an effective and efficient Web Services infrastructure to the NLETS system, broad deployment of Web Services throughout the NLETS membership will take years. It is therefore important that the legacy infrastructure and new Web Services be fully interoperable. The relationship between old and new must be structured to enable a clear and viable transition path from proprietary to open standards. The AISLE Project answered this challenge by deploying a commercially available product, the

XML Message Router (XMR), at NLETS to provide bi-directional transaction transformation capability. The XMR allows for both format conversion and protocol transition. The XMR handles the transformation between XML and legacy transaction formats, and provides the ability to exchange information between Web Services and legacy transport.

4.3 Web Services Description

The AISLE Project Web Services provides for self-defining XML transactions rather than a more specific and more complex WSDL. This approach avoids the difficulties with different vendor WSDL incompatibilities, but requires additional logic to determine the appropriate service to process the transaction. Future designs will be more efficient by expanding the Web Services to affect a direct receipt by the appropriate process, but these future designs will likely retain a single XML transaction document.

Transaction formats are consistent with the federal initiative to define a standardized XML data dictionary. This dictionary, called the Justice XML Data Dictionary, and sponsored by the Office of Justice Programs, will serve as the basis for all XML efforts at both the federal and state levels. The deployment of the initial Web Services was performed in parallel with the Justice XML Data Dictionary definition. XML standards for the law enforcement and criminal justice communities are still under development. The AISLE Project extended the XML definitions Wisconsin had already implemented – intra-state – to a national level. The AISLE Project contributed considerable value to the national law enforcement community in gaining transaction-oriented Web Services experience. Feedback was also provided to the national justice XML standards organizations on the use of XML in real-world operations.

4.4 Web Services Image Attachments

Despite the tremendous value of images in law enforcement operations, few law enforcement agencies use the current system to exchange image data. Web Services Attachments have the simplicity of Internet e-mail attachments at a programmatic level, which

will help to promote the adoption of Web Services. The AISLE Project's deployment of a Web Services infrastructure has already contributed greatly to the image exchange capability of the community. The AISLE Project implemented Web Services Attachments to support the transfer of images. Direct Internet Message Encapsulation (DIME) was used to support this capability. Initial experiences integrating different vendor implementations were problematic. In particular, automated WSDL tools did not produce compatible definitions and manual definitions were required. As with XML formats, legacy image formats and DIME attachments were made to be fully interoperable to promote the acceptance of the Web Services approach.

5.0 Implementation Strategy

Creating data standards is a difficult and lengthy process, and there is a natural tendency to defer development projects until standards are complete. By contrast, introducing new technology using the same data can occur relatively quickly, particularly if the new technology is interoperable with existing technology. The AISLE Project provided fully bi-directional transformations between XML and legacy formats. This successful approach

deployed XML and Web Services using interim data standards, allowing for the continued definition of XML standards to occur in parallel. Tangible results were immediately provided. There was the additional advantage of providing the benefit of operational experience back to the standards process, which can otherwise be a less grounded process. Collectively, these implementation strategies were principal reasons for the success of the AISLE Project. (See Figure 2.)

5.1 End User / Technical Documentation

The law enforcement community is extremely diverse and autonomous in terms of technology. Because of the breadth of the community, comprehensive technology specifications and an educational outreach program are required. As part of AISLE, the primary mechanism used to promulgate Web Services technology was a major revision of the end user and technical documentation with a new section devoted to XML and Web Services. Since technical documentation is nearly always inadequate, efforts to enhance the documentation were universally welcome throughout the law enforcement community.

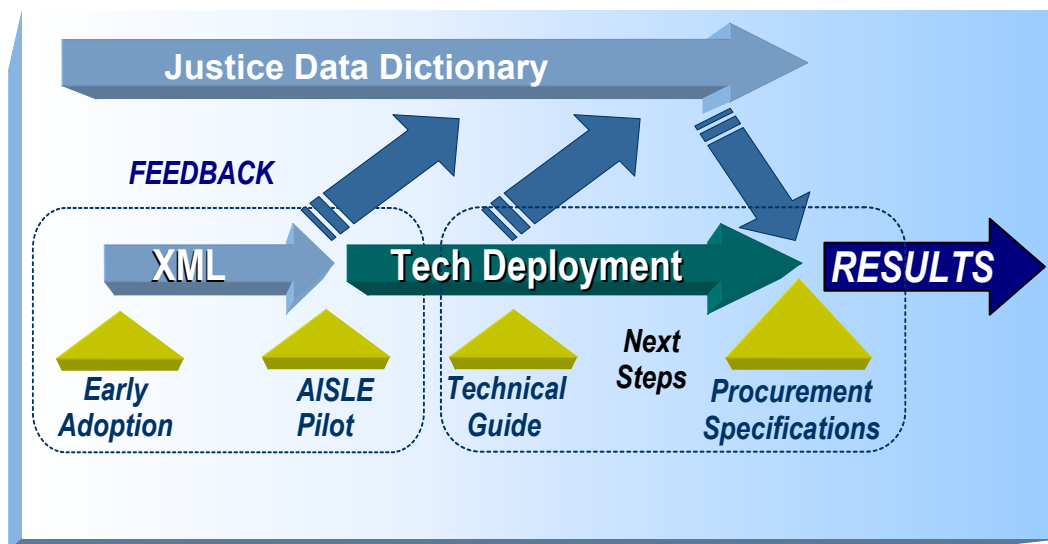


Figure 2. AISLE Implementation Strategy

5.2 Procurement Specifications

A key to the broad adoption of these new technologies are detailed specifications sufficient for procurement. Because of the participating agencies' autonomous natures, each with independent budgets and technology, procurement specifications are critical. The AISLE Project provided extensive technical documentation, including integrated XML cross references to legacy transactions and extensive XML and Web Services appendices. Emphasis was placed on XML instances that matched existing examples of text based transactions. This documentation serves as the basis for strategic planning and future procurements.

5.3 Mainframe System Interoperability

Web Services configured for guaranteed message delivery competes against IBM's WebSphere® MQ in a diverse environment that includes mainframe systems. Web Services offers several compelling advantages as it does not require a costly license, has rapidly evolving extensions for security and attachments, is supported natively by most server vendors, has extensive application development tools, and has standardized protocols for discovery and service description. The AISLE Project provides interoperability between Web Services and MQ to support the law enforcement community segment that adopted MQ prior to Web Services general availability.

6.0 Next Steps

6.1 Web Services Security

Advancements in Web Services security standards are particularly valuable to law enforcement since security concerns are critical issues. The Web Services infrastructure provided by the AISLE Project addresses information exchange between systems. These subsystems are assumed to have performed authentication of individuals. Consequently, standards such as biometric identification are not directly applicable to the AISLE Project. The AISLE Project must address authorization, privacy, and encryption. Security related standards from World Wide Web Consortium

and Organization for the Advancement of Structured Information Standards (OASIS) will be considered. Nearly all current security specifications are applicable including WS-Federation, WS-Security, WS-Policy, WS-Privacy, WS-Trust, WS-Authorization, WS-SecureConversation and WS-SecurityPolicy as well as security, encryption and key management markup language specifications.

6.2 Synchronous Web Services

With the AISLE Project, Web Services was initially used to provide asynchronous message delivery using the message switching model. Unlike a typical Web Service, in the asynchronous model, the Web Service delivers the inquiry and returns a message acknowledgement rather than the transaction response. A peer Web Service delivers the response at varying intervals based on the member state network speed and message switch infrastructure. In this case, the Web Services description merely provides for a text transaction and optional image.

The next step is the definition of synchronous Web Services that interact with and mask the legacy message switching and asynchronous Web Services. The synchronous Web Service would appear to interact directly with the data sources and return the transaction response despite the complexity of the intervening message exchanges and interactions. The synchronous Web Services may operate by suspending the requesting application (blocking) or by providing a notification of response (non-blocking), but in either case there is only a single Web Service interaction that includes both inquiry and response.

The adoption of the synchronous Web Service model will result in a single Web Services transaction model for both the central federal model (NCIC) and the distributed state model (NLETS). Further, transaction formats will be aligned because the Justice XML Data Dictionary will serve as the basis for all XML efforts at both the federal and state levels. The use of a common service model and standardized dictionary will streamline operations and reduce costs.

6.3 Distributed Web Services

As the number of connecting agencies grows, the architecture becomes more complicated. It is common for a large number of agencies to need access to a single data source. Traditionally, a "message switch" would funnel inquiries from many agencies into a single data source, and route the replies back to the inquirer. Web Services could simply be the protocol between the message switch and data source, but many other possibilities now exist. Perhaps the inquiring agent program running on a server could make its own inquiry directly to the data source using Web Services. NLETS is an international message switch, connecting state-level message switches to thousands of local enforcement agencies and many hundreds of state data sources. Today, all inquiries have to pass through many layers of switches to process a transaction. With Web Services, one can envision a direct connection from a local system to a data source in another state.

6.4 Object Oriented Approach

Web Services and new XML standards have initially been structured to mirror existing transactions. These transaction formats were established many years ago based upon efficient network routing and legacy system processing. A different set of criteria has more bearing today and new transaction formats are being developed to reflect new criteria. In particular, transactions are being considered from an object oriented perspective and the initial XML work has focused this approach. The Wisconsin Crime Information Bureau developed the first operational implementation of these new transactions and works closely with the Justice XML Data Dictionary Project to promote this new approach. From a technical perspective, this approach will use the Resource Description Framework.

6.5 Inter-organizational Messaging

NLETS provides support for inter-organizational messaging in addition to the online transaction processing. These messages can be very urgent or simply informational. Historically, these messages have been treated like all other text based

transactions. In the case of urgent messages there is a need to push the message to the end user. Inter-organizational messages can be supported through Web Services but delivery to the end user is more likely to take the form of e-mail or instant messaging. As a result, the use of e-mail or instant messaging as an end-to-end solution may be more appropriate.

6.6 Wireless Support

Web Services is expected to greatly accelerate the adoption of wireless services and vice versa. Current wireless services rely on proprietary gateway systems that add to cost and complexity. Web Services offers a well supported application development framework for wireless devices. XML stylesheets can easily format responses to accommodate the smaller size of wireless handheld devices.

6.7 The Promise of Web Services

Clearly, Web Services offers the potential to provide more cost effective links to criminal justice organizations, e.g. courts and prisons at a local level. It is an economical transport choice for any server-to-server connection between a pair of agencies. A police department might want to transfer custody information to the county jail, or a prosecutor might want to file a complaint with a criminal court. In the future, Web Services holds the promise of very rapid publishing and discovery of new services and very efficient access to data repositories at all levels from national to local. While most law enforcement information services are highly regulated, there is increasing need for more rapid deployment of new services for such operations as homeland defense, or newer "Amber Alert" public notification systems. Web Services can be used to meet these needs. The AISLE Project has been instrumental in providing the operational framework to allow the broad deployment of XML and Web Services and promote the acceptance of these technologies in the criminal justice community.