

## **Interoperability Standards and the Procurement Process**

Procurement methods should seek to identify a framework within which information transfer and interoperability requirements may be implemented quickly and economically as future needs dictate. Rarely, if ever, will a buyer know at the time of procurement all of the possible information interactions that the system will need to handle in the future. Buyers should specify that products or custom solutions must embody implementations based upon open standards rather than proprietary methodologies. Established open standards are more likely to have implementations available from a wider selection of product or solution suppliers thus increasing your selection pool and offering flexibility for future expansion.

As in other areas of procurement, the buyer should refrain from proposing detailed specifications regarding the information exchange methods being sought and, instead, request providers to specify in detail how their solution will be able to deal with the implementation of future and as yet unknown exchange requirements. Buyers should concentrate on developing requirements that identifying those standards and specifications the supplier's solution must incorporate. Buyers have a responsibility to ensure that they have adequate technical representation on their procurement governance committee to fully evaluate approaches to interoperability being offered by providers. If necessary, this may be a point at which obtaining outside technical expertise in evaluating suggested approaches may be well worth the cost.

Avoid the snare of narrowly selecting a solution that only addresses a currently known interoperability requirement and focus instead on seeking a broad framework to interoperability that offers an ongoing agile and economically feasible way to implementing interoperability requirement that may be required in the future. It is very important that you require Suppliers to describe in detail how provisioning of their interoperability services is accomplished focusing on cost and timing for provisioning a new endpoint.

Interoperability is generally defined as the ability of heterogeneous networks, applications, or components to exchange and use information. Unless you plan on living in isolation in an otherwise connected world, it is essential that you specify a set of interoperability standards that must be part of the solution that you are seeking. This is even more important if you do not have a well-defined Enterprise Architecture in place since this will provide a structure for you to participate in exchanging data with other systems in the future. In the following sections, we will discuss what an open standard is, how open standards fit in an interoperability framework and how to approach data transformations in defining interoperability in the procurement process.

### **Understanding Open Standards in an Uncertain World**

While most agree on the value of open standards for helping achieve interoperability, there continues to be considerable debate about how best to define open standards. The broadest definition of a standard is a specification that has been agreed upon by a community, through usage or declaration. The narrowest definition of a standard is that they must have been derived by a standards development organization (SDO). Common standards-setting organizations include the Internet Engineering Taskforce (IETF), the Institute of Electrical and Electronics Engineers (IEEE), the National Institute of Standards and Technology (NIST), the International Organization for Standardization (ISO), and the International Telecommunications Union (ITU). Something that may not have this sort of common agreement that is a prerequisite of a standard is sometimes called a *specification*. While all standards are a specification, not all specifications are standards. One example is a widely-used web services protocol stack Simple Object Access Protocol (SOAP). Although used extensively as a web service with implementations by numerous

suppliers, it is a specification and a recommendation of the W3C but is not by the most restrictive definitions of a standard.

There is no universal agreement on what constitutes an open standard. The Office of Management and Budget (OMB) [Circular A-119](#) defines an open standard as a voluntary consensus defined by the following attributes:

- Openness.
- Balance of interest.
- Due process.
- An appeals process.
- Consensus, which is defined as general agreement, but not necessarily unanimity, and includes a process for attempting to resolve objections by interested parties, as long as all comments have been fairly considered, each objector is advised of the disposition of his or her objection(s) and the reasons why, and the consensus body members are given an opportunity to change their votes after reviewing the comments.

Two further examples illustrate the divergence on defining a standard and presents differing views of what an open standard should be.

The first definition is that fostered by the [World Wide Web Consortium](#) (W3C) an important provider of web technology Standards, notably [XML](#), [HTTP](#), [HTML](#), [CSS](#), and [WAI](#), follows a process that promotes the development of high-quality standards based upon the following definition.

- Transparency (due process is public, and all technical discussions, meeting minutes, are archived and referencable in decision making)
- Relevance (new standardization is started upon due analysis of the market needs, including requirements phase, e.g. accessibility, multi-linguism)
- Openness (anybody can participate, and everybody does: industry, individual, public, government bodies, academia, on a worldwide scale)
- Impartiality and consensus (guaranteed fairness by the process and the neutral hosting of the W3C organization, with equal weight for each participant)
- Availability (free access to the standard text, both during development, at final stage, and for translations, and assurance that core Web and Internet technologies can be implemented Royalty-Free)
- Maintenance (ongoing process for testing, errata, revision, permanent access, validation, etc.)

The [Digital Standards Organization](#) (DIGISTAN) defines an open standard as “creating unrestricted competition between vendors and unrestricted choice for users.” DIGISTAN’s definition of an open standard is summarized as follows:

- A free and open standard is immune to vendor capture at all stages in its life cycle. Immunity from vendor capture makes it possible to freely use, improve upon, trust, and extend a standard over time.
- The standard is adopted and will be maintained by a not-for-profit organization, and its ongoing development occurs based on an open decision-making procedure available to all interested parties.

- The standard has been published and the standard specification document is available freely. It must be permissible to all to copy, distribute, and use it freely.
- The patents possibly present on (parts of) the standard are made irrevocably available on a royalty-free basis.
- There are no constraints on the re-use of the standard.

A key defining property in the DIGISTAN definition of standards is that an open standard is immune to vendor capture at all stages in its life cycle. Immunity from vendor capture makes it possible to improve upon, trust, and extend an open standard over time.

In August 2012, the W3C combined with the IETF and IEEE to launch [OpenStand](#) and to publish The Modern Paradigm for Standards. This captures "the effective and efficient standardization processes that have made the Internet and Web the premiere platforms for innovation and borderless commerce." In general, the approach being adopted by OpenStand seems to embody a more functional definition of Standard summarized as follows:

- Cooperation among standards organizations,
- Adherence to due process, broad consensus, transparency, balance and openness in standards development,
- Commitment to technical merit, interoperability, competition, innovation and benefit to humanity,
- Availability of standards to all, and
- Voluntary adoption by the market and that their success is determined by the market.

The adoption of standards, interoperability, and reuse are basic tenants of Enterprise Architecture because EA defines the components of the system and the interfaces that the components expose.

Enterprise Architectures exists for many domains and while they may vary from one domain to another, they adhere to certain basic tenants. IT systems while remaining locally independent should be able to both access and provide access to other users while maintaining the integrity and independence of each system.

There are numerous papers that discuss the concepts of Enterprise Architecture at an abstract level laying out the principles that should govern this approach some of which are posted on our [the IJIS Institute's Procurement Innovation Resources page](#). It is interesting to note that one generally accepted definition of interoperability is defined as "the ability of heterogeneous networks, applications, or components to exchange and use information."

To those buyers seeking a product or custom solution that will provide the broadest reach for future interoperability, the question of how to specify interoperability standards can be vexing. This, in part, occurs because many thought leaders and policy makers often misuse the term open standard when they mean open specification. From the buyer's viewpoint, the objective is to acquire a system that provides interoperability based upon both open standards and specifications that are *extensively utilized by other systems with which the system being acquired by the buyer may reasonably be expected to exchange information with in the future.*

### **Defining a Framework for Interoperability**

There is no generally accepted definition of Interoperability but Wikipedia's semantic definition of Interoperability is a reasonable interpretation. "Interoperability is defined as the ability to automatically

interpret information exchanged meaningfully and accurately in order to produce useful results as defined by the end users of both systems. To achieve semantic interoperability, both sides must refer to a common information exchange reference model.”

Within the justice domain, the exchange reference model that applies is the Global Reference Architecture (GRA), which began its existence under the name Justice Reference Architecture (JRA). The latest version of the Global Information Standard was released in November of 2012. The standard based to a large part upon the [OASIS Reference Model](#) for Service-Oriented Architecture (SOA) defines at the abstract level how such architecture should be applied in the justice community.

Systems Oriented Architecture became the great hope during the late 1990s and was developed around the concept that Instead of building dedicated applications, SOA would enable system architects to create components of software to mimic specific business processes. While great in concept SOA never really took off and became a mainstream approach to Interoperability in part because of the difficulty in implementing the concepts within the infrastructure of that period.

Historically, existing legacy systems have been able to provide a SOA Interface for external data exchanges through the use of an [Enterprise Service Bus](#) (ESB). Typically, an ESB provides a set of capabilities to enable integration and service-oriented architecture (SOA), including data mapping and transformation to XML schemas, service creation and mediation, routing, data transformation, and management of messages between endpoints. There are numerous commercial ESB implementations and in the past, they were licensed as a standalone product usually resident on their own server. One disadvantage of older ESB implementations was that provisioning<sup>1</sup> required a significant amount of programming to adapt to even a minor change in an Interoperability requirement.

In recent years, some COTS suppliers have begun to embed many of the traditional ESB functions into their product. Further, a new concept the Integration Platform as a Service (IPaaS) has begun to emerge as part of the movement to a Hybrid Integration Platform. A recent [Gartner report](#) defines the IPaaS as “a combination of some of the features found traditionally in on-premises integration platform software, such as enterprise service buses (ESBs), data integration tools, B2B gateway software, application service governance platforms and managed file transfer products.” An integration platform is a form of platform as a service that provides capabilities to enable subscribers (usually referred to as tenants) to implement integration projects involving any combination of cloud-resident and on-premises endpoints. While, IPaaS is currently an emerging alternative Gartner projects this as one of the fastest growing cloud technologies.

There is a difference between the architectural concept and the technical requirement that have been developed in support of Service Oriented Architecture. Because procurement requirements’ by their nature deal with technical needs and specifications, because they need to specify what a service or a product needs to provide, we have to look to those requirement’s specified in GRA that translate into specifications usable in a procurement.

The reference architectural concepts among other things divide the universe into service consumers and providers of information. Many if not most end points are probably both consumers of services and providers of services. One of the most important features of the GRA is the separation of consumer systems from provider systems by a services exchange layer. This is the defining characteristic of a service-oriented architecture and is the key to minimizing the implementation dependencies between systems. The federal government spearheaded by Information Sharing Environment ISE is advocating

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<sup>1</sup> As used herein the term provisioning is the process of preparing and equipping a network to allow it to provide new or modified services to its users.

that all federal grants for IT systems contain provisions requiring any services or products obtained with the funding conform to GRA standards.<sup>2</sup>

It is worth expressing a word of caution regarding the application of interoperability standards, which are too narrowly defined. Developing and applying standards that are applicable only to a domain or business sector, which is small, in terms of its economic profile may reduce competition and increase costs. Developing an implementation of a standard by a company requires a commitment of capital both human and monetary. Since a company must balance the cost of an implementation against the likelihood of recovering the development cost a limited market potential can inhibit the availability of COTS solutions that meet a standard so narrowly defined that it has a limited chance of producing a return on investment. In general, the broadest possible procurement standards that meet your needs are preferable over those very narrowly defined.

[OMB Circular-119](#) recommends the use of voluntary consensus standards wherever possible stating in part “all federal agencies to use voluntary consensus standards in lieu of government-unique standards in their procurement and regulatory activities, except where inconsistent with law or otherwise impractical.” The policies in this Circular are intended to reduce to a minimum the reliance by agencies on government-unique standards thus supporting by implication the concept that broad standards are more cost effective.

It is one thing to define standards for establishing interoperability between separate systems but it is a different matter to specify how those standards should be specified in a procurement process. The core requirement to transfer data seamlessly between systems with disparate internal data formats is an essential requirement of any procurement. The following sections discuss the three areas within which the procurement process must define how interoperability can be achieved.

### **Transforming Data for Information Exchanges**

The ability to exchange or receive data from any external system in a common format even though the internal data may be kept in a proprietary format requires that the IT system or custom solution you are seeking be able to send and receive data to or from other systems. This requires using a Service Interface that will map internal data elements to an XML conforming schema and similarly translate incoming XML schema's to internal data formats.

XML is the Lingua Franca of data exchanges via the internet at least as between servers. Data local to an entity on the other hand is usually in a proprietary format for reasons of speed of retrieval and file efficiency. To bridge the gap between local and proprietary data formats and the favored format for data transmission it is necessary to map the local format to an XML format usually by means of a schema called an [XSD XML Schema Definition](#) that describes the structure of the XML document. Many Service Providers provide implementations that map proprietary data formats to any XML schema that conforms to the World Wide Web Consortium (W3C) specification.<sup>3</sup>

For a successful exchange of data to take place between two or more parties, there must be agreement on the Schema that is to be used to carry out the exchange. In recent years, this has been made easier by the emergence of the National Information Exchange Model (NIEM) that, in essence, provides a library of information exchange components that can translate to XML Schemas. NIEM provides a way that communities that share common interests can more quickly adopt a common understanding for the exchange of information even though the underlying systems maintain the data in a completely

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<sup>2</sup> ISE has created a Sub-Committee of the Information Sharing and Access Interagency Policy Committee (ISA IPC) to further refine standards to apply to information sharing. Thus the following discussion represents a likely basis for final standards.

<sup>3</sup> XSD 1.1 became a W3C Recommendation in April 2012, which means it is an approved W3C specification

different format. This is not intended as a complete or even partial description of NIEM so those interested in a more in depth understanding of NIEM model should visit [www.niem.gov](http://www.niem.gov).

Historically, existing legacy systems have been able to provide a Service Interface for external data exchanges through the use of an [Enterprise Service Bus](#) (ESB). Typically, an ESB provides a set of capabilities to enable integration and service-oriented architecture (SOA), including data mapping and transformation to XML schemas, service creation and mediation, routing, data transformation, and management of messages between endpoints. There are numerous commercial ESB implementations and in the past, they were licensed as a standalone product usually resident on their own server. One disadvantage of older ESB implementations was that provisioning<sup>4</sup> required a significant amount of programming to adapt to data transfer requirements. Standardized schemas such as NEIM have helped by providing a common set of XML schemas for the exchange of data improving the speed and ease that common transformations can be implemented. Improved provisioning has enhanced the ease with which data mapping and transformation can be implemented reducing considerably the amount of manual programming required.

In recent years, some COTS suppliers have begun to embed many of the traditional ESB functions into their product. Further, a new concept the Integration Platform as a Service (IPaaS) has begun to emerge as part of the movement to a Hybrid Integration Platform. A recent [Gartner report](#) defines the IPaaS as “a combination of some of the features found traditionally in on-premises integration platform software, such as enterprise service buses (ESBs), data integration tools, B2B gateway software, application service governance platforms and managed file transfer products.” An integration platform is a form of platform as a service that provides capabilities to enable subscribers (usually referred to as tenants) to implement integration projects involving any combination of cloud-resident and on-premises endpoints. While, IPaaS is currently an emerging alternative Gartner projects this as one of the fastest growing cloud technologies.

Once the buyer has developed a requirement for an agile approach to mapping internal data elements to an XML schema to facilitate the transmission of the information to be exchanged, the Buyer needs to address the issue of specifying how the data will be transmitted between the user and the provider. In today’s environment, most communications between endpoints will take place via the World Wide Web (WWW).

Since that advent of the WWW, a group of services based upon and open standards and specifications has been developed and are available for managing the physical transmission of data between endpoints. Web services are web functions used repetitively in Web information transfers, which can be used by other applications. Buyers should insure that the solution/product being acquired supports a robust set of web services and a mechanism for exposing those web services the product will support for transmitting data via the WWW and how those services will be exposed to other consumers and providers of information.

It is well beyond the scope of this paper to provide a detailed discussion of web services but to put the issue in perspective the following is a brief introduction. Web services are grouped together in what is often referred to as a stack<sup>5</sup>, starting at the transmission level and progressing upward to the more abstract application layer. A number of widely used standards/specification is sometimes referred to as commodity standards. An example of such a “commodity” standard is [TCP/IP](#), a widely used stack for

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<sup>4</sup> As used herein the term provisioning is the process of preparing and equipping a network to allow it to provide new or modified services to its users.

<sup>5</sup> A stack is a collection of services with individual layers that work together moving upwards from the bottom (most primitive) to the highest (Most Abstract) Level.

internet data transmission. Other web service stacks such as HTTP and SOAP, interact with the TCP/IP stack and provide additional services at a higher level of abstraction. The W3C in its publication on Web Standards states, "An important point is that, towards the bottom layers of the stack, the technologies and concepts are relatively more mature and achieve a higher level of standardization than many of the upper layers." It further goes on to opine that as web usage grows and matures stacks at a higher level of abstraction will achieve a similar level of standardization.

Services, which are available to other consumers and providers, should be published using Web Services Definition Language (WSDL). While most reference architectures do not specify any specific web services SOA principles provide that a conformant entity include a public accessible repository called a [Service Interaction Profile](#) that defines the web services required to access the services available to a consumer. The repository also should provide information that informs a potential consumer of the services that are available and the requirement the consumer must meet to access these services including the format of required agreements and MOU's. While SOA does not specify the repository structure, most SOA constructs use [Web Services Definition Language](#)<sup>6</sup> (WSDL) to define the basic services provided by the end point.

The relationship between SOA and web services often becomes confusing. In an April 2003 Gartner report, Yefim V. Natis makes the distinction as follows: "Web services are about technology specifications, whereas SOA is a software design principle. Notably, Web services' WSDL is an SOA-suitable interface definition standard and is where Web services and SOA fundamentally connect." The benefit of specifying that the service or product delivered by the supplier include a WSDL capability is that it will offer a platform-neutral approach to accessing services and better interoperability as more and more Service Providers support more and more Web services specifications.

### **Single Sign-on Authentication**

Once an entity is committed to the concept of sharing information through information exchanges with other organizations and has clearly specified the need for data transformations to a common exchange format and a set of web services for transmitting data an additional problem must be addressed. When data is available only to those within the buying organization information security and integrity is a local matter. Once an organization has entered a federated environment, within which it shares information with a number of other organizations a new requirement for information security is needed.

The need for security in a framework that permits the exchange of information between different consumers and providers has resulted in the creation of the [Global Federated Identity and Privilege Management](#) (GFIPM) standard. GFIPM provides a framework for identity management by addressing the issue of authorization, and privilege management, within systems and applications in a federated environment. "In such a federation, there are trusted identity providers and service providers governed by rules detailing access rights to the various computer systems that are a part of the federation. Under the agreed upon rules, identity providers establish the authentication of the user and the privileges associated with that user. The service providers then trust these identity providers and can avoid any manual labor in creating lists of users from other agencies who have pledged to follow the rules. This federated approach eliminates the barrier to information sharing on a broad basis."<sup>7</sup>

GFIPM is more of an architectural concept than an open standard and probably does not reach the threshold of an open standard by most definitions. However at least in the public safety and justice

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<sup>6</sup> The Web Services Description Language is an XML-based interface description language that is used for describing the functionality offered by a web service.

<sup>7</sup> Quote from Wormeli blog 3-13-2013.

community, it has gained a reasonable measure of acceptance but whether the different implementations reach the level of a standard is uncertain. If public safety and justice are truly sufficiently different from other sectors to require a separate standard more work needs to be done to elevate GFIPM to conform to acceptable standards requirements.

Perhaps the broadest standard for single sign-on authorization is sponsored by the Organization for the Advancement of Structured Information Standards (OASIS), which has developed an open standard for single sign on authorization, [SAML](#) (Security Assertion Markup Language). SAML is an XML-based description language that defines how SAML asks for and receives an assertion that allows a user to log on once for affiliated but separate websites. SAML is designed for business-to-business and business-to-consumer transactions. Protocol binding defines how SAML message exchanges are mapped to Simple Object Access Protocol ([SOAP](#)) exchanges. SAML works with multiple protocols including Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP) and File Transfer Protocol (FTP). It also supports BizTalk, and Electronic Business XML (exBML). SAML is the dominant single sign-on authorization in the business-to-business world but has been slow to be adopted by government agencies.

Procurement approaches must include requirements for how security is handled in an interconnected environment. No longer is access to data limited to personnel in a single organization but other agencies will be accessing data with personnel not under the control of the hosting agency. To be both successful and secure procurements that involve interoperability must require that the acquired product provide a framework for a single sign-on capability.