THE Open GROUP

An Introduction to Boundaryless Information Flow

Including Business Process and Web Services

A White Paper by:

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An Introduction to Boundaryless Information Flow, Business Process, and Web Services

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Boundaryless Information Flow™
achieved through global interoperability
in a secure, reliable, and timely manner

Executive Summary

The primary purpose of this document is to set the context for a work item to identify and track open standards activity related to Boundaryless Information Flow which is the subject of a separate document *Open Standards in the Field of Boundaryless Information Flow, Business Process, and Web Services*.[1]

This document introduces Boundaryless Information Flow and the customer requirement. It considers the role of web services and identifies the need to examine business process systems and languages. It reports on some of the perceived barriers to adoption of web services and shows the use of The Open Group Architectural Framework and especially the Technical Reference Model as a way of mapping standards activity with requirements. Finally, there is a brief mention of the hype curve and how consortia can work together to ameliorate its effects and ensure the right set of standards are adopted and implemented to achieve the promise of Boundaryless Information Flow.

[1] Open Standards in the Field of Boundaryless Information Flow, Business Process, and Web Services, Version 1, July 2002, Doc. No. W202, issued by The Open Group.

About this Document

The primary purpose of this document is to set the context for a work item to identify and track open standards activity related to Boundaryless Information Flow.

The starting point for this particular document is a desire to understand the requirements for Boundaryless Information Flow and to explore the relationships between Boundaryless Information Flow, business process, and web services. The Open Group's *Interoperable Enterprise Business Scenario*[2] sets out the customer requirements for Boundaryless Information Flow.

This paper is one of two; the second document relates to the work item above.

Some of the views expressed have been taken from recent articles and items on the web.[3] We welcome feedback and discussion to improve the document for future versions. We will also extend the scope of the document as necessary to cover related fields of activity and to complement the paper on open standards.

[2] *Interoperable Enterprise Business Scenario*, published by The Open Group; this document uses material developed by members of The Open Group management team.

[3] The views expressed in this document are not necessarily the views of The Open Group or its membership. They are offered to reflect current issues and concerns expressed in the literature and on the web to encourage debate.

Boundaryless Information Flow

Introduction

Every innovation has side-effects, either now or in the future

Creating organizational structures that allowed functional departments to operate was for a long time the most efficient method of managing a large enterprise. Amongst other benefits, this method of organization fostered the development of increasingly specialist skills whose owners could work on specific aspects of an activity or set of activities so that tasks could be accomplished better, faster, and cheaper. As each activity moved through the organization it would pass from department to department, each having its inputs from the one before, its own set of processes, before sending its output to the next department in the line.

In today's world where speed, flexibility, and responsiveness make the difference between success and failure, this method of working is no longer appropriate. Consequently, organizations have been trying, for some time, to overcome the limitations imposed by traditional organizational structures. Cries of "be big, act small" have been around for some time. Re-engineering was largely about removing unnecessary processes and hand-offs and about having different functional departments share a single computer system. Many re-engineering efforts were abandoned because they were too ambitious, whilst others cost far more in both time and money than originally intended. And there is a lesson we can learn here for the future. Start simple – prove the concept – before moving to bigger objectives.

Today, organizations need not abandon functional or departmental organization altogether. They can enable the right people to come together in cross-functional teams so that all of the skills, knowledge, and expertise can be brought to bear on any specific problem or business opportunity. The first challenge this introduced is that different departments had different cultures and different values from others. Often they would use information as a weapon; "information is power" was heard more in internal political battles than in negotiations with customers and suppliers or simply when competing in the market. In many ways most of these issues have been overcome by many of the leading enterprises.

Boundaries often hinder interactions between partners, slow down processes, help preserve the status quo, and thwart economies of scale. However, boundaries may provide privacy and security, allow efficiencies of locality, reduce costs of unnecessary scale, allow competitive differentiation and strategic advantage, help enforce accountability, and define domains of process integrity.

In General Electric, Jack Welch invented the term "the Boundaryless Organization" not to mean there are no boundaries (as he says, "that would be silly") but to make them permeable. Effective boundaries demand respect such as bounded domains of authority and accountability, boundaries of personal "space" and privacy, economic boundaries of competition, property rights (real, personal, intellectual), and physical boundaries of space and time. Allied Signal, Honeywell and many others have adopted this approach although many may not have used the same name. The term "Boundaryless Organization" is inspirational in its way of describing the way people must work in order to be effective and to grow shareholder value.

However, the IT systems, which have been built over a period of 20 or 30 years at a cost of many billions of dollars and are not about to be thrown out and replaced, were built for each functional department. So although we can get people to work together effectively (which is no minor achievement) the IT systems are stubbornly stuck with the old-style thinking. The information does not flow in a boundaryless way. It simply cannot do so today.

The response

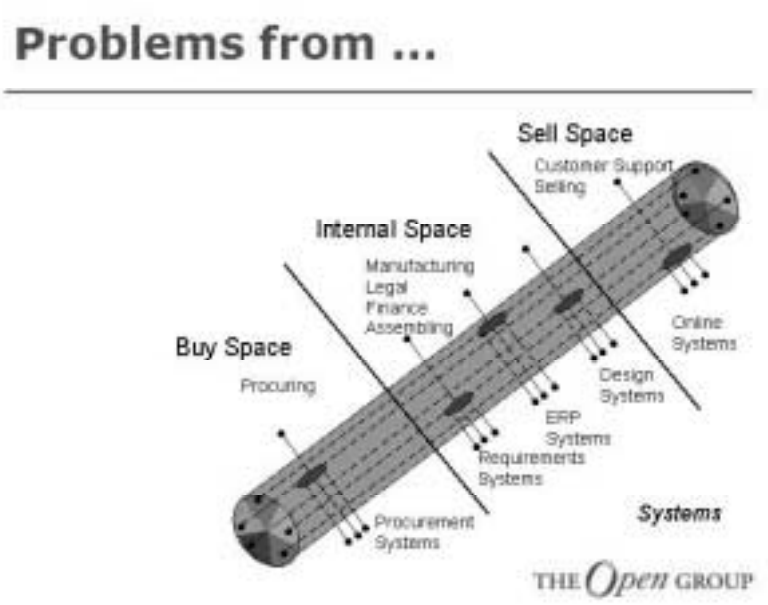
The Open Group's Vision and Mission related to Boundaryless Information Flow are based on the customer's problem statement which says that I (as the customer) could run my business better if I could gain operational efficiencies improving the many different business processes of the enterprise both internal, and spanning the key interactions with suppliers, customers, and partners using integrated information, and access to that information.

The Open Group Vision: Boundaryless Information Flow achieved through global interoperability in a secure, reliable, and timely manner.

CIOs are under enormous pressure to provide access to integrated information to each team on an as-required basis, yet the sources of this data are huge. Imagine, if you will, an organization that manufactures a custom-built product; that brings together representatives from sales, marketing, manufacture, design, and procurement (amongst others) so they are able to respond rapidly to the customer's request for proposal, or reduce the time to delivery of the end product. Amongst other things they need information about parts availability from the ERP (enterprise resource and planning system), which is linked to the procurement systems, which are linked to the systems of their suppliers. This manufacturer has 3,000 business partners or suppliers, many of which have links with the company via as many as 50 point-to-point applications. How do you get all the information you need, when you need it? What happens if the information changes later? How can they quickly see the impact of a design change on the price of the product, the delivery time, or the availability of parts? These are exemplified in a flow diagram.

The Open Group Mission: To drive the creation of Boundaryless Information Flow achieved by:

- *Working with customers to capture, understand, and address current and emerging requirements, establish policies, and share best practices*
- *Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate open specifications and open source technologies*
- *Offering a comprehensive set of services to enhance the operational efficiency of consortia*
- *Developing and operating the industry's premier certification service and encouraging procurement of certified products*



If we picture the enterprise without the Boundaryless Information Flow it might have hundreds of interconnections between its own departments (marketing, sales, procurement, design, inventory, etc.), and its partners and suppliers' own systems. Their point-to-point connections are expensive and inefficient. The enterprise is looking for an infrastructure that allows information to flow between all the systems; this is an infrastructure that is boundaryless.

The Economist in their February 2002 supplement entitled *A Survey of the Real-Time Economy* used a much simpler example. "Customers of a mobile-phone company can easily discover how well-integrated the company is. All they have to do is telephone their mobile-phone operator and ask how much airtime they have used this month. The chances are that the people on the customer-service desk will be unable to tell them, because their computer is not linked to the firm's main database."

The IT systems in place today do not allow for information to flow in support of the boundaryless organization – when it does, we will have Boundaryless Information Flow.

Today's technologies have their own boundaries:

- **Infrastructural** boundaries inhibiting interconnection, and lacking underlying facilities to interconnect
- **Structural** boundaries where system growth is limited by the "strength" or scalability of its structure
- **Architectural** boundaries where differently architected technologies often just don't "fit" with each other
- **Semantic** boundaries where different ways of representing the same

things exist and are hard to reconcile

The enterprise needs to know what information and applications are available and where they are. They need to be able to get at all the information they need, when they need it. They need to know when the information changes and obtain updates. They need to be able to respond to the new information. At present this relies on people talking to people, paper, translations, resulting in errors, and unpredictable results, and high costs.

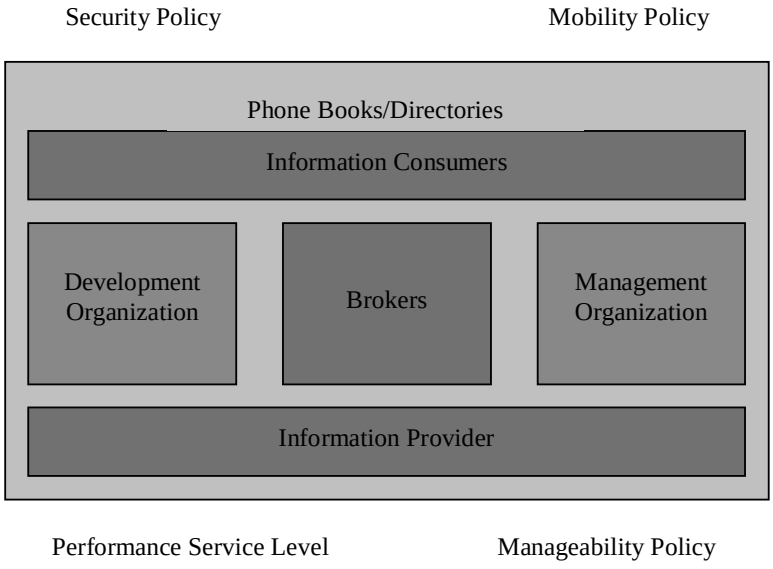
This leads to a Business and Related Technical Taxonomy for Boundaryless Information Flow.

For IT, boundaryless means:

- *Structuring IT so that it doesn't create boundaries for its own sake*
- *Being able to deploy IT so that its boundaries align with "real" boundaries with value and utility*
- *Not creating boundaries that mean you can't get there from here*
- *Eliminating or surmounting technology boundaries when appropriate*
- *Use of bridges and gateways as fundamental infrastructure elements*

… (continued)

Boundaryless Information Flow: Business Taxonomy



For Boundaryless Information Flow we need to provide a number of services:

- Information provider services respond to requests and provide rudimentary access to information.
- Brokering services manage the requests from any number of clients to and across any number of service providers.
- Information consumer services deliver content to the user of the system, and serve access requests to the information.
- Directory services locate information and/or application services.
- Workflow services automate the delivery of information in support

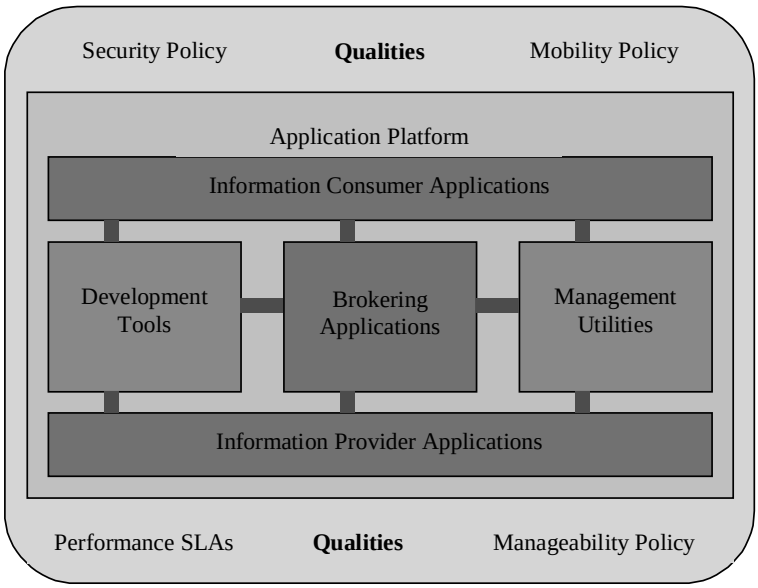
of a business process.

- Development tools provide modeling, design, and construction tools.
- Management utilities provide all the necessary utilities to operate and manage information and the system.

(continued) …

- *Use of gatekeeper functions to ensure security, privacy, and other forms of autonomy*
- *Effective and yet transparent technology boundaries*
- *Exposing information with opaque boundaries using directories and locator services*

Boundaryless Information Flow: Technical Taxonomy



In addition, qualities such as security and reliability as well as manageability need to be adequate. The enterprise needs to have end-to-end information and control for its key business processes embracing its customers, operations, contractors, suppliers, and partners.

It follows that Boundaryless Information Flow will not be achieved by web services, nor any list of technologies, alone, but by many technical and best practice standards that together contribute to global interoperability, since the information must be available to those who are authorized to have it, and for them to obtain it in the form that they need it and when they need it[4].

[4] As examples, The Open Group is already beginning to look at services and issues such as:

Boundary services for protected systems: security, integrity, discovery

Political and regulatory limits on information flow

Property rights in a boundaryless world

Information aggregation and disaggregation: portals and beyond

All to help organizations turn data into information, information into knowledge and understanding, and eventually to address how to get wisdom.

Web Services

Technologies have broken boundaries in the past by ignoring them. Telegraphy, telephony, radio, and now the Internet all transcended political boundaries and transformed both war and peace. Transport systems technologies such as rail, highway, and air reduced geographical limits to market expansion, leading to the rise of large manufacturing/marketing organizations and restructuring of local small business economies.

Will web services become a set of technologies that break down the boundaries that cripple the flow of information?

Definition

A complete web service:

- Is available over the Internet or private (intranet) networks
- Uses a standardized XML messaging system
- Is not tied to any operating system or programming language
- Is self-describing via a common XML grammar
- Is discoverable via a simple find mechanism

Web services are applications that are accessible using open web standards, thereby facilitating new open distributed computing capabilities.

Web services represent a move from human-centric to application-centric webs in which conversations can take place between applications as easily as between web browsers and web servers.

Web services offer the promise of lowering the barriers to application interoperation. They rely on standardization. Through a web service Architecture we can look at web service roles (service providers, service requestors, and service registries) and/or look at a web service stack (service transport, XML messaging, service description, and service discovery). Full automation of processes is in people's minds.

"A web service is a software application identified by a URL whose interfaces and binding are capable of being defined, described, and discovered by XML artefacts and which supports direct interactions with other software applications using XML-based messages via Internet-based protocols."

[W3C Web Service Architecture WG]

"A web service is application components whose functionality and interfaces are exposed to potential users (including computer applications) through the application of existing and emerging Web technology standards."

[Security in a Web Service World: A Proposed Architecture and Roadmap]

There are several contenders providing competing frameworks and proposals for web services. These are Microsoft .NET, IBM's web services, Hewlett-Packard's NetAction, and Sun's Open Net Environment (ONE). They all share the same basic web service definition and a common set of technologies, mainly XML, SOAP, WSDL, and UDDI. This paper is concerned with the common definitions and technologies employed by these major vendors. It is also concerned with the whole business rationale and need for web services.

The standards most closely associated with web services provide the means for a mark-up language (XML), communication between applications (SOAP), description of the application (WSDL and RDF), and directory and location (UDDI).[5] However, we need to look at business process frameworks such as ebXML.

Barriers to the adoption of web services

Web services can be built to do some of the things required for Boundaryless Information Flow. For example, a web service application can provide a brokerage service, as shown by MedBiquitous who use web services to gather course listings from other societies and present a single list to a doctor looking for all training opportunities.

Boundaryless Information Flow needs information to flow between applications not designed to be integrated. We can look towards web services being deployed to fulfil the former requirements. The list of services and quality criteria were discussed above.

This gives rise to a number of questions relating to the present state of the web service art. Are web services real today? Do they meet the enterprise customer needs for Boundaryless Information Flow? What needs to be done to fully meet the needs of customers? How are the many consortia involved going to co-operate to achieve the promise?

An initial look at these questions suggests that the flow of data between applications required for Boundaryless Information Flow can be handled successfully by web services today. The flow of data descriptions required for the applications needs to be catered for, as does the flow of policy.

[5] XML can help us understand the information, but this depends on everyone talking the same language. By way of a simple example, some applications may identify people by first name – others may use christian name. This could defeat our ability to get the information we need.

SOAP can help us communicate among Web Services applications that may provide access to the information we need – again it assumes the applications are known and registered.

WSDL and RDF can help us find our way into the application to find the information we need – but it depends on the application's ability to output that information. If it would not naturally come out of the application in its normal usage, it will not come out for us now.

UDDI can help to find the applications that might get access to the information we need – provided that the applications are on the network and are registered – we need them to be doing the equivalent of waving a flag to tell us that they exist and where we can find them.

The Microsoft web site observes that most Internet-based scenarios should not require stateful objects or distributed transactions, because both place server resources (for example, database locks) under the control of remote clients. In practice, this means that the services exposed by a Web Service are:

***Stateless**: All the information required to perform the service is either passed in with the request message or can be retrieved from a data store based on some information provided with the request.*

***Atomic**: Each service represents a complete unit of work that leaves data stores in a consistent state. For example, if clients need to be able to move money between bank accounts, the service should accept a MoveMoney request message, not just Debit and Credit requests.*

Enterprises will question the level of expertise required (hence the cost) to implement the technology, the lack of agreed vocabularies, and the inability to implement enterprise IT policies.

Taking a more general view of the current state of web services, we can say that web services are in the "early adopter" phase. The standards are immature. The infrastructure for commercial business transactions needs to be in place.

Key barriers to adoption[6]

Security[7]	Ability to guarantee information confidentiality and integrity of information that is passing over a public network. Ensuring that instances of service delivery or consumption can be proven to have occurred (as necessary to settle any dispute arising). No broad agreement on types of security needed. Overlap or conflict between emerging standards.
Identity[8]	Ability to find resources and authenticate access to services. This may be provided by UDDI. There appears to be no agreement on how information about users should be managed.
Transaction	Conferring ACID properties on web services transactions. Web services are based on a loosely coupled architecture – there is currently no support for distributed transactions.
Messaging	Semantic mapping: Application-level data structures may be different on the client and server sides of a service and information must therefore be mapped as it passes from one to the other. There may be better options than custom application programming. There is no standard mechanism for reliable messaging. There are conflicts between existing messaging systems.
Processes	Workflow: Ability to preserve the correct sequence of transactions in fulfilment of a complex service. The means to define collaborative business processes, such as XLANG from Microsoft and WSFL (Web Services Flow Language) from IBM, which are only in the early phases.
Infrastructure	Audit: Ability to meet business and/or legal requirements for auditing of service delivery. Intellectual property: Protection of intellectual property when delivered via a web service. Payment models: How services should be charged for and what mechanisms are needed to support that. There is currently no system for billing, payment, and provisioning for commercial web services. Currently there is no mechanism for automating business relationships. For example, current service descriptions do not cover guarantees on pricing, delivery schedules, or legal ramifications if deliveries are not made. Given a service description, you cannot assume that a service is bug-free or that the service is available 100% of the time.

[6] At least these are perceived barriers or limitations that need to be addressed and resolved.

[7] There are initiatives by Microsoft, IBM, and Verisign to fill the gap.

[8] It is not clear how this ties up with LDAP.

	Existing eCommerce services over the web rely on use of specific rules and policies in a client/server relationship, often with human intervention.
Management	Configuration, backup, measurement, etc. may require specific treatment in a web services context.
Performance	Ensuring that a required level of service can be guaranteed if required. Can adequate throughput be achieved, given practical infrastructure constraints in processing power, storage, and network bandwidth? Overcoming the deficiencies in simple Internet protocols (especifically HTTP) is one of the issues. XML is a lengthy data format which leads to a 10-fold increase in document size and a performance hit on XML parsers. Processing speed will be a factor.
100% Interoperability	Completion of SOAP, WSDL, and underlying "type systems" to fulfil the vision of cross-platform web services.
Debugging, Testing, and Certification	Verifying that complex services built using web services work correctly, and providing endorsement for services that comply with standards.
…..[9]	

Towards Boundaryless Information Flow

Web services will contribute to the provision of Boundaryless Information Flow. They will help break down boundaries. We still have the challenge of how we would manage the information flow – the information we extract could represent a huge quantity of data. And much of this suggests that we suck data from applications when we need it. But what happens if the data changes – if parts required for the assembly of a manufactured product that were available when we ran the inquiry are no longer available, how would we know? Is there a way that the information would flow as we needed it? As it changes?

Web services may help liberate the information from the systems which hold it so dearly today – today the information is under the stewardship of various mechanisms: databases, files, applications, etc. Standard approaches to liberate the information from the legacy are needed. Are these provided by web services? Do web services address communication from a web services application to a legacy system?

Information must be secured as it is flowing in the environment, especially as it travels a public Internet. Information privacy also must be maintained, following the rules of the world. Do web services alone ensure security and privacy?

[9] For example:

Application Development – features such as code repositories, versioning, and change management.

Integration and Coordination – features such as workflow and business process management, service interaction, data transformation, content-based routing.

Reliability and Mediation – features such as instrumentation and performance monitoring, logging and auditing, authentication and security, reliable messaging, and non-repudiation.

So web services have a role in Boundaryless Information Flow, but it is by no means the whole story.

Business Processes

The customer requirements for Boundaryless Information Flow echo the need for IT systems to meet the business requirements. We are familiar with systems offering Enterprise Application Integration (EAI),[10] Business-to-Business (B2B),[11] and Enterprise Information Systems (EIS)[12] solutions. These offerings are based on different technologies or paradigms and reflect the technology of the day.

An Enterprise Business Process (EBP) is the description of steps needed to carry out a business activity regardless of the systems involved. This provides a high-level view of the steps involved and can be used to model, benchmark, and document existing or future designs. Enterprise business processes are actually free to span multiple corporations as a result of their nature, which is not bounded to systems. An example would be describing all the steps that must occur for a pair of shoes to be manufactured in Asia and appear at your favorite store at the mall.

The need for systems that satisfy the business process needs of the customer is central to the delivery of Boundaryless Information Flow. Web services offer a new method of communication and access to applications through web technology. In the middle is the development of business process management systems and languages. These are often industry-specific.

A discussion of ebXML and other business framework standards, as well as business process languages, is the subject of *Open Standards in the Field of Boundaryless Information Flow, Business Process and Web Services*.

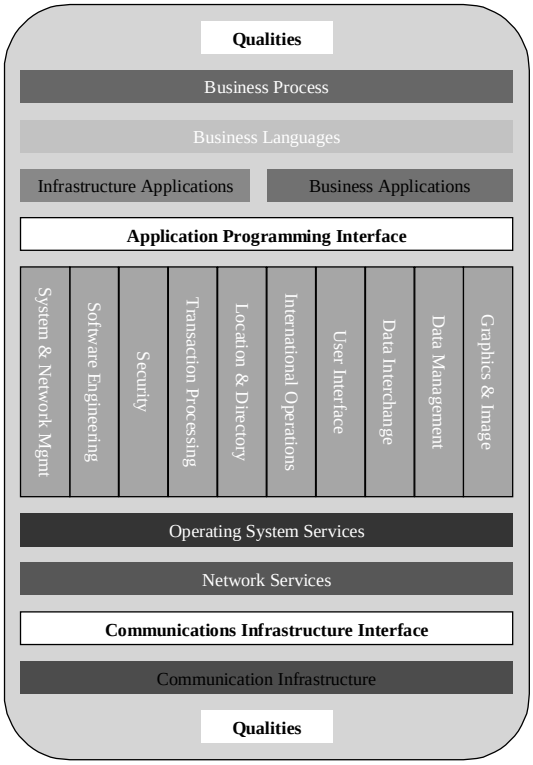
[10] EAI (Enterprise Application Integration) frameworks appeared in the mid-1990s with New Era Of Network (NEON), Mercator, or Oberon Software. Most of these players have been acquired, while new players such as WebMethods or CrossWorlds have brought this technology to a level of maturity that also provides a homogeneous environment which enables a BPMS to interact with virtually any enterprise and legacy systems.

[11] B2B (Business-to-Business) Middleware based on standards such as ebXML also provides a homogeneous way to securely connect business process management systems to the outside world. BPMS can take advantage of Trading Partner Agreements to route messages dynamically to the correct business partner system. Again, without such a common infrastructure, BPMS vendors would spend a good deal of their resources reconciling different protocols.

[12] EIS (Enterprise Information Systems) focus around time-tested and cutting-edge technologies from the leaders in technology including Sun, IBM, Novell, Microsoft, and Caldera.

Relationship between Boundaryless Information Flow, business process, and web services

The system components that build towards those that meet the need for Boundaryless Information Flow can be viewed from an architectural standpoint. The business taxonomy and technology taxonomy for Boundaryless Information Flow is introduced above and can be related to the TOGAF TRM,[13] augmented to add the important context-setters: business process and business language. In this way we can show how the various standards activities relate.



Business Process covers:
- ebXML, UBL, ACORD, HIPPAA, etc.

Business Language covers:
- Xlang, WSFL, BPML, WfMc, UML, etc.

Location & Directory Services covers:
- UDDI
- WSDL

Data Interchange Services covers:
- XML
- SOAP

Communications Infrastructure covers:
- TCP/IP, SMTP, HTTP, SSL, etc.

This diagram shows the mapping of the various components and standards activity covered in this paper to the augmented TRM. Viewed as a series of layers we can easily distinguish the components of the so-called web service stack. At the bottom is the transport mechanism. Above this we have the components of the messaging language, the description of the services, and the discovery of the services. This leads to a quite distinct set of activities concerned with business process.

[13] The *Architectural Framework (TOGAF) Technical Reference Model (TRM)*, published by The Open Group at www.opengroup.org/togaf.

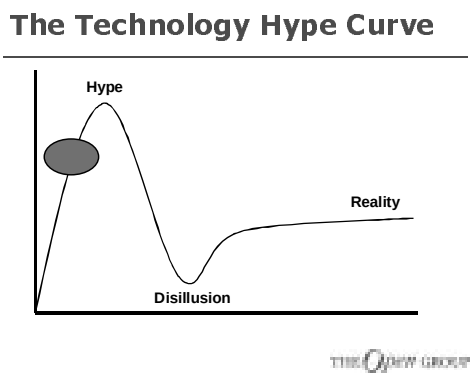
This analysis shows where web services, and business process management and languages for that matter, fit into the picture for Boundaryless Information Flow.

This mapping is the subject of *Open Standards in the Field of Boundaryless Information Flow, Business Process, and Web Services*.

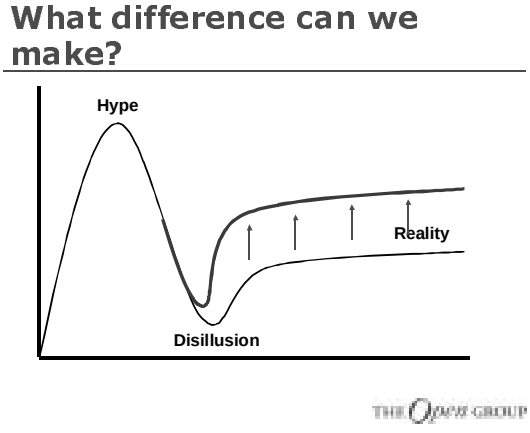
Technology hype

Today we are doing what this industry does with relentless repetition – we are in danger of yet again charging up the hype curve. Web services is the greatest thing since sliced bread – and by the way it can make coffee too.

"… we are doing what this industry does with relentless repetition – we are in danger of yet again charging up the hype curve …"



Yes, there will be some disillusionment. We can alleviate the problem by setting the right expectations and by user education. Consortia can work together to identify and develop the right set of standards, to promote their adoption throughout the industry, and to ensure conformance to the standards through appropriate certification programs. In this way we can avoid fragmentation of standards and use our joint ability to bring the industry together so that products from different suppliers interoperate easily and reliably.



The technology hype curve can be modified by our efforts.

About the Author

Dr. Phil Holmes has been a member of The Open Group staff for over ten years. His current role is Director, Consortia Relations working, amongst other things, on the creation and development of a knowledge database of open standards and consortia activities across the whole spectrum of IT. An ongoing assignment is to identify and understand the contributions of consortia in the field of web services. Web services is one facet of The Open Group's work towards Boundaryless Information Flow.

Over the years Phil has developed a number of white papers pulling together and analyzing developments in selected technology areas covering topics ranging from network computing and distributed networking to security-related subjects. He is currently examining developments in the field of digital rights management and business process transactions.

About The Open Group

The Open Group is a vendor-neutral and technology-neutral consortium, committed to a vision of **Boundaryless Information Flow** achieved through global interoperability in a secure, reliable, and timely manner.

The Open Group's mission is to drive the creation of **Boundaryless Information Flow** by:

- Working with customers to capture, understand, and address current and emerging requirements, establish policies, and share best practices
- Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate specifications and open source technologies
- Offering a comprehensive set of services to enhance the operational efficiency of consortia
- Developing and operating the industry's premier certification service and encouraging procurement of certified products

The interoperability that characterizes **Boundaryless Information Flow** results in gaining operational efficiencies and competitive advantages. Through access to integrated information, across the extended enterprise and beyond, employees, trading partners, and customers are enabled and empowered.