Family Of Architectures

DRAFT VERSION FOR REVIEW AND COMMENT

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Boundaryless Information Flow Reference Architecture

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Boundaryless Information Flow™
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Executive Summary

The Open Group Architecture Framework presents an Architecture Continuum that demonstrates the need for a set of architectures rather that one architecture. The architecture continuum depicts a Foundation Architecture, Common Systems Architectures, Industry Architectures, and Organizationally Specific Architectures as all needing the attention of an organization. In this paper we elaborate a bit further on these concepts and position the necessary architectures to address the Boundaryless Information Flow problem. The set of necessary architectures that address the Boundaryless Information Flow problem is called the Boundaryless Information Flow Reference Architecture that is described in a separate document.

This document is presented as a "straw man" for high-level strategic recommendations. The customers and members of The Open Group are encouraged to critique the document, ideally offering comments regarding specifics of strategy and the implementation of these strategies to one of the authors. These comments will then be incorporated into a White Paper published by The Open Group.

Understanding the position of The Boundaryless Information Flow Architecture Framework clearly supports The Open Group vision: **Boundaryless Information Flow**.

Introduction

The Open Group Architecture Framework presents an Architecture Continuum that demonstrates the need for a set of architectures rather that one architecture. The architecture continuum depicts a Foundation Architecture, Common Systems Architectures, Industry Architectures, and Organizationally Specific Architectures as all needing the attention of an organization.

The Architecture Continuum suggests relationships between these architectures, but is fairly general in its description. In the following we suggest a slightly different representation of the Architecture Continuum and suggest a specific set of related architectures that support Boundaryless Information Flow in the Common Systems Architecture area.

By understanding this specific interpretation of Architecture Continuum we better understand the requirements for addressing the issues.

Architecture Continuum of TOGAF

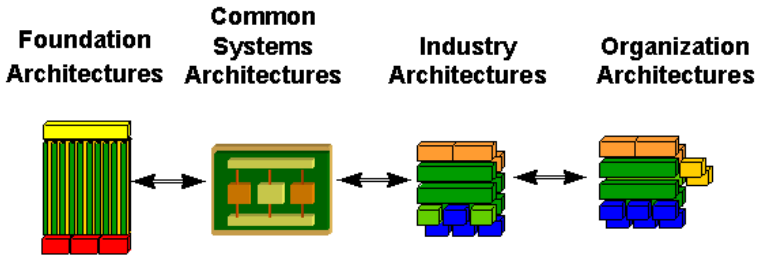
TOGAF is the Starting Point

The Architecture Continuum is documented in The Open Group Architecture Framework Version 8. TOGAF 8 describes, "The Architecture Continuum represents a structuring of re-usable architecture assets... The Architecture Continuum shows the relationships among foundational frameworks such as TOGAF, common systems architectures such as the Integrated Information Infrastructure Reference Model, industry architectures, and enterprise architectures. The Architecture Continuum is a useful tool to discover commonality and eliminate unnecessary redundancy."

The concept in the continuum is that there is not a single architecture that covers the enterprise. Rather there is a continuum of architectures, each comprised of architectural building blocks organized in specific architectural styles representing architecture models that contribute to the enterprise architecture.

The Architecture Continuum, and the relative positioning of different types of architectures within it, is illustrated in Figure 1.

Figure 1 The Basic TOGAF Architecture Continnum



The figure illustrates how an enterprise or organization architecture is

developed, leveraging a very generic set of architecture concerns in the foundation architecture, addressing a set of common systems concerns in the common systems architectures, addressing industry specific considerations in the industry architecture, and finally addressing organization specific concerns in the organization architecture. Of course, there is more complexity in the continuum than this basic model demonstrates.

Applying the Architecture Continuum

An approach to creating IT architectures is only useful if it, and the architectures it creates, can be effectively applied to meet genuine business objectives. The TOGAF principle of the architecture continuum, to be effective, must be employed in a number of dimensions.

Mapping the Latitude and Longitude of the universe if IT Architecture

The most important of these are the **common system continuum** of IT architectures and the **business continuum** of IT architectures. We think of these continua as the latitude and longitude of IT architectural space, and their points of intersection to be specific business solutions, each using IT in a way that is optimal for the specific business.

Interrelated types of Architecture

The TOGAF addresses primarily IT System Architectures. IT systems strategies and procurement are clearly driven by Systems Architecture considerations, but they are also influenced by other architectural issues. Figure 2 shows a confluence of four sorts of architecture that strongly influence enterprise IT choices. These are System Architecture, Data (or information) Architecture, Network and Communications Architecture, and Business Architecture.

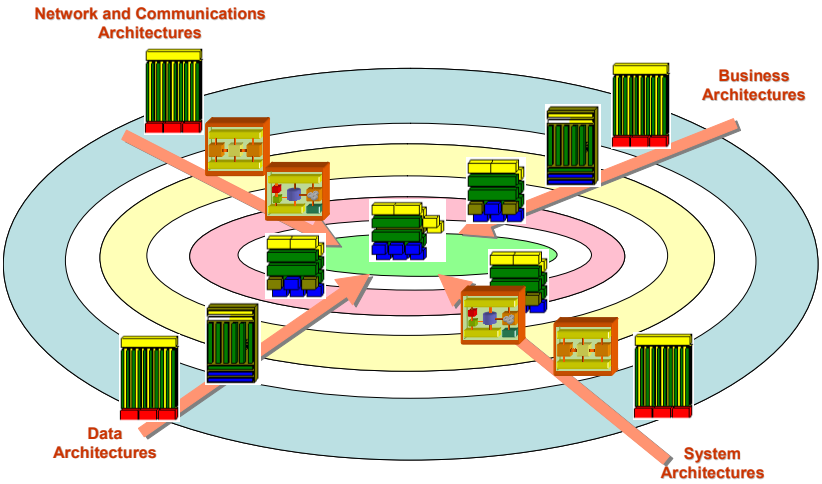


Figure 2 A Confluence of Architectural Disciplines

This identification of four areas of architectural effort is based on, among other things, the author's observation that in many companies, there are separate departments for each of these; that each of these areas is supported

by its own educational programs, professional journals, societies, and so on; and that, while there is much overlap, each of these disciplines has large areas that are separate and distinct from the conventional understanding of the other three. Each of these architectures has its own continua, allowing practitioners to work from broadly applicable principles through a series of refinements and specializations to specific designs, implementations, or constructions that address the needs of individual clients.

The balance of this white paper addresses System Architecture, but, from time to time, references will be made to the interactions between systems architecture and the others.

The Common System Continuum

Decomposition by Technical Characteristics

Common Systems Architectures describe and guide the creation of specific services defined in the Foundation Architecture. Examples of Common Systems Architectures include Security Architectures, Management Architectures, Messaging Architectures, Data Management Architectures, and so on. By following a Common System Architecture, the implementer of these services ensures that their solutions satisfy the requirements for the specific service, and also fit with other common systems to create complete business systems.

Common Systems Architectures are incomplete in terms of overall information system functionality — that is, they don't provide complete solutions for business problems— but are complete in terms of their particular problem domain. For example, an implementation of a *complete* security architecture will provide all the services and construction guidance to allow all of an enterprise's systems to be secure. An implementation of a complete data management architecture will enable an enterprise and all its IT systems to consistently, reliably, and efficiently store and retrieve information

Common System Architectures constitute reusable building blocks for the creation of comprehensive IT architectures. Similarly, solutions implementing common system architectures form the building blocks of functionally complete information systems. Creating comprehensive IT architectures from common system architectures allows IT architects to benefit from best practices and mature engineering where it exists, and innovate or customize where that best serves the objectives of the architecture.

Common system architectures form a two-dimensional "continuum" across the IT architecture space. In one dimension, the architectures differentiate themselves by the technical area they address. In the other dimension, they become increasingly specific, addressing subsets of the functionality of the preceding architecture, or describing a specific approach to address the functionality. Each such narrowing presents the opportunity to "branch,"

creating two or more complementary architectures.

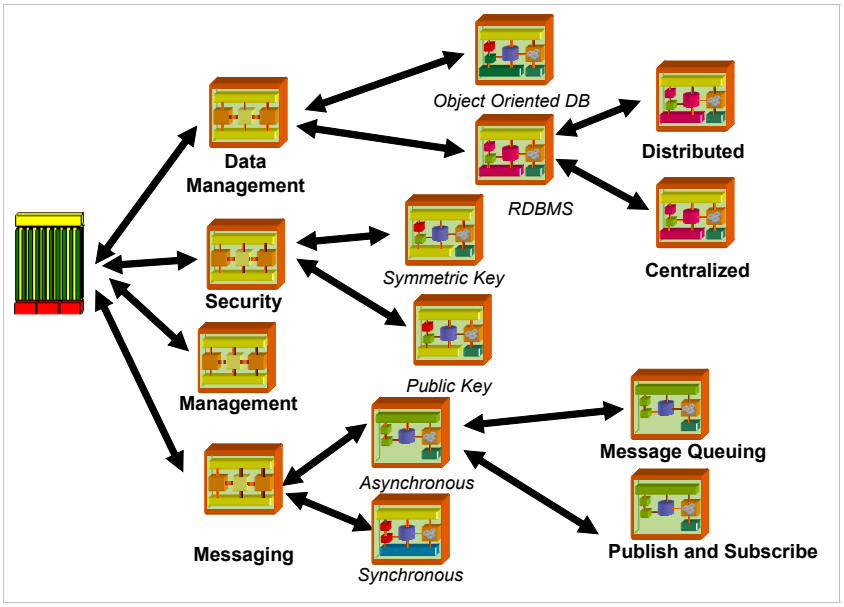


Figure 3The Continuum of Component Architectures

The Business Continuum of IT Architectures

Architectures for Specific Industries

The TOGAF model for system architectures begins with the technical reference model, which provides a consistent way to identify and analyze the elements that make up any IT architecture. From this are derived, in one dimension, what are called industry architectures. Industry architectures refine and particularize the elements of the Technical Reference Model to meet the needs of the particular industry.

Some aspects of an industry architecture are explicitly created by the industry. This is sometimes accomplished through industry groups' creation of *de facto* or *de jure* standards. In many cases, market adoption of dominant solutions, often defined by the leading solutions vendor to the industry, implicitly defines the industry's architectural choices.

Each element of an industry architecture accomplishes one of several things with respect to the Technical Reference model or foundation architecture:

- It refines or constrains the choices available to more precisely meet the industry's needs
- It extends the foundation architecture by describing elements or services that are used or exist only in specific industries
- It identifies a specific solution (or set of solutions) that are in some way optimal or preferred for use in the industry.

What is not included is as important in defining an industry architecture as what is included. Obviously, any IT components or services of the TRM

that are not relevant to the needs of participants in the industry are not part of the architecture. Common systems that are adequately described in a more-generic architecture need no further refinement in the industry architecture. In some cases, though, the relevance of these services, or the specific requirements that would make one implementation preferable to another only become apparent at a sub-industry or more specific level. In those cases, the industry architecture includes a placeholder for the type of system, which is replaced with specific choices or preferences in sub-industry architectures.

Figure 4 shows a few of the industries for which there are de facto or de jure industry architectures. In some cases, sub industries with their own, more-specialized normative architectures are shown. For example, the industrial and manufacturing sector shows, as example sub-industries, pharmaceutical manufacture (which could be considered a sub-subindustry under chemical manufacturing), automotive manufacturing, and aircraft manufacturing.

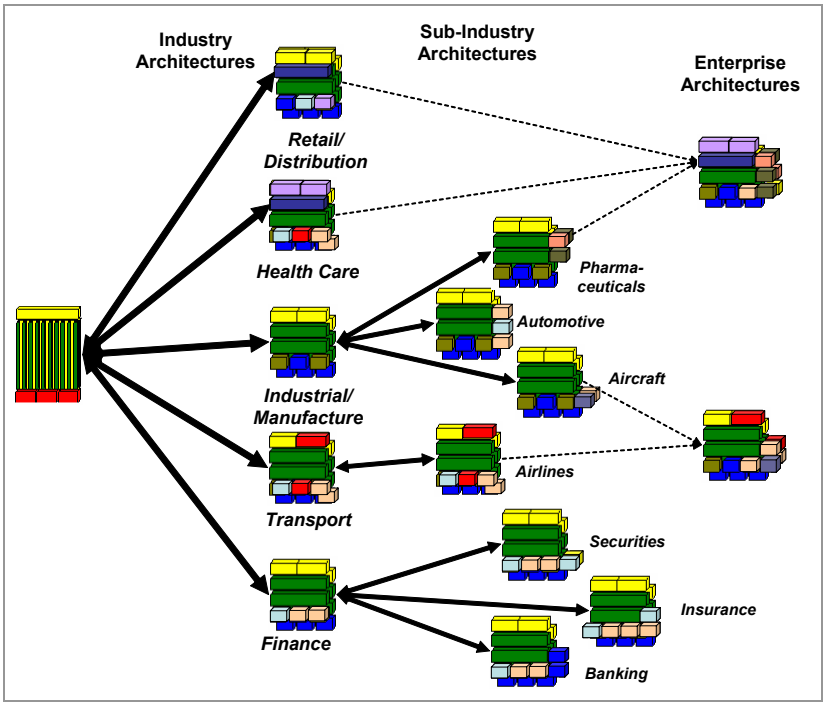


Figure 4 The Business Continuum of IT Architectures

At the end of the continuum shown in Figure 4 lie the enterprise architectures. These represent the planned IT selections made by individual firms. For some firms a well-defined industry architecture will give much of the guidance needed to create an appropriate enterprise architecture. But for some firms it may not be sufficient. The enterprises shown in Figure 4 are ones that find themselves to be participants in more than one industry. These firms will create their enterprise architectures by selecting from the various relevant industry architectures. The combination of these different IT approaches will be guided, in part, by the principals set out in the

foundation architecture and other "higher-level" elements of the continuum. But to a significant extent, a firm that has positioned itself astraddle the conventional boundaries of industries will look to its own competitive strategy to guide it in combining architectural options into an effective business tool.

Competitiveness and IT Architecture

When IT Does (or Doesn't) Make a Difference

As discussed above, some things are not included in an industry architecture. Some are irrelevant, some are sufficiently specified by more-generic architectures, and some are better left to more-specific architectures. Some elements of IT architecture are best left to the enterprise architecture to be fully described. These elements are ones for which there is no benefit to an enterprise in following the same path as others in the industry. In some cases, this is because the IT function doesn't meaningfully define or enhance a firm's ability to compete in the industry. With regard to these services, being different from other firms in the industry neither weakens nor strengthens a firm's ability to compete. As the enterprise creates its own IT architecture it should rely on detailed common component architectures to guide it in identifying products or solutions that will satisfy the functional requirements and meet the requirements for interoperability. But the choice of specific solutions should be based on whatever criteria prove most beneficial for the firm itself, such as minimum total cost of ownership, prior relations with IT vendors or partnering considerations.

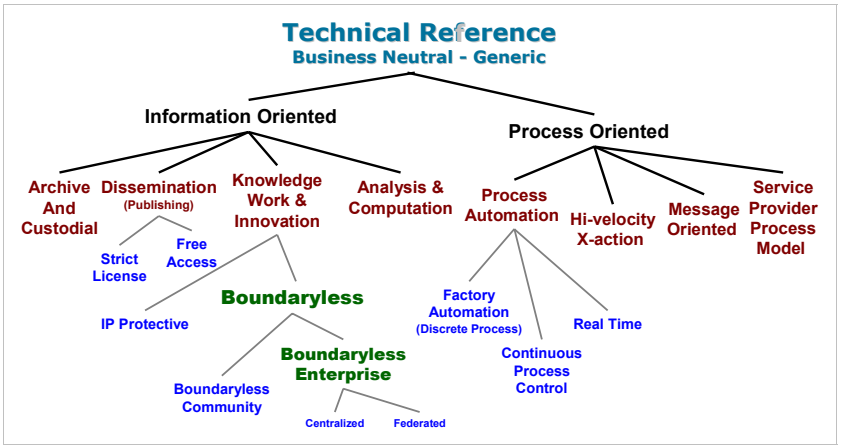
More important to a company's use of IT in its business strategy are those elements of IT that are excluded from the standard industry architecture *because* they contribute to a firm's ability to differentiate itself from others in the industry. These elements of IT are the ones that a firm can use, as part of an overall business strategy, to differentiate it from its competitors. In some cases, the industry's normative IT architecture may include a "usual" way to meet a particular requirement, but the innovative firm rejects that approach, and chooses a different component architecture. In other cases, the particular requirement may have no conventional solution, and *every* firm will create its own approach.

Aligning Technology with Generic Business Strategies

Generic business models or strategies describe ways enterprises approach doing their business and, more specifically, how they do business in ways that get them an appropriate competitive advantage. There are many ways to identify and classify business models. Porter's three generic competitive strategies is a frequently used model. Boston Consulting Group's quadrant model of stars, cows, and dogs is another approach to describing corporate business strategy. IT choices made by a company should be appropriate to the company's strategy, no matter how it is analyzed. We recommend an approach to analyzing and classifying corporate strategy whose perspective (or viewpoint) emphasizes aspects that strongly influence IT architectural

options. Figure 5 illustrates the approach. The first differentiation is between enterprises who compete on information and those that compete with processes or capabilities. Some businesses base their competitive position on having more or better information than their competitors, or on being better able to manage the information. Other companies base their competitive edge on having better processes to work with information (or whatever resources the systems process). A business of this sort might, in fact, have no information of its own, but process information that belongs to and is managed by its clients.

Figure 5 IT and Generic Business Strategies



Info-centric companies are further differentiated by the uses to which they (or their clients) put the information. We identify in the figure four major ways in which information is used which might call for meaningfully different IT architectures. One is Information Dissemination. (Digital publishing is an example of an industry that has this model.) Another is "Knowledge work," often in the form of research and development, but also represented as professional services, education, and similar businesses. Analysis and computation is the third information oriented business model, and information archiving is the fourth.

Information dissemination and knowledge work each are shown with two major subdivisions. In both cases, one of the two subdivisions represents a business model that (generally) emphasizes strict control over the information, and one that emphasizes easy access and broad use of the information. The latter are the "Boundaryless" business models that strongly benefit from a "boundaryless" IT architecture. All businesses have some aspect of their strategy or operation that emphasizes sharing information, but for some that ability is at the heart of their competitive capabilities. How central Boundarylessness is to a company's IT strategy and architecture is influenced not only by what the company does, but also by how the company is organized to its business.

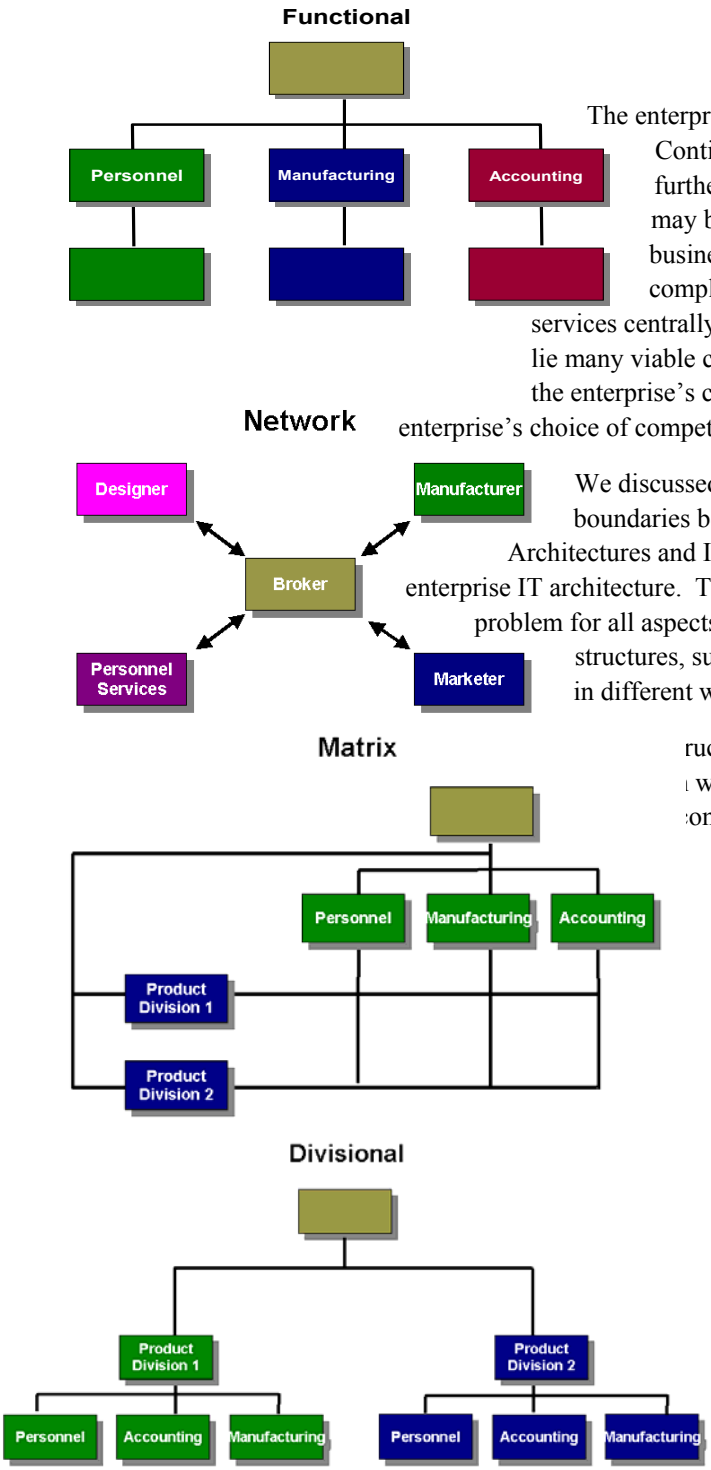


Figure 6 Example Organizational Structures

Matching the Stucture of the Enterprise

The enterprise is not necessarily the end point in the Business Continuum. We've discussed how industries' needs may be further refined in sub-industries. Similarly, enterprises' needs may be further refined by the specific needs of individual business units. Some enterprises choose to give their units complete autonomy in their IT choices, others provide IT services centrally and exercise strong control. Between those two extremes lie many viable choices. Often the approach to governing IT is reflective of the enterprise's corporate structure, which, in turn, is a reflection of the enterprise's choice of competitive strategy.

We discussed in an earlier section the case of the firm that straddles the boundaries between industries, and how the various Common System Architectures and Industry Architectures might be brought together into an enterprise IT architecture. This is not only a problem for the company's IT, it is a problem for all aspects of the company's business. Different organizational structures, such as the ones illustrated in Figure 6, address this problem in different ways. In divisional organization, for example, the enterprise ructured as if it wee two companies, one in each industry, with its own IT architecture. In the network model, the ompany is structured as a set of supplier companies, each in its own industry. (Contract manufacturing or employee leasing, for example.) The organizational model chosen as part of the company's business architecture (business strategy) will provide the strongest guidance for constructing the Company's IT architecture.

The organizational structure influences (and is influenced by) more than the way different industries' influences are integrated in the company. Organizational structures like ngly affect a company's approach to innovation, financial ement's ability (or desire) to delegate or centralize various ties, corporate image and advertising, product strategies, r relations, and so on. These choices are key inputs to the tion of the company's IT architecture, at least as important as the industries in which the company competes. Whether and how an organization values boundarylessness, as an example, is influenced and demonstrated by the company's approach to inter-divisional interactions in general.

Locating Boundaryless Information Flow

Boundaryless Information Flow exists at the latitude of component architectures that provide Boundarylessness and the longitude of businesses that benefit from it. Specific component architectures will tend to emphasize (or de-emphasize) boundarylessness in their design choices[1]. Industry and sub-industry architectures will specify the use of boundaryless component architectures for aspects of the industry's normative business model that benefit from it. Industry architectures with a preponderance of boundaryless components may be said to be boundaryless industry architectures.

Organizational and enterprise architectures are the ones for which the competitive benefits of boundarylessness may be most clearly demonstrated. Most industry architectures will be relatively neutral with respect to boundarylessness, including options that allow individual firms to strike their best balance between flexibility and efficiency, between predictability and the potential for innovation.

Summary

The Open Group's TOGAF provides the starting point form which to develop a wide variety of architectures that can provide actionable guidance and solutions choices for those who need IT solutions to business problems. The Boundaryless Information Flow initiative will provide the first example of a targeted set of architectures from the family of architectures.

[1] The objectives that most often conflict with boundarylessness are efficiency, low latency, and security, or, more broadly, deterministic behavior. In data management, for example, ad hoc query models tend to favor boundaryless behavior, and prestructured query models tend to favor efficiency.

About the Authors

Eliot M. Solomon has worked on the leading edge of information technology for more than thirty years. He gained experience in such diverse fields as electronic warfare, military C^3, international telecommunications, medical electronics, and office automation equipment. Common to all this work was real time operation, mission- or life-critical significance, distributed and networked computing, and a need for security, privacy, and assured integrity for the information being processed.

For the last seventeen years Solomon has brought his expertise and creativity to the Securities Industry. In fifteen years at the Securities Industry Automation Corporation (SIAC) and its subsidiary SECTOR, Solomon made significant contributions to the architectures of systems and networks the entire market relies on. He was appointed SIAC's first Distinguished Technologist and Vice President, in recognition not only of his contributions to SIAC, but also to the entire industry.

Solomon is founder and chair of The Securities Industry Middleware Council, Inc. (SIMC), an industry organization that works to improve the infrastructure of the Securities Industry. Solomon has guided SIMC since its founding in 1996, and helped it become a significant influence on the software vendors deliver to the industry, and the way the Securities Industry uses infrastructure technology. At The Open Group Solomon chaired the DCE program and is now a member of the Security Forum steering committee. He is frequently invited to speak at major conferences on the subject of linking information security and business policy, and the management of risk and trust. He hold an A.B. from Columbia University, and an M.S. from Polytechnic University.

Terence (Terry) Blevins is Vice President and CIO of The Open Group LLC. Terry has two major roles within The Open Group. First, Terry is working with the customer community to better understand key business oriented issues and driving programs to best address those issues, most recently helping to formulate Boundaryless Information Flow. Secondly, Terry looks over the internal information technology strategy applying the same principles and techniques from The Open Group's Architecture Framework that he uses in the first major role.

Previously, Terry was with the NCR corporation (21 years), last holding the position of Director of Strategic Architecture where he had responsibility for the management and oversight of NCRs Corporate Architecture, Architecture Development Process, and NCRs Architecture Capability Maturity. Terry chaired NCR's Architecture Council and was Co-chair of The Open Group's Architecture Program Group in 1999 and 2000.

Terry has BA and MS degrees in Mathematics from the Youngstown State University

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.