White Paper

Building Enterprise Architectures with TOGAF

An Introduction to Using the Framework, Method, and System Architect

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Overview

Enterprise architecture is the capture of all important information and behavior that goes on in an organization -- the who, what, why, when, where, and how of the business. An enterprise architecture provides important value adds to an organization, enabling high-level management to strategize more effectively, with a knowledge of cause-effect relationships; business managers to oversee business processes and network infrastructures with a clear understanding of the impact of changes; and policies and procedures to be communicated to all employees so that everyone can be on the same page. In short, it enables you to run an effective, efficient organization.

The Open Group Architecture Framework (TOGAF) is an important enabler of enterprise architecture. TOGAF consists of a framework for categorizing what you need to capture about the enterprise and a definitive and proven step-by-step method, called the Architecture Development Method (ADM), for developing, implementing, and maintaining the enterprise architecture.

Telelogic System Architect® is an important enabler of TOGAF and enterprise architectures. It is a repository-based modeling tool that enables you to capture all of the information that TOGAF prescribes, and disseminate that information to a wide audience through automatic report generation and publishing of the architecture to the Web.

This paper introduces you to TOGAF and the ADM, and describes how System Architect is used with TOGAF to build and deploy an enterprise architecture.
Introduction

The Open Group Architecture Framework (TOGAF) is quickly emerging as one of the most widely accepted paradigms for developing an enterprise architecture. Created by The Open Group (www.theopengroup.org), TOGAF is not just a framework for categorizing what you need to capture about the enterprise, but also provides an Architecture Development Method (ADM) for developing, implementing, and maintaining the enterprise architecture. This method plays along with many of the industry’s most popular techniques and notations, such as business process modeling with the Business Process Modeling Notation (BPMN), the Unified Modeling Language (UML), relational data modeling, IDEF (Integrated Computer-Aided Manufacturing (ICAM) DEFinition), and even the techniques of the Department of Defense Architecture Framework (DoDAF).

TOGAF is an open framework, the result of continuous contributions from a large number of architecture practitioners in The Open Group’s Architecture Forum. The Open Group freely disseminates the TOGAF specification and all related documentation on its Web site, and encourages the use of it by any organization embarking on enterprise architecture. TOGAF is highly customizable, enabling companies to tailor it to their particular challenges.

There are two main components to TOGAF, represented by two different graphics familiar to TOGAF practitioners. The first is the TOGAF framework itself (pictured to the left in Figure 1), whose progression of circles illustrate the stages of its Architecture Development Method. The second is the Enterprise Continuum (pictured to the right in Figure 1). The Enterprise Continuum describes how the developing architecture is componentized into building blocks that are built upon, from the general (foundation) to ones specific to your organization.

History and Origin

TOGAF originated as the Technical Architecture for Information Management (TAFIM) in the US Department of Defense. The framework was adopted by the Open Group in the mid-1990s, at the US DoD’s urging. The first TOGAF specification was introduced in 1995, and the latest version, TOGAF 8 (the Enterprise Edition), was released early in 2004. TOGAF 9 is scheduled for release in December 2004.

What Is Enterprise Architecture and Why Are People Doing It?

Enterprise architecture is the capture of all behavior that goes on in an organization, the data that is processed, who does what, where everything is, and why everything is done. In a sentence, the who, what, why, when,
where, and how of the business, at every perspective, from high-level corporate goals to the code of low-level programs that implement business processes to achieve those goals. Part of an effective enterprise architecture is communicating it to all necessary parties in an organization.

With an enterprise architecture in place and effectively communicated, companies can realize a multitude of benefits. High-level management can strategize more effectively, with a better understanding of the outcome and ancillary effects of decisions that they make. Business managers can manage business process and network infrastructure with a clear understanding of the impact of changes. The enterprise architecture presents all stakeholders in an organization with a view of the information, processes, and related knowledge that they require to undertake their tasks effectively.

In addition, new legislation such as Sarbanes-Oxley and the OFR legislation that comes into force in January 2005 have made many organizations look at enterprise architecture as an almost mandatory investment of time and resources, to help them effectively deal with the new regulations.

**Obstacles to Enterprise Architecture**

The need for an enterprise architecture has been around for a long time, but several obstacles prevented many organizations from undertaking it successfully:

- There was a lack of standard tools for capturing, developing and managing models.
- Once modeled, it was difficult to maintain the information.
- It was difficult to disseminate the information – everyone in the organization needed a copy of the modeling tool.
- There was a lack of a standard notation and consistent vocabulary for enterprise architecture.
- The ROI of a successful EA implementation was difficult to calculate.

**Enablers of Enterprise Architecture**

In recent years, new technologies have arrived to help make enterprise architecture achievable:

- Corporate Intranets and the Internet offer a medium to disseminate information to everyone in the organization.
- A new generation of enterprise architecture modeling tools has arrived, capable of:
Building Enterprise Architectures with TOGAF

- supporting a broad spectrum of modeling notation;
- providing a scalable and flexible underlying repository capable of storing and integrating models across all architecture domains; and
- offering sophisticated reporting and publication facilities.

The final obstacle to overcome is the lack of a standard notation and method for developing and maintaining an enterprise architecture. And that is where TOGAF comes in.

What TOGAF Is and Why Companies Are Now Starting to Use It

What makes TOGAF popular is that it contains a definitive and proven step-by-step method for developing and maintaining an enterprise architecture. It covers the four principal architecture domains of business, information systems (application and data) and technology infrastructure, and focuses strongly on the need for architecture to support business objectives and requirements. It also takes into account establishing the goals and objectives of the enterprise architecture effort itself, guiding users on determining how much of the enterprise you need to model to get significant gains and the realities of getting buy-in from throughout the organization.

With TOGAF you are gaining the benefit of years of research and work performed by originally by the US DoD, and in subsequent years by a large group of the world’s leading enterprise architects in all industry sectors, and it is all open, customizable, and free.

How Telelogic System Architect Enables TOGAF

Telelogic System Architect® is an important enabler of TOGAF. It is a repository-based modeling tool that enables you to capture all of the information that TOGAF prescribes to capture about your enterprise architecture, and disseminate that information to a wide audience through automatic report generation and publishing of the information to the Web.

True to the nature of TOGAF, System Architect does not limit you to a narrow set of modeling notations to choose from to build your enterprise architecture. It provides an extensive suite of diagram types, supporting all of the notations and methodologies suggested by TOGAF. This includes business modeling, UML, relational data modeling, network diagramming, IDEF, DoDAF, and other techniques. All of the information that you capture using the various techniques is integrated in the System Architect repository. This integration of information is important. It enables you to realize an important byproduct of enterprise architecture – traceability of information, enabling cause-effect analysis from the highest-level
overview of the organization down to lowest-level technology design views.

System Architect’s repository can also hold requirements and ancillary documents, or references to external documents. Your entire enterprise architecture can be captured and maintained in the repository. Automatic reporting and Web publishing capabilities enable you to disseminate the enterprise architecture information to a wide audience.

In addition to all of these natural capabilities of the tool, System Architect provides specific support for TOGAF, which includes definition types, diagram types, cross-reference matrices, and automatic Word reports that capture information specified by TOGAF, and automatically generate TOGAF work products. Sections are provided in this white paper that illustrate how System Architect provides direct support for TOGAF.
TOGAF

TOGAF is a framework and a method for performing enterprise architecture. This makes it different from something like the Zachman Framework, which is a framework that is concerned only with content and not a method for building enterprise architectures. The term framework is widely used in the industry today to mean different things. The definition of framework as used by Zachman or TOGAF is that it is a tool for thinking about and categorizing the information that needs to be captured about an organization, to understand how everything works and to enable the building of information systems that efficiently support the business. This is starkly different than frameworks of pre-built components such as the .NET framework.

But even when defined as a tool for thinking about what information you need to capture, the term framework is a bit of a misnomer for TOGAF. As we mentioned, TOGAF does prescribe a method – the Architecture Development Method (ADM) to be precise.

As shown in Figure 1, TOGAF has two main components, the ADM (shown on the left side of Figure 1) and the Enterprise Continuum (right side of Figure 1). The ADM is visually distinct from the Zachman rectangular grid of cells; the TOGAF ADM graphic is dynamic – a set of circles representing the progression through the phases of the ADM and the architecture models used and created during the phases of enterprise architecture development.

The ADM is a detailed, step-by-step method on how to build, maintain and implement an enterprise architecture. These phases are navigated iteratively in a cycle. The circles represent the major phases of building and maintaining the enterprise architecture using the ADM.
Figure 1. TOGAF Enterprise consists of the Architecture Development Method (ADM) (pictured left) and the Enterprise Continuum (right). Source: The Open Group (www.theopengroup.org).
The Enterprise Continuum

While the ADM specifies a process for building an enterprise architecture, the Enterprise Continuum is a resource and philosophy for developing an enterprise architecture through reusable building blocks.

TOGAF’s Enterprise Continuum (Figure 2) specifies a progression for developing architectures and solutions using architecture building blocks (ABBs) and solution building blocks (SBBs), in a continuous, iterative fashion. A building block is simply a grouping of functionality defined to meet business needs. An architecture building block is described with a general level of detail. For example, an architecture building block might be specified as an on-line database and the application used to access it. Later on in the ADM, you replace ABBs with SBBs, which reflect real products or specific custom developments.

Looking at the Enterprise Continuum pictured in Figure 2, you can see that it is composed of the Architecture and Solution Continuums. At the top of the graphic you can see the Architecture Continuum, which provides guidance, direction, and support to use the Solutions Continuum (below it) to build your particular technology architecture.

You build your architecture by navigating the two continuums, from left to right, top to bottom, so that you are specifying architecture building blocks at each stage, and then the solution building blocks that implement them, and continuing right-ward, building upon your solution and adding increasing detail. In the end, the Solutions Continuum defines the solutions that deliver your architecture, which include either off-the-shelf solutions and/or your organization’s own custom solutions.

As we will discuss later in this white paper, it is the TOGAF ADM that guides you through the left-to-right progression from the general architectures and solutions (on the left), to organization-specific ones (on the right).
The Architecture Continuum

The Architecture Continuum defines the components that specify the architecture of your organization. You start your architecture effort with a Foundation Architecture, then build upon this foundation using common systems architectures (for example, a generic security architecture), and industry-specific architectures (for example, a Retail Industry Architecture), to reach the architecture specific to your organization (on the right).

During the preliminary stage of ADM, you establish how much of your Foundation Architecture can be established from what is already in place in your organization. TOGAF provides a Foundation Architecture to help you get started, embodied in the Technical Reference Model (TRM) and Standards Information Base (SIB). The SIB is provided on www.opengroup.org. It provides you with a portal to an exhaustive list of standards that an architecture should mandate, and the availability in the market place of products guaranteed to conform to those standards.

Once your organization has been through its first TOGAF ADM iteration, your own Technology Architecture and solutions portfolio form part of your Foundation Architecture for the next cycle.

- **Foundation Architectures** -- A Foundation Architecture is what you start with. It consists of architecture building blocks and corresponding standards that support your complete computing environment. You may use TOGAF’s pre-supplied Foundation Architecture, which consists of the Technical Reference Model and Standards Information Base. You then follow the steps of the
TOGAF ADM to get from that foundation architecture to one specific to your organization.

- **Common Systems Architectures** -- A Common System Architecture is complete in terms of a particular problem domain, but incomplete in terms of the overall information system functionality. Examples of Common Systems Architectures are a Network Architecture, a Security Architecture, and so forth.

- **Industry Architectures** -- Industry Architectures include pre-built, off-the-shelf architectures that have been developed for particular vertical industries. These pre-built architectures often offer pre-built data models and processes. Examples are the ARTS Retail Data Model, the AKMA Insurance Data Frame, and the NHSIA Patient Care Process.

**The Solutions Continuum**

The Solutions Continuum defines the set of solutions that implement your architecture. You build from left to right, in parallel with the Architecture Continuum, starting with a generic set of products and services that deliver the Foundation Architecture, adding Systems and Industry solutions (for example, a DBMS such as Oracle 8 and a CRM package application), to build the set of technology and business solutions specific to your organization.

- **Products and Services** -- Products include hardware and software that you may purchase. Services include training, consulting services, and technical support. Services enable you to maximize your investment in products and help you to get everyone up and running in minimal time.

- **Systems Solutions** -- A System Solution is an implementation of a Common System Architecture comprising of a set of products and services, which may be certified or branded.

- **Industry Solutions** -- An Industry Solution is an implementation of an Industry Architecture. Examples might be a particular CRM system, or Web-based product purchasing system.
The Architecture Development Method (ADM)

The ADM (Figure 1) forms the core of TOGAF. At the heart of ADM is requirements management. The business, information systems, and technology architectures are always aligned with requirements and related business goals, and the arrows indicate that this is continuous process throughout the ADM stages.

Figure 3. TOGAF Enterprise. Source: The Open Group (www.theopengroup.org).
Preliminary Framework and Principles

A part of the architecture effort not to be overlooked is the preliminary stage, during which the architecture vision and the scope of the enterprise architecture effort are established, and key questions about the architecture are answered – how much information will you capture, how will you maintain it, how will it be used and what kind of management buy-in is needed. In other words you specify the who, what, why, when, and where of the architecture effort itself.

“What” is the scope of the architecture effort. You need to understand from the outset how encompassing your architecture effort will be. When you look at any organization, there is a lot to model. Off the top, you might start with the business processes integral to the organization, the applications and databases that those processes use, and the network architecture that everything runs on. But there’s a lot more – from highest-level goals and objectives of the company, to ancillary processes such as, for example, the techniques that the human resource department uses to find new hires, down to the technical specifications and models for the products that the company develops. You need to understand from the outset how much of this you intend to model.

And you must specify “who” is going to model it. TOGAF considers this the “architecture footprint” for the organization – the people responsible for performing the architecture work, where they are located, and their responsibilities. Will there be a core architecture group that does all the modeling? Will individual department managers be tasked to model their department’s processes? Who is responsible for product specifications?

You determine “how” you will develop the enterprise architecture, specifying the framework and method that you will use to capture information. You may use the TOGAF framework and method, or tailor it to suit your needs, or use it in conjunction with other methods. During the preliminary phase you also specify deliverable dates of the architecture effort – the “when.”

And then there is the matter of management buy-in. To support the "why are you doing this” question, you need to establish the business principals, goals, and drivers of the organization. Showing how the architecture effort will help you meet these goals helps you get management buy in.
**Stage A – Architecture Vision**

In stage A you continue the work begun in the preliminary phase, and add more substance to it. You evaluate any architecture that your organization already has in place and consider how it may be re-used, for example the hardware systems that have been documented, and the relational databases that have been designed. How is their entry point into enterprise architecture different than other companies?

Each stage of TOGAF has inputs and outputs. An important input to Stage A is a Request for Architecture Work document, which gets transformed during the stage into an important output – the Statement of Architecture Work, which defines the work to be done and is an input to all later ADM stages.
Request for Architecture Work

One of the important inputs to stage A is a Request for Architecture Work. This is a document provided by that part of the organization that is sponsoring the architecture effort (for example, high-level management).

TOGAF specifies the types of information that this Request for Architecture Work might entail. For example, it might include the Mission Statement of the company and how the architecture effort relates to it, the strategic business plans that are supported, business goals, constraints on the organization to perform this work (such as time limits, resources available, and financial constraints), and specification of what the current business system is, and the identity of the developing organization.

The Request for Architecture work can be specified in a document, or you may specify it in Telelogic System Architect® by filling out appropriate fields in a Request for Architecture Work definition template. If created in System Architect, you may use the product’s Word interface to automatically generate the definition to a Microsoft® Word document.

Request for Architecture Work

In System Architect, you may fill out a definition type called Request for Architecture Work, to store and manage the details in the repository. Automatic Word reporting enables you to generate the definition to a formatted Word document.

![Image of Request for Architecture Work](image-url)

**Figure 4.** A Request for Architecture definition can be maintained in System Architect and generated to a formatted Word document.
Stage B – Business Architecture

Stage B undertakes building and maintaining a Business Architecture. In stage B you define the ‘as is’ (or baseline) Business Architecture and the ‘to be’ Business Architecture.

At the start of this stage, you describe the ‘as is’ business architecture to the extent necessary to support the target business architecture. TOGAF prescribes not spending too much time going into unwarranted detail of the ‘as is’ architecture if it is not going form the basis of the ‘to be’ architecture.

Next, you begin building the ‘to be’ business architecture by doing three things:

1. Formulate what viewpoints that you are developing the business architecture for (for example Operations, Management, Sales, Marketing, or Financial Services) so that you can demonstrate how stakeholder concerns are being addressed by the modeling effort;

2. Select relevant business architecture resources (such as pre-built reference models and patterns) from the Architecture Continuum, and

3. Decide what notations, methods, and tools you will use to model the business architecture.

You then commence to build the ‘to be’ models for each viewpoint. Later, you can perform Gap Analysis to figure out where the architecture falls short of stakeholder concerns.
Methods and Notations to Choose

TOGAF is method-neutral. It prescribes using industry standard notations and/or methods such as BPMN, IDEF, UML, and DoDAF to develop the required models.

During this stage, you develop the following:

1. **Organizational Structure** – using an Organizational Chart diagram, you develop the hierarchy in the organization, and relate it to the business locations where organizational units are located. While the hierarchical organizational chart is very familiar to most people as the way to model the hierarchy of an organization, there are other diagram types that offer other views of decision-making hierarchy, such as the Decision Chart (pictured below).

![Modeling Organizational Hierarchy](image)

*Figure 5. Sample Organizational Chart and Decision Chart*
2. **Business Goals and Objectives** – you document goals and objectives for each organizational unit. Goals and Objectives and other such artifacts are typically captured as textual information, not modeled diagrammatically. However, there are new diagram types being introduced in the field that enable you to model such artifacts visually. System Architect offers an Enterprise Direction diagram, based on the work of the Business Rules Group (businessrulesgroup.org), to model the ends and the means of business strategy.

### Modeling High-Level Goals and Objectives

Besides capturing high-level business-objective-type artifacts as definitions, you may also visually model these “Zachman Row 1” definition types via System Architect’s Enterprise Direction diagram. The diagram is based on the work of the Business Rules Group ([www.businessrulesgroup.org](http://www.businessrulesgroup.org)), and enables you to model the following:

**Means:**

- Mission
- which breaks out into
- Strategy
- which breaks out into
- Tactics
- which breaks out into

**Ends:**

- Vision
- which breaks out into
- Goals
- which breaks out into
- Objectives

**Guidance:**

- Policy
- which breaks out into
- Business Rules

*Figure 6. Sample Enterprise Direction Diagram*
3. **Business Functions** – you model the functions of the business, starting from a high level and decomposing to lower levels. Functional decomposition can be performed using traditional Functional Decomposition diagrams, or IDEF0 diagrams, or UML Use Cases.

![Modeling Business Functions](image)

*Figure 7. Diagrams used to model the functions that the business and its organizational Units perform include Functional Hierarchy diagrams, IDEF0, or UML Use Cases.*

4. **Business Services** – model the services that the business provides to customers, both external customers and internal customers.
5. **Business Processes** – model the ‘as is’ and ‘to be’ processes, using your chosen notation. Here again, you might use a notation such as the Business Process Modeling Notation (BPMN) of BPMI.org, or an IDEF3 Process Flow diagram, or a UML Activity diagram, depending on your judgment of the expressive power of the notation.

![Diagram of Business Processes](image)

*Figure 8. Diagrams used to model business processes, such as BPMN Business Process diagram or IDEF3 Process Flow. (Additional types, such as UML Activity diagram, not shown.)*

6. **Business Roles** – understand the roles of workers in the company, and their necessary skill sets. Roles generally correlate or are contained within organizational units in the business, although some employees perform multiple roles that transcend multiple departments.
7. **Correlate Organizations and Functions** – specify what parts of the organization perform what functions. In a modeling tool, you use cross-reference matrices to specify and also get a bird’s-eye view of the relationships.

### Cross Reference Matrices

<table>
<thead>
<tr>
<th>System Architect</th>
<th>Business Goal</th>
<th>Business Objective</th>
<th>Business Goal vs Business Objective</th>
<th>ABB vs ABB</th>
<th>Requirement vs ABB</th>
<th>Requirement vs SBB</th>
<th>SBB vs ABB</th>
<th>TRM Component vs ABB</th>
<th>TRM Component vs SBB</th>
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</table>

**Figure 9. Matrices Are Used to Correlate Definition Types, for example Processes to Roles, Organizations to Functions, Processes to Entities, and so forth.**

### Creating Architecture Building Blocks (ABBs)

As you develop the business architecture models, you gather your models into architecture building blocks (ABBs). ABBs define what functionality will be implemented, capture business and technical requirements, are technology aware, and direct and guide the development of Solution Building Blocks. More specifically, an ABB specifies its fundamental functionality, its interfaces, any dependent ABBs, and its mapping to relevant business goals, objectives, and policies.
System Architect provides an Architecture Building Block definition type, within which you specify the information that makes up each architecture building block artifact. This information contains the following:

- The models that make up the architecture building block. These are the models and diagrams that you have built to represent particular solutions. This includes Business Architecture diagrams, Business Concept diagrams, BPMN Business Process diagrams, Class diagrams, Entity Relation diagrams, IDEF0 Functional diagrams, Organization Charts, UML Sequence diagrams, System Architecture diagrams, and UML Use Case diagrams.

Creating Architecture Building Blocks (ABBs)

In System Architect, an Architecture Building Block (ABB) is a definition type that you build by grouping other heterogeneous models that exist in the repository, which combine to represent a particular part of the business architecture.

- The organizational units that own the architecture building block.
• The business context of the architecture building block. This includes specifying business policies that it maps to, requirements that it maps to, products and projects that it is related to, and the standards list that it meets or is subject to.

• The functional specification of the architecture building block. This includes the functional category that it belongs to (for example, Database Management, Network Management, Security Management, Wireless Services, etc). You also specify the Solution Building Blocks that the Architecture Building Block maps to.

At the beginning of your architecture effort, you may use pre-built models that you gather from the Enterprise Continuum to create architecture building blocks. This includes pre-built, industry-standard patterns, and reference models. As you continue to iterate through the TOGAF method, developing and maintaining your business architecture, you build upon these initial architecture building blocks, creating your own models that you use to further develop your architecture.

**Stage C – Information Systems Architectures**

Stage C was introduced in TOGAF 8. Previously, TOGAF built on the Business Architecture defined in Stage B to create the Technical Architecture which was the sole focus on TOGAF 7, and earlier. In Stage C, TOGAF 8 focuses on the Information System Architecture, which includes the Data Architecture and Application Architecture. TOGAF describes detailed steps for defining the data and application architectures.

**Data Architecture**

In this stage you specify the major types and sources of data necessary to support the business. You do not do database design of your physical database – your models at this stage should be independent of final technology that you might use.

Early in the process of developing your data architecture, you specify what your modeling principles are, what viewpoints you will be modeling to, and the tools that you will use to model your data architecture. You can also see if you can use off-the-shelf reference models that are available in the industry. An example would be the ARTS data model available for the Retail Industry.

As you then go forward modeling your data architecture, you use traditional data modeling techniques including object role modeling, conceptual data modeling, and logical data modeling. This is a major undertaking and like we say, the TOGAF ADM provides detailed steps, ranging down to advice on relating data entities to business functions in the Business Architecture, indicating which of the CRUD operations
(Create, Reference, Update, and Delete) are performed by which functions. During this process you build architecture building blocks that are used in your data architecture. You also create a Data Architecture Report, which comprises your conceptual, logical, and physical data models, data entity/business function matrices, and data interoperability requirements (for example, XML schema and security policies).

**Modeling the Data Architecture**

System Architect enables you to build conceptual and logical data models of your data architecture, separate from physical models. You may create an underlying data dictionary of data elements, independent of any technology. Logical data modeling support includes ability to separate a design into manageable subject areas, or to automatically summarize a number of subject areas into a 'master' model diagram.

Later, you can have System Architect automatically map logical models to physical data models that can each be targeted towards a specific DBMS. This enables you to maintain your logical models to represent your understanding of business requirements, and maintain the separate physical models to take into account the implementation constraints of each DBMS.

![Figure 11. Logical and Physical Data Models in System Architect.](image)

**Application Architecture**

In this stage you specify the major kinds of applications necessary to process the data and support the business. You do not perform application system design. You may create matrices of current applications in the business, and ones that you will need in the target architecture, perform Gap Analysis, and then correlate business functions against target applications. You fully document your application building blocks.
Stage D – Technology Architecture

With your business architecture completed, you develop your Technology Architecture. This part of the TOGAF ADM is very detailed, and was the heart of the TOGAF specification in version 7 and earlier (before TOGAF was expanded to encompass enterprise architecture in version 8). Stage D is represented by its own mini-framework, detailing how to architect the technology underpinnings of the organization. The Technology Architecture that you develop is important—it forms the basis of all implementation work that you do.
In steps 1 through 3, you create your baseline technology architecture, consider all views, and for each viewpoint, you create the model for the specific view required, using your selected tools and methods. This includes networked computing and hardware views, communications views, processing views, cost views, and standards views. You then select the services that each architecture building block provides, confirm that your business objectives are being satisfied by the architecture building blocks that you have developed, and choose the standards and specifications that your technology must adhere to.

**Modeling the Technology Architecture**

The Unified Modeling Language (UML) is one of the tools available in System Architect to use for modeling the Technology Architecture.

![Figure 13. All UML diagram types are available in System Architect for modeling the Technology Architecture.](image)

Finally, in step 7 of the ADM’s Technology Architecture stage (Figure 11), you refine your architecture building blocks with sufficient detail (specifying such information as their interfaces, APIs, data formats, and protocols) so that they become solution building blocks.
Solution Building Blocks (SBBs)

Solution Building Blocks (SBBs) relate to the Solutions Continuum, and may be either procured or developed in house. They define what products and components will implement the functionality.

In System Architect, a Solution Building Block is a definition type within which you list the models and diagrams that you have created to specify a solution – for example the physical data models, relationship maps, system architecture diagrams, UML component diagrams, UML Deployment diagrams, Network Concept, and Technical Architecture diagrams.

These models specify each SBB’s functionality and interfaces. Within the SBB definition, you also specify the ABBs that the SBB implements, which requirements it fulfills, and how it maps to the Technical Reference Model.

Stage E – Opportunities and Solutions

You might ask why are you looking for opportunities and solutions at such a late stage as stage E? Shouldn’t you be doing these things from the outset? The answer is that this stage is the first that is directly concerned with implementation. You evaluate the models that you have built for the
current and target architectures, identify the major work packages or projects to be undertaken to implement the target architecture, and classify them as new development, purchase opportunity, or reuse of existing system. As part of this effort, you review the Gap Analysis performed in Stage D.

The output of this stage is a high-level implementation plan, a general migration strategy, and an Impact Analysis report that consists of a generalized project priority list.

Note that “Impact Analysis” in the TOGAF context refers not to the usual “what is the impact if I change xyz?,” but “what is the impact of implementing this target architecture on the working resources that will be required to carry it out?” In other words it defines the program of work required to implement the architecture.

**Stage F – Migration Planning**

During migration planning, you take a harder look at the priority order of projects to undertake, taking into account the myriad of real-world implications and hurdles, including value add, short-term payoff (to create impetus for proceeding), technical hurdles, killing multiple birds with one stone, low hanging fruit, and organizational behavior implications. In this stage you perform cost/benefit analysis and risk analysis.

The output of this stage is a more detailed Impact Analysis report that consists of a detailed implementation and migration plan.
**TOGAF Workproducts**

Information that you capture in System Architect’s repository can be automatically output to Microsoft Word documents, so that you may disseminate reports in hardcopy form. An impact analysis report is one of many TOGAF work-product reports that can be generated in this fashion. Some of the TOGAF automatic Word reports provided are as follows:

- Architecture Building Block (ABB) Report
- Business Architecture Report
- Impact Analysis Report
- Request for Architecture Work Report
- Solution Building Block (SBB) Report
- Statement of Architecture Work Report

**Stage G – Implementation Governance**

In stage G, the projects are undertaken as a planned program of work and managed so that they deliver the agreed architecture as an integrated set of architecture-compliant solution components. The output of this stage is an architecture contract and the architecture-compliant implemented system.

In this stage, the architecture team is actively involved in (and may lead) the key implementation projects to ensure compliance of the implemented solution.

**Stage H – Architecture Change Management**

The ADM describes the drivers for change (including technology-related drivers and business drivers), and how to manage change, from simple maintenance to architecture redesign. The ADM provides strategies and recommendations for this ongoing stage.

A useful tool to use, provided by System Architect, is the Explorer diagram. This diagram enables you to visually analyze the cause-effect relationships between architecture artifacts in your repository, enabling you to answer such questions as “If I update the operating system on this server, what business processes might it affect?” and so forth. You may drag and drop any type of architecture artifact onto the diagram (from business processes to servers), and then drag reports onto the diagram to cause relationship lines to be drawn between respective artifacts.
At the Center of It All – Requirements Management

Requirements management is both literally and figuratively at the center of ADM. Requirements management is illustrated as the center circle of the TOGAF framework, and is tied to all stages of ADM. This represents the fact that requirements – which themselves are ever-changing and being refined – are identified, stored, and fed into, and out of, relevant ADM stages.

Requirements creation and management is another course of study in itself, and TOGAF provides an overview of how to endeavor into creating and maintaining requirements, and addressing those requirements to the
parts of the architecture that satisfy them. Use Case diagrams, for example, are a time-proven technique for developing requirements that meet business scenarios. Modeling tools and off-the-shelf requirements management tools, and their associated repositories, provide technological solutions for requirements management.

Managing Requirements

System Architect provides you with options on managing the requirements of your architecture. You may choose to manage requirements in the repository of the modeling tool itself, or to manage them in an off-the-shelf requirements management tool such as Telelogic DOORS® and link them to models in the modeling tool’s repository.

Managing Requirements in System Architect’s Repository

You may add requirement definitions directly into System Architect as your project proceeds, or import them from Excel spreadsheets or requirements management tools. If System Architect does not provide the specific type of requirement you need, then you can add brand new requirement types by customizing the repository metamodel. You can create definition types to correspond with the varied requirement types that you track, such as Business Requirements, Functional Requirements, System Requirements, and so forth. The individual properties of each requirement type can also be customized. In this way you can tailor the requirement definition templates to capture all of the information that you need.

Once specified, you may track requirement-type definitions against model artifacts in one of two ways:

- "Address" them to model symbols.
- Customize the metamodel so that various definition types (for example a Use Case definition or a Business Process definition) contains property that is a list of associated requirements.

System Architect’s reporting system enables you to create and generate reports to see how requirements are being met (or not met) by model artifacts.

Managing Requirements in a Requirements Management Tool

System Architect provides interfaces to requirements management tools, such as Telelogic’s DOORS. The link enables you to associate requirements in the requirements management tool with model artifacts in the System Architect repository. The link is bi-directional so that change to requirements or models can be managed.
Conclusion

**TOGAF: Key to a Competitive Advantage**

In summary, TOGAF 8 (Enterprise Edition) is becoming widely accepted as the definitive method for building and maintaining enterprise architectures. A number of technology enablers, such as more powerful, repository-based modeling tools that publish information to corporate Intranets, have made enterprise architecture achievable. This combination of tool and methodology enables companies to use their enterprise architecture to help them make better decisions about technology investments and business process improvement.

As an enabler of enterprise architecture, TOGAF provides the following benefits:

- **Proven Method** – TOGAF offers a proven method that is the result of years of research and development by the world’s leading enterprise architects.

- **Common Vocabulary** – TOGAF guides architects in using a standard taxonomy for business, information systems and technology modeling. This shared vocabulary means that everyone in an organization can read and understand the information.

- **Communication** – Models of the enterprise architecture give visual representation to business concepts; and, when published on the corporate Intranet, disseminate knowledge of the business to the workforce. Models of the business give visual representation to concepts. Seeing a process flow diagram or a technology model of the systems architecture give a much richer sense of what is happening and eliminates the difficulties presented by the possibly contradictory, stand-alone and unrelated text and pictures in (say) a set of Word documents.

- **Command Decisions** – A business-focused enterprise architecture provides knowledge about an organization and enables managers to make better-informed decisions, such as “what is the impact of a proposed database software upgrade?”; “what applications will be impacted by this change?”; and “who needs to know about it?”

- **Reduced complexity** – A well-developed architecture leads to a better integrated solution portfolio, fewer interfaces, increased data sharing, improved reliability of the solutions, and easier maintenance.

- **Business-IT alignment** - The business focus of the architecture development process and the strong emphasis on the need for the
implemented solution to be architecture-compliant together will help ensure that IT solutions are aligned to the needs of the business.

With its comprehensive and detailed methodology approach to enterprise architecture, TOGAF offers companies a proven way to align their technology to their business goals, and reap the competitive advantages of corporate agility, governmental compliance, and improved cost management and resource allocation.

TOGAF is freely available at [http://www.opengroup.org/architecture/togaf8-doc/arch/](http://www.opengroup.org/architecture/togaf8-doc/arch/)

About Telelogic

Telelogic® is a leading global provider of solutions for automating and supporting best practices across the enterprise – from powerful modeling of business processes and enterprise architectures to requirements-driven development of advanced systems and software. Telelogic’s solutions enable organizations to align product, systems and software development lifecycles with business objectives and customer needs to dramatically improve quality and predictability, while significantly reducing time-to-market and overall costs.

To better enable our customers’ drive towards an automated lifecycle process, Telelogic supports an open architecture and use of standardized languages. As an industry leader and technology visionary, Telelogic is actively involved in shaping the future of advanced systems and software development by participating in industry organizations such as INCOSE, OMG, The Open Group, Eclipse, ETSI, ITU-T, and the TeleManagement Forum.

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