TOGAF®

TOGAF & Major IT Frameworks, Architecting the Family

by Danny Greefhorst, MSc., Director of ArchiXL

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ITpreneurs is pleased to share with you a deeper knowledge of various frameworks and domains— connecting their usage and application for the betterment of the IT profession. Our appreciation goes to the industry experts who generously share their invaluable knowledge and experience with us.

White Paper

Introduction

Organizations need a concerted approach to change. This is where enterprise architecture and TOGAF comes in. Enterprise architecture is at the heart of change, providing a set of tools and techniques that make the strategy concrete, showing employees what is really expected from them and guiding the necessary changes. Alignment of enterprise architecture with other processes is essential to ensure successful change. Frameworks such as TOGAF®, PRINCE2®, ITIL® and COBIT® provide guidance in identifying and executing the relevant processes. TOGAF is the best-practice framework for enterprise architecture, consisting of a step-by-step development method and a set of guidelines. The other frameworks address project management, IT service management and governance. This paper provides an overview of enterprise architecture and TOGAF, and how they relate to COBIT, PRINCE2 and ITIL.

1. The Need for Enterprise Architecture

Change is inherent in organizations and requires adaptation to changing market conditions, laws and regulations, as well as technology. Corporate strategy should guide organizations in their quest for growth, but is in practice only partially successful. Organizations find it difficult to make strategic decisions and adhere to them. Also, there is a big gap between corporate strategy and the daily operations of an organization. The strategy reaches employees in the organization. However, it is often not clear to them the how it affects their own work. Enterprise architecture provides instruments to make the strategy more concrete, construct a more detailed plan and govern the implementation of it. It translates strategic goals and core values into principles that express the fundamental qualities that are needed. Roadmaps and high-level designs are required to make clear the direction in which an organization needs to go. First, a roadmap needs to be created. A roadmap shows the big picture on a CIO level. Topics mentioned in the roadmap will require their own high-level design. A high-level design is a succession of roadmaps. A high-level design of the necessary changes is often constructed, including an impact analysis on all relevant aspects of the organization, which make the changes more concrete.

Many changes in organizations also have an impact on information technology (IT), and managing the execution of the corporate strategy is especially relevant in this area. In practice, a lot of IT development, procurement and implementation are not aligned with what the organization really needs. There is a gap between the business demand and IT supply. It is no surprise that IT has been a focus area of enterprise architecture. What makes IT a bigger challenge is that a highly detailed specification of changes is needed for it to work. An ambiguous specification can lead to an incompatible solution. Enterprise architecture, therefore, strives to remove ambiguities from the corporate strategy and the business goals that need to be supported. It aims to provide insight into the processes and systems that are impacted, and the technology that is involved. It ensures that the right technical solutions, applications and infrastructure are put in place, at acceptable levels of cost and quality.

The Overall Process Chain and IT Process Frameworks

Enterprise architecture is an important process, but it only covers a part of the total process landscape that consists of three phases that we refer to as directing, changing and operating IT. Before starting an enterprise architecture engagement, the overall direction needs to be clear: enterprise governance needs to be in place, the corporate strategy needs to be defined and portfolio management needs to be organized. Also, the changes identified in the enterprise architecture need to be implemented in a controlled manner. This requires proper management of the programs and projects that implement the changes. Finally, the changes lead to (transformed) operational processes that need to be governed from an architectural perspective as well, requiring IT service management to ensure proper operations. So, although enterprise architecture is an important link in the chain from directing, to changing, to operating—the total process-chain needs to be taken into account.
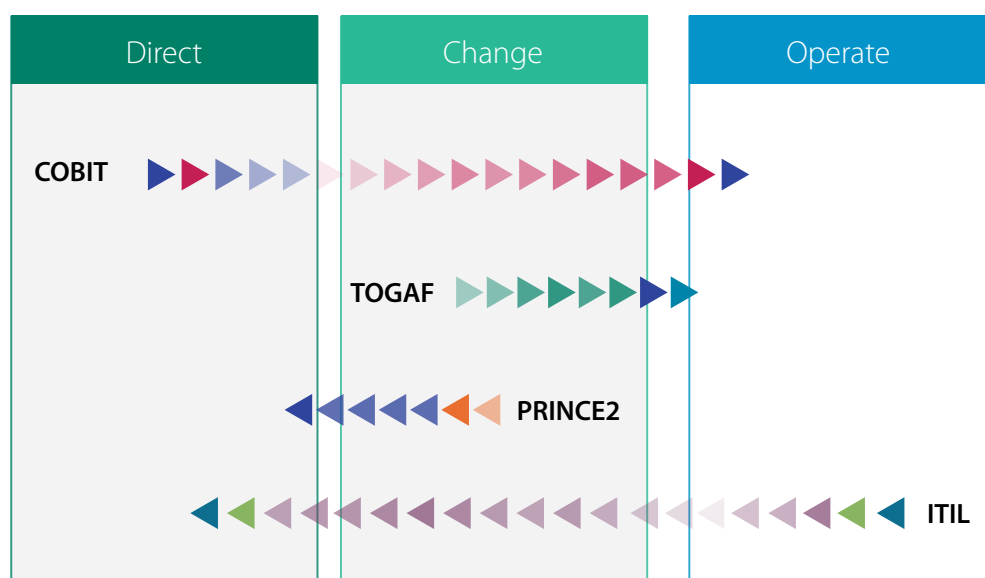

Figure 1: The overall process landscape and major IT frameworks

Organizations increasingly understand that they should reuse existing process frameworks and best practices in implementing their own process chain. In general, organizations look for open standards that they can adopt in order to avoid the challenges that arise from using proprietary tools. Also, open standards build on the experiences and best practices of many organizations. In the area of enterprise architecture TOGAF is the leading standard process framework that is adopted by organizations around the globe. Other IT process frameworks that seem to have gained major adoption are COBIT (for IT governance), PRINCE2 (for project management) and ITIL (for IT service management). This paper, therefore, shows how TOGAF supports enterprise architecture, and how it relates to these other frameworks in support of the IT processes. It introduces the frameworks, and provides insight into their relationships. The focus, however, is on enterprise architecture and TOGAF.

Before the various process frameworks are described in more detail, this paper first explores the process landscape to better understand the position of enterprise architecture and how it relates to other processes. This will make it easier to understand the positioning of the other frameworks. Figure 2 shows a more detailed view of the three phases described in the previous section, and most importantly the information flows between the processes. It also shows that what we referred to as "directing" includes a governance process that defines and guides the responsibilities of the people involved in the various processes. These responsibilities are typically defined using RACI, where those who are Responsible, Accountable, Consulted and Informed are identified. Also the basic principles underlying the governance should be described; the main direction is set in the strategic planning process. This includes the corporate strategy, as well as other strategic plans such as the IT strategy, marketing strategy and HR strategy. The direction is defined in terms of goals that provide insight into the priorities of the organization, policies that define the boundaries in which to operate and a roadmap that describes the coherent actions

that are needed to realize the goals. Any pre-existing enterprise architecture may be reused in defining these goals, policies and roadmap. Otherwise, high-level enterprise architecture is typically developed in parallel to the strategy. It provides high-level insight into the impact of the goals on the organization, processes, information systems and technology. More detailed architectures are developed later on, which determine the more detailed impact and the subsequent roadmap. The project portfolio management process is where the priorities of potential programs and projects are determined, business cases may be refined and change initiatives are initiated. This process will also monitor whether programs and projects will actually realize the business case that was defined upfront, and may take corrective actions or even stop the initiatives when this is not the case. Although enterprise architecture contributes to the strategic planning and portfolio management processes, the main goal of the process is to provide guidance to the design and implementation of changes. These changes are typically performed in the form of programs and projects, but could also be the result of change requests from operations. The output of the enterprise architecture process consists mainly of architecture principles and models. The architecture principles are more specific policies that provide restrictions on design and support the way in which an organization sets about fulfilling its mission. The models are high-level designs that are the starting point for the transformation process. The products of the design and implementation process are reviewed for compliance with the enterprise architecture. Such reviews may lead to changes in the design or architecture, or to a dispensation to deviate. The actual business operations takes place in the architecture. The implemented system will be delivered to operations and management process, as well as the management of processes, data, information systems and technology. These processes are also a potential source for requirements for the enterprise architecture process.
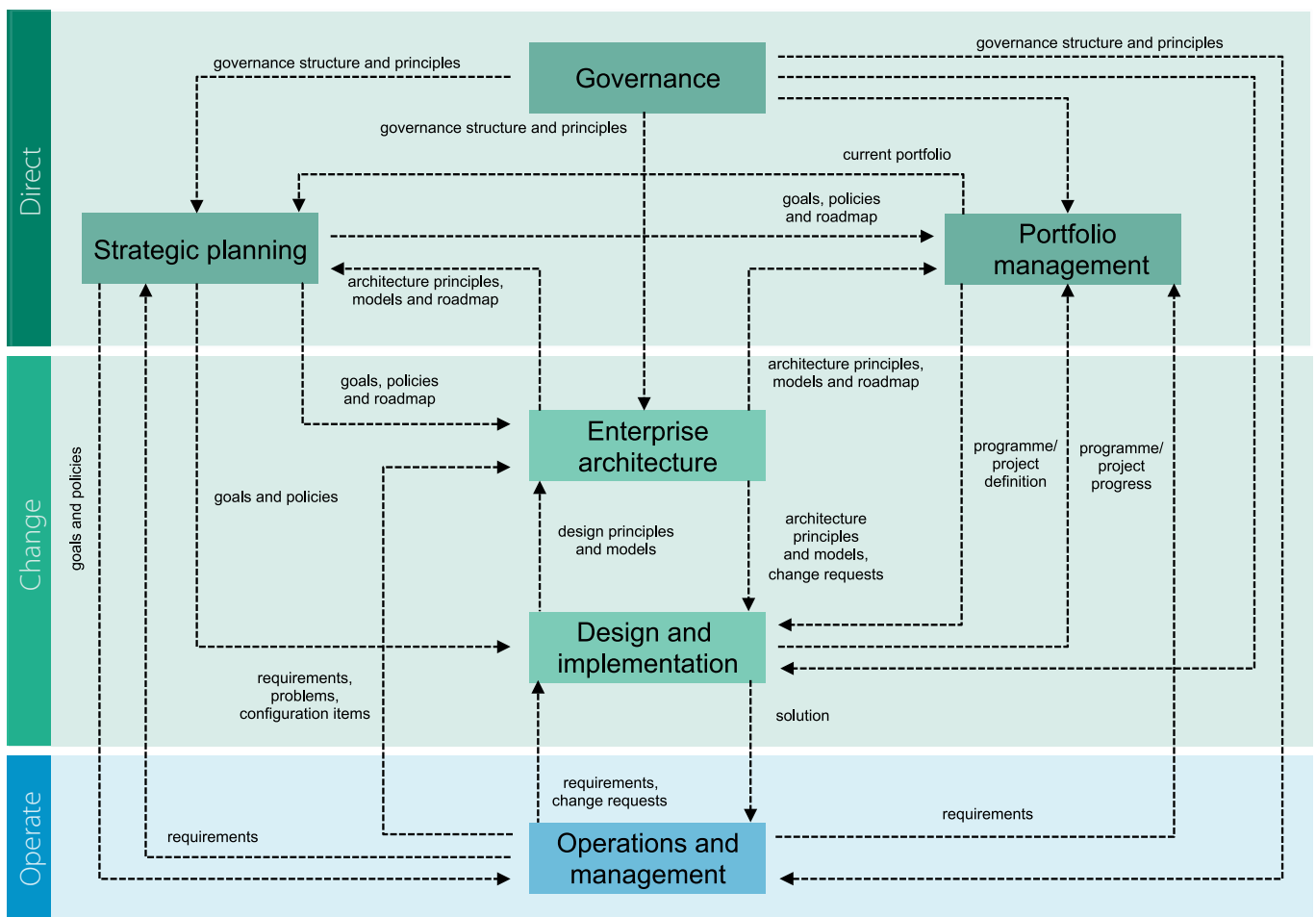

Figure 2: Process chain in more detail

Now that the overall process chain and the role of enterprise architecture has been defined, it is possible to take a closer look at the various frameworks and their relationships with enterprise architecture and TOGAF. The next section starts with a more detailed description of TOGAF.

2. Overview of TOGAF

TOGAF is a collection of methods, techniques and best practices in the field of enterprise architecture. It describes how organizations can organize enterprise architecture. The core of TOGAF is the Architecture Development Method (ADM), see Figure 3, which provides a step-by-step approach and guidelines for how to execute these steps. In addition, TOGAF provides information on how to actually construct the architecture deliverables and how to set-up the architecture capability in organizations.

TOGAF is developed and managed by The Open Group, a consortium of more than 400 organizations, focused on IT standards. These member organizations span all sectors of the IT community — customers, systems and solutions suppliers, tool vendors, integrators and consultants, as well as academics and researchers. The Open Group is also responsible for the ArchiMate standard, which is an enterprise architecture modeling standard and highly related to TOGAF. Future versions of TOGAF are expected to explicitly link to ArchiMate.

Why Is TOGAF the Leading Standard?

The field of enterprise architecture has been very fragmented in the past, which is partly due to the fact that the field as a whole is still very much in development. A large number of architecture frameworks and approaches have been developed in the past with very different views on enterprise architecture. They have different interpretations of what an enterprise architecture looks like, and as a result they also have a different view on the process that is needed to develop and use it. It is clear that such fragmentation is undesirable. Organizations do not know which framework to adopt and/or risk becoming dependent upon a proprietary framework that is not supported in the market. As mentioned before, organizations increasingly understand that adoption of open standard methods, frameworks and best practices is important. That is why the availability of an open standard framework for enterprise architecture is really important.

TOGAF is an open standard enterprise architecture framework. It has been developed over a period of almost two decades and builds on standards that were developed even before this time. The adoption of TOGAF has grown over the years, especially in the past decade, during which TOGAF versions 8 and TOGAF 9 were introduced, with version 9.1 appearing in 2011. Major IT vendors and consulting companies have adopted TOGAF over their own proprietary frameworks and approaches. Currently, TOGAF has become the framework of choice for most organizations around the world: 80% of the Fortune 500 companies now use it and the amount of certified professionals has grown to 17,000 with a staggering 120% increase annually. Finally, more than 25,000 complete book-sets have been sold. There really is no alternative, open standard, enterprise architecture framework that is comparable to TOGAF on the market.

A Process Perspective on TOGAF

The Architecture Development Method (ADM) provides a step-by-step approach for developing and applying enterprise architecture. It consists of a number of phases that are typically performed in sequence, although iteration between phases is also possible. These phases consist of steps, which describe the actual activities. For every phase, the objectives as well as the inputs and outputs are identified and expressed in terms of the content framework that is also part of TOGAF. The content framework specifies the architecture deliverables, as well as the artifacts (models), and the concepts that they capture.

In the preliminary phase, the method is adapted to the specific context and the specific phases and steps, and the order in which they will be performed is determined. In the architecture vision phase, an initial high-level view of the architecture is developed, and the most important business requirements are determined. In the follow-on three phases the architecture is developed from various perspectives: the business architecture, the information systems architecture and the technology architecture. In every phase, the architecture building blocks in the current situation and in the target situation are determined, and the gaps between them are identified. In the opportunities and solutions phase, the architecture is translated into a set of solution building blocks and a high-level roadmap. This roadmap is refined in the migration planning phase in which change initiatives are prioritized and scheduled. During the implementation governance phase, the architecture is used to ensure that projects align and adhere to the corporate vision and strategy. In the architecture change management phase, internal and external developments are monitored and translated into changes in the architecture. This can lead to small changes or a new cycle of the development method. The requirements management phase is central to all processes and it is the phase where all the requirements of the architecture are managed.
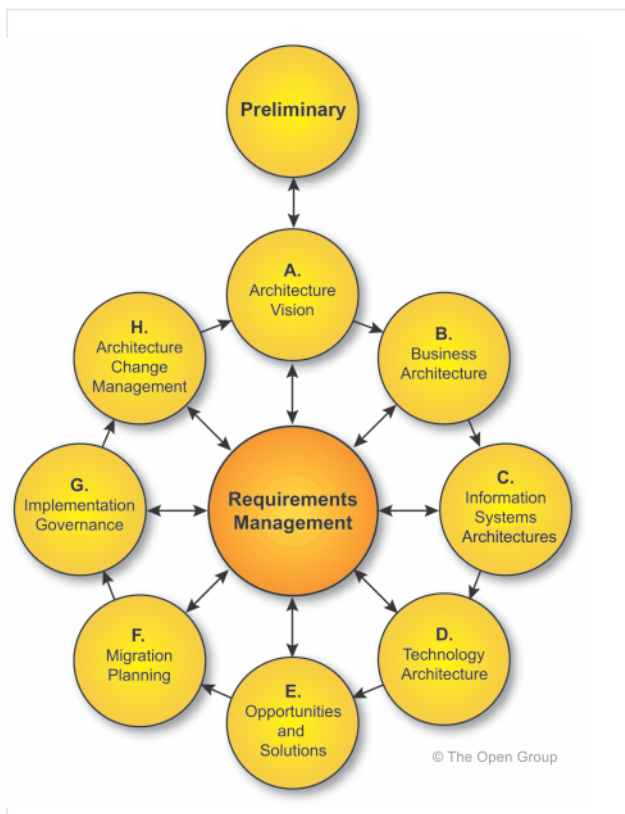

Figure 3: TOGAF Architecture Development Method

In addition to the ADM, TOGAF also describes a number of techniques that can be applied during the execution of the method. This includes generic techniques such as stakeholder management, risk management and business readiness assessments, as well as architecture specific techniques. Furthermore, it is important to note that the ADM does not provide a full view of all the architecture activities. In particular, the governance and management of the architecture requires additional activities. Most of these are identified in the chapter on architecture governance in TOGAF and are the responsibility of an executive level architecture board. This includes activities for determining which architectures need to be developed, handling dispensations, and managing the Architecture Repository. This repository is the place where all outputs of the architecture project are stored.

3. TOGAF and COBIT

COBIT stands for "Control Objectives for Information and Related Technologies" and is a framework for the governance and management of enterprise IT. The standard is developed by ISACA. The most recent version is COBIT 5, which consists of multiple documents. The core document describes the main principles of COBIT and gives an overview of what IT governance is. Other documents include "Enabling Processes", which provides an elaborate description of all IT processes, and "Implementation", which provides guidance on the actual implementation of IT governance. The core principles of COBIT are: Meeting stakeholder needs, Covering the Enterprise End-to-End, Applying a Single Integrated Framework, Enabling a Holistic Approach, and Separating Governance From Management. COBIT provides an end-to-end view on IT governance, and is driven by the enterprise goals and the IT-goals. In previous versions, there was not a clear distinction between IT governance and IT management. COBIT 5 is much more clear. It provides definitions of governance and management, and specifically identifies five processes that are part of IT-governance. Governance ensures that stakeholder needs, conditions and options are evaluated to determine balanced, agreed-on enterprise objectives to be achieved—setting Governance establishes direction through prioritization and decision-making—and monitors performance and compliance against agreed-on direction and objectives. Management executes activities in alignment with the direction set by the governance body.

The heart of COBIT is a (high-level) description of all IT processes, which are based on and aligned with various other process frameworks, including TOGAF. The process reference model in Figure 4 provides an overview of the processes. The five governance processes are shown in the figure under the heading "Evaluate, Direct and Monitor".
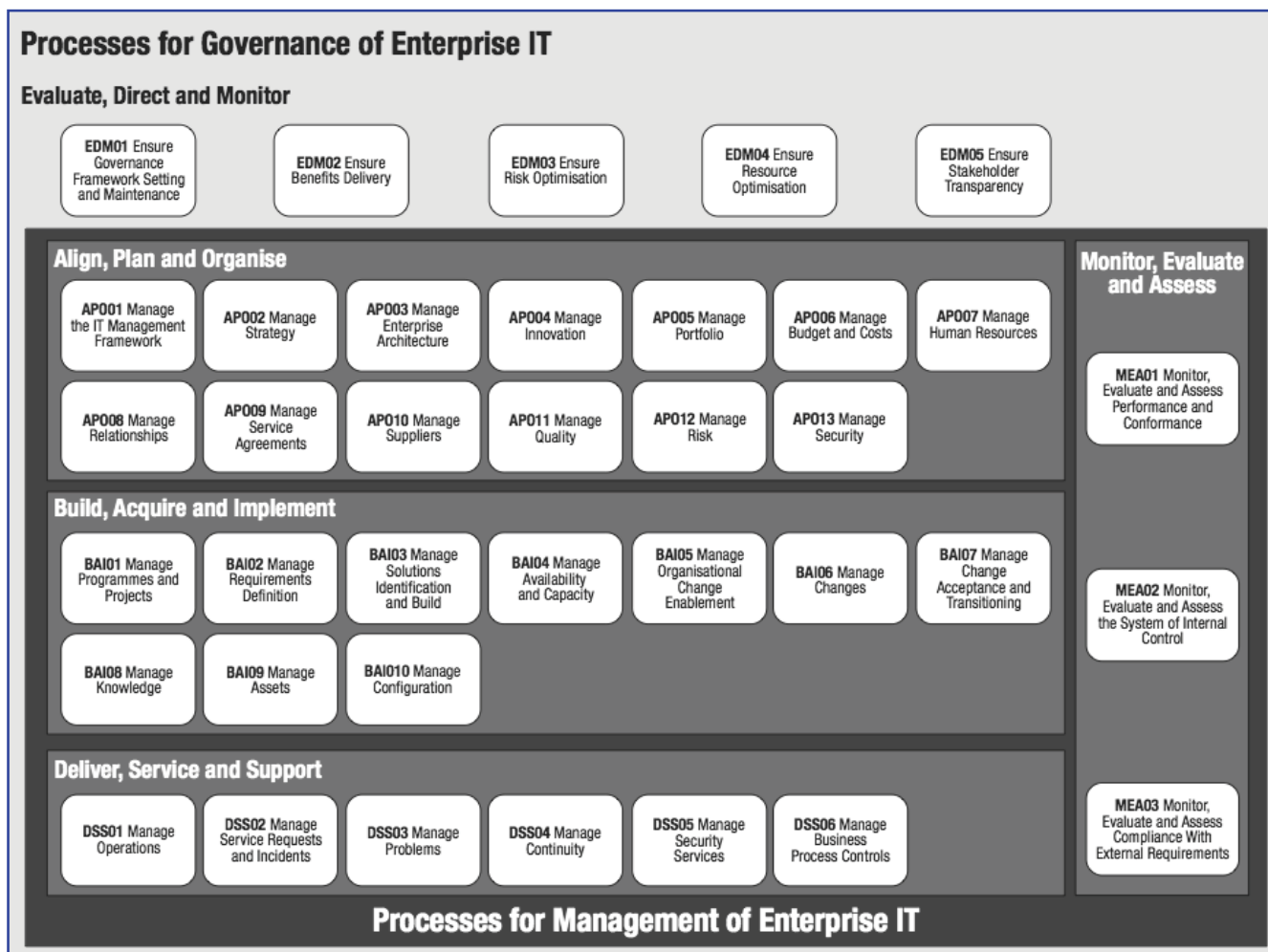

Figure 4 COBIT Process Reference Model

The first of these processes, Ensure Framework Setting and Maintenance, is where the governance structure itself is defined. The other governance processes focuses on monitoring benefits, risks, resources and stakeholder transparency. The rest of the processes fall into the category of management and are clustered into four domains that resemble the process chain described earlier in this document. Enterprise architecture falls into the "Align, Plan and Organize" domain, together with other strategic and tactical processes. The "Manage Strategy" process is equivalent to the strategic planning process described earlier, but is focused only on IT strategy. COBIT describes the various processes using a standard template, which includes a description of the activities, inputs and outputs. The main contribution of COBIT is that it also describes the relationship with all other related processes, linkages to the IT-related goals and the responsibilities of all stakeholders in the form of a RACI chart.

Relationship of COBIT with TOGAF

The most important relationship between COBIT and TOGAF, is that enterprise architecture is one of the processes described in COBIT. Actually, when you look at the description of enterprise architecture in COBIT 5 you see that they have looked at TOGAF closely and included most of the TOGAF Architecture Development Method in the description of the process. Table 1 shows a mapping between the TOGAF processes and activities, and COBIT. Consequently, most of the TOGAF methodology can be found in the "Manage Enterprise Architecture" process of COBIT. The architecture vision phase, as well as the opportunities and solutions, and migration planning phases, have their own "management practice" in COBIT. The phases in which business architecture, information systems architecture and technology architecture are defined, are combined into the practice "Defining Reference Architectures". This is strange since these phases are used for different types of architectures, and not just reference architectures. Reference architectures are generic architectures that can be used as a template for specific enterprise or solution architectures. The management practice "Architecture services" is also a combination of other phases and activities in TOGAF. It includes the implementation governance, architecture change management and requirements management phases. Separating these three phases from the rest is logical in the sense that they are really more continuous activities, while in contrast to the other phases, they are more continuous in nature. The preliminary phase is not clearly mapped onto any of the management practices in the Manage Enterprise Architecture process. Most of it, however, seems to map onto the process "Manage the IT Management Framework", which is where the organizational structure, roles and responsibilities, and general policies are defined. Architecture governance is also not part of the Manage Enterprise Architecture process. COBIT considers this part of the governance processes, the "Ensure Resource Optimization" process in particular. The architecture board, which is defined in TOGAF as the most important governance structure for enterprise architecture, is also included as a stakeholder in a number of processes. COBIT seems to cover all the TOGAF phases and activities, one should remember. Note however that enterprise architecture is broader than IT; it also provides guidance to how the business itself is organized. On the other hand, most of the COBIT processes are not really IT-specific in the sense that if you remove references to "IT"," than a lot of the processes are also very relevant for the organization as a whole. This especially holds for the processes within "Align, Plan and Organize" such as Manage Strategy, Manage Innovation, Manage Human Resources, Manage Relationships, Manage Suppliers and Manage Quality. In fact, the process reference model can be a very good source of inspiration for defining the process architecture of any organization.

TOGAF Phase/Activity phase/activity	COBIT Process/Practice process/practice
Preliminary phase	Manage the IT Management Framework
	Manage Enterprise Architecture
Architecture vision	Developing an architecture vision
Business Architecture	Defining reference architectures
Information Systems Architecture	Defining reference architectures
Technology Architecture	Defining reference architectures
Opportunities & Solutions	Selecting opportunities and solutions
Migration planning	Defining architecture implementation
Implementation governance	Architecture services
Architecture change management	Architecture services

Requirements management	Architecture services
Architecture Governance	Ensure Resource Optimization

Table 1 Relating COBIT and TOGAF activities

Along with including enterprise architecture and TOGAF as a process, COBIT also adds additional information and insights. It links enterprise architecture to general IT-related goals and adds the responsibilities of stakeholders, as well as shows how enterprise architecture contributes to the general IT-related goals of aligning business and IT strategy, IT agility and optimization of IT assets, resources and capabilities. COBIT links all IT-related goals to enterprise goals, allowing us to understand how enterprise architecture contributes these enterprise goals. Also, process goals are defined that express the value of enterprise architecture in a more specific way, and makes them more concrete by defining metrics. The latter is very valuable when you want to define key performance indicators for the enterprise architecture department in your organization. As an example, one of the process goals is "the architecture and standards are effective in supporting the enterprise" and one of the related metrics is "project benefits realized that can be traced back to architecture is only effective when the governance process, and the architecture board process requests from projects.involvement". The RACI chart provided for enterprise architecture also provides a lot of insight that is not included in TOGAF. It shows for example, that the CEO is accountable for most of the enterprise architecture activities and that a lot of management-level stakeholders are to be consulted when defining the enterprise architecture.

Another interesting value that COBIT adds to TOGAF is that it puts enterprise architecture in the context of all other IT processes. It shows the relationship with other processes, and the inputs from and outputs to these processes the enterprise architecture products are an input. These two perspectives are summarized in the following two tables. A number of the inputs are not specific to enterprise architecture; they are generic inputs for multiple processes. Managing quality, security, conformance, performance, internal control and compliance do have an impact on enterprise architecture, but also on many other processes. A lot of the products that are mentioned in the tables are not identified in TOGAF, and provide a useful addition. On the other hand, the naming of the outputs of enterprise architecture does not follow the names of the deliverables in TOGAF, and a number of them are also missing. For example, in TOGAF, the opportunities and solutions phase delivers, among others, a roadmap and a high-level implementation and migration plan. The roadmap is completely missing in COBIT, and the implementation and migration plan is renamed to be an implementation and migration strategy, carrying different semantics. It almost seems like the authors of COBIT have tried to invent their own version of TOGAF. I think it would have been better to stick to the formal TOGAF deliverables.

From Process	Product
Outside COBIT Enterprise drivers	Enterprise strategies
Ensure Resource Optimization	Guiding principles for enterprise architecture
Manage the IT Management Framework	Enterprise operational guidelines Definition of organizational structure Defined operational placement of IT function Evaluation of options for IT organization Data classification guidelines Communication ground rules IT-related policies Communication on IT-objectives Process improvement opportunities
Manage Strategy	Strategic road map Proposed enterprise architecture changes Communication package

Manage Quality	Quality management standards Process quality of service goals and metrics Communications on continual improvement and best practices Examples of good practice to be shared Quality review benchmark results
Manage Security	Information security risk treatment plan
Monitor, Evaluate and Assess Performance and Conformance	Monitoring targets Performance reports Remedial actions and assignments
Monitor, Evaluate and Assess the System of Internal Control	Results of internal control monitoring and reviews Results of benchmarking and other evaluations Self-assessment plans and criteria Results of reviews of self-assessments Control deficiencies Remedial actions Assurance plans Refined scope Assurance review results Assurance review report
Monitor, Evaluate and Assess Compliance with External Requirements	Communication of changed compliance requirements

Table 2 Enterprise Architecture inputs in COBIT

Product	To
Architecture concept business case and value proposition	Manage Strategy Manage Portfolio
Process architecture model	Manage the IT Management Framework
Defined scope of architecture High-level implementation and migration strategy Transition architectures	Manage Strategy
Information architecture model	Manage Strategy Manage Requirements Definition Manage Solutions Identification and Build Manage Security Services
Baseline domain descriptions and architecture definition	Manage Security Manage Requirements Definition Manage Solutions Identification and Build
Architecture principles Solution development guidance	Manage Requirements Definition Manage Solutions Identification and Build
Resource requirements Implementation phase descriptions Architecture governance requirements	Manage Programs and Projects

Table 3 Outputs from Enterprise Architecture in COBIT

4. TOGAF and PRINCE2

PRINCE2 stands for "Projects IN Controlled Environments" and is a structured project management method. It is endorsed by the UK Government as the project management standard for public projects. The method encompasses the management, control and organization of a project. The most recent version of PRINCE2 is the 2009 edition, which is published in two books, "Managing Successful Projects with PRINCE2 - 2009 Edition" and "Directing Successful Projects with PRINCE2 - 2009 Edition". PRINCE2 is built on seven principles: Continued business justification, learn from experience, defined roles and responsibilities, manage by stages, manage by exception, focus on products and tailor to suit the project environment.

The heart of PRINCE2 is formed by the seven processes (also see Figure 5). PRINCE2 starts with a pre-project phase, triggered by a mandate, received from the sponsor. During the start up, in this pre-project phase, the project management team is appointed, a first outline of the Business Case, a description of the end-product to be delivered, the project management team structure, the project approach and a Project Brief are prepared. The overall approach to be taken is decided and the next stage of the . When the project seems viable and achievable the project will start with the initiation stage. In this stage strategies on Risk, Quality, Configuration and Communication Management, a first global planning, called the Project Plan and a detailed Business Case are produced. These documents are gathered in the Project Initiation Documentation. Directing a Project describes the work of the Project Board; how it authorizes Stage Plan(s), gives ad hoc direction to the project and closes a project. Controlling a Stage is the day-to-day management by the Project Manager described. This includes the way in which Work Packages are authorized and received from the Team Manager(s), as well as how progress is monitored and reported. The Managing a Stage Boundary process dictates what should be done towards the end of a stage. A next Stage Plan should be planned and the overall Project Plan, and Business Case (including the risk profile) should be amended if needed. The Managing Product Delivery process controls the link between the Project Manager and the Team Managers by authorizing, accepting and executing Work Packages to be produced on the work floor. Closing a Project covers a controlled hand over of the project's output to the user and maintenance organization, and evaluation of the project's achievements.
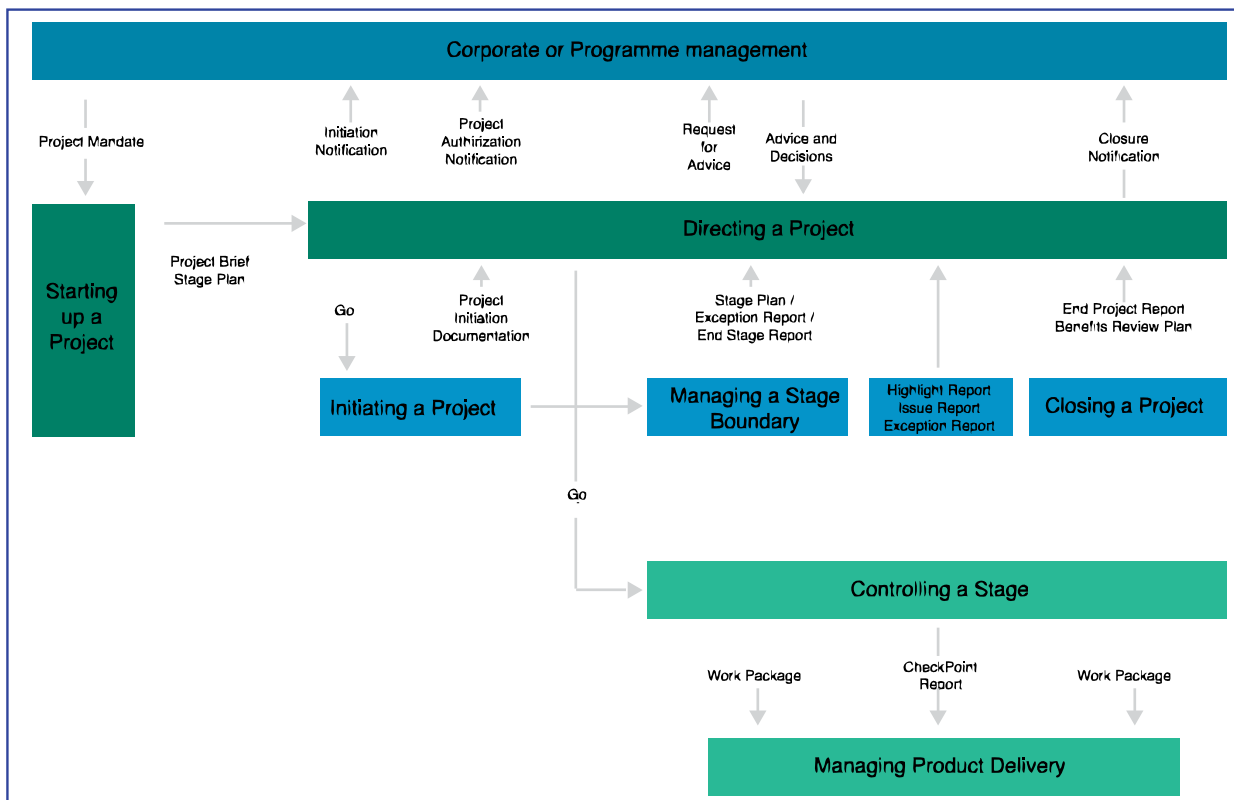

Figure 5 Seven Processes of PRINCE2

Relationship of PRINCE2 with TOGAF

There are various relationships between PRINCE2 and TOGAF: Defining an enterprise architecture is typically performed in the form of a project, enterprise architecture governs projects to ensure that they contribute to the enterprise goals, and enterprise architecture can lead to new projects that are needed to realize the goals. The paper looks at all these perspectives in turn.

Most of the phases of the Architecture Development Method in TOGAF are executed in a project fashion, with the exception of implementation governance and architecture change management. These phases are really more continuous activities. Actually, a number of architecture projects may be performed in parallel, where each project is delivering a specific type of architecture. For example, in a complex organization that consists of multiple divisions, each division will typically define its own enterprise architecture (also called segment architecture in TOGAF). Enterprise architecture projects may actually be very large and complex projects, involving a large number of stakeholders, running for as long as a year and spending more than a million dollars. It may be clear that such a project needs a structured project management approach. TOGAF includes a lightweight project management approach, and accompanying deliverables. Most importantly, it recognizes the need for a formal Request for Architecture Work as a trigger to startup an enterprise architecture project, which is quite similar to a project mandate. The architecture function will then construct a Statement of Architecture Work, which is really a project plan that is included in the Project Initiation Documentation. It is even suggested in TOGAF that the Architecture Development Method may be used as an approach for non-architecture projects, although I do not think that it would be wise to do so. On the other hand, PRINCE2 is very suitable as a project management method for managing an enterprise architecture project. In such a case, some of the deliverables in TOGAF should be tuned to PRINCE2, such as the deliverables mentioned before (also see Table 6). Actually, tailoring to suit the project environment is one of the principles of PRINCE2. The general adaptation of PRINCE2 to the organization is referred to as "embedding". Table 6 shows the PRINCE2 products that are strongly related to TOGAF products.

The enterprise architecture can be used to define the scope of a project during the start-up of a project: What are the parts of the organization that are impacted by the project. In particular, the enterprise architecture provides models that show the organization and its information technology from several perspectives, and these models are well suited to be used for scoping. For example, a business function model shows all the business functions of the organization, which are relatively stable elements that describe what the organization does. Expressing the scope of the project in terms of these business functions is really helpful.

An architectural approach can be seen as part of the quality management of a project. During the project initiation process a quality plan is constructed, and business requirements should be part of this plan. Architecture principles can be seen as high-level requirements that need to be translated to the project. The translation of the enterprise architecture to the project is defined in an architectural contract between the architecture function and development partners. This architectural contract can be seen as a complement to (or part of) the project initiation document in PRINCE2, or an issue in the project, and may be fixed by the project team. This issue should be taken care of in the "directing a project process" of PRINCE2. This will require a collaboration of the project board that controls the project, and the architecture board that is responsible for the enterprise architecture. In the management of a stage boundary process in PRINCE2, issues that require additional work may lead to an exception report that also needs to be handled by the project board. During the closing of a project, it needs to be determined whether all enterprise-architecture related issues are solved or identified as follow-on activities.

TOGAF Product	PRINCE2 Product that Overlaps
Request for Architecture Work	Project Mandate for architecture project
Statement of Architecture Work	Project Initiation Document for architecture project
Communications Plan	Communications Management Strategy for architecture project
Implementation and Migration Plan	Project Brief Mandates for projects identified in architecture
Decision Log part of governance log	Issue Log created in architecture governance

Table 6 Relating TOGAF and PRINCE2 and TOGAF Products

Enterprise architecture is meant to provide guidance to design, which is typically performed in a project. Such guidance is part of the implementation governance phase in TOGAF. The enterprise architecture can be used to define the scope of a project during the pre-project phase: What are the parts of the organization that are impacted by the project. In particular, the enterprise architecture provides models that show the organization and its information technology from several perspectives, and these models are suited to be used for scoping. For example, a business function model shows all the business functions of the organization, which are relatively stable elements that describe what the organization does. Expressing the scope of the project in terms of these business functions is helpful. The same holds for models that show the main groups of information and applications. Figure 7 shows all the relevant architecture related activities for each of the PRINCE2 processes. It is strange that PRINCE2 does not specifically mention enterprise architecture. One way of looking at it is that architecture can be seen as part of quality management, which is incorporated in PRINCE2. During the Project Initiation process a quality plan is constructed, and architectural requirements should be part of this plan. Architecture principles can be seen as high-level requirements that need to be translated to the project. Architecture models can be seen as a high-level design that is to be refined in the project. The impact of the enterprise architecture on the project is defined in an Architecture Contract between the architecture function and development partners. This Architecture Contract can be seen as part of the Project Initiation Documentation in PRINCE2. Project documentation (especially any design documentation) should be reviewed for compliance with the enterprise architecture. Informal reviews can take place at several moments of a project during the Controlling a Stage process in PRINCE2 terminology. A formal compliance review will be performed as part of the Managing Product Delivery process in PRINCE2. TOGAF provides elaborate guidance for performing such compliance reviews. Deviations that are identified during a compliance review are recorded as issues in the project, and may be fixed by the project team. When the enterprise architect and project team do not come to an agreement on how to handle the deviation, the issue may be escalated. This issue should be taken care of in the Directing a Project process (give ad hoc directions) of PRINCE2. This will require a collaboration of the project board that controls the project, and the architecture board that is responsible for the enterprise architecture. The project may need to adjust certain products in order to comply with the enterprise architecture. The architecture board may also give dispensations for deviations from the enterprise architecture. In the Managing a Stage Boundary process in PRINCE2, issues that require additional work may lead to an exception report that also needs to be handled by the project board. During the closing of a project, it needs to be determined whether all enterprise architecture related issues are solved or identified as follow-on activities.

The last and most important relationship between PRINCE2 and TOGAF. TOGAF is that an enterprise architecture may identify projects that need to take place in order to attain the goals. This is the result of the migration planning phase in TOGAF, and is described in the Implementation and Migration Plan. This plan provides a list and schedule of the projects that will realize the target architecture. It consists of an implementation and migration strategy, a project and portfolio breakdown and may include a list of project charters. These project charters can be considered as Project Mandates in PRINCE2 terminology, although they may already include information at the detail level required for a Project Brief. It includes information about the business value, risk, issues, assumptions, dependencies, resource requirements and costs. It is interesting to see that these project charters are optional, and also that they were mandatory in the previous version of TOGAF (9.0). This seems to indicate that there is no agreement on the level of detail that the implementation and migration plan provides on projects that are needed. Also, the portfolio management process is meant to deal with the total project portfolio, and determine which projects to actually start. In practice, organizations should determine the exact interfaces between their enterprise architecture, portfolio management and project management processes.
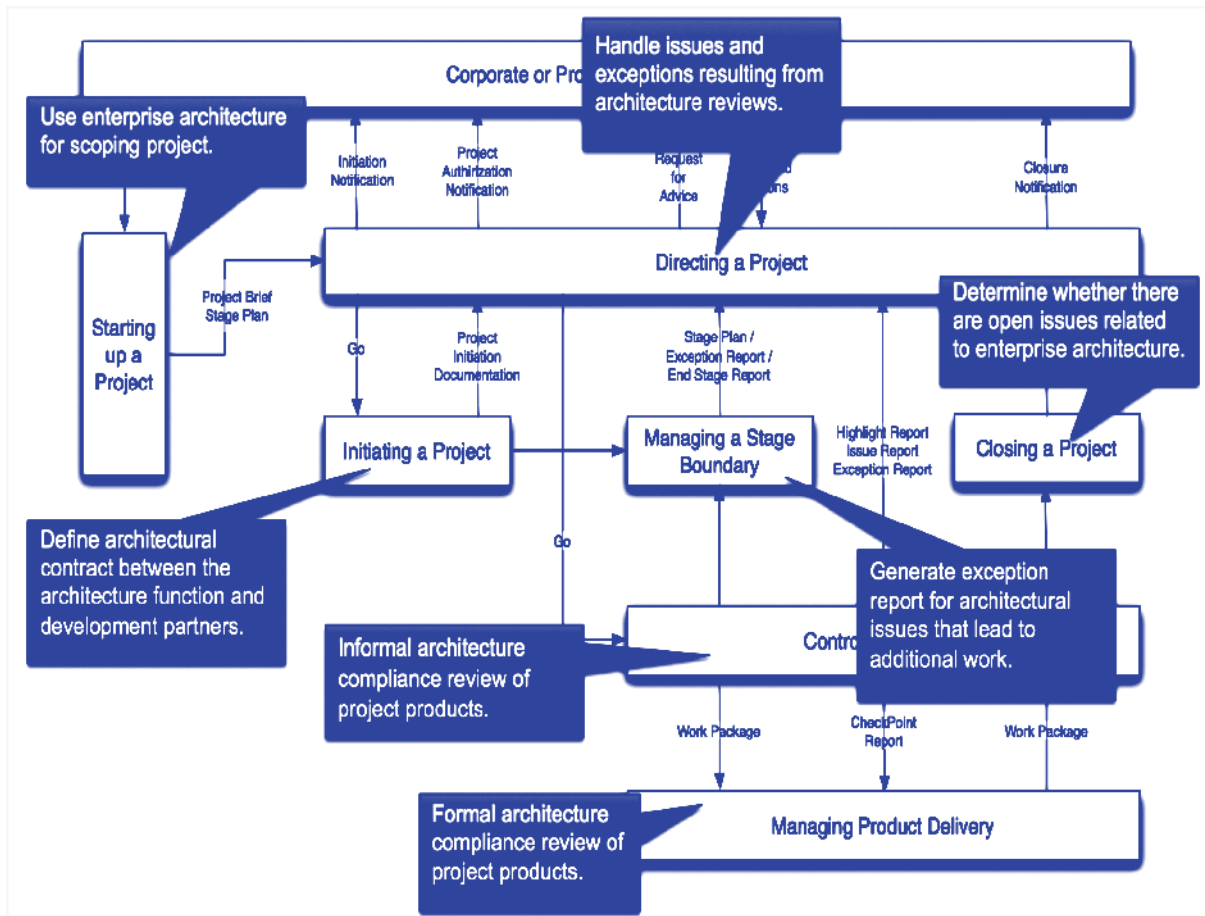
5. TOGAF and ITIL

Figure 7 Mapping architecture to PRINCE2 processes

ITIL stands for "Information Technology Infrastructure Library" and is a framework for IT service management. ITIL provides guidance to service providers on the provision of quality IT services, and on the processes, functions and other capabilities needed to support them. The framework is managed by the Cabinet Office of the UK Government. In 2007, a major refresh of ITIL was published (ITIL version 3) in response to significant advancements in technology and emerging challenges for IT service providers. In 2011, as part of its commitment to continual improvement, the Cabinet Office published the most recent version (ITIL 2011 edition) to improve consistency across the core publications. ITIL defines 26 processes, organized into 5 volumes: Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement. In addition to the core publications, there is also a complementary set of ITIL publications providing guidance specific to industry sectors, organization types, operating models and technology architectures.

The five volumes of ITIL form the main structure of ITIL, and together form the ITIL Service Lifecycle (also see Figure 8). The purpose of the Service Strategy stage of the service lifecycle is to define the perspective, position, plans, and patterns that a service provider needs to be able to execute to meet its business outcomes. It is aimed at executives and managers who are responsible for defining the strategy of a service provider. Service Design provides guidance for the design and development of services and service management practices. It covers design principles and methods for converting the strategic objectives into services. The scope of Service Design is not limited to new services; Service Design is also about changes to existing services. Service Transition provides guidance for the development and improvement of capabilities for introducing new and

changed services into supported environments. It describes how to transition an organization from one state to another, while controlling risk and supporting organizational knowledge for decision support. The purpose of the Service Operation stage of the service lifecycle is to coordinate and carry out the activities and processes required to deliver and manage services at agreed levels to business users and customers. Service Operation is also responsible for the ongoing management of the technology that is used to deliver and support services. Continual Service Improvement (CSI) provides guidance to align IT services with changing business needs by identifying and implementing improvements to IT services that support business processes. These improvement activities support the lifecycle approach through service strategy, service design, service transition and service operation. CSI is always seeking ways to improve service effectiveness, process effectiveness and cost effectiveness. The processes in this volume form a closed loop feedback system, based on the Plan-Do-Check-Act (PDCA) cycle. Figure 8 provides an overview of the various processes that are part of the five volumes.
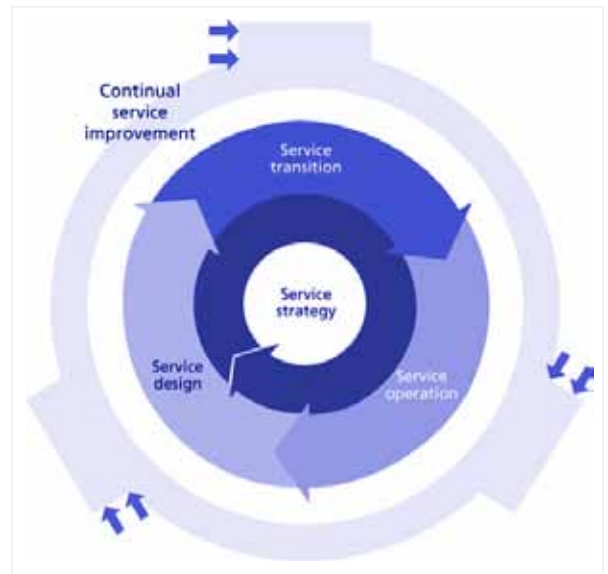

Figure 8 ITIL Service Lifecycle

Service Strategy	Service Design	Service Transition	Service Operation
• Strategy management for IT services • Service portfolio management • Financial management for IT services • Demand management • Business relationship management	• Design coordination • Service catalogue management • Service level management • Availability management • Capacity management • IT service continuity management (ITSCM) • Information security management • System security management • Supplier management	• Transition planning and support • Change management • Service asset and configuration management • Release and deployment management • Service validation and testing • Change evaluation • Knowledge management	• Event management • Incident management • Request fulfillment • Problem management • Access management
Continual Service Improvements				

Figure 8 ITIL Processes

Relationship of ITIL with TOGAF

As for the other frameworks, there are also multiple relationships between TOGAF, ADM and ITIL. The first is that ITIL can be seen as an architecture for IT service management, and could in theory have been constructed in a TOGAF-ADM-like process. In particular, ITIL provides a very elaborate description of the various lifecycle stages of a service and all the processes needed for IT service management to support the service throughout the whole lifecycle, which is really a process architecture (or even a business architecture for the business of IT service management). It describes the processes in a very structured and elaborate manner, including the information that is managed in the processes, the critical success factors, key performance indicators and the relationships that exist with other processes. Given that ITIL also provides a description of all the information that is managed in the processes and information systems that should support them, it also provides an information systems architecture. In particular, it identifies a number of information systems that manage information about availability (Availability Management Information System), capacity (Capacity Management Information System), suppliers and contracts (Supplier and Contract Management Information System), security (Security Management Information System), Security Management Information System) and configuration items (Configuration Management System) and media (Definitive Media Library).

ITIL also introduces the concept of a Service Knowledge Management System, as an all-encompassing information system that manages all information that is relevant for IT service management and that includes the previously mentioned information systems. As the name suggests, knowledge management is seen as an important aspect of IT service management, and ITIL also provides elaborate general information on this subject. It also goes into more detail on the architecture of the Service Knowledge Management System by showing the layers that should be part of such a system (see Figure 9). The presentation layer enables searching, browsing, retrieving, updating, subscribing and collaboration. The knowledge processing layer is where the information is converted into useful knowledge, which enables decision-making. The information integration layer provides integrated information that may be gathered from data in multiple sources in the data layer. The data layer includes tools for data discovery and data collection, and data items in unstructured and structured forms.
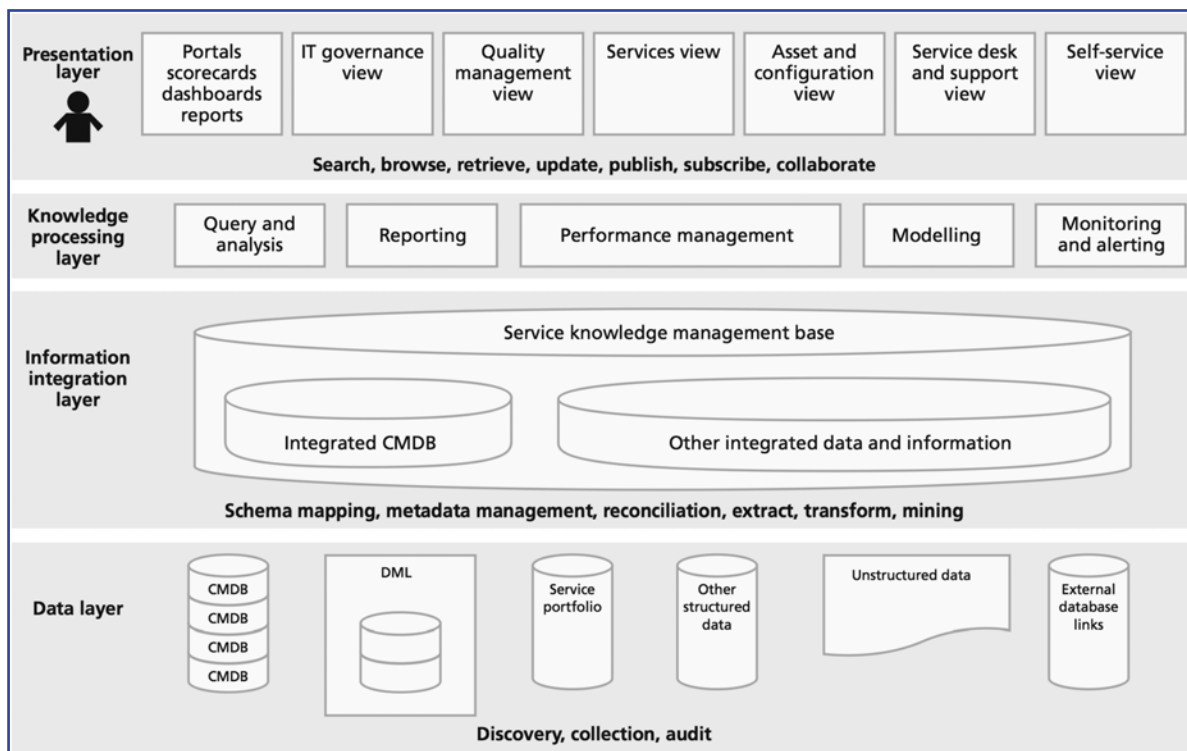

Figure 9 The Architecture of the Service Knowledge Management System(SKMS)

Looking at ITIL as an architecture for IT service management can help organizations in the implementation of IT service management. In particular, implementing IT service management is very similar to implementing other architectures. In terms of TOGAF, ITIL provides the target architecture, which should be confronted with the baseline architecture of a specific organization, the. The gaps between the baseline and target architecture should be aggregated and grouped into a roadmap; and an implementation and migration plan should be constructed. Also, an Architecture Contract should be developed for the program that will implement IT service management based on ITIL, describing the essential requirements from an architectural perspective.

Probably the most important relationship between ITIL and TOGAF is that there is a strong relationship between the processes (although these relationships are not clearly identified in ITIL). In particular, the first builds on the results of the latter. An enterprise architecture describes services that are needed at a high level and these services are designed in the Service Design stage in ITIL. During the development of the enterprise architecture level, the focus is on identifying the services, based on the goals and requirements of the organization. During Service Design all necessary details are added. Enterprise architecture can be seen as a high-level form of design (essential design), and from that perspective, you could say that there is a progression from high-level to low-level design (also see Figure 10). Multiple levels of detail are also recognized in TOGAF; a strategic architecture is a very high-level architecture, while segment architectures and capability architectures go into more detail for specific segments (departments, themes) and capabilities. Service Design can also be seen as existing of multiple levels of design. The highest level of design is what is typically called "solution architecture", which is close to what TOGAF calls "capability architecture". The difference between an enterprise perspective (such as in a capability architecture) and a solution perspective (as provided by ITIL) is that the former focuses on alignment with organization-wide goals, while the second focuses on realizing a solution within predefined constraints. At an even lower level, we typically talk about detailed design. So both TOGAF and ITIL provide guidance in the design of services, albeit at a different level of detail. Also, design in ITIL is focused on IT services while enterprise architecture has a much broader focus (also looking at non-IT services). Note that design activities are not only performed as part of projects in ITIL; changes that are handled as part of the change management process will typically also contain design activity, albeit in a more minimalistic manner. Designs at various levels are also reviewed for compliance with the enterprise architecture, similar to what is described in the section on the relationship between TOGAF and PRINCE2.
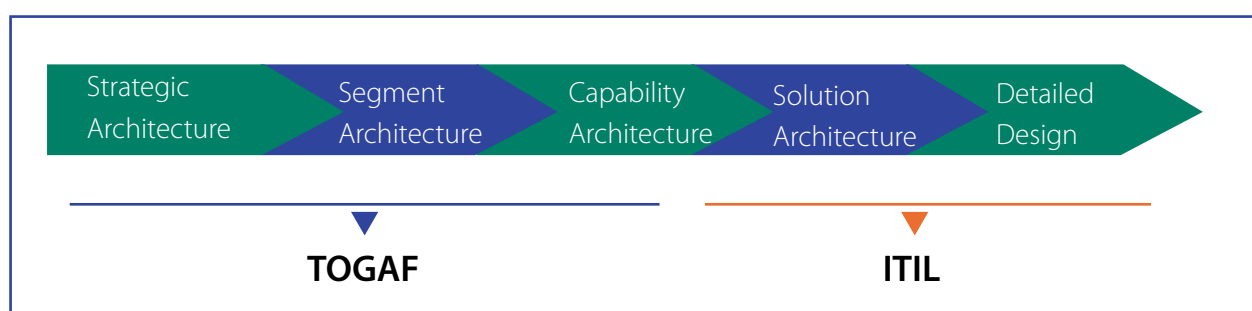

Figure 10 Progression from Enterprise Architecture to Design

In addition to the design-related interface as described in the previous paragraph, there is also a planning-related relationship between the two frameworks. The work packages that are identified in the Implementation and Migration Plan in TOGAF may be too small for a project and it may be more appropriate to handle them as change requests that can be handled in the change management process as part of the Service Transition volume in ITIL. As indicated before, this typically triggers design work that should also be checked for compliance with the enterprise architecture.

There is also a relationship between the problem management process in ITIL and enterprise architecture. In particular, problems may be drivers for change with an architectural impact. Formulated differently, enterprise architecture also includes a form of problem management, where structural solutions are sought for recurring issues. Given that such identification of solutions is part of TOGAF as well as ITIL, communication between the involved processes is needed to prevent redundancy of effort and/or conflict between suggested solutions.

Another important interface between the ITIL and TOGAF processes is that the Service Strategy processes in ITIL are really an input to enterprise architecture. In particular, the "strategy management for IT services" process maps onto the strategic planning process as depicted in Figure 2. It defines the goals, policies and actions that the enterprise architecture needs to build upon. Given the scope of ITIL, this strategic planning process is restricted to IT-strategy, and more specific to IT service strategy. However, a lot of what is described in the Service Strategy volume also applies to business strategy. Formulated even stronger: If you want to understand business strategy in general, you should really read the Service Strategy volume in ITIL. So TOGAF and enterprise architecture really lies between the Service Strategy and Service Design processes of ITIL. Note that this is not true for the business architecture, since defining the business strategy is not part of ITIL.

The final relationship of importance between ITIL and TOGAF is that the artifacts and information systems repositories that support them are related. This is a direct consequence of the fact that service design builds upon the deliverables of the enterprise architecture. Services that were identified in the enterprise architecture will be refined during service design. In practice, design is not only a top-down process. The enterprise architecture will start with describing the baseline architecture, and the IT services in the existing situation. Such IT services are administered in the service asset and configuration management process within ITIL Service Transition. Both ITIL and TOGAF propose repositories for documenting such building blocks. TOGAF positions the Architecture Repository as the location where all architecture deliverables, as well as the individual building blocks they consist of are administered. This architecture repository is part of an overall enterprise repository, and can take many different forms such as a database or file system. ITIL positions the Service Knowledge Management System, containing the Configuration Management System, as the location for storing information about IT services. The Configuration Management System can consist of multiple physical Configuration Management Databases that provide the actual administration of these IT services. Given that services are both input, as well as output from enterprise architecture, careful thought needs to go into how to manage this information. Figure 11 provides a recommended architecture. The Architecture Repository administers the IT services at a logical level, with relatively low detail. The Architecture Repository can initially be populated with information from the Configuration Management System. The latter provides a detailed description of IT services, focused on supporting the IT service management processes. It should also provide the link to the higher-level architectural layer, linking IT services at a logical level to IT services as a physical level. For example, a service "customer administration" in the architecture may link to multiple specific Customer Relationship Management systems that specific departments may have at a physical level. Linking these logical and physical levels will ensure that there is alignment between the enterprise architecture and IT service management. It provides the opportunity to drill down from the enterprise architecture to the detailed configuration information. Also, it allows IT specialists to understand how configuration items fit into the enterprise architecture. An overarching enterprise repository may be used to facilitate the integration of information from the Architecture Repository and Configuration Management System. This enterprise repository could become the true enterprise knowledge management system, integrating all sorts of information sources. In addition to the Architecture Repository and Configuration Management System, this could include sources such as process definitions, data definitions and software specifications. The author has successfully employed semantic wiki technology in the past for realizing such an enterprise repository.

Common Capabilities

The previous sections described how enterprise architecture and TOGAF relate to COBIT, PRINCE2 and ITIL. What has not been described so far, are their commonalities. What is interesting to see is that a number of general subjects are described in a number of frameworks. This includes subjects such as change management, risk management, stakeholder management and governance. To a lesser extent this also includes subjects such as knowledge management and requirements management (also see Table 4). The fact that these subjects are described in multiple frameworks indicates that they are really basic capabilities that organizations need. Some of these are described as processes in some of the frameworks, while in reality these capabilities may crosscut several processes and operate at different levels. Inherent with capabilities, is that they are
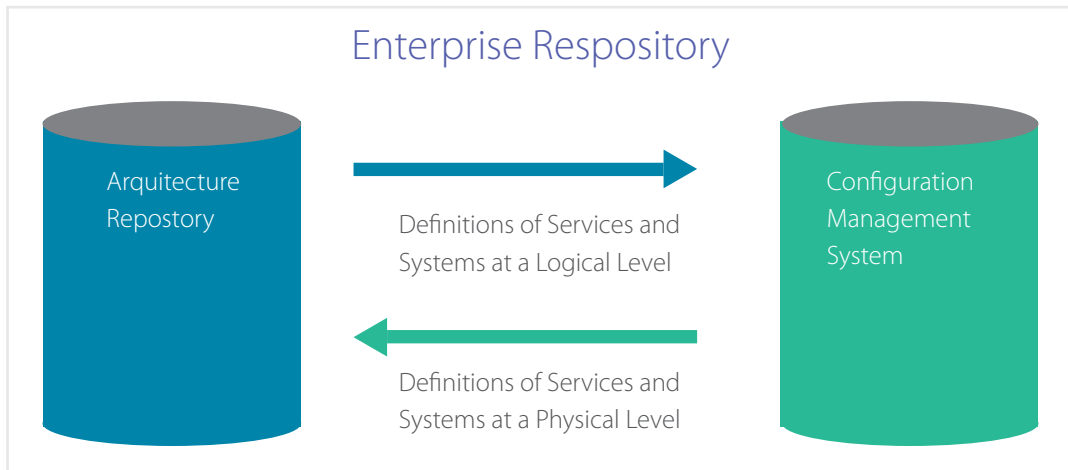
Figure 11 Connecting Repositories

more than just a process; they are the ability to do something that also requires skills, knowledge and tools. It would be good to have one place or framework that is the source of the capability, so that other frameworks can just refer to the source. As a matter of fact, one can say that COBIT is the source of all information related to the governance capability.

Capability	TOGAF	COBIT	PRINCE2	ITIL
Change management	√	√		√
Risk management	√	√	√	√
Stakeholder managemeßnt	√	√	√	√
Governance	√	√	√	√
Requirements management	√	√		√
Knowledge management	√	√		√

Table 4 Common Capabilities in Frameworks

Conclusion Remarks

This paper has described the relationships that TOGAF and enterprise architecture have with other process frameworks: COBIT, PRINCE2 and ITIL. These frameworks are all popular and used within a large number of organizations. In practice, people using these frameworks operate in a fairly isolated manner; they are also targeted at specific audiences: Architects use TOGAF, management uses COBIT, project managers use PRINCE2 and IT service managers use ITIL. This introduces the risk that these disciplines act in isolation, leading to process inefficiencies, communication problems and collaboration issues; and should be prevented as much as possible. This paper has attempted to provide assistance in breaking down/spanning these boundaries by describing their relationships and commonalities. The focal point has been TOGAF and enterprise architecture, which seems logical given that enterprise aims to bridge the gap between strategy and operations. The author, therefore, (pro) poses that enterprise architecture and TOGAF should play a pivotal role in organizations. In addition, TOGAF should also be integrated with other process frameworks such as COBIT, PRINCE2 and ITIL.

About the Author

Danny Greefhorst, MSc. is a Principal Consultant and Director of ArchiXL, an enterprise architecture consulting firm in The Netherlands. He acts as an architect and consultant for clients in the financial and public sector. Danny is responsible for the EA portal Via Nova Architectura and is a member of the board of the architecture section of the Dutch Computer Association (Ngi). He is author of the book, "Architecture Principles - The Cornerstones of Enterprise Architecture". In 2011 he received a medal of honor from the Dutch Architecture Forum for his contributions to the architecture community.

Acknowledgements

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Contacts

Danny Greefhorst
Principal Consultant and Director, ArchiXL

Tel: +31 (0)64 52 39 926
dgreefhorst@archixl.nl

ArchiXL
www.archixl.nl
Nijverheidsweg-Noord 60-27
3812 PM Amersfoort
The Netherlands

KvK nummer 05084421

Laurens Gunneweg
Product Manager | ITpreneurs

Tel: +31 (0)10 71 10 260
Email: laurens.gunneweg@itpreneurs.com

ITpreneurs
www.ITpreneurs.com
Weena 324-326
3012NJ Rotterdam
The Netherlands

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