

## *TOGAF® Series Guide*

### **Architecture Maturity Models**

Prepared by The Open Group Architecture Forum



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TOGAF® Series Guide

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## Preface

### The Open Group

The Open Group is a global consortium that enables the achievement of business objectives through technology standards. With more than 870 member organizations, we have a diverse membership that spans all sectors of the technology community – customers, systems and solutions suppliers, tool vendors, integrators and consultants, as well as academics and researchers.

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- Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate specifications and open source technologies
- Offering a comprehensive set of services to enhance the operational efficiency of consortia
- Developing and operating the industry's premier certification service and encouraging procurement of certified products

Further information on The Open Group is available at [www.opengroup.org](http://www.opengroup.org).

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### The TOGAF® Standard, a Standard of The Open Group

The TOGAF Standard is a proven enterprise methodology and framework used by the world's leading organizations to improve business efficiency.

### This Document

This document is a TOGAF® Series Guide to Architecture Maturity Models. It has been developed and approved by The Open Group.

More information is available, along with a number of tools, guides, and other resources, at [www.opengroup.org/architecture](http://www.opengroup.org/architecture).

### **About the TOGAF® Series Guides**

The TOGAF® Series Guides contain guidance on how to use the TOGAF Standard and how to adapt it to fulfill specific needs.

The TOGAF® Series Guides are expected to be the most rapidly developing part of the TOGAF Standard and are positioned as the guidance part of the standard. While the TOGAF Fundamental Content is expected to be long-lived and stable, guidance on the use of the TOGAF Standard can be industry, architectural style, purpose, and problem-specific. For example, the stakeholders, concerns, views, and supporting models required to support the transformation of an extended enterprise may be significantly different than those used to support the transition of an in-house IT environment to the cloud; both will use the Architecture Development Method (ADM), start with an Architecture Vision, and develop a Target Architecture on the way to an Implementation and Migration Plan. The TOGAF Fundamental Content remains the essential scaffolding across industry, domain, and style.

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## Referenced Documents

The following documents are referenced in this TOGAF® Series Guide.

(Please note that the links below are good at the time of writing but cannot be guaranteed for the future.)

- Architecture Capability Maturity Model (ACMM), Version 1.2, United States Department of Commerce (DoC), December 2007
- ISO/IEC/IEEE 42010:2011: Systems and Software Engineering – Architecture Description; refer to: <https://www.iso.org/standard/50508.html>
- Standard CMMI Appraisal Method for Process Improvement (SCAMPI®); refer to: <https://resources.sei.cmu.edu/library/asset-view.cfm?assetID=9703>
- The TOGAF® Standard, 10<sup>th</sup> Edition, a standard of The Open Group (C220), published by The Open Group, April 2022; refer to: [www.opengroup.org/library/c220](http://www.opengroup.org/library/c220)
- TOGAF® Series Guide: Architecture Skills Framework (G198), published by The Open Group, April 2022; refer to: [www.opengroup.org/library/g198](http://www.opengroup.org/library/g198)



# 1 Introduction

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## 1.1 Objective

This document introduces the concept of Architecture Capability Maturity Models, techniques for evaluating and quantifying an organization's maturity in Enterprise Architecture, including a publicly available framework as an example, which can be used by any enterprise to develop their own organization-specific maturity model.

## 1.2 Background

Organizations that can manage change effectively are generally more successful than those that cannot. Many organizations know they need to improve their processes in order to successfully manage change but don't know how. Such organizations typically either spend very little on process improvement, because they are unsure how to proceed; or spend a lot, on a number of parallel and unfocused efforts, to little or no avail.

Capability Maturity Models (CMMs) address this problem by providing an effective and proven method for an organization to gradually gain control over and improve its change processes. Such models provide the following benefits:

- They describe the practices that any organization must perform in order to improve its processes
- They provide a yardstick against which to periodically measure improvement
- They constitute a proven framework within which to manage the improvement efforts
- They organize the various practices into levels, each level representing an increased ability to control and manage the development environment

An evaluation of the organization's practices against the model – called an “assessment” – determines the level at which the organization currently stands. It indicates the organization's ability to execute in the area concerned, and the practices on which the organization needs to focus in order to see the greatest improvement and the highest return on investment. The benefits of CMMs to effectively direct effort are well documented.

## 1.3 History and Application

The Software Engineering Institute (SEI),<sup>1</sup> operated by Carnegie Mellon University, developed the original CMM (Capability Maturity Model) for Software (SWCMM) in the early 1990s, which is still widely used today. This CMM provided a framework to develop maturity models in a wide range of disciplines.

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<sup>1</sup> Refer to [www.sei.cmu.edu](http://www.sei.cmu.edu).

The increasing interest in applying these techniques to other fields has resulted in a series of template tools which assess:

- The state of the architecture processes
- Completeness of the architecture description
- The organization's buy-in to both

The main issues addressed by these models include:

- Process implementation and audit
- Quality measurements
- People competencies
- Investment management

They involve use of a multiplicity of models, and focus in particular on measuring business benefits and return on investment.

A closely related topic is the Architecture Skills Framework (see the TOGAF Series Guide: Architecture Skills Framework), which can be used to plan the target skills and capabilities required by an organization to successfully develop and utilize Enterprise Architecture, and to determine the training and development needs of individuals.

## 2 US DoC ACMM Framework

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### 2.1 Overview

As an example of the trend towards increased interest in applying CMM techniques to Enterprise Architecture, all US Federal agencies are expected to provide maturity models and ratings as part of their IT investment management and audit requirements.

In particular, the US Department of Commerce (DoC) has developed an Architecture Capability Maturity Model (ACMM) to aid in conducting internal assessments. The ACMM provides a framework that represents the key components of a productive Enterprise Architecture process. The goal is to enhance the overall odds for success of Enterprise Architecture by identifying weak areas and providing a defined evolutionary path to improving the overall architecture process.

The ACMM comprises three sections:

1. The Enterprise Architecture maturity model
2. Enterprise Architecture characteristics of operating units' processes at different maturity levels
3. The Enterprise Architecture CMM scorecard

The first two sections explain the Architecture Capability maturity levels and the corresponding Enterprise Architecture element and characteristics for each maturity level to be used as measures in the assessment process. The third section is used to derive the Architecture Capability maturity level that is to be reported to the DoC Chief Information Officer (CIO).

### 2.2 Elements of the ACMM

The DoC ACMM consists of six maturity levels and nine architecture elements. The six levels are:

- 0 None
- 1 Initial
- 2 Under development
- 3 Defined
- 4 Managed
- 5 Measured

The nine Enterprise Architecture elements are:

- 1 Architecture process
- 2 Architecture development
- 3 Business linkage
- 4 Senior management involvement
- 5 Operating unit participation
- 6 Architecture communication
- 7 IT security
- 8 Architecture Governance
- 9 IT investment and acquisition strategy

Two complementary methods are used in the ACMM to calculate a maturity rating. The first method obtains a weighted mean Enterprise Architecture maturity level. The second method shows the percentage achieved at each maturity level for the nine architecture elements.

## 2.3 ACMM Scoring Characteristics for Each Level of the Maturity Model

The following sections show the detailed characteristics of the Enterprise Architecture maturity levels as applied to each of the nine elements of the maturity model. For example, Level 3: Defined, point number 8 (Explicit documented governance of majority of IT investments) shows Maturity Level 3's state for Element 8 (Architecture Governance).

### Level 0: None

No Enterprise Architecture program. No Enterprise Architecture to speak of.

### Level 1: Initial

Informal Enterprise Architecture process underway.

1. Processes are *ad hoc* and localized. Some Enterprise Architecture processes are defined. There is no unified architecture process across technologies or business processes. Success depends on individual efforts.
2. Enterprise Architecture processes, documentation, and standards are established by a variety of *ad hoc* means and are localized or informal.
3. Minimal, or implicit linkage to business strategies or business drivers.
4. Limited management team awareness or involvement in the architecture process.
5. Limited operating unit acceptance of the Enterprise Architecture process.

6. The latest version of the operating unit's Enterprise Architecture documentation is online. Little communication exists about the Enterprise Architecture process and possible process improvements.
7. IT security considerations are *ad hoc* and localized.
8. No explicit governance of architectural standards.
9. Little or no involvement of strategic planning and acquisition personnel in the Enterprise Architecture process. Little or no adherence to existing standards.

## **Level 2: Under Development**

Enterprise Architecture process is under development.

1. The Basic Enterprise Architecture process is clearly documented. The architecture process has developed clear roles and responsibilities.
2. IT vision, principles, business linkages, Baseline, and Target Architecture are identified. Architecture standards exist, but not necessarily linked to Target Architecture. Technical Reference Model (TRM) and Standards Profile framework established.
3. Explicit linkage to business strategies.
4. Management awareness of architecture effort.
5. Responsibilities are assigned and work is underway.
6. The DoC and operating unit Enterprise Architecture web pages are updated periodically and are used to document architecture deliverables.
7. IT Security Architecture has defined clear roles and responsibilities.
8. Governance of a few architectural standards and some adherence to existing Standards Profile.
9. Little or no formal governance of IT investment and acquisition strategy. Operating unit demonstrates some adherence to existing Standards Profile.

## **Level 3: Defined**

Defined Enterprise Architecture including detailed written procedures and TRM.

1. The architecture is well defined and communicated to IT staff and business management with operating unit IT responsibilities. The process is largely followed.
2. Gap analysis and Migration Plan are completed. Fully developed TRM and Standards Profile. IT goals and methods are identified.
3. Enterprise Architecture is integrated with capital planning and investment control.
4. Senior management team aware of and supportive of the enterprise-wide architecture process. Management actively supports architectural standards.
5. Most elements of operating unit show acceptance of or are actively participating in the Enterprise Architecture process.

6. Architecture documents updated regularly on the DoC Enterprise Architecture web page.
7. IT Security Architecture Standards Profile is fully developed and is integrated with Enterprise Architecture.
8. Explicit documented governance of majority of IT investments.
9. IT acquisition strategy exists and includes compliance measures to IT Enterprise Architecture. Cost benefits are considered in identifying projects.

#### **Level 4: Managed**

Managed and measured Enterprise Architecture process.

1. Enterprise Architecture process is part of the culture. Quality metrics associated with the architecture process are captured.
2. Enterprise Architecture documentation is updated on a regular cycle to reflect the updated Enterprise Architecture. Business, Data, Application, and Technology Architectures defined by appropriate *de jure* and *de facto* standards.
3. Capital planning and investment control are adjusted based on the feedback received and lessons learned from updated Enterprise Architecture. Periodic re-examination of business drivers.
4. Senior management team directly involved in the architecture review process.
5. The entire operating unit accepts and actively participates in the Enterprise Architecture process.
6. Architecture documents are updated regularly, and frequently reviewed for the latest architecture developments/standards.
7. Performance metrics associated with IT Security Architecture are captured.
8. Explicit governance of all IT investments. Formal processes for managing variances feed back into Enterprise Architecture.
9. All planned IT acquisitions and purchases are guided and governed by the Enterprise Architecture.

#### **Level 5: Measured**

Continuous improvement of Enterprise Architecture process.

1. Concerted efforts to optimize and continuously improve architecture process.
2. A standards and waivers process is used to improve architecture development process.
3. Architecture process metrics are used to optimize and drive business linkages. Business involved in the continuous process improvements of Enterprise Architecture.
4. Senior management involvement in optimizing process improvements in architecture development and governance.

5. Feedback on architecture process from all operating unit elements is used to drive architecture process improvements.
6. Architecture documents are used by every decision-maker in the organization for every IT-related business decision.
7. Feedback from IT Security Architecture metrics are used to drive architecture process improvements.
8. Explicit governance of all IT investments. A standards and waivers process is used to make governance-process improvements.
9. No unplanned IT investment or acquisition activity.

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## 3 Capability Maturity Models Integration (CMMI)

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In recent years the industry has witnessed significant growth in the area of maturity models. The multiplicity of models available has led to problems of its own, in terms of how to integrate all the different models to produce a meaningful metric for overall process maturity.

### 3.1 CMMI

The SEI is currently involved in developing, expanding, and maintaining several capability models, one of which is the Capability Maturity Model Integration (CMMI®).

#### 3.1.1 Introduction

The CMMI is a proven set of global best practices that drives business performance through building and benchmarking key capabilities.

Originally created for the US Department of Defense to assess the quality and capability of their software contractors, CMMI models have expanded beyond software engineering to help any organization in any industry to build, improve, and measure their capabilities and improve performance. For over 25 years, high-performing organizations around the world have achieved demonstrable, sustainable business results with the CMMI.

CMMI best practices focus on what needs to be done to improve performance and align operations to business goals. Designed to be understandable, accessible, flexible, and integrate with other methodologies such as agile, CMMI models help organizations to understand their current level of capability and performance and offer a guide to optimize business results.

The CMMI Institute helps enterprises to meet the challenges of the changing global business landscape.

#### 3.1.2 CMMI Views and Models

CMMI Institute models help to identify and improve the key capabilities that elevate your organization's performance, quality, and profitability. Many times, in business, the problem or solution is not obvious. With proven best practices, CMMI Institute models allow you to see how your organization's existing processes measure up and where performance improvements are needed.

Use of the models and views results in reduced risk, rework, defects, delivery errors, and cost. It also results in increased customer satisfaction, productivity, decision-making ability, quality, and competitive advantage.

The CMMI family of resources is broken into views (as per the TOGAF Standard and ISO/IEC/IEEE 42010) and models, both of which are sets of best practices and key capabilities.



The CMMI views are as follows:

- The CMMI V2.0 Model – Development View is an integrated set of best practices that improves an organization’s capability to develop quality products and services that meet the needs of customers and end users

**Key benefits** are Increase Quality, Reduce Cost, Improve Time-to-Market, Improve Product Lifecycle Management, and Gain Organizational Agility.

- The CMMI V2.0 Model – Services View is an integrated set of best practices that improves an organization’s capability to efficiently and effectively deliver quality service offerings that meet market and customer needs

**Key benefits** are Gain Customer Loyalty, Develop Resiliency, Improve Time-to-Market, Increase Quality, and Reduce Cost.

- The CMMI V2.0 Model – Supplier Management View is an integrated set of best practices that improves an organization’s capability to identify and manage suppliers and vendors in a way that maximizes supply chain efficiency and reduces risk

**Key benefits** are Meet Growth Demands, Keep Pace with Product Demands, and Reduce Supply Chain Risk.

The CMMI models are as follows:

- The People Capability Maturity Model (People CMM) provides guidance for improving the capability of an organization’s workforce

These best practices help to identify skill gaps to break down workflow bottlenecks and empower team members to develop skills that will help the organization succeed.

**Key process areas** are Communication & Coordination, Empowered Workgroups, Compensation, Continuous Workforce Innovation & Planning, Competency & Career Development.

- The Data Management Maturity (DMM) model provides guidance for improving your organization’s capability across the enterprise to build a customized roadmap for data management improvement

The DMM provides best practices for implementing data strategy, governance, quality, operations, and architecture.

**Key process areas** are Data Management Strategy, Data Governance, Data Quality, Data Operations, and Data Architecture.

According to the SEI, the use of the CMMI models improves on the best practices of previous models in many important ways, in particular enabling organizations to:

- More explicitly link management and engineering activities to business objectives
- Expand the scope of and visibility into the product lifecycle and engineering activities to ensure that the product or service meets customer expectations
- Incorporate lessons learned from additional areas of best practice (e.g., measurement, risk management, and supplier management)

- Implement more robust high-maturity practices
- Address additional organizational functions critical to its products and services
- More fully comply with relevant ISO standards

CMMI is being adopted worldwide.

## 3.2 SCAMPI<sup>®</sup> Method

The Standard CMMI Appraisal Method for Process Improvement (SCAMPI) is the appraisal method associated with CMMI. The SCAMPI appraisal method is used to identify strengths, weaknesses, and ratings relative to CMMI reference models. It incorporates best practices found successful in the appraisal community, and is based on the features of several legacy appraisal methods. It is applicable to a wide range of appraisal usage modes, including both internal process improvement and external capability determinations.

The SCAMPI method definition document<sup>2</sup> describes the requirements, activities, and practices associated with each of the processes that compose the SCAMPI method.

For additional information on this method, refer to: <https://resources.sei.cmu.edu/library/asset-view.cfm?assetID=9703>.

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<sup>2</sup> Available at: <http://www.sei.cmu.edu/publications/documents/01.reports/01hb001.html>.

## 4 Conclusions

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This document has sought to introduce the topic of CMM-based methods and techniques for use in relation to Enterprise Architecture.

The benefits of using CMMs are well documented. Future versions of the TOGAF Standard may include a maturity model to measure adoption of the TOGAF Standard itself.

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