IT@Intel White Paper

Intel IT
IT Best Practices
IT Investment Management
May 2011

Developing a Standard Enterprise Architecture Practice

To achieve the full benefits of enterprise architecture, such as reuse of technology and processes, we need to be able to define architecture that can be applied across Intel IT. This requires an enterprise-wide architecture practice.

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Executive Overview

Enterprise architecture is a critical component of Intel's IT strategy. Enterprise architects map the way that technology and information help Intel achieve its current and future business goals. They produce strategic and solution-specific architectures used by all major IT projects at Intel, and partner with Intel IT strategic planning, engineering, and operations groups to deliver solutions based on these enterprise architectures.

Enterprise architecture has become increasingly important as Intel's business processes become more reliant on technology. To achieve the full benefits of enterprise architecture, such as reuse of technology and processes, we need to be able to define architecture that can be applied across Intel IT. This requires an enterprise-wide architecture practice—a community of practitioners with standard governance, methods, and tools.

This enterprise-wide practice has evolved over more than a decade. Before 2000, use of common IT architecture across Intel was limited. IT architects were primarily engineers, with most of their efforts focused on individual projects and programs. To develop our enterprise architecture practice, we:

- Created a dedicated architecture group and adopted an enterprise architecture framework that defined a standard methodology, set of deliverables, tool set and repository, and governance.
- Added business architecture skills to help translate business needs into technology.
- Focused on developing talent and a common skill set across Intel IT, using a skills certification program, annual summit, and other methods.
- Implemented a continuous improvement process based on a structured assessment methodology.

Our goal is to continue to increase the reach and process sophistication of our practice. This will help accelerate development timelines and reduce complexity and risk due to simplified design and reuse of technology and processes.

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THE VALUE OF ENTERPRISE ARCHITECTURE

Enterprise architecture is a critical component of Intel's IT strategy. Enterprise architects map the way that technology and information help Intel achieve its current and future business goals. To achieve this, they define, assess, and document a holistic view of the structure and operation of the enterprise—from business processes to the information, applications, and technical infrastructure that support them.

Enterprise architects produce strategic and solution-specific architectures used by all major IT projects at Intel. They partner with Intel IT strategic planning, engineering, and operations groups to deliver solutions based on this enterprise architecture.

Architects help Intel IT and business groups transition from current to future technology. They define a blueprint of the current state, focus on the areas most affected by proposed changes, and then define a blueprint for the future. Because architecture can be used across multiple IT projects, it helps drive technology reuse, which results in productivity benefits and cost savings.

Enterprise architects are also an integral part of the Intel IT strategic planning process, typically working in small teams with strategic planners and financial analysts to translate business needs into technology architecture. They play key roles in the Intel IT annual Environmental Scan and IT Roadmap Planning. The Environmental Scan is an element of the strategic planning process in which we identify important technology and business trends so that Intel IT can determine where to focus its resources in the future. IT Roadmap Planning analyzes the needs of our internal customers over the next three to five years and then determines the strategies and prioritized deliverables required to meet those needs.

The Challenge: Creating an Enterprise-wide Architecture Practice

To achieve the full benefits of enterprise architecture, we need to be able to define architecture that can be applied and reused across Intel IT. This requires an enterprise-wide architecture practice—a community of practitioners with standard governance, methods, and tools.

Until 2000, however, use of common IT architecture across Intel was limited. IT architects were primarily engineers who focused most of their efforts on individual programs. There was little emphasis on commonality across programs; this limited the ability to achieve benefits such as reuse across our enterprise environment.

Over the past decade, we have established and matured a standardized enterprise architecture practice across Intel, as shown in Figure 1. This evolution required organizational change as well as the adoption of standard practices and tools. Our vision was to enable increased agility, help manage complexity by increasing commonality and simplifying architectural design, and help reduce development time.

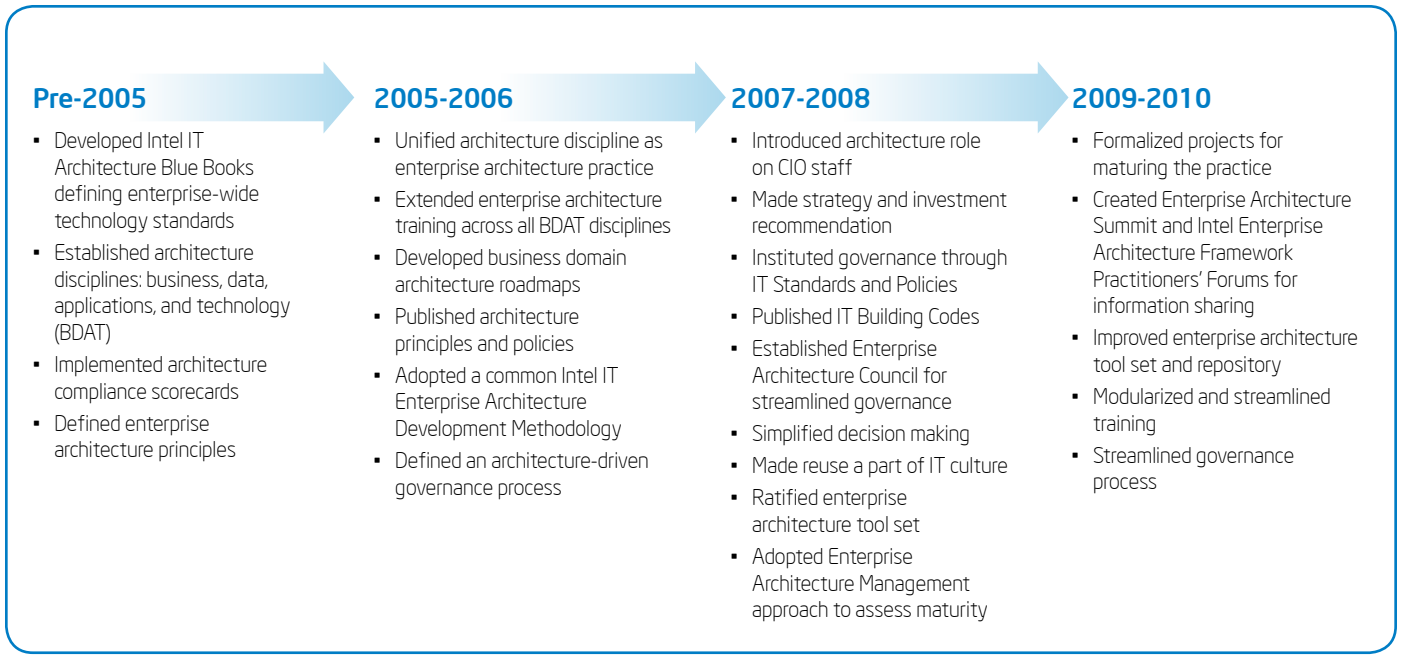

Figure 1. Intel IT's enterprise architecture practice has evolved over the last 10 years.

EVOLUTION OF AN ENTERPRISE ARCHITECTURE PRACTICE

We began evolving our enterprise architecture practice by creating and adopting technical standards for use in production systems across Intel IT in the late 1990s. Examples include defining specifications for minimum security requirements and for messaging infrastructure.

These standardized specifications described product configurations and provided implementation guidance. However, they did not provide long-term roadmaps. As Intel's business groups became more dependent on IT, it became increasingly apparent that we needed technology roadmaps to help plan for the future.

In 2001, we addressed this need by creating Intel IT Architecture Blue Books, which include three-year roadmaps for specific technologies. These Blue Books communicate the vision for the future technology state, along with a recommended course of action to reach this state. Blue Books provide strategic guidance to project teams; they define architecture policies, standards, and procedures in areas that include security, usability, and infrastructure. Use of the common Blue Books across multiple projects has helped drive standardization and simplify the environment.

Though we had begun to create enterprise-wide technology standards, we still lacked an enterprise-wide architecture practice. In 2004, as Intel's business processes continued to become more reliant on IT, we decided to establish a centralized enterprise architecture group to complement the architects already associated with specific business groups. At the same time, we began to develop a standard practice for use across Intel IT.

We also realized that our architects needed broader skills in order to translate business requirements into technology. At the time, architects were typically skilled in one or more of three architectural disciplines: Data Architecture, Applications Architecture, and Technical Architecture. We added a fourth discipline, Business Architecture, to better meet business needs and complete our skill set. To help build Business Architecture expertise, we added and trained specialists from specific Intel business groups, such as finance and manufacturing. Some of these people were then dedicated to creating Business Architecture for the business groups. We also defined and created a Business Architecture training program.

To develop a standardized enterprise architecture practice and apply it across Intel IT, we needed to align culture, skills, and methods across these architectural disciplines.

Intel Enterprise Architecture Framework

A key step in the evolution of our standard practice was developing the Intel Enterprise Architecture Framework. This provides a common language and way to categorize activities; the creation of this framework helped us prioritize initiatives and drive standardization on common tools, methods, and deliverables.

The framework has four main components, as shown in Figure 2, including the Intel IT Enterprise Architecture Development Methodology, standard definitions of architecture deliverables, a common tool set and repository, and governance. Together, these components determine how we build enterprise architecture. Each component is described in more detail below.

INTEL IT ENTERPRISE ARCHITECTURE DEVELOPMENT METHODOLOGY

This methodology defines the standard processes for developing architecture deliverables. We based this methodology on an industry-standard framework. It includes five steps:

1. Plan and align the specific architecture. This includes helping to ensure that the architecture has management support and is aligned with business goals. It also includes defining scope and key constraints.
2. Identify, develop, or refine the baseline (as-is) architecture.
3. Identify, develop, or refine the target (to-be) architecture.
4. Perform gap analysis and recommend an implementation approach.
5. Communicate results to all stakeholders.

We employ this methodology to develop each of the architecture deliverables described below.

STANDARD DEFINITIONS OF ARCHITECTURE DELIVERABLES

We standardized on three main architecture types: Strategic, Reference, and Solution. Each of these has Business, Data, Application, and Technical Architecture components.

Strategic Architecture

Strategic Architecture sets direction over the longer term—typically 18 months to five years—and helps drive planning discussions. It articulates the context, priorities, and plans that set the boundary conditions and roadmap for the development of Reference and Solution Architectures over the prescribed period. Strategic Architecture is the most abstract of the three architecture types.

Reference Architecture

Reference Architecture focuses on identifying and standardizing a solution for a particular domain; it provides a proven template solution for that domain. It also defines common vocabulary, boundaries, and guidelines, with the goal of promoting integration, standardization, and reuse. A Reference Architecture is characterized by a medium level of abstraction.

Solution Architecture

Solution Architecture describes a specific solution in detail to enable its implementation in the near term. The focus is on defining a solution for specific IT projects, based on a business group's requirements and plans.

COMMON TOOL SET AND REPOSITORY

As we centralized our architecture practice, we needed to make architectural information available in a consistent, reusable form across Intel.

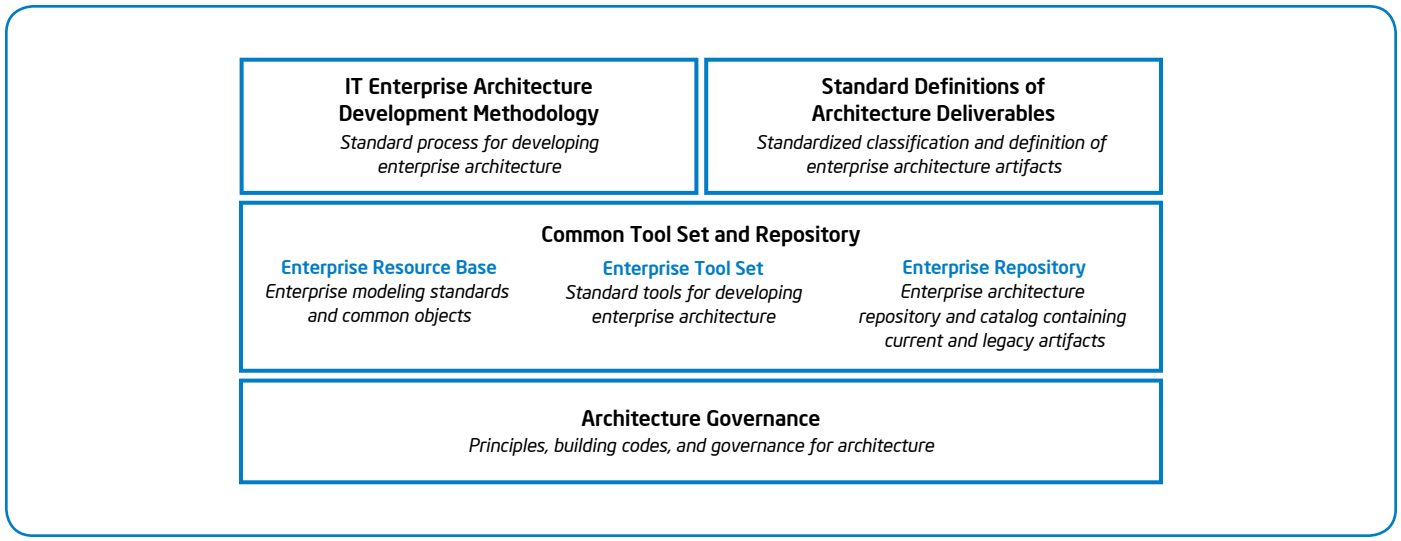

Figure 2. Intel's Enterprise Architecture Framework has four main components: the Intel IT Enterprise Architecture Development Methodology, standard definitions of architecture deliverables, a common repository and tool set, and governance.

Accordingly, in 2006 we standardized on a single enterprise architecture tool set. Previously, disparate groups of enterprise architects used different tools to create and maintain architectural information. In conjunction with this, we created a common repository and a single portal for accessing our standard processes, templates, and tools.

Standardization made it easier to reuse and share architectural artifacts such as diagrams and reports across Intel. This helped promote reuse and improve the quality and consistency of deliverables.

GOVERNANCE

Strong governance is essential to develop a consistent enterprise-wide practice and to help ensure that IT projects comply with the established architecture standards.

Our initial steps included defining a set of enterprise architecture principles that we use to guide our architecture policies and standards. These principles include enabling business strategy, designing solutions with the end user's needs in mind, and addressing production support requirements.

IT Building Codes

We created IT Building Codes designed to align projects to the relevant architecture. They contain policies, standards, and procedures for project areas such as security, usability, and hosting.

Each project must assess which codes are relevant and then use a scorecard to measure compliance. Compliance involves adherence to specific Blue Books, the use of the appropriate tools, providing required documentation, and other requirements. This self-assessment model simplifies project management by allowing project managers to make more decisions themselves, consulting with an enterprise architect only as necessary.

Streamlining Decision Making

In 2007, Intel IT adopted a standard decision making methodology for use across the IT organization, including the enterprise architecture group. By applying this methodology, we identified the need for a top enterprise architecture technical decision making body. We call this body the Enterprise Architecture Council (EAC).

The EAC approves, promotes, and enforces architecture technical standards. It includes Intel IT senior management and is chaired by the head of the Intel IT enterprise architecture group. The council creates committees that recommend ratification of changes to Building Codes; audit compliance to architecture; and approve waivers. There are also workgroups and committees focused on specific architecture topics.

Talent Development

To translate business needs into technology architecture, enterprise architects at Intel are expected to speak the language of business and acquire Business Architecture skills.

We established a series of programs and forums to facilitate the development of a broad, common skill set and to create a culture that unifies architects with different backgrounds. For example, we provided opportunities for enterprise architects to participate in an industry-standard certification program, with the goal of growing a worldwide, standard enterprise architecture competency. We also established an internal mentoring program.

Our aim was to help architects become conversant with all four architectural disciplines—Business, Data, Application, and Technology—and strengthen proficiency in both strategic and tactical architecture development.

Ongoing forums provide opportunities for architects to learn and share information. Practitioners meet regularly to share best-known methods, network, and integrate Intel's enterprise architecture. These forums are reinforced by an annual internal conference, the Enterprise Architecture Summit.

We also developed a handbook to help architects learn or refresh their memories about specific enterprise architecture topics and a newsletter to share interesting projects and successes.

Assessment and Continuous Improvement

Based on the results of a broad Intel IT internal review in 2007, IT management requires that that we provide an assessment of continuing efforts to improve our enterprise architecture practice.

To do this, we use an approach called Enterprise Architecture Management (EAM), which is an element of the IT Capability Management Framework (IT-CMF). Intel IT initially developed the IT-CMF, and it is now part of the research and education agenda of the Innovation Value Institute, a consortium of more than 50 industry and academic organizations (www.ivi.ie).

EAM defines eight capability building blocks in three broad categories: planning, practices, and people. Within each of these areas, we assess the maturity of our practice, assigning a score from 1 to 5. Maturity is based primarily on two factors: reach within the organization—from individual projects to enterprise-wide—and process sophistication. To manage the assessment, we established a core team that includes participants from key groups. The assessment results in specific recommendations for improvement in each area. We continue to conduct these assessments annually; they have become the foundation of a continuous improvement process. By implementing the recommendations identified in each assessment, we have achieved significant improvements, as shown in Figure 3.

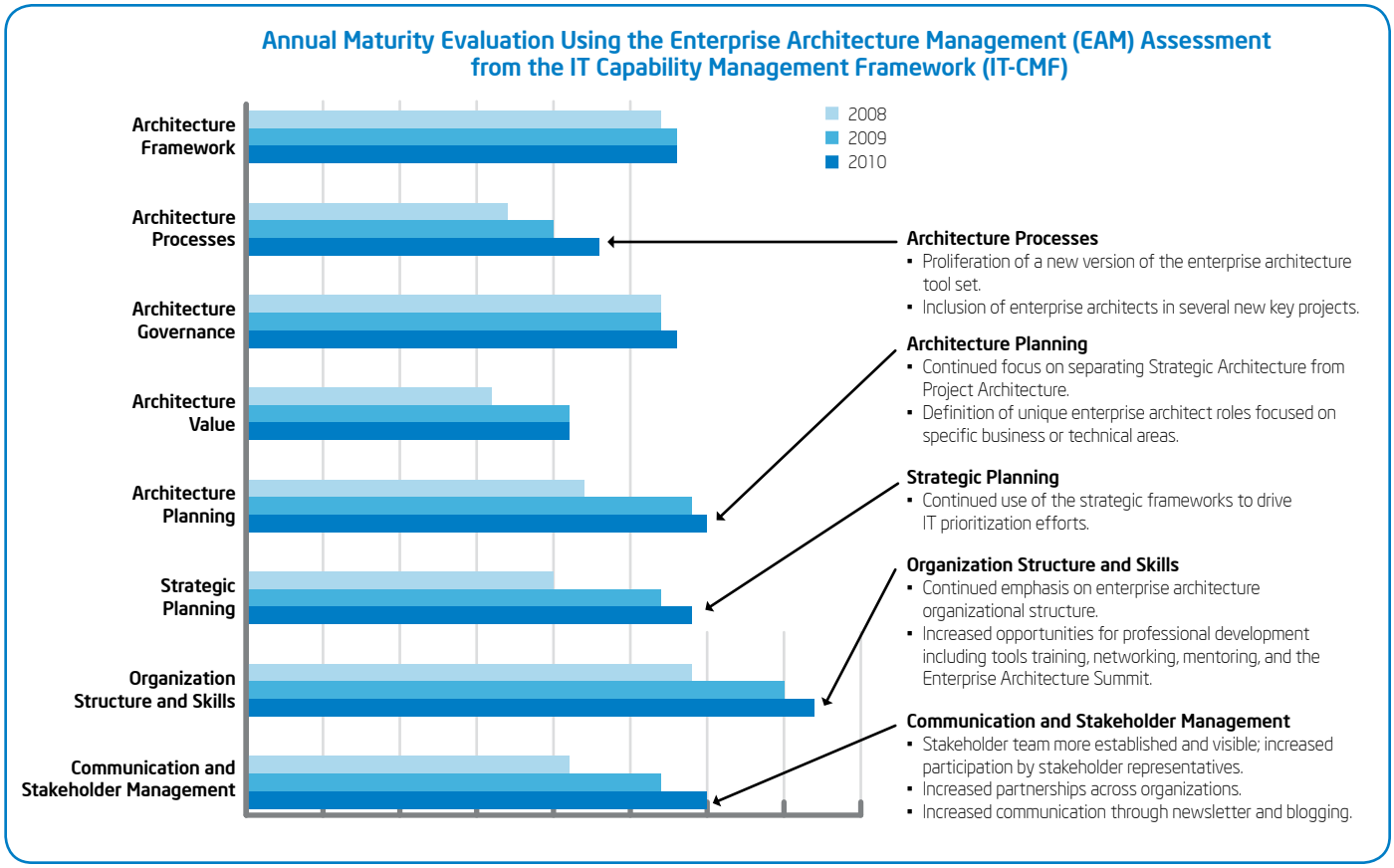

Figure 3. Intel IT has seen continuous improvement in our enterprise architecture practice as the result of annual maturity assessments.

RESULTS AND CURRENT PROJECTS

The evolution of our enterprise architecture practice has resulted in significant benefits to Intel. A standard architecture highlights substantial opportunities to reuse technology and processes across Intel IT, increasing productivity.

To encourage reuse, we initially tracked benefits attributable to reuse across Intel IT. For example, we created the architecture for an authentication mechanism that was then reused across multiple projects. Since 2008, reuse has been considered an established part of IT culture, and we no longer need track reuse in order to demonstrate the benefits. Examples of current architecture successes include service transformation architecture, IT consumerization, and enterprise customer information management.

Service transformation architecture. Intel IT's operations group is transforming the way we provide services and support, using an approach based on the Information Technology Infrastructure Library* (ITIL*) framework. This involves a shift away from supporting individual products to a strategy that delivers and supports end-to-end services such as e-mail and connectivity. This strategy is already achieving benefits such as reductions in major incidents and service calls. Enterprise architects helped enable this transformation by mapping Intel business processes to IT services, accelerating reuse of Solution Architecture across different service scenarios and helping to understand total cost of ownership. Architecture deliverables included a new service interaction model that helps Intel IT groups understand and define services, the dependencies between them, and the value they provide to users.

IT consumerization. An increasing number of Intel's employees want to use their personally owned handheld devices within the enterprise. This trend is known as IT consumerization. The number and variety of these devices is increasing rapidly; today it includes smart phones, tablets, and personal PCs, and in the future will include new device categories that have not yet emerged. Enterprise architects worked with other Intel groups to create a Reference Architecture that defines policy and the services we can support for devices that Intel IT does not manage. In 2010, Intel IT began letting employees use personal smart phones to access corporate e-mail and calendar services. This initial groundwork helps Intel's client engineering teams more quickly support new devices, such as tablets, non-standard PCs, and a wider range of smart phones, as they become available.

Enterprise customer information management. We defined a Strategic Architecture for customer information management that provides a vision for

unifying all information about each Intel customer. Today, such information may be held in variety of systems. The new architecture defines an end-to-end view across the customer life cycle, from sales leads to support. This helps guide implementation and improve data quality.

CONCLUSION

Over the past decade, Intel IT has transformed our enterprise architecture practice into a strategic capability based on a common set of methods and tools. Enterprise architects partner with Intel IT engineering and operations teams to create solutions; the deliverables—Strategic, Reference, and Solution Architectures—are used by all major IT projects within Intel IT.

Within Intel overall, there are now more than 150 enterprise architects. About 60 work in our core enterprise architecture group, and 40 are associated with specific Intel business groups.

We continue to work on improving our practice by applying a structured assessment methodology and focusing on the recommendations identified in each assessment. Our goal is to continue to increase the reach and process sophistication of our practice. This will help accelerate development timelines and reduce complexity and risk due to simplified design and reuse of technology and processes.

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ACRONYMS

BDAT	business, data, applications, and technology
EAC	Enterprise Architecture Council
EAM	Enterprise Architecture Management
IT-CMF	IT Capability Management Framework
ITIL	Information Technology Infrastructure Library

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