intel®

# IT@INTEL

# Enterprise Architecture: Enabling Digital Transformation at Intel

**Modernizing, simplifying, and mapping IT assets and processes promotes innovation and transformation, reduces technical debt, improves business agility, and supports Intel's strategic growth imperative**

*Our enterprise architecture efforts have provided a framework for digital transformation, helping to bring order to chaos.*

## Author

**Palvinder Singh**
Principal Engineer, Intel IT

## Table of Contents

## Executive Summary

Enterprise architecture (EA) has become essential for corporations to be successful in addressing and supporting digital transformation and business growth at a much faster pace in an ever-changing environment. At Intel, we define EA as applying technology advancements across the entire architecture ecosystem to radically change how we operate, compete, and grow across businesses and geographies.

Business models, technologies, and customer needs are changing at a break-neck pace. Intel must quickly adapt to necessary transformations (digital or otherwise) and technology disruptions to not only survive, but to *thrive*. Intel IT is in a unique position to support that agility—but only if we know what we have to work with and what effect changes will have.

In 2016, with a new CIO and mandate around EA, we began our journey to build an effective EA. For Intel IT, this meant that we needed end-to-end, integrated, consistent reference architectures and a long-term technology roadmap that are aligned with business needs and corporate strategies, industry and technology advancements, and supplier landscape. Now, and into the future, EA provides the following benefits:

- Accommodate an ever-changing business landscape and industry trends
- Place decision makers in front of a reliable representation of the enterprise to help them influence the direction of the company and the relevant processes
- Reduce technical debt with a modern and simplified architecture
- Remove or reduce bureaucratic processes with governance automation

Our EA efforts have provided a framework for digital transformation, helping to bring order to chaos.

## Intel IT Contributors

**Craig Chvatal,** Principal Engineer

**Nikhil Chhabra,** Director of IT Strategy

**Jason Devoys,** Principal Engineer

## Acronyms

| | |
|---|---|
| **APM** | application portfolio management |
| **BDAT** | business, data, application, and technology |
| **BOS** | business outcome statement |
| **BU** | business unit |
| **CIO** | Chief Information Officer |
| **CoE** | Center of Excellence |
| **CTO** | Chief Technology Officer |
| **CoP** | Community of Practice |
| **DaaS** | data as a service |
| **EA** | enterprise architecture |
| **IaaS** | infrastructure as a service |
| **KPI** | key performance indicator |
| **LSA** | lead segment architect |
| **PaaS** | platform as a service |
| **SaaS** | software as a service |
| **TOGAF** | The Open Group Architecture Framework |
| **TRC** | Technical Review Committee |
| **TWG** | Technical Workgroup |

## Business Challenge

In today's data-driven and fast-paced marketplace, Intel's continued success hinges on quickly adapting to market disruptions and opportunities through innovation and digital transformation. Intel IT is committed to contributing to that success by:

- Supporting a radical rethinking of Intel's business processes and outcomes, as Intel's business strategy transforms
- Continuously assessing and taking actions to level up the maturity of business and technical capabilities
- Accelerating delivery of effective, scalable solutions to support Intel's transformation from a PC-centric company to a data-centric company and beyond
- Using optimization, modernization, and simplification to reduce and prevent technical debt, thereby shifting investment dollars from "run" to "innovate"

However, though Intel IT has long had an enterprise architecture (EA) mindset, support and commitment (and EA results) have been inconsistent over the years, due to several challenges.

Most importantly, upper management commitment to EA was lackluster at best because of an inconsistent approach to EA from several IT organizations. Most of these organizations were not fully funded and resourced with the right skills for EA, but some other organizations were. This resulted in an imbalance of EA resources and skill sets across Intel IT.

Also, IT and business strategies were not previously well aligned or understood by all stakeholders due to a tenuous integration between IT and Intel business units (BUs). IT was perceived more as an order taker and a PC supply organization than a business partner. EA processes were bureaucratic, and the value of EA was not understood by all stakeholders. IT delivery teams and Intel's BUs worked in their own silos, with little or no partnership.

Another challenge was that our legacy EA documentation tool focused mainly on business architecture, with limited access to other architects from business, data, application, infrastructure, security, and technology domains. And lack of standardization and automation across our toolset and artifact modeling notation resulted in inconsistency, unnecessary complexity, and lack of reuse.

These challenges had several negative effects:

- It was difficult and labor intensive to analyze the impact of any change, or identify areas of improvement that were much needed for digital transformation.
- We were slow to keep up with the change in Intel's business and technology landscape.
- Alignment and alliance with Intel's BUs were suboptimal.
- Architecture was created and managed in silos and reference architecture blueprints lacked consistency and cohesiveness of end-to-end integration between the business, data, application, and technology (BDAT) domains. Moreover, these blueprints were lifeless and mostly out-of-date.
- It was difficult to identify technical debt or technical gaps due to lack of visibility into foundational reference architectures (that is, EA building blocks).

## What's in a Name?

Here's how Intel IT defines several key terms used in this paper.

**Enterprise architecture (EA)** is "a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes," according to the Gartner IT Glossary. It is also important to note that for Intel, EA covers not only on-premises capabilities, but the entire ecosystem: business, data, applications, and technology (BDAT)—both on-premises and off-premises.

**Digital transformation** refers to the use of technology that generates, stores, and processes data to achieve a fundamental change to an organization's day-to-day business—from the types of products and services it produces to how it delivers them.

**Key performance indicators (KPIs)**, as defined by KPI.org, are the critical (key) indicators of progress toward an intended result. KPIs provide a focus for strategic and operational improvement, create an analytical basis for decision making, and help focus on what matters most.

## Solution

Due to the rapid pace of change and Intel's ongoing digital transformation, and with sponsorship from the Chief Information Officer (CIO) and Chief Technical Officer (CTO), we are reinvigorating Intel's EA.

The following sections provide an overview of our approach to EA, discuss our new EA operating model, then delve deeper into how we have, and continue to solve the aforementioned challenges with **people, processes,** and **tools**. We also describe how using an industry-standard EA framework has allowed us to make steady progress in achieving our EA goals.

Although our EA journey is not yet complete, we anticipate great business value from our efforts. Refer to the Results section for more details on EA business benefits and our accomplishments so far, along with some examples.

### Intel IT's EA Operating Model

We learned from past mistakes and obtained management buy-in and support on our EA initiative. We researched the following commonly used EA operating models:

- **Centralized EA model.** EA is owned by one organization under one leader, such as the Director of EA or VP of Enterprise Architecture. Most of the enterprise architects report to this organization.
- **Distributed model.** Multiple independent architecture groups, each reporting to different managers.
- **Federated model.** A centralized architecture group under the CTO, and architects in other value streams and solution groups[1] with dotted-line responsibility to the central group.

Given Intel's large size, we chose the **Federated** model and presented our plans to management. Having management commitment meant we could make the necessary investments in people, processes, and tools that we needed to succeed. Our EA organizational structure is illustrated in Figure 1.

---

[1] Value streams are generally verticals such as finance, human resources, and supply chain; solution groups are horizontal domains: platform as a service (PaaS), data as a service (DaaS), information security as a service (ISaaS), infrastructure as a service (IaaS), enterprise architecture (EA), and business of IT (BoIT).

### A Closer Look at Technical Debt

Industry definitions vary—here is Intel IT's take.

Intel IT defines technical debt as the following:

- Redundant applications that enable similar business processes or functions
- Applications or data with exposure to risks (including security, compliance, copyrights, and licenses)
- Duplicate IT services for infrastructure, platforms, competing products, database solutions, and more
- Solutions that are not consuming reusable assets
- Technologies or solutions that have low return on investment, low cost efficiencies, or minimal usage
- Systems and applications that run on unsupported suppliers' products or are out of compliance with Intel future-state platforms
- Reducing/avoiding/de-commissioning custom-coded solutions and integrations that implement non-differentiating capabilities

Next, we took advantage of existing governance structures and also created a few new entities that would support our EA efforts. This structure comprises four main entities:

- **EA Center of Excellence (CoE)** to form our EA strategy (new)
- **Technical Workgroups (TWGs)** to build the EA foundation (existing)
- **EA Community of Practice (CoP)** to make our vision a reality (new)
- **EA Compliance and Governance** to oversee, through Technical Review Committees (TRCs), the entire process (new and existing)

In addition, our CTO leads an EA Review Board that meets quarterly.
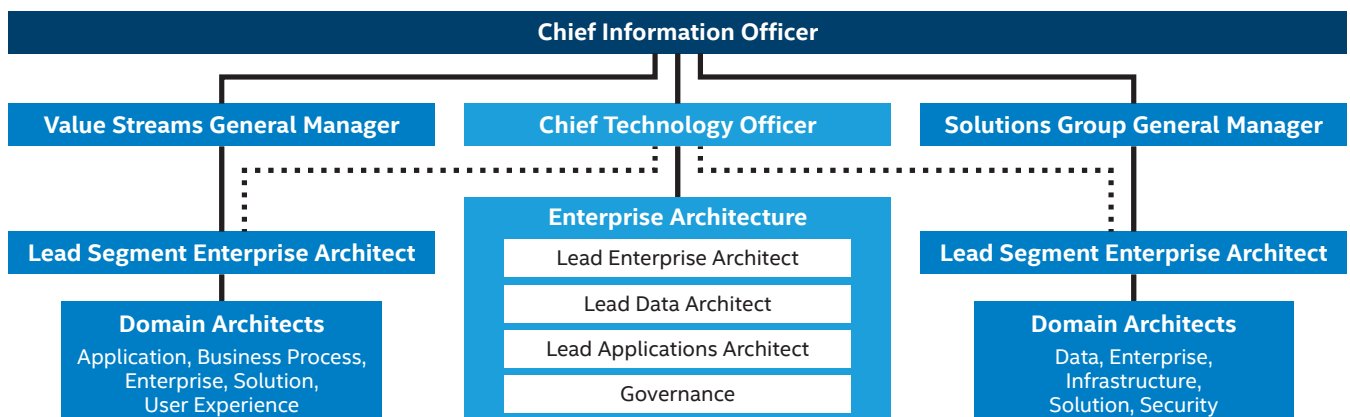


**Figure 1.** Our enterprise architecture (EA) organizational structure links lead segment architects (LSAs), enterprise architects, and technologists to frame a holistic view of Intel's business and technology needs.

## Enterprise Architecture Center of Excellence (EA CoE) Sets the EA Strategy

Our EA CoE defines our EA vision, objectives, and goals, aligning with Intel's business strategies and imperatives that enforce EA. The EA CoE directly supports Intel IT's overall digital transformation and also defines practices and principles for delivering uniform, cohesive, and consistent architecture blueprints for all BDAT domains. We created end-to-end, integrated multi-year technology roadmaps aligned with business needs, industry and technology advancements, and supplier landscape, and we highlighted potential gaps. We also refined processes to establish overall reference architectures (sometimes called "North Star" architectures or "EA building blocks"). Working with the TWGs, the EA CoE addresses compliance, governance, and automation.

The EA CoE consists of key domain owners (or their delegates) and meets once a month. Domains span the entire architecture ecosystem (not just on-premises assets)—see Table 1.

### Keeping on Track

To ensure we make measurable progress and achieve our expected results, we established several tracks for every domain and defined key performance indicators (KPIs) to measure progress toward goals. Tracks are pathways or initiatives that lead us toward North Star reference architectures and digital transformation, and that meet corporate and IT objectives. Tracks provide complete visibility to all stakeholders as to what is coming up (now and in the future). We use three types of tracks:

- Active programs within a one- to two-year horizon
- Exploration of new business and technical capabilities within a two- to three-year horizon
- A "wish list" of disruptors and revolutionary capabilities that are realistic and well-aligned with Intel's strategic objectives. These tracks generally have a three-year horizon, or more.

Examples of tracks include predictive analytics, cloud infrastructure strategies, self-learning, and governance automation.

### The EA CoE Is Key to Digital Transformation

The EA CoE is instrumental in promoting innovation, simplifying and modernizing architecture, reducing technical debt, and enforcing reusability of IT assets. A modern EA is characterized by the following:

- Information security and compliance
- Data-as-a-service (DaaS) capabilities
- The right balance of technologies and capabilities to achieve business goals
- Intelligent, automated workload placement so every application is hosted on the right platform and infrastructure

The EA CoE can highlight predictable capabilities, analyze unplanned changes, enable elastic architecture, and drive technology decisions—all of which are necessary for true digital transformation.

**Table 1.** Enterprise Architecture Center of Excellence (EA CoE) Domains and Responsibilities

| Domain | Responsibilities |
|---|---|
| **Business processes as a service (BPaaS)** | Business architecture including business processes and capabilities; strategic and corporate objectives; key initiatives; key performance indicators (KPIs); and alignment with application, platform, data, and infrastructure architecture strategies (this domain is embedded in the software-as-a-service solution group) |
| **Data as a service (DaaS)** | Corporate data architecture including technology landscape, strategies, guidelines and policies, and standards that span all platforms and application strategies and align with business architecture strategies |
| **Information security as a service (ISaaS)** | Information security architecture including technology landscape, strategies, prescriptive guidelines, policies, and standards |
| **Software as a service (SaaS)** | End-to-end application architecture and strategies that span business and platform strategies and that align with data architecture strategies |
| **Platform as a service (PaaS)** | Platform architecture and strategies aligned with domain strategies |
| **Infrastructure as a service (IaaS)** | Infrastructure solutions and services (cloud, hybrid cloud, on-premises hosting) architecture, plans, roadmaps, and strategies that align with business imperatives |
| **Technical debt reduction** | Reduction and prevention of technical debt as indicated by domain strategy and integrated with IT's new operating model and enterprise architecture (EA) |
| **Artificial intelligence and machine learning** | Define guidelines on best-known methods, standards, policies, and tools for artificial intelligence and machine learning and align with business, data, applications, and technology (BDAT) domains |
| **Business intelligence and analytics** | Define and create business intelligence and analytics architecture guidelines including tools, technologies, policies, and standards |
| **Governance** | Governance across all domains of EA (BDAT) to ensure compliance with architecture principles, policies, and standards |
| **Federated capabilities** | **Business of IT:** DevOps, Program Management Office, test automation, EA tool, continuous integration/continuous delivery, and application portfolio management (APM) architecture and strategies<br><br>**Innovation:** Framework and programs<br><br>**Mergers and acquisitions:** Framework and BDAT solution mapping<br><br>**Technologies:** Align with key domains to maintain and sustain Intel's suppliers and technologies landscape |

## Technical Workgroups (TWGs) Develop and Deliver EA Standards

The TWGs are primarily classified as functional and foundational. Functional TWGs are primarily purposed for value steams; foundational TWGs are for solution groups. TWGs work cohesively to develop and deliver EA standards.

The TWGs serve as liaisons to deliver the strategic vision for EA across the BDAT domains (see Figure 2). The TWGs form the heart of our EA efforts, driving uniform, cohesive, and consistent EA blueprints. Through their governance function, they guarantee adherence to reference EA standards and deliver a common framework for multi-year integrated roadmaps. Additionally, the TWGs maintain the IT asset inventory and repository. IT assets include services/APIs, applications, infrastructure components, business processes, data models, policies, total cost of ownership (TCO) and run/build analyses, and capabilities. The TWGs also maintain integrations among IT operational tools such as our EA, application portfolio management (APM), process management, and work and resource management tools.

The TWGs use several models and frameworks to inform analytics that address transformations, consolidation, application end-of-life decisions, and so on. These include Gartner's Tolerate, Invest, Migrate, Eliminate (TIME) model and Gartner's Pace-Layered Application Strategy (see the sidebar, "An Overview of Gartner's Pace-Layered Application Strategy").

We have approximately 16 TWGs, consisting of various lead segment architects (LSAs) and enterprise architects (the exact number of TWGs may change over time). The TWGs meet periodically as needed (weekly, bi-weekly, or monthly).

EA is a foundational service to the corporation. It has its own EA TWG that is primarily responsible for tools, standardization, governance automation, and other horizontal solutions such as APM, application TCO, and integration of tools and processes.

## Enterprise Architecture Community of Practice (EA CoP) Gets the Work Done

The EA CoP is community of enterprise architects responsible for delivering a uniform, cohesive, and consistent reference EA that is aligned with our EA principles, guidelines, and policies. They discuss and share best-known methods, practices, and learnings. They also drive constant collaboration, communication, and feedback to help us reach our EA maturity-level goals.

Through learning continuously and sharing wins by socialization, our EA CoP functions as a fast track to deliver architecture blueprints and remove any roadblocks. Members of the EA CoP include several types of architects (enterprise, business, data, application/solution, and security/domain) as well as TWG chairs, key domain owners, and LSAs or their delegates. The EA CoP meets once a month.

## Enterprise Architecture Compliance and Governance Process

The EA governance process is designed to ensure that solutions comply with EA policies, principles, guidelines, and standards, and is driven by two committees: TWGs are responsible and empowered for pushing decision making to lower levels of the organization to avoid the bureaucracy of having everything reviewed via centralized governance (TRCs), which causes an ivory-tower bottleneck. TRCs are virtual entities where large audiences/stakeholders are represented. TRCs review only high-impact solutions, which are defined as:

- They impact one or more value streams or solution groups
- They introduce a new supplier or technology
- They require substantial integrations with other systems and solutions

The committees work in tandem with the other EA entities. For example, the TWG and TRC chairs assume responsibility for understanding the EA principles and keeping all solutions compliant, while the EA CoE (through TWGs and TRCs) is responsible for an overall EA compliance health check.
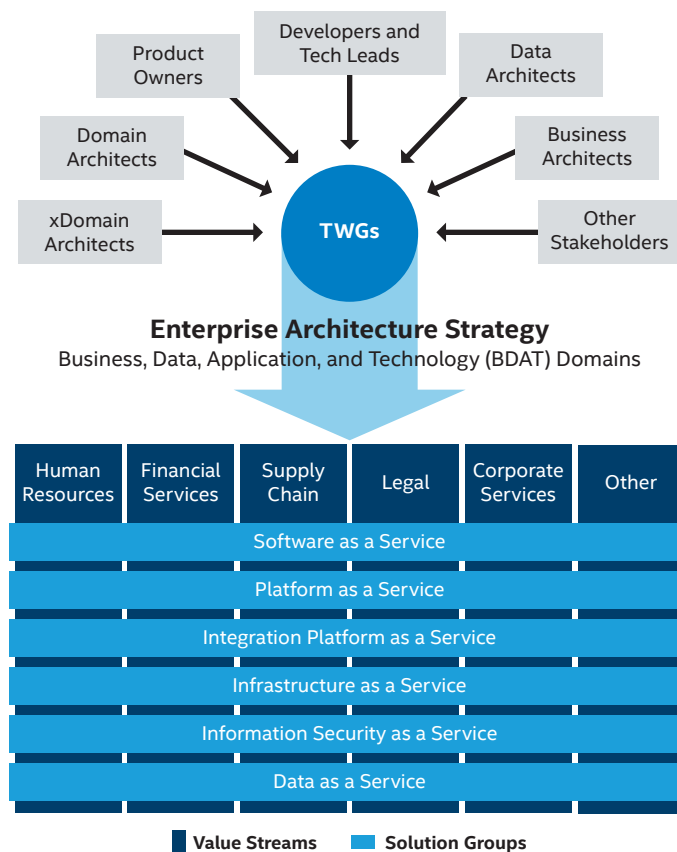


**Figure 2.** Enterprise Architecture (EA) Technical Workgroups (TWGs) deliver the strategic vision for EA across the business, data, application, and technology (BDAT) domains.

## Supporting EA with People

As mentioned previously, it was paramount to our success to obtain commitment and support from upper management at the outset of our EA efforts. Building on that, we could then assign people and resources to the EA CoE, EA CoP, TRCs, and TWGs. These groups could then be held accountable for their deliverables.

The EA and governance teams described previously—where enterprise architects work closely with all LSAs to define technology strategy, establish architecture definitions, and drive technology governance—report to the CTO. We also have a Pathfinding and Product Innovation team, which also reports to the CTO. This team continuously scans for technology innovations in data center, cloud, network, high-performance computing, storage, and artificial intelligence (AI) algorithms. The Pathfinding and Product Innovation team is highly aligned to Intel's lines of business.

Our efforts have resulted in active and engaged participation from all the enterprise architects and other stakeholders. Everyone is committed to their deliverables, and roles and responsibilities are well-defined and understood.

## Supporting EA with Processes

In concert with actively engaging IT staff, BUs, and upper management with our revitalized EA program, we made sure we also streamlined and automated processes. Here are a few of the most important changes we made:

- Integrated EA blueprint deliverables with project lifecycle management.
- Set up architecture review processes with the TWGs and delivery teams.
- Implemented an auto-governance process and integrated it with our operating model.
- Added workflows to address data quality and completeness.
- Established a process to capture EA KPIs, metrics, and maturity model level.

As a reference point, we use an EA maturity model defined by the Department of Commerce (DoC) - Architecture Capability Maturity Model (ACMM) that consists of nine elements:

1. EA process
2. Artifacts and standards documented
3. Linked to business strategies or drivers
4. Senior managers involved
5. Accepted by the BUs
6. Content of the EA is available
7. Governance process in place
8. Architect skills improvement and pipeline development
9. Aligned and adopted across the IT organization

Along with the assessment areas above, EA maturity can be assessed by examining decreased cost, reduced complexity, reduced risk, and increased agility and efficiency. The model defines five maturity levels (see Table 2). We are currently at level 3.0, and are pushing to the next level. All actionable items to improve our EA maturity level to 3.5 in 2019 have been planned. We also plan to use an external agency to perform future assessments. Our 2020 goal is to reach 4.0 or above.

## Supporting EA with Tools

With the right teams and processes in place, we were ready to turn our attention to tools and technologies. Rather than building our own EA tool, we chose a third-party solution that creates a digital representation of an organization to enable better planning and execution of a business transformation initiative. This tool integrates with our existing systems, such as application profiler, service management, data modeling, and project portfolio management tools. The EA tool also helps identify foundational capabilities that we can reuse.

With our modern EA tool, we can represent and maintain realistic reference and solution architectures that are uniform across all the value streams and solution groups, and that reflect all recent changes. The tool serves as a common repository for all EA blueprints, and features a dashboard that we use to communicate uniform KPIs and metrics to stakeholders. With all the relevant systems integrated through the EA tool, we have improved data quality and completeness.

We anticipate great business value from our EA tool as it helps us with digital transformation or to run an impact analysis to address changes in our current solution space. For example, a few years ago we moved the entire portfolio of human resources tools and processes from an enterprise application to a software-as-a-service (SaaS)-based human-capital management tool. It took us over six months with more than 40 people to evaluate the impact of change across the BDAT domains. If a functional EA tool had been in place, we could have achieved the same result in a couple of weeks and with very few staff. See the Results section for a more detailed discussion of EA business benefits and our accomplishments so far.

**Table 2.** Enterprise Architecture (EA) Maturity Levels

| Domain | Responsibilities |
|---|---|
| **1. Initial** | Processes are ad hoc and localized. Some enterprise architecture (EA) processes are defined. There is no unified architecture process across technologies or business processes. Individual efforts drive success. |
| **2. Under development** | The basic EA process is documented based on industry best practice framework, such as The Open Group Architecture Framework (TOGAF*) Architecture Development Methods. The architecture process has clear roles and responsibilities. |
| **3. Defined** | The EA process is well-defined and communicated to Chief Information Officer (CIO) staff and business-facing management with IT segment responsibilities. The process is largely followed. |
| **4. Managed** | The EA process is part of the culture. Quality metrics associated with the EA process are captured. |
| **5. Optimizing** | Concerted efforts are made to optimize and continuously improve the EA process. |

**3.0 MATURITY LEVEL** We have achieved a respectable maturity level of 3.0.

## EA in Practice for Enabling Business Transformations

There is a feedback loop where we have an opportunity to continuously improve. EA can tend to be intangible—how does it really work? As shown in Figure 3, we learned from The Open Group Architecture Framework (TOGAF*) and several other consortiums and created a high-level, eight-step process that enables us to achieve our EA objectives:

1. **Instantiate the business outcome statement (BOS).** Intel has defined four digital transformation business outcomes: productive workforce, engaged customers, reimagined and optimized decision making and operations, and new products and services. The BOS relates a reference architecture to one of these business outcomes, thus enabling strategy development. The BOS includes several components such as identifying disruptive industry and corporate mega-trends, setting goals and objectives, and developing strategies. When setting goals and objectives, we address organization, BU, portfolio, and service levels.

2. **Start development with capability-based planning.** The BOS triggers a course of action that maps strategies to capabilities, and those capabilities to business processes. It also identifies and addresses gaps, if any, in our value streams to execute the strategy. In rare cases, it may require us to reorganize our Agile teams or business processes to address gaps.

3. **Perform enterprise portfolio management.** This step provides insight into our current solution offerings and is the pivot point between strategy and realization. The capabilities are mapped to solutions, enabling us to run a fit-gap analysis (invest, divest, change, or reuse) to address the requirements. Given the current service or solution offering and newer requirements to meet our goals, we define the scope and build plans. This step is closely integrated with step 4.

4. **Perform program/project management.** The overview provided in step 3 is the key to managing change in an integral manner, considering various dependencies and interactions within the ecosystem. During this step we manage and source internal and external resources and skills, then execute plans.

5. **Apply continuous delivery (DevOps) methods to execute plans.** The EA tool provides complete insight into the artifacts of our ecosystem (reuse, build, or buy). EA enables instant impact analysis, highlights gaps, and enables a faster decision making process to size the program increments. With automated governance and processes using the EA tool, delivery of solutions is more agile, and we can identify exceptions proactively.

6. **Build and manage services to support solutions.** Through close communication between the Agile teams, service management addresses the organization, service, and support of the solution.

7. **Perform process, rule, and data management.** Our EA tool enables the definition of systems of record for business process rules, data bindings, and data transformations and integrations, with end-to-end insight into the BDAT domains. The result is an integrated business and data architecture through application architecture.

8. **Address governance, risk control, security, and regulatory compliance.** We implement governance across all BDAT domains. Artifacts are stored in one common repository and when most of the IT assets data is integrated, it becomes easy to evaluate any risk or compliance issues. For example, an application that contains sensitive data cannot be hosted in specific network zones or cannot store data in an unencrypted server environment. Having the accurate blueprints in the EA tool can find these exceptions ahead of time when building a proposed reference architecture.
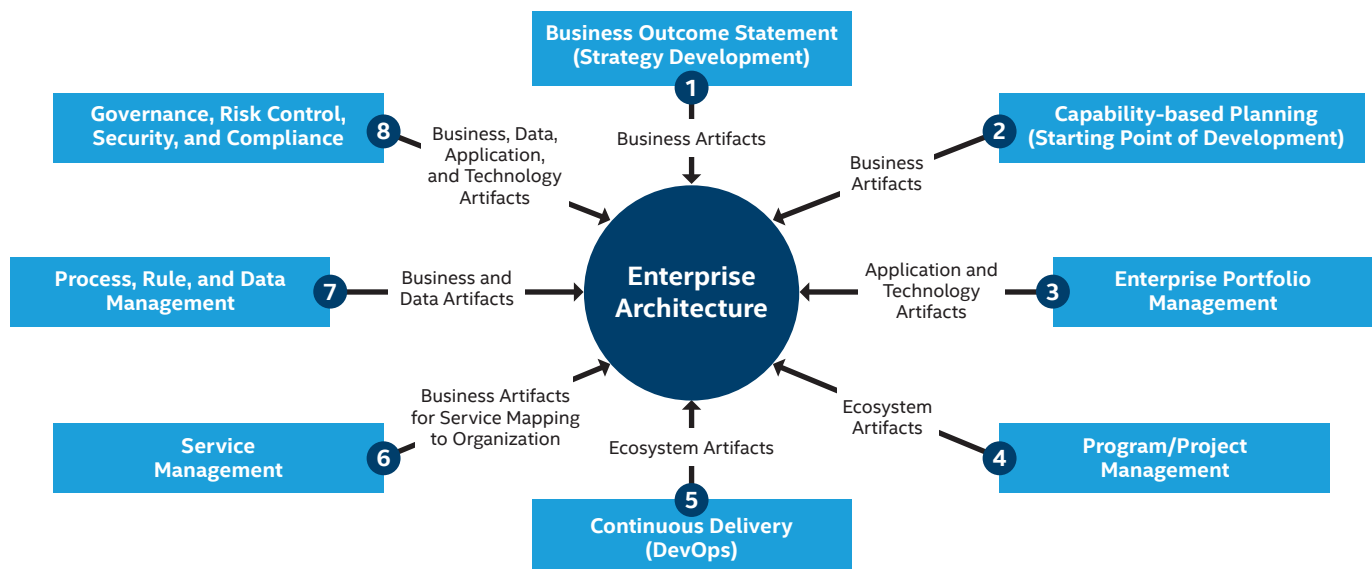


**Figure 3.** By following an industry-standard enterprise architecture (EA) framework, we can create a business outcome statement (BOS) that leads to strategy, then to capability-based planning, and finally resulting in an integrated business and data architecture through application architecture.

## Results

Approximately two years into our EA journey, we have made significant progress. As noted earlier, we have already achieved an EA maturity level of 3.0. Our reference EA strategies enable digital business transformation and we are in a much better position to gracefully handle industry disruptions and be more agile. At the end of 2018, we had automated approximately 40 percent of our governance processes and will soon complete about 95 percent of EA blueprints.

> At the end of 2018, we achieved about 40 percent automation of our governance processes and will soon complete approximately 95 percent of EA blueprints.

## Business Value

EA can provide significant business value through architecture simplification, modernization, and automation. It becomes easier for architects to collaborate through a consistent and common repository of artifacts that enables reuse and faster decision making. Example of benefits at Intel include the following[2]:

- Instant impact analysis of transformation can be up to 8X more efficient than prior change evaluation processes.
- Productivity and time savings of 25 percent are possible through advanced analytical solutions that accelerate the decision making process.
- Articulation of architecture blueprints, including BDAT, improved enterprise effectiveness, efficiency, and agility.
- Technical debt can be reduced by over 50 percent (by 2020 in our case).
- Data quality will improve by 45 percent through integration with automated systems and processes.
- We expect long-term TCO can be lowered by 65 percent.

> **8X** We anticipate an 8X improvement in efficiency through the ability to perform instant impact analyses.[2]

---

[2] These are our best estimates for the business value of enterprise architecture (EA) at Intel. Actual numbers will vary depending on a company's EA maturity level and size.
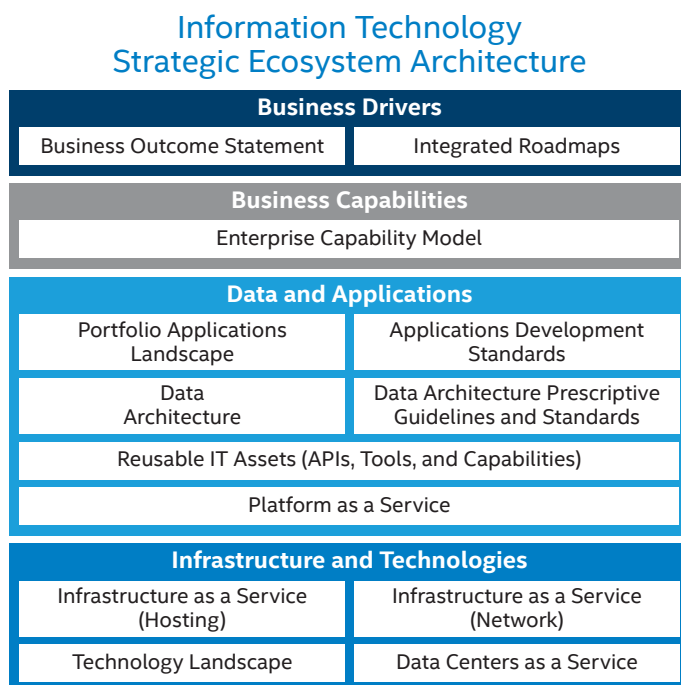
With an end-to-end view of our EA, we have substantially improved the reusability of IT assets and now have business and technical roadmaps that help us execute the strategies, programs, and project plans. We can communicate the most recent, overarching picture of the enterprise reference architecture to all stakeholders—whether that is an application developer, a new hire, or management. And, we are enabling faster decision making with value chain analysis and end-to-end enterprise capability management.

Our EA will continue to drive business value as we improve our EA maturity level—the goal is to reach level 3.5 in the next year, and 4.0 in 2020.

### Delivering "IT on a Page"

It took months and over hundreds of enterprise architects to deliver "IT on a Page" (see Figure 4). This is a common representation of architecture blueprints to represent or publish the artifacts associated with a reference architecture. The template is uniform, cohesive, and always-current (including all BDAT domains) across IT and aligns with Intel's strategies and imperatives. We can use these artifacts to discover opportunities for optimization (whether for business process improvement, business capability, or application rationalization).

More importantly, we can perform an instant impact analysis including cost, value, and effort for any changes or additions to the current state of the architecture. For example, if we decide that an application must be end-of-lifed or upgraded, we can instantly know which BUs, server sets, data objects, and other applications will be affected. We can use that information to reach out to those organizations and people to open a dialogue.

## Information Technology Strategic Ecosystem Architecture

| Business Drivers | |
| --- | --- |
| Business Outcome Statement | Integrated Roadmaps |

| Business Capabilities | |
| --- | --- |
| Enterprise Capability Model | |

| Data and Applications | |
| --- | --- |
| Portfolio Applications Landscape | Applications Development Standards |
| Data Architecture | Data Architecture Prescriptive Guidelines and Standards |
| Reusable IT Assets (APIs, Tools, and Capabilities) | |
| Platform as a Service | |

| Infrastructure and Technologies | |
| --- | --- |
| Infrastructure as a Service (Hosting) | Infrastructure as a Service (Network) |
| Technology Landscape | Data Centers as a Service |

**Figure 4.** Using an industry-standard framework, we now deliver "IT on a Page" for enterprise architecture (EA) blueprints with a common look and feel.

## Improving Application Management

As we continue on our EA journey, we plan to upgrade our APM software with more sophisticated and industry-standard tools. These tools are foundational to transformation, modernization, architecture simplification, and technical debt management because they provide insight into the impact of change, help accelerate innovation, and enable efficiencies and automation. We use the APM suite to provide information such as:

- Total cost of an application (direct and indirect costs, including risk analysis)
- The footprint of a particular supplier or technology in our organization
- More evidence that can help us make smarter decisions that support our strategies around mobile, cloud, and SaaS, as well as application rationalization decisions

While our APM solution is not yet complete, our vision is that all applications will be registered, with automated data attribute checks and workflows and with governance in place. The solution will improve the user experience and simplify registration of applications. It will also dynamically validate applications on a regular cadence and serve as a single system of record for all applications at Intel that meet data governance standards. In short, we plan to accelerate Intel's growth through best-in-class IT solutions and services through applications.

## Automating Governance

We are enabling automated governance through scripts and new processes, and by intercepting and refining existing processes by anchoring more check points. Some examples of governance automation include following:

- Invalid or missing relationships between business, application, and technology architecture layers
- Elements with invalid naming conventions (APIs, reference architecture names, and so on)
- Data objects with invalid data classifications
- Any element that is not connected to business drivers (direct and indirect relationships)
- Blueprints older than six months
- Any architecture blueprint with missing approver details
- Out-of-compliance reference or solution architecture. There are many checks; here are two examples:
  – If an invalid data integration pattern is used among applications, the governance process will trigger an alert.
  – If an unsupported technology is used, or a custom solution is developed instead of using an EA capability, the governance process will highlight such exceptions.
- Automated work-flow process initiation based upon certain architectural changes

Our governance process consists of three steps (see Figure 5), starting with the TWGs and culminating in a quarterly report. We have found that embedded and automated governance processes reduce bureaucracy and increase efficiency.

## Enterprise Architecture Rules to Live By

These guiding EA principles provide a foundation for business and IT architectures, standards, and development policies.

- **Business before technology.** The needs of the business should drive change, for technology or otherwise.
- **Control technical debt.** Control the age and variety of technologies, products, processes, suppliers, and platforms.
- **Keep it simple.** Choose the simplest solutions to maintain and deliver capability levels with the aim to reduce operational complexity.
- **Data is an asset.** Use enterprise-wide policies to handle data creation, data modification, and data use, in compliance with corporate data governance policy.
- **Customers are at the center.** Deliver the best experiences to customers with services and products.
- **Learn fast, fail fast.** Do the hard and unknown stuff first. Address risk early. When things do not work, learn and adapt quickly.
- **Pursue innovation.** Seek innovative ways to use technology for business advantage.
- **Enforce security and legality.** Manage security across the enterprise in compliance with corporate security governance policy and operate per all applicable laws and regulations.
- **Reuse before buy, buy before build.** Maximize reuse of IT assets. If it is not possible to reuse, procure externally. As a last resort, build custom solutions.
- **Maximize benefit.** Aim to provide maximum long-term benefits to the enterprise as a whole, while optimizing cost efficiency and minimizing risk.

**Governance Process**

1 — Governance starts with Technical Workgroups (TWGs); known exceptions are addressed with the project team.

2 — Governance review continues with Technical Review Committees (TRCs), which highlight actionable items for the TWGs and program teams.

3 — Quarterly report out for information sharing and alignment with IT staff; highlight actionable items for program team.

**Figure 5.** Responsibility for governance lies primarily with the Technical Workgroups (TWGs), with reviews to ensure compliance.

## Next Steps

We are excited about what we have accomplished so far, but have much more to do in all areas (people, processes, and tools):

- **People**
  - Invest further in developing people's skill sets and continue to embrace TOGAF's Architecture Development Methods.
  - Collaborate, engage, and share progress with stakeholders, highlight risk areas, and proactively ask for help.
  - Continue to collaborate with IT and business leaders to address their use cases proactively, and continuously highlight the value of EA with examples.

- **Processes**
  - Periodically assess and improve our EA maturity level. Our goal is to reach a 3.5 maturity level by the end of 2019, and 4.0 in 2020.
  - Automate application rationalization using Gartner's TIME model and Pace-Layered Application Strategy.
  - Achieve continuous data quality improvements through automated workflows.
  - Perform a periodic assessment of business roadmaps to run fit-gap analysis.
  - Continue to update and publish EA tracks for visibility to larger stakeholders.

- **Tools**
  - Further automate governance, with a goal of over 85 percent, through people, processes, and tools.
  - Continue to invest and harden EA tools by consolidating several IT assets at one place and enabling APM.
  - Deliver an automated and fully integrated dashboard with KPIs and metrics and make the dashboard available to Intel's CIO.

As we check these things off our to-do list, we will have met our commitment to management to create an adaptive reference architecture that can support any type of short- or long-term disruptions or transformations.

**↓50%** By 2020, we expect our enterprise architecture to lower technical debt by 50 percent.[2]

## An Overview of Gartner's Pace-Layered Application Strategy[3]

Gartner's Pace-Layered framework enables IT organizations to build some systems for rapid change and others for stability, depending on the business need. It uses three pace layers:

- **System of record.** Established packaged applications or legacy homegrown systems that support core transaction processing and manage the organization's critical master data. Rate of change is slow.

- **System of differentiation.** Applications that enable unique company processes or industry-specific capabilities. Rate of change is moderate, with frequent reconfiguration to meet changing business or customer needs.

- **System of innovation.** New applications that are built on an ad hoc basis to address new business requirements or opportunities. Rate of change is fast (measured in months, not years).

This framework enables an IT organization to keep the business running while still accommodating digital transformation.

[3] Source: Gartner, April 2016, "Pace-Layered Application Strategy and IT Organizational Design: How to Structure the Application Team for Success." gartner.com/binaries/content/assets/events/keywords/applications/apn30/pace-layered-applications-research-report.pdf

## Conclusion

Intel IT is using EA to help Intel execute digital transformation strategies. Through a combination of people, processes, and tools, we are building a comprehensive operational framework that accommodates all of Intel's functional areas while defining how technology benefits and serves Intel's overall mission.

We have discovered that EA is all about discipline—defining clear-cut goals; enforcing standardization, consistency, and governance; and relentlessly pursuing technical debt. Although our EA journey is not yet complete—and no EA journey is—we are confident that our efforts will result in increasing Intel's business agility and preparing the company for whatever lies ahead.

## Related Content

If you liked this paper, you may also be interested in these related stories:

- 2018-2019 Intel IT Annual Performance Report
- Enterprise Technical Debt Strategy and Framework white paper
- Intel's IT Multi-Cloud Strategy: Focused on the Business white paper
- Data Center Strategy Leading Intel's Business Transformation white paper

## For more information on Intel IT best practices, visit intel.com/IT.

### Fun Facts We Learned Along the Way

We are still learning, but the following are some of the key ideas we have discovered so far.

- Success depends on a strong desire and support from the top, with absolute commitment and passion from change agents.
- Select a few teams to lead the way, build the momentum, and constantly collect feedback.
- Data quality is paramount.
- Reuse IT assets as much as possible, including data, industry-standard frameworks and processes, and enterprise architecture (EA) principles (see sidebar, "Enterprise Architecture Rules to Live By").
- Influence key stakeholders by showing value with real-life examples of EA and collect feedback— encourage open communication.
- Create foundational reference architectures: they help with fit-gap analysis, reduce technical debt, aid in architecture simplification, and help build plans that address business strategies and digital transformation.
- Insist on consistency (standardization), enable automation wherever possible, and reduce bureaucracy.
- Create business-driven architecture blueprints that support EA objectives and principles.

### IT@Intel

We connect IT professionals with their IT peers inside Intel. Our IT department solves some of today's most demanding and complex technology issues, and we want to share these lessons directly with our fellow IT professionals in an open peer-to-peer forum.

**Our goal is simple:** improve efficiency throughout the organization and enhance the business value of IT investments.

Follow us and join the conversation:
- Twitter  |  #IntelIT  |  LinkedIn
- IT Peer Network

Visit us today at intel.com/IT or contact your local Intel representative if you would like to learn more.