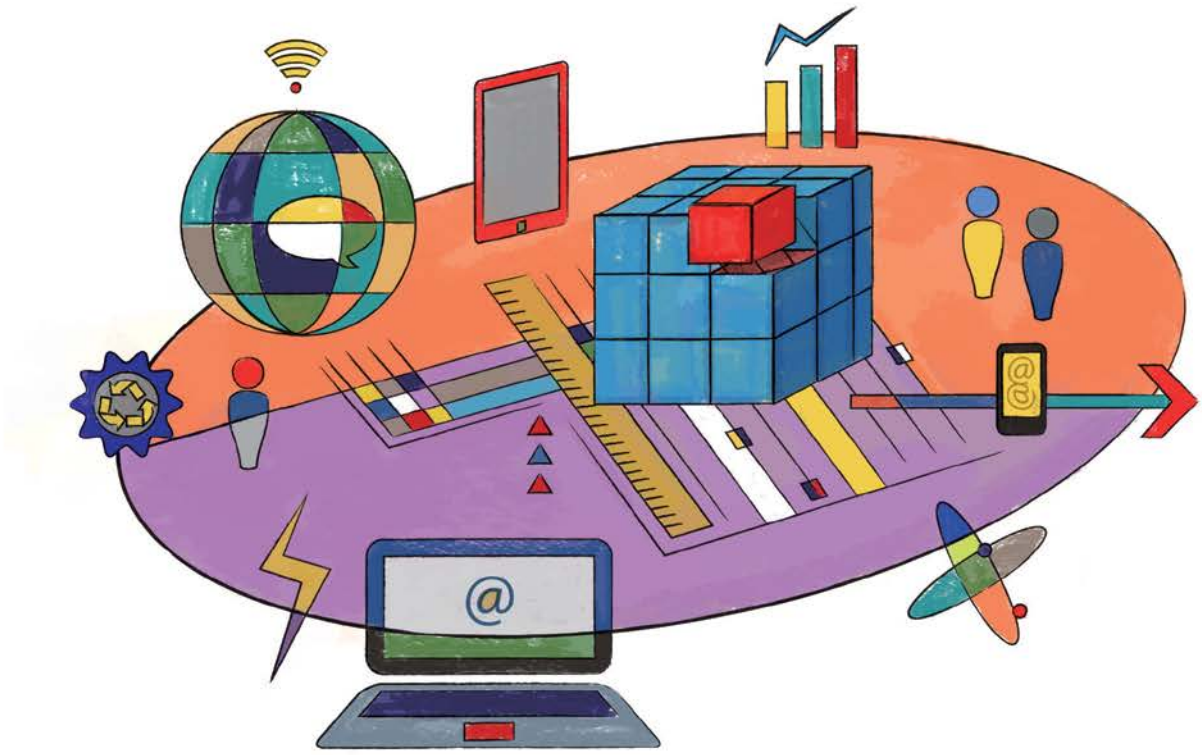
KNOWLEDGE SHARING SERIES

ISSUE IV

ENTERPRISE ARCHITECTURE



UNITED NATIONS ESCAP
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/APCICT

Knowledge Sharing Series

Issue 4

ENTERPRISE ARCHITECTURE

Saleem G. Zoughbi, Ph.D.

APCICT ASIAN AND PACIFIC TRAINING CENTRE FOR INFORMATION AND COMMUNICATION TECHNOLOGY FOR DEVELOPMENT

Knowledge Sharing Series

Issue 4: ENTERPRISE ARCHITECTURE

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Contact:

United Nations Asian and Pacific Training Centre for Information
and Communication Technology for Development (UN-APCICT/ESCAP)
5th Floor G-Tower, 175 Art center daero,
Yeonsu-gu, Incheon City (22004)
Republic of Korea

Tel: +82 32 458 6650
Fax: +82 32 458 6691
E-mail: info@unapcict.org
http://www.unapcict.org

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PREFACE FOR KSS ON ENTERPRISE ARCHITECTURE

The United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development (UN-APCICT/ESCAP) was established on 16 June 2006 in Incheon, Republic of Korea as a regional institute of the United Nations Economic and Social Commission for Asia and the Pacific (UN/ESCAP). The role and mission of APCICT is to strengthen the efforts of the 62 ESCAP member and associate member countries to use ICTs in their socio-economic development through building the human and institutional capacity for ICT. In pursuance of this mandate, APCICT's work is focused on three inter-related pillars—Training, Research and Knowledge Sharing, and Advisory Services. Together they form an integrated approach to ICT human capacity building.

A core activity based on the integrated approach is the Academy of ICT Essentials for Government Leaders (Academy), a flagship programme of APCICT. The Academy is a comprehensive ICT for development (ICTD) training curriculum that aims to equip policymakers with the essential knowledge and skills to fully leverage opportunities presented by ICTs to achieve national development goals and bridge the digital divide. It has reached thousands of individuals and hundreds of institutions throughout the Asia Pacific and beyond since its official launch in 2008. In 29 countries, the Academy has been adopted in government human resource training frameworks, and incorporated in the curricula of university and college programmes. The Academy training curriculum, with 11 modules and more forthcoming, has been translated into 15 languages, and is available as an online course on the APCICT Virtual Academy.

Complementing the Academy, APCICT has been conducting research on ICTD human resources development and promoting knowledge sharing among member countries on different aspects of ICTD through the development and dissemination of in-depth analyses, policy notes, case studies and best practices. APCICT also has an online knowledge sharing portal that includes: (1) a handful of communities of practice with a network of professionals committed to share knowledge and learn about different aspects of ICTD; and (2) the e-Collaborative Hub, a dedicated online platform to enhance their learning and training experience through access to ICTD resources, training courses, news and events.

Based on a continuous demand for step-by-step "how-to" guidelines on different aspects of ICTD that translates technical details into a form that can be easily referenced, understood and applied by government officers, APCICT has created the Knowledge Sharing Series to further strengthen APCICT's knowledge sharing efforts and strategically contribute to ICTD capacity building.

The development of this fourth issue under the Knowledge Sharing Series would not have been possible without the support of the Korean International Cooperation Agency (KOICA) and the dedicated efforts of many individuals and organizations. I would like to especially acknowledge the author of this issue, Saleem G. Zoughbi, the editor Christine Apikul, the participants of the Online Expert Group Meetings on "Knowledge Sharing Series on Enterprise Architecture", as well as everyone else who provided valuable feedback during the content development process.
I hope that interested governments in the Asia Pacific region will find the insights and practical guidance in this publication useful in developing and implementing an Enterprise Architecture.

Hyeun-Suk Rhee, Ph.D.
Director
UN-APCICT/ESCAP

ABOUT ISSUE 4 OF THE KNOWLEDGE SHARING SERIES

The Knowledge Sharing Series intends to help bridge the knowledge divide on how ICTs can be used for social and economic development, and ultimately help bridge the digital and development divide.

Aimed at policymakers and at government officials in operational departments and offices in developing countries, the series provides step-by-step guidelines, concrete strategies, proven best practices and select case studies on different aspects of ICT for development (ICTD). By making research findings, analyses and lessons learned easily accessible and comprehensible, the series can be useful for making informed decisions.

Each issue in the series focuses on a specific ICTD theme, programme or project, and offers an end-to-end road map that can help policymakers in their planning, implementation, monitoring and evaluation processes.

Three issues have already been produced by APCICT under the Knowledge Sharing Series. The first issue, on the topic of "ICTD Institution Building", provides fundamental knowledge needed to develop common vision and strategies, mobilize resources and promote institutional coordination. The second issue on "Cybersecurity", focuses on developing cybersecurity policies and strategies, and devising appropriate national initiatives to counteract cyberthreats. The third issue focuses on "Government Chief Information Officer (GCIO) Development in Developing Countries". It examines the crucial role of a GCIO in providing leadership on ICT matters within government and promoting ICT-enabled socio-economic development. It also examines the main issues related to skill development and training of GCIOs, and describes some good practices in GCIO programmes that may be replicated in a developing country setting.

This fourth issue highlights the importance of developing an enterprise architecture for government to deal with rapid changes in society, particularly the swift advances in ICTs. This issue introduces the key principles and methods for developing enterprise architecture, and provides a step-by-step guide on how to initiate the process and who to involve. The issue also draws attention to good practices and potential pitfalls in enterprise architecture.

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Acronyms

APCICT	Asian and Pacific Training Centre for Information and Communication Technology for Development (United Nations)
BPMN	Business Process Modelling Notation
CEO	Chief Executive Officer
CIO	Chief Information Officer
EAESC	Enterprise Architecture Executive Steering Committee
ESCAP	Economic and Social Commission for Asia and the Pacific (United Nations)
FEA	Federal Enterprise Architecture
FEAF	Federal Enterprise Architecture Framework
ICT	Information and Communication Technology
ICTD	Information and Communication Technology for Development
IT	Information Technology
MoTIT	Ministry of Telecommunications and Information Technology
NTP	New Technology Process
ROI	Return on Investment
TEAF	Treasury Enterprise Architecture Framework
TOGAF	The Open Group Architecture Framework
UN	United Nations

Objectives

The objectives of this issue on Enterprise Architecture are to:

- Introduce the concept and benefits of enterprise architecture
- Discuss the roles of enterprise architects and the ways in which they can work together with other teams and staff members to develop an enterprise architecture
- Explain the different methodologies in enterprise architecture
- Describe and suggest ways to integrate enterprise architecture practices in your organization

CHAPTER 1.
THE RISE OF ENTERPRISE ARCHITECTURE

Building a large, complex, enterprise-wide information system without an enterprise architect is like trying to build a city without a city planner. Can you build a city without a city planner? Probably.

Would you want to live in such a city? Probably not.

– Roger Sessions

CHAPTER 1.

THE RISE OF ENTERPRISE ARCHITECTURE

With rapid transformations in the realms of business, governance and technology, and ever-changing socio-economic trends, enterprises including private companies, government entities and non-governmental organizations of all sizes must be able to respond to these changes efficiently and effectively.

Enterprise architecture emerged as a discipline to guide organizations through the business, information, process and technology changes necessary to execute their strategies and achieve their goals.

Box 1. It is called enterprise architecture

1.1 A New Discipline is Born

The accelerated technological advances and rapid diffusion of information and communication technologies (ICTs) have resulted in three major phenomena:

1. Transformation of people's everyday life to the extent that many people are now dependent on ICTs when carrying out daily activities.
2. Exponential increase in the wealth of knowledge, information and data. It is estimated that 90 per cent of the data stored worldwide has been generated in the last two years.[1]
3. Pervasion of ICTs in all sectors, and a general agreement that ICTs are essential for social and economic development.

In the deployment of ICTs, the cost factor is a major issue. In 1987, J. A. Zachman laid out both the challenge and the vision of enterprise architectures with his famous statement: "The cost involved and the success of the business depending increasingly on its information systems require a disciplined approach to the management of those systems."[2] Zachman encouraged a holistic approach to systems architecture that looks at every important issue from every important perspective.

Since then, this discipline became known as enterprise architecture.

One of the main goals of using enterprise architecture is to reverse the situation in an enterprise (i.e., company, organization, entity, etc.) from more cost, less value to less cost, more value. This is known as increasing the return on investment (ROI).

It is a fact that the cost and complexity of ICT systems have increased exponentially, while the chances of obtaining real value from these systems have dramatically decreased. Often, the higher the cost of ICT systems, the less is the value obtained. This is because major operational problems exist in many large organizations that include the following:

[1] SINTEF, "Big Data, for better or worse: 90% of world's data generated over last two years", ScienceDaily, 22 May 2013. Available from http://www.sciencedaily.com/releases/2013/05/130522085217.htm.

[2] J. A. Zachman, "A framework for information systems architecture", IBM Systems Journal, Vol. 26, No. 3 (1987), p. 276. Available from http://management-class-global.com/it/ibmsj2603e.pdf.

- ICT systems becoming increasingly complex and costly to maintain
- ICT systems hindering the organization's ability to respond to current, and future, market conditions in a timely and cost-effective manner
- Mission-critical information being consistently out-of-date and/or just plain wrong
- Distrust between the business and technology sides of the organization
- The privacy and security of information processed and maintained by ICT systems having inefficient and inadequate attention

Any methods of enterprise architecture will aim to address these problems in order to reduce ICT cost and complexity, while increasing business value and effectiveness—in other words, to improve competitiveness in an increasingly competitive world.

1.2 What is an Enterprise

An enterprise is a term that can be used to describe a project or an organization.

A project can be thought of as a special organization that exists for the period of its implementation.

Enterprises can take different forms. These could be private sector companies or business firms; government offices such as authorities, ministries and departments; or non-governmental and not-for-profit organizations.

A business enterprise could be an entire business corporation or a business unit that is part of a larger enterprise. A more elaborate enterprise could be a multinational grouping of several organizations, such as a joint venture or partnership. The term enterprise can also be used for a single or multiple outsourced business operations.

What is more important is that the term enterprise includes the multifaceted socio-technical structures or systems that include people, information, processes and technologies.

1.3 What is Enterprise Architecture?

Enterprise architecture is not an abstract concept. It is a well-defined practice for conducting enterprise analysis, design, planning and implementation. A holistic approach is always used to consider all aspects of development that include the business, information, process and technology changes necessary to successfully execute the enterprise strategy.

In general, the purpose of enterprise architecture is the greater alignment between ICT and business concerns, and the greater coherency between the various concerns of an enterprise (human resources, ICTs, operations, etc.), including the link between strategy formulation and execution.

Although the term architecture originally refers to the way that buildings are designed, the term extends to much more than this scope. It refers to a high-level or conceptual description of the enterprise. In this sense, it refers to the enterprise's business structure, the products and services it provides, and its internal structures and behaviours, both human and technical.

An enterprise architect is the professional who is entrusted with the task of assessing and recommending changes, and supervising implementation. The changes are aimed at enhancing and developing the enterprise to perform better, more efficiently and save costs. They typically include:

- Innovations in the structure or processes of an organization
- Innovations in the use of information systems or technologies
- Integration and/or standardization of business processes
- Improving the quality and timeliness of business information
- Improving the contents and the actual applications within management information systems legacy for team sharing

A major bank has been considering expanding. A policy is adopted to grow through a series of acquisitions from other financial institutions.

It has a large information technology (IT) service department and routinely has over 50 infrastructure and service projects in progress.

The Governing Board has decided that a more structured approach to its infrastructure and services is necessary to protect the business, especially during critical business and financial crisis.

There must be a review of the current initiatives and projects in the bank portfolio as well as potentially create new projects in order to realize the vision.

The implementation approach must accommodate the constantly occurring changes to the technology and business landscapes. Other concerns exist too.

Box 2. Example for need of an enterprise architect

1.4 Benefits of Enterprise Architecture

An enterprise architecture offers tangible benefits to the enterprise and those responsible for evolving the enterprise. These are best described as follows: [3]

- Capture facts about the mission, functions and business foundation in an understandable manner to promote better planning and decision-making
- Inform, guide and constrain the decisions for the enterprise, especially those related to ICT investment
- Support the capital planning and investment control processes by providing a tool for assessment of benefits, impacts and capital investment measurements, and supporting analyses of alternatives, risks and tradeoffs
- Improve communication among the business organizations and ICT organizations within the enterprise through a standardized vocabulary
- Provide architectural views that help communicate the complexity of large systems and facilitate management of extensive, complex environments
- Focus on the strategic use of emerging technologies to better manage the enterprise's information and consistently insert those technologies into the enterprise
- Improve consistency, accuracy, timeliness, integrity, quality, availability, access and sharing of ICT-managed information across the enterprise

[3] Chief Information Officer Council, "A Practical Guide to Federal Enterprise Architecture", 6 February 2001, p. 6.

- Highlight opportunities for building greater quality and flexibility into applications without increasing cost
- Achieve economies of scale by providing mechanisms for sharing services across the enterprise
- Expedite integration of legacy, migration and new systems
- Ensure legal and regulatory compliance

1.5 Concerns of Enterprise Architecture

ICT decisions are important to the development of the enterprise, and it affects the quality of operation and the ROI. Some of the concerns that enterprise architects have to deal with include the following:

- Doing more with less – Continuous economic concerns have led large companies to cut their budget by 50 per cent or more in some cases. Such cut is to be done without jeopardizing operations and quality of work. It aims at maintaining the same service level agreements as they did in the past.
- Trimming existing project costs – Project costs are reduced to streamline business and ICT directions.
- Revitalizing the skills base – Human resources are a real asset to any enterprise. The growing trend of applying smart technologies and recent technical solutions require advanced technical skills.
- New approaches to outsourcing – As technology develops, there are new ways of doing things that are of value to companies. These include platform-as-a-service and software-as-a-service vendors.

1.6 Why should an Organization Consider Enterprise Architecture

Gone are the days when chief executive officers (CEOs) of organizations and enterprises would consider purchasing large computers with expensive management information systems that are costly to operate and maintain. Migration to enterprise resource planning systems has made it much cheaper as they allow enterprises to tailor the systems to their needs and budget. But this does not mean that the ICT solutions have become simpler. On the contrary, they have become more elaborate and more complex due to the rapid technological changes taking place. This is the reason why enterprise architecture has been adopted.

Enterprise architecture is the way to strategically manage a company's investment in ICT. It is a strategic planning tool in principle and not systems, information, service or solution architecture. It focuses on maximizing investment return. To put it in simple words, enterprise architecture is about ROI, objectives and performance.

Imagine that a successful enterprise architecture has been implemented in an enterprise. Several benefits can be achieved. For example, by having a well-established idea of what infrastructure is going to be needed in the enterprise, efforts can go into building it with growth in mind. When a specific business application is to utilize this infrastructure, it is already built and ready to run. Human resource development can benefit greatly from the enterprise architecture, as staff would be able to better focus on training and other employee development actions.

Creating and maintaining an enterprise architecture is an investment for sure, with the payoff occurring sometime in the future. The goal is to be able to deliver the right information to the right decision makers at the right time.

Architectures are not set in fixed unchangeable setting. If a business case is made for something that deviates from these standards set by the implemented architecture, it becomes a reason to stop and think about it. It is this "stopping and thinking" that may necessitate a change. This shows where an enterprise architecture adds value. Architecture plans need to be flexible enough to allow these kinds of changes as the technology and the business also changes.

Some of the benefits of enterprise architecture including the following:

- Enterprise architecture has a strong ability to unify and integrate business processes across the enterprise.
- Deliverables and outcomes of enterprise architecture processes include detailed documentation of the enterprise that can become readily available.
- It provides the ability to unify and integrate data across the enterprise and to link with external partners.
- It helps to simplify and structure use of ICT in the enterprise. The changing technology and its advances, together with increased agility would be easily accommodated as enterprise architecture lowers the "complexity barrier."
- It helps reduce solution delivery time and development costs by maximizing reuse of enterprise models and resources.
- Perhaps one of the most important benefits of enterprise architecture is the ability to create and maintain a common vision of the future shared by both the business and ICT communities, driving continuous business/ICT alignment.
- One additional benefit of enterprise architecture is that it helps to look at the government duty not only in micro and process level, but on a more general level from a macro point of view, thus helping government officials to redefine their duties efficiently according to adopted government policies and strategies.

1.7 The Purpose of Enterprise Architecture

Architects have in mind tasks that have to be done, some of them in sequence, and others can be carried out simultaneously. In a simple way, we can think of these tasks as umbrellas that cover more detailed activities. Six of these tasks can be easily seen as six major "parts" of constructing an enterprise architecture as follows:

1. Identify the current state of how ICT is currently being used in the organization, what technologies are being used and how they are deployed along with the business value that ICT is providing.
2. Examine and document any current initiatives currently being planned or implemented that involves ICT resources.
3. Document the future state if the current plans execute and business continues as usual.
4. Document the desired future state, where the business would like to be in from an ICT perspective.
5. Document the "gap" between the two future states. This is the difference between where the organization is heading and where it would like to be.
6. Construct a list of projects and initiatives to put the ICT infrastructure back on track towards the desired future state. This transition plan will attempt to close the gap previously identified.

Implementing these tasks can be tricky. They are not necessarily a linear process. However, each task of this process may trigger changes in previous tasks. Conversely, any change in the business environment of the enterprise may change the content and priority of many of the ICT projects being implemented in the enterprise.

1.8 Ten Important Enterprise Architecture Pitfalls

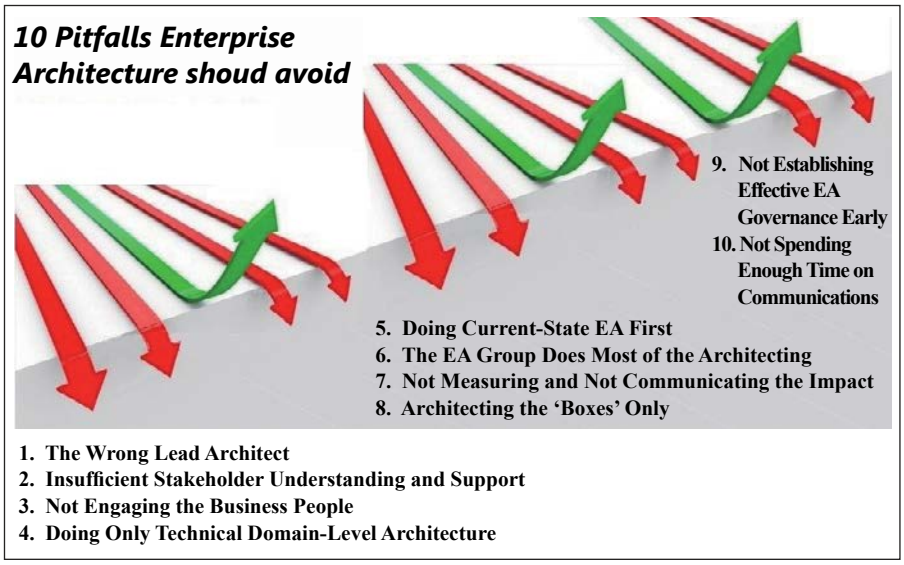

Figure 1. Enterprise architecture pitfalls

From experience, it has been well established that the most common mistakes or pitfalls that enterprise architects encounter include the following:

1. The wrong lead architect – The single biggest enterprise architecture problem is having an ineffective leader. Irrespective of his/her knowledge and expertise in enterprise architecture, ineffective leadership skills is enough to cause failure. Lead architects should have "soft" skills such as enthusiasm, communication and passion, as well as being well respected and strategically minded.

2. Insufficient stakeholder understanding and support – The enterprise architecture team works towards implementing the architecture change, however if the other employees of the enterprise do not participate or cooperate with the enterprise architecture team and the programme they try to implement, this is a serious impediment. Insufficient stakeholder understanding and support can be managed by adopting enterprise architecture education and communication as a top priority to secure executive-team sponsorship. As experts often say: "The key is to 'sell' first and architect later."

3. Not engaging the business people – Senior staff members from the enterprise who are managing the business operation may become involved in situations where they try to make technical decisions although they are not fully knowledgeable in the technical aspects. It is highly recommended that architects engage with senior staff members from the beginning and develop the architecture together. Simultaneously, the enterprise architects should get involved in the development of the business context and engage jointly with other employees in the business architecture. Alignment will be beneficial for all. Working in "silos" is a major pitfall to avoid.

4. Doing only technical domain-level architecture – Enterprise architecture is not only about technology. Therefore, doing only technical domain-level architecture is not a positive strategy. Holistic enterprise architecture best practice is much broader as it includes business, information and solutions architecture.

5. Doing current-state enterprise architecture first – Very often, when architects start their work, they think almost immediately of conducting an analysis of the current situation. They try to

map the current state architecture, which is a relatively easy job. However, this is not a good starting point because they will most likely lose the vision of the future. Instead, it is better to establish the business context and focus first on future-state enterprise architecture.

6. The enterprise architecture group does most of the architecting – The primary job of architects is to lead the enterprise architecture process rather than impose enterprise architecture content on the organization. They should form virtual teams to create content and seek consensus on the content. One of the pitfalls is when the enterprise architecture team does most of the architecting.

7. Not measuring and not communicating the impact – As the outcome and value of enterprise architecture work is indirect and often intangible, many in the enterprise may not notice the success of enterprise architecture work. It is therefore important to announce these successes and achievements. Not measuring and not communicating the impact is a pitfall that may expose enterprise architecture work to the risk of failure.

8. Architecting the "boxes" only – The enterprise architecture team follows a standard process and method of architecting units of the enterprise by treating them as smaller enterprises in order to simplify enterprise architecture work. This is a pitfall that many enterprise architecture teams fall into. Integration and interoperability standards are high enterprise architecture priorities and must account for more than just technical architecture. Architects should focus more on the links between the boxes.

9. Not establishing effective enterprise architecture governance early – Enterprise architecture governance is the structure by which an enterprise defines appropriate strategies and ensures development alignment with those strategies. This has to be done early. Some enterprise architecture teams wait for more architecture content before setting governance processes. However, they should try to establish effective enterprise architecture governance early in their work and develop content in parallel.

10. Not spending enough time on communications – Not putting enough attention to public relations and not spending enough time on communications is a pitfall indeed. Enterprise architects must work to spread knowledge and awareness of enterprise architecture and the expected impact of work, and educate the enterprise staff. It is highly useful that enterprises develop and execute an enterprise architecture communications plan with messages that are properly developed for each audience.

Taking these pitfalls into consideration when designing and implementing the enterprise architecture could better ensure success.

Mr. R. Scot Bittler of Gartner summarizes it eloquently as follows:

> The key for enterprise architects is to create not the perfect or most elegant architecture for the moment, but the most adaptable architecture for the future, enterprise architecture is a challenging discipline and careful attention to the basics can mean the difference between failure and success.

1.9 An Enterprise Architecture Team

Enterprise architecture teams are composed of professionals from different backgrounds. A misconception is that the technical people matters most, but this is of course not true. The issue here is not which subject matters to have experts from, but what types of work and decisions are needed that will determine the composition of the team.
In all cases, there are three kinds of people who are needed in the enterprise architecture

team. These are areas of expertise and professionalism that match the policies and standards of enterprise architecture work, namely:

- Technology – Infrastructure, tools and applications
- Enterprise – Business and data
- Policies – Integration and security

However, these expertise and skills will be shared by three categories of people. The enterprise architecture team should consider having members from these three categories.

- Business leaders
- Business unit or speciality architects
- Enterprise architects

People who understand the information needs of the company and how they fit in with the business plans are business leaders and they are the ones who run the enterprise. Normally, they are an executive, chief information officer (CIO), vice president, or similar high-ranking individual. Such members of the team act as a liaison with the upper management of the enterprise to present the plans to upper management and support their decisions, which is a very significant role. Business drivers act as a source for business/ICT strategy that supports the (1) needed business processes, and (2) information requirements. From these two components the ICT architecture is developed, and results in the implementation of the ICT architecture. Consequently, the ICT infrastructure is developed.

The second category of team members is the architects or planners of individual business units of the enterprise. Such people may also be specialized ICT groups for specific ICT projects or technologies. These are the subject matter experts who know their area very well and can provide the necessary insights. In general, many of these people are also involved in the implementation of the ICT architecture.

As for the third category, they are experienced enterprise architects, and they are the ones who consolidate the business information and goals with the individual business units and speciality groups. They also have the capability to coordinate with other high-level architects in the areas of data management, applications development and infrastructure.

1.10 Processes that Enterprise Architecture Supports

The power of enterprise architecture includes a very important quality: It supports processes to achieve good results.

For example, enterprise architecture fully supports project management processes. This is done by defining work packages that can be plugged into a project management plan. These work packages follow certain specifications that are common across the enterprise. Project teams can then study the list of requirements and patterns to identify the work needed. These patterns can help with resource management: Less expert staff is needed in project implementation, thus freeing up the time of senior staff for unusually challenging work. These patterns can be assigned approximate estimates of time, which can be plugged into high-level resource planning. These patterns can also support service management.

Similarly, ICT governance can be supported through enterprise architecture, for example, by creating a mechanism for reviewing and controlling ICT asset purchases. With this mechanism in place, ICT assets should only be purchased if they fit within the enterprise architecture standards. Enterprise architecture also enables ICT governance decisions, by making it easier for ICT to change in the way ICT governance wants.

Business processes inside enterprises are often examined for potential enhancement, and redesigned to act in a better and more efficient way. Enterprise architecture supports ICT process improvement. One way of doing this is by creating a place for process improvement knowledge to be stored and used again. This information would indicate what changes are needed and in what way to re-engineer it.

In a developing country X there are three important ministries that are highly affected by ICT. These are the ministries of health, interior and education. Each ministry has sufficient funds to have their own independent ICT department, fully supported with infrastructure and platforms.

The Ministry of Telecommunications and Information Technology (MoTIT) runs among other projects, a data centre, a government connectivity network and a gateway portal to other portals of these ministries.

The development of an enterprise architecture can enhance the efficiency of an existing situation and support decision-making on future management. An enterprise architecture can also be used to explore better ways of managing the whole structure of knowledge and information, with the idea of seeking scenarios and situations of "what-ifs". For example:

A. Identify possible solutions. These could include, but are not limited to any of the following:

   1) Remove all e-services and government resource planning elements from these ministries and integrate them within MoTIT, using the same data centre and connectivity, thus connecting ministries virtually through a central platform and central data resources. (i.e., abolish platform, systems and data resources and move them to a central site).

   2) Maintain infrastructure and platforms well kept by each ministry and move only the data resources to the central MoTIT data architecture.

   3) Maintain all aspects within each ministry, including data, but introduce a virtual connected database well planned to operate as a central visual centre.

B. Government leaders will select an option to adopt, not the enterprise architecture leader or team. Experienced enterprise architects can support the selection process by simulating each architecture solution and examine the pros and cons, thus helping the decision maker select the best solution, following which the enterprise architect will design and plan the implementation of the enterprise architecture.

Box 3. Case for enterprise architecture supporting other important decisions

1.11 New Technology Process

An enterprise architect's work is ongoing as s/he continually reviews the technology profile of an enterprise in relation to new and emerging ICTs. A process known as New Technology Process (NTP) is the mechanism whereby new technologies that have not been previously identified as needed in the architecture plans, are introduced into the enterprise.

The NTP is initiated when a customer group or a member of the ICT organization recognizes the need for a piece of technology that is not currently being used. An NTP committee is formed with the relevant technical architects and business managers. This committee then reviews any current technology to see if it can meet the requirements. If not, acquisition of such technology becomes imperative according to the enterprise business rules.

1.12 Summary

Gartner, a leading IT analysis firm, defines enterprise architecture as a discipline where an enterprise is led through change. According to their glossary:[4]

> Enterprise architecture (EA) is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analysing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision-making toward the evolution of the future state architecture.

The methods of analyzing information technology needs ways of adoption in organizations and enterprises have changed, no surprisingly due to the way business and enterprises have evolved and the scope and way technology has developed. Especially as these enterprises is public organization all under the government stricture. This new trend of analysis and design is referred to as enterprise Architecture (EA).

While an enterprise is an organization that functions as an autonomous entity, it could be public such as a ministry or government authority, providing service to the citizen as well as to other government entities or private sector.

The term enterprise covers all kinds of organizations, public and private, large and small. Moreover, it may comprise a single department, or every department in a large organization in multiple countries.

From a public sector perspective, an enterprise architecture can be seen as a strategic planning framework that relates and aligns ICT with the business functions that it supports. It is also used as a framework or umbrella for explaining the relationships among the government's ICT projects and managing change.[5]

Enterprise architecture (EA) is a a well-defined practice for conducting enterprise analysis, design, planning, and implementation. It studies best changes possible to consider all aspects of development and execution of strategy successfully which cover business, information, process, and technology changes to come up with an enterprise strategy that will bring about quality improvement, resource optimization, cost reduction and ROI necessary to execute the enterprise strategy. In general EA enterprise architecture aims at providing an enterprise with the potential of controlling the investment of ICT optimizes resources utilization and enhance the return on investment (ROI). In general, it helps the enterprise to implement the strategic goals it has set for itself.

Enterprise architecture typically focuses on three core descriptions: the "current state" of the enterprise, its "future state", and the road map or plan for achieving the future state. Enterprise architecture is business-driven and focus first on business strategy. The object is to document

[4] Gartner, "IT Glossary - Enterprise Architecture (EA)". Available from http://www.gartner.com/it-glossary/enterprise-architecture-ea/.

[5] UNDP, e-Government Interoperability: Guide (Bangkok, 2007).

strategic goals and to ensure that the analysed functions, processes, systems and enterprise components are aligned with and support the execution of that business strategy. Enterprise architecture also expresses enterprise-wide standards, policies, rules and principles and expects that systems and business processes will comply with these.

Enterprise architecture is an ongoing process. It is not something that is done once and completed. It influences and informs planning and decision-making and, in turn, it is reshaped and refined by the outcomes of business and ICT investments that transform the underlying enterprise.

Enterprise architecture teams are composed of professionals from different backgrounds, mainly business leaders, business unit speciality architects and enterprise architects. They form the expertise in the three main areas of enterprise architecture—technology, enterprise and policies.

CHAPTER 2.
TIME FOR CHANGE

The most successful ~~businessman~~ (architect) is the man who holds onto the old just as long as it is good, and grabs the new just as soon as it is better.

– Lee Iacocca

The best ~~executive~~ (architect) is the one who has sense enough to pick good men to do what he wants done, and self-restraint to keep from meddling with them while they do it.

– Theodore Roosevelt

CHAPTER 2.

TIME FOR CHANGE

2.1 Key Architectural Principles

Enterprise architects follow four major principles to guide their work safely. These principles are perhaps the most important ones for many reasons. They form a protective life cycle where each action empowers the next action, and ensures the effectiveness of the development and implementation process. These principles have a well-defined strategy that guides the architecting process as follows:

> Through essential aspects of the enterprise, reduce costs and optimize ICT adoption in such a way to maximize the ROI.

This can be presented in a simpler way by outlining the following four principles:

1. Align – Find direct links to essential and critical sections of the enterprise
2. Optimize – Produce more and do more with available resources
3. Externalize – Move ICT assets outside of the ICT operating environment, if they do not add value
4. Consolidate – Reduce unnecessary redundancies

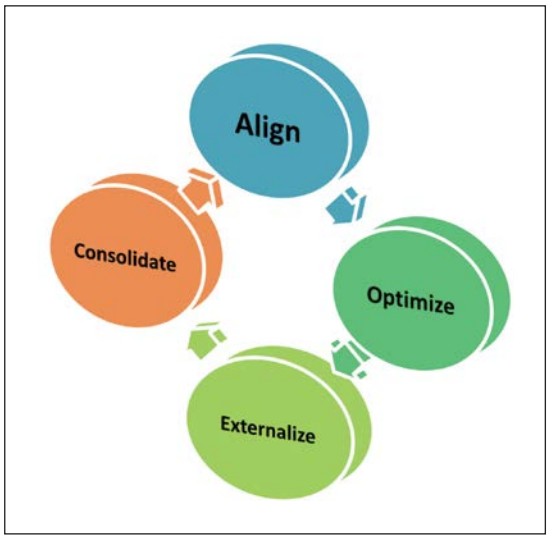

Figure 2. Key architecture principles

2.1.1 Align

As an enterprise is composed of different parts and sections, it is natural that their relationship to each other determines the functionality and efficiency of the enterprise itself. Making sure that these parts work together and enhance each other's impact is the main objective of this principle. In fact, the many pressures on businesses will force ICT alignment with the business objectives of the enterprise. Finding new and better ways of aligning ICT with different parts of an enterprise are essential. Certainly, no decision can be done unless proper study is carried out to understand the different parts of an enterprise.

This requires the ability to measure and quantify architecture decisions. Some of the ways of doing so include the following, although other ways can be suggested as well:

- Key metrics – It is said that "what cannot be measured cannot be improved". Indicators and quantifiers can be suggested to assess the results of architecting the enterprise. Using ICT indicators will help greatly. Such measurements will not only help to demonstrate enterprise architecture effectiveness, but also to quantify it.
- Assessments – Continuous and periodic evaluation and assessment of enterprise architecture solutions is a must. Results will support decision-making. Assessments include architecture-viability assessments, architecture trade-off analysis, architecture decisions documents, and standard request for proposal assessments.
- Requirements management – This is the process of defining in detail the methods of analysing, prioritizing and agreeing on requirements in order to control change while communicating to relevant stakeholders. Naturally, these requirements are the capabilities to which enterprise architecture should conform. It is important to note that capturing functional and non-functional requirements in reusable ways will help align architectures to the business. This is the fastest and easiest way to get such alignment.
- Architecture management – As changes are designed and implemented, it would be important to look at how these changes fit into existing and new imperatives of the enterprise. Architecture management links with standard processes, such as applications management, information systems management and project management office processes.

2.1.2 Optimize

When changes take place, a new task has to be handled to optimize the existing solutions. Architects will need to evaluate current solutions by determining how they are used, and if they are running in the best way possible. Architects have to find any redundancy and assess whether the changes fit the use that the business intends. These are very difficult to do and find out since a great deal of information is required that may or may not be available. There is a strong dependency on process. However, to obtain this information, architects can review the ICT collection of applications. This will enable them to see how the ICT solutions link back to the business and business processes, and how the solutions are maintained. The overall cost can also be estimated this way. In addition, architects can study the application life-cycle management improvements, which can include business process re-engineering, process optimizations, and new tools to automate and accelerate applications development.

2.1.3 Externalize

The applications that have strategic value can be effectively used to determine the best course of action. In fact, a trend to externalize ICT assets is becoming popular in enterprise ICT management. Examples are traditional outsourcing, managed services providers, and so on.

2.1.4 Consolidate

As architects optimize their enterprise, they will look at ways to optimize and consolidate applications themselves. This includes ICT infrastructure such as the hardware backbone of the enterprise; and ICT services such as collaboration, voice over Internet protocol, e-mail, usiness intelligence, portals, system monitoring, and project management systems. Others examples of consolidation could take place in solutions and processes.

2.2 Enterprise Architecture Policies and Standards

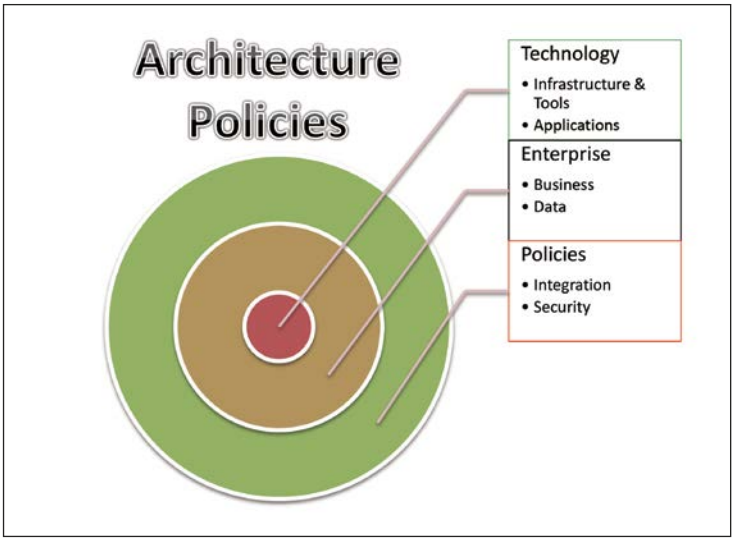

Figure 3. Architecture policies

Enterprise architecture policies have been well defined. They relate to understanding and defining the areas where architecture engineering can, and should, work. The fact that these areas are often classified under other areas of knowledge and practice does not exclude them from being an integral part of the enterprise architecture policies. For example, data and how it is organized and shared in an enterprise is the core of ICT engineering, yet it cannot be studied alone without aligning it with other areas such as the processes and business architecture in an enterprise. Therefore, the enterprise architecture efforts have to look at several of these related areas, integrate and offer standards according to adopted policies. These include the following:

1. Business architecture – The business architecture components focus on the enterprise's business nature, such as who it is, what it does and where it intends to go. The business standards define the enterprise (department) structure, workflow for business concepts, processes and rules. ICT is based on the use of standard definitions, which drives the capture of reusable data and process elements to ensure that minimum effort is required in scaling in future.
2. Data architecture – Data architecture describes an overall framework for the information across the enterprise, and describes the internal as well as the external sharing principles and policies across organizational lines while respecting the security, privacy and appropriate use of that information. Data standards should include how data is managed and used within entities from an architectural standpoint, rather than from an implementation perspective.
3. Applications architecture – The applications architecture sets details of unified and adopted view of solutions, applications and information systems to achieve benefits such as increase in reuse, reduction of solution complexities, and fast and reliable management. Applications developed and run by the entities will be based on the idea of using standardized components that have reusability applied as a core concept. This will help to integrate components together with minimal effort needed.
4. Technology architecture – The technology architecture contains a foundation of development and support platforms, tools, processes, practices and requirements that can implement business processes and meet the organizations' ever changing business needs. Standards and best practice designs are necessary for the underlying infrastructure and platform components (system and network hardware and operating systems), which enable the adequate functioning of all other layers.

5. Integration architecture – This area is so important that it has to be carefully handled. It may not look like an area as much as it is a policy directive, yet it addresses the inter-connection of all layers of the architecture and standards within and across the enterprise. Adequate standards should be defined for significant components such as database integration, message integration, transaction process monitor integration and services, enterprise service bus, service-oriented architecture, and instant messaging.
6. Security architecture – The security layer is present and pervade through all the architectural areas and layers. It covers access to data, systems and services, along with other dimensions of protection from threat, vulnerability exploitation and intrusion. Related standards should be clearly specified.

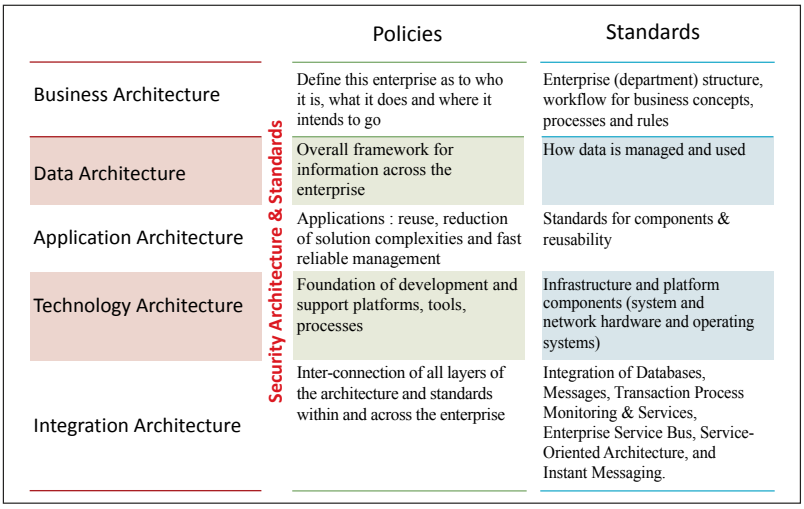

Figure 4. Relationships between architectures, and policies and standards

2.3 Key Startup Activities

Enterprise architects follow four major principles to guide their work safely. These principles are perhaps the most important ones for many reasons. They form a protective life cycle where each action empowers the next action, and ensures the effectiveness of the development and implementation process. These principles have a well-defined strategy that guides the architecting process as follows:

To begin an enterprise architecture endeavour, there are three critical steps to follow:

1. Adopt business goals and prioritize them. Guiding questions include:
   - What does the enterprise want to be as it evolves?
   - What services does it offers?
   - Who are its users?
   - What characteristics and strengths does it want to build or maintain?
   - What overarching policies is it going to embrace?

2. A vision has to be developed to address these questions:
   - How the set goals will be achieved?
   - What is the common vision for the concept of operations?
   - What options are there for new concepts of operations?
   - Which concepts currently work successfully?

3. Very often the current systems, applications and infrastructure are completely ignored. The lack of knowledge about the current situation is due to the lack of continuous update of

available resources. Therefore, an important step is to create and maintain such knowledge of “as-is” resources.

2.4 The Role of ICT in Enterprises

ICT is used to refer to all kinds of technologies that provide, support and deal with information and communication. It refers to any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning.

Studies have shown evidence of the importance of ICT for social and economic development, even in the least developed countries, and many sectors have used ICTs in innovative ways. ICTs are indispensable in all sectors because: (1) There are all kinds of information generated and used in these sectors; and (2) They need to be communicated from one place to another. Most relevant of these applications is technology in government. The application of ICTs in government entities and enterprises has become a leading concern for governments around the world. Many countries have established official organizations for the promotion of ICTs, headed by a person referred to as the CIO of the country.

The role of ICT in an enterprise can be classified into four broad categories as follows:

1. Function technology systems – Function ICT systems are applications that allow individuals to function effectively in the workplace. An application is operated by a user, to manage information needs and provide processing according to predesigned procedures and needs. These are off-the-shelf and can enhance workplace functions such as word processor applications, spreadsheet applications, statistical analysis software and more specialized ones like computer-aided design programmes. Employees can work and perform their task individually or collectively using these specialized software technologies.
2. Network technology systems – ICT systems operate a network and create channels of communication between parts of the enterprise, to allow effective communication capabilities. This communication can also be to outside the enterprise. Examples including e-mail systems, blogs, web portals, instant messaging and electronic conferencing. These types of technologies promote interaction and collaboration among working groups and also facilitate quick information flow at all levels.
3. Management technology systems – These management systems refer to planned applications that are designed to process data and transform the processed data into useful information for management decision-making. Such applications range from very simple to complex systems. It is important to note that management information systems are subsets of the ICT systems used in the enterprise. As management operates at different levels, it is possible to apply management information systems at these varied levels accordingly. Basic examples of management information systems are human resource management systems, financial management information systems and marketing management information systems.
4. Enterprise technology systems – These systems, which are basically management information systems, are technologies that are designed to integrate and manage entire business processes for large organizational structure, such as a big corporation or a ministry. Typically, enterprise application software is hosted on large servers over a powerful computer network. Private clouds can also serve such purpose. Examples of enterprise information systems include accounting software, health care specific software or electronic data interchange. Another good example of software application within this category is customer relationship management software.

2.5 Realizing Immediate Value

It is important to realize immediate value while the overarching vision is being set. Enterprises cannot stop operations without missing chances or opportunities, nor can they stop the actual work and delivery of services. Enterprise architecture aims to carry a strategic as well as detailed plan to transfer an enterprise from the current status (referred to as the “as-is”) to the desire one (the “to-be”). A good amount of time would lapse before actual success and completion is achieved. Such time period may extend to several years. Ideally, the enterprise can wait during this period until the entire “to-be” enterprise architecture has been described and inspected before analysing and describing a strategic plan forward. However, this is not realistic. It is not possible that valuable architecture assessments can be completed in the meantime.

Although there are changes that would take time to plan and implement, there are also changes that are relatively small and can be implemented quickly as short-term solutions through which enterprises can start realizing value and benefit from enterprise architecture efforts. These are normally referred to as “quick wins”. Enterprises can have small-scale architecture development successes. These practical and tangible results can provide the necessary strengthening and advocacy often needed to continue support and funding for overarching enterprise architecture efforts.

An example of such small-scale development can include the acquisition and deployment of top-priority systems within a short period of time, such as a year, making certain that these systems are defined well enough to ensure integration into the greater enterprise. Another example of such efforts can involve saving operations and maintenance costs by analysing business processes and determining what type of redundancies exist. While the overall vision is being designed and set, the enterprise could adopt such quick-wins practices and technologies.

2.6 Summary

Enterprise architecture has certain principles that form the backbone of its application. These are:

- Align – Find direct links to essential and critical sections of the enterprise
- Optimize – Produce more and do more with what is available from resources
- Externalize – Move ICT assets outside of the ICT operating environment, if they do not add value
- Consolidate – Reduce unnecessary redundancies

Policies and standards that enterprise architecture implementation follows focus on specific architectures that form the building paths of an enterprise. They cover six major areas:

1. Business architecture – The way business goes in the enterprise with its business structures and processes
2. Data architecture – The overall framework for the information and data across the enterprise
3. Applications architecture – The details of unified and adopted view of solutions, applications and information systems to be used
4. Technology architecture – The foundation of development and support platforms, tools, processes, practices and requirements (such as system and network hardware, and operating systems)
5. Integration architecture – The inter-connection of all layers of the architecture and standards within and across the enterprise
6. Security architecture – All security issues, practices and strategies in the enterprise

The role of ICT in development can be classified into four broad categories. These categories include function performance (function technology systems), communication through networking (network technology systems), management (management technology systems), and enterprise roles (enterprise technology systems).

CHAPTER 3. ENTERPRISE ARCHITECTURE: FRAMEWORKS, PLANS, AND ACTIONS

CHAPTER 3.

ENTERPRISE ARCHITECTURE: FRAMEWORKS, PLANS, AND ACTIONS

3.1 Visions and Missions

3.1.1 Introduction

Since architecting the enterprise aims at implementing a change in the way the enterprise is and operates, with emphasis on ICT, a clear motivation for such change should be implied by or brought about with the vision of the enterprise. The vision is a short statement that describes how we want the enterprise to be after some years in the future. Normally one addresses long term visions, such as at least five years ahead.

Once a vision is defined, a mission has to be formulated. This is a statement that is a little longer than the vision in words. It describes the purpose of changes that are intended to be done during the planned period of development. In other words, one could define the way to move for the current situation to the future that relates to the vision statement.

Following the definition of purpose of change, goals can be set and detailed objectives are formulated. There may be principles that have to be respected while planning such development work.

Finally, actions and task are designed and developed to achieve the objectives and goals. These actions form projects and activities. Normally, a good road map is also developed in order to have a clear idea of how these tasks and activities are to be implemented.

It is extremely difficult, in fact impossible, to define a good vision, mission, goals and objectives without knowing the current situation of the enterprise. This current status has to be obtained through a study and assessment of the current situation, and provide clear understanding of the current problems and challenges that face the enterprise.

Figure 5 shows a well-established methodology to launch an enterprise architecture work. It is a pyramid divided into four layers. The top most, which is the highest level, is of a policy and strategic nature. It is focused on what the enterprise wants to be in the future. The second one, just below it is the mission. It is about where the enterprise is now, and what the priorities are. Next is the level of the goals and objectives, indicating what should be done. Finally, the fourth level is the most detailed, and it addresses the changes, and how they could be “architected”. In sum, this is the scope of enterprise architecture.

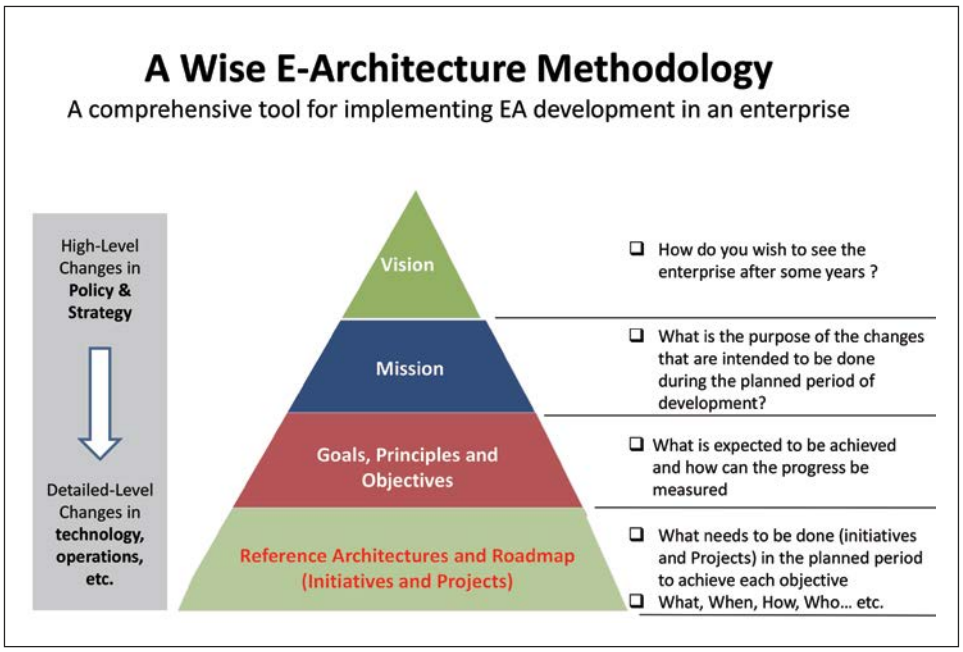

Figure 5. Overview of enterprise architecture

3.1.2 A Vision Statement

A vision is normally a short sentence. It could be around 50 words. The brevity of this sentence is important, and hence there are basic concerns to follow:

- It must be future focused as it describes the organization's desired future. It sets the context for action.
- It must provide direction and should make clear where the organization is going.
- It must be clearly articulated and easily understood.
- It is not logical to talk of the future of an enterprise if it does not have relevance to its history, so a vision should be relevant to what the enterprise has been doing, or trying to do.
- It must include reference to a meaningful purpose, and does not bypass the core values of the enterprise.
- It must provide challenge and encourage people to commit to the enterprise goals.
- It must be memorable and conjures up a vivid intellectual image.

Look for example at the Vision 2030 of the Philippines' Department of Health. It is simple, short and clear:

> A global leader for attaining better health outcomes, competitive and responsive health care system, and equitable health financing.

Table 1 provides suggestions for developing a vision statement using the Philippines example above.

Vision Characteristics	Reference to example
Future focused	"..attaining..", 2030
Provide direction	Better health outcomes
Clearly articulated and easily understood	Eighteen-word sentence that is simple to read by citizens
Relevance to what has been going on	Health care
Meaningful purpose and core values	Competitive and responsive health care system
Provide challenge and encourage commitment	Equitable health financing

Table 1. Vision characteristics

3.1.3 A Mission Statement

A mission is normally a longer sentence or a couple of sentences long, which aims to define the purpose of changes that have to be done to move from the current situation to the future situation as described by the vision. The following are the most important characteristics that a successful mission statement should exhibit:

- It should be as brief as possible.
- It is better to make it easy to memorize. Being memorable means that it is something that people will be able to remember the key elements of, even if not the exact text.
- It should focus on important issues such as how to uniquely strive to work differently and how to achieve excellence.
- It must be realistic, as it is supposed to be a summary of why the entity exists and what it does. It is a description of the present, not a vision for the future.

The following is the mission statement of the Philippines' Department of Health:

> To guarantee equitable, sustainable and quality health for all Filipinos, especially the poor, and to lead the quest for excellence in health.

Table 2 provides suggestions for developing a mission statement using the Philippines example above.

Mission Characteristics	Reference to example
Brief	One sentence, 22 words
Easy to memorize	Memorable words such as guarantee, equitable, poor, Filipinos, excellence
Focus on important issues	Equitability, sustainability, quality
Realistic (why the entity exists)	"…to lead the quest for excellence in health"

Table 2. Mission characteristics

3.2 Frameworks Here, Frameworks There… and Everywhere!

3.2.1 What is a Framework

As studies and recommendations are developed for changes in strategy and goals, other studies should be going on to define business processes, decide on specifications, and design new software applications. Enterprise architecture defines all of these elements, and also defines how they fit together to ensure that the organization functions as intended. Therefore, it is critical that rules and methods are well thought out and adopted to regulate the architecting process. Normally, a steering committee is set up to assume the specific responsibility of the enterprise planning team.

Very often, people think that enterprise architecture involves creating a lot of documents, which may be true; and the success of the enterprise architecture process is measured by the quantity, quality and relevance of these documents, which is partially true. However, these documents never make enterprise architecture. Unless these are well integrated they remain just a pile of documents. The integration process is normally achieved by using special software technical tools, usually an enterprise or business process modelling tool that relies on a technical repository containing all the plans, models and documents with logical relationships.

This process is addressed and regulated by what we call a framework. Normally, frameworks provide well-established rules, principles, methods and practices to create the different architecture descriptions of an enterprise called artifacts. It helps enterprise architects to logically structure their thinking and work by dividing the architecture description into domains, layers or views, and generates models (normally these are matrices and diagrams) for documenting each view.

In short, an enterprise architecture framework provides a structure composed of methods, relationships and artifacts (well-described documents, etc.) in order to establish and use an enterprise architecture.

Figure 6. Working with frameworks

Source: Willy P. Schaub, “Willy’s Cave Dwelling Notes #10”, 23 November 2012. Available from http://blogs.msdn.com/b/willy-peter_schaub/archive/2012/11/23/willy-s-cave-dwelling-notes-10-managed-extensions-framework-mef-simplicity-rules.aspx.

3.2.2 Framework Models

Two common problems found in any enterprises are:

- System complexity – Enterprises are spending an increasingly large proportion of their budget on ICTs, mainly to purchase new ICT systems.
- Poor business alignment – As new systems are introduced in the enterprise, with more technology, and with more cost, these ICT systems become increasingly difficult to align with business operations and needs.

This increasing cost and decreasing value have today reached a crisis point. As the cost and complexity of ICT systems have continuously increased, chances of deriving real value from those systems have dramatically decreased. Enterprise architecture provides a solution, with methods and practices to address these problems. The way these methods and practices are structured scientifically are known as framework models.

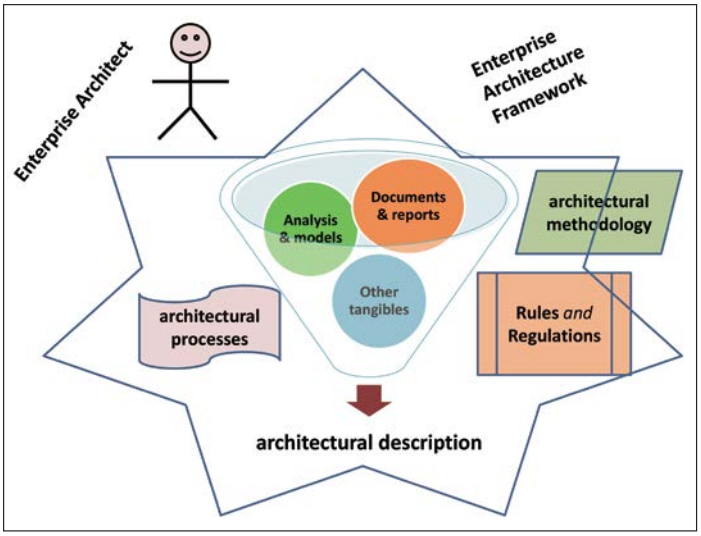

Figure 7. Enterprise architecture framework concept

Researchers and practitioners have made significant contributions to building enterprise architecture methodologies and frameworks. Of these, four are used currently by about 90 per cent of the enterprise architects (see Table 3). Although they are called frameworks, each has a different trend and modality.

Framework	Trend
The Zachman Framework for Enterprise Architectures	It is actually more accurately defined as a classification and categorization methodology
The Open Group Architectural Framework (TOGAF)	It can be better defined as a process
The Federal Enterprise Architecture (FEA)	One can see this as either implemented enterprise architecture or a conservative methodology for creating enterprise architecture
The Gartner Methodology	It is best described as an enterprise architectural practice

Table 3. Four models of enterprise architecture frameworks

These frameworks are united in providing a way to solve problems that result from ICT systems becoming unmanageably complex and increasingly costly to maintain, and are hindering the enterprise' s ability to respond to current, and future, market conditions in a timely and cost-effective manner. Two other concerns are vital in enterprise operations:

- Operation-critical data and information that is out-of-date, invalid and just simply wrong
- A culture of distrust and unwillingness to cooperate between the business and technology sides of the organization

Careful examination reveals that none of these models is really complete as each has strengths in some areas and weaknesses in others. In fact, professionals in enterprise architecture and well-skilled enterprise architects tend to use what has become known as the blended methodology. This is simply the practice of using parts from each of these frameworks, modify and merge them according to the specific needs of the enterprise.

In this section we will briefly look at three of these frameworks, namely the Zachman Framework, TOGAF and FEA.

3.2.3 The Zachman Framework for Enterprise Architectures

The Zachman Framework model adopts a two-dimensional organization or classification of the architectural artifacts. It is simply a matrix in the form of a comprehensive table showing the structure and relationships. One dimension is set as the rows of the table, and it relates to the various actors involved in the enterprise, or the “players in the game”, for example, an owner, builder, planner or designer.

The enterprise architect is responsible for preparing different artifacts for each of these players. Every actor in the architecting process expects actual and complete information. Completeness is relevant to each of these actors, as what is complete for someone is not complete for another of these actors. One simple example about information “completeness” is as follows:

- The owner of the enterprise is interested in a complete description of the functionality and the way the enterprise looks.
- The builder is interested in a complete description of the systems, components and materials, and the process of building the changes in the enterprise.

The owner is less concerned about what systems or software is used and implemented as long as it works, and the builder is less concerned about why this platform of software or systems are selected, as long as s/he knows how to get them and build (install) them.

The second dimension for architectural artifact organization (set as columns) is the description of the artifact: The who, what, when, where, why and how of the project. The content of this dimension has nothing to do with the actors (first dimension). For example, both the builder and the owner need to know what, but the owner's need to know what is different from the builder’s need to know what. An interesting way to put this fact is: “What what is what depends on who is asking the question”.

In the Zachman Framework there are six descriptive tracks that form the second dimension: data, function, network, people, time and motivation. As for the first dimension (actors), there are six perspectives: planner, owner, designer, builder, subcontractor and enterprise. The matrix and related description are shown in the table below.

In the Zachman Framework, the items in the business managers section such as the scope of business (e.g., list of things important to the business and list of events significant to the

business) and the enterprise model (e.g., business process model and business plan) are artifacts that are documents in relevant forms. Once these documents are well prepared and designed, the architecture of the enterprise becomes defined. In the same token, for IT managers and developers, items such as data definition and actual application are also artifacts, and they can be documents, specifications or designs.

The enterprise architect would have to generate all these with his or her team. Once completed properly, it would form the designed architecture.

Finally, out of these documents, a set of activities, projects and tasks are designed in order to implement changes indicated in these artifacts. The time plan and requirements of how these can be implemented is what is known as the road map for the enterprise architecture implementation.

3.2.4 The Open Group Architecture Framework

The Open Group Architecture Framework, known as TOGAF is developed by The Open Group firm.

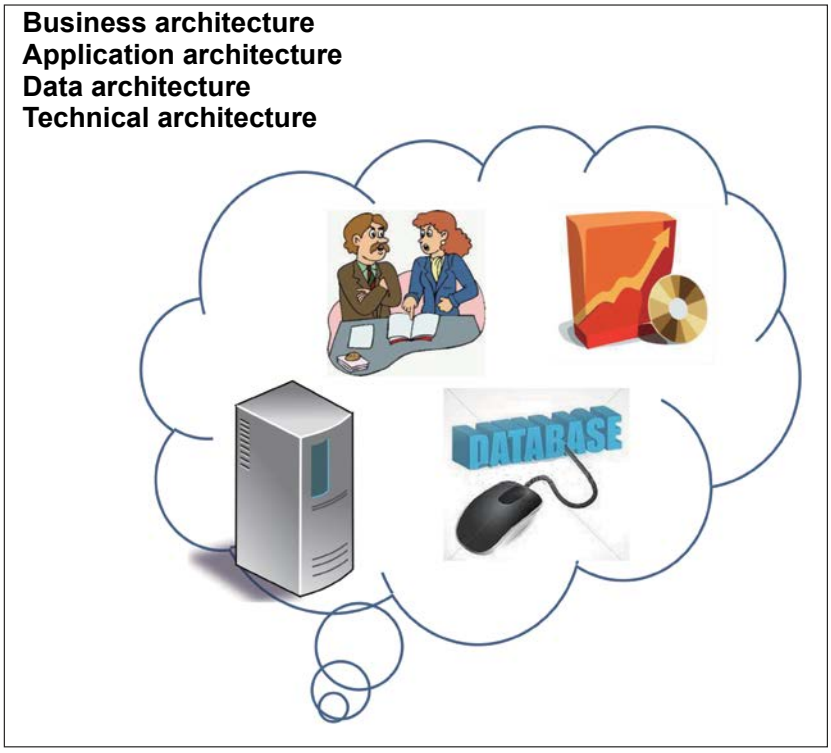

Figure 8. Structure of the TOGAF model

The TOGAF enterprise architecture is divided into four categories, as follows:

1. Business architecture – Describes the processes the business uses to meet its goals
2. Applications architecture – Describes how specific applications are designed and how they interact with each other
3. Data architecture – Describes how the enterprise data sets and data servers are organized and accessed
4. Technical architecture – Describes the hardware and software infrastructure that supports applications and their interactions

		Data *What*	Function *How*	Network *Where*	People *Who*	Time *When*	Motivation *Why*
Busines Managers	SCOPE (Contextual) Planner	List of Things Important to the Business	List of Processes the Business Performs	List of Locations in Which the Business Operates	List of Organizations Important to the Business	List of Events Significant to the Business	List of Business Goals/ Strategies
	ENTERPRISE MODEL (Conceptual) Owner	Semantic Model	Business Process Model	Business Logistics System	Work Flow Model	Master Schedule	Business Plan
IT Managers & Developers	SYSTEM MODEL (Logical) Designer	Logical Data Model	Applications Architecture	Distributed System Architecture	Human Interface Architecture	Processing Structure	Business Rule Model
	TECHNOLOGICAL MODEL (Physical) Builder	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
	DETAILED REPRESENTATIONS (Out-of-Context) Subcontractor	Data Defintion	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
	FUNCTIONING ENTERPRISE	Actual Business Data	Actual Application	Actual Physical Networks	Actual Business Organization	Actual Business Schedule	Actual Business Strategy

Table 4. Summary of the Zachman Framework

Source: Microsoft Development Network, “A Comparison of the Top Four Enterprise-Architecture Methodologies”, May 2007. Available from http://msdn.microsoft.com/en-us/library/bb466232.aspx.

TOGAF is composed of different processes as parts. One major part of it is called the Architecture Development Method, which is a procedure to create architectures using all artifacts. These architectures can be generated in different levels, ranging from generic to more specific levels. The most generic architectures are referred to as Foundation Architectures. In principle, these are architectural designs that can, theoretically, be used by any ICT organization in real life. While the Common Systems Architectures are those that can be used in many types of enterprises. The most specific architectures are those referred to as Industry Architectures, which are specific across enterprises of the same domain.

TOGAF is composed of eight different architecting phases. However, an initial phase is responsible for kicking off the architecture work. These phases are as follows.

- The Preliminary Phase describes the preparation and initiation activities.
- Phase A (Architecture Vision) describes the scope, identifies stakeholders, and creates the architecture vision for approvals.
- Phase B (Business Architecture) describes the development of a business architecture to support an agreed architecture vision.
- Phase C (Information Systems Architectures) describes the development of information systems architectures for an architecture project, including the development of data and applications architectures.
- Phase D (Technology Architecture) describes the development of the technology architecture for an architecture project.
- Phase E (Opportunities and Solutions) conducts initial implementation planning and the identification of delivery vehicles for the architecture defined in the previous phases.
- Phase F (Migration Planning) addresses the formulation of a set of detailed sequence of transition architectures with a supporting implementation and migration plan.
- Phase G (Implementation Governance) provides an architectural oversight of the implementation.
- Phase H (Architecture Change Management) establishes procedures for managing change to the new architecture.

3.2.5 Federal Enterprise Architecture

3.2.5.1 Introduction

A large government such as the United States would need a framework to unite its many entities and functions within a single common and ubiquitous enterprise architecture. To do so a very careful and well-conducted architecture project is needed. It is referred to as the FEA method. It is a comprehensive and complete methodology. In fact, it combines the excellent classification power of the Zachman Framework, and at the same time provides very well-articulated architectural process, like TOGAF. It is a very efficient framework for governments in general.

FEA is composed of five major reference models. These are essential of course, but managing these models would require elaborate steps. These steps are as follows:

- An overview of the enterprise architecture by segments. This is called the segment model.
- A set of five reference models for describing different perspectives of the enterprise architecture of the government
- A process for creating an enterprise architecture
- A transitional process for migrating from the “as-is” (or pre-enterprise architecture) to the “to-be” (or post-enterprise architecture paradigm)
- An approach to measuring the success of using enterprise architecture, and observe outcomes, ROI characteristics and business value

FEA provides a common language and framework to describe and analyse ICT investments, and enhance collaboration and ultimately transform the government into a citizen-centred, results-oriented and market-based organization.

The view on how the enterprise architecture should look like is best achieved by dividing the government enterprise into segments. A segment is a major line-of-business functionality, such as human resources. All segments can be classified as belonging to one of two categories:

- A core mission-area segment that is central to the mission or purpose of a particular political boundary within the enterprise. For example, health is a core mission-area segment.
- A business-services segment that is basic and foundational to most, if not all, political organizations, such as financial management.

Very often, an enterprise service is viewed as a well-defined function that spans major boundaries within the enterprise or government. Security management is an example, as it works over all parts of the enterprise. So if the services covers the whole enterprise it is referred to as an enterprise service, but if limited to certain parts, it is referred to as a business service.

3.2.5.2 FEA Reference Models

Reference models are important to make sure that all terms, conventions and understandings are well defined and shared by all. This is essential to facilitate communication, cooperation and collaboration across the government or business entities that form the overall enterprise. The five reference models are as follows:

1. The Business Reference Model gives a business view of the various functions of the government. For example, this model would view the water resource management as a standard business capability, which is a subfunction of natural resources that is a part of the broader services for citizens.
2. The Components Reference Model gives an ICT view of systems that can support business functionality.
3. The Technical Reference Model defines the various technologies and standards that can be used in building ICT systems.
4. The Data Reference Model defines standard ways of describing data that is generated, used and managed within the enterprise (in part or in full).
5. The Performance Reference Model defines standard ways of describing the value delivered by enterprise architectures. Quality, for example, is a technology measurement area that is defined by this model.

3.2.5.3 FEA Process

The simplest way to understand the FEA method is to consider the whole government enterprise as a group of entities that are clustered according to sectors based on the nature of their services and business processes, which clearly form the baseline for such segmentation.

The overall segment-architecture development process is (at a very high level) as follows:

Step 1 – Architectural Analysis:
Define a simple and concise vision for the segment, and relate it back to the organizational plan.

Step 2 – Architectural Definition:
Define the desired architectural state of the segment, document the performance goals, consider design alternatives, and develop enterprise architecture for the segment,

including business, data, services and technology architectures.

Step 3 – Investment and Funding Strategy:
Consider how the project will be funded.

Step 4 – Programme Management Plan and Projects Execution:
Create a plan for managing and executing the project, including milestones and performance measures that will assess project success.

This framework is more elaborate and requires experience by the architects who would lead the effort of applying it to a government or large enterprise to achieve best results.

3.3 Recipe for Change

As enterprise architecture is aimed at developing change to achieve certain set goals, it would be very useful to have a practical guide with set procedures to follow. Some questions can be put forward to ensure that the process of implementing the architecture is sound and successful. Based on these questions, the proper approach and needed models can be identified and selected.

Before outlining the steps and procedures, let us remind ourselves that enterprise architecture include these following related areas:

- Business – Processes, strategies, organization charts and functions
- Information – Conceptual, logical and physical data models to show what information is needed and how it relates to other information
- Applications – Portfolios, interfaces and services
- Infrastructure – Network concept diagrams and technology reference models

Figure 9 summarizes the set of steps that form the guidelines for implementing enterprise architecture. These steps provide a safe and practical method towards migrating the enterprise from the “as-is” to the “to-be” status. Certainly they fit in accordance to logical development of planning and actions, yet it is important to realize the distinctiveness of some of these steps.

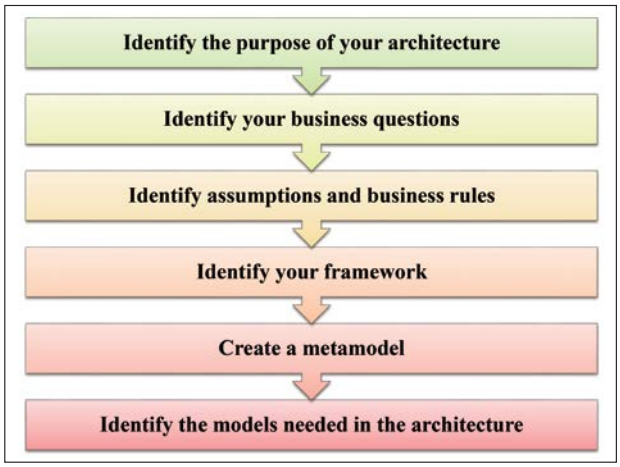

Figure 9. Steps to follow in doing enterprise architecture

Below, the description of these steps are given. They are not intended as detailed explanations, but rather as some thoughts to consider. In addition, these are practical steps that come from practical experience. The logic is essential in determining the sequence of these steps, but the way of doing them can change from one case to another to make the whole process as smooth and as efficient as possible.

1. Identify purpose of the architecture

As the architecture is about change there must be reasons why change is needed in the enterprise. This is the first important step. In order to better define the purpose of the architecture being sought, one should consider the following questions:

- What information is important for the architecture?
- How much detail is needed to support analysis and decision-making?
- Who will produce or use the architecture?
- What is the expected ROI of the architecture?
- What are the maintenance considerations?

2. Identify business issues

These are the issues that are critical to the enterprise. Some of these are hard to identify, so discussion and exchange of ideas with the enterprise professional staff would help to identify the ones that are critical and hard to decide on. The following are some questions to consider:

- What is the impact of retiring a systems application?
- What is the impact of moving a location?
- What ICT applications are needed to support a business process?
- What is the impact of replacing data servers?
- What processes need to be developed and/or re-engineered to support a new strategy?
- Where are the gaps or redundancies in existing and planned applications?

3. Identify assumptions and business rules

When the audience, purpose and questions are well identified as above, it is important to identify business rules that constrain or explain the area of interest. Every business as an enterprise has rules, hence for having information about critical business processes, any regulations or corporate standards related to them should be well identified and respected.

4. Select framework for enterprise architecture

As there are different frameworks and methodologies to develop enterprise architecture, it is important to select one or a blended set of methodologies to be adopted in order to design an enterprise architecture. These are industry standard frameworks that can be used to create an enterprise architecture, for example, the Zachman Framework, TOGAF, EA3 and the United States Department of Defense Architecture Framework (DoDAF). The chief architect is usually the one who will make this decision. Sometimes it is possible to combine frameworks such as TOGAF and Zachman (they are often used together). The selected framework(s) would provide guidance on organizing information, but they do not suggest a specific implementation for your architecture.

One key thing to remember is that a framework provides guidance on what to model. Methodologies are then used to create models. These are sets of rules that explain how to model something in an enterprise such as a process or a component. For example, the Business Process Modelling Notation (BPMN) methodology gives precise rules and symbols to model a business process.

5. Create meta-model

A meta-model is an abstract view of your architecture. It shows the data that is being identified and the relationships among the data. This is where alignment can be realized based on the answers to the business issues in step 2. There is no need for a direct relationship between

everything in the meta-model, only the things that have logical relationships, thus migrating along a well-articulated logic of actions. These start with identifying the business function concerned in order to select the process owned by that function. Next actions involve moving to a new “location”, meaning the context in which this process is to be implemented through an application, and selecting the proper technology for its implementation. Figure 10 shows this migration.

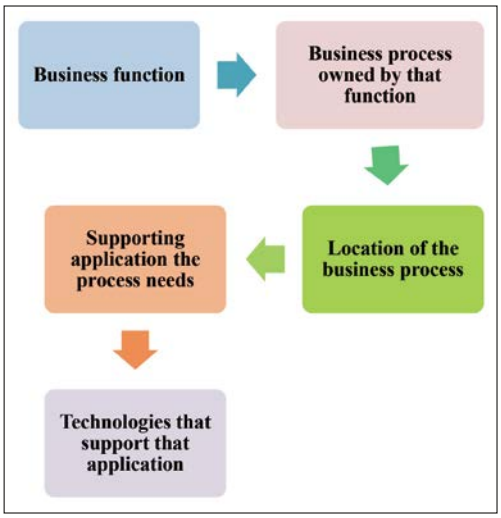

Figure 10. Implementation model

The main components of meta-models should include the following features:

- Relationships between the architecture elements such as a business process to an application.
- Definitions of the elements, for example, what is meant by an “application” and what are the associated properties.

6. Develop needed models in the

The meta-model lays down the abstract characteristics and view of the architecture. But models that draw from this have to be identified and figured out. For example, using a business process, there are many industry standards that support modelling business processes, such as BPMN and flow charts. A good modelling methodology should consider selecting methods that are suited to the target audience. For example, managers understand simple diagrams like BPMN; but software developers normally prefer unified modelling language sequence diagrams or use cases. It is important to keep in mind the following question: “What ICT applications support what business processes?”

7. Integrate the architecture

As architecture components are developed based on a master plan, it is essential to make sure that they are linked and integrated according to that master plan. As architecture components are developed based on a master plan, it is essential to make sure that they are linked and integrated according to that master plan. Relationship linkages are really hard to do without a repository. It is very useful to have such a repository in which all kinds of architecture and tools are available. With a rich repository it is very practical to create an enterprise architecture by populating the required enterprise architecture from the bottom up. This will also facilitate the standardization of the models and terminologies that are used across the enterprise.

One of the reasons for major hiccups in enterprise architecture development is political reactions within the enterprise: “My organization is using a different method for capturing our architecture.”

No one is special. No one has a valid reason for not doing things in a standard way. The enterprise staff should feel comfortable and understand what is expected of them. This will make them willing to follow standards, otherwise a more serious decision regarding them has to be considered.

Box 4. Resistance from standard actions

3.4 Summary

Enterprises have two important statements. The first is the vision, which is a short statement that describes how we want the enterprise to be after some years in the future (usually about five years). The second one is the mission statement, which defines the purpose of changes that have to be done to move from the current situation to the future situation as described by the vision.

As architects try to do their work, they need standards and well-disciplined rules on how to proceed and how the deliverables are worked out, etc. In other words, they need a framework through which they can develop their architecture plans. These are called enterprise architecture frameworks. They provide a structure composed of methods, relationships and artifacts (well-described documents, etc.) in order to establish and use an enterprise architecture.

Researchers and practitioners have contributed a lot towards building enterprise architecture methodologies and frameworks. Of these, four are used currently by about 90 per cent of the enterprise architects. These four frameworks are: the Zachman Framework for Enterprise Architectures, The Open Group Architectural Framework (TOGAF), the Federal Enterprise Architecture (FEA) and the Gartner Methodology.

Applying enterprise architecture framework would necessitate following a series of steps that are somehow defined in general but done differently according to the particular framework adopted. Frameworks are intended as guidelines but not strict rules. Within these guidelines, the experienced architect team can have flexibility to adopt what is best for its work. In general, there are certain steps that have to be followed irrespective of the framework adopted. These are the following:

1. Identify purpose of the architecture
2. Identify business issues
3. Identify assumptions and business rules
4. Select framework for enterprise architecture
5. Create meta-model
6. Develop needed models in the architecture
7. Integrate the architecture

CHAPTER 4.
A DISCIPLINE FOR CHIEFS AND TEAMS

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A DISCIPLINE FOR CHIEFS AND TEAMS

4.1 Enterprise Architecture Communities

Different people's work is based on, affected by, or directly impact enterprise architecture. One could use the word "stakeholder" to refer to them. Here, the term "community" is used.

An enterprise architecture community is a group of people whose work affects or is affected by enterprise architecture activities. There are more than one type of communities, based on the functions and roles associated with them.

Enterprise architecture goes into several modes and modalities in its life cycle. All through this cycle, certain professionals and people are affected in many ways by activities related to enterprise architecture. These groups of people are communities that have certain characteristics, interests and capabilities. Figure 11 shows an overview of such communities.

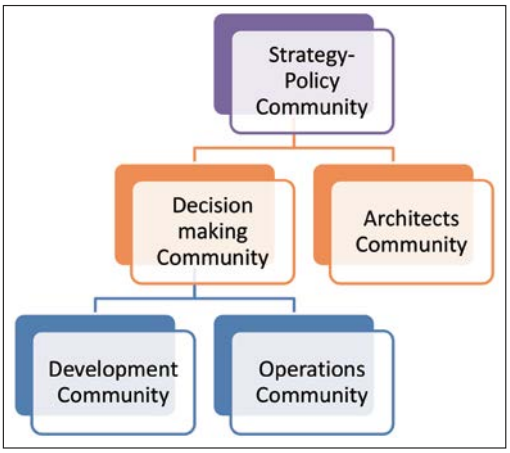


Figure 11. Architecture communities

The following is a general description of the different communities shown in Figure 11:

- Strategy-Policy Community – This is perhaps the highest level of authority in the overall enterprise architecture. It is composed of high-level officials who set the policy and strategy to adopt, and make high-level decisions. They are responsible for how to enable the other communities in their work by providing appointments, budgets, resources and decision at the highest level.

- Architects Community – These are professionals who possess the skills of analysis and design, and ability to view architectures in different ways. They are the ones who come up with recommendations and guidelines on what to do and what to change to achieve a more efficient solution to the enterprise. They include all kinds of skilled professionals who are capable of identifying solutions related to the business architecture that include business processes modelling and re-engineering; applications architecture that include specifications and technical details; data architecture that includes data hubs and their design, and the management of data centres; and technical architecture that covers all infrastructure and networking.

- Development Community – Several types of technical persons are included in this community. They are basically the doers. While the Architects Community focus on design, formulation and planning solutions, this community focus on implementing and building these solutions. They include people such as programmers, developers and technicians.

- The Decision-making Community – This important community is composed of administrative staff that will hold the responsibility for the implementation of the architecture. They include CIOs and CEOs, and relevant personalities that work together to manage the project management office, and supervise the building and implementation. They have to take serious decisions from time to time to make sure that implementation is proceeding efficiently and properly. They consider different aspects of enterprise architecture scopes. These scopes may include, but are not limited to, the following:

  - Relevance of activities, functions, organizations, timeframes, etc.
  - Examination of the enterprise scope (relations and commitments within the enterprise, and with other relevant organizations and domains)
  - Operational scenarios, situations and geographical areas to be considered
  - Projected economic benefits
  - Projected business and technical risk areas
  - Projected availability and capabilities of specific technologies during the target timeframe

- Operations Community – This group is composed of professionals and technicians who are in total charge of operations. The "total' implies functions that are not simply monitoring and switching on and off operations, it includes abilities and functions to optimize operations, look at ways where operations can be enhanced and become more efficient, and following major directives from the decision-making community. Their major tasks include, but are not limited to, the following:

  - Sustaining operations during transition
  - Managing existing technical assets and contractual agreements
  - Managing development programmes currently underway
  - Anticipating management and organizational changes
  - Responding to business goals and operational priorities (including legislation and executive directives)
  - Managing budget priorities and constraints

4.2 Chiefs and Teams Involved in Enterprise Architecture

In the enterprise architecture communities, there are certain leaders that have to be identified and chartered for responsibilities and functions. Some of these need support staff members. Their functional roles and responsibilities needed to support enterprise architecture development, use and maintenance are standard in general, but it can be modified according to need.

- Enterprise Head – This is the most senior person responsible for the enterprise. S/he establishes enterprise architecture as an overall priority. S/he is responsible for issuing policy governing the development, implementation and maintenance of the enterprise architecture. S/he also selects qualified members for an Enterprise Architecture Executive Steering Committee (EAESC).

- Capital Investment Council – This is a council that has the important function of reviewing major ICT investments proposed and making the final funding decision. It also selects projects, monitors progress and evaluates results for investment decision-making. Normally, members of this council include the heads of the departments of the enterprise, their deputies, relevant

units' heads, senior budget staff, official senior procurement officer, official legal counsel, CIO and chief financial officer.

- Chief Architect – This is the most important technical person who heads the enterprise architecture team. S/he selects this enterprise architecture project team carefully. S/he also works with the CIO to develop a base document, referred to as the Enterprise Architecture Primer, which outlines intentions for work and the policy on how to approach the complete project work, including architecture policy. This document serves as guidelines on how to work. S/he oversees enterprise architecture work and deliverables, and monitors product development, use and refinement. In addition, s/he acts as owner of the enterprise architecture repository and is responsible for the architecture sequencing plan. Normally, s/he reports directly to the CIO of the enterprise, who is a part of the decision-making community.

- Chief Information Officer – CIOs are important leaders in decision-making as they are the experts about information and technology. The CIO in the enterprise architecture in principle engages and provides strategic direction to the EAESC. S/he enhances the enterprise head's understanding and appreciation for enterprise architecture. S/he is also responsible for appointing the chief architect. One other important function for the CIO is the responsibility of marketing the benefits of enterprise architecture across the enterprise to other executives and stakeholders by creating collaborative forums, obtaining participatory commitments from senior executives and introducing enforcement measures.

- Configuration Control Board – This is a group of people who are the project stakeholders responsible for evaluating and approving or disapproving proposed changes to the enterprise architecture being developed, prioritizing the incorporation of approved changes, and scheduling the changes for forthcoming releases.

- Configuration Manager – This is the person in charge of maintenance and configuration control of all enterprise architecture products and systems.

- Domain Owners – This is the group of all business unit managers in the enterprise. They provide senior-level stakeholder and sponsor participation, and work with the architecture team on standards insertion and renewal. They also assign expert resources (subject matter experts) and oversee review of business architecture products.

- Enterprise Architecture Executive Steering Committee – This is a very important committee. It is composed of senior representatives from all organizations and operational entities within the enterprise. It may include senior executives (e.g., CIOs) within the business community. It strategizes, plans and allocates resources related to the development and maintenance of the enterprise architecture products. It approves the initial enterprise architecture and provides strategic direction, thus ensuring corporate support. It sponsors, reviews and approves an overarching architecture management strategy, including approval of significant changes to the enterprise architecture.

- Enterprise Architecture Project Management Office – Composed of the chief architect and architecture core team, it provides for management and control of enterprise architecture activities as a formal project. It creates and maintains the enterprise architecture programme plan and associated enterprise architecture project plans including definition of tasks, resources and schedules. It also provides for project management, monitoring and control of enterprise architecture product development and maintenance.

- Enterprise Architecture Core Team – This team is the most critical and most active in enterprise architecture development. It is composed of the chief architect, business architect, systems architect, data architect, infrastructure architect, security architect, senior architecture

consultants and a technical writer. It is responsible for the development and refinement of enterprise and applications architectures, and for populating the enterprise architecture repository. It develops formal standards requirements, manages the architecture processes and provides guidance to other teams. In addition, it provides for the administration of the enterprise architecture processes, thus influences enterprise officials so that project resources are obtained/retained, objections are properly handled, progress is maintained, and a high-quality, usable architecture framework is established. Additional tasks include monitoring and measuring the architecture's effect on projects through process and product evaluation.

- Independent Validation and Verification Team – This is a neutral third party from the enterprise, external organization or a contractor. It is mandated to conduct architecture compliance evaluations, to provide quality assurance checking on project information (cost, schedule, and performance data), as well as the proper implementation of the architecture methodology.

- Quality Assurance Manager – An expert is asked to ensure quality of all architecture products. S/he participates in architecture product working sessions and reviews, reporting directly to the CIO.

- Risk Manager – An expert has the function of identifying, monitoring, controlling and taking action to mitigate the risks in enterprise architecture projects. S/he reports directly to the CIO.

- Subject Matter Experts – These are domain and substantive experts from within the organization (one from each business unit) and may be supplemented with outside consultants. They support the chief architect and staff in documenting the defined mission or business requirements and related objectives. They support definition of policies that impact business goals and review enterprise architecture repository products.

- Technical Review Committee – This committee is composed of business unit managers in the enterprise (domain owners), senior architectural consultants, and business and technical representatives. It is mandated to assess business alignment and solution proposals, including technical compliance, and evaluate architecture compliance. It is entrusted to assess waiver/exception requests and conduct standards review.

4.3 Personality Skills for Enterprise Architects

Enterprise architects are expected to have several essential skills. In addition to being educated in the field of technology and having extensive work experience in providing technology solutions, enterprise architects need to deal with many other factors besides technology, such as project management, change management and communication. Besides technology skills, the following personality skills are vital for enterprise architects:

- Motivational – Enterprise architects must be able to motivate and inspire. A large part of the job is to influence or evangelize a set of ideals in the enterprise.

- Negotiation – There will be times at the decision-making table when an enterprise architect must negotiate to get things accomplished. Most enterprise architects are individual contributors and do not have organizational power.

- Critical thinking – Being able to think quickly and on your toes is often required.

- Problem solving – Enterprise architects often face a set of complex and unique problems, so they must be able to evaluate and solve problems.

- Big thinking – Avoiding tunnel vision and being able to look at a problem from multiple angles to test your own rationale is crucial to an enterprise architect's role.

- Business savvy – Knowing the industry in which you work is essential, to help you understand how the technology can really affect the business. Being in tune with the business gives enterprise architects much-needed credibility.

- Process orientation – Thinking in terms of process is essential for an enterprise architect. Building repeatable and reusable processes are important.

- People skills – An enterprise architect's job requires interacting with people constantly, so not having people skills could mean trouble.

However, these are not the only skills needed. They are necessary but not sufficient since detailed technical and professional skills are the final judge of the abilities of successful enterprise architects.

4.4 Professional Skills for Enterprise Architects

Different roles about experts, chiefs and teams involved in enterprise architecture have been identified and a general overview was presented in section 4.2 above. In each of these roles certain competencies are expected that are identified with levels within the enterprise architecture team. Professional skills for enterprise architects should be well verified and assessed in terms of three aspects:

1. The roles within an enterprise architecture area of work
2. The skills required by those roles
3. The depth of knowledge required to fulfil each role successfully

It is essential to be able to successfully identify skills and gaps. If a proper procedure is adopted to do this, a realistic and efficient measurement for staff development can be obtained. One major aspect of this is that it ensures the right person does the right job.

These skills can be grouped in the following categories:

- Generic skills – These are the general skills and can be viewed as basic and everyone (almost) has to have such skills. They include leadership, team-working and inter-personal skills.

- Business skills and methods – These skills are related to the ability to identify and analyse business cases and business process, and undertake strategic planning.

- Enterprise architecture skills – They include technical and substantive knowledge and skills in architecture techniques and methodology, for example, modelling, building block design, applications and role design, and systems integration.

- Project management skills – Certainly management skills are as essential as the technical ones. These focus on managing business change, and project management methods and tools.

- IT general knowledge – These skills include the technical ability of the architect to assess and manage decisions related to applications, asset management, migration planning and service level agreements.

- Technical IT skills – These include highly technical skills that focus on software engineering, security, data interchange and data management.

- Legal skills – These skills are needed to ensure that the enterprise architecture comply with data protection laws, contract law, procurement law, etc.

The depth of skills can be categorized in levels of proficiency. Criteria can be placed in order to measure the strength and depth of skills. In fact, this can be viewed as a certification process for enterprise architects. The following table shows the level classification for enterprise architects as suggested by TOGAF.

Level	Achievement	Description
1	Background	Not a required skill but able to define and manage skill if required.
2	Awareness	Understands the background, issues and implications sufficiently to be able to understand how to proceed further and advise client accordingly.
3	Knowledge	Detailed knowledge of subject area and capable of providing professional advice and guidance. Ability to integrate capability into architecture design.
4	Expert	Extensive and substantial practical experience and applied knowledge on the subject.

Table 5. Skills level and description

Exams, methods and case study testing could be designed in order to enable human resource managers and project leaders to measure the skills of a candidate for a role.

4.5 Summary

An enterprise architecture community is a group of people whose work affects or is affected by enterprise architecture activities. There are more than one type of communities, based on the functions and roles associated with them. Different members of the communities have different scopes and expertise, and consequently different mandates or stake in enterprise architecture activities.

As the highest level of authority in the overall enterprise architecture, the strategy-policy community lays down strategic vision and policies for the architects community to follow, who in turn are responsible for the design and planning of the enterprise architecture. The decision-making community is composed of administrative staff responsible for the implementation of the architecture, and is supported by members of the development community who are the doers. Finally, the operations community is composed of professionals and technicians who are in total charge of operations.

Leadership is crucial in enterprise architecture. The selection of the right person to lead a team is a critical success factor. Teams are formed for a certain purpose with qualified members. The team leader is the person responsible for the team's functions and deliverables. The most senior leader is the enterprise head or the CEO. S/he appoints an EAESC to oversee the work and implementation of the enterprise architecture plan, which is normally composed of senior representatives from all organizations and operational entities within the enterprise.
There are several other important groups. The Capital Investment Council has the important

function of reviewing major ICT investments proposed and making the final funding decision. The Configuration Control Board is responsible for evaluating and approving or disapproving proposed changes to the enterprise architecture being developed, prioritizing the incorporation of approved changes, and scheduling the changes for forthcoming releases.

In additions, there are other leaders that play a major role in any enterprise architecture work. They include the chief architect, CIO, configuration manager and domain owners.

The people involved in developing the enterprise architecture, particularly the enterprise architects, should have certain personal and professional skills. Personal skills include motivation, negotiation, critical thinking, problem solving and others, while professional skills include generic skills, business skills and methods, enterprise architecture skills, project management skills, IT general knowledge, technical IT skills and legal skills.

Conclusion

An enterprise could be a business, an organization, or a government entity such as a ministry or an authority. Regardless of its domain or mandate, an enterprise is a living entity. This means that as time passes, the enterprise has to respond to changes in the external environment, and change its missions, priorities and policies. With the rapid advancement of ICTs, it is inevitable that enterprises adapt to these technological changes. Agility and alertness to changes in ICTs are mandatory to enterprise efficiency and cost-effective operations. This is why people in charge of the enterprise (executives) must step back periodically to look at the enterprise as a whole, and make proper decisions about the way the enterprise is functioning.

Enterprise architecture is a tool to help these executives do that.

Enterprise architects locate a large and wide variety of information about the enterprise, compile and classify such information in all of its forms such as documents, diagrams, knowledge units, process descriptions and so on, and they establish relationships among them and store all of the information together in a single repository. Doing this, the managers and stakeholders can then see these relationships, ask questions, identify problems, or even run simulations to help make decisions about changes they are considering.

Once decisions about changes are done, architects identify and design the most efficient and feasible way to architect the enterprise accordingly. They use what is called an architecture framework to do that.

There are different frameworks that can provide guidance to successful enterprise architecture. These frameworks as simply well-established rules, principles, methods and practices to create the different architecture descriptions of the enterprise.

Successful enterprise architectures are characterized by having all of its components being “SMART” in the following way:

- Specific – They are well defined and completely specified
- Measurable – They can be measured and evaluated objectively
- Actionable – They can relate to each other and comply to the solution for the planned objectives
- Realistic – The bounds of the technology capability and cost constraints are clearly defined
- Time-bound – There is a clear indication about the lifetime of this component, i.e., when it stops to be useful

Enterprise architecture involves a lot of skills and have roles from different kinds of professional staff. The proper management of the enterprise architecture project can determine how often, how many, and in what ways such skills and professional expertise are needed.

In addition, there is no one size that fits all. The practice of enterprise architecture is not a standard procedure that provides a standard product. The framework is standard in the sense that guidelines are standard and well defined, but the practical methodology of applying them has to be adapted and designed to fit the enterprise being studied. In addition, one can apply enterprise architecture for a part of the enterprise, and not all of it at once, as long as relationships, dependencies and forward planning are well maintained.

The enterprise architecture will provide managers with the ability to understand and assess the implications of any specific change scenario, so the enterprise can respond in real time, having the proper capability and wisdom to quickly make key decisions for the future of the enterprise.

APPENDIX A. Republic of Korea's Government Enterprise Architecture

Introduction

In the last decade, the Republic of Korea has embarked on an e-government journey that is recognized as one of the best in the world. With a vision, intelligent planning and hard work, great results were achieved. Major pioneering actions include:

- IT Architecture Projects (1999-2004) that covered surveys on IT architecture, research on IT standards and development of IT technical reference model
- Measurement methodologies of interoperability levels for information systems
- Technical standard on interoperability for public IT
- Case studies on e-government interoperability policy
- Reform of government CIO policy

In 2003, the work on developing a government-wide enterprise architecture framework started.

Objectives of the Republic of Korea's Government Enterprise Architecture

The Government Enterprise Architecture of the Republic of Korea had set for itself three major goals:

1. Alignment – National IT strategic plan is aligned with agency-level IT projects and resources
2. Integration – Information resources are integrated to provide high quality services to citizens
3. Transformation – The government enterprise architecture provides a road map for government-wide public business innovation

Enterprise Architecture Laws

The Korean government realized the significance and the challenge that ICT in government play. During the 1990s, government ministries, organizations and enterprises developed their own strategic plans and actions to enhance their performances in government business and services to the citizen. This was to be achieved through the implementation of major government resource planning systems. The government realized then that these efforts should be well coordinated and redesigned with the idea of reducing cost, maximizing resource mobilization and achieving better performance. All of these are the goals of enterprise architecture. Hence, the government took the daring decision to develop a major law on this.

The Enterprise Architecture Law was enacted in 2005 to resolve ineffective information resource management:

> Agencies must adopt enterprise architecture, and all public IT projects and e-government must be carried out based on enterprise architecture.

Some of the strong and binding parts of this law are stated in these articles:

Article 11	CIO should direct agency's enterprise architecture
Article 12	Enterprise architecture related policies should be discussed at CIO Council
Article 15	Enterprise architecture should be utilized to achieve public informatization
Article 43	Enterprise architecture should be reported annually to the National Assembly
Article 44	Pursuit of e-government should be based on enterprise architecture
Article 45	Establishment of Enterprise Architecture Master Plan and Government Enterprise Architecture
Article 46	Enterprise architecture introduction in public sector
Article 47	Promotion of enterprise architecture introduction and operation
Article 68	Analysis and evaluation of enterprise architecture achievements
Article 71	Designation of enterprise architecture specialized agency—the National Information Society Agency

Key Actions

Major actions that the enterprise architecture initiative focused on include infrastructure, business architecture and enterprise resource planning.

The following are the major achievements of enterprise architecture in the Republic of Korea:

- Provision of government information systems and resource planning applications to major government business processes, such as customs, tax, patent, etc.
- Establishment of efficient and high-standard e-government infrastructure with enhanced privacy and security
- Development and improvement of e-services for citizens and businesses
- Enhancement of administrative efficiency and transparency through reform of government work and business methods
- The linking of government information systems and sharing of common data as needed
- Introduction of citizen-centric services and enhanced public participation

Progress in Enterprise Architecture

In the Republic of Korea, a major turning point in the history of ICT in government was when a Framework Act on National Informatization was adopted. This Act was about electronic government research focusing on information resources of the public sector (Office for Government Coordination, April 2002). Its main scope was to address ineffective information resource management.

As the enterprise architecture legislation was enacted in May 2005, priority was clearly placed on ensuring the effective introduction of information systems and operations in government. This was integrated into the Electronic Government Act in May 2010.

Major milestones include:

- Establishment of the First Enterprise Architecture Master Plan and Guidelines (June 2006)
- Establishment of Government Enterprise Architecture (September 2009)
- Preparation and implementation of comprehensive countermeasures to prevent duplicate investment (March 2010)
- Establishment and implementation of the Second Enterprise Architecture Master Plan (May 2011)

Impact of Government Enterprise Architecture

The impact of enterprise architecture in the Republic of Korea can be seen in the country's governance system.

1. Citizen Centricity

As the citizen was the main focus in the Republic of Korea's e-government strategy, and consequently the government enterprise architecture strategy, its implementation resulted in empowering the citizen, mainly in three major aspects as follows:

I. An online citizens forum at http://www.epeople.go.kr where citizens can engage with the Korean government. The online forum supports citizen participation and involvement in 244 local governments, 47 central administrative institutions, 144 overseas diplomatic missions, 26 institutions, 195 education offices, and the judiciary. The portal enables citizens to interact with all these government bodies for:

   - Civil Petition Service: All complaints and queries, for example, about where and how to resolve citizens' complaints, and where and how long services may be obtained.
   - Civil Proposal Service: Any creative proposals and positive and good ideas about an unreasonable system or custom can be expressed here.
   - Policy Discussion: Any citizen can talk about governmental policies and measures.
   - Corruption Reporting Service: Citizens can express concerns if they ever witnessed an illegal act caused by a public official.
   - Administrative Judgment: Citizens can report their grievances if they feel that they were under unfair administrative disposition.

II. The e-voting system, which has been a direct result of successful enterprise architecture implementation.

III. The single window for online citizen services at http://www.egov.go.kr, which has played a major role in placing the Republic of Korea at the top of the rankings in the United Nations e-government surveys since 2010.

2. Common Infrastructure and Interoperability

A major impact of the enterprise architecture implementation by the Ministry of Public Administration and Security (MOPAS) was to produce an infrastructure architecture that avoided duplication among agencies and supported collaboration. It created a successful and efficient underlying IT architecture that ensured common standards government-wide. Such standards include government information sharing platform, integrated security system and integrated authentication system, among several others.

3. Collaborative Services and Business Operations

Many government services require the involvement and coordination of multiple agencies. MOPAS, as part of the Republic of Korea national enterprise architecture, ensured avoidance of duplication among the agencies through the Sharing Project of the enterprise architecture infrastructure of the Republic of Korea in 2009.

4. Public Sector Governance

The Republic of Korea's enterprise architecture has been used to establish and manage ownership of government services with multiple stakeholders. In addition, it is linked tightly to the

national ICT project. As a result, overlaps and duplication are avoided. Moreover, the Government Enterprise Architecture in the Republic of Korea supports the three key e-government directions: administrative procedure reforms, civil services reforms and information resource management reforms.

5. Networked Organizational Model

Well-designed and proper procedures with networking have realized collaborative services delivered by the government, including the identification, assessment and selection of partners in the private sector.

6. Social Inclusion

Extending e-government to localities and supporting local governments, particularly through its information network village (http://www.invil.org) and the online citizen participation portal (http://www.epeople.go.kr), citizen engagement was enabled and resulted in improved government responsiveness.

The First Enterprise Architecture Master Plan

The First Enterprise Architecture Master Plan addressed one major concern: Many ICT resources were scattered across the government, with no coordination, and hence a lot of waste of resource capabilities had to be handled.

The purpose of the first plan was:

> Realizing performance-based integrated management system for national information resources.

This first plan focused on the implementation of enterprise architecture in each government agency. The concern was how to mobilize all resources with efficient investment in order to obtain an integrated management system across the government.

There were three main goals for this plan:

1. Initiating enterprise architecture-based government-wide informatization
2. Developing the foundation for mutual utilization of IT resources
3. Establishing enterprise architecture for major public sectors

The Master Plan was successfully implemented during the period from 2005 to 2010, and results were clearly observed nationally and internationally.

The Second Enterprise Architecture Master Plan

For the following five years starting in 2011, the government decided to launch a Second Enterprise Architecture Master Plan.

The purpose of the second plan was:

> Utilizing information resoures effectively and improving performance of national IT projects.

It focused on enhancing government-wide informatization performance and agency performance. Its major focus was on making sure that the achievements of the first master plan are properly maintained, and further development investigated and adopted.

This plan was more ambitious as it intends to identify any faults or negative factors that would setback ICT progress in the government system. This second plan aims to achieve the following goals:

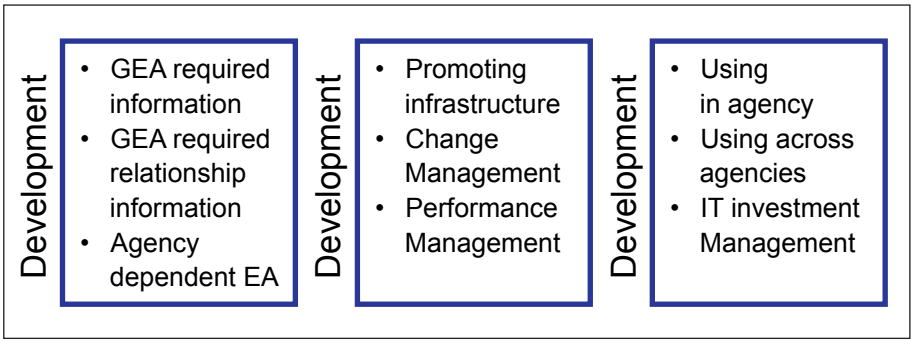
1. Institutionalizing enterprise architecture-based informatization
2. Supervising progresses of IT projects
3. Preventing duplicated IT investment
4. Improving functions of the Government Enterprise Architecture and information quality
5. Connecting and integrating public services
6. Connecting and integrating master data
7. Establishing interoperable and technical foundation
8. Providing interoperable and secure notification

Achievements of Enterprise Architecture

During the first plan, the number of government agencies implementing enterprise architecture grew at a steady rate.

Year	Gov't agencies
2008	79
2009	83
2010	100
2011	110
2011	110

The level of enterprise architecture maturity is defined using five levels, and they are rated as an index of value ranging from 1 to 5. This number measures how advanced the enterprise architecture implementation is. These five levels describe the success of enterprise architecture implementation with three dimensions—development, management and use.



Government Efforts in Enterprise Architecture Promotion

The Korean government has stressed the need for promoting enterprise architecture in the public sector. This is done in two levels:

1. Government decision and actions – This is focused on the following tasks:

    - Restructuring the governance and direction
    - Disseminating enterprise architecture guidelines
    - Enhancing maturity assessment
    - Expanding training programmes

2. Providing training for professionals across the government agencies – A training curriculum was developed that included courses on the following topics:

    - Enterprise architecture concept
    - Enterprise architecture applications
    - Government enterprise architecture configuration and status
    - Enterprise architecture case study
    - Enterprise architecture implementation procedures and adoption method
    - Enterprise architecture advancement and development plan
    - Enterprise architecture operation and management
    - Government enterprise architecture portal demonstration and application method

Best Practices and Results

The following shows some of the best practices and results achieved by Korean agencies that adopted enterprise architecture:

1. Ministry of Land Transport and Maritime Affairs
    - Management of redundant IT investment, saving USD 20 million per year
    - Integration of existing information systems (41 to 21)

2. Statistics Korea
    - Prior review of IT investment, saving USD 0.3 million
    - Reduce decision time of information resources management, saving USD 0.04 million

3. Korea Meteorological Administration
    - IT management cost reduction by reusing idle resources, saving USD 0.4 million

4. Rural Development Administration
    - Integration of existing web pages (from 30 to 20)
    - Integration of information systems, saving USD 0.7 million

5. Korea Customs Service
    - Management of redundant IT investment, saving USD 15 million for two years (2010-2011)
    - Management of redundant coordination and reorganization

6. Korean Electric Power Corporation
    - Prior review of IT investment, saving USD 0.7 million
    - Organization through information system utilization analysis, saving USD 0.15 million

Acknowledgement: Special thanks to Dr. Daul Shin, National Information Society Agency, Republic of Korea, for his assistance in providing information for this appendix.

APPENDIX B. First Steps!

In this appendix, a set of steps are recommended on how to start an enterprise architecture initiative.

What this appendix will tell you is how to:

- Imagine what an enterprise architecture for your enterprise could mean
- Set the background for enterprise architecture thinking
- Lobby and form reliable teams and colleagues who will sail with you on this voyage! Or rather, the soldiers who will fight along your side for enterprise architecture to be approved and started
- Kick-off with a set of activities

What this appendix will NOT tell you is how to:

- Design enterprise architecture plans
- Implement the plans
- Produce deliverables and outputs
- … and certainly, how to architect your enterprise…

First Steps to Enterprise Architecture

The impact of enterprise architecture in the Republic of Korea can be seen in the country's governance system.

1. Understand what enterprise architecture could do for your enterprise

Try to develop this understanding in two steps: First, hunt for problems, such as lagging projects, interrupted technical operations, invalid data and information exchanged within the enterprise departments, unused or underused technical and human resources, etc. Next, try to make this more formal by developing concrete and convincing short reports about these issues.

A more detailed explanation of these steps are given below.

Action	Example	Expected outcome
Look for problems in ICT operations	• Data shared within the enterprise is taking too long to find • Incompatible datasets are found • A business process takes a long time • Too many data servers while few can be used to host what all servers have	An informal report that contains samples of these problems, together with the cost of each of these samples
Talk to people involved informally about these things, such as department heads, technology staff and the CIO	Organize informal meetings with these individuals, with the help of good coffee, to understand the identified problems better	You have raised the interest and question in the minds of these individuals, who would most likely be important partners in the enterprise architecture project

Try to understand why things are not working	Write a convincing case of how the enterprise is not working well in it	A revised informal report

2. Set the background for enterprise architecture thinking

It is important now to take the step to formalize the issues. In order to do so, you may need to develop a "current status report" or what is known by some architects as the "as-is" enterprise description. This preliminary report will be needed for decision-making to go ahead with the enterprise architecture mandate.

This report should have clear and convincing narrative, tables and figures that addresses the following:

Business goals:

- What does the enterprise want to be as it evolves?
- What services does it offers?
- Who are its users?
- What characteristics and strengths it wants to build or maintain?
- What overarching policies it is going to embrace?

Common vision of the desired "to-be" state:
How the set goals will be achieved?
What is the common vision for the concept of operations?
What options are there for new concepts of operations?
Which concepts currently work successfully?
Very often the current systems, applications and infrastructure are completely ignored. The lack of knowledge about current situation is due to lack of continuous update of available resources. So, an important step is to create and maintain such knowledge of "as-is" resources.

3. Lobby and form reliable teams

This step is critical. At this point, you have to convince the CEO and his/her decision-making staff of the importance of adopting an enterprise architecture project. If you have carried out step 2 well, you are already half way through.

a) Call for official meetings with key persons in the enterprise, such as the department heads, CIO and senior technical staff. In this meeting (or meetings), share with them the initial reports, start a discussion on how serious these problems are, and explain why an enterprise architecture project is needed to solve these problems. Use your negotiation skills and convincing experience to make sure that the majority of the people attending would be voting to go ahead with enterprise architecture initiative.

b) Do not forget that these colleagues who are in these meetings will most likely become members of the steering committee.

c) Finally, as you have accumulated enough positive support, call for an official meeting with the CEO and provide these ideas. Make sure that you present this not as your endeavour or your idea. Always make it clear that this is a collective idea of many of the senior staff in the enterprise.

4. Kick-off with a set of activities

Prepare a set of activities to launch the enterprise architecture project. Some of these activities could be the following:

a) Organize several awareness lectures on what is enterprise architecture and how it helps enterprises.

b) Pick one simple and short problem that was studied in the previous step and conduct a workshop or brainstorming session(s) with your internal technical and professional staff to exchange ideas on what can be done to solve it, or provide a scenario of what-ifs.

c) Organize technical and professional meetings with some professional from other enterprises that have already completed their enterprise architecture, and set up question and answer sessions.

d) During all this, keep coordinating and talking to the CEO in order to seek official approval.

e) Prepare a suggested list of names of resources persons and experts who may be engaged or ready to become your team when the work on enterprise architecture starts.

Glossary A: Chiefs and Tribes

There are a number of acronyms that refer to visionary roles in an enterprise, but they can be confusing. Below is a list of common acronyms used by modern corporations to describe their C-level executives:

Chief Executive Officer (CEO) is often, but not always, also the president of a company, reporting to the Chairman of the Board and board members.

Chief Financial Officer (CFO) is sometimes also the company treasurer and, in many companies, is seen as the second most important person in the company (since managing the quarterly results often depends on an understanding of how to keep the books). S/he is the corporate official in charge of a company's finances.

Chief Information Officer (CIO), a relative newcomer to the ranks of the top executives in a corporation, is responsible for a company's internal information systems, and, especially with the arrival of the Internet, is sometimes in charge of the company's e-business infrastructure.

Chief Technology Officer (CTO), another relatively new arrival to the top executive ranks in many companies, is likely to be seen as the second or third most important person in any technology company. The CTO is responsible for research and development and possibly for new product plans.

Chief Security Officer (CSO), a recent arrival, is responsible for the security of a company's communications and business systems.

Chief Compliance Officer (CCO), yet another newcomer, is responsible for ensuring that a company and its employees are in compliance with government regulations and internal policies.

Chief Knowledge Officer (CKO) is responsible for an organization's knowledge management.

Chief Compliance Officer (CCO), yet another newcomer, is responsible for ensuring that a company and its employees are in compliance with government regulations and internal policies.

Chief Knowledge Officer (CKO) is responsible for an organization's knowledge management.

Glossary B: Architecture-related

Term	Definition	Source
"As-Is" Architecture	The current state of an enterprise's architecture (see baseline architecture).	Treasure Enterprise Architecture Framework (TEAF)
"To-Be" Architecture	The target state of an enterprise's architecture (see target architecture).	TEAF
Architectural Artifacts	The relevant documentation, models, diagrams, depictions and analyses, including a baseline repository, standards and security profiles.	FEA Framework (FEAF)
Architecture Product	The structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time.	IEEE STD 610.12
Architecture	A framework or structure that portrays relationships among all the elements of the subject force, system or activity.	United States Department of DefenseDoD Joint Publication 1-02
Architecture	A set of design artifacts or descriptive representations that are relevant for describing an object such that it can be produced to requirements (quality) as well as maintained over the period of its useful life (change).	John Zachman
Architecture Repository	An information system used to store and access architectural information, relationships among the information elements, and work products.	TEAF
Artifact	An abstract representation of some aspect of an existing or to-be-built system, component or view. Examples of individual artifacts are a graphical model, structured model, tabular data, and structured or unstructured narrative. Individual artifacts may be aggregated.	TEAF
Baseline Architecture	The set of products that portray the existing enterprise, the current business practices and technical infrastructure. Commonly referred to as the "as-is" architecture.	
Baseline Architecture	Representation of the cumulative "as- built" or baseline of the existing architecture. The current architecture has two parts: • The current business architecture, which defines the current business needs being met by the current technology. • The current design architecture, which defines the implemented data, applications and technology used to support the current business needs.	FEAF

Term	Definition	Source
Business Architecture	A component of the current and target architectures, and relates to the enterprise mission and goals. It contains the content of the business models, and focuses on the business areas and processes responding to business drivers. The business architecture defines business processes, information flows and information needed to perform business functions.	FEAF
Capital Planning and Investment Control Process	A process to structure budget formulation and execution, and to ensure that investments consistently support the strategic goals of the enterprise.	Office of Management and Budget
Enterprise	An organization supporting a defined business scope and mission. An enterprise is comprised of interdependent resources (people, organizations, and technology) that should coordinate their functions and share information in support of a common mission (or set of related missions).	TEAF
Enterprise Architecture	A strategic information asset base, which defines the business, the information necessary to operate the business, the technologies necessary to support the business operations, and the transitional processes necessary for implementing new technologies in response to the changing business needs. It is a representation or blueprint.	FEAF/TEAF
Enterprise Architecture	The set of primitive, descriptive artifacts that constitute the knowledge infrastructure of the enterprise.	John Zachman
Enterprise Architecture Policy	A statement governing the development, implementation and maintenance of the enterprise architecture.	
Enterprise Architecture Products	The graphics, models and/or narrative that depict the enterprise environment and design.	
Enterprise Engineering	A multidisciplinary approach to defining and developing a system design and architecture for the organization.	TEAF
Enterprise Life Cycle	The integration of management, business and engineering life cycle processes that span the enterprise to align IT with the business.	
Federal Enterprise Architecture Framework (FEAF)	An organizing mechanism for managing development, maintenance and facilitated decision-making of an enterprise architecture. The framework provides a structure for organizing resources, and for describing and managing enterprise architecture activities.	FEAF

Term	Definition	Source
Framework	A logical structure for classifying and organizing complex information.	FEAF
Legacy Systems	Those systems in existence and either deployed or under development at the start of a modernization programme. All legacy systems will be affected by modernization to a greater or lesser extent. Some systems will become transition systems before they are retired. Other systems will simply be retired as their functions are assumed by modernization systems. Still others will be abandoned when they become obsolete.	TEAF
Methodology	A documented approach for performing activities in a coherent, consistent, accountable and repeatable manner.	TEAF
Model	Representations of information, activities, relationships and constraints.	TEAF
Principle	A statement of preferred direction or practice. Principles constitute the rules, constraints and behaviours that a bureau will abide by in its daily activities over a long period of time.	TEAF
Principles	A component of the strategic direction. In terms of the FEA, principles are statements that provide strategic direction to support the vision, guide design decisions, serve as a tie breaker in settling disputes, and provide a basis for dispersed, but integrated, decision-making.	TEAF
Repository	An information system used to store and access architectural information, relationships among the information elements, and work products.	TEAF
Sequencing Plan	A document that defines the strategy for changing the enterprise from the current baseline to the target architecture. It schedules multiple, concurrent and interdependent activities and incremental builds that will evolve the enterprise.	
Spewak Enterprise Architecture Planning Methodology	Formal methodology for defining architectures for the use of information in support of the business and the plan for implementing those architectures developed and published by Steven H. Spewak.	Enterprise Architecture Planning, S.H. Spewak
Standards	A set of criteria (some of which may be mandatory), voluntary guidelines and best practices. Examples include applications development, project management, user support, technology evaluation and architecture governance.	FEAF

Term	Definition	Source
System	A collection of components organized to accomplish a specific function or set of functions.	IEEE STD 610.12
Systems Development Life Cycle	Guidance, policies and procedures for developing systems throughout their life cycle, including requirements, design, implementation, testing, deployment, operations and maintenance.	TEAF
Target Architecture	Representation of a desired future state or "to be built" for the enterprise within the context of the strategic direction. The target architecture is in two parts: • Target Business Architecture – Defines the enterprise future business needs addressed through new or emerging technologies. • Target Design Architecture – Defines the future designs used to support future business needs.	FEAF
Transitional Enterprise Architecture Components	Representation of a desired state for all or part of the enterprise for an interim milestone between the baseline architecture and the target architecture. A time-sliced set of models that represent the increments in the sequence plan.	
Zachman Framework	Classic work on the concepts of information systems architecture that defined the concept of a framework and provided a 6x6 matrix of architecture views and perspectives with products.	John Zachman, 1987 IBM Journal Article

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Enterprise architecture is not only found in business, but is also widely used in government and education. Please refer to the following examples:

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About the Author

Saleem Zoughbi is an international advisor for ICT. He has been providing technical assistance and advisory services to over 30 countries. His focus is on development and has been assisting governments at the strategic and policy levels on e-governance, smart cities, national strategies and ICT development. He conducts consultancies for major consulting firms such as Booze, PricewaterhouseCooper and others in technical missions and projects. He is active in a number of international communities on e-governance, strategies and policies of smart governance, mobile government, smart cities and smart sectors, and ICT for development. He previously held the post of ICT Regional Adviser in UN-ESCWA, and then moved to UNU-IIST. Currently, he is engaged in enterprise architecture work with UN-ESCAP. Recently, he helped develop change management and capacity building strategic plans for all ministries of Libya according to the eLibya Strategy. He is also the IEEE STC e-Government Committee Secretary and Officer-in-Charge of e-government development projects.

UNITED NATIONS
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5th Floor G-Tower, 175 Art center daero,
Yeonsu-gu, Incheon City, Republic of Korea
Tel: 82 32 458 6650 Fax: 82 32 458 6691
E-mail: info@unapcict.org, http://www.unapcict.org

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