
THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE



PUBLIC SERVICE MANAGEMENT

Enterprise Architecture



*A Step-by-step Guidebook for Formulating
and Governing Enterprise Architecture*

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Abbreviations

EA, Enterprise Architecture

ICT, Information and Communication Technologies

MDA, Ministries, Departments and Agencies

KPI, Key Performance Indicator

PO-PSM, President Office – Public Service Management

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1 Introduction

1.1 Purpose of this Guidebook

The aim of this Guidebook is to provide a step-by-step and practical approach to formulating Enterprise Architecture (EA) to achieve alignment of business and Information and Communication Technologies (ICT) in an organisation. It combined the experiences in developing EA in both the public and private sectors in advanced countries. It is intended for use by officers in the Ministries, Departments and Agencies (MDA) performing the role of Enterprise Architect.

1.2 Structure of this Guidebook

This Guidebook documents an integrated EA formulation methodology that has five independent and yet connected Stages. Each Stage is documented as a separate chapter in the Guidebook. This Guidebook is organised to show the readers how to systematically perform the tasks to create the EA to support the entire organisation.

The five Stages are:

- Define Vision and Principles
- Formulate Business Architecture
- Formulate Information Architecture
- Formulate Technology Architecture
- Implement Architecture Governance

Each Stage is documented as follows:

Task:	Task in each Stage to be performed and the specific inputs required and outputs.
Applicable Concepts:	Key management concepts or ideas which are employed in this Task.
Steps:	Detailed Steps in each Task to be carried out.

Guidelines: Suggestions on what need to be considered, best practices and tools to employ.

Some Steps could be optional and the guidelines provided should not be deemed as the only ways to develop the outputs. The practitioners have to exercise judgement and make use of reasoned decision to perform the steps as deemed necessary.

2 Overview of Enterprise Architecture

2.1 Definition of Enterprise Architecture

First, we need to understand the meaning of "ICT Architecture". Simply it means the components of information systems based on common ICT standards and the framework on how these information systems can be connected to one another in term of network, applications, system software and databases.

Enterprise is defined as the business, organisation, the government agency or stakeholder while Architecture is the design and construction of buildings. Enterprise Architecture or EA provides the form and function to the organisation's ICT environment. It provides the building blocks to manage technology and align to the business needs.

EA is represented in the form of models, diagrams and text. It describes the operation of the organisation such as:

- How business processes and rules relate?
- How information flow?
- Where work happens?
- Who are the users?
- What hardware, software, data and security is used for the organisation?

2.2 Objectives of Enterprise Architecture Framework

The main objective of having an EA framework is to align technology closely with the business. Traditionally, the ICT organisation is always trying to play catch up with the business. The ICT organisation is found to be doing planning separately from business planning. Hence, when the business requirements

change, the ICT organisation could not anticipate and refresh the ICT systems to keep pace with the change resulting in misalignment.

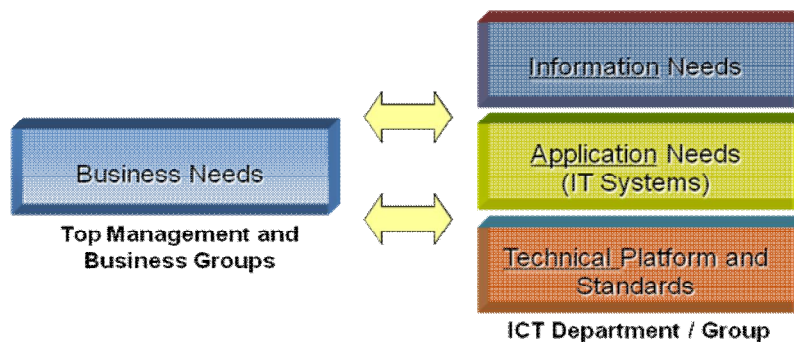


Figure 1: Aligning Technology with Business

In addition, there is a lack of capability for the ICT organisation to understand the impact to ICT when business requirement change. EA provides such a capability to address this need.

2.3 The Need for Enterprise Architecture

In a nut shell, a well developed EA could serve the following purposes:

- A way to understand what the organisation does and how
- Models of how things work in the organisation
- Information in a form that helps manager make decisions
- A way to prevent reinventing the wheel

More importantly, the EA helps to address business issues which are lessons learnt from enterprise ICT programmes of large multi-national corporations and governments. Often, organisation issues tend to affect the development and implementation of ICT application systems. It should be noted that real success of ICT depends on blending of people, process and technology.

The key benefits of an EA is summarised in the following table:

Benefits	Outcomes
1. Captures organisation mission and business processes in effective and structured manner	Facilitate better planning and decision making
2. Improve communication between business and ICT groups	Enriches engagement (show interrelationships and dependencies)
3. Facilitate economies of scale	Sharing common services across organisation
4. Enhance consistency, accuracy and timeline of IT management information	Share information collaboratively across organisation
5. Provide high level views to communicate complexity for large systems	Understand how different parts (sub-systems / department) work together
6. Support analysis of alternatives, risks and trade-offs for investment management process to reduce risks	Avoidance of pitfalls: <ul style="list-style-type: none"> • Building systems that do not meet business needs • Wasting resources on developing duplicated functionality (support re-use)

Table 1: Benefits of Enterprise Architecture

2.4 Examples of Enterprise Architecture Frameworks

There are several EA frameworks such as:

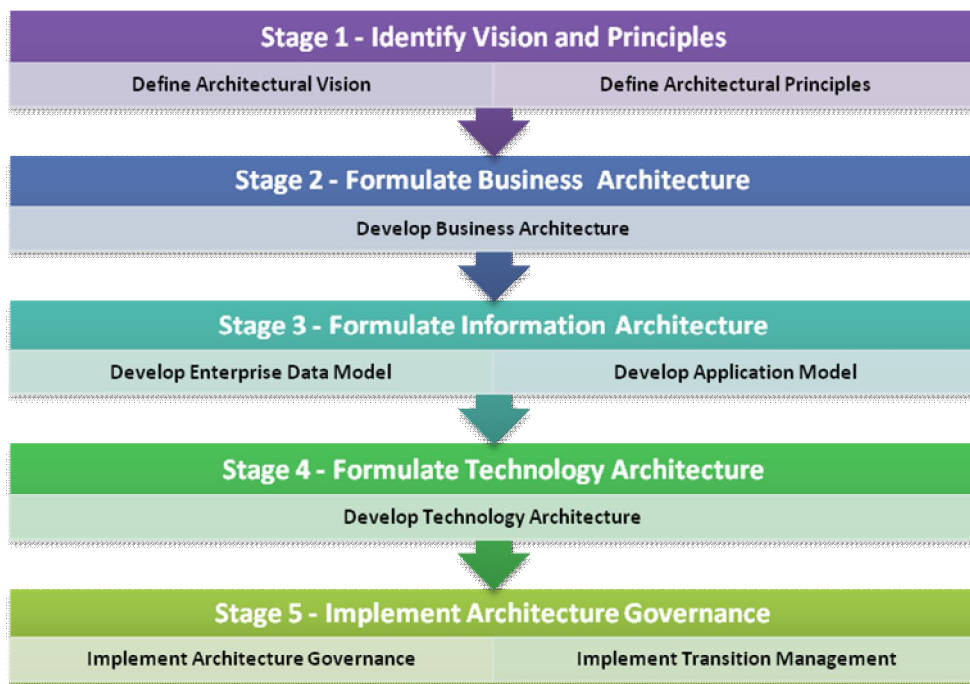
- Industry sponsored framework
 - Open Group Architecture Framework (TOGAF)
- Propriety framework
 - Metagroup Enterprise Architecture Framework
 - Zachman Framework

The EA framework in this guidebook provides a comprehensive approach to the design, planning, implementation and governance of EA. It is modelled at 3 domains: Business, Information and Technology. It has an architecture development cycle for developing the EA. It integrates elements of TOGAF to meet the business and ICT needs of the organisation.

In this guidebook, an effective framework to formulate and apply EA will be described.

2.5 Enterprise Architecture Framework Methodology

To ease understanding, this methodology is structured into five distinct STAGES and key TASKS.



2.6 Scope of Enterprise Architecture Framework

This Guidebook applies to MDA embarking on formulating an EA. The EA supports the business by providing the fundamental technology and process structure for an ICT strategy. It also provides a strategic context for the evolution of the ICT systems in response to the constantly changing needs of the business environment.

The EA does not cover:

- Detailed functional requirements of ICT systems
- Business process redesign (please refer to the separate BPR Guidebook)

2.7 Key Responsibilities

The composition required to carry out the EA formulation shall consist of the following parties:

- EA Management Board
- Architecture Team
- Extended Team

Composition	Organisation Function	Main Responsibilities
EA Management Board	Senior Management group chaired by Chief of ICT or his deputy as the Executive Sponsor	Responsibilities of members of Board include: <ul style="list-style-type: none"> • Provide senior management guidance and feedback • Define study objectives and scope • Provide access to resources (personnel, information etc.) • Review all recommendations on opportunities, approach and resources • Review and endorse all key deliverables
Architecture Team	Chief Architect and architects for Business, Information and Technology	Key responsibilities include: <ul style="list-style-type: none"> • Gather and review existing documentations on business and IT • Facilitate workshops and interviews to obtain inputs for the study • Document all information gathered and verify with stakeholders • Analysis and synthesise findings into actionable recommendations
Extended Team	Functional Representatives from the business and other units.	Key responsibilities include: <ul style="list-style-type: none"> • Participate in the team meetings, visits and workshops • Provide operational objectives and surface key challenges • Provide inputs for current process review • Review all identified improvement opportunities • Assess feasibility of recommendations in actual operational context

2.8 Summary of the Enterprise Architect Framework Methodology

Stage	Performed By	Inputs	Outputs
1. Define vision and principles	ICT Steering Committee Architect Team	<ul style="list-style-type: none"> • Business principles, business goals, business driver 	<ul style="list-style-type: none"> • Architectural Vision • Architectural Principles
2. Formulate Business Architecture	Architect Team Working Teams	<ul style="list-style-type: none"> • Current services and work processes • Current performance gaps 	<ul style="list-style-type: none"> • Business processes and services • New business needs • KPIs
3. Formulate Information Architecture	Architect Team Working Teams	<ul style="list-style-type: none"> • Information used in current processes and existing databases • Information about current applications 	<ul style="list-style-type: none"> • Data principles • Data dictionary • Conceptual/logical Data models • Application principles • Application inventory list • Application models
4. Formulate Technology Architecture	Architect Team Working Teams	<ul style="list-style-type: none"> • Business Architecture • Information Architecture 	<ul style="list-style-type: none"> • Standards and best practices • Technology Logical model • Technology Physical Model • Inventory of Technology Resources
5. Implement Architecture Governance	Architect Team ICT department	<ul style="list-style-type: none"> • New business requirements 	<ul style="list-style-type: none"> • Updated EA

3 STAGE 1 – Define Vision and Principles

3.1 TASK 1.1 – Define Architectural Vision

3.1.1 Applicable Concepts

Architectural Vision – An Architectural Vision describes how the new EA will meet the business goals and strategic objectives.

3.1.2 Key Steps

Step 1. Identify stakeholders, concern and business requirements.

Step 2. Confirm and evaluate business goals, business drivers and constraints.

Step 3. Evaluate business capabilities.

Step 4. Identify what is in and what is outside the scope of the architecture effort and the constraints that must be dealt with.

Step 5. Articulate the Architectural Vision.

Step 6. Seek consensus with the stakeholders and get it approved by the management.

3.1.3 Guidelines

Typically, the business principles, business goals, and strategic drivers of the organisation are already defined elsewhere in the enterprise. If so, the activity in this task is involved with ensuring that existing definitions are current, and clarifying any areas of ambiguity.

3.2 TASK 1.2 – Define Architectural Principles

3.2.1 Applicable Concepts

Architectural Principle – Principle that establishes the basis for a set of rules and behaviours to govern the EA processes and implementation of the architecture.

3.2.2 Key Steps

Step 1. Define the architectural principles which will form part of the constraints on any architecture work undertaken in the organisation.

Step 2. Review with stakeholders on the architectural principles.

3.2.3 Guidelines

Nil

4 STAGE 2 – Formulate Business Architecture

4.1 TASK 2.1 – Develop Business Architecture

4.1.1 Applicable Concepts

Business Architecture – Business Architecture defines the business strategy, governance, organization, and key business processes of the organisation.

4.1.2 Key Steps

Step 1. Define the business goals.

Step 3. Define the business processes and services.

Step 4. Identify opportunities for cross-agency business interaction and interoperability between the external organisations.

Step 5. Identify new business needs.

Step 6. Define Key Performance Indicators (KPI).

Step 7. Review the business architecture with stakeholders.

4.1.3 Guidelines

When defining the Business Architecture, the following should be considered:

- a. If a Strategic ICT Planning has been undertaken at the organisation level, the business processes, services, KPIs and ICT needs would have been identified. This stage could thus be skipped.
- b. If a central EA is to be defined for the entire government, it is important to involve all key MDAs in this stage so that a high-level business capability model depicting the core and support functions of the government could be developed.

- c. Further opportunities for some of the support functions (such as authentication and payment services) could be rationalised at the "whole-of-government" level to create seamless integration for the entire government.

5 STAGE 3 – Formulate Information Architecture

5.1 TASK 3.1 – Develop Enterprise Data Model

5.1.1 Applicable Concepts

Information Architecture – An Information Architecture describes the structure of an organisation's information and application assets.

Enterprise Data Model – An Enterprise Data Model describes the structure of data and their relationship.

Data Dictionary – Contains detailed information of the content, format and structure of the data objects or items in an Enterprise Data Model.

5.1.2 Key Steps

Step 1. Develop the data principles which is useful to facilitate data sharing.

Step 2. Identify what, when and where the information is needed.

Step 3. Identify the form of information is needed.

Step 4. Identify how and who need the information.

Step 5. Create the logical data models for the enterprise by defining the data entities for each information type.

Step 6. Develop data dictionary.

Step 7. Build the data view points which can be in form of data/business function matrix to identify which business function is using what data.

Step 8. Review the information architecture with stakeholders.

5.1.3 Guidelines

Nil

5.2 TASK 3.2 – Develop Application Model

5.2.1 Applicable Concepts

Application Model – An Application Model is a blueprint for the individual application systems to be deployed, the interactions between the application systems, and their relationships to the core business processes of the organisation with the frameworks for services to be exposed as business functions for integration.

5.2.2 Key Steps

Step 1. Define the application principles i.e. how application should be developed and integrated including exchange of data.

Step 2. Create the application inventory list.

Step 3. Create the Application Model which includes both business application as well as collaborative/shared applications.

Step 4. Develop the application view e.g. a matrix defining which application using what information (refer to Appendix A for example).

Step 5. Review the Application Model with stakeholders.

5.2.3 Guidelines

While reviewing and defining the Application Model, some areas for improvement could be identified:

- a. Creation of common services to remove duplicated services across business functions.

- b. Consolidation of applications especially when applications perform similar functions.
- c. Simplification of applications i.e. those that have become complex or over-patched.

6 STAGE 4 – Formulate Technology Architecture

6.1 TASK 4.1 – Develop Technology Architecture

6.1.1 Applicable Concepts

Technology Architecture – Technology Architecture describes the hardware, software and network infrastructure needed to support the deployment of business, data and application services.

Architecture View – Architecture View is a representation of the overall architecture that is meaningful to one or more stakeholders in the systems. Typically it comprises of Technology Logical Model and Technology Physical Model.

6.1.2 Key Steps

Step 1. Create the set of technology principles and product standards, and best practices for the model.

Step 2. Develop the Technology Logical Model (see Appendix B for an example).

Step 3. Develop the Technology Physical Model which includes connectivity, servers, workstations and peripherals (see Appendix C for an example).

Step 4. Build the inventory list of hardware and software such as application such as application servers, database, business intelligence tools, collaboration software, content management software, etc.

Step 5. Review the Technology Architecture with stakeholders.

6.1.3 Guidelines

Develop the target Technology Architecture at different level of scope according to organisation needs and level of details and timeframe.

7 STAGE 5 – Implement Architecture Governance

7.1 TASK 5.1 – Implement Architecture Governance

7.1.1 Applicable Concepts

Architecture Governance – Architecture Governance is the practice and orientation by which EA and other architectures are managed and controlled at an enterprise-wide level.

7.1.2 Key Steps

Step 1. Specify the decisions and accountability to encourage use of the EA.

Step 2. Provide guidance and sufficient usage of resources / core assets to ensure that organisation's business objectives can be sustained.

Step 3. Define control of the creation and monitoring of architecture components and activities.

7.1.3 Guidelines

To achieve a technical environment which is secure, consistent and interoperable, adequate controls must be implemented throughout the ICT value chain. These controls could include:

- a. Conceptualisation and design phases of ICT system to ensure that architectural standards are followed properly across the organisation.
- b. Planned audit of implemented ICT resources to ensure compliance with internal and external standards including regulatory compliance.
- c. Regular review cycle for EA to update and promulgate the changes in the EA to the entire organisation.

7.2 TASK 5.2 – Implement Transition Management

7.2.1 Applicable Concepts

Transition Management – Transition Management is a process during which the changes of EA are implemented in a controlled manner.

7.2.2 Key Steps

Step 1. Monitor business and technology changes.

Step 2. Conduct impact analysis to identify areas of architectural update based on the changes.

Step 3. Define the strategy and case for transition.

Step 4. Obtain approval from the EA Board.

Step 5. Implement the transition and monitor the outcome of the transition.

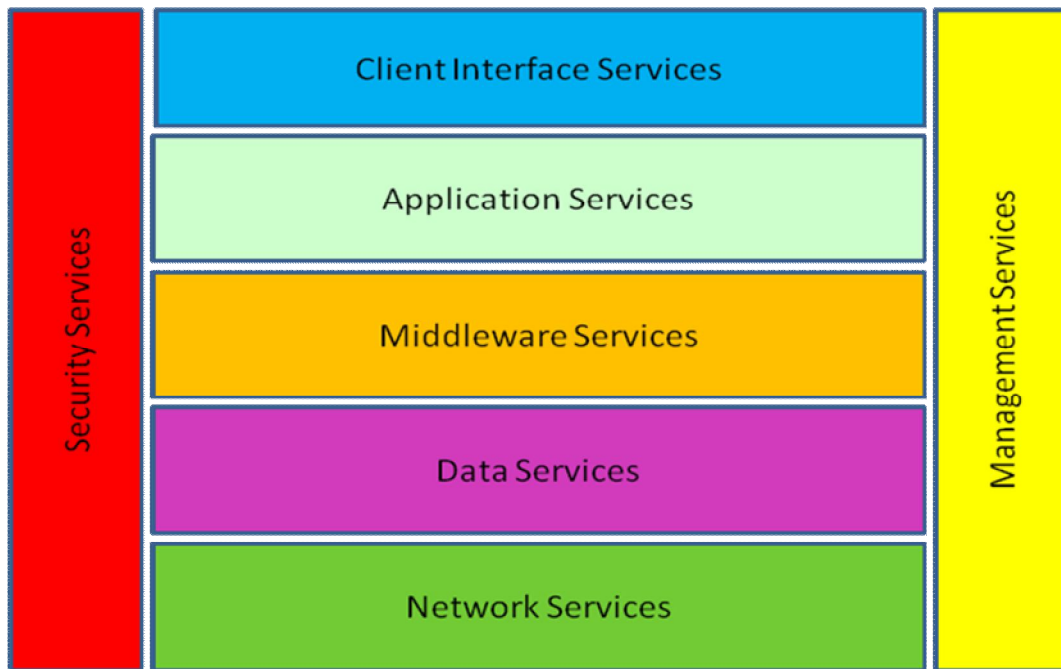
7.2.3 Guidelines

Nil

Appendix A – Example of a Process-Application-Data View Matrix

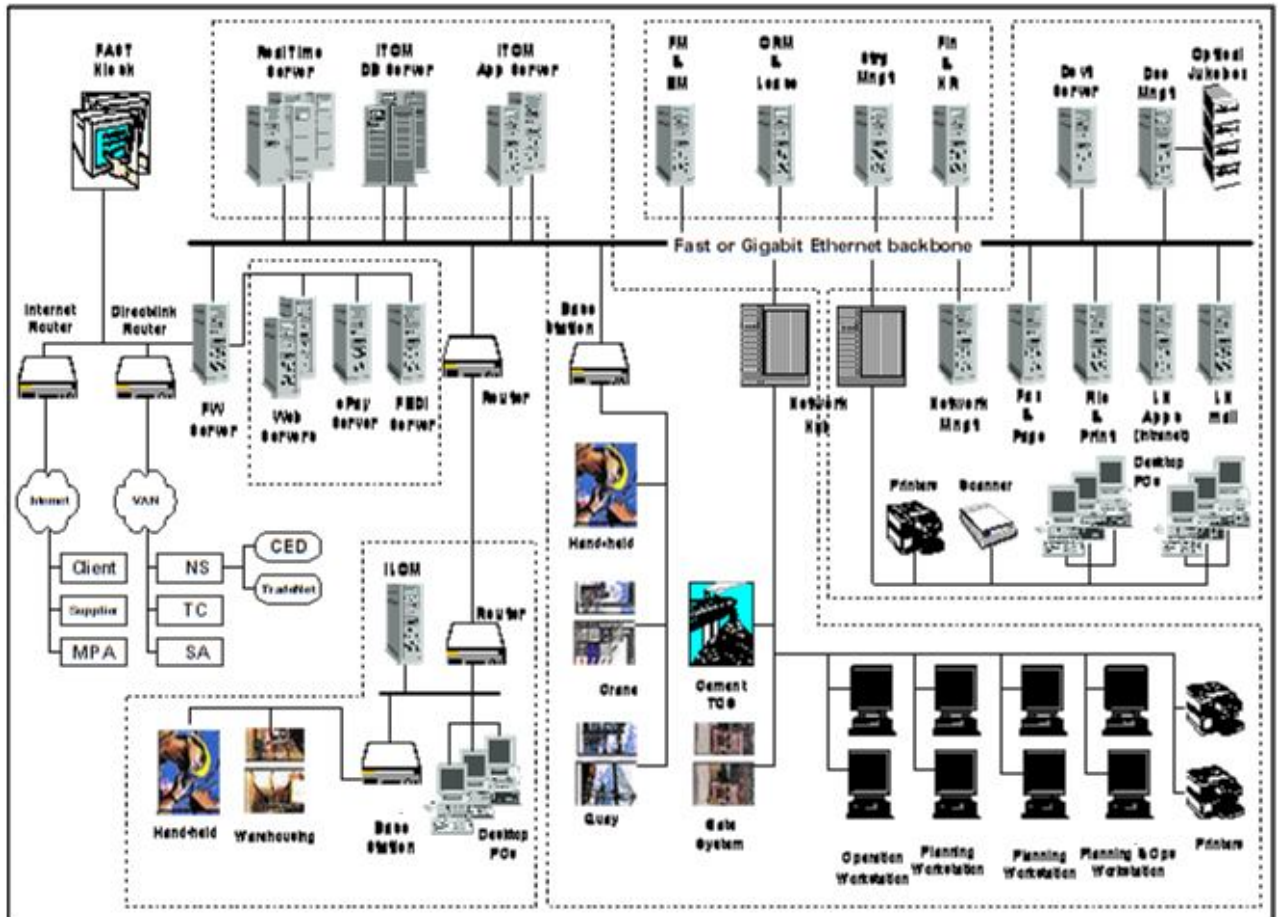
Process	Application	Entity
Resident Identity Management	Resident Management System	<ul style="list-style-type: none"> • Citizen (ID) • Birth-Record • Death-Record • ID-Card-History • Archival Record
Citizen Application	Citizenship Application System	<ul style="list-style-type: none"> • Foreigner • Citizenship-Application • Approval-Information
Passport Management	Passport Management System	<ul style="list-style-type: none"> • Passport-Holder • Passport-Record Details • Passport-Record-History
Investigation Service	Investigation Case Management System	<ul style="list-style-type: none"> • Case-ID • Subject-ID • Case-History

Appendix B – Example of a Technology Logical Model



Building Blocks	Definition
Client Interfaces services	Services that ensure the users are presented with meaningful information and the means to transact business with ease of use functionalities
Application Services	Applications that support critical functions and processes.
Middleware Services	Layer that provide supporting services that shields application from system and infrastructure services
Data Services	Services ensure the right information is available when needed by the right people
Network Services	Services to support distributed applications requiring data access and applications interoperability in heterogeneous or homogeneous networked environments.
Security Services	These services protect the systems from hacking, intrusions and harmful elements to provide a reliable environment.
Management Services	Applications that monitor the various services, enabling fine tuning for better performance and enhance support.

Appendix C – Example of a Technology Physical Model



Appendix D – Template of a Component of the Technology Architecture

Services: XXX (Example: Client Interface)

1. TTT (Example: PC Internet Browser)
 - 1.1 Technology Basics
 - 1.2 Available Products
 - 1.3 Standard(s)
 - 1.4 Platform of Choice

2. YYY (Example: Phone Browser)
 - 2.1 Technology Basics
 - 2.2 Available Products
 - 2.3 Standard(s)
 - 2.4 Platform of Choice

3. ZZZ

Appendix E – Examples of Principles for Enterprise Architecture

1. Protection of Intellectual Property must be enforced. Protection must be reflected in the architecture, implementation, and governance processes.
2. Ensure recoverability to protect the continuation of business by having
 - Adequate and appropriate backups of all data
 - Software with built-in error checking and recovery capabilities
 - Integration and compatibility of hardware with redundancies for critical operations
3. Data should be captured once at its source.
4. Data should be administered centrally and maintained for shared access.
5. Data storage will use relational technology.
6. Data that is stored online will be continuously available.
7. Integrate diverse forms of data from multiple sources.
8. Maintain the security of data, software and hardware assets at all levels of the technology architecture, with security being as transparent as possible.
9. Common use of applications should be adopted over the development of similar or duplicative applications which are only provided to a particular organization.
10. System development methodology should employ information engineering methods, and should be supported by CASE and repository tools from requirements analysis through code generation.
11. Adhere to national and international standards for network protocols and messages.
12. Adopt open-systems concept i.e. it should be:
 - Portable: run across multiple vendor platforms
 - Scalable: run across a wide range from small to large computer
 - Interoperable: run in a heterogeneous environment
 - Compatible: enable technology advances to be integrated with other components