An introduction to

TOGAF

(The Open Group Architecture Framework)

Part 1 :
TOGAF Basics & History

Who is in charge of TOGAF?

- The Open Group Architecture Forum
  - Architecture Framework (TOGAF)
  - Architecture Tools
  - Certification
- TOGAF is freely available for internal use of organizations

TOGAF version history

- TOGAF 7 ("Technical Edition ") , published in December 2001
- TOGAF 8 ("Enterprise Edition") , first published in December 2002 and republished in updated form as TOGAF 8.1 in December 2003
- TOGAF 9 : work on it still in progress

Main Difference with other frameworks

- Other Frameworks list deliverables but do not say 'how'
- TOGAF answers the 'how' (with its ADM)
- TOGAF can be used in companion with other frameworks to deliver their deliverables
- TOGAF is a framework by itself, it can be used by its own to prepare its own deliverables , too!

What architecture domains does TOGAF cover?

- TOGAF 8.1 :
    - Technology Architecture
    - Application Architecture
    - Data Architecture
    - Business Architecture
- TOGAF 7 only covered Technology Architecture
- In this presentation , from now on , by 'TOGAF' I mean 'TOGAF 8.1'

TOGAF components

- ADM
- Enterprise Continuum
- Resource Base
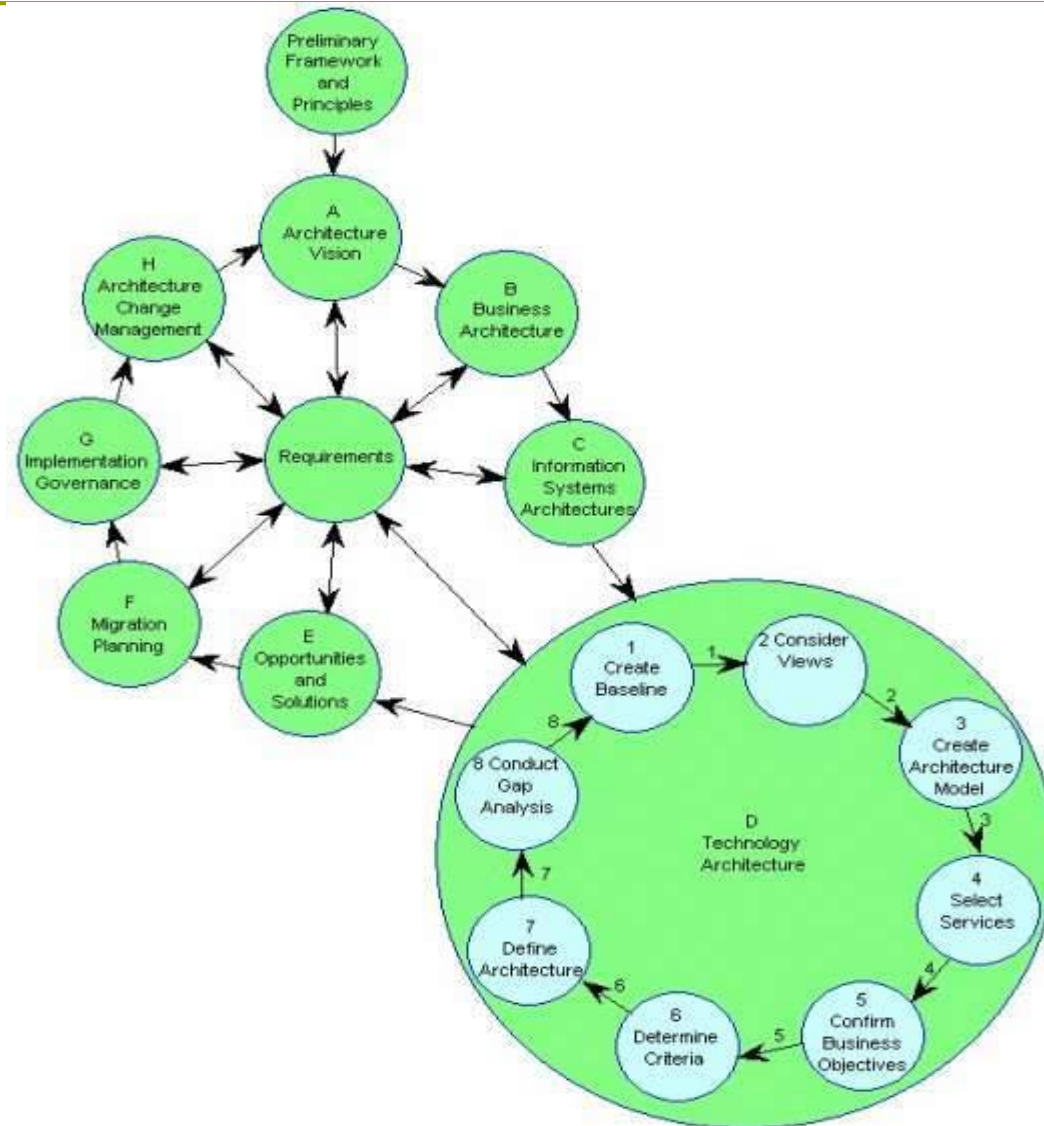
Part 2:
TOGAF Components

Part 2 - a

ADM
(Architecture Development Method)

ADM (Architecture Development Method)

Key points about ADM

- ADM might need adoption due to :
  - The enterprise 's circumstances
  - To be integrated with another framework
- ADM is iterative, over the whole process, between phases, and within phases.
- For each iteration of ADM decide about:
  - The scope
  - What needs to be leveraged in the organization's Enterprise Continuum

About scoping

- It has to be done for every architectural activity
- We have to scope because of limitations in time, human resource and finance
- Scoping dimensions:
  - Horizontal scope (enterprise scope)
  - Architecture domains
  - Vertical scope (level of detail)
- Scoping decision made must create value to the enterprise

ADM Phases

- A-H phases
- For each phase, TOGAF 8.1 has defined :
 - Objectives
  - Approach
  - Inputs
  - Steps
  - Outputs
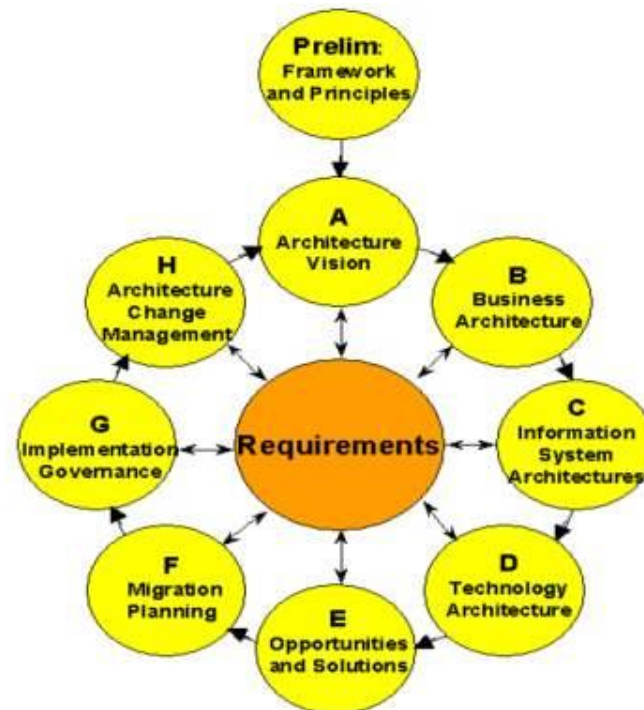
ADM preliminary phase

- Make sure all who should be involved are committed

- Define architecture principles and assumptions

- List the people performing it and their locations and responsibilities

- Define framework and methodology

- Define procedures for evaluation
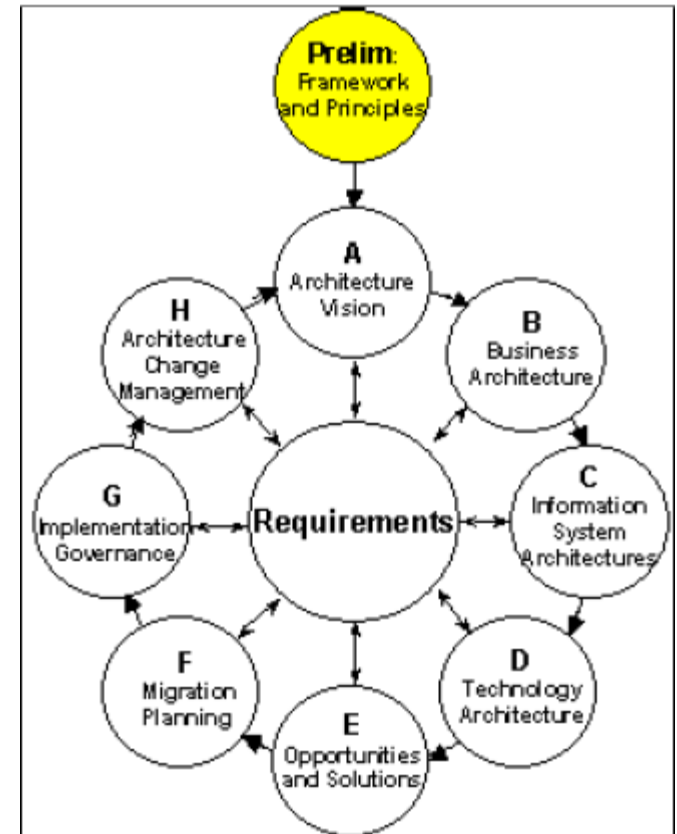
ADM Phase A: Architecture Vision

- validate the business principles, business goals, and strategic business drivers of the organization

- define the scope of, and to identify and prioritize the components of the current architecture effort

- define the relevant stakeholders, and their concerns and objectives.

- define the key business requirements to be addressed in this architecture effort, and the constraints that must be dealt with

- secure formal approval to proceed.
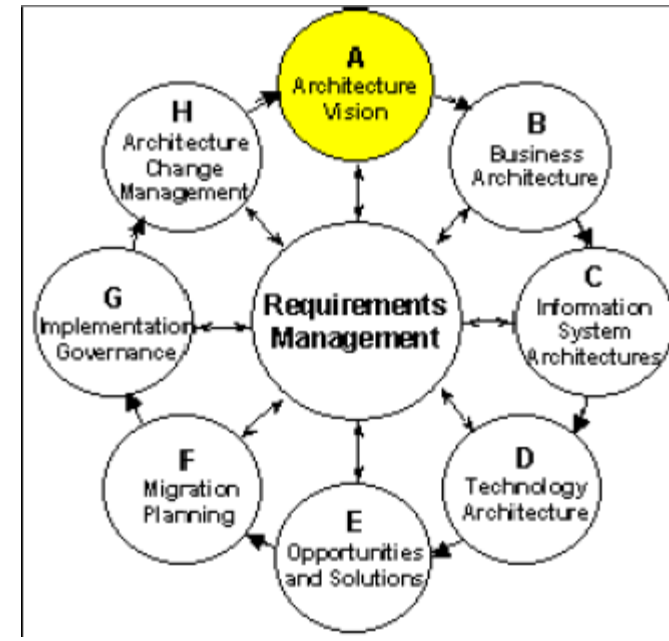
ADM Phase B : Business Architecture

- **describe the current** baseline business architecture (using modeling tools such as UML)

- **develop a target** Business Architecture, describing the product and/or service strategy, and the organizational, functional, process, information, and geographic aspects of the business environment, based on the business principles, business goals, and strategic drivers.

- **analyze the gaps** between the baseline and target Business Architectures
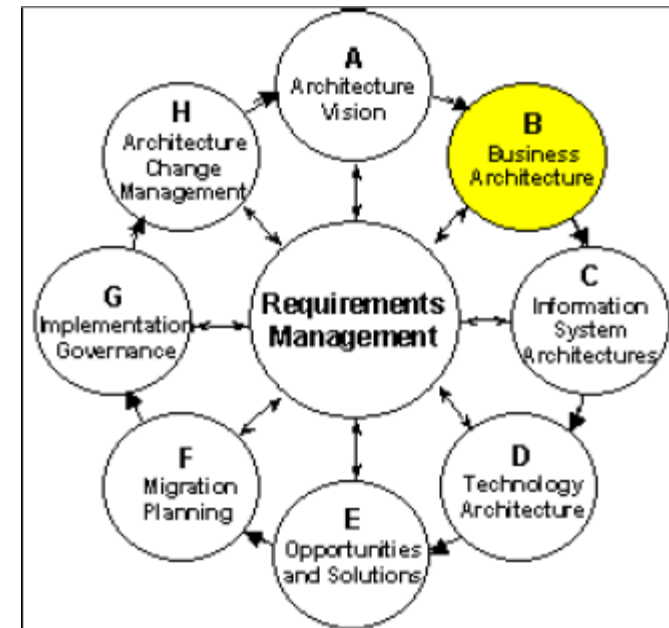
ADM Phase C :Information System Architecture

- develop target architectures covering either or both (depending on project scope) of the Data and Application Systems domains.

- Data: define the major types and sources of data necessary to support the business – define data entities – no database design

- Applications: define the major kinds of application system necessary to process the data and support the business – described as logical groups of capabilities– without reference to particular technologies – stable and relatively unchanging over time, whereas the technology used to implement them will change over time
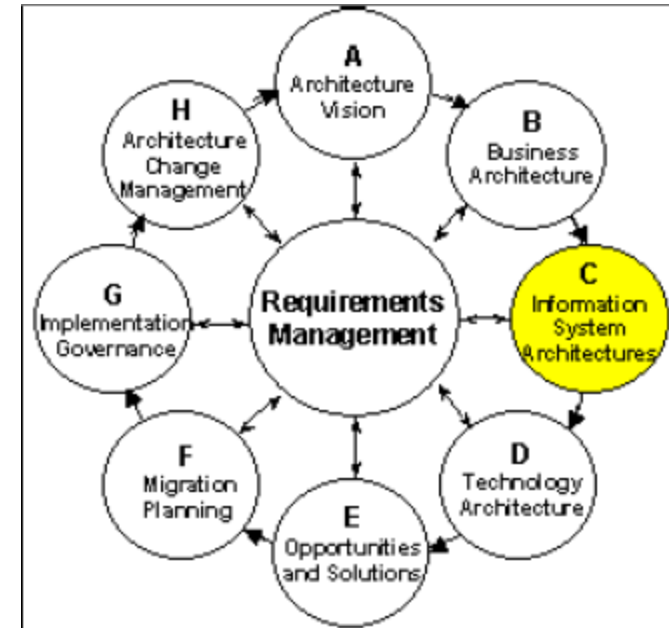
ADM Phase D : Technology Architecture

- develop a technology architecture that will form the basis of the following implementation work

- As part of this Phase, the architecture team will need to consider what relevant technology architecture resources are available in the [Architecture Continuum](#) like TOGAF Technical Reference Model (TRM)
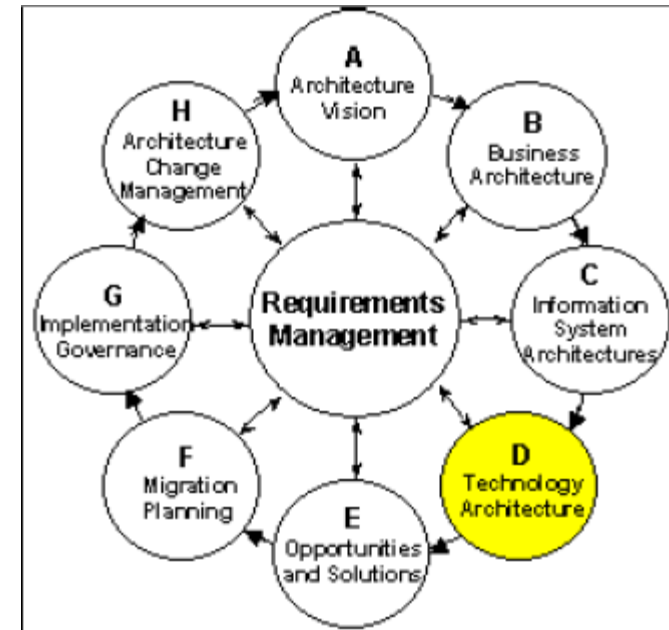
More on Technology Architecture

- Guides procurement process

- Service bundles are represented in a Technology Architecture in the form of "Building Blocks".

- The IT architect must analyze the services actually needed in order to implement an IT infrastructure that meets the enterprise's business requirements in the optimal manner, and define the set of optimal solution building blocks - real-world "platforms" - to implement that architecture.

- One of the key tasks of the IT architect in going from the conceptual Application Platform of the TRM to an enterprise-specific Technology Architecture, is to look beyond the set of real-world "platforms" already in existence in the enterprise.

ADM Phase E : Opportunities and Solutions

- evaluate and select among the implementation options identified in the development of the various target architectures (for example, build vs. buy vs. reuse options)

- identify the strategic parameters for change, and the top-level work packages or projects to be undertaken in moving from the current environment to the target

- generate an overall implementation and migration strategy
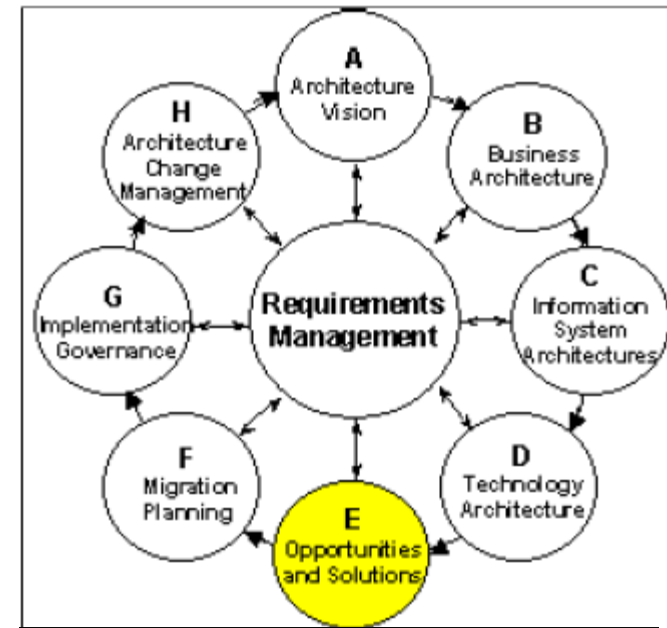
ADM Phase F : Migration Planning

- to sort the various implementation projects into priority order

- Generate a detailed implementation plan
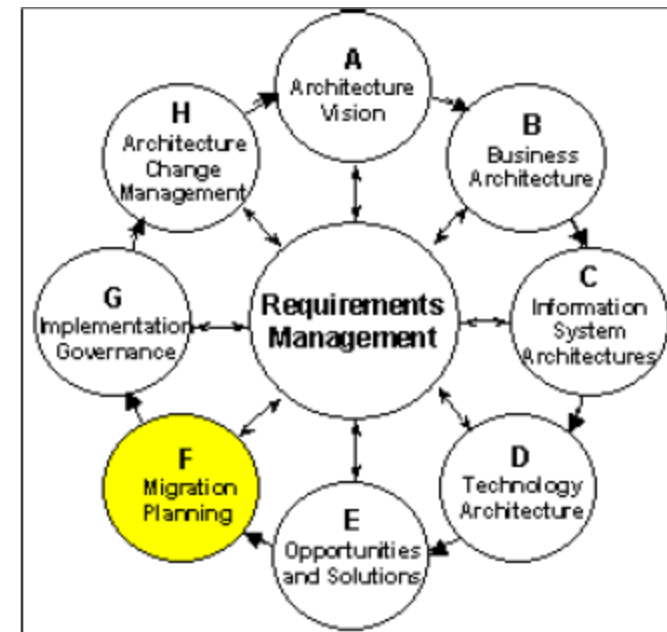
ADM Phase G : Implementation Governance

- **formulate recommendations** for each implementation project

- **perform appropriate governance functions** while the system is being implemented and deployed

- **ensure conformance with the defined architecture**
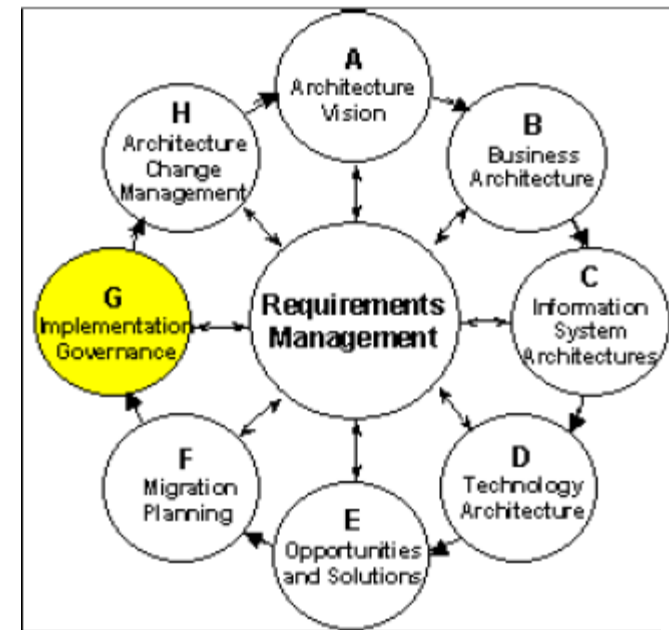
ADM Phase H : Architecture Change Management

- □ provide for the continual monitoring of such things as new developments in technology and changes in the business environment, and for determining whether to formally initiate a new architecture evolution cycle
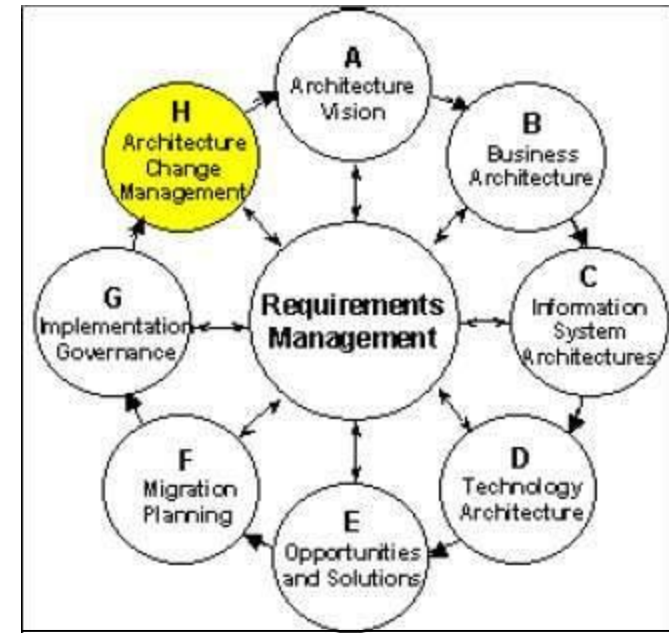
ADM Architecture Requirements Management

- not a static set of requirements, but a dynamic process whereby requirements for enterprise architecture *and subsequent changes to those requirements* are identified, stored, and fed into and out of the relevant ADM phases.

- Changes such as changing market conditions, new legislation, etc.
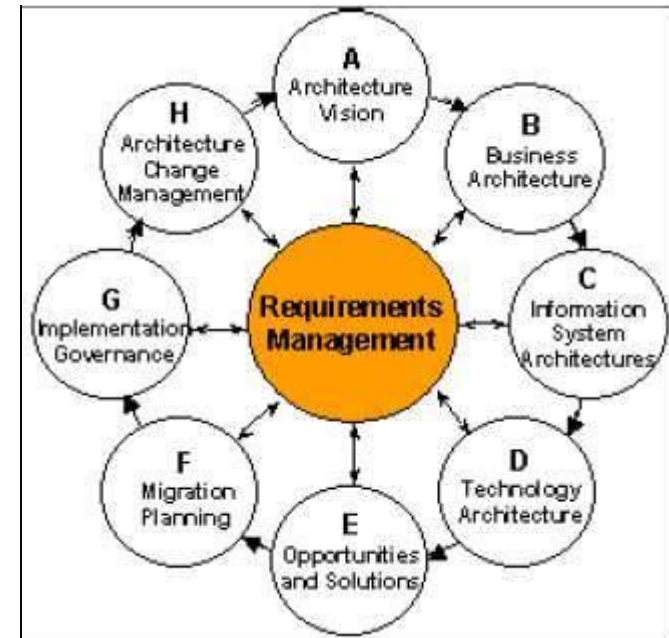
Part 2 - b

Enterprise Continuum

Enterprise Continuum

- A repository of reusable building blocks
- ADM both uses (ready building blocks) from and adds (organization-specific building blocks) to it
- Contains :
  - Work in progress
  - Previous work done in this organization
  - Reference models and patterns
- Sample content:
  - In the development of a Technology Architecture, this may be TOGAF's own Foundation Architecture.
  - In the development of a business architecture, it may be a reference model for e-Commerce taken from the industry at large.

Enterprise Continuum

Read details about the components in this picture, here.
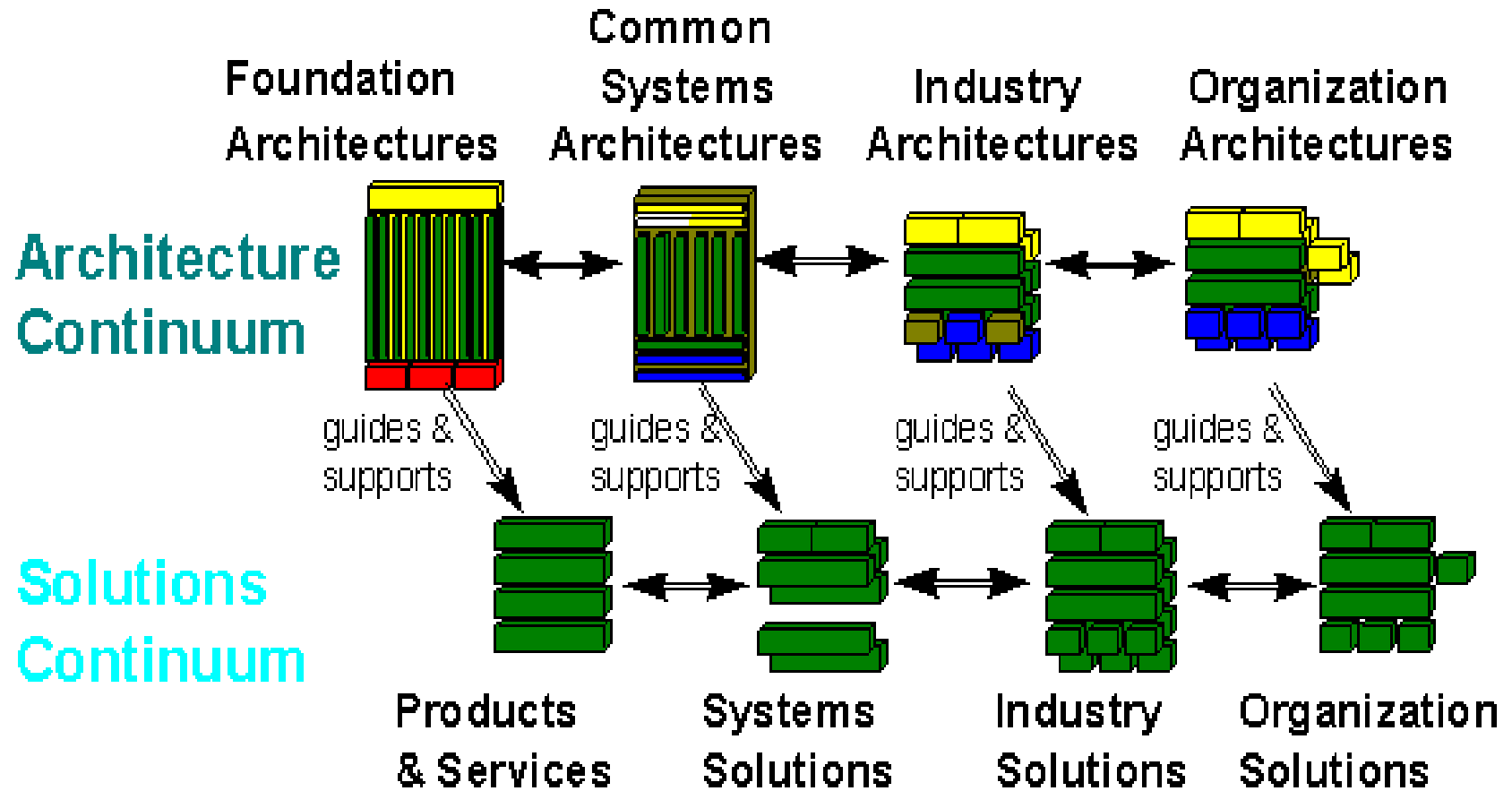
Enterprise Continuum

- specifies a progression for developing architectures and solutions using architecture building blocks and solution building blocks in a continuous, iterative fashion.

- A building block is simply a grouping of functionality defined to meet business needs. An architecture building block is described with a general level of detail. Solution building blocks reflect real products or specific custom developments.

- The TOGAF ADM guides you through the left-to-right progression from the general architectures and solutions (on the left), to organization-specific ones (on the right).

- The relationship between the *Architecture Continuum* and the *Solutions Continuum* is one of guidance, direction, and support. You build an architecture by navigating the two continuums, from left to right, top to bottom, so that you are specifying architecture building blocks at each stage, and then the solution building blocks that implement them, and continuing rightward, building upon the solution and adding increasing detail.

About the Enterprise Continuum components

- A **Foundation Architecture** consists of architecture building blocks and corresponding standards that support a complete computing environment. TOGAF's pre-supplied Foundation Architecture consists of the Technical Reference Model and Standards Information Base.

- A **Common System Architecture** is complete in terms of a particular problem domain, but incomplete in terms of the overall information system functionality. Examples of Common Systems Architectures are a *Network Architecture,* or a *Security Architecture.* A **System Solution** is an implementation of a Common System Architecture comprising a set of products and services.

- **Industry Architectures** include pre-built, off-the-shelf architectures that have been developed for particular vertical industries. These often include pre-built data models and business processes. An **Industry Solution** is an implementation of an Industry Architecture.

Reference Models

- Used in conjunction with ADM
- Each reference model consists of :
  - Taxonomy : defines terminology, and provides a coherent description of the components and conceptual structure of the model
  - Graphic : provides a visual representation of the taxonomy, and the inter-relationship of the components, as an aid to understanding.

TRM

graphic

TRM

taxonomy

Foundation
architecture

Standards
Information Base
(SIB)

Location and Directory Services
- Directory Services
- Special Purpose Naming Services
- Service Location Services
- Registration Services
- Filtering Services
- Accounting Services

Network Services
- Data communications services
- Electronic Mail services
- Enhanced telephony functions
- Shared screen functions
- Video conferencing functions
- Broadcast functions
- Mailing list functions
- Distributed time services
- Distributed data services
- Distributed file services
- Distributed name services
- Remote process (access) services
- Remote print spooling and output distribut

Operating System Services
- Kernel operations services
- Command interpreter and utility services
- Batch processing services
- File and directory synchronization services

Software Engineering Services
- Programming language services
- Object code linking services

TRM - Graphic

TRM – Taxonomy - Definitions

Business Applications

Business Applications are applications that are specific to a particular enterprise or vertical industry. Such applications typically model elements of an enterprise's domain of activity or business processes. Examples of Business Applications might include:

- patient record management services used in the medical industry;
- inventory management services used in the retail industry; or
- geological data modeling services used in the petroleum industry.

Over time, particular Business Applications may become Infrastructure Applications, if they become sufficiently ubiquitous, interoperable, and general purpose to be potentially useful to a broad range of enterprise IT users.

Application Platform

The "Platform" Concept

The term "platform" is used in many different ways within the IT industry today. Because of the different usages, one often see the term qualified: for example, "Application Platform", "Standardized" and "Proprietary Platforms", "Client" and "Server Platforms", "Distributed Computing Platform", "Portability Platform". Common to all these usages is the idea that someone needs a set of services provided by a particular kind of "platform", and will implement a "higher level" function that makes use of those services.

The TOGAF Technical Reference Model focuses on the Application Platform, and the "higher level function" is the set of Application Software, running on top of the Application Platform, that is needed to address the enterprise's business requirements.

It is important to recognize that the Application Platform in the TOGAF Technical Reference Model is a single, generic, conceptual entity. From the viewpoint of the TOGAF TRM, the Application Platform contains all possible services. In a specific target architecture, the Application Platform will contain only those services needed to support the required functions.

TRM – Taxonomy - Definitions

Infrastructure Applications

Infrastructure Applications are applications that have all, or nearly all, of the following characteristics:

- Widespread availability as commercial off-the-shelf software means that it is uneconomic to consider custom implementation;
- User interaction is an important part of the application's function;
- Implementations are based on infrastructure services;
- Implementations may include significant extensions beyond that needed to use the underlying infrastructure services; and
- Interoperability is a strong requirement.

Examples of Applications in this category include:

- Electronic payment and funds transfer services
- Electronic mail client services
- Publish and subscribe

Qualities

Besides the set of components making up the TRM, there is a set of attributes or **qualities** that are applicable across the components. For example, for the management service to be effective, *manageability* must be a pervasive quality of all platform services, applications and communications infrastructure services.

❑ Application Platform Service Categories:

- Data Interchan...
  - Documer...
  - Documer...
  - Graphic...
  - Speciali...
  - Electror...
  - Fax ser...
  - Raw gra...
  - Text pro...
  - Docume...
  - Publishi...
  - Video p...
  - Audio p...
  - Multime...
  - Media s...
  - Informa...
  - Hyperte...
- Data Managen...
  - Data di...
  - Databas...
  - Object...
  - File mar...
  - Query p...
  - Screen...
  - Report...
  - Network...
  - Wareho...
- Graphics and...
  - Graphic...
  - Drawing...
  - Imaging...
- International...
  - Charact...
  - Cultural...
  - Local la...

- Location and Directory Serv...
  - Directory Services
  - Special Purpose Nam...
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  - Command interpreter...
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  - File and directory syr...
- Software Engineering Servic...
  - Programming languag...
  - Object code linking s...
  - Computer Aided Soft...
  - Graphical User Interf...
  - Scripting language se...
  - Language binding ser...
  - Run Time Environmer...
  - Application Binary Int...

- Transaction Processing Services
  - Transaction manager services
- User Interface Services
  - Graphical client-server services
  - Display objects services
  - Window management services
  - Dialogue support services
  - Printing services
  - Computer-based training and on-line help services
  - Character-based services
- Security Services
  - Identification and authentication services
  - System entry control services
  - Audit services
  - Access control services
  - Non-repudiation services
  - Security management services
  - Trusted recovery services
  - Encryption services
  - Trusted communication services
- System and Network Management Services
  - User management services
  - Configuration management (CM) services
  - Performance management services
  - Availability and fault management services
  - Accounting management services
  - Security management services
  - Print management services
  - Network management services
  - Backup and Restore services
  - On-line Disk Management services
  - License Management services
  - Capacity Management services
  - Software Installation services
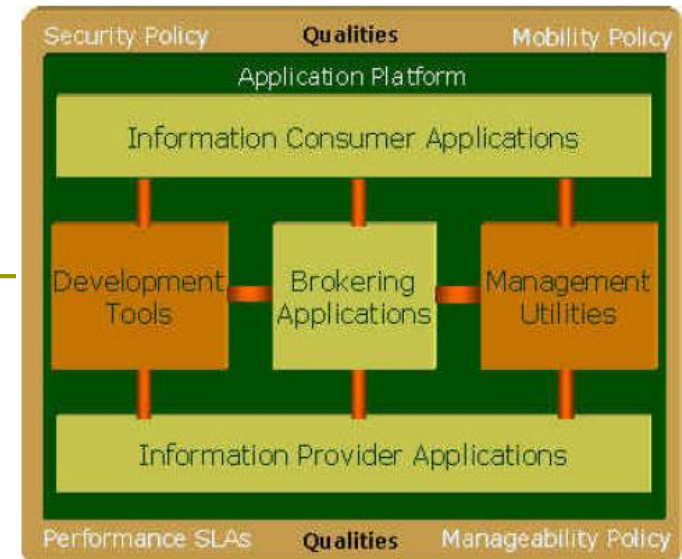 - Trouble Ticketing functions

IIIRM

graphic

IIIRM

taxonomy

Common
System
Architecture

Standards
Information Base
(SIB)

Application Platform

All the different types of application described above are built on t

The Application Platform component of the Integrated Information
the services defined in the TOGAF Techical Reference Model, the s
Specifically, it comprises all those services in the TRM application
and processing the information required, rather than understandin

The services of the Application Platform component can be used to
Information Consumer, and Information Provider applications. Wh
this way, such an approach enables maximum leverage of a single
effective and consistent transfer of data between processes, and t
management of applications.

The Application Platform component comprises the following categ

Software Engineering Services

- Languages
- Libraries and
- Registries

Security Services

- Authentication, Authorization, and Access Control
- Single Sign-On
- Digital Signature
- Firewall

Why IIIRM? (What problem does it address?)

- Goal :
  - getting information to the right people at the right time in a secure, reliable manner in support of core organization operations
- Goal prerequisite:
  - Get over limitations imposed by traditional organization structures.
- Solution :
  - cross-functional teams
- Solution prerequisite:
  - provide access to information to each cross-functional team on an as-required basis, and yet the sources of this data can be numerous and the volumes huge.
- Obstacle:
  - the IT systems were built for each functional department (do not allow for information to flow in support of the boundaryless organization)
- Approach:
  - **Integrated Information Infrastructure**
    - integrated information
    - integrated access to that information

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The Open Group published IIIRM, which depicts the major components required to address the Boundaryless Information Flow problem space, and can help the architect in this task.

IIIRM vs. TRM

- IIIRM Consists of : application, application platform, and qualities

- Shift of attention from Application Platform space in TRM to Application space in IIIRM

- TRM is a "Foundation Architecture" in the Enterprise Continuum. IIIRM is a "Common Systems Architecture" .

- IIIRM is a subset of TRM in terms of its overall scope, but also extends the Applications part to enable "boundaryless information flow".

IIIRM - Graphic
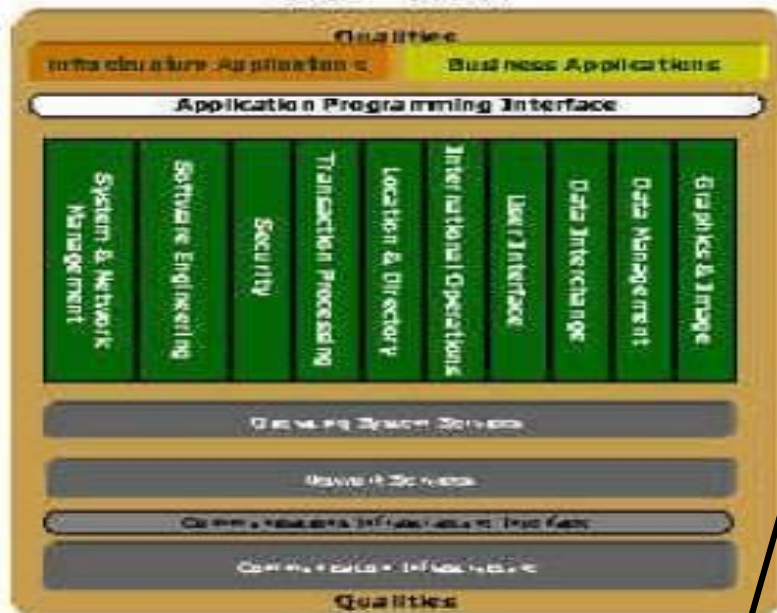
Grey areas are not in IIIRM.

Side View

Top Down View
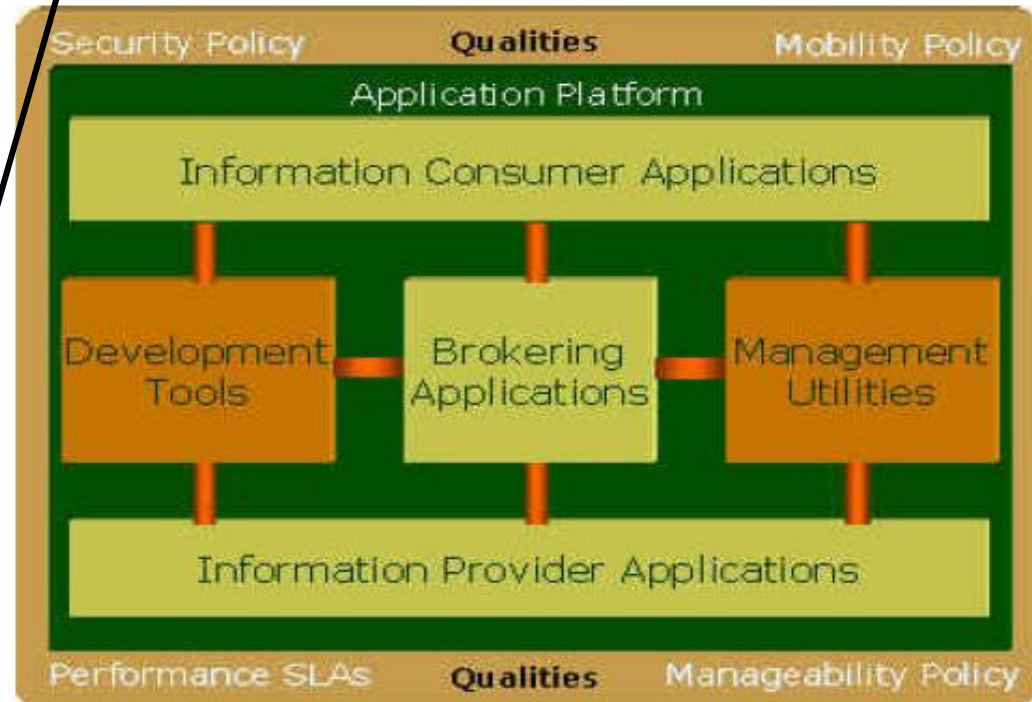
IIIRM – Taxonomy

Components of the High-Level III-RM

The Integrated Information Infrastructure Reference Model has the following core components:

- **Business Applications**, denoted by the light-brown boxes in the high-level model (corresponding to the light-brown "Business Applications" box in the TRM graphic). There are three types of Business Application in the model:
  - **Information consumer applications**, which deliver content to the user of the system, and provide services to request access to information in the system on the user's behalf
  - **Brokering applications**, which manage the requests from any number of clients to and across any number of Information provider applications
  - **Information provider applications**, which provide responses to client requests and rudimentary access to data managed by a particular server
- **Infrastructure Applications**, denoted by the dark-brown boxes in the high-level model (corresponding to the dark-brown "Infrastructure Applications" box in the TRM graphic). There are two types of Infrastructure Application in the model:
  - **Development tools**, which provide all the necessary modeling, design, and construction capabilities to develop and deploy applications that require access to the integrated information infrastructure, in a manner consistent with the standards of the environment
  - **Management utilities**, which provide all the necessary utilities to understand, operate, tune, and manage the run-time system in order to meet the demands of an ever changing business, in a manner consistent with the standards of the environment
- An **Application Platform**, which provides supporting services to all the above applications, in areas such as location, directory, work flow, data management, data interchange, etc., and thereby provides the ability to locate, access, and move information within the environment. This set of services constitutes a subset of the total set of services of the TRM Application Platform, and is denoted by the dark green underlay in the high-level model (corresponding to the dark green of the application platform in the TRM graphic).
- The **Interfaces** used between the components. Interfaces include formats and protocols, application programming interfaces, switches, data values, etc. Interfaces among components at the application level are colored brown. Interfaces between any application-level components and their supporting services in the applicaiton platform are colored white (corresponding to the white of the Application Programming Interface box in the TRM graphic).
- The **Qualities** backplane, denoted by the beige underlay in the high-level model (corresponding to the beige of the Qualities backplane in the TRM graphic). The applications and application platform must adhere to the policies and requirements depicted by the qualities backplane.

Part 2 - c

Resource Base

Resource Base

- a set of resources - guidelines, templates, checklists, and other detailed materials supporting the TOGAF ADM

A sample checklist:
Architecture Review Checklist - Information Management

- **Data Values**
  - 1. What are the processes that standardize the management and use of the data?
  - 2. What business process supports the entry and validation of the data? Use of the data?
  - 3. What business actions correspond to the creation and modification of the data?
  - 4. What business actions correspond to the deletion of the data and is it considered part of a business record?
  - 5. What are the data quality requirements required by the business user?
  - 6. What processes are in place to support data referential integrity and / or normalization?

Architecture Review Checklist - Information Management

- ❑ **Data Definition**
  - ▪ 1. What are the data model, data definitions, structure, and hosting options of purchased applications (COTS)?
  - ▪ 2. What are the rules for defining and maintaining the data requirements and designs for all components of the
  - ▪ information system?
  - ▪ 3. What shareable repository is used to capture the model content and the supporting information for data?
  - ▪ 4. What is the physical data model definition (derived from logical data models) used to design the database?
  - ▪ 5. What software development and data management tools been selected?
  - ▪ 6. What data owners have been identified to be responsible for common data definitions, eliminating unplanned
  - ▪ redundancy, providing consistently reliable, timely, and accurate information, and protecting data from misuse and destruction?

A sample checklist : (cont 'd)
Architecture Review Checklist - Information Management

- **Security/Protection**
  - 1. What are the data entity and attribute access rules, which protect the data from unintentional and unauthorized
  - alterations, disclosure, and distribution?
  - 2. What are the data protection mechanisms to protect data from unauthorized external access?
  - 3. What are the data protection mechanisms to control access to data from external sources that temporarily have internal residence within Boeing?

Architecture Review Checklist - Information Management

- **Hosting, Data Types, and Sharing**
  - 1. What is the discipline for managing sole-authority data as one logical source with defined updating rules for physical data residing on different platforms?
  - 2. What is the discipline for managing replicated data, which is derived from operational sole-authority data?
  - 3. What tier data server has been identified for the storage of high- or medium-critical operational data?
  - 4. What tier data server has been identified for the storage of type C operational data?
  - 5. What tier data server has been identified for the storage of decision support data contained in a data warehouse?
  - 6. What database management systems have been implemented?

A sample checklist : (cont 'd)
Architecture Review Checklist - Information Management

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A sample checklist : (cont 'd)
Architecture Review Checklist - Information Management

- ❑ **Common Services**
  - ■ 1. What are the standardized distributed data management services (e.g., validation, consistency checks, data edits,
  - ■ encryption, and transaction management) and where do they reside?
- ❑ **Access Method**
  - ■ 1. What are the data access requirements for standard file, message, and data management?
  - ■ 2. What are the access requirements for decision support data?
  - ■ 3. What are the data storage and the application logic locations?
  - ■ 4. What query language is being used?

A second sample checklist
Architecture Review Checklist - Security

- **Security Awareness**
- **Identification / Authentication**
- **Authorization**
- **Access controls**
- **Sensitive Information Protection**
- **Audit Trails and Audit Logs**
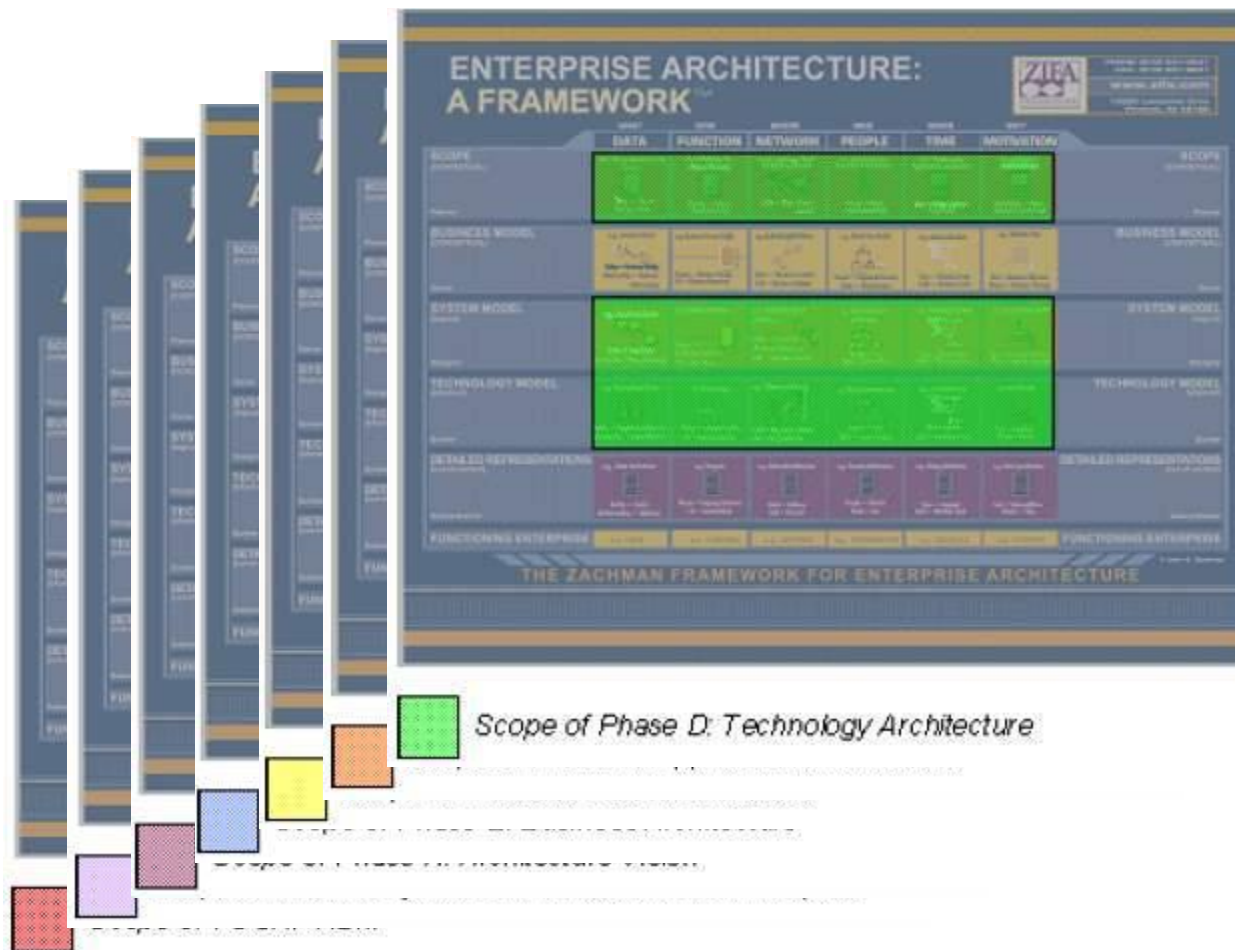- **External Access Considerations**

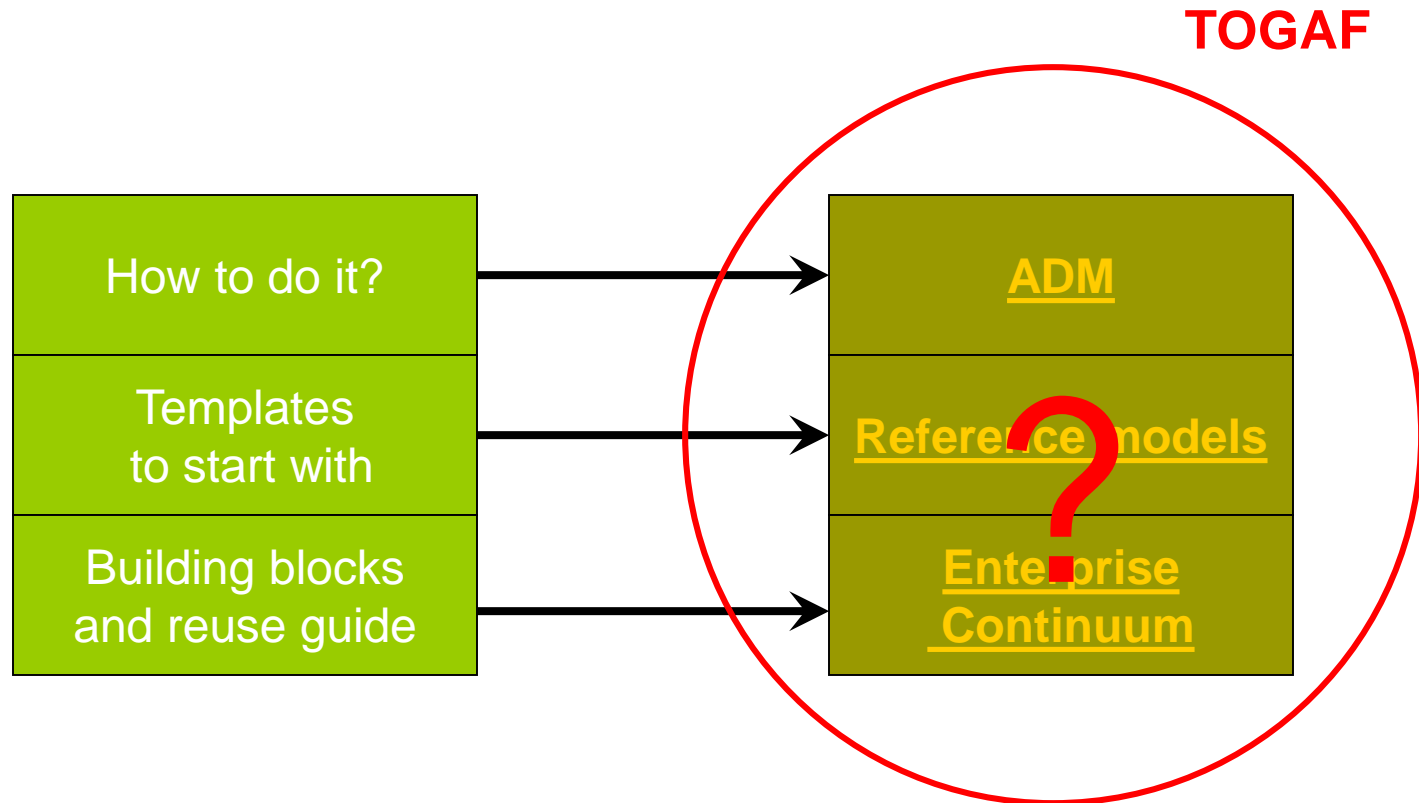# Part 3 :
Last Words about TOGAF

TOGAF vs. Zachman Framework

- Zachman Framework is a logical structure for describing any complex object like an enterprise. It is known as a de facto standard for classifying the artifacts developed in enterprise architecture.

- The Open Group's vision for TOGAF is as a vehicle and repository for practical, experience-based information on how to go about the process of enterprise architecture, providing a generic method with which specific sets of deliverables, specific reference models, and other relevant architectural assets, can be integrated.

Mapping the TOGAF ADM to Zachman Framework

Scope of Phase D: Technology Architecture

Putting it Altogether :
What does TOGAF provide for IT Architects?

TOGAF

How to do it?	**ADM**
Templates to start with	**Reference models**
Building blocks and reuse guide	**Enterprise Continuum**

?

References

- [Open Group TOGAF homepage](#)
- IBM whitepapers:
  - [Introducing The Open Group Architecture Framework (TOGAF)](#)
  - [Understand The Open Group Architecture Framework (TOGAF) and IT architecture in today's world](#)
- [Developers.com](#)
- [Wikipedia](#)