

What is Architecture?





Module outline

▶ **Introduction and objectives**

What is architecture?

IT Architects

Summary and references



At the end of this module, you should be able to:

- Explain what is meant by architecture and how we use it to help us design viable IT systems
- Understand why architecture is important in the modern age of fast-paced change
- Describe what an IT Architect is and what one does in the design on IT systems
- Describe the relationship between:
 - Enterprise architecture and solution architecture
 - Business architecture and IT architecture



Before we begin

Spend five minutes thinking about the following questions:

- What is your definition of architecture?
- What is the difference between architecture and design?
- Why is architecture important to IT systems design, and why do projects need it?
- What is the role of the IT Architect?
- What diagrams and models do you currently use to represent architectures?
- What do *you* think is meant by architectural thinking?

Popular misconceptions



Here are some popular misconceptions about architecture:

- Architecture is just paper.
- Architecture and design are the same thing.
- Architecture and infrastructure are the same thing.
- <My favorite technology> is the architecture.
- A good architecture is the work of a single architect.
- Architecture is simply structure.
- Architecture can be represented in a single blueprint.
- Architecture cannot be measured or validated.
- Architecture is a science.
- Architecture is an art.





Module outline

Introduction and objectives

► **What is architecture?**

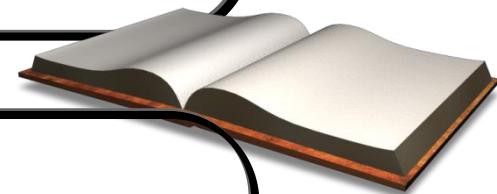
IT Architects

Summary and references



Architecture (as an artefact):

*The architecture of a system describes its overall **static structure** and **dynamic behaviour**. It models the **system's elements** (which for IT systems are software, hardware, and its human users), the **externally manifested properties** of those elements, and the static and dynamic relationships among them.*



Architecture (as a discipline):

*Architecture is an **engineering discipline** that studies methods of designing **IT systems** that provide a **solution to a business problem**. The solution must **satisfy** functional and non-functional **requirements** in a way that best balances **competing stakeholders' concerns** and must take **constraints** into account.*



Why Architecture is Important? (1 of 4)

Think about the following statements and see if you agree with them:

- I don't have time for architecture – it's just a document that no one needs anyway. My solution will work perfectly without the need to produce these documents and/or diagrams
- There are too many architectural artefacts that the method defines. I don't have time to complete all this work even if I think it's got value
- We do not need architecture today. Modern ways of delivery use agile methods that make architecture superfluous
- We use cloud based and “Platform as a Service” environments that “decide” on the architecture and spin out the necessary resources for me behind the scenes
- We use a “Commercial off the Shelf” product (i.e. a package) or “Software as a Service” (SaaS) cloud based solution. It has its own architecture that is hidden from me. Therefore I don't need to develop architecture
- We use Design Thinking workshops to work on the solution. This removes the need to develop architecture



Why Architecture is Important? (2 of 4)

What is the role of architecture? Some of the imperatives for producing architecture:

- Solution blueprint that can be reviewed and validated
- Communication tool for stakeholders and teams (business, IT delivery and BAU – IT Operations), future reference for maintenance and change, developing neighbouring systems and integration
- Delivery Environments: Input into the delivery environments' design and specification, tools and platforms of choice for solution delivery
- Delivery Planning: Starting point for developing the project plan (Traditional delivery), solution and feature backlog (Agile delivery), resource requirements and team structure
- Estimates: Starting point for cost estimation (labour, licences, platform costs, etc)
- Foundation for segregation of responsibilities between various parties – e.g. Client and Solution Provider, Solution Provider and Partner(s)/Subcontractor(s) (e.g. RACI matrices)



Why Architecture is Important? (3 of 4)

Why do we need it?

- In the age of continuing advances in technology and delivery methods (e.g. DevOps, Continuous Delivery, etc), architectures are as important as ever:
 - to ensure completeness and feasibility of functional capabilities
 - to account for Non-functional and Quality of Service requirements
 - within the context of often significant constraints
- Unless we are dealing with a very basic solution that has a very low level of complexity (e.g. a simple mobile or web app developed in isolation), lack of existing solution architecture often leads to:
 - misinterpretation of functional capabilities, non-functional qualities, integration required and the risks involved. This usually manifests itself towards the end of the delivery cycle at the times of testing (or even worse, at early production stages). A decision not to have architecture developed does not solve this problem but simply pushes it off to a later stage within the delivery cycle when the cost of rectification is significantly higher, if such rectification is achievable at all
 - poor understanding of the solution structure and how parallel development can be achieved and how inter-component dependencies can and should be managed



Why Architecture is Important? (4 of 4)

Why do we need it?

- Both Functional capabilities and Non-functional requirements & Service Levels may be contractually binding:
 - Failure to achieve targets may result in financial penalties and/or a loss of business for the Client
 - It is an issue of significant severity if an architecture that meets the specified requirements cannot be established. This may be due to lack of a viable solution in principle (e.g. we cannot solve a given problem with the amount of funding available) or due to poor design and the latter needs to be improved. Regardless, if the answer is negative, the sooner this is known the better for all the stakeholders
- The effort expended should always be proportionate to the risk and return involved. Without a developed architecture, it is rare that all significant risks are known and well understood
- Lack of architecture means that there is no basis for solution cost and delivery time estimates

Architecture can be at any scale, and the scale is defined by the characteristic dimension of the architecture's elements (1 of 4)



Paraphrasing the definition: **Structure and behavior of the elements of a system**

- What is a system?
- What is an element?



Architecture can be at any scale, and the scale is defined by the characteristic dimension of the architecture's elements (2 of 4)



Paraphrasing the definition: **Structure** and **behavior** of the **elements** of a system

- What is a system?
- What is an element?

It's all a question of **scale**:

- The elements of a hi-fi are its tuner, amplifier, speakers, cables, and remote controls.
- The elements of an amplifier are its case, the power supply, and the circuit board.
- The elements of a circuit board are its resistors, fuses, and integrated circuits.
- The elements of an integrated circuit are transistors and other components.



Architecture can be at any scale, and the scale is defined by the characteristic dimension of the architecture's elements (3 of 4)



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- The elements of an integrated circuit are transistors and other components.

Whatever the scale of the system we're focused on, we say:

- '**Above**' that scale are the '**requirements**' of the world in which the system sits.
- '**At**' that scale is the '**architecture**' between the elements of the system.
- '**Below**' that scale is the '**design**' of the insides of the elements of the system.



Architecture can be at any scale, and the scale is defined by the characteristic dimension of the architecture's elements (4 of 4)



Paraphrasing the definition: **Structure** and **behavior** of the **elements** of a system

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So, in our world of IT:

- Our IT system's requirements are modeled as interactions (use cases, and so on.) with actors and other IT systems
- Our IT system's architecture's elements are components and nodes, and so on.
- Our IT system's design or designs model the insides of components, nodes, messages, and connections

Architecture also helps us ensure that our systems are good systems



Architecture is also used to describe best (or preferred) practice, documented as *architecture guidance*, that helps ensure our system is a good system.

Architecture guidance includes:

- Good things
 - Tried and tested parts
 - Tried and tested structures of parts (reference architectures)
- Good ways of doing things
 - Principles and patterns that help ensure the architecture is created in a good way

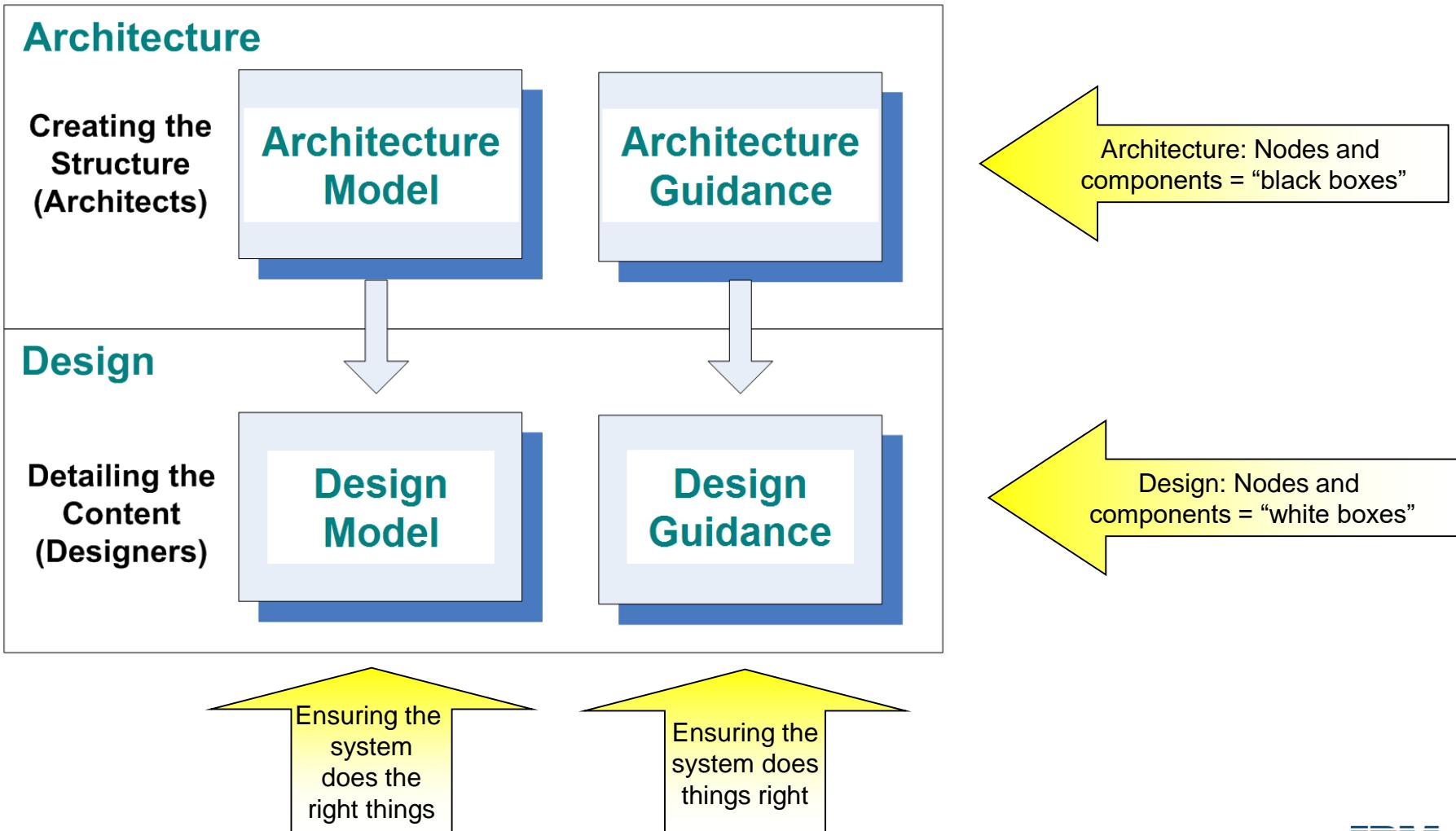
This architectural catalogue of guidance may be found in:

- An enterprise's own architecture asset databases
- The World Wide Web
- Reference Architectures and other design guidance available from hardware and software vendors



The focus of architecture and design on the target system

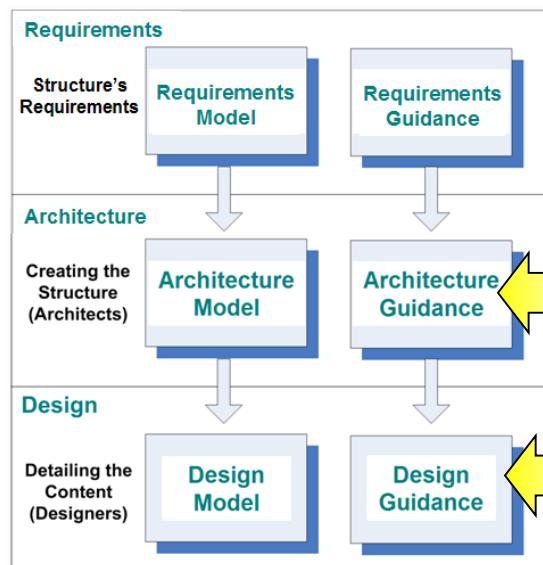
Overall, architecture and design both focus on the content and the context of the target system, ensuring that it does the right things and does things the right way.



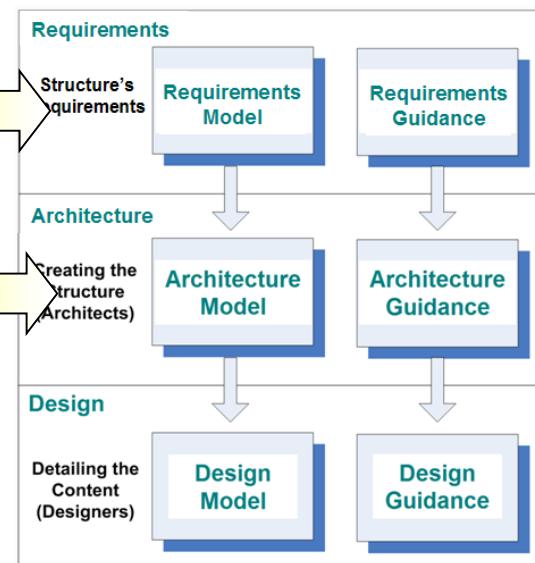
This simple framework can be extended, enabling us to see a repeating pattern across the scales



Architecting the Amplifier



Architecting the Circuit Board



What is architecting?



Time for a question



What is the correct definition of architecting?

- A. The process of analyzing and solving, at a high level, technical problems using various business theories
- B. The process of analyzing and solving, at a high level, business problems using various technologies
- C. The process of solution design

What is the value of architecting?



Time for a question



What is the value of architecting?

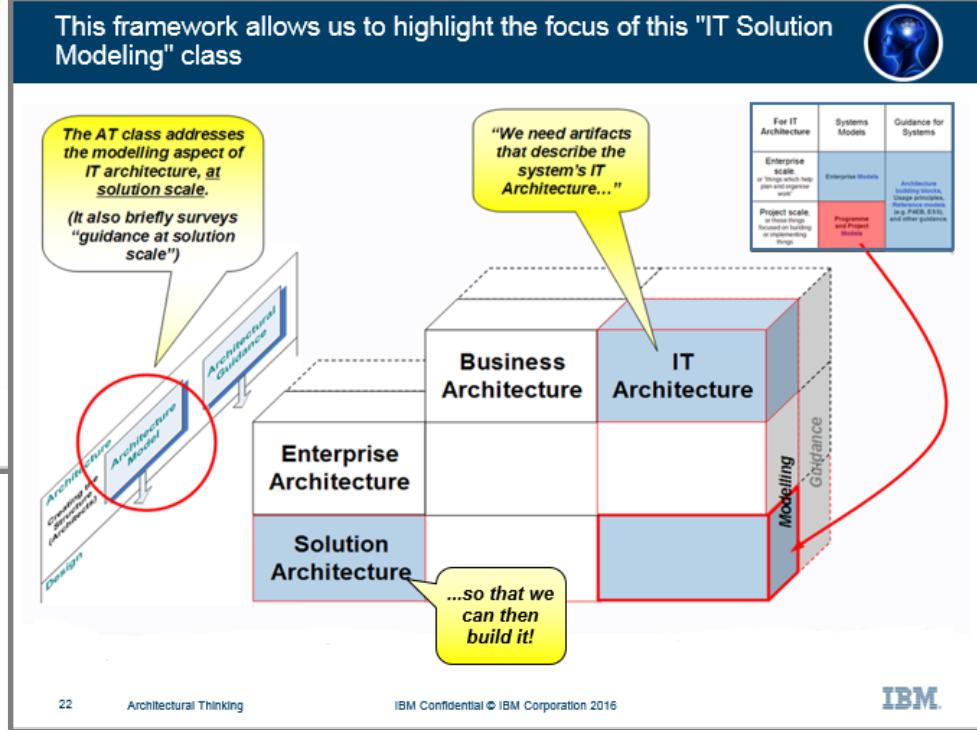
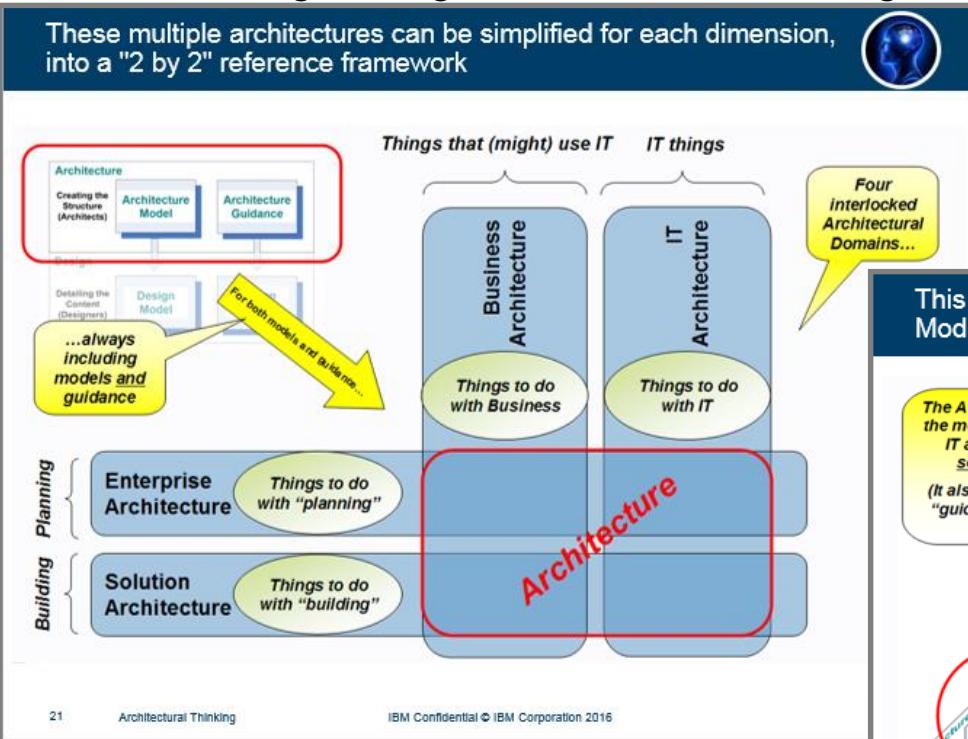
- A. To deliver the project on time and within budget
- B. To address a business problem with a technical solution involving technologies, people and processes
- C. To bring the vision of the most effective solution into reality



Architectural domains

IT architecture is just one of the architectural domains we need to consider if our IT system is to do the right things and do them in the right way.

These multiple architectures can be simplified for each dimension, into a "2 by 2" reference framework





Thus this class focuses on the models needed to describe the IT architecture of solution-level systems

The artifacts covered in this class present models of the target IT system.

They can be **driven by models of the broader business system**, of which this target IT system is a part.

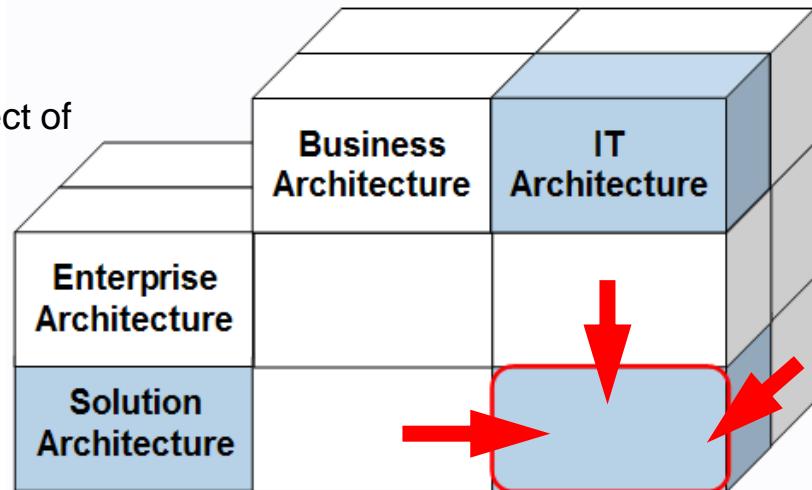
- The target IT system must meet the specific business requirements placed on it.
- Whether it meets those requirements or not is the subject of **Solution Assurance**.

They can be **guided by artifacts** documenting architectural principles, patterns, and building blocks.

- The target IT system must meet the wider architectural requirements placed on it.
- Whether it meets those requirements or not is the subject of **Architectural Conformance**.

The class focuses on the use of these IT system model artifacts **at the solution scale**, by IT Architects.

- They are also used by Enterprise Architects at the enterprise scale as they plan (in outline) transition initiatives, and so on, in which case they may be **elaborated** by the IT Architect.



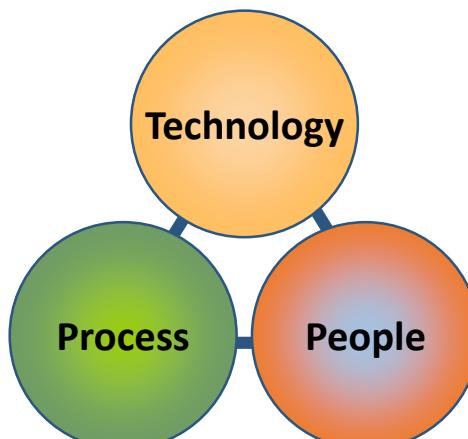
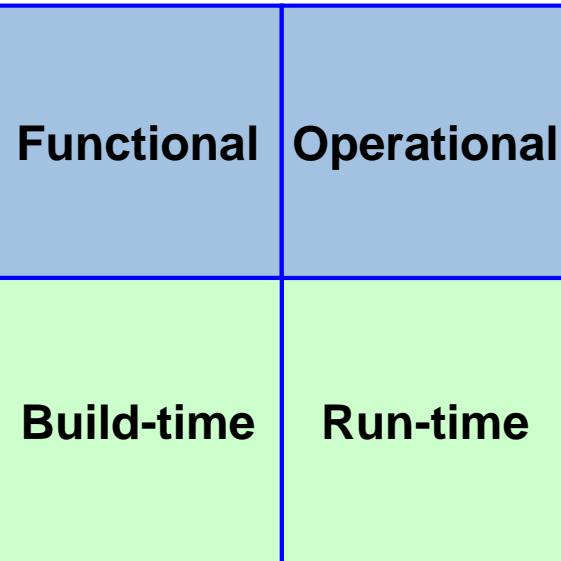


Aspects of IT Architecture (1 of 2)

An architect asks questions for the different aspects each with technology, process and people to deliver a complete architecture

**What is your system actually going to do?
How are its applications and software organised?**

How does your system and application get developed, integrated and tested?

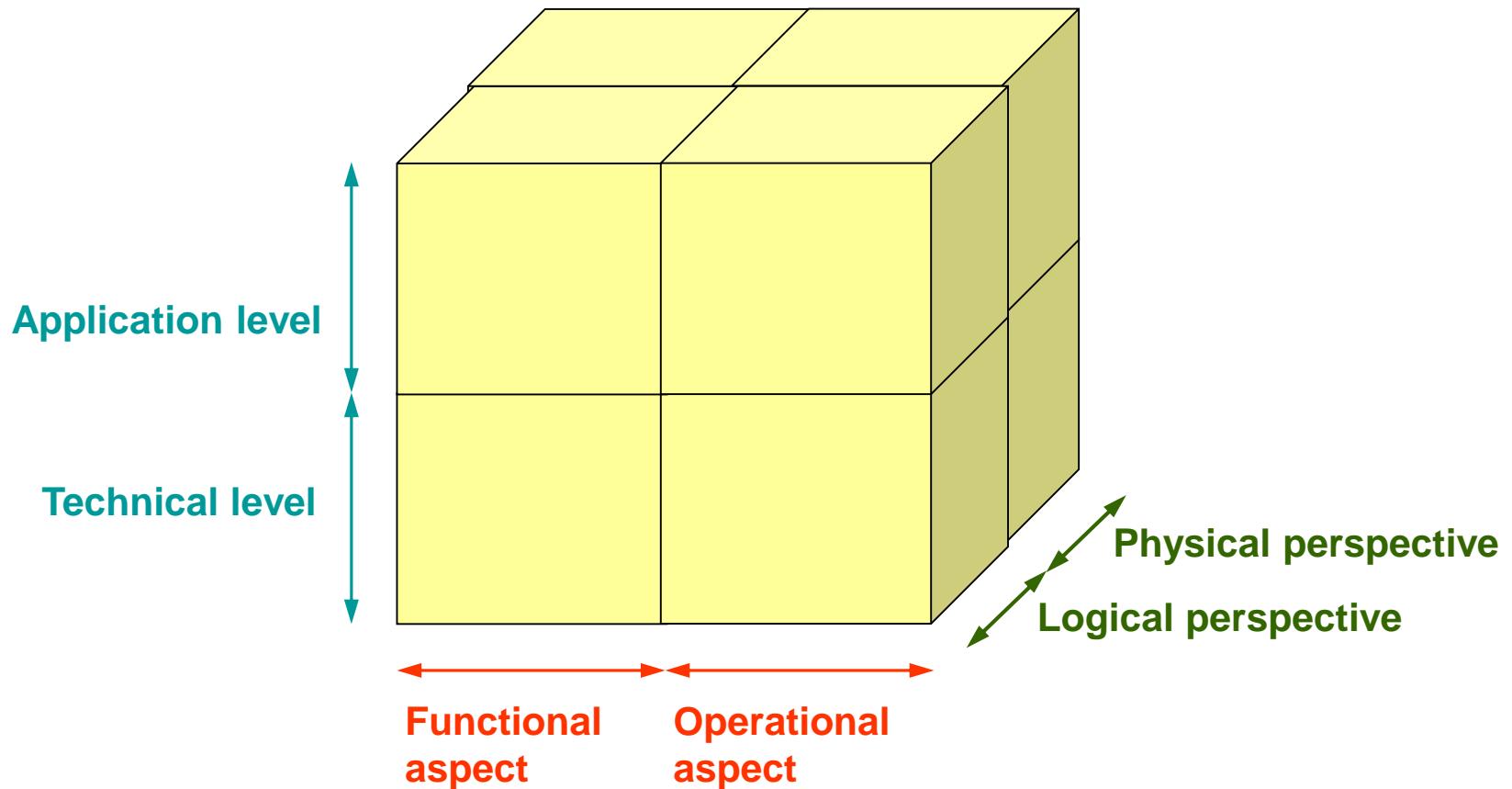


Where is your system going to operate? How are the computers inter-connected and how many will you need?

What happens to your system when it runs? How will it be managed over its lifetime?



Architects look at a problem in a number of dimensions to organise their thoughts





Module outline

Introduction and objectives

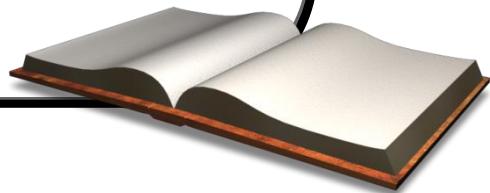
What is architecture?

► **IT Architects**

Summary and references



Architect: An Architect *defines the structures of solutions* and architectures to address client business problems. The Architect *understands client needs and business constraints*, works in levels of abstraction, applies industry knowledge, and *leverages appropriate business elements and information technology to address those needs*. The solutions are manifested as *business, enterprise, or IT architectures* and can include systems, applications, and process components. They may also involve the application and integration of a broad variety of products, technologies and services, and various architectural styles and domains.





What an Architect does

An Architect defines the structures of solutions... [based on] client needs and business constraints... [leveraging] appropriate business elements and information technology to address those needs. ...Solutions [can address] business, enterprise, or IT architecture... domains.

Architects work:

- At the front:
 - Listening to clients
 - Understanding business requirements
 - Negotiating feasible requirements and scope
 - Forming detailed definitions of solution structures
- At the back:
 - During construction
 - Serving as a customer advocate
 - Guiding the team



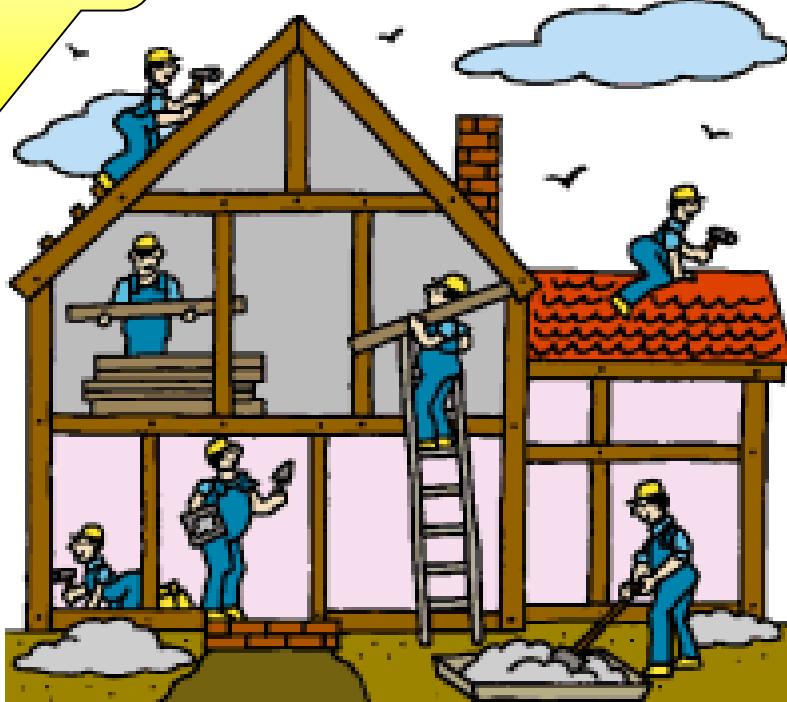
Who is needed to create a new house?



Architect

Many specialists are required to construct the house: Framers, Plumbers, Electricians, and Painters.

Builder, Subcontractors



The Architect draws up the plan to meet the occupants' needs and ensures that the builders meet the specifications, understands the influence of building codes, other regulations, legacy, power and gas services, and the neighborhood architecture review committee guidelines.



Occupants

Occupants will live in the house and have wants and needs.



Building Inspector

The Inspectors ensure that the house is built as per quality standards such as local building codes.



Project Manager

The Project Manager manages the construction of the house and coordinates subcontractors.

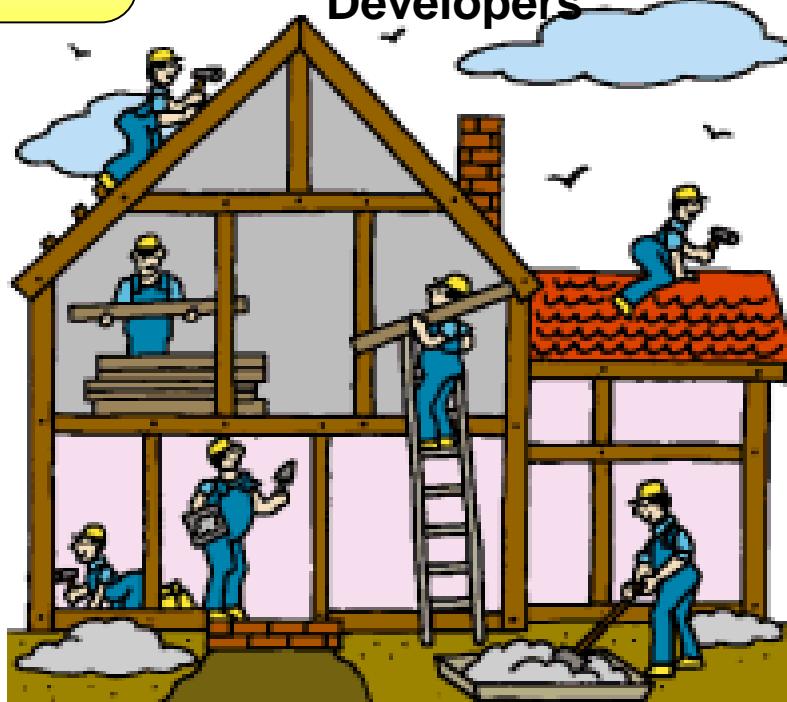


What's this got to do with architecture?



Solution Architect

Designers, Coders, Package Specialists, Testers, and others are needed to construct the solution.



Technical Specialists, Designers, and Developers



Business Sponsor, Users

Users and their delegates have their requirements.



Enterprise Architect

The Enterprise Architect ensures that the solution architect complies with enterprise standards, governance, and roadmaps.



Project Manager



Architect

Defines and owns the technical or business solution

Project Manager

Develops and owns the project plan

Designer/Developer

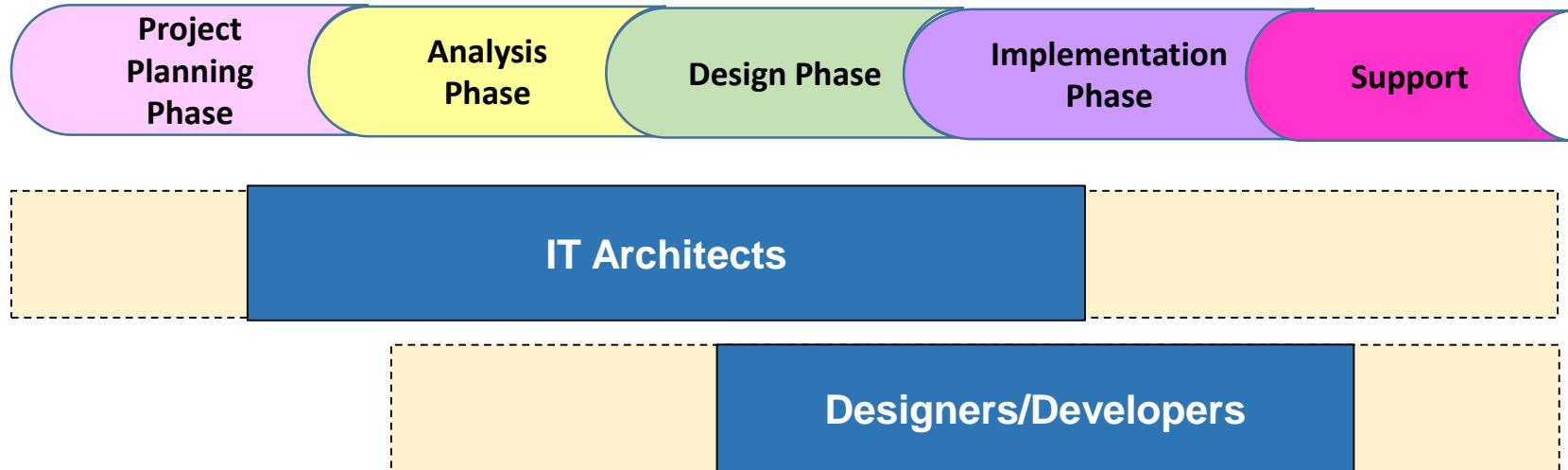
Develops and owns the delivered solution

Each team member contributes to the development of key artifacts for delivery excellence.

The transfer between team members is a critical component of success.

Everyone should have common goals and objectives.





IT Architects

- Define solutions to client business problems. Resultant architectures can include systems, applications, and process components.
- Focus on the front end of the solution life cycle. May be involved in the construction of the solution as a client advocate.

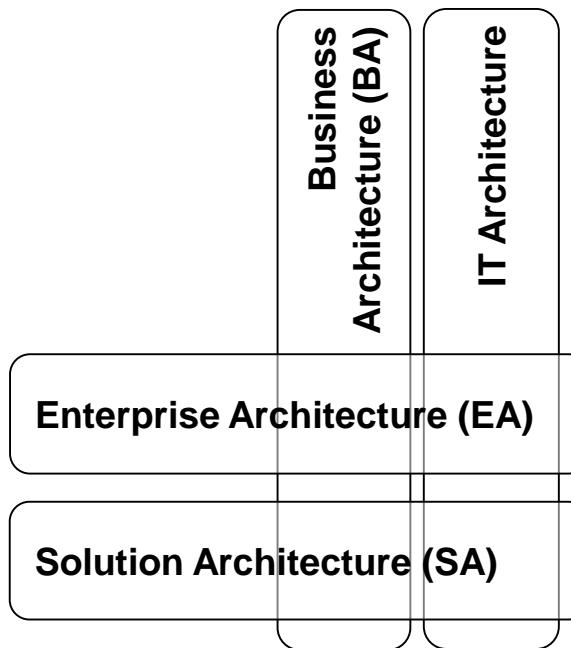
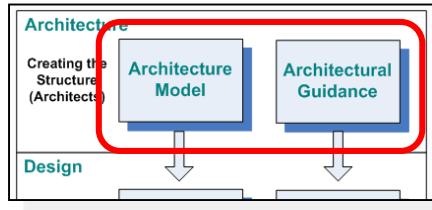
Designers/Developers

- Develop proof of concept, design, develop, build, test, and implement systems
- Are hands-on professionals with in-depth understanding of products, offerings, and services within their specialty



Architect supports two distinct dimensions (1 of 5)

Embracing both models and guidance:

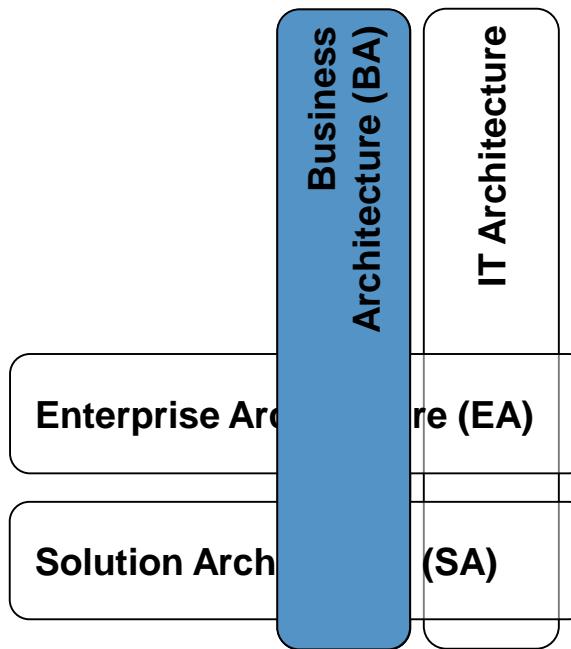
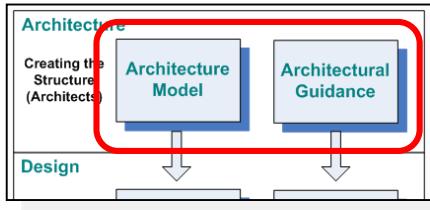




Architect supports two distinct dimensions (2 of 5)

Embracing both models and guidance:

- Business Architects “do” BA
 - *At both EA and SA levels.*

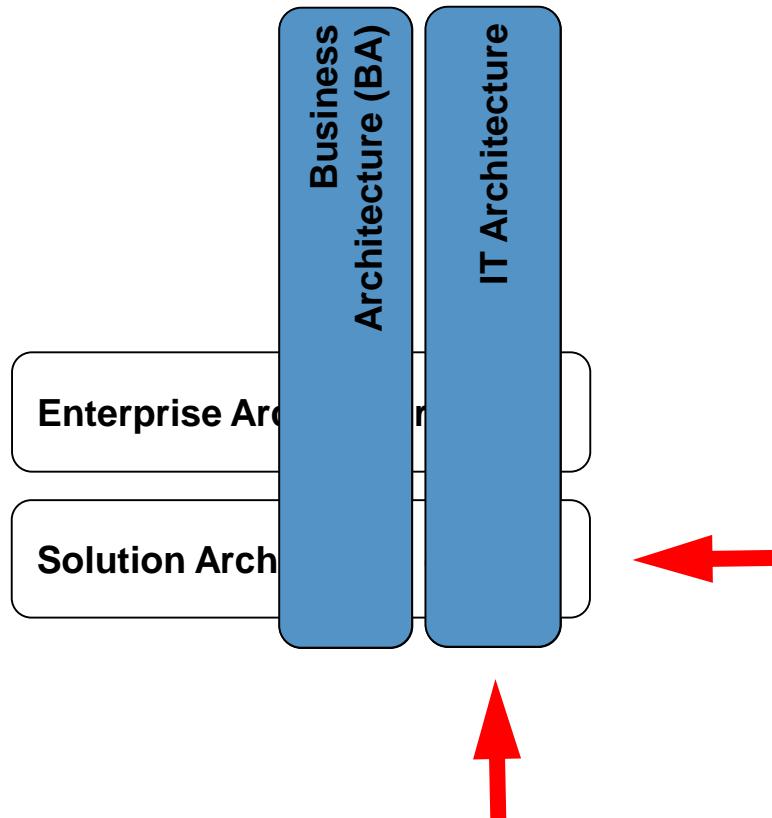
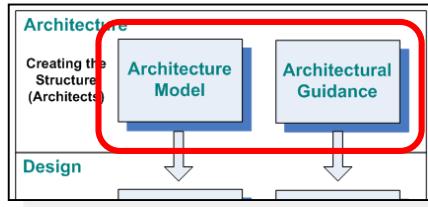




Architect supports two distinct dimensions (3 of 5)

Embracing both models and guidance:

- Business Architects “do” BA
 - *At both EA and SA levels.*
- IT Architects “do” ITA
 - *Mostly at the SA level.*

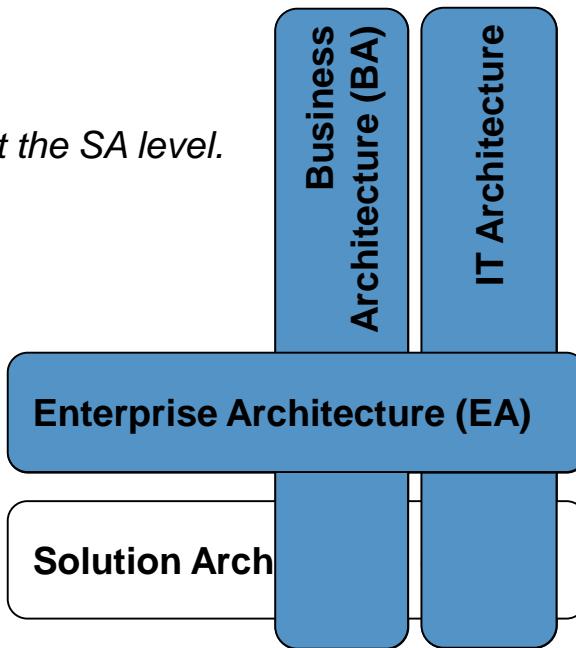
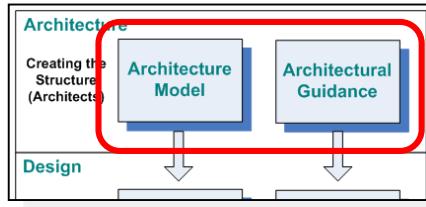




Architect supports two distinct dimensions (4 of 5)

Embracing both models and guidance:

- Business Architects “do” BA
 - *At both EA and SA levels.*
- IT Architects “do” ITA
 - *Mostly at the SA level.*
- Enterprise Architects “do” EA
 - *Across both BA and ITA.*
 - *They often own guidance at the SA level.*

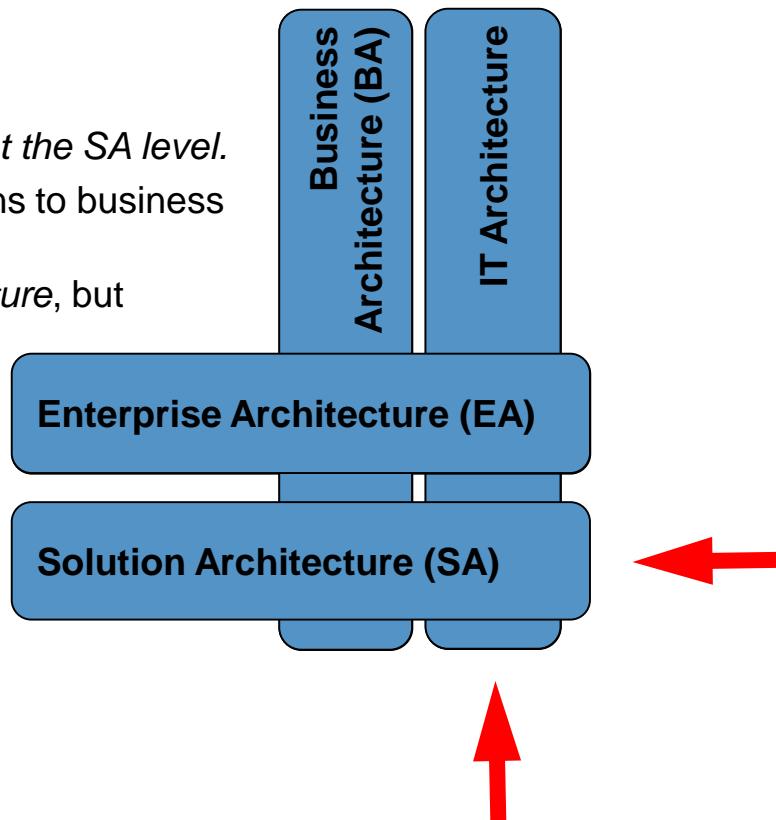
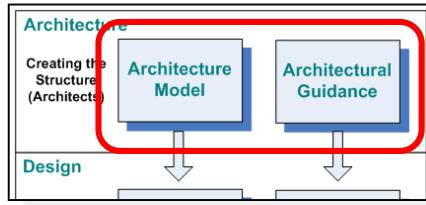




Architect supports two distinct dimensions (5 of 5)

Embracing both models and guidance:

- Business Architects “do” BA
 - *At both EA and SA levels.*
- IT Architects “do” ITA
 - *Mostly at the SA level.*
- Enterprise Architects “do” EA
 - *Across both BA and ITA.*
 - *They often own guidance at the SA level.*
- Solution Architect create solutions to business problems – SA
 - *Typically within IT Architecture, but*
 - *Can create BAs too*





Time for a question



Which of the following choices is the better description of an Architect?

- A. A practitioner, a results-oriented person, a good communicator, a leader
- B. A “top-level” software designer, a project manager, a technology expert, a product expert, a lone scientist



Module outline

Introduction and objectives

What is architecture?

IT Architects

- ▶ **Summary and references**



- The architecture of a system describes the structure and behavior of its parts.
- The parts of an IT system are its software and hardware elements, interacting with the IT system's human and IT system users.
- An IT Architect defines the models and guidance needed to model IT or business systems to meet the business intent.
- When working on an IT system solution architecture, the IT Architect designs IT solutions to client business problems.

Back Up Slides: architecture vs Design





It is also possible to conceive of architecture and design in a rather different, possibly confusing, way (1 of 2)

In this alternative framework:

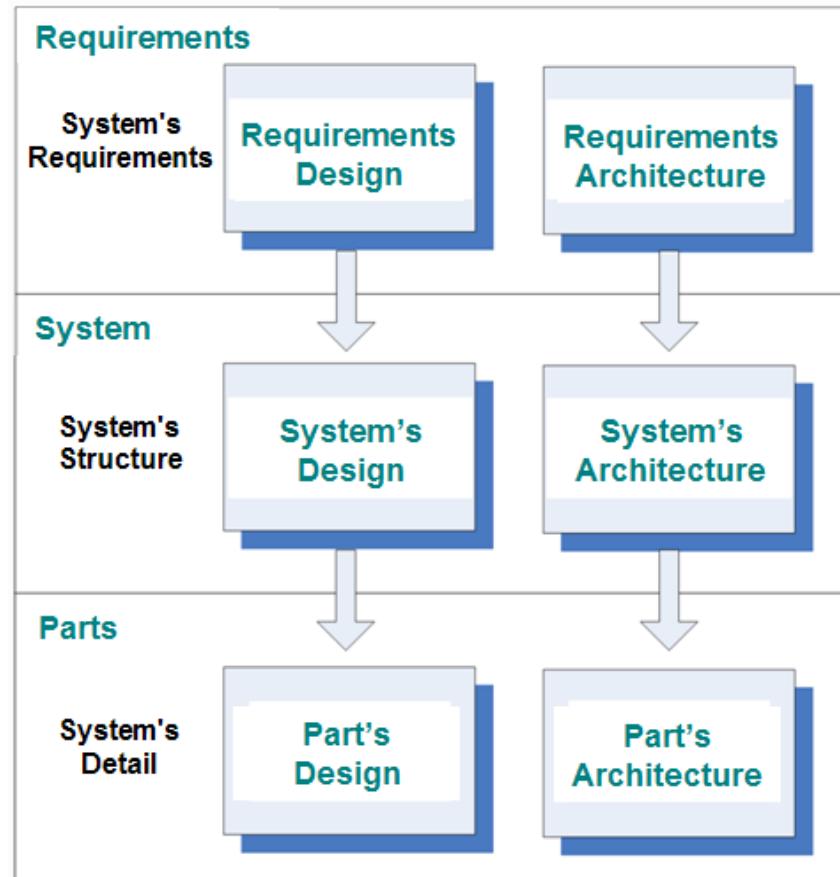
- Ensuring the system meets its specific requirements is called design.
- Ensuring it is designed in the right way is referred to as its architecture.

Ask yourself:

- What is the design of a bridge?
- What is the architecture of a bridge?

And:

- How many bridge architectures are there?
- How many bridges (that is, bridge designs) are there?





It is also possible to conceive of architecture and design in a rather different, possibly confusing, way (2 of 2)

In this alternative framework:

- Ensuring the system meets its specific requirements is called design.
- Ensuring it is designed in the right way is referred to as its architecture.

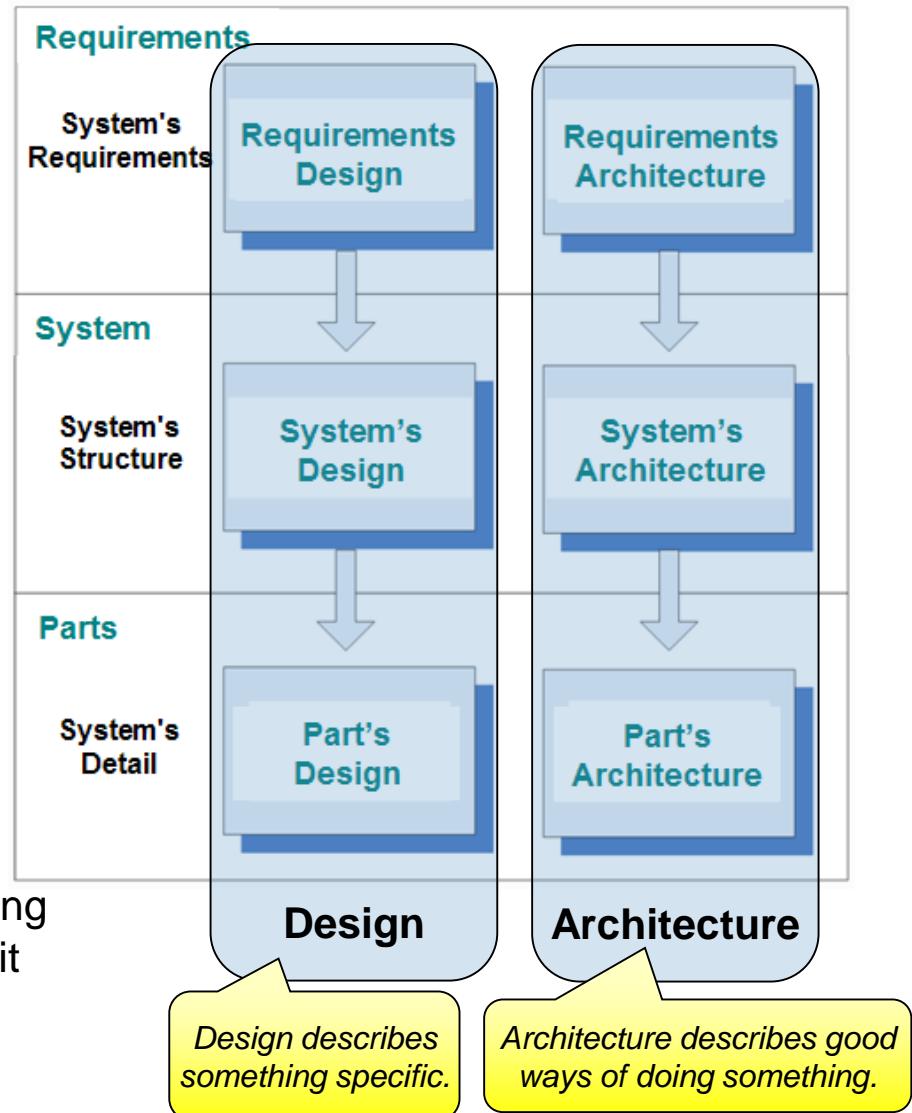
Ask yourself:

- What is the design of a bridge?
- What is the architecture of a bridge?

And:

- How many bridge architectures are there?
- How many bridges (that is, bridge designs) are there?

This terminology is common, particularly among our clients and in enterprise architecture, but it has not been adopted by IBM's Architect profession.





References

[COOK07] Cook, Denise, Cripps, Peter, Spaas, Philippe.

[*An Introduction to the IBM Views and Viewpoints Framework for IT Systems*](#), IBM,
December 2007

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