# Does My Picture Tell You the Story? Conventions for Effective IT Architecture Diagrams

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## **1** Introduction

Architecture is a discipline. It is also a device to help in thinking and communication. As the latter, Architecture deals with the static and dynamic views of a system by creating models of its components, their externally visible features and the relationships between them.

Drawings are one of the oldest and most straightforward ways we represent things, real or imaginary. Naturally, drawing is the heart of architectural thinking and modelling. It defines and communicates the model. So, diagramming well is a critical ability for an architect.

In this article, I will put down some conventions to produce clear, compelling and consistent architecture diagrams. There exist ISO, DIN, ANSI and other standards for process flow diagrams, IEEE for electrical diagrams, etc. The UML (Unified Modelling Language) standard is available for software application architecture modelling many architects use it, but in my view, it is non-intuitive, confusing, dry and limited.

Most architects prefer just to draw some closed shapes and connect them with arrows to express their model. While this is natural, the practice should not be different for each architect and left uncodified.

For the dynamic aspect of the architecture, I find Sequence Diagrams to be quite adequate, as long as they use the same objects that are in the static model.

In this article, I will deal with static diagrams as they are usually where an architect begins the modelling. Plus, static diagrams typically attempt to convey a lot more information than Sequence Diagrams and therefore need conventions more.

# 2 The Conventions

## 2.1 Information Conveyed

A picture can speak a thousand words. Or more. Some of the information that static diagrams try to convey are:

- Functional units
- Relationships
- Scope of functional responsibility
- Scope of work
- Completeness of work
- The extent of Impact on a functional unit or relationship due to an enhancement
- Technology of a functional unit
- Vendor of a functional unit

- Criticality, business or technical
- Layers of the static aspect
- Zones by user type
- Zones by security type
- Human users
- Things of the world other than computers and software

An architecture diagram can very quickly get very complicated. There are two aspects to static diagrams:

- 1. The combination of audience and detail
- 2. The artefacts used in them

We can call the former the level of the drawing and define conventions for using the latter.

#### Levels

## 2.2 Levels

We describe the following levels and diagram names:

• Level 0 – Business Capabilities Diagram

The key audience is business executives and non-technical stakeholders.

• Level 1 – Technology Capabilities Diagram

The key audience is CIOs, CTOs, CISOs and Strategy & Planning managers.

• Level 2 – Architecture Diagram

The key audience is Designers and Project Managers.

• Level 3 – Design Diagram

The key audience is coders, testers and architects.

Diagrams with more details than the above are left to the Application Designers. They can be reviewed by architects but are not core deliverables for them.

Level 1, 2 and 3 diagrams can be drawn either to show the functional or the operational (hardware, software) information.

This article will focus on the conventions for functional architecture diagrams.

## 2.3 Artefacts and their attributes

Now, this is where things get a bit involved. So, pay attention, please.

There are several artefacts that we can use in a diagram along with their attributes to represent the items of the real world. The most important artefacts, with their most important attributes, are:

- Closed shapes
  - $\circ \quad Type \ of \ shape-rectangular, \ circular, \ oval$
  - Outline type solid, dashed
  - o Fill colour
  - Position in the drawing
- Lines
  - $\circ$  Type of line solid, dashed
  - $\circ~$  Shape of the line straight (includes multi-section lines with 90° bends), curved
  - Colour of the line

- $\circ$  Direction of arrowhead
- Text
  - $\circ$  Type of text Uppercase, Lowercase
  - $\circ$  Weight and size of text
  - $\circ \quad Colour \ of \ the \ text$
- Special Shapes
  - Cylinder (used to represent a data store, as it is at the heart of Information Technology)
- Icons
  - Text caption of the icon (e.g. mobile user, automobile, satellite, etc.)

## 2.4 Mapping information to artefacts

Information	Artefacts Used	Artefact Guidance	Attribute Guidance
Туре			
Functional	Closed Shapes	•Use rectangles for domains, sub-	•Use solid outlines
units		domains, systems, components and	•Use rounded corners for domains, systems
		sub-components	and scope.
		•Use ovals to represent an entire	•Use sharp corners for components and
		solution, e.g. in a context diagram	sub-components.
		•Use cylinders to represent data stores	
		• Overlap multiple instances to indicate	
		clusters if it is essential information	

Mapping information to artefacts 1				
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Relationship	Lines	• Connect with a separate line for each	•Use arrowheads to show the direction of	]
s		relationship from end to end. Use	the action (indicating the direction of data	
		centres of functional units as far as	flow is deprecated as often it flows in both	
		possible as the endpoints. Align and	directions on the same interface)	
		overlap the lines for neatness.	•Use straight lines for hardwired	
			integrations	
			•Use curved lines to show possible	
			interactions	
			•Use text in the line to indicate the essential	
			data that flows between the functional	
			units. It can be in the same or a different	
			direction to the direction of the arrow that	
			points out the action flow, so use the word	
			"Get" or "Put" before the data name.	

Mapping information to artefacts 12				
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Domain of	Closed Shapes	•1 Use closed shapes if it does not add	•1 Use text captions to name each domain	
business or	or	confusion. Otherwise,	of responsibility	
operational	• Lines	•2 Use straight lines to demarcate areas	•2 Use text captions to name each domain	
responsibilit		of responsibility (e.g. Sales vs Finance	of responsibility	
у		in business; reporting vs security in		
		operations)		
Scope of	• Colour of	•1 Use different fill colours for the	•1 Avoid the use of Red and Green as fill	
work	Closed Shapes	closed shapes to indicate the scope of	colours for this as we usually use them to	
	or	work for each party involved in the	show criticality, completeness, etc. and can	
	• Lines	solution unless fill colour is in use for	give the wrong impression. A legend is a	
		something more significant.	must if you use this option.	
		Otherwise,	•2 Use text captions to indicate the party	
		•2 Use lines to demarcate the scope of	for each scope area demarcated.	
		work for each party involved in the		
		solution		

		Mapping information to artefacts		_13
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Completene	• Colour of	•1 Use different fill colours for closed	•1 and 2 Use only a few completeness levels	
ss of work	Closed Shape	shapes to indicate the extent of work	and colours as too many will not be useful	
	or	completed for its build or changes if	for decision making. Typically, use Red,	
	• Colour of	you are not using fill colour for	Amber, Yellow, Blue and Green for Not	
	Closed Shape	something more significant.	Started, 25% done, 50% done, 75% done	
	outlines	Otherwise,	and Completed.	
		•2 Use different colour outlines for the		
		closed shapes to indicate the extent of		
		work completed for its build or changes		

Mapping information to artefacts 14				_14
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Extent of	• Colour of	•1 Use different fill colours for the	•1 and 2 Use only a few impact levels and	
Impact on a	Closed Shape	closed shapes to indicate the level of	colours as too many will not be useful for	
unit or	and	impact on a functional unit due to a	decision making. Typically, use Red,	
relationship	• Colour of	requested change or transformation	Amber, Yellow and Green for High,	
for an	Line	•2 Use different colours for relationship	Medium, Low and No impact.	
enhancemen		lines to indicate the level of impact on		
t		it due to a requested change or		
		transformation		
Technology	• Text or	•1 Put the name of the technology in	•1 Make the font two points smaller than of	
of a	• Colour of	parentheses under the name of the	the functional unit name	
functional	Closed Shape	functional unit. Otherwise,	•2 Ensure the colours are sufficiently	
unit		• 2 Use a different colour to fill the	different if there are more than a handful	
		closed shape for each technology	of technologies. A legend is a must if you	
			use this option.	

		Mapping information to artefacts		15
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Vendor of a	•1 Text or	•1 Put the name of the vendor in	•1 Make the font two points smaller than of	
unit	• 2 Colour of	parentheses under the functional unit	the functional unit name, or two points	
	Closed Shape	name or below the technology name, if	smaller than of the technology name, if	
		present. Otherwise,	present.	
		•2 Use a different colour to fill the	•2 Ensure the colours are sufficiently	
		closed shape for each vendor.	different if there are more than a handful	
			of vendors. A legend is a must if you use	
			this option.	

Mapping information to artefacts 16				
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Criticality,	• Colour of	•1 Use the colour of the closed shape	•1 Select the colours (e.g. red, amber,	
business or	Closed Shape	unless it is in use for something more	green) and shades of the colours to	
technical	or	significant. Otherwise,	indicate the level of criticality. A legend is	
	• Closed Shape	•2 Use closed shapes to indicate the	a must if you use this option.	
		criticality of sets of functional units	•2 Use the colour of the outline of the	
			closed shape to indicate criticality (e.g. red,	
			amber, green). Use the maximum strength	
			shade of the colour as outlines do not	
			stand out enough for us to notice their	
			shades. A legend is a must if you use this	
			option.	
Layers of the	• Position of	• Locate the shapes as they would be in	•Locate the shapes as they would be in the	1
static aspect	Closed Shapes	the real thing, either top to bottom or	real thing, either top to bottom or left to	
		left to right	right	

Mapping information to artefacts17				
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Zones by	Closed Shapes	•1 Use closed shapes if the diagram	•1-1 Use dashed outlines if the diagram	
user type	or	includes functional units within any	includes functional units within any zone.	
	• Lines	zone. Otherwise,	•1-2 Otherwise use a solid outline for each	
		•2 Use lines to demarcate the zones	zone's artefact.	
		• Common - Use text captions to name	•2-1 Use straight dashed lines to separate	
		the zones	the different zones	
Zones by	• Closed Shapes	•1 Use closed shapes if the diagram	•1-1 Use dashed outlines if the diagram	
security type	or	includes functional units within any	includes functional units within any zone.	
	• Lines or	zone. Otherwise,	•1-2 Otherwise use a solid outline for each	
	• Colour of	•2 Use lines to demarcate the zones	zone's artefact.	
	Closed Shapes	• Common - Use text captions to name	•2-1 Use straight dashed lines to separate	
		the zones	the different zones	
		•Use a different fill colour for the closed		
		shapes of each zone		

		Mapping information to artefacts		18
Information	Artefacts Used	Artefact Guidance	Attribute Guidance	
Туре				
Things	ISO or IEEE	•Use standard icons or symbols	•Use text captions to indicate type and	
other than	icon		quantity.	
computers	<u>https://www.iso.</u>			
and software	<u>org/obp/ui</u>			

### 2.5 Legends

Unless a drawing is using only one type of closed shape and line, and they all have the same attributes (type, colour, weight, etc.), you must have a legend for the diagram.

- 1. Legends should be in the corner of the layout, ideally at the bottom right
- 2. They should be enclosed in a box and titled 'Legend'
- 3. They should put an example of each artefact they are differentiating by attribute and put the text description next to it
- 4. The legend should not miss anything that needs to be differentiated
- 5. The legend should be easily visible and readable but not distract from the diagram

## 2.6 Getting maximum impact

We read drawings through the eye-brain combination. Human eyes and the parts of our brains that process the visual data have evolved to convert the data into information that maximises safety and the ability to use the objects in the world. There are two categories of capabilities – natural and nurtured. The former is genetic and innate, the latter learned in life. Understanding this makes it easier for us to create impactful drawings. Here is how the eye-brain combination probably processes information, in order of informational utility and ease.

- 1. Motion is acutely detected as it can indicate a dangerous animal or water
- 2. Size is absorbed rapidly as a larger animal or object can be more dangerous or useful
- 3. Location is mapped quickly as something near or directly in front can be more hazardous or easy to grasp
- 4. Colours are noticed after size as it can help to identify foe or food by standing out from the background

- 5. Contrast is detected for differentiation after colours
- 6. Shapes are recognised as familiar or new to classify or look closer
- 7. Details within the mass of the animal or object are observed last

Here are some skills that we likely learn with experience:

- 1. Gravity causes things to fall downwards
- 2. Vertical stacks make structures
- 3. Most things move horizontally
- 4. Most languages and written left to right and we begin seeing any picture from the left side
- 5. We focus on the centre of images for the longest time before exiting them
- 6. Clusters indicate multiples instances of a single type

7. Things that rise or go upwards indicate life, energy and positivity

So, think of your drawing as the surroundings of a person walking in a forest or savanna. How will you catch her or his attention? As we are only using static 2-dimensional drawings, motion is not at our disposal. So, we can create a semblance of it with prominent lines and arrowheads. We need to use size, position, colour, contrast, shape and text for maximum impact.

Here are the resulting guidelines:

- 1. Make important things larger and centre them
- 2. Start the story from the left and let it lead to the focal point in the centre and leave from the right side
- 3. Create a strong mainstream of flow through the drawing by using positioning and arrows
- 4. Use colour well for impact

- 5. Put similar or related things together in loose clusters
- 6. Use simple shapes for ease of understanding
- 7. Verbalise the detail with text moderately for a richer and pleasant experience
- 8. Position the secondary and tertiary information in sidestreams through which the eye can detour and return to the mainstream

## 2.7 Guidelines by level

### 2.7.1 Level 0 – Business Capabilities Diagram

The Business Architect or Business Analyst typically draws this diagram. An Enterprise Architect can also draw it who has sufficient knowledge of the business domain. It shows all the essential capabilities required to carry out the business.

- It should not connect the business components with lines as they do not add any practical information.
- It should not have technology elements in it.
- There should ideally be one Business Architecture Diagram for the entire business landscape and separate architecture diagrams for each business domain if required.

### 2.7.2 Level 1 – Technology Capabilities Diagram

The Enterprise Architect typically draws this diagram. It shows all the essential technical capabilities required to deliver the business capabilities.

- It should show systems and sub-systems that map to the business capabilities.
- It can connect the systems or sub-systems to indicate critical relationships, although it is not a must.
- It should not show the individual applications and interfaces of the technology systems.
- The systems and sub-systems of a Level 0 diagram can be referenced in a Level 1 diagram if it is covering the same or a large enough scope.

There should ideally be one Enterprise Architecture Diagram for the entire solution landscape and separate architecture diagrams for each technology domain if required.

#### 2.7.3 Level 2 – Architecture Diagram

The Level 2 diagram is usually the most essential and standard architecture diagram. The conventions of this article are most applicable to it.

- Depending on the scope of the drawing, it can be drawn by different types of architects as below:
  - o Overall enterprise landscape Enterprise Architect or Integration Architect
  - Integration Architecture Integration Architect
  - o Information Architecture Information Architect
  - Application Architecture Application Architect
  - Infrastructure (aka hardware) Architecture Infrastructure Architect
- It should show all the components and integrations that are in the scope of the drawing.

- A component is a precisely defined term in IT architecture and represents a cohesive set of technical functions. Components are loosely coupled to other components. Defining proper components is a necessary precursor to the drawing of a Level 2 diagram.
- The systems and sub-systems of a Level 1 diagram can be referenced in a Level 2 diagram if it is covering the same or a large enough scope.
- Don't mix up functional and infrastructure Level 2 drawings. Make one for each. There should ideally be one Enterprise or Integration Architecture Diagram for the entire solution landscape and separate architecture diagrams for each technology domain if required.

### 2.7.4 Level 3 – Design Diagram

A Level 3 diagram falls into the domain of detailed design rather than architecture. It is defined here for the sake of completeness. An application designer draws it.

- It should show the sub-components, objects or classes that comprise a Level 2 architectural component, and their relationships or interfaces.
- UML notation can be used for Level 3 diagrams effectively.
- Each diagram should represent a module or sub-module of software.

## 2.8 General do's

- 1. Do name your functional units with nouns that indicate their action (e.g. Data Analyser, Report Generator), ideally. Alternatively, use nouns that indicate their function & form (e.g. Data Analysis Engine, Reporting Module).
- 2. Do spread out the closed shapes evenly across the drawing, unless there is a reason to create clusters
- 3. Do use colours for impact. And make sure you put a legend.
- 4. Do be consistent in the attributes of all artefacts of the same level or type (e.g. shape outline thickness and colour; line thickness, colour, arrowheads; text size, font and colour, etc.)
- 5. Do ensure all lines begin and end at an artefact or an external link icon
- 6. Do ensure all lines end at the boundary of artefacts and do not stop short or overshoot it
- 7. Do spell-check your drawing

- 8. Do expand any acronyms or mnemonics in a footnote or the legend
- 9. Do make sure the drawing looks nice
- 10. Do put yourself in the shoes of the reader and check if everything is self-explanatory and your drawing is telling the story you want it to tell

## 2.9 General don'ts

- 1. Don't mix up the levels of your drawing. Create multiple drawings if required.
- 2. Don't clutter up your drawing with information overload. Create multiple drawings if needed.
- 3. Don't use flashy colours for any artefacts. Pastels and standard colours such as Red, Amber and Green are best. Use grey shades for less critical objects.
- 4. Don't forget the legend! It is the most common omission. Colours are used abundantly and wildly, and the viewer is left wondering if it means anything.
- 5. Don't make the viewer wonder what anything is on the diagram

### 2.10 Examples of architecture diagrams

The following four pages have examples of each level of architectural drawing. Please note they do not follow all the conventions laid down here. The reader can take it as an exercise to see where they observe and deviate from it.

The PowerPoint document accompanying this article has an example or template for a Level 2 Diagram as it is drawn most often and serves the widest purpose.

#### 2.10.1 Example Level 0 Drawing



#### 2.10.2 Example Level 1 Drawing



#### 2.10.3 Example Level 2 Drawing

#### Application Architecture Diagram example.



#### 2.10.4 Example Level 3 Drawing



## 3 EndNote

The conventions laid down are not exhaustive. But, once you start thinking in this way, about how to communicate clearly and consistently through drawings, you will naturally fill in the gaps and extend the system yourself.

It is the system I use and have propagated in my circle of architects, but you may follow something somewhat different. That is okay, as long as you disseminate it through your area of influence and use it consistently. If I have forgotten something significant and routine, please send in your comments, and I will update this article to make it more complete and useful.

Also, there are dimensions I have not used, such as 3D representations, hyperlinks, cardinality, etc. as they can overload an architecture diagram and slow down their creation. If a situation warrants their use, please feel free to apply them. But still, pause to think of a consistent convention for their use. Trust me that it will pay off for architectural quality and its communication to others.

Draw well, architect.

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