



Universidad de Oviedo



# Architecture techniques



SOFTWARE  
ARCHITECTURE

2023-24

# Software architect

Discipline evolves

Architect must be aware of

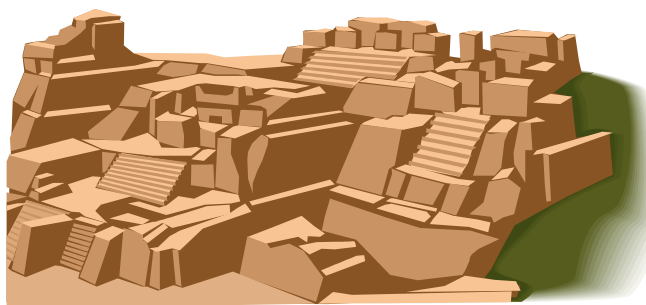
New development techniques

Styles and patterns

Best tool = experience (*no silver bullet*)

Self experience

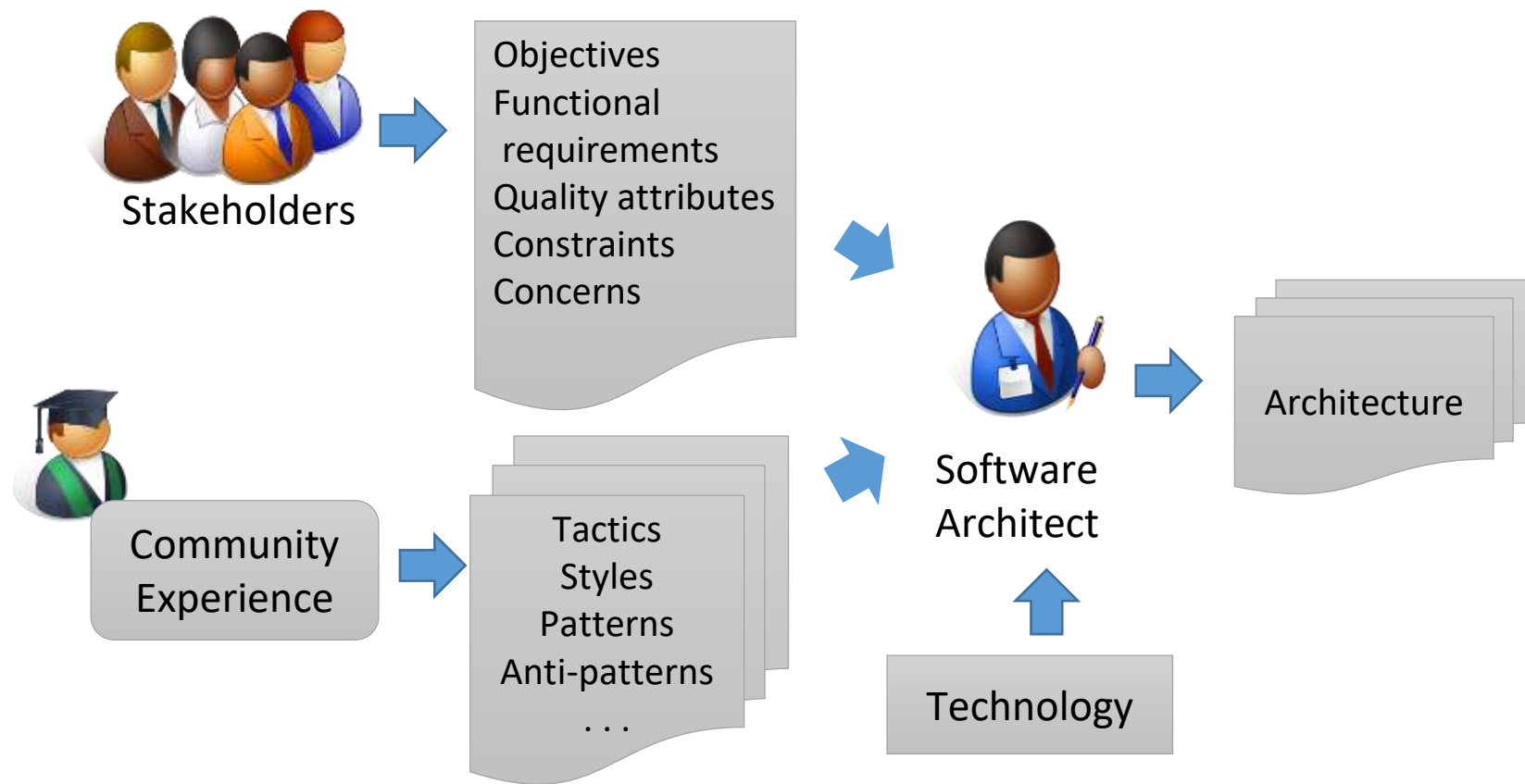
Experience from community



Architect



# Role of software architect



# Tactics

Design techniques to achieve a response to some quality attributes

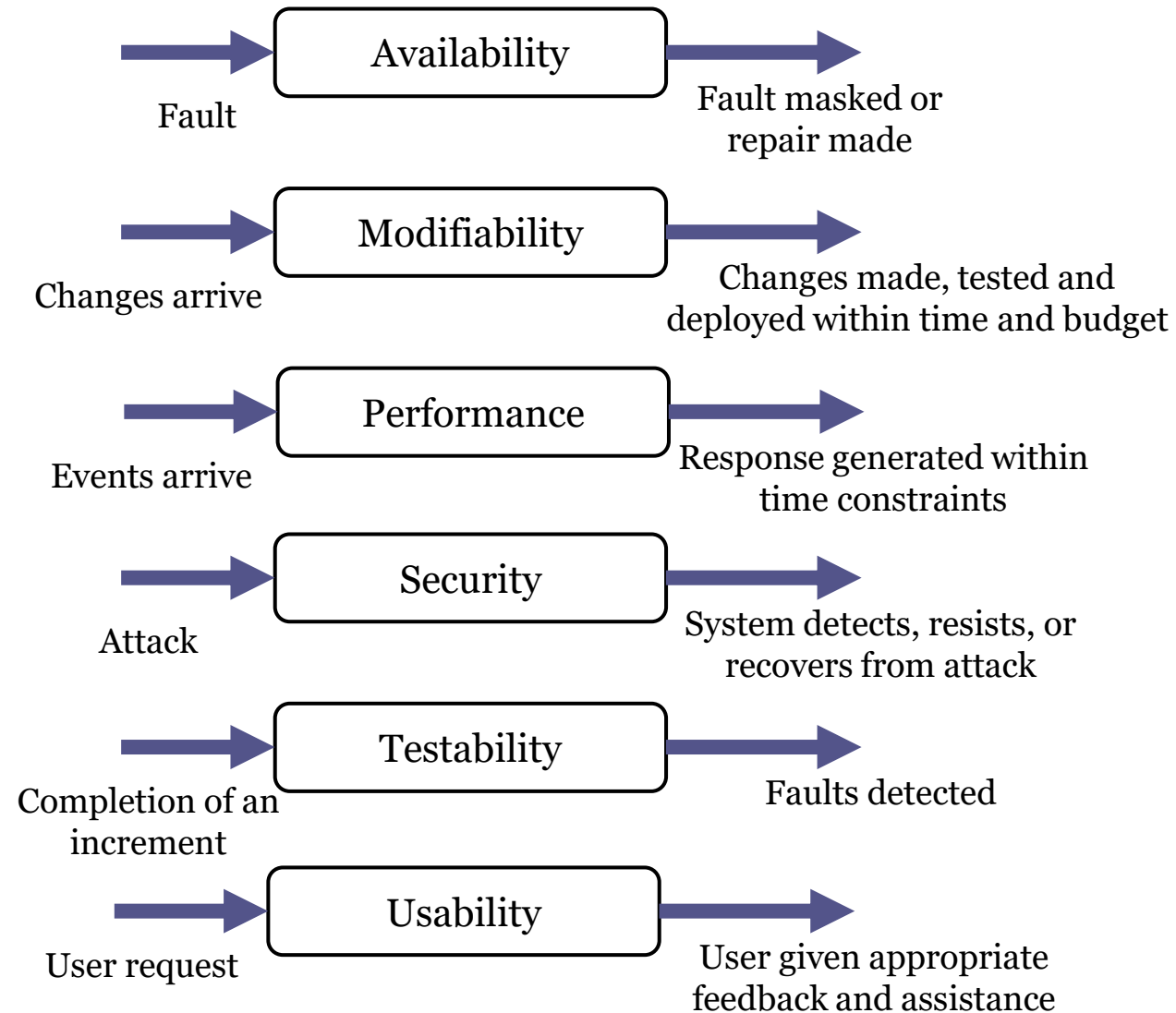
Tactics focus on a single quality attribute response

They may compromise other quality attributes

Tactics are intended to control responses to stimuli



# Tactics depend on QA



# Where can we find tactics?

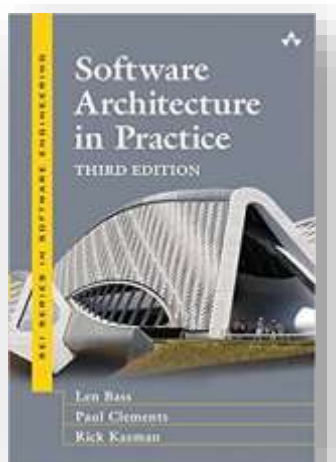
Architect's own experience

Documented experience from community

Books, conferences, blogs,...

Tactics evolve with time and trends

Book "Software architecture in practice" has a list of tactics for quality attributes



<http://www.ece.ubc.ca/~matei/EECE417/BASS/ch05lev1sec1.html>

<https://www.cs.unb.ca/~wdu/cs6075w10/sa2.htm>

# Architectural styles

Define the general shape of a system

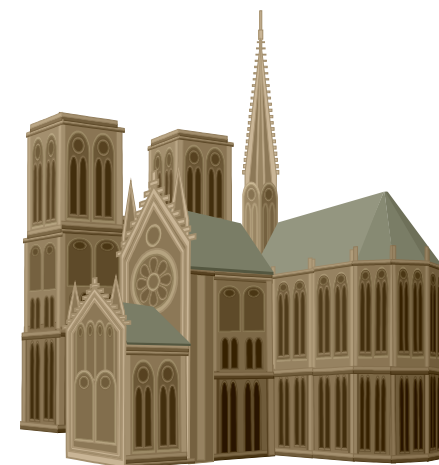
They contain:

Elements: Components that carry out functionality

Constraints: define how to integrate elements

List of attributes:

Advantages/disadvantages of a style



# Are there pure styles?

Pure styles = idealization

In practice, pure styles rarely appear

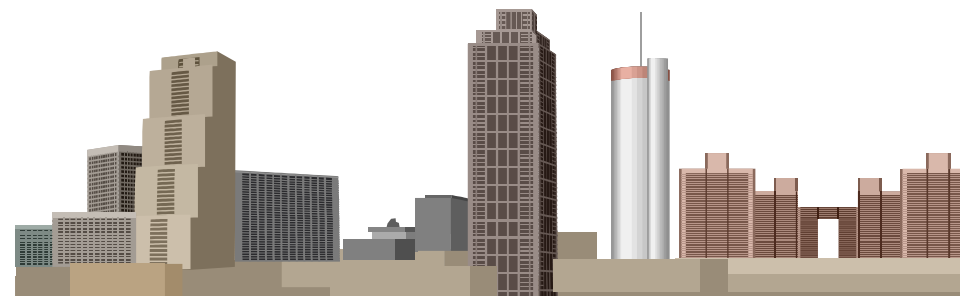
Usually, systems deviate from pure styles...

...or combine several architectural styles

It is important to understand pure styles in order to:

Understand pros and cons of a style

Assess the consequences of a deviation from the style





# Architectural pattern

Reusable and general solution to some recurring problem that appears in a given context

Important parameter: **problem**

3 types:

Structural: Build time

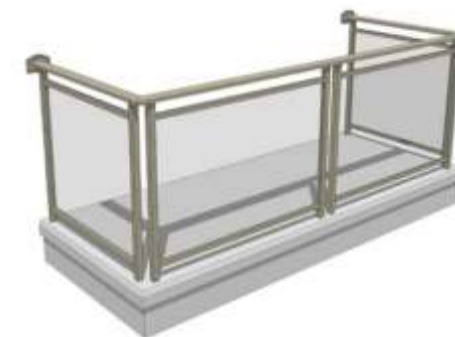
Example: Layers

Runtime (behaviour)

Example: Pipes & filters

Deployment

Example: Load-balanced cluster



# Pattern vs style

Pattern = solution to a problem

Style = generic

Does not have to be associated with a problem

Style defines general architecture of an application

Usually, an application has one style

...but it can have several patterns

Patterns can appear at different scales

High level (architectural patterns)

Design (design patterns)

Implementation (idioms)

...

# Pattern vs Style

Styles, in general, are independent of each other

A pattern can be related with other patterns

A pattern composed of several patterns

Interactions between patterns

# Pattern languages and catalogs

## Pattern catalog

A set of patterns about a subject

It does not have to be exhaustive

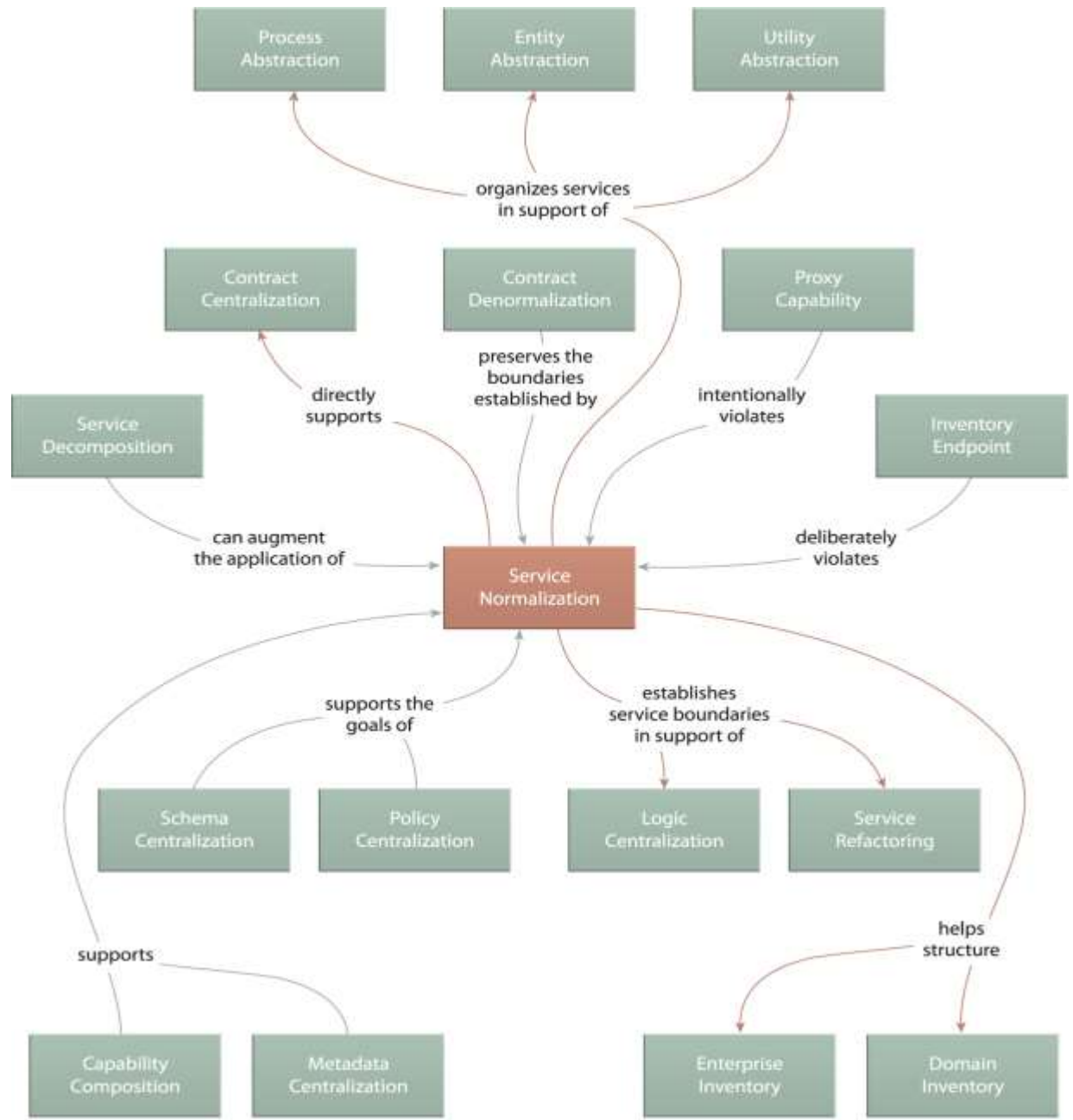
## Pattern language

A full pattern catalog about some subject

Goal: document all the possibilities

They usually include relationships between patterns

Graphical map



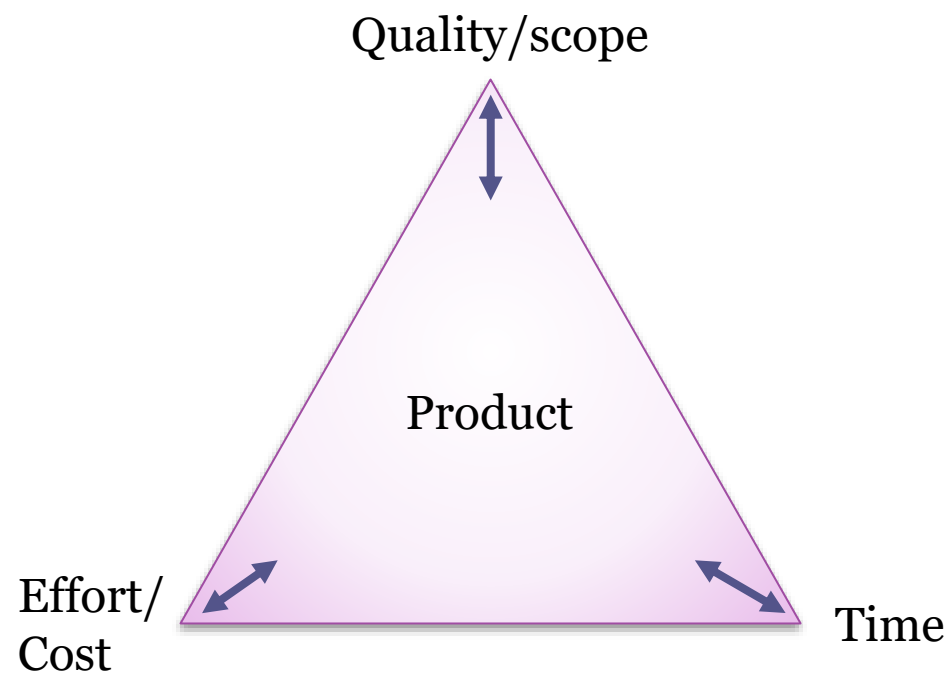
Example of pattern language  
Source: "SOA with REST" book

# Build vs reuse

In some domains, reusing existing architectures may be more efficient

Reference architectures

Externally developed components

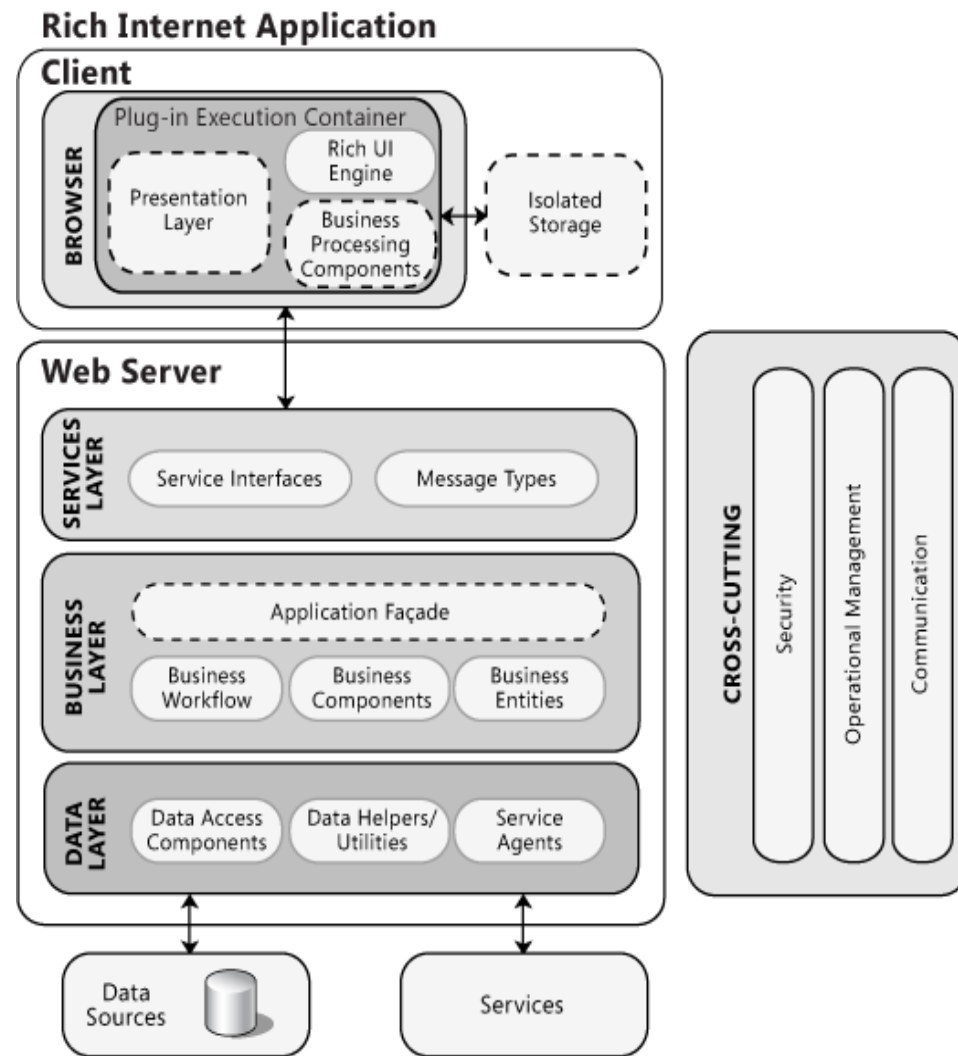


# Reference architectures

Blueprints that provide the overall structure for particular types of applications

They contain several patterns

Can be the de-facto standard in some domains



Source: [Microsoft Application Architecture Guide, 2<sup>nd</sup> Ed.](#)

# Domain Specific Software architecture

## Combination of:

- Reference architecture for an application domain
- A library of components for that architecture
- A method of choosing and configuring components to work within an instance of the reference architecture

Specialized for a specific domain

Examples:

ADAGE, MetaH





# Externally developed components

## Technology stacks or families

**MEAN** (Mongo, Express, Angular, Node), **LAMP** (Linux, Apache, MySQL, PHP), ...

## Products

**COTS**: Commercial Off The Shelf

**FOSS**: Free Open Source Software

Be careful with licenses

## Application frameworks

Partial implementation of a specific area of an application

Very popular for UIs

## Platforms

Complete infrastructure to build & run applications

Example: JEE, Google Cloud