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DesignNews

Real-Time System Software Architecture Design

DAY 1 : What is Software Architecture?

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THE SPEAKER

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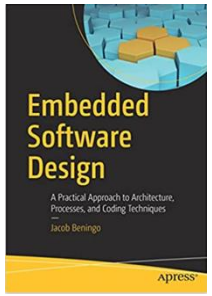
Beningo Embedded Group – CEO / Founder

Focus: Software Architecture, Processes, and Dev Skills

At Beningo Embedded Group, we believe everyone deserves the skills to confidently advance their careers, meet deadlines, and deliver quality embedded systems. We provide modern strategies, insights, and hands-on training to equip developers and teams with the tools they need to succeed.



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This week's topics:

- What is Software Architecture?
- Design Philosophies and Principles
- Modeling with UML and the 4C Model
- Data-Centric Architecture Design
- Beyond UML – Data, Isolation, Security

What is Software Architecture?

01

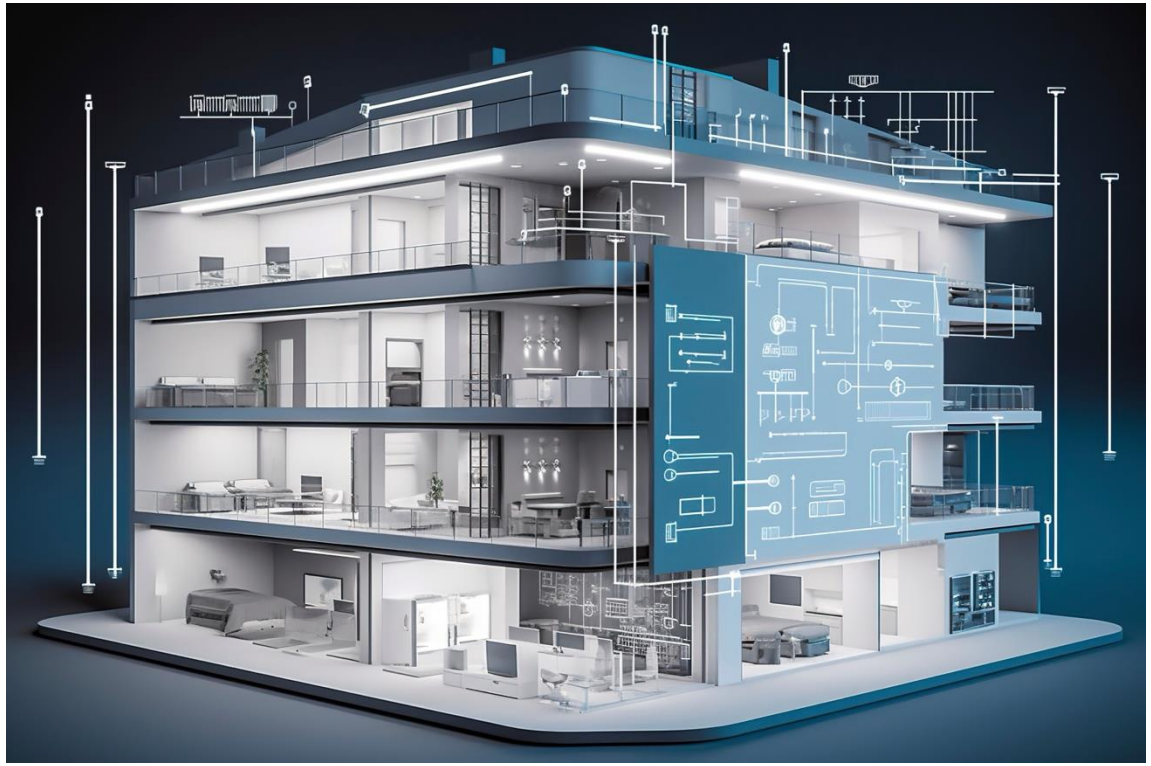
Definition

A software architecture is the fundamental organization of a system embodied in its components, their relationship to each other and the environment, and the principles guiding its design and evolution.

- IEEE 1471

The fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution.

- ISO/IEC/IEEE 42010:2011



Definitions Galore!

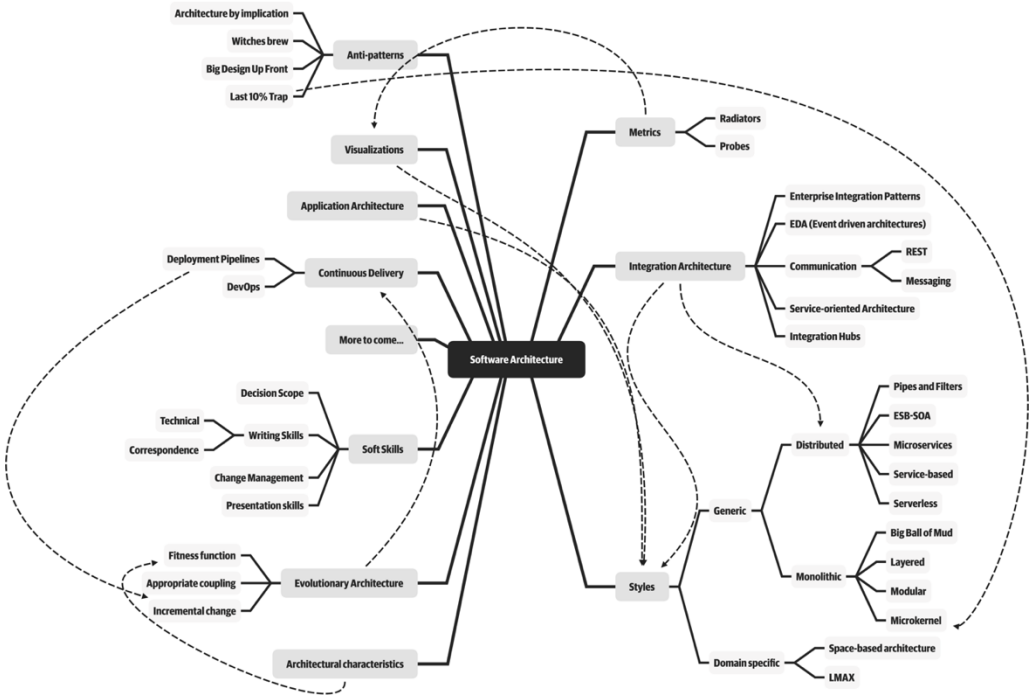
"Architecture is the decisions that you wish you could get right early in a project."

"Architecture is about the important stuff . . . whatever that is."

-Ralph Johnson

Architecture is the blueprint . . .

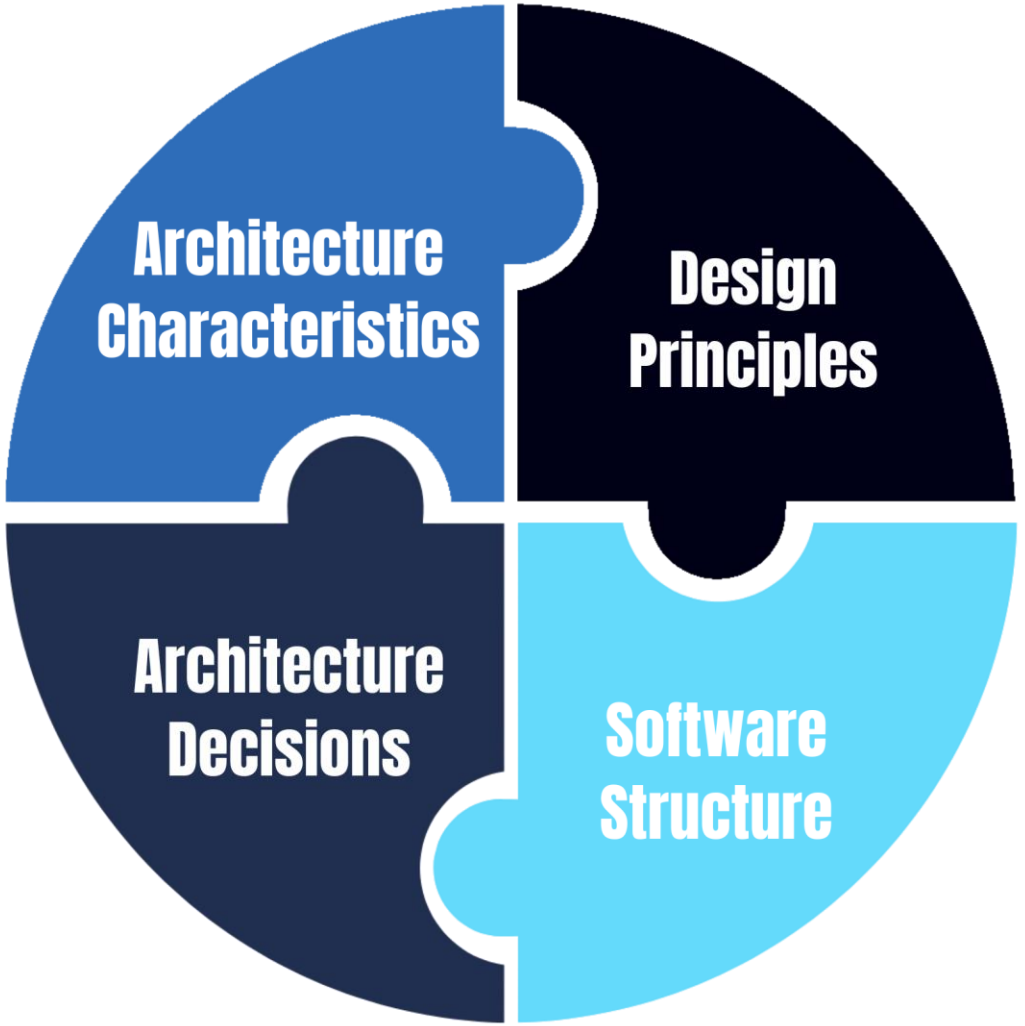
Architecture is the roadmap . . .



Source: Fundamentals of Software Architecture

The Pieces to the Puzzle

- Software architecture is . . .



Audience POLL Question

Do you start your development projects with a software architecture?

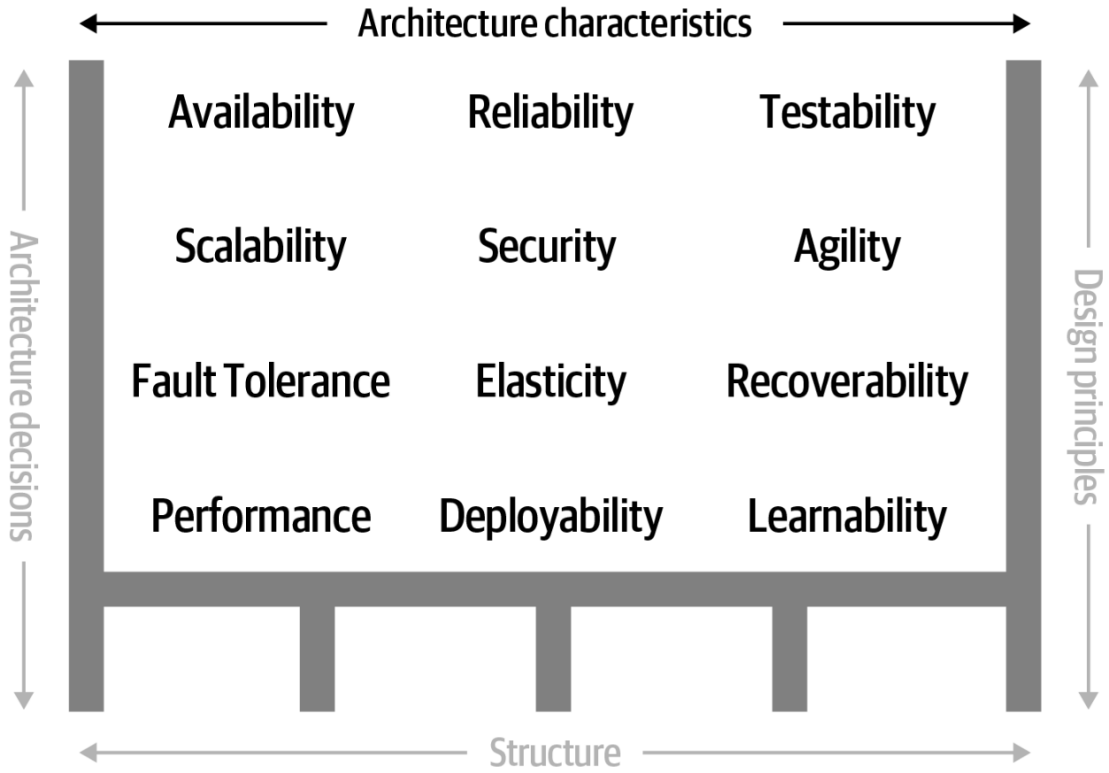
a) Yes
b) No
c) Other

The Missing Pieces

01

Architecture Characteristics

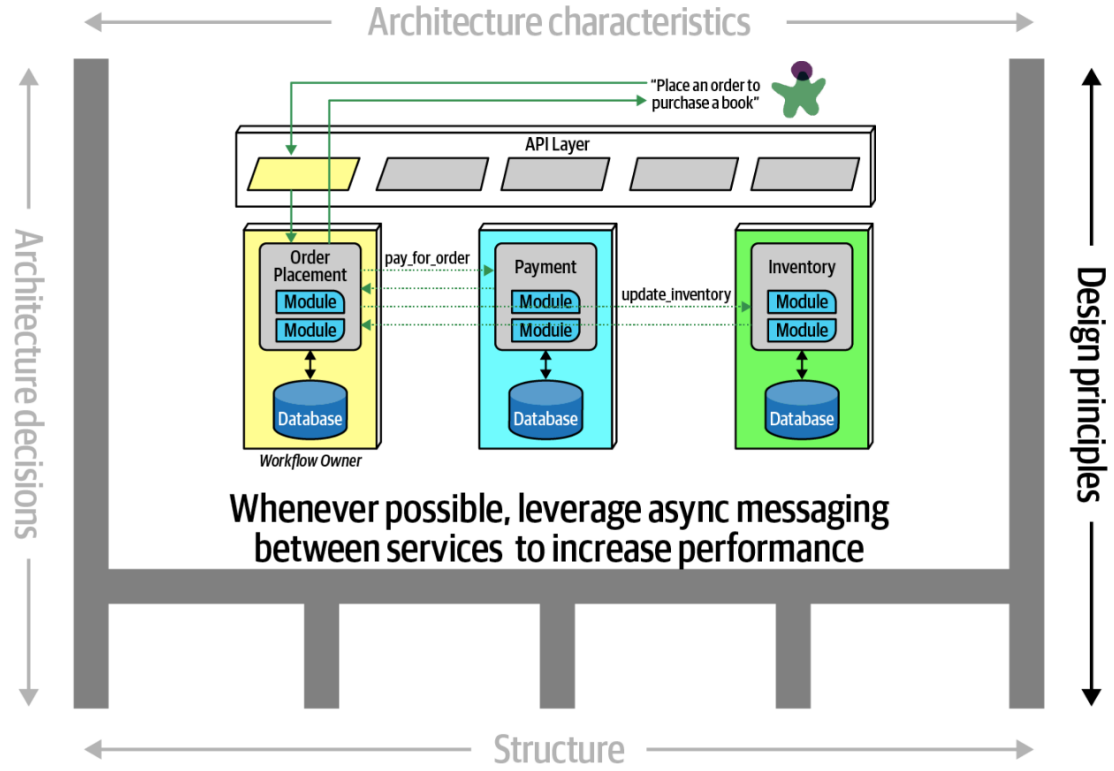
- Define the success criteria of the system
- Intrinsic qualities that define a system's behavior and performance.
- Drive trade-offs between flexibility, efficiency, and constraints.
- Ensure the system meets business and technical requirements.
- Shape long-term success by guiding architectural decisions.



Source: Fundamentals of Software Architecture

Design Principles

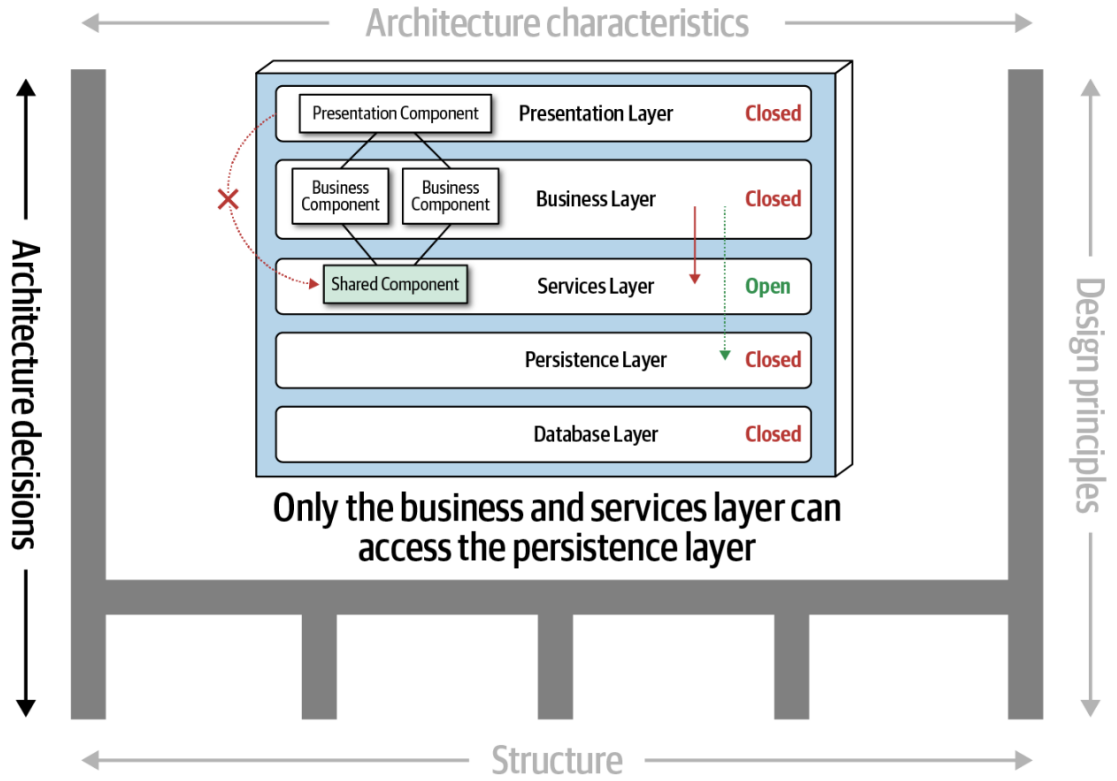
- Guiding rules that shape software architecture decisions.
- Ensure scalability, maintainability, and flexibility.
- Help manage complexity and improve system reliability.
- Balance performance, security, and adaptability.
- Provide a structured approach to building robust software.



Source: Fundamentals of Software Architecture

Architecture Decisions

- Define rules for system construction and evolution.
- Shape structure and behavior through key choices.
- Select technologies, patterns, and trade-offs for implementation.
- Balance defined architecture characteristics to meet system goals.
- Document decisions in Architecture Decision Records (ADRs) to ensure clarity and adaptability.



Source: Fundamentals of Software Architecture

Audience POLL Question

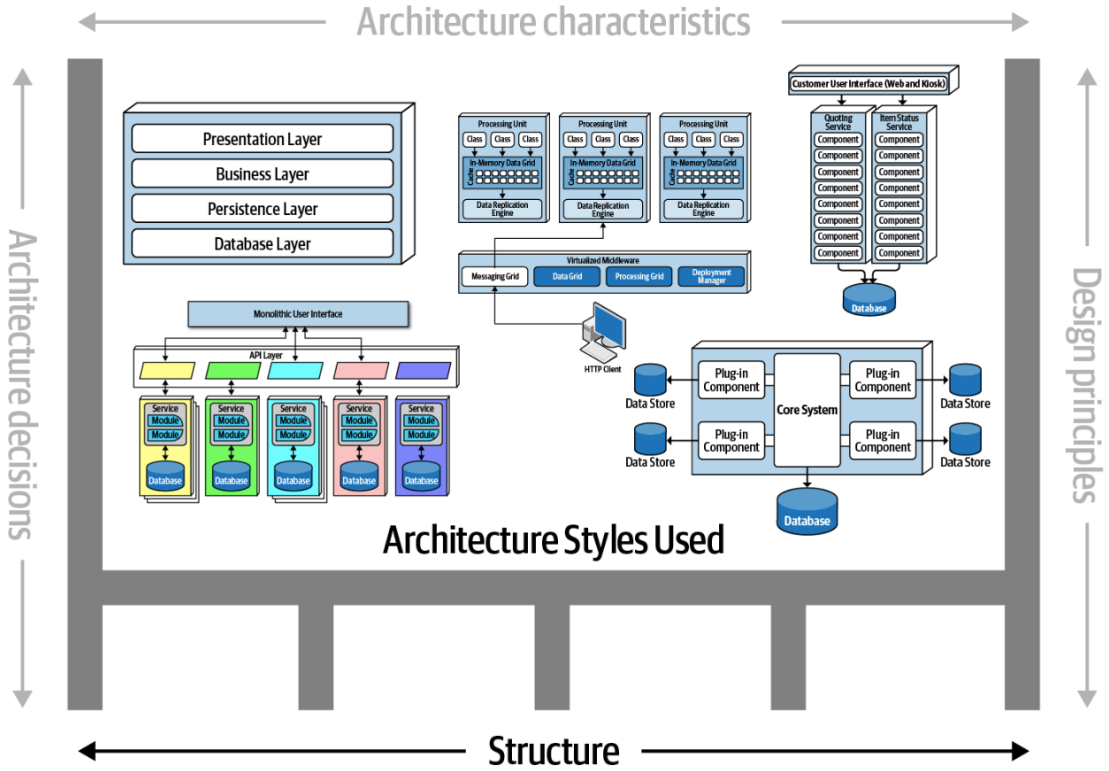
When you develop a software architecture, which of these 3 pieces do you include?

a) Software Characteristics
b) Principles and Philosophies
c) Architectural Decisions
d) All the above
e) None of the above

03 Software Architecture Goals

Define the Software Structure

- Determines the architecture style and patterns used in the design.
- Defines how system components are organized and interact.
- Establishes boundaries, dependencies, and modularity for clarity.
- Shapes system behavior and evolution based on design choices.
- Provides a foundation for implementation and maintainability.



Source: Fundamentals of Software Architecture

The Goal

Software architecture aims to minimize the human resources required to build and maintain the system:

- Number of developers
- Time to market
- Cost to market
- Maintenance costs
- Technical debt

A good architecture will also be scalable, maintainable, and flexible to change.

The Benefits of a Well-Defined Software Architecture

- Provides a clear roadmap for system development and evolution.
- Acts as a communication tool for engineers, management, and stakeholders.
- Reduces rework by enabling structured and maintainable designs.
- Optimizes development costs by improving efficiency and minimizing waste.
- Ensures long-term adaptability to meet future requirements and product lifecycles.

Warning:

Just because you “do Agile”,

doesn’t mean you don’t design your

architecture up front!

Audience POLL Question

Should a software architecture be emergent?

a) Yes
b) No
c) Other

Next Steps

04

Going Further

Download the extra resources:

- https://beningo.short.gy/25DNCEC-10-Architecture-Resources

Get Hands-On:

- Analyze an existing projects software architecture
- Draw a new software architecture
- Invest a widget to practice your architecture skills
- Join an Embedded Software Architecture Kata

Downloadable Resources:

- Characteristics Worksheet
- Modern Principles
- Architecture Book List
- ADR Template

Save $100:
https://beningo.short.gy/DNCEC2510

Additional Resources

Please consider the resources below:

- Jacob's Blogs
- Jacob's CEC courses
- Embedded Software Academy

- Embedded Bytes Newsletter
  - http://bit.ly/1BAHYXm

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Next Steps

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