LECTURE 1.

INTRODUCTION TO SOFTWARE ARCHITECTURE AND DESIGN

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WHAT IS ARCHITECTURE

Contemporary Arts Center, Cincinnati, Ohio (1997–2003)

Administration building of BMW Factory in Leipzig, Germany (2001–2005)

Phaeno Science Center, Wolfsburg, Germany (2000–2005)

Vitra Fire Station in Weil am Rhein, Germany (1991–93)

Bergisel Ski Jump, Innsbruck, Austria (1999–2002)

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WHO IS ARCHITECT

Zaha Mohammad Hadid

Zaha Hadid in Heydar Aliyev Cultural center in Baku nov 2013	
Born	Zaha Mohammad Hadid 31 October 1950 Baghdad, Iraq
Died	31 March 2016 (aged 65) Miami, Florida, United States
Nationality	Iraqi, British
Alma mater	American University of Beirut Architectural Association School of Architecture, London
Occupation	Architect
Parent(s)	Mohammed Hadid Wajeeha Sabonji
Practice	Zaha Hadid Architects
Buildings	MAXXI, Bridge Pavilion, Maggie's Centre, Contemporary Arts Center
Website	www.zaha-hadid.com

WHAT IS ARCHITECTURE

- **Architecture** is both the process and the product of planning, designing, and constructing buildings or any other structures.
- **Structure** is an arrangement and organization of interrelated elements in a material object or system, or the object or system so organized.

WHAT IS SOFTWARE ARCHITECTURE

SOFTWARE ARCHITECTURE

- The software architecture of a system depicts the system's organization or structure, and provides an explanation of how it behaves.
- A system represents the collection of components that accomplish a specific function or set of functions.
- In other words, the software architecture provides a sturdy foundation on which software can be built.

SOFTWARE ARCHITECTURE

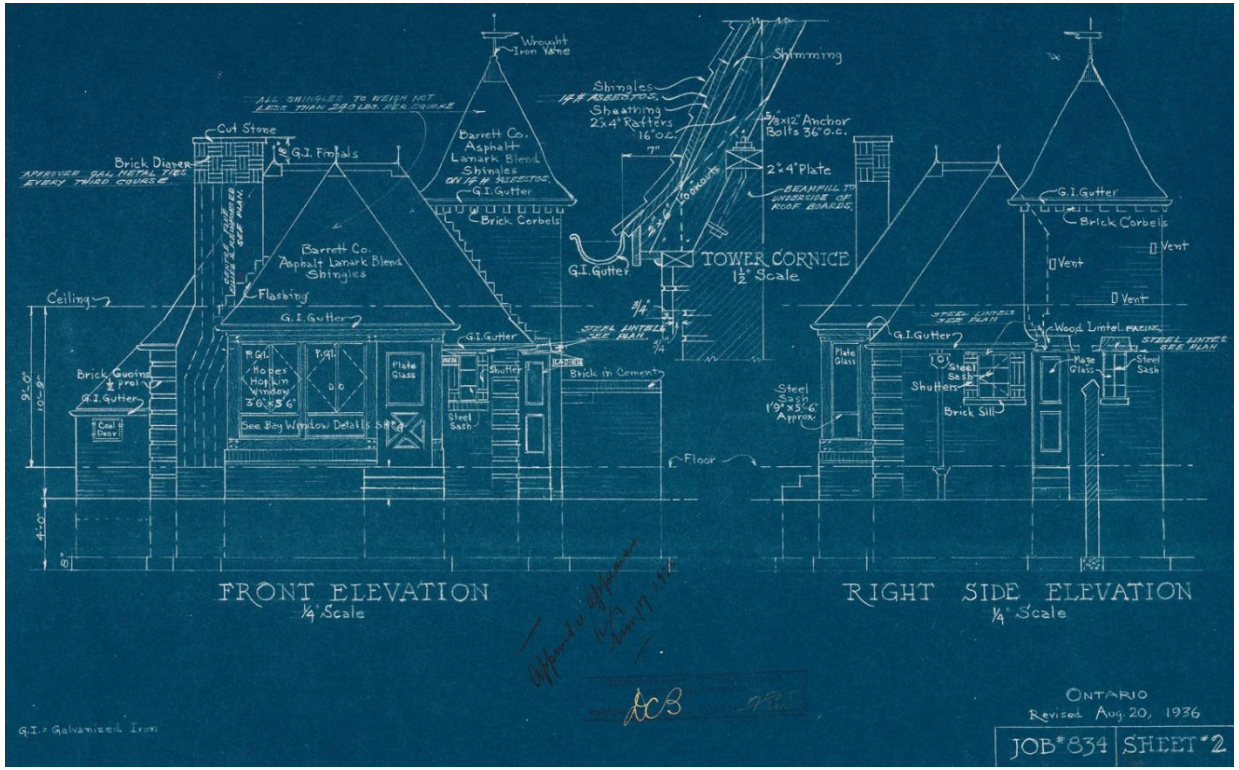
Architecture serves as a **BLUEPRINT** for a system.

- It provides an abstraction to manage the system complexity and establish a communication and coordination mechanism among components.

WHAT I BLUEPRINT

- A **blueprint** is a reproduction of a technical drawing using a contact print process on light-sensitive sheets.
- Introduced by Sir John Herschel in 1842, the process allowed rapid, and accurate, production of an unlimited number of copies.
- It was widely used for over a century for the reproduction of specification drawings used in construction and industry.
- The blueprint process was characterized by white lines on a blue background, a negative of the original.
- The process was not able to reproduce color or shades of grey.

WHAT I BLUEPRINT



WHAT I BLUEPRINT

Modern Blueprint for the architecture

SOFTWARE ARCHITECTURE

- It defines a **structured solution** to meet all the technical and operational requirements, while optimizing the common quality attributes like performance and security.
- Further, it involves a set of significant decisions about the organization related to software development and each of these decisions can have a considerable impact on quality, maintainability, performance, and the overall success of the final product.
- These decisions comprise of −
  - Selection of structural elements and their interfaces by which the system is composed.
  - Behavior as specified in collaborations among those elements.
  - Composition of these structural and behavioral elements into large subsystem.
  - Architectural decisions align with business objectives.
  - Architectural styles guide the organization.
  - Read more about Architectural Design Decisions
  - https://melsatar.blog/2017/04/29/architectural-design-decisions/.
  - Architectural Styles, Architecture Patterns, Design Patterns, and Language Idioms

https://melsatar.blog/2017/07/02/architectural-styles-architecture-patterns-design-patterns-and-language-idioms/

ARCHITECTURAL STYLES

- Client-server
- Shared nothing architecture
- Object request broker
- Peer-to-peer
- Representational state transfer (REST)
- Service-oriented
- Microservices
- Cloud computing
- Internet of Things
- Blockchain

SOFTWARE DESIGN

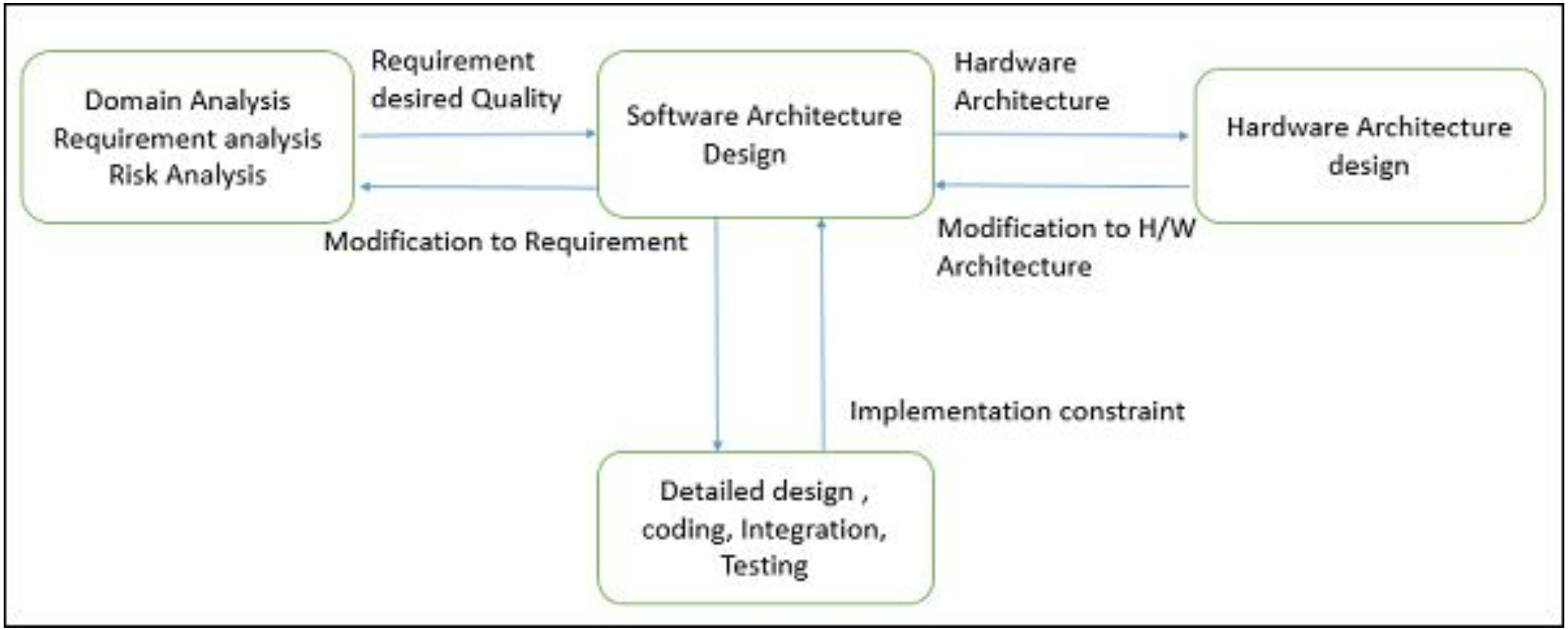
- Software design provides a **design plan** that describes the elements of a system, how they fit, and work together to fulfill the requirement of the system.

The objectives of having a design plan are as follows –

- To negotiate system requirements, and to set expectations with customers, marketing, and management personnel.
- Guide the implementation tasks, including detailed design, coding, integration, and testing.

Act as a **BLUEPRINT** during the development process.

SOFTWARE DESIGN



GOALS OF ARCHITECTURE

- The primary goal of the architecture is to

identify requirements

that affect the structure of the application.

A well-laid architecture reduces the business risks associated with building a technical solution and builds a bridge between business and technical requirements.

GOALS OF ARCHITECTURE

Some of the other goals are as follows –

- Expose the structure of the system, but hide its implementation details.
- Realize all the use-cases and scenarios.
- Try to address the requirements of various stakeholders.
- Handle both functional and quality requirements.
- Reduce the goal of ownership and improve the organization's market position.
- Improve quality and functionality offered by the system.
- Improve external confidence in either the organization or system.

TYPES OF SOFTWARE ARCHITECTURE

- 1. Business Architecture
  2. Application Architecture
  3. Information Architecture
  4. Information Technology Architecture

LIMITATIONS

- Software architecture is still an emerging discipline within software engineering.

It has the following limitations –

- Lack of tools and standardized ways to represent architecture.
- Lack of analysis methods to predict whether architecture will result in an implementation that meets the requirements.
- Lack of awareness of the importance of architectural design to software development.
- Lack of understanding of the role of software architect and poor communication among stakeholders.
- Lack of understanding of the design process, design experience and evaluation of design.

ROLE OF SOFTWARE ARCHITECT

- A Software Architect provides a solution that the technical team can create and design for the entire application. A software architect should have expertise in the following areas –

DESIGN EXPERTISE

- Expert in software design, including diverse methods and approaches such as object-oriented design, event-driven design, etc.
- Lead the development team and coordinate the development efforts for the integrity of the design.
- Should be able to review design proposals and tradeoff among themselves.

DOMAIN EXPERTISE

- Expert on the system being developed and plan for software evolution.
- Assist in the requirement investigation process, assuring completeness and consistency.
- Coordinate the definition of domain model for the system being developed.

TECHNOLOGY EXPERTISE

- Expert on available technologies that helps in the implementation of the system.
- Coordinate the selection of programming language, framework, platforms, databases, etc.

METHODOLOGICAL EXPERTISE

- Expert on software development methodologies that may be adopted during SDLC (Software Development Life Cycle).
- Choose the appropriate approaches for development that helps the entire team.

HIDDEN ROLE OF SOFTWARE ARCHITECT

- Facilitates the technical work among team members and reinforcing the trust relationship in the team.
- Information specialist who shares knowledge and has vast experience.
- Protect the team members from external forces that would distract them and bring less value to the project.

DELIVERABLES OF THE ARCHITECT

- A clear, complete, consistent, and achievable set of functional goals
- A functional description of the system, with at least two layers of decomposition
- A concept for the system
- A design in the form of the system, with at least two layers of decomposition
- A notion of the timing, operator attributes, and the implementation and operation plans
- A document or process which ensures functional decomposition is followed, and the form of interfaces is controlled

LIST OF FAMOUS SOFTWARE ARCHITECTS

- https://www.ranker.com/list/notable-software-architect_s)/reference