# Software System/Design & Architecture

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# Sessional Marks

- Midterm 20%
- Final 40%
- Assignment + Quizez 20 %
- Lab Work 10 %
- Presentations 10 %

# Software System Design & Architecture (SE-304) Course Content

# Design

**Design** is the creation of a plan or convention for the construction of an object or a system (as in architectural blueprints, engineering drawing , business process, circuit diagrams and sewing patterns).

OR

Another definition for design is a roadmap or a strategic approach for someone to achieve a unique expectation. It defines the specifications, plans, parameters, costs, activities, processes and how and what to do within legal, political, social, environmental, safety and economic constraints in achieving that objective.

# Approaches to Design

- A design approach is a general philosophy that may or may not include a guide for specific methods. Some are to guide the overall goal of the design. Other approaches are to guide the tendencies of the designer. A combination of approaches may be used if they don't conflict.
- Some popular approaches include:
- KISS principle, (Keep it Simple Stupid), which strives to eliminate unnecessary complications.
- There is more than one way to do it(TIMTOWTDI), a philosophy to allow multiple methods of doing the same thing.
- Use-centered design, which focuses on the goals and tasks associated with the use of the artifact, rather than focusing on the end user.
- User-centered design, which focuses on the needs, wants, and limitations of the end user of the designed artifact.
- Critical design uses designed artifacts as an embodied critique or commentary on existing values, morals, and practices in a culture.
- Trans generational design, the practice of making products and environments compatible with those physical and sensory impairments associated with human aging and which limit major activities of daily living.

# Design Terminology

The word "design" is often considered ambiguous, as it is applied differently in a varying contexts.

- ✓ **Design and art (buildings )**
- ✓ **Design and engineering ( Software / Systems )**
- ✓ **Design and production (Product / laptop camera )**

# Software Design

**Software design** is a process of problem solving and planning for a software solution. After the purpose and specifications of software are determined, software developers will design or employ designers to develop a plan for a solution. It includes low-level component and algorithm implementation issues as well as the architectural view.

# Why Design

# Design For Good

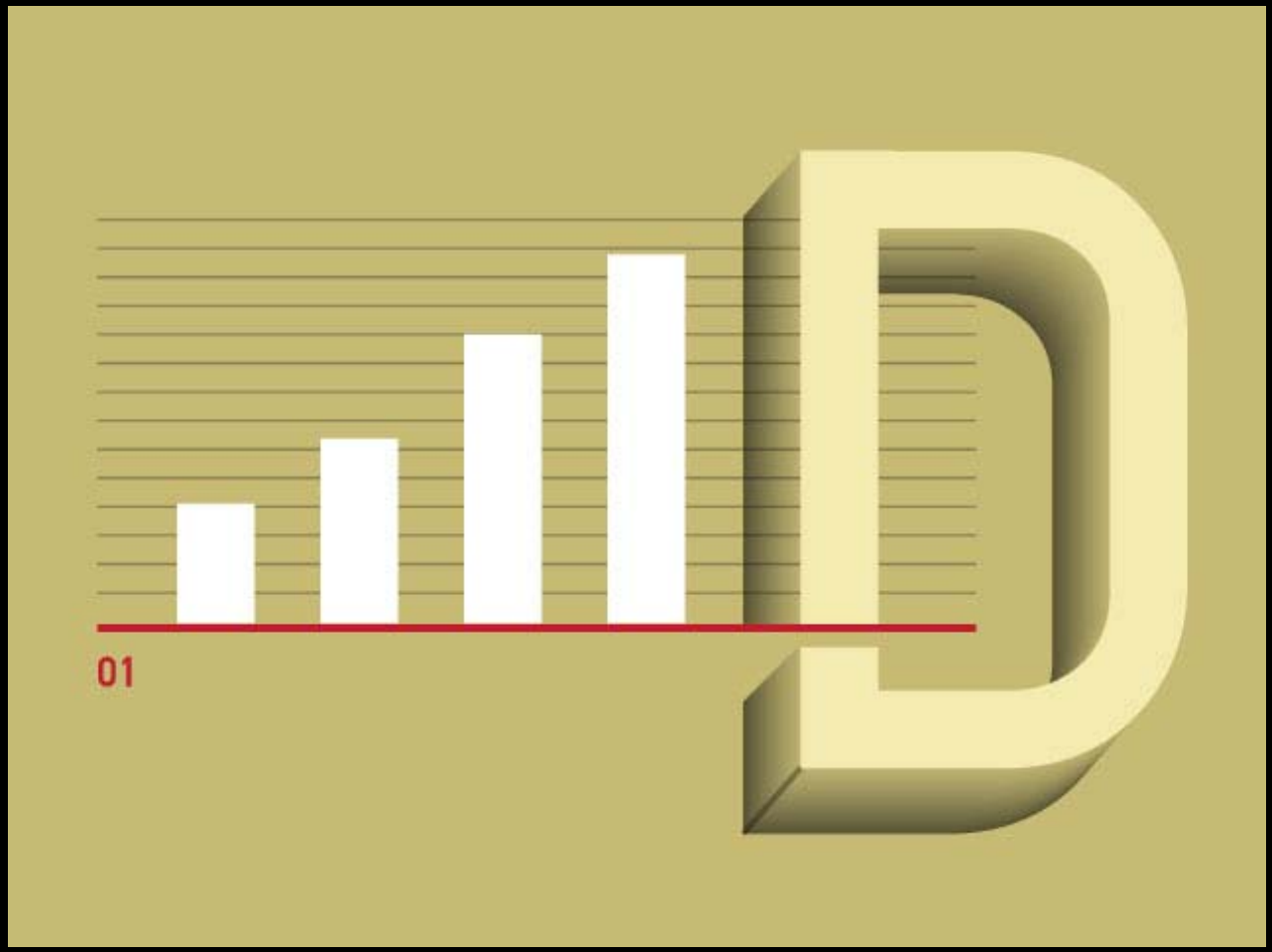
***A movement to ignite, accelerate and amplify design-driven social change***

Design for Good is a platform to build and sustain the implementation of design thinking for social change. This platform creates opportunities for designers to build their practice, their network, and their visibility. Design for Good recognizes the wide range of designers' work and leadership in social change which benefits the world, our country and our communities.

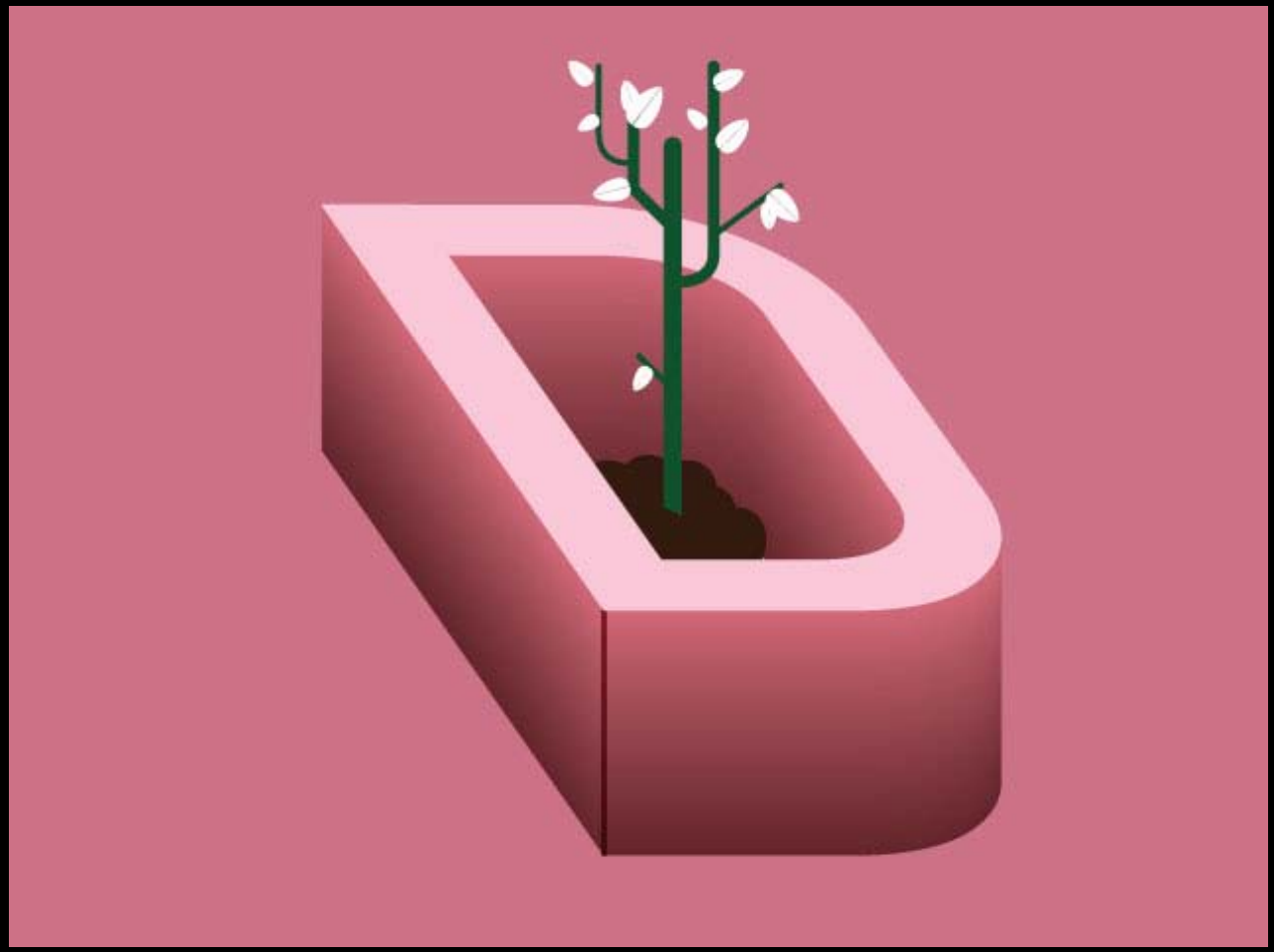
# DESIGN CREATES VALUE FOR BUSINESS STRATEGY

Design is an investment in innovative thinking, positioning, branding and communication that creates value for businesses in terms of competitive advantage, customer trust and loyalty, and market share. In a rapidly changing global and local business environment, design thinking helps business counter the complexity of conditions with creative solutions. In a global economy in which production gravitates toward the lowest cost producer, human-centered design provides the competitive differentiation needed to gain market share. Design is a critical strategic asset that is most effective when employed early in corporate plans, not as a decorative finality.

# DESIGN CREATES VALUE FOR BUSINESS STRATEGY



# GOOD DESIGN RESPECTS THE ENVIRONMENT SUSTAINABILITY



# GOOD DESIGN RESPECTS THE ENVIRONMENT SUSTAINABILITY

Designers welcome the challenges of designing within constraints; sensitivity to the environmental, economic, social and cultural implications of design is central to the professional designer’s ethical commitment. Good design respects planet, profits and people and welcomes the opportunity to meet client needs within these challenges. Sustainability applies to more than the environment; the designer's goal is to enhance human experience and client need while doing no damage to civilization.

# DESIGN IMPROVES SOCIETY
# SOCIAL ENGAGEMENT

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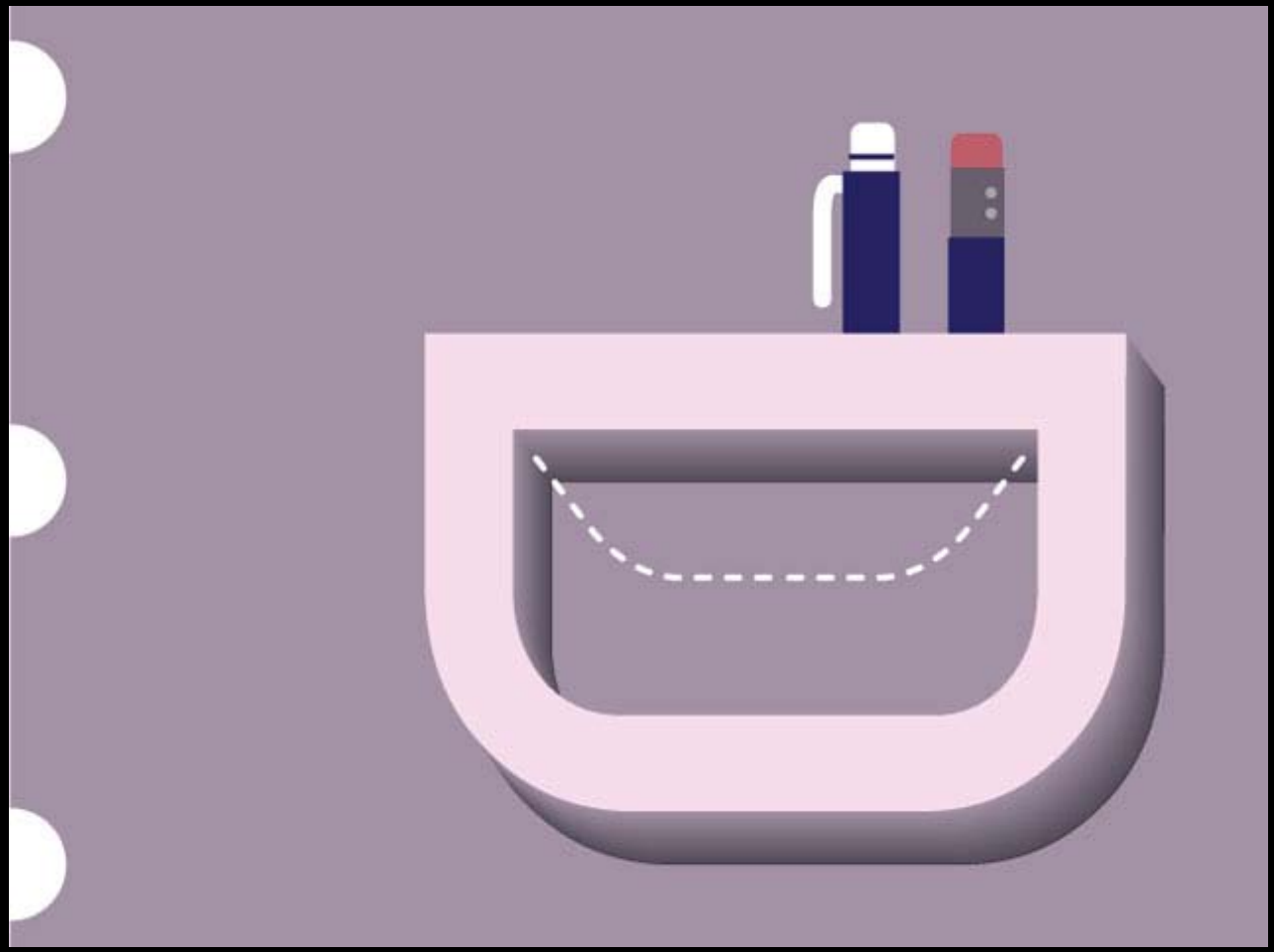
# SOCIAL ENGAGEMENT

Designers bring empathy and creativity to social challenges. The first helps to understand the human-centered solutions that can make a real difference in real people's lives; creativity can defeat habits with innovative approaches to making a measurable difference. It is the designer's approach to the process of solving complex problems, particularly in the willingness to test risky options that transcend the traditional view of problems, that is a strategic advantage. Every designer is encouraged to become engaged with socially relevant projects in order to use their creative talents to their highest and best purpose and to demonstrate the value of designers and design thinking.

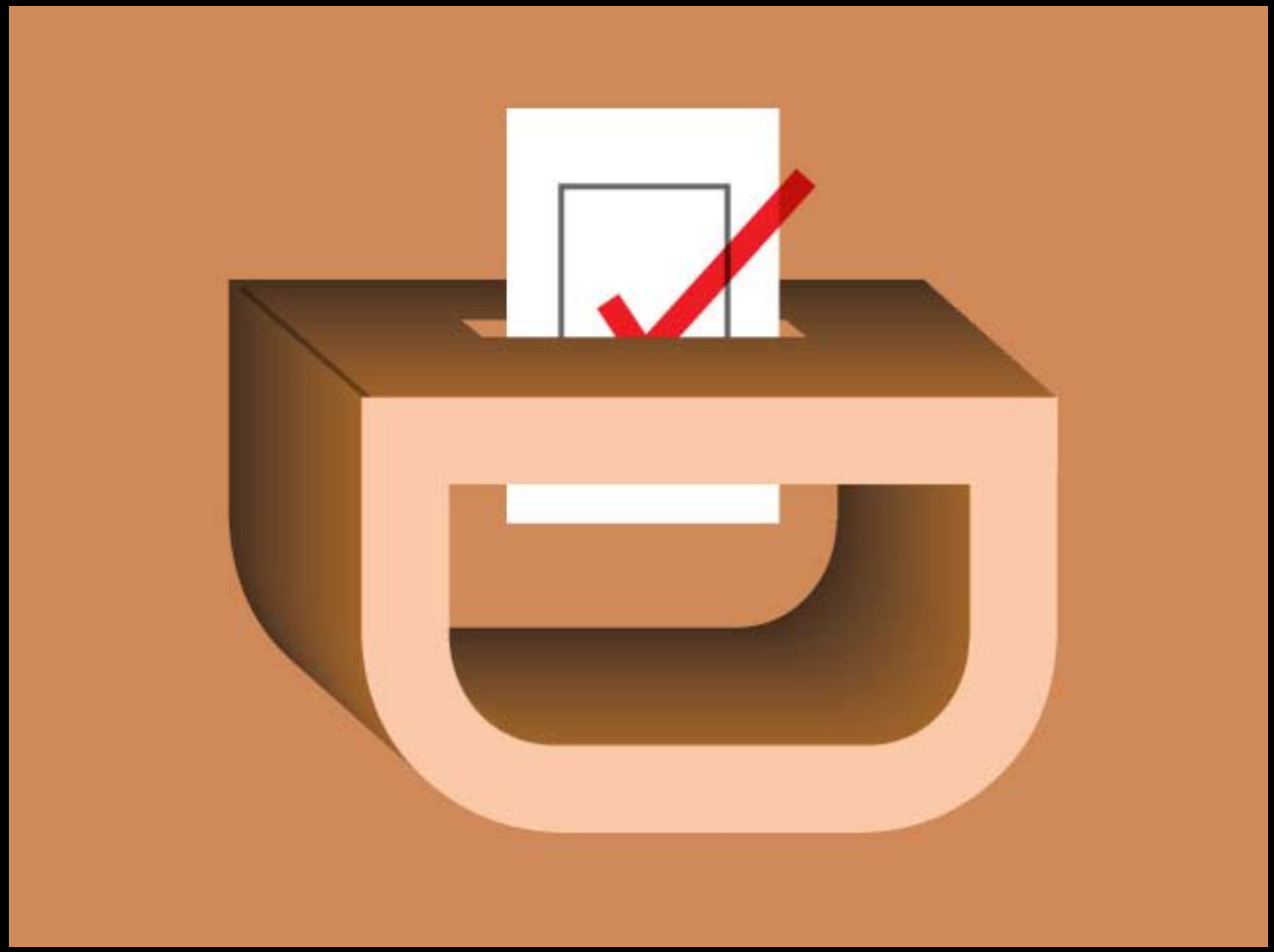
# PROFESSIONAL DESIGNERS SERVE CLIENTS BEST QUALITY



# PROFESSIONAL DESIGNERS SERVE CLIENTS BEST QUALITY

Professional designers are committed to ethical principles and business practices that serve the client's interests. AIGA establishes standards for professional practice that describe the expectations clients deserve in gaining the full advantage a designer's talents and process. These standards serve both the client and the designer in bringing clarity and integrity to the designer-client relationship.

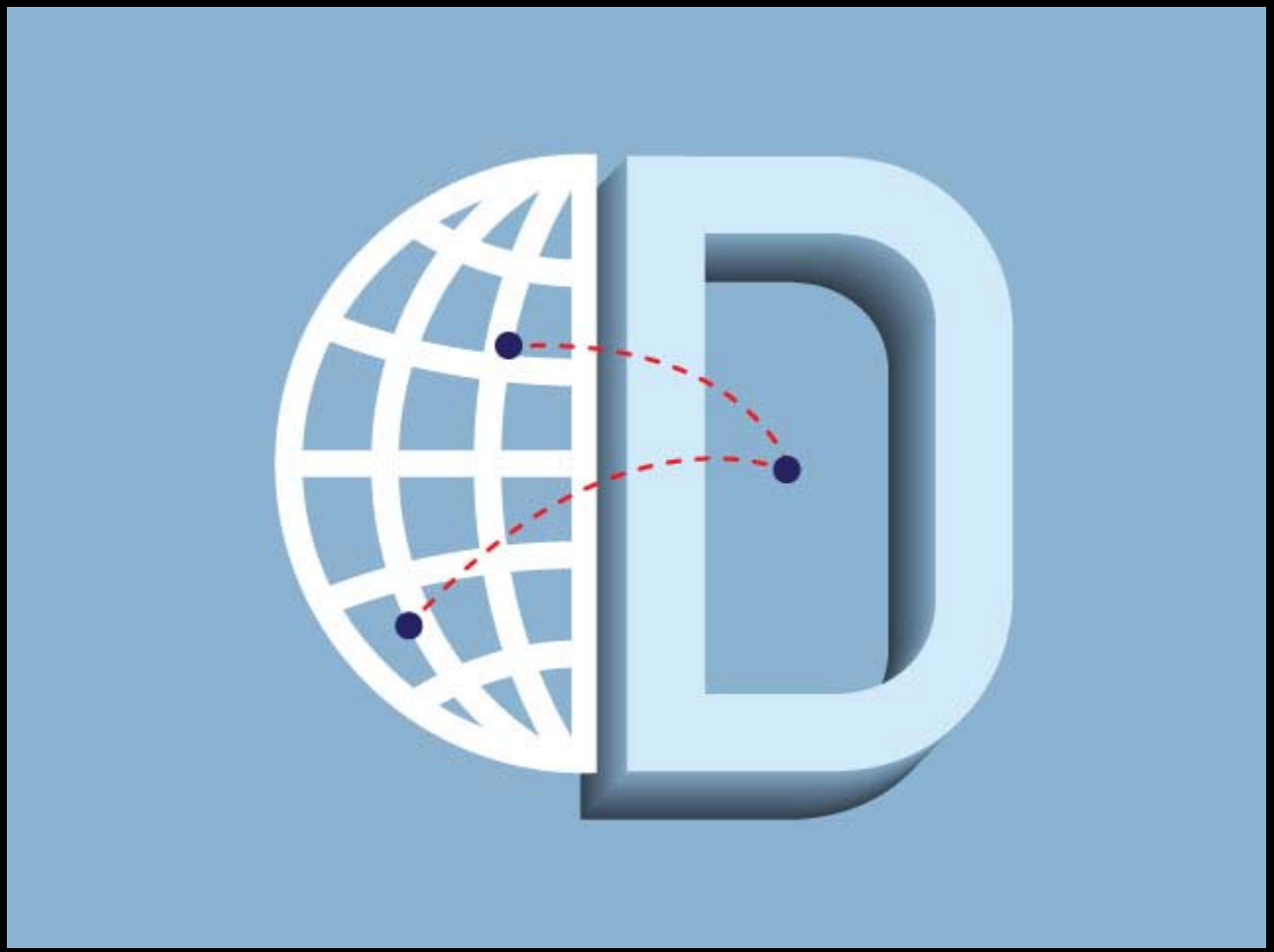
# DESIGN MAKES THE CITIZEN EXPERIENCE CLEAR TRANSPARENCY



# DESIGN MAKES THE CITIZEN EXPERIENCE CLEAR TRANSPARENCY

Design can strengthen democracy by building trust in the communication between government and the governed. Trust emerges from understanding; design is a critical intermediary in making the complex clear and enhancing understanding. In most of the interactions between government and its citizens, there is an exchange of information. Communication design can simplify and clarify this process; designers can also design service experiences that are more effective, more comprehensible and more efficient. AIGA is deeply involved in initiatives to encourage government use of designers to improve democracy and to demonstrate the power of design.

# DESIGN FOSTERS CULTURAL UNDERSTANDING CULTURE



# DESIGN FOSTERS CULTURAL UNDERSTANDING CULTURE

Effective design focuses clearly on the audience, the customer or the ultimate beneficiary. The design process begins with research into how real people behave, often in the form of ethnographic research. The intent of successful design is to find human-centered solutions that will really work to address a problem and to do so in the context of existing cultures. This is an important issue in an ever-shrinking world in which design must address the unique needs of many different cultures without imposing values upon them. AIGA is committed to assisting designers in understanding different cultures, through activities focused on multiculturalism, developing channels for U.S. designers to build relationships with designers from other cultures, and in diversifying the profession.

# Types of Software Design

- ✓ **Data Design**
- ✓ **Architectural Design**
- ✓ **Process Design**
- ✓ **Interface Design**
- ✓ **Procedural Design**

# ARCHITECTURE (ANSI/IEEE 1471-200)

"Architecture is the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution"

# ARCHITECTURE

## Architecture is:

- All about communication.
- What ‘parts’ are there?
- How do the ‘parts’ fit together?

## Architecture is not:

- About development.
- About algorithms.
- About data structures.

# Why these Building Architecture are Famous ?

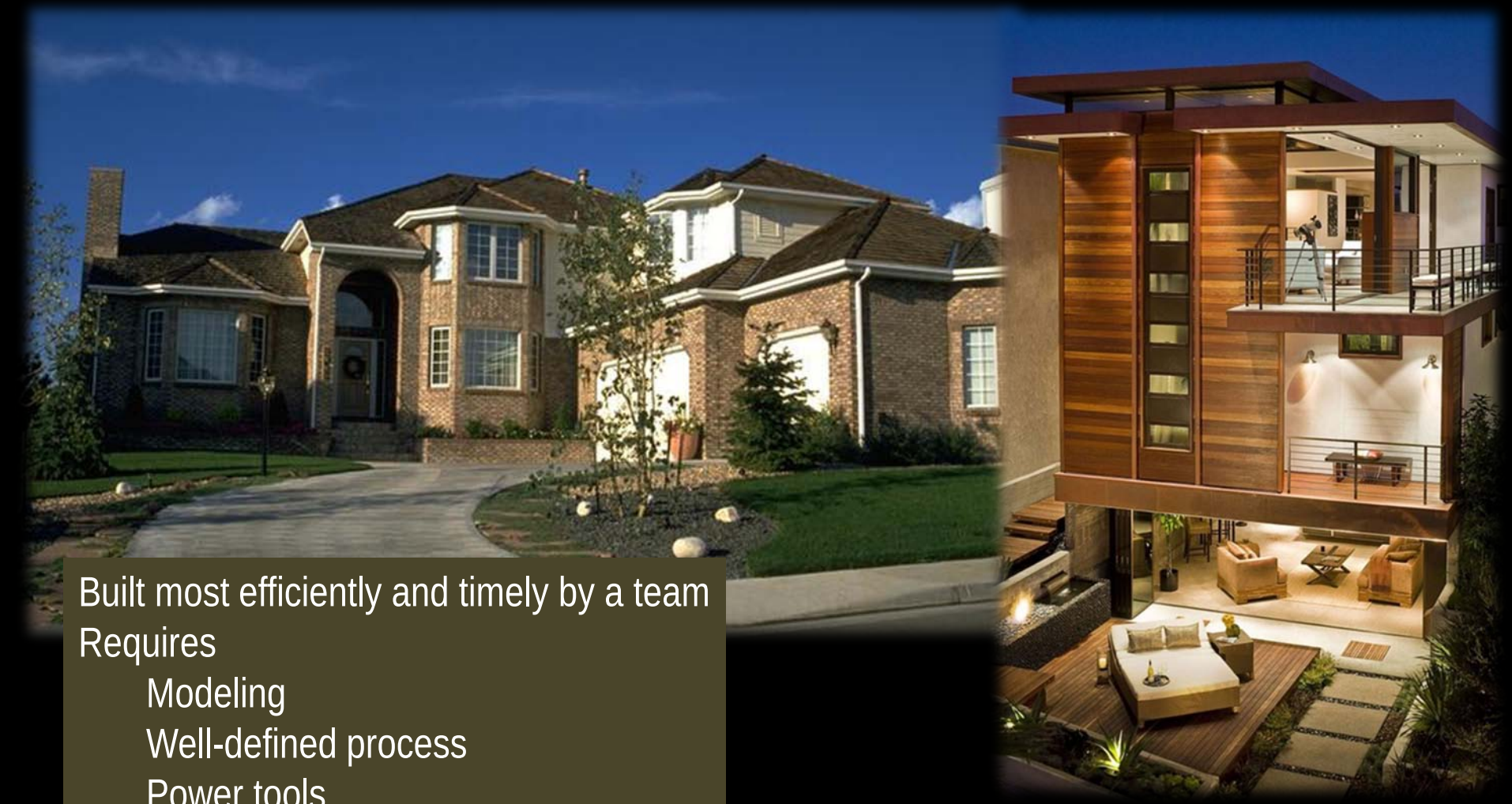

# The Need of Architecture
# The Winchester "Mystery" House

- 38 years of construction – 147 builders 200 architects
- 160 rooms – 40 bedrooms, 6 kitchens, 2 basements, 950 doors
- 65 doors to blank walls, 13 staircases abandoned, 24 skylights in floors
- No architectural blueprint exists

# Architecting a Dog House

Can be built by one person
Requires
- Minimal modeling
- Simple process
- Simple tools

# Architecting a house



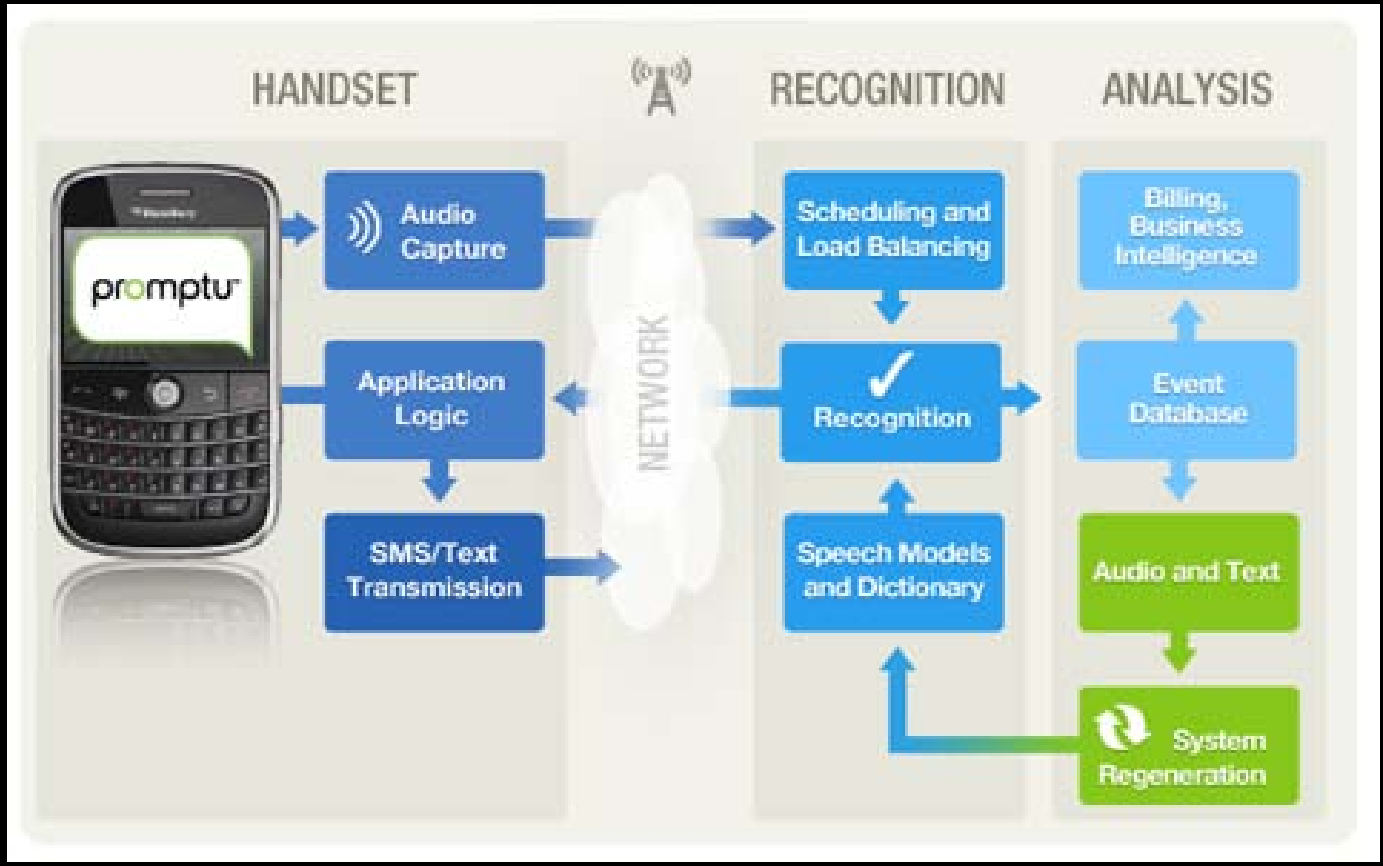
Built most efficiently and timely by a team
Requires
- Modeling
- Well-defined process
- Power tools

# Software Architecture

- “The software architecture of a program or computing system is the structure or structures of the system, which comprise software elements, the externally visible properties of those elements, and the relationships among them.
- The **software Architecture** of a system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both.

- The term also refers to documentation of a system's "software architecture." Documenting software architecture facilitates communication between stakeholders, documents early decisions about high-level design, and allows reuse of design components and patterns between projects.

# Software Architecture



# Software Architecture (Eoin Woods)

"Software architecture is the set of design decisions which, if made incorrectly, may cause you project to be cancelled."

- Software architecture encompasses the set of significant decisions about the organization of a software system
  - Selection of the structural elements and their interfaces by which a system is composed
  - Behavior as specified in collaborations among those elements
  - Composition of these structural and behavioral elements into larger subsystems
  - Architectural style that guides this organization

# Software Architecture

The conceptual fabric that defines a system

- All architecture is design but not all design is architecture.
- Architecture focuses on those aspects of a system that would be difficult to change once the system is built.
- Architectures capture three primary dimensions:
  - Structure
  - Communication
  - Nonfunctional requirements

# Software Architecture

- Structure

  The software architecture of a system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both.

# Software Architecture

- Communication

The Software Communications Architecture (SCA) is an open architecture framework that tells designers how elements of hardware and software are to operate in harmony within a software .

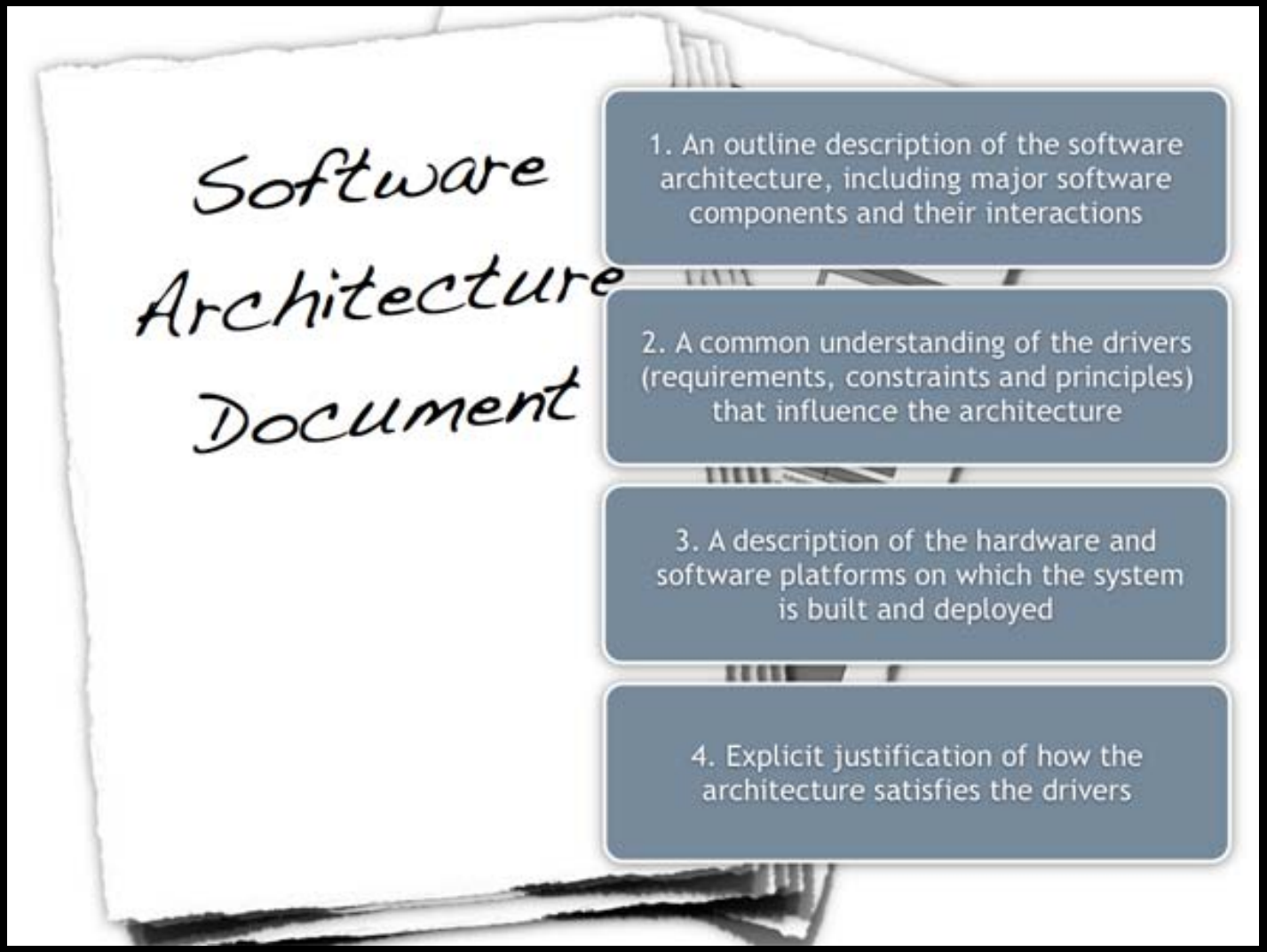
# Non Functional Requirements

Technical constraints: restrictions made for technical reasons

- Business constraints: restrictions made for business reasons
- Quality attributes: e.g., the ‘ilities’
- Scalability
- Security
- Performance
- Maintainability
- Evolvability
- Reliability/Dependability
- Deployability

Tracebility

# Documenting software Architecture



# What Is Software Architecture?

- The software architecture of a program or computing system is a depiction of the system that aids in the understanding of how the system will behave.

- Software architecture serves as the blueprint for both the system and the project developing it, defining the work assignments that must be carried out by design and implementation teams. The architecture is the primary carrier of system qualities such as performance, modifiability, and security, none of which can be achieved without a unifying architectural vision. Architecture is an artifact for early analysis to make sure that a design approach will yield an acceptable system.

# What Is Software Architect

**Software architect** is a computer programmer that makes high-level design choices and dictates technical standards, including software coding standards, tools, or platforms.

# The Main Responsibilities of a Software Architect

- ✓ Limiting choices available during development by
  - Choosing a standard way of pursuing application development
  - Creating, defining, or choosing an application framework for the application
- ✓ Recognizing potential reuse in the organization or in the application by
  - Observing and understanding the broader system environment
  - Creating the component design
  - Having knowledge of other applications in the organization
- ✓ Subdivide a complex application, during the design phase, into smaller, more manageable pieces
- ✓ Grasp the functions of each component within the application
- ✓ Understand the interactions and dependencies among components
- ✓ Communicate these concepts to developers

# The Duties of a Software Architect

- ✓ Architect makes high-level design choices much more often than low-level choices. In addition, the architect may sometimes dictate technical standards, including coding standards, tools, or platforms.
- ✓ Software architects may also be engaged in the design of the architecture of the hardware environment, or may focus entirely on the design methodology of the code.
- ✓ Architects can use various software architectural models that specialize in communicating architecture.

# Duties of the Software Architect

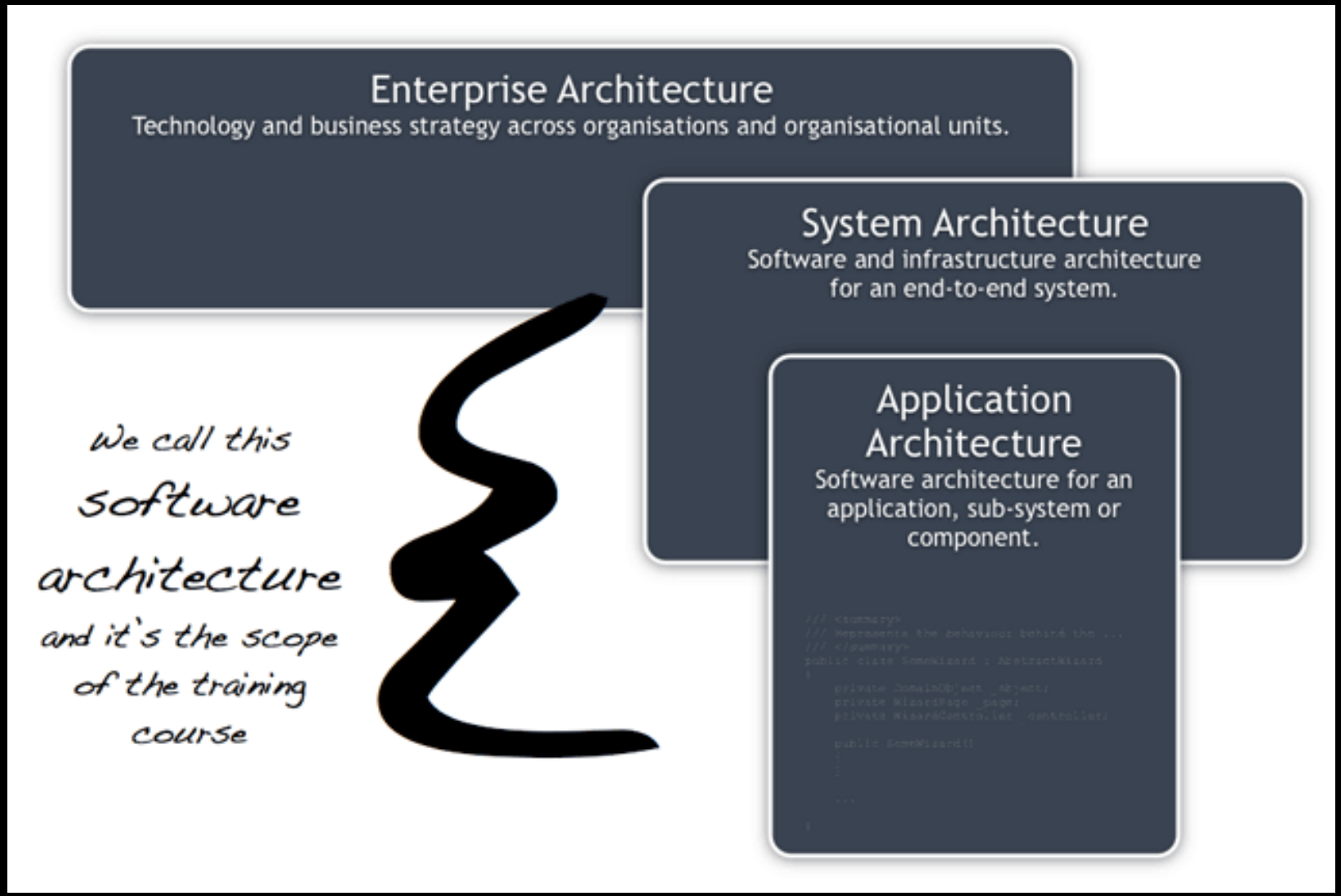
**Drive** architecture

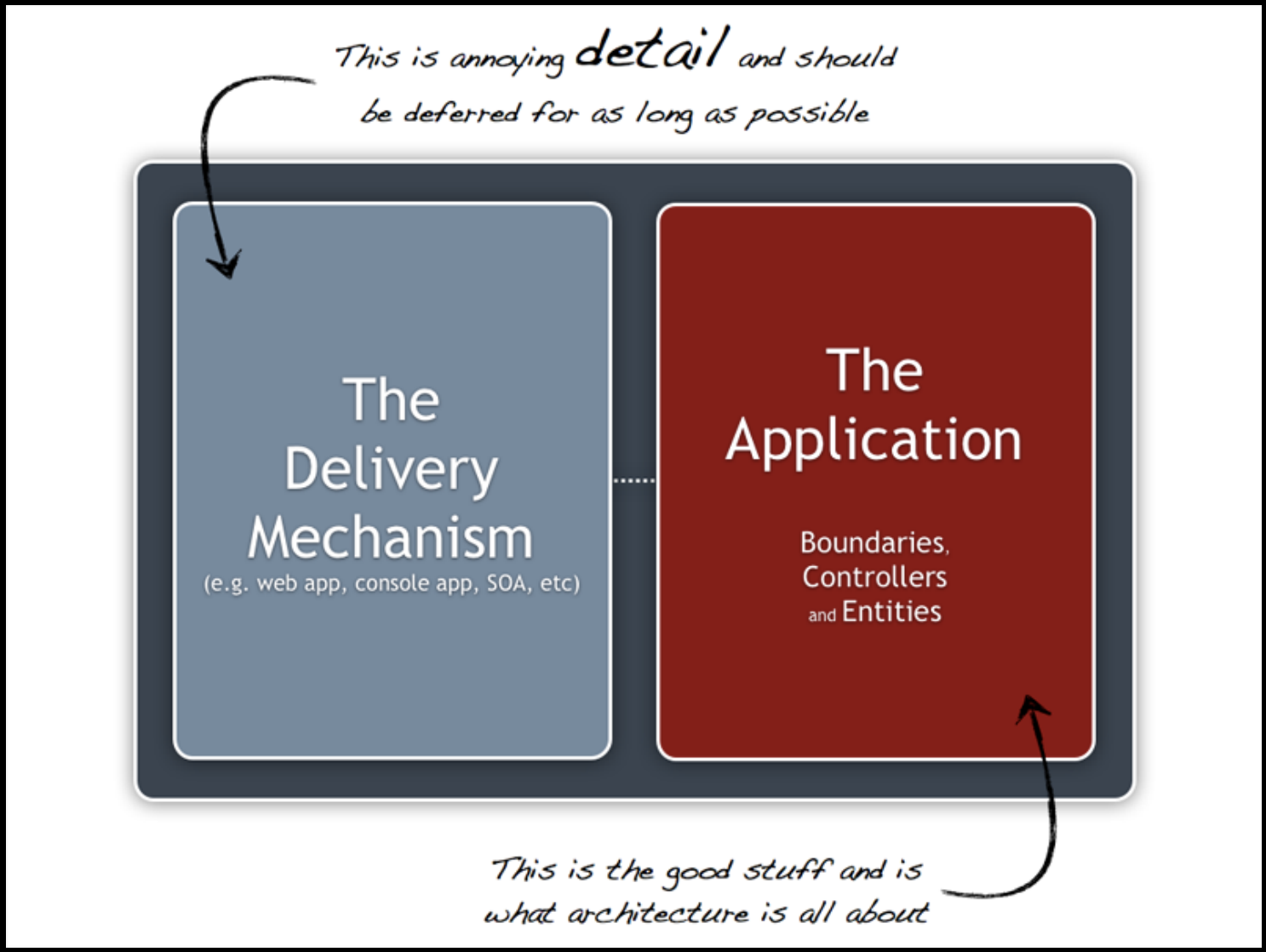
**Coach** team

**Decide!**

# What is "Software Architecture for Developers"?

Designing software given a vague set of requirements and a blank sheet of paper is a good skill to have, although not many people get to do this on a daily basis. However, with agile methods encouraging collective ownership of the code, it's really important that everybody on the team understands the big picture. And in order to do this, you need to understand why you've arrived at the design that you have. In a nutshell, everybody on the team needs to be a software architect.





# Why Apple Products Are Irresistible?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# Assignement # 01

## Activity

- Architect a Mobile Phone (iphone)
- What are the high-level requirements?
- What systems are involved?
- What properties do the systems have?
- How do they interact?
- How is the phone used?

# Assignement # 01

## Iphone Architecture Discussion

- What are the components?
- What are their properties?
- What are their relationships?
- Present and critique design alternatives.

**Due Date : 13 September 2012**

If you have any query please feel free to ask

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