Software Architecture

- Definitions
  - http://www.sei.cmu.edu/architecture/published_definitions.html
  - ANSI/IEEE Std 1471-2000, Recommended Practice for Architectural Description of Software-Intensive Systems
    - Architecture is defined by the recommended practice as *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 and Design

- Software design is often divided into two categories:
  - Software architecture design
    - Top-level design, high-level software structure and organization of components
  - Software detailed design
    - Describing each component sufficiently to allow for its construction

Testing

- V
- Requirements -> Acceptance Testing
- Architecture -> System Testing
- Design -> Integration Testing
- Construction -> Unit Testing

Design Strategies

- Divide-and-conquer/stepwise refinement
- Top-down vs. bottom-up
- Data abstraction and information hiding
- Use of heuristics
- Use of patterns and pattern languages
- Iterative and incremental approach

Design Methods

- Function-Oriented (Structured)
- Object-Oriented
- Data-structure-centered
- Component-based

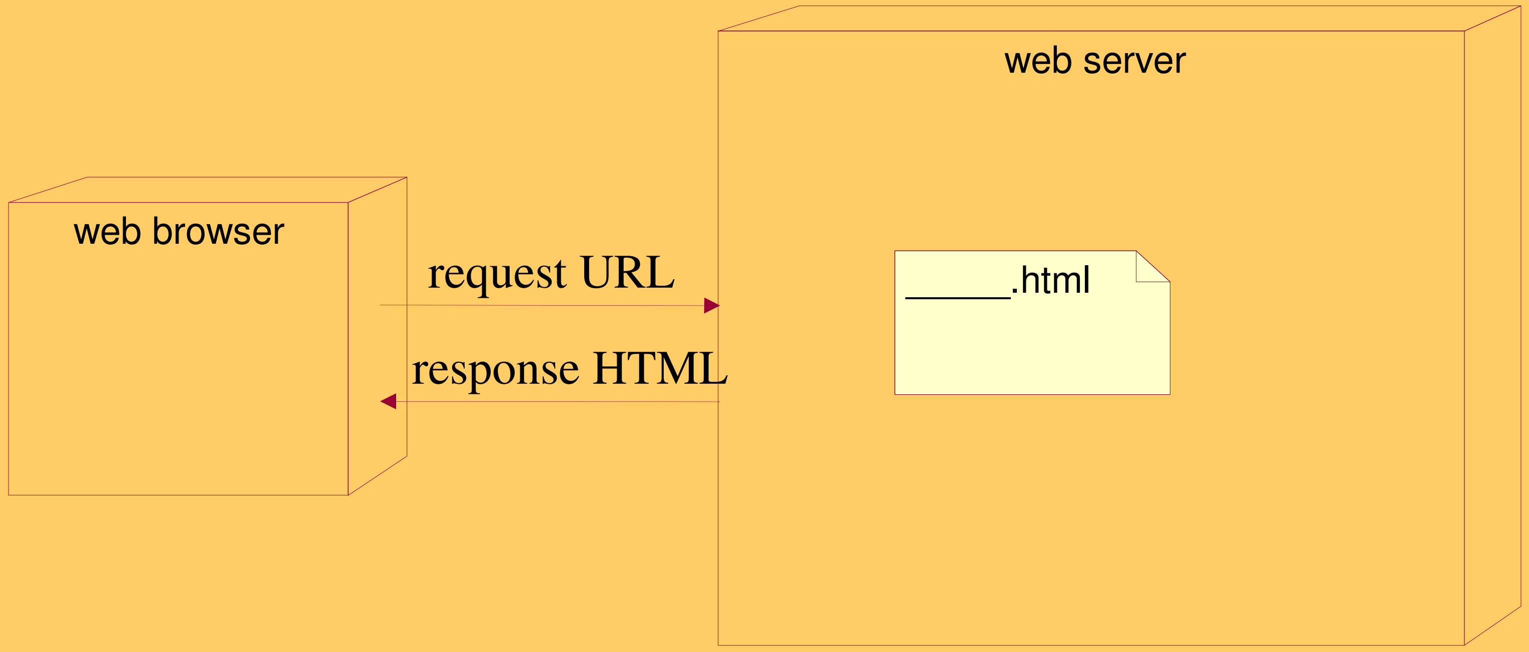
Architectural Styles

- Sequential
- Layered/Multitier
- Client-Server
- Event-driven
- Pipe-and-Filter
- Parallel
- State-Machine

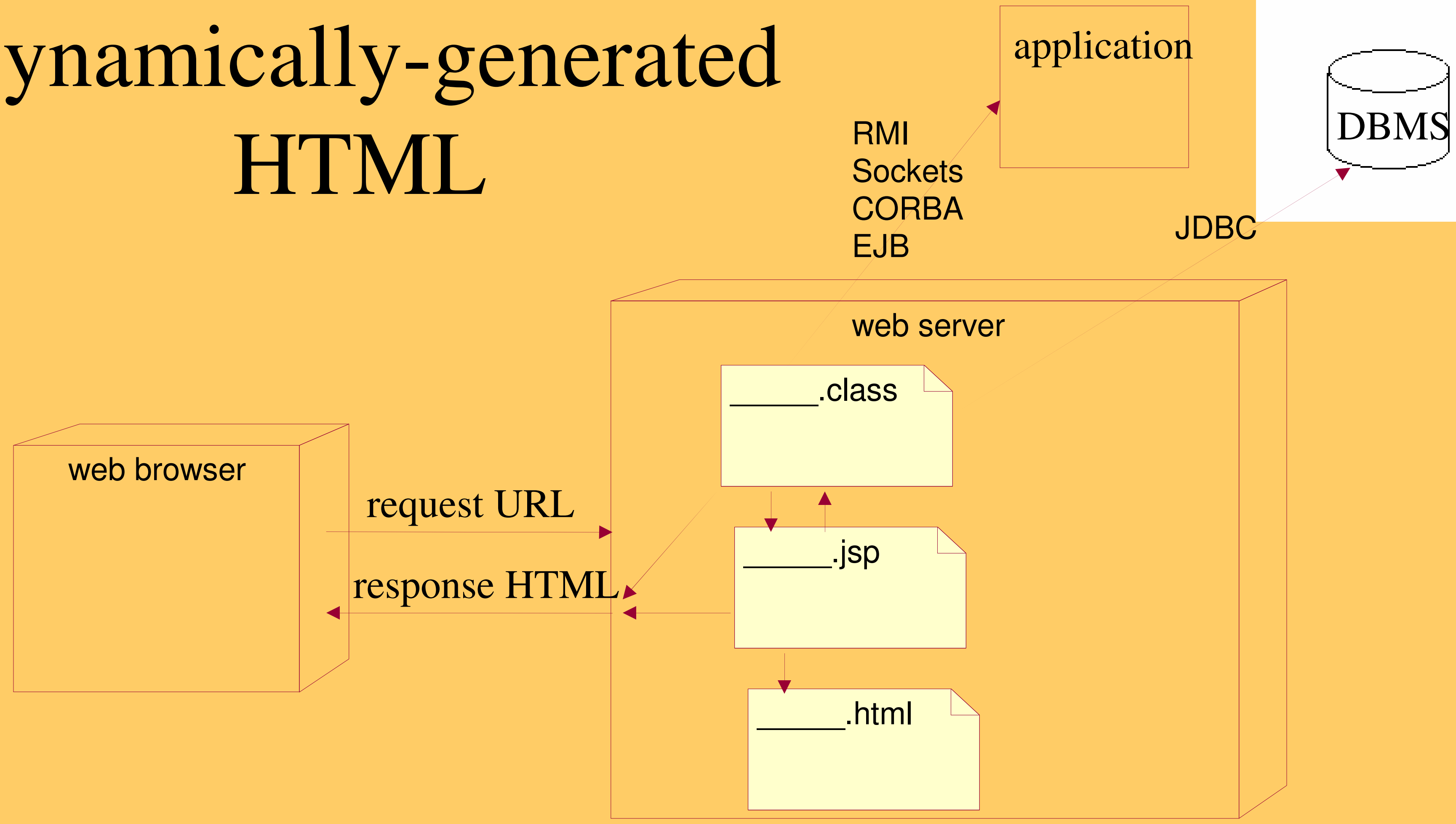
Web Architecture Overview

- Static html
  - text file containing html tags created manually
  - may include some client-side scripts (e.g. JavaScript)
- Dynamically generated html
  - html file produced at time of request
  - cgi, php, asp, jsp, Servlets
- Html with active content
  - html contains a program that runs at the client inside a web browser
  - Java applets, javascript

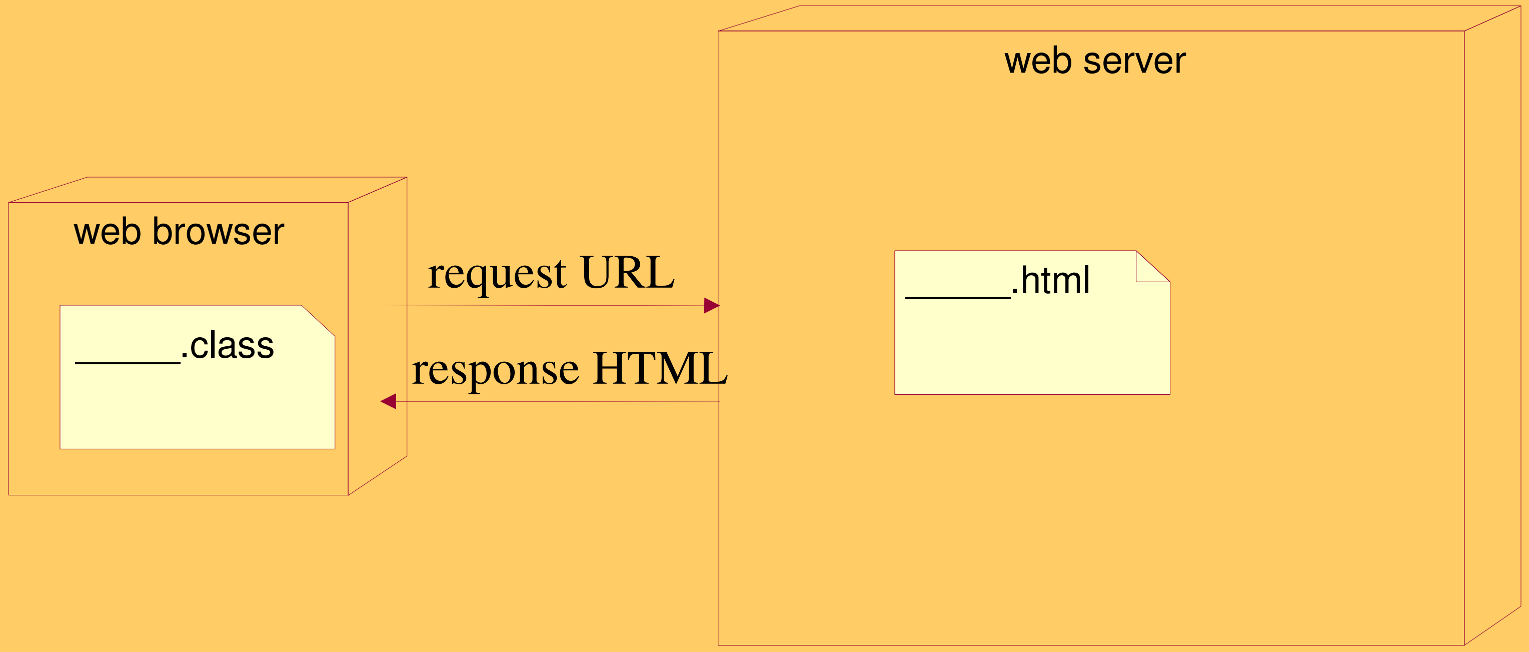
Static HTML



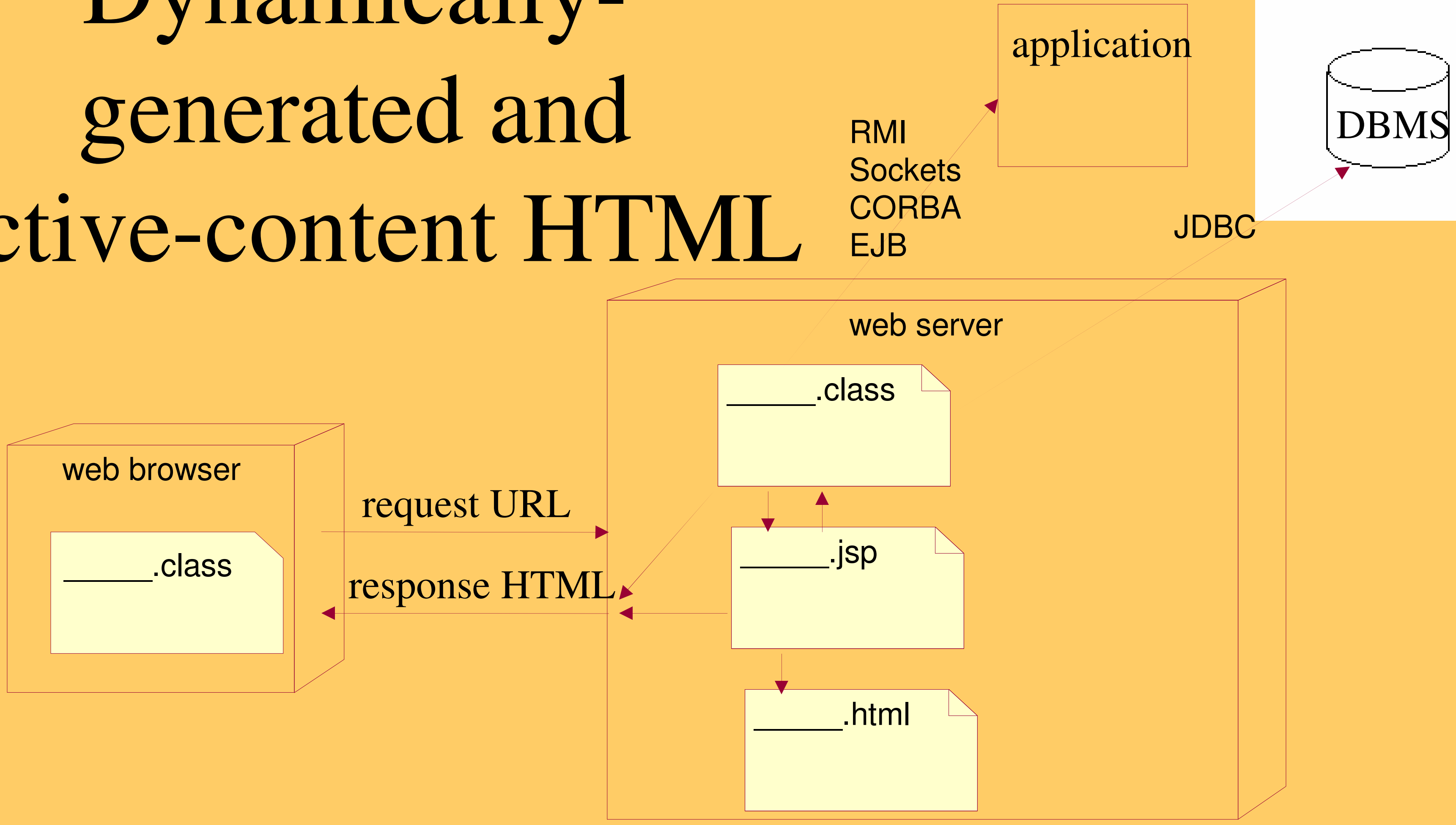
Dynamically-generated HTML



HTML with Active Content



Dynamically-generated and Active-content HTML



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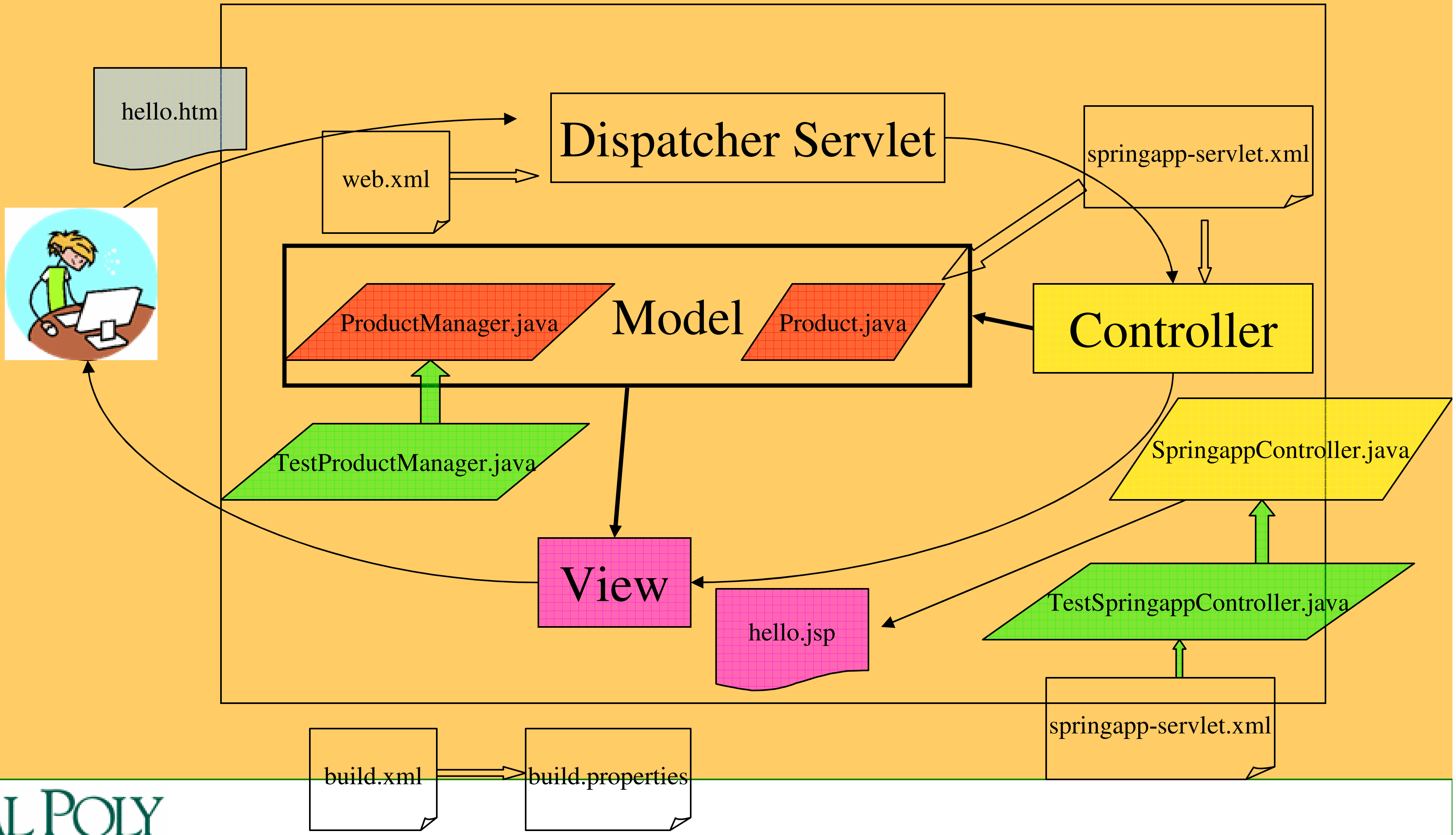
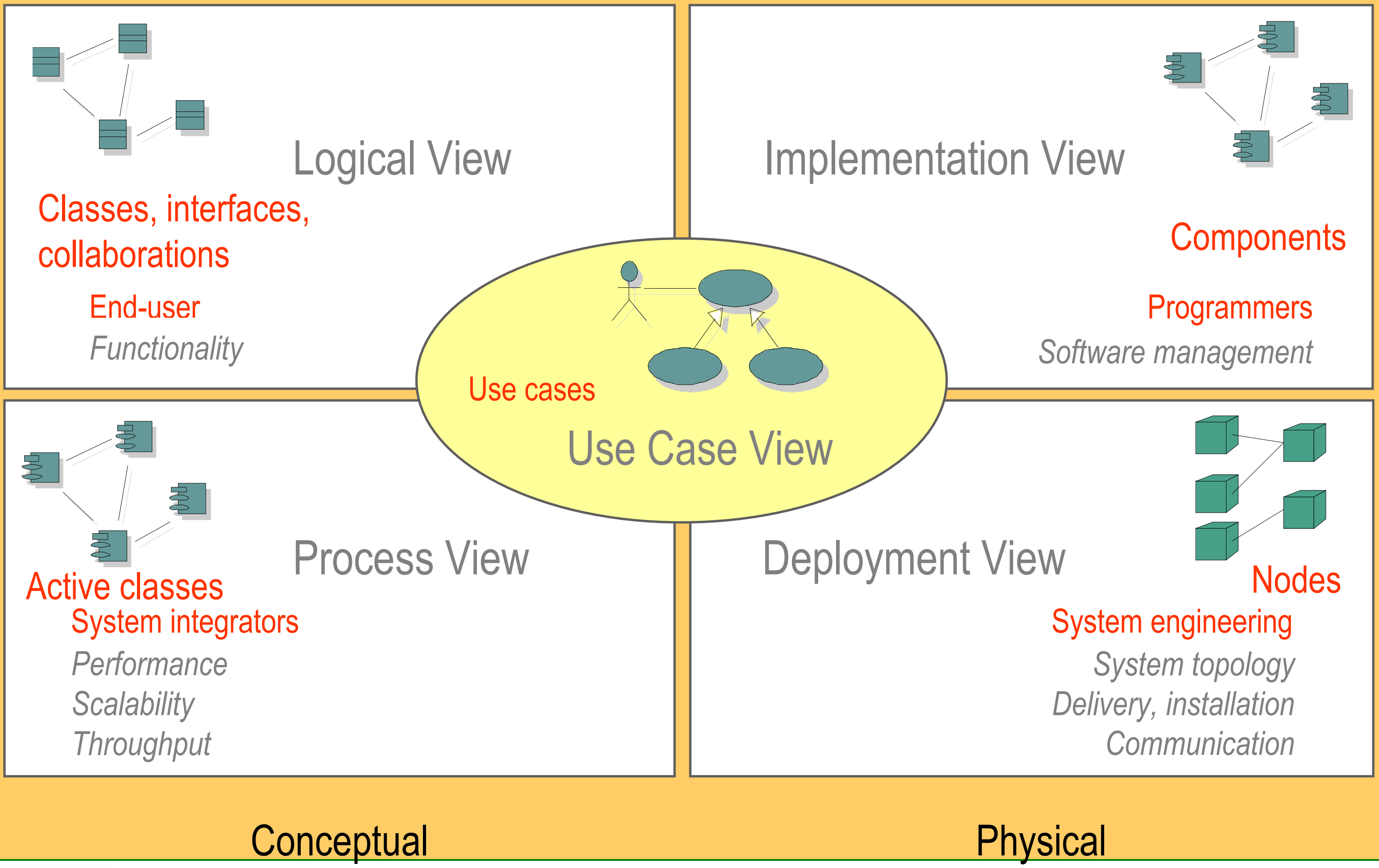
Sample Web Architecture with Spring Framework



4+1 Architecture Views from the Unified Process



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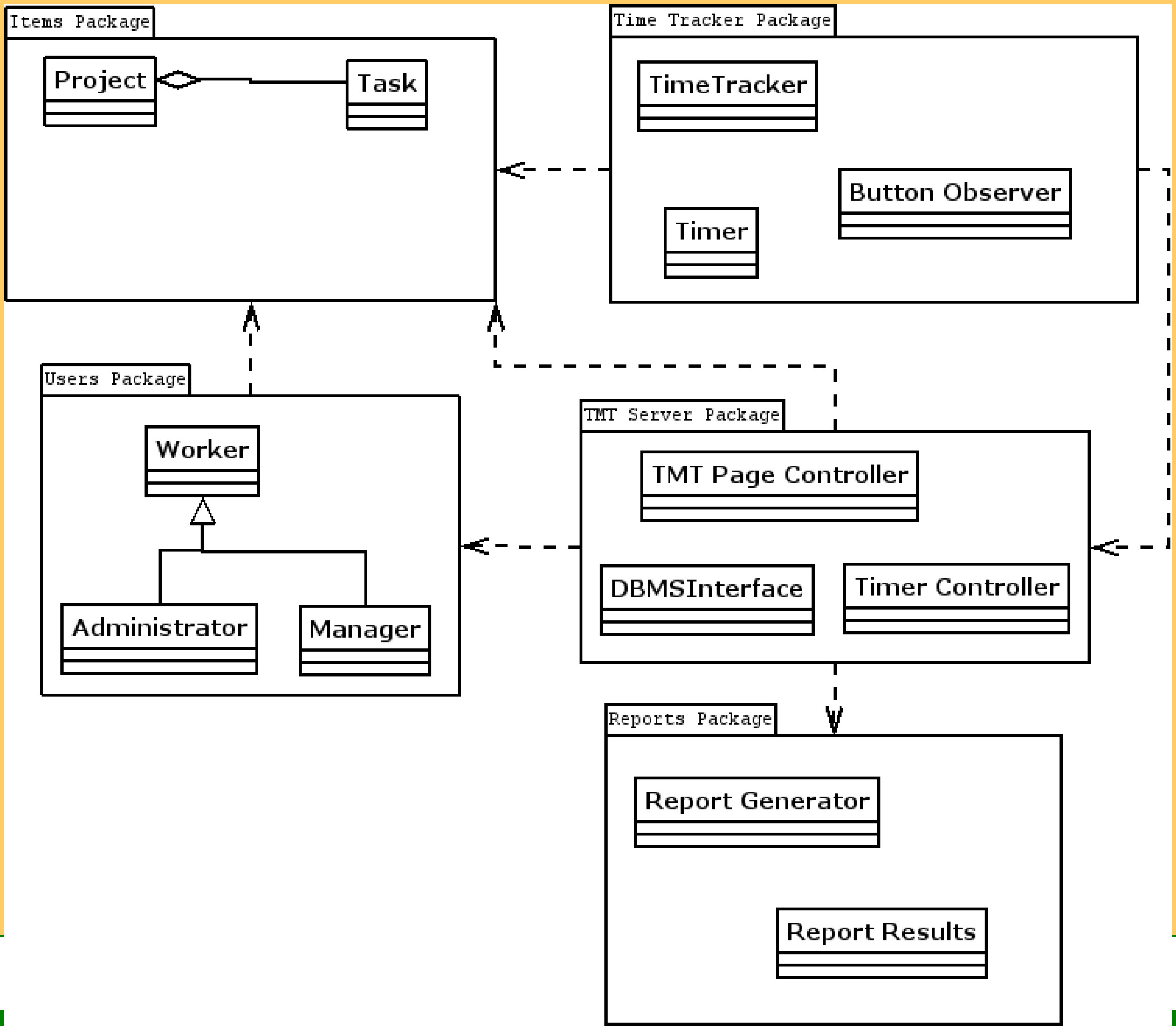
Modeling

- CASE
- Model->code-generation->source code
- Source code->object code
- Reverse engineering

UML Diagrams

- Structural
  - Class, Object, Component, Deployment Diagrams
- Behavioral
  - Use-Case, Activity, Sequence, Communication/Collaboration, Statechart Diagrams

Architecturally Significant Classes Organized by Package



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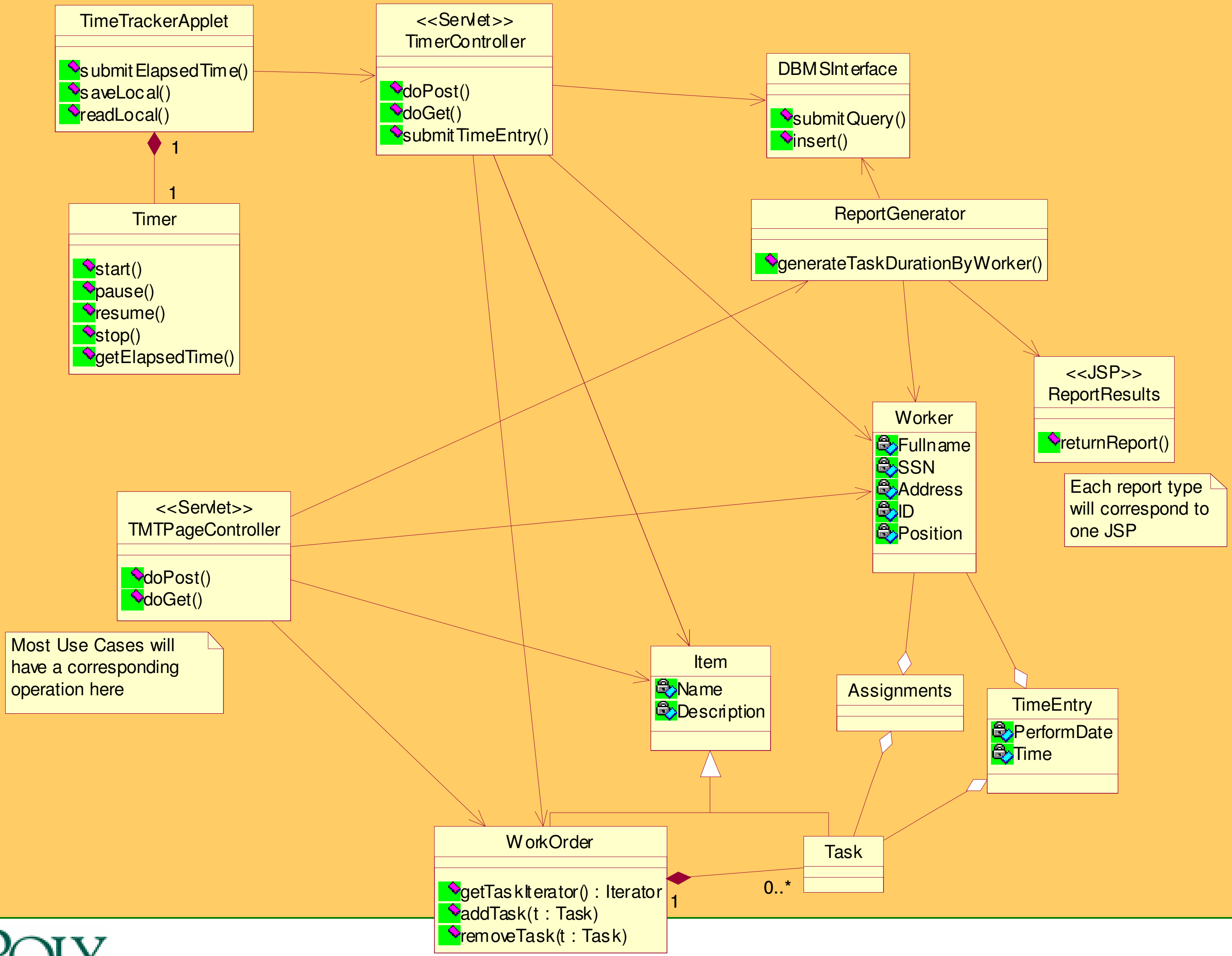
Architecturally Significant Classes



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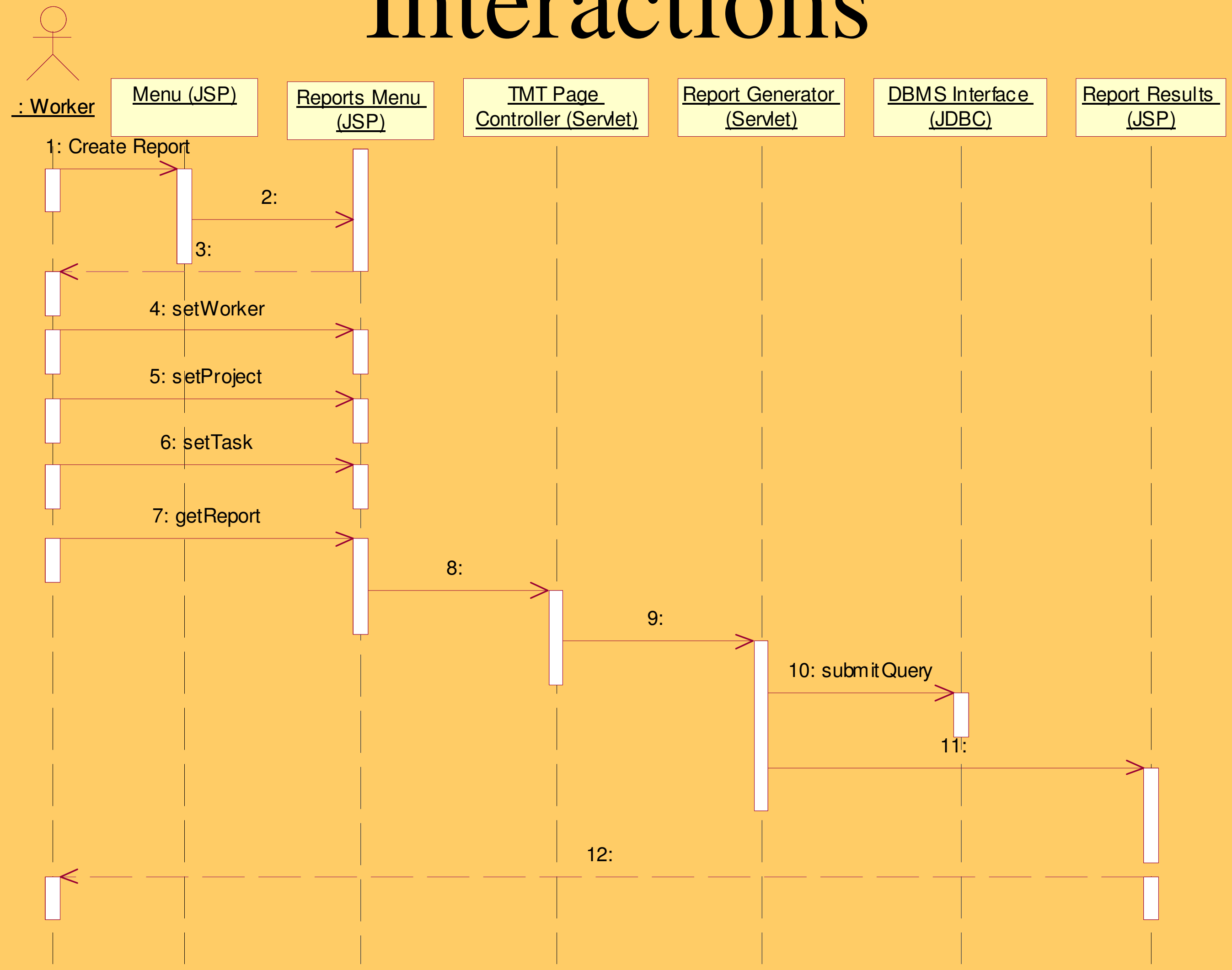
Class Diagrams

- Classes, attributes, operations
- Associations, aggregation, composition
- Inheritance/generalization

Architecturally Significant Interactions



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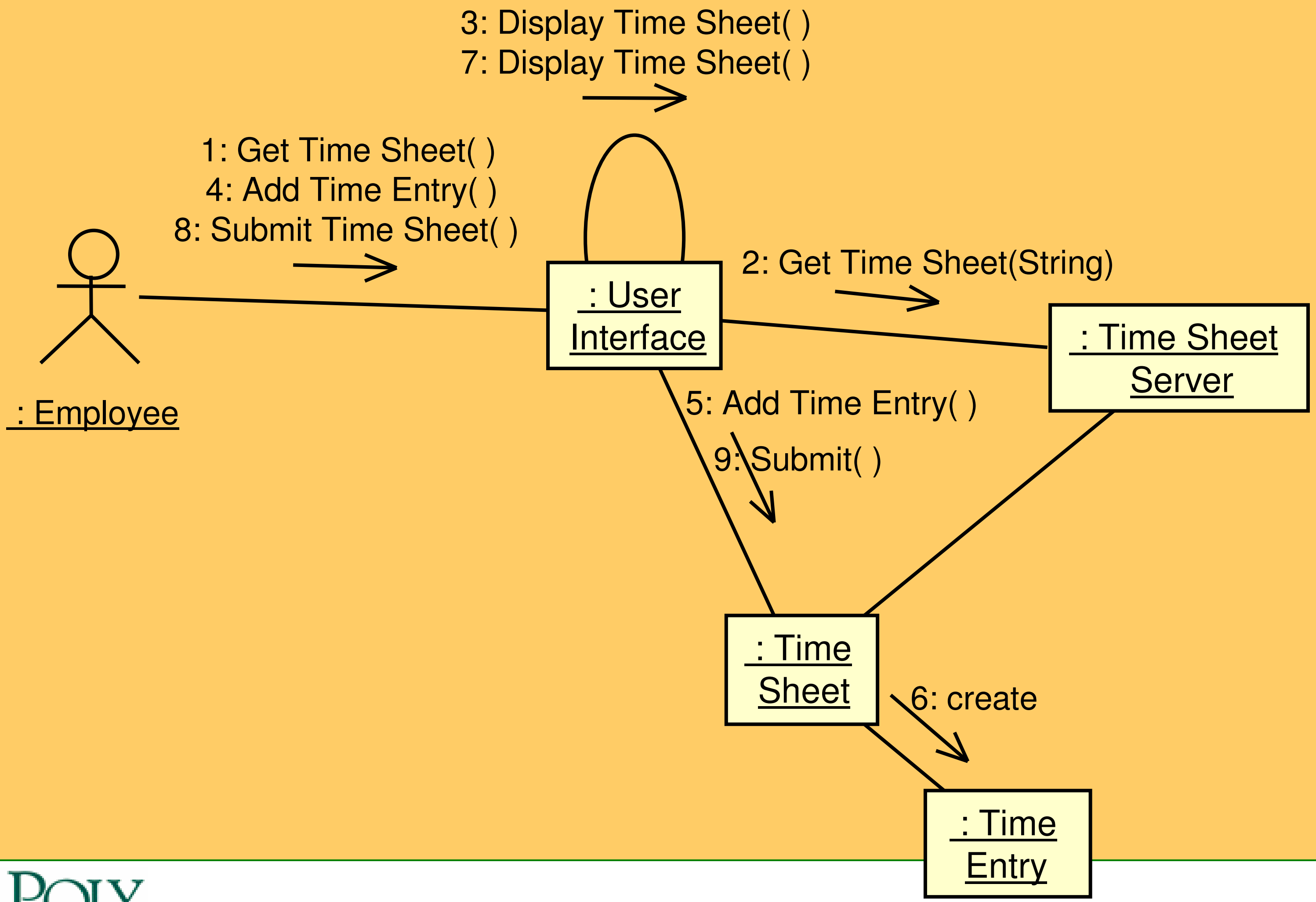
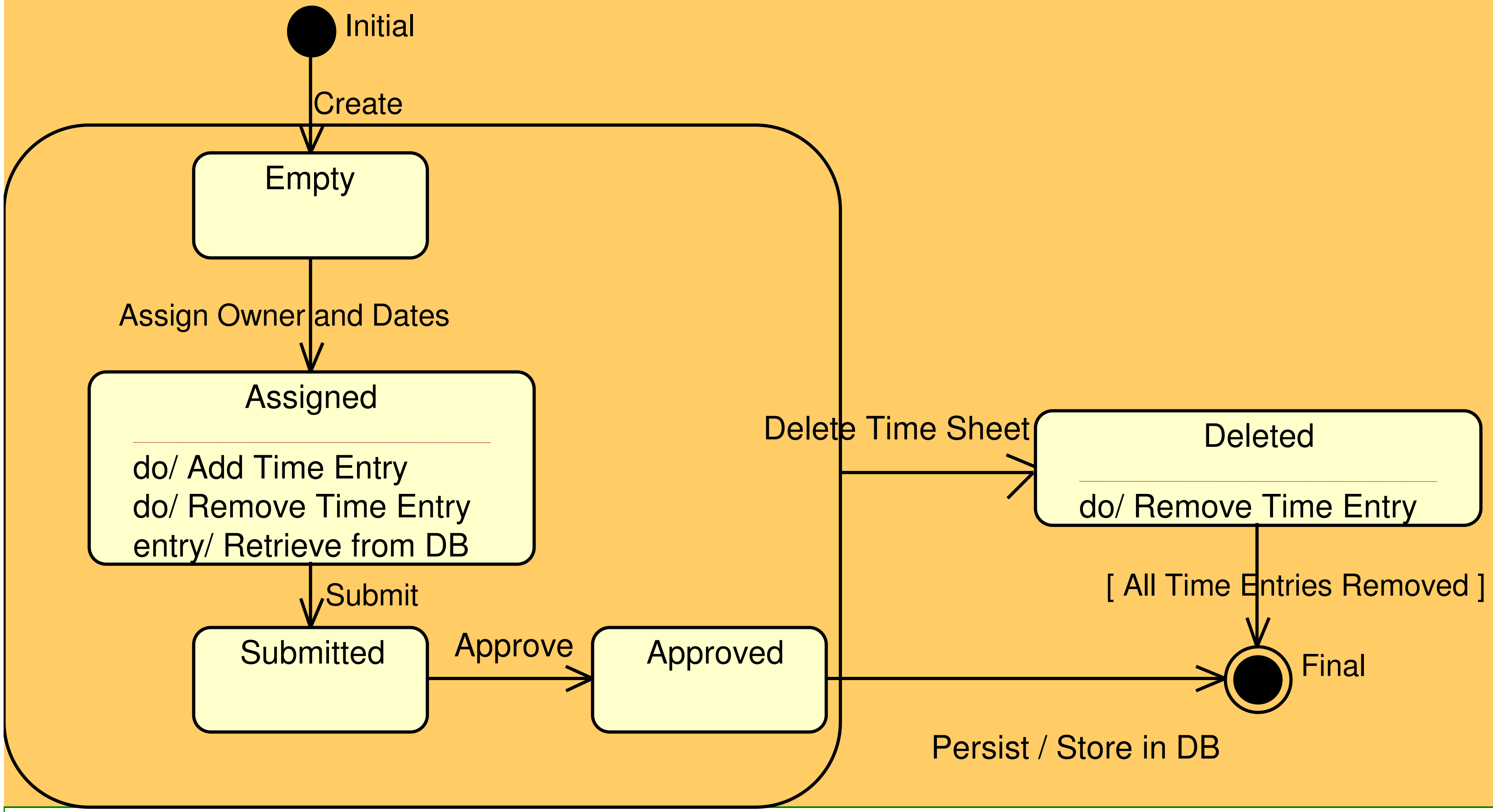
Communication Diagrams



State Diagrams



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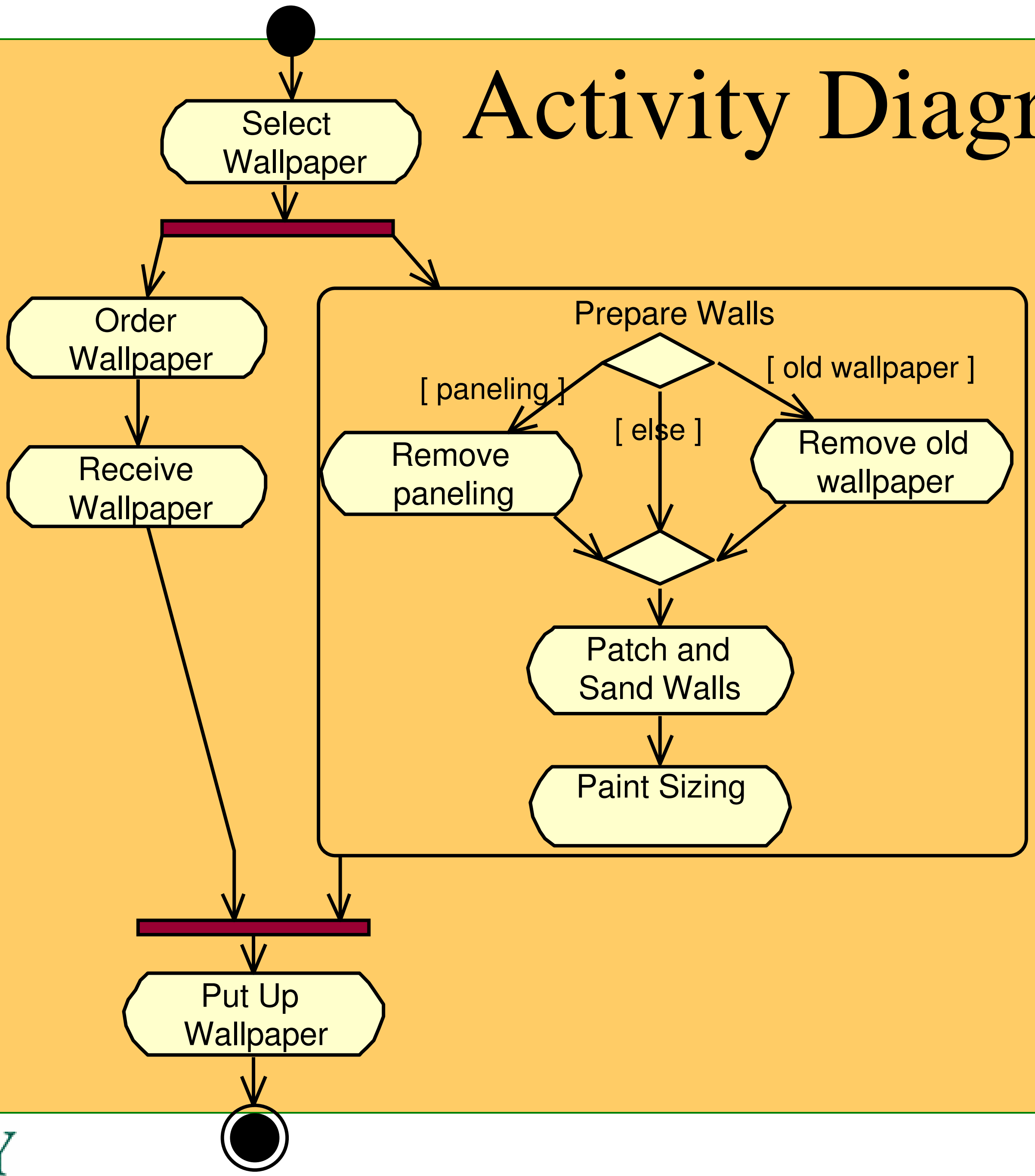
Activity Diagrams

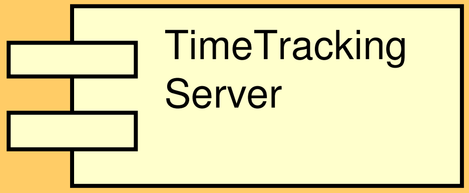


Logical View

- Describes an architecturally significant subset of the design model
- Contains a subset of classes, packages, and use-case realizations
- Concerns the functionality, behavior, use of frameworks and patterns
- Uses Class, Interaction, and State Diagrams

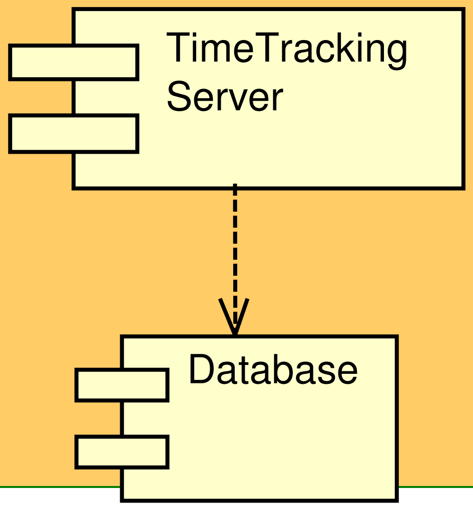
Process View

- Describes threads of control and communication between them
- Concerns the availability, reliability, scalability, performance, synchronization
- Uses Component, Class, and Collaboration Diagrams



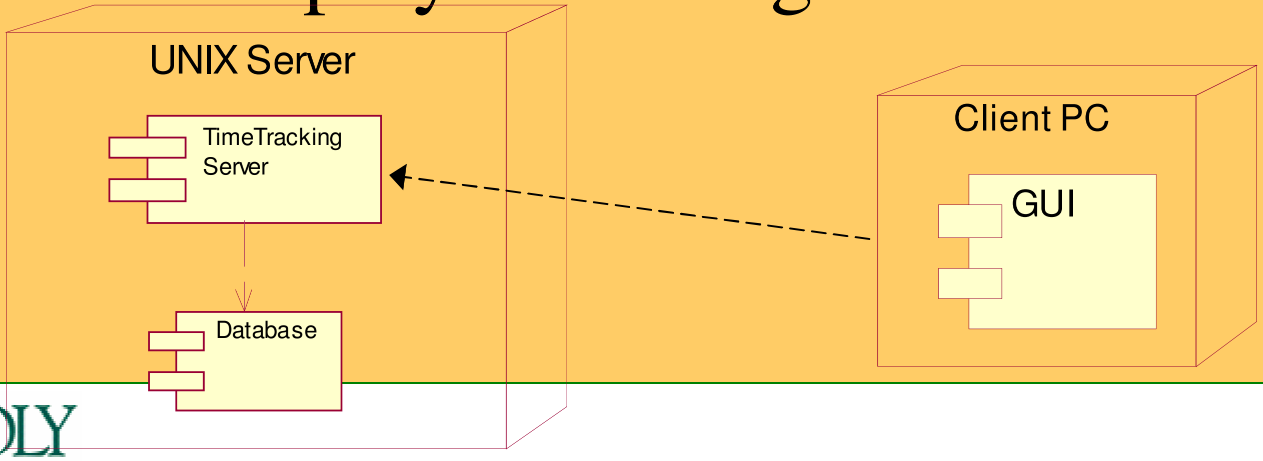
Implementation View

- Describes software component organization
- Concerns team organization and configuration management
- Uses Component Diagrams



Deployment View

- Describes physical network configurations
- Concerns the performance, throughput, fault-tolerance, availability, installation, and maintenance
- Uses Deployment Diagrams



UNIX Server
TimeTracking Server
Database
Client PC
GUI