CS5386
SOFTWARE DESIGN & ARCHITECTURE

LECTURE 3:
ARCHITECTURE TACTICS

Quality Attributes Material from:
Software architecture in Practice: Bass, Slements, Kazman

Outline for Today

- Feasibility Study Discussion
- Achieving quality attributes through tactics
- Group work
Semester Teams

- T1: Randy, Max, Kassie, Jose
- T2: Martin, Kristian, Kim, Michael (M)
- T3: Christian, Alejandro, Nadezda, Emmanuel
- T4: Damian, Adeel, Almaraz
- T5: Edgar, Mitchell, Michael (E)

Achieving Quality Attributes

- Scenarios allow for the characterization of quality attributes
- But they do not provide help on how to achieve these qualities
- Tactics do
- An architecture is a collection of tactics to achieve certain quality attributes
### Tactics

- Design decisions with known ramifications for a system’s quality attribute
- A collection of tactics is called an *architectural strategy*
- Architectural patterns and styles incorporate several tactics

#### Availability Tactics

- Detect Faults
  - Ping / Echo Monitor
  - Heartbeat
  - Timestamp
- Sanity Checking
- Condition Monitoring
- Voting
- Exception Detection
- Self-Test
- Recover from Faults
  - Preparation and Repair
  - Active Redundancy
  - Passive Redundancy
  - Spare
- Exception Handling
- Rollback
- Software Ugrade
- Retry
- Ignore Faulty Behavior
- Degradation
- Reconfiguration
- Remindation
- Shadow State
- Resynchronization
- Escalating Restart
- Non-Stop Forwarding
- Prevent Faults
- Removal from Service
- Transactions
- Predictive Model
- Exception Prevention
- Increase Competence Set

Fault Masked or Repair Made
Modifiability Tactics

- Reduce Size of a Module
- Increase Cohesion
- Reduce Coupling
- Defeat Binding

Change Arises

Split Module
Increase Semantic Coherence
Encapsulate
Use an Intermediary
Restrict Dependencies
Refactor
Abstract Common Services

Change Made within Time and Budget

Performance Tactics

- Control Resource Demand
  - Manage Sampling Rate
  - Limit Event Response
  - Prioritize Events
  - Reduce Overhead
  - Bound Execution Times
  - Increase Resource Efficiency

- Manage Resources
  - Increase Resources
  - Introduce Concurrency
  - Maintain Multiple Copies of Computations
  - Maintain Multiple Copies of Data
  - Bound Queue Sizes
  - Schedule Resources

Event Arrives

Response Generated within Time Constraints
Security Tactics

Testability Tactics
Usability Tactics

Example Use of Tactics
Fault Detection: Ping/Echo

- Component A sends a “ping” command to component B

- Component A expects an “echo” message within a predefined time

- Ping can be sent to multiple components grouped to achieve a single task
  - i.e. B can be $B_1$, $B_2$, ..., $B_n$
Requestors and responders identified (at least one of each)
- In most cases this will result in the creation of a new requestor
- Requestor (component) should have the following functionality
  - Issue a ping command and send it to appropriate components
  - Manage a timer to identify appropriate respond time
  - Receive confirmation echo (provide interface)
  - Repeat in case of success
  - Respond appropriately to lack of or delayed response
- Responder (component) should have the following functionality
  - Receive a ping command (provide interface)
  - Respond to requestor by sending a message

A tactic is usually selected because it will improve a particular QA
- More often than not the tactic will have an impact on other QA or other aspects of the same QA
- Example: Ping and Echo
  - Performance: number of messages, timeliness of detection
  - Testability: complexity, non-determinism
  - Modifiability: distributed/localized responsibility
In Class

1. Team tactics assignment
   - T1: Availability {Fault detection, Recovery Preparation/repair}
   - T4: Availability {Recovery reintroduction, prevention}
   - T2: Performance {Resource demand}
   - T5: Performance {Resource mgmt., resource arbitration}
   - T3: Security

2. Pick one tactic from the list assigned to your team and present it to the class

Plan for Next Week

- Read chapters 4&5 of Software Architecture in Practice
  - Quiz at the beginning of class
- Each team will present (using slides) the tactics related to the QA assigned on slide 15 of this presentation
- Lecture: Architecture Views
  - Module Views
Deliverable

- Power-point presentation
- Both due by 5:30 pm on Tuesday 02/27/2018 by e-mail to isalamah@utep.edu

Get to work