

Distributed Software Development

Summary

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Themes

- We've covered a lot of territory this semester, but there are several themes that have shown up repeatedly
 - Communication
 - Heterogeneity
 - Coordination and Consensus
 - Scalability and Failure

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Communication

- Communication is an essential problem in a distributed system.
 - Synchronous/asynchronous, reliable/unreliable, in-order/not in-order
 - How to sequence messages without a global clock?
 - How to request services and reply to requests?

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Heterogeneity

- Distributed system components can be heterogeneous in many ways:
 - Software
 - Operating System
 - Hardware
 - Network
 - Capabilities
 - Requirements

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Heterogeneity

- Ramifications:
 - XML, RDF, XSLT are language/platform independent
 - Service-oriented computing
 - P2P architectures account for network differential
 - Distributed problem solving
 - Integration and interoperation

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Coordination and Consensus

- This is a fundamental problem in distributed systems
- Occurs at many different levels.
 - Causality
 - Group Membership
 - Leader Election
 - Mutual Exclusion
 - Task Assignment
 - Transactions
 - Replication
 - Problem Solving

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Coordination and Consensus

- Different sorts of problems demand different solutions
- By characterizing the problem, we know whether solving this will be trivial, difficult, or impossible.
- In general, we can tolerate either failing processes or a failing network, but not both.

Scalability and Failure

- Many of the topics we've discussed are responses to failure or scalability:
 - Replication
 - Peer-to-peer
 - Leader Election
 - Group Formation

Scalability and Failure

- We've also talked about how failure and scalability can affect an algorithm's implementation.
 - Centralized bottlenecks
 - Types of failure
 - Failure detection and recovery
 - Multilateral negotiation
 - Search in large-scale networks