

Computing and Communication in the Presence of Mobility

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Mobile Computing Laboratory

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Project Team

➤ Faculty

- ❑ Gruia-Catalin Roman

➤ Doctoral Students

- ❑ Chien-Liang Fok
- ❑ Radu Handorean
- ❑ Jamie Payton
- ❑ Rohan Sen
- ❑ Octav Chipara (NSF - ITR)

➤ Doctoral graduates

- ❑ Christine Julien
(UT Austin—2004)
- ❑ Qingfeng Huang
(PARC—2003)

Recent Developments

➤ **Research results dissemination**

- ❑ 21 published papers
- ❑ 8 accepted papers

➤ **Keynote talks & invited papers**

- ❑ Abstract State Machines (ASM 2003)
- ❑ Fundamental Approaches to Software Engineering (FASE 2004)
- ❑ Software Engineering for Large-scale Multi-agent Systems (SELMAS 2004)

➤ **Planning for ICSE 2005**

- ❑ Contessa project workshop
- ❑ International research summit

Research Themes

➤ MURI Project Themes

- ❑ Interoperability
- ❑ Context-awareness
- ❑ Formal models
- ❑ Middleware

➤ WUSTL Distinct Perspective

- ❑ **Rapid development** of **dependable** applications in the presence of **mobility**

Crosscutting Aspects

- Operational environment
 - integrated treatment of logical and physical mobility*
 - ❑ Ad hoc networks — Carl
 - ❑ Sensor networks — Carl, Gul, Nalini
 - ❑ Agent systems — Gul, Nalini
- Solution strategies
 - from models and analysis to middleware and applications*
 - ❑ Focus on adaptation mechanisms — Carl, Nalini
 - ❑ Reliance on context-awareness — Carl, Nalini, Gul
 - ❑ Convergence around coordination models — Nalini
 - ❑ Formal specification and analysis — Carl, Gul, Jose

Project Evolution

➤ **Middleware for Mobility**

❑ **EgoSpaces**

- Asymmetric coordination constructs
- Transparent context maintenance
- Simplification of application development

❑ **Service Oriented Computing in Ad Hoc Networks**

[MURI Meeting Dec. 2003]

- Automated code management
- Knowledge-driven interactions
- Follow-me sessions

❑ **Mobile Agents in Sensor Networks**

- Flexible in-network reprogramming
- Autonomous processing
- Intelligent emergent behavior

Collaborative Dimensions

- **Multi-faceted collaboration with UCI**
 - ❑ Agent Systems for Sensor Networks
 - Development of autonomous agents
 - Deployment on 50 motes in the Mobilab
 - ❑ Mobile Interoperating Systems
 - Adaptable applications for grid and ad hoc networks
 - Intelligent evolution between modes
 - ❑ Access Control in Resource Poor Environments
 - Multi-level security domains

Project Evolution

- **Advanced primitives for mobile computing**
 - **Context-Sensitive Data Structures (CSDS)**
 - Language level coordination
 - Distributed data structures across ad hoc networks
 - **Context-Sensitive Binding (CSB)**
 - Context-aware resource usage
 - Decoupling of interface from realization
 - Knowledge acquisition and planning

Project Evolution

➤ Foundations for Mobile Computing

□ Algorithms

- Network Abstraction [MURI Meeting Apr. 2003]
- Mobicast
- Spatiotemporal Communication
- Disconnected Message Delivery

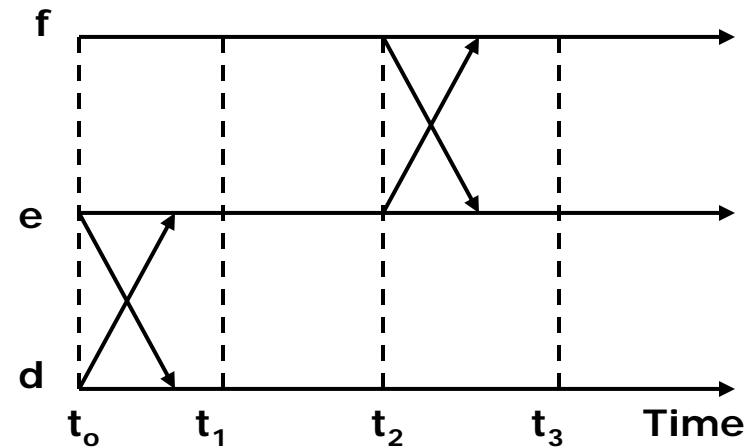
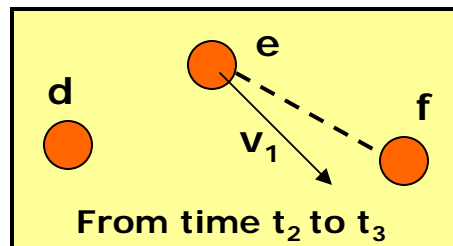
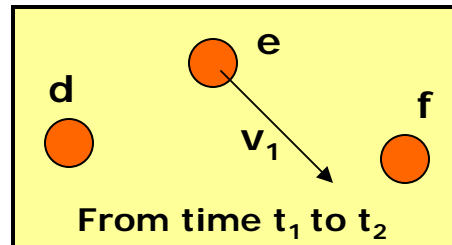
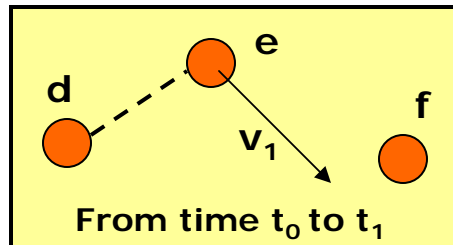
□ Formal Models

- Mobile UNITY
 - Coordination Middleware Semantics
 - Coordination Schemas
- Context UNITY [MURI Meeting Jun. 2004]

Feature Presentation

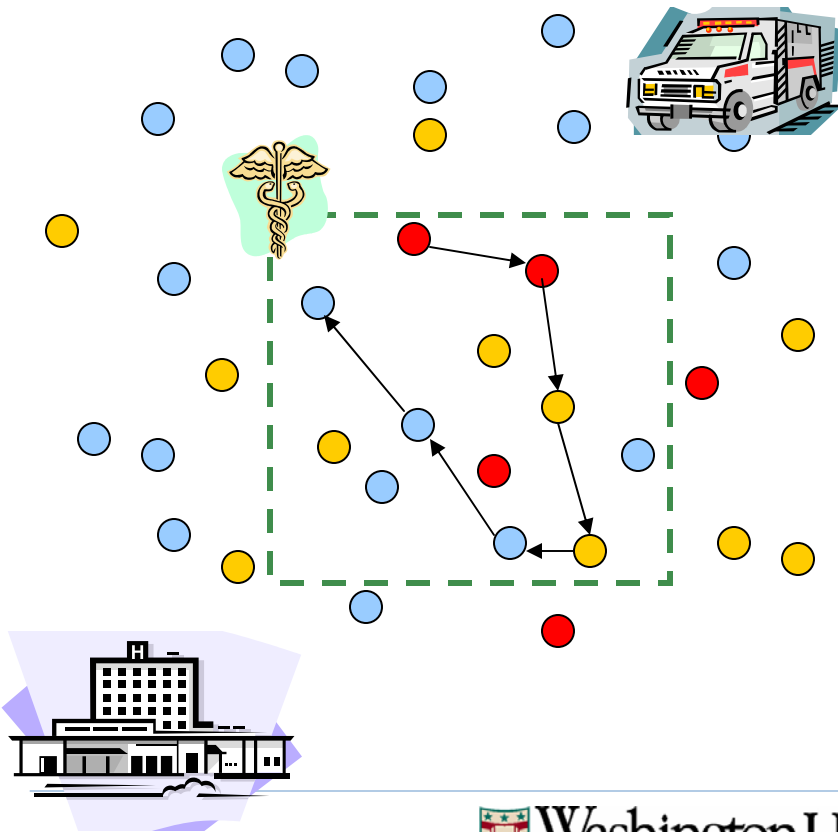
An Agent-Centered Perspective on Context-Aware Computing

Disconnected Message Delivery

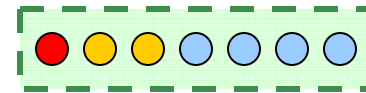


Context-Sensitive Data Structures

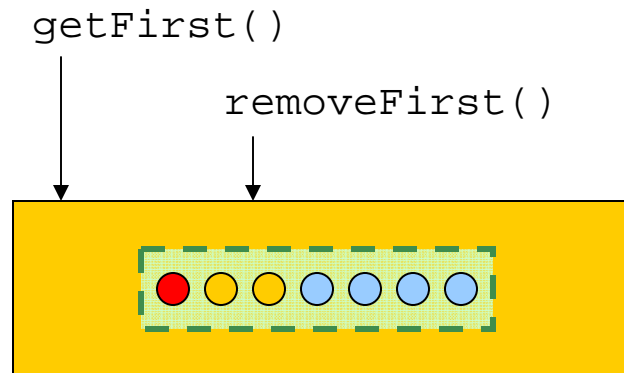
Dynamic Context



Logical View



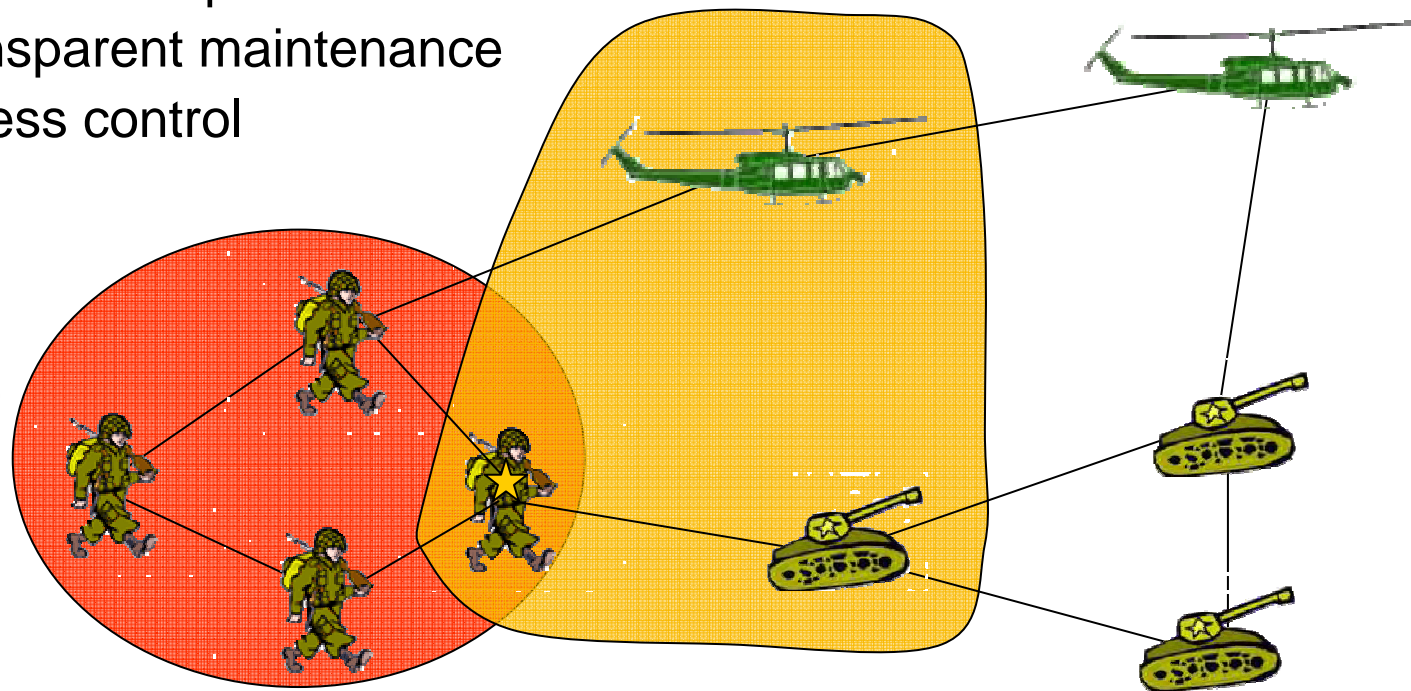
Programmer's Perspective



EgoSpaces

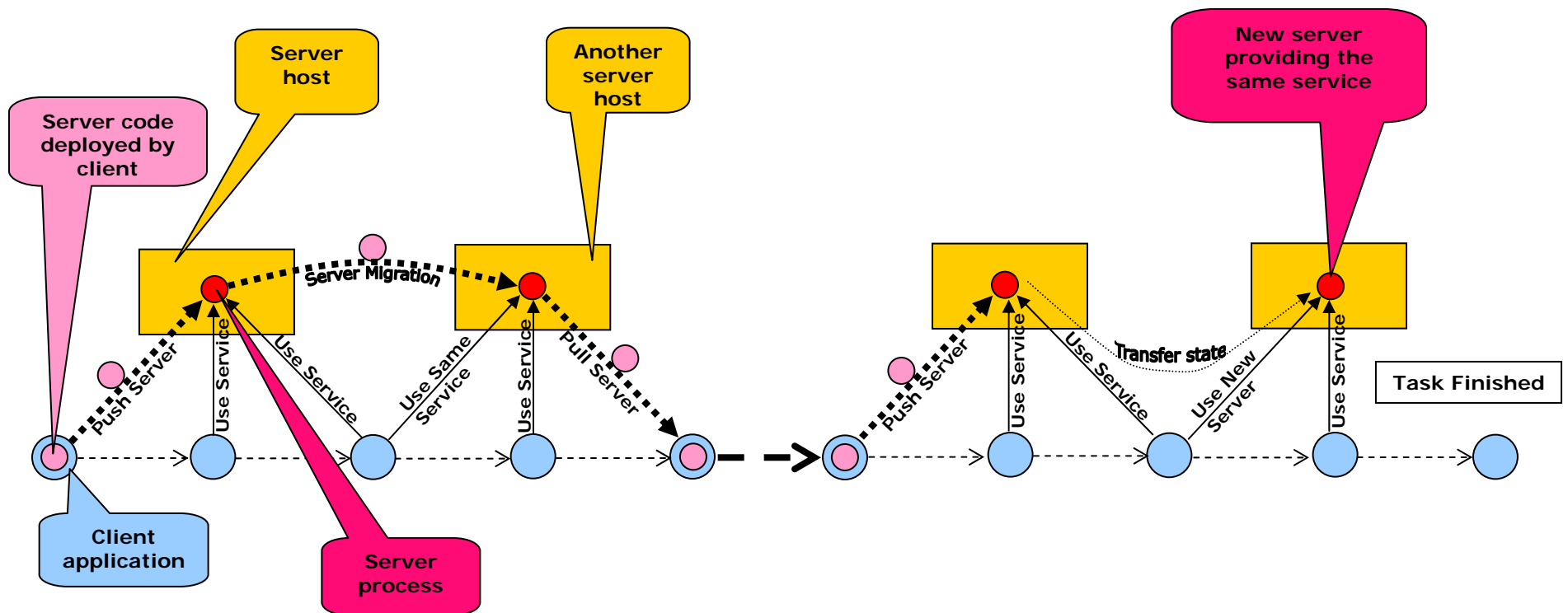
➤ Asymmetric coordination middleware

- ❑ Personalization
- ❑ Declarative specification
- ❑ Transparent maintenance
- ❑ Access control



Service Provision in Ad Hoc Networks

- “Follow-me” session management



Agent Coordination in Sensor Nets

