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Emergence of Composite Services in Smart Environments

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Opportunistic Software Composition

Connected objects in an ambient environment

User
Constant mobility
Unpredictable needs
Services
Unpredictable availability

Environment
Uncertain
Highly unstable

How to provide a working and relevant composite service?
How to let the user manipulate an emergent service?

Opportunistic Composition Engine “OCE”

Principles
- Environment-directed service composition
- Emergence of new composite services adapted to the context and the user
- Dynamic and continuous adaptation
- Learning by reinforcement
- Decentralized and automatic decision
- Integration of new appearing services

Artificial Intelligence & Learning
Multi-Agent System
Announcement-based interaction protocol
Binding decision and feedback to the agent

Interactive Control Environment “ICE”

Generate feedback from the user’s actions
Let the user modify and edit the emerging service or create one from the available components

Methods and Tools
- Domain Specific Languages (DSL)
- Model-Driven Engineering (MDE)
- Model transformations
- Eclipse Modeling Framework, GEMOC

Current status
- Operational prototypes of OCE and ICE
- Demonstration of simple use cases with real connected objects
  - Arduino, Android, Node.js, WComp...

Future Work
- Consolidation of the learning mechanism in OCE
- Interface adaptation to the user
- Feedback generation by ICE
- Feedback exploitation by OCE
- Full integration of OCE and ICE
- Scalability assessment