

Project Overview

Computer networks are becoming more common and more diverse; they are moving away from the office environment, where they can be controlled with relative ease, into everyday user devices, homes, and automobiles.

The multitude of uses and environments these networks are operated in lead to components that are increasingly heterogeneous and complex. Currently these systems describe similar data in different ways, creating a semantic barrier to interoperability, integration of these diverse components is now an intricate exercise beyond the average user's capability.



Fig. 1. The market

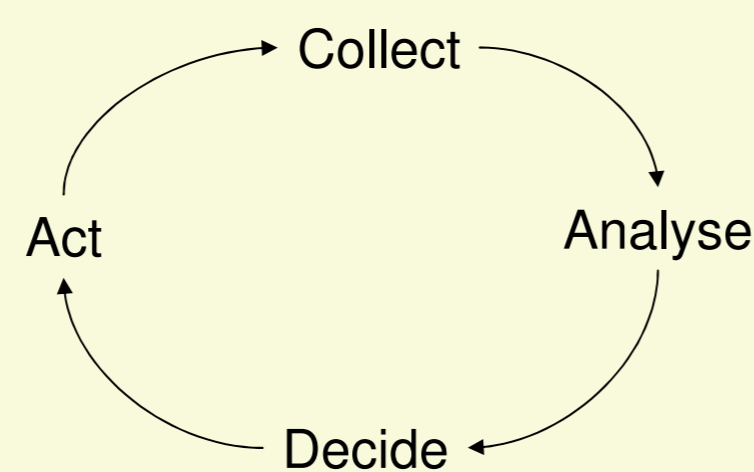


Fig. 2. The autonomic life cycle

The Automotive sector has been chosen as the domain in which this project will be applied; there are a number of interesting issues associated with the automotive industry, including computationally constrained devices, real-time computing, and the potentially massive networks that can be instantiated.

“Anyone hoping to test-drive a new car must first endure a training session to master the dashboard...” – The Economist, *Strap in and boot up*, August 24 2006

Solution

- ❑ Autonomic middleware capable of self-* properties
- ❑ Semantic model of automobiles and their components
 - The semantic model will enable a broadening of the information envelope, enabling autonomic agents to more accurately asses situations and therefore be less prone to errors
- ❑ Adhere to the automotive industry's open standards currently being developed (in particular Flexray and AUTOSAR)

Test Platform

- ❑ Soekris Engineering Net 4801-60 Boards

- CPU: 233MHz
- RAM: 256MB
- 3 Ethernet, 2 Serial, and USB
- IDE Connector and CF slot
- Chosen as they resemble the processing power available in many automotive components



Fig. 3. Soekris board

To ascertain the hardware's suitability to run reasoning agents, a reasoning engine will be installed onto a number of Soekris boards along with Construct, which is a decentralised context aggregation infrastructure. Initially, sensor and context data will be simulated, and the reasoning capabilities will be increased until the test platform lacks CPU cycles to adequately complete the tasks.

State of the Art

- ❑ Technology within the automotive domain is rapidly advancing
 - ABS ⇒ ASR ⇒ ESP
 - Increasing intercommunication within the car, enabling more informed decisions
 - Drive-by-wire
 - Toyota Prius, first production car with electronic throttle control
 - User devices, e.g. mobile phones, PDAs, MP3 players, must also be integrated
- ❑ The automotive industry is moving towards open shared standards, that are produced collaboratively
 - Flexray, GST/ERTICO, AUTOSAR
- ❑ The hardware used is frequently similar in processing power to a low-end PDA
- ❑ Autonomic computing offers the ability to integrate all these heterogeneous systems without user interaction
 - e.g. self-configuring components and compositions of components
- ❑ Autonomic systems consist of distributed, decentralised constituent elements that 'know' their context
 - Adding a semantic layer to data; creating information

Traditional Validation Methods

- ❑ Validating traditional systems is relatively easy because:
 - The network topology will not change rapidly
 - Determinism exists within the system
 - The consequences of a failure can be anticipated at the design stage
- ❑ Validating the semantics of single systems can be automated

Validating Autonomic Systems

- ❑ Validating autonomic systems is non-trivial
 - Deterministic guarantees are replaced by probabilistic ones
 - Autonomic agents do not all share the same information
- ❑ One agent's actions can affect many others, altering an entire system
- ❑ Bounds must be determined and enforced within the system
- ❑ A potential validation method is to model and analyse the complete adaptive space a priori for conflicts
- ❑ Combining different semantic views automatically is still a research topic

Relevant Publications

Simon Dobson. Autonomic networking: Achieving stability in the face of pervasive uncertainty. Keynote presentation at Autonomic Networking, Paris, September 2006.