Reflection, Self-Awareness and Self-Healing in OpenORB

Gordon Blair, Geoff Coulson, Lynne Blair, Hector Duran-Limon, Paul Grace, Rui Moreira and Nikos Parlavantzas

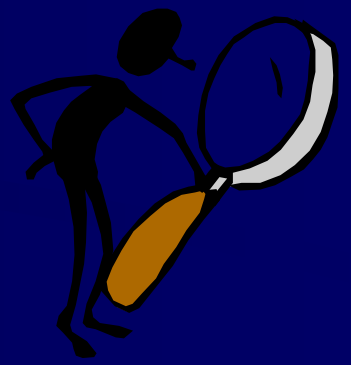
Distributed Multimedia Research Group,
Computing Department, Lancaster University, UK

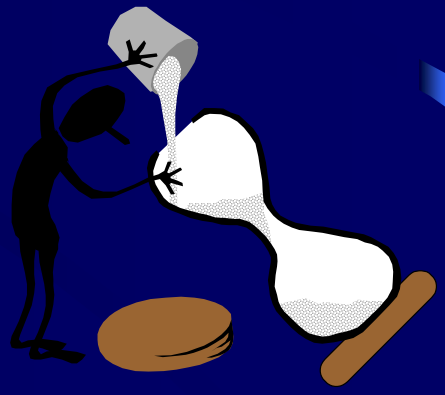
Introduction

- What does self-healing mean to you?
  - Potential to mask failure, overcome environmental changes, manage changing user needs …
  - Specifically overcoming these in middleware
- Properties of a self-healing middleware?
  - ***Openness*** i.e. Access to underlying infrastructure
  - Ability to ***reconfigure*** structure at run-time
  - Maintain ***integrity*** of a running system
- Self-healing Middleware (OpenORB)
  - Reflective middleware that can support self-healing systems

Why Reflection?

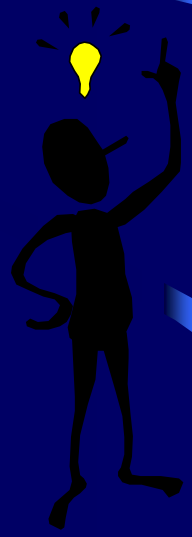
- Support for introspection
  - The ability to inspect the structure and behaviour of the system
    - e.g. dynamic monitoring or accounting
- Support for adaptation
  - Short term dynamic re-configuration
    - e.g. changing protocol configuration
  - Longer term evolution
    - e.g. adding new multimedia service





The Open ORB Architecture: A Marriage of Three Technologies

- Components
  - Apply component-oriented programming at base and meta levels
- Reflection
  - Use reflection to access structure and behaviour of the underlying middleware platform
  - Four meta-models (Interface, Architecture, Interception and Resource)
- Component Frameworks
  - Domain-specific ‘life-support environments’ for plug-in components



Application Areas

- *Multimedia* - adaptive stream bindings
- *Mobile Computing* – dynamic protocol configuration to overcome heterogeneity and environment's limited resources
- *The NETKIT Project* - application of Open ORB principles to programmable networks
- Other areas
  - Grid computing
  - Co-operative scientific visualisation
  - Distributed virtual environments
  - Digital libraries

Self-Adaptation in OpenORB

- Inject components for monitoring and adaptation

Monitoring	
Event Collector	Observe behaviour of underlying functional components and generate relevant QoS events.
Monitor	Collect QoS events and report abnormal behaviour to interested parties.
Control	
Strategy Selectors	Select an appropriate adaptation strategy (i.e. strategy activator) based on feedback from monitors.
Strategy Activators	Implement a particular strategy, e.g. by manipulating component graph.

Other Issues

- Self-Healing algorithms
  - Less reliance on static strategy selection
- Larger scale self-healing systems
  - Ideas concentrate on middleware platforms