CORBA, MinimumCORBA, MinatureCORBA, microCORBA: How low can we go? How low must we go?

A Position Paper By

A. David McKinnon, David E. Bakken, John C. Shovic

SRES Laboratory
School of Electrical Engineering & Computer Science
Washington State University

CORBA

- Well suited to enterprise computing
- Separates the interface from the implementation
- Encapsulates
  - Communications protocols
  - Processing environments
- COTS implementations exist

Existing CORBA Specifications

- MinimumCORBA
  - Removes support for dynamic interfaces, etc
  - Reduces the memory footprint of an ORB
- Real-time CORBA
  - Provides tools to better predict time delays
  - Enables hard real-time CORBA applications

Is microCORBA Needed?

- Embedded Systems
- Cost
- Security
- Future Directions
  - QoS
  - Components

Embedded Systems Market

- Large embedded systems
  - Aircraft
  - Automobiles

- Medium sized embedded systems
  - PDA's (e.g., PalmOS, WinCE)

- Small
  - "Dick Tracy" wrist-watch

  - Distributed networks of disposable sensors
  - Home appliances

Size of the Market

- 11 Billion parts per year
- Application volume varies
  - High volume
    - Automobiles
    - Cable TV set-top boxes
  - Low volume
    - Satellites
    - Research equipment

www.pnl.gov

PNNL Air Sampler Example

- Designed by the U.S. DOE for the CTBT distributed sensor network
- Connectivity
  - Data transmission via e-mail
  - User interface is CORBA based
- Large ORB reduced flexibility
  - Limited the number of remote users

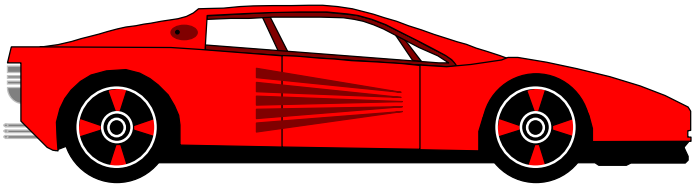
Radionuclide Aerosol Sampler/Analyzer

The Network is Coming

- *Embedding the Internet*, CACM, May 2000
  - Smart building materials, wireless computing, smart pills, dog collars, street lights, …
- Wireless computing
- Home Networks/Smart Homes

Pennies Count

- Would you rather have a new car?



$20,000 - $60,000

- Or a penny for every new car produced this year?

$200,000+

(i.e., 20+M cars/year)

Smaller is Better

- "System on a chip"
  - Constrained resources
  - On-chip RAM/ROM is expensive
  - Examples
    - Single-chip radio (Lucent)
    - Physically smaller (4x) network switch (Siemens)
- Enabling factor for intelligent sensors

Intelligent Sensors

- Sensor Networks
  - Environmental monitoring
  - Home alarm system
  - Wildlife research
- Disposable/One-Time Use
  - Hazardous environments
  - Battlefield deployment
  - Or simply inexpensive enough to leave behind!

Security & Reliability

- Benefits of a smaller code base
  - Easier to inspect / understand
  - Easier to model
    - See “Proving Security and Reliability Attributes for Distributed Real-Time Systems using Meta Object Models” by Shovic, McKinnon, Bakken

It’s Not Just the Memory

- Several small ORBs already exist
  - legORB — UIUC, ~ 6 Kb Client IIOP engine
  - e*ORB — Vertel, < 60 Kb ORB
  - ORBlite — HP Labs
- There are other resources/constraints that need to be managed and/or optimized

Help the Developer

- Add QoS
- Add Configurability
- Provide CASE tools
  - Not everyone will be an expert

Quality of Service

- QoS properties
  - Latency/Throughput
  - Security constraints
  - Real-time
  - Fault tolerance
- New resource issues
  - Power awareness

Configurability

- Each embedded system is slightly different
- Not everyone will need the kitchen sink
- Let the developer pick and choose
- Configure QoS properties, too

CASE Tools

- Not all developers are created equal
- Make it easy for the casual programmer
  - Domain expert, QoS novice
  - Lifecycle support personnel
  - Temporary/contract employees
- Let the tools choose compatible components based upon
  - QoS requirements
  - Resource configuration

Conclusions

- microCORBA is needed
  - Reduces costs
  - Enhances reliability & security
  - Allows standards-based connectivity to the deeply embedded systems market
- Further work is also needed
  - QoS components
  - CASE configuration tools