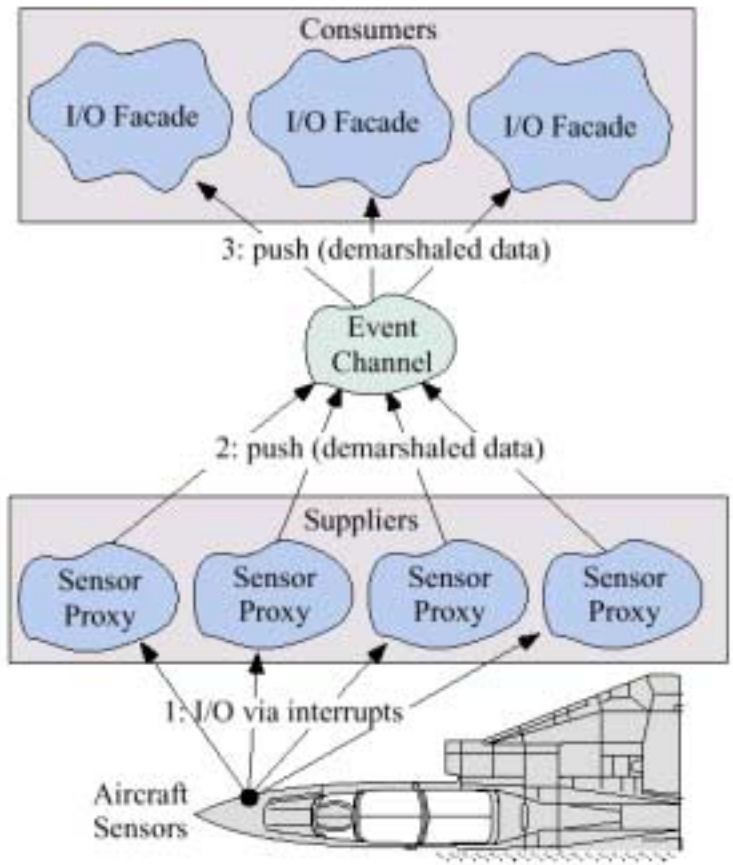
The Design and Performance of Real-time CORBA Event Services

Carlos O'Ryan

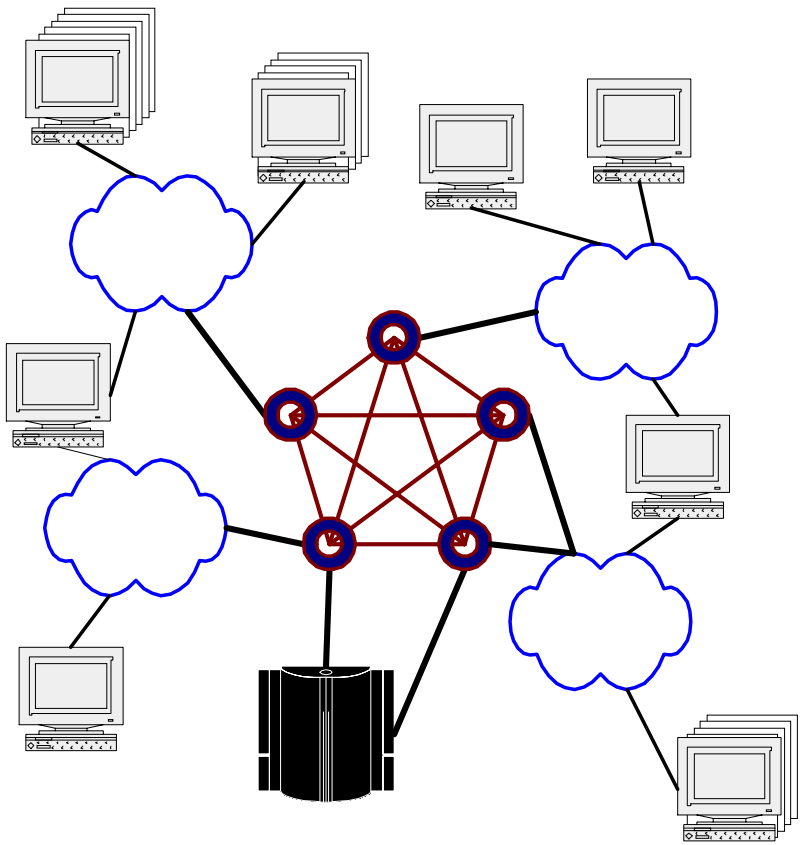
June, 2001

Motivation: Applying CORBA to Real-time Avionics



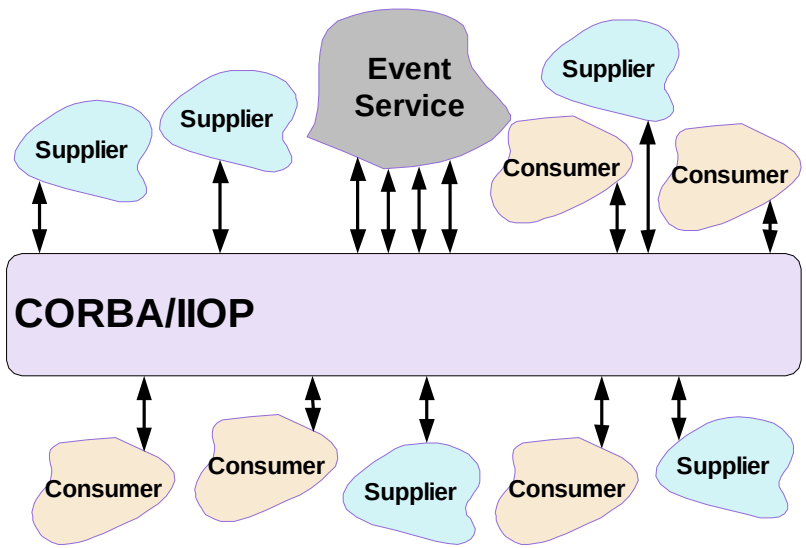
- Typical interactions:
  - I/O arrives
  - Proxies demarshal data
  - Facades process data
- Advantages
  - Anonymous consumers and suppliers
  - Asynchronous event delivery
  - Centralized filtering and scheduling

Motivation: Applying CORBA to Distributed Interactive Simulation



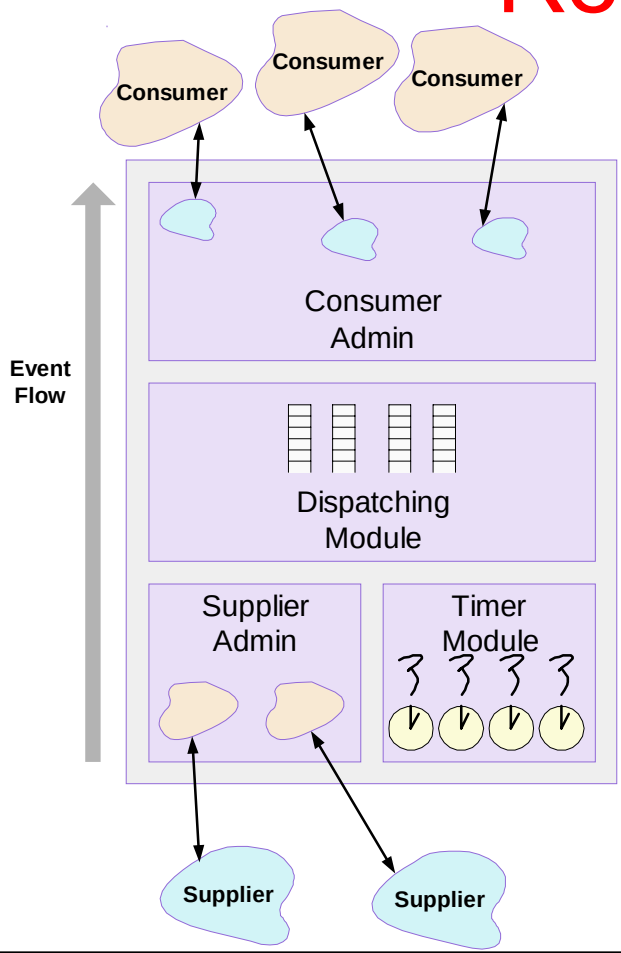
- Typical interactions:
  - Large number of hosts
  - Widely distributed
  - Large number of events
- Why CORBA?
  - Reduced development costs
  - Standards based

Limitations of Traditional Event Services



- High Latency:
  - Two network traversals per message
- Poor scalability:
  - Event Service host must process all requests
- No support for Real-time
  - No filtering
  - No support for priorities
  - Implementation can have unbounded priority inversions

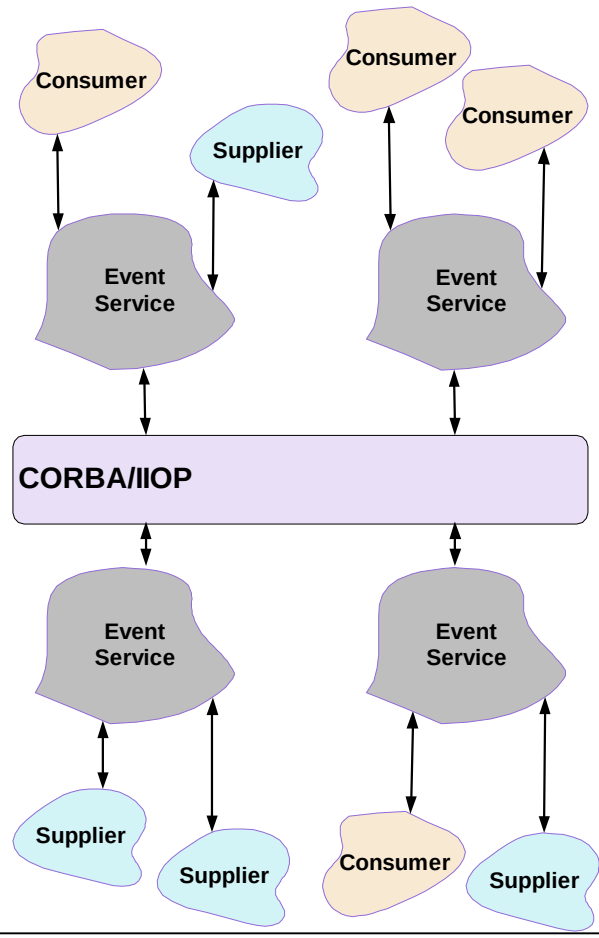
Extensions to Support Real-time Requirements



- Extend event types to support filtering
  - Consumers declare types of interest
  - Suppliers declare event types published
- Consumers can register for periodic events
- Dispatching is done in priority order
- Internal data structures avoid unbounded priority inversions

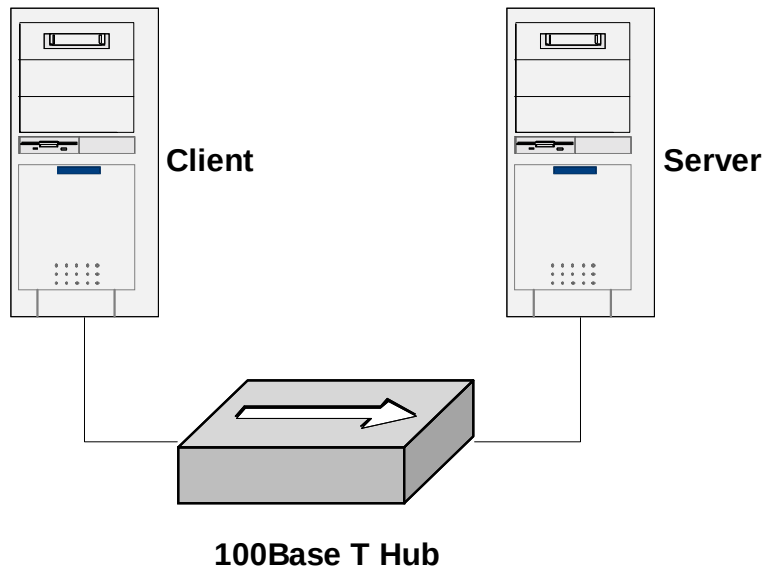
Using Federations to Reduce Latency and Improve Scalability

- Multiple Event Services are connected to for a Federation
  - Minimal latency for collocated consumer- supplier pairs
  - Worst case latency: single network traversal
  - Improved scalability due to reduced network traffic
- Replacing IIOP with a multicast protocol can improve scalability even further

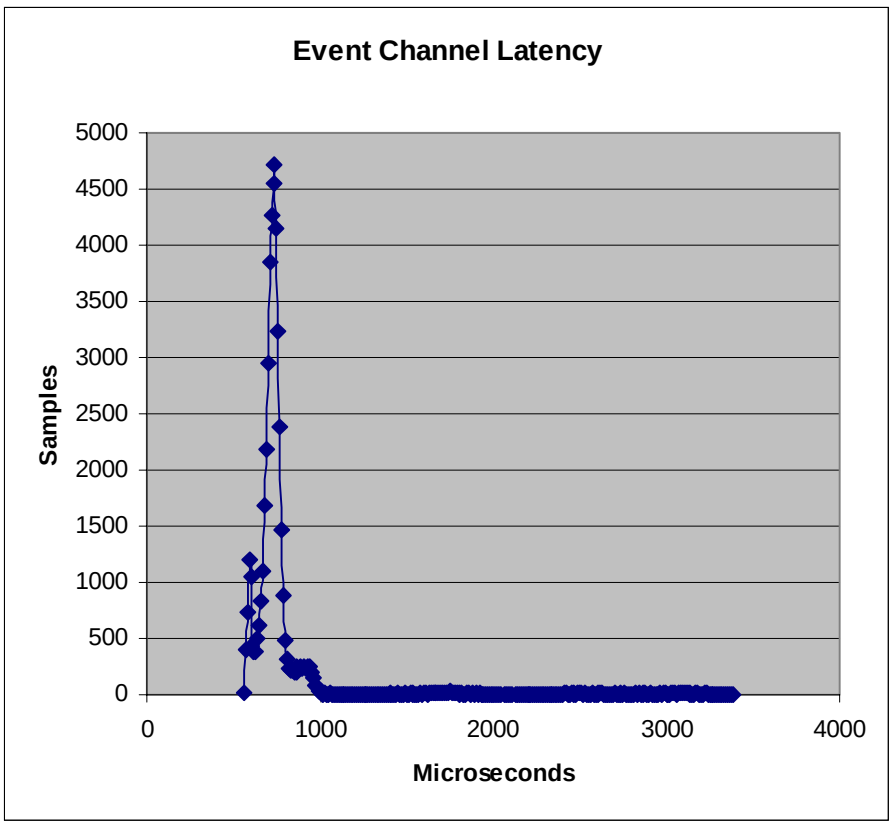


Empirical Results: Testbed

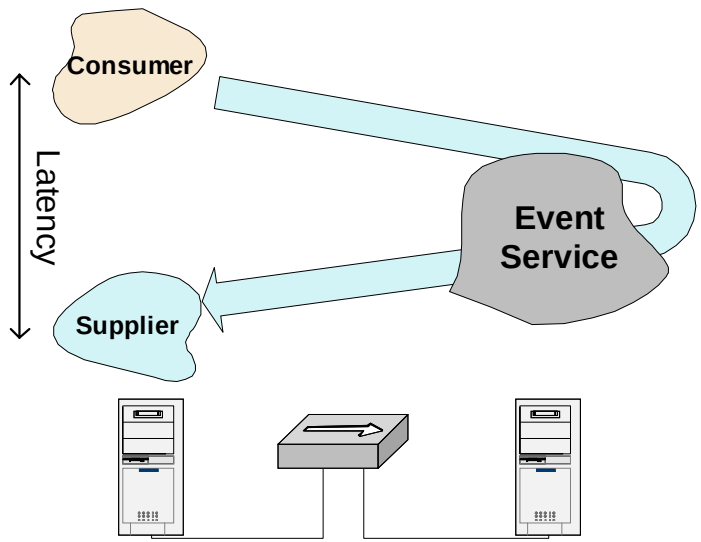
- Hardware configuration:
  - Dual Pentium III @ 700Mhz
  - 256Kb Cache
  - 512Mb RAM
  - 100BaseT NIC and Hub
- Software configuration
  - TAO v.1.1.15
  - gcc-2.95.2 (-O3, static)
  - RedHat Linux 6.2 (2.2.14 kernel)



Event Channel Latency



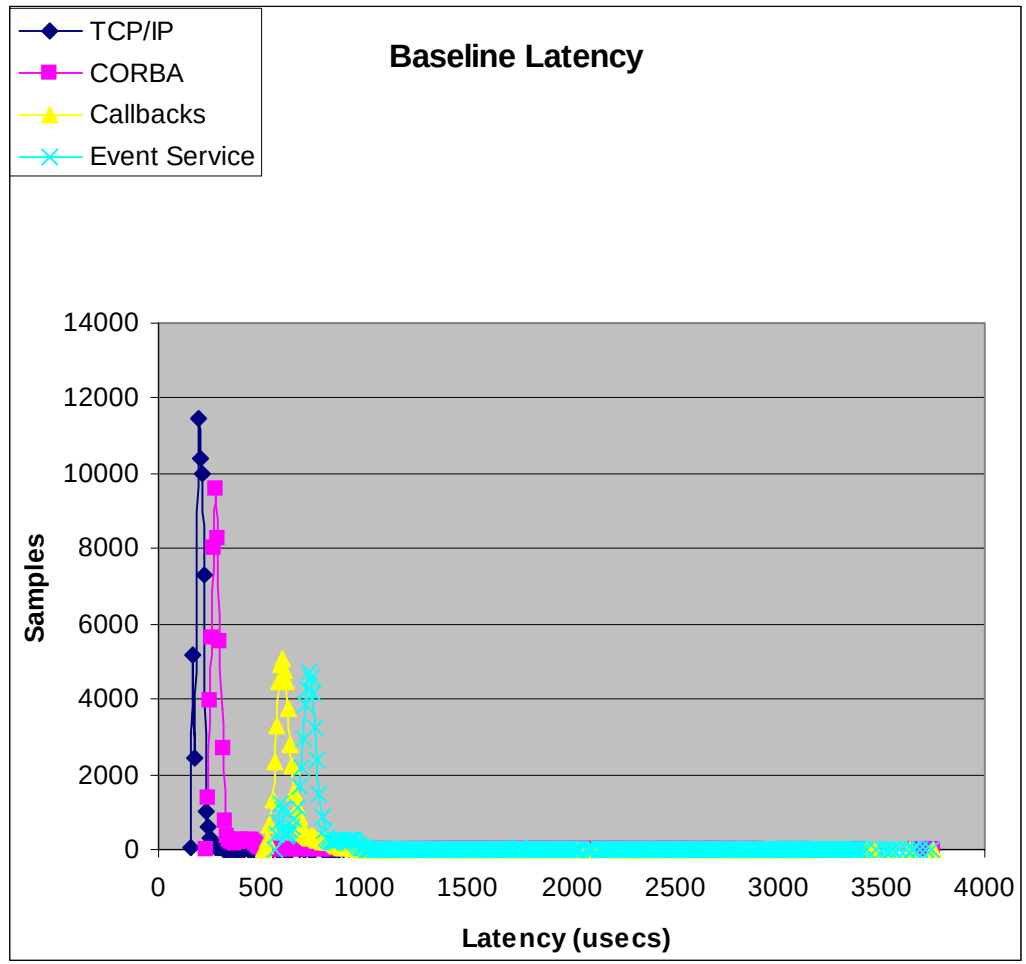
- Main results:
- Latency 784 usecs
- Jitter 48 usecs
- 99.9% below 3380 usecs



Identifying Sources of Overhead

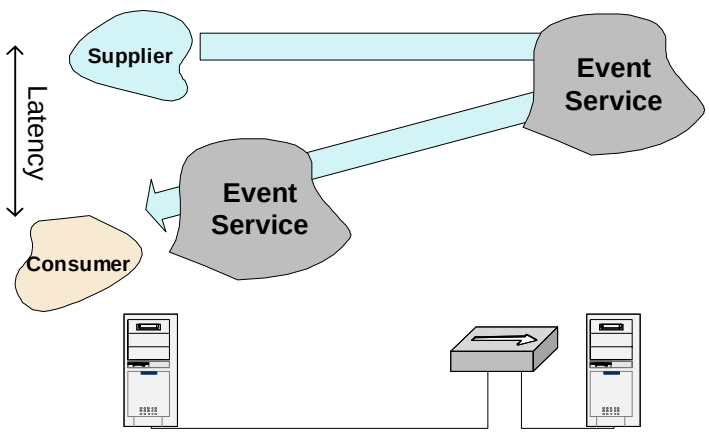
- Contrast with
  - TCP/IP
  - CORBA Requests
  - CORBA Callbacks

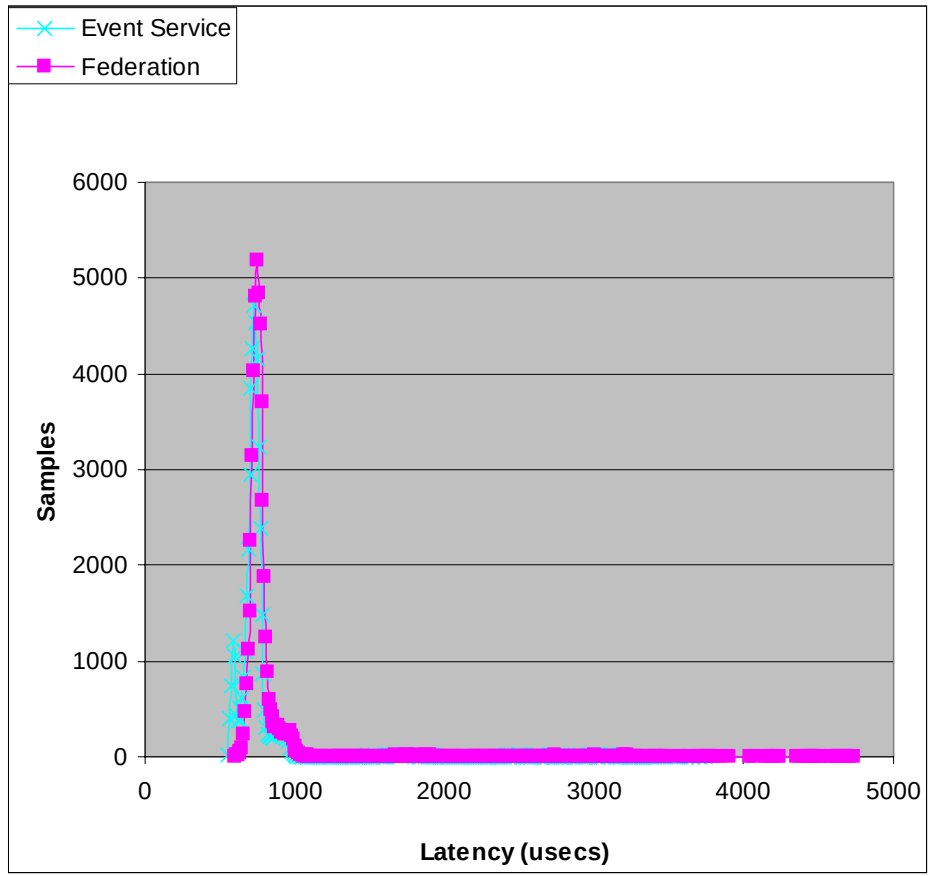
	Latency (usecs)
TCP/IP	224
CORBA	315
Callback	641
Event	784



Federation Latency

- The **roundtrip** latency is comparable to a normal event channel (803 usecs)
- However the **oneway** latency is significantly smaller
  - Estimated 650 usecs





Concluding Remarks

- The Real-time properties of a CORBA Event Service are largely an implementation detail
  - But the interface lacks a number of fundamental features
  - Both the Notification Service and our extensions overcome those problems
- CORBA Event Services can minimize network overhead using:
  - Federations
  - Multicast protocols
- More information available from
  - http://doc.ece.uci.edu/~coryan/EC/
  - http://ace.cs.wustl.edu/Download.html