Assessment of Distributed Object Middleware

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Background

*Sept ’98 (15 mos): Joint project GSFC/ARC/SJ SU - ECS Distributed Object Middleware & Alternative Technology*
  - *Nov ’98 (18 mos): grant to SJ SU – Assessment of Distributed Object Middleware*

*Objective:* Technology assessment & performance evaluation of alternative technology to OODCE within EOSDIS
Tasks

- Develop test environment
- Examine ECS Middleware
- Analyze Subscription Server & Design alternative
- Investigate alternatives to OODCE/DCE interface
- Investigate alternatives to CDS - using LDAP
- Evaluate CORBA/DCOM bridges
- Evaluate CORBA/DCE bridge

http://www.engr.sjsu.edu/fatoohi/eosdis
Develop test environment

- Acquired & installed DCE, OO-DCE, CORBA, ECS IDLs, … at SJ SU

- Lab has Solaris (UltraSPARC II), NT (Pentium II), AIX (RS6000) machines
Examine ECS Middleware
(D. McNab, R. Fatoohi, T. Lasinski)

- Observations on ECS:
  - Problems w/ DCE: non O-O, complexity, …
  - Lack of abstraction model
  - Lack of COTS usage

- Future Directions:
  - Hard to extract DCE due to crosstalk & abstraction violation
  - Replacement w/ non COTS component
  - Replacement w/ COTS – CORBA

http://www.engr.sjsu.edu/fatoohi/eosdis/mcnab.html
Analyze Subscription Server & Design Alternative
(R. Maheshwari & R. Fatoohi)

- Analyzed ECS Subscription Server
- Designed & implemented subscription server based on OMG Notification Service
  - Uses Structured Push Style communication
- Tested for Auction Alert System

http://www.engr.sjsu.edu/fatoohi/eosdis/Subscription.pdf
Main Features of Designed Subscription Server

- Push Type Communication Model
- Structured Events
- Event Forwarding Filters
- QoS properties: Connection Reliability & Event Reliability
- Admin properties: MaximumSuppliers, MaximumConsumers & MaximumQueueLength
- In memory persistent objects
- Ability to restore state
- An advertiser which advertises offers made by suppliers & subscriptions made by consumers
Subscription Server Architecture

EVENT FLOW
FILTER OBJECT
DATABASE OBJECT
Investigate alternatives to CDS
(S. Ahmed & R. Fatoohi)

- Evaluated Triangulum bridging products that allow replacing CDS w/ LDAP
- Using LDAP as generic Naming & Directory Service to replace others: CORBA Naming, RMI Registry & CDS
  - Develop CDS Service Provider Interface API as plug-in to JNDI 1.2 API
  - Testing using online bill payment system
    http://www engr sjsu edu/fatoohi/eosdis/jndi_ldap_java.html
DCOM/CORBA Bridges
(Q. Wang, C. Zheng & R. Fatoohi)

- 2 bridges: ObjectBridge by Visual Edge & OrbixCOMet by IONA
  - Both bi-directional & dynamic
- NT 4.0 w/ Pentium II 233 MHz, 128 MB
- C++(both), Java & Applet (ObjectBridge)
  - Same language for both client & server
- Count: Invokes method to increment variable 1000 times & measures average response time
- C: Client, S: Server, B: Bridge; X, Y, Z: 3 machines; all results in milliseconds.
## ObjectBridge C++ Client & Server

<table>
<thead>
<tr>
<th></th>
<th>CORBA Server</th>
<th>DCOM Server</th>
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<tbody>
<tr>
<td><strong>CORBA</strong></td>
<td></td>
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<tr>
<td><strong>C &amp; S on X</strong></td>
<td><strong>0.397</strong></td>
<td><strong>C, B &amp; S on X</strong>: <strong>1.525</strong></td>
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<tr>
<td><strong>C on X, S on Y</strong></td>
<td><strong>0.991</strong></td>
<td><strong>C &amp; B on X, S on Y</strong>: <strong>1.604</strong></td>
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<tr>
<td><strong>C on X, B &amp; S on Y</strong>: <strong>0.841</strong></td>
<td></td>
<td><strong>C on X, B &amp; S on Y</strong>: <strong>1.702</strong></td>
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<td><strong>D COM</strong></td>
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<tr>
<td><strong>C &amp; B on X, S on Y</strong>: <strong>1.141</strong></td>
<td></td>
<td><strong>C on X, S on Z</strong>: <strong>1.834</strong></td>
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<tr>
<td><strong>C on X, B &amp; S on Y</strong>: <strong>1.082</strong></td>
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<tr>
<td><strong>C on X, B on Y, S on Z</strong>: <strong>1.191</strong></td>
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<td><strong>C</strong></td>
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DCOM/CORBA Bridges: Observations

- ObjectBridge is faster than OrbixCOMet
- Each bridge adds ~ 0.5 ms overhead
- In general, C++ outperforms Java
- Bridge location impact is insignificant
- Java Applet is slow

http://www.engr.sjsu.edu/fatoohi/Bridge.pdf
DCE/CORBA Bridge
(V. Gunwani & R. Fatoohi)

- DCE-CORBA bridge by Inprise
- Unidirectional: CORBA client -> DCE server
- Acts as CORBA server (<= CORBA client) & DCE client (=> DCE server)
- Supports VisiBroker ORB only
- Generates CORBA IDL from DCE IDL
- Solaris 2.5, UltraSPARC IiI 333 MHz, 128 MB
- Client language: C++, Java, Java Applet
## DCE-CORBA Bridge

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<tr>
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<th>DCE Server</th>
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<th>CORBA Server</th>
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<tbody>
<tr>
<td><strong>DCE C</strong></td>
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<tr>
<td><strong>C</strong></td>
<td>C, B &amp; S on X: 0.698</td>
<td>C on X, S on Y: 1.089</td>
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<tr>
<td><strong>C++</strong></td>
<td>C, B &amp; S on X: 7.832</td>
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<td>C &amp; S (C++) on X: 0.583</td>
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<tr>
<td><strong>CORBA C</strong></td>
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<tr>
<td><strong>C, B &amp; S on X:</strong></td>
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<tr>
<td><strong>C on X, S on Y:</strong></td>
<td>C &amp; B on X, S on Y: 7.996</td>
<td>C on X, S (C++) on X: 0.583</td>
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<tr>
<td><strong>Java</strong></td>
<td>C, B &amp; S on X: 8.334</td>
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<td>C &amp; S (Java) on X: 1.472</td>
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<tr>
<td><strong>CORBA C</strong></td>
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<td><strong>C, B &amp; S on X:</strong></td>
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<tr>
<td><strong>C on X, S on Y:</strong></td>
<td>C &amp; B on X, S on Y: 8.271</td>
<td>C on X, S (Java) on X: 1.472</td>
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<td><strong>C on X, B &amp; S on Y:</strong></td>
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<td>C on X, S (Java) on Y: 1.401</td>
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<td><strong>Java applet</strong></td>
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<tr>
<td><strong>CORBA C</strong></td>
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<td><strong>C, B &amp; S on X:</strong></td>
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<td>C &amp; S (Java) on X: 4.373</td>
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<td><strong>C on X, B &amp; S on Y:</strong></td>
<td>C on X, B &amp; S on Y: 28.161</td>
<td>C on X, S (Java) on Y: 25.807</td>
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<td><strong>C on X, B on Y, S on Z:</strong></td>
<td>C on X, B on Y, S on Z: 29.661</td>
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DCE/CORBA Bridge: Observations

- Delay through bridge: 7 ms
- CORBA IIOP is bit faster than DCE RPC
- C++ faster than Java & much faster than Java Applet
- Bridge location impact is insignificant

http://www.engr.sjsu.edu/fatoohi/eosdis/Vandana.pdf
<table>
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<th>OODCE-CORBA Bridge</th>
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<tr>
<td><strong>OODCE Server</strong></td>
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<td><strong>OODCE Client</strong></td>
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<tr>
<td><strong>C++ CORBA Client</strong></td>
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<td><strong>Java CORBA Client</strong></td>
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Alternatives to OODCE/DCE interface
(D. Jensen, S. Gawai & R. Fatoohi)

- **OODCE over IIOP**
  - Motivated by Java RMI over IIOP
  - IIOP is mature & well-supported technology
  - No change to application code
  - Work in progress

- **Source-level Migration**
  - Encapsulate CORBA stubs & skeletons within OODCE-style classes
  - Use idl++, ORB & converter

[http://www.engr.sjsu.edu/fatoohi/eosdis/ASMOC.pdf](http://www.engr.sjsu.edu/fatoohi/eosdis/ASMOC.pdf)