Distributed Communications Enabling

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Enterprise Web Applications

Basic Web Applications

Client
Browser

Web
Server

Enterprise
Data

Internet Connection

Databases

CGI, SSJS, NSAPI, ISAPI, WAI, Etc.
Robust Web Applications

Presentation Tier
- Web Browser
- Rich Clients (Java/C++, VB)

Business Logic Tier
- Web Servers
- Application Server(s)

Data Tier
- Database

Application Servers Internals

Client
- Scalable, Reliable Application Architecture
- Pre-Built System & Application Services
- Network Services
- Operating System

Application Server
- Distributed Object Infrastructure
- Open and Extensible

Application Servers Technical Architectures

Extensibility
- TP Monitors
- Legacy
- ClusterServer

Data Sources
- RDBMS
- Oracle
- Informix
- Sybase
- DB2
- SQL Server
- OODBMS
- Ogi
- DBC & JDBC

Platforms
- Sun Solaris
- RISC
- SGI Irix

Open Client Library
- Java, C/C++, VB

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Extensions
- Open Client Library
- Java, C/C++, VB
Application Server Categories

- CORBA-based (OMA-based)
- Java-based (J2EE-based)
- COM+-based
- HTML-Extended
- XML-based
- Adaptive
- http://www.appserver-zone.com/guide.asp lists 77+ unclassified products !!!!
- All categories operate on top of a DOC layer

Application Servers Selection Criteria

- Usability
- Scalability
- Security
- Manageability
- Reusability
- Support
- Skills
- The underlying DOC platform is a key driver in the selection process

Distributed Object Computing and Application Servers
Computing Layers & Facilities

- Course Outline
- Distributed Object Computing
- Application Server Categories
- Client Interfaces (MOM & POP Applications)
- Web Application Modeling (UML/XML)
- Adaptiveness & Model-Driven Application Generation

Distributed Object Computing Models

- CORBA
- EJB & J2EE
- COM+
Common Object Request Broker Architecture

- Open distributed computing infrastructure/platform (OMA)
- Programming language independent DOC environment
- Based on OMG IDL, and IIOP/GIOP
- Standardized by the OMG
- Automates common networking programming tasks
  - Object registration, location, activation
  - Request demultiplexing
  - Framing and error handling
  - Parameter marshalling and demarshalling
  - Operation dispatching

New in Corba 3

- Component Model (CCM)
- Quality-of-service control
- Messaging invocation model
- Tightened integration with the Internet
- POA (Portable Object Adapter)
- EJB and Java support
- OMG specifications for analysis and design, and application interoperability
  - UML, MOF, XMI, Common Warehouse Model

Overview of Corba: OMG Reference Model Architecture
Object Services (CORBAservices)
- Domain-independent interfaces used by many distributed object programs
- Naming Service: allows clients to find objects based on names
- Trading Service: allows clients to find objects based on their properties
- Other services: persistence, lifecycle management, security, transactions, event notification, etc.

Common Facilities (Horizontal CORBAfacilities)
- Horizontally-oriented interfaces
- Oriented towards end-user applications
- E.g.: Distributed Document Component Facility (DDCF)
- Compound document facility based on OpenDoc
- Allows for presentation and interchange of objects based on a document model (e.g., linking of spreadsheet object into a report document)
- Printing, Secure Time, Internationalization, and Mobile Agent Facilities

Domain Interfaces (Domain CORBAfacilities)
- Role similar to Object Services and Common Facilities
- Oriented towards specific application domains
- E.g., Product Data Management (PDM) Enablers for the manufacturing domain
- Other possibilities in the telecommunications, medical, and financial domains
**Application Interfaces**

- Interfaces developed for a given application
- Not standardized
- Might become candidates for future OMG standardization

**CORBA ORB Architecture**

**Object Implementation**

- Defines operations that implement a CORBA IDL interface
- Object implementations can be written in a variety of languages
  - C, C++, Java, Smalltalk, Ada, etc.
Client

- Program that invokes an operation on an object implementation
- Accessing the services of a remote object is transparent to the caller
  - As simple as calling a method on an object
  - E.g., obj->op(args)

Object Request Broker (ORB)

- Provides mechanism for transparently communicating client requests to target object implementations
- Simplifies distributed programming by decoupling the client from the details of the method invocations
- Client requests appear to be local procedure calls
- ORB is responsible for finding the object implementation, activating it, delivering the request to the object, and returning a response to the caller

ORB Interface

- Abstract interface for an ORB
- ORB may be implemented in various ways
  - One or more processes, set of libraries, etc.
- Interface provides various helper functions
  - Converting object references to strings
  - Creating argument lists for requests made through the dynamic invocation interface
CORBA IDL Stubs and Skeletons

- Serve as the “glue” between the client and server applications, and the ORB
- CORBA compiler automates the transformation between CORBA IDL definitions and the target programming language
- Use of compiler reduces the potential for inconsistencies between client stubs and server skeletons
- Use of compiler facilitates automated optimizations

Dynamic Invocation Interface (DII)

- Allows a client to directly access the underlying request mechanisms provided by an ORB
- Applications use the DII to dynamically issue requests to objects without requiring IDL interface-specific stubs to be linked in
- DII allows clients to make non-blocking deferred synchronous (separate send and receive operations) and oneway (send-only) calls

Dynamic Skeleton Interface (DSI)

- Server side analogue to the client side DII
- Allows an ORB to deliver requests to an object implementation that does not have compile-time knowledge of the type of the object it is implementing
- Client making the request has no idea whether the implementation is using type-specific IDL skeletons or dynamic skeletons
Object Adapter

- Assists the ORB with delivering requests to the object
- Assists the ORB with activating the object
- Associates object implementation with the ORB
- Can be specialized to provide support for certain object implementation styles (e.g., OODB object adapters for persistence)

ORB Products

- BEA WLE (formerly BEA M3)
- Expertsoft CORBAplus
- IBM WebSphere Product Family (Component Broker)
- Inprise VisiBroker Middleware Products
- IONA Orbix
- Merant CORBA Technology for COBOL
- PeerLogic DAIS
- ObjectSpace Voyager

Questions?
EJB and Java 2 Platform Enterprise Edition

Java 2 Platform, Enterprise Edition

- Released on 9/27/99
- Complete development platform architected to meet the needs of enterprise application development
- Makes all Java APIs and functionality available and accessible in a well integrated fashion
- Simplifies the development, deployment, and management of multi-tier server-centric solutions
- Built on Enterprise JavaBeans component architecture

Java Technology Findings

- Open standards are better than closed
- Write Once, Run Anywhere beats proprietary vendor-lock technology
- Findings motivate the creation of a single, unified platform with an easy-to-use model for building distributed ebusiness applications across a wide array of products
J2EE Platform and Enterprise Computing Solutions

J2EE Key Value Propositions
- Simplified enterprise development
- Supports various pieces of server software
- Industrial strength scalability
- Legacy connectivity
- Open platform (choice/flexibility)
- Security
- Portability

J2EE Platform:
The Whole is Greater than the Sum of its Parts
J2EE: A Complete Computing Environment

- Platform Specification
  - Lists required elements of the platform
  - Lists policies to follow for a valid implementation
- Reference Implementation
  - Semantically correct prototype to test against
- Compatibility Test Suite
  - API-level compatibility, component-level tests, end-to-end compatibility
- Application Programming Model: java.sun.com/j2ee

The Three Cs: Components, Containers, Connectors

J2EE: Components

- Enterprise JavaBeans
  - Server-side solutions can be built without regards for the database, transaction server, or application they run on
- Servlets
  - Run on vast majority of web servers
- JavaServer Pages
  - Dynamic content leverages off the full power of Java
J2EE: Containers

- Containers provide high-performance, scalable environments for J2EE-enabled servers
- J2EE-enabled servers support EJB-based components, servlets, and JSP-based pages

J2EE: Connectors

- Connectors allow J2EE-based solution to preserve, protect, and leverage off of existing enterprise investments

J2EE: Unifying the Three Cs

- Single platform
- Standard platform-independent technology
- Applications built with components can be run on any J2EE server, and are able to talk to enterprise-class systems that exist today
**J2EE Technologies**
- JavaIDL
- RMI/IIOP
- JDBC
- JDBC 2.0 Client parts
- JNDI
- Servlets
- JavaServer Pages
- JavaMail, JavaBeans Activation Framework
- JTS, EJB, JTA, JMS, Connector/Resource Mgmt. Comp.
- XML (platform independent data)

**Questions?**

**Goals**
Show by example that COM+ makes it:
- As easy to develop Server Components as it is to develop Client Components
- As easy to deliver enterprise apps as it is to deliver workgroup apps!
Technology Scenario

The caring, sharing environment for your components

Application Scenario

- Online service like MSN or AOL
- User login causes two databases to be updated
  - Customer Billing Log
  - Customer Login Status
- Total connect time is tracked
- User is notified of various activities while they are logged in
  (i.e. chat rooms)

Application Flow
Application Object Model

Application Requirements

- Ultimate customer response and availability
- Always accept Logon
- No freebies! Always bill for entire time online
- Use existing billing system
- Use existing dev resources

Many others...

Tackling The Application Requirements

- Ultimate customer response and availability
- Always accept legitimate login
- No freebies! Always bill for entire time online
- Use existing billing system
- Use existing dev resources

- Keep billing, Customer Online and other systems consistent
- Real-time two way info on who is on
- Real-time info on what is going on
- Flexible administration
- Maximize use of platform, minimize development time

Many others...
Requirement: Simplify Server Side Development

• Issues:
  – Threading
  – Synchronization
  – Data Base Connection pooling
  – Communications - front and back ends

• Solution: core COM+ Services
  – You write a “single user” component as though it were the only user of DB resources
  – COM+ provides the rich service environment which makes your component multi-user, multi-threaded and resource pooled

Core Application Services

• COM+ provides:
  – Administrator controlled process placement
  – The context
  – Sharing automatically managed by COM+
  – Auto Completion (or explicit SetComplete, SetAbort)

• All you have to do:
  – Stick with the model (or be aware of consequences of leaving model)
  – (Basic component walkthrough)
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Flexible Administration

- Issues
  - Different Administration dimensions
  - Application Distribution
  - Connectivity

Now! Now!

Flexible Administration

- Solution: COM+ Administration
  - Features: extends administration to all COM Components, supports administration of new services and provides a complete programmatic interface for installation, configuration and deployment
Administrative Model

- Applications are defined and components are installed in the applications that they are to run in
- Attributes are set declaratively on the components
  - Transactions
  - Security roles
  - Activation properties
- SDK - complete automation capabilities

Administration Example

- Walkthrough of Billing system deployment
- Billing components are updated on the dev machine
- The Application can be exported manually:
  - Application information and the DLLs to be moved to the accounting server and...
  - ActiveX® Control is downloaded to the client using the CODEBASE tag and a CLSID
  - Or...
- Auto download of components on demand
  - Requires Windows 2000 Directory Service

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Database Consistency

- Issues:
  - Updating multiple Resource Managers
    - (DB, IMDB, MSMQ)
  - Avoiding conflicts
  - Multiple simultaneous users
  - Indeterminate numbers of users

Solution: COM+ Transaction Services

- Features:
  - System provided transactions on activation, commit on deactivation, abort on errors
  - System enforced serialization
  - Manual (SetComplete, SetAbort) or Auto completion

Consistency Example

- COM+ Transaction Services
  - Transaction code and attribute walkthrough
  - Bus_Customer calls db_CustomerBilling and db_CustOnlineStatus
  - Distributed transaction occurs (transparently) when user logs on
  - Without Transactions customer could be billed for time even if they failed to complete the logon or...
  - They might not get billed even though they successfully logged on
  - Auto Completion (not in the Preview)
  - Transaction code and attribute walkthrough
Tackling The Application Requirements

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Application Security

- Issues:
  - Security Dimensions
  - Distributed application
  - Components being Compounded

Application Security

- Solution: COM+ Security Services:
  - Role-based access control on classes, interfaces and METHODS.
  - Mapping roles to Windows 2000 domain accounts
Security Example

• Application context
  – Customer billing information needs to be protected
  – When a user logs on the bus_Customer component running on the Web server will call the accounting server
  – Using roles the Web server will be allowed to call the accounting server but you may not call the component directly
  – Roles established in package definition
  – Roles established in the IDE
  – Code and Attribute walkthrough

Tackling The Application Requirements - The Story So Far

• Ultimate customer response and availability
  • Keep billing, Customer Online and other systems consistent
  • Real-time two way info on who is on
  • Real-time info on what is going on
  • Flexible administration
  • Maximize use of platform, minimize development time

• Always accept legitimate logon
• No freebies! Always bill for entire time online
• Use existing billing system
• Use existing dev resources
• Other…

Tackling Other Application Requirements

• Ultimate customer response and availability
  • Keep billing, Customer Online and other systems consistent
  • Real-time two way info on who is on
  • Real-time info on what is going on
  • Flexible administration
  • Maximize use of platform, minimize development time

• Always accept legitimate logon
• No freebies! Always bill for entire time online
• Use existing billing system
• Use existing dev resources
• Other…
Even Easier!

• Coming soon
  – Direct manipulation of attributes from IDE
  – Direct manipulation of COM+ administration from IDE
• The COM+ Wizard

Conclusion

COM+ makes it:
• As easy to develop Server Components as it is to develop Client Components
• As easy to deliver enterprise apps as it is to deliver workgroup apps!

Call To Action

• Architecting, designing, developing:
  – Assume COM+ level of service and use Windows 2000 now
• Deploying and in production:
  – Use Microsoft Transaction Server now - your components will be uplifted when COM+ is installed
• Everything discussed is a standard feature of Windows 2000
References on COM+

• Books
  – Chappell. *Understanding ActiveX and OLE*
  – Eddon. *Inside DCOM*
  – Grimes. *Professional DCOM*
  – Box. *Essential COM*

• COM Home Page
  – http://www.microsoft.com/com/

• Windows 2000 Platform SDK
  – NT 5.0 Beta 2 or later

Questions?