Agenda

• Why CORBA is used
• How CORBA is used
• Agent architectures
Traditional Approaches to Network Management

Enterprise World

Telnet client

Network Manager

User Interface (GUI)

Network Elements

Embedded World

Telnet, TL-1

SNMP, CMIP

HTTP

Traditional Approaches to Network Management
Network Management Today

- **Users**
  - Windows or Java Client

- **Billing Object**

- **Customer App(s)**

- **Billing App**

- **User Interface (GUI) C++ or Java**

- **Management App(s)**

- **Internet/Intranet/Extranet**

- **Gateway**

- **WebServer**

- **Browser**

- **Management Objects**

- **Application Objects**
CORBA in the Network Element

Enterprise Component Integration

Network Management

Internal Distribution

Network Element

CPU

ORB

ORB

ORB

ORB

ORB

Network Management Agent
Motivations for CORBA Management

- Suitability of CORBA for next generation technologies: optical, wireless, ATM, VoIP...
  - Object-oriented CORBA/IDL well-suited to modeling
  - SNMP inefficient due to simplicity, lack of object orientation
  - CMIP/GDMO too complex, expensive and scarce

- Economics of CORBA being a broadly deployed, general-purpose IT standard
  - Tools are lower cost and more broadly available
  - Greater # of knowledgeable engineers, more training and literature
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• Why CORBA is used
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• Agent architectures
Network Management
Uses

Interface for custom management apps
– Including Web-based

Standard interface for element & network management systems
CORBA for Custom Management Apps

Device
- Card
- Card
- Embedded Agent (C++ & C)

ORB

Management Application (usually Java)

ORB

Web browser

ORB

Management Applet
Management with Java and CORBA

• Java is well-suited to custom management applications
  – Platform independence
  – Easily build sophisticated GUIs

• Java includes CORBA
  – From Java 2 (JDK 1.2)

• With CORBA, embedded C++ objects look native to Java-based manager

```java
RFC1213_MIB.system s = ...;
System.out.println("Sys Admin: " + s.sysContact);
```
Web-based Management

• Java applets served via HTTP
  – Simple distribution
• VM not required in device, uses browser’s
CORBA As An Open Interface

- IDL provides safe programmability to customers
- Augments or replaces a command-line/scripting interface
  - Write Java apps instead of scripts
• Define CORBA objects and operations to reflect real-world use

```idl
// IDL
interface IPStack {
    boolean DeleteRoute(in string interface,
            in string destination);
};
```

```java
// Java Management Application
IPStack myIP = ... ;
boolean OK;

OK = myIP.DeleteRoute("149.101.10.32", "microsoft.com");
```
SNMP Equivalent

-- the IP routing table
ipRouteTable OBJECT-TYPE
SYNTAX SEQUENCE OF IpRouteEntry
ACCESS not-accessible
STATUS mandatory
DESCRIPTION
"The IP Routing table."
 ::= { ip 21 }

ipRouteEntry OBJECT-TYPE
SYNTAX IpRouteEntry
ACCESS not-accessible
STATUS mandatory
DESCRIPTION
"A route ..."
INDEX   { ipRouteDest }
 ::= { ipRouteTable 1 }

-- Only relevant entries shown
IpRouteEntry ::= SEQUENCE {
   ipRouteDest IpAddress,
   ipRouteIfIndex INTEGER,
   ipRouteType INTEGER,
}

ipRouteType OBJECT-TYPE
SYNTAX INTEGER {
   other(1),
   invalid(2),
   direct(3),
   indirect(4)
}
ACCESS read-write
STATUS mandatory
DESCRIPTION
"...Setting this object to the value invalid(2) has the effect of invalidating the corresponding entry in the ipRouteTable..."
 ::= { ipRouteEntry 8 }
SNMP Algorithm

1. Scan the ipAddrTable to identify the ipRouteIfIndex corresponding to the interface of the route to be deleted.
2. Scan the ipRouteTable to identify the row with the appropriate ipRouteIfIndex and ipRouteDest.
3. Set the value of ipRouteType in that row to invalid(2).
Network Management Uses

Interface for custom management apps
- Including Web-based

Standard interface for element & network management systems
CORBA Is Already Broadly Used for Mgmt

- Business
- Service
- Network Mgmt
- Element Mgmt

CMIP  SNMP  TL1

Network Elements
CORBA Management Standards

- Joint Inter-Domain Management (JIDM)
  - Mapping from SNMP and GDMO/CMIP
  - From TMF & OMG, adopted by X/Open

- Native CORBA standards
  - Developed by ITU and technology-specific organizations
JIDM Scenarios

From www.jidm.org
interface system : SNMPMgmt::SmiEntry {
    readonly attribute DisplayStringType sysDescr;
    readonly attribute ASN1_ObjectIdentifier sysObjectID;
    readonly attribute TimeTicksType sysUpTime;
    attribute DisplayStringType sysContact;
    attribute DisplayStringType sysName;
    attribute DisplayStringType sysLocation;
    readonly attribute ASN1_Unsigned16 sysServices;
};
Native CORBA Standardization

• ITU-T, based on T1M1
  - X.780: Guidelines for defining CORBA Managed Objects
  - Q.816: CORBA-based TMN Services
  - M.3120: CORBA network information model

• 3GPP

• ATM Forum

• DSL Forum (formerly ADSL Forum)

• Network and Service Integration Forum (NSIF)

• Software Defined Radio (SDR) Forum
  - Joint Tactical Radio System (JTRS)
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CORBA Management Summary

- Same middleware can be leveraged for:
  - Network management
  - Internal distribution
  - General-purpose enterprise integration
  - Programmability interface
- Well-suited to Next Generation network technologies & topologies
  - Fully distributed, not point-to-point
  - Endorsed by international standards bodies