Using CORBA for Network Management of Next Generation Networking Equipment

Ken Black
Founder and President
Highlander Engineering

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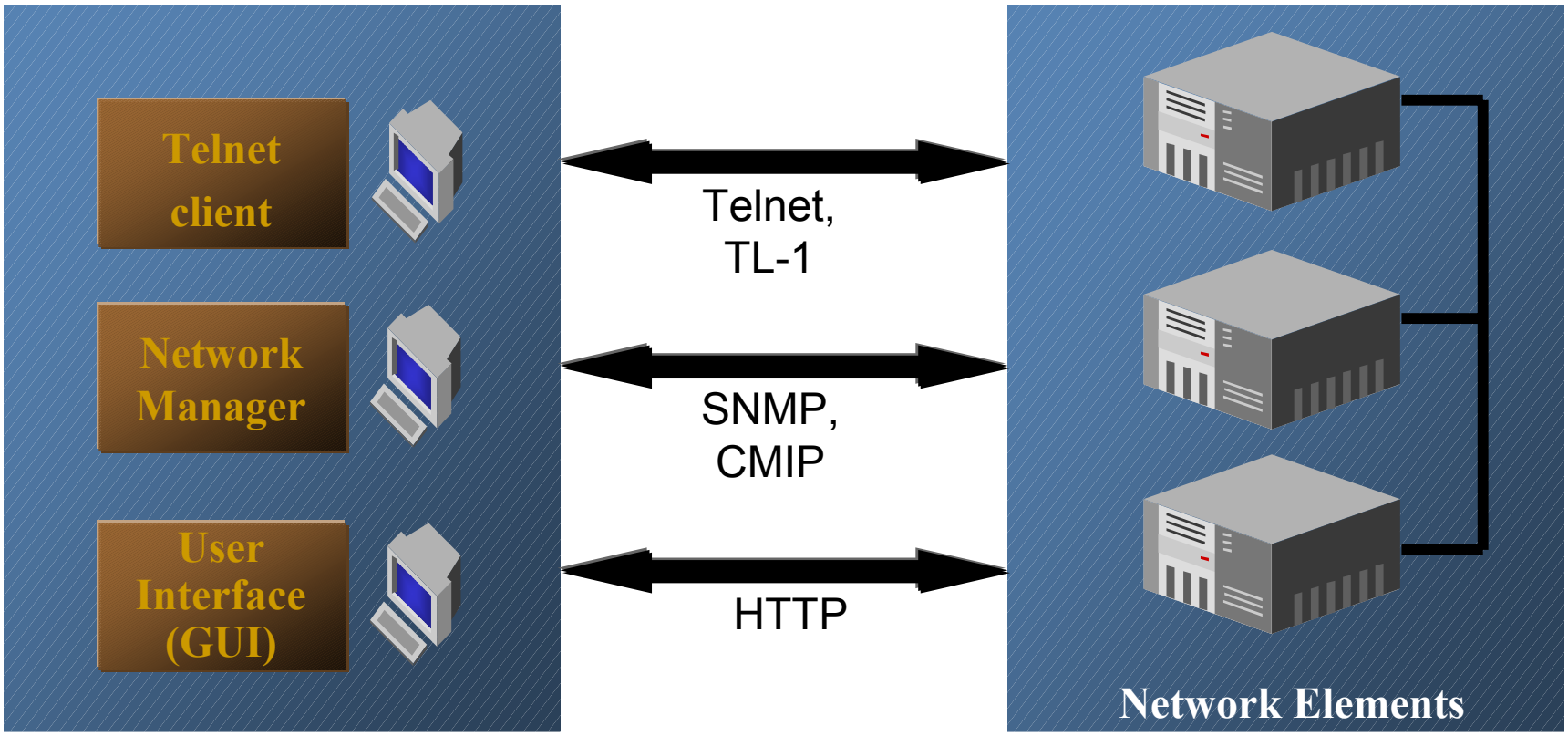
HIGHLANDER™

Agenda

- Why CORBA is used
- How CORBA is used
- Agent architectures

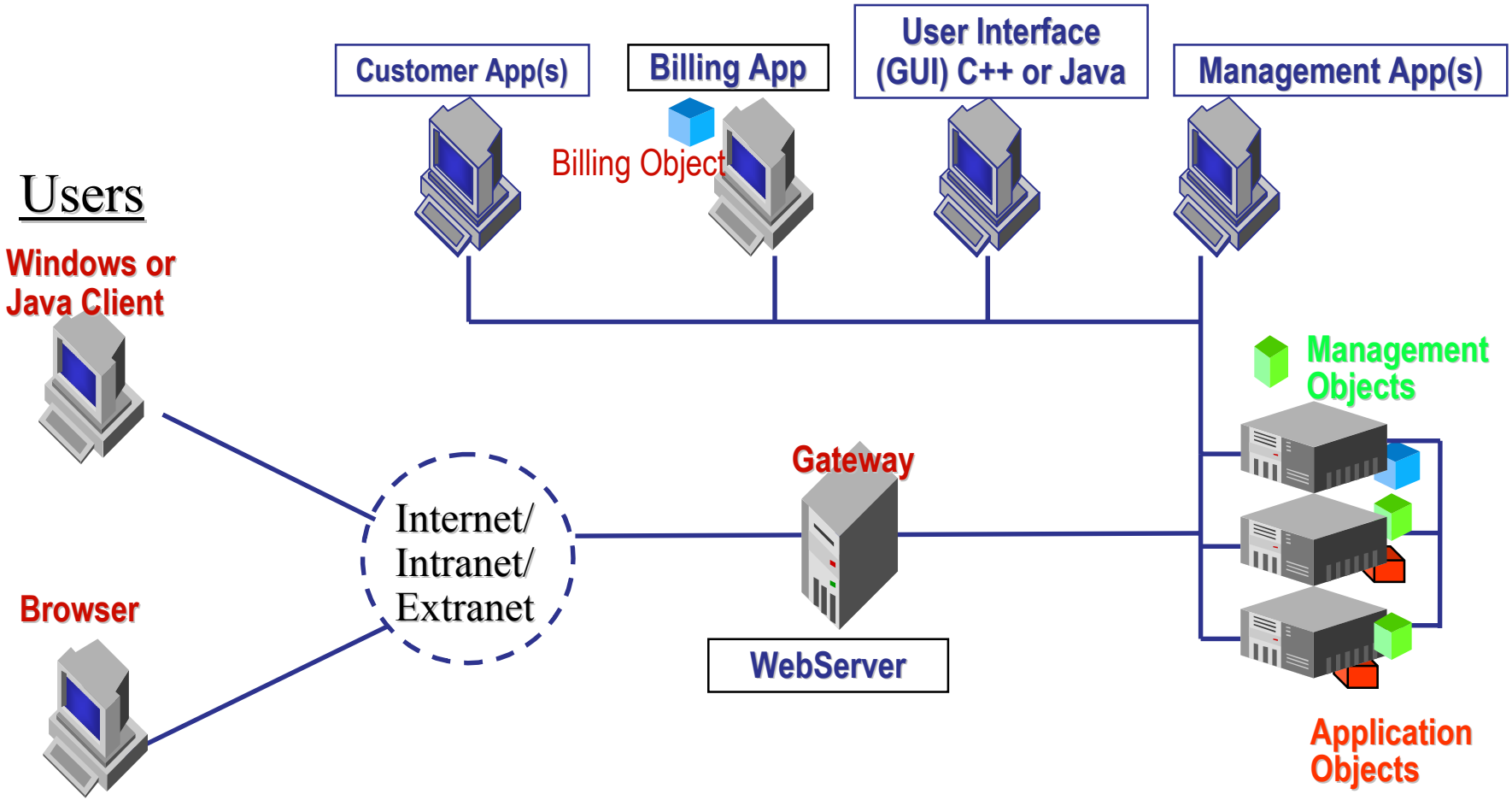
Traditional Approaches to Network Management



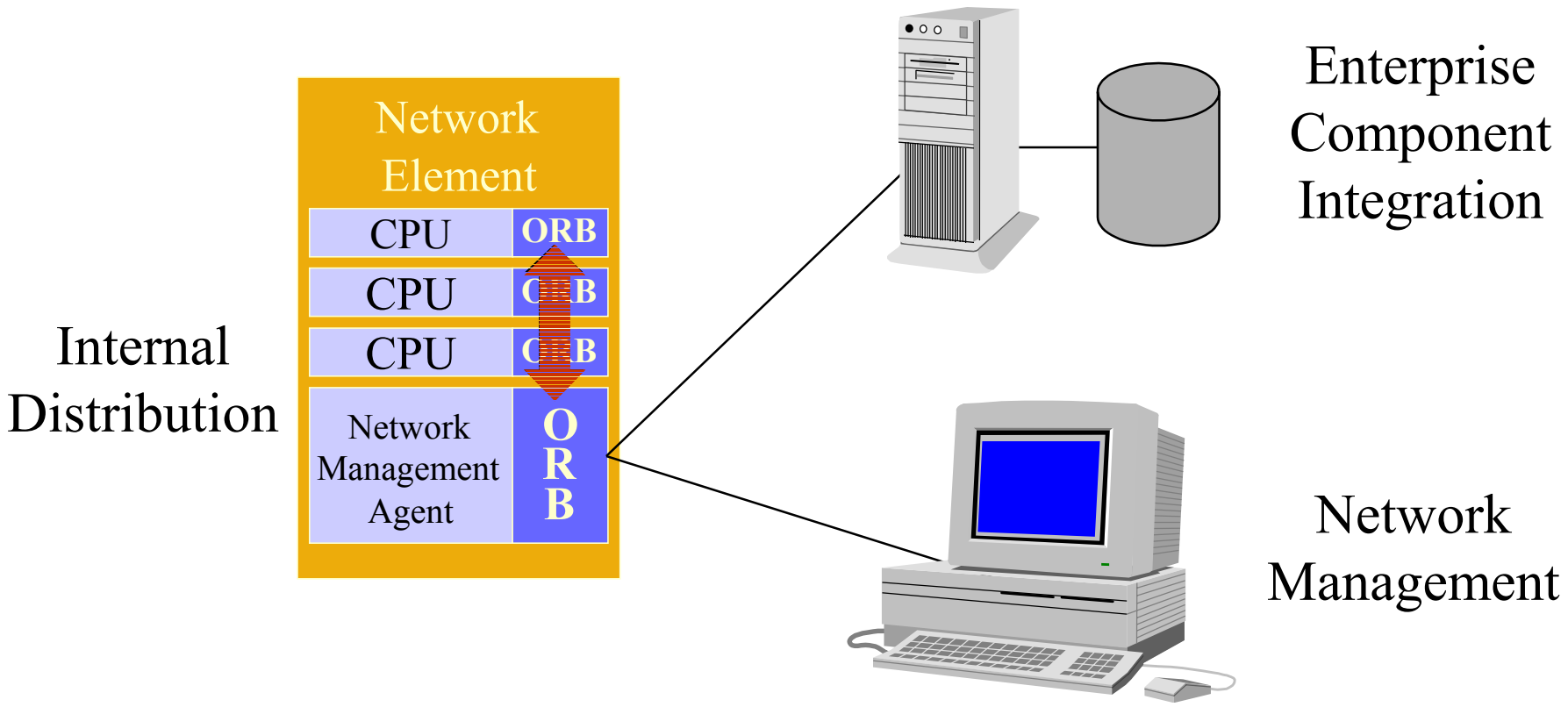
Enterprise World

Embedded World

Network Management Today



CORBA in the Network Element



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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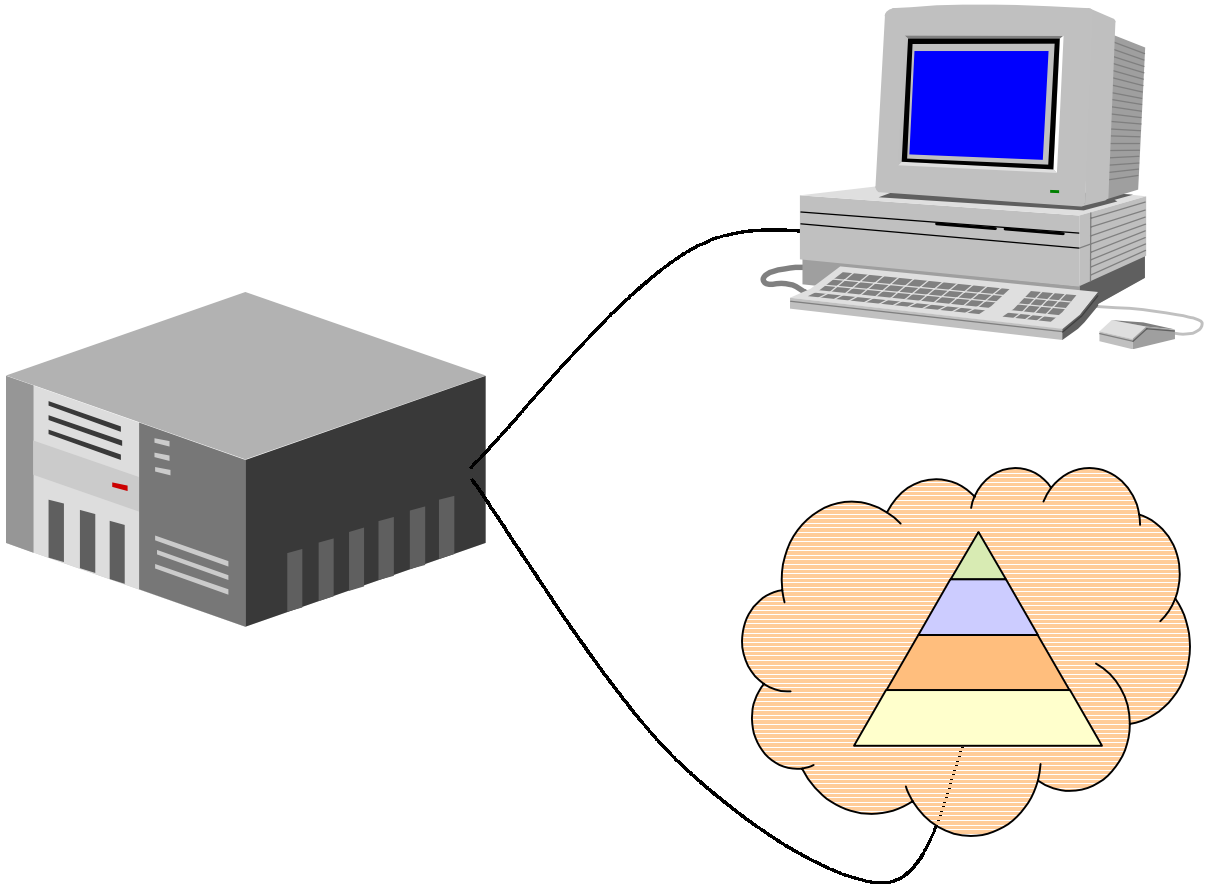
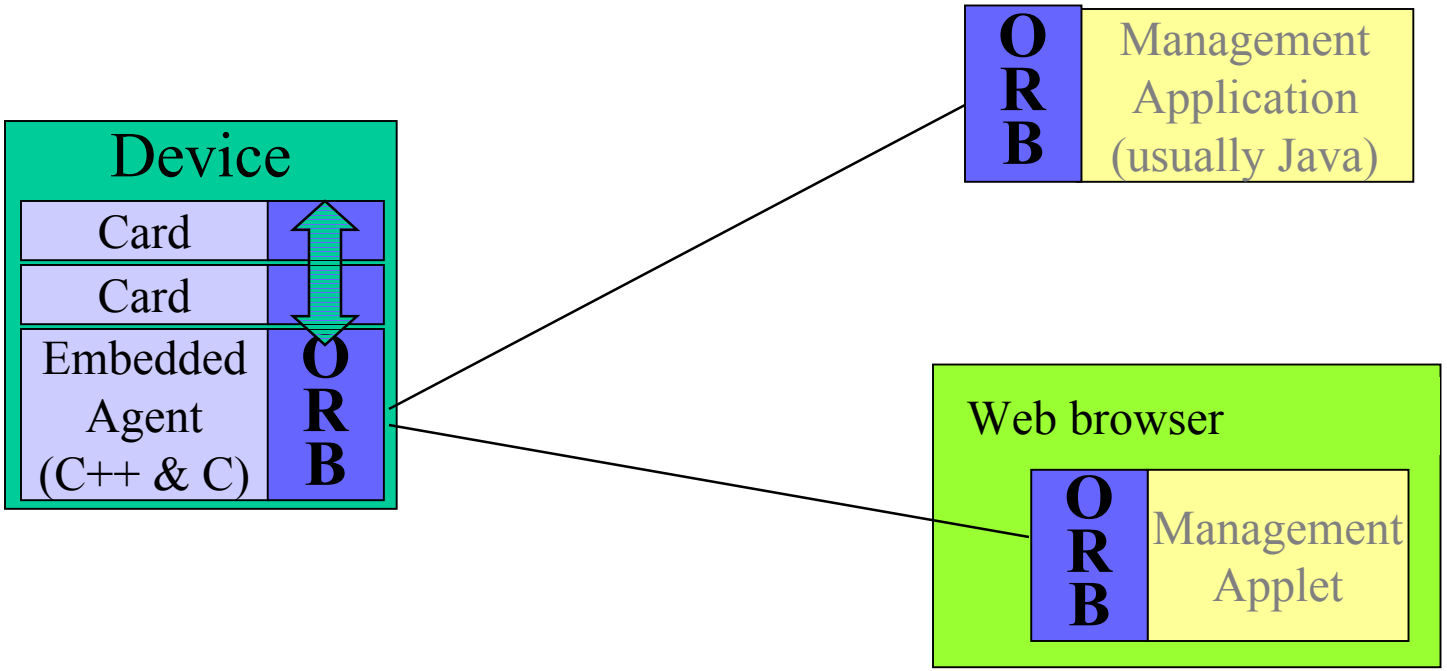
Network Management Uses



Interface for custom management apps
– Including Web-based

Standard interface for element & network management systems

CORBA for Custom Management Apps



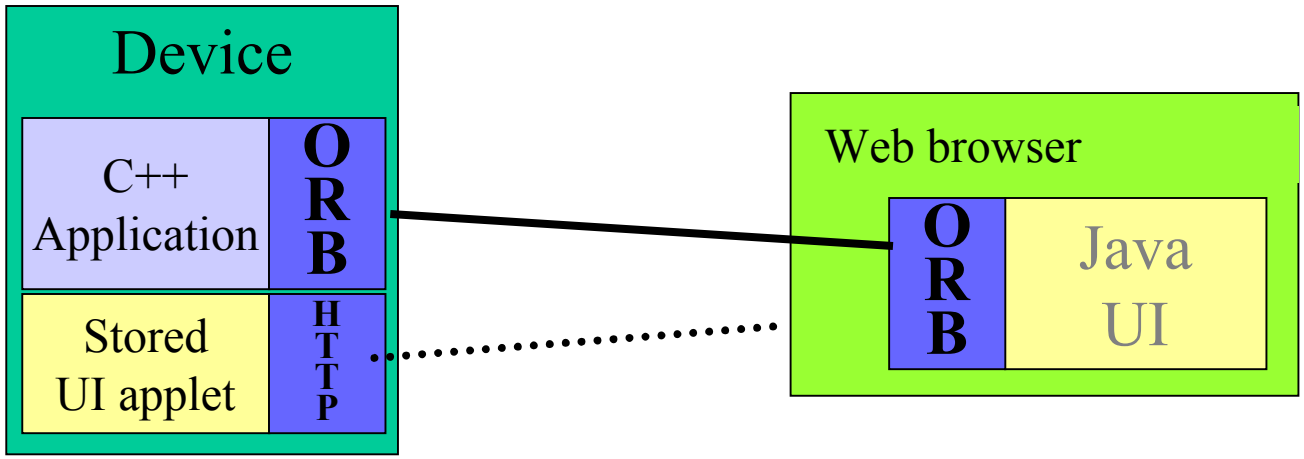
Management with Java and CORBA

- 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

```
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

Information Modeling for Custom Management Apps

- Define CORBA objects and operations to reflect real-world use

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

```
// Java Management Application
IPStack myIP = … ;
boolean OK;

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

SNMP Equivalent

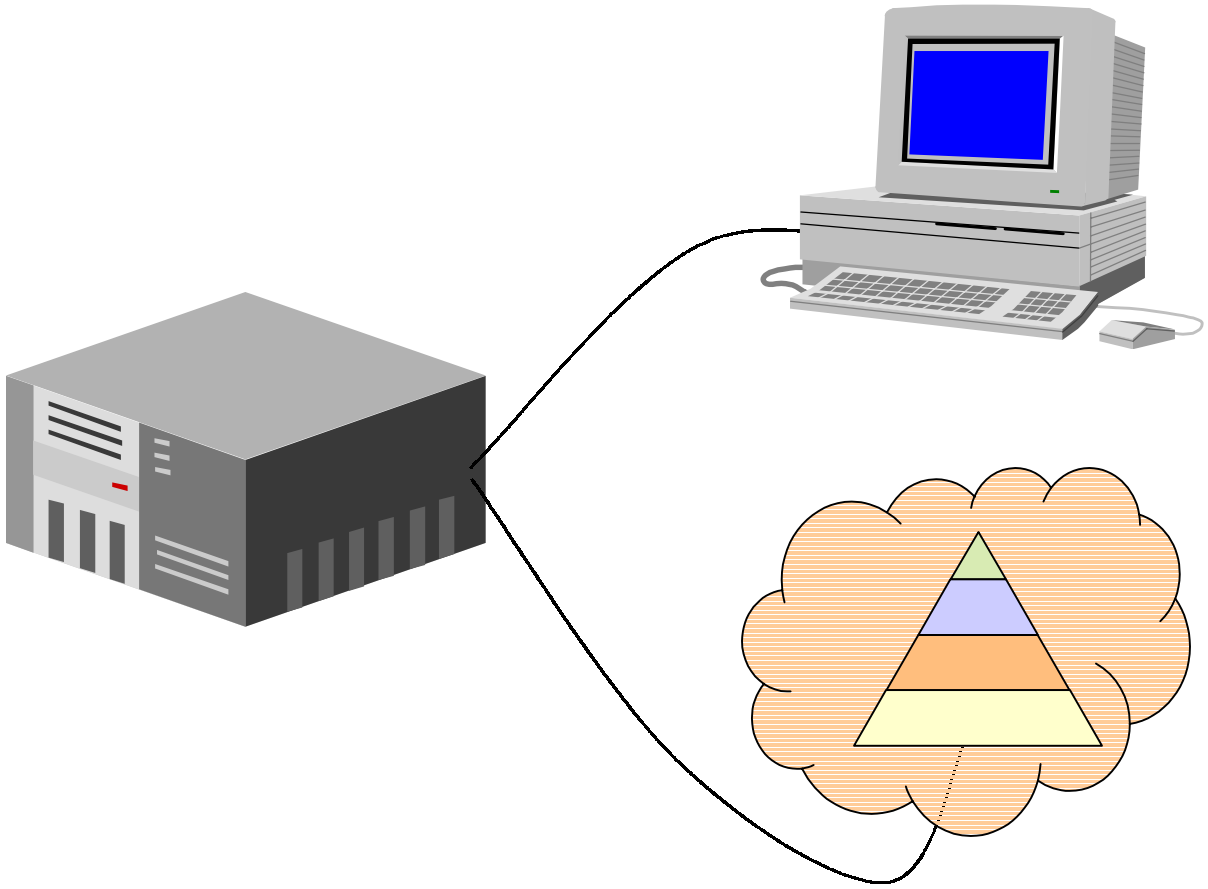
```
-- the IP routing table
ipRouteTable OBJECT-TYPE
    SYNTAX SEQUENCE OF IpRouteEntry
    ACCESS not-accessible
    STATUS mandatory
    DESCRIPTION
      "The IP Routing table."
    ::= { ip 21 }

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



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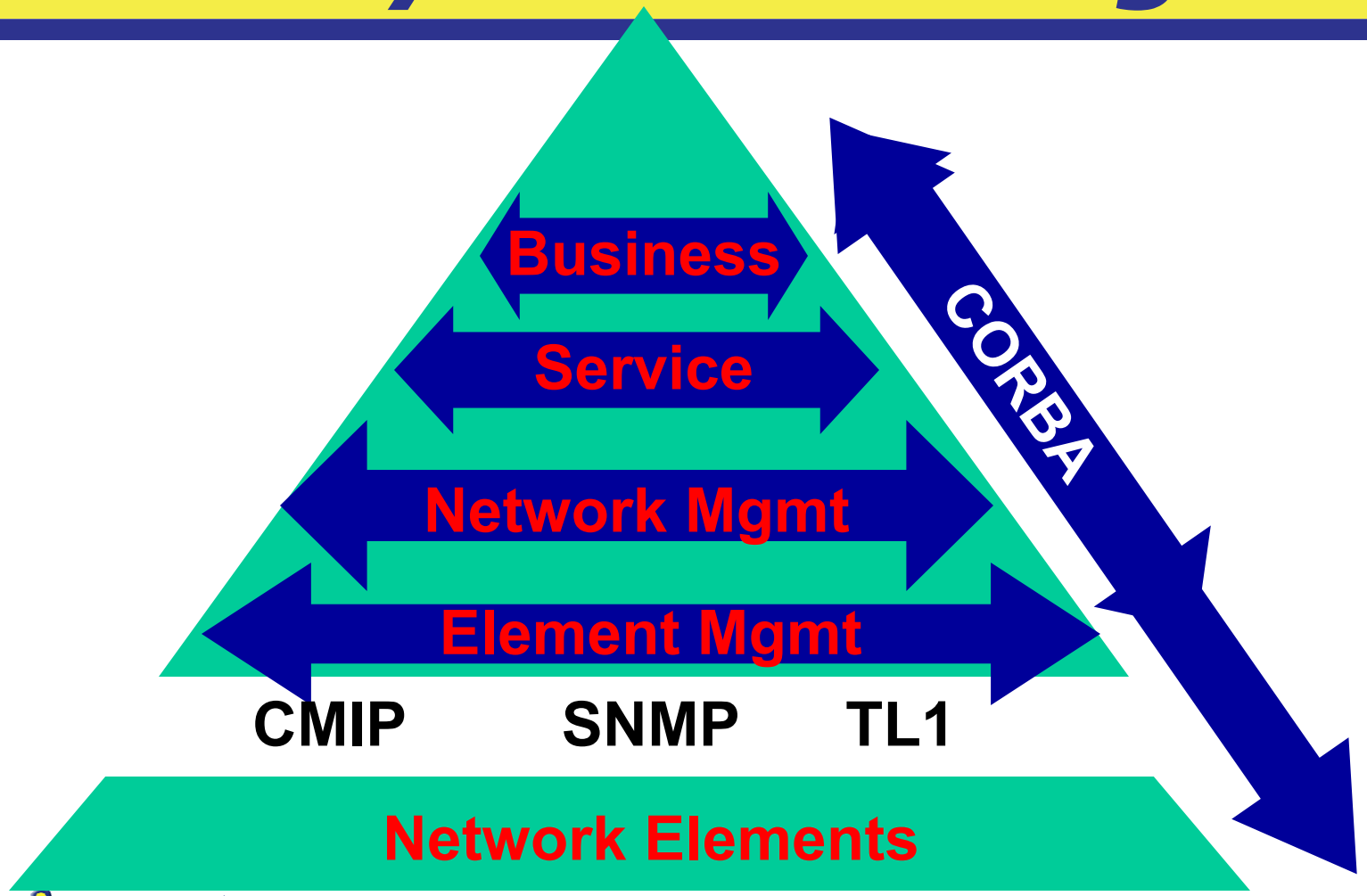
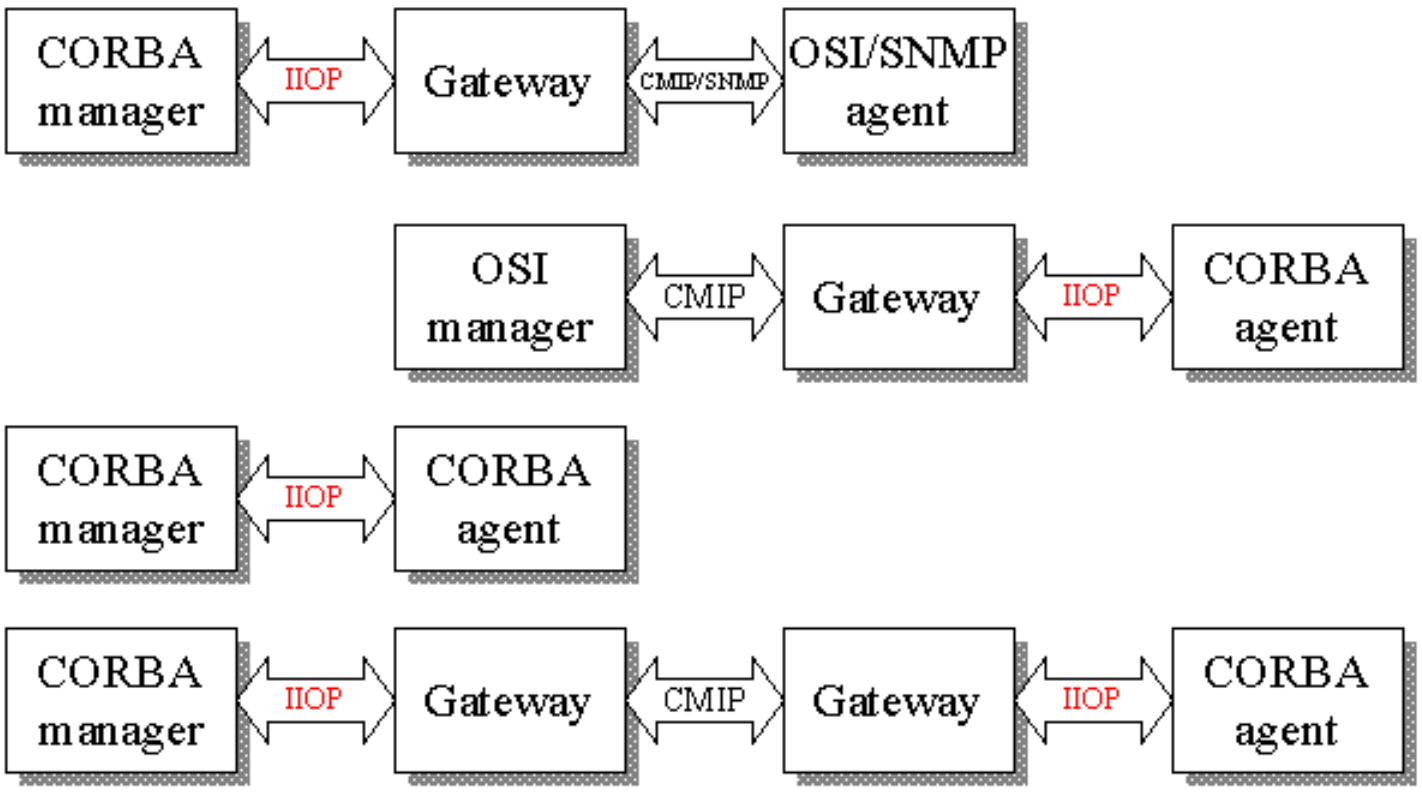
CORBA Is Already Broadly Used for Mgmt



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`

JIDM Example
IDL Mapping of MIB-II System Group

```
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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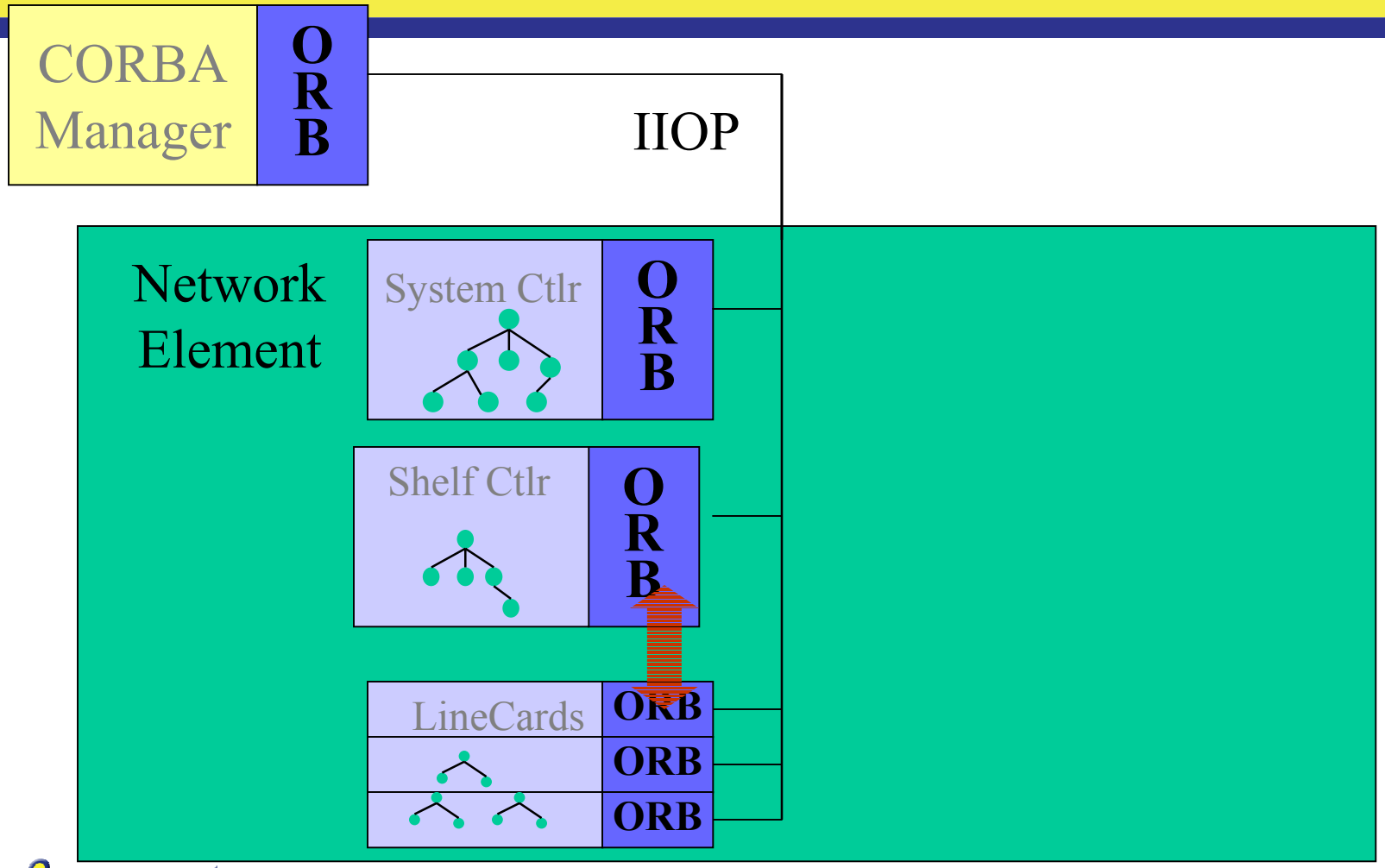
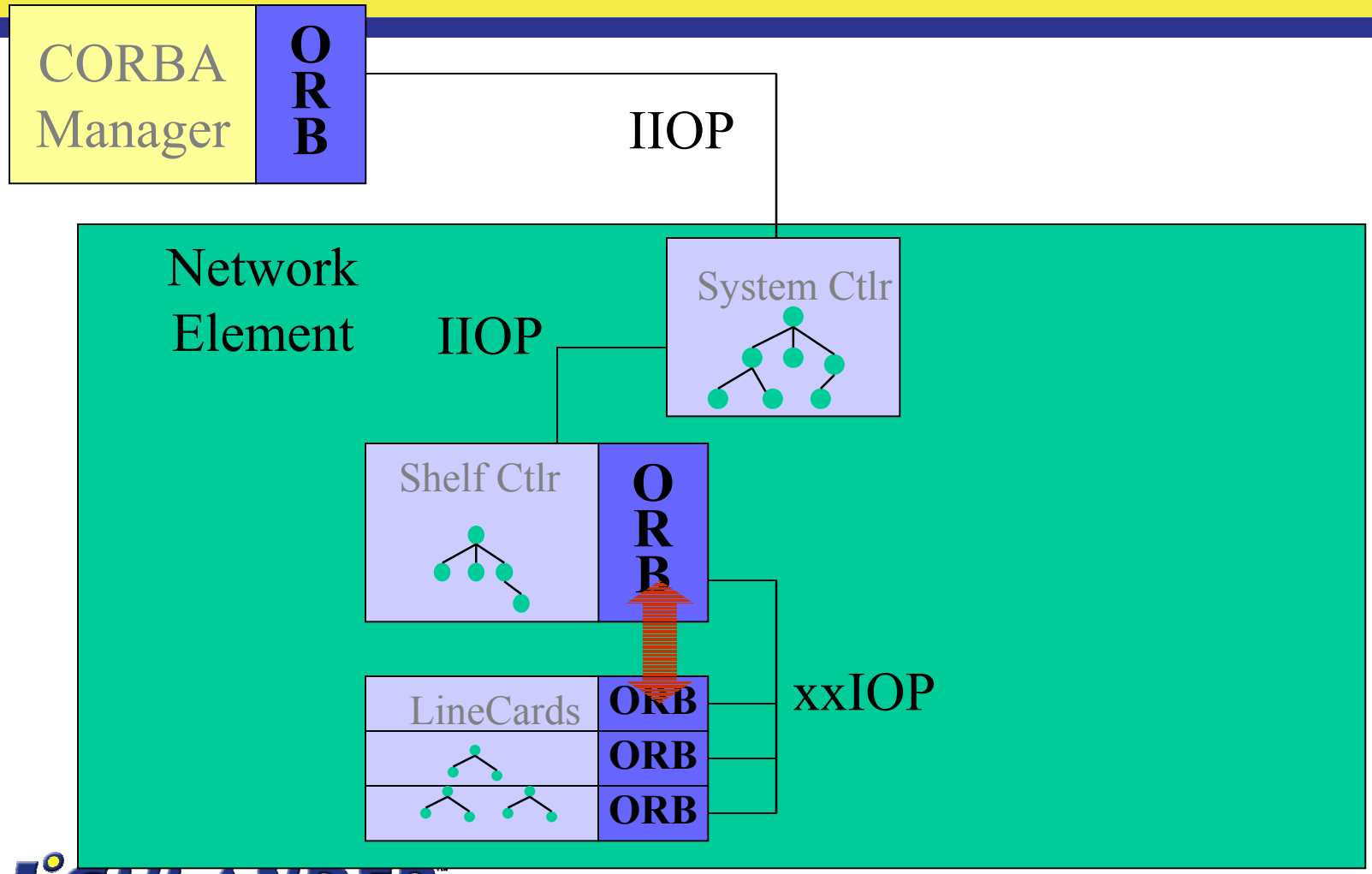
Agent Architecture



Agent Architecture



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