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CORBA-based Performance Management System

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Outline

- Objectives
- Scope
- Design
- Implementation
- Examples
- Performance Evaluation
- Conclusion & Next Steps

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Objectives

- Assess the applicability of CORBA in Telecom Network Management
  - Verify the information model
  - Verify the mapping to proprietary interface
  - End-to-end connection
  - Performance/Scalability

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Performance Management Requirements

- Monitor real-time traffic (calls/packets/cells)
- Control network traffic congestion
- Provide "agreed-upon" Quality of Service

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CORBA PM Information Model

- Based on T1M1 CORBA NM Framework guideline
- Inherited from X.721 and M.3100 IDL model
- Includes X.739, X.738, Q.822, and Q.823
- Key Objects:
  - Scanner, Simpler Scanner
  - Current Data, History Data, Threshold Data
  - State Indicator
  - Traffic Controls

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Scope

- 30-second Discrete Data
  - status discretes - indication of problem at the office, or routine status advisories
  - configuration change discretes - indication of surveillance and control changes in the office,
- 5-minute Measurements
  - office (machine) data - various office-wide counts on total traffic at the office, total processor load
  - trunk group data - peg count, incoming and outgoing calls per circuit hour,
  - control data - total number of controls in effect on an office, attempts and successes on call gaps and reroutes
- Traffic Control
  - manual control - destination code control

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Design

- System Architecture
- Function Block Diagram
- Interface Inheritance Hierarchy
- Interface Examples
- Naming Tree
- POA Structure
- POA Policies

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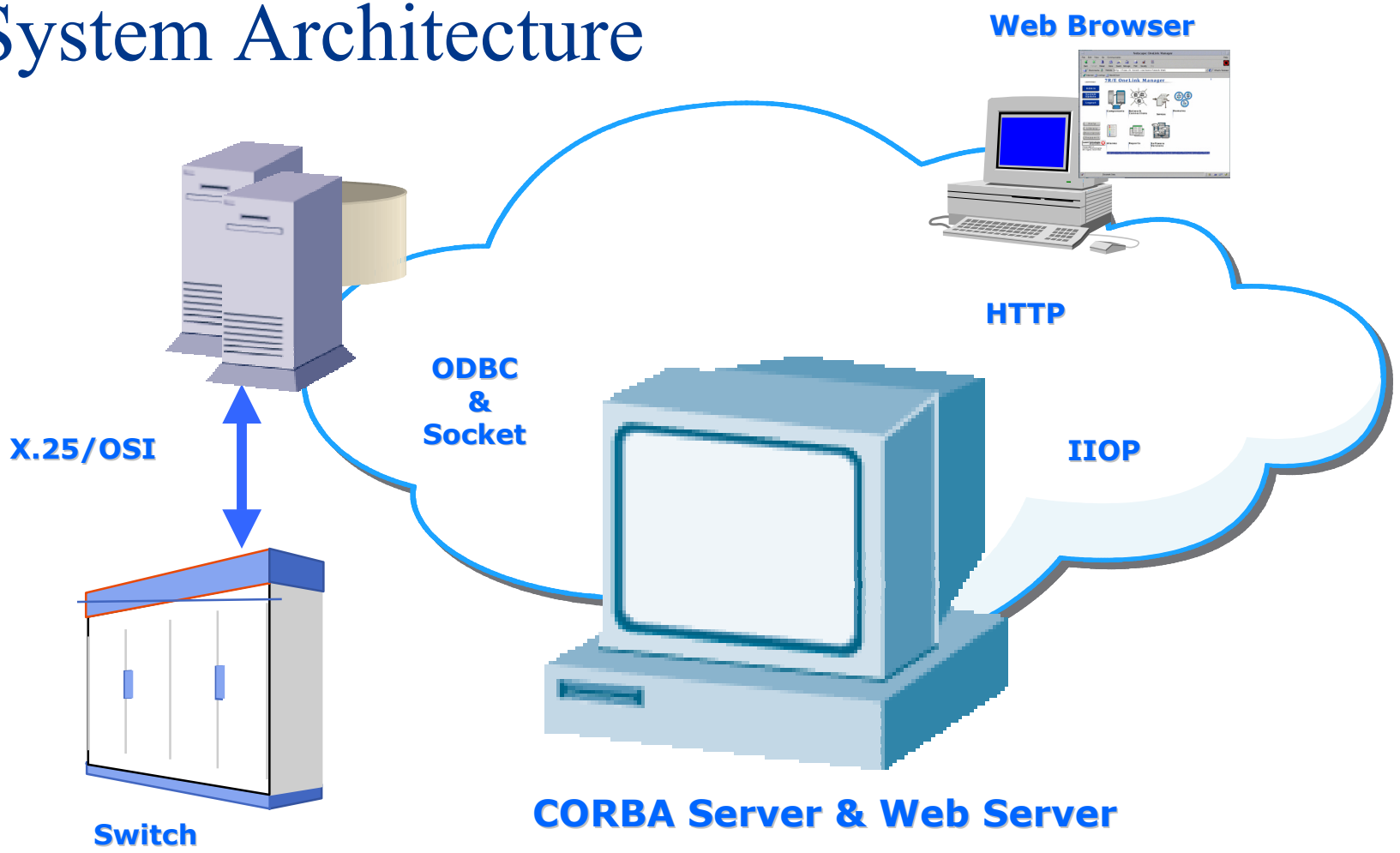
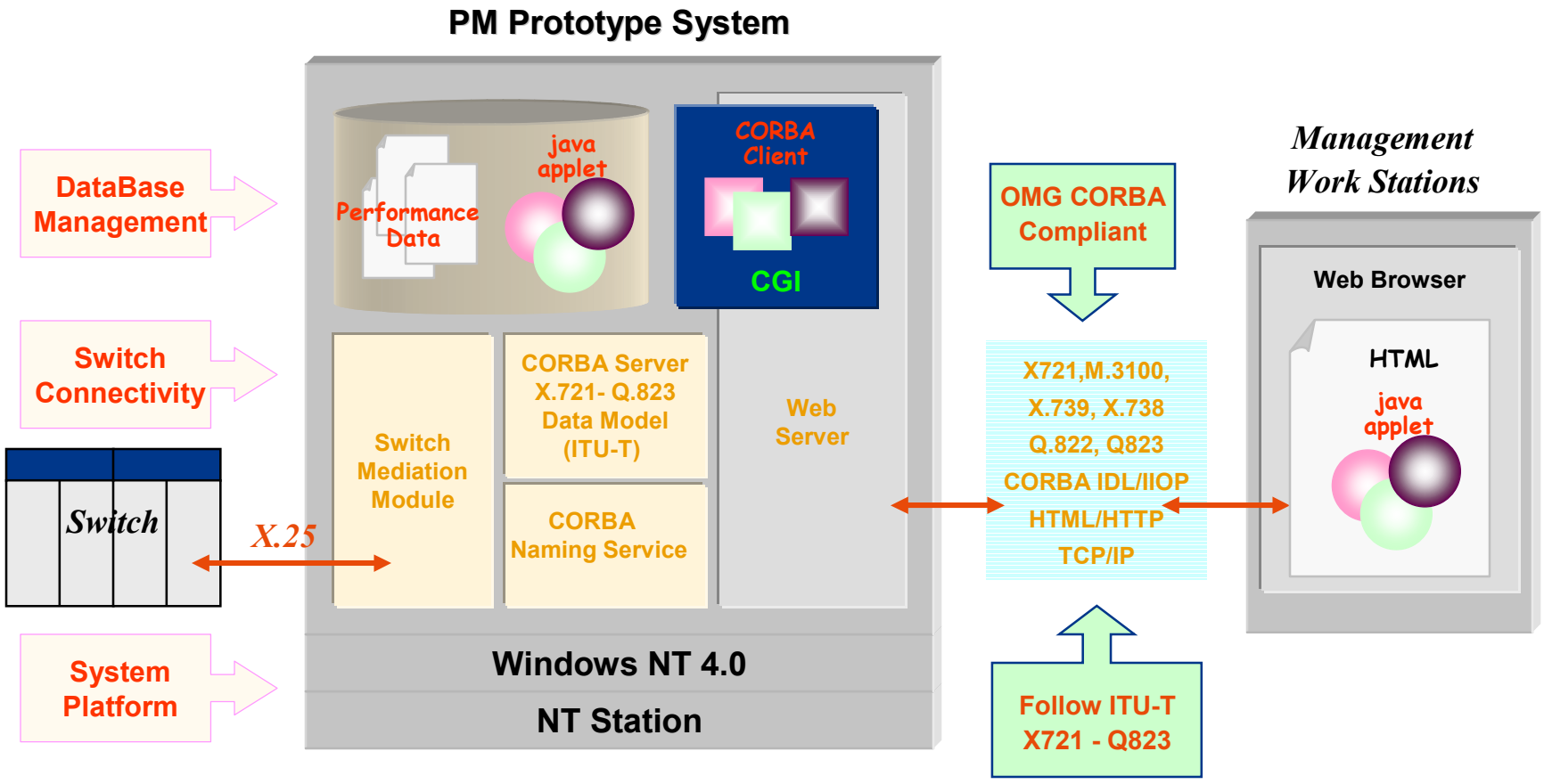
System Architecture



Function Block Diagram



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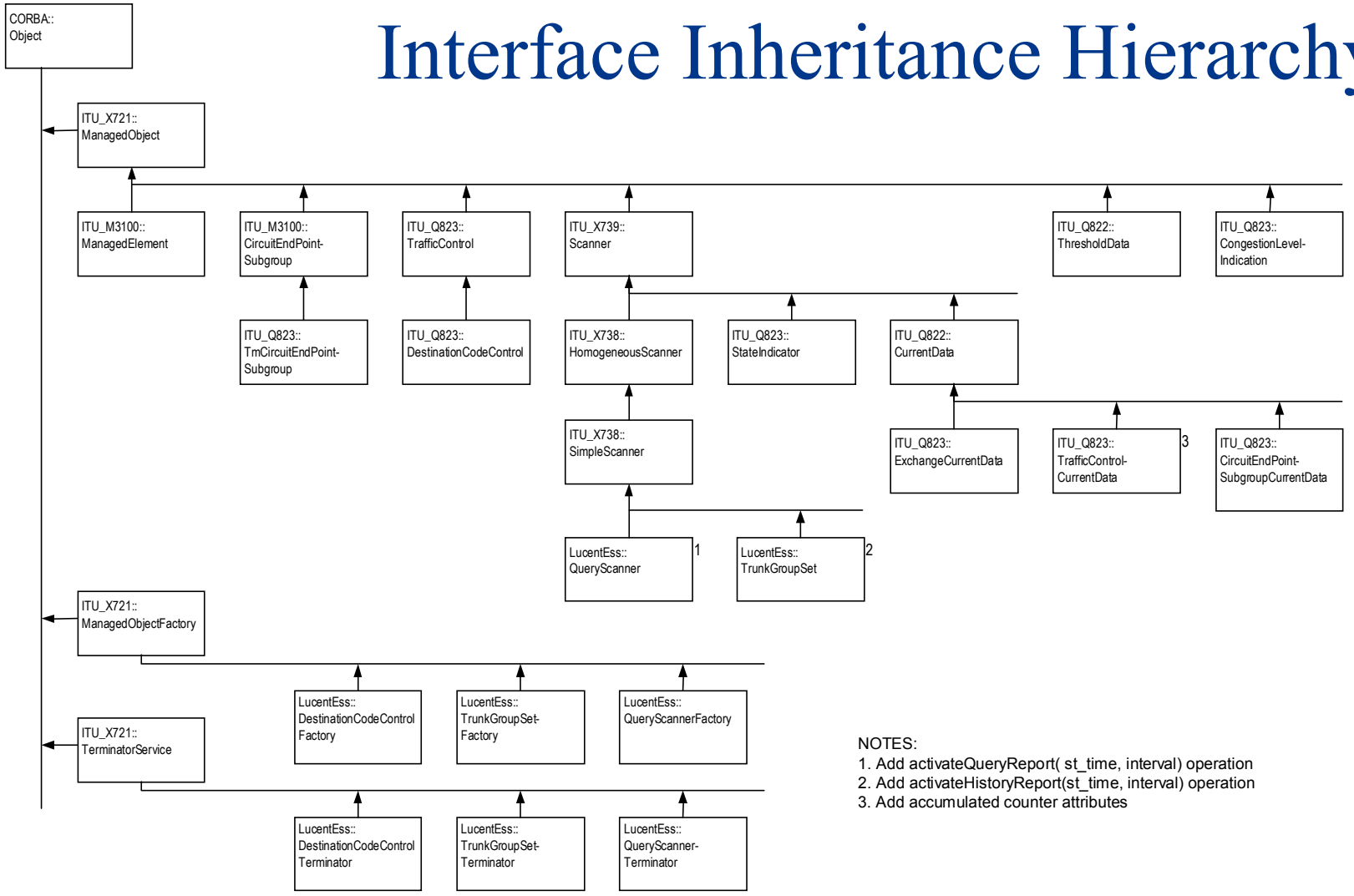
Interface Inheritance Hierarchy



NOTES:
1. Add activateQueryReport(st_time, interval) operation
2. Add activateHistoryReport(st_time, interval) operation
3. Add accumulated counter attributes

Interface Example 1: Scanner

Inherited From: Managed Object

Attributes:

Administrative State:[RW] activates and deactivates (administratively suspending the scanner from emitting PM summary reports) the function performed by the scanner.

Operational State:[R] identifies whether or not the scanning function represented by this entity is capable of performing its normal functions.

Availability State:[R] identifies whether a scanner is on duty or not.

Granularity Period:[RW] specifies the time between scans (e.g., retrieve PM data every 24 hours).

Start Time:[RW] defines the date and time at which this scanner starts functioning.

Stop Time:[RW] defines the date and time at which this scanner stops functioning.

Notifications:

Attribute Value Change:

State Change:

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Interface Example 2: CurrentData

Inherited From: Scanner

Attributes:

Granularity Period:[R] inherited from Scanner, specifies the PM parameters collection period (5 minutes, 15 minutes, 1 hour, or 24 hours).

Suspect Interval Flag:[R] indicates that the performance data for the current period may not be reliable, or the NE was unable to collect data ('True'). For reliable data the value of this attribute is 'False'.

Elapsed Time:[R] represents the difference between the current time and the start of the present summary interval.

Threshold Data Instance:[R] * identifies the Threshold Data entity which contains the threshold values for the performance monitoring data collected by this entity. Initially this attribute identifies a Threshold Data entity that contains default threshold values.

History Retention:[RW] specifies the history data retention time for History Data entity (7 days of 5 minutes, 15 minutes, 1 hour, or 24 hours intervals,).

Notifications:

Quality of Service Alarm:

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Interface Example 3: SimpleScanner

Inherited From: Homogeneous Scanner

Attributes:

Once Report Attribute Id List:[RW] contains a set of attribute Ids. The value of the attributes identified shall be included only once in the summary report if they have the same value across all the observed objects.

Numeric Attribute Identifier Array:[RW] contains a numeric array of attribute identifiers for reporting purposes.

Actions:

Activate Scan Report: initiates a scan according to the current entity and attribute selection attributes of the scanner. The reply includes all scanned attribute values.

Notifications:

Scan Report: emitted upon completion of a scan, and includes the name of the observed objects and requested attribute values observed during the scan.

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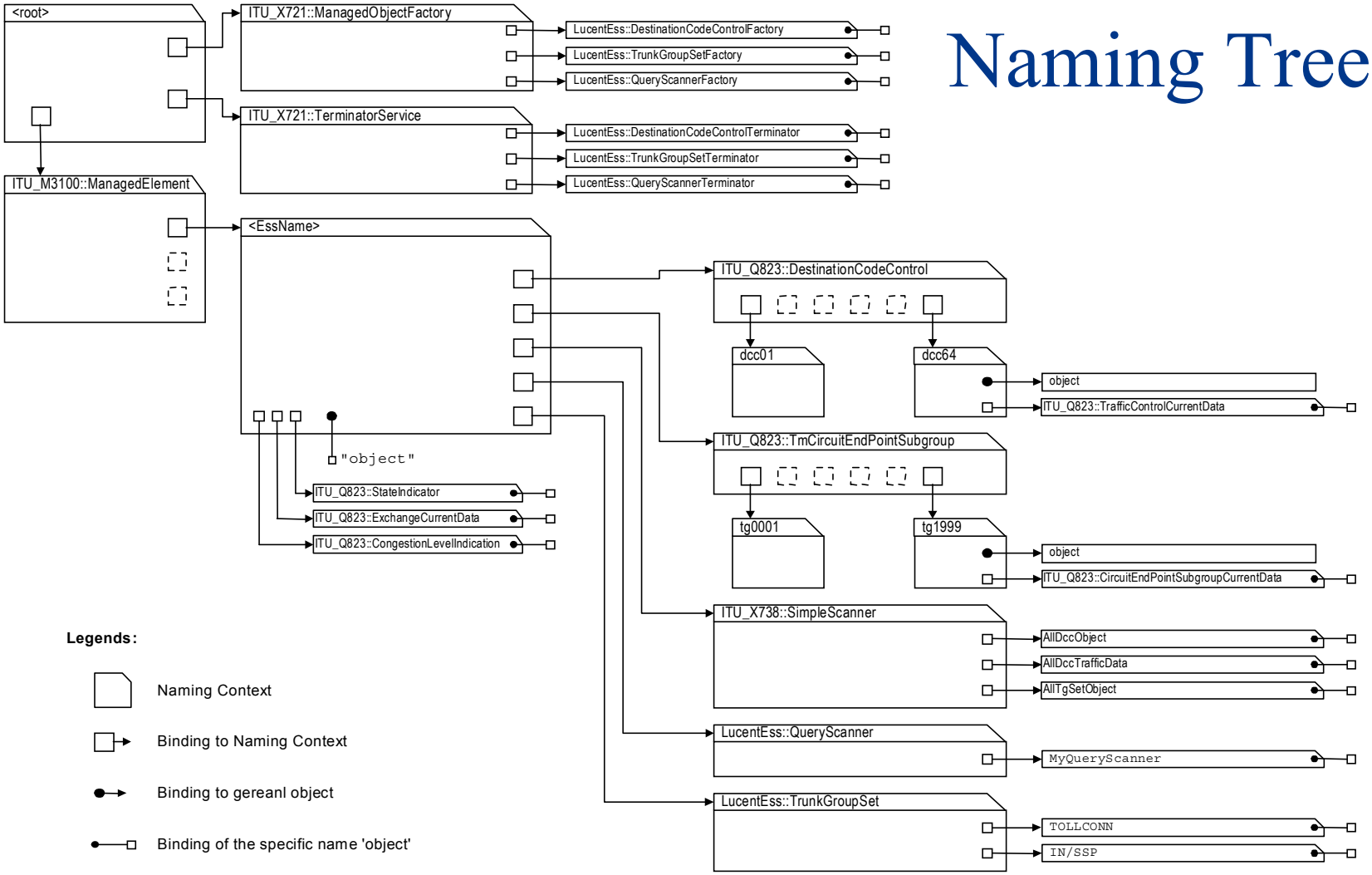
Naming Tree



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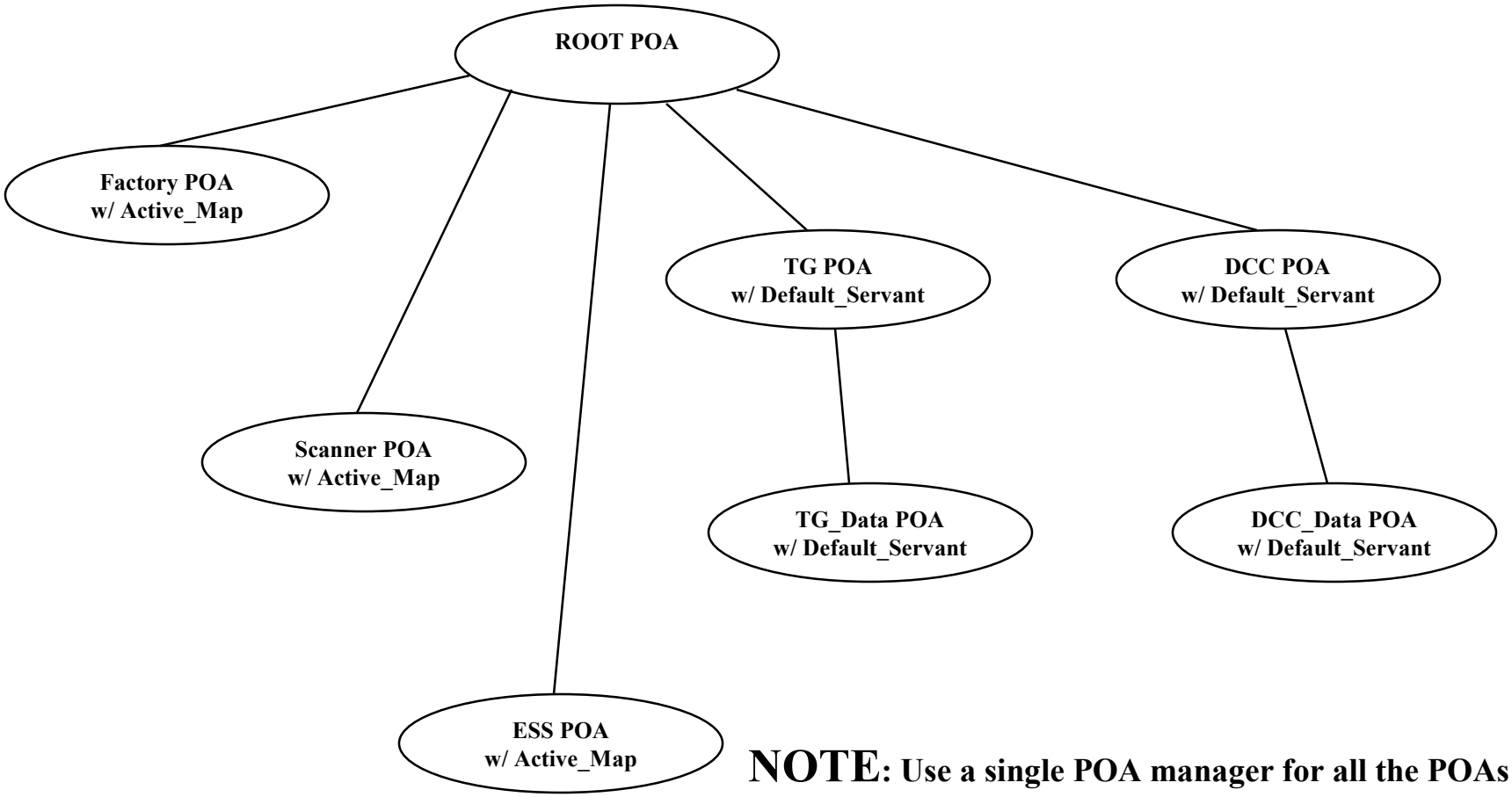
POA Structure



NOTE: Use a single POA manager for all the POAs

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Polices for Map-type POA

Policy Type	Polity Value	Comments
LifespanPolicy	PERSISTENT	Server needs CORBA objects that live beyond any particular process in which they are created or activated.
IdAssignmentPolicy	USER_ID	Server needs to assign its own identifiers to its persistent objects for keeping track of them.
ImplicitActivationPolicy	NO_IMPLICIT_ACTIVATION	Server needs to explicitly activate CORBA objects for PERSISTENT policy.
RequestProcessingPolicy	USE_ACTIVE_OBJECT_**MAP**_ONLY	Since only a few objects under this poa, Server can use active object map.
IdUniquenessPolicy	UNIQUE_ID	Server needs unique association between object id and the corresponding servant in the active object map.
ServantRetentionPolicy	RETAIN	Again, for only a few objects under this poa, Server can keep the associations in the active object map.
ThreadPolicy	ORB_CTRL_MODEL	Server needs multiple threads to service multiple requests concurrently.

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Polices for Default Servant-type POA

Policy Type	Polity Value	Comments
LifespanPolicy	PERSISTENT	Server needs CORBA objects that live beyond any particular process in which they are created or activated.
IdAssignmentPolicy	USER_ID	Server needs to assign its own identifiers to its persistent objects for keeping track of them.
ImplicitActivationPolicy	NO_IMPLICIT_ACTIVATION	Server needs to explicitly activate CORBA objects for PERSISTENT policy.
RequestProcessingPolicy	USE_DEFAULT_SERVANT	Containing many thousands of objects with the same IDL interface type under this poa, Server needs to use default servant.
IdUniquenessPolicy	MULTIPLE _ID	To map multiple object identifiers to a single servant, Server needs MULTIPLE _ID policy.
ServantRetentionPolicy	NON_RETAIN	With DEFAULT_SERVANT, Server doesn't need to retain the associations.
ThreadPolicy	ORB_CTRL_MODEL	Server needs multiple threads to service multiple requests concurrently.

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Implementation

- System - Windows NT 4.0
  - CPU: 366 MH; Memory: 128MB; Disk: 10 GB
- Toolkit - IONA's Orbix2000
- CORBA Service - Naming Service
- DB Connection - ODBC
- Inter Process Communication - Socket
- WebServer - Apache v1.3
- Language - C++, Java

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Examples

- 5 min. Exchange Data
  - the switch data is updated to a database every 5 minutes
  - the CORBA server retrieves the data every 5 minutes
- Destination Code Control
  - Factory Object creates the Control Object and
  - sends switch-specific control command to the switch
  - Terminator Object destroys the Control Object and
  - cancels the control command from the switch

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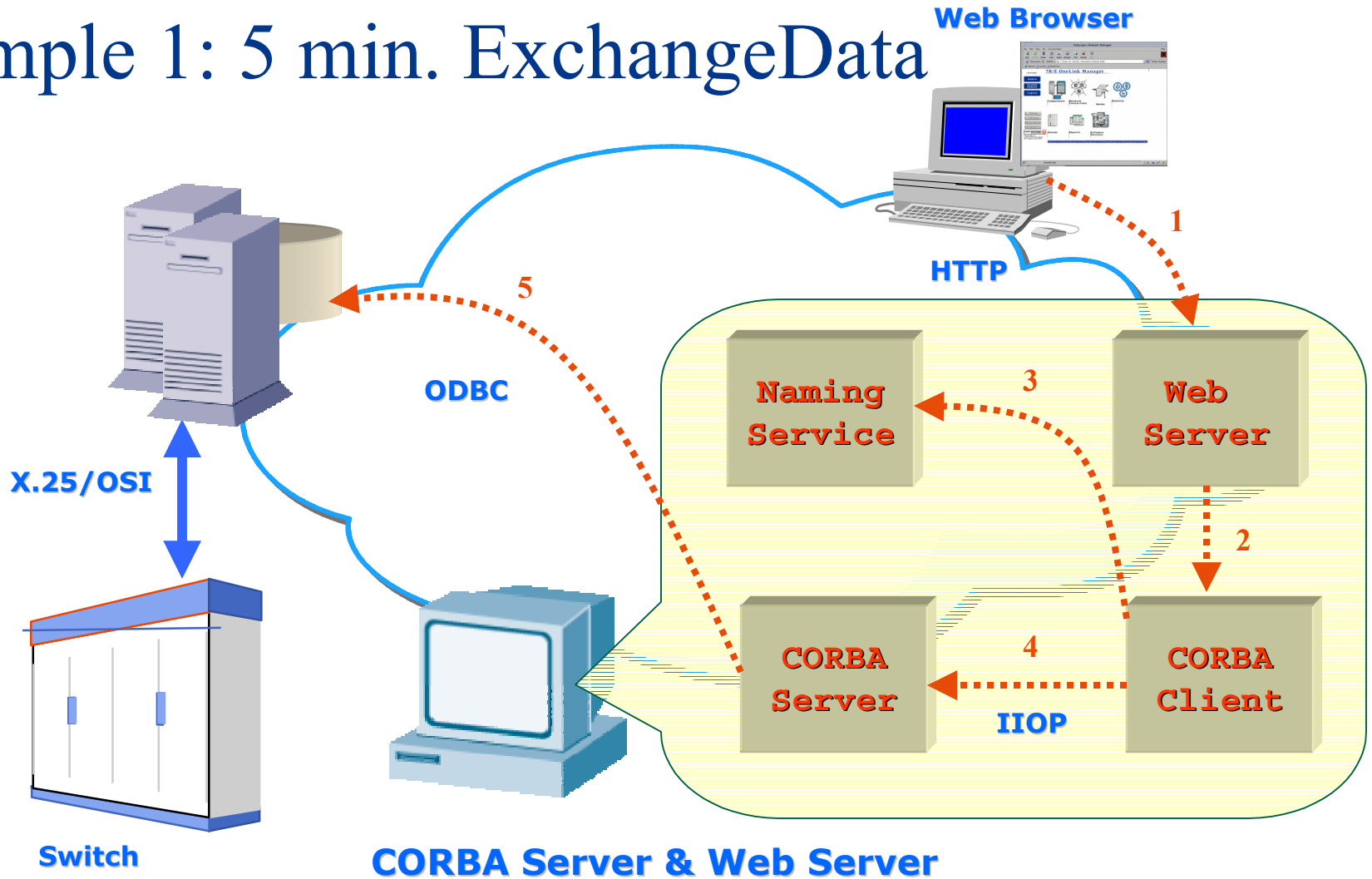
Example 1: 5 min. ExchangeData



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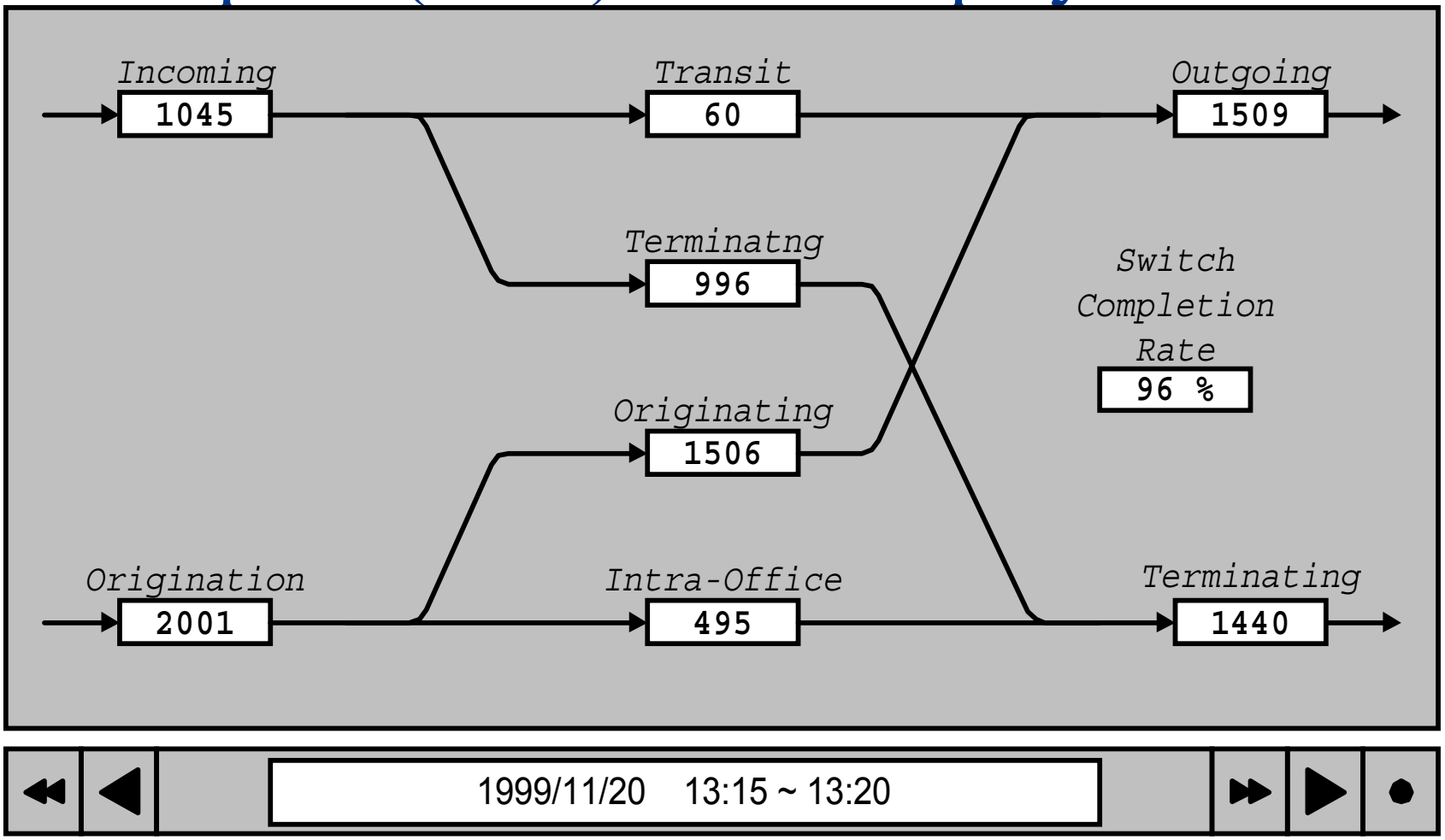
Example 1 (cont.): Data Display



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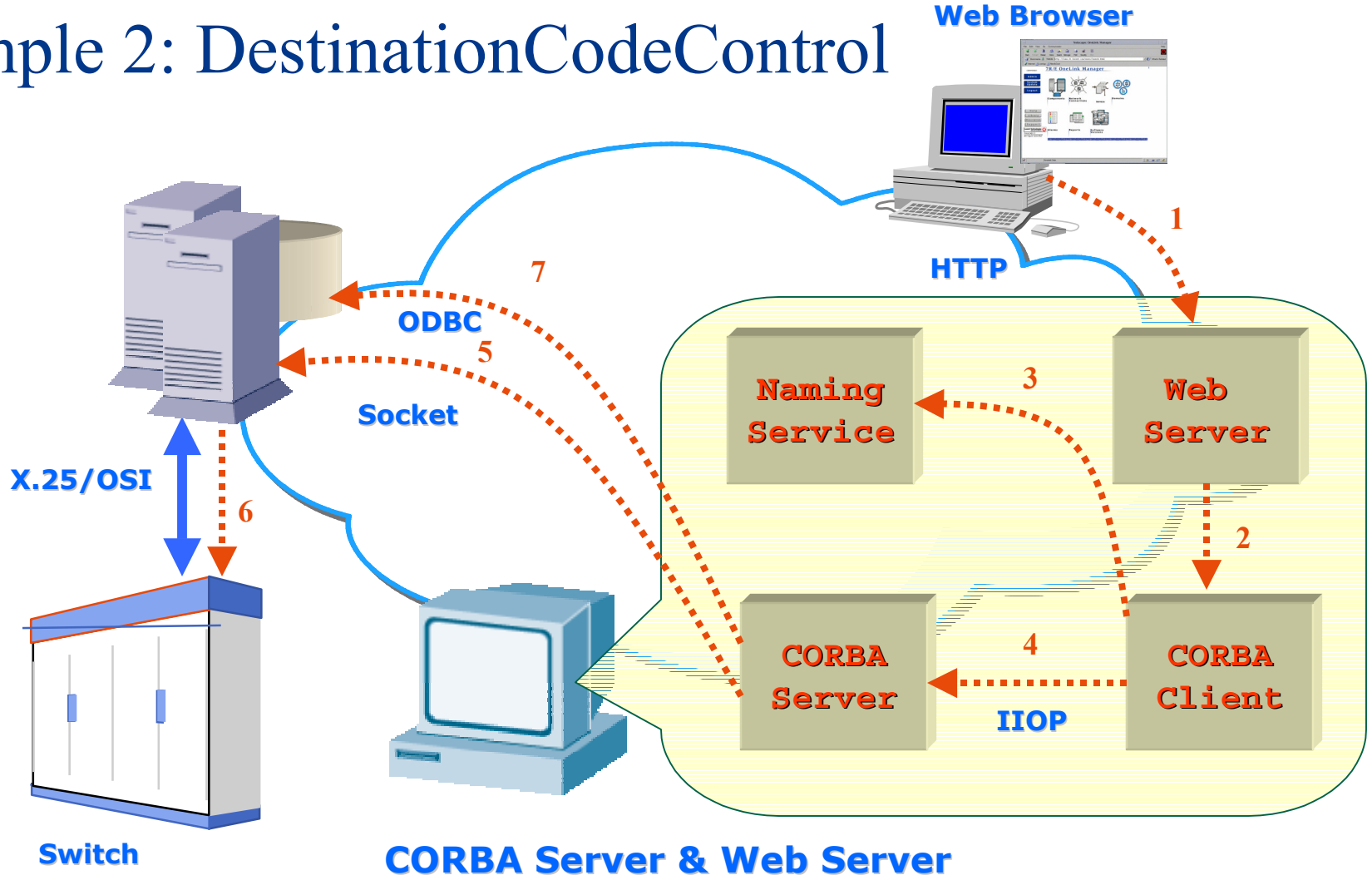
Example 2: DestinationCodeControl



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Example 2 (cont.): Data Display

Destination Code Control Table

ID	Parameters						Current Counts		Accumulated Counts		
	Type	Code	Pri.	Pct.	Gap.	Ann.	Attempt	Pass	Elapse	Attempt	Pass
005	ALL	35779	ALL	12.5 %		NCA	81	11	101	7205	902
010	INTL	86	ALL		0.25 sec	EA1	128	16	20	980	125
022	ALL	2547	ALL	25 %		NCA	32	8	5	160	40
. . .											

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Performance Evaluation

- Number of Instances
- Number of Name Bindings

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Number of Instances

- Facts
  - the number of different types of objects is small
  - the number of instances is large
- Approach
  - use a default-servant to represent a object type
  - use database records to represent instances
- Performance
  - the performance is only bound by the underlying database system

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Number of Name Bindings

- Facts
  - the number of "to be published" instances is large
  - the number of Name Bindings is large
- Approach
  - T1M1 CORBA NM Framework defined a principle for mapping from TMN containment tree to CORBA Naming tree
- Performance
  - the performance is bound by the specific Naming Service implementation

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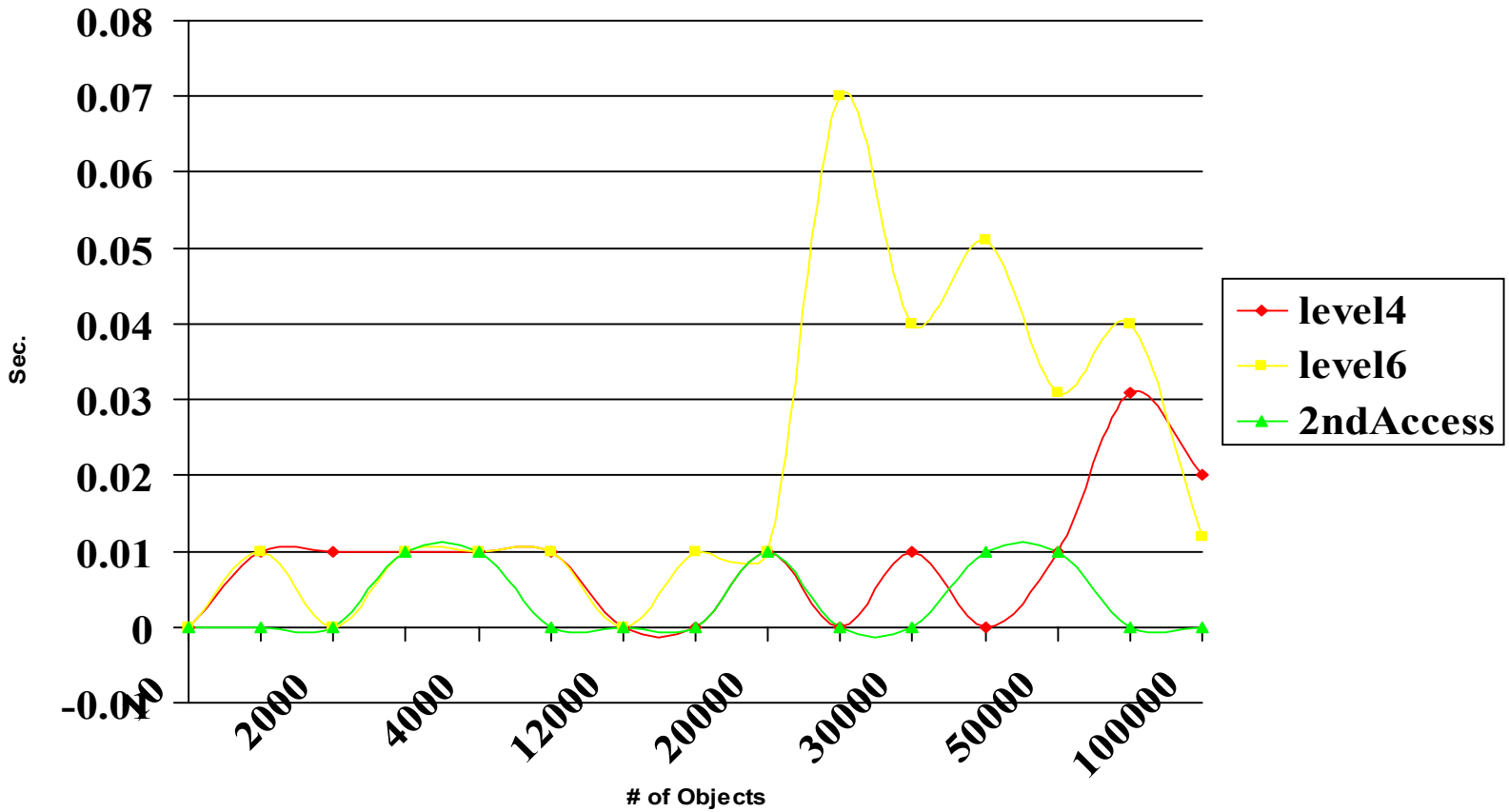
Object Resolving Latency



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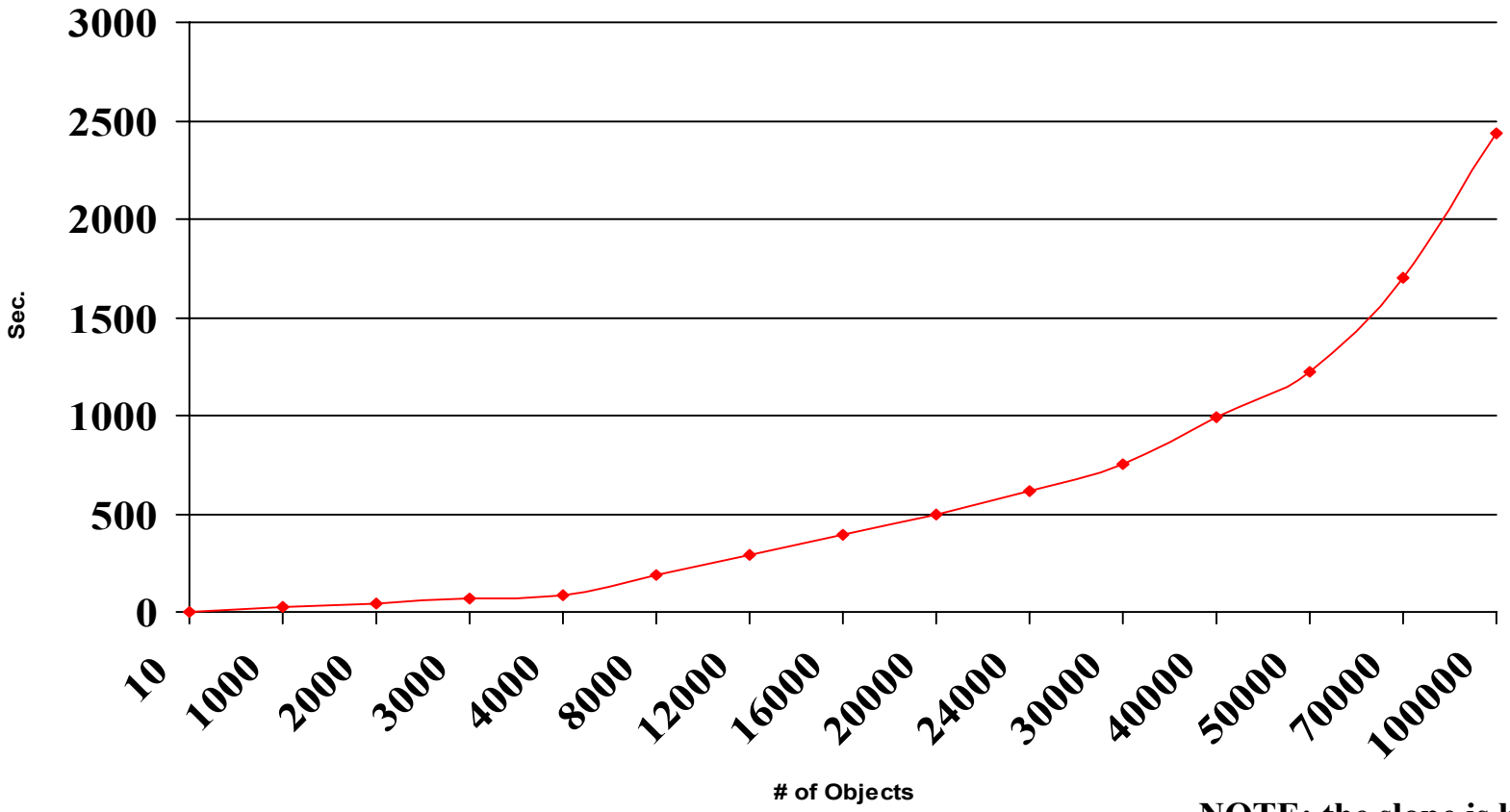
Naming Tree Building Time



40 min.

NOTE: the slope is linear (ave sec/obj = 0.025)

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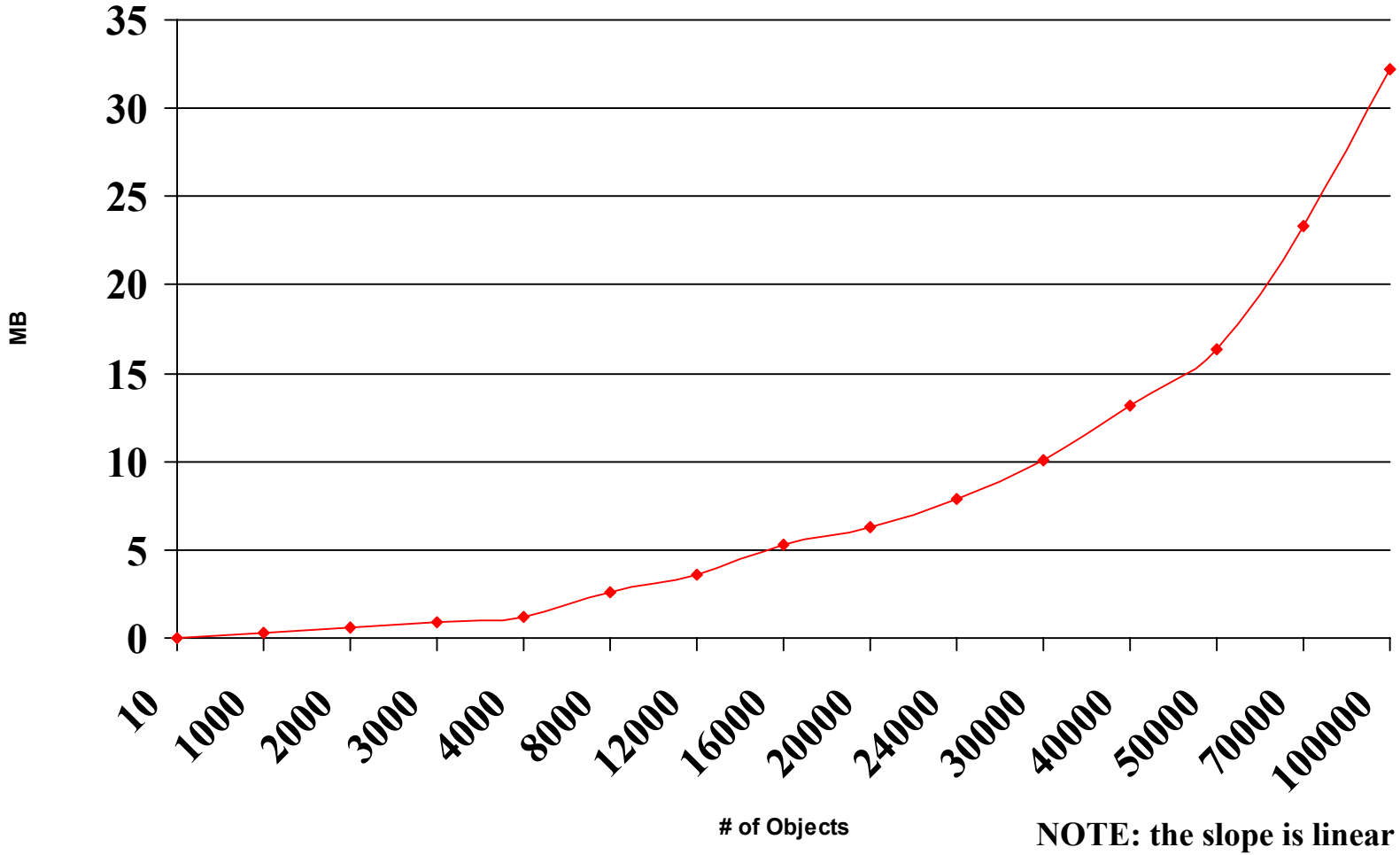
Memory Size of Naming Service



NOTE: the slope is linear (ave byte/obj = 320)

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Conclusion

- CORBA can be used in Network Management
  - CORBA NM framework
  - IDL information model
  - mapping to proprietary interface
  - end-to-end connection (integration)
- Performance is acceptable
  - with POA, large number of instances will not cause performance problem
  - with current Naming Service implementation, resolving a name is very fast, but initialization time and memory size might need to be considered when the number of name bindings become large

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Next Steps

- Cooperate with Notification Service
- Expend it to cover packet side (ATM switch)
- Submit a joint contribution on Performance Management to standards body (T1M1, ITU-T)