

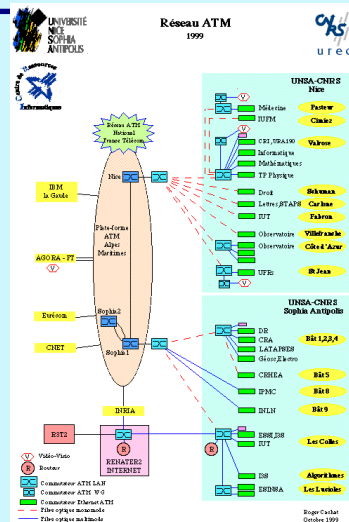
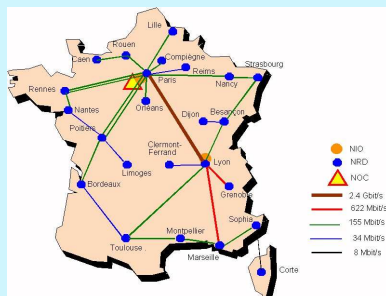
Introduction to Network Management

- NM Concrete
- NM Real
- Actors in the NM Business
- NMS Illustrated : Presenting an Alarm Management System
- NMS Illustrated : Demonstrating EMS tools
- Normalisation TMF et nouvelles technologies (UML XML, SOA, WSDL, JMS...)

MichelBesson@yahoo.com

NM Concrete Concrete Example 1 (Network)

- Renater: more than 600 sites connected
<http://www.renater.fr>



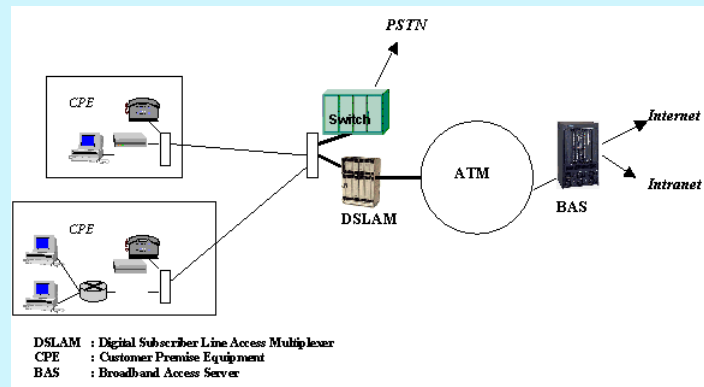
NM Concrete

Concrete Example 1 (Service)

- Connecting to Renater :
 - Procédures de raccordement d'un site à Renater,
 - Obtention d'adresses IP,
 - Tarifs,
 - Utilisation autorisée.
- Additional Services :
 - Vidéo numérique :
 - Visioconférence, diffusion de cours et conférences, exposés enregistrés en multimedia (vidéo à la demande)
 - Distribution des News
- Network Services :
 - IPv4, IP Multicast
 - IPv6
 - VPN ATM
 - En cas d'incident

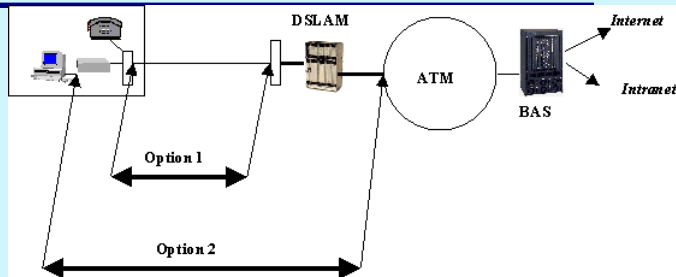
NM Concrete

Concrete Example 2 : ADSL



NM Concrete

Concrete Example 2 : ADSL

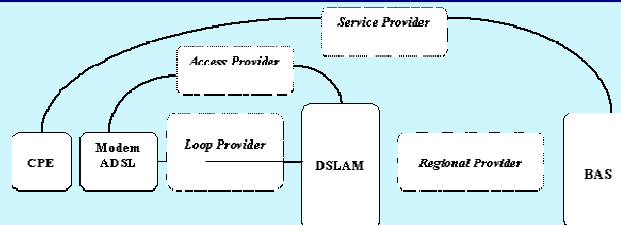


Options de dégroupage

- **Option1:** L'opérateur historique (*Loop Provider*) fournit une paire de cuivre " nue " à l'opérateur entrant, qui déploie ses propres équipements dans les locaux de l'opérateur historique. Ce nouvel opérateur devient ainsi *Access Provider*
- **Option2:** Le trafic est livré sur des circuits virtuels (a priori de niveau ATM).

NM Concrete

Concrete Example 2 : ADSL



- **Le Loop Provider** exploite la paire de cuivre :
en France c'est aujourd'hui exclusivement France Télécom.
- **L'Access Provider** exploite les DSLAM et les modems ADSL chez le client, c'est donc lui qui définit l'offre ADSL (débit / QoS)
ex: LDCOM/9Telecom, Easynet, Colt, FreeTelecom
- **Le Service Provider** aujourd'hui il s'agit essentiellement de l'*Internet Access Provider (IAP/FAI)* : ex: Free, 9OnLine, Tiscali, AOL, Club-Internet, Wanadoo offrant des services à des *Internet Service Providers*
- **Le Regional Provider** achemine le trafic depuis les DSLAM répartis près des commutateurs d'accès téléphoniques, vers les BAS centralisés.

NM Concrete

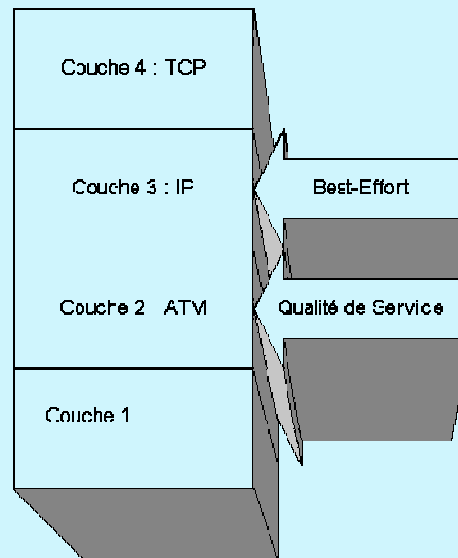
Concrete Example 2 : ADSL

ATM propose 3 types de qualité de service:

•**UBR** : Unspecified Bit rate. En fait il s'agit ici de fournir à ATM de la **non qualité de service**. On se retrouve dans la bonne vieille technique du best effort. C'est à dire que, comme le câble, certains utilisateurs sont plus avantagés que d'autres sans aucune règle particulière sur le réseau.

•**CBR** : Constant Bit Rate. Le flux définit pour ce PVC est constant et défini à l'avance.

•**VBR** : Variable Bit Rate. Le flux définit pour ce PVC est, globalement, borné entre une valeur minimum et maximum.



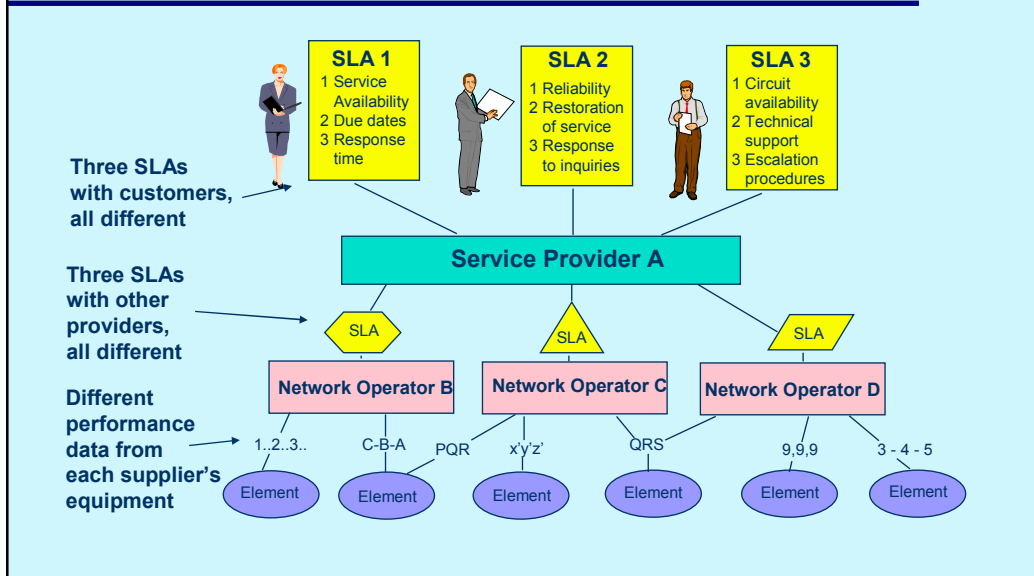
NM Concrete

Roles, Rights and Responsibilities

- End User
 - Service available on demand
 - Appropriate support in case of problems (SLA: Service Level Agreement)
- Network Infrastructure Operator
 - Different kinds of equipment from different vendors
 - Minimize cost
 - Maximize revenue
- Service Provider
 - Acts as a User and an Operator

NM Concrete

Example: Performance Reporting



NM Concrete

The NM Process of the Operator: Global Sequence

Planning and engineering

- Network Design
- Product planning and development



Provisioning and Operations (Networks & Services)



Customer Care and Billing

- Collecting CDR (Customer Data Records)
- Pricing / Rating
- Billing
- Customer Service / Customer Support

NM Concrete

The NM Process of the Operator: Operating the Network

- **Network and Service Provisioning**
 - Configuration Management
 - Inventory Management
 - Service Order Processing
 - Service Activation

- **Operations**
 - Network Operations / Fault Management
 - Network Health Reporting
 - Repair/Field Service
 - Security



NM Concrete

The NM Process of the Operator: Equipment Management

- **Configuration Management**
 - Set / Modify control parameters, statically or dynamically
 - Read parameters modified by the equipment

- **Alarm Management**
 - Collects errors (hardware, software) or events (usage)

- **Accounting Management**
 - Information about resource consumed

- **Performance Management**
 - Collects usage statistics

- **Security Management**
 - Control access rights, notify of security breaches (fraud)

NM Concrete

Standards for NM (EMS) : SNMP and CMIP

SNMP

```

system OBJECT IDENTIFIER ::= { mib-2 1 }

sysDescr OBJECT-TYPE
    SYNTAX DisplayString (SIZE (0..255))
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "A textual description of the entity..."
    ::= { system 1 }
    
```

Specifications Information

- SNMP use Variables and Tables
- CMIP use Objects

CMIP

```

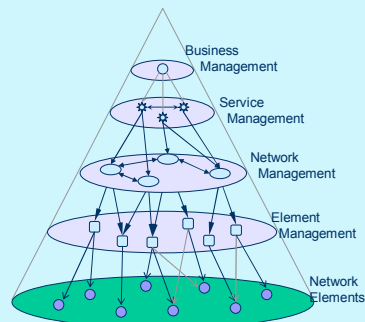
system MANAGED OBJECT CLASS
    DERIVED FROM top;
    CHARACTERIZED BY
        systemPkg PACKAGE
        -- SEE MIB II [16] for attribute semantics
    ATTRIBUTES
        sysDescr GET,
        sysObjectId GET,
        sysUpTime GET,
        sysContact GET-REPLACE,
        sysName GET-REPLACE,
        sysLocation GET-REPLACE,
        sysServices GET;
    NOTIFICATIONS
        coldStartEvent,
        warmStartEvent,
        entSpecificEvent;;;
    REGISTERED AS {mib 1};

sysDescr ATTRIBUTE
    WITH ATTRIBUTE SYNTAX
        OIM-Module.PrintString;
    MATCHES FOR Equality;
    -- SEE MIB II [16] for attribute semantics
    REGISTERED AS {system 1};
    
```

NM Real

Different Kinds of NM

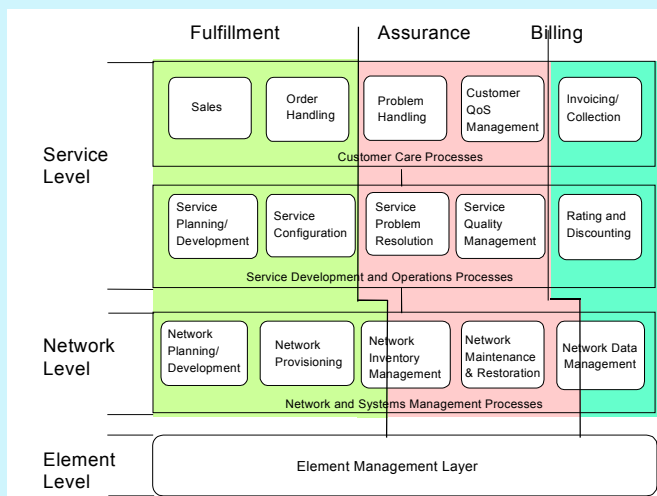
- Enterprise NM # Operator NM
- NM in the large # in the small
- TMN: Piling up different levels
 - Element Management
 - Network Management
 - Service Management



NM Real

TMF: From NM Standards to OSS Components Sets

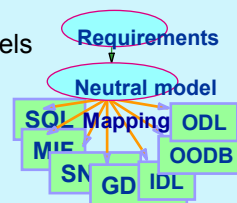
- The TOM OSS Business Model



NM Real

TMF: From NM Standards to Computing Technologies

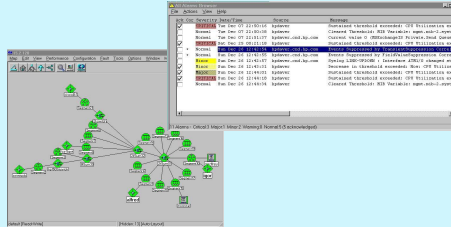
- ▼ Neutral object models
- ▼ Reusability



- ▼ Use 'off-the-shelf' *computing* techniques
 - (eg CORBA, JAVA, etc)
- ▼ Develop Component Sets for consistent implementations
- ▼ Identify and resolve integration and migration issues
- ▼ Deployment of Object Oriented technologies in TMN system
 - CORBA, (OLE / COM / Active X)
- ▼ Deployment of Internet / Web technologies
 - Intranets, Web Browser / generic GUI
- ▼ Use of Mobile Code [eg Java]
 - Apps. Portability,
 - Thin Client / Network Terminals / Dist. Intelligence

NM Real Technology for NM (Generic Platforms)

- HP OpenView
- Compaq TeMIP
- Tivoli
- CA Unicenter TNG
- Bull OpenMaster -> Evidian
- ...



NM Real Technology for NM (OSS Specific)

- Provisioning
 - Orchestream
 - Dorado
- Fault Management
 - MicroMuse
 - RiverSoft
- QoS
 - Infovista
 - Quallaby
- ...

Learning More

Some References

- Books, Documents
 - SNMP, SNMPv2, SNMPv3, William Stallings, 3rd ed, 1999, Addison-Wesley
 - Understanding NMP MIBs Perkins, 1997, Prentice Hall
 - RFC 1214 For a good comparison of SNMP SMI versus GDMO
- Organisation
 - TeleManagement Forum: <http://www.tmforum.org>
 - IETF
 - ITU-T
- Tutorials / Reference / Software
 - <http://www.iec.org/online/tutorials/ems/>
 - <http://netman.cit.buffalo.edu/index.html>
 - <http://snmp.cs.utwente.nl/ietf/>

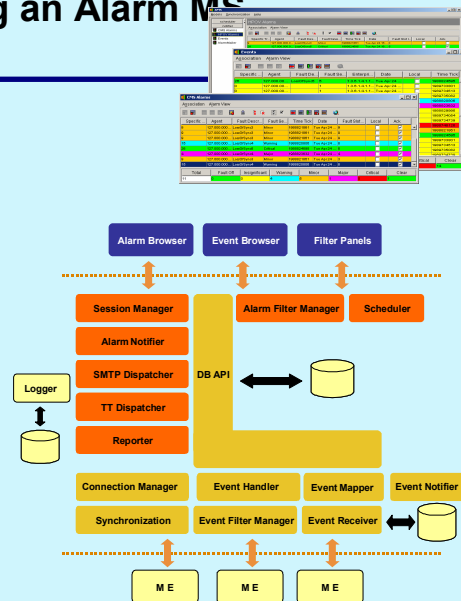
NMS Illustrated: Presenting an Alarm MS

Key Concepts

- Event
 - happens only once
 - owns property attributes (different syntax, different format)
- Alarm
 - tracks over time the status of specific problems
 - has a life cycle that is domain/system specific
- Synchronisation
 - based on the capabilities of the monitored items:
no synch, event log synch, active pbs synch

NMS Illustrated: Presenting an Alarm MS Architecture and Services

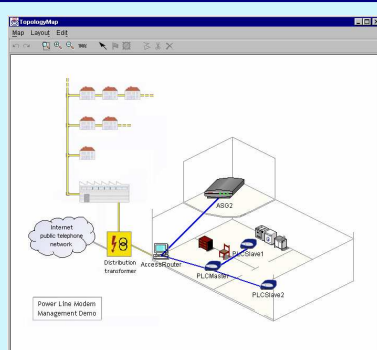
- Multi-Protocol Connection Handling
- Event Collection
- Alarm History
- Alarm and Event Display
- Event / Alarm Filtering
- Data Base Repository
- API to Notify External Applications (TT systems, Reporter, SMTP...)



NMS Illustrated: Presenting an Alarm MS

(1) Operating Powerline Modems:

Disabling Telnet Access - Before the Reboot



SNMP Group Attributes	All Attributes
Name	
ascomPlcNodeType	2
ascomPlcPhyType	1
ascomPlcSerial	4
ascomPlcTelnetConsole	2
ascomPlcStorePersistent	1
ascomPlcReboot	0

```

Telnet 172.16.100.20
Connect  Edit  Terminal  type

Ascom Powerline User Trial System
Copyright (C) 2000 Ascom System AG, Applicable Research & Technology
Build date: Nov 13 2000, 13:47:40

plc> plc>
    
```

SNMP Group Attributes	All Attributes
Name	
ascomPlcNodeType	2
ascomPlcPhyType	1
ascomPlcSerial	1
ascomPlcTelnetConsole	1
ascomPlcStorePersistent	0
ascomPlcReboot	0

NMS Illustrated: Presenting an Alarm MS

(1) Operating Powerline Modems:

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ascomPlcNodeType		2	
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ascomPlcSerial		4	
ascomPlcTelnetConsole		2	
ascomPlcStorePersistent		0	
ascomPlcReboot		1	

10.0.0.30	minor	opened	Tue Nov 21 15:19:19 C...		
10.0.0.25	minor	opened	Tue Nov 21 15:19:19 C...		
avisto.com	minor	opened	Tue Nov 21 15:19:58 C...		
PLCSlave2	minor	opened	Tue Nov 21 15:22:42 C...		

NMS Illustrated: Presenting an Alarm MS

(1) Operating Powerline Modems:

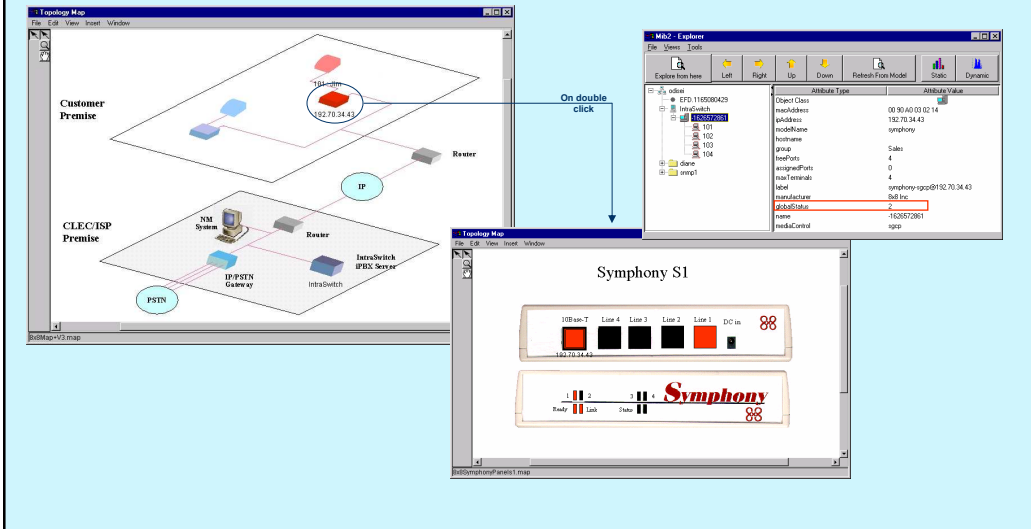
Disabling Telnet Access - After the Reboot

SNMP Group Attributes		All Attributes	
Name			
ascomPlcNodeType		2	
ascomPlcPhyType		1	
ascomPlcSerial		4	
ascomPlcTelnetConsole		2	
ascomPlcStorePersistent		0	
ascomPlcReboot		0	

10.0.0.30	minor	opened	Tue Nov 21 15:19:19 C...		
10.0.0.25	minor	opened	Tue Nov 21 15:19:19 C...		
avisto.com	minor	opened	Tue Nov 21 15:19:58 C...		
PLCSlave2	minor	cleared	Tue Nov 21 15:22:42 C...	Tue Nov 21 15:24:48 C...	

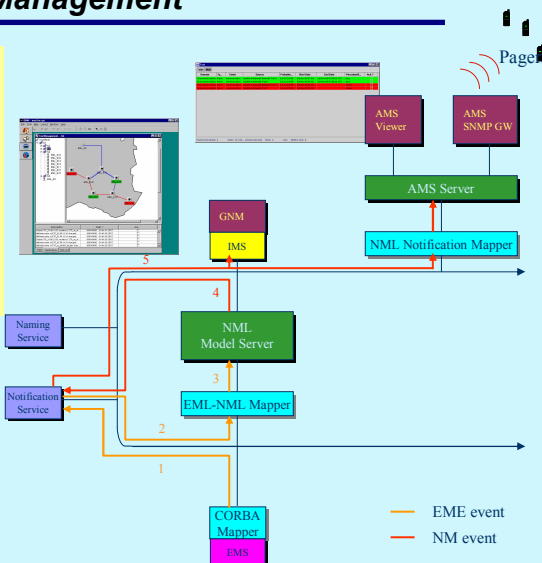
After the reboot, the node is available again and the telnet console is disabled

NMS Illustrated: Presenting an Alarm MS (3) Operating VoIP equipment: Event Handling



NMS Illustrated: Presenting an Alarm MS (4) End to End Trail Alarm Management

- Correlation of EML alarms to generate NML alarms
- Creation and activation of alarm filters
- Creation and control of alarm logs
- Alarm acknowledgement



What is TMForum ?

- ▼ Funded in 1988 (AT&T, BT, Nortel, HP)
- ▼ Non-profit global consortium focused on Operations Support Systems (OSS) and Business Support System (BSS) issues and solutions
- ▼ Provides strategic leadership by giving the industry a common direction and approach to solving problems
- ▼ Focus on business process automation for telecom companies
- ▼ Work includes technical specs and agreements, collaborative developments and the TeleManagement World conference/expo
- ▼ 350 members representing the full telecom value/supply chain

What TMForum does ?

The image shows a screenshot of the TMForum website. A large yellow starburst is overlaid on the page, containing the following text:

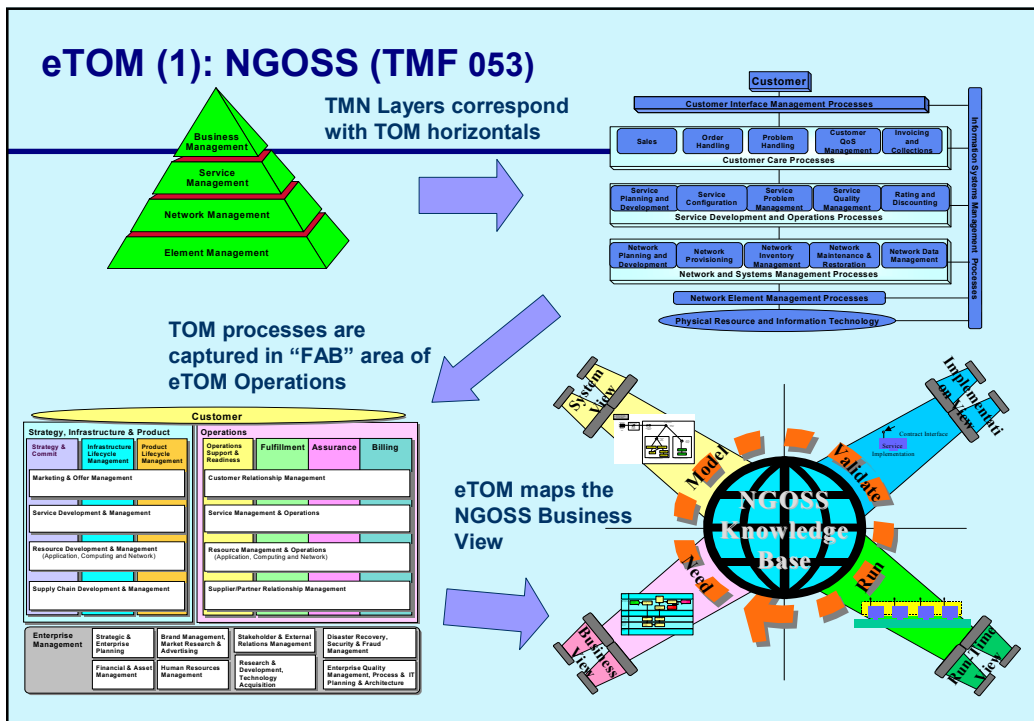
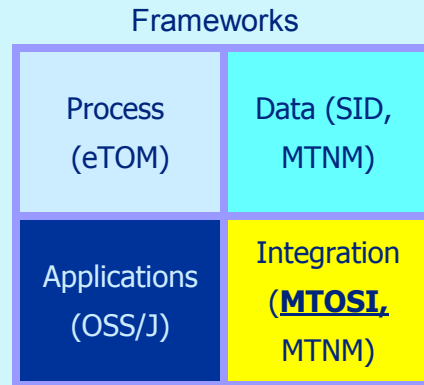
- NGOSS
- eTOM
- SoIP
- IPNM
- Multi-Tech NM
- MTOSI
- SID model: NGOS Shared Information Data

The background of the screenshot shows the website's navigation menu and a list of technical programs. The navigation menu includes: Home, About the TM Forum, Technical Programs, Education, Training, Documents, TeleManagement World, and Search. The list of technical programs includes: NGOSS, eTOM, NGOSS Architecture, NGOSS Shared Information/Data Model, NGOSS Compliance, NGOSS Lifecycle, Catalyst Program, BSS-Billing Projects, Human Machine Interface, Industry Liaison Program, IP Network Management, MTHM, Service Framework, Service Level Agreement Management, Services Over IP Project, Service Provider Leadership Council, Mobile Market Center, Value Chain Market Center, Team Action Week, and Team Archive. The main content area displays the 'Technical Programs' section, highlighting the 'NGOSS' program and listing various sub-projects like 'Introduction to NGOSS', 'NGOSS Latest Release', 'NGOSS Lifecycle - How to use NGOSS', 'eTOM Business Process Map', 'SID Shared Information/Data Model', 'NGOSS Architecture', and 'NGOSS Compliance'. Other sub-projects listed include 'Human Machine Interface Team', 'IP Network Management', 'Multi-Technology Network Management', 'Service Level Agreement/GoS', 'Service Framework Team', and 'Wireless Service Measurements'.

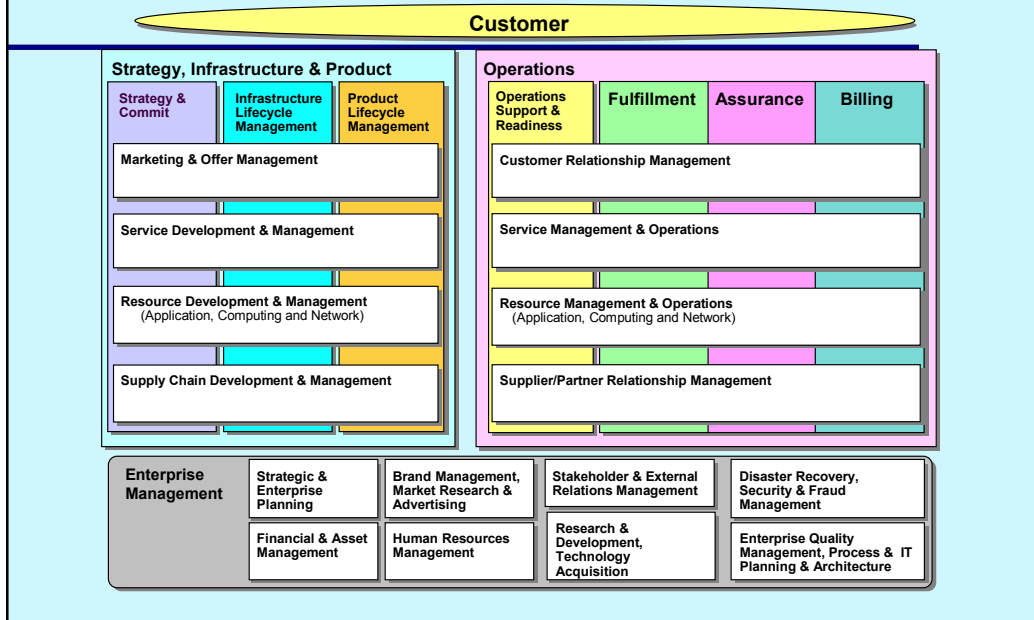
MTOSI: Multi Technology Operations System Interface

Business Driver: Reduce Integration Cost

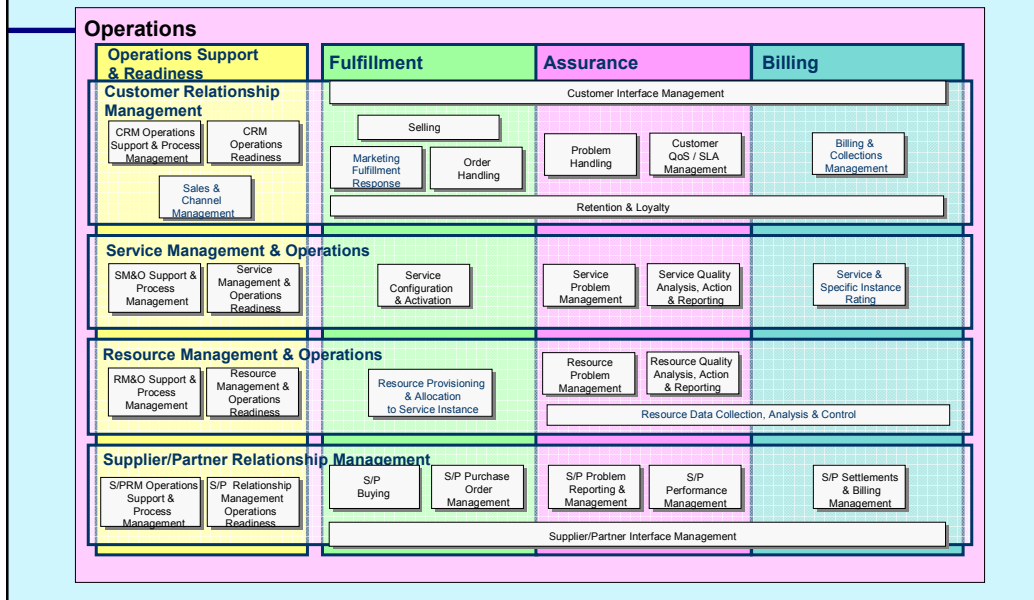
- While about 4% of service provider revenues are spent on operation systems...
- 50%+ of operations costs are devoted to integration [source: Keith Willets, TMW Dallas 2003]
- OS interface standards drive down the high cost of integration
- Need to re-focus TM Forum work on development of an "integration framework"



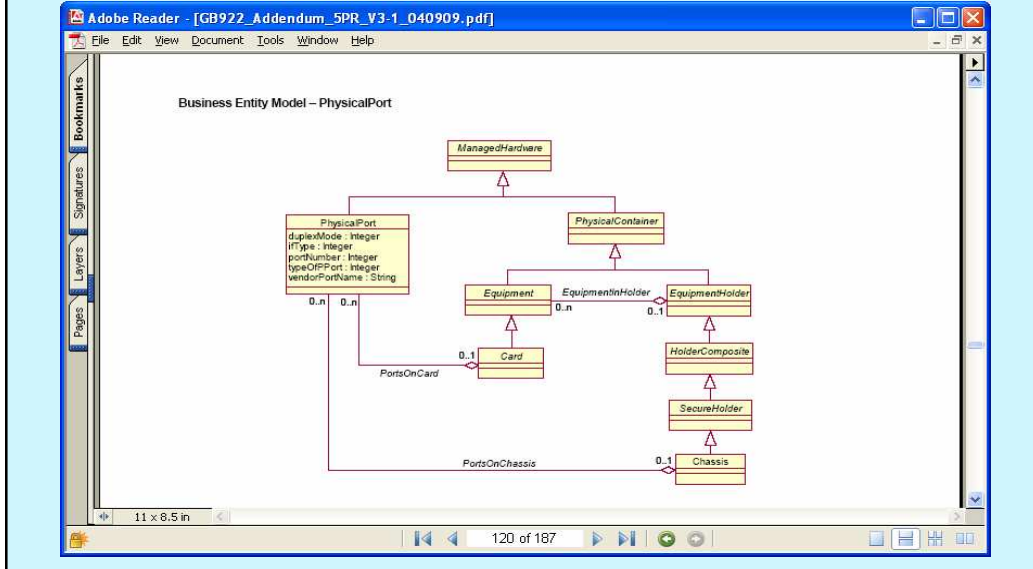
eTOM (2): NGOSS Business Map



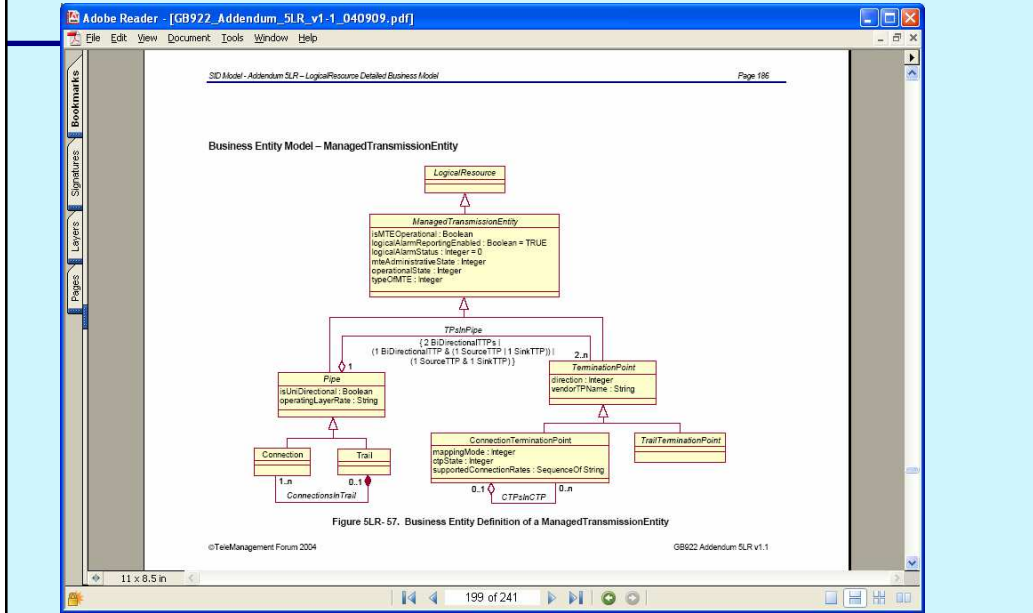
eTOM (3): The Operations Area



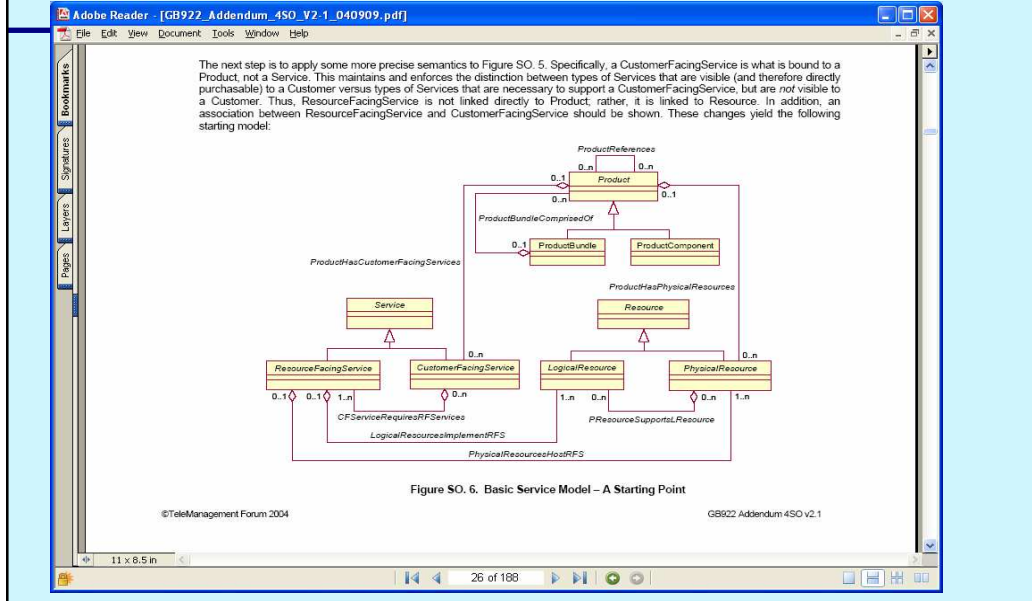
SID (1): Resources



SID (2): Resources

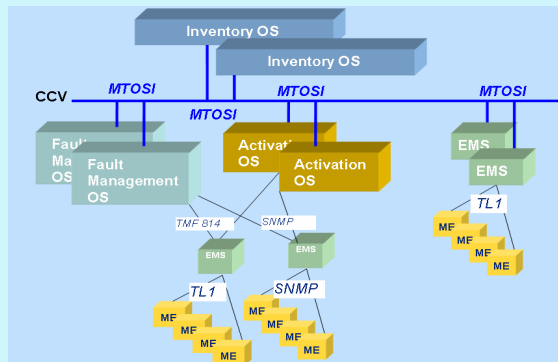


SID (3): Products, Services and Resources

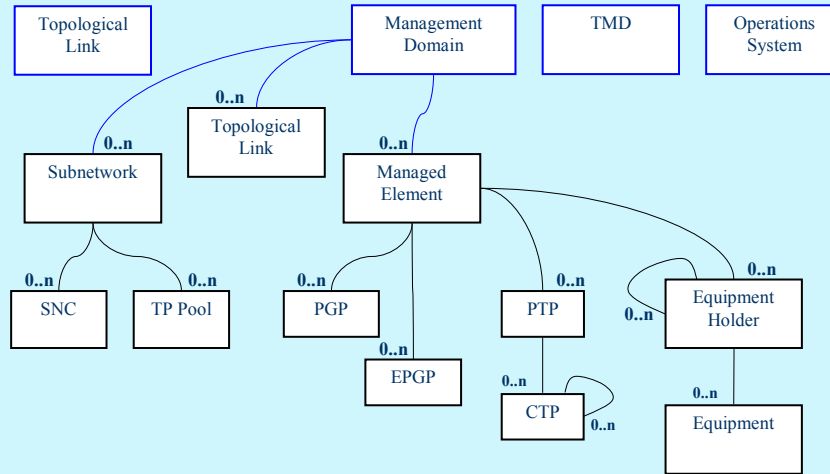


MTOSI Release 1 Focus

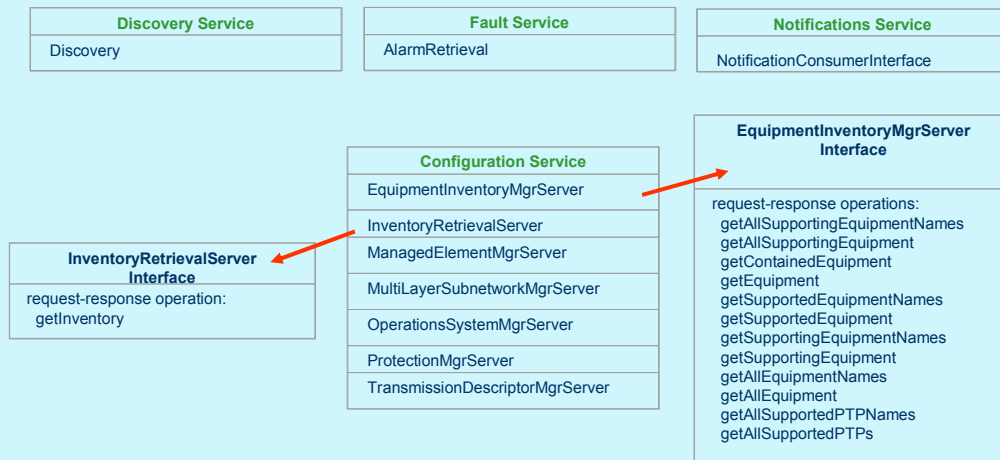
- ▼ OS to OS interface which covers the NMS/EMS interface as a special case
- ▼ Release Version 1.0 designed for:
 - Inventory Retrieval from NMS/EMS
 - Active Alarm Retrieval
 - Inventory Notifications
 - Alarm Notifications



MTOSI Object and Naming Diagram (Release 1)



The Four MTOSI Release 1 Services



Anatomy of an MTOSI XML message

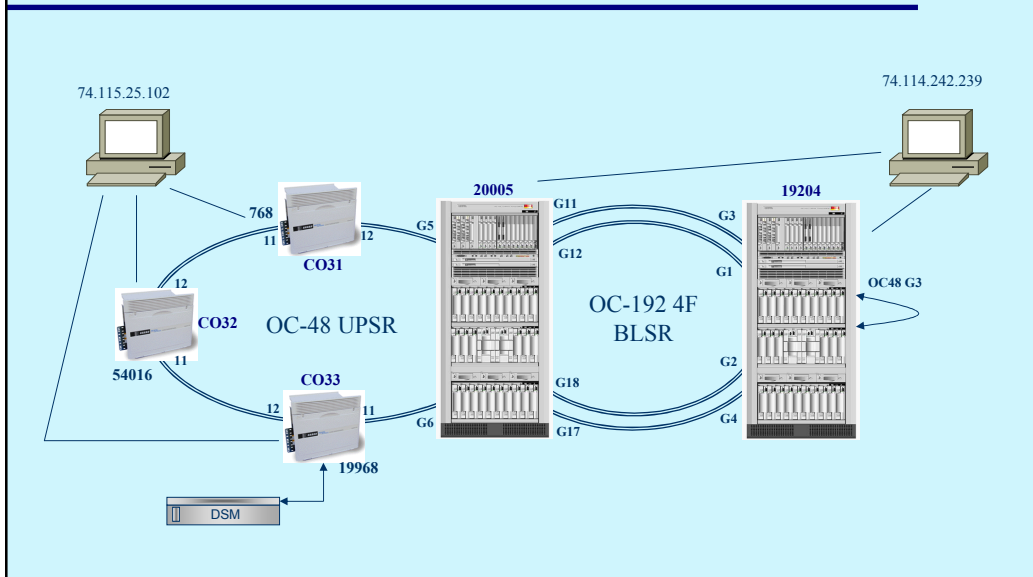
```

<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope">
  <soap:Header>
    <MTOSIHDR tmf854Version="1.0">
      <domain>Inventory</domain>
      <activityName>getInventory</activityName>
      <msgName>getInventory</msgName>
      <msgType>REQUEST</msgType>
      <payloadVersion>1.0</payloadVersion>
      <senderURI>http://senderEndpoint</senderURI>
      <destinationURI>http://destination</destinationURI>
      <replyToURI>http://JNDIreplyToEntry</replyToURI>
      <correlationId>0001</correlationId>

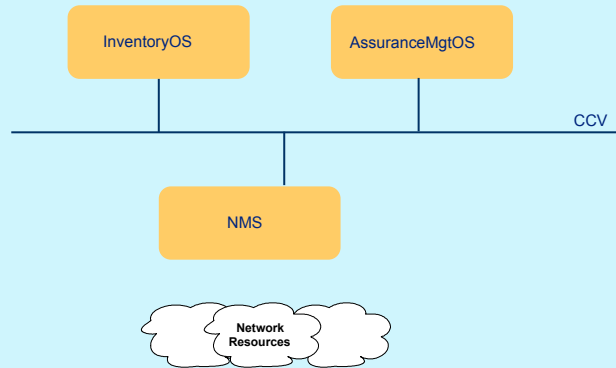
      <communicationPattern>MultipleBatchResponse</communicationPattern>
      <communicationStyle>MSG</communicationStyle>
      <requestedBatchSize>0</requestedBatchSize>
    </MTOSIHDR >
  </soap:Header>
  <soap:Body>
    <getInventory tmf854Version="1.0">
      <filter>
        <includedObjectType>
          <objectType>ME</objectType>
          <granularity>ATTRS</granularity>
        </includedObjectType>
        <includedObjectType>
          <objectType>MD</objectType>
          <granularity>ATTRS</granularity>
        </includedObjectType>
      </filter>
    </getInventory>
  </soap:Body>
</soap:Envelope>

```

Example



The OS Applications



MultipleResponses Pattern The JMS Destinations

RequestorOS
(InventoryOS)

createProducer

createConsumer

jms/RtoNMSQA

requests

jms/RtoInventoryOSQA

responses

SupplierOS
(NMS)

createConsumer

receive

MultipleResponses Pattern

MultipleResponses Header

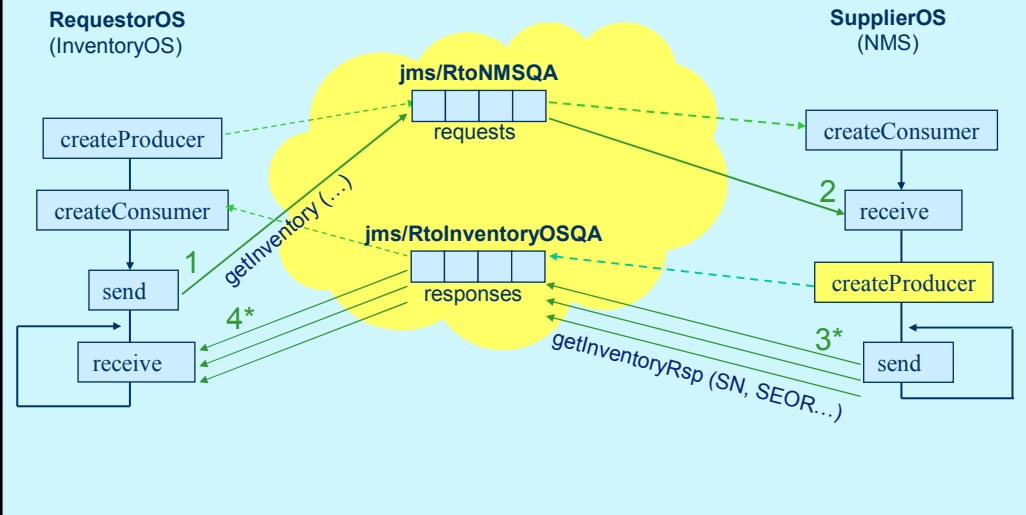
```
<Header xmlns="tmf854"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="..." version="1.0">
  <domain>Inventory</domain>
  <activityName>BulkInventoryRetrieval</activityName>
  <msgName>getInventory</msgName>
  <msgType>REQUEST</msgType>
  <payloadVersion>1.0</payloadVersion>
  <destinationURI>jms/RtoNMSQA</destinationURI>
  <originatorURI>jms/RtoInventoryOSQA</originatorURI>
  <failureReplytoURI>jms/RtoInventoryOSQA</failureReplytoURI>
  <correlationId>2</correlationId>
  <priority>4</priority>
  <communicationPattern>MultipleBatchResponse</communicationPattern>
  <communicationStyle>MSG</communicationStyle>
  <requestedBatchSize>2</requestedBatchSize>
</Header>
```

MultipleResponses Pattern

Mapping on JMS Header

MTOSI_destinationURI="jms/RtoNMSQA"
MTOSI_originatorURI="jms/RtoInventoryOSQA"
MTOSI_domain="Inventory"
MTOSI_activityName="BulkInventoryRetrieval"
MTOSI_msgType="REQUEST"
MTOSI_msgName="getInventory"
JMSReplyTo= The JMS destination (of type Destination) whose JNDI name is "jms/RtoInventoryOSQA"
MTOSI_failureReplytoURI="jms/RtoInventoryOSQA"
MTOSI_payloadVersion="1.0"
JMSPriority=4
MTOSI_communicationPattern="MultipleBatchResponse"
MTOSI_communicationStyle="MSG"
MTOSI_requestedBatchSize=2

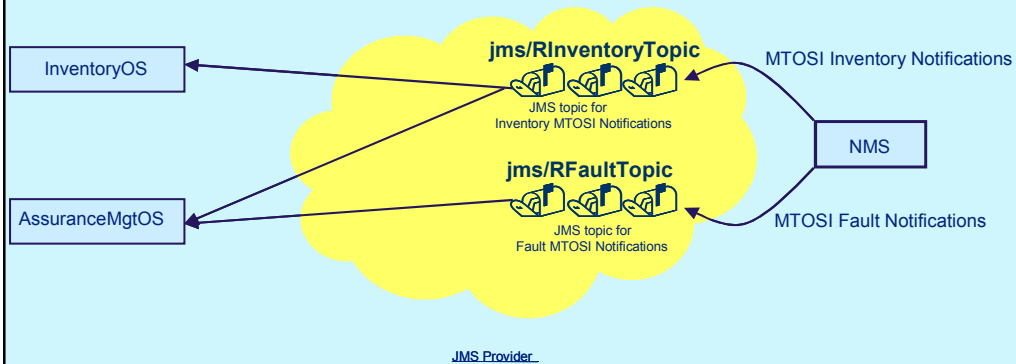
MultipleResponses Pattern The Flow of Information



MultipleResponses Pattern The 3 Responses

- The 3 responses
 - response 1 with ME 1 & 2 (OM3500CO32 54016 and OM3500CO31 768)
 - response 2 with ME 3 & 4 (OM3500CO33 19968 and 20005)
 - response 3 with ME 5 (19204)
- Each response is sent back to the JMS Provider as soon as it is available.
- Indeed, each response message can be collected at will by the InventoryOS once received by the JMS provider.

Notification Pattern The JMS Destinations



Notification Pattern InventoryOS MessageSelector

```
// Declare a message consumer
MessageConsumer tConsumer;

// Look up for the destination topic where to receive
notifications
Destination d =(Destination) context.lookup("jms/RInventoryTopic")

// Create a message consumer for this topic, with the appropriate
message selector
tConsumer =
    session.createConsumer
        (d,
         "MTOSI_EventType = 'ObjectCreation' OR
          MTOSI_EventType = 'ObjectDeletion' OR
          MTOSI_EventType = 'AttributeValueChange'");
```

Notification Pattern

AssuranceMgtOS MessageSelectors (1)

```
// Declare message consumers
MessageConsumer tConsumerInventory,
                tConsumerFault;

// Create a message consumer for the jms/RInventoryTopic topic,
// with the appropriate message selector
tConsumerInventory =
    session.createConsumer
        (context.lookup("jms/RInventoryTopic"),
         "MTOSI_EventType = 'ObjectCreation' OR
          MTOSI_EventType = 'ObjectDeletion'");
```

Notification Pattern

AssuranceMgtOS MessageSelectors (2)

```
// Create a message consumer for the jms/RFaultTopic topic,
// with the appropriate message selector
tConsumerFault =
    session.createConsumer
        (context.lookup("jms/RFaultTopic"),
         "MTOSI_EventType = 'AlarmInformation' AND
          (MTOSI_perceivedSeverity = 0 OR
           MTOSI_perceivedSeverity = 1 OR
           MTOSI_perceivedSeverity = 2)");
```