Network Resource Management System for Grid network service

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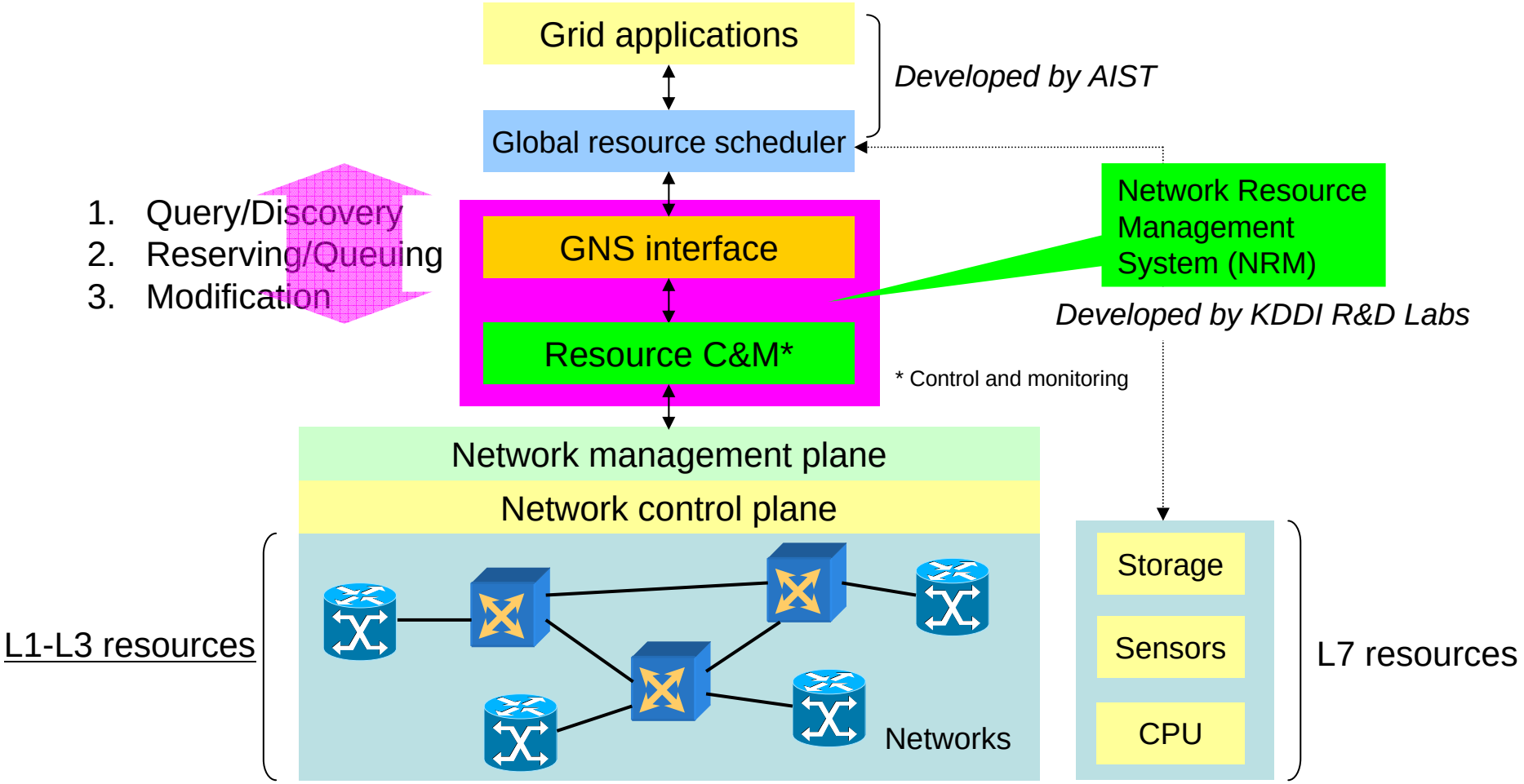
NRM as a GNS enabler

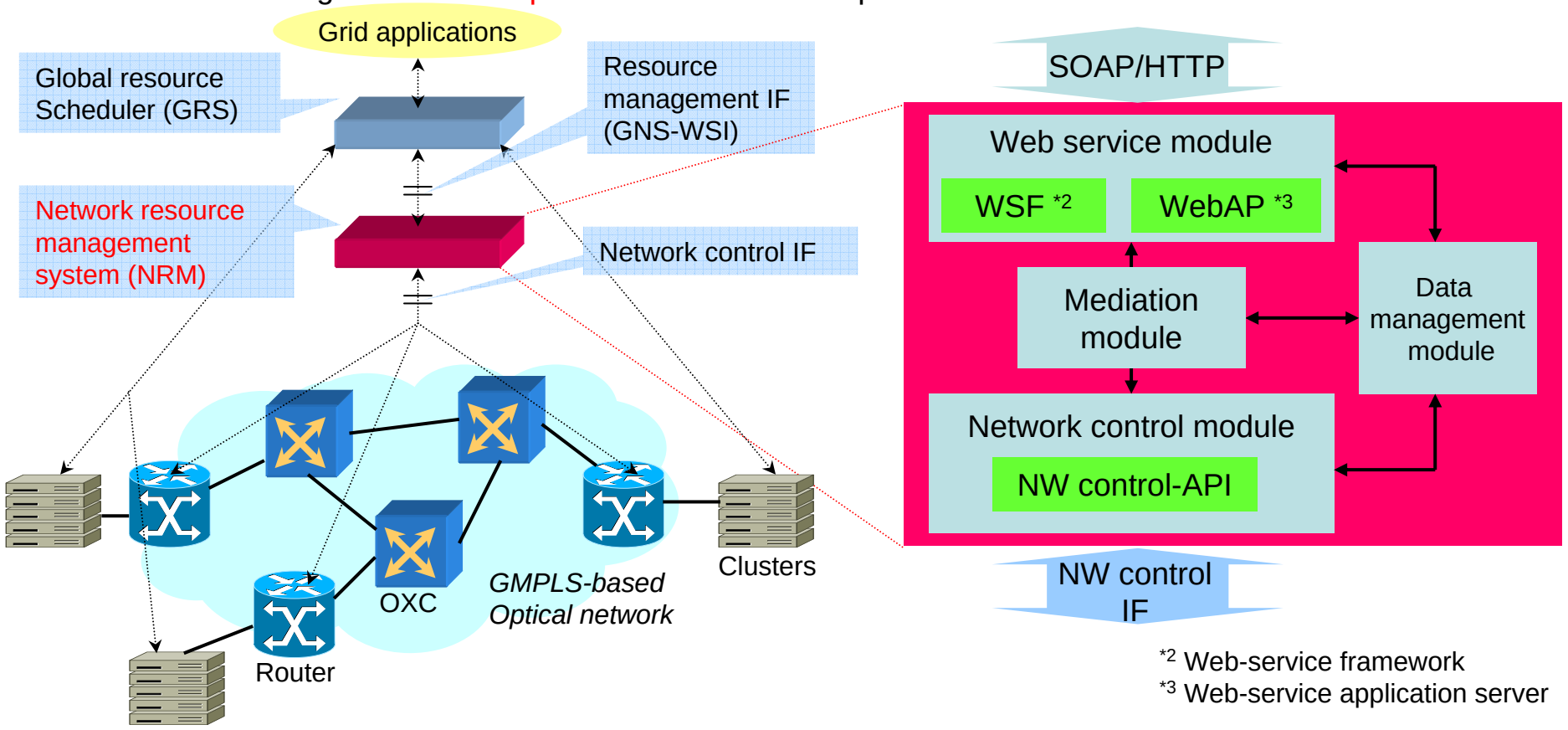
- AIST/KDDI R&D Labs/NTT/NICT's joint work on defining GNS (Grid Network Service) interface
- Network resource management system (NRM)'s primary services
  - Network monitoring and information service (Query/Discovery)
  - Advance reservation and data transport service (Reservation/Queuing)
  - Modification of queue or reservation (Modification)



NRM architecture and implementation

- Arrangement of network resource for grid application via GNS-WSI[*1]
  - Advance reservation according to WSDL-defined service requirement and procedure
  - RPC-based service request and monitoring over SOAP/HTTP messaging
- Mediation functionality between application request and network resource
  - Topology abstraction and virtualization of GMPLS optical networks
  - Lambda-path scheduling of multiple advance reservations
- Control and monitoring (C&M) of GMPLS networks
  - Provisioning of lambda-paths through network control IF
  - Monitoring of status and performance of lambda path

[*1] GNS Web-Services Interface



[*2] Web-service framework
[*3] Web-service application server

Profile of GNS-WSI service parameters

- Six methods are implemented to provide GNS
  - Methods are initiated by GRS (NRM responds to the relevant HTTP port)
  - Reservation and Forced release (Network reservation service)
  - Query (Network information service, Status check of reservation/queue)
  - Modification (Time and BW parameters)
- Status parameters for network information service
  - Availability (Specific resource or network topology)
  - Status of reservation and queue

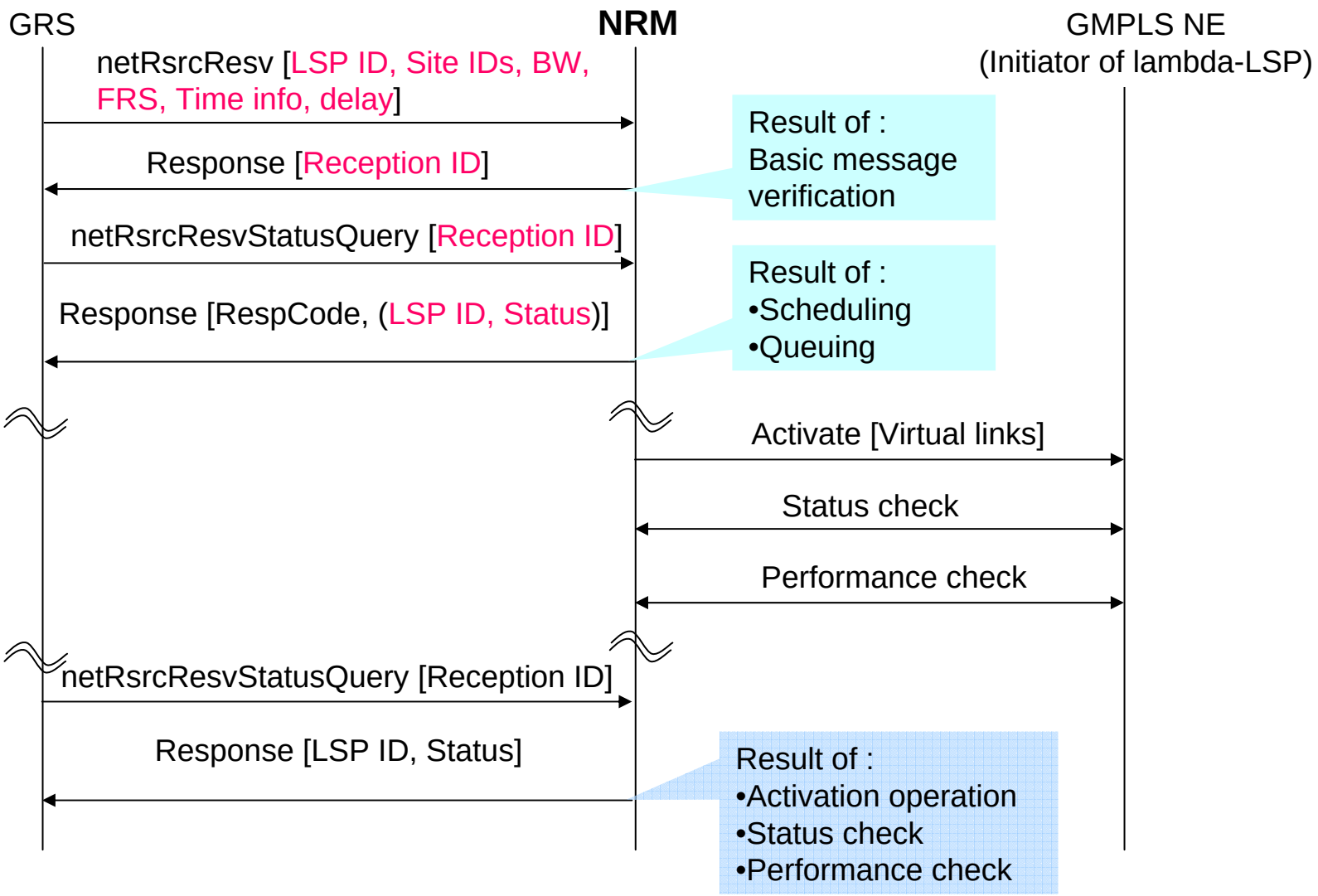
SOAP methods

#	Method name	Operation
1	netResourceReservation	Network resource reservation requests
2	netResourceModification	Modification of reserved or queued requests
3	netResourceReservationStatusQuery	Query of reservation status or queuing status
4	netResourceRelease	Forced release of reserved or queued requests
5	netResourceQuery	Query of specific network resource availability
6	netAvailableResourceQuery	Query of topology view available to serve

Status parameters

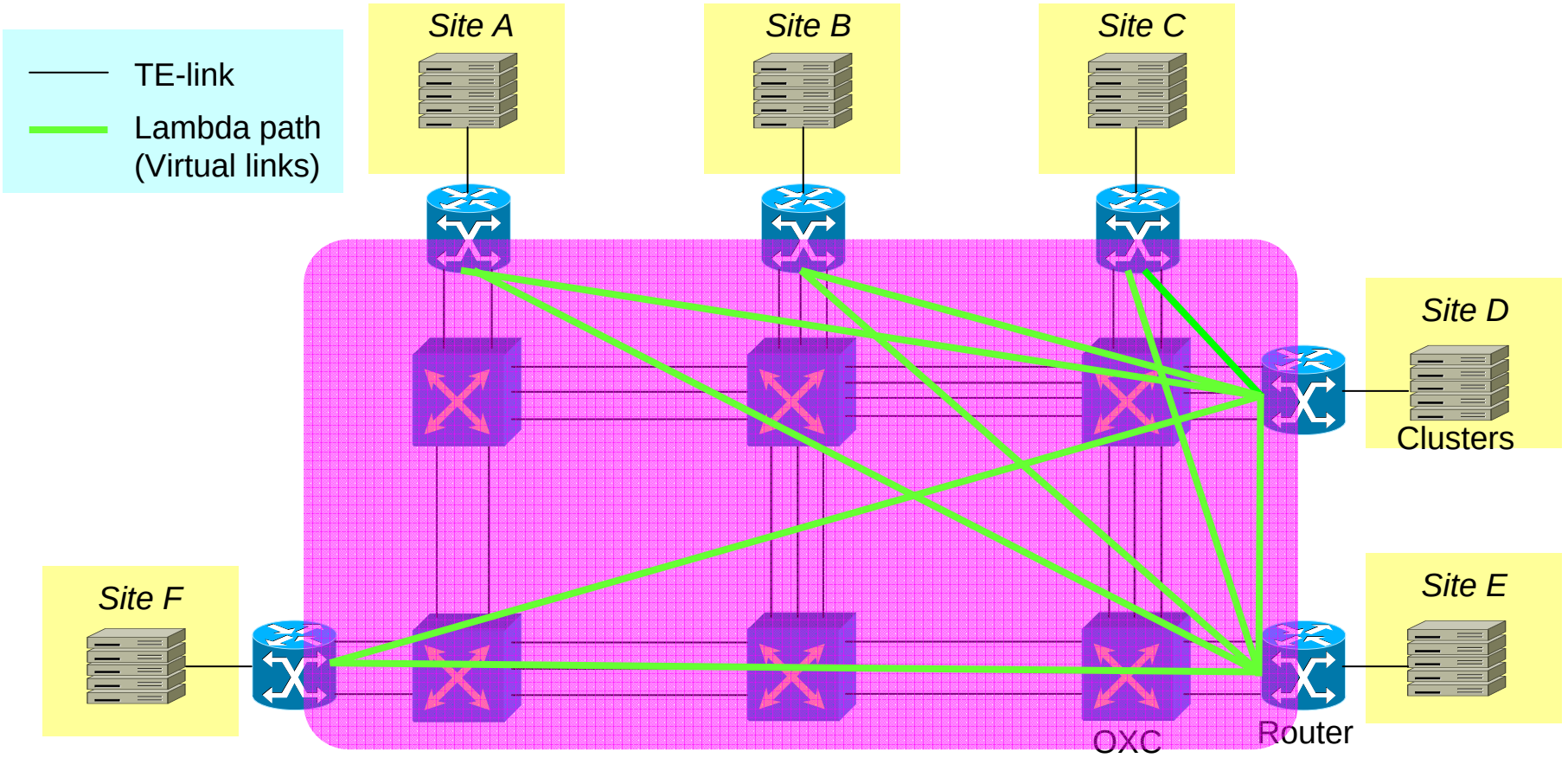
#	Status code name
1	*Reserved code #*
2	Available
3	Not available
4	Queued
5	Queuing error
6	Queuing modified
7	Queuing modification error
8	Queuing cancelled
9	Reserving
10	Reserved
11	Reservation error
12	Reserve modified
13	Reservation modification error
14	Releasing
15	Released
16	Release error

Advance reservation operation



Network resource virtualization and control

- Network resource virtualization
  - GMPLS network consists of number of TE-links, routers and OXCs, etc.
  - Lambda LSPs : Virtual links between end points -> Policy-based network virtualization
  - Resource scheduling based on the virtual links
  - IP addresses : Site ID
- NRM adaptively access GMPLS edge nodes
  - Ingress nodes of lambda path
  - Control (Activate/deactivate/monitor/measure) lambda paths with CLI



Network service properties
(WSDL snapshot for netRsrcResv)

Resource reservation properties (per LSP ID)

```
  <sequence>
    <element name="APoint" nillable="true" type="xsd:string"/>
    <element name="ZPoint" nillable="true" type="xsd:string"/>
    <element name="availability" nillable="true" type="xsd:int"/>
    <element name="bandwidth" nillable="true" type="xsd:int"/>
    <element name="delayTime" nillable="true" type="xsd:int"/>
    <element name="endTime" nillable="true" type="xsd:dateTime"/>
    <element name="lspId" type="xsd:int"/>
    <element name="startTime" nillable="true" type="xsd:dateTime"/>
   </sequence>
```

Cluster site names

Network parameters
(Delay time, Fault recovery schemes)

Time properties
(Reservation time, Release time)

Resource reservation response properties

```
<complexType name="IResponseLSPInfo">
   <sequence>
    <element name="lspId" type="xsd:int"/>
    <element name="statusCode" type="xsd:int"/>
   </sequence>
</complexType>
<complexType name="IResponseReserveInfo">
   <sequence>
    <element name="receptionId" nillable="true" type="xsd:int"/>
    <element name="responseLspInfos" nillable="true"
      type="impl:ArrayOf_tns2_IResponseLSPInfo"/>
    <element name="returnCode" type="xsd:int"/>
   </sequence>
</complexType>
```

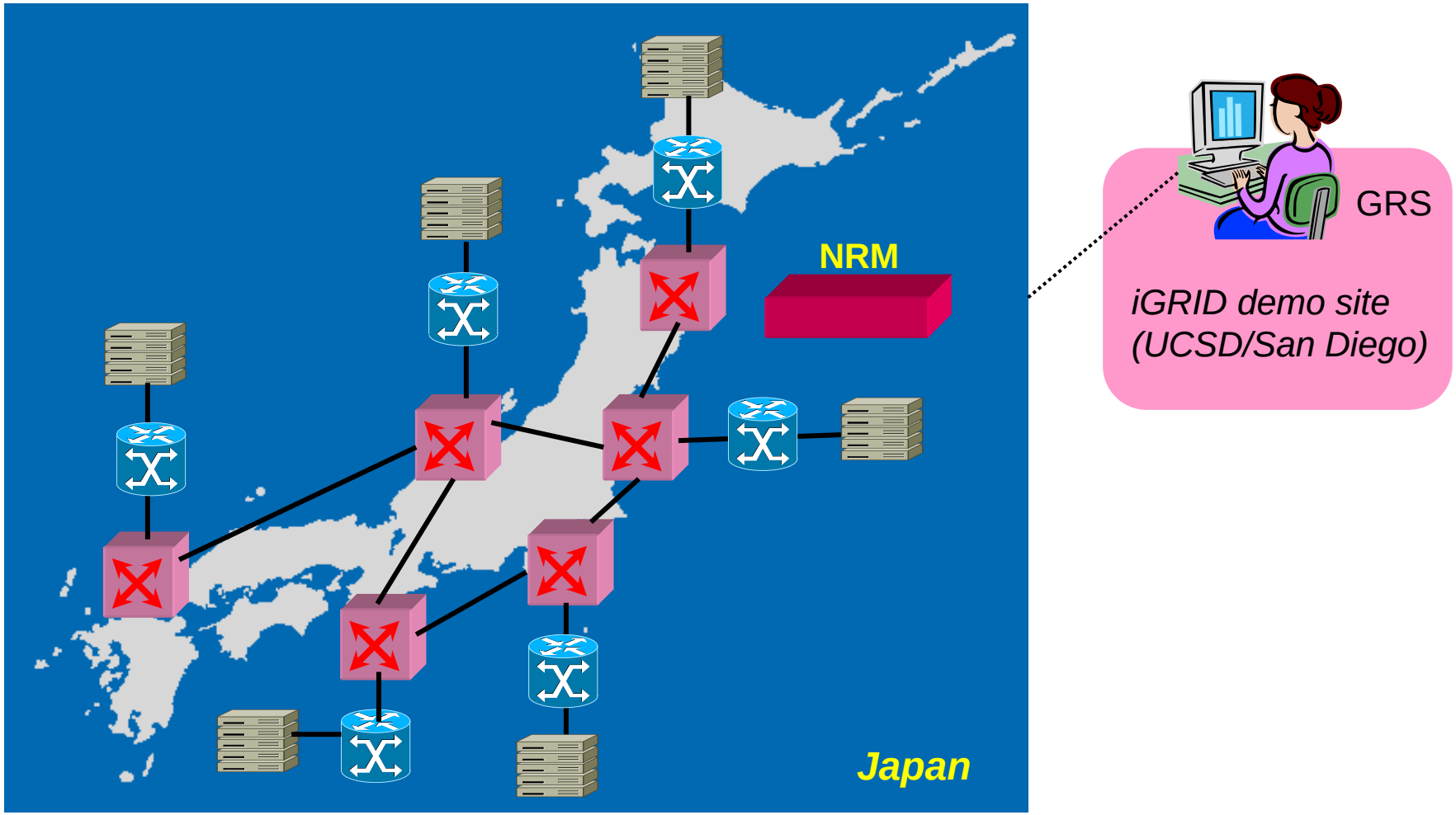
Status code (per LSP ID)

Reception ID

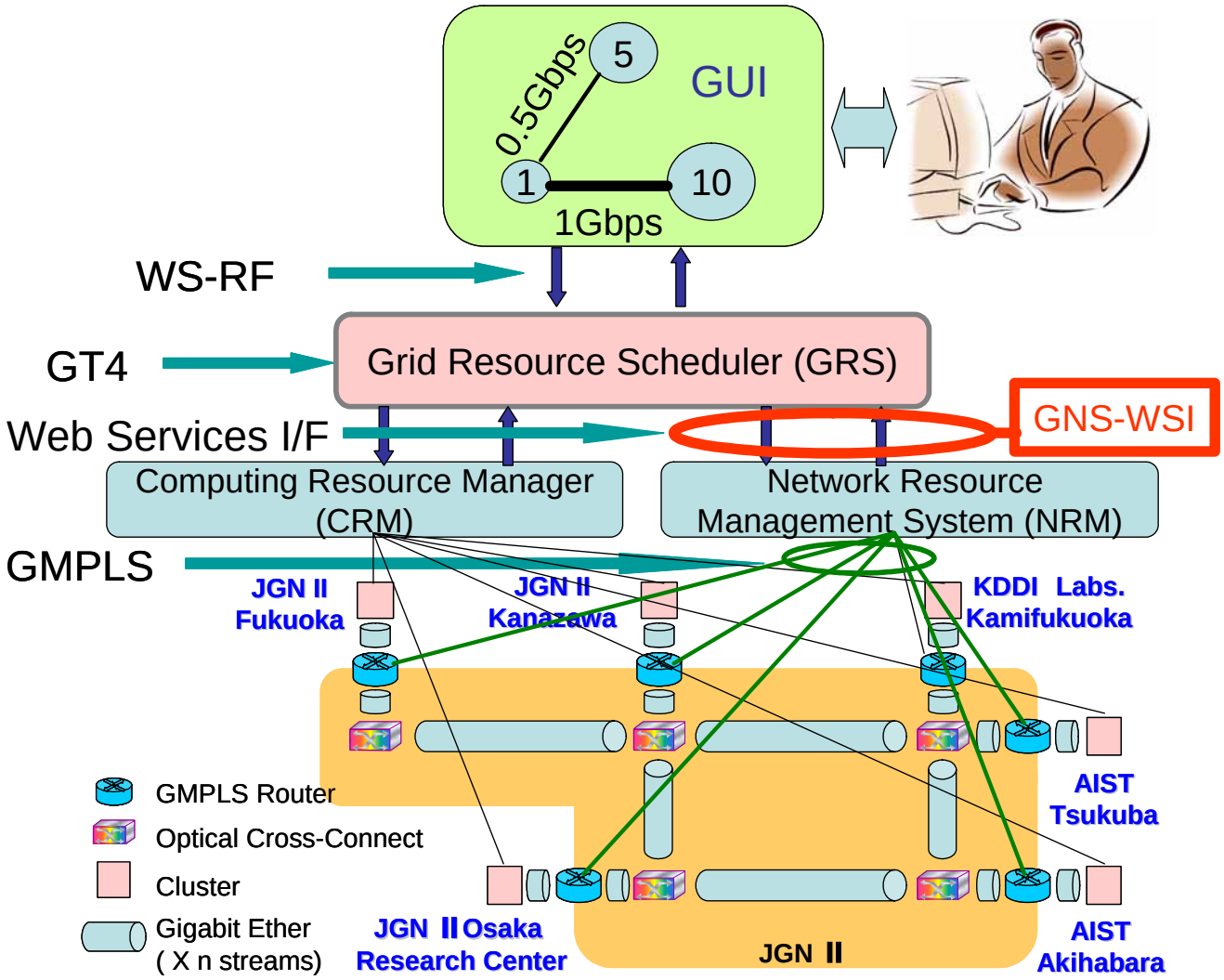
Response code (per reception ID)
(for Ack and Error messaging)

Nation-wide demonstration in iGRID2005

“Coordination of Grid Scheduler and Lambda Path Service Over GMPLS”
-Toward Commercial Lambda Path Service-
(by AIST/KDDI R&D Labs./NTT/NICT)



Demonstration overview



① User requests service via GUI, specifying the required number of computers and the network bandwidth needed

②The computing resources and GMPLS network resources are reserved as the result of interworking between the GRS and NRM using GNS-WSI (Grid Network Service / Web Services Interface)

③ A molecular dynamics simulation is executed using the reserved computers and lambda paths. Ninf-G2 and Globus Toolkit 2 (GT2) are used at each cluster.

Summary

- Resource management interface (GNS-WSI) is implemented
  - WSDL definition considering grid application requirements and network properties
- Network resource management system (NRM) for lambda path service
  - GMPLS lambda LSP-based resource virtualization and scheduling
- Successful nation-wide demonstration in iGRID2005
  - AIST/KDDI R&D Labs/NTT/NICT

Next step

- Extension of GNS functionalities
  - More user requirements
  - SLA treatment
  - QoS-awareness
  - etc.
- GNS over multiple policy domains
  - GMPLS interworking at E-NNI interface
  - IP-based interworking