# Network Service Level Agreement (SLA) Implementation

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# Outline

- Introduction
- SLA parts
- Models of SLA establishment
- Monitoring of SLAs
- Discussion

# Introduction

- **Whenever an amount of traffic is transferred from one EGEE RC (Resource Centre) to another, a Network Service Instance (NSI) is established.**

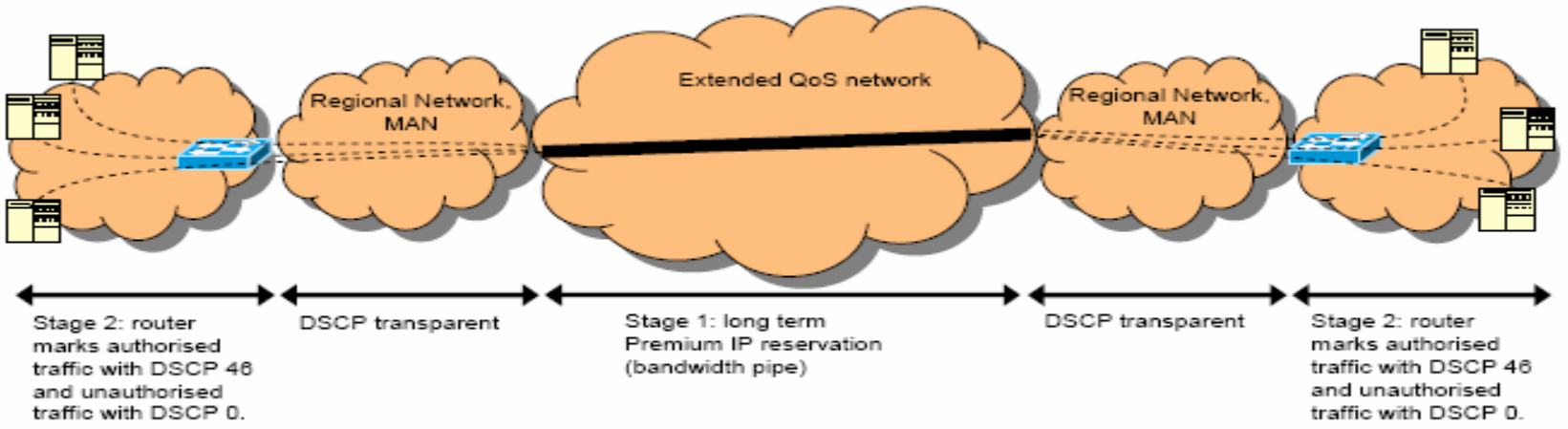
- **For every NSI an end-to-end SLA is defined providing the technical and administrative details to perform**
  - Maintenance
  - Monitoring
  - Troubleshooting

# SLA parts

- **ALO (Administrative Level Object)**
  - Contacts
  - Duration
  - Availability
  - Response times
  - Fault handling procedures
- **SLO (Service Level Object)**
  - Service instance scope
  - Flow description
  - Performance guarantees
  - Policy profile
  - Excess traffic treatment
  - Monitoring infrastructure
  - Reliability guarantees: max downtime (MDT), time to repair (TTR)

# Model 1 of SLA implementation

- **Preliminary agreement of ENOC with participating domains & RCs**
  - Made once for the whole project lifetime
- **Stage 1: Service Request (SR)**
  - PIP (Premium IP) reservation in extended QoS network (GEANT/NRENs)
- **Stage 2: Service Activation (SA)**
  - Configuration of the routers in the last mile network

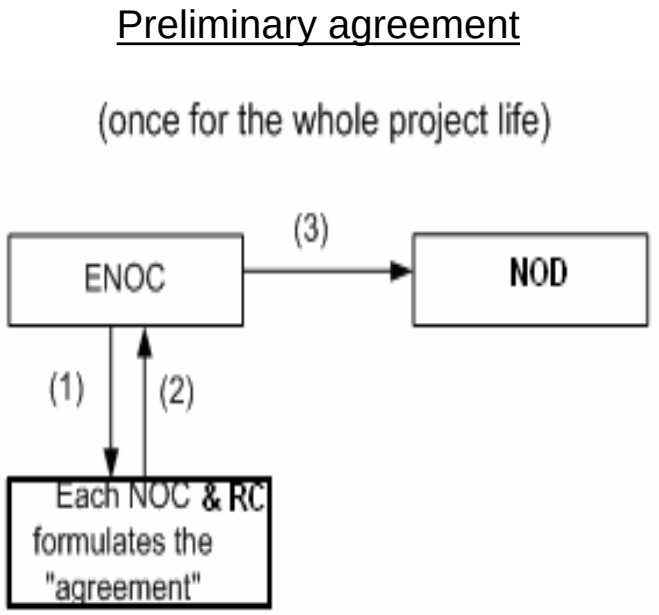



Two stage provisioning process

# Preliminary agreement

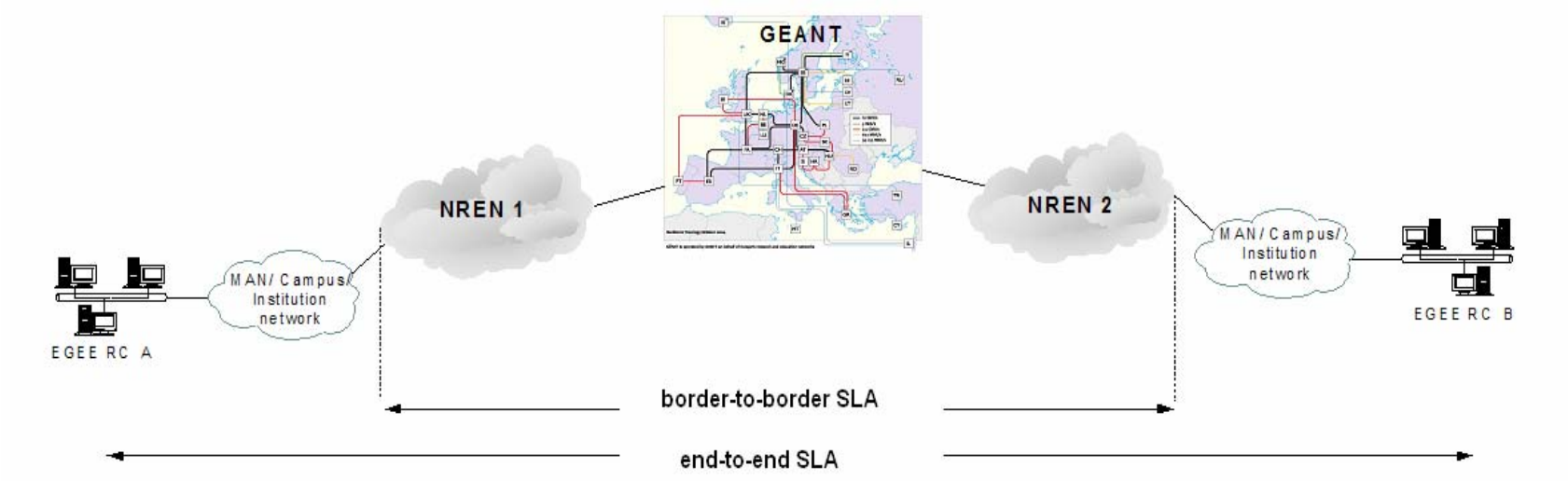
1. **ENOC asks from every participating domain and RC to formulate an agreement**
2. **Each domain NOC provides**
   - the ALO (Administrative Level Object)
   - max bandwidth allocated for EGEE

   **Each RC**
   - provides administrative and technical details
   - signs Acceptable Use Policy (AUP)
     - Provisioned network resources used only for EGEE purposes
3. **ENOC stores the received information to the NOD (Network Operational Database) and classifies the domains to PIP compliant/supportive/indifferent**



# Service Request and Activation

- **Stage 1: In the Service Request (SR) stage:**
  - PIP reservation in extended QoS network
    - Case 1: automatic reservation
    - Case 2: manual reservation
  - border-to-border SLA (GEANT/NRENs SLAs)
- **Stage 2: In the Service Activation (SA) stage :**
  - Configuration of the routers in the last mile network
  - end-to-end SLA (b2b SLA + NREN client domains' SLAs)

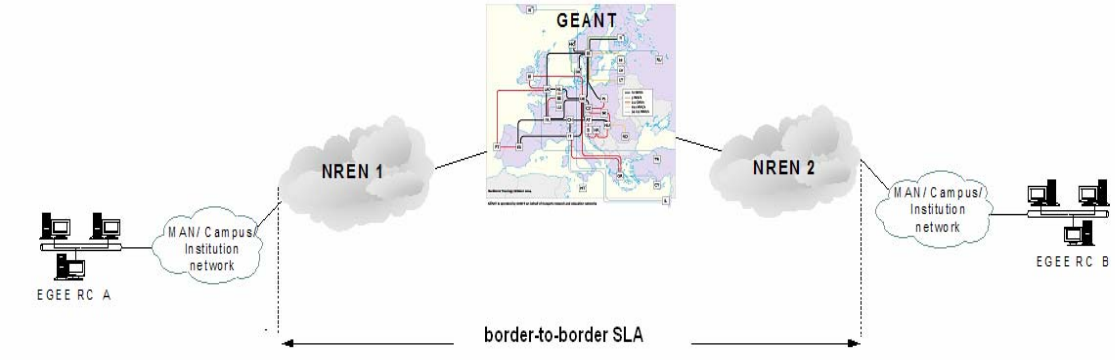


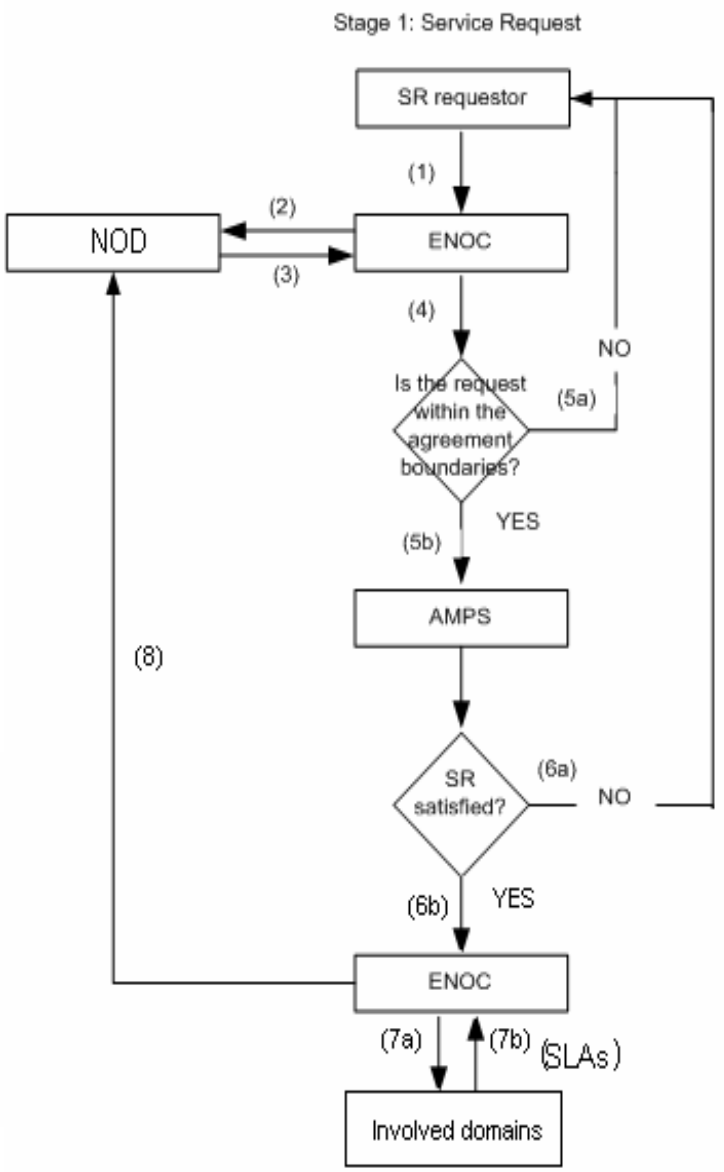
# Differences between EGEE II & EGEE I concerning stages 1 & 2 of SLA establishment

- **BAR (Bandwidth Allocation & Reservation) service not to be supported in EGEE II**
- **L-NSAP (Local –Network Service Access Point) service, responsible for the configuration of routers in local networks, to be operated manually**
- **NSAP service to be provided by AMPS (Advanced Multi-domain Provisioning System)**
  - AMPS system:
    - In development stage by the GEANT project
    - Management of the whole PIP provisioning process from user request through to the configuration of the appropriate network elements in GEANT/NRENs

# Stage 1: Service Request (SR) case 1: automatic reservation

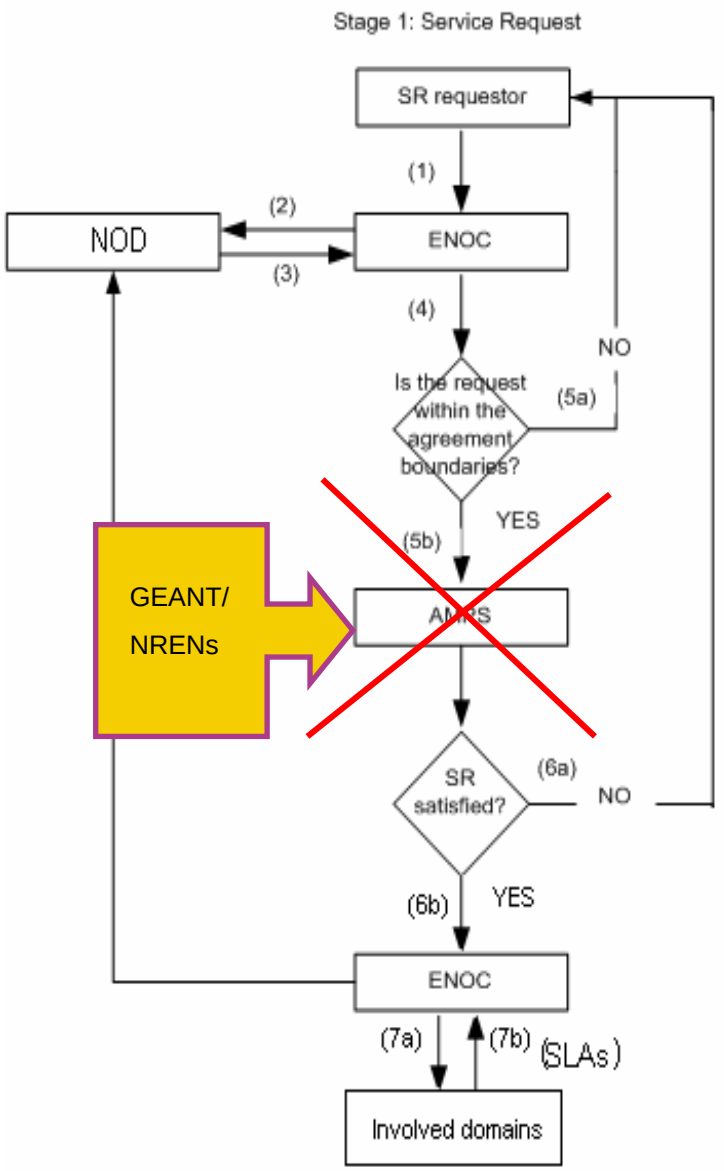
- Reservation via AMPS servers of hosting NRENs and GEANT
- ENOC identifies involved GEANT/NREN domains
- GEANT/NRENs provide individual SLAs
- Synthesis of b2b SLA: performed by ENOC based on reported GEANT/NRENs SLAs



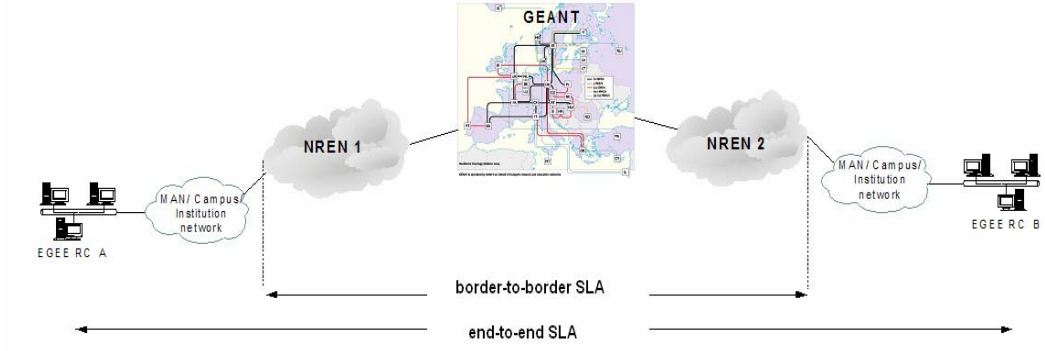
# Stage 1: Service Request (SR) case 2: manual reservation

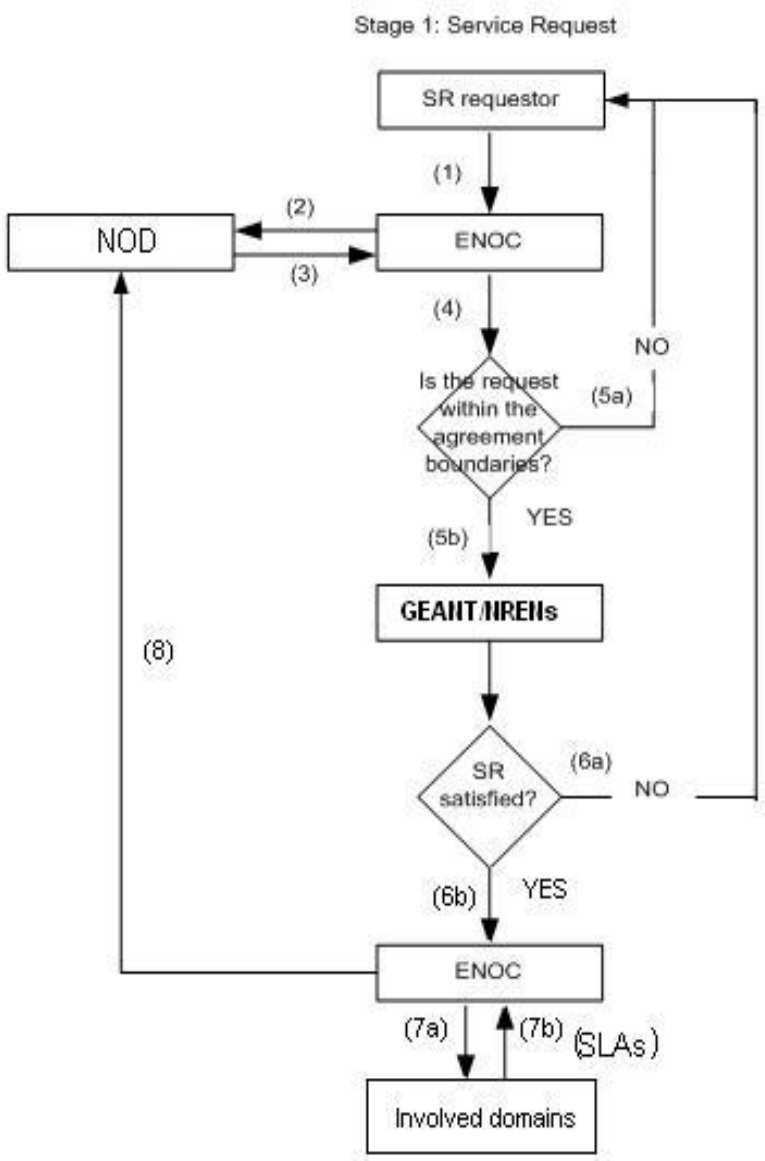
- **Cases with no AMPS servers installed in NRENs**



# Stage 1: Service Request (SR) case 2: manual reservation

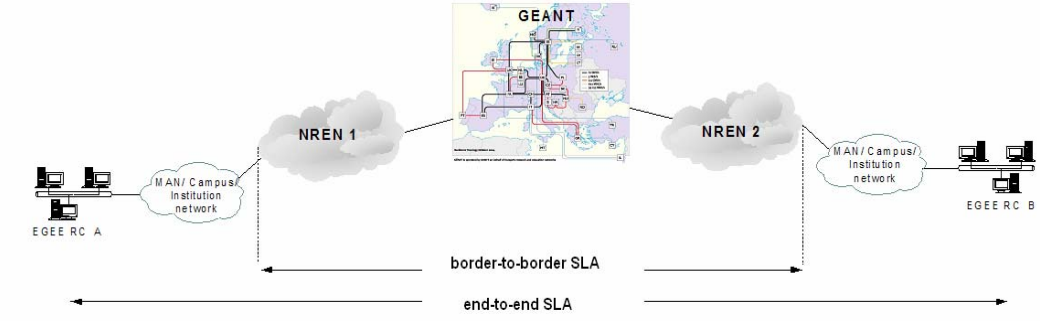
- No AMPS servers installed
- ENOC identifies involved GEANT/NREN domains
- ENOC initiates manual requests to individual domain NOCs
- NOCs reply by email and provide individual SLAs
- Synthesis of b2b SLA: performed by ENOC based on reported domain SLAs

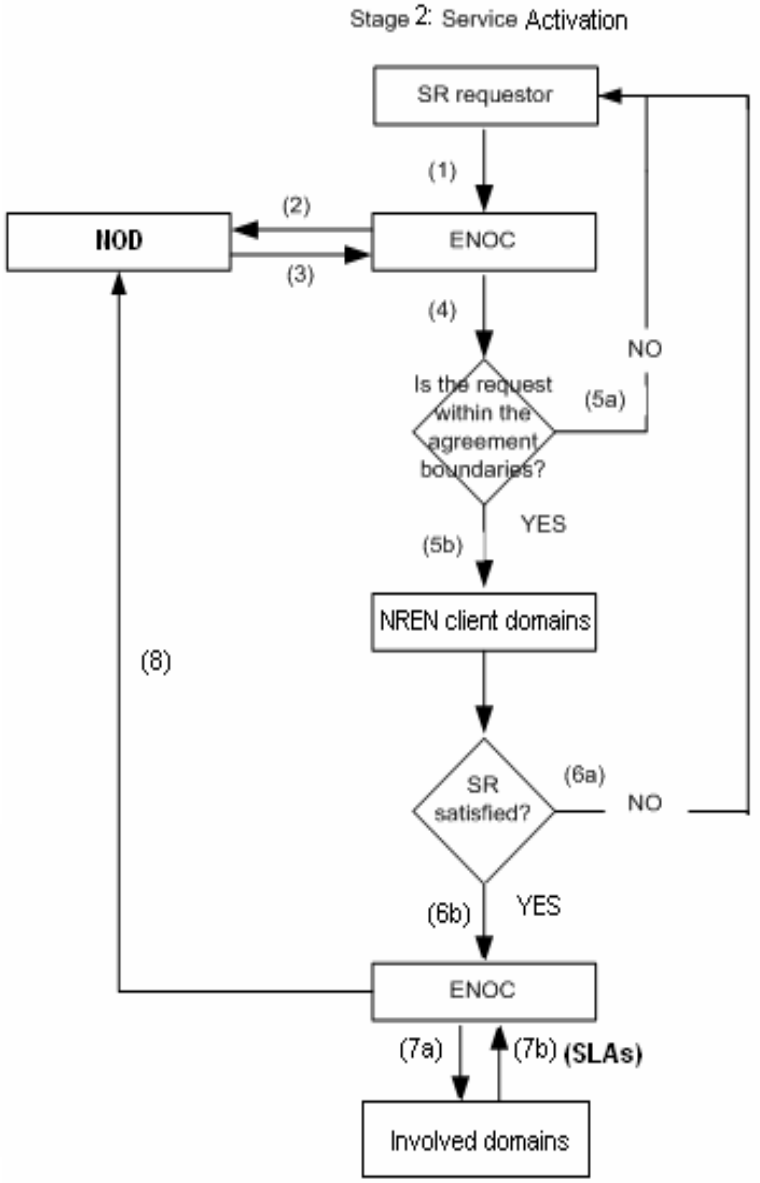


# Stage 2: Service Activation (SA)

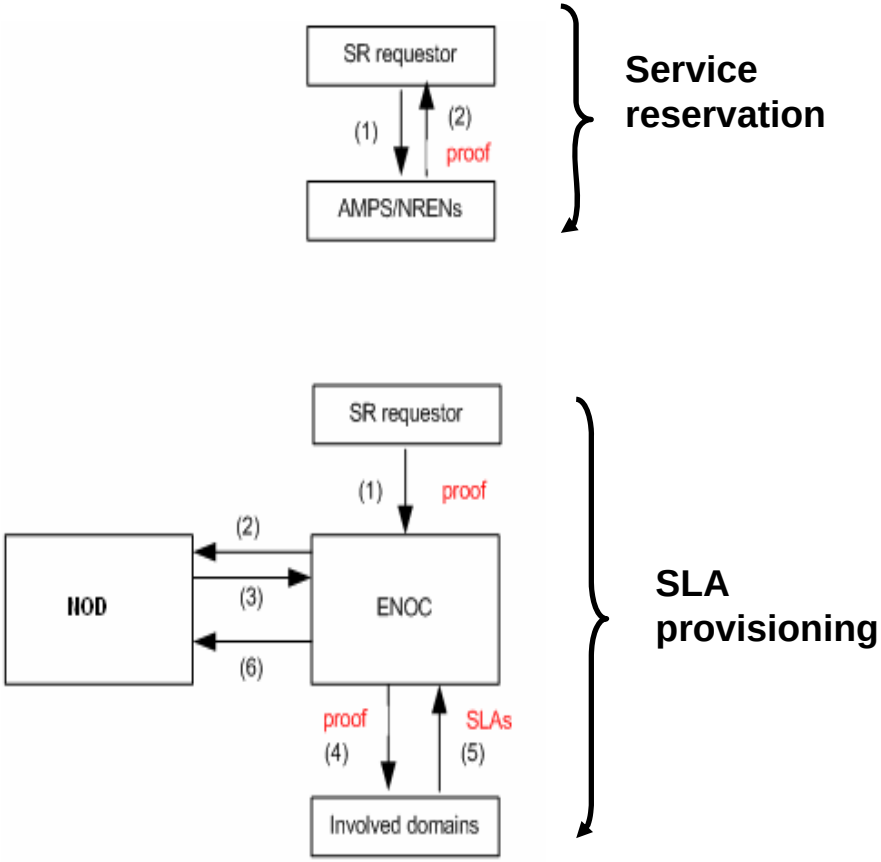
- **ENOC identifies the involved NREN client (MAN/campus/institution) domains and queries for the max bandwidth allowed for EGEE traffic**
- **Checks if NREN client domains can support the request**
- **NREN client domains provide their SLAs**
- **ENOC produces e2e SLA based on:**
  - reported NREN client domains' SLAs
  - b2b SLA from stage 1



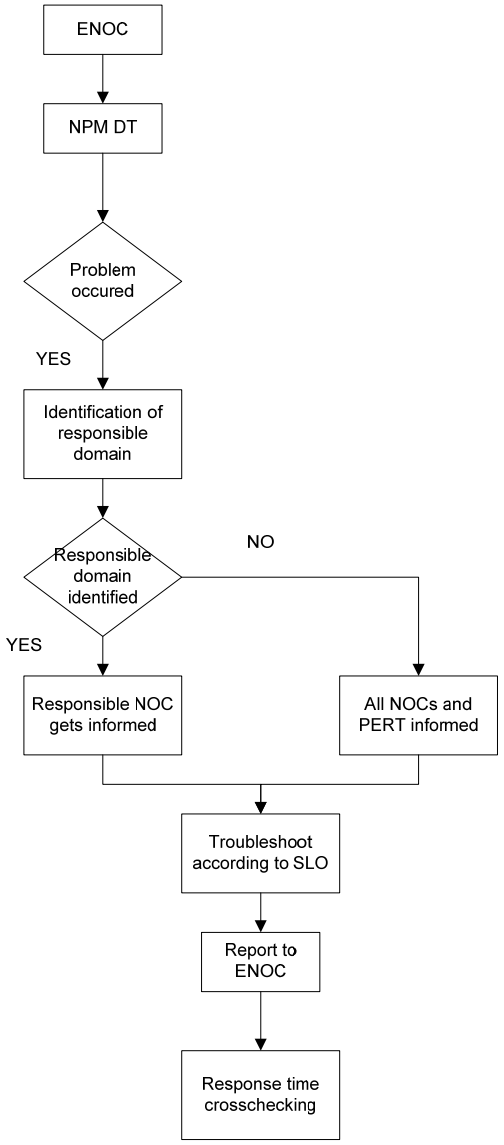
# Model 2 of SLA implementation

- **Decoupling the two services:**
  - service provisioning
  - SLA service
- **User makes a reservation for a NSI**
  - automatically (through AMPS)
  - manually (through its NREN)
- **In both cases a service reservation 'proof' is provided**
- **If user wants SLA for his reservation then addresses ENOC providing his reservation 'proof'**
- **ENOC identifies involved domains and asks for their SLAs**
- **Synthesis of e2e SLA: performed by ENOC based on individual SLAs**



# Monitoring of SLAs

- **ENOC queries NPM DT (Network Performance Monitoring Diagnostic Tool)**
- **NPM DT provides measurement data from *perfSONAR* (GEANT/NRENs) and *e2emonit* (RC-to-RC) monitoring frameworks**
- **Fault Identification/Notification**
  - Case 1: ENOC identifies & notifies responsible domain
  - Case 2: ENOC (not able to isolate the problem) informs all domains and GEANT PERT (Performance Enhancement Response Team)
- **Reaction-Repair according to SLAs**
- **ENOC checks SLA compliance**



# SLA monitoring requirements

- **e2e Metrics:**
  - OWD (One Way Delay)
  - IPDV (IP Packet Delay Variation)
  - RTT (Round Trip Time)
  - Packet Loss
  - Available bandwidth
  - Achievable bandwidth

  Performance metrics

  - TTR (Time To Repair)
    From trouble ticket issue to recovery, per violation
  - MDT (Maximum DownTime)
    Maximum total TTRs for all violations in a given period

  Reliability metrics
- **Monitoring features**
  - Frequent e2e and partial domain monitoring of performance metrics (e.g. every 15') in agreed service availability period
  - Capability of setting thresholds on metrics to generate violation alarms
    - Different severity levels (?)
  - Trouble tickets, triggered by users and ENOC operators on alarms, managed via TTM (Trouble Ticket Manager)
  - Statistics from trouble tickets to infer MDT & TTR

# Issues for discussion (1)

- **Who is the service requestor?**
- **End user authentication & authorization to ENOC?**
- **Does EGEE define different user profiles?**
  - How PIP quota is allocated to various users and VOs?
  - Does GEANT support these profiles, i.e. create different policy rules in AMPS?
- **Does AMPS handle individual end-users or groups (EGEE group: ENOC)?**
  - Can an EGEE individual user/VO interface with AMPS?
- **Which is the minimum reservation period for the GEANT network?**
  - Till now is 2 weeks due to manual configuration

# Issues for discussion (2)

- **Are monitoring tools (to be) deployed within campus LANs compatible with perfSONAR and/or e2emonit frameworks so that measurement data can be accessed from NPM?**
- **Is SLA designated only for PIP?**
  - SLAs for L1/2 circuits?
  - Is it acceptable to make a PIP reservation without SLA?
- **How the last mile's reservation is accomplished in the 2nd model?**
  - AMPS will be installed only to the QoS network (GEANT/NRENs)
- **Will AMPS provide reservation 'proof'?**
- **Is ENOC authorized to provide e2e SLAs for a GEANT service, e.g. Premium IP?**
- **Possible use cases that can support SLA service?**