



Enabling Grids for E-science

EGEE II - Network Service Level Agreement (SLA) Establishment

EGEE'07

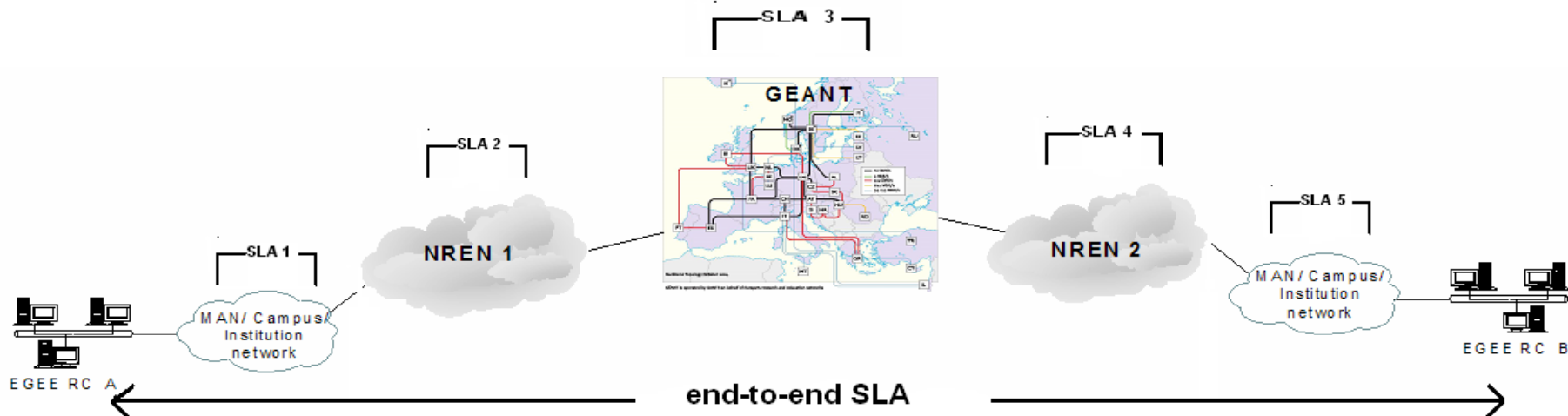
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- **Introduction**
- **Model of SLA establishment**
- **Monitoring of SLAs**
- **GRIDCC project**
- **SLA application scenario**
- **Measurements**
- **Conclusions – Future Work**

- Whenever a GRID application requires specific levels of QoS for an end-to-end (e2e) path between two Resource Centers (RC) then an e2e SLA has to be established
- The e2e SLA provides the technical and administrative details to perform
 - Maintenance
 - Monitoring
 - Troubleshooting
- Synthesis of end-to-end SLA based on individual domain SLAs



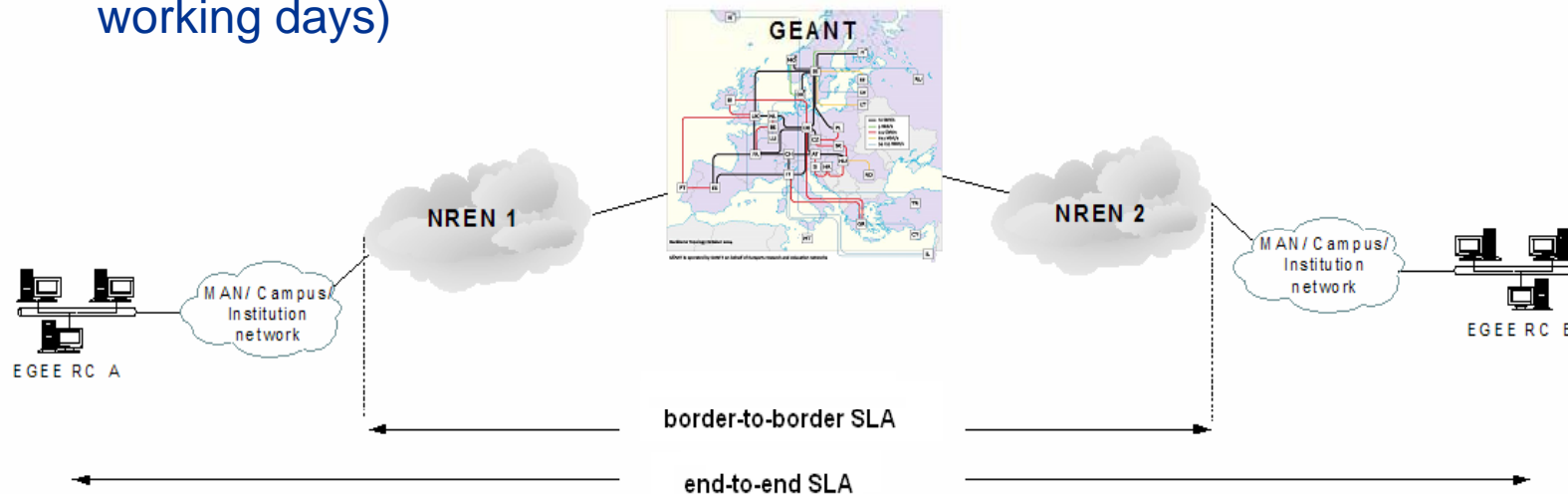
- **ALO (Administrative Level Object)**
 - Contacts
 - Duration
 - Availability
 - Response times
 - Fault handling procedures
- **SLO (Service Level Object)**
 - Service instance scope
 - Flow description
 - Performance guarantees
 - Policy profile
 - Excess traffic treatment
 - Monitoring infrastructure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

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

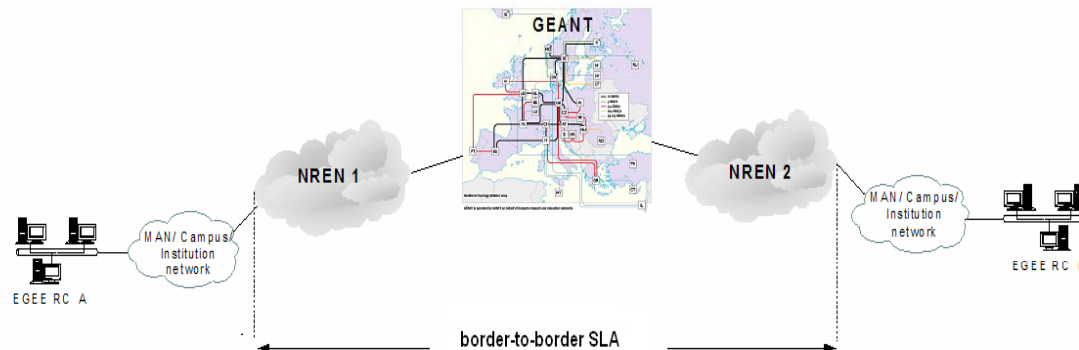
2-Stage Provisioning Model due to:

Manual configuration of the routers

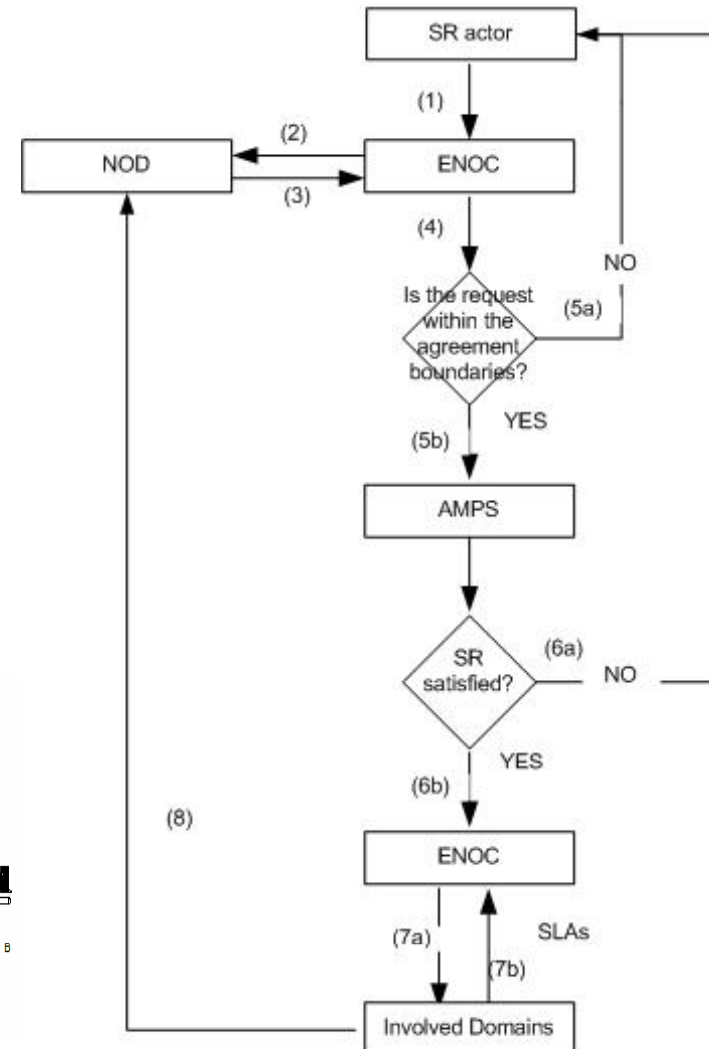
Lead time between service request and service reservation (currently 2 working days)



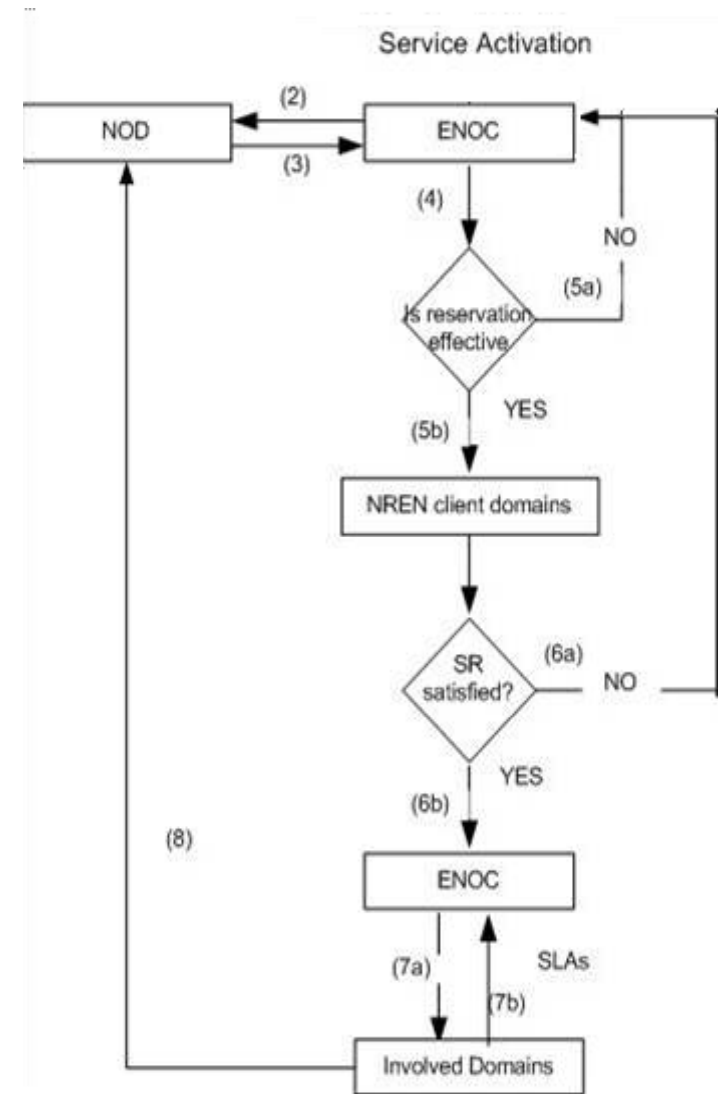
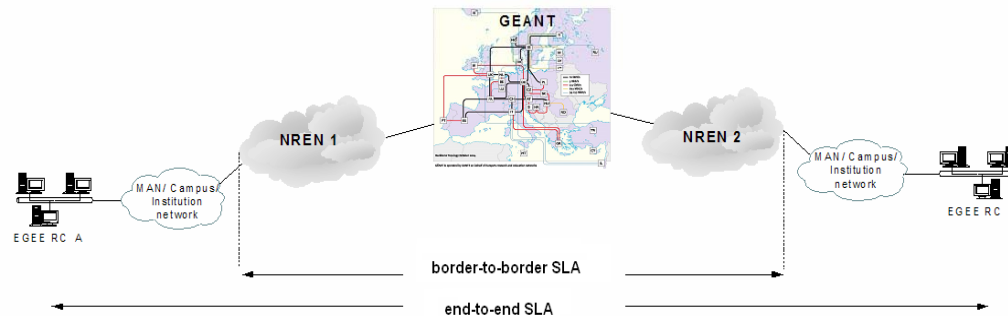
- **Reservation via AMPS (Advanced Multi-domain Provisioning System) servers of hosting NRENs and GEANT**
- **AMPS system:**
 - In development stage by the GEANT project
 - Management of the whole PIP provisioning process from user request through to the configuration of the appropriate network elements
- **ENOC identifies involved GEANT/NREN domains**
- **GEANT/NRENs provide individual SLAs**
- **Synthesis of b2b SLA: performed by ENOC based on reported GEANT/NRENs SLAs**



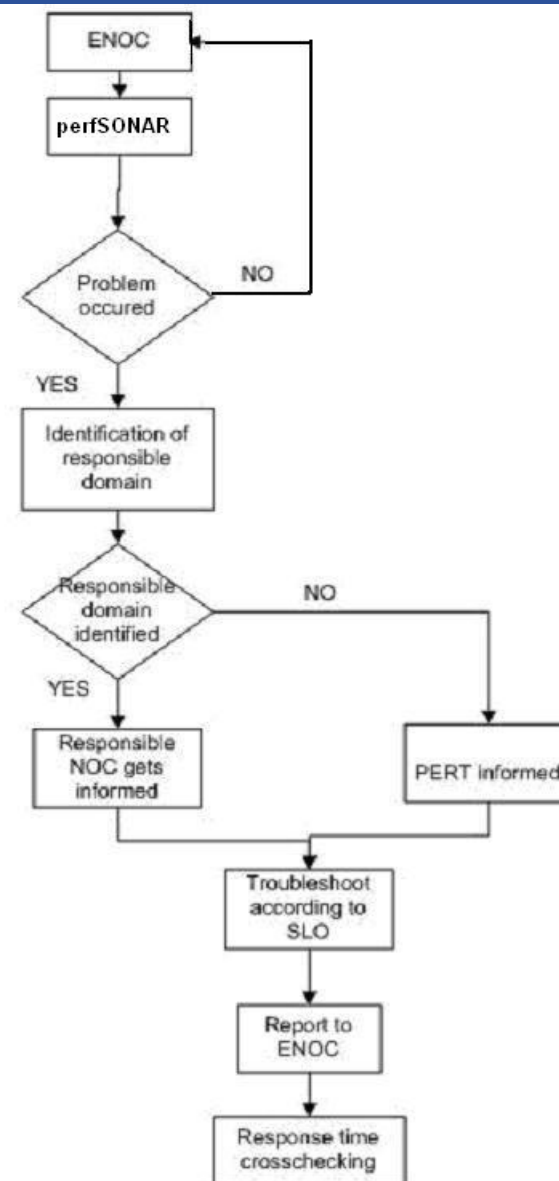
Automatic Service Reservation



- ENOC verifies that the reservation in the extended QoS domain is still effective and retrieves it
- Checks if NREN client domains (MAN/campus/institution) 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



- **ENOC queries perfSONAR monitoring tools (BWCTL, OWAMP application)**
 - BWCTL: BandWidth ConTrolLer
 - OWAMP: One Way Active Measurement Protocol (OWD, Packet Loss)
- **If a problem occurs:**
 - ENOC identifies & notifies responsible domain
 - Otherwise : ENOC (not able to isolate the problem) informs GEANT PERT (Performance Enhancement Response Team)
- **Reaction-Repair according to SLAs**
- **ENOC checks SLA compliance**



- **e2e Metrics:**

- OWD (One Way Delay)
- Packet Loss
- Bandwidth

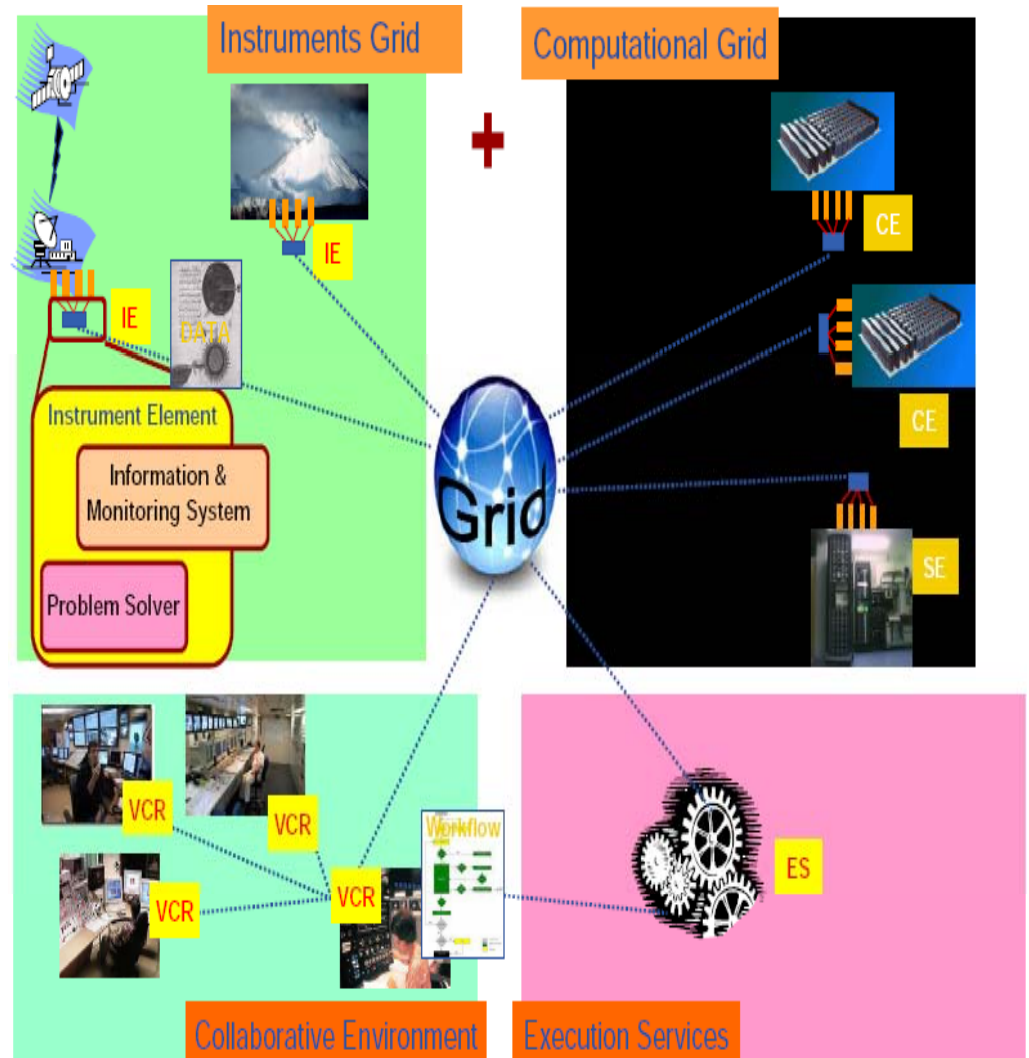
} Performance metrics

- 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

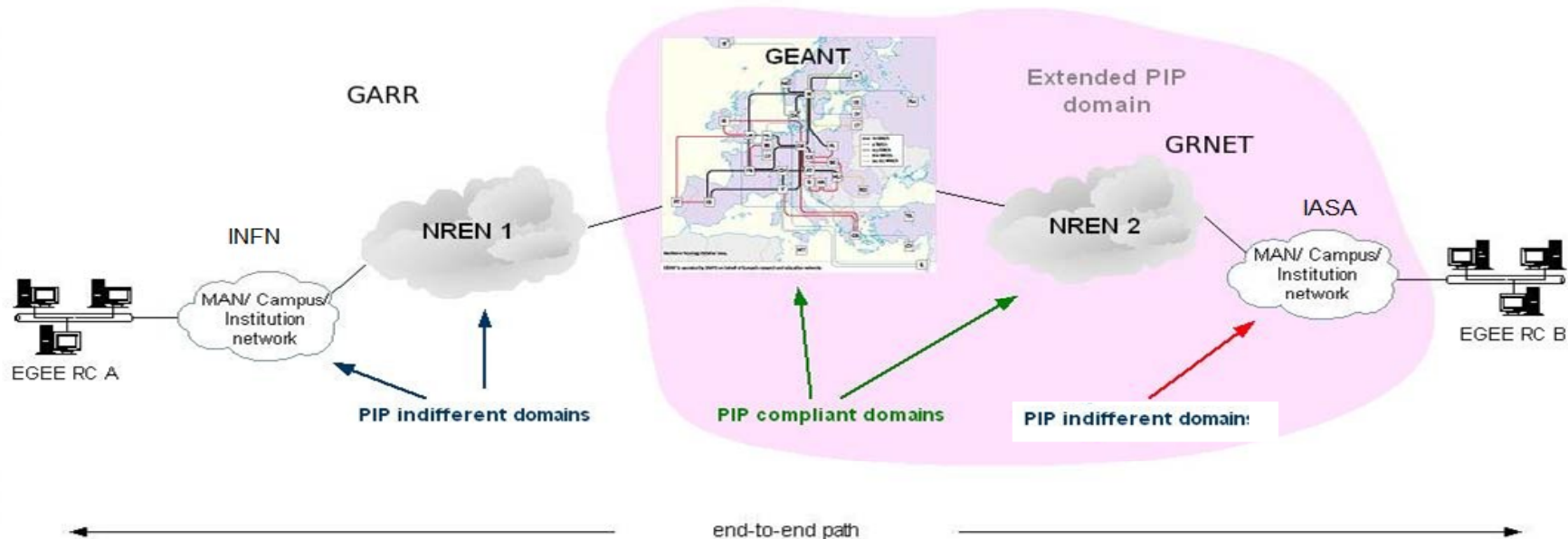
- **Collaboration between EGEE-II and GRIDCC project**
- **GRIDCC (Grid enabled Remote Instrumentation with Distributed Control and Computation), is a EU FP6 project**
- **Aims to provide access to and control of distributed complex instrumentation**
- **The goal of GRIDCC is to remotely operate and monitor scientific equipment using the grid's massive memory and computing resources for storing and processing data generated by this kind of equipment**

- IE (Instrument Element):
 - unique concept to GRIDCC
 - collection of services to configure, partition and control the physical instrument
- Remote control and monitoring of Instruments and Sensors
- Perfect integration between control, data acquisition and grid based data storage and data processing
- Human interaction with Grids and Enactment of complex workflows via the Virtual Control Room (collaborative environment)



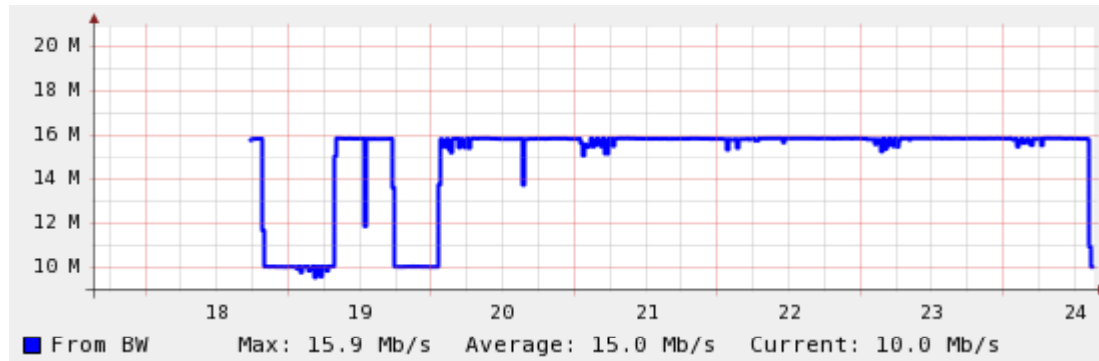
- Remote control of IE located in Legnaro/INFN (ITALY) and GEANT
- Transfer of data produced by the IE to a storage node in Athens/IASA (GREECE)
- E2e path between INFN and IASA:
 - INFN-GARR-GEANT-GRNET-IASA
- Network performance guarantees described in e2e SLA (capacity and packet loss)
- Monitoring of the SLA through available monitoring tools (in this test we used perfSONAR)

- **GRIDCC application tests:**
 - 1st test: Between IASA (GRNET) and INFN (GARR) and
 - 2nd test: Between IASA (GRNET) and GEANT
- **E2e PIP path via AMPS desirable to ensure the network performance metrics (One Way Delay, Packet Loss, Bandwidth)**
- **AMPS in production phase in GRNET and GEANT and in progress in GARR**
 - 1st test: non-PIP path between GRNET and GARR
 - 2nd test: PIP enabled path between GRNET and GEANT

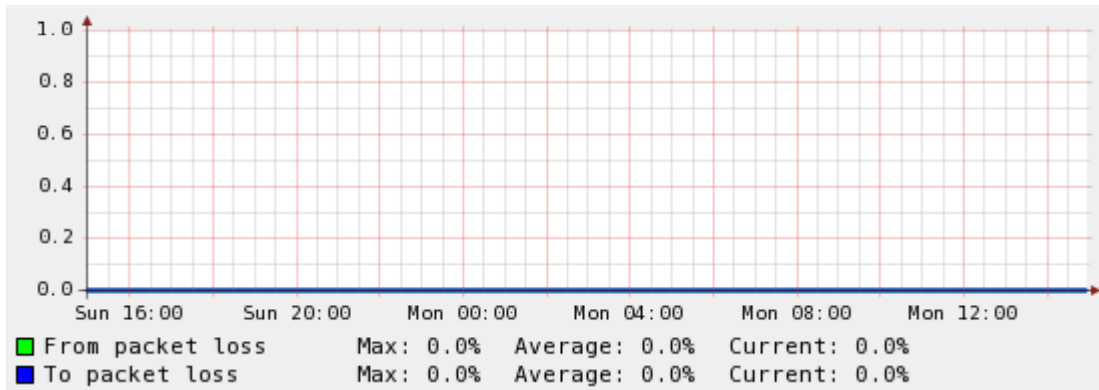


- **PIP request between GRNET and GEANT approved**
 - GRNET uses the ANS (Intra GRNET provisioning) tool as Interface to the AMPS tool (automatically)
- **GRIDCC Grid applications for the remote control of the instruments installed in the end sites (IASA, GEANT, INFN)**
- **PerfSONAR monitoring tools installed in end sites**
- **RRD tool for the graphical representation of the measure data has been installed**
- **E2e network measurements taken without PIP (IASA→INFN)**
- **Measurements without & with PIP (IASA→GEANT)**

- **Contact individual domains (IASA, GRNET, GEANT, GARR, INFN) to fill the SLA templates**
- **PIP configuration of the routers in GRNET and GEANT - completed**
- **Monitoring procedure followed during the SLA duration supported by PerfSONAR**
 - No fault identification during the SLA duration

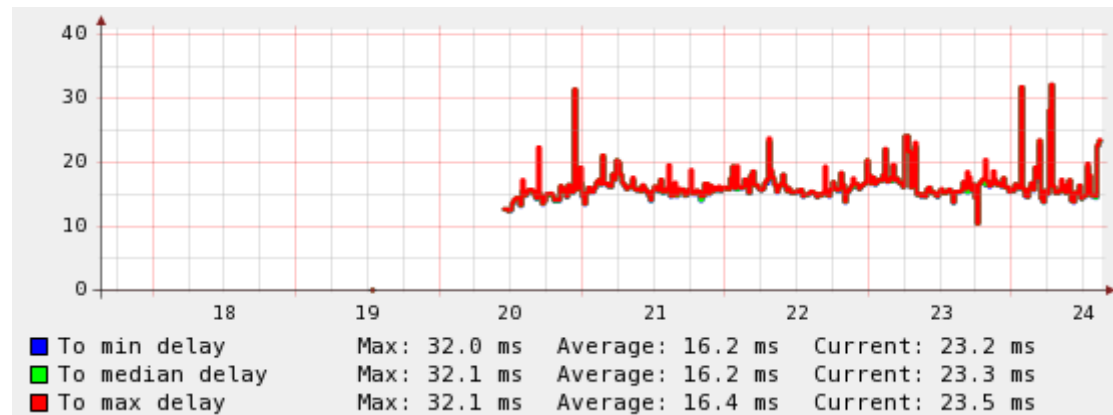
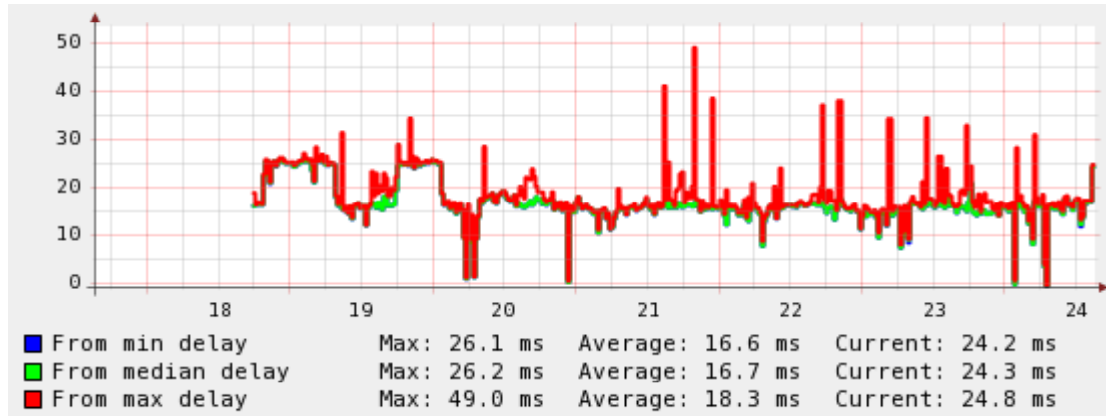


Bandwidth

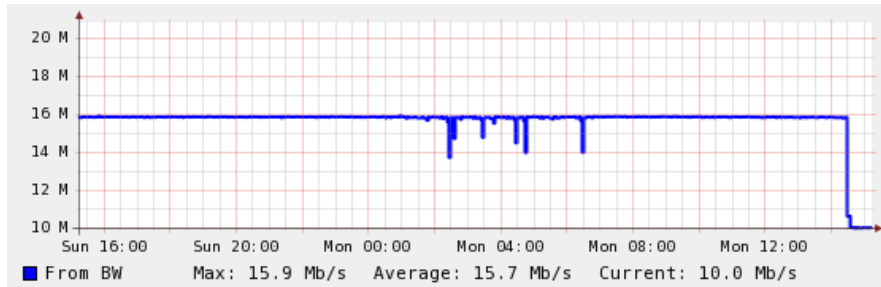


Packet loss

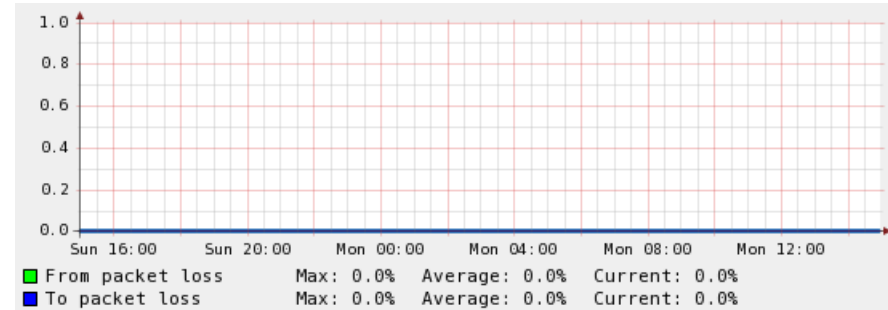
- OWD from IASA to INFN and backwards



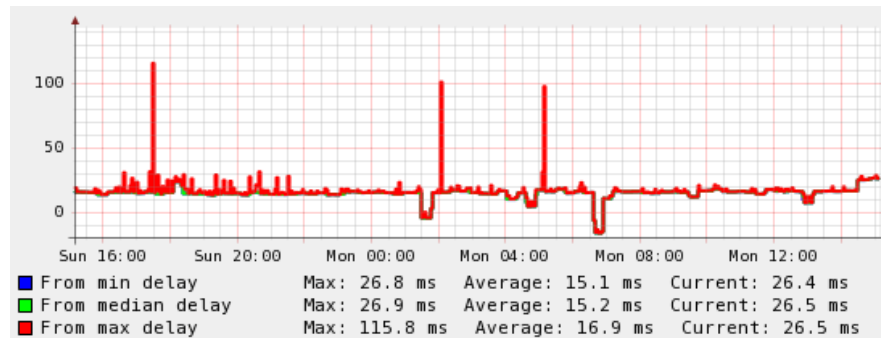
Bandwidth IASA-GEANT



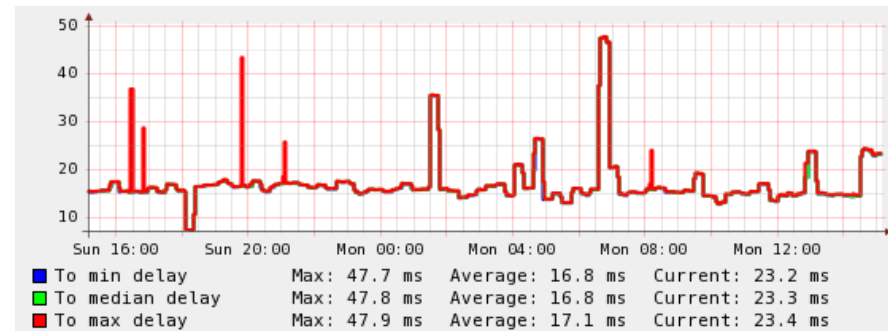
Packet Loss



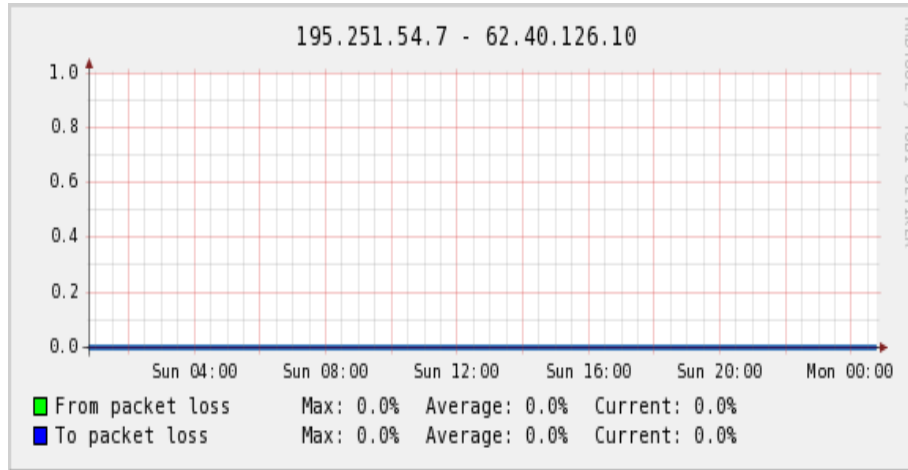
Delay IASA-GEANT



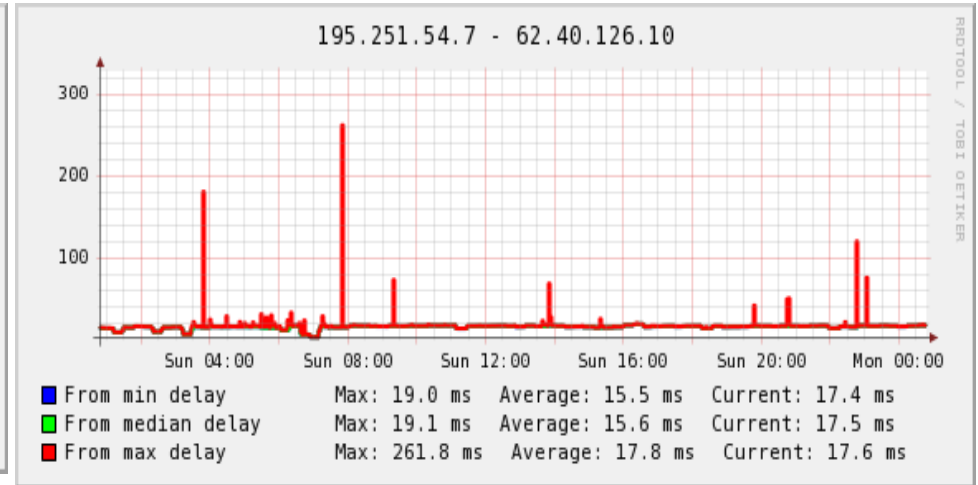
Delay GEANT-IASA



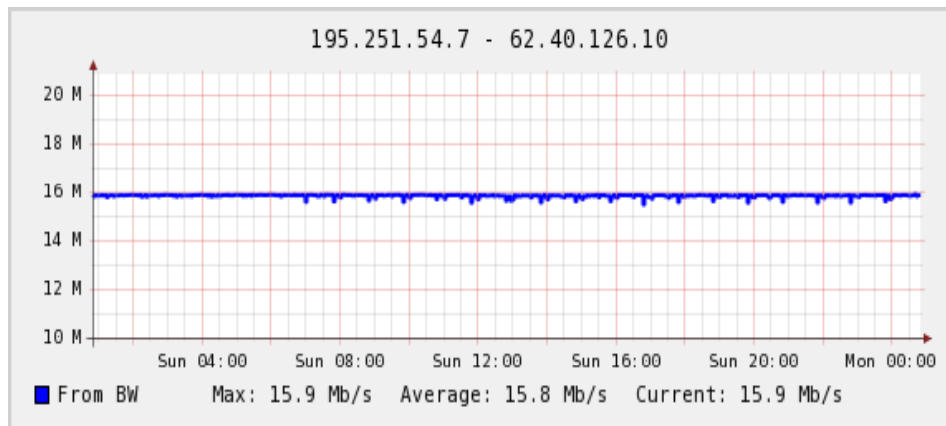
Packet Loss



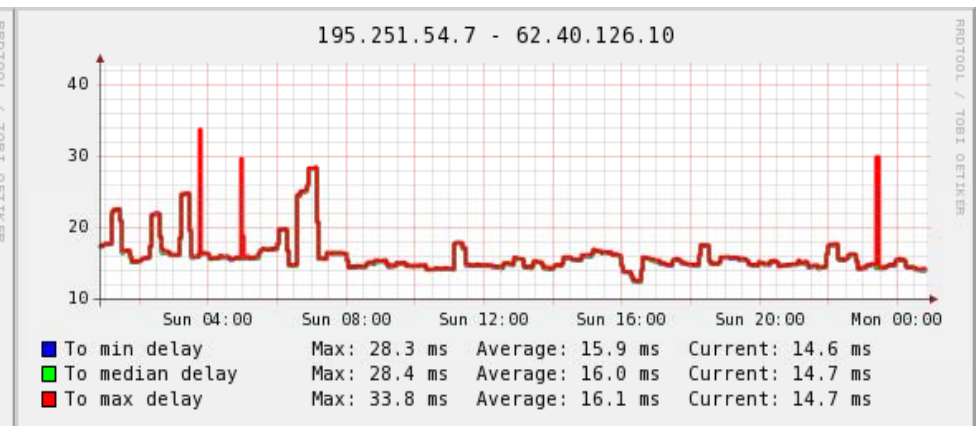
Delay IASA-GEANT



Bandwidth IASA-GEANT



Delay GEANT-IASA



- **More stability and better performance in PIP measurements than non-PIP**
- **More NRENs should support PIP service so that e2e path becomes PIP compliant**
 - better performance will be achieved than what it is now
- **Automatic PIP request can be achieved via the AMPS tool installed in all domains**
- **SLA installation procedure should also become more automatic**
- **We will continue the experiments with bigger amount of control data, in order to test the SLA procedure more effectively (including and PIP in GARR domain)**