Network Service Interfaces to Grid

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GGF11 doc: https://forge.gridforum.org/projects/ghpn-rg/document/draft-ggf-masum-grid-network-services-0/en/1
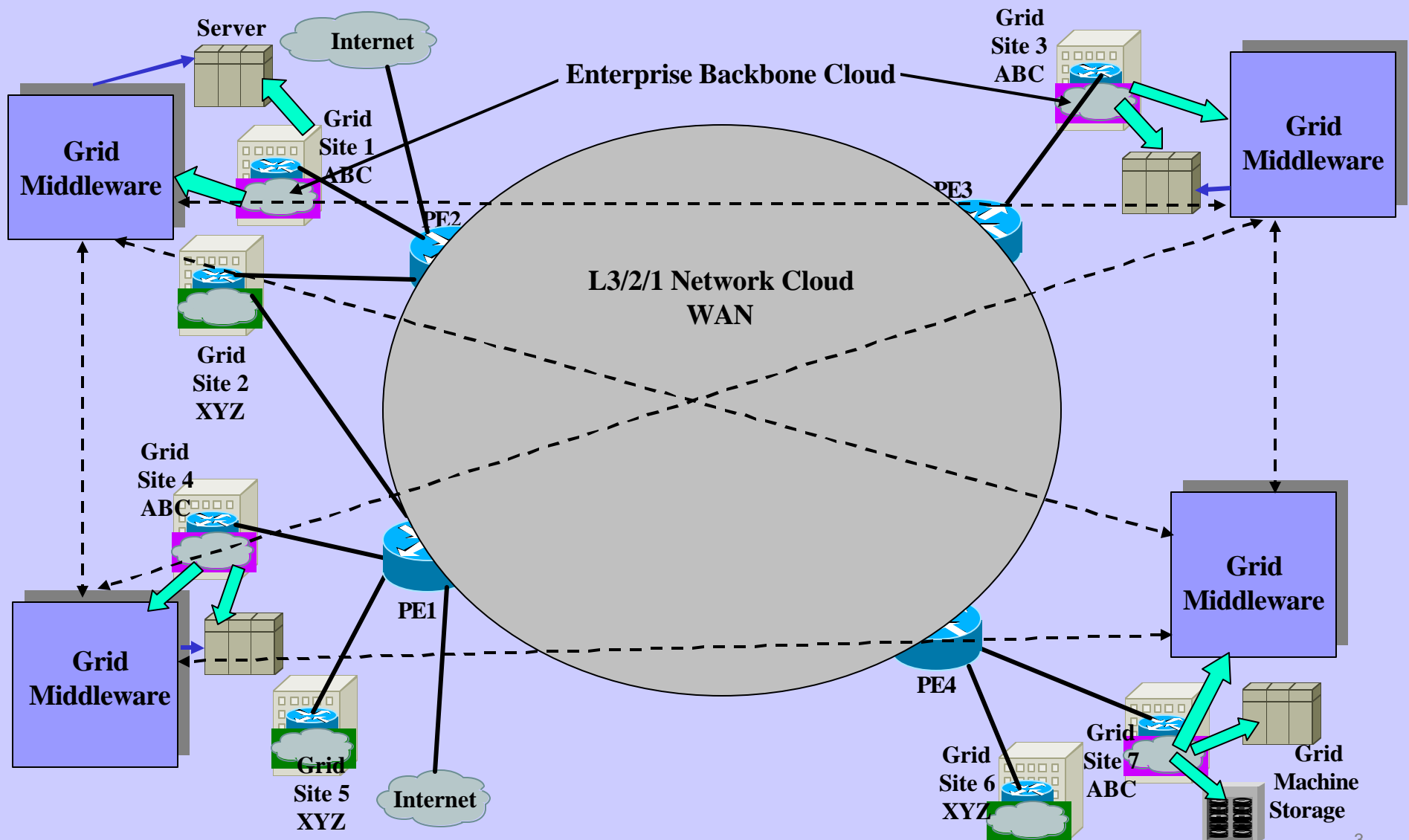
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1

Introduction

- **Grid: Anything to do with Distributed, Parallel, Networked Processing**

- **Grid networks are *Layer 7 (L7) overlay networks* on top of underlying L3/2/1 networks**
  - **Grid Resources**
    - **L7 NEs: Workstations, Servers, Supercomputers**
    - **Processes/Applications/Tasks (computational units)**
    - **CPU, Memory, Files**
    - **Storage**
    - **Data-sets, Databases**
    - **L7 services (web, database, e-commerce, gaming, etc.)**
    - ❏ **Grid Resources managed by a Grid Middleware, such as *Globus***

- **Need to provide L3/2/1 *Network Service Interfaces* (*NSI*) to Grid (Middleware/Appl.)**
  - **Interfaces should be *abstract* (high level) hiding details of L3/2/1 network resources**
    - **Transparent access to network resources via abstract NSI**

- **Make use of existing network services**
  - **Grid middleware or applications will be able to perform network-aware Grid functions (scheduling, storage management, etc.).**
  - **New types of Grids (Network Service based Grids) can be built. For example, a secure Grid where each Grid site is an MPLS VPN site.**
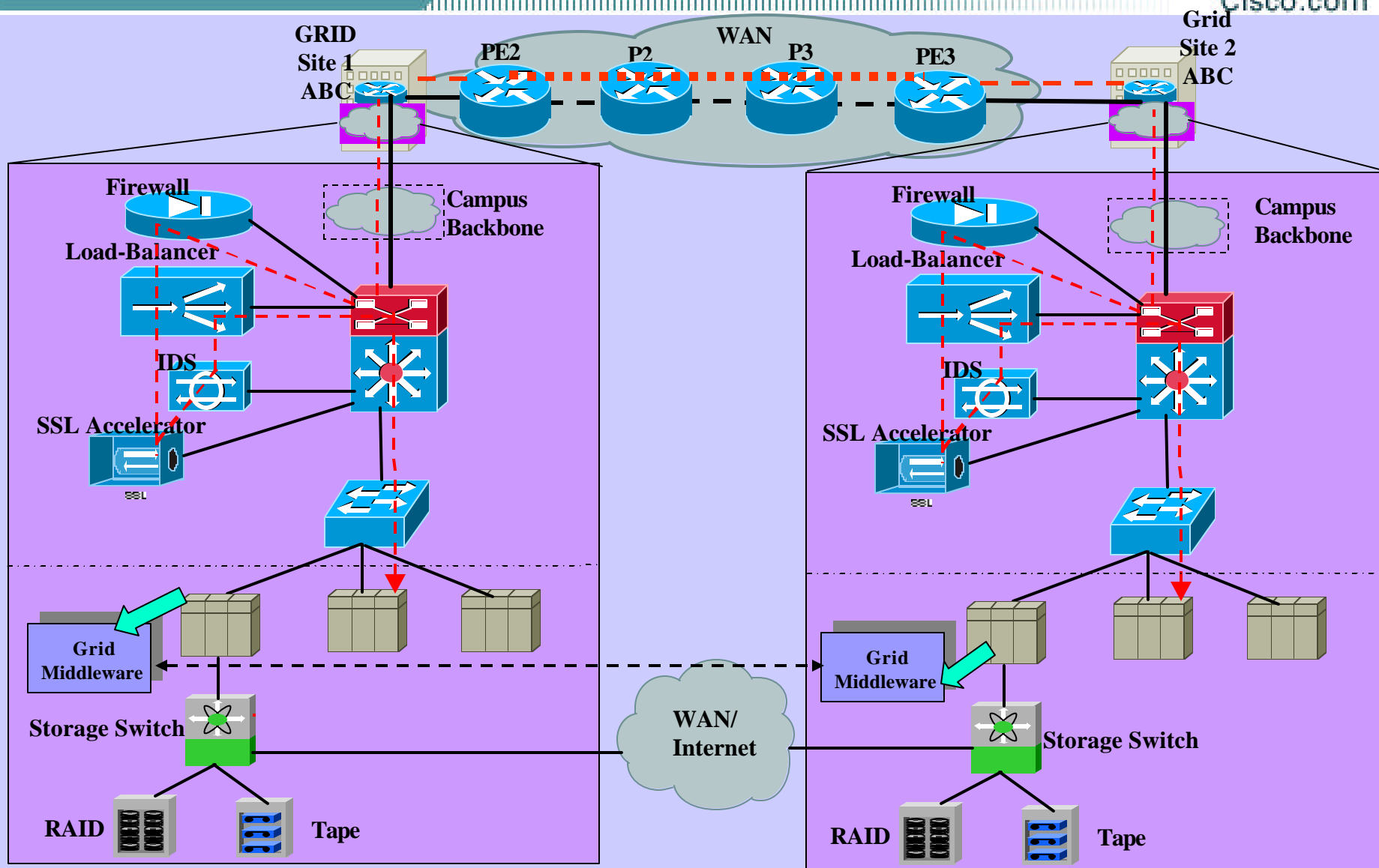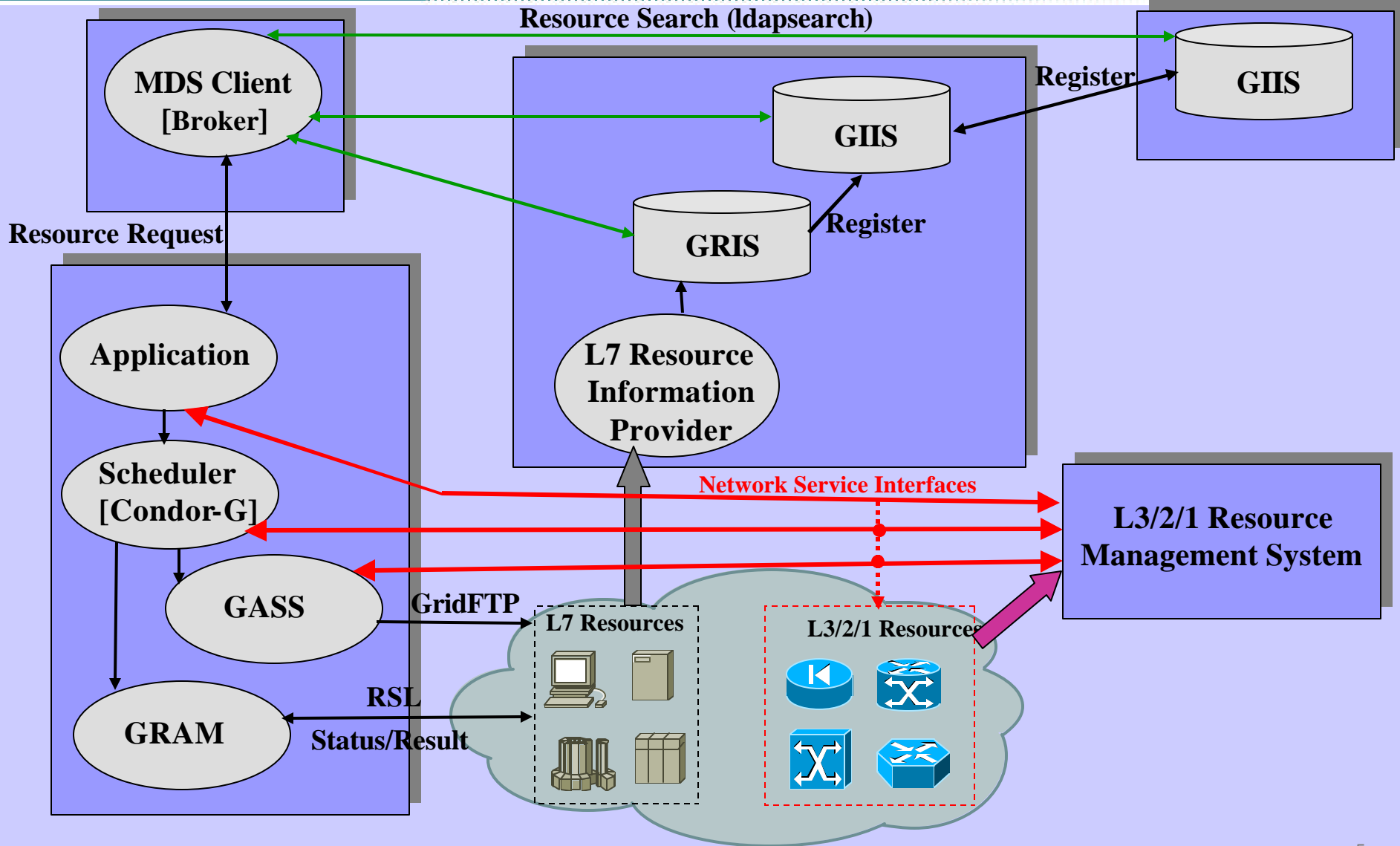
2

Example: Overlay Grid network

Example: With Campus Network Shown

GRID
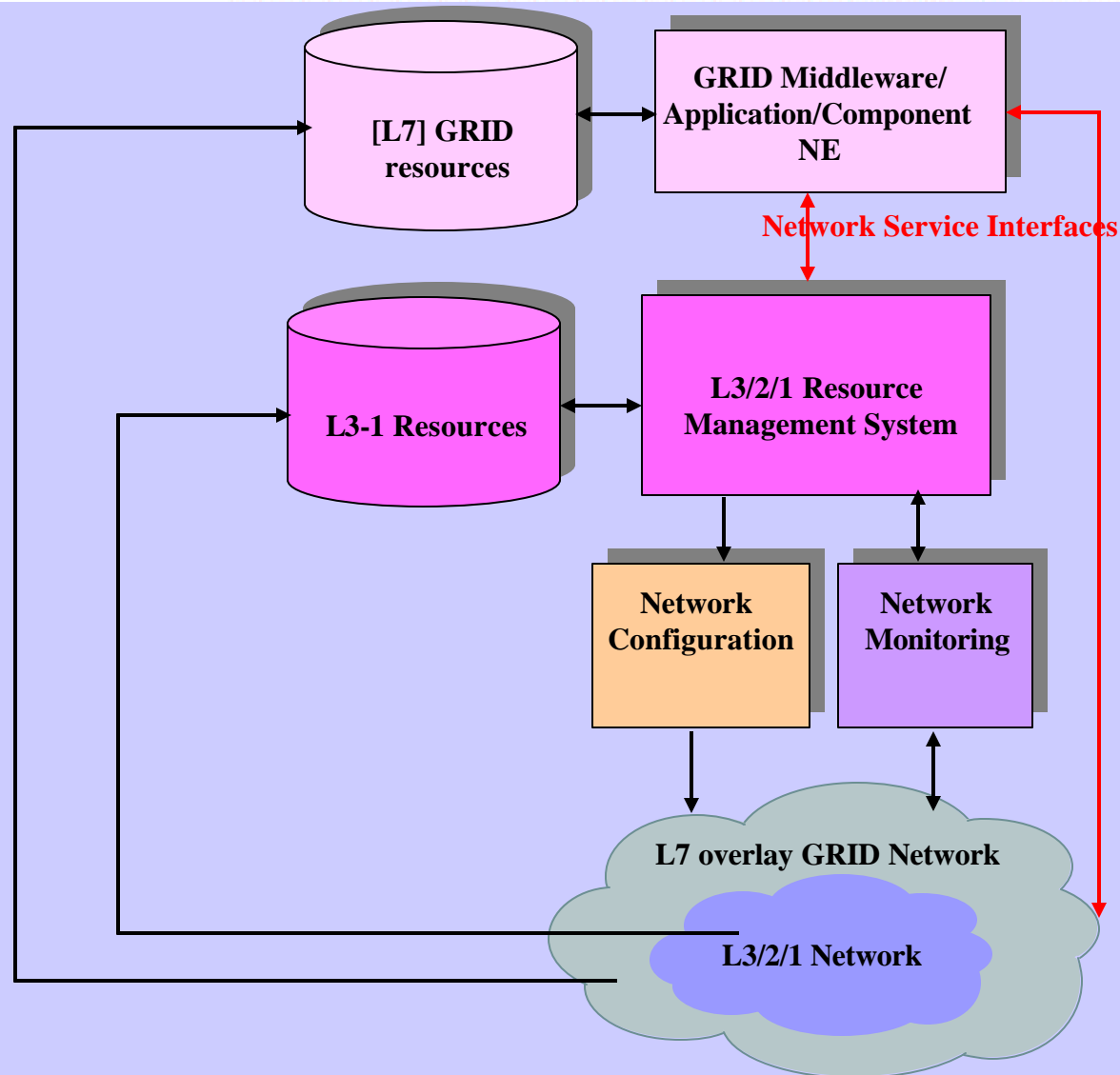Site 1
ABC

WAN

PE2   P2   P3   PE3

Grid
Site 2
ABC

Firewall

Campus
Backbone

Load-Balancer

IDS

SSL Accelerator

Grid
Middleware

Storage Switch

RAID   Tape

Firewall

Campus
Backbone

Load-Balancer

IDS

SSL Accelerator

Grid
Middleware

Storage Switch

RAID   Tape

WAN/
Internet

Grid Middleware NSI Interaction Example

Resource Search (ldapsearch)

MDS Client [Broker]

GIIS

Register

GIIS

Resource Request

GRIS

Register

Application

L7 Resource Information Provider

Scheduler [Condor-G]

Network Service Interfaces

L3/2/1 Resource Management System

GASS

GridFTP

L7 Resources

L3/2/1 Resources

GRAM

RSL

Status/Result

5

High Level View of Grid NSI based Resource Management Architecture

[L7] GRID resources

GRID Middleware/ Application/Component NE

Network Service Interfaces

L3-1 Resources

L3/2/1 Resource Management System

Network Configuration

Network Monitoring

L7 overlay GRID Network

L3/2/1 Network

Network Service Interfaces

- **Depending on underlying L3/2/1 networks, wide varieties of NSI possible:**
  - **Bandwidth related services**
  - **CoS/QoS related services**
  - **L3/2/1 VPN/Security**
    - **L3 MPLS VPN**
    - **L3 IPSEC VPN**
    - **L2 VPN (Any Transport over MPLS or L2TPv3 based)**
  - **G/MPLS Traffic Engineering (TE) based services**
  - **Optical connection services**
  - **Firewall services**
  - **IDS services**
  - **SSL Acceleration services**
  - **Optimized BGP alternate path selection services (for multi-homed connections).**

Example: Network Service Aware Grid Functions

- **With NSI a task scheduler could perform the following**
    - **Make a decision on task distribution (before actually distributing them)**
    - **Query the condition on the communication paths between Grid sites and adjust distribution based on query result**
    - **Redistribute based on network condition after the tasks have been distributed**
    - **Request bandwidth and QoS constrained paths (pipes/tunnels), if supported, between relevant sites**
        - **For example, if the underlying (L3/2/1) network is [G]MPLS, then the Grid may request provisioning of MPLS TE LSP tunnels between relevant sites.**

8
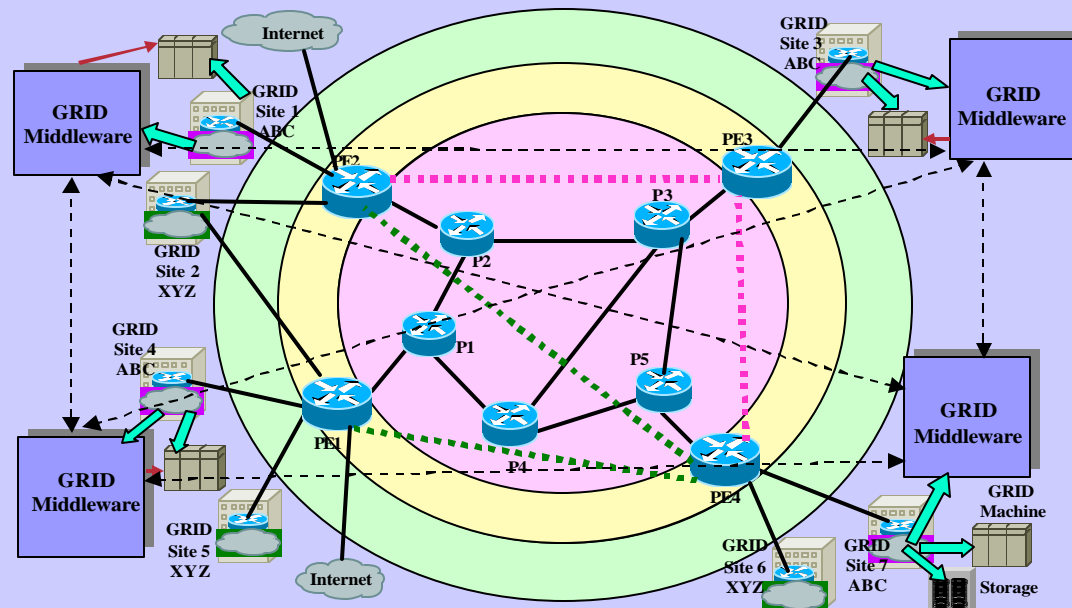
Network Service Types and Abstraction

- **Configuration related**
  - **Ex: Configure_Path, Join_in_VPN**

- **Monitoring**
  - **Ex: Monitor_Configured_Network_Path**
  - **Utilize network monitoring facilities, such as OAM monitoring, SNMP MIB**

- **Many different types of L3/2/1 network, provide abstraction**
  - **Ex: Configure_Path (Source, Destination, QoS)**
    - **Depending on underlying network *"path"* can be anything that satisfies QoS**
      - **Ex: A BGP outbound or inbound optimized "path"**
      - **Ex: A MPLS TE Tunnel (path)**
  - **Path not necessarily a "circuit"**
  - **QoS abstracted; Ex. Platinum QoS, which can be any of (depending on support)**
    - **DiffServ EF**
    - **Relevant IntServ QoS**
    - **Priority queue + DS-TE tunnel + FRR protection**
    - **Firewall + SSL Acceleration + IDS + Redundancy**

Summary

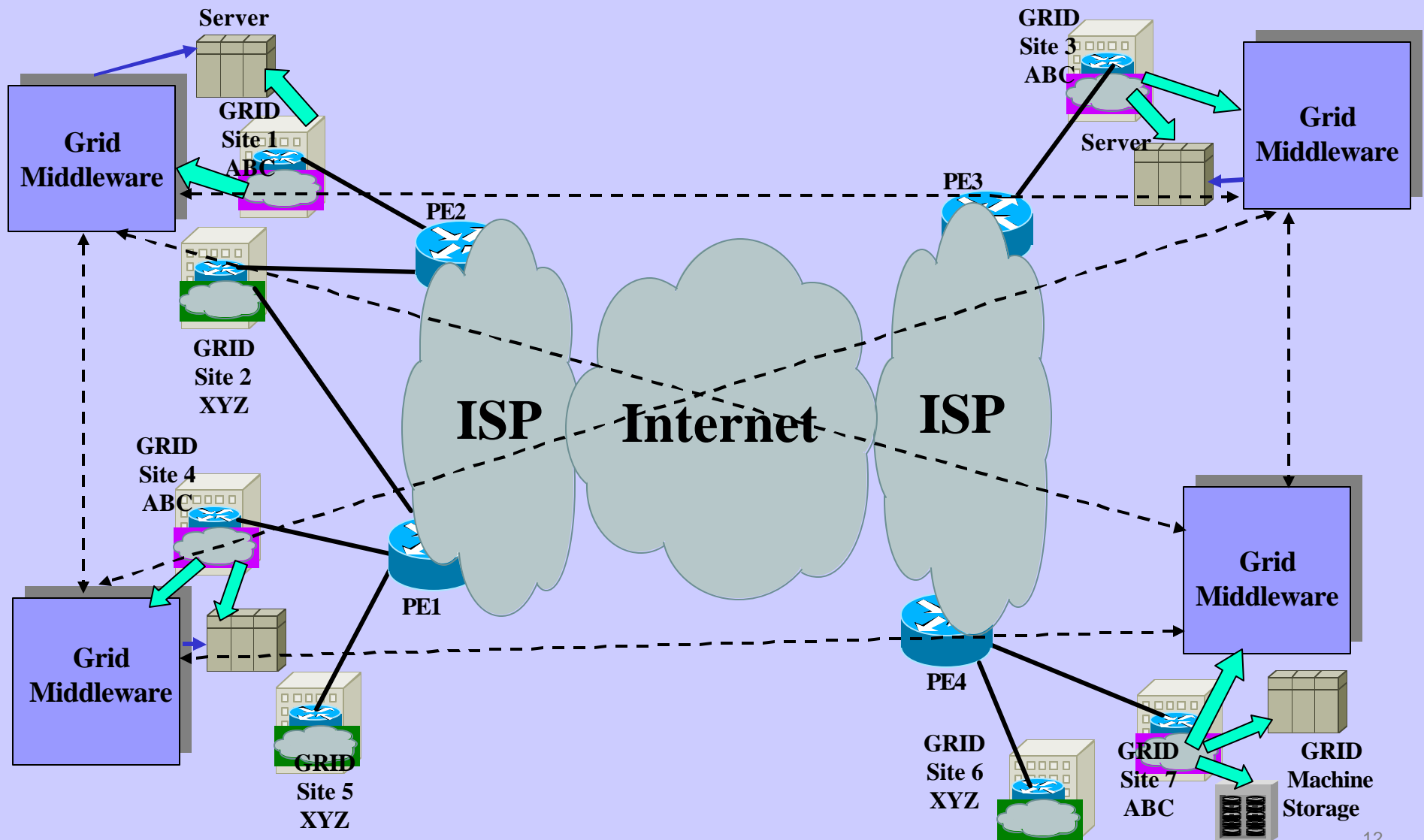- **Proposal: Define Abstract Network Service Interfaces for Grid**

Network Types

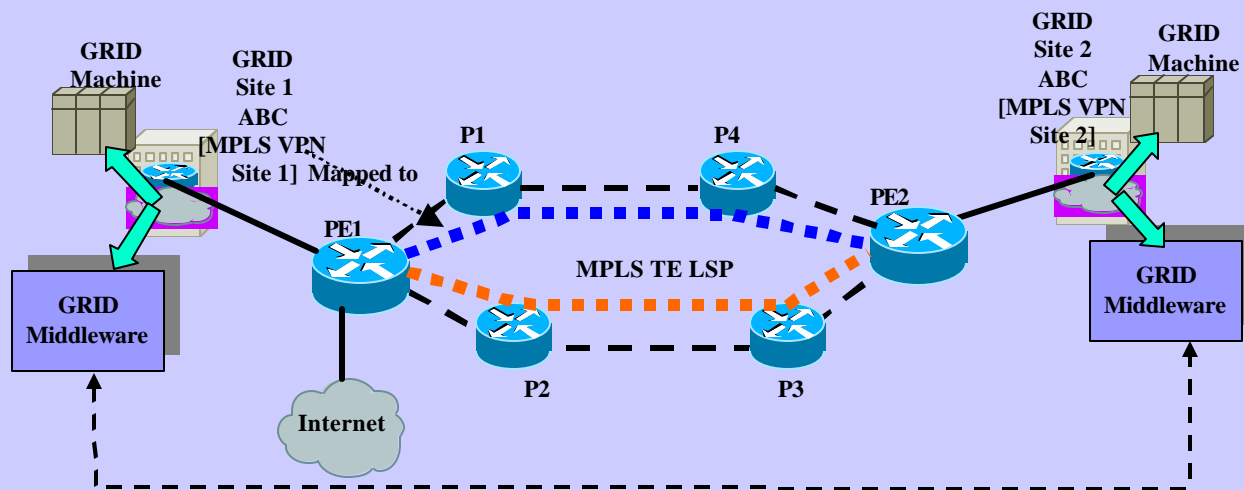- Examples of many different types of networks in next few slides

Grid on Public Internet

12

Grid over MPLS Network (Grid MPLS VPN)

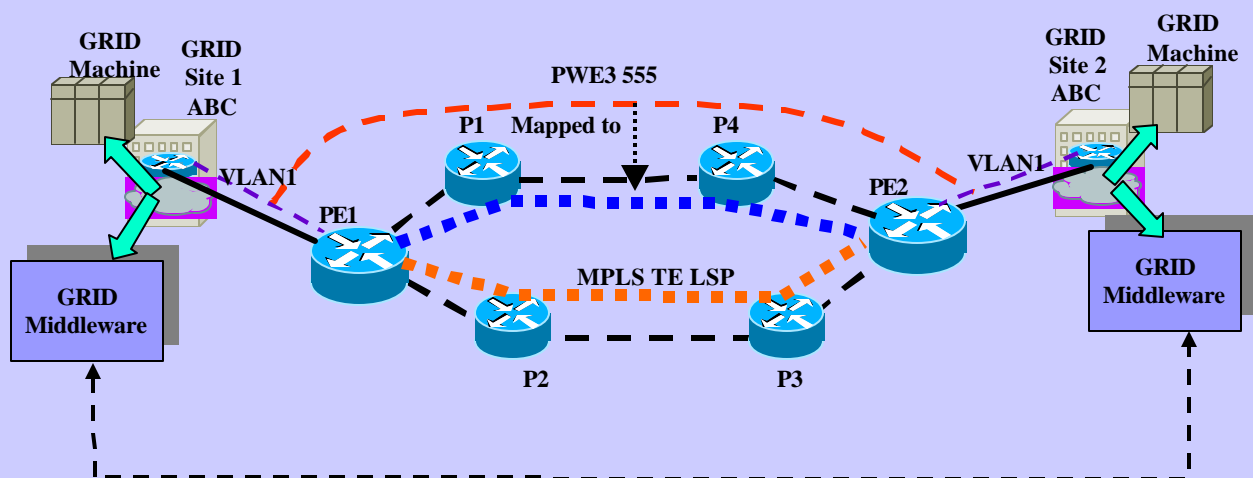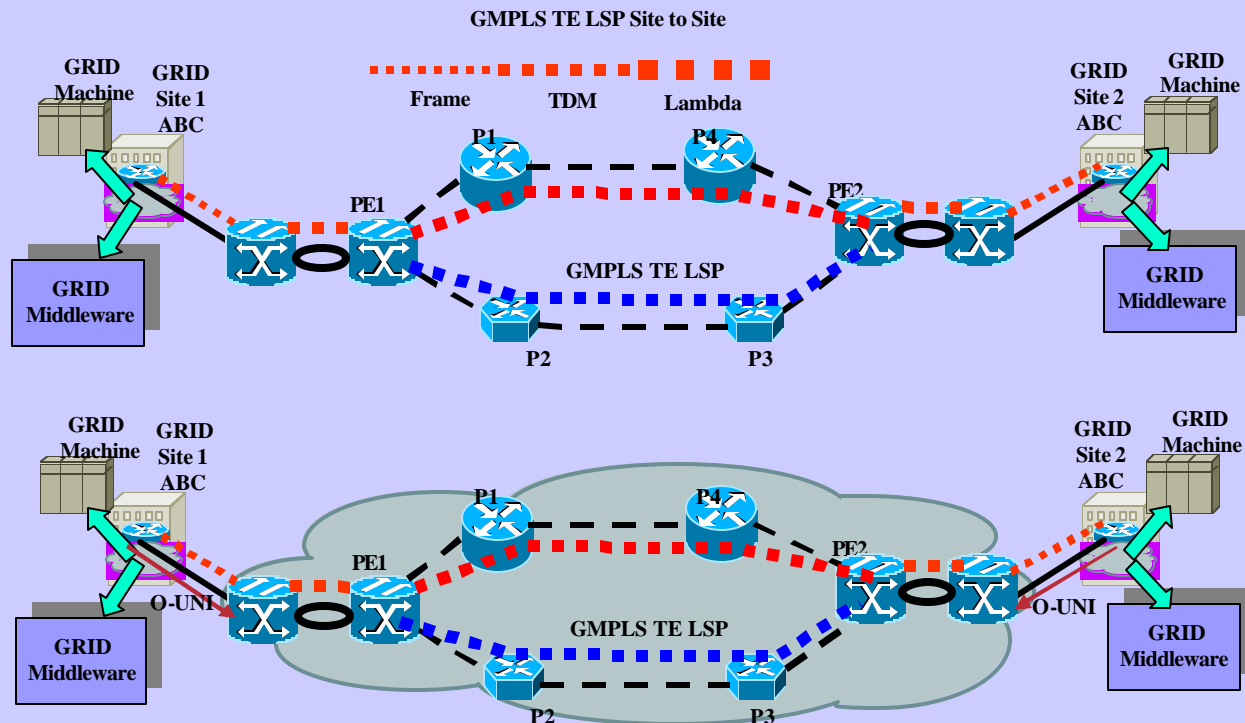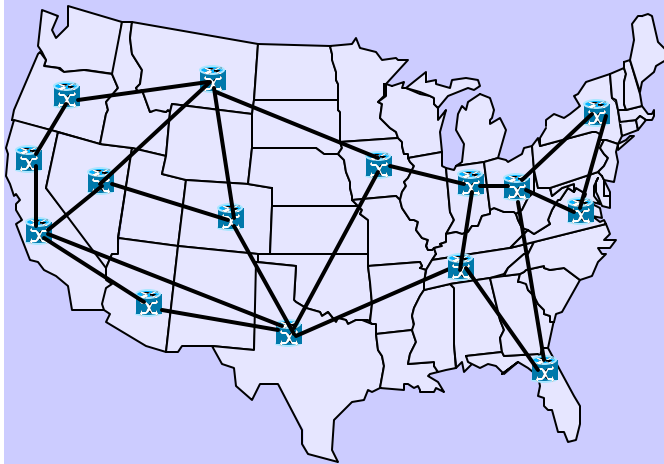# Grid over AToM (Any Transport over MPLS) (Grid L2VPN)

Grid over Optical/Transport/GMPLS/ASON Network

The All Encompassing Everything Grid!!

- Internet is Grid
- Campus Net is Grid
- Wireless Net is Grid
- PSTN is Grid
- Optical Net is Grid
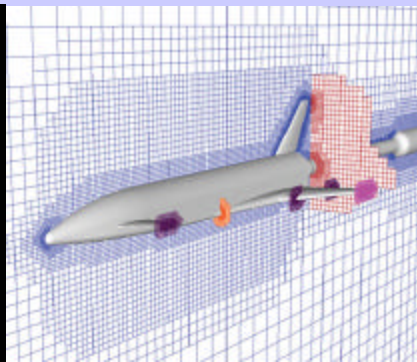- MPLS Net is Grid
- Data Center Net is Grid
- …

- There has to be justifications to calling anything Grid

- Grid is L7 overlay Grid network on which applications and services run distributed/in parallel, managed by a Grid Middleware

- Unless L3/2/1 networks GRID-aware or Gridified (whatever that means), we shouldn't call them Grid, like Optical or Wireless Grid

- But Grid can make use of Network Services provided by L3/2/1 networks

- It might be possible to Gridify (or make Grid-aware) L3/2/1 networks by incorporating Grid resource information and functions in the control plane, such as Grid-aware L3 routing

GRID

GRID

GRID

GRID