

An Hierarchical Policy-Based Architecture for Integrated Management of Grids and Networks

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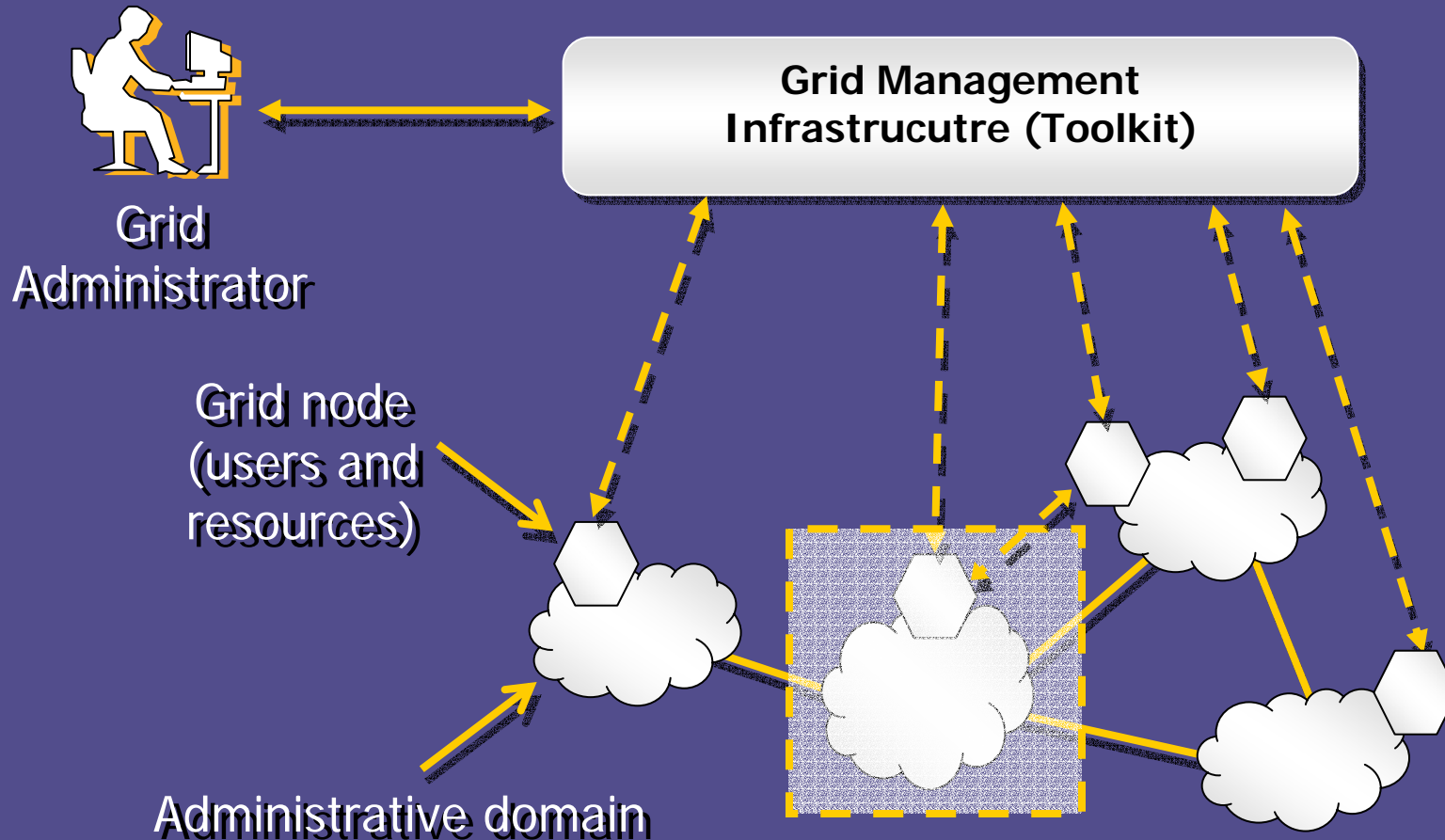
Outline

- Introduction
- Grids, networks and policies
- Hierarchical mapping architecture
- System prototype
- Conclusions and future work

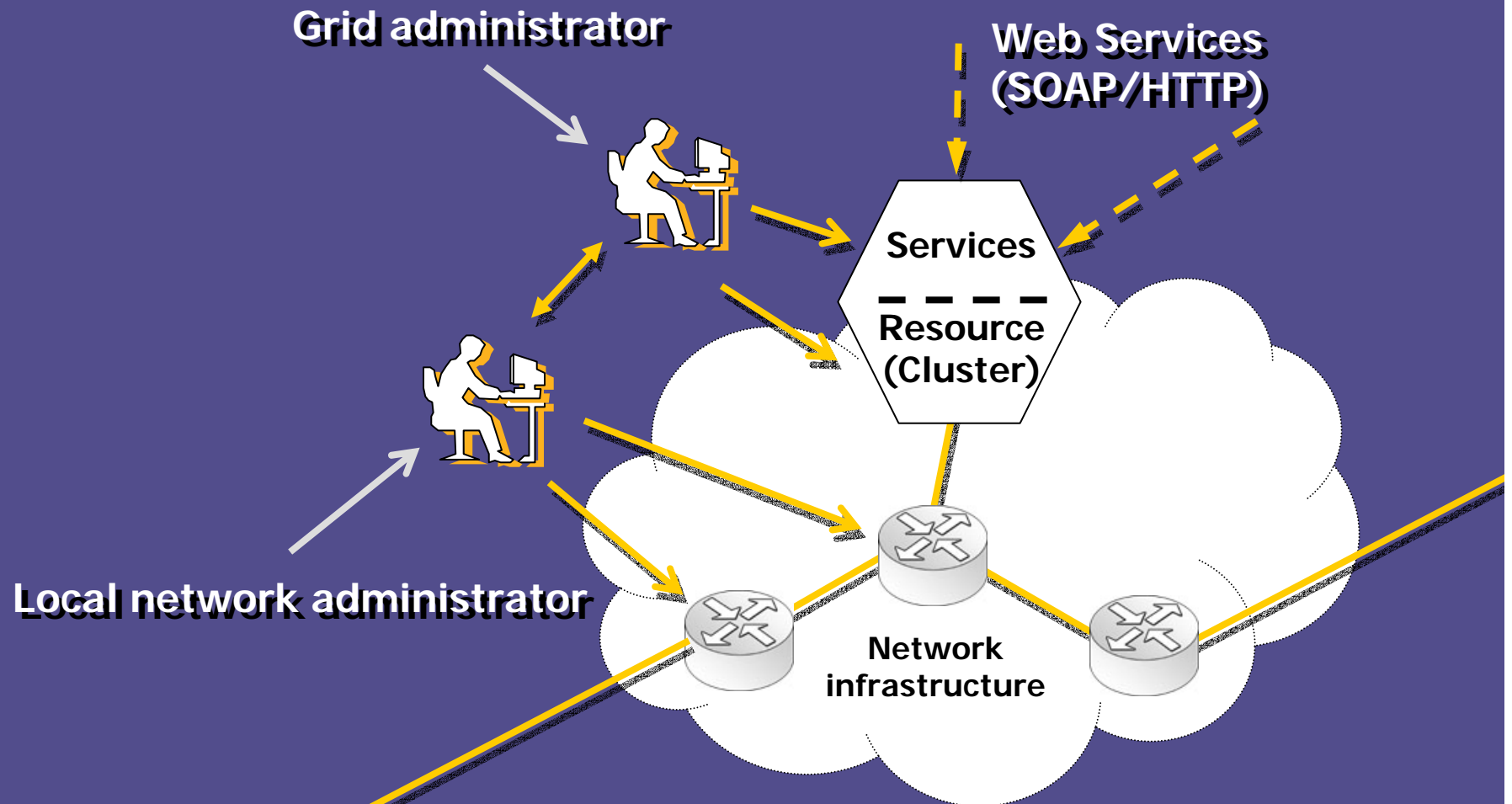
Introduction

- Configuration of the underlying network to allow the grid operation
- Grid resources distributed along several network administrative domains: management problems?
- Network policies x Grid policies
- A system to generate network policies based on grid policies

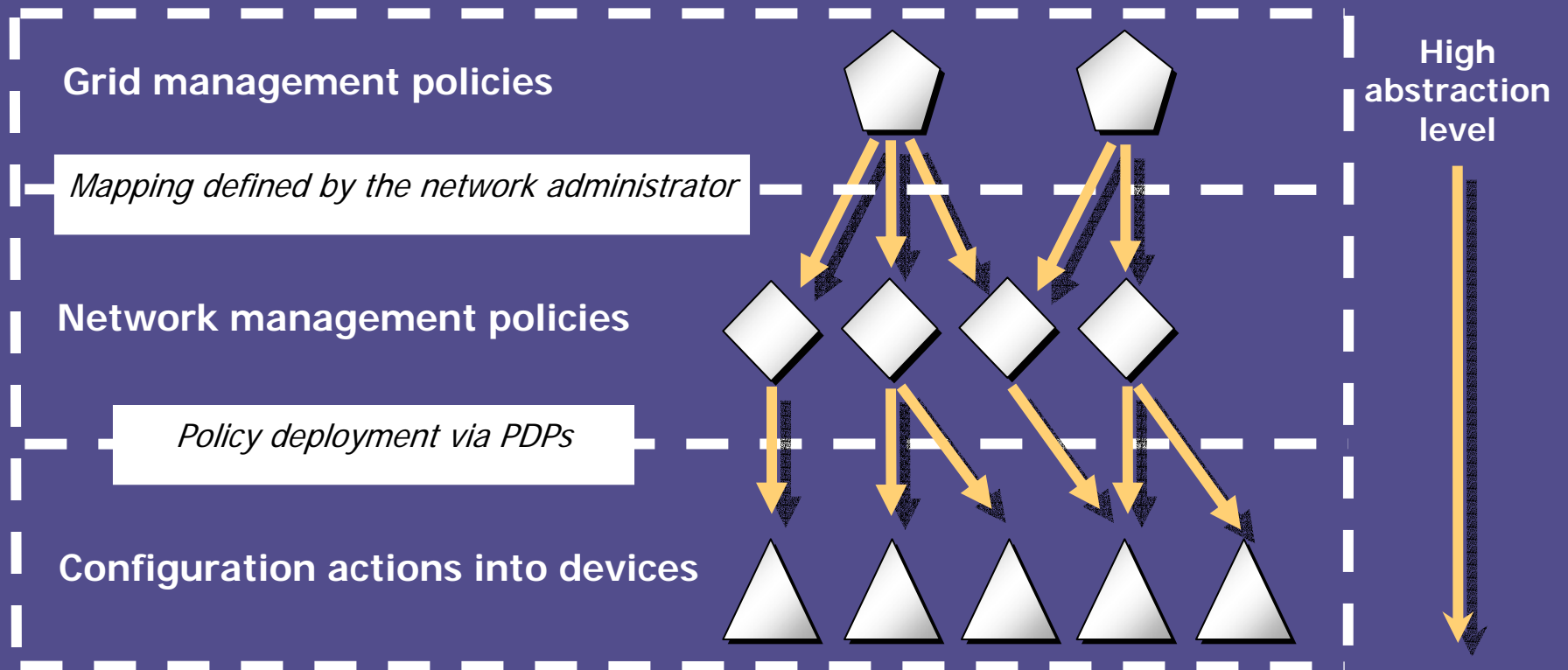
Grids, networks and policies



Grids, networks and policies



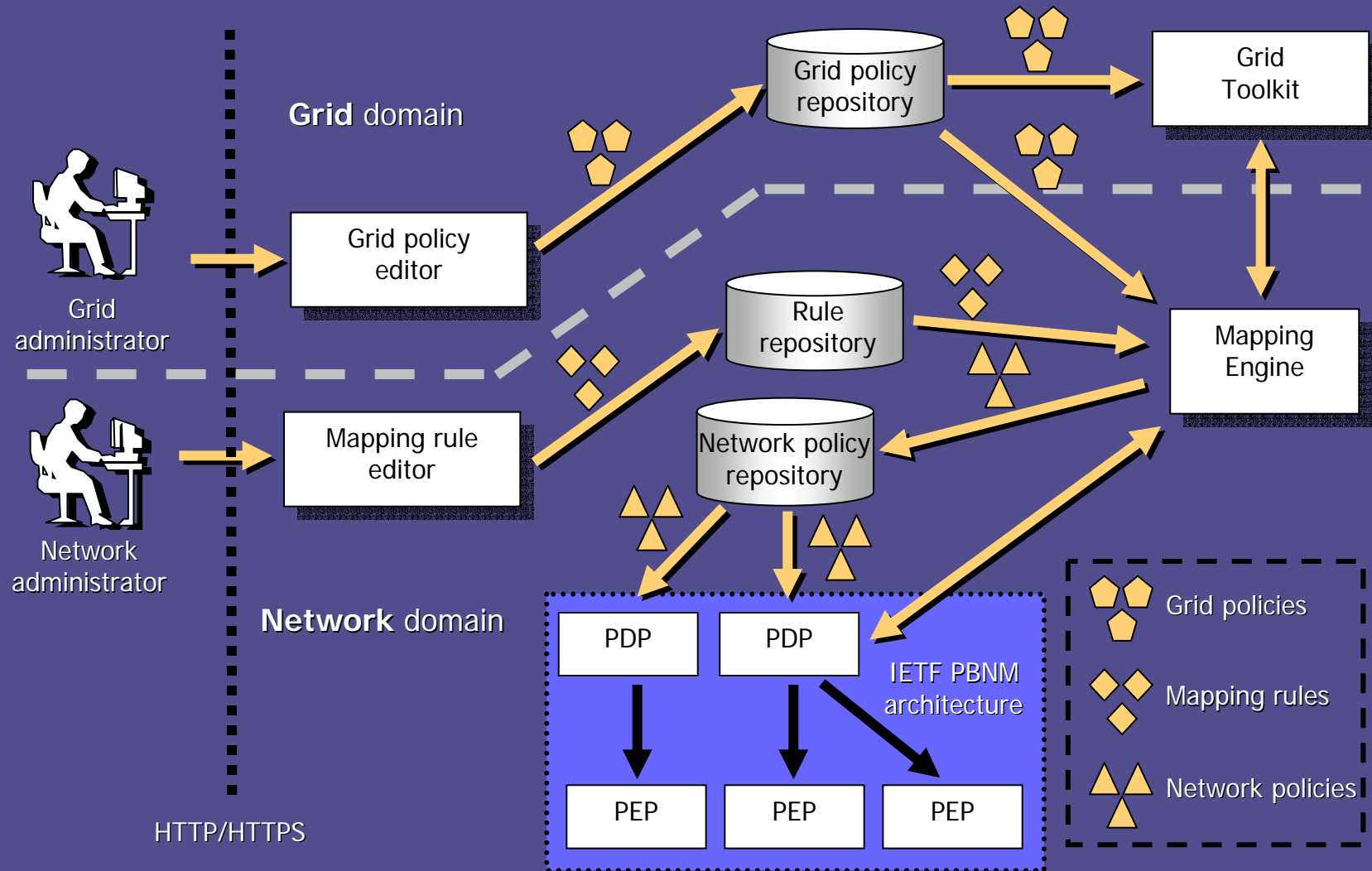
Hierarchical policies and grids



Grid policy examples

```
if (user == "neisse" and
    startTime >= "11/25/2003 00:00:00" and
    endTime <= "11/25/2003 23:59:59")
{
    if (resource == "LabTec Cluster") {
        allowAccess = true;
        login = griduser;
        maxProcessing = 50%;
        networkQoS = remoteProcessControl;
    }
    if (proxy == "LabTec Cluster" and
        resource == "UFRGS Data Server")
    {
        allowAccess = true;
        maxAllowedStorage = 40GB;
        networkQoS = highThroughputDataIntensive;
    }
}
```

Mapping architecture



Mapping architecture

```
if (srcResource.address/24 == 143.54.47.0/24 and
    dstResource.address/24 != 143.54.47.0/24 and
    dstResource.port == 80 and
    dstResource.protocol == TCP)
{
    p1 = new NetworkPolicy();
    p1.addCondition(startTime, ">=", schedule.startTime);
    p1.addCondition(endTime, "<=", schedule.endTime);
    p1.addCondition(srcAddress, "==", srcResource.address);
    p1.addCondition(dstAddress, "==", dstResource.address);
    p1.addCondition(dstPort, "==", dstResource.port);
    p1.addCondition(dstProtocol, "==", "tcp");
    p1.addAction(DSCP, 2);

    p2 = new NetworkPolicy();
    p2.addCondition(startTime, ">=", schedule.startTime);
    p2.addCondition(endTime, "<=", schedule.endTime);
    p2.addAction(DSCP, 2);
    p2.addAction(bandwidth, requiredQoS.requiredBandwidth);
}
```

Mapping architecture

```
if (srcResource.address/24 == 143.54.47.0/24 and
    dstResource.address/24 != 143.54.47.0/24 and
    dstResource.port == 80 and
    dstResource.protocol == TCP)
{
    p1 = new NetworkPolicy();
    ...
    inPEPs = select pep
                .within[srcResource.address, 143.54.47.1]
                .direction["in"]
                from device.type["DiffServDevice"];
    inPEPs[0].deployPolicy(p1);

    p2 = new NetworkPolicy();
    ...
    outPEPs= select pep
                .within[srcResource.address, 143.54.47.1]
                .direction["out"]
                from device.type["DiffServDevice"];
    outPEPs.deployPolicy(p2);
}
```

System prototype

The screenshot shows a Microsoft Internet Explorer browser window displaying the QAME (QoS-Aware Management Environment) web interface. The browser's address bar shows the URL: `https://noc.metropoa.tche.br/neisse/main/qame.php`. The page title is "QAME - QoS-Aware Management Environment (Skin Color GUI) - Microsoft Internet Explorer".

The interface features a navigation menu on the left with the following items:

- QAME
- Network map
- QoS Policies
 - Class of Services
 - Flows
 - Schedule
- Grid Admin
 - Policies
 - Mapping Rules
- SNMP Traps
 - Received Actions
 - Severity
- Descoberta
- LDAP Explorer
- Logout

The main content area is titled "Grid Policies" and contains a "Policy List" section. The list displays the following configuration:

```
// UFRGS VO Policies
if (user == 'neisse' AND startTime >= '25/11/2003 00:00:00' AND endTime <= '25/11/2003 23:59:59') X X
{
  :: Insert(Rule/Action) ::
  if (resource == 'Cluster LABTEC') X X
  {
    :: Insert(Rule/Action) ::
    AllowAccess = true;
    Login = gridUser;
    NetworkQoS = RemoteProcessControl;
    MaxProcessing = 50%;
  }
  if (resource == 'Data Server' AND proxy == 'Cluster LABTEC') X X
  {
    :: Insert(Rule/Action) ::
    AllowAccess = true;
    NetworkQoS = HighThroughputDataIntensive;
    MaxAllowedStorage = 40Gb;
  }
}

... New Policy ...
```

The browser's status bar at the bottom shows the URL: `https://noc.metropoa.tche.br/neisse/main/qame.php?xml=apps/gridPolicies/policies.php` and the Internet Explorer logo.

System prototype

The screenshot shows a web browser window titled "QAME - QoS-Aware Management Environment (Skin Color GUI) - Microsoft Internet Explorer". The address bar shows the URL "http://noc.metropoa.tche.br/neisse/main/qame.php". The page content is divided into a left sidebar and a main content area.

Left Sidebar:

- QAME logo
- Network map
- QoS Policies
 - Class of
- Services
 - Flows
 - Schedule
- Grid Admin
 - Policies
 - Network CoS
 - Mapping Rules
- SNMP Traps
 - Received
 - Actions
 - Severity
- Descoberta
- LDAP Explorer
- Logout

Main Content Area:

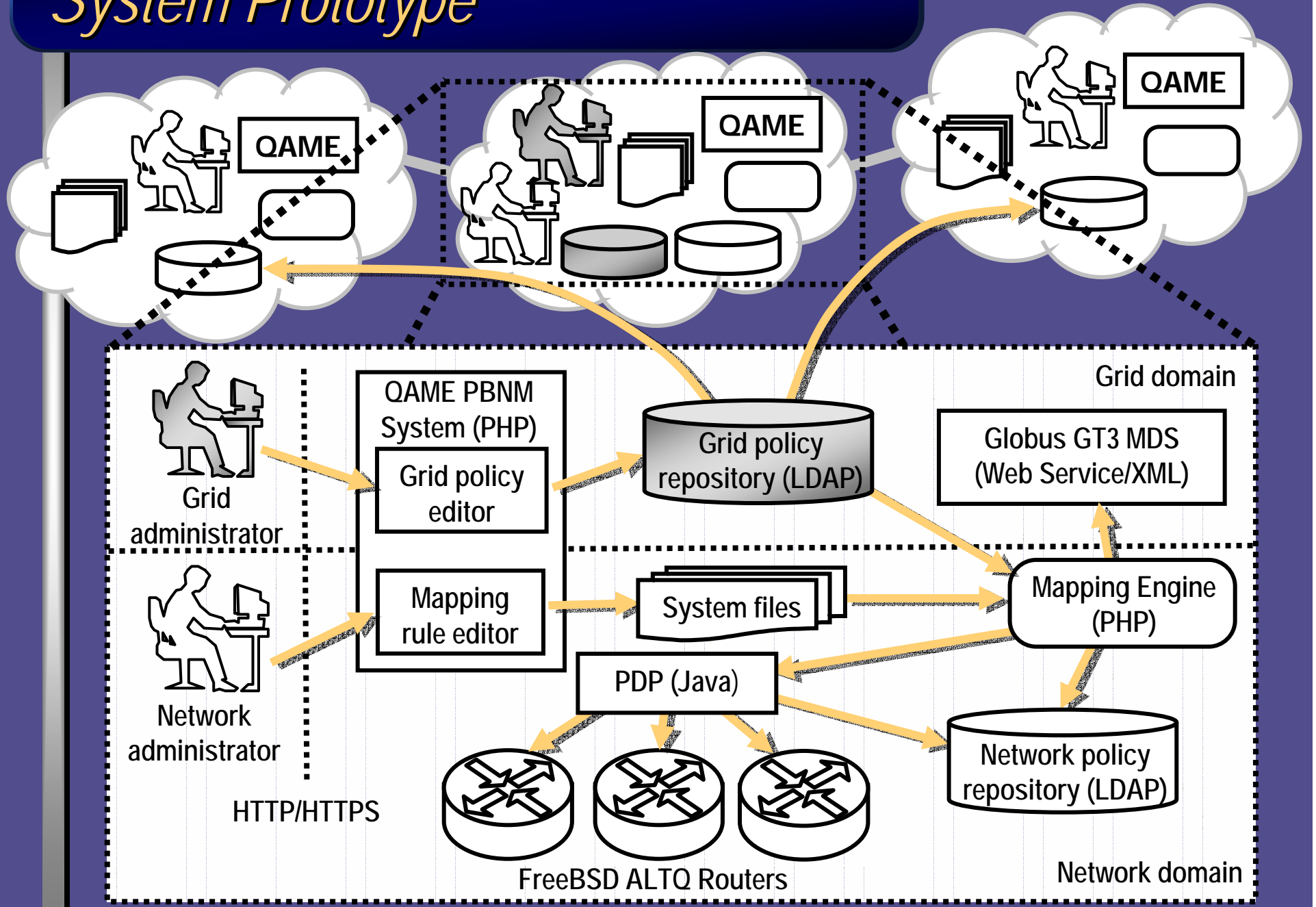
Mapping Rules

Mapping Rule List

```
// Mapping Rule test
if (srcResource.address == "143.54.47.0/24" AND
dstResource.address != "143.54.47.0/24" AND
dstResource.port == "80" AND
dstResource.protocol == "tcp")  X
{
    :: Insert Condition ::
    p1 = new NetworkPolicy();
    p1.addCondition(startTime,">=",schedule.startTime);
    p1.addCondition(endTime,"<=",schedule.endTime);
    p1.addCondition(srcAddress,"==",srcResource.address);
    p1.addCondition(dstAddress,"==",dstResource.address);
    p1.addCondition(dstPort,"==",dstResource.port);
    p1.addCondition(dstProtocol,"==","tcp");
    p1.addAction(DSCP,2);
    inPEPs =
        select pep.within[srcResource,"143.54.47.1"].direction["in"]
        from devices.type["DiffServRouter"];
    inPEPs[0].deployPolicy(p1);
    p2 = new NetworkPolicy();
    p2.addCondition(startTime,">=",schedule.startTime);
    p2.addCondition(endTime,"<=",schedule.endTime);
    p2.addCondition(DSCP,2);
    p2.addAction(bandwidth,requiredQoS.requiredBandwidth);
    outPEPs =
        select pep.within[srcResource,dstResource].direction["out"]
        from devices.type["DiffServRouter"];
    outPEPs.deployPolicy(p2);
}
```

... New Mapping Rule ...

System Prototype



Conclusions

- Grid policies: they are needed, but with network policies integration
- Mapping rules are not easy to define, requires:
 - Preview agreement between grid and network administrator
 - Good knowledge of the network and grid infrastructure
- Future work
 - How to make the definition of mapping rules easier?
 - Bandwidth and performance evaluation
 - Policy conflicts

Questions?

- Contact information:
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- Thanks for your attention!