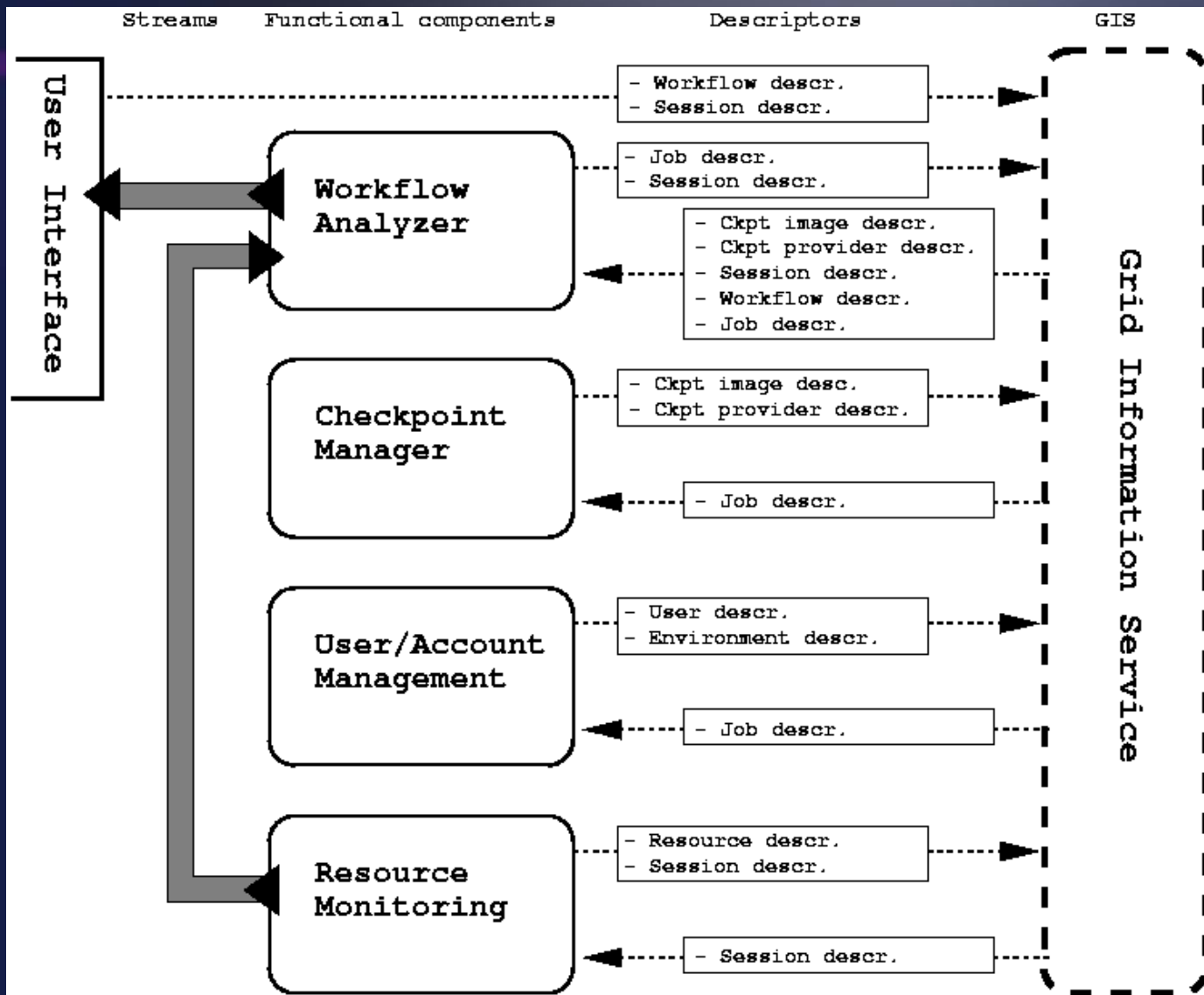# Network Monitoring Session Schema

WP5 Meeting - Rennes
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Augusto Ciuffoletti - INFN – Italy

(joint work with M. Polychronakis – Forth - Crete)

Summary

- **Describe a network monitoring framework**
- **Define a solution**
- **Introduce the schema describing network monitoring requests within such solution**

Narrowing the scope: GRID resources

- A GRID is a collection of resources: among others, network paths

- A path is seen as an atomic resource: we do not distinguish links, routers etc.

- A path exists between any pair of non-network resources

- Non-network resources are partitioned into Domains

Narrowing the scope: Network Monitoring

- Network Monitoring addresses network paths
- Network Monitoring is **performed** by specific resources, that we call Network Monitoring Elements
- Network Monitoring is **managed** by specific agents, that we call Network Monitoring Agents
- There is at least one Network Monitoring Agent for each Domain
- Each network path can be monitored by at least one Network Monitoring Element

Narrowing the scope: NM management

- **Network Monitoring Agents form a community that cooperate peer-to-peer**

- **A Network Monitoring Agent directly controls the activity within a single Domain**

- **As a general rule several Network Monitoring Agents can cohexist in the same Domain (e.g. a Network Monitoring Agents may be specialized in monitoring specific domains)**

- **A Network Monitoring Agent controls a number of Network Monitoring Elements**

Narrowing the scope: NM requests

- **Network Monitoring aims at the observation of the performance of network resources allocated to a complex computational task, that we call Workflow**

- **NM requests are issued by the agent responsible for Workflow management**

- **NMA dynamically configure NMEs to operate measurements**

- **NMEs returns a stream of observations to the Workflow Management Agent**

# The Big Picture (small example)
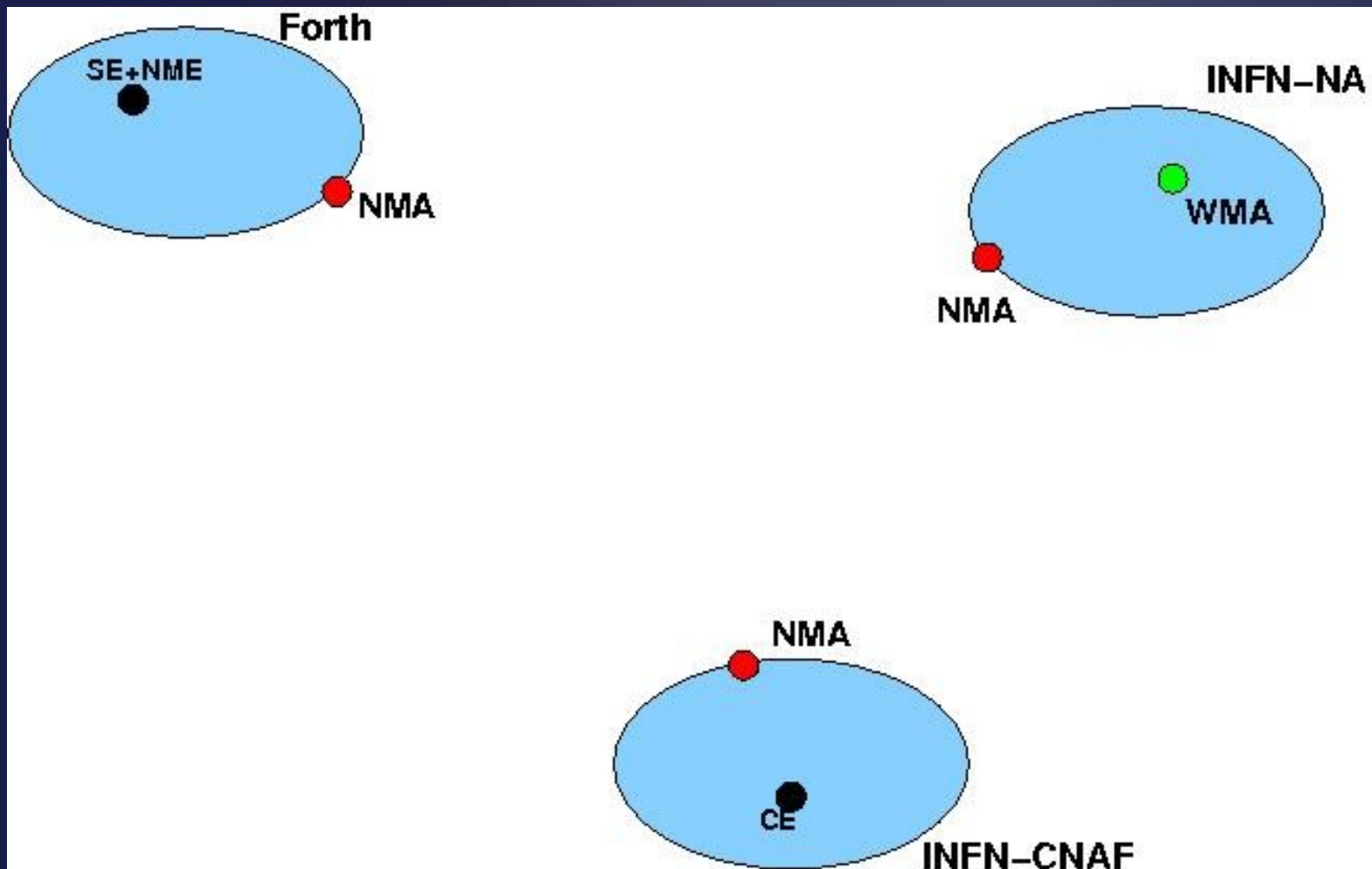
Observations: pro

- **No repositories needed for traces, since observations are produced and consumed on the fly**

- **Scalability is improved:**
  - **no n^2 structures in the system**
  - **no n^2 activities in the system**
  - **domains limit the scope of agents to a fraction of n**

- **Directories describe static capabilities of resources (which is what they are done for)**

Observations: con

- **Design a coordination pattern for Network Monitoring Agents**

- **Network Monitoring Elements must be dynamically configurable (no ping.conf)**

- **A protocol to submit monitoring requests from Workflow Monitoring Agents to Network Monitoring Elements (via NMAs)**

- **Another to return observations backward, possibly as a multicast**
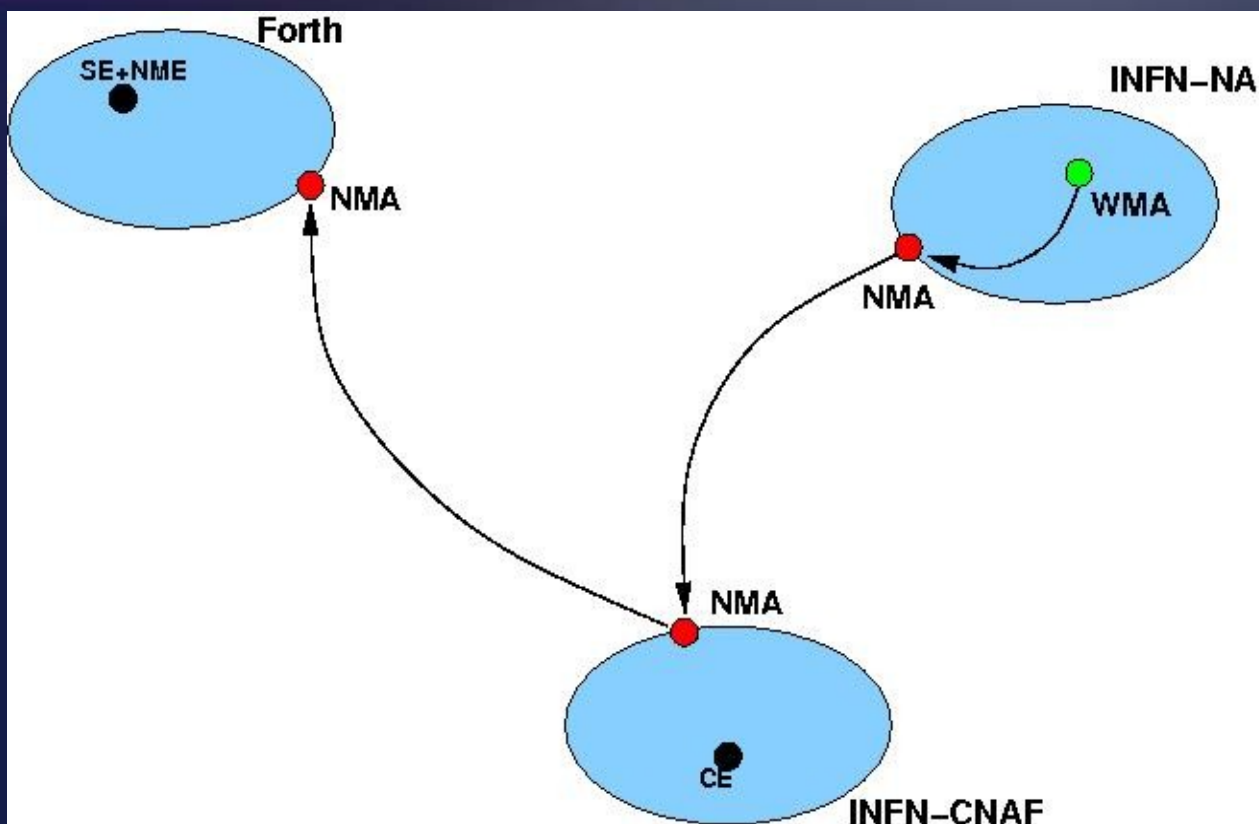
Request/Response protocol
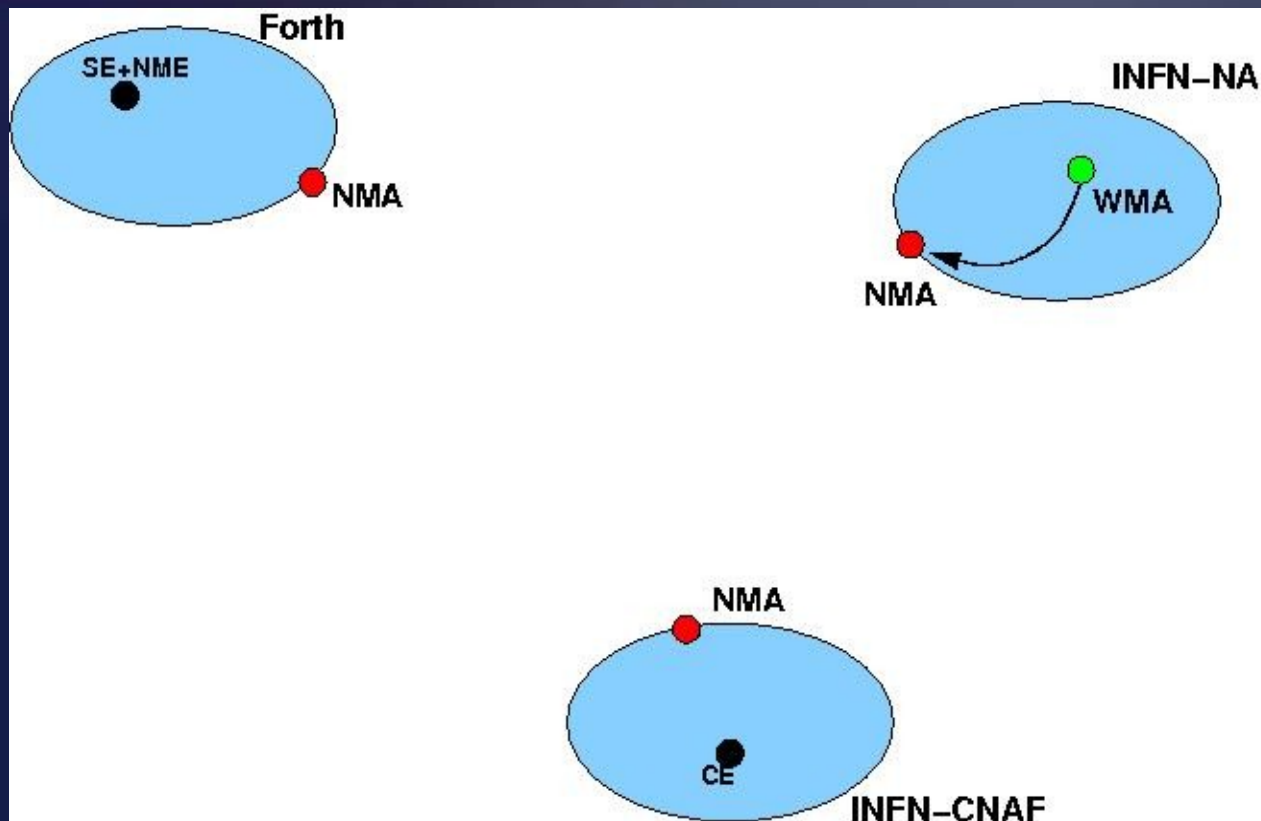
The Workflow Monitoring Agent issues a request to the local Network Monitoring Agent
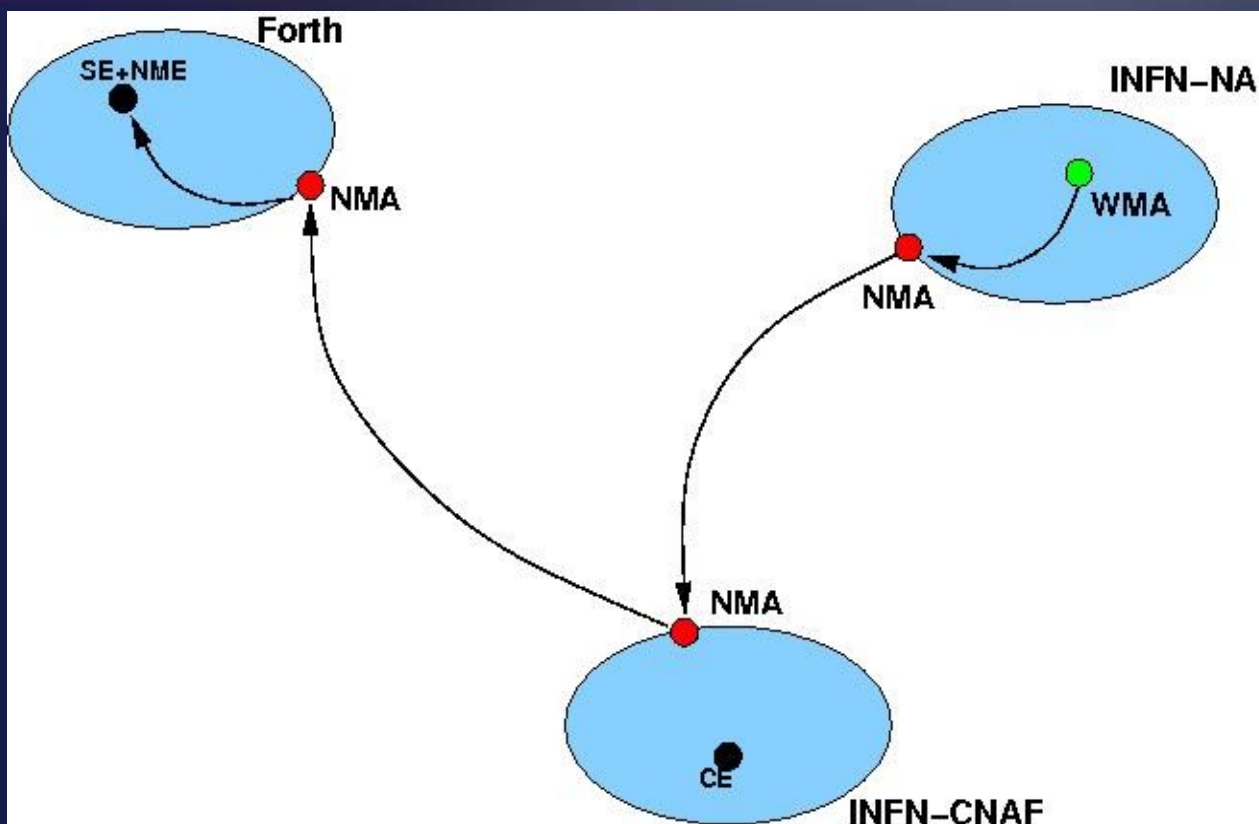
Request/Response protocol
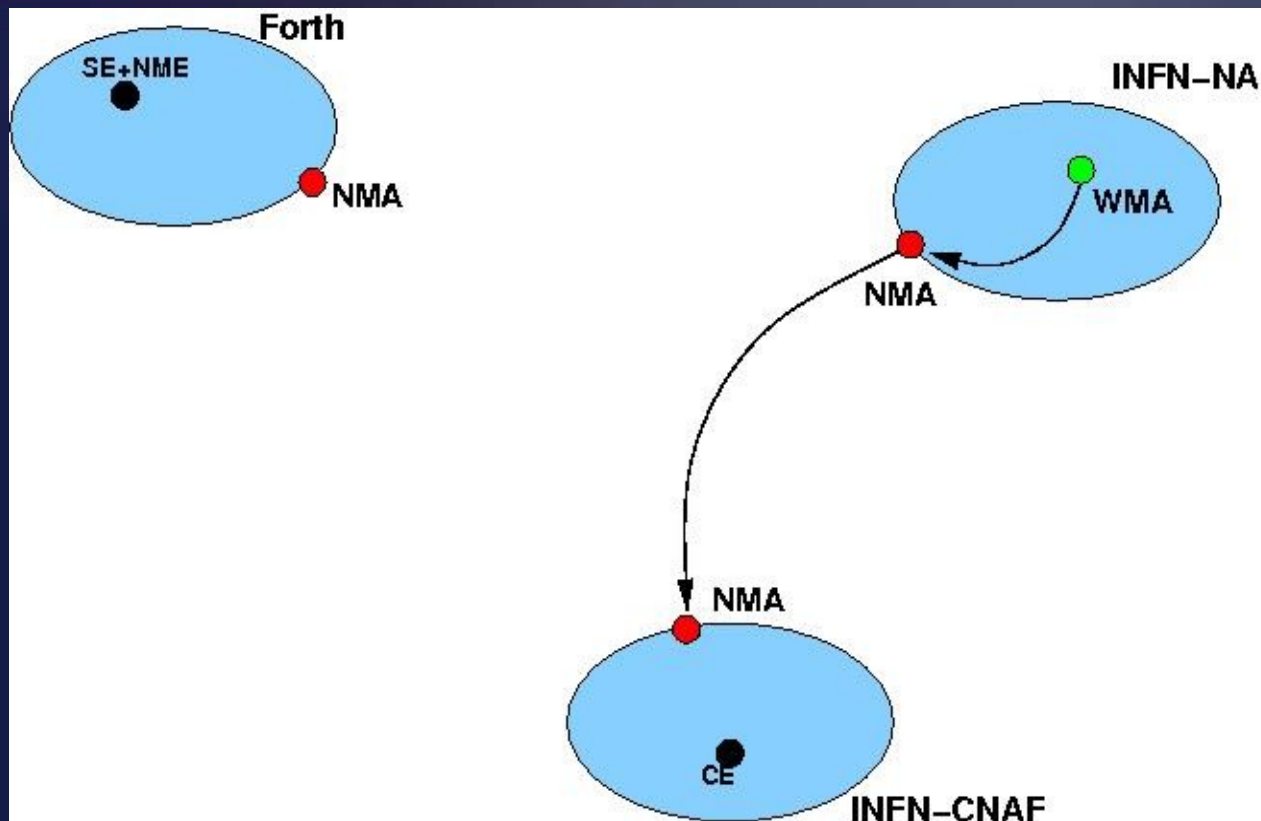
The Workflow Monitoring Agent routes the request to a peer (hierarchy?)
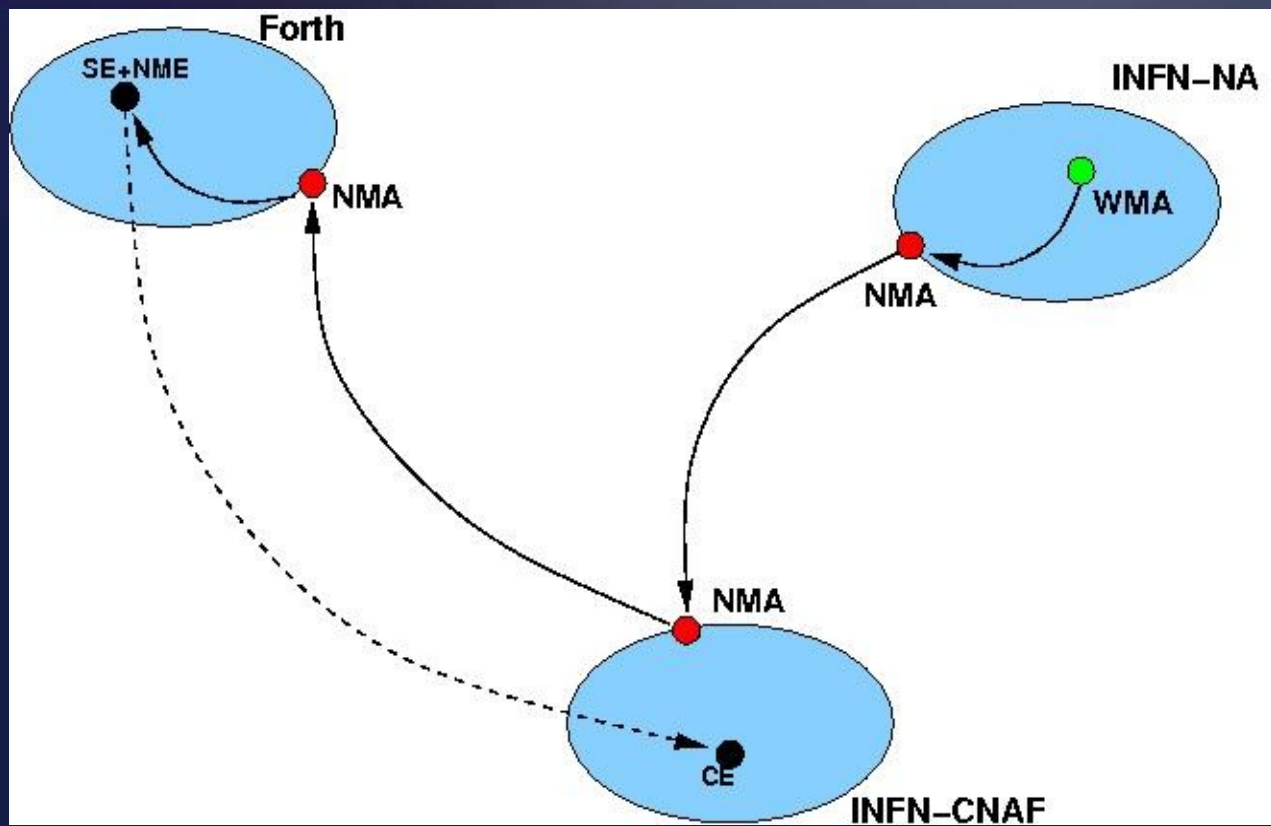
Request/Response protocol

The Workflow Monitoring Agent routes the request to a peer (2nd step)
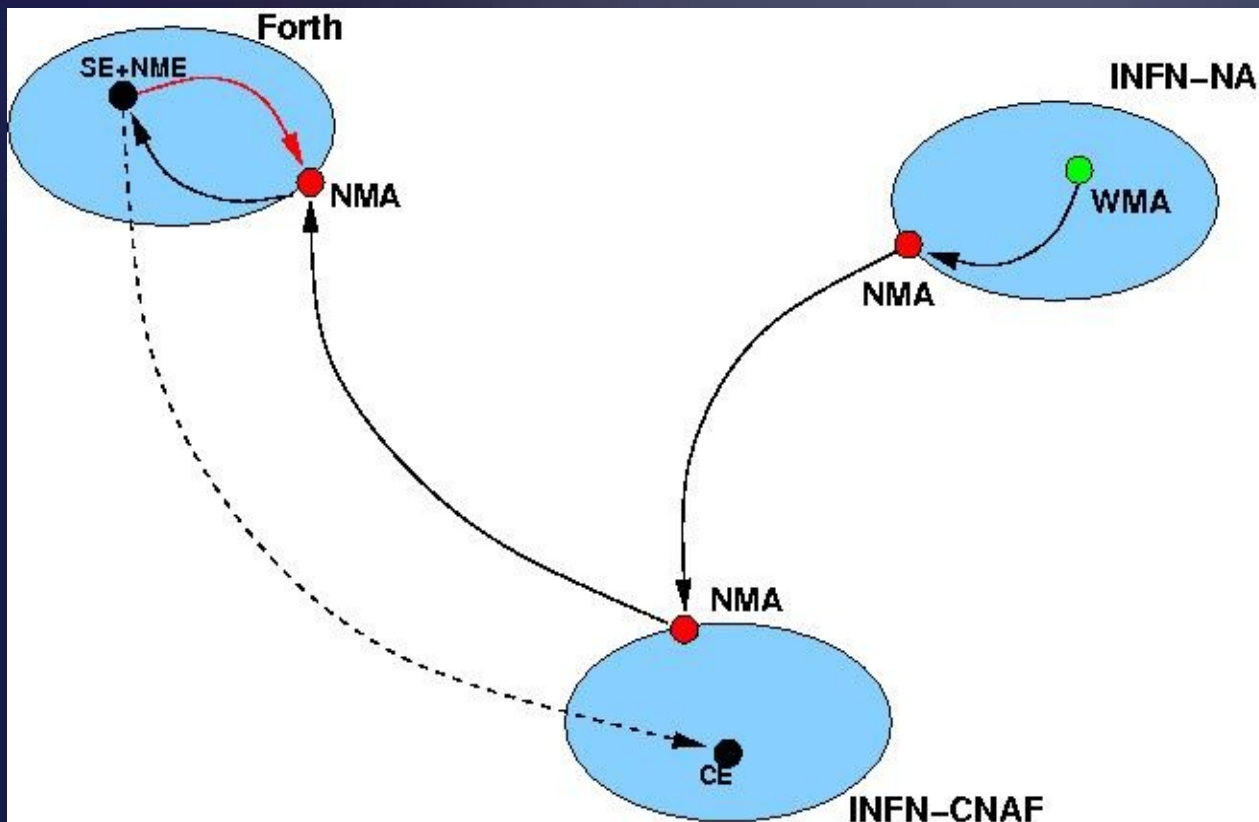
Request/Response protocol

The Workflow Monitoring Agent delivers the request the the Network Monitoring Element

Request/Response protocol

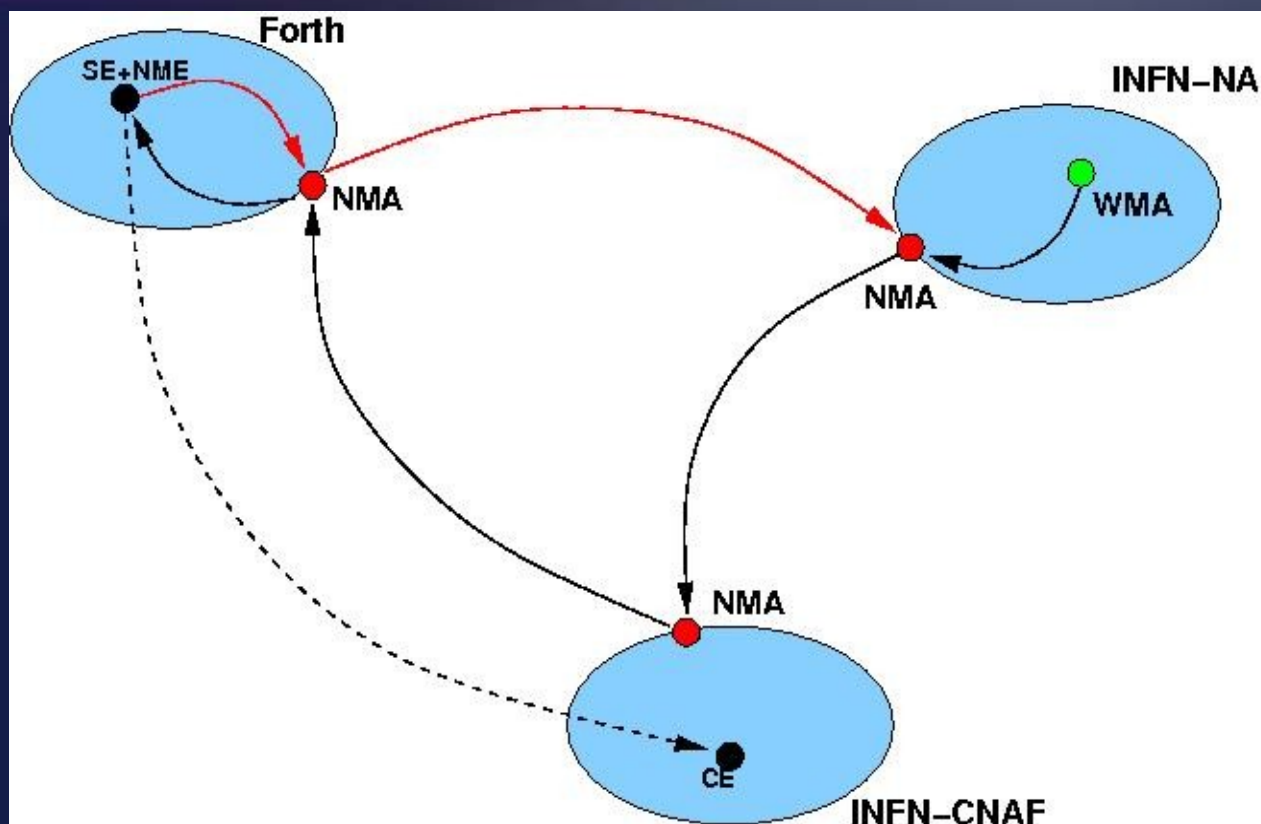**The Network Monitoring activity starts between the Storage and the Computing Elements**
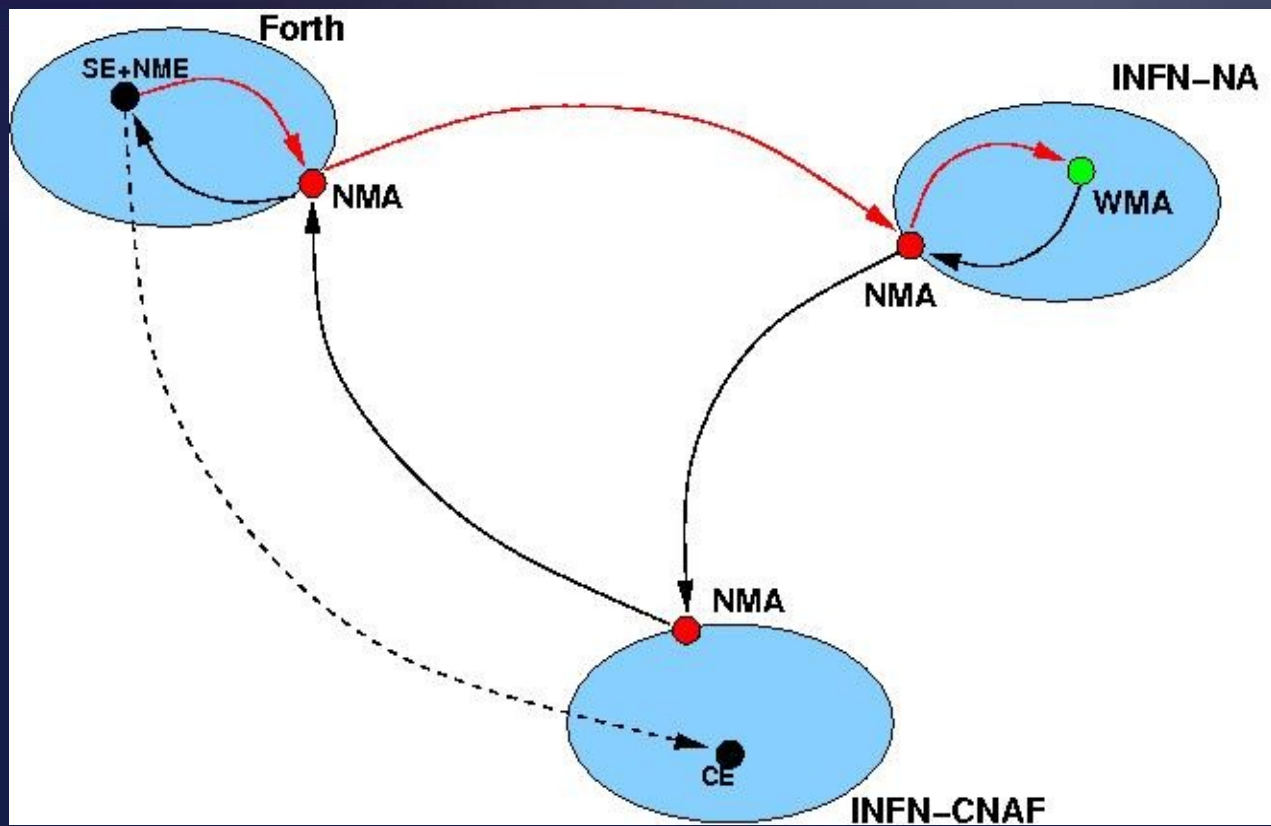
Request/Response protocol

The Observations stream is directed to the controlling Network Monitoring Agent

Request/Response protocol

The Observations stream by-passes the intermediate Network Monitoring Agent

Request/Response protocol

The Observations stream reaches the requesting Workflow Monitoring Agent

Security issues

- **All communications are authenticated (except those produced by the monitoring tool inside the NME)**
- **Only communications between the Network Monitoring Agents require a global authentication support (a prototype exists)**
- **Other can be based on local policies**

The XSD schema

- **The schemas have been written to fixate the ideas about the architecture.**

- **The use of XML addresses the portability of a possible implementation.**

- **The basic data item is the NetworkMonitoringSession type**

Attributes of the Network Monitoring Session

Identification

```
<attribute name="SessionId" type="string"
   use="required"/>
```

Lifetime

```
<attribute name="StartAt" type="dateTime"
   use="required"/>
<attribute name="Duration" type="duration"
   use="required"/>
```

Required Resources

```
<attribute name="BandwidthLimit"
   type="nonNegativeInteger" default="0"/>
<attribute name="Priority"
   type="nonNegativeInteger" default="0"/>
```

Elements of the Network Monitoring Session

Identification of the requesting WMA (for routing)

```
<element name="RequestFrom"
type="nmsd:WorkflowMonitoringTaskType"
maxOccurs="unbounded"/>
```

Route stack (for reverse routing)

```
<element name="Route" type="nmsd:RouteStackType"/>
```

Involved Domains (for NME selection)

```
<element name="NetworkElement"
type="nmsd:NetworkElementType"/>
```

Measurement descriptor (details in next slide)

```
<element name="MeasurementStream"
type="nmsd:MeasurementStreamType"/>
```

Definition of the Measurement Stream

A Measurement Stream contains several distinct data streams, with an identifying attribute:

```
<attribute name="CharacteristicStreamId" type="string"\>
```

each data stream is described by elements:

```
<element name="SamplePeriod" type="float" minOccurs="0"/>
<element name="SourceIP" type="string" minOccurs="0" maxOccurs="unbounded"/>
<element name="DestinationIP" type="string" minOccurs="0" maxOccurs="unbounded"/>
```

...and by a choice of tool specific options...

Tool specific options

Each element contains options for one single tool:

```
<choice>
<element name="PingOptions"
type="pt:PingOptionsType"/>
<element name="AppmonOptions"
type="am:AppmonOptionsType"/>
</choice>
```

Each element is passed (in principle untouched) to a single NME.

Ping (active): packet size, data aggregation etc.

Appmon (passive): packet filter, data aggregation, characteristic, anonymization etc..

Separation of concern

- **NMA access all parts of the Network Monitoring Session description except the Measurement Stream descriptor (header?)**

- **WMA and NME produce/consume the sequence of Measurement Stream descriptors (payload?)**

- **The inter-NMA protocol acts as a transport for Network Monitoring Stream descriptors**

Tool oriented description

- **The WMA directly addresses a tool, and its capabilities**
- **Decouples design of network monitoring tools**
- **The protocol between the NMAs does not depend on the definition of the requested measurements**

Outline of the stream contents

- **One frame series for each element in the Measurement Stream descriptor**

- **Demultiplexing using Session and Measurement identifiers**

- **Also in this case, NMAs offer a transport service**

- **De-multiplexing is on the WMA, as well as frame unmarshalling.**

- **We focus on monitoring activity finalized to workflow monitoring**
- **We introduce an architecture that includes consumers, producers and infrastructure**
- **We outline a request protocol, and design a schema that describes a monitoring session**
- **We outline a streaming protocol to deliver the results**
- **Experiments on the way...**
- **Published at CoreGRID workshop at ISC2007**