Overview

Logical Infrastructure Composition Layer and enhanced Network Control Plane

EU-FP7 GEYSERS project

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Problem Statement

- Grids, cloud computing and SOAs in general at large rely on a commodity: **the network.**
  - An ever-increasing number of distributed computing applications...
  - ... but their network service(s) still treated as “always-on”
    - Application layer unable to exploit the automatic control potentialities of the current optical and non-optical network technologies
    - Steps forward have been done in NSI-wg, but still a path to walk
- IT resource dynamics **completely uncorrelated** from the network resource ones
  - Common trend to over-provision network services
  - Inefficient resource utilization in the network, above all in case of fault recovery
- Network services are coupled to the network infrastructure
  - Net services not only depend on technology, but also on vendor, configuration language & i/f, multi-layer operation, etc.
  - But the elemental (abstract) service is always the same: connect A to B
- …
Logical Infrastructure Composition Layer (LICL)

• Arena for creating **Virtual Infrastructures**, based on network and IT resources abstraction and composition

• **Partitioning** of the physical optical network and IT resources:
  – Sync mechanisms to keep consistency (physical & virtual)
  – Enable resource monitoring functionalities through virtual resource
  – Provide support to the SLA mechanism needed between stakeholders
  – Scheduling and allocation mechanisms for resources
  – Secured access to information and resources

• Dynamic creation of multiple isolated virtual infrastructures sharing the same physical resources

• Energy efficiency consideration: LICL includes “green” or “energy-aware” attributes (to be defined) in resource models
  – Enable new constraints for path computation or IT resource selection
LICL Architecture

Virtual infrastructure isolation

Virtual Infrastructure Composition and management

Convergence of IT and optical network resources

Virtual Infrastructure Planning and re-planning

Physical resource abstraction and partitioning

Physical resource adaptation

Semantic resource description and resource information modeling

Physical Resource synchronization and monitoring

Physical Resources

1. Physical Resource adaptation

2. Virtual Infrastructure Composition and management

3. Virtual infrastructure isolation

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LICL Architecture Key Facts

1. Physical resources are abstracted as a set of uniform attributes, characteristics and functionalities
   - Hiding unnecessary characteristics from the resource itself, and enabling partitioning and aggregation

2. LICL is responsible for synchronization and maintaining information consistence and coherence between the virtual and physical resources.

3. LICL offers a set of tools and features for Virtual Infrastructure Providers (VIP) and Virtual Infrastructure Operators (VIO):
   - For the VIP, in order to compose and manage virtual infrastructures
   - For the VIO, in order to keep isolation of the virtual resources provisioned, as well as no-interference of VI management when sharing same physical substrate
LICL Arch. Draft (I)

Upper-LICL (tools for VIP)

Lower-LICL (tools for PIP)

Demarcation points

ONGOING WORK
NIPS: Net + IT Provisioning Service

**A NCP service** that allows the dynamic on-demand provisioning of network and IT resources in a single-step, through a set of integrated procedures.

- NIPS i/f is offered by GEYSERS enhanced NCP.
- Beyond a UNI, towards a Cloud/Service-to-Network i/f
- Generalized semantics to describe
  - the characteristics of both IT sites/resources and NEs (exported from LICL)
    - i.e. resource types, capabilities and availabilities
      - E.g. sites, attached services, capabilities and capacities of network, computing and storage elements, etc.
  - also the non-functional IT service characteristics
    - Workflow descriptions
    - Interaction properties
    - SLAs/SLSes
    - AA credentials and security context
    - Accounting models
Main work items for NCP+/PCE+

• @Routing plane [GMPLS+/PCE+]
  – OSPF-TE extensions for net+energy TE params flooding
  – PCEP extensions for
    • NIPS PCReq/PCRep
    • IT+energy TE params advertisements (through PCNtf)
  – Energy efficient network + IT path computation algorithms
  – Procedures for inter-PCE cooperation

• @Signalling plane [GMPLS+]
  – Protocol extensions for Net+IT resource reservations
NCP and NIPS

Network Control Plane

Centralized NIPS Server in each network domain
✓ Offering a service interface for NaaS
✓ Single NCP Service Access Point towards the SML/VITM

Service Middleware Layer

Virtual IT Manager
NIPS Client

SML
✓ IT service coordination
✓ IT resources management

NIPS Server

PCE +

NCP controllers

LICL
**Current LICL focus**
- VI Design/planning
- VR Deployment
- Enable config. and monitoring
- Manage VI service

**VI operation**
- LICL is only an enabler, all actions are taken by NCP
- Allow dynamic VI re-planning
The NCP in the VI workflow

NCP instantiation
- Deployment
- Configuration
- Initialization

VI operation
- On-demand network + IT provisioning
- Dynamic VI re-planning

VI Provisioning Workflow:
- Service Request/SLA Negotiation
- Planning/Design
- Deployment/Instant & Config, Sync
- Operation & Monitoring
- Decommissioning

On-demand Service Provisioning Workflow:
- Service Requests/SLA negotiation
- Composition/Reservation
- Deployment
- Register & Sync
- Operation (Monitoring)
- Decommissioning

Re-Composition
Re-Planning
Recovery/Migration

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Detection of re-planning conditions

- statistics on service requests and resource utilization in medium/long terms
- policies for specific customers’ SLAs

Re-planning management

- policies for VIP-VIO SLAs
- notifications for manual re-planning
- LICL commands and NCP re-configuration triggers for automatic re-planning

Re-planning request

Re-planning confirmation

Notifications

New controller

PCE+

VI re-planning triggers

Synch triggers

VI re-planning manager

Policy

External Manager

New virtual network node

VI Service Coordinator

LICL

NCP

Policy
Moltes gràcies!
Many thanks!

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GEYSERS @ a glance

Generalized Architecture for Dynamic Infrastructure Services

- Instrument: Collab. Project - Large Scale Integrated Project (IP)
- Activity: ICT-2009.1.1 The Network of the Future, FP7 Call 4
- Project duration: 36 months
- Project start date: January 2010
- Project budget: 10.433.205€ (7.035.000€ EC contrib.)
- Project resources: 947 person-months
GEYSERS Consortium

- Pan-European carriers: Interoute
- Telco SME: Nextworks, Martel
- Telco manufacturers: ADVA, Alcatel-Lucent Italy
- Service providers: SAP AG
- Telco operators & NREN: Telefónica I+D, Telekom. Polska, PSNC