Contents

1. A Bit of History
2. NaaS: Motivation
3. ITU's NGN Strata Model
4. NaaS Vision
5. OpenNaaS: An Implementation

1

A Bit Of History

Previous Work

- User Controlled Light-Paths (UCLP)† (around 2005)
  - Concept of the Articulated Private Network, APN
  - Built around Grid computing and SOA
- IaaS Framework (evolution of UCLP)
  - Generalisation of UCLP/Argia to any kind of resources
  - Engine + Resource + Capability + Service and Tools
- Cloud Computing (IaaS)
  - Following the pay-per-use model for infrastructure resources
  - Definition of IaaS for networks is still unclear, mostly depends on technology
- Manticore (2009), NaaS (2010), OpenNaaS (>2011)
  - Inherits from IaaS Framework, but newer programming technology
  - EU FP7 Mantychore, EU FP7 GEYSERS projects

2

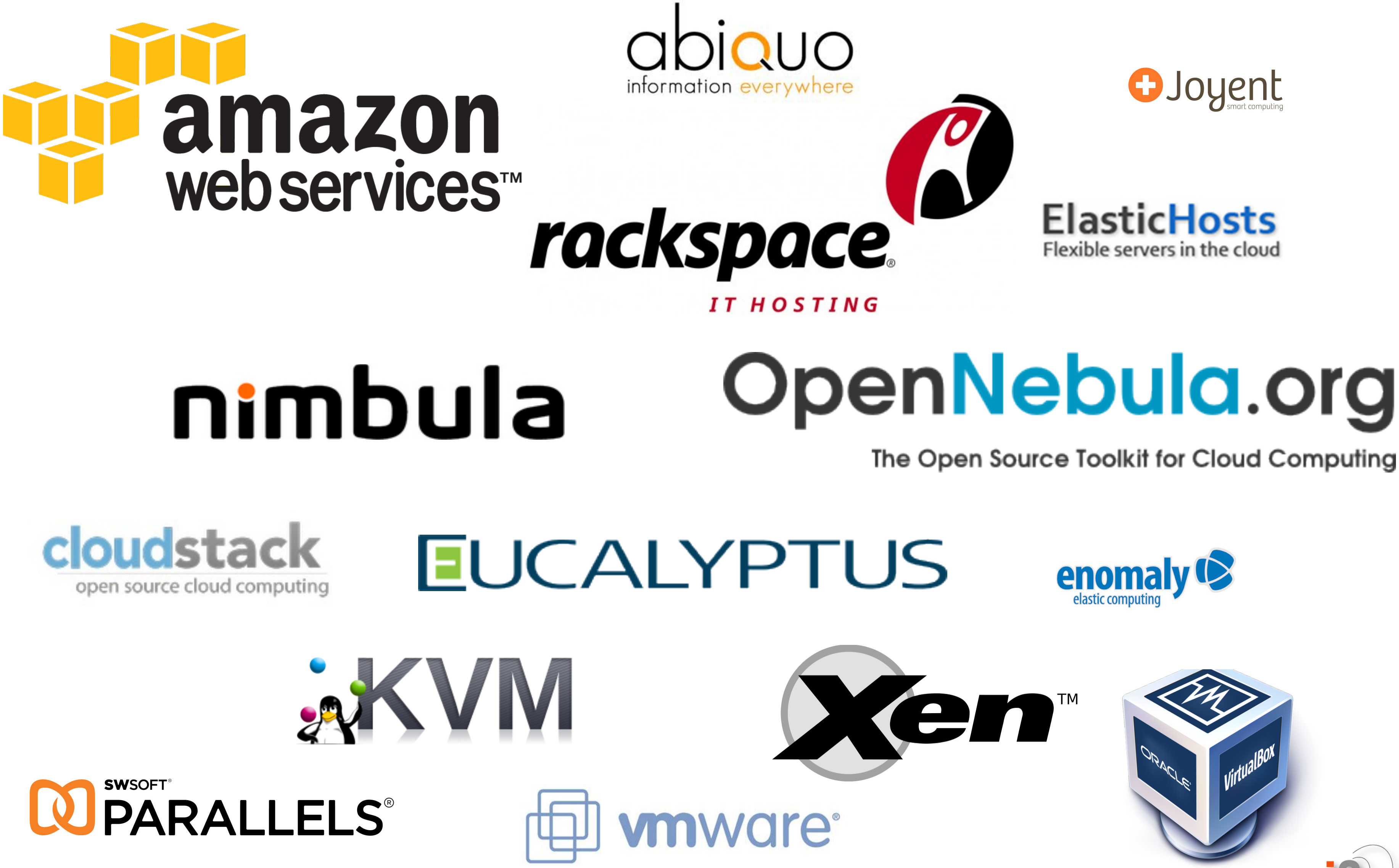
NaaS: Motivation

NaaS: Motivation

- The network counterpart for IaaS
  - What do I get serviced?
  - What's the granularity of the service?
  - What are the requirements for this?
  - What about the unbounded range of net techs and protocols?
- More information (DANA blog post):
  - www.OpenNaaS.org
  - On Keywords related to Cloud, services and virtualisation:

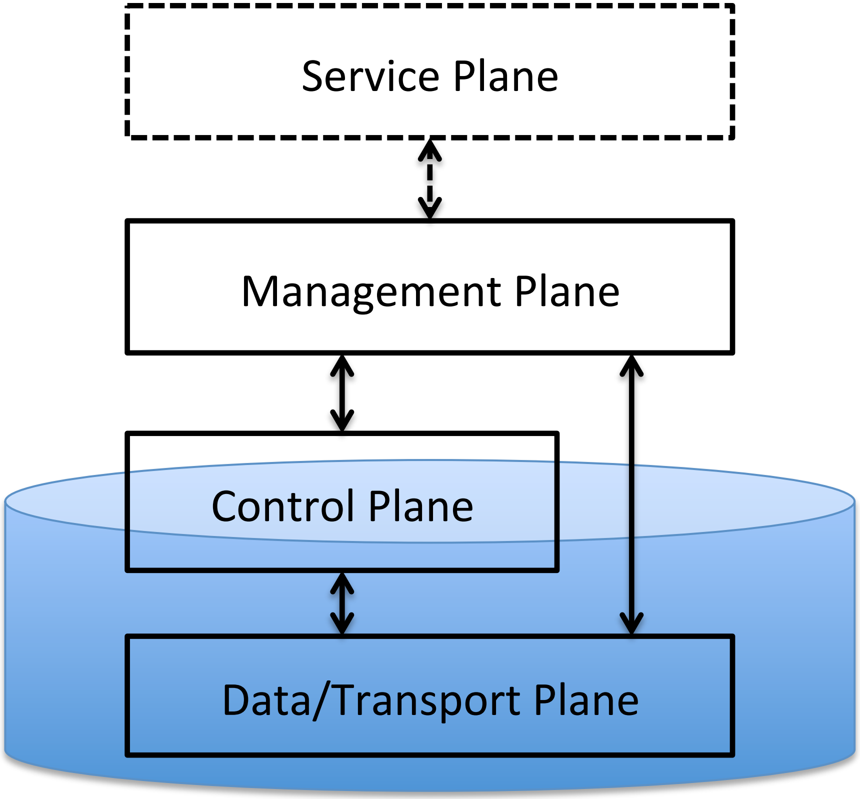
http://dana.i2cat.net/on-keywords-related-to-cloud-services-and-virtualisation/uncategorized/

IaaS (server oriented) implementation


amazon web services™
abiquo information everywhere
Joyent smart computing
rackspace® IT HOSTING
ElasticHosts Flexible servers in the cloud
nimbula
OpenNebula.org The Open Source Toolkit for Cloud Computing
cloudstack open source cloud computing
EUCALYPTUS
enomaly elastic computing
KVM
Xen™
ORACLE VirtualBox
SWSOFT® PARALLELS®
vmware®

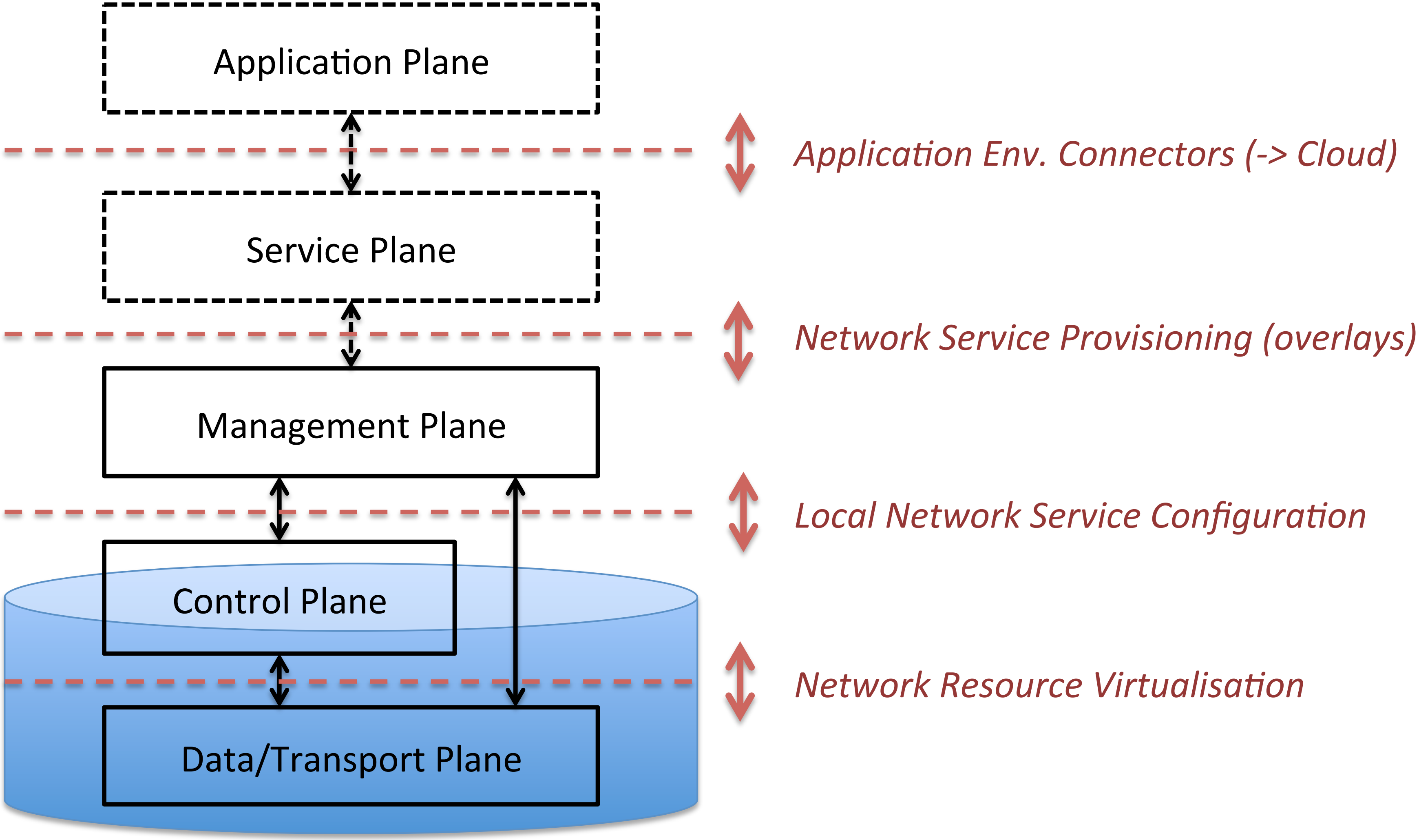
Simplified NE Model Limitations

Vertically Plane Separation



- *Service Plane* is normally replaced by human-assisted functions in telco environments
- *Management Plane* abstracts control functions for human interaction
- *Control Plane* can be:
  - In-box (e.g. MPLS)
  - Mixed (e.g. GMPLS w/PCE)
- *Data/transport Plane* or the plethora of network technologies

NaaS Decoupling Points

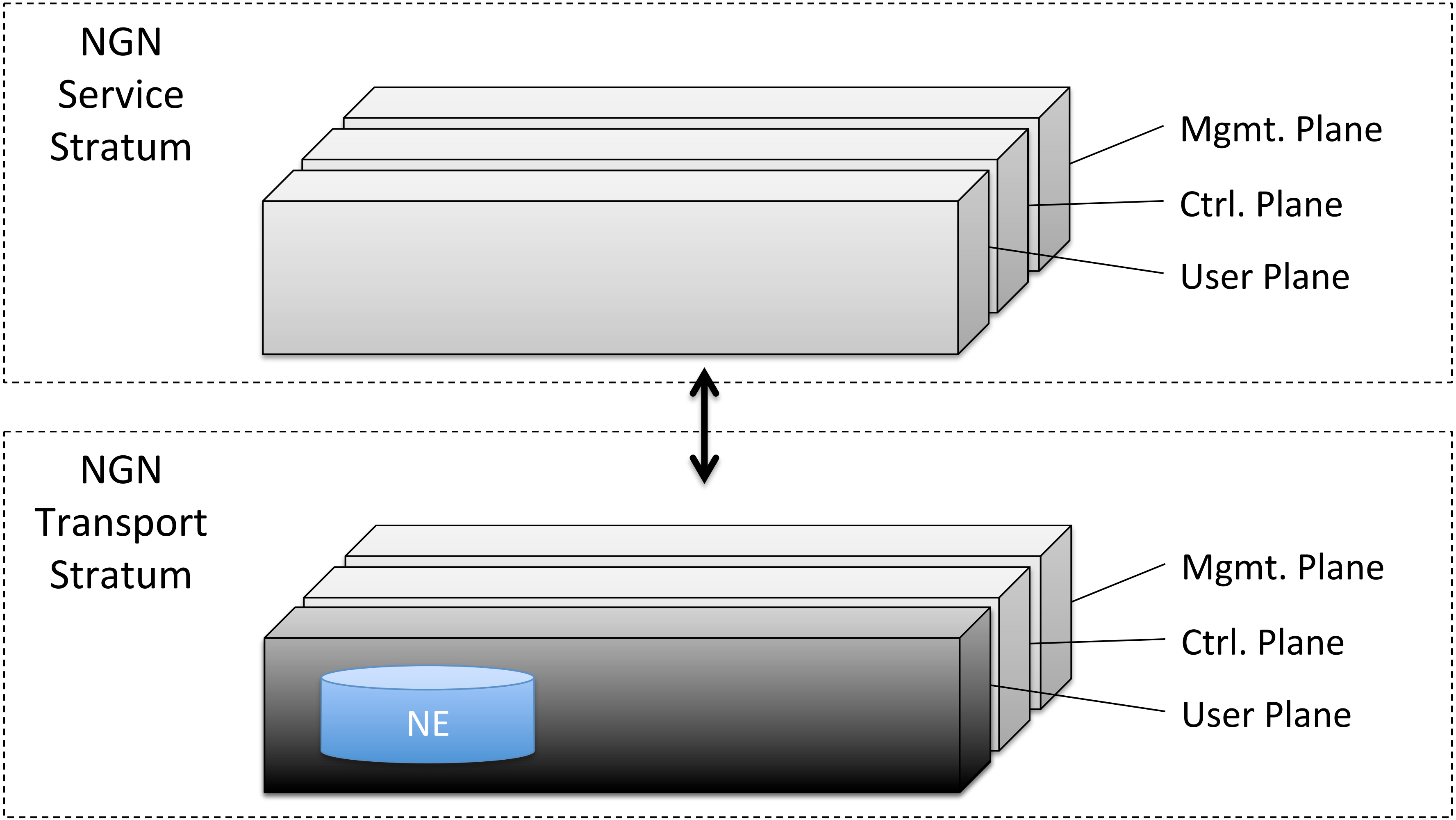

Application Plane
Service Plane
Management Plane
Control Plane
Data/Transport Plane
Application Env. Connectors (-> Cloud)
Network Service Provisioning (overlays)
Local Network Service Configuration
Network Resource Virtualisation

3

ITU’s NGN Strata Model

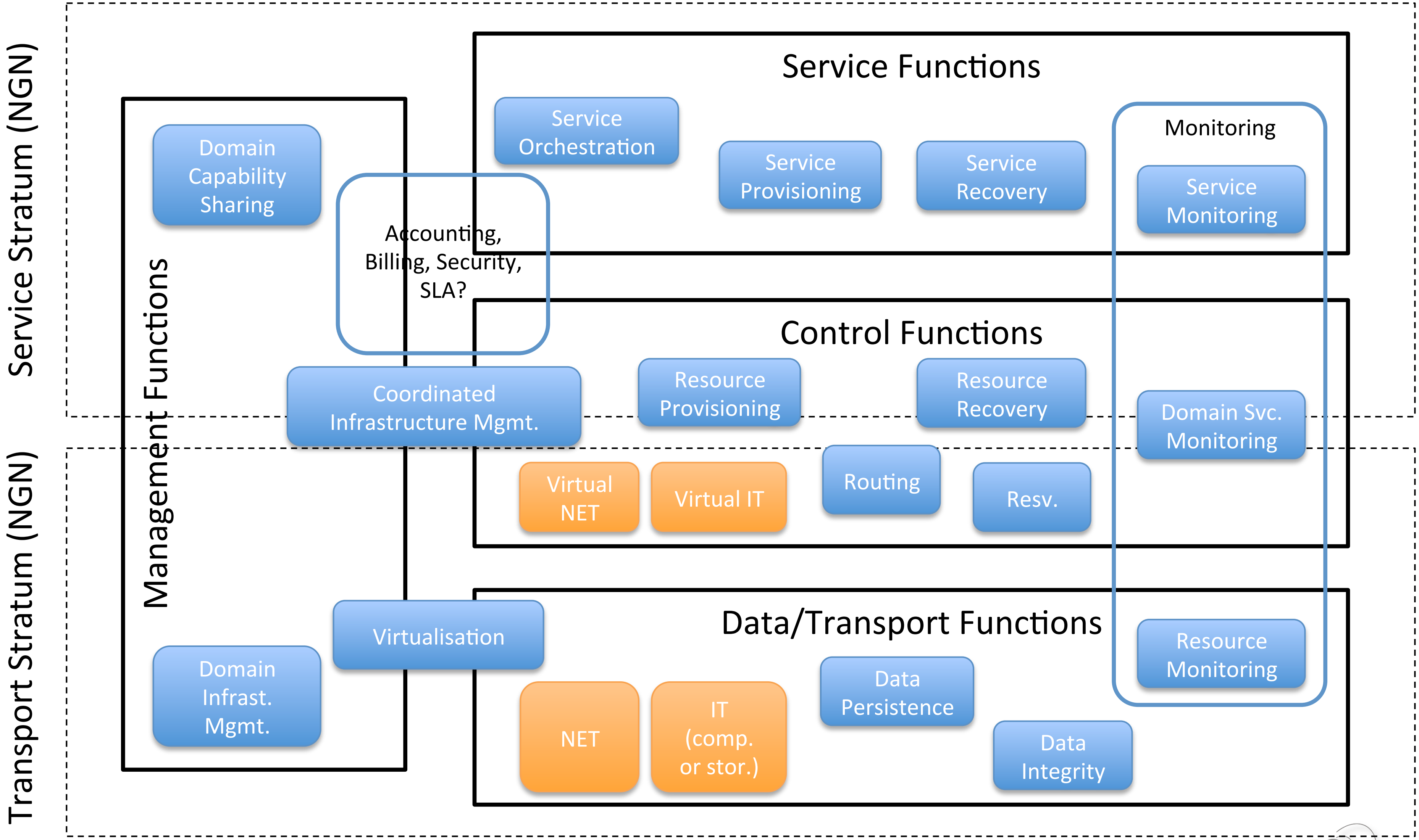
ITU Y.2011 (10/2004)

Basic Functional Separation



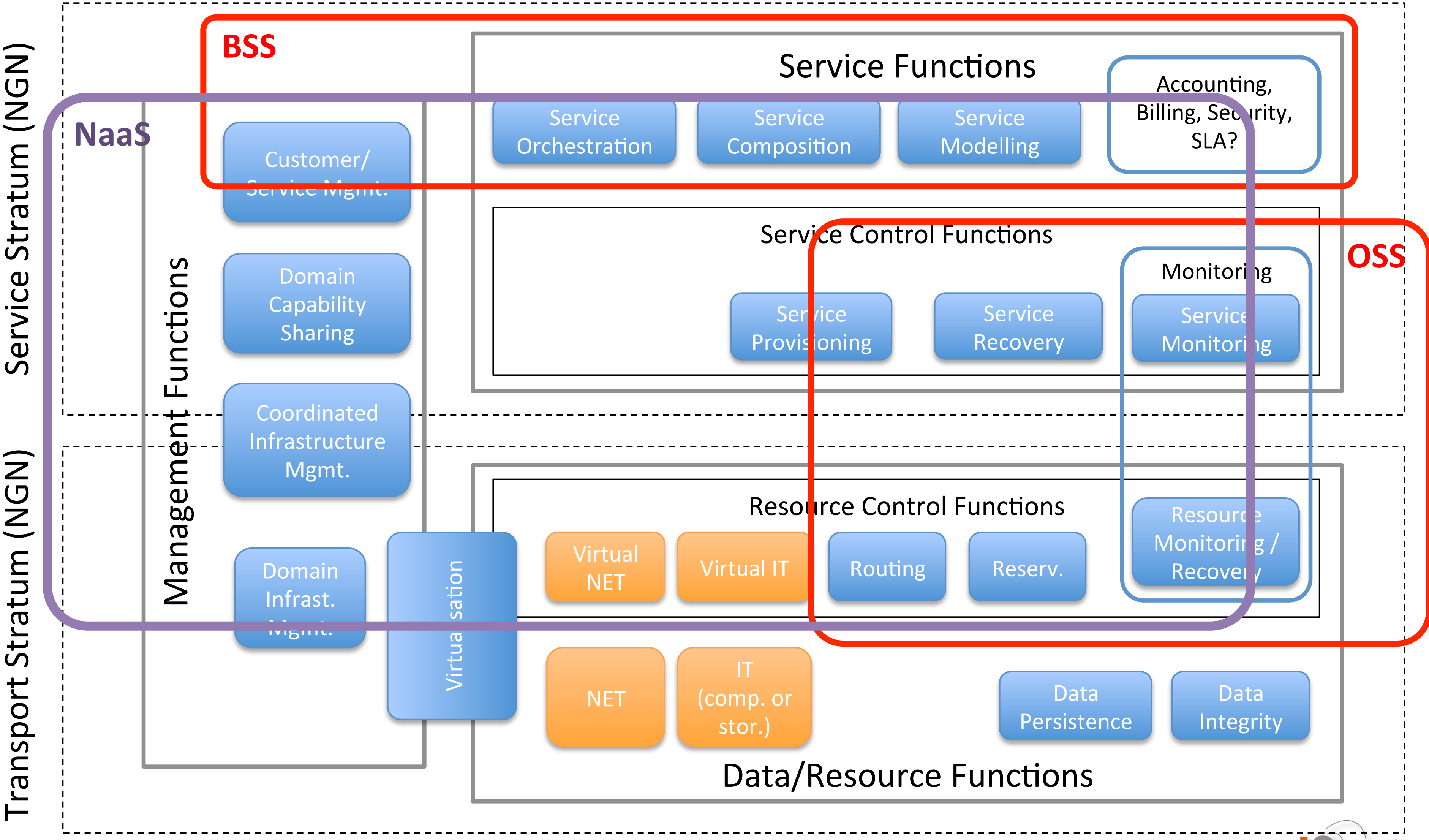
ITU Y.2001 NGN (12/2004)

NGN Strata Model – Abstracted View



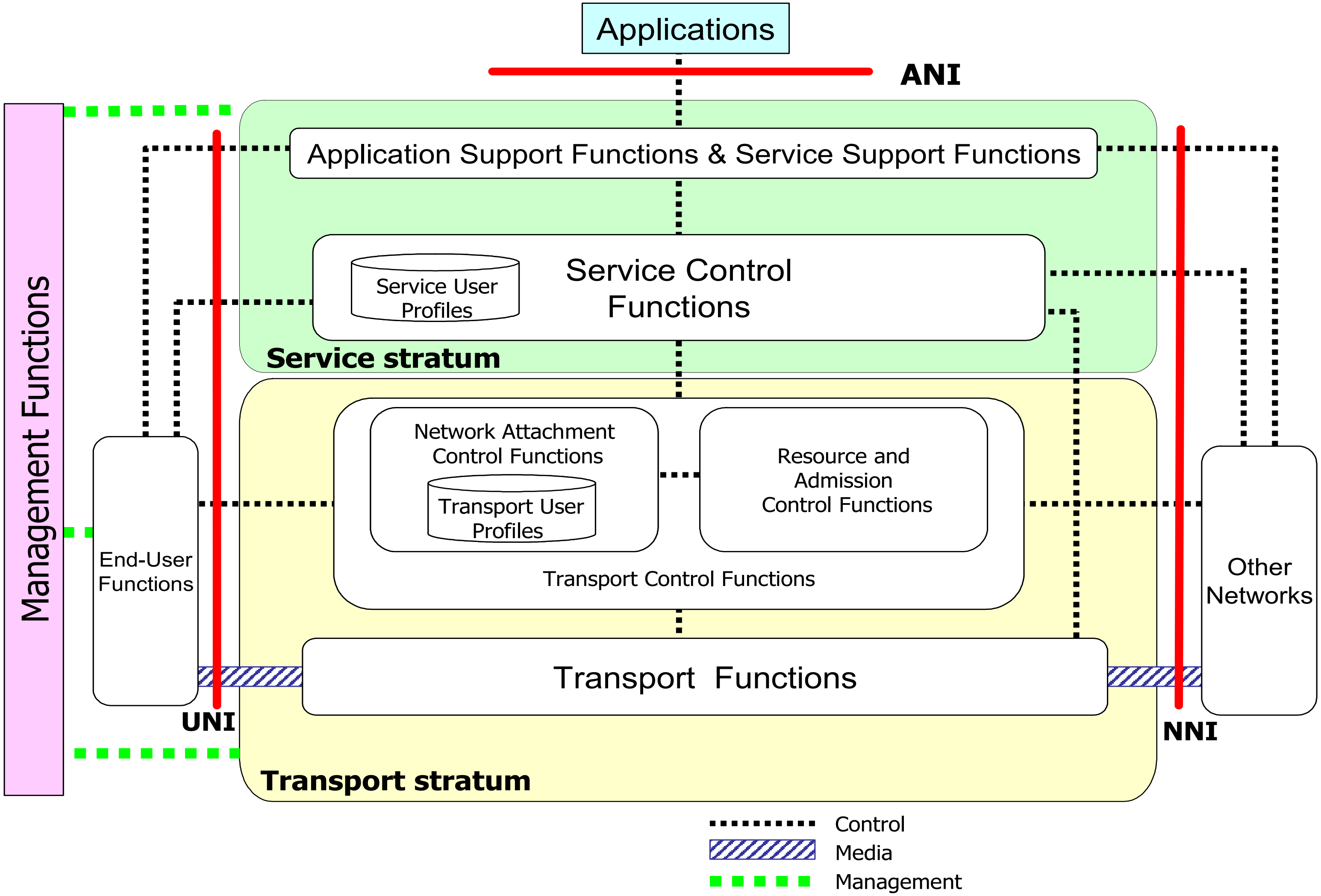
ITU Y.2001 NGN (12/2004)

NGN Strata Model – Abstraction for BSS/OSS and NaaS



ITU Y.2007 NGN (01/2010)

NGN Architecture Overview



4

NaaS Vision

Fundamentals

- NaaS is a business model related to network infrastructure servicing, analogous to IaaS for servers

- The four pillars for NaaS:
  - **Decoupled** network resource mgmt./ctrl. from actual services delivered
  - **Abstracted** mgmt./ctrl. functions for logical manipulation in the service stratum
  - **Coordinated** mgmt. and ctrl. functions along different strata (x-stratum)
  - **Policed** resource and capabilities access, depending on different resource access rights and ownership patterns

- The previous confer NaaS biz/tech flexibility and adaptability to Cloud computing needs.

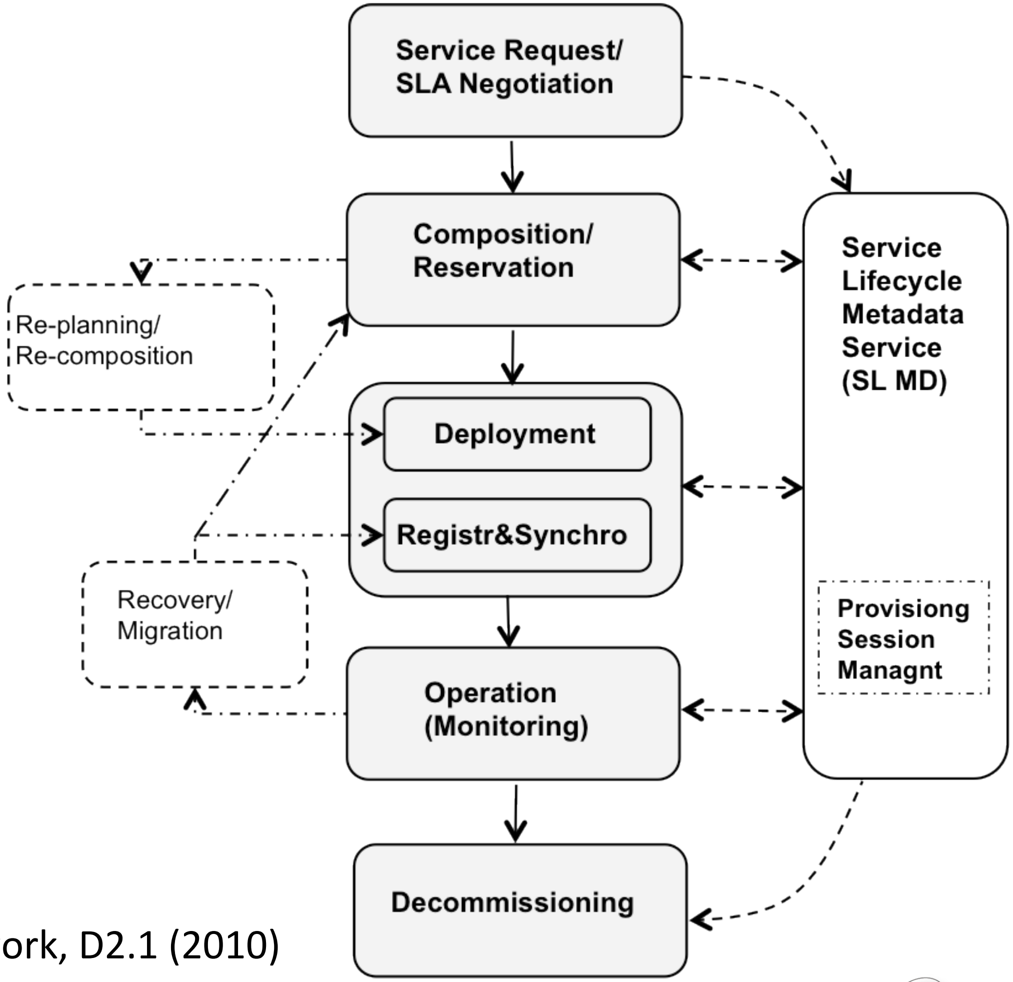
(Network) Infrastructure Virtualisation

- Nowadays, computer virtualisation is a step ahead of network virtualisation
    - Cloud is built on top of IaaS model, with advanced interfaces
    - A number of virtualisation technologies, with remarkable interoperation capabilities

- Cloud essential characteristics to be addressed:
    - On-demand self-service
    - Extended (virtual) resource manipulation rights
    - Resource pooling
    - Flexibility and elasticity
    - Dynamic service management

Service Delivery

- FI Architectures are adopting service-oriented approach
- IT and Network coordination is a must for ensuring:
  - Full Dynamicity
  - Automation
  - Optimisation
  - Elasticity
- How can infrastructure virtualisation help?

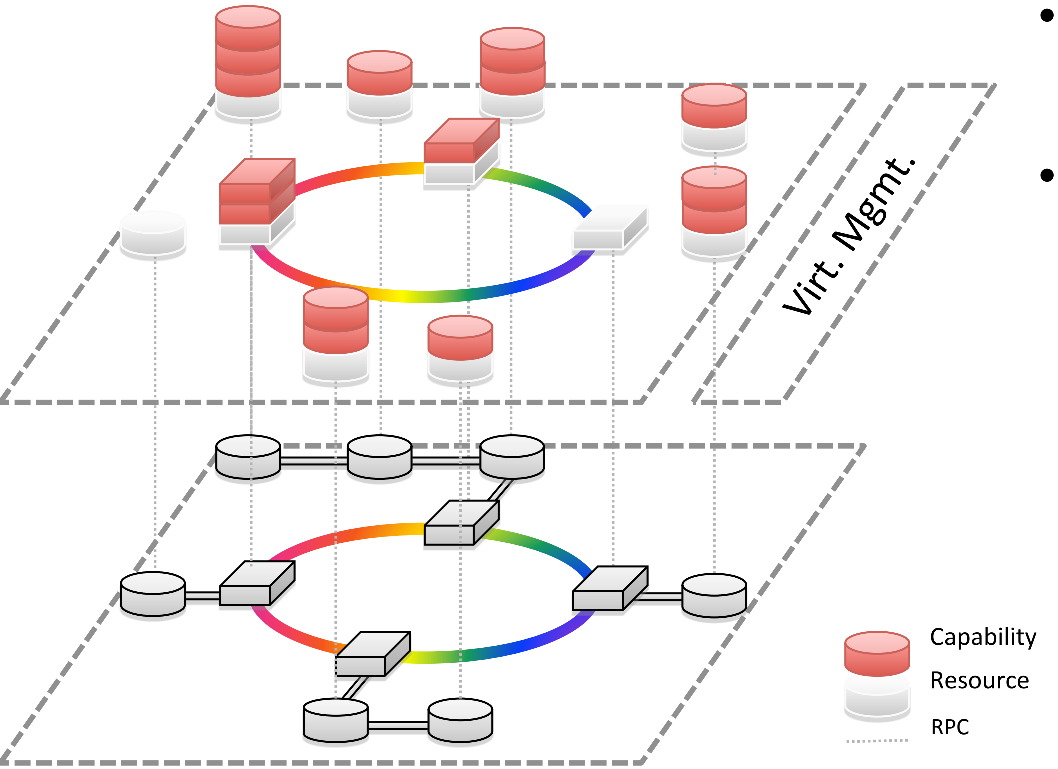


Source: GEYSERS Service Delivery Framework, D2.1 (2010)

5

OpenNaaS: An Implementation

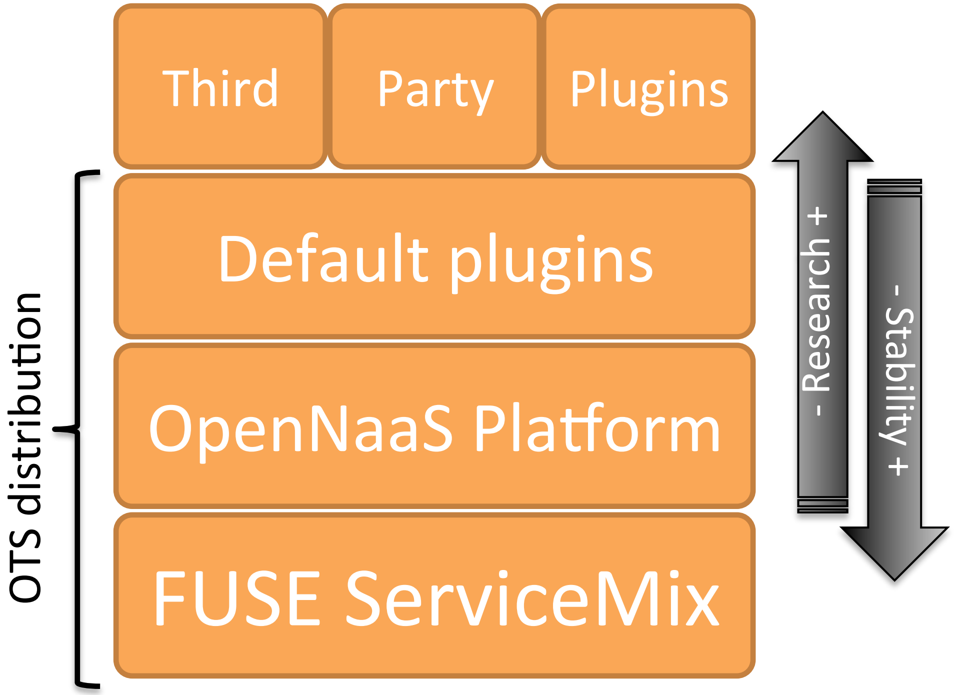
NaaS Lightweigth Abstraction



- On demand (user-triggered) provisioning of network resources
- Recursive delegation of access rights over managed resources
- Lightweight Abstracted operational model.
  - Decoupled from actual vendor-specific details.
  - Flexible enough to accommodate different designs and orientations
  - Fixed enough so that common tools can be build and reused across plugins
    - Security
    - Lifecycle
    - Monitoring
    - Deployment and upgrade

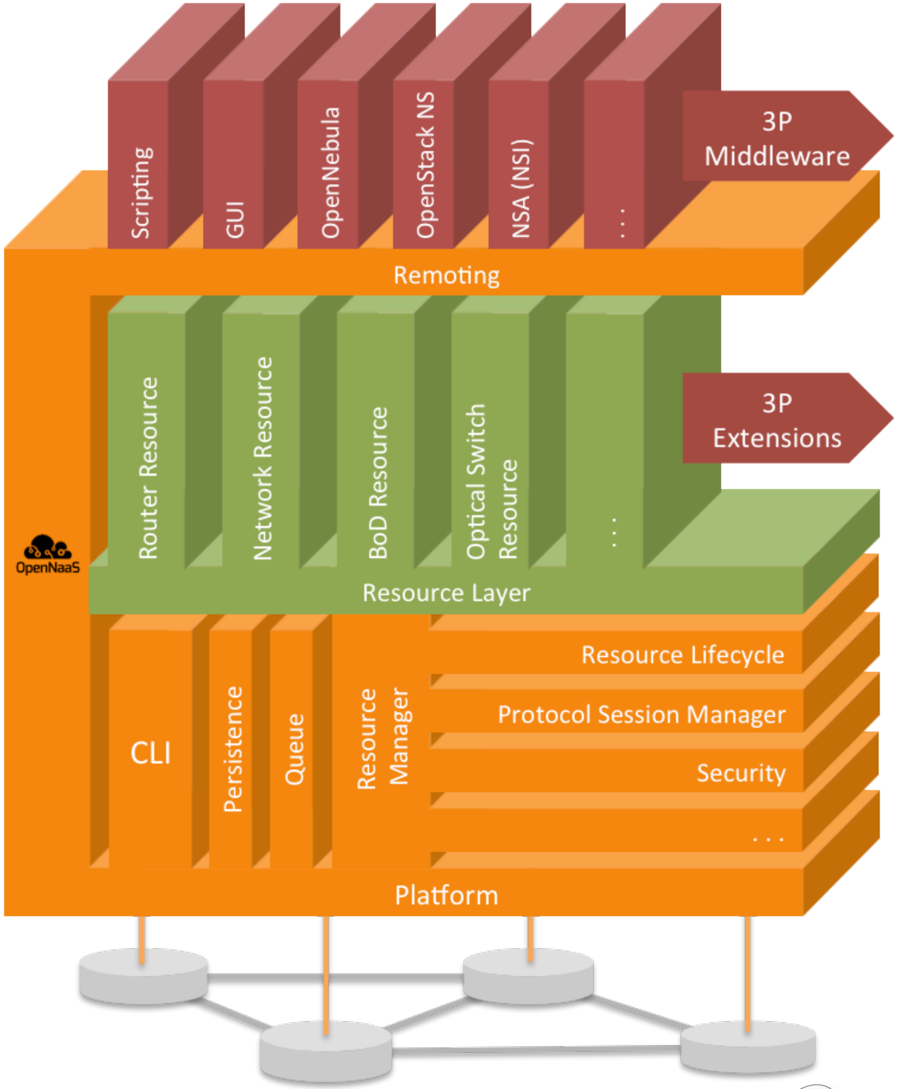
OpenNaaS Stakeholders

- Network Operators with an interest on NaaS:
  - NREN.
  - Cloud Datacenter.
  - New services for ISP's.
- ISV and integrators
  - Swiss Army Knife for middleware-network integration.
- Developers and network researchers.



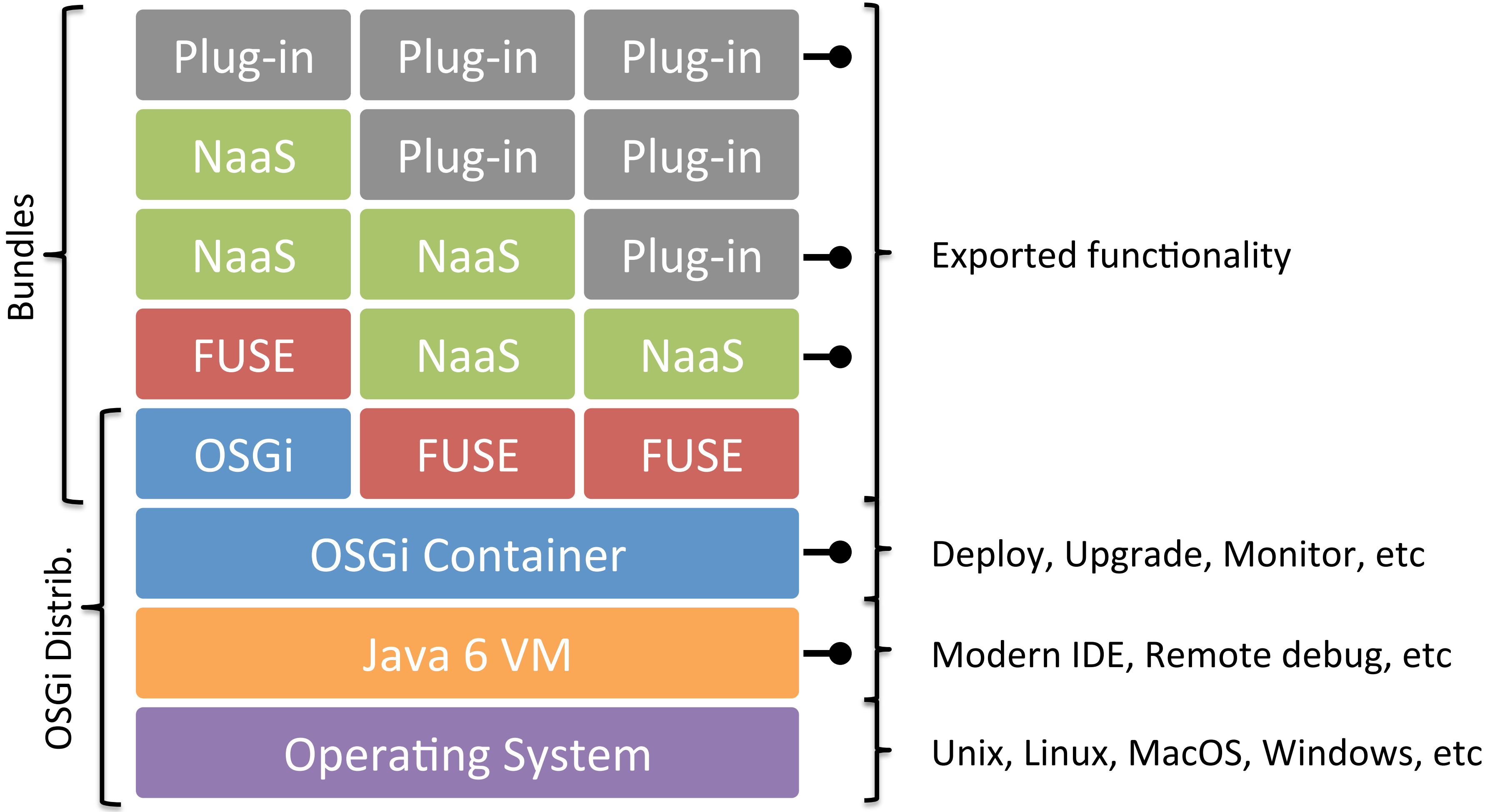
OpenNaaS Architecture

- **OpenNaaS v0.10** – NREN support (FP7 Mantychore)
- OpenStack **Quantum** – under development
- **OpenNebula** Network Control – from v3.0
- Nicira **Network Virtualisation Platform**
- Cisco **Open Net Environment**
- Juniper **QFabric**
- …



Source: MANTYCHORE project (2012)
http://dana.i2cat.net/opennaas-announcement/software

OpenNaaS Component Architecture



Bundles

OSGi Distrib.

Plug-in Plug-in Plug-in

NaaS Plug-in Plug-in

NaaS NaaS Plug-in

FUSE NaaS NaaS

OSGi FUSE FUSE

OSGi Container

Java 6 VM

Operating System

Exported functionality

Deploy, Upgrade, Monitor, etc

Modern IDE, Remote debug, etc

Unix, Linux, MacOS, Windows, etc

Extensions

Done	Current	Short-term (<6m)	Mid-Term (>6m)
L1 ROADM			
L2 BoD Domain client • AutoBAHN		**BoD Domain Server** • Porting Harmony IDB	**BoD Domain Server** • NSI interface.
	L2 / L3 Router		
	L3 Network		
			Manager GUI
		Security Manager • SAML Idp	
		Cloud Manager connectors • OpenStack NetworkService drop-in replacement • OpenNebula 3.0	• Energy consumption metrics. • Infrastructure Marketplace.
			OpenFlow Controller

Thank you!

Gràcies!

Joan A. García-Espín

jage@i2cat.net

i2CAT Foundation, Barcelona.ES

(+34) 93 553 2518 ☎

janange S

www.OpenNaaS.org

OpenNaaS

Mantychore

www.mantychore.eu

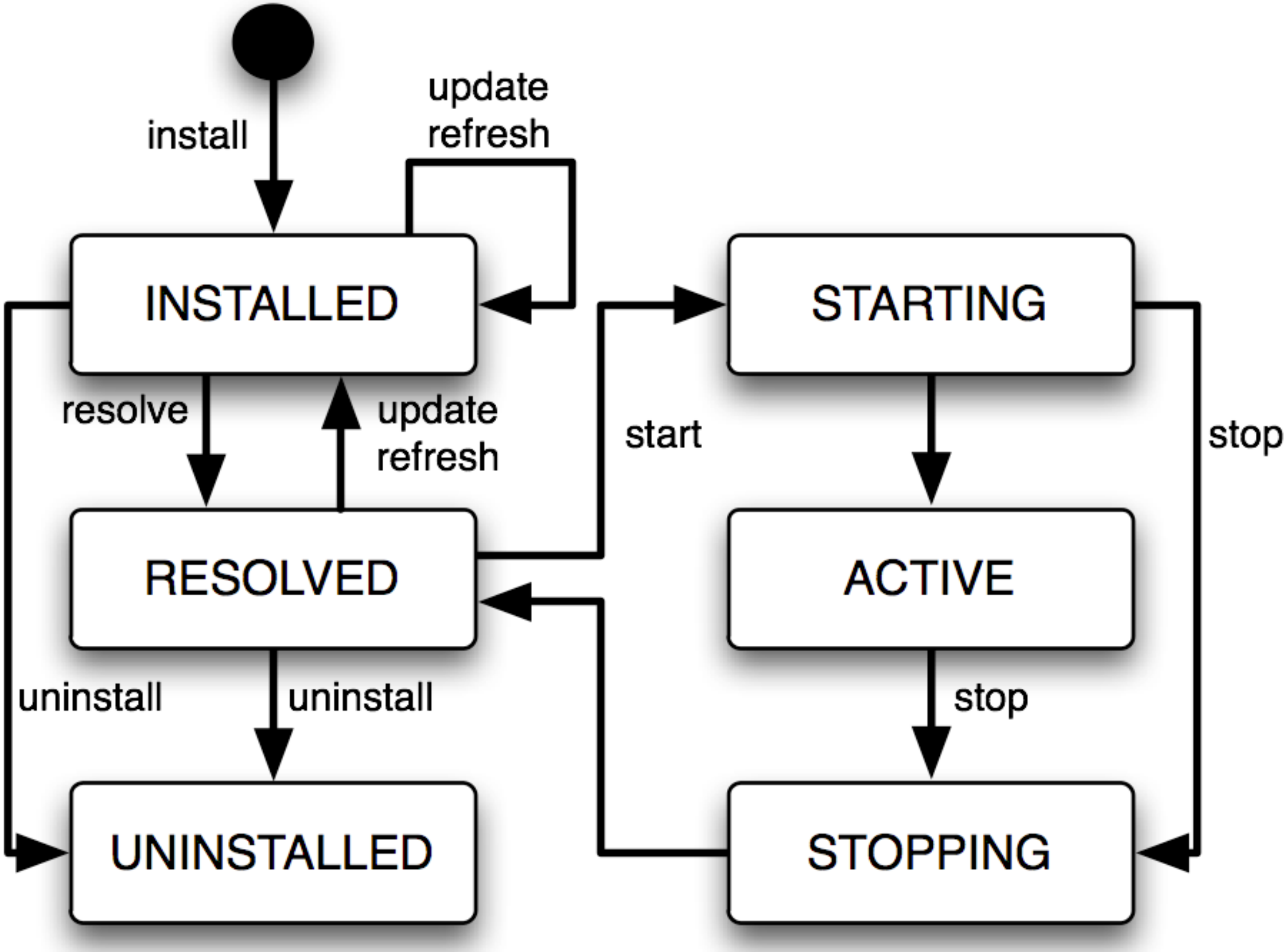
BACK UP

OpenNaaS Platform Details

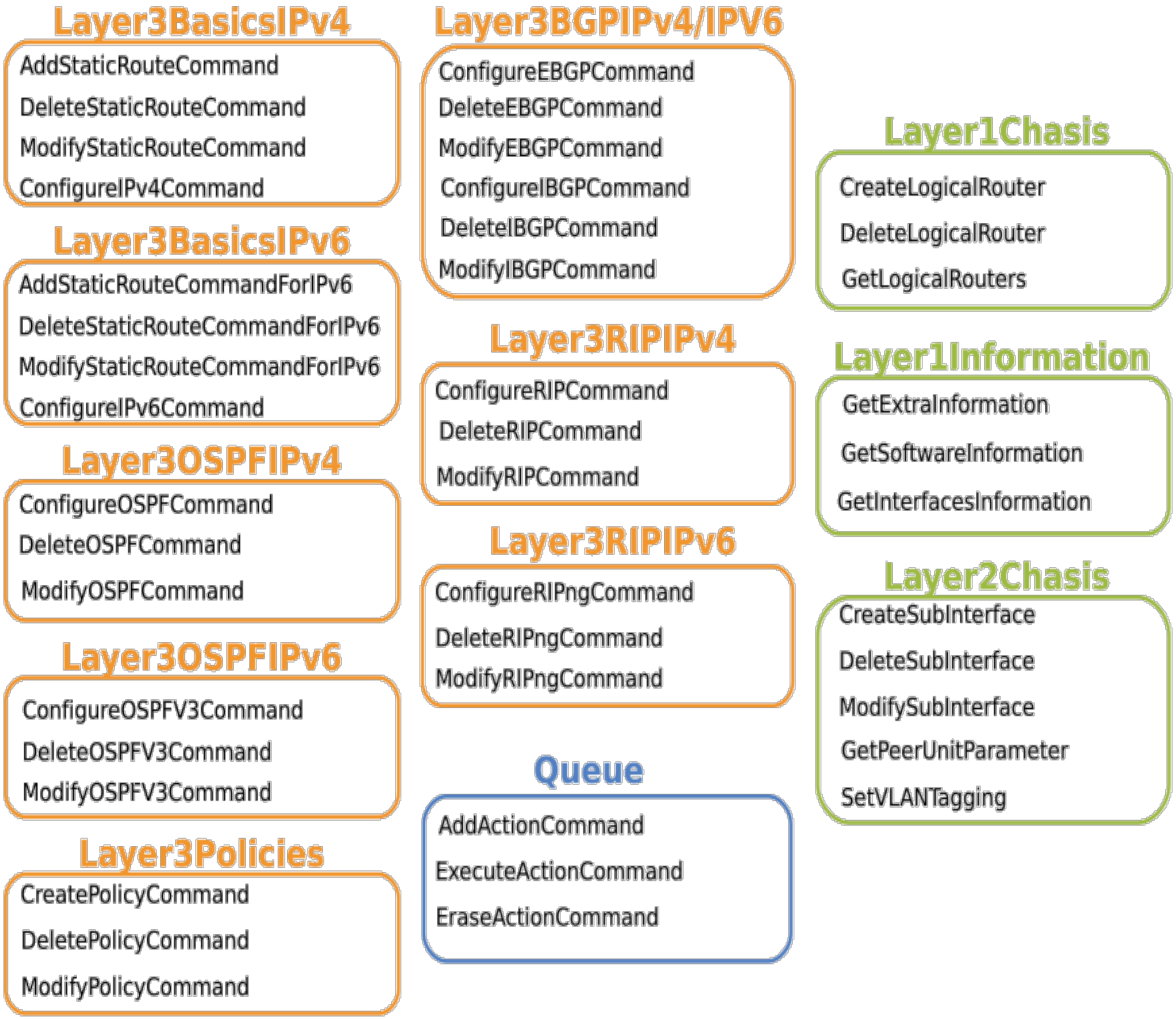
- For developers:
  - Modern IDEs available
  - Maven based build system and dependency management
  - Plugin howto documentation
  - Several available open source plugins as reference
  - An open OpenNaaS community
  - Comercial support for underlying technologies

- Leverage building blocks, both using existing resources or for creating new ones.
  - Resource Respository and Manager
  - Protocol Session Manager
  - Standard Capabilities
  - Protocol Endpoints for remoting (SOAP, REST, etc).
  - Platform manager
  - *.apache.org deployment ready libraries.
    - While plugins can chose to use technologies like hibernate, spring or ESB, they don't have to.

OpenNaaS Bundle Lifecycle



Capabilities Map



Layer3BasicsIPv4
- AddStaticRouteCommand
- DeleteStaticRouteCommand
- ModifyStaticRouteCommand
- ConfigureIPv4Command

Layer3BasicsIPv6
- AddStaticRouteCommandForIPv6
- DeleteStaticRouteCommandForIPv6
- ModifyStaticRouteCommandForIPv6
- ConfigureIPv6Command

Layer3OSPFIPv4
- ConfigureOSPFCommand
- DeleteOSPFCommand
- ModifyOSPFCommand

Layer3OSPFIPv6
- ConfigureOSPFV3Command
- DeleteOSPFV3Command
- ModifyOSPFV3Command

Layer3Policies
- CreatePolicyCommand
- DeletePolicyCommand
- ModifyPolicyCommand

Layer3BGPIPv4/IPV6
- ConfigureEBGPCommand
- DeleteEBGPCommand
- ModifyEBGPCommand
- ConfigureIBGPCommand
- DeleteIBGPCommand
- ModifyIBGPCommand

Layer3RIPIPv4
- ConfigureRIPCommand
- DeleteRIPCommand
- ModifyRIPCommand

Layer3RIPIPv6
- ConfigureRIPngCommand
- DeleteRIPngCommand
- ModifyRIPngCommand

Queue
- AddActionCommand
- ExecuteActionCommand
- EraseActionCommand

Layer1Chasis
- CreateLogicalRouter
- DeleteLogicalRouter
- GetLogicalRouters

Layer1Information
- GetExtraInformation
- GetSoftwareInformation
- GetInterfacesInformation

Layer2Chasis
- CreateSubInterface
- DeleteSubInterface
- ModifySubInterface
- GetPeerUnitParameter
- SetVLANTagging