

OPNFV 소개/설치 및 활용

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OPNFV 소개

OPNFV

- Open Platform for NFV
- ETSI에서 정의한 NFV 프레임워크를 기반으로 다양한 upstream 프로젝트 연동
 - OpenDaylight, OpenStack, ONOS, Xen 등
- 2014년 9월 프로젝트 시작
 - 현재 60여개 기업이 멤버로 활동
 - 이동통신사에서의 참여가 활발
 - 국내에서는 SK, KT가 Silver 멤버로 참여
- <http://www.opnfv.org>



Platinum

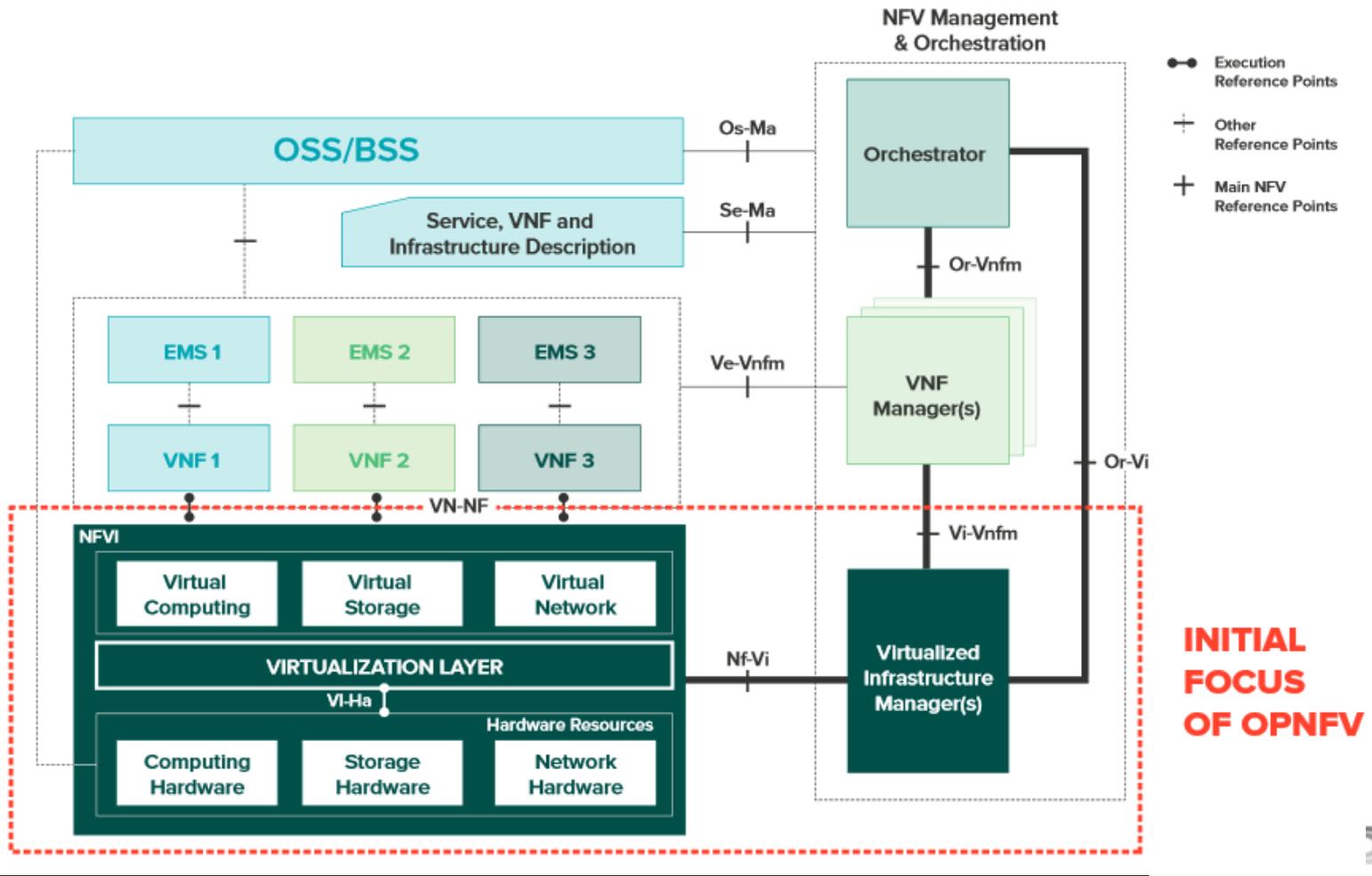


Silver



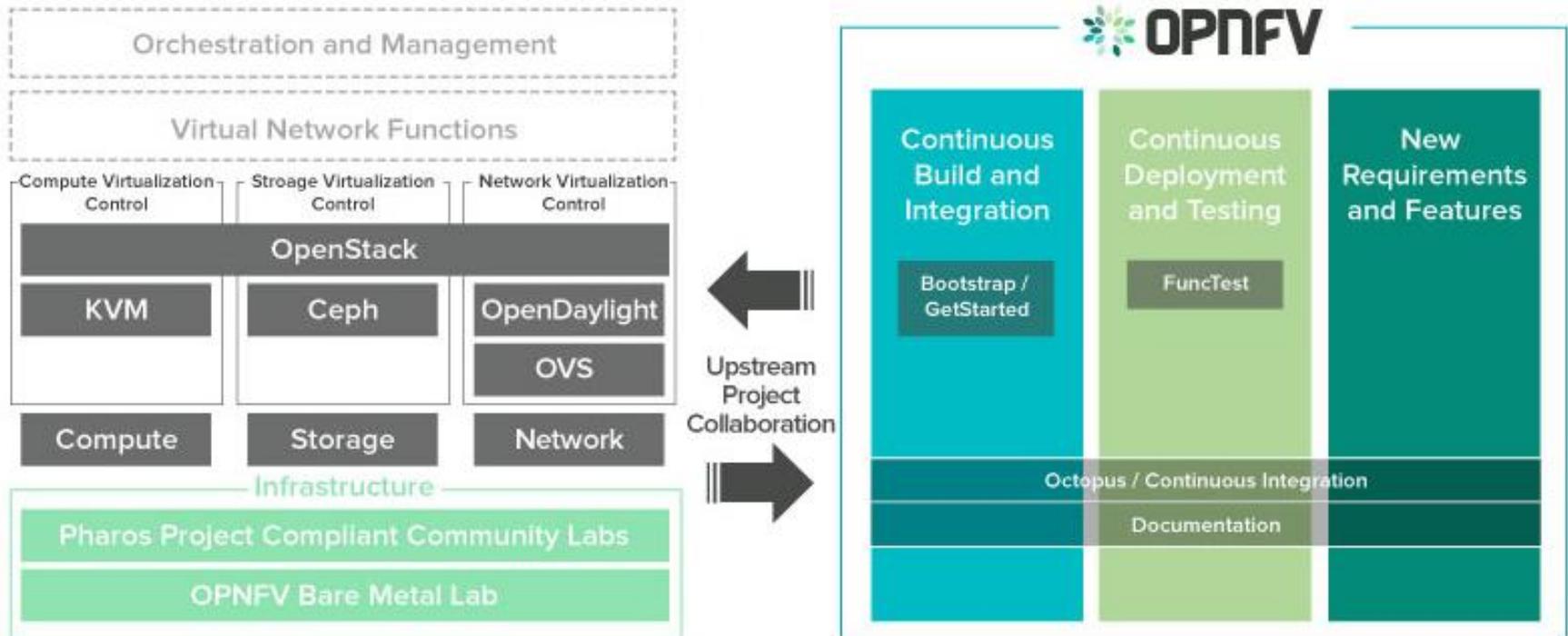
OPNFV Scope

- 초기에는 VIM과 가상화 인프라 연구에 집중



OPNFV Framework

- Upstream 프로젝트들의 연동 및 기능 테스트에 초점



OPNFV Release plan

- Release 1: 'Arno'

- 2015월 6월 배포
- NFVI + VIM 솔루션
- 6개의 H/W 서버 구성으로 정의
- 개발 플랫폼 위에서 단순 VNF 동작 확인 가능

- Release 2: 'Brahmaputra'

- 2015년 12월 배포 예정
- 연구실 단계에서 사용 가능한 기본 기능들을 추가
- 프로젝트 기능들에 대한 접근 및 사용 가능

OPNFV Projects

OPNFV Projects

- 4 종류의 프로젝트 그룹
 - Requirements
 - NFV 기능 구현을 위한 요구사항 정의
 - Integration & Testing
 - 다양한 OS 및 하드웨어 플랫폼을 위한 OPNFV 설치 및 테스트 진행
 - Collaborative Development
 - 서로 다른 upstream project들을 연동한 NFV 기능 구현 연구
 - Documentation
 - 문서화 작업
- 총 44개의 세부 프로젝트 진행 중

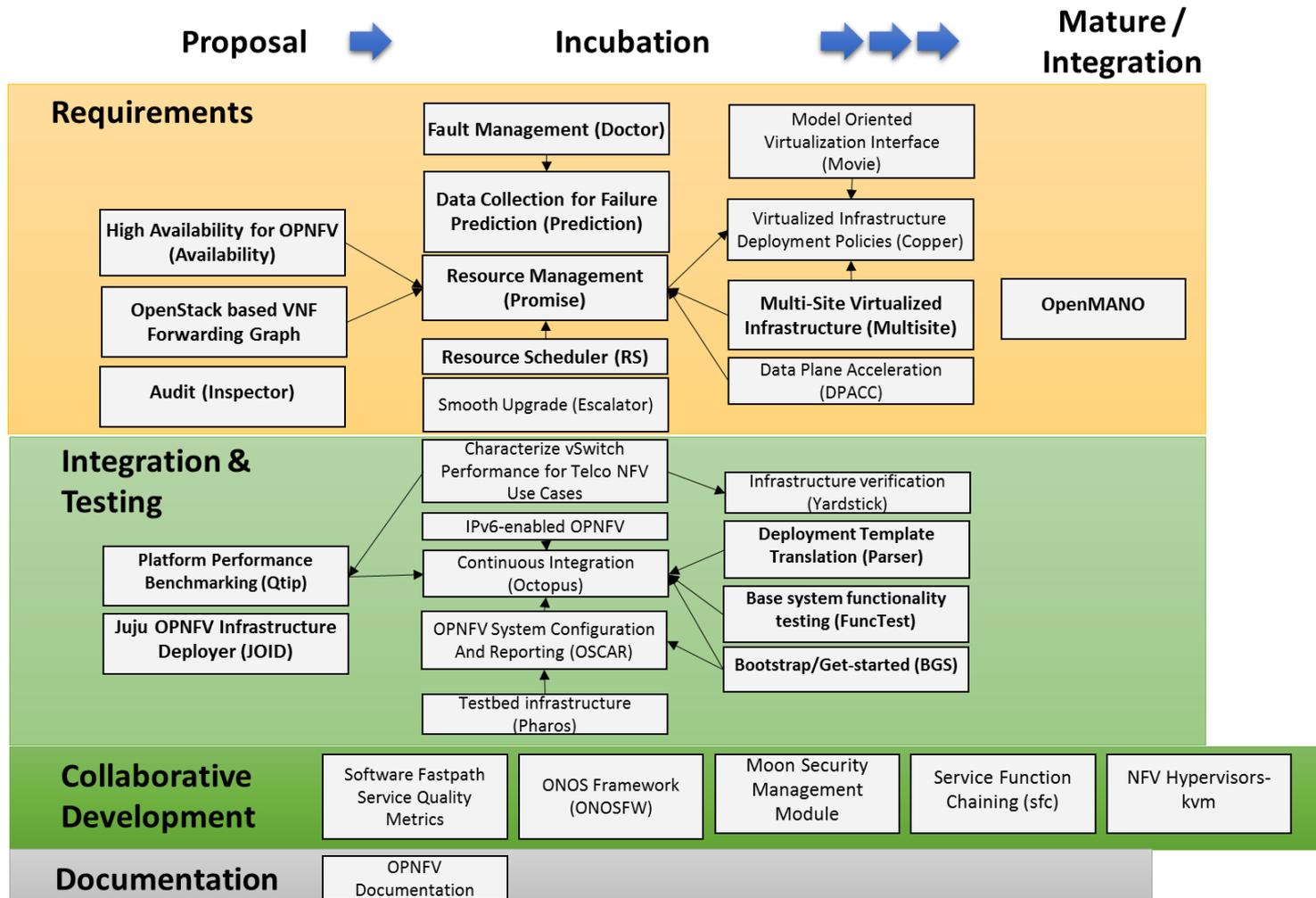
OPNFV Projects

- OPNFV Projects list

Requirements	Integration & Testing	Collaborative Development	Documentation
Fault Management (Doctor)	Continuous Integration (Octopus)	Software Fastpath Service Quality Metrics	OPNFV Documentation
Virtualized Infrastructure Deployment Policies (Copper)	Bootstrap/Get-started (BGS)	ONOS Framework (ONOSFW)	
Resource Management (Promise)	IPv6-enabled OPNFV	Moon Security Management Module	
High Availability for OPNFV (Availability)	Characterize vSwitch Performance for Telco NFV Use Cases	Service Function Chaining (sfc)	
Data Plane Acceleration (DPACC)	OPNFV System Configuration And Reporting (OSCAR)	NFV Hypervisors-kvm	
OpenStack based VNF Forwarding Graph	Testbed infrastructure (Pharos)	Open vSwitch for NFV	
Data Collection for Failure Prediction (Prediction)	Base system functionality testing (FuncTest)	OpenContrail Virtual Networking for OPNFV	
Resource Scheduler (RS)	Platform Performance Benchmarking (Qtip)		
Model Oriented Virtualization Interface (Movie)	Deployment Template Translation (Parser)		
Multi-Site Virtualized Infrastructure (Multisite)	Infrastructure verification (Yardstick)		
Smooth Upgrade (Escalator)	Juju OPNFV Infrastructure Deployer (JOID)		
Audit (Inspector)	Release Engineering (Releng)		
Connectivity Services LSO (LSOAPI)	Apex OPNFV installer		
Genesis	Compass OPNFV installer		
Edge NFV(ENFV)	Fuel based OPNFV installer		
Fault localization (RCA)	Bottlenecks		
	DoveTail		
	ARMBand		
	Storage Performance Benchmarking for NFVI (StorPerf)		
	Policy Test (policytest)		

OPNFV Projects

- OPNFV Project Dependency



———> Soft/optional dependency

OPNFV Projects Overview

프로젝트명	주요 내용
High Availability for OPNFV (Availability)	<ul style="list-style-type: none"> Carrier-grade NFV 환경을 고려한 서비스 가용성 요구사항 도출 H/W, 가상 인프라 및 서비스의 세가지 분류로 나누어 가용성 요구사항 정의
Fault Management (Doctor)	<ul style="list-style-type: none"> 가상 인프라 위에서 동작하는 네트워크 서비스의 가용성을 위한 장애 관리 및 유지 기법 연구
Resource Management (Promise)	<ul style="list-style-type: none"> 현재 자원 사용량을 기반으로 미래의 자원 사용량을 예측 및 이를 통한 가상화 자원 관리
Data Collection for Failure Prediction (Prediction)	<ul style="list-style-type: none"> NFV-REL 001 문서를 기반으로 하여 OPNFV 환경 내 장애 예측을 위한 요구사항 도출 <u>OpenStack Celometer, Monasca</u>

OPNFV Projects Overview

프로젝트명	주요 내용
Resource Scheduler (RS)	<ul style="list-style-type: none">이동통신망에 응용 가능한 자원 스케줄러 및 이에 따른 CPU/Memory 등의 효율적인 자원 할당
Virtualized Infrastructure Deployment Policies (Copper)	<ul style="list-style-type: none">사용자 및 VNF 개발자 관점에서의 가상 인프라에 대한 지식이 필요없는 정책 기반의 VNF 관리<u>OpenStack Congress, ODL-GBP(Group Based Policy)</u>
Model Oriented Virtualization Interface (Movie)	<ul style="list-style-type: none">Orchestrator 및 VNF Manager를 위한 더 추상화된 VIM Northbound Interface 설계
Multi-Site Virtualized Infrastructure (Multisite)	<ul style="list-style-type: none">Multi-site 환경을 고려한 OPNFV 환경 설계

OPNFV Projects Overview

프로젝트명	주요 내용
Continuous Integration (Octopus)	<ul style="list-style-type: none">• Upstream 프로젝트들에서 업데이트되는 개발 내용들을 효율적으로 OPNFV 플랫폼에 반영하기 위한 연구
Testbed infrastructure (Pharos)	<ul style="list-style-type: none">• 글로벌한 OPNFV Community lab 인프라 관리 및 테스트를 위한 툴 제공
Infrastructure verification (Yardstick)	<ul style="list-style-type: none">• 여러 시나리오 및 토폴로지를 통한 OPNFV 실행 테스트• ETSI TST 001를 기반으로 한 인프라 테스트 방법 연구
Base system functionality testing (FuncTest)	<ul style="list-style-type: none">• OPNFV 기능 테스트를 위한 툴 개발 및 이에 대한 설치 및 구성 정보 제공• 테스트 항목 정의

OPNFV Projects Overview

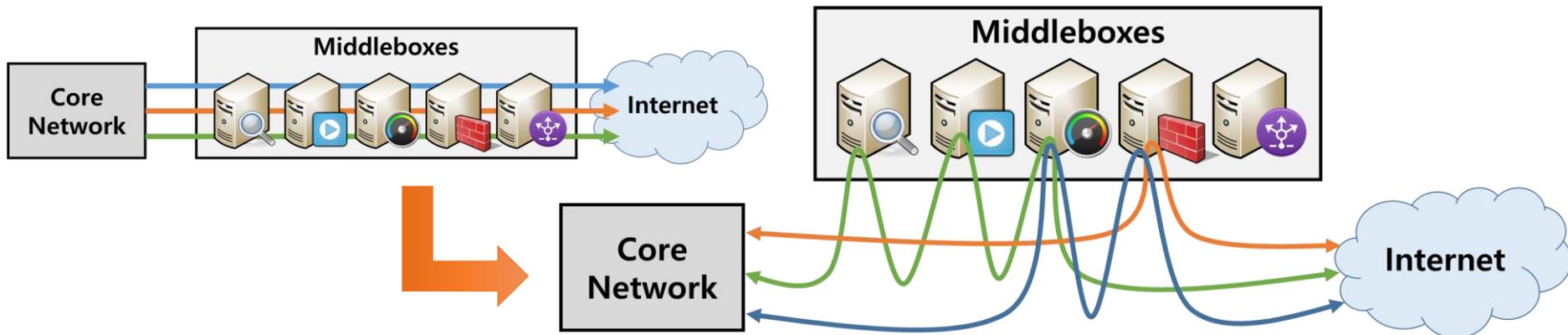
프로젝트명	주요 내용
OpenStack based VNF Forwarding Graph	<ul style="list-style-type: none">• VNF Forwarding Graph 생성 및 이를 통한 Service Chaining을 위한 인터페이스 및 컴포넌트 설계
Service Function Chaining (sfc)	<ul style="list-style-type: none">• OPNFV 환경에서 Service Function Chaining을 구현하기 위한 upstream project들간의 연동 및 요구사항 도출• <u>OpenStack Tacker, ODL-SFC</u>
ONOS Framework (ONOSFW)	<ul style="list-style-type: none">• ONOS SDN 컨트롤러와 OpenStack 연동을 통한 NFV 환경 구축 연구
NFV Hypervisors-kvm	<ul style="list-style-type: none">• NFVI 기능 지원을 위한 Hypervisor 강화 연구 (KVM)• Minimal interrupt latency, Inter-VN communication, Fast live migration

OPNFV Use Case

Service Function Chaining (SFC)

Service Function Chaining (SFC)

- 기존에 물리적으로 구성된 네트워크의 한계
 - 모든 서비스들이 같은 경로 내 네트워크 기능들을 거쳐가야 함
 - 트래픽 오버로드, 서비스 관점에서 비효율적인 프로세싱
- 트래픽 종류에 따른 네트워크 기능들의 동적 연결 구성
 - 서비스 종류에 따른 구분: Web browsing, Video Streaming, ...
 - 가입자 종류에 따른 구분: Member grade, ...
 - 트래픽 로드 분산



Service Function Chaining (SFC)

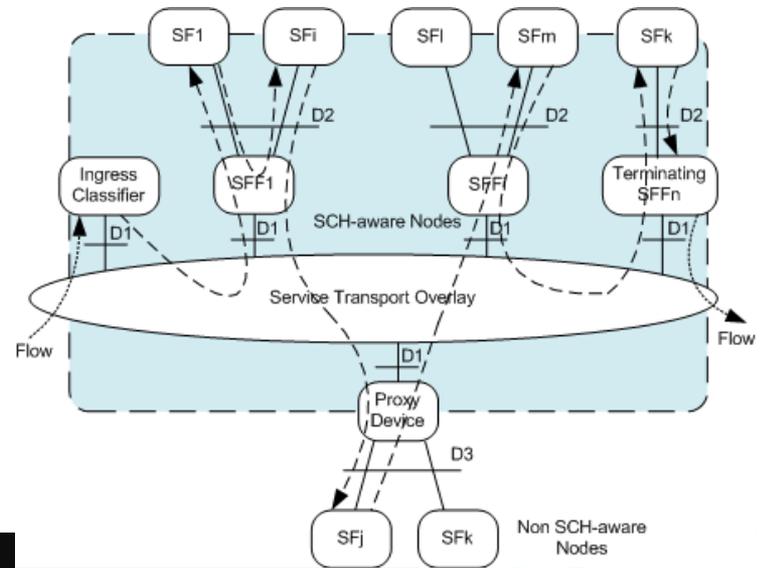
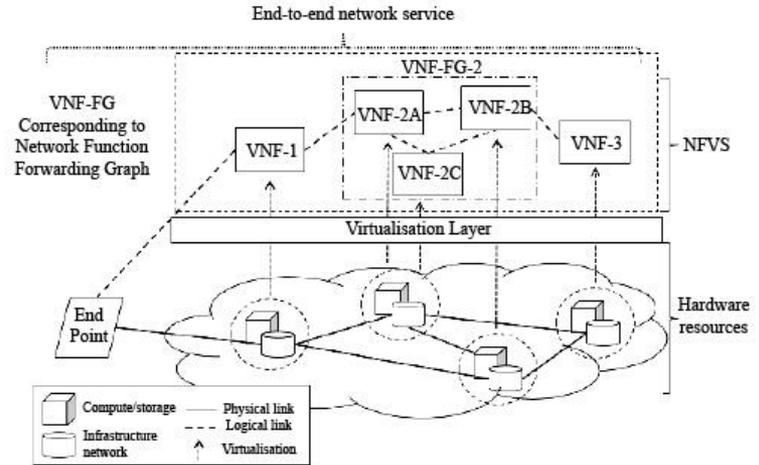
- ETSI NFV ISG

- VNF Forwarding Group(VNFFG)으로 정의
 - VNF간의 논리적 연결로써, NFV MANO에서 이를 관리

- IETF SFC WG

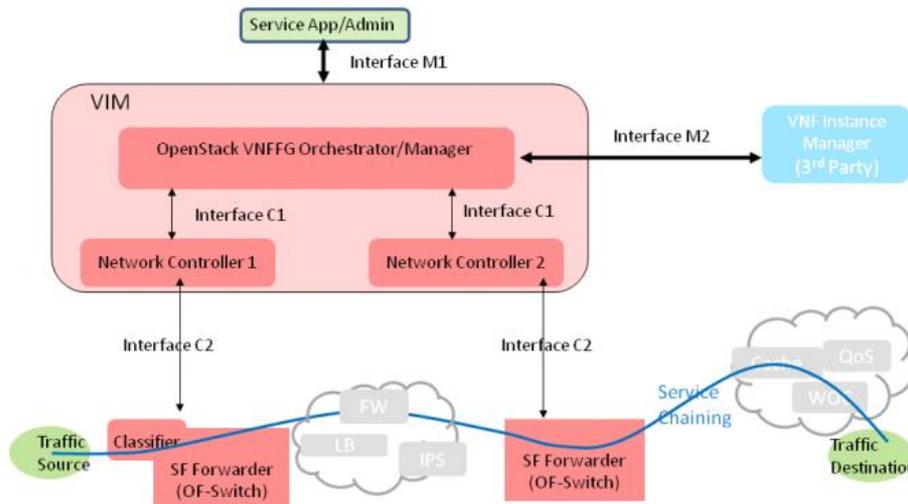
- Service Chain을 구성 및 트래픽 전달을 위한 표준 논의

- SF (Service Function)
- SFF (Service Function Forwarder)
- SFP (Service Function Path)
- Classifier / NSH (Network Service Header)



Service Function Chaining (SFC)

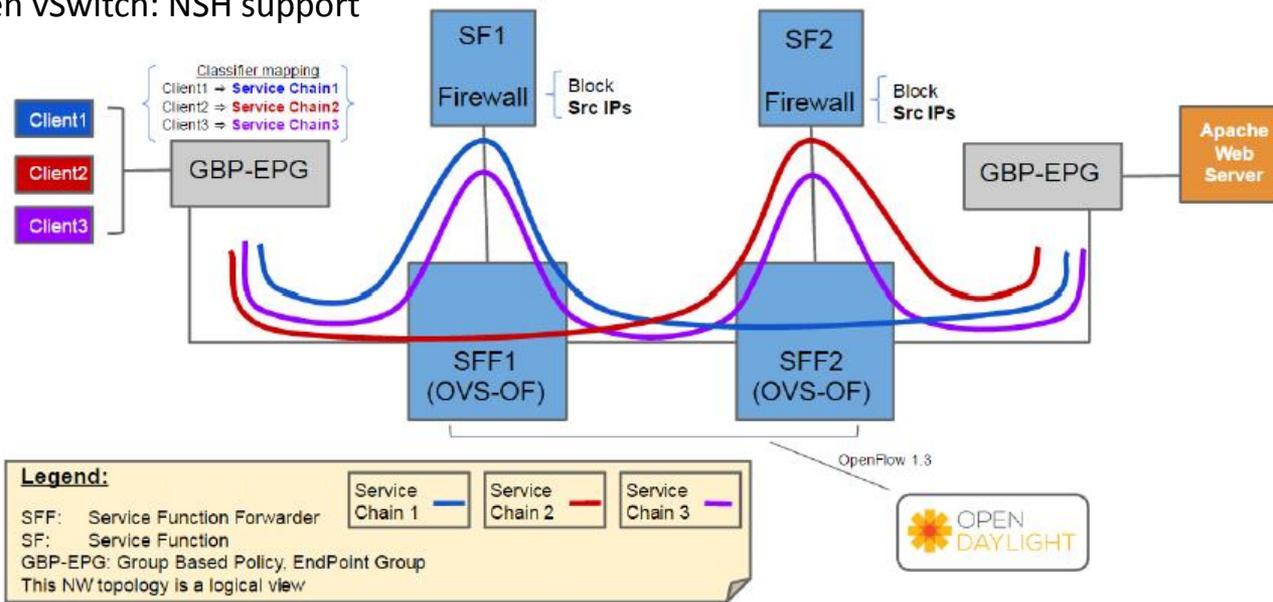
- OPNFV Project: OpenStack based VNF Forwarding Graph
 - SFC Management/Control Plane 기능 및 인터페이스 설계
 - OpenStack과 SDN Controller 간의 SFC 연동을 위한 요구사항 및 인터페이스 정의
 - OpenStack Neutron SFC API 개발
 - <https://wiki.openstack.org/wiki/Neutron/APIForServiceChaining>



Service Function Chaining (SFC)

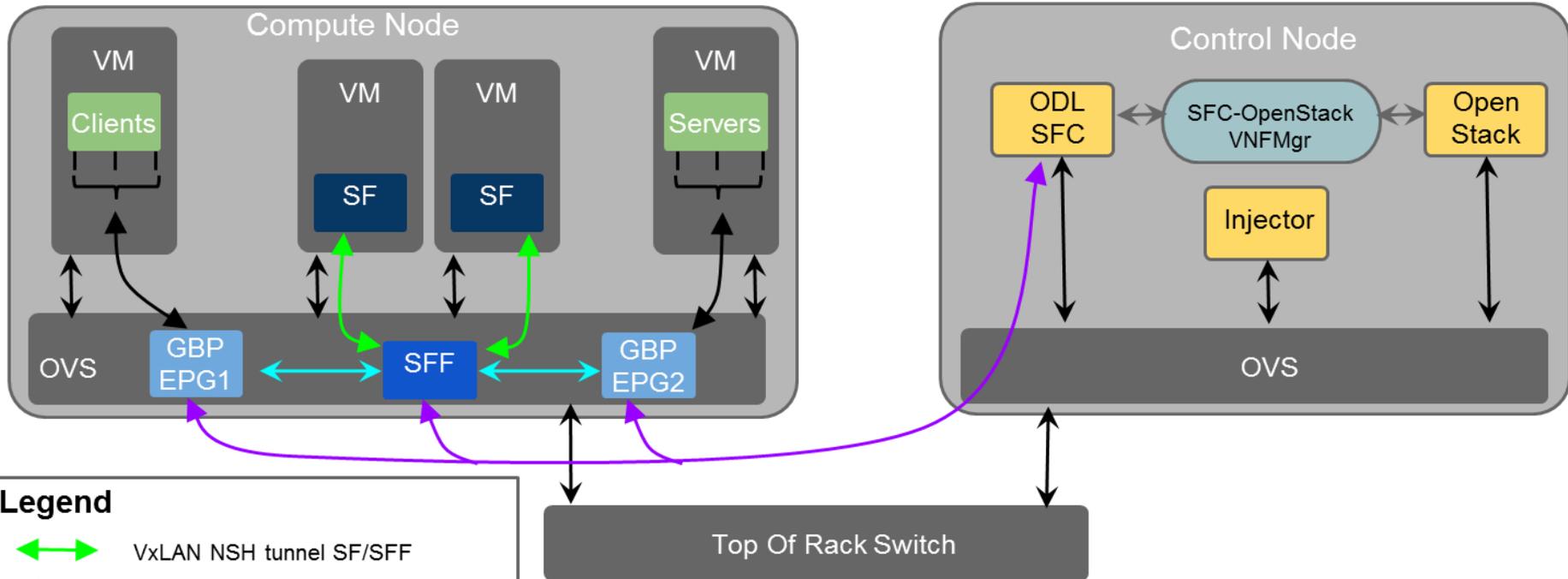
- OPNFV Project: Service Function Chaining (SFC)
 - OpenDaylight SFC 기능을 통한 OPNFV 내 VNF간의 Service Chaining 구현
 - 다양한 Upstream project들과의 연계
 - OpenDaylight: SFC, GBP(Group Based Policy), Neutron northbound API, OVSDB, ...
 - OpenStack Tacker: VNF Manager
 - Open vSwitch: NSH support

https://wiki.opnfv.org/service_function_chaining



OPNFV SFC

- Initial Network Topology



Legend

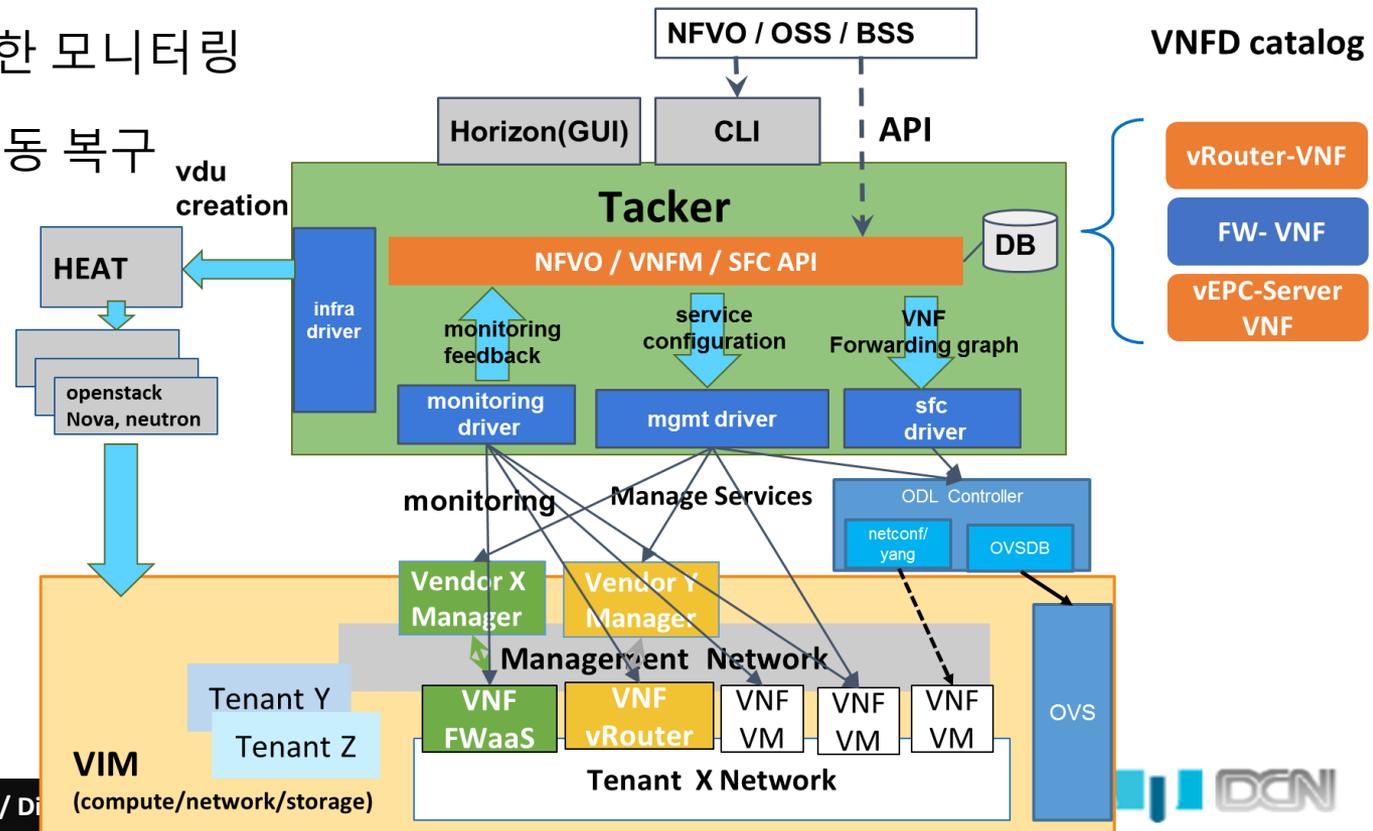
- VxLAN NSH tunnel SF/SFF
- GBP creates VxLAN NSH tunnel
- OpenFlow 1.3

GBP EPG Group Based Policy End Point Group. Replaces SFC classifier

OPNFV SFC

- VNF manager: OpenStack Tacker

- VNF lifecycle 관리
- TOSCA-Template 기반의 VNF 생성/해제
- VNF 상태에 대한 모니터링
- VNF 장애 시 자동 복구
- Auto-Scaling
- SFC 연동

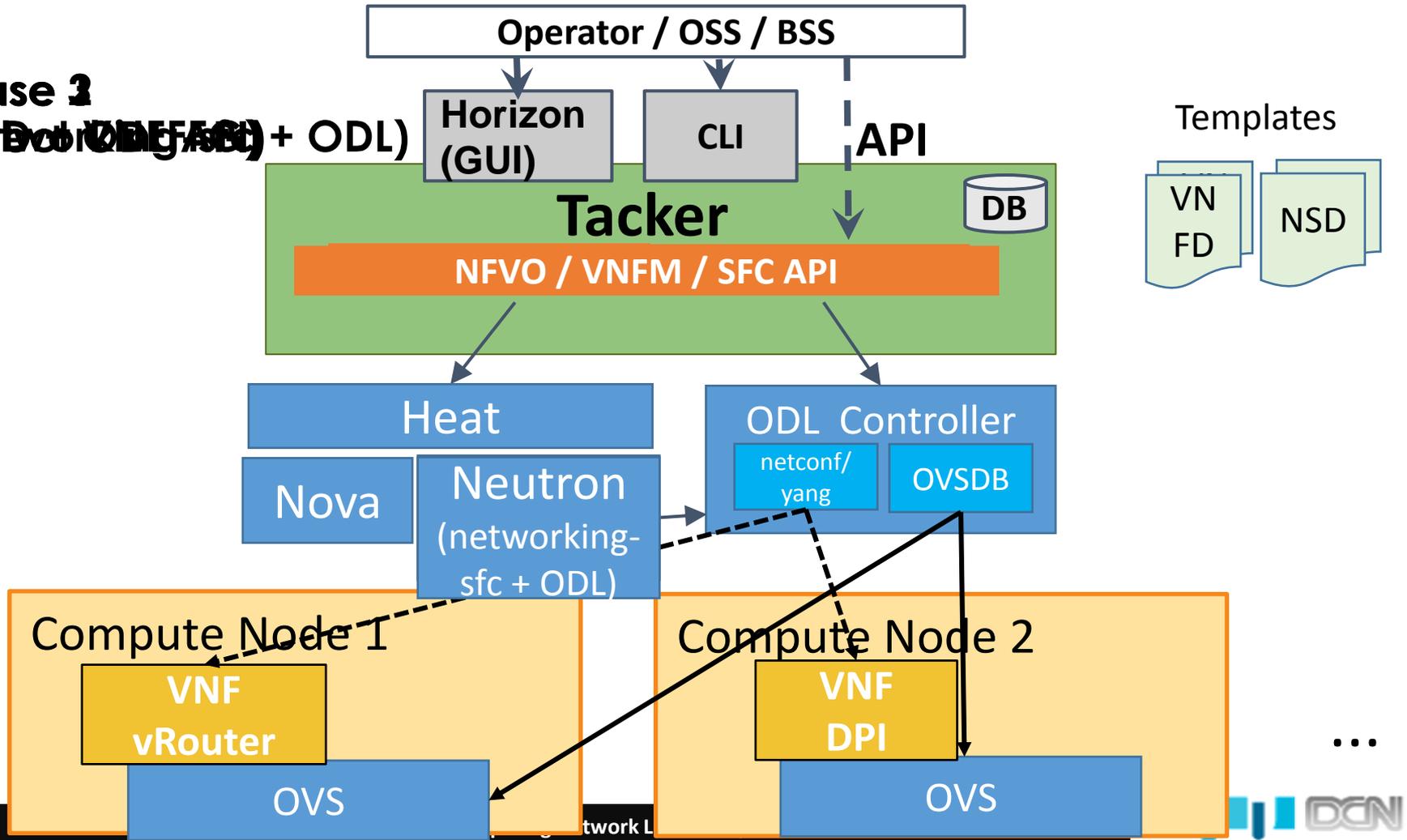


OPNFV SFC

- OpenStack Tacker + SFC

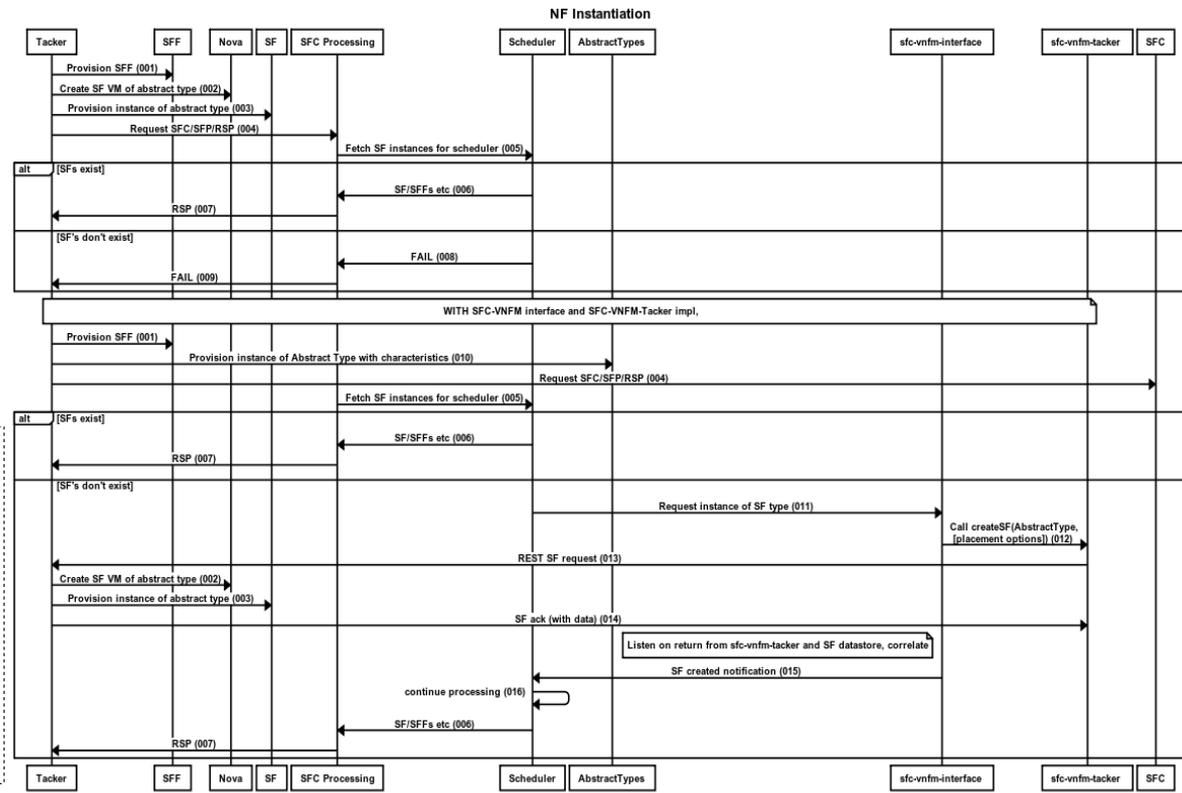
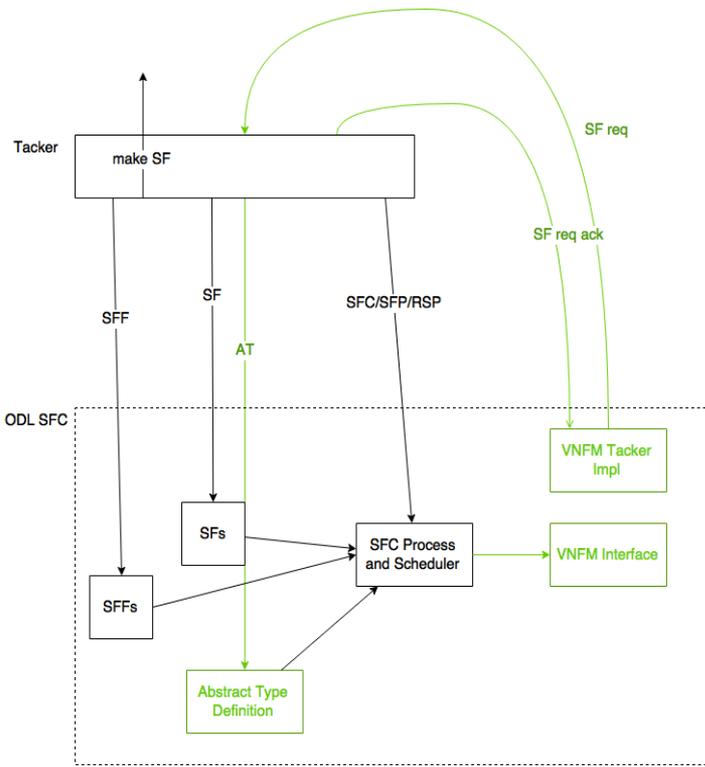
Phase 3

(NSD + VNFD) + ODL



OPNFV SFC

- ODL SFC + OpenStack Tacker



OPNFV 설치

Release 1 “Arno”

OPNFV Arno Software Download

- <https://www.opnfv.org/software/download>

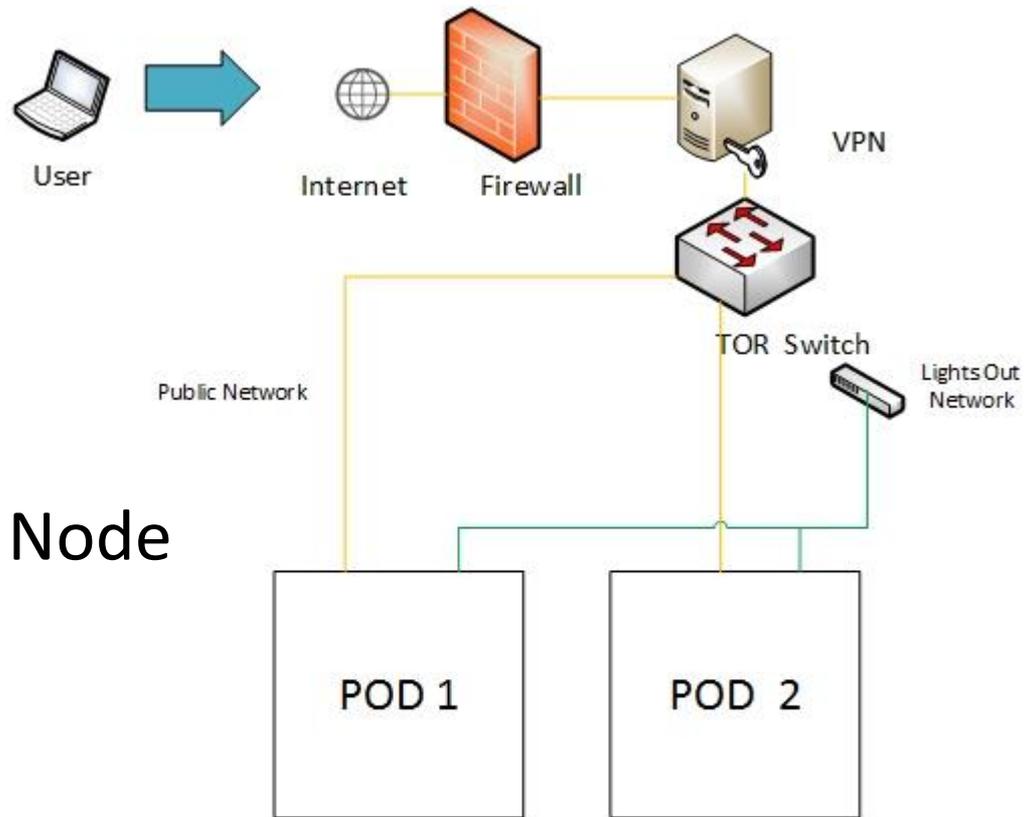
Latest Downloads

Release	Version	Release date	Downloads	Documentation
Arno	SR1	Thu, 10/01/2015	<ul style="list-style-type: none">• ISO (Foreman/QuickStack deployment)• ISO (Fuel deployment)	<ul style="list-style-type: none">• Arno User Guide• Function Test• Hardware configuration guide• Automated Deployment guide• Foreman/QuickStack deployment<ul style="list-style-type: none">◦ Release Notes◦ Install Guide• Fuel deployment<ul style="list-style-type: none">◦ Release Notes◦ Install Guide

[Release Archives](#)

Hardware Setup

- 2 PODs
 - POD 1: Fuel
 - POD 2: Foreman
- Each POD has
 - 1 Jump Server
 - 3 Control Nodes
 - At least 1 Compute Node



Key

Public Network
Lights Out Network



Minimum Hardware Requirements

The following minimum hardware requirements must be met for the installation of Arno SR1 using Fuel:

HW Aspect	Requirement
# of nodes	Minimum 6 (3 for non redundant deployment): <ul style="list-style-type: none">• 1 Fuel deployment master (may be virtualized)• 3(1) Controllers• 1 Compute• 1 Ceilometer (VM option)
CPU	Minimum 1 socket x86_AMD64 with Virtualization support
RAM	Minimum 16GB/server (Depending on VNF work load)
Disk	Minimum 256GB 10kRPM spinning disks
Networks	4 Tagged VLANs (PUBLIC, MGMT, STORAGE, PRIVATE) 1 Un-Tagged VLAN for PXE Boot - ADMIN Network note: These can be run on single NIC - or spread out over other nics as your hardware supports

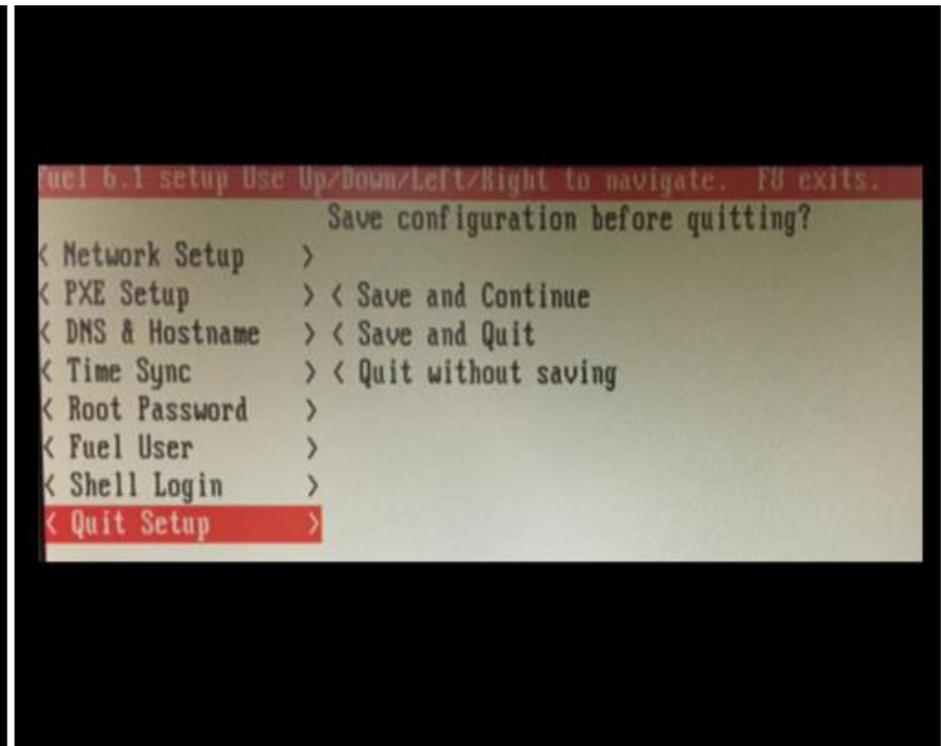
LAB Environment Spec

- Jump Server / Control Node
 - Intel Xeon 2620 (2.4GHz) / 16G DDR4 RAM
 - 120GB SSD / 2TB HDD
 - 10G LAN (SFP+)
- Compute Node
 - Intel Xeon 2690 (2.4GHz) X 2
16G DDR4 RAM X 10
 - 120GB SSD / 7TB HDD (RAID 60)
 - 10G LAN (SFP+)



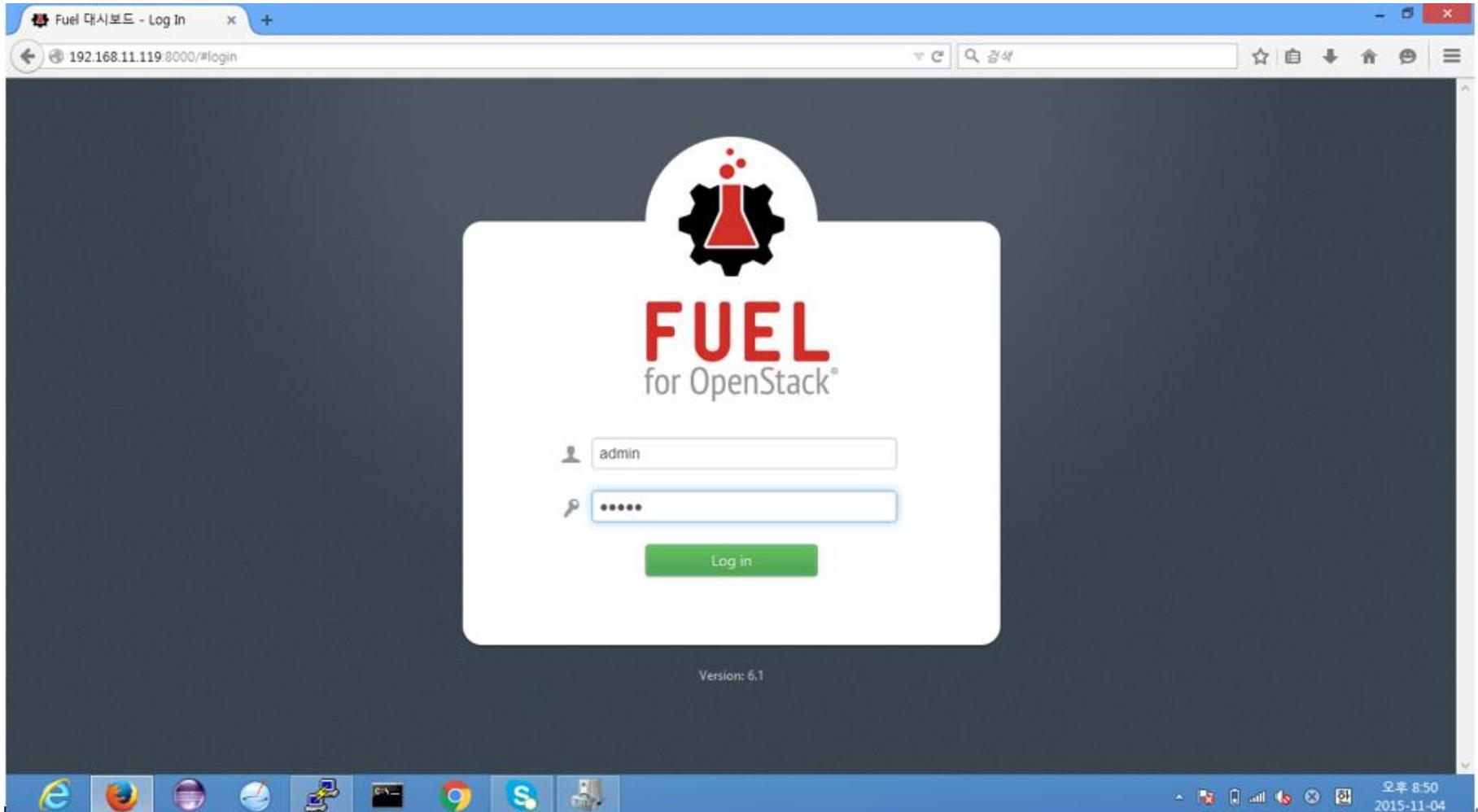
Fuel Installation

- OpenStack 에서의 Development/Installation tool을 OPNFV Arno 설치에 적합하게 수정
- Jump Server에 Fuel 설치



OPNFV-Fuel POD Deployment

- 웹 대쉬보드 접속



Preparing the POD nodes

- 노드 서버들에 대한 인지

The screenshot shows the FUEL for OpenStack web interface. At the top right, the user is logged in as 'admin' with options for 'Change password' and 'Logout'. A notification bar indicates '4 총 4 알림되지 않은 노드' (4 total 4 notifications not read nodes). The main content area shows 'OpenStack 환경' (OpenStack environment) with a 'DCN_ARNO' section displaying '노드: 0' (Nodes: 0) and a '새로운' (New) button. A cloud icon with a plus sign is labeled '새로운 OpenStack 환경' (New OpenStack environment). On the right, a notification panel lists four discovered nodes with their specifications: 'New node is discovered: 48 CPUs / 160.0 GB RAM / 0.12 TB HDD', 'New node is discovered: 12 CPUs / 32.0 GB RAM / 0.12 TB HDD', 'New node is discovered: 12 CPUs / 32.0 GB RAM / 0.12 TB HDD', and 'New node is discovered: 12 CPUs / 32.0 GB RAM / 0.12 TB HDD'. A warning message is also present: 'WARNING: There may be updates available for Fuel. You should update this node with `yum update`. If there are available updates, run `dockerctl destroy all; bootstrap_admin_node.sh;` to repeat bootstrap on Fuel Master with the latest updates. For more information, check out Fuel documentation at: <http://docs.mirantis.com/fuel>. A '전체 보기' (View all) button is at the bottom of the notification panel.

Create an OPNFV Environment

- OPNFV 동작 OS 선택

Create a new OpenStack environment ×

Name and Release

Compute

Networking Setup

Storage Backends

Additional Services

Finish

Name

DCN_ARNO

OpenStack Release

Juno on Ubuntu 14.04.1 (2014.2.2-6.1) (default ▾)

By default, packages will be fetched from external repositories. Please make sure your Fuel master node has internet access.

To specify alternate repositories, or to create a local mirror, please check the Settings tab before deployment.

This option will install the OpenStack Juno packages using Ubuntu as a base operating system. With high availability features built in, you are getting a robust, enterprise-grade OpenStack deployment.

Cancel

← Prev

Next →

Create an OPNFV Environment(cont)

- Neutron Networking 설정

새로운 OpenStack 환경을 만듭니다

- ✓ 이름 및 출시
- ✓ Compute
- 네트워크**
- 저장소 백엔드
- 추가 서비스
- 끝마침

VLAN을 사용하는 Neutron
The networking equipment must be configured for VLAN segmentation. This option supports up to 4095 networks.

GRE를 사용하는 Neutron
The networking equipment must support GRE segmentation. This option supports up to 65535 networks.

Nova-Network
Choose this option if you use VMware vCenter or require different subnets for public and floating IP addresses. Note that OpenStack is moving to deprecate nova-network in upcoming releases.

취소 ← 이전 다음 →

Create an OPNFV Environment(cont)

- 각 서버에 노드 역할 지정

The screenshot displays the OpenStack dashboard interface for configuring nodes. At the top, there are tabs for '그룹으로' (Group) and '필터로' (Filter), with a dropdown menu set to '하드웨어 정보' (Hardware Info) and a search box containing '노드 이름/MAC'. Buttons for '취소' (Cancel) and '변경적용' (Apply Changes) are visible.

The main section is titled '역할 지정' (Role Assignment) and lists several roles with checkboxes and descriptions:

- Controller**
The Controller initiates orchestration activities and provides an external API. Other components like Glance (image storage), Keystone (identity management), Horizon (OpenStack dashboard) and Nova-Scheduler are installed on the controller as well.
- Compute**
A Compute node creates, manages and terminates virtual machine instances.
- Storage - Cinder** ⚠️
Cinder provides scheduling of block storage resources, typically delivered over iSCSI and other compatible backend storage systems. Block storage can be used for database storage, expandable file systems, or providing a server with access to raw block level devices.
- Storage - Ceph OSD**
Ceph storage can be configured to provide storage for block volumes (Cinder), images (Glance) and ephemeral instance storage (Nova). It can also provide object storage through the S3 and Swift API (See settings to enable each).
- Telemetry - MongoDB**
A feature-complete and recommended database for storage of metering data from OpenStack Telemetry (Ceilometer).
- Operating System**
Install base Operating System without additional packages and configuration.

At the bottom right of the role list is a '모두선택' (Select All) button.

Below the role list, there are two node configuration panels:

- Panel 1: HDD: 111.8 GB RAM: 160.0 GB (1). It contains a table with one row: 'Untitled (a7:92)' with a checkbox, '활동되지 않음' (Inactive), '오프라인' (Offline) status, a 'REMOVE' button, and resource details: CPU: 2 (48), HDD: 111.8 GB, RAM: 160.0 GB. A '모두선택' (Select All) button is at the bottom right.
- Panel 2: HDD: 111.8 GB RAM: 32.0 GB (2). It contains a table with one row: 'Untitled (1d:e6)' with a checkbox, '활동되지 않음' (Inactive), '오프라인' (Offline) status, and resource details: CPU: 1 (12), HDD: 111.8 GB, RAM: 32.0 GB. A '모두선택' (Select All) button is at the bottom right.

Configure the OPNFV environment

- 노드 설정

The screenshot displays the FUEL for OpenStack web interface. At the top, there is a navigation bar with the FUEL logo and tabs for '환경' (Environment), '출시' (Release), and '지원' (Support). The user is logged in as 'admin' with options to 'Change password' and 'Logout'. A notification shows '4 nodes' and '3 nodes not ready'. The breadcrumb trail is '홈 / 환경 / DCN_ARNO / 노드'. The main heading is 'DCN_ARNO (1 노드)'. Below this, it states 'OpenStack 출시: Juno on Ubuntu 14.04.1 (2014.2.2-6.1)' and '환경배치 모드: 고가용성(HA) 다중노드'. A row of icons includes '노드', '네트워크', '설정', '로그', '건강체크', and '작업'. A blue button '변경내용 배치' is on the right. The '그룹으로' dropdown is set to '역할' and the '필터로' input is '노드 이름/MAC'. Action buttons include '디스크 설정', '인터페이스 설정', and '+ 노드 추가하기'. There are two '모두선택' checkboxes. The main content area shows 'Compute (1)' with a table containing one node: 'Untitled (1d:e2) COMPUTE'. The node details include '오프라인' status, a 'REMOVE' button, and hardware specifications: 'CPU: 1 (12) HDD: 111.8 GB RAM: 32.0 GB'.

Verify the network

- 설치할 노드간의 네트워크 연결 검증

8.8.8.8

네트워크 검증은 4단계로 수행됩니다

1. L2 connectivity checks between every node in the environment.
2. DHCP discover check on all nodes.
3. Packages repo connectivity check from master node.
4. Packages repo connectivity check from slave nodes via public & admin (PXE) networks.

검증에 실패했습니다.
Repo availability verification using public network failed on following nodes Controller4 (1d:e6), Controller5(14:92), Controller3 (1d:e2). Following repos are not available - <http://archive.ubuntu.com/ubuntu/>, <http://mirror.fuel-infra.org/mos/ubuntu/>. Check your public network settings and availability of the repositories from public network. Please examine nailgun and astute logs for additional details. Node Controller3 (1d:e2) discovered DHCP server via eth2 with following parameters: IP: 192.168.11.1, MAC: f0:79:59:77:88:90. This server will conflict with the installation. Node Controller5(14:92) discovered DHCP server via eth2 with following parameters: IP: 192.168.11.1, MAC: f0:79:59:77:88:90. This server will conflict with the installation. Node Controller4 (1d:e6) discovered DHCP server via eth2 with following parameters: IP: 192.168.11.1, MAC: f0:79:59:77:88:90. This server will conflict with the installation.

노드 이름	노드 MAC 어드레스	노드 인터페이스	기대하는 VLAN (수신되지않음)
Controller4 (1d:e6)	00:1e:67:e3:1d:e6	eth0	1024, 1026, 1027, 1028, 1029, 1030, 1025, 101, 102, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1

Installing OPNFV environment

- 각 노드들에 대한 설정으로 배포

The screenshot displays the FUEL for OpenStack web interface. At the top, there is a navigation bar with the FUEL logo and tabs for '환경' (Environment), '출시' (Release), and '지원' (Support). The user is logged in as 'admin' with options to 'Change password' and 'Logout'. The environment name is 'DCN_ARNO' with 4 nodes. Below the navigation bar, there are icons for '노드' (Nodes), '네트워크' (Network), '설정' (Settings), '로그' (Logs), '건강체크' (Health Check), and '작업' (Jobs). A progress bar shows 44% completion. The main content area is titled 'DCN_ARNO (4 노드)' and includes the OpenStack version 'Juno on Ubuntu 14.04.1 (2014.2.2-6.1)'. Below this, there are filters for '그룹으로' (Group) and '필터로' (Filter), and buttons for '디스크 설정' (Disk Settings), '인터페이스 설정' (Interface Settings), and '+ 노드 추가하기' (+ Add Node). The nodes are listed in two groups: 'Controller, Telemetry - MongoDB (3)' and 'Compute, Storage - Cinder (1)'. Each node entry includes a checkbox, the node name and role, a progress bar for 'UBUNTU설치중' (Installing Ubuntu), and hardware specifications (CPU, HDD, RAM).

Group	Node Name	Role	CPU	HDD	RAM
Controller, Telemetry - MongoDB (3)	Controller3(1d:e2)	CONTROLLER · MONGO	1 (12)	111.8 GB	32.0 GB
	Controller4 (1d:e6)	CONTROLLER · MONGO	1 (12)	111.8 GB	32.0 GB
	Controller5(d2:f0)	CONTROLLER · MONGO	1 (12)	111.8 GB	32.0 GB
Compute, Storage - Cinder (1)	Compute1 (a7:92)	COMPUTE · CINDER	2 (48)	2.8 TB	160.0 GB

Installing Complete

- OpenStack / ODL 대쉬보드 접근 가능

The image displays two screenshots from a web browser. The top screenshot shows a 'Success' message box with the text: 'Deployment of environment 'test' is done. Access the OpenStack dashboard (Horizon) at http://172.16.0.2/'. Below the message is a navigation bar with icons for Nodes, Networks, Settings, Logs, Health Check, and Actions, along with a 'Deploy Changes' button. The main content area is titled 'Configure disks on Untitled (e4:86)' and shows a disk 'sda (disk/by-path/pci-0000:00:0d.0-scsi-0:0:0:0)' with a total space of 0.5 TB. A green bar represents the 'Base System' (0.5 TB) and a blue bar represents the 'Image Sto...' (48.8 GB). At the bottom are buttons for 'Back To Node List', 'Load Defaults', 'Cancel Changes', and 'Apply'.

The bottom screenshot shows two browser windows. The left window is the OpenStack Horizon login page, featuring the OpenStack logo and a 'Log In' section with 'User Name' and 'Password' input fields and a 'Sign In' button. The right window is the OpenDaylight Dlux topology page, showing the 'OPEN DAYLIGHT' logo and a 'Topology' section with a tree view containing 'Nodes', 'Yang UI', and 'Yang Visualizer'.

More Information

- OPNFV Download Site
 - <https://www.opnfv.org/software/download>
 - Fuel/Foreman ISO
 - Hardware Guide
 - Installation Guide
- OPNFV Installation Tutorial Video
 - <https://www.youtube.com/watch?v=fgxmWjWl3l4>

OPNFV Demo

VNFM(Tacker) + SFC

Q & A

Thank you for attending!