\Orchestrating a brighter world NEC

NEC Cloud System (OSS Building Model)

OSS-based Cloud Infrastructure Building Solution

16th November , 2016

Chieko Takahashi
NEC

Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.
We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.

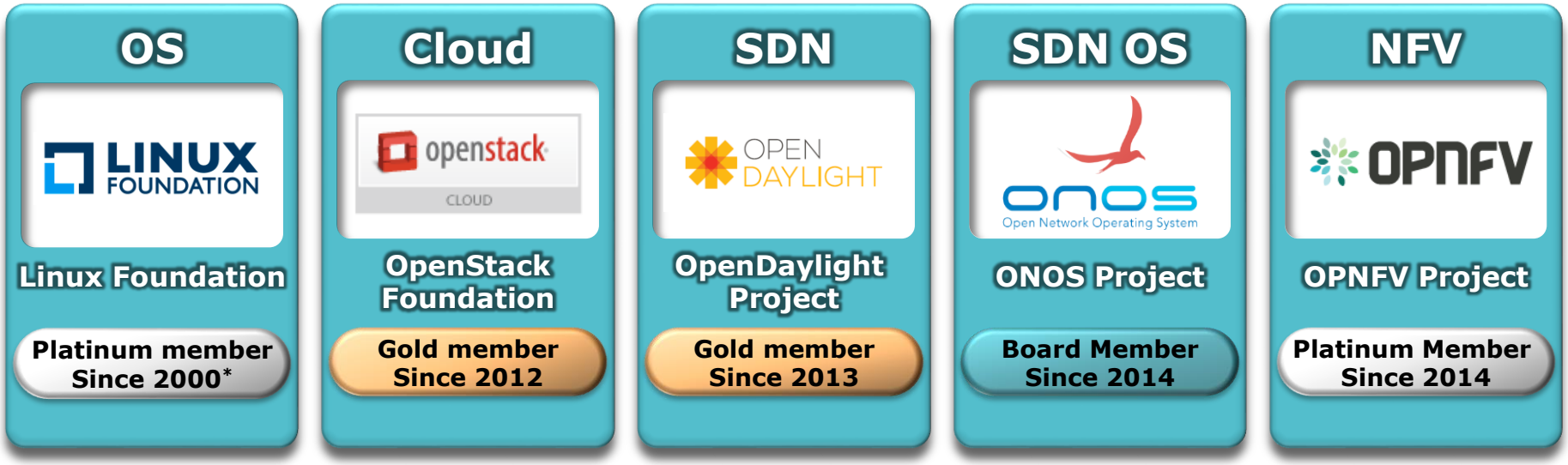
Agenda

- NEC's Open Source Activities Overview
- OSS-based Cloud Infrastructure Building Solution
  NEC Cloud System (OSS Building Model)
- -New functions-
- Summary

NEC's Open Source Activities Overview

Activities for Open Source Communities

Joining five major open source communities and providing cloud infrastructure SI and services using open sources



CORE INFRASTRUCTURE INITIATIVE

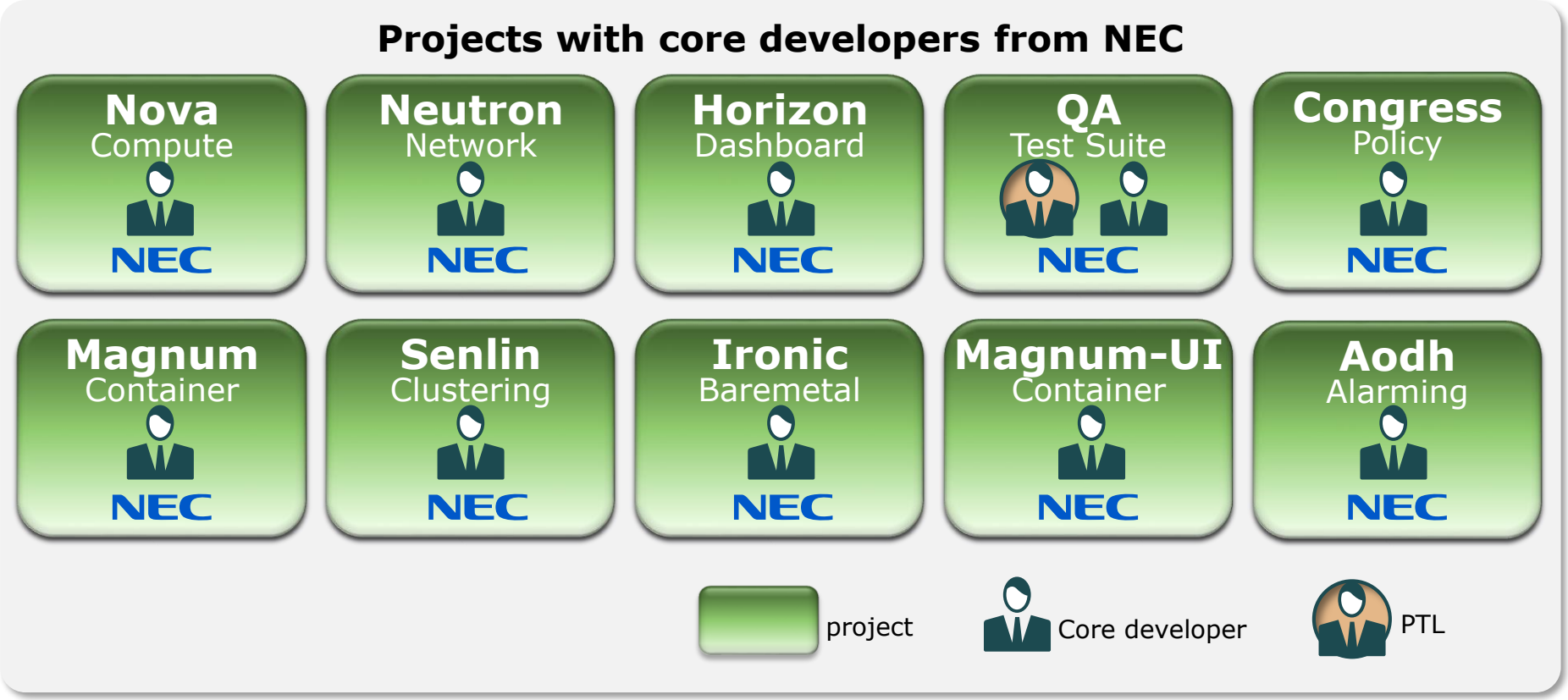
OSS security risk reduction in Linux Foundation
Joined since 2014

*Joined OSDL (Open Source Development Labs), the predecessor of Linux Foundation

Latest Contribution Status

(As of Sept. 2016)

- Approx. 30 developers from NEC are participating
- No. 1 contributor in Japan (for 3 consecutive years, covering 6 versions)
- Member appointed as Project Team Lead (PTL) of the Quality Assurance project in April 2016, a first for a Japanese



In addition to the above, developers from NEC are also participating in the Designate (DNSaaS), Kolla (Deployment), and Tacker (NFVO/VNFM) projects.

Japan's First OpenStack Community Project Leader

NEC America's Kenichi Ohmichi named Project Team Lead of the Quality Assurance project

(http://www.nec.com/en/press/201604/global_20160422_01.html)

Tokyo, April 22, 2016 - NEC Corporation (NEC; TSE: 6701) today announced that Mr. Kenichi Ohmichi, Senior Software Engineer, Global Solution Platform Center, NEC Corporation of America, has been named Project Team Leader (PTL) with the OpenStack Community's Quality Assurance (QA) Project. This is the first time that a Japanese national has been awarded this honor.

OpenStack is a cloud operating system that controls large amounts of compute, storage and networking resources throughout a datacenter. Mr. Ohmichi has made important contributions to improving the quality of OpenStack as a member of the OpenStack Community's QA Project, one of the most important of the OpenStack Community's approximately 50 projects.

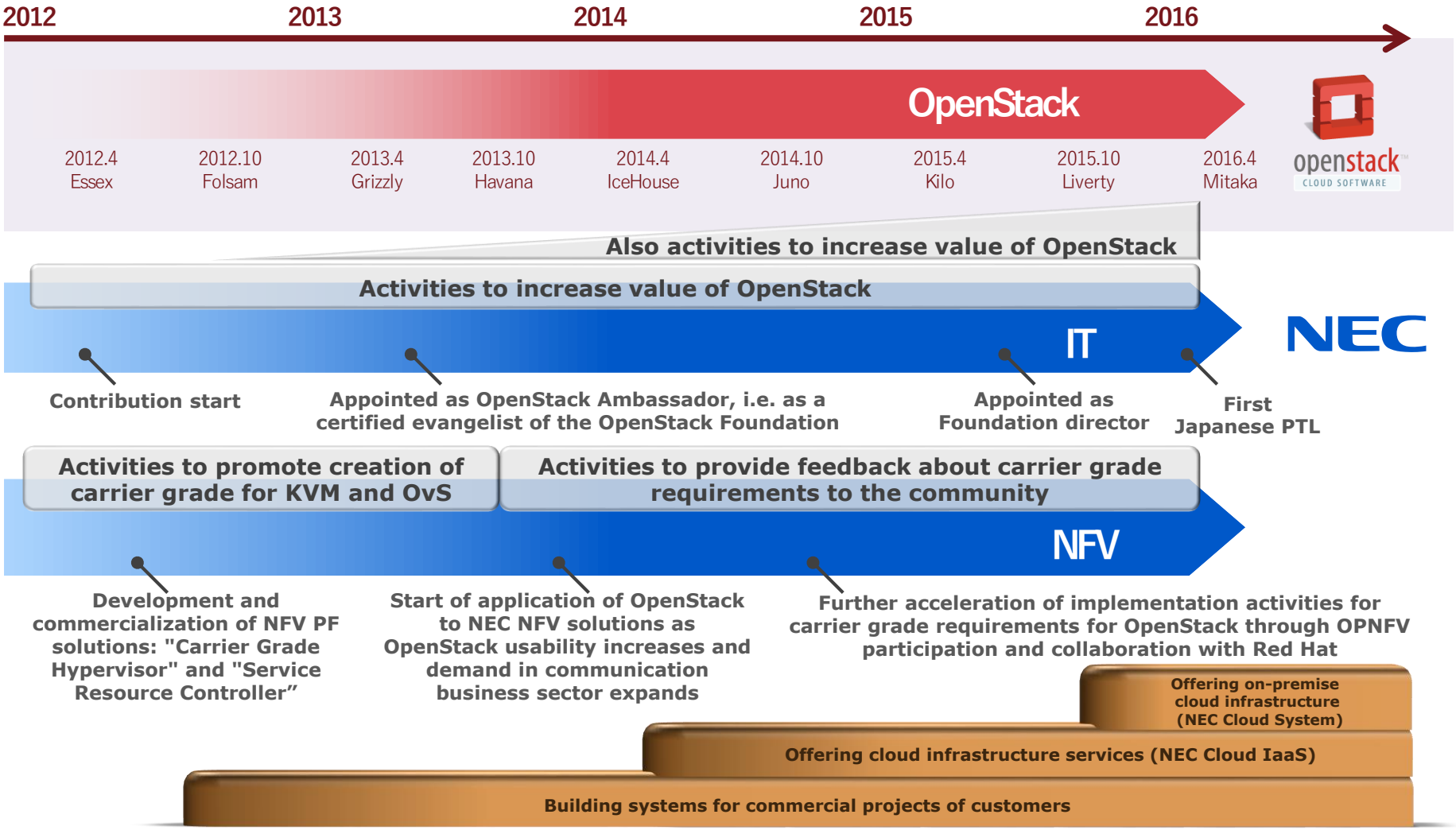
The PTL is a valuable representative of the OpenStack Community who is responsible for formulating and discussing project development targets, as well as participating in negotiations and debates regarding these targets, while leading a diverse team of developers who are based throughout the world.

Ohmichi has been active in the OpenStack Community since 2012, where he has helped to develop the "Nova V2.1 API" and the "Tempest Integration Test" for the Nova and QA projects. Ohmichi's selection as a PTL reflects the valuable contributions he has made to the OpenStack Community.

"We congratulate Mr. Ohmichi on his election as the Quality Assurance PTL. DefCore interoperability testing is a priority for the Foundation this year, and this relies on a close working relationship with the QA team. We look forward to progress in this effort under Mr. Ohmichi's leadership," said Mark Collier, COO of the OpenStack

Roles of NEC in Development of OpenStack

NEC has been contributing to quality improvement from the beginning, and has been an early participant also in customer projects and cloud services.

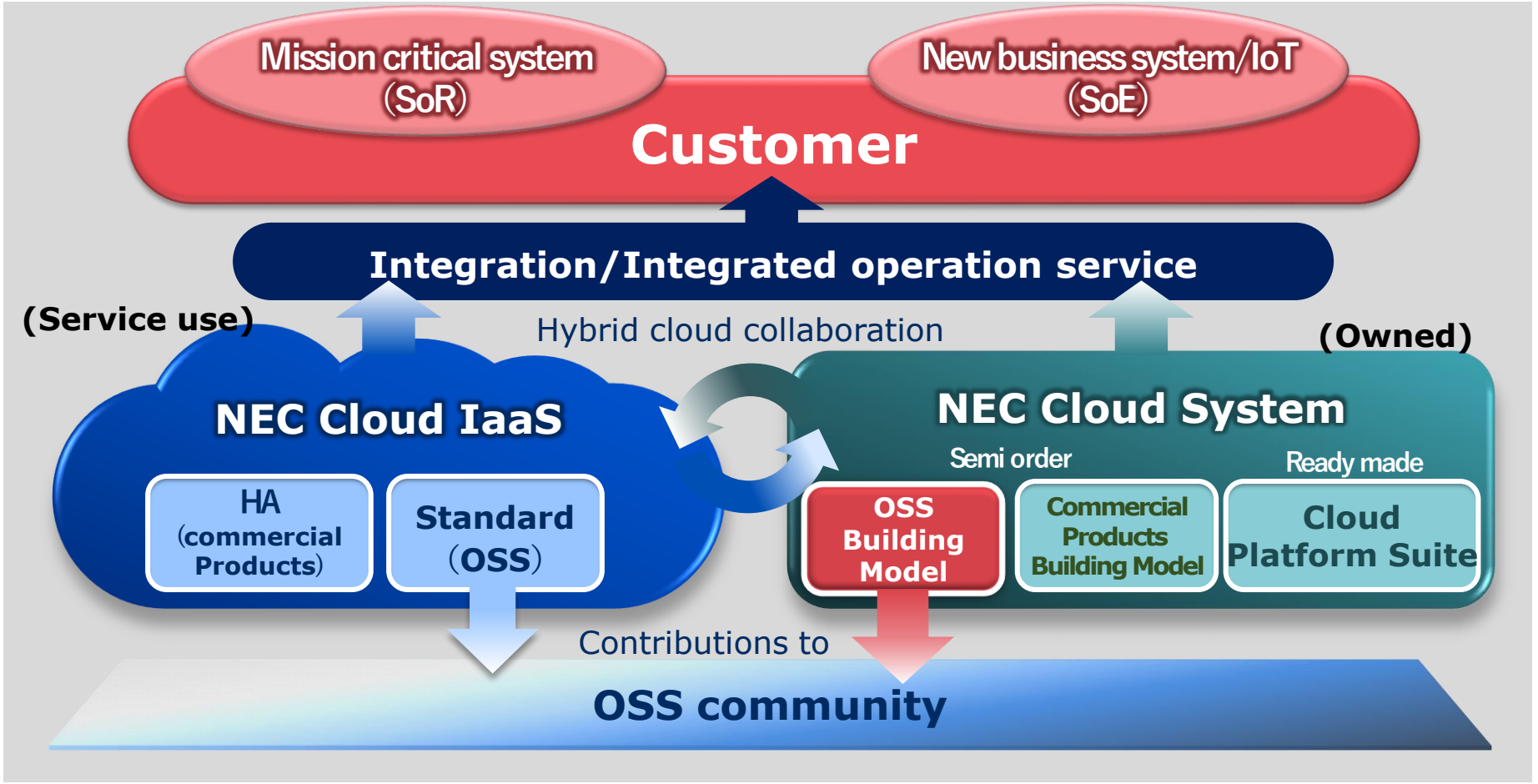


OSS-based Cloud Infrastructure Building Solution

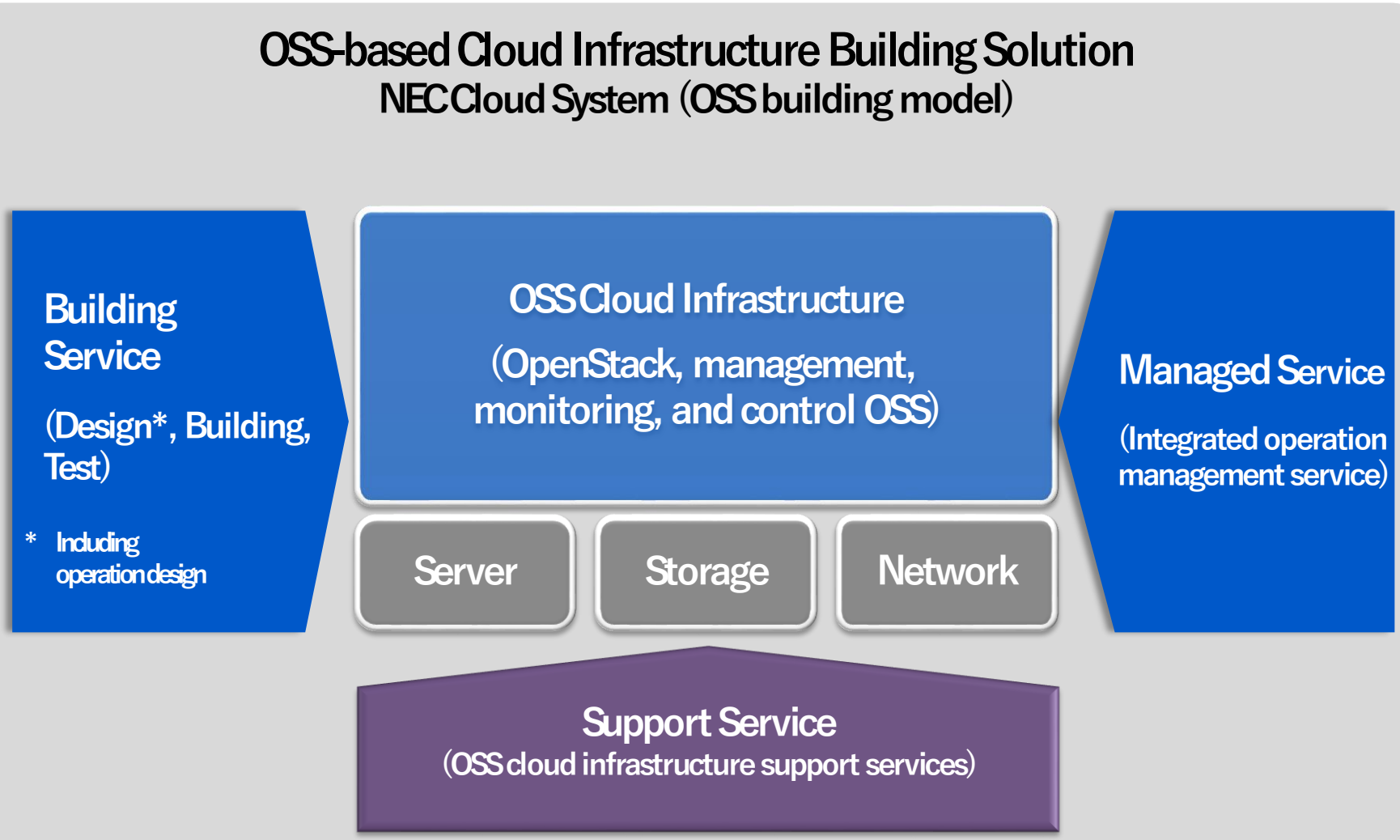
NEC Cloud System (OSS Building Model)

NEC's Cloud Infrastructure solutions overview

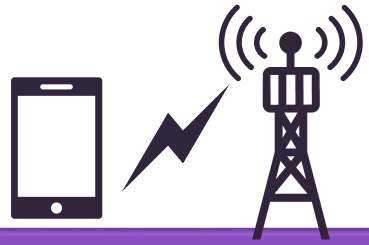
- NEC provides both cloud service (NEC Cloud IaaS) and cloud environment building solution (NEC Cloud System)
- Both use OSS (OpenStack, etc.) and feedback (customized codes etc.) from operating cloud and building system is provided to OSS community.



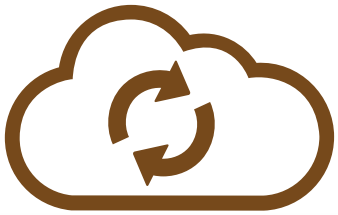
NEC Cloud System (OSS building model) offerings



Target Area of NEC Cloud System (OSS building model)



Telecom carriers



Service providers

Enterprises

NFV	Data center business	Enterprise systems

Specific needs

- NFV Operation
- Service Chaining
- Charge back
- Advanced Security
- Effective use of legacy assets

Common needs

- Openness
- Quality/performance
- Automatic operation
- Scalability
- Provisioning
- Self-service
- Security
- User management
- Resource efficiency
- Shorten TTM
- Hybrid cloud
- DevOps
- Effective use of legacy assets
- Building cost reduction
- BC/DR
- Multi-DC management

Features of NEC Cloud System (OSS building Model)

Openness	(1) Highly reliable and scalable open cloud platform (2) NFV extension on fully open basis
High Quality	(3) Rapid building of high quality cloud environments
Support	(4) OpenStack quality enhancement (5) Total support organization

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Highly reliable and scalable open cloud platform

Providing open cloud platform with high reliability and scalability by combining NEC's OMCS technology* and open standard technologies such as OpenStack and SDN

◆ High openness

- Combining "Red Hat OpenStack Platform" and other OSSs for management/monitoring/control.
- Customized functions for each user are also to be opened and committed to community
- Network functions support OpenDaylight, which is highly compatible with Neutron

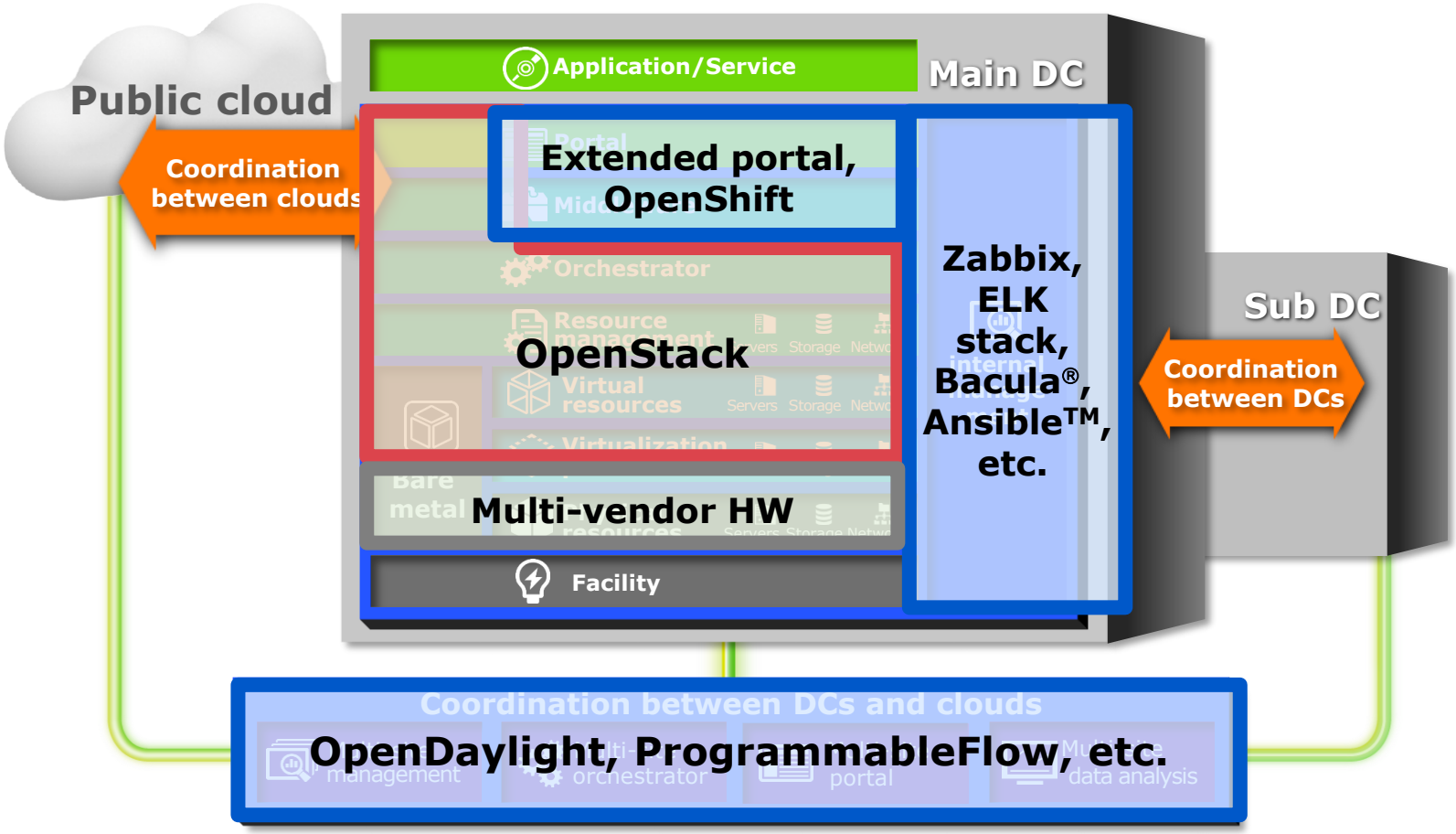
◆ Multi-site environment by SDN technology

- Enhancing scalability and providing BC/DR function by integrating multiple DCs as a single virtual DC.

* Technology for assuring quality of open system building which satisfy 6 non-functional requirements (availability, performance, operability, scalability, co-operability and confidentiality) defined by NEC

Combination of other OSSs with OpenStack

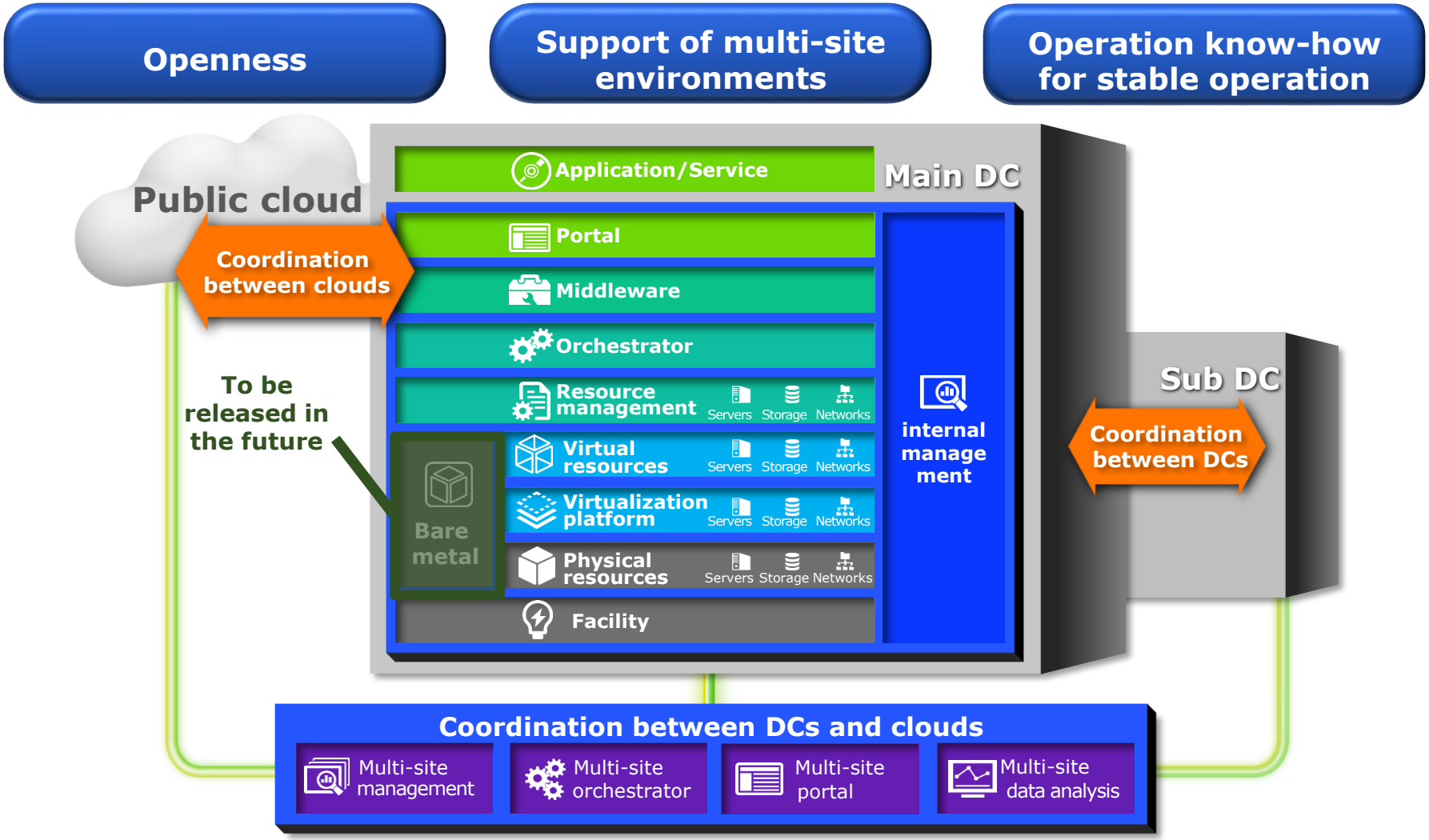
- No vendor lock-in, contribute additional codes to OSS
- Modified/developed code will be opened and contributed to OSS communities when no OSSs can satisfy customer requirement.



ELK stack (Elasticsearch™, Logstash™, and Kibana™)

Architecture of NEC Cloud System

ICT infrastructure architecture for keeping pace with business changes and expanding business opportunities



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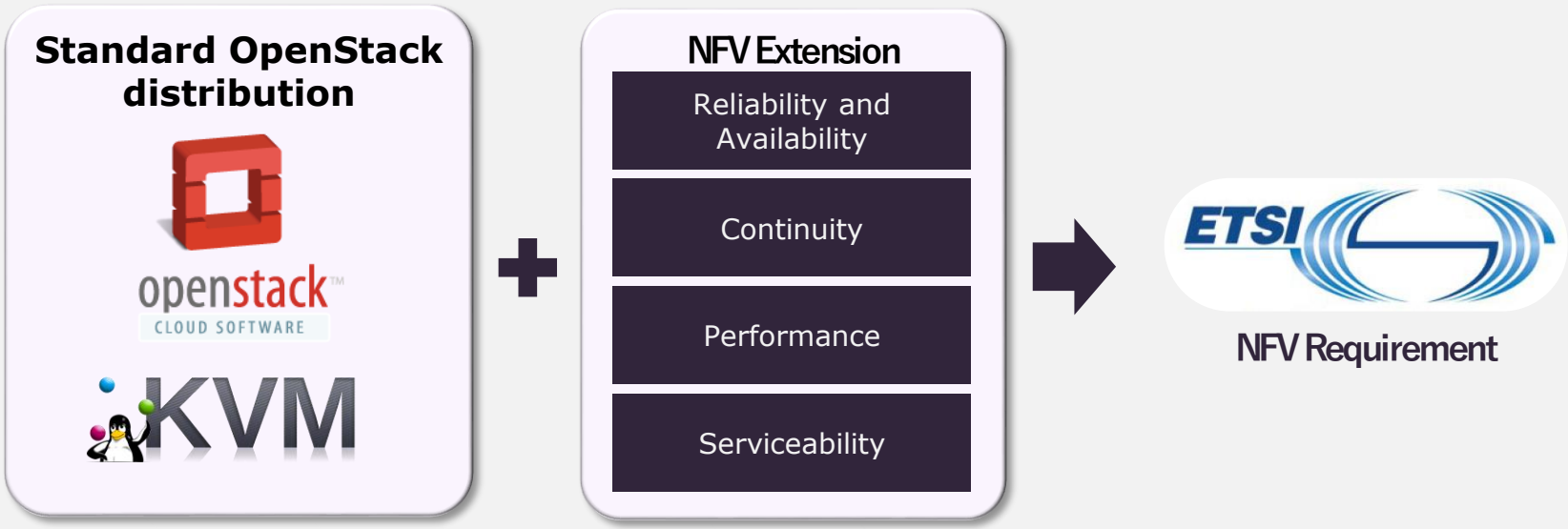
NFV extension on fully open basis

Complementation/extension of missing functions in OpenStack or KVM

- Open upstream implementation is assumed if a function gap is detected.
- However, extended functions are developed if upstream implementation takes a long time.
- The developed extended functions are all supplied to the open-source community (full openness).

Major extended functions

- Resource control, performance management, fault management, performance improvement, etc.



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Rapid building of high quality cloud environments

Flexibly combining verified functions selected according to system requirements and size (Building blocks)

Extracting common requirements for wide range of cloud environment

Listing up functions satisfying the requirements, and verify the combination

Providing parameter sheet for design standard and automatic building tools

Usage of building/operating know-hows of NEC Cloud IaaS

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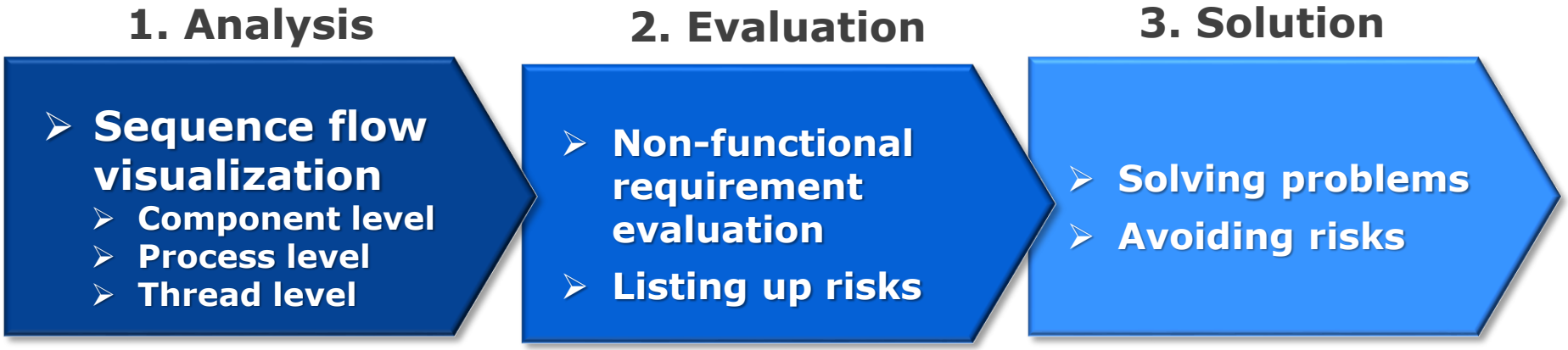
OpenStack quality enhancement

- Solving/avoiding problems quickly by non-functional requirement evaluation based on NEC's OMCS technology
- Modified codes are contributed to community to enhance the quality of OpenStack

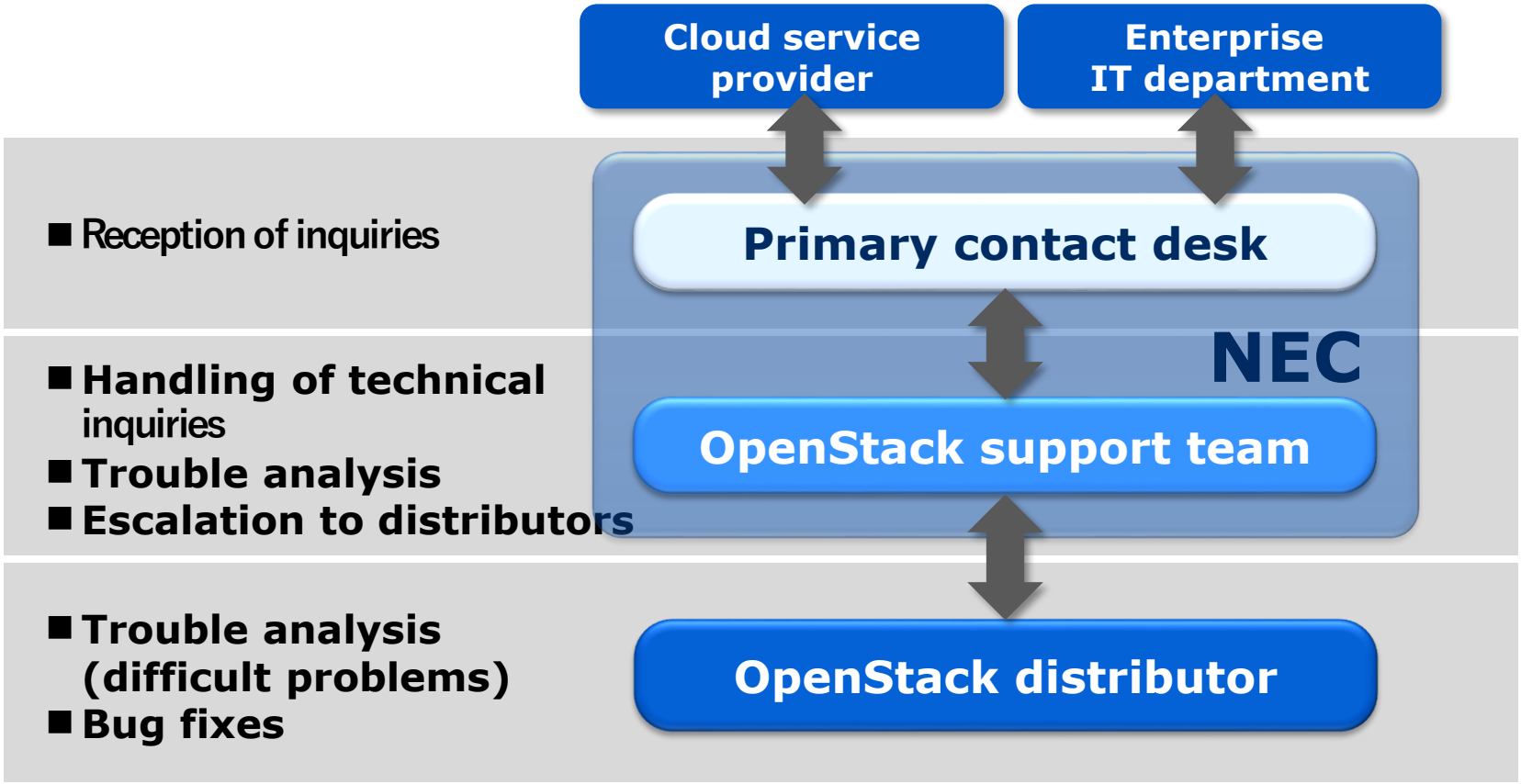


＊Non-functional requirements for mission critical systems

Total support organization

Providing one-stop support by OpenStack dedicated team for whole cloud platform including other OSSs

High SLA support service for OpenStack
24h × 7days / Emergency avoidance for failure



-New functions-

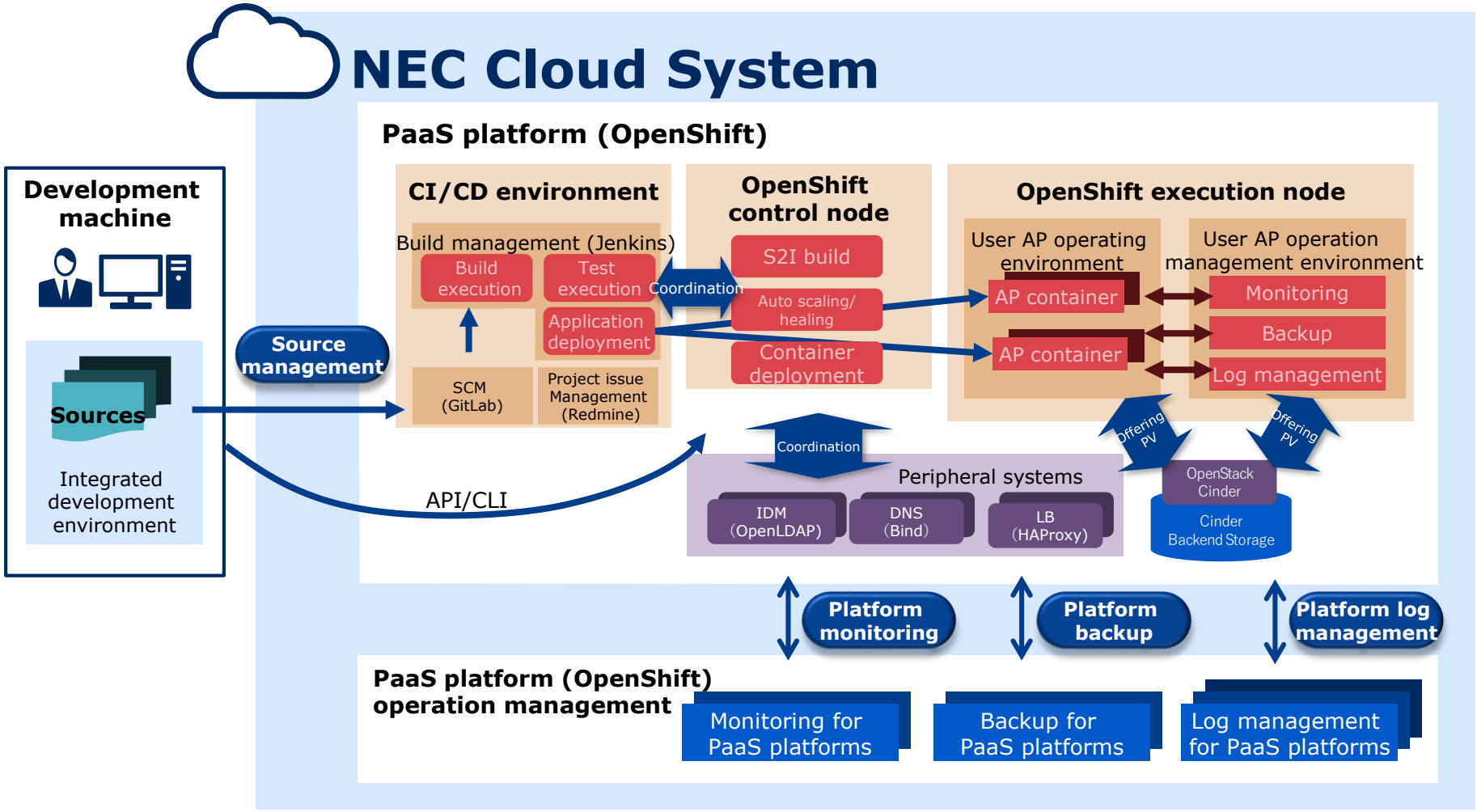
New Functions of NEC Cloud System OSS Building Model
To be released in December 2016

Main functions

(1) Offering of development environment for rapid digital business launch	PaaS platform (OpenShift)
(2) Further improvement of operability	VNF/PNF management for service providers and enterprises
(3) Quick incorporation of state-of-the-art technology through upgrade to latest version of OpenStack	Rolling upgrade
(4) Improvement of scalability and stability lacking in OpenStack network functions	OpenDaylight support

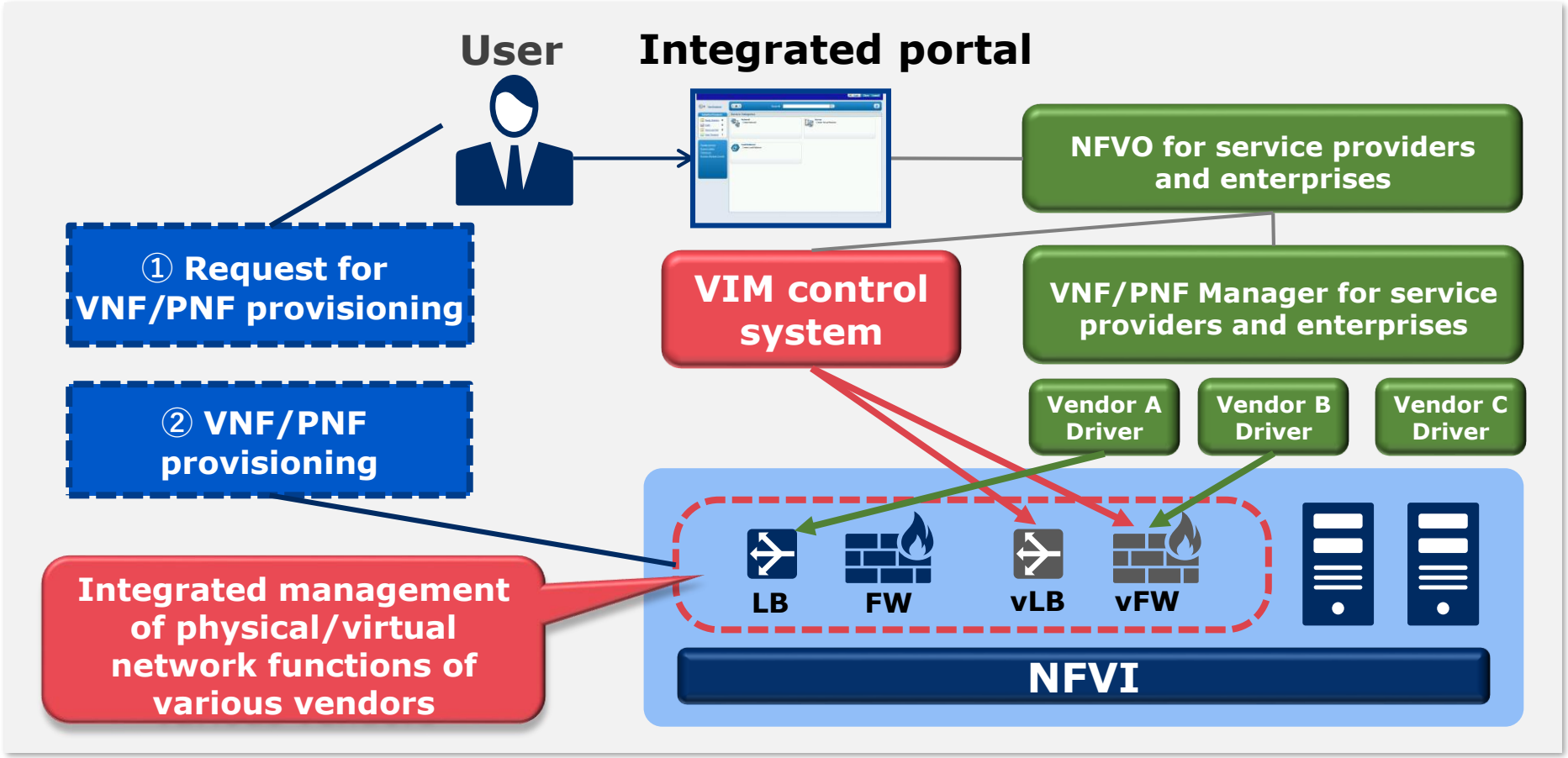
PaaS platform (OpenShift)

- Easily creates DevOps environment on IaaS environment built based on OpenStack
- Offers container-type application development environment that uses Docker



VNF*/PNF** management enhancement for service providers and enterprises

- Orchestration that supports various services such as firewalls and load balancers, for both physical and virtual network functions of various vendors
- Automatic generation of configurations



*VNF (Virtual Network Function):Network functions such as firewalls and load balancers provided by virtual appliances
**PNF (Physical Network Function):Network functions such as firewalls and load balancers provided by physical appliances

Summary

Summary

Pure open brings speed and flexibility.
Pure open overcomes platform limitations.

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