



SDN Vision for Social Cloud Infrastructure

2012/8/24

Cloud System Research Labs

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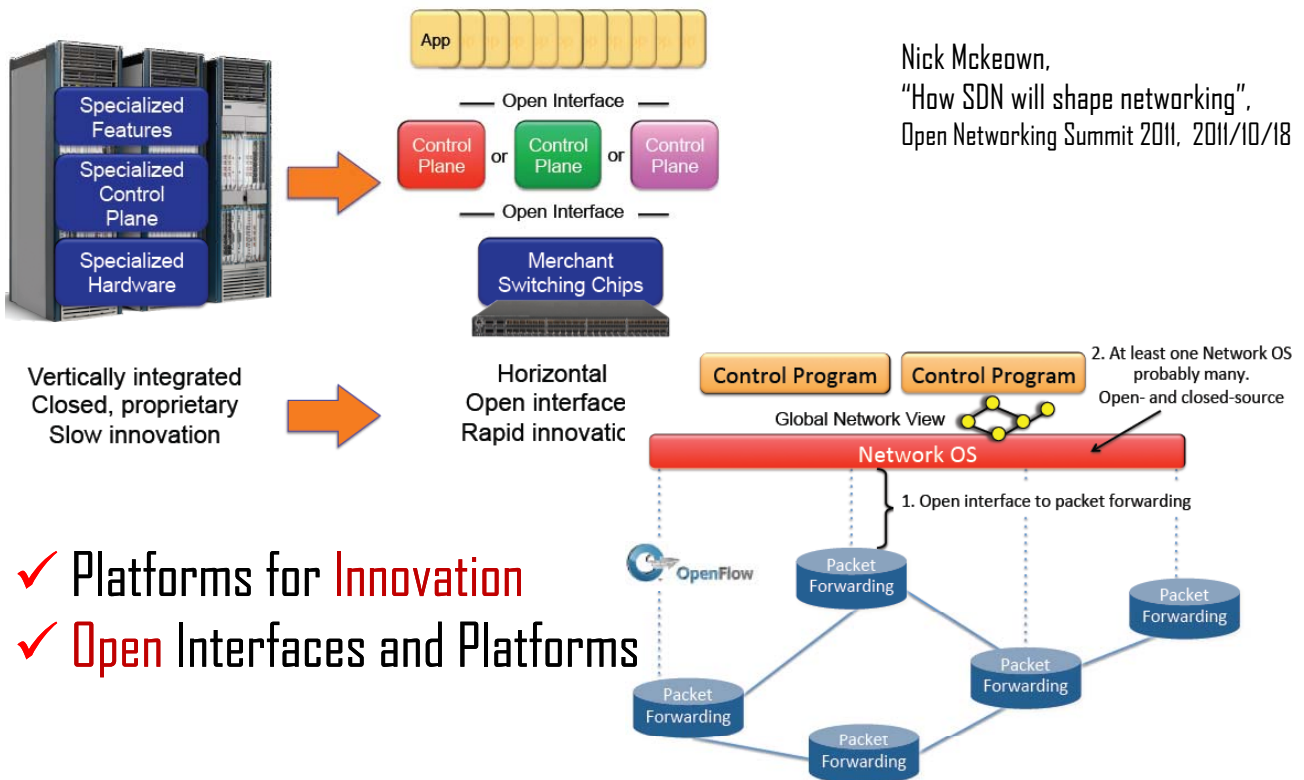
2nd Network Virtualization Symposium in Kyoto

Agenda

- Towards SDN (Software Defined Network)*
- ITNW Infrastructure Requirements in BigData Era.*
- NEC ProgrammableFlow and NW Virtualization*
- DSS Activities for OpenFlow / SDN*
- Other Research Challenges*
- Conclusion: Next Steps for SDN success*

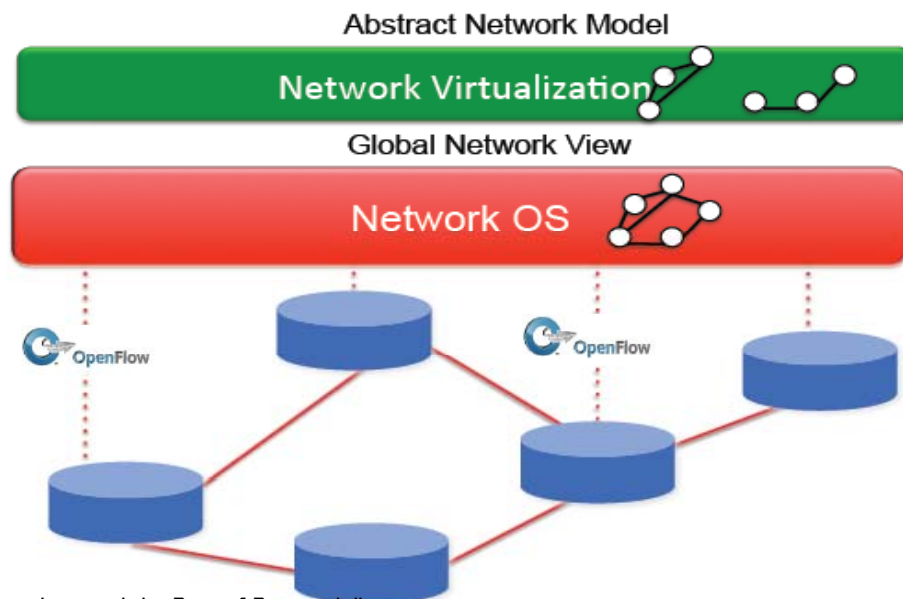
Towards SDN (Software Defined Network)

Driving force of OpenFlow/SDN



SDN and Network Virtualization

- ✓ **Network OS:** Hide heterogeneities of physical network resources
- ✓ **Net. Virtualization:** Abstraction & Simplification of Network Capabilities



Scott Shenker,
"The Future of Networking and the Past of Protocols",
Open Networking Summit 2011, 2011/10/18

How different is SDN from previous approach ?

Not Technical, I think

Environment: Clouds, Smart Phones, Big Data / Cyber-Physical

More User Centric, More Open, Smarter.. accelerate SDN !

SDN Expections

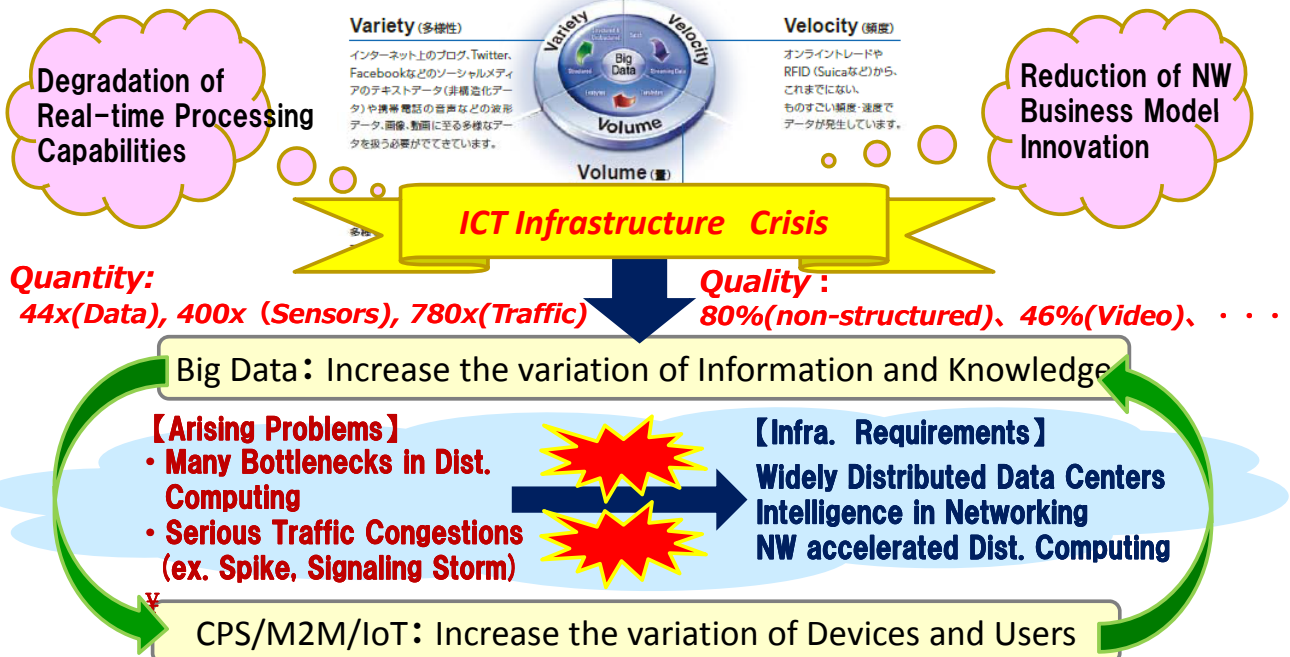
- Realize Sustainable / Evolvable Systems
- Grow out of Next Generation Syndromes
- **Abstraction and Simplification of Complex Systems**

Open, Abstracted, but Simpler Solutions for Networking !

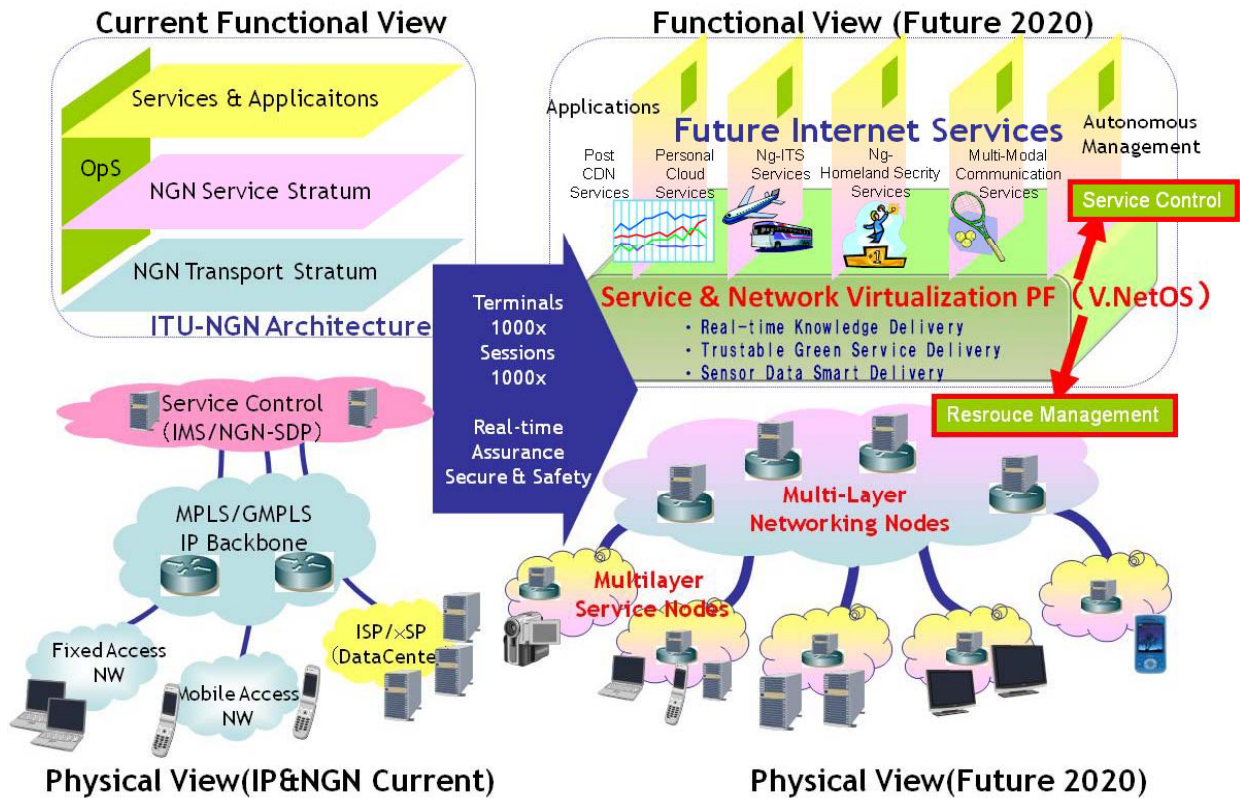
ITNW Infrastructure Requirements in BigData Era.

Req. on IT/NW Infrastructure in BigData/M2M Era.

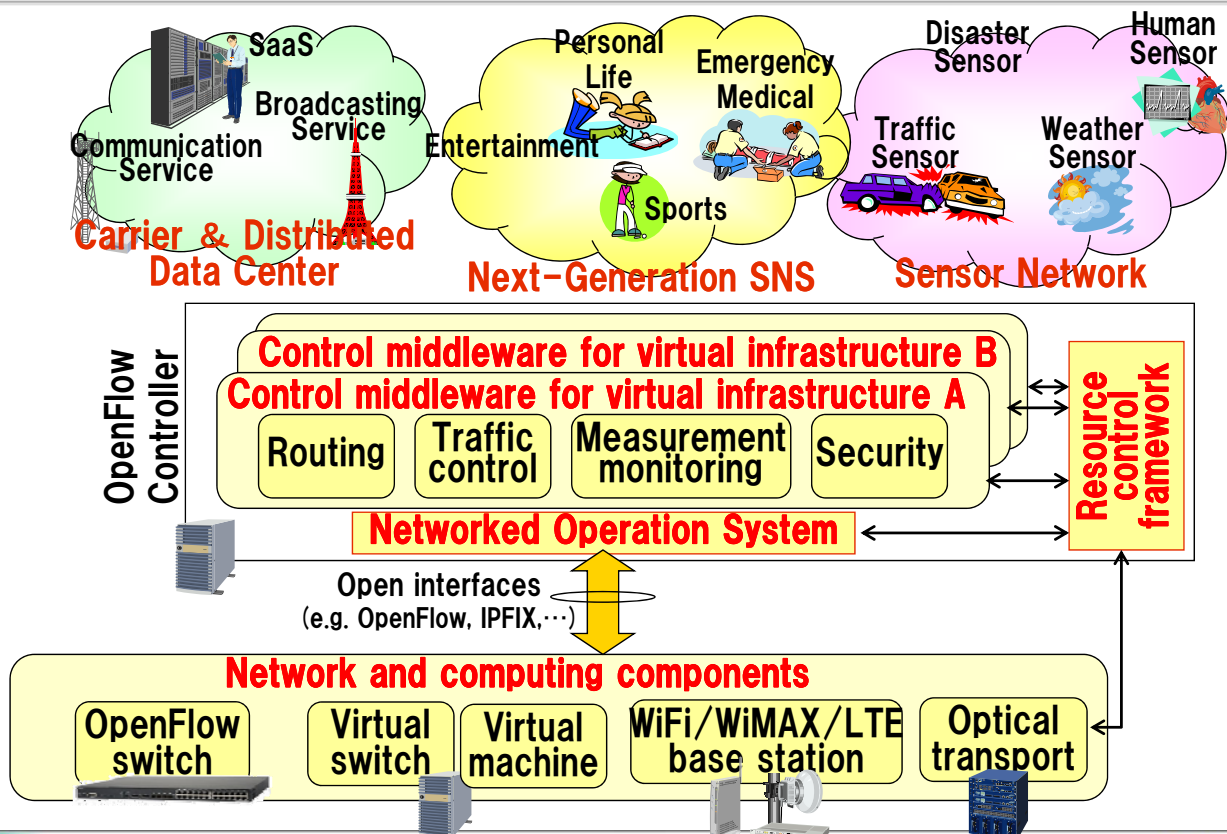
- Dist. Data Processing in DC will reach a Performance Limitation
- Data Transport also will reach a Scalability Limitation (e.g. many headers)



Future Networking View for BigData/M2M Services



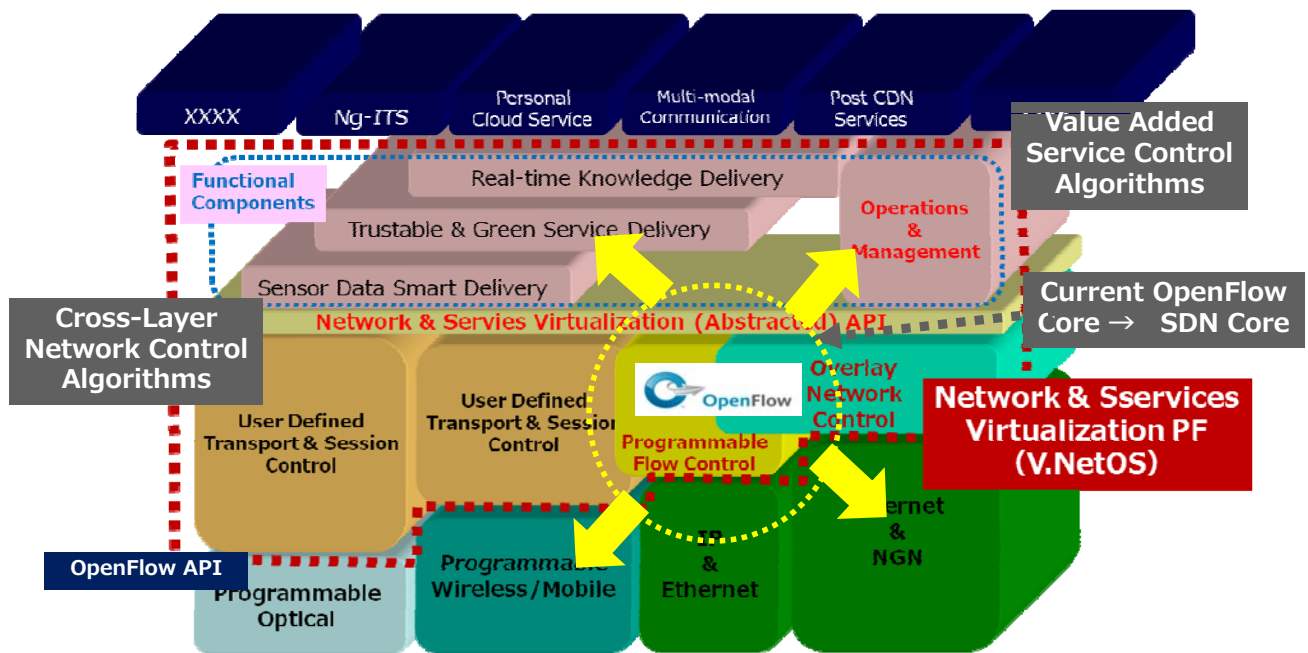
Open Platforms for Social Cloud Infrastructures



From OpenFlow to SDN Transition

Large-Scale DC → Ultra Dist. DCs → BigData/M2M Infrastructure

Global Eco-Systems: Tools, Open Source Software, Communities



NEC ProgrammableFlow and NW Virtualization

NEC's Position in Software Defined Networking

Core member of OpenFlow specs and trials

- Original member of Stanford Clean Slate Program & Laboratory (2007-2011), and Open Networking Research Center (ONRC) (2011-)
- <http://www.openflow.org/>
- Have been working together with Stanford to specify OpenFlow specs and succeeded in several OpenFlow trials in campus networks
 - Stanford/Georgia Tech/Rutgers , Internet2, JGN-X backbones



Contributions to Open Networking Foundation (ONF)(2011-)

- <http://www.opennetworkingfoundation.org/>
- Actively participating in ONF activities
- Succeeded in OpenFlow interoperability testing last week

World First OpenFlow Products shipments



Introducing ProgrammableFlow

Simple, Scalable, Secure, Open Networking

- First OpenFlow-enabled fabric
- Secure, barrier-free network virtualization
- Variety of applications: Cloud services, network aggregation, monitoring, DDOS, appliance pooling, and many others



Univerge PF Series

ProgrammableFlow Controller (PFC)



PF6800

ProgrammableFlow Switch Family (PFS)

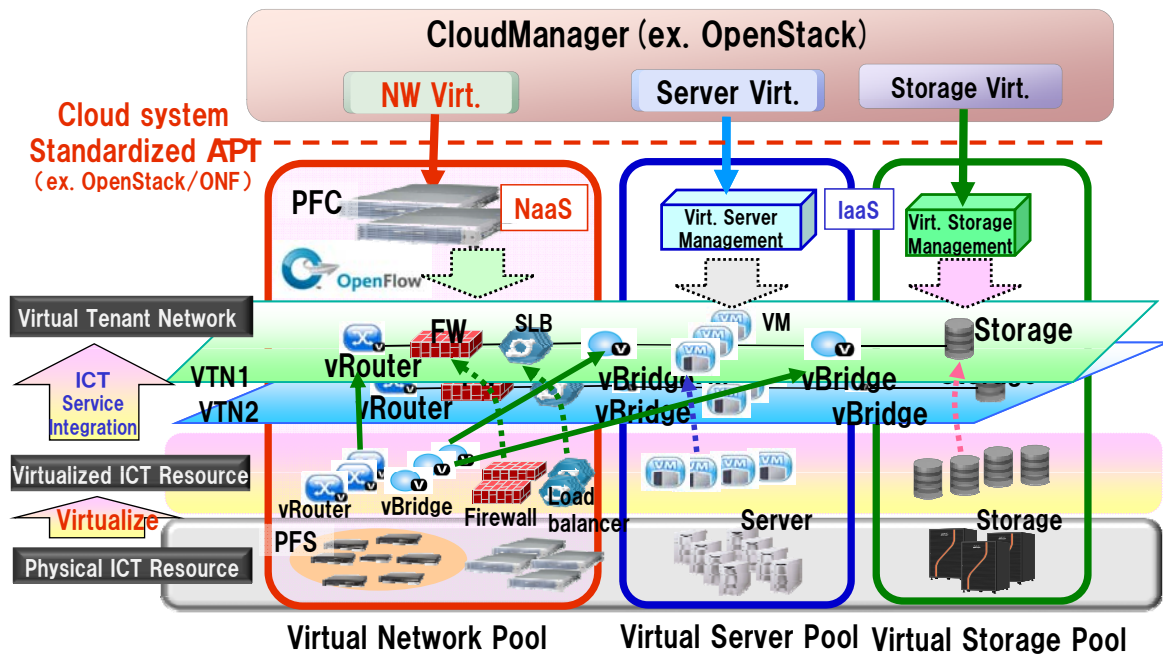


PF5820

PF5240

ProgrammableFlow Datacenter Virtualization

Virtual Tenant Network: Pooled Resources through Network Virtualization/Abstraction
Integrated ICT (Server, Storage, Network, Appliance, ..) Resource Operations by CloudManager

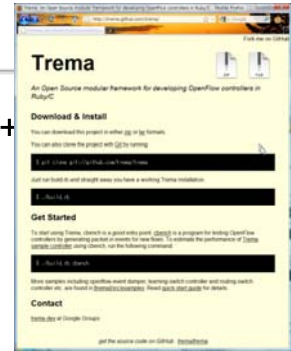


OSS activities for OpenFlow / SDN

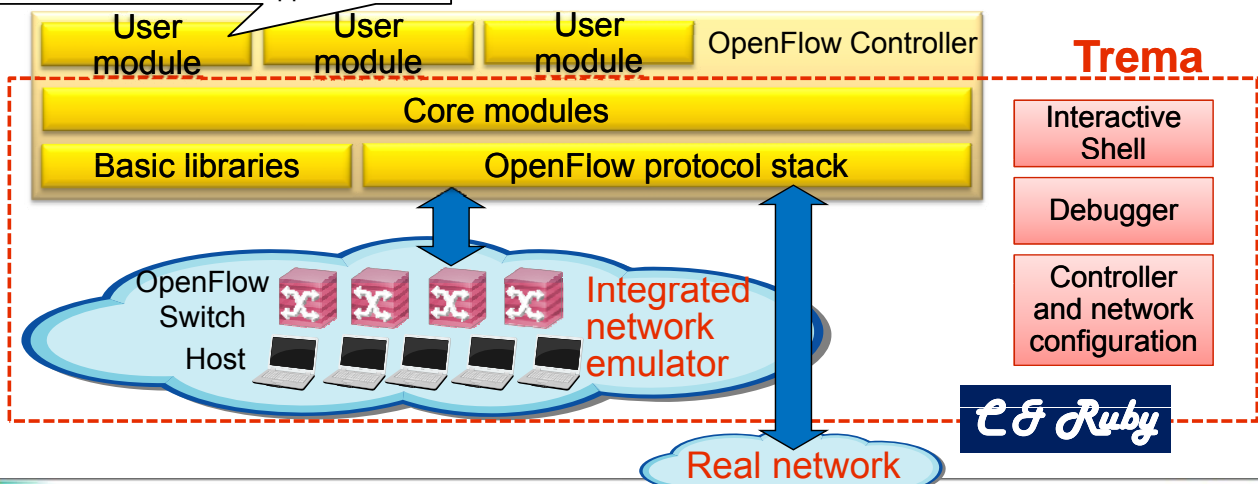
OpenFlow Framework: Trema (OSS)

- Trema = **OpenFlow framework** = controller platform + integrated network emulator and debugging environment
- Why framework? ---- Tight loops of "coding, testing, and debugging" makes high productivity

Routing control, topology discovery, Authentication-driven application



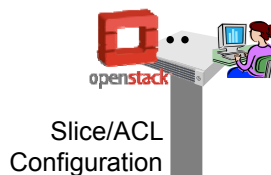
GPLv2 Free Software
<http://trema.github.com/trema>



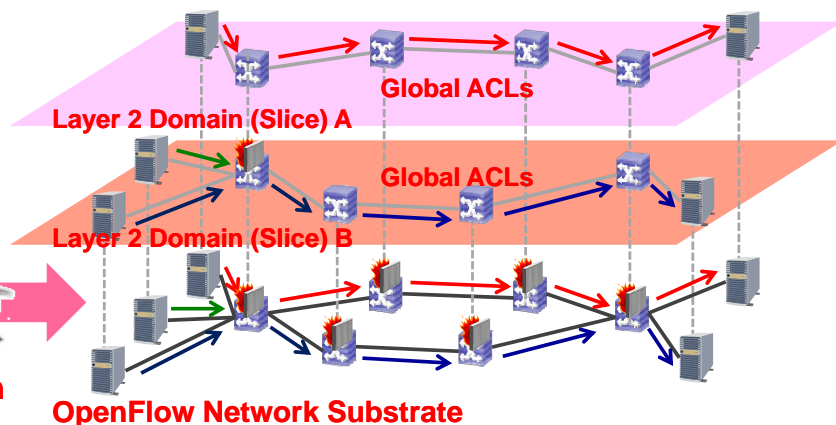
Trema Apps: Sliceable routing switch

- Trema application – free software (GPLv2)
 - **Layer2 network virtualization**
 - Virtual flat L2 network domains + L1-4 access control list
 - **Simple REST-API to create/remove/change slices**
 - Create slice with slice name and attach host by port or MAC

Slice management
 Access management



Sliceable routing switch on Trema



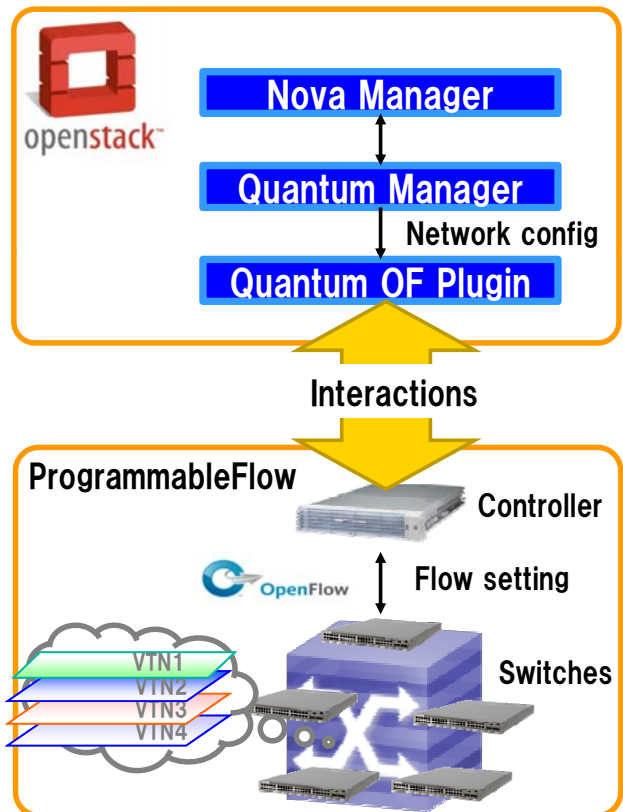
OpenFlow Quantum Plugin for OpenStack

Quantum Managers & OF Plugin

- OSS-based network design tool
- Extract virtual network configuration
- Manages the network configurations
- Deploy the configuration

ProgrammableFlow

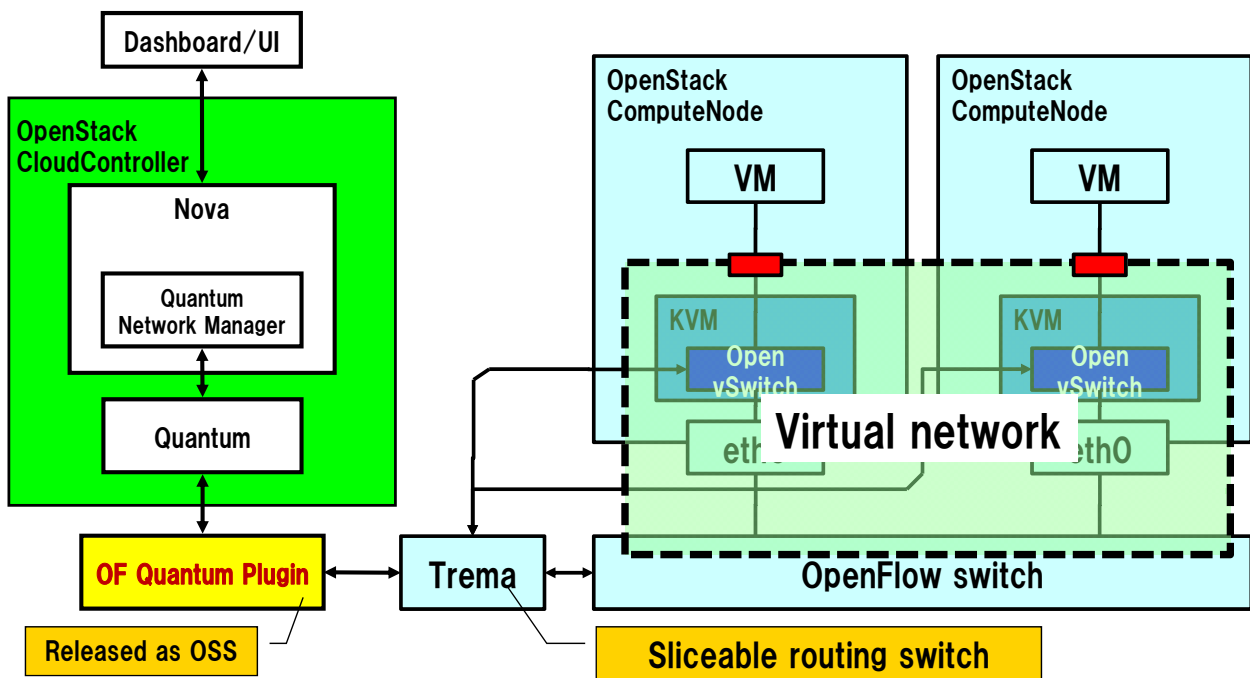
- Deploy virtual networking capabilities on the physical network
- Establishes flows for the networking capabilities and virtual machines
- Distribute flows when physical configuration changes



OpenFlow Virtual Network Config. through OpenStack

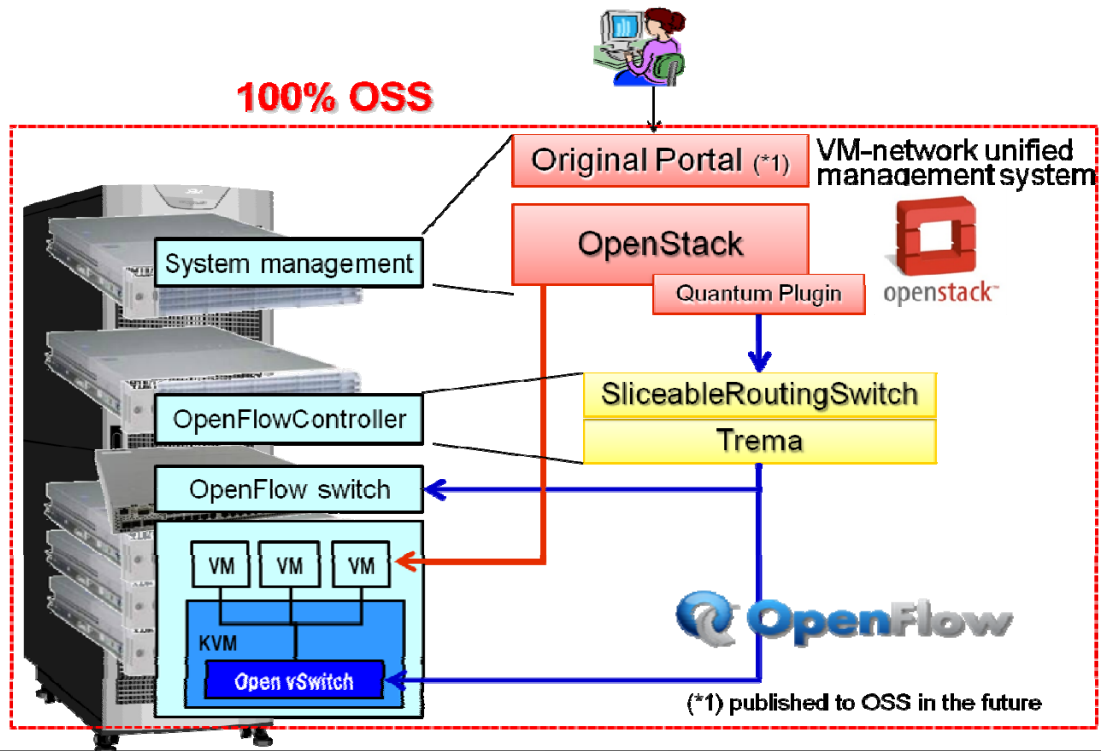
OpenFlow Quantum Plug-in is downloadable from :

<https://blueprints.launchpad.net/quantum/+spec/quantum-nec-of-plugin>



OpenFlow + OpenStack Rack

Ready to start for various collaboration projects !!



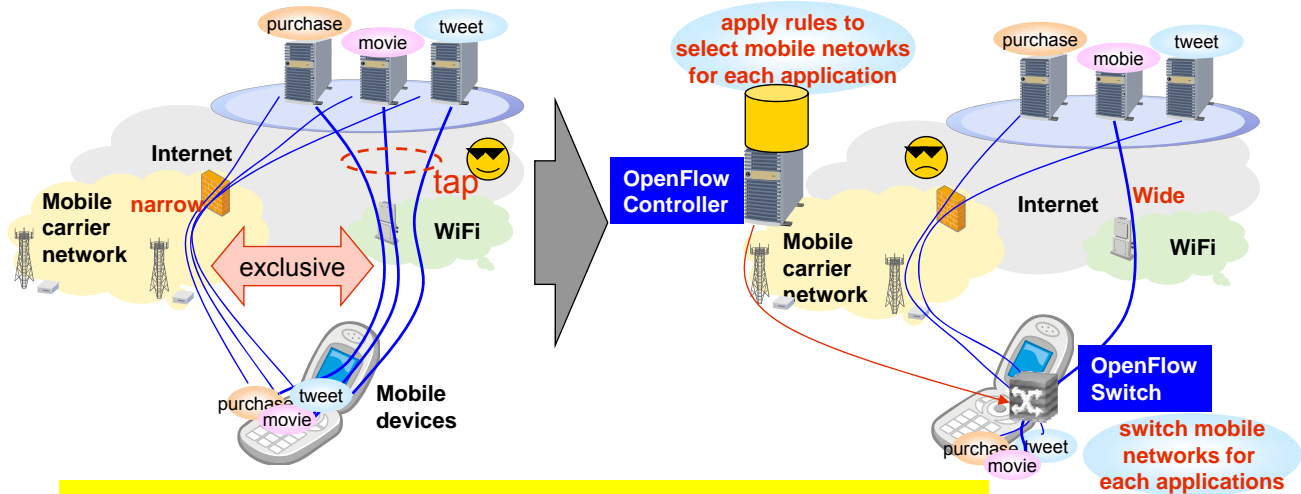
Other Research Challenges

WiFi Offloading against Mobile Traffic Increase

WiFi is used to reduce overload of cellular networks

Issues: **Security** and **Connectivity** of Wifi

Requirements: Operators driven network control for each mobile application



Configure the best network flexibly and provide high quality and efficient mobile communication services

Conclusion

Conclusion: Next Steps for SDN success

Towards realization of **Social Cloud Infrastructure**

- Graceful Evolution of Network Capabilities
- Technology Neutrality
- **System APIs for enabling Innovation**

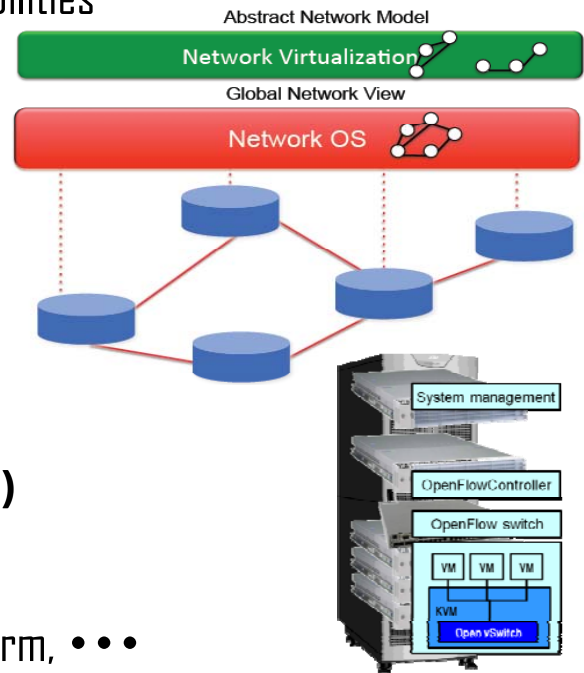


Network Innovation APIs

- Routing/QoS API → OpenFlow
- **Traffic Engineering API**
- **Operation API, Security API**
- **Communicating API (Hadoop, SNS, ...)**

(Re)Vitalization of Community

- R&D Ecosystems, Tools, Open-Platform, ...



Empowered by Innovation

NEC