NTT

NTT Information Sharing Platform Laboratories

Flows as a topology chart

Hiroshi ASAKURA, Kensuke NAKATA,
Shingo KASHIMA, Hiroshi KURAKAMI

NTT Information Sharing Platform Labs.

Background

- Target
  - IaaS platform (cloud computing environment)
  - ISP backbone

- Our Goals
  - Referring to our tool for provisioning / capacity planning
  - Reducing the cost for troubleshooting

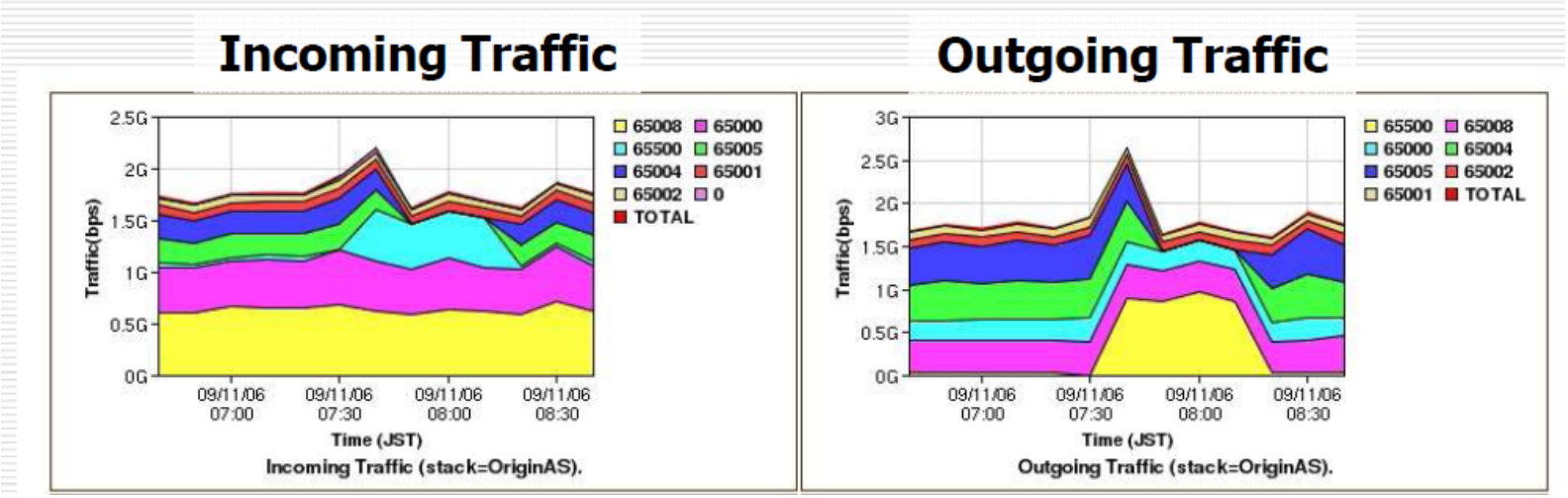
- Traffic Monitoring System “SASUKE”
  - “SASUKE” is a hero of Ninja, covert agent
    - fictitious character, a story of 16th century.
  - Collects Flow information from Exporters like a covert agent and report traffic information to a manager

“SASUKE”

Background – cont'd

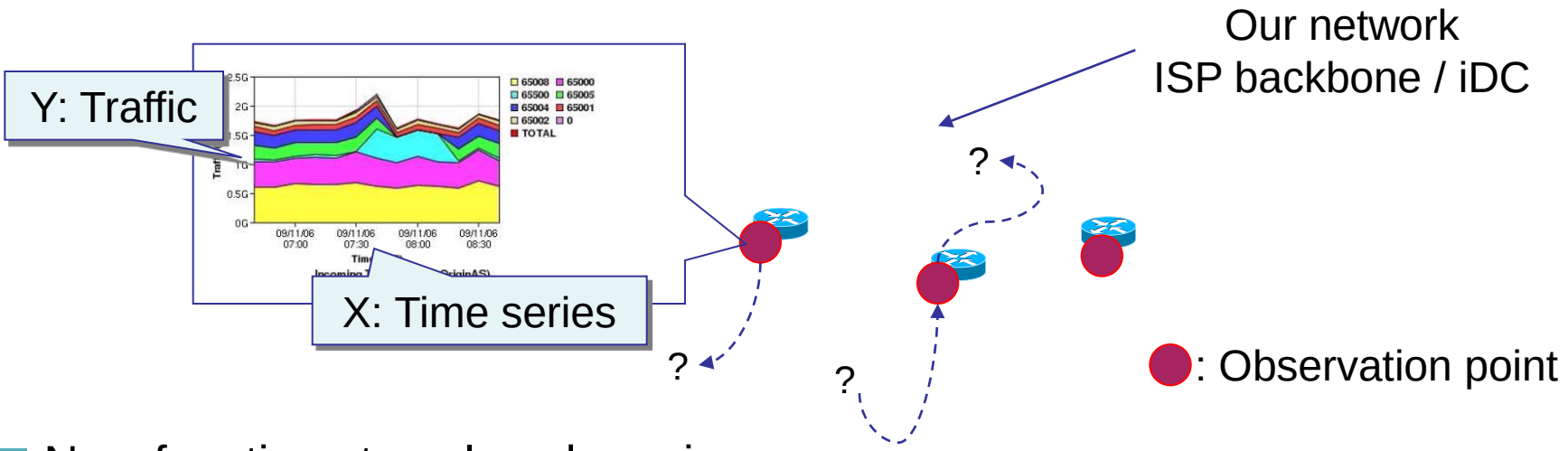
- In FLOCON 2010, last year
  - Atsushi Kobayashi
    "SASUKE" Traffic Monitoring Tool: Traffic Shift Monitoring Based on Correlation between BGP Messages and Flow Data

- Features of this system:
  - Visualizing traffic data using BGP routing information and Flow data.
  - Showing these data as a stacked line chart



An Issue

- A part of this system has been tested in commercial service, but there is an issue.
  - Only traffic change of observation point is visualized over the time by stacked line charts.
  - The chart doesn't show where flows go or come from.
  - We have to trace flows manually on inside / outside our network

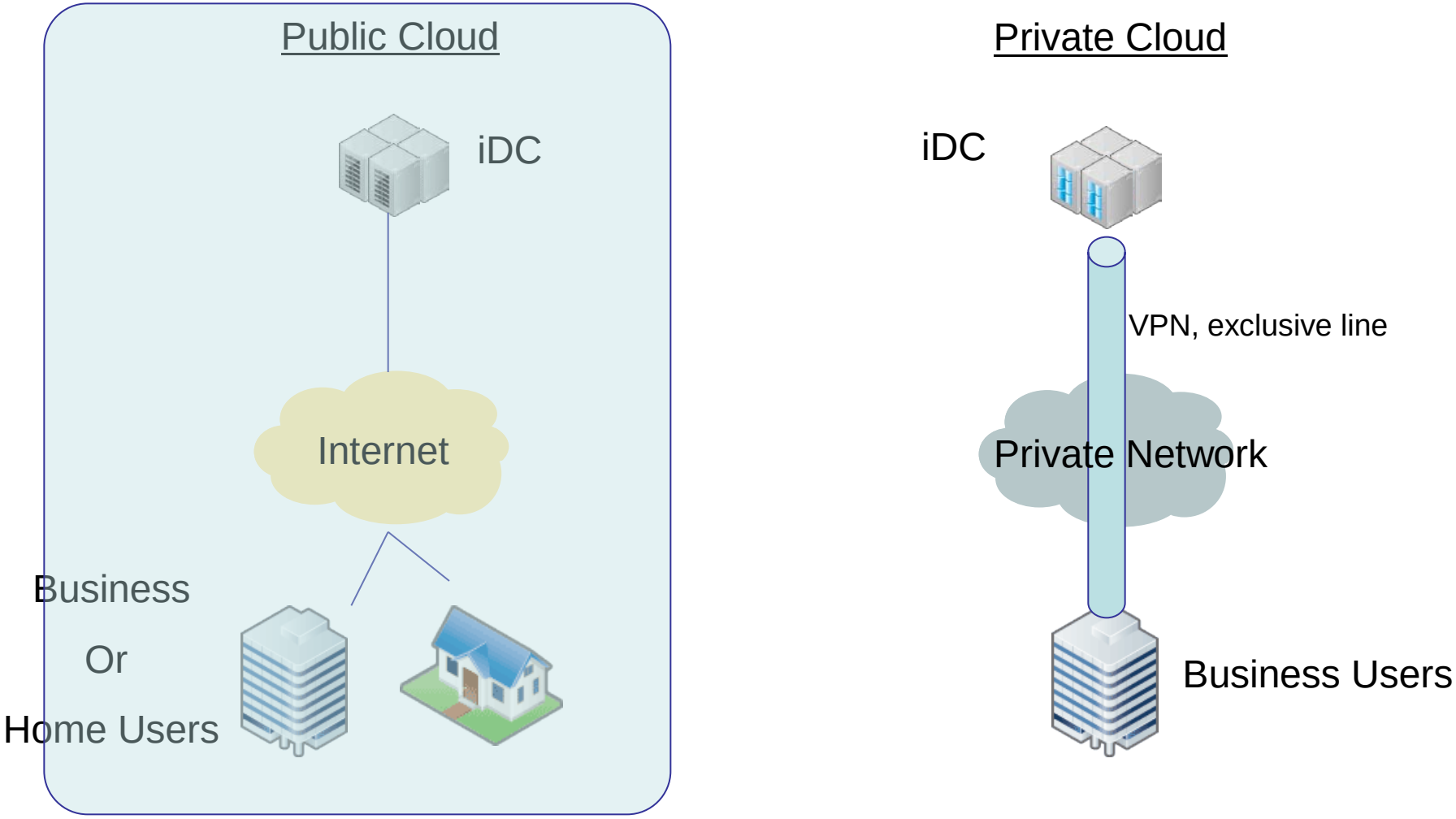


- New functions to solve above issue.
  - AS Network Topology Chart (for outside of our NW, iDC)
  - VM Network Topology Chart (for inside of our NW, iDC)

Outside of Data Center

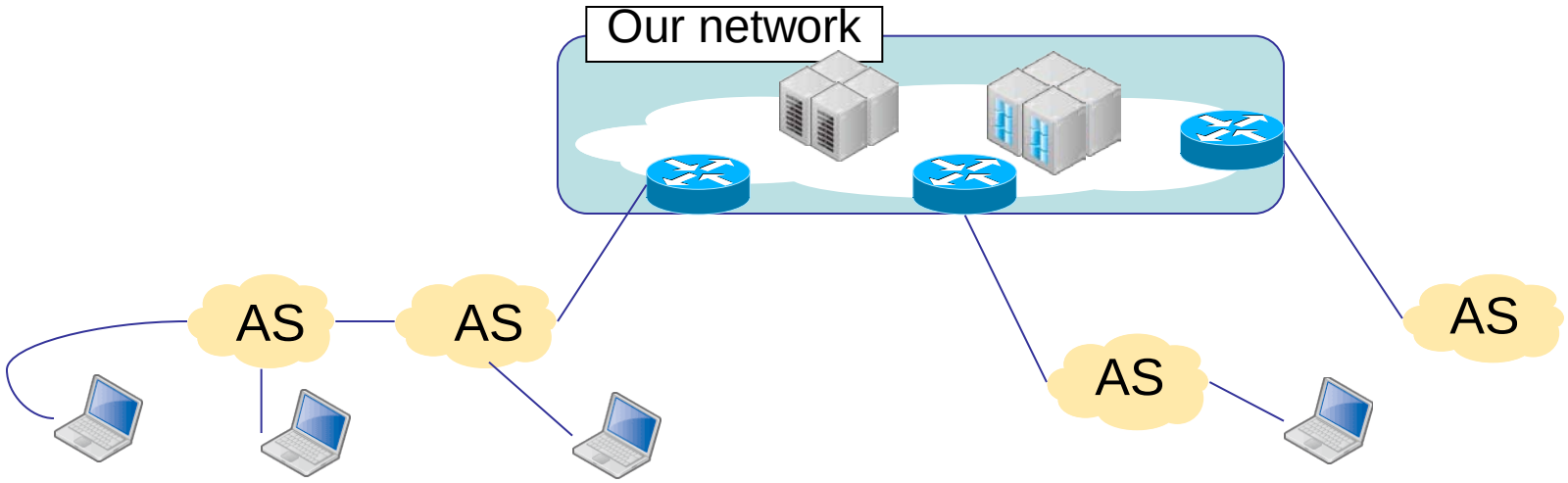
Clouds, Clouds, Clouds…

- Two types of cloud



A Network Architecture of a Public Cloud

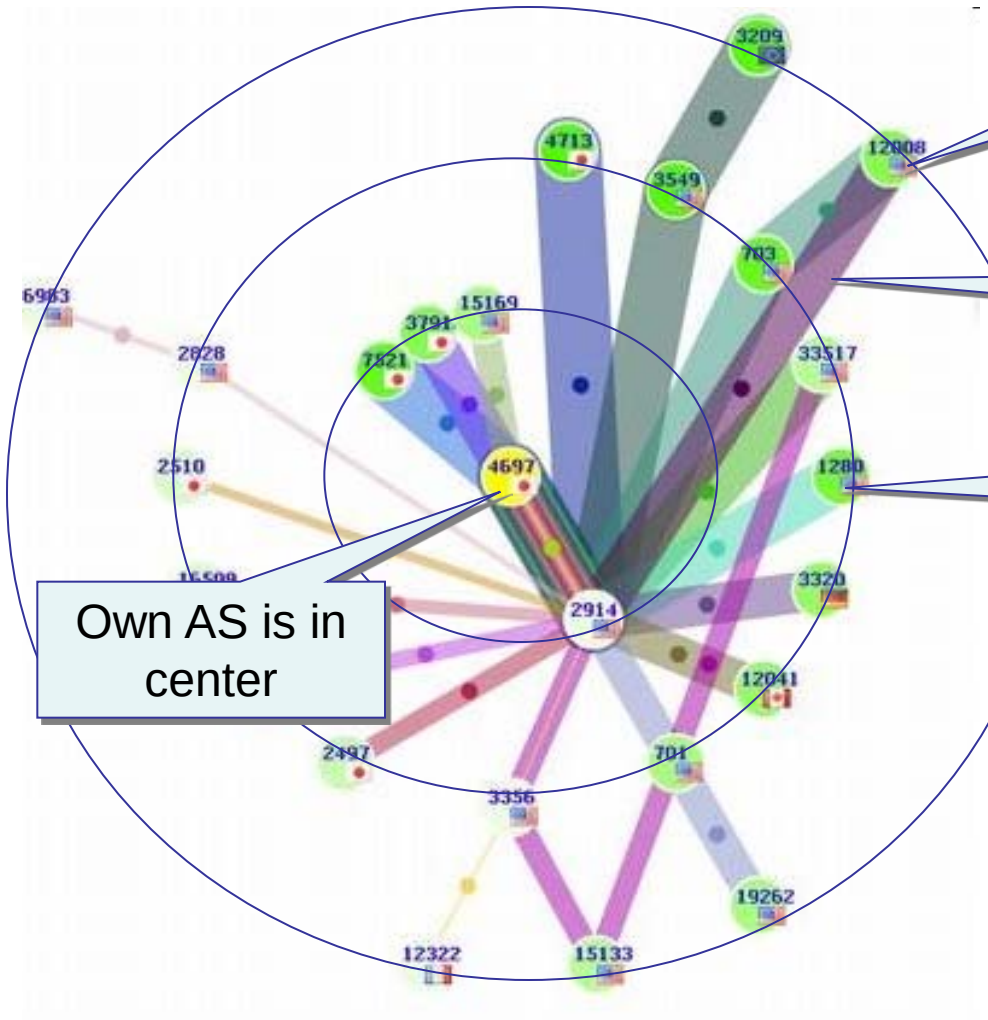
- AS's connect clients with servers of the data center.
- Complicated network.
  - The routes have been always changing.



- Knowing of end-to-end flow is very important
  - To reduce the cost of trouble shooting for IaaS operators.
  - To choose a location of data center for IaaS users.

New! AS Topology Chart

- Represents relationships between own AS and others
  - top-k traffic and BGP routing information of any 5 min.



Node: AS

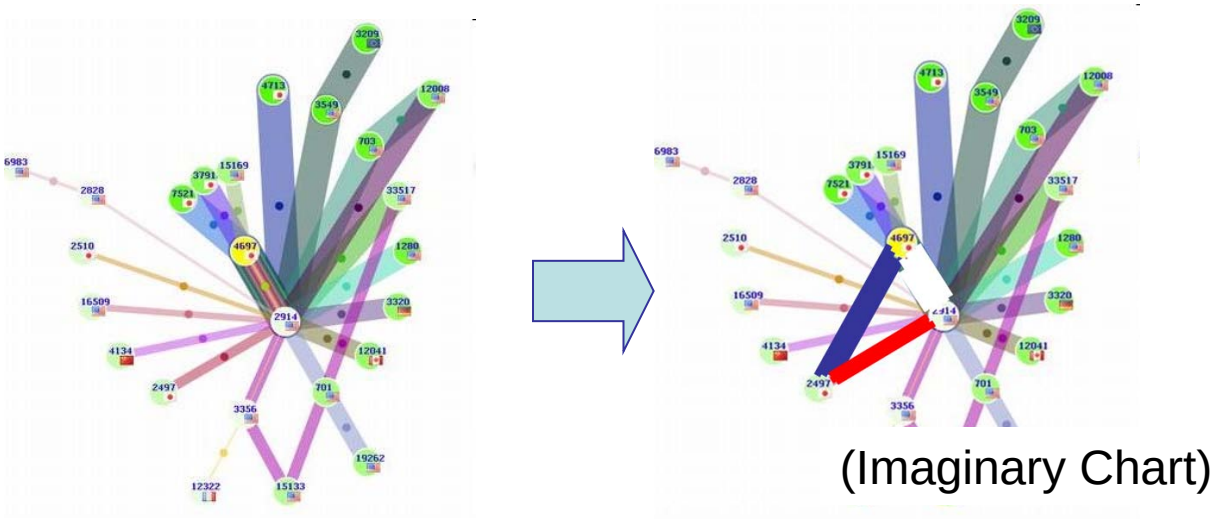
Width: traffic

Distance: hop count

Own AS is in center

Effectiveness (1) Roundabout Route

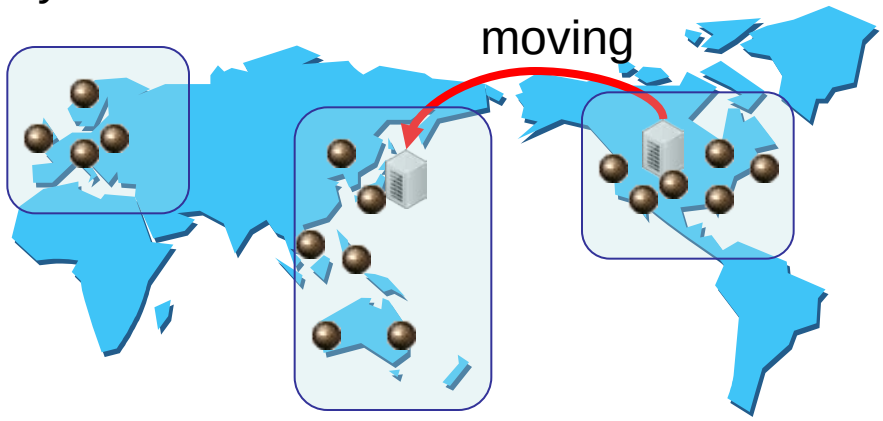
- Link Down between AS's
  - If a connecting link between AS's has gone down, the route may have changed and traffic which related with own AS may change extremely.
  - IaaS operators have to know what happened and whether roundabout route was created or not.



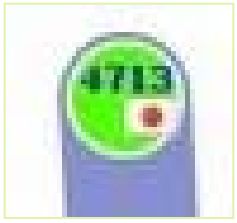
(Imaginary Chart)

Effectiveness (2) – Choosing iDC

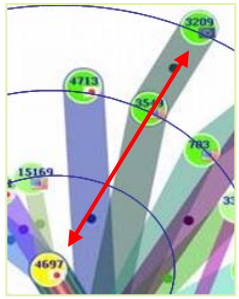
- Recently, IaaS users can choose a server location, typically, from Europe, North America or Asia Pacific.
  - In the near the future, choices may be increased.



- To choose a location of iDC, IaaS users can get some information from the chart.
  - Check large traffic nodes



foreign country?

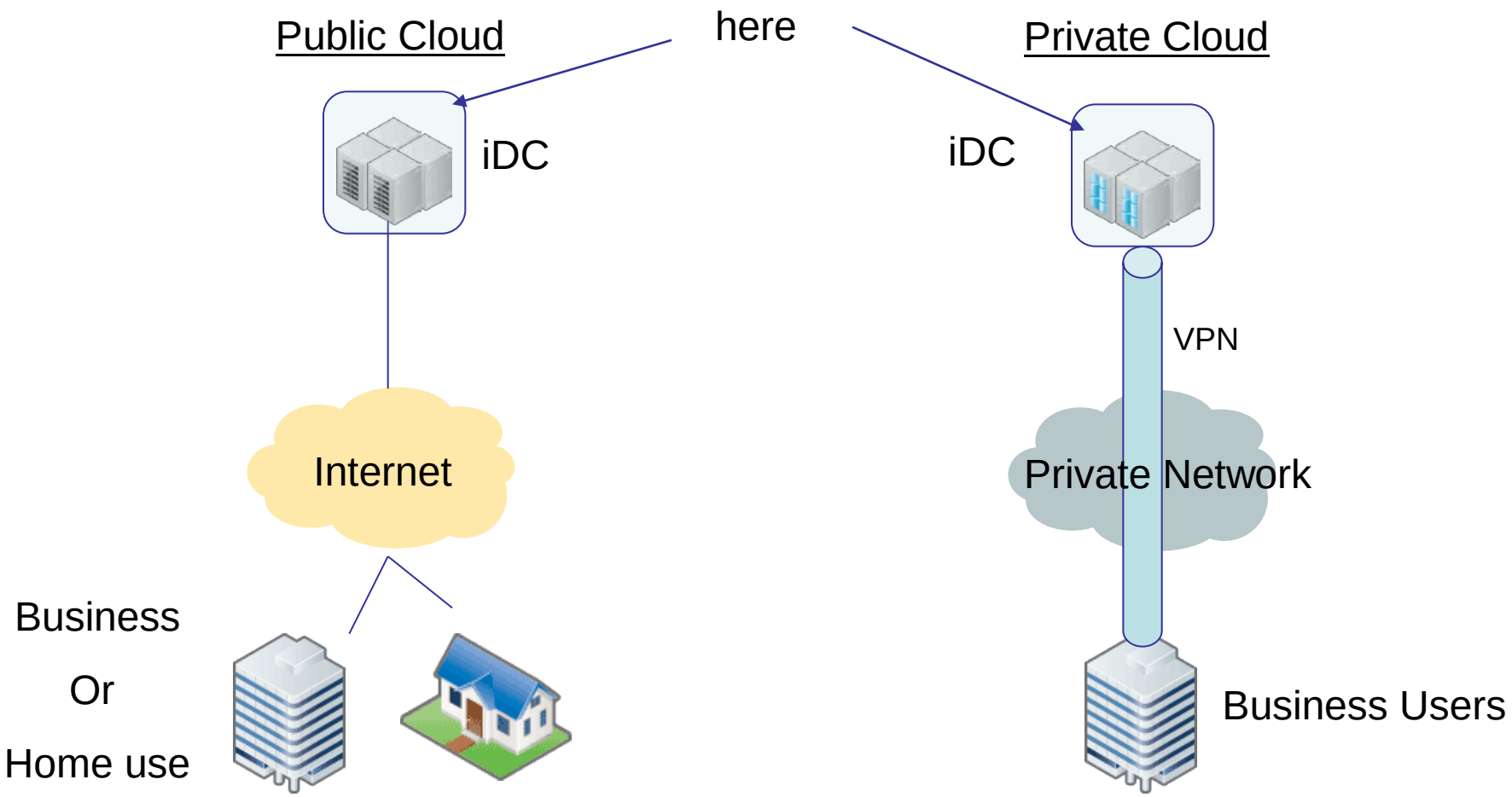


large # of hop count?

Next…

Inside of Data Center

Inside of Data Center



Features & Approaches

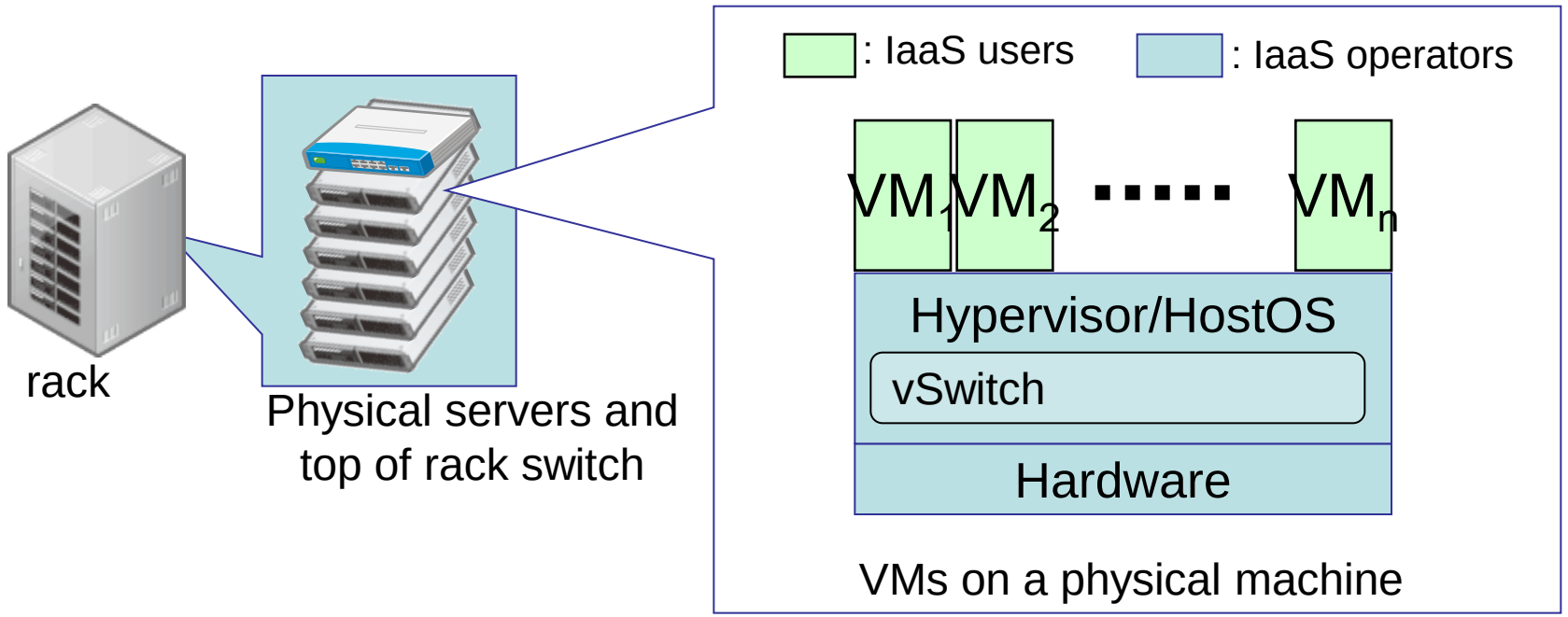
- More complicated structure than traditional one

- New technologies:
  - Virtualization technology
    - Physical machine includes virtual machines and switch(es)
    - Virtual LAN is also used

  - Live migration technology
    - Moving of a running VM to another physical machine without suspension
    - Any VMs may be moved to another physical machines, network structure may be changed.

- Approaches to visualization
  - Create a model of virtualized servers and network in a physical server.
  - Extend the visualizing scope to all physical servers in the data center.
  - Supporting the live migration is future work.

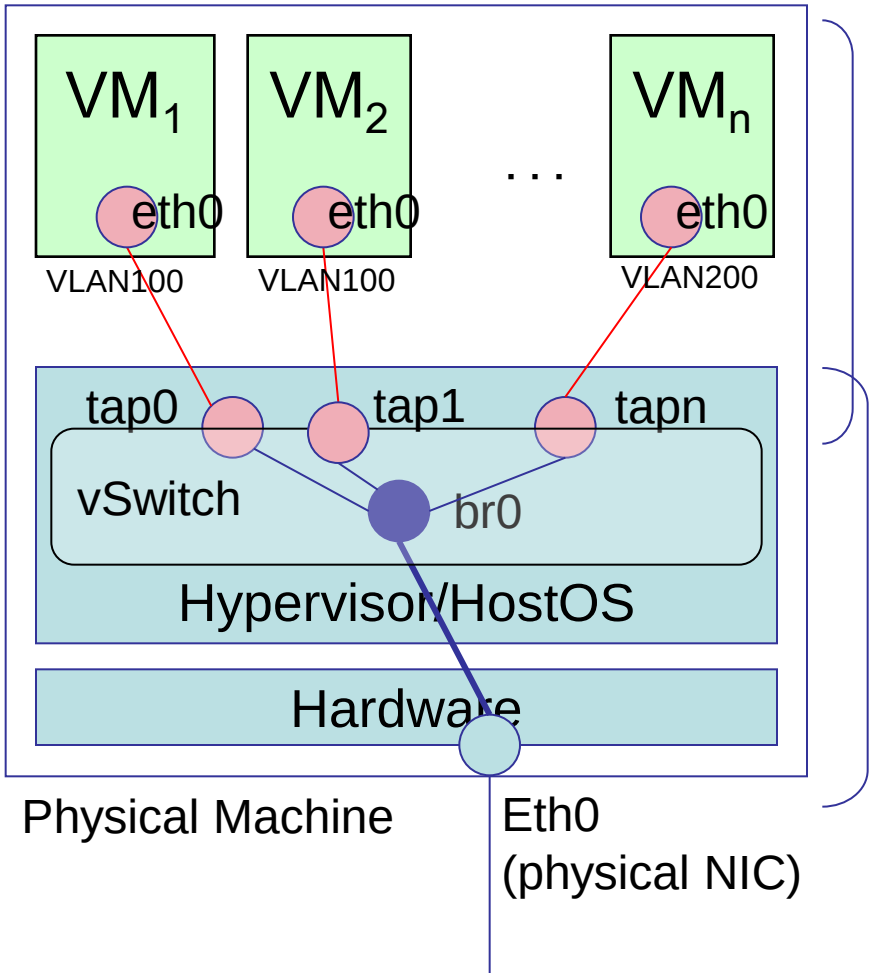
A Model of Virtualized Servers and Network



- VM (Virtual Machine) / Guest OS
  - A software implementation of machine
  - Logical instance, same as physical one
- Hypervisor / Host OS
  - Monitor and manage VMs
  - IaaS operator can control this component.

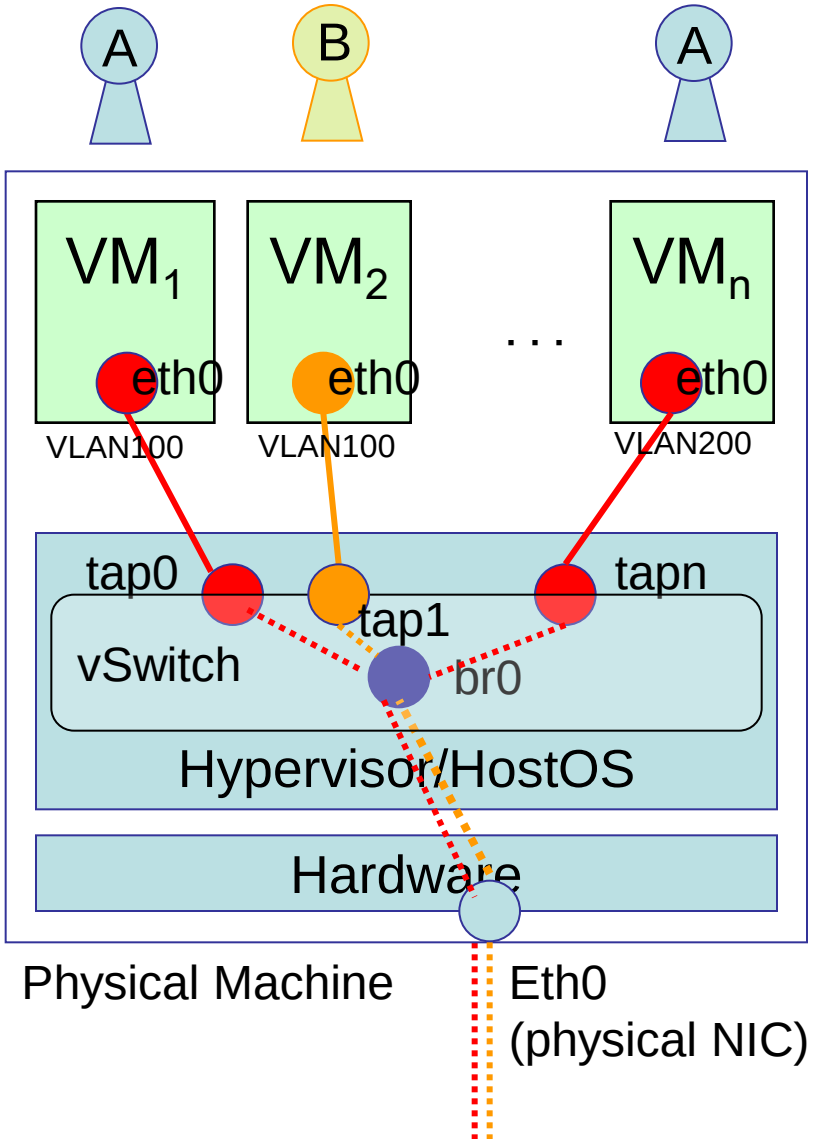
A Model of Virtualized Servers and Network

VMs and vSwitch on a physical machine



- VM – vSwitch
  - each VM has I/F (like eth0)
  - It is connected with tap device of Host OS
- vSwitch – physical NIC
  - Tap and bridge devices in vSwitch
- The bridge device is connected with NIC

A Model of Virtualized Servers and Network



- Tagged VLAN
  - Some users share a physical machine
  - Each user has to be separated from other users
    - Each user's VM has to be in same L2 segment

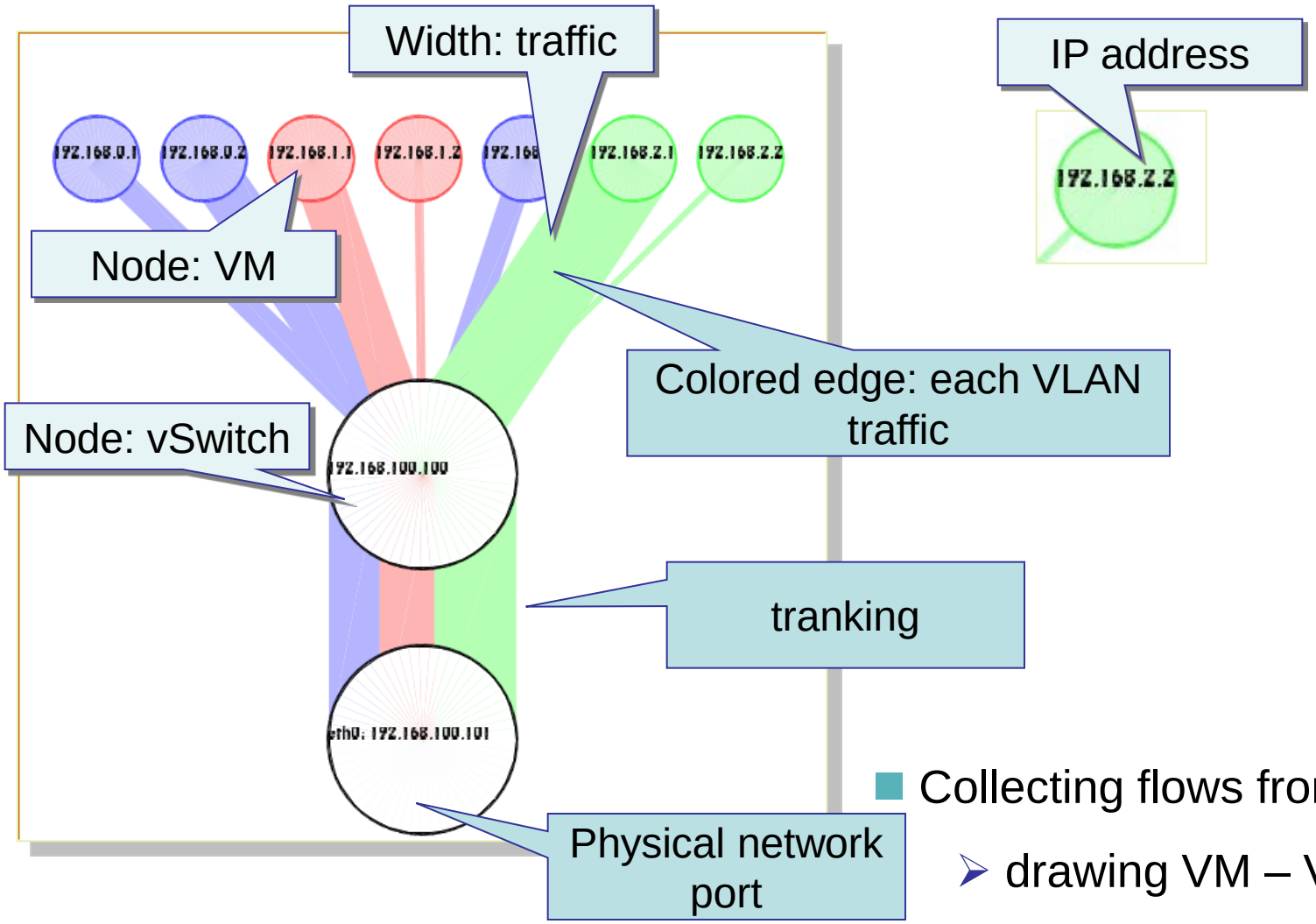
To meet above condition, tagged VLAN and vSwitch are needed.

Untagged packet

Tagged packet

New! VM Network Topology Chart

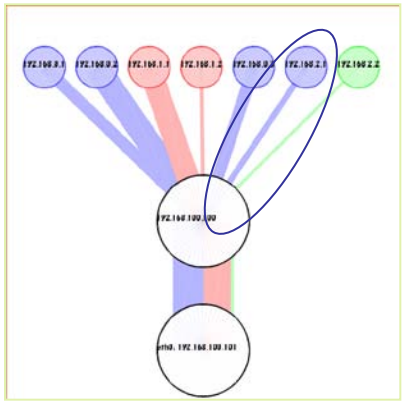
- Shows a traffic topology in the physical server



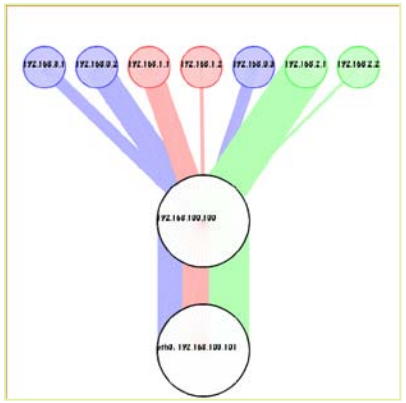
- Collecting flows from vSwitch
  - drawing VM – VM traffic.

Effectiveness

- Finding a misconfiguration of VM and vSwitch

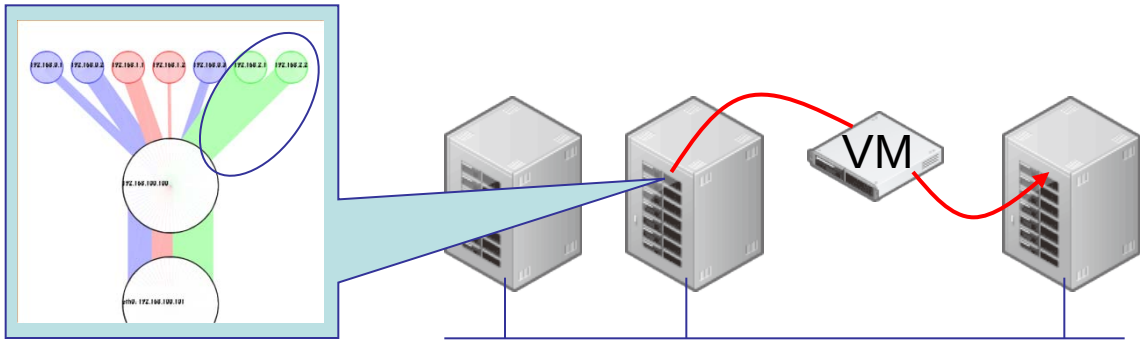


Abnormal case



Normal case

- Finding VMs which should be moved in capacity planning and migration



(extending the scope of visualization may be needed)

Future Works

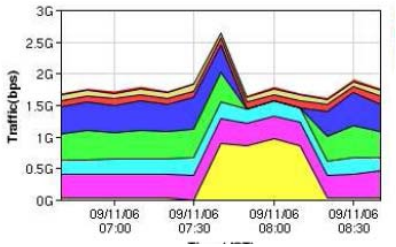
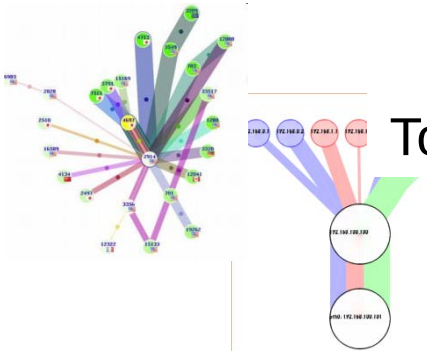
- Extending visualization scope to all of the server and network in our iDC.
  - The scope of the chart is only one physical machine now
  - Processing very large flow data

- Supporting next generation data center technologies
  - Not only basic VLAN (802.1Q) but also MAC-in-MAC (802.1aq/802.1ah) and VN-TAG (802.1Qbh)
  - using draft-kashima-ipfix-data-link-layer-monitoring-04
    - which is flexible IPFIX extension for all kinds of L2 components.

- Supporting changes of VLAN and VM location automatically
  - Live Migration, increase/decrease in the number of VMs
  - Linking resource DB

Conclusions

- We challenged to visualize inside and outside of our network by network topology charts using Flows.

Type of chart	We can know…
 Line chart	A traffic change over the time (a part of a complicated network)
 Topology chart	Relationships of each node and an overview of a complicated network.

The more complicate network we observe,

the more important these topology charts.