Okinawa Open Days 2014

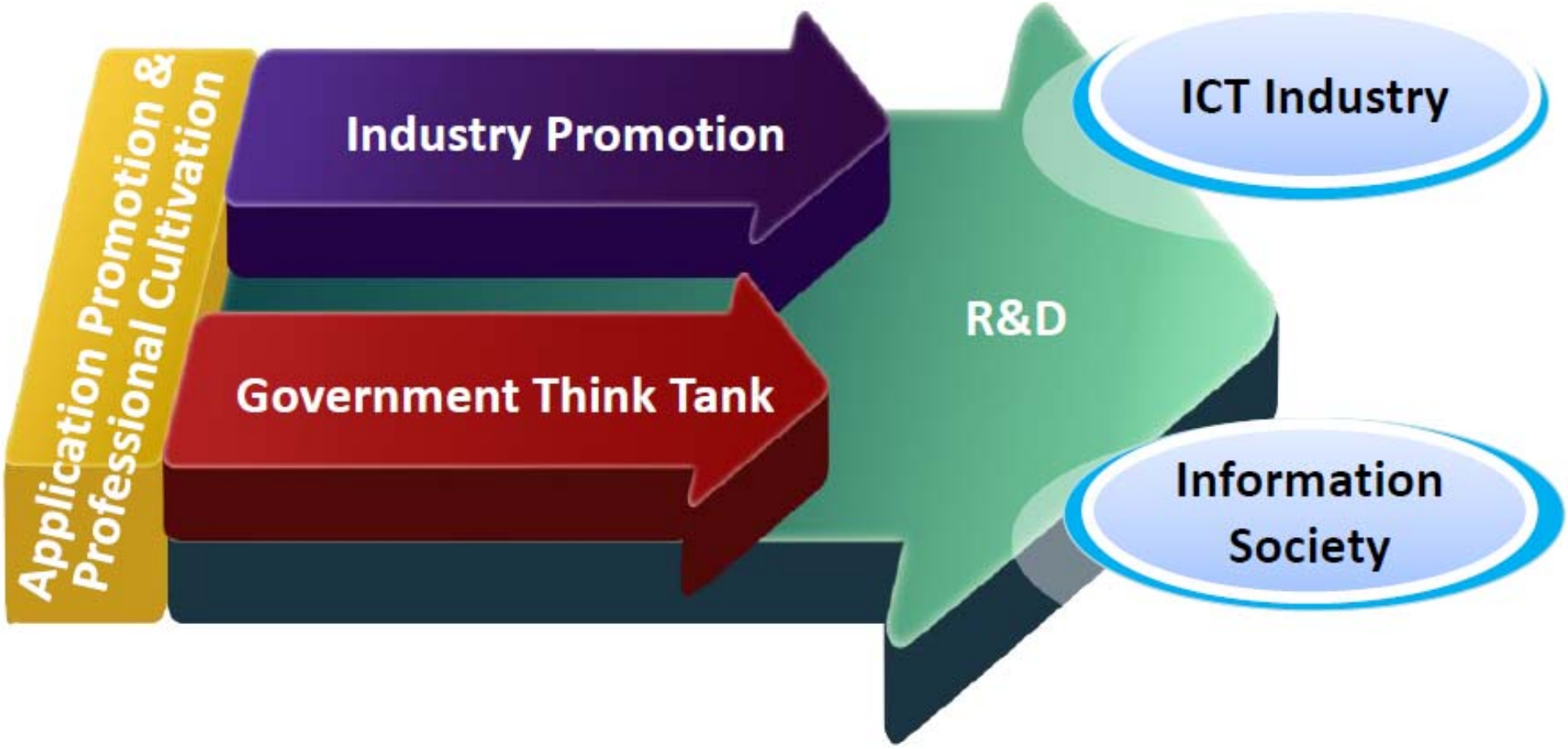
SDN Development in Taiwan

Wen-Chien Hung
Broadband Network Applications Center
Institute for Information Industry (III)
Dec. 11, 2014

Who are we?

- Institute for Information Industry (a.k.a. III) founded in 1979 as a Government Sponsored Research & Development Organization
- HQ in Taipei, with the Goal to Develop a World-class Information Industry as well as Society in Taiwan, R.O.C.
  - Facilitate the Development of Domestic Information and Communication Technology (ICT) Industry
  - Promote the Application of ICT in Public & Private Sectors
  - Pivotal Contribution to the Development of a Taiwan's ICT Industry & Information Society

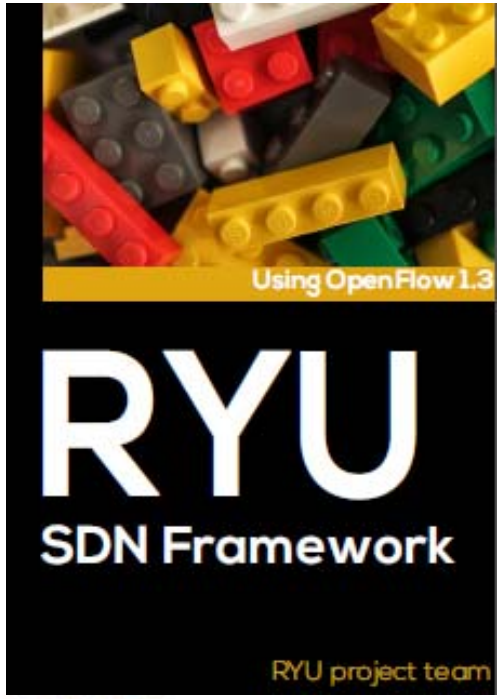
Our Operation & Business Focus

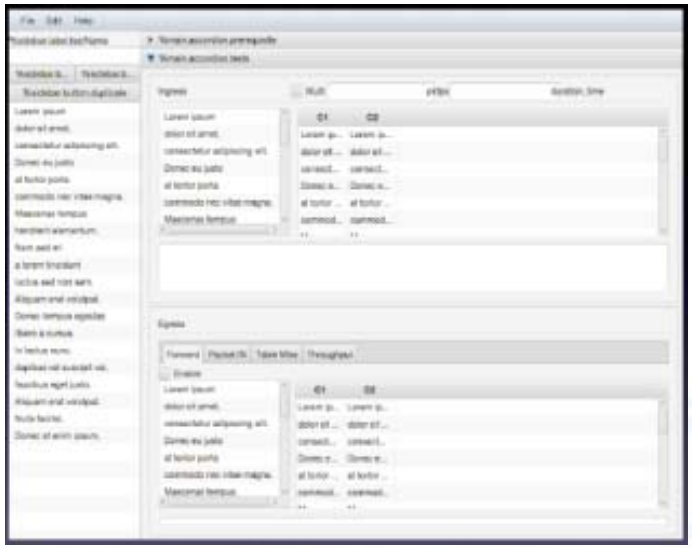


Member of OOL

- III is the first invited member of OOL in Taiwan
  - Ryu Framework Joint Development
  - Ryu-based International SDN Testbed: Remote Connection between Japan and Taiwan
  - Ryu Book Translation (Chinese version)
  - Ryu Certification: Graphic User Interface

OKINAWA OPEN LABORATORY





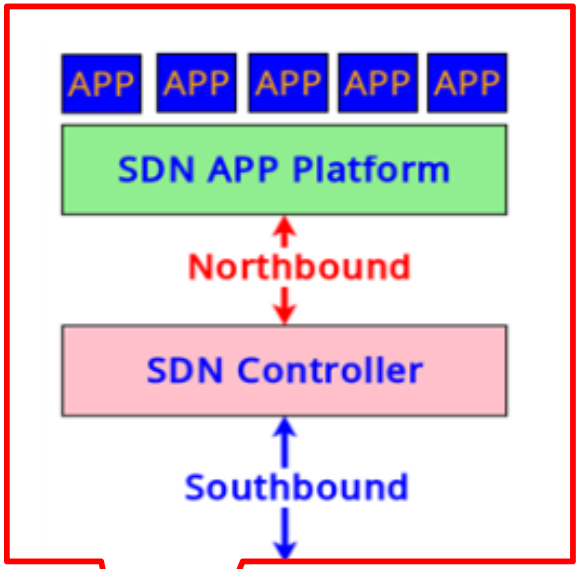
Our Efforts in SDN

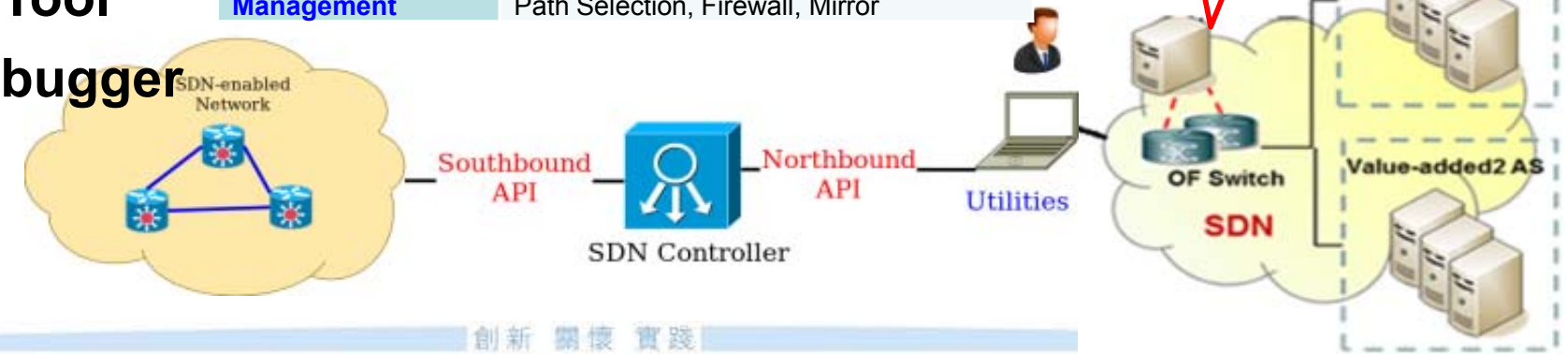
Highly Involved in SDN Development

Our Major Topics in SDN

- Broadcast-Free Network
- Intelligent Multiple WAN
- IGMP-enabled SDN
- DDoS Mitigation
- APT Prevention
- Centralized Management Tool
- OpenFlow Debugger

System Information	
OS	Linux
Language	Python 2.7
OpenFlow	
OpenFlow	1.3
Northbound	Restful API
Controller	Ryu
Network Functions	
L2 Switching	ARP Proxy + Shortest Path Switching
IP	IPv4
Tunnel	GRE Tunnel
DHCP	Support DHCP with 65535 clients
Routing	Shortest Path Routing
Switch and Link Discovery	LLDP Support
Loop Avoidance	Support
QoS	Support max transmission rate control
Firewall	Ethernet/IP/TCP/UDP rules support
Mirror	Support
DDoS Mitigation	Support
APT Prevention	Support
Network Management	
Visualization	Topology, Switch/Flow Statistics
Management	Path Selection, Firewall, Mirror

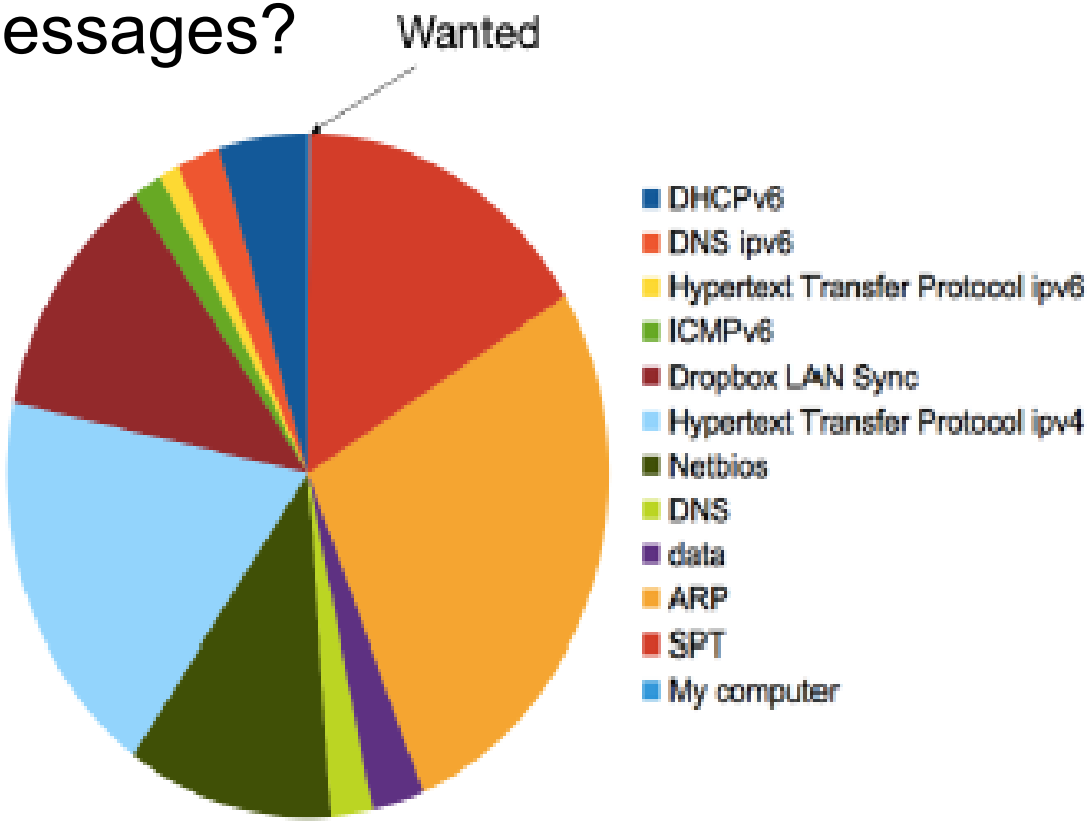




Broadcast-Free Network

We have built an OpenFlow-based network solution without any broadcast messages.

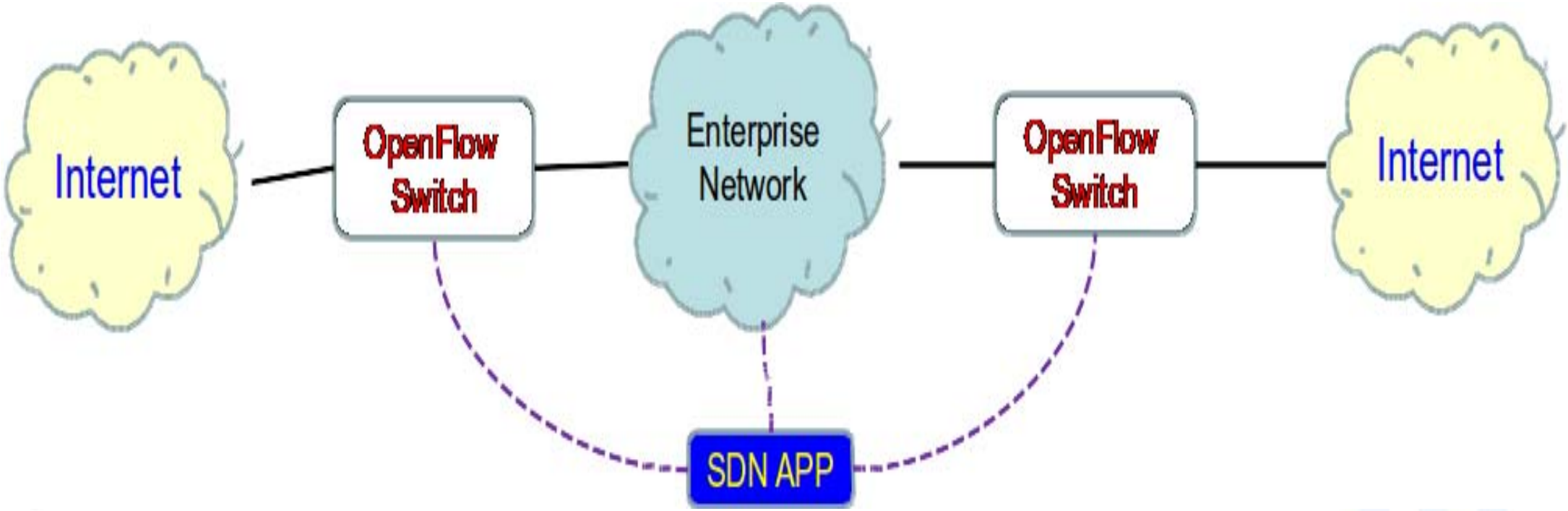
- There are many broadcast messages in legacy networks: ARP, DHCP, IPv6, NetBios . . .
- Why do we need broadcast messages?
  - *We have no idea where our targets are.*
  - *We want to announce something in a subnet.*
- Do we need a loop-free topology for avoiding broadcast storming?
  - *STP is an inefficient protocol.*



Intelligent Multiple WAN

We have built a Multiple-WAN SDN solution, which supports NAT and policy-based WAN traffic dispatching

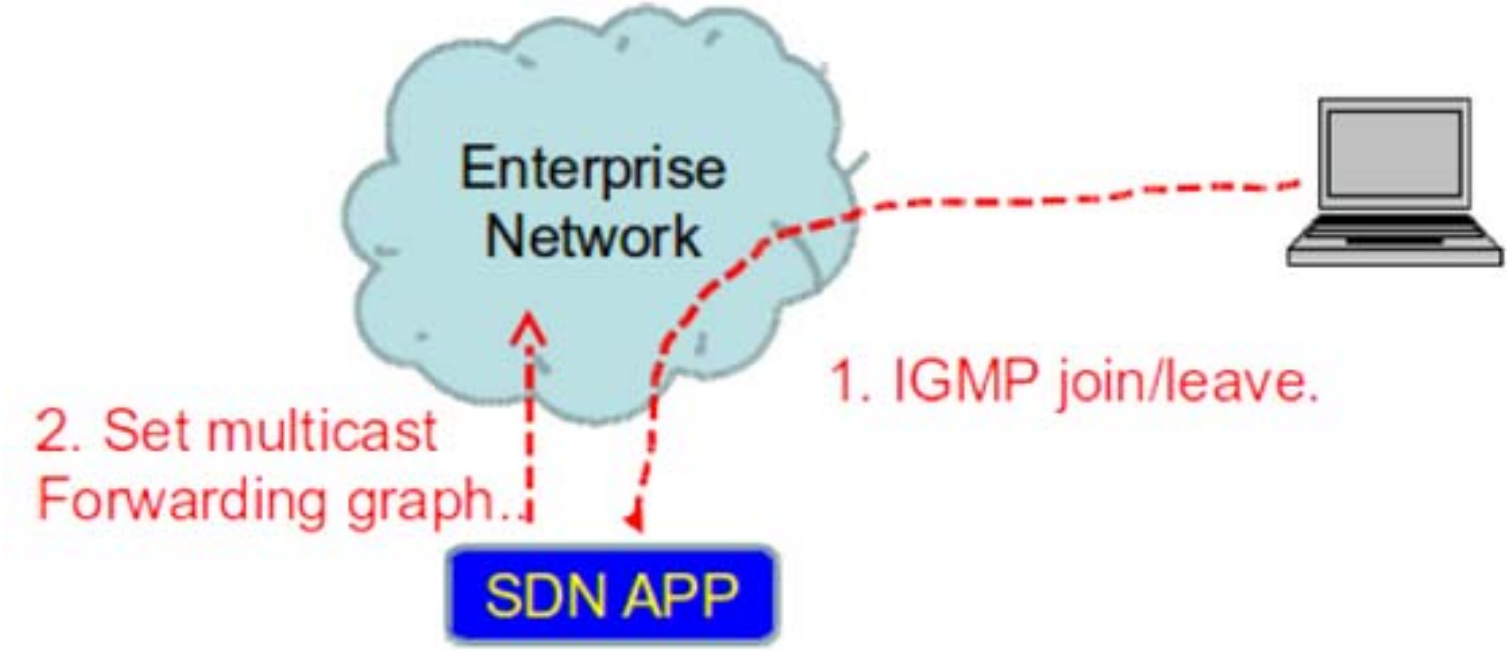
- Most enterprise/campus networks have multiple WAN
- Therefore, they use bandwidth aggregators on their gateway:
  - Expensive, and all outputs are physically located on the same place



IGMP-enabled SDN

We have built an IGMP-enabled SDN solution, which supports bandwidth allocation without IGMP propagation

- IGMP is a multicast management protocol in local area networks
- IGMP messages will be propagated on the path from the host to the multicast server



Develop SDN APPs based on Ryu

FNS (Future Network Solution)

SDN Apps

APT Attack Block | DDOS Attack Mitigation | SDN Multiple WAN Service | SDN UI Service | ••• | More App

Middleware

Ryu Pre-defined SDN Interface (Restful APIs)

New-defined Restful APIs

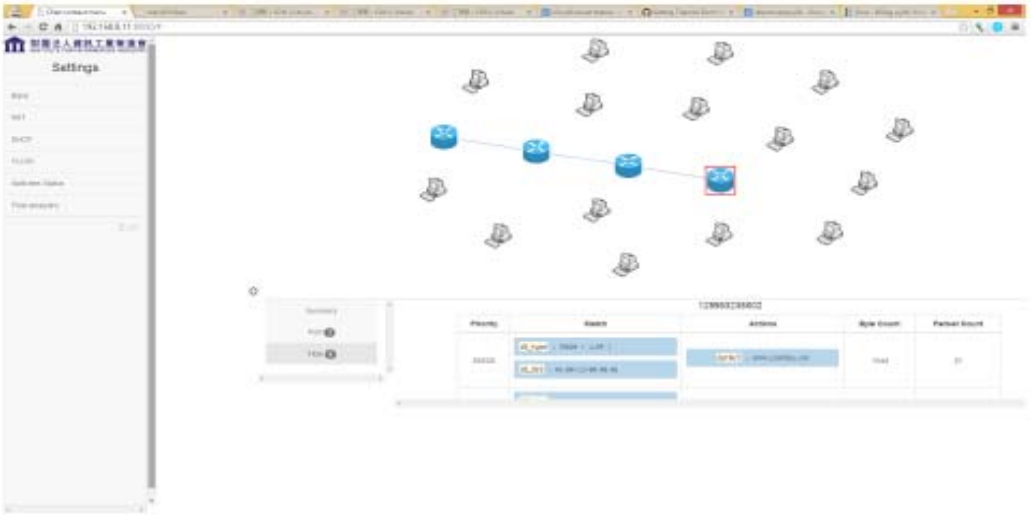
SDN Controller

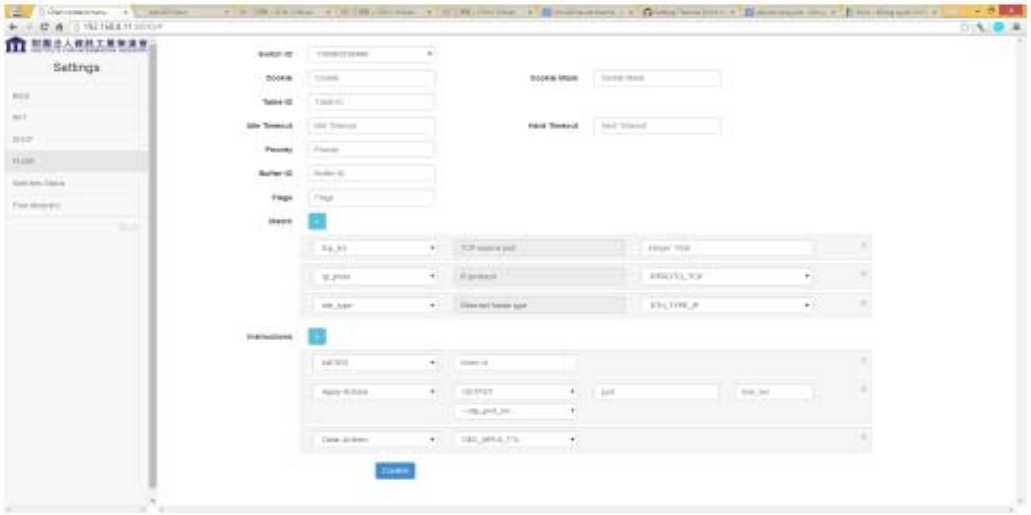
Ryu Controller Platform

Ryu SDN FrameWork

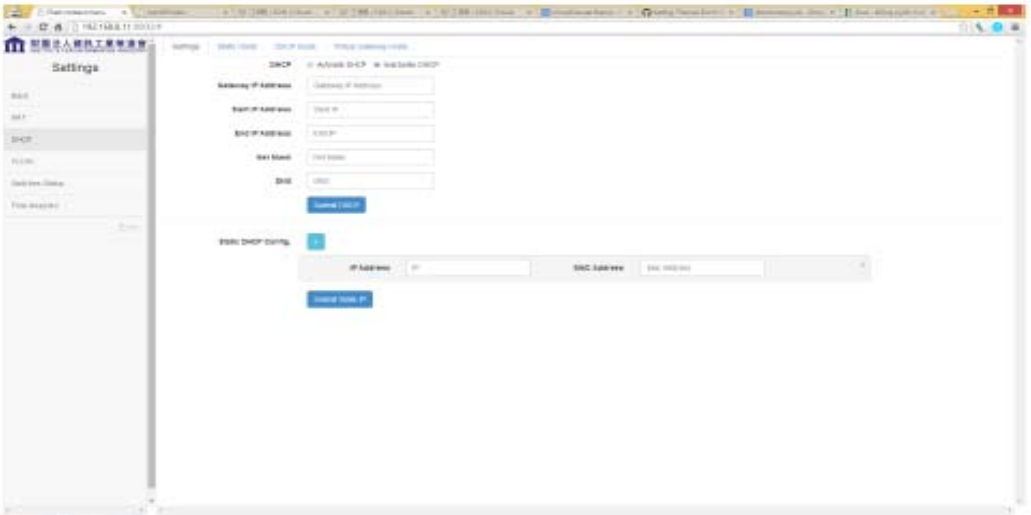
SDN Solutions :
Controller + Middleware + App + Switches

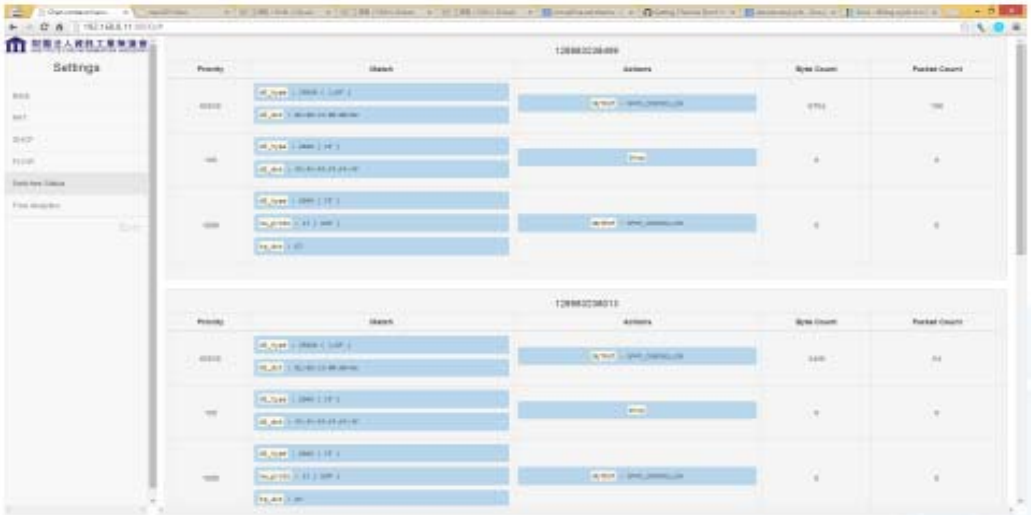
Centralized SDN Management Tool





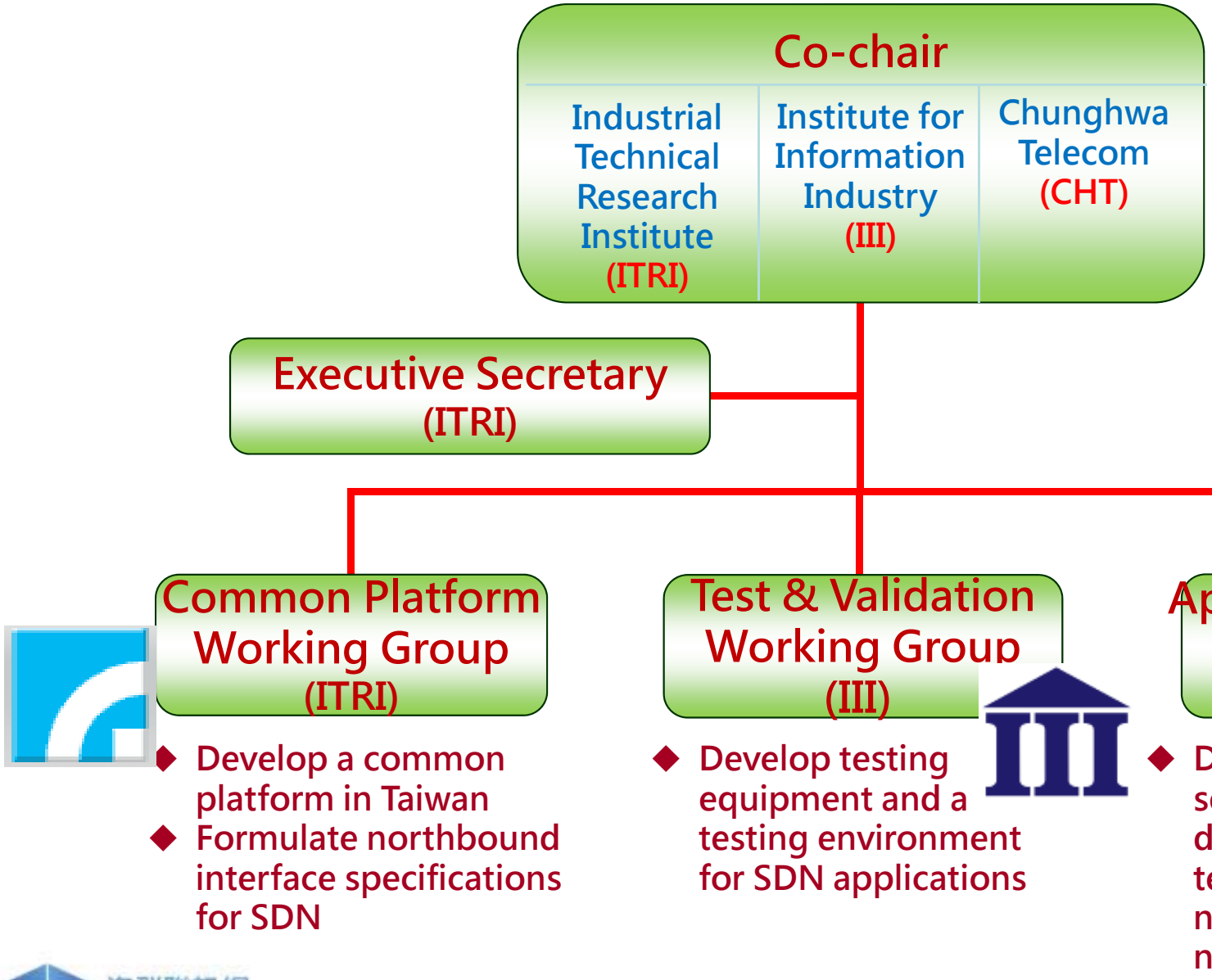
Use HTML5 + Restful API





Taiwan SDN Alliance

Taiwan SDN Alliance



Members

- Telecom operators
- System integrators
- Software developers
- Network equipment manufacturers
- Chipset designers
- Testing lab

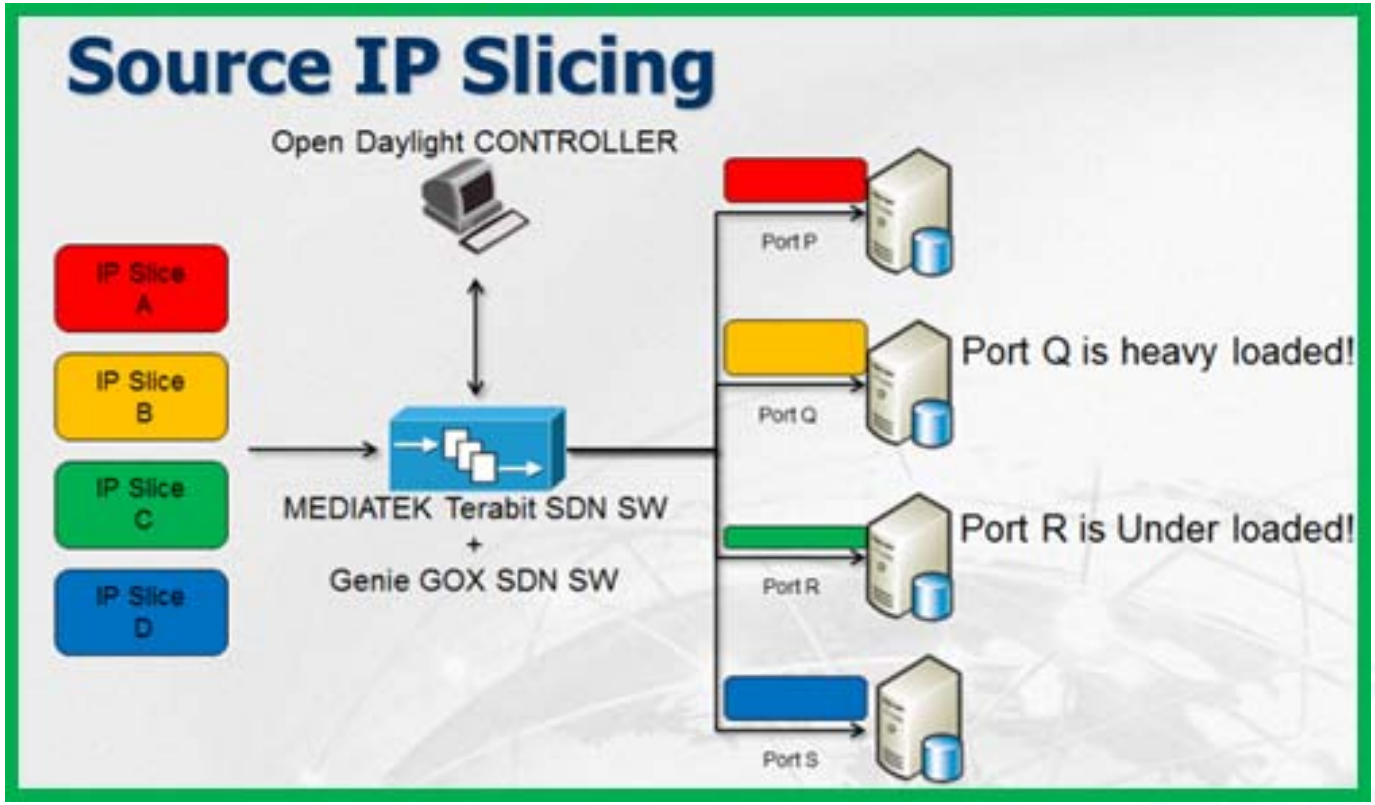
- Develop a common platform in Taiwan
- Formulate northbound interface specifications for SDN

- Develop testing equipment and a testing environment for SDN applications

- Develop SDN application service solutions for the demands of data centers, telecommunications networks and enterprise networks

Application 1: SDN L4 Load Balancer

- Make the Load Balancer scale-up and scale-out
  - Tera-bit performance load balancer is possible
- Reasonable number of flow on a SDN switch
  - Depends on the slicing granularity and number of service cluster
- Cost Efficient



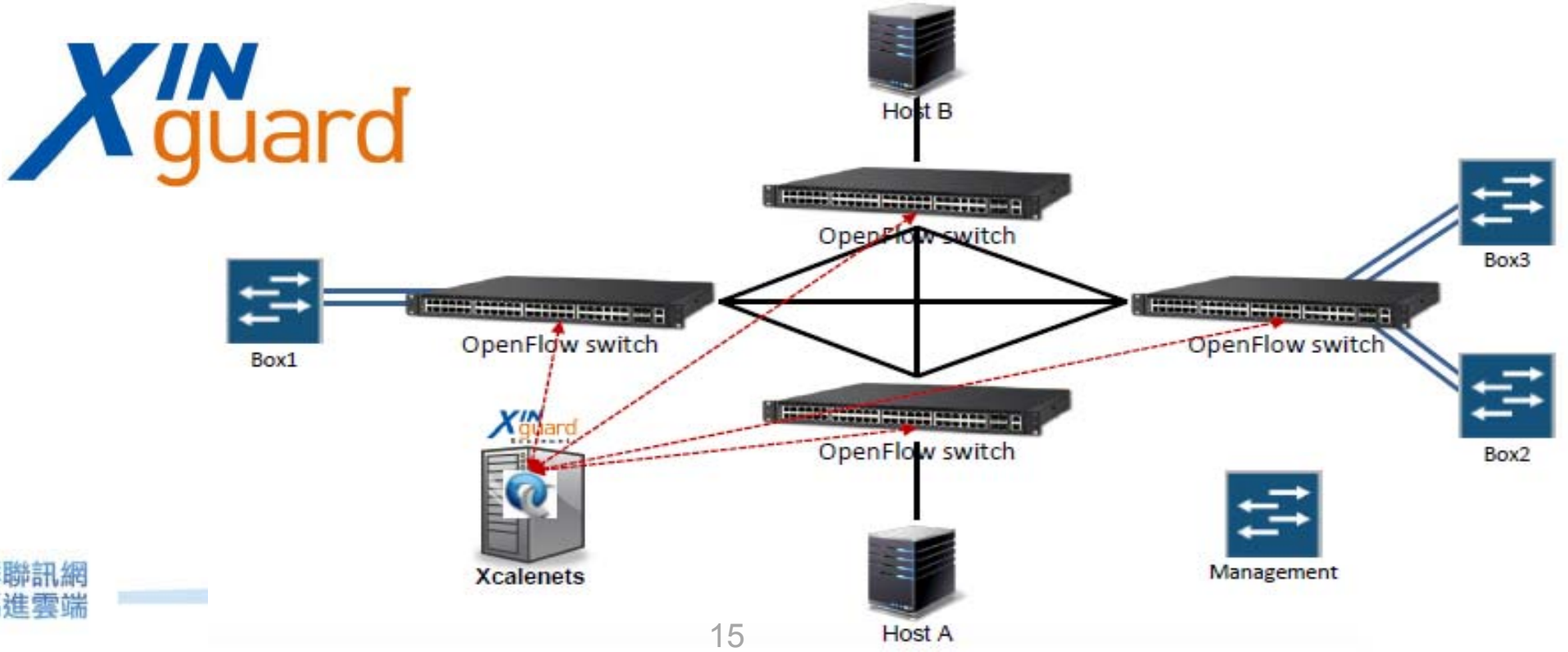
GenieNetworks

MEDIATEK

ITRI Industrial Technology Research Institute

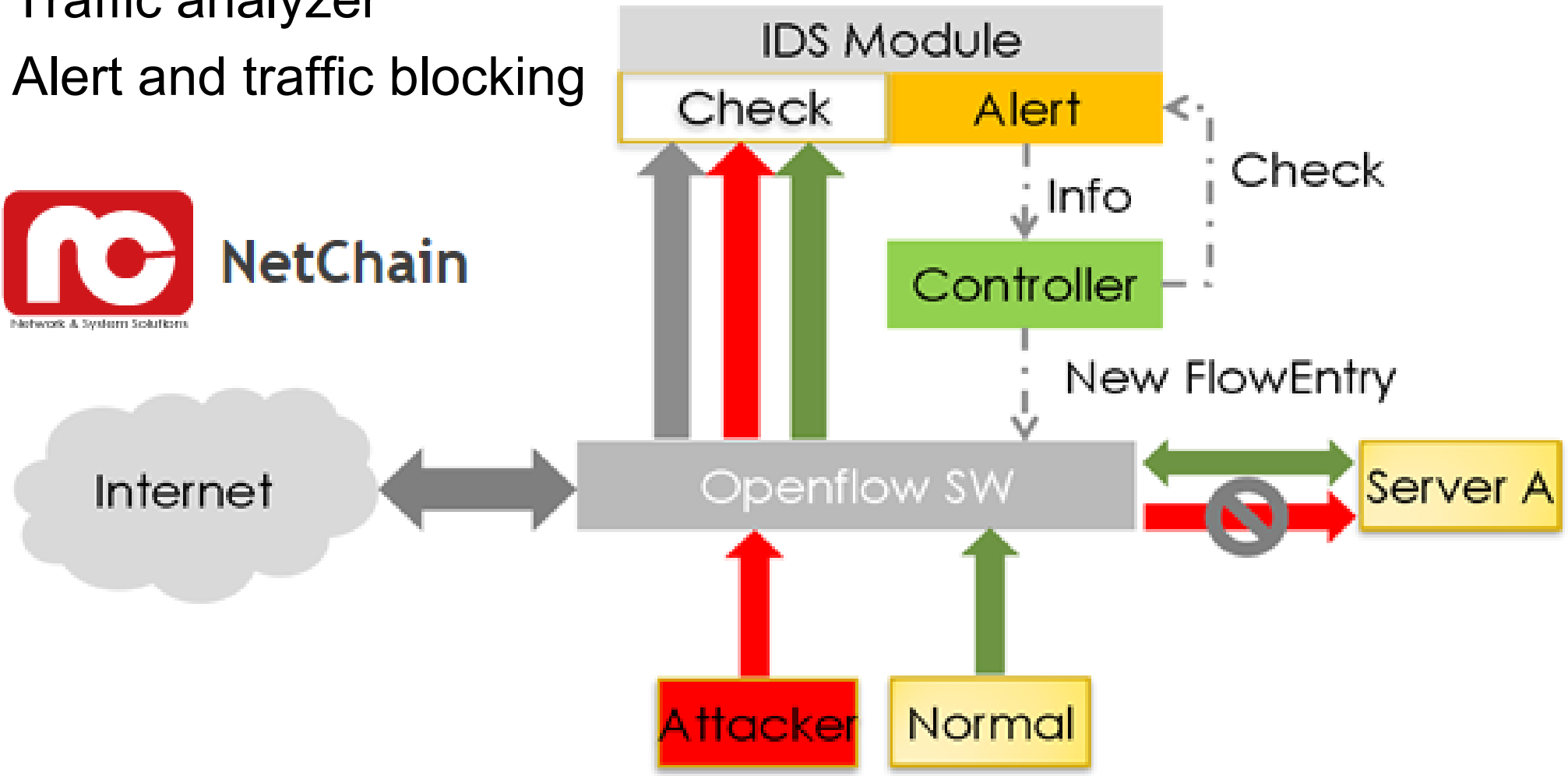
Application 2: Policy-based Forwarding

- Normal L3 forwarding & link fail-over
- Policy-based forwarding & link fail-over
- Transparent box health-check & box fail-over
- Transparent box health-check & box backup
- Policy-based forwarding by event-trigger action



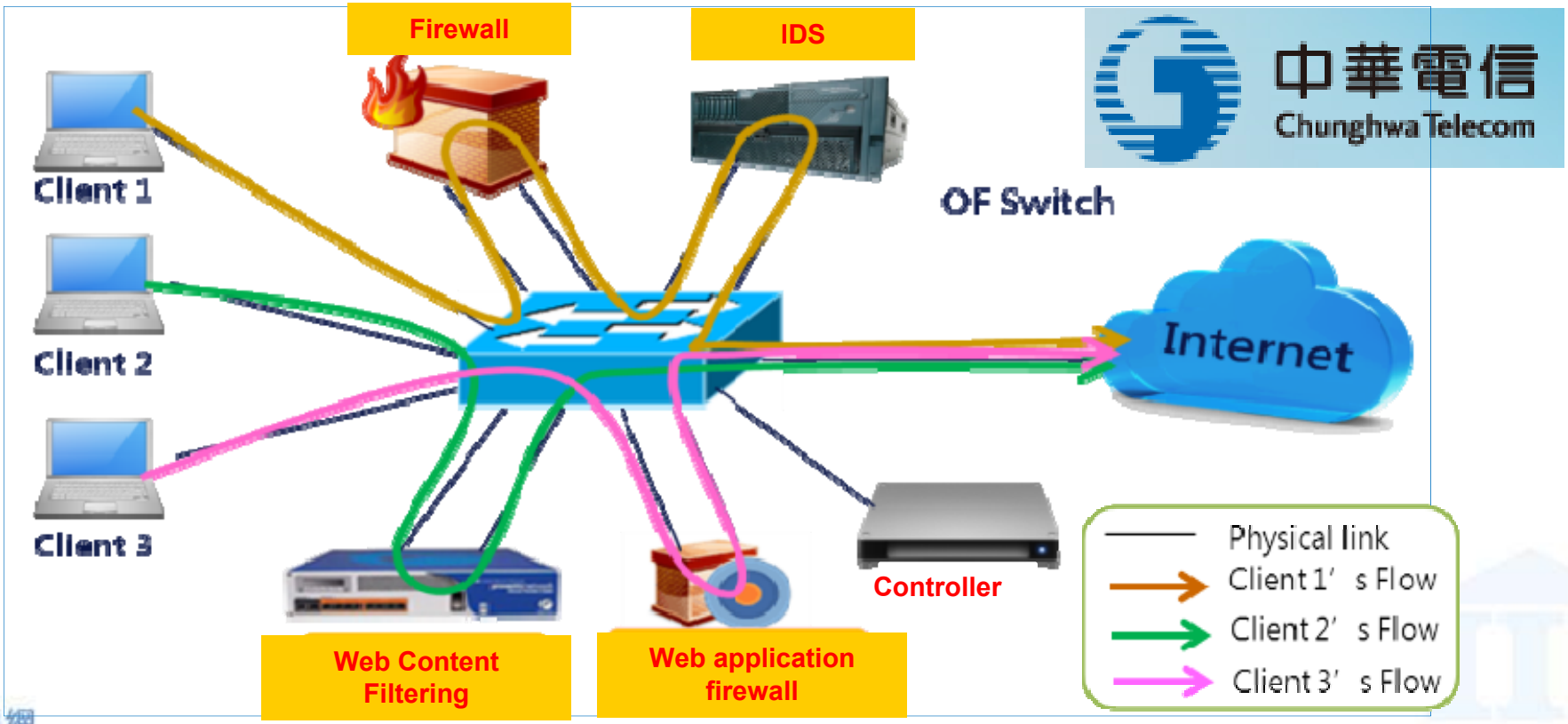
Application 3: Intrusion Detection System

- Openflow 1.3 based
- Traffic re-direct to IDS
- Traffic analyzer
- Alert and traffic blocking

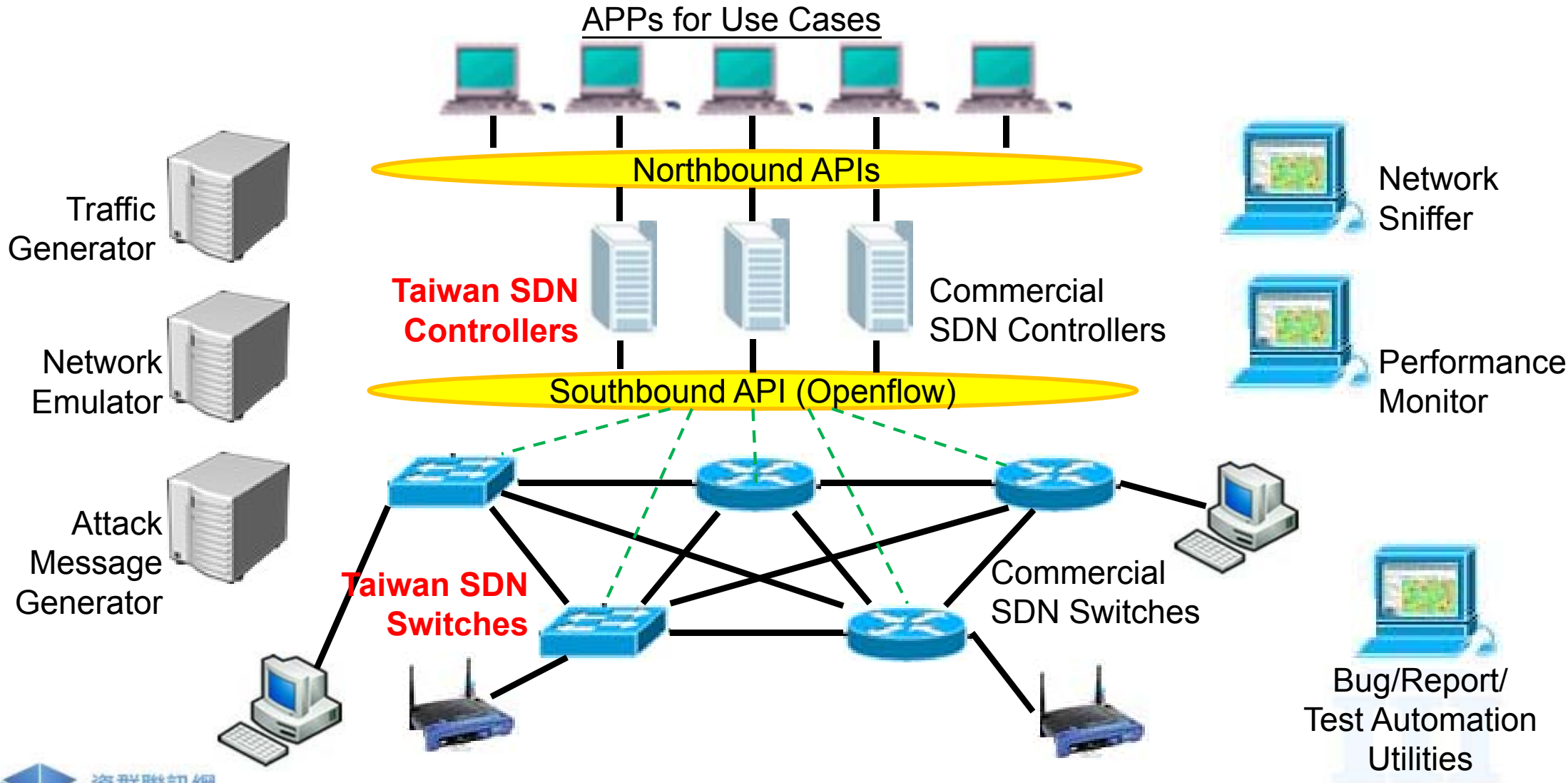


Application 4: Service Chaining

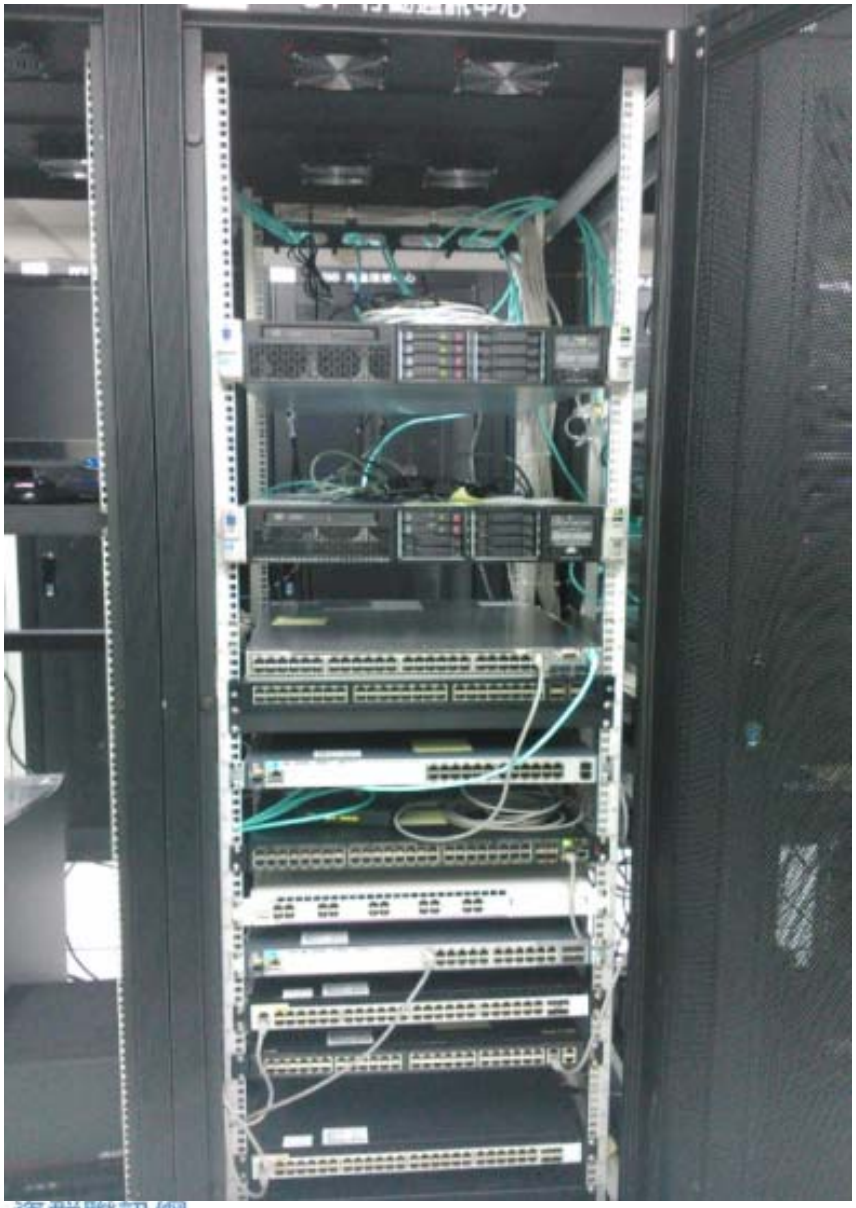
- Service Chaining/Steering: On-demand security services
- Dynamic Provision and modification
- Compared to current architecture, this SDN/OpenFlow architecture can reduce 70% cost of network devices



Multi-vendor SDN Testbed (1/2)



Multi-vendor SDN Testbed (2/2)



Controller

OPEN DAYLIGHT

NEC

Ryu

Floodlight

hp

Switch

hp

centec networks

PICA8 OPEN NETWORKING

Alcatel·Lucent

NEC

Testing Tools

Mininet

SHENICK

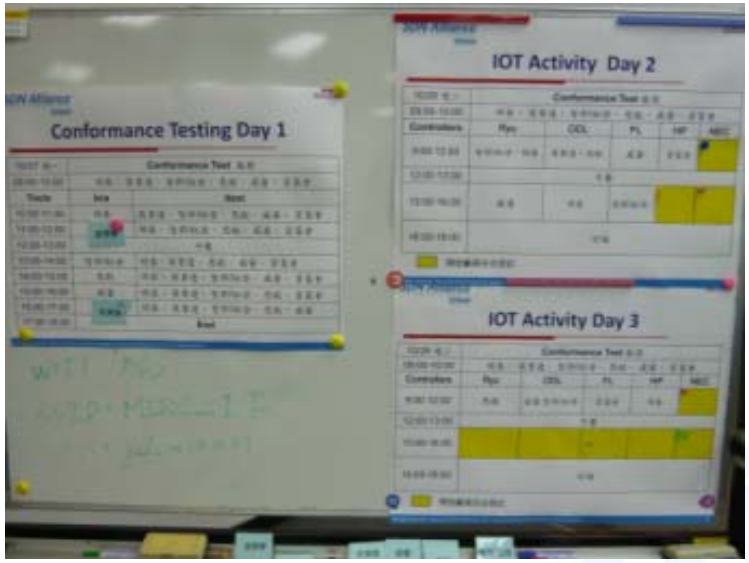
WIRESHARK

Implementation of SDN Test Cases

Suite	Group	Number
130	Flow table/Action Set	3
140	Flow table/ Modification messages	2
150	Flow table/Modification messages	10
210	Protocol Messages/ Port Structures struct ofp_port	6
240	Protocol Messages/ofp_switch_features	8
260	Protocol Messages/OFPT_FLOW_MOD	10
320	Protocol Messages/OFPT_MULTIPART_REPLY	15
330	Protocol Messages/OFPT_MULTIPART_REPLY	1
340	Protocol Messages/OFPT_MULTIPART_REPLY	8
410	Protocol Messages/Packet-In Message	9
450	Protocol Messages/Symmetric Messages	7
Plugfest 01	Conformance Test for Basic Plugfest	20
Plugfest 02	1-on-1 IOT Test for Basic Plugfest	8
Plugfest 03	Small-topology IOT Test for Basic Plugfest	1
Total		108

2014 Taiwan SDN Plugfest Workshop

- Date: Oct 27-29, 2014
- Place: National Chiao Tung University, Hsinchu, Taiwan
- Co-host: Institute for Information Industry (III) and Network Benchmarking Lab (NBL)
- Member Companies: 6 (all Taiwan companies)
- Testing Equipment: Spirent, and Ixia



2014 Taiwan SDN Plugfest Workshop

Conformance TC	1	2	3	4	5	6	7	8	9	10
Ixia	4	4	5	4	4	5	5	4	2	NA
Spirent	5	5	2	3	3	NA	2	4	3	3

Conformance TC	11	12	13	14	15	16	17	18	19	20	Avg. Pass Rate
Ixia	NA	NA	NA	5	4	2	4	2	NA	5	64%
Spirent	1	2	1	5	1	1	NA	1	NA	1	42%

ID	IOT Test Case
2.1	The switch replied with properly content
2.2	Features reply – Datapath ID
2.3	Discovery and Port Forwarding
2.4	Flow_mod priority
2.5	The Table-miss with Packet_in Action
2.6	GroupFeatureRequest
2.7	Table-id: OFPTT_ALL
2.8	Removal of all listed match fields flows

SDN Industry in Taiwan

SDN Industry in Taiwan (1/4)

- 5 foci of Taiwan ICT industry to enter new markets: (Nov 2014)
  - Servers and Storage for big data access and cloud computation
  - Innovative software of SDN and NFV for cloud services
  - Small Cells for enhancement in service coverage and data throughput
  - Chipsets for applications of Internet of Things (IoT)
  - Essential IP for chipsets of smart 5G handsets

- Realtek and Mediatek, two of famous chipset design companies in Taiwan, have formed RD teams to develop high-level network chipset solutions for SDN switches, which can be used in data centers and enterprises. Realtek and Mediatek will lead the SDN industry in Taiwan to a new era of SDN-based core network products. (Dec 2013)

SDN Industry in Taiwan (2/4)

- Edge-Core Networks, a Taiwan networking solution provider, announce its plan in SDN products and Cloud Network services, which will be important parts of its end-to-end networking solution that can be utilized in providing efficient diversified wireless services for its customers. (May 2014)

- Alpha Networks, a Taiwan networking manufacturing company and a member of D-Link Group, announced its new release of SDN switches for data centers, and its future plan in SDN controller and SDN total solutions for Medium and Small Scale Enterprises. (Mar 2014)

SDN Industry in Taiwan (3/4)

- Quanta Computer and Accton, two of famous ODM companies in Taiwan, have been supported by Facebook in developing network equipment including SDN switches, reported by JP Morgan. Meanwhile, Macquarie emphasizes that SDN will be one of the major new directions of Accton, and its SDN switches will make 10% of the yearly revenue of Accton. (Jun 2014)

- Caswell, a Taiwan ICT design and manufacturing company, announced its new plan in developing solution for SDN and NFV products, including SDN controller, switch, and software which can be elastically and efficiently used in data centers, cloud computing, and enterprises. (Oct 2014)

SDN Industry in Taiwan (4/4)

- Systex Corporation, the No.1 Taiwan-based IT services provider, announce its cooperation with AMIYA, a Japanese security and auditing management software company, to jointly develop SDN technologies with information security features for enterprises. (Mar 2014)

SYSTEX

- Chunghwa Telecom, the No.1 telecom operator in Taiwan, signed a Joint Research Agreement with NTT Data, to cooperate in research and development of SDN technologies in telecom networks, in order to reduce the CAPEX and OPEX, and to introduce the innovative applications and value-added services. (Jun 2014)

中華電信 Chunghwa Telecom

ONF Authorized Testing Lab

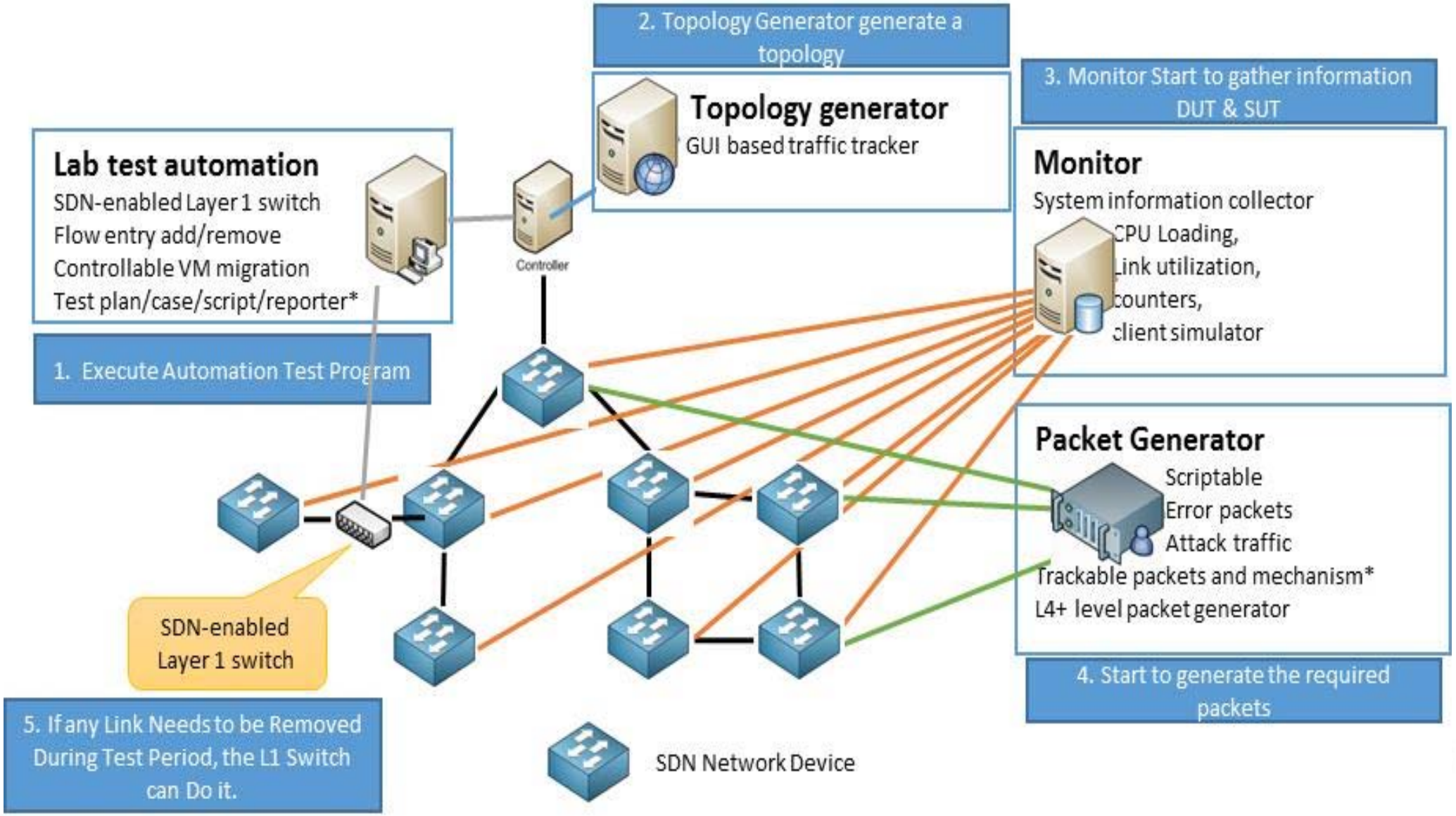
Network Benchmarking Lab (NBL)

- The 6th ONF-authorized testing lab: **Network Benchmarking Lab (NBL)**
  - Announce by Dr. Dan Pitt in Sept 2014 in ONF Member Workdays

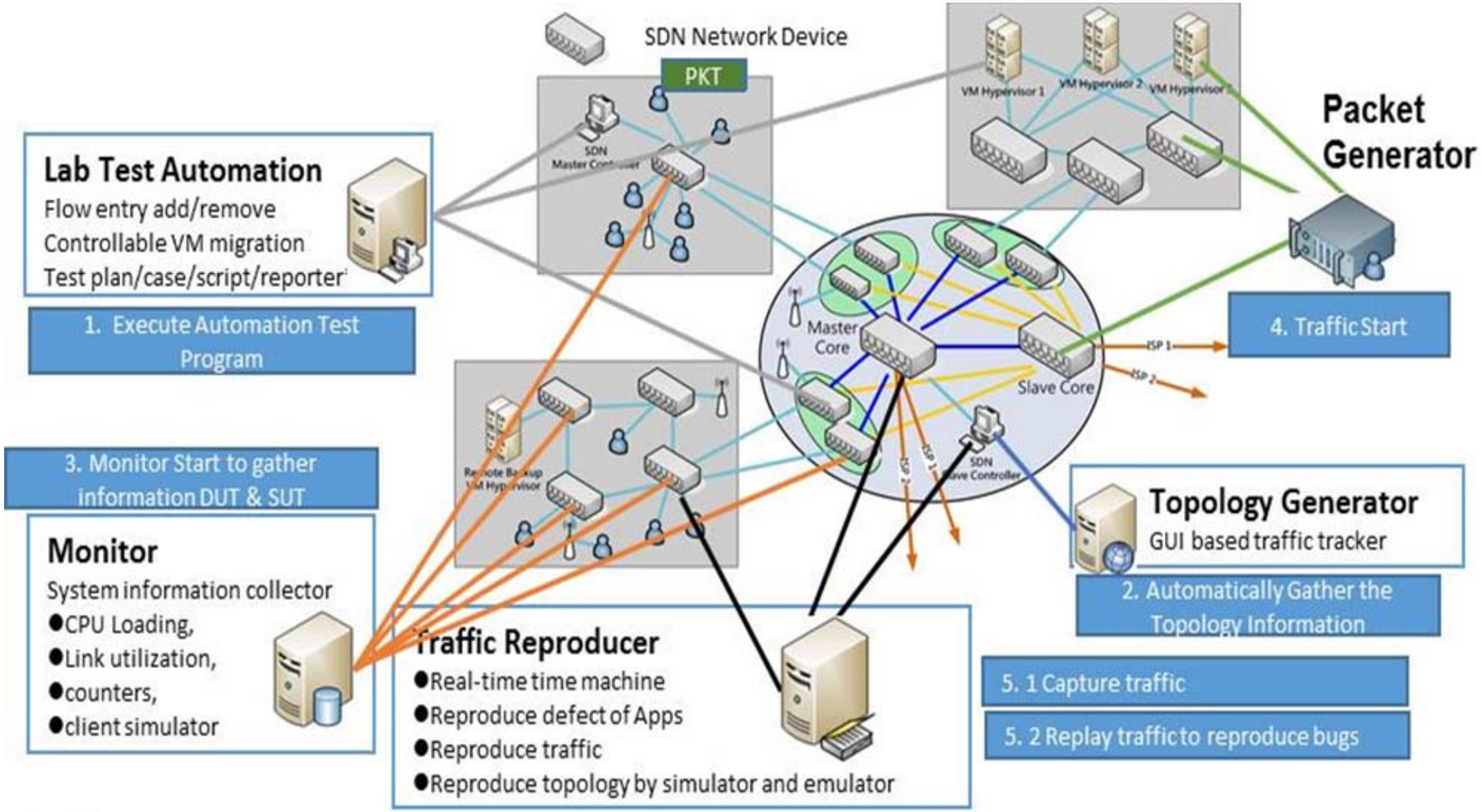
Introduction of NBL

- Profile of NBL
  - Hosted by National Chiao Tung University in Taiwan as a test service and tool provider
  - A third-party laboratory dedicated to functionality, conformance, interoperability, performance, and stability testing on switch/router, security, wireless, and VoIP products
  - NBL utilizes campus real traffic for live and replay testing and a generic test framework for automatic script-based testing.
  - Through industrial and academic collaboration, NBL now offers conformance, robustness, and interoperability test services and tools for SDN-enabled appliances and applications to global clients.
- A Member of Taiwan SDN Alliance
  - Collaborate with Institute for Information Industry in developing SDN test cases and hosting SDN plugfest activities.

SDN Test (Lab and Auto)



SDN Test (Beta Site)



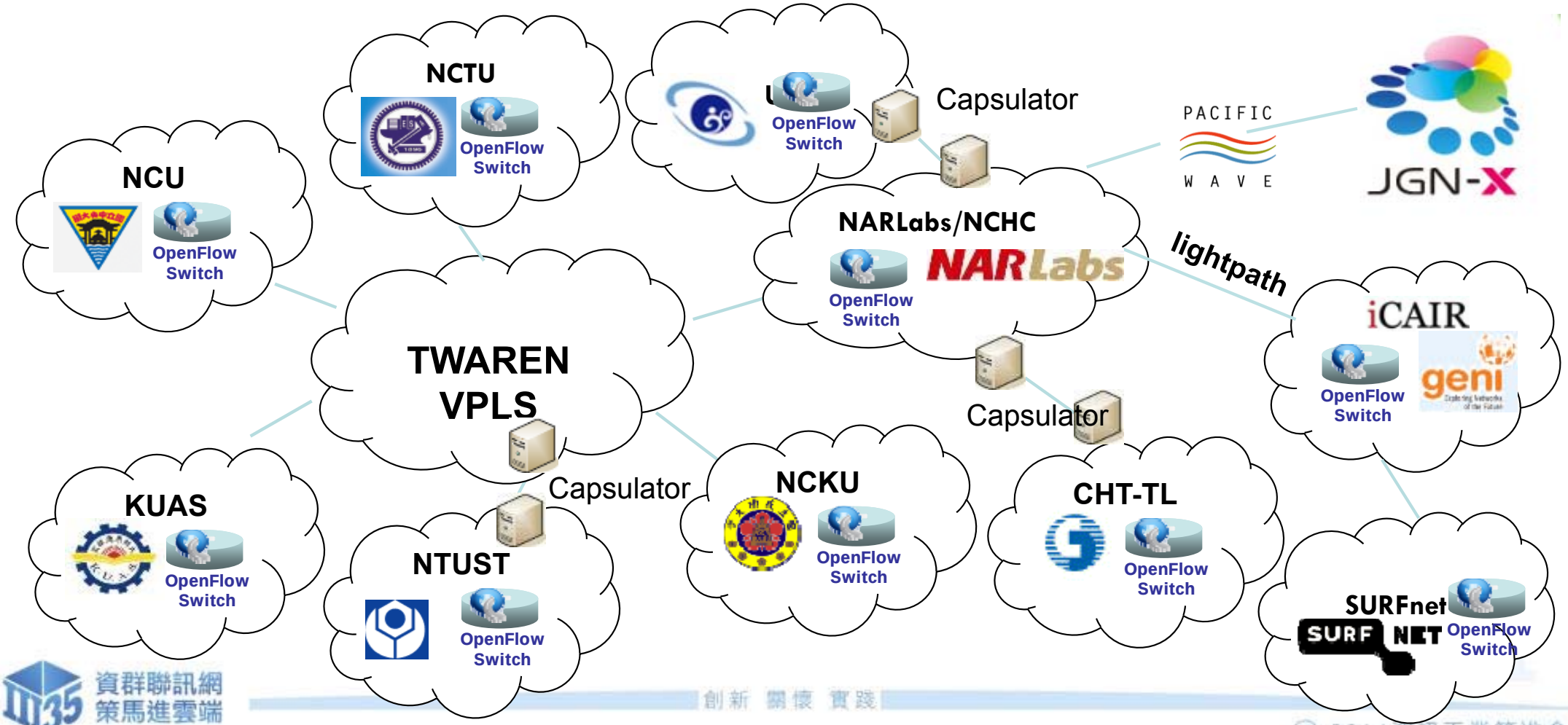
Industrial Customers

SDN R&D in the Academic

TWAREN SDN Testbed

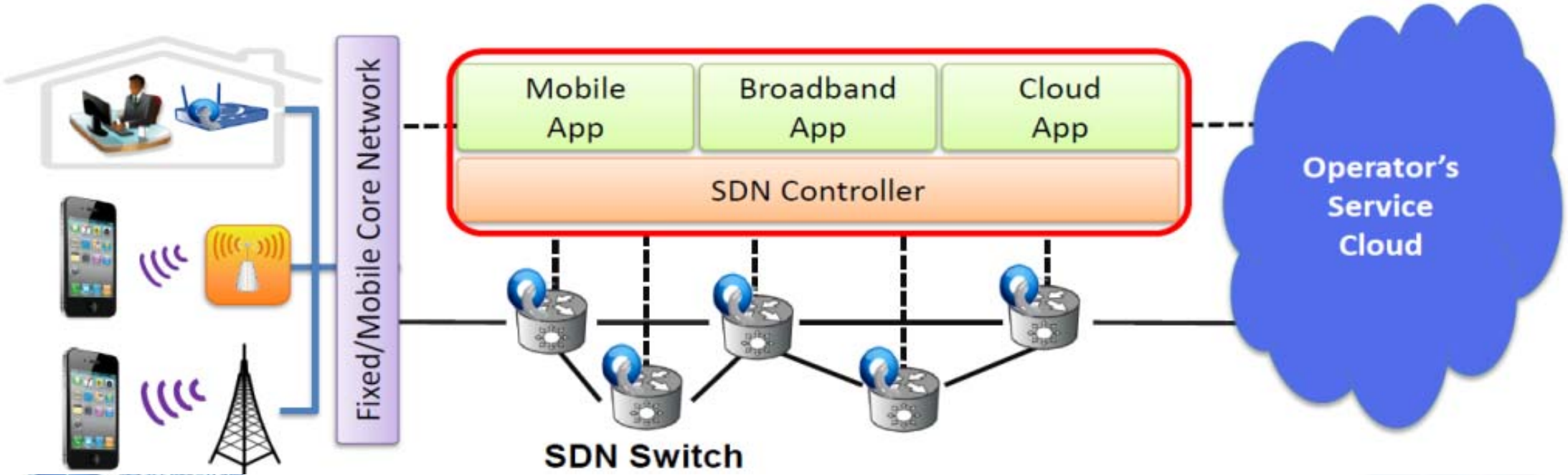
(Taiwan Advanced Research & Education Network)

- Creating dedicated SDN environment through TWAREN VPLS Service
- Extends to JGN-X and SURFnet

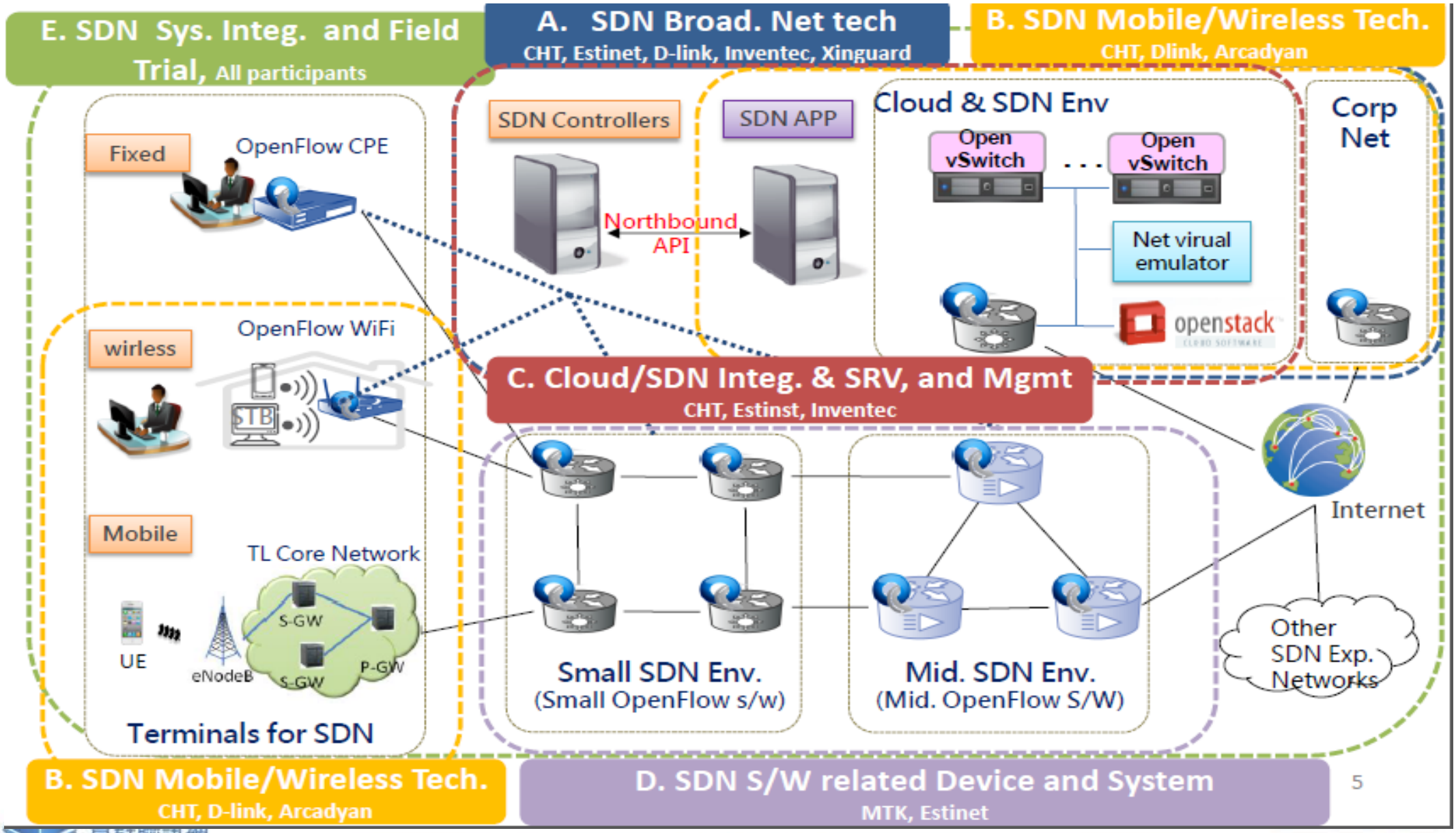


Collaboration between SDN Industry and the Academic

- Project Name: **SDN-enabled Cloud-based Wireless and Broadband Network Technologies & Services**
- Sponsors from industry: Chung-Hua Telecom, D-Link, EstiNet, MediaTek, Arcadyan, Xinguard, and Inventec
- Universities: NCTU, NTHU, and Academia Sinica (more than 30 professors in total)

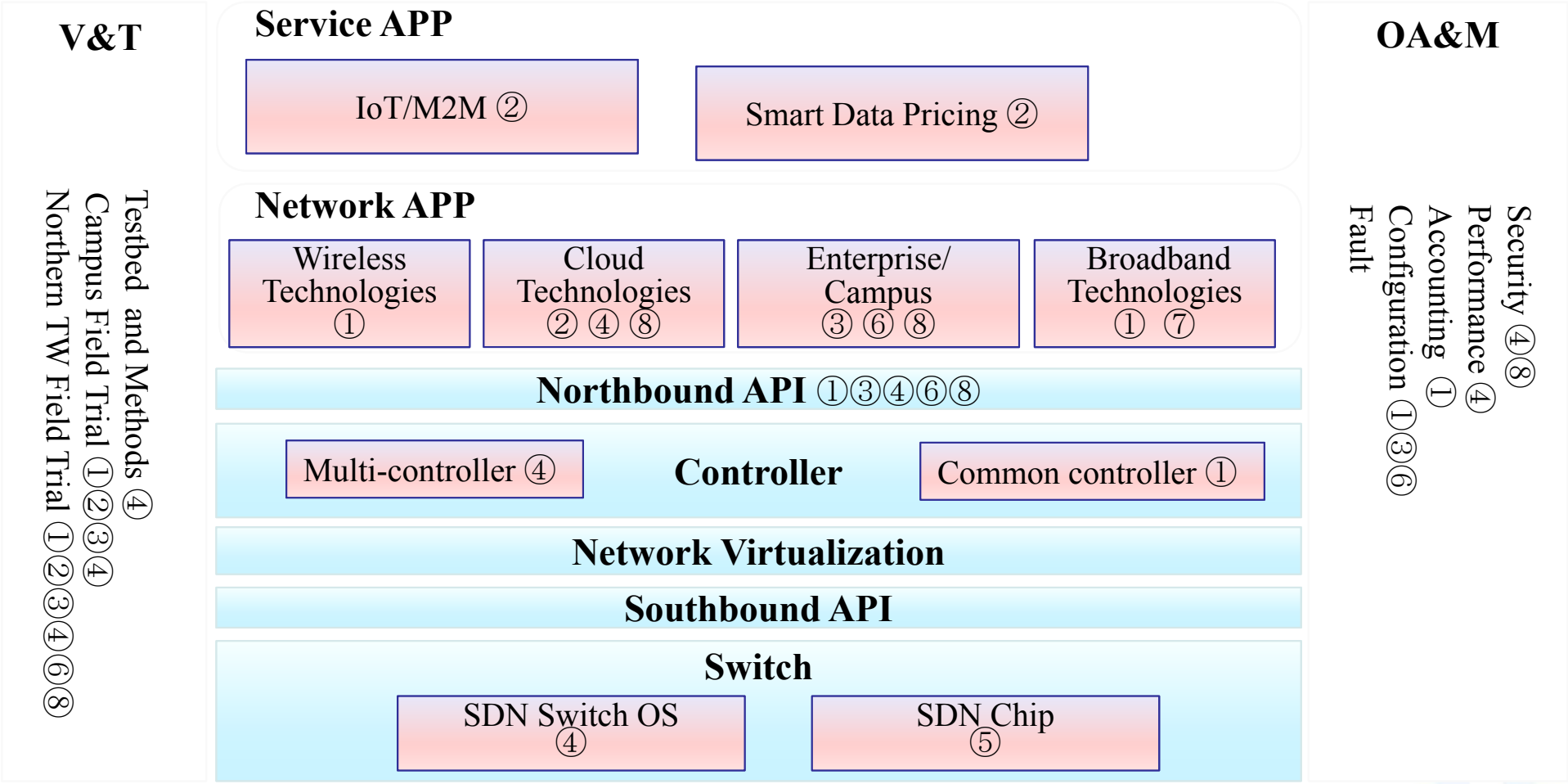


5 Sub-projects and Their Foci



Layered Architecture

①CHT (Wireless/BB/Security) ②CHT (Cloud/Billing/IoT) ③D-Link
④EstiNet ⑤MediaTek ⑥ Arcadyan ⑦ Xinguard ⑧ Inventec



Conclusion

Conclusion

- In order to meet the global trends of SDN, the ICT industry in Taiwan has made efforts in developing SDN solutions and products. By means of Taiwan SDN Alliance, member companies help each other in moving towards the market together.
- There is an ONF-authorized testing laboratory in Taiwan, which will offer instant local testing supports to the industry and help reduce their product testing and certification cost.
- The academic in Taiwan is also highly involved in SDN research and development, which will provide qualified SDN engineers to the industry.
- Among the SDN activities in Taiwan, Institute for Information Industry (III) plays an critical role in both technical R&D and industrial promotion.

Thank You!

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