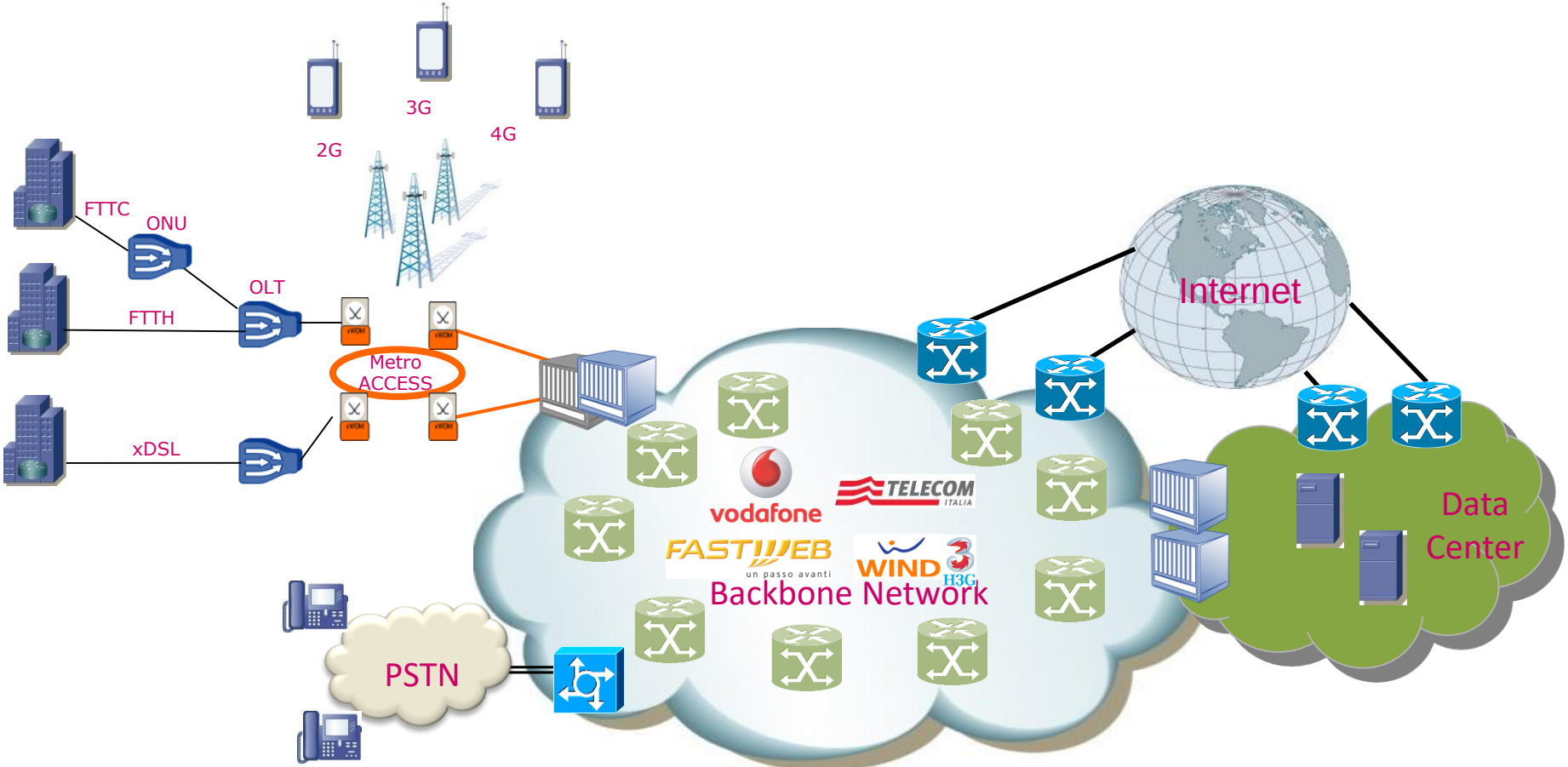
State of the art Routers Architecture (Juniper, Cisco, Huawei)

Relatore: Ing. Nicola Zambelli (K Labs Trainer and Professional Services Engineer)

Agenda

- Core Routers Evolution
- SDN/NFV Evolution
- Router Simulation
- K Labs Job opportunities
- K Labs Internship

TELCO Architecture



Worldwide Top Router Vendors

Core Router

Front view

- CMU: 1+1 backup mode
- MPU: 1+1 backup mode
- Fan modules: total of 17, 1+1 backup mode
- LPU: total of 12
- SFU: 5+1 backup mode
- Air intake frame
- Power modules: 6+6 backup mode
- Power frame: total of 3, 12-way AC power

Rear view

Router design: Key Points

Scalable System Platform

- High-speed Interconnection
- Large Capacity Powering/Heat Dissipation
- Highly Integrative Chip
- High-density Optical Module

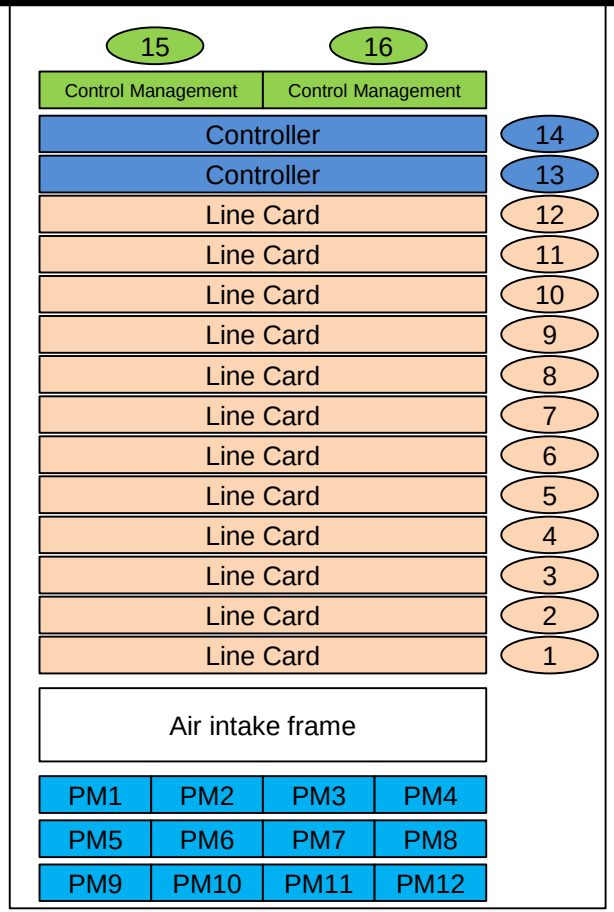
Unblock Switching

- Dynamic CLOS Switching
- VSC Exchange
- Distributed Arbitration
- Dynamically Distributed Buffer

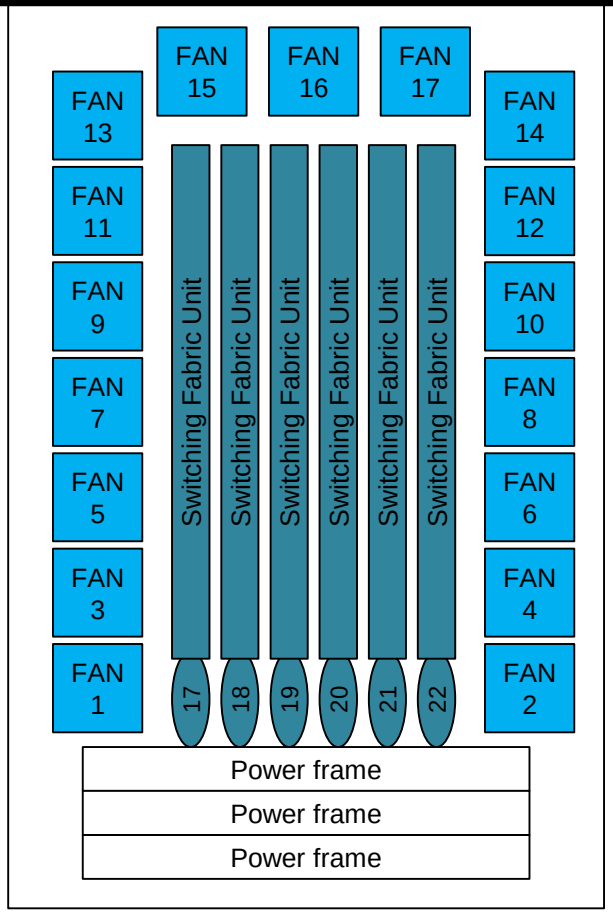
Energy-Saving

- Patented Heat Dissipation Design:Orthogonal Front-to-rear Air Channels
- Separated Air Channels on Service Slots and Switching Fabric Units
- Innovative Panel Heat Dissipation Design
- On-demand Powering/Dynamic Energy-saving

Slot Distribution Diagram example

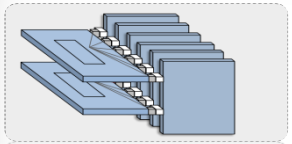


front view

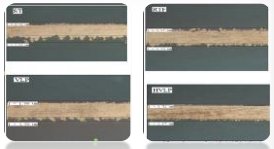


rear view

High-Speed Interconnection



Orthogonal Architecture with “0” Cable on Backplane



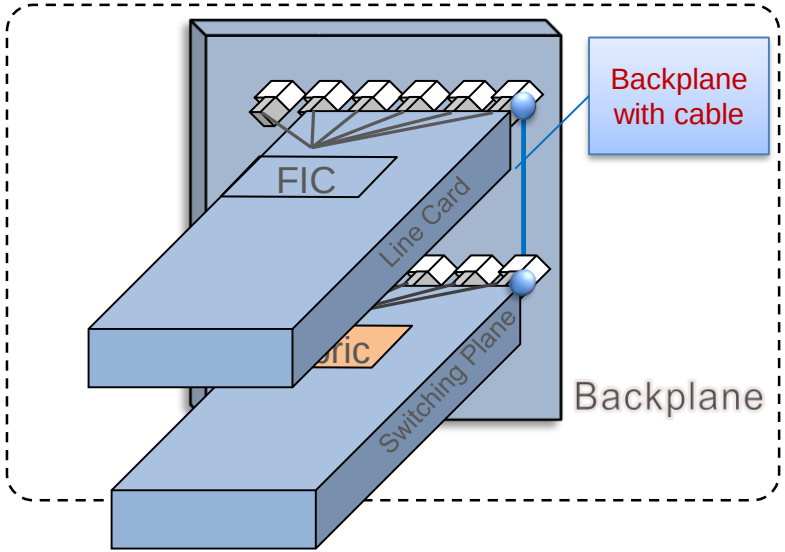
High-Speed PCB Design

High-speed Connector

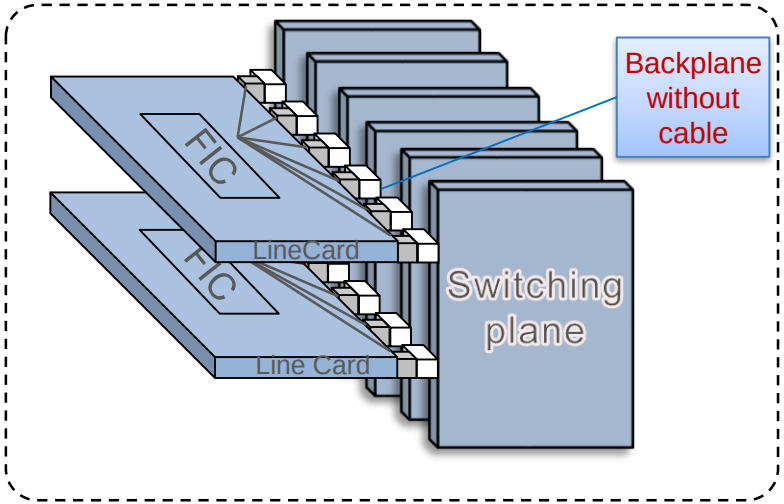
Highly Precise, Strengthened Chassis

·Ensuring high performance of end-to-end high-speed links·

Hardware Architecture



Traditional switching architecture

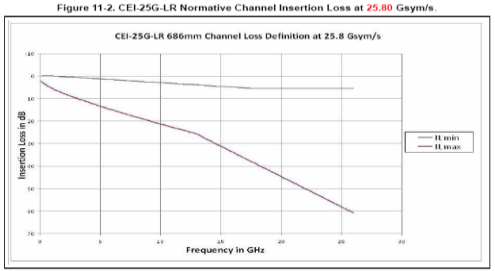


Fully orthogonal architecture

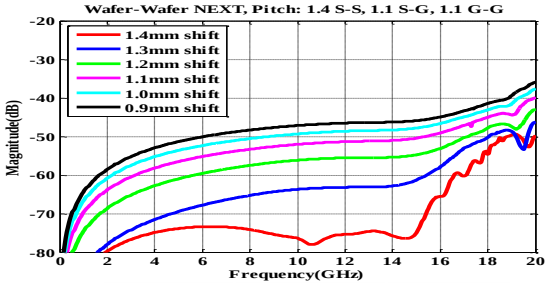
Fully orthogonal design of line cards and Switching Fabric Units

- On a core router, the cables from line cards to Switching Fabric Units are the most important factor affecting slot bandwidth.
- In the traditional architecture, the length and rate of backplane link are the important factors affecting device bandwidth and evolution capability.
- The orthogonal architecture, **reducing the backplane cable length to 0** and improve system bandwidth and evolution capability.

High-Speed Orthogonal Connectors

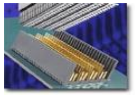


Insertion loss



Interference

2000



1.25-3.125G

2004

3.125-6.25G

2008

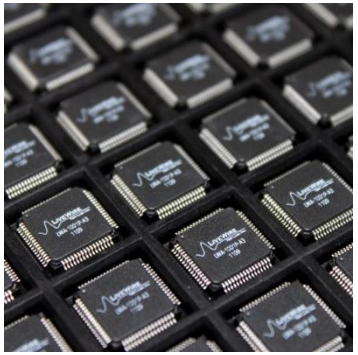
6.25-10.3G

2012

10.3-25G

High-speed connector is the basis of core switch
Next-generation core routers use a minimum of 10.3G links, which can be upgraded to 25G

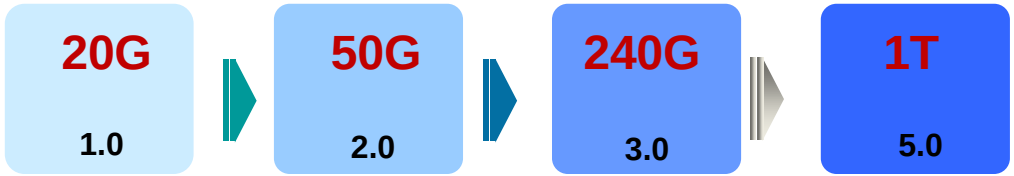
Control Plane and Data Plane Separation 1/2



ASIC

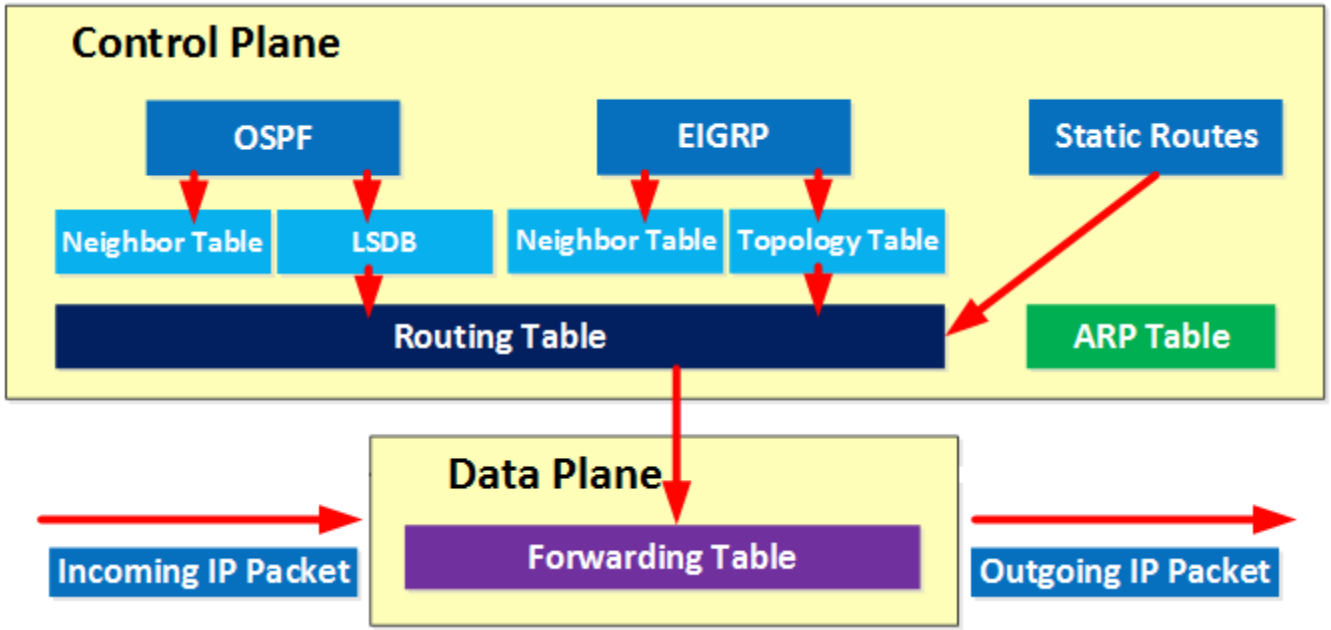
VS

General Purpose CPU

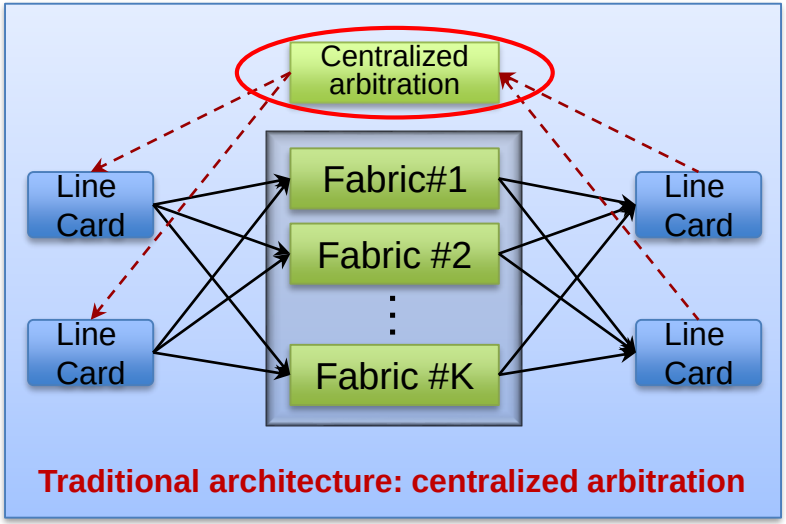


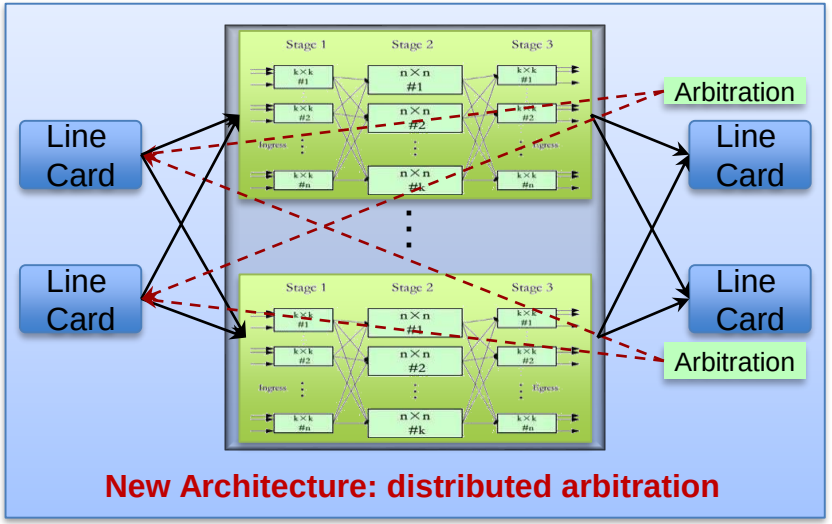
ASIC Chipset Evolution

Control Plane and Data Plane Separation 2/2

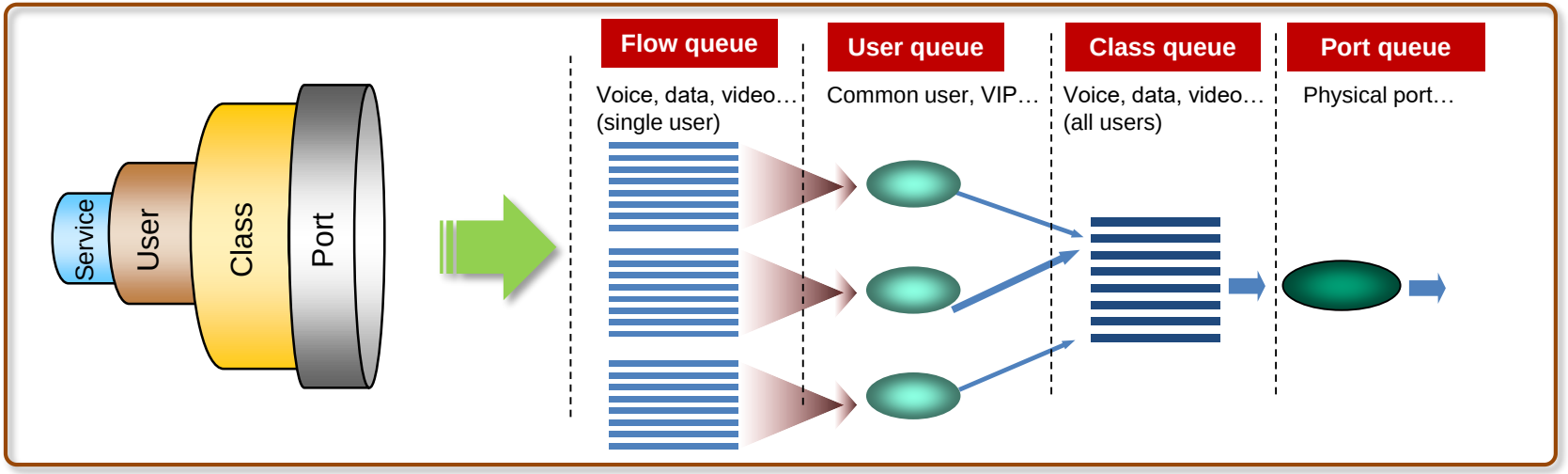


Distributed Forwarding





Distributed arbitration improves scalability of the switching network



Traditional QoS

- **Per port bandwidth control:** service traffic is differentiated based on classes of service but not users
- **Unable to manage and schedule multiple services of multiple users**

H-QoS

- **Hierarchical per-user-per-service scheduling,** quality guarantee for VIP users and high-priority services
- **High performance**

High Density Line Cards 1/2

36*100GE QSFP28

36*40GE QSFP+

48*10GE SPF+ + 2*40GE+2*100GE

10GE Flex Port

SFP-T: RJ45, GE electrical

100m

SFP: GE optical port connection

500m, 10Km, 40km, 80km, 100km

10GE AOC: Short-distance, low-cost connection

3m, 10m, 20m

10GEcopper cable: Low-cost connection within 5m

1m, 3m, 5m, 7m, 10m

SFP+: 10GE optical port connection

100m,220m, 300m, 1.4km, 10km, 40km, 80km

40GE Flex Port

QSFP+ connection

100m, 150m, 300m, 400m, 1.4km, 10km, 40km

40GE copper cable: Low-cost connection within 5m

1m, 3m, 5m

40GE AOC: Short-distance, low-cost connection

10m

One 40GE splits into 4*10GE

Fiber connection

300m,1.4km, 10km

Copper cable connection

1m, 3m, 5m

AOC connection

10m

High Density Line Cards 2/2

100GE Flex Port




CFP 100G fiber connection

100m,
10km, 20km,
40km, 80km

CXP 100G fiber connection

100m

CFP2 100G fiber connection

100m, 10km

QSFP28 100G fiber connection

100m, 500m
2km, 10km

100GE split into 2/3*40GE

100m

Cable connection

10m

100GE split into 8/10/12*10GE

100m

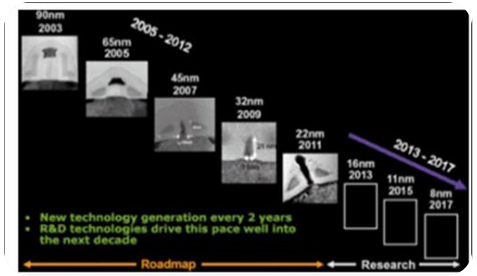
100GE split into 4*25GE

100m, 500m

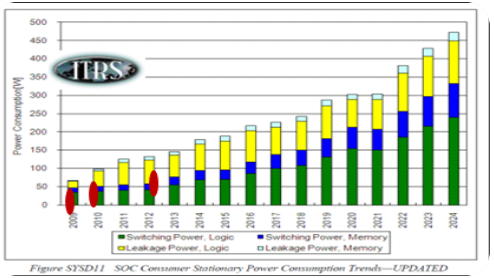
1m,
3m, 5m

Large Capacity Powering/Heat Dissipation

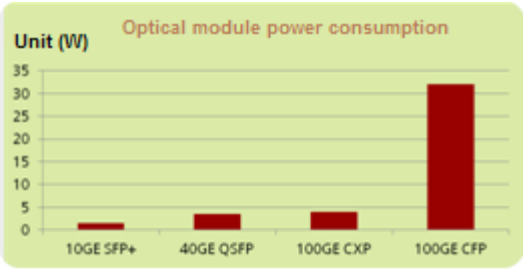
Chip techniques upgrade every two years



Power consumption of a single chip exceeds 100W



Power consumption of optical module greatly increases

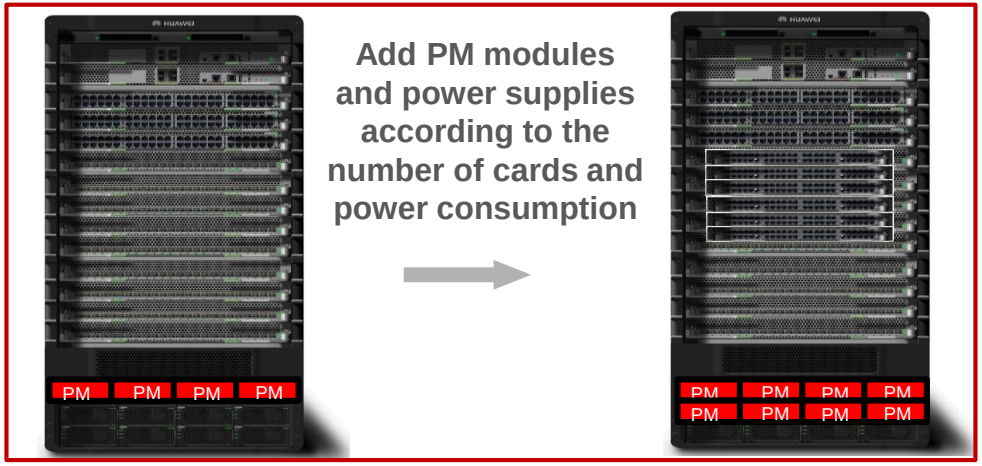


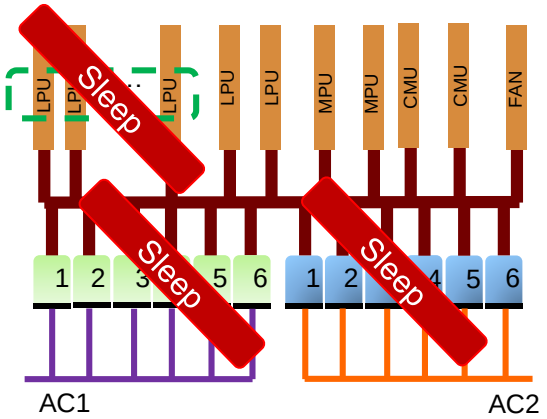
A highly integrative chip has high power consumption. In 2012, the power consumption of a single chip exceeds 100 W.

The optical module is migrating to 100GE, with increasing power consumption.

Increasing power consumption of chip and optical module poses high requirements on core devices:
System powering capability---20KW for the chassis
System heat dissipation---heat dissipation per slot exceeds 1000W

On-demand Powering/Dynamic Energy-Saving





On-demand power configuration

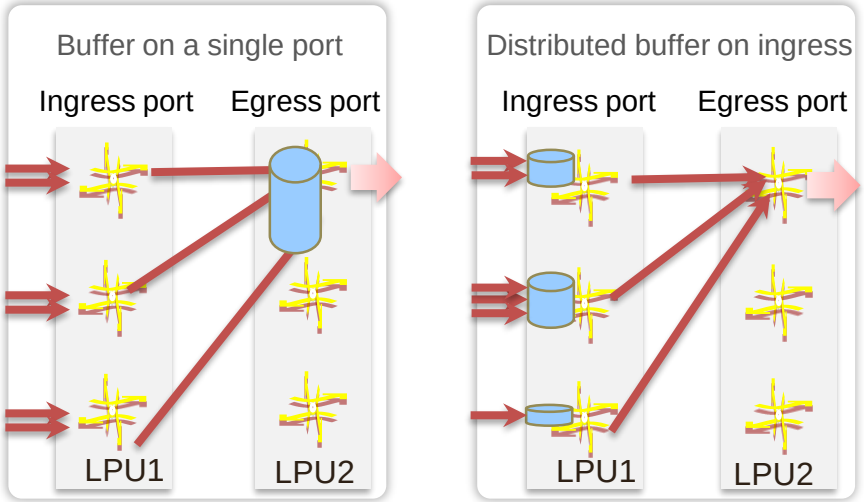
- Restrict the number of initially configured power modules, controlling initial investment
- Power module control based on small granularities, expanded on demand

Improve power efficiency, reduce conversion loss

- Accurate power configuration implements 80% power loading and increases power use efficiency to **96%**.

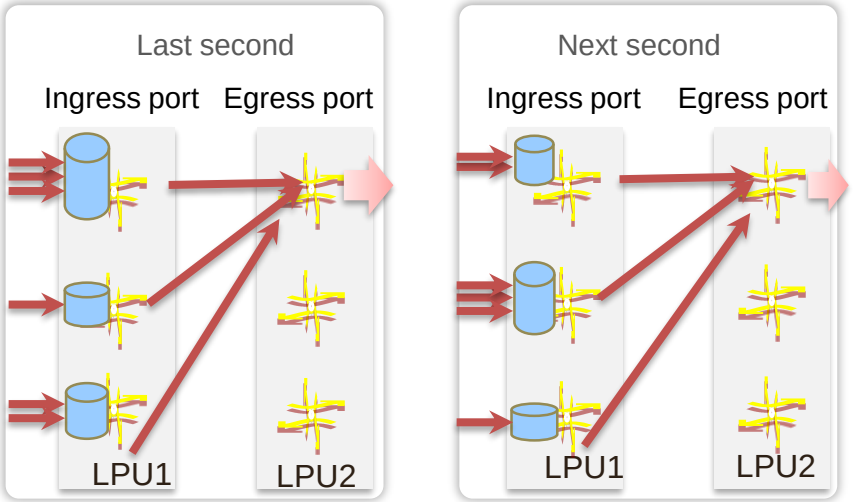
Dynamically Distributed Buffer

Distributed buffer can accommodate burst traffic



・Distributed buffer on ingress eases buffer loads on a single port・

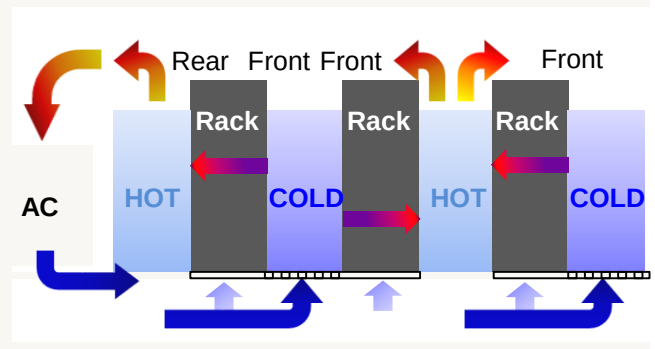
Dynamic buffer improves buffer use efficiency



・Buffer is allocated on demand and dynamically adjusted・

Data flow Buffer

Air Channel Standard and Trend in Data Center Room



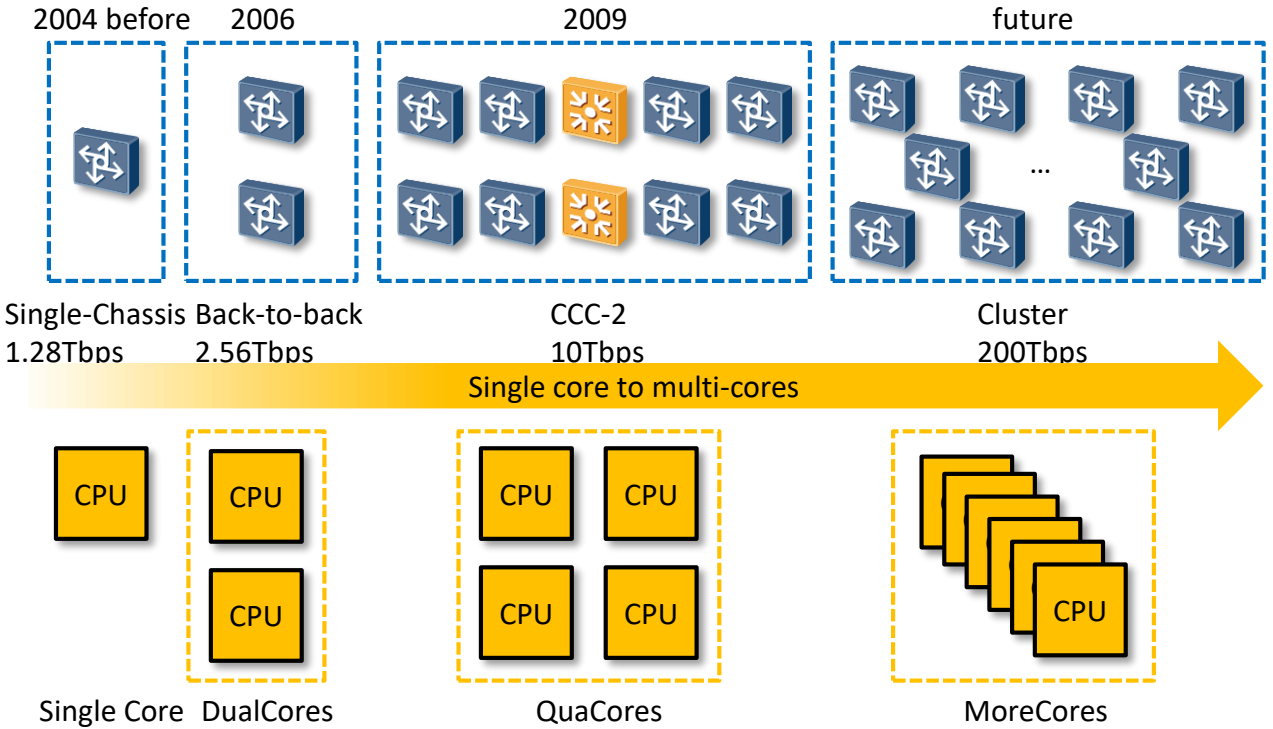
Typical air channel in Data Center Room

- The cabinets are placed in the "**face-to-face, back-to-back**" manner, separating the cold and hot air channels.
- After flowing into the cabinet and chassis through the bottom of the cabinets, cold air becomes the hot air, flows into the hot air channel, and flows back through the return air channel.

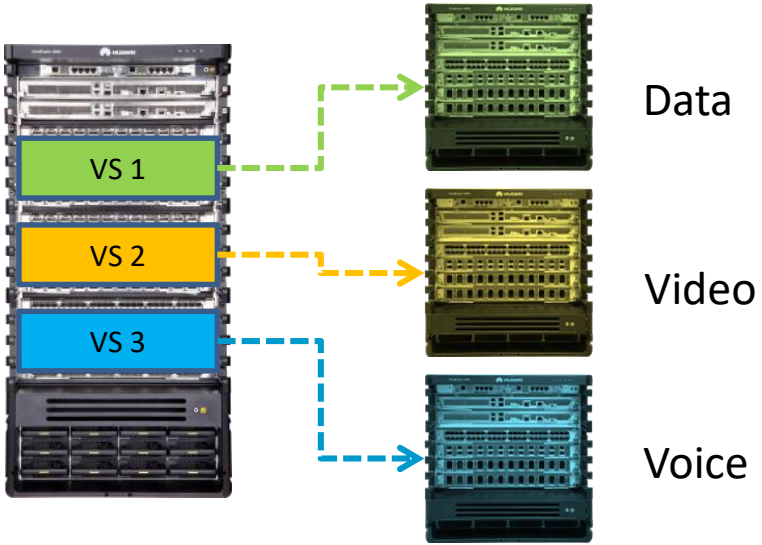
Trend: front-to-rear, complying with standards

- ANSI TIA-92
- NEBS GR-63-CORE
- If the chassis does not comply with standard, increase **10℃** to perform test in high temperature.
- Data center devices must provide the front-to-rear air channels.

Hardware and operating system evolution

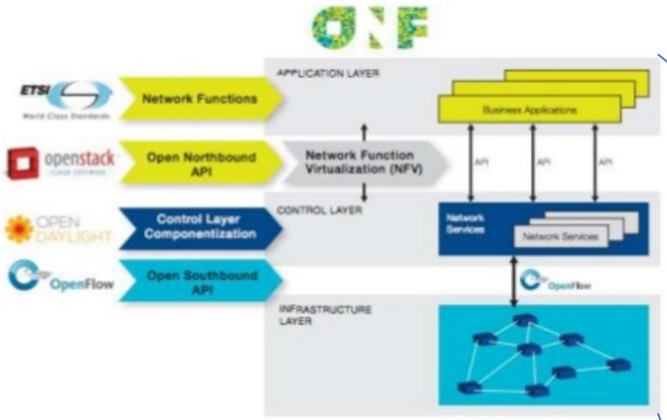


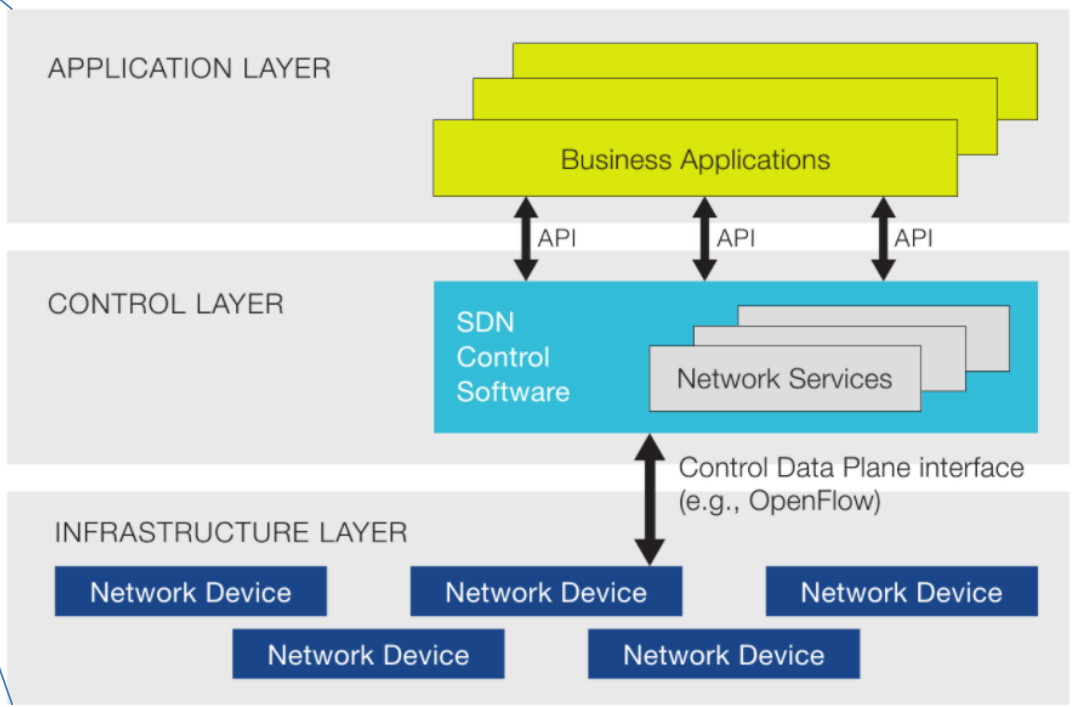
Virtual System(VS)



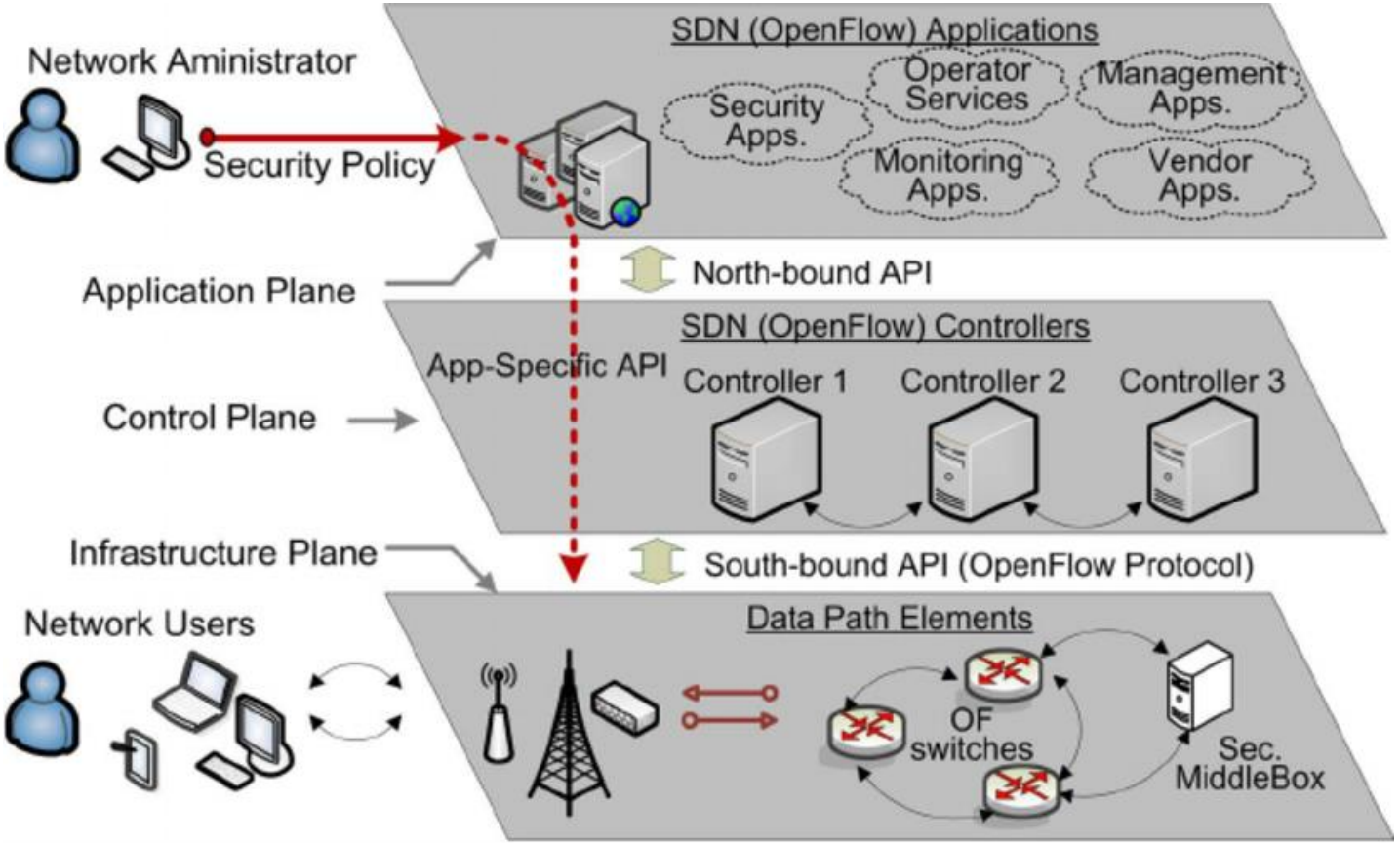
VS technology can make the handling capacity of a single physical router powerful fully utilized and simplify network, simplify management, strengthen the safety and reliability

Software Defined Networking (SDN)

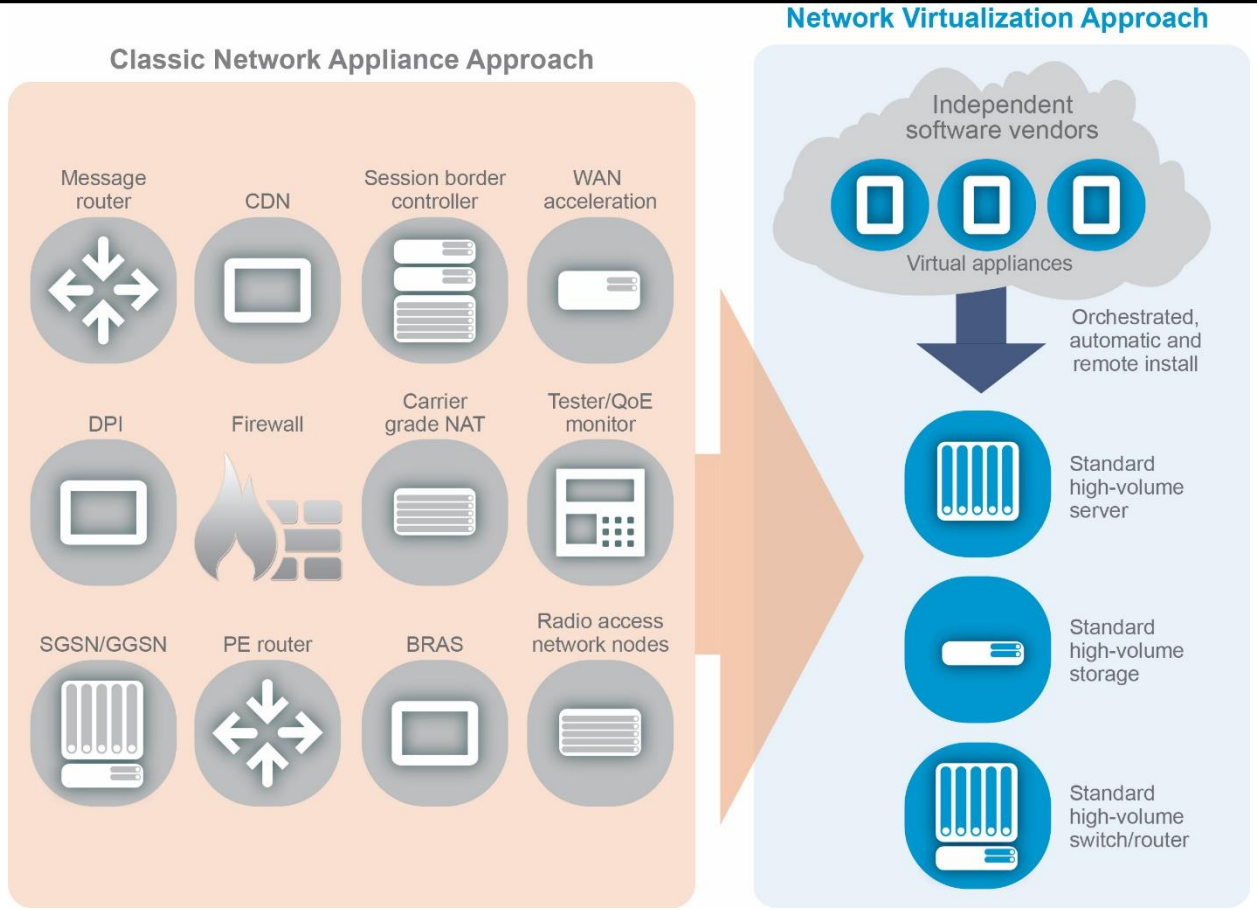




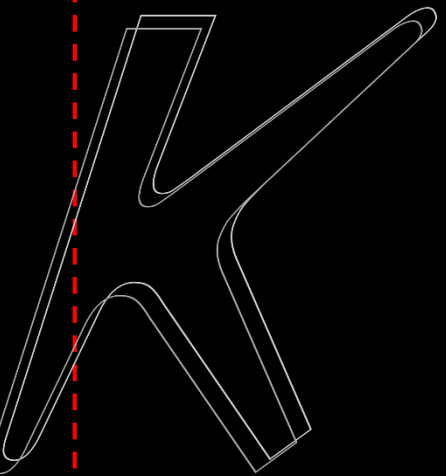
Network Processor for SDN Scenario



Network Function Virtualization (NFV)



K Labs Company Presentation



K Labs is a company specialized in Technical Trainings for Telco and ICT market

ISO 9001:2008 Certified

Business Mission


The ICT Knowledge factory

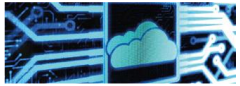

Our aim is to deliver **vendor-independent**, **high-quality** training courses that provide delegates with **real-life experience** on software and hardware in addition to imparting **theoretical knowledge**. As such, our courses include plenty of practical **hands-on** time.






Technologies

- DATA CENTER



- CLOUD COMPUTING

- IP NETWORKING

- ICT SECURITY

- CARRIER

- FIXED ACCESS

- LTE

- MOBILE NETWORKS

- MULTIMEDIA

- PERFORMANCE TESTING

- GREEN IT

- SOFTWARE

Customers and Partnership

K Labs delivers training services to a lot of big players or companies involved in the Telecommunication and ICT Market.

TIM
WIND
H3G
FASTWEB
un passo avanti
vodafone
TELESPAZIO
A Finmeccanica / Alcatel Company
SAMSUNG
sky
hp
bticino
MEDIASET
brennercom
Consortium GARR
NCSA
NATO CIS SERVICES AGENCY
Ministero delle Comunicazioni
Presidenza del Consiglio dei Ministri
United Nations Logistic Base

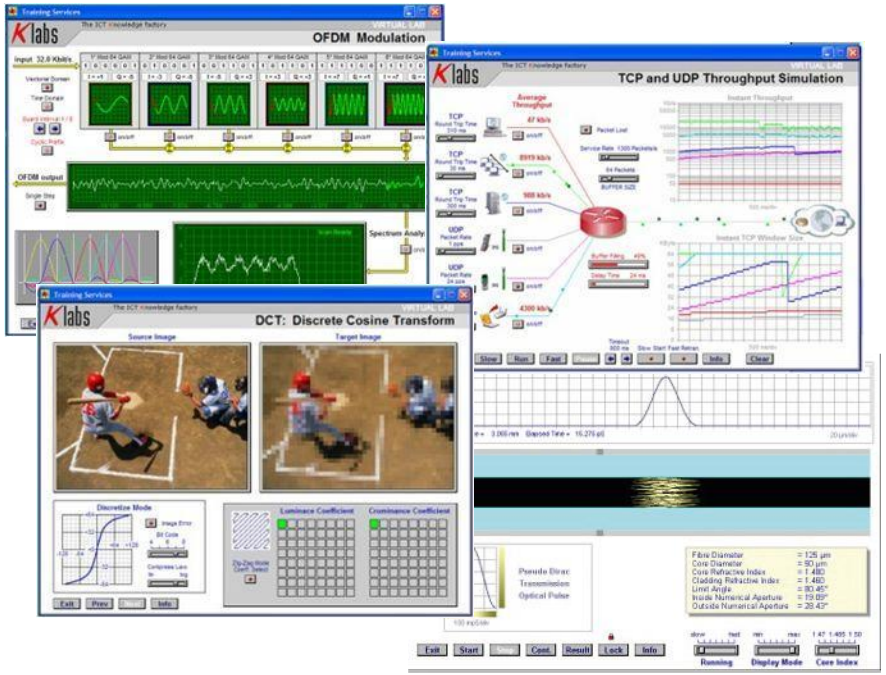
K Labs signed training partnership with the most important Manufacturers in the ICT Global Market.

radware
Authorized Training Center
CISCO
Learning Partner
HUAWEI
Authorized Learning Partner
JUNIPER NETWORKS
Authorized Education Partner
ARUBA networks
Certified Instructors
vmware TRAINING
Check Point SOFTWARE TECHNOLOGIES LTD.
Authorized Training Center
Alcatel·Lucent Enterprise
Accredited Training Partner
ERICSSON
Nokia Siemens Networks
paloalto NETWORKS
f5 NETWORKS

Educational Lab
(Multivendor)

Test Instruments

Virtual Lab
(Software simulations)



K Labs is looking for talents

Do you enjoy the challenge of learning the newest technologies on the ICT market ?

Do you have a pioneering spirit and enjoy being seen a subject matter expert ?

K Labs want to invest in bright and dynamic Engineers that would like to join our team of enthusiastic and highly qualified: **“Trainer and Professional Engineer”**

For more information on Interships and Job positions:
Tel. 059 821229, e-mail: job@klabs.it **www.klabs.it**

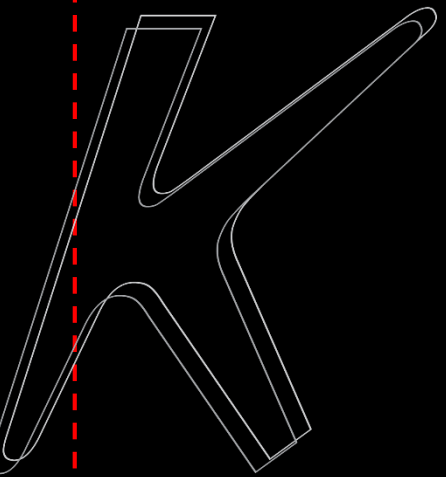
Requirements for the applicants

- 2nd or 3rd year of Telecommunications, Computer Science or Electronics preferred
- Passion for technology and telecommunications
- Good communication skills
- Good knowledge of English
- Flexibility and Adaptability to change
- Optimism, Proactivity

The candidates will be interviewed before being admitted to the internship

K Labs Internship

an opportunity to jump into the ICT world



Software Defined Networking

Internet of Things

Mobile 5G

Internship 1: Software Defined Networking

Field: Software Defined Networking

Description: Preliminary study and development of a test evironment able to check multivendor devices interworling controlled by SDN.

Test Environment Design, SDN Function Evaluation, Test Execution, Reporting.

Team work in cooperatin with K Labs engineers.

Application Deadline: Available Year-round

Internship 2: Internet of Things

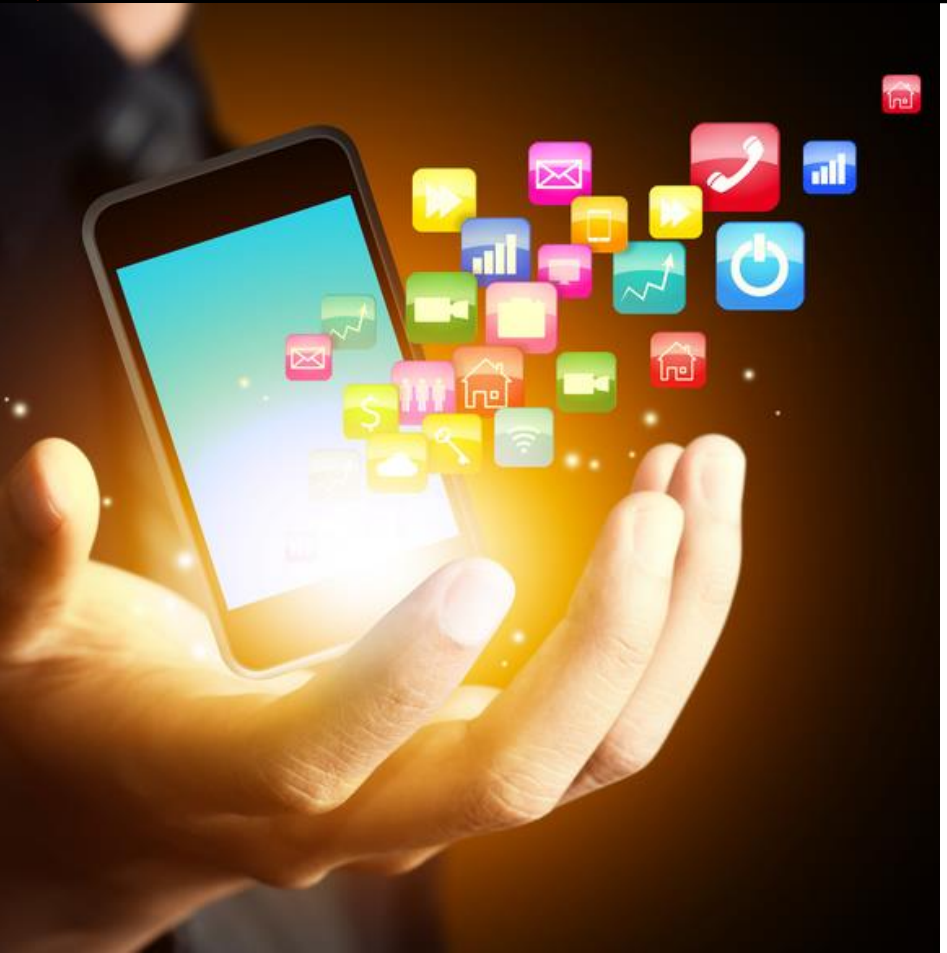
Field: Internet of Things

Description: Preliminary study and development of a test evironment able to check multivendor IoT devices interworling.

Test Environment Design, IoT Function Evaluation, Test Execution, Reporting

Team work in cooperatin with K Labs engineers.

Application Deadline: Available Year-round



Field: 5G

Description: Preliminary study and content development of an e-learning training course focused on 5° Generation Mobile Network and Services.

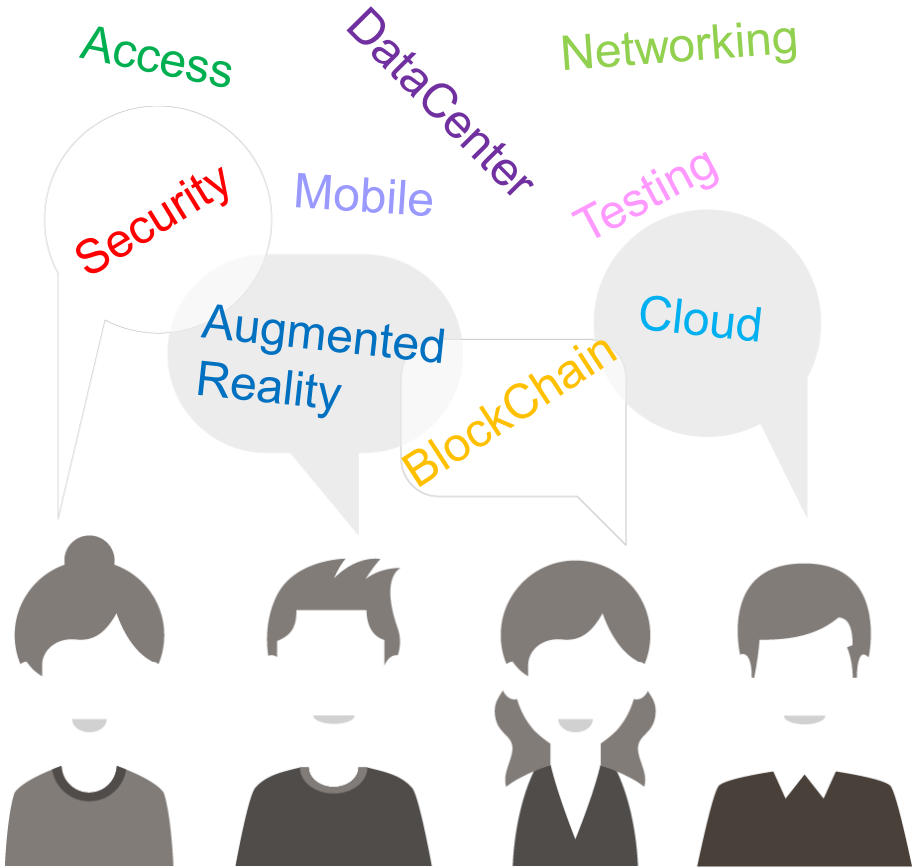
5G Standard evaluation, Learning Objects Design, cooperaton with Multimedia Developer for e-learning course implementation.

Team work in cooperatin with K Labs engineers.

Application Deadline: Available Year-round

Suggestions?

You can suggest us also different topics, in order to design together your internship @K Labs



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