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

**Relatore: Ing. Marco Grimandi (K Labs Trainer and Professional Services Engineer)**

# Agenda

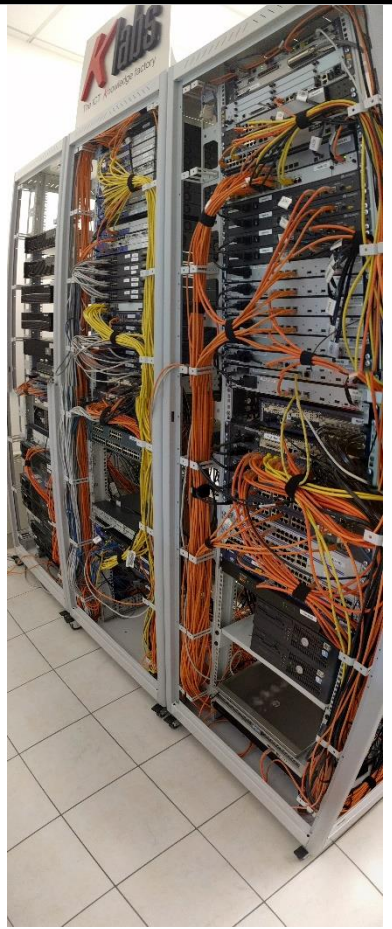

- K Labs intro
- Core Routers Evolution
- SDN/NFV Evolution
- Router Simulation
- K Labs Internship
- Cisco CCNA Certification

# K Labs' Business Mission

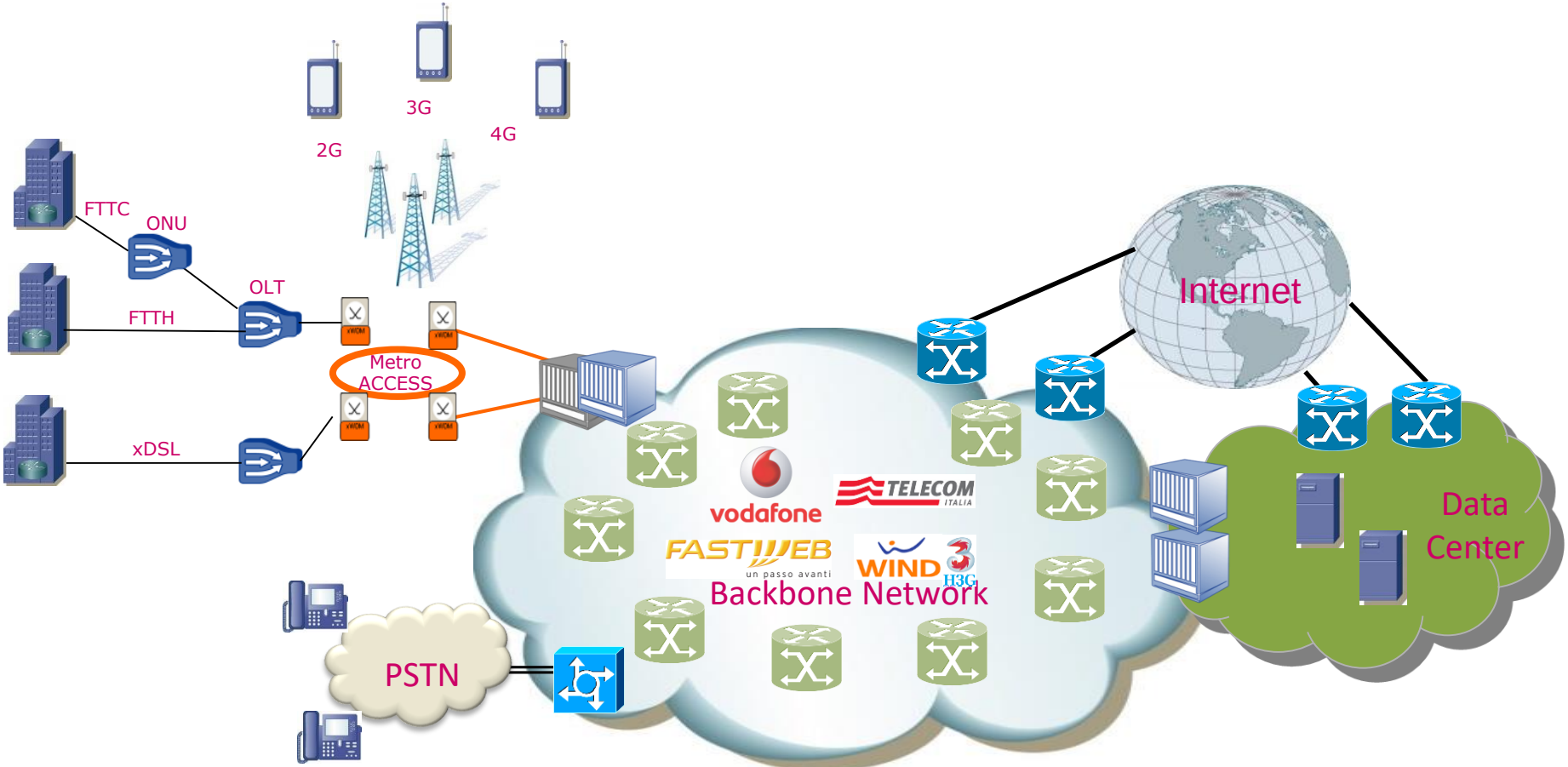
- **High-quality training courses**
- **Real-life experience**
- **Theoretical knowledge**
- **Plenty of practical hands-on**
- **Best learning experience**

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

**Modena**
**Via Salgari 17**



# TELCO Architecture



# Worldwide Top Router Vendors

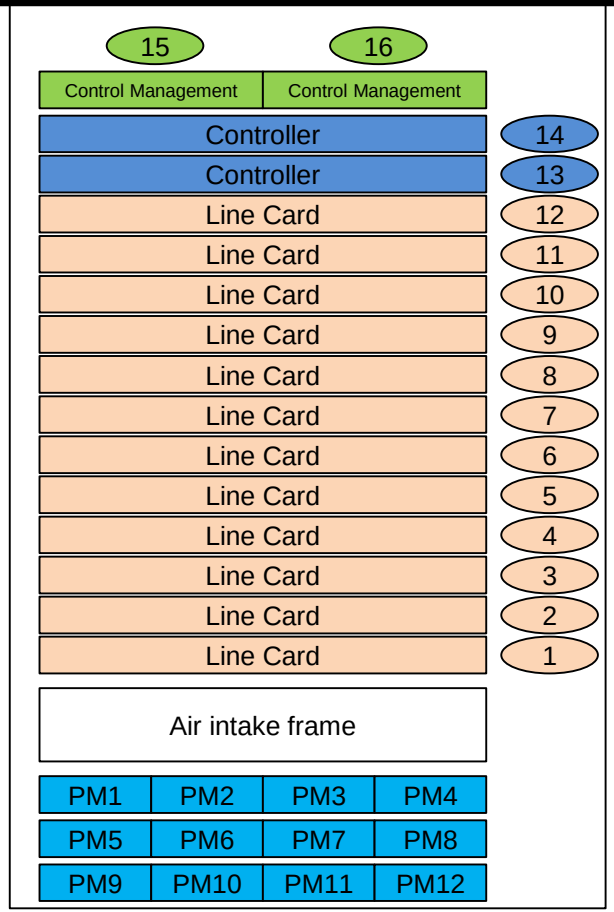
# Core Router

Front view

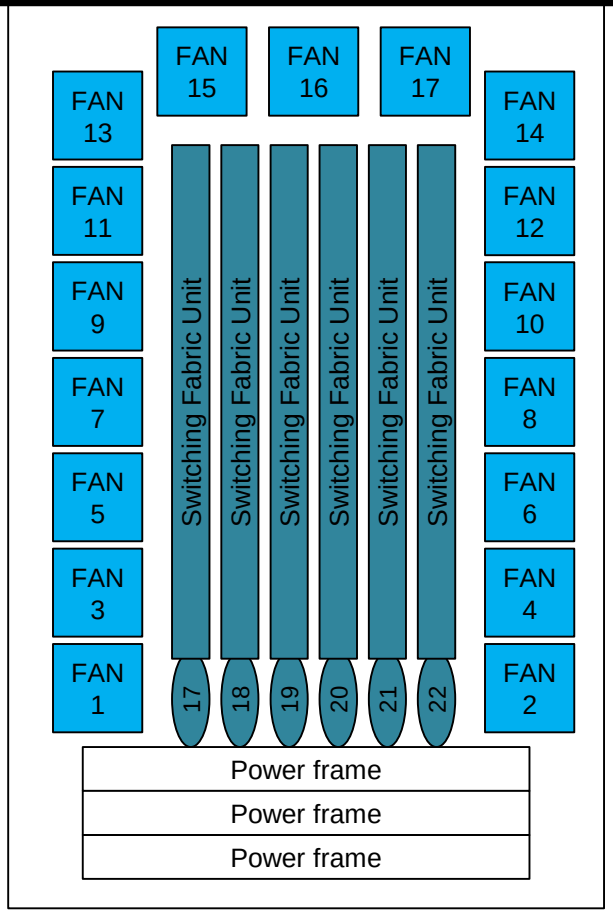
- CMU: 1+1 backup mode
- MPU: 1+1 backup mode
- Fan modules: total of 17, 1+1 backup mode
- LPU: total of 12
- SFU: 5+1 backup mode
- Air intake frame
- Power modules: 6+6 backup mode
- Power frame: total of 3, 12-way AC power

Rear view

# Slot Distribution Diagram example




front view




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

# Scalable System Platform

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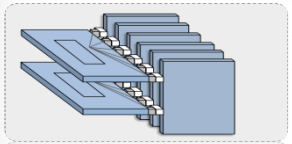
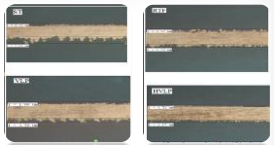
# High-Speed Interconnection



Orthogonal Architecture with “0” Cable on Backplane



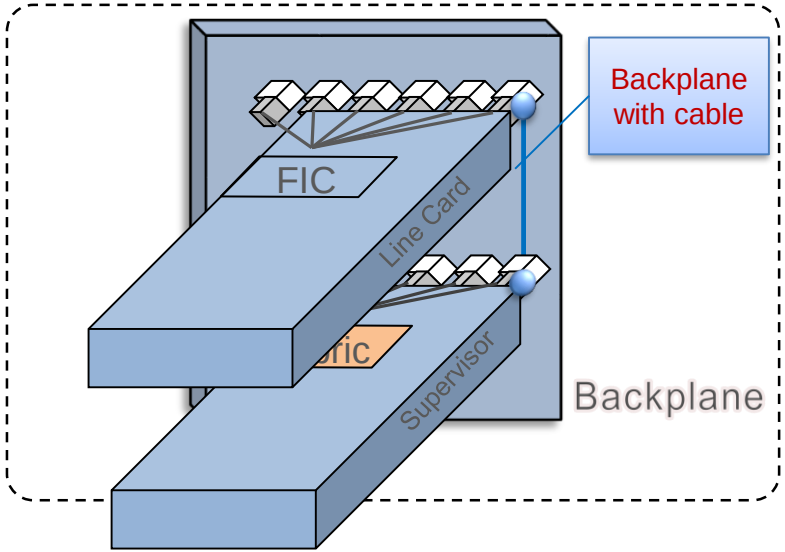
High-Speed PCB Design


High-speed Connector

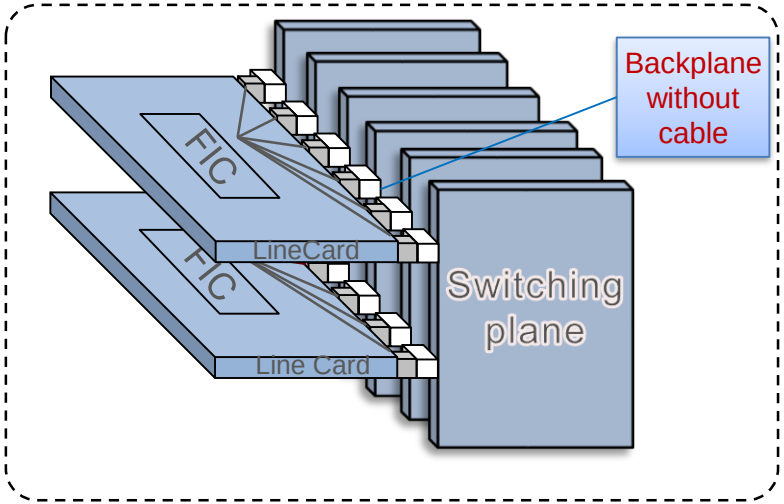
Highly Precise, Strengthened Chassis

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

# Hardware Architecture




Traditional switching architecture

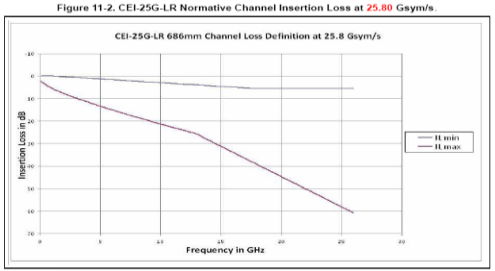



Fully orthogonal architecture

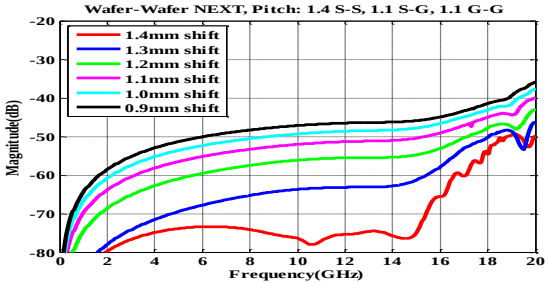
## Fully orthogonal design of line cards and Switching Fabric Units

- 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

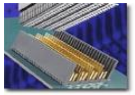



Insertion loss




Interference

2000



1.25-3.125G

2004

3.125-6.25G

2008

6.25-10.3G

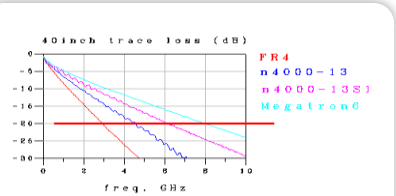
2012

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**

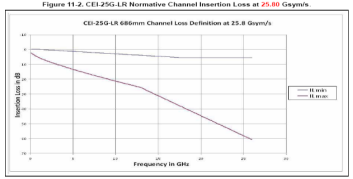
# Migrating to 100T Platform

**25G platform will be commercially used in 2015. The core switches must support migration to 25G.**




10.3G link

Connector bandwidth




25G link

**2013**

Switching capacity: 64T
Line card: 1T (unidirectional)
Slot bandwidth: 2T (unidirectional)

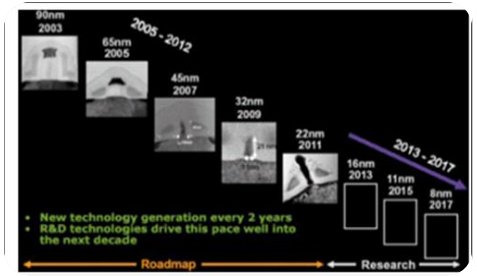
Capacity of the Entire Core Router

**2015**

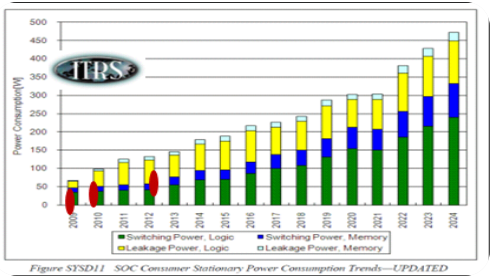
Switching capacity: 160T
Line card: 4T (unidirectional)
Slot bandwidth: 4.8T (unidirectional)

# Large Capacity Powering/Heat Dissipation

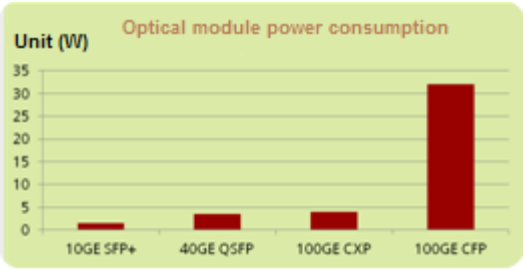
**Chip techniques upgrade every two years**




**Power consumption of a single chip exceeds 100W**




**Power consumption of optical module greatly increases**

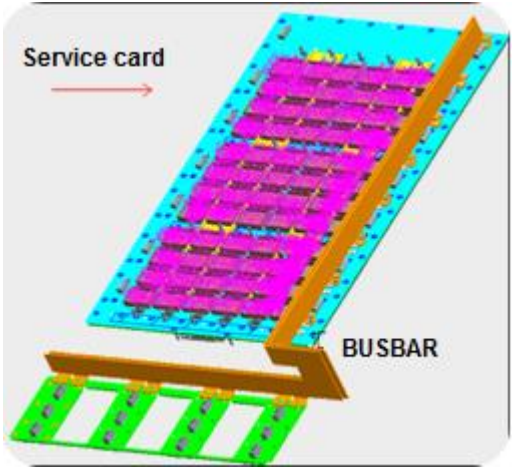


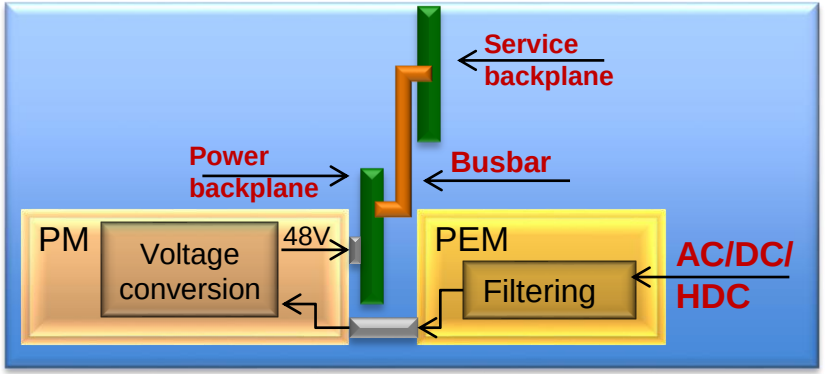

**A highly integrative chip has high power consumption. In 2012, the power consumption of a single chip exceeds 100 W.**

**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**

# Powering Technology




- Changing traditional PCB powering to BUSBAR powering
- Heat dissipation capability of the entire equipment > 20+ KW, and more than 1200W per slot

- Support AC 220V, DC 48V, 240V/380VHDC
- Separation PEM from PM, and signal cables from power cables. The power supplies and power cables are replaced and maintained separately

# Unblock Switching

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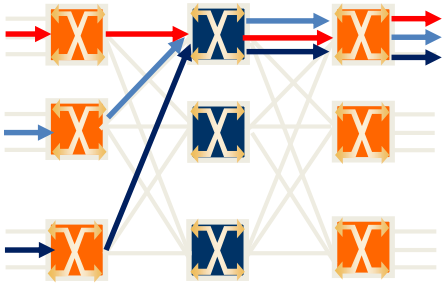
# Dynamic CLOS Switching

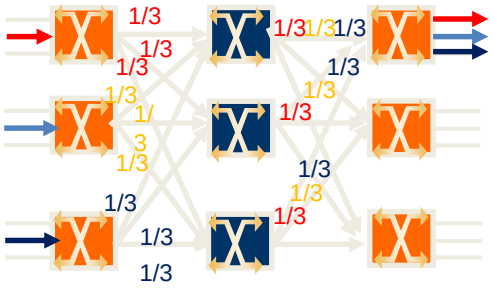
## CLOS-Static route



- CLOS-Static route. Switch fabric use efficiency is low, failing to support non-blocking switch

Blocked

## CLOS-Dynamic route




- CLOS-Dynamic route. Unblock switching is supported, providing high reliability and unlimited scalability

Unblocked

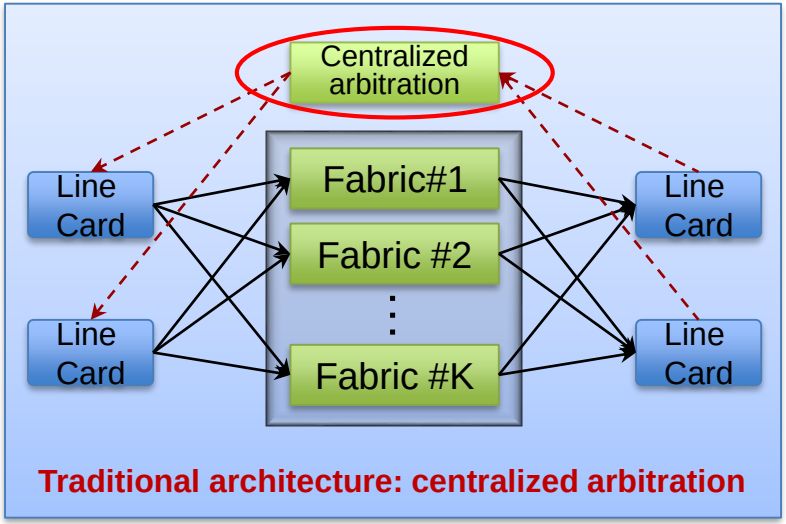
## CLOS switching structure

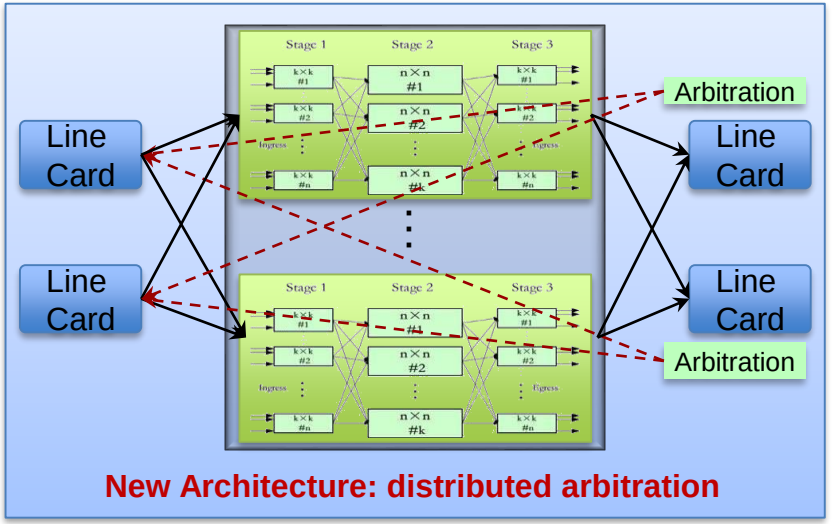
- Cell exchanging improves forwarding efficiency, avoiding large packets that affect switching performance.
- Complete VoQ scheduling mechanism, avoiding packet loss caused by congestion.

## Dynamic routing, load balancing

- **Dynamic routing,** which is irrelevant to traffic model, avoiding unbalanced traffic caused by static HASH path selection
- Distributed arbitration. Centralized arbitration may cause message loss during active/standby switchovers.

# Distributed Arbitration

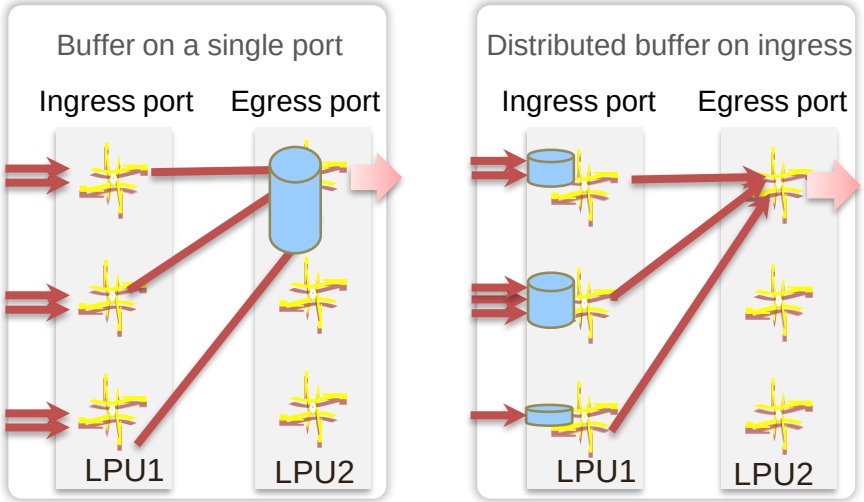



**Distributed arbitration improves scalability of the switching network**

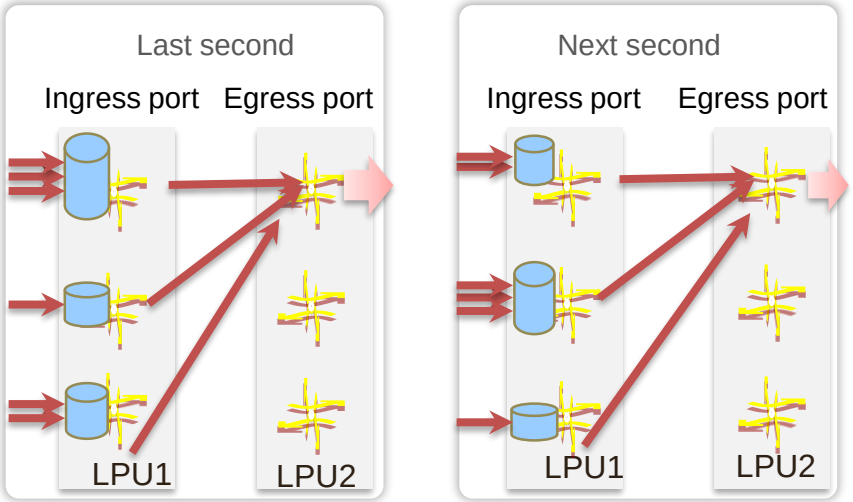
# Dynamically Distributed Buffer

## 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

# Energy-Saving

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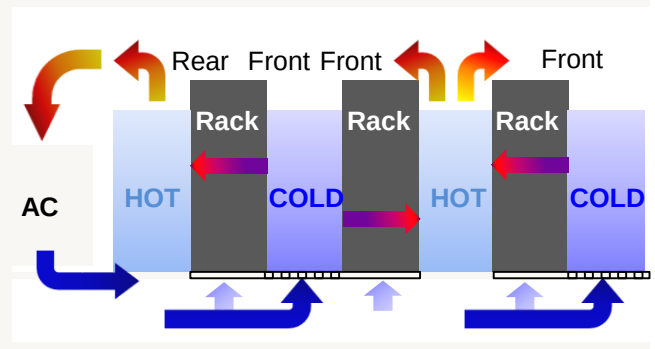
# Air Channel Standard and Trend in Data Center Room



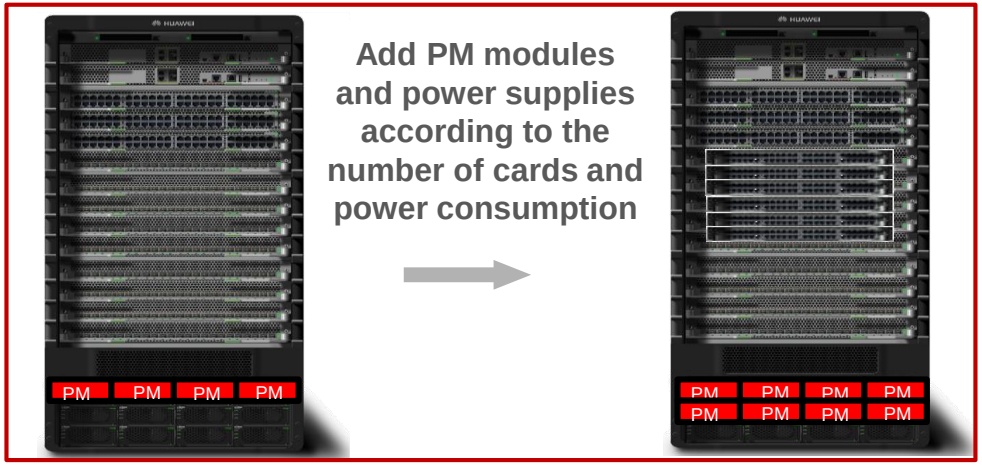

## Typical air channel in Data Center Room

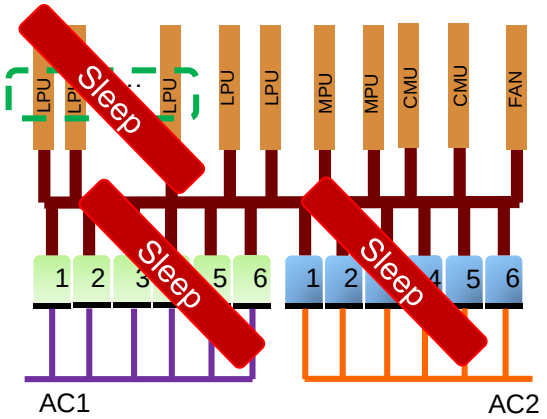
- The cabinets are placed in the "**face-to-face, back-to-back**" manner, separating the cold and hot air channels.
- After flowing into the cabinet and chassis through the bottom of the cabinets, cold air becomes the hot air, flows into the hot air channel, and flows back through the return air channel.

## 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.

# On-demand Powering/Dynamic Energy-Saving



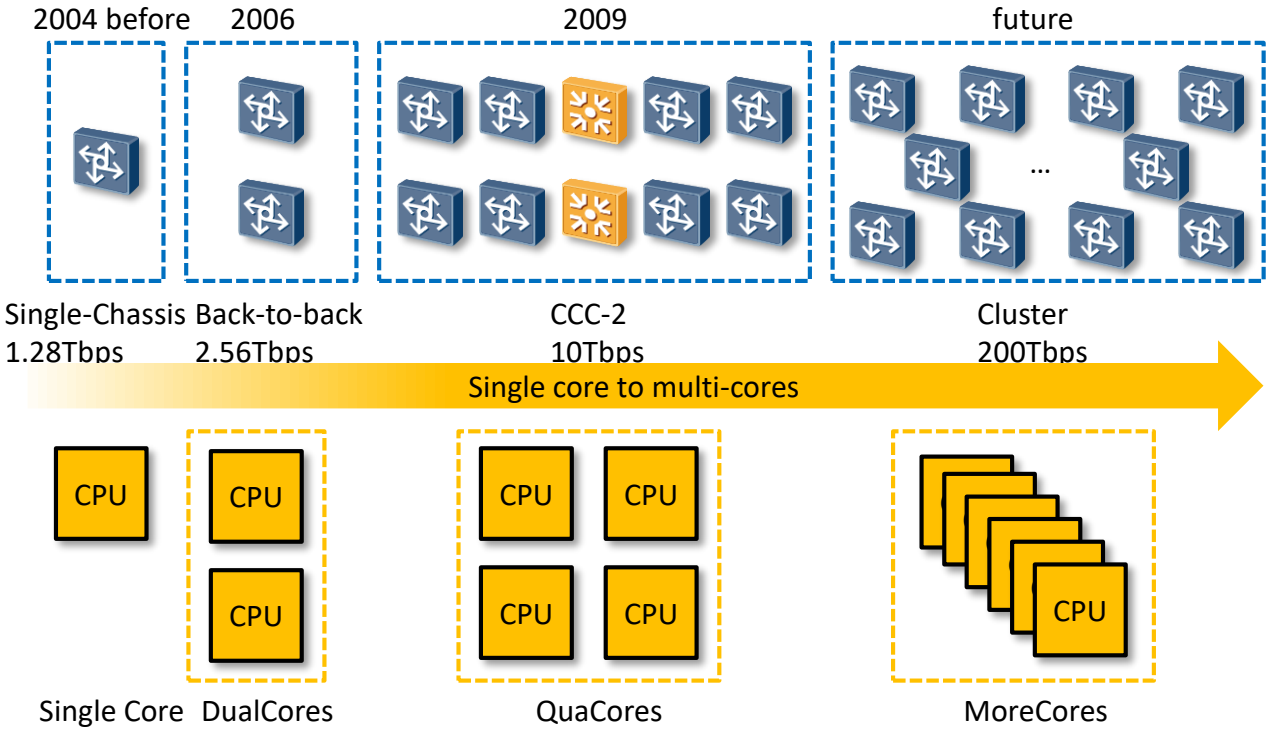

## On-demand power configuration

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

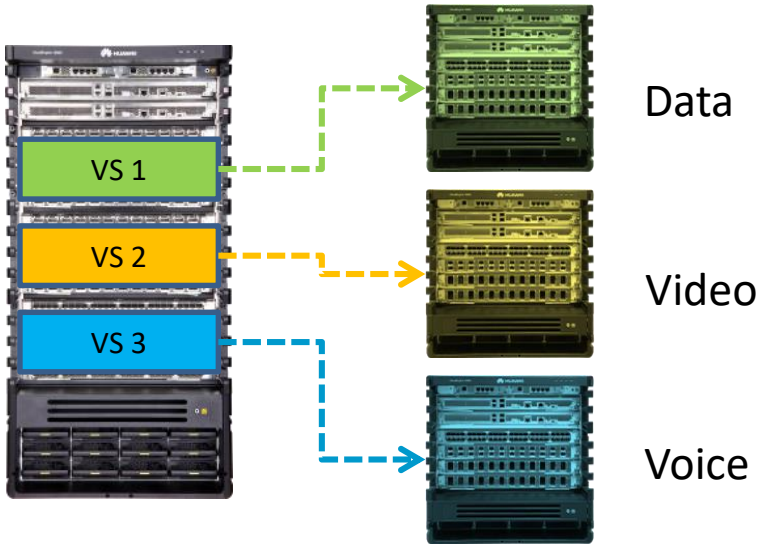
## Improve power efficiency, reduce conversion loss

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

# Hardware and operating system evolution



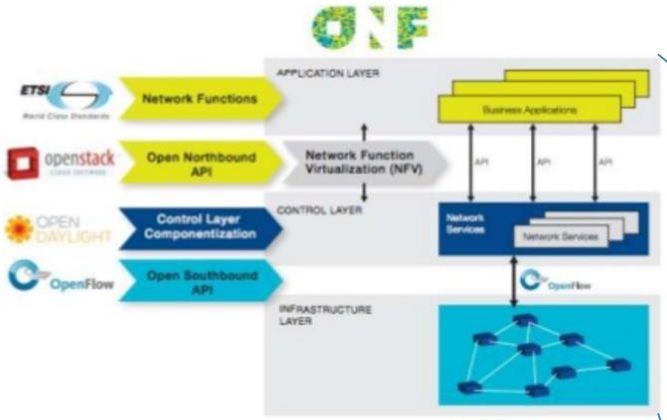
# Virtual System(VS)

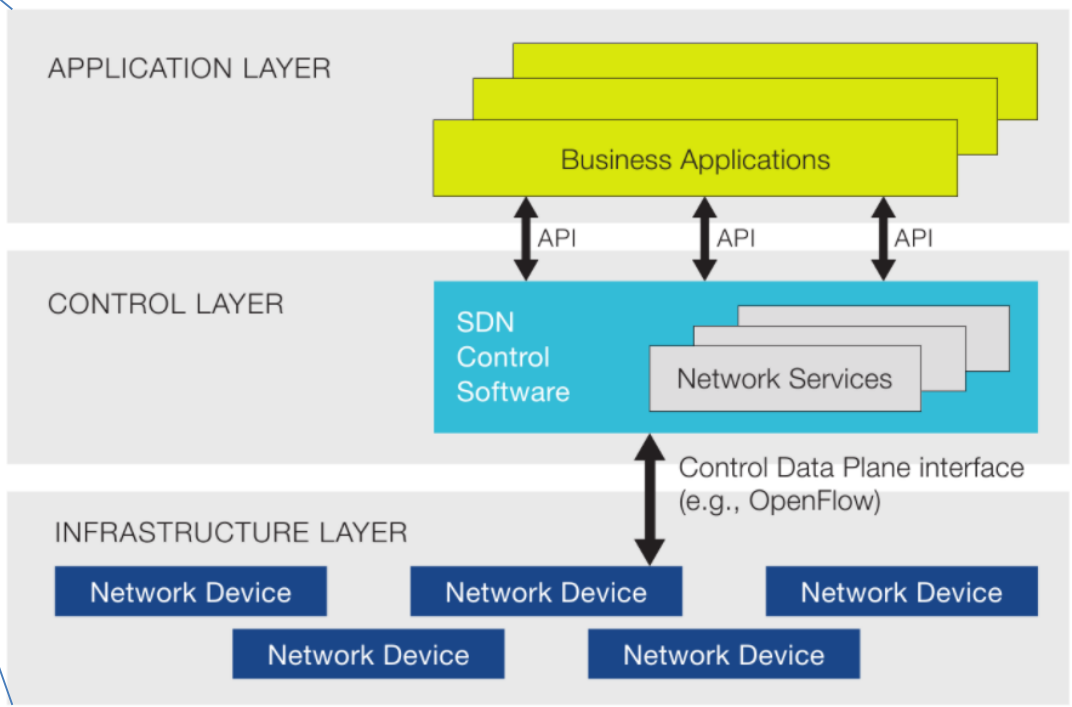



VS technology can make the handling capacity of a single physical router powerful fully utilized and simplify network, simplify management, strengthen the safety and reliability

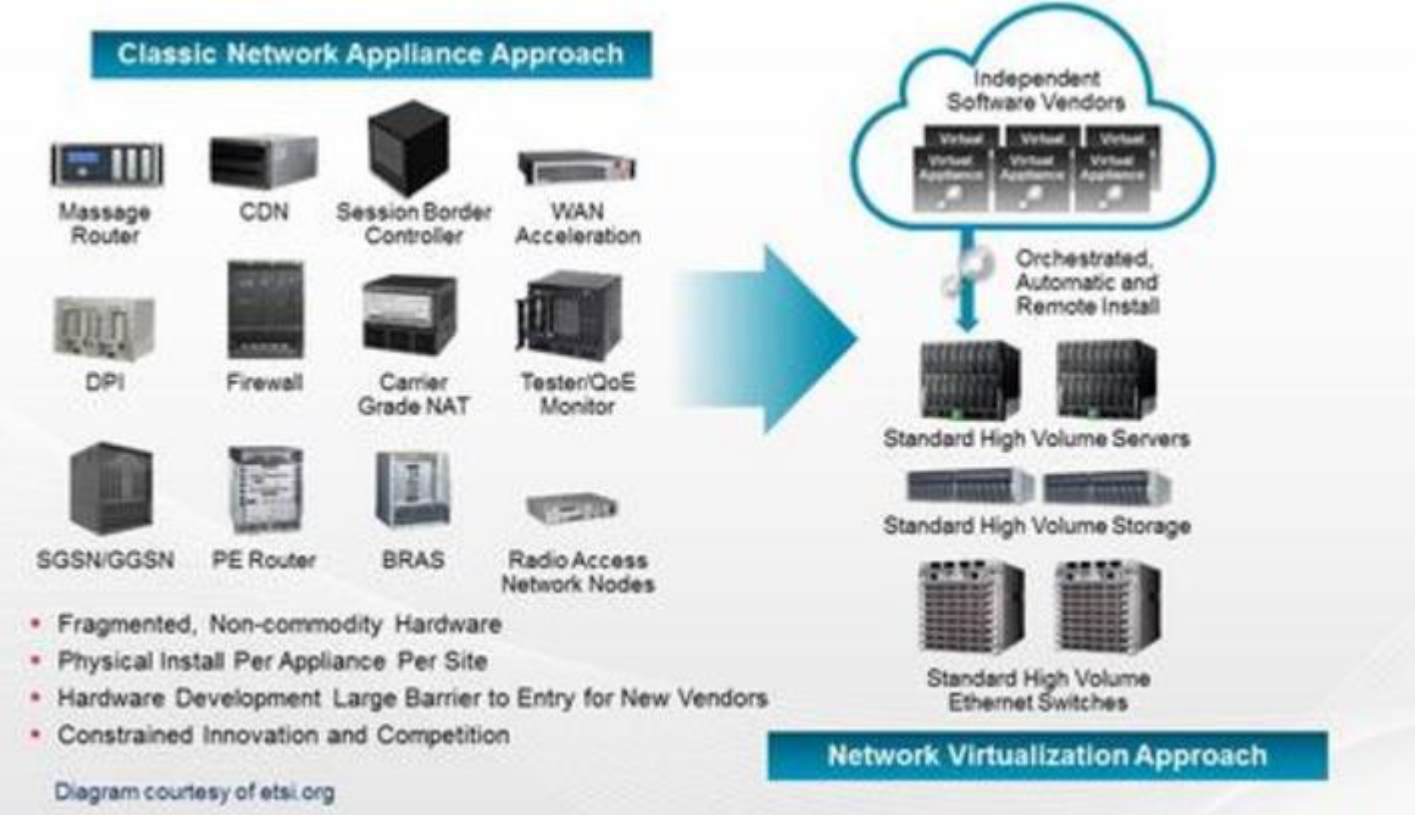
# Network Operating System evolution

# Software Defined Networking (SDN)



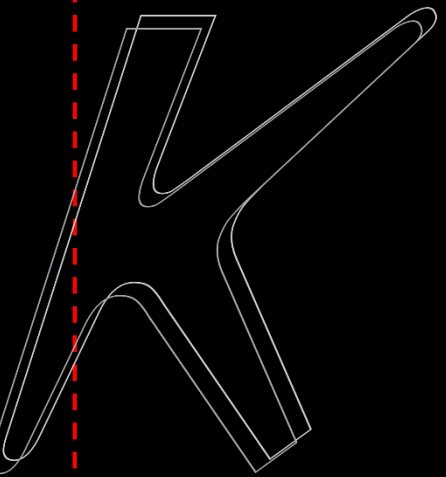



# Network Function Virtualization (NFV)



# K Labs Internship

## an opportunity to jump into the ICT world



# 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.

**Language:** Italian / English

**Application Deadline:** Available Year-round

# Internship 2: Internet of Things

**Field:** **Internet of Things**

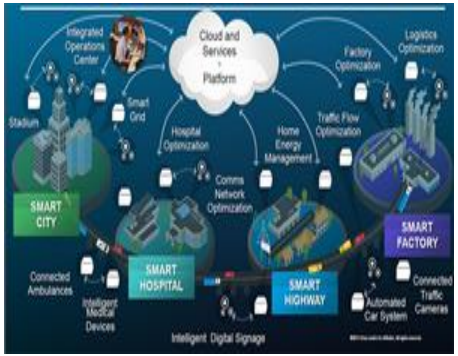
**Description:** Preliminary study and  development of a test evironment able to check multivendor IoT devices interworling.

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

Team work in cooperatin with K Labs engineers.

**Language:** Italian / English

**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.

**Language:** Italian / English

**Application Deadline:** Available Year-round

# CISCO

## an opportunity to get CCNA with K Labs

## Corso gratutito per la preparazione alla certificazione CCNA

# ‘Build your Cisco Career with KLABS’

**4-15 Settembre 2017**
**Presso K Labs, via Salgari 17 / Modena**

# Vantaggi del Corso

- **Opportunità rivolta a neo-Ingegneri (Telecomunicazioni, Informatica, Elettronica)**
- **K Labs erogherà i due corsi ICND1 (4-8 Settembre) e ICND2 (11-15 Settembre)**
- **Al termine del corso ai più meritevoli verrà proposto di sostenere l'esame per la certificazione Cisco CCNA Routing & Switching e un impiego a tempo indeterminato in K Labs**

Ottieni la **certificazione CCNA**. Diventa esperto nella Gestione delle Reti!


**Invia la tua richiesta di partecipazione al seguente link:**

**http://www.klabs.it/job-klabs**

# *Grazie per l'attenzione*

Per maggiori informazioni:

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**www.klabs.it**

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The ICT Knowledge factory