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

Relatore: Ing. Nicola Zambelli (K Labs Trainer and Professional Services Engineer)
• Core Routers Evolution
• SDN/NFV Evolution
• Router Simulation
• K Labs Job opportunities
• K Labs Internship
TELCO Architecture

Internet

Data Center

Backbone Network

vodafone

TELECOM

ITALIA

FASTWEB

WIND

PTSGN

FTTC

ONU

OLT

FTTH

xDSL

Metro ACCESS

3G

4G

2G

TELCO Architecture
Worldwide Top Router Vendors

- HUAWEI
- CISCO
- JUNIPER NETWORKS
Core Router

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
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:

- Control Management: Controller
- Line Card
- Line Card
- Line Card
- Line Card
- Line Card
- Line Card
- Line Card
- Line Card
- Line Card
- Control Management
- Air intake frame

Air intake frame:
- PM1
- PM2
- PM3
- PM4
- PM5
- PM6
- PM7
- PM8
- PM9
- PM10
- PM11
- PM12

Rear view:

- Switching Fabric Unit
- Switching Fabric Unit
- Switching Fabric Unit
- Switching Fabric Unit
- Power frame
- Power frame
- Power frame
High-Speed Interconnection

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

4 keys

- Orthogonal Architecture with “0” Cable on Backplane
- High-Speed Connector
- Highly Precise, Strengthened Chassis
- High-Speed PCB Design

End-to-end cable length
Component insertion loss
Link interference
Link impedance
- 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

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 Chipset Evolution

ASIC

20G 1.0
50G 2.0
240G 3.0
1T 5.0

General Purpose CPU
Control Plane and Data Plane Separation 2/2

Control Plane

- OSPF
  - Neighbor Table
  - LSDB
- EIGRP
  - Neighbor Table
  - Topology Table
- Static Routes
  - ARP Table

Routing Table

Data Plane

- Incoming IP Packet
- Forwarding Table
- Outgoing IP Packet
Distributed arbitration improves scalability of the switching network.
HQoS

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

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

High performance
High Density Line Cards 1/2

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

10GE copper 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

- Copper cable connection
  - 1m, 3m, 5m

- AOC connection
  - 10m
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

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.
Add PM modules and power supplies according to the number of cards and power consumption.

**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

Buffer on a single port

· 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.
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°C to perform test in high temperature.
- Data center devices must provide the front-to-rear air channels.
Hardware and operating system evolution

2004 before 2006 2009 future

Single-Chassis 1.28Tbps Back-to-back 2.56Tbps CCC-2 10Tbps Cluster 200Tbps

Single core to multi-cores

Single Core  DualCores  QuaCores  MoreCores
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
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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
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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

www.klabs.it
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 environment able to check multivendor devices interworking controlled by SDN.


Team work in cooperation 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 environment able to check multivendor IoT devices interworking.

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

Team work in cooperation with K Labs engineers.

Application Deadline: Available Year-round
Internship 3: 5G

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, cooperation with Multimedia Developer for e-learning course implementation.

Team work in cooperation 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
Per maggiori informazioni:

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