

Campus Network Design Workshop

Choosing Routers for the Campus

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Choosing a Core Router



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Core router: essential features

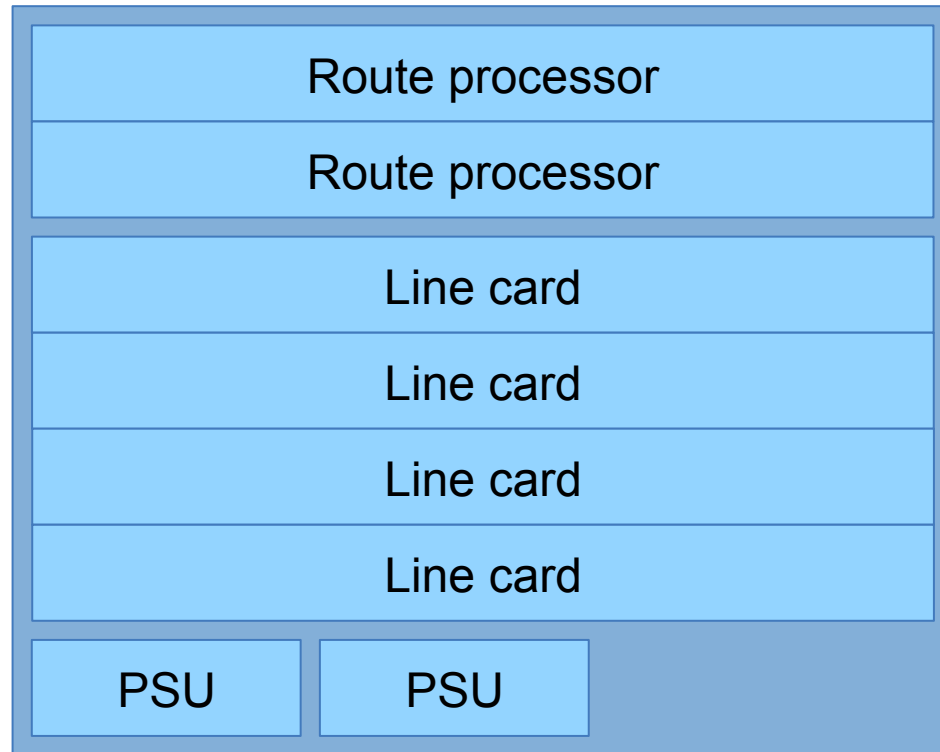
- Lots of fiber ports
 - SFP (1G) or SFP+ (10G)
- Robust, line-rate routing (layer 3 forwarding)
 - IPv4 and IPv6, static routes
- Sufficient ARP (IPv4) and NDP (IPv6) entries
- DHCP relay (DHCP helper)
- Management: SNMP, netflow/jflow/sflow etc

Core router: optional features

- OSPF (v2 and v3) or IS-IS
- HSRP/VRRP
- Hardware redundancy (e.g. dual PSU)
 - But would you be better buying a whole second device?



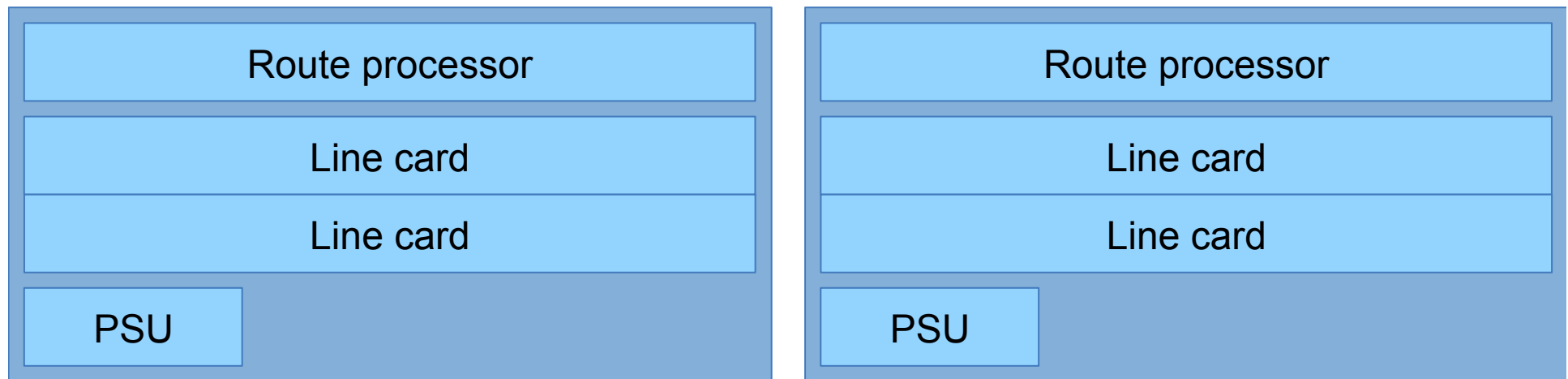
One super-redundant device



- Chassis failures are not unknown ☹️
- What would you do if that happened?



Two less-redundant devices



- Running "live-live" so everything is tested
- In emergency, can move key users to other side
- Key buildings can be dual-homed
 - This is where OSPF and HSRP/VRRP come in



Don't spend too much!

- Many “edge” L3 switches make fine campus core routers
- You won't be carrying a full routing table
 - So a limit of say 16K routes isn't a problem
 - Check how many IP interfaces/VLANs it supports
- Whatever you buy today will be obsolete in 3-5 years anyway
- If it's cheap you can afford two

Cisco C3750X-{12,24}S-E

- 12 or 24 SFP ports
 - Plus 2-4 optional uplinks ("service module")
 - Only does Netflow on the service module ports
- Stackable (up to 9 units)
- Needs *IP Services* licence for IPv6



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Cisco C4500-X

- 16 or 32 SFP+ ports (1G/10G)
 - Plus optional 8-port 10GE expansion module
- IPv4/IPv6 with IP Base licence
 - Enterprise licence gives you BGP
- Can stack two, using 10GE ports (“VSS”)



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Juniper EX4200-24F

- 24 SFP ports
- Optional 2x10G modules
- Stackable (up to 10)



"Advanced Feature" licence not required - only for IS-IS, BGP and MPLS

Juniper EX4500

- 40 SFP+ ports (1G/10G)
- Optional uplink modules

Beware limit of only 1,000 IPv6 NDP entries in hardware; use with L3 distribution switches?



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Not big enough?!

- Above this you are looking at chassis switches
- Examples:
 - Cisco 4500E
 - Juniper EX8208, EX8216



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Maybe you already have one!

- Check the features of your existing devices
 - And check on forums for experiences of people using the same device for routing
- May need to enable it: “ip routing” or similar
- May need to update to latest stable firmware
- Test with a spare device if you have one

Choosing a Border Router



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Border router: essential features

- Robust, line-rate routing (layer 3 forwarding)
 - IPv4 and IPv6, static routes
- Strong CPU, Large Memory
- Sufficient ARP (IPv4) and NDP (IPv6) entries
- Management: SNMP, netflow/jflow/sflow etc
- OSPF (v2 and v3) or IS-IS
- NAT (if using internal private IPv4 address space)
- Hardware redundancy (e.g. dual PSU)
 - but would you be better buying a whole second device?

Border router: optional features

- If Multihoming:
 - Full support for BGP
 - Ability to carry full BGP table (if needed)
 - Support of all BGP Attributes, implementing BGP policies

Sizing a Border Router

- Consider connection to upstream provider
 - Allow for headroom far greater than link capacity
 - Bandwidth upgrades needed
 - Traffic growths larger than expectation
 - Dealing with Denial of Service Attacks from outside
- Physical chassis size is irrelevant
 - Smaller the better, reduced power and space requirements
- Border router needs:
 - Internal interface (to network core)
 - External interface(s) (to upstream provider(s))
 - 1 Rack Unit is usually enough



Typical Examples

- Cisco 7301 or Cisco 7201
 - Now end of sales, but excellent 1RU router with 3 and 4GE interfaces respectively
 - 7301 good for links up to 300Mbps (real world)
 - 7201 good for links up to 600Mbps (real world)



- Not really equivalent, but:
 - Cisco 4451 (2 RU), 4431 (1 RU) & 3945 (4 RU)
 - All offer performance similar to 7201 and 7301



Typical Examples

- Cisco ASR 1000 Series
 - “replaces” Cisco 7201
- Popular choices:
 - ASR1001X (1RU) is popular border router
 - 2x10GE and 6x1GE interfaces
 - 2.5Gbps throughput default
 - Licence activated throughputs up to 20Gbps
 - ASR1002X (2RU)
 - 6x1GE interfaces
 - 5Gbps throughput default
 - Licence activated throughputs up to 36Gbps



Typical Examples

- Cisco ASR 9001
 - Not really a border router, but being used as such by many operators
 - 4 built-in 10GE SFP+ interfaces, with support for 10GE and 40GE modules (2RU chassis)
 - Throughput of 120Gbps
 - Suitable for uplinks of 10Gbps and above



Typical Examples

- Juniper MX5 to MX80
 - One common chassis (2RU)
 - Model upgradable by licence
 - Throughputs from 20Gbps to 80Gbps
 - 4x 10GE interfaces (activated on MX40 & MX80)
 - Two expansion slots
- Juniper MX240 upwards
 - 6 RU chassis
 - Throughput of 480Gbps
 - Four expansion slots (no builtin interfaces)



Summary

- Core Router
 - Focus on scalability, sufficient CPU to ensure current and immediate future needs
 - Router or “L3 Switch” is often appropriate, as routing needs in the Core are not onerous
- Border Router
 - Physical size unimportant → small!
 - Needs v few interfaces
 - Needs big CPU to handle border functions
 - Consider future BGP needs



Questions?

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