

Network Architecture & Design (Ch 2)

Essentials: Hierarchical design, 3-layer model, L2/L3 operation

Agenda

- Pop quiz: Ch 1 material
- In The News: Maybe "more difficult" is a better teaching/learning method?
- Expectations for time commitment: min 6 hrs/wk outside of class (truly!)
- Reminder: Free, legal copy of first 3 chapters of textbook: see Wk1Day1
- Let's make the course material real! Review the 7 network areas, then:
<https://www.cisco.com/c/dam/assets/prod/switches/cisco-switch-selector-how-to/index.html>
- Any questions from previous class & Lab 1?
- Review last page of notes from last lecture
- Ch 2 material

Schedule for Regular Weekly Due Dates

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	'3012 in-class Q				'3011 in-class Q	
'3012-A1 post-lab		'3011 Cisco Q		'3012-A2 post-lab	'3011-A1/2 post-lab	

Post-lab and Cisco online quiz deadlines are 11:59pm (i.e. midnight), except the deadline for NET3011 post-labs is 12:59pm (after lunch).

Assigned Readings & Lab work

- Read Ch 2 in FLG; due next Wed at 3pm; expect a pop quiz
- Lab 1 pre-lab: due by Fri @ 1pm (but normally **before your lab** period)
- Lab 1 post-lab: by Fri @ 1pm (every week; see above schedule)
- Lab 2 **pre-lab**: due **before** your lab next week.

In The News

"Amjad Masad, a programmer who works at Facebook, has put up a post about intuition and programming. It's based on a series of experiments (PDF) into how the presentation of a problem affects the **learning** involved in solving it."

<http://developers.slashdot.org/story/16/01/04/1637257/overcoming-intuition-in-programming>

"In a series of experiments, researchers set out to discover the relationship between difficulty or "disfluency" and cognition. They presented the same test to two groups, one in an easy to read (intuitive) format and the other in a difficult (disfluent) format. **And in all the experiments they carried out, the disfluency group scored substantially higher.** The theory behind this is that people will default to relying on the automatic, effortless, and primitive system for reasoning. But if things are counter-intuitive or harder to understand we switch to the deeper, deliberate and analytical mode of thinking." <http://amasad.me/2016/01/03/overcoming-intuition-in-programming/>

Both the original research as well as Amjad's observations would tend to suggest that there is more learning if people are first required to struggle with a problem... Perhaps that's a technique that (responsible?) teachers should incorporate?

Ch 2: Network Architecture and Design

Hint: Memorize this!!

Key concepts include:

1. Hierarchical design, and a 3-layer model: Core, Distribution, Access
2. Types of switches: recall *cut-through* vs *store-and-forward* and *managed* vs *unmanaged*
3. L2 vs L3 forwarding ("switching"): incl. sequence of operations, hardware
 - L2: CAM table for MAC addresses; TCAM for ACLs and QoS
 - L3: 3 types: process(or), route caching, topology-based switching (Cisco terms = process, fast switching, CEF)
TCAM for CEF, ACLs, and QoS;

Definition for a Managed Switch: (ref: p. 23 FLG)

- can assign an IP address, **and**
- can connect remotely; **and**
- can change settings/configuration

Key aspects of Layers:

- How far down does L3 go (as opposed to pure L2)?
- What types of devices connected to each layer?
- What policies and/or security are implemented at each layer?
- What functionality and features are provided by each layer?

... **Read** the textbook and find the answers to all these questions!!

Additional notes:

- *Route processor*: this term is used extensively and is defined (finally!) on p. 33: "The Control Plane (CPU/route processor) of ..."
- There is **no such thing as 100% uptime!!!** (ref: p. 9, 15) At best, you might aim for achieving "5 nines" or "6 nines" uptime.

It's important to be able to distinguish Campus and Datacentre network features:

... **Read** the textbook and find the answers to all these questions!!

... and in case you're wondering, yes, networking is a rapidly evolving field:

<https://queue.acm.org/detail.cfm?id=2874238>

Frame Forwarding (Ver 1.0 – store-and-forward, with VLANs)

Here's a better version of frame forwarding, but it's still only ver 1.0; it doesn't consider ACLs, QoS, or overload conditions.

1. Receive entire frame [input buffer]
2. Re-compute CRC
3. Discard frame if bad CRC; otherwise continue processing
4. Determine VLAN:
 - for access ports, according to configured VLAN
 - for trunk ports, according to VLAN tag on frame (or Native VLAN if no tag)
5. Look in MAC address table, according to VLAN, for possible match
 - if match, then select single egress port/trunk
 - if no match, then select flooding as egress method
6. Determine whether to add or strip VLAN tag:
 - Add a tag if passing from access to trunk (new tag = access VLAN #)
 - Strip the tag if passing from trunk to access
 - No change if not crossing access / trunk boundary
7. If VLAN tag added or stripped, re-do CRC
8. Queue the frame on selected egress port(s) [output buffer(s)]