Virtual Local Area Networks

(VLANs)

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Introduction

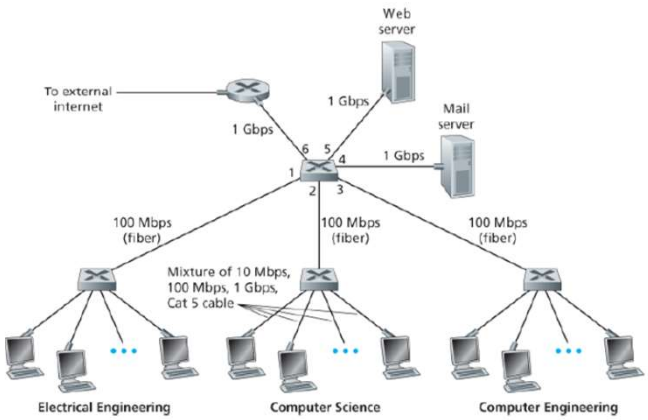

Figure 6.15 An institutional network connected together by four switches

- Modern institutional LANs are often configured hierarchically.
- A configuration works well in ideal world.

Three drawbacks can be identified

- Lack of traffic isolation.
- Inefficient use of switches.
- Managing users.

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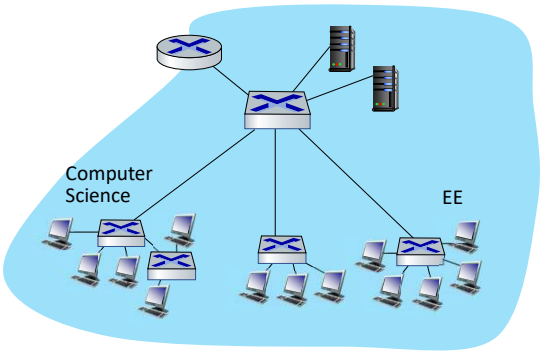
Virtual LANs (VLANs): motivation

Q: what happens as LAN sizes scale, users change point of attachment?



single broadcast domain:

- *scaling:* all layer-2 broadcast traffic (ARP, DHCP, unknown MAC) must cross entire LAN
- efficiency, security, privacy issues

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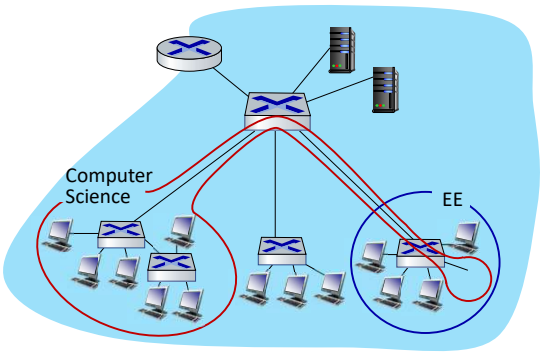


single broadcast domain:

- *scaling:* all layer-2 broadcast traffic (ARP, DHCP, unknown MAC) must cross entire LAN
- efficiency, security, privacy, efficiency issues

administrative issues:

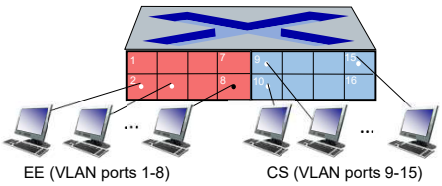
- CS user moves office to EE - *physically* attached to EE switch, but wants to remain *logically* attached to CS switch

Port-based VLANs

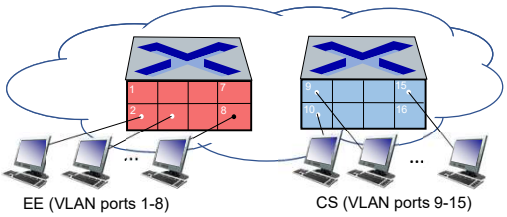
Virtual Local Area Network (VLAN)

switch(es) supporting VLAN capabilities can be configured to define multiple ***virtual*** LANS over single physical LAN infrastructure.

port-based VLAN: switch ports grouped (by switch management software) so that *single* physical switch ……

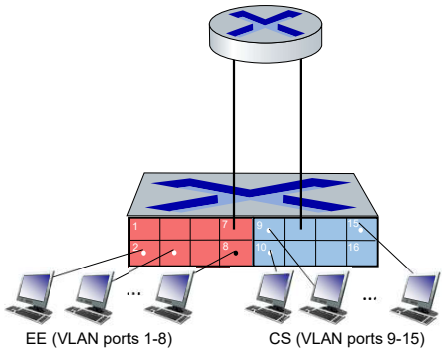


… operates as multiple virtual switches



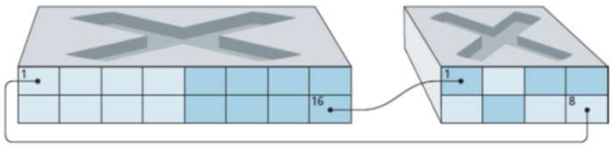
Port-based VLANs

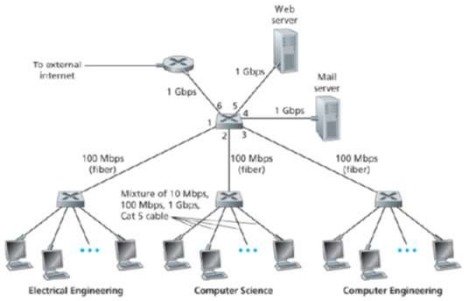
- traffic isolation: frames to/from ports 1-8 can *only* reach ports 1-8
  - can also define VLAN based on MAC addresses of endpoints, rather than switch port
- dynamic membership: ports can be dynamically assigned among VLANs
- forwarding between VLANS: done via routing (just as with separate switches)
  - in practice vendors sell combined switches plus routers



how should two switches be interconnected

1) Two Cables





- This solution does not scale
  - N VLANS would require N ports on each switch to interconnect two switches.

2) Trunked

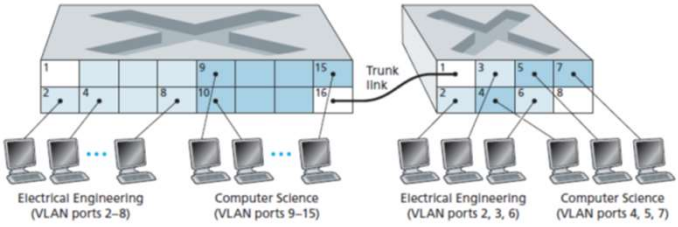


Figure 6.26 Connecting two VLAN switches with two VLANs: (a) two cables (b) trunked

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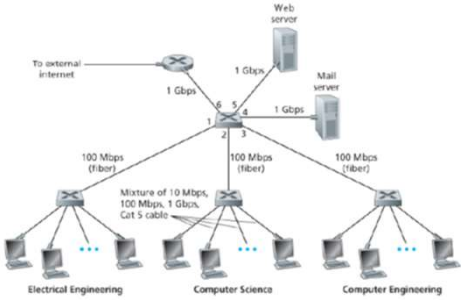
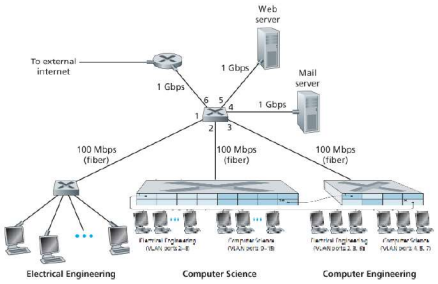
how should two switches be interconnected





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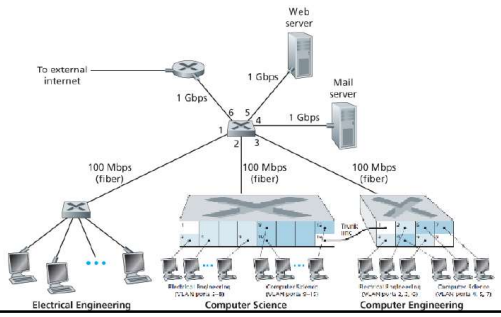

2) Trunked

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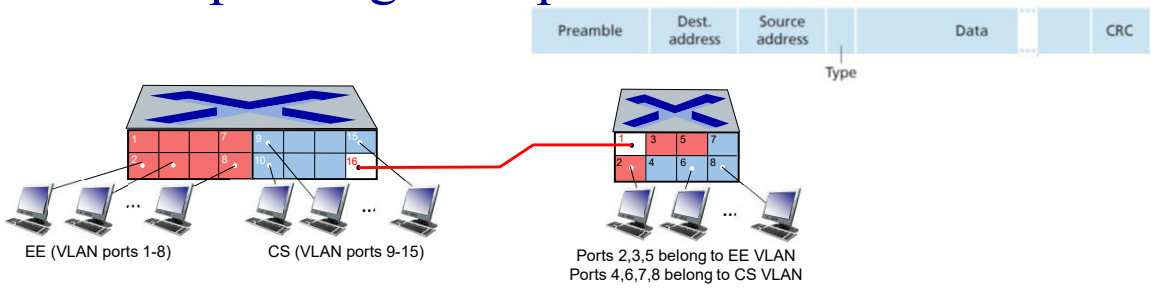
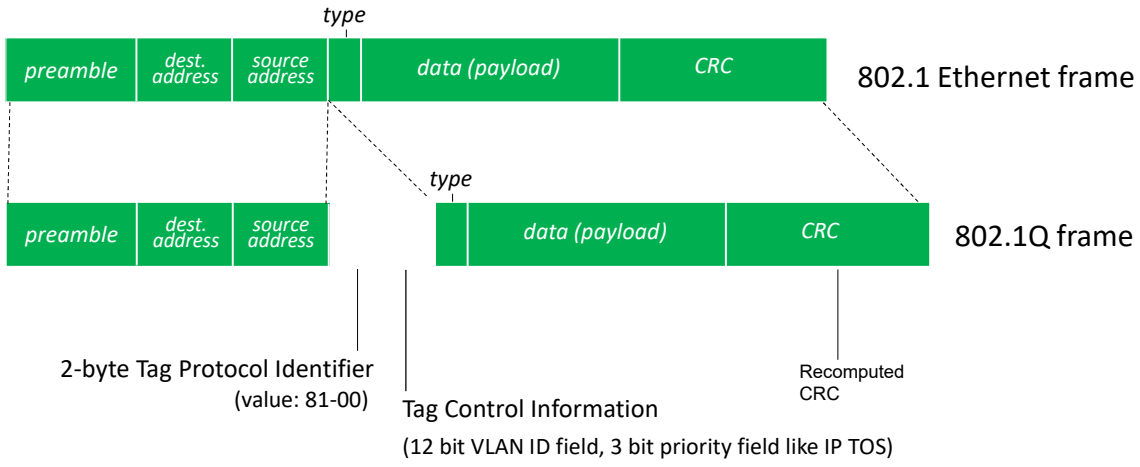
VLANS spanning multiple switches



trunk port: carries frames between VLANS defined over multiple physical switches

- frames forwarded within VLAN between switches can't be vanilla 802.1 frames (must carry VLAN ID info)
- 802.1q protocol adds/removed additional header fields for frames forwarded between trunk ports

802.1Q VLAN frame format



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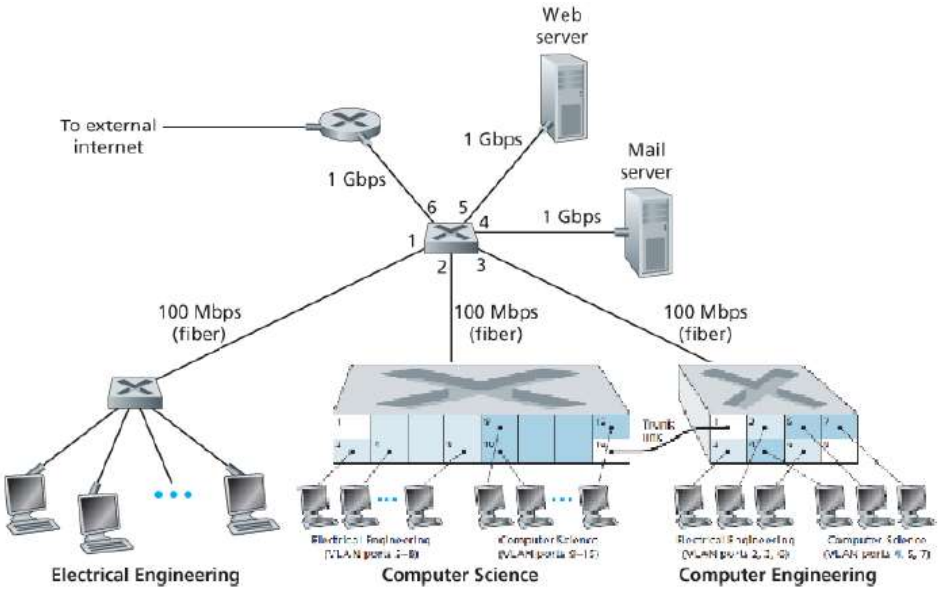

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