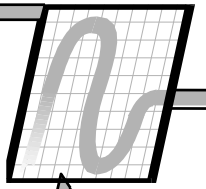
Some IT Considerations

Acronyms

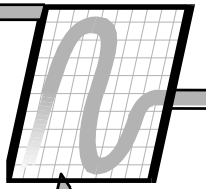
- IP – Internet Protocol: the ***key*** Internet technology
- TCP – Transmission Control Protocol
- UDP – User Datagram Protocol
- HTTP – HyperText Transport Protocol
- HTML – HyperText Markup Language
- XML – eXtensible Markup Language
- SOAP – Simple Object Access Protocol
- DHCP – Dynamic Host Configuration Protocol
- DNS – Domain Name Service
- NTP – Network Time Protocol
- SMTP – Simple Mail Transport Protocol
- SNMP – Simple Network Management Protocol
- PEBCAK – Problem Exists Between Chair And Keyboard
- ID-Ten-T……..

Data Packets



- Packet is chunk of data with additional information
- Header
  - Source Address
  - Destination Address
  - Size of data packet
  - Encryption information
  - Sequence or ID Number
  - Priority
- The actual data, sometimes called the “payload”
- Different protocols have different packet definitions

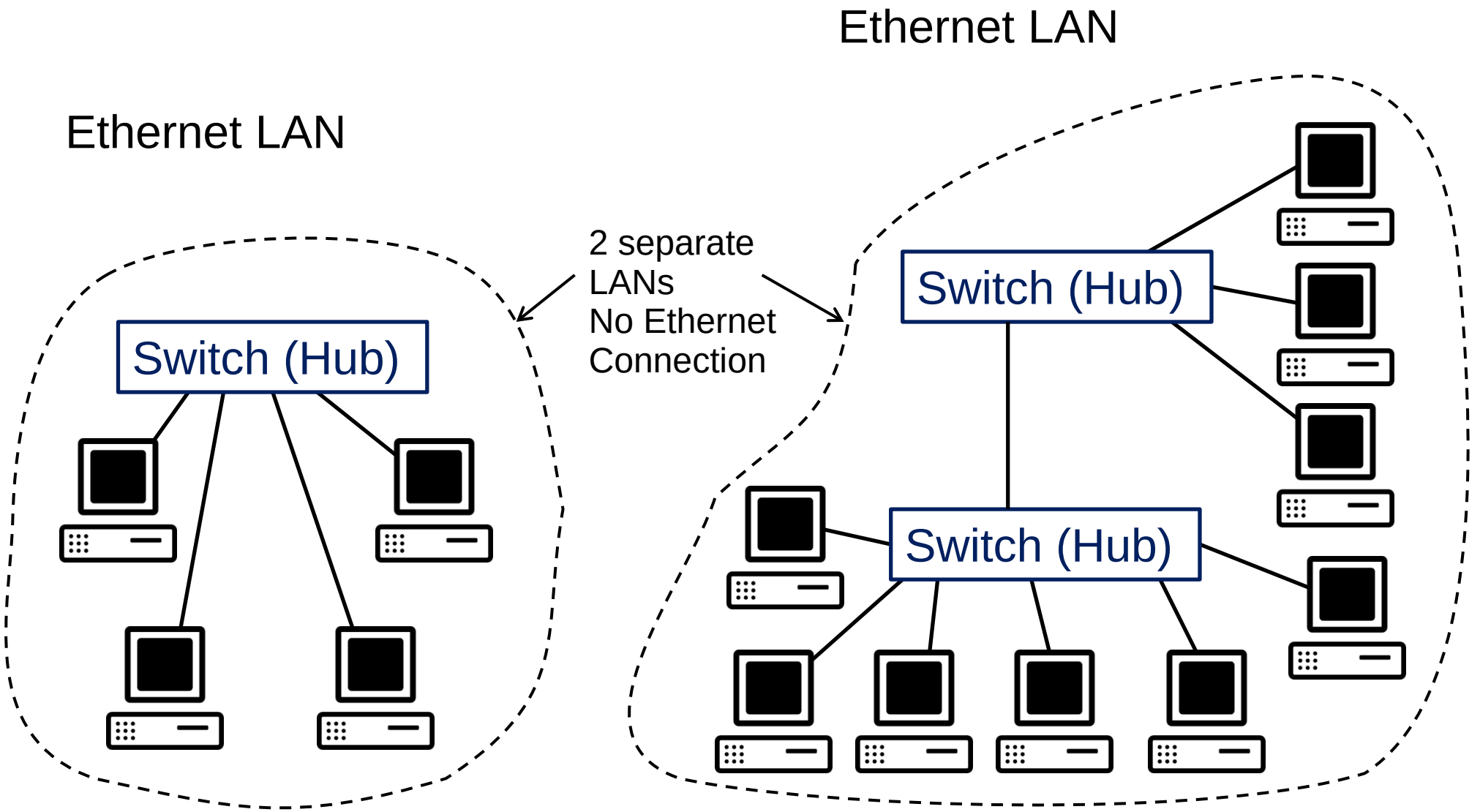
IP vs Ethernet vs Media



- IP is an addressing scheme (e.g. “192.168.1.23”)
- ***Many*** different protocols run on IP
- Doesn’t depend on the wire
- Runs on ***many*** media types
  - ***Ethernet***, ATM, SONNET, PPP, VPN, WiFi, WiMax, etc.

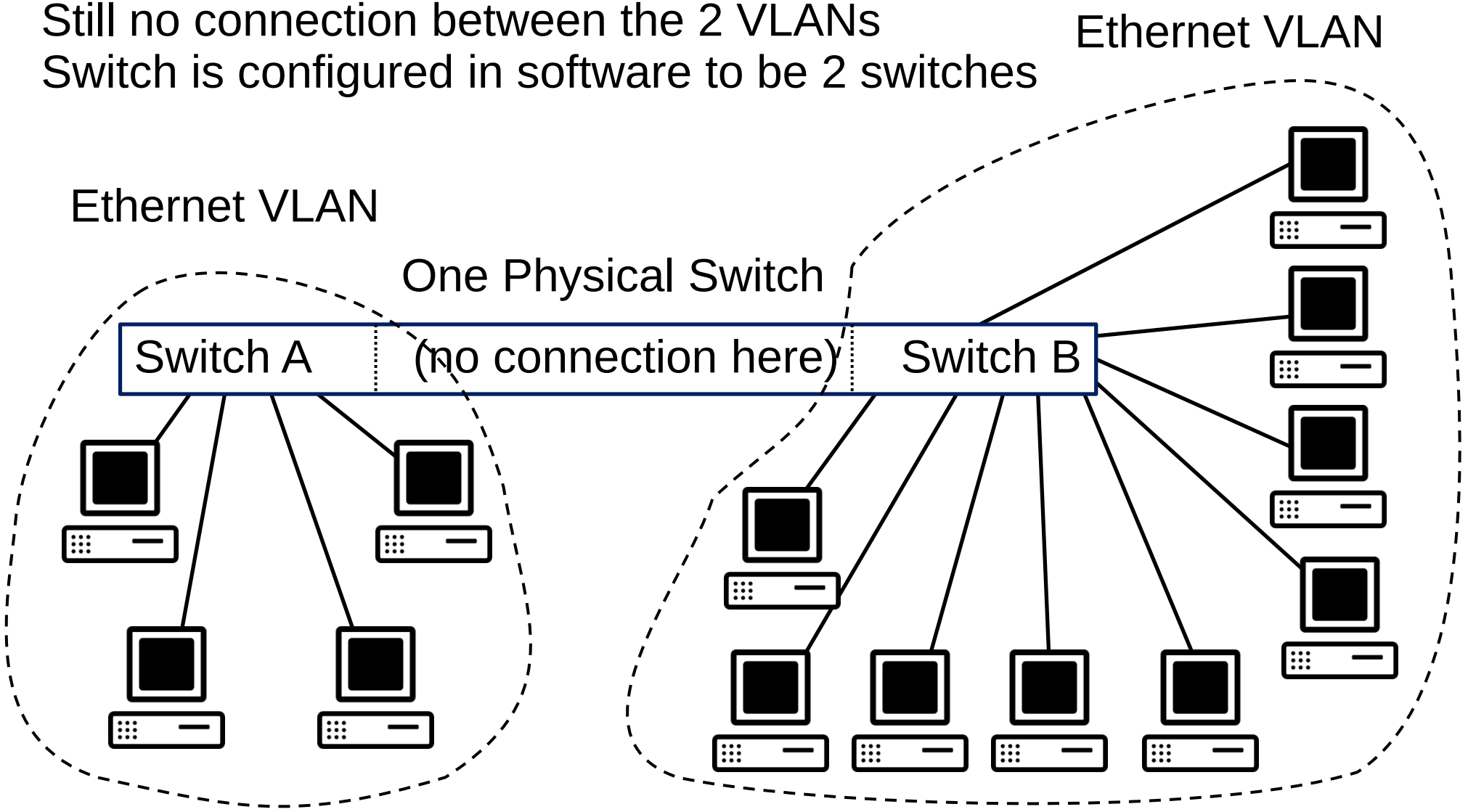
- Ethernet is a collection of wire and media types
- Includes it’s own addressing
  - MAC address (of your desktop Ethernet card…. Not the same as WiFi MAC address – WiFi has it’s own MAC addressing)
- Covers multiple media types
  - Cat 5 / Cat 6, Fiber Optic, etc.

Ethernet architecture

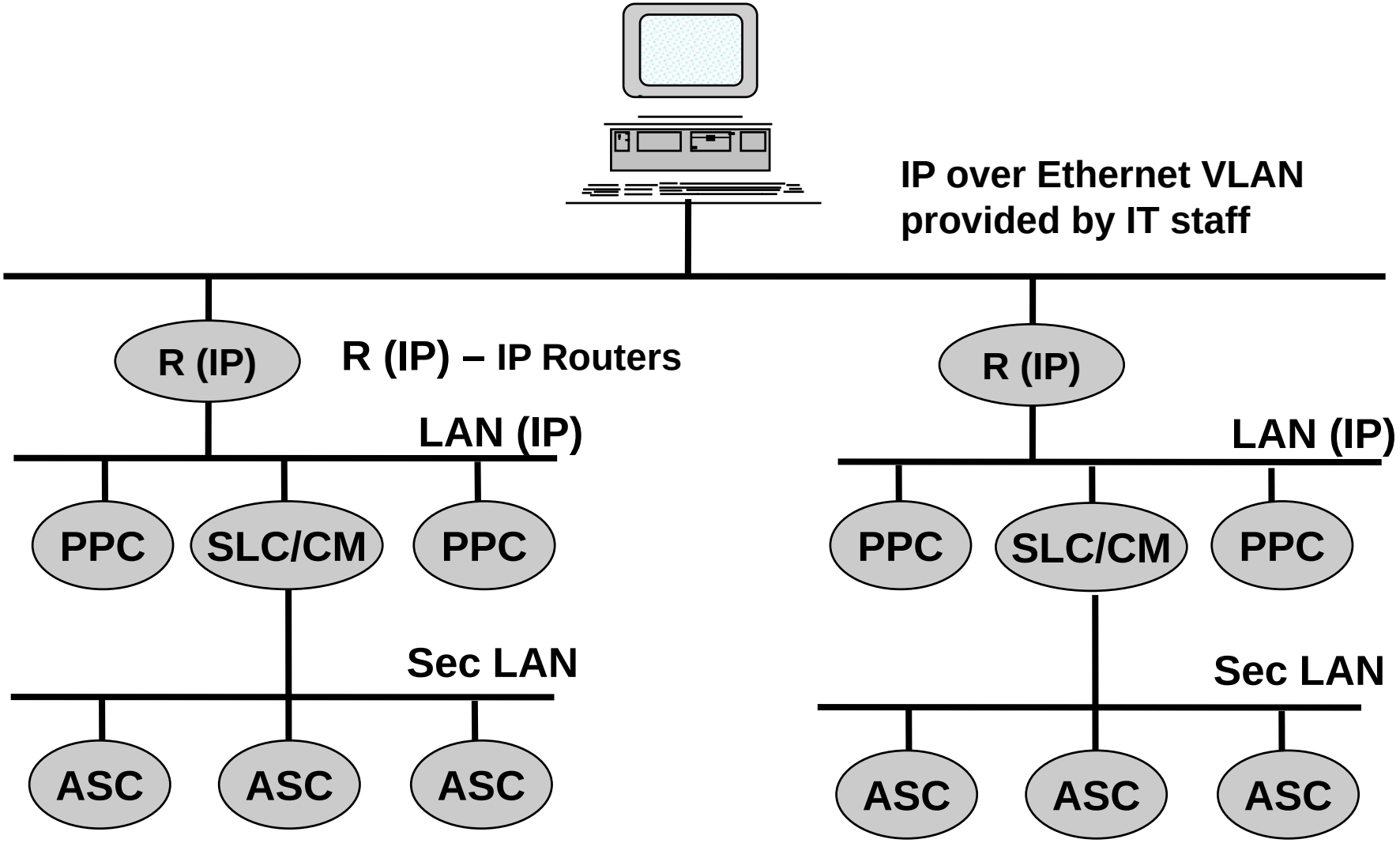


Virtual LAN (VLAN)

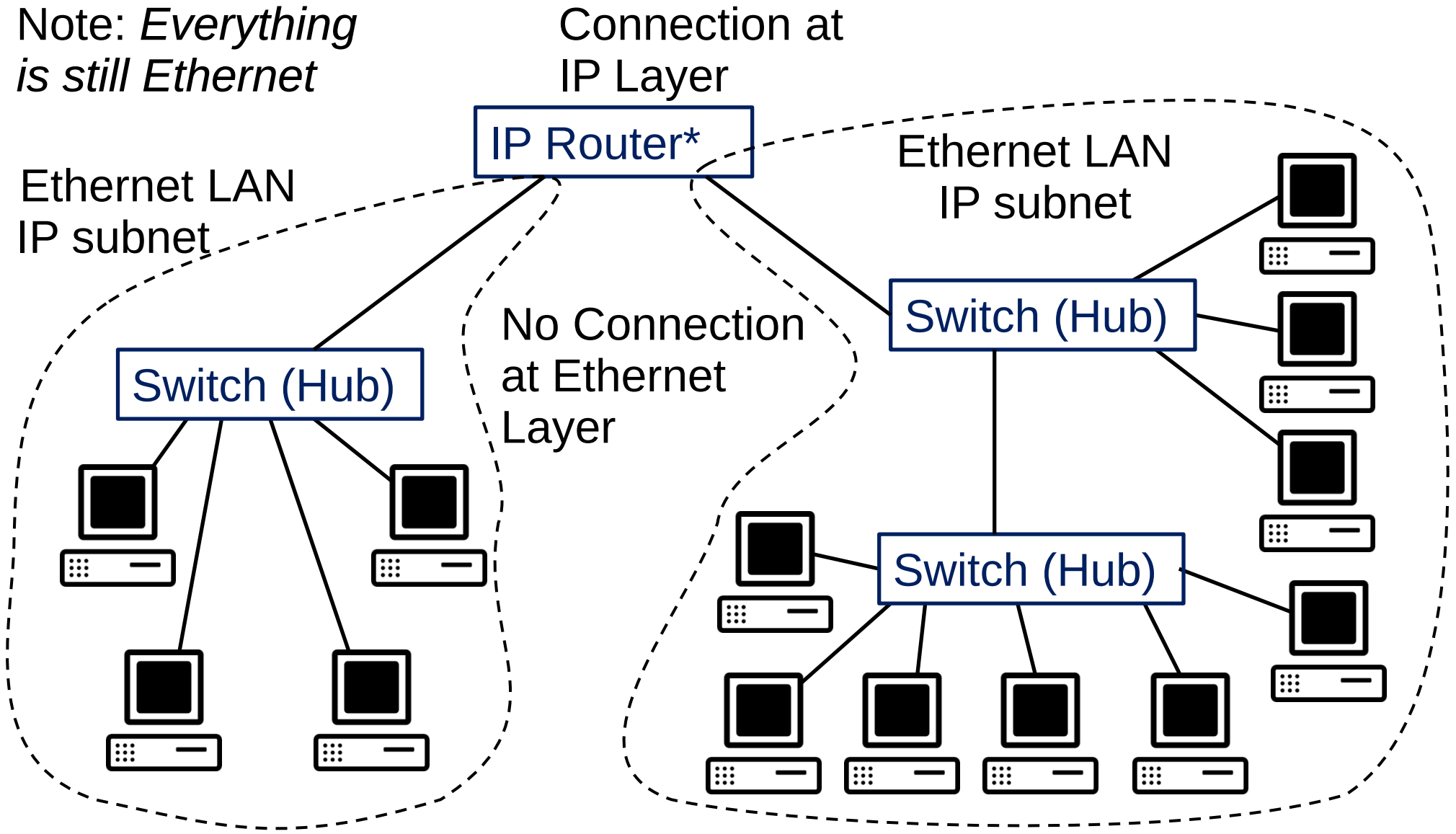
Still no connection between the 2 VLANs
Switch is configured in software to be 2 switches



Typical Campus BAS



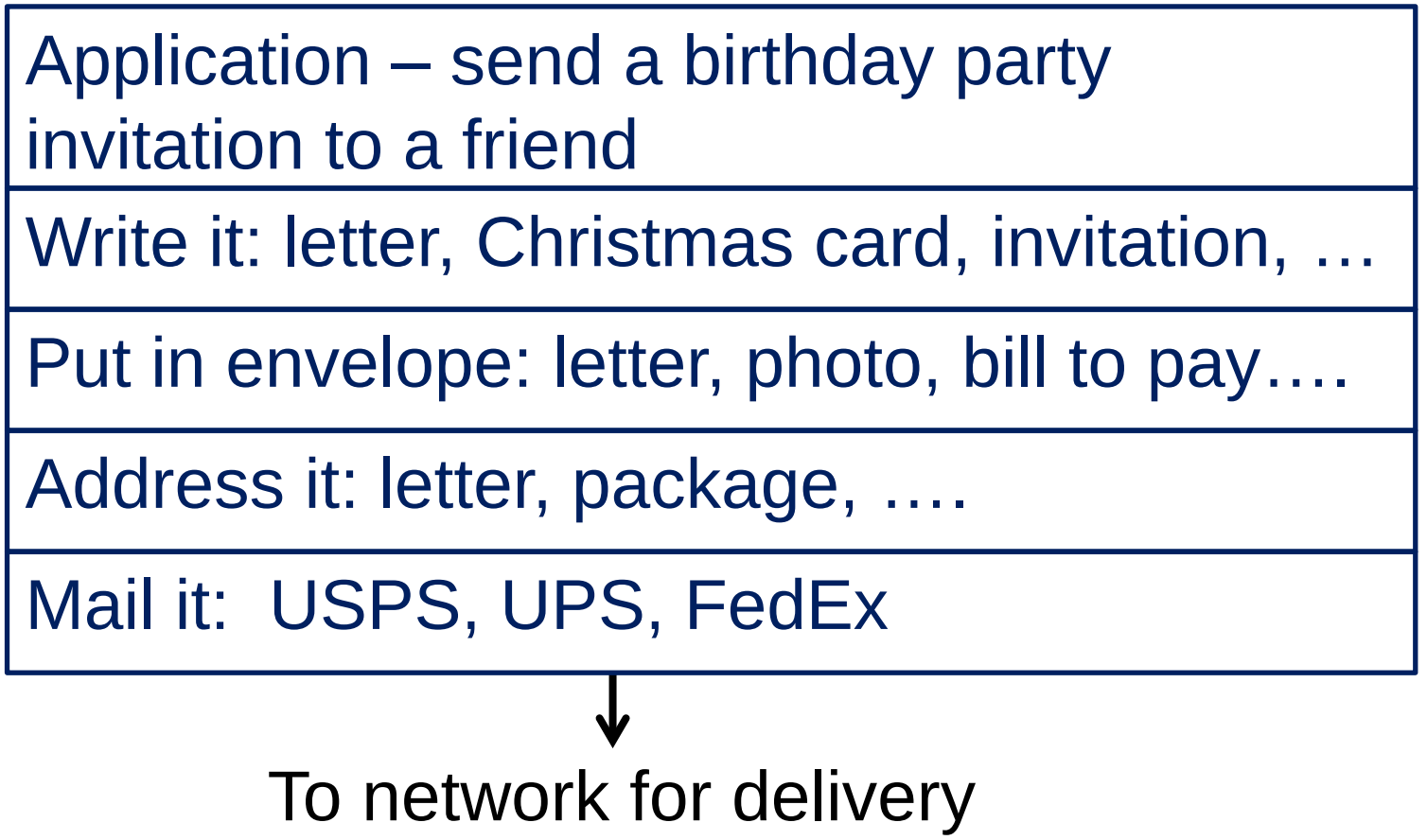
IP / Ethernet architecture



* --What the IT world may call a gateway

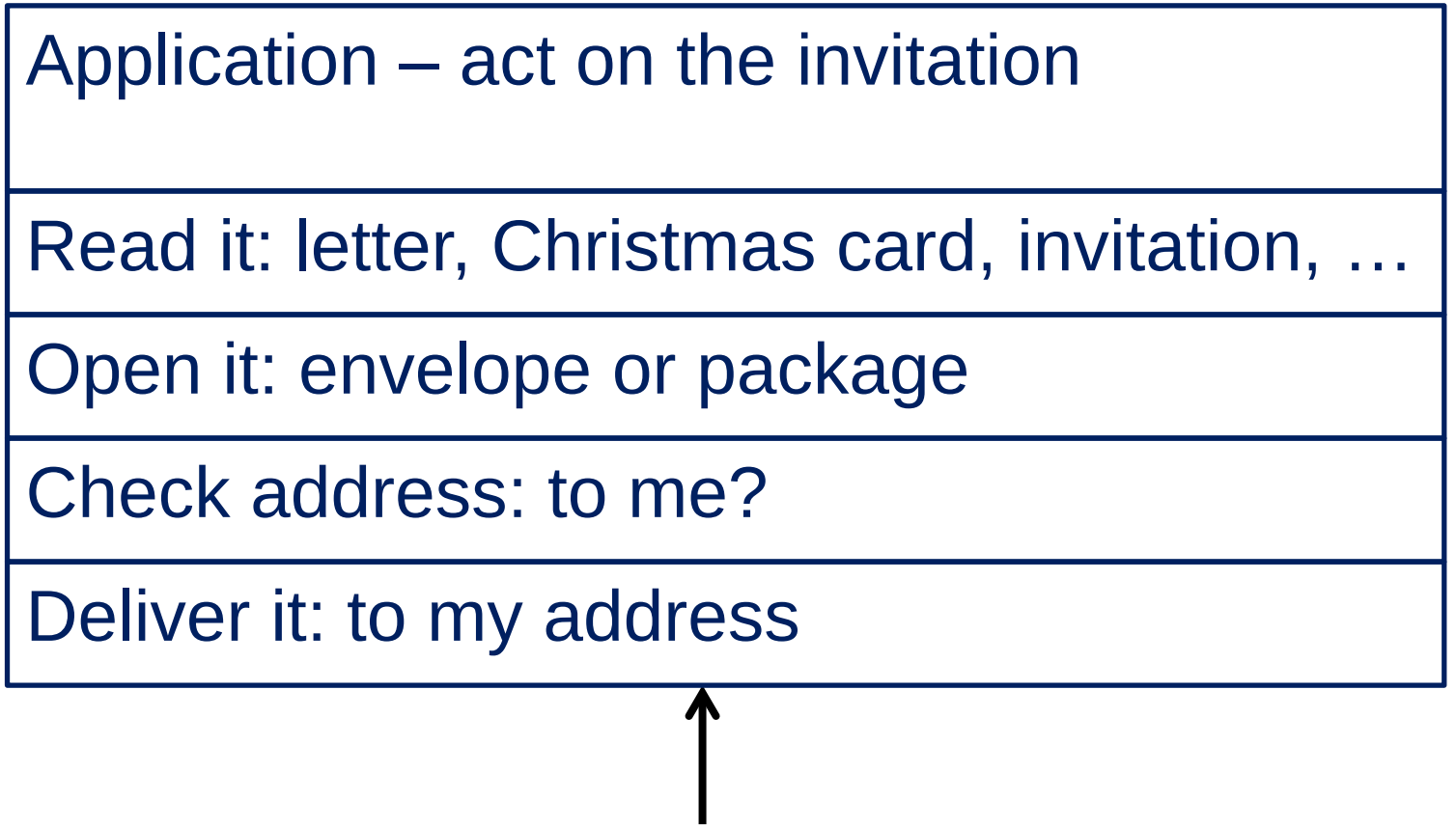
Protocol Stack

- Break a process down into simple steps
  - Example: mailing something



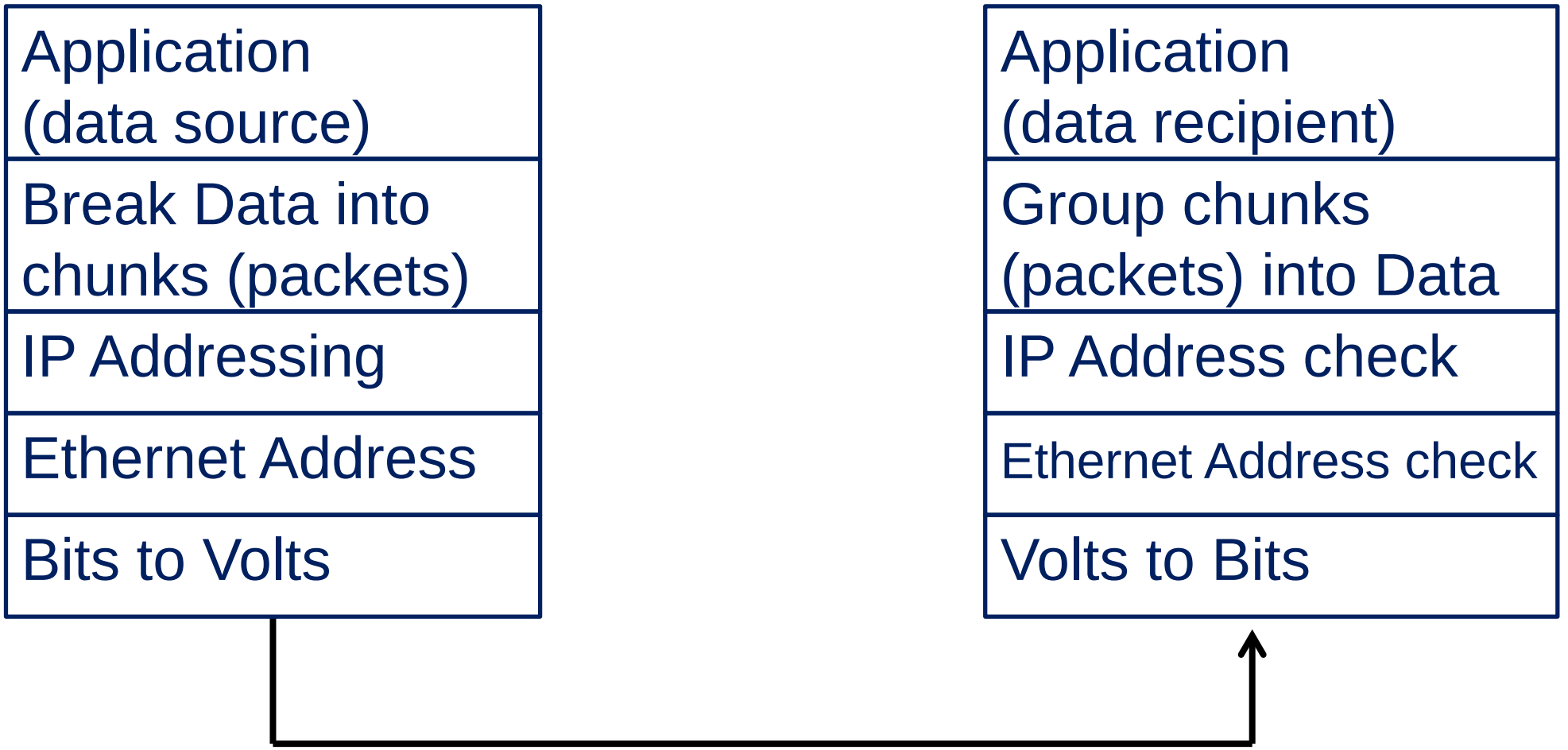
Protocol Stack

Getting something in the mail

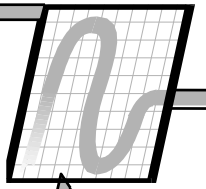


Protocol Stack

Sending BAS data over the network



Protocol Stack



- Each layer provides an interface to the layer above it
  - IP to Application: “Here’s how to send data using IP”
- Each layer uses the interface of the layer below it
  - IP to Ethernet: “Hey Ethernet, send this data to that Ethernet address”
- Each layer performs a specific function
- No layer knows the details about what is above or below it
  - Layers above IP look down and just see “a network”
  - IP layer handles data packets provided by layers above -- has no idea what the ***content*** is

Envelopes inside Envelopes

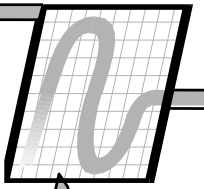
Ethernet packet: For MAC 00:F1:23:00:23:23:01:4D

IP Layer: IP packet: For 192.168.1.5

Application Header:
For PI loop, AHU-15

Data:
SA-T = 65

More Envelopes



Ethernet packet: For MAC 00:F7:44:DB:08:79:4D:12

IP Layer: IP packet: For 243.21.8.234

To IP Layer: “I’m just an Application

Tunnel IP Layer: VPN packet

To Application: “I’m the IP Layer”

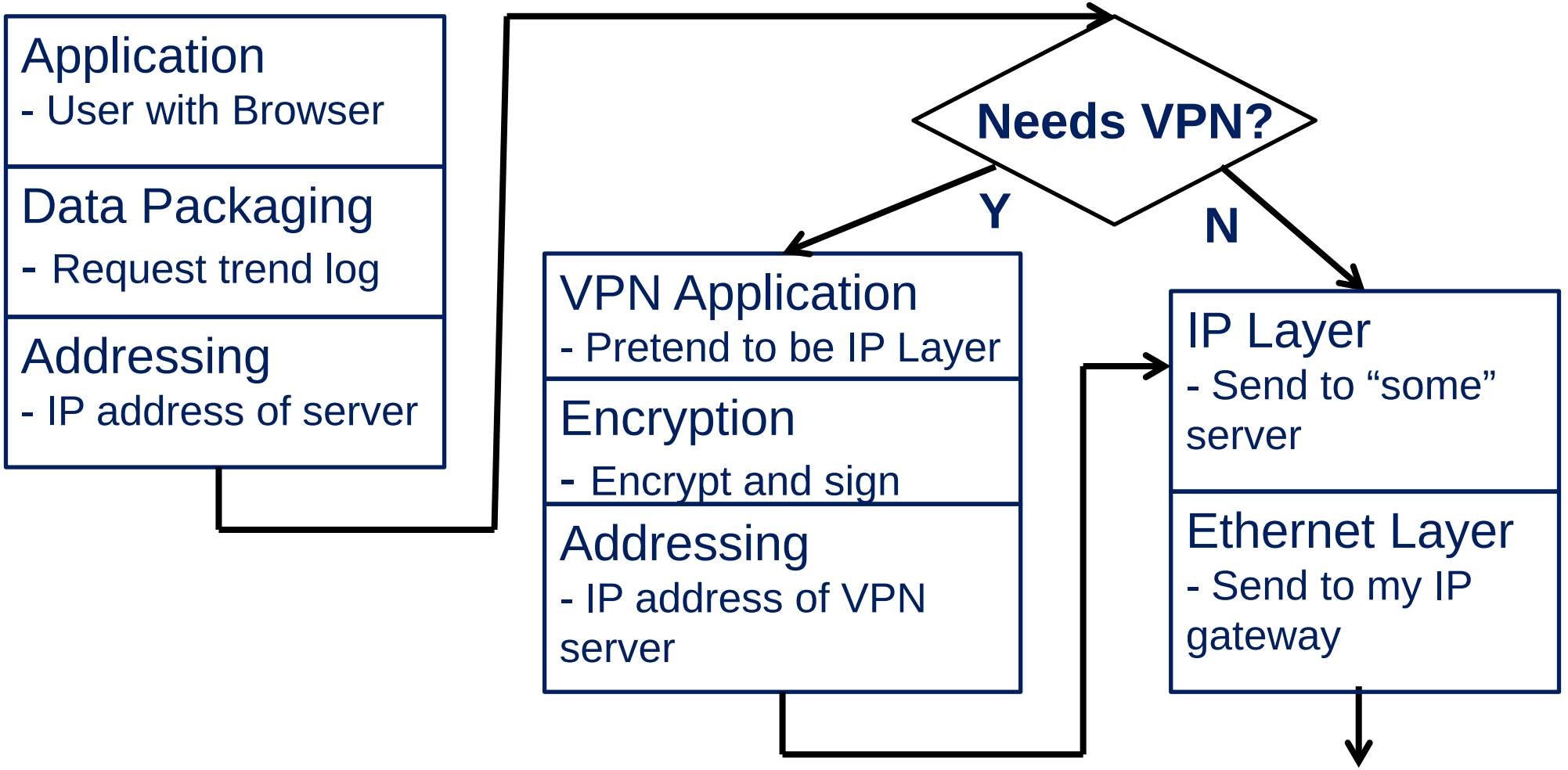
Application Header:
For PI loop, AHU-15

Data:
SA-T = 65

So What?

- Applications that ***can't*** run on the Internet
  - Some Applications, for technical reasons, won't work over the Internet
  - This "Tunnel Layer" hides the Internet from the Application, so it can run
- Applications that ***shouldn't*** run on the Internet
  - Insecure ones
    - Maybe ***YOUR*** BAS with Admin Password = "Admin"
  - This "Tunnel Layer" can provide encryption and security.

Browse BAS via VPN

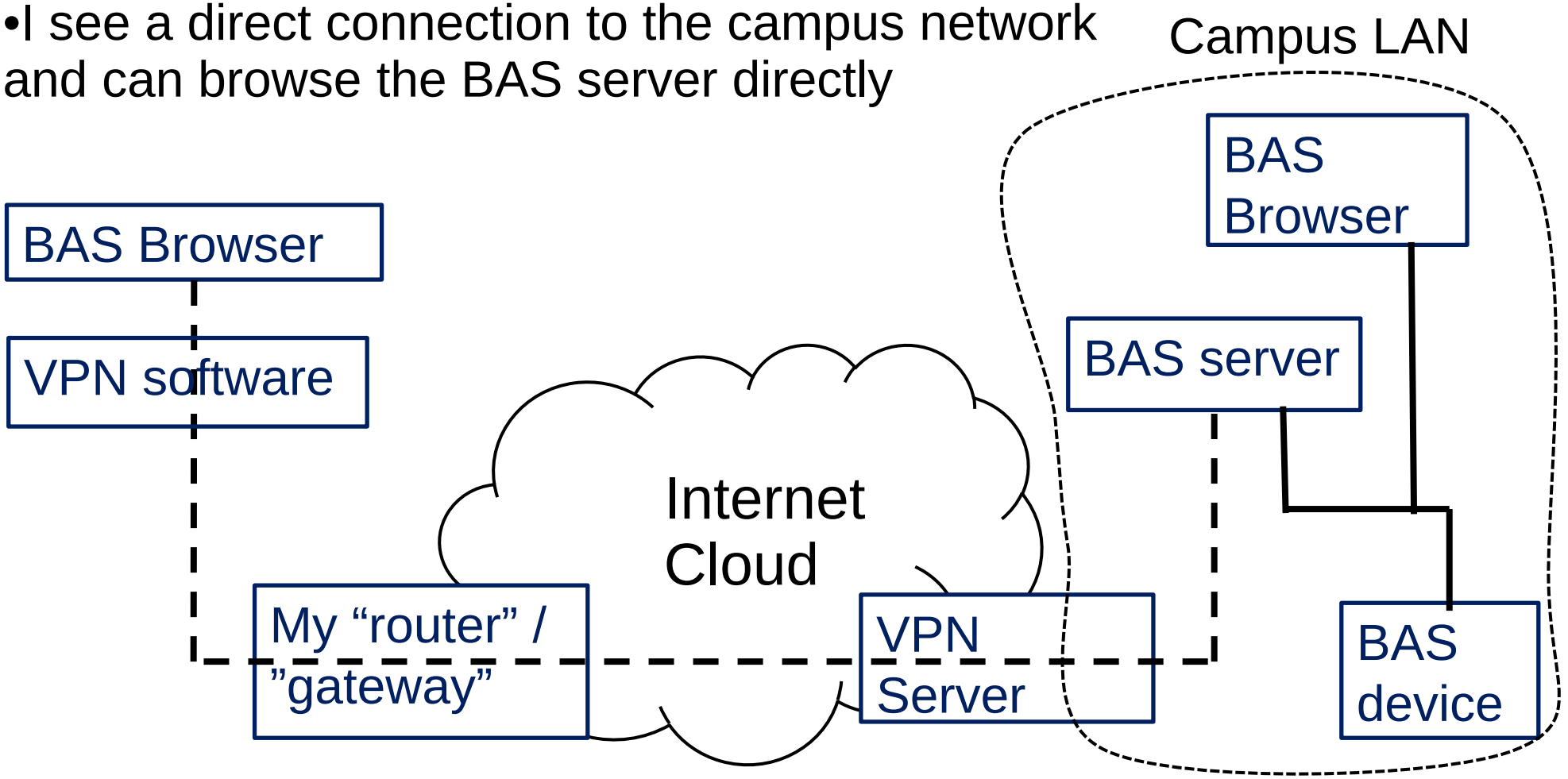


Similar process happens at the other end

Network delivers to VPN Server

VPN via Tunneling

- The VPN client and VPN server hide the Internet
- Dashed line looks like a direct wired connection
- I see a direct connection to the campus network and can browse the BAS server directly



BAS to IT Dictionary

- Router vs. IP Router
  - (General) Performs sorting (filtering) based on address
    - Post office mail sorter is a router
    - Ethernet Switch is really a router
  - (IT) “All routers are IP routers”
- Servers and Desktop machines
  - (BAS) Our front end machine is a Server
  - (IT) A Server machine has specific hardware / software
  - Our “Server” may run on their “Desktop” PC

BAS to IT Dictionary

- Gateway vs. Gateway
  - (BAS) protocol translator (e.g. Lon –to- BACnet)
  - (IT) Router in the architecture
    - The Router that connects your PC to other networks
- Application vs. System
  - (BAS) We have a Building Automation ***System***
  - (IT) Your “system” is an Application on our Network
- IP vs. Serial Protocol
  - (BAS) Lon over TP/FT-10, BACnet over MS/TP, etc.
  - (IT) If it’s not IP…. it is a “serial” protocol

Other areas of confusion

- Product Lifecycle
  - IT Equipment often purchased with service contract
  - IT Equipment is obsolete in 3 – 5 years
    - “Patch by replacement”
  - BAS systems have 20+ year lifetimes
    - Most of our systems can’t be patched and can’t be replaced
- Sole Source is the Rule: Microsoft, Cisco, Dell/HP/Lenovo
- Virtual World vs. Real World
  - A hacker can do “anything” with your IT data
  - A hacker can’t blow up your boiler (actual concern from IT)
    - SCADA systems may have real dangers, HVAC generally doesn’t

Areas of concern to IT staff

- Old systems that can’t be patched
  - Isolate in stand-alone mode whenever possible
- Connections to critical systems
  - Design with limited access / remote functionality
- Remote Access
  - Talk to IT about how to secure this
  - Be careful with using WiFi without talking to IT
  - Do ***NOT*** install commercial cable modem / DSL
- Default passwords & Vendor back-doors
  - Make sure they are changed / closed

Conclusion

- The World is moving towards IT
- HVAC is moving towards IT
  - Controllers on IP
  - Web-based front ends
  - Access from home via VPN and browser
  - Enterprise systems
- Get your IT staff involved up front!
  - Anticipate problems
  - Learn to speak their language