Network-to-network connections

Unit objectives

- Identify network-to-network connection components
- Install LAN wiring
- Identify LAN wiring tests and equipment

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Topic A

- Topic A: Network-to-network connection components
- Topic B: LAN wiring
- Topic C: LAN wiring tests

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Network Access Points

- Connects and routes traffic between smaller commercial backbones
- Four original NAPs
- MAE West and MAE East
- Public Internet exchange points
- Also - private Internet exchange points, Commercial Internet Exchange (CIX), and Federal Internet Exchange (FIX)

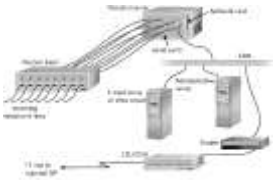
DATA COMMUNICATIONS AND COMPUTER NETWORKS

Internet service providers (ISPs)

- Used by smaller companies and individuals
- Provides connectivity to the Internet
- One city or many cities
- ISP services
  - Physical connection to the ISP
  - Software to communicate over the Internet
  - Unique IP address

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Small ISPs

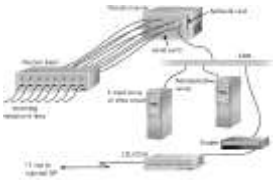


- No high-speed equipment to connect to Internet backbone directly
- Subscribes to regional ISP
- Uses a T1 connection to regional ISP
- May use modem banks
- Connections to terminal server

continued

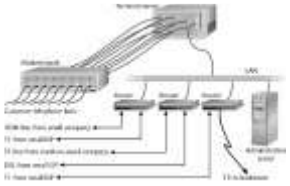
DATA COMMUNICATIONS AND COMPUTER NETWORKS

Small ISPs



- LAN can have multiple servers
- Router connects LAN to regional ISP
- CSU/DSU cleans up and formats signal before sending on T1 line

Regional ISP



- Supports several small ISPs and medium-sized companies, as well as individuals
- Incoming connections – T1 and DSL
- Uses a T3 connection to commercial backbone
- 44.7 Mbps

DATA COMMUNICATIONS AND COMPUTER NETWORKS

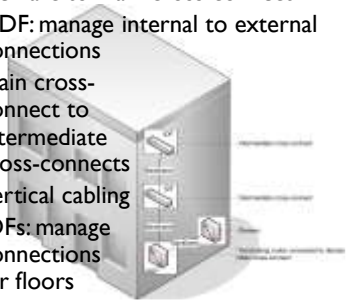
LAN installation components

- Demarc – ISP connection point
- Demarc terminating device – code and protocol conversions, buffering
- Also known as
  - Network terminating interface (NTI)
  - Network terminating unit (NTU)
  - Network terminating device (NTD)
  - Smart jack
  - MPOE (minimum point of entry)
- Type of device depends on connection
- From this point in – your responsibility

DATA COMMUNICATIONS AND COMPUTER NETWORKS

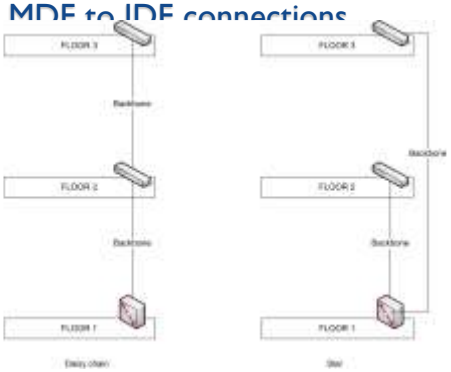
Cross-connects

- Demarc to main cross-connect
- MDF: manage internal to external connections
- Main cross-connect to intermediate cross-connects
- Vertical cabling
- IDFs: manage connections for floors



DATA COMMUNICATIONS AND COMPUTER NETWORKS

MDF to IDF connections



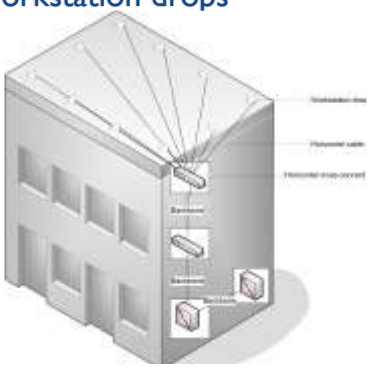
DATA COMMUNICATIONS AND COMPUTER NETWORKS

Standards

- TIA/EIA-569-A standards for
  - Entrance facility
  - Equipment room
  - Backbone pathways
  - Telecommunications room
  - Horizontal pathways
  - Recommended space requirements
- TIA/EIA-568-C standards for
  - UTP workstation runs

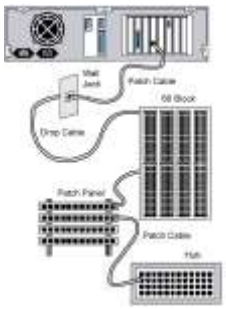
DATA COMMUNICATIONS AND COMPUTER NETWORKS

Workstation drops



Typical UTP installation

- Multiport hub
- Patch cables
- A terminating block/patch panel
- Drop cables
- Wall jacks



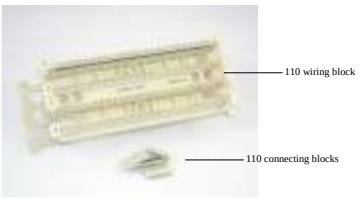
Telecommunications room

- Where network wiring is terminated
- Two termination choices
  - Punchdown terminal
  - Patch panel
- Terminate both workstation drops and backbone wiring
- Direct patch panel terminations common in Cat 5e/6

Termination choices

Punchdown block

- Terminate station cables
- Cross-connect to other punchdown locations
- Two types: 10 block and older 66M block
- 110 wiring block and 110C connecting block



Wire placement

- Terminate workstation run cables at rear
- Cross-connects at front

Topic B

- Topic A: Network-to-network connection components
- Topic B: LAN wiring
- Topic C: LAN wiring tests

DATA COMMUNICATIONS AND COMPUTER NETWORKS

LAN wiring

- Two types
  - Permanent – use solid cable
  - Movable – use stranded cable
- Permanent
  - Backbones
  - Workstation runs
  - Cross connects
- Movable
  - User cords
  - Patch cords
  - Terminated with RJ-45

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Guidelines

- Avoid proximity to electromagnetic fields
- Run away from
  - Motors
  - Pipes
  - Structural steel
  - Power lines
- Minimize sharp bends in cable
- Don't run spans of unsupported cables
- Avoid over-tightening tie wraps

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Backbone installation

- Telecommunications room over one another
- Utility shaft between rooms
- Fiber optic backbone is common
- Fiber has much longer max. run distance

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Workstation runs

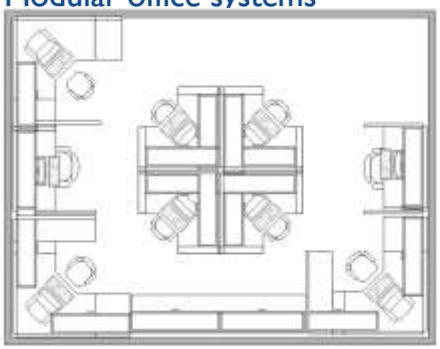
- Through floors or ceilings
- Support cables with
  - Hangers
  - Clips
  - Trays
- Trays prevent kinks, sharp bends
- Hangers & clips best for straight runs
- Can't exceed media max. length – user equipment to final termination point

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Calculate workstation run length

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Modular office systems



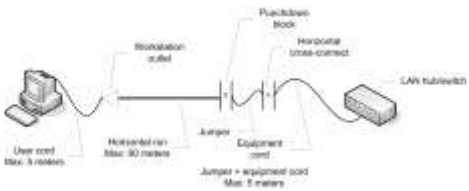
Modular considerations

- Arrangement not always near a wall
- Run cables within panels
- Installation of cables comes after panels
- TSB-75 guidelines
  - Consolidation point
  - MUTAO

Telecommunications room

- Clearly identify every cable, termination fixture, patch panel and cross-connect
- Follow TIA/EIA-606 guidelines
- Use the color coding specs in TIA/EIA-569-A in wire termination areas
- Route cables
  - Standoffs
  - Distribution rings
  - Rack and equipment wiring channels
- Secure cables when possible

Telecommunications room equip



Patch panel

- Advantages
  - It's a permanent link
  - Channel testing is easier
  - It's a solid connection
  - Moves easily
- Disadvantages
  - Panel itself added expense
  - Adds more wires
  - Modular connections create crosstalk

Connecting block

- Advantages
  - Long-term corrosion is rare
  - Signal deterioration doesn't occur
- Disadvantages
  - Troubleshooting is more difficult
  - More difficult to locate individual workstation cables
  - Increased potential for installation mistakes
    - Incoming connection at the connection block
    - Two connections for the cross-connect jumper
    - The multi-circuit termination leading to the LAN hub/switch

Punchdown tool

Five-pair tool

Single-pair tool

Topic C

- Topic A: Network-to-network connection components
- Topic B: LAN wiring
- Topic C: LAN wiring tests

LAN wiring tests

- Hire a certified company
- Test to TIA-568-B and C standards
  - Each individual cable link
  - Permanent link from the workstation outlet to the cross-connect block or patch panel
  - Channel testing of user and patch cords and cross-connect wires
- Wire map checks for wiring errors/cable faults
  - Continuity issues
  - Shorts
  - Crossed pairs
  - Reverse pairs
  - Split pairs
- Measure wire lengths electronically
- Attenuation and NEXT tests

Testing equipment

- Continuity tester
- Cable wire map tester
- Cable tracer
- Cable scanner
- Time domain reflector (TDR)
- Fiber optic tester (Optical time-domain reflectometer – OTDR)

Unit summary

- Identified network-to-network connection components
- Installed LAN wiring
- Identified LAN wiring tests and equipment