Switching

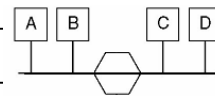- **Introduction**
  - Technologies
  - Why bridges
- **Bridges**
  - Between different LANs
  - Transparent bridges
  - Spanning tree bridges
  - Remote bridges
- **Virtual LANs**

1

Repeaters, & Hubs

- **Repeater**
  - Task: _____
  - Layer: _____
  - Process _____

- **Hub**
  - Task: _____
  - Layer: _____
  - Process _____

2
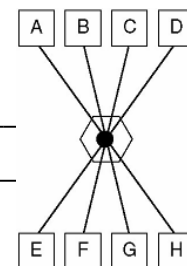
Bridges & Switches

- Bridges
  - Task: _____
  - Layer: _____
  - Process _____

  A B C D

  E F G H
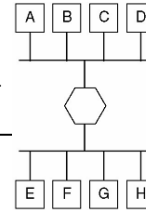
- Switches
  - Task: _____
  - Layer: _____
  - Process _____
  - Cut-through switches and _____
    store-and-forward switches _____

  A B C D

  E F G H

3
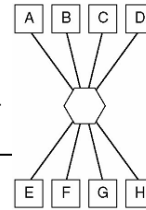
Routers & Gateways

- Routers
  - Task: _____
  - Layer: _____
  - Process _____

- Gateways
  - Task: _____
  - Layer: _____

4

Why bridges?
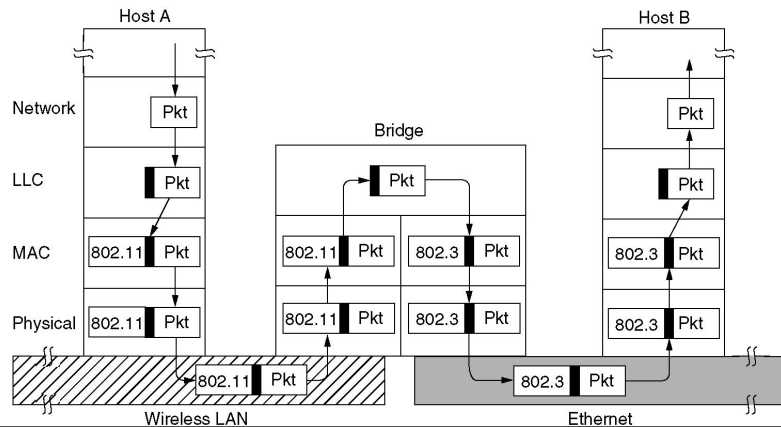
- History : _____
- Geographical spread…
  - Cost: _____
  - Overall distance: _____
- Overall load _____
  - Restrict _____
- Reliability: _____
  _____
- Security: _____
  _____

5
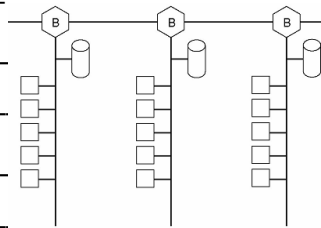
802.x to 802.y bridges

- Packet _____
- LLC header _____
- MAC header _____

	Host A	Bridge	Host B
Network	Pkt		Pkt
LLC	Pkt	Pkt	Pkt
MAC	802.11 Pkt	802.11 Pkt / 802.3 Pkt	802.3 Pkt
Physical	802.11 Pkt	802.11 Pkt / 802.3 Pkt	802.3 Pkt
	Wireless LAN / 802.11 Pkt		Ethernet / 802.3 Pkt

6

Problems

- **Different formats**
  - Meaning of fields? _____
  - CPU time: _____

802.3	Destination address	Source address	Length	Data	Pad	Check-sum

802.11	Frame control	Dur-ation	Address 1	Address 2	Address 3	Seq.	Address 4	Data	Check-sum
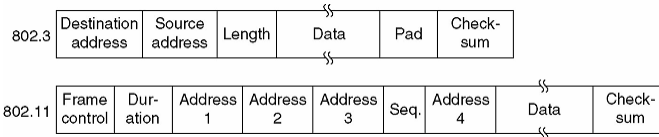
- **Buffering:** _____
- **Security:** _____
- **Quality of Service:** _____

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Setting up bridges

- Connecting bridges
  - We would like to just _____
  - But initially routing tables _____
- Use Promiscuous mode?
  - Send everything everywhere
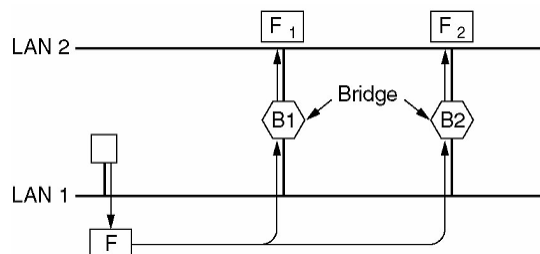 - Pros & Cons: _____
    _____

F   G   H

Bridge

LAN 4

A   B   B1   C   B2   D   E

LAN 1   LAN 2   LAN 3

8

4
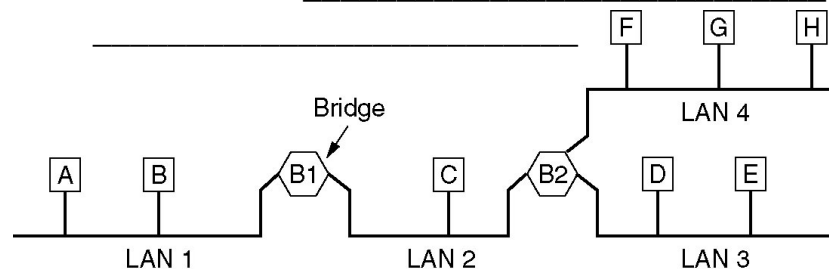
Transparent bridges

- Start in promiscuous mode
- Learn routings _____
  - Backward learning: _____
    _____

- Routing logic
  - $LAN_{Destination} = LAN_{Source}$ _____
  - $LAN_{Destination} \mathrel{!=} LAN_{Source}$ _____
  - $LAN_{Destination}$ unknown _____
- Dynamic topologies? _____
  - Maintain times: _____
  - Purge old entries: _____

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Parallel Bridges

- Reliability:
  - Multiple paths _____

- Example (problem):
  - $F \rightarrow F_1$ and F_2
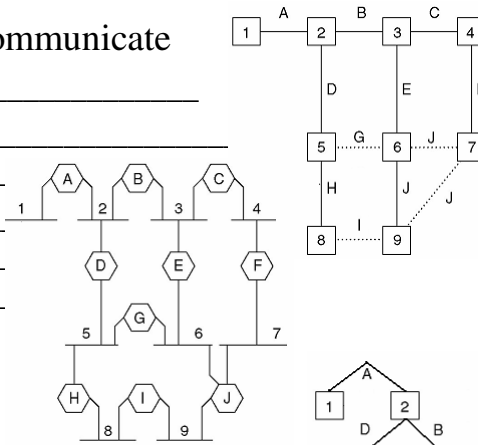 - $F_1 \rightarrow F_{12}$
  - $F_2 \rightarrow F_{21}$
  - …

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Spanning Tree Bridges

- Solution: Bridges communicate
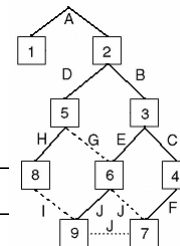 - Extract a _____
  - Then ignore _____
    _____
  - Pros & Cons: _____
    _____
    _____

- General Solution: Spanning tree
  - Nominate the root: _____
  - Find the shortest paths _____
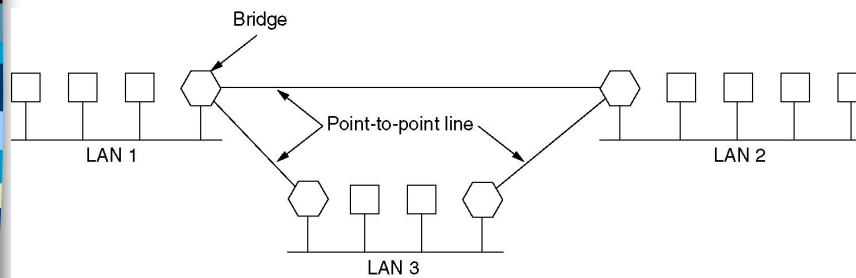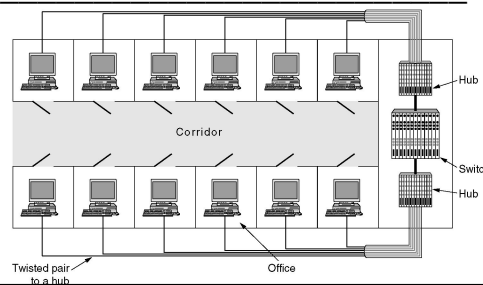
11

Remote Bridges

- Remote LANs:
  - Often connected using _____
  - To create one large LAN _____
  - Each Point-to-point line is treated as a _____

Bridge

Point-to-point line

LAN 1

LAN 2

LAN 3

12

6

LAN organisation

- Originally LAN membership _____
  - LANs based on Multidrop lines
- Want LAN membership based on _____ _____
  - This is more feasible due to the use of _____ _____

Hub

Corridor

Switch

Hub

Twisted pair to a hub

Office

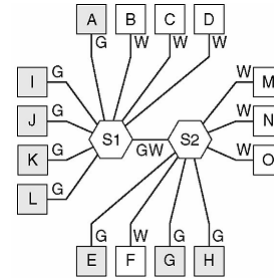13

LAN membership issues

- Security: Who can hear the messages?
- Load: Can we keep the traffic local?
- Broadcasting: Can we cope if stations start broadcasting messages?

- More flexibility needed
  - Pulling out plugs _____
  - What if related users are connected to _____
  - How can we react quickly to _____
  - Can we solve the problem in _____?

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VLANs _____

■ Decisions:
- Number of VLANs
- VLAN members
- VLAN names

■ Based on VLAN aware switches: _____
_____

- VLAN ↔ Port / Line
- Where traffic is from?
    • Every port => VLAN _____
    • Every MAC address => VLAN _____
    • Every IP address => VLAN _____

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Identifying Payload

■ Which VLAN? _____
- Frame header? _____

■ Solution
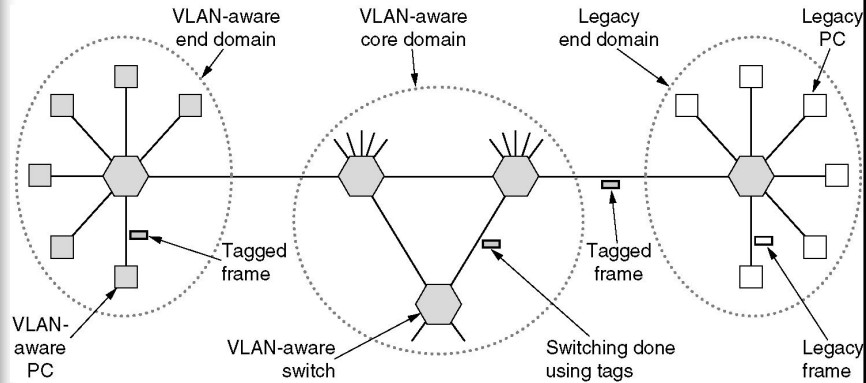- 802.1Q – Change the Ethernet frame format!

■ Problems
- Throw away all existing Ethernet cards? _____
_____

- If not, who generates the fields? _____
_____

- What if a frame is already at max. size. _____
_____

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8

Transition to 802.1Q

- Legacy and VLAN aware _____
  - End domains _____
  - Switches _____

VLAN-aware end domain | VLAN-aware core domain | Legacy end domain | Legacy PC

Tagged frame

VLAN-aware PC | VLAN-aware switch | Switching done using tags | Legacy frame

Tagged frame

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802.1Q frame format

- Two 2-byte additions
  - VLAN protocol _____
  - Tag containing:
    - Pri _____
    - CFI _____
    - VLAN identifier _____

	Destination address	Source address	Length	Data	Pad	Check-sum
802.3						

	Destination address	Source address		Tag	Length	Data	Pad	Check-sum
802.1Q								

VLAN protocol ID (0x8100)

Pri	CFI	VLAN Identifier

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