

SMARTBIT量測實驗

Po-Ning Chen
Dept. of Communications Eng.,
National Chiao-Tung Univ.

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Outline

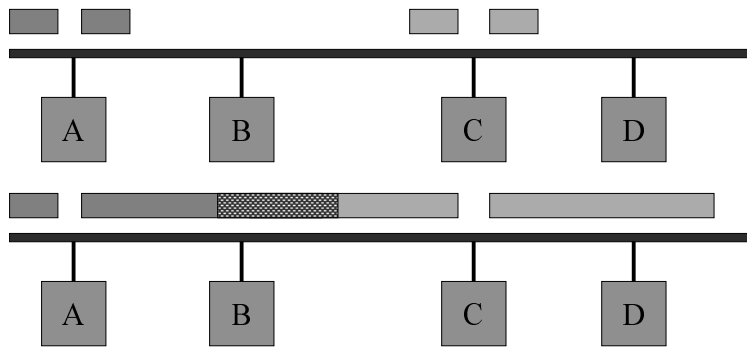
- Background Knowledge of Ethernet Switch
 - ┆ The concept of CSMA/CD
 - ┆ Wired Hub
 - ┆ Trends of Ethernet
- Why Switched Hub
 - ┆ Architecture
 - ┆ Operation
- Introduction to Smart-Bit Exp.
 - ┆ Why Testing
 - ┆ Equipment & Software
 - ┆ Testing Items

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The Concept of CSMA/CD

- Bus Topology

- Operation



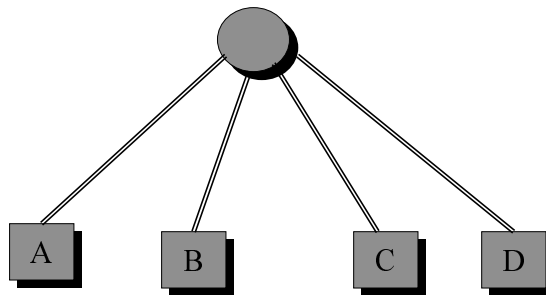
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The Concept of Hub

- Star Topology

- Logically Bus Topology

- Operation (Repeated Hub)



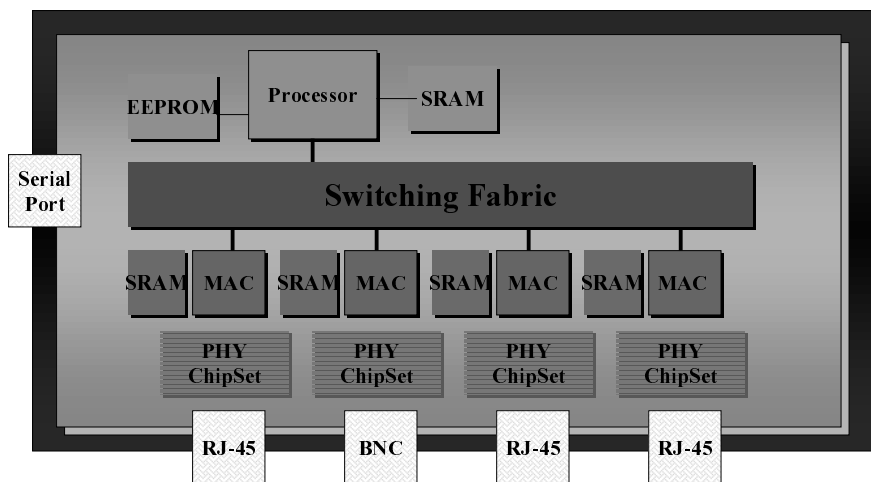
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The Trend of Ethernet

- Higher Speed
- Scalability
- Advanced Capability and Application
- L2 Switching v.s. L3 Switching

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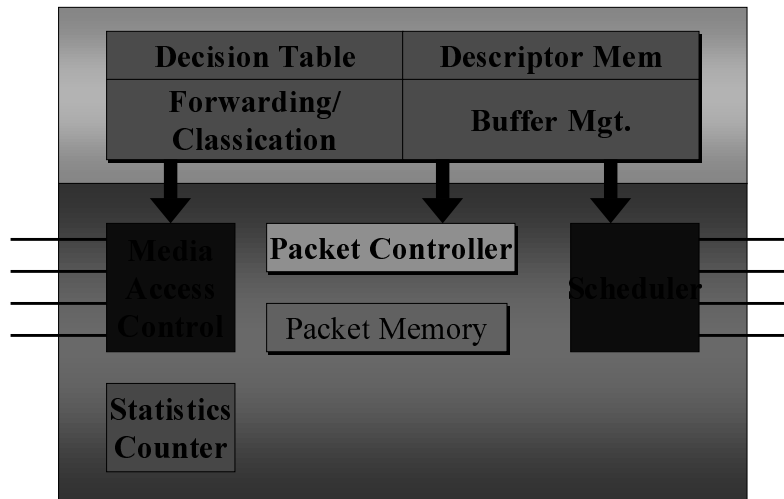
Switching Hub — Architecture



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test

Switching Hub — Functional Component



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Switch Operation

- Frames arrivals
- Header Lookup
- Switching Decision and Translation
- Routed or Queued at Output Buffer

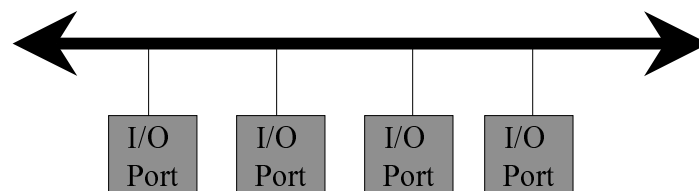
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Switching Fabric

- Backplane Switching
- Shared Memory Switching
- Crossbar Switching
- Multiplane Switching
- Knockout Switching

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Backplane Switching System



- The Bus is used to connect the inlet / outlet ports together.
 - Cells are transported via the Bus.
 - Outlet ports accept cells/packets based on their address

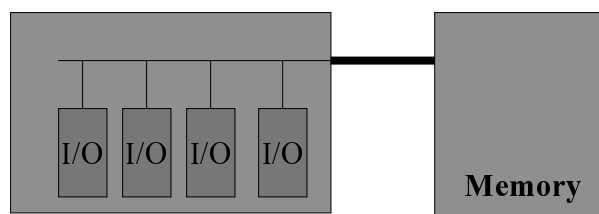
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Backplane Switching System

- Non-blocking bus: $\Sigma [\text{Port speed}] < \text{Bus throughput rate}$
 - Blocking bus effect can be reduced via statistical muxing effect.
- Advantages:
 - Multicasting is easily supported
 - Bandwidth limited to about 2 Gbps.
 - Easy integration with existing LAN equipment based on backplane technology, such as hubs.

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Shared Memory Switching System



- The Shared Memory is used to connect the inlet / outlet ports together.
 - Cells are temporarily buffered
 - Outlet ports pull cells/packets based on their queue

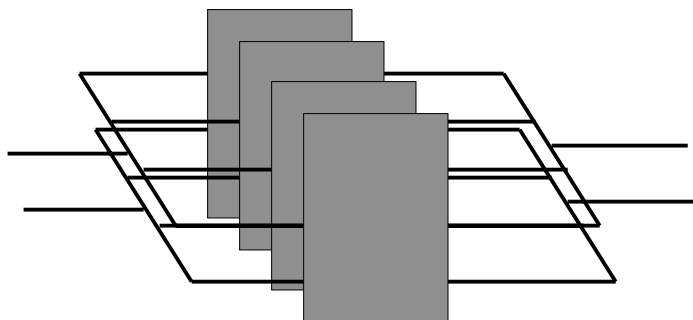
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Shared Memory Switching System

- Non-blocking memory bandwidth required:
 - ┆ $\Sigma [\text{Port speed}] < \text{Memory throughput rate}$
- Advantages:
 - ┆ Memory usage reduced via sharing
 - ┆ Multicasting is easily supported
 - ┆ Bandwidth limited by memory technology.

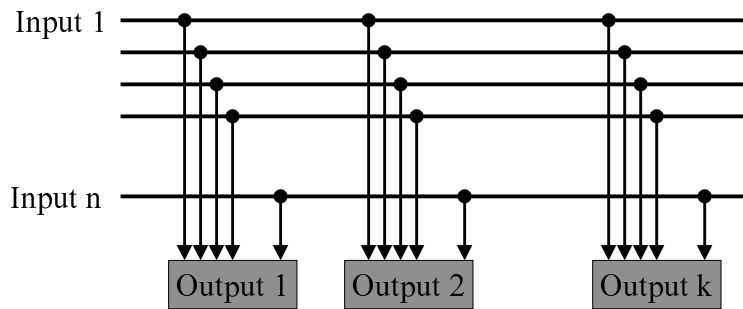
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Multiplane Network



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Knockout Switching System



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Queueing Strategies

- Blocking Effect in Switch
 - Internal blocking
 - External blocking (Output contention)
- Input Queueing
 - Head of Line blocking
- Output Queueing
- Internal Queueing
- Shared Buffering

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Other Functions

- Address Learning
 - ┆ Forwarding database
 - ┆ Flooding
- Broadcast and Multicast
- Flow Control
- Priority Handling

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The Need for Testing

- Throughput
 - ┆ How many frames per second can be forwarded through a device before it starts losing frames?
- Packet loss
 - ┆ How many packets per second are lost through a device at various throughput loads?
- Latency
 - ┆ What is the delay created by sending a packet through a network device under various load conditions?

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The Need for Testing

■ Traffic Bursts

- Devices and networks can be very sensitive to bursts of traffic above the normal load. Most devices have memory buffers. This metric examines how a device copes with bursts of traffic.

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Equipments

■ SmartBit 2000 with four ML-7710 Smart Cards

- A product of Netcom Systems, Inc.

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Software tools and DUTs

- **Advanced Switch Tests (AST) for Ethernet (AST 1.3)**
 - ┆ AST executes the tests for **Ethernet**/Fast Ethernet/Gigabit Ethernet switches based on RFC 2285
 - ┆ ML-7710 Smart Cards only support Ethernet Testing
- **Devices under test**
 - ┆ Intel Inbusiness Switch (10/100Mbps)
 - ┆ Accton Switchhub (ES20212107-TX) (10Mbps)

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Testing items by AST

- **X-Stream Switch Throughput test for Ethernet**
 - ┆ load vs. packet loss
 - ┆ throughput versus frame size
 - ┆ latency versus frame size
- *Layer 3 Throughput*
- Many to One switching
- Head-of-Line Blocking
- *BackBone Switching*
- Fanout Switching
- Illegal Frame Handling

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Architecture

Testing items by AST

- Latency and Frame Forwarding Rates for Broadcast Frames
- Maximum Forwarding Rate and Minimum Interframe Gap
- Address Handling and Address Learning Speed

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Architecture

Half-duplex versus full-duplex

- Each test can be performed either in half-duplex mode or in full-duplex mode.
 - The half duplex mode simulates a single medium for simultaneous transmit and receive at each port.
 - | transmit 50% of the load in each direction.
 - The full duplex mode simulates one dedicated medium for transmit and one dedicated medium for receive at each port.
 - | 100% load sends traffic at 100% wire rate for both the transmit and receive functions at each port.

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Architecture