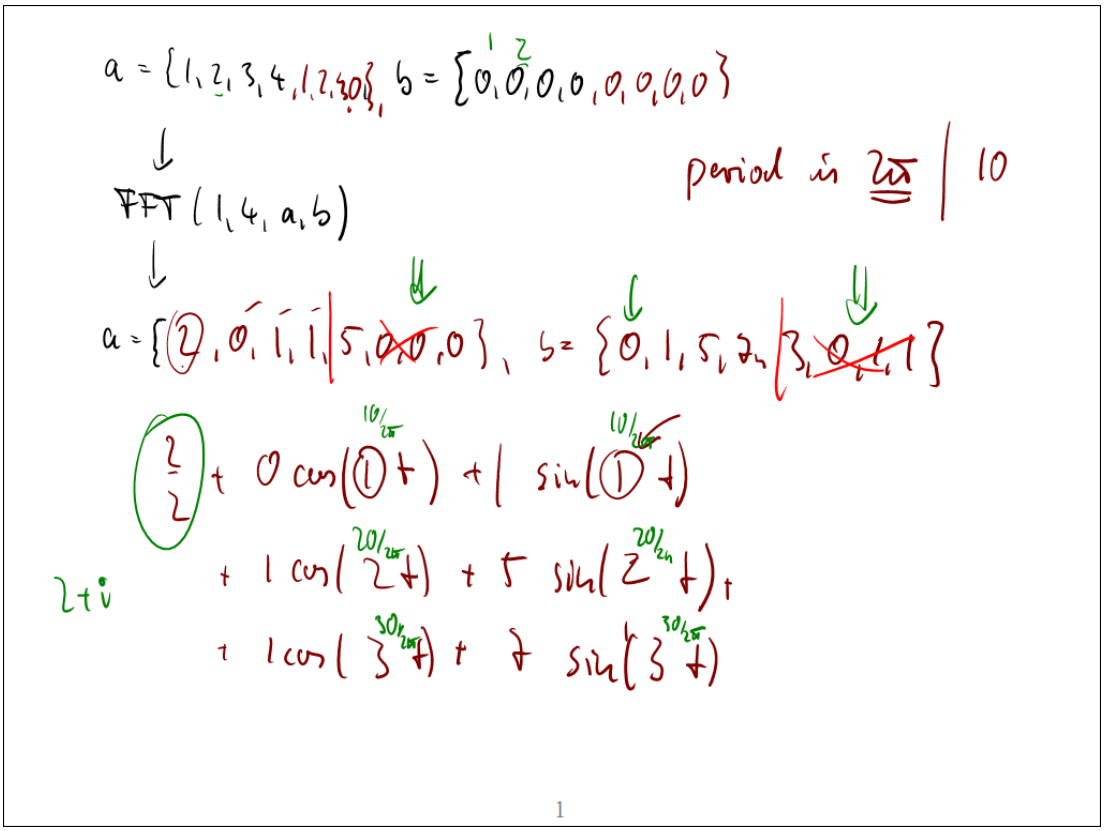
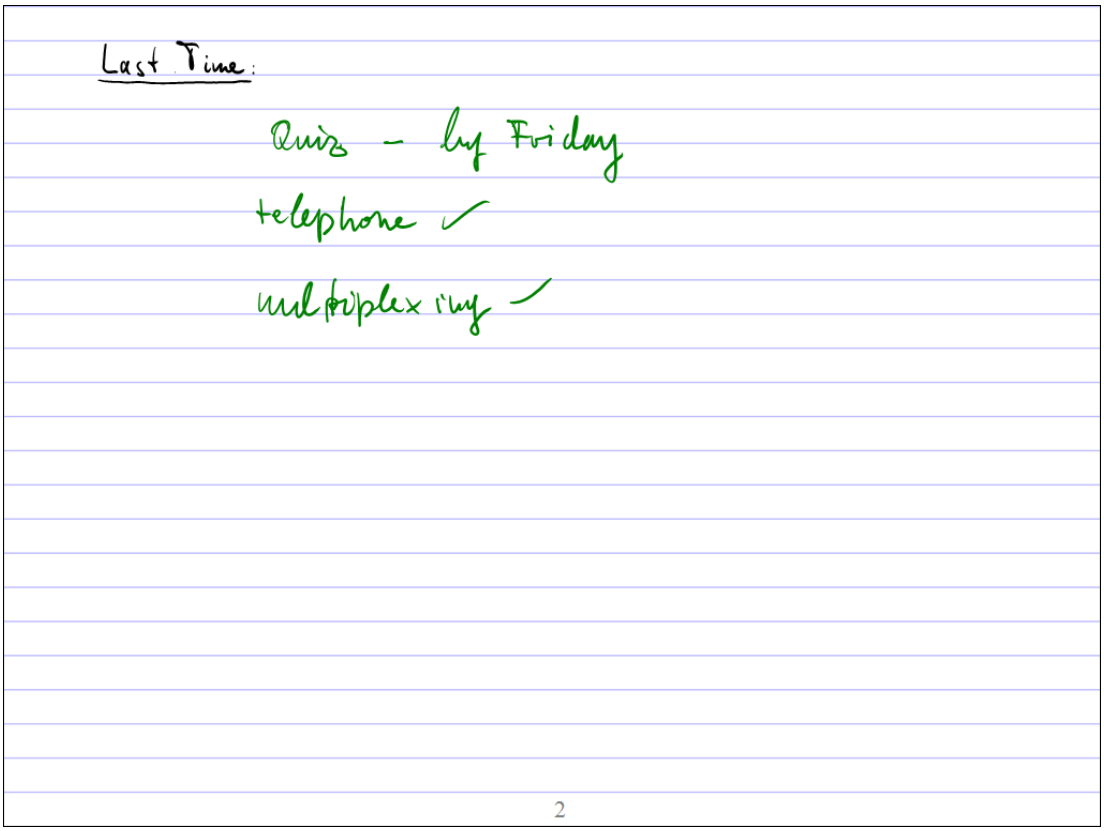
Panel 1



1

Panel 2



2

Panel 3

Switching

Stowger switch

3

Panel 4

Circuit Switching vs Packet Switching

Circuit switching: establish a "copper" path from A to B, then send data

Packet switching: break data into packets, send individually

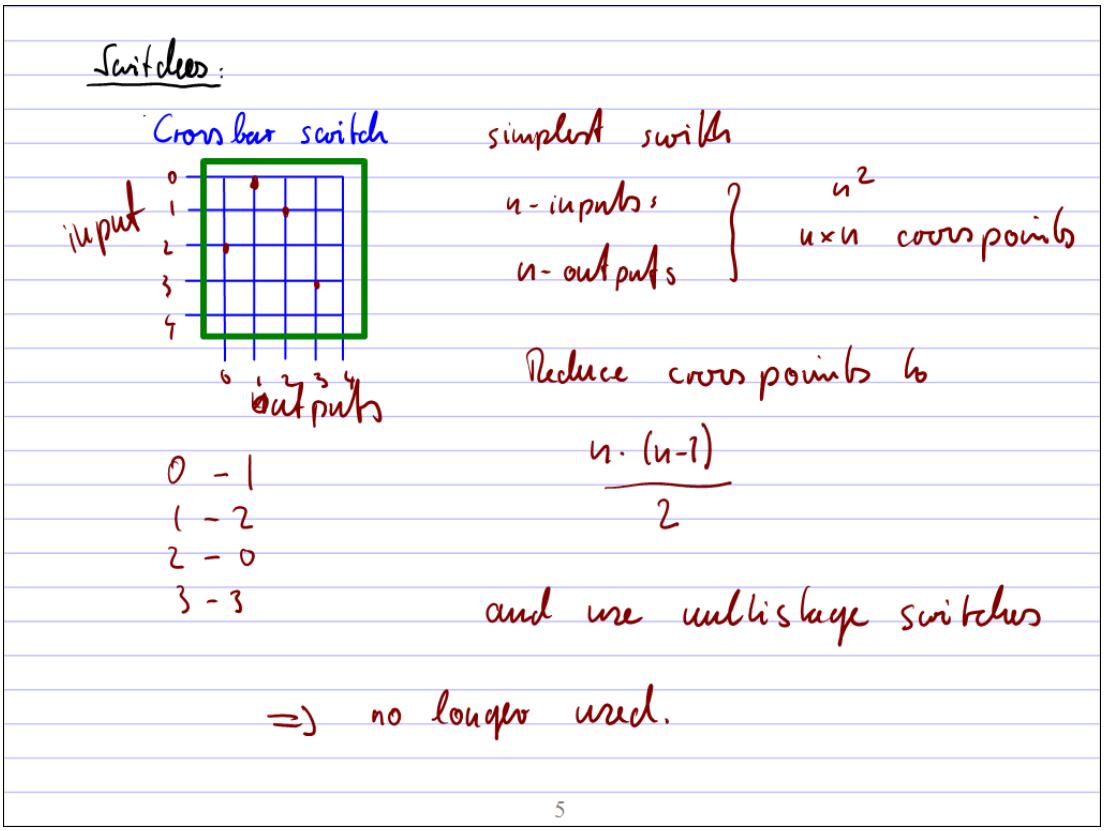
pro/con

circuit switch: long set up (10 sec), then fast speeds, no delays or congestion

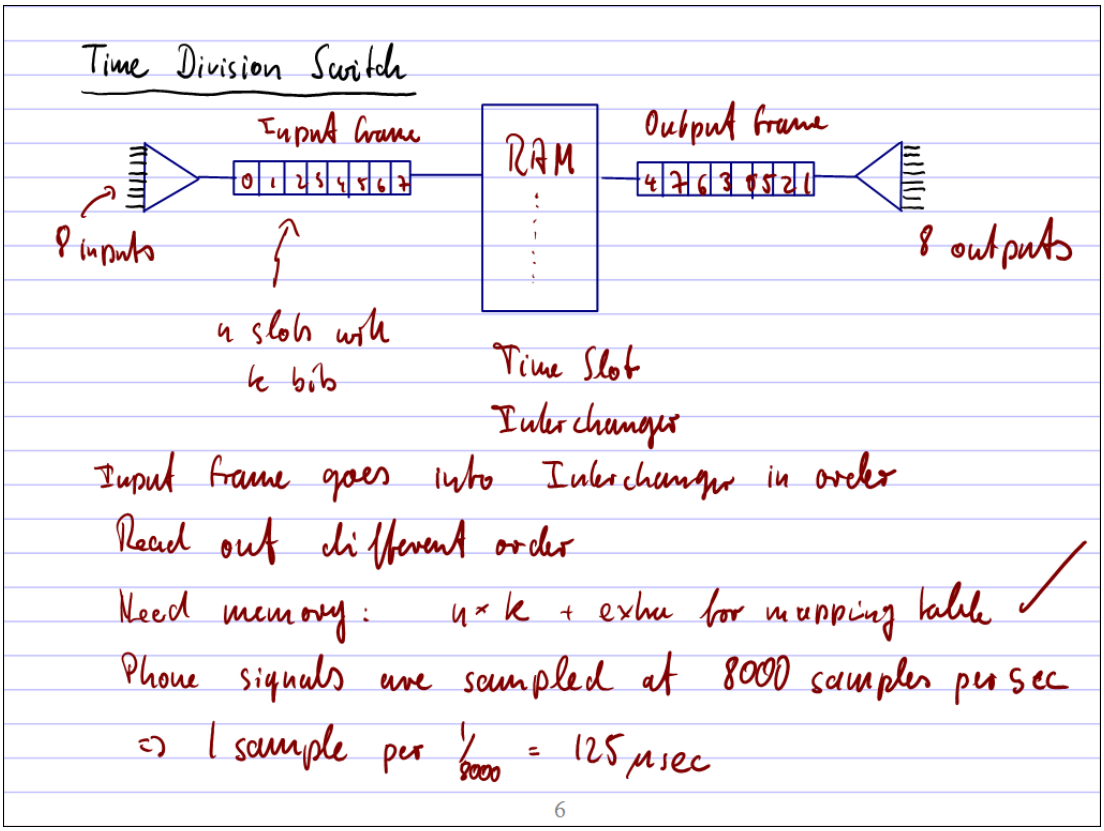
packet switching: more efficient use of resources but packets could get lost.

4

Panel 5



Panel 6



Panel 7

RAM chip must read in and out n samples every 125 μsecs (T1 lines)

Suppose a memory read/write cycle takes T μsecs

$\Rightarrow 2nT = 125$

$T = 55$ n secs

$\Rightarrow n = 125/2T$

$n = \frac{125 \cdot 10^{-6}}{2 \cdot 55 \cdot 10^{-9}} = \frac{125}{110} \cdot 10^3 = 1000$ lines

20 Gbps

$\Rightarrow T$

T2 lines : $4T1 \sim \frac{1000}{4} = 250$ lines

T3 : $\frac{250}{7} \approx 40$ lines

T4 : $40/6 \simeq 6$ lines (400 Mbps)

Chip cycle time

7

Panel 8

The Data Link Layer

8

Panel 9

The Data Link Layer

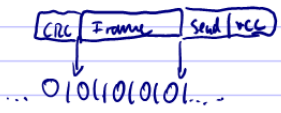
Transforms physical layer into a reliable link between nodes on one network.

Framing: divides bits into groups called frames

Physical address: e.g. MAC address of sender + receiver

Flow control: mechanism to throttle transm. speed so not to overwhelm node

Error control: must detect + retransmit incorrect frames (CRC checksums)



9

Panel 10

Data Link Layer

① breaks bits into frames
- sends frame, could wait for acknowledge
- check frame for accuracy, request resend or send ackn.

How to break bits into frames?

...0110000011110001100110.....

① Clear count: added field for count (8 bits)

if counter is invalid, can't recover any frame!

10

Panel 11

011000...01111100100111110010...

② Insert flag code: 01111110 ← flag byte

Problem: flag byte could occur in data

⇒ stuffing: replace every 11111 with 111110

unstuff: replace every 111110 with 11111

Next assignment...

11