I/O Notes (Shit)

Spring 2015
Fall 2018

* Characteristics
  - Parts: Medium, Device, Controller
  - How: Poll, Interrupt, DMA, I/O Proc
  - Instructions: Memory-Mapped, Special
  - Synch/Asynch

* Buses
  - Wires: Data, Address, Control
    - Multiplexed
  - Arbitration
    - Central: PAU
    - Distributed: "Owner Table"
  - Transfer
    - Asynch/Synch
    - Asynch - Handshaking (Slow) No Clock Everything Explicit
    - Synch - Most Implicit (Fast) Fast if Short Distance
    - Pending/Split-transaction
    - Pipeline vs. Tagged

* Disk Arrays (See 5)
I/O Notes (Sheet 2)

An Asynchronous Bus

Transaction

Arbitration

Vanilla:

1. Does Not Want BG:

Is There A Problem?
**A Race Condition (SHT 3)**

Device does not want the bus.

So controller passes it on.

Someone asserts SACK.
Controller knows it no longer has to pass on the grant signal.

Controller returns to idle.

**What Is The Problem?**

**What Happens If:**

```
\[\text{Time} \quad \text{Controller passes SGE} \quad \text{Device wants service} \quad \text{Another device controller asserts SACK}\]
```

**The Problem?**

**The Fix?**
I/O Notes

What if Dev wants Bus After Grant?

4. At Same Priority — Tough!
3. At Higher Priority — PAU Must Not

Once Granted, That Is It

How? M/S Flipflop Will Do The Trick (Most Of The Time)

Recall SACK is Negated During Arbitration

When Will This Not Work?

What if We Introduce Logic Next To The PAU:
The Transaction

\[ \text{DATA} \rightarrow \]

\[ M \quad \text{DATA} \quad S \]
\[ \quad \text{SSYN} \quad \quad \text{MSYN} \quad \text{C} \quad \text{SSYN} \quad \text{DATA} \quad \text{SSYN} \quad \]
\[ \quad \text{MSYN} \quad \text{SSYN} \quad \text{SSYN} \quad \text{SSYN} \]

\[ \text{DATA} \leftarrow \]

\[ M \quad \text{C} \quad \text{MSYN} \quad \text{ADDR} \quad \text{SSYN} \quad \text{DATA} \quad \text{MSYN} \quad \text{SSYN} \quad \text{SSYN} \]

\[ \text{BBSY} \quad \text{MSYN} \quad \text{SSYN} \quad \text{IDLE} \quad \text{SSYN} \]

\[ \text{SSYN} \quad \text{SSYN} \quad \text{SSYN} \]
1. Distribute the file
2. Redundancy

RAID 0  Coarse
       No Red.

RAID 1  Coarse
(Mirror)
       Red.

RAID 2  Fine
       ECC

RAID 5  Fine
        Parity

RAID 4  Coarse
        Parity

RAID 5  No Parity dist.