The I/O entity:

- the medium
- the transducer electronics
- the device

Basic types:

- interrupt-driven
- polling
- I/O controller (e.g., DMA)
- I/O processor

Disk storage:

1. track, cylinder, aerial density
2. Rotation, seek
3. disk block
4. I/O processor mechanism: e.g., elevator
5. Disk arrays -- RAID levels, performance vs. redundancy

Buses:

1. Signals: A, D, C
2. Separate A,D lines vs. Multiplexed A,D lines
3. Pending bus vs. Split-transaction bus
4. Asynch vs. Synch
5. Arbitration: Centralized vs. Distributed
I/O Notes (Sheet 1)

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* 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: "Dinner Table"
  - Transfer
    • Asynch/Asynch/Shared
      Asynch - Handshaking
      (Slow) No Clock
      Everything Explicit
  • Synch - Most Implicit
    (Fast) Fast if Short Distance
    • Pending/Split-Transaction
  • Pipeline vs. Tagged

* Disk Area (800-5)
An Asynchronous Bus

Transaction

Arbitration

Vanilla:

Does not want BG:
I/O Notes (Set 3)

2. What if Dev wants bus after Grant?
   a. At this priority level, tough!
   b. At higher level: PAU must not

Answer: Once PAU has granted, can not grant to latecomer

8. What is "done"?

Diagram: Flowchart showing states and transitions with BBSY, MSYN, and SSYN.
1. Don't want bus
**Race 1**

You pass grant, the device waits service...

**Race 2**

PAU granted but, high priority mg. come in...

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**Notes:**
- BG: Busy
- Idn: Idle
- BR: Busy
- SACK: System Acknowledgment
- BBSY: Busy Signal

Or. Hap.
1. Distil.
2. Reducing in abs.

Dual cap

Mirror

Chained decks

Initial Interleaf deck

Pail

Production
RAID 3
- Five grand stripe
  - First disk
  - Second disk
  - Strip part

RAID 2
- Five grand stripe
  - ECC
  - Mirror
  - Drive - no redundancy