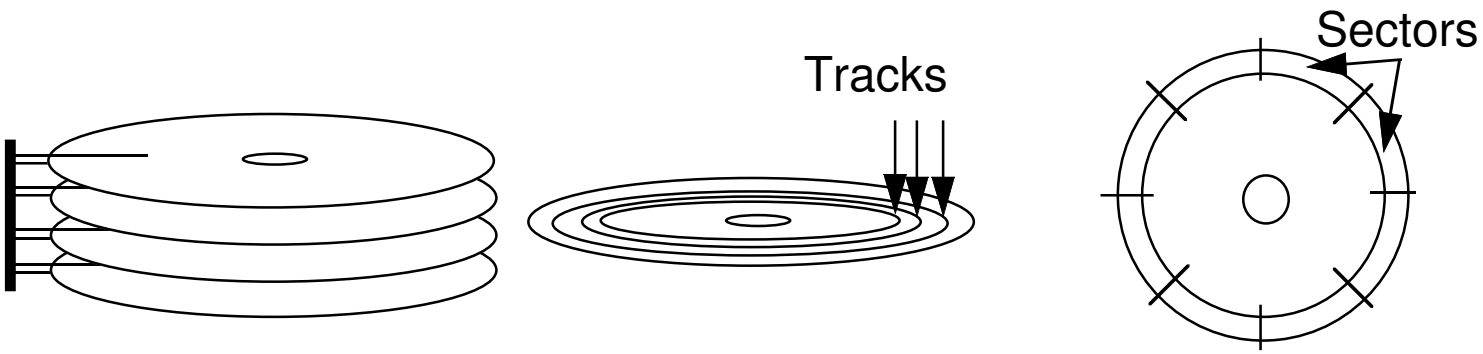
Disks

Floppies are cheap and mobile.

A hard disk has more favorable properties:

- It can be larger because it is rigid.
- It can store more because it can be more precisely controlled.
- It can transfer data faster because it can spin faster.
- It can incorporate more than one platter.



Disk Terminology

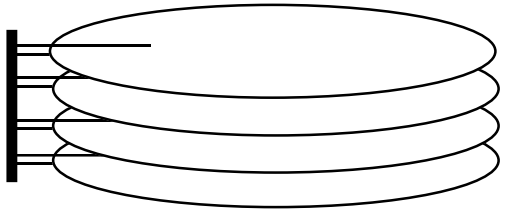
Seek time -- time to move the arm so the read head is positioned on a specific track. 12-20 ms average.
Performance measures:

Min seek time, Max seek time, Average seek time.

Average seek time: Sum of all seeks/number seeks.

Observed average is lower than reported average due to consecutive reading and OS efforts at to locality.

Rotational latency -- delay before the proper sector moves under the disk read head. 0.5 of revolution 3600-5400 RPM
Transfer rate -- MB/sec rate at which a sector is read off of the disk and transferred to the system bus. 2-4MB/sec.



Networks

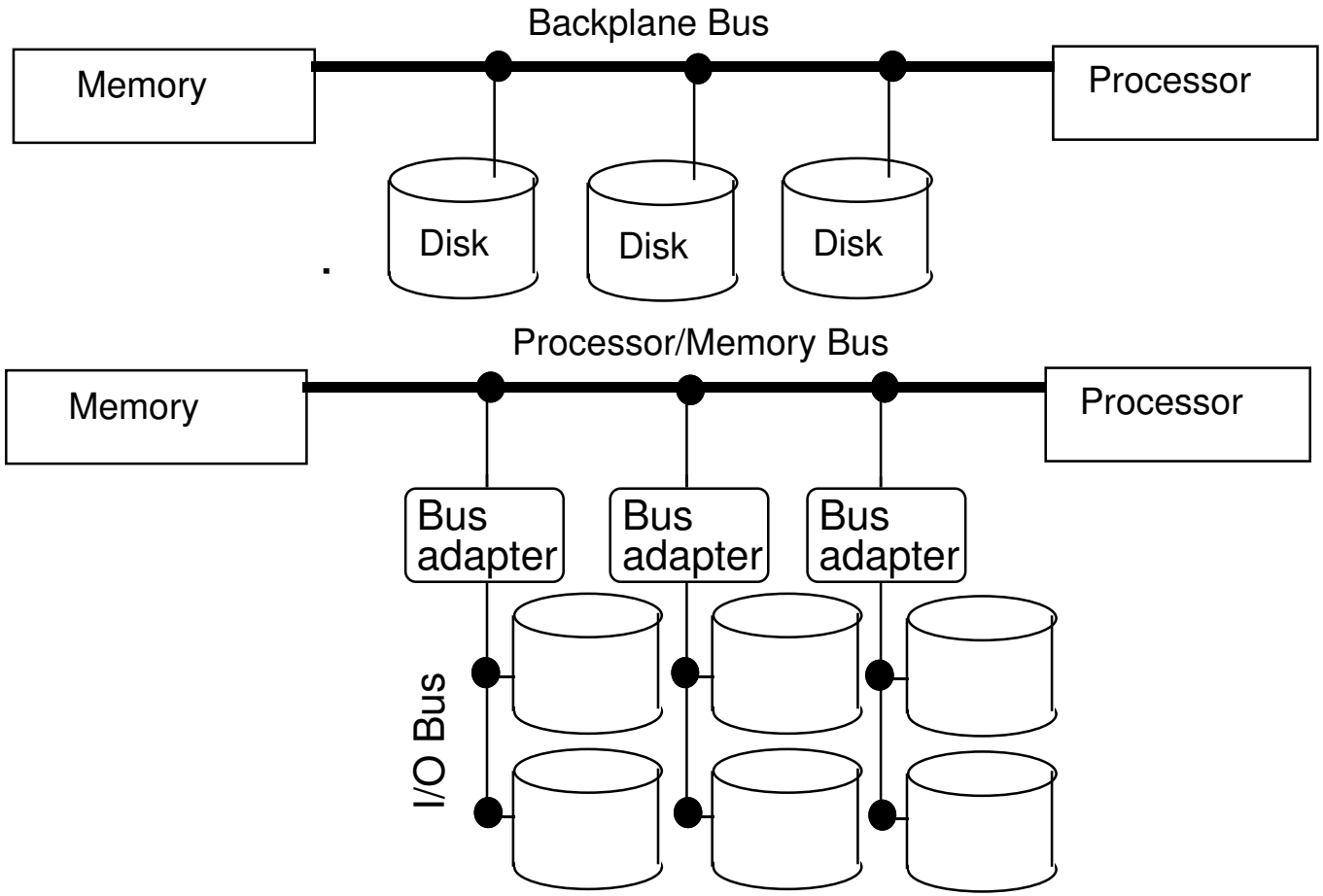
RS-232 is a 0.3-19.2Kb/sec. standard for attaching terminals to computers.

Local Area Network (LAN) or Ethernet is a 10Mb/sec packetized interconnect technology.

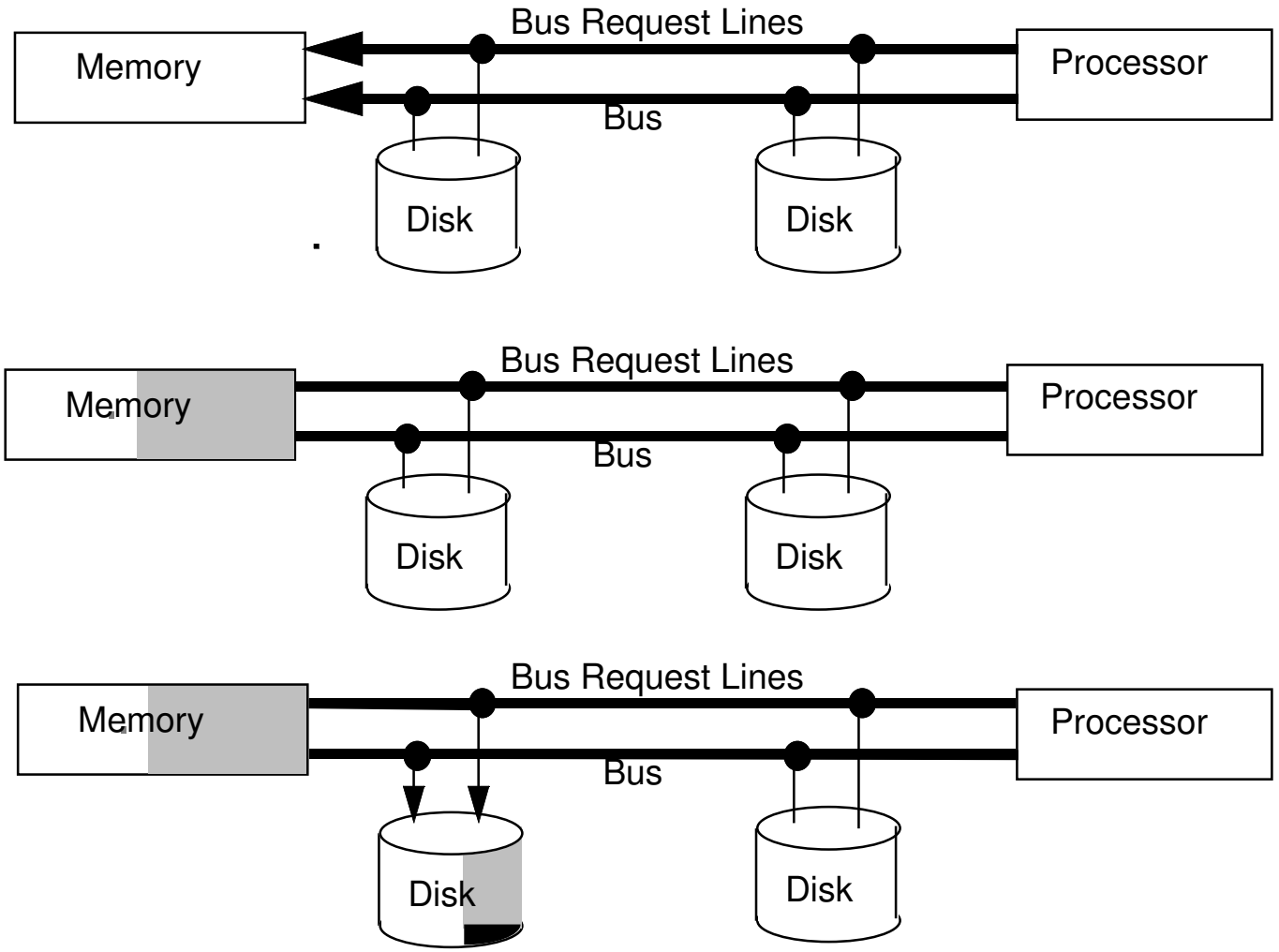
Wide Area Networks typified by ARPANet use 56Kb telephone lines and store-and-forward packetization for long-haul communication.

Newer technologies, e.g. fiber optics, can raise transfer rate to 1 Gb/sec.

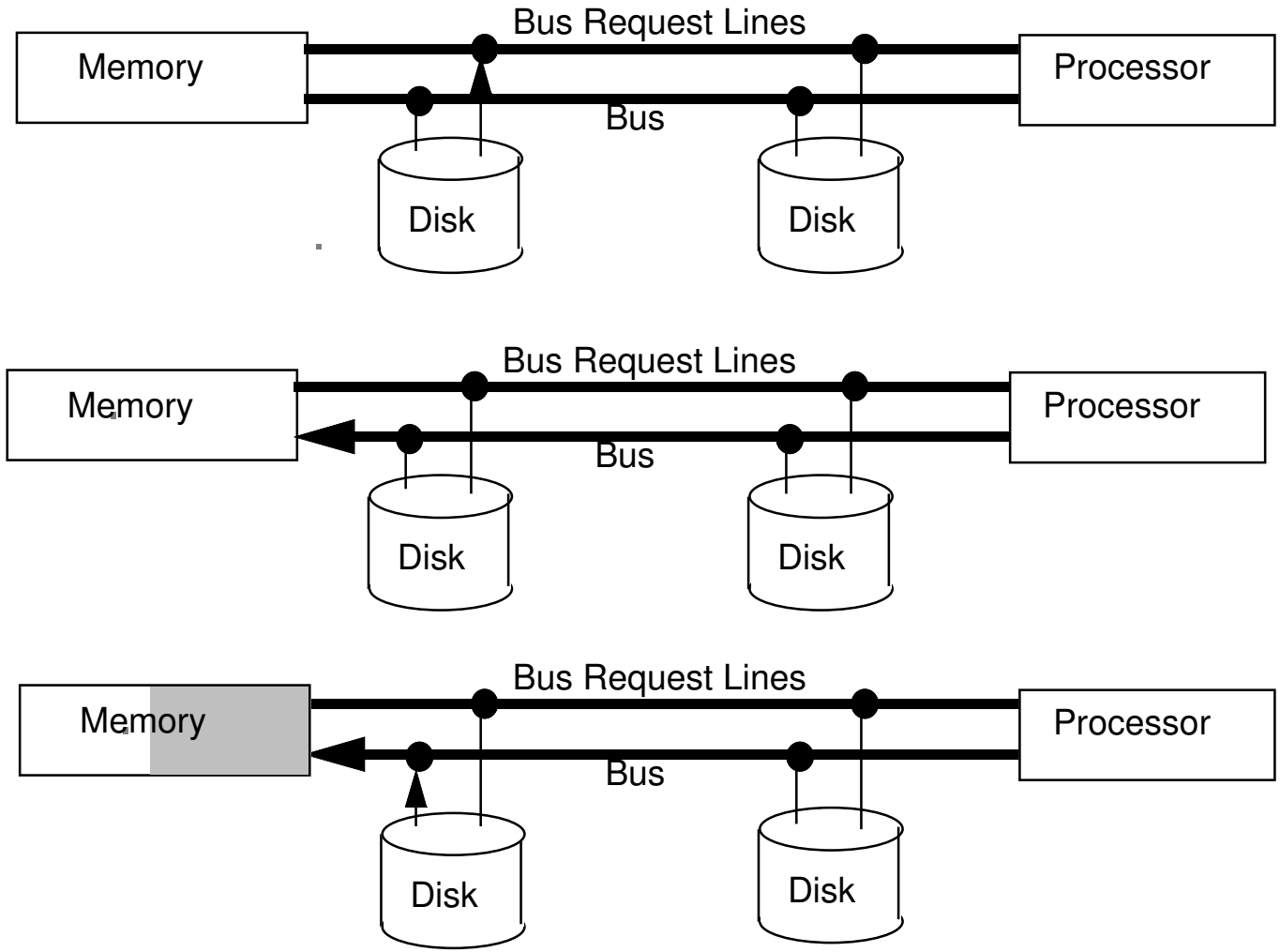
Alternatives



Example Output

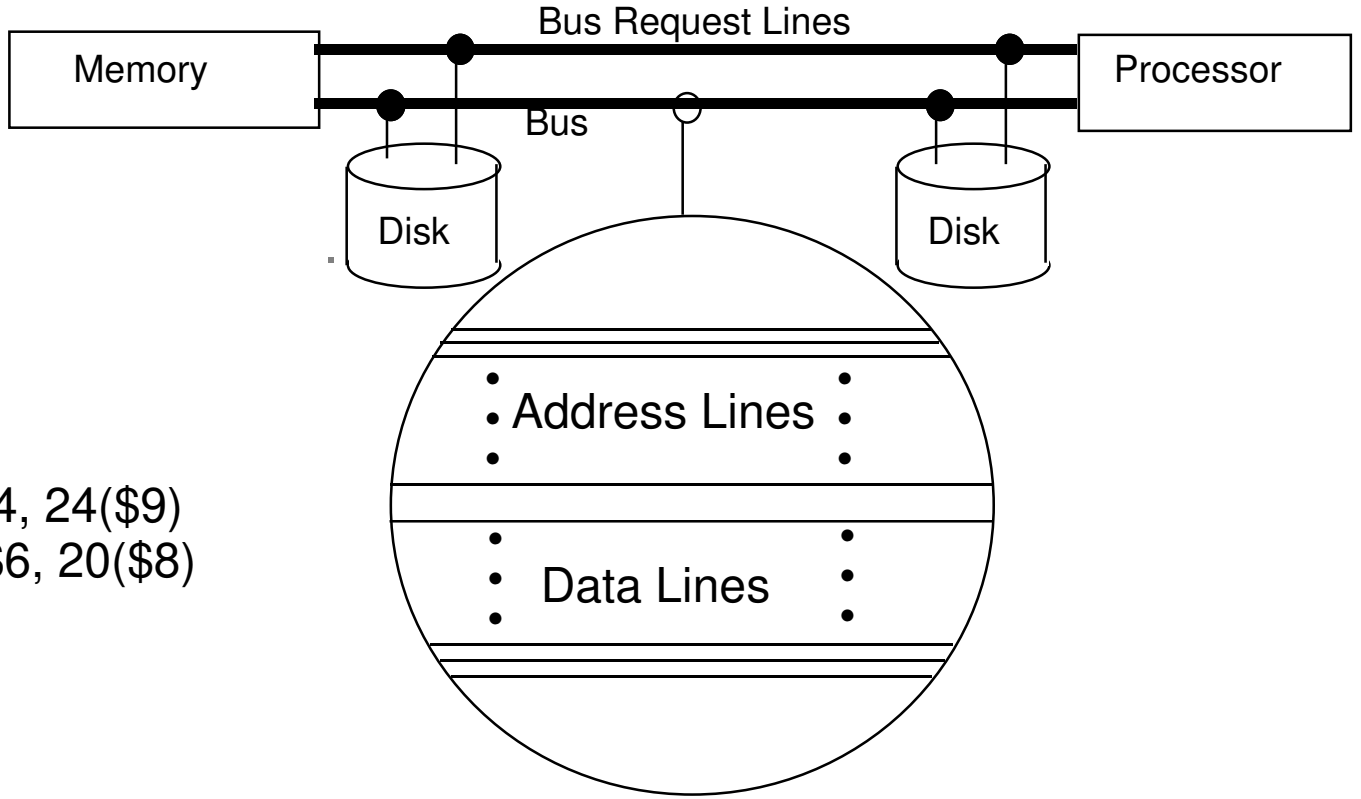


Single Bus Master



Memory Mapping

How does the processor refer to the memory and to peripheral devices over the same bus?



lw $4, 24($9)
sw $6, 20($8)

Bus Arbitration

- Deciding who will use a multimaster bus
- Goals: Prioritization and Fairness
- Four different schemes:
  - Daisy chaining
  - Centeral Master (PCI)
  - Distributed Self Selection (NuBus)
  - Distributed Arbitration by Collision Detection (Ethernet)

Transferring Data

Three techniques --

- Polling -- processor checks periodically
  - Ideal for low bandwidth devices, e.g. mouse
  - Impractical for fast devices
  - Penalized when no activity
- Interrupt Driven -- processor initiates, then is interrupted
  - Ideal for occasional use, faster devices, e.g. floopy
  - Impractical for very fast devices
- Direct Memory Access -- offload task to special controller
  - Ideal for disks
  - Relies on processor caching

DMA -- It's complicated

Type of addressing --

- Physical addressing: Cannot cross page boundary due to non-contiguous allocation
- Virtual addressing: Requires translation
  - Include a small address map with setup
  - Chain pages together

Coherency

- Data transfer to memory can differ with cache contents
  - Route all memory accesses through cache
  - Let software invalidate/flush cache
  - Allow hardware to invalidate/flush cache