An Open, Parallel I/O Computer as the Platform for High-Performance, High-Capacity Mass Storage Systems

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For those of you who are not familiar with APTEC Computer Systems, we are a Portland, Oregon based manufacturer of I/O computers. About 400 of our systems are installed today, typically in real-time oriented, high bandwidth environments. Applications have included satellite ground systems, mass storage archival systems, signal and image processing systems, etc.

Much of the discussion here today has focused on mass storage solutions exclusively. That is high density storage media, attached to a general purpose computer, which in turn supports network connections to users.

APTEC's focus in this environment is on programs requiring real-time data capture, with low latency processing and storage requirements. As an example my second introductory slide illustrates the Loral / Space Telescope - Data Archival and Distribution System. This is an existing Loral AeroSys designed system, which utilizes an APTEC I/O Computer.

The key attributes of a system architecture to address these types of requirements include:

- Data acquisition alternatives
- A wide range of supported mass storage devices
- Data processing options
- Data availability through standard network connections
- An overall system architecture (hardware and software designed for high bandwidth and low latency.

The following slides outline APTEC's approach, which is designed to provide flexible, standards based, system solutions.

Aptec

- Introduction
- Mass storage system attributes
  - Data acquisition
  - Mass storage devices
  - Processing options
  - Data availability
  - Architecture
- Conclusion

Introduction / Data Deluge

- ERS-1

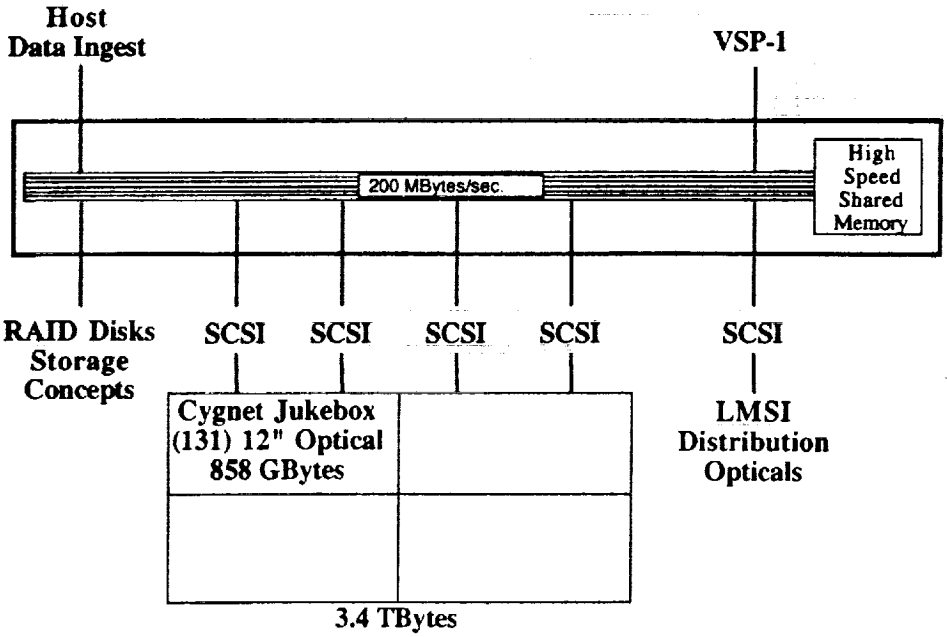
  Transmits data at 100 Mbits/sec. During this 30 minute presentation 160 9-track 6250 bpi tapes would be filled with data.

- EOS

  Expected to exceed 1 TByte/day

Introduction / Loral ST-DADS

Space Telescope Data Archival and Distribution System

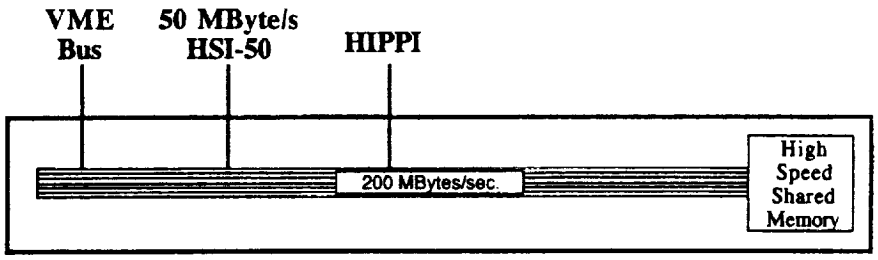


Mass Storage System

Attributes

- Data acquisition
- Mass storage devices
- Internal processing capabilities and connections to external processing elements
- Data availability
- Architecture

Data Acquisition Options

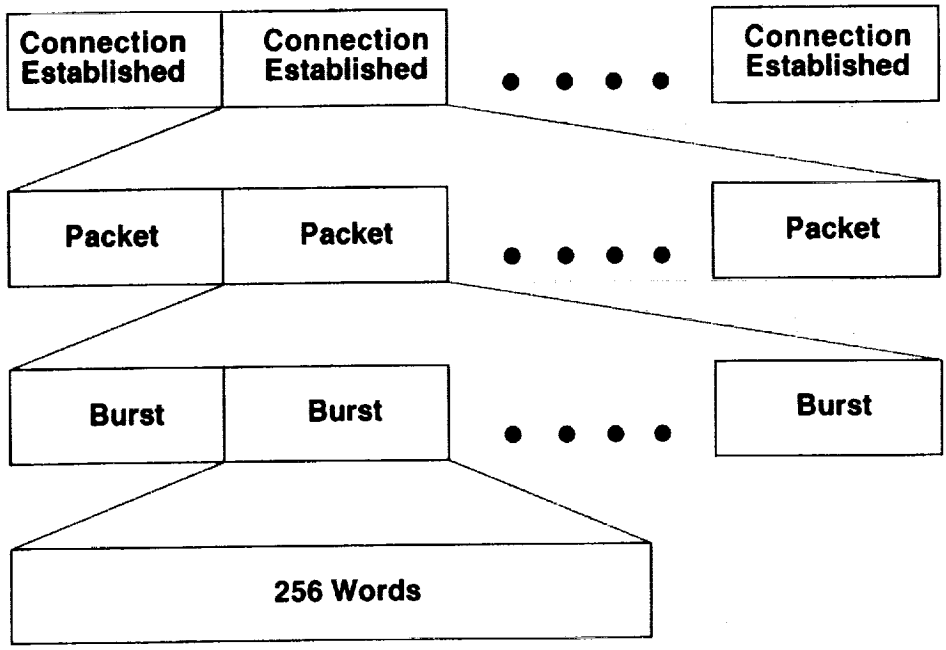


HIPPI

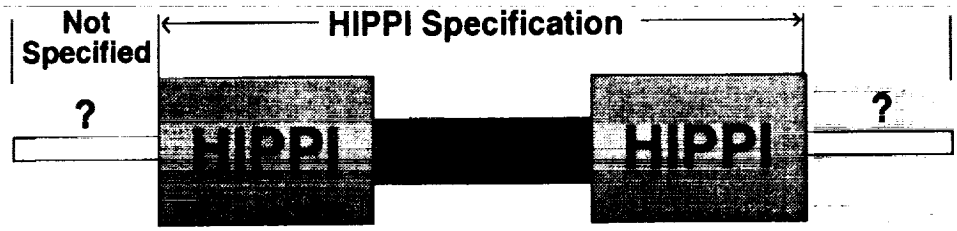
High Performance Parallel Interface

- ANSI Standard (X3T9.3)
- Efficient high speed interconnection optimized for large block transfers
- Point-to-point connection
- 32-bit channel
- 100 MByte/sec simplex channel

HIPPI



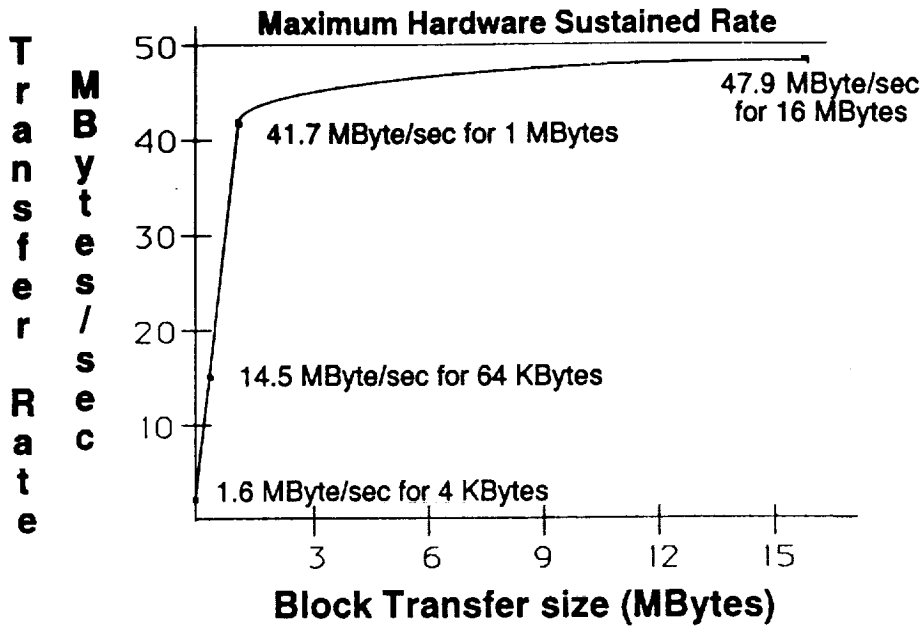
HIPPI



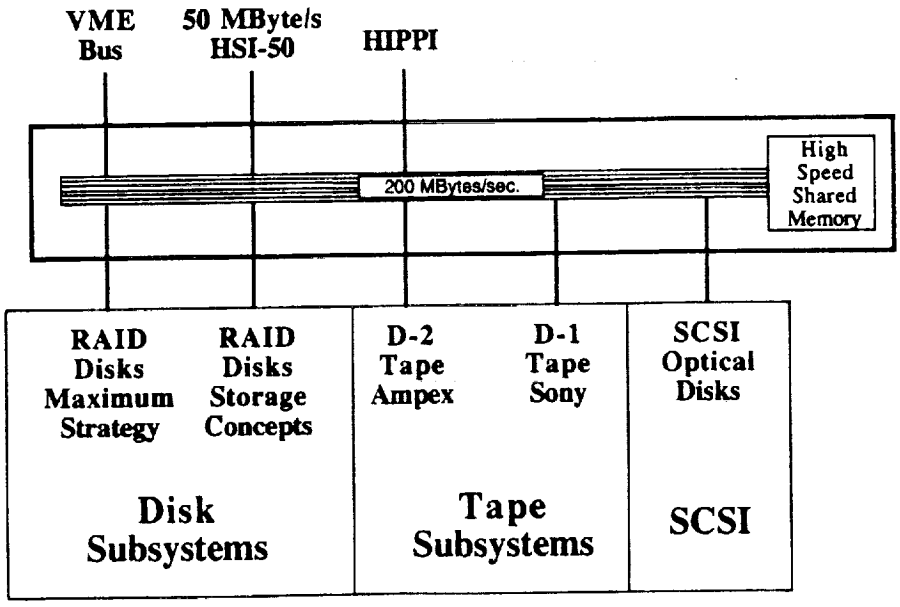
Only HIPPI channel runs at 100 MByte/sec.
How fast the HIPPI channel is fed is not specified.

The Aptec HSI-50 / HIPPI design provides 50 MByte/sec sustained throughput to/from the HIPPI channel.

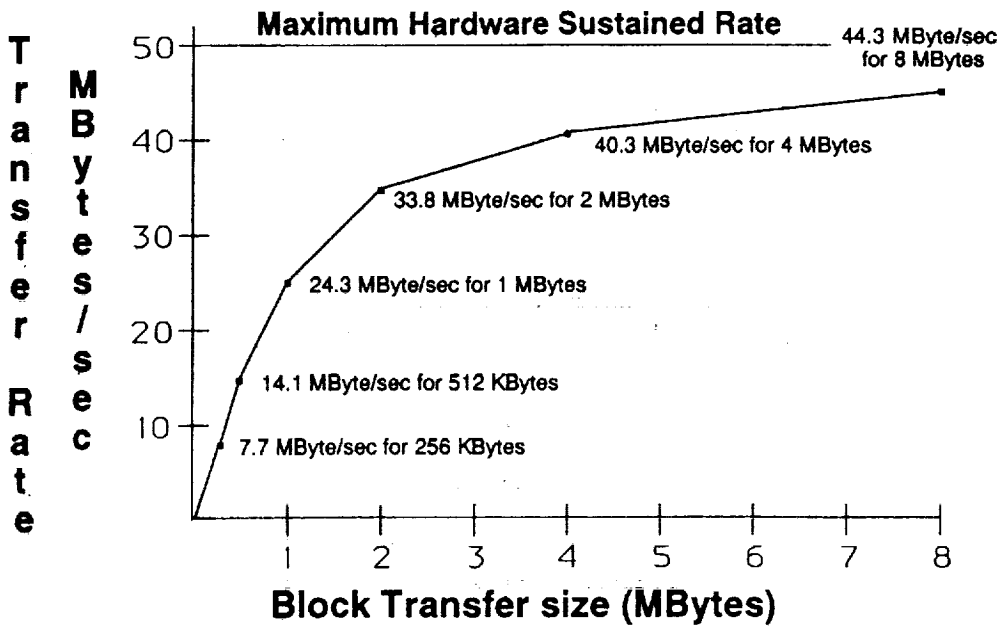
HIPPI (User defined ULP)



Mass Storage Devices



Maximum Strategy Disk



Tape Drives

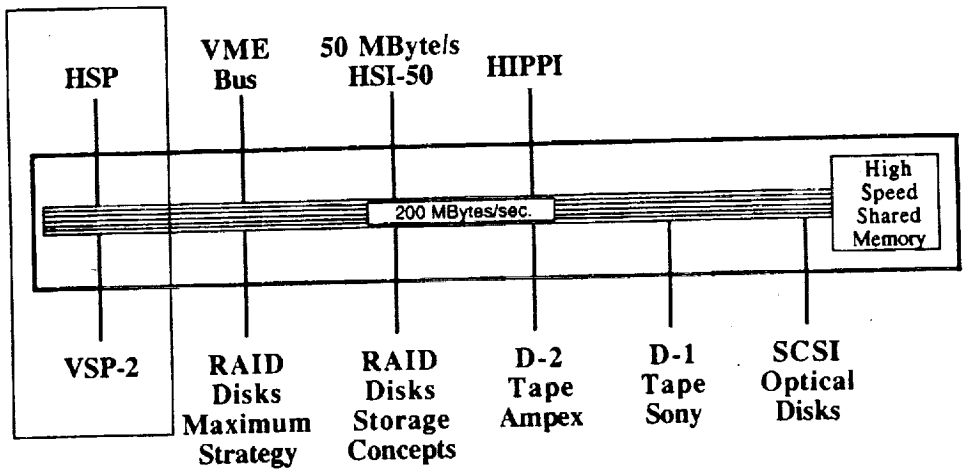
Ampex DCRSi
- 11.4 MByte/sec transfer rate
- 38 GByte capacity per cartridge

Sony DIR 1000 (D-1)
- Up to 32 MByte/sec transfer rate
- 12, 41, or 96 GByte capacity per cartridge

Ampex TeraStore (D-2)
- 15 MByte/sec transfer rate
- 25, 75, or 165 GByte capacity per cartridge

Ampex TeraAccess robotic system (6.4 TByte)

Processing Options



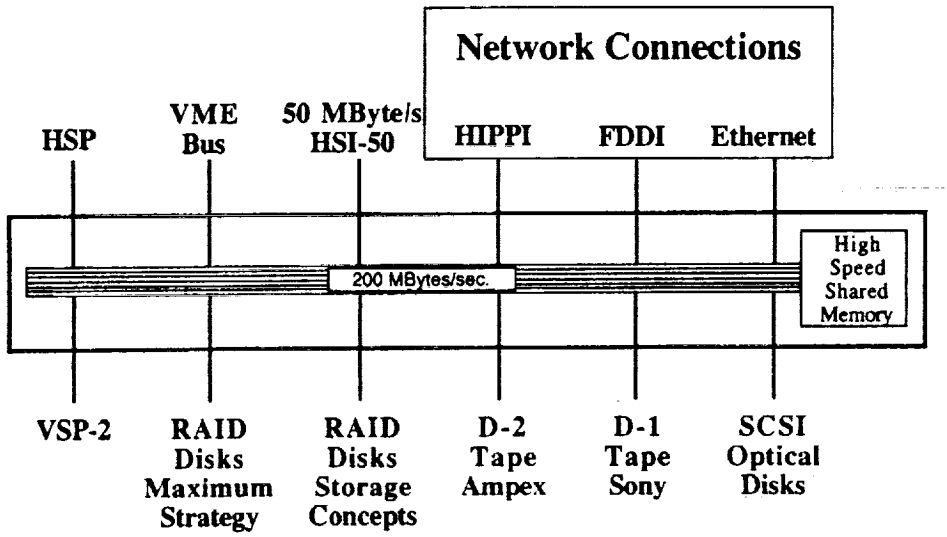
Processing Options

- HSP - High Speed Scalar Processor
  20 MIP processor with 50 MByte/sec connection to memory.
  VxWorks and C.

- VSP-2 - Vector / Scalar Processor
  150 MFLOP Array Processor with 50 MByte/sec connection to memory.
  VxWorks, C, and Math Advantage library of callable vector subroutines.

- Many external processor links supported. Convex, Alliant, Sun, Silicon Graphics, AMT/DAP, HIPPI etc.

Data Availability



Data Availability

Client / Server Model

- **TCP/IP Access**
- **Server Software**
- **NFS Network File Access**

- **HIPPI**
- **FDDI**
- **Ethernet**

Architecture

Aptec architecture can sustain multiple concurrent high data rate transfers with predictable repeatable performance.

- Synchronous bus
- Dedicated I/O Processors
- Real-time kernel / VxWorks with Aptec's MultiProcessor services

Conclusion

- High performance solutions are available today using commercial-off-the-shelf systems and peripherals.
- They are cost effective and low risk systems offering flexible, modular architectures.
- Standards based.
  - UNIX development environment
  - Connectivity / networking
  - VME, HIPPI, FDDI, Ethernet, TCP/IP
  - VX/Works real-time kernel