

SCSI Adapter Analysis – i5/iSeries

This StorFacts™ Report analyzes the past four generations of i5/iSeries SCSI adapters. Features discussed include the following:

1. FC0645 / FC0647
2. FC5712 / FC5715
3. FC5736
4. FC5775



For more information – <http://www.gstinc.com/store/SCSI-C141.aspx>

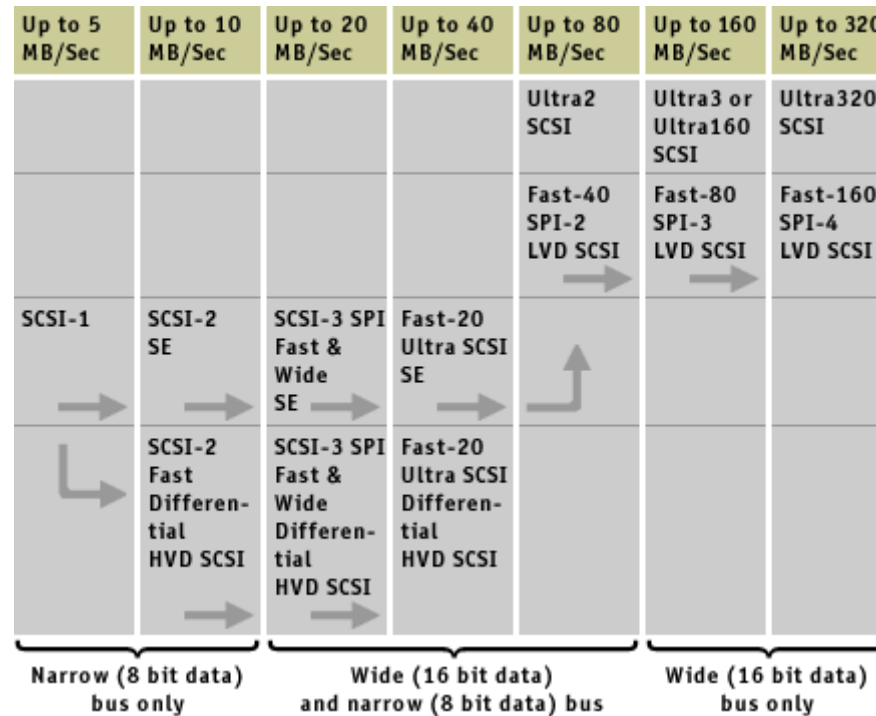


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SCSI Overview

Introduction

SCSI celebrates its 20th anniversary with a bang by moving to the seventh generation of the bus that introduces a maximum data transfer at a staggering 320 MB/sec. Over the course of the past two decades the protocol has evolved from an 8-bit, single-ended interface transferring data at 5 MB/sec to a 16-bit, differential interface transferring data at 160 MB/sec. For the first time SCSI protocol has been revised to reduce the time spent on processing overhead, resulting in increased performance.





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SCSI

SCSI's commitment to backward compatibility and legacy support are the primary reasons for its durability as an I/O interface. Throughout SCSI's 20-year history, each successive generation of the standard has been backward compatible with each and every previous generation of SCSI. As a result SCSI is the industry standard for disk drive connection in virtually all high-performance servers.

Because of SCSI's backward compatibility, migrating to Ultra160 SCSI required minimal investment. This allowed for a fast smooth transition to Ultra160 SCSI. Ultra320 SCSI has the same commitment of compatibility and should prove to be just as easy to use. Ultra320 SCSI is slated to launch in 2005 and will further enhance SCSI's legacy in the computer industry.

New Features Speed Ultra320 SCSI

Ultra320 SCSI is the next step in the SCSI evolution. With the introduction of Ultra160 SCSI, three key technologies were introduced: Dual Edge Clocking, Domain Validation, and Cyclic Redundancy Check (CRC). Now Ultra320 SCSI introduces additional technologies that include for the first time, protocol changes that will reduce overhead and improve performance. These changes will allow data to transfer safely and reliably at 320 MB/sec.

Ultra320 SCSI includes the following key features:

- **Double Transfer Speed:** This doubles the transfer rate across the SCSI bus to a burst rate of 320 MB/sec allowing higher transfer rates across the SCSI bus and increasing the disk drive saturation point. This results in increased performance, especially in environments that use extended transfer lengths or have many devices on a single bus.
- **Packetized SCSI:** This includes support for packet protocol. Packetized devices decrease command overhead by transferring commands, data, and status using DT (dual transition) data phases instead of slower asynchronous phases. This improves performance by maximizing bus utilization and minimizing command overhead. Furthermore, packet protocol also enables multiple commands to be transferred in a single connection. In Ultra160 SCSI, data is transferred in synchronous phase at 160 MB/sec, while the command and status phases are still transferring at slower asynchronous phases and limited to a single transfer per connection.
- **Quick Arbitration and Selection (QAS):** This reduces the overhead of control release on the SCSI bus from one device to another. This improvement reduces command overhead and maximizes bus utilization.



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Key Features, Continued

- **Read and Write Data Streaming:** This minimizes the overhead of data transfer by allowing the target to send one data stream LUN Q-TAG (LQ) packet followed by multiple data packets. In a non-streaming transfer, there is one data LQ packet for each data packet. Write data streaming performance is also increased because the bus turn-around delay (from DT data in to DT data out) is not incurred between each LQ and data packet.
- **Flow Control:** This allows the initiator to optimize its pre-fetching of data during writes and flushing of data FIFOs during reads. The target will indicate when the last packet of a data stream will be transferred which will allow the initiator to terminate the data pre-fetch or begin flushing data FIFOs sooner than was previously possible.

Ultra320 SCSI lines up with PCI-X

Faster I/O performance will saturate the PCI bus, therefore most host implementations are tied to PCI-X. Disk drive media rates continue to increase. Later this year the drive data rates are expected to exceed 40MB/sec. SCSI will need to jump past Ultra160 SCSI in order to support sustained throughput from the average number of drives in a server (four).

Under standard PCI the host bus has a maximum speed of 66 MHz. This allows for a maximum transfer rate of 533 MB/sec across a 64-bit PCI bus. With Ultra160 SCSI, two SCSI channels on a single device achieve a maximum transfer rate of 320 MB/sec leaving plenty of overhead before saturating the PCI bus. However, at 320 MB/sec, two SCSI channels can now achieve 640 MB/sec, which will saturate a 64-bit / 66MHz PCI bus. In addition to PCI-X doubling the performance of the host bus from 533 MB/sec to a maximum of 1066 MB/sec, there are protocol improvements so that efficiency of the bus is improved over PCI. Together PCI-X and Ultra320 SCSI provide the bandwidth necessary for today's applications.





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Applications for Ultra320 SCSI

With the acceleration of microprocessor performance, bottlenecks in the I/O channel continue to be a cause for concern. SCSI continues as the workhorse technology that addresses this problem. With a transfer rate of 320 MB/sec, Ultra320 SCSI is the next step in the evolution. With PCI-X delivering bus rates up to 1066 MB/sec, high-performance SCSI I/O allows for greater speeds across the entire PC bus.

As computer systems increase in capability, new applications evolve to take advantage of the available power and features. For example, desktop publishing, scientific visualization, video and audio editing, digital broadcasting and other data-hungry applications continue to push the I/O bandwidth and require a more advanced interface to handle increased data transfer.

In addition to the increased speed of 320 MB/sec, the new technology that reduces overhead will benefit real transaction process applications such as data-mining, material requirements planning (MRP), and other database programs. Random access applications such as these can involve searching for data on many different disk drives on the server. Technology such as QAS will benefit these applications by reducing the overhead of control release from one device to another on the SCSI bus.

To keep up with the multiple data streams that today's processors can accept and generate, high-performance RAID arrays are required. These large disk farms with RAID configurations can also benefit from Ultra320 SCSI's high bandwidth. For example, high-end workstations have applications where they must merge several video and audio clips from different channels and disk drives. A high-performance RAID array can have between eight and fifteen disk drives attached to a single channel. Include a dual channel controller and the total array can be up to 30 disk drives, which makes SCSI a natural choice. Finally, Ultra320 SCSI's transfer rate of 640 MB/sec across both channels will insure that there is adequate bandwidth to provide maximum performance.

New streaming video and audio editing applications have taken advantage of the accelerated performance of I/O. Ultra320 SCSI will provide the bandwidth to manage tomorrow's increasingly rich collection of dynamic media. Media creators require performance that allows them to work faster and more efficiently. Ultra320 SCSI provides the speed, capacity, scalability and reliability that these I/O hungry applications require.

As demand for external storage in the SAN environments continues to grow, Ultra320 SCSI insures that the technology is there to allow integrators to take full advantage of their existing installed base and not effect the performance of Ultra320 SCSI. With SAN, customers have an extensive fabric connecting to several SCSI drive boxes throughout their company. Ultra320 SCSI maintains compatibility with existing low voltage differential (LVD) SCSI technology and allows customers to mix new and old technologies without interruption.



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SCSI Continues to Protect your Investment

Companies continue to face the challenges of managing ever growing amounts of data and are turning to new emerging technologies that can boost performance while easily integrating into their existing computing infrastructure. SCSI technology continues to evolve to address these greater needs and allows customers to build on their existing infrastructure and protect their existing investment.

SCSI has always been designed to provide an upgrade path with low switching cost and Ultra320 SCSI continues that legacy. Ultra320 SCSI maintains the backward compatibility with previous versions of SCSI even with its new added features. For example, packetized SCSI is compatible with non-packetized parallel SCSI. As a result, packetized SCSI devices can reside on the same bus as non-packetized SCSI devices.

SCSI scalability has always been an advantage and Ultra320 SCSI is no exception. Ultra320 SCSI offers the scalability and performance that entry, mid- and high-range servers require. It allows up to 15 SCSI devices on a single channel with up to 30 across dual channels. As companies' needs expand SCSI enables them to add additional storage as needed. And because Ultra320 SCSI maintains compatibility with existing Ultra160 SCSI, Ultra2 SCSI, and Ultra Wide SCSI devices, companies can easily and inexpensively expand their infrastructure.





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Conclusions

SCSI enters its 20-year anniversary by ushering in a new technology. Ultra320 SCSI is sure to add to the existing legacy of past SCSI technologies. SCSI has come a long way from its original 5MB/sec transfer rate. At 320 MB/sec, Ultra320 SCSI is only the latest in SCSI evolution. As technology continues to move into the 21st century, the industry can continue to look forward to new and faster SCSI technology. Ultra640 is already in development.

With new technologies such as packetized SCSI, QAS, training and pre-comp, SCSI will continue to deliver performance safely and reliably for generations to come. As performance continues to grow, so will the applications that can take full advantage of greater I/O performance. PCI-X accelerates performance across the host bus to 1066 MB/sec and Ultra320 SCSI is there to take full advantage of this available bandwidth.

And as always, SCSI maintains its backward compatibility allowing customers to protect their investment while concurrently giving them the ability to grow as their needs increase. No other I/O technology can provide these advantages. SCSI continues to increase its performance, features, enhancements and market share. Ultra320 SCSI is the newest example of SCSI's continued commitment to providing the industry with the I/O bandwidth necessary for an increasing number of performance hungry applications. SCSI will continue to evolve and with Ultra640 SCSI already on the roadmap, it will be impossible to replace.



0645

Direct Attach-5712

#0645 is ordered when the function of a #5712 PCI-X Tape Controller is required and the card will be controlled by a non-OS/400 operating system. Cards controlled by a non-OS/400 operating system do not use/require PCI IOPs. Direct attach cards are supported only in a non-OS/400 partition.

The #0645 has 2 SCSI buses, each SCSI bus can be either internal (internal port) or external (external port), but not both. Internal devices connect to the internal ports (1 or 2) and are driven at the Ultra320 SCSI bus data rate of 320MBs. The 2 external ports have VHDCI connectors and also are driven at the Ultra320 SCSI bus data rate of 320MBs. A #1850 VHDCI to P Converter Cable is available to connect to external devices with type P connectors.

- Attributes provided: Attachment capability of up to 2 internal SCSI devices and up to 2 external SCSI devices, maximum of 2 total.
- Attributes required: One available 3.3 volt PCI or PCI-X slot and #0140.





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0647

PCI-X Disk/Tape Ctrl No IOP

Provides a PCI-X Disk/Tape SCSI Controller with zero write cache and without RAID support. A maximum of six disk drives are supported on the #0647. Removable media devices (tape, optical libraries, CD-ROM, DVD-ROM, and DVD-RAM) are also supported on the #0647.

The #0647 has two U320 buses each with a bus data rate of up to 320MBs. Each SCSI bus can be either internal (using an internal port) or external (using an external port), but not both. There are four physical ports on the #0647, two internal and two external.

Internal devices connect to the internal ports (1 or 2). External devices connect to the external ports (1 or 2) and use an LVD (Low Voltage Differential) interface and VHDCI connectors. A #1850 VHDCI to P Converter Cable is available to connect to external devices with type P connectors.

#0647, #5736, #5766 and #5775 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools how the card is being used. #0647 indicates that the card is dedicated to an AIX 5L or Linux partition and an IOP is not being used.

- Attributes provided: Two U320 SCSI VHDCI ports which may be either internal or external but not both.
- Attributes required: One available 3.3 volt PCI or PCI-X slot

5712

PCI-X Tape Controller

The #5712 provides SCSI Ultra-320 PCI attachment capability for up to two external tape/CD/DVD devices.

The #5712 connector ports are 68-pin VHDCI. A #1850 VHDCI to P Converter Cable is available to connect external SCSI devices with P style connectors.

- Attributes provided: Support/connectivity of up to two external tape/CD/DVD devices
- Attributes required: One 3V PCI card slot (either long or short)



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5715

PCI-X Tape/DASD Controller

#5715 provides one SCSI port for external removable media devices, and one SCSI port for up to six internal disk units. RAID protection is not supported. If two external removable media devices need to be supported, a #5712 should be ordered.

- Attributes provided: Support for up to six disk units and one external tape/CD/DVD device
- Attributes required: One 3V PCI card slot (either long or short)

5736

PCI-X Disk/Tape Ctrl w/IOP

Provides a PCI-X Disk/Tape SCSI Controller with zero write cache and without RAID support. Disk mirroring support is supported through i5/OS. A maximum of six disk drives are supported on the #5736. Removable media devices (tape, optical libraries, CD-ROM, DVD-ROM, or DVD-RAM) are also supported on the #5736.

The #5736 has two U320 buses each with a bus data rate of up to 320MBs. Each SCSI bus can be either internal (using an internal port) or external (using an external port), but not both. There are four physical ports on the #5736, two internal and two external.

Internal devices connect to the internal ports (1 or 2). External devices connect to the external ports (1 or 2) and use an LVD (Low Voltage Differential) interface and VHDCI connectors. A #1850 VHDCI to P Converter Cable is available to connect to external devices with type P connectors.

#0647, #5736, #5766 and #5775 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration.

#5736 should be the choice over #5702/#5712 or #5705/#5715 controllers for systems running V5R3, or later.

- Attributes provided: Two U320 SCSI VHDCI ports which may be either internal or external but not both.
- Attributes required: One available 3.3 volt PCI or PCI-X slot

5775

PCI-X Disk/Tape Ctlr-No IOP

Provides a PCI-X Disk/Tape SCSI Controller with zero write cache and without RAID support. Disk mirroring is supported through i5/OS. A maximum of six disk drives are supported on the #5775. Removable media devices (tape, optical libraries, DVD-ROM, or DVD-RAM) are also supported on the #5775.

The #5775 has two U320 buses each with a bus data rate of up to 320MBs. Each SCSI bus can be either internal (using an internal port) or external (using an external port), but not both. There are four physical ports on the #5775, two internal and two external.

Internal devices connect to the internal ports (1 or 2). External devices connect to the external ports (1 or 2) and use an LVD (Low Voltage Differential) interface and VHDCI connectors. A #1850 VHDCI to P Converter Cable is available to connect to external devices with type P connectors.

#0647, #5736, #5766 and #5775 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration.

#5775 should be the choice over #0624/#0645 (#5702/#5712 IOP-less equivalent) or #5705/#5715 controllers for systems running V5R3, or later.

- Attributes provided: Two U320 SCSI VHDCI ports which may be either internal or external but not both.
- Attributes required: One available 3.3 volt PCI or PCI-X slot

