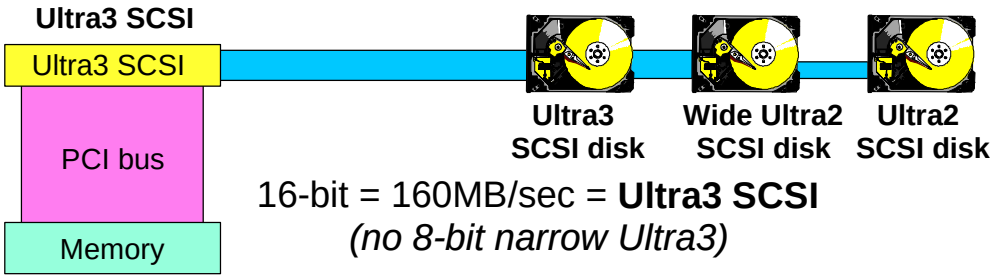
Ultra 160/m (Ultra3 SCSI)

- Emerging SCSI standard replacing Ultra2 SCSI
- Ultra 160/m is a subset of Ultra3
- Ultra 160/m: double-edge clocking, CRC, domain validation



16-bit = 160MB/sec = **Ultra3 SCSI**
(no 8-bit narrow Ultra3)

- Requires low-voltage differential (LVD) disks
  - Slower speed if use Ultra2 disks
- Ultra2 cabling, terminators, and connectors fully compatible

Ultra2 SCSI

In late 1998, the SCSI Trade Association (STA) ratified Ultra3 SCSI. Ultra 160/m is a subset of Ultra3 SCSI that was introduced in 1999 by major industry vendors. Ultra 160/m is not a STA recognized term. The "m" portion of the name stands for manageability due to the new Cyclical Redundancy Checking and domain validation features.

The Ultra3 specification describes five new features: double-edge clocking, Cyclical Redundancy Checking (CRC), domain validation, packetization, and Quick Arbitration and Select (QAS). Ultra3 calls for the use of any, or none, of the features listed in the specification. Double-edge clocking, CRC, and domain validation are necessary components of the Ultra 160/m specification. Packetization and QAS are not included in Ultra 160/m because these features would add cost but give little benefit to most installations.

Double-Edge Clocking (Double Transition (DT) clocking or Fast-80DT) - Before the development of the Ultra3 SCSI specification, data was transferred over the SCSI bus using a single edged clock. With a single edged clock, the maximum data transfer rate is half of the clock speed — thus, a 160MHz data clock would only support an 80MB/sec maximum transfer rate. With clocking performed at each edge of the clock signal (lead edge and trailing edge), two data pulses can be handled during each clock cycle, enabling data to be transferred at data clock speeds. A 160MHz signal supports a 160MB/sec data transfer rate.

Ultra2 SCSI (continued)

Cyclic-Redundancy Checking (CRC) - CRC is, by now, a time-honored method of verifying that transferred data is received correctly. CRC has been used in telecommunications for more than a decade. CRC has also been used to provide error-free data transmission over ethernet, FDDI and Fibre Channel. By applying CRC to the SCSI signal, the accuracy of data transfers has been made almost perfect. With data streaming at rates as high as 160MB/sec, such checking can be an important addition to the data transfer protocol. The rate of undetected random errors drops to approximately 2-32 when CRC is used. Without CRC, noise, signal flutter, and other phenomena can render data transfer at such high rates to be unreliable and, in the worst case, unusable.

Domain Validation - Domain validation tests the SCSI network before it completes negotiation for network bandwidth. If portions of the network are unable to operate at maximum speed, the network will reduce the data speeds for that portion of the network to levels that will provide error-free data transfer. In the event that the network develops a problem, the Ultra 160/m can automatically fall back to a lower data rate. Implementation of the drop back feature is an area where there may be differences among Ultra 160/m providers. In some cases, once the speed is dropped back to a lower speed, the SCSI bus will continue operating at the lower data rate. Regular polling of the SCSI domain may result in further drops, if the domain does not appear to be able to support higher rates. Other implementations, however, may enable the bus to return to higher transfer rates if polling indicates that the bus will support the faster rate.

Ultra2 SCSI (continued)

As with previous upgrades of SCSI standards, Ultra 160/m also has backward compatibility. Existing Ultra2 cabling, cable lengths, terminators, connectors, connector spacing, terminators, and back plane designs are fully compatible with Ultra 160/m.

Because Ultra 160/m SCSI supports LVD signaling, Ultra 160/m controllers can support Ultra2 SCSI devices in Ultra2 SCSI modes. Moreover, Ultra2 controllers can support Ultra 160/m SCSI devices in Ultra2 SCSI modes. This allows mixing Ultra 160/m SCSI and Ultra2 SCSI devices on the same bus. Either an Ultra 160/m SCSI or an Ultra2 SCSI host controller can support such a bus. When an Ultra 160/m SCSI controller operates such a bus, each attached device operates independently at the maximum allowed speed — Ultra SCSI devices at up to 80MB/sec and Ultra 160/m SCSI devices at up to 160MB/sec.

The SCSI protocol allows each device to separately determine the data transfer rate between itself and the adapter. For example, a SCSI-2 bus could have some devices running at 5MB/sec, some running Fast/Wide at 20MB/s, and some running at Wide Ultra SCSI at 40MB/sec all sharing the same bus. However, since Ultra2 and Ultra 160/m busses rely on Low Voltage Differential (LVD) type bus driver circuits to support longer cable lengths and faster data rates, if a device that is not capable of operating in LVD mode (i.e., SCSI-2 device with single-ended drivers) is connected to an Ultra2 or Ultra 160/m capable bus, then the entire bus reverts back to single-ended mode which will limit the cable length, number of devices, and maximum data rate for all devices to Ultra SCSI limits (40MB/sec for Ultra Wide devices). If only LVD devices are attached to a common bus, then the Ultra2 devices can run at up to 80MB/sec and the Ultra 160/m devices can run at up to 160MB/sec.