Compaq/Conner CP341 IDE/ATA Drive

1987   **Compaq/Conner CP341 IDE/ATA Drive**

Emergence of IDE/ATA as widely used interface.

Why it's important

The IDE/ATA (Integrated Drive Electronics/AT Attachment) interface, now known as PATA (Parallel ATA) and SATA (Serial ATA), became the dominant hard disk drive (HDD) interface for IBM compatible PCs, initially because of its low cost and simplicity of integration. Today it is supported by most operating systems and hardware platforms and is incorporated into several other peripheral devices in addition to HDDs. As an intelligent drive interface universally adopted on personal computers, IDE/ATA was an enabler of the acceleration of disk drive capacity that began in the early 1990s.

Discussion:

The IDE interface development was initially conceived by Bill Frank of Western Digital (WD) in the fall of 1984 as a means of combining the disk controller and disk drive electronics, while maintaining compatibility with the AT and XT controller attachments to a PC without changes to the BIOS or drivers. WD floated that idea by its largest customers, IBM, DEC, and Compaq in the winter and spring of 1985. Compaq showed interest, so Bill Frank collaborated with Ralph Perry and Ken Bush of Compaq to develop the initial specification.

WD formed a Tiger team in the spring of 1985 to build such a drive, using externally purchased 3.5" HDAs (Head Disk Assemblies), but initially just provided IDE to ST506 controller boards that Compaq hard-mounted to 10MB and 20MB 3.5" Miniscribe ST506 drives for their Portable II computer line, announced in February 1986 [3, 15, 20]. Compaq also worked with Control Data (CDC) to put the IDE interface into a 5-1/4" half-height 40MB Wren drive for the Compaq DeskPro 286 computers but it isn't clear how many actually shipped [1, 2, 21].

The IDE interface didn't really take off, however, until it was fully integrated into Conner Peripheral's CP34x line of 3.5" drives, with the CP341 announced in Compaq's Portable III computers in February 1987 and the Conner CP342 announced in June 1987 for other OEMs [6]. The CP342 was apparently then replaced by the CP344, which had the same specs and was the first IDE drive tracked by Jim Porter in Disk/Trend reports [19]. Compaq had invested heavily in Conner, in order to do a joint ASIC development for this integration and assure supply, resulting in Conner becoming the fastest growing startup in history, by exceeding $1Billion in revenue in just 3 years [8].

CDC was not interested in 3.5" drives at that time, since they were focused on the 5-1/4" SCSI high-performance market [2].

WD bought Tandon in 1988 and became one of the largest drive suppliers in the world, while shipping almost exclusively IDE/ATA/SATA drives [9]. Seagate acquired CDC's disk drive operations (Imprimis) in 1989, Conner in 1996, and Maxtor in 2006, and also became one of the largest suppliers in the world [10], with the bulk of the drives having the ATA/SATA interface.

IDE was specified by the Common Access Method (CAM) committee, an ad hoc industry group, as ATA in April 1989 and adopted by the American National Standards Institute (ANSI) i January 1993 [7]. It is currently supported by T13, a Technical Committee for the InterNational Committee on Information Technology Standards (INCITS)[14] and is in its eighth major version. Throughout its evolution, the ATA standard has maintained a high degree of compatibility with earlier versions, while providing higher performance, additional functions and / or additional device support.

The market demand for "enterprise-like" reliability in PC drives led to the development of SMART (Self-Monitoring. Analysis and Reporting Technology), a specification written by Fujitsu, Hewlett Packard, IBM, Maxtor, Quantum, Seagate, and Western Digital, with active participation of other companies. This was distributed as SFF-8055i and incorporated into ATA-3.

A significant enhancement made in ATA-4 was the incorporation of a SCSI-like packet interface know as ATAPI (ATA Packet Interface). ATAPI has been specified by the Small Form Factor (SFF) Committee to support devices other than HDDs, including CD and DVD devices.

Over the past 20 years, well over 80% of all HDDs shipped have used a version of the IDE/ATA interface. The level of intelligence in the HDDs has been significantly increased every year, with the addition of more sophisticated data encoding, ECC, defect management, zoned recording, serial interfaces, etc, yet all ATA drives still support the original IDE command set, assuring compatibility across generations.

All of the 3.5" PATA drives used the 40-pin connector that was originally conceived by Ralph Perry [1] but a 44-pin variant, incorporating the power pins, was introduced by Conner that became the forerunner of the 50-pin SFF-8212 connector specified by the SFF Committee for 2.5" ATA drives in 1995 [18]. The latest version of ATA is SATA 3.0, which is currently shipping in 2TB 3.5" drives and 1TB 2.5" drives, while transferring data at 6Gbp over a common 7-pin serial interface with SAS (Serial SCSI).

The major reasons that IDE/ATA has become the most successful disk drive interface are:

1. Ease of integration: the emulation of the WD1003 controller implementation in the PC/AT allowed booting without BIOS modifications, initially up to 528MB and subsequently to 137GB, although there were a number of other barriers to increased capacity that also had to be overcome along the way [16]
2. Low host cost and complexity: by separating the WD1003 functions from the host functions, the cost of the host adapter was reduced to the point were it could be integrated first on to the motherboard and then into the "southbridge."
3. Acceleration of technology advancement: Like SCSI and the other "intelligent" interfaces, this broke the "controller barrier" but IDE/ATA was the only one that also had the above two advantages, providing a significant reduction in time-to-market and enabling IDE/ATA to rapidly catch up to the high end areal density growth curve, where it became the disk capacity leader, with the lowest cost per GB.

Timeline:
- Fall 1984 – Bill Frank of WD develops the initial IDE concept and it is shown to IBM, DEC, and Compaq that winter and spring [1]
- May 1985 - Compaq Deskpro 286 announced, apparently containing a conventional AT controller and ST506 drive.
- July 1985 - WD IDE business plan includes a "40 pin, single cable connection for IBM PC compatible card" and states that WD "is negotiating a custom project with Compaq Computer. The product will be a 20 megabyte Integrated Drive possibly using either a Microscience or a Tandon head/disk controller." [5]
- February 1986 - Compaq Portable II announced, containing an IDE drive comprising a WD IDE controller mounted on a 3½-inch drive by from MiniScribe [3]
- September-October 1986 - Ken Hallam of WD presented a paper on IDE at Buscon East [4].
- Late 1986 - Compaq Deskpro 386 ships, containing an IDE drive comprising a WD controller and a 5¼-inch CDC drive. At this time, it is likely the same drive was incorporated into an enhancement to the Deskpro 286, originally shipped in May 1985.
- February 1987 - Compaq Portable III announced, containing the Conner 40MB 3.5" CP341 IDE drive
- June 1987 - Conner announces the CP342 IDE drive as an OEM product.[6]
- April 1989 - CAM Committee releases first draft of the ATA and EATA specifications.
- Late 1989 – Compaq announces SystemPro PC server, using IDE drives in a RAID configuration [3]
- August 1991 – Draft ATA-1 spec submitted to ASC X3T9.2 by CAM [7]
- January 1993 – ATA-1 spec approved and then published in 1994 as ANSI X3.221 [7]
- July 1995 - SFF 8212, rev 1.2, 50-pin ATA connector spec for 2-1/2" drives released by SFF Committee [18,19]
- 1996 - ATA-2 spec published as ANSI X3.279 - adds LBA, PIO, DMA, and increases transfer rate to 16MB/s [11]
- 1997 - ATA-3 spec published as X3.298 - adds SMART and Security [11]
- 1998 – ATA/ATAPI-4 spec published as INCITS 317 - adds ATAPI (packet interface) protocols, Ultra DMA, command overlap, and increases transfer rate to 33MB/s [11]

- July 1998 - SFF-8049, 80-conductor ATA cable assembly published to provide means for ATA to boost transfer rates beyond 100MBps.
- 2000 – ATA/ATAPI-5 spec published as INCITS 340 - changes a few commands and increases transfer rate to 66MBps [11]
- 2000 – Serial ATA Working Group formed, led by Intel to create the SATA 1.0 spec [13]
- October 2001 – ATA/ATAPI-6 spec completed by T13 as INCITS 1410, increasing transfer rate to 133MBps [11] February 2003 – SATA 1.0a is released with same connectors as SAS (Serial SCSI) [13]
- 2003 – SATA 1.0a products start to ship with 1.5Gbps transfer rate [13]
- April 2004 – SATA 2.0 spec announced with multiple cable options and 3.0Gbps transfer rate [13]
- Early 2005 – ATA/ATAPI-7 spec completed as INCITS 1532 adding new commands and incorporating SATA 1.0 (published May 2007) [11]
- May 2009– SATA 3.0 spec released with new command queuing and 6.0Gbps transfer rate [12]
- September 2009 - ANSI INCITS 452 **-** Information Technology - AT Attachment 8 - ATA/ATAPI Command Set (ATA8-ACS) published.

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Approved: Storage SIG Meeting, July 21, 2011