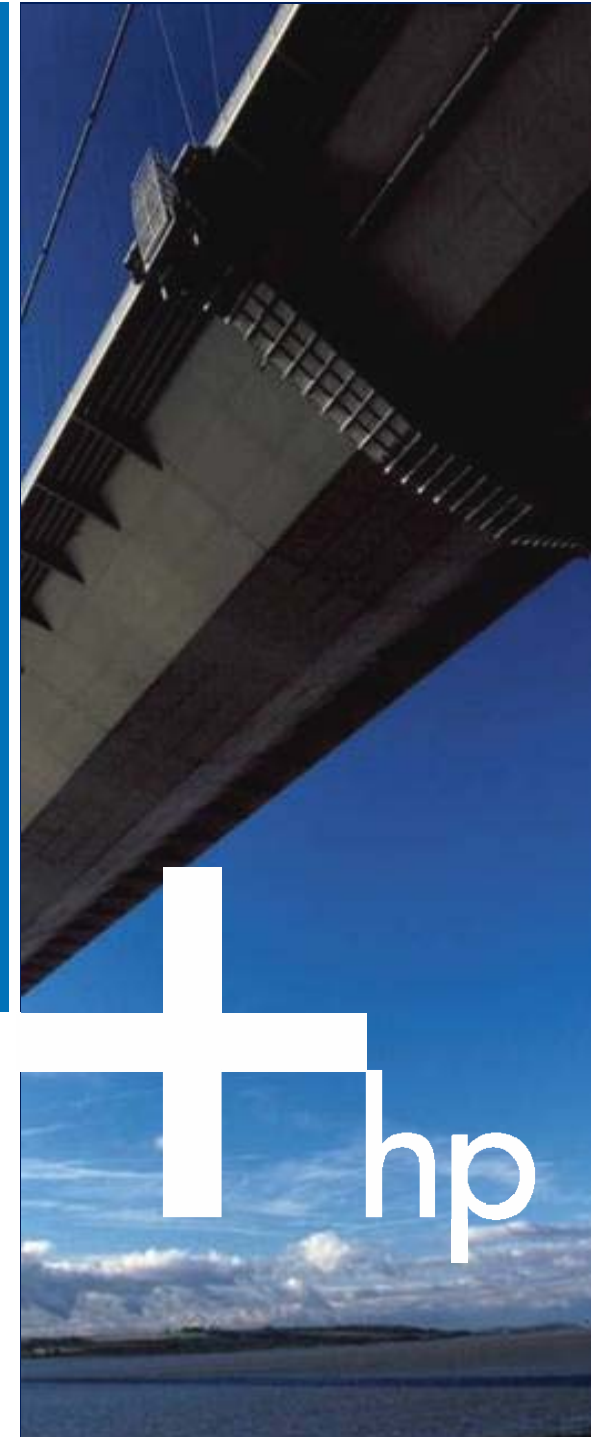




A Brief History of Communication

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China Postal Service 1500 - 1800

- 2000 Express Stations
- 30,526 horses
- 50,000 foot messengers

The Bandwidth of Change

- 1834 – Telegraph, Samuel Morse
- 1872 – Duplex Technology, Joseph Stearns
- 1874 – TDM (5 bit character) Jean Maurice Baudot
- 1876 – “Speaking Telegraph”, Bell
- 1877 – First telephone conversation between Boston and New York
- 1884 – Linotype Composing Machine ~1500 Char/hr



Bandwidth of Change - Continued

- 1904 – Printing Telegraph, Howard Krum
- 1910 – Morse Keyboard Transmitter, EE Kleinschmidt
- 1916 – Baudot printer, E. E. Kleinschmidt
- 1930 – Teletype purchased by Bell System – formed TWX
- 1953 – First Data Phone (modem) – 50bps
- 1962 – Data Phone sold publicly, 45-2400bps



Bandwidth of Change - Continued

- 1966 – Analog Wide-Band Data service, 50kbps
- 1972 – Digital Data Service (DDS)*, 56kbps
- 1983 – 300 Baud Modems Introduced
- 1986 – 1200 Baud Modem
- 1988 – 2400 Baud Modem
- 1992 – 28.8k Baud Modem
- 1995 – 56k Baud Modem
- 1990 – ISDN Modems use 64kbps lines
- 1997 – DSL/Cable Modems 256kbps
- 1999 – DSL 500kbps up-to 15Mbps

Bandwidth of Change - Continued

- 1984 – T1 tested -24 lines, 1.544Mbps
- 1984-1989 – Bell Systems divested
- 1993 – T1 to T4 available, T4 –4032 lines, 274Mbs
- 2001 – Dense Wavelength Division Multiplexing (DWDM)
 - 8 Strands of Fiber, x-mit 400Gbps/fiber
 - Totals 3.2tbps – 90,000 encyclopedia/sec
- 2004 – Crystal Hollow Fiber (NEC & Alcatel)
 - 10 trillion bps
 - 150 mil simultaneous phone calls
 - all 140 mil items in Library of Congress each second
 - 400k DVD movies per sec
 - each 1” cable will house between 800-1400 fiber strands



Bandwidth of Change – Continued

- Nano and Photon Technology (billionth)
 - Very low power
 - uses in materials (including clothes), communications, automotive, chemicals, printing, pharmaceuticals, medical/surgical, manufacturing, energy, technology, space exploration, national security
- Smart Dust
 - 1 cubic millimeter
 - Energy storage (similar to solar energy)
 - Light and Sound sensors
 - Communicate with each other
 - Environment, security, military, household



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