

DATABASE

COMPONENTS

PRECEDENTS

ECHOES

- 3500BC** The development of writing (ca. 3500 BC) and the use of documents were critical to organised and consistent administrative systems. Although the term 'bureaucracy' was not coined until the mid 18th century, a concept of bureaucracy can be traced to ancient Sumer, where an emergent class of scribes used clay tablets to administer the harvest and allocate its spoils. Ancient Egypt also had a hereditary class of scribes that administered the civil service bureaucracy .
- 499 AD** The first sine tables were created by the mathematician and astronomer Aryabhata in ancient India. These tables are a precursor to contemporary lookup tables that reduce computational load and data storage requirements (see 1979 below).
- 1613** The term 'computer' first used by the Christian author Richard Braithwaite to describe a person who did calculations.
- 1614** John Napier discovered logarithms and made everyday use of the decimal point in arithmetic and mathematics.
- 1753** Jeremiah Milles, Dean of Exeter, pioneered the research questionnaire.
- 1786** Line, area, and bar charts of economic data invented by William Playfair.
- 1780s** Major underpinnings of a commercial control structure through commercial banks.
- 1788** Watt's steam governor.
- 1800** interchangeable parts.
- 1800** United States (US) system of bankruptcy.
- 1800** British shipping capacity exceeded 1.5 million tons.
- 1801** The pie chart and circle graph, invented by William Playfair, to show part-whole relations.
- 1801** Jacquard loom programmable by punch cards.
- 1810** Regular packet service to England from the US.
- 1810** Steam power was first successfully applied to printing.
- 1818** The first known English-language use of the word 'bureaucracy'. Combines the French word bureau (desk or office) with the Greek word kratos (rule or political power).
- 1820** Desktop calculators commercially mass-produced in Europe.
- 1824** Laws of thermodynamics developed out of a desire to increase the efficiency of early steam engines.
- 1830** Samuel Morse linked Baltimore to Washington with the telegraph.
- 1830s** Ship-to-shore semaphore systems.
- 1830s** The first railways.
- 1830s** Specialized New York City workers called 'jobbers' adopt fixed prices, publish catalogues, and mail them to customers.
- 1832** Babbage wrote, "On the Economy of Machinery and Manufactures".
- 1833** The design for Charles Babbage's steam-powered Analytical Engine contains the essential components of a digital computer: punch-card input and programming, internal memory, a central processing unit, and output to be printed or set into type.
- 1837** The telegraph was demonstrated and patented.
- 1838** The questionnaire was invented by the Statistical Society of London.
- 1839** First electric press.
- 1839** Photographic daguerreotypes.
- 1840s** Packaging containers of fixed sizes and weights.
- 1840s** A succession of innovations in scheduling, multi-system coordination, and centralisation of bureaucracy.
- 1844** The Rochdale Pioneers instigated the cooperative movement. Cooperative principles bind democratic processes with workers rights. They predate the interventionist state and the working class right to vote.
- 1850s** Production line and staff structures produce the concept of a line manager.
- 1850s** Standardised sorting, grading, weighing, and inspection methods.
- 1850s** Railroads come to employ more accountants and auditors than the US federal or state government.
- 1852** Widespread use of postage stamps.
- 1850s-60s** Modern accounting techniques.
- 1850** A growing network of grain elevators, warehouses, and mounting demand for mass storage and shipment of grain make it difficult to keep track of individual shipments of grain and cotton.
- 1852** Gyroscope. French physicist Leon Foucault creates a self-regulating device.
- 1858** Transatlantic telegraph cable links America and Europe. Service terminates after two weeks.
- 1858** Pencil introduced with an eraser attached.
- 1860s** emergence of bureaucracy in its modern form, complete with departments controlled by a hierarchy of salaried managers with differentiation and specialisation of bureaucratic control structures.
- 1860s** Wholesalers organise the movement of goods and cash among hundreds of manufacturers and thousands of retailers.
- 1860s** US travelling salesmen.
- 1860s-70s** Professional managers.
- 1865** June 19th marked the end of slavery in the US.
- 1867** Automated rail signals.
- 1868** James Clerk Maxwell wrote "On Governors", the first theoretical analysis on control.
- 1870** The stock-ticker.
- 1873** James Clerk Maxwell theory of electromagnetic radiation brought in a new medium of electronic telecommunication.
- 1870s** Systematisation of office record keeping.
- 1870s to 1880s** Rapid bureaucratisation.
- 1876** Alexander Graham Bell patented the telephone.
- 1879** Cash register to order and control sales.
- 1879** Gottlob Frege's "Begriffsschrift" set out a formal system of logic.
- 1880** Modern offices contain paper business forms, file cabinets, directories and a telephone, use of international record carriers.
- 1880s** Standardized clothing sizes.
- 1880s** Elmer Sperry's early analogue computers.
- 1880s** The information required to run a large business involving billing, sales analysis, and inventory proliferates in scope and complexity.
- 1881** Automated cigarette rolling and match manufacture.
- 1882** Henry Crowell applies continuous-processing technology to oatmeal which produces twice the national consumption and creates a need to generate new markets.
- 1883** Food canning.
- 1883** Adoption of a uniform standard time.
- 1884** Press clipping service.
- 1884** Long-distance telephone service.
- 1884** Photographic film processing.
- 1885** Dictating machine demonstrated and patented.
- 1887** Comptometer – modern office calculating machine.
- 1889** Punch-card tabulating machine created by Herman Hollerith, who was inspired by train ticket systems.
- 1889** Typewriters come into everyday use in US offices.
- 1890s** Copywriting becomes a full-time specialty.
- 1890s** Hans Berliner's gramophone.
- 1890s** US capital investment in the office equipment industry rose by 194% compared to 64% for manufacturing.
- 1891** Prudential Life Insurance becomes the first commercial firm to use Hollerith equipment.
- 1892** Adding-subtracting machine with a printer mechanism created by William Burroughs.
- 1894** Card punch sorter could process fifteen thousand cards per hour to enact an automated data processing system.
- 1895** Cafeteria restaurant with a serving line opens in Chicago, inspiring self-serve supermarkets.
- 1899-1902** British army used wristwatches to synchronise troop movements in the Boer War, which developed an awareness of clock time.
- 1900** Automatic punch card sorter introduced commercially.
- 1903** World's first production line system.
- 1903** Wright brothers' first flight.
- 1905** Robert Whitehead develops a torpedo with a gyroscope to automatically control its direction.
- 1907** Transatlantic wireless communications.
- 1908** The Pittsburgh Survey. G. Stanley Hall used eight hundred workers to administer sixteen different questionnaires to around eighty thousand school children.
- 1910** The Photostat, a machine that creates photographic copies of documents on sensitised paper introduced by Eastman Kodak.
- 1910** Automatic bread plant opens in Chicago. Humans do not touch dough and loaves except when placed on a wrapping machine.
- 1910s** Bureaucracies begin to realise that the same hardware that processes numerical data might process information more generally.
- 1911** Frederick Winslow Taylor publishes "The Principles of Scientific Management".
- 1914** The Audit Bureau use questionnaire surveys of magazine readership.
- 1916** Clarence Saunders opens the Piggly Wiggly grocery. A self-service store with aisles, turnstile, and checkout requires customers to pass by all displayed goods. Patented "means of processing customers" where control was in the floor layout.
- 1920s** Statistical quality control
- 1920s** Henry Laurence Gantt developed Gantt charts as a visual tool to show a projects' scheduled and actual progress.
- 1920s** Electric printing calculators marketed.
- 1921** Percival White develops the concept of 'measurable markets'.
- 1922** George Radford's "The control of quality in manufacturing" solidified the idea that goods only had to be "good enough".
- 1924-1932** The Hawthorne effect. Experiments involving some twenty thousand indicated that the productivity of a workgroup increases as a direct result of any concern shown by outsiders in the group's activities.
- 1928** Attitudinal and opinion surveys.
- 1920s** Multiple-register accumulating calculators linked as difference engines to produce data tables.
- 1928** 80 column punch card adopted by IBM.
- 1930** Colorscope. A photoelectric cell reacts to colours more precisely than the human eye and produces electric currents capable of controlling machinery.
- 1931** Automated doors for commercial organisations.
- 1935** Electric typewriter introduced.
- 1936** Alan Turing describes a mathematical model of a general-purpose computer.
- 1938** A Symbolic Analysis of Relay and Switching Circuits is the title of a master's thesis written by computer science Claude E. Shannon. His thesis underlined that information could be treated like any other quantity and manipulated by a machine, which profoundly affected the first generation of computer pioneers.
- 1941** The world's first general-purpose, program-controlled calculator in regular operation created by Konrad Zuse.
- 1941** ENIAC (Electronic Numerical Integrator and Computer), the first programmable general-purpose electronic digital computer.
- 1951** The LEO I (Lyons electronic office I) was the first computer used for commercial business applications, created by J. Lyons and Co., a catering and food manufacturing company.
- 1958** The term 'folder' was introduced to computing and used in a hierarchical file system design for the Electronic Recording Machine, Accounting (ERMA) Mark 1.
- 1959** 6-digit postal code nationally adopted in the UK.
- 1960s** Emergence of computerised databases. In this decade, two popular data models included a network model called CODASYL and IMS, which was a hierarchical model.
- 1960** IBM developed the SABRE databases system to help American Airlines manage its reservations data.
- 1960** Charles Bachman developed a database system for General Electric.
- 1968** David Childs definition of the relational database.
- 1969** The first version of the UNIX operating system created by Kenneth Thompson and Dennis Ritchie, who were system engineers at AT&T's Bell Labs. Progressed ideas of time-sharing to share computing resources among many users (processes) through multiprogramming and multitasking dramatically lowered the cost of providing computing capability.
- 1970s** Relational Database Management System (RDBMS) became a recognised term.
- 1970** Codd proposed a relational database model which changed the way people thought about databases. His model disconnected the logical organisation of a database from physical information storage and became the standard principle for database systems.
- 1972** Karen Sparck Jones established the basis for Search Engines. She combined statistics with linguistics to establish formulas that embodied principles for how computers could interpret relationships between words.
- 1974-1977** Two major relational database system prototypes were created. 'Ingres' used a query language known as QUEL and led to the creation of Ingres Corp., MS SQL Server, Sybase, Wang's PACE, and Britton-Lee. 'System R' used the SEQUEL query language and contributed to emergent SQL, DB2, Ailbase, Oracle, and Non-Stop SQL database systems.
- 1974** IBM System R database system built as a research project at IBM's San Jose Research Laboratory in 1974. System R was the first implementation of Structured Query Language (SQL).
- 1976** Robert Metcalfe and Robert Boggs experiment with ethernet packet switching on one kilometre of coaxial cable with 100 nodes.
- 1976** P. Chen proposed a database model called Entity-Relationship, which helped database designers focus on data applications instead of logical table structure.
- 1977** Unix first made commercially available by Interactive Systems Corporation.
- 1978** The Spreadsheet, Harvard Business School student, Daniel Bricklin, came up with an interactive visible calculator. Subsequently, Bricklin and Bob Frankston co-created VisiCalc, the first "killer application" for personal computers.
- 1979** VisiCalc introduced a LOOKUP function among its original 20 functions. Lookup tables were one of the earliest functionalities implemented in computer spreadsheets and are comparable to contemporary database functionality.
- 1980s** SQL became the standard query language.
- 1980s** Relational database systems became a commercial success as the rapid increase in computer sales boosted the database market. The IBM Personal Computer helped develop database systems and products such as PARADOX, RBASE 5000, RIM, Dbase III and IV, OS/2 Database Manager, and Watcom SQL DB2 became the flagship database product for IBM.
- 1980s** The Galaksija computer . A craze in 1980s Yugoslavia inspired thousands of people to build computers in their own homes. The idea was to make technology available to everyone.
- 1985** ARM1 computer processor containing 25 thousand transistors.
- Early 1990s** New client tools for database applications include Oracle Developer, PowerBuilder, and VB. Tools for personal productivity also emerged such as ODBC, Excel, and Access.
- Mid 1990s** The advent of the Internet led to the exponential growth of the database industry. Average desktop users began to use client-server database systems.
- Late 1990s** Increased investment in online businesses resulted in a rise in demand for Internet database connectors, such as FrontPage, Active Server Pages, Java Servlets, Dream Weaver, ColdFusion, Enterprise Java Beans, and Oracle Developer 2000.
- Late 1998** The acronym NoSQL was first used in 1998 by Carlo Strozzi to describe an open-source relational database that did not use SQL.
- 2007** 10gen software company began developing the NoSQL database system MongoDB.
- 2000s** NoSQL databases are increasingly used in big data and real-time web applications. Prominent systems include MongoDB, ElasticSearch, DynamoDB (built by Amazon), HBase, and Cassandra (built by Facebook).
- 2016** The Bank Of England's Real-Time Gross Settlement (RTGS) service is the infrastructure that holds accounts for banks, building societies and other institutions. RTGS handles transactions worth around 500 billion pounds a day.

Figure 17. Fold-out: Database components, precedents, echoes.