Database History: From Dinosaurs to Compact Discs

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In only 20 years, the database/online industry has become a large and thriving segment of the information industry. This article summarizes the growth of databases, major milestones, issues, and trends of those 20 years.

Without doubt the most important phenomenon in the past 20 years of the information industry has been the emergence and popularity of machine-readable databases, particularly online databases. In fact, databases can almost be said to have created the information industry as we now know it.

Thus to write a historical summary of the database phenomenon is potentially a gargantuan task! For example, Hawkins's definitive bibliography of online retrieval includes 3,337 references [1]. (Hawkins has also analyzed this literature [2].) We can cite here only a tiny percentage of these sources, and can make only the briefest mention of the many complex and interrelated events in the database industry of the past 20 years.

Overview and Chronology

The Early Years to 1970

Unlike the case of Adam and Eve, there seems to be no documentation in the literature of the very first databases. Since any computer-readable file can be rightly called a "database," the first databases must have been those decks of punched cards used by computers in the 1950's, such as the numeric databases created in 1951 by the U.S. Bureau of the Census [3]. However, a major thrust of the information industry has been the "word-oriented"—and, particularly, bibliographic—databases, and these originated in the mid 1960's, as abstracting and indexing (A&I) services began to convert to computer-driven photocomposition and, as a result, began to keyboard citations, abstracts, and subject terms onto magnetic tape. The National Library of Medicine (NLM) began designing its MEDLARS system in 1960; by 1964, the Library was running on-demand batch searches on the MEDLARS database. (While MEDLARS is an acronym for Medical Literature Analysis and Retrieval System, a "medlar" is also a fruit that in earlier times was used in medicine [4].) Similarly, Chemical Abstracts Service (CAS) established a pioneering research and development department in 1955, and by 1965 issued *Chemical and Biological Activities* (*CBAC*) simultaneously in printed form and on magnetic tape for computer searching. The year 1965 also marked the beginning of the CAS Chemical Registry System database, jointly funded by the National Science Foundation, the National Institutes of Health, and the Department of Defense [5].

Other A&I services were quick to follow the lead of NLM and CAS: Engineering Index (now Engineering Information) had a magnetic tape distribution service in 1967, and BioSciences Information Service (BIOSIS) had one in 1969. Also in 1969 the Library of Congress MARC (MAchine Readable Catalog) tapes for books became available on subscription.

Sources disagree somewhat as to how many databases were available in these early years. One study cites a number of sources for a range of 12–20 databases in 1965 to 50–60 "pre-1970" [6]. Gechman also refers to various sources to suggest that the range for that time period might have been from 25 in 1968 to 50–100 in 1970 [7]. The discrepancies seem to stem from definitions: counts were probably taken differently depending on whether nonbibliographic databases or databases used only in house (and not leased or sold) were included.

During the 1965–1970 period, state-of-the-art computer technology for accessing these databases was batch searching, an expensive and unsatisfactory process, as there was no way to experiment with search strategies. Concurrently, a number of federally funded projects were investigating the feasibility of online interactive searching

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of databases. The online approach promised faster results as well as a method to test a search strategy and refine it before printing out results. Bourne dates the first public demonstration of online bibliographic searching to 1960 (SDC's Protosynthex, using a full-text approach) and the first "production search service" to 1967 (Lockheed's DIALOG, serving NASA Headquarters) [8].

Meanwhile, full-text databases were making their appearance. According to Beard, legal full-text systems date back to the early 1960's with the so-called "Pittsburgh System" [9]. In 1967, Data Corporation received a contract to test a proposed system for the Ohio Bar Automated Research (OBAR) full-text retrieval system. Data Corporation became Mead Data Central (MDC) in 1970, and the outcome of the project was the MDC LEXIS system, which became operational for the legal community in 1973. Numeric databases were also growing in number. Data Resources Inc. (DRI) began its career as a numeric database vendor in 1969 with about 3,000 time series, "data values associated with a defined phenomenon observed at equally spaced times" [10].

1970 to 1975

Between 1967 and 1971, online systems functioned to serve limited constituencies: NASA laboratories, U.S. Air Force bases, selected New York State medical libraries (conducting searches of the MEDLARS database through modified IBM software). 1971–1972 was the period, as Bourne put it, when online services began to "extend access" [8]. Lockheed began to offer its DIALOG service to interested database producers, and by 1974 offered 18 databases to the public [11]. In 1971, NLM's own online system MEDLINE (MEDLARS-On-Line) went into operation.

In general, the years 1970–1975 were marked by the growing dominance of online over batch searching, and by a greater number and variety of organizations deciding to produce databases. In 1971, Carlos Cuadra wrote of online, "It's pretty hard to keep an information user down on the farm after he's gotten this kind of service. From the standpoint of turnaround speed, on-line systems have no competition" [12]. Throughout the 1960's, the U.S. government had led the conversion of bibliographic files to machine-readable formats, followed closely by some of the scientific societies that publish A&I services (American Petroleum Institute, American Society for Metals, CAS) and a few for-profit companies (Institute for Scientific Information, Derwent) [13]. The transition to online searching was also led by the government organizations, as discussed above. The U.S. government became involved as well with scientific numeric databases, such as the Chemical Information System (CIS) developed by the National Institutes of Health and operated by the Environmental Protection Agency (EPA) starting in 1973 (now operated by Fein-Marquart, Associates).

During the first half of the 1970's, nearly all the major A&I services began to computerize their operations with a view to cutting production costs and time lags for print products as much as to provide online access. Wilde cites studies showing that Engineering Index (Ei) cut their time lag for the print index from 419 days in 1971 to 141 days in 1973 when the company switched to a computerized system [14]. During this period, for-profit companies began cautiously to enter the A&I market (e.g., Data Courier, Congressional Information Service, Predicasts) and began to produce databases as well as print products. These databases, byproducts of the computerized photocomposition of the print product, were leased, sold, and/or offered online through DIALOG or SDC's ORBIT search services. In-house services on request began to die out: NLM discontinued its service in 1973.

Beginning with its first issue in 1974, the *Bulletin of the American Society for Information Science* carried a regularly appearing column on "Data Bases," prepared initially by W. T. Brandhorst alternating with Martha Williams and later by Williams alone.

1975 to 1980

By the mid 1970's, the information industry began to recognize the "online revolution," in Europe as well as in the U.S. [15]. Word-oriented databases (online and otherwise) had grown to about 300 in number and were listed in the first large database directories to be published [16,17]. Numeric databases had also grown, in similar degree [18]. Increasingly, commercial companies began to produce databases, and by 1975 a committee had been formed by the Information Industry Association (IIA) to investigate the status of databases under existing proprietary-rights laws and related legal market issues [19]. In 1975, in fact, the first major lawsuit between a database processor and a database producer was pressed; as Martha Williams observed dryly, "Never before [had] the financial considerations involved been great enough to make such a lawsuit worth the effort" [20]. In 1976, *Library Journal* published an introduction-to-online article, which stated that "online searching has become one of the fastest growing services in academic and research libraries" [21]. The American Society for Information Science (ASIS), having earlier recognized the importance of online by founding a special interest group (SIG) on user online interaction in 1971, added a SIG for numeric databases in 1975 and in the same year changed the name of its SIG on Selective Dissemination of Information (SIG/SDI) to Computerized Retrieval Services (SIG/CRS). In 1977, *Online* and *Online Review* made their appearance as the first journals of the field (*Database* followed in 1978), and the first International Online Information Meeting was held in London. The first U.S. online meeting occurred two years later, with Online '79 in Atlanta. (Interestingly, the three continuing online conferences and the three major online journals have all

been sponsored by private, commercial organizations rather than by professional associations.) And finally, in a small but significant step, the *Annual Review of Information Science and Technology* (*ARIST*) standardized the spelling of *online* to one word in 1976 and *database* to one word in 1979 (a standard that is still not always recognized in 1985).

1980 to the Present

The early 1980's saw a near explosion in the database and online industry as scores of commercial firms sought to capture a piece of the growing market that had previously been heavily dominated by nonprofit and government database producers. (This explosion was heralded by a 1980 article in *Fortune*, which must have served as the official "seal of approval" for the new market [22].) The National Federation of Abstracting and Indexing Services (now the National Federation of Abstracting and Information Services) recognized these new "players" in the bibliographic database arena by granting for-profit companies associate membership in the Federation in 1981 and full membership in 1983.

Databases continued to grow, doubling in number from 300 in 1975 to 600 in 1980, and then more than quadrupling between 1980 and 1984 to over 2400 [23,24]. (The last figure includes numeric and full-text databases, produced worldwide.) Full-text databases, formerly a very small number, began also to increase sharply, beginning with MDC's NEXIS in 1980. By this time, newspapers had also converted to computer-driven photocomposition, and full-text newspaper databases also started to appear.

Throughout the 1980's, more vendors as well as database producers have entered the marketplace. Some organizations began to provide search services for their own databases: CAS introduced CAS ONLINE in 1980, which is still the only online source for CAS's abstracts, although the bibliographic information in the file has been widely available through other vendors since the 1970's.

"Official recognition" of online and databases has continued strongly into the current decade. In 1980, the *Journal of the American Society for Information Science* published the first issue of this "Perspectives" series—on "On-line Systems in Science and Technology" [25], and the first National Online Information Meeting was held in New York City. Datapro Corporation, which had published guides to the computer industry since 1970, published a *Datapro Directory of On-Line Services* in 1980 and *Complete Guide to Dial-Up Databases* in 1984. Marquis Who's Who also climbed aboard the bandwagon in 1984 with a *Directory of Online Professionals*. *Fortune* and *Business Week* continue to cover the "online" industry [26,27], and *Science* recently published a lengthy introductory article about electronic databases, geared to scientific researchers [10].

This, then, is a quick chronology of the online and database industry over the mere 20 years of its existence. Let us now briefly dip below the surface and highlight some of the major trends and issues of those few years.

Trends and Issues

The Early Years to 1970

Two factors providing impetus for the development of databases were the enormous growth in post-World-War-II and—especially—post-Sputnik (1957) scientific research, and the development of computer processing technologies. With so much more scientific information available, the old manual ways of indexing and retrieval became too slow and inefficient. The U.S. federal government funded much of the early database research and development: The NLM system has already been described; two other large-scale long-standing search systems, Lockheed's DIALOG and SDC's ORBIT, were developed under contracts with NASA and the Department of Defense, respectively.

These government-produced, government-used, and government-subsidized databases and systems were largely *mission* oriented, e.g., "put a man on the moon." Nonprofit organizations (such as API and CAS), experimenting with computers, at this time produced *discipline*-oriented databases, reflecting the traditional disciplines of science and technology. As yet, with the major exception of the ERIC education database, there was little funding or interest in producing databases in areas unrelated to science or technology.

Before the 1970's, database searching was done in batch mode, the only way to access information on magnetic tape. Queries were accumulated, and then a number of search strategies were run simultaneously against the database. (It would have been far too expensive to run only one query/search strategy at a time!) This mode of searching, plus the availability of only recent material in computer-readable form, combined to produce selective dissemination of information (SDI): "The routine bombardment of each worker with an appropriate amount of information about what is going on in his specialty" [28]. Concocting search strategies was part esoteric art and part guesswork as, once initiated, the SDI searches could not be modified interactively as is done now online.

An early online search capability within a network was available during this period with the Neurological Information Network (NIN). Using TTYs, participants could search member databases. Funded by the National Institute of Neurological and Communicative Disorders and Stroke (NIH), NIN included four information-analysis centers located in university medical centers.

1970 to 1975

The transition from batch to online searching around 1970 was again made possible by computer technology,

that of disc storage systems. Material on disc can be "random accessed" (as can individual songs on a phonograph record); no longer need an entire tape be read to locate information. On disc, it became possible to create elaborate inverted file indexing, so that now every word in a title, abstract, and index-term string could be searched. This is free text searching as we now know it, and it made searching full-text databases possible. Simultaneously, computer storage and computer time became less expensive. With online searching, one query at a time could be searched, and the strategy modified interactively. Retrospective as well as SDI searches became feasible, especially since nearly five years of material was now available in computer-readable form.

As more nongovernment organizations began to produce databases, special libraries and a few academic libraries joined the government agencies as database users. Social science databases began to appear. A new profession was born: the online searcher, or "intermediary." As yet, there was little in the way of user education; however, what little there was was conducted by the online search services. There was also little marketing of databases, as most database producers were either government organizations with subsidized operations and products, or nonprofit abstracting and indexing services that derived their revenues from subscriptions to print index and abstract journals and at the time regarded their products as services to their members. Pricing of databases, an issue of the 1980's, was originally determined largely by the search services or vendors.

Before 1970, the focus was on testing the feasibility of computerized batch and online searching, and in getting the systems to work at all. Later, issues in the field concerned quality control, overlap among databases, and especially search and retrieval techniques and measurement of search relevance, recall, and precision.

1975 to 1980

Diversification was the most important trend for databases during 1975-1980. The early success of the government-funded online experiments and the acceptance of databases and online in the information community established the legitimacy of the medium. Now more nonprofit and, especially, commercial organizations undertook to produce databases.

No longer were most databases scientific/technical in content, but many were covering the social sciences, humanities, and general interest or popular topics. Some of the new commercial database producers developed whole product lines of business databases, covering marketing, finance, economics, and industrial directory information, plus industry-specific topics such as computers, real estate, insurance, and publishing. Types of databases other than bibliographic began to be noted. Numeric databases were increasing in number, particularly in business areas. Directory and referral databases appeared, an early example being the Smithsonian Science Information Exchange (SSIE) database of information on government-sponsored research. Full-text databases also increased in number.

The user community expanded to include more academic libraries and a few large public libraries. Together with the expansion and diversification of users came an increase in user education programs. Joining the new job category of "intermediary" came the still-newer category "online trainer." Formerly, most user education programs were conducted by the online search services. Now, however, the database producer began to develop their own training materials and their own training staff. There was even some discussion and research efforts towards training the "end user" to search online.

Meanwhile, research and development at the database producer organizations had not stood still. By 1980, most had adopted online text processing techniques in database production. Whereas, earlier, indexers and abstractors wrote their contributions on a form of some kind which would be keyed by another department for entry into the database, the indexers and abstractors now sat at terminals and typed their output directly into the database. Frequently, spelling checks and indexing term verifications were built into the system, providing immediate editing and correction.

By the beginning of the 1980's, marketing surfaced as an issue of prime importance to database producers. Databases were no longer regarded as merely spinoffs of printed publications, but as products in their own right, to be priced and marketed separately and, perhaps, differently. The entry of commercial database producers into the marketplace intensified competition amongst *all* database producers, and many nonprofit organizations established marketing departments and instituted marketing plans for their online products. Distribution links were established to Europe and Australia in the mid 1970's. By the 1980's, marketing plans included Japan, the People's Republic of China, and Southeast Asia, as database producers saw up to 50% of their sales coming from outside the U.S.

The first whisperings about "print-online migration" also fueled increased marketing efforts, as well as intense concern over database and online pricing [29]. Trend data in the late 1970's, as well as some research findings, indicated that the popularity (and pay-as-you-go characteristic) of online might be leading subscribers of print A&I products to cancel their subscriptions in favor of using the online equivalent alone. At a time when many database producers derived most of their income from the print subscriptions, the threat of this "migration" cast a shadow over the otherwise bright and growing future of the online industry [30,31].

1980 to the Present

The last five years have seen continued strong growth of the online and database industries (although the *rate*

of growth seems to be slowing [32]), with increased crowding and competition as many more commercial organizations have entered the marketplace. The customer base, or "the users," have suddenly become more visible and more important, as more organizations are courting old and new customers.

Public libraries are increasingly joining special and academic libraries as purveyors of online services. However, the buzzword of the 1980's is "end user." The explosion of the home-computer market in the early 1980's has resulted in a rapidly expanding population of millions who are comfortable at a computer terminal, and in the last five years a number of databases and online services have sprung up to cater to this new market. The Source and CompuServe online services each offer a supermarketlike variety of databases for the general public, e.g.: Career Network, Dial-A-Date, Airline Itineraries, Cineman Movie Reviews (The Source), Electronic Gourmet, Fifth Avenue Shopper, Hollywood Hotline, Music Information Service (CompuServe).

Not to be outdone, two "old guard" online service organizations, DIALOG and BRS, initiated satellite search services with simpler query languages for end users using personal computers. DIALOG's Knowledge Index and BRS After Dark are both designed for evening use by the general public and make available to them the most popular databases, e.g., ERIC, MEDLINE, PsycINFO, Mathfile.

Another new class of online products designed for the end-user market include those called variously front ends, intermediary systems, and gateways. All are user-friendly "transparency" aids [33], which make online systems and databases easier to use, and make differences between them *transparent* (or invisible) to the user. An example of such a service is EasyNet from Telebase Systems, Inc., which offers 800-number access and credit card payment, and "prompts" the user to select the appropriate database and search strategy by the use of menu screens. While standards for the industry have been hotly debated since the early 1970's, none have ever been implemented for database formats or online command languages. Thus one of the functions of these products (described by Martha Williams in one of the accompanying papers) has been to compensate for the lack of standards.

Together with many more companies producing databases in the 1980's, many more databases are being produced—bibliographic, numeric, and full text—and now on every conceivable topic. The Horse database contains numeric data on pedigrees, breeding records, and race records of North American thoroughbreds; Hollywood Hotline covers news of the entertainment industry obtained from press releases, publicists, and (rather intriguingly) "personal contacts." Many are spinoffs of larger files. Among the newer abstract and indexing databases, some have no print equivalent. This would seem to support Lancaster's prediction [34] of an eventual completely electronic information environment. Yet Engineering Information, after beginning Ei Engineering Meetings in 1982 as a database only, added a print version (*Engineering Conference Index*) in 1985.

Earlier predictions of the demise of indexing have been no more reliable than predictions of the demise of print. As full-text databases increased in number, it was thought that (1) full text would eventually supplant files of surrogates only (i.e., abstracts and index terms), and (2) free searching on the full text itself was sufficient—that index terms were not needed for adequate retrieval. However, some recent full-text databases, like Information Access Company's Magazine ASAP, include controlled index terms. As Duckett puts it [35], "The capacity for retrieval of categories is not necessarily just a quirk of tidy-minded information scientists." In other words, indexing serves real user needs and cannot easily be dispensed with.

General industry issues in the last five years have all emerged from the increased crowding of the market and the intense competition for customers. Migration has continued as an issue into the 1980's, and the fear of dropped subscriptions to print products has pushed A&I database producers to establish higher and more realistic pricing algorithms for databases. Whether or not migration is occurring or will occur (sources vary), databases are now paying their own way.

A second specter crowding on the heels of migration foretold decreased revenues from downloading. It was feared that users, seeking to cut high online costs, and having powerful PC software on hand, would transfer large portions of databases, or "download" them, onto personal computer files, thereby to search subsequently free of charge on their own systems. Here again, the industry has turned a threat to an advantage: those database producers, who felt potentially subject to such piracy, instituted downloading policies whereby users could pay fees for downloading certain quantities of records. Now, in 1985, downloading is not a prime issue.

The public-private interface, however, still generates more heat than light. At issue is the fear of the private sector that lower prices of the government-subsidized databases will undercut the customer base of the private-sector files. MEDLINE in particular has been challenged by other biomedical database producers. However, as all databases producers and vendors benefitted from the investments which the government made in early database and online research, and as freedom of public access to information is a concern, particularly for the library community, the issue is more complex than it seems and will not be easily settled.

Vertical integration, which refers to companies attempting to control all parts of the online "chain" (from primary publishing, through print and database products, to online services) has been one facet of an intense cooperative activity in the industry. This too seems to stem from sudden crowding of the marketplace, and from competition. Vertical integration can be accomplished through new product/service development (with

producers becoming online search services, or vice versa), mergers, acquisitions, and joint ventures. By the early 1970's, for example, Systems Development Corporation merged with Burroughs Corporation, Ziff Davis acquired Information Access Company and Management Contents, and BRS and Predicasts joined forces with Radio Suisse to produce DATA-STAR, a search service operating out of Switzerland [36]. This cooperation has also resulted in a number of coproduced database products (for example, ABC-Clio and Data Courier are collaborating on the publication of books generated from the ABI/INFORM database), and fewer exclusive contracts between database producers and online services.

Cooperation has also extended to government-operated systems. In 1982, several federally funded projects explored the possibility of a Combined Health Information Database (CHID). Initially, three projects joined forces to combine their databases to make them publicly accessible through a national vendor (BRS). Reasons were cost economies and easier user access. While each project maintains its own subfile on CHID, a user can search one or more subfiles or across all files. The initial three online participants were the Arthritis Information Clearinghouse, the National Diabetes Information Clearinghouse, and the Center for Health Promotion and Education, Centers for Disease Control [37].

The Future

On the basis of merely 20 years, can we make any predictions about the future of databases and online? As the saying goes, "Forecasting is difficult, especially about the future." Just the same, there is no dearth of predictions.

Most seem to assume that someday nearly everyone will use terminals, that nearly all information (numeric, full text, etc.) will be online, and that databases will go a long way towards supplanting and perhaps replacing print information sources—in other words, that observed trends will continue along the same lines. In the *short term*, these predictions probably make sense:

1. Information systems are evolving slowly in the direction of more electronic distribution (and possibly less paper) [34].
2. More end users will be searching online [38] (see Ojala's article, also in this issue), and online will be used by those in lesser developed countries. (According to the Fall 1984 issue of the Cuadra Associates *Directory of Online Databases*, Tymnet now goes to most of Africa as well as to Europe, South America, and the Far East.)
3. Source databases (full text and numeric) will increase [38], solving some acute document delivery problems, but not necessarily eliminating dependence on abstracting and indexing [35]. (MDC, formerly an exclusively full-text database producer and vendor, added bibliographic files to its full-text offerings in 1985.)
4. Software and systems will be developed to permit more fact or "knowledge retrieval" [39] (see Doszkocs's article, following).
5. More "transparency aids" and user-friendly systems will be developed [39].
6. Primary and secondary publication (full text/abstracts) will be integrated electronically throughout creation (by authors), production, and distribution, possibly as "hybrid files" [39,40].
7. Databases will be distributed in forms other than magnetic tape: via floppy disc, videodisc, CD-ROM, and compact disc technologies.

However, in the long term, we really do not know if these trends will continue indefinitely. The new technologies, in particular, are bound to have unforeseen applications—and drawbacks. Librarians will remember the "microfilm revolution" in the 1960's, when a "cuddly" fiche reader was supposed to soon occupy every lap in the library. Microfilm has found a place in information retrieval, but early predictions about the public's adoption of the medium have not been fulfilled. Stobaugh, Weisgerber, and Wigington [41] put it well:

> All of these economic pressures and technological opportunities will, however, be modified by the psychology and sociology of information users. Some people do not respond well to technological aids, keyboards, for example, or even dictation units. Some will not work with microfilm stores. How many will browse and otherwise depend solely on the transient images painted on electronic devices? (p. 64)

In other words, the users will ultimately shape the future of online, as no industry can exist without a market. Russell Rowlett's analogy likens the future of information services to Darwin's principle of natural selection:

> *User selection* will determine those species [of information systems] which best suit each environment and can adapt to that environment as it also changes" [42, p. 69, italics added].

Appendix

Databases: A Time Line Overview

1951	Computer manipulation of numeric census data
	Investigation of the online bibliographic searching at MIT [8]
1960	National Library of Medicine begins design of MEDLARS
	First demonstration of online bibliographic searching
1961	The "Pittsburgh System" full-text law database made available
1964	MEDLARS operational for batch searching
1965	Chemical Abstracts Service's CBAC database available for batch searching
	12-20 databases available

1967 Engineering Index begins two magnetic tape services

1969 Data Resources, Inc. founded
Library of Congress MARC database (books) available
BioSciences Information Service begins magnetic tape service
Neurological Information Network initiates online searches

1970 50–100 databases available

1971 MEDLINE operational
Ohio College Library Center (OCLC) shared cataloging system operational, with 54 libraries participating

1972 DIALOG begins commercial operation with three databases
First *Annual Review of Information Science and Technology* (*ARIST*) chapter on machine-readable databases

1973 National Institutes of Health and the Environmental Protection Agency cooperate to found the Chemical Information System
SDC's ORBIT begins commercial operation with three databases
Engineering Index implements a computerized production system.
National Library of Medicine discontinues in-house batch searching on request

1974 Lockheed conducts project DIALIB (1974–1977)
New York Times Information Bank available online.
Bulletin of the American Society for Information Science introduces column on "Data Bases"

1975 300 databases available

1976 U.S. and European databases directories published
"Online" becomes one word in *ARIST*
First online user groups are founded

1977 First International Online Information Meeting
Online and *Online Review* founded
Bibliographic Retrieval Services (BRS) founded
Historical Abstracts (ABC-Clio) offered online

1979 "Database" becomes one word in *ARIST*
First U.S. online conference: Online '79

1980 *Fortune* runs article on the online industry
600 databases available
CAS established CAS ONLINE service
NEXIS full text database available
First *JASIS* "Perspective" on online systems
The microcomputer industry begins to grow
Trend begins for mergers, acquisitions, and joint ventures

1981 First National Online Information Meeting
Videodisc technology tied to online retrieval
Public sector/private sector contention
OCLC changes name to Online Computer Library Center

1982 Downloading emerges as a major concern
Knowledge Index (DIALOG) and BRS After Dark initiated
Full text databases increase in number

1983 National Federation of Abstracting and Information Services (NFAIS) admits for-profit companies as full members
Increased U.S. marketing by European systems (e.g., ESA-IRS, Questel)
Online pricing becomes more complex and creative
STN International founded, a gateway system permitting transparent switching between a U.S. and European host

1984 Marquis Who's Who *Directory of Online Professionals* published
H.W. Wilson indexes available online for the first time
Over 2,400 databases available
New front-end systems aimed at end users introduced, including EasyNet (Telebase Systems, Inc.) and In-Search (Menlo Corp.)

1985 Mead Data Central adds bibliographic databases to its full-text offerings
Over 6,000 libraries participate in OCLC system
Combined Health Information Database (CHID), files of several federally funded projects, goes public on BRS.

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