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BANKING AND THE INFORMATION UTILITY\*

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## BANKING AND THE INFORMATION UTILITY

There is a very high probability that within the next 25 to 30 years the banking industry probably will be transformed into a vast electronic information system of national and international scope. Today's banks may or may not maintain their identities under the transformation. It depends on the attitude and role that banking management assumes as its mode of doing business undergoes a modern metamorphosis.

The metamorphosis is already in its incipient stages, as evidenced by:

1. This conference and its two predecessors;
2. Progressive fires in the halls of 90 Park Avenue, kindled by the ABA's special committee on automation;
3. Scattered brush fires throughout the banking community, such as the recent study by Bankers Trust pointing to the immediate practicality of terminating check flow at the paying bank;
4. Bonfires ignited by the communications industry with a match called bill-payment-by-phone and a lighting fluid known as Touch-Tone;
5. Flame fanning by the computer manufacturers with a technology that IBM calls Tele-Processing and others call on-line real-time systems;
6. A credit card blaze which has spread within 15 years from the local charge





accounts of individual stores, to the company-wide credit of geographically dispersed firms, to the multi-purpose cards of hotel chains and oil companies, to the general purpose documents of American Express, Diners Club, Carte Blanche, and Bank of America, to semi-automatic credit bureaus like Telecredit in Los Angeles, to the still more comprehensive citywide, statewide, and nationwide computerized systems currently under discussion;

7. Sparks from an accelerated speed up in the velocity of money and a hotly competitive money market.

I choose the metaphor of burning, not to be inflammatory, but simply to dramatize the dream that many of us have had of a complete conflagration of checks and cash. Maybe that does seem inflammatory to some of you. But to most of us paper currency is highly flammable in the sense that its volume of flow has been increasing exponentially and is the biggest headache of banking operations today. Many is the tired vice president who has awoken refreshed after dreaming of the cremation of the check.

Can elimination of the check be more than a dream? It does not require a great deal of technical expertise to see that it can. There are legal problems, to be sure, especially in the context of present laws (signatures, valid documents, etc.). I shall be interested to hear what John Clarke has to say about them. But the engineering know-how and the physical hardware to displace checks are ready. What it takes is a network of simple, inexpensive terminals placed at retail outlets around the country and connected on-line to a complex of central credit files stored on



flexible computer systems with large, fast random access memory. Memories are relatively cheap and are getting cheaper. Terminals like the Touch-Tone telephone set are fairly cheap, and they will get cheaper too. When it comes to cost comparisons, electronic communication will win hands down over proof and transit.

I wrote something about the possibility of an automated credit exchange last May in the Atlantic, as part of a broader discussion of the concept of an information utility. The ramifications extend far beyond the automatic payment of bills. John Case considered some of the banking opportunities and practical details last July at this meeting. I believe he may continue on that theme today. Joseph Halina covered the communication side of the system two years ago at this meeting. John Cocke discussed similar notions several years ago at IBM; and I know that the basic ideas go back much further than that, although I am not the one to try to trace them.

Let me mention just a word about the form that the credit instrument of the future may take. First there is the universal credit card. John Cocke has called it a money key. It is an encoded plastic card that unlocks, figuratively speaking, by insertion into a simple remote terminal, the current contents of the customer's money box stored in the files of the credit exchange. The card carries the account number of the owner, and the terminal identifies the vendor. The amount of the sale is entered



into the terminal and the computer does a fast turnaround to be sure that the customer's balance and credit rating are adequate for consummation of the transaction. Possible safety measures range from a photograph of the owner pressed into the face of the card, to a computer program that can recognize the owner's voice and detect an imitation. In the event of serious uncertainty or risk, the computer conducts an on-line interrogation before it makes its evaluation.

From the individual's point of view, the advantage of a single credit card over the check book, wallet, and plethora of cards many of us now carry needs no discussion. Operationally there are a few small problems. The concept of a money key depends on ready access to information in a central file and requires communicating and processing each separate transaction in real time. But the cost of real time is not justified for purchase of a newspaper, any more than the cost of a toll call is justified for a message of negligible information content. Furthermore, certain transactions will require communication with a distant credit exchange, as, for example, when J.G. rushes to Wichita from New York to visit his ailing mother and stops off at the Wichita Florist for a cheery bouquet of flowers. Such long-distance transactions demand a proportionately larger threshold amount for justification, just as a long-distance telephone call normally demands a greater urgency or information content than a local call.



There are several ways that transactions whose amounts fall below threshold levels may be handled. Some can be accumulated locally and transmitted by batch in a delayed store and forward procedure. Others may be paid by cash in the traditional manner. There is no reason why all traces of coins and paper currency must be erased from this system of the future. J.G. presents his card to a terminal at the Wichita Bank and requests \$100 to cover his expenses while he is in town. The \$100 transaction warrants a long distance connection, whereas a \$5 transaction for the flowers may not. A small service charge makes the transaction profitable to the Wichita Bank.

There is one cashless alternative that sounds like science fiction. Let me call it a money card as contrasted with the money key. It is a solid state device that electronically retains dynamic information on the working balance of its owner, together with static information on his identity and other characteristics. Instead of presenting J.G. with \$100 in cash, the Wichita Bank provides him with a money card of equivalent value. The card is produced by a special machine at the bank which may be one and the same with the terminal of the credit exchange. J.G.'s money key is inserted into this machine, the \$100 amount is entered, an on-line inquiry is made at the credit exchange, a debit is registered, and the new money card pops out. Again the bank makes an appropriate charge.





The nice thing about the money card is that it replaces a wallet-full of bills and pocket-full of coins with a single document that need never be "broken". The retailer simply inserts the customer's card into a specially engineered device that he has on the premises and enters the amount of a purchase. If this amount is less than the balance electronically recorded on the card, the purchase is approved and the balance debited. A money card belonging to the retailer is also inside the device, and it is credited simultaneously with the same amount. The retailer can transmit the balance on his money card to his credit exchange account via his own on-line terminal or the terminal of a local bank. He normally does this at the end of the business day. A few merchants take their money cards home with them at night and slip them under their pillows as they fall off to sleep.

Notice that the money card differs from the money key, not only in carrying its own balance, but also in not requiring connection to the credit exchange and not requiring real time communications. This advantage is also a limitation. When a money key is misplaced, its loss can be noted by the credit exchange as soon as the owner discovers the loss, and use of the key is thereafter blocked. The misplaced or stolen money card, on the other hand, may be used repeatedly by its unlawful holder well after the loss has been discovered, but only up to the balance on the card at the time of the loss. This property



the money card shares with cash. It could be made more like a traveler's check by making the coded characteristics of its lawful owner, such as his birth date, intelligible to the vendor. The vendor can also learn from the credit exchange whether the card has been reported missing. Whether he would or not depends on where the liability lies. If it lies with the owner, the money card is, like a real ticket, essentially variable cash. If, after the loss has been reported, the liability lies with the vendor, then the money card is a reusable check. Like a traveler's check, it cannot bounce because of overdrawn funds if its balance was produced legitimately and covers the sale.

I think the main difficulty with the concept of a money card, outside of the legal thorns, is not the problem of designing the card itself, but rather the related problem of designing the special device that processes the card. This device must be simple enough to be within the cost reaches of small retailers, yet complicated enough to make tampering next to impossible. A device that was rigged to register credits to the customer's card instead of debits, without the benefit of corresponding charges to the retailer's card, would be a counterfeiting machine unparalleled in the annals of crime.

We could go on to discuss ways of safeguarding against counterfeiting, but this has already been a lengthy digression and the notion of a money card is in no way important to the realization of an automated credit



exchange. If anything at all stands in the way of its realization, it is our own inertia, built up over many years of getting used to checks and cash. We can place the blame with our laws, but they reflect our attitudes, subject to a little lag. Attitudes can change quickly, however, under the duress of economic and competitive pressures. All it takes is one group to lead the way and make a success of it.

Let me try to draw an analogy from some very recent history that is still in the making. About six years ago, M.I.T. convened a faculty committee to study the long-range computational requirements of the Institute and recommend a future course of action. At a place like M.I.T. you seldom find near unanimity, particularly in a faculty committee, but this one was an exception. There developed during the deliberations an overwhelming consensus that M.I.T. needed a very large computer system with 100 or more on-line terminals spread throughout offices, laboratories, and classrooms around the Institute.

The proposed method for operating the system was called time sharing. It is different from customary batch processing in a fundamental way. The user does not completely define his requirements for a run in advance; he does not submit the run to a dispatching intermediary for merger on a batch tape with other runs; and runs are not fed to the computer serially with the user absent. Instead, the user enters his requirements directly to the computer from his terminal. He does not enter them all at



once, but develops them gradually with the computer's help. The computer provides him with intermediate results and detects his errors as he makes them. It makes available to him a vast programming library that has been constructed over a period of time. Although a large number of users are active at separate terminals simulataneously, the computer gives each the impression that it is continuously accessible and immediately responsive. This kind of relationship between man and machine has a big payoff in a variety of contexts, commercial as well as intellectual.

I think it is fair to say that the idea of time sharing was considered "far out" by most people as recently as 1959, even in the academic and scientific communities. In 1961 we held a lecture series to celebrate the M.I.T. Centennial. The subject of the series was Management and the Computer of the Future. John McCarthy reviewed the reasoning and conclusions of the faculty committee in a paper on time-shared computer systems, J.C.R. Licklider argued emphatically for starting work immediately on interactive computers, Robert Fano commented on prospects for an automated library, and a large number of other participants spoke enthusiastically, persuasively, and authoritatively on a range of future possibilities. Computer users appeared to be listening attentively, but managements in the computer and communication industries were yet to be convinced of the potentialities for a vast new market.





Since 1961 several relevant events have taken place. F.J. Corbato and his group at the Computation Center developed a supervisory program called CTSS that converted M.I.T.'s current computer into a time-shared operation. J.C.R Licklider joined the Advanced Research Projects Agency of the Department of Defense to campaign energetically for interactive computers and time sharing throughout the country. And encouraged by Licklider and the promise of substantial financial support from the Defense Department, M.I.T. formed Project MAC (Multi-Access Computer, alias Machine-Aided Cognition) with Robert Fano as director. Using CTSS and a computer that was not intended for multi-access operation, Project MAC began time sharing in the summer of 1963.

Today the same computer, with the help of some additional equipment, serves over 100 terminals distributed around M.I.T. and its environs. About half of the terminals are model 35 teletypewriters and the other half are IBM 1050 selectric typewriters. There are also a few terminals with provision for graphical input and output to facilitate computer-aided engineering design. To maintain good response times, no more than 30 of the terminals are permitted to be active at once. Communication between terminals and computer is by voice-grade telephone lines via a special M.I.T. private branch exchange which was established for this purpose. The computer is also linked with the Bell System switched network and with the Western



Union International Telegraph network, so that both TWX and TELEX services are available. Demonstrations of the MAC computer have been held at terminals in California, Norway, Great Britain, and Buenos Aires.

By next year at this time the number of active Project MAC terminals may have increased by a factor of five. A new computer system, now on order, that was designed expressly for multi-access operation, should be installed and running by then. Planning for the new system is a cooperative venture with Bell Telephone Laboratories who have ordered four identical systems for their own use. Many other universities, companies, and research establishments now have time sharing systems in operation or in advanced stages of construction. These include: System Development Corporation, Carnegie Tech, the University of California, Stanford University, Cal Tech, the Rand Corporation, General Motors, General Electric, Westinghouse, IBM, Case Institute of Technology, Dartmouth College, and Bolt, Beranek, & Newman. As you would expect, major computer manufacturers are mobilizing and reorganizing for the blossoming market they now see ahead.

The story is far from over. Interactive computation could still turn out to be nothing more than a lovely, short-lived dream. But that possibility is infinitely remote to those of us who have been working regularly at a terminal. I could no more conceive of returning to old-style computation than I could imagine trading in my



telephone for a carrier pigeon. My guess is that by 1969, within 10 years from the time that work on time sharing began in earnest, interactive computation will be firmly entrenched as the dominant mode of using the computer in research, engineering, and education throughout the country.

Automatic credit could move in just as fast, but probably will not because of legal barriers and financial inertia. It will come, however. Its convenience to the customer, its benefits to the retailer, and its other economic incentives are too striking to be overlooked by our entrepreneurial society. Within 15 years it may already be challenging checks for sovereignty.

Let us speculate on the form the development will take. Automatic credit bureaus will increase in number and expand in scope. They will find that supplying credit information has limited potential, and that consummating transactions is a logical and profitable way to grow. They will take over the customer's liability and begin to trade information with banks and other credit operations. Gradually, communication networks will connect the computers and memories of cooperating enterprises, and new organizations will be created to forge the links and provide compatibility.

As the system evolves, more companies and stores will begin to appreciate the economic advantages of eliminating their receivables and credit activities. Customers will be paying monthly bills by Touch-Tone, and mightily enjoying the consequent reduction in check writing and book



balancing. They will be using separate dialing cards for each bill, plus another for their bank account, and they will welcome the opportunity to trade these in for one general-purpose card that pays the itemized bill of the credit exchange. This card will be an early form of the money key. It will eventually be the same instrument that the customer carries to identify himself and establish credit when he goes shopping. The customer will applaud its replacing the onerous packet of credit cards he totes around today.

By now the credit exchange will be feeling the need for greater liquidity. Since the customer is carrying his money key with him at all times, the credit exchange can encourage him to pay for his purchases as he makes them by offering an instant discount. It can also permit him to specify a future date for consummation of the transaction at a proportionate reduction in discount. As Putnam Livingston has remarked, the time value of money is certain to attract greater attention as automatic credit systems bloom.

On the other side of the ledger, employees will be requesting the automatic assignment of salaries to their accounts in the credit exchange. With the communication network at a high state of development, companies will have little reason to mail out pay checks. During the nighttime shift, their computer systems will feed the payroll directly into the information network. Payroll credits will be distributed to the proper accounts like messages through a





message switching center. Since companies will have eliminated their receivables, they will be able to pay employees frequently, perhaps even daily, as a special service. This will make it easier for employees to avail themselves of instant discounts when making purchases. Ultimately, companies will send wage rates to the credit exchange, and then communicate with it only on an exception basis and not regularly; for example, when an employee is promoted.

Thus the flows of money into and out of the units of our economy will tend to become smoother, more continuous, and more synchronized with the physical flows of goods and services and the productive processes that give rise to them. Float will vanish and cyclical fluctuations of the economy will be dampened.

In the ultimate automated system, money flow will change from a movement of documents to an electronic transfer of information. Bank accounts of individuals and corporations will become electronic records containing data on future earnings, to facilitate credit ratings and payroll processing, as well as data on past accumulations. Frequent statements will be transmitted to subscribers with detailed listings of transactions. A complete historical file of all transactions will be maintained in electronic form for audits and error checks. The electronic records will be conveniently accessible to persons with the authority to see them, and inaccessible to others.



The fact is that money is basically information, and the banking industry is what Oettinger called it last July at this conference: "A Fiduciary Financial Information System". Banking and finance are very important components of a very big information business that includes: education, research, statistical surveys, medical diagnosis, engineering design, marketing, management control, communications, security and commodity trading, publishing, libraries, traffic control, federal fiscal and monetary operations, and numerous other intellectual, economic, and political activities. The rapid and continuing growth of information processing technology is going to have a major impact on all of these activities. As they reach higher and higher levels of automation, they will want to share data and establish communication links for their mutual advantage. The information utility that I discussed in the Atlantic article will provide the necessary interfaces and make cooperation economically attractive.

Early forms of the information utility are already in various stages of budding. Items: (1) time sharing experiments like Project MAC at MIT are educating present and future researchers in the power of interactive computers, and are pushing forward the state of the art; (2) the KEYDATA System of Charles Adams Associates is bringing time sharing into the commercial arena and extending it from the largest government agency to the smallest liquor dealer; (3) the QUICKTRAN Service of IBM



has been given national publicity in full-page newspaper advertisements, and this is just the start of time sharing at IBM; (4) the TRADIVAC System is planning to accept and match orders to buy and sell securities over an electronic counter from brokers everywhere, and expects to be profitable as soon as volume exceeds 70,000 shares per day; (5) the company-wide computer systems of American Airlines, Metropolitan Life, and Westinghouse, to mention just a few, are continuing to create competitive pressures; (6) A.T. & T. is brandishing and honing its multi-edged sword, preparing for the government to remove some of the regulatory sheath; (7) while another giant in the communications industry has been working with a consulting firm to test the temperature of the market.

If these are pointers to the future, what do they indicate for banking? The crystal ball is still clouded, but a few things seem clear. Checks, bills, credit cards, and the elaborately composed titles of ownership and certificates of indebtedness that we have treasured will gradually wither and disappear. Float and lags in money flow will also vanish. Income and expenditure streams will assume greater certainty, and the economy will become internally stabler. The commercial customer will become more sophisticated in his investment behavior and money-market activities, and demand deposit balances will level out and possibly turn down.



Some of these prospects sound fine: a return to sanity in paper handling and a consequent reduction in operating costs. Others seem ominous: a dwindling base for bank loans, and increased competition from the customer. But this is to judge tomorrow on the basis of the way things look today. Laws are going to change, government regulation will change, the structure of interest rates will change, services and service charges will change, market operations will change, the procedures for negotiating loans will change, the process of underwriting new issues will change, and indeed the entire nature of banking and finance will change. My sketch of the future has deliberately left blank the identity of the credit exchanges and the information utilities, and it has said very little about who will be paying what to whom. These are open questions, and they will remain open questions until the participants begin to take their places on the starting line.

In many ways bankers have a running lead. They already enjoy a confidential relationship with their customers. They have a good understanding of the whole of American industry and finance. They are knowledgeable in international affairs. They are accustomed to processing large volumes of information. And they are familiar with the ways of networks, through branch and correspondent banking and membership in the Federal Reserve.

Bankers are on a threshold. In the past is their carefully cultivated reputation for conservatism and





deliberation. In the future is their urgent need to stake out a claim and pursue it with purpose and foresight.

The chairman of this conference last year, Charles Agemian, postulated as the last of his five laws of prudent thinking that "those who lean too far into the future will fall flat on their faces". The practical wisdom of this advice for the reckless computer enthusiast needs no comment. Yet today we might add a small codicil:

Those who do not bend forward, when moving into a stiff gale, will land on their backs; and those who do not look up to see where they are going, neither will they see who is ahead.





