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June 17, 1970

Memorandum to: CTC
IBM Fellows

Subject: International One-Design Computer System

The attached memo proposes a one-design computer system to meet the needs of developing countries. While the document proposes that the design be based on the Model 25, I have since concluded that it may be better to base it on a low member of the new NS line.

As a first experimental step, we hope to install terminals in Dominican Republic and Haiti operated from a computer in Poughkeepsie. The steps to follow would depend on what we learn from possibly a year of this kind of operation.

S. W. Dunwell

SWD:jc
Attachment

INTERNATIONAL ONE-DESIGN COMPUTER SYSTEM

The technical needs of developing countries are not the same as those of the major countries of North America and Europe. There is a tendency for them to leap over steps in technical evolution. They adopt the airplane before completing an adequate network of automobile roads, adopt radio communication before their telephone system is fully developed, and go directly from folk medicine to the most recent pharmaceuticals.

At the same time, the technical equipment needs of developing countries, while advanced in nature, are not the same as those of North America and Europe. American cars, which perform so well on our fine roads, are no match for the Land Rover where roads are bad or nonexistent. The Boeing 747, while suitable for flights across North America, would be useless within most developing countries. They need a different kind of airplane. Similarly, American medical needs and theirs are quite different.

World Trade Corporation Equipment Needs

As in the above examples in other fields, the business equipment needs of the indigenous businesses of developing countries are quite different from those of American and European concerns. This fact does not weigh heavily in the plans of World Trade Corporation because most of its business is

with businesses in Europe or with branches of American or European concerns in developing countries. The latter can import personnel from the parent company and so avoid many problems.

For these reasons, IBM has been satisfied to place its World Trade Corporation laboratories under the control of the domestic IBM, and to develop in them equipment suited to American and European needs. The number of people in developing countries is very large, but the potential business with them is small. Consequently we have not addressed ourselves to the development of equipment to meet their needs.

General Goal for International One-Design

This memorandum proposes a World Trade International One-Design computer system tailored to the specific needs of domestic businesses in developing countries.

It is believed that the proposed equipment would facilitate the development of local businesses in developing countries. However, in proposing it we are not ignoring the fact that the principal obstacles to growth of businesses in these countries is lack of capital and lack of a large middle class, neither of which is addressed by this proposal. It also must be acknowledged that International One-Design will not find a large immediate market in developing countries, and that its principal markets might be the United States and Europe.

There are a number of reasons for adopting one design. Several alternatives for the one design deserve consideration. In order to clarify the design goals, this memorandum will describe one possibility based on the System/360 Model 25. A rather good case can be made for basing the design on the System/360 Model 40, as well as for basing it on one of the smaller models in the NS line. However, the choice of system does not alter the basic one-design principle which we wish to set forth.

Terminal-Oriented Processing

It is proposed that the system be controlled and used exclusively through teleprocessing. Anyone wishing to use the system would do so through a terminal. The terminal might be in the same room or the same building as the computer, or might be some distance away. The equipment needs of a user would include one or more terminals and telephone lines to the computer. The computer itself would be managed by a service organization which might fulfill the needs of a number of businesses, governmental agencies and educational institutions.

Data Base

The computer would include a data base with space for each of the organizations it serves. The system would be able to read and punch

cards, to print reports and to read to and from magnetic tapes. In this way, it could offer all of the services customarily provided today. The ability to transfer data between the data base and magnetic tape would avoid the need for a data base large enough to hold simulatneously all the data of all customers. The data base management would conform to the standards set by IBM for GIS-IMS.

Single Partition Operation

Since all applications would be designed for teleprocessing, it would be possible to do everyone's work within a single partition. This partition would provide access to the card reader-punch, the printer and magnetic tapes as well as to disk files.

No Job Control Language

The job control languages provided by DOS and OS and the job-stream concept of computer control would not be used. In effect, each user at a terminal would be an operator of the system. Batch processing would be done in the same partition with teleprocessing. It would be under the control of a teleprocessing terminal and would be a teleprocessing task like all others.

External Language

Customers would do all of their programming in one or another high-level language. APL would be provided for general use. In addition, a number of specialized high-level languages would be provided to meet particular needs. These might include DL/1 for data base references, SORT, RPG for report generation, CWIII for Computer-Assisted Instruction, ATS for document editing, etc.

Internal Language

The internal language would be APL. This would consist of a subset of the external APL microprogrammed in the high-speed memory of the Model 25 system, and would be a cardinal reason for choosing the Model 25. NS-1 offers similar possibilities.

No customer or IBM person concerned only with International One-Design would need to know System/360 machine language.

Elimination of Compilers

Since the system would operate in APL, there would be no need for compilers such as we use today. Compiling would be immediate as it now is for Coursewriter III. Programs would be entered at a terminal, and would be arranged for later efficient execution one statement at a time as they are entered. One should not assume that programs entered in this

way must run inefficiently. The amount of work which the system can handle in a given space of time using this method of operation may be considerably greater than can be handled by the same system using the present kind of multi-partition job-stream operation.

Hardware

International One-Design would offer only a single model of the card reader-punch, the line printer, magnetic tape and disk file. Only one type of terminal, possibly the 2740 or the 2741, would be accomodated. In this way, an IBM Customer Engineer trained to maintain the specific model units included in the International One-Design would be able to maintain any system since only one model of each unit would ever be encountered. A minimum amount of training would be needed for a Customer Engineer to be able to handle his job.

Publications

Because of the one design and the simpler concept of the system, much of the present IBM literature would not be needed. We already have observed that the Customer Engineer would be concerned with only a small subset of the equipment IBM offers, and with a comparably small subset of the CE documentation. The same holds for system operation and programming. There would be no need for the manuals on System/360 machine language, compilers

or job control. None of the OS operating system literature would be required.

It is proposed that a much simplified and condensed set of documents be produced for exclusive use with International One-Design. These documents would omit the large amount of information in the present documentation which would not be needed for the One-Design operation. This would result in a small number of documents concerned with programming, system design, operation and installation, possibly five or six. This number would be small enough to permit them to be issued in several languages-English, French, German, Spanish, and Hindi at the least.

Data Entry

Although the applications for the system would be oriented toward direct data entry through a terminal, it would be possible to enter data by keypunching, as it is commonly done today. While conversational entry of data requires more costly hardware, it permits the data to be edited as it is entered. This reduces the accuracy and skill required for preparation of data and for key entry, and permits the immediate rejection of much incorrect data which is accepted when cards are punched. There can be no doubt that interactive data entry allows less skilled personnel to be used and produces a more accurate result. Both are important assets in situations where good clerical help is hard to find.

Programming

Experience with conversational entry of computer programs has demonstrated that it requires less training than the present program process, and that a programmer's efficiency is increased possibly ten-fold when he works in this way. This also can be especially important in emerging countries, where there may be few skilled people to train as programmers.

Partition Supervisor

International One-Design would use the Multiple Application Partition Supervisor (MAPS) which has been developed for use with Coursewriter III. It is the MAPS software which makes it possible to intermingle application languages within a single partition and to handle a relatively unlimited number of different applications within the 48K memory space of the Model 25.

Number of Users

The number of users which an International One-Design based on the Model 25 might handle simultaneously can not be established with any certainty at this point. It is reasonable to suppose that acceptable teleprocessing response time could be obtained with fifteen to thirty terminals connected, since even the 16K Model 1440 was able to handle 25 CAI terminals.

Also, we know from present experience that only 20% to 50% of the terminals served by a single computer are dialed in and in operation at any given point in time. Thus, the total number of user terminals which a single International One-Design system based on the Model 25 can serve may lie between possibly thirty and one hundred.

Telephone System

The design of present IBM teleprocessing equipment is such that a considerable unnecessary burden is put on the computer and teleprocessing multiplexer if the terminals are wired in directly, rather than through a telephone switching system. One of the things which World Trade might consider is to design a new teleprocessing multiplexer which would include within itself some of the switching provided by a telephone dial system, together with means for serving many terminals over a single telephone wire pair. This would improve the efficiency of the system in those countries where the telephone system is not advanced, and would increase IBM's experience in telephone switching. Work along this line is, of course, now going on at Nice and Zurich.

Multiprocessing

In those cases in which the user demand is greater than can be served by a single system, two or more systems would be provided rather than offering a single larger system. These systems might be cross-coupled so that limited service might be offered when either one of them is out of operation.

Software

The software used with International One-Design would be different from that for other IBM equipment. Since it would consist only of an APL definition of the task to be done, since this could be tested conversationally, and since it would not be necessary to retrace the costly development process by which IBM orginally explored these applications, it is reasonable to assume that the cost of creating software for International One-Design would be possibly one-fiftieth the cost of its SYSTEM/360 counterpart. This would place the software costs within the range of what can be offered free to promote sale of equipment.

S. W. Dunwell
March 10, 1970