

Worldwide systems engineering

by T. G. Peck

IBM systems engineering celebrates its 25th anniversary in 1985. This paper provides a perspective of the part systems engineering has played in the success of IBM in the information processing business during that 25-year period. The history of systems engineering is briefly reviewed, and the similarities and differences in worldwide systems engineer functions are examined. The relationships among marketing, systems engineering, and customers are discussed. Also discussed are career paths for systems engineers. Expectations and challenges for systems engineering in the future are explored.

When the success of IBM is discussed, the contributions of our personnel and management are usually acknowledged. These contributions result in the service, product excellence, and marketing skill that customers expect. Special credit is always given to IBM systems engineers for their contributions to the company's reputation for its marketing skill.

Systems engineering as a career was created on December 5, 1960, when the Data Processing Division president, Gilbert E. Jones, announced that five new systems engineering positions were being created. Initially, the new group was composed of applied scientists and systems representatives, and it was open to systems service personnel. From that group of slightly more than one thousand persons worldwide, the systems engineering force has grown to over 20 000, with about 9300 in the United States, 4500 in Americas/Far East, and almost 10 000 in Europe/Middle East/Africa.

In 1960, the day-to-day work of systems engineers often consisted of highly detailed installation assistance. Their most frequent task was that of wiring

accounting machine boards, which adapted those machines to specific applications. (The boards were thus analogous to the computer programs of today.) This assistance was often necessary for the successful installation of those machines because many customers had not developed board-wiring skills. Other activities included application programming and design for such early IBM computers as the IBM 650, the IBM 7040/70/90 series, and for the newly delivered IBM 1401 system. Installation activities normally made up a large part of the systems engineer's customer-related time, with technical marketing support accounting for the remainder.

In the early to mid-1960s computers replaced accounting machines as the major installation activity. In the place of board wiring, systems engineering involvement in application programming and design grew in importance. During this time, IBM undertook a major business risk with the development of the System/360, which was announced in 1964. To help handle the many expected conversions from earlier systems to the System/360, a large number of new systems engineers were hired shortly following this announcement.

Systems programming became a major activity for systems engineers during the late 1960s and early 1970s, although customers were rapidly developing

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these capabilities as well. Systems engineers then began shifting from a product emphasis to a systems emphasis, as systems became more complex and communications and data bases became more important.

Systems engineers involved in systems programming have made significant contributions to IBM products over time. Examples of major current software products that have evolved from branch office systems engineering efforts are CICS/VS (which evolved from the utilities industry support product Customer Information Control System) and JES2 (which evolved from the Houston Automatic Spool Program—HASP).

With the announcement of System/3 in 1969, IBM became a major supplier of small systems. Application design and marketing developed as critical requirements to the effective selling and installation of these systems.

In 1969, branch offices were realigned to perform two distinct functions. Traditional marketing support continued as before. Systems engineering services, however, were offered as a chargeable option to customers. The reason for this change was to reduce the price of the hardware and at the same time offer education, software, and detailed installation assistance as required by each individual customer. Many services, such as programming and detailed design, were thus available for a fee from IBM. In 1971, the system engineer's role as an integral part of the marketing function was restated, and systems engineering resumed its involvement in many marketing support activities. Chargeable systems engineering services began to evolve into a new business area for IBM, with major projects handled by a centralized service organization that was separate from the branch office. Branch office systems engineers continued to offer systems engineering services for smaller projects as appropriate.

With the announcement of System/370 and the virtual storage operating systems in the early 1970s, creative approaches to selling and supporting large systems were developed. The numbers of hardware and software products were growing significantly, and the account systems engineer was becoming specialized in some areas and was a coordinator of technical resources for other areas. Product expertise focused on leading-edge and strategic products. By the mid-1970s, installation planning began to occupy a large portion of systems engineer time. A much

closer relationship was developing between the systems engineer and the customer management, and an increasing proportion of the systems engineer's time was devoted to installation planning, information systems planning, technical planning, and communications issues.

The reorganization of the Data Processing Division in the United States in 1974 created the General Systems Division. This development in the marketing environment provided different environments

The need for specialization to address many new issues became evident.

for systems engineers in two divisions. However, the new marketing division did not change the fundamental role of system planning and installation for systems engineers. Thus, when a parallel reorganization occurred in countries covered by the General Business Group/International organization, the customer/systems engineer relationship also remained unchanged.

As the complexity of systems and environments increased, the need for specialization to address many new issues became evident. In 1975, a systems specialist program was announced to provide training and information exchange for such specialized areas as data base, communications, and large systems. Account systems engineers retained direct responsibility for technical support to their assigned accounts; these systems engineers maintained a broad set of skills. In addition, they also developed some degrees of specialization as well. The systems specialists received comprehensive training and experience in their areas of specialty. For their part, account systems engineers learned to use these specialized skills to help solve difficult problems quickly, to shorten project learning curves, and to augment technical planning by adding the skills of the systems specialists to their own broad experience.

By the late 1970s, the planning and systems coordination roles became more fully developed. Products were decreasing in price while personnel costs were increasing. System/34 was announced, offering new levels of price-performance for users of small systems. The large numbers of small-system installations strained the ability of systems engineering to provide its traditional kind of support. Productivity improvements were sought in many areas. For example, local installation centers were developed.

In the large-system area, the IBM 303X series of processors was announced, and systems engineering specialists in that area were ready with the requisite skills. With the announcement of the IBM 4300 series of processors in 1979, the Data Processing Division focused on many of the installation productivity issues that had previously been met by the General Systems Division. Branch Support Centers were implemented to address the large numbers of installations by offering concentrated centers of systems and installation skills. Customers were offered the use of these centers to train and practice for successful installation of their 4300 systems.

During the 1980s, there has been continued evolution of systems engineering, with heavy emphasis on productivity issues and problem solutions. The Branch Support Center has evolved into the Customer Support Center, and more recently into the Customer Center. Throughout this process, the number of products supported and types of services offered have increased significantly. To increase our responsiveness, Customer Assistance Centers have been introduced to provide centralized nationwide installation support via toll-free telephone service to augment service to customers during the time of installation of a new CPU. Other services to help IBM improve customer support include Application Marketing Centers, increased specialization, and electronic delivery of support and information. Two examples of the latter are ASKINFO and INFOExpress.

In 1982, there was a reorganization in the United States of the Data Processing, General Systems, and Office Products Divisions into the National Accounts Division and the National Marketing Division, adding the marketing support representatives of the Office Products Division to the systems engineering ranks. This divisional reorganization broadened the scope of the jobs of systems engineers from each of the former divisions and greatly increased the number of product options on which each systems engineer was required to advise the customer.

Both the systems engineers and marketing support representatives acquired new skills to fully represent the entire product line to customers. The Europe/

The environments in which systems engineers work are diverse.

Middle East/Africa (E/ME/A) and Americas/Far East (A/FE) countries soon created similar organizations to augment their capabilities to support their customers.

Current perspective

Today, IBM systems engineers support more than three hundred hardware products and 2700 software products. In 1985 alone, it is possible that there will be one thousand product announcements worldwide.

The environments in which systems engineers work are similarly diverse. Systems engineers in E/ME/A and A/FE countries work in many different cultures and languages on a day-to-day basis, whereas systems engineers in the United States work with a fairly homogeneous language and culture. Systems engineers on large accounts usually have highly specialized tasks compared to those working with new accounts. A systems engineer covering a general territory in the National Marketing Division branch office in Billings, Montana, spends the day very differently from a systems engineer covering information and support requests in the Customer Center in Houston, Texas. Both of these situations are very different from that of a systems engineer in a highly specialized National Accounts Division banking branch office in New York or San Francisco. All of these systems engineers would agree that their tasks are different but that their role of customer support remains the same.

The complexity of the systems engineer's job of providing technical support in each of these diverse

environments is extremely challenging. The complexity of each customer environment, especially that of large-systems users, is increasing so quickly that the customer and IBM are continually challenged to respond and prepare for the future. A corresponding complexity exists with small-systems and personal computer users, because of the large volumes of units requiring support.

The numbers of products requiring support and the complexity of customers' environments have caused a gradual shift of the focus of systems engineering from product to process. There was clear product involvement by systems engineers in the earlier days of systems engineering. Gradually, the movement has been toward supporting the installation planning

Systems engineers are making contributions throughout the world.

process. This evolution is still visible early in the careers of new systems engineers as they start out with heavy product emphasis and then move gradually to processes, after they have established a strong base of product knowledge.

However, these changes have merely modified the composition of the job's technical nature. For example, the systems engineer who desires strong technical involvement can achieve this in a variety of ways, such as system specialties, Customer Center positions, or staff assignments in Marketing Support Centers or Systems Centers. The systems engineer who wishes application involvement can be an account systems engineer or an industry specialist. If a high degree of customer involvement is preferred, the systems engineer can continue to be an account systems engineer or choose to work in a Customer Center.

IBM management is constantly searching for ways to improve the quality of support by using systems engineers for support of issues that have even greater value to customers than those issues supported today.

International dimensions of systems engineering

The brief history of systems engineering in IBM presented earlier in this paper reflects primarily the evolution of the systems engineering experience in the United States. Systems engineers are making similar contributions throughout the world, although the task makeup differs slightly.

Products in most countries are very similar, with a small but important number of products that are unique to a country or region. One can readily imagine product differences that result from the support of national language requirements for different countries. Nevertheless, differences in culture, language, business forces, and government can influence product design and systems engineering support. On one hand, Canada and Europe closely parallel the United States, and changes in systems engineering in these countries are similar to those discussed for the United States. On the other hand, more significant differences exist in many Asian and newly developing countries. For example, southeast Asia is one of the fastest-growing business areas in the world at the present time, and growth in the information processing marketplace in southeast Asia through 1990 is expected to be about twice the rate of growth in the United States.

Corresponding differences in support structures exist in Asian and developing countries, due primarily to the need for self-sufficiency. Time differences, geographical remoteness, and language differences make access to existing support impractical much of the time. For example, systems engineers in Hong Kong, although they are fluent in Cantonese and English, cannot converse with United States Support Centers because of the 12-to-16-hour time difference. Neither can they converse with the large centers in Japan because of language differences. Communication with Australian centers is possible, but geographical distance requires a responsive organization for effective on-site support. Of course, support is available; nevertheless, both IBM and its customers are developing personnel to deal locally with the growth in business and system sophistication.

Sources of systems engineers

It is impossible to characterize the typical systems engineer by background or by current working environment. Although systems engineering is technical in nature, the background of systems engineers is highly varied. Almost all systems engineers hired

today have college educations, and many have degrees in technical disciplines such as computer science, engineering, or mathematics. A large number, however, have business backgrounds, as well as backgrounds in other areas such as the arts and music.

IBM uses these varied talents by training the systems engineers as they join the company and on a continuing basis. Entry-level training for systems engineers

Systems engineers may continue along the technical professional career path or choose a management career.

and marketing representatives is very similar during their first year with the company. Initial training assumes very little knowledge of computers. This training intensively covers computer principles, effective communications, and IBM principles and ethics. A sound base is developed to allow the building of general skills or of systems or industry specialties.

More specialized training often begins during the period of entry-level training because systems engineers also attend implementation classes and receive such assignments during this period. Systems engineers and marketing representatives are also involved in account planning and support during this time. Subsequent training in products, applications, management, and techniques is offered regularly to develop additional skills.

Career options

To be a successful systems engineer requires that one achieve a blend of technical and business understanding, personal relations, and effective communications. Because these are highly desirable characteristics for success in any position, systems engineers are in high demand within the systems engineering field organization and in many other IBM groups.

Systems engineers who stay in systems engineering may continue along the technical professional career path or choose a management career path. These parallel paths are known as the "dual ladder." Because systems engineering offers several levels of qualified positions within the technical career path, significant professional and financial growth is available there. Management options, beginning with the position of systems engineering manager, offer entry into technical and marketing management positions.

Some options outside systems engineering in the field are product planning, marketing support, information systems, software development, technical education, and technical support positions.

Relations with the customer

To understand the present role of systems engineering, it is helpful to review the fundamental relationship of the IBM marketing representative, the IBM systems engineer, and the customer. IBM has always encouraged marketing representatives and systems engineers to act as a team with their customers to understand the customer's business needs and to offer IBM solutions in the customers' best interests. Entry-level training courses, qualified marketing training, application schools, and management guidance have consistently emphasized teamwork.

After working with the customer to understand his requirements, the marketing representative and systems engineer match their understanding of the customer's requirements against various IBM product offerings and the customer's current systems environment. They then determine the best IBM solution or set of alternatives to address the requirements.

Although they work as a team with similar objectives, the marketing representative and the systems engineer play different roles for the customer. The marketing representative develops an understanding of the customer's business needs and marshals the resources necessary to determine the best IBM solutions to meet these needs. The marketing representative and the systems engineer then show the customer that IBM products and services can satisfy these needs. The systems engineer works with the marketing representative and the customer to define the customer's requirements. Through analysis and experience, the systems engineer proposes a system solution and alternatives where appropriate, specifying the technical steps necessary to achieve the solution and anticipate possible obstacles. Finally,

the systems engineer establishes an implementation plan to achieve the desired results. The work of the systems engineer is not entirely defined by or limited to functioning as a team member. This has been only a brief presentation of that one very important aspect of the job.

By providing this balance, IBM offers the customer ideas for achieving results. The intent of both the marketing representative and the systems engineer is to work for the customer's best interests. The marketing representative offers a business perspective of the proposed solution, emphasizing results and benefits. The systems engineer supports the implementation plan by concentrating on the technical steps necessary to succeed. If unforeseen technical obstacles are identified, the systems engineer helps to overcome them during the installation and operation of the system.

Other members of the IBM team are customer engineers and program support representatives, who have responsibility for the preventive maintenance of hardware and software and the repair of defects. Together with systems engineers, customer engineers and program support representatives have also had a strong relationship with customers throughout the years. Although both groups are often thought of as the IBM team that solves hardware and software problems, they both play a larger role in helping anticipate problems through pre-installation planning and research. A formal program known as *systems assurance* aids the pre-installation process for new and complex installations and encourages communication among the members of the IBM and customer installation team.

Common ingredients

An understanding of these relationships and the history of the changing role of the systems engineer provides insight into systems engineering in different cultures and at various maturity levels. The following are some of the common ingredients of systems engineering over time throughout the world.

Whereas marketing representatives are coordinators of all IBM resources, systems engineers are specifically coordinators of IBM technical resources. They offer customers the technical support for the business evaluation emphasized by the marketing representative. Systems engineers also help customers anticipate the technical implications of IBM products and strategies. They help customers deal with the com-

plexity of their own changing environments by seeking ways to coordinate the complex parts of their systems and networks. Systems engineers help identify and overcome obstacles to results desired by the customers.

Systems engineers provide skills to help guide customers into leading-edge areas.

Systems engineers provide skills to help guide customers into leading-edge areas. Typically, these are skills in which, at a given time, very few persons are trained. Although it may seem quaint today, board wiring was one of those skills thirty years ago. Examples of other once-leading-edge skills are programming, systems programming, systems planning, and systems management. These skills are still in demand, but systems engineering support has shifted to newer leading-edge areas.

Current leading-edge skills are those that help the customer deal with the increasingly complex systems environments required to support a modern user-oriented information service. Examples of such support are: helping the customer integrate the many system elements required for operation, helping with the design and management of systems that require extremely high availability, and assistance in connecting and managing personal computer networks used with large systems and data bases. Skills required to provide this support are broader than those required in the past. They encompass more technical areas with less detailed knowledge of each area. This is consistent with the change from product orientation to process orientation of the systems engineer.

Future direction

The general direction of the role of the systems engineer is expected to continue, with emphasis on teamwork with the customer and the marketing representative. This means that a gradual shift is likely from a focus on assistance with implementation of systems and products to assistance with application identification and increasing involvement with end

users. This will occur as improved offerings to provide technical support are realized. It is certain that the tasks systems engineers will perform in the future will continue to change. As the complexity of customers' environments increases, systems engineers will become even more necessary to help customers prepare for these changes and deal with the complexity. General tasks will continue to be planning, technical obstacle identification, problem solving, implementation assistance, and technical guidance.

Continued multinational growth will create the need for a greater international perspective on the part of many systems engineers. International communications and remote management issues will be of special importance.

IBM productivity techniques may be extended to customer versions as needed. Some examples of techniques that may be useful to customer organizations are the following:

- Derivatives of Customer Center and end-user marketing programs may help customers offer effective support to their own end users.
- Electronic delivery of information on products, technical issues, configurations, hardware and software problems, and education may be delivered by the IBM HONE networks to be utilized by customers.

Productivity improvements will continue to be required, and pressure to find and implement them will be intense.

Concluding remarks

Many changes in system engineering have occurred over time, and the role of the IBM systems engineer varies from country to country, in different business environments, and in different geographical situations. Nevertheless, the fundamental role of technical support is unchanged. The systems engineer's role in providing technical solutions to complex problems will continue. As the complexity and numbers of customer systems increase, the need for the value added by systems engineering support will grow.

There are two major challenges for systems engineers and their management. Very important is the development of new skills to deal with the increasing complexity of systems and especially networks. Perhaps even more challenging is the creation of new

ways of dealing with ever-increasing volumes of systems while maintaining the traditional customer/marketing representative/systems engineer team spirit. The strong educational backbone of systems engineers and their experience in the field will continue to be the necessary ingredients for strong technical marketing and customer support.

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HONE: The IBM marketing support system

by W. Boos

The storage, retrieval, and dissemination of data pertaining to a large, complex product line is made possible by the Hands-On Network Environment (HONE) discussed in this paper. HONE provides on-line interactive support to marketing, systems, and administrative personnel, and, most recently, to customers. The evolution of HONE is presented. Discussed in detail are new HONE distributed processing capabilities now enabled under an advanced network architecture. In that environment, the processing power and data bases of HONE and other host systems will be interconnected and support the speed and processing autonomy of IBM Personal Computers as workstations.

To be the most efficient in everything we do is our goal for the 1980s. The achieving of that goal requires not only the deployment of dedicated people but also providing them with the technology that can multiply their effectiveness and ensure their productivity. That is the role of the Hands-On Network Environment (HONE), an IBM on-line support service for tens of thousands of IBM personnel that brings the power of information systems to their everyday activities.

Having the right information and support where it is needed and when it is needed is essential to any company's effectiveness in the marketplace. The establishment, use, and redesign of that environment are discussed in this paper. HONE is matching ever-increasing IBM customer requirements by accelerating the addition of tools and data, by building new and easier-to-use applications, and by exploiting leading-edge products and techniques. The mission of HONE is the on-line delivery of all marketing support to the field, and appropriate subsets of this support directly to customers.

To achieve this goal, it is necessary not only to understand and plan for future customer and IBM support needs but also to provide state-of-the-art solutions for effective delivery of that support.

HONE, which had its beginnings sixteen years ago, today provides on-line support to over 500 field locations in the United States. Dual sites in Palo Alto and Dallas provide efficiency in handling traffic load and ensure compliance with systems management standards and user service levels. Additional sites around the world support IBM personnel and customers in over 100 countries.

In early 1986, the combined production systems at both the Dallas and Palo Alto locations will total nineteen 3081 processors and have a DASD capacity of 450 billion bytes. These systems will serve 35 000 users in a combined VM and MVS environment, using Systems Network Architecture (SNA). HONE employs remote operation. Operators in Palo Alto, located outside the machine room, can monitor and control both sites. Most of the terminals connect directly through the IBM Corporate Communications Data Network (CCDN). Indirectly, terminals on the separate Area Information Center (AIC) networks also can access HONE.

In addition, by the end of 1985, HONE terminals installed at customer sites for use by IBM personnel

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will have grown to over 1900. A rapidly growing number of headquarters and product division locations also are using HONE. For example, most IBM internal computing centers use the HONE configurators to determine their own equipment orders and to access other files for vital information to help them operate more efficiently.

Our challenge is to manage one of the world's largest computer complexes in a stable fashion while responding to changing application needs, technolog-

HONE evolved in direct response to needs of the field.

ical innovation, and new marketplace requirements. This paper discusses some of the current offerings of HONE as well as new requirements and looks at the future potential for direct, on-line support for both IBM personnel and our customers.

The evolution of HONE

HONE evolved in direct response to needs of the field. Its history reflects the changing interests and needs of IBM systems engineers and marketing representatives over the past sixteen years.

When HONE first started in 1970, there was an urgent need to give systems engineers on-line proficiency with a rapidly expanding volume of IBM programming languages and applications, so that they could continue to provide expert assistance to a growing base of customers who were installing and using these products. At that time, HONE used a System/360 Model 67 in a CP-67 environment. (CP-67 was the forerunner of VM.) Each branch office had a Branch Learning Center (BLC) furnished with a single 2741 typewriter terminal. HONE was available to each BLC for two hours a day, which was quite adequate for that time. Also, display terminals were still in the future.

By 1972, HONE had expanded its support nationwide. By that time, also, IBM hardware and software prod-

ucts were becoming more numerous and sophisticated. Systems engineers and marketing representatives were spending more and more time determining for their customers the best combinations of capacity, performance, and costs. Accurate specification of all the model numbers, options, features, cables, power supplies, etc., was also becoming more complex. Therefore, in 1972, HONE added a tools-and-aids facility, which was a set of programs to guide our field personnel through a series of on-line questions about the hardware. This facility would then calculate an accurate answer. There were the following four major categories of these programs:

- *Configurators* to ensure the operational compatibility of the hardware components and generate output to be transcribed to an order form
- *Systems analysis and design* programs to estimate performance for a given user application or environment
- *Financial analysis* programs to evaluate various acquisition plans
- *Installation planning* programs to assist in scheduling initial installation tasks and to project future requirements based on customer growth assumptions.

These programs expanded the usefulness of HONE from a training facility to a valuable tool for even the most experienced systems engineer.

During the years 1976 and 1977, HONE became a major offering on the recently created Corporate Consolidated Data Network (CCDN). This gave HONE a significant improvement in accessibility. Concurrently, the system and all the applications were converted to support IBM 3270 display terminals.

At the same time, field personnel were spending an increasing number of days in classes to maintain their product currency. HONE was a natural way to reduce the traveling time to distant classes. By converting many of the courses to on-line access, education centers were relieved of some training load, travel costs were reduced, and loss of productive time away from the field was noticeably reduced through self-paced learning.

From 1980 onward, HONE has provided more and more new types of offerings to meet increasing field requirements for information. Systems engineers, marketing representatives, and, more recently, administrative personnel all have an increasing need for current information about all aspects of the grow-

ing IBM product line. Prices, function, delivery schedules, operating characteristics, terms and conditions, software support, installation procedures—information traditionally available in hundreds of published documents, but now revised and expanded too frequently for periodic print and distribution cycles to keep up to date. In 1980, HONE put the *IBM Sales Manual* on line, followed rapidly by additional documents such as announcement letters, directories, and education schedules.

Also in 1980, the HONE facility known as the Electronic Question and Answer Library (EQUAL) was implemented. Systems engineers increasingly required guidance from experts in numerous IBM support centers on answers to what-if questions. Before EQUAL was instituted, there was often several days' delay in reaching the experts to pose a question and then obtain the response. EQUAL routed on-line questions from the field to the appropriate support center which in turn provided an on-line response, usually in one working day. EQUAL also provided a valuable new bonus. HONE saved all the questions and answers in a constantly growing data base. Field personnel could first search the data base to see whether a question had already been answered. If it had, the user would have the answer immediately, rather than up to 24 hours later. Depending on product maturity, an answer already exists 50 to 90 percent of the time, saving field personnel valuable time.

Since 1980, HONE usage has grown at a 50 percent compound annual rate, due to a concurrent increase in offerings and number of users. Examples of this growth are now described in more detail.

Configurators and analysis tools. Today HONE provides over 100 programs for configuring and evaluating hardware and software products. This number varies from time to time as product offerings change. Currently, users invoke these programs over 200 000 times a month. The following is a simplified scenario of a configurator execution.

In execution, each configurator presents a series of question-and-answer screens to obtain from the user all the parameters necessary for processing. For example, when the system configurator is invoked, the user serially specifies such parameters as the processor identification and model number, identification and quantity of storage devices, communication controllers, and the lease/purchase alternative desired. The output is a listing of each device with its required features and total costs. Users often run a configu-

rator of this complexity more than once, each time varying parameters so as to converge on an optimum system. The resultant configuration may then be entered into a performance, capacity, or financial

Information retrieval is the fastest growing facility on HONE, both in volume and in activity.

analysis program. If the results obtained from any of these analyses are unsatisfactory, the user returns to the configurator and restores and modifies a previous configuration. The user then recycles the process.

Training. HONE currently offers about 70 IBM Field Training System courses and tests. Both entry-level and experienced employees use these courses about 20 000 times a month.

Information retrieval and electronic publishing. Today, the field organization has on-line access to over 50 document data bases covering product information, procedures, directories, and other high-activity, frequently updated subjects. Information retrieval is the fastest growing facility on HONE, both in data volume and in activity. Users currently access this information about 700 000 times a month.

Question-and-answer. The EQUAL question-and-answer facility is also growing dramatically both in the number of product areas it supports and in its usage. Users currently access EQUAL data bases 130 000 times a month.

Growing base of users. HONE was created in 1970 to support systems engineers, and they are still the core community of users who rely on HONE. As new functions and systems capabilities are added, HONE resources are becoming just as useful to marketing representatives. Usage measurements recorded since the early 1980s confirm that systems engineers and marketing representatives use HONE about equally.

Plant sites and other internal computing centers use the HONE configurators to improve the accuracy of their equipment and software orders. Headquarters locations access the information retrieval data bases. The recently formed alternate marketing channels are growing users of HONE facilities.

During the past 18 months, special emphasis has been given to increased support of administrative functions. The independent administrative systems that make possible such functions as on-line order entry, billing, customer backlog checking, etc. have been in place even longer than HONE. Now, with the opening of new marketing channels and procedures, there is an increased need for administrative access to information about procedures, forms, terms and conditions, etc. Thus we have created for HONE a special EQUAL data base, called ADMIN/INFO, with on-line access to administrative specialists. Field administration personnel now have immediate access to consistent, reliable information in more than 30 subject areas ranging from order to product scheduling to tax regulations to accounts receivable. Plans for expanded administrative assistance are described later in this paper.

In addition, we have implemented a facility in HONE called Multiple Marketing Support Systems (MMSS). MMSS provides automatic transmission of volume purchase proposals to headquarters locations for on-line sign-off, thereby reducing the approval process by up to 10 days per proposal.

Direct delivery to customers. Since 1980, the HONE organization has produced two IBM Program Products, INFO/MVS and INFO/VM-VSE, that run under the INFO/SYS Program Product search facility. These products contain technical information such as bulletins, program fixes, tips, and techniques. Update tapes are supplied monthly to IBM Software Distribution (ISD) for subsequent shipment to subscribing customers. More recently, customers have had the option of receiving these updates on line via the IBM Information Network (IIN). Both products also are available to the field organization as a data base under HONE.

Early in 1984, IBM announced a new on-line customer offering called ASKINFO. During a defined contract period, Volume Purchase Agreement (VPA) customers have access to an on-line EQUAL data base of questions and answers on the VPA product line. They also may enter new questions.

In 1985, a field test program, called INFOExpress, offered selected customers on-line access to a subset of HONE facilities: sales manual, software catalog, publications catalog, announcement letters, and

An on-line bridge enables users to go automatically from one application to another.

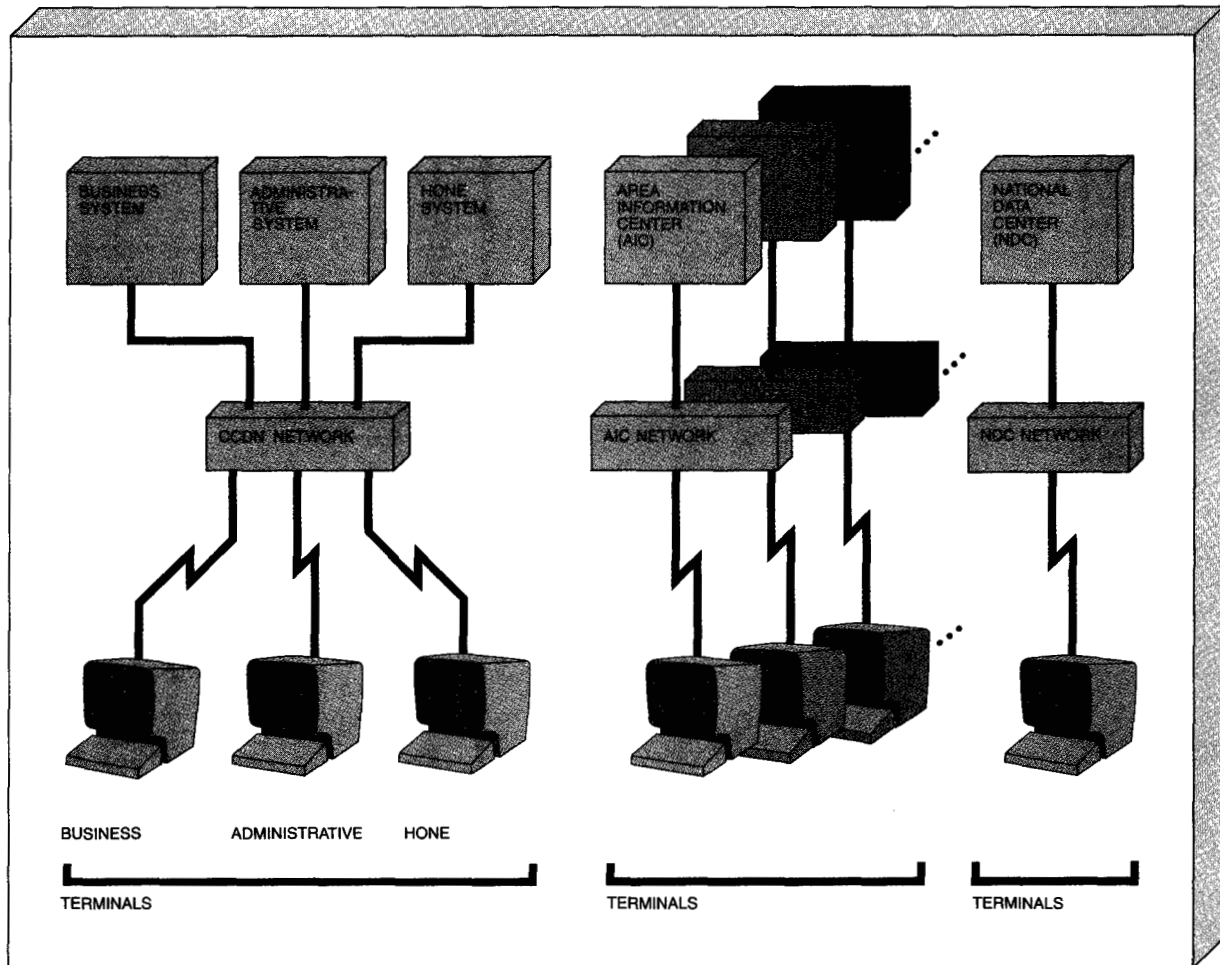
some of the configurators. The program has an electronic notes facility for on-line communication with the IBM branch office. INFOExpress is delivered to customers via the IBM Information Network (IIN).

Automatic inter-application transitions. Each of the several hundred individual applications and data bases on HONE today has been developed and added over time, with its own particular cost and productivity justification. However, field personnel do not necessarily use them in a stand-alone mode. Several sequences of two or more applications have been identified that are regularly used together. An on-line bridge or linkage has been implemented that enables users to go automatically from one application to another, rather than signing off one and onto another, or re-entering printed output from one application into another. Among these linked applications are the following:

- Automatic incorporation of final Configurator results into a Proposal document prepared on HONE
- Automatic transmission of Configurator output to the Administrative Order Entry System to save rekeying time
- The ability, at any point in a configurator or analysis session, to refer to the on-line sales manual and return
- Automatic transfer between the EQUAL and INFO/DATA data bases, for improved cross-reference capability

Linkages such as these increase the productivity of HONE by reflecting natural field processes, rather than requiring independent steps of work.

Figure 1 Today's networks



New delivery technology

The year 1985 marks the beginning of a planned cutover to a major new network architecture. This new architecture is designed to supersede the separate networks shown in Figure 1 that currently support the field organization. The new architecture will affect all the field-support systems on those networks; it has been designed to provide end users with a true single-system image, thereby enhancing the ease of use and productivity of the systems. Before describing the HONE enhancements for this environment, we discuss briefly the architecture of the hardware and software of the new network.

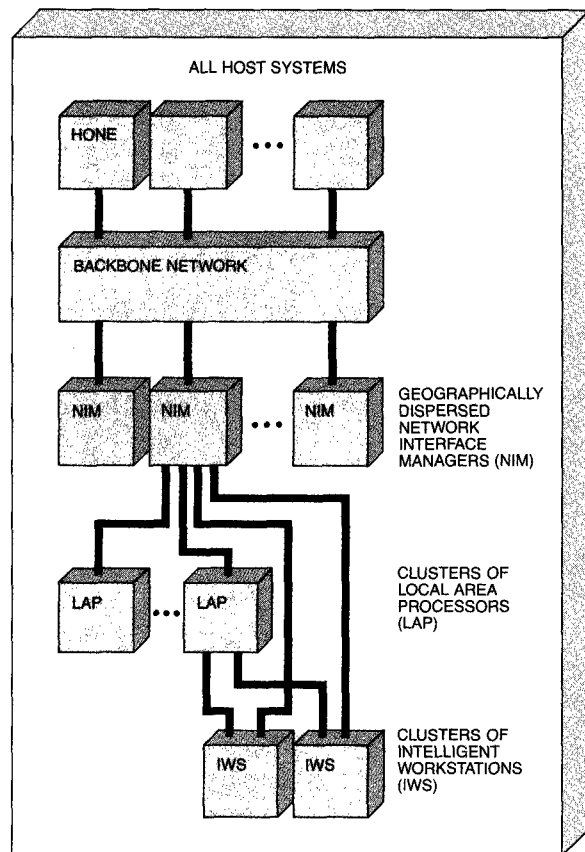
Figure 2 is a simplified representation of the overall network architecture. As shown in the figure, geo-

graphically clustered Intelligent Work Stations (IWS) and Local Area Processors (LAPs) are interconnected through a Network Interface Manager (NIM). Each NIM will have access to all of the field-support host systems through a backbone network of concentrators. High-level technology and alternate paths will make possible faster response time and maximum availability. The first NIM went into pilot test in March 1985. Others will be brought on line over the next two years.

Functionally, the NIM is the heart of the network. In it will reside much of the system intelligence for the following functions:

- Log-on and password processing
- Local and central network management

Figure 2 New network architecture



- Local session and terminal management
- Data collection for accounting and performance measurements
- Display management of initial application directories
- Host and end-user file-transfer management

Portions or subsets of these functions will also reside in the LAPs and host systems.

Effect on users. The anticipated benefits to users of the new network architecture are impressive. Until now, all of the functions just given, except the local and central network management, have resided in each individual host system. Separately developed, they imposed different procedures and protocols on users. For the most part, they required different physical terminals, different IDs and passwords, and different use of function keys. The new network architecture will give users a truly *single-system im-*

age. That is, with a single sign-on, a user will have direct access to all the applications on every host system, as well as to the Local Area Processor (LAP).

Replacement of today's terminals with Intelligent Work Stations (IWS) should provide equally powerful benefits for users. IWS processing capability and storage capacity will enable users to download data and applications from host systems for execution at local processing speeds. For example, when a user wants to review announcement letters, a file of multiple pages can be downloaded to the IWS for review at local display speed, rather than requesting and transmitting them one screen at a time. In addition, users will be able to combine data from different applications or hosts, to perform analyses or prepare tailored reports.

Preparation for the new architecture

Over the past two years, the HONEY designers have been deeply engaged in tasks to position HONEY for the new network. Many of these tasks are transparent to the user community, but others are already visible to end users. Some of the most important of these are the following:

Workstation pilot program. In 1984, the HONEY designers conducted a field pilot study that led to the selection of the IBM Personal Computer (PC) family as the strategic field workstation. Controlled replacement of field terminals with PCs has begun this year, paced by network capability and business considerations.

Concurrent system support of terminals and IWSs. This year, the HONEY organization installed a major enhancement to the user front end—called EZHONEY—that provides a concurrent interface to the current terminals and to their IWS replacements. EZHONEY also makes possible the following dual modes of access to HONEY applications and data bases: a *fast path* for experienced users, and a *guided menu path* for the casual or new user. Consistent user procedures for such things as function keys and naming conventions have been implemented across all HONEY applications. EZHONEY supports overall design specifications for the new network architecture, so that, at the proper time, appropriate portions can be migrated to the Network Interface Managers (NIM) and Local Area Processors (LAP).

A complementary EZHONEY interface is being installed on Intelligent Workstations. The functions resident in the IWS include the following:

- System management for error handling, security, space management, and data collection
- Display and dialogue management for the rws
- Distributed control for file transfer functions
- Development support functions to reduce development effort for future applications that will run in this environment and will interface with the other three functions

This interface is consistent with the new network architecture and will be usable by other host systems as they begin to support intelligent workstations.

Applications for the new network. Several HONE applications have been implemented during 1985 that anticipate the new environment.

One of these applications is a *net-additional configurator*. Until now, HONE configurators operated on the assumption that all elements of the hardware and software would have to be ordered. In reality, most new orders are upgrades to systems that are already installed or on order, and the marketing representative needs to correct the base. Therefore, the new configuration facility obtains installation and on-order information from the Administrative System for use by the appropriate configurator. The configurator uses this information to produce a *net-new-additional* output listing for automatic transmission to the order-entry application. This eliminates the need for manual comparison.

The new single-system network will facilitate appreciably the development of inter-host applications similar to this one.

Another application for the new network provides *on-line documents and forms generation*. In most IBM offices, administrative personnel maintain file cabinets of blank business forms. In recent years, business expansion has increased the number of forms and has accelerated the rate of form revisions. Ensuring the currency of forms has become increasingly difficult. In 1985, we implemented a pilot program called Documents Available When Needed (DAWN) that replaces the file drawers of forms with an Intelligent Work Station and the IBM 3812 high-speed, high-quality printer. DAWN makes possible the on-line availability of updated forms rather than using bulk distribution. Overnight, as required, HONE downloads to a workstation in each office a copy of the new and revised forms. During the day, administrative personnel can view the proper version of the form at the workstation and obtain hard copy printouts by pushing a button.

Follow-on expansion of this application plans to make possible the calling out of text or data from other applications for use in filling out the form on line. The expanded application could then print out copies and/or transmit them electronically. A natural extension of this distributed print capability involves such other high-volume/high-usage documents as announcement letters or sales manual material. Here the approach would involve selective distribution via user profiles.

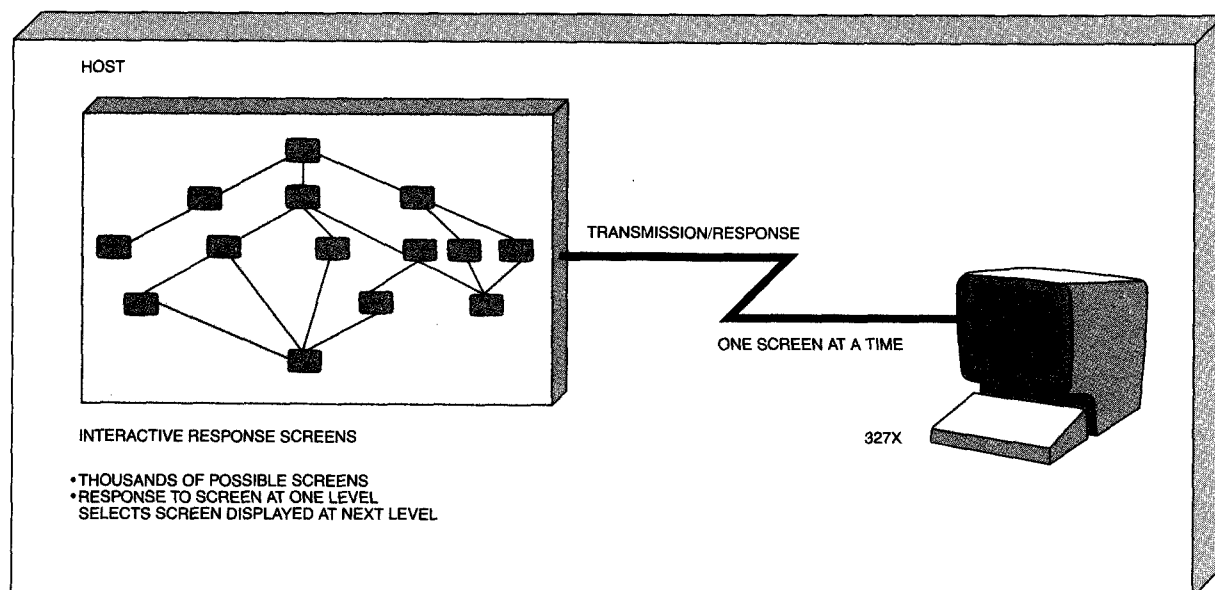
A third application is known as the *account administrator's SMART DESK*. The HONE SMART DESK sup-

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port being piloted this year will provide Intelligent Work Stations for all administrative personnel and a tailored subset of HONE offerings (including ADMIN/INFO, *Sales Manual*, *Branch Office Manual*, publications catalog, and similar useful HONE and local PC offerings). SMART DESK is an initial umbrella for the new network environment, under which administrative applications from other host systems can be made available to administration.

Cooperative processing for the configurators. More than any of the new HONE enhancements in 1985, the conversion of the most frequently used configurators to cooperative execution capitalizes on the capabilities and benefits of the new network environment and intelligent workstations. In the previously given scenario of a typical configurator session, a series of question-and-answer screens were filled in by the user to provide input. In execution from conventional terminals, HONE transmits the consecutive screens one at a time, selecting the next screen for transmission on the basis of input to the previous screens. The process (illustrated in Figure 3) is highly interactive and consists of many network transactions. When a configurator is developed, input response screens must be designed for every possible

Figure 3 Traditional configurator processing



contingency a user may wish to specify; hence, each configurator may have a file of hundreds of possible screens.

A simple approach to taking advantage of intelligent workstations would be to transmit the entire input response file of screens to the iws whenever a user invokes a configurator. However, that would nullify the advantage of the network-distributed processing capability. Every time a large file of screens was transmitted, the response time for other interactive users would be affected.

Usage analysis of the most frequently used configurators with large response screen files shows that they follow an 80-20 rule: 20 percent of the screens are invoked for 80 percent of the activity. The solution we are piloting in 1985 is illustrated in Figure 4. When a session begins, the most frequently used screens (i.e., the 20 percent) are already resident within the workstation for processing at local response-time speed. Only in infrequent instances, when a user requires a nonresident screen, is an additional host interaction required.

When the response file is complete, logic in the iws compresses and transmits it to HONE for high-speed host processing. The results are transmitted, in compressed form, back to the iws, where local display and print logic present it to the user.

This cooperative division of processing logic between the host and iws optimizes the advantages of the distributional capabilities of the network, the local interactive speeds of the iws, and the processing power of the host.

Tomorrow's capabilities and management challenges

HONE has progressed from batch processing with next-day turnaround to on-line execution; from tape records to indexed data bases; from dial telephone lines to network communications; from typewriter-like, impact-print terminals to full-color displays, high-quality printers, and intelligent workstations; from long strings of coded information to easy-to-use menus of multiple-choice input; from single-site operations to remote management of multiple sites. Such change has made possible an expanded set of offerings, improved service, and increased productivity for users. The proficiency of the HONE environment has matured in such management disciplines as the following:

- Eighteen-hour-per-day availability across four time zones
- Change and recovery management for hardware, software, and applications
- Asset protection procedures

- Remote operation of geographically replicated hosts, storage, and software

Until 1985, HONE and other IBM internal systems operated as self-contained microcosms. Now the new network architecture makes it possible for all these systems to become part of a macrocosm of cooperatively interacting distributed systems, with the goals of moving all applications and data outboard, as close to the end users as feasible.

New and future capabilities for users. Users should enjoy new ranges of power and convenience in obtaining information and assistance; that is, what they need, when they need it, and only as much as they need. "Drowning in paper" will not be replaced by drowning in electronic data.

Electronic publishing will provide on-line access to all published material for browsing, searching, or extracting selected hard copy. Voice, video, and graphics display and print capability will be incorporated.

Personalized delivery of information will be achieved by the automatic distribution of selected data through profiling techniques.

Software products can be delivered to customers on line, including supporting documentation. A cus-

tomers can confer on line with a systems engineer, each referring to the same document electronically. If the customer has an installation or execution problem, relevant data can be routed to the systems engineer and/or to a support center expert for on-line resolution. All parties can work with the same version of the document, with the assurance of currency.

Currency and consistency of data can be ensured. Instead of each host system having to maintain its own data base of product features and prices, for example, there will be one correct, current version to be referenced by all hosts and all users.

Response time for the most part will be at local workstation speeds. Interaction with the host will become the exception.

Applications and data bases will begin to merge within a host or between host systems, conforming to the natural process of a user's sequence of activities.

Expert systems and artificial intelligence techniques are being explored to enhance the power and convenience of existing and new applications. Table 1 suggests the potential for future configurators.

Figure 4 Cooperative configurator processing

