EDITOR'S PROFILE of this issue

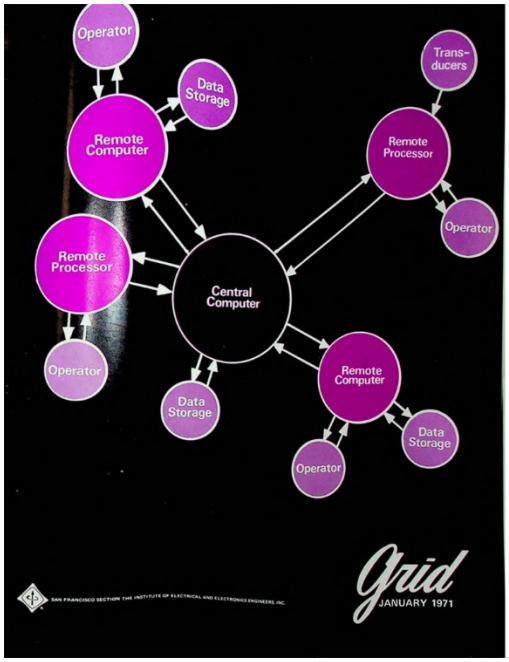
from a historical perspective …

with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

January, 1971:

Cover: Shown is a representation of a distributed computing system. Computer storage is covered in an article on page 6.

Page 15: Bob Lucky of Bell Labs returns to our Section to participate in a tehcnical symposium on digital communications.



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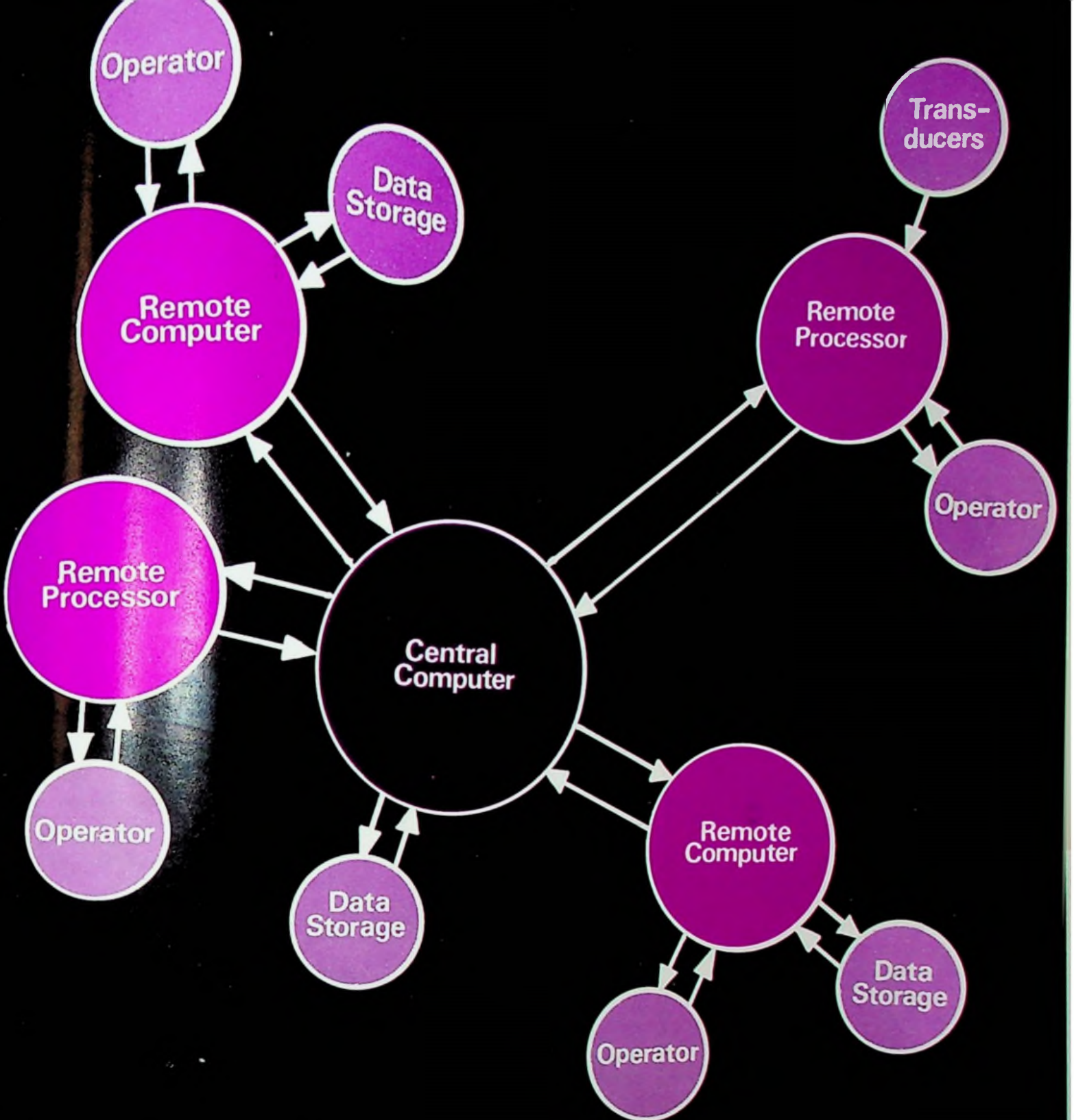
https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History

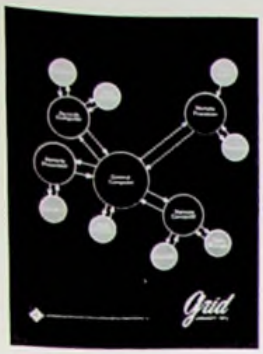
At time of scanning, the bound volumes are held by Paul Wesling. April, 2025 Contact p.wesling@ieee.org



SAN FRANCISCO SECTION THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Grid

JANUARY 1971



THE COVER

This issue of the Grid features three special articles. On pages 6 and 7 will be found "Computer Storage Techniques" submitted by the Computer Group through Steve Lundstrom. On page 9, the "California Aqueduct Control System" was submitted by Hewlett Packard. Pages 12 and 13 carry the story on Information Theory, and its inter-relationship with communication and computer systems. This article was submitted by the Information Theory Group Chapter through Tom Magill. The figure on the cover is a conceptual diagram of a geographically distributed Communication/Computer System.

Grid

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JANUARY 1971

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meeting

AEROSPACE & ELECTRONIC SYSTEMS
JAN. 21

Story on page 8

TOUR OF RINCONADA WATER TREATMENT PLANT. Tour Director; J. W. Garrett, Deputy Director of Engineering, Santa Clara Water District. Tour limited to 60 persons.

JAN. 21, Thursday, 7:00 PM, Santa Clara Water Treatment Center, More Ave., Los Gatos. See story for directions to plant. No dinner. For tour reservations: Pat Hoppe, (415) 326-4350 ext. 6143 by Jan. 18th.

ANTENNAS & PROPAGATION
JAN. 20

Story on page 14

RADAR TARGETS WITHOUT MODELS. Dr. J. Richard Huynen, Lockheed M & S Co., Sunnyvale.

JAN. 20, Wednesday, 8:00 PM, Lockheed Research Lab Auditorium in Bldg. 202, 3251 Hanover St., Palo Alto. Cocktails: 5:30 PM; dinner 6:15 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. No reservations required.

AUTOMATIC CONTROL
JAN. 19

Story on page 8

CONTROL AND INFORMATION FLOWS IN LARGE SYSTEMS. Prof. Pravin Varaiya, Dept. of Electrical Engineering and Computer Sciences, UC, Berkeley.

JAN. 19, Tuesday, 8:00 PM, Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto. Dinner: 6:15 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. No reservations.

CIRCUIT THEORY
JAN. 23

Story on page 16

THIRD ONE-DAY SEMINAR ON ACTIVE RC FILTERS: THEORY AND APPLICATIONS.

JAN. 23, Saturday, 9 AM to noon; 1 PM to 5 PM, SLAC Auditorium, 2575 Sand Hill Road, Menlo Park. Fee includes lecture notes and lunch in SLAC cafeteria. For registration form and information see story.

COMMUNICATION TECHNOLOGY/SAN FRAN SECTION
JAN. 19

Story on page 15

ALL-DAY TECHNICAL SYMPOSIUM: TRENDS IN DIGITAL COMMUNICATION. R. W. Lucky and D. D. Sullivan of Bell Telephone Labs, N.J.; Jurgin Elkan, General Tel. & Electric Lab, Waltham, Mass.; William C. Hood, Pacific Telephone, San Jose.

JAN. 19, Tuesday, 9 AM, Cabana Hyatt House, 4290 El Camino, Palo Alto. $6.50 fee includes luncheon. Reservations: Don Kidder, (415) 591-8461, ext. 897, by Jan. 15th.

COMPUTER
JAN. 26

Story on page 3

INTERPRETING THE RESULTS OF A HARDWARE SYSTEMS MONITOR. Dr. E. David Crockett, formerly V.P. of Computer Synectics, Santa Clara.

JAN. 26, Tuesday, 8:00 PM, Skilling Auditorium, Stanford. Dinner: 6:15 PM, Rick's Swiss Chalet, 4085 El Camino, Palo Alto. Reservations: Judy DeMetre, 321-3300, ext. 270, by Jan. 25th.

EAST BAY SUBSECTION
JAN. 25

Story on page 14

TOUR OF KTVU TELEVISION STUDIOS. Jack Butterfield, Assistant Chief Engineer, KTVU, Oakland.

JAN. 25, Monday, 8:00 PM, KTVU Studios, No. 1 Jack London Square, Oakland. Reservations: Peggy Youngs, (415) 843-2740 or (415) 447-1100, ext. 7671, by Jan. 22nd.

ELECTROMAGNETIC COMPATIBILITY
JAN. 18

Story on page 13

EMC IN SMALL, HIGH FREQUENCY POWER CONVERTERS AND REGULATORS. Eugene R. Hnatek, Product Marketing Dept., National Semiconductor Corp., Santa Clara.

JAN. 18, Monday, 8:00 PM, Hewlett-Packard Auditorium, 5301 Stevens Creek Blvd., Santa Clara. Dinner: 6:15 PM, Custom House Restaurant, 20060 Stevens Creek Blvd., Cupertino. Reservations: Don Clark, (415) 321-3320, ext. 404, by noon, Jan. 18th.

calendar

EELECTRON CDEVICES
JJAN. 19

Story on page 14

CURRENT FLOW IN INSULATORS. C. A. Mead, CIT, Pasadena.

JJAN. 19, Tuesday, 8:00 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. CCocktails: 6:00 PM; dinner: 7:00 PM. Reservations: Section office (415) 327-6622.

EENGINEERING MMANAGEMENT
JJAN. 13

Story on page 8

DECISION-MAKING AND THE TIME-SHARED COMPUTER. T. J. O'Rourke, President and Chairman of the Board, TYMESHARE, Inc.

JJAN. 13, Wednesday, 8:00 PM, TYMESHARE, Inc., 10201 Bubb Road, Cupertino. No-host cocktails: 6:00 PM; dinner: 6:30 PM, Blackberry Farm REstaurant (Chez Marcelle) 22100 SStevens Creek Blvd., Cupertino. Reservations: Sue Mendell, (415) 321-2300, ext. 3619, by JJan. 11th.

EENGINEERING IN MMEDICINE & BBIOLOGY
JJAN. 12

Story on page 10

COMPUTERS IN DIAGNOSTIC MEDICINE. Richard Crow, M.D. and William Sanders, Stanford Univ. School of Medicine.

JJAN. 12, Tuesday, 8:00 PM, Stanford Univ. Medical Center, Room M-112. Dinner: 6:00 PM, Red Cottage, 1706 El Camino, Menlo Park. Reservations: Harry Miller, 321-1200, ext. 66141, by 5:00 PM, Jan 11th.

GGOLDEN GATE SSUBSECTION
JJAN. 14

Story on page 10

SOCIAL RESPONSIBILITY OF ENGINEERS. Gerd D. Wallenstein, Lenkurt Electric Co., San Carlos.

JJAN. 14, Thursday, 12 noon, Leopard Cafe, 140 Front St., San Francisco. Reservations: M. WW. McLaren (415) 764-5234 or Ken Walters (415) 399-2105 by Jan. 13th.

IINFORMATION THEORY
JJAN. 21

Story on page 11

DETECTORS, BANDPASS NONLINEARITIES AND THEIR OPTIMIZATION. Nelson M. Blachman, Senior Scientist, Sylvania Electronic Systems, Mt. View.

JJAN. 21, Thursday, 5:30 PM, Stanford Research Institute Bldg. 1, 333 Ravenswood Ave., Menlo Park. Dinner: 7:30 PM, Sakura Gardens, 2116 El Camino Real, Mt. View. Reservations: Gieri Gibling, (415) 326-6200, ext. 3381, by Jan. 20th.

POWER
JAN. 12

Story on page 11

EDUCATION IN ELECTRIC POWER ENGINEERING. Dr. David W. Olive, Prof. of Electrical Engineering, USC.

JAN. 12, Tuesday, 7:30 PM, Engineers Club of San Francisco, 160 Sansome St., S.F. Cocktails: 5:30 PM; dinner 6:30 PM. Reservations: Engineers Club (415) 421-3184, by Jan. 12th.

RELIABILITY
JAN. 14

Story on page 10

APPLICATIONS OF VIDEO TAPE IN ELECTRONICS. C. R. Mahurin, Corporate Training Mgr., Hewlett-Packard Co.

JAN. 14, Thursday, 7:30 PM, Hewlett-Packard Training Center, 640 Page Mill Road, Palo Alto. No dinner — coffee and cookies will be available.

SYSTEMS, SCIENCE & CYBERNETICS
JAN. 18

Story on page 11

A SURVEY OF ATTEMPTS TO COMMUNICATE WITH A COMPUTER IN ENGLISH. Dr. L. Stephen Coles, Research mathematician with Artificial Intelligence Group at SRI.

JAN. 18, Monday, 8:00 PM, Conference Room B, Bldg. 1, SRI, 333 Ravenswood Ave., Menlo Park. Dinner: 6:00 PM, Coach and Six, 1906 El Camino, Menlo Park. Reservations: Section office, (415) 327-6622 by noon, Jan. 15th.

VEHICULAR TECHNOLOGY
JAN. 18

Story on page 8

RADIO COMMON CARRIER TODAY AND TOMORROW. Don Cook, President, Cook's Communication Corp.

JAN. 18, Monday, 8:00 PM, DiMaggio's Restaurant, Fisherman's Wharf, San Francisco. Cocktails: 6:00 PM; dinner: 7:00 PM. Reservations: G. L. Godwin, (415) 894-4675 or (415) 894-4492 by Jan. 18th.

Interpreting computer measurement results

Recently, hardware monitoring devices have come into use to assist the data processing manager in fulfilling his responsibility to meet data processing needs with a cost effective computer system. A brief overview of hardware monitors and the necessity of system measurements will be presented at the January 26th Computer Chapter meeting. The selection of events to be measured — significant occurrences in the processing of a unit of work by the system — will be shown. A "performance optimization cycle" is developed and actual results of a monitoring run are shown.

The major focus of the talk will be the heretofore neglected area of interpretation of the results. The stress is on providing quantitative measures to assure that an economic return on the computer system is obtained. The system performance profile is presented and the basic indicators in interpreting the profile are developed. Methods are given for corrective actions of system reconfiguration, program changes, data set reorganization, job scheduling, and operator procedures. Predictive methods are developed whereby corrective actions can be evaluated prior to their implementation.

The speaker is Dr. E. David Crockett who received the BES degree from Brigham Young University in 1962, the MS degree from Stanford University in 1964, and the Ph.D. degree from the University of Illinois in 1967. At the University of Illinois his Ph.D. dissertation was on serial decomposition of sequential machines. In 1969, he was a Guest Lecturer in Electrical Engineering at Stanford.

Dr. Crockett has authored technical papers in communications, sequential machine decomposition, computer-aided systems design, and computer system measurement and performance. He is a member of IEEE, ACM, American Academy for the Advancement of Science, New York Academy of Sciences, Blue Key, Tau Beta Pi, and Sigma Xi.

The meeting, scheduled for January 26, 1971, will begin at 8:00 P.M. in Skilling Auditorium, Stanford (near Durand Building). The dinner preceding at 6:15 will be at Rick's Swiss Chalet. For dinner reservations, call Judy DeMetre, 321-3300, ext. 270, by January 25.

FELLOW AWARDS

ARTHUR FONG

For contributions to microwave measurement techniques and instrument design.

Art Fong joined Hewlett-Packard in 1946 as a development engineer. He was promoted to signal generator group leader in the Microwave Division in 1953 and to section head in charge of spectrum analyzer development in 1960. In 1964 he was one of three engineers honored by HP's board of directors by appointment to the newly-created position of senior staff engineer, recognizing those making significant contributions to the company's technical progress. In July of 1970 he was named research and development manger of Yokogawa-Hewlett-Packard, Ltd. in Tokyo.

Before joining HP, Fong was employed by Massachusetts Institute of Technology's Radiation Laboratories and by an FM radio laboratory.

He holds a degree in electrical engineering from the University of California and has done graduate work at MIT and Stanford University. A member of the Institute of Electrical and Electronics Engineers and the Research Society of America, he holds several patents on microwave devices.

WILFRID F. NIKLAS

For technical contributions in image intensification devices, and leadership in the application of these devices for medical diagnostic purposes.

Dr. Niklas has attained considerable stature in the field of image intensification, and is now president of a joint-venture company to exploit this equipment, Varian/EMI, of Palo Alto, California.

The field of image intensification, especially as applied to X-Rays, has valuable medical implications in permitting lesser dosages for diagnostic exploration and in other applications. He has made important contributions in cathode-ray tube technology, low-light-level amplifiers and zoom camera tubes. The breadth of his work is attested by the roster of publications and patents. Dr. Niklas has been an exceptionally prolific and creative technical contributor in these fields of light-sensitive and emitting devices.

While other work is of a classified nature, it can be stated with assurance that he has contributed to low-light-level applications to military use both directly and indirectly. Equally important has been the liaison with the medical profession in developing quite exotic devices for their needs. Dr. Niklas has headed research teams of up to 100 people and continues in this leadership role in cooperation with the British firm of EMI (Electrical and Musical Industries, Ltd.).

JOHANN R. HECHTEL

For contributions to electron optics, microwave tubes, and the development of the electrostatically focused power amplifier klystron.

Dr. J. R. Hechtel is a well-known figure in the world of high power microwave tubes, both in the U.S.A. and abroad, on account of his publications and his appearance at IEEE conventions and at International Microwave Tube Conferences in Europe and Japan. He obtained his Ph.D. in Germany in 1940, and since then his career has been characterized by a number of successful attempts to advance the state-of-the-art in methods of analysis and in electron device design. In Germany, from 1940 until 1958, his pioneering contributions which are well documented were mainly in electron optics. Noteworthy are his papers on electron ray tracing applied to the improvement of electron guns, using an early form of analog computer he developed.

Since 1958, in the U.S.A., he has become known mainly for his work with the electrostatically focussed multi-cavity klystron power amplifier. Others have made contributions in this field but before Hechtel it was widely believed that this device, so attractive in concept, would never be made to work in useful form with acceptable characteristics. Now of course its place is assured.

DIOGENES J. ANGELAKOS

For contributions to antenna research, to engineering education, and for administration in university research.

Dr. Angelakos received the BSEE from University of Notre Dame in 1942 and joined Westinghouse Electric Corporation, where he worked on 3 cm. magnetrons for a year, being given major responsibility of their design when magnetrons were pretty much "state-of-the-art." In 1943, he returned to Notre Dame as an instructor, and over the next three years, his responsibilities included setting up the microwave laboratory there, as well as teaching graduate courses. Realizing his need for advanced education, he enrolled at Harvard and

received his MS degree in 1946 and Ph.D. in 1950.

In his early work at California, Dr. Angelakos worked on flush-mounted antennas for use in aircraft-carrier approach antenna system. He was the first to show that ferrites could be used to shift the radiation pattern of an antenna, and used ferrites to couple energy between two different modes of propagation in a multi-mode wave guide.

Dr. Angelakos has also been active in education within the Department of Electrical Engineering and Computer Sciences at Berkeley. He helped develop a course on microwave communications, which resulted in a book by that name. More recently, he has guided organized research in the Department as Director of the Electronics Research Laboratory, and has demonstrated great qualities of leadership in this position. He has been the invited guest of both the Polish and Hungarian Academies of Science during 1966 for two weeks each, and has a similar invitation for the Spring of 1970 in Rumania.

GEORGE L. TURIN

For contributions to statistical communication theory and its applications.

Professor Turin received his Ph.D. degree from MIT in 1956. Since then, he has had an outstanding career as a researcher and teacher. His early papers on statistical communication theory and random multipath channels are basic references. His paper on matched filters is the standard reference on the subject. More recently, he pioneered the important investigations on communication systems with information feedback. A glance at the citation index of the IEEE Transactions on Information Theory for the last few years shows that Professor Turin's work is among the most cited in the field.

Professor Turin has also made important contributions to professional activities, especially those of IEEE. He was the Program Chairman of the important 1959 International Symposium on Information Theory, held at Los Angeles. He has held many important offices, both local and National, in the Information Theory Group, culminating in the chairmanship of the International Administrative Committee from 1961 to 1962. He was a member of USA Commission VI of URSI and of the USA delegation of the XIV URSI General Assembly.

Professor Turin is well known as a teacher, having been responsible for establishing the curriculum in communication theory and stochastic processes at Berkeley. He is also well known for his role as the principal lecturer in the summer course on communication theory at the University of Southern California and as a consultant to industry.

R. ALBERT ISBERG

For contributions to the engineering aspects of television broadcasting, and for leadership in demonstrating the important application of television techniques to university-level teaching.

Mr. Isberg is without question the engineer most intimately associated with television in the San Francisco Bay Area. His introduction to the industry was in New York as part of the technical crew of the world's first commercial television station W2XBS, which is now WNBT. Immediately after the war he came to San Francisco to design and put into operation this area's third television station, KRON-TV. He was a key part of the small group at Ampex which brought videotape recording into being and revolutionized the entire industry. In 1960, Mr. Isberg established the then unique concept of a television office at the University of California at Berkeley. Under his direction, Berkeley experimented with a wide gamut of instructional television techniques, ranging from relatively simple closed-circuit systems to provide close-up views for large audiences to extensive multi-campus live lecture exchanges which is in most extensive use today. In his later role as communications engineer for the massive statewide University of Calif. complex, Mr. Isberg explored and demonstrated numerous advanced concepts for high speed interchange of graphic material over long distances for library, business, and lecture purposes. The findings of these tests have provided both guidance and challenges for an important segment of our industry.

Few men in this area have devoted as much time and devotion to professional society activities as has Al Isberg. He has been chairman of the San Francisco Section of both the IRE and the SMPTE.

WILLIAM H. KAUTZ

For contributions to the fields of switching networks and error-correcting codes, and to engineering education.

Dr. Kautz is currently a Staff Scientist of the Stanford Research Institute, and he has worked in this area since receiving his doctoral degree in 1951.

Since his early work in designing the variable-redundancy code and the memory executive system of the SRI-ERMA computer, Dr. Kautz has been an outstanding and prolific contributor to the theory and design of information processing machines. The central themes of his work have been twofold, first the deepening of the understanding of the fundamental relationship between the structure and the behavior of switching networks, and second, the development of coding schemes that are best suited to the physical characteristics and constraints of particular information systems. His major contributions have been in the theory and design of switching networks, the theory and practice of error-correcting codes, and the theory and practice of fault-tolerant logical networks.

An indication of the significance and quality of his contributions is given by highly laudatory reviews, in the June 1966 Spectrum of his survey paper on Soviet Switching Theory, and in the January 1969 Computing Reviews.

Computer storage techniques

With the recent introduction of semiconductor memories in computers, there has been an increased interest in computer storage techniques. The following discussion will briefly discuss the concepts behind these techniques for those unfamiliar with computer organization. The Computer Group is planning a Symposium on LSI Memory System Organization which will cover some of these topics in much greater depth. Watch the GRID for the announcement.

A programmable digital computer consists of only a few basic elements as shown in Figure 1. In any application, a computer must "communicate" with the people operating and using it. The man/machine interface where this communication takes place may involve card readers, line printers, teletypes, display terminals or voice response units. In many applications, a computer is also used to control other hardware. Control applications range from control of steel mills to control of typesetters; from control of medical diagnostic equipment to monitoring and control of space probes. In any application, there is a need for a way to store the instructions which are executed by the computer (the program) and to store the data the computer is to manipulate, use, generate, or collect. The technologies available for the required storage vary widely in cost, capacity and speed of data retrieval. Typical of these technologies are the magnetic tapes, magnetic discs, magnetic cores and semiconductor memories available from Bay Area companies.

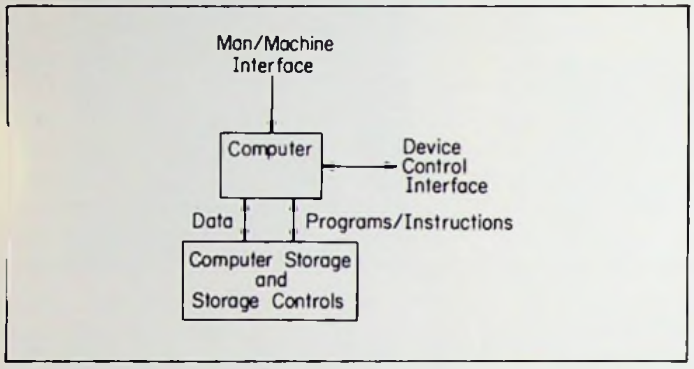


Figure 1: Basic Computer Organization

Sequential Storage

In general, the least expensive storage technique is a sequential or linear technique. It is simply a "linear" storage medium which can be moved past a data control point (see Figure 2). Any writing (storing) or reading (retrieving) of information can occur only at the control point. Thus, if some unit of information is desired which is not at the control point, the control unit must move the storage medium until the information desired is at the control point. The magnetic tape is a typical example. The tape is the storage medium, in this case by unidirectionally magnetizing the magnetic material on the tape. To retrieve information, the tape must be moved from one reel onto another until the unit of information desired is at the control point (read/write head) where it can be accessed. Sequential storage often requires long times to access a particular unit of information because of the time required to move the information to the control point. However, if the information desired is also sequentially organized, the sequential storage media is very economical and may be a satisfactory technique.

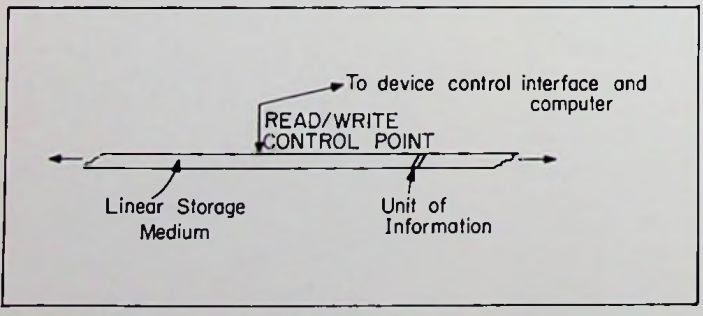


Figure 2: Sequential Storage Technique

Cyclic Storage

Cyclic Storage has the property that all information in the storage is available at the control point periodically. The technique is best visualized by looking at Figure 3. Consider that the "linear" storage medium discussed in the previous section is wrapped around so that the front and back ends are connected. Then allow this information to be continuously moved in one direction past the control point where information is read or written. Again, there is obviously a delay before the desired information is at the control point (access time), but because the medium is not starting and stopping in the case of the electromechanical versions of this technique, the technologies allow much faster accessing of the information. The most common implementations of this storage technique are magnetic discs and magnetic drums. A disc is a rotatable metal platter. A drum is a rotatable metal cylinder. In either case, there may be only one control point which can be moved to different rings (tracks) of the disc or drum surface, or there may be many control points which monitor all of the tracks in parallel. Selection of a track of information is accomplished mechanically by moving the control point in the first case and electrically by logically selecting the control point desired in the second case. The second case is faster because of no mechanical motions but is more expensive usually because of the additional read/write electronics.

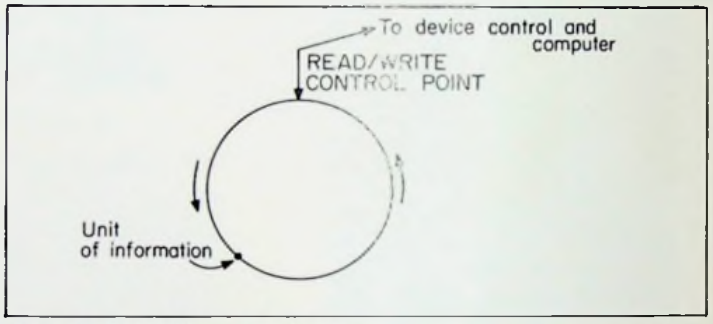


Figure 3: Cyclic Storage Technique

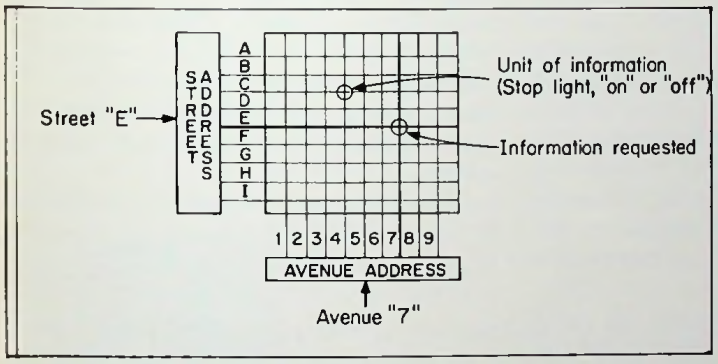
A more recent implementation of the cyclic storage tech-

nnique is the semiconductor shift register memory. This technnique is faster and more expensive than the electromechanical vversions discussed above. Semiconductor LSI shift register eelements are interconnected to have many of the characteristics eof a disc or drum system. The information is accessible only at tthe output of the shift register and can be written only at the iinput of the shift register. Electronics join the output and iinput to make the system cyclic. Such a memory is certainly sslower than generally available random-access memory (discussed in the next section) but is faster than disc or drum mmemory systems because no mechanical motion is required. MNote, however, that in the case of power failure, the information in the semiconductor memory will be lost (usually not ttrue for magnetic memories).

In some of the cases mentioned above, the storage media ccan be used as "off-line" storage. That is, the storage media ccan be removed from the control unit, kept at some other llocation until it is needed, and then replaced on the original ccontrol unit (or some other one with the same characteristics) aand the information will be retained. Magnetic tapes and some ttypes of magnetic discs have this property. It is especially uuseful in the case of large amounts of data which is infrequentlyy used.

FRandom Access Storage

Random Access Storage, as its name implies, is storage wwhere data can be easily accessed at random, with no penalty iin performance due to the location of the desired information. OOne way where all units of information are accessible in the ssame amount of time is shown in Figure 4. All of the information can be considered arranged in an array. Consider each unit



FFigure 4: Random Access Storage Technique

cof information can be specified by the status of the stop light aat the intersection of a "street address" and an "avenue aaddress." If both the street and avenue address are given, only cone unit of information, the information required, is available. MMany physical systems implement this storage technique. Disc aand drum memories discussed in the previous section can iimplement random access storage techniques if some additionaal logic controls are added. In these cases, angular position and ttrack address might be the coordinates used to locate a particular unit of information. The most commonly-used random aaccess storage technique today is the magnetic core memory. IIn this technology, there are a set of "street" wires and a set of "avenue" wires, each of which thread through magnetic toroids. The toroid at which the "street" and "avenue" wires coincide is the one which holds the information of interest. The newest random access storage technique is the semiconductor memory. Most semiconductor memory systems are faster (and more expensive) than core memories. They allow the same fabrication techniques as those in the rest of the computer to be used. The "streets" and "avenues" are implemented both in logic addressing on the printed circuit boards and in the LSI memory devices themselves. The general rule of the faster it is, the more expensive it is holds in the case of random access memories also.

A special case of the random access memory is the read-only memory. This kind of memory is accessed at random, but the data in it is fixed at the time of construction. Because read-only memories are usually less expensive than read/write memories, applications where the contents of the memory do not change, such as code conversion for a particular device, or process control programs which are not being modified, read-only memories are often considered. Data in read-only memories is not affected by cycling power. With appropriate design, magnetic core memories can retain their data through power on/off cycles but semi-conductor memories cannot.

One of the newest computer storage organizations is the buffer memory (sometimes known as a cache memory). A buffer memory (which is a random-access memory) is used in conjunction with a second random-access memory called the main memory of the backing store. The buffer memory is usually about ten times as fast as the main memory. In operation, the buffer memory itself is transparent to the user. The user, therefore, is only concerned with the information and addresses to the information in the main memory. Additional electronics are added so that when information is accessed from the main memory, that information and its closest neighbors (for example, all units of information on a "street" are saved in the buffer memory. If that information or its neighbors is accessed again, it is retrieved from the buffer (very fast) instead of from the main memory (slower). If the buffer is sufficiently large, the majority of the access will be from the buffer, thus giving a faster average access time to the data in the main memory.

This short discussion of various memory storage techniques cannot go into sufficient detail (nor is it intended to) to provide the detailed information to determine the proper memory organization for any particular computer system. More information can be obtained from the Computer Group publication, COMPUTER. The November/December 1970 issue is devoted to advances in memory system technology, memory element design and trends in data organization and access methods. One should note that there is no "best" computer storage organization for all applications. Intelligent consideration of the actual requirements for system performance and the natural organization of the data to be handled together with the storage techniques available can result in an economical storage system which combines many of the techniques discussed above.

contributed by: Computer Group

Decision making and the time shared computer

Only five years ago time-sharing was a campus curiosity depending entirely upon government research funds. Today, time-sharing is a full-fledged industry offering a wide variety of services to businessmen and engineers alike.

Timeliness and economy are important and vital in all facets of business and industry. Here the time shared computer is far superior to any other method in use. Thus the engineer, the market forecaster, the accountant, and the shipping clerk can, with a call to a single local telephone number, receive "up to the minute" data and immediate solutions to his particular problem.

A presentation on this subject will be made by Thomas J. O'Rourke at the Engineering Management Chapter Meeting on January 13th. Mr. O'Rourke is President and Chairman of the Board of TYMESHARE INC. TYMESHARE is one of the largest and best organized computer time-sharing services in the United States.

Mr. O'Rourke received his BSEE from the University of Washington. Prior to becoming President of Tymeshare, Mr. O'Rourke was the Western Region Marketing Manager of the Computer Department of the General Electric Company and has served in many executive positions for the company in Business Data Processing and Computers.

Thomas O'Rourke

After the presentation, a tour will be conducted of TYMESHARE's computer facility in Cupertino.

Demonstrations of the time-shared computers capability will be held. There will be an opportunity for those that are interested to operate the terminals themselves. In addition to programs specifically tailored to business and industry, those gamblers within the group can try their luck at Blackjack or Draw Poker with the computer as dealer.

Preceding the presentation, an optional cocktail hour and dinner will be held at nearby Blackberry Farm's Restaurant (Chez Marcelle), 22100 Stevens Creek Blvd. The menu is Roast Beef, $4.50 including tax and tip. See calendar for details.

Water center tour

The Aerospace and Electronics Systems Group will feature a tour of the Santa Clara County Water Treatment and Distribution Control System and Center on More Avenue in Los Gatos. Mr. J. W. Garrett, Deputy Director of Engineering, Santa Clara Flood Control and Water District, will conduct the tour of this large new facility on Thursday, January 21, at 7:00 PM.

This computer-controlled water treatment and distribution system is a particularly interesting example of the application of Aerospace System design concepts. The overall system has a capability of 40,000,000 gallons per day. Remote station sensors at numerous locations in Santa Clara County report water quality, water flow, water level, pressures, and valve settings to the central process computer. The computer, together with the monitoring display console, controls the distribution of the water to numerous retail agencies and to irrigation and percolation facilities.

To reach the Center, turn off Freeway 280 south on Lawrence Expressway, continuing on Quito Road to Pollard Road. Turn east on Pollard to More Avenue and south on More to the Main Plant.

Tour is limited to 60 persons. For reservations call Pat Hoppe, 326-4350, ext. 6143, by January 18.

Radio common carrier

The Vehicular Technology Group will meet Monday, January 18, 1971 at DiMaggio's Restaurant, Fisherman's Wharf, San Francisco, to hear Mr. Don Cook talk on "Radio Common Carrier Today and Tomorrow." Cocktails are at 6:00 PM, dinner is at 7:00 PM and the meeting is at 8:00 PM'

Mr. Cook will cover the radio common carrier business as it is today and where it is going tomorrow. He will cover new aspects of the business as well as technics, the effect of miniaturization, voting systems, etc. He will cover the growth of one-way paging and the move toward citywide personnel communication. He will also discuss telephone dial paging as well as the move toward automation of services and the flexibilities possible in different systems and operations.

Mr. Cook attended high school in Hamilton, Ohio, and attended the University of Cincinnati. After serving in the Army Signal Corps and teaching Radar and Electronics for three years in Fresno, he decided to remain in California and open a business which he did in 1947. He now owns and operates several companies throughout California. He employs over 100 people and serves 5,000 customers. He has been a radio ham since 1937.

Control and information flows in large systems

The Automatic Control Group will meet on Tuesday, January 19, 1971, at 8:00 PM in the Lockheed Auditorium, Bldg. 202, 3251 Hanover Street, Palo Alto. Professor Pravin Varaiya will speak on "Control and Information Flows in Large Systems."

A large system is characterized by the fact that the system behavior is governed by more than one decision maker each having partial information of the state (and the environment) and partial control. Organization can then be defined as the distribution of information and control. The central question is: "Which organizations are compatible with a given goal?" Examples from economics, automata theory, and transportation networks are presented. If time permits, reference will be made to sociological insights gained from this approach.

Pravin Variya received his BS degree from University of Bombay, and the MS and Ph.D. (1966) degrees from the University of California at Berkeley, where he is now an Associate Professor of Electrical Engineering and Computer Sciences.

Pravin Varaiya

A meet-the-speaker dinner will be held at 6:15 PM at Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto, No reservations necessary.

California aqueduct control system

The California Department of Water Resources has embarked on the largest single hydro project in the world to be financed at one time. The 450-mile California aqueduct system involves use of 21 pumping stations in moving water from the northern half of the state to the southern half. The average annual rainfall in California ranges from more than 100 inches per year in the mountainous areas of the northwest to about 2 inches per year in the desert areas of the southeast.

The primary purpose of the project is to conserve and convey surplus surface waters of northern California to areas in need in central and southern California, where it will be used for agriculture, municipal and industrial purposes. In the overall system there are 27 pumping and power plants, 66 check structures with 213 separate gates and a minimum of 49 major turnout structures where deliveries will be made to water service customers.

Probably the first question that occurs to anyone is: "Why have these pumping stations, check structures and an elaborate control system been designed merely to let water flow through an aqueduct?" The answer lies in the principal objectives of the system. Normally, it would take a particle of water eight to ten days to travel the total distance of 450 miles. Under ordinary conditions, without special controls, water status and regulation at the beginning end of the system would have to be forecast at least eight to ten days in advance to provide service to the terminal end. The engineers of the Department of Water Resources studied the problem at length and developed what is known as the Controlled Volume Concept of Operation. The purpose of this concept is to make an open canal operate as much like a closed pipeline as possible. One of the fundamental characteristics of a pipeline system is that it responds quickly to changes in demand. Ordinarily an open conduit system is not so responsive; to get more water out of the far end you have to put more water in at the head. Furthermore, the hydraulic head of the wave action resulting from the input of water has to work its way down the aqueduct. This is a slow process, taking eight to ten days, as previously mentioned. In the controlled volume concept, pumping units and check structures are operated in unison when a change of flow is required. Simultaneously additional pump units are operated and gates positioned to cause an increase in flow in every reach from one end of the system to the other.

In the conventional system of aqueduct operation, checks are irregularly spaced and are used to hold the water level sufficiently high to serve the upstream turnouts. In achieving the controlled volume concept it was decided to use check structures spaced at regular intervals, thus subdividing the aqueduct system into a series of small reservoirs, each containing a constant volume of water.

In a conventional aqueduct system many facilities are operated manually on telephone instruction from a central office. For the State Water Project it was decided to start with a remote control system operated from control centers along the aqueduct which can be converted to a centralized computer control system at a later date.

Each of four area control centers communicates with a designated section of the aqueduct system and monitors and/or controls events at the check structures, pumping plants, flow measurement stations, and turnouts. Each area control center contains a digital computer which operates through a console which is the primary man/machine interface for the system. The peripheral equipment included in the area control center includes high speed paper tape equipment, mass storage, an input/output teletypewriter and other essential peripherals. The area control center makes a complete scan of all remote sites under its surveillance every minute. The operator at the area control center has a visual CRT display on which he can call up any of the structures or plants on the canal and read a page of data which will indicate all of the variables at that site. Should the operator desire to change any of the parameters or set-points, then he simply moves a cursor on the CRT display to the variable that he desires to change and types in the new value. Once he is satisfied that the value he has typed is correct, he then depresses an execute button and the new parameter is immediately incorporated in the system. The area control center processor transmits this data over the telephone lines to the remote site where a processor immediately accepts the setpoint and starts the necessary action at the structure to meet the new requirements. The information on the CRT display is continually updated each minute.

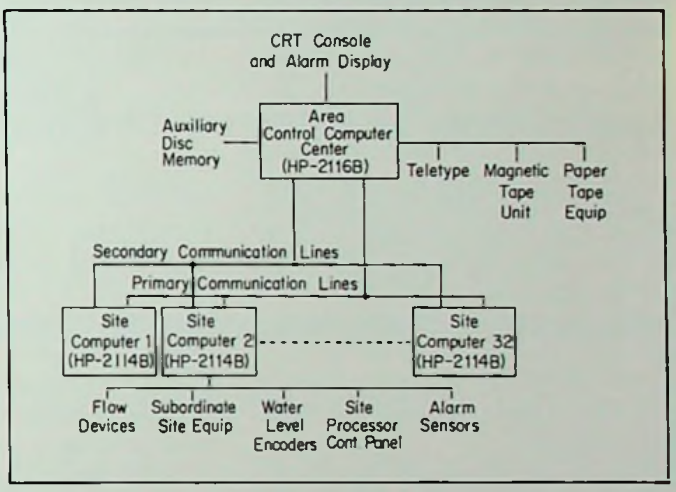


Figure 1. Aqueduct Area Control Computer System

The site equipment includes a variety of digital to analog, analog to digital, digital to resistive, shaft encoder, flow measuring, velocity measuring, power/current/voltage measuring, data modem, and specially fabricated encoding and decoding devices. The site computer system continually scans the various devices and stores the resultant data, status and alarm intelligence until interrogated from the area computer system. It also processes and issues coded commands received from the site processor control panel and from the area control center. In addition to interrogating and storing the most recent data from site devices and subordinate sites, the computer performs certain number conversions and mathematical computations. All devices at each site are scanned every three seconds by the site processor. In the future, the site processor will also determine flow requirements for customer usage and position the turnout gates to ensure that the user receives the water for which he contracts at the time he desires it.

Article submitted by HEWLETT–PACKARD

Dedicated computers in diagnostic medicine

The San Francisco Group Chapter on Engineering in Medicine and Biology will host a most interesting session on the application of small dedicated computers in the field of "diagnostic medicine." Two eminently qualified speakers will discuss their present experiences in the use of computers to diagnose medical problems in the respective fields of electrocardiography and cardiac dynamics.

Richard Crow, M.D. will speak about Computer Analysis of the ECG. The value of the digital computer for the analysis of the ECG is well recognized; however, the objectives pursued and the role played by the computer vary significantly with the user. Within these variations, two distinct approaches emerge: The operationally-oriented approach stresses automation and simulation of a cardiologist's interpretation while the research-directed approach emphasizes advanced methods of data processing and mathematical statistical classification of disease categories. The system to be discussed by Dr. Crow is of the latter type which is directed to enhancing the diagnostic accuracy of the ECG and expanding the knowledge of the heart as a current generator.

Dr. Crow received his M.D. degree in 1966 from California College of Medicine and has worked extensively for the past four years applying advanced computer technics in medicine. Dr. Crow is presently instructor in the Cardiology Division, Department of Medicine, Stanford University School of Medicine.

"An Automated System for the Collection and Analysis of Cardiac Catheterization Data" will be the topic of Mr. William Sanders. A cooperate venture has been undertaken by the Cardiology Division, School of Medicine at Stanford University and Hewlett-Packard Medical Electronic Products division to develop an interactive computer system in the specialty field of cardiovascular diagnosis. Mr. Sanders will describe hardware, software and operational concept of this unique dedicated on-line, real-time system which he has been involved in developing. Mr. Sanders holds a BS and MSEE degree from the University of California at Berkeley and has had 10 years of experience in computer systems programming. He is presently head of the computer facility in the Cardiology Division, School of Medicine, Stanford University.

The meeting will be held in room M-112 of the Stanford University Medical School (Medical Center) at 8:00 PM, Tuesday, January 12th. A pre-meeting no-host dinner will be held at the Red Cottage Restaurant, 1706 El Camino Real in Menlo Park at 6:00 PM. Reservations should be made prior to 5:00 PM January 11th by calling Mr. Harry Miller, 321-1200, ext. 6141. Members and guests are welcome to both dinner and meeting.

Applications of video tape in electronics

Video tape is becoming more important as a medium for engineers in all fields to keep themselves current on new developments. In addition, closed-circuit video equipment is very useful in day-to-day analysis and evaluation.

Improvement of equipment reliability can be a prime beneficiary of these new techniques.

The speaker will describe several uses of video tape and closed-circuit video with examples. Pre-recorded tapes on tutorial subjects, new instrumentation, and design phases will be shown, as well as the live use of instant playback equipment.

C. R. Mahurin

Carl Mahurin's Hewlett-Packard career dates from 1942. He has held a variety of positions, including service manager and, currently, corporate product training manager. Before joining HP, he was a research assistant at the Carnegie Institution, Palo Alto, and a teacher at Sequoia High School, Redwood City, California.

From Stanford University, Mahurin received a degree in biological sciences in 1937 and a teaching credential in 1939.

He is a senior member of the Institute of Electrical and Electronics Engineers, a member of the Sales and Marketing Executives Association and of the National Society of Sales Training Executives. see calendar.

Social responsibility of engineers

The Golden Gate Subsection will gather for a luncheon meeting at the Leopard Cafe, 140 Front Street, San Francisco at 12 noon on Thursday, January 14, 1971. The topic will be "Social Responsibility of Engineers" and the speaker will be Mr. Gerd D. Wallenstein.

Mr. Wallenstein retired in April, 1970, as Vice President-Planning of Lenkurt Electric Co., Inc. He has been responsible for the company's product position and for the development of a large part of its key technical and management personnel. He studied Electrical Engineering at the Technical University, Berlin. He is the author of many articles for technical and trade journals and has been a frequent guest lecturer at American Management Association seminars. The AMA has published his bulletin "Fundamentals of Technical Manpower Planning" and a book CONCEPT AND PRACTICE OF PRODUCT PLANNING. He is a senior member of IEEE.

Gerd Wallenstein

Reservations for the lunch can be made by calling M. W. McLaren (415) 764-6464 or Ken Walter (415) 399-2105 by January 13, 1971.

Education in electric power engineering

While there are indications that the Electric Power field is enjoying a period of renewed emphasis and interest, we still are far from the "good old days." For continuing progress in the power field, the first step must be a realistic appraisal of the current situation in our colleges and universities. The university's role, student attitudes regarding power, and the availability of Electrical Engineering graduates with an interest in power are areas requiring investigation.

Dr. David W. Olive will speak on these and other aspects of Education in Electric Power Engineering at the January 12, 1971, Power Group meeting at the San Francisco Engineers' Club, 160 Sansome Street. The meeting will start at 7:30 PM with a cocktail hour beginning at 5:30 and dinner at 6:30.

Dr. Olive is a Professor of Electrical Engineering at the University of Southern California. He received his BSEE in 1950 from the University of Nebraska, Lincoln; his MSEE degree in 1954 from Illinois Institute of Technology, Chicago; and his Ph.D. degree in 1960 from the University of Wisconsin, Madison.

Communication with a computer in English

Natural language processing on a computer is a new and exciting branch of computational linguistics and artificial intelligence. Getting a computer to verify that a given statement is syntactically correct has already been shown to be a manageable job for computers. Yet computer understanding of English input sentences has proved very difficult indeed. At the January 18 meeting of the Systems Science and Cybernetics group at SRI, Dr. L. Stephen Coles will review the state of the art of computer programs that attempt to process their input semantically as well as syntactically.

Dr. Coles is currently a Research Mathematician with the Artificial Intelligence Group at Stanford Research Institute. At SRI he is helping to develop novel applications of computers, including the design of a deductive information-retrieval system and problem-solving programs for a computer-controlled robot. In addition to his research at SRI, Dr. Coles has served as a Lecturer with the Computer Science Department at Stanford University, the Department of Electrical Engineering and Computer Science at UC Berkeley, and the Systems Program of the Federal University of Rio de Janeiro.

Detectors, bandpass nonlinearities and their optimization

The Information Theory Group will meet at 5:30 PM on Thursday, January 21, 1971 to hear Nelson M. Blachman, Senior Scientist at Sylvania Electronic Systems, talk on "Detectors, Bandpass Nonlinearities and their Optimization." The meeting place is Stanford Research Institute, Bldg. 1, 333 Ravenswood Ave., Menlo Park.

When any narrowband input $u(t) = a(t) \cos [\Omega t + \phi(t)]$ is fed to a memoryless nonlinearity, its output v(u) can be very conveniently separated by a simple Fourier expansion into low-frequency, fundamental, and harmonic components. The amplitude of the mth-harmonic component will be a function $v_m(a)$ of the input amplitude a(t), and the phase will be m times the phase $\phi(t)$ of the input. Although $v_m(a)$ can be obtained quite straightforwardly from v(u), no general method has been known for inverting this linear transformation.

The inversion is of interest because, as will be shown by means of a very useful technique, the best detector or bandpass nonlinearity for various purposes, e.g., maximization of the output signal-to-noise ratio, is most readily described in terms of its amplitude-response characteristic $v_0(a)$ or $v_m(a)$. It will be shown that a simple integration over the desired $v_m(a)$ will yield the corresponding voltage-response characteristic v(u) for use in an optimum detector (m = 0), bandpass nonlinearity (m = 1), or harmonic generator (m > 1).

Dr. Blachman received the B.S. degree in physics from the Case School of Applied Science in Cleveland, Ohio and the A.M. and Ph.D. degrees from Harvard. He is a Fellow of the IEEE and the AAAS and a member of the Institute of Mathematical Statistics, the Society for Industrial and Applied Mathematics, the International Scientific Radio Union (URSI). Dr. Blachman is vice-chairman of the IEEE Group on Information Theory.

A dinner will follow at 7:30 PM at Sakura Gardens, 2116 El Camino Real, Mountain View. For reservations, call Miss Geri Gibling at 326-6200, ext. 3881 by Wednesday, January 20, 1971.

Information theory in communications/computer systems

Information theory has had its practical base in communication systems and in computer systems. The interest in error-free or low-error transmission (or high signal-to-noise ratio) communication systems provided the background for the mathematical development of information theory. The coding aspects of information theory were initially pursued with respect to error correction in digital computers. Thus, information theory has been closely allied to the separate fields of communication systems and computer systems. At present, one of the major growing technical areas is the development of hybrid computer/communication systems and the proper interfacing of the computer with the data communication system. Figure 1 is a conceptual diagram of one potential configuration for such a system. This geographically distributed network might be a good model for a national information bank, a business information processing system such as an insurance company's record system, a warranty accounting system for a large automobile manufacturer, a computer-controlled chemical process, or a military command and control system just to list a few possibilities.

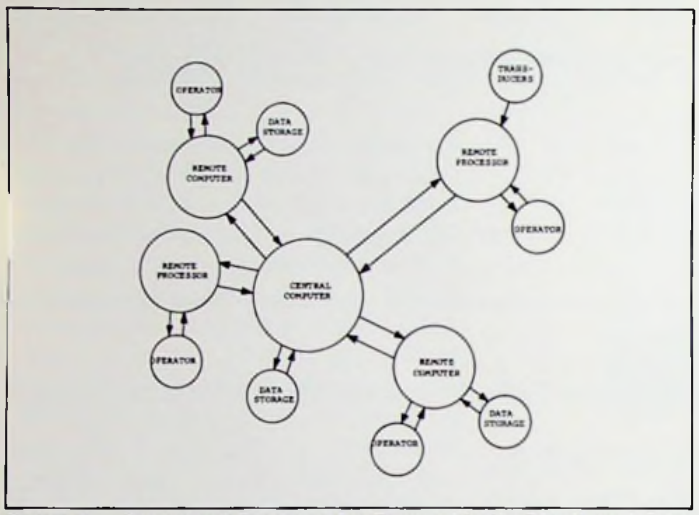


Figure 1 — Conceptual Diagram of a Geographically Distributed Communication/Computer System. The Communication network is denoted by the arrows.

The communication links might be wire, cable, line-of-sight microwave, HF, or multi-hop communication satellite or a mix of the above. Each of these possesses different characteristics and a different channel capacity. For example, the communication satellite link can be very nicely characterized by the familiar, additive white Gaussian noise model. Wire links are more complex in nature possessing channel filtering and switching or impulse noise in addition to additive Gaussian noise. The coding and modulation approaches to these and other channels are quite different, each based on fundamantal theory considerations.

The technical requirements include data communication that is efficient both with respect to bandwidth occupancy and the energy per bit required to obtain a given error rate. The present growing interest in spectrum conservation (or simply limited cable bandwidth) is creating greater study of modulation and coding techniques that require a minimum bandwidth for a given data rate. Multi-level phase shift keying is being used more frequently. Convolutional codes have received great attention recently in connection with sequential decoding algorithms. Use of these sequential decoders has permitted communication with near error-free transmission at close to Shannon's channel capacity. Thus, energy efficient transmission close to the information theoretic limit is being achieved. Figure 2 illustrates the performance obtainable with several decoding algorithms as compared to Shannon's limit. For computer systems and information banks it is indeed necessary to achieve near error-free transmission. Credit statistics, health records, etc. must be error-free unless one is to risk great damage to individuals. Convolutional coding and sequential decoding (several competing algorithms) is one of the most promising approaches to this data communication problem. Threshold decoding is a slightly less efficient but a much simpler approach that may be employed more commonly in future system due to its economy. Excellent performance is achievable with a rate one-half convolutional code (only minimal improvement is obtainable with lower rate codes). Thus, for example, by utilizing this code type with quadriphase (4-level phase-shift keying) signalling it is possible to obtain very good energy efficiency while requiring no more bandwidth than with conventional binary phase-shift keying.

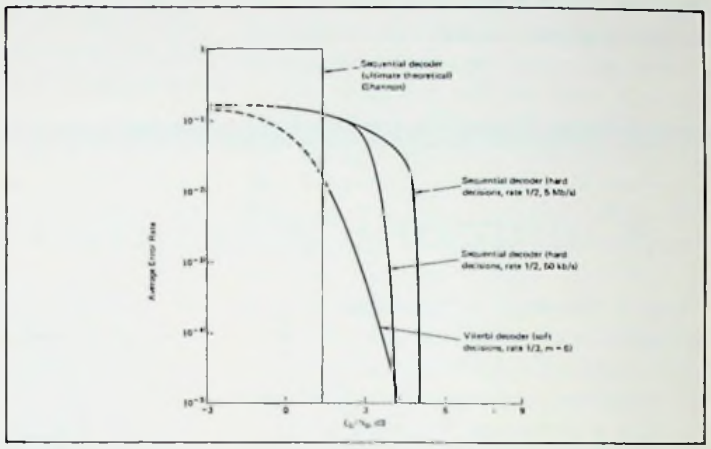


Figure 2 — Error rate performance of several dequential decoding algorithms as a function of energy-per-bit to noise-power-spectral-density ration (E_b/N_o) versus the Shannon theoretical limit.

Future information theoretic work and application will extend coding concepts to include more complex links that possess additional disruptive effects. Presently burst-trapping code concepts are being explored as a means of combating burst errors due to such interference effects as impulse noise which occurs in switched telephone circuits.

Theoretical, economical, and practical interest are developing in techniques for interfacing the computer with the transmission facility (communication system). Here the chief concern is the efficient (temporally) use of the communication channel with random, intermittent data sources, e.g., teletypewriters and computers. Presently research and development studies of asynchronous time division multiplexing and buffering for this interface are being pursued at a high level of effort. This work is based on information theory concepts such as information loss when the buffers overflow. Information theory has and will continue to play a crucial integrating role

in the design of complex computer/communication systems.

A second technical area has had a large interaction with information theory. Satellite communication has grown over the past decade to the point where it is increasing the capability of or replacing conventional communication links such as submarine cables. Satellite communication complements and increases the capability of existing line-of-sight microwave systems. Furthermore, it can provide a wide coverage broadcast service that is not presently available. In addition, new services have been rendered by communicating scientific information from deep space. In each of these cases the link is adequately modelled by a simple additive, white Gaussian noise channel. Thus, the channel capacity is readily established and classical information processing techniques can be pursued. Furthermore, in many of these systems the initial costs are sufficiently high that one can afford to employ the analog-to-digital converters, coder/decoders, and processing techniques that permit near error-free transmission at rates close to channel capacity. The advent of satellite communication has been a very strong motivating force in the development of modulation, coding, and signal processing techniques based on information theory concepts. Future growth in satellite communication will further enhance this relationship.

Satellite links have been included as portions of computer/communication systems. Preliminary tests have transmitted data stored on tape recorders at one computer location through a satellite and recorded this data at a second computer location. This link has the potential of megabit per second data rates with average bit error rates as low as 1 in 10^{11}. This performance is achievable with convolutional codes and simple threshold decoders. The future for such satellite communication/computer systems is enormously rich in potential application. Thus, the technological areas of satellite communication and computer/communication systems are anticipated to have substantial overlap further benefiting the development of information theory concepts.

There is a third major force having its impact on information theory. Interestingly enough, this force is related to digital computers but only in a hardware sense. Due to the information theoretical advantages of digital signalling, there has been a tremendous development of digital hardware. Needless to say, most of this development has been created by the amazing growth of digital computers. The development has progressed from transistors through integrated circuits (IC), medium-scale integration (MSI), and large-scale integration (LSI), which is presently in the early stages of development. The size and cost economies associated with the spectacular development are so great now that the hardware designer frequently finds that a very large proportion of the system cost is the mechanical package hardware, e.g., compare the price of a high-quality dual-inline IC socket with the price of the IC. The IC itself performs the functions that some 20 years ago would have required: (1) a drawer of vacuum tubes, (2) associated cooling, and (3) a large set of power supplies.

The impact of this development is that it is now much easier to digitize signals and process them digitally. Thus, many of the information theoretic concepts that were prohibitive in the analog and/or vacuum tube approaches can now be readily accomplished. Thus, the communication capabilities determined by information theory for a given channel, can now nearly be attained by implementing digitally data processing techniques developed from information theory concepts. In fact, many data modems are in effect special purpose digital computers or in some cases simply programs for general purpose computers.

The impact of computers has been so great that a symposium on "Computer Processing in Communication" was held in April of 1969. Particular techniques under development consist of data compression by source redundancy removal (Hadamard transform smearing is one of many promising techniques), digital filtering by fast Fourier transform, and probabilistic decoding by computer tree search algorithms (sequential decoding).

Many of the past applications of data compression have been for transmission systems. The goals being a reduced requirement for spectrum and an increased energy per transmitted data bit. Recently, the need for more reliable computer-controlled electronic information storage systems (more retrievals before information degradation) has generated interest in digital rather than analog FM storage on tape recorders. Here data compression and the sensitivity of the compressed digits to errors produced by the tape system are of great practical interest. Further development and expansion of such computer-oriented information processing is anticipated in many industrial and commercial areas.

In conclusion, information theory has had its roots in communication and computer systems and it is still (and will be in the future) nurtured and cross-fertilized by these areas. The advent of computer/communication systems, satellite communication, and digital hardware and processing has had major impact on the development of information theory concepts. As these three technological areas rapidly expand through the 70's, the application of information theory will increase in proportion. *Contributed by: Information Theory*

Electromagnetic compatibility group meeting

On January 18, 1971, the EMC Group will hear Eugene R. Hnatek speak on "EMC in Small, High Frequency Power Converters and Regulators." The meeting will be held in the Hewlett-Packard Auditorium, 5301 Stevens Creek Blvd., Santa Clara.

Small, High Frequency DC/DC Converters, Inverters and Switching Regulators are widely used in military and industrial products. This trend will continue as semiconductor switching devices become more broadly adapted to commercial equipment. There is an important EMC problem associated with this type of equipment which must be dealt with correctly during the design of the product.

Mr. Eugene R. Hnatek, Military Products Marketing Manager, National Semiconductor Corp., will describe how the EMC problems originate and what the designer should do to control them. Both circuit designers and EMC engineers will benefit from this presentation.

Mr. Hnatek obtained both the BS and MS degrees in electrical engineering from Bradley University, completing the program in 1965. He was formerly employed at Lockheed Missile and Space Co., Sunnyvale, where he specialized in spacecraft power conditioning equipment.

A dinner at the Custom House Restaurant, 20060 Stevens Creek Blvd., Cupertino, will precede the meeting. See calendar for details.

Radar target without models

The January meeting of the Antennas and Propagation Group will feature a talk by Dr. J. Richard Huynen of Lockheed Missiles and Space Company entitled "RADAR TARGETS WITHOUT MODELS."

For the case of radar targets it has indeed been customary to determine the radar cross-section for specific targets through analytic modelling based on given geometry and material properties or through lab-modeling for experimental investigations. It indeed seems surprising that any fault could be found with these established procedures. A little reflection will show, however, that the most difficult task in modeling is not the derivation of a particular parameter based on the target model, but rather to show that the model at hand matches the real world situation. Radar targets come in the most varied shapes, sizes, and materials. For chaff clouds and terrain types, statistical features are also attributed to the target. How can one know that these features represent the real world situation? For example, what is the dielectric constant of a eucalyptus grove, what are the effects on radar return of grooves or rough edges on a production model target, how round is an inflated balloon or how rough is a rough surface? These questions continue to baffle investigators in the field of radar target scattering.

One may then ask what is the alternative to target modeling. Can anything be said about the radar return from targets without constructing a specific model? The author has developed an

Dr. Huynen

alternative approach, called phenomenofic target models. One novel result is the orientation independent terrain scattering target (IEEE Proceedings, Sept. 1970). Some of the ideas in this talk were developed in the author's recently completed Ph.D. thesis. "Phenomenological Theory of Radar Targets" (December 1970).

Dr. Huynen received the BS, MS, and Ph.D. degrees in Electrical Engineering from the University of Technology, Delft, Netherlands, in 1946, 1948 and 1970 respectively, and the MS degree in mathematics from Stanford University, Stanford, Calif. in 1961. Until 1956 he was employed by the Dalmo Victor Co., Belmont, Calif., as a Research Engineer in Radar antenna design and the theory of polarization in terrain scattering. Since that time, he has been with Lockheed Missiles & Space Company as a Group Leader in reflectivity and radome research and, at present, as a Staff Scientist specializing in radar target and terrain scattering phenomena. Dr. Huynen is a member of the Scientific Research Society of America, Tau Beta Pi, the Royal Netherlands Institute of Engineers, and is a Senior Member of IEEE.

The meeting will be held on Wednesday, January 20th, at 8:00 PM, at the Lockheed Research Laboratories Auditorium in Building 202, 3251 Hanover Street, Palo Alto. Meet-the-Speaker Dinner at Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. Cocktails 5:30, Dinner 6:15 PM. No reservations required.

Current flow in insulators

January 19, 1971, is the date for the Electron Devices Group meeting at Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. The 8:00 PM meeting will be preceded by cocktails at 6:00 and dinner at 7:00.

Much progress has recently been made in the understanding of current flow-through insulators. Two basic types of insulators are known to exist – those in which the current flow is determined by bulk trapping effects and those in which the current is limited by energy barriers at the surface. In each class, the current can be either thermionic in origin or due to electron tunneling. Experimental observations of different processes will be discussed and various practical applications reviewed.

The Speaker, Dr. C. A. Mead, received the BS, MS and Ph.D. degrees (the latter in 1959) from the California Institute of Technology. He has been on the faculty of the California Institute of Technology since 1959, and presently holds the position of Professor in the Department of Electrical Engineering. Professor Mead has carried out research in various areas of solid-state electronics, including current flow through insulators, wide bandgap materials, energy barriers at surfaces, and special semiconductor devices. At present, he is also a consultant to several semiconductor firms.

1971 Director

Dr. Leo Young has been elected 1971-72 Director for Division 4 of the new formation of clusters of the present Groups. Division 4 covers AP, ED, MTT, S&U, PMP and MAG. Dr. Young has served IEEE well in many capacities having been a member or chairman of numerous IEEE committees on the local, national and international levels. He received his Fellow award in 1968 for his contribution in the field of Microwaves; the IEEE Microwave Prize in 1963 and National Lecturer IEEE award in 1968.

He joined SRI in 1960 and is presently on leave in Israel.

Tour of KTVU television studios

Oakland's television station KTVU will open its doors to members of the East Bay Subsection for a tour of its studio facilities on January 25th. The tour, to be led by Jack Butterfield, Assistant Chief Engineer at the station, will include Control Rooms, Studios and the station's Remote Operations Van. In addition, the many operational and technical problems associated with getting both live and taped programs onto the air will be described.

Mr. Butterfield has been in television broadcasting for 18 years, 5 at KHJ-TV in Los Angeles and the last 13 at KTVU. He has been with the station since its inception in 1957.

The tour will be held Monday, January 25th, starting at 8:00 PM in the lobby of the station's studio. The studio is located at 1 Jack London Square in Downtown Oakland. Because the tour is limited by space, please call Peggy Youngs at 843-2740 or 447-1100, Extension 7671 in both cases for reservations.

Trends in digital communications

The Communications Technology Group will present its third technical symposium. The all-day affair is entitled TRENDS IN DIGITAL COMMUNICATIONS. The symposium will be held at the Cabana Hyatt House in Palo Alto on January 19, 1971. The program is scheduled to start at 9:00 AM. The cost will be $6.50 per person. This fee includes the cost of the luncheon. Reservations will be taken by Don Kidder at 591-8461, Ext. 897. All reservations must be in by January 15.

There will be five papers given. Below the papers are listed in the order that they will be given.

William C. Hook Jr. – Pacific Telephone & Telegraph Co., San Jose, Calif.

DIAGNOSTIC TOOLS & PROCEDURES FOR TROUBLE SHOOTING DIGITAL DATA SYSTEMS

Sectionalizing, isolating and locating trouble in the complex digital data systems of today can be frustrating and costly. An already complex problem is even more difficult when the products of several separate vendors are combined in a single system. When a user experiences trouble whom should he approach first? What tests are best for isolating defects? Of what good are tests of individual system components? When each component of the system passes individual tests but the system fails to function as a whole, what next? What is the role of a communications consultant?

At present, Mr. Hook is Plant Staff Supervisor for Pacific Telephone & Telegraph Co. He provides technical assistance to field forces in matters pertaining to transmission in voice, data and carrier systems.

Mr. Hook is a member of Phi Kappa Phi, Tau Beta Pi, Sigma Tau, and Eta Kappa Nu.

Dr. R. W. Lucky – Bell Telephone Laboratories, Holmdel, New Jersey

COMPUTER COMMUNICATIONS

This is a survey talk describing the present state-of-the-art in data communications on telephone facilities and the profound changes which are likely to take place in the near future. In the past several years, the emphasis has been on the development of higher speed modems, often employing automatic equalization and error control systems, and on the design of lower cost and special-purpose modems. New technology and new policies with respect to the interconnection of customer-owned attachments are presently affecting the voiceband data market, but the main current trend is in the direction of increasing usage of concentration and multiplexing in the implementation of data networks.

Dr. Lucky's present responsibilities include theoretical and applied research in the areas of communication and information theory, error control, and techniques for data communications on telephone facilities. Among his publications is a book "Principles of Data Communication," McGraw-Hill, 1968. In 1967, he received the honorable mention award in Eta Kappa Nu's selection of the most outstanding young electrical engineer. Dr. Lucky is a member of IEEE, Eta Kappa Nu, Tau Beta Pi and Sigma Xi.

D. D. Sullivan – Bell Telephone Laboratories, Holmdel, New Jersey

ADAPTIVE ERROR CONTROL SYSTEM FOR VOICEBAND DATA TRANSMISSION

Extensive investigations of disturbances encountered on voiceband data channels have repeatedly confirmed that such disturbances exhibit a compound nature, with errors occurring both "randomly" and in clusters, or "bursts." Since the vast majority of error correcting codes have been designed either for random-error correction or for burst correction, such codes are relatively ineffective when used for error control on telephone channels. In this talk, we will present two techniques which have recently been developed at Bell Laboratories for error control on telephone data channels.

Dr. Sullivan is now employed by Bell Telephone Laboratories, Inc., Holmdel, N.J., where he is currently supervisor of a group concerned with the analysis and design of error control techniques for data communication systems. He is a member of Tau Beta Pi and Sigma Xi.

Thomas M. Whitney, Hewlett-Packard Laboratories, Palo Alto, Calif.

DIGITIZING TRADITIONAL ANALOG SYSTEMS

The cost of digital components is decreasing so rapidly that virtually any electronic system can be considered a candidate for digital implementation. Digital circuitry costs have decreased by approximately an order of magnitude every five years since 1955 when electron tubes and relays were the prevalent circuitry. At each decrease some traditional analog function has become more economical to implement digitally. Although the rate of decrease will level off in the decade ahead, the impact of large-scale integrated circuitry is forcing a continual analysis of cost-performance tradeoffs.

Dr. Whitney joined Hewlett-Packard Laboratories in 1967 and has participated in a variety of logic design and computer application projects. He is presently the Leader of the Digital Systems Section of the Electronics Research Laboratory.

He is the past Secretary-Treasurer of the San Francisco IEEE Computer Group and is a Lecturer in Digital Systems at Santa Clara University.

Jurgin Elkan – General Telephone & Electronics Laboratories, Inc., Waltham, Massachusetts

WIDEBAND TECHNOLOGY IN COMMUNICATIONS

Wide Spectrum Services is the generic name used by telephone companies to designate switched and dedicated services ranging from 4 kHz voice up to 10 MHz bandwidth (for high-definition video), all supplied over a single communication system. In this system coaxial cable is bustituting for or augmenting the cable pairs in nearly universal use in the distribution plant today. The crucial equipment developments are wideband switches and versatile multiplex equipment.

From 1955 to 1961 Mr. Elkan was with Hermes Electronics Co., where he was engaged in Tropo Scatter and line of sight radio telephone and telegraph systems development. The next two years, until 1963, he worked on Microwave Filters for Sage Laboratories Inc. Since 1963, Mr. Elkan has been with the General Telephone and Electronics Labs involved with wide spectrum services studies among other projects.

CT short course on active RC filters

A one-day short course on ACTIVE RC FILTERS: THEORY AND APPLICATIONS will be offered on January 23, 1971, at the main Auditorium, Stanford Linear Accelerator Center, 2575 Sand Hill Road, Palo Alto, California. This course is the third in a series of short courses being presented by the San Francisco chapter of the IEEE Circuit Theory Group. The purpose of this course is to familiarize the practicing electronics engineer with the design and applications of the state-of-the-art active inductorless filters.

Eight lectures are scheduled for this course. Professor S. K. Mitra is the organizer of this course and will present an overview of the active filters area. Professor Mitra received his Ph.D. degree from the University of California, Berkeley, and is now on the faculty of electrical engineering at the University of California, Davis. He has authored numerous papers in active and passive networks and is the author of ANALYSIS AND SYNTHESIS OF LINEAR ACTIVE NETWORKS (Wiley). He is currently an Associate Editor of the IEEE Transactions on Circuit Theory and chairman of the San Francisco Chapter of the Circuit Theory Group.

Mr. M. A. Soderstrand, Member of Technical Staff, Sandia Laboratories, Livermore, will lecture on sensitivity aspects of active filters. Mr. Soderstrand received his M.S. degree from the University of California, Davis, in 1969 and is continuing his doctoral studies there.

Professor A. Antoniou of Sir George Williams University, Montreal, Canada, will discuss generalized-immittance-converters and their applications to active filter design. Professor Antoniou received his Ph.D. degree from Battersea College of Technology, University of London in 1966. He was formerly associated with the General Electric Company, London; Post Office Research Department, London and Northern Electric Company, Canada.

Dr. J. Gorski-Popiel will speak on Negative-Impedance-Converters and their use in active filter design. Dr. Gorski-Popiel was awarded the Ph.D. degree from London University in 1967. He was previously employed by the Associated Electrical Laboratories, London. He is now with the M.I.T. Lincoln Laboratory, Lexington, Massachusetts.

The topic of active filter design using voltage amplifiers will be presented by Professor W. J. Kerwin. Professor Kerwin received his Ph.D. degree from Stanford University in 1967. He was previously associated with the Ames Research Center, NASA, Moffet Field and Stanford Linear Accelerator Center before joining the University of Arizona, Tucson, as Professor of Electrical Engineering and Director of Solid State Engineering Laboratory.

LC Filter Simulation techniques will be discussed by Dr. D. Sheahan of Lenkurt Electric Company, San Carlos. Dr. Sheahan received his Ph.D. degree from Stanford University in 1968 and is currently manager of the network development department at Lenkurt.

The last two topics concern the design and applications of Thin-Film Transistor Gyrators and will be presented by Mr. I. Kanemitsu, Oki Electric Company, Tokyo, Japan and Professor T. Yanagisawa, Department of Electronics, Tokyo Institute of Technology, Tokyo, Japan.

The fee for this course is $10.00 for IEEE regular members, $5.00 for student members and $20.00 for non-members. The fee also includes the lecture notes to be handed out and lunch at SLAC cafeteria. The enrollment for this course is limited. Therefore, persons interested in taking this course are urged to enroll early by completing and mailing the registration form below. To ensure enrollment, completed registration forms must be received before January 15, 1971. For additional information concerning this program, write or call: Dr. A. B. Grebene, Signetics Corporation, 811 East Arques Avenue, Sunnyvale, California 94086, phone: (408) 739-7700.

ACTIVE RC FILTERS COURSE
REGISTRATION FORM

(Should be received before January 15, 1971)

Mail to:

Dale Nielsen
c/o IEEE San Francisco Section Office
Suite 2210
701 Welch Road
Palo Alto, California 94304

Enclosed is check (payable to San Francisco Circuit Theory Group)

in the amount of $.....
to cover the enrollment fee.

Name: .....
(please print full name)

Home Address: .....
(Street)

.....
(City and State) (Zip)

Business Address: .....
(Street)

.....
(City and State) (Zip)

Position or Title: .....

Business Phone: .....

IEEE Affiliation (Check One)

☐ Member
☐ Student Member
☐ Non-Member

IEEE Membership No.: .....