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COMMUNICATIONS
FORUM

A NEW RESEARCH ORGANIZATION FOR A DISINTEGRATED TELECOMMUNICATIONS SYSTEM

October 24, 1985

Seminar Notes

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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Alan G. Chynoweth
Bell Communications Research

A NEW RESEARCH ORGANIZATION FOR A DISINTEGRATED TELECOMMUNICATIONS SYSTEM

Dr. Alan G. Chynoweth
Bell Communications Research

Dr. Chynoweth described the breakup of the single telecommunications system and traced the formation of Bell Communications Research (Bellcore). The research organization in its present form has been in existence a little over two years, during which time they have been trying to put together what was left after the divestiture. He called it a multidimensional fragmentation in that the original telecommunication system was broken up horizontally (into a number of different businesses), geographically (into seven regions), and vertically (interruption of the former chain between research and development through manufacturer up to field services). There was also fragmentation of the ways in which network technology could be advanced, network services introduced, and the way in which technological advance altogether could be achieved. In discussing the reason for fragmentation, Chynoweth stated that the strategy in the old Ma Bell was a balancing act between low cost universal service and reliability with high quality. However as technology advanced there was public demand for more choice. The resultant fragmented telecommunication system now has three dimensions with the added dimension of choice. Because "there is no such thing as a free lunch", offering choice can often be done only at the expense of overall quality and/or cost of service.

Looking at the horizontal fragmentation, he said that instead of being unified the industry had divided into a number of sub-industries. The problem here, he said, was

that the laws of the land restricted the degrees to which these various industries could work together. As a result major changes to services often require complex coordination across various industry interfaces. As for geographic fragmentation the seven regions are further broken up into 164 LATA's (Local Access Transport Areas). He recounted the early days of fragmentation (after January 8th 1982) when it took a few weeks or months for various members of AT&T, the old Bell System, to figure out how life could be put together again. One of the early tasks was to appoint CEOs or potential CEOs to be in charge of the seven regions. One area which was centralized was national security and emergency preparedness and the all important topic of network standards. These functions were committed to a Central Services Organization (CSO).

The CSO was initially received with a lot of mixed feelings by almost everybody including the regulators, equipment vendors and even some of the owners. He said that the CSO had become a very strong organization and one of the main reasons was that the seven regional companies did not want to duplicate research seven times over for cost reasons, and there was not enough expertise to go around the seven companies anyway. The CSO was charged with the heavy responsibility for the protection of high standards of the American telephone system. This was fully supported by the Court. As for a name, after appealing to the judge and going through a lot of procedures, they were finally allowed to use the word Bell - resulting in the name Bell Communications Research (Bellcore).

Chynoweth then went on to describe Bellcore's organization structure and job description. He used a slide (appendix A) to describe the flow of market signals/feedback and technology transfer between the various areas of AT&T prior to

its fragmentation. In the present system however, he said this chain did not exist any longer. Bellcore had therefore to work in the areas of research appropriate to the regional company networks and thereby influence vendors to develop the equipment needed by the operating companies. In addition to setting up Bellcore to serve the operating companies, the new operation had to centralize the responsibility for national security and emergency preparedness, which reports ultimately to the White House.

Bellcore is responsible for such centralized activities as market research and services, network planning and standards, engineering and operations procedures, equipment assessment, information systems, and applied research. The organization structure of Bellcore describing the distribution of the above mentioned functions are given in appendix B. Bellcore he said now had nearly 8000 employees. Most of the technical people had come from Bell Labs, Bellcore is reputed to be the biggest research consortium in the world and from a R&D budget point of view Bellcore ranked 8th in R&D expenditures in 1984 ($848 million), ahead of such firms as Eastman Kodak, Exxon, etc. (refer to appendix C). Bellcore has a complicated governance structure with representatives from the seven regions on the organization's Main Board of Directors, as well as on the three operating technical councils (Network Council, Research Council, Information Systems Council). Dr. Chynoweth noted that an instinctive objective in applied research was to maximize productivity, which can be defined:

Productivity (of research) = Innovation/cost.

But he noted that this can lead to debates as to whether the best way to do this was by maximizing innovation for a given cost, or minimizing cost for a given innovation.

As a research organization Bellcore focuses on "service in the information age rather than manufacturing in the industrial age." For a role model, he likened Bellcore more to such organizations as the Dept. of Defense, Comsat, British Telecom, NT&T, etc. rather than manufacturing companies. Chynoweth as VP for applied research described his division's mission as follows -"to access, advance and exploit the knowledge an technology base necessary for the current and future provision of exchange telecommunications and access services by the Bell Operating Companies". In his opinion applied research needed to work effectively with three principal constituencies, namely, Bellcore, the Bell Operating Companies, and the external world (refer to appendix D).

Chynoweth described his view of the future using a slide titled "Network Evolution" (refer to appendix E). He said that in "prehistoric" times we had Plain Old Telephone Services (POTS), that did not satisfy everybody. Some people, business customers in particular, set up their own private data networks. The public network responded by developing some data capabilities of their own. He said that the Integrated Services Digital Network (ISDN) is currently in vogue and networks are rapidly advancing into creating that capability as universally as possible. He said this still will not satisfy everybody and the public networks have therefore to keep evolving towards wider band capability. The role of the research area is to spearhead this advance.

He then traced the path of their research work supporting the Bell Operating Companies via the rest of Bellcore. Information is soon available to other researchers as a result of their publications. There is collaboration between Bellcore and other research organizations, and quoted a recent (1984) example relating to progress in an

area of light wave technology. Following up on the research of other organizations, Bellcore was able to develop and obtain a good usable signal over several kilometers of the fiber. They are now able to communicate using LED's at 560 Mb/s over distances up to 15 kms. This development provides a simple, reliable, and robust means of communications over short distances. This example illustrates how technological directions shift when the focus is more on short and medium distance lightwave transmission rather than on long-hand.

Going back to the effect of fragmentation on the network, Chynoweth described the existing structure as a "quintified" network, where a call can involve five different companies. The best that they could do in this situation, he said, is to address the interface and attempt to establish some good standards so that various pieces fit together as well as possible. This then enables a variety of vendors and service providers to compete more effectively, within each sub-industry. He said that there was a need for standards in such areas as network architecture, equipment, service, interface, and performance. What was needed, he said, were a few simple yet effective standards. In this regard he commented that the FCC had not been very helpful so far. As an example he quoted the confusion relating to the definition of 'network termination'.

In closing Dr. Chynoweth highlighted a few potential areas for R&D investigation in the future: (a) Future development in portable telephones; (b) research work in network system topologies; (c) wide band era - possibilities of working at home in the future (including the related social problems).

Speaker's Response to Comments & Questions

The question was raised regarding the equation relating production to innovation and cost, and a definition was sought for innovation. Chynoweth described innovation as the whole array of outputs from a research operation. It may be information of a professional, technical nature, paper publications, patents, research prototypes, demonstration of new types of equipment, etc.

There was an inquiry relating to the suggestions made by the National Association of Regulatory Utility Commissions (NARUC) subcommittee, to which he replied describing how the subcommittee went about its work. He said the Bellcore institution was at the early stages of being set up when the investigation took place and ideas taken and used were very early work ideas of those who were new to the job and the environment. Further, the subcommittee's report came up with very peculiar criteria by which to judge the relevance of research work.

A question was asked about the differences between Bellcore and Bell Labs, to which he responded saying that Bell Labs had a research area and also a sort of common technology development area divided into software and process technology. It also has the systems development areas - switching, transmission, CPE, etc. The people drawn by Bellcore from Bell Labs for applied research were about 1/3 from research, 1/3 from common technology, and 1/3 from exploratory systems organizations.

Regarding the specific services ISDN offers in the next five years, Chynoweth speculated that networks would go to 1.5 Megabit digital, better quality data with voice, and build on that to wider band digital systems. About specific software

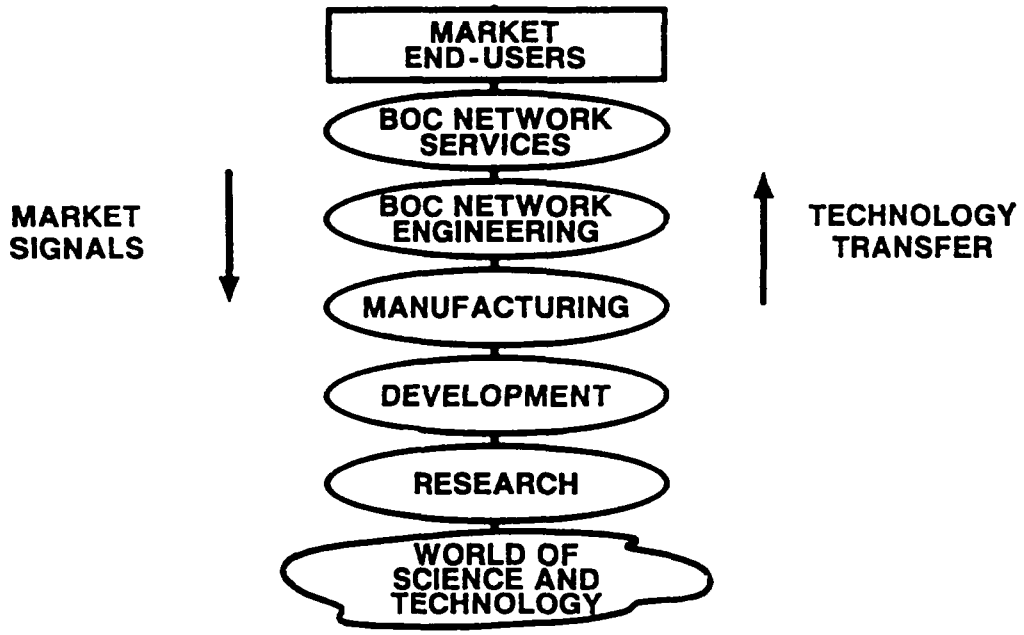
applications, he said that they had not focussed heavily on this area in applied research since this was mainstream activity structure in Bellcore. Rather, they had concentrated on the underpinnings in distributed data base management, artificial intelligence, and improving software quality, productivity and software control.

Finally with reference to wide band compatibility to ISDN and existing systems, he said that they were challenged to do research to enable grafting on of wide band onto the existing system.

APPENDIX A

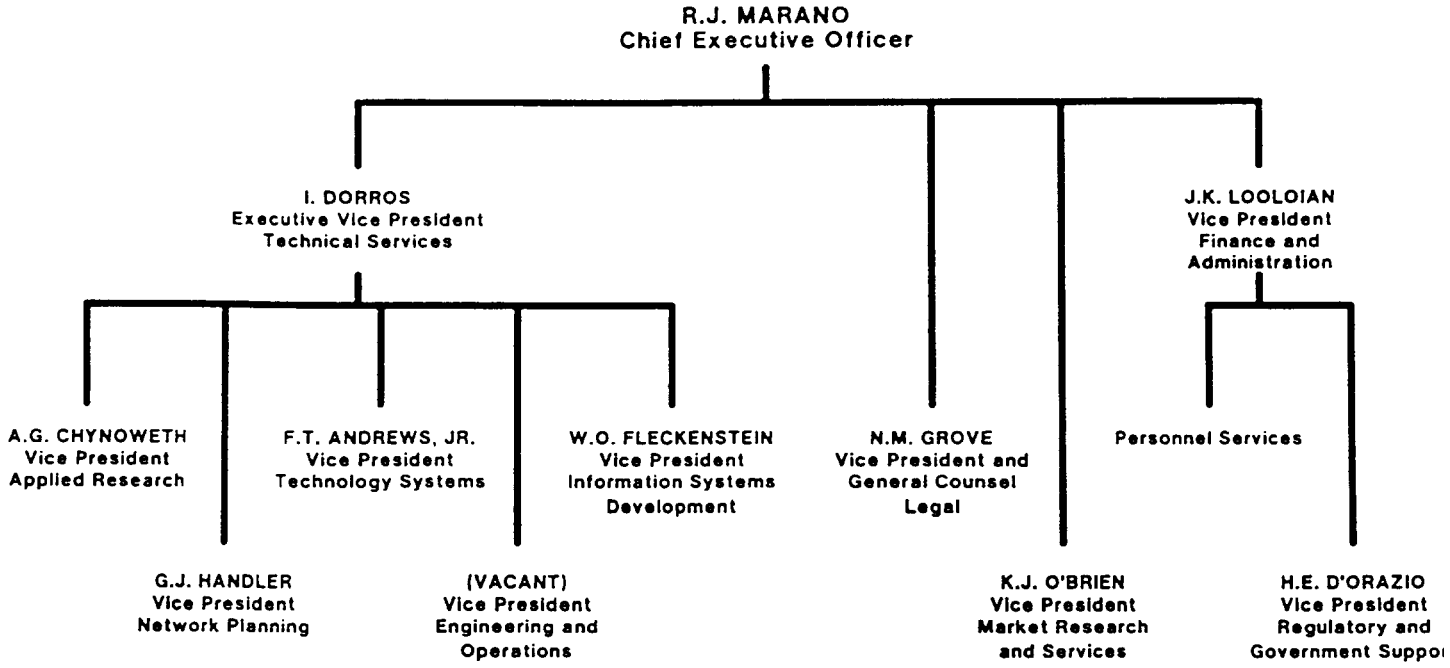
VERTICAL INTEGRATION

(OVERALL TRANSIT TIME IS 0-20 YEARS, DEPENDING ON COMPLEXITY OF TECHNOLOGY)



APPENDIX B

BELL COMMUNICATIONS RESEARCH



As of October, 1985

APPENDIX C

R/D EXPENDITURES IN 1984

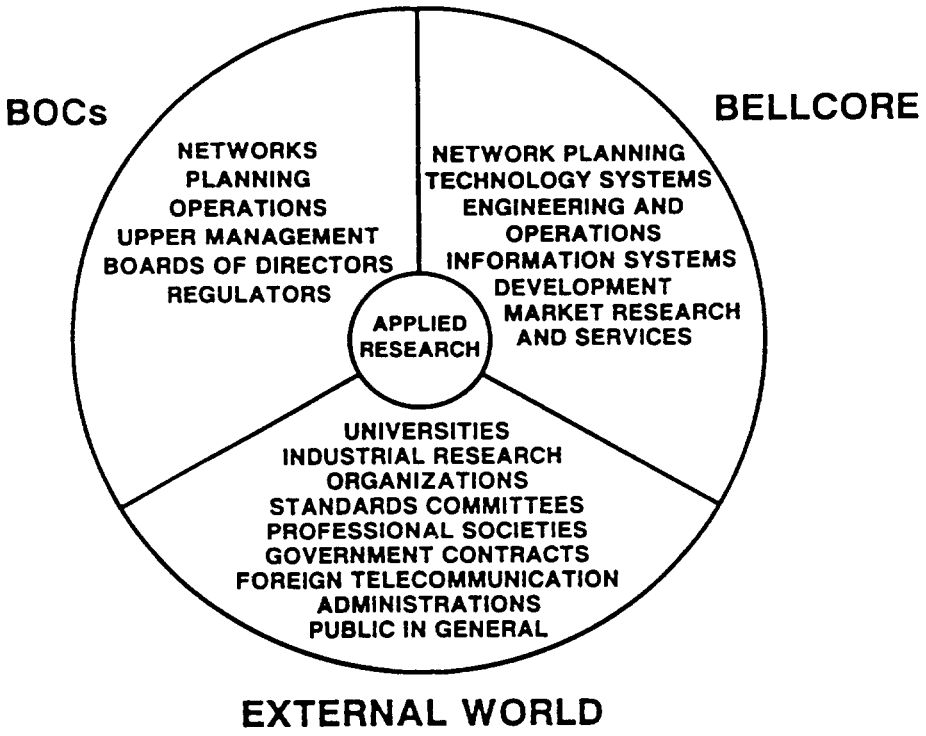
(IN TOTAL DOLLARS, MILLIONS)

1. IBM	3,148
2. GENERAL MOTORS	3,076
3. ATT	2,368
4. FORD MOTOR	1,915
5. DUPONT	1,097
6. GENERAL ELECTRIC	1,038
7. UNITED TECHNOLOGIES	1,012
8. BELLCORE	848
9. EASTMAN KODAK	838
10. EXXON	736
11. DIGITAL EQUIPMENT	631
12. HEWLETT PACKARD	592
13. XEROX	561
14. ITT	520
15. DOW CHEMICAL	507

SOURCE: BUSINESS WEEK; JULY 8, 1985

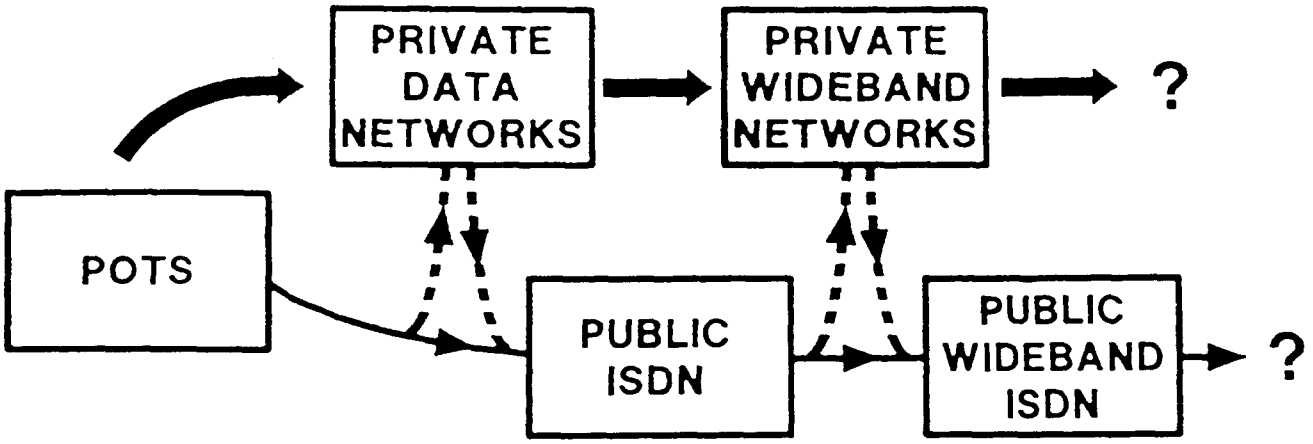
APPENDIX D

THREE PRINCIPAL CONSTITUENCIES



APPENDIX E

NETWORK EVOLUTION



NETWORK TECHNOLOGY

ANALOG → DIGITAL → WIDEBAND DIGITAL → ?

INCREASING COMPETITION

BETWEEN PUBLIC, REGULATED NETWORK
AND PRIVATE, UNREGULATED NETWORKS