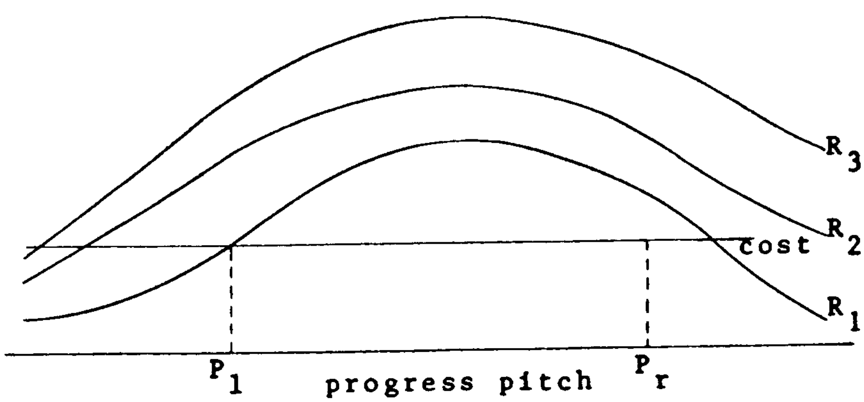
If each audience is worth equally in terms of advertising revenues, with a constant "per thousand" advertising charge of t, revenues are also normally distributed

$$R_1 = t \cdot B(2\pi)^{-\frac{1}{2}} e^{-\frac{1}{2}P^2} \tag{25}$$

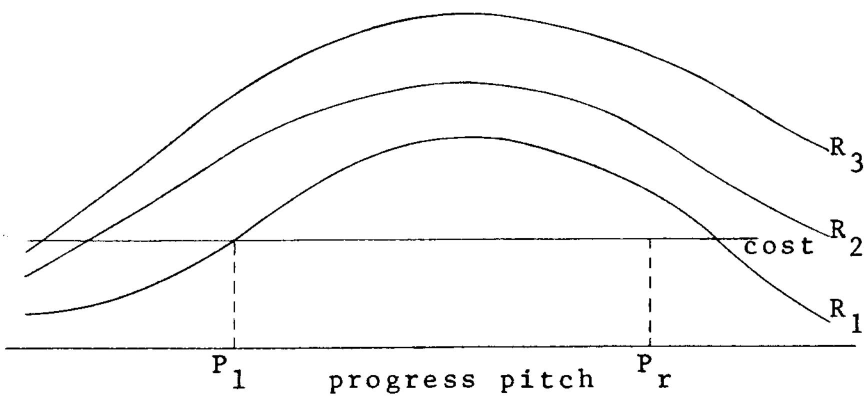
This defines the range of economically feasible pitches, for a one-channel system between the intersection points P_L and P_R of cost and revenue curves.

Graph 6



If the upper-pitch audiences are more valued than the lower ones, the curve would be tilted upwards around its peak, resulting in the feasibility range shifting to the right. Conversely, if high-quality programs are more expensive to produce than low quality ones, the cost line will tilt upwards and shift the feasibility range towards lower quality.

FIGURE 4.5



H6

Private Local Networks: The Next Frontier of Competition in U.S. Telecommunications

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by *Eli M. Noam*

I. *Introduction*

In recent years, U.S. deregulatory policies have liberalized several segments of the telecommunications industry, among them long-distance telephony, terminal equipment, U.S. international communications, enhanced services and cable television.[1] Changes in these areas have received much attention.

1 Noam, *Local Distribution Monopolies in Cable Television and Telephone Service: The Scope for Competition*, in TELECOMMUNICATIONS REGULATION TODAY AND TOMORROW 351–93 (E. Noam ed. 1983).

Less well known, particularly outside the United States, are the changes that are taking place on yet another frontier: local communications, local transmission and local switching. It is in local telecommunications that competitive forces are peeling yet another layer away from the core of natural monopoly, raising a host of new regulatory issues. These changes are taking place, in similar fashion, both in telephony and cable television.

It is the intention of this survey to familiarize the reader with several of the underlying developments. Modesty is required at the outset. Local communications in the United States is subject to regulation by 51 separate and independent state public utility commissions. In addition, as the regulator of interstate communications, there is the Federal Communications Commission (FCC) with its ever-increasing scope. The FCC is also the exclusive regulator of over-the-air communications and the unenthusiastic enforcer of *Computer II* rules. There is, furthermore, Judge Greene and the Justice Department's Antitrust Division as the keepers of the divestiture flame – presiding over what might be called the greening of American telecommunications – and a dozen state commissions and thousands of municipalities as regulators of cable television. Given the multitude of actors and the very fluid state of technology, applications and regulatory decision making, it is impossible to do more than describe the basic developments.

What are these changes? New forms of private local networks are emerging in the business and residential spheres. They are small, in contrast to the earlier generation of global private networks of multinational corporations, but their effect may be just as important in the long run.

In the office setting, these communications links include *local-area networks* (LANs), employed mostly for the transfer of high-speed data and voice and the connection of information equipment, and *shared tenant services* (STS), generally made use of within buildings or clusters of buildings in order to bundle the communications of small users and achieve the economies of scale and flexibility previously available only to large firms. These two types of building-based office networks are becoming interconnected and overlapping. They tend to squeeze local telephone companies from the user end by shifting capital equipment, such as increasingly intelligent private-branch exchanges, upstream towards users. Whereas in the past, a telephone network had a »smart« center and »dumb« branches, the user end increasingly is becoming technically sophisticated and the branches intensely utilized; the use of private unswitched lines makes the center relatively less significant than before. These networks also shift the scope of regulation by moving the functions of the regulated exchange carriers upstream into the unregulated customer-equipment region, partly in response to the unequal regulatory treatment.

For private networks that aggregate the communication needs of several tenants, the driving force is economies of scale. The economic logic of such bundling does not stop at the building's property line, and hence, private telephone clusters will emerge in central business districts. In effect, such networks become quasi-local service providers and competitors to the established local telephone companies, not only in transmission but also in switching services. These developments are unavoidable, given two decades' experience in the U.S. in trying to block competitive entry through regulation.

Parallel developments are beginning to take place, though more slowly, in the residential market, where shared tenant services have started in large apartment buildings and dormitories. Of significance is the emergence of *»private cable« systems* (SMATVs) – building-based, broadband video-transmission networks – that are competing with »public,« i.e., franchised, cable television. They, too, can potentially provide shared tenant services to apartment-house dwellers and entire neighborhoods and eventually offer an alternative to local telephone companies.

The emerging private networks add major complicating factors to an already complex communications environment. To anticipate the trends they herald, it is necessary to understand better their technical, economic and regulatory aspects and to observe the parallelism in their development.

II. *Local Telephone Services*

A. *Shared Tenant Services*

One of the latest developments in office communications is the advent of so-called »smart« office buildings, whereby a building owner, or his agent, provides multiple tenants with a variety of communications services known collectively as »shared tenant services« or STS. »Intelligent« office space, in fact, is becoming a selling point in overbuilt markets (for example, Denver had a 24.7% office vacancy rate in 1985; Houston, 19.5%; Dallas, 17.3%; Los Angeles, 12.4%). STS offers tenants a variety of shared links to the outside and can provide discounted long-distance telephone service, electronic mail, facsimile message service, videoconferencing, data processing and storage and telex service.

The key element in an STS system is a private branch exchange (PBX), which makes it possible to channel communications traffic from multiple users into a few, intensely used communications links; as a rule of thumb, eight individual internal lines call for one outside link. PBXs are envolving into software-driven small computers, whose various features include voice messaging, call forwarding, conferencing and speed dialing, with as many as 20,000 terminals connected to them. Late-generation digital PBXs are also increasingly able to switch high-speed data transmissions, making it possible to link computer terminals to various computers and to interconnect local-area networks.

Of particular importance for STS is the ability of programmed PBXs to select the cheapest carrier for a long-distance call, given the time of day, destination and traffic density. To reach long-distance carriers, STS utilizes a variety of private lines and other links that bypass the public switched networks of local telephone companies. Since a single tenant could not afford to undertake this, STS has been described as »reselling« local transmission service.

Another economic advantage of PBXs is their »leakiness«; incoming long-distance calls can be routed into a building's PBX through a leased line and then routed into the local network like a regular local call. Local telephone companies, which at present receive a substantial share on a per-minute basis from long-distance tolls, thus lose much revenue, since the long-distance nature of the call is undetectable.

Economies of scale can be significant, both for equipment and services. For example, AT&T's long-distance, bulk-rate WATS service is cheaper by about 50% for heavy users. For MCI, a similar comparison shows a rate differential of 35-50%.[2]

One reason for the emergence of STS is the recreation of one-stop telephone service. The AT&T divestiture had accelerated the move away from a fully integrated system; local telephone service, long-distance telephone service and telephone equipment were being provided by different suppliers. This increased complexity generated incentives for new entrepreneurs to recreate some simplicity for users by offering integrated, building-based communications packages consisting of the various components of competitive suppliers.

Residential usage of shared tenant services is also emerging, though less frequently than in the office setting. Residential and office use can also be combined. For example, several universities resell long-distance service to students in their dormitories, employing their leased lines that tend to be unused after office hours.

2 AT&T, TARIFF BROCHURE (1985); MCI, PRICE LIST (Oct. 1984).

STS is mostly relevant for newly constructed buildings. For already existing structures, inside wiring is typically owned by the local telephone company, which charges for its usage. Even where the existing wiring could technically be used for STS, it must be purchased from the local telephone company, which has no incentive to reduce its rate base or to make the bypassing of its services easier by agreeing to convenient terms of purchase. In most instances, a costly rewiring – known as »retrofitting« – becomes necessary, which may involve the disruption of telephone service to the existing tenants and requires a change in telephone numbers. The growing use and capabilities of fiber-optic cables with their smaller bulk may make retrofitting significantly easier in the future.

Regulatory issues lurk close to the surface. Tenants may become dependent on the communications prices charged by landlords. Similarly, the components of telephone charges are so complex and devoid of transparency that tenants could be de facto at the mercy of a landlord's software program. Such dependency would be reduced if the public telephone company had easy access to tenants as an alternative supplier of service. Since tenant-landlord disputes on communications billings will unavoidably arise, it is likely that some form of regulatory safeguards will be imposed in the future on landlords as providers of communications services. For example, a quasi-common-carrier status of sorts has already emerged, such that tenants cannot be precluded from using, for a fee, the landlord-owned wiring in order to access communications carriers that are not necessarily part of the landlord's package.

A landlord's chosen mix and quantity of outside lines also affects the public network as a whole. Too few links results in difficulties in making outside calls or in receiving incoming calls. For some users, this can be of vital importance. There is also a public interest in these questions: a public network receives no revenue from unsuccessful attempts to connect outside calls through a busy PBX, despite the burden to its switches.

A related consideration is liability. A landlord's PBX could fail for several days, causing severe financial losses to a tenant dependent on telephone connections. Telephone companies, by law, are free from consequential damages in such cases. However, they are regulated in their quality standards. STS operations presumably would seek, by law or contract, to protect themselves similarly. Yet it is unlikely that such protection would be entirely independent from the quality and performance standards set by the regulation.

For landlords, the various technical, financial, legal and maintenance problems involved may add a burden that is better shouldered by a specialized franchisee, known as a shared tenant service provider. Such a firm selects, installs and maintains the PBX, negotiates with the telephone company, runs the message center and services the telephone equipment in the building. Several of these frequently undercapitalized firms have experienced finanical problems when the sign-up rate of tenants was lower than expected – in some instances, only 20% of a building. This has slowed the rate of introduction of STS, which was estimated to be in around 200 buildings in early 1986. However, the basic concept behind STS keeps attracting entrants.

The logic that drives STS (and LANs, as we shall see) is economies of scale, which encourages the bundling of the communications of multiple tenants. Rather than stopping at the property line of a building, this logic compels the consolidation of the communications services of several buildings and, over time, of entire areas. The first examples of such multi-building STS systems have begun to emerge, indicating that STS clusters are likely to develop in central business districts as regulatory barriers crumble. These groupings, centered around large PBXs, will be functionally quasi-local telephone exchange companies, even though their regulatory designation may be technically different. Their emergence will establish local competition not only on the level of *transmission* (»bypass«) but also on the level of local *switching* services. The FCC, in its *Computer III* decision in 1986, established the framework of »open network architecture« for dealing with segmented and competitive switching. It is a further step in the direction of a network system in the United States that is different from those in Europe – an increasingly decentralized network comprised of increasingly varied networks customized to users rather than a centralized network comprised of increasingly integrated services.

C. *Local-Area Networks*

Local-area networks (LANs) are communications links that permit computers and other electronic equipment located in the vicinity of each other to communicate. LANs can interlink mainframe computers, PCs, word processors, CRTs, printers, disc drives, data banks, etc. LANs make possible the sharing and functional integration of equipment, thus reducing the cost of operation.

The definition of a LAN varies with users and suppliers. It is probably best described as a facilities-based data network that does not use a common-carrier transmission facility.[3] At present, LANs are largely outside the PBX and thus not directly connected to the other communications links of users, such as a shared tenant communications. But this is changing. PBXs are beginning to have the capacity to handle the data speed of LANs and serve in linking them to each other.

In that fashion, LANs are becoming a way of internally gathering and aggregating communications flows and concentrating them for transmission to the outside via a PBX and its local links. LANs carry, in some instances, nearly 60% of an organization's communications flow. They are not only proliferating and being integrated through PBXs with bypass options but also beginning to expand geographically into »Wide-Area Networks,« or WANs, outside the public network.

LANs operate mostly on the principle of a data stream passing all participants that is coded for a particular destination. There are three major forms of LAN network architecture: a star (with a PBX in its center), a ring (to which equipment is connected through nodes) and a tree (also known as a »bus«), which is the most common architecture today and the one used in the DEC and Xerox Ethernet, the most popular LAN. IBM's system operates on the ring principle. Though fiber-optic cable is likely to be the superior technology, at present coaxial cable – broadband or baseband – is prevalent. Transmission rates of LANs range from 1000 kbps to as high as 50 Mbps.

When LANs are »internetworked« with each other, they may require adjustment of protocols and present other interface problems. This interconnection problem is part of a more general one: as communications links overcome the insularity of various parts of equipment in an office setting, compatibility becomes ever more important. Hence, the emergence of LANs is a force for standards and compatibility.

The introduction of the PBX into the LAN permits the linkage of several LANs, as well as their interconnection with medium- or low-speed regular office wiring. It also provides the LAN with the PBX control features of accounting and recording, making it possible to bill for LAN use in much the same way as at present for telephone costs and permitting a shared tenant services arrangement of shared LANs.

D. *Alternative Forms of Local Transmission*

A driving force behind the interest in shared communications services is the potential for the use of communications links other than those of the local

3 *See* Murphy, *A LAN Primer*, COMMUNICATIONS AGE 27, 27–29 (June 1984).

telephone company. This competition is normally referred to as »bypass.« A major reason for shared tenant services has been described as the resale of *local* bypass transmission service. The FCC defines bypass as »the transmission of long distance messages that do not use the facilities of local telephone companies available to the general public, but that could use such facilities.«[4] Hence, the non-switching use of private lines that are leased from the local telephone company is included. Though such lines still allow local telephone companies to accumulate revenues, the amount is normally considerably lower than that which they would realize through the same traffic on their public switched network. A bypass using lines leased from the local telephone company is termed by the FCC a »service bypass,« as distinguished from the »facility bypass« using non-telco transmissions paths. In the FCC's view, service bypass will be the most prevalent form of bypass in the next few years.[5] There are by now a good number of alternative forms of local communications available to users, several of which are supplied by the telephone company. The information below provides a somewhat technical overview of the service options available in New York. It is summarized in Table 1.

(1) The basic *switched voice-grade circuit* can normally sustain transmission rates of 1.2 kilobits per second (kbps) or, when upgraded with special equipment, 9.6 kbps. Because of the cost and slow speed of these circuits, they are increasingly used in volume transmission for backup and for short distances only. Line costs in Manhattan are $25.61 per month for business users (including access charge) plus 8 cents for the first 5 minutes and 1 cent for each additional minute. (Rates are considerably lower for residential use.)[6]

There are several categories of private data-grade lines provided by telephone companies, which since 1985 have been permitted to »raid« each other's territory for such service, making competition in telephone company leased lines likely. The types of services include the following:

(2) *Direct analog data-communications* lines are private, unswitched lines leased from the telephone company. Requiring four wires, these lines are capable of rates of up to 9.6 kbps, which is enough for several interactive

4 FCC, COMMON CARRIER BUREAU, BYPASS OF THE PUBLIC SWITCHED NETWORK (Dec. 19, 1984).
5 *Id.* at 31.
6 For sources, see notes accompanying Table 1.

terminals but insufficient for many other data-processing applications. For a 9.6-kbps circuit, New York Telephone charges a monthly $111.60 for one mile and $236.40 for five miles.

(3) *Digital Data Systems service* (DDS) permits medium-speed Dataphone use between computers or terminals, with transmission rates of 2.4-56 kbps. The cost of service is sensitive to distance and the transmission rate. For instance, for a 5-mile distance, New York Telephone charges $145.75 per month for 2.4. kbps and $373 for 56 kbps.

(4) *»T«-grade service* permits high-speed data transmission for computer use. It consists of 24 time-division multiplexed channels of 64 kbps, enabling a speed up to 1.544 Mbps, known as the DS-1 or T1 rate. Repeaters are necessary at every mile since T1 circuits use coaxial lines. T1 rates charged by New York Telephone are $720.22 per month (1 mile) and $2645.26 per month (5 miles). In addition, improvements in the basic T1 system permit transmission rates of 6.132 Mbps, designated as T2.

(5) Technically different from copper-based wire lines are *fiber-optic* links. Advantages of this form of transmission include freedom from electromagnetic interference and a reduced need for repeaters; whereas copper wire T1 circuits require repeaters at every mile, fiber technology for the same T1 rate may permit a repeater spacing of 30 miles (in experiments, over 100 miles). Fiber cable also affords a high degree of security since it is very difficult to intercept. Furthermore, since the glass strands are considerably thinner per equivalent transmission capacity than copper or coaxial cable, they permit a more efficient use of duct space. Cables with a transmission capacity of up to 90-135 Mbps are now operating, and a 432-Mbps cable will be on line soon. (A digital video television signal requires about 90 Mbps.) Experimental transmission rates of 1.5 billion bits/second have been demonstrated. At present, commercially available fiber-optic links support T2-type transmission rates.

There are, however, several disadvantages with fiber-optic cable. It is less convenient than traditional cable to install within buildings due to difficulties in bending, splicing and tapping. In addition, terminal equipment is quite expensive at present. Moreover, it is uneconomical to use fiber for low-volume traffic. Thus, fiber is mainly used for concentrated bulk transmission by telephone companies and in high-speed local-area networks linking computers. However, fiber use in local loop communications is developing quite rapidly. In New York, the firm Teleport Communications, an affiliate of Merrill Lynch, offers such alternative fiber transmission.

(6) *Coaxial Institutional Cable (I-Net)* has long been used for high-capacity voice and data transmissions and for cable television. Its bandwidth has been continuously increased and has reached 550 MHz for operational cable television; it can now carry up to 70 video channels. Because of its shielding, it is relatively immune to electrical interference, and it can be worked on by semiskilled installers. The typical cost for laying coaxial cable is $10,000 to $15,000 per mile of above-ground cable, but it can be as high as $300,000 per mile underground.[7] Because of their long-standing involvement with coaxial-cable technology and given their plant and service personnel, some cable television companies have offered data-transmission services to large business users in the areas of their franchise operations. The first such service was in 1974 by Manhattan Cable, which offered customers data transmission over a trunk system that was »dedicated« and mostly physically separate from the company's television transmission facilities. The company's headquarters functions as the equivalent of a telephone company's central office, though not as a switch. Depending on the customer's equipment, various transmissions speeds are offered. Transmission ranges up to the T1 rate are available.

Because of its emergence as a ubiquitous second system of communications wires in America, cable television has the potential to broaden its communications offerings and function as a communications carrier partly in competition with telephone companies; this is likely, over the long run, to increase competition between telephone and cable companies in a wide range of services.[8] In a speech to the National Cable Television Association, William McGowan, the chairman of MCI, offered cable operators an alliance in which they would carry MCI's traffic the »last mile.« Subsequently, MCI has linked up with several cable companies. MCI's »Cablephone« can operate on two-way cable systems, and it permits access to its long-distance node by the use of a touch-tone telephone set over cable. A 6-MHz video channel is used to provide 240 voice circuits. Despite MCI's introductory rate of $10 per month, the Cablephone has not been a commercial success.

When Cox Cable, one of the major cable operators that entered into agreements with MCI, started to offer »Indax« and »Commline« service in Omaha, Nebraska, the local Bell Company complained to the Nebraska Public Utilities Commission. The Commission asserted jurisdiction and defined Cox Cable as a »communications service for hire,« subject to

7 Rothbard, *Underground Building Woes Push Costs Higher*, CABLE AGE 15 (Aug. 29, 1983).

8 *See* Noam, *Towards an Integrated Communications Market*, 34(2) FEDERAL COMMUNICATIONS BAR JOURNAL 209 (1982); Baer, *Telephone and Cable Companies: Partners or Rivals in Video Distribution?*, in VIDEO MEDIA COMPETITION 187 (E. Noam ed. 1985).

restrictive regulation. This led to proceedings before the FCC, which in 1985 preempted state regulation.[9] In New York, the Public Service Commission asserted jurisdiction in a similar case in 1983. The Cable Communications Policy Act of 1984 largely precludes state regulation for services other than conventional voice telephony.[10] This and the current regulatory position of the FCC are likely to lead to the largely unregulated provision of data-transmission links by cable companies.

(7) *Point-to-Point Microwave* is provided by in-house systems, private microwave common carriers, STS providers and local telephone companies. Such transmission requires an unobstructed line-of-sight transmission path and is affected by interference both from meteorological factors, such as rain, and from other users of the same frequency. The technology for the lower ends of microwave (upwards to 2 GHz)) is more mature, cheaper and requires less power. On the other hand, higher frequencies (up to 32 GHz) can carry more information. However, in communications-intensive areas, such as Manhattan, the more desirable lower frequencies are filled up.

(8) *Digital Termination Service (DTS)* is a point-to-multipoint microwave-transmission technology that permits fairly small users from numerous locations to use microwave. Originally developed by Xerox for its now-abandoned XTEN national office-communications network, DTS was opened for licensing in 1981 by the FCC as the local end of a national, all-digital microwave system. DTS consists of central »nodes« through which microwaves from all directions are transmitted to or received from transceivers located on customers' premises. These nodes in turn interconnect with one another and with long-distance carriers by point-to-point microwave. The nodes have switching capability, and their range is about six miles. The first DTS service was provided by Local Area Communications (LOCATE) in Manhattan. At present, most service is point-to-point rather than switched, but than can change.

(9) *Multipoint Distribution Systems (MDS)* uses multidirectional microwave for the one-way transmission of video and data. It was approved by the FCC in 1962 as a common carrier for low-power communications and has a range of 15-30 miles. A transmitter costs about $1 million, and reception equipment is

9 For more information on these issues, see Noam *The New Local Communication: Office Networks and Private Cable*, 6(2) COMPUTER LAW JOURNAL 260 (1985).

10 *See* Cable Act, 47 U.S.C. §§ 521(3); 522(4), (5), (11) and (16); and 556.

about $200. Because MDS is used largely for pay-TV transmission – though this was not anticipated when the service began – lease rates for data reflect the opportunity cost of video transmission, which in turn depends on the status of cable television. An MDS channel can be leased in Manhattan for $5000 per month.

(10) *Satellite* links connect a user directly to a communications satellite via a parabolic »dish« antenna. Connections are through earth and space facilities provided by a satellite carrier or a reseller, which can also lease or buy a transponder from a satellite carrier such as RCA or Western Union and use it for whatever transmission purposes it requires. At present, a transponder sells for $3 million, depending on the orbital slot and frequency band. Though, in the past, users had to buy or lease a full transponder, it has more recently become possible to acquire fractional transponders.[11] Although a satellite is not a local-distribution medium in the normal sense (though it certainly could be used as such, via a 46,000-mile hop), it integrates the local and long-distance parts into one transmission, if undertaken from the user's premises. Recent technological developments in SAES (small aperture earth stations) make cheap, on-premises uplinks feasible. One of a satellite's advantages is that it can be used to reach numerous recipients simultaneously.

(11) *Cellular radio* provides an efficient use of frequencies for radio communications. As a stationary system, it is a rival to local-exchange companies' basic service. After more than a decade of regulatory wrangling, it was introduced in major U.S. markets under an arrangement that provided for two licensed operators in each location. One licence was to go the local telephone company or its holding company; the other one was given to one of the numerous applicants, many of whom were from the RCC (Radio Common Carrier) or paging industries. Despite the tremendous technological improvement that cellular radio provides, it is relatively expensive (though prices are dropping), and it cannot sustain transmission rates above regular voicegrade. New York subscription prices range from $15-69 per month; usage charges range from $.40-.75/minute to $.25-.35/minute (non-peak). Equipment costs $1300-2200 installed. At present, data can be transmitted only from a stationary position and is limited to a 300-bps rate in New York. By way of example for data application, cellular radio allows a civil engineer to be

11 Roswell, Miller & Seh, *Corporate Private Networks*, TELECOMMUNICATIONS 73, 73–74 (May 1984).

directly connected from a field location to his company's data base and computer capabilities.

(12) *Infrared or laser transmission* involves the use of a modulated light source, such as infrared or laser-generated light, to provide a low-cost transmission system. Such signals are subject to interference from light sources, heat, smoke, haze and rain. Primary use is for short transmission paths, such as the crossing of a street. Unlike the use of microwaves (which requires a frequency assignment by the FCC) and of cables (where the crossing of public rights of way requires a local franchise), such transmission needs no license and affords no regulatory nexus. T1-capacity (1.544 Mbps) infrared equipment costs $14,000; its range is 3/4 mile.

(13) *Miscellaneous:* FM subcarriers (for one-way data transmission); Specialized Mobile Radio (SMR); Radio Packet Communications (RAPAC); Cable Packet Communications (CAPAC); land mobile radio; citizens-band radio; satellite mobile communications.

E. *Price Comparison of Local-Service Options*

Table 1 summarizes the information discussed above regarding leased forms of local service in Manhattan. To permit a comparison, they are normalized to provide the prices, per 1-kbps transmission capacity per month, for each of the alternative forms of local transmission. As can be seen in the table, microwave is cheapest at $.20-.65. Fiber-optic links ($.61), coaxial cable lines ($1.15) and T1 telco carriers ($1.70) are other low-cost providers.

For the user, the optimal choice of communications links depends not only on the price but also on a number of technical, economic, environmental and regulatory variables. These include, for example, data volume, availability of duct space, microwave paths and frequencies, lines of sight, southern exposure, order lag of leased lines, number of origination and destination points and desired security and reliability. It also depends on the willingness to own and maintain equipment and a network, to be served by a multiservice communications carrier or to deal with multiple communications providers for separate services.

Table 1 Price Comparison of Local Transmission Links
(Manhattan: leased lines or channels: 5 miles unless noted)

Transmission Medium	Price per Month (leased)	Capacity (kilobits per second)	Price (per 1 kilobit per second transmission capacity per month)
Switched Voice-Grade Circuit	117.16(a) (69.16)(b)	1.2	97.60 (57.60)
Direct Analog Data Communications	236.40(c)	9.6	24.60
Digital Data Service (DDS)	373.00(c)	56	6.70
T1-grade copper line carrier	2645.26(c)	1544	1.70
Fiber Line	950	1544	.61
Coaxial Cable Line (I-NET)	1750(m)	1544	1.15
Point-to-Point Microwave	1200(k) 1000	6132 1544	.20 .65
Digital Termination Service (DTS)	600(l)	56	10.71
Multipoint Distribution System (MDS)	5000(j)	3088	1.62
Satellite Transponder	110,000(d)	64,000 (max of 1,544 kbps)	1.70
Cellular Radio	2000(e)	.3(f)	6667
Infrared	400(g,h)	1544	.25

a. Assummes $21.16 basic business-rate access charge, plus usage charge for 8 hours/day usage, 20 days/week.

b. Assume usage of 4 hours/day, 20 days/week.

c. New York Telephone.

d. Prices range from $66,667 to $150,000, depending on length of lease and preemption protection. Source: RCA Globecom.

e. $15-69 basic service depends on type of service; usage depends on peak/off-peak. Assumes 4 hours peak/day; 20 days/week ($1920 usage). Equipment installed $1300-2200. Assumes 5-year life. Source: NYNEX.

f. Voice rate: 1.2 kbps.

g. Owned equipment: $14,000. 5-year life; maintenance: $1000/year. Source: Light Communications, Inc.

h. Range: 3/4 mile.

i. Teleport Communications.

j. Class-Y service (24 hours/day), one-way only. Source: Contemporary Communications.

k. Contemporary Communications. ((1) T2 transmission. (2) T1 transmission.) Eastern Microwave's rate is $900 equipment, $22/mile video coverage. 6 Mbps.

l. On basis of 30% use of node ports (100 ports). Contemporary Communications.

m. Manhattan Cable.

Quite typically, 3% of the customers of local telephone companies account for 50% of the revenues. Telephone companies are thus susceptible to major revenue losses if their best customers opt for bypassing; the fixed cost of the network then has to be distributed over the remaining subscribers, resulting in rate increases and further incentives to bypass or drop off the network altogether. For example, in New York the local telephone company charges AT&T more than eight cents per minute for a connection, with costs of only three cents per minute. (Other calculations put these numbers at seven and four per cents, still a fair margin.) Bypassing could thus be profitable for AT&T even if its costs were five cents.

In order for local telephone companies thus to discourage bypassing, large customers will obtain cheaper local service than residential customers – a reversal of the traditional redistribution where business customers had paid more for their service than residential subscribers for local service.

The political and regulatory pressures that such a historic change presents are significant. The federal regulatory response to this problem has been to impose a flat-rate, end-user access charge as a partial substitute for the usage-sensitive charges on the long-distance carrier that provided an incentive for bypass. Under a flat-rate access charge on the *user* of telephone service, however, such incentives for »uneconomic« – i.e., regulation-induced — bypass would be reduced. This policy has been severely criticized for shifting the burden to users and away from carriers. Congress was so sufficiently aroused that the FCC postponed its implementation until after the 1984 elections.

State regulators have found themselves in a dilemma on the question of bypass. If they restrict telephone companies from providing bypass service or matching the lower prices of bypassers in their regular service, they may only accelerate the departure of large users. This has led to different responses. Some states have permitted local telephone companies to price their services in a differentiated fashion. Others, such as California, have considered banning the bypass of intrastate carriers, thus taking the opposite approach.

Shared tenant service provides a powerful mechanism to make bypass affordable also for small- and medium-sized users. Therefore, several local telephone companies have eyed it with hostility, while others have decided to supply it rather than fight it. Opponents of STS have argued that it creates revenue losses, duplication of facilities, technical fragmentation, »stranding« of surplus facilities and negative technical externalities on the public network. Southwestern Bell, one of the seven Bell Regional Holding Companies

(RHCs) has tried to restrict STS. In Arkansas and Oklahoma, it severely limited the shared or common use of STS and required a »partitioning« of common PBXs. Southern Bell is the other regional company that has been aggressively fighting STS, and its South Carolina tariff gives the company discretion to deny interconnection where local resale occurs. In Arizona, the Mountain Bell (a US West subsidiary) approach has been to structure a tariff that reduces the economic incentive for sharing.

The Arkansas Public Service Commission has affirmed that the local telephone company is the sole provider of local exchange service. It described STS as the »resale of local transmission service« and required for its exercise a »certificate of public convenience and necessity,« for which a showing must be made either that it is »privately beneficial and not publicly detrimental« or that the local telephone company »is not providing reasonably adequate telephone service.«[12] This requirement is very difficult to meet. It also required a partitioning of PBXs by users. The Arkansas Commission held that:

> In essence, what the proponents propose is to create »islands« within telephone company certificated areas, and to allow the reseller to provide unregulated telephone service to those located within that island. ... We are unable at this time to see how the certificated telephone companies in this state could furnish, provide, and maintain adequate and efficient telephone service when at any given moment they could be told that they are no longer to provide service to a particular island.[13]

In Texas, on the other hand, the state commission has taken the opposite approach and has permitted STS, using language that in the past would have been extrordinary for a state commission:

> Defining these services as local exchange telephone service would, for all practical purpose, impose certification and rate regulation on these shared services. Regulations of this type would well retard the development of Texas telephone users.
>
> The Commission is of the opinion that where new technologies arise which can thrive only in an unregulated environment, then regulation should give way to technology rather than vice-versa....[14]

In addition, in 1985 IBM filed a petition with the FCC asking for a declaratory ruling that the FCC, by its various actions, had formerly preempted the states from regulating the provision of shared tenant services. The FCC decided this

12 In re Southwestern Bell Tel. Co., No. 84–213–U (Ark. P.S.C. Jan. 7, 1985).

13 *Id.*

14 In re Southwestern Bell Tel. Co., No. 5827 (Tex. P.U.C. Nov. 21, 1984).

case in January 1986, finding that it had not preempted the states in this issue in the past (except for the state requirement of partitioning a PBX).[15] At the same time, it invited comments in a »Notice of Inquiry« to help it determine its future policy on STS. In earlier comments to the FCC, the Commerce Department's National Telecommunications and Information Agency (NTIA) had opposed state limitation of STS as a matter of substantive policy, but it had argued that procedurally they should be entitled to do so without federal preemption. There is a possibility that on this matter the FCC will not continue its preemptive tendency, which over the past decade has increasingly excluded the states from regulation of state-related telecommunications issues that affected interstate communications.

Prohibition (à la Arkansas) and deregulation (à la Texas) are not the only conceivable policy responses. In the past, business communications have contributed towards the maintenance of residential service; the transfer was undertaken largely within the traditional Bell system. There is no conceptual reason why such a transfer arrangement could not also encompass communications outside the scope of traditional carriers and reach bypassers. This would mean a tax or surcharge on bypass, which would be used to subsidize a universal service fund. Of course, the money for such a fund could come out of general revenues, but that seems politically less likely.

III. *Local Video Transmission*

A. *Private Cable*

Small-scale, building-based communications networks are also emerging in the market for the distribution of video programs. Generally known as »SMATVs« (satellite master antenna systems), they extend the capabilities of conventional »MATVs« (master TV antennas) that distribute over-the-air broadcasting programs to tenants: an SMATV operator adds an antenna for satellite reception of special channels, such as pay TV, and then sells the services themselves to the residents, much like a cable television operator. (More recently, the term »private cable,« considerably more descriptive, has come into vogue.) The »S« in SMATV is really of secondary significance; any

15 Int'l Bus. Mach. Corp. (STS Preemption), 59 Radio Regulation 2d 964 (1986) (hereinafter cited as RR).

method for »importing« programming – satellites, microwave transmission, etc. – can do. What is significant, however, is the emergence of cable television systems that operate in an unregulated fashion under the control of property owners, in contrast to the regulated, franchised »public« cable network, whose universal service obligations are analogous to those of the public telephone network.

The rivalry between private and public cable television is often presented as a conflict between two transmission technologies, similar to that between direct satellite broadcasting (DBS) and public cable television. However, this form of presentation misses the point. Both public and private cable television use virtually the same technology – transmission to subscribers, over coaxial cable, of multiple channels of programming received via satellite and broadcast stations. Rivalry lies not in the technology but rather in the control over (and profits from) the wire that delivers video programming into the home. In that sense, private cable becomes the residential and mass-media equivalent of building-based telephone shared tenant communications. There are other similarities. A private cable system resembles a »bus« LAN in that it has a tree-and-branch architecture, high capacity and a coaxial mode of providing a large number of display terminals (called television sets) with a large amount of information flow (called television programs). With proper adaptation, such a plant could be used for two-way communications and interactive services, such as videotex. It is also possible to have communications between different terminals by providing some switching capability, either through star architecture or by cable packet switching. Similarly, the future use of the private cable plant for telephone distribution and shared tenant use in a residential setting is an option when the appropriate PBX and architecture are introduced.

At present, there is not much demand for non-video, high-speed communications capabilities in residential markets, but the penetration of the personal computer (17 million in 1984, including offices; up from 10 million in 1983 and 5 million in 1982) may change that over time. Similarly, local-area networks in business settings can be adapted for video transmission, though at present this is commercially more interesting for video conferencing than for television entertainment programming. However, there is a substantial conceptual overlap of landlord-supplied video and business communications, despite distinct application and differentiated, but convergent, technologies.

The regulatory issues, too, have similarities. Landlord-supplied private cable television is being opposed on such grounds as cream-skimming, threats to universal service, unequal regulation in comparison to the dominant carrier, loss of economies of scale and technological fragmentation. Just as in the case of telephony, the falling cost of the technology has encouraged entrepreneurial private-cable entry, which, in turn, has led to substantial deregulation by the FCC, in opposition to state and local authorities and established public cable carriers. The struggle, however, is far less bitter than telephony. Public cable operators still have many growth opportunities – including private cable – and the service is considered to be far less of a public necessity. Thus, the struggle over private cable has been considerably more low key than that over private telephone networks.

B. *Emergence of Private Cable*

Private cable emerged in the late 1970s when the public cable franchising process in many large cities bogged down in controversy, leaving a substantial portion of the nation's urban population without cable TV. In this situation, private cable systems, which did not require a franchise, emerged to fill the pent-up demand for premium programming. The development of private cable accelerated in 1979 when the FCC deregulated TV receive-only satellite antennas (TVROs). This led to increased demand and a rapid drop in prices, thus improving the economic feasibility of the service.

Another reason for the emergence of private cable is somewhat more shady: signals of pay-TV suppliers, such as HBO, could be easily received and distributed by SMATV without payment to the supplier. One study estimates that of the 500,000 SMATV users in late 1982, perhaps 150,000 were »pirates.«[16]

In some instances, public cable companies themselves felt compelled to enter the cable field before an area was wired for conventional cable in order to preempt private cable competitors. After obtaining the general franchise, they would integrate the SMATV »islands« into their local distribution network. However, in other instances, property owners and condominium associations themselves became involved in private cable operations or contracted with entrepreneurial SMATV operating firms. According to the SMATV's trade association, the National Satellite Cable Association, about 2000 SMATV systems were listed with the association in early 1984, with a total subscriber count of about 600,000. Although most private cable systems serve apartment complexes of 300 to 1000 units, some are much larger; the Co-Op City project in New York encompasses 15,000 apartments, and one project in Queens has 6000 units.

16 Henry, *The Economics of Pay-TV Media*, in VIDEO MEDIA COMPETITION, *supra* note 8; Int'l Bus. Mach. Corp (STS Preemption), 59 RR2d 964 (1986).

In principle, the channel capacity of a private cable system is the same as that of public cable. 70-channel, single-coaxial-cable systems are feasible under present technology; dual cables would double that number. A number of systems in fact provide 54 channels, but most private cable operations have significantly fewer. This can be explained, among other reasons, by the desire to reduce costs and by the absence of local franchise requirements. A private cable system could decide to carry only the most popular over-the-air broadcasters (such as the three commercial networks), omitting the low-budget, independent UHF stations that, by regulation, must be carried by franchised cable systems. This »must carry« requirement of public cable TV is presently being contested before courts and regulatory bodies.[17] Furthermore, private cable need not provide so-called »PEG« (public access, educational and governmental) channels. Because a private cable system has only a limited number of subscribers – who may well be more homogenous than a city's population – the SMATV operator can omit channels for which there is little interest. For example, in a building predominantly occupied by senior citizens, the rock-music channel MTV may not be essential. (Of course, through program choice, a homogenization of tenants may be promoted, which raises social and legal issues.)

C. *Regulatory Status of Private Cable*

Two regulatory issues are of particular significance for private cable. The first deals with regulatory obligations; the second, with competitors' rights of access to a building that has been wired by the landlord.

The public cable industry has complained about the unfair advantages possessed by unregulated private cable. Similarly, regulators have posed the question whether obligations imposed on public cable TV operators by federal, state and local authorities ought to be applied also to SMATV operators. Public cable operators are required to fulfill a variety of obligations: they must provide universal service to the entire franchise area (including its economically less attractive parts) at uniform rates; they must offer basic subscription rates that have been set by local or state regulation, though this has changed significantly in the aftermath of the 1984 Cable Act; and, as previously described, public cable operators must allocate a number of their channels to programs from which they may not benefit economically, such as small UHF stations and public-access, governmental and educational

17 Quincy Cable T.V. Inc. v. FCC, 768 F.2d 1434 (D.C. Cir. 1985).

channels. In the case of public-access channels, operators may, by the terms of their franchise contracts, also have to supply studio facilites at nominal or no charge.
The basis for such regulation is, first, to prevent the emergence of an »information underclass« that is unable to receive or afford the media experiences available to the majority of the population. Second, the provisions are aimed at reducing the gatekeeper powers of public cable operators by depriving them of editorial control over at least a portion of the system's channels. Third, it is a response to the political power of private broadcasters and local governments. A typical municipal-franchise contract, as well as the 1984 cable legislation, permits the franchising authority to collect 5% of gross revenues from a public cable operator. No similar payments need to be made by private cable operators (though they do pay landlords).
For all these reasons, SMATV operations are a thorn in the sides of municipal regulators, public cable companies and broadcasters (private and public), parties that do not normally see eye to eye.
When states began to restrict private cable, the FCC responded in November 1983, declaring that states were preempted from regulating SMATV systems.[18] The decision was appealed to the U.S. Court of Appeals for the District of Columbia by the New York Commission on Cable. In December 1984, Judge Edward Tamm upheld the FCC preemption over state and local regulation.[19]

D. *Regulation of Access by Public Cable*

The second significant legal issue involving private cable concerns the access rights of its competitors, in particular of public cable television. Given the relatively high penetration rate that must be achieved for private cable systems to break even, direct competition from public cable operators may well make SMATV uneconomical.
Conflicts about public cable's access rights to apartment houses have been persistent. The local franchise grants a public cable operator the right of access to public rights of way, but it does not carry the right to enter private property unless state law creates such access rights. A public cable operator must negotiate such rights with the landlord, who often demands compensation. To ensure that tenants are provided with cable television, several states

18 *In re* Earth Satellite Communications Inc., 55 P&F RR2d 1427 (1983).
19 N.Y. State Comm'n on Cable Television v. FCC, 749 F.2d 804 (D.C. Cir. 1984).

have passed statutes affording public cable companies the right of access over landlord objections.[20]

In one case, a New York landlord denied access to Teleprompter (now Group W Cable) of Manhattan. This led to litigation that ulitimately reached the U.S. Supreme Court in *Loretto v. Teleprompter.*[21] The Court agreed in principle with Loretto's argument that such access rights to real property were a taking, even though the intrusion was only minor; on the other hand, the Court held that a proper compensation would overcome such frustration of property rights. The New York Commission on Cable, called upon to set such compensation, found that a token $1 per year for the building was a just compensation, making Loretto's constitutional victory rather pyrrhic. For practical purposes, then, the state's power to establish access rights to apartment complexes for public cable companies was established.

One sensible alternative approach would be to give the public cable operator, for a fee, the right to some transmission capacity in landlord-provided internal wiring, with the right to upgrade this capacity when it is not adequate. Thus, in effect, public cable operators would be able to connect into a building's private cable system and reach potential subscribers directly. This would be part of the public cable operator's package of rights and obligations for universal service. This approach is similar in concept to the right of access that a telephone company has in landlord-wired buildings. There, too, the landlord's right to provide his own communications system is balanced against the rights to choose alternative services and to participate in a larger, public network. In the video mass-media field, it is too early to discuss such an approach. However, as cable-transmitted video becomes the primary form of mass media and as the conflicts between local public cable companies and landlord-affiliated private cable increase, as they inevitably must, a shared approach based on access rights and compensation seems a sensible arrangement in a system of private communications.

E. *Private Cable Regulatory Outlook*

The social goals behind public cable regulation are not likely to disappear. In this situation, the development and success of a transmission system that prospers partly due the absence of these requirements will be controversial. Further, it is likely that landlord-affiliated private cable will generate its share

20 FLA. STAT. ANN. § 718.1232 (West 1985).
21 Loretto v. Teleprompter, 458 U.S. 419 (1982).

of bad publicity. It is unavoidable that some operators will be overly aggressive in charging tenants for their services, while others will be slow in bringing their system to a reasonable level of channel capacity and service reliability. Still others may load the video channels with programs either of their own ideological or moral bias or geared towards tenant types of their preference. As such instances occur, public pressure for some form of private cable regulation will grow, fueled by tenants who would like to reduce their monthly payments and by municipalities eager to expand their tax bases.

It seems therefore realistic to expect that as private cable gains a larger presence, it will be subject to regulatory burdens that more closely resemble those of public cable. This is likely to include a fee similar to the municipal franchise fee of 5% for public cable. It may also include some obligations to carry educational, public-access-type programs. Furthermore, as has been discussed above, landlords may be required in the future to provide franchised cable TV with access, in return for a fair compensation. This access can be either through existing physical wiring or through leasing capacity on the private cable's wiring.

On the other hand, it is also reasonable to expect that, in time, the geographic limitations that restrict private cable to a single building complex will break down. The regulatory barriers for exclusive franchising are already crumbling with a recent Ninth Circuit decision affecting a California franchise (the *Preferred Cable* case).[22] As in the case of telephone and data communications, the emerging small, private forms of communications distribution will thus expand to cover entire neighborhoods and partially overlay the public cable network. Through this process of expansion and partial regulation, private cable will increasingly be called upon to contribute to policy goals, including universal service and diversity of information sources that have characterized U.S. communications for a long time.

IV. *Outlook*

This survey has discussed the emergence of new, local, private communications systems in the United States, both in the office setting and in the residential mass-media market. We have seen how the development in both

22 Preferred Communications v. Los Angeles, 754 F.2d 1396 (9th Cir. 1985).

these areas exhibits strong parallels. Business-oriented shared tenant services and local-area networks and consumer-oriented private cable are increasingly likely to overlap and fulfill some of each other's functions. In both instances, one can observe both the emergence of private, building-based networks that are landlord-controlled and largely unregulated and the partial separation of the communications facilities of users from the established »public« systems of local telephone companies and cable television operators.

There is no reason to assume that this process will stop soon. Instead, these local islands will expand geographically and functionally, since court decisions have already raised doubts about the legality of quasi-exclusive territorial restrictions. The *Preferred* case raised this question for cable television. In the telephony field, the FCC in late 1985 permitted a »raid« by Southwestern Bell into GTE territory in Texas to access the Arco Oil company.[23]

These developments result in the contribution of communications resources and flexibility to business users and, typically, to middle-class residents; at the same time, they leave behind those that are outside these private systems and require them to contribute more to maintain public communications services. Since the public and universal goals and service obligations are not likely to be dropped, the policy alternatives are either to adopt restrictive rules that are costly and, over time, ineffective or to establish different forms of support for communications services that are socially desirable. The less restrictive alternative is to subject new local networks to some forms of levies that will support universal service, to levy similar fees on the public system and then to use the proceeds for some form of a universal service fund. It is in the interest of social policy, technical progress and communications policy to reestablish the social compact of a telecommunications policy in which deregulation is encouraged, whereby the communications needs of some classes of users who are worse off than before would be supported by the other users. The alternative is several decades of regulatory strife.

23 Atlantic Richfield Co., 59 RR2d 417 (Common Carrier Bureau 1985).

FIGURE 4.1

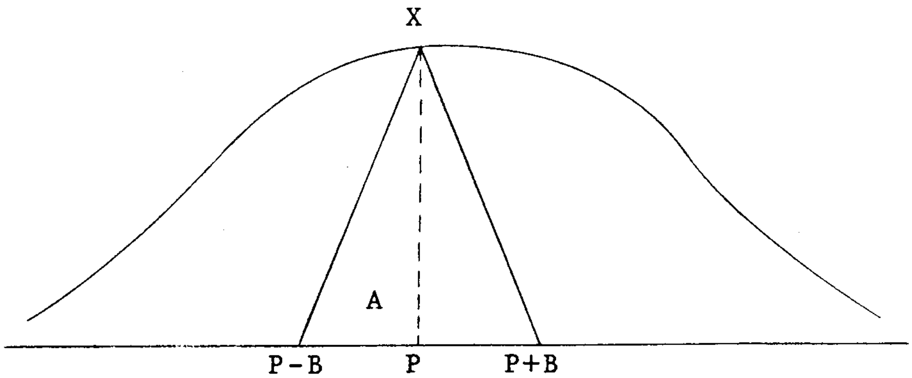

FIGURE 4.2

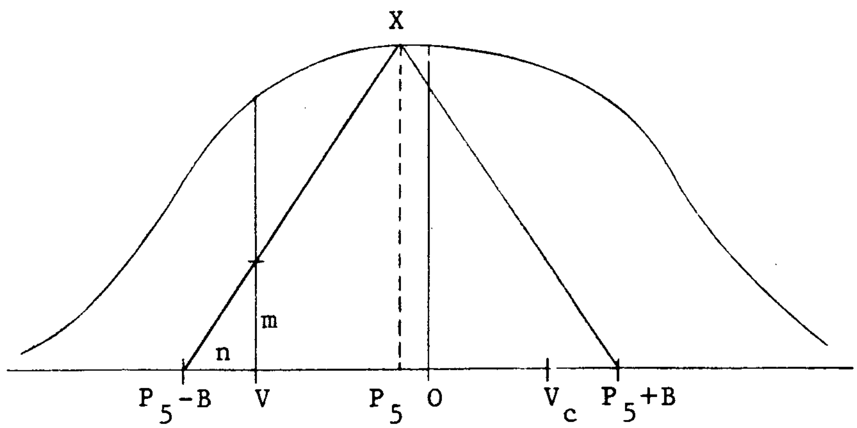

FIGURE 4.3

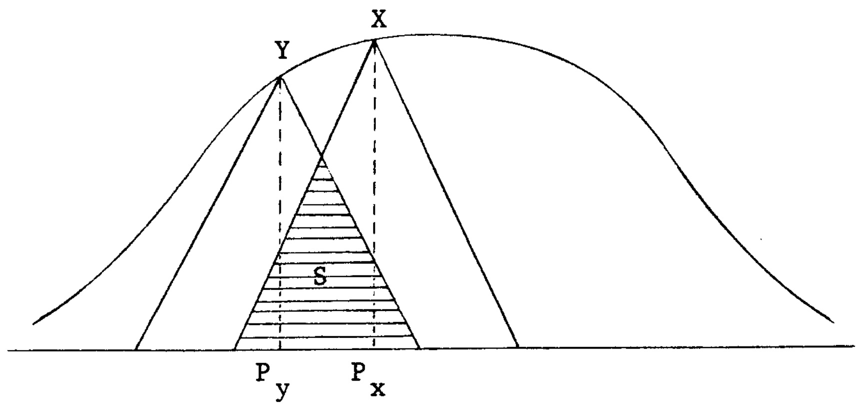

FIGURE 4.4

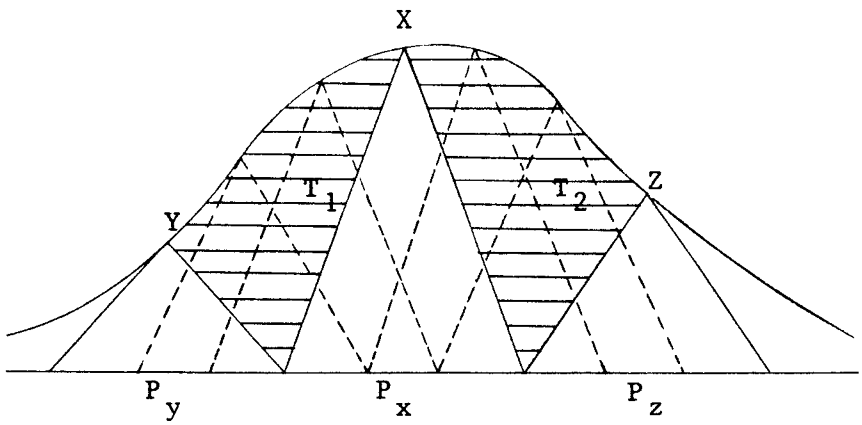

FIGURE 4.5

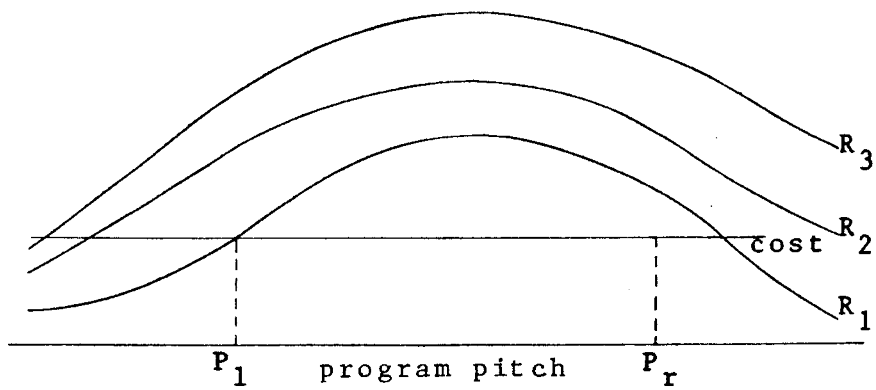

FIGURE 4.5