Chapter 4

The Japanese ISDN Market

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NTT first announced Japan's ISDN, the Information Network System (INS), in 1979. When NTT was a monopoly service provider before privatization in 1985, INS was seen as a national goal for upgrading the nation's telecommunications network from a basic telephone service network. It was not really considered to be a strategic product in a pluralistic network environment.

As a matter of fact, the telecommunications market has since changed quickly and dramatically. There are multiple network services provided both by Type 1 carriers such as NTT and new common carriers (NCCs), and Type 2 carriers. Type 2 carriers lease circuits from Type 1 carriers and resell value-added services. These other service providers along with large-scale private networks, operated by national and global customers, affect all of Japan's common carriers' revenue streams.

But today, ISDN is not a public service depending on taxpayers' money or a technological gimmick for engineers' satisfaction. It is neither a rosy dream of the future information society nor a panacea to cure all communications problems. It is an innovative network solution of the next generation. ISDN offers a practical alternative for telecommunications users and a way for telephone companies to generate new revenues.

But there are many new challenges for NTT and the NCCs. Policy makers should be involved in the process as NTT and the NCCs accept the challenge to further extend enhanced information highways.

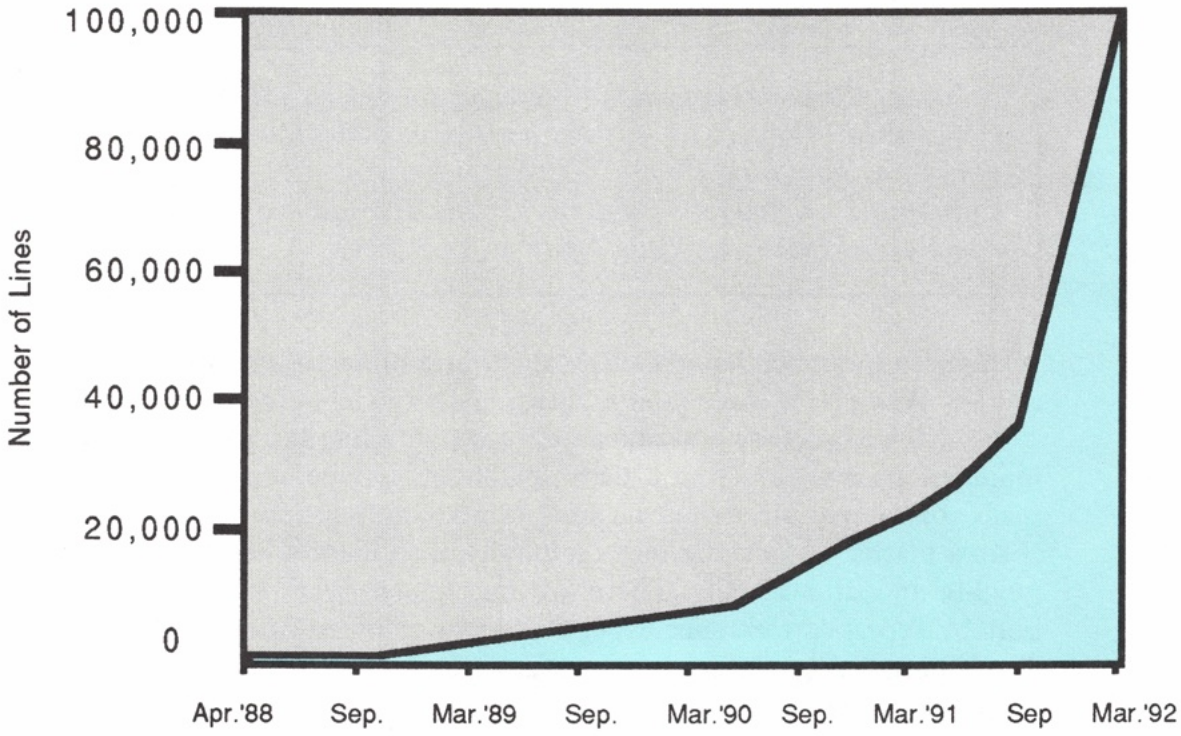
Current Market Overview

Unlike the complex ISDN situation in the United States, NTT's ISDN is not a

Centrex-based "island BRI" or T-1/proprietary PBX-based "bypass PRI." INS-Net 64 and INS-Net 1500 are nationwide public switched services that are available in more than 97% of Japanese cities.

INS-Net 64 service began in April 1988 with 29 subscribers and 114 lines. ISDN sales since then have proven to be one of the fastest growing network services ever. As of January 1992 the number of INS-Net 64 circuits was 72,000, and INS-Net 1500 circuits totaled 1400. There were a total of 86,000 circuits at that time. The estimated total number of subscribers for both services at the end of fiscal year 1991 reached 100,000 (Figure 1).

Figure 1
Increase in INS-Net Subscriber Lines



NTT's mid-term business plan forecasts the size of the ISDN market as 1 million lines generating 150 billion yen ($1.2 billion) in revenues by the end of 1995.

Alongside the ISDN market growth, the average price of terminal equipment has dropped dramatically. For example, an NTT standard ISDN telephone set costs only ¥30,000 ($230). A Group 4 facsimile, which is one of the most popular terminals for ISDN applications, costs one third of its average price four years ago, and is now available for ¥100 million ($7700). Standard terminal adapters cost between ¥100,000 ($770) and ¥200,000 ($1500)—sometimes much less expensive than high-speed modems.

Since ISDN services began, the total number of users has reached 14,000 nationwide. The market has rapidly evolved from a national large business

users market (National Accounts: NAs) to a regional corporate users market (Regional Accounts: RAs) and to local mid-sized business users market (Local Accounts: LAs).

Stage 1: 1988-1989

Back-up circuit use for private networks and experimental uses of NAs: National banks adopted ISDN to provide redundant circuits to back up their on-line banking T-1 trunk networks. Some early adopters such as large manufacturers got the service for experimental use. At this early stage of the service, users were limited to curious NA customers. This was true for several reasons: limited serving areas such as large cities; limited available application software; and high terminal equipment costs. These factors, along with low initial circuit cost compared to digital leased circuits and DDX-C (switched 48 kb/s service), were attractions the curious NAs could not ignore. ISDN was still regarded at this time as a potential but unknown secondary sub-network for business users.

Stage 2: From Mid-1990

Nationwide center-to-end data network systems of NAs: In the summer of 1990, a large convenience store chain adopted ISDN as its point-of-sale (POS) data network platform to connect its sales and distribution control center in Tokyo with 4400 stores nationwide. This case triggered explosive demand for national ISDN and other large national business telecommunications users also started rushing to ISDN-based network construction.

So many NAs can create national quasi-private networks because in April 1990 NTT announced a new service area extension policy to respond to demand everywhere in Japan. This move was intended to attract more business customers.

Stage 3: From 1991

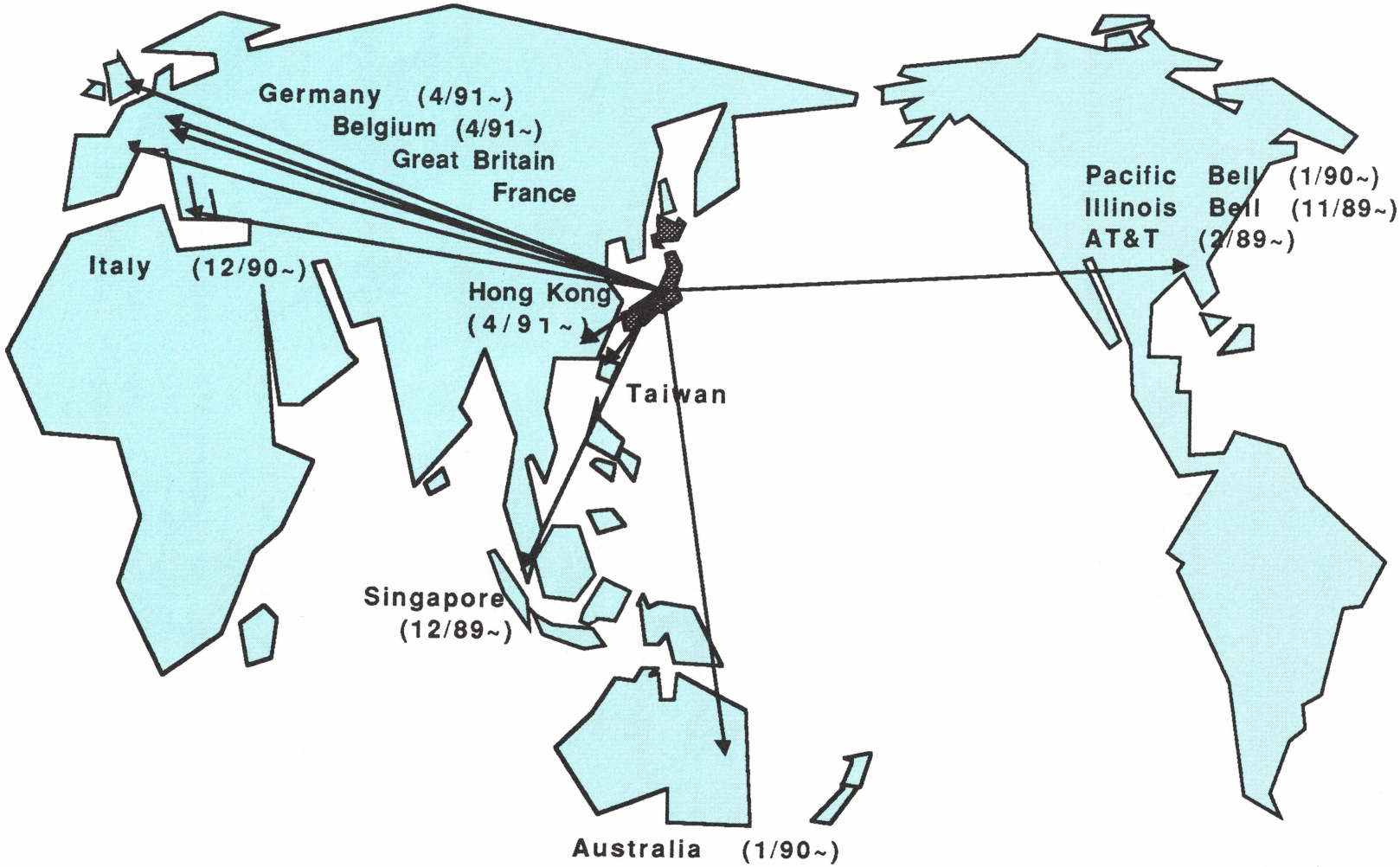
Regional network systems of RAs: While the NA market grows because of quick expansion of the service areas, the RA market grows simultaneously. As a matter of fact, it's growing much faster than the NA market. Now more than 70% of monthly sales comes from regional banks, municipal governments, schools and agricultural co-ops.

Stage 4: From Second Quarter of 1991

Mid-sized systems of LAs and single-line users: The market is vigorously expanding toward a mid-sized local business market. In this market, outside sales channels such as local terminal equipment vendors and value-added resellers (VARs) play a key role in the sales of small systems based on G4 facsimile and PC terminal adapters. In addition the number of single circuit users who access existing national or regional network systems, such as PC VAN, G4 facsimile and E-mail, are rapidly increasing.

As a result, 80% of the total number of circuits are owned by NA or RA

Figure 2
Global ISDN



private network operators; the rest are owned by single-line users. But in terms of the number of users, 90% are single-line users.

Stage 5: From 1989

Global network systems of multinational business users: It is a natural transition for corporate networks to extend outside Japan to foreign locations, since most business telecommunications users operate in the global economy. Of course, ISDN is not an exception to this inevitable trend. NTT is actively promoting transnational interconnection of ISDN with foreign carriers on a customer-driven basis (Figure 2).

Service Area Extension Plan

When demand is uncertain, the decision to invest in capital-intensive construction projects like ISDN is a difficult one. It is understandable that U.S. telephone companies have been reluctant to deploy ISDN nationwide, even if interconnection and SS7 can be realized between interexchange carriers (IXCs) and local exchange carriers (LECs). To minimize the initial investment risks, LECs must find customers first, then install a switch to provide ISDN access lines within a selected single serving office, which creates an "ISDN island."

In Japan, the situation is a little different. Although the future is bright for Japanese telecommunications users, the same competitive issues exist for NTT and the NCCs.

In addition to network digitization that is introducing fiber optics trunks as well as digital toll and local switches, NTT is extending ISDN service areas with less cost and a shorter time frame, using an ISDN subscriber module (ISM—also known as an I-interface Subscriber Module). ISMs are an adjunct on existing D70 local switches and remote terminals (RTs) that are installed in non-D70 central offices or at the customer premises (Figure 3).

In compliance with the area extension plan, ISDN service began in the Tokyo-Nagoya-Osaka megalopolis corridor in April 1988, and then expanded to about 30 major cities nationwide at the beginning of 1989. Those areas were considered the most profitable and least risky. However, as described in Stage 1, market growth was unexpectedly slow at the end of September 1989.

Service providers want to be sure that the revenues will be there, while users want to know what the benefits of a new service will be. Which should come first? NTT changed its service area extension policy drastically in April 1990 and will extend service areas to respond to demand from users throughout Japan, rather than in only selected service areas. This user-driven approach to promote ISDN as a nationwide service is one way NTT was able to break out of the vicious circle of market growth (Figure 4).

As a result, ISDN now is available in 97% of Japanese cities that have a population of more than 30,000, and sales records show that it is one of the fastest growth areas (Figure 5).

Figure 3

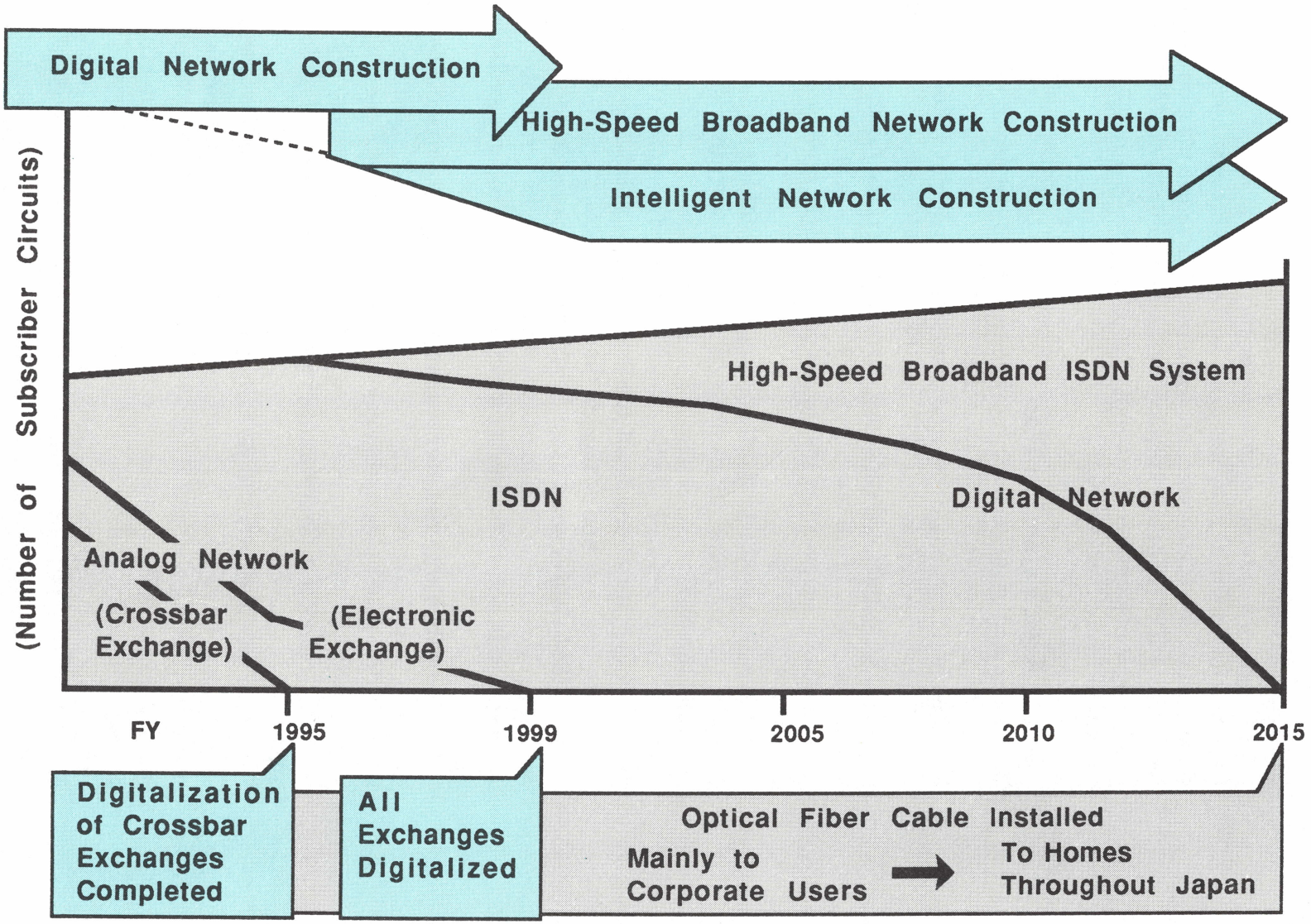

Digital Network Construction
High-Speed Broadband Network Construction
Intelligent Network Construction
(Number of Subscriber Circuits)
High-Speed Broadband ISDN System
ISDN
Digital Network
Analog Network
(Crossbar Exchange)
(Electronic Exchange)
FY
1995
1999
2005
2010
2015
Digitalization of Crossbar Exchanges Completed
All Exchanges Digitalized
Optical Fiber Cable Installed
Mainly to Corporate Users
To Homes Throughout Japan

Figure 4
Vicious Circle

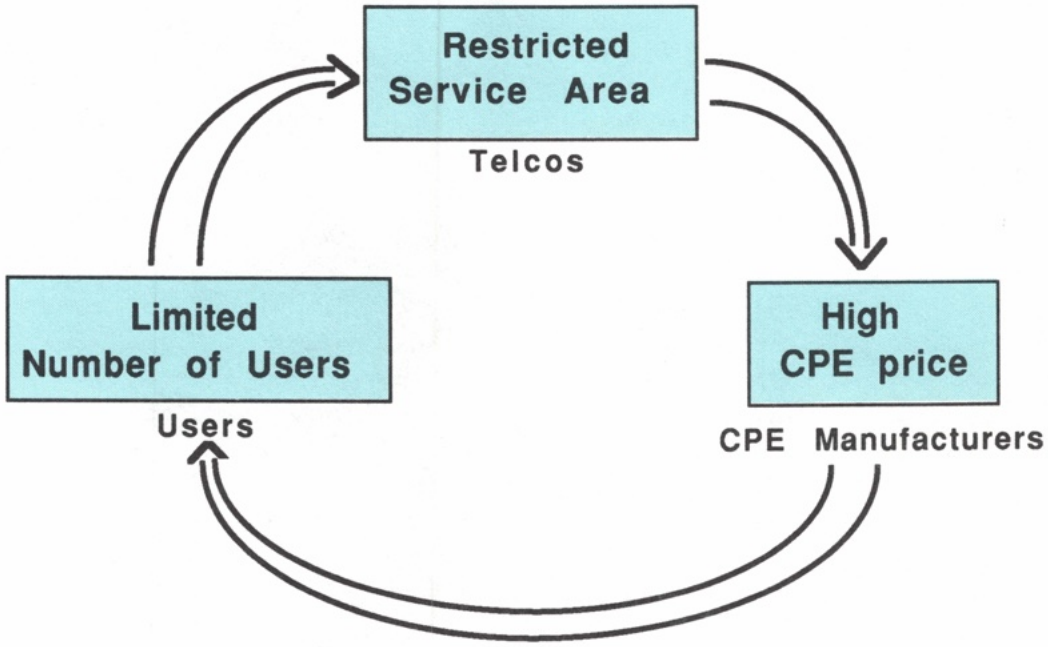


Figure 5
INS-Net Service Area

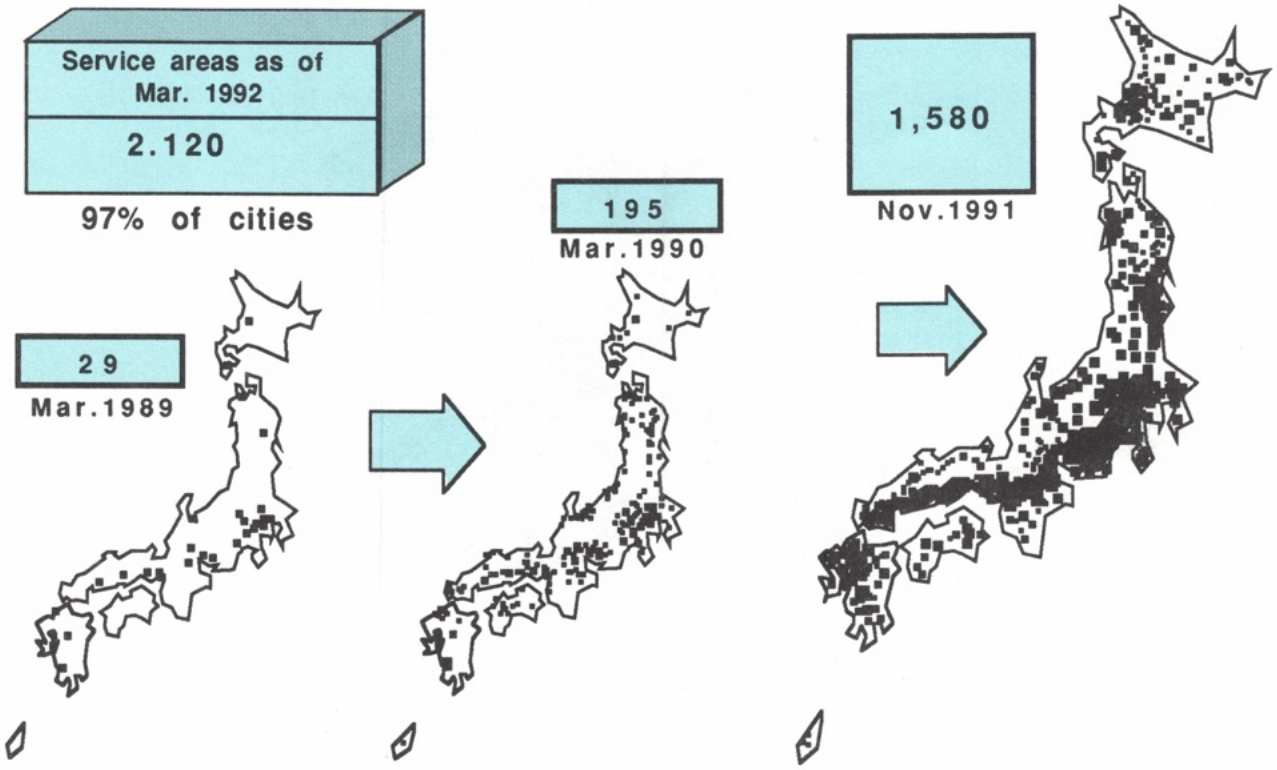
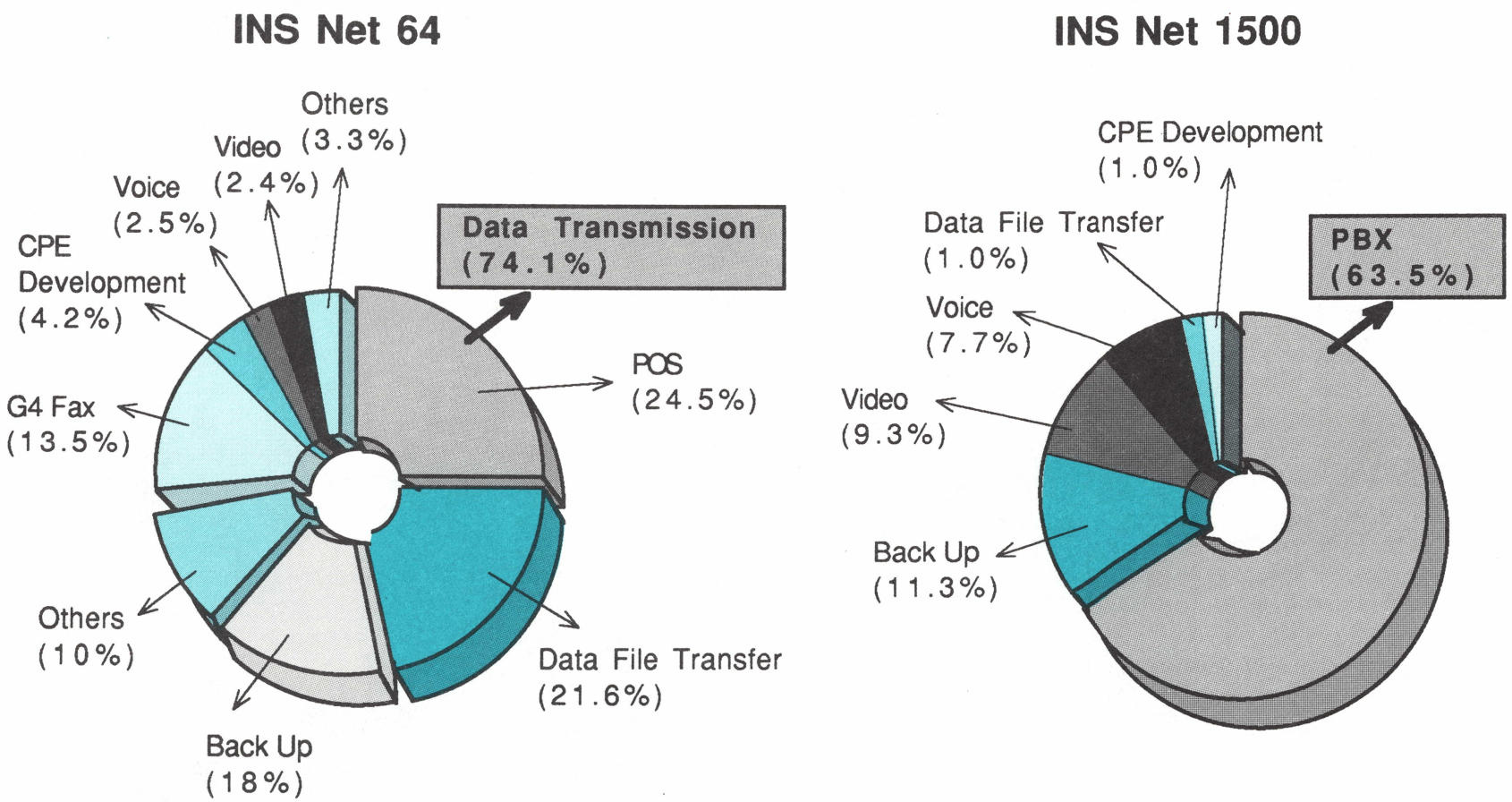


Figure 6
ISDN Applications



Applications of ISDN in Corporate Networks

A horizontal extension of a variety of ISDN applications to clients in all industries is essential to make ISDN a popular network solution. Since service began in 1988, it is now possible to identify feasible and practical applications for both INS-Net 64 and INS-Net 1500.

According to the recent analysis of existing user applications, 72% of INS-Net 64 is used as an on-line data network platform for both circuit-switched and packet-switched data (Figure 6).

INS-Net 64 has many interesting applications, some of which include the following: a point-of-sale, packet-switched data network used by a large convenience store chain to interconnect 4400 franchise stores with its headquarters CPU (Figure 7); a ticket reservation system for travel industries; dealing and G4 facsimile systems for brokerage firms; claim processing systems based on image/text databases for insurance companies (Figure 8); ATM monitoring and operation systems for banks; document delivery systems for local government offices; and LAN bridging to transmit CAD data in manufacturing and construction industries (Figure 9).

On the other hand, 63.5% of INS-Net 1500 is used for voice-oriented corporate networks integrated with some data applications such as G4 facsimile and electronic mail on digital PBX nodes (Figure 6). INS-Net 1500 is also used for a color, still-image processing system that allows printing industries to share image databases as well as conduct remote processing and proofreading between designers and factories.

The Users' Viewpoint

Why has ISDN become so popular? What are the real values for users? Users like ISDN because it is economical, provides value-added services and gives them a strategic advantage.

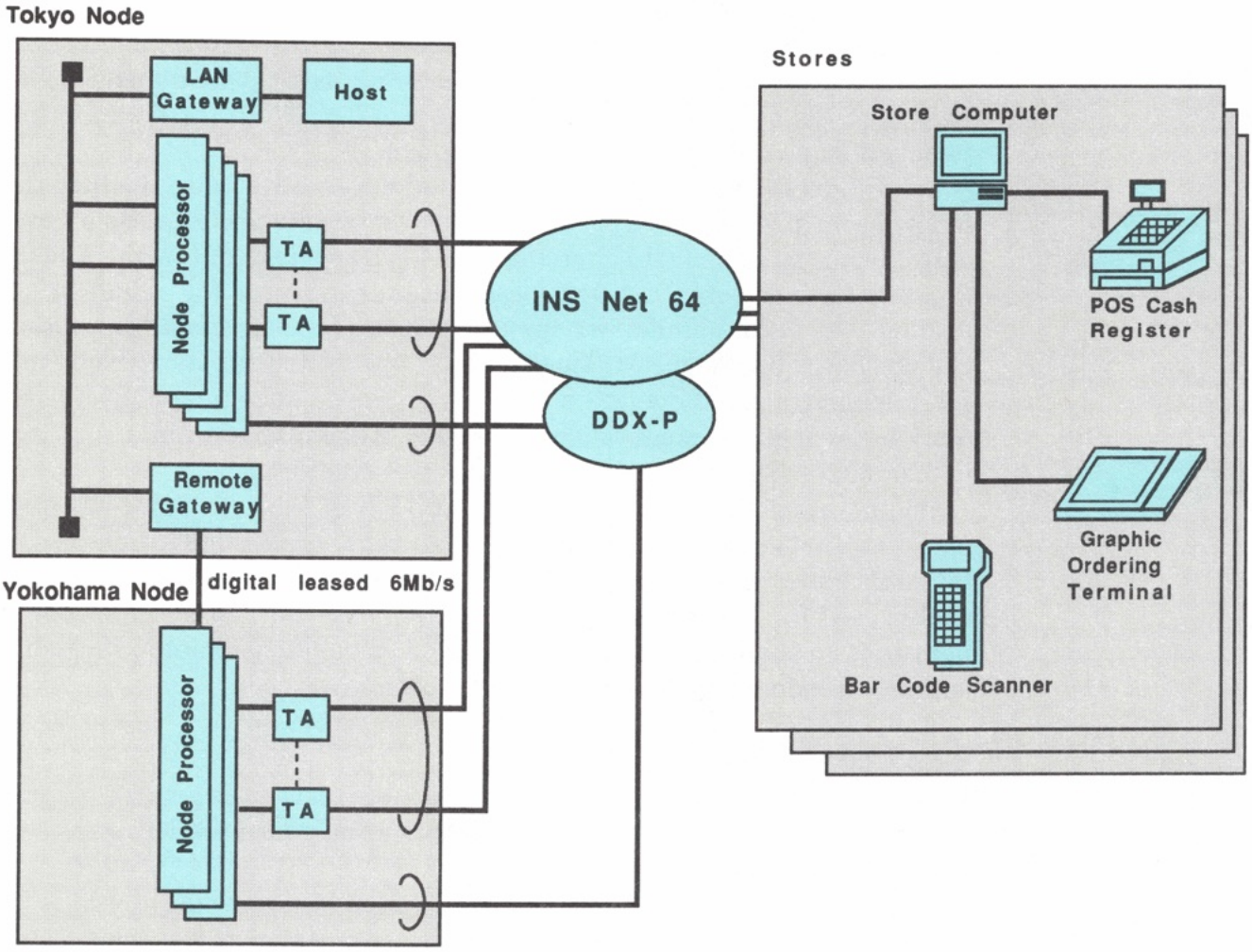
Since ISDN is a public-switched service available nationwide as well as an traffic-sensitive, tariff-based service, it is an economical digital solution for comparatively low data traffic users—compared to digital leased-line services. It is beneficial for users who need higher speed and higher quality data than the public switched telephone network (PSTN) can offer, but can not justify DS-0 or DS-1 digital leased lines (Figure 10).

High-speed transmission means low-cost data transmission because ISDN adopts the same tariff as the PSTN. For example, to send four sheets of A4 size document by G4 facsimile from Tokyo to Osaka, a distance of approximately 450 km, takes only 12 seconds and costs ¥30 (23¢). An analog G3 facsimile will transmit the same number of pages in 120 seconds at a cost of ¥350 ($2.70). In terms of monthly charge, a cost per channel of INS-Net 64, which has two B-channels, is almost equivalent to that of the PSTN. INS-Net 1500, which has 23 or 24 B channels, on the other hand, is less expensive than the PSTN (Figures 11 and 12).

In addition, the monthly charge for the ISDN packet-mode service is approximately one seventh the cost of DDX-Packet service.

New applications such as image and high-volume data file transfer have

Figure 7
ISDN Application (1)
POS Data Network



not been achieved through conventional methods. For example, some real estate agents have installed videotex terminals and G4 facsimile at their offices to retrieve image and text information for certain properties for their clients by accessing centralized databases through ISDN. A similar kind of application has been adopted by used car dealers in central Tokyo, where storage space is so expensive that few cars can be shown in their sales offices. This aspect of ISDN creates a new piece of the telecommunications market pie.

Consequently, economy and value-added features of ISDN improve the operational efficiency of user network systems. Yet, ISDN can do more than that. In the convenience store case, having the ability to react in a timely manner to consumers' needs through the use of real-time sales and inventory data on more than 60,000 items from 4400 stores is the key to surviving in a competitive retail market. This system can also support each store so each

Figure 8
ISDN Application (2)
Image/Text Database System

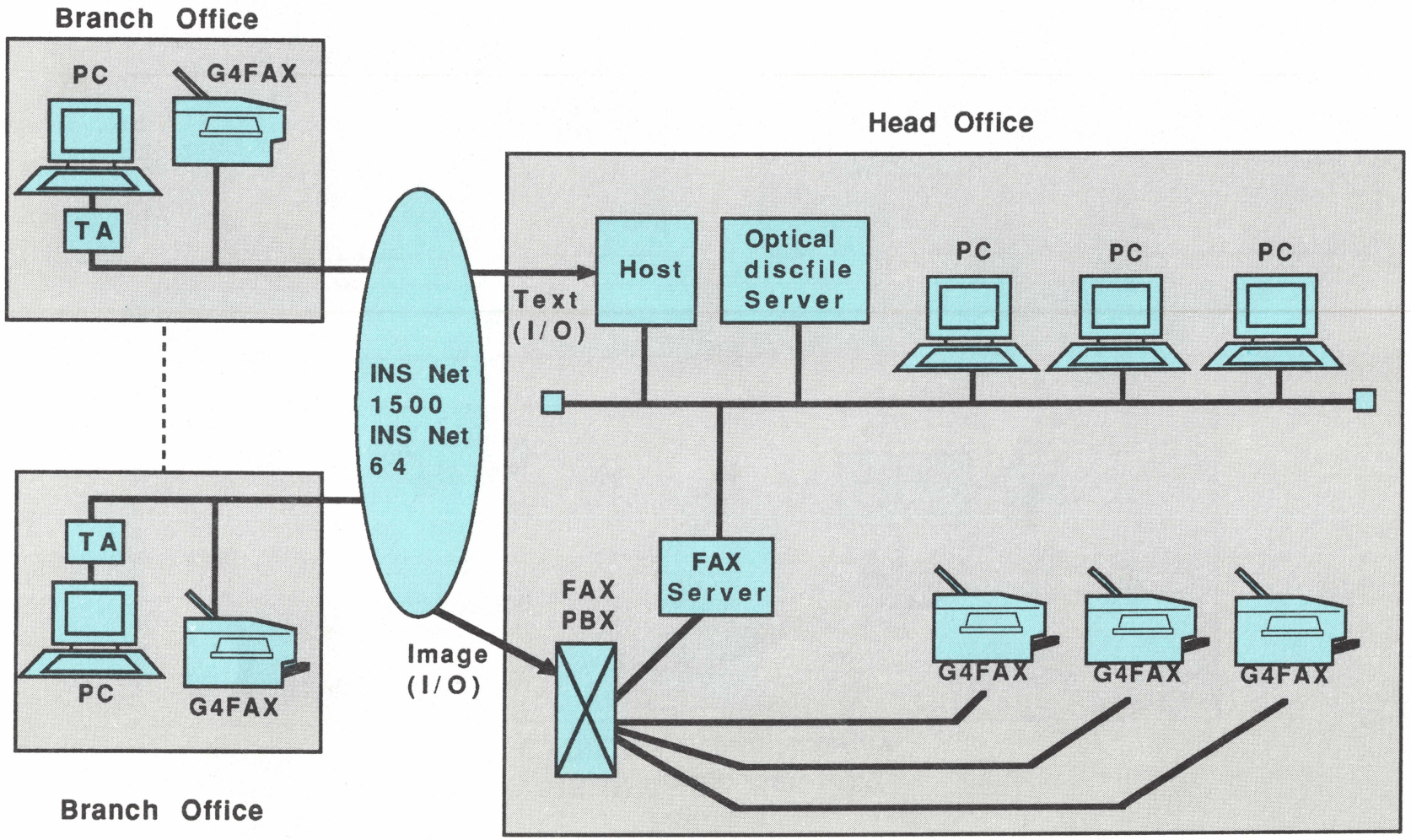


Figure 9
ISDN Application (3)
CAD/CAM Data Network

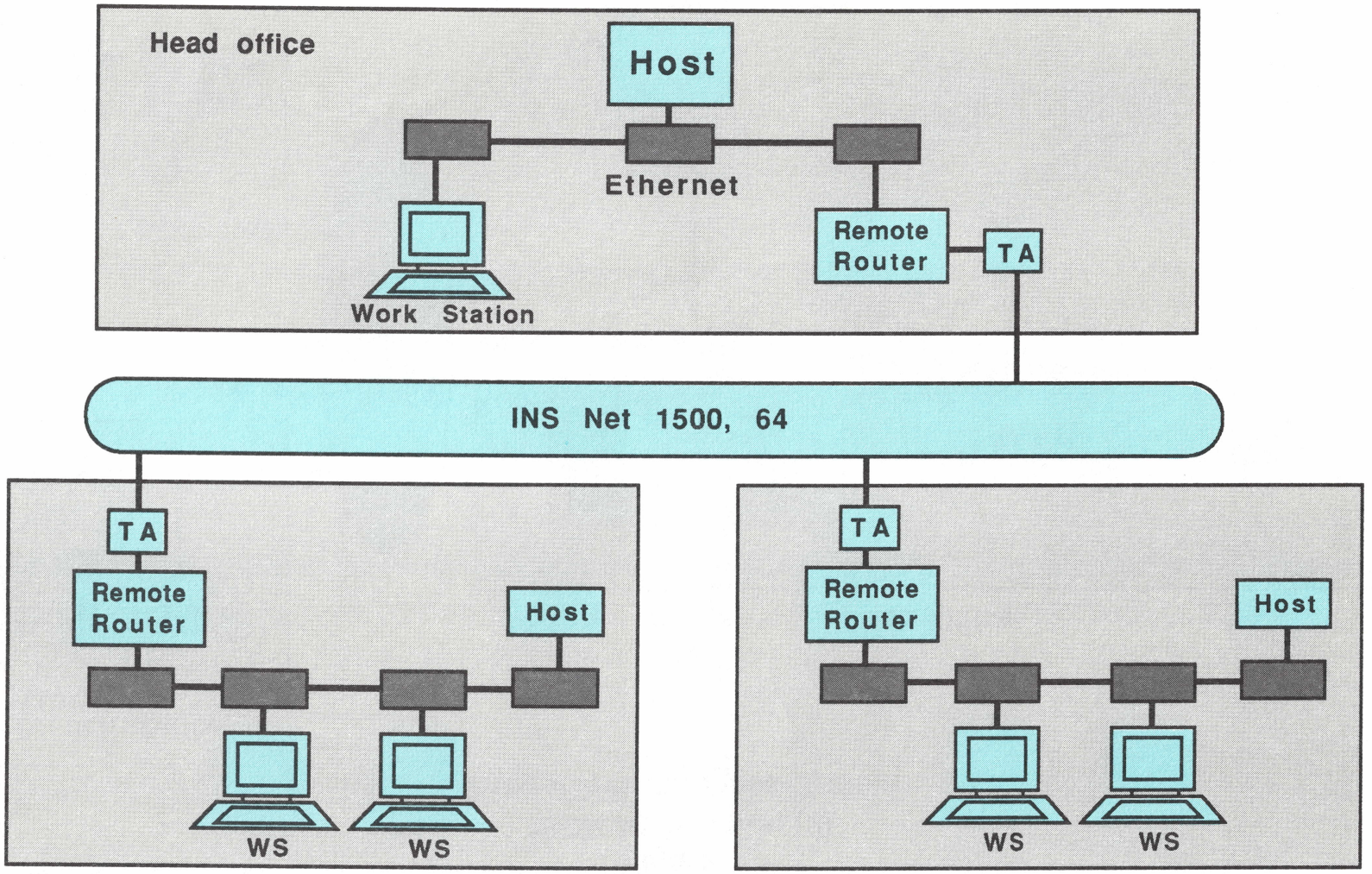
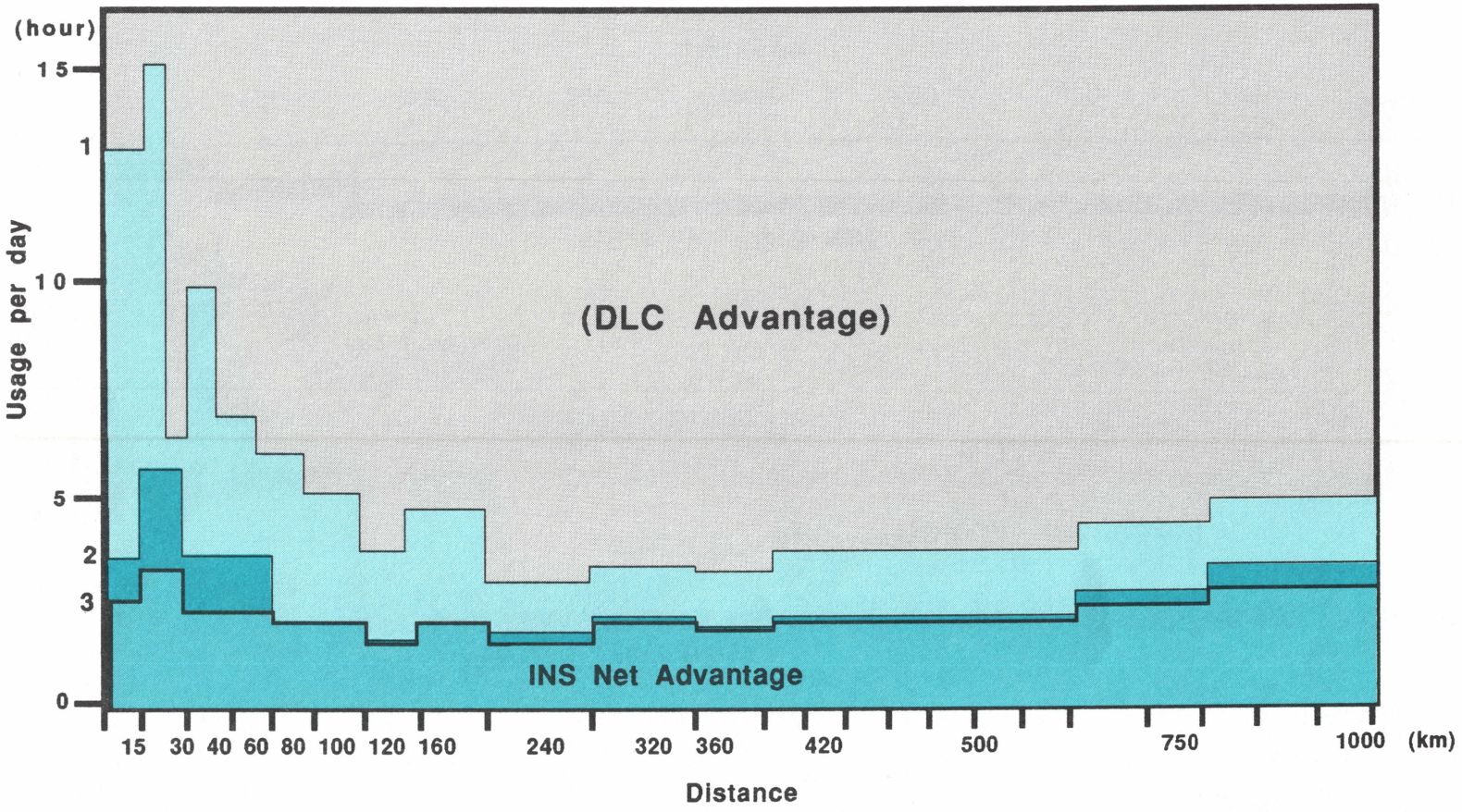


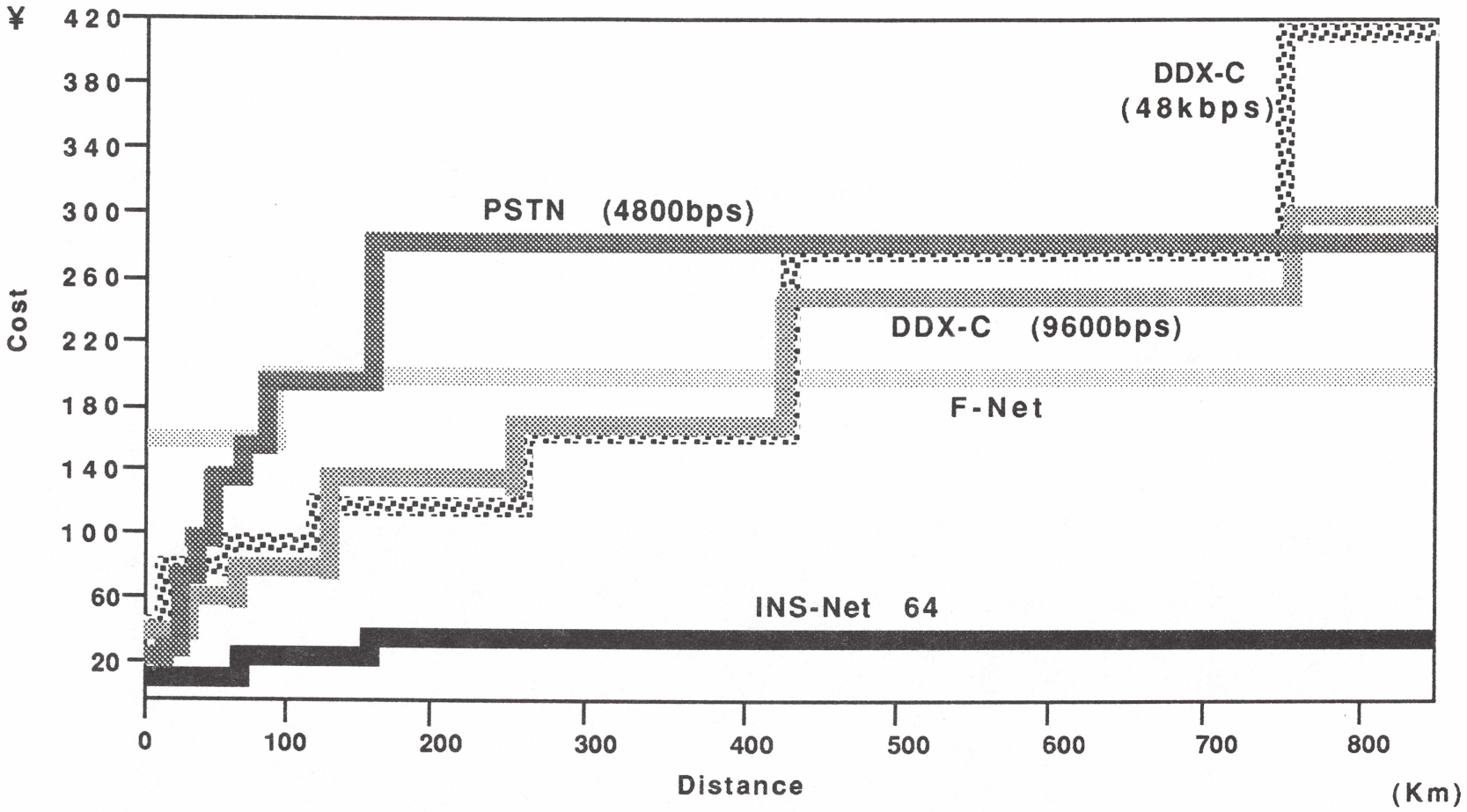
Figure 10
Cost Comparison
INS-Net vs. Digital Leased Circuit
(25 working days/month)



1. INS-Net 64 vs DLC (64kb/s)
2. INS-Net 1500 vs DLC (384kb/s)
3. INS-Net 1500 vs DLC (1.5Mb/s)

DLC = Digital Leased Circuit

Figure 11
ISDN vs. Other Switched Services
(cost / 1Mbps)



one can get better sales results and keep inventories moving by supplying consumer-oriented products that are delivered directly from producers on a just-in-time basis. In a strategic sense, this system differentiates this specific convenience store chain from other franchise chain systems and attracts local store owners to become part of the chain.

Thus, ISDN is considered as a new strategic tool that has a greater effect on the decision-making process so management resources can be shared inside and outside corporations.

Service Provider's Viewpoint

For users, ISDN dramatically reduces communications costs. But does it mean that service providers lose money because ISDN reduces the revenues generated by conventional services?

According to NTT's analysis of existing ISDN users, 33% are new subscribers. This indicates that ISDN is creating new telecommunications markets and is attracting users from other communications media such as mail, transportation and hand-delivery service.

ISDN also affects T-1 based private network configurations. Again, according to NTT's analysis, even though ISDN is sometimes superior to digital leased-line services in terms of cost, users who transferred from digital leased lines (64 kb/s-1.5 Mb/s bandwidth) amount to only 0.5%. This number suggests that both digital leased-line services and ISDN can co-exist in one corporate network as a hybrid private network. ISDN is filling the niche between these two markets.

In terms of average revenue per line, ISDN generates ¥18,500 ($145) while basic telephone service generates ¥9000 ($70). Basic service is losing revenue per line gradually, partly because of competition with NCCs in the long-distance telephone service market. This is the first time there has been a drop in revenues for NTT since telephone service started 100 years ago in Japan. Under these circumstances, ISDN is expected to be a new revenue source for NTT.

On the other hand, most ISDN users still use only one mode—either one B channel or one D channel. Although users can select three different modes on a call-by-call basis—audio-speech mode, circuit-switched data mode and packet-switched data mode through a single interface—there are few multimode users right now. There is potential that further applications can generate more traffic by using another channel.

Issues for Future Innovative Services

NTT has been investing in a national information highway network as a digitally integrated infrastructure. However, a single service provider like NTT should not have to bear all the costs under the new regulatory and market structure. Whether it is an ongoing narrowband ISDN or a next generation broadband ISDN, a reasonable cost-sharing mechanism for users, NCCs and the public sector should be developed to promote a future innovative infrastructure.

Figure 12-A
INS Net 64 Tariff

Monthly Charges

Line charge (basic charge)	Business use	Per subscriber line	¥3.630
	Residential use		¥2.830
Surcharge for line charge	Packet communications surcharge	Per B channel	¥3.500
		Per D channel	¥1.000
Wired equipment usage charge		Per wired line	¥60
Equipment rental charge		Per DSU	¥1.700

Telephone Mode / Digital Mode Charges

Mode / Distance, etc.		Charge		
		Telephone Mode		Digital Modes 64kb/s
		¥10 per unit of time noted below		
		Daytime 8 a.m. to 7 p.m.	Night time 7 p.m. to 11 p.m.(also includes Saturday and holiday daytime)	Late night and early morning 11 p.m. to 8 a.m.
Local-area calls		3 min		4 min
Neighboring Area calls		90 s		2 min
Inter-area calls (long distance)	Distance Between Areas / Up to 20 km	90 s		2 min
	Up to 30 km	45 s		1 min
	⋮			
	Over 160 km	7.5 s	13 s	14 s

For further details, refer to PSTN tariff.

Packet Mode Charges

Classification / Distance between areas / Packet length	Charge (per chargeable packet)			
	Daytime 8 a.m. to 7 p.m.		Night time 7 p.m. to 8 a.m. (also includes Saturday and holiday daytime)	
	Up to 100 km	Over 100 km	Up to 100 km	Over 100 km
Up to 128 octets	¥0.4	¥0.5	¥0.24	¥0.3
Up to 256 octets	¥0.8	¥1.0	¥0.48	¥0.6
Up to 512 octets	¥1.2	¥1.5	¥0.72	¥0.9
⋮				

For further details, refer to DDX tariff.

Figure 12-B
INS Net 1500 Tariff

Monthly Charges

Line charge (basic charge)		Per subscriber line	¥31.000
Surcharge for line charge	High speed communication surcharge	Per subscriber line	¥2.000
	Packet communication surcharge	Per B channel	¥3.500
		Per D channel	¥1.000
Wired equipment usage charge		Per wired line	¥2.000
Equipment rental charge		Per DSU	¥12,000

Telephone Mode / Digital Mode Charges

Mode / Distance, etc.		Charge				
		Telephone Mode	Digital mode			
			64kb/s		384kb/s	1.5M/bs
		¥10 per unit of time noted below			¥30 per unit of time noted below	¥60 per unit of time noted below
		Daytime 8 a.m. to 7 p.m.	Night time 7 p.m. to 11 p.m. (also includes Saturday and holiday daytime)	Late night and early morning 11 p.m. to 8 a.m.		
Local-area calls		3 min		4 min	90 s	50 s
Neighboring Area calls		90 s		2 min	45 s	25 s
Inter-area calls (long distance)	Distance Between Areas / Up to 20 km	90 s		2 min	45 s	25 s
	Up to 30 km	45 s		1 min		
	⋮					
	Up to 160 km	7.5 s	18.5 s	20 s	7 s	6 s
	Up to 320 km		13 s	14 s	6.5 s	5 s
	Over 320 km				6 s	4.5 s

For further details, refer to PSTN tariff.

* Packet Mode Charges apply the same tariff as INS Net 64

First of all, the ISDN tariff is a traffic-sensitive rate structure that is common to other public switched services like PSTN. As a matter of fact, many ISDN concepts and articles are borrowed from the PSTN tariff. For this reason, many users highly evaluate the merits of ISDN as a public switched service. Some applications, however, such as backup circuits for T-1 backbone private networks make it difficult for a service provider to recover the cost because of zero traffic.

In addition, many NA and RA users use ISDN as a kind of virtual private intra/intercorporate network based on a public switched network rather than on leased circuits. In other words, those users expect a common carrier to provide a network integration option including closed-user-group type network management, 24-hour maintenance, prioritized connections and unified billings, which are common service options for private network outsourcing.

The above-mentioned cases are a new and unexpected phenomenon appearing in the gray zone between public switched services and dedicated leased-line services. ISDN users enjoy the benefits of public switched service in a different way. Service providers should consider new pricing structures as well as new business opportunities to cope with the situation.

Second, when either NCCs or Type 2 carriers enter the ISDN market, an access charge or other cost-sharing mechanism should be developed when they interconnect to NTT's ISDN access to promote nationwide digital accessibility. So-called "cream skimming" may seriously delay local access digitization, because it is the most capital-intensive part of total investment.

Finally, cost sharing among carriers to build the future basic telecommunications service is not always a business matter, it is sometimes a public policy issue. In other words, if ISDN becomes a universal service like the PSTN, compensation and/or a subsidization mechanism from public resources such as a tax or universal service funds—which are advocated by several economists to maintain existing basic services—should be considered.

In a competitive telecommunications market, ISDN should be neither a public service nor a charity bazaar. It should be a business for telcos. To effectively create an innovative infrastructure for the future information society, the role of each player should be recognized, even though the chaos of politics and economics surrounds ISDN.