MIT COMMUNICATIONS FORUM

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
COMMUNICATIONS FORUM

"The National Information Infrastructure: Made in Japan"
14 April 1994
Massachusetts Institute of Technology
Bartos Theatre
20 Ames Street
4:00 to 6:00 p.m.

MIT COMMUNICATIONS FORUM
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Dr. Tetsuhiko Ikegami, Senior Vice-President
Nippon Telephone and Telegraph

Dr. Vincent Chan
Lincoln Laboratory
Massachusetts Institute of Technology

Kelly M. Greenhill, Rapporteur
Graduate Student, Department of Political Science
Massachusetts Institute of Technology

Moderator VINCENT CHAN: Welcome to today's Communications Forum. We are very happy to have Dr. Ikegami from Nippon Telegraph and Telephone [NTT] here to talk about the "National Information Infrastructure [NII]: Made in Japan." Today you will have the pleasure of hearing about some of the new technologies and programs being developed in Japan.

In 1968, Dr. Ikegami received his doctorate (on dynamics of laser diodes) from the Tokyo Institute of Technology, and in 1972, he joined NTT Laboratory. That, coincidentally, was the same time that NTT decided that there was a viable future in fiber communications and that laser diodes were the appropriate source; so he joined at the right time. Later, when working on direct modulation of the laser diode in his laboratory, he discovered the resonance phenomena in the laser diode. He has spent a great deal of time working on the reliability study of laser diode, and in this area, Dr. Ikegami has made significant contributions to the field.

In 1982, he successfully launched the first demonstration of an over 100 kilometer transmission at 400 megabytes per second, using DFB lasers--at that time, a rarity, but now a routine in fiber communication. He was the research leader of the optoelectronic integrated circuits and optical devices group at NTT until 1989, when he became the executive manager of the optoelectronics laboratories. In 1992, he assumed the position of senior vice-president at NTT, and he is also the deputy senior executive manager of NTT Research and Development Headquarters. In addition, he has assumed a very important position in the area of laser and electrooptics, and was recently elected [the first foreign] president of the LEOS [the Laser and Electro-optics Society] of the U.S.-based IEEE.

With that as an introduction, I give you Dr. Tetsuhiko Ikegami.

TETSUHIKO IKEGAMI [TI]: It is my great pleasure to be here, and to have an opportunity to give a talk to the MIT Communications Forum. My talk will cover what is going on in Japan, associated with the so-called NII. I will also touch on the emerging technologies, and will introduce the funding system in Japan. Most people, including me, believe the funding system in Japan is a bit strange, so I would like to increase everyone's understanding this system. Also, I want you to know that this talk does not represent NTT, and that all opinions expressed today are my own.

As you know, microelectronics and optoelectronics have changed communications technologies drastically. With the help of these technologies, NTT can almost catch up with the United States in the area of telephone service, an area in which we used to be twenty years behind. The main Japanese player in this area became private in 1983, however NTT is still the biggest operating company in Japan, and has about 58 million subscribers and a revenue of about $50 billion. We have 230,000 employees, which are said too many, to tell the truth. We are facing financial difficulties due to new common carriers, particularly in the long distance area. They are already sharing 44% of long distance service, which was taken from us. [Keep in mind that international calls are not handled by NTT, but by KDD, a different company. This arrangement is, of course, very different from AT&T or British Telecom.] Also, about 60% of NTT's stock is owned by the Ministry of Finance, so although we are technically private, we are in many senses, extremely regulated.

In 1990, NTT announced the so-called VI&P, Visual, Intelligent, and Personal Communications Service Plan. It was a future vision of telecommunications services on broadband ISDN. It included an ambitious plan for connecting every office and house through optical fiber by the year 2015. That was a very aggressive fiber to the home plan. But if you reexamine this VI&P plan, you may recognize that it was neither a business plan, nor a strategic plan, nor an implementation schedule. According to Toshi Sueyoshi, who is a professor at the Ohio State University, it was just a wish list. I agree with that assessment.

In 1992, the president of NTT "whispered" that fiber to the home [FTTH] was not necessarily profitable. Then the fiber to the home plan toned down. So, we can say that whispering from the top is very dangerous. After that time, discussion of the FTTH or the emerging NII, made in Japan, was back to an in-house issue for NTT and the Ministry of Post and Telecom. After the Clinton-Gore team won the U.S. presidential election by propagating change and competitiveness [and emphasizing the development of the NII], the number of

players in Japan interested in fiber to the home suddenly increased. In March 1993, NTT revised the VI&P plan, after the review of its future whole business plan. During the review, it was recognized that Japan was far behind in computer communication network area. In addition, we added multi-media services and the integration of telecommunications and broadcasting, which were strongly regulated by the government, Ministry of Post and Telecom. NTT also announced over $400 billion in implementation plans for the future infrastructure.

In the middle of the last year, 1993, at long last, the Hosokawa coalition administration started deregulation in Japan. Then, the "NII: Made in Japan" became a hot issue. Although the Ministry of Post and Telecom had presented a governmental view and policy direction on Japanese infrastructure, it had until recently, lacked a long-term strategic plan. In February 1994, the government disclosed a plan aimed at the year 2010. This new plan is much closer to the NII in the United States than NTT's plan. The Ministry's plan proposes, by 2010, to have a nation-wide fiber-optic network, which will produce a $1.15 trillion market [including a $500 billion new market related to multi-media services], as well as create 2.4 million new jobs. NTT's plan, on the other hand, proposes, by 2015, to have FTTH, to make $400 billion over the next 20 years, and to create a computer network, while expanding multi-media, telecommunications, and broadcast services.

Putting aside plans for the future, I will now focus on the present. The reality in Japan, with respect to INTERNET or NREN, is that we are very behind. We have small, so-called grass roots networks, like JUNET, WIDE, and SINET at some universities, but they are very, very small. Of late, the Japan Committee for Research NW [JCRN] has been preparing to produce some new projects for the future. And of course, government committees, such as the Ministry of Education, Science and Technology Agency [STA], and MITI, are very concerned about these things, and are actively pursuing the development of a Japanese NREN. But, Japan needs to do quite a bit of catching up in this area.

We see a similar phenomenon if we compare Japan and the United States in the area of personal computers. In the U.S., there are 4.2 personal computers to every one in Japan. In the area of INTERNET, in the U.S., there are 30 networks for every one in Japan. Moreover, the "national computer power" [i.e., average MIPS times the number of sets/population] of the U.S. is 520 ^{K} versus 140 ^{K}. Likewise, in the area of databases, Japan is far behind. For instance, the number of firms involved in databases in the U.S. is 1,670 versus 220 in Japan, and database sales in the U.S. of 1.28 trillion yen dwarf sales of 220 billion yen in Japan.

The multi-media alliance between most countries has been going on since the middle of last year. It is one example of PDA [Personal Digital Assistants]. Products that emphasize Personal Information Management [PIM] include the Newton Message Pad (created by Apple and Sharp) and the Zoomer (created by Tandy & Casio). Products directed at network terminals include personal communicators like AT&T's EO and Motorola's Envoy. There are also products aimed at adding basic PIM functions to portable telephones, such as IBM & Mitsubishi Electric's Simon. These products hold much promise for the future despite their high price.

In this multi-media arena, NTT has some alliances with Microsoft, Nextel, and with General Magic. The nature of the alliance depends on the objectives of each company. For instance, in alliance with General Magic and Microsoft, NTT seeks to create the new generation network field. A similar situation exists in the area of CATV, in which there are a great many joint business plans taking place. Sumitomo Shoji [which is providing investment funds for Suginami CATV] is in an alliance with TCI. Itoh-Chu Shoji, which has an alliance with Time Warner, Inc., is investing in CV 21, and TOMEN, in alliance with NYNEX, has invested in Yokonama CATV. [Note that most of Japanese partners are Trading Co., "Sohgohshosha."] So far there are many small CATV companies in Japan (about a hundred), but heretofore, business has been very bad. We are sure that over time these alliances will become profitable.

So, "NII: Made in Japan," as of the end of last year, was very hardware-oriented, with the telecommunications infrastructure by NTT, serving as the base at present for the NII. Unlike in the U.S., this is NOT a national policy initiative, it is NOT national industrial policy, and it is NOT a technology reinvestment project. Also, there is no consensus, as of this time, about who

shall build, who shall own, who shall operate, and how to use, the NII. However, the deregulation set into motion by Hosokawa has opened up a whole new horizon that shall continue even after his resignation.

I would now like to say something about the conceptual gap between telecommunications in Japan and Europe and those in the U.S. In Japan and Europe, it is believed that the telecommunications network should be a public utility first, given by the public sector, managed from top-down, with regulation, so everything is very government-oriented. In the U.S., on the other hand, it is my impression that everything is customer, business and service first, with standards that arise from bottom-up, grassroots *de facto* standardization. If you look at the orientation of these countries, there is a kind of crossing under way now, so we have to look for a new goal in the future.

[At this point, Dr. Ikegami showed a video that displayed a number of the services using a Gbit Network in NTT Laboratories.]

After you have seen some of the services we want to offer, I just want to review NTT's fiber-to-the-home plan. As mentioned above, this plan envisions FTTH by 2015, which is very far from now. Of course, some things will happen before then. For instance, we expect a completion plan for the large business area by approximately 1997 and for the small business area by the end of the century. We also plan to create so-called high-speed broadband backbone networks. These are only at the planning stage right now, but are expected to have a bit rate of 2.4 Gb/second and 10 Gb/second transmission system, using the existing fiber-optic network. In this new network we are attempting to construct, and shall use ATM-XC [cross-connect] system. The ATM-XC is our experimental system, and it includes eight channels of 2.4 Gb/s par port.

I will now show you some data from a soliton experiment by Nakazawa. He was very aggressive in soliton transmission systems, and very soon he succeeded in sending a single-pass soliton data transmission over 2000 kilometers at 20 gigabits/second and 1000 kilometers at 40 gigabits/second. The basic speed is 10 gigabit, which is doubled by time domain multiplexing into a 20 gigabit, while 40 gigabit was multiplied by polarization multiplexing.

Most of you recognize the impact of optical amplifiers [EDFA]; they give us a very, very powerful tool. These amplifiers allow us to eliminate the loss limit [i.e., we now "don't care of distance], and provide bit-rate independent amplification [i.e., we "don't care of bit-rate"] as well as bulk-amplification [i.e., this gives us "easy handling of color, WDM/FDM"]. With the addition of ATM, optical amplifiers will provide a simple and flexible physical network, which will allow us to realize so-called "photonics through the network" in the future.

One device area in which a great deal of research is taking place is "MQW-Modulator/DFB-LD," an integrated, laser incorporated, device with a quantum modulator. Presently, the resultant performance is better in hybrid, that is, a simple combination of laser diode and MQW Modulator, which is much better than an integrated device. But in the future, these so-called "integrated opto-electronic device" will be a key device, particularly in providing high speed and low cost "fiber to the home."

I would now like to discuss a rather controversial topic, the future of optical switching. Engineers in switching technologies at NTT are very excited about photonic switching. The idea behind this is that in the future, each network, operating like an island, will handle a very high bit rate. We need to be able to connect these islands through some kind of cross-connect. The people studying switching claim that, for this purpose, we need to use optical technologies. They propose a frequency division as a very powerful tool to connect high bit rate signal channels. Very recently, our switching people succeeded in creating 16 ports, each of which can handle 10 gigabits. It was a fantastic trial in the laboratory! A kind of formal statement can be made about the merging of photonics and electronics in the future, though the time scale is unclear: in the tera-bit realm, "future nodes merging photonics and electronics will remove complexity in network and will provide flexible and inexpensive networks."

The rest of my talk will focus on the funding system in Japan. Funding by the government is a bit different than here in the United States. For instance, how money flows into

the research body is quite different. The Ministry of Education directs "pure" [i.e., for the most part, for basic research] money to the universities. MITI's funding, on the other hand, is very different. MITI forms consortia or corporations, and then gives funding to these newly created bodies. Also, MITI asks [or forces] industry to join these consortia. Industry responds by sending some engineers and money to the new consortium. Usually, industry's share is the same amount of money funded by the government. These consortia have been very effective and efficient when Japan is trying to catch up to the United States in the production and manufacturing areas. Before the 1980s, the objective of that consortium was to realize plans for manufacturing. This was very practical research, for MITI's mission was [and is] to promote industry in Japan, and increase the competitiveness of Japanese manufacturers.

At the end of the1980s, however, a big confrontation arose between Japan and the U.S. with respect to the semiconductor industry and the terms of trade in this sector. The U.S. basically accused Japan of a "free ride", and thus, MITI realized that it ought to redirect more of its money into basic research. [Similarly, the Science and Technology Agency does some basic research and also uses some consortia, but this agency gets along much better with the international community, in general.] One of the research-shift projects by MITI is the Real World Computing Partnership [RWC]. The target of MITI's RWC is very similar to that of the so-called "Grand Challenge" in HPCS [High-Performance Computing Systems] and ASTA [Advanced Software Technology and Algorithms] in the U.S. It has a $600 million budget, spread over 10 years, and its principal missions are flexible information processing and massively parallel and distributed systems. This project also includes optical computing and devices and neural systems, which is very different from the similar project in the U.S.

Among other projects I want to mention is the Yamamoto Quantum Fluctuation Project--a very strange name, actually, as the project is not fluctuating, but is going on rather vigorously. It is a five year project, run by Professor Yoshi Yamamoto in the Ginston Lab at Stanford University and at NTT's labs. This kind of very basic research is principally funded [@ $20 million] by the Science and Technology Agency, through the Research Development Corporation of Japan. I see it as a kind of link between Japan and the U.S., since there are two labs, one in each country, with funding from the Japanese government. Another similar project is the Japan Key Technology Center, which provides funding to MITI's Group and the Ministry of Post and Telecom [MPT] Group. In Japan, the political system is very different than in the U.S., and the ministries are very strong, which means that bureaucrats are very clever and very strong, and the bureaucracy is very stable. So even though the prime minister may change, there is no change in the real world that is Japan up to now.

The barriers between MITI and the MPT are very high, so the money is used very differently in each of these two groups. In the MPT Group, we have very good research laboratories, such as the Advanced Telecommunications Research Institute International [ATR]. As noted above, the funding for ATR comes from the Japan Key Technology Center. The Center's money comes from the stock dividend of NTT. As I said before, the Ministry of Finance owns 60% of our stock, and about $500 million/per year is given by the Ministry of Finance to this Technology Center, which then dispenses the money to MITI and MPT Group.

Recently, a new trend has arisen. MITI and MPT jointly created the Ultra-high Speed Network and Computer Technology Laboratories [UNCL]. UNCL was founded in March 1994, with $300,000 in working capital. [They hope that the project will reach $30 million by 1998.] The creators were the Japan Key Technology Center, NEC, Hitachi, and Fujitsu. The mission of UNCL is to research Ultra-high speed computer networking, as well as management of proprietary and associated business. And as noted, it is also [newly, as a result of deregulation] supported by MITI and the MPT.

In two years, by using a 600 megabit experimental system, they will produce a kind of issue finding. There are four laboratories in UNCL, and networking, access, protocol, and application will occur in each lab. But different tasks will be handled by different firms: Networking, by NTT; Access, by Fujitsu; Protocol, by NEC; and Application, by Hitachi; it looks like a very strange system. After the issue finding, they will perform an experiment with a sub-system at 2.4 gigabit/second, and will integrate, implement, and evaluate these subsystems at

the end of 1997. Then, by the end of 1998, they hope to create high-speed computer network technology. The interesting thing here is that there is no interconnect between each of the laboratories, thus information can only flow in one direction--toward a common end. This is also a very Japanese system. And the fact that NTT is involved makes everything run more smoothly since, though manufacturers in Japan do not like to work together, they all like to work with NTT because we are not a vendor. Thus, NTT acts as a sort of adhesive in Japan.

Next, I want to discuss OITDA, which stands for OptoElectronic Industry and Technology Development Association. It was erected at the beginning of 1980, and is a kind of consortium to promote Japanese optoelectronic manufacturers. OITDA is supported by MITI, which is problematic because most countries' visions of MITI are not so good. Though, as I said, MITI has begun to do research, few countries believe that. Recently, however, there has been a positive development in this area. That is the U.S.-Japan Joint Optoelectronics Project [JOP] . It is a joint high-level committee between MITI and the U.S. and the Office of Technology Policy. This committee decided to create a joint management committee, whose purpose is to create a kind of optoelectronic device. The goals of this project is to improve the availability of novel prototype optoelectronic devices, circuits, and modules, to stimulate R&D activity in optoelectronics for computing, to implement the successful results of a resolution in the Plan of Action associated with Global Partnership agreement, and to develop a model for U.S.-Japan cooperative research.

The concluding remarks for my talk are as follows: First, the NII: Made in Japan is not [so far] a national policy initiative. Japan has not decided how to use it, and it is still being discussed in government circles. A number of proposals involving the integration of telecommunications and broadcasting have been submitted, but it is still not clear how this network will be used in Japan. One reason is that, as mentioned before, the barriers between ministries are high. Basically, the Japanese system is run on a consensus basis, but consensus building takes a very long time. Second, NTT has proposed the VI&P plan independently, and it is expected to serve as the infrastructure of Japan's NII. Since NTT is a private company, its plan should not be the NII, but it will be, perhaps, the infrastructure of the NII. Third, we believe that multi-media and telecommunications and broadcasting will create a big market. And finally, deregulation in Japan has helped us to promote more cooperation between Japan and the United States.

Thank you very much.

QUESTION 1: Please comment on either your own, or NTT's, view on digital wireless, both terrestrial and satellite, in the scheme of the infrastructure.

TI: Formally, we are going to use satellites in case of emergency, or to connect isolated places. At present, as far as satellites are concerned, there is a great deal of strongly conservative regulation by the ministries. So, NTT's networking will mainly be conducted through fiber. Satellites will be used by the broadcasting groups, such as NHK, in particular for broadcasting of high-definition television. But the NTT's own network does not depend on satellites at present.

As far as wireless is concerned, we are very keen about digital personal and hand-held sets. Our system architecture consists of very narrow [e.g., 100 meter in diameter area] cells, in order to make the best use of a limited source of frequency. Also, almost all of these technologies have been prepared, but so far, the government has not allowed us to put them into service. But, in the future, these kinds of cellular services should be very important in terms of multi-media.

QUESTION 1, part II: What is your time frame in seeing these services on the market?

TI: Maybe at the end of this year. We are not allowed to pursue them right now, but the other companies, (i.e., the new common carriers), are allowed to do so.

QUESTION 2: Two questions. On your budget numbers, were those just public funds, or were they total funds, including corporate contributions to these efforts?

TI: Those were the totals. However, construction cost is excluded.

QUESTION 2, part II: As a greater number of competitors come into a stronger position, do you see NTT being able to continue in its national research role, or as being constrained, as in this case, where competitors are free to try new things?

TI: This is a very delicate question. So far, in the long distance area, we have four or five very strong competitors, who share about 44% of the market. As you know, the profit from telecommunications usually comes from long distance service, so we are facing some financial difficulties at present. If our bottom line goes into the red, we will not be able to continue to support research laboratories. But our prospects may be looking up, so perhaps our laboratories can continue for at least five to seven years.

As far as competitors are concerned, in the mobile area, there was some pressure from the U.S. to promote much more of analog systems made in the U.S. The NTT system is analog, and a very domestically-oriented system. Now the system is changing from analog to digital, so in that case, there could be room for discussion about a more global system. At present, the analog system is much cheaper, but if you think about the expansion of services, perhaps digital would be better. But for now, digital is much more expensive than analog systems. A kind of cost-effectiveness discussion will be held [maybe] between Japan and the United States. There is, of course, risk of a confrontation, but it will likely be a more interactive, healthy sort of discussion between the two countries.

I would also like to say something about the MITI consortia. MITI's big project was very effective 10 or 12 years ago, when we were trying to catch up with the United States. But now, the project's goals are not so clear. We have no image of how to use optical computing, for instance. Perhaps it is good for basic research, but as before, MITI has asked manufacturers to join the project. Manufacturers should send good researchers and money. But in order to do so, they have to take people from other, seemingly more important, areas. So to tell the truth, manufacturers are not thrilled about having to join these kinds of consortia at present because they require such a long-term investment.

QUESTION 3: Whose ATM switch do you use?

TI: That is a very good question. There are many discussions about that, but right now we are in the process of introducing ATM switches in the NTT network. As you know, ATM is very good. It is a kind of data exchange system, so voice quality will not be better than the present digital exchange system. But we have chosen to use ATM in NTT, anyway, so we can obtain the flexibility needed to provide various kinds of new services.

As far as which manufacturer's equipment we will use, there are many candidates to choose from; the field is very open right now.

QUESTION 3, part II: One other question. At lunch today, some people from Intel were talking about replacing the telephone with the PC. What are you doing in that area?

TI: Yes, we are discussing the same thing. The Multi-Media Service will be based on the PC by the end of this century.

Also I want to add one more thing about ATM procurement, we are not a public network but we are also selling a kind of LAN system. Most LAN systems were purchased [recently] from the United States, as they are producing very cheap ATM switches.

QUESTION 4: In your discussions about fiber, you did not mention fiber-to-the-curb. Is that something you have given up, or just something you did not mention?

TI: When I say fiber-to-the-home [FTTH], it includes fiber-to-the-curb. But to tell the truth, houses in Japan are very densely distributed. So, as part of our plan to distribute FTTH, wherever there is a main office or area within a group of residences, we are installing optical-fiber cables containing 2000 fibers, to each house. So, in other words, if there is a base camp at the end of these fibers, then we distribute these fibers according to the request.

If you define fiber-to-the-curb as the idea that the signal will be changed from light wave to electric, we could do these configurations. Since we believe that the most important thing, as an operating company, is how to manage, maintain, and operate an access network, we think the simplest is best. So our plans for design, operation, and management are based on fiber to the home.

QUESTION 5: One of the applications for the future we've heard a lot about is teleconferencing between companies. If two of your company's branches are say, in Tokyo and in Los Angeles, what are the potential issues for networks internationally? Has any thought been given to issues that may arise in global networking?

TI: That is a very good question. NTT is not allowed to do international communication. But KDD and AT&T are now implementing a new system using an optical fiber amplifier, at a rate of five gigabits or so. It will be completed at the end of 1995, or in 1996. So, there will be a very powerful connection between the two countries.

VC: There is also an international standards body that defines interfaces, so that everyone can work together and connect.

TI: Yes, it is really a significant issue. Once the interface is defined, we can easily adjust it because one could simply change the signal format using an LSI technology.

VC: Thank you very much for coming.

The "National Information Infrastructure" made in Japan: Emerging Optical Communication Technologies

MIT Communication Forum

April 14, 1994

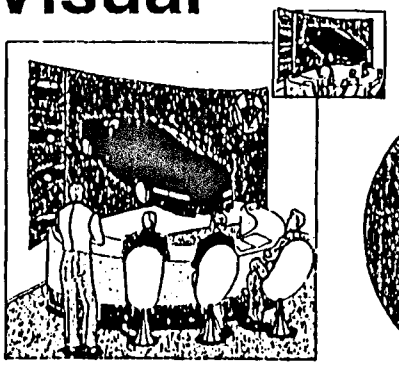
Tetsuhiko IKEGAMI

Nippon Telegraph and Telephone Co.

NTT

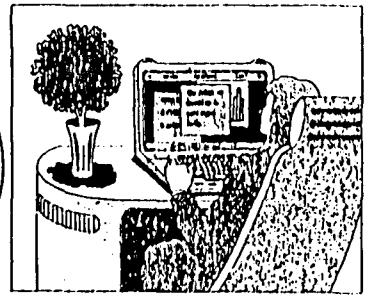
Service Vision for the 21 Century

Visual



- ○ Multi-point multimedia (MM) Conferencing
- ● 3D-MM Conferencing
- ○ Vidual Shopping
- ○ Electric Library
- ○ Electric Newspaper

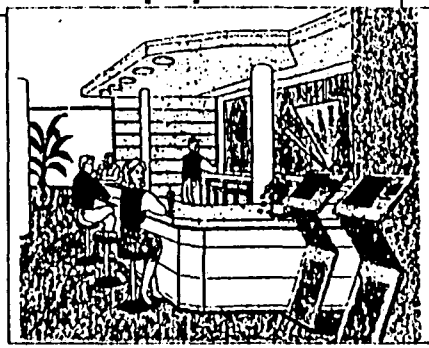
Intelligent



- ○ Voice Dialing
- ○ Electric Secretary
- ● Communication with Automatic Translation
- ○ Customer Networking

VI&P

Personal



- ○ Personal Number
- ● Temporary Private-Phone
- ○ Selective Receiving
- ○ Electric Voting

March, 1990

NTT

"NII" Made in Japan (1)

VI&P Plan

- Future Vision of Telecom Service on B-ISDN
- FTTH by 2015

(Not Strategic / Implementation Plan)

Clinton - Gore
"NII"

Hosokawa
Deregulation

FTTH, Tone-Down

"Not Necessarily Profitable"

M. Post & Telecom Experiment Plan (Kansai)

Survive, VI&P

- $ 400 B / 20 yrs
- Computer NW, Multi-Media Teleco & Broardcasting

"NII" Discussion ····►
CATV Fever ····►
Multi-Media Fever ····►

'90 '91 '92 '93 '94

"NII" Made in Japan (2)

Ministry of Post & Telecomm. (Feb. 1994)

- National Wide Fiber-Optic NW
- Produce $ 1.15 Trillion Market (¥ 123 T)
  Incld. $ 500 B New Market Related To Multi-Media Service
- Create 2.4 M New Jobs
- By 2010

NTT (March 1993)

- Fiber-To-The-Home (FTTH)
- $ 400B / 20 yrs
- Computer NW, Multi-Media, Teleco + Broadcast
- By 2015

"NII" Made in Japan (3)

- Computer NW In JAPAN
  - No INTERNET (Global NW) / NREN
  - Small Independent Grass-Root NWs

    JUNET, WIDE, SINET etc.
- JCRN (Japan Committee for Research NW)

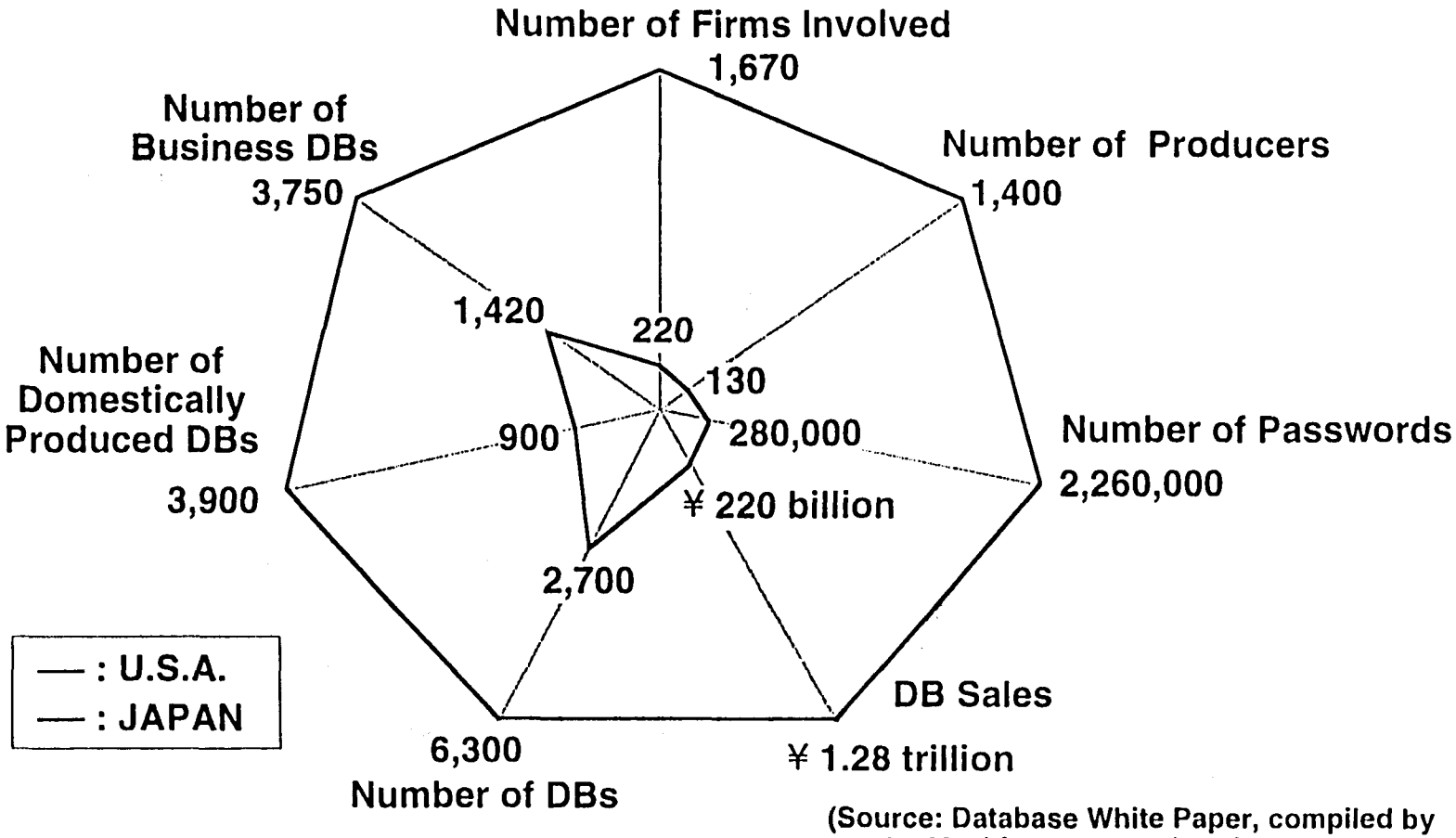
  Will Produce New Projects
- Government(M. Education, STA, MITI)

  Is Very Concern and Positive

JAPAN vs USA

	JAPAN	USA
Personal Computer	1	4.2
LAN	1	4.2
Internet	1	30
National Computer Power (MIPS.Sets / Population)	140 K	520 K

Comparison of Databases in Japan and United States



(Source: Database White Paper, compiled by the Machinery and Industries Bureau, Ministry of International Trade and Industry)

"NII" Made in Japan (1)

VI&P Plan ⊙

- Future Vision of Telecom Service on B-ISDN
- FTTH by 2015

(Not Strategic / Implementation Plan)

Clinton - Gore
"NII"

Hosokawa
Deregulation

FTTH, Tone-Down ⊙

"Not Necessarily Profitable"

M. Post & Telecom Experiment Plan (Kansai)

Survive, VI&P ⊙

- $ 400 B / 20 yrs
- Computer NW, Multi-Media Teleco & Broardcasting

"NII" Discussion ····►

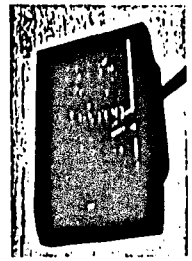
CATV Fever ····►

Multi-Media Fever ····►

'90 '91 '92 '93 '94

Active Alliance and Various Approaches Involving Personal Digital Assistants (PDAs)

(Photo from MAC POWER, Oct. 1993.)



Products emphasizing Personal Information Management (PIM)

- Newton Message Pad (Apple & Sharp)
- Zoomer (Tandy + Casio)

Products directed at network terminal

- Personal Communicator (AT&T's EO)
- Envoy (Motorola)

Products adding basic PIM functions to portable telephones

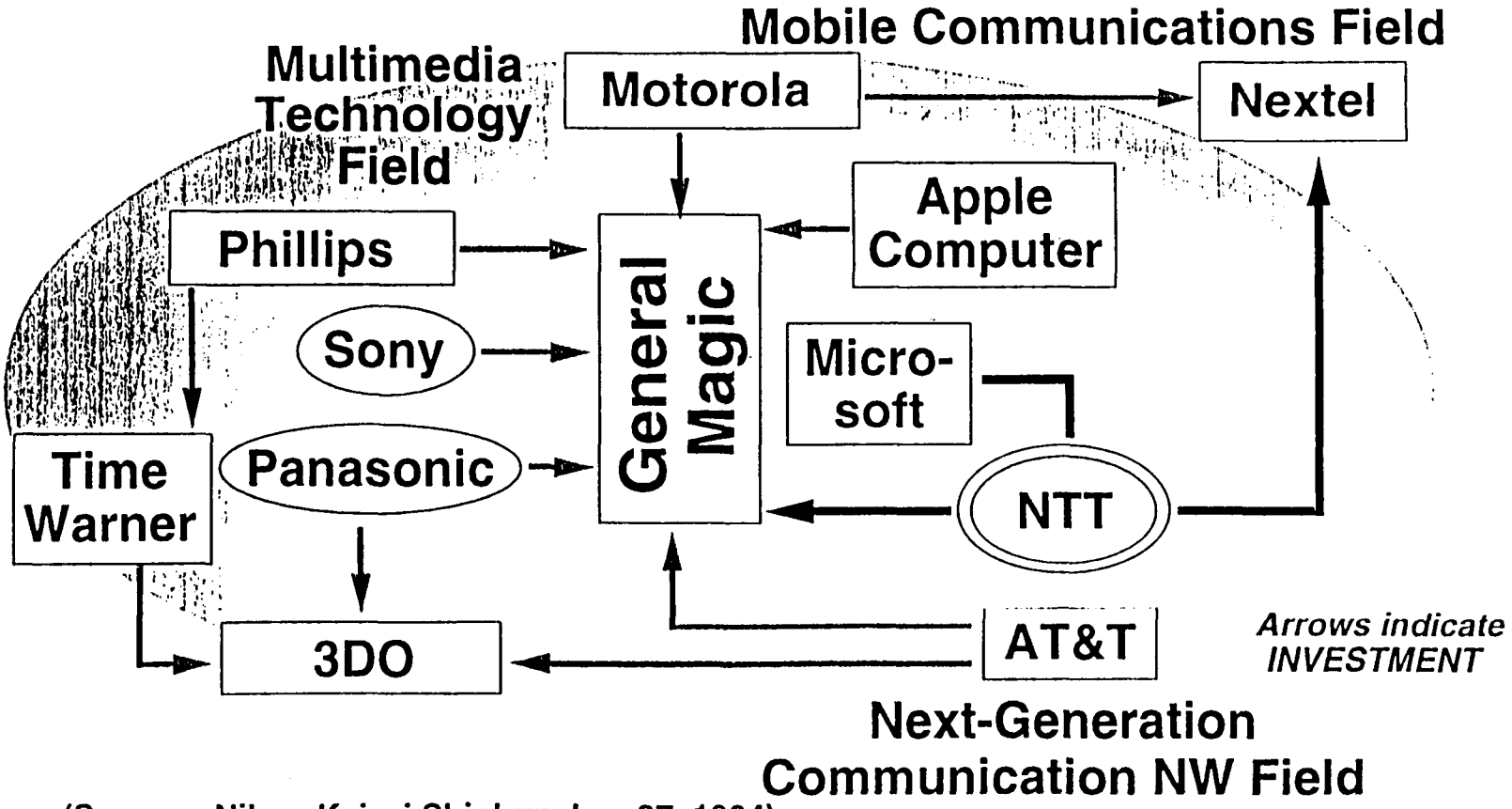
- Simon (IBM & Mitsubishi Electric)

HP
Sony
Toshiba
COMPAQ
and
others
have
selling plans

These products hold much promise for the future despite their high price

NTT

Where NTT is in Multimedia Arena ?



(Source: Nihon Keizai Shinbun Jan. 27, 1994)

Joint CATV Business Plan in Japan

[CATV Companies]				[U.S. Companies]
Suginami CATV (Tokyo)	INVESTMENT ←	Sumitomo Shoji	ALLIANCE ↔	TCI
CV 21 (Hakata, Kyushu)	INVESTMENT ←	Itoh-Chu Shoji	ALLIANCE ↔	Time Warner Inc.
Yokomama CATV	INVESTMENT ←	TOMEN	ALLIANCE ↔	NYNEX

Aggressive Partners

Shosha's

SECOM

NTT

stock price, USA TODAY columnist Dan Dorfman reported Thursday on CNBC-TV. Blockbuster Chairman Wayne Huizenga told Dorfman that he sees the merger proceeding. But Huizenga says he understands why Blockbuster shareholders are unhappy with the price of the deal. PaineWebber stock analyst Craig Bibb told Dorfman that Viacom will have to pay at least $30 a share. When the merger was announced Jan. 7, it was valued at about $21 a share. Blockbuster rose 1⅛ to $25½ Thursday.

EXPORT CHANGES: The Clinton administration proposed legislation to relax procedures for granting export licenses for sensitive technology. Revisions to the 1979 Export Administration Act would update rules left from the Cold War. The proposal shortens the review for export licenses and restricts the government's export controls on U.S. companies.

TENNECO CEO STEPS DOWN: Mike Walsh gave up his duties as chief executive to recover from ongoing cancer treatments. Walsh, 51, remains chairman. He was diagnosed with brain cancer a year ago. Dana Mead, president and chief operating officer, was named CEO.

MORTGAGE RATES: Mortgage rates rose this week. The average for 30-year fixed loans climbed to 7.32% from 7.11% last week, the Federal Home Loan Mortgage Corp. said. The 15-year fixed-rate average rose to 6.80% from vs. 6.64% last week. Average one-year adjustable-rate loans rose to 4.25% from 4.18%.

CORRECTION: Bell Atlantic is the third-largest regional telephone company in terms of revenue. A story Thursday was wrong.

MONEY HOT LINE: 1-900-555-5555 95¢ per minute
Travel weather, stocks, rates, used-car prices

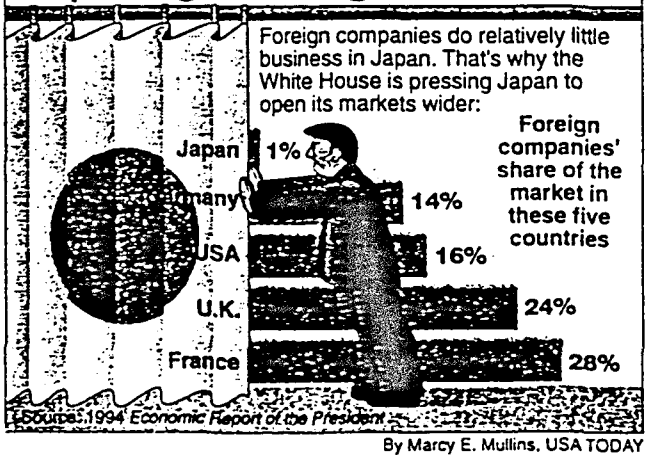
By Money staff

Inside MONEY

USA SNAPSHOTS®

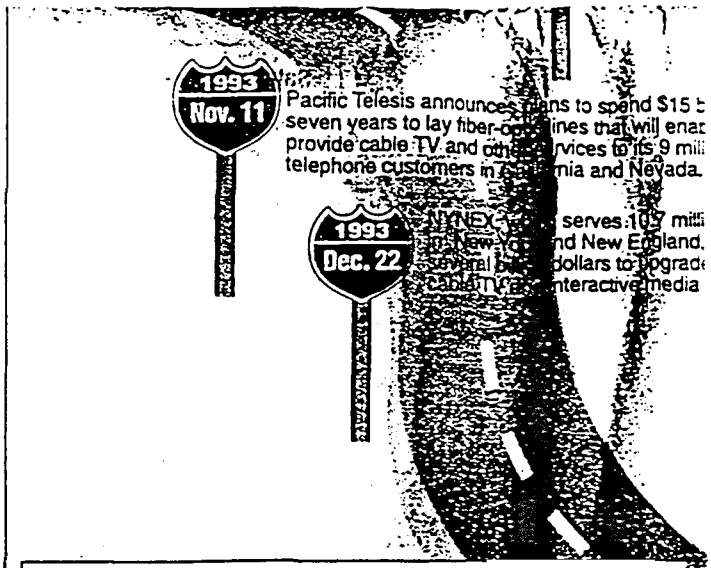
A look at statistics that shape your finances

Opening to foreign firms



Source: 1994 Economic Report of the President

By Marcy E. Mullins, USA TODAY



COVER STORY

Why did TCI, Bell Atlantic pull the plug?

By Paul Wiseman and James Cox
USA TODAY

The deal of the century is dead. Now, the inquest.

Who or what killed Bell Atlantic's $20 billion stock swap takeover of cable giant Tele-Communications Inc.? More important, will its demise late Wednesday snuff out other deals between cable TV and telecommunications companies — deals considered crucial to the creation of the vaunted information highway?

The short answers: The Federal Communications Commission — and its latest effort Tuesday to cut cable rates — is the No. 1 suspect because it clouded TCI's financial outlook. But experts aren't unanimous about the FCC's guilt. And, no, telecom-cable dealmaking will almost certainly continue, perhaps after a brief timeout. In fact, the takeover frenzy might speed up — now that deal-

Please see COVER STORY next page ▶

Source: USA TODAY research

"NII" Made In JAPAN AS OF THE END, '93

- Fiber-Optic NW Oriented
- The Telecom-Infrastructure By NTT

NOT National Policy Initiative

NOT National Industry Policy

NOT Technology Reinvestment Project

(Who Builts, Owns and Operates ??)

→ Deregulation Discloses New Horizon

日本経済新聞
夕刊
発行所 日本経済新聞社
東京本社 〒100-66 ☎(03)3270-0251 東京都千代田区大手町1-9-5 振替口座 東京3-555番
大阪本社 〒540 ☎(06)943-7111 大阪市中央区大手前1-1-1 振替口座 大阪2-73217番
名古屋支社 〒460 ☎(052)203-2561 名古屋市中区栄2-3-1 振替口座 名古屋3-6149番
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細川首相 退陣表明

佐川問題で引責

後継に羽田氏ら


細川首相

細川首相は八日、退陣を決断した。同日午後、首相官邸に社会党の村山委員長ら連立与党の首脳を招き、辞意を表明するとともに、今後の対応については「みなさんにお任せします」と述べた。首相は自らの東京佐川急便からの一億円借り入れ問題などで九四年度予算案審議のメドが立たず政局運営が行き詰まっていることから引責することにした。細川連立政権は昨年八月の発足以来、八カ月で幕を降ろす。後任には新生党の羽田党首（副総理・外相）や自民党の渡辺元副総理・外相らの名前が挙がっているが、連立与党・自民党を巻き込んだ動きが進んでおり、政局は政界再編もからみ流動化しそうだ。

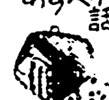
首相は同日午後一時、首相官邸に連立与党各党の党首ら首脳を集めた。席上、首相は「すでに国会のこう着状態を招いているのは私個人の問題として起こっている。それが審議の障害になっている。一億円の問題は完済しているが、若干、問題があ

ると指摘されている。日本電信電話（NTT）株問題は基本的に問題があるわけではない」と説明。そのうえで、「新たな問[illegible]

公共料金 上げ幅
政府基本

政府は八日午前、物価問題に関する関係閣僚会議を開き、公共料金の取り扱いに関する基本方針を正式に決めた。方針は「民間企業が経営合理化に努力している状況を踏まえ、公益事業なども一層の合理化に努める[illegible]

あすへの話題



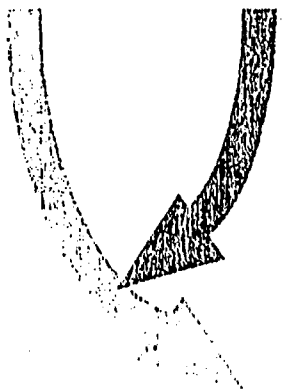
一九九一年十一月、突然ニューヨーク市のパーセント・フォー・アート・プログラムという所から郵便物が届いた。いつもながらドラマは突然始まる。このプログラムは、公共の建築費の予算の一％を美術に使うことで、公共環境を充実しようというものだ。

手紙にはこう書いてあった。「ニューヨーク市クイーンズ区役所の増築に際して計画されている美術制作の候補者六人の一人にあなたは選ばれた。一六〇十分の[illegible]

Concept On Telecom NW

JAPAN, EUROPE

- Public Utility First
- Given By Public Sector
- Top-Down & Regulation
- Security

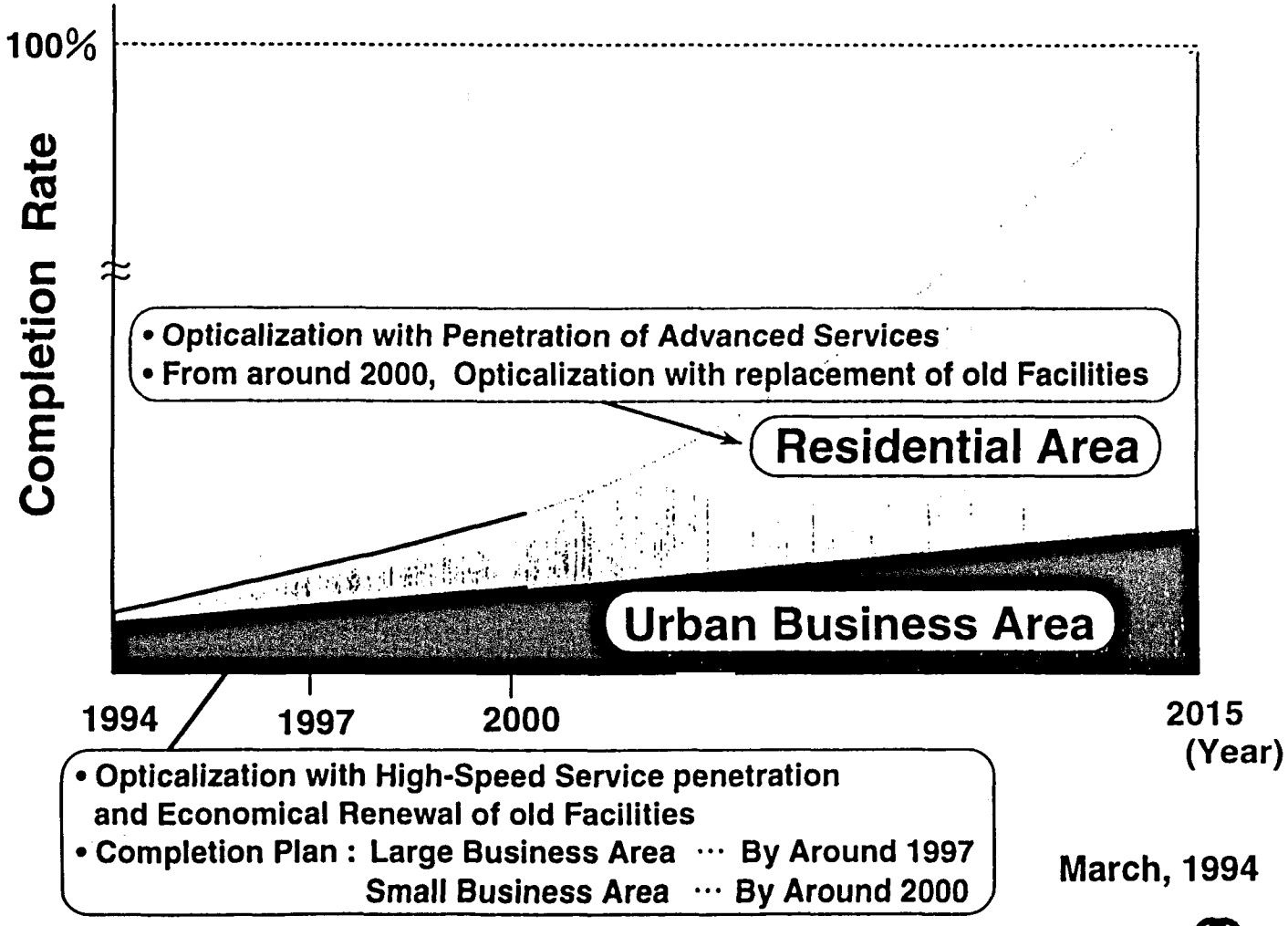


USA

- Customer First
- Service First
- Business First
- Grass-Root (de facto)
- Security

New Goal

Overview of Optical Access Network

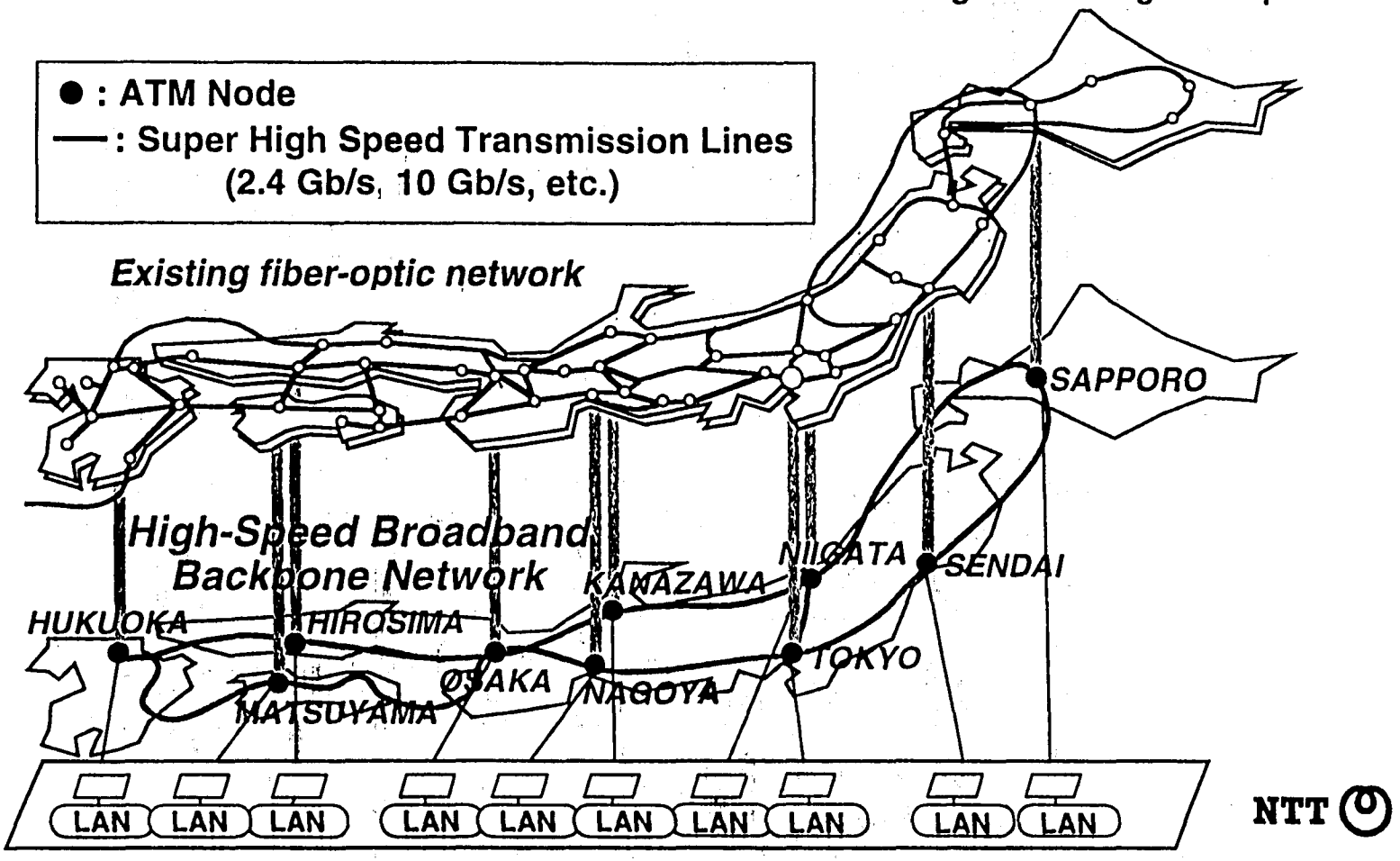


March, 1994

NTT

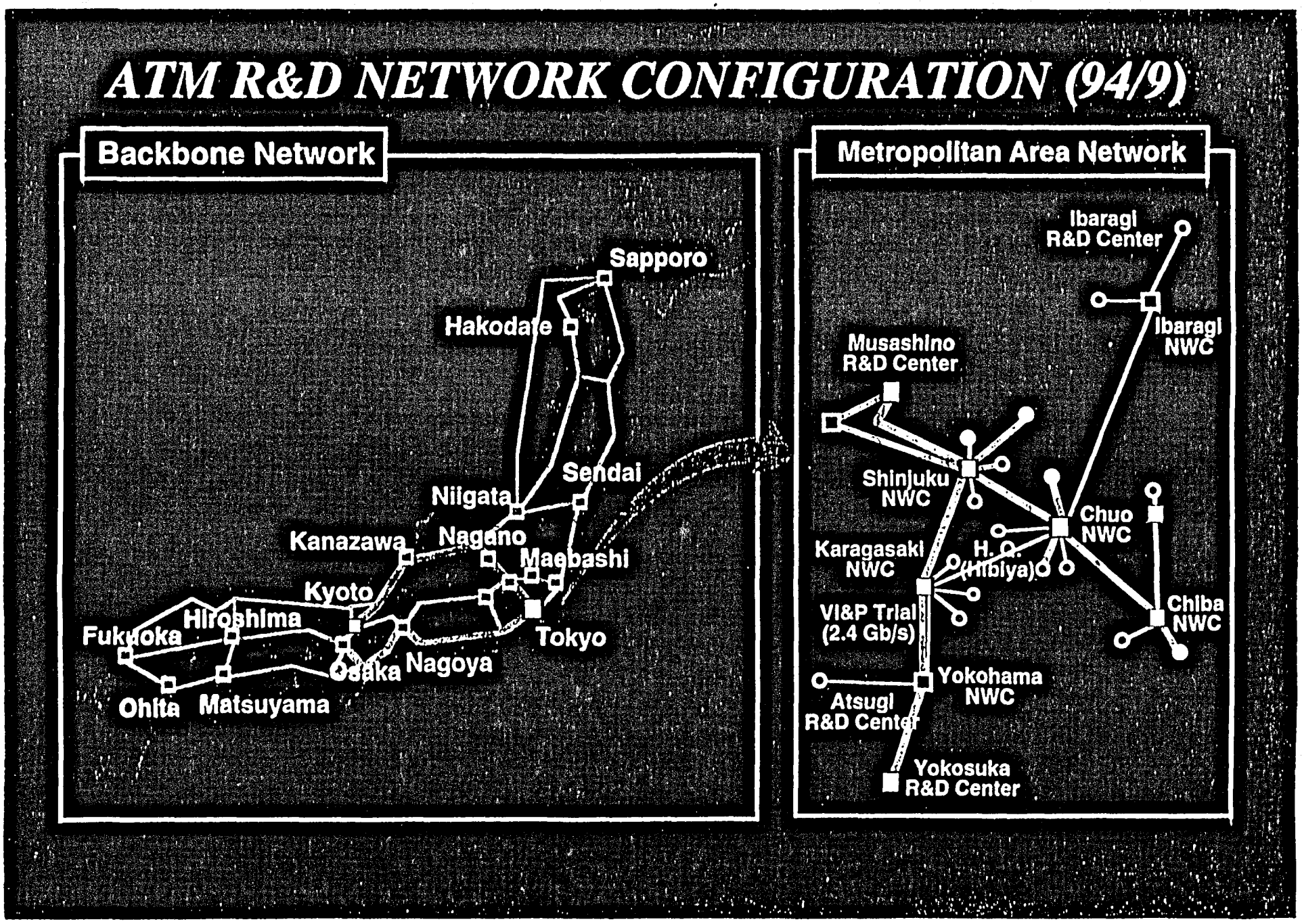
High-Speed Broadband Backbone Network

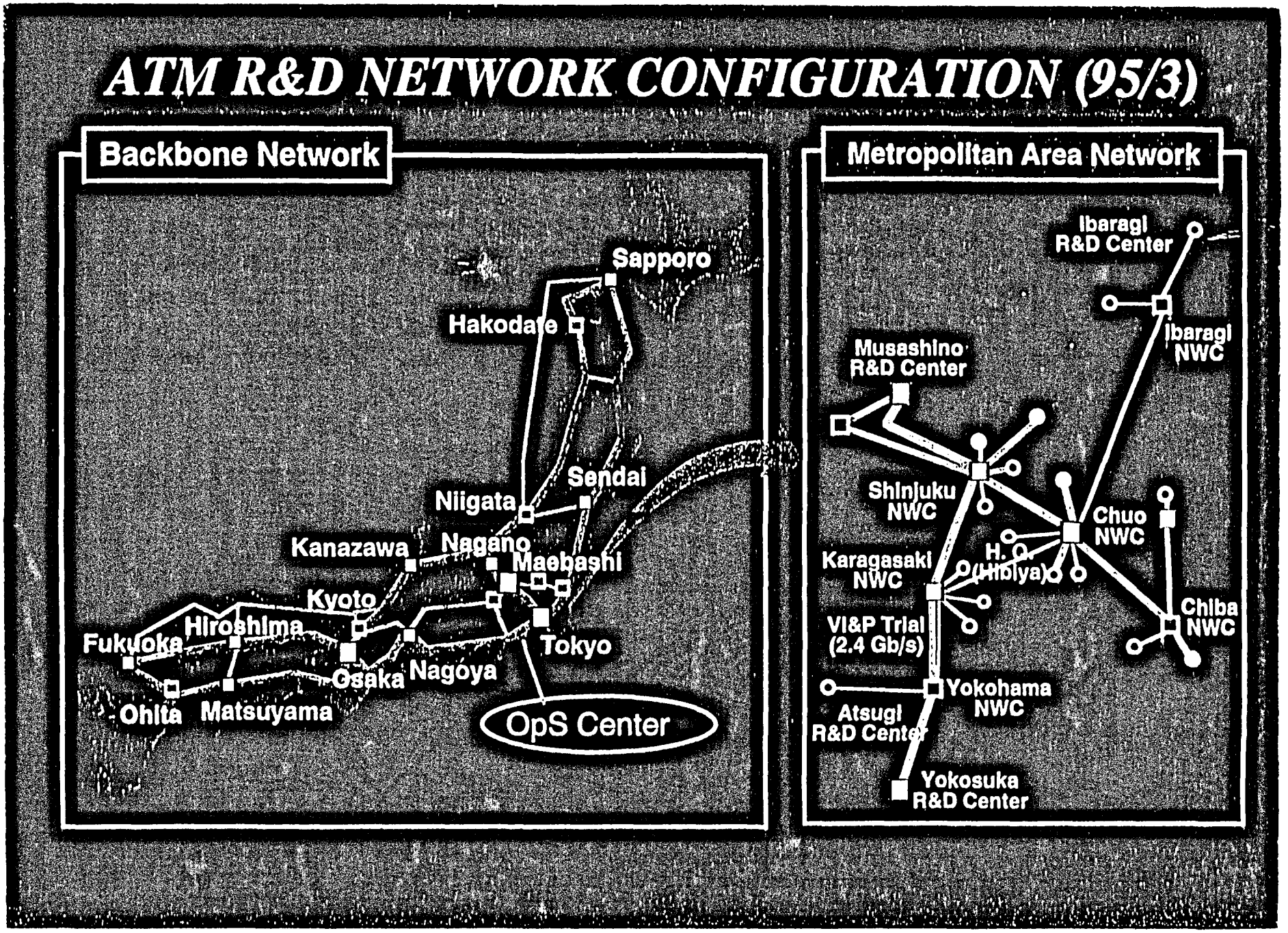
Construction of 2.4 Gb/s and 10 Gb/s transmission svs. using the existing fiber-optic NW



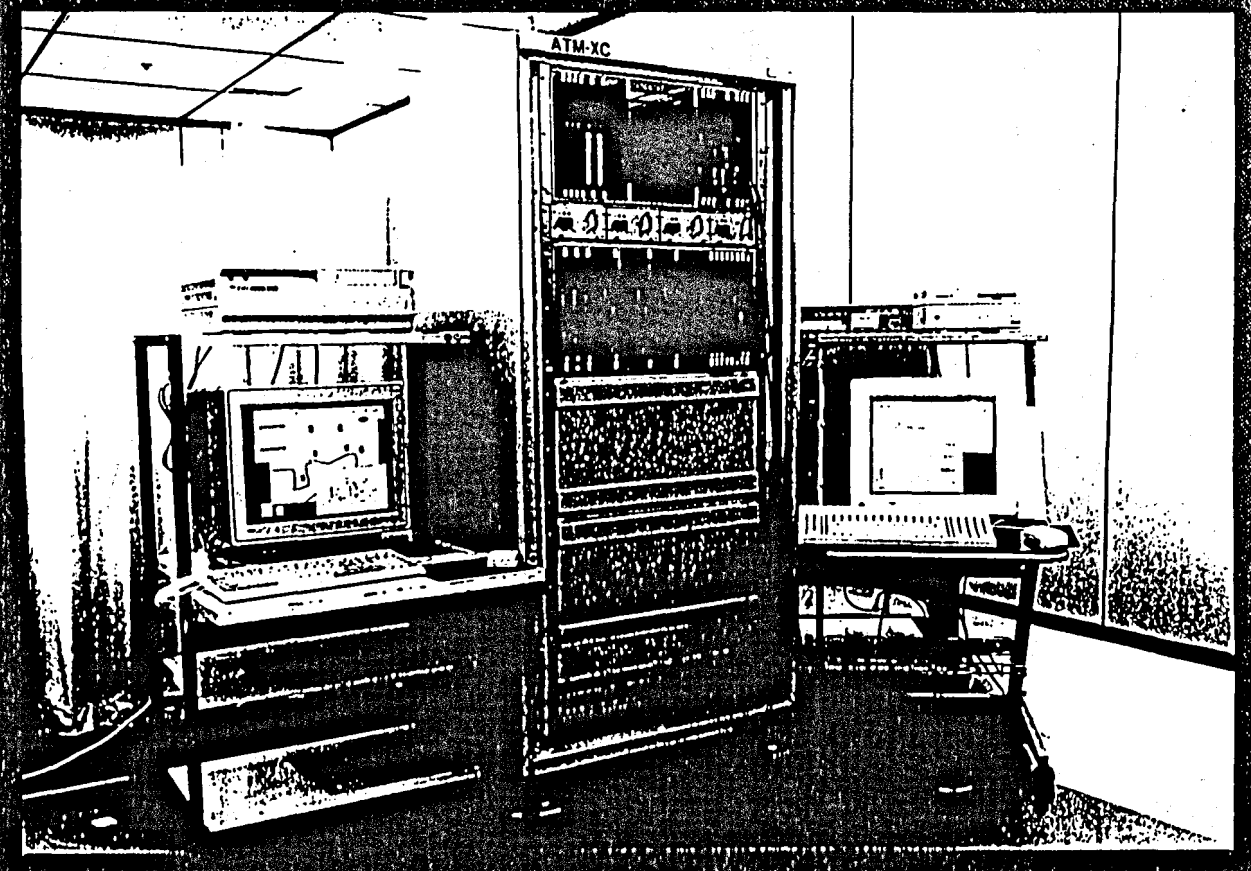
NTT

ATM R&D NETWORK CONFIGURATION (94/9)



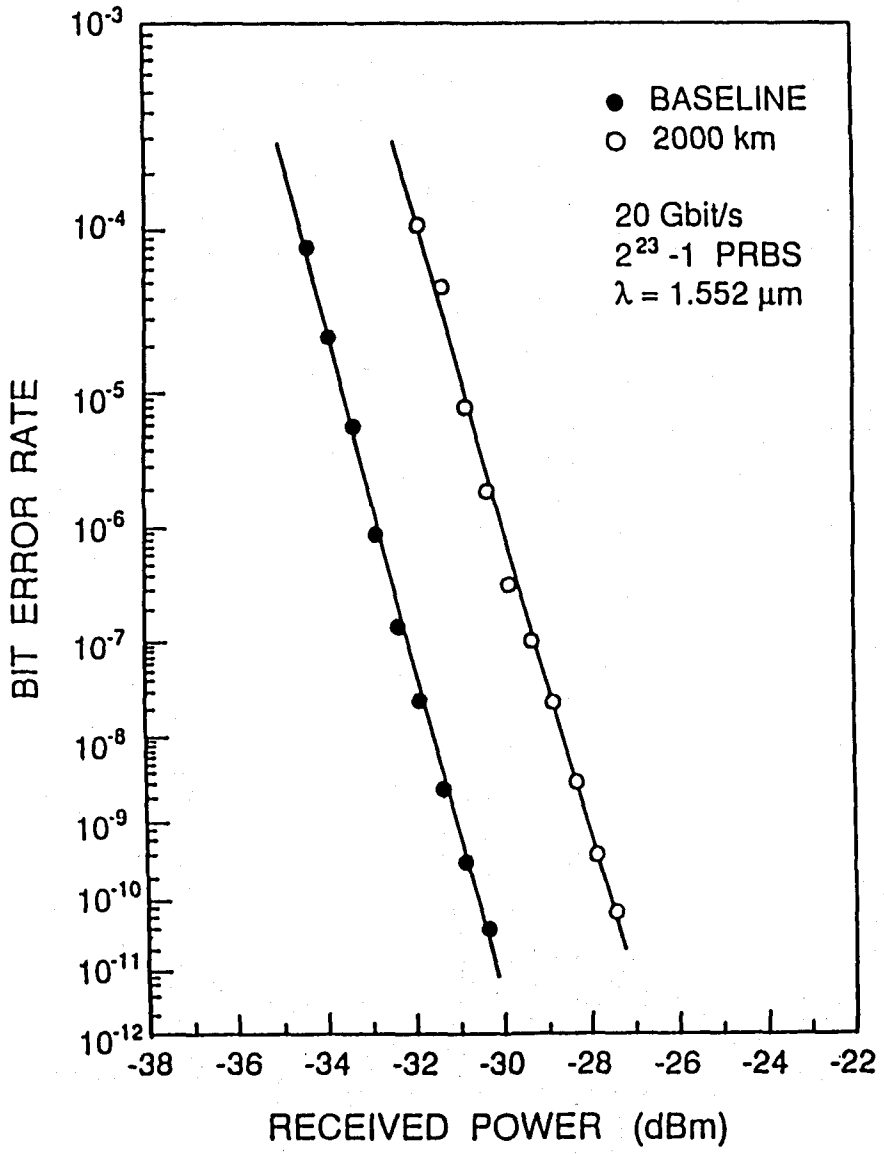

ATM R&D NETWORK CONFIGURATION (95/3)
Backbone Network
Sapporo
Hakodate
Sendai
Niigata
Kanazawa
Nagano
Maebashi
Kyoto
Hiroshima
Fukuoka
Tokyo
Osaka
Nagoya
Ohita
Matsuyama
OpS Center
Metropolitan Area Network
Ibaragi R&D Center
Ibaragi NWC
Musashino R&D Center
Shinjuku NWC
Chuo NWC
Karagasaki NWC
H.
(Hibiya)
Chiba NWC
VI&P Trial (2.4 Gb/s)
Yokohama NWC
Atsugi R&D Center
Yokosuka R&D Center

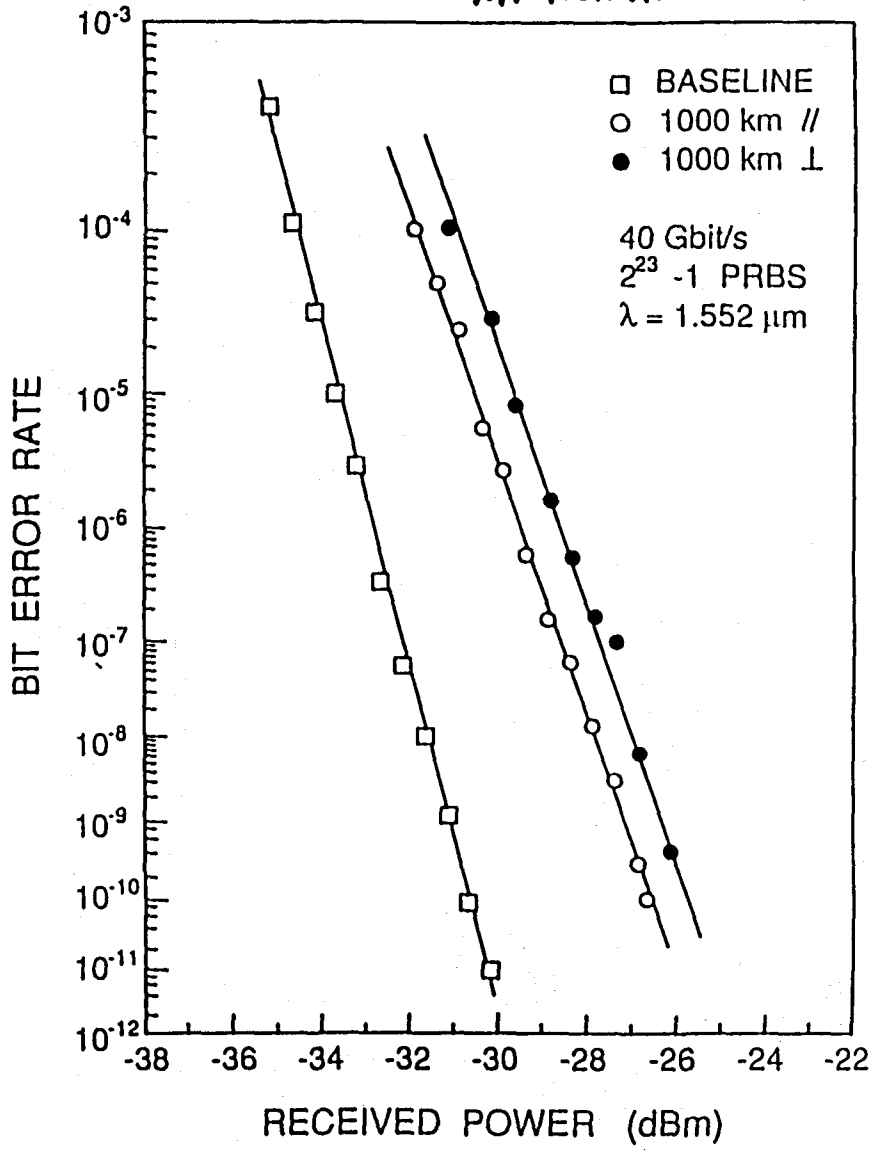
PHOTOGRAPH OF ATM-XC SYSTEM

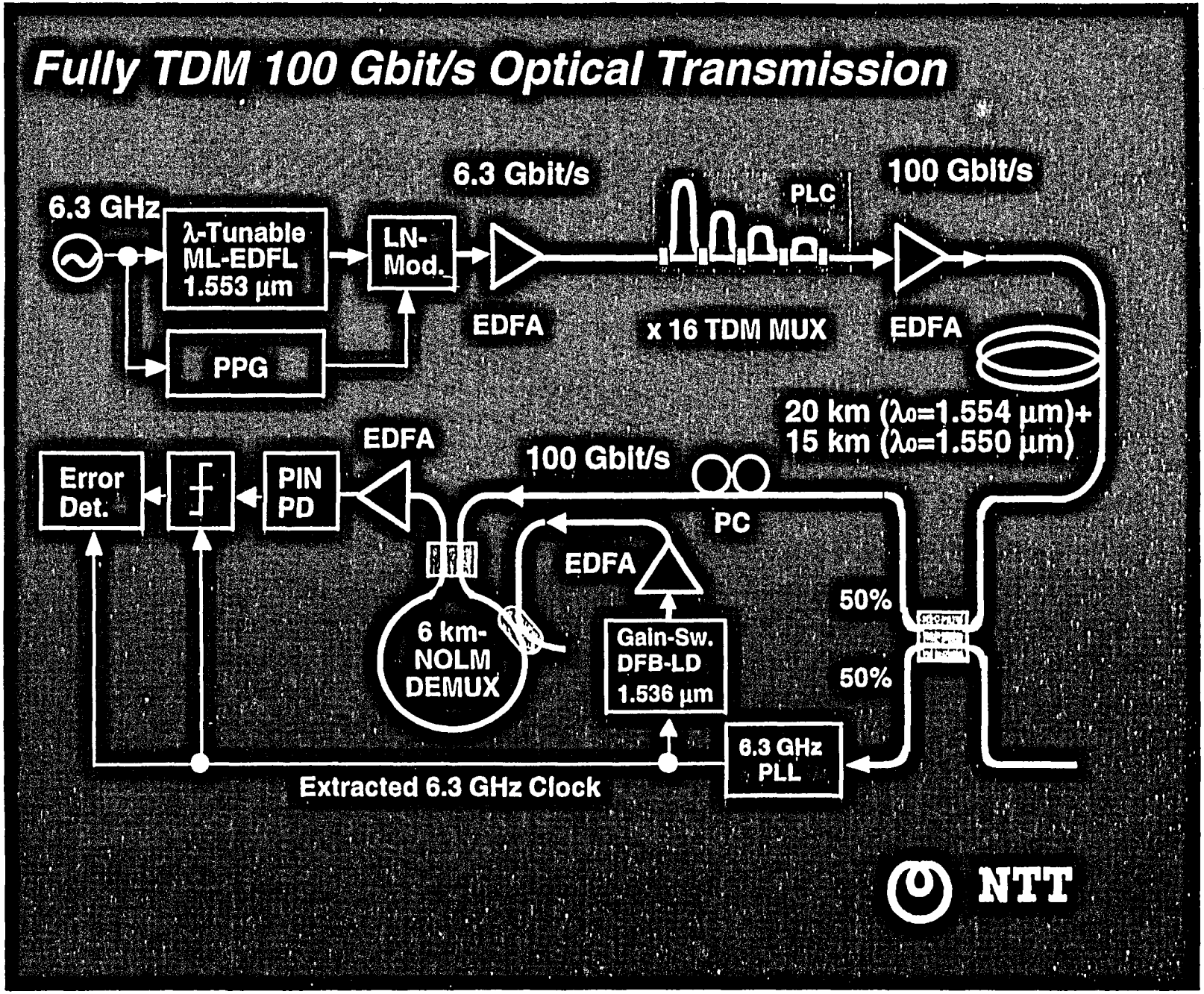


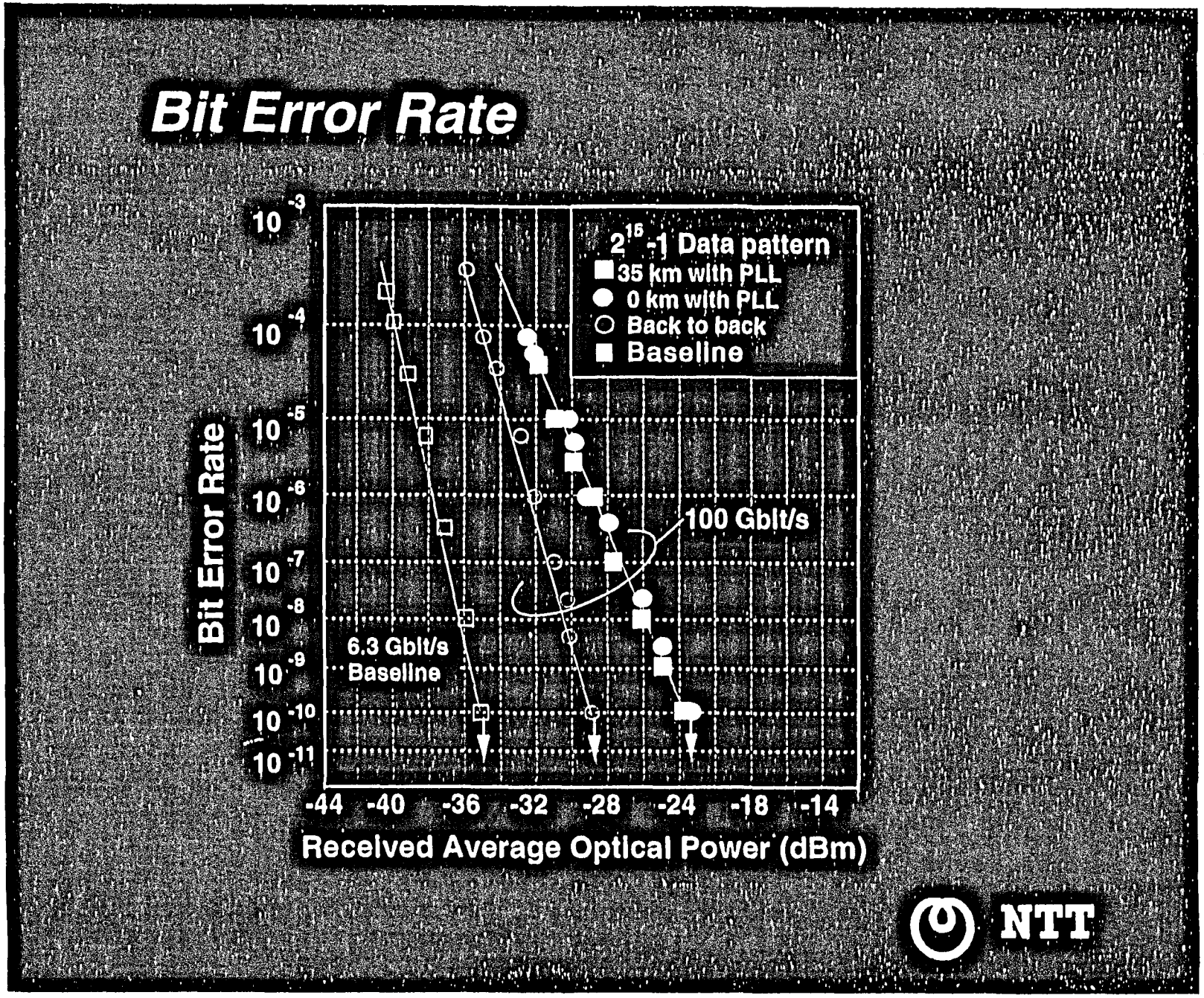
Single-pass Soliton Data Transmissions over 2000 km at 20 Gbit/s and 1000 km at 40 Gbit/s

EDFA ~50km Sep
NAKABAWA NTT '93






Fully TDM 100 Gbit/s Optical Transmission
6.3 GHz
λ-Tunable ML-EDFL 1.553 μm
LN-Mod.
6.3 Gbit/s
EDFA
PLC
x 16 TDM MUX
100 Gbit/s
EDFA
PPG
20 km (λo=1.554 μm)+
15 km (λo=1.550 μm)
EDFA
100 Gbit/s
PC
Error Det.
PIN PD
EDFA
50%
50%
6 km-NOLM DEMUX
Gain-Sw. DFB-LD 1.536 μm
6.3 GHz PLL
Extracted 6.3 GHz Clock
NTT


Bit Error Rate
Bit Error Rate
10 -3
10 -4
10 -5
10 -6
10 -7
10 -8
10 -9
10 -10
10 -11
2 15 -1 Data pattern
35 km with PLL
0 km with PLL
Back to back
Baseline
100 Gbit/s
6.3 Gbit/s
Baseline
-44 -40 -36 -32 -28 -24 -18 -14
Received Average Optical Power (dBm)
NTT

Impact of Optical Amplifier (EDFA)

1. ELIMINATE LOSS LIMIT "Don't Care of Distance"

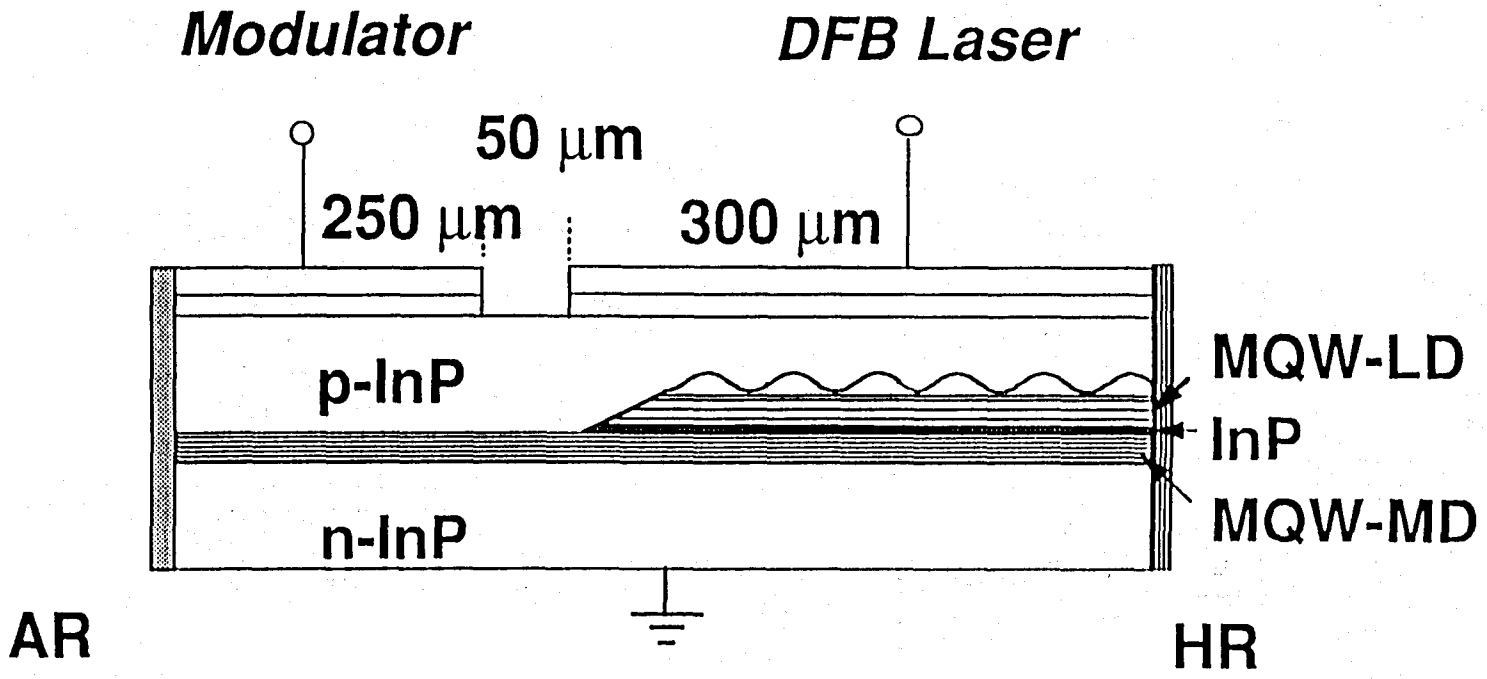
2. BIT-RATE INDEPENDENT AMPLIFICATION (Booster / Pre-Amplifier) "Don't Care of Bit-Rate"

3. BULK-AMPLIFICATION (Several THz by EDFA) "Easy Handling of Color, WDM / FDM"

Simple and Flexible Physical Network
Photonics-Through-The-Network

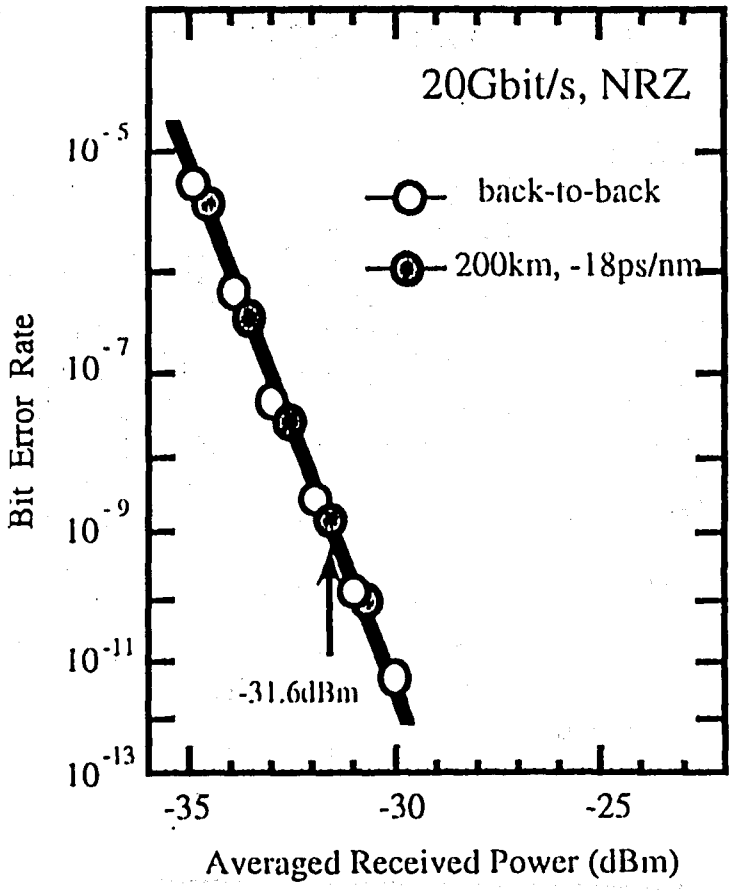
NTT

MQW-Modulator/DFB-LD Monolithic Light Source

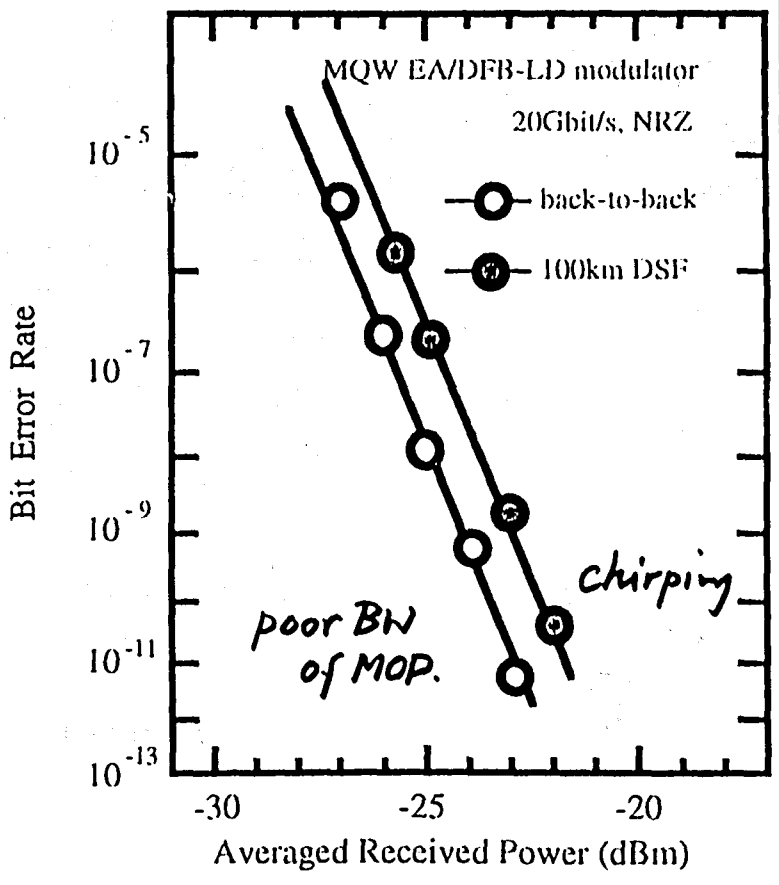


NTT

LN vs MQW Modulator : 20 Gbit/s NRZ modulation



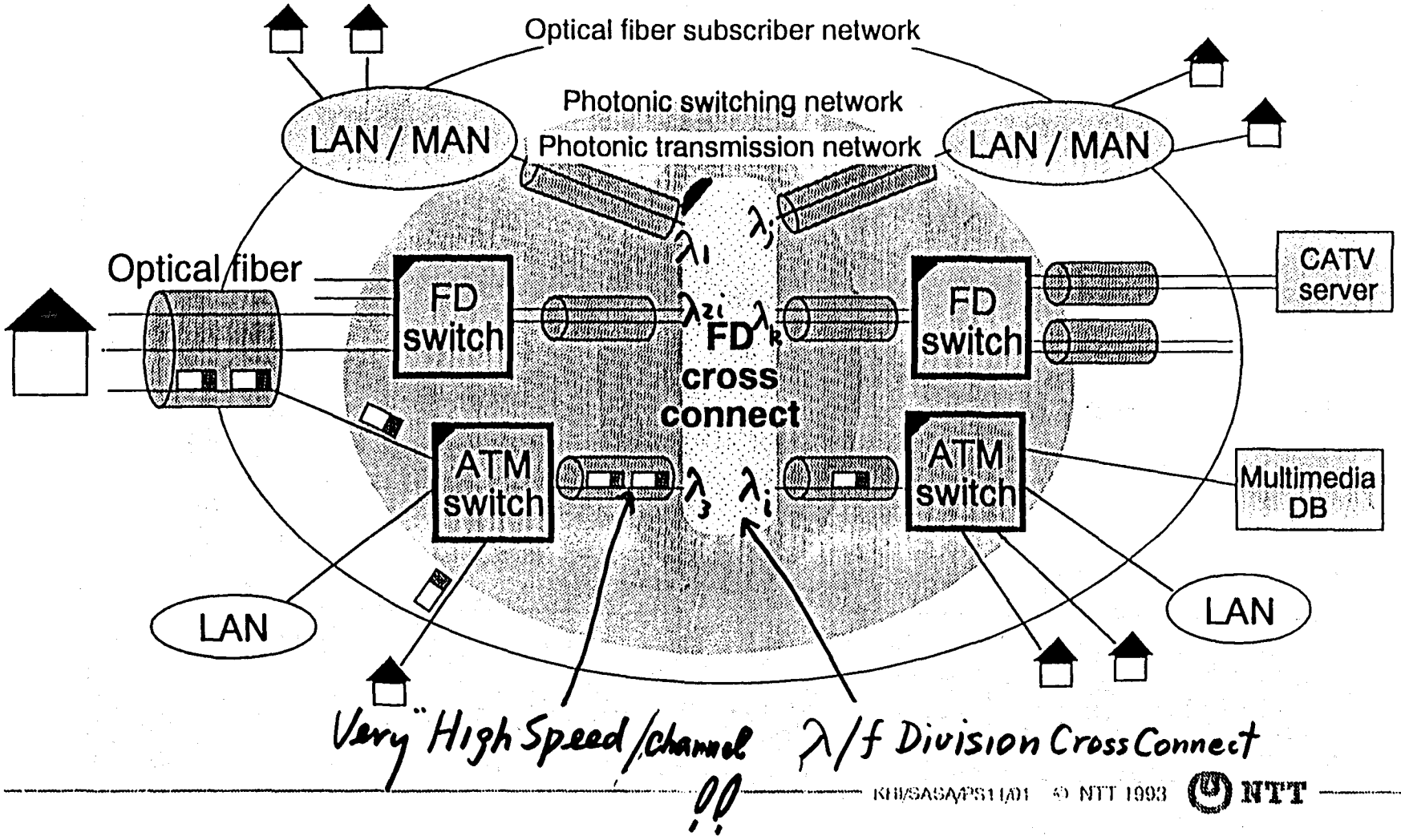
LN-MZ Mod DSF:200km



MQW-EA/LD Mod. DSF:100km

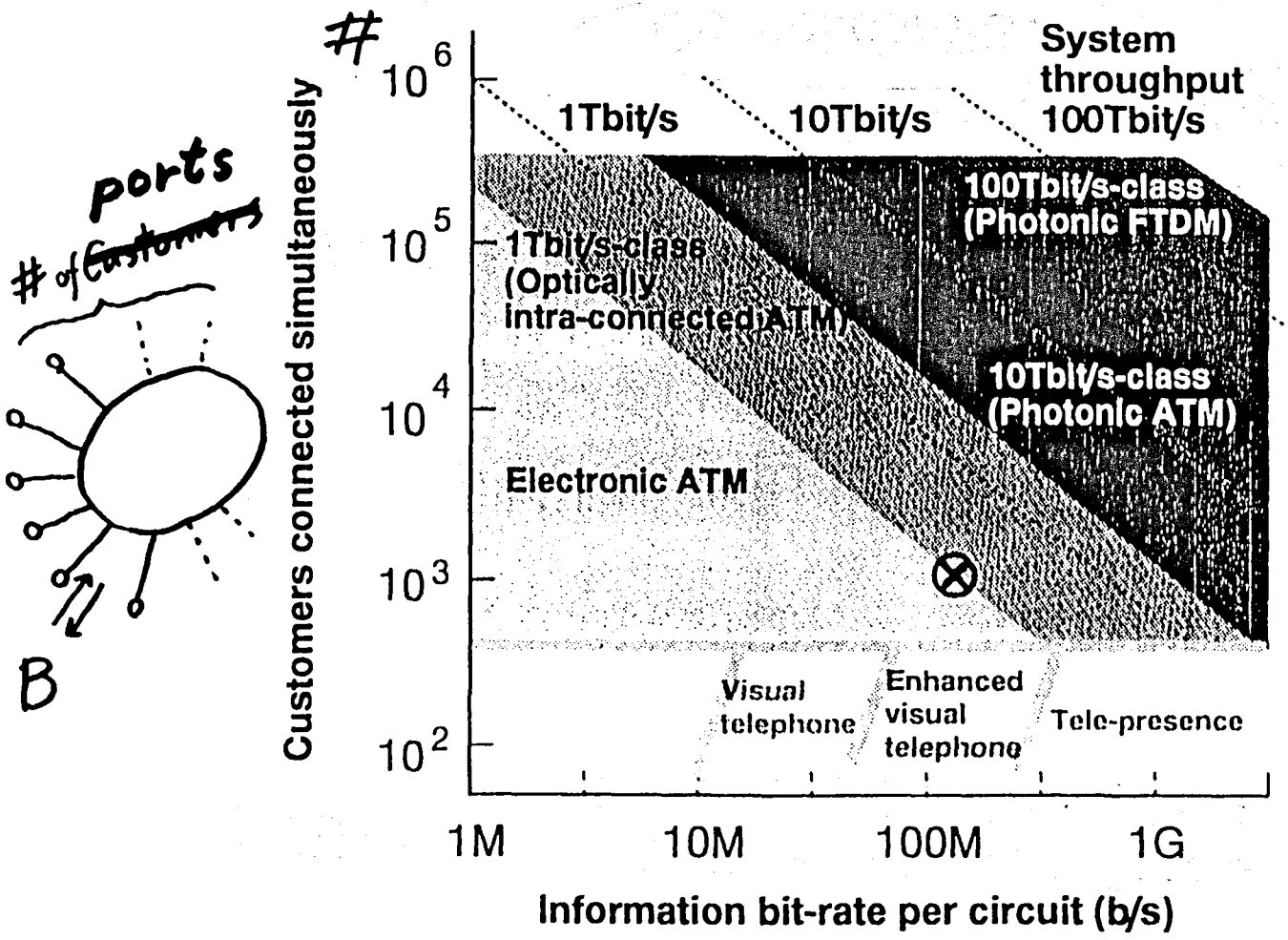
NTT

FUTURE PHOTONIC NETWORK ARCHITECTURE



  NTT

INCREASE in SYSTEM THROUGHPUT by PHOTONIC TECHNOLOGIES



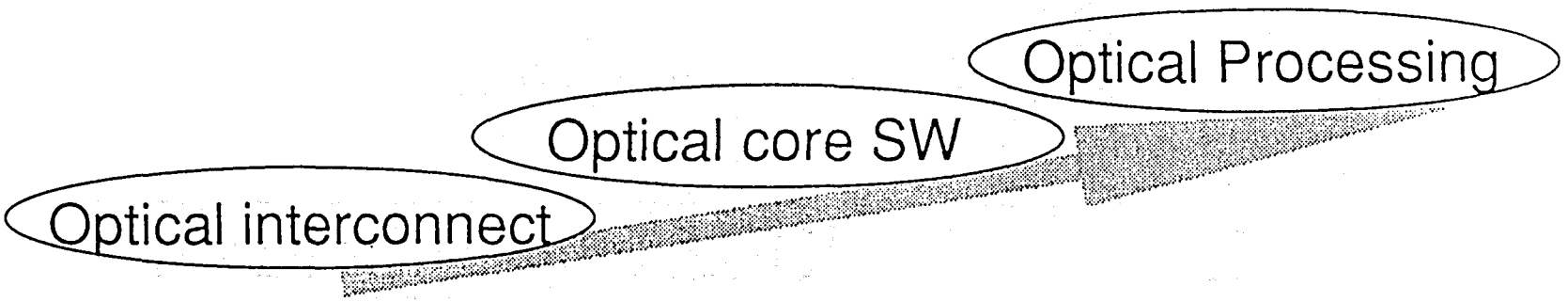
B

Tera-bit Realm

Future Nodes merging Photonics with Electronics

will remove complexity in network

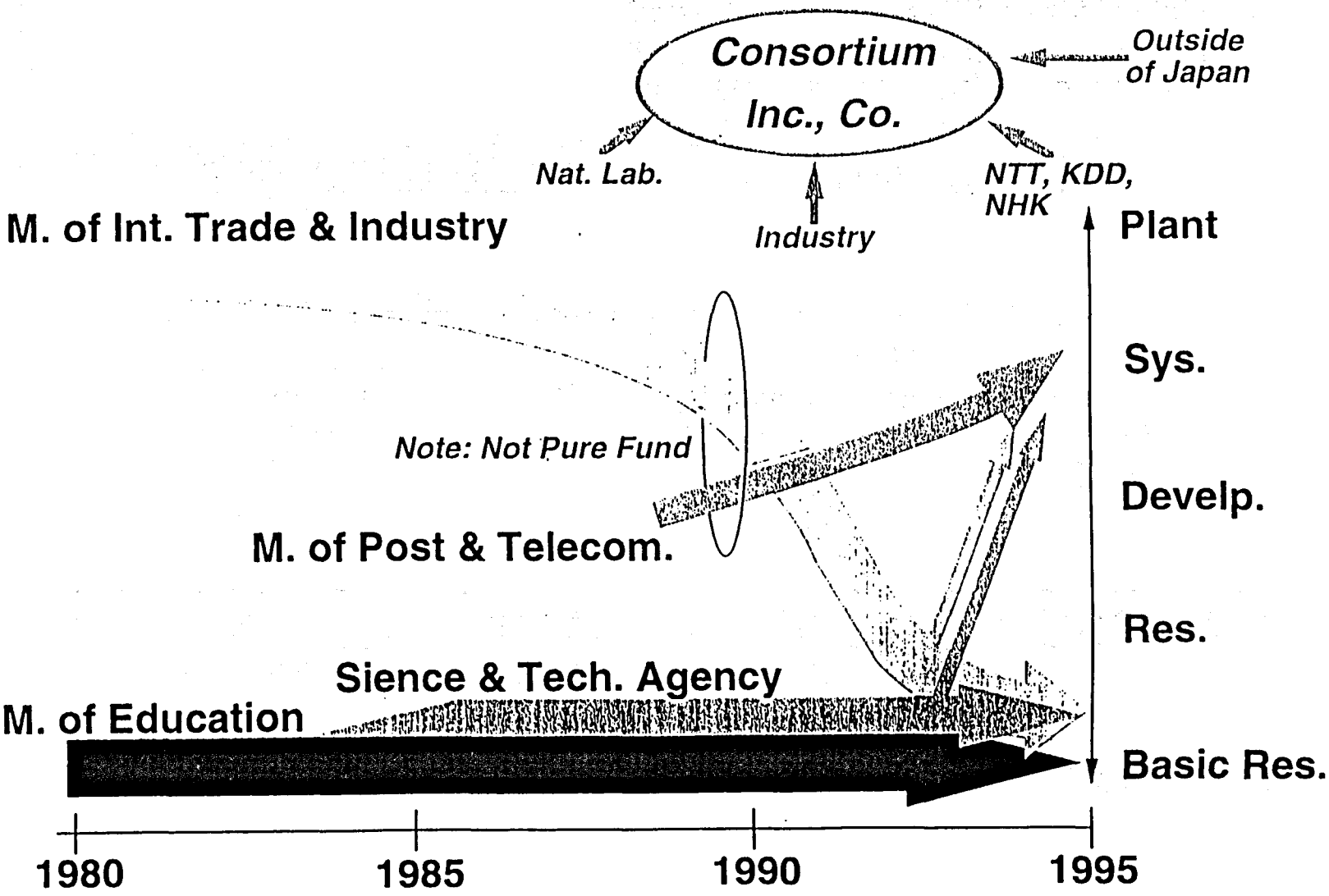
and will provide flexible and inexpensive network



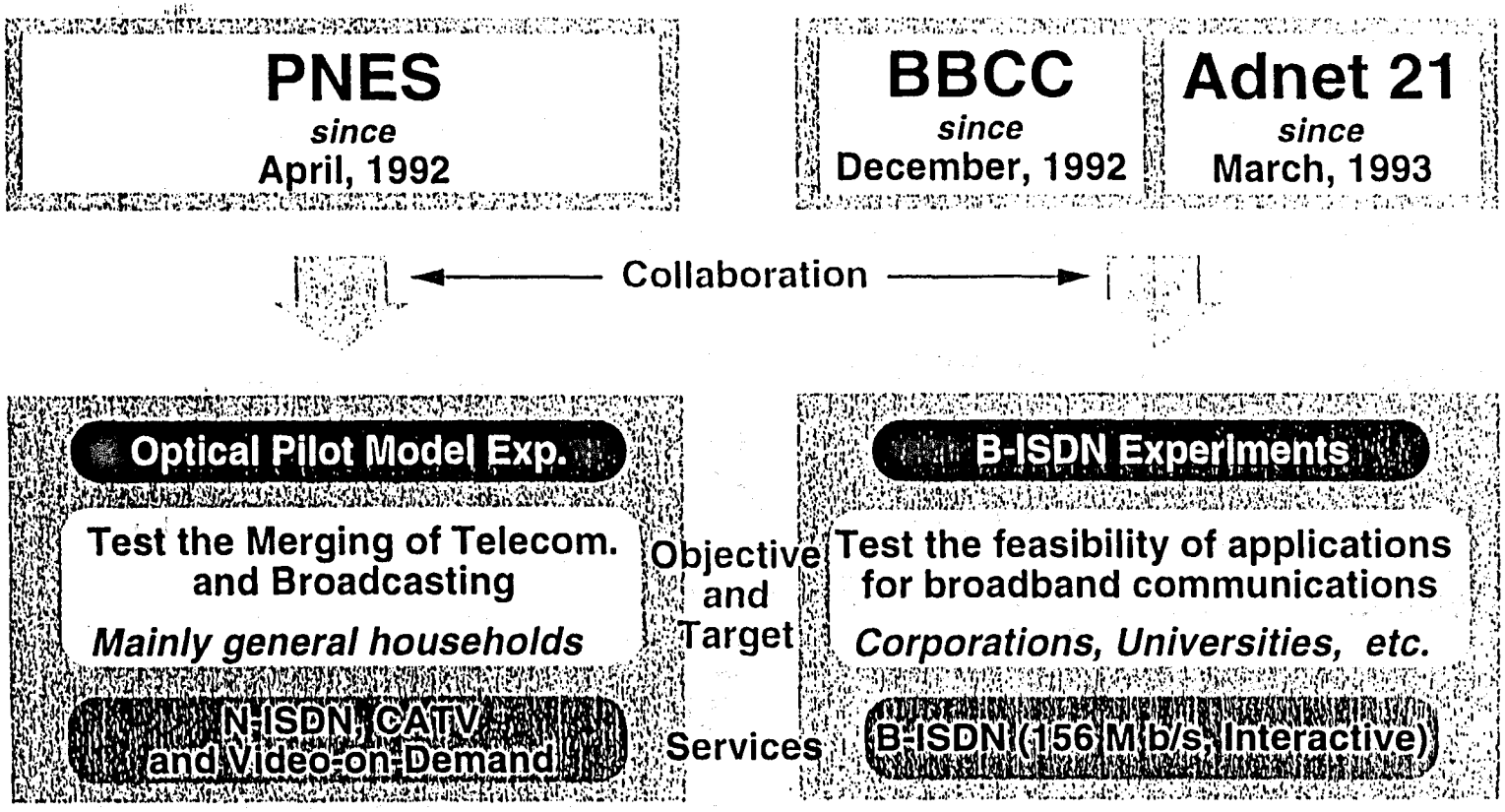
Nov. 1993 T. Ikegami

NTT

"FUNDING" SYSTEM



Experiment Plans in Kansai (M. Post & Telecom)



RWC

1. Real World Computing Partnership (RWC)

2. July 13,1992

3. Budget: 600 M$ / 10 years, ~ 40 M$ @ '92 ~ '93
   ~ 45 M$ @ '94

4. Ministry of International Trade & Industry (MITI)'s "Big Project"

5. Mission
   - Flexible Information Processing
   - Massively Parallel and Distributed Sys.
   - Optical Computing & Devices, Neural Sys., Soft Logic

"Funding"

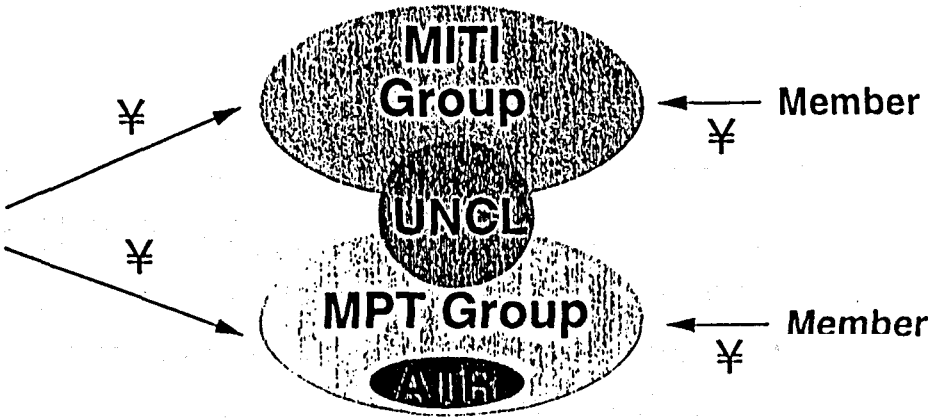
1. Yamamoto Quantum Fluctuation Project

Prof. Y. Yamamoto (Stanford Univ., NTT)
5 Years Project, Labs in Ginston Lab. and NTT Lab.
~ $ 20 M Funded by Science & Technology Agency (STE)
Trough Res. Dev. Corp. of Japan (JRDC)

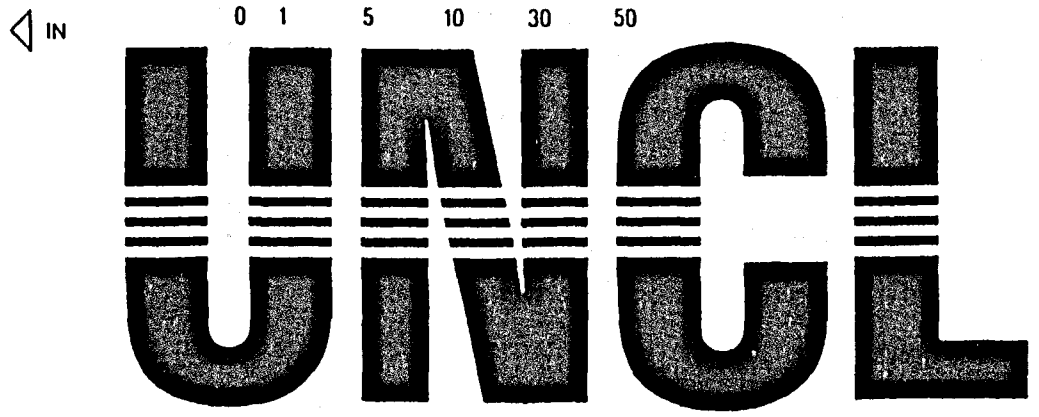
2. Japan Key Technology Center

¥

Stock Dividend of NTT
(M. of Finance Has 60 %)



Advanced Telecom. Res. Int. International
NTT, KDD, NHK, Manufacturer, USA, Europe



株式会社超高速ネットワーク・コンピュータ技術研究所

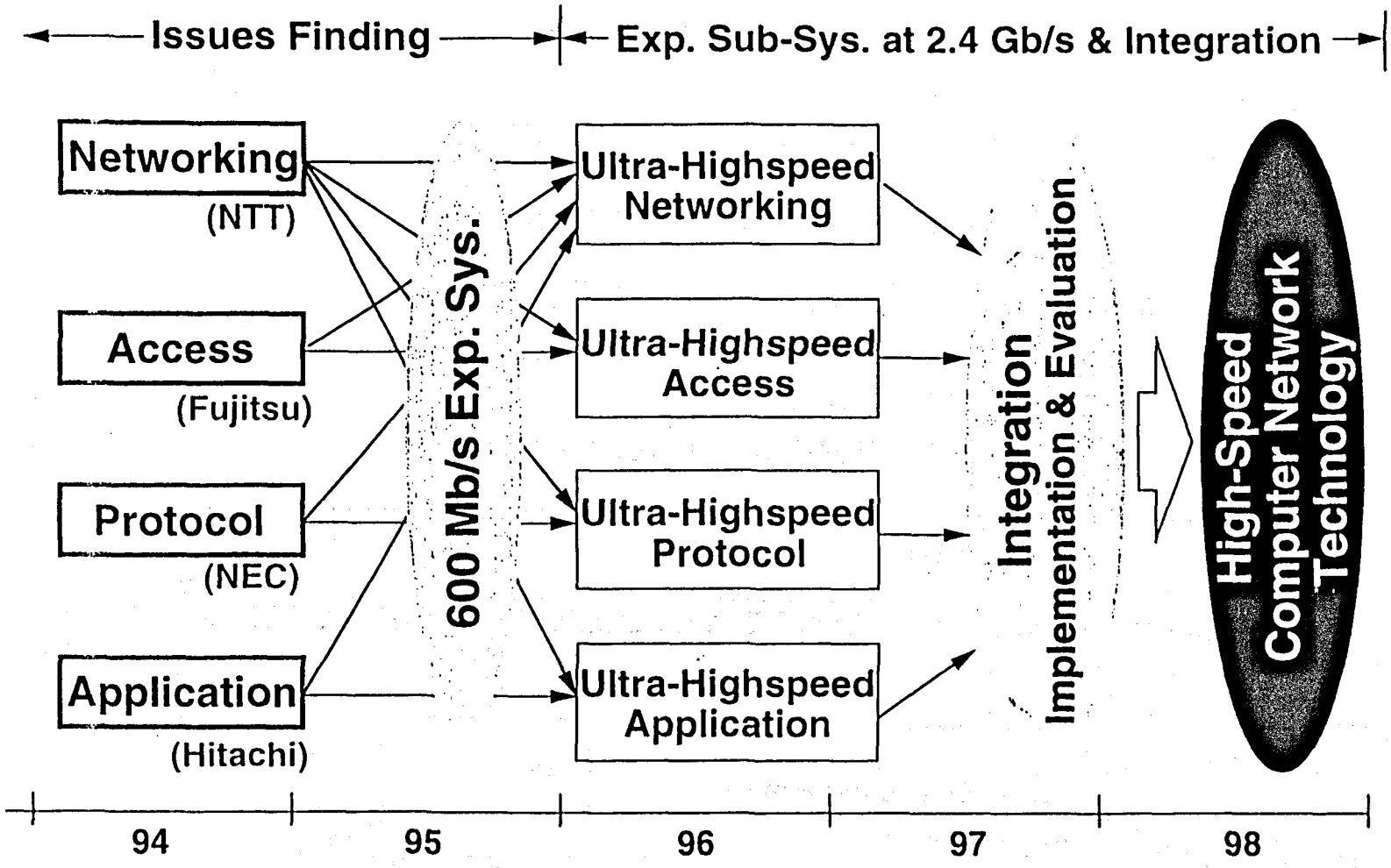
Ultra-high Speed Network and Computer Technology Laboratories

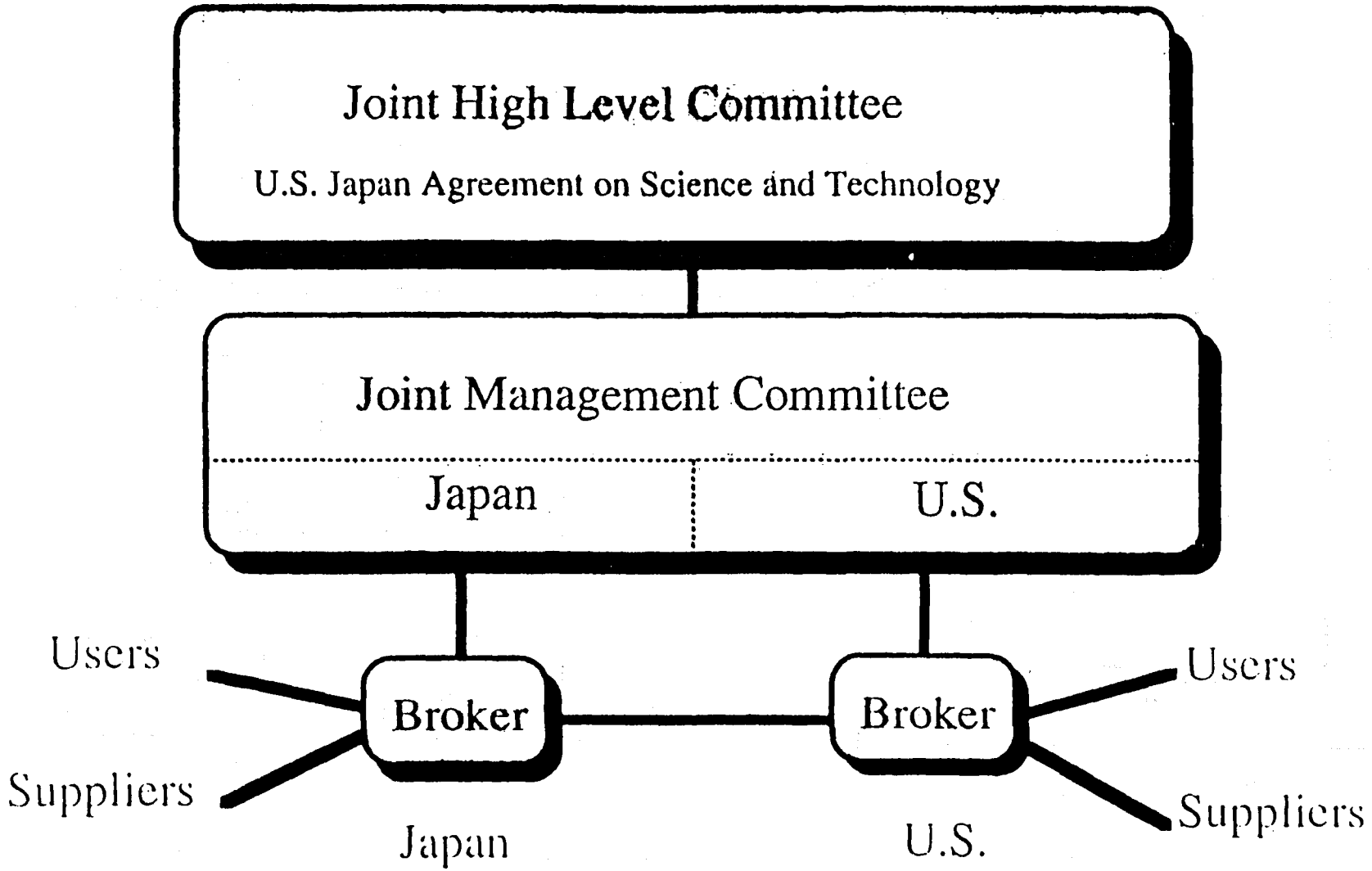
TELEPHONE CARD 50

UNCL Inc.

1. Ultra-high Speed Network & Computer Technology Labs, Inc. (UNCL)
2. March 30,1994
3. Capital: ~ 0.3 M$ (~ 30 M$ Projected in '98)
4. Inventor: Japan Key Technology Center, NEC, Hitachi, Fujitsu
5. Mission
   - Research on Ultra-high Speed Computer Networking
   - Management of Proprietary
   - Associated Business
6. Supported by MITI and MPT (new!)

Schedule & Target




Joint High Level Committee
U.S. Japan Agreement on Science and Technology
Joint Management Committee
Japan
U.S.
Users
Broker
Suppliers
Japan
Broker
Users
Suppliers
U.S.

Goals of the Project

OITDA

1. Improve the availability of novel prototype optoelectronic devices, circuits, and modules

2. Stimulate R&D activity in optoelectronics for computing

3. Implement the successful results of a resolution in the Plan of Action associated with Global Partnership agreement

4. Develop a model for U.S.-Japan cooperative research

Events Related to JOP

OITDA

OITDA: Optoelectronic Industry and Technology Development Association
Consortium founded by MITI in 1980
The counterpart in USA is OIDA

October	1991	OSTP proposed interested topics of US side (Optoelectronics Module Prototype Fabrication Fsacility)
January	1992	Agreement on "Japan and US will undertake a F/S on cooperation on optoelectronics technology ('Global Partnership Action Plan)
December	1993	US/Japan JMC meeting
March	1994	Agreement on IMPLEMENTATION PLAN (scheduled)

Concluding Remark

- "NII" Made In Japan
  So Far, Not National Policy Initiative
  How To Use It Is Not Clear
  Under Consensus Building In Government

- NTT Proposed VI&P Independently.
  It Will Be Infrastructure of "NII".

- We Believe Multi-Media & Integration of Teleco.
  & Broadcasting Will Create Big Market.

- Deregulation In Japan Help Us To Promote
  More Collaboration.

NTT's Investiment Plan for the Info-Infrastructure

Items	Cumulative Amount (-2015)	Content
Fiber Subscriber Loop Circuit	10 trillion yen	Optical Subscriber Loops Exclude Construction Cost
Digital Communication	10 trillion yen	Digitalization and Broadenization of Network
Service Software	8 trillion yen	
Research and Development	5 trillion yen	Software development for New Services
Maintenance/ Replacement/etc.	12 trillion yen	Service Maintenance, Building Plant, etc.
Total	45 trillion yen	(about 2 trillion yen / year)

March, 1993 NTT

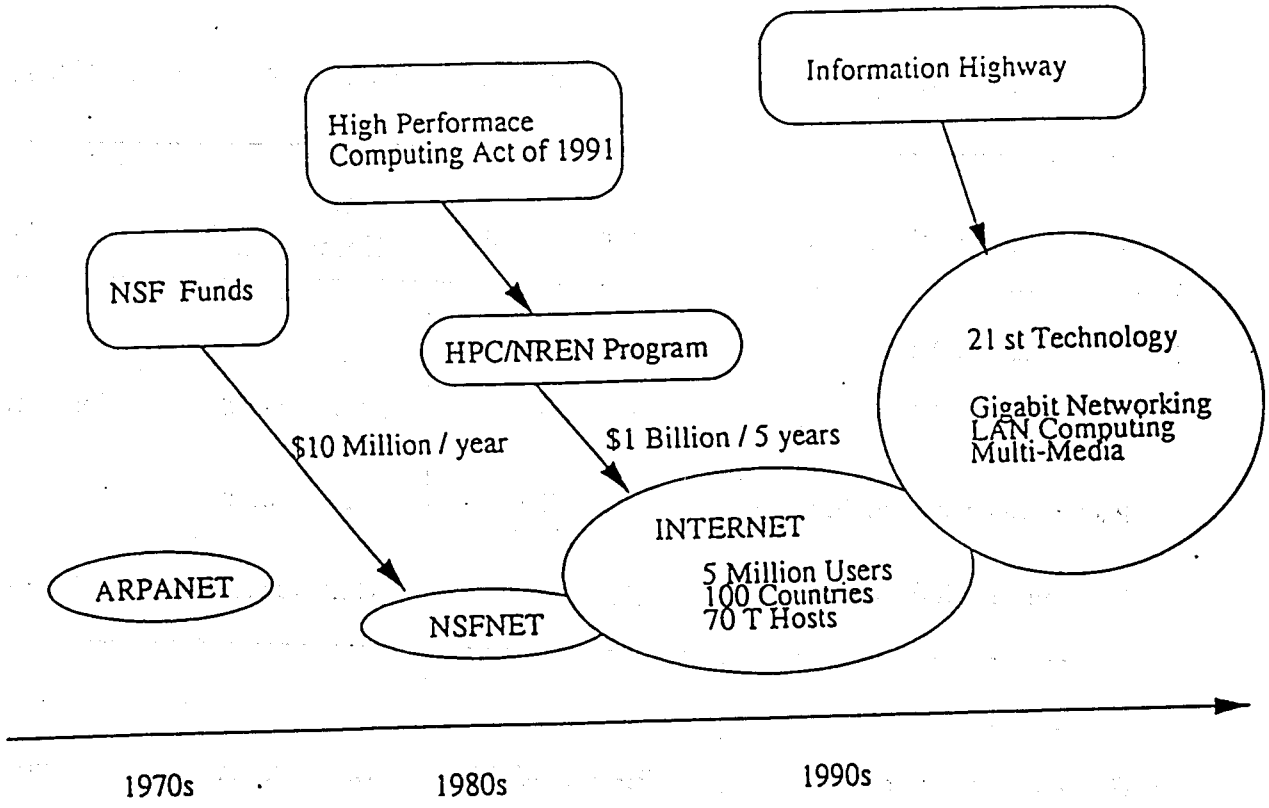


Figure 1: Clinton - Gore's Information Highway

INFORMATION INFRASTRUCTURE DEVELOPMENT: INTERNATIONAL COMPARISON BETWEEN THE UNITED STATES AND JAPAN

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(Fax) 614-292-1651

Table 1: Information Infrastructure Backbone: Bilateral Comparison between USA and Japan

Infrastructure Backbone	The United States	Bilateral Comparison	Japan
Government			
(a) Policy Making Process	Top-Down	USA > Japan	Consensus Building
(b) Public Administration Structure	Decentralized	USA < Japan	Centralized
(c) Governmental Influence	Funding	USA < Japan	Direct Control
Business			
(a) Global Computer Network	INTERNET/NREN	USA > Japan	Almost None
(b) CATV Industry	Large CATV Industry	USA > Japan	Almost None
(c) Fiber Optic Industry	Large Industry	USA = Japan	Large Indusrty
(d) Consumer Electronics Industry	Small Industry	USA < Japan	Very Large Industry
(e) Computer Industry	Hardware & Software	USA > Japan	Hardware
(f) Industrial Structure	Competition in Toll Regulation in Local	USA = Japan	Competition in Toll Monopoly in Local

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Feb. 1994