R&D efforts towards next-generation network in NTT

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Outline

1. The current status and future direction of Japan's telecommunications market

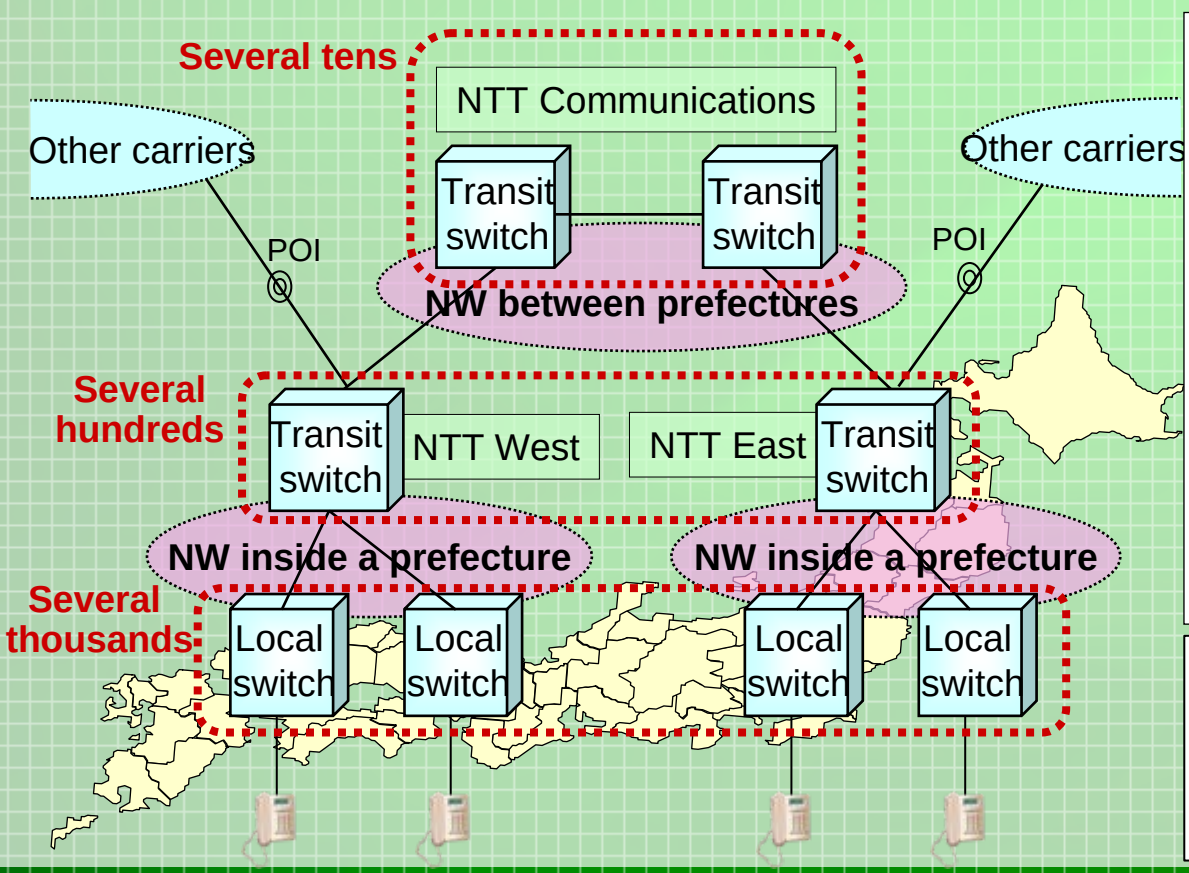
2. NTT's plans for the deployment of its NGN

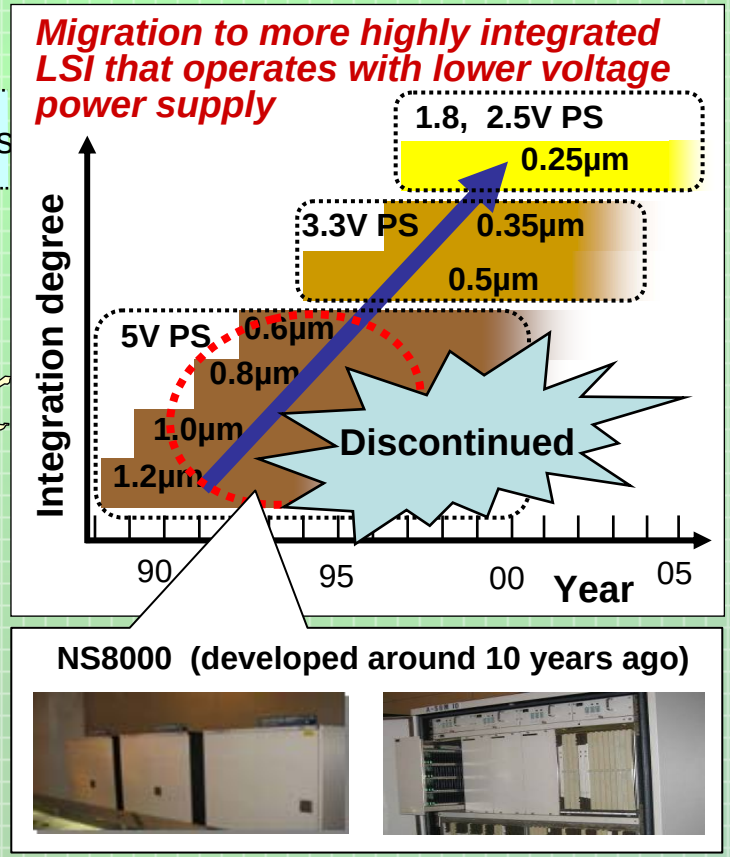
3. Technologies to promote FTTH

4. Future visions for the NGN

Measures taken to prolong the lifetime of NTT's PSTN facilities

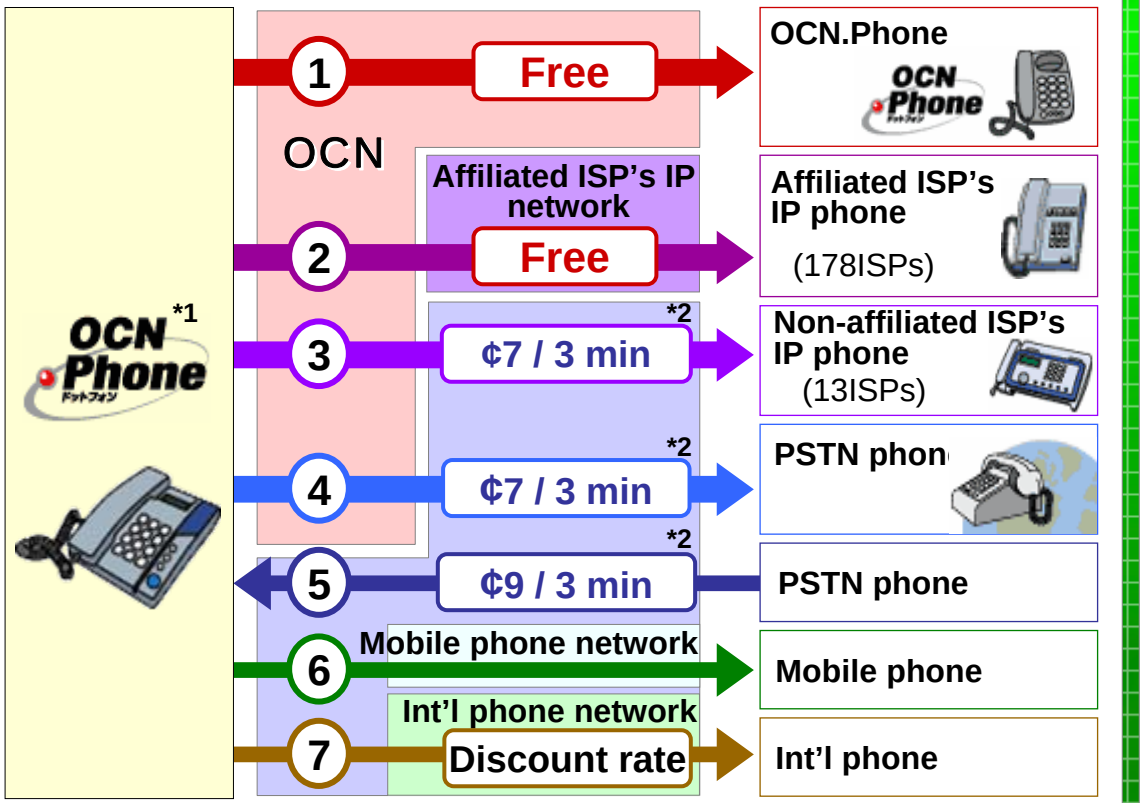
- NTT's PSTN consists of several thousand switches.
- Although a then-state-of-art switching system (NS8000) was developed around 10 years ago, the rapid progress in technology since then has resulted in the discontinuation of production of some components used in the system. Currently, we are trying to prolong the lifetime of the switches by re-establishing sources for such components.



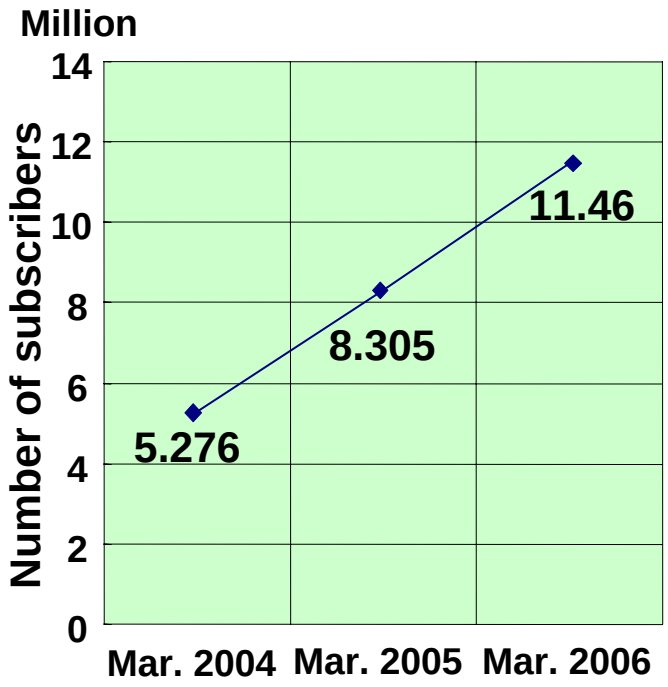


Maturing of IP telephony technology in Japan

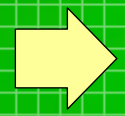
- IP telephony is spreading from business users (IP-PBX). Low rates (or free between specific points) offered by ISPs have increased the number of IP phone users in Japan to more than 10 million.
- NTT already provides an IP phone service “Hikari Phone” using the ordinary telephone numbering plan.



Increase of subscribers to IP phone service



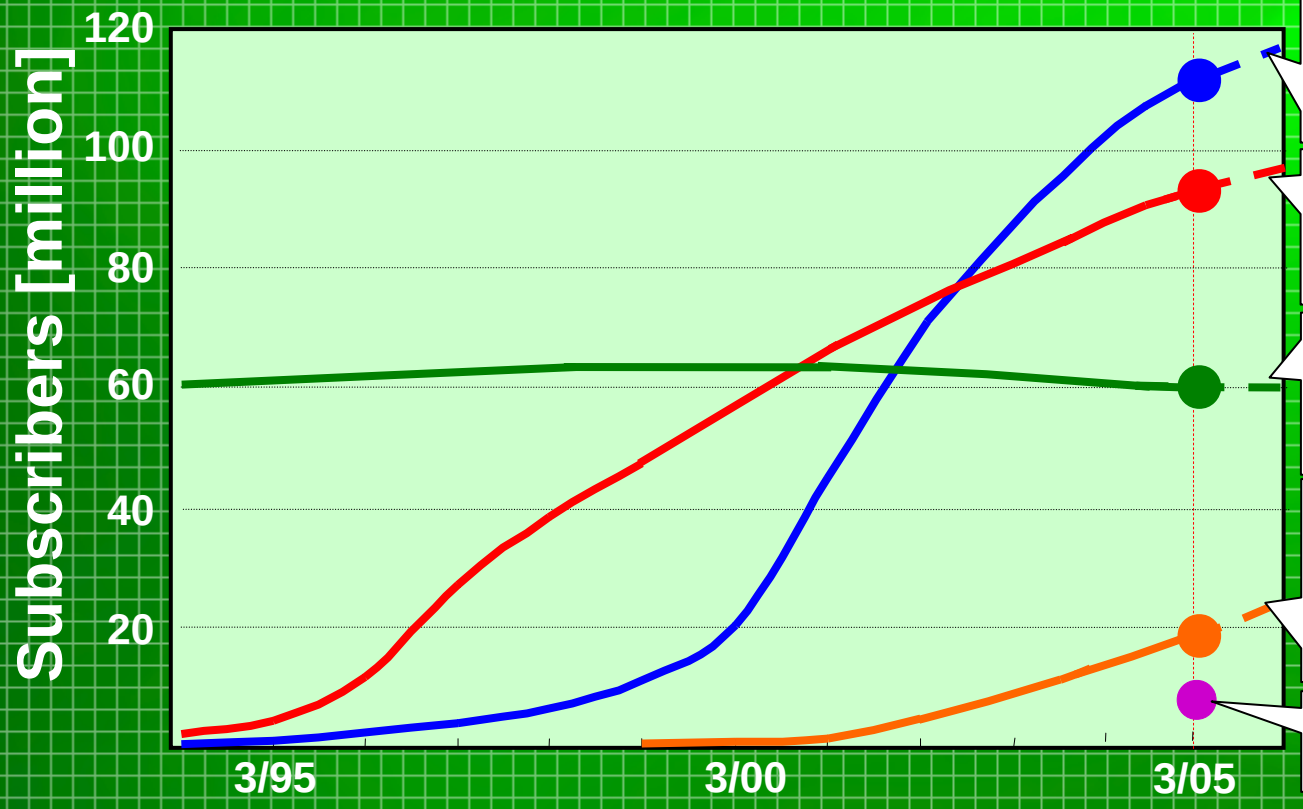
*1: NTT Communications, Inc.: http://www.ocn.ne.jp/english/personal/option/voip/
*2: not changed by distance

PSTN 

- Time is ripe for an IP network to replace PSTN.
- Migration to the IP network will reduce both capital and operational expenditure.

Paradigm shift of Japan's telecommunications market

- The number of mobile phone subscribers has far exceeded the number of subscribers to fixed-line telephony.
- The number of Internet users continues to increase.



Internet
(Fixed line + mobile phone)
Internet users: 106.24 million

Mobile phone
Mobile phone users: 91.48 million

POTS + ISDN
Fixed-line-phone users: 58.79 million

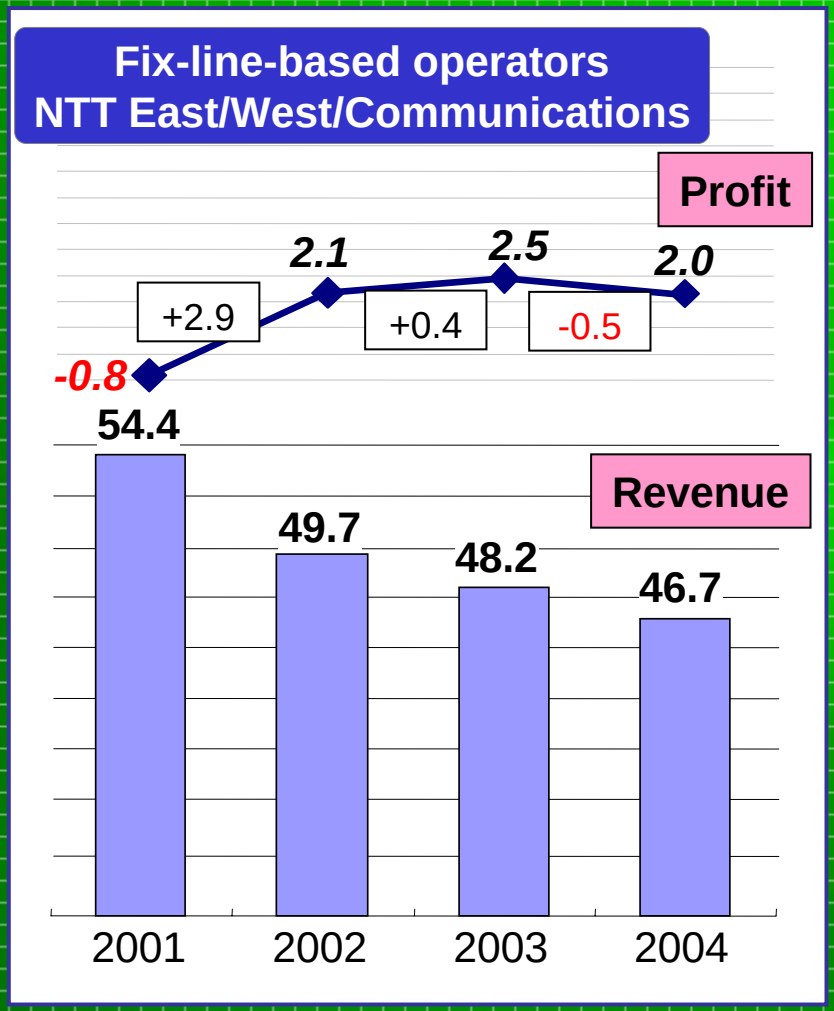
Broadband
(Optical, ADSL, etc.)
Broadband users: 19.49 million

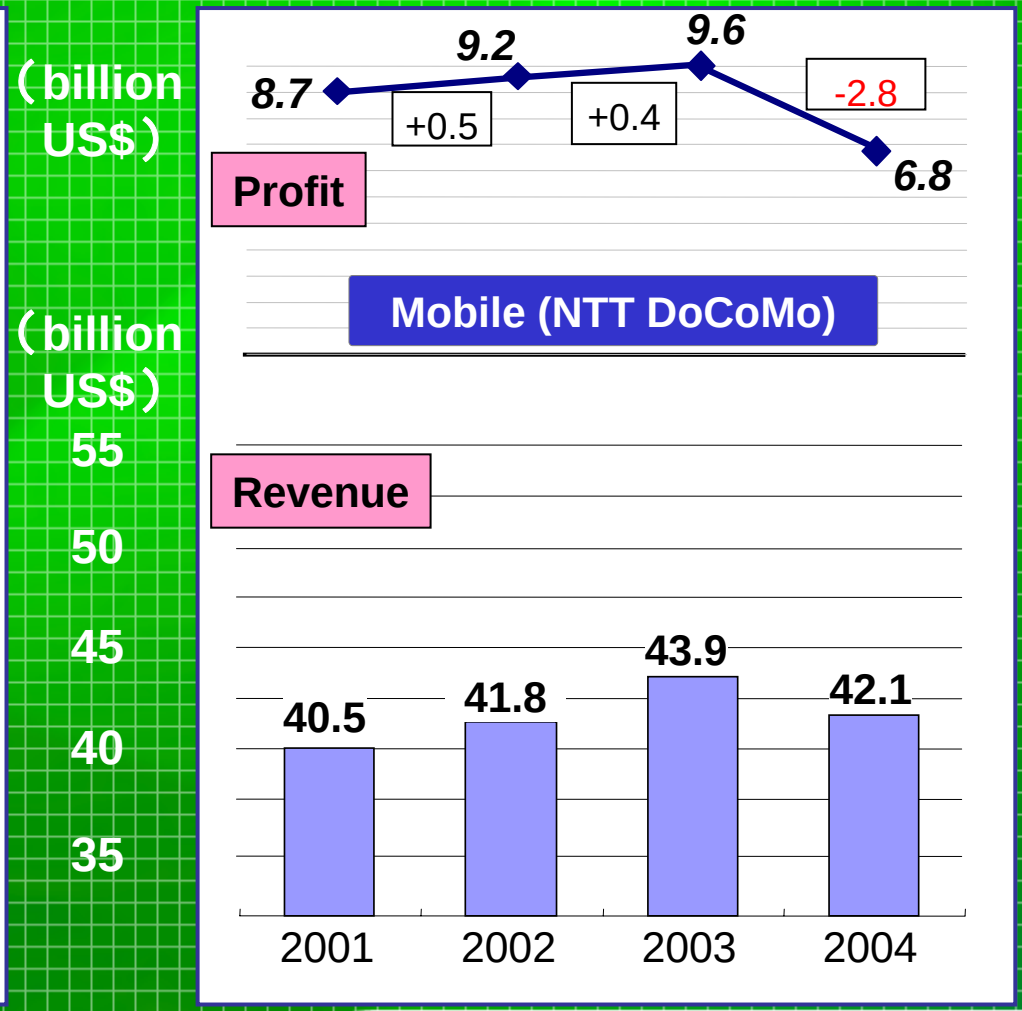
IP phone users: 8.3 million

Sources: Ministry of Internal Affairs and Communications, Consortium for Promotion of Mobile Computing, InfoCom Research Inc., and others.

Decrease in revenues from both fixed-line and mobile phone services of NTT

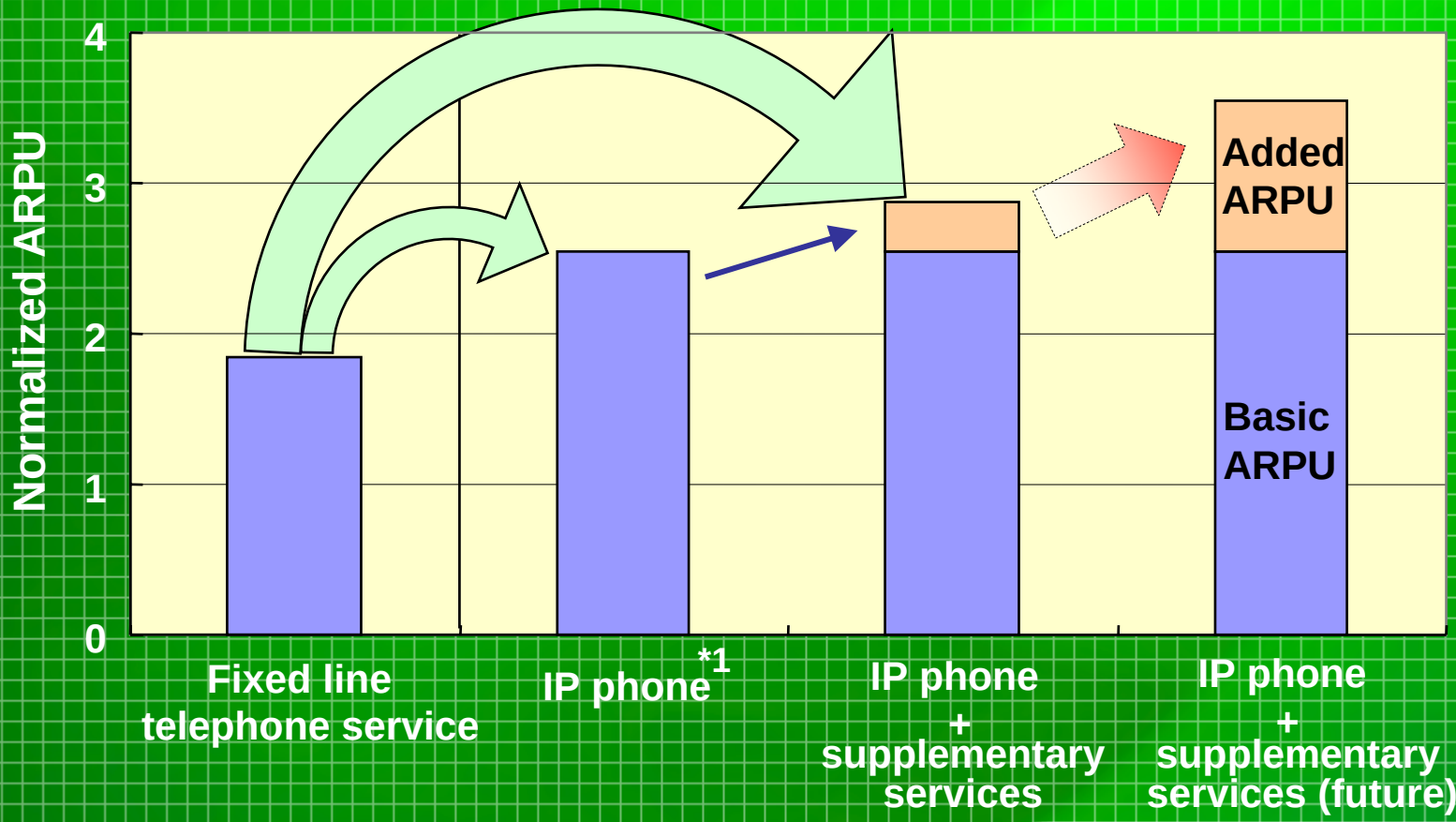
- The revenue from the fixed-line phone service has decreased considerably.
- The revenue from the mobile phone service has also begun to decrease.





Increase in ARPU of broadband services

- There is a shift from low-price IP telephony, exploiting IP technology, to the provision of value-added services, such as video delivery and videophone, exploiting the availability of broadband access.
- The provision of value-added services is increasing ARPU.



*1: Broadband access charge (including ISP charge)

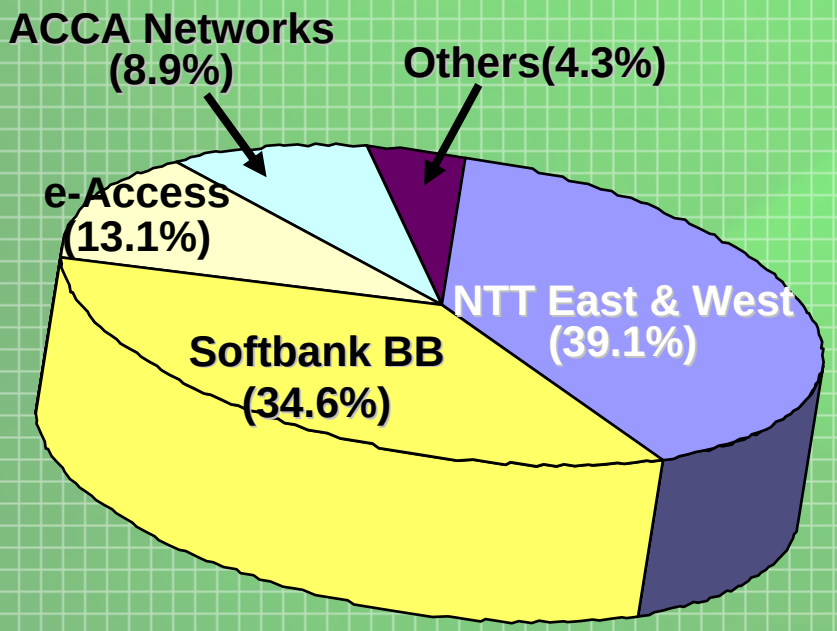
Revenue source of telecom carriers

- **Carriers need to shift their main revenue source from the telephony service to broadband services.**

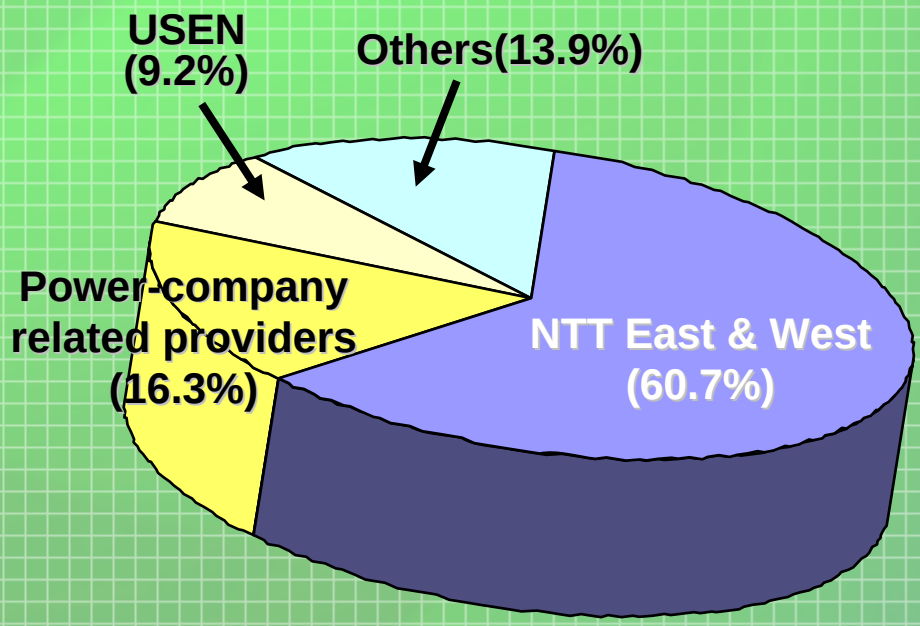
Intense competition in broadband access in Japan

- Competition in the telecoms market is intensifying in Japan.
- NTT faces tough competition in gaining share in broadband access, and its share for ADSL is now matched by an aggressive competitor, Softbank BB.

<Shares in ADSL market>



<Shares in FTTH market>

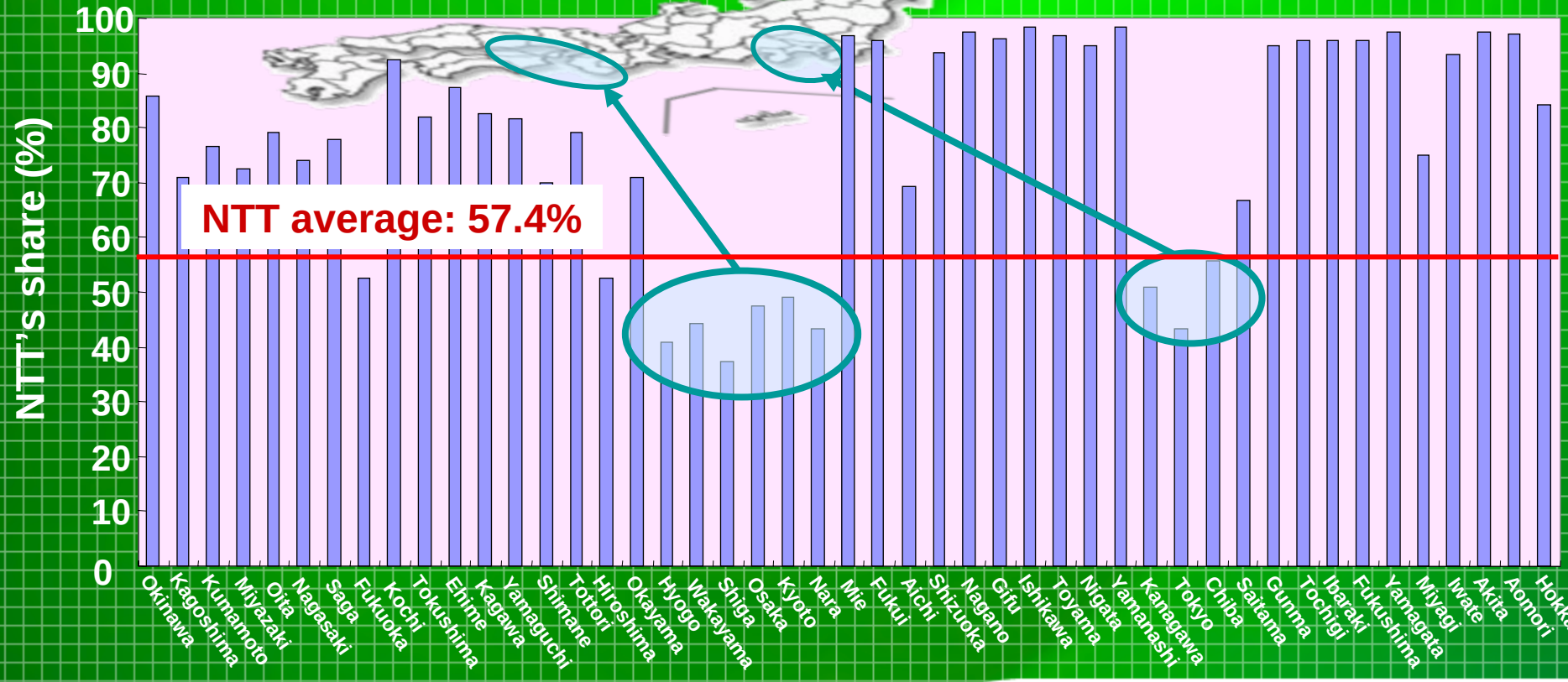


As of December 2005

Competition for share of FTTH is particularly fierce in urban areas

- NTT has over 50% share in optical access nationwide. However, in urban areas, where fibers can be installed efficiently, NTT faces tough competition and is falling behind in many prefectures.

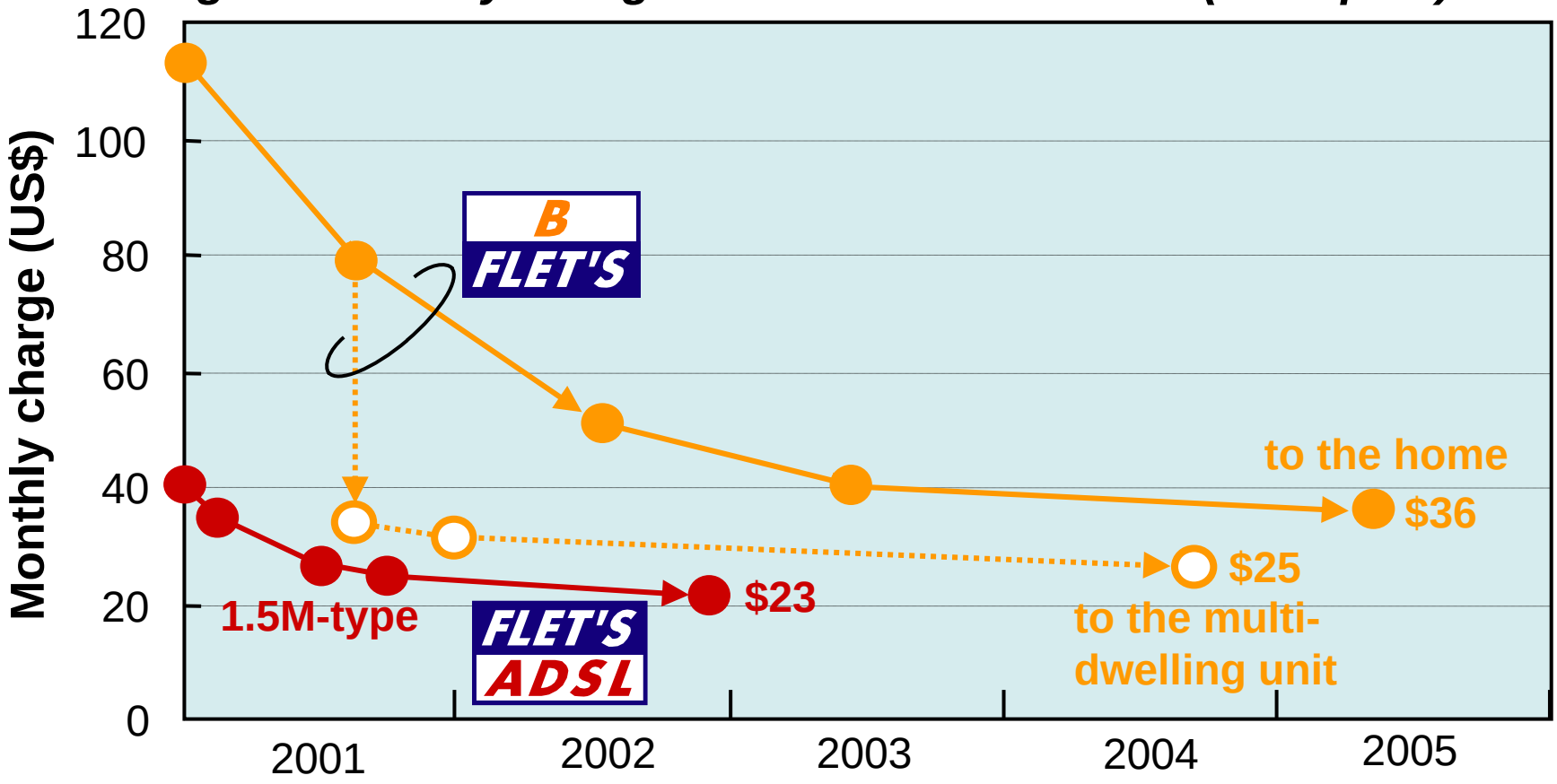
Share of FTTH market in individual prefectures (As of March 2005)



Rapid reduction in the charge for broadband access in Japan

- Competition has intensified into a price war, bringing down the charges for ADSL and even FTTH dramatically.
- This has resulted in a significant reduction in telecom traffic revenue.

Change in monthly charge for broadband access (examples)

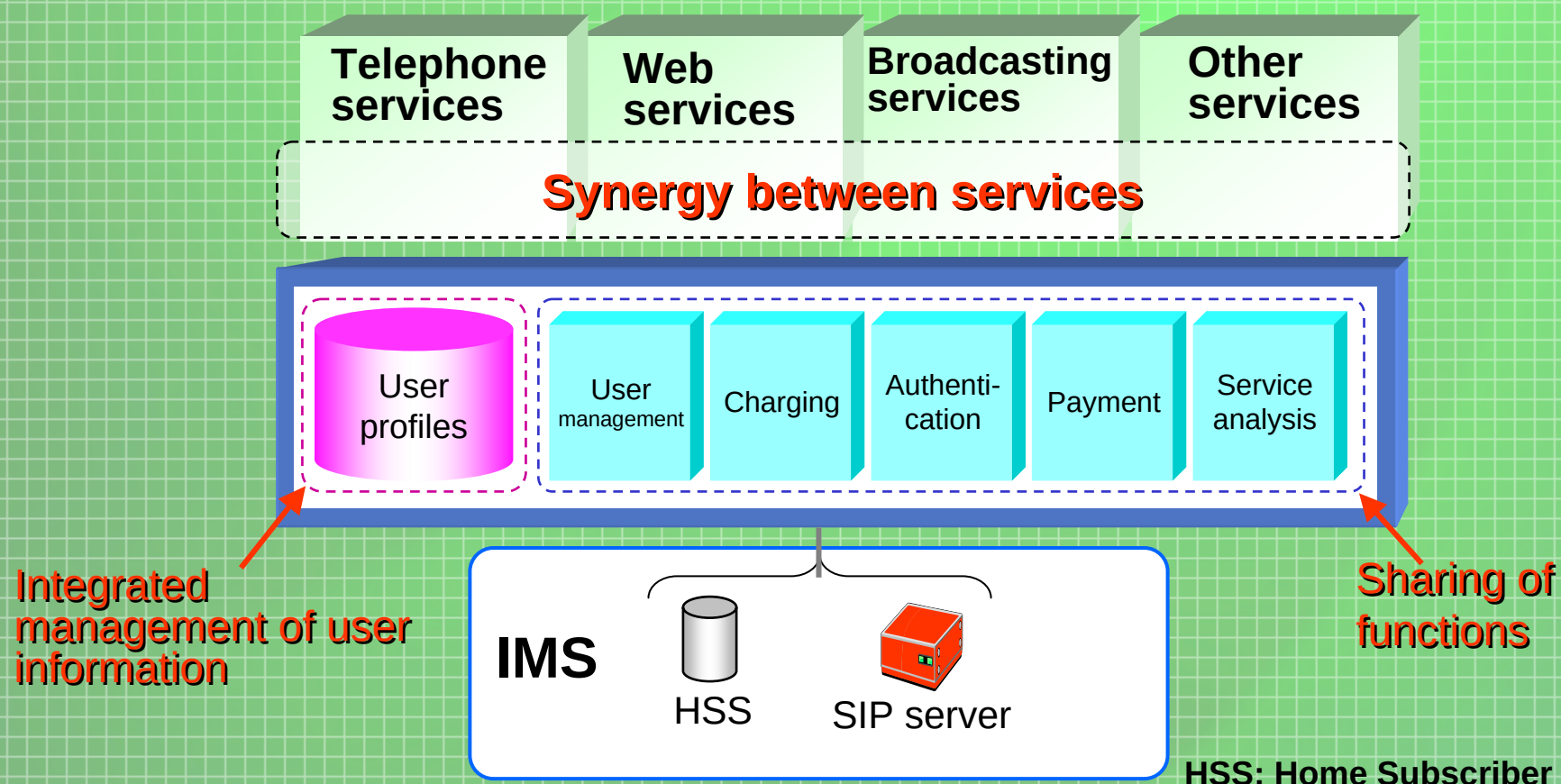


Status of competition in Japan

- **Competition has intensified into a price war, making it necessary to create new markets that will generate revenue.**

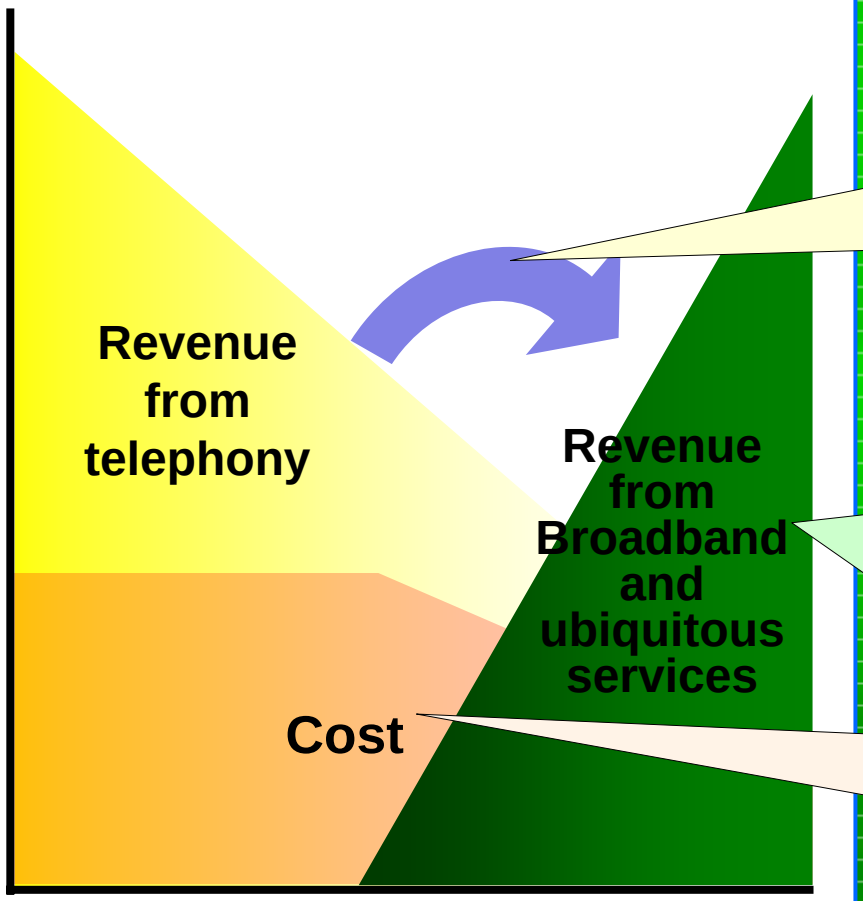
A variety of application services

- The Service Delivery Platform (SDP) is provided to enable various types of service providers to offer telephone, Web and broadcasting services, and to permit collaboration between these services.



NTT's actions to deal with the competition

- It is urgent for NTT to increase profit by increasing revenue in addition to reducing capital and operational expenditure.



- Promote broadband & ubiquitous services like FMC and triple play
  > **Revenue shift** from telephony
- Establish service delivery platform for new seamless businesses
  > **Expand telecom market**
- Migrate telephone network to IP
  > Reduce **capital and operational expenditure**

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Approach to NGN

Build NGN that is of high quality, flexible and secure

Smooth migration from existing fixed-line to **IP** telephony, and from copper to **optical access**

Develop and spread **broadband and ubiquitous services** that allow fixed-mobile convergence (**FMC**)

Expand business opportunities by exploiting broadband and ubiquitous services

Open network that allows collaboration with other carriers and xSPs

Provide new **business opportunities to xSP**

- **Provide optical access to 30M users by 2010**
- **Strengthen competitive edge** and financial base for NTT
- Contribute to **strengthening of Japan's international competitiveness**

Basic concept of NTT's NGN

Community, e-commerce

ASPs and various service players

Lifestyle support, home appliance manufacture

Broadcast, content providers

SNI

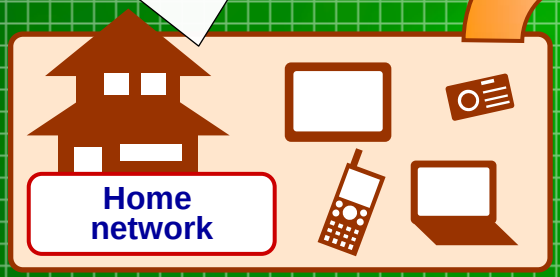
Disclose Service Node Interface (SNI) to enable various service players to provide a wide array of applications on the NGN

SDP

IMS

N G N

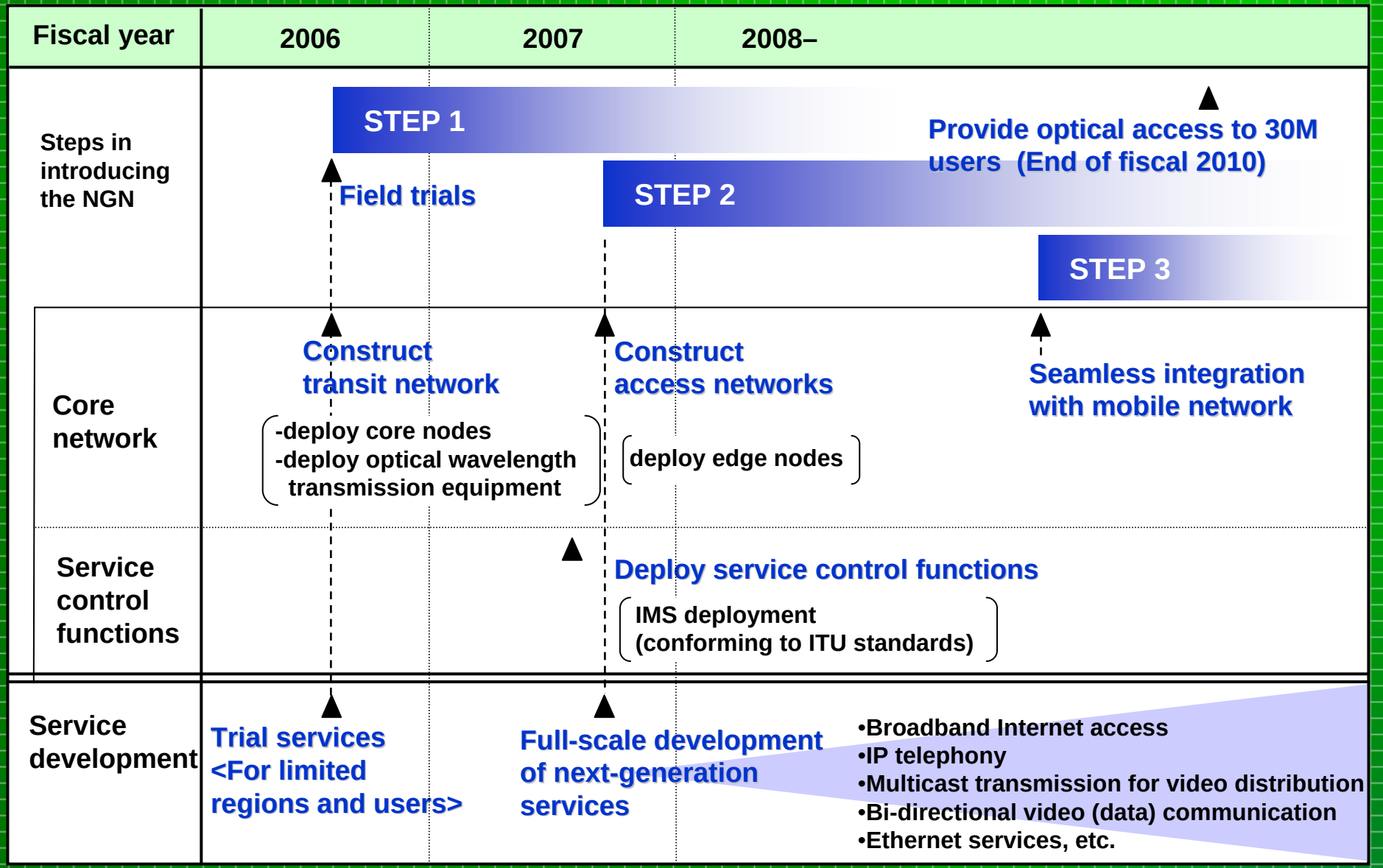
IP-based network enabling provision of **seamless fixed and mobile** services



Safe, **secure**, and **convenient** network equipped with features of both the existing fixed-line telephone and IP networks

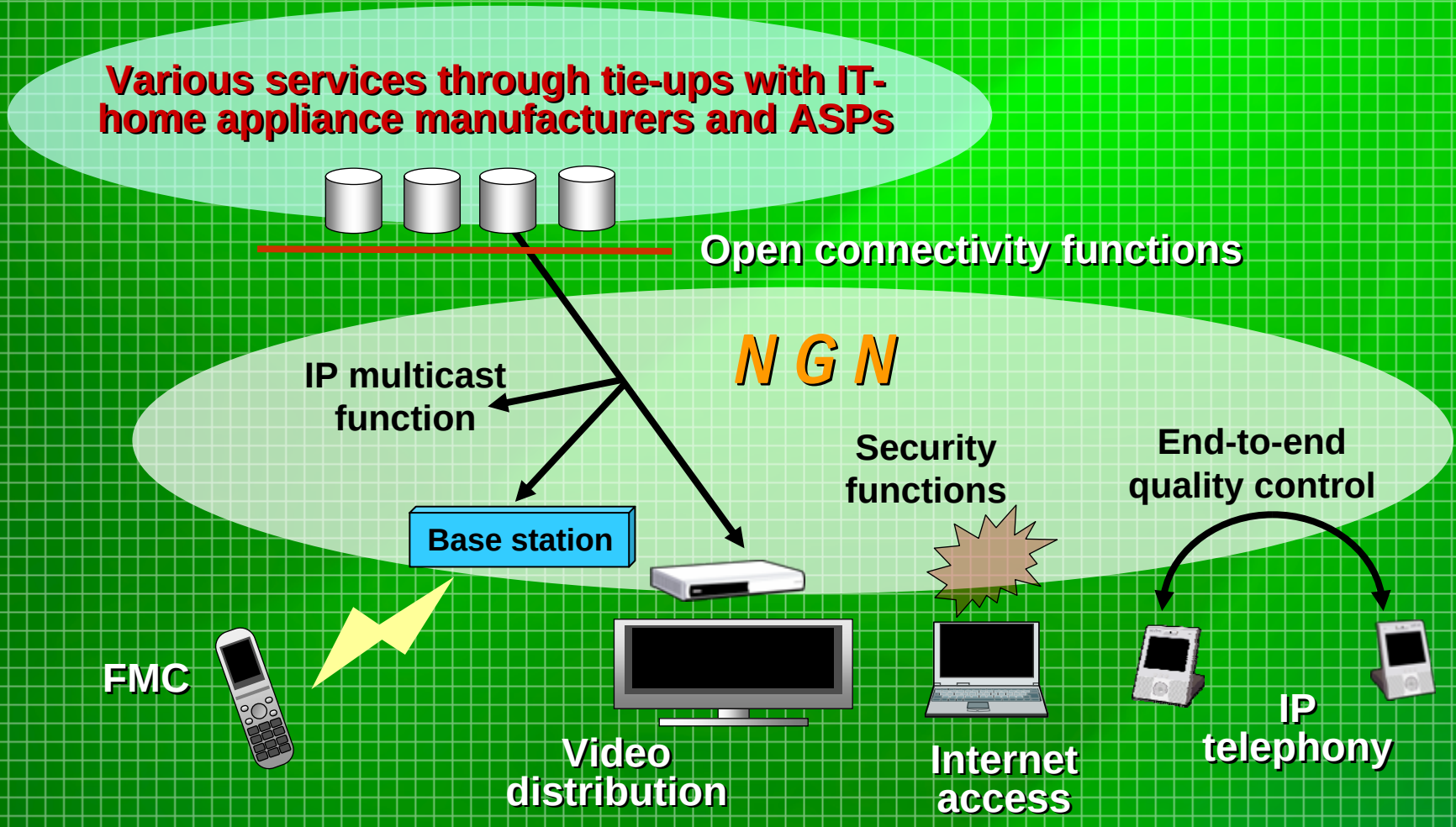
SDP: Service Delivery Platform
IMS: IP Multimedia Subsystem

Roadmap to building NTT's NGN



Overview of Field Trials of NTT's NGN

- Trial period: One year from Dec. 2006
- Areas: Tokyo and its surroundings and Osaka



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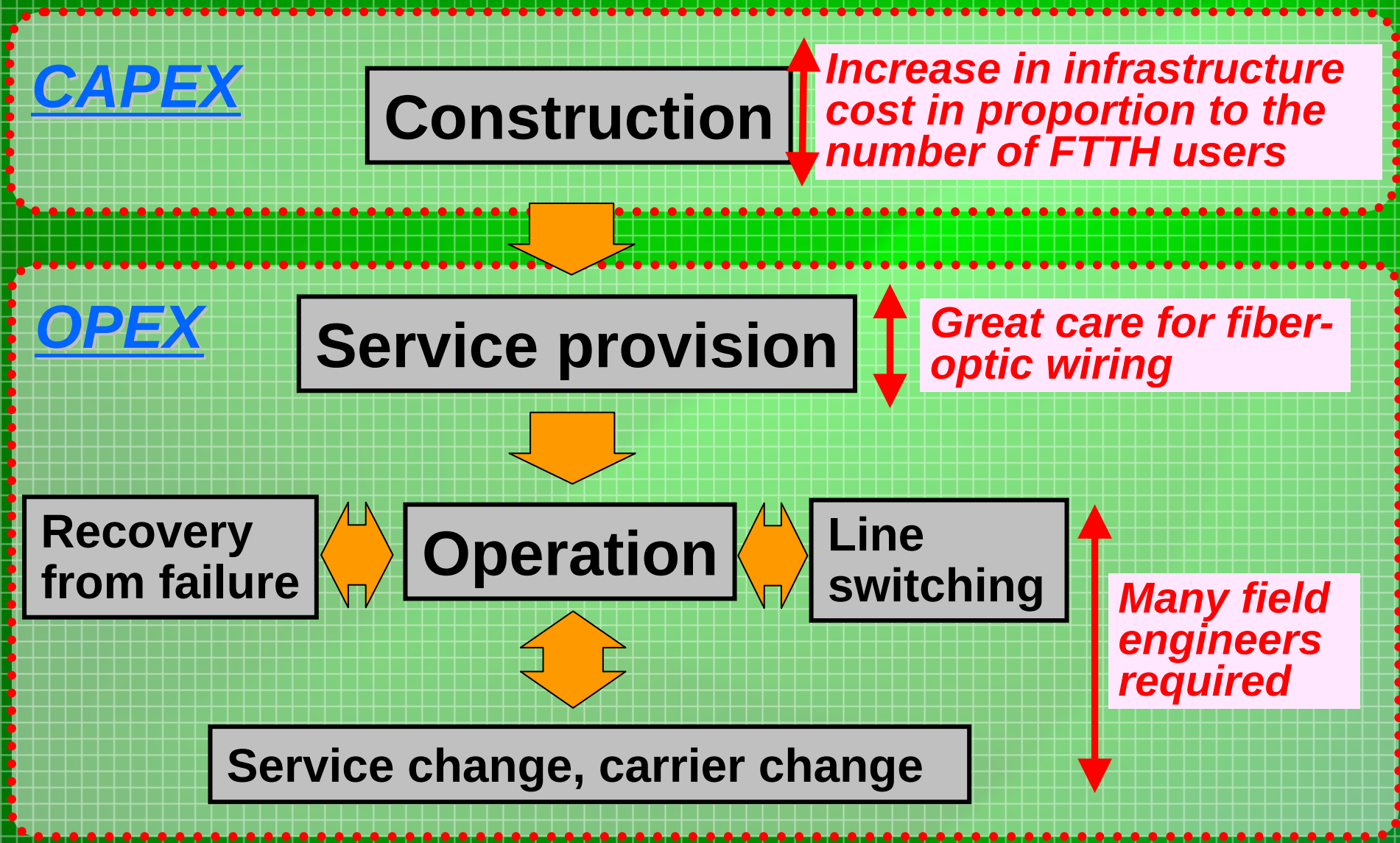
Issue of Optical Access Network



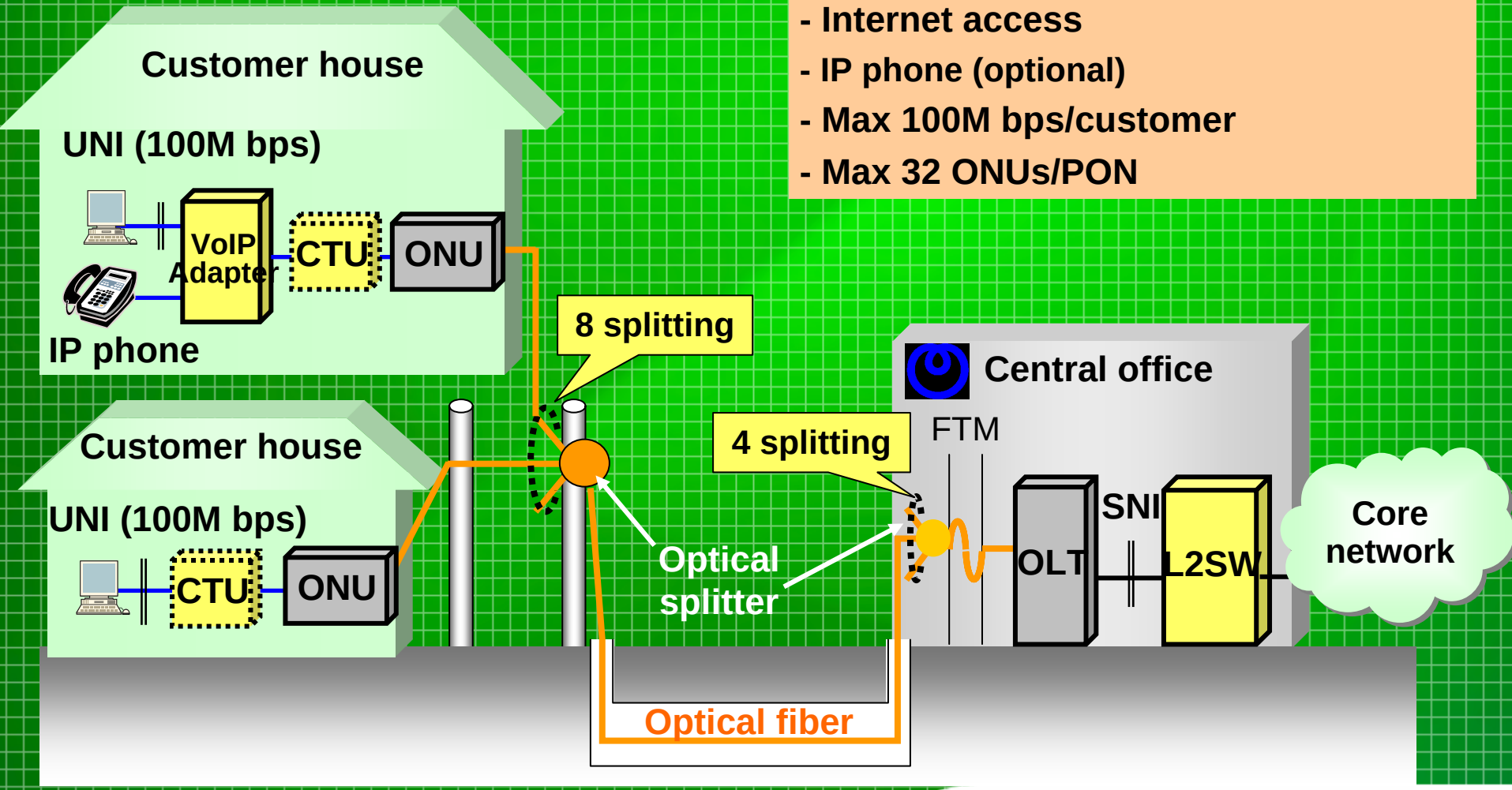
Key Technologies of Optical Access

- **Reduction in CAPEX**
  - *Gigabit Ethernet (GE) PON system enabling sharing of optical fibers and equipment*
- **Reduction in OPEX**
  - *Remote testing technique without dispatch of field engineers*
- **Quick service provision**
  - *Rapid construction techniques for handling optical fibers roughly*

GE-PON for FTTH service

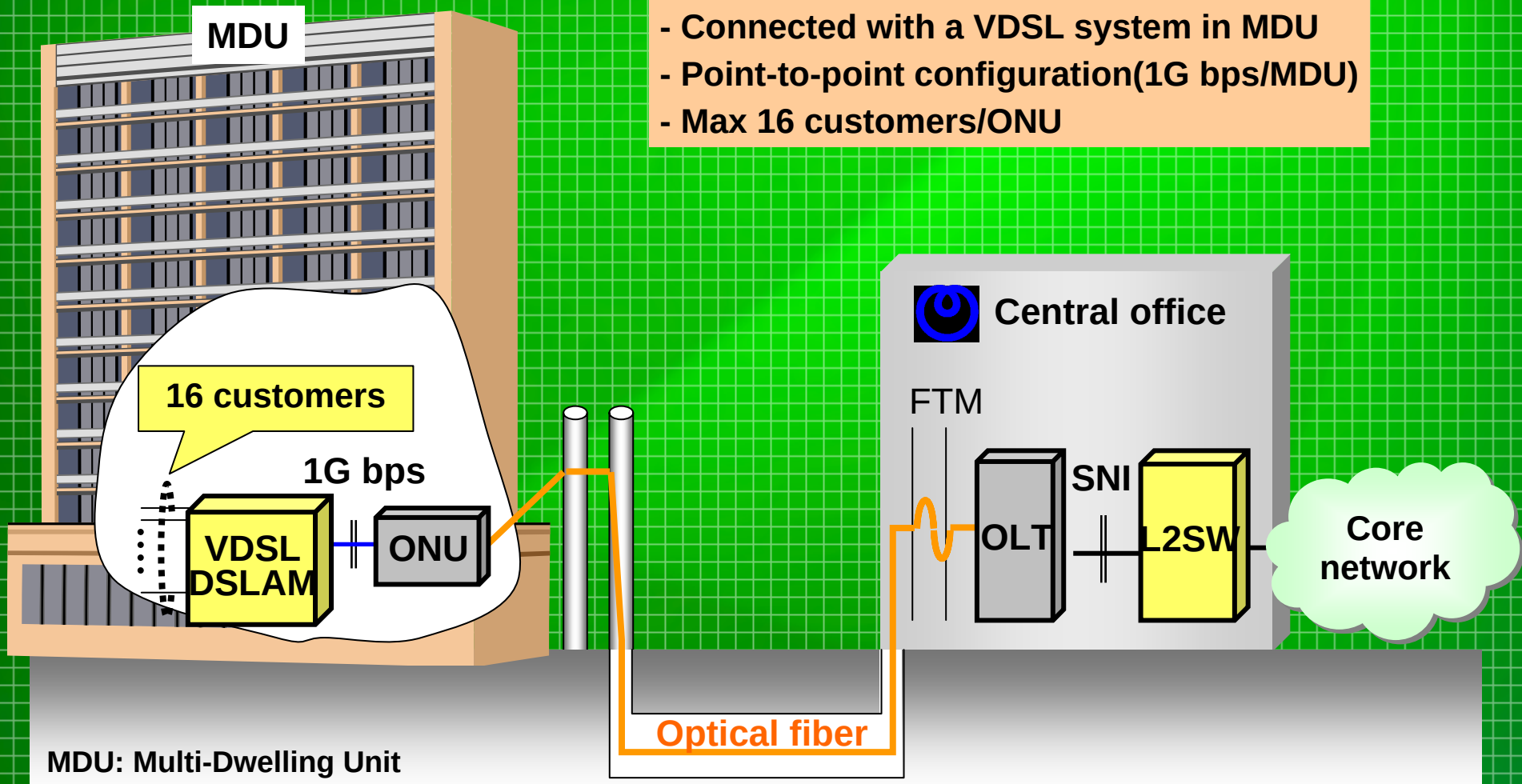
- GE-PON commercial services since Nov. 2004.
- NTT's GE-PON conforms to IEEE 802.3ah.

- Internet access
- IP phone (optional)
- Max 100M bps/customer
- Max 32 ONUs/PON



System configuration for FTTMDU service

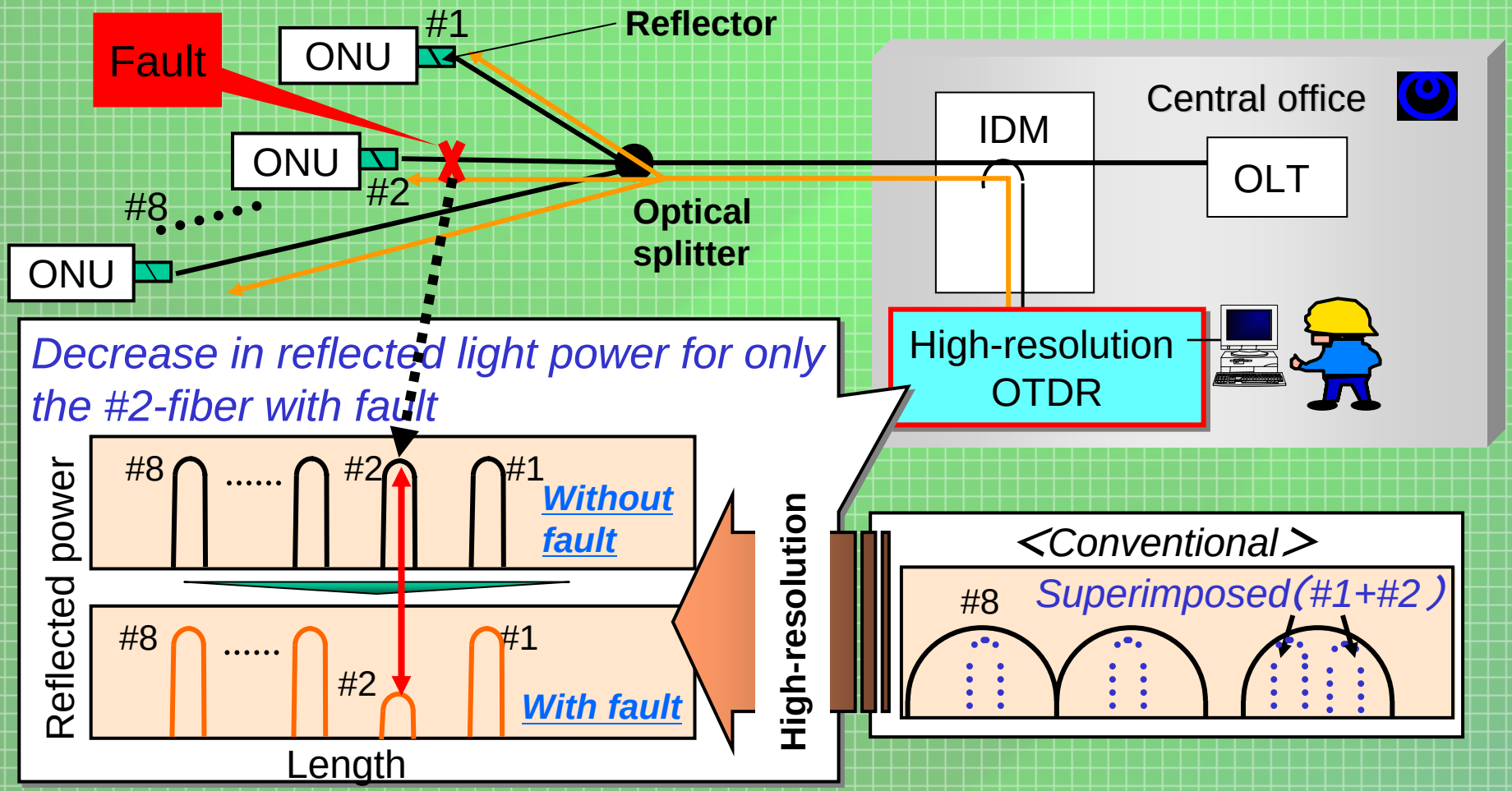
- Internet access
- IP phone (optional)
- Connected with a VDSL system in MDU
- Point-to-point configuration(1G bps/MDU)
- Max 16 customers/ONU



MDU: Multi-Dwelling Unit

Remote testing

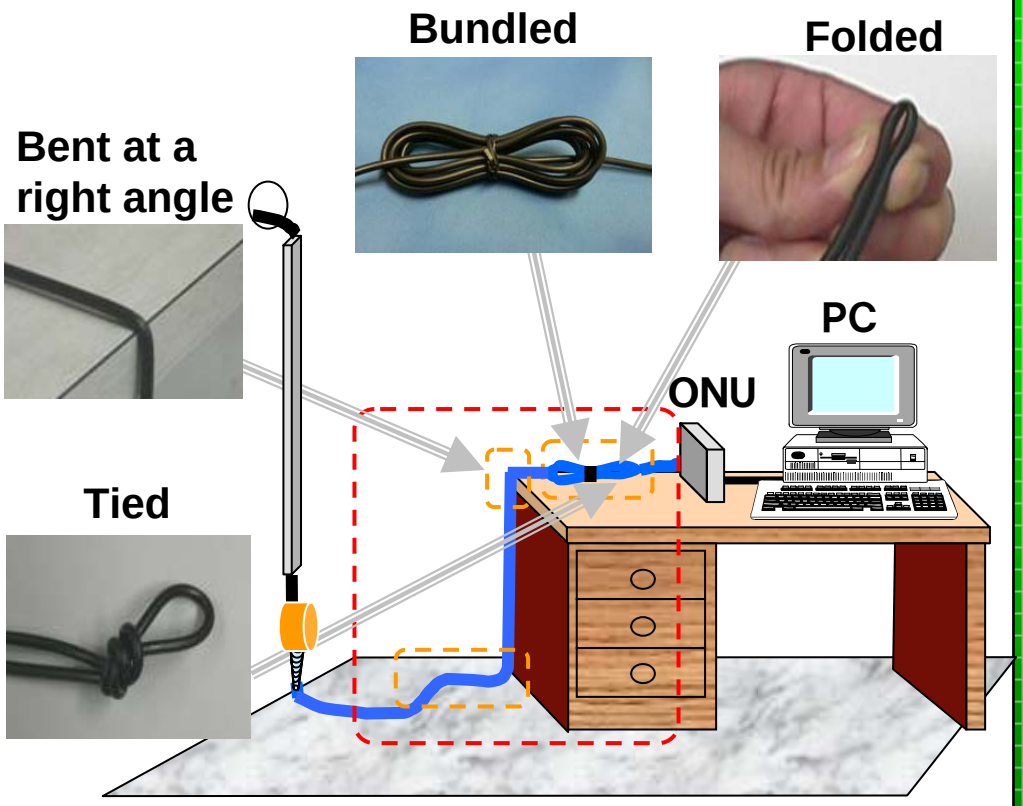
•Fault isolation for individual customers from central office by comparing reflection powers of each reflector with and without fault.



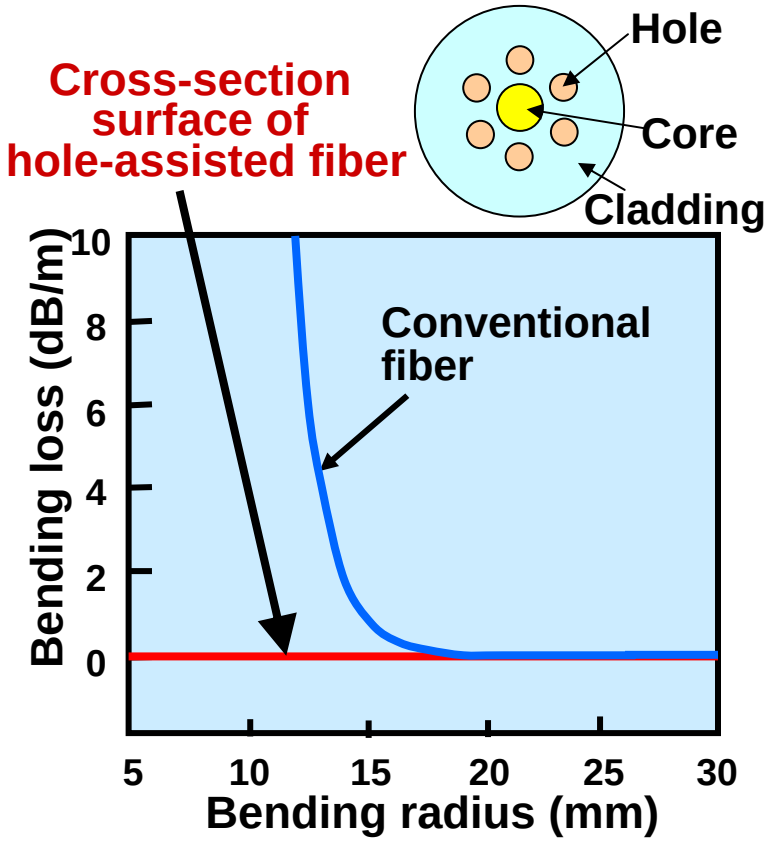
Bending-tolerant fiber cord

- Cord can be bent, folded or tied.
- "DIY" installation of fiber cable by anyone, not just experts.

Applications on customer premises

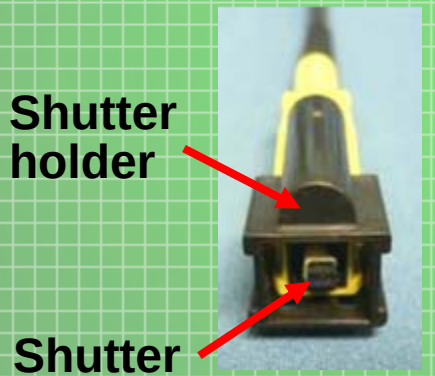


Observed bending loss characteristics



Dust-resistant connectors

- Mechanism prevents dust from adhering to the connector surfaces.
- Compatible with global standard SC connectors.

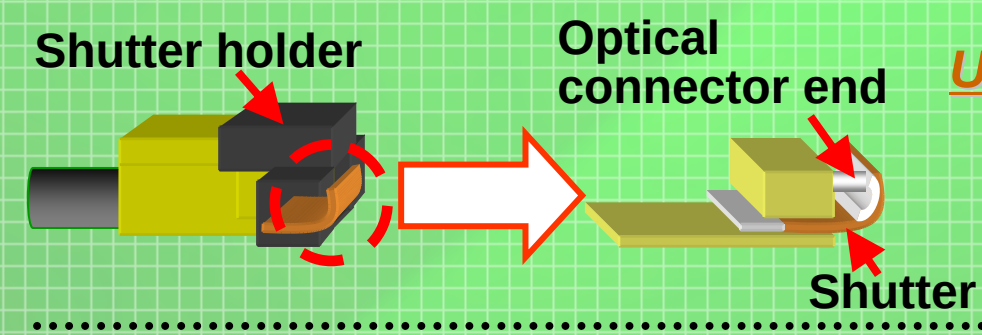


<Front>

<Rear>

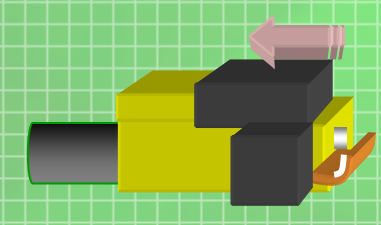
<Outside>

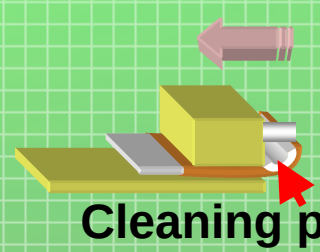
<Inside>



Unused

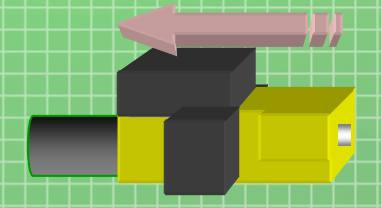
Protection of optical connector end

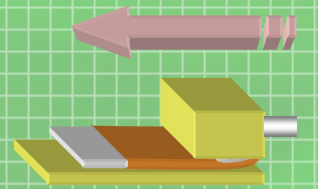


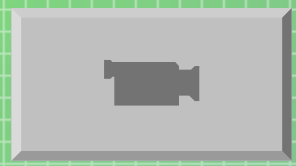


Used

Connector end cleaned as holder is pulled back







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New activities for the NGN

- **Upgrade the fixed-line telephone network to an IP telephone network by applying the latest optical and broadband IP technologies**
  - Provide broadband and IP telephony services at attractive prices
  - Reduce capital and operational expenditure
  - Achieve a target of 30 million customers using optical fiber access by 2010
- **Deploy new broadband services**
  - Provide seamless services, such as triple play and FMC services
  - Create non-traffic services
- **Create new markets by collaborating with various service players on the network**
  - Disclose Service Node Interfaces
  - Provide the Service Delivery Platform, to promote collaboration.

Changes in society that the NGN will bring about

Changes in distribution structure

< Now >

Distribution through *intermediaries*, who handle the flow of *physical goods*, *information*, and *money*.

< Future >

Distribution will be led by consumers assisted by the emergence of an environment (the NGN) that facilitates *negotiation*.

Changes in enterprise structure

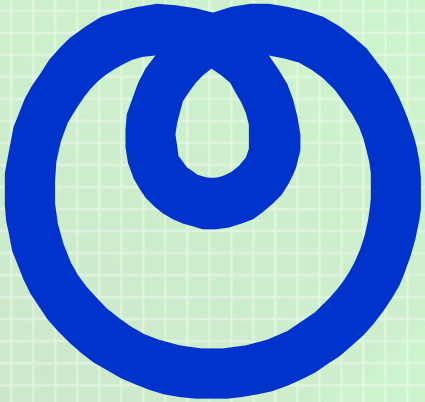
< Now >

Enterprises retain all necessary functions (routine and non-routine tasks, provision of hardware and software).

< Future >

The emergence of fora (supported by the NGN) for sharing information and knowledge will enable enterprises to retain only their core competence and to benefit from the flexibility to form alliances appropriate for individual circumstances.

Source: Toshiharu Aoki, "From efficiency to value creation" (in Japanese)



NTT