

An example of System Implementation of
Broadband Wireless Access in Japan

***Broadband Access by “Fiber + Radio”
-WIPAS (Wireless IP Access System)-***

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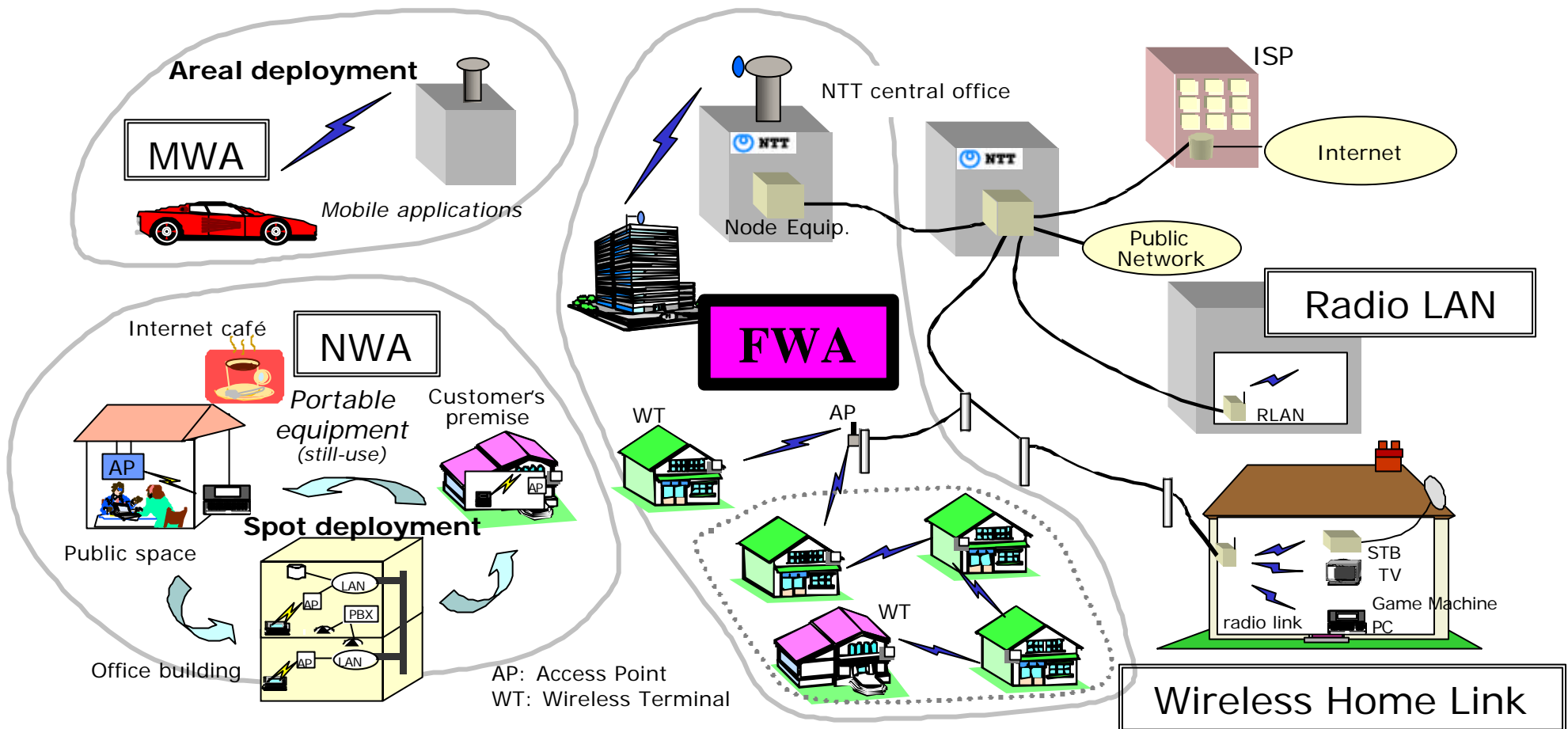
NTT Access Network Service Systems Laboratories

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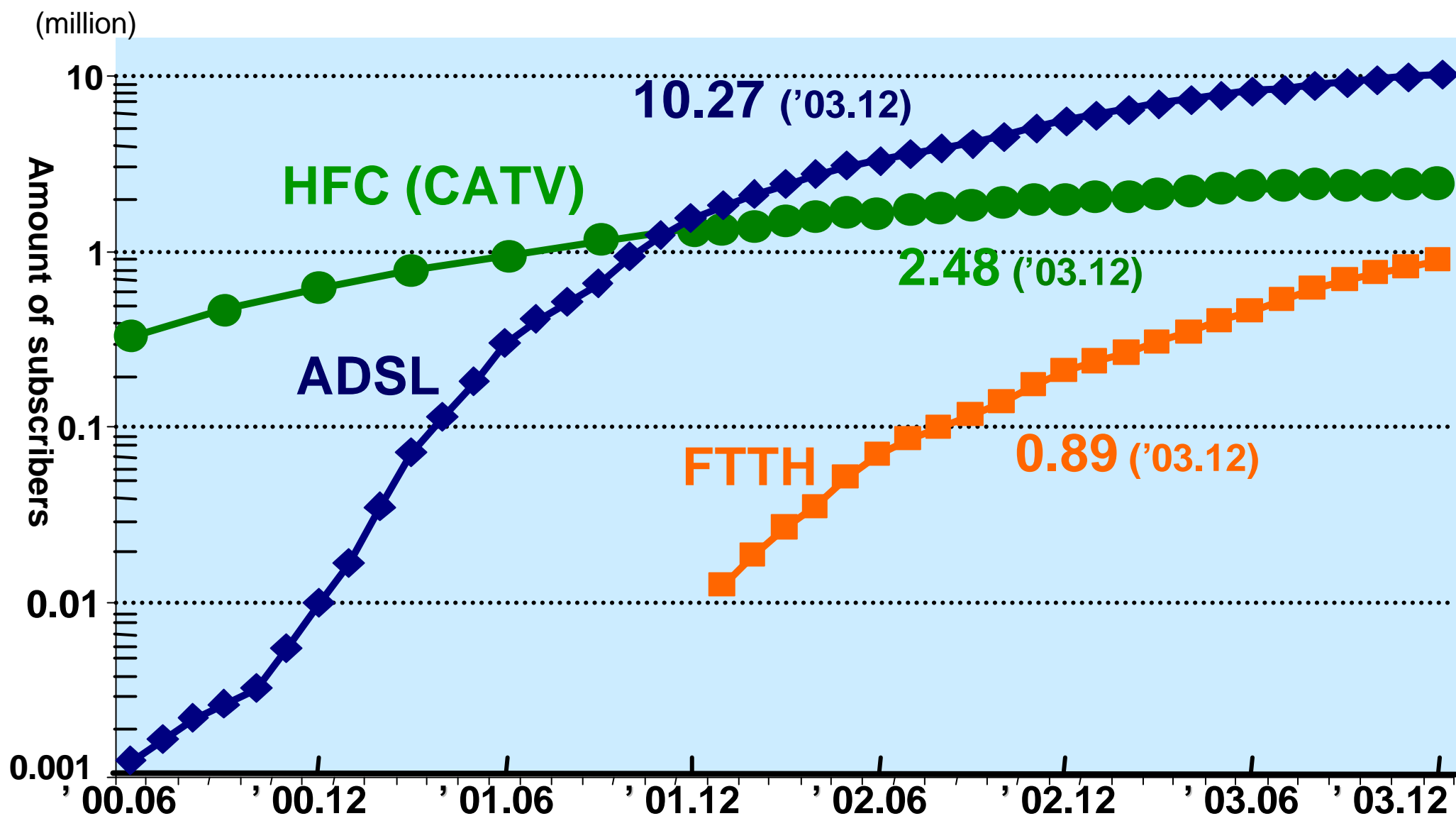
- Overview of Wireless Access and Broadband Services
- Broadband Access by “Fiber + Radio”: *WIPAS*
- Characteristics of *WIPAS*
- Examples of Broadband Services by “Fiber + Radio”

Classification of Wireless Access Systems

Network Service System	?	FWA (Fixed Wireless Access)	... ex. Broadband Access by "Fiber+Radio"
Customer System	?	NWA (Nomadic Wireless Access)	... ex. "Hot Spot" service
	?	MWA (Mobile Wireless Access)	... ex. Cellular phone
	?	Radio LAN	... ex. RLAN for office (indoor)
	?	Wireless Home Link	... ex. RLAN for home user, Bluetooth

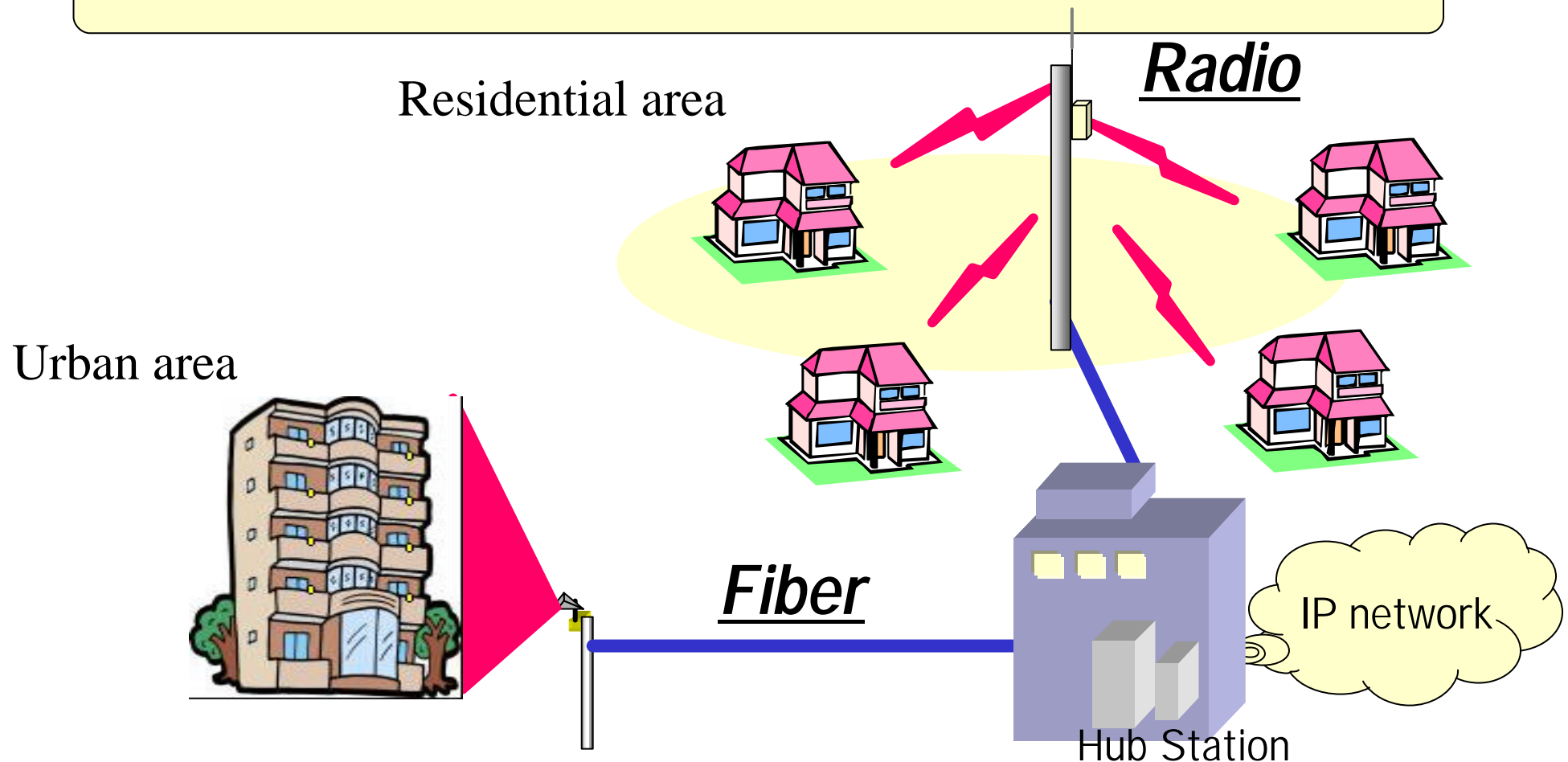


Broadband Service Market in Japan



Broadband Access by “Fiber+Radio”

Broadband Wireless Access, compatible speed to FTTH
...*Fiber Optic Cable* + **WIPAS (Wireless IP Access System)**



WIPAS: Wireless IP Access System

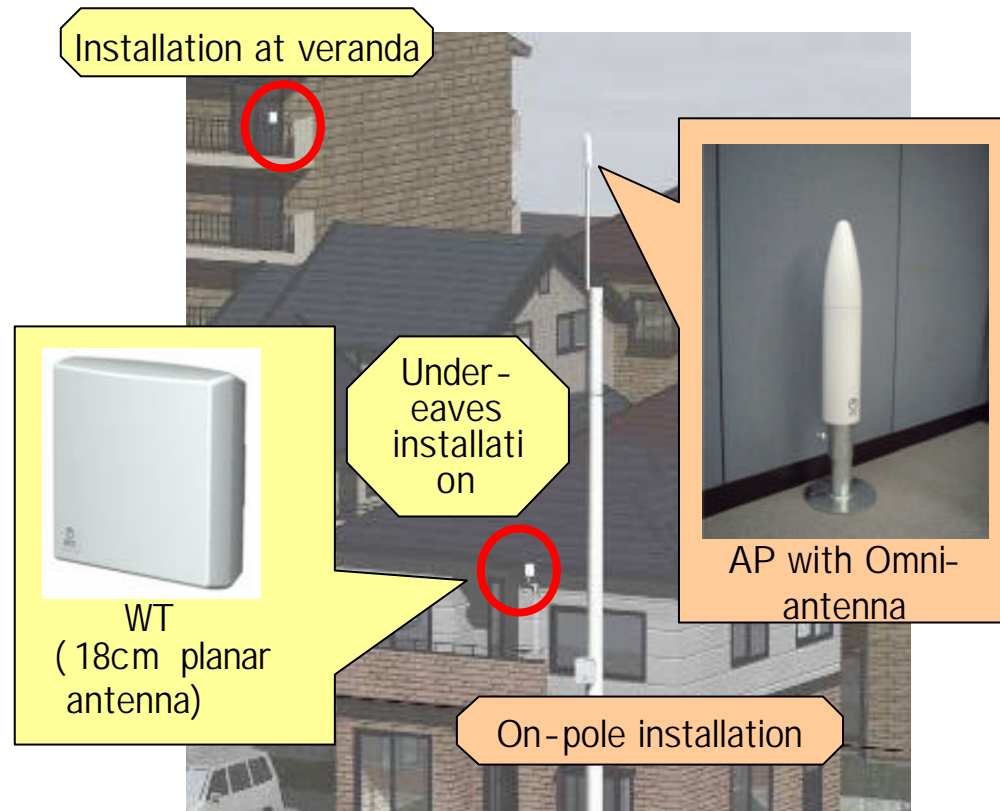
WIPAS is the Broadband FWA (Fixed Wireless Access) system that consists of AP (Access Point) and WTs (Wireless Terminal) employing upper SHF: 26GHz band. Transmission rate of the wireless section is 80Mbit/s (Maximum transmission rate of Ethernet is 46Mbit/s), which is shared among the plural WTs.

- **Transmission rate**

16QAM: 80 Mbit/s (46Mbit/s)

QPSK : 40 Mbit/s (23Mbit/s)

? (): Maximum transmission rate of Ethernet frame



WIPAS System Design Concept

Conventional Systems (mainly for Business users)

(1) Services

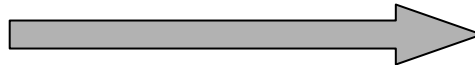
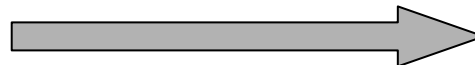
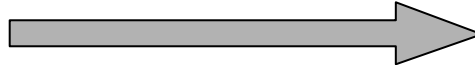
Telephone
/ Leased line/(IP)

(2) Transmission Range

A few kms

(3) Installation Site of AP

Building Rooftop
/Tower



WIPAS

(for SOHO/Consumer users)

Focus on IP Services

Up to 1 – 2 km
(in Japan, climatic zone K)

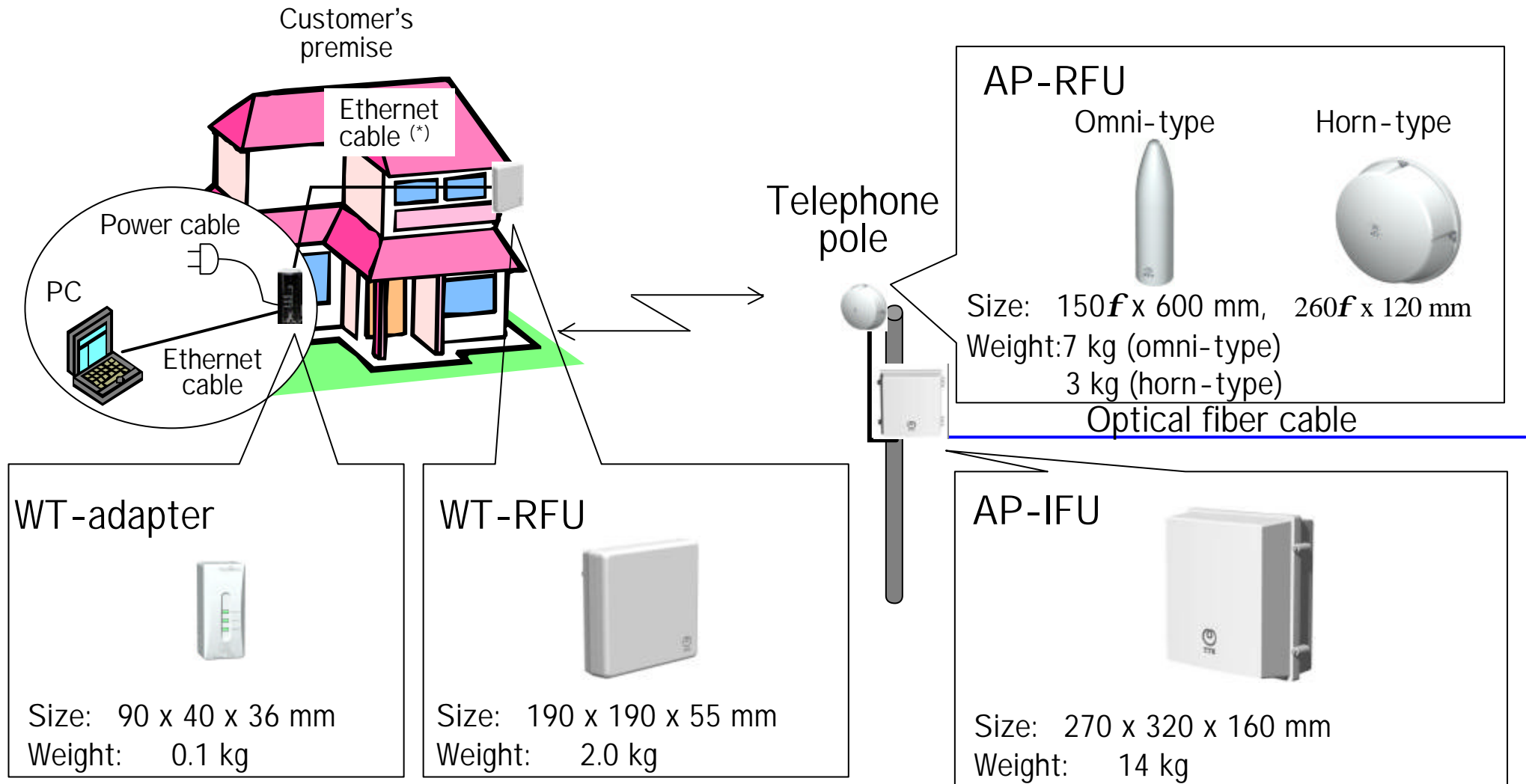
Telephone Pole

Technical Specifications of WIPAS

...conformable to ARIB STD T 58(P-P) / T 59 (P-MP)

Frequency Band		26 GHz band
Communication Scheme		TDMA/dynamic TDD
Symbol Speed		20M Symbol/Sec
Modulation Scheme		Adaptive Modulation (16QAM/QPSK)
Wireless Transmission Speed (Maximum forward rate of Ethernet frame)		QPSK: 40 Mbps (23 Mbps) 16 QAM: 80 Mbps (46 Mbps)
Transmission Power		QPSK : 14dBm 16 QAM : 11.5 dBm
Maximum Number of Subscriber		239 Subscriber Stations per Access Point
Network Interface		100 Base-TX or 100 Base-FX (Interactive service can be attained by one optic fiber)
User Interface		100 Base-TX or 10 Base-T
Antenna Gain	Access Point (AP)	Horn Antenna (5.5 dBi) Omni Directional Antenna (6 dBi)
	CPE (WT)	18cm Flat Antenna (31.5dBi)
Transmission Range		1-2 km (Line of Sight)
Bandwidth Control		-Fairness Queuing Control by Round-robin -Minimum Bandwidth Grant by Priority Queuing

Overview of WIPAS Equipment

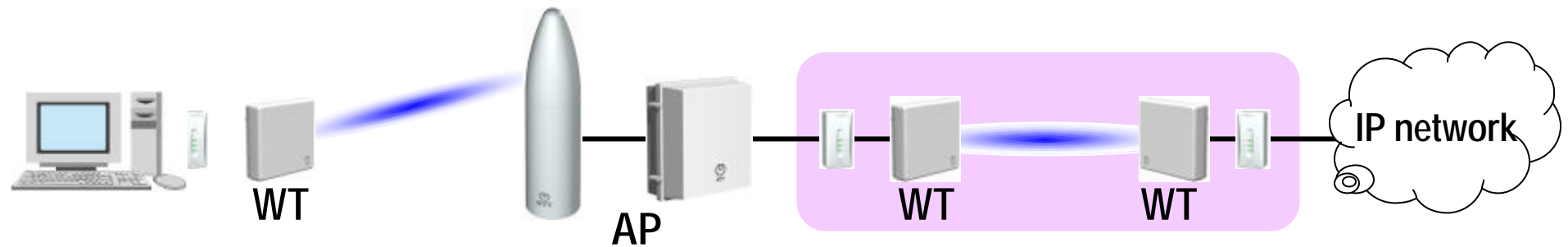
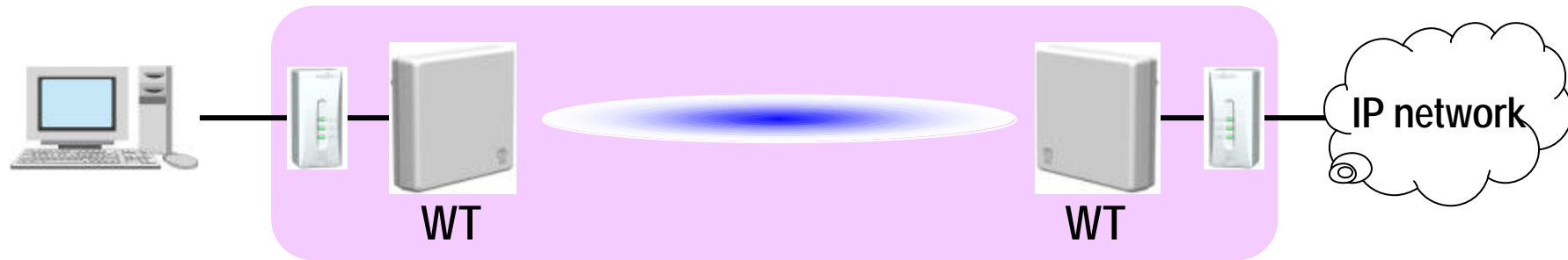


AP: Access Point
WT: Wireless Terminal
RFU: Radio Frequency Unit
IFU: Interface Unit

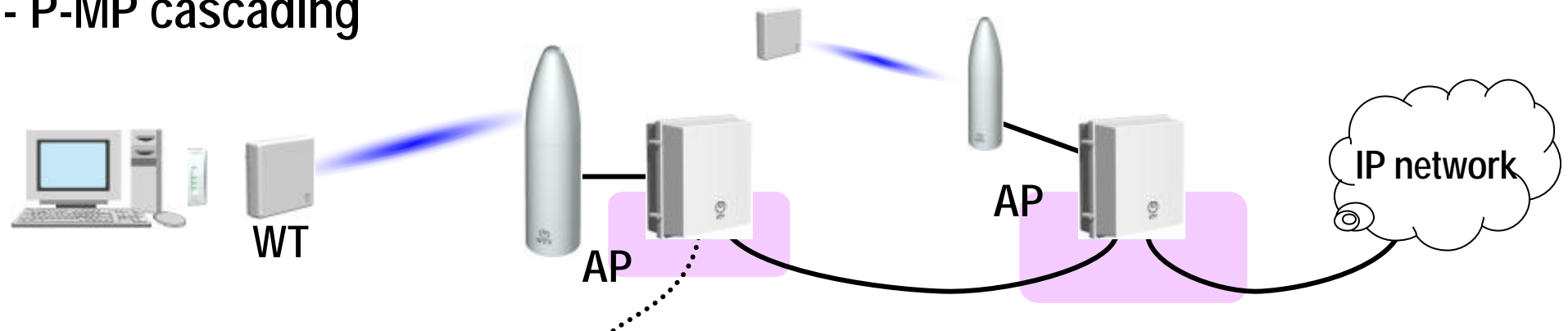
(*) Vacant cores within Ethernet cable are used for power supply to WT.

Variations of System Configuration







- P-P access line / entrance line



- P-MP cascading



WT/AP Installation Images

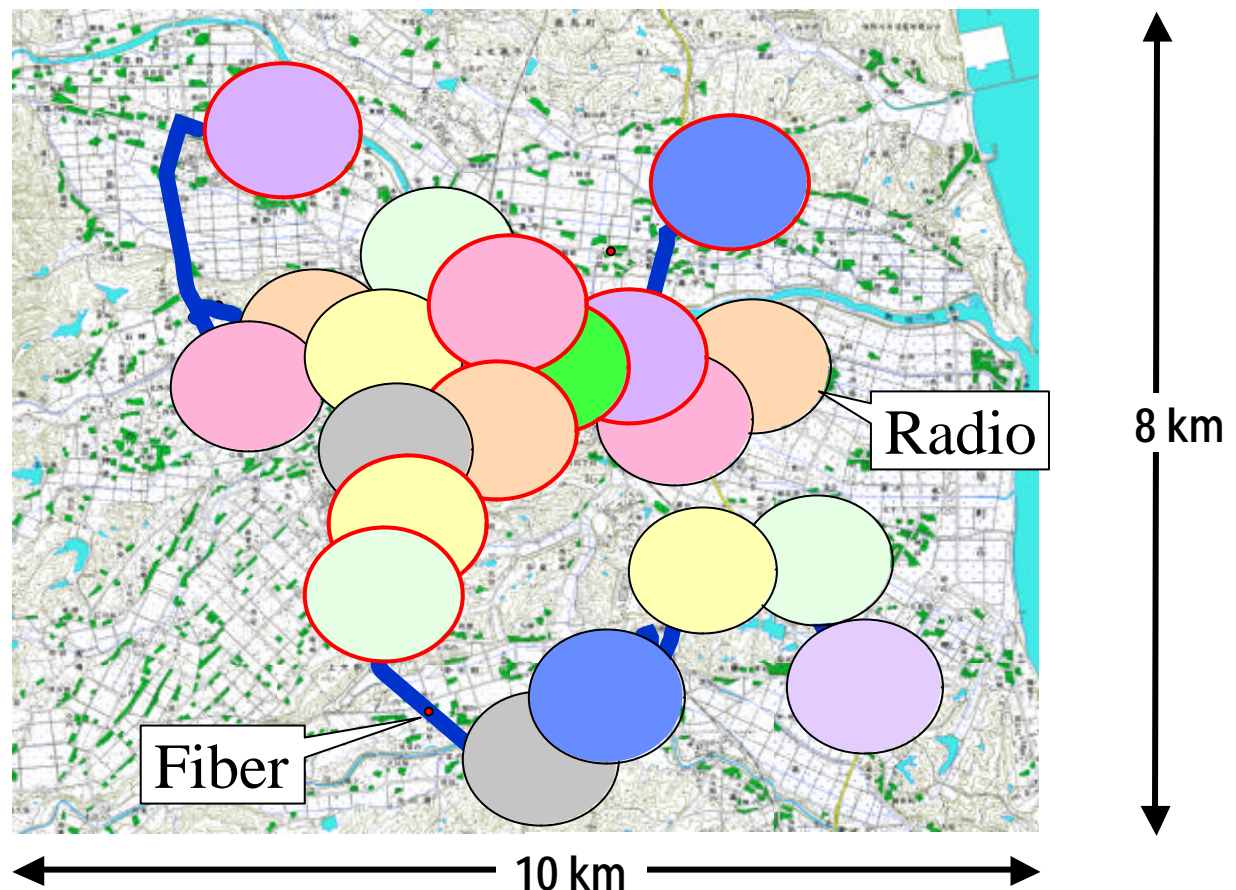
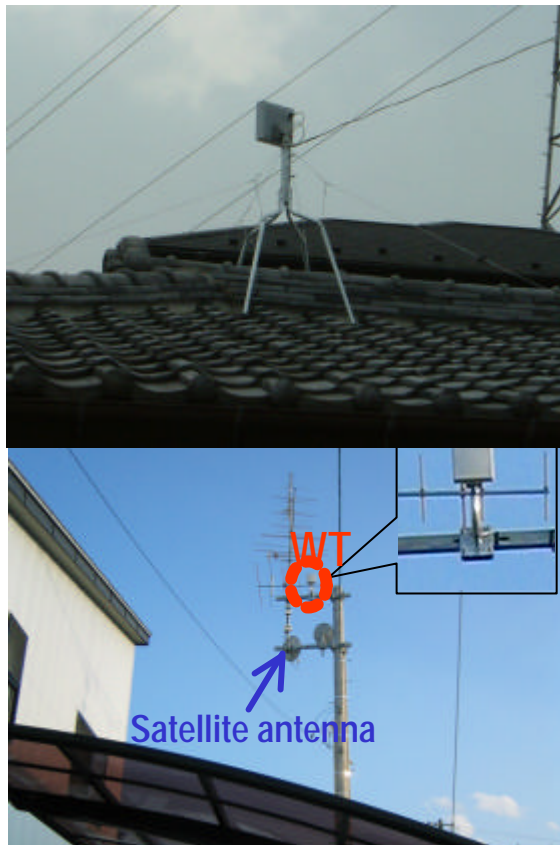
W T	<p>Veranda railing</p> 	<p>Concrete fence</p> 	<p>Indoor (window glass)</p> 
A P	<p>Dedicated pole</p> 	<p>Common pole</p> 	<p>Building rooftop</p> 

Examples of Broadband Services by “Fiber + Radio”

- Suburban redidential area-

Dense deployment in Haramachi city

- designed to have more than 80 % LOS with premises in the cell



Installed AP at suburban residential area



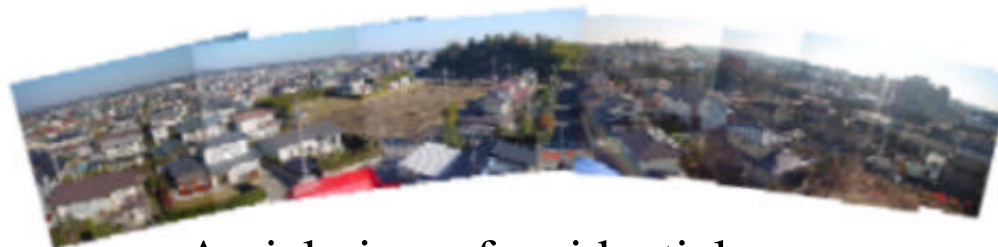
AP-RFU



AP installed at a park in residential area.



AP-IFU



Aerial view of residential area

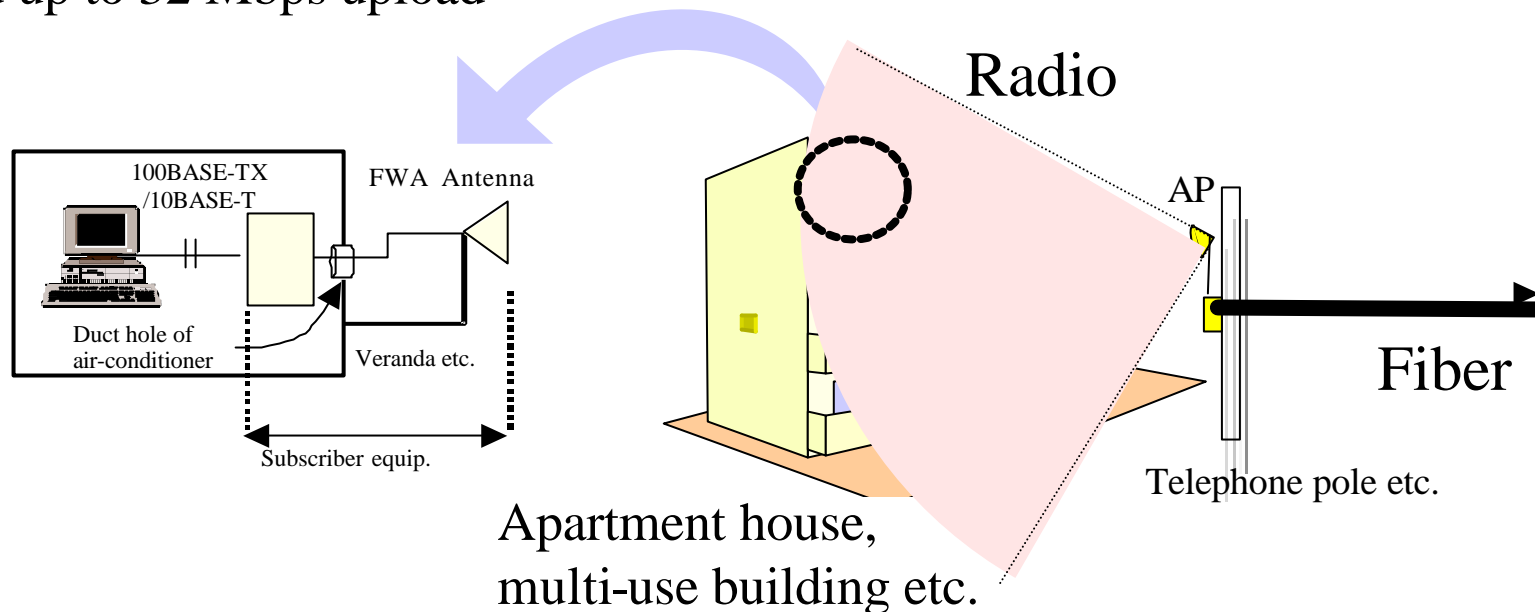
Examples of Broadband Services by “Fiber + Radio”

- *Urban residential spot-*

Spot deployment at apartment houses

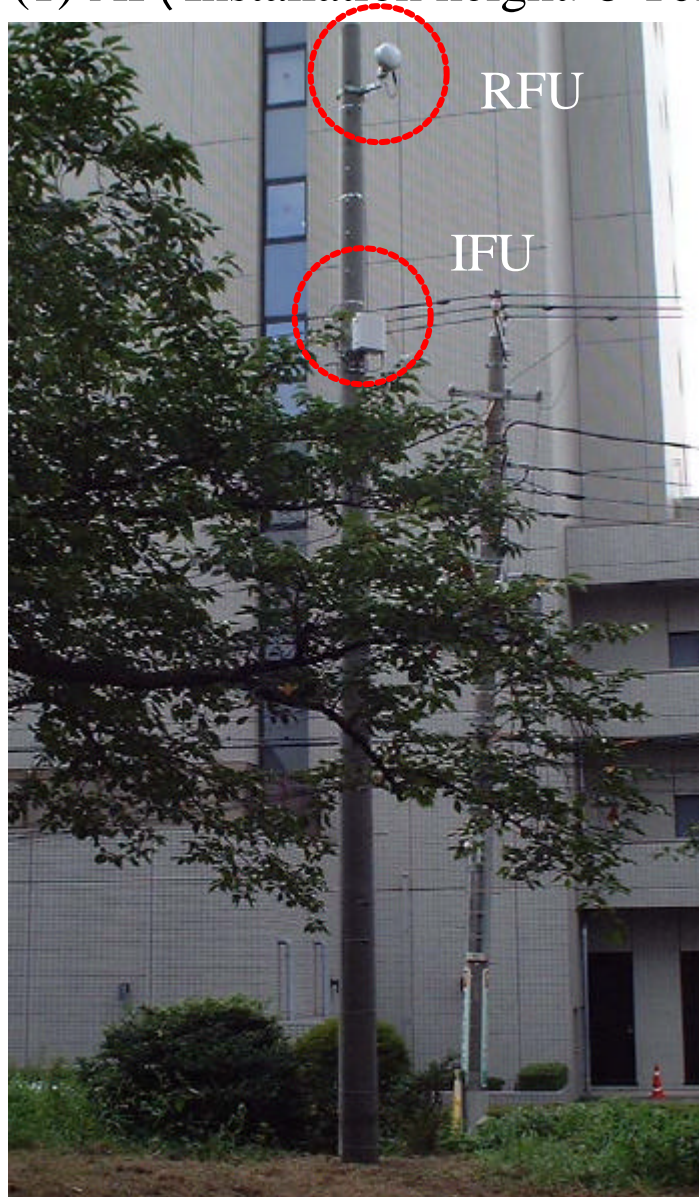
- fiber construction problems due to architectural limitations

Share connection of up to 46 Mbps download
and up to 32 Mbps upload



Installed Equipment at urban spot area

(1) AP(Installation height: 8-10m)

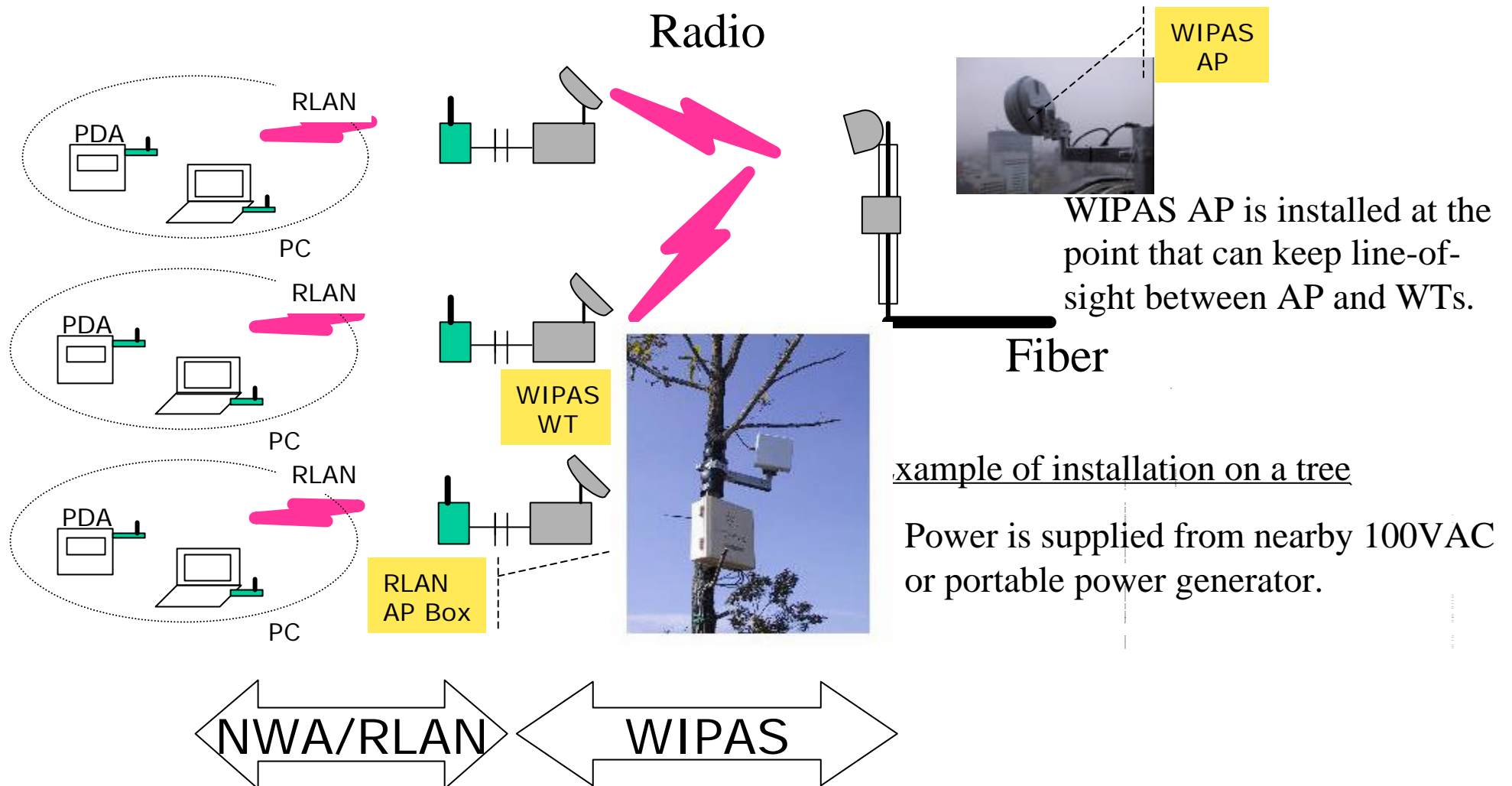


(2) WT



Examples of Broadband Services by “Fiber + Radio”

- *NWA/RLAN Backhaul* -

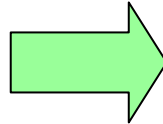


Required Technologies for Higher Speed “Fiber + Radio” FWA

Background

- Digital broadcasting services has been started in 2003 in Japan.
- Last-one-hop problem is still essential.

High speed
(>100 Mbit/s)



Key technologies

- Frequency resource management
- Multi-level modulation
- Selected beam antenna
- Transmitter power problem
- Higher efficiency for MAC

Summary

- Broadband Access by “Fiber+Radio” may be useful concept for deploying of Broadband Wireless Access Network.
- FWA systems using upper SHF band (for example: 26GHz band) can be introduced in Broadband Access Service Network effectively.
- Higher speed capability of FWA will be also required as complement for FTTH in the future.