

# 10Mbps Visible Light Transmission System

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Special thanks for

**TAMURA CORPORATION**

Visible Light Communications Consortium

# Contents

- 1. Features**
- 2. System Looking & Presentation**
- 3. ARIB STD-T50**
- 4. Topology on Optical PHY Layer**
- 5. Specification (VLC Wireless LAN System)**
- 6. Establishment of 1toN Transmission**
- 7. Demo System**
- 8. Summary**

# Features

- **10Mbps-Transmission Speed is realized by using White LEDs(RGB+W).**
- **Bi-directional & Full-duplex Communication is available.**
- **Enable 1 to N Connection**
- **Compliance of a Japanese Standard (ARIB STD-T50)**
- **Enable Direct Connection to Ethernet (IEEE802.3) Devices.**

# System Looking & Presentation



Presentation at IT Pro Expo 2008

**LED照明を用いた可視光通信**  
Visible optical communication that uses LED lighting

特許出願処理中  
協力 日本ビクター株式会社

**LED照明でLAN接続!!** LAN connection with LED lighting

**特長**

- 可視光通信で10Mbit/s LAN接続(10BASE-T)が可能
- 電波の発信が禁止・制限されている場所で無線通信が可能  
(例えば、病院・コンピュータールーム・機械室・計器室・etc)
- 無線なのに隣の部屋等への漏えいがない  
(セキュリティが高く、情報漏えいがない)
- 見える光だから通信範囲が特定し易くかつ遮断しやすい

**Feature**

- It can be 10Mbit/s LAN connection (10BASE-T) in a visible optical communication
- It is possible to make it to the wireless in the place where the electric wave's being sent is prohibited and limited. (For instance, hospital, computer room, machine room, and meter room)
- There is no leakage to room next to mine though it is a wireless. (Security is high, and there is no information leakage)
- It is easy to be comprehensible the range of the communication because it is seen light, and to intercept it.

【可視光無線LAN装置 主要諸元】

項目	仕様
通信方式	LED照明を用いた可視光通信
通信速度	10Mbit/s
接続方式	10BASE-T LAN
電源	AC100V
外形寸法	φ100mm x 100mm
重量	約100g
設置場所	天井・壁・机下
設置角度	任意
設置高さ	任意
設置距離	約10m
設置環境	直射日光・強い電磁波を避ける
設置条件	設置場所の照明が点灯していること

**TAMURA**

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Poster Display

# ARIB STD-T50

STD-T50 is designed to fundamentally meet the ISO/IEC 8802-3:2000. So, Optical Wireless LAN System complying with this standard is able to connect the Ethernet devices.

Trans. Speed feature, type	10Mbps	100Mbps	1000Mbps
Transmission Topology	1 to 1, or 1 to N		
Access Control	support CSMA/CD method network configuration		
Data Rate	10Mbps	100Mbps	1000Mbps
Type of Trans. Signal	<b>10BASE-T</b> (Manchester encoding)	100BASE-FX (4B/5B encoding)	100BASE-X (8B/10B encoding)
Transmitting Function	In case of available on signal data, transmit predefined signal type. Other case, hold idling signal or similar signal.		
Receiving Function	Predefined trans. signal is received, idling signal is sent back when no reception. Sensitivity is shown by $\mu W/cm$ or dBm		
Others	Loop back, collision detection and link confirmation function		

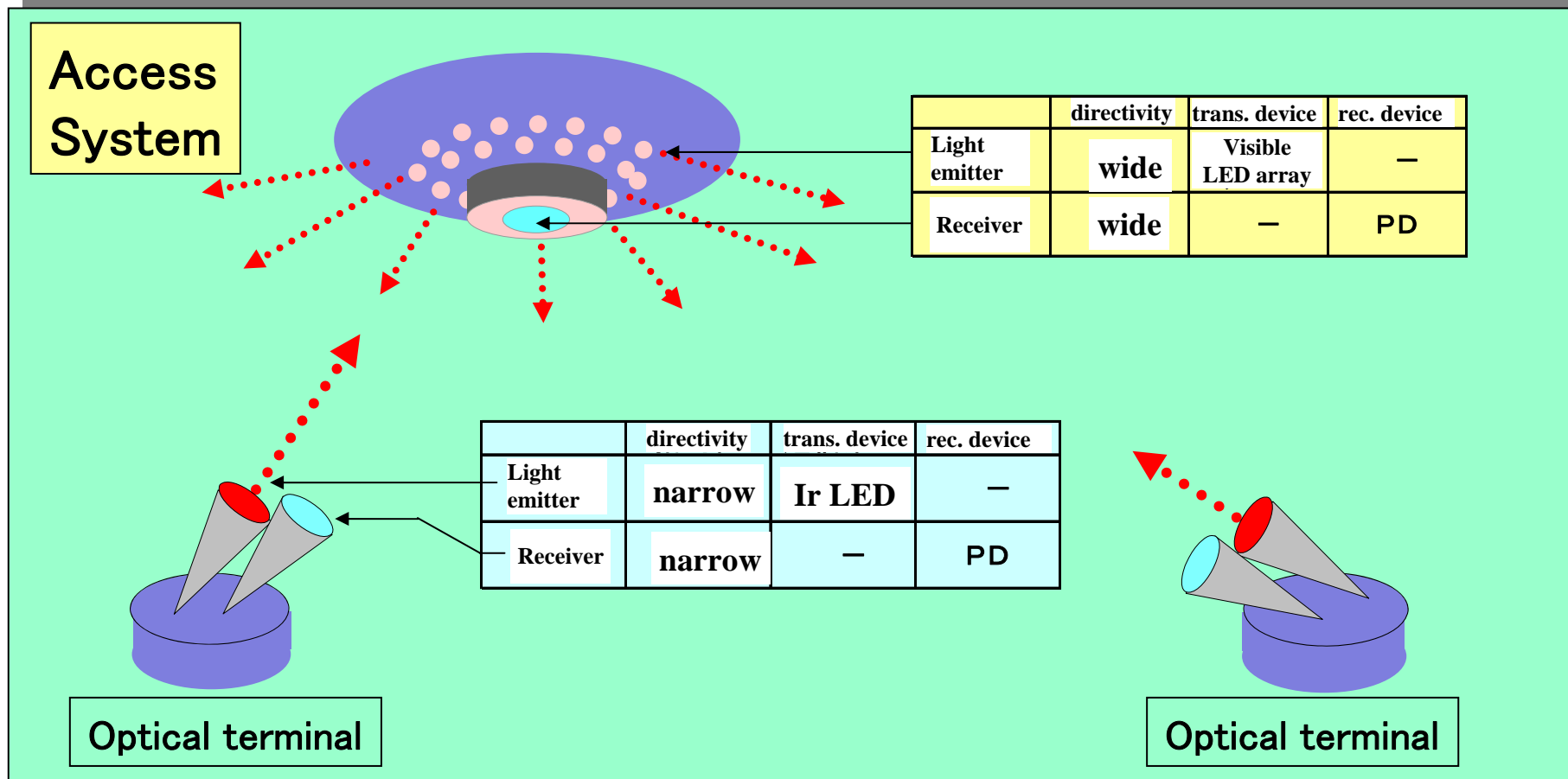
**Specification of STD-T50 PHY Layer**

Trans. Speed item	10Mbps	100Mbps	1000Mbps
Optical media	assuming 680~1600nm, or other W.L. is available		
Optical device	LED or LD for trans. Device, PD or APD for receiving device		
Safety Regulation	Indoor : Class 1, defined by IEC60825-1Edition1.2		
	Outdoor: recommending Class 1 or Class 1M		

**Specification of STD-T50 Optical Transmission System**

# Topology on Optical PHY Layer

This System can be established 1toN Multi-Channel Access between the Access System on the ceiling /wall and Several Optical terminal located inside the System Covering Area.



# Specification (VLC Wireless LAN System)

	item	elements	
1	Trans. Distance	< 2m	
	Trans. Area	Vertical: 9.5 ~ 50° Horizontal: +/-60° from underneath	
2	Base Station	W.L. for Transmitter	400~750 nm White(745nm/680nm) <b>620~630 nm Red</b> 525~530 nm Green 460~470 nm Blue
		W.L. for Receiver	680~1600 nm(Ir)
		Logical I/F	<b>ARIB STD-T50 compliance</b>
		Data Rate	<b>10Mbit/s Max</b>
		Encoding	Manchester encoding
		Lighting Intensity	14 lx (2m)
		Trans. Power	~2W(Red), ~12W(RGB+W)
		Power Supply	100Vac
		Power Consumption	15W
		Operation Temp.	0~40°C
		Operation Humidity	20~85%(no condensation)
		Dimensions	W222 x H185 x D129 mm

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# Specification (Optical Terminal)

	item	elements	
3	Optical Terminal	W.L. for Transmitter	680~1600 nm (Ir)
		W.L. for Receiver	350~750 nm
		Logical I/F	ARIB STD-T50 compliance
		Data Rate	10Mbit/s Max
		Encoding	Manchester encoding
		Power Supply	5Vdc
		Consumption Current	720mA
		Operation Temp.	0~40°C
		Operation Humidity	20~85% (no condensation)
		Dimensions	W60 x H70 x D120 mm
		Weight	150g



# Establishment of 1toN Transmission

**CSMA/CD(Carrier Sense • Multi Channel Access / Collision Detect)  
system is a MUST**



**Conventional wireless system hard to make CD**



**Issue of receiving signal masking by transmission to be leared**



**Break through the issue by employment of Visible light for  
down-link and Ir-light for up-link**



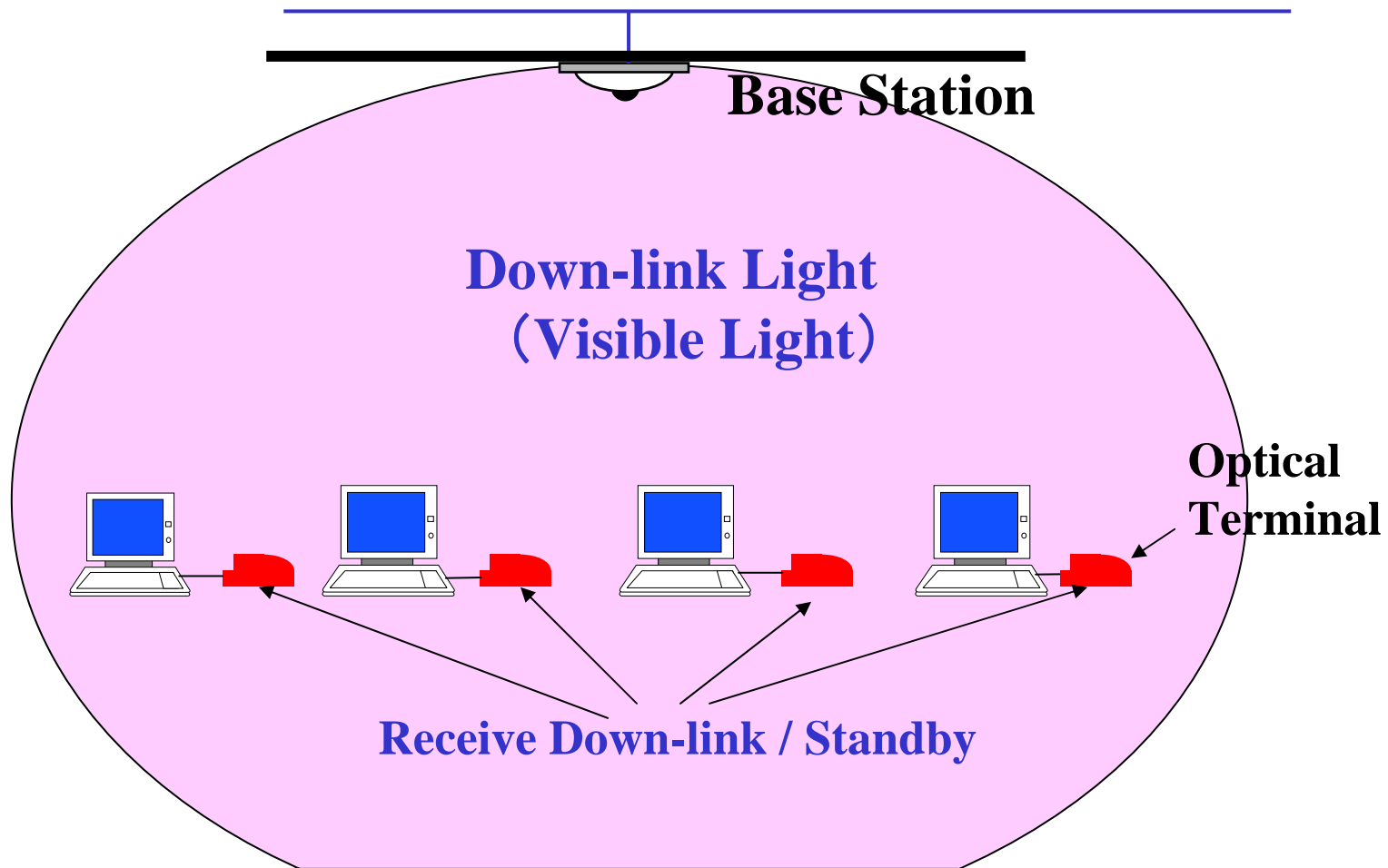
**In addition, to support STD-T50, then established  
CSMA/CD system**

# Down-link

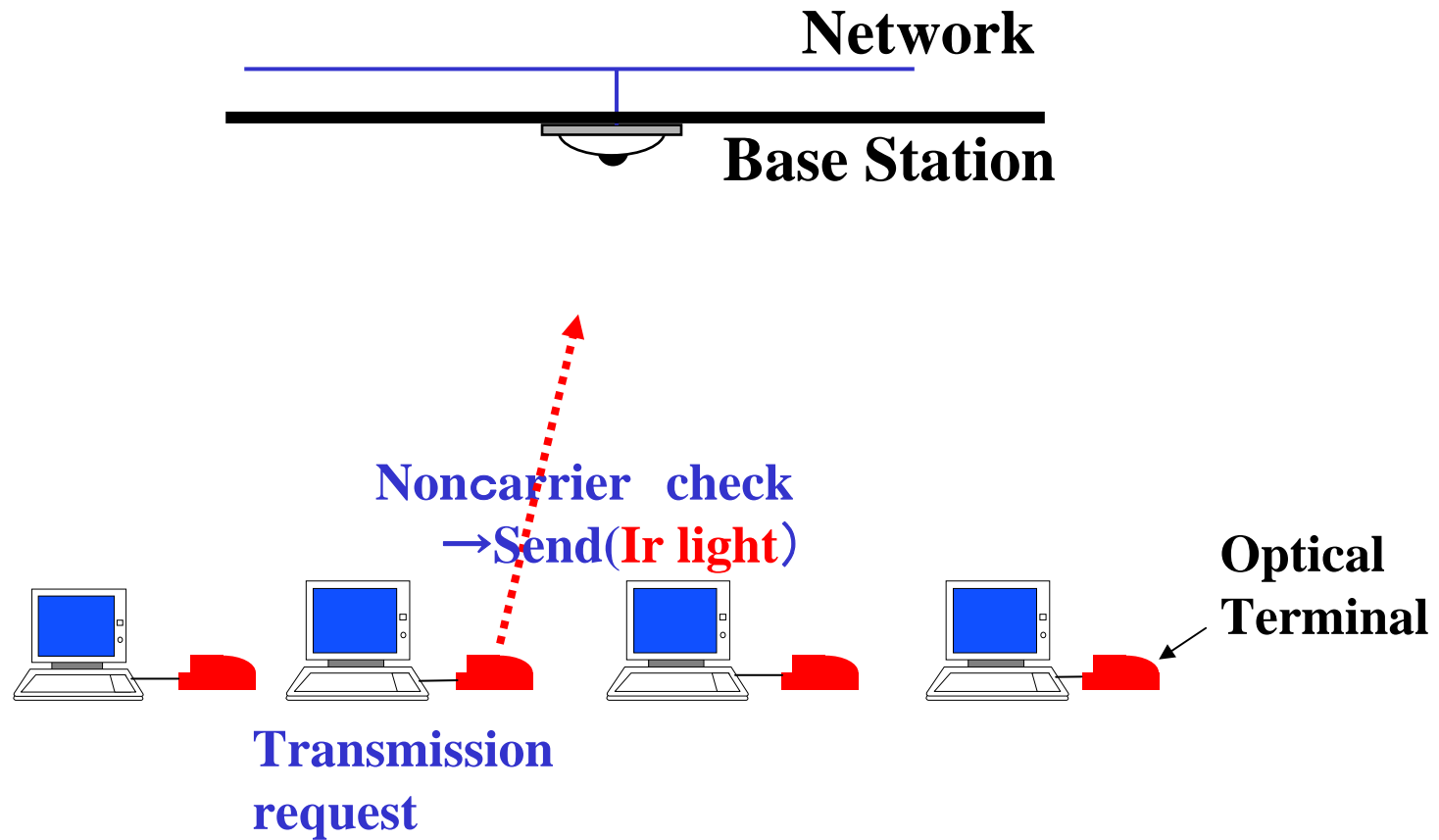
## Initiating packet on Network

→ Check no Up-link, then send packet.

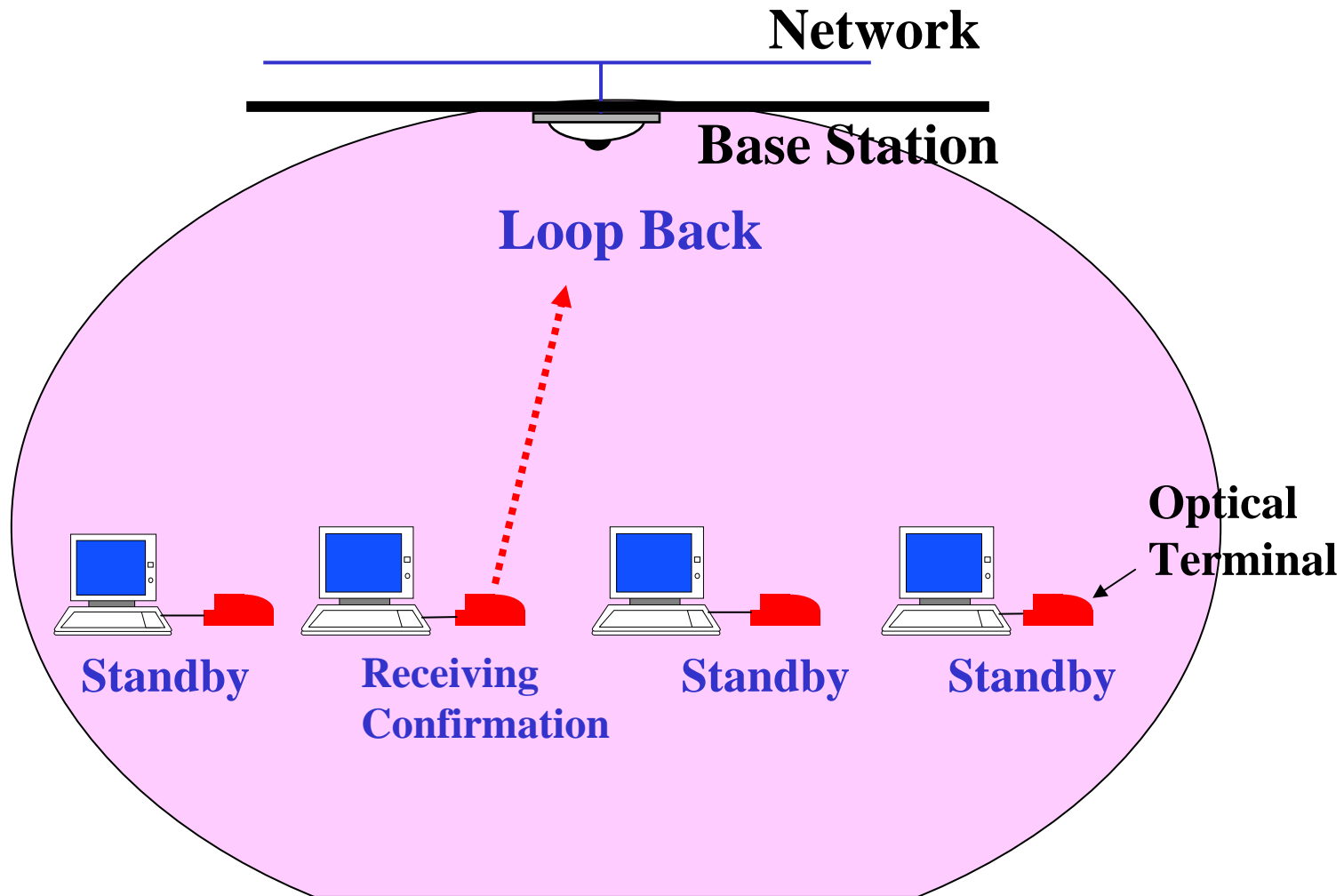
**Network**



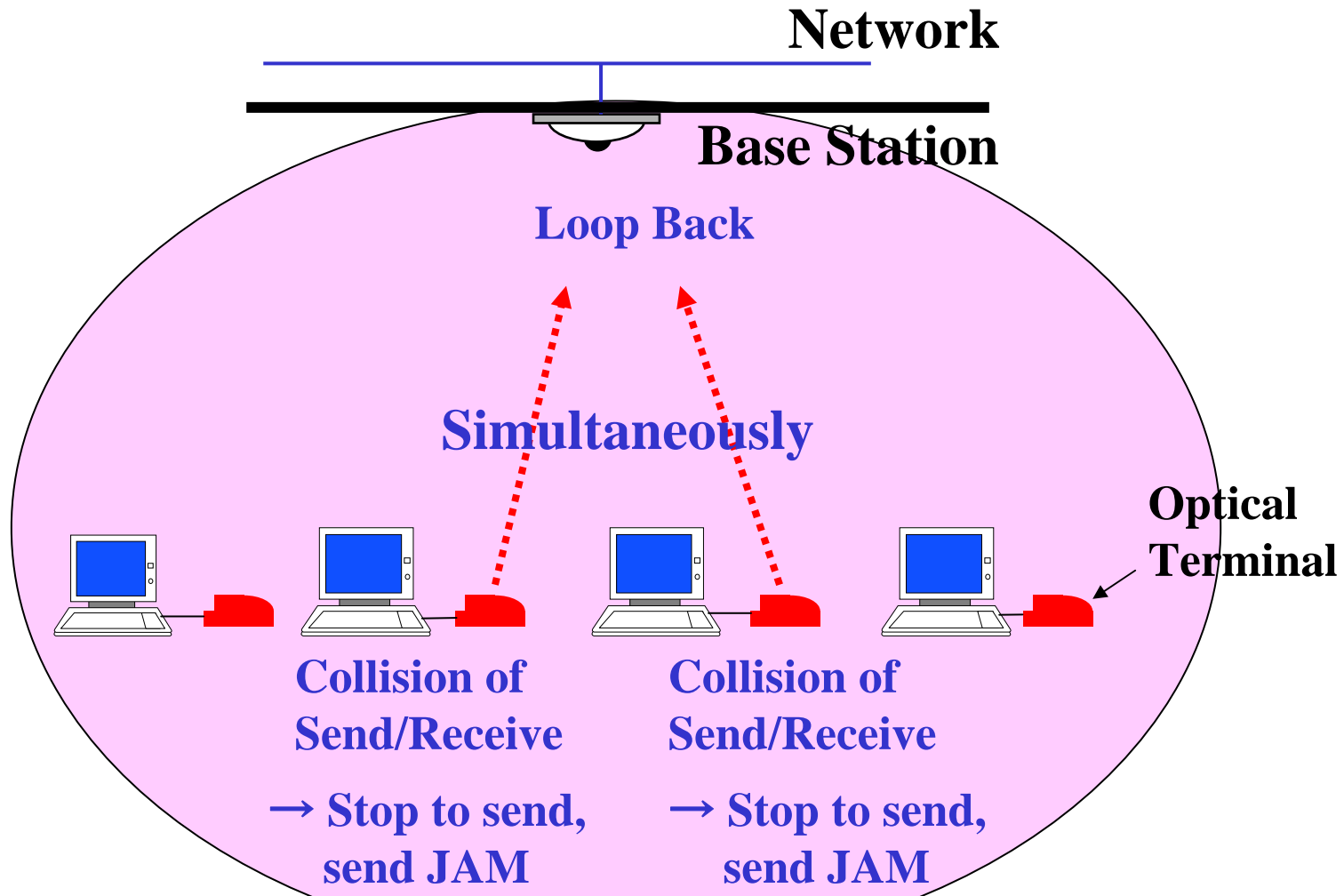
# Up-link 1



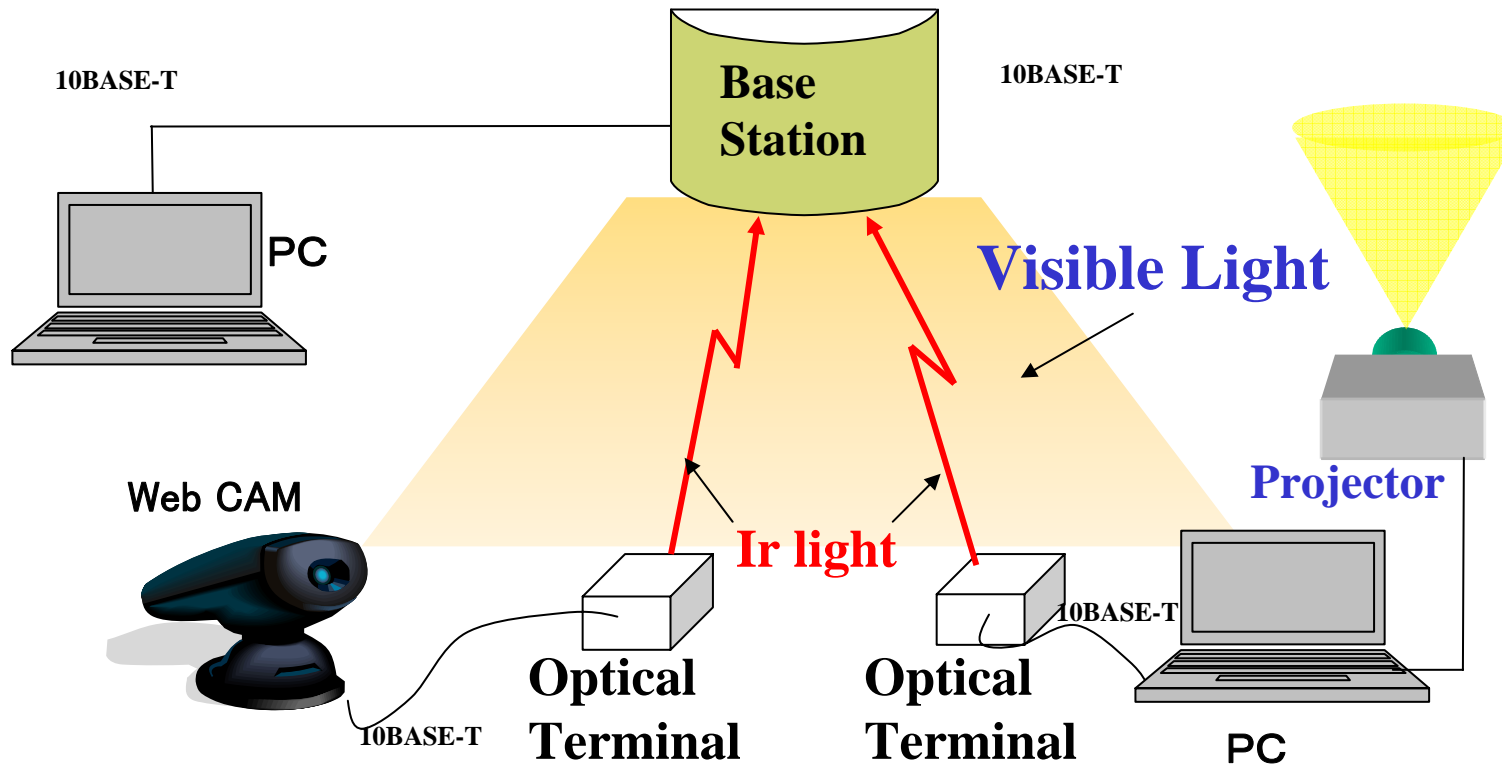
# Up-link 2



# Collision Case



# Demo System



# Summary

- Confirmed the capability of establishment of 10Mbps wireless LAN using White LEDs(RGB+W).
- Utilizing the lighting system for down-link and IR light for up-link makes 1toN wireless LAN configuration.
- Direct Ethernet connection is available by supporting ARIB STD-T50. That application, on conventional wireless LAN disable environment, has potential for office use, which needs care for compromise, or for medical institution, which requires high-level safety.