

# Evolution for Optical Wireless Communications in Personal Area Network Environment

3 June 2004

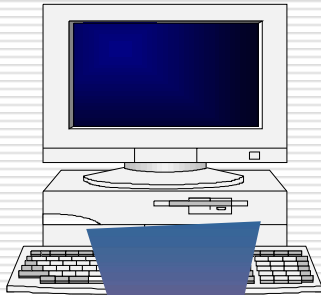
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GITS, Waseda University

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# 1<sup>st</sup> Generation IrDA

Desktop PC



File transfer

Print out

Printer



(P C Based Point and Shoot)

Mobile PC

A personal digital assistants (PDA) boom was occurred at 1990s. Newton, electronic notebook, Personal Communicator, etc.

Infrared Technology was used widely for remote control of TV-set, a stereo, an air-conditioner, etc.



To make *De facto*-standardization, The IrDA consortium was established in 1993.

# Concept of 1<sup>st</sup> Generation IrDA

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- ❑ Realization of Connectivity around Note PC (Users Model)
  - ❑ Point and shoot (Beam)
  - ❑ Develop IrDA Standard Protocol (Introduce the HDLC Technology)
  - ❑ Low Cost, Quick Implementation
  - ❑ No Regulation, No IPR
-

# Main Application for recent Infrared Transmission

## PDI Application



Personal Data Interchange

- vCard
- vMessage
- iMelody
- vBookmark
- e-Squirt

NM502 | 同士で  
NM502iを持つ人同士なら、電話  
番号やアドレス、スケジュールとい  
ったPIM情報をすでに共有できる。



Beam URL as  
Internet shortcut



## Printing Application



Personal Data printing

- vCard
- vCalendar
- e-mail printing
- vMessage



## Network Application



Internet Provider Access

- e-mail
- Internet, Network connection
- i-mode Mail using vMessage
- Braising of large screen
- Simple Editing
- Data storage

WorkPad 等のPDAと  
赤外線ポートを合わせて接続すれ  
ば、入力し直すことなくそのままの  
データを送ることができます。

## Sync. Application



Phone book Sync.

- vCard
- Schedule Alert
- vCalendar

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Application Concepts of IGA Control

IGA Control Compliant Transceiver

IGA Control

www.igacontrol.com

IGA Control

www.igacontrol.com

IGA Control

www.igacontrol.com

# Universal connection



# Appearance of Bluetooth 1998

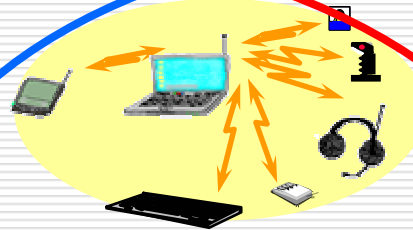
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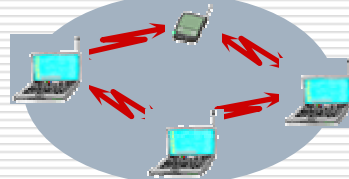
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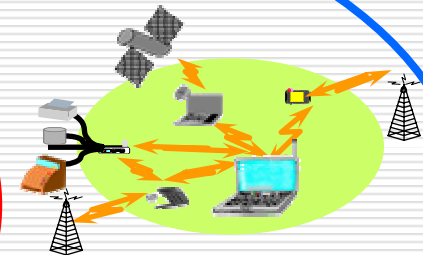
IrDA  
Point and Beam



Cable replacement

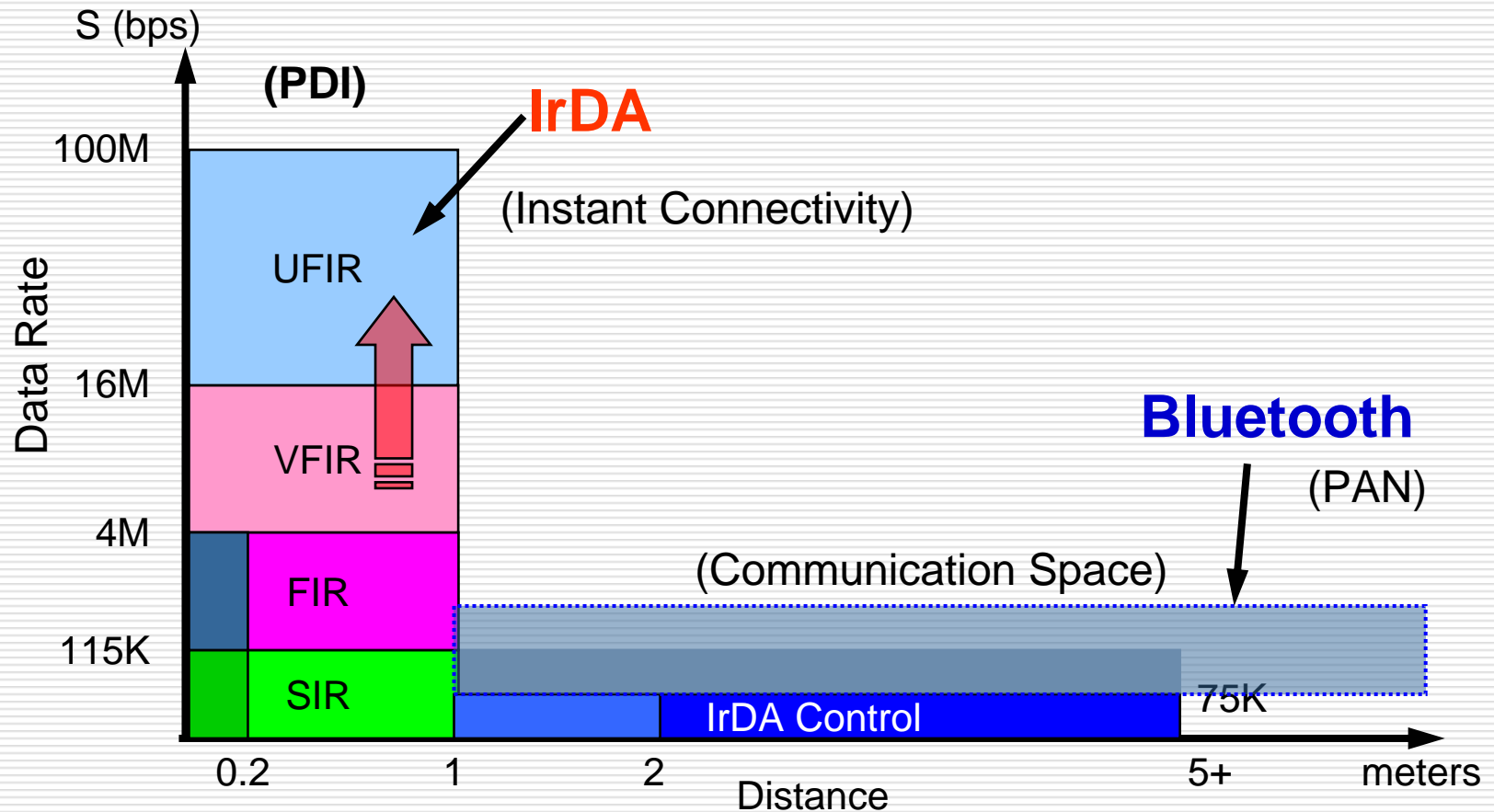


Ad-hoc Network

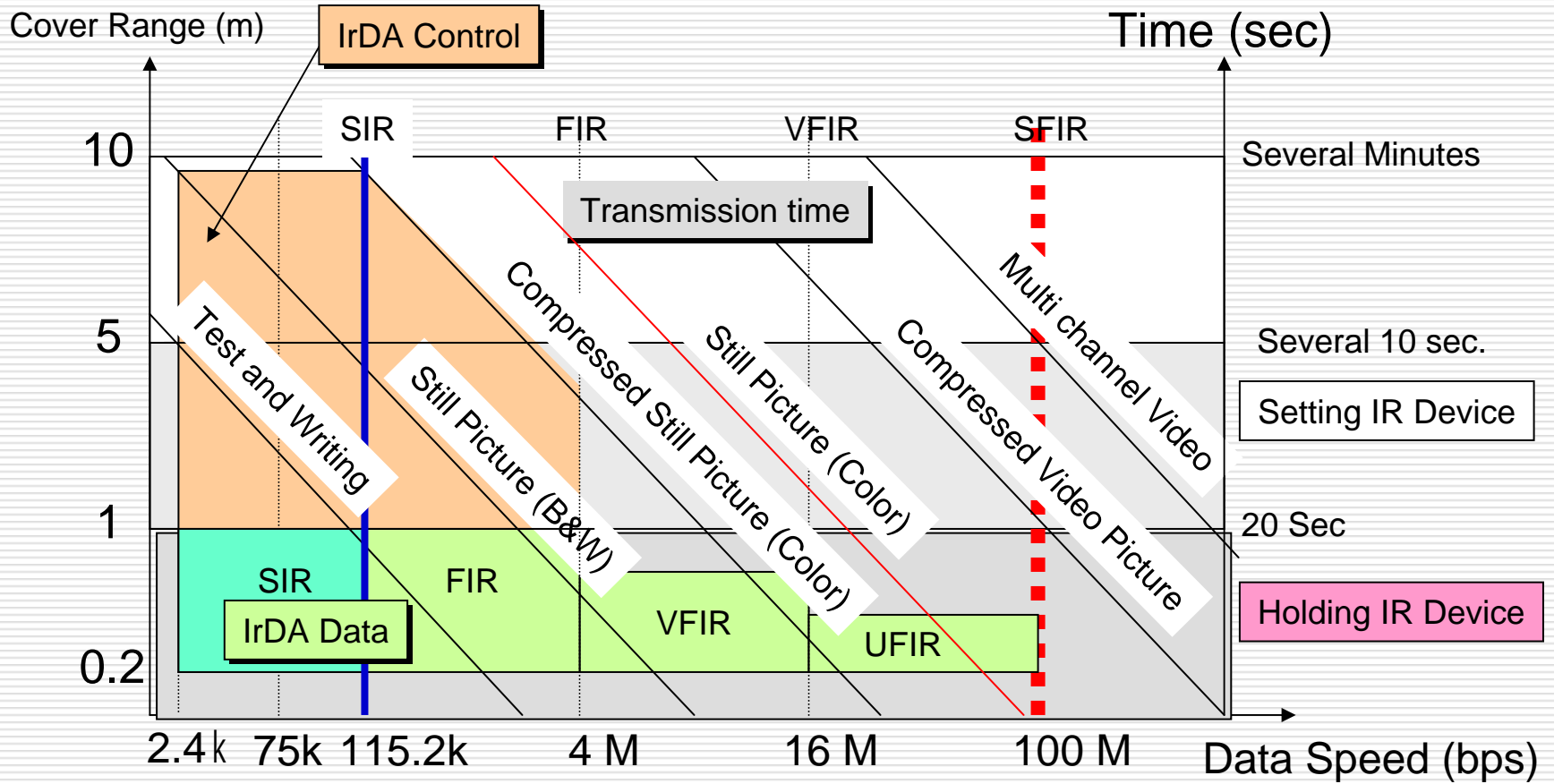


Data/Voice AP

# The Main Features IrDA & Bluetooth



# Infrared Transmission speed, Time and Coverage range



# Progress of IrDA 2nd Generation

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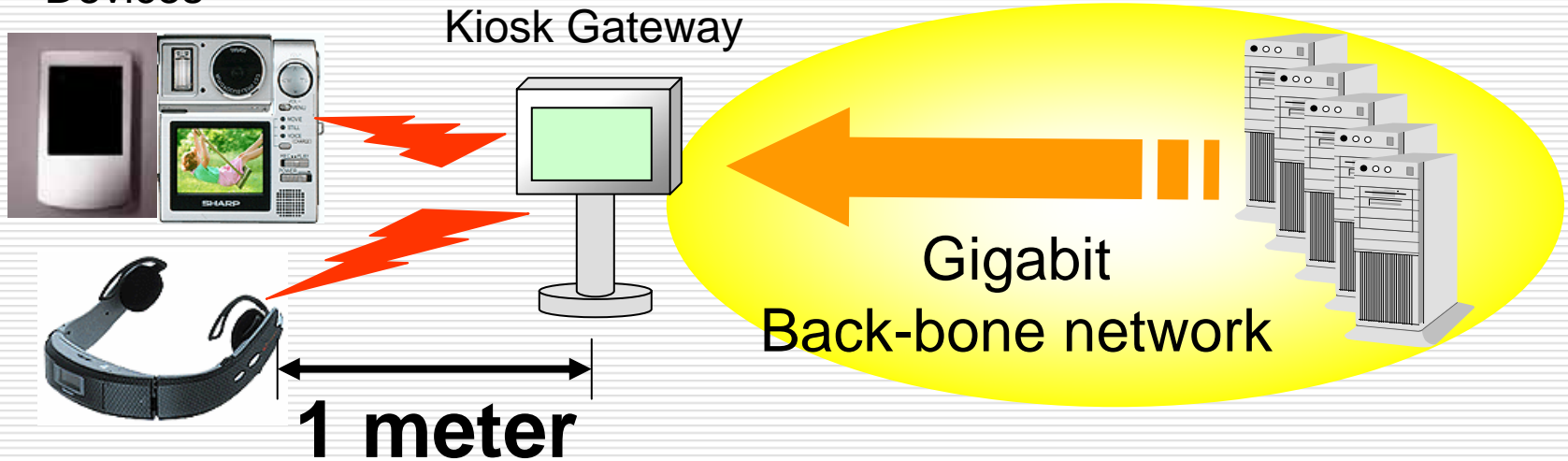
- ◆ Point and Shoot : High Speed extension  
UFIR, IrBurst
  - ◆ Networking : Server and Client Model  
IrFM
-

# The last ONE meter Solution

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No High speed Download, Upload Interface wireless technology for Multimedia or Music data at this moment  
IrBurst SIG

Devices



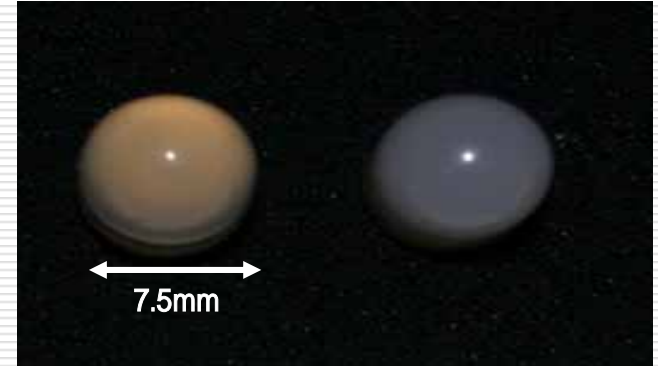
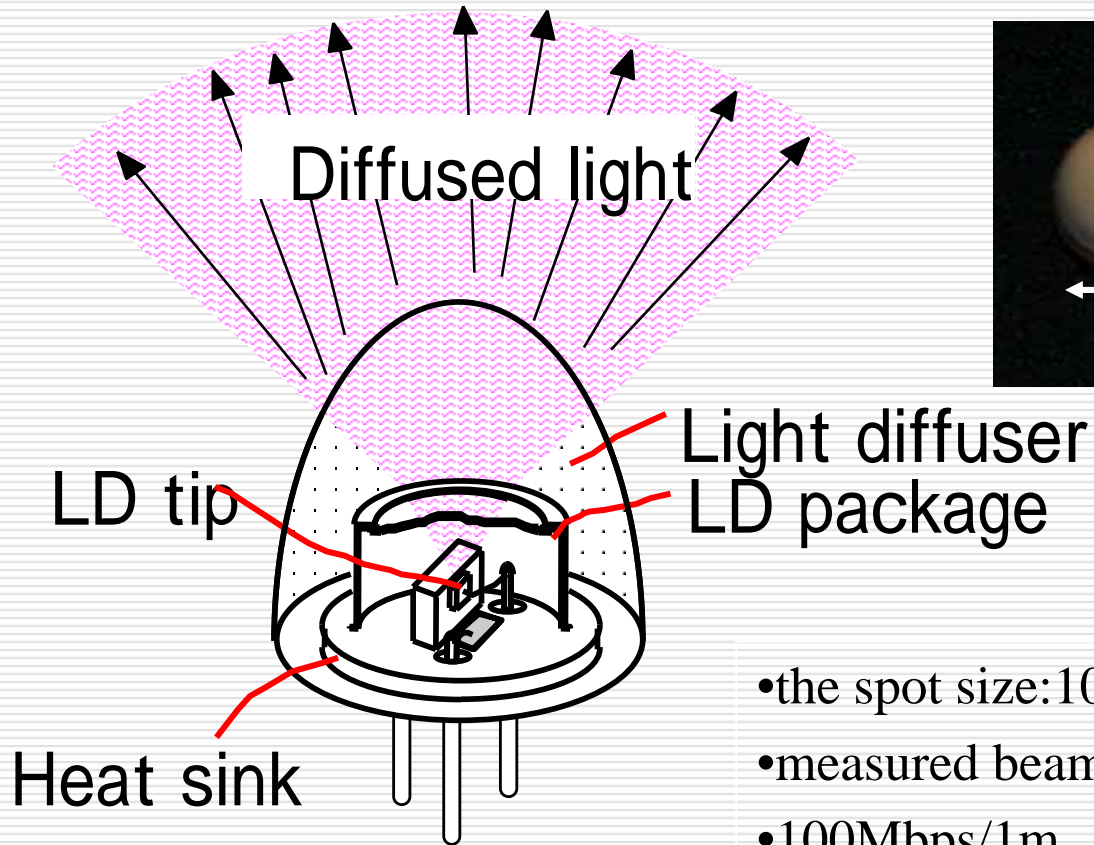
# Development of Technology

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- High speed Physical Layer: UFIR
  - High Throughput Protocol: IrBurst
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# Eye Safe Laser Diode

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- the spot size:1000 times
- measured beam diameter:4mm
- 100Mbps/1m

# Frequency characteristic result according to the distance of LD and LED

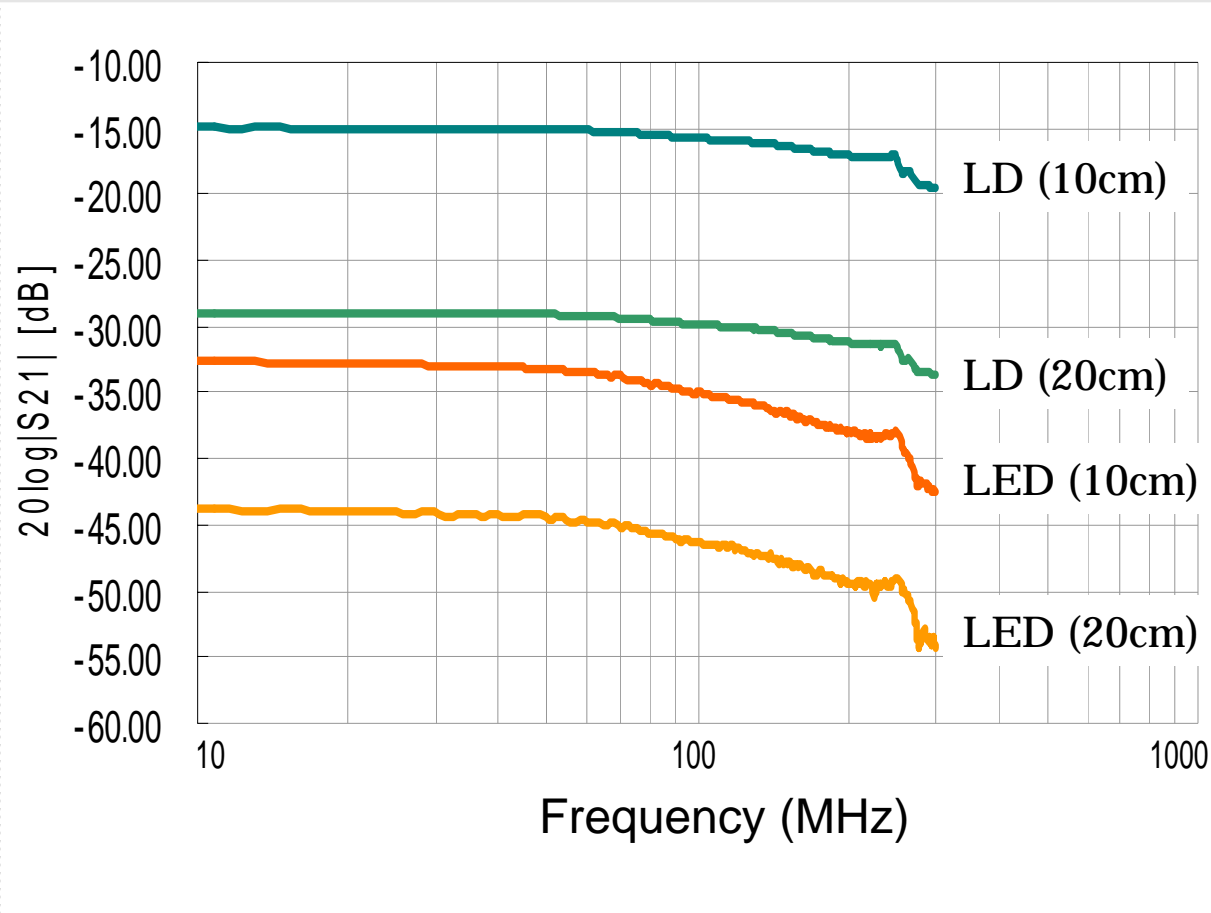


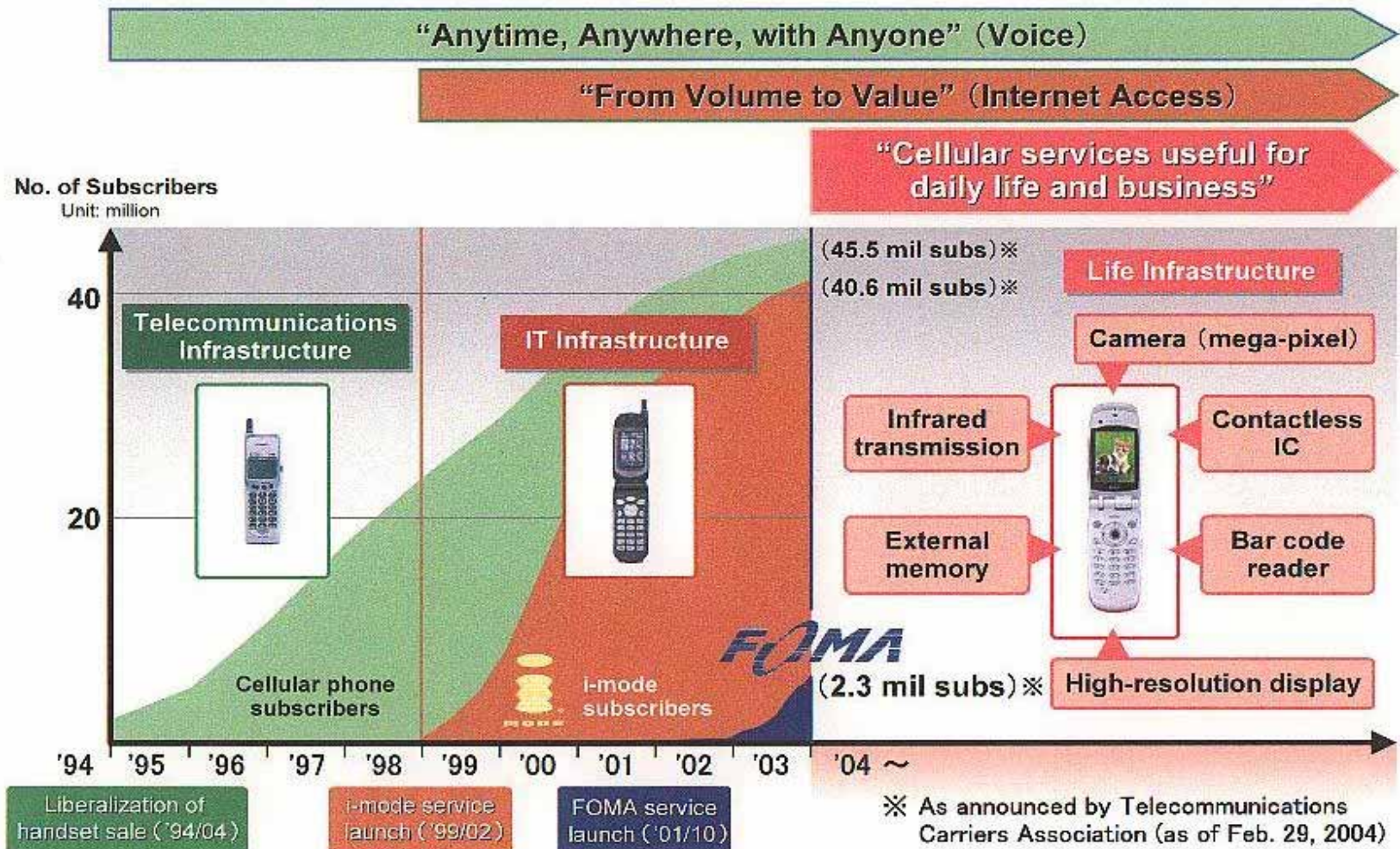
Fig. 1

# Experiment



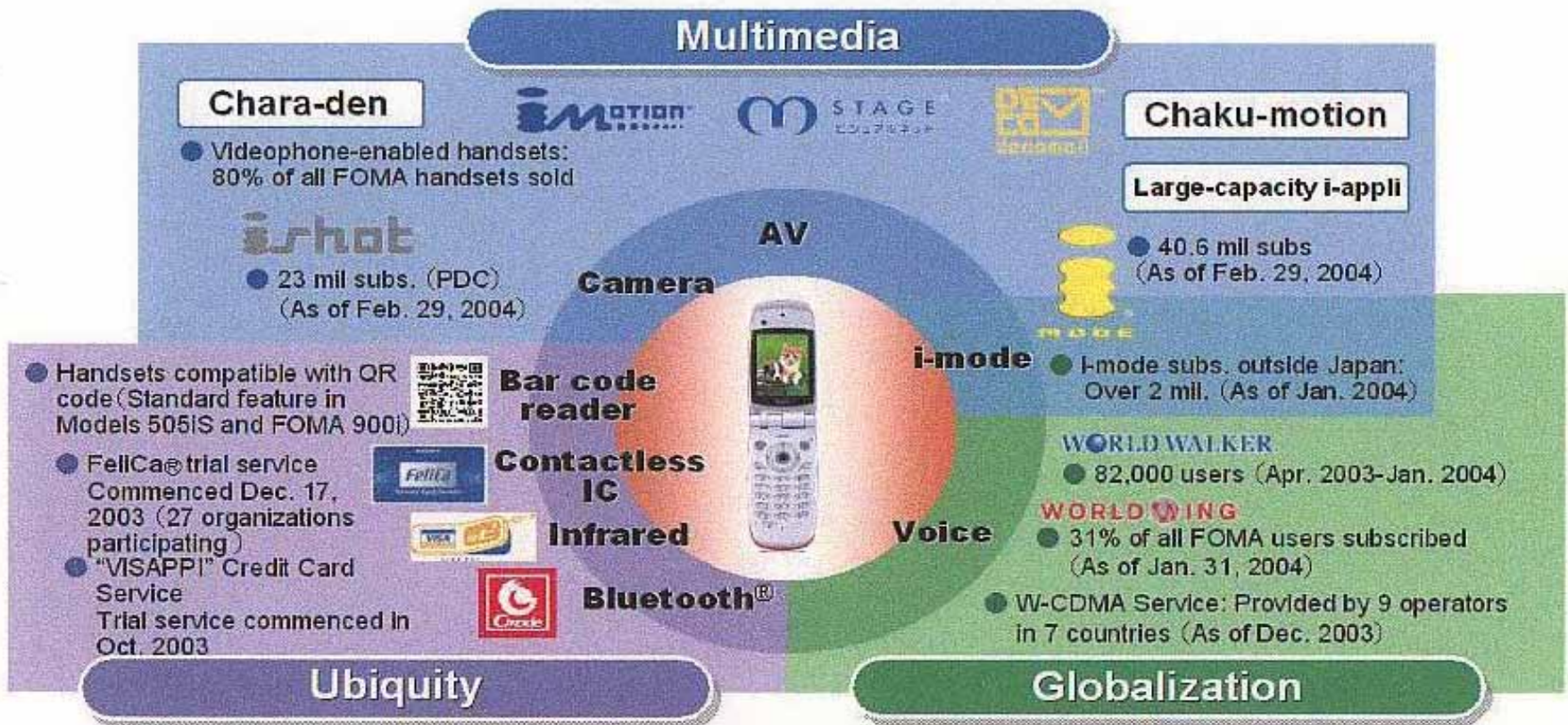
# Evolution of Cellular Service

(by NTTDoCoMo)



# Creation of New Value

(by NTTDoCoMo)



## Security (Safe and Secure Access)

- Authentication (FirstPass)
- Location Information
- Handset Lock
- Anti-Virus Engine
- Over-the-Air Download
- Countermeasures Against Unsolicited Bulk e-mail
- Message Board Service in Disaster

® i-mode®, FOMA®, FirstPass®, Chara-den®, Large-capacity i-appli®, i-hot®, i-motion®, Chaku-motion®, i-ecoveral®, iB-tag®, WORLD WALKER® and WORLD WING® are trademarks or registered trademarks of NTT DoCoMo Inc. in Japan. NTT DoCoMo's messaging services are available only to subscribers in Japan.  
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# Create one Worldwide standard for “Real eCommerce” IrFM (Infrared Financial Messaging)

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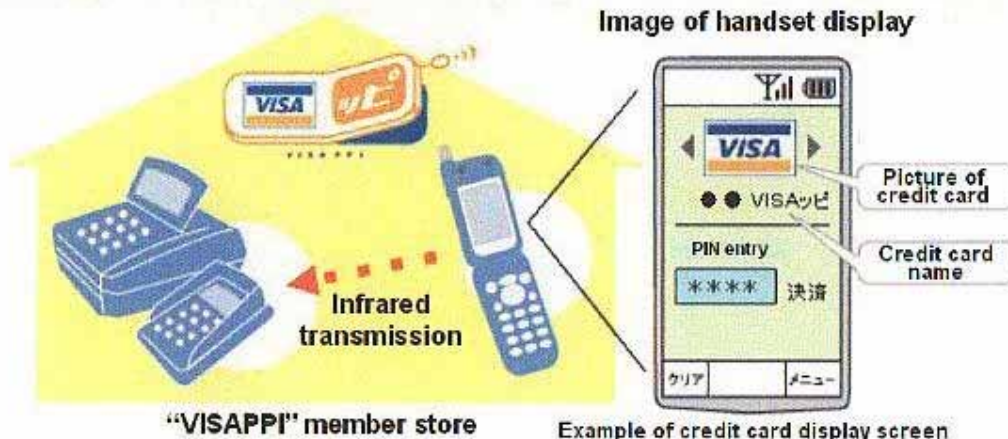
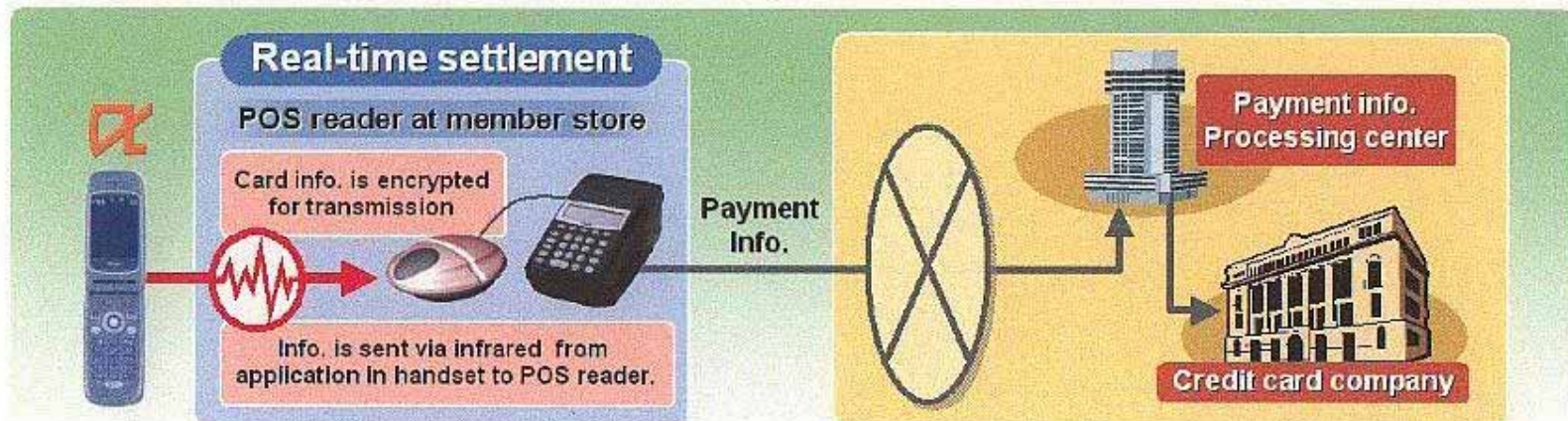
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Combine real financial transactions and short distance connections

# Example for Infrared Transmission

(by NTTDoCoMo)

## ● Credit card payment using infrared transmission



※ "VISAPPI" is a trademark of Visa International.

# Mobile commerce (Cmode NTT DoCoMo / Coca-Cola)



2 dimensional  
bar codes



- **Cell phone – Vending Example**  
Items can be purchased from a vending machine (tickets, coupons, town information)

- ☀ **Merits**

- Value added features for Vending Machines (larger amounts can be billed)**

- Purchase items can be selected in advance on the cell phone(no lines)**






- Can be used in other non vending machine devices (Info Kiosks etc.)**

- ☀ **Issues**

- Cell phone operation is cumbersome (how do we accommodate all age groups)**

- IrDA Cell phones can implement IrFM easily**

# Possibilities for Local Interface

Method	Feature	Practical Use
<b>Barcode</b> 	<ul style="list-style-type: none"> <li>◇ Low cost</li> <li>◇ High directivity and Short reach</li> <li>◇ Low security</li> </ul>	<ul style="list-style-type: none"> <li>◆ membership card</li> <li>◆ Coupon</li> <li>◆ Vending machines</li> </ul>
<b>IrMC</b> 	<ul style="list-style-type: none"> <li>◇ Low cost</li> <li>◇ High directivity and Short reach</li> <li>◇ Financial transactions</li> </ul>	<ul style="list-style-type: none"> <li>◆ Video rental membership</li> <li>◆ Karaoke</li> <li>◆ Vending machines</li> <li>◆ Credit Cards (Overseas, Tests)</li> </ul>
<b>Bluetooth<sup>®</sup></b> 	<ul style="list-style-type: none"> <li>◇ 1 to n transmission is possible</li> <li>◇ Low directivity and Long reach</li> <li>◇ Fast data transmission process</li> <li>◇ Confidential; frequency hopping</li> </ul>	<ul style="list-style-type: none"> <li>◆ Connection of mobile phone to PC</li> <li>◆ Peripherals and PC</li> <li>◆ Remote controls and headsets</li> </ul>
<b>Contactless IC Card</b> 	<ul style="list-style-type: none"> <li>◇ Compatible with only one chip</li> <li>◇ Fast transmission</li> <li>◇ Financial transactions</li> </ul>	<ul style="list-style-type: none"> <li>◆ Commuter pass (Suica Edy)</li> <li>◆ Prepaid card</li> <li>◆ IT experimental city</li> </ul>
<b>RFID</b> 	<ul style="list-style-type: none"> <li>◇ Long reach (Depends on setting)</li> <li>◇ Fast transmission process</li> <li>◇ Financial transactions</li> </ul>	<ul style="list-style-type: none"> <li>◆ ETC</li> <li>◆ Gas Station Payment card</li> </ul>

# Handsets compatible with External Interface

(by NTTDoCoMo)

Compatible Handsets			Usage
Camera	Approx. 25 mil units	<ul style="list-style-type: none"> <li>● FOMA Model 900i</li> <li>● FOMA Models 2101V, 2102V, 2701, 2051</li> <li>● Mova Models 505i, 505iS, 504iS, 25Xi</li> </ul>	<ul style="list-style-type: none"> <li>● Shoot photo of scenery/people</li> <li>● Read two-dimensional codes</li> <li>● Input device for picture/video</li> </ul>
Infrared Transmission	Approx. 20 mil units	<ul style="list-style-type: none"> <li>● FOMA Model 900i</li> <li>● FOMA Models 2102V, 2701, 2051</li> <li>● Mova Models 505i, 505iS, 504i, 504iS</li> </ul>	<ul style="list-style-type: none"> <li>● Membership certificate</li> <li>● Remote controller for appliances</li> <li>● Vending machines</li> <li>● Credit card</li> <li>● Exchange address book info</li> </ul>
Bar Code Reader (QR code)	Approx. 3.8 mil units	<ul style="list-style-type: none"> <li>● Mova Model 505iS and FOMA Model 900i all have built-in bar code reader as standard feature.</li> </ul> <p>※ All I-mode handsets (approx. 40 million), except for some models, can display QR codes on screen.</p>	<ul style="list-style-type: none"> <li>● Membership card ● Poster</li> <li>● Mail order brochure ● Coupon</li> <li>● Magazine/newspaper ad</li> <li>● Entry pass ● Business card</li> <li>● Vending machine</li> </ul>
Videophone	Approx. 2 mil units	<ul style="list-style-type: none"> <li>● FOMA Model 900i, 2102V, 2101V</li> </ul>	<ul style="list-style-type: none"> <li>● Videophone call</li> <li>● Video conference</li> <li>● Streaming video in real time</li> </ul>
Contactless IC (FeliCa®)	Planned for release in FY2004/1H	<ul style="list-style-type: none"> <li>● Trial service in progress (since Dec. 17, 2003)</li> </ul>	<ul style="list-style-type: none"> <li>● Commuter pass ● Coupon</li> <li>● Prepaid card ● Entry pass</li> <li>● Ticket ● Membership card</li> </ul>
Bluetooth®	Planned for release in FY2004/1H	—	<ul style="list-style-type: none"> <li>● Car-mount hands-free kit</li> <li>● Connection between cellular handset and PC</li> <li>● Connection between peripheral equipment and PC</li> <li>● Remote controller, headset</li> </ul>

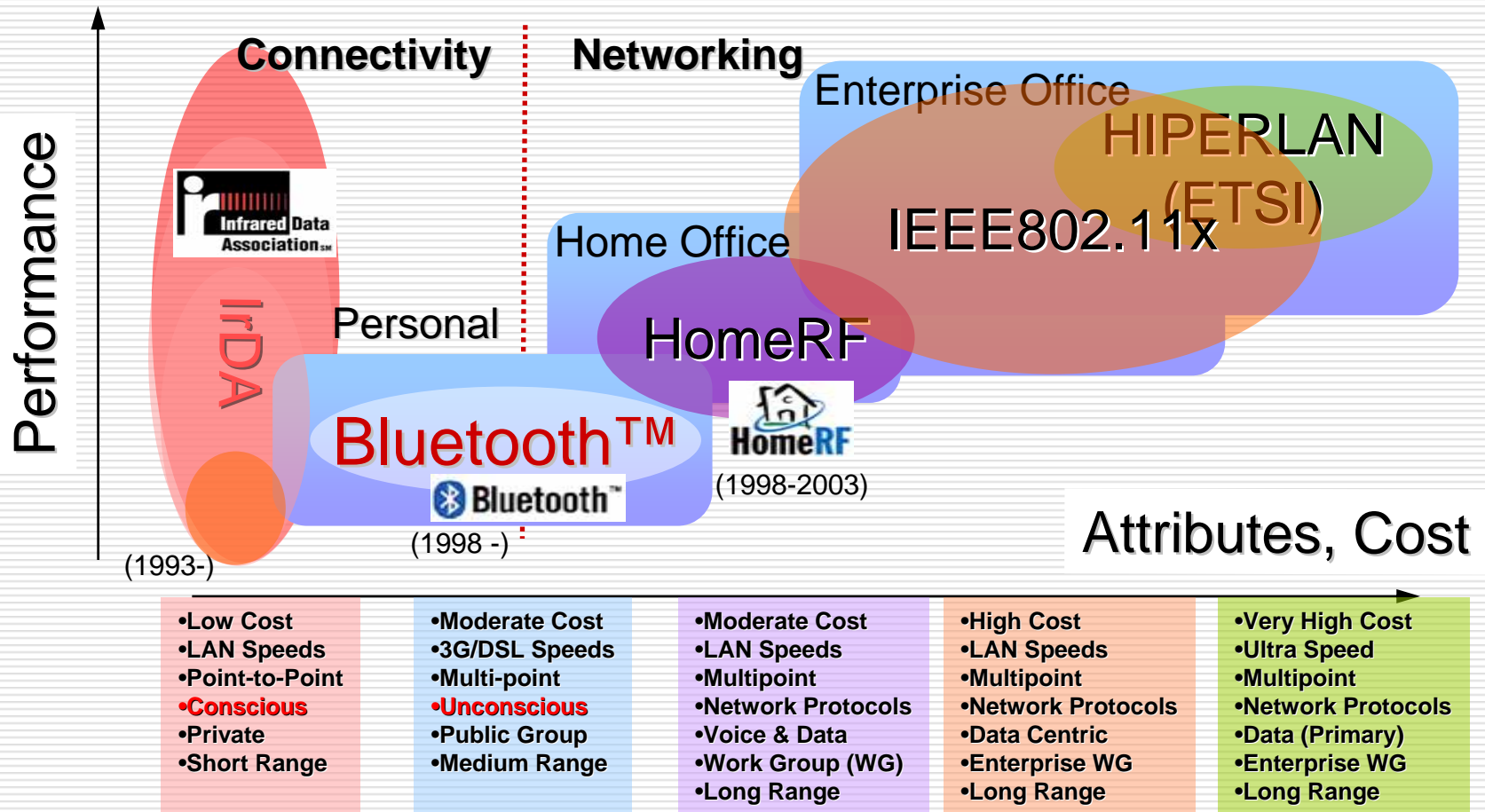
※ Number of units are as of Feb. 29, 2004

※ "Bluetooth" is a registered trademark or registered trademark of Bluetooth-SIG Inc. in the United States.

※ "FeliCa" is a registered trademark of Sony Corporation.

※ "QR Code" is a registered trademark of DENSO WAVE Inc.

# Applicable field for Optical Wireless Technology



# Hivision Optical wireless Video transmission system

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**Optical Transmitter**



**Optical Receiver**



by JVC

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# Next Generation Infrared Killer Application

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IrRADIO Transmitter  
500kbyte/sec  
MP3 and Java Objects

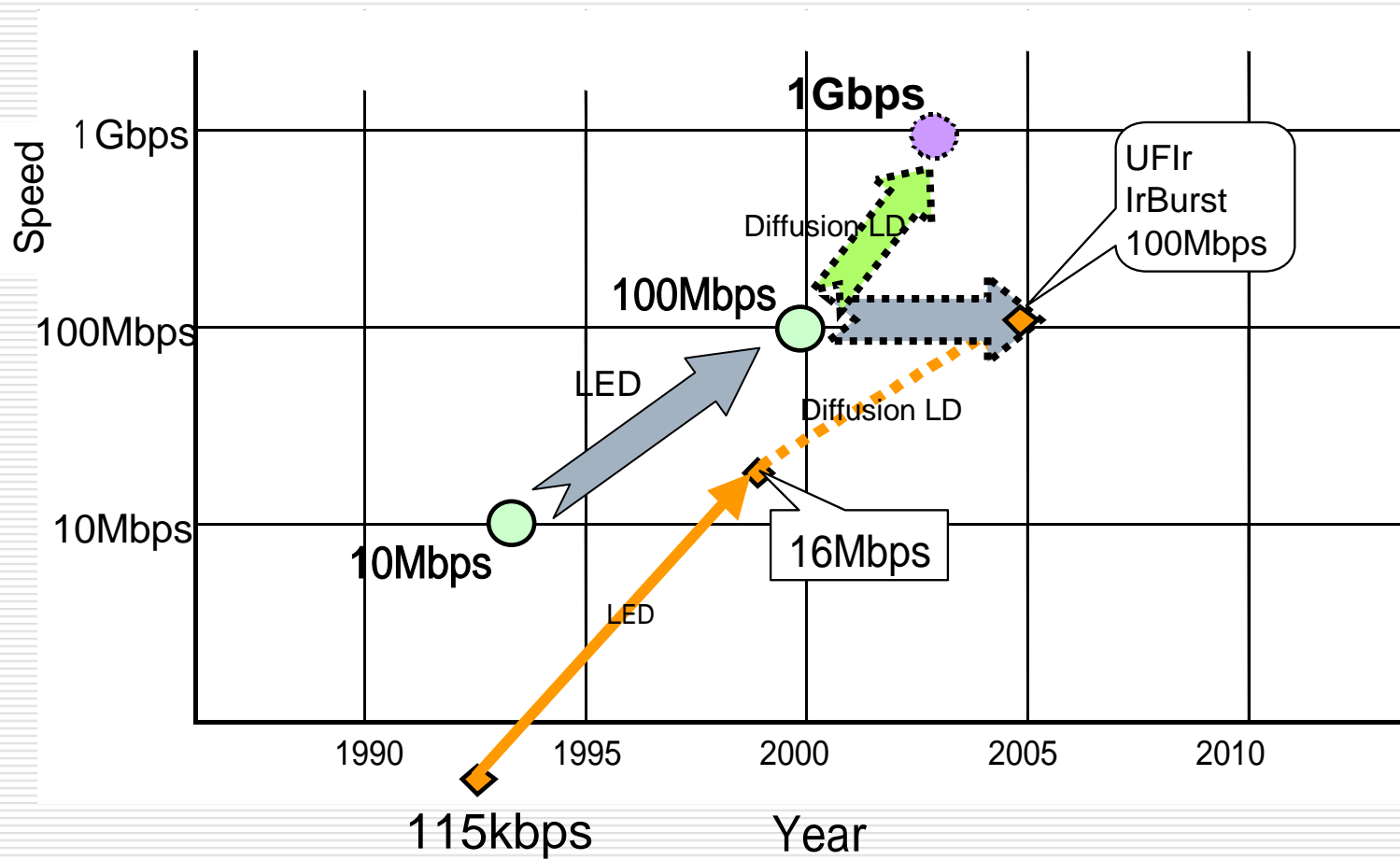


IrRADIO Receiver  
10Mbytes Capacity  
MP3 decoder player

## Infrared Radio (IrRadio/IrShower) Application

- Broadcast MP3, Java (Infrared Downstream data)
  - Use IrDA FIR physical layer and IrBRC Protocol
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# Roadmap for Indoor Optical Wireless Communication



# Conclusion

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- ❑ IrDA 100Mbps is usefulness for the Interface of High speed Large volume download.
  - ❑ In the Personal Area Network environment, many technologies are available and each Technology has proper applicable field.
  - ❑ These PAN Technologies will be supported by the PDA or Cellular phone.
  - ❑ These approach will be started from Japan
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