High Speed Circuits and Systems Lab

Goal Hardware-oriented world-class research in very high-speed circuits and systems

Supports & Collaborations
- IHP, Germany
- ETRI, Korea
- Samsung, Korea
- 과학재단, Korea
- 서울시정연구개발원, Korea
- Yonsei IT SoC 설계기술 연구센터, Korea

Members
- Ph. D. Student : 9
- Master Student : 5

High-Speed CMOS Circuits

- High-Speed Interface Circuits (PLL, Clock and Data Recovery, Equalizers, SerDes)
- Applications: Data communication systems with high data rates (USB, SATA, Display port ...)

Millimeter-Wave Communication Systems

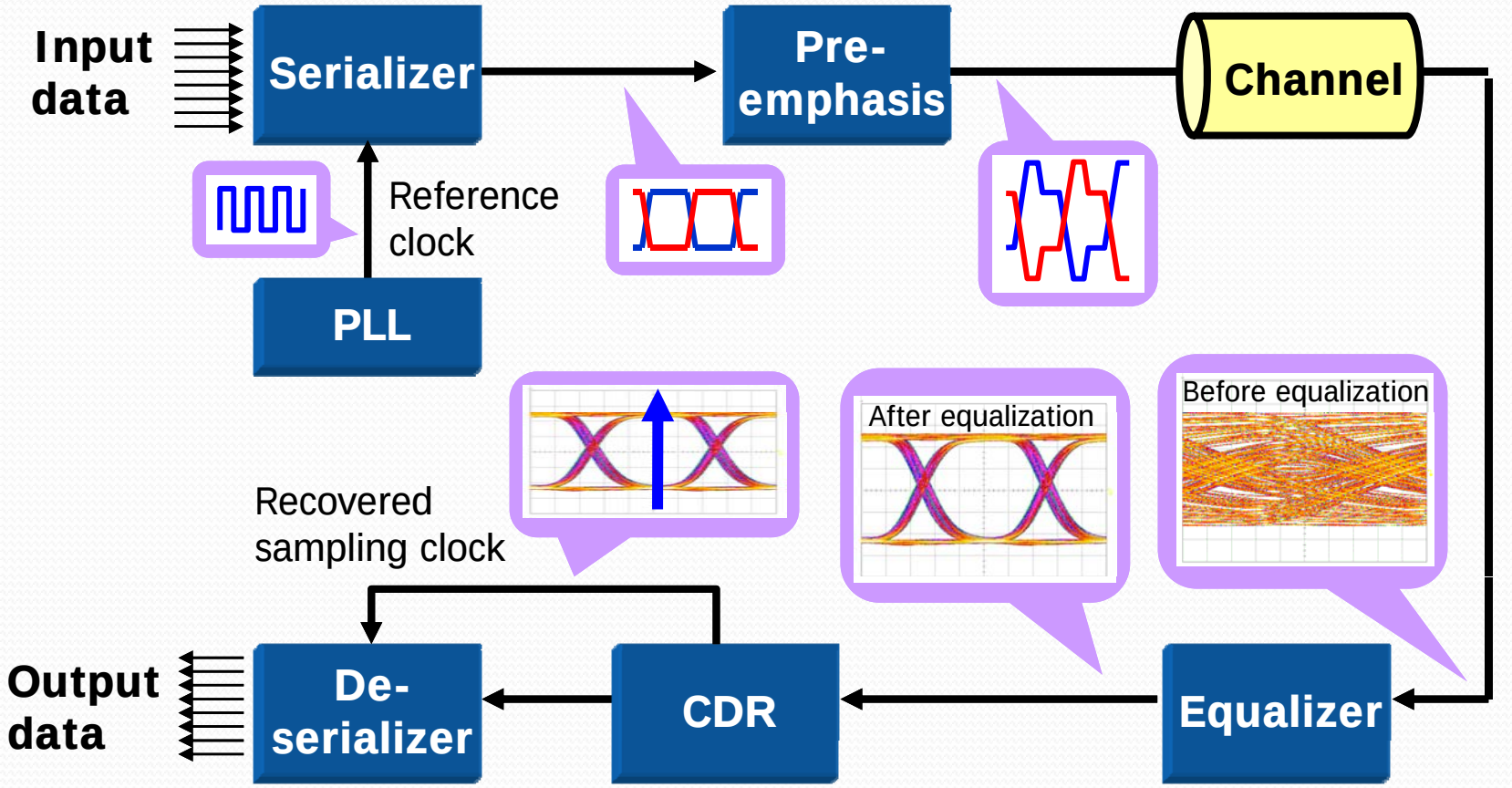
- 60GHz RF Integrated Circuits in CMOS/BiCMOS Technology
- Giga-bps Wireless Communication Links

Photonics Technology

- CMOS-compatible Si Photodetectors
- Integrated Optical Receivers in CMOS/BiCMOS Technology
- Radio-over-Fiber (RoF) Systems

High-speed CMOS circuits

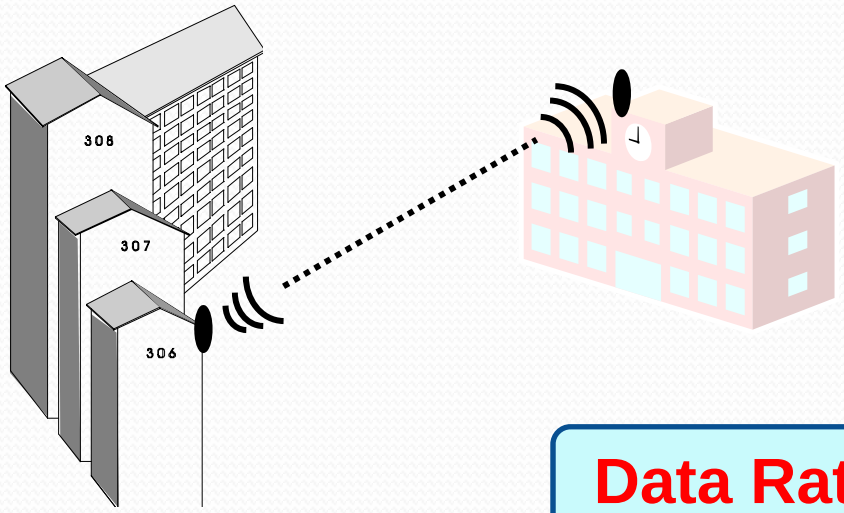
Channel: Display port cable
/ USB cable / PCB trace / etc...



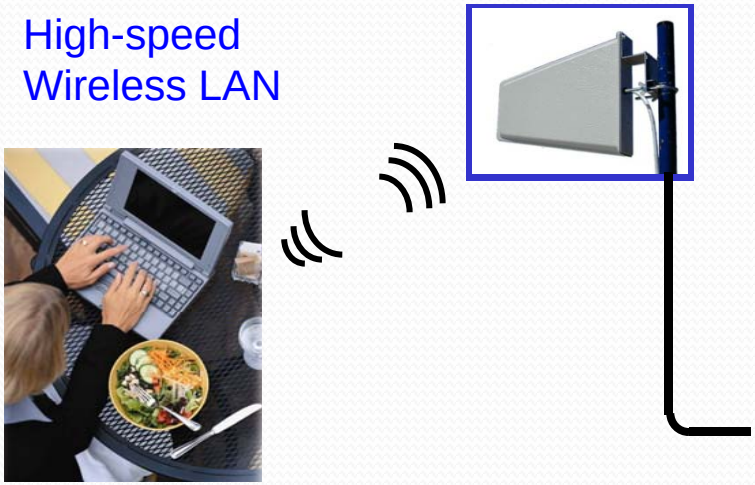
Single-chip integration with CMOS Technology

60GHz For Wireless Communications

Broadband Wireless Access

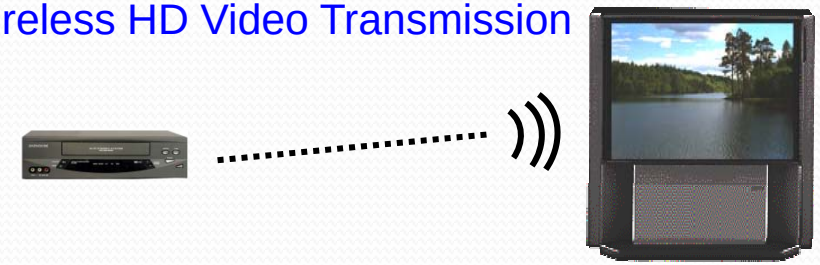


High-speed
Wireless LAN



Data Rate > 1 Gb/s

Wireless HD Video Transmission

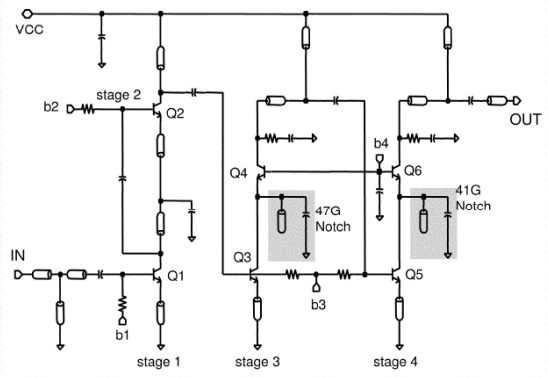


Wireless Personal
Area Network (WPAN)

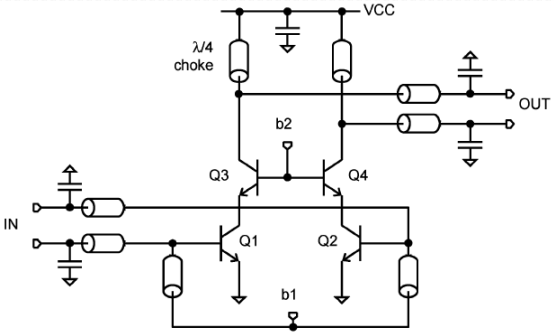
- Growing interest in 60GHz
  - 60GHz as unlicensed band

60GHz RF Integrated Circuits

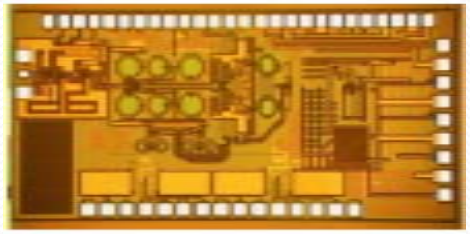
LNA

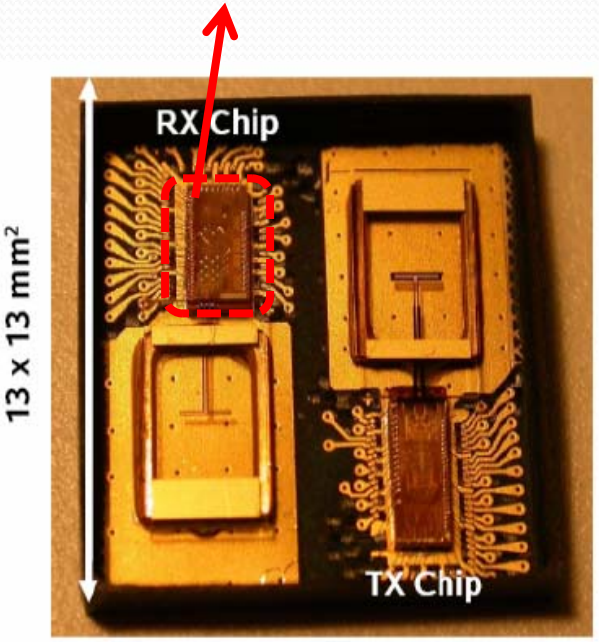


PA

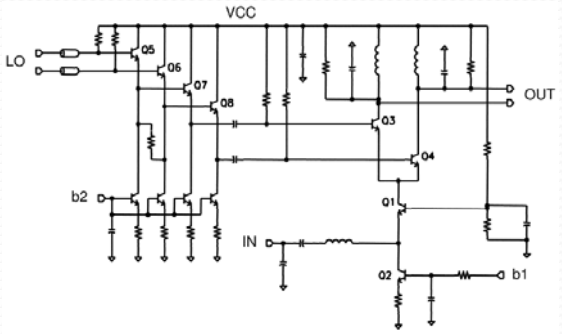


3.4 x 1.7 mm²

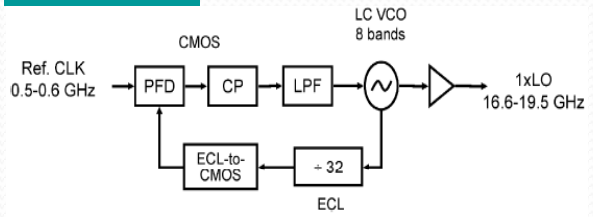




Mixer



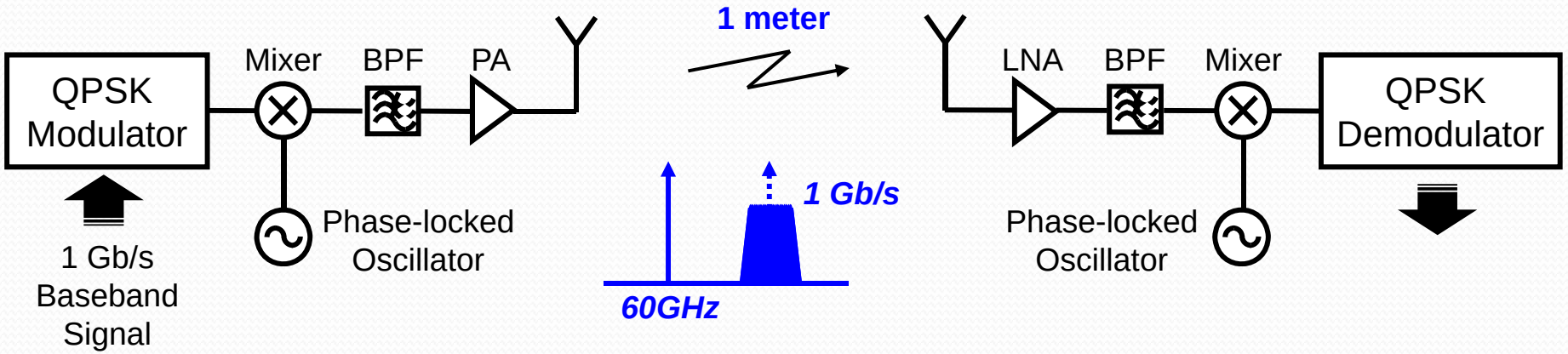
PLL

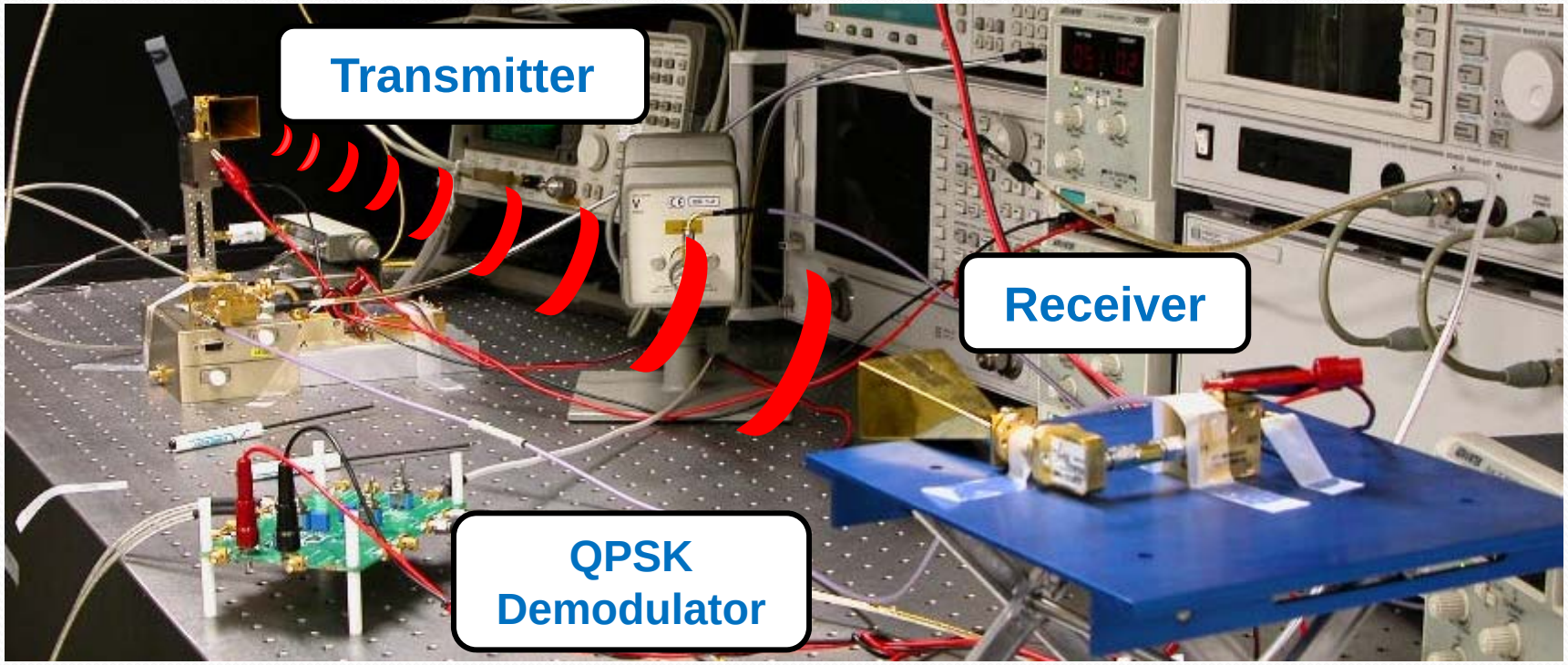


Single-Chip Solution!

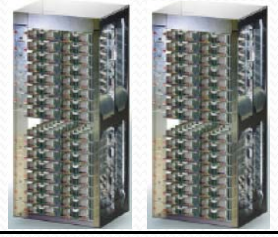
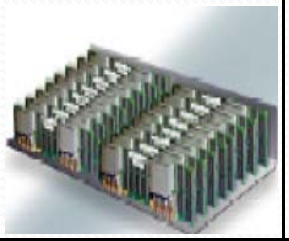
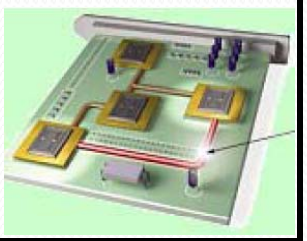
Ref: S. Reynolds, et al., JSSC 2006

Gigabit 60GHz RF Link Test-Bed





Evolution of Optical Communication

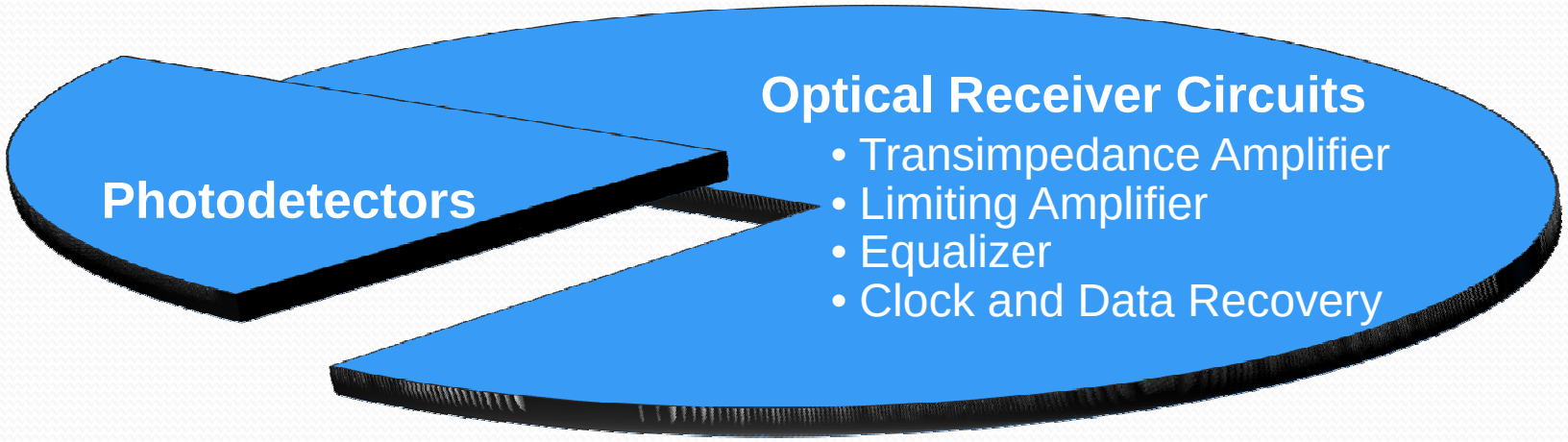
	Wide Area Network	Cables-Long	Cables-Short	Board-to-Board	Chip-to-Chip
					
Distance	Multi-km	10-300 m	1-10 m	0.3-1 m	5-100 mm
No. of lines per system	Tens	Tens to thousands	Tens to thousands	Tens to thousands	Approximately ten thousand
Use of Optics	Since the 1980s and the early 1990s	Since the late 1990s	Present time, or very soon	2010+	Probably after 2015

(IBM J. RES. & DEV., Vol. 49, No. 4/5, 2005)

Increasing volumes

Cost issue!

CMOS Technology on Silicon Wafer

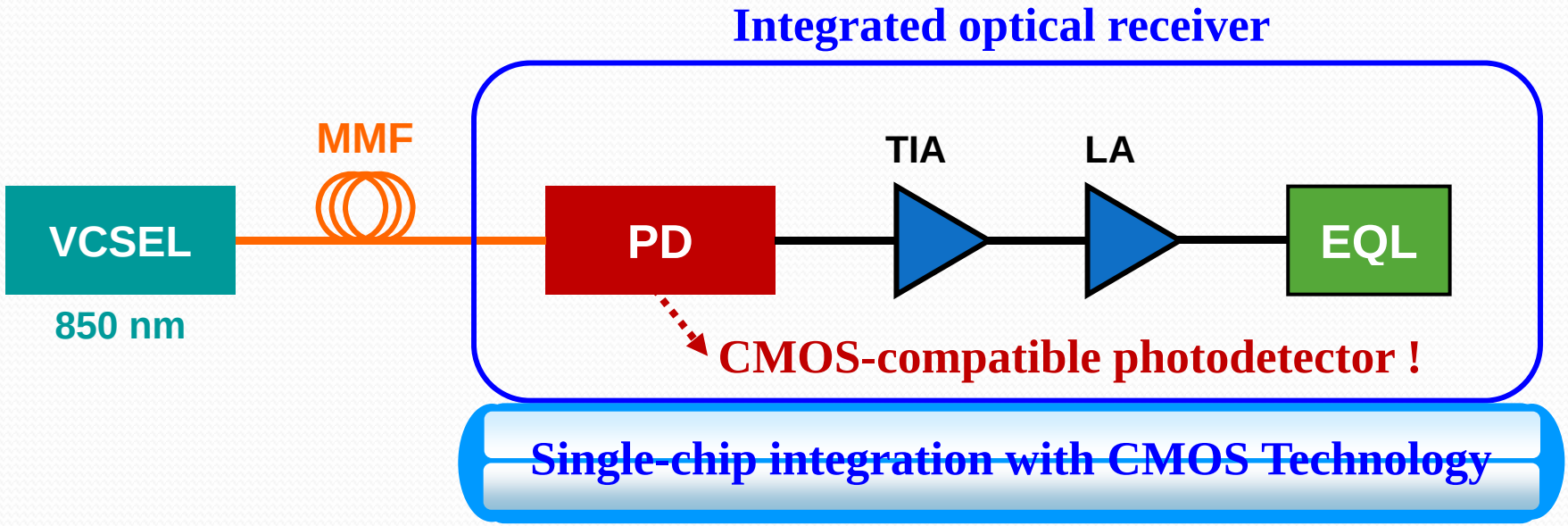


Universal platform for electronic circuits

CMOS Technology for photodetectors

- ❖ Low fabrication cost compared with III-V compound semiconductor
- ❖ High-volume production
- ❖ Solution for single chip integration

Low-Cost Optical System Using CMOS Process



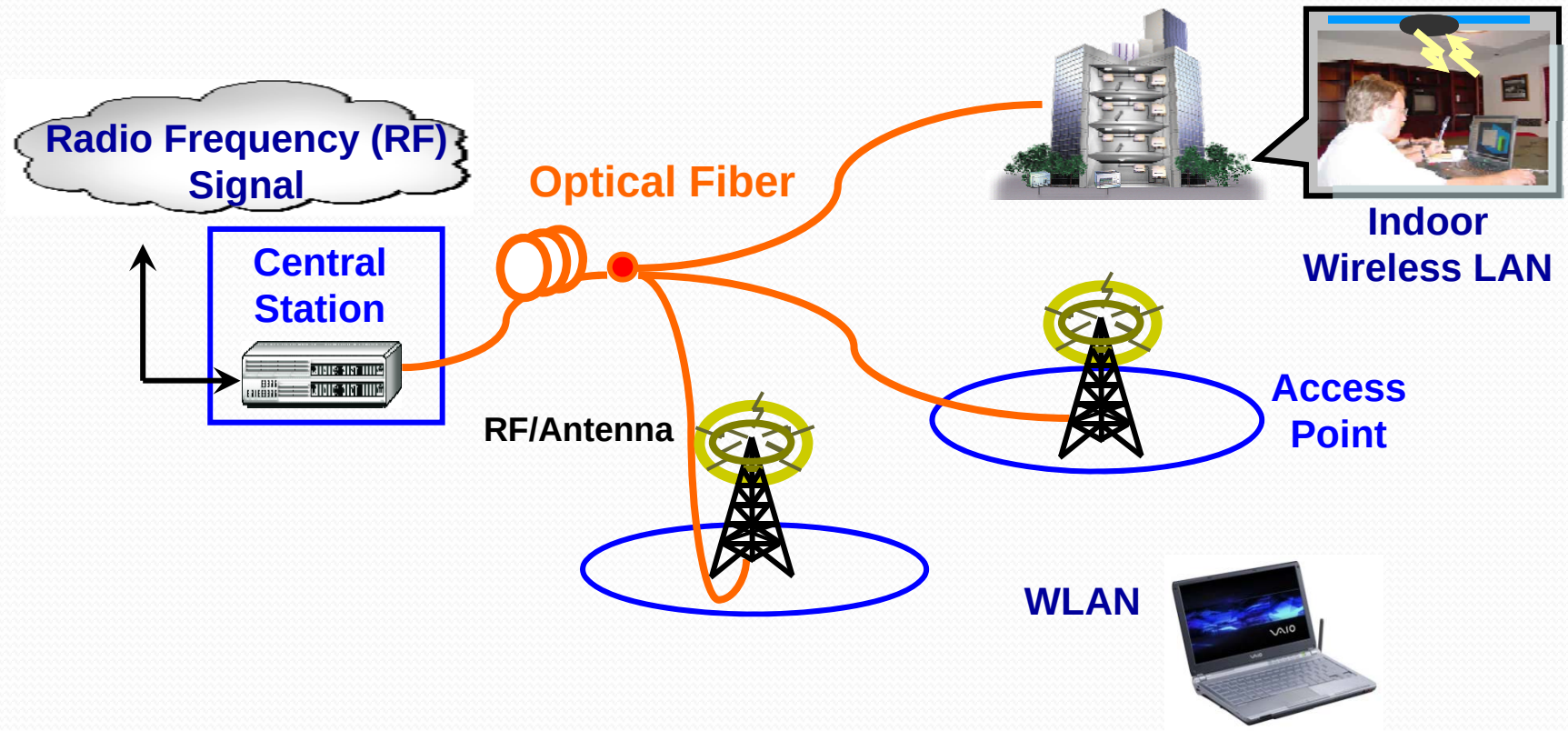
Optical transmitter & medium

- Low-cost and high-speed **VCSEL**
- Multi-mode fiber (**MMF**)

CMOS Technology

- ✓ **Low fabrication cost**
- ✓ **High-volume production**
- ✓ **Universal platform for electronics**

Radio-over-Fiber (RoF) Systems



Radio-over-fiber (RoF) systems

- Efficient distribution of radio signals
- Extension of coverage between central station (CS) and access point (AP)
- Centralization of equipments

- Related undergraduate courses:

  Solid understanding of circuits (전자회로 2) and electromagnetic waves (전자기2)

- For undergraduate interns and graduate studies in HSCS laboratory, please contact Prof. Woo-Young Choi at 02-2123-2874 or wchoi@yonsei.ac.kr