Signify

Lighting infrastructure use cases for FTTR

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Joint ETSI ISG F5G, BBF, CCSA TC6 and ITU-T SG15 Workshop on FTTR

June 14, 2021

Outline

About Signify

FTTR for wireless access integrated in luminaires / lighting fixtures

About LiFi

Three lighting infrastructure use cases for FTTR

Signify is the world leader in lighting

We provide high-quality energy efficient lighting products, systems and services

Light sources	Luminaires	Systems and Services

No. 1
Connected, LED, Conventional

€6.5bn
sales in 2020, 80% LED-based

83 million
connected light points and growing

100%
Carbon neutral operations

Some of our brands: PHILIPS interact trulifi PHILIPS hue COLORKINETICS WiZ

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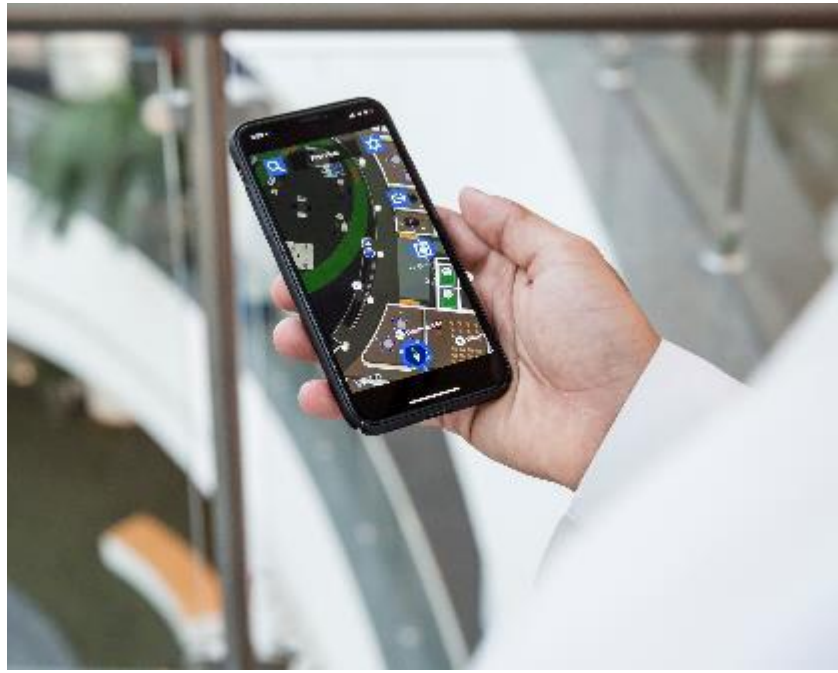
No. 1 in connected LED lighting

- Our networked smart lighting systems are in homes, offices, warehouses, factories, …
- FTTR can be the next generation wired backhaul to the luminaire



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FTTR for wireless access integrated in luminaires / lighting fixtures

High-speed wireless access (Wi-Fi, 5G, LiFi) requires high-capacity backhaul

Wireless Access Points (APs) provide best coverage when located in the middle of the ceiling

Luminaires are already in the ceiling!

Wireless APs should be integrated into luminaires

- Requires power (mains or PoE) and high-speed connectivity
- Varying degrees of integration are possible, from mechanical to electrical to optical (with LiFi)
- Fiber can go all the way to the luminaire or partway (e.g., in combination with powerline)

Ericsson and Signify see 5G connectivity in a new light with joint indoor solution

Ericsson 5G Radio Dot will be embedded in Signify's indoor luminaire in a joint offering that will enable service providers to easily add indoor connectivity to buildings when the lighting systems are being built or upgraded.

NEWS | JUN 27, 2019

https://www.ericsson.com/en/news/2019/6/joint-indoor-solution-from-signify-and-ericsson

What is LiFi?

General coverage

Wi Fi™ 5G 4G LTE ...

- Limited bandwidth
- Licensed spectrum
- High propagation

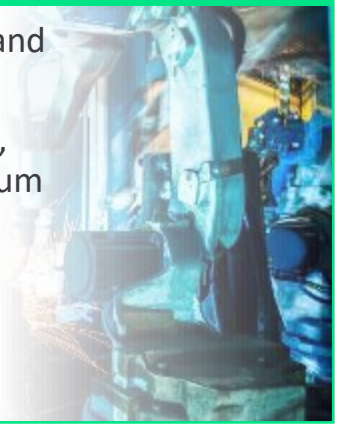
Ultra performance

LiFi

- Ample bandwidth
- Unlicensed spectrum
- Line of sight

Benefits of LiFi

- ☑ Extremely stable and low latency
- ☑ Ample bandwidth, unlicensed spectrum
- ☑ Physically secure
- ☑ RF interference resistant



Radio waves | Microwaves | Infrared | Visible | Ultraviolet | X-rays | Gamma

◀ Longer — Wavelength (m) — Shorter ▶

10^{2} 1^{1} 1 10^{-1} 10^{-2} 10^{-3} | 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} | 10^{-9} 10^{-10} 10^{-11} 10^{-12} 10^{-13}

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Signify is leading global standardization for LiFi

ITU

- ITU-T SG15/Q18
- G.hn (G.9960,G.9961 …) for home networking
- Adapted for LiFi (G.vlc/G.9991)
- Signify was main contributor of key LiFi features:
  - Interference Management
  - Handover
  - Network Security

G.vlc published
Commercial products available

IEEE

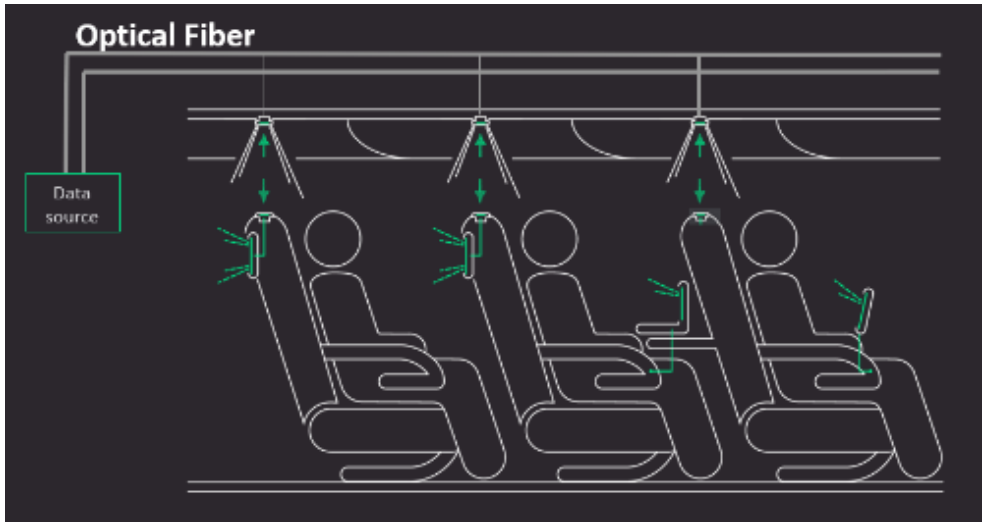
- IEEE 802.11bb
- Adds LiFi support to the 802.11 family
- Signify is driving key LiFi features at both the PHY and MAC layers
  - Definition of the center frequency
  - Support for low-cost devices

Light Communications Alliance

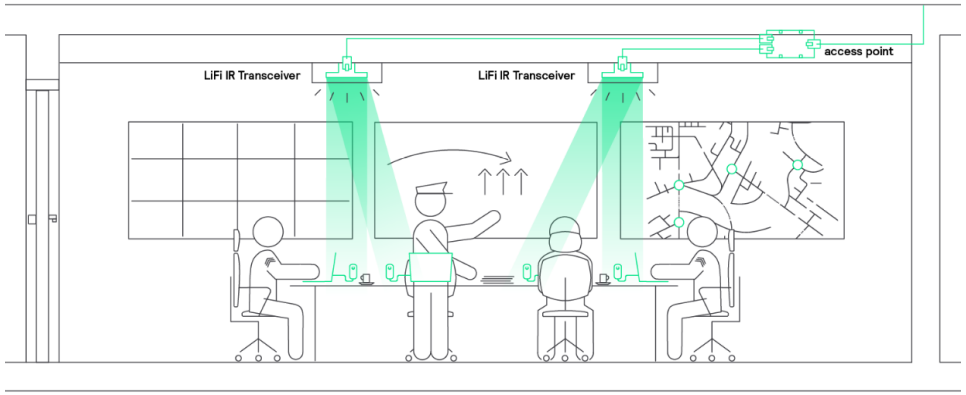
- Signify is Strategic Member of the LCA
- Signify has a seat on the Board of Directors
- Signify leads the definition of the growth strategy of the LCA

Some applications for Trulifi by Signify

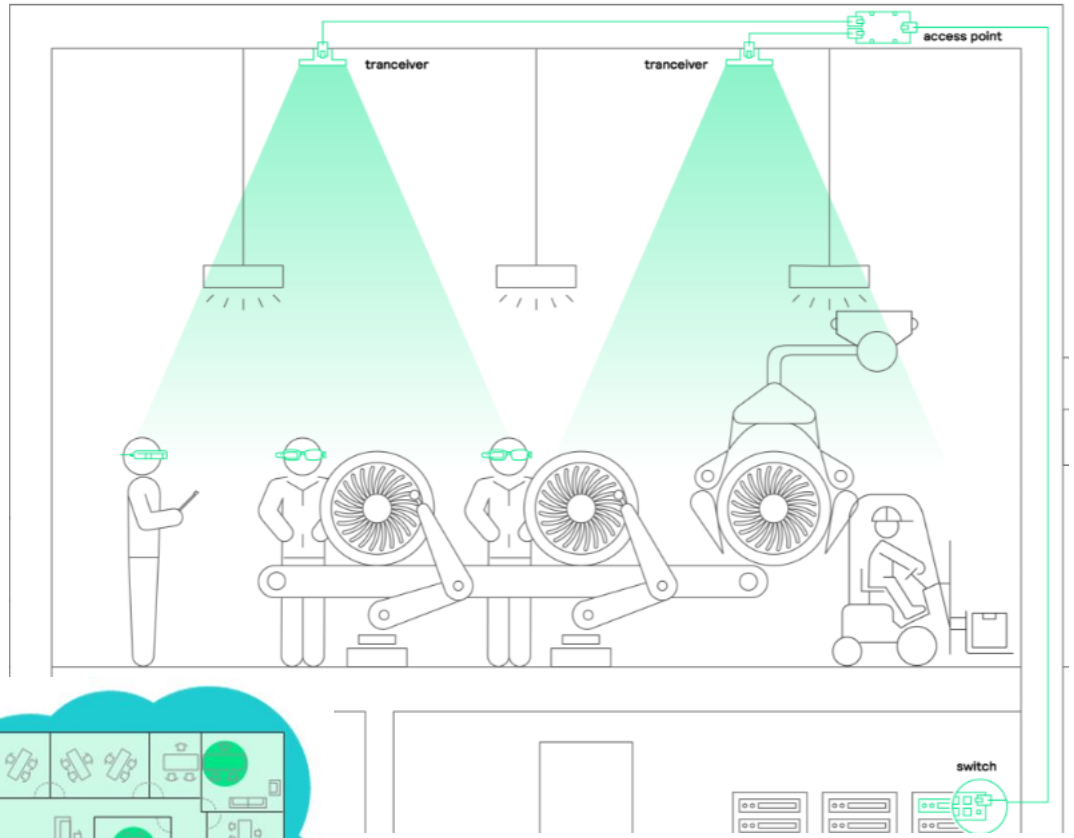
In-cabin communication



Secure meeting rooms

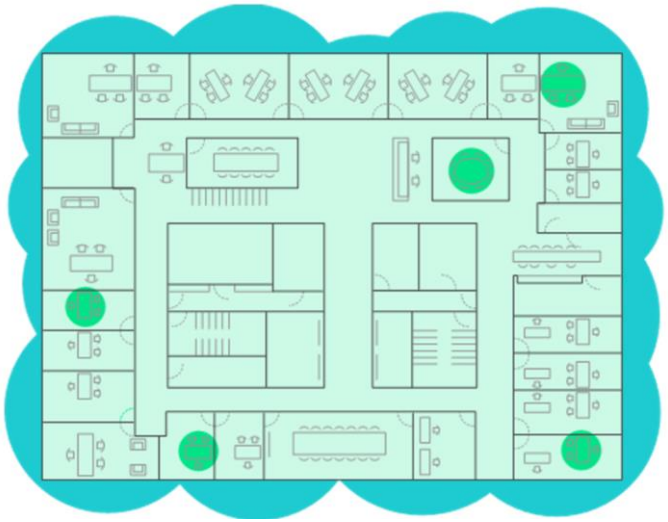


Low latency connectivity for factories, AR/VR devices



LiFi

WiFi



High performance hotspots

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Use case 1: Wireless AP integration into luminaire

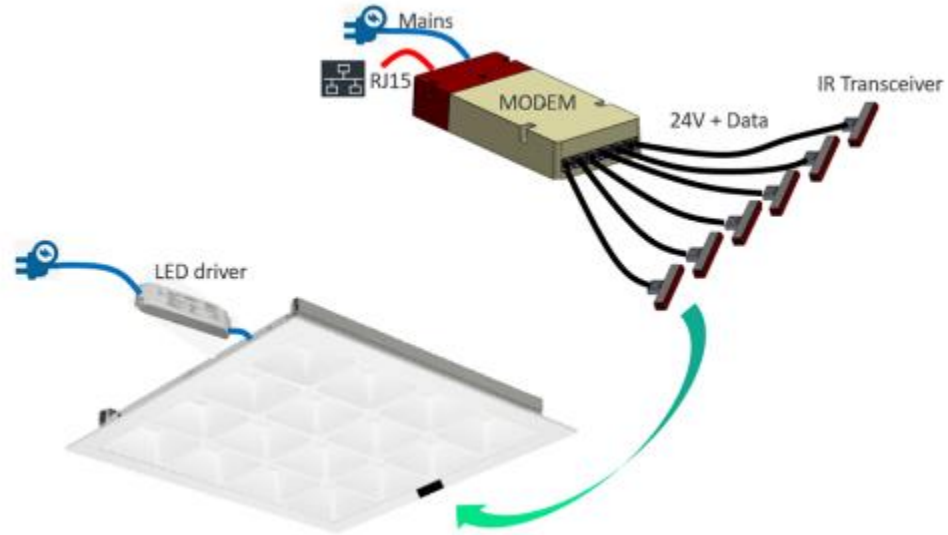
Option 1: mechanical and power integration; communication components independent from illumination

Option 2: (partial) integration of backhaul and/or fronthaul data communication components into LED driver

Implementation considerations:

- Wireless APs include processing for the backhaul data interface (e.g., fiber, power line, ethernet) and the fronthaul data interface (e.g., Wi-Fi, 5G, LiFi).
- Desired AP characteristics: small size, low power consumption, suitable to be plenum rated (in-ceiling fire safety).

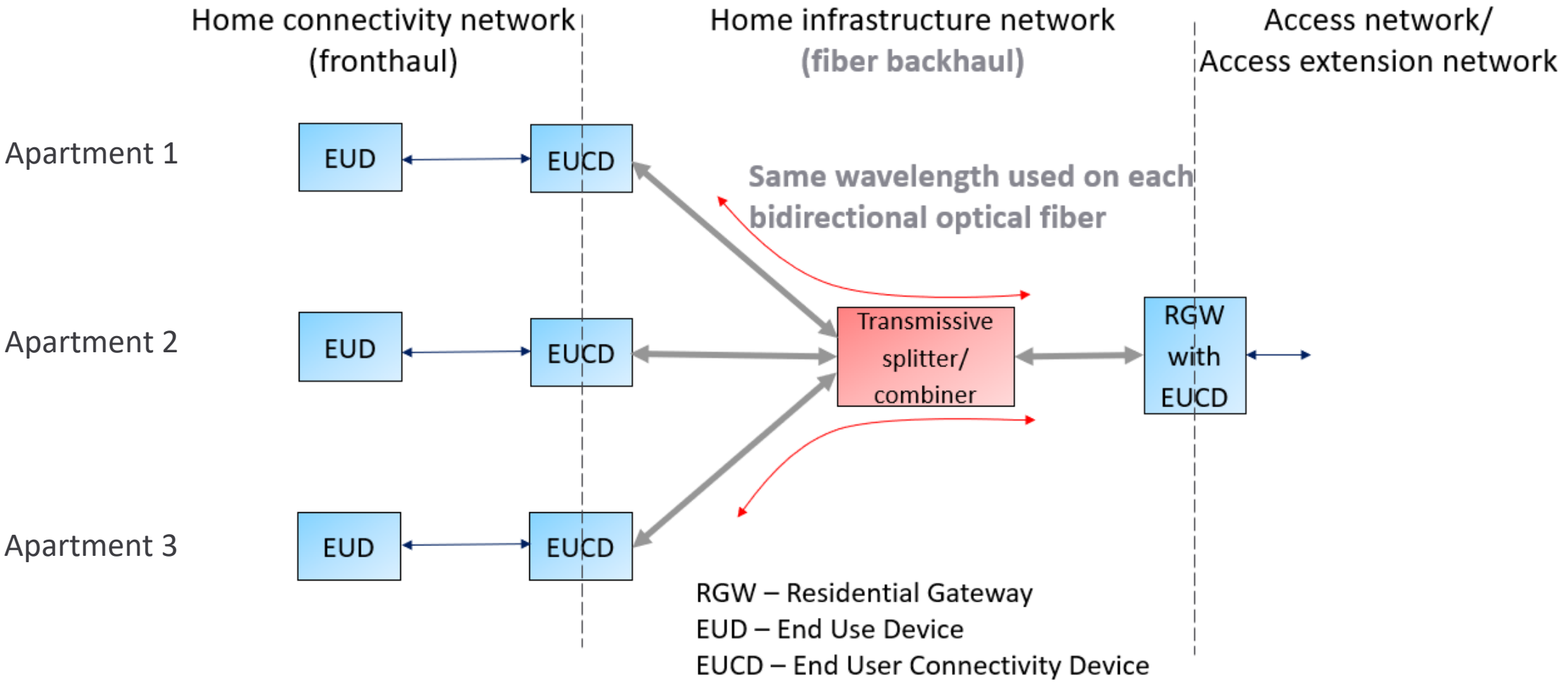
Trulifi 6002 IR Transceiver plugin for mechanical slot



Use case 2: PON-based high-speed connectivity for wireless AP

various optical splitter types in fiber backhaul possible depending on application

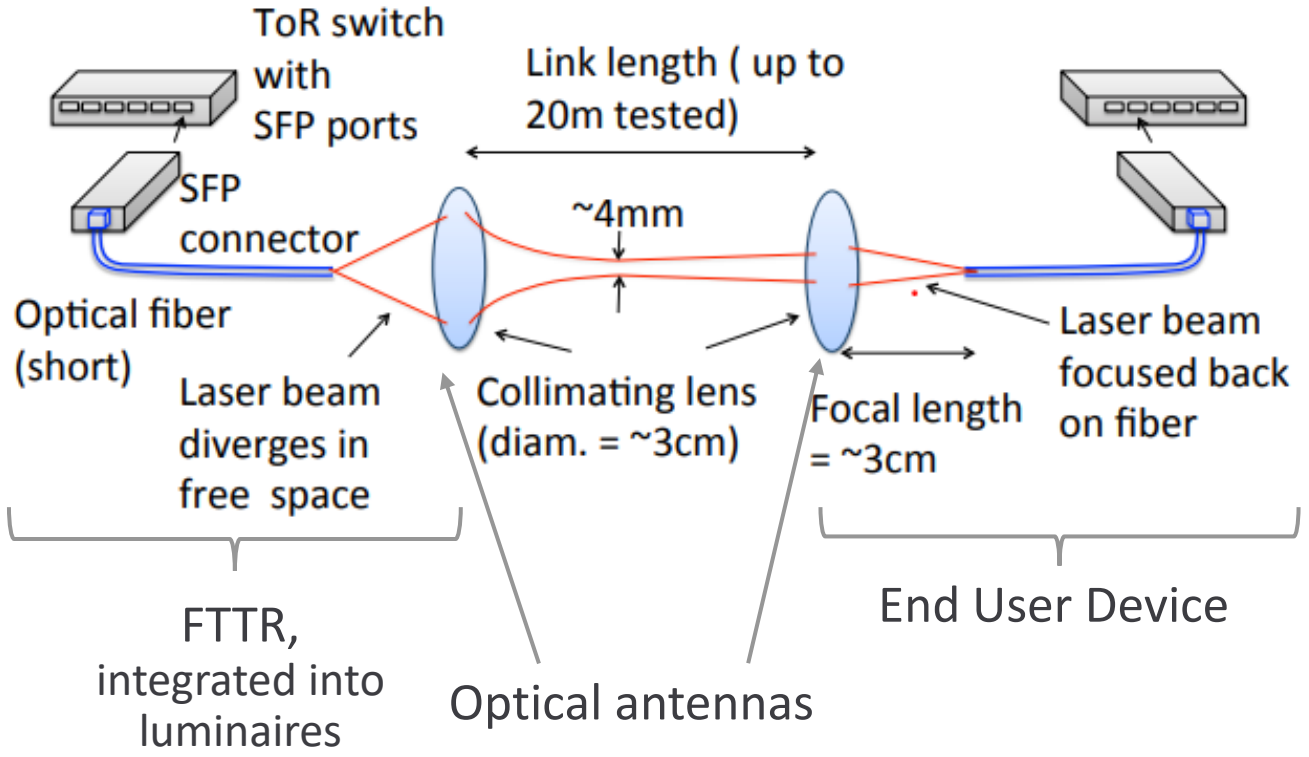
Example: Multi-Dwelling Unit



Use case 3: “Optical antenna” for FTTR

Why not use the FTTR signal directly from the fiber and transmit it over the air?

Below an example for an optical wireless link for a data center use case



From https://people.csail.mit.edu/alizadeh/courses/6.888/papers/firefly.pdf

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Summary

Signify sees potential for FTTR to merge lighting and communications infrastructure

The ceiling is the best place to put wireless AP in a room

Further synergies are possible with optical antennas

Signify supports standardization of FTTR as backhaul to wireless access (RF & optical fronthaul)

FTTR standardization should take into consideration use cases with lighting infrastructure

Thank you!

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For more information about Trulifi by Signify: https://www.signify.com/global/innovation/trulifi