

An Overview of Emerging Wireless Communication Systems in 5G

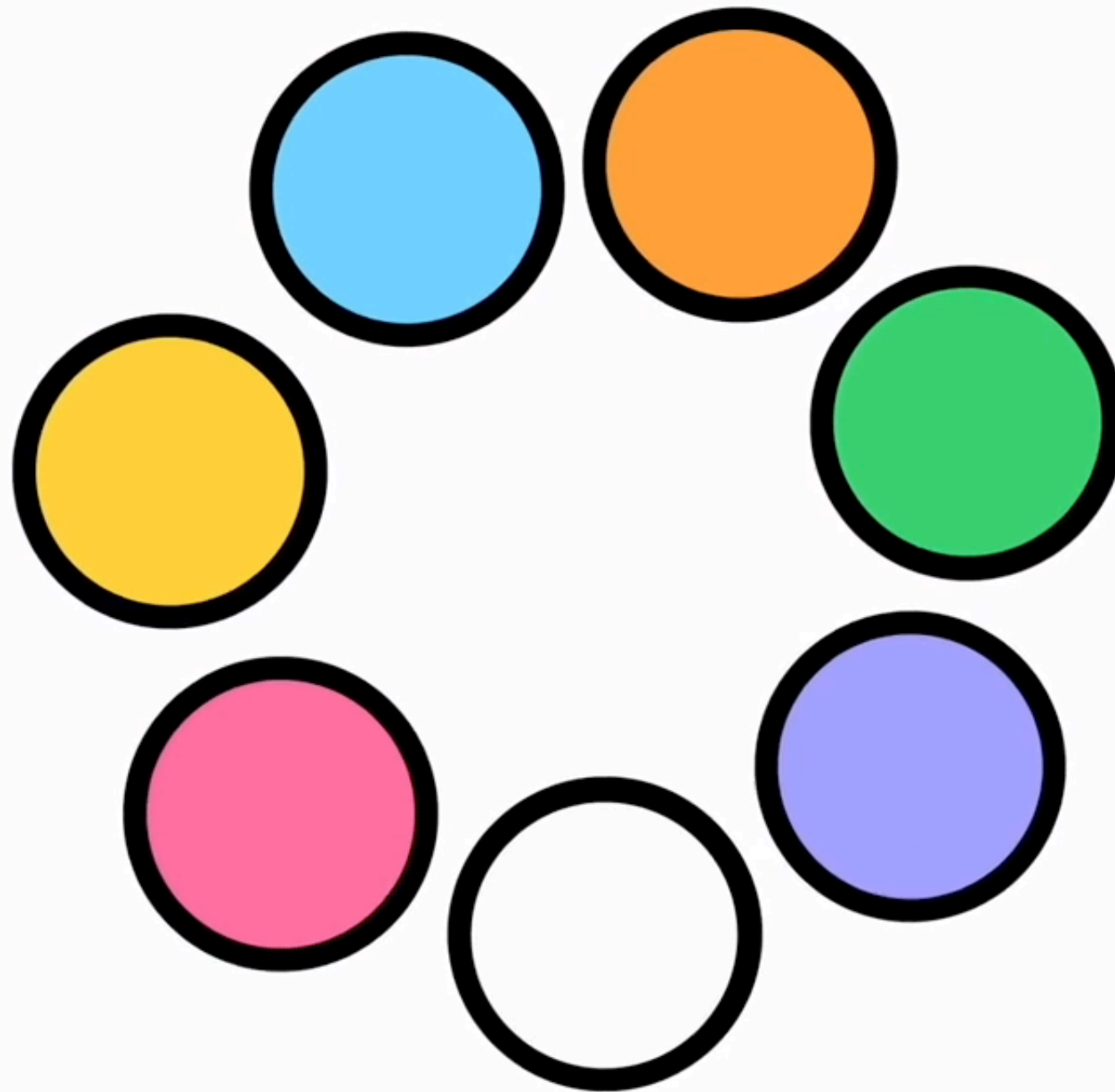
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Ananya Pandya, Bhargav Bhatt

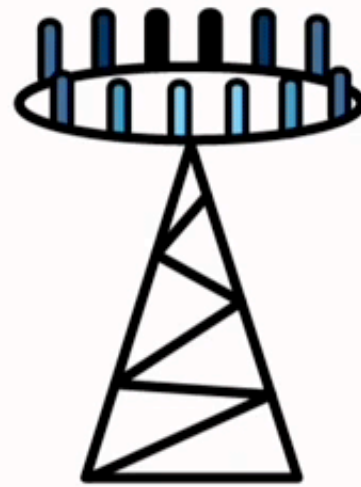
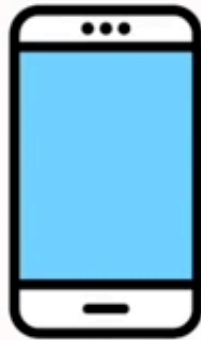
Outline

- Introduction
- Emerging Technologies
 - Li-Fi
 - LoRa
- Applications of 5G
- Conclusion

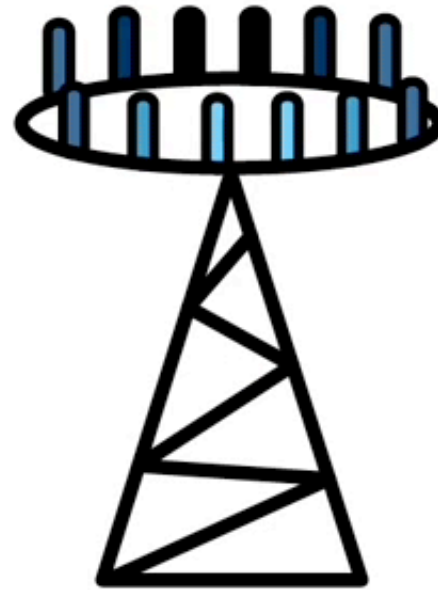
Introduction



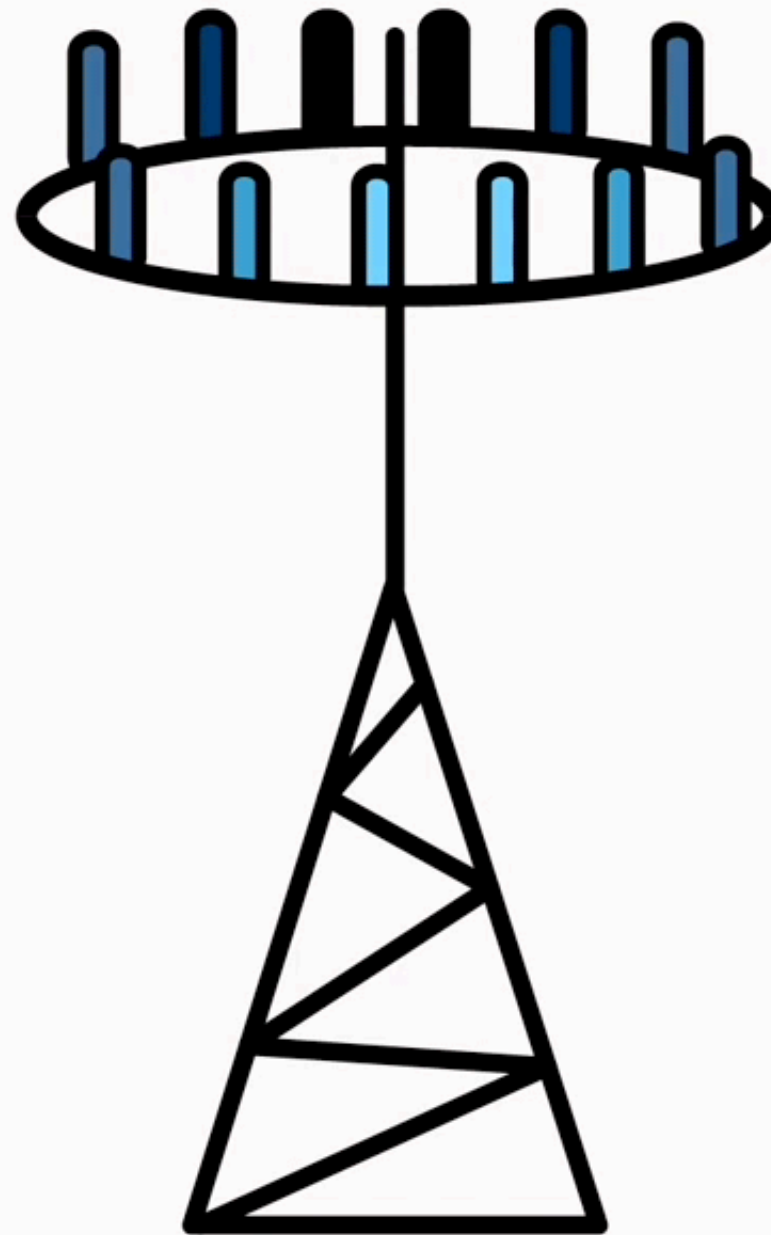
Milimeter Waves



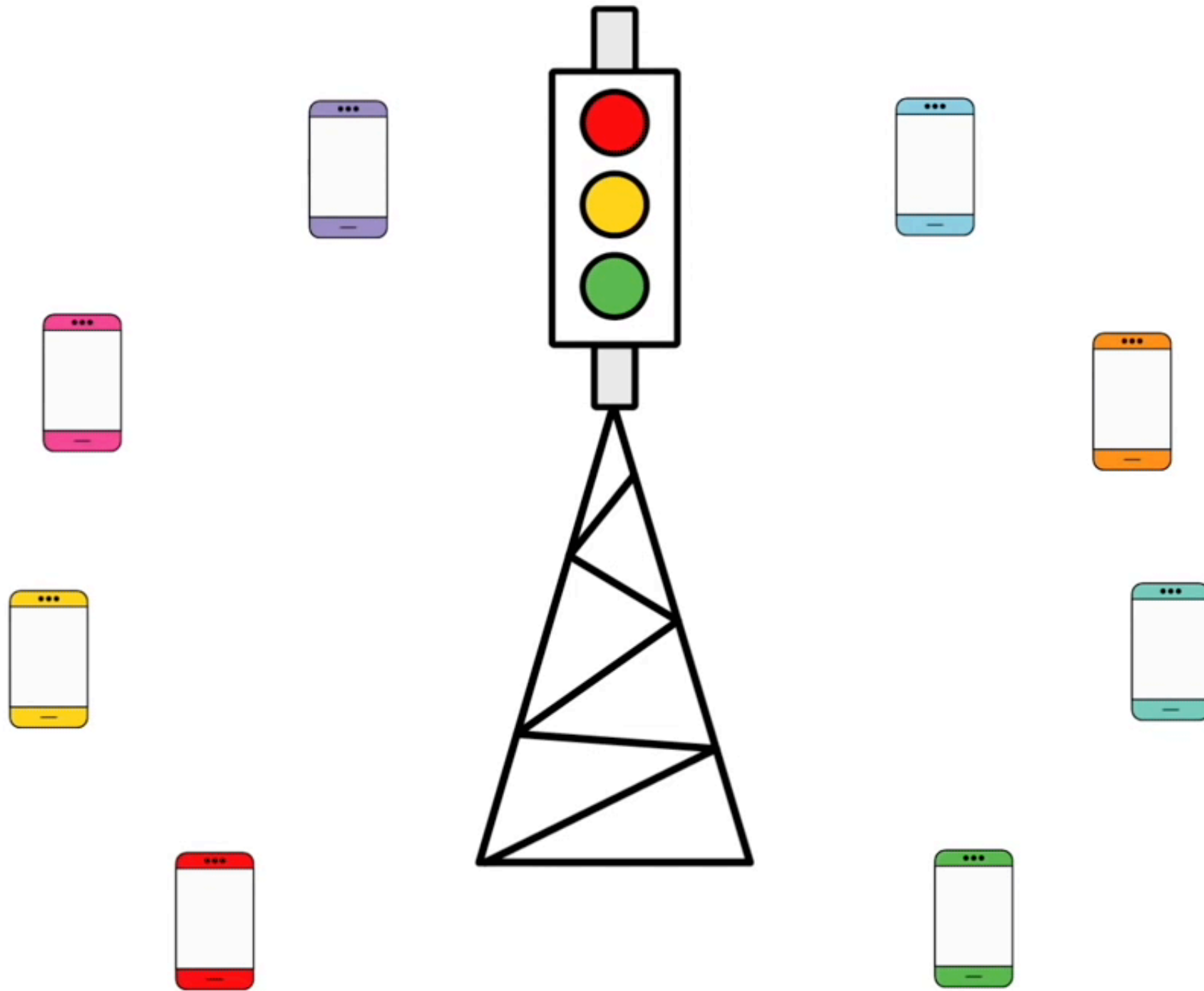
Small Cells



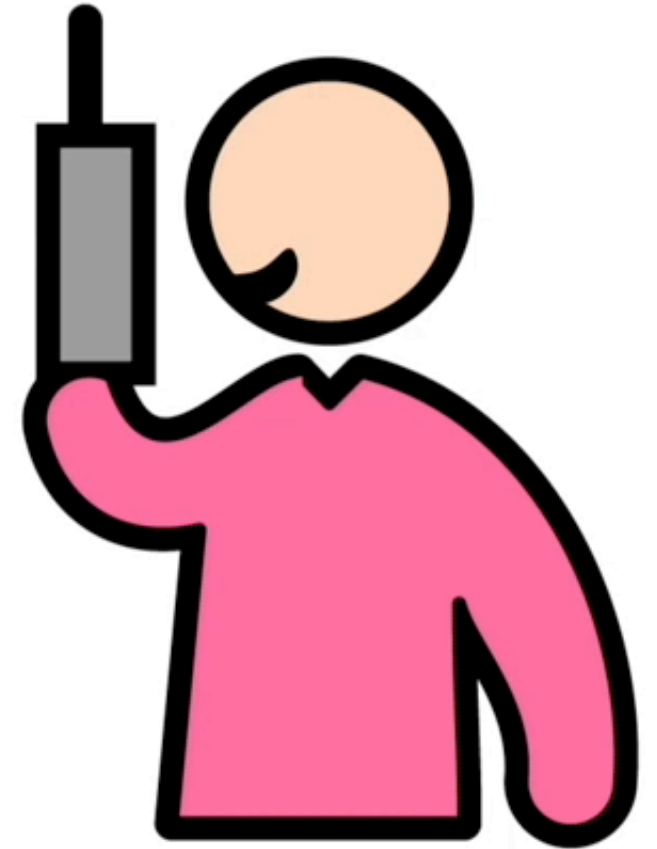
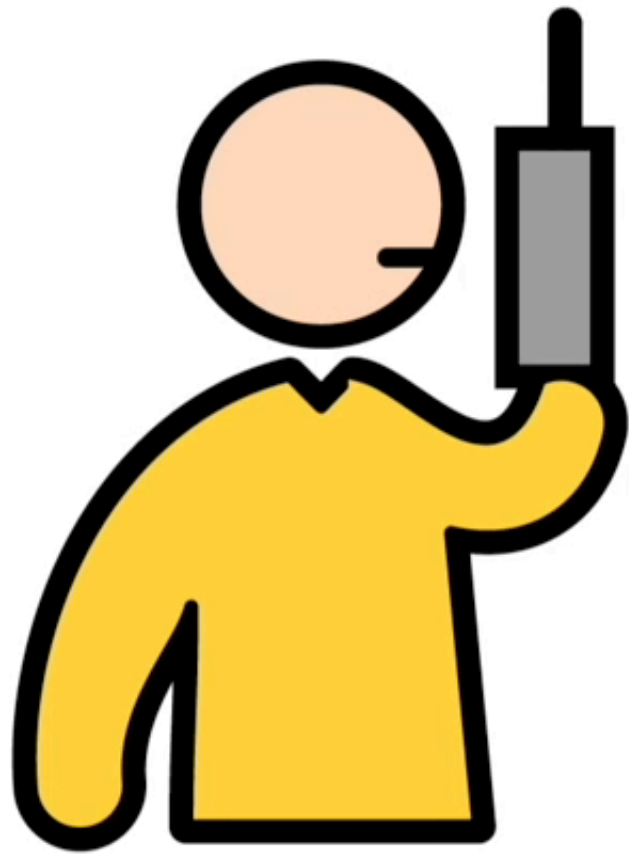
Massive-MIMO



Beamforming



Full-Duplex



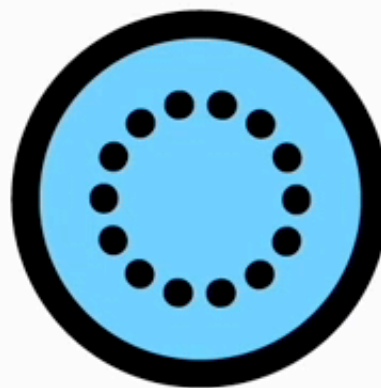
Introduction



**Millimeter
Waves**



Small Cell



**Massive
MIMO**



Beamforming



Full Duplex

Emerging Technologies

Li-Fi

What is Li-Fi ?

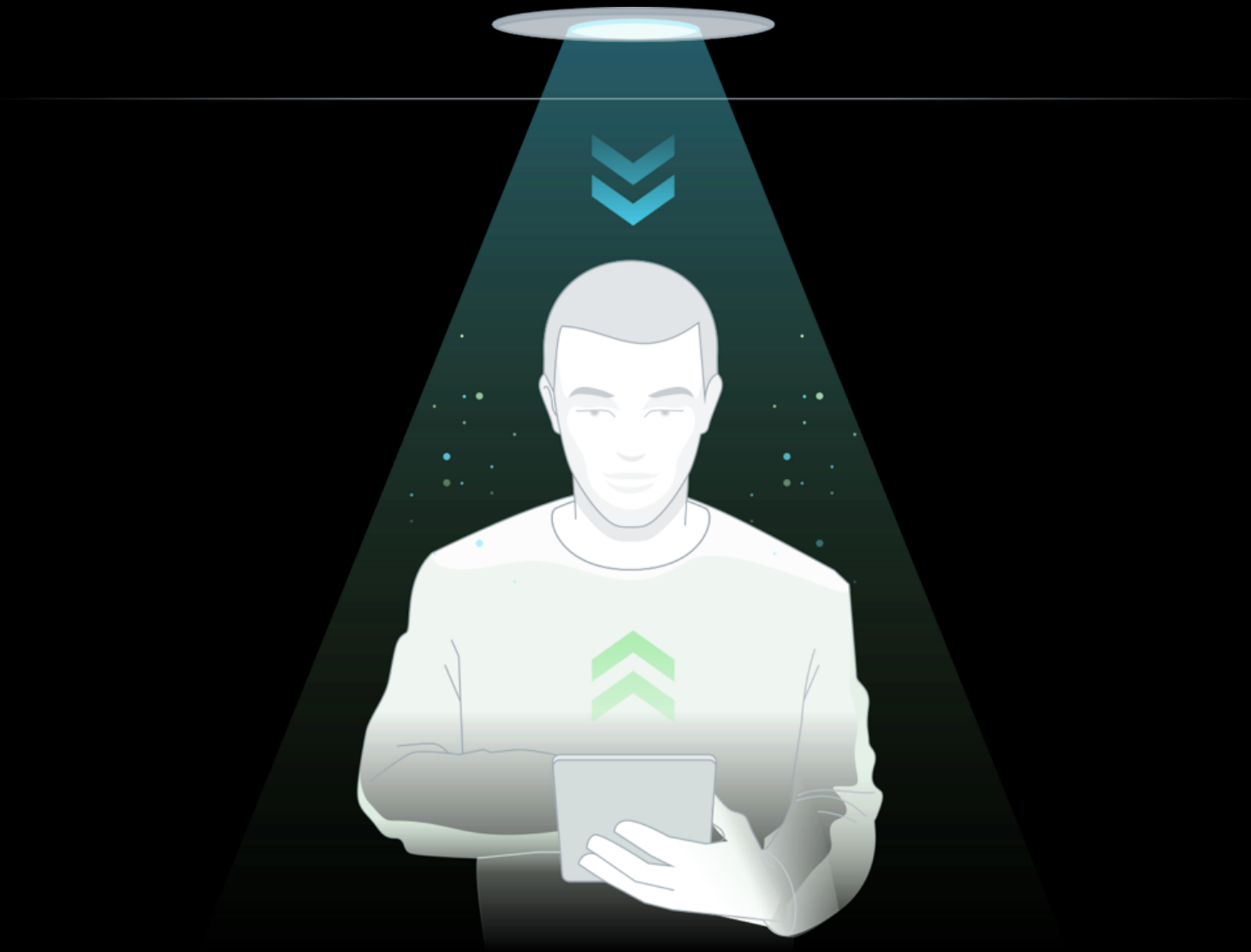
- Li-Fi - Light Fidelity
- Invented by Harald Haas from University of Edinburgh, Scotland in 2011.
- Li-Fi uses Visible Light Communication (VLC).



Source: comsoc.org

Li-Fi

Li-Fi



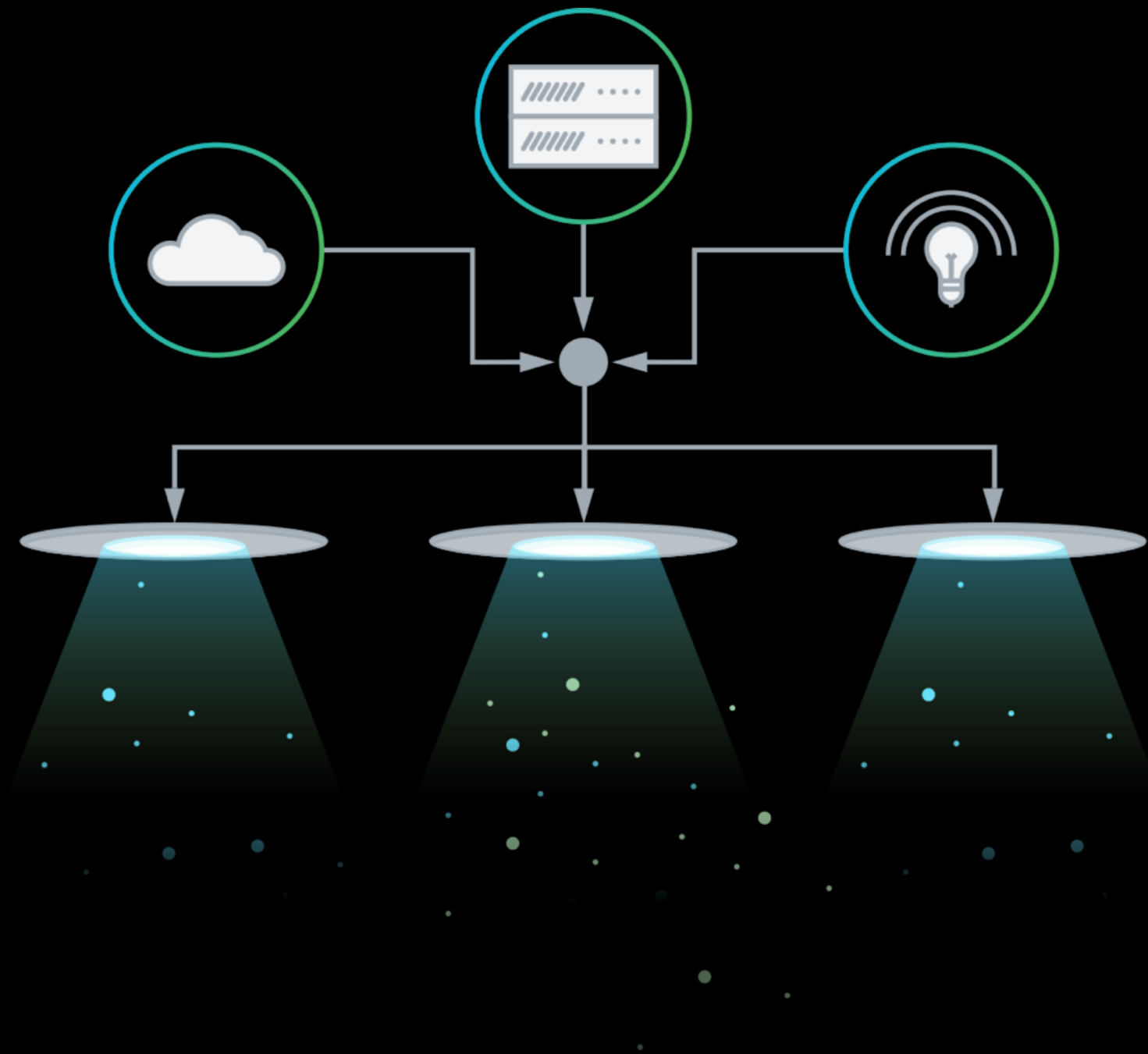
Bi-Directional & Full Duplex

Li-Fi



Fully Networked for full Mobility

Li-Fi



Light & Communications in single infrastructure

How Li-Fi works ?



Applications of Li-Fi

- Security
- Cellular Communication
- EMI Sensitive Environments

Li-Fi in Future...

A dark blue background with a complex network of glowing white lines and dots, resembling a constellation or a data network. The lines connect various points, creating a web-like structure. In the center, the text "LiFi" is displayed in a bold, white, sans-serif font. To the left of the text, there is a small, bright blue light source with several small dots trailing off to the left, suggesting a signal or data flow.

LiFi

Li-Fi Use case



Source: purelifi.com

Babcock is pioneering leading edge engineering services using Li-Fi.

Oxford Researchers Achieve 224 Gbps Connection Using Light: LiFi Will Let You Download 1.5GB Movie In A Blink

Source: techtimes.com

Philips Lighting introduces LiFi: broadband data through light

Source: philips.com

LoRa

- Chirped Spread Spectrum (CSS) radio modulation format.
- Originally found by French Company Cycleo
- Overtaken by Semtech Company in 2012
- Launch of SX1272 chip in 2013

LoRa Alliance

76

Network Operators

57

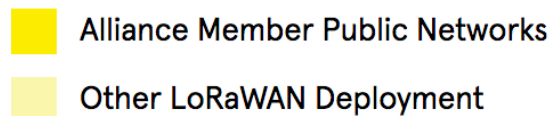
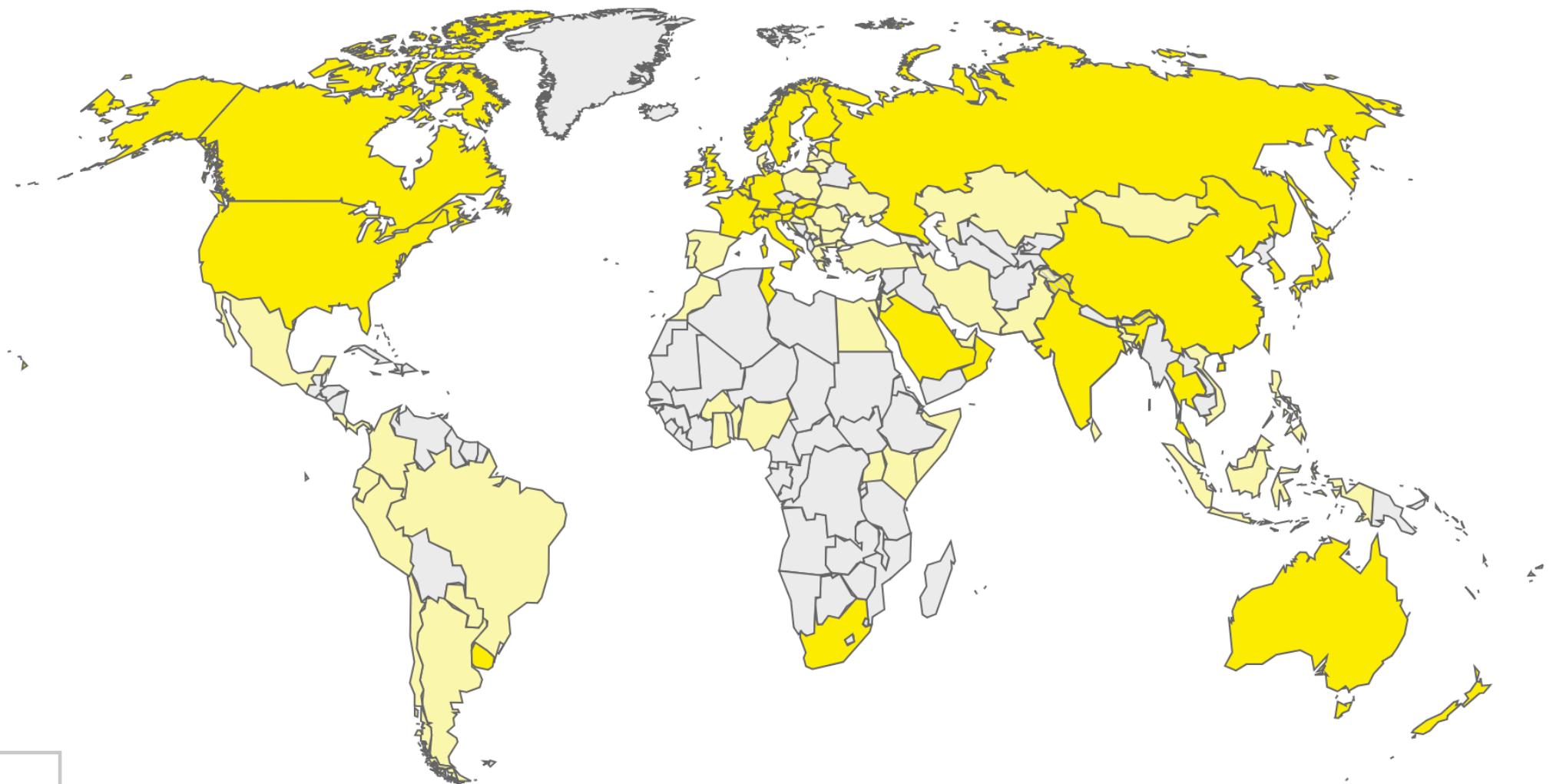
Alliance Member
Operators

43

Countries operating in

100+

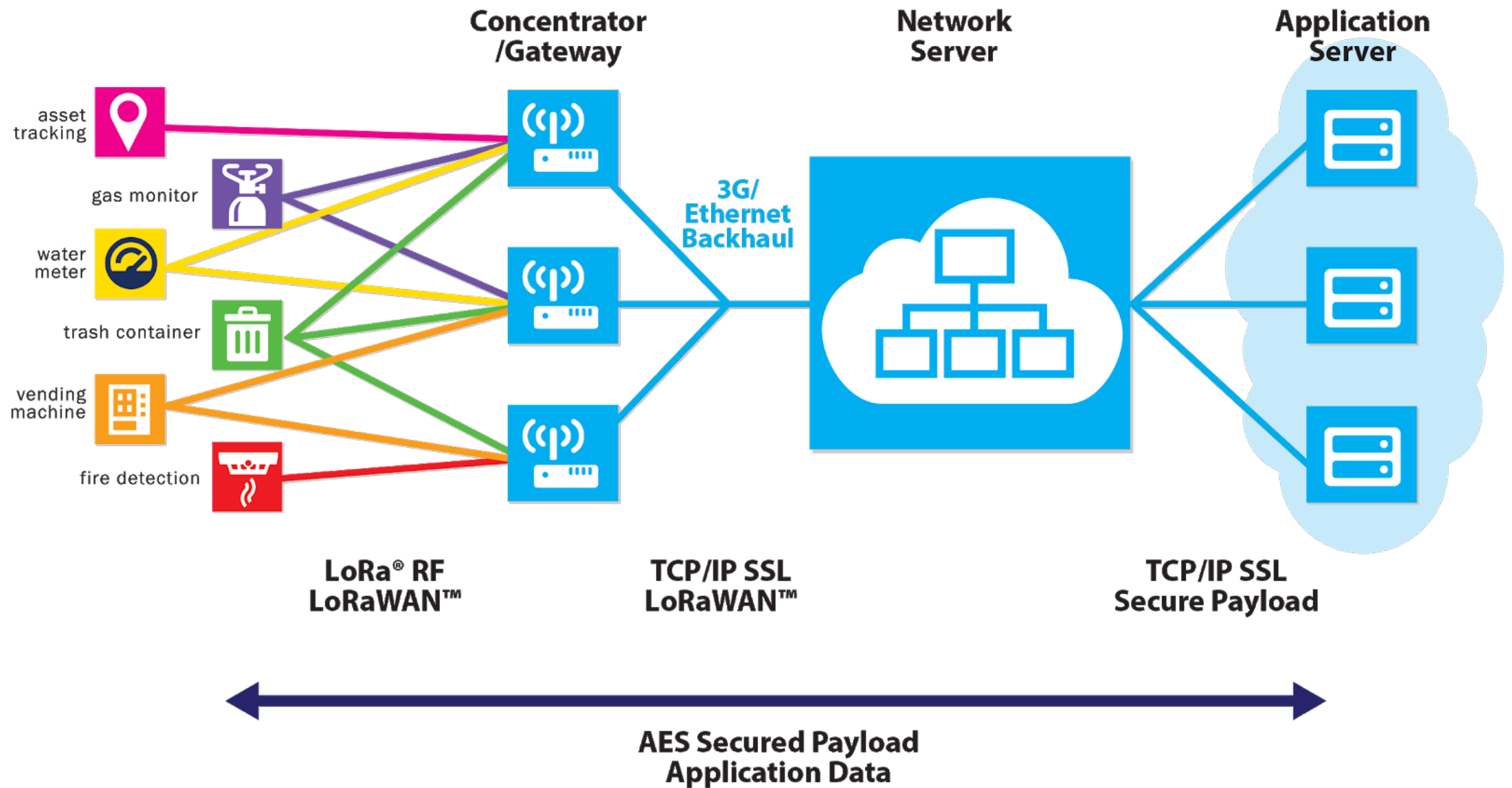
Countries with
LoRaWAN Deployments



LoRa - Key Features

- Long Range
- Low Power
- Multi-usage
- Low Cost
- Geolocation
- Secure

LoRaWAN Network



LoRaWAN Network Protocol

Application

LoRaWAN MAC

MAC options

Class A

Class B

Class C

LoRa Modulation

Regional ISM band

EU 868

EU 433

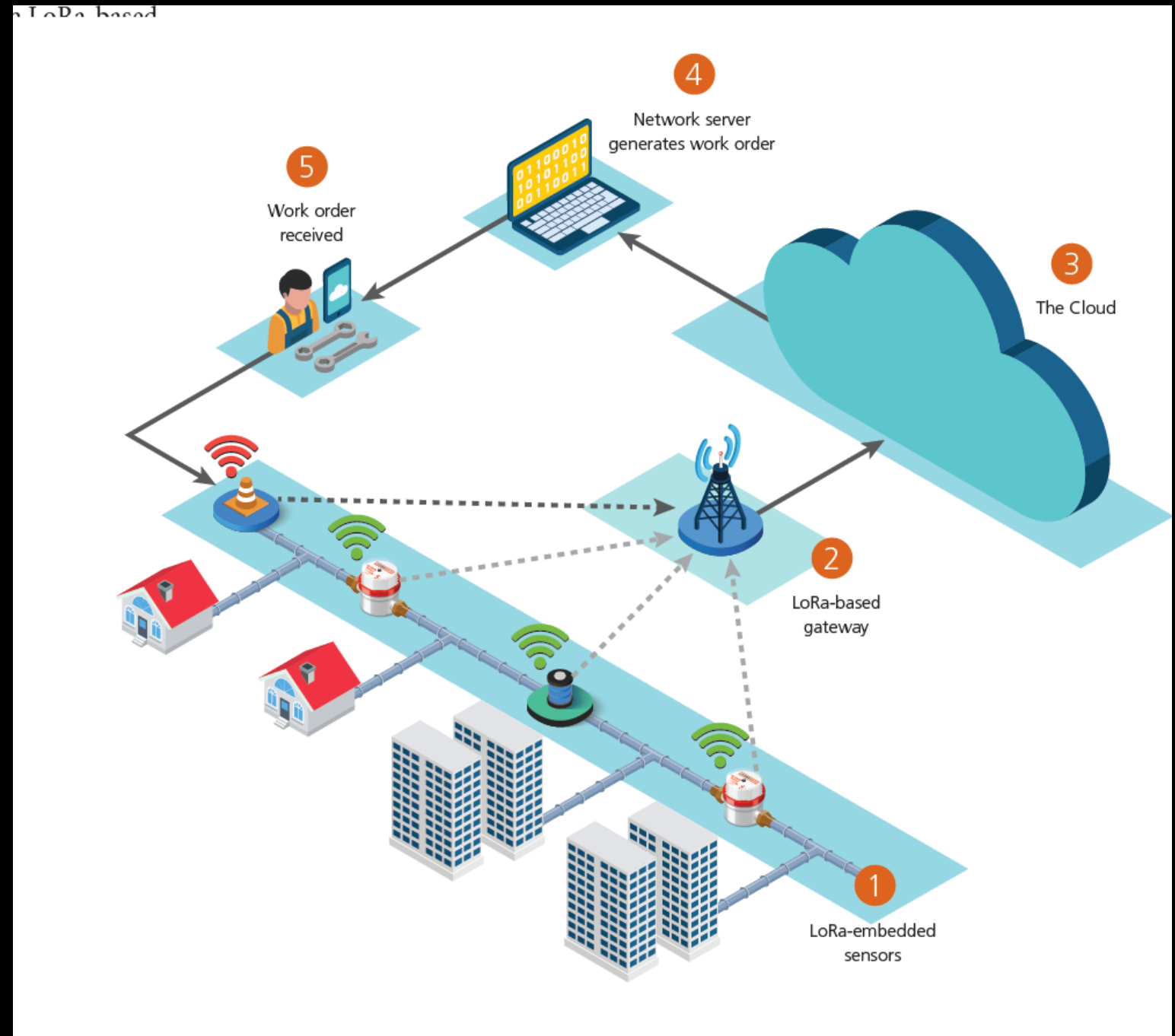
US 915

AS 430

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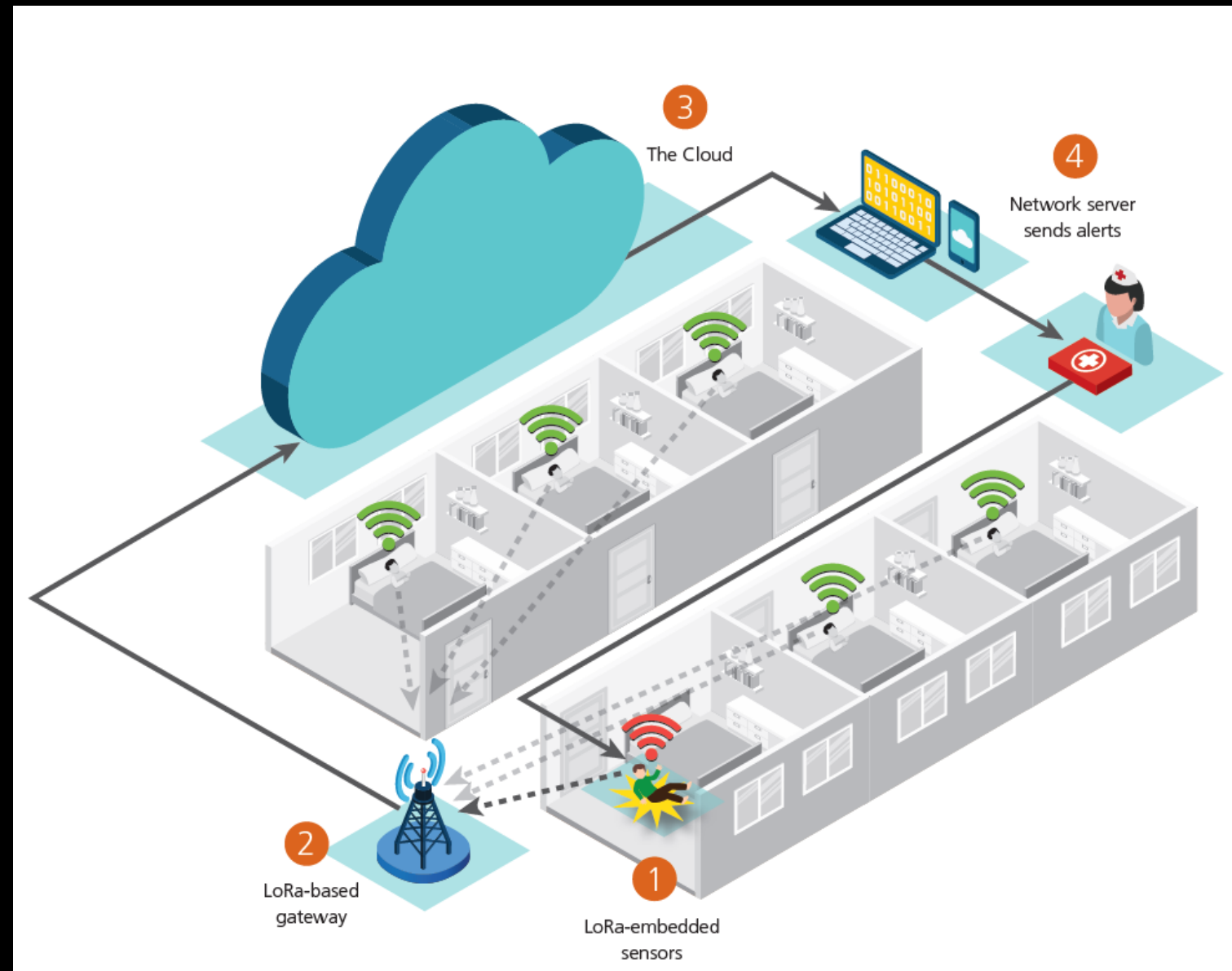
LoRa - Water Flow Monitoring

- Leak detector
- Smart water meters
- Fire hydrant monitors
- Automatic Valve shutdown



LoRa - Fall Detection

Reduces the impact and consequences of falls among the elderly people by detecting and reporting such occurrence.



Applications of 5G

Applications of 5G

- Internet of Things (IoT)
- Smart Vehicles & Transport
- Augmented Reality/Virtual Reality
- User centric Computing Services

Connected Cars



AR/VR



AR/VR



Conclusion

Thank You...!



Millimeter
Waves



Small Cell



Massive
MIMO



Beamforming



Full Duplex

Discussion

Q1: Will 5G be able to scale and find appropriate business demands ?

Q2: Do you think that Li-Fi will be as acceptable as Wi-Fi ?

Q3: Do you want your home appliances to be equipped LoRa technology ?

Q4: Will there be a relation between 5G and Wi-Fi ?

Q5: What are the factors that are driving the spike in mobile video traffic ?

Q6: Do you really think we need 5G in terms of speed & is 4G LTE sufficient for regular use?