Introduction

Zero1 LiFi Technology LLC

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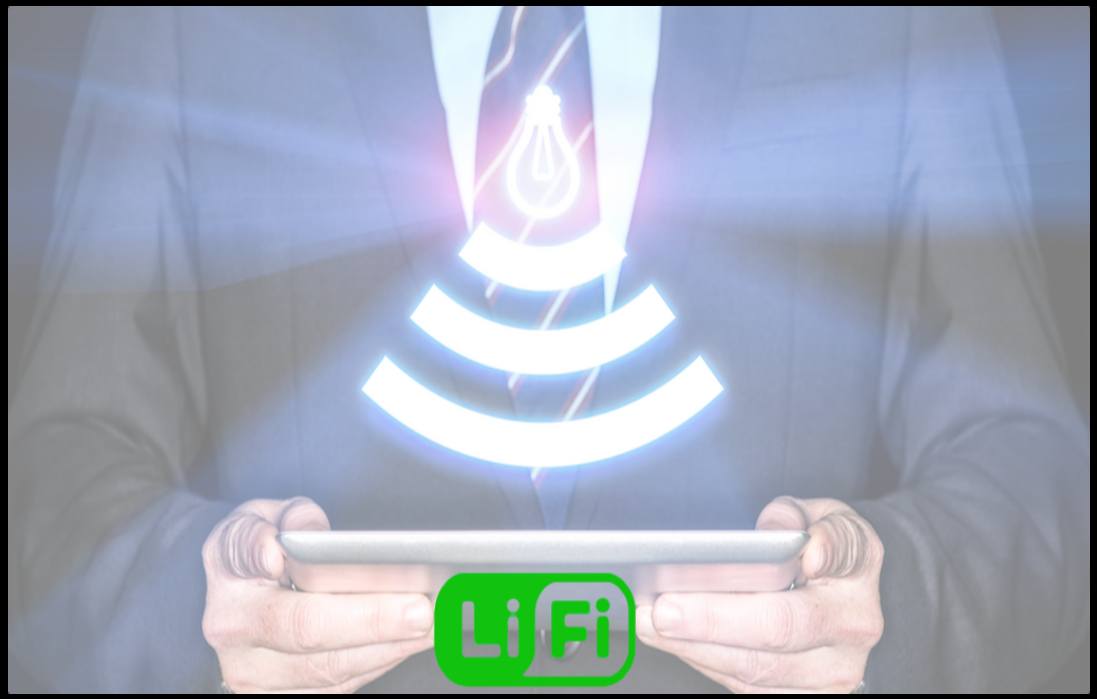
LiFi (Light Fidelity)

- LiFi is a wireless communication technology, which utilizes light to transmit data and position between devises. The term was first introduced by Prof. Harald Haas during 2011 TED Global Talk in Edinburgh.
- LiFi uses lights to send data embedded in its beam. LiFi holds the key to solve the challenges faced by 5G. LiFi can transmit at multiple gigabits, is more reliable, virtually interference free and uniquely more secure than radio technology such as Wi-Fi or cellular.

LiFi



Why LiFi

- Faster
- No Interference
- No radio frequency
- More Secure
- Reliability & Data Density
- Smart offices
- Low Latency

Optical camera communication

- OCC is a One directional LiFi technology to broadcast data. OCC Driver modulates the LED light at very high frequency –invisible to the naked eye-and transmits information digitally. We use the camera of the smart phone or tablet for the detection of LiFi signal.
- It can be used with any LED available in the Market by adding a simple Halo Driver, No Additional electric power or hard wares required.
- The download flow uses visible light (VLC)

OCC Requirements

« **FOCCAL** » Zero1's offer is global, modular or 100% integrated & composed of hardware and software

Halo Driver

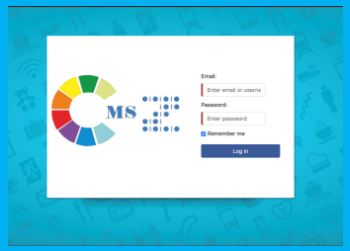
Electronic card modulates LED light at very high frequency - and transmits information digitally

FOCCAL Portal Appli. Web

To order drivers and licences and manager each LIFI spaces

FOCCAL CMS

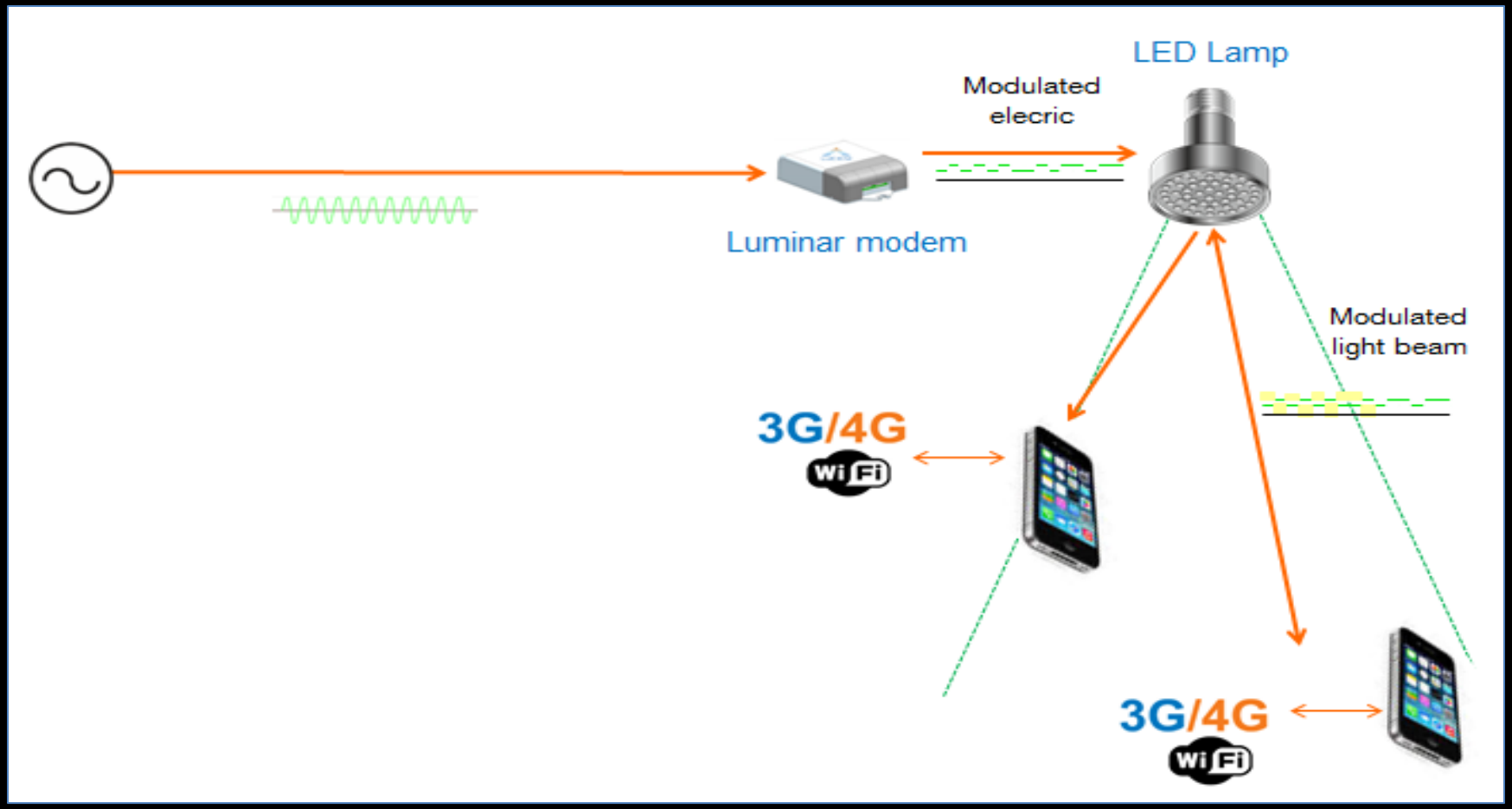
Application web to manage and distribute contents for broad cast mapping and indoor geo localization



MOBILE APP /SDK

Mobile application strain or SDK to integrate in your own app.

How OCC works



Use Cases of OCC

- Retail , Shopping Malls (Marketing and Push notifications)
- Airports and Railway stations
- Smart Cities
- Hospitals , Inside the Aircrafts
- Museums and Art Gallaries
- Smart living
- Indoor Mapping and Indoor positioning
- Vehicle to Vehicle or Things communication
- AR and VR

Founder Member of LCA

LCA is an association of Global leaders in the communications, lighting, infrastructure and device manufacturing industries to promote new wireless technologies enabling Light Communications (LC). The LCA is an open, non-profit association of members who aim to promote Light Communications technology with a consistent, focused and concise approach. The LCA will highlight the benefits, use cases and timelines for Light Communications adoption. The organisation will align innovative leaders across the industries that light and communications touches, defining standards for education, communication, and interoperability

LCA Vision

Establish and Advocate the use of standards

Driving a consistent, focused & concise approach to market education that

will highlight the benefits, use cases & timelines

For Light Communications

Why LCA

- **Interoperability and multi-vendor supply** are essential for mass market adoption
- **Technology adoption is faster and easier** when the entire ecosystem is **communicating the same message**
- **Provide a known heartbeat/pace for the industry**, setting customer expectations

- Writing the technical standard can be done through
- A technical standards body, *e.g.*, ETSI, IEEE
- Or technical working group in a new ‘Alliance’, ‘Special Interest Group’ (SIG) or ‘Forum’

Standards: what are they & who's waving them?

- There are 4 primary standardization bodies for digital communications:
  - IEEE – generally access technologies
    - 802.3 – Ethernet network protocol
    - 802.11 – Wi-Fi
    - 802.15.4 – ZigBee
    - 802.15.3 – Bluetooth
  - ITU-T – generally core network technologies
    - G.hn – powerline communications
    - G.FAST – VDSL, etc.
    - G-PON – optical
  - 3GPP
    - Rev. 14 – 4G Advanced
    - Rev. 15 – New Radio AKA "5G"
    - Rev. 16 – Software Defined Networking (Network virtualization) = Real 5G
  - Internet Engineering Task Force – Internet ☺

LiFi standardization efforts

- **802.11 has the opportunity to exploit the light spectrum**

Existing Standardization Efforts

ITU-T Study Group G.vlc

- Based on G.hn – Home Networking standard
- Customer Premises Equipment may use G.hn

802.15.7r1

- Originally based on 802.15.4 - Not designed for networking, e.g., NO 48 bit MAC address, different security,…

802.15.13

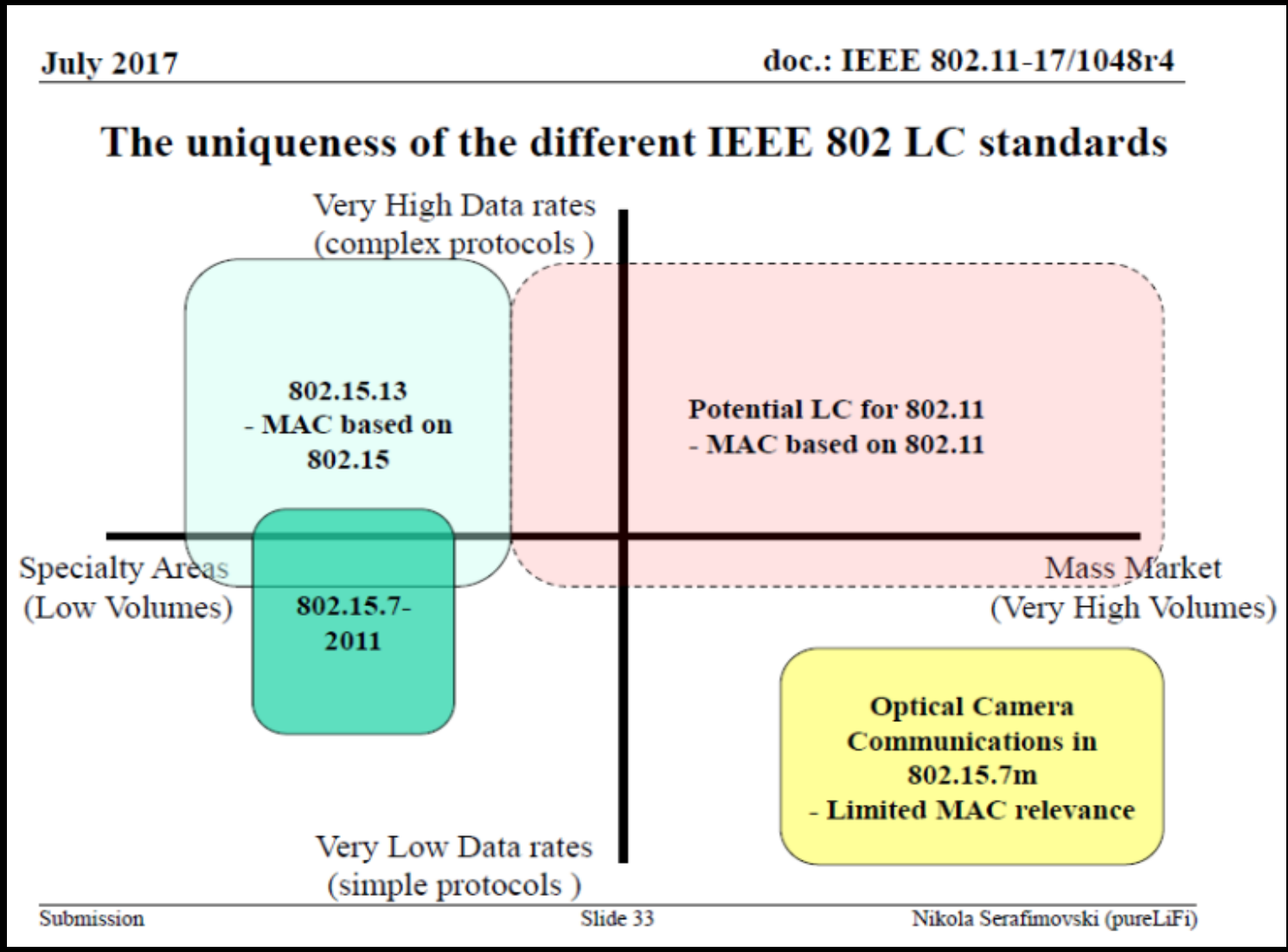
- Based on 802.15.7r1 with focus on Muli-Gigabit/s Optical Wireless Communications suitable for speciality wireless networks

Problem

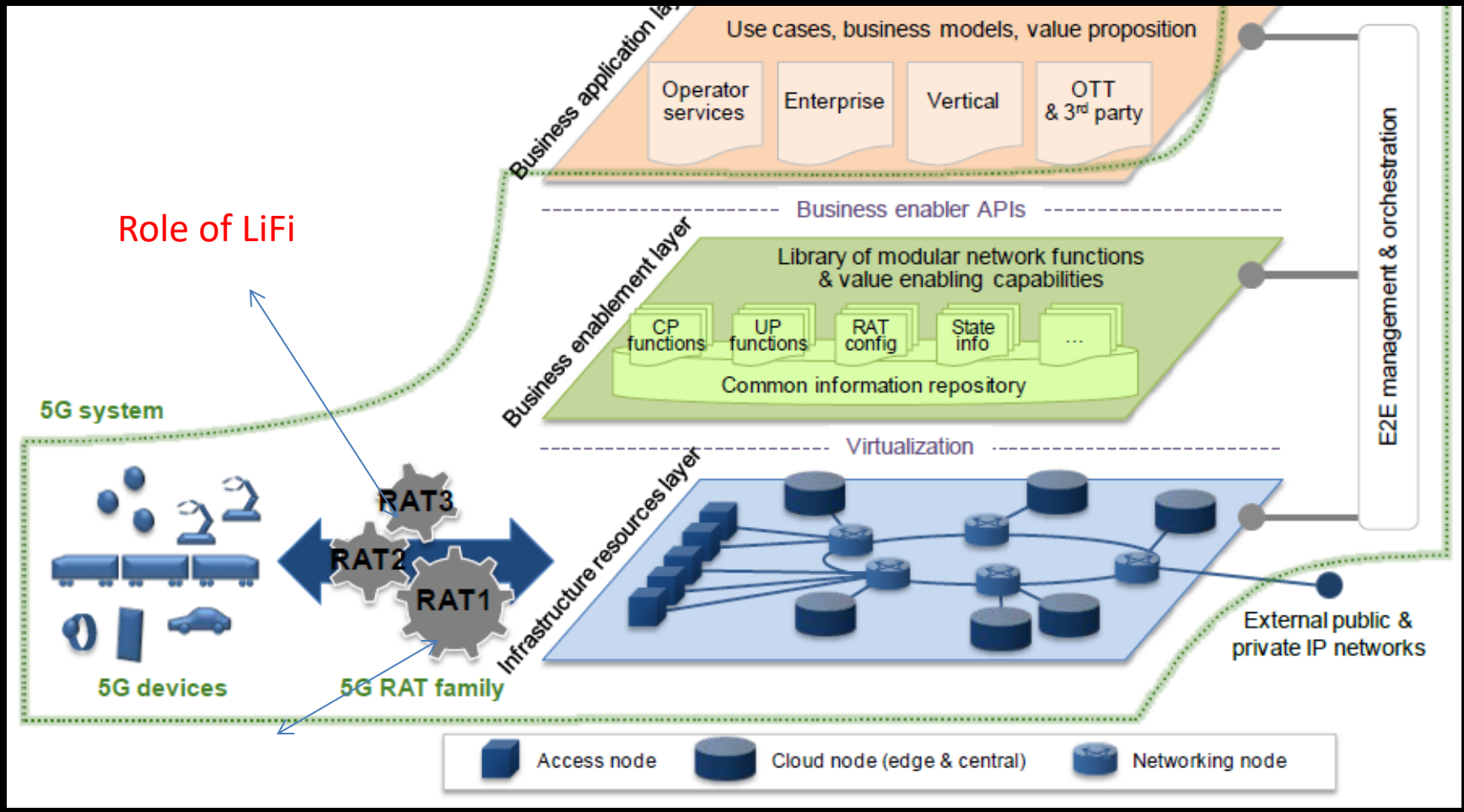
Neither effort has the comprehensive ecosystem of partners required for mass market adoption of LC.

Proposed – 802.11 has unique ecosystem

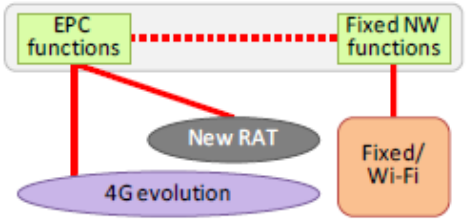
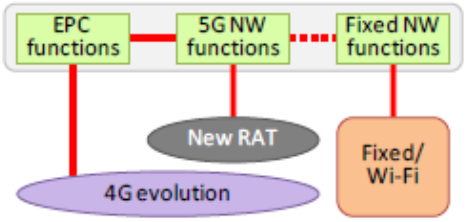
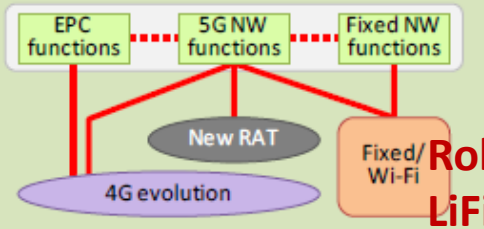
LiFi standardization efforts



What is 5G? 5G as seen from the Telecoms



5G from Telecoms – 3GPP Rev. 15 (high level)

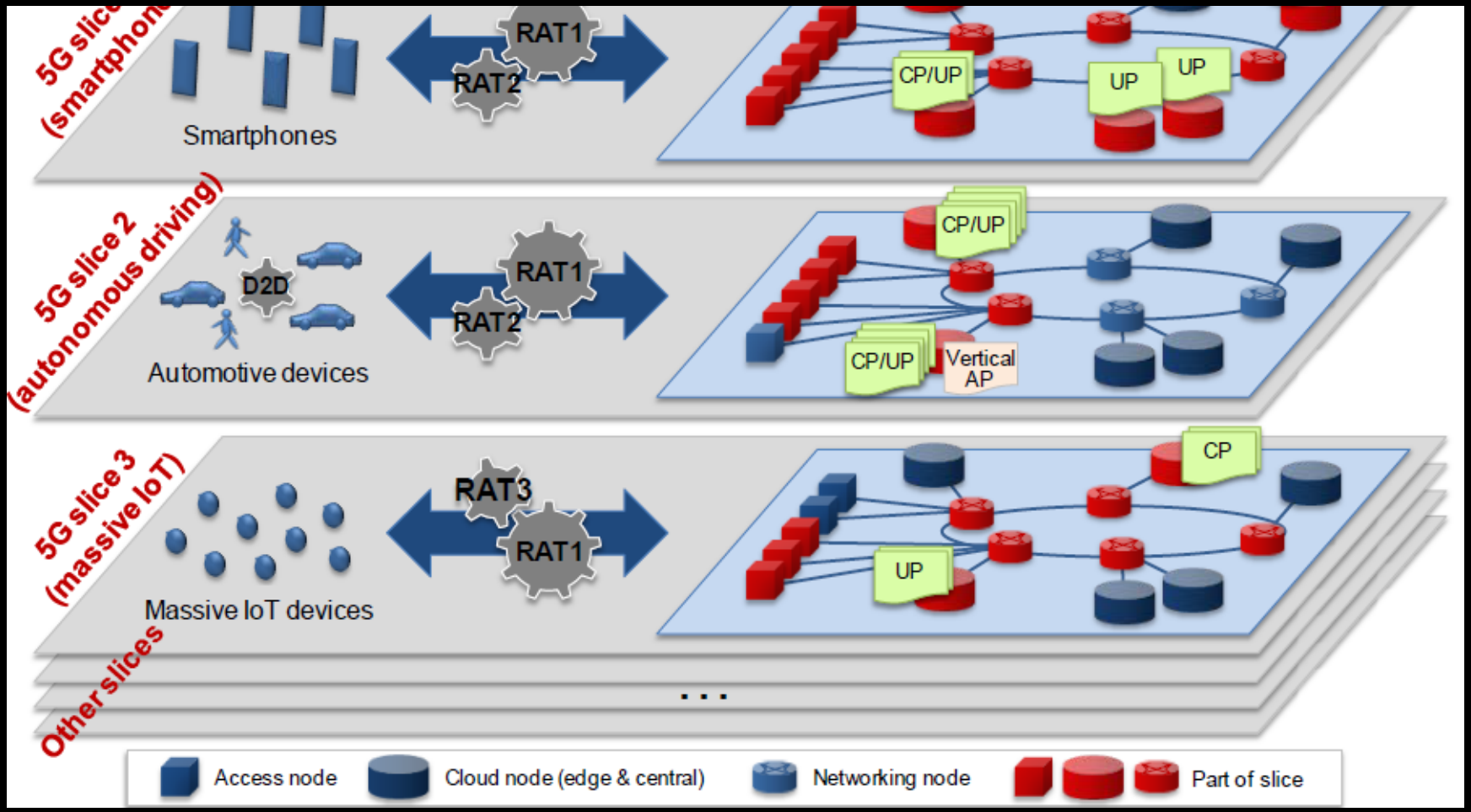
	Option 1	Option 2	Option 3
			 Role of LiFi
Pros	▪ No changes to 4G RAN ▪ No need for revolutionary 5G NW functions design	▪ No changes to 4G RAN ▪ 5G NW functions/ new RAT design can be optimized to fully benefit from new technologies (e.g., virtualization)	▪ 5G NW functions/ new RAT design can be optimized to fully benefit from new technologies (like virtualization) ▪ Solves mobility issues of option 2 ▪ Provides a sound migration path
Cons	▪ Tied to the legacy paradigm for all the use cases (which may be expensive)	▪ New design could only be utilized where there is new RAT coverage ▪ Potential signalling burden due to mobility if the new RAT does not provide seamless coverage	▪ Potential impact on legacy RAN to operate concurrently with legacy CN functions and 5G NW functions.

NW Network
EPC Evolved packet core
RAN Radio access network
RAT Radio access technology

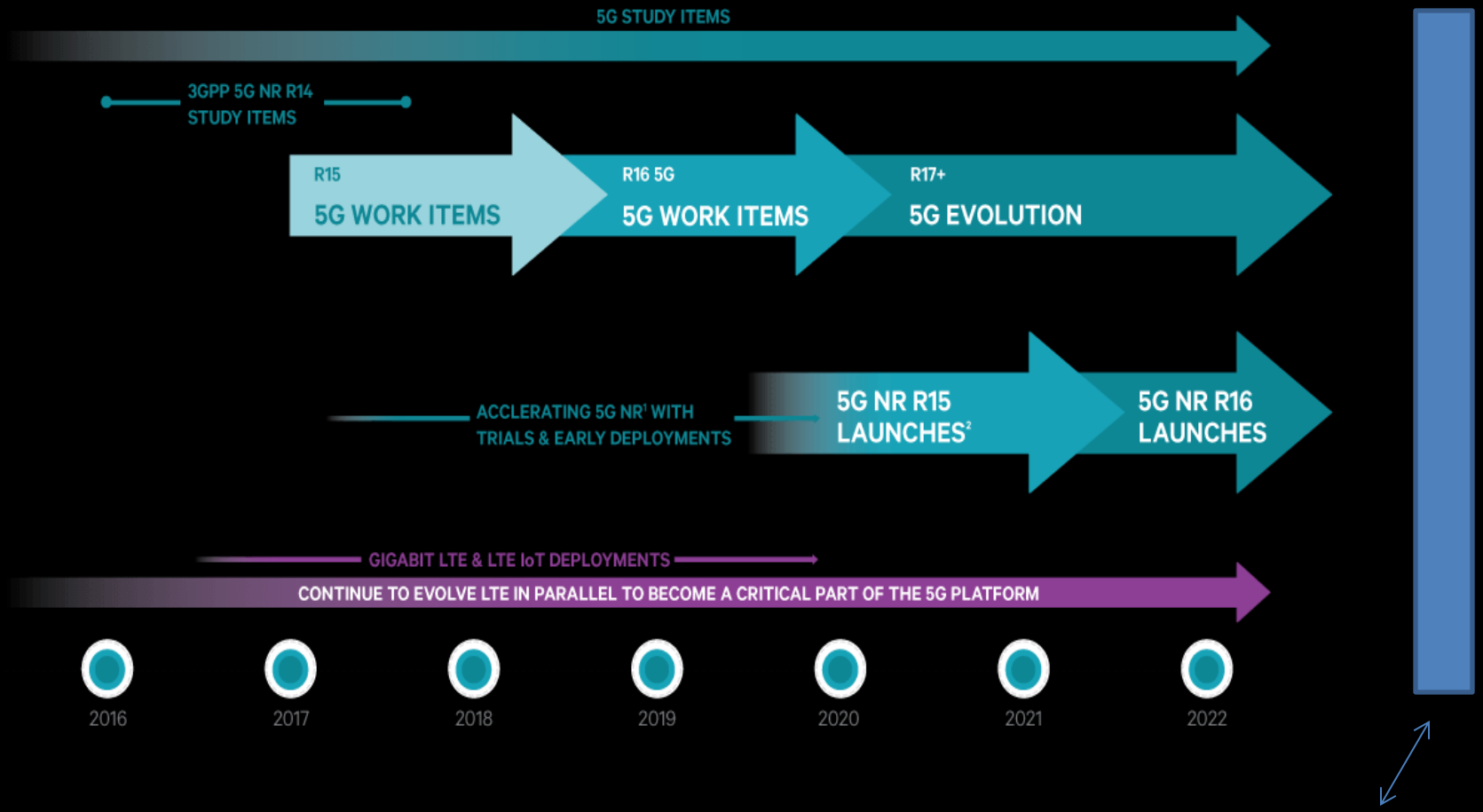
Defined interface/ reference point
Potential interface/ reference point

Figure 10: Access-technology interfacing options[2]

5G from Telecoms – 3GPP Rev. 16 (high level aim)

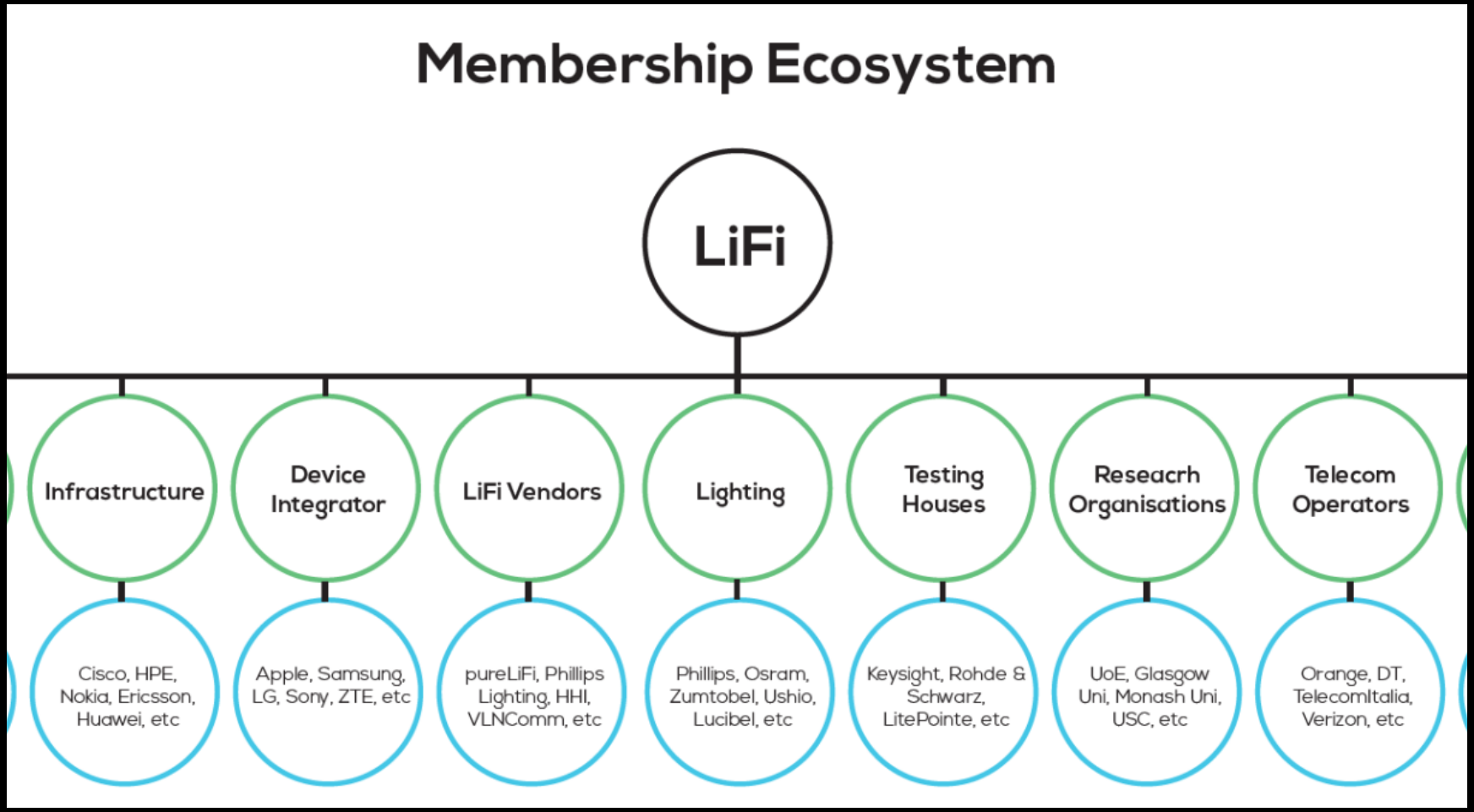


3GPP Rev. 15 and Rev. 16 timeline (Qualcomm)



SYNC-LiFi AND 5G

LiFi Ecosystem (L C A)



Where is LiFi in 5G?

- LiFi Industry Association create a white paper to position LiFi in the 5G context
  - *"Light Communications for Wireless Local Area Networking"*

- Co-authors:
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  - Ronan Lacroix (DT),
  - Micheline Perrufel (Orange),
  - Sylvian Leroux (Orange),
  - Simon Clement (Liberty Global),
  - Nirlay Kundu (Verizon),
  - Dominique Chiaroni (Nokia),
  - Gaurav Patwardhal (HPE),
  - Andrew Myles (Cisco)
  - Christophe Jurczak (Lucibel),
  - Marc Fleschen (Zero.1),
  - Marty Ragusky (VLNComm),
  - Volker Jungnickel (HHI)
  - Dimitri Ktenas (CEA Leti),
  - Harald Haas (University of Edinburgh)

Cellular Generations	Paradigm Shifts	Service pull	Impact
1G → 2G	Analogue to digital	Mobile telephony	Revolution
2G → 3G	Small cell concept	Mobile Internet	Evolution
3G → 4G			
4G → 5G	Multi-Access Network	Machine to machine communications	Evolution
Beyond 5G New Radio (3GPP Rev. 15)	**RF to Light**	**LaaS, IoT and eMBB**	**Revolution**

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Thank You