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# Multiuser Indoor Visible Light Communication Systems

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Abstract : Optical wireless communications (OWC) has recently emerged as a solution to augment radio-frequency-based transmission systems, especially for indoor environments where up to 70% of wireless traffic takes place. An interesting approach is to exploit the visible part of the spectrum; what is referred to as visible light communications (VLC). Advantages such as unregulated spectrum, low cost, and implementation simplicity, are encouraging the use of the VLC technology in a variety of applications. However, such links potentially suffer from problems including the degradation in signal-to-noise ratio due to the presence of ambient noise sources, and multiple reflections that can (in special circumstances) impact the achievable data rate. In our work, we aim at developing efficient multiple access techniques for indoor VLC systems. In addition, we work on developing appropriate cellular architectures for VLC systems

## What is Visible Light Communication?

Visible Light Communication (VLC) basically uses LED lighting infrastructure for providinging wireless connectivity. The technology has numerous advantages such as:

- having huge unregulated bandwidth,
- implementation simplicity,
- transmission inherent security,
- not interfering with current existing RF systems.

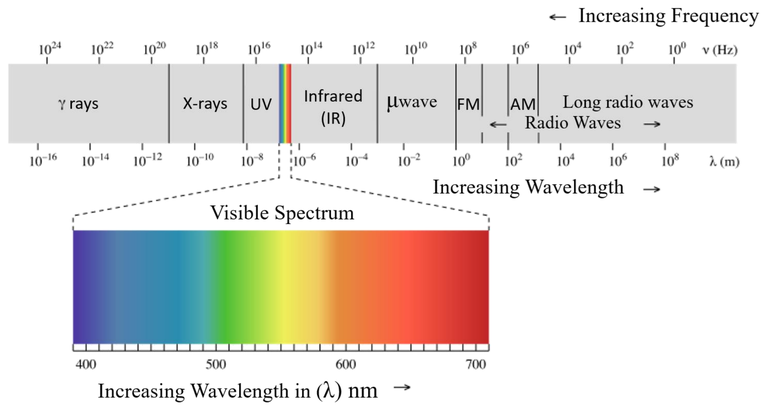



*Figure 1. Visible light spectrum.*

## Multiple Access Techniques for VLC

- Sharing the available resources in the network among the users.
- Important difference with RF: the multiple access techniques for VLC must produce positive and real signals.
- This puts limitations on the applicability of some of the “classical” multiple access techniques used in RF systems.

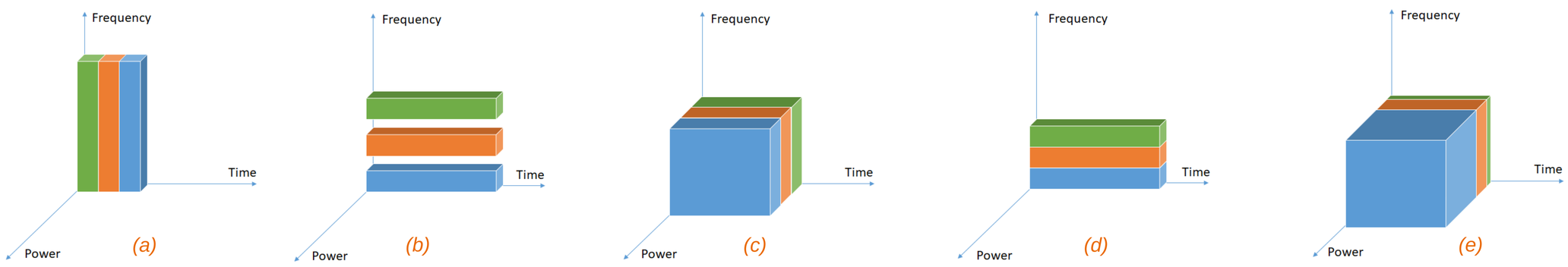
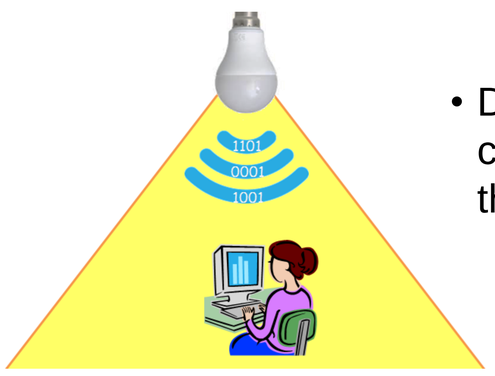



*Figure 2. Time-frequency-power resource sharing for (a) TDMA, (b) FDMA, (c) CDMA, (d) OFDMA, and (e) NOMA.*

## Cellular Architectures in VLC Networks




- Developing appropriate cellular architectures for the VLC context.

*Figure 3. A typical VLC link, where an LED is used for simultaneous illumination & communication.*

## Conclusion

We aim at developing reliable VLC systems supporting high data rates for multiple users. The two research directions we are working on are: developing efficient multiple access techniques, and suitable cellular architectures.

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