Visible Light Communications for Gb/s Indoor Connectivity
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Why Visible Light?

- Create a dual-use lighting-communication system
- Ubiquitous, energy efficient transmitters
- Visible light is suitable for RF sensitive environments
- High data throughput possible
- Secure and safe

Uses:
- Indoor communications (Li-Fi)
- Indoor positioning
- Very short-range outdoor (e.g., V2x)
Applications
Indoor Communications

- Wi-Fi cannot continue to support many users with increasing data demands
- VLC can support > 1 Gp/s per access point with current technology
- Access points can be densely packed with high reuse factor per room
- Can augment Wi-Fi or create a stand-alone system

Figure: Spectral efficiency of several VLC modulation schemes (using LED 3 dB bandwidth) showing advantage of transmitter and receiver-based signal processing
Indoor Localization

- Location based services are growing, enabled by advanced mobile devices
- No currently available wide-spread indoor positioning system
- VLC can achieve cm accuracy
- Can use existing lighting infrastructure – only new LED-driver needed

Figure: Advantage of VLC over Wi-Fi-based positioning. VLC fingerprinting method with site-survey collected using Wi-Fi crowd-sourced data.
Open Research Problems

- What are the fundamental limits of VLC networks?
- What kind of devices are needed to support VLC?
- How does it converge with the current telecomm infrastructure – Wi-Fi, PONs, PoE, PLC, etc.?
- How can communications drive lighting?
- How can emerging technologies exploit VLC:
  - Internet of things (peer-to-peer ?)
  - Cloud computing
  - Personalized health care
  - 5G
- What is the killer app?