Towards a Visible Light **Network** Architecture for **Continuous** Communication and Localization

Jialiang Zhang, Chi Zhang, Xinyu Zhang, Suman Banerjee

University of Wisconsin - Madison

Current Status of VLC Research

- Speed

- More speed

- Localization accuracy

- Higher localization accuracy
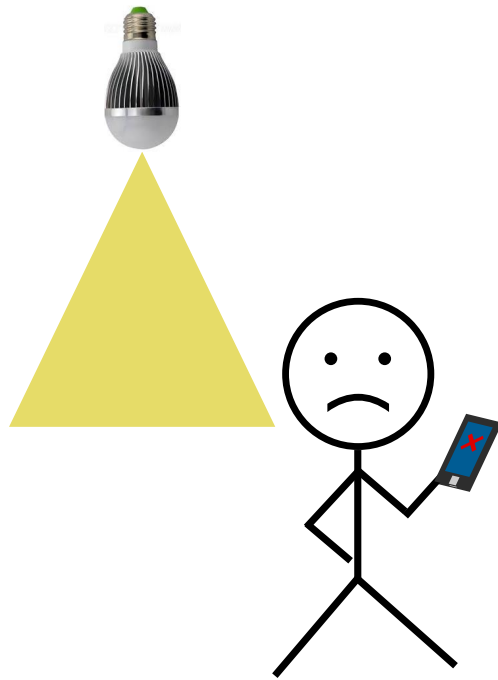
Current Status of VLC Research

Without **mobility**,
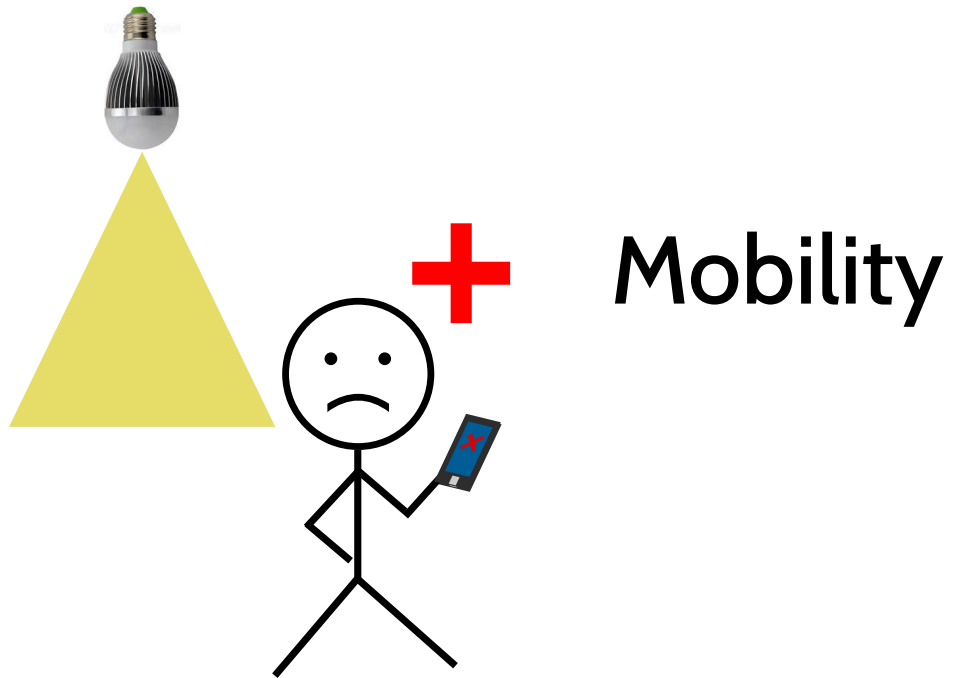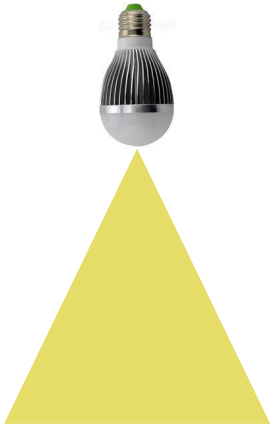   wireless connection and localization mean **nothing!**

Goals

From VLC

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From VLC

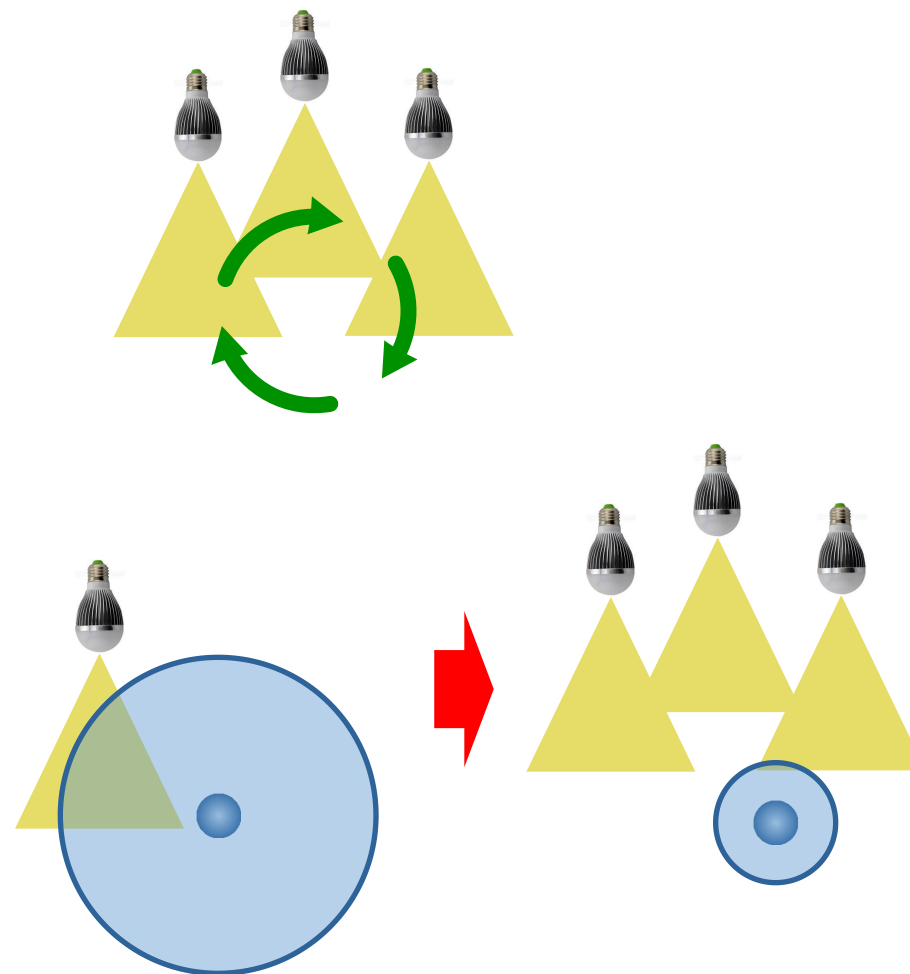
+ Mobility

# Goals

From VLC

+ Mobility = To VLN

Goals

- **Continuous communication**
  - Seamless roaming
  - Uninterrupted service

- **Realtime localization**
  - More AP, better accuracy

Components of VLN

- **Front-haul**
  - Clusters of APs that directly talk to clients

- **Back-haul**
  - Facilitates coordinations between APs
  - Provides Internet access

- **Central server and management algorithm**
  - Maximize overall trhoughput
  - Guarantee uninterrupted service
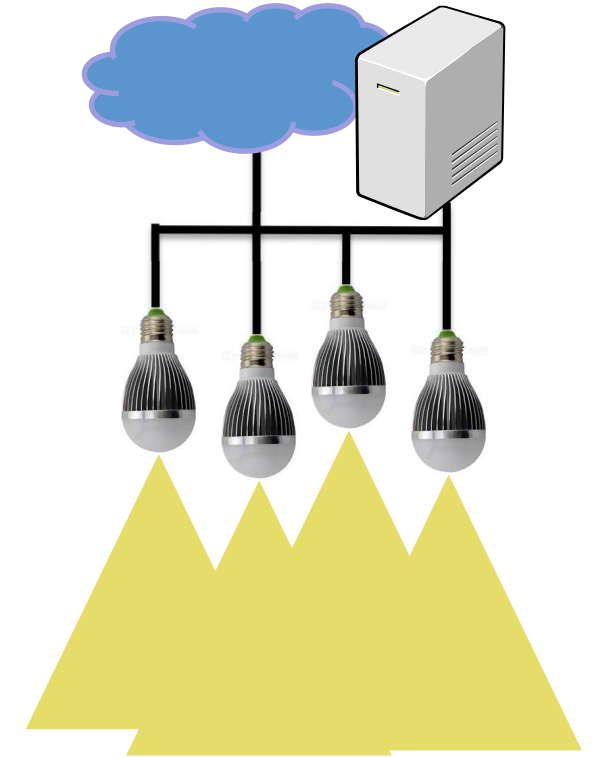
Front-haul

- **Downlink AP with ceiling LED**
  - High throughput
  - Spatial reuse increases capacity

- **Uplink via Wi-Fi**
  - Reliability is more important
 - Reusing current infrastructure simplifies deployment

Back-haul

- **Power Line Communication (PLC)**
  - Dual role front-haul: lighting and communication
  - Back-haul needs to facilitate these 2 roles
 - No need for new wiring

Central server

- **Connectivity management**
  - Coordinates APs
  - Collects channel feedback from clients

- **Realtime localization**
  - Spatial relations of APs are known to server
  - Reliably localizes a client based on feedback
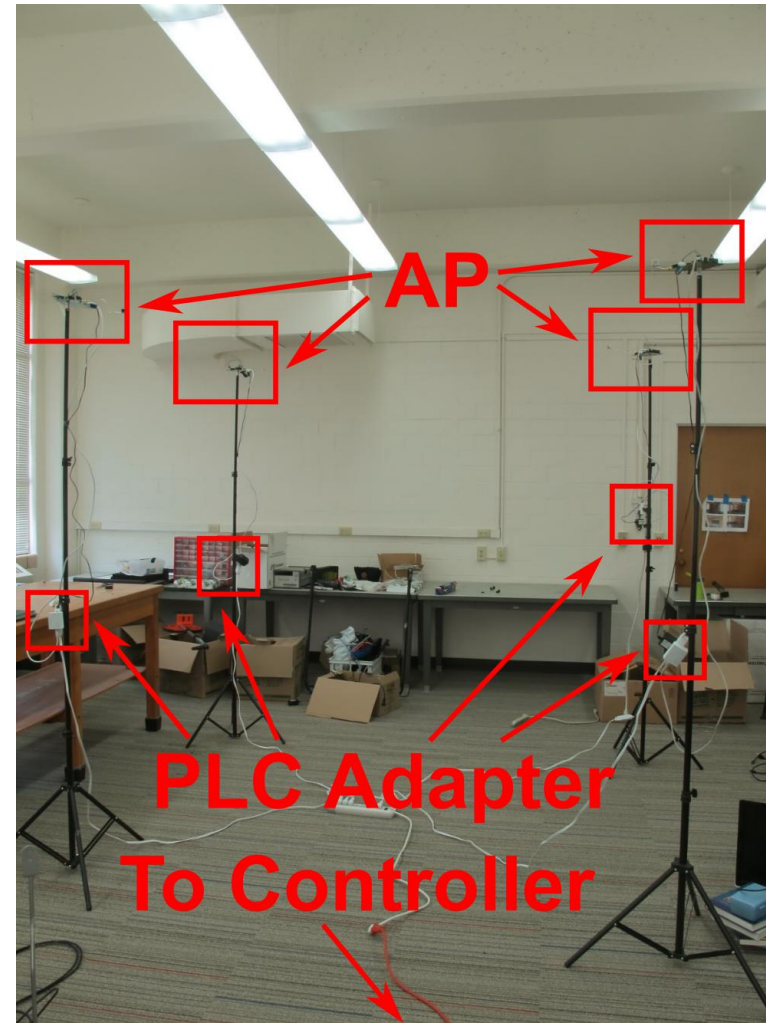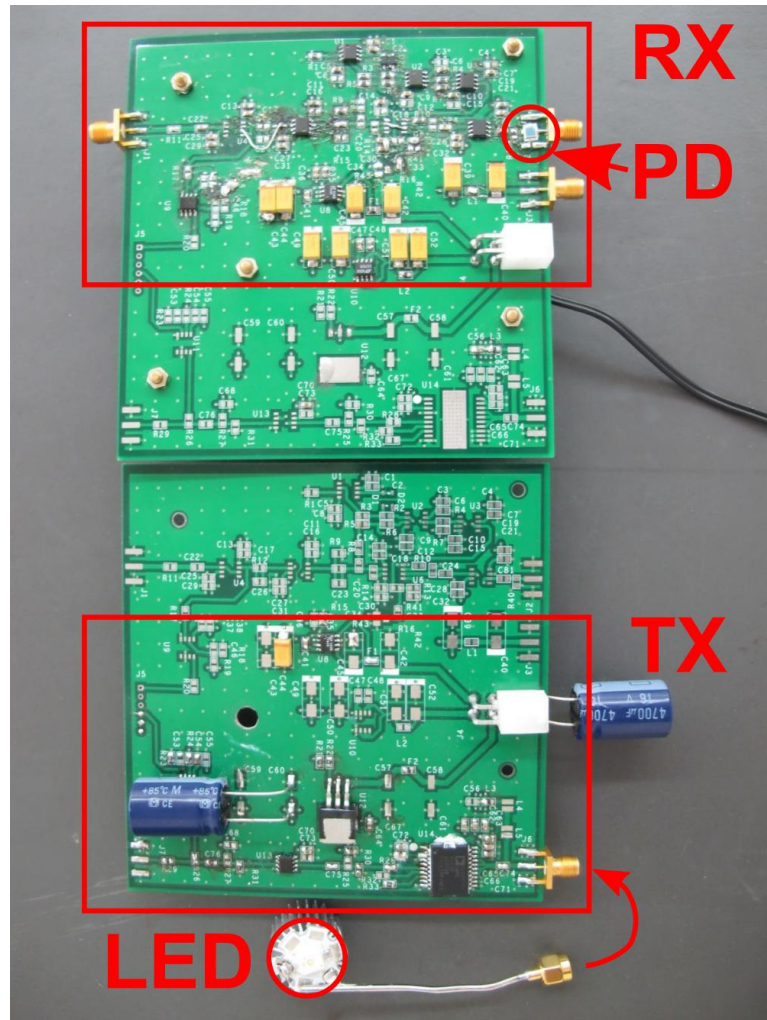 - Facilitates active connectivity management
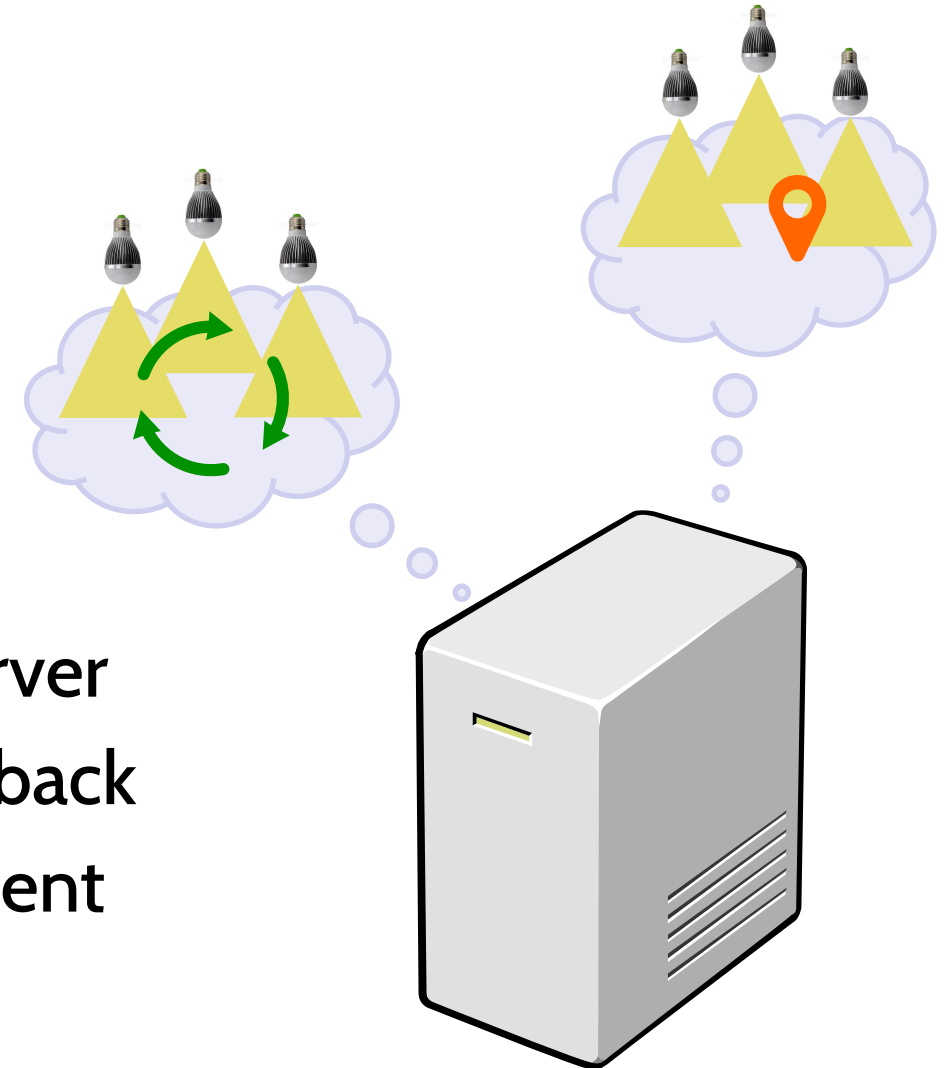
Connectivity Management

- **Dynamic clustering**
  - Increases SNR, expands range

- **Soft binding**
  - Let APs do the roaming for you

- **Centralized scheduling**
  - Maximizes spatial reuse
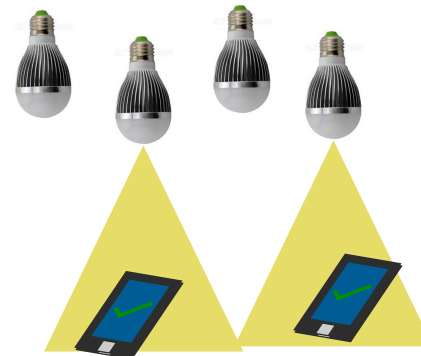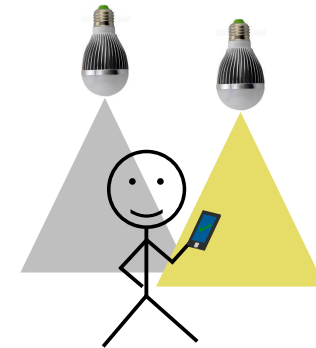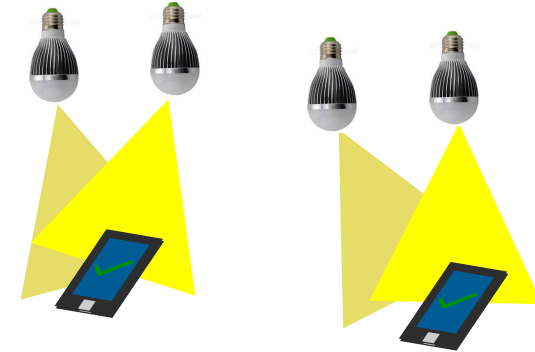
Implementation

Performance

- **Basic performance**
  - PDR > 95 % coverage: 1.5m @ 2W Tx power
  - 90% sync error < 10us
  - Bitrate: 10 kbps (limited by synchronization)
  - Total latency: 200-300ms, with 100-200ms from Wi-Fi

Performance

- **Dynamic clustering**
  - Coverage increases by 2m to 4m
  - Much less sensitive to device rotation
  - Up to 3dB RSS improvement with 4 APs
  - PDR doubles at network edge
  - Capacity is scalable with number of APs

Thanks!