

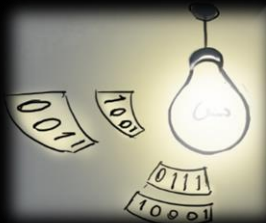
Let us Make Communication  
Experience BETTER!

Qian Zhang

Hong Kong University of Science and Technology

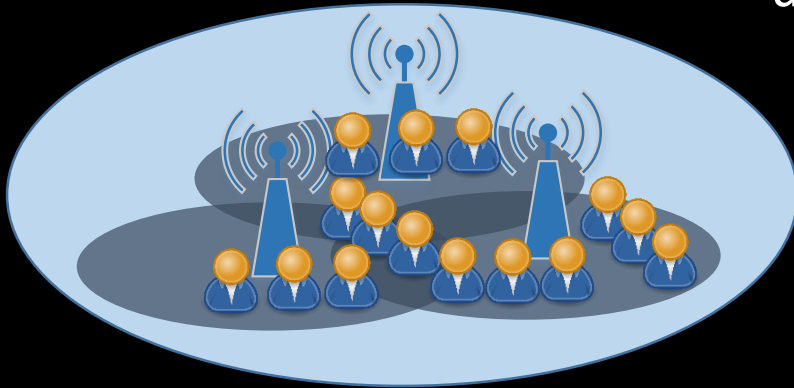
2015-09-21

# Communication is the Basis

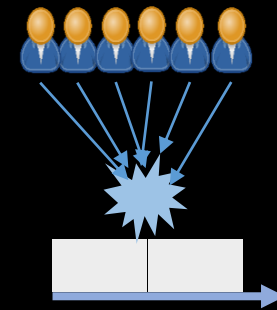


# Condensed WiFi Networks

- Massive connectivity leads to inefficient usage



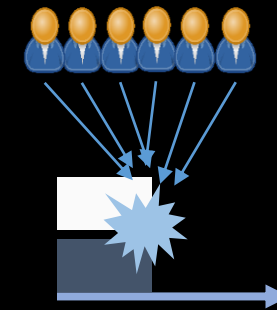
Time  
inefficiency



Intense contention



Frequency  
inefficiency



Limited spectrum

# Motivation

AP1

AP2

ClientA

ClientB



# Motivation

AP1

AP2

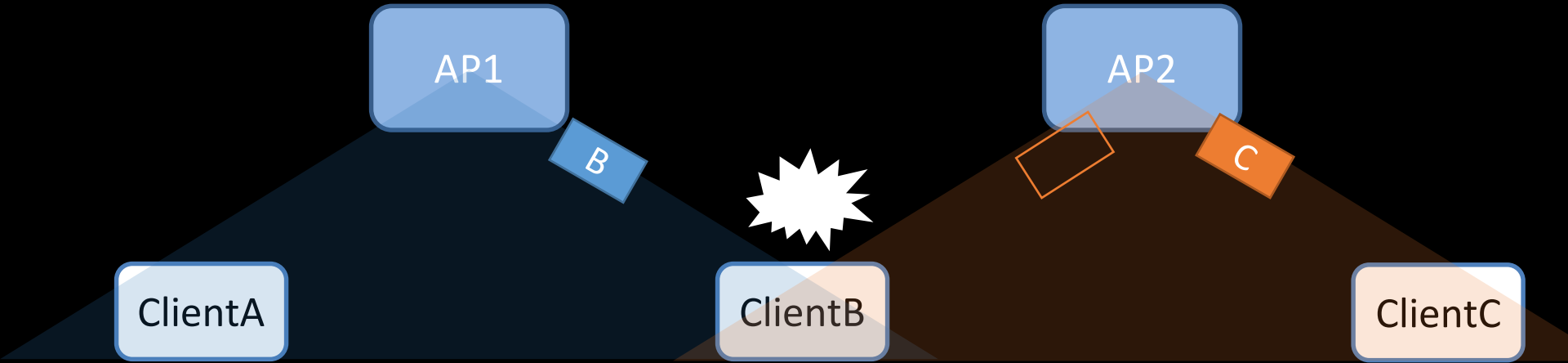
ClientA

ClientB

ClientC

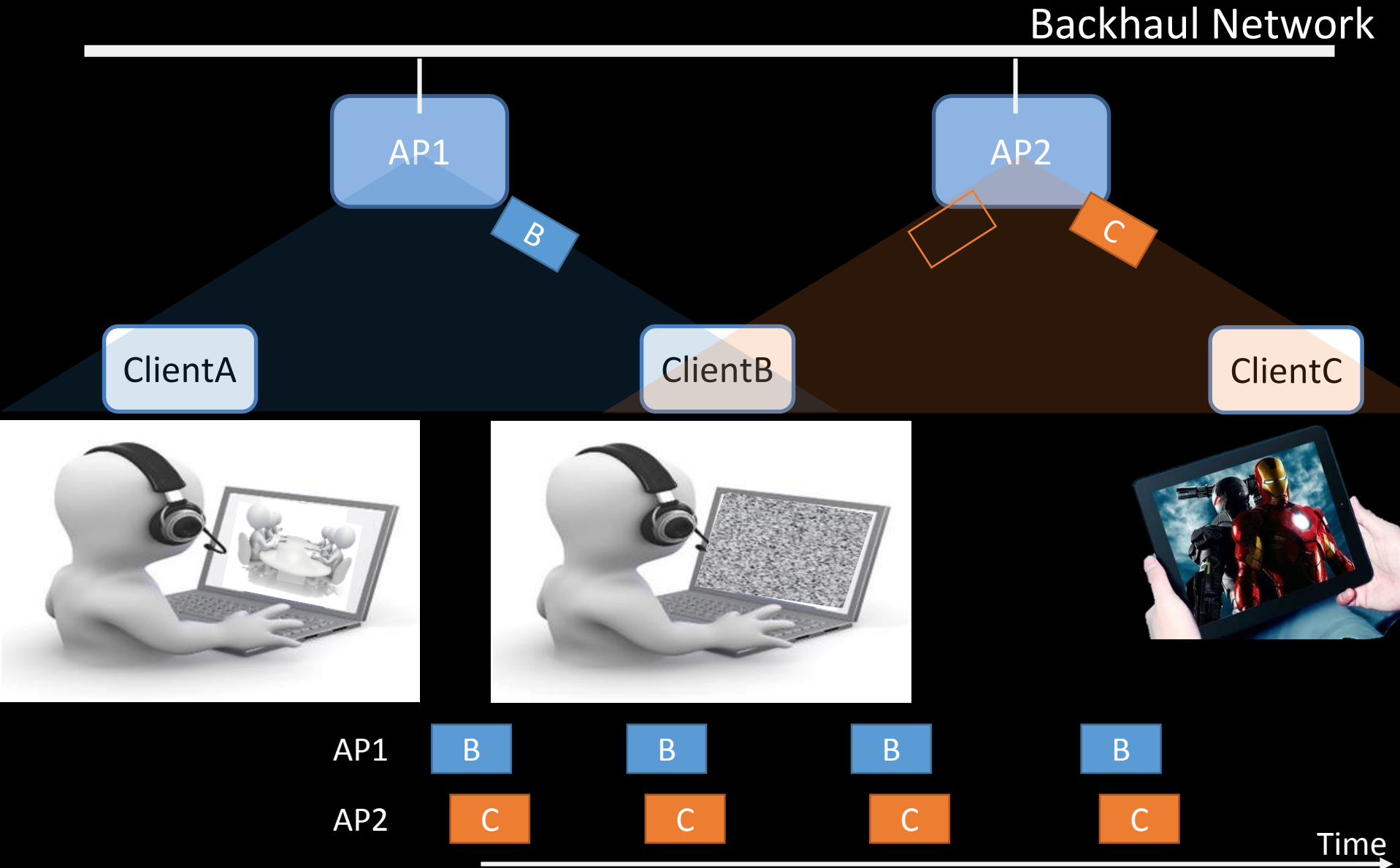


# Motivation

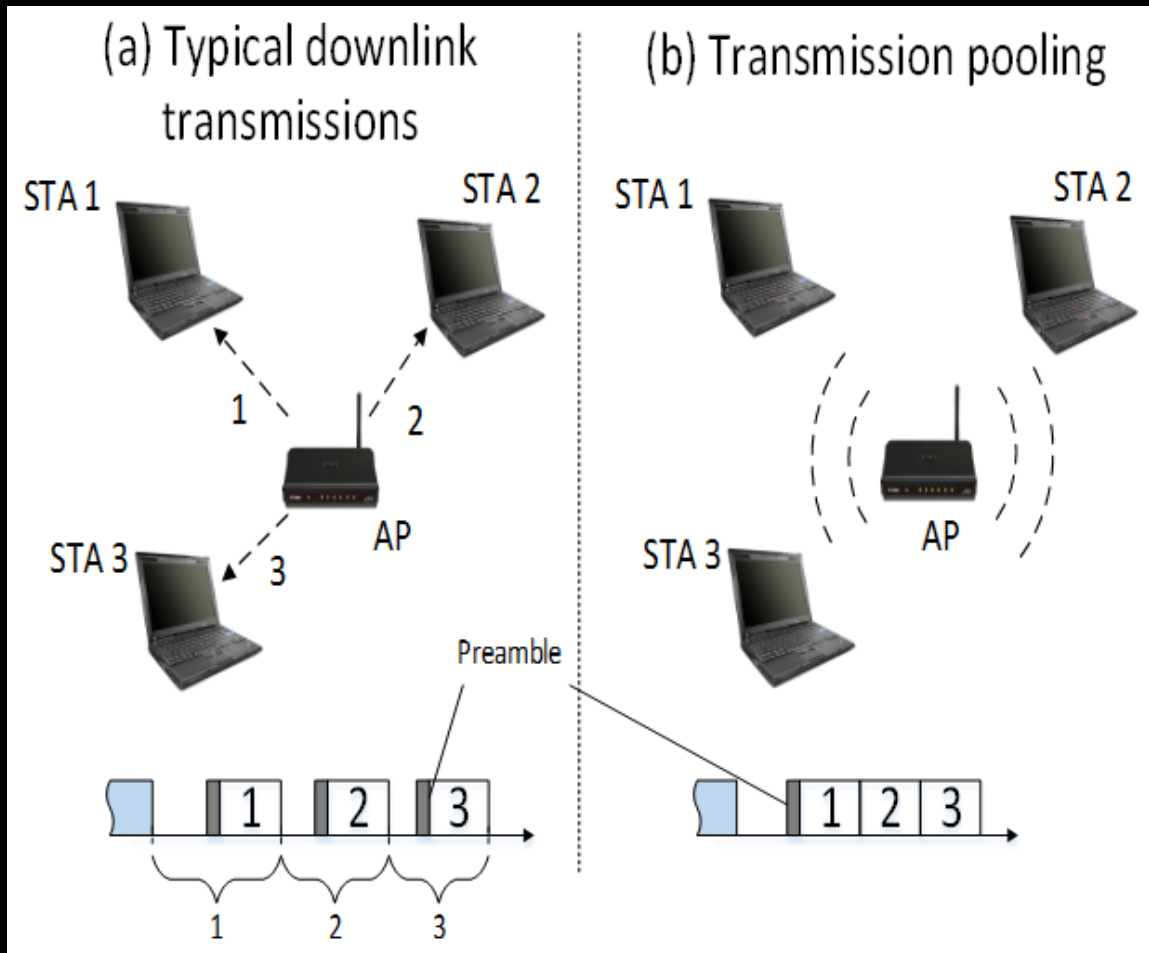


Time

# How to Fill the Gap? -- TDMA



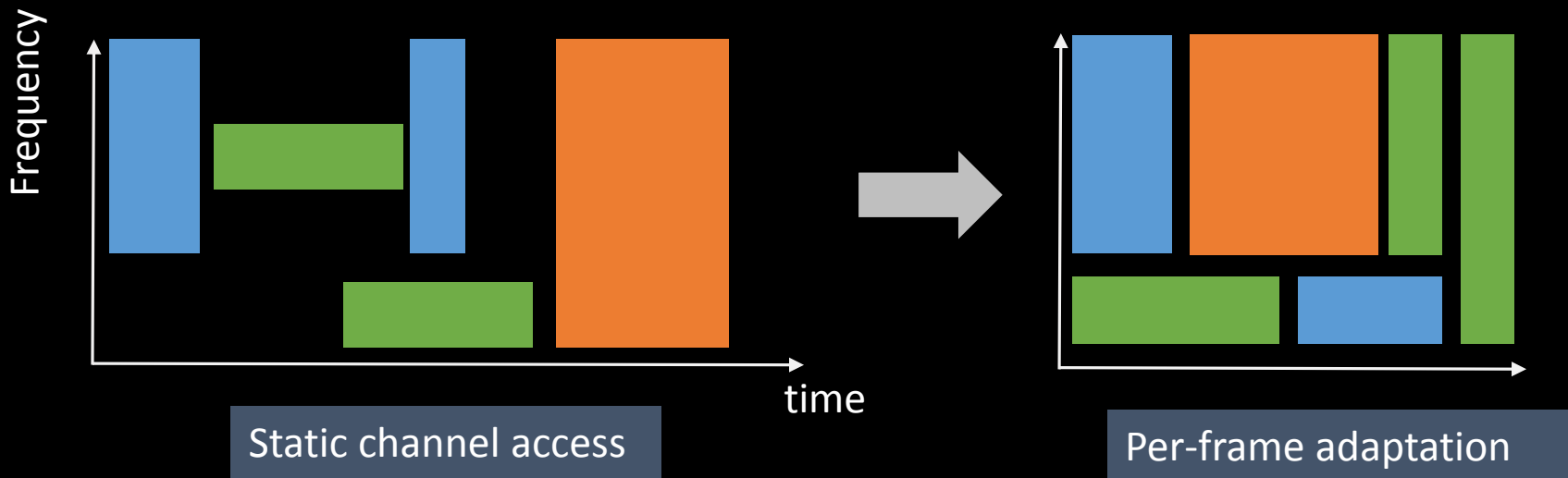
# Carpool: Mitigating MAC Overhead



- Reduce downlink contention overhead
- Respond multiple requests with one transmission



# Inefficiency Due to Heterogeneous Devices



Wideband device starves because of narrowband interference

# Visible Light Positioning



# Visible Light Positioning

- Visible Light Positioning (**VLP**) is an emerging positioning technique that based Visible Light Communication (**VLC**)
  - Light bulbs are densely deployed
    - Location anchors are ubiquitous
  - Light beam is very directional
    - No multipath, localization is simple and accurate
  - More...
    - Light is free of radio wave
    - Positioning through light bulbs is green in energy

# How VLC generally works?

- Modulate Light Intensity

Normal Light



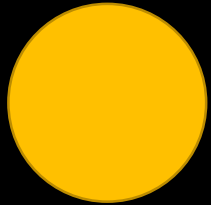
Modulated Light



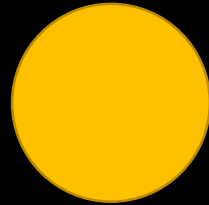
Time

# Problem in VLC: Flickering

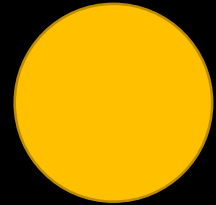
10Hz



100Hz



>1000Hz



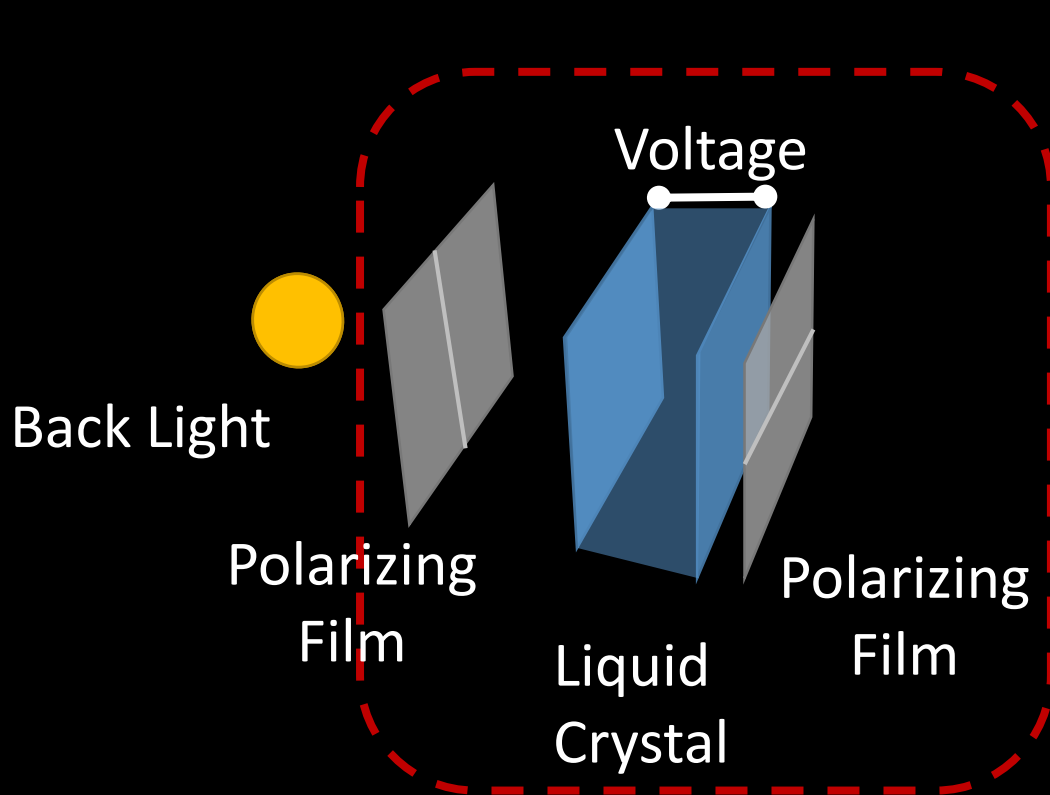
# Idea: Flickering-free Modulation

- Instead of changing the intensity, we modulate information by changing the **polarization** of light
  - Human eyes CANNOT perceive changes in polarization

Therefore low baud rate in transmitters

Therefore low decoding overhead in clients

# PIXEL: VLC Transmitter



VLC Transmitter

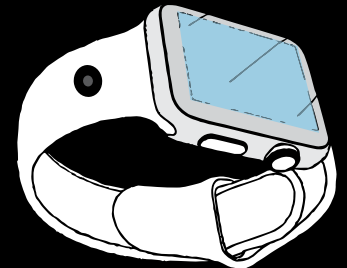
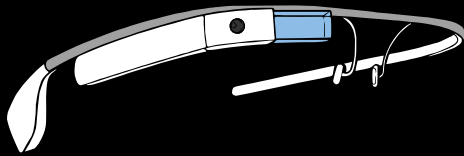
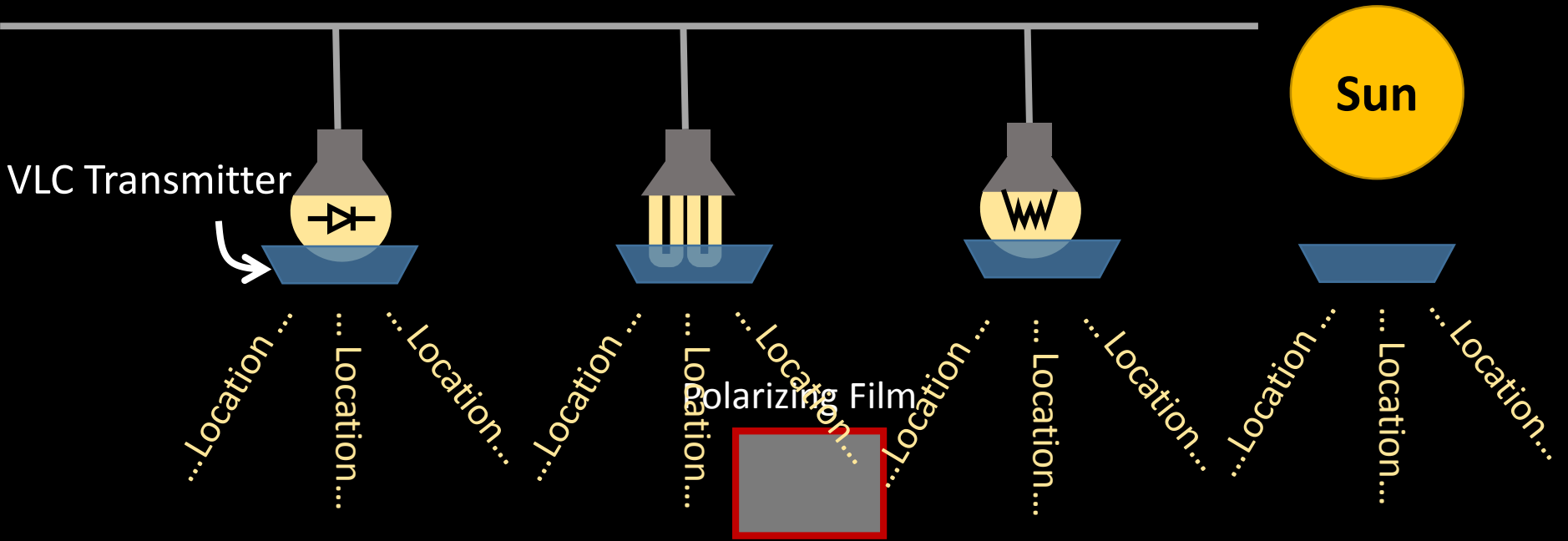


Eyes

Camera



# PIXEL: VLP Architecture





Thank You!