



# Enabling Dense Spatial Reuse in mmWave Networks

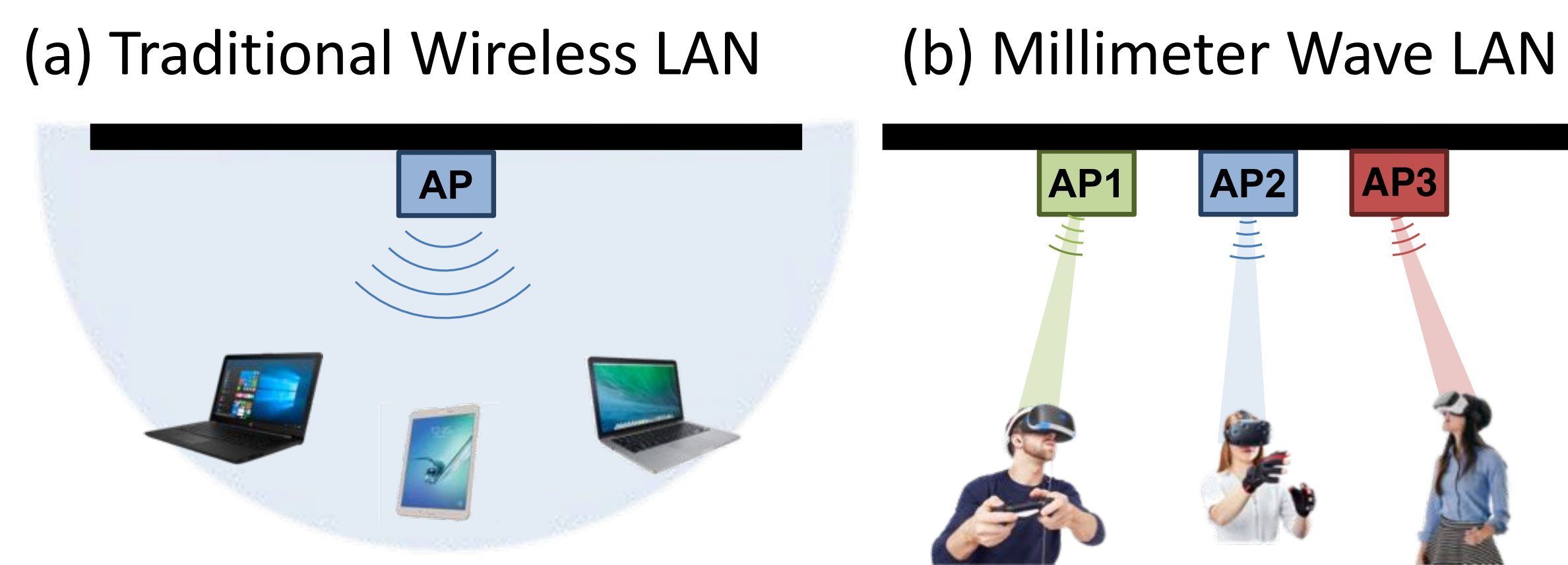
## ACM SIGCOMM Student Research Competition (SRC) Winner – First Position

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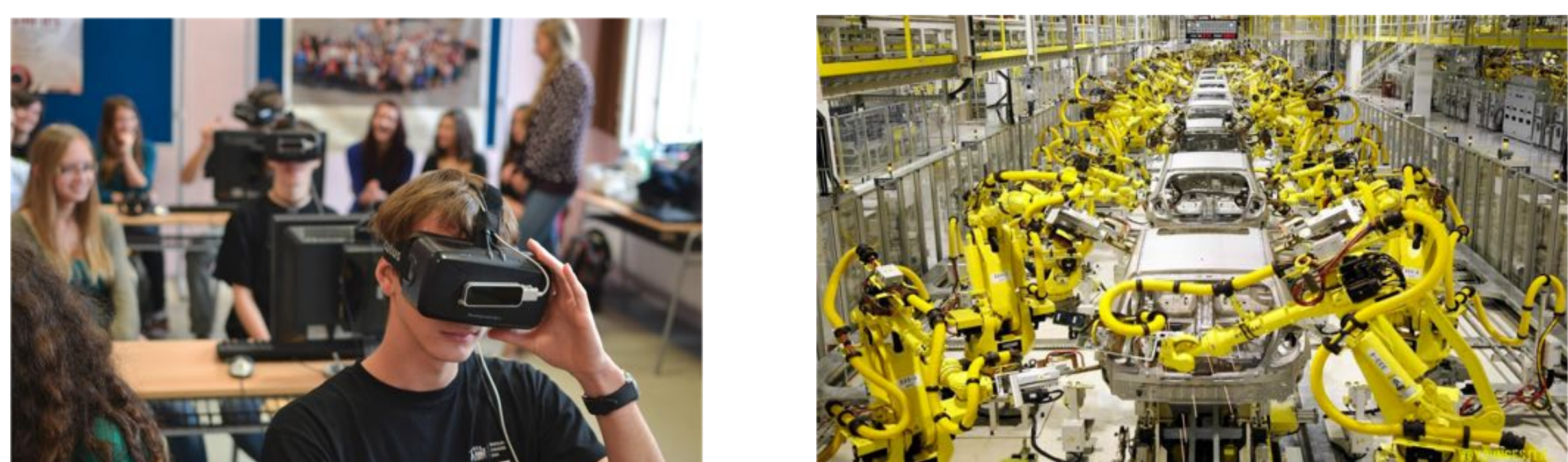
### Opportunity for Extreme Spatial Reuse



mmWave links use extremely narrow directional beams, providing new ways to exploit spatial reuse

### Applications

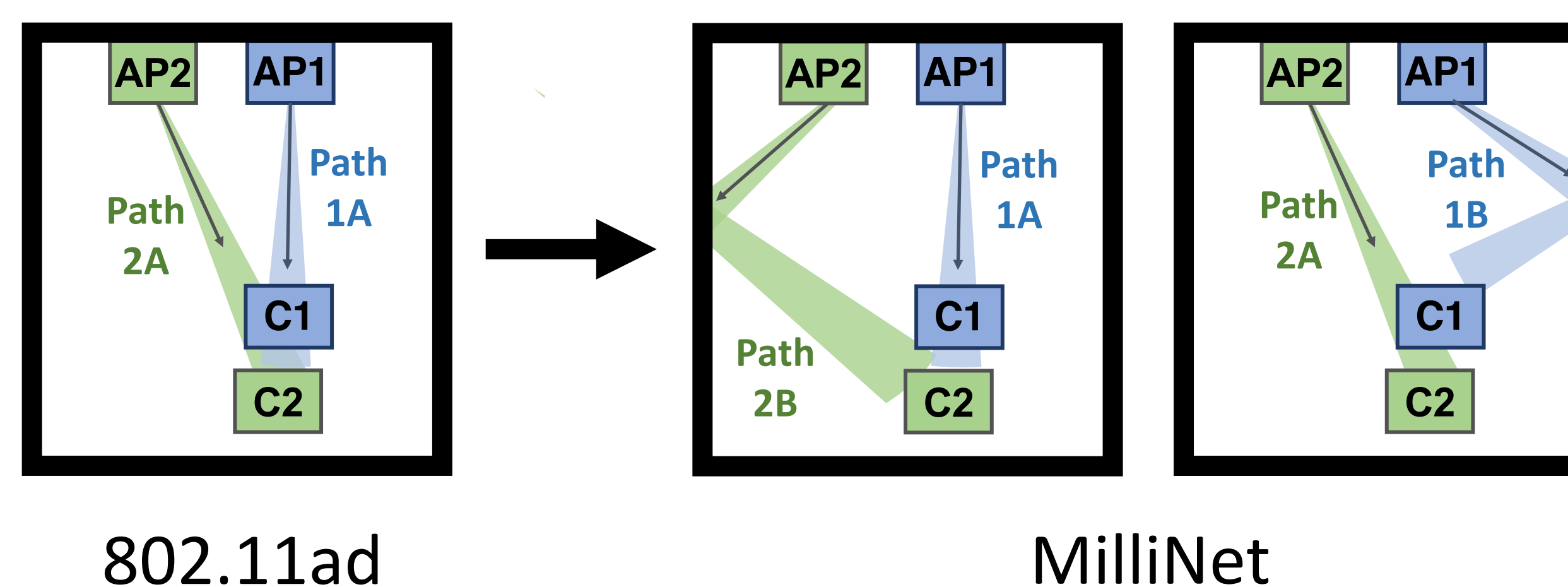
(a) Wireless VR for Education (b) Robotic Factory Automation



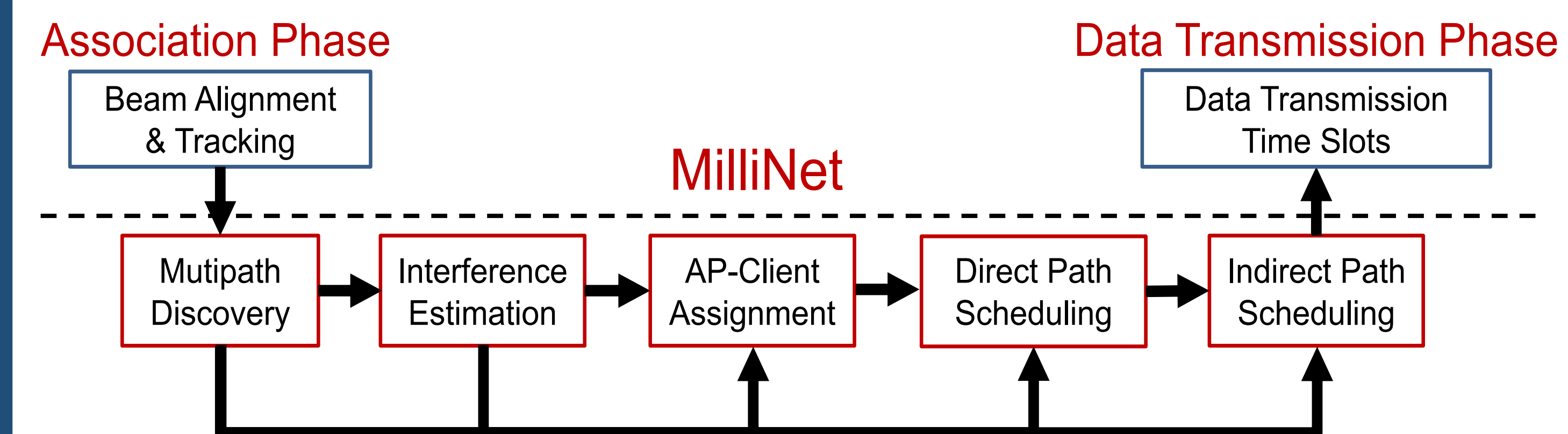
Directional beams and multi-Gbps links makes mmWave attractive for high bandwidth applications

### Challenges

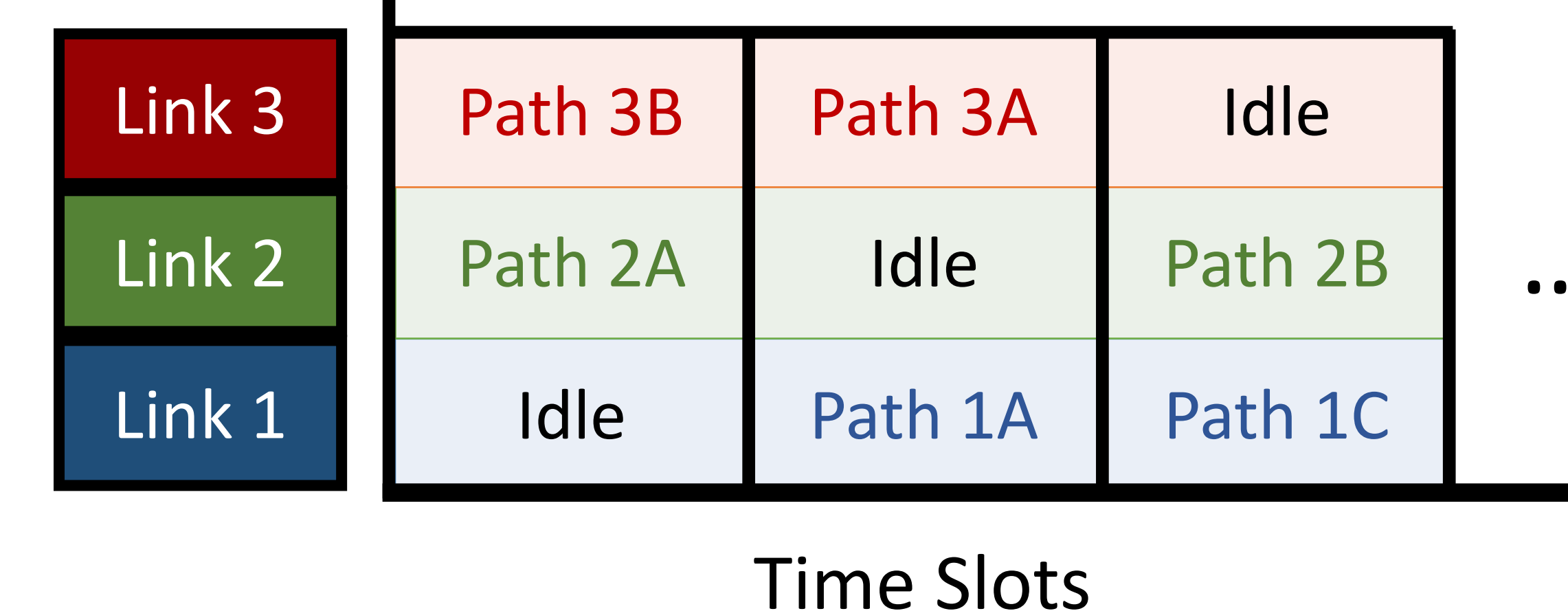
- 1) Beam Alignment :** Links could interfere along the Line-of-Sight paths. Hence, beams should be aligned so as to increase spatial reuse by exploiting multipath.
- 2) Client Mobility :** Mobility changes interference patterns and remeasuring interference requires  $O(n^2)$  measurements. MilliNet folds multipath discovery and interference estimation into the beam alignment phase, thus maintaining up-to-date view of the network in real-time.



### MilliNet System Architecture

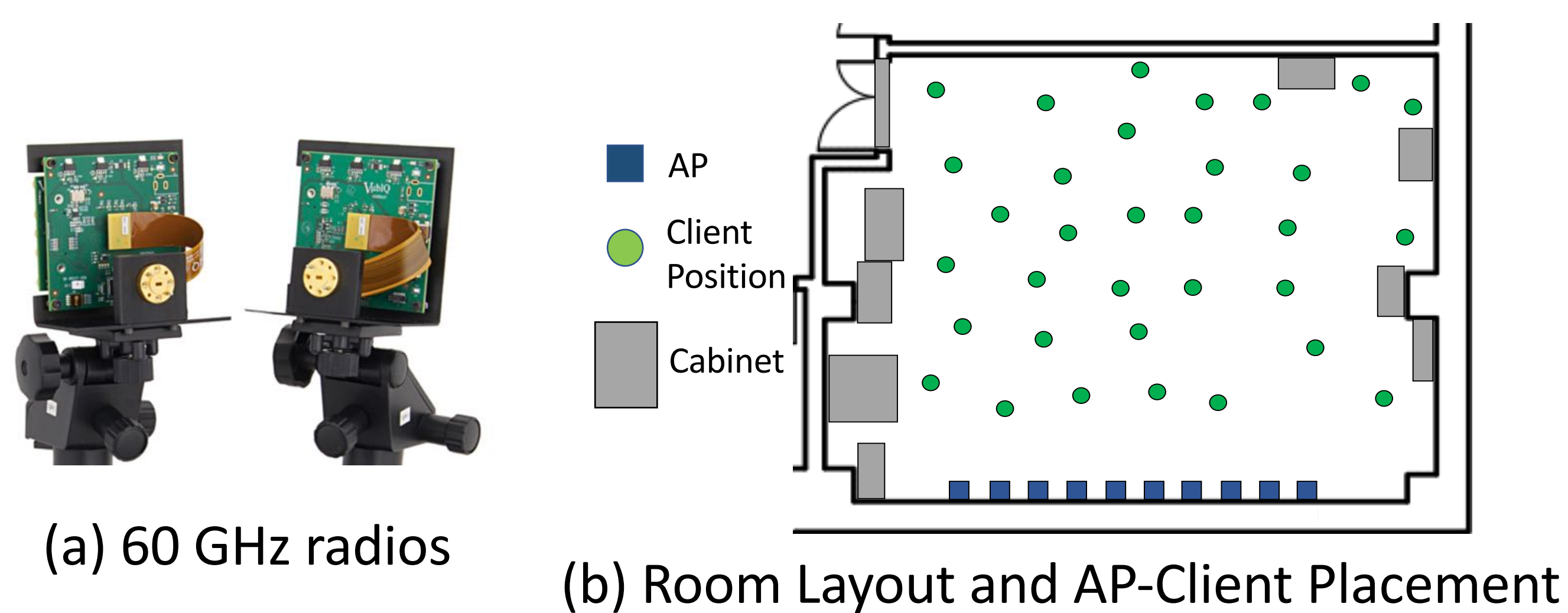


MilliNet computes link alignments for every time slot in Beacon Interval

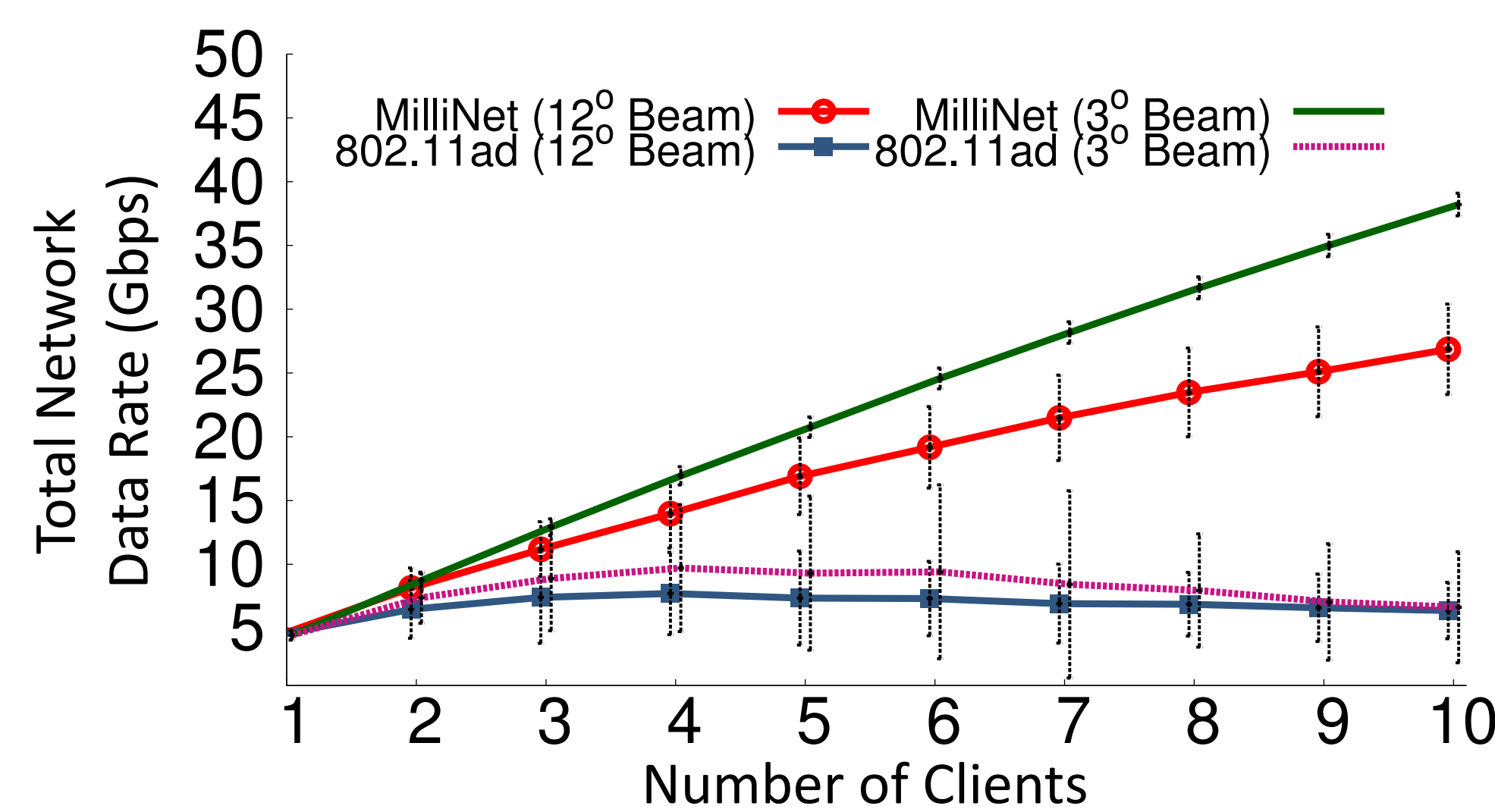


### Experimental Setup

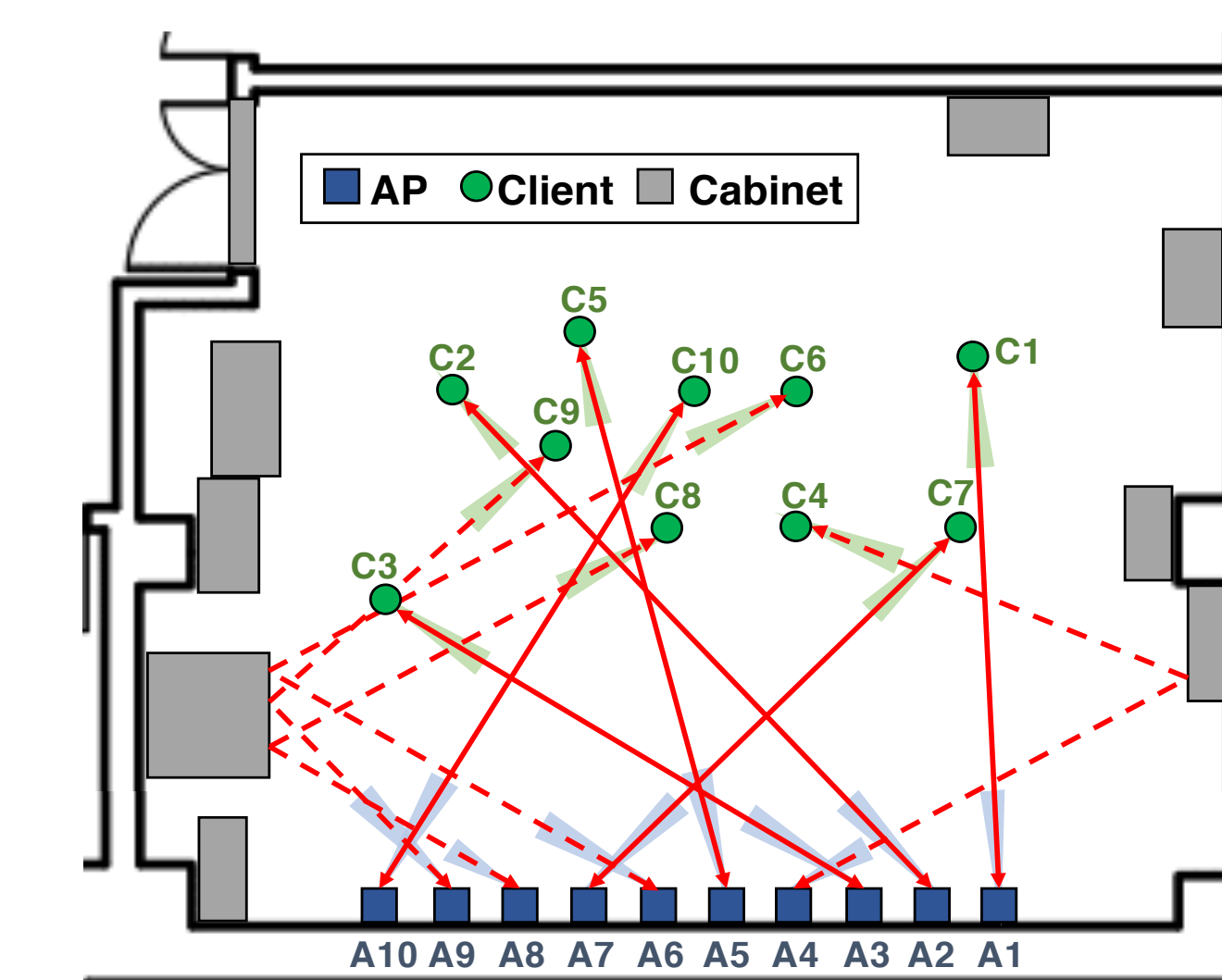
Deployed testbed with up to 10 links



### Preliminary Results



MilliNet can scale network data rate with number of clients, delivering more than 38 Gbps for 10 clients (5.8X higher)



Example time slot where MilliNet aligns beams to enable concurrent communication for all 10 links