Scoping Environment to Assist 60 GHz Link Deployment

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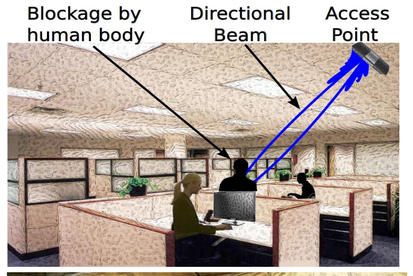
1. Line-of-Sight Blockage Issue of 60 GHz Links

60 GHz links are enabled via highly directional beams

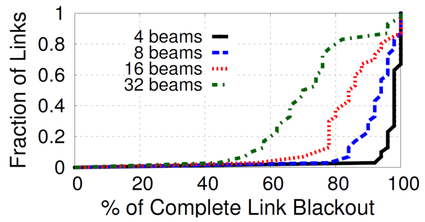
- High *propagation loss* is overcome by *phased-array*, which forms laser-like beams by combining signals coherently from multiple antenna elements
- Directional beams are *highly susceptible* to human blockage
  - Human blockage may cause up to **20 ~ 30 dB** link loss!
- Beamsteering may overcome blockage but its effectiveness depends on the environment/deployment
  - e.g., *availability* of strong reflectors

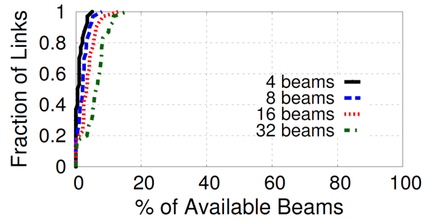


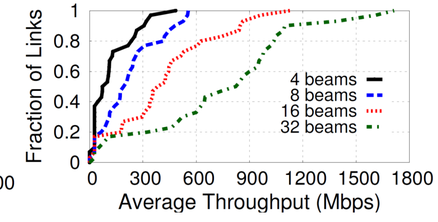
2. Deployment Issue of 60 GHz Links

How severe is the deployment issue?

- Large *disparity* of link performances occurs during human blockage





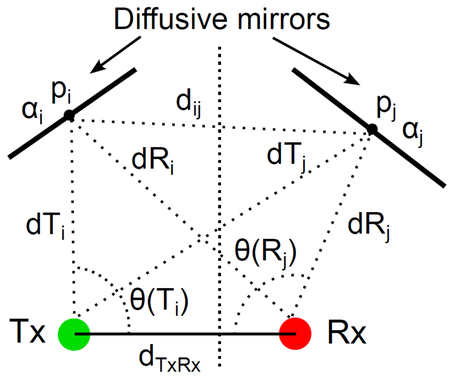


- Measurements across 30 different links in an office environment
  - Difference in blackout time between best and randomly deployed links can be 8% to 56%
  - The average achievable throughput difference between best and randomly deployed links can be from 480 Mbps to 1.7 Gbps depending on the number of available beams

3. Identifying Best Deployment Spot

Identifying quality of potential deployment spots

- Quality of potential deployment spots may be identified by *war-driving* through the entire area which is a high overhead procedure
- Our objective is to find out the performance quality without war-driving and potentially *using a single measurement*

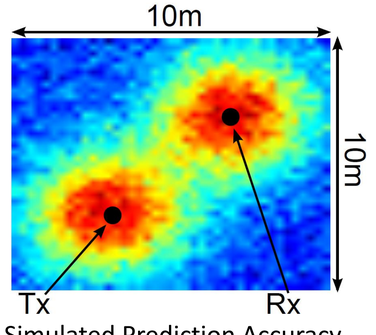


- **Key Idea:** Characterize the environment by *reverse-tracing* sparse 60 GHz signal paths, exploiting measurements from a single link deployment!
  - Treat strong reflector points as *diffusive mirrors* that may generate diffusive paths when incident rays hit upon
  - Model the measured Channel Impulse Response of $\mathrm{K}\times\mathrm{K}$ beams to identify K potential paths, which are shared by measured spot and unobserved spots

4. Preliminary Results and Conclusion

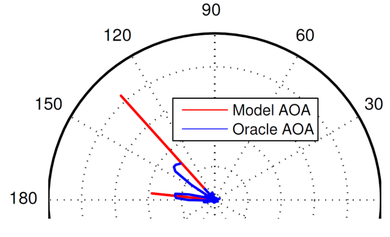
Spot performance prediction accuracy

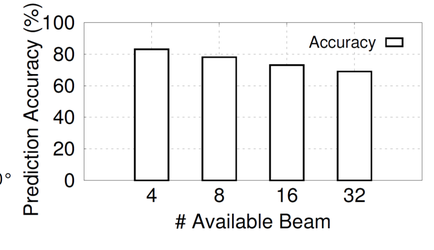
- We simulate our approach in a 10mX10m indoor environment and predict the performance of *unobserved spots*



Simulated Prediction Accuracy

- We evaluate the prediction algorithm on a 60 GHz software radio testbed, which shows more than 80% of accuracy in predicting link performance





Conclusion

- 60 GHz link performance highly depends on environment characteristics
- We can identify the best link deployment using a single measurement. No war-driving!