

Towards Efficient Distributed Simulation of Next-Generation Wireless Use Cases in ns-3

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Background

- Project focuses on upgrading ns-3 to meet the challenges of efficient yet accurate simulation-based performance evaluation of next-generation wireless networks
- Developing simulation methods that balance maintaining simulation run-time efficiency while preserving accuracy of measured network parameters – in the face of increasing complexity
- Research plan explores a variety of techniques
 - Efficient link-to-system mappings
 - Pruning of network state representations that do not impact simulation accuracy
 - Parallelization approaches based on optimistic simulation for scenarios with limited interdependence between logical processes after pruning

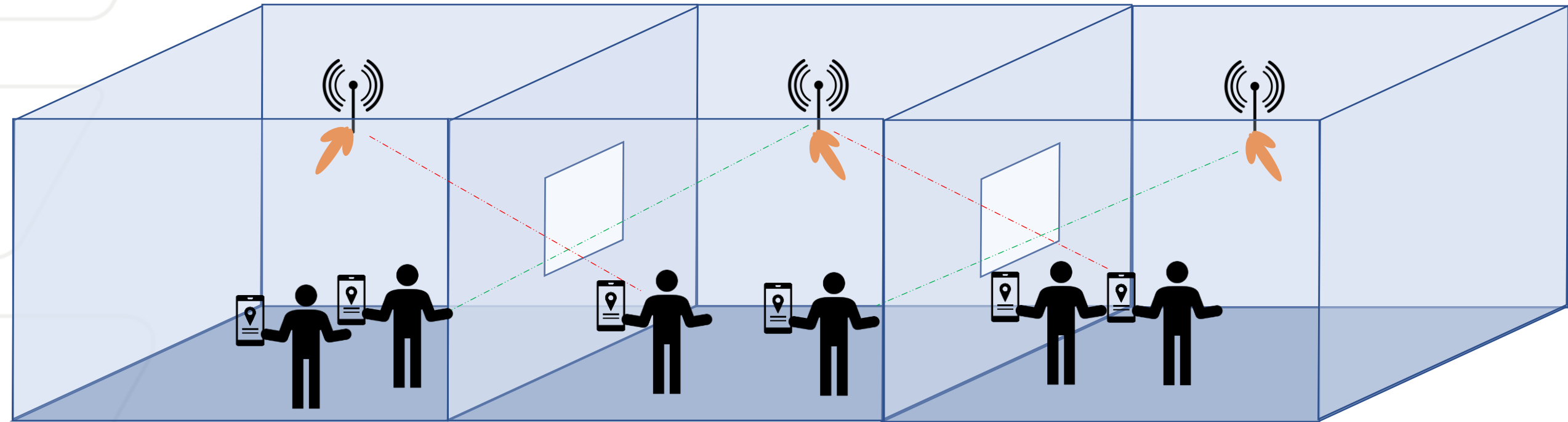
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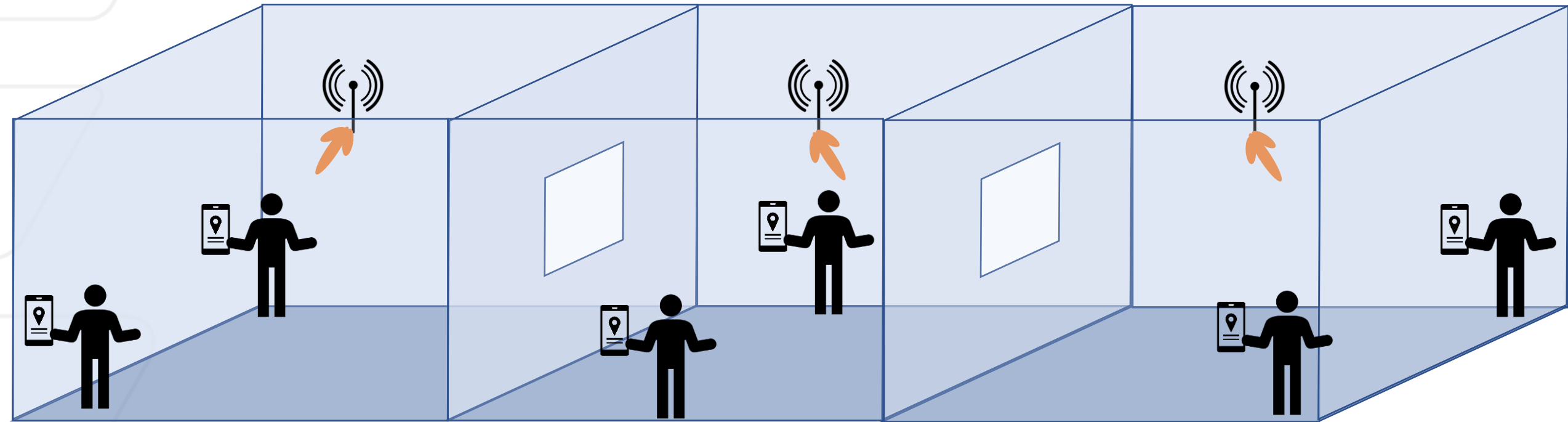
Prior Efforts

- Developed DmgWifiRemoteChannel classes inheriting from DmgWifiChannel
 - Designated interfaces and mechanisms for passing WifiPpdu and WifiTxVector objects to ns-3 distributed simulator
 - Handles serialization and deserialization of WifiPpdu
- Developed line-of-sight and non-line-of-sight distinction to preemptively prune certain non-line-of-sight transmissions

Simple Example Scenario for mmWave LAN



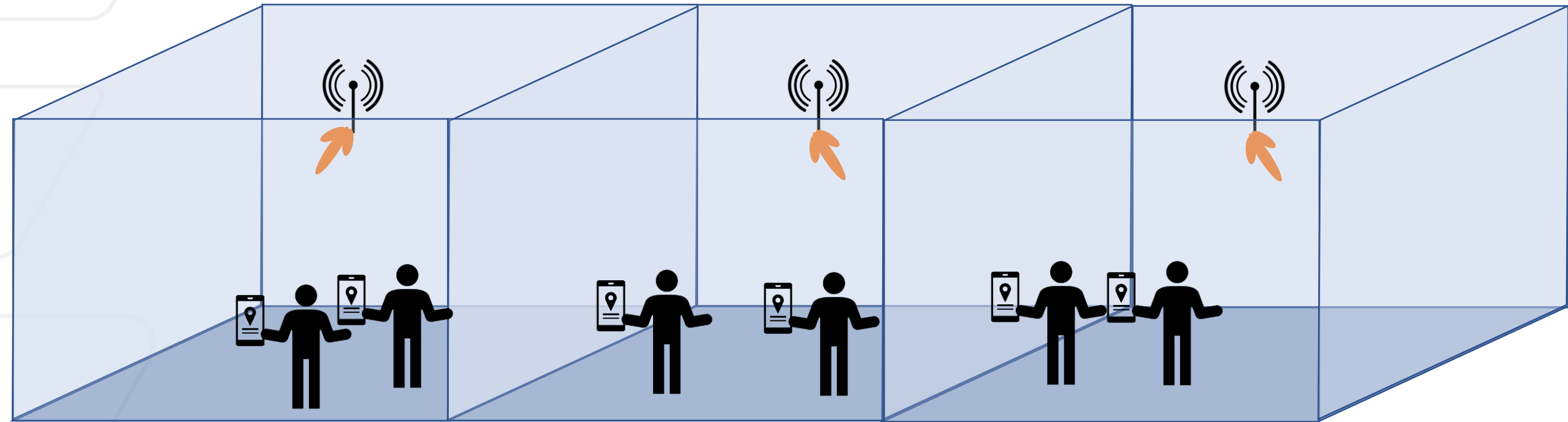
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Updates

- Extended distributed simulation mechanisms for Null Message (Chandy Misra Bryant) MPI interface
- Developed `Simulator::SetNextExternalEventTime`
 - Provides model- and simulator-specific interface for designating times that synchronization can safely be skipped
- Currently troubleshooting discrepancies between sequential and distributed handling of steering angle in analytical codebook

Example Implementation for mmWave LAN

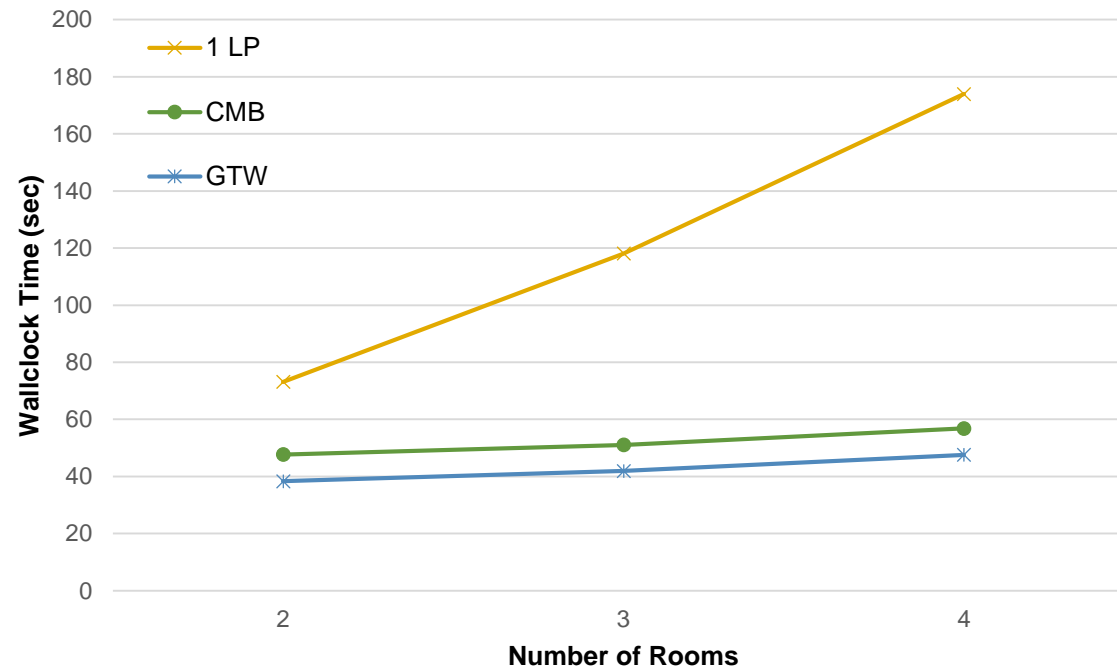


*Remove openings at pre-determined “safe time” to remove cross-room interference rather than predict moments when clients move in and out of sensitive regions

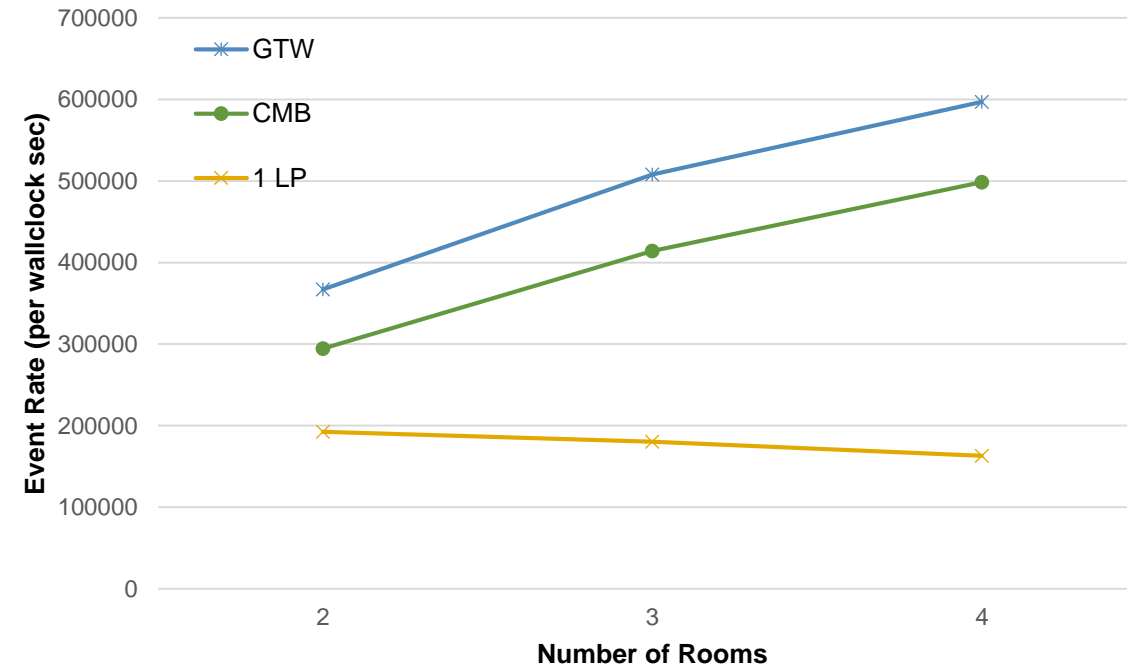
“Embarrassingly Parallel” Results

Example implementation results compare increasing number of LPs to coincide with number of rooms against running the entire scenario on a single LP

Runtime Performance

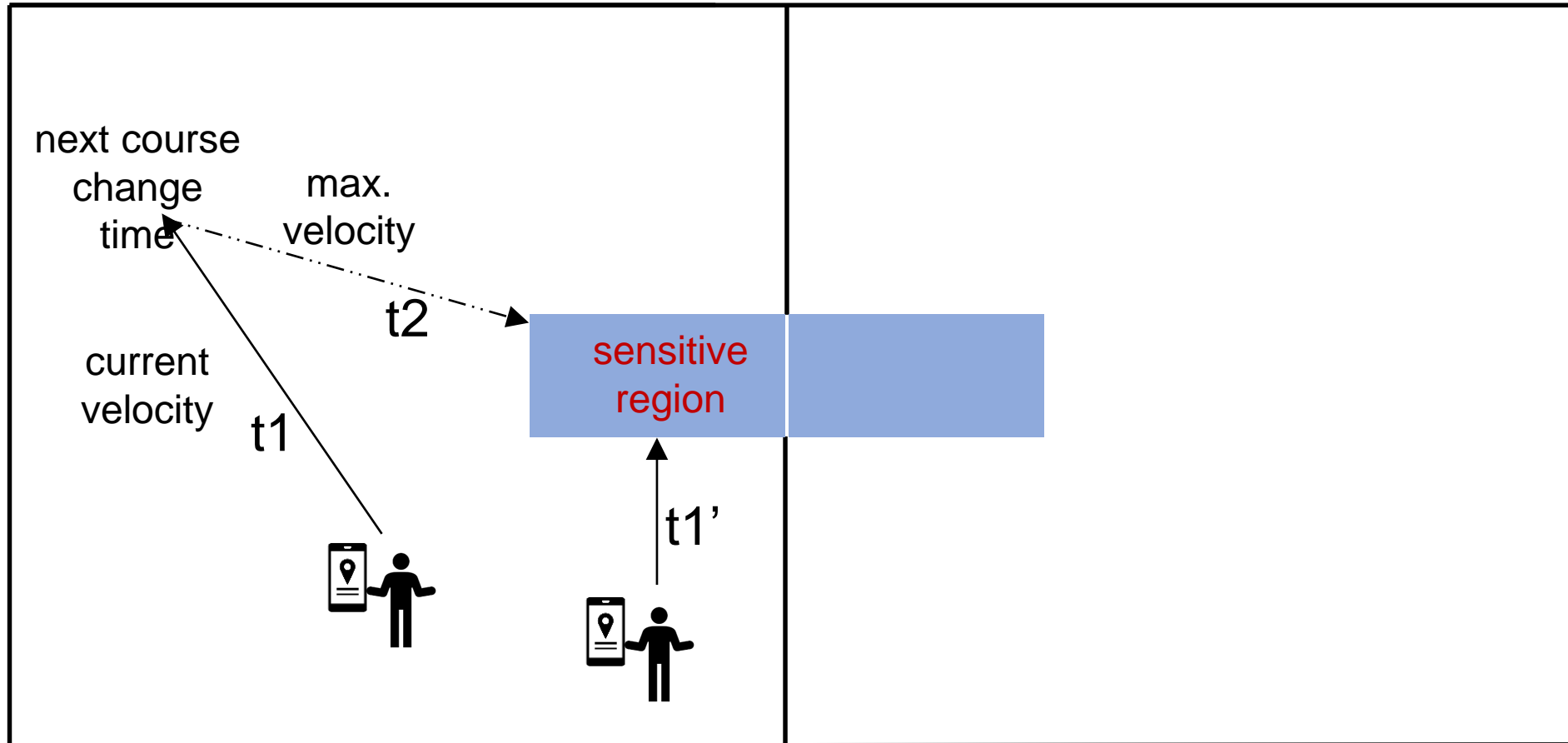


Event Processing Rate



Simulation Time	Safe Time	Clients per Room	APs per Room	Data Rate
10 seconds	0 seconds	4	1	200Mbps

Future Work: Use of Mobility to Dynamically Determine Lookahead



safe lookahead = $\min(t1' \text{ or } t1 + t2)$ over all users in the room

Other Future Work

- Merge current developments with ns-3 WiGig models

Discussion/Questions