

Coupling Microscopic Mobility and Mobile Network Emulation for Pedestrian Communication Applications

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Outline

CrowNet

Emulation Extension

Architecture

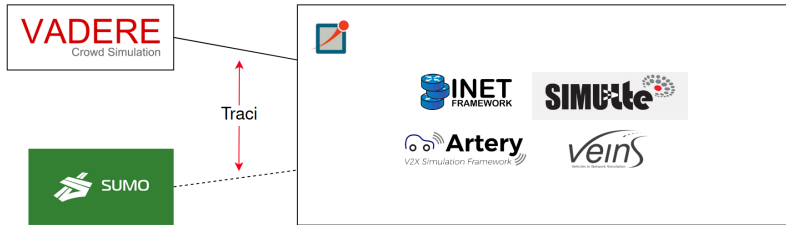
Performance Measurement

Demo

Conclusion

CrowNet (Crowd Network)¹

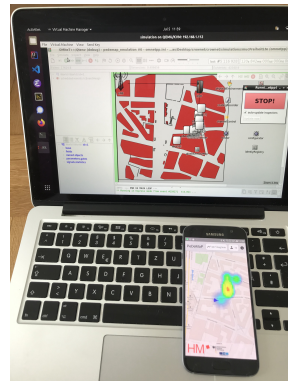
- ▶ Combines pedestrian locomotion simulation with wireless communication simulation.
- ▶ Pedestrians (nodes) exchange position beacons.
- ▶ Open Source: <https://github.com/roVer-HM/crownet>.



¹<https://crownet.org/>

CrowNet Emulation Extension

- ▶ Developing a network emulation extension of the CrowNet Framework.
- ▶ Exchange of beacons and mobility data between simulation and real devices.
- ▶ Coupling of mobile Android applications.
- ▶ Motivations:
 - ▶ Test mobile applications in pedestrian communication scenarios.
 - ▶ Demonstrate the application.
 - ▶ Enable user-studies.



Extension Architecture (1/3)

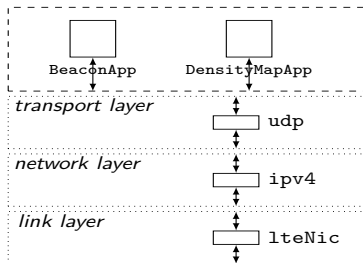
OutboundEmulation Receives position beacons from other nodes and forwards them to the coupled device.

NodeLocationExporter Sends the position of one node to one coupled device to spoof its location.

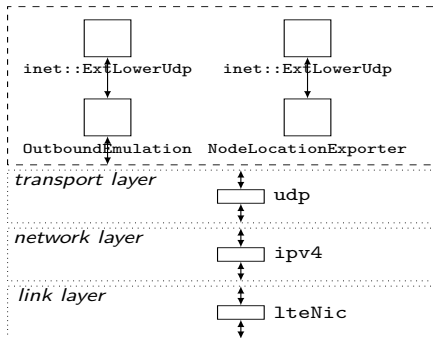
InboundEmulation Receives position beacons from coupled devices and forwards them to emulated nodes.

Communication with the coupled device: IP/UDP + ProtocolBuffers

Extension Architecture (2/3)



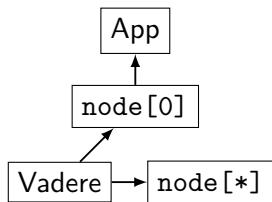
(a) node[*]



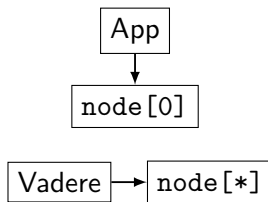
(b) node[0]

Figure: Structure of a generic node and node[0], serving as emulation bridge.

Framework Architecture (3/3)



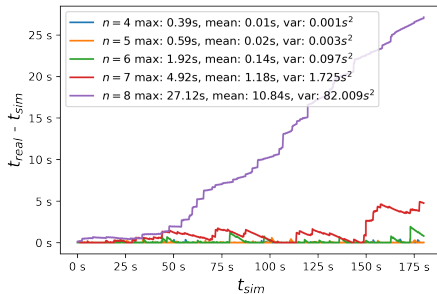
(a) NodeLocationExporter



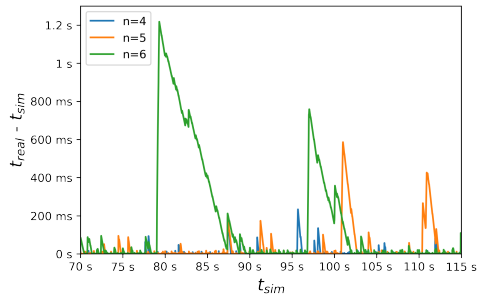
(b) InboundEmulation

Figure: Flow of mobility data between Vadere, the simulated nodes, and the coupled app.

Performance Measurement



(a) Overview



(b) Detailed view of 80-115s for 4-6 nodes

Demo

Conclusion

- ▶ Extension of the CrowNet framework allows network emulation for mobile apps using pedestrian communication.
- ▶ Number of nodes is limited by performance requirements.

Future work:

- ▶ Find performance bottlenecks.
- ▶ Integrate more data formats.

Thank you for your attention!

Source code available at

https://github.com/roVer-HM/crownet/tree/emulation_omnetsummit21