



## **OSC contribution proposal**

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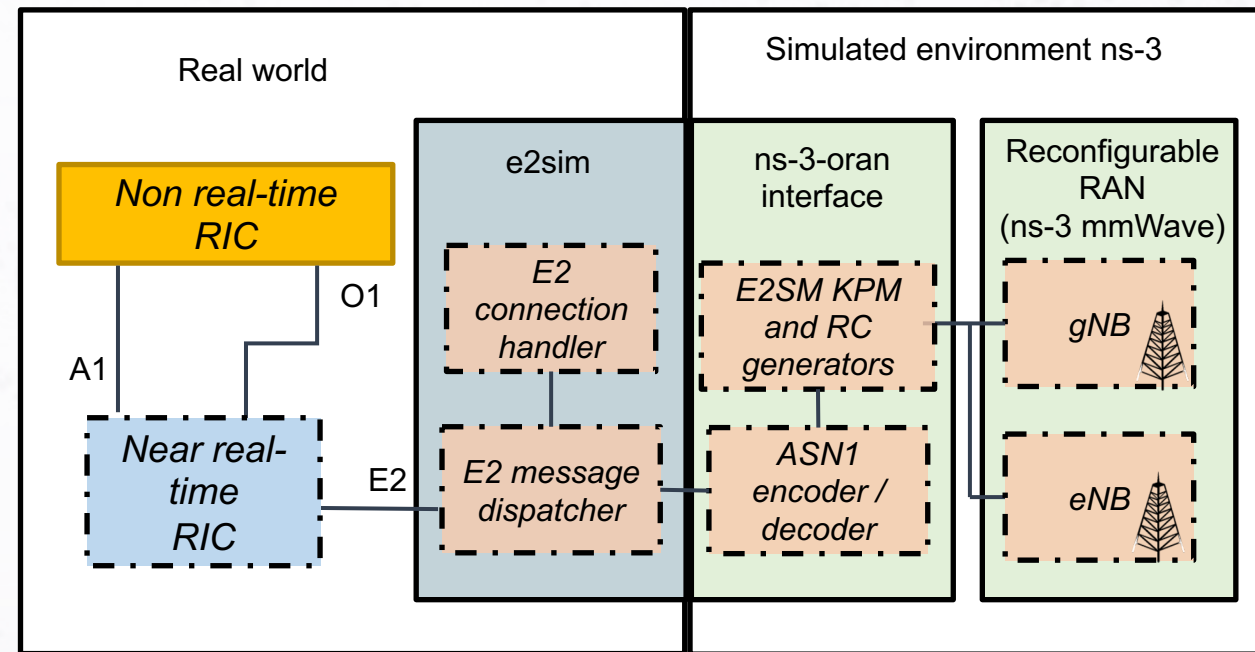
Institute for the Wireless Internet of Things – Northeastern University

With contributions from Mavenir (lead: Rajarajan Sivaraj)

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# Programmable and Customized Intelligence for Traffic Steering in 5G Networks Using Open RAN Architectures

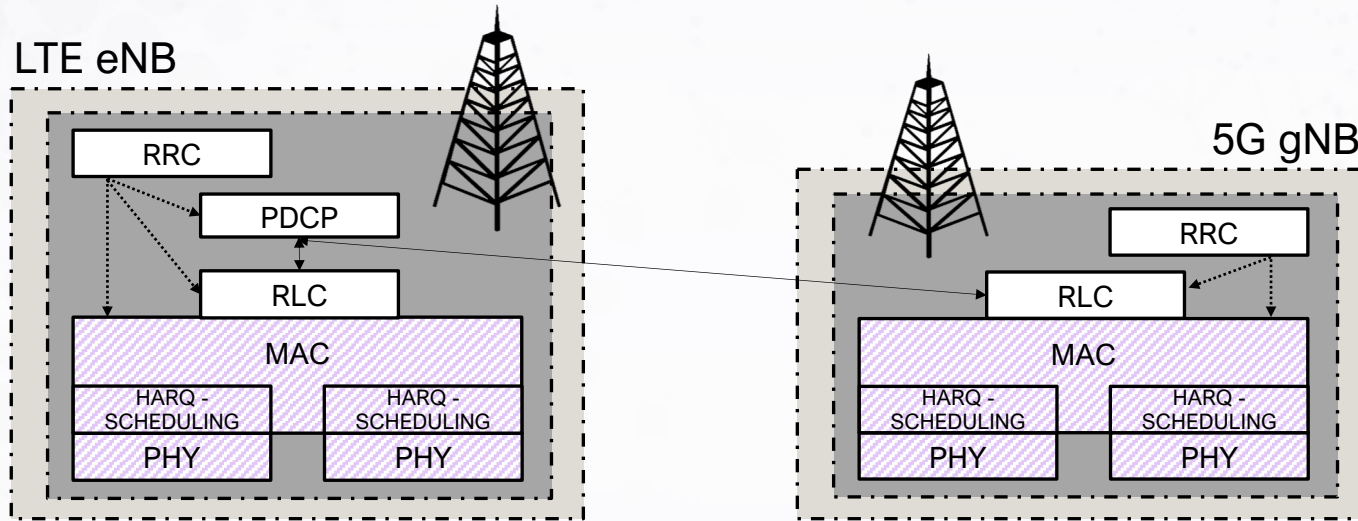
- Integration of a real world RIC with a simulated RAN
- Enabling large scale simulations for O-RAN
- Realistic dataset generation
- Framework for AI and xApps
- No infrastructure expenses
- 3 main repositories



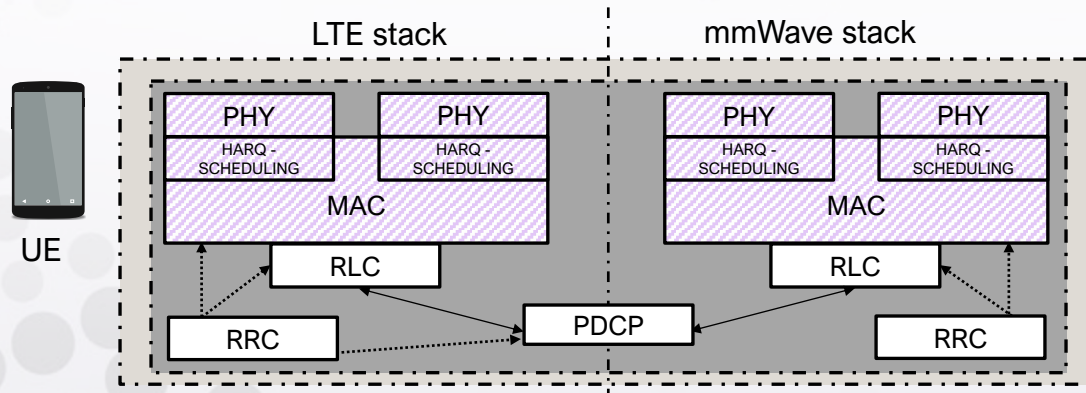
# ns-3 mmWave module

- Focus: 5G cellular networks

Original project name: now also works for FR1

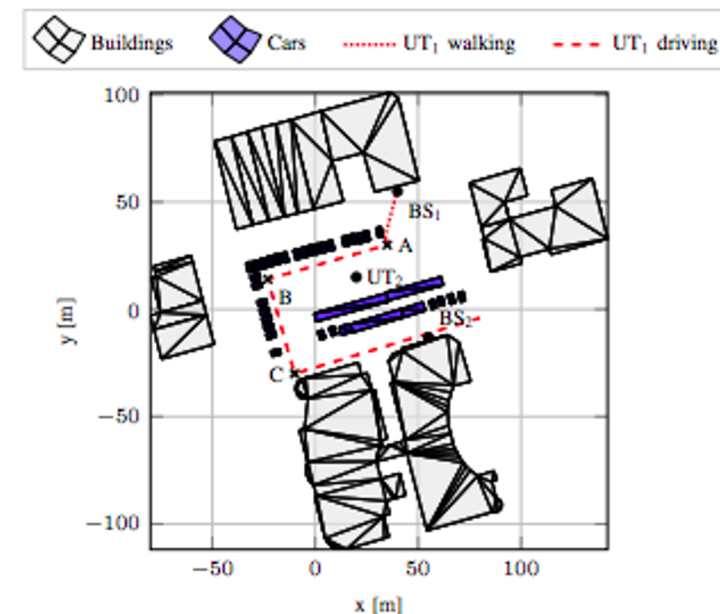
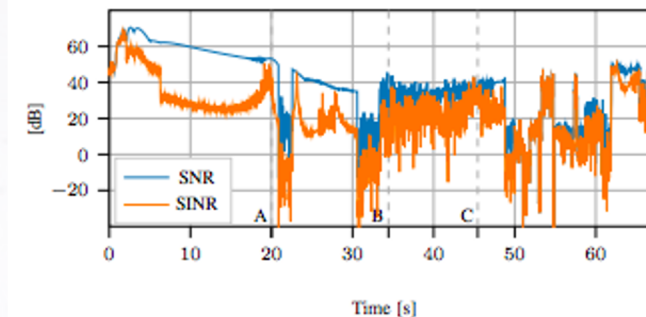


- ns-3 also provides
- core network
  - TCP/IP
  - mobility models
  - building and obstacle models
  - other wireless technologies

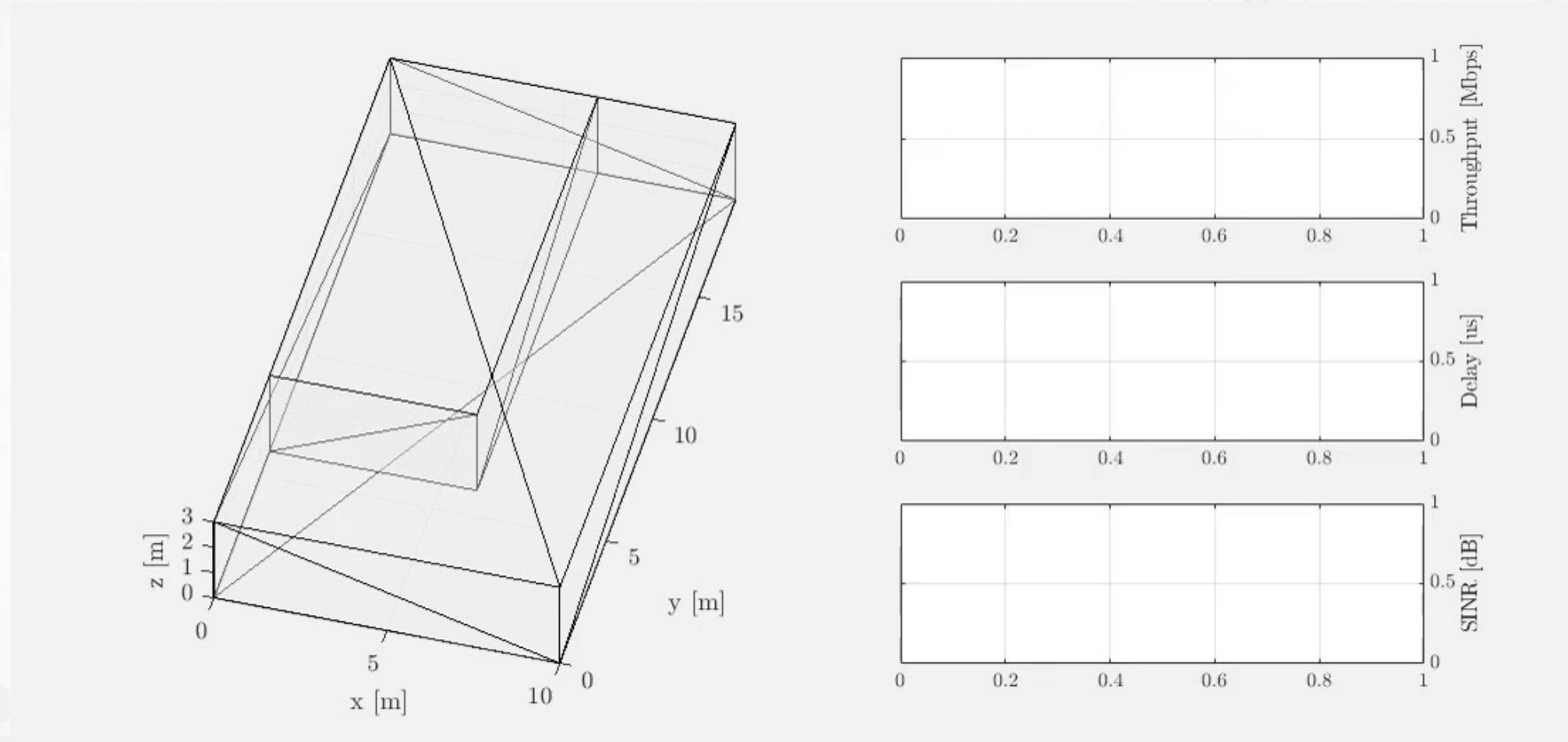


# Channel models

- 3GPP stochastic SCM  
TR 38.901
  - between **0.5 and 100 GHz**
  - urban, rural, indoor scenarios
- RT-based channel model
  - integration with [open-source ray tracer](#)
  - accurate characterization of the propagation environment



# Example of RT-based channel and scenario



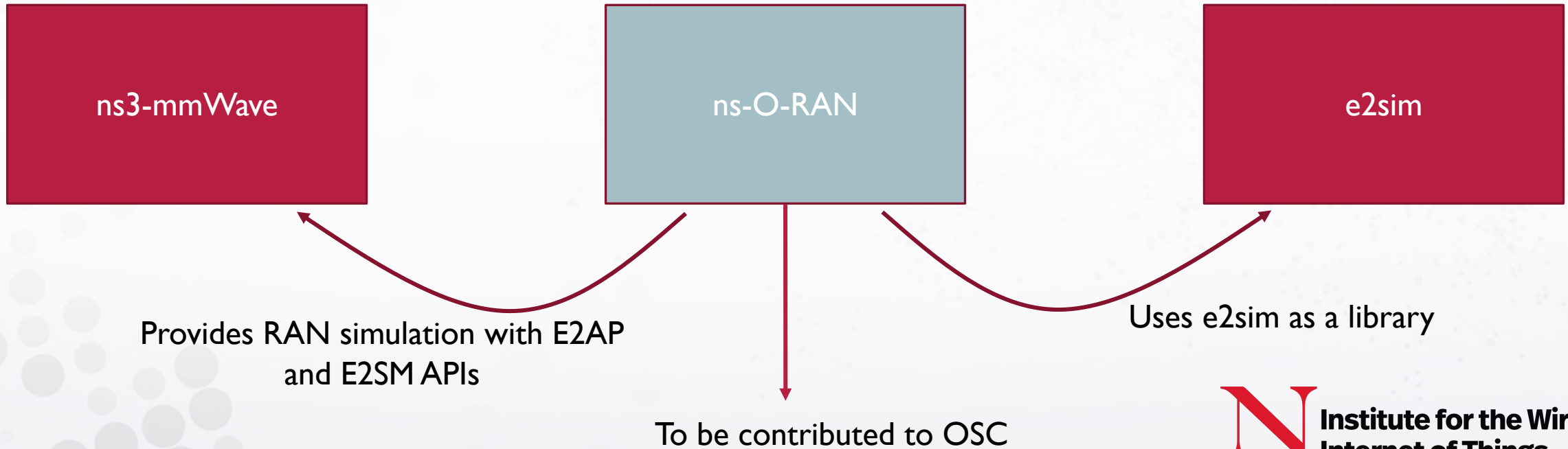
# Codebase structure

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- 3 repositories

RAN functional simulator, fork of <https://github.com/nyuwireless-unipd/ns3-mmwave> (aligned to latest updates)

Fork of <https://github.com/o-ran-sc/sim-e2-interface> in Dec. 2020 – commit a8f2a19da36d7401beefce321f30ceb0982ed342



# ns-3 mmWave module

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- Customized fork of the ns-3 mmWave module [1]
- Adapted to develop oran-e2sim and use cases
  - Already implemented subset of standard KPMs
- It will be upstreamed to the original project  
(<https://github.com/nyuwireless-unipd/ns3-mmwave>)

[1] M. Mezzavilla et al., "End-to-End Simulation of 5G mmWave Networks," in IEEE Communications Surveys & Tutorials, vol. 20, no. 3, pp. 2237-2263, third quarter 2018, doi: 10.1109/COMST.2018.2828880.

# ns3-oran-interface (or ns-O-RAN)

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- Main contribution to OSC
  - TBD: license
- Wrapper on e2sim library (compiled into a .deb) for ns-3
  - Agnostic from RAN module
  - Can be employed on different configurations
  - Uses code from ns-3 (Ptr, Object, Simulator)
  - “Helper” that can be extended to support newer ASN.1c definitions
- Enables O-RAN E2AP and E2SM
  - Anybody can implement its own simulated RAN

```
def configure(conf):  
    conf.env.append_value('CXXFLAGS', '-I/usr/local/include/e2sim')  
    conf.env.append_value("LINKFLAGS", ["-L/usr/local/lib"])  
    conf.env.append_value("LIB", ["e2sim"])
```



# oran-e2sim

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- Fork of OSC E2sim Dec. 2020 – commit `a8f2a19da36d7401beefce321f30ceb0982ed342`
- Updates:
  - Enables multiple E2 connections on the same process
  - Implements parsing and callback system for control messages
- TBD: upstream or new repo to support ns-O-RAN?

**Thanks for the attention!**  
**Questions?**