

# Demo: SkyRoute, a Fast and Realistic UAV Cellular Simulation Framework

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'AT&T Labs Research

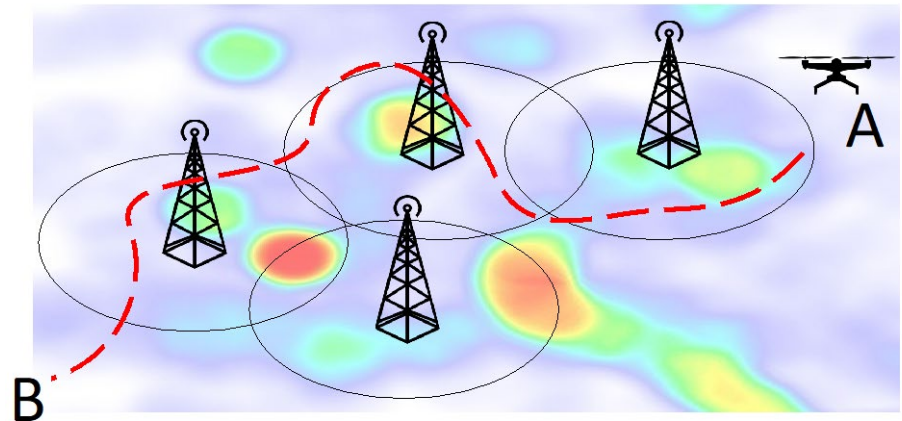
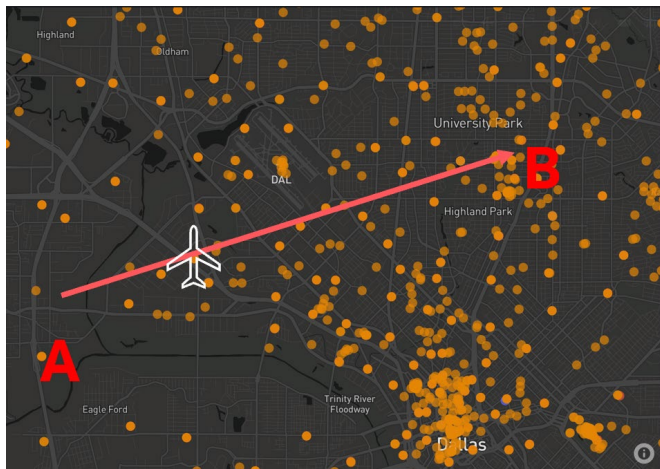
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# Project Motivation

- Unmanned Aerial Vehicle (UAV, also called drone) are finding more and more commercial applications.
- How to ensure the reliable and stable wireless communication?
- High-altitude network environment testing is extremely expensive!
- It is impossible to use real drones to measure the city's high-altitude communication data.
- **We need a high-altitude cellular environment simulator!**
- **There is a need for a visual tool that shows the flight path and the situation when flying!**

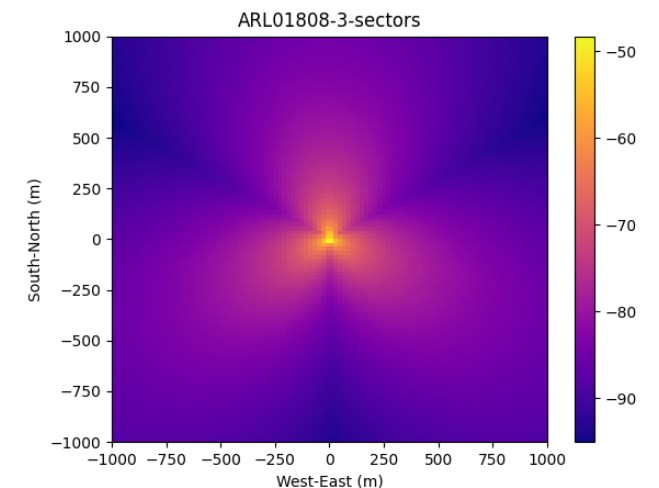
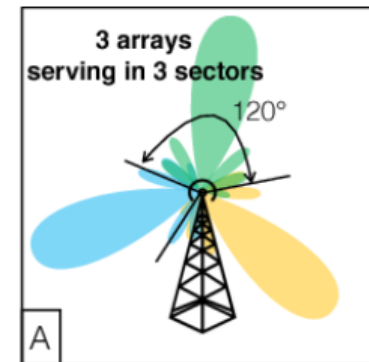
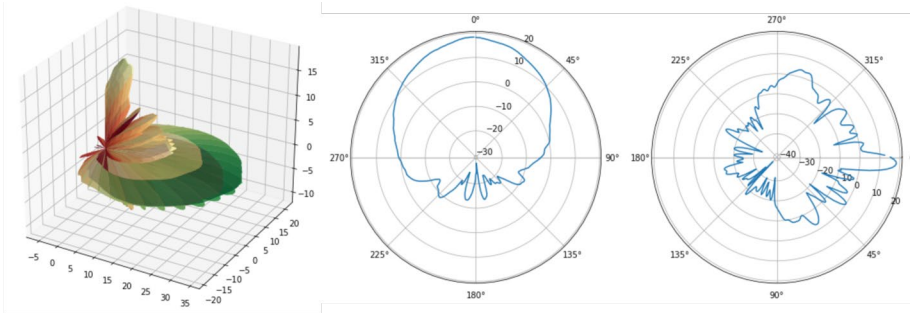
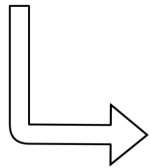


# Data Source

- Realistic data is important for any simulation!
- We have worked closely with one of the largest tele-communications and cellular network company in the US.
- Real LTE and 5G base stations data
  - Location, bandwidth, altitude, antenna model, antenna direction
- Commercial antenna model and antenna array sectors data
  - Antenna gain, antenna orientation

## Antenna Diagram

A0006009B400C4  
09BE00280AD200  
8C0AE.....



# Network Simulator

- Widely-used ns-3 discrete-event network simulator
  - The ns-3 simulator includes full stack emulation of 3GPP 4G and 5G systems
  - A key challenge with ns-3 has been the prohibitive computational cost for large cellular simulations
- We create a lightweight version of the ns-3: NSLite
- NSLite simplifies the protocol stack
  - skips control messages, PDU (protocol data unit) and SDU (service data unit) construction between layers, among other improvements that reduce the simulation's running time.
  - NSLite has expanded network functions and focus PHY layer signal strength measurement, MAC layer scheduling and advanced multi-carrier multi-cell traffic management modules.
- We added a wide variety of auxiliary methods into NSLite for constructing multi-cell scenarios and measuring high-altitude cellular environments.

# SkyRoute Components

- SkyRoute platform consists of three interrelated components:
- Deployment database
  - use real base stations and antennas data to achieve near-realistic simulations
- Network simulator
  - NSLite: fast network simulator
- UAV flight path planner
  - allows flexible customization of UAV's flight mission including way-point trajectory, flight altitude and speed.

