DensQuer

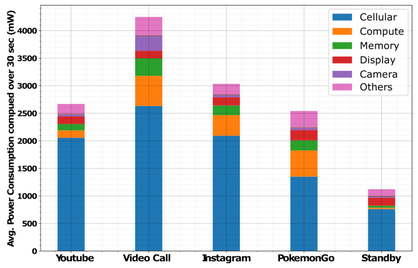
Densified, smaller base-stations can conquer the increasing carbon footprint problem in nextG wireless

Agrim Gupta*, **Adel Heidari***, Jiaming Jin*, Dinesh Bharadia

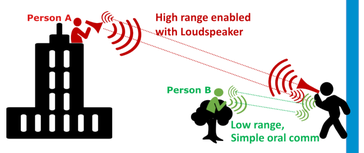
UC San Diego
Electrical and Computer Engineering
JACOBS SCHOOL OF ENGINEERING

WCSNG
Wireless Communications Sensing and Networking

Cellular power consumption



Cellular is dominating cell phone battery draw



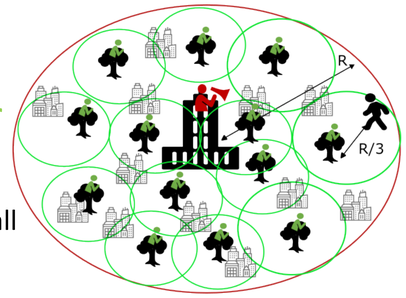
Enabling last mile connectivity significantly increases power consumption

- ATT (2023): **15 Million CO_2E**
- Microsoft Datacenters (2023): **18 Million CO_2E**

Cellular carbon emission is comparable to those of the datacenters

Densification

1. Using a greater number of **small** base-stations
2. Each base station has **lower power consumption**
3. Total base-station **power consumption** will be lower than a tall high-power base-station
4. Smartphones transmit at **lower power** to communicate with nearby base stations

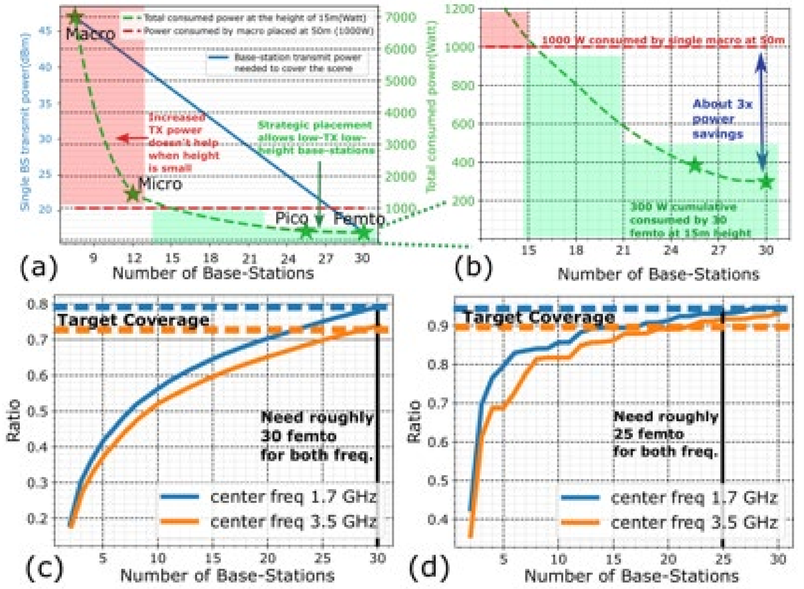


How many Person B's do you need to cover the entire area of Person A?

Analogy of densification to simple human oral communication

Evaluation

Base-station power analysis:



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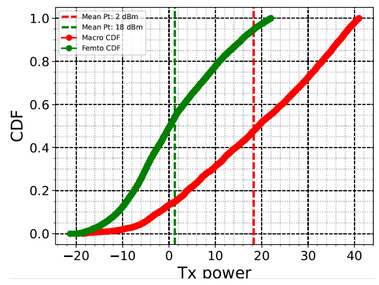
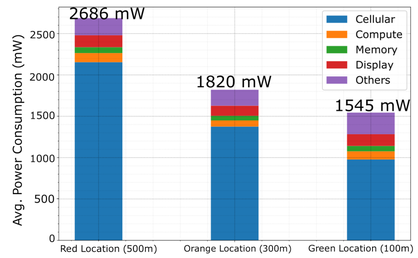
UE power analysis:
Simulation

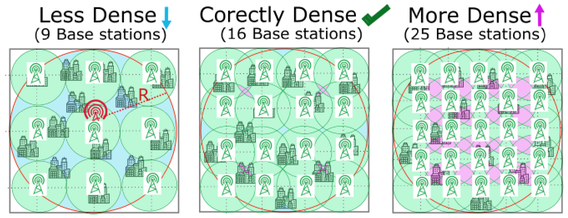
Sionna simulation for **UE Tx power** in a densified network



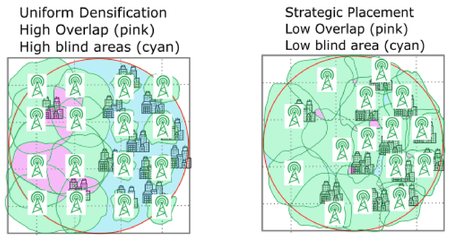
Hardware measurements



Past approaches



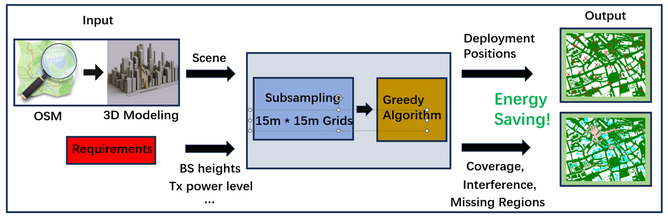
Past work approaches densification problem by performing uniform densification



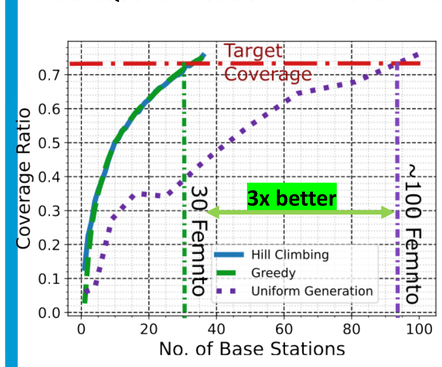
Uniform densification fails because of inherent asymmetric environment?

Strategic base-station placement optimize the deployment of smaller base-stations to reduce the nextG carbon footprint

DensQuer Methodology



DensQuer utilizes Sionna framework that provides environment information



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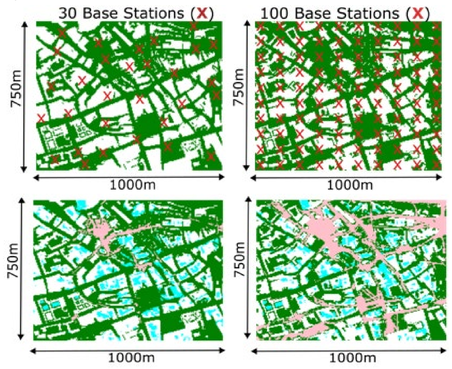
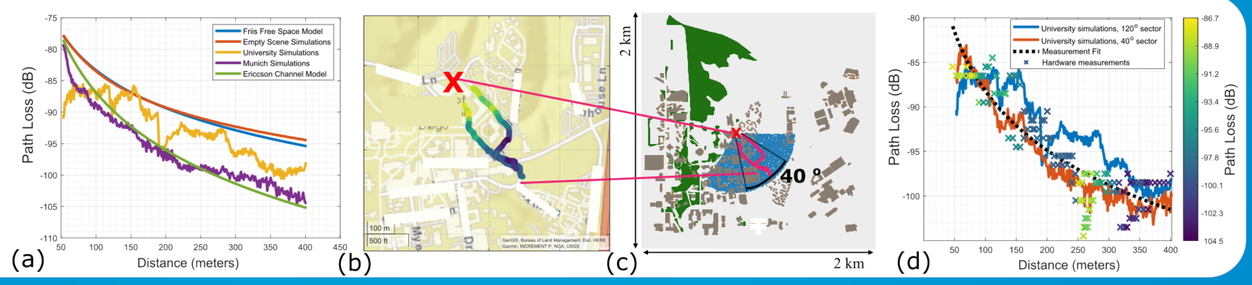


Interference-free (green), interference (pink), missed coverage (cyan)

Sionna path-loss model verification

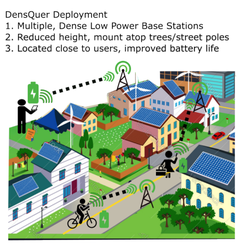
Path-loss verification for different maps using well-known theory models and hardware measurements



Summary

Current Deployments
1. Sparse High Power Base Stations
2. Dedicated Tower Infrastructure
3. Located far from the users, increased battery draw on uplink

DensQuer Deployment
1. Multiple, Dense Low Power Base Stations
2. Reduced height, mount atop trees/street poles
3. Located close to users, improved battery life



Paper website: