Emerging Antenna Array Technology: *What do we need in practice?*
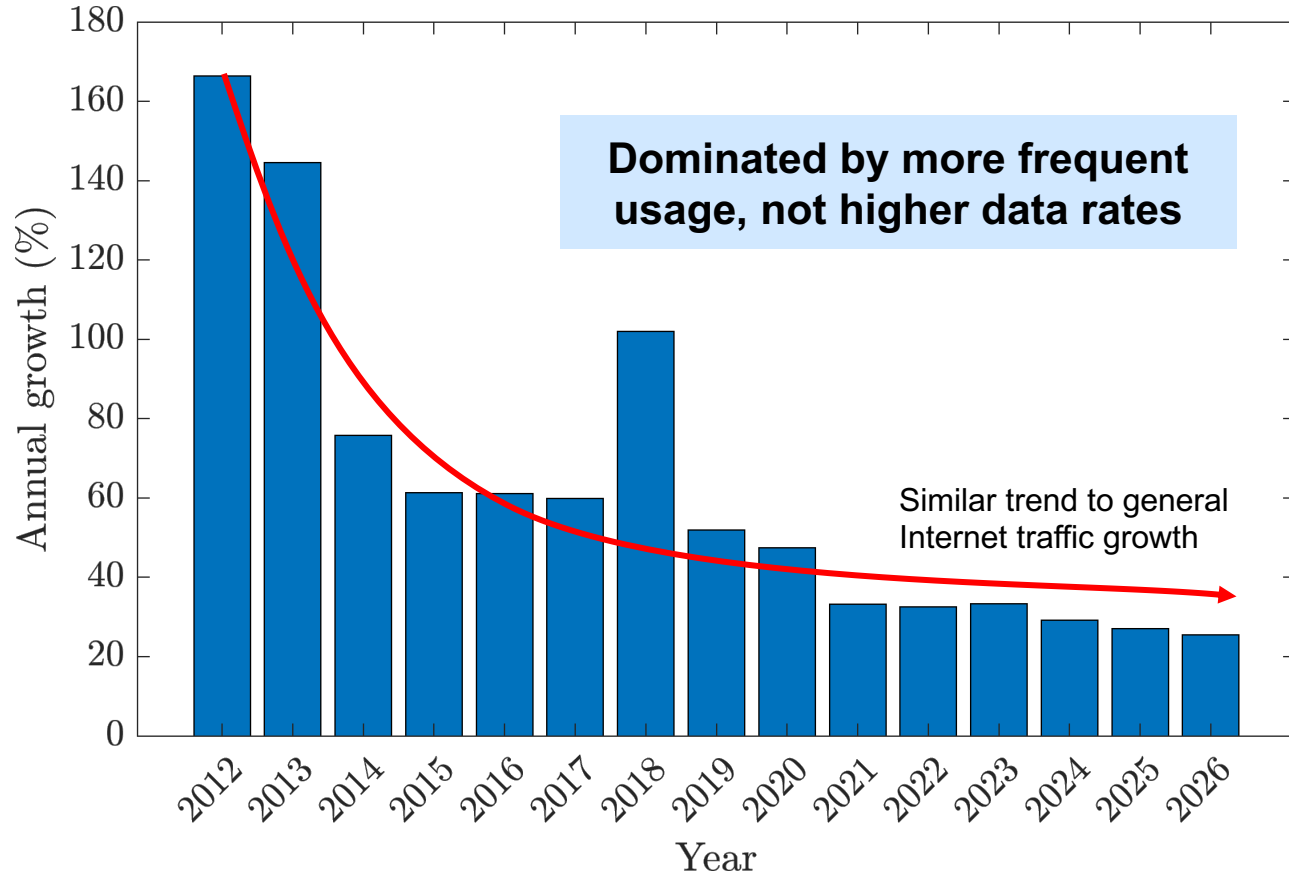
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Fellow of IEEE, Digital Futures, Wallenberg Academy

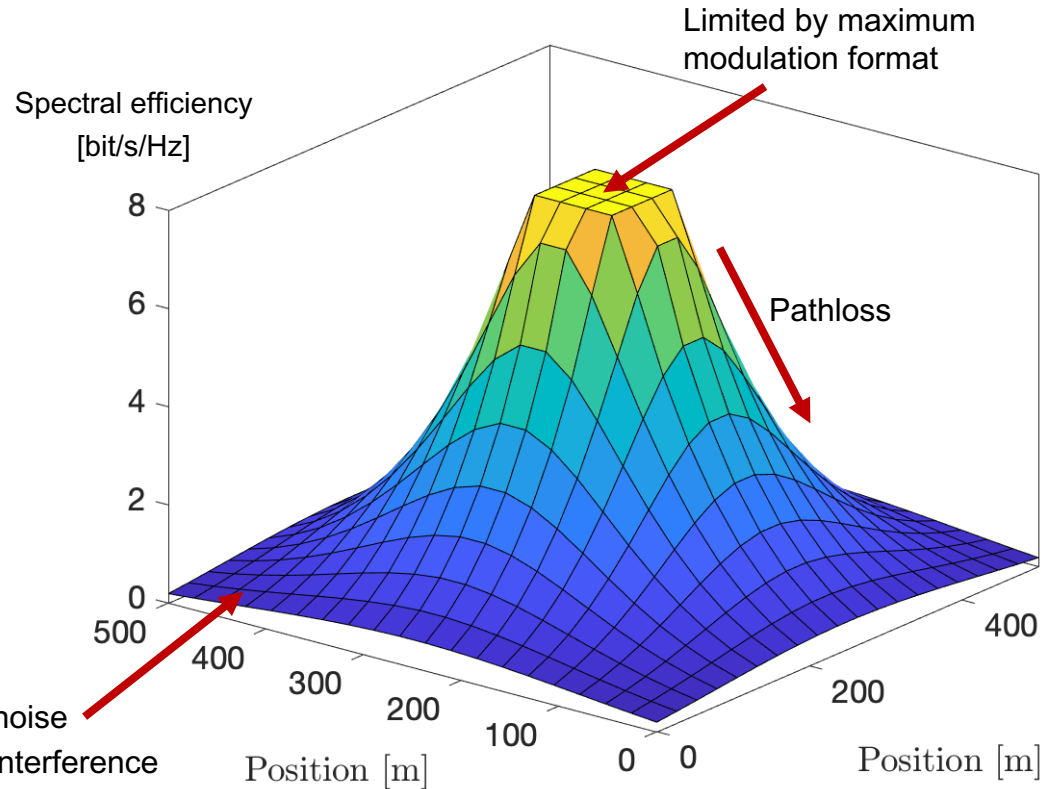KTH Royal Institute of Technology, Sweden

Observation 1: Traffic Growth Around 30%

Dominated by more frequent usage, not higher data rates

Similar trend to general Internet traffic growth

Observation 2: Most Active Users at the Cell Edge

Spectral efficiency [bit/s/Hz]

Limited by maximum modulation format

Pathloss

Large cells: Limited by noise
Small cells: Limited by interference
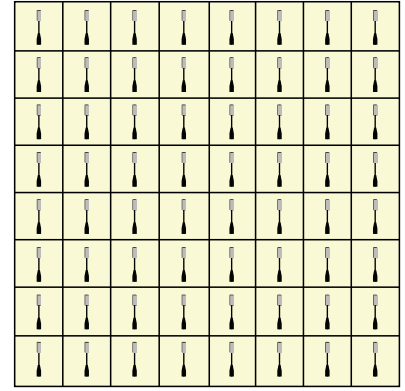
Position [m]

Position [m]

Same services everywhere: Most *active* users at cell edge!
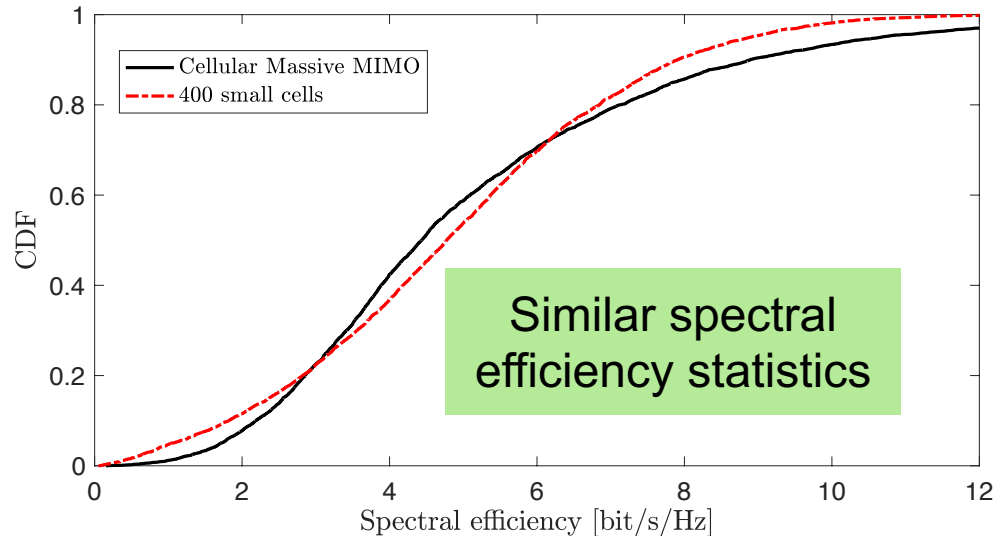
Example: Spectral Efficiency in Two Cellular Networks
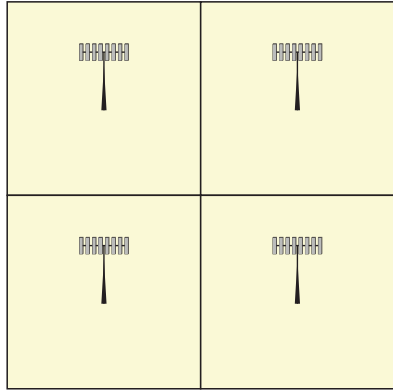
4 cells, 100 antennas
"Massive MIMO"

Large variations!

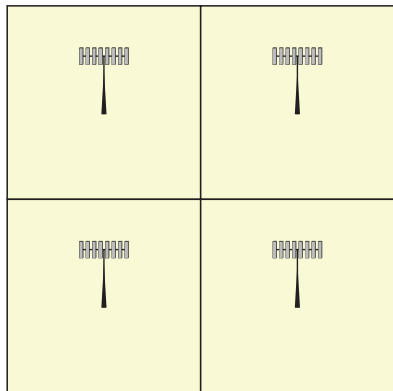Similar spectral
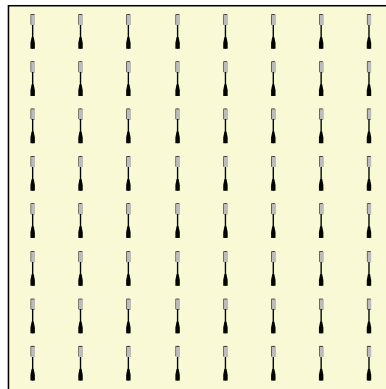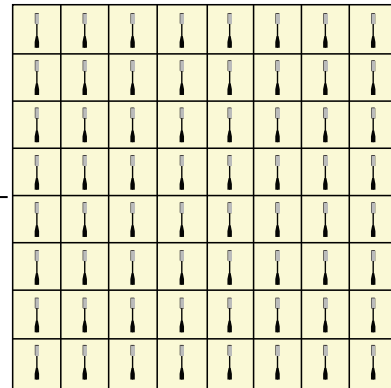efficiency statistics

400 cells, 1 antenna
"Small cells"

MIMO = Multiple input
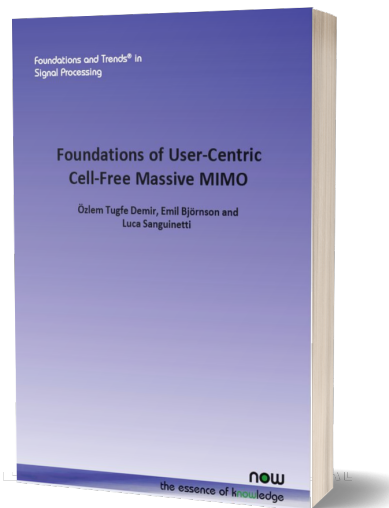multiple output

Solution: "Cell-Free Massive MIMO"
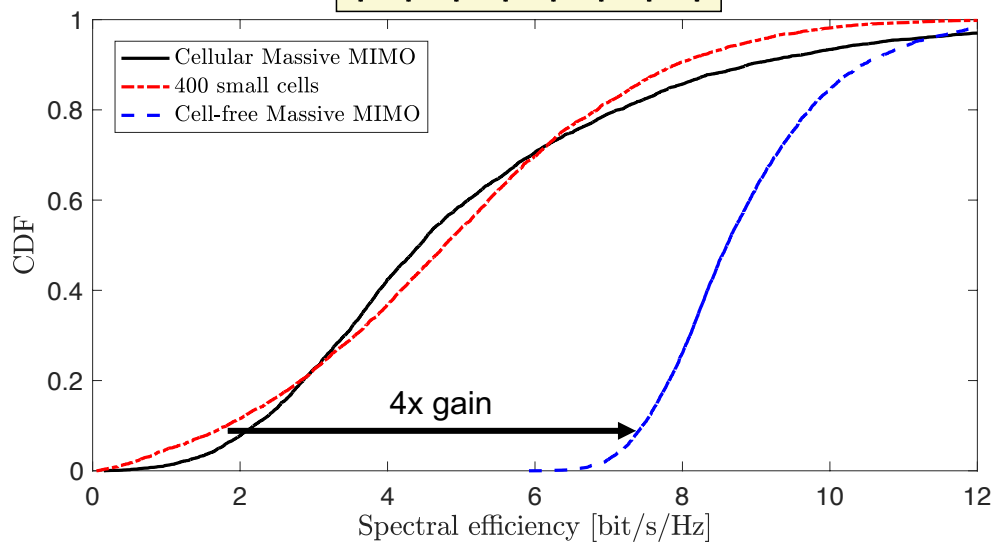
4 cells, 100 antennas
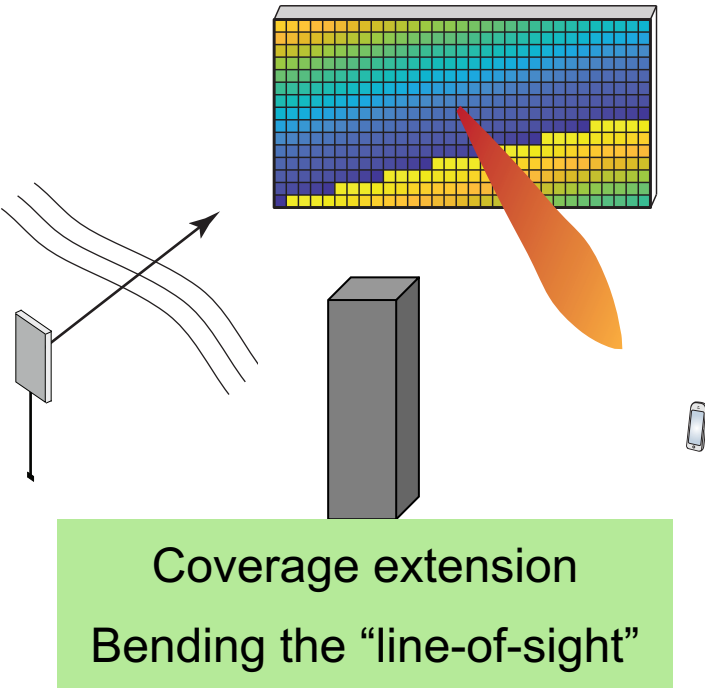
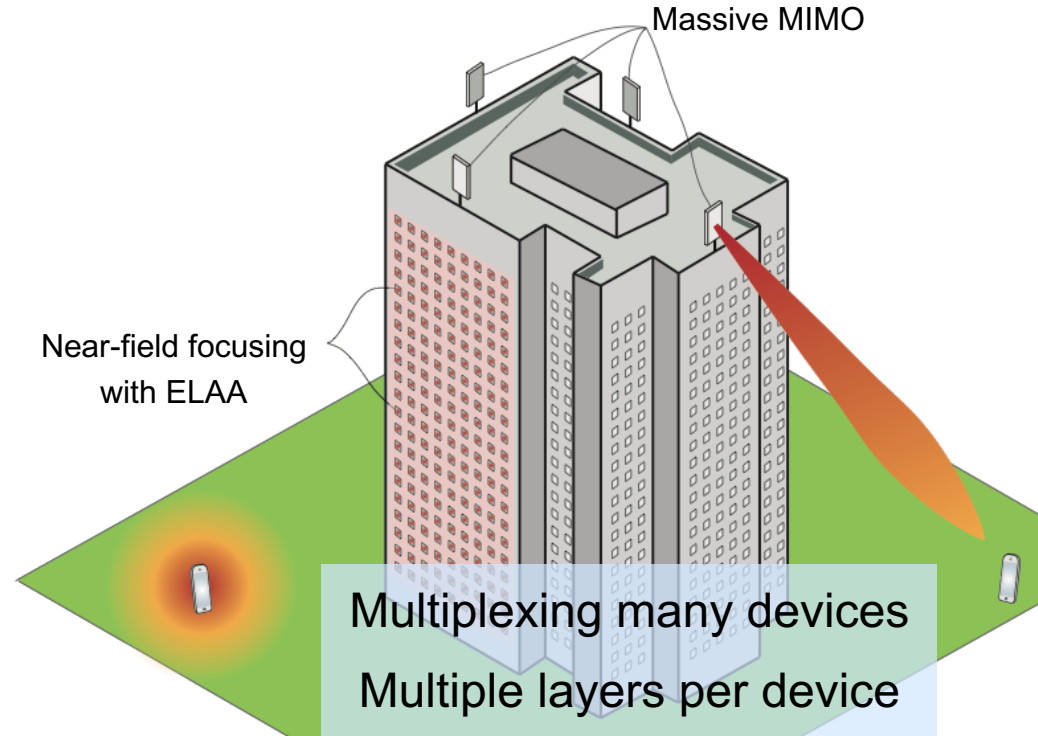*400 cells, 1 antenna*

All antennas cooperate

4x gain

Two Long-Term Flavors of MIMO

1) Reconfigurable intelligent surface
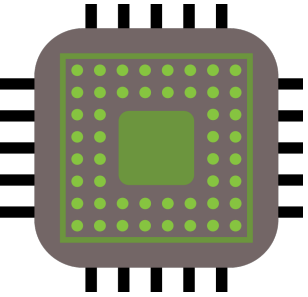

Coverage extension

Bending the "line-of-sight"

2) Extremely large aperture arrays (ELAA)

Massive MIMO

Near-field focusing with ELAA

Multiplexing many devices

Multiple layers per device

Paradigm Shifts do Happen!

More details on these MIMO technologies

https://www.youtube.com/wirelessfuture