AI-ENABLED RADIOS FOR DYNAMIC SPECTRUM SHARING

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SPECTRUM COLLABORATION CHALLENGE

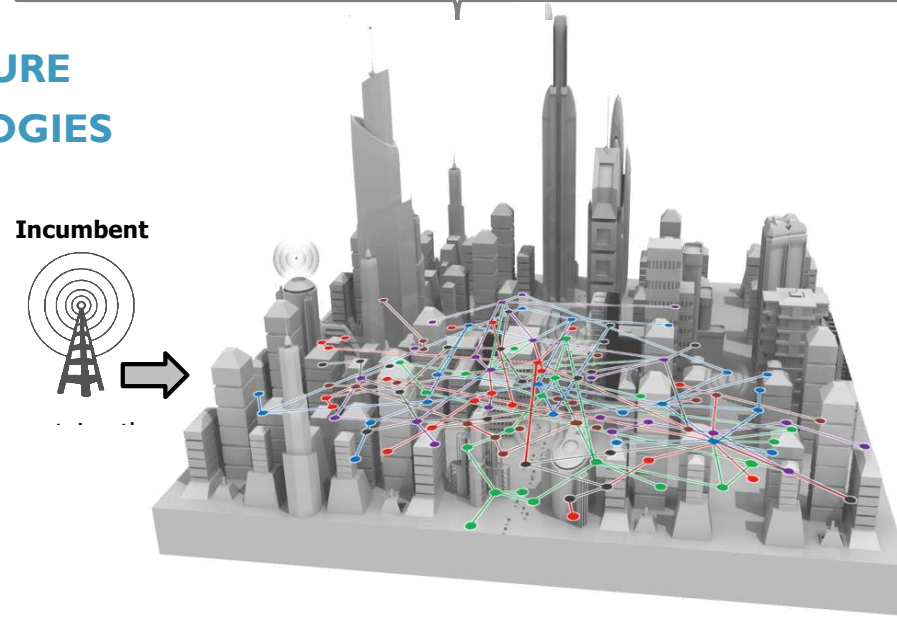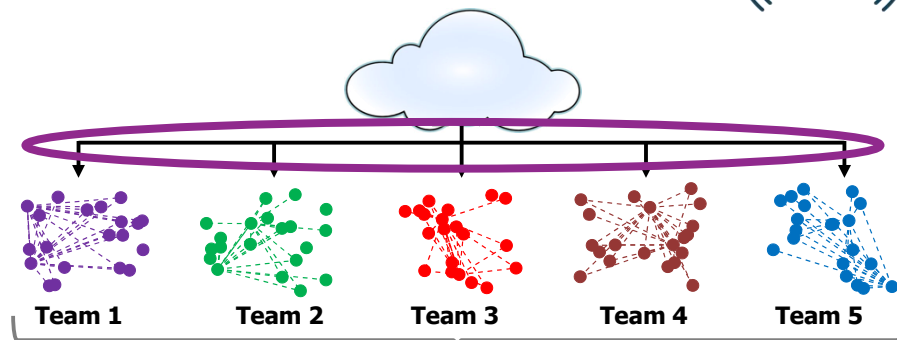**OPEN COMPETITION**
WIRELESS NETWORKS
SPECTRUM SHARING

NO PLANNING
COMMUNICATION INFRASTRUCTURE
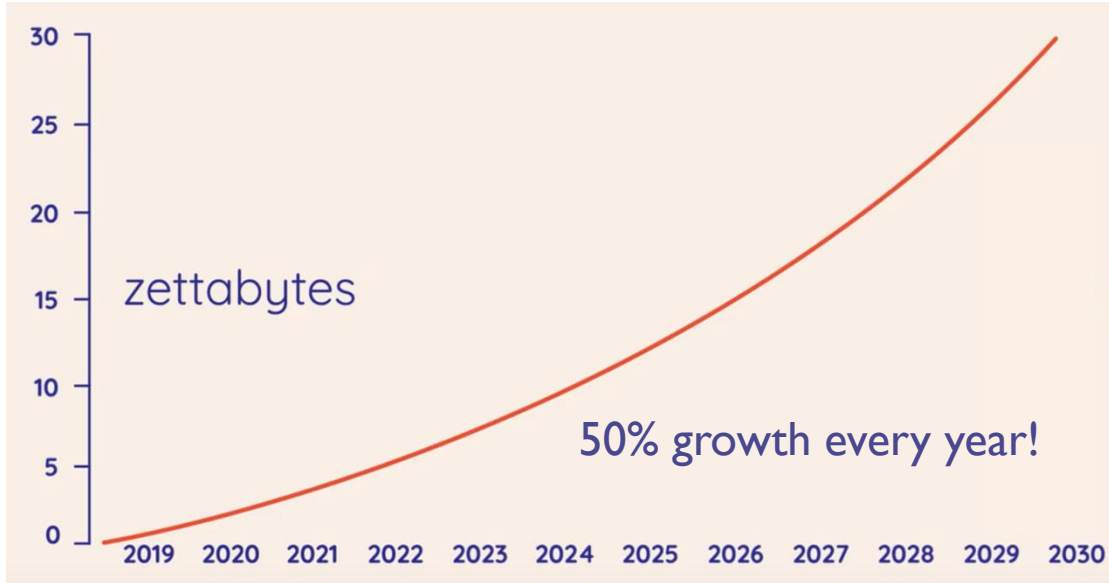STANDARDISED RADIO TECHNOLOGIES

INTELLIGENCE
LEARN TO ADAPT

COLLABORATION
OPTIMIZE SPECTRUM CAPACITY

Team 1   Team 2   Team 3   Team 4   Team 5

Incumbent

WHY SPECTRUM SHARING
GROWING DEMAND OF WIRELESS TRAFFIC

zettabytes

50% growth every year!

Source: Darpa SC2, https://youtu.be/cd3kCPvaXOw

< 6 GHz spectrum cannot grow!

WHY SPECTRUM SHARING?
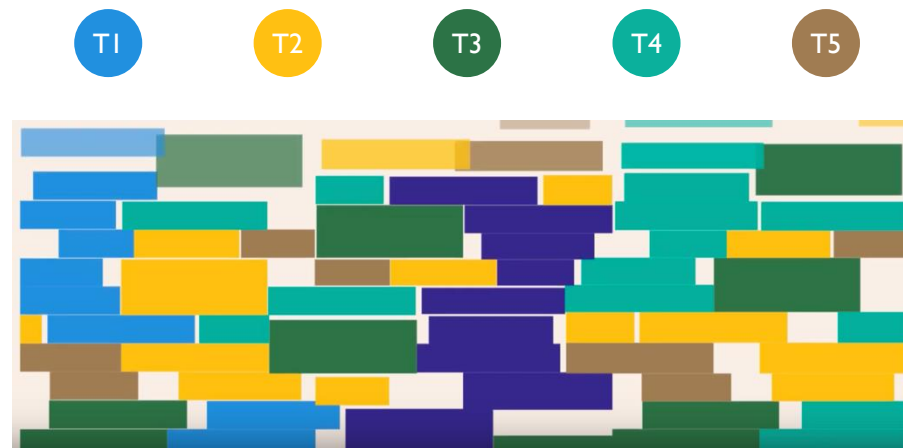## MANY UNUSED SPECTRUM

Source: Darpa SC2, https://youtu.be/cd3kCPvaXOw

MOVE AWAY FROM ISOLATION OF SPECTRUM

ISOLATION → AUTONOMY & SPECTRUM COLLABORATION

Spectrum silos lead to overdimensioning and waste of spectrum

Source: Darpa SC2, https://youtu.be/cd3kCPvaXOw

EXAMPLE OF SPECTRUM SHARING

Source: Darpa SC2, https://youtu.be/cd3kCPvaXOw
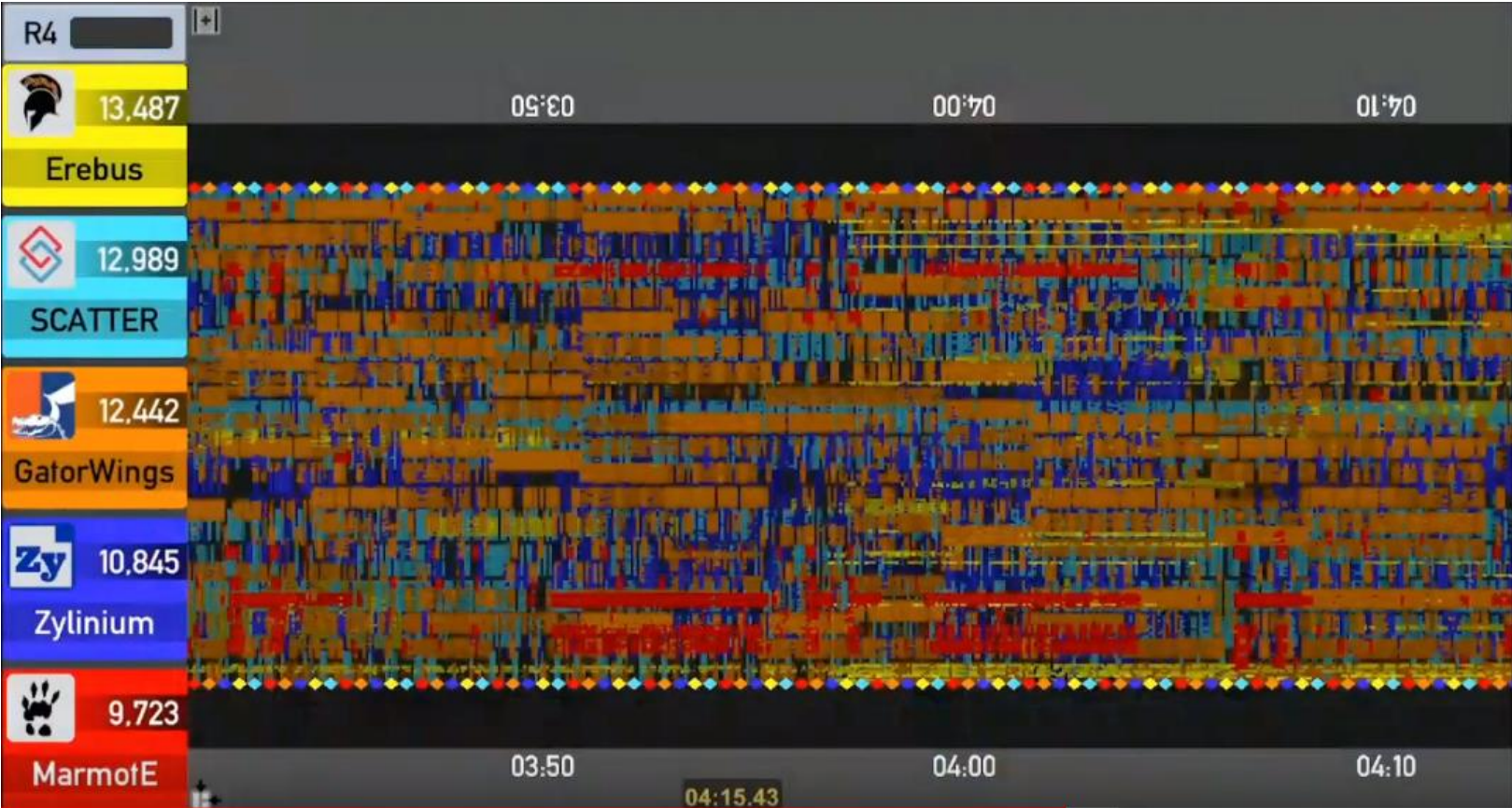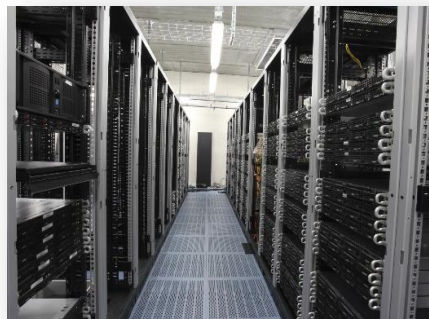
EXAMPLE OF MANDATES ACHIEVED
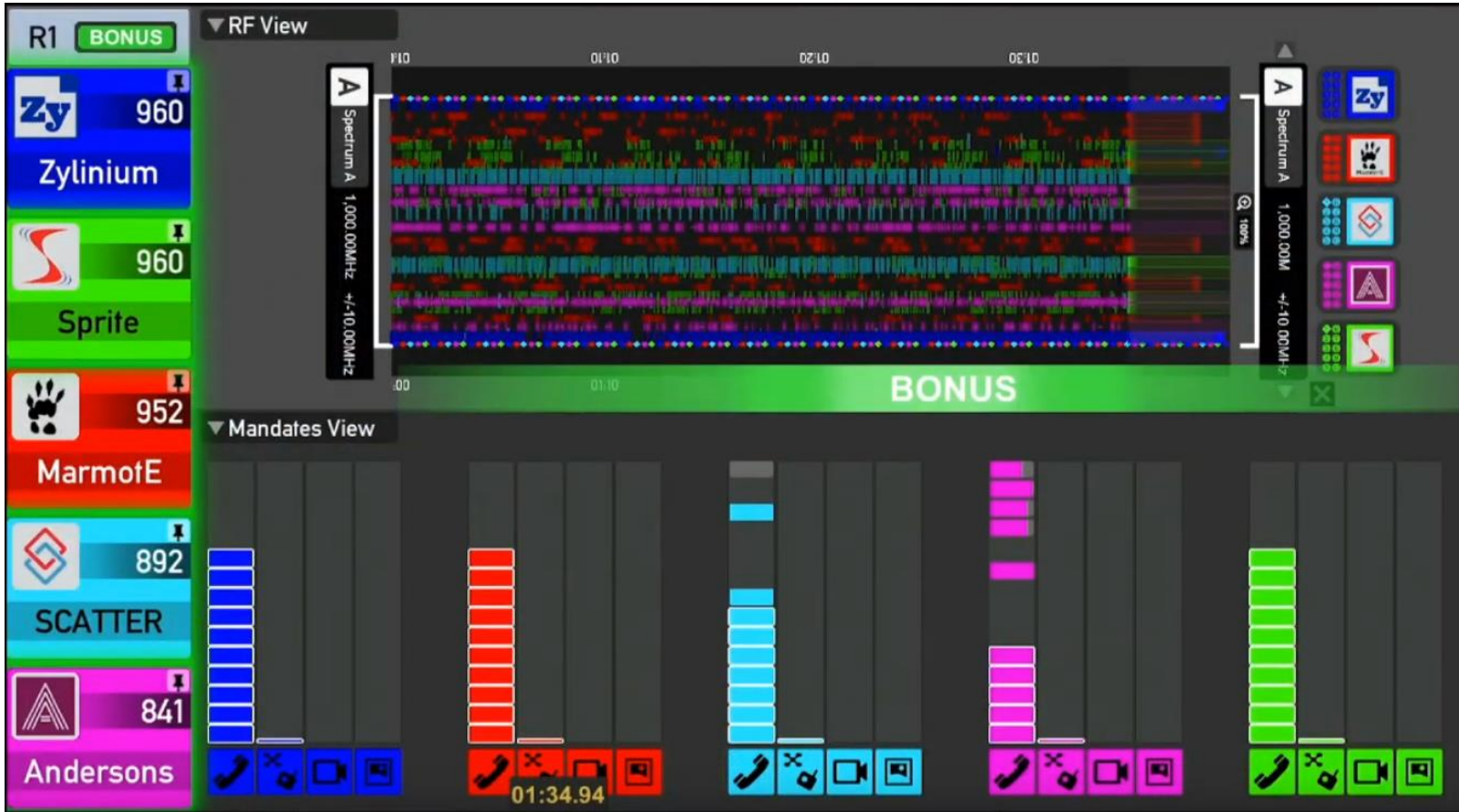
PLAYGROUND FOR EXPERIMENTATION
INTELLIGENT RADIOS (SDR, CPU, GPU) + ENVIRONMENT EMULATION

DARPA COLOSSEUM
(US)

IMEC Virtual wall, GPULab, w-iLab.t
mini-Colosseum
(EU)

RUTGERS Orbit testbed
(US)

TEAM SCATTER: DOUBLE PRIZE WINNER + FINALIST @ MWC (LA)

Dec 2017: 750 000 USD prize

Dec 2018: 750 000 USD prize

Oct. 2019: finalist, 6th position (out of 10)

LESSONS LEARNED

- Spectrum sharing outperforms spectrum isolation, but this is just the start… MORE RESEARCH & EXPERIMENTATION REQUIRED

- Centralized control (cf. 5G) versus autonomy (distributed intelligence & decisions in SC2)… DO NOT IGNORE END DEVICES: NEED FOR OPEN SOURCE SDR PLATFORMS

- Per flow QoS support… NO MORE NEED FOR OVERDIMENSIONING OF CAPACITY TO REALIZE QoS

- DARPA SC2 solutions are technology agnostic, multiple radio technologies can live together in harmony… COLLABORATION PROTOCOL NEEDS FURTHER ATTENTION

- Colosseum is a facilitator for continued cross-continental collaborative research, but WILL NON-US RESEARCHERS BE ABLE TO ACCESS COLOSSEUM FURTHER ON?

imec IDLab INTERNET & DATA LAB UNIVERSITEIT GENT Universiteit Antwerpen RUTGERS
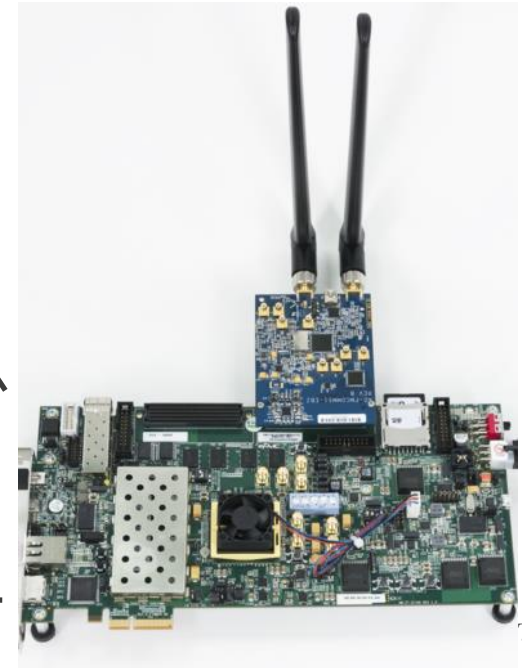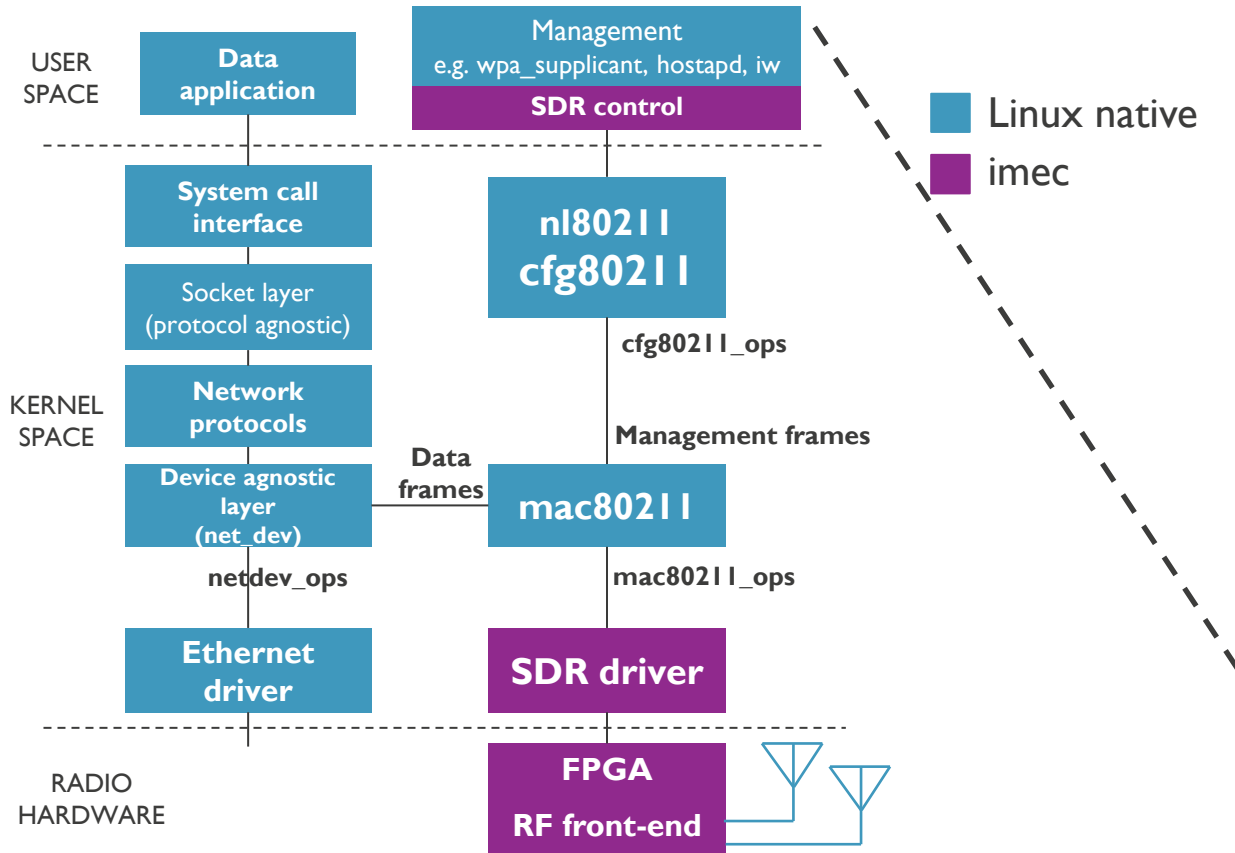
WHAT'S NEXT?
OPEN SOURCE SDR PLATFORMS!

- **srsLTE** (SRS): packet-based & resource-optimized LTE version used in DARPA SC2
- **OAI** (Eurecom): 5G NR to be used in POWDER testbed for validation of DARPA solutions in outdoor wireless environment (mandatory for DARPA prize winners)
- **Open-Wi-Fi** (imec)
  - First FREE open source full stack real-time Wi-Fi
  - Developed in ORCA and to be launched in January 2020 (GPLv3)
  - Implemented on Xilinx SoC: FPGA with embedded ARM and Linux
  - With the native Linux driver framework, SDR behaves like a commercial Wi-Fi card
  - Talks to commercial devices, and also allows easy customization
  - Roadmap: .ax features (numerology, OFDMA, colouring…)
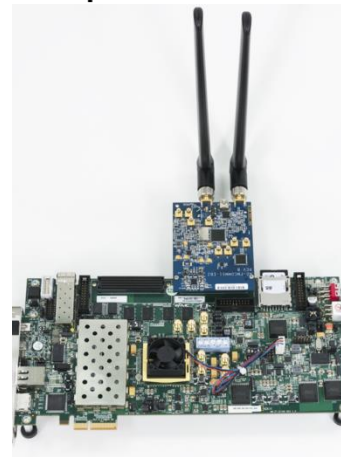
Open source full stack real-time SDT WiFi on FPGA with embedded ARM and Linux

TEAM SCATTER THANKS YOU