Analog & Digital Radio over Fiber in 5G Networks

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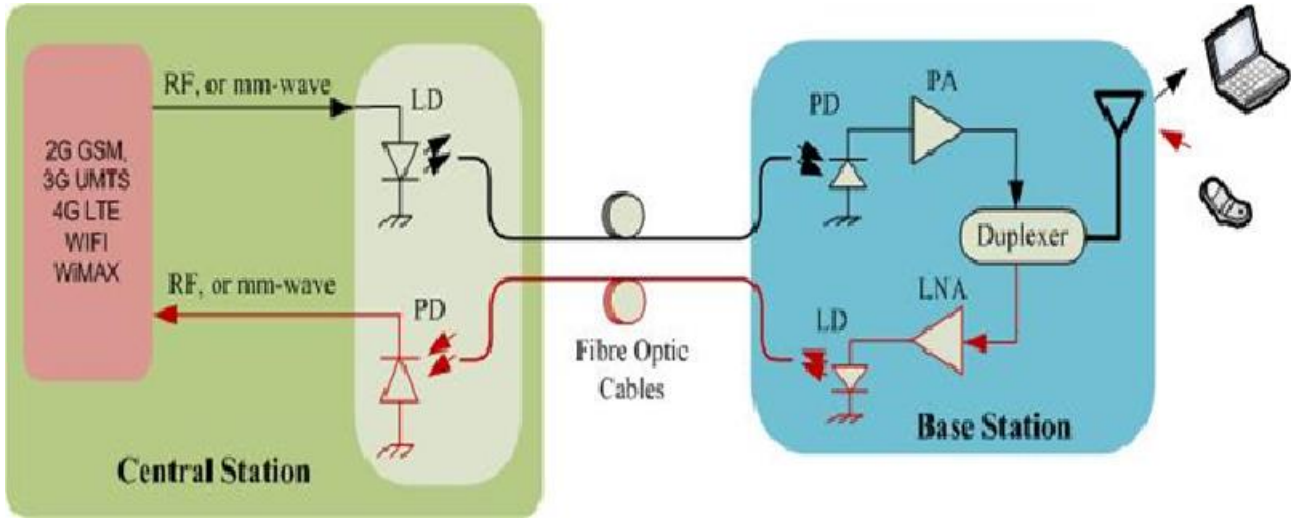
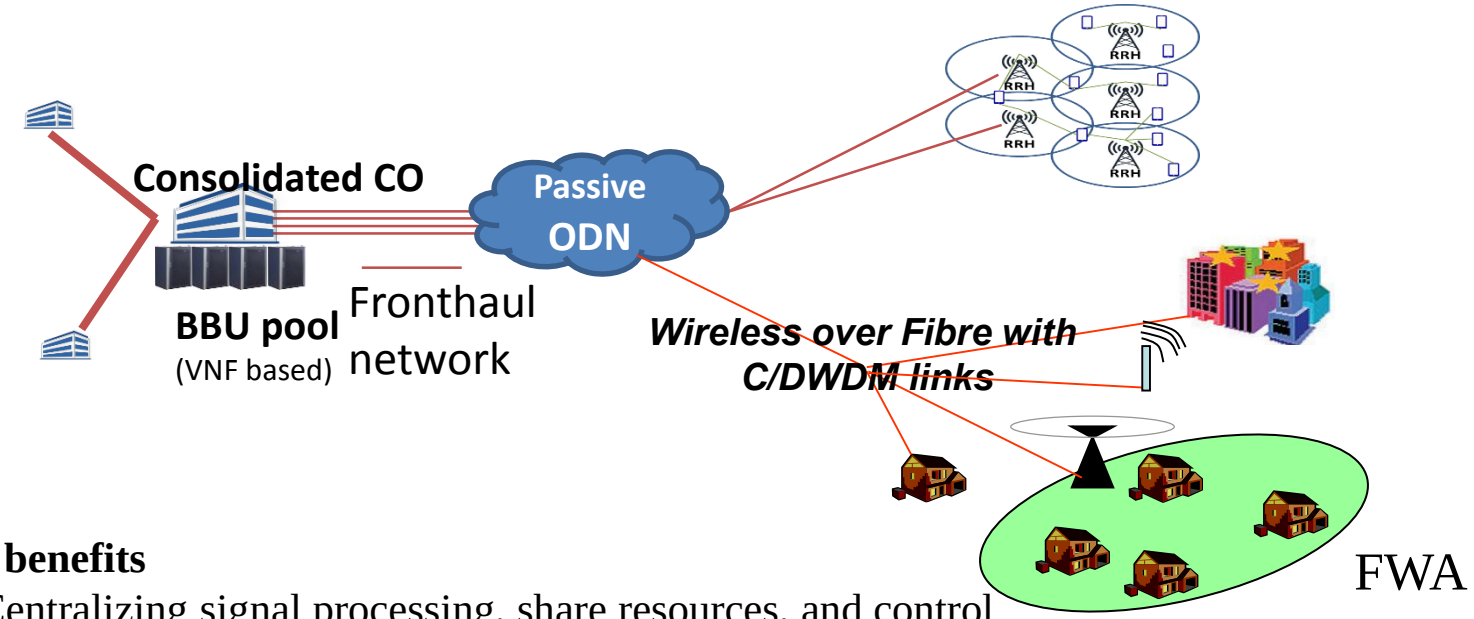
Radio over Fibre (RoF) Technique



Integration of wireless and fibre optic communication technologies, and modulating wireless signals over optical carrier for transporting over fibre optic cable.

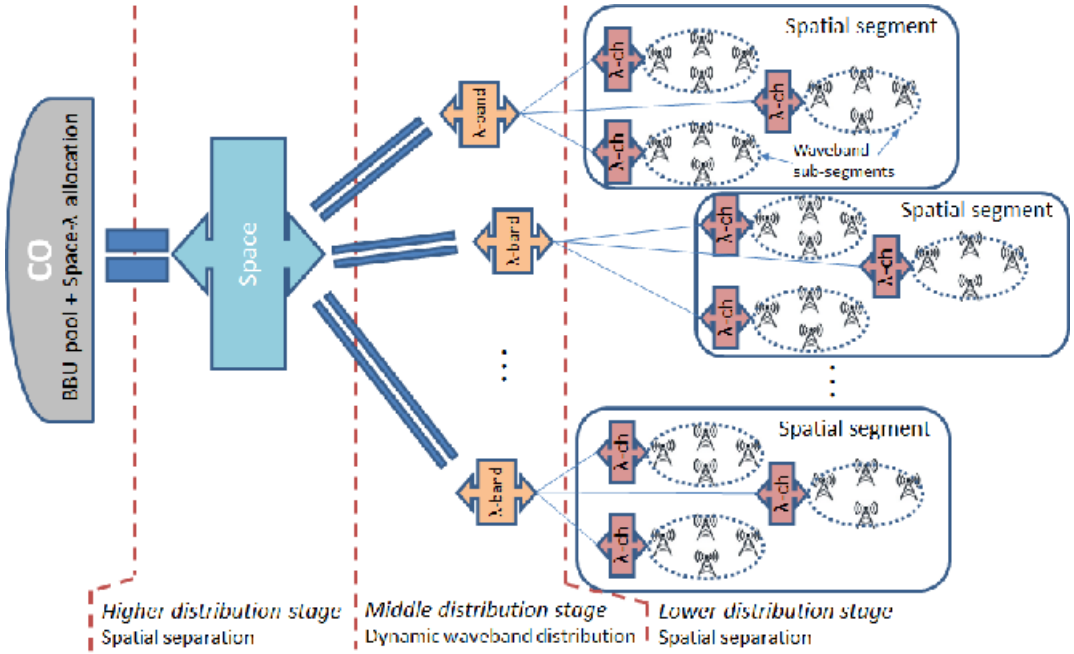
Targeted C-RAN architecture model (blueSPACE)

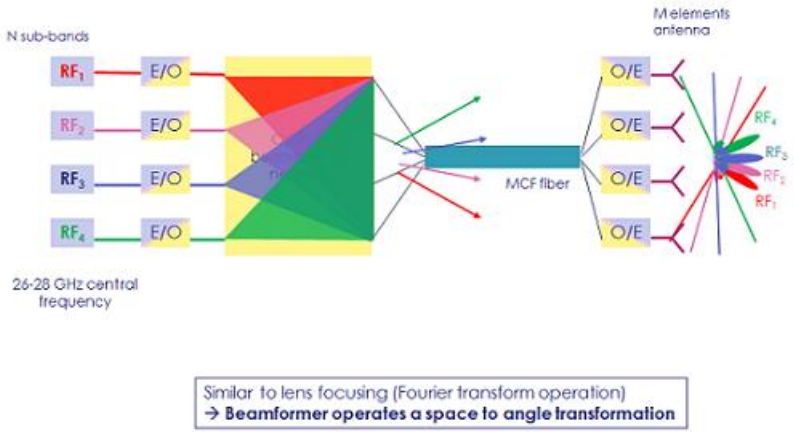


RoF benefits

- Centralizing signal processing, share resources, and control and management.
- Cheaper, smaller size & simpler base stations.
- Smaller cells: allocates higher bandwidth to end-users.
- Could be accommodated with passive optical network (PON) Infrastructures.
- Can use wavelength division multiplexing (WDM) technique for improving the network throughput.
- Physical BBUs located at the CO.
- Actual BBUs can be replaced by virtual BBUs Some HW functions are still needed (encryption, HARQ, FEC, Beam forming)

Convergence optical to wireless

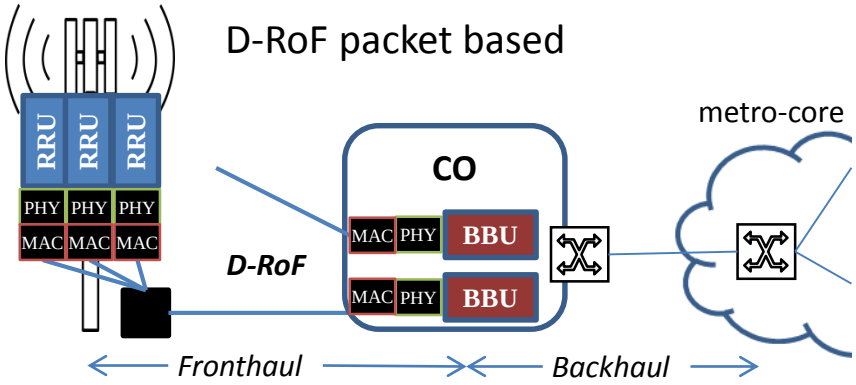


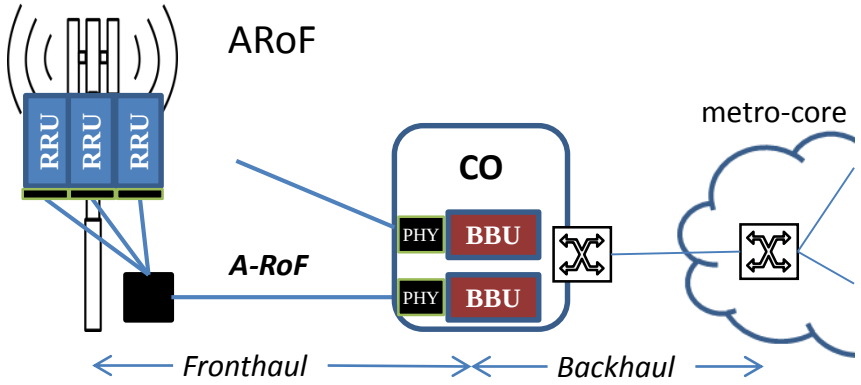


Optical Beamforming: carries the RF signals in MCF to the antenna arrays

BlueSPACE design options – DRoF and ARoF

- Two main approaches to be considered
  1. Move towards packet based DRoF approaches (NGFI and eCPRI)
     → Requires MAC layer processes to be added in RRU site thus increasing the overall cost, complexity and power consumption
  2. Move towards ARoF approaches thus avoiding the digitization process
     → Performance limitation and immature transceiver prototypes.





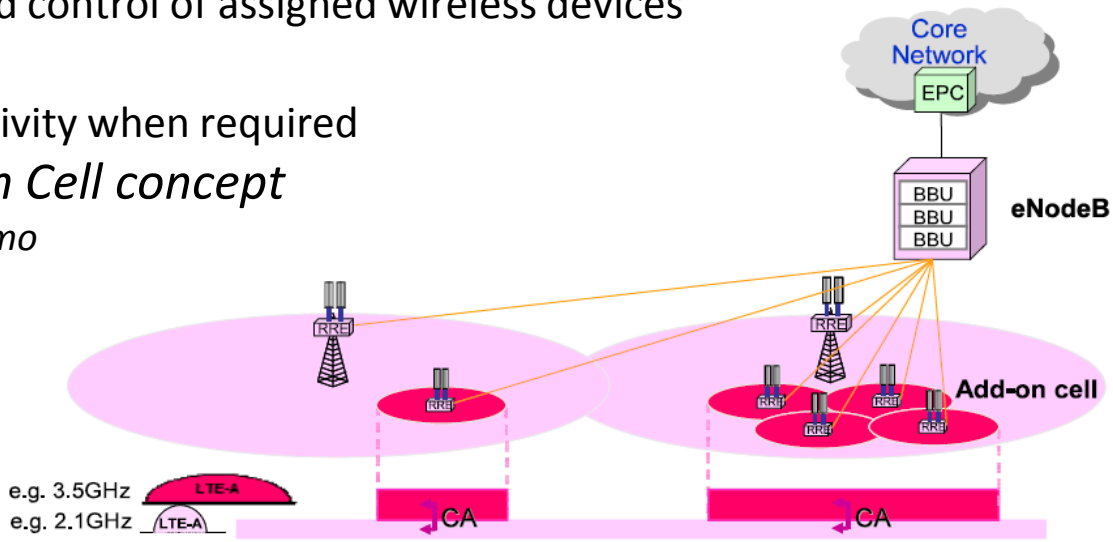
- Study the requirements of NGFI/eCPRI
- Use as benchmarking for comparison with ARoF
- No new developments
- Study the potential benefits by the use of space dimension

- Main development target for blueSPACE
  - Technologies for SDM enabled ARoF
  - Network dimensioning, cost, feasibility
  - Control plane requirements
- Focus on optical fronthaul at 26GHz … but define also wireless access requirements

European Commission | Horizon 2020 European Union funding for Research & Innovation

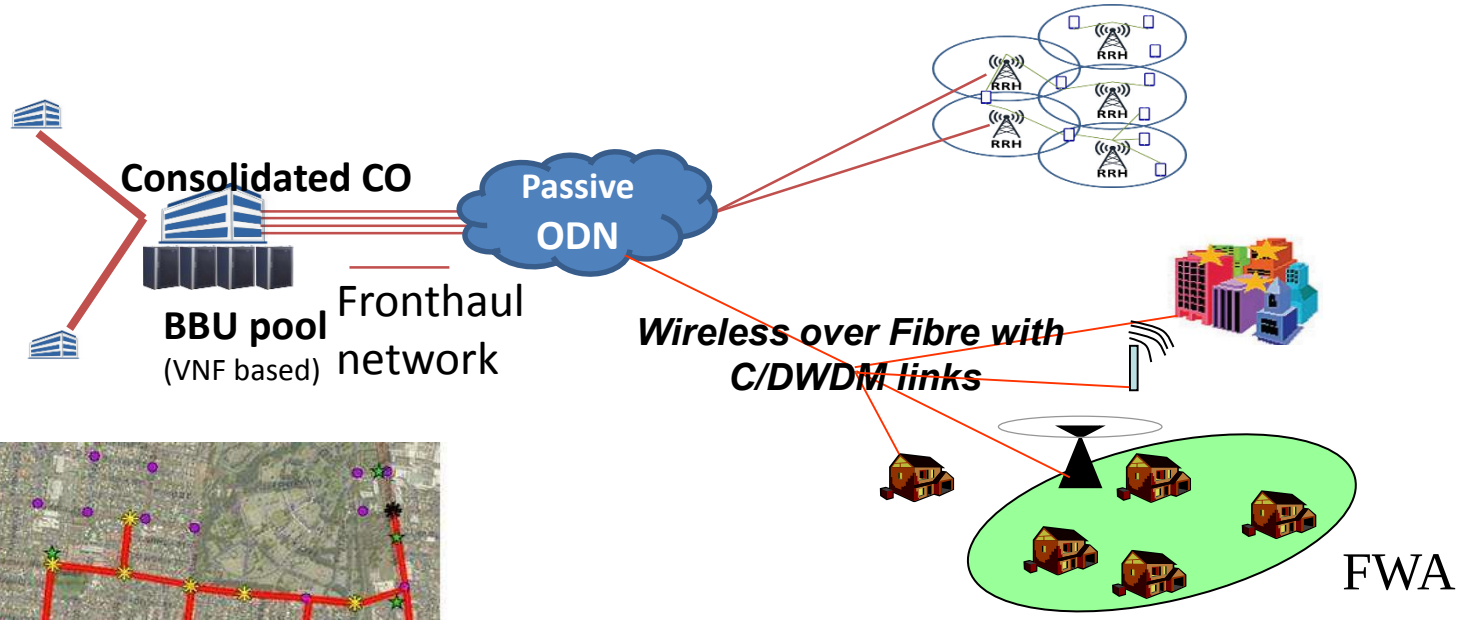
Hybrid macro- small-cell infrastructure model

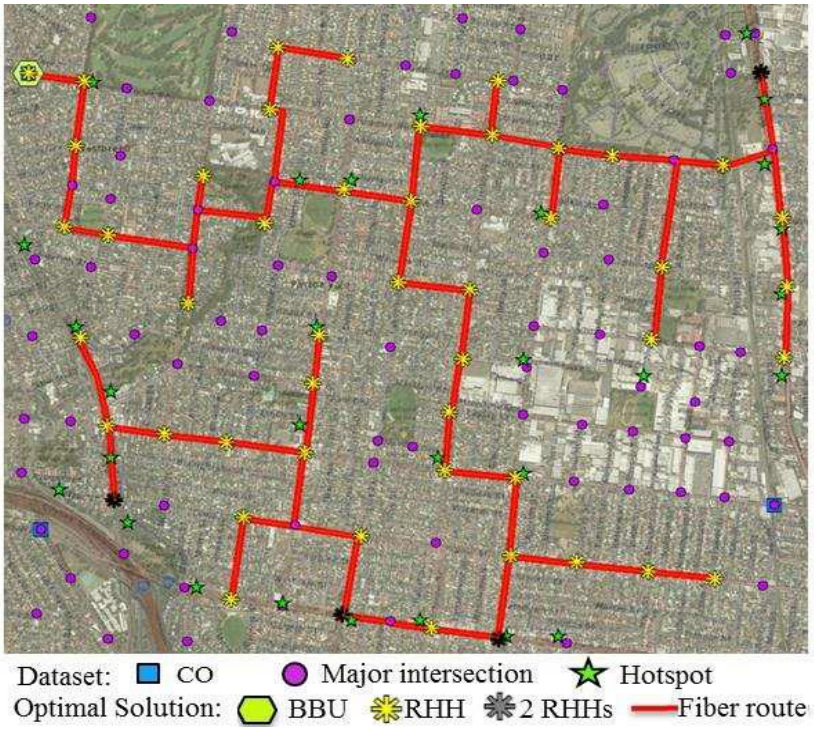
- Concept: *Make the best use of the two wireless bands at sub-6GHz and 26GHz*
  - Sub-6GHz to provide:
    - → basic connectivity and services
    - → registration, tracking and control of assigned wireless devices
  - 26GHz to provide:
    - → high bandwidth connectivity when required
  - Referred as the *Phantom Cell concept*
    - *Proposed by NTT Docomo*



- New design aspects:
  - Small cells offer super high bit rate transmission using higher frequency bands (26GHz) and wider bandwidth and are overlapped onto macro cells (sub-6GHz) that support coverage and mobility
  - The radio links corresponding to User (U)-plane and (C)-plane are separately supported by small cells and macro cells, respectively.

Business Cases to be studied

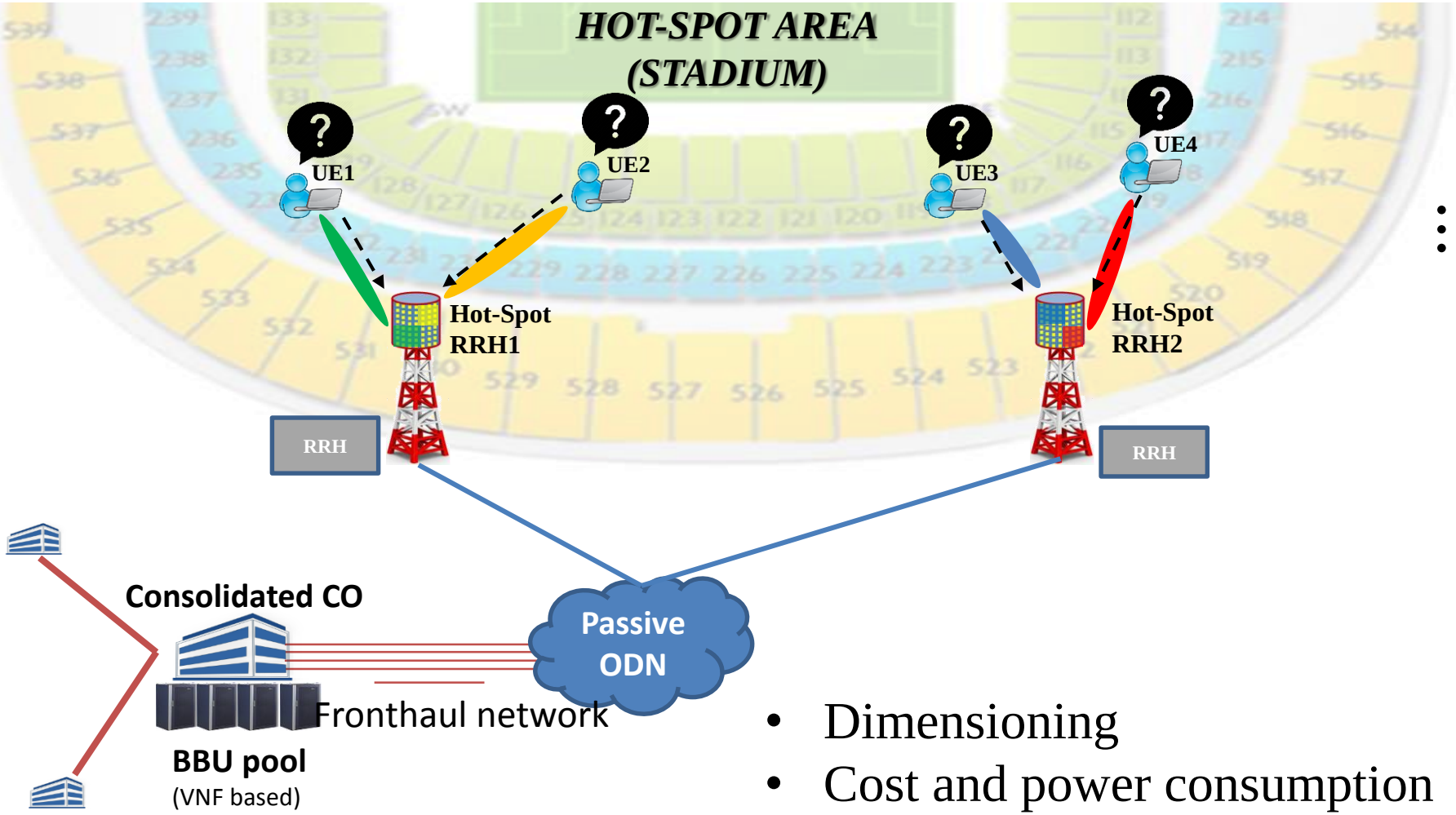




Fixed wireless access in high frequency to create hot spots and also give access inside houses

Business Cases to be studied

- Real dense urban areas
- Office connectivity requirements
- Stadium, Shopping malls (and other large outdoor are



- Dimensioning
- Cost and power consumption

Thank you