

6G-REFERENCE

6G haRdware Enablers For cEll fRee cohEReNt Communications & sEnsing

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6G-REFERENCE focuses on ultra-dense cell-free deployments for joint coherent communications and sensing at cm-waves, which balance the benefits of sub-6GHz (e.g. reduced pathloss) and mm-wave (e.g. wide bandwidth) ranges. 6G-REFERENCE targets transceiver hardware innovations enabling 6G densely distributed systems exploiting distributed MIMO. To allow for flexible deployment, fiber access cannot be taken for granted.

6G-REFERENCE motivation

In urban areas, 6G will need to rely on a sustainable solution to cope with the ever-increasing traffic demands and population densification, while providing disruptive capabilities like the materialization of the internet of sense. Synchronization in frequency and time over the air then becomes a key challenge. Distributed cell-free MIMO systems arise as a promising solution to address required improvements in data capacity, while also supporting distributed sensing functionality. Realizing all this functionality in practical hardware with low complexity, cost, and power consumption is a key challenge. We believe this may be possible exploiting cm-wave 10-15 GHz spectrum.

6G-REFERENCE objectives and hardware

The development of 6G hardware enablers for joint communications and sensing

In-Band MIMO full duplex transceiver innovations

- Data capacity enhancement
- Solving scheduling challenge
- Enabling monostatic radar

Novel synchronization solutions

- For accurate phase/frequency/time sync
- Continuous sync enabled by full duplex (FD SYNC)

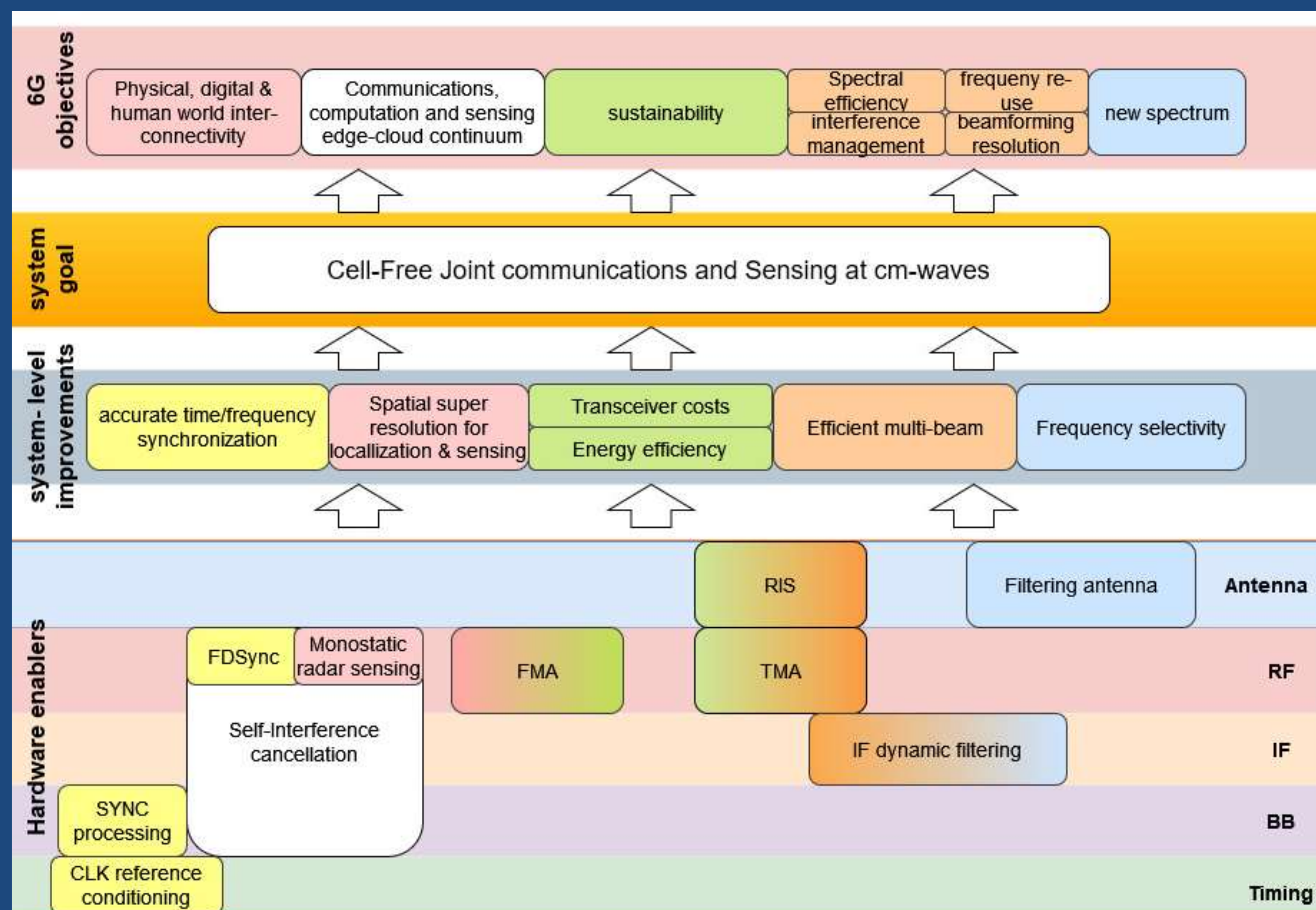
Novel RF and antenna components

- Reduced complexity/cost
- Time modulated arrays
- Frequency modulated arrays
- RIS
- Environmental sensors

Dynamic filtering (IF and antenna)

- Frequency selectivity
- Spectrum coexistence (10-15 GHz)

Hardware solutions and their relation to system level improvements and 6G goals



6G-REFERENCE challenges

Five fundamental challenges:

- The need of accurate synchronization among distributed radio units
- Fronthaul data distribution
- Integration of sensing capabilities
- Low complexity/cost/consumption radios
- Coexistence with other services

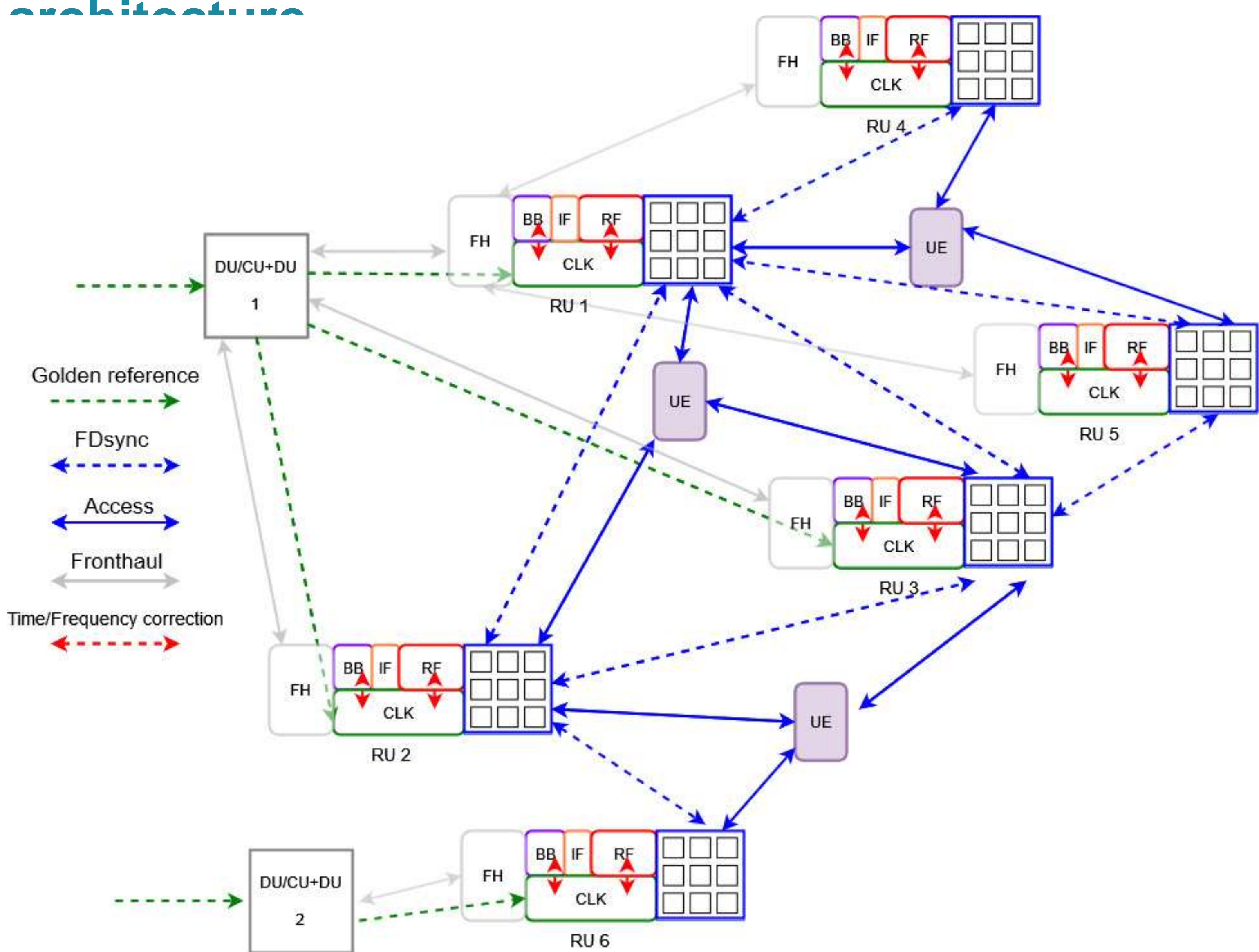
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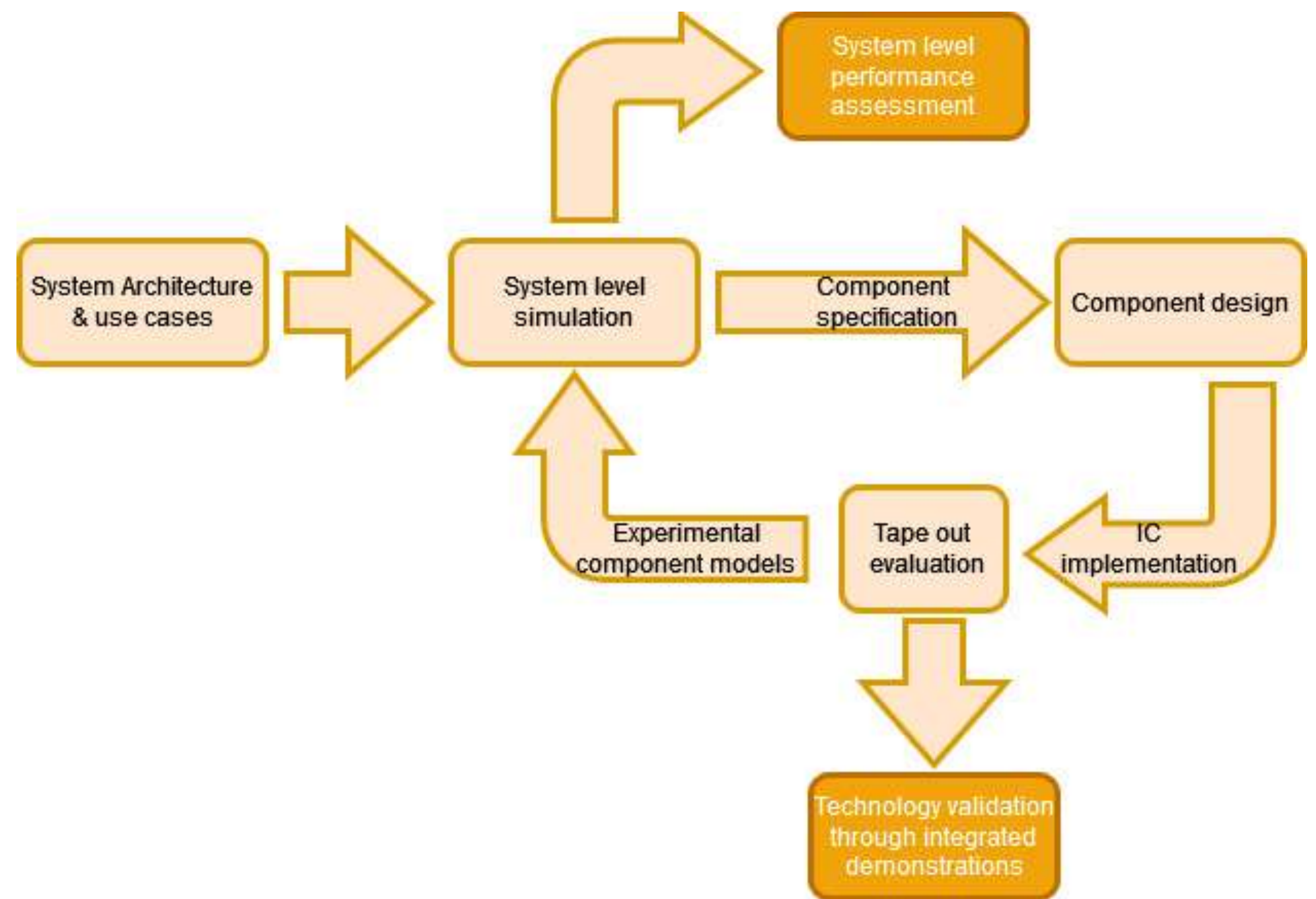
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6G-REFERENCE activities and goals

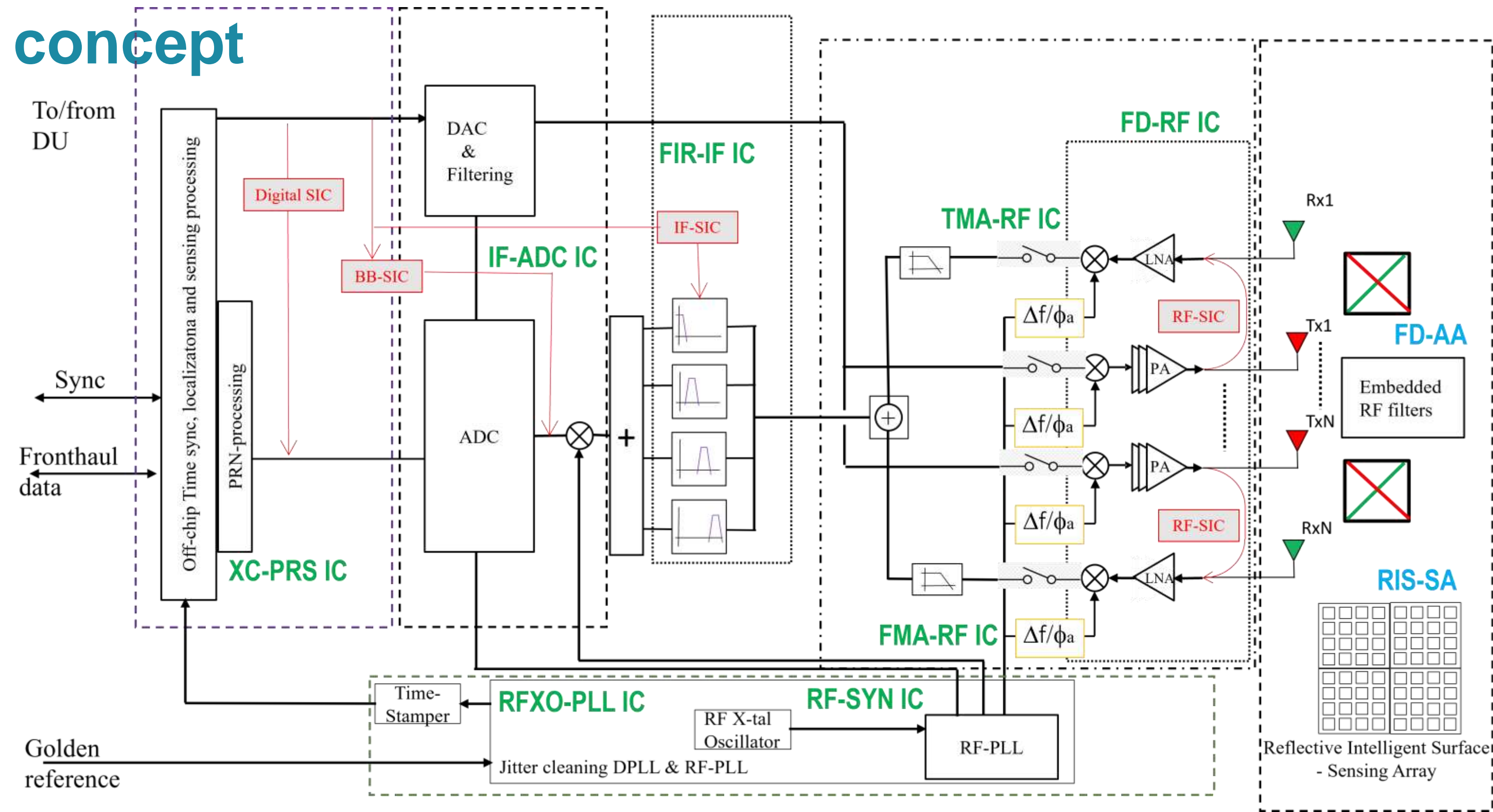
6G-REFERENCE Preliminary baseline architecture



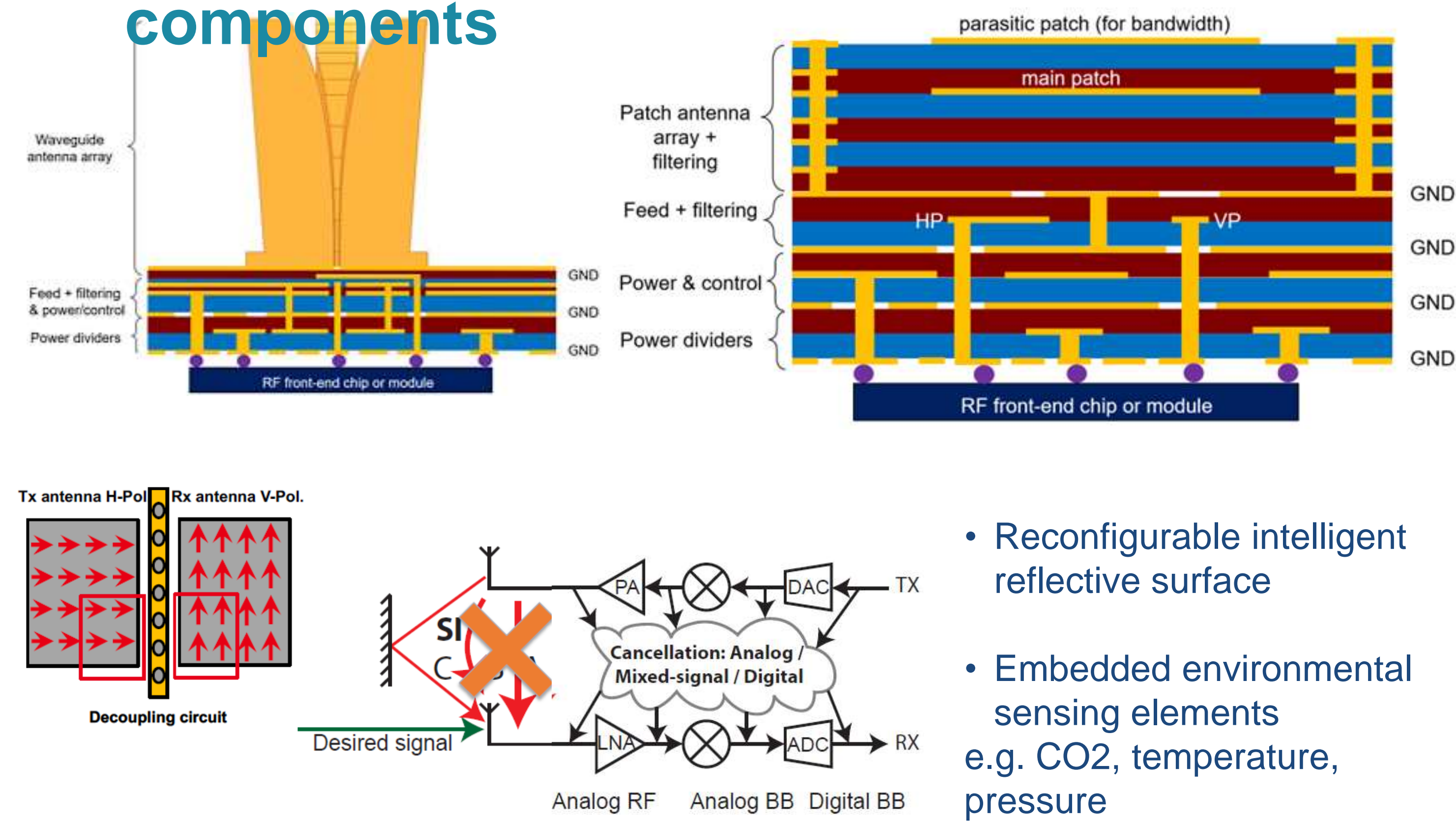
6G-REFERENCE Integrated Circuit Development



6G-REFERENCE Radio unit concept



6G-REFERENCE RF and antenna components



6G-REFERENCE Time Modulated Array – Frequency Modulated Array

