FANTASTIC

Achievements & Next Steps
Selected project outcomes and follow-up

Frank Schaich with the help of the complete consortium

June 2017

Agenda

1. A recap – focus of the project
2. Selected project outcomes/recommendations
3. Continuation, future exploitation of the project outcomes

A recap – focus of the project

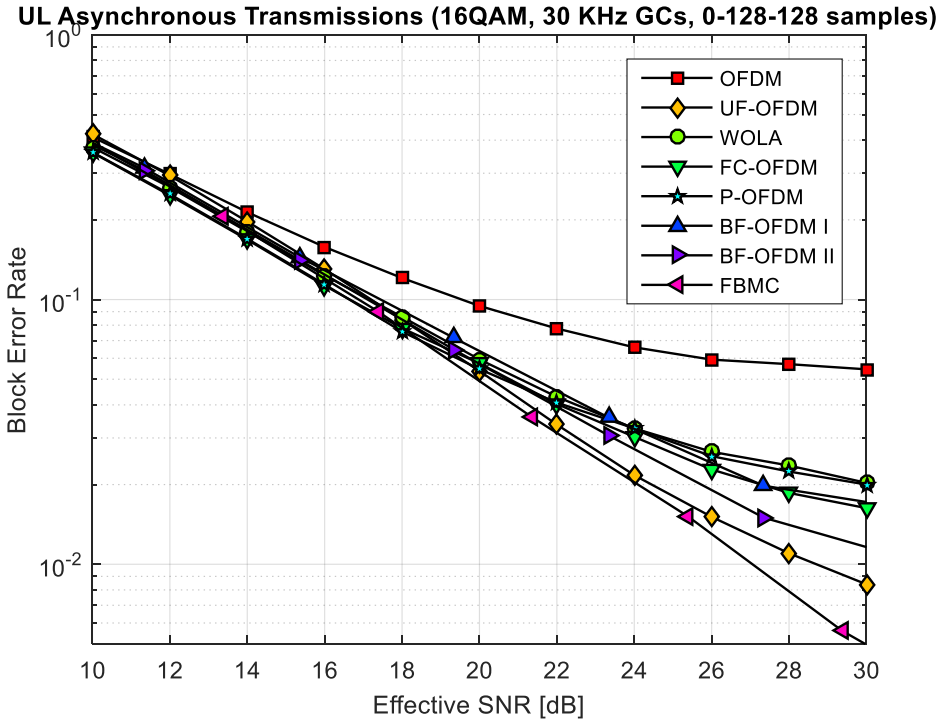
- Flexible Air iNTerfAce for Scalable service delivery wiThin wIreless Communication networks of the 5th Generation
- The project is focussed on
  - < 6 GHz
  - proposing/investigating technical enablers at
  - complex baseband covering
  - PHY/MAC/RRM for
  - eMBB, MMC (a.k.a. mMTC), MCC(a.k.a. URLLC), BMS and V2X

Selected project outcomes/recommendations (1)
Waveform comparison activity and recommendations

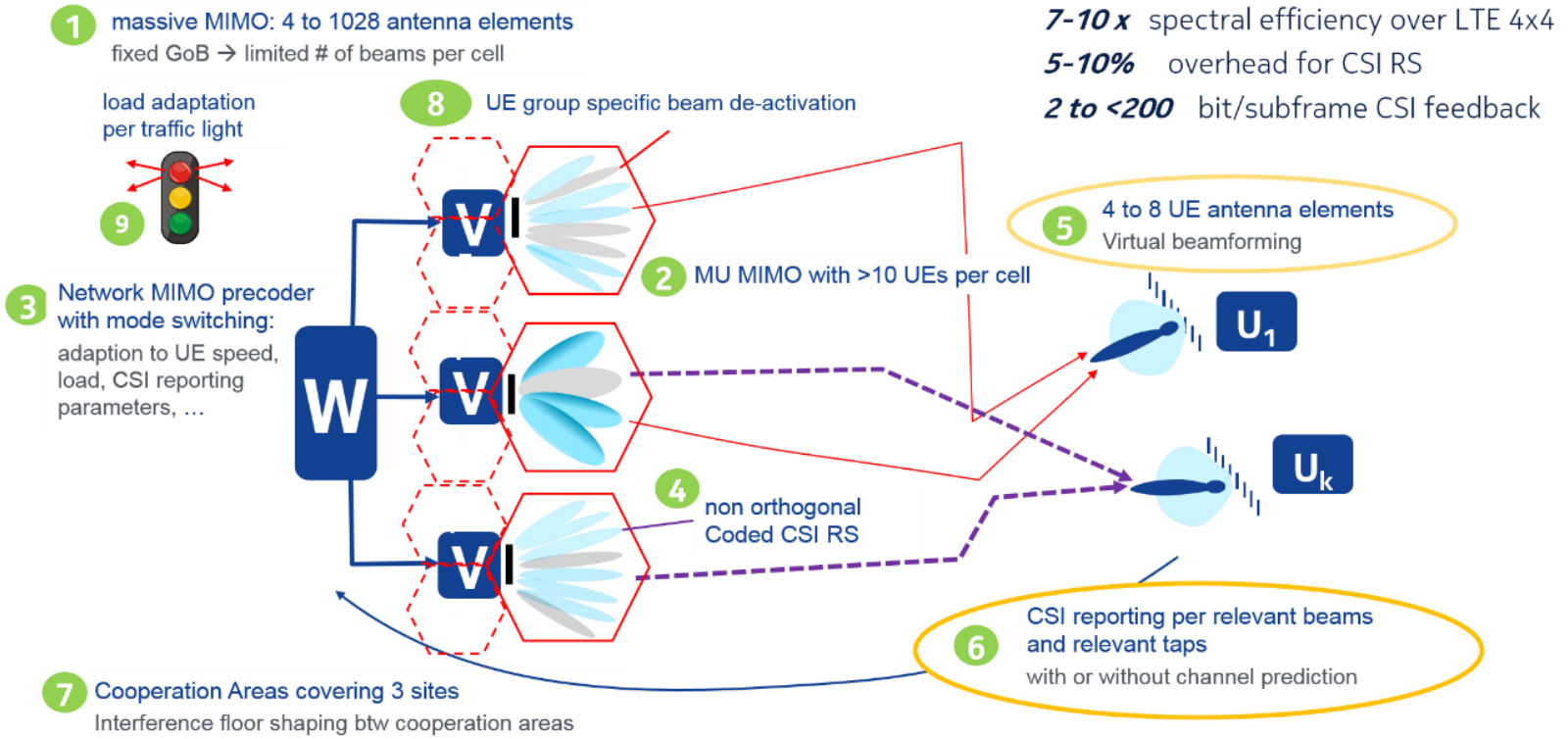
- Waveform candidates being studied/compared:
  - CP-OFDM (baseline)
  - Subband-wise filtered waveforms: UF-OFDM, BF-OFDM
  - Subcarrier-wise filtered waveforms: FBMC, FC-OFDM, P-OFDM
  - Windowed waveforms (following considerations in 3GPP): WOLA
- With calibrated simulators we have compared those candidates in the light of 3 scenarios:
  - Uplink asynchronous transmission (single numerology case)
  - Downlink high speed transmission (single numerology case)
  - Uplink synchronous transmission (mixed numerology case)

Selected project outcomes/recommendations (1)
Waveform comparison activity and recommendations (ctd.)

- Example: UL asynch transmissions
  - (CP-)OFDM performs worst
  - FBMC performs best
  - filtering is superior to windowing
- nota bene:
  - this is a tiny glimps into the overwhelming cosmos of waveform comparisons
- FANTASTIC-5G has conducted comparions related to a myriad of relevant aspects such as
  - Complexity, applicability of MIMO, coexistence …
- and has developed a set of recommendations



Selected project outcomes/recommendations (2)
System integration of mMIMO



7-10 x spectral efficiency over LTE 4x4

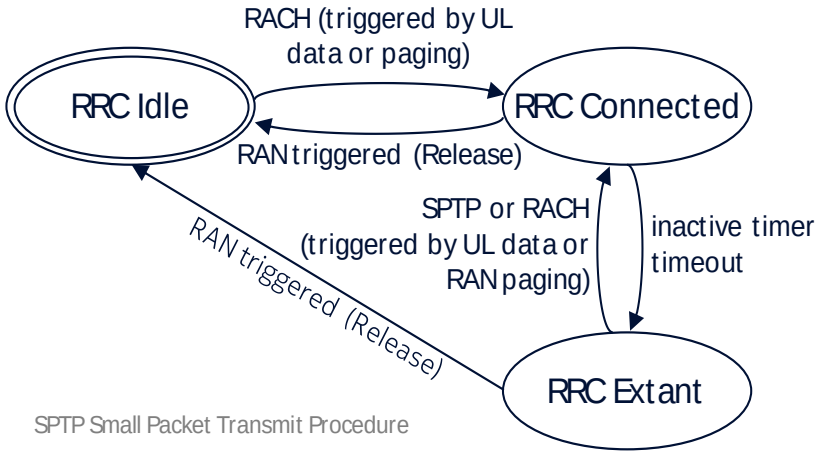
5-10% overhead for CSI RS

2 to <200 bit/subframe CSI feedback

Selected project outcomes/recommendations (3) efficient support of energy constraint devices

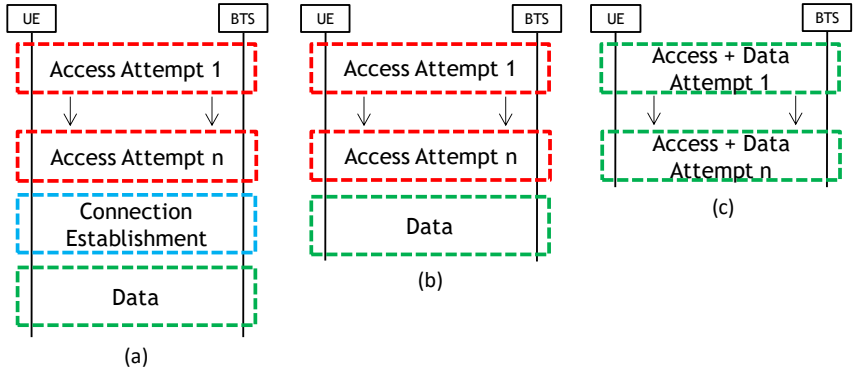
- we need to simplify the steps to be taken by the low-end devices to access the system

Between transmissions



lean state transistion protocols

During transmissions



lean protocol design for data transfer (more on this in the next talk)

project outcomes/recommendations

details to be found in D3.2 and D4.2 @ http://fantastic5g.eu/

- Channel coding (polar codes vs. LDPC vs. turbo codes)
- Modulation formats (FQAM, non-uniform constellations)
- MIMO – physical layer aspects (applicability of OQAM-based waveforms, high mobility scenarios)
- PAPR reduction techniques (e.g. applicability of variants to selected device classes and use cases)
- Fundamental signal and frame design characteristics (sampling rate, bandwidth support, numerology options, relative timing, lean channel/signal design, time/frequency confined structures, access procedures)
- HARQ (e.g. elastic design, feedback enhancements, early feedback)
- Sequence design for random access (Cyclic Delay-Doppler shifted M (CDDSM) sequences)
- Control channel design (in-resource control channels)
- Multi-node connectivity (e.g. data-split, data duplication)

project outcomes/recommendations

details to be found in D3.2 and D4.2 @ http://fantastic5g.eu/

- Mobility enhancements (e.g. RA-less handover, mobility enhancements for multi-node connectivity)
- Dynamic resource allocation (e.g. Scheduling formats and methods, Punctured scheduling for latency critical traffic)
- Service classification techniques (e.g. based on machine learning techniques)
- NOMA (e.g. throughput and fairness, power allocation)
- D2D (e.g. proximity discovery with full-duplex capable devices)
- Efficient support of broad- and multicast services (e.g. non-orthogonal transmission schemes for stream multiplexing, Mixed Broadcast/unicast protocol with retransmissions)
- Network based interference coordination (e.g. specification needs, required device capabilities)
- Advanced multi-user detection (e.g. receiver design for IDMA and NOMA)

Continuation, future exploitation of the project outcomes

- The industry partners from FANTASTIC-5G have submitted >60 Tdocs covering the work being done in FANTASTIC-5G and thus have impacted the current status of New Radio so far and will do so in upcoming 3GPP activities, respectively.
- Horizon 2020, phase 2: ONE5G (inofficial follow-up of FANTASTIC-5G) has started beginning of June
  - ONE5G builts upon F5G and the initial considerations of 3GPP

- Per partner continuation:
  - Obviously topics being started druing the projects will continue being treated by the partners
  - The discussion within the project have shaped those opening new paths and directions
  - Partners from accademia have implemented the knowledge being created in the project into courses

Thanks!