Radio Frame Design for 5G mmWave Systems

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**OBJECTIVE**

- Design of the mmWave MAC layer frame structure and control signalling to achieve ultra-low latency, support large number of user devices, and efficient handling of heterogeneous data traffic.

**MOTIVATION**

- High degrees of freedom in mmWave systems.
- Large scale M2M communication.
- Ultra low latencies (≈ 1 ms).
- Massive MIMO and beamforming.

**REFERENCE**


**FRAME DESIGN**

- **TDD Subframe**
  - Fixed TTI
  - Flexible TTI

- **Radio Frame Design**

- **PHY Layer Control Messages**
  - SR/BSR
  - DL Grant
  - UL Grant
  - HARQ

- **Beamforming**
  - Analog
  - Hybrid
  - Low power
  - Digital

**ANALYSIS**

- **Control Overhead**: Fraction of the time used for PHY layer control messages.
- **Utilization**: Fraction of the allocated radio resources used.

**PARAMETERS**

- Beamforming gain at BS = 18 dB
- Beamforming gain at UE = 12 dB
- OFDM Symbol Duration = 4.16 µs
- Max TTI = 125 µs
- Bandwidth = 1 GHz

**CONCLUSION**

- Flexible frames better utilize allocated resources.
- Digital/Hybrid BF can considerably reduce control over heads.

**RESULTS**

- **Figure 1**: Control Overhead versus the number of users.
- **Figure 2**: Effect of RRC packets on data rate.
- **Figure 3**: Utilization vs. max TTI for full buffer TCP data (32 UEs)