Informationstechnisches Kolloquium
Research on 5G and Beyond at TU Wien
CD-Lab for Dependable Wireless Connectivity for the Society in Motion

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Characteristics of 5G

5G Research @ ITC TU Wien

CD-Lab Research Examples
Characteristics of 5G – Heterogeneity of Use-Cases

- 5G is expected to support much more than mobile phones
- Different use-cases map to very different quality of service (QoS) requirements
  - These requirements are represented in the three 3GPP work areas: eMBB, URLLC, mMTC
Dependable Wireless Connectivity for the Society in Motion

Characteristics of 5G – Heterogeneity of Use-Cases

- **mobile broadband**: network capacity, perceived throughput, coverage
- **augmented/virtual reality**: perceived throughput, peak data rate, low latency
- **remote control/automation**: low latency, reliability, failure safety
- **vehicular communications**: low latency, reliability, high mobility
- **Sensors/IoT/M2M**: connection density, energy efficiency, coverage

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- Different use-cases map to very different quality of service (QoS) requirements
- These requirements are represented in the three 3GPP work areas: eMBB, URLLC, mMTC
Macro base stations, indoor/outdoor static/mobile small cells and distributed antenna systems, Cloud/edge processing and dynamic on-demand wireless back/front-hauling.
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Cloud/edge processing and dynamic on-demand wireless back/front-hauling
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How to handle this high-degree of heterogeneity of applications and corresponding requirements?

- **Link level adaptability**
  - Adaptation of transmission parameters (flexible numerology, adaptive beamforming)
    ⇒ throughput vs. reliability vs. energy efficiency

- **System level adaptability**
  - Dynamic coordination of cloud and edge solutions – efficiency vs. latency
  - Multi-point and multi-carrier connectivity – diversity, reliability
Characteristics of 5G

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CD-Lab Research Examples
5G Research at the Institute of Telecommunications at TU Wien is pooled within the

**Christian Doppler Laboratory for Dependable Wireless Connectivity for the Society in Motion**

- Dependability: availability and reliability – coverage, error probability, latency
- Society in motion: focus on densely populated urban areas
• Enhancing efficiency of wireless communications for **large numbers of mobile (moving) users**

• Providing **dependable services** rather than pure best-effort, especially for vehicular scenarios

• This encompasses mMTC, URLLC and eMBB with **emphasize on mobility**
• 5G key technologies build the basis of our research work
• We apply several levels of abstraction to provide a holistic view of performance
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5G Research @ ITC TU Wien

CD-Lab Research Examples
Transmission in the mmWave Band

- Channel characterization in the mmWave band (60 GHz):
  - Angular distribution of received power, derivation of fading statistics
  - Impact of Doppler-shifts, evaluation of Doppler spectra, estimation of multipath components
- Development of mmWave transceivers
Enhancing robustness of beamforming w.r.t. position uncertainties and user movement
• Utilizing device-to-device communications for coverage enhancement in vehicular scenarios
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• Coordinated small cells vs. DAS vs. dynamically configured DAS
• Significant improvement in terms of coverage due to macroscopic diversity gain
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Transmission in the mmWave Band (II)

- Channel characterization in the mmWave band (60 GHz):
  - Angular distribution of received power, derivation of fading statistics
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- Development of mmWave transceivers
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