TERAPOD

Contributions to Standards and Regulation

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Thomas Kürner
TU Braunschweig

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Presentation overview

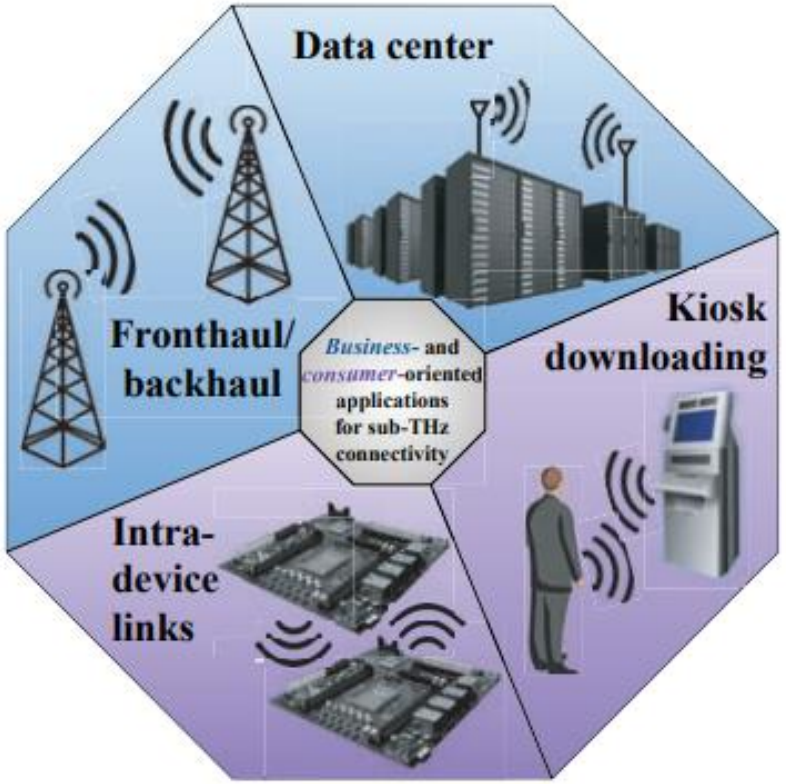
- *Standardisation and Regulation Activities 2017-2021*
- *IEEE Std. 802.15.3d-2017*
- *Results of WRC 2019*
- *Concrete Contributions made by TERAPOD*
- *Conclusion and Outlook*

Standardisation and Regulation Activities 2017-2021

- The life-time of TERAPOD included two important milestones:
  - In October 2017 the first wireless standard at a carrier frequency of around 300 GHz has been published: IEEE Std. 802.15.3d-2017
    - Wireless links in data centers are one out of four target use cases
  - In November 2019 World Radio Communications Conference (WRC 2019) identified 137 GHz of additional spectrum for Land-Mobile Service and Fixed Service above 275 GHz (i.e. for THz Communications)

IEEE Std. 802.15.3d-2017: Target Applications

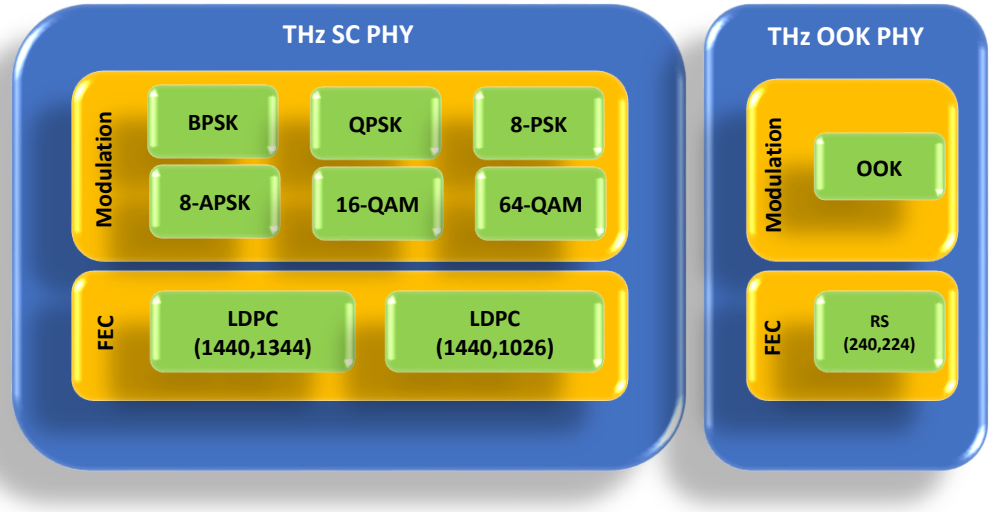
- Target applications are fixed point-point links with *a priori* knowledge of antenna positions

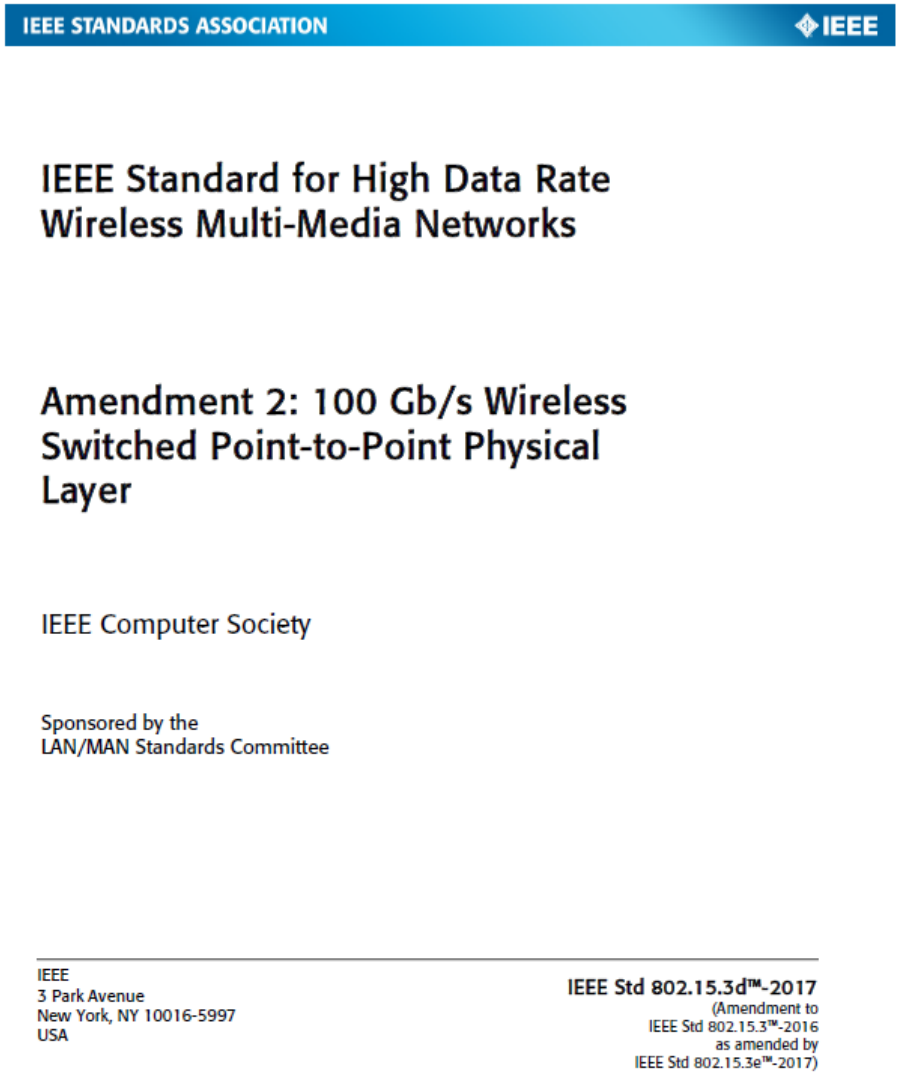


V. Petrov, T. Kurner and I. Hosako, "IEEE 802.15.3d: First Standardization Efforts for Sub-Terahertz Band Communications toward 6G," in IEEE Communications Magazine, vol. 58, no. 11, pp. 28-33, November 2020

Key Features of IEEE 802.15.3d-2017

- New 300 GHz PHY for Std. IEEE 802.15.3-2016
- MAC is mainly based on IEEE 802.15.3e-2017, which introduced the concept of „Pairnet“
- Point-to-point nature with highly-directive antennas reduces the problem of interference and „fighting for access“
- 8 different channel bandwidths (as multiples of 2.16 GHz) at 252-321 GHz




IEEE STANDARDS ASSOCIATION IEEE

IEEE Standard for High Data Rate Wireless Multi-Media Networks

Amendment 2: 100 Gb/s Wireless Switched Point-to-Point Physical Layer

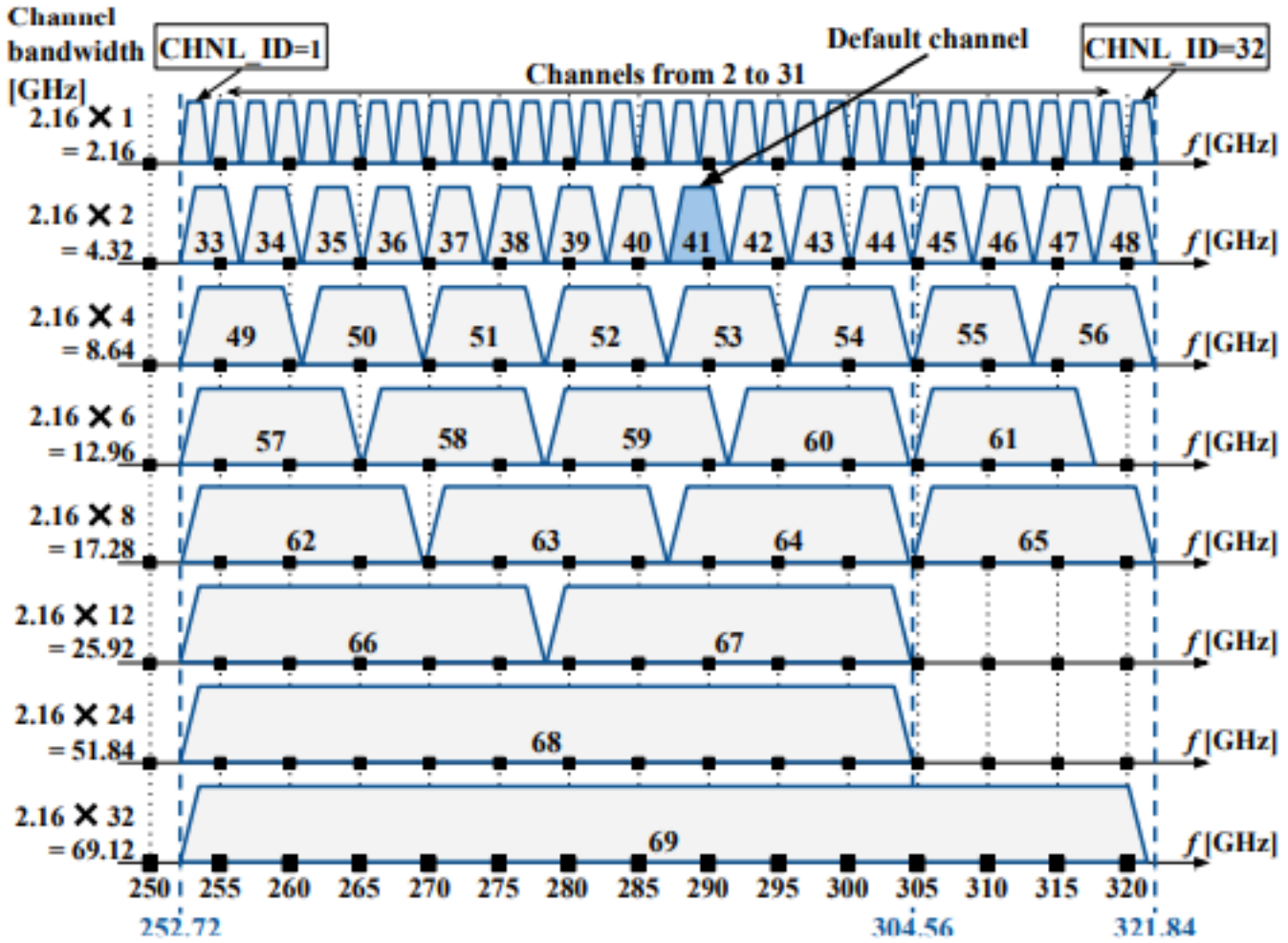
IEEE Computer Society

Sponsored by the LAN/MAN Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 802.15.3d™-2017
(Amendment to IEEE Std 802.15.3™-2016 as amended by IEEE Std 802.15.3e™-2017)

Channel Plan



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Results of WRC 2019

- Conditions for the Use of Spectrum for THz Communications

Frequency in GHz	Status in Radio Regulations
252-275	Allocation for land mobile and fixed service on a co-primary basis
275-296	Identification for use for the implementation of land mobile and fixed service according to FN 5.564A; no specific conditions are necessary to protect Earth exploration-satellite service (passive) applications
306-313	
318-333	
356-450	
296-306	may only be used by fixed and land mobile service applications when specific conditions to ensure the protection of Earth exploration-satellite service (passive) applications are determined in accordance with Resolution 731 (Rev.WRC-19).
313-318	
318-356	

T. Kürner, A. Hirata, On the Impact of the Results of WRC 2019 on THz Communications, Proc. International Workshop on Mobile THz Systems, 2-3 July 2020

A Sound Regulatory Framework for the Implementation of THz Communications

- The outcome of WRC 2019 provides a sound regulatory framework for the implementation of future THz communication systems in the frequency band 252 to 450 GHz.

- Within this band, four contiguous bands with bandwidths of

  - 44 GHz (between 252 and 296 GHz),
  - 7 GHz (between 306 and 313 GHz),
  - 15 GHz (between 318 and 333 GHz) and
  - 94 GHz (between 356 and 450 GHz)

  are available for almost unrestricted use by THz Communications.

Concrete Contributions made by TERAPOD

- When TERAPOD started both IEEE Std. 802.15.3d and preparations for WRC 2019 were already at mature status.
- Focus of TERAPOD was on implementing IEEE Std. 802.15.3d-2017 features in the PHY layer simulation
- TERAPOD mainly contributed to the ongoing IEEE 802.15 Standing Committee THz, which is looking for further opportunities for standards development in THz communications:

  - Introduction to the H2020 ICT-09-2017 Cluster (partial contribution in doc. : 15-18-0177-01-thz-H2020-ICT-09-2017-Cluster, Warsaw, May 2018)
  - THz Communications – An Overview and Options for IEEE 802 Standardization (partial contribution in doc.: IEEE 802.15-18-0516-00-0thz-Tutorial_TAGthz, Bangkok, November 2018)
  - 300 GHz Channel Measurements in a Real Data Center - First Results (full contribution in doc.: IEEE 802.15-18-0519—00-0thz_300_GHz_Channel_Measurements, Bangkok, November 2018)

Conclusion and Outlook

- The SW and HW demonstrators developed in TERAPOD are in line with the newest standards and regulation achievements, which evolved during the life-time of Terapod.

- Lessons learnt from the HW implementation and the SW demonstration capabilities form a sound basis for further post-project contributions:

  - The TUBS PHY layer Simulator developed in TERAPOD allows IEEE Std. 802.15.3d-2017 compliant simulations

  - Currently an IEEE 803.15 SG has been applied for to work on either a new amendment or a revision of IEEE 802.15.3

Thankyou for your attention!!

For general project enquiries please contact:

Bruce Napier; Vivid Components

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