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Wireless 100Gb/s and Beyond: A Special Focus Program of the German Scientific Foundation

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Outline

- **Introduction to the Motivation and Goals of the Special Focus Program**
- **Introduction of the Panelists**
- **Statements of the Panelists**
- **Panel Discussion**

Motivation

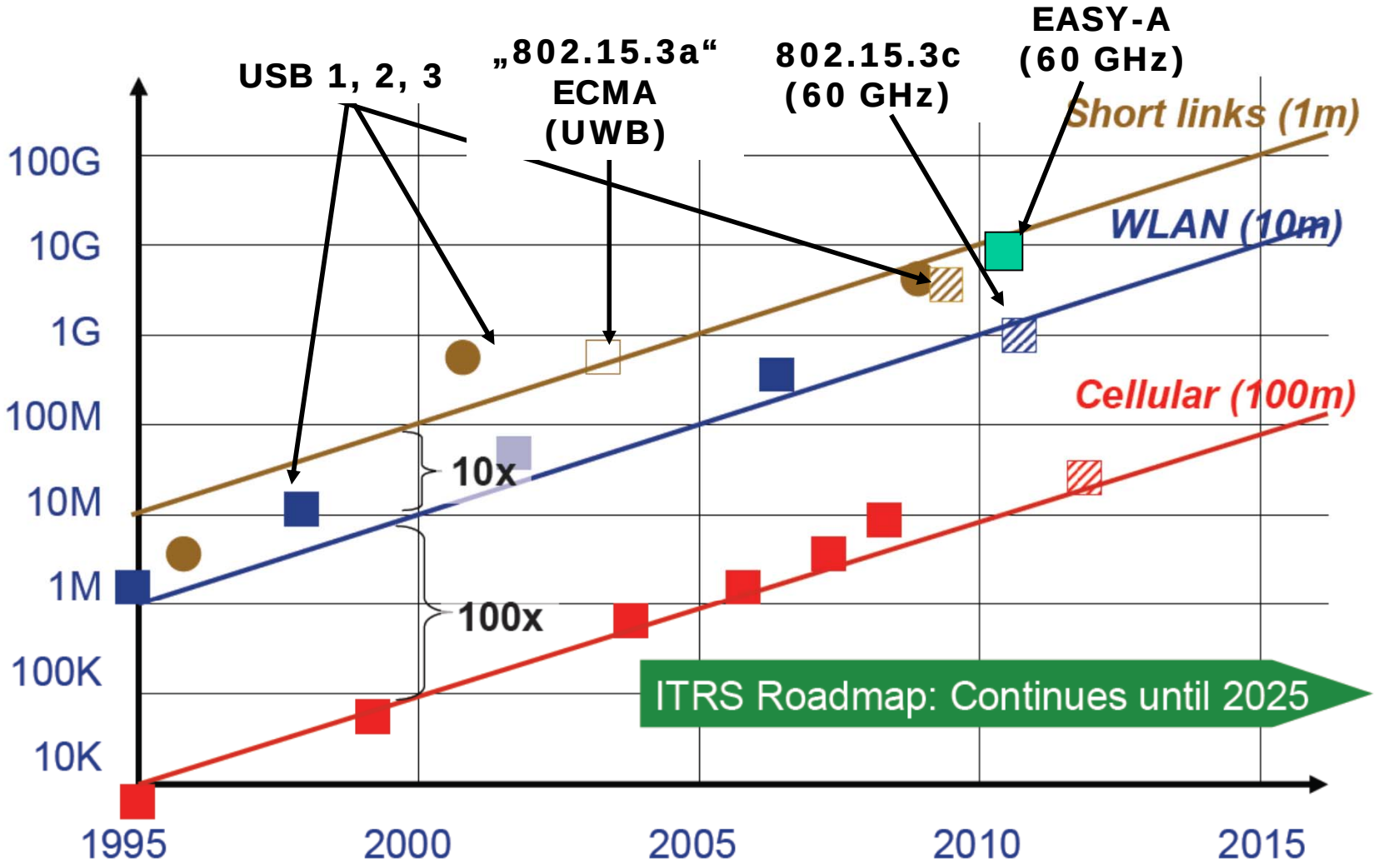
- **Wireless communication is a mature and very successful technology today**

- **Cellular wireless is one of the big success stories both in terms of technology development as well as in terms of economy and impact onto the daily live of almost everybody.**

- **Our focus in the special focus project “Wireless 100Gb/s and beyond” wants to address future solutions for even higher speeds. Traditional approaches seem to be not easily applicable such that we need some breakthroughs to achieve the goal.**

- **The impact will not only be on wireless communication as such but also on ultra low power technologies for any electronic component.**

Motivation and Goals of the Special Focus Program



G. Fettweis, IEEE VTC 2007

How to achieve wireless 100Gb/s

- **Two basic approaches:**

- **Use high bandwidth and moderate bandwidth efficiency**
  High bandwidth can be found at 200GHz and above
  Problems with path-loss, antennas, propagation, power amplification

- **Use high bandwidth efficiency and moderate bandwidth**
  Can be found below 100GHz (e.g. 60GHz, or even 3-10GHz)
  Problems are the very high SINR because of high modulation schemes
  MIMO schemes might help

Trade-Off between HW/SW, Analog/Digital Design

- **The necessary computational power of the signal processing will be huge**
  - **In approach 1 we face a extremely high symbol rate of up to 50GS/s**
  - **In approach 2 we need to demodulate, with extreme speed**
- **An overall estimation of the required DSP equivalent results in 2-5 TFLOPS/s**
- **Therefore we have to think about new paradigms to achieve the results:**
  - **Can we find schemes that can mostly be handled in the analog domain?**
  - **Can we use “massive MIMO” to get lower data rates per SISO channel**
  - **Can we avoid ADCs at symbol speed**
- **How do we get the 100Gb/s up to the processor?**
  - **The MAC protocol has to handle all remaining errors with extremely high speed**
  - **How shall be the trade-off between MAC protocol state engines and HW-accelerators to support calculation**
  - **Is there a new structure for a NIC**

Dr. Domain Dudek

Dr.-Ing. Damian Dudek is the program officer for electrical engineering at the German Research Foundation, Deutsche Forschungsgemeinschaft (DFG) since 2010.

Dr.-Ing. Damian Dudek received the doctoral degree in electrical engineering from the University of Wuppertal, Germany in 2009 in the frame work with the University of Bochum, Germany. He worked as a Postdoctoral scientist for two years in the Nanophotonics group of Prof. Sotomayor-Torres at the Catalan Institute of Nanotechnology (ICN) in Barcelona, Spain.

Prof. Dr.-Ing Frank Ellinger

Prof. Ellinger is full professor and head of the Chair for Circuit Design and Network Theory at the Dresden. He has been an IEEE MTT-S Distinguished Microwave Lecturer since August 2006,.

Frank Ellinger graduated from the University of Ulm, Germany. He received an MBA, PhD degree and habilitation degree from ETH Zürich (ETHZ), Switzerland. He authored more than 250 scientific publications. For his works he received several awards including the IEEE MTT-S Outstanding Young Engineer Award and the ETHZ Medal.

Prof. Dr.-Ing. Christoph Scheytt

Prof. Scheytt was appointed as full professor for Circuit Design by University of Paderborn, Germany and research group leader at the Heinz-Nixdorf Institute in Paderborn in 2012.
J. Christoph Scheytt received his diploma degree (M.Sc., 1996) and PhD degree (2000, with highest honours) both from Ruhr-University Bochum, Germany. In 2000 he co-founded advICo microelectronics GmbH, a German IC design house for RFIC and fiber-optic IC design. For 6 years he served as CEO at advICo. From 2006 to 2012 he was with IHP as head of IHP's circuit design department. Dr. Scheytt has authored and co-authored more than 100 refereed papers and holds 12 patents.

Prof. Dr.-Ing. Eckhard Grass

Prof. Grass is full Professor at the Department of Informatics at Humboldt-University Berlin since fall 2011. He also holds the position of Group leader for wireless broadband systems at IHP

Prof. Eckhard Grass received the Dr.-Ing. degree in Electronics from Humboldt-University Berlin, Germany, in 1993. He was a Visiting Research Fellow at Loughborough University, U.K., from 1993 to 1995, and a Senior Lecturer in Microelectronics at the University of Westminster, London, U.K., from 1995 to 1999. Since 1999, he has been with IHP, leading several projects on wireless broadband communication systems. Since 2007, E. Grass is team leader of the Wireless Broadband Communications Group at IHP. He has published about 80 papers at international conferences and in international journals.

Prof. Dr.-Ing. Jörg Nolte

Jörg Nolte is tenured professor for computer science at the Brandenburg University of Technology in Cottbus (Germany) where he holds the chair for distributed systems and operating systems.

Jörg Nolte received his M.S. (Dipl. Inform.) in computer science in 1988 and his Ph.D. (Dr.-Ing.) in 1994, both from the Technical University of Berlin. He was a principal member and finally the vice-head of the PEACE group that developed the operating system for Germany's first massively parallel supercomputer. In the 90s he was a post doc fellow and senior researcher in the Tsukuba Research Center (TRC) of the Real World Computing Partnership (RWCP) in Tsukuba Science City, Japan. Prof. Nolte’s group currently participates in the Intel MARC program (Many-core Applications Research Community

Presentations

1. Dr. Domain Dudek (DFG)
2. Prof. Frank Ellinger (TU-Dresden)
3. Prof. Eckhard Grass (Humboldt University Berlin)
4. Prof. Christoph Scheytt (University Paderborn)
5. Prof. Dr. Jörg Nolte (TU-Cottbus)