2020 7th International Conference on Internet of Things: Systems, Management and Security (IOTSMS) | 978-0-7381-2460-5/20/$31.00 ©2020 IEEE | DOI: 10.1109/IOTSMS52051.2020.9340195

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Crystal-Free Architectures for Smart Dust and the Industrial IoT

Abstract:

A crystal-free architecture of a low-power wireless node allows for a small and cheap design. The Single-Chip micro Mote (SCuM) is the first crystal-free mote-on-chip to be compatible with standards such as Bluetooth Low Energy and IEEE802.15.4, and develops as a collaboration between Kris Pister's team at UC Berkeley and Thomas Watteyne's team at Inria. This keynote will go through our 2019-2020 research journey around the SCuM chip. We start by detailing why a "crystal-free" architecture is such as radical move away from traditional low-power wireless radio design. We discuss the challenges of calibration and compensation in these designs, and show how we get a SCuM chip to communicate with off-the-shelf motes and participate in a standards-based IoT network. We then present an unexpected use case that crystal-free motes enable: tracking Asian hornets as they fly from a beehive back to their nest. We illustrate this presentation with numerous videos and hands-on experience. We finish this talk by discussing why crystal-free micro-robots are the next frontier of IoT research, addressing all open IoT networking research questions at once, which a tremendous potential for pioneering applications such as micro-wearables and swarm robotics. This keynote is tailored to the advanced researcher or engineer in embedded system, IoT and low-power wireless. It draws on recent activities within Inria's EVA team (team.inria.fr/eva/), UC Berkeley's Pister lab (bamlab.berkeley.edu) and their collaborative project around crystal-free architectures (www.crystalfree.org).

Biography:

Thomas Watteyne (http://www.thomaswatteyne.com/, @thomaswatteyne) is an insatiable enthusiast of low-power wireless mesh technologies. He holds an Research Director position at Inria in Paris, in the EVA research team, where he leads a team that designs, models and builds networking solutions based on a variety of Internet-of-Things (IoT) standards. He is Senior Networking Design Engineer at Analog Devices, in the Dust Networks product group, the undisputed leader in supplying low power wireless mesh networks for demanding industrial process automation applications. Since 2013, he co-chairs the IETF 6TiSCH working group, which standardizes how to use IEEE802.15.4e TSCH in IPv6-enabled mesh networks, and is member of the IETF Internet-of-Things Directorate. Prior to that, Thomas was a postdoctoral research lead in Prof. Kristofer Pister's team at the University of California, Berkeley. He founded and co-leads Berkeley's OpenWSN project, an open-source initiative to promote the use of fully standards-based protocol stacks for the IoT. Between 2005 and 2008, he was a research engineer at France Telecom, Orange Labs. He holds a PhD in Computer Science (2008), an MSc in Networking (2005) and an MEng in Telecommunications (2005) from INSA Lyon, France. He is Senior member of IEEE. He is fluent in 4 languages.