Future of Computing

Opening Remarks by Session Chair

T. Signamarcheix
Vice President, Strategic Development,
CEA-Leti, Grenoble, France

Abstract
Not Applicable

Biography
Thomas Signamarcheix joined CEA-Leti in 2008, and in 2011, he was named manager of a research laboratory on substrates engineering. From 2015 to 2019, he was in charge of business development management for Leti's Silicon Component Division and Architecture and Embedded Software Division. As Key Account Manager of several strategic collaborations, he also directly managed a wide range of activities (semiconductor, alternative energy, sensor, radio-frequency, etc.) promoting innovation at both hardware and architecture levels.

He has been vice president of CEA-Leti's strategic development since 2020, managing Leti's strategic program (Quantum Electronic, Artificial Intelligence, wearable healthcare devices and mixed reality) and strategic partnerships. He has a PhD in the physics of semiconductor devices from Grenoble Institute of Technology (INPG), and he has contributed to nearly 10 patents and co-authored more than 50 scientific publications.

Com-Putare: Together We Think

M. Peeters
VP R&D Connectivity
imec, Leuven, Belgium

imec
embracing a better life

Abstract

Digitization is upon us. And while it feels we have been taking about smart devices forever, it is only in the past years that we have gone from devices that we just call smart to devices that actually need to be smart. And with it, these have gone from simple sensors that measure scalar point values to lidars that map out the world around us. All of this data only has value when consumed, processed and used to close some loop. Here is the crux of our sustainability issue: how do we manage this balance between sending data and processing data, what are the technologies that will enable a sustainable future of computing.

Biography

"If you can't explain it simply, you don't understand it well enough." (attributed to Einstein, Feynman, and others) → This is the key element in success to every endeavour in research and development. Be it the technical or the business aspects. It drives the three skills I constantly aim to improve: understanding, communicating, and the focus to think and reduce things to their core.

Today, I am VP of R&D for Connectivity at imec. We build the enabling platforms for the next generation of communication systems, from the materials, devices, circuits, signal processing all the way up to the orchestration engines. My previous experience as CTO for both the Wireline and Wireless business lines at (what is now) Nokia was built on the culture, enthusiasm, and love for technology and science that I got from my time at Bell Labs—and the principles of Free Inquiry bestowed on me by my Alma Mater, the Vrije Universiteit Brussel (VUB).

During my research career starting with a Ph.D. in Applied Physics and Photonics from the VUB, I have authored more than 100 peer-reviewed publications, many white papers and hold patents in the access and photonics domains. An electrotechnical engineer by training, I am a senior member of IEEE and a Fellow of the VUB.

Outside of work, my quest to discover the recipe for a perfect lasagna is balanced by bouts of long-distance running to offset the inherent caloric intake.

Will More-than-Moore Technologies with 3D Integration meet the Challenges of Edge AI Devices ?

S. Joly
Parnerships Manager 3D integration and packaging
CEA-Leti, Grenoble, France

Abstract
In the world of high performance computing, over a decade the performances of the computing has constantly increase beyond the almost automatic but slowing down improvement in processor performance with Moore's Law. Big players have moved to new architectures such as chiplets only possible thanks to the integration of More-than-Moore technologies. 2.5D and 3D integration, memory cubes, accelerators and heterogeneous architectures are key elements of the success towards performance and energy efficiency. This transition has shown clear benefits and sustainability for HPC market. The question is still open for Edge AI components where real time, ultra-low power, large amount of data, low cost are the main drivers: how can 3D integration play a role for these embedded processors? CEA-Leti has been involved for more than two decades in 3D integration with industrial partners. This presentation will discuss about:

- What are the main drivers for computing in edge devices ?
- What could be the architectures' new paradigm ?
- How 3D integration will be an enabler, and how CEA-Leti's roadmap supports this promising technology

Biography
Sylvie Joly is currently working as 3D integration and packaging Partnerships Manager at CEA-LETI. Sylvie received M.Sc. in Microelectronics from ISEP "Institut Supérieur d'Electronique de Paris" in 1989. She completed her education with a Master in Marketing and Innovation at the Grenoble Ecole de Management (GEM) in 2001. Prior to this position, she worked for more than 8 years as display business developer at CEA-LETI. In 2004 as Sr. Marketing Engineer in the CEA's Technology Transfer Department, she built a strong experience in setting up and managing technical marketing surveys. Before joining CEA, she spent 10 years in the industry as an R&D engineer, and 8 years as Sales engineer in several companies including Hewlett Packard and Ericsson.

FMD Competence Center for Resource-Conscious Information and Communication Technology

S. Guttowski
Managing Director
Fraunhofer Group for Microelectronics / Research Fab Microelectronics Germany, Business Office, Berlin, Germany

Abstract

On August 1, the *FMD Competence center for resource-conscious information and communication technology* was launched. The establishment of the center under the leadership of Forschungsfabrik Mikroelektronik Deutschland (FMD) is funded by the BMBF and directly supports the German government's Green ICT mission.

The aim of this Green ICT competence center is to build on the services, structures and competencies created by FMD for application-oriented research in the field of microelectronics, and to support a gradual and demand-oriented expansion in terms of resource conservation and a significant reduction of the CO_2 footprint in the further development of ICT applications and infrastructures. As a Green ICT vision, FMD offers Green ICT technologies and cross-technology Green ICT overall solutions up to a high level of technical maturity from a single source for partners in industry and science. As part of a holistic approach to the topic of "Green ICT", FMD is able to disseminate value propositions for industry, for users of ICT systems, as well as for politics and science. The unique selling point of FMD offering is that Green ICT-specific issues can be addressed with a single interface and coherent structures.

The core of the technical work is formed by three regional hubs on specific issues and focusing on the topics of sensor edge cloud systems, energy-saving communication infrastructures and resource-optimized electrical production. In addition, an annual camp for students, special support for startups in the field of Green ICT and a new microelectronics academy will be part of the work at the business office.

FMD offers the unique opportunity, on the one hand, to take a comprehensive systemic view and further development of Green ICT issues with its partner network and, on the other hand, to create the necessary technical depth in the overall system view with its technology competencies.

Biography

Dr. Stephan Guttowski studied electrical engineering at TU Berlin and subsequently earned a doctorate in the field of electromagnetic compatibility. This was followed by a postdoctoral position at Massachusetts Institute of Technology (MIT) in Cambridge, USA. After his return, he initially worked in the Electric Drives Research Laboratory of DaimlerChrysler AG before moving to the Fraunhofer Institute for Reliability and Microintegration IZM in 2001. At IZM, he was initially head of the Advanced System Development Group before taking over at the System Design & Integration department. From June 2017 to December 2020, he was Technology Park Manager for Heterointegration at the Research Fab Microelectronics Germany (FMD). Since January 2021, he has led the joint office of the Fraunhofer Group for Microelectronics and FMD.
(see: https://www.forschungsfabrik-mikroelektronik.de/en/About-FMD/Excellence_in_Research/NL82.html)

A Materials to Systems Understanding of a BEOL Embedded Analog NVM Memory Technology for Edge Compute Applications

M. Chudzi
VP of Technology for IMS
Applied Materials, Dresden, Germany

Abstract

Coming Soon

Biography

Dr. Chudzik is VP of Technology for IMS at Applied Materials focusing on device and module engineering solutions in the specialty and packaging segments.
He has a PH.D in Electrical engineering from Northwestern University.
Mike has been at Applied Materials for 8 years and prior to that he worked at IBM for 14 years in various roles in DRAM and CMOS process integration and management.

MicroLED Advance Bonding Method to enable AR Metaverse

R. Yan
Business Unit Director
GLOBALFOUNDRIES, Dresden, Germany

Abstract

Mark Zuckerberg and companies seem to think that smart glasses will one day replace smartphones. They're not alone, and it will probably happen at some point in the not-too-distant future. But for such a product to exist, we still face plenty of challenges both in hardware and software, especially in the microdisplay that is required for smart glasses.

MicroLED is one of the best microdisplay solutions for smart glasses. The key challenges are how to integrate LED arrays from a small epi wafer to a full-size CMOS backplane wafer in a way that is cost-effective. A crude method is coring: the larger CMOS wafer is cored to the size of the epi wafer and the two are bonded with wafer-to-wafer (W2W) bonding tools. This is suitable for R&D and low volume production, but there is too much wasted CMOS wafer to be valid for mass production. Another method is Direct Die-to-Wafer (D2W) Integration: the pixelated frontplane epi wafer is diced and the resulting dies are then bonded to corresponding locations on the backplane wafer. While this reduces the amount wasted, bonding accuracy becomes more challenging, and throughput is potentially slower.

GF believes that innovative D2W integration is a good way to increase throughput. In this method, epi dies are first transferred to blank wafer of the same size as the backplane wafer. Standard W2W bonding is then used to finish the integration of frontplane and backplane.

In this paper, we will present GlobalFoundries® (GF®) advanced D2W bonding solution to resolve the microLED manufacturing challenges.

Biography

Ruby is a Business Line director in AIM Strategic Business Unit. She is responsible for HMI (Human-Machine-Interface) product line in wearable, AR/VR, smart home and machine vision applications.

The Metaverse - Embracing the 4th wave of Personal Computing

M. Mailos
Mixed Reality Go To Market Manager
Microsoft, Mixed Reality, Munich, Germany

Abstract

Every 10-20 years there is a paradigm shift that opens a new era of Personal Computing.

We are just entering the 4th wave now where computing transcends screens and goes 3D. We can now bring computing into the real world, and the real world into computing.

The new use cases arising enable companies and individuals to reduce costs, improve outcomes, cut emissions and connect in a very different way.

This is no longer science fiction, this is the new reality today for many, and its only just getting started.

Biography

Native from Argentina and with a multi-cultural background, Mariano developed a curiousity for computers from his early age.

Having worked at Microsoft in several roles spanning operations and finance in the consumer space for more than 14 years, he joined AWS in 2018 to get closer to cloud computing and the enterprise world.

Back to Microsoft in 2019 Mariano has been focusing on the German enterprise hardware market as Surface Product Marketing Manager until 2021 and for the last year as Mixed Reality Go To Market Manager he has been driving the Microsoft efforts on the Metaverse space.

Building Scalable and Ultra-Coherent Quantum Computers with Carbon Nanotubes

P. Desjardins
CEO & co-founder
C12, Paris, France

Abstract

C12 builds next generation quantum computers powered by the most elementary material: carbon nanotubes. Unlike other quantum computers, we use carbon nanotubes as the fundamental building block of our processor. By combining the power of an ultra-pure material with an easy-to-manufacture semiconductor device, we are building the next generation of quantum computers, designed to provide unparalleled fidelity, connectivity, and scalability. Our first product will be a quantum accelerator able to run hybrid quantum-classical algorithms for chemistry applications.

Biography

Pierre Desjardins holds a Master of Science degree from Columbia University (2013) and later worked for six years as a strategy consultant. He founded the startup C12 in 2020. C12 is leading the next materials leap in quantum computing and is on a mission to build reliable quantum computers to speed up highly complex computing tasks, thanks to a unique know-how developed at CNRS and the Physics Laboratory of the Ecole Normale Supérieure in Paris. C12 believes that only a materials science breakthrough will enable large-scale quantum computers.

Superconducting Quantum Computers and Synergies with the Semiconductor Industry

K. Tan
CTO and Co-Founder
IQM Quantum Computers, Espoo, Finland

Abstract

Quantum computers are earmarked as the next generation of disruptive computing technology capable of unprecedented advances in materials design, drug discovery, supply chain optimization, and cybersecurity. It promises exponential speedup in special class of computation thus enabling applications that would otherwise be impossible with contemporary computing methods. At IQM, we build, integrate, and deliver full-stack quantum computers based on superconducting qubits technology. These systems are delivered to customers on-premises as quantum accelerators to complement conventional high-performance computing.

In this talk, I will introduce IQM's progress on building full-stack quantum computers and highlight the synergies between quantum processor and semiconductor chip fabrication. In principle, there are plenty of innovation and best practices in the semiconductor industry that could accelerate the progress of quantum computing. On the other hand, new developments are needed to meet specialized requirements of quantum processor design and fabrication. I will also give the motivation why now is the right time to invest in quantum processor production capabilities.

Biography

Kuan holds a PhD from the University of New South Wales and is an experimental physicist by training. Prior to founding IQM and assuming the CTO role, he was a scientist working on various quantum computing technologies. He has published more than 40 peer-reviewed journals throughout his scientific career. Science has led him to many continents, including Australia, the US and Europe where he has spent time in world-class laboratories. Outside academia, he has also worked at Intel and Microsoft. In his free time, he enjoys sports, checking out the latest gadgets, and a pint of beer.