Press Release

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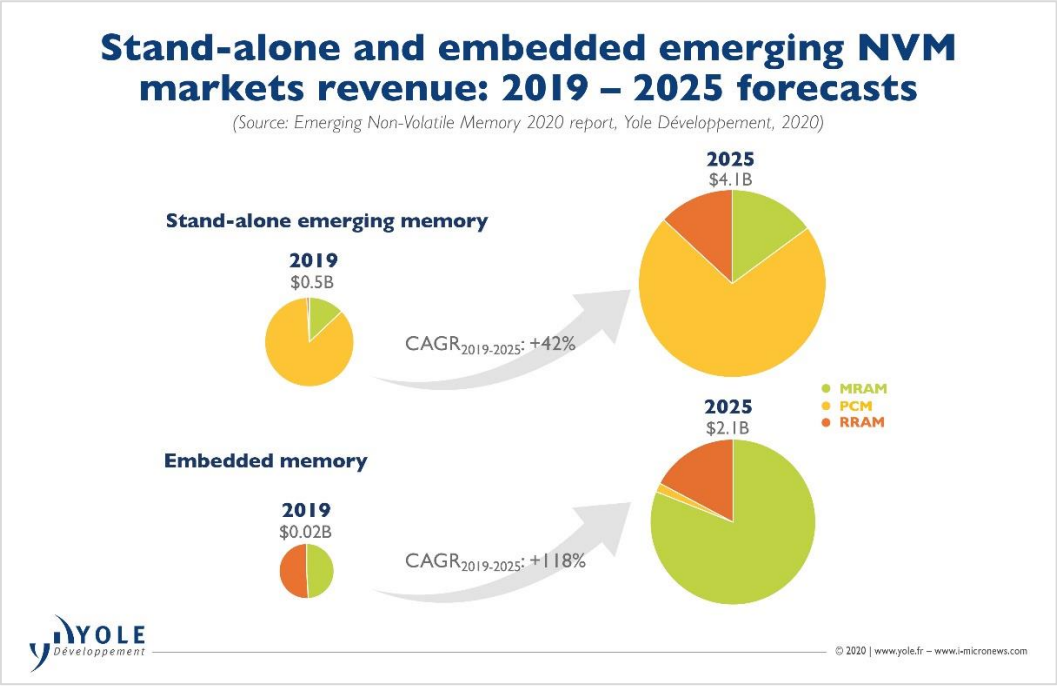
LYON, France

After the 3D XPoint take-off, emerging NVM keeps growing[1]

OUTLINES:

- PCM[2]-based persistent memory hit the market in 2019. And embedded STT-MRAM[3] has finally moved into mass production.
- The overall emerging NVM[4] market is poised to reach over US$6 billion in 2025. The embedded business will account for 1/3 of it.
- Foundries and IDMs[5] are accelerating the adoption of embedded emerging NVMs at advanced technology nodes.
- Rise of in-memory computing is triggering new players' dynamics.

"The stand-alone emerging NVM market will grow to over US$4 billion in 2025", explains **Simone Bertolazzi, PhD. Technology & Market Analyst at Yole Développement (Yole).** *"It will be driven by two key segments: low-latency storage (enterprise and client drives) and persistent memory (NVDIMMs)."*



[1] Extracted from Emerging Non-Volatile Memory, Yole Développement, 2020
[2] PCM: Phase-Change Memory
[3] STT- MRAM : Spin-Transfer Torque Magnetoresistive RAM
[4] NVM: Non-Volatile Memory
[5] IDM : Integrated Design Manufacturer

The embedded emerging NVM entered the takeoff phase. The embedded market segment is showing a 118% CAGR[6] between 2019 and 2025, reaching more than US$2 billion by 2025.

In this dynamic context, the market research and strategy consulting company Yole, releases its annual memory report, Emerging Non-Volatile Memory. The 2020 edition presents an overview of the semiconductor memory market with stand-alone[7] and embedded memories[8]. Yole's memory team proposes today a deep understanding of emerging NVM applications with related market drivers, challenges, technology roadmap, players, and main trends. This report also offers detailed 2019-2025 market forecasts. In addition, the Emerging Non-Volatile Memory report describes the emerging NVM technologies with their working principle, manufacturing methods, advantages/limitations, development status, price, time-to-market and latest product development status for each key market player. The competitive landscape is also well analyzed in this new report, with updated information on recent acquisitions and funding…

What is the status of the newly emerging applications: stand-alone code/data storage and embedded NVM for analog ICs[9]? What is the market size of SCM[10] market segment and its expected evolution? How will the PCM sector evolve? Could we think about multiple scenarios? What are the market positioning of the Chinese memory companies... Yole's analysts invite you to deeply dive into your memory to get a deep understanding of this emerging industry.

Yole investigates the memory market for a while and delivers today numerous technology and market analyses. As part of its memory collection available on i-Micronews, the Memory Market Monitors, DRAM[11] and NAND[12] are the most recent and example of the significant commitment of Yole's team in this industry. Analysts are daily discussing with leading memory companies to evaluate the market evolution and measure key market figures and all data are combined in a powerful database, the Memory Market Monitors. In addition, all year long, Yole's analysts mixed their technology and market expertise to deliver relevant memory analyses, the technology & market reports.

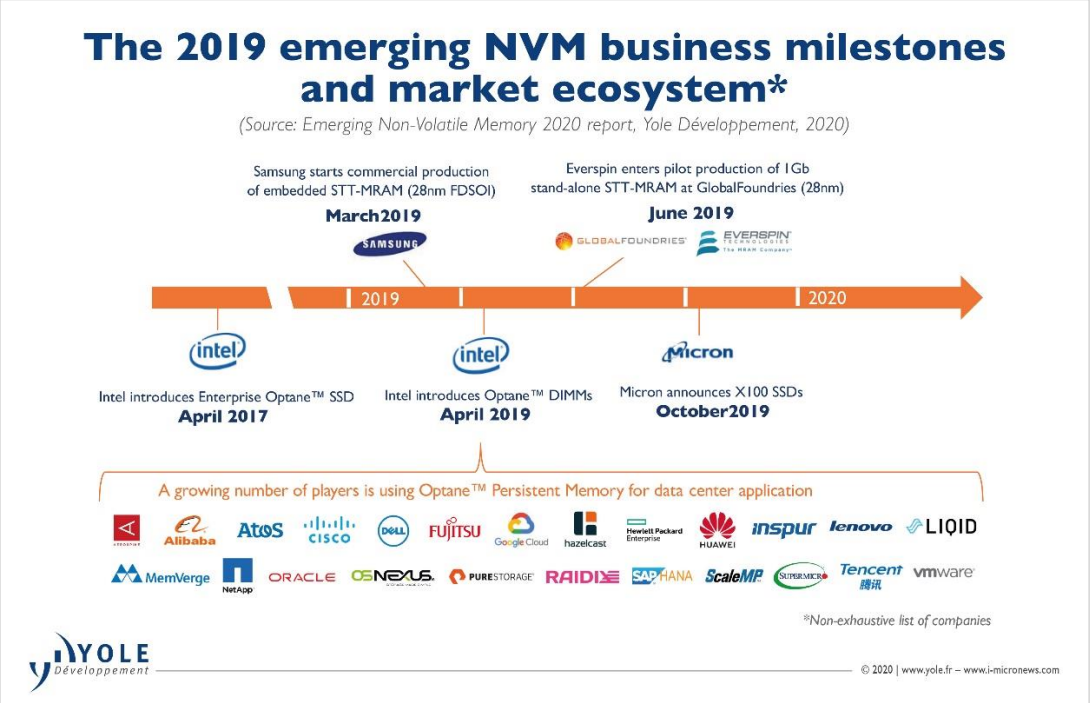
The Emerging Non-Volatile Memory report is part of them and offers a detailed overview of this industry. As part of the stand-alone memory market segment, PCM will be the leading technology thanks to the sales of 3DXPoint products – particularly NVDIMMs[13] – which are sold by Intel in a bundle with its server CPUs[14].

[6] CAGR: Compound Annual Growth Rate
[7] Including NAND, DRAM, NOR etc.
[8] Including eFlash, SRAM
[9] IC : Integrated Circuit
[10] SCM : Storage Class Memory
[11] DRAM: Dynamic Random Access Memory
[12] NAND : Flash memory with logical NAND-type structure
[13] NVDIMM: Non-Volatile Direct Input Memory Module
[14] CPU : Central Processing Unit

In 2019, Everspin entered pilot production of 1Gb STT-MRAM parts at GlobalFoundries (28nm). In the coming years, STT-MRAM market penetration will continue through the adoption of 1Gb chips in special drives. *"If successfully executed, this will promote sales/ volume growth and motivate foundries to continue supporting the MRAM business through the development/manufacturing of high-density parts (≥ 4Gb),"* comments Simone Bertolazzi from Yole.

So far, RRAM has been commercialized mainly by Adesto with low-density CBRAM™ products for EEPROM replacement. The highest RRAM density today is only 8Mb (Fujitsu-Panasonic), but swift progress is expected: new 100Gb-class chips for low-latency storage products by an IDM player are anticipated for 2020/2021.

In parallel, the embedded emerging memory market segment will be driven by MCUs[15] and IoTs[16], as well as memory buffers for ASIC[17] products (i.e. AI accelerators, display drivers, and CMOS image sensors). *"At Yole, we expect embedded MRAM will lead the embedded emerging NVM market in the next five years,"* details Simone. *"However, PCM and RRAM are not out of the race: due to their unique memristive properties (synapse-like), both are promising for analog in memory- computing applications that could take off by 2023."*



The last three years have witnessed the takeoff and rapid expansion of the storage-class memory market. According to Yole's report, this memory market is projected to reach billion-dollar revenue within the next few years.

[15] MCU : Micro Controller Unit
[16] IoT : Internet of Things
[17] ASIC : Application Specific Integrated Circuit

Key to this was clearly the introduction of 3D XPoint, a stand-alone PCM-based technology developed by Micron and Intel and commercialized by Intel since 2017 with the brand name Optane™.
In early 2019, Intel started commercializing Optane™ Persistent Memory together with the latest generation of Xeon scalable processors (i.e. Cascade Lake).
A number of leading companies have been exploring the use of persistent memory for a host of datacenter applications. According to Intel, there are currently more than 200 ongoing proofof- concepts based on Optane™ DIMMs, and the conversion rate from proof-of-concept to deployment has already exceeded 80%.
In late 2019, Micron revealed its own 3D XPoint-based SSD named X100, and other IDM players could enter the SCM market in the coming years. However, Intel has a significant advantage in the persistent-memory business as it is the only player capable of providing a complete solution for data-intensive applications via combinations of Cascade Lake CPUs and Optane™.
Intel's competitors face delays as they need to work on alternative architectures that leverage new interconnects and protocols that are currently being developed.
Among the embedded emerging NVM technologies, MRAM has advanced at a relatively faster pace thanks to the strong involvement of IDM/foundries and the support of equipment suppliers which have been providing new solutions to difficult technical challenges. Notably, in March 2019 Samsung announced the mass production of embedded MRAM for applications in MCUs, Internet-of-Things (IoT) applications, and memory buffers…

An in-depth overview of the growing persistent memory business, its competitive landscape, product roadmaps and players' dynamics is provided in the Emerging NVM report from Yole.

Will the emerging NVM market continue to soar in 2020 and beyond? – Webcast powered by Yole Développement on Feb. 27 at 5.00 PM – Register today!
After the take-off of 3D XPoint, the emerging NVM market will keep growing, fueled by both stand-alone and embedded applications. – Speaker: Simone Bertolazzi, PhD, Technology & Market Analyst, Memory

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About our analysts

Simone Bertolazzi, PhD is a Technology & Market analyst at Yole Développement (Yole) working with the Semiconductor & Software division. He is member of the Yole's memory team and he contributes on a day-to-day basis to the analysis of nonvolatile memory technologies, their related materials and fabrication processes.
Previously, Simone carried out experimental research in the field of nanoscience and nanotechnology, focusing on emerging semiconducting materials and their opto-electronic device applications. He (co-) authored more than 15 papers in high-impact scientific journals and was awarded the prestigious Marie Curie Intra-European Fellowship.
Simone obtained a PhD in physics in 2015 from École Polytechnique Fédérale de Lausanne (Switzerland), where he developed novel flash memory cells based on heterostructures of two-dimensional materials and high-κ dielectrics.
Simone earned a double M. A. Sc. degree from Polytechnique de Montréal (Canada) and Politecnico di Milano (Italy), graduating cum laude.

Emilie Jolivet is Director of the Semiconductor & Software Division at Yole Développement, part of Yole Group of Companies, where her specific interests cover package & assembly, semiconductor manufacturing, memory and software & computing fields.
Based on her valuable experience in the semiconductor industry, Emilie manages the expansion of the technical and market expertise of the Semiconductor and Software Team. The team interacts daily with leading companies allowing semiconductor & software analysts to collect a large amount of data and integrate their understanding of the evolution of the market with technology breakthroughs.
In addition, Emilie's mission focusses on the management of business relationships with semiconductor leaders and the development of market research and strategy consulting activities inside the Yole group.
Emilie Jolivet holds a Master's degree in Applied Physics specializing in Microelectronics from INSA (Toulouse, France). After an internship in failure analysis at Freescale (France), she was an R&D engineer for seven years in the photovoltaic business where she co-authored several scientific articles. Enriched by this experience, she graduated with an MBA from IAE Lyon and then joined EV Group (Austria) as a business development manager in 3D & Advanced Packaging before joining Yole Développement in 2016

About the reports

Emerging Non-Volatile Memory

The stand-alone emerging NVM market keeps soaring, led by storage-class memory applications. Meanwhile, foundries are propelling the embedded business. – Performed by Yole Développement

And related reports:

- Status of the Memory Industry 2019
- MRAM Technology and Business 2019
- Neuromorphic Sensing and Computing 2019

About Memory Market Monitors: NAND - DRAM

A full package:

- The DRAM Quarterly Market Monitor and the Monthly Pricing Monitor include the following deliverables:
- Excel database with all historical and forecast data
- PDF slide deck with graphs and comments/analysis covering expected evolutions
- Direct access to a Yole Développement analyst for one year, providing an opportunity for on-demand Q&A and discussions regarding trends, analyses, forecasts, and breaking news

Frequency:

Receive every quarter the updated Market Monitor documents and every month the updated Pricing Monitor documents

About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide… More

For more information and images, please visit www.i-Micronews.com

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