LYON, France – January 14, 2019: Emerging non-volatile memory (NVM) was long restricted to niche applications because of poor scalability, high cost, and a lack of support from major memory makers. But in 2015, after more than 15 years in development, the first PCM-based technology for storage-class memory applications was presented by Micron and Intel: its name, 3D XPoint. However, it took these companies another two years before introducing their first commercial products. Two years after, Intel introduced Optane SSDs and storage accelerators. Developments should not stop there as persistent memory modules, the Optane DIMMs are expected in 2019. “3D XPoint sales have finally accelerated thanks to Intel’s dominant position in the enterprise processor business,” comments Simone Bertolazzi, PhD, Technology & Market Analyst at Yole Développement (Yole). “Optane DIMMs will be sold in combination with the latest generation of Intel’s Xeon server processors.”

Samsung and Toshiba’s prompt response to Intel Optane consists of 3D NAND-based SCM solutions: Z-NAND and XL-Flash, respectively. However, these technologies will be used in enterprise SSDs - with performance limited by the interface - and will not compete in terms of speed with DDR4-compatible Optane DIMMs…

What are the latest technology developments for (STT-) MRAM, PCM, and RRAM? What will 3DX Point’s future entail once Micron and Intel’s joint venture ends? What goals are foundries pursuing within the embedded memory business? What strategies are emerging eNVM players adopting to introduce their new technologies to the market? The market research and strategy consulting company Yole proposes a comprehensive technology & market survey dedicated to the emerging non-volatile memory technologies and markets, titled Emerging Non-Volatile Memory.
This report presents an overview of the semiconductor memory industry including NAND, DRAM and embedded memory in MCU/SoCs. In addition to a wide description of each technology, it details the current technological status and points out a relevant roadmap for the coming years. Under this new report, Yole’s analysts reveal the total addressable market, market drivers & challenges. They present the players involved with a detailed competitive landscape. Main market trends are provided for a total of eight application fields: industrial, transportation and consumer electronics, enterprise and client storage, microcontrollers, mobile devices, high-end processors, AI at the edge…

ENVM technology trends and industry evolution will be presented during an online event powered by Yole. “Challenges and strategies for mass adoption of emerging NVM technologies” webcast takes place on January 24, 2019 at 5 PM CET - 8 AM PDT. During one hour, Simone Bertolazzi, PhD, Technology & Market analyst, Memory Research at Yole will point out the status of the ENVM industry. Yole’s webcast provides an overview of stand-alone and embedded eNVM technologies/markets, covering their current status and evolution. Join Yole’s event to get a better understanding of memory market trends from several perspectives, including market & technology and competitive dynamics. Register today!

In the stand-alone business, emerging NVM brings new features and functionalities, but at a higher price. “Thus, new solutions must be found for triggering this NVM’s market penetration,” asserts Simone Bertolazzi from Yole. Among big IDMs, Intel has a unique position: it is both a stand-alone memory supplier and a CPU leader. Intel can combine its 3D XPoint products with its new generation of Xeon processors, which will act as the aforementioned Trojan horse for introducing 3D XPoint into the data-center technology market. STT-MRAM developers are rather small companies. Yole’s analysts identified: Everspin, Avalanche, Spin Memory that view memory module suppliers (Smart Modular, for example) as the ideal partner for entering the enterprise storage market. These module suppliers are midsized companies inclined to develop niche applications in the early stages.

In the embedded business, the top foundries are the key decision makers: they can promote the adoption of new embedded NVM in applications such as MCUs or cache memory. Therefore, it is critical for IP memory companies to convince foundries to develop edge-node (28/22nm) technology platforms for emerging NVM, a goal that has already been achieved by STT-MRAM players. In fact, RRAM has been adopted at 22nm by TSMC, but other foundries are hesitating to scale down to 28/22nm… A detailed description of Yole’s emerging NVM report is available on i-micronews.com, memory reports section.
In addition to the webcast taking place by the end of January, Simone Bertolazzi from Yole will attend next week the 2019 Joint MMM-Intermag (Jan. 14-18 in Washington, USA) to meet and discuss with the leaders of the ENVM industry. Feel free to ask for a meeting with him right now! Contact: Fanny Vitrey.
ABOUT THE REPORTS:

*Emerging Non-Volatile Memory*

After more than 15 years in development, PCM has finally taken off in stand-alone applications. – Produced by Yole Développement (Yole).

**Companies cited in the report:**


**Authors:**

- **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.

  He (co-) authored more than ten papers in high-impact scientific journals. Simone obtained a PhD in physics in 2015 from École Polytechnique Fédérale de Lausanne (Switzerland), where he investigated novel flash memory cells based on heterostructures of 2D materials and high-k dielectrics.

- **Yann de Charentenay** works as a Technology & Market Senior Analyst for Yole Développement (Yole). Yann is strongly involved in the technology & market analysis of the applications of disruptive technologies and components: memory, MEMS and sensors... Prior his mission at Yole, Yann was engaged as a marketing engineer at the Commissariat à l’Energie Atomique (CEA, France) as well as a consultant at Algoe (France). He has spoken in numerous international conferences and has authored or co-authored numerous press articles.

  Yann graduated from the University of Compiegne (France) with a master degree in innovation management. He is also graduated from INP Phelma (Grenoble, France) with a master degree in materials science.

*Leading-edge 3D NAND Memory Comparison 2018*

A deep technology analysis and cost comparison report on cutting edge 3D NAND memory chips from Toshiba/SanDisk, Samsung, SK Hynix and Intel/Micron – Produced by System Plus Consulting.

**Authors:**

- **Belinda Dube** is working for System Plus Consulting as Analyst in Semiconductor Memories and Integrated Circuits. She holds a Masters degree in Nano Science and Nanotechnologies from Ecole Central Lyon and INSA Lyon.

- **Véronique Le Troade** has joined System Plus Consulting as a laboratory engineer. Coming from Atmel Nantes, she has extensive knowledge in failure analysis of components and in deprocessing of integrated circuits.

About **DRAM/NAND MEMORY services**

**A full package:** The DRAM/NAND 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.
Options:

- Pricing Monitors can be bought individually (NAND, DRAM or both).
- Memory Research are available for DRAM, NAND and both.

More Information about memory reports on [i-micronews.com, memory reports section](http://www.i-micronews.com).

**ABOUT YOLE GROUP OF COMPANIES**

Specializing in patent analysis and scientific information, **Knowmade** provides technology intelligence and IP strategy consulting services. The company supports R&D organizations, industrial companies, and investors in their business development by offering them a deep understanding of their IP environment and technology trends. Knowmade operates in the following industrial sectors: Compound Semiconductors, Power Electronics, RF & Microwave Technologies, LED/OLED Lighting & Display, Photonics, Memory, MEMS & Sensors, Manufacturing & Advanced Packaging, Batteries & Energy Management, Biotechnology, Pharmaceuticals, Medical Devices, Medical Imaging, and Agri-Food & Environment.

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**System Plus Consulting** specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product.

System Plus Consulting engineers are experts in Integrated Circuits - Power Devices & Modules - MEMS & Sensors - Photonics – LED - Imaging – Display - Packaging - Electronic Boards & Systems. Through hundreds of analyses performed each year, System Plus Consulting offers deep added-value reports to help its customers understand their production processes and determine production costs. Based on System Plus Consulting’s results, manufacturers are able to compare their production costs to those of competitors. System Plus Consulting is a sister company of Yole Développement. More info on [www.systemplus.fr](http://www.systemplus.fr) and on LinkedIn and Twitter.

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 covering MEMS & Sensors - Imaging - Medical Technologies - Compound Semiconductors - RF Electronics - Solid State Lighting - Displays - Photonics - Power Electronics - Batteries & Energy Management - Advanced Packaging - Semiconductor Manufacturing - Software & Computing - Memory and more...

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. For more information, visit [www.yole.fr](http://www.yole.fr) and follow Yole on LinkedIn and Twitter.

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