

# MI: Apple did it<sup>1</sup>

## OUTLINE:

- APU<sup>2</sup> market dynamics:  
Q4 2020 APU revenue expected just below US\$10 billion.  
Yole Développement (Yole) is expecting a US\$38 billion market for 2020.  
Near term: seasonally weak Q1-20 and COVID-19 impacts are overlapped to place H1-20 revenue just 3% above H1-19.  
Long term: following the bounce back of demand in 2021, expecting modest unit and ASP<sup>3</sup> growth will combine and generate growing APU revenues by 2023.
- Recent news...  
Apple announced two new processors A14 and M1. M1 is the long-awaited introduction of a Mac processor designed on Apple silicon.  
Strongly impacted by US – China tensions, HiSilicon collaborates now with the Chinese foundry SMIC for the development of its Kirin710A.  
Qualcomm has chosen to switch from TSMC to Samsung foundry to manufacture their latest flagship processor.
- Apple's M1 marketing data - M1 SoC contains these major IP blocks: Four "Firestorm" high-performance CPU cores - Four "Icestorm" power efficient CPU cores - Eight GPU cores - Machine learning core, "Neural Engine" - Dual core secure processor, "Secure Enclave" - PCI Express high speed serial interfaces (X2) - Display engine.

It is now done. Apple did it. Last November, the leading smartphones manufacturer, Apple has released its first ARM-based SoC<sup>4</sup>. M1 has been designed by Apple, as a CPU<sup>5</sup> for its line of Macintosh product and Apple claims that the M1 SoC is the world's fastest CPU with the best CPU performance per watt.

*"Two new Apple MacBook models and the Mac mini are now powered by an Apple in-house SoC design," announces **Belinda Dube, Technology & Cost Analyst, Memories at System Plus Consulting**. And she adds: "The transition from Intel x86 processors has created shockwaves felt throughout the processor and computing world. This new, first SoC for Mac features 4-CPU high-performance cores, 4-CPU high-efficiency cores, and 8-GPU cores."*

---

<sup>1</sup> Extracted from: [Apple M1 System-on-Chip report](#), System Plus Consulting, 2020 | [APU Quarterly Market Monitor](#), Yole Développement, Q4 2020

<sup>2</sup> APU: Application Processing Unit

<sup>3</sup> ASP: Average Selling Price

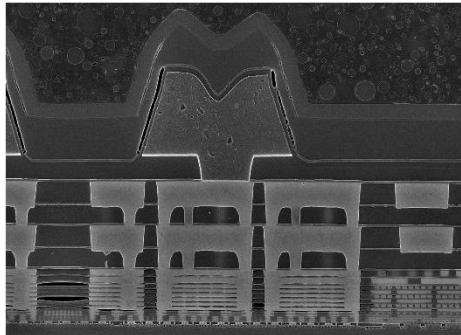
<sup>4</sup> SoC: System on a Chip

<sup>5</sup> CPU: Central Processing Unit

The tight software-hardware integration inside Apple enabled a compact, efficient processor for personal computer that outcompetes many premium microprocessors. 16 billion transistors using TSMC 5nm process were used to build it. The chip architecture provides optimized power efficiency.

**Apple M1 - Die cross section**

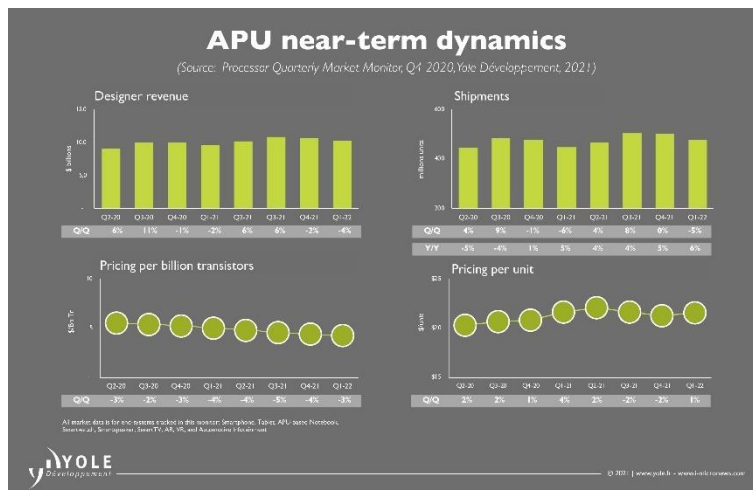
(Source :Apple M1 System-on-Chip report, System Plus Consulting, 2020)



© 2021 | www.systemplus.fr | www.systemplus.com

**John Lorenz, Technology & Market Analyst, Processors at Yole Développement**

**(Yole)** comments: “By switching to the M1 processor, Apple gives a boost to the prospects of ARM-based PCs, previously the domain of low-performing Chromebooks. Not only is this a well-spec’d solution for Apple, this is likely saving some cost on the MacBook’s components. Other notebook OEMs<sup>6</sup> are sure to take note and may further examine their x86-based solutions, although Apple can do more coordination between hardware and software as they control their operating system. Most Windows-based OEMs would not have that luxury.”



<sup>6</sup> OEM: Original Equipment Manufacturer

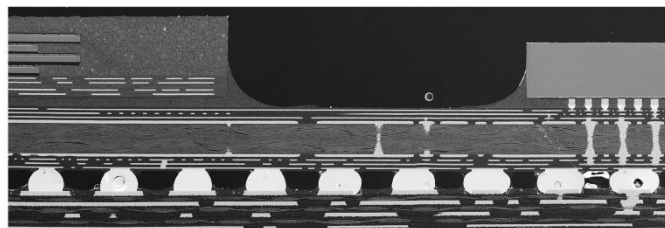
System Plus Consulting, the reverse engineering and costing company is pleased to announce a dedicated analysis focused on the latest Apple's innovation. This report is titled: **Apple M1 System-on-Chip.**

To reveal all the details of Apple M1, System Plus Consulting' report features multiple analyses: a floor plan analysis to understand the high-level chip architecture with IP<sup>7</sup> block area contribution measurements, a front-end construction analysis that reveals the most interesting features of the new TSMC 5nm process, a back-end construction analysis of the packaging structure, and a detailed manufacturing cost analysis.

“On the SoC side, it appears that the die area of the M1 was optimized for functionality rather than SRAM cache,” comments **Belinda Dube from System Plus Consulting.** According to the Apple M1 report, there is limited on-chip cache, taking cues from mobile SoC designs relying on the UMA<sup>8</sup> concept and external LPDDR4X DRAM. Significant die area is devoted to standard cell functions, indicating that Apple is leveraging in-house chip design to optimize hardware for the operating system.

#### Apple M1 - Package cross section

(Source :Apple M1 System-on-Chip report, System Plus Consulting, 2020)



© 2021 | www.systemplus.com | www.reversecosting.com

On the packaging side, the same structure is used for Apple's A12X and A12Z, with the integration of the DRAM on the SoC substrate, and embedded silicon capacitors in the substrate.

Don Scansen collaborates with System Plus Consulting's team to analyze Apple's M1. “The first product from Apple's chip design team meant for the personal computer line surpassed many competing microprocessors and nearly everything currently in other Apple products, particularly in single core and GPU tests...”, wrote Don in a dedicated article for EETIMES. Discover the full article: [here](#).

<sup>7</sup> IP: Intellectual Property

<sup>8</sup> UMA: universal memory architecture

*In collaboration with Yole Développement, System Plus Consulting publishes numerous reports and tracks all year long. In addition, experts realize various key presentations and organize key conferences. Make sure to follow our activities on i-Micronews.*

### **Press contacts**

**Sandrine Leroy**, Director, Public Relations, [leroy@yole.fr](mailto:leroy@yole.fr)

**Marion Barrier**, Assistant, Public Relations, [marion.barrier@yole.fr](mailto:marion.barrier@yole.fr)

Le Quartz, 75 Cours Emile Zola – 69100 Villeurbanne – Lyon – France – +33472830189

[www.yole.fr](http://www.yole.fr) - [www.i-micronews.com](http://www.i-micronews.com) – [LinkedIn](#) – [Twitter](#)

### About our analysts

**Belinda Dube** serves as a Technology & Cost Analyst at System Plus Consulting, part of Yole Développement (Yole). Belinda's core expertise is memory technology, especially DRAM and 3D NAND flash memory. At the same time, she also investigates IC technologies as well as advanced packaging.

Belinda's mission is to develop reverse engineering & costing reports. She also works on custom projects, where she works closely with the laboratory team to set up significant physical & chemical analyses of innovative memory chips. Based on the results, Belinda identifies and analyzes the overall manufacturing process and all technical choices made by the memory makers. The objectives of these analyses are to understand the structure of the device, identify all materials used, and point out the link between functionality and technology selected by the memory company.

In addition, a significant portion of her mission is dedicated to a strategic technology watch, where her aim is to identify innovative memory chips and manufacturing processes. Based on her expertise, Belinda updates internal simulation tools and runs custom training sessions and demos with industrials.

Belinda attends many international trade shows & conferences where she collects valuable information and meets leading memory players. She regularly has an opportunity to reveal pertinent results during key onsite presentations and webcasts.

Prior to System Plus Consulting, Belinda had the opportunity to work on several R&D projects dedicated to MEMS technologies and new substrates at INSA (Lyon, France).

With a core Micro & Nano Electronics expertise, Belinda graduated from INSA (Lyon, France) with a master's degree in Instrumentation & Nanotechnology Engineering.

**Stéphane Elisabeth**, PhD is Senior Technology and Cost Analyst at System Plus Consulting, part of Yole Développement (Yole). Stéphane regularly works on numerous reverse engineering and costing reports while also managing custom projects in the RF electronics and advanced packaging fields.

His mission at System Plus Consulting is to provide an in-depth understanding of the technologies selected by the leading semiconductor companies as well as the ecosystem around a device.

In this context, Stéphane is leading a strategic watch to identify the latest innovative devices and collaborates closely with System Plus Consulting's laboratory to analyze devices or components. His aim is to reveal the link between functionality and the technical choice made by the device maker. Based on the identification of each process step and process flow, our analysts can then provide an accurate evaluation of the manufacturing cost. His significant industrial and technical knowledge allows him also to update internal simulation tools developed by System Plus Consulting's experts.

In addition, Stéphane supports the development of RF electronics activities through key customer projects, including presentation of their results.

Prior to this collaboration with System Plus Consulting, Stéphane worked on projects in partnership with THALES for the development of innovative hybrid RF circuits. He also regularly publishes articles and interviews within key RF electronics and packaging magazines.

Stéphane holds an engineering degree in electronics and numerical technology (Université de Nantes, France) as well as a PhD. in Materials for Microelectronics (Université de Nantes, France).

**John Lorenz** is a Technology and Market Analyst within the Computing & Software division at Yole Développement (Yole), part of Yole Group of Companies. John is engaged in the development of market and technology monitors for the logic segment of advanced semiconductors, with an initial focus on processors. Prior to joining Yole, John held various technical and strategic roles at Micron Technology.

On the engineering side, his roles included thin film process development and manufacturing integration on DRAM, NAND, and emerging memory technologies and industrial engineering / factory physics for the R&D fab.

On the strategic side, John ran the memory industry supply & capex model for corporate strategy / market intelligence, and established the industry front-end costing model within strategic finance.

John has a Bachelor of Science degree in Mechanical Engineering from the University of Illinois Urbana-Champaign (USA), with a focus on MEMS devices."

*And this analysis has been developed in collaboration with Don Scansen:*

**Don Scansen** has partnered with System Plus Consulting to launch the new die architecture and front-end process analysis of advanced SoC devices including APU, CPU, GPU, and FPGA. Don previously supported clients ranging from individual patent owners to Fortune 500 companies providing competitive analysis and intellectual property support.

He holds a PhD in electrical engineering.

### **About the report and monitor**

#### **Apple M1 System-on-Chip**

*A deep-dive analysis of Apple's first in-house CPU for Mac – A reverse engineering & costing report performed by System Plus Consulting.*

This report is a complete teardown with detailed photos, floor plan analysis, precise measurements, materials analysis, front-end structural analysis with TEM, back-end structural analysis with CT-Scan, supply-chain evaluation, and manufacturing cost analysis...

#### **Application Processor Quarterly Market Monitor**

*With SMIC, China is positioning as a competitor in foundry business and thereby catching the dynamic of the APU market. – Yole Développement*

The Quarterly Market Monitor examines and forecasts the application processor segment of the semiconductor industry, as dissected across multiple dimensions. The monitor tracks processor revenue, units, and wafer volumes at both fabless chip designers and at the foundries themselves, sliced across various relevant parameters including process node, end-product segment, core and IP type, etc..

### **Related reports**

- [Intel Foveros 3D Packaging Technology](#) – System Plus Consulting
- [Advanced System-in-Package Technology in Apple's AirPods Pro](#) – System Plus Consulting

### **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](#)

### **About System Plus Consulting**

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... [More](#)

**For more information and images, please visit our website [i-Micronews](#)**

**###**