



# Technology Brief...

September, 2020

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Research, Analysis, Strategy, Insight

## Intel: One step backwards, two steps forward

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*"...While Intel's competitors have made significant gains in both performance and market share, it's important not to simply count Intel out. If anything, the "black eye" it's received by losing the "process war" has given it a new incentive to pick up the challenge. Intel has considerable resources it can deploy and much engineering prowess. While it's certainly true that not being at the most current process node has hurt, Intel continues to push boundaries on other design criteria that will keep it competitive....."*

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Much has been made of Intel being eclipsed in process technology by its largest chip manufacturing competitor TSMC, and rightly so. Until recently Intel consistently had a 2 year lead on process technology that set it apart in the industry and gave it a significant competitive advantage. But it stumbled badly trying to get to the 7nm process node as TSMC (and others like Samsung) perfected the process, and is now probably 2 years behind the competition.

Although the process node alone is not a complete determiner of chip performance, the process node that chips are manufactured on does have a significant impact on the overall performance of the device. It's allowed a revitalized AMD to create some very competitive x86 family chips using the outsourced fabrication capability of TSMC and capturing an increased market share in both PCs and servers. Process node alone was not the only thing that helped AMD – it spent a great deal of time and effort on designing new architectures that have paid off in performance gains. Coupled with the process node advantage, it has made AMD chips highly competitive – more so than they've been in years.

But lately, frustrated by its inability to get to the next process step, Intel has been focused increasingly on other components of performance that can leverage its engineering prowess. To this end, Intel has recently provided details on its engineering successes beyond the process node that will set it apart from the competition, at least for a few years. Intel's one large step backwards as they lose their lead in process technology will be compensated for by two steps forward as they lead with new transistor designs and interconnect (and add packaging as a bonus). As Intel puts it, synchronized and co-architected advances of transistors, packaging and designs are essential for the future of Moore's Law.

#### Transistors

Intel pioneered the FinFet a decade ago. Intel now has created something its calls the SuperFin for its 10nm process node. By significantly increasing performance through improved gate design, smaller size and decreased capacitance, Intel claims to have achieved a full node of performance improvements (15%-20%) without moving beyond the current 10nm node. This improved transistor technology should allow them to catch up with the 7nm competition, and this advantage will continue once Intel transitions to the next process node, which may not be for another 6-12 months. This emphasizes the fact that looking at the process node alone is not sufficient to determine overall performance. There are many other factors that determine the performance of a chip. Which lead directly to the next improvement that Intel has announced.

#### Interconnects

The age of monolithic silicon chips is rapidly coming to an end as we move to an era of increased complexity and SoC designs necessary to increase the functionality of semiconductors. Indeed, many processors have had multiple silicon die placed onto a

substrate before final packaging for several years. But the interconnections that make this work have been less visible, despite their importance. Intel is placing much more emphasis on interconnect technology now that so many of its designs have multiple die. The primary two are EMIB and Foveros.

EMIB provides a small bridge interconnect between die on a substrate, while Foveros is a high density vertical stacking technology. Both play a key role in providing final products that can utilize “chiplets”, both created from Intel as well as obtained from third parties. As an example, Intel’s Stratix product used EMIB for chiplets from 3 different foundries and includes 6 different chiplets, while Intel’s Lakefield used Foveros 3D stacking technology to substantially increase density and reduce SoC size. Both allow Intel to use the best fit chiplets to create improved performance, lower cost and more dense products. Both technologies are attractive for data center and HOPC designs, and the continuing improvements in density and stacking are critical to future products. Having this interconnect capability that Intel claims is superior to others in the market provides them with a competitive advantage going forward, allowing much more complex products to be produced while eliminating the need for a fully monolithic implementation that would create extremely large chips with lower yields and higher cost.

**Bottom Line:** While Intel’s competitors have made significant gains in both performance and market share, it’s important not to simply count Intel out. If anything, the “black eye” it’s received by losing the “process war” has given it a new incentive to pick up the challenge. Intel has considerable resources it can deploy and much engineering prowess. While it’s certainly true that not being at the most current process node has hurt, Intel continues to push boundaries on other design criteria that will keep it competitive.

## Intel’s PC EVO-lution

Intel has announced that it will be creating a new brand called EVO – its first new platform brand in over a decade. While EVO is essentially Project Athena Generation 2, it is important as Intel, and the PC space generally, continues to try and innovate to meet the challenge of the mobile world. Based on 11th Generation Core processors (Tiger Lake) that include new high speed transistors, new interconnects and redesigned CPU, GPU (Iris XE graphics), WiFi6 and AI, Intel is pushing to recapture the lead in laptop processors. In addition, EVO has a 4G or 5G option using Intel’s partner MediaTek that will begin shipping in the next few quarters

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The original Project Athena was a successful initiative in that it created a whole new generation of fast, thin and light, and superior battery life machines. This was important to revitalize a moribund laptop market that was stagnant, with users hesitant to upgrade for no great perceived benefit. Indeed, while in the past just upgrading the processor may have created an upgrade cycle, the performance improvements in the processor alone no longer stimulate upgrades as the performance of older machines remains adequate for most general uses. Athena ushered in the thin and light age, and created a newly innovative product set that appealed to many users, thus stimulating sales. And although the original machines were all premium priced (\$800-\$1200+) that limited their impact, recent machines have been much more affordable and have seen increased sales as a result. I expect the first batch of EVO machines to be similar high end premium priced machines, with lower priced models coming to market in 12-18 months, likely with lower end processors and other cost cutting options.

EVO is an attempt to “up the ante” on Project Athena and create a new set of appealing capabilities for notebooks. Indeed, Intel looks to regain the leadership position in processors, despite the lack of 7nm process node currently used by its primary competitor, AMD. The EVO brand is probably the most important new brand for Intel since Centrino which ushered in the age of wireless connectivity,

and that was an incredible success for Intel. I expect EVO to be a major catalyst for a laptop upgrade cycle.

Certified EVO devices will include:

- less than 1 second wake from sleep
- 9 Hours battery life on typical system
- 2 times more responsive than a 2 year old laptop
- Fast charging to achieve 4 hours of battery capacity after 30 minute charge
- All systems with Thunderbolt 4 and WiFi 6, and
- increased microphone capability that can extract out traffic noise, dog barking, etc., using the AI capabilities on the 11th gen processor (3 different AI engines in chip)
- 50 designs in market this year (150 partners over 50 systems in market shipped on 1st edition Project Athena)
- EVO branding requires test and verify that systems meet specs

**Bottom Line:** EVO is the first new brand for Intel in many years, and while not all Intel attempts at creating brands in the past have been successful, Project Athena was a very successful market initiative that created new and innovative form factors created by multiple vendors that were well received. EVO is a good way for Intel to differentiate from the competition and show customers why they need to upgrade. While I expect EVO to be successful, it's likely that the initial high cost of devices will limit adoption, at least until lower price devices are made available in the next 12-18 months.

## Why foldable smartphones are important, even if you never get one...

Recently, Samsung announced its second generation Galaxy Z Fold 2 5G and Microsoft announced its Surface Duo foldable devices. Others have tried foldables in the past with limited success (LG, Huawei, Motorola), so why do these now?

The market for smartphones has gone tepid, with overall sales falling (not just because of Covid). With little incentive to upgrade due to lack of major compelling new features, as well as increasing prices on premium smartphones, people are keeping their devices longer (this is true for both Android and iOS devices). Average life times are increasing from the previously common 12-18 months to a more PC-like 24-36 months for many consumers. Vendors believe, rightly so, that new and innovate products will drive sales in an otherwise saturating market (Apple has played this strategy well over the years). Innovative new products like foldables can drive a renewed interest and increase sales.

*These devices can be very good for the manufacturers.*

Since they are premium products, the margins are quite good and help the bottom line well out of proportion to the relatively small sales numbers. These “halo” products show the engineering prowess of the particular vendors, giving them “bragging rights”, and as a result expanded brand preference with consumers. So even with a relatively small market compared to mainstream mid-tier consumer devices, there is a real advantage for smartphone makers to go this route (BTW this is a similar strategy used by many PC vendors, as well as smart appliances, cars, and other commodity products). Further, much of the advanced engineering created for this class of high end devices, both in hardware and software, will eventually make it into lower tier devices, so the new design and advanced manufacturing processes necessarily created for these devices can be leveraged for many future devices as well, thereby lowering the overall risk and the substantial development costs. Finally, this is also a win for Google's Android, as the new features needed by these devices (e.g., split

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screens, connections to the Windows world, multitasking, etc.) make Android a more compelling OS.

*Who will these foldable devices appeal to?*

Based on the somewhat different design targets and price points, the Microsoft Surface Duo (\$1400) will probably appeal more to business users who are focused on Microsoft productivity apps, while the Samsung Galaxy Z Fold 2 (\$2000) will also appeal to business users but have broader appeal and include high-end consumers with social media and/or creator aspirations. I don't expect the Duo to sell in great numbers (by smartphone standards) as Microsoft's distribution and brand recognition in smartphones is limited. But Microsoft doesn't need to sell 100s of millions of devices to be successful, as its other Surface products have shown. With a tight coupling to Microsoft's back end productivity (Office 365) and other services (Xbox), each device represents a revenue stream for Microsoft far greater than just the purchase price of the Duo device alone. Samsung on the other hand has a huge distribution channel of carriers and third party sellers that can essentially make the devices available to nearly everyone on the planet, so will see a much bigger uptake of devices. And by offering a family of foldables (including the Galaxy Z Flip 5G priced lower at \$1300 and targeted primarily at social media conscious millennials), Samsung can cover a wider market space.

*Will users be willing to pay as much as \$2,000 for a phone?*

The short answer is yes. Some have speculated the high price will make these devices unsellable. But buyers will spend if they perceive enough value in usability or "bragging rights" (look at the success in the market for high-priced laptops, some at or near the \$2K price). I don't expect the price to be a big barrier to adoption, especially since it will drop over time. And since these early class devices are hard to manufacture, the relatively high price keeps the vendors from being overwhelmed by demand while they get their processes tuned to higher volumes. So while the high prices might be a limit to some adoption, it likely will not be much of an impediment to adoption by the targeted user base. And like all electronic devices, I expect the prices to drop over time, especially on previous generation devices that continue to be offered.

**Bottom Line:** I expect this form factor to emerge as an important subcategory for virtually all the phone vendors to compete in (and my speculation is that will eventually include Apple). Manufacturers will continue to innovate in this space, both at the high end and scaled down to the mid tier. I further expect the foldables market to capture 10%-20% of the premium product space within the next 2-3 years, influenced heavily by business buyers who are much less put off by the price tag and more focused on tools that increase their productivity. And finally I expect to see more innovative form factors coming out of the vendors as they try to revitalize a smartphone market that needs some boosting, and repurpose some of the leading edge technology going into these devices.

## About J.Gold Associates, LLC.

*J.Gold Associates provides advisory services, syndicated research, strategic consulting and in-context analysis to help its clients make important technology choices and to enable improved product deployment decisions and go to market strategies. We work with our clients to produce successful new product strategies and deployments through workshops and reviews, business and strategic plan coaching and reviews, assistance in product selection and vendor evaluations, needs analysis, competitive analysis, and ongoing expertise transfer.*

*J.Gold Associates provides its clients with insightful, meaningful and actionable analysis of trends in the computer and technology industries. We have acquired a broad based knowledge of the technology landscape and business deployment requirements, and bring that expertise to bear in our work. We cover the needs of business users in enterprise and SMB markets, plus focus on emerging consumer technologies that will quickly be repurposed to business use.*

*We can provide your company with a trusted and expert resource to maximize your investments and minimize your risk. Please contact us to see how we can help you.*



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