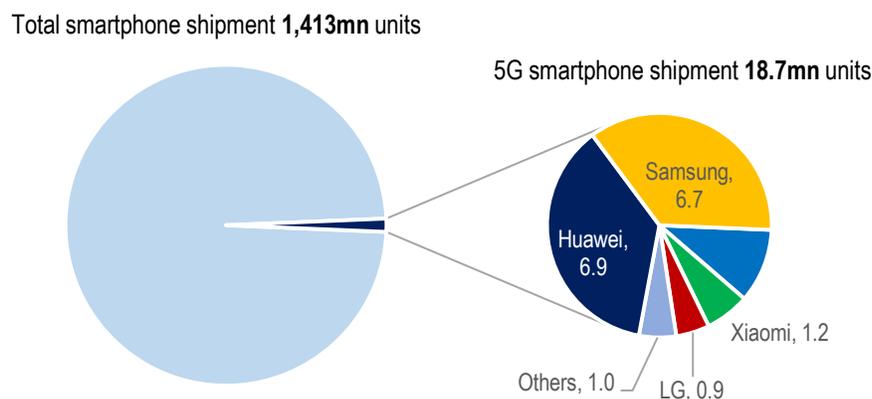




5G smartphone growth – powered by chipmaker

Figure 1: 5G smartphone shipments by manufacturer in 2019



Source: Strategy Analytics, AMTD Research

AMTD views: “Year of 5G” arrives with an unexpected outbreak of COVID-19. GSMA cancelled MWC2020 in February and there is mounting concerns about disruptions to the smartphone supply chain. However, a slew of new 5G chips introduced by chipmakers ready to power the 5G devices and the manufactures’ determination of pushing 5G products this year could alleviate the impact of coronavirus epidemic, in our view. 5G devices ramp is expected to come in the second half of this year. According to Strategy Analytics, global 5G smartphone shipments reached 18.7mn units in 2019. Huawei topped the list with a total shipment of 6.9mn units, followed by Samsung with 6.7mn units, Vivo 2.0mn units, Xiaomi 1.2mn units, and LG 0.9mn units. Looking ahead to 2020, Strategy Analytics forecasted 5G smartphone shipments will reach 199mn globally with 5G penetration rising from 1% in 2019 to 15% of the total in 2020. Separately, major 5G chipmakers, MediaTek and Qualcomm disclosed their forecasts for 5G shipments of 2020 on the latest earnings calls, in the range of 170mn-200mn units and 175mn-225mn units, respectively.

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Semiconductor

5G Modem

5G modem – integrated or not?

Qualcomm, Huawei, Samsung and MediaTek had all introduced their integrated 5G SoCs before the “Year of 5G” – 2020. Just entering 2020, Qualcomm launched its 3rd-gen discrete 5G modem – X60 in February instead of an integrated 5G SoC. Qualcomm’s explanation on this is that the choice to not integrate the modem is not a matter of technical ability but the consideration of the complexity of 5G platform, including RF systems and antenna designs. What we found is all current 5G SoCs don’t support mmWave, which is much faster and has higher bandwidth than Sub-6, and is thought to be the key part of building next-gen applications, such as AR&VR. Of course, discrete modem needs to be powered separately, but it does not mean battery inefficiency, however, the best counterargument is iPhone, which always has had discrete modem solution. In the short term before the 5G technologies mature, for performance reason, we think flagship models will adopt AP+modem solution, while for the best price to performance ratio, we expect 5G SoC to become mainstream in the mass market. As we known, Xiaomi had launched the cheapest 5G smartphone Redmi K30 5G powered by Qualcomm’s mid-end 5G SoC Snapdragon 765G.

Figure 2: specs of 5G modems introduced by chipmakers

Chipmaker/ Target market	5G Modem	Discrete or Integrated SoC	Process/ Foundry	Network	Frequency	Peak DL rate (Gbps)	Release date
Qualcomm							
High-end	Snapdragon X50	Discrete	10nm/TSMC	NSA	sub-6/mmWave	5.0	Oct-2016
High-end	Snapdragon X55	Discrete	7nm/TSMC	NSA/SA	sub-6/mmWave	7.5	Feb-2019
Mid-end	Snapdragon X52	Snapdragon 765G	7nm/Samsung	NSA/SA	sub-6/mmWave	3.7	Dec-2019
High-end	Snapdragon X60	Discrete	5nm/Samsung & TSMC	NSA/SA	sub-6/mmWave	7.5	Feb-2020
Huawei							
High-end	Balong 5000	Discrete	7nm/TSMC	NSA/SA	sub-6/mmWave	6.6	Jan-2019
High-end		Hisilicon Kirin 990	7nm/TSMC	NSA/SA	sub-6	2.3	Sept-2019
Samsung							
High/mid-end	Exynos 5100	Discrete	10nm/Samsung	NSA/SA	sub-6/mmWave	6.0	Aug-2018
Mid-end		Exynos 980	8nm//Samsung	NSA/SA	sub-6	2.55	Sept-2019
High-end	Exynos 5123	Discrete	7nm//Samsung	NSA/SA	sub-6/mmWave	7.35	Oct-2019
MediaTek							
High/mid-end		Dimensity 1000	7nm/TSMC	NSA/SA	sub-6	4.7	Nov-2019
High/mid-end	MT6885	Dimensity 1000L	7nm/TSMC	NSA/SA	sub-6	4.7	Dec-2019
Mass market	MT6873	Dimensity 800	7nm	NSA/SA	sub-6	3.5	Jan-2020

Source: Company Info, AMTD Research

Qualcomm – leading the 5G chip technology

Without a shadow of a doubt, Qualcomm is leading the 5G chip technology. In the latest “What’s Next in 5G” event, Qualcomm introduced a series of new 5G technologies. Major highlights were: 1) third-generation 5G Modem-RF system: Snapdragon X60 is the first modem built on a 5nm process, supports carrier aggregation between Sub-6 and mmWave, and offers up to 7.5 Gbps download speeds. The sample X60 is being shipped to OEM in Q1. Samsung Foundry has won the contract to produce 5nm 5G X60 Modem; 2) ultraSAW RF filter technology: Qualcomm ultraSAW filters offer a higher performance solution compared to competing bulk-acoustic (BAW) filters in the sub-2.7 GHz frequency range. This technology allows lower-cost, more power-efficient RF paths in 4G/5G mobile devices. Separately, the flagship Snapdragon 865 5G mobile platform, launched in last December, will be expected to be paired with X55 5G modem to power many premium-tier Android smartphones this year. So far, Qualcomm has won more than 275 5G design wins, including 70+ for its Snapdragon 865 SoC.

Huawei – leading the 5G competition

As of February 2020, Huawei was still the leader on 5G commercial contracts with a total number of 91, ahead of the 81 and 63 announced by Ericsson and Nokia, respectively. In the mobile market, Huawei has also demonstrated its strong competitiveness in 5G. Last September, Huawei launched the world’s first 5G integrated SoC – Kirin 990 5G. Built on 7nm+ EUV, the chip has more than 10 billion transistors while manages to have a 36% smaller PCB size than its rival, Snapdragon 855 and its X50 modem, in the same period. However, only support four sub-6 5G bands, peak UL/UL rates are slower than those of chips that support mmWave band. Kirin 990 5G has powered its Mate 30 series launched in fourth quarter last year and will power its upcoming new P40 series 5G smartphone as expected. In addition, in “5G Full Scenario” press event on 24 Feb, Huawei announced that its 5G smartphone shipments exceeded 10mn units as of January 2020.

Samsung – sharpening its competitiveness in 5G

Built on the 8nm FinFET process and consisting 2X new Cortex-A77 CPU, Samsung’s first integrated 5G SoC – the Exynos 980 5G was unveiled last September and hit the market in later December with the launch of Vivo X30 5G smartphone. Samsung is sharpening the competitiveness in 5G by strengthening R&D cooperation with Chinese companies, and is seeking to increase market share by expanding 5G chip supply lines to Chinese smartphone manufacturers, such as Vivo and Oppo. With only support for sub-6GHz, we believe Samsung positions its first 5G SoC – the Exynos 980 in the mid-end market. Furthermore, a teaser posted online recently suggested that upcoming Galaxy A71 5G may be coming with an Exynos 980 5G SoC. On the other hand, Samsung will continue to use Qualcomm’s and its own 5G platform with discrete modem for its flagship series (S/Note). The upcoming Samsung S20 Series will be upgraded to Snapdragon 865 plus X55/Exynos 990 plus Modem 5123.

MediaTek – target 40% of the SAM over the lifetime of the 5G

In the latest earnings call, MediaTek management expected the total global 5G smartphone shipment to be around 170mn to 200mn units in 2020. Over the lifetime of the 5G, management targeted 40% of the SAM. MediaTek announced its first high-end Dimensity 1000/1000L 5G SoC at the end of last year. It’s positioned against the Snapdragon 765G. In Jan 2020, MediaTek unveiled another budget-friendly 5G SoC - Dimensity 800. Those chips will likely appear on future Oppo, Vivo, Xiaomi, and even Huawei and Samsung’s low-end smartphones (A/M series). MediaTek Flagship 5G chip, Dimensity 1000, is being shipped already; mid-tier Dimensity 800 will be shipped in the second quarter; and the mass-market SoC was expected to be shipped in mid to late third quarter.

News update

28 Feb 2020

Cloud/SaaS

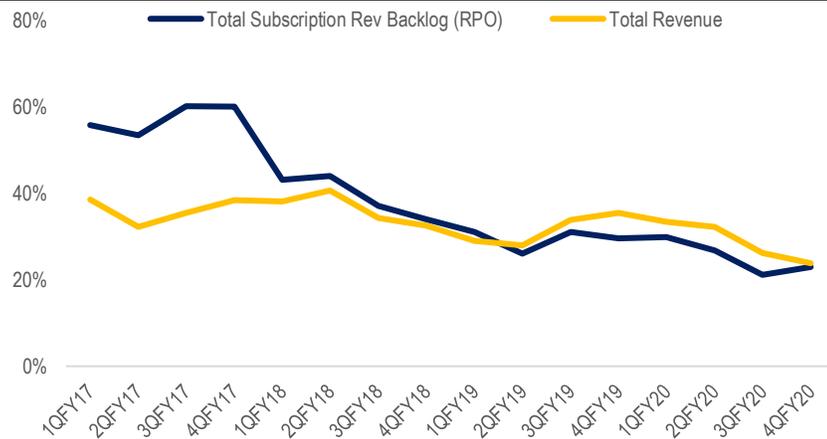
Workday

Solid Q4 results back on HCM & FINS strength

Workday reported solid Q4 results driven by strong performance of HCM and FINS. Total revenue grew by 23.8% YoY to US\$976.3mn, among which subscription revenue was US\$839.7mn, up 24.7% YoY. Driven by healthy net new bookings add-on business and strong renewals (net retention once again over 100%), revenue backlog grew by 23.0% YoY to US\$8.29bn, among which US\$5.48 bn will be recognized within the next 24 months, up 22.6% YoY. The company raised FY21 subscription revenue outlook to US\$3.755bn - \$3.770bn. Non-GAAP operating margin was expected to be 14.5% in full year of FY21. (Source: [Workday](#))

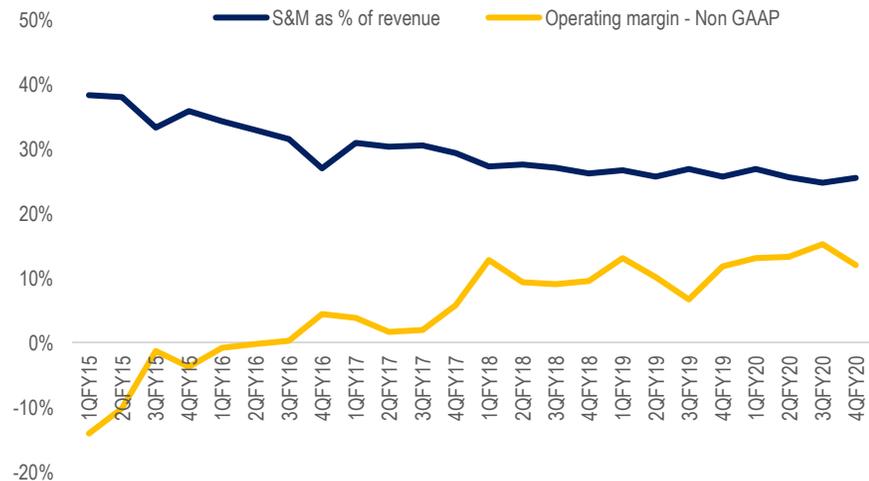
AMTD views: HCM had another strong quarter as the company added 11 new Fortune 500 customers, and now have 45% of the Fortune 500 as HCM customers including 60% of the Fortune 50. As HCM business is becoming mature, the company is seeking growth opportunities in the medium enterprise segment. On the other hand, as product synergies between HCM and FINS are improving, FINS could be another growth driver for Workday.

Figure 3: Workday's backlog and revenue growth, YoY



Source: Company data, AMTD Research; Note: FY20 ended 31 Jan 2020

Figure 4: Workday's S&M expenses as % of total revenue and operating margin (Non-GAAP)



Source: Company data, AMTD Research; Note: FY20 ended 31 Jan 2020

26 Feb 2020

Cloud/SaaS

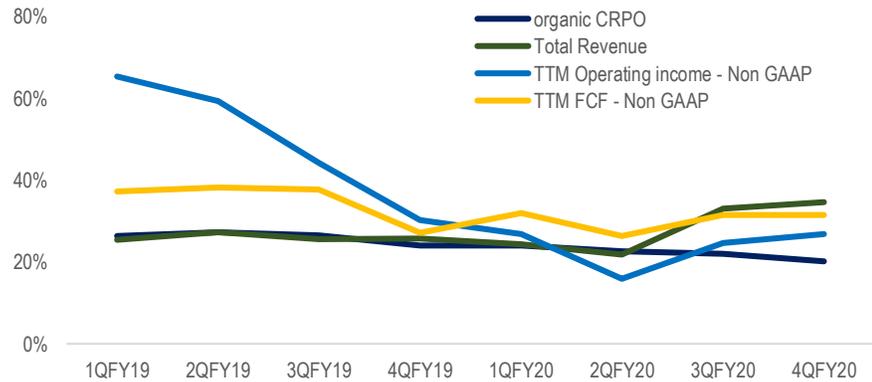
Salesforce

Strong Q4 results with FY24 revenue target on track

Salesforce reported strong Q4 results. Current remaining performance obligations (CRPO) bookings was US\$15.0bn, up 27% YoY in cc. Organic cc CRPO grew by 20% YoY to US\$14.3bn by excluding approximately US\$700mn contribution from Tableau and .org. Total revenue came in at US\$4.85bn, up 34% (organic +22%) YoY in cc. Non-GAAP operating margin was 15.4%, down 110bps YoY, due to the timing of Dreamforce in Q4 vs Q3 last year as well as the timing of integration and other investments in Tableau. Thanks to strong cash collection, Q4 FCF was US\$1.5bn, up 29% YoY. For next quarter, CRPO growth was guided to 23-24% YoY and total revenue was expected to be US\$4.875-4.885bn. Operating cash flow growth was guided to 20% YoY in full year of FY21. (Source: [Salesforce](#))

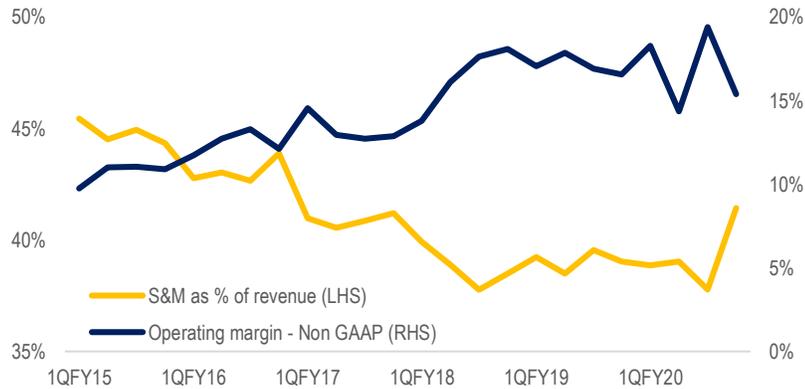
AMTD views: Investors always challenge salesforce acquisitions business model as those target companies were not cheap and costed much in M&A. However, Salesforce is always able to plug each acquisition into Salesforce system, cut costs, and accelerate organic revenue growth later. The most recent cases were MuleSoft, which accelerated to 77% YoY in Q3 vs 60% YoY stand-alone, and the acquisition of Tableau for strengthening Customer 360. In addition, Salesforce is expanding industry offering with the acquisition of Vlocity in Q4. The deal is expected to close during the Q2FY21 with approximately US\$50mn revenue contribution in FY21. Overall, we think Salesforce remains on track to deliver US\$34bn to US\$35bn in revenue in FY24, representing a 4-year CAGR of approximately 20%. However, Keith Block stepping down as co-CEO after with Salesforce for 7 years could be an execution risk for the company.

Figure 5: Salesforce's organic CRPO cc, total revenue, TTM operating income, and TTM FCF growth, YoY



Source: Company data, AMTD Research; Note: FY20 ended 31 Jan 2020

Figure 6: Salesforce's expenses as % of total revenue and operating margin (Non-GAAP)



Source: Company data, AMTD Research; Note: FY20 ended 31 Jan 2020

27 Feb 2020

Cloud

Microsoft

Microsoft has warned it will miss revenue guidance due to Coronavirus

Microsoft has warned it will miss its revenue guidance for its Windows and Surface businesses, blaming uncertainty around the coronavirus. The company said, the supply chain is returning to normal operations at a slower pace than anticipated at the time of the Q2 earnings call. Microsoft previously advised the business segment called "More Personal Computing", which includes sales of Windows and its Surface hardware, would generate between \$10.75bn and \$11.15bn in revenue in fiscal third quarter. (Source: [WSJ](#))

27 Feb 2020

Component

PCB

PCB production in Japan has shrunk for 12 consecutive months

According to the Japan Electronics Packaging Circuits Association (JPCA), volume of PCB production in Japan have decreased to 0.973 million m² in Dec 2019, indicating a 16.6% YoY decline. It is the 13th consecutive month of decline. Total production value has dropped 7.9% YoY to JPY36.263 bn, contracting for the 12th consecutive month.

Production of Rigid PCB has decreased to 0.759 million m², implying a decline of 8.7% YoY, shrinking for the 13th consecutive month. Total production value dropped 6.8% to JPY24.42 bn, contracting for the 10th consecutive month.

Production of Flexible PCB has decreased to 0.149 million m², implying a decline of 43.0% YoY, shrinking for the 31st consecutive month. Total production value dropped 38.2% to JPY2.743 bn, contracting for the 17th consecutive month. It is the largest reduction in nine months.

Production of Module Substrates has decreased to 0.065 million m², implying a decline of 11.1% YoY, shrinking for the 7th consecutive month. Total production value increased 4.3% to JPY9.1 bn, showing a growth for the 2nd consecutive month. (Source: [Moore](#))

26 Feb 2020

Semiconductor

AMD

AMD launched two more low-power Ryzen Embedded processors

AMD launched its lower cost and lower power versions of its Embedded R1000 family with Ryzen Embedded R1102G and Ryzen Embedded R1305G processors with a TDP of respectively 6W and 10W. The details of the new processors are as follows:

Ryzen Embedded R1102G – 2-core/2-thread @ 1.2 GHz / 2.6 GHz (Turbo); 3x CU Radeon Vega 3 graphics cores @ 1.0 GHz; 6W TDP

Ryzen Embedded R1305G – 2-core/4-thread @ 1.5 GHz / 2.8 GHz; 3x CU Radeon Vega 3 graphics cores @ 1.0 GHz; 8-10W TDP (Source: [AMD](#))

26 Feb 2020

Cloud

Google

Google plans to invest \$10 billion in US offices and data centers in 2020

Google announced it would invest more than \$10 billion in offices and data centers across the United States in 2020. The company added that new investments will focus on 11 states including Massachusetts, New York and Ohio. The company's total cost and expenses surged about 19% at \$36.81 billion for the recently reported fourth quarter ended Dec 31 (Source: [Reuters](#))

26 Feb 2020

Smartphone

Apple

2019 iPhone XR shipments are the world's first to sell 46.3 million units

Apple's iPhone XR accounted for nearly half of global smartphone shipments in 2019, followed by its latest iPhone 11, which was launched in September, according to Omdia's Smartphone Model Market Tracker. Apple shipped an estimated 46.3 million iPhone XR units across 2019, besting its iPhone 11 successor. The company's latest "affordable" iPhone saw 37.3 million units ship since its debut in September, Omdia said. (Source: [Omdia](#))

26 Feb 2020

Cloud/SaaS

Salesforce

Salesforce acquired Vlocity for \$1.33 billion

Salesforce announced the acquisition of Vlocity, Inc., a cloud and mobile software provider by \$1.33 billion. The acquisition is expected to close during the second quarter fiscal 2021. Vlocity's feature set will continue to enhance and complement Salesforce's industry capabilities and product knowledge, open up new industry capabilities built on the Salesforce platform, and provide customers with even more tools and expert guidance to digitally transform. Salesforce also announced that Keith Block, the company's co-CEO, is stepping down and Marc Benioff would be the sole CEO. (Source: [Techcrunch](#))

25 Feb 2020

Smartphone

Vivo

iQOO 3 5G smartphone launched with price at RMB3598

iQOO launched its iQOO 3 5G at an online event on February 25. The iQOO 3 features a 6.44-inch Full HD+ (2400 x 1080 pixels) resolution Super AMOLED screen and UFS 3.1 high-speed flash memory. It runs on snapdragon 865 (supports SA, NSA dual-mode 5G) and is equipped with standard LPDDR5 operating memory. Prices of the phone start at RMB 3,598. (Source: [Vivo](#))

25 Feb 2020

Semiconductor

Qualcomm

Snapdragon 865-powered Redmi K30 Pro coming in March

On February 25, Redmi announced that the K30 Pro will be officially released in March. The K30 Pro uses an OLED full-screen display and is powered by the latest Qualcomm Snapdragon 865 processor with dual-mode SA and NSA 5G support. The phone is expected to be equipped with LPDDR5 memory and UFS 3.0 flash memory. Its camera may be SONY IMX686 (64 megapixels) and it will support fast charging. (Source: [Androidheadlines](#))

24 Feb 2020

Semiconductor

Intel

Intel Announces Unmatched 10nm Base Station SoC and New 2nd Generation Xeon Scalable Platforms

Intel launched new microprocessors, including a second-generation Xeon processor for data centres and a 10nm chip for wireless 5G base stations-P5900. As a highly integrated 10nm SoC, the Intel Atom P5900 is designed to meet critical 5G network needs, including high bandwidth and low latency to deliver what's required for 5G base stations today and in the future. The new 2nd Gen Intel Xeon Scalable processors deliver an average of 36% more performance and an average of 42% more performance per dollar² than the prior generation Intel Xeon Gold.(Source: [Intel](#))

24 Feb 2020

Smartphone

Huawei

Huawei announced new hardware and technology updates

Huawei delivered a virtual press conference on 24 Feb. Yu Chengdong (Richard Yu) said the company's sales revenue reached RMB850 bn (\$121 bn) in 2019, with 18% YoY. Its smartphone shipments exceeded 240 million (+16.8%YoY), ranking the second in the global market. Personal computer, wearable devices and wireless audio businesses also saw robust growth of 200% YoY, 170% YoY and 200% YoY, respectively. By January this year, Huawei's 5G smartphone shipments had exceeded 10 million. In the meanwhile, Huawei announced new hardware and technology updates.

- **2nd Mate Xs foldable phone:** Adopting the unique Falcon Wing with an innovative hinge, Huawei Mate Xs is a 5G phone with 8-inch foldable screen and FullView Display, powered by the Kirin 990 5G chipset. This chipset uses 7nm+EUUV process, and has the most transistors and features. Mate Xs folding smartphone is priced at € 2,499 (RMB 19,000).
- **New MatePad Pro 5G:** Equipped with 10.8-inch FullView Display, Kirin 990 5G SoC and 7250mAh battery, the MatePad Pro 5G is the first full-screen tablet. It is available in WiFi, LTE and 5G version. WiFi and LTE versions of the MatePad Pro start at € 549 and € 599 and will be available in April, while the 5G variant starts at € 799 with availability depending on markets.
- **MateBook X Pro:** it is an ultra-slim laptop with FullView display of 91% screen-to-body ratio. The new notebook equipped with 3K LTPS touchscreen, Intel i7-8550U (quad-core, 8MB cache, up to 4.0 GHz). The new MateBook X Pro will be available in April 2020, starting at €1,499 (RMB 11,400).
- **WiFi 6+ routers:** While Huawei's new routers are Wi-Fi AX3 and 5G CPE Pro 2, Wi-Fi AX3 is the world's first Wi-Fi 6+ router. Huawei also launched Gigahome 650 and Kirin W650, the latest Wi-Fi 6+ chipsets designed for routers and smartphones respectively. The new Huawei Wi-Fi AX3 Series is equipped with the Gigahome 650 chipset.
- **Huawei MH5000 5G module:** Huawei released the first commercial 5G industrial module – MH5000 for the industrial field with a single-piece price of RMB999. The Huawei 5G Module is powered by 7nm processed Balong 5000 chip and supports NSA/SA dual-mode network architecture.
- **HMS Core 4.0 and Apps Gallery:** Huawei opened more development kits and released HUAWEI QuickApp to build its global ecology. Besides, Huawei also rolled out "Shining-Star" program and \$1 billion incentive fund to support developers and provide them a vigorous ecosystem for innovation. (Source: [Huawei](#))

20 Feb 2020

Semiconductor

Samsung

Samsung starts mass production of 6nm and 7nm EUV chips

Samsung has announced that its foundry business has started mass producing 6nm and 7nm chips using the EUV (Extreme Ultraviolet) lithography process. By the end of this year, Samsung's cumulative investment on the production line will reach \$6 billion, and the production capacity will triple when compared to last year. The South Korean chipset giant has mentioned that its 6nm and 7nm products will be delivered to customers in the first quarter of 2020. The company's new V1 facility, which is also its first dedicated production line for manufacturing chips using the EUV process, broke ground in February of 2018 and started testing wafers production in the second half of 2019. (Source: [SAMmobile](#))

20 Feb 2020

Semiconductor

AMD

AMD announces design of Zen2 which can cut costs by more than half

Since the launch of the Ryzen 3000 processor last year, AMD has a 7nm Zen2 architecture that has a lot to do in the desktop, server and notebook markets. Other than that, on the core number alone, AMD can do 64 core 128 threads, double than the opponent side, but with less than half price. In AMD's Zen2 architecture, AMD in the original MCM multi-chip design further, to use the chiplets small chip design, simply put, the CPU core and IO core separation, respectively, using different processes, the former is TSMC 7nm process, the latter is the GF 14/12nm process. (Source: [NotebookCheck](#))

19 Feb 2020

Cloud

Google

Google acquires Cornerstone Technology for mainframe migration

Google Cloud announced it has acquired Cornerstone Technology to help customers migrate their mainframe workloads. The terms of the deal were not disclosed. The Dutch Company, founded in 1989, helps companies migrate mainframe data through a highly automated process, and it helps them convert languages and databases to prepare applications for modern environments. (Source: [GoogleCloud](#))

18 Feb 2020

Semiconductor

Qualcomm

Qualcomm launches 3rd generation Snapdragon X60 5G modem, built on 5nm

Qualcomm has unveiled its third generation 5G modem, that is, the Qualcomm Snapdragon X60 5G. The Snapdragon X60 is the world's first 5G modem that has been built using the 5nm process node. The Qualcomm Snapdragon X60 modem comes loaded with features such as mmWave-sub6 aggregation, sub-6 FDD-TDD aggregation and Voice-over-NR (VoNR), which give operators the flexibility to deploy unprecedented peak speeds with available spectrum resources. (Source: [AnandTech](#))

17 Feb 2020

Smartphone

Apple

Apple will use Qualcomm's 5G chips on iPhones till 2023

Apple will reportedly use Qualcomm's 5G chips on iPhones for the next four years, according to a document published by the United States International Trade Commission. It confirms that the Qualcomm Snapdragon X55, X60, X65, and X70 chipsets will be supplied to Apple over a period of roughly 4 years. It also states that Apple is slated to release a 5G-ready iPhone in 2020, which will be powered by a Snapdragon X55 5G modem. (Source: [NotebookCheck](#))

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We, Brian Li, Halsey Wu and Yanyan Feng, hereby certify that (i) all of the views expressed in this research report reflect accurately our personal views about the subject companies and their securities; and (ii) no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed by us in this research report, nor is it tied to any specific investment banking transactions performed by AMTD Global Markets Limited.

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