

Emerging technology divide in areas like 5G infrastructure and processors

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5G technology

- 5G is expected to become the most important digital infrastructure of the years ahead, spanning all parts of society
 - Technology race
 - Digital backbone
 - Strategic importance
 - Enabler of new services
- Currently only 3 global vendors are able to deliver complete 5G infrastructure
 - Huawei (complete vendor)
 - Ericsson (with partners)
 - Nokia (with partners)
- Contenders:
 - Samsung, Fujitsu, NEC, partly enabled by Huawei blockade
 - ZTE (hard hit by US sanctions)
 - Software defined vendors (Mavenir, Altiostar and many others)
 - Where is the US? Apple and Qualcomm have 5G modems, but no basestations
- *Next: A key to 5G technology is the building block of all ICT systems – the processor, including CPUs, GPUs, FPGAs and DSPs – where is China?*

As a direct effect of the ongoing trade war, Chinese domestic CPU development is gaining pace, examples:

- Huawei (HiSilicon) Kirin (mobile) and Taishan (server) **ARM-based CPUs**
 - Sugon (domestic HPC vendor) licensed **AMD EPYC** CPU (US) and use **AMD Radeon** GPU accelerators
 - Hygon Dhyana provides x86 processors (**AMD** license)
 - Zhaoxin (supported by VIA technology): Kaixin CPU family, KX-U6780A, performance similar to Intel i5 processor (US) and Zhaoxin Hygin, a licensed version of the **AMD's EPYC x86** processor (US).
 - Longsoon **MIPS64** CPUs developed at the Institute of Computing Technology (ICT), Chinese Academy of Sciences (CAS)
 - Phytium provides (FT-2000+/64 core) a **Chinese CPU architecture**, 16nm, moving to 7 and 5nm server CPUs (Manufactured by TSMC, Taiwan) and 14 nm processors for desktop and embedded markets (Chinese fabs)
 - **Sunway** SW26010 CPU (used in the WUXI HPC supercomputer)
 - Tianhe, Intel Xenon plus **Matrix-2000** DSP developed by China's National University of Defense Technology (NUDT)
 - Galaxy FT-1500 CPUs, a **SPARC** derivative designed and built by NUDT
 - In addition, several other commercial initiatives are known
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- Conclusion: From a CPU architecture point of view, China will most likely become independent of USA in a few years as an effect of the trade war. This is not good news for American silicon companies. Development regarding AMD and ARM licensing is critical.
 - Example of global CPU policy challenges: US interests have pushed ARM to decline further licensing to Huawei, a recent development is that nVidia (US) purchased ARM (JP), AMD has been under fire for licensing x86 to Chinese manufacturers.
 - *Next: A key to all processor development is semiconductor fabrication, where is China?*

Semiconductor manufacturing so far dominated by US, Taiwan and South Korea

- US: **Intel** (7nm), TI, Micron (25nm), Global Foundries (owned by Emirate of Abu Dhabi)
- Taiwan: **TSMC** (5, 7, 16nm), UMC United Semiconductor (14nm), Nanya (20nm), Micron (20nm)
- South Korea: **Samsung** (7, 10, 14nm)
- Japan: Rohm, UMC - USJC / Fujitsu
- Europe: Global Foundries (12, 22nm)
- China (some examples):
 - Fabs established by TSMC
 - Fabs established by UMC
 - Tsinghua Unigroup (20nm)
 - Semiconductor Manufacturing International Corporation (8, 14nm)
 - Advanced Semiconductor Manufacturing Corporation
- Conclusion: China is so far dependent on TSMC for high performance processors. TSMC has been under strong pressure to decline manufacturing for Chinese customers like Huawei due to TSMC dependency on American semiconductor manufacturing technology. China is very actively building own capabilities.