Technology Flash...

December 1, 2016

Chip Vendors racing to make IoT "Smart"

A PUBLICATION OF J.GOLD ASSOCIATES

There are an increasing number of companies competing to become the internal "brains" driving the Internet of Things (IoT). With so many chip vendors vying for share, is there likely to be a dominant player(s)? Which will lead versus follow?

There is not a single IoT market. Rather there are many and varying needs necessary to make devices appropriate for different markets like sensor networks, smart cities, health care, automotive/drones, manufacturing production systems, wearables, AR/VR, etc. From very low end sensors-based "throw-aways" to Enterprise of Things (EoT) intelligent high-end devices, the contest is on as to which suppliers will dominate this high growth market over the next 2-3 years.

Let's evaluate some key players (listed below in alphabetical order) supplying the "brains" of IoT, with some pros and cons for each:

•**ARM** – while not a supplier of chips itself, ARM's IP is the primary CPU architecture powering the mobile marketplace, and is attempting to move into servers and cloud as well. It offers a range of design components that its large number of licensees can use to create custom System on Chips (SoCs). While I expect the ARM ecosystem to be a primary player in IoT, the varying capabilities of the licensed ARM players will mean not all the suppliers will be equally successful, or will be players in all aspects of the market. Below we'll discuss some specific suppliers.

•**Intel** – over the past 2 years Intel has placed increased emphasis on building chips using its x86 architecture targeted at specific IoT markets. Its work in 3D imaging, wireless radios, drone/autonomous vehicles, AR/VR initiatives and backend analytics makes it attractive to those wanting to leverage the x86 ecosystem and existing software assets. I expect Intel to be more successful at the higher end of the market, and particularly in EoT, but overall it will have its hands full trying to compete with the ARM-based players. It will primarily supply "off-the-shelf" products rather than a variety of customized SoCs, and supply processors to higher end but relatively lower volume products by carving a niche in high value devices and services. However, I expect lots of competition for Intel, and in particular from its most capable competitor, Qualcomm.
Pros: Leverage its substantial existing embedded market, particularly for those with major software assets and legacy designs.
Cons: Much of IoT market will go with the ARM ecosystem putting x86 at a disadvantage.

•**Mediatek** – I expect Mediatek (an ARM licensee) to leverage its strength in its Far East partnerships to become a key component supplier to IoT producers particularly for high volume products. But I don't expect it to play a major role in innovating for leading edge products that require more technology capabilities or specialized functionality that's not off-the-shelf. MediaTek is a volume provider and generally

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not a leading edge market innovator.
Pros: high volume producer of standardized components at competitive prices.
Cons: little innovation or differentiation and generally lacking leading edge capabilities.

•**Nvidia** – Nvidia will do well in providing large numbers of parallel processing element SoCs built on its industry leading graphics engines for specific functions, like high end vision processing for automotive, or in portable AI/machine learning systems. Nvidia is a license of ARM, but I don't expect it to be a major general purpose SoC vendor outside of its key technology strengths. It will mostly supply peripheral processors coupled to other devices.
Pros: leader in massively parallel processing for specialized requirements like AI
Cons: not a general purpose processor, but rather a peripheral component supplier.

•**Qualcomm** – Qualcomm has a deep understanding of requirements based on its dominant position in the mobile chip market. It's a licensee of ARM, but has done a significant amount of innovative design to the core ARM architecture and key areas of an SoC, putting it ahead of most competitors. It also has the widest range of technology available to design into SoCs powering a variety of devices from low to high end, including custom DSPs, security, graphics and wireless subsystems. It has the largest partner program through relationships with virtually every mobile player and is extending this to others, and has developed many reference platforms to accelerate time to market. I expect Qualcomm to be the largest supplier of SoCs powering the mid to high end of the IoT/EoT market, and particularly in leading edge innovations. And while it may not be able to dominate to the same extend it did in mobile due to the vast variety/needs of the market and the multiple vendors, it nevertheless will likely have the largest share of chips powering IoT, and produce the widest range of tailored solutions for multiple markets.
Pros: widest range of functional components and ability to offer customized SoCs fostering innovation
Cons: Geared towards mid to high end products.

•**Samsung** – Samsung is placing a good deal of emphasis on its chip design and production capability that is mostly centered on its own internal needs. Its ARM based chips are capable and power a number of Samsung mobile devices. I expect Samsung to be a major player going forward, but mostly targeting its own end product needs, although it will also be a major chip production facility for other companies (e.g., Apple). I further expect that Samsung consumer IoT products will also continue to use other vendor's processors, much as is done in its smartphone business currently with chips from Qualcomm, etc.
Pros: Vertically integrated to supply its internal product needs and act as a high capacity fab as required.
Cons: not a supplier of specialty SoCs with a variety of leading edge functionality.

Conclusion: The next 3-4 years will see an explosion of IoT devices which will dramatically change our lives and the way companies operate. And while there won't be a single dominant player powering all "things", it's clear that some will stand out in fostering early adopter innovation and some will be more associated with high volume steady state devices. I expect the above vendors to be major players within the bounds that I specified although entry of newer players and jockeying for position will go on for some time.

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This article also appeared in Computerworld

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