Technology Insights...

January 4, 2017

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Research, Analysis, Strategy, Insight

Microsoft extends Windows 10 support to Snapdragon (ARM): Will it work?

A PUBLICATION FOR CLIENTS OF J.GOLD ASSOCIATES

Microsoft and Qualcomm recently announced that they are working to create Windows 10 devices running on Snapdragon processors, and that such devices will be available in the second half of 2017. Both Microsoft and Qualcomm (and by extension, the greater ARM based ecosystem) have significant incentives to do this. But there are numerous questions yet to be answered. Below is our analysis of the strategy, potential challenges, and whether this will be successful overall.

Motivation

Microsoft made a point of stressing that a key ingredient of this strategy was to enhance the power efficiency (e.g., battery life) and connectivity options of new devices, and that Snapdragon has advantages in those areas. And it made a point of specifying notebook form factors as a key driver, at least for now. But is this effort really about low idle power and more connectivity options that expand form factors as Microsoft claims or something else?

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We believe Microsoft is doing this for several reasons. First, Microsoft wants to pressure Intel to reduce prices and/or be more innovative in chips offered. They believe this could stimulate the market, especially in lower price points and innovative designs. This is a laudable goal.

Next, Microsoft would like Windows to not be sole sourced on x86. Microsoft is under pressure from emerging markets where low cost ARM processors are abundant. Indeed, emerging markets may be the primary driver behind this effort, particularly in China and India. Qualcomm is also part of this announcement and although they have a large mobile market share, they are seeing significant competition in these emerging markets. Ultimately Microsoft would like to maximize market control (and margins). Working with Qualcomm provides them the ability to be on ARM while maintaining minimum device standards as well as manage margins in the relatively higher end of the product space. It's unlikely Microsoft would go around Qualcomm and work directly with extremely low cost producers, some of dubious quality/performance despite being on ARM architecture, so Qualcomm is critical to Microsoft's success.

Ultimately, Microsoft desires to compete more fully in an ARM dominated mobile world in phones and tablets, where x86 has negligible market share, and where price/performance are key buying criteria in a consumer-driven marketplace. But can Microsoft and Qualcomm prove a price/performance advantage for Windows powered devices? Will consumers buy into this model? Microsoft wants to compete more equally with Chrome and Android based devices in both mobile and Chromebooks, and this is one way to do so. But competing also means keeping users happy and achieving the level of performance users have grown accustomed to.

Is this strategy new?

Taking an existing ecosystem (Wintel) and porting to another environment is not new. This has been tried before with little success. Microsoft tried it with Windows RT and it failed, primarily due to a lack of support for existing Windows apps, and poor performing hardware. Microsoft is being smarter this time by offering emulation of Windows 32 (but not 64bit) apps and potentially better performing hardware.

Back in 2000, Transmeta tried transcoding Windows on a RISC-based architecture and failed despite claiming RISC was fast enough to make it work. Current chips have greatly advanced over Transmeta hardware, making transcoding faster. But the OS has become much more complex and needs many more compute cycles to operate.

There have also been many attempts to make Windows run in an emulator on MacOS and Linux, with some success, although not always with full compatibility or acceptable performance. Clearly Microsoft has learned much from Windows RT (and even from Transmeta's failure), but it's still difficult to do a proper emulation for all situations and have the performance that users will accept.

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Bill of Materials (BOM) impact

The primary way to reduce device cost is through lower BOM. Microsoft hasn't been clear on which devices it wishes to enable, but our speculation is that it is squarely targeting the emerging crop of Chromebook-like devices that are penetrating markets like education and some consumer areas. They are having success based on their relatively lower price and complexity compared to full notebooks.

If Microsoft and Qualcomm are primarily targeting cheaper Chromebooks, then the price of the CPU is a major cost contributor. But the cost of a CPU is approximately 15%-25% of notebook BOM cost and may be closer to 10% on lower end systems like a Chromebook. What does this mean to device cost?

The cost of a notebook CPU ranges from $50 or less at low end to $200+ at high end. In lower end Chromebooks, the CPU cost may be as little as $20-$25. But by primarily targeting the low end notebook marketplace, as Microsoft has indicated it is, the numbers may not be that advantageous. Even if an ARM chip is half the price of x86 (and that's not the case if you use an aggressively priced AMD x86 chip or a very competitively priced Intel Celeron or Pentium targeted at lower end systems), then the BOM saving .5 x 15%, or approximately 7.5%. The vendor still needs equivalent memory, storage and peripherals, so those costs balance out and the total retail device cost savings is only $15 - $20 at best on a $200-$300 machine.

From a pure BOM perspective there may ultimately be an ecosystem for ARM-powered devices, particularly if powered with low priced chips. But Qualcomm announced its top tier Snapdragon 835 for its first efforts, which is not a $15-$25 part. Indeed, smartphones currently on the market that use these high end chips are in the $500-$700 range. We believe that Qualcomm and Microsoft have to go high end in order to get the performance equivalence necessary to be acceptable. That means the real BOM cost advantage over an x86 chip, and particularly a lower price Intel Celeron or Pentium is doubtful. With no significant cost advantage, can Windows 10 on Snapdragon meet the equivalent performance users expect of Wintel?

Major challenges

We believe that there are a number of challenges that Microsoft will face that will impact acceptability of any devices targeting the notebook market. First Microsoft is concentrating on running Universal Apps, of which there are still relatively few (although increasing). This is of particular concern in business environments.

Next, there will be a number of "Apps Left Behind". There is currently no Win64 support (and unlikely to be any time soon), which is critical for many newer generation apps with specific calls to x86 instructions. Many performance-oriented graphics-centric apps require this capability.

Further, while the core OS may run on the ARM instruction set, the Windows apps will run in emulation mode. That means that there will likely be some "glitches" in making the proper emulation compatible with all existing apps. This is particularly a problem in business where the scope of apps is much greater than in the consumer space.

Heavy graphics apps won't run in emulation very well if at all. Indeed, most graphics-centric apps use direct calls to the CPU to enhance performance. How well emulation will work in these cases is not clear, although we speculate that performance in many cases will be unacceptable.

Microsoft has been doing a good deal of work in making Windows10 more modular, and in this case is building core OS code to run on ARM instructions. But Windows code has been highly optimized over the years to take advantage of Intel's x86 instructions. It's unclear how well this will work.

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Microsoft and Qualcomm claim a key component of this strategy is about much lower idle power and increasing connectivity options (indeed, Qualcomm has many cellular modem enabled chips although Intel is also a major supplier of modems). But if vendors add a modem and it's used a lot, the battery life will go down and negate the lower idle power. And if users have to burn more cycles in an emulator than a native instruction, that uses more power as well. So the claim of longer battery life may be hard to achieve based on usage model and the amount of wireless connectivity, particularly 4G LTE cellular data.

Many users indicate 4G device connectivity as a preference, but notebook users have been very reluctant to sign up for cellular connections. Only 5%-15% of notebooks are currently connected through a wireless carrier. It's doubtful that having a potentially lower cost notebook with 4G inside will make uptake any better, given that most current notebooks are capable of adding a broadband modem (although at a high cost). We expect that this trend will continue, particularly with consumers who are reluctant to add high cost connectivity when they have free WiFi availability in most places.

We expect the majority of 4G connected notebook-like devices (and soon 5G as Intel and Qualcomm rush to release next generation modems) to be deployed by business users. Indeed our research indicates that user productivity lost opportunity cost without the broadband connection is as much as $8400 per year. But we believe it will still be hard to get people to sign up given current carrier pricing. It is unlikely that Microsoft will offer subsidies to stimulate demand. LTE has been available for years and not taken off due to the perceived high cost, and we don't think this initiative will improve uptake until carrier prices are significantly reduced.

Questions remain as to Microsoft's sighted idle power improvement. For highly optimized systems, the CPU power is a minor portion of overall requirements (typically 15%-25%), so x86 vs. ARM overall system power are much closer. Further, power requirements are highly dependent on the app. Streaming video is heavy CPU use, while reading a pdf is not.

There is also a question about boot times. Previous efforts around transcoding and/or emulation have shown they may significantly increase boot time. The effect at this point is unknown, but past experience says it's a challenge and something that Microsoft will need to address.

There are also some very specific challenges for enterprise users. Device management is critical, but what does it mean to do enterprise management in an emulated environment? How do you do updates? Will existing device management suites be able to address these new devices? All are critical requirements for a device deployed in an enterprise setting.

Peripherals like external drives, scanners, etc., are also a challenge. Older devices may or may not work and will need to be fully tested. And more generally while MSFT claims all current Windows 10 peripherals will run on the ARM version, it's still unclear that all drivers will be able to run compatibly, and key peripherals that load their own drivers for unique functions may not operate correctly.

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Additional issues – Apps and the user experience

The main success factor for any device is what users ultimately think of it. There are a number of issues that need to be fully addressed before usability will be satisfactory. First, because of the need to do emulation, it's likely there will be some significant differences in usability/performance from app to app. Those that are lower level using only basic operations should work fine. But highly optimized apps that require specific hardware processes/acceleration may not perform to user expectations. As an example, a Microsoft demo at WinHEC used an older and not widely used version of Photoshop, as well as an older 32 bit version for Adobe, likely chosen as best for the emulation process. If past history is any judge, users will try to do things that these devices weren't targeted at and be disappointed. This variability may prove frustrating to users. What are the long term ramifications if these systems make users unhappy?

A further challenge will be in security. Indeed, will security be left behind? Leading anti-virus and antispyware apps have deep roots into the OS/chip interface and those will go away with emulation. Although attack vectors will be different, so ARM based systems may not be (fully) susceptible to the same malware generally targeting x86 Windows 10 systems, "security by obscurity" is a dubious strategy, and it's unlikely many of the AV companies will offer products until the volumes (and potential revenues) merit it. And if such devices become popular, it's extremely likely malware will be produced that targets them.

Finally, a major component of this strategy is to produce more cost conscious systems. But as we have shown, the actual cost difference between a similarly performing system on ARM vs. x86 is not that great. If users can purchase an x86 notebook for $300, will they be willing to buy an ARM based system for $280? That was the basic argument for Netbooks several years ago and it didn't work.

Bottom Line

There are several key take-aways to our assessment of this strategy. While this "Windows 10 on Snapdragon" strategy might work, there are many variables which require more information that Microsoft has not yet disclosed (and may not yet fully appreciate). We applaud Microsoft for trying to expand its ecosystem and for Qualcomm trying to leverage its broad base of available chips, and for extending the Windows franchise to a larger user base at more price points and with potentially new innovative products, as well as attempting to capture a nascent emerging market. This is critical to both Microsoft's and Qualcomm's future growth.

But there is a long established relationship between Microsoft and Intel processors that has set a high level of reliable performance expectation for Windows users, even in lower end devices. At this point, the Windows on Snapdragon strategy is unproven compared to traditional Windows on Intel based systems and it's still unclear whether Windows on Snapdragon will perform to expectations. With so many questions and given past experience, we recommend waiting until it has been fully tested and proven before choosing devices powered by this new environment. For enterprise customers, given the wide variety of apps and other components in use, it's very likely that these devices won't meet corporate requirements. Business users should be highly cautious before deploying these new products as Windows 10 PC or tablet replacements.

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