Technology Brief...

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Research, Analysis, Strategy, Insight

Inside This Issue

Can you hear me better now?

Earbuds have become the defacto way many people interact with their smartphones, and many times other devices as well. The convenience of no wires connection over Bluetooth with good sound quality and long battery life has made earbuds essential. Indeed, while there are still many low cost earbuds to be had, the high end ($150-$200+) has had incredible growth. But for many users, the audio quality has not been stellar due to deficits in their hearing functions. This is especially true for an aging population that acquires some hearing deficits over time, but is also true with many younger people who also may have something other than the assumed linear frequency hearing capability. For those users that receive less than optimum audio, Qualcomm wants to do something about this.

Qualcomm already powers many manufacturers' high end earbuds with its QCC5100 processor. What it plans to do is make those devices more receptive to the hearing anomalies of its users, thus improving overall sound quality that's customized to each individual user. It is partnering with Jacoti, a company from Belgium that created a set of European and USA regulatory agency approved algorithms for customizing audio playback based on a user's unique frequency response curve. Through a convenient smartphone app for iOS or Android, individual users can run a test that maps their frequency and volume response curve for each ear. The customized response curve can then be loaded into the DSP of the processor in the earbuds so that the specially equalized audio is completely adapted for the user's ears.

"….With its capability to significantly enhance user understanding of voice conversations, as well as provide a more flattened audio curve so it's not necessary to crank the volume up to hear, this Qualcomm technology will go a long way to improving the quality and versatility of things we put in our ears…. over the next 1-2 years nearly all mid to high end earbuds will include this functionality....."

This has major implications for the hard of hearing, obviously, with parallel functionality to hearing aids, but hearing aids don't work very well with smartphones and similar devices. This adaptation is attractive as a substitute for some functions for hearing aid users, but also attractive for many other users wanting to optimize their listening experience. And the customized frequency performance is not only valuable for music listening, to "flatten the curve" for better quality for which many earbuds are designed. It is also beneficial to those who simply need to have better audio experiences in noisy environments, especially on voice calls where it may be difficult to understand the speaker without such enhancement. It could even be helpful in live conversations to hear through background noise that impacts comprehension of a conversation.

The audio mapping capability is necessary for customizing the equalization, but it can potentially be useful as a diagnostic tool over time as well, making the earbuds part of an overall wellness application. Keeping a record of the audio tests can show hearing degradation or problems as an analytical representation. It can also

provide some incentives for those users who keep their audio levels at top volume to turn it down, by seeing the damage they may be doing to their hearing over time.

Coupled with other DSP and processing enhancements available like ANC, this enhancement to the processor can significantly increase usability and overall end user satisfaction with devices, making them much more attractive for consumers. This could stimulate upgrade sales for those users who desire enhanced clarity and improved sound quality.

While it's theoretically possible that this capability could be used to update existing earbuds built using the Qualcomm processor, in all likelihood earbud manufacturers will require you to buy a new device to take advantage of this functionality. I expect to see new devices in the market with this combined Qualcomm/Jocati functionality in the first half of 2021. It's likely they will be available at a premium price, at least to start, even though the additional parts cost required to implement this function are minimal. But ultimately I expect this technology to make its way down into the midrange products, and to also be extended beyond just consumer earbuds, and into professional earphones for specialty users.

Bottom Line: With its capability to significantly enhance user understanding of voice conversations, as well as provide a more flattened audio curve so it's not necessary to crank the volume up to hear, this Qualcomm technology will go a long way to improving the quality and versatility of things we put in our ears. I expect over the next 1-2 years to see nearly all mid to high end earbuds include this functionality. We're now reaching a point where dynamic programmability of earbuds will be a requirement going forward.

Intel Vulnerability called Thunderspy – Much ado about nothing?

"…There are indeed vulnerabilities in all complex systems, and many do require concern for the security and privacy of personal and corporate systems and data. But we need to discriminate the "theoretical" vulnerability from the practical, and not overreact. While its necessary to take any and all vulnerabilities seriously, these types of vulnerabilities, often generate headlines that take the focus away from real and practical threats……"

Recently, we've heard about a vulnerability in the Thunderbolt interface that Intel has been building into its chip sets for Windows PCs and Macs for the past several years. While it's never good to have a vulnerability, it's also true that every complex system ever built has some flaw that can be found and potentially exploited with enough effort. The question is, what's the risk from these potential exploits in the real, and not just theoretical, world, and should we be worried about them? Let's look at this one in particular as what I believe is a case study on the "exploitation of an exploit".

First, this potential exploit is only on Thunderbolt enabled systems. For Windows PCs, that's a fairly small installed base of mostly high end systems, and an even smaller number for ones that are more than a year or two old. In the Mac world, the installed base is higher as Apple was much more aggressive at installing Thunderbolt on its systems, especially in their relatively higher end Macs. So the majority of systems installed in both business and consumer environments are fairly small.

Second, the only way to exploit this vulnerability is to have physical access to the computer. Any attack would have to utilize a purpose-built piece of hardware that attaches to the Thunderbolt port on the system. This is not something an average hacker could do, given the nature of the attack vector. And it requires that the physical location of the system would have to be accessible to the hacker for some period of time to deploy the exploit. This might be possible for some spy agency that attacks your machine in your hotel room while you are out to dinner, but it's

unlikely to occur in very many situations.

Third, Intel stated that it has been aware of this vulnerability for some time and has already patched it in most systems. Indeed, in 2019, all the major operating systems (Windows, Mac and Linux) implemented Kernel Direct Memory Access (DMA) that essentially isolated the individual Thunderbolt connection from having access to main memory, thus essentially limiting any exploit to only obtaining the contents of that Thunderbolt interface memory location. This is not exactly a highway to the contents of the computer that people would be concerned about. Of course, this means that only updated systems are immune, but its likely the majority of installed systems have been updated.

And finally, this type of exploit is not what a typical bad actor would want to deploy. Hackers generally are motivated by the desire to destroy machines, capture sensitive personal or corporate data, or hold devices for ransom. To do this, they need to deliver their malware via an electronic means that can target large numbers of machines, and then have those machines spread that malware to other machines thus greatly increasing the possibility of success. Having to physically be at each machine attacked would mean that the hackers would have to do a lot of moving around. While this might be OK for an individual who is trying to do damage to a single or small group of machines to perhaps get back at someone or some company, it certainly would not be in the playbook of the average bad actors. And if someone had physical access to a machine and wanted to do damage, they could do much more damage without the need for this exploit (as an example, they could easily remove and/or copy the hard drive for data extraction at their leisure).

Bottom Line: There are indeed vulnerabilities in all complex systems, and many do require concern for the security and privacy of personal and corporate systems and data. But we need to discriminate the "theoretical" vulnerability from the practical, and not overreact. While its necessary to take any and all vulnerabilities seriously and do our best to mitigate them, these types of vulnerabilities, often generate headlines that take the focus away from real and practical threats that all of us must be reacting to. This makes for good headlines, but bad policy if companies have to utilize scarce resources in response.

The Battle for the 5G Cloud Enablement

"…All cloud and virtualized software companies see 5G as a major opportunity to both increase market share for their respective offerings, and to generate potentially massive revenues from the huge numbers of 5G user transactions which may be billed "as a service". There will likely be enough market for all players, but we expect that within the next 3-5 years, the market will coalesce around 3-4 main players with others relegated to niche positions…."

The build out of 5G is gaining momentum worldwide. Indeed, Ericsson estimates that 3.5B people will have 5G access by 2026, an increase from the 220M 5G subscribers by the end of 2020. Further, by 2026, 54% of all worldwide mobile network data traffic and 80% of US subscribers will be on 5G. And 5G is not just about enabling mobile users. Ericsson estimates that Fixed Wireless Access (FWA) will have 180M connections by 2026, accounting for about 25% of network traffic. This is an unprecedented expansion of mobile networks eclipsing all previous "G" versions.

But to make 5G a reality, network operators must update their core network functions, both for capacity and functionality. Today's networks are primarily built with purpose-built hardware; dedicated and often single purpose switches and routers that do one or a small number of fixed functions and that are not easily upgraded. While this has worked well in previous versions of cellular networks with their fairly limited feature set, it won't work with the complexity of 5G services. Many of those functions require a virtualized network built on standard off the shelf hardware and cloud-native systems to enable them. As a result, there is a race underway to achieve virtualized functions across the core of the networks. Nowhere is that more apparent in the move towards a virtualized Radio Access Network (vRAN), and in particular with work towards a non-proprietary version called Open RAN (ORAN).

The new network operations that underlie 5G must run in distributed and cloud native format if they are going to meet the full potential of the technology, using off the shelf general purpose programmable computing products rather than the old style dedicated hardware of networks past. In fact, operators have been shifting towards a virtualized network environment for several years, with some achieving nearly full conversion to virtualization but with many still having significant work to do. However, the need to enable 5G expanded functionality and in particular on the newer stand alone (5G-SA) networks, has accelerated

the need dramatically. As a result, all the major cloud and virtualization vendors are seeking a big piece of this expanding pie, and are lining up partnerships and cooperative agreements to make it happen. Some are even acquiring the needed technology (e.g., Microsoft/Affirmed Networks, also see our April 17, 2020 report, "Can Microsoft be the Operating System Enabling 5G?").

Highlighted below are several such initiatives and what they mean to the overall market.

- Microsoft and AT&T are working to enable AT&T network services for its subscribers on top of Azure cloud powered infrastructure, including Affinity Networks products
- AWS and Verizon are collaborating on upgrading the Verizon network to a virtual environment using cloud native AWS, as well as working on Edge computing system with AWS Telegraph
- Intel is collaborating on a cloud based version of ORAN running on cloud platforms on Intel hardware based Xeon XScale processors, FlexRAN software reference architecture, FPGA accelerators and OpenNESS software. This also includes work with VMware platform running on top of AWS cloud.
- Google offers a Mobile Edge Cloud (MEC) platform to power many of the future MEC functions needed to increase network operator revenues and bring apps closer to the user location, and is working with AT&T and others to accomplish this
- Rakuten worked with Intel hardware and software and Mavenir services to create its new Japanese ORAN based 5G network, but is also developing its own product set it intends to market as a service
- Samsung is working with Intel and WindRiver to power a Verizon virtualized 5G core as well as an SK Telecom network in South Korea
- Mavenir is working with several network partners on providing their services to establish both VRAN and ORAN powered networks
- Cisco, a major provider of dedicated routers and switches to previous network generations, is partnering with Verizon and others to update to an ORAN strategy essential for its future in 5G

This is by no means an inclusive list of vendors and/or partnerships, and each of the named companies will likely have multiple partnerships going forward. There is no single dominant player in this space, nor is there likely to be anytime soon.

Bottom Line: All cloud and virtualized software companies see 5G as a major opportunity to both increase market share for their respective offerings, and to generate potentially massive revenues from the huge numbers of 5G user transactions which may be billed "as a service". There will likely be enough market for all players, but we expect that within the next 3-5 years, the market will coalesce around 3-4 main players with others relegated to niche positions. It's not yet clear who the primary cloud providers will be, but most likely they will be the same as the primary players in the general cloud marketplace.

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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.

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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.