JAMES BREHM & ASSOCIATES

The Connected Conversation

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IoT Summer Recap

News Flash:
Summer of Acquisitions & What's Next for Ericsson

ARM Acquires Apical

In May, ARM, a leading supplier of microprocessor technology, acquired the entire share capital of Apical Limited, an imaging and embedded computer vision intellectual property (IP) products company, for a "cash consideration for $350 million." This accelerates ARM's growth into new markets, such as connected vehicles, robotics, smart cities, security systems, industrial/retail applications and IoT devices.

Source: *Apical*

Verizon Makes Another Play in Fleet with Fleetmatics

On the 1st of August, Verizon purchased Fleetmatics for a cool $2.4 billion in order to accelerate the company's position as a leading provider of fleet and mobile workforce management solutions. Within the last year or so, the carrier has made several plays within fleet telematics markets, including last month's acquistion of Telogis. We are keeping a close eye on Verizon to see just how it's going to leverage its greatly expanded position throughout the rest of the year.

Source: *Fortune; Verizon*

Walmart Makes Digital Marketplace Play, Acquires Jet.com

This week, Walmart purchased Jet.com, a fledgling online-only shopping site, for $3 billion cash, plus roughly $300 million in shares for for Jet.com founders and other employees. While Jet.com will retain its identity separate from the Walmart brand, Walmart plans to leverage the site's customer base to expand it's core market. Jet.com CEO, Marc Lore, will leverage that for the retail giant by continuing to lead his company, but will also be taking over Walmert's online market. This is an huge play in the digital marketplace for Walmart, and is even more interesting as several corporate employees were spotted at this year's IoT Evolution conference. Can't wait to see what Walmart will to do next.

Source: *TechCrunch*

"Moving the Needle" on Smart Cities

In June, I attended the Smart Cities Innovation Summit in Austin, and much like May's Big Communications Event (BCE) did for the telecom space, the Summit demonstrated the industry's shift beyond the hype cycle and onto the concrete realities of IoT.

By Joyce Deuley

The sessions at the *Innovation Summit* were informative and attempted to grapple with the nitty-gritty of how the Tech sector and the government will to work together to make smart cities happen. We have been stuck for so long on the potentials of IoT, it is good to see these kinds of discussions happen. Though, I'm afraid, we are going to be stuck on the "how" for quite some time. While the "how" discussions are in the relatively early stages, three constant themes at the Innovations Summit were sustainability, interoperability, and funding.

Sustainability

Owing to a recent *UN prediction* that more than 9.7 billion people are expected to be living in cities by 2050, urbanization has become one of the biggest concerns for municipalities. Because of this, cities are struggling to put systems in place that will be able to handle the influx of people. Improving urban mobility is at the top of the list, as are utility management and distribution, smart street lighting, and smart building solutions.

However, sustainability isn't just referring to mitigating stress on city systems due to population increases. From a technology standpoint, the public sector is struggling to determine what types of solutions they'd like to deploy that will last over the next decade or so. But, given that the transition from legacy infrastructure is, in itself, a big shift and that most departments in government are siloed, the IoT industry is still maturing. As we move towards consolidation and standardization, agencies will be able to better determine the technologies and solutions that will provide them with long-term sustainability and, ultimately, scalability as city populations increase.

Interoperability

Interoperability of various systems within a city is the golden key that will unlock the true potential of the Smart City. Having a bunch of connected systems isn't enough on its own. Instead, it's the sum of all parts that will transform our current municipalities into the efficiency-havens we are all dreaming of. The benefits of the Smart City will spill over into social aspects of a community as well, primarily in terms of improved access to education, healthcare, and jobs. The trick is figuring out not just how systems will be connected, but how we are going to manage the data that is collected, in addition to day-to-day operations.

While connecting disparate infrastructure systems is crucial to developing a successful smart city, connecting

disparate departments is also key. Unfortunately, this will require a massive culture shift within the private and public sectors. It requires embracing interdepartmental and community transparency in order to unify the municipality's smart city goals and then actually execute them.

In an example of how departments in the public sector are heavily siloed, one panelist stated that there were about 54 different departments in her city government, and it was nearly impossible to know which had already begun their own foray into IoT and which hadn't. Additionally, many departments can be territorial about their processes and data, making it even more difficult for city governments to work cohesively, overall. The public sector will have to start breaking down some walls in order to make it all happen.

Now for the question we've all been waiting for:

Who's Going to Pay for It?

I need to congratulate the City of Austin representatives who really took this question head on. Austin had recently applied for the *U.S. Department of Transportation's Smart City Grant* to improve urban mobility, particularly in the city's underserved areas. Austin had a one-in-six chance to win $50 million in funding to connect and transform its transformation system. However, the U.S. Department of Transportation announced that *Columbus, OH* took home the prize instead. In addition to the $50 million put up by the U.S. Department of Transportation and Vulcan, Inc., Columbus also walked away with an additional $90 million pledged by local businesses to aid in smart city efforts.

Besides discussing the grant, the Austin representatives mentioned several potential revenue streams for the city surrounding the collection of community data. It was repeatedly stressed that the citizens of Austin did not sign up to sell their data to businesses. Once that was said, however, the City of Austin did say it is trying to determine how best to get value from the data it would ultimately be collecting anyway. One way to do so would be to create some form of data exchange, much like what is occurring in *Copenhagen* as an innovative big data marketplace.

Other than government funding and creating new revenue streams, cities are struggling to determine who is going to cover the massive costs associated with retrofitting legacy infrastructure. One steady line of thought has been to treat these massive costs as a large,

but lucrative investment, which could be won back through future cost-savings. However, as one of the conference panelists pointed out, utilities and governments would be forced to find new sources of revenue once those cost-savings eventually and—inevitably—leveled off.

In the End

While we are still in the nascent stages of actually implementing and deploying smart city systems, there are definitely some wins for the IoT ecosystem. In particular, we have pulled the dusty, old "moving the needle on this" off of the shelf and are breathing new life into it. Though ultimately void of any real, contextual meaning, our new mantra implies that our transition from future benefits of IoT and smart city solutions has shifted onto the "how's-it-gonna-look" stage. The real kicker is that no one knows quite yet; like many things in life, we—and the needle—will just have to wait and see.

**Originally published on our Blog.*

Fun Facts: IoT Evolution

Last month, IoT Evolution closed out its 16th Conference and Expo, proving, once again, to be a hub for leading technology and trends within the IoT space. This Expo was exceptional with the quality (and quantity) of keynote presentations, panel sessions, and networking events. Here are some fun facts about the Las Vegas show:

Attendees

Over the years, IoT Evolution attendee numbers have continued to increase. This show totaled:

—2,600 Attendees

—40 Exhibitors

Conference Tracks & Sessions

There were more than 95 sessions held at IoT Evolution in Vegas, with over 150 knowledgeable speakers that particpated.

—Connected Home & Building Conference

—Connected Transportation Conference

—IoT Evolution Developers Conference

—Fog Computing, Data & Analytics Conference

—Enterprise IoT Track

—IoT Smart, Connected & Secure

Awards

While IoT Evolution has multiple competitions, inlcuding its Business Impact Aawards and its Best of Show Awards, the real action occurs the first night of the conference at the Battle of the Platforms. Six companies are selected to complete and demonstrate which has the best platform in IoT. This year's winners are:

—Best Platform Overall: Davra Networks

—Best Industrial Platform: Numerex

—Best Smart Cities Platform: Aeris Communications

—Best Connected Transportation Platform: WebNMS

5G Before 2020? The Future is Less than Clear

The race to 5G is on and many telecommunications carriers are vying for first place.

By Consuelo Azuaje

The one that can deploy the first 5G network, will gain a leading edge and be the leader in cutting edge connectivity.

Defining 5G

Defined by the International Telecommunications Union (ITU) in 2015, the *standards for a 5G network* require a 5G network to be capable of transmitting data at 20 gigabits/second (Gbps), and of providing more than 100 megabit/second (Mbps) average data transmission to over 1 million IoT devices in 1 square mile. To the everyday user it would mean the difference between having to wait 10 seconds versus 40 minutes (or more) to download an ultra high-def 2.7 Gb copy of Citizen Kane. Put even more plainly: it's going to easily outstrip previous networks, and that's very reassuring news. Considering how IoT has crept into nearly every industry with Usain Bolt-swiftness and cement-like finality, it's going to have to. Going forward, *it's been projected* that future mobile users are going to need 10 simultaneous mobile connections for everyday life. Also, future households will supposedly average over 100 connected devices.

We at James Brehm & Associates, in fact, projected the number of cellular devices would more than triple in the span of five years, climbing from 308 million in 2015 to 991 million in 2020. The total number of satellites, too, would grow from 3 million in 2015 to 7.5 million in 2020. GSMA estimated in a *2011 report* that the total revenue value of connected devices for mobile operators will grow to $1.2 trillion by 2020.

Used jointly with low power wide area networks and other connectivity options, 5G —called *"the nervous system of the digital society and digital economy"* by European Commission member, Gunther Oettinger— will be needed in the future to accommodate the coming IoT-flood. In light of current trends and industry predictions, many companies are eager to cash in and roll out their own 5G networks.

Competition, Cooperation, & Co-opetition Within the Mobile Industry

SK Telecom and Verizon have emerged as *frontrunners*, with SK Telecom projecting that its 5G network will be commercially available by 2018, just in time for the Pyeong Chang Winter Olympic Games. While Verizon, on the other hand, plans to begin field testing by 2017.

Not to be outdone, however, Ericsson and Nokia *showcased their 5G tech* at the 2015 Mobile World Congress, with Ericsson achieving 5.8 gigabytes per second via a 15 GHz super high frequency (SHF) radio frequency. Nokia demonstrated 2 Gbps data-transfer speeds, but the notable features of its demo were its capacity to maintain a network connection between

a stationary base and a moving device and its use of a 73.5 GhZ frequency which falls into the extremely high frequency (EHF) spectrum. Being that today's 4G-and-lesser phones use frequencies beneath the SHF 3 GhZ-threshold, Nokia users would have to trade up their phones to reap future, 5G-benefits. Additionally, major players Megafon and Huawei have promised a 5G trial launch by the *2018 World Cup*.

If you read enough reports by these 5G pioneers, you begin to see past the ambitious predictions and can almost hear espresso machines buzzing as developers clamor to gain even a few inches on the competition. It's perhaps due to this competition that issues with labeling standards and generations remain an *open question*. By the standards of some, Moscow-based Art Communications provided a functional 5G network as early as 10 years ago. Others, however, are opting out of strict competition, and are instead choosing co-opetition. Co-opetition is an approach wherein would-be competitors collaborate for mutual benefit. In keeping with this reemerging trend, AT&T announced in early June of this year that it would be *working with Nokia* to define 5G features, capabilities, and test cases for capabilities. AT&T and Nokia expect to complete outdoor 5G wireless connectivity trials by the end of this summer in several cities across the US.

Ulf Ewaldsson, CTO of Ericson, and Marcus Weldon, CTO and President of Bell Labs, have respectively predicted that 5G will be an *"open innovation platform"*

for "omnipresent" connectivity. To Nicola Ciulli, the Head of Research and Development at the Italian startup Nextworks, 5G is nothing more than a *"brand name"* and "umbrella term," useful for identifying "future architectures, technologies, and paradigm shifts emerging on the telecomms landscape."

One point, on which experts have come to agree upon following ITU's boomingly-announced 20 Gbps-standard is that the progression from 4G to 5G will be exponential, not linear. 5G will be much greater than a faster, higher-capacity 4G, in that not only will it succeed where 4G's technical limitations commit it to failure, but it will do so by using novel methods of managing connectivity, and it will seek out new possibilities and new applications, boldly going where no tech has gone before.

Challenges of 5G

Plainly stated, despite the ambitious goals set by SK Telecom, Verizon, and others, many in the tech community are skeptical to claims of a pre-2020 5G network. Having *increased by 70%* in the period of a single year, 2013-2014, mobile traffic continues to surge at an astonishing rate, and standardization of 5G networks is still in the planning stage. On the user-end, *mobile device limitations* such as range, battery life, and size, could slow 5G's pre-2020 goal-time even more. The most realistic outcome is that major players, such as SK Telecom and Verizon, will release limited, temporary versions of 5G which offer 100 Mbps, the standards-target defined by ITU in 2015, and eventually roll out a fully-loaded network after the kinks get worked out.

High standards and device limitations, aside, 5G-developers will have to *design around diverse needs* which unanimously demand the ability to handle a high workload while maintaining high security. Call it an Everest, a White Whale, or whatever you want—the truth is that 5G is the stuff of dreams—and nightmares. It's up to these pre-5th-gen's tech professionals to scale

the mountain and slay the beast—to boldly go where... well, let's just say there's a lot to be done here. For instance, 5G standardization will have to accommodate for a huge range of low-power IoT devices, on top of a massive mobile broadband which will need to be able to handle high-definition video streaming for millions of users. Similarly, future networks will have to be more efficient with energy and operating costs, as well as be more intelligent to auto-adapt to ever-changing usage of mobiles. A new approach will be needed to allocate radio frequencies, which Ewaldsson *predicts* will become as precious and scarce to the tech industry *as crude is to the oil industry.*

In Search of Answers, Upgrading Antennas & Test Riding mmWaves

Some of the *bigger challenges* to transitioning to the use of higher frequencies is that higher frequency radio signals die out over short distances, have trouble penetrating building walls, and cannot go around corners in city blocks. To solve this problem, some have proposed sending radio signals in tight beams, rather than using today's blanket approach which covers "large swaths" of area.

One of Nokia's principal research scientists, Mark Cudak, has reported that use of *"highly directional" antennas* may be the solution needed to deliver the desired data rate. For example, Nokia expects to deliver 1 Gbps to 95% of people within a 120-meter distance of its radio station.

Although which exact radio frequencies carriers will use has not been established, the march through the radio spectrum is definitively upwards. The industry is moving away from the sub-3 GHz, ultra-high frequency (UHF) norm and into a new 1-100 GHz range which spans both the SHF (3-30 GHz) and EHF (30-300 GHz) *radio frequency (RF) spectra*.

Massive Multi-User Multiple Input Multiple Output (MU-MIMO) is expected to *deliver Gbps data rates* going forward, and will also require the 2-4 antenna elements that are placed at 4G base stations be replaced with hundreds or even thousands of antenna elements. These massive antenna arrays would generate "ultra-narrow beam patterns" that could be precisely directed towards an intended audience and "simultaneously suppress… energy to unintended ones." Called "precision beamforming," it's an extremely efficient technique for two reasons: First, its highly precise nature precludes interference created by misaimed (and therefore, wasted) radio beams—improving spectral efficiency; Second, it effectively boosts signal power by several orders of magnitude by eliminating interference, a factor which would otherwise *weaken signal power.*

According to *Weldon*, the strategies to realizing 5G can be summed up by three terms: spectrum, spatial efficiency, and spectral efficiency. Let's tackle "spectrum" first: While higher frequencies can't cover the same distance that lower frequencies can without dying out, they possess much more capacity on the "mmWave" (>20 GHz) spectrum, making them the natural next step in the transition to 5G. The mmWave-frequencies' shorter lifespans, we can easily overcome that by building more base stations and small cells, and by re-using old ones, increasing their spatial efficiency overall. Lastly, network spectral efficiency could be boosted by using new types of waveforms which require neither rigid timing nor strict frequency synchronization. New radio and antenna designs that could up frequency capacity could help, too. For the uninitiated, "waveform" in this context refers to a radio signal's shape as it travels through space. It might seem like a minute detail, but it's a tiny choice that casts a long shadow, and at the end of the day it could greatly increase the data-transfer rate, latency, and energy efficiency across the network.

Still Searching for More Answers—Sprucing up Networks & Slowing Down with LTE CAT-1

While some are focusing on the future nuts and bolts of 5G, others are looking past the required materials and are, instead, focusing on organizational needs. Take the European Union's recently formed public-private partnership (PPP), the 5G Infrastructure Partnership, for example. Having received €700 million from the European Commission for research, the 5G Infrastructure Partnership's vision has five points: (1) wireless capacity; (2) energy savings of up to 90% per service; (3) communication networks in which the majority of the energy consumed comes from the radio access network; (4) reduction of service reaction time from ~90 hours to 90 minutes; (5) a network that can support connections from over 7 trillion wireless devices and serving more than 7 billion people. To these ends, the 5G Infrastructure Partnership has begun developing a new management model which involves software-defined networking (SDN) and network function virtualization (NFV).

Despite often being pitted against each other, when used jointly, SDN and NFV may just be the ticket to a 5G-future. Networking today has been described as *"rigid"* and *"proprietary"* by professionals, who often find themselves at odds with the constrains of legacy networks. SDN will allow tech professionals to build a "programmable 5G architecture" which, according to Nokia, is the "system-of-systems." The goal is to make more efficient use of all spectra at once. SDN is an approach to networking which separates the control plane from the data plane in network architecture. By doing so, it brings more flexibility in how networks are deployed and managed, but most importantly, it allows many of the SDN components to be deployed on industry-standard x86 servers. NFV, on the other hand, is poised to improve network function by focusing—not on separating the control and data planes—but on standardization of devices and replacing the physical with the virtual. However, both would spur replacement of the physical platform with x86-driven platform(s)—replacing proprietary networking equipment with software running either industry-standard server hardware or on virtual machines hosted on servers. By combining SDN and NFV, industry partners in the PPP reportedly expect five-fold returns on their investments. Ewaldsson, Weldon, and Ciulli—all of whom are involved in the PPP—maintain that collaboration is key to the development of 5G; competition can come later.

Furthermore, in the interest of boosting energy and cost efficiency, many industry giants are turning to LTE CAT-1 technology. While "slow" typically isn't a compliment in the tech world, it is precisely this quality which makes LTE CAT-1 a desirable option. At a max of 10 Mbps downlink speed—versus LTE's max downlink speed of 300 Mbps—CAT-1 sacrifices speed for a smaller module size, reduced power consumption, and reduced cost. A beneficial trade-off in low data-rate applications of M2M and IoT. Overlooked for years, CAT-1 has begun to garner attention from the likes of Verizon Wireless and Ericsson which conducted *joint CAT-1 device and network trials in 2014* and demonstrated that (slower) CAT-1 devices and high-performing LTE devices could coexist. This January, in fact, AT&T released a series of LTE modules for IoT devices designed to meet the diverse needs of a broad range of IoT applications. AT&T's uses *Altair's FourGee-1160 chipset* for its LTE-only CAT-1 module.

Final Thoughts

Experts forecast minimal, *less-than-one-millisecond latency with 5G networks*. While the switch from 3G to 4G slashed latency in half, the switch from 4- to 5G is expected to more than decimate latency, dropping it by 95%. Those aren't just flashy numbers. This unprecedented speed will be put to use by the health and medical industry, connected homes and buildings, secure transport, asset tracking, and more. *To the consumer using a self-driving car*, it is the difference between a having a car that—at a speed of 62 mph (100kmph)—would travel 4.6 feet (1.4 m) before being able to come to a stop, as opposed to a 5G car that would travel ~1 inch (2.8 cm) before braking in an emergency situation.

But, oh, the possibilities: 5G in smart homes and driverless cars, of course, but also in tele-surgery, virtual reality, and an unforeseeable number of new venues. Enter the new Eden, the Garden of 5G which—as one journalist so aptly *quipped*—will "tickle" the senses. The Tactile Internet—development of which began as late as 2012—is an emerging technology that will allow users to both transmit and receive tactile information (a.k.a "haptic interaction") while still receiving audiovisual feedback.

Realization of the *Tactile Internet* will demand enormous strides in the field of robotics, as well as (seemingly) impossibly quick data rates, but just as technology has made distance no object to visual and audio communication, the Tactile Internet will conquer distance to allow users to communicate and receive touch, as well. This sparkling possibility would grant "double presence" for surgeons whose delicate movements could save otherwise inaccessible patients and for deployed service members separated from family whose touch could reassure their children that they will return home soon.

Although, the use of mobile phones for data collection and streaming (in addition to voice) is a growing trend that becomes only more visible with time, the evolutionary destiny of its earliest version—the telephone—was far from obvious when it was first being developed. And there's a good reason for that. I'll explain.

Mark Twain once famously declared *Truth stranger than Fiction*. The second half of that quote, though often forgotten about, is that Truth's relationship to Fiction could very well mirror future generation techies' Collective Imagination and the Future Reality to ours. Meaning that the creativity and imagination of today's engineers and scientists will be outstripped by the creativity and imagination of future ones who aren't confined by modern-day limitations. It's only natural, because we can only see as far as our current vantage point allows. There's some comfort to be found in the fact that this generation's efforts will push the next to greater heights--and so on.

Take *Sir William Preece*, the distinguished and exacting Welsh engineer who studied under the legendary physicist and chemist, Michael Faraday, and who also personally advanced the field of telephony, for example. As onlookers into the past, we could say that Preece was better equipped and, more than anyone, should have seen the enormous potential of telephones. But, that wasn't the case. Preece's contributions to telephony when it was still an emerging field have been largely forgotten by the general public and he is more commonly known for this *dismissive soundbite*: "The Americans have need of the telephone, but we do not. We have plenty of messenger boys." Moving toward the future, and the future 5G network, let's think bigger than the proverbial smart fridge crying "buy more milk," and throw faith and support into today's developers in whose hands the future partially rests.

IoT Evolution Takeaways

It's been nearly a month since IoT Evolution Conference in Las Vegas ended, and things have finally sunk into my brain. I attended a number of sessions and all of the keynotes the conference had to offer.

By Enrique Pavlioglou

It all started on Monday with a fabulous run down of "What is IoT?". This was a great way to refresh from January. Even though I have been to this session at a previous conference, this one was no less compelling. The speakers were engaging and informative, and brought something new to the table. After a few other sessions, I attended the Battle of the Platforms, where IoT companies put their platforms to the test, where *Davra Networks* won Best Overall. And for those of you wondering what is IoT? It's something that has a different meaning for everyone and consists of how one uses it.

Tuesday morning got off to an amazing start with "Analyze This". In this roundtable, big name IoT analysts discuss and explore the future of IoT, focusing on who are the big players and where the market is headed from now until the end of the year. The discussion is a balanced one, taking multiple industry perspectives so we can have a holistic view of what is currently taking shape. Keynotes throughout the day included speakers like James Euchner from Goodyear tire and Chris Penrose from AT&T, among others. The day culminated with the opening of the Expo floor where attendees could check out the latest in IoT gadgetry and services, as well as network with numerous market leaders.

Wednesday was the heavy-duty meeting day. Sessions took off in all corners of the conference hall. My favorite is a tight battle between the "Autos and Autonomy: Keeping the Right Eyes on the Road" and "Show Me The Money" sessions. Autos and Autonomy centered on what's next for connected cars, while Show Me the Money was lead by 151 Advisors' Steve Brumer and focused on where the money in IoT really comes from and how companies can be sure to get measurable ROI.

Thursday was the final day of the show, but it certainly wasn't the end: IoT Evolution still had a couple up surprises up its sleeve for those who stuck it out. IoT Evolution's "Connected Transportation Conference", opened my eyes to the marvels of geofencing. Geofencing technology has been around for some time, but the way IoT is utilizing it is a game-changer. An easy example for all pet lovers out there (like me), would be pinpointing the exact location of their pets and then can be notified in real-time whenever your dog/pet escapes. However, geofencing technology is utilized in multiple markets, particularly in asset tracking and logistics.

While 6 days in Vegas is far too long, it was totally worth it. The return flight? Not so much, as turbulence is always guaranteed. However, all good things must come to an end, and this year's conference was definitely that: Good. Can't wait to see what *February's conference* has in store.

Come See Us

Telit Innovation Summit, September 6 Las Vegas

The Telit Innovation Summit will demonstrate how industry leaders are currently leveraging the latest in IoT across various markets. This year's pre-CTIA event will be held in Las Vegas, and will highlight what is actually working in IoT, and how companies can start taking advantage of its innumerable benefits now.

CTIA Super Mobility 2016, September 7-9 Las Vegas

CTIA will be held at the Sands Expo in Las Vegas, NV. Here, there will be an intense focuse on smart cities, and all things Mobility. Industry leaders and experts are set to showcase the latest IoT solutions, as well as hold thought-provoking panel discussions.

If you are interested in meeting with James Brehm & Associates, please contact info@jbrehm.com in order to set up a meeting date and time.

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