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Conversations with industry about IoT in HEALTHCARE

JULY 2021

– connected healthcare got a boost with Covid-19 – but access to healthcare innovation hinges on access to broadband

by Sean Kinney
Editor, Enterprise IoT Insights

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Images: 123rf

The vision for digital transformation of industries is deceptively simple yet incredibly complex. The logic goes that using internet-of-things devices to gather data from people, equipment, and mobile and stationary devices will unlock extensive opportunities for process optimization, bringing about efficiencies that improve business outcomes while cutting costs.

Realizing this vision, however, certainly has to do with generating data but that next step – understanding the context and meaning of the data – involves myriad technologies ranging from connectivity like Wi-Fi and cellular, compute and storage infrastructure to run the necessary workloads, artificial intelligence and machine learning to make sense of the inputs, and people capable of turning data insights into actionable insight capable of driving meaningful organizational change.

Digital transformation has been the primary objective of enterprise C-suites for years but, particularly as it relates to the IoT and everything that it encompasses, navigating from pilot to scale is a consummate sticking point. Specific to the healthcare sector, the response to the global COVID-19 pandemic largely served to accelerate the adoption of digital technologies for a number of reasons: the sheer volume of patients forced new types of digital patient record management to the forefront out of necessity; the transmissibility of coronavirus meant that previously in-person interactions around diagnostics, patient monitoring and other types of care be moved online; and the need for new remote sites where clinicians could conduct testing and administer vaccines challenged existing models around centralized facility operation and management.

The question becomes whether the healthcare industry can take learnings from the COVID-19 response, recontextualize its learnings into larger technology implementations, and meet the demand from patients for digital healthcare experiences

Given this rapid seachange, the question now becomes whether the healthcare industry can quickly take learnings from the COVID-19 response, recontextualize those learnings into larger technology implementation strategies, and effectively meet the demand from patients for digital healthcare experiences.

Capitalizing on the gains made in the past year-and-a-half is shrouded in challenges ranging from system interoperability and overcoming technical debt to pairing how patients want to use technology with what is most effective and maintaining strict control of personal health data. In addition to these challenges, there's a larger issue in play. The subject of the digital divide has long been a talking point for politicians, economists, and other pundits; there was renewed focus during COVID-19 as school children transitioned to remote learning and office workers set up shop at kitchen tables and in spare bedrooms. But, in the context of healthcare, if the goal is to move patient/clinician interactions online, this serves to further highlight the question that if billions of people don't have access to broadband, will they ultimately also not have equitable access to healthcare?

Sean Kinney, Editor,
Enterprise IoT Insights

Virtual consultations and sensor devices – use cases for connected healthcare

Digital care apps are multiplying with the rising popularity of IoT devices, demand for remote care, and promise of 5G and AI

The primary use case for connected healthcare is currently telemedicine – a patient interfacing with a medical professional via videoconference. Meeting with a medical professional using a desktop, laptop, tablet or smartphone hinges on connectivity, whether it's cellular, Wi-Fi or a wired connection.

While you could make the case that this use case sits under the umbrella of IoT – the aforementioned devices are most certainly 'things' – a more pure representation of an IoT connected healthcare use case would be remote patient monitoring wherein medical devices of varying degrees of specialization provide physicians with a more regular stream of patient data, covering such things as blood pressure, blood sugar levels, and heart rate. Equipped with more patient-related data than could be gathered during a typical appointment, clinical staff gains a more clear picture of the patient's well being; this allows for more accurate, effective diagnoses, treatment plans, and outcomes.

IoT – providing physicians with a regular stream of data about blood pressure, blood sugar, heart rate (Image: 123rf)

In a study conducted in 2020 by Samantha Tam, MD, MPH, of the Department of Otolaryngology—Head and Neck Surgery of the Henry Ford Health System and Henry Ford Cancer Institute in Detroit, and focused on uptake of telemedicine in patients being treated for head and neck cancer, the use of telemedicine surged during COVID-19 as clinics shut down. According to figures published in Nov. 2020 by the JAMA Network, between March 14 and April 24 last year, of 346 encounters with 234 patients, 25% were in person, 49.1% were virtual, and 23.6% were conducted over the telephone.

In 2019 there were no telemedicine visits. Tam also found that a lower completion rate of virtual visits was seen among patients based on multivariable adjustment for insurance type, household income, education level, low median household income, and other factors.

Regarding the finding around lower completion rates of virtual visits seen in the patient group studied, Tam wrote that, "This disparity was not demonstrated in telephone calls. While synchronous audio and visual communication in virtual visits

offer a more comprehensive assessment, telephone visits may be an important avenue to access care."

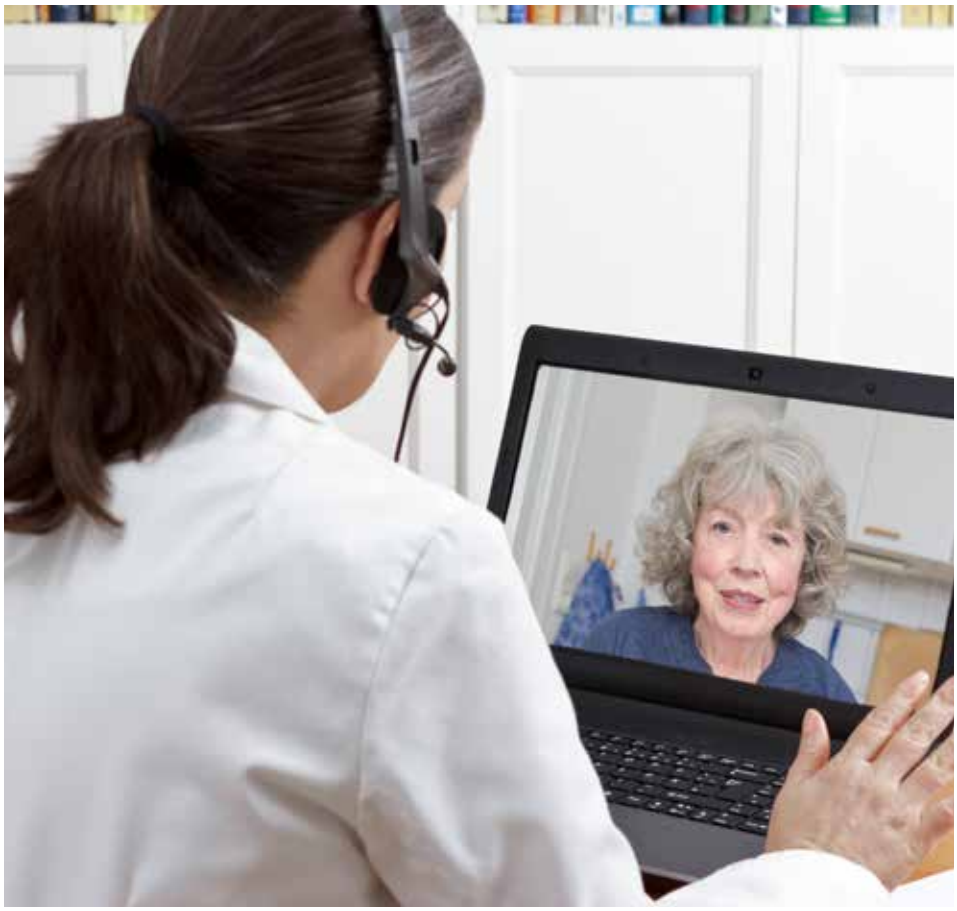
McKinsey & Company has also tracked the uptake of telehealth during the pandemic closely. According to the authors of the report "Telehealth: A quarter-trillion dollar post-COVID-19 reality?," the use of telehealth for office and outpatient visits grew 78 times between February and April, 2020. By July they found that the use of telehealth "stabilized at levels 38X higher than before the pandemic."

This is driven by three factors detailed in the report: "1) increased consumer willingness to use telehealth, 2) increased provider willingness to use telehealth, 3) regulatory changes enabling greater access and reimbursement." During the pandemic, "telehealth offered a bridge to care, and now offers a chance to reinvent virtual and hybrid virtual/in-person care models, with a goal of improved healthcare access, outcomes, and affordability."

The McKinsey team estimated in 2019 "that up to $250 billion of U.S. healthcare spend could potentially be shifted to virtual or virtually enabled care. They write that "investment in virtual care and digital health more broadly has skyrocketed, fueling further innovation…" and "Virtual healthcare models and business models are evolving and proliferating," with services expanding in range and focus areas.

Remote patient monitoring effectively extends the reach of data collection out of clinical settings and into the world beyond the four walls of a healthcare facility. Instead of point-in-time data, physicians and other medical workers can collect more data and make better, more effective care and treatment decisions.

In an analysis of 91 studies focused on remote patient monitoring published by medical trade journal BMJ in March this year, researchers from the Centre for Health Services Research at the University of Queensland found the most common metrics remotely monitored are heart rate, blood pressure, weight, and oxygen saturation. Cardiac implantable electronic devices (CIEDs) were also used to glean data about heart rhythm and arrhythmic episodes.



Consultations – COVID-19 has shown the value of remote video care, but digital access remains a barrier (Image: 123rf)

"Disparity was not demonstrated in telephone calls. While synchronous audio and visual communication in virtual visits offers a more comprehensive assessment, telephone visits may be an important avenue to access care."

Samantha Tam, MD, MPH, Department of Otolaryngology, Henry Ford Health System and Henry Ford Cancer Institute

Technologies used for remote patient monitoring included dedicated units or hubs, CIEDs, pacemakers, tablet- and smartphone-based applications, websites, electronic health diaries, inhalers, medication devices, scales, pulse oximeters, and thermometers.

According to the authors, remote patient monitoring "for all disease conditions was reported to have reduced admissions, length of stay and [emergency department] presentations…" in more than 40% of the studies reviewed. The other half of studies considered in the analysis "largely reported no change in acute care use for remotely monitored patients. A very small number of studies report RPM increased acute care use."

In its own analysis, network equipment provider Ericsson looked at how 5G could enable digital transformation in the healthcare sector and found four use cases categories:

- **Patient-centered, out-of-hospital, application like precision medicine, remote monitoring, alert delivery, and administration of medicine**
- **In-hospital applications such as telemetry and VR-based surgical training**
- **Medical data management applications, including real-time data set transmission and electronic recordkeeping**
- **And other applications that accelerate care delivery like 3D printing and ambulance drones**

Then there's the long-discussed 5G-enabled healthcare application—remote robotic surgery. While this particular example is far from mainstream, Ericsson did scope out the required network resources that would be necessary to deliver remote robotic surgery. This could potentially give an idea of the technologies the healthcare sector will evaluate, deploy and use in the future.

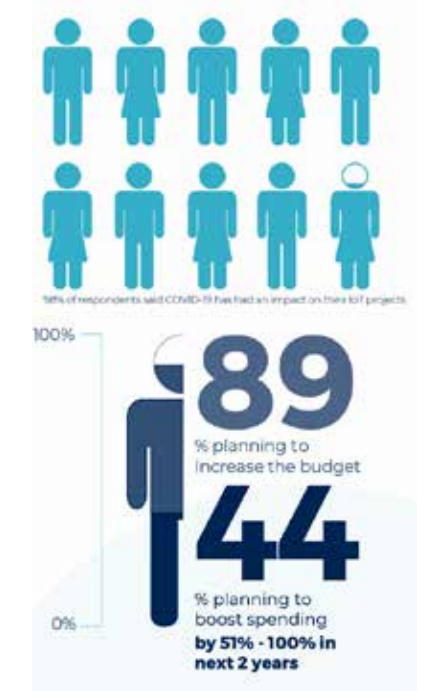
According to the equipment vendor, 1 millisecond latency is needed for haptic feedback; high throughput will support HD imagery streaming; high network availability and minimal packet loss will allow an uninterrupted procedure; and mission-critical security given potentially life-threatening implications of a breach.

Robot surgery – the tech is being tested (Image: 123rf)

IoT in the time of coronavirus – by the numbers

A good deal of the commentary around the acceleration of IoT and other tech solutions during COVID-19 is somewhat anecdotal, based on the perspectives of individuals serving in varying capacities at firms that sell technology. U.K.-based Eseye, which specializes in cellular IoT, including hardware and consultancy services, worked to quantify it by engaging research house Opinion matters to survey 500 senior decision makers in the U.S. and U.K.

The survey covers five verticals: healthcare and medical devices, supply chain and logistics, manufacturing, electric vehicle charging and smart grid, and smart vending. While the results are somewhat mixed in terms of how COVID-19 impacted IoT investments, it's clear that the pandemic indeed did have a marked impact. As reported by Eseye in its "2021 State of IoT Adoption Report,":



- **98% of survey respondents said COVID-19 had an impact on IoT plans**
- **27% said IoT plans accelerated during the pandemic**
- **31% said their investment in the area has increased**
- **77% said "their IoT project was at best only somewhat successful in meeting expectations and realising benefits"**

Despite the mixed bag, respondents seemed to still have a favorable perspective on IoT as a driver of organizational change. From the report:

- **86% of the 500 people survey "said IoT is a priority for their business"**
- **49% plan more IoT projects in the next two to three years**
- **89% plan to increase budgets for IoT-type projects**

Among the top challenges to IoT implementations identified in the Eseye report were security, connectivity, device onboarding, testing, certification, and variations in cellular connectivity from country to country. Eseye CEO Nick Earle, noting "a number of false starts" around the scale of IoT adoption, said, "COVID-19 has accelerated IoT trends that were already underway as large enterprises move from experimenting to understanding how to deploy IoT; our research found that the larger the project, the faster the acceleration as organizations embrace IoT."

Patients want a 'digital front door', says KPMG

The digital maturity of healthcare providers runs the gamut from 'world-class' to, mostly, way-behind other industries

In a conversation with *Enterprise IoT Insights*, KPMG Managing Director, Emerging Technologies, Michael Krajecki considers the challenges and opportunities for driving IoT adoption into the healthcare sector, and provides insight on how patient expectations for digital experiences throughout the care progression are shaping investment from medical providers.

We've heard broad discussion of how COVID accelerated the digital transformation of vertical industries. Specific to healthcare, have you observed that same acceleration of technology investments?

"Before COVID, the healthcare industry was gaining momentum with various technology investments and initiatives. The experiences over the last year have magnified the technology shortcomings that many healthcare providers struggle with, including a lack of effective digital communication channels, minimal interoperability among systems, and large amounts of expensive tech-debt that isn't meeting clinician or patient expectations. As we begin to emerge from the pandemic, we've witnessed a major shift of momentum into large-scale digital transformation, and this has caused healthcare leaders to desire a comprehensive digital strategy that expands across the patient care continuum and accelerates innovation throughout the health system. At KPMG, we are combining our deep healthcare experience with patient-centric design and modern digital architecture and emerging technologies. We are helping our healthcare clients bring their vision to life throughout the digital transformation lifecycle."

"As we begin to emerge from the pandemic, we've witnessed a major shift of momentum into large-scale digital transformation, and this has caused healthcare leaders to desire a comprehensive digital strategy…"

Michael Krajecki,
Managing Director, Emerging Technologies, KPMG

Could you give me a candid assessment of where hospitals or healthcare facilities are in general on the technology adoption curve – are they leading, lagging, consistent with other verticals?

"Healthcare providers really span the spectrum of technology adoption. The world-class leading health institutions have long been on the cutting edge of technology, including early adoption of cloud platforms, artificial intelligence, and the Internet of Medical Things. However, most health systems are lagging other industries. They carry a lot of isolated point-solutions, M&A growth has created a fragmented technology infrastructure, and healthcare data comes with a significant regulatory and compliance burden. Combined with very lean margins and limited investment funds, digital technology innovation hasn't always been a priority. Fortunately, the tides have quickly turned and the demand for digital health

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experiences is accelerating adoption."

In your engagements with customers in the healthcare sector, what types of problems are they typically trying to solve with technology investments?

"We are seeing healthcare technology investments being very focused on how to drive better patient experiences and outcomes. For patient experiences, there is an undeniable need for a modern digital front door that serves the patient throughout their care progression. People have grown accustomed to elegant digital experiences and expect the ability to interact and transact with a few touches of a screen.

"Patients are asking why it is so difficult to schedule and manage appointments, why the registration process is redundant and often tied to clip boards, why they don't have easy access to medical records and test results, etc. I expect our digital interactions with our health provider to greatly evolve and improve in the coming years, and it may become a brand differentiator for health systems to attract and maintain patients.

"There are also major investments occurring related to clinical care. The power of modern technology has truly helped the industry move closer to precision medicine. Connected biomedical devices are providing new treatment options, AI and ML are helping us predict adverse events before they happen, and concepts like remote/virtual surgery are becoming a reality. Technology investments in healthcare are literally saving lives every day."

Specific to IoT in a healthcare environment, what are the primary use cases you're seeing today and what use cases do you expect to gain traction in the near- to mid-term?

"The internet of things has become pervasive within healthcare facilities. Everything

from the thermostats controlling the operating room temperature, to the pulse oximeter on the patient's finger, to the robotics used by a surgeon, are all likely internet-connected and collecting mass amounts of data. Modern hospitals have thousands of IoT devices.

"One of my favorite IoT topics is wearable monitoring devices. These can range from consumer-grade watches to inpatient clinical-grade vital sign monitors. It's amazing how much innovation has occurred with the sensors capable of monitoring all the major vital signs within a small wireless adhesive patch or wristwatch. Wearables are being used in clinical trials to reach wider populations of participants, they are being leveraged to extend the point of care before and after hospital visits, and they are providing better ways of remotely monitoring inpatients across all nursing units.

"The industry is just starting to understand the significant impact wearables can have on clinical outcomes, as the real magic lies within the new treasure trove of data that is streaming from these devices. Many healthcare organizations are currently analyzing this data using advanced AI/ML techniques to understand the patterns and correlations hidden within our vital signs, and combining these data insights with personal health history, recent test results, or genetics has the potential to alter the way we make clinical care decisions."

How do privacy concerns and regulations related to patient information figure into IoT decisions made by healthcare stakeholders?

"Healthcare providers continue to be one of the most targeted industries for cyberattacks, especially focused on data theft and ransomware. In combination with the extensive regulatory requirements for handling protected health information (PHI), there is a lot to consider when implementing new IoT solutions for healthcare. We are seeing the leaders in the industry build dedicated capabilities related to medical device security, improve their IT asset management programs to cover IoT devices, and embrace the concepts of security and privacy by design.

"The by-design concepts require rethinking the way hospitals segment their networks, requiring more involvement by information security functions during device procurement and onboarding, and establishing more robust device monitoring and governance capabilities.

"As healthcare IT functions continue to improve their capabilities around protecting IoT devices, it's important for everyone in the healthcare setting to understand what IoT devices are capable of and seek to understand where PHI data resides at all times."

"There's a lot of ideation with 5G. The increased bandwidth and low latency can be a huge benefit to support the growing number of IoT devices used by hospitals – many of which struggle with poor Wi-Fi. 5G also helps with modern network concepts like micro-segmentation."

Michael Krajecki, Managing Director, Emerging Technologies, KPMG

Can you share any insight into how healthcare C-suites are thinking about 5G and private networks, if at all?

"Like other industries, there is a lot of ideation and experimentation occurring related to 5G. The increased bandwidth and ultra-low latency can be a huge benefit to support the growing amount of IoT devices used by a hospital. Many hospitals struggle with poor Wi-Fi performance and bandwidth issues, and 5G also helps with modern network concepts like micro-segmentation. 5G can also benefit hospital-at-home programs, which are increasingly placing IoT devices in patients' homes. We are quite early on the 5G adoption curve for healthcare, but I think the conceptual benefits are well-known and we'll see 5G make an impact to healthcare in the near future.

"Private networks gained a lot of interest during the early stages of the pandemic when healthcare systems were creating pop-up facilities to increase bed capacity. One of the challenges faced was how to extend the hospital network to a remote location and provide the necessary connectivity for the clinical technology equipment. If a hospital was already using private cellular network technology, the ability to extend the network to a new location could have been more easily accomplished without the costly infrastructure requirements."

Zooming back out from IoT for healthcare to IoT for enterprises in general, what challenges to adoption and tying investment to a use case and business case are you tracking?

"We've reached the point that technology has sufficiently advanced and the cost structures are reasonable, so we at KPMG are focused on helping our clients identify the right use-cases, rapidly experimenting and evaluating, and implementing IoT programs that are tailored to their unique situation.

"One of the main challenges is actually caused by the proliferation of IoT, which is how to manage and control many IoT initiatives happening within the same organization. IoT is being used throughout the front, middle, and back office, but often different IoT initiatives are not closely aligned. To help remedy this, we have helped our clients establish enterprise-wide IoT governance programs that offer the right accelerators and standards to encourage innovation while providing the right balance of structure and support to make IoT programs secure and sustainable.

Bringing IT infrastructure into non-traditional IT environments – with CPI

Demand for greater network capacity and compute resources is driving a modernization and reorganization of IT infrastructure

The centrality of connected technologies to digital transformation in most all sectors of business, including the healthcare vertical, is prompting a major change in near- and long-term demand for network capacity. As Chatsworth Products (CPI) Senior Data Center Consultant, Steve Bornfield, discusses, the increasing demand for IT infrastructure in non-traditional IT environments is promoting collaboration and creativity to ensure seamless wireless access.

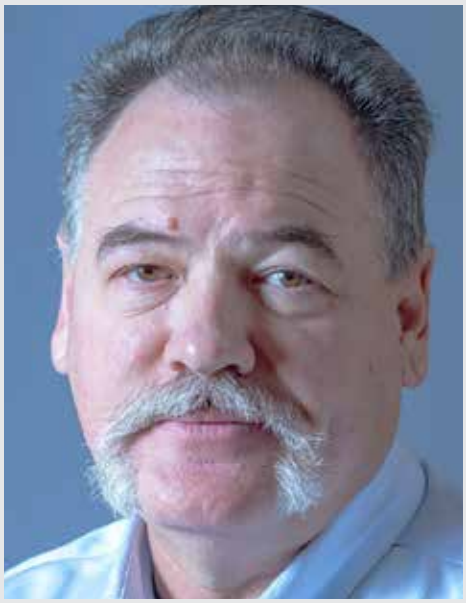
We've heard broad discussion of how COVID-19 accelerated the digital transformation of vertical industries. If we drill into healthcare, have you observed that same acceleration of technology investments?

"The Internet of Things (IoT) is changing the dynamic in most businesses. We're starting to see entire network configuration requirements—the systems, the demands, all that—changing in demand. Today, most of those systems are now being integrated into an IT-based solution.

"If you look at just the way we're building today, if you think of the structures themselves with low-e [low emissivity] glass and a lot of other construction methodologies, the challenge to wireless [connectivity] is going from inside out. It's getting to where you have to have accessibility on both sides. These buildings or companies are having to go through their infrastructure footprint and provide a seamless solution."

"Consider today that an individual has approximately three devices. Put that in the context of healthcare and add in the demands around the hospital—all the medical monitoring solutions that are starting to get connected. Then mix in the integration of facility systems. All of this is adding to unprecedented demands on the sector."

Steve Bornfield,
Senior Data Center Consultant,
Chatsworth Products



What does the expansion of public 5G networks and private, site-specific cellular networks, both LTE and/or 5G, mean for healthcare technology investment planning?

"We're starting to see a lot of demand or need within the data center or IT spaces. What used to be a small space or a non-used space, a comms room [telecommunications room] with a 5-8 kilowatt [power] load now requires 50 to 100 kilowatts. They have servers, network devices and storage solutions. This is really being used to drive rapid deployment and capability like we've never seen before.

"It's starting to create a new challenge where end users potentially don't have the

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From advanced, life-saving medical equipment to electronic patient records and the telemedicine boom, the need for reliable network availability in traditional health care facilities and newer edge environments is a constant and rapidly on the rise. But, diagnosing the challenges of bandwidth, privacy and security that come with this mission-critical proliferation is not easy.

Thankfully, throughout its 30-year history of powering and protecting technology investments, Chatsworth Products (CPI) has provided countless hospital systems, health care facilities and other medical IT professionals with the critical information and communications technology (ICT) infrastructure needed to help ensure quality care, record keeping and more—from the data center to the edge. And as more organizations continue their digital transformation journey, now's the time to ensure your ICT infrastructure is ready for what's happening now and next.

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physical space in these rooms for the cooling or power. Our customers are trying to fix what's there today and CPI is working to make sure they're positioned for 5 to 10 years down the road. We're trying to both stay on the cutting edge and keep a mindful eye on the demand."

How would you gauge the technological-readiness of the healthcare sector and what challenge or challenges do you foresee in the larger digital transformation trajectory?

"Healthcare, for the most part, has done an incredible job of staying ahead of the demands and needs [of digital transformation]. They've also been very well-funded, so they've been able to do that. Healthcare has been more funded and has had more money allocated toward it where they can perform these upgrades. If you look at other industries, they're having to do it all on their own. The healthcare folks have done an incredible job of positioning themselves for success and getting these systems in place.

"I think the biggest challenge is understanding all the connectivity requirements, particularly around remote sites. COVID-19 drove new needs for distributed sites and seamless wireless access. Before [COVID-19], focus was more concentrated in the building. Now customers are having to focus more on outside environments and address all this demand out there."

For connectivity and IoT in the healthcare sector, what trends are changing investment?

"Consider today that an individual has approximately three connected devices. Put that in the context of healthcare and add in the demands around the hospital—all the medical monitoring solutions that are starting to get connected. Then mix in the integration of facility systems. All of this is adding to unprecedented demands on the sector. That's where we're really starting to see a transition.

Data centre – unprecedented demand on IT systems in data centers is seeing network capacity go to 100 GB (Image: CPI)

"In the past, when you had a 1 GB network, you'd see maybe half a GB and think, 'Wow, this is huge!' Now you're sitting there going, 'Wow, we really need to go to 10 or 100 GB.' I think that's the shift. All of these network systems are starting to see more and more demand from all the new devices that are out there and CPI is really putting our focus on the solutions that will help customers solve for that."

Specific to your products, what do you need to support installations in non-traditional IT environments and how do you balance your own production scale with need to customize?

"That's always been the challenge. If we think about a non-typical IT environment, that would probably be an edge solution. CPI works with [customers] to understand what devices they are going to install, how much power is needed and then understanding what the cooling requirements are for those devices. A lot of demand on those edge products has gone up and it has pushed the delivery on those items due to accessibility of materials. For a custom solution, those could take 8 to 12 months, but CPI can provide it in four weeks or less. Chatsworth Products really strives to maintain flexible capabilities in our factories.

"There's also a range of demands within these remote or edge solutions. These sites may be solely comprised of compute or they may need Wi-Fi access and be able to install those access points in different locations.

"We had a customer come to CPI for a connected solution that needed to match the [aesthetic] design they already had, so we provided a custom color on our solution so it wouldn't stand out. We've worked with a lot of folks—helping them design a complete, integrated solution so that they don't have to force together different components.

"Someone can always open a catalogue and point to a product. But at CPI, we build to order. Our focus, a core value, is that we're here to delight the customer. We want the customer to understand that we feel that ownership of the products and solutions we're selling."

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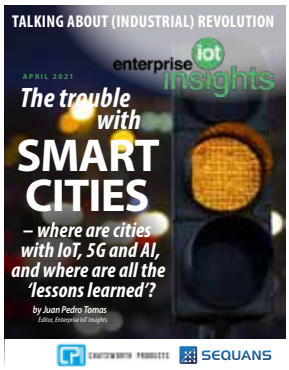
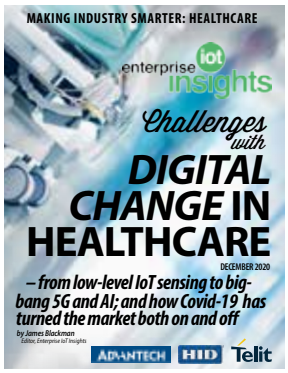


APR 2021 | SMART CITIES

APR 2021 | INDUSTRIAL 5G



DEC 2020 | SMART HEALTH

OCT 2020 | IOT TRACKING

JUL 2020 | HYBRID IOT

APR 2020 | INDUSTRIAL AR

MAR 2020 | SMART LIGHTING

DEC 2019 | CO-CREATION

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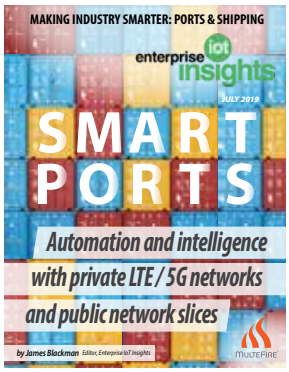

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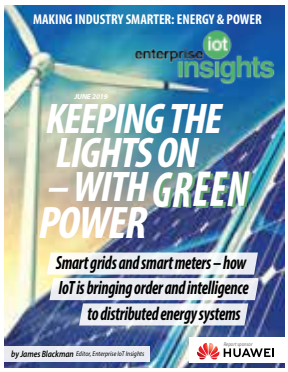
JUL 2019 | LPWA NETWORKS



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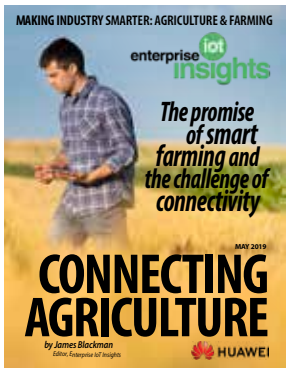

MAY 2019 | SMART FARMING

MAR 2019 | SUPPLY CHAIN

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In the end, connected healthcare depends on access to connectivity

Like parallel narratives, inevitably converging, the tale of digital healthcare will be forever linked to the main story of digital access

Lack of access to reliable broadband internet service is a global problem. At the end of April, Data Reportal found there were 4.72 billion global internet users and the number is growing. However, that means there are more than 3 billion people that are not online with the majority of those people located in India, China, Brazil, and on the African continent.

As such, the vision for widespread use of connected healthcare is directly correlated with the end user having access to the internet. To draw a parallel, the shift to remote learning during the COVID-19 pandemic helped students maintain educational continuity but only if they had access to broadband and a device at home; closing the homework gap came into focus in the past 18 months, with governments and companies subsidizing device and broadband service expenses.

Given that lack of access to broadband is a global issue with no single clear solution other than massive investment, a variety of stakeholders are engaged in individual and collaborative efforts geared toward expanding the availability of connectivity. The World Economic Forum is looking to better address the issue via its EDISON Alliance, a working group established in February in an effort to "accelerate and foster unprecedented collaboration between the ICT community and other critical sectors of the economy" with an eye on "rapid digital development."

> "When we work on infrastructure problems, we're going to the core of capex and opex challenges. I think the more we invest here, the more good stuff happens."
>
> ***Dan Rabinovitsj, Vice President, Facebook***

During the virtual Davos Agenda event earlier this year, WEF Founder Klaus Schwab commented: "The time for gradual change toward digital access and adoption is over. We must highlight the critical nature of this challenge as foundational to so many others—and bring those who care about education, health, climate, equality and growth to also be champions in our mission to bring connectivity to all."

Verizon CEO Hans Vestberg serves as EDISON Alliance chairman. He tied the group's goal to telehealth, remote work and distance learning prompted by COVID-19, saying in February that these connected use cases have "leapfrogged at least five to seven years in digital inclusion in the world...Everything has basically changed."

Vestberg also tied expanded-broadband access to the United Nations Sustainable Development Goals—number three of 17 is "good health and well being). Vertberg reckons the goals are all "underpinned by mobility, broadband, and the cloud".

But we also need to be clear that work that government, private sectors, different industries, ICT sectors, have done in the last nine to 12 months is just unheard of…

[but] still it's over 3 billion people on this earth that are not online."

Specific to the physical infrastructure needed to expand broadband access, bridging the digital divide doesn't just have to do with cellular radios, terrestrial fiber, powerful core networks, or any one other network domain. In an interview, Facebook Vice President Dan Rabinovitsj said, "There's no silver bullet to solving the world's connectivity challenges."

That's why Facebook Connectivity, the division of the social media giant focused on working with partners to develop scalable, cost-effective connectivity solutions, is taking a multi-faceted approach with recent announcements highlighting investment in fiber in Africa and South Asia; integration of its open source packet core software with Amazon Web Services' edge compute offering; and ongoing work with partners on Open RAN reference designs to help accelerate adoption of disaggregated radio systems at scale.

Rabinovitsj said Facebook Connectivity spends its time and money on "things that we believe will inflect the market. What we do is really focus on making partners successful. We want good outcomes and sustainable businesses as a result of that… That for us looks like success."

As operator commitments to deploy Open RAN systems accelerates, Facebook worked with partners on the Evenstar RAN reference design software for open 4G and 5G radio access networks. The company's Magma packet core software was brought under the auspices of Linux Foundation earlier this year. Rabinovitsj pointed to Magma-related activity on GitHub as indicative of the heightened level of interest around cost-effectively customizing crucial core software functions.

On the transport front, Facebook and partners 2Africa and Liquid Intelligent Technologies, are working to bring connectivity to more of the Democratic Republic of Congo by deploying 2,200 kilometers of fiber, linking East and West Africa.

"If there's one place on earth with the fastest growing population and most acute need to leapfrog, it's Africa," Rabinovitsj said, adding that there are Open RAN conversations happening with operators on the continent but the fiber problem needs to be solved before the wireless problem.

Big picture, Rabinovitsj said, "When we work on infrastructure problems, we're going to the core of capex and opex challenges. I think the more we invest here, the more good stuff happens."

Number three – of the Sustainable Development Goals from 2015, including targets for maternal and infant mortality, along with disease control and environmental health fatality

Connected healthcare is only available to connected people, says Kajeet

Kajeet has gone from a kid-friendly MVNO set on internet safety to a telco with grand plans for digital access and digital healthcare

Kajeet is perhaps best known as a mobile virtual network operator and MVNO enabler. The company was founded on a core mission of making connections for good. As Director of Strategy and Business Development Dominic Marcellino explained, this core mission has evolved from making the internet safe for kids to include bridging the digital divide, closing the homework gap and enabling connected healthcare.

Can you give me some background on how Kajeet has evolved and expanded over the years while maintaining focus on the company's core goal?

"Kajeet was founded 18 years ago by three dads who had 16 kids among them and were thinking about, at that point, making cell phones safe for kids to use. That evolved into how to make the internet safe, reliable, and useful to students and bridging the digital divide.The company ended up building out a really robust technical capability first as an [MVNO] then as a [MVNO] enabler. We ended up creating a bunch of capabilities that cut across our core products. Last year, we saw rapid growth; we had 5x growth of enterprise, 20x growth of education.

"We have recognized the need to continue to support the customers we have and tried to do a little pattern recognition of our successful customers – what is Kajeet doing and is there a way to leverage our ability and do repeatable customer engagements. We began engaging further than providing the connectivity and platform. We were involved in device procurement, device onboarding, managing device profiles, and providing after-deployment support, and basic device troubleshooting.

"If the internet is where care is happening, and you don't have access to the internet, that's not equitable"

Dominic Marcellino, Director of Strategy and Business Development, Kajeet

"The next evolution for us is in healthcare. It's about taking the core pieces, expanding out, and engaging with healthcare device manufacturing companies and pitching ourselves as their connectivity partner. Our core mission is connections for good. We really like being engaged in businesses that are helping people. We want to be engaged where that's what's happening."

Can you expand on how Kajeet is positioning itself in the healthcare space and what you see happening more long-term?

"Our healthcare position is going to be to continue to be an enablement company. We're not going to go build new medical devices. We're not going to build a bespoke healthcare platform. We are partnering with companies that are offering those products or platforms to pull together fuller solutions. When someone has a specific need in the healthcare space, we'll serve as a systems integrator, a solutions company—we'll go get all the pieces together.

"We're also offering consultative assistance to new product manufacturers as they go through the product certification

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process. Our team has broad experience to bring to bear to help them.

"Healthcare was a big driver and it's the core vertical focus we have right now. Ideally what we do is spin it off sort of like education and have business units that are vertically-focused. The stickiness of telehealth, it's a tricky one. Look at the learnings that came out of New York [schools] that there will no longer be snow days. We know that you can learn that day...I think that that tells us the learnings are basically this is supportable, there's no reason to have a day off for learning when you have access to it.

"For healthcare, there are great reasons for people that are in recovery to not get in a car and be seen [in person]; good reasons for people with specific symptoms to not come into a place. There are things best done in person and things that can be done in a connected way. Anecdotally, I think behavioral health will end up being the big one. I think you'll see strong uptake and more prevalence of connected behavioral health."

What is Kajeet doing to support remote patient monitoring and how does ease-of-use impact rate of adoption?

"Remote patient monitoring depends on how do I get this data from a diverse set of devices, make sure it gets where it's supposed to go securely and reliably, and the operation and functioning of a diverse set of devices. We're going to provide the hardware and make this process as easy as we can for our users. We're going to send you a device...All you have to do is show up, charge your phone, hit a link.

"I would prefer you to not have to engage with an interface you've never seen before to connect. I'm sending out an electronic cuff or a thermometer and a hub that sends the data. There are some really cool companies that have done a great job manufacturing all the pieces. I'll have an agent live on a hub that can ingest any kind of identifiable data and aggregate and send it securely. It is going to allow for much real time synchronous engagement. You'll see improvements in overall care. There's no reason to wait for someone who feels bad to come in."

The premise of connected healthcare assumes the patient has access to connectivity but we know that's not always the case. What do you make of that misalignment?

"On the healthcare side, last year exposed significant differences in access to the internet that I think is actually going to be an opportunity to address and solve the issue or it's going to become a bigger challenge. Extending telehealth and remote patient monitoring into homes without the internet is impossible. The equity piece is critical for this to be the future of healthcare.

"If there are better ways to do that by leveraging technology, that's a world where publicly-interested companies, governments and providers have a way to do this. If the internet is where care is happening, and you don't have access to the internet, that's not equitable. And there are going to be tough conversations around that."

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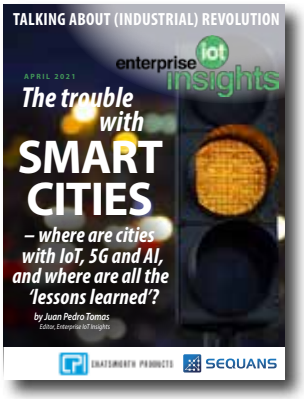

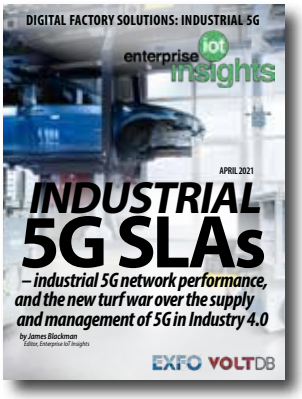

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