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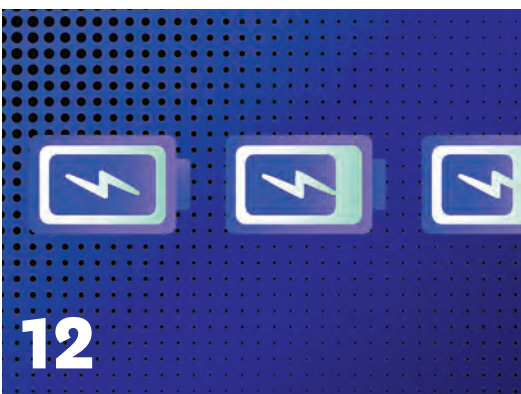
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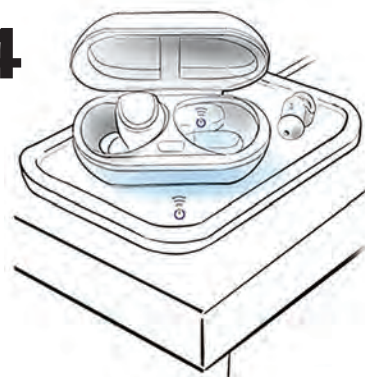
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# After a year of COVID, things are *remotely* different



It's been more than a year since COVID-19 was declared a national emergency. With workers moving into remote,

mostly home-based offices as the new normal, the pandemic has been a powerful reminder of the importance of connectivity.

Even as we've been physically apart, the wireless ecosystem has brought us together digitally and rose to the new challenges. Since last March, we've connected virtually with our co-workers, our health care providers, and our kids' teachers in new and critical ways.

As we continue to navigate the pandemic today, wireless networks continue handling an unprecedented surge in mobile voice and data traffic almost overnight. In many other countries, wireless networks strained to maintain quality and speed as COVID-19 drove increased demand last spring, while our networks kept pace quite capably.

Canada's wireless telecommunications industry continues to be a driving force in this country's economy, according to a recent report commissioned by the Canadian Wireless Telecommunications Association (CWTA). The report shows that our wireless industry is a major contributor to the economy; generating jobs, making significant contributions to GDP, and increasing productivity through the use of advanced wireless technology.

## Key findings of the CWTA report indicate:

Canada's wireless industry contributed \$48.2 billion to the Canadian economy in 2018,

representing 2.5% of the total Canadian GDP.

The wireless industry generated 327,000 full-time equivalent, well-paying, jobs in 2018.

GDP contribution includes \$12.6 billion from productivity improvements enabled by the use of wireless services in other industry sectors, and \$4.7 billion as a result of an increase in wireless penetration.

Facilities-based wireless network operators made \$3.1 billion in capital investments in 2018 to expand and upgrade Canada's wireless infrastructure.

The report also demonstrates that while a technical transformation has already begun, the launch of commercial 5G services will require substantial investments on the part of Canadian facilities-based wireless operators.

## AI & automation

Amidst the commotion caused by COVID, the changing nature of work in Canada continues to morph, driven by advances in automation technology. During this time, businesses have adopted technology to improve productivity, which generally results in workers spending less time performing routine, manual tasks in favour of non-routine, cognitive tasks. Recent and significant advances in artificial intelligence (AI) may have accelerated this trend. A Statistics Canada study shows us that the pandemic could further encourage firms to adopt automation technology as they look to make the production and delivery of goods and services more resilient in the future.

The Stats Can results reveal a gradual shift from occupations involving routine tasks to those involving non-routine tasks over

the past three decades. No sudden shifts were observed over the last decade as the development of AI expanded. This suggests that—at least until 2018—AI has not accelerated the changing nature of work in Canada, which had already been underway for decades. Nonetheless, the cumulative changes over this period are notable.

## Robots rising

It is also interesting to note that among the Canadian firms that 'hired' robots in 2020 have also hired more, not fewer human workers, as you may be led to believe. The surprising findings shows the human workforce is 15% higher in firms with robots than in similarly placed firms. But, they hire fewer managers to oversee them, and tasks and responsibilities shift within the firm. Turnover increases for all types of workers, but middle-skilled workers appear to fare worse than both their high and low skilled counterparts, according to the report.

The study also demonstrates that robot investment has been concentrated in certain manufacturing industries, but is now spreading to other areas of the economy.

Of the 3,085 Canadian businesses importing robot hardware in 2020, over half appear to be using them in production.

The truth of the matter is that the response of Canadian businesses to COVID-19 have sped-up the adoption of telco, digital, AI and automated technologies by several years. Many of these changes will not go away, but accelerate into the long haul. **EP&T**

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# EP&T

**ELECTRONIC PRODUCTS & TECHNOLOGY**

Canada's information leader for electronic engineers and designers

**MARCH / APRIL 2021**  
Volume 43, Number 2

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EP&T is published eight times per year by  
**ANNEX BUSINESS MEDIA**

111 Gordon Baker Road,  
Suite 400  
Toronto, ON M2H 3R1  
Tel (416) 442-5600  
Fax (416) 510-5134  
www.annexweb.com

## SUBSCRIPTION RATES

Canada – \$58.50 one year; \$94.00 two years  
USA – \$134.00 (CAD) per year  
International – \$183.50 (CAD) per year  
Single copy – Canada \$15

**ISSN 0708-4366** (print)  
**ISSN 1923-3701** (digital)

**PUB. MAIL AGREEMENT NO. 40065710**  
Return undeliverable Canadian addresses to: EP&T Circulation Department,  
111 Gordon Baker Rd. Suite 400,  
Toronto, ON M2H 3R1



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**PRINTED IN CANADA**

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## WEARABLES

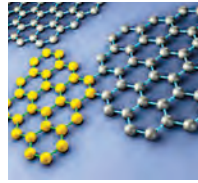
### UOTTAWA TEAM UNEARTHS LIMITLESS POSSIBILITIES OF WEARABLES

University of Ottawa professor Benoît Lessard and his team are developing carbon-based technologies which could lead to improved flexible phone displays, make robotic skin more sensitive and allow for wearable electronics that could monitor the physical health of athletes in real-time.

With the help of the Canadian Light Source (CLS) at the University of Saskatchewan (USask), a team of Canadian and international scientists have evaluated how thin film structure correlates to organic thin-film transistors performance. Organic electronics use carbon-based molecules to create more flexible and efficient devices. The display of smart phones is based on organic-LED technology, which uses organic molecules to emit bright light and others to respond to touch.

Lessard is excited about the data his team has collected at the HXMA beamline. To improve on this technology, the team is engineering the design and processing of phthalocyanines, molecules used traditionally as dyes and pigments.

"The features that make a molecule bright and colourful are features that make them able to absorb and emit light effectively," Lessard said. "A lot of things we want in a dye or pigment is the same thing we are looking for in your OLED display --brightly coloured things that make light."



*A U of Ottawa team of scientists evaluate how thin film structure correlates to organic thin-film transistors performance.*

## INNOVATION HUB

### KANATA NORTH BIZ GROUP UNVEILS HUB350

Kanata North Business Association (KNBA), a technology park outside of Ottawa, announced the state-of-the-art global technology centre Hub350. The facility will promote growth on a global scale by bringing together industry, academia and finance professionals in Kanata North to further support its member companies.

Hub350 represents the creation of a physical community to support members and its employees, community partners and sponsors. KNBA president and executive director Jamie Petten said the centre will serve as the 'gateway to Canada's largest technology park.'

"This will be a gateway to growth, to finance, to talent, to success,"



*Innovation hub is intended to become a "gateway to growth, finance, talent and to success."*

Petten said. "The Hub350 space will be the truest intersection of nature and technology – a trendy, natural atmosphere to attract world class talent and companies, while showcasing Kanata North as Canada's destination to live, work, play and learn."

The centre will be supported by and connected to three pillars – private sector, finance and academia – in order to connect members of the technology park to a wide range of resources that will support their continued growth. Hub350 will better facilitate introductions for member companies to funding resources, research, and new talent.

## EDUCATION

### SAMSUNG PARTNERS WITH CENTENNIAL COLLEGE



Samsung Electronics Canada has extended its partnership with Centennial College's Electronics Engineering Technician program through 2023. Over the last five years, Samsung has supported more than 275 Centennial students to develop the skills needed to pursue a wide range of opportunities in electronics engineering for digital appliances, with a number of program graduates now working at Samsung Service Centres across the province.

The SamsungTech Institute and the Electronics Engineering Technician program integrate curriculum that was developed in response to the strong demand for electronic technicians in the digital home appliance service sector. At the heart of the two-year program is a fully-functioning digital servicing and home appliance lab at the Progress Campus in Toronto.

## ACQUISITION

### ITAC SOFTWARE ACQUIRES COGISCAN

iTAC Software AG, a member of the Dürr Group, is strengthening its position in the area of digitalization/ Industry 4.0 by acquiring 100% of the shares of Canadian company Cogiscan Inc., a solution provider for the electronics manufacturing industry. A leader in connectivity and analytics, Cogiscan will continue to operate independently.



Bromont-based Cogiscan brings a deep domain expertise in the area of connectivity, analytics and factory automation software along with an extensive network of partnerships with leading machine and software vendors.

"Digitalization is one of the Dürr Group's core competences and offers great potential for growth. With the acquisition of Cogiscan, we will be adding a strong team of experts and key technologies to the Digital Factory, which is a cross-divisional virtual organization for joint development of digital products within the Dürr Group," explains Peter Bollinger, CEO of iTAC Software AG.

### EXFO PARTNERS WITH OPENREACH FOR FULL FIBRE INITIATIVE

EXFO Inc., Quebec City-based communications industry's test, monitoring and analytics player, and Openreach, the United Kingdom's largest digital infrastructure firm, announced its collaboration on a major initiative to accelerate Full Fibre deployment, and enhance the quality of build and experience for customers across the UK.

The project is essential for delivering next-generation Fibre-to-the-Premises (FTTP) networks, which provide the digital infrastructure required to work, learn and socialize. As part of its industry-leading Fibre First programme, Openreach has committed to delivering 20 million homes passed with FTTP by the mid-to late 2020s, assuming it has the right investment conditions. Openreach has also committed to building out this new digital infrastructure to 4.5 million premises by the end of March 2021.

Following a competitive tender process, Openreach awarded EXFO the contract to supply optical test heads and test access switching for this initiative. With its cloud-based Nova Fiber solution, EXFO will equip Openreach to assure its build, thereby accelerating the programme and avoiding costly return visits to fix connection problems.

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# GREENLIGHT INNOVATION rides growth in fuel cell vehicle adoption



Ross Bailey, managing director at Greenlight in Vancouver shares his thoughts on the role hydrogen fuel cells will have in electric vehicles.



A global leader in the supply of fuel cell and battery test equipment, Greenlight Innovation enables its customers in next-gen energy sources.

Based on the position of the burgeoning hydrogen fuel cell, electrolyzer, and energy storage device industries, Greenlight Innovation has reason to be confident about its future as a leading-edge supplier of test equipment to this market. Clean energy policy is driving the need for clean, emission-free transportation. The emission from Hydrogen fuel cell vehicles is water, and Greenlight has been growing by double digits since 2016. WestTech Report was given the opportunity to chat with managing director Ross Bailey about the niche that fuel cells will fill with the growth of electric vehicles, the challenges since taking control of the company in late 2007, and future challenges having grown the company organically.

## Complimentary benefits to transportation needs

Electric vehicles have dominated the headlines since the meteoric rise and fall in the valuation of hydrogen fuel-cell company Ballard Power. After many false starts, hydrogen-powered fuel cell solutions are re-emerging, but it may not be a case of fuel cell cars beating electric cars.

"I expect we are going to see both technologies providing complimentary benefits to our diverse transportation needs," says Bailey. "For one thing, fuel

**"Those early, tough years helped to galvanize the core members of the company, but the core mission has remained the same"**

cell development was at a lower technology readiness level than batteries and hence Lithium-Ion battery technology was commercialized first. Secondly, I think batteries are doing a good job for light-duty passenger vehicles, primarily in cities."

On the other hand, where fuel cells may have found their niche is in heavy-duty transportation, such as buses, trucks, and commercial vehicles, especially where goods are being transported. Fuel cell vehicles can deliver a range similar to internal combustion cars, without the burden of batteries, with a refueling time similar to gasoline or diesel. To illustrate the impact of this, consider long-haul trucking industries having to allow cargo to sit on trucks for extended periods while recharging takes place. It takes hours to recharge electric batteries as opposed to minutes with fuel cells.

One caveat is that the infrastructure for the hydrogen fueling stations needs to be built out. But, it is coming. Switzerland is receiving trucks. Nicola is planning on building the infrastructure for their hydrogen trucks.

"There is no other solution coming along that could meet [the need for emission-free long-haul trucking]. It is going to be fuel cells. And, we will be there. If we are going to be decarbonizing, this is the only solution," Bailey emphasized.

Greenlight was founded in 2008 as a spin-off from Hydrogenics Corp., which is a Mississauga-based fuel cell and hydrogen electrolyzer company:

"I led a management buyout with three other managers who were working there at the time. I felt this could be a viable company if it was right-sized since there was some market demand and we had product offerings," adds Bailey. "It turned out that the spring of 2008 wasn't a great time to launch a business with automotive companies as your customers."

## Test equipment used on next-gen energy tech

Those early, tough years helped to galvanize the core members of the company, but the core mission has remained the same.

"We all believe we are doing something meaningful for the planet. We may not be creating

clean energy products ourselves but the test equipment we make is used by our customers to create the next generation of energy technologies," explains Bailey. "Many of the fuel cell vehicles that are in development or on the road now have been developed on our test equipment. It is rewarding because we are selling to virtually every automotive company that has a fuel cell program."

Covid-19 has forced many businesses to change business models, and Greenlight is no stranger to pivoting. Consider that revenue from the automotive industry for Greenlight went to 0% from 2009-2011 due to the global recession, and now it accounts for 80% of revenues. With the pandemic restrictions easing off, Greenlight can focus on handling double-digit growth, and even with the expansion to a new, larger building last year, they are already considering taking additional space. Perhaps the Covid-19 trend towards home offices might even work in their favour.

To learn more, go to [www.greenlightinnovation.com](http://www.greenlightinnovation.com). **EP&T**



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# The importance of interoperability testing for O-RAN validation

*Being 'locked in' to a proprietary RAN has put mobile network operators (MNOs) at the mercy of network equipment manufacturers*

BY DYLAN MCGRATH, KEYSIGHT TECHNOLOGIES



Photo: eMetanetworks / Adobe Stock

Throughout most of cellular communications history, radio access networks (RANs) have been dominated by proprietary network equipment from the same vendor or group of vendors. While closed, single-vendor RANs may have offered some advantages as the wireless communications industry evolved, this time has long since passed. Being 'locked in' to a proprietary RAN has put mobile network operators (MNOs) at the

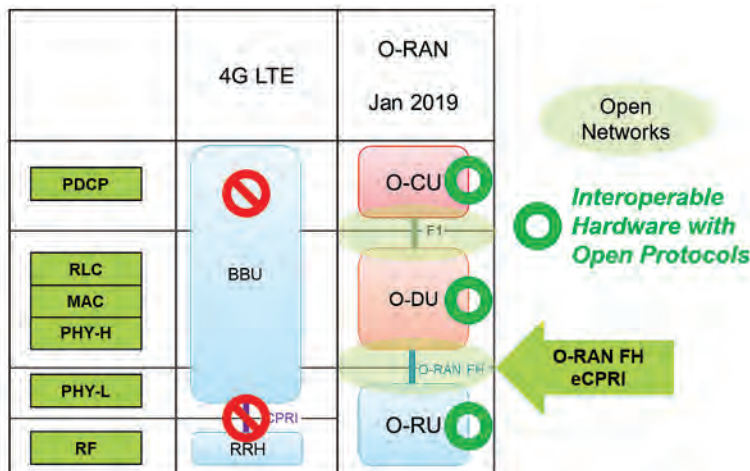
mercy of network equipment makers and become an innovation bottleneck.

Eventually, the rise of software-defined networking (SDN) and network function virtualization (NFV) brought to the network core greater agility and improved cost efficiencies. But the RAN, meanwhile, remained a single-vendor system.

In recent years, global MNOs have pushed the adoption of an open RAN (O-RAN) architecture for 5G. This article examines the advantages of

## 5G

The advantages of implementing an open RAN architecture for 5G and the importance of conducting testing.



Closed Interfaces and Proprietary Hardware / Protocols

Open Networks  
Interoperable Hardware with Open Protocols  
O-RAN FH eCPRI

**Figure 1.**  
The major components of the 4G LTE RAN versus the O-RAN for 5G.

implementing an open RAN architecture for 5G. It also discusses the principles of the open RAN movement, the structural components of an open RAN architecture, and the importance of conducting both conformance and interoperability testing for open RAN components.

### The case for open RAN

The momentum of open RAN has been so forceful that it can be challenging to track all the players, much less who is doing what.

The O-RAN Alliance — made up of more than 25 MNOs and nearly 200 organizations from across the wireless landscape — has since its founding in 2018 been developing open, intelligent, virtualized, and interoperable RAN specs. The Telecom Infra Project (TIP) — a separate coalition with hundreds of members from across the infrastructure equipment landscape — maintains an OpenRAN project group to define and build 2G, 3G, and 4G RAN solutions based on general-purpose hardware-neutral hardware and software-defined technology. Earlier this year, TIP also launched the Open RAN Policy Coalition, a separate group under the TIP umbrella focused on promoting policies to accelerate and spur adoption innovation of open RAN technology.

In February, the O-RAN Alliance and TIP announced a cooperative agreement to align on the development of interoperable open RAN technology, including the sharing of information, referencing specifications, and conducting joint testing and integration efforts.

The O-RAN Alliance has defined an O-RAN architecture for 5G and has defined a 5G RAN architecture that breaks down the RAN into several sections. Open, interoperable standards define the interfaces between these sections, enabling mobile network operators, for the first time, to mix and match RAN components from several different vendors. The O-RAN Alliance has already created more than 30 specifications, many of them defining interfaces.

Interoperable interfaces are a core principle of open RAN. Interoperable interfaces allow smaller vendors to quickly introduce their own services. They also enable MNOs to adopt multi-vendor deployments and to customize their networks to suit their unique needs. MNOs will be free to choose the products and technologies that they want to utilize in their



networks. As a result, MNOs will have the opportunity to build more robust and cost-effective networks leveraging innovation from multiple sources.

Enabling smaller vendors to introduce services quickly will also improve cost efficiency by creating a more competitive supplier ecosystem for MNOs, reducing the cost of 5G network deployments. Operators locked into a proprietary RAN have limited negotiating power. Open RANs level the playing field, stimulating marketplace competition, and bringing costs down.

Innovation is another significant benefit of open RAN. The move to open interfaces spurs innovation, letting smaller, more nimble competitors develop and deploy breakthrough technology. Not only does this create the potential for more innovation, it also increases the speed of breakthrough technology development, since smaller companies tend to move faster than larger ones.

Other benefits from an operator perspective may be less obvious, but no less significant. One notable example is in the fronthaul — the transport network of a Cloud-RAN (C-RAN) architecture that links the remote radio heads (RRHs) at the cell sites with the baseband units (BBUs) aggregated as centralized baseband controllers some distance (potentially several miles) away. In the O-RAN Alliance reference architecture, the IEEE Radio over Ethernet (RoE) and the open enhanced CPRI (eCPRI) protocols can be used on top of the O-RAN fronthaul specification interface in place of the bandwidth-intensive and proprietary common public radio interface (CPRI). Using Ethernet enables operators to employ virtualization, with fronthaul traffic switching between physical nodes using off-the-shelf networking equipment. Virtualized network elements allow more customization.

Figure 1 shows the layers of the radio protocol stack and the major architectural components of a 4G LTE RAN and a 5G open RAN. Because of the total bandwidth required and fewer antennas involved, the CPRI data rate between the BBU and RRH was sufficient for LTE. With 5G, higher data rates and the increase

in the number of antennas due to massive multiple-input / multiple-output (MIMO) means passing a lot more data back and forth over the interface. Also, note that the major components of the LTE RAN, the BBU and the RRH, are replaced in the O-RAN architecture by O-RAN central unit (O-CU), the O-RAN distributed unit (O-DU), and the O-RAN radio unit (O-RU), are discussed in greater detail below.

### Principles and components of open RAN architecture

As stated earlier, one core principle of the open RAN architecture is openness, specifically in the form of open, interoperable interfaces that enable MNOs to build RANs that feature technology from multiple vendors. The O-RAN Alliance is also committed to incorporating open source technologies where appropriate and maximizing the use of common-off-the-shelf hardware and merchant silicon while minimizing the use of proprietary hardware.

A second core principle of open RAN, as described by the alliance, is the incorporation of greater intelligence. The growing complexity of networks necessitates the inclusion of artificial intelligence (AI) and deep learning to create self-driving networks. By embedding AI in the RAN architecture, MNOs can increasingly automate network functions and minimize operational costs. AI also helps MNOs increase the efficiency of networks through dynamic resource allocation, traffic steering, and virtualization.

The three major components of the O-RAN for 5G (and retroactively for LTE) are the O-CU, O-DU, and the O-RU.

- The O-CU is responsible for the packet data convergence protocol (PDCP) layer of the protocol.
- The O-DU is responsible for all baseband processing, scheduling, radio link control (RLC), medium access control (MAC), and the upper part of the physical layer (PHY).
- The O-RU is the component responsible for the lower part of the physical layer processing, including the analog

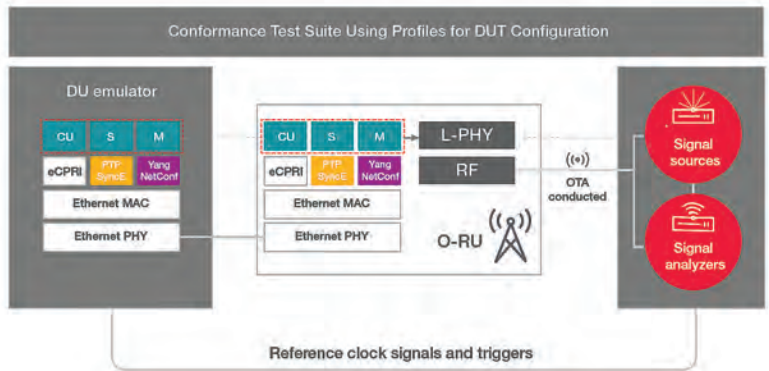


Figure 2. Test equipment radio in the O-RAN conformance specification.

components of the radio transmitter and receiver.

Two of these components can be virtualized. The O-CU is the component of the RAN that is always centralized and virtualized. The O-DU is typically a virtualized component; however, virtualization of the O-DU requires some hardware acceleration assistance in the form of FPGAs or GPUs.

At this point, the prospects for virtualization of the O-RU are remote. But one O-RAN Alliance working group is planning a white box radio implementation using off-the-shelf components. The white box enables the construction of an O-RU without proprietary technology or components.

### Interoperability testing

The introduction of the open RAN and distributed RANs change the current testing equation, requiring test of each component of the RAN in isolation for conformance to the standards and testing combinations of components for interoperability.

Why test for both conformance and interoperability? It is essential to determine both that the components conform to the appropriate standards in isolation and that they work together as a unit.

Conformance testing usually comes first to ensure that all the components meet the interface specs. Testing each component in isolation calls for test equipment that emulates the surrounding network to ensure that the component conforms to all capabilities of the interface protocols.

Conformance testing of components in isolation offers several benefits. For one thing, conformance testing enables the conduction of negative testing to check the component's response to invalid inputs, something that

is not possible in interoperability testing. In conformance testing, the test equipment can stress the components to the limits of their stated capabilities. Conformance testing also enables test engineers to exercise protocol features that they have no control over.

The conformance test specification features several sections with many test categories to test nearly all 5G O-RAN elements.

Interoperability testing of a 5G O-RAN is like interoperability testing of a 4G RAN. Just as 4G interoperability testing amounts to testing the components of an eNB as a unit, the same procedures apply to testing a gNodeB (gNB) in 5G interoperability testing. The change is minimal.

Conformance testing is quite different for 5G O-RAN and requires a broader set of equipment. For example, the conformance test setup for an O-RU includes a vector signal analyzer, a signal source, and an O-DU emulator, plus a test sequencer for automating the hundreds of tests included in a conformance test suite. Figure 2 shows the test equipment radio in the O-RAN conformance test specification.

### Conclusion

As we have seen, the open RAN movement has considerable momentum and is a reality in the era of 5G. While the adoption of open RAN architecture brings significant benefits in terms of greater efficiency, lower costs, and an increase in innovation.

### EP&T



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# Opportunities for bringing IEEE TSN standards to wireless applications

Key takeaways from Avnu Alliance's wireless TSN whitepaper

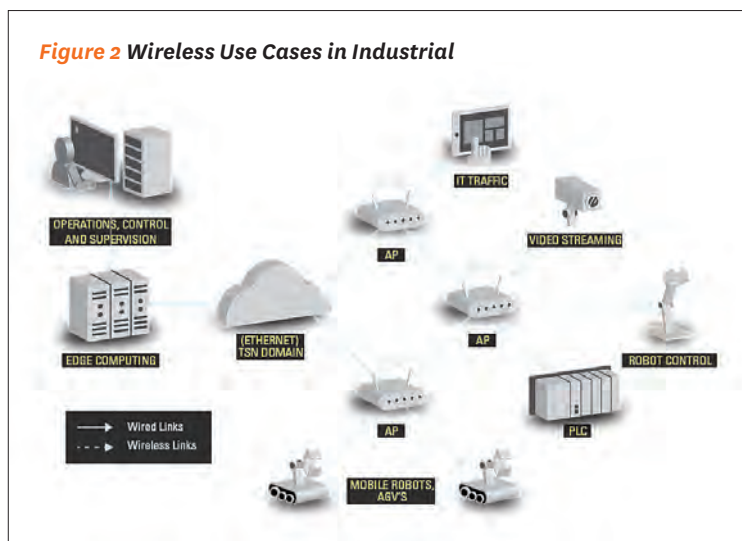
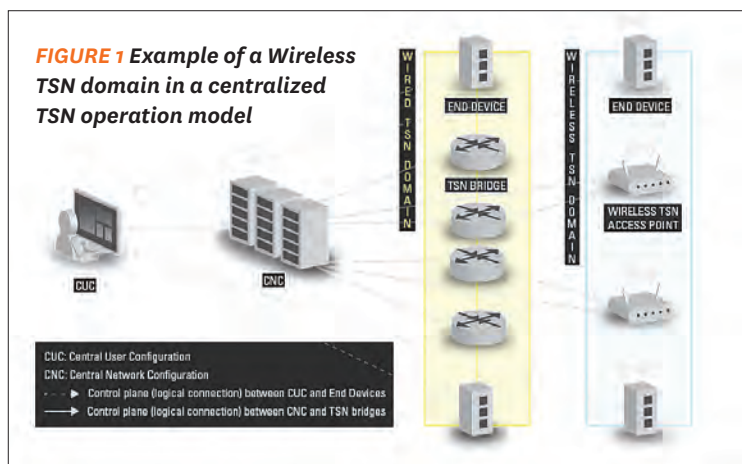
BY DAVE CAVALCANTI, PRINCIPAL ENGINEER, INTEL & AVNU ALLIANCE  
WIRELESS TSN WORKING GROUP CHAIR



The rise of 5G and Wi-Fi 6/6E networks combined with Time Sensitive Networking (TSN) technology, a family of IEEE 802.1 standards to enable time synchronization and data delivery with strict latency bounds, is poised to accelerate the adoption of TSN and dramatically expand the use cases for wireless networks. Traditional time-critical applications for TSN have been in Ethernet-based wired network applications, most extensively in the pro media and industrial markets. Global Market Insights estimates that the TSN market will grow by 30% annually over the next five years, increasing from \$200 million USD in 2019 to over \$1 billion USD in 2026. This explosive growth is driven largely by the 'things' in our lives getting smarter - factories, power plants, cars, etc. - and relying more and more on wireless networks to do so.

As the benefits of wireless communications are becoming increasingly apparent, e.g., greater flexibility, higher mobility and reconfigurability, and lower maintenance costs, interest in extending TSN to wireless applications is also growing.

As an organization dedicated to driving change and creating an interoperable ecosystem of networked devices using the foundational, open IEEE TSN standards, Avnu Alliance is well-positioned to help the industry determine next steps. As an introduction to these new opportunities and to guide Avnu's activities, the WTSN group published a whitepaper, titled *Wireless TSN - Definitions,*



*Use Cases & Standards Roadmap.* The whitepaper introduces the basic terminology, use cases, and standards for extending TSN capabilities over wireless networks including Wi-Fi and 5G. It also serves as an introduction to the larger concept of wireless TSN and a resource for defining the work required within Avnu, along with the contribution of industry partner organizations, to test and prepare the technology for the market. Key takeaways are summarized here.

## Defining the terminology

As TSN-enabled devices and networks start to be deployed, enabling extensions of similar capabilities over wireless is a natural next step, with TSN-enabled networks extending from wired (Ethernet) to wireless domains. The term "Wireless TSN", is used to refer to a wireless network that extends IEEE 802.1 TSN capabilities over wireless media. The Wireless TSN links can enable wireless access to end devices and computing

resources as well as extend the range of wired TSN networks. But not every wireless technology is currently capable of supporting TSN features. Therefore, the Wireless TSN group within Avnu have decided to narrow our focus to the IEEE 802.11/Wi-Fi and 5G standards, given the recent advances and features available to enable TSN-grade performance from these two technologies.

To fully tap into and leverage the IEEE 802.1 TSN standards and ecosystem developed around them, it is important to enable seamless operation and interoperability that extends from wired to wireless TSN domains. Some of the challenges associated with mapping TSN capabilities to wireless include the fundamental differences between wireless and wired communications - for example, the variable capacity of wireless links and the Packet Error Rate (PER) being typically higher in wireless. The broadcast nature of wireless is another important aspect to be considered. On one hand, it may open up the possibility to reach more devices with a single transmission and on the other, it is more susceptible to interference. As a result, coordinated access is very important as well as resilience to interference.

## Potential Applications

The potential applications and use-cases for Wireless TSN are numerous, but one of the most promising area is the Industrial IoT (IIoT). TSN applications in Industrial have continued to expand in the last few years, as these settings have witnessed increasingly sophisticated network requirements as more operational components and IT networks converge. In today's smart factories, sophisticated industrial robots and assembly line machines require new levels of mobility, flexibility, and reconfigurability of tasks. Wireless TSN allows the remote control, programming, diagnostics, re-routing, and real-time control of robots - without requiring them to be fixed in place.

Use cases related to control of Power Grid components have also been described in the IETF



DetNet group. One unique aspect to be considered in some electrical power grid systems is the required coverage area, which may vary from local (e.g. substation) to wide areas (distribution and transmission). Industrial control systems require the highest level of determinism and reliability, which can be enabled by the IEEE 802.1Qbv time-aware scheduling standard for wired and wireless networks.

Though the IIoT encompasses some of the largest use cases for TSN, wireless TSN will also enable better and more efficient large-scale media experiences. Live performances often require miles of Ethernet cabling that must be set up and torn down over the course of a few hours. The cables and connectors inevitably get damaged over time, creating issues that are difficult and time consuming to troubleshoot. As wireless TSN technology matures, cables will be replaced by portable wireless connections, significantly reducing the overall cost of deployment and operation of live audio systems. The adoption of standards-based wireless networks such as Wi-Fi 6 and 5G for media transport in live sound applications will address another problem for live sound applications as well: currently, UHF bands are used in professional wireless audio links with highly specialized RF solutions. These dedicated spectrum resources are dwindling.

Additional potential use-cases for Wireless TSN include automotive and transportation – for example, to reduce production costs that wiring harnesses and other network components can bring to transportation.

### Where is Wireless TSN headed?

Wireless TSN has enormous potential to radically transform networking across industries in an open, standards-based fashion. This technology is still in its youth, though, and face hurdles that must be addressed to ensure its growth.

Anticipated challenges with widespread adoption include the problem of network interference and wireless channel dynamics. Security is also another important requirement. Because TSN is

based on Ethernet and wireless standards (IEEE 802.11/Wi-Fi and 5G), networks can take advantage of security best practices and standards that have already been developed for Ethernet, 802.11/Wi-Fi, and 3GPP systems.

Other challenges include latency during mobility and roaming procedures, and the need for ongoing management and configuration of TSN features and network resources. In order to continue leveraging existing

TSN standards and ecosystems, we'll also need to define a common model with clear service requirements and capabilities to integrate and test wireless technologies with a TSN domain.

Moving forward, it is important for the TSN community to gain a deeper understanding on how wireless networks can provision resources to serve time-sensitive traffic. Some of the next steps will include detailed requirements analysis for different markets,

test procedures and certification plan for future WTSN products. **EP&T**



**Dave Cavalcanti** is a PhD in computer science & engineering from the University of Cincinnati. He is Principal Engineer at Intel Corp. He is also a senior member of the IEEE and serves as chair of the Wireless TSN working group in the Avnu Alliance. For whitepaper, visit [avnu.org/wirelessTSN](http://avnu.org/wirelessTSN).

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# Low power optimizations for a Bluetooth connected wearable

*MistyWest improves the battery life of a Bluetooth wearable using optimized firmware*

BY JUSTIN LAM, WITH CONSULTATION FROM KEVIN LOCKWOOD, SYSTEMS & BLUETOOTH ENGINEER AT MISTYWEST

Bluetooth Low Energy (BLE) devices have seen exponential growth over the past five years, and companies are constantly adding greater functionality to stay connected (such as adding machine learning to low power devices). When it comes to battery-powered IoT devices like wearables, battery life will make-or-break your product for end-users. As devices become more complex, increasing in features, processing power, data rates, and range, the added functionality typically comes at a reduction in battery life.

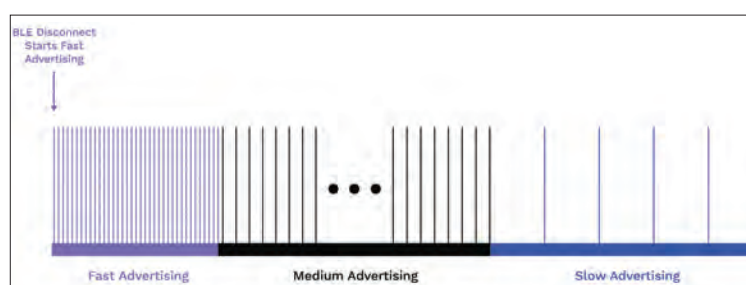
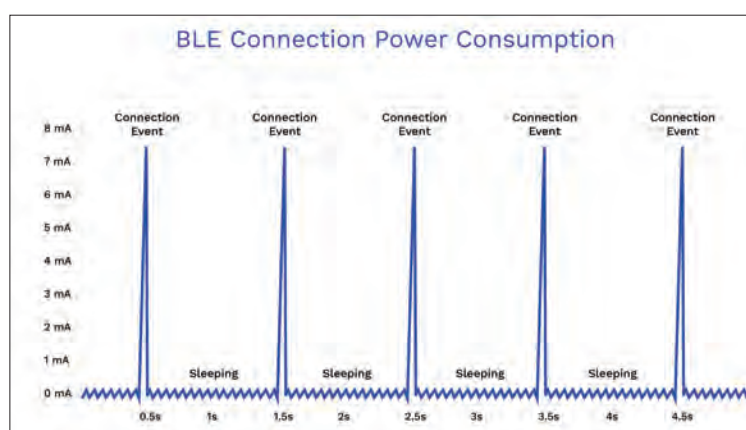
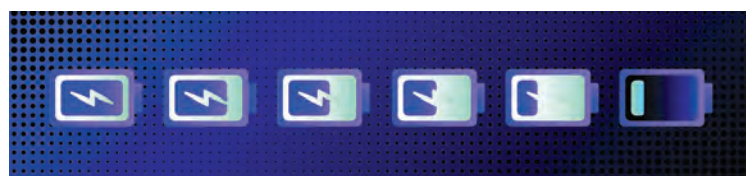
In addition to a negative user experience, poor battery life also results in the need to have frequent charging, which impacts the overall battery lifetime health. Since lithium batteries have a limited number of charge cycles, frequent charging will lead to faster degradation and a reduction in total charge capacity.

Power consumption issues are typically a result of poor hardware and firmware design, and there are scenarios where time and/or budget do not provide an opportunity for another hardware revision to fix said issues. Fortunately, clever firmware design can often mitigate issues around excessive power consumption.

In this article, we'll discuss how we took a client's hardware of a BLE wearable IoT device and improved the battery life from under 10 days to over 45 days through firmware optimizations alone.

## A Primer on Bluetooth

Bluetooth was originally developed by Ericsson Mobile in 1989, with the original purpose of developing wireless headsets. This is known as Bluetooth 3.0, or Bluetooth Classic, and this



Current Consumption Comparisons			
	Original Firmware	Improved Firmware	Improvement Factor
Advertising	0.144 $\mu$ A	0.009 $\mu$ A	16
Active Connection	0.16 $\mu$ A	0.007 $\mu$ A	23
Sensor Reading	0.013 mA	0.005 mA	3
Peripheral Consumption	0.22 mA	0.08 mA	3
Battery Life	~10 days	~45 days	4

specification had high power consumption and was not appropriate for battery powered sensors with intermittent, low data rate transmission. Eventually, we arrived at the birth of Bluetooth 4.0, or Bluetooth Low Energy (BLE), specifically for the low power IoT sensor industry.

Bluetooth LE provides considerably lower power consumption and cost while maintaining a similar communication range. The protocol allows for the BLE Radio to sleep idle for the majority of the time between RF events, keeping power consumption in the  $\mu$ A range.

This allows for devices to operate on coin cell batteries with a lifetime of years. The maximum data through-put depends on which version of BLE as well as and the Connecting Host device. Practical Maximum Throughput:

- Bluetooth 4.0-4.1:  
2.13 Kbytes/sec
- Bluetooth 4.2:  
28.8 – 126.4 Kbytes/sec
- Bluetooth 5.0:  
57.6 – 171.48 Kbytes/sec

## BLE Radio

A Bluetooth LE radio can either be included as a single system on chip with an integrated microprocessor with an external host microprocessor. While the integrated option can save on board space and will have a smaller physical footprint, an external radio can be more power efficient since the microcontroller doesn't need to be on for the radio peripheral to operate. The needs of your specific application will determine which implementation is the most suitable.

With any wireless protocol, if a device is frequently connecting and disconnecting, the more power it consumes. Specifically with Bluetooth, advertising (when disconnected) consumes significantly more power since it broadcasts across three radio-frequency channels. However, once a connection has been established, it drops down to one active channel and consumption is reduced. Bluetooth is a short range protocol, proximity is (or should) never be guaranteed. Devices must be able to operate efficiently if not connected to a host device for hours/days at a time.

In firmware, a state machine can be used to optimize the advertising intervals. By starting with 'fast advertising', we can ensure that if a host device is nearby, we can connect to it quickly. However, if one isn't present for some time, we can reduce the advertising interval to a 'medium advertising' mode. If one is still not present after minutes have elapsed, we can further reduce to a 'slow advertising' mode since the probability of a nearby host is low. Typical current consumption values for each of the modes is below,



where each sequential mode is a magnitude (or more) lower:

- Fast =  $\sim 0.48$  mA
- Medium =  $\sim 0.078$  mA
- Slow =  $\sim 18$   $\mu$ A

You can imagine that if the device is always in fast advertising but is disconnected for hours or days, the battery life will be significantly reduced compared to if different states were used. Data throughput can also be managed dynamically, where it is maximized only when data transmission is required, and reduced to a keep-alive pulse when no new data is present to simply maintain the connection.

On our client's hardware, data was collected off an inertial measurement unit (IMU) to analyze and determine insights on the user's behaviour. The original firmware used a software timer polling implementation, where the microcontroller would wake up, read the sensor for data, then go back to sleep. However, this is an inefficient method because there is power overhead in both

waking up the microcontroller and reading a single measurement from the sensor over a fast SPI interface. The microcontroller consumes significantly more power at operation ( $\sim 4$  mA) compared to the sensor ( $< 5$   $\mu$ A), leading to a non-trivial amount of excess consumption.

An improvement to this is to use an interrupt-driven, first-in-first-out (FIFO) queue. In this implementation, the IMU continually stores samples in its internal FIFO, and when a watermark is reached, it wakes up the microcontroller and delivers all stored samples (configurable up to several hundred) at once. In comparison, the power hungry microcontroller can read and process hundreds of samples instead of reading one at a time, as done in the polling method. Writing to non-volatile memory like flash or EEPROM can also draw a significant amount of current, and reducing the frequency of this operation will only help

increase battery life. Writing to SRAM consumes much less current than writing to non-volatile memory, and since the microcontroller is always powered, the volatile memory is not at the risk of losing data. By offloading the processing to the lowest power device, we were able to reduce the average consumption by  $\sim 3$ x.

### Peripheral Management

When programming microcontrollers, it's easy to fall into the habit of enabling peripherals without considering their lifetime or impact on battery life. To truly optimize battery life, careful control of peripherals and resources should be done to ensure they're disabled when not in use. This is typically done by setting or clearing a bit in a power register. Using a real-time operating system like FreeRTOS can help simplify this management of resources, since tasks can be easily suspended and resumed while maintaining

clean code and a clear separation of concerns between modules.

The table (at left) provides a summary of the high level components and the resulting reduction in current consumption. In certain areas, we were able to reduce current consumption by a factor of 3, and others by orders of magnitude. Ultimately, we were able to increase battery life on a 100mA lithium-ion battery from  $\sim 10$  days to  $\sim 45$  days.

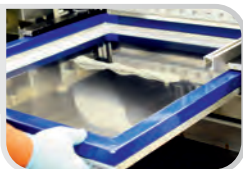
### Conclusion

Always-on, connected devices provide challenges to hardware and firmware engineers. A host of optimizations can be done including timing accuracy, RF optimization, antenna design, minimizing leakage current across components and other fine-tuned power management. **EP&T**

*MistyWest is a product development partner that acts as the bridge from lab to assembly line for intelligent and connected devices [www.mistywest.com](http://www.mistywest.com)*



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# The (re)emergence of inductive resonant wireless charging

*High-frequency solutions are becoming leading contenders for new use cases*



About three years ago, a major inflection point happened in the wireless power industry. Apple announced that its phones would charge wirelessly using the Wireless Power Consortium's Qi Standard. This was a big moment for the industry, as it brought together all the major players on a single standard, offering the benefits of interoperability and safety on a global scale.

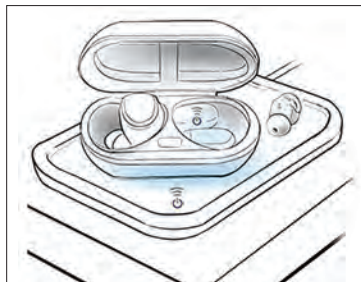
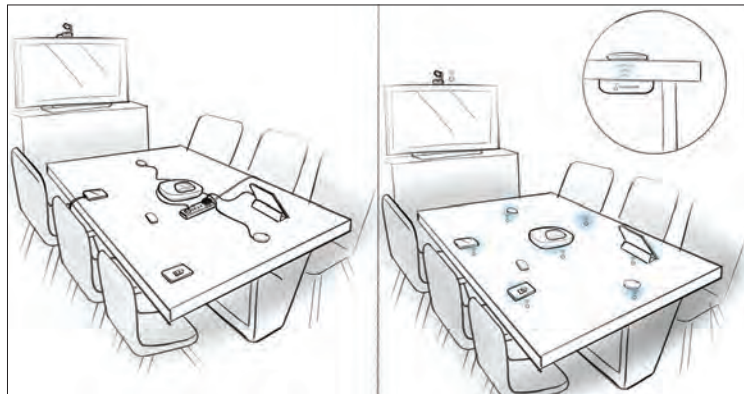
Qi's low-frequency, inductive charging method prevailed over a high-frequency, inductive resonant method promoted by the AirFuel Alliance (which merged the Power Matters Alliance (PMA) with the Alliance for Wireless Power (A4WP)). As a result, billions of Qi-certified phones and chargers have since been sold, making Qi a global wireless charging standard.

But, Qi-based charging has limitations — most notably, power levels, freedom of placement and a constrained design limitation of the outer dimensions of the wireless power antenna (~25mm diameter). Because of these limitations, product developers who value the benefits of wireless charging are revisiting high-frequency solutions promoted by the NFC Forum and AirFuel Alliance.

## Power and Data Using NFC

NFC is the newest entrant into the wireless power standards game, and its potential is massive. With an installed base of billions of devices, NFC traditionally has been used as a communications platform, but earlier this year its standards body — the NFC Forum — turned on a small amount of power transfer (~0.5 watts received) as part of the protocol.

This innovation opens up opportunities for wireless charging in a variety of small, space-constrained devices like smartwatches, fitness bands, smartglasses,



and styluses. Some of the initial products rolling out with this method of wireless power transfer include Samsung's Galaxy Fit and Huawei X Gentle Monster Smartglasses.

But, for this technology to really take off, the amount of power received needs to increase, while keeping NFC's data transfer rates in the 106 – 848 kb/s range.

NuCurrent — a US-based wireless charging technology developer with over 125 patents — has created a proprietary NFC extension that

enables up to 3 watts of power received while driving data transfer rates at 106kb/s and up.

Moving forward, NuCurrent sees applications of this proprietary extension being applied by a broad range of manufacturers across many product categories, providing a premium wireless charging experience for their users. Soon, you'll see complete wireless charging of wearable devices (either in cases or directly placed on top of the NFC antenna of the phone), which means you'll have on-the-go charging for small wearable devices with these NFC charging capabilities on-board.

AirFuel — which promotes an inductive resonant charging technology that operates at 6.78Mhz — may have lost to Qi as the de facto phone charging standard, but this method of charging has many powerful attributes. These

include a greater separation between transmitter and receiver, a one-to-many relationship between transmitter and receiver, higher power potential, and greater spatial freedom.

With all these advantages, it's easy to wonder why this method didn't take off. The answer is pretty straightforward. It comes down to cost of components, balancing system dynamics, and mastering electromagnetic interference (EMI).

Using the principles in the AirFuel standard, NuCurrent has developed a proprietary extension that clears those two hurdles to the commercialization of the technology. One example is the development of a platform that features a series of modular tiles that form an extended-range surface for wireless charging — suitable for workspaces and other areas with multiple devices of different types.

Proprietary extensions of wireless charging (in this case, Qi) create opportunities for greater functionality within a product ecosystem. Through these announcements, phone makers appear to be saying "your phone will work on Qi, but it will work best using our proprietary extension," so this is a space to keep monitoring.

But Qi (and proprietary extensions of it) aren't limited to smartphones. One example outside of mobile phones is Honeywell's CN80/85 computing platform which features a wireless charging solution developed by NuCurrent. By developing an extension off of the Qi standard, NuCurrent delivered 10 watts of charging over a 10mm gap with an authentication scheme and voltage regulation to support use in multiple vehicle types. **EP&T**

## How is Qi advancing?

Almost immediately following Apple's decision to adopt the Qi standard, Apple and Samsung began promoting proprietary extensions to Qi that allowed for faster charging of their phones. Apple's fast charging bumped the speeds from 5 watts to 7.5 watts and Samsung's extension took charging from 5 watts to 8 watts. These proprietary extensions were developed to provide a better user experience for their specific devices pushing wireless charging closer to their wired charging counterparts.

Earlier this year, Apple announced the re-launch of its proprietary MagSafe platform, which includes wireless charging up to 15 watts, but only with the iPhone 12 and at a different operating frequency than Qi. Apple's announcement follows the development of other proprietary charging extensions by major players in the industry including Huawei and Samsung.

Article submitted by NuCurrent  
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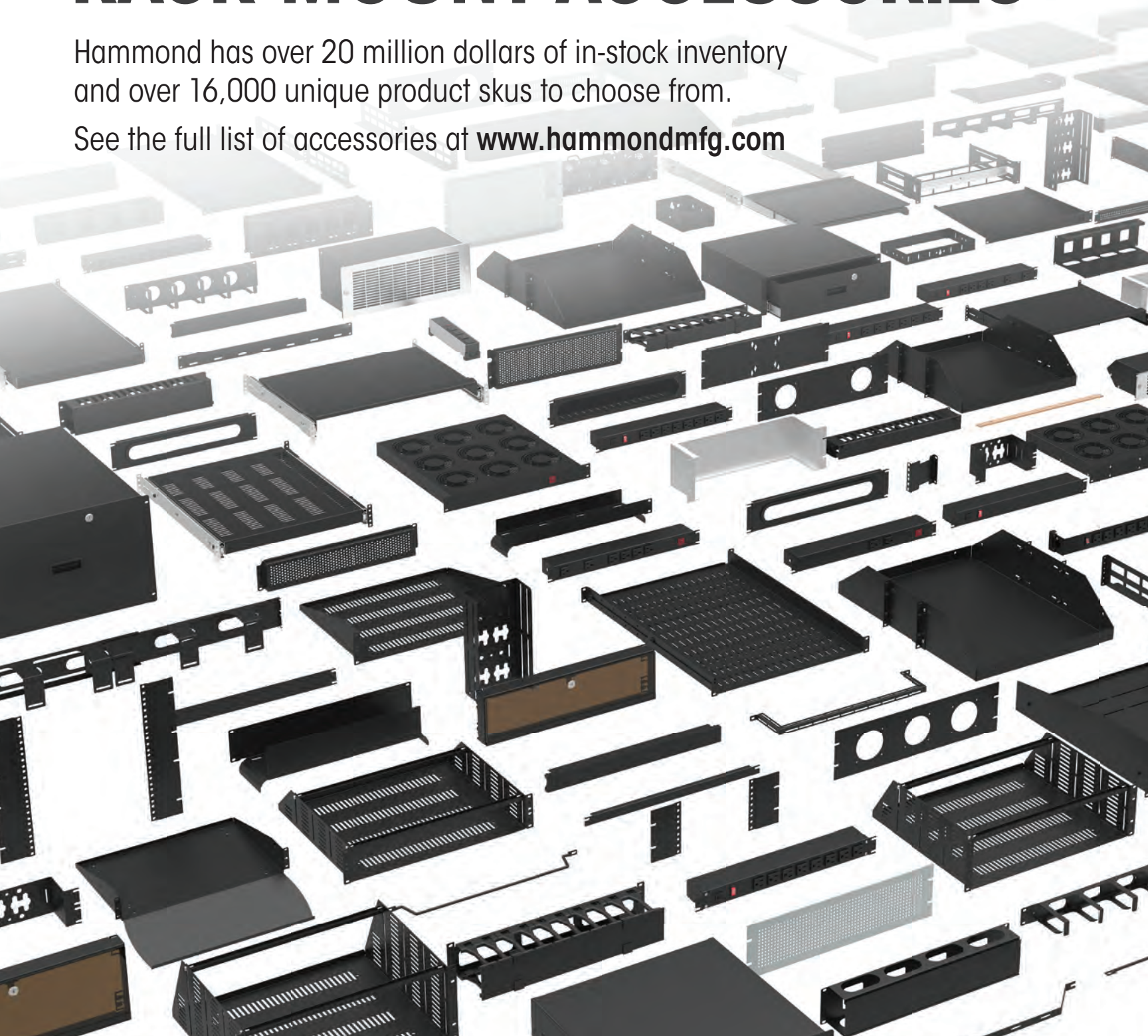


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# Editor's welcome to EPTECH On Demand



After more than 30-years of bringing Canada's electronics industry together in each of the major centres country-wide, EPTECH traditional table-top trade shows are going virtual. Bowing to the existing conditions thrust upon the business community by a global pandemic, Canada's premier B2B electronics trade show series will appear in a virtual format four different times through 2021.

Unlike the analog version of the shows, EPTECH On Demand will air for three hours, beginning at 1pm EDT each show day. The first of four virtual events to be held in 2021 is on April 28th. EPTECH On Demand will continue to provide top-notch sessions, led by industry experts, to help attendees stay on trend and grow their business. Each show date will feature a keynote speaker to kick off the day.

Leading the way on April 28th is Jean-Rémi Pouliot, CEO of Brilliant Matters, a Quebec City-based supplier of organic semiconductors and conductors for electronic OEMs. Pouliot will address the rise of printed electronics, more specifically the sub-market of organic printed electronics. The goal intended is to give a glimpse of the possibilities (market, drivers, applications, economics).

The opening keynote on May 19th will be led by Kevin Bailey, founder & CEO of Ottawa-based electronic engineering design house Design 1st. Bailey will help attendees get educated on the manufacturing process, stressing the importance of integrating manufacturing early in the product design lifecycle.

On June 16th Ethan Escowitz, founder & CEO of Arris Composites will lead a discussion on innovations in materials and manufacturing technology that permit reimagining of product design and performance.

On September 15th Tony Chahine, founder and CEO of Toronto-based textile computing giants Myant Inc., will provide industry leading insights in the area of wearable technologies.

## Face-to-face video calls and chat

EP&T's parent group, Annex Business Media, has secured PheedLoop as its online show platform – including EPTECH on Demand. The virtual event portal allows exhibitors to see, in real-time, who is visiting their booth. Interactive features include face-to-face video calls and chat. Users can share their screen on a video call, walking attendees through a website, presentation, or anything else.

We've invested a lot of time into developing the virtual EPTECH experience, that will help both exhibitors and attendees achieve a strong return on investment and on their time. Our virtual equivalent will provide attendees with the ability to have direct contact with product and service suppliers. Show visitors can still drop in on exhibitors 'booths' and chat about their project and find solutions, partners or new suppliers.

I look forward to 'virtually' seeing you there! ■

STEPHEN LAW • Editor • [slaw@ept.ca](mailto:slaw@ept.ca)

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# EPTECH Schedule

## Wednesday, April 28

**STREAM 1: Connectors and Component, Wire, Harness and Cabling**

**STREAM 2: Switches, Sensors and Displays**

**01:00 PM - 01:40 PM**

Opening Keynote

Jean-Rémi Pouliot



**Brilliant Matters**

**01:40 PM - 02:00 PM**

Trade Show & Networking

**02:00 PM - 02:30 PM**

Product Showcase

Connectors & Components, Wire, Harness and Cabling



**Schleuniger**

**02:30 PM - 03:00 PM**

Product Showcase

Connectors & Components, Wire, Harness and Cabling



**LEMO**

**03:00 PM - 03:20 PM**

Trade Show & Networking

**03:20 PM - 03:50 PM**

Product Showcase

Switches Sensors, Displays



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**03:50 PM - 04:20 PM**

Product Showcase

Switches Sensors, Displays

**04:20 PM - 04:30 PM**

Closing remarks

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## April 28 – Keynote Speaker

**Jean-Rémi Pouliot • Brilliant Matters Organic Electronics**



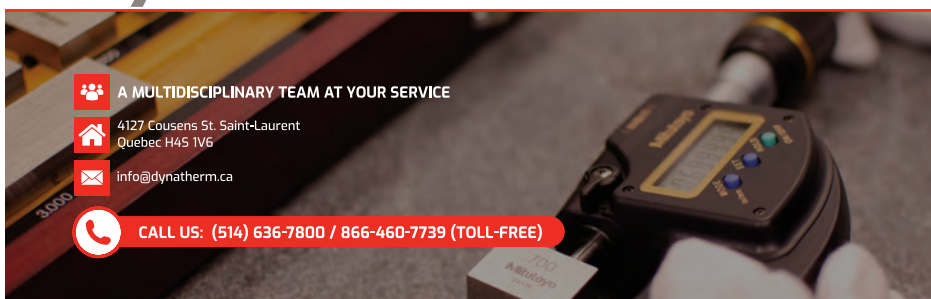
Jean-Rémi Pouliot was born in Quebec City, and received his B.Sc. in Chemistry from Université Laval in 2011. He was awarded an NSERC Graham-Bell scholarship while doing his Ph.D. under the supervision of Professor Mario Leclerc. His research focused on the development and adaptation of direct (hetero) arylation polymerization with an emphasis on high-performance materials for plastic electronics. Believing in the commercial potential of this technology, he co-founded Brilliant Matters along with Philippe Berrouard in 2016. The idea was to bring sustainable, greener material production methods to the printed electronics market and sub-markets. Due to this innovative business model and high-quality products, Brilliant Matters has customers worldwide, from Vancouver to Tokyo.

Jean-Rémi will address the rise of printed electronics, more specifically the sub-market of organic printed electronics. He will give a glimpse of the possibilities (market, drivers, applications, economics) of this fast-growing field and deliver a real case study in Brilliant Matters, and its printed organic solar cells.

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# Canada's unveils first lab, incubator for semiconductor, hardware

*ventureLAB initiative enables tech companies building foundational technologies in transformative sectors like AI, clean tech, IoT, and beyond*



ventureLAB, a leading technology hub located in York Region, northeast of Toronto, has received \$4.73-million in

Fed/Dev Ontario to create the Hardware Catalyst Initiative, Canada's first hardware lab and semiconductor incubator.

This competitive program enables tech companies building foundational technologies in transformative sectors like AI, clean tech, IoT, and beyond, to accelerate their time to market in a sector that normally incurs lengthy entry and scale times. The Hardware Catalyst enables the creation of transformative technologies that will power the products of tomorrow — including healthcare technology, consumer electronics, telecommunications, smart energy, connected transportation, and more.

Semiconductors are a critical component at the core of many emerging industries and innovations, ranging from electric vehicles, to robotics in



precision agriculture, to 5G communications and mobile devices.

The injection of funding will allow ventureLAB to purchase advanced computing infrastructure for the lab to virtualize equipment, which has become essential in the COVID-19 context. This will enable entrepreneurs from across Canada, including in rural regions, to utilize the platform remotely, expanding the reach of the Hardware Catalyst Initiative beyond the Greater Toronto Area. In addition, the facility will purchase cutting-edge

equipment (with a focus on 5G technologies, autonomous vehicles, and AI development) not currently available in Canada. Building more end-to-end capabilities to commercialize new hardware and semiconductor products domestically will encourage growing Canadian companies in this sector to keep operations in Canada.

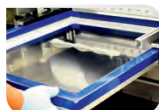


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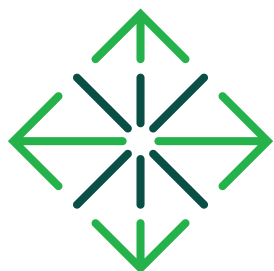


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### Growth of domestic hardware

The lab expansion will help to address the increasing demand for this specialized technology, which includes providing a Canadian-made solution to help meet global demand for microchips used by automotive and consumer electronics manufacturers. It will accelerate the growth of an additional 17 domestic hardware and semiconductor companies, support the commercialization of eight new products, and generate \$7 million in new product sales, bringing the total number of companies supported through the FedDev Ontario investment in the Hardware Catalyst Initiative to 60. This investment will also leverage an additional \$1.35 million in private investment and will create 35 skilled jobs.

"The Hardware Catalyst Initiative is exactly what we needed: industry-specific mentorship, connections to the necessary partners in a semiconductor supply chain, and access to a state-of-the-art lab to support our product development. Joining the program was a major step forward for our company," said Brenden Crowley, co-founder & CEO, Micromensio Inc., developers of next-generation sensing technologies.

The team has been an invaluable resource throughout our journey. The ventureLAB advisors are always available to share the wealth of their experience and it has been fantastic working with them this past year. I would highly recommend the program to any hardware company looking to scale their business," says Joseph Ma, CEO, Bionic-i Inc. ■



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# EPTECH Schedule

## Wednesday, May 19

**STREAM 1:** CEM Design & Manufacturing

**STREAM 2:** Production Equipment & Coatings

**01:00 PM - 01:40 PM**

Opening Keynote

Kevin Bailey



**01:40 PM - 02:00 PM**

Trade Show & Networking

**02:00 PM - 02:30 PM**

Product Showcase

CEM Design & Manufacturing



**02:30 PM - 03:00 PM**

Product Showcase

CEM Design & Manufacturing



**03:00 PM - 03:20 PM**

Trade Show & Networking

**03:20 PM - 03:50 PM**

Product Showcase

Production Equipment and Coatings



**03:50 PM - 04:20 PM**

Product Showcase

Production Equipment and Coatings

**04:20 PM - 04:30 PM**

Closing Remarks

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## May 9 – Keynote Speaker

**Kevin Bailey • Why Integrating Manufacturing Early in the Product Design Lifecycle is so Important**



Kevin Bailey is the founder and CEO of Design 1st, an electronic design house in Ottawa. For more than 25 years, organizations have turned to Design 1st for its full suite of end-to-end product development expertise - research, design, engineering, prototypes, testing, marketing support, transfer to production and finalizing product for first market release. Under Kevin's leadership, Design 1st has delivered more than 750 products to market across a variety of industries, which influence millions of people globally. Design 1st has helped global firms turn ideas into successful commercialized products, including Motorola, Acer, Stanley Tools, Ericsson and Christie Digital.

Prior to founding Design 1st, Kevin was on the ground floor of global hardware product innovation, cutting his teeth with National Research Council, General Motors, Shell, Bell Northern Research Labs and Nortel Networks - where he played an integral role in their forward-thinking behavioral research focused design team on next generation communication devices, including the first global smartphone design, development and initial production in 1994.






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# Venture capital fund to support next-gen tech



Quebec welcomes a new player in its innovative ecosystem with the launch of Boreal Ventures, the first venture capital fund dedicated to high-tech companies. Created in partnership with Centech, a Montreal-based incubator specializing in technology, this fund will support the development of companies in the pre-seed and seed stages in science and engineering.

With an initial investment capital of \$26-million, Boreal Ventures will support companies that emerge from Centech and Quebec's innovative ecosystem. The start-ups targeted by this new fund operate in applied science (deep tech) sectors such as artificial intelligence (AI), medical technologies, industry 4.0, and connected objects.

"Boreal Ventures is addressing a real need among companies in deep tech, explains David Charbonneau, managing partner at Boreal Ventures. "Cutting-edge innovation is marked by a development cycle that is sometimes longer and requires more capital than its purely software counterparts. Consequently, there are few Canadian funds available for this type of company. However, the potential for companies specialized in deep tech is



**Richard Chénier, general manager of Centech (on left) with David Charbonneau, managing partner at Boreal Ventures.**

vast and what they create meets the needs of today's and tomorrow's society."

"This new fund will provide our entrepreneurs with the financial leverage they need to start and grow ambitious projects. The government's support for successful high-tech companies is essential for economic recovery," said Pierre Fitzgibbon, Quebec's Minister of Economy and Innovation.

## Collaboration with Centech

Centech has a strong reputation. Since 2016, it has reviewed some 1,175 projects, raised more than \$150 million in capital by its companies, created nearly 500 jobs, and these companies have a survival rate of 65% after five years. With its privileged access to Centech's experts, Boreal Ventures will be able to rely on an expanded multidisciplinary team to assist with due diligence services, operations, and the outreach

of the fund and the companies it supports.

With Quebec being an important player in AI and the research that emanates from its universities, one of Boreal Ventures' main objectives is to highlight the full potential of Quebec's high-tech entrepreneurial cluster. ■

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**Chroma**

# EPTECH Schedule

## Wednesday, June 16

**STREAM 1:** Enclosures, Metalwork, Thermal Management

**STREAM 2:** Power Supplies, Power Management, Batteries

**01:00 PM - 01:40 PM**  
Opening Keynote

Ethan Escowitz, founder and CEO.



**01:40 PM - 02:00 PM**  
Trade Show & Networking

**02:00 PM - 02:30 PM**  
Product Showcase

Enclosures, Metalwork, Thermal Management



**02:30 PM - 03:00 PM**  
Product Showcase

Enclosures, Metalwork, Thermal Management



**03:00 PM - 03:20 PM**  
Trade Show & Networking

**03:20 PM - 03:50 PM**  
Product Showcase  
Power Supplies, Power management, Batteries



**03:50 PM - 04:20 PM**  
Product Showcase

Power Supplies, Power management, Batteries

**04:20 PM - 04:30 PM**  
Closing Remarks

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## June 16 – Keynote Speaker

**Ethan Escowitz • Innovations in materials and manufacturing technology allow reimagining of product design and performance**



The end of enclosures. The dawn of integrated devices. While software and electronics have advanced at incredible rates, materials and manufacturing technologies have not - limiting the design and performance of our devices. Arris removes the constraints of the past, unlocking the next era of thin, lightweight, truly portable devices. Ethan Escowitz, founder and chief executive officer of Arris, will discuss the future of hardware design, materials, and manufacturing.

In his role, Ethan leads the firm's strategic direction with a big mission: to unlock advanced composites for world-changing high volume products. Ethan has a rich history of experience that spans a formative period in manufacturing that has witnessed the rise, fall, and stabilization of additive manufacturing. His ascent to Arris CEO has included roles across the organization and across the product and manufacturing space.

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# CMC Microsystems and Deeplite seek to advance AI R&D

*Canadian groups partner on next-gen machine learning, AI-powered products*



CMC Microsystems, manager of Canada's National Design Network (CNDN), a leading technology and innovation support organization in Canada, and Deeplite, a Canadian AI

software company dedicated to enabling AI everywhere, have signed a Memorandum of Understanding (MOU) to initiate their partnership.

The MOU outlines the initiatives that CMC and Deeplite will collaborate on, including making the Deeplite Neutrino AI software platform available to researchers throughout CMC's diverse network of researchers and entrepreneurs throughout Canada.

For Gordon Harling, president and CEO of CMC Microsystems, this is a perfect fit of made-in-Canada solutions on the bleeding edge of AI technology. "Deeplite's platform is incredibly powerful and has the potential to profoundly change AI and machine learning. We are very excited to help deliver this on our cloud networks and provide training so that researchers and entrepreneurs can use the platform to its full potential."



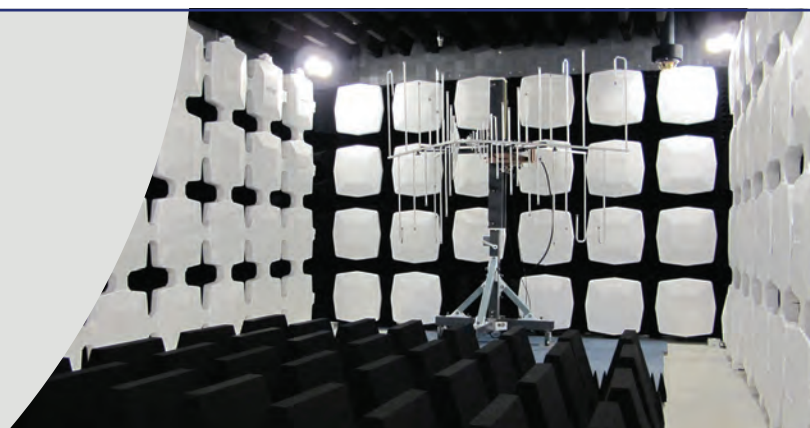
Deeplite's proprietary AI software, Deeplite Neutrino, automatically makes other AI models faster, smaller and more energy-efficient creating highly compact, high-performance deep neural networks (DNNs). The platform

provides an automated way for AI engineers and hardware developers to deploy neural networks on low-power, resource-limited solutions, previously not suitable for AI. This enables engineers and application developers to deploy DNNs on edge devices such as cameras, sensors, drones, smartphones and autonomous vehicles with unparalleled performance.

Optimizing neural networks with Deeplite and providing developers instant access to advanced AI software tools requires computing power and infrastructure. "CMC has a proven record of delivering intricate platforms seamlessly through their cloud infrastructure and developing training programs to support innovation. We're looking forward to working with CMC and their network of researchers and entrepreneurs" said Davis Sawyer, co-founder and CPO at Deeplite. ■



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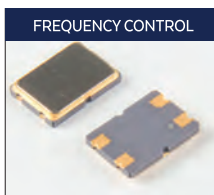
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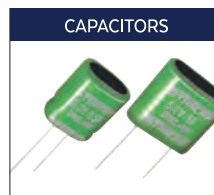
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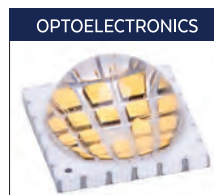
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# EPTECH Schedule

## Wednesday, September 15

**STREAM 1:** Wearable, Flexible, IoT and Wireless

**STREAM 2:** Test & Measurement and Regulation

**01:00 PM - 01:40 PM**  
Opening Keynote

Tony Chahine



**01:40 PM - 02:00 PM**  
Trade Show & Networking

**02:00 PM - 02:30 PM**  
Product Showcase

Wearable, Flexible, IoT, Wireless



**02:30 PM - 03:00 PM**  
Product Showcase

Wearable, Flexible, IoT, Wireless

**03:00 PM - 03:20 PM**  
Trade Show & Networking

**03:20 PM - 03:50 PM**  
Product Showcase

Test & Measurement, Regulation



**03:50 PM - 04:20 PM**  
Product Showcase

Test & Measurement, Regulation



**04:20 PM - 04:30 PM**  
Closing Remarks



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V<sub>p-p</sub>=02.80V  
-0.251 V

AC/DC Voltage

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Signal Generator

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I<sub>p-p</sub>=00.28A  
-0.158 A

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## September 15 – Keynote Speaker



**Tony Chahine • Textile Computing –Transforming human connectedness through textiles.**



Fascinated by the potential for textile computing to act as an interface to the human operating system, Tony began his search in 2010 for the infrastructure needed to produce these wearable solutions at scale. He visited supplier after supplier, from yarn companies and manufacturing plants, and R&D labs around the globe. What he found was an unwillingness and inability to innovate or contemplate an alternative future. It was from these roadblocks that Myant was founded – born from a desire to build a bridge to a future that nobody thought was possible. Toronto-based Myant has become the world's first end-to-end Textile Computing™ company and its mission is to empower humanity using IoT-enabled textiles. The firm has developed the capabilities required to design, engineer and manufacture connected textile solutions so that

other innovators, be they large enterprises or small startups, can help deliver on the promise of textile computing.

Myant knits sensors and actuators into everyday textiles, giving them the ability to sense and react to the human body.

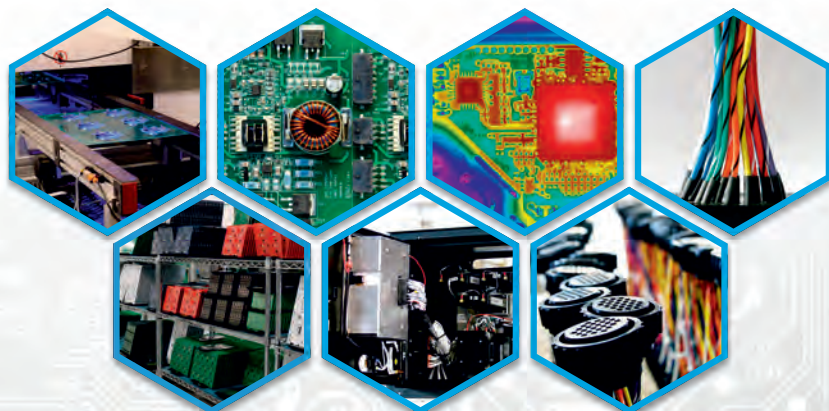


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# Ensuring compliance in the smart wearables market



Since 1500 CE mark and the invention of the wearable clock, people have loved wearable technology. Today, we are fascinated by smart wearable devices (SWD) that enhance our daily lives in a multitude of ways.

## A growing market

It was predicted in 2014 that the global market for SWD would be worth \$22.9-billion by 2020 (all figures in USD\$). In reality, this figure was exceeded far earlier, with the market reaching more than \$25-billion and over 245 million devices sold by 2019. This growth is expected to continue, with an estimated 368.9 million users of smart wearable tech by 2024, each spending at least \$79.75.

## What are smart wearable devices?

The term wearable device refers to items that are worn on the body that contain electrical or



electronic components. Examples include watches, lights on shoes, and gloves that heat the hands. However, SWD takes wearable technology to the next level, with these devices now able to communicate wirelessly with other designs.

Smart wearables have proven to be very popular in the fields of entertainment, information and communication, medicine, health and fitness.

The health and fitness sector has been a key driver in the market, with fitness trackers still the largest product category by unit sales.

SWD are now readily incorporated into various aspects of our daily lives and the range of products available to consumers is ever growing. Examples include:

- Watches that connect to smart phones to show messages etc.
- Wireless headsets to relay telephone calls
- Exercise trackers
- Sleep trackers
- Clothing & boots that warm your feet

Wearable technology has certainly come a long way since Peter Henlein designed the first wearable clock. There are now even canine trackers that connect with a smart phone, showing that SWDs are not just for humans.

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## Regulations

SWDs incorporate both an electrical and non-electrical component and are, by their very nature, classified as cross category products. The electrical component might be contained in jewelry, clothing, footwear, etc. and it therefore needs to conform to the regulatory requirements for both electrical and electronic (EE) products and the relevant regulations for the surrounding structure.

Products that fail to conform to these standards are at risk of recall. In some cases, the reason for the recall has been the electronic component – for example, in 2008 the EU recalled some wireless headsets where the lithium-ion batteries short circuited, causing overheating. In other cases, the cause of the recall was the non-electrical component – for example, in the US in 2014, tracking wristbands were recalled because they irritated the skin and caused blistering.

It is therefore important for manufacturers to ensure their products conform to all the relevant legislation enforced in their target market. This can make the process more complex as product testing needs to be considered in relation to:

## Products that fail to conform to these standards are at risk of recall. In some cases, the reason is a bad electronic component

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- Compliance related to other categories (textiles, toys, etc.)
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Manufacturers operating in EU markets need to ensure mandatory chemical substance compliance against a variety of pieces of legislation, including REACH, directives on packaging and batteries, and regulations covering persistent organic pollutants (POPs) and the allergenic effect. In terms of EE components, EU regulations include:

- Directive 2011/65/EU Restriction of Hazardous Substances (RoHS)
- Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE)
- Regulations on radio frequency and electro-magnetic compatibility (EMC)

When operating in the US, manufacturers must consider:

- Toxics in Packaging Clearing House (TPCH)
- California Proposition 65
- US Public Law 104-142 for batteries
- Regulations enforced by the Federal Communications Commission (FCC)

Most countries will also have safety standards to which the product must conform. These regulations represent just the tip of the iceberg and manufacturers are advised to partner with an experienced testing and certification service provider to ensure they are complying with the correct legislation. ■

This article was submitted by SGS.

<https://www.sgs.com/en/consumer-goods-retail/electrical-and-electronics>



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➤ [www.keysight.com/ca/en/cmp/2021/keysight-smart-bench-essentials-test-instruments.html](http://www.keysight.com/ca/en/cmp/2021/keysight-smart-bench-essentials-test-instruments.html)

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➤ [gansystems.com](http://gansystems.com)

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➤ <https://www.st.com/en/evaluation-tools>

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ordering platform has digitized the pcb manufacturing process. The firm's software automation reduces errors and operating costs, thus lowering the price. The eManufacturing platform will help correct issues as you proceed with order. The simulated production process enables platform users to quickly source pcbs, while also identifying and resolving any issues on the spot. Platform removes days off the ordering process, improve accuracy.

➤ [www.boardera.ca/](http://www.boardera.ca/)

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## REWIREABLE IEC CONNECTORS ENABLES CUSTOM CABLING

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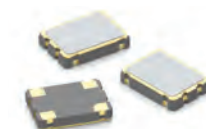
Series 4782 rewirable IEC cord connectors (C13, 70°C) and 4781 (C15, 120°C), to

include gray and white versions in addition to black. The added colors allow for distinguishing between multiphases in data centres. The detachable cord connectors are suitable for small series builds with varying cable lengths and country-specific plugs.

➤ [www.schurter.com](http://www.schurter.com)

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➤ [www.we-online.com](http://www.we-online.com)

## ACQUISITIONS

### VARITRON ACQUIRED BY ATLANTA-BASED EMS

East West Manufacturing, LLC, a global design, manufacturing and distribution services business, has acquired Varitron Inc., a Montreal-based provider of integrated electronics manufacturing services (EMS), including advanced printed circuit board assemblies, box-build assemblies, testing and new product introduction services.

Founded in 1991, Varitron operates four facilities in and around the greater Montreal area. This acquisition further enhances the growth of East West by adding a well-established nearshore operation in Canada and advances the firm's strategic focus on growing its North American EMS capabilities.

"We are excited to partner with Varitron to expand our integrated design, manufacturing and distribution services into Canada," says East West co-founder and CEO Scott Ellyson.

"Varitron has an established presence for innovation in a variety of high-growth sectors such as medical, industrial, telecommunications and defense," Ellyson continues. "Varitron allows us to offer our customers even greater nearshore, higher mix, lower volume, quick turn electronic manufacturing services."

### DUPONT TO ACQUIRE LAIRD PERFORMANCE MATERIALS



DuPont has entered into a definitive

agreement with Advent International, one of the

world's largest private equity firms, to acquire Laird Performance Materials for USD\$2.3-billion.

The transaction is expected to close in the third quarter of 2021, subject to regulatory approvals and other customary closing conditions.

Laird Performance Materials is a global leader in high-performance electromagnetic shielding and thermal management with a comprehensive offering of performance components and solutions that manage heat and protect devices from electromagnetic interference.

Laird Performance Materials has a workforce of more than 4,300 employees with a global network of 11 manufacturing sites in North America, Europe, and Asia and 2020 revenues of \$465-million.

### HENKEL INVESTS IN TECHNOLOGY START-UP FEELIT

Henkel Adhesive Technologies is aiming to strengthen its capabilities for maintenance, repair and overhaul (MRO) solutions by investing in Feelit. The Haifa, Israel-based start-up has developed a unique sensor technology for predictive maintenance for various applications in manufacturing. With the investment Henkel aims to further expand its leading MRO portfolio for its broad customer base in industrial markets.

Founded in 2017, Feelit has developed a highly sensitive, flexible, printed nanomaterial sensor that is applicable on static and rotating machinery parts. This sensor can measure strain in ultra-high resolution, as well as other parameters such as temperature, vibration, and pressure.

Based on an industrial IoT platform for real-time remote sensing of structural changes in mechanical assets, the system serves as an 'electronic skin' that alerts on critical structural and operational anomalies in advance. The sensor delivers a 50 times higher sensitivity compared to current standard market applications.

### AMPHENOL ACQUIRES POSITRONIC



Positronic, a global manufacturer of high reliability electronic connector products based in Springfield, MA, has been acquired by Amphenol Corp., one of the world's largest designers and manufacturers of electronic and fiber optic connectors and interconnect systems.

The deal brings together industry-leading knowledge and experience in the market, providing customers with a broad range of products and technical design support.

"Positronic is a strong fit with Amphenol, aligning well with its technological expertise, manufacturing versatility, and customer support," states David Kean, recently named general manager for Positronic. "As part of Amphenol, Positronic will continue to provide the connector products and services our customers demand."

Positronic products complement the Amphenol offering, and the acquisition will allow customers to take advantage of a broad D-sub military / aerospace connector portfolio and have access to new, innovative technologies in the future.



*Based on the unique sensor technology of Feelit Henkel aims to expand its offering for predictive maintenance across multiple industries.*

### LITTELFUSE ACQUIRES HARTLAND CONTROLS

Littelfuse Inc., a global manufacturer of circuit protection, power control and sensing technologies, has acquired Hartland Controls, Rock Falls IL, manufacturer of electrical components used primarily in heating, ventilation, air conditioning, and refrigeration (HVAC/R) and other industrial and control systems applications.

For 2020, Hartland Controls had sales of approximately \$70-million.

"Hartland Controls is a premier provider of control products and assemblies, with an outstanding reputation for quality, engineering, and customer service," says Peter Kim, VP & GM, Littelfuse industrial business.

### BOURNS ACQUIRES KASCHKE COMPONENTS


Bourns Inc., manufacturer and supplier of electronic components, announced that a newly-formed subsidiary has acquired all shares and interests of the various entities comprising the Kaschke Group with its headquarters in Göttingen, Germany. The terms of the transaction were not disclosed.

Kaschke is a market leader in the field of customized magnetic components and ferrite cores. The company was founded by Kurt Kaschke in 1955 and became known for its high competence in the development and production of application specific magnetic products.

The firm's mission is to use its ferrite core knowledge base for the development of solutions tailored to specific customer requirements matches Bourns' culture of innovative design.



# PRODUCT SOURCE GUIDE



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# Sony PlayStation 5 gaming system

BY IFIXIT



These findings are from iFixit, the open source repair guide. The popular online site teaches people how to fix just about any electronic device, and sells the parts and tools to make it possible. For this teardown, the engineers at iFixit have finished gaming and put down their PS5 long enough for a proper investigation. Here, they take the PS5 gaming station and controllers down to the studs.

The dismantling of this gaming system revealed the following components:

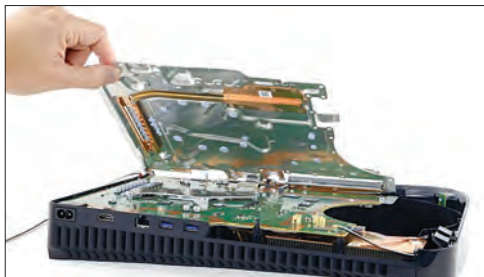
- AMD custom 8-core / 16-thread 3.5 GHz Zen 2 CPU
- AMD custom RDNA 2 GPU (2230 MHz with 36 compute units)
- 16 GB GDDR6 RAM
- 825 GB of SSD storage (plus an m.2 SSD expansion slot)
- HDMI 2.1 connectivity with support for 8K video at 60 Hz, or 4K at 120 Hz

The PlayStation 5 is a huge leap forward in console gaming technology, just like its Microsoft rival. It may have taken the iFixit team a few weeks, but they learned a lot in their time with the PS5. The device's relatively modular and repair-friendly design is slightly overshadowed by some software locks and annoying (if not rare) Torx security screws.

## Controllers

Out come the guts: button sensors, motherboard, haptic drivers, and adaptive triggers, all mounted to a black midframe. Both adaptive trigger assemblies connect with cables, but the haptic drivers, USB-C port, and joysticks are all held down by soldered connections. On the backside lives the main circuit board. And where there's a circuit board, there are chips:

- SIE CXD9006GG — Likely a custom Sony chip doing all the grunt work
- Dialog DA9087 PMIC
- Realtek ALC524 audio codec
- Nuvoton NAU8225 3.0 W Class-D Audio Amplifier



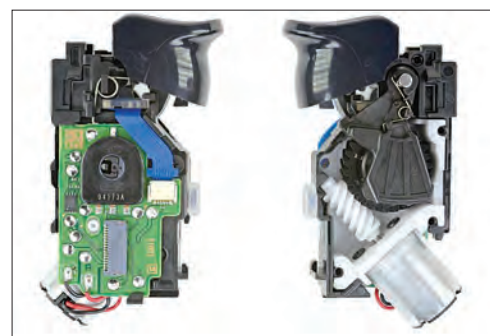
**Under the hood: a heat pipe for cooling a row of VRMs, connected to a baby fin stack. Looks like we're seeing the back of the main board here—all the really serious cooling hardware is mounted below.**



**Compared to the Xbox Series X's heatsink, the PS5's definitely has some more surface area to spread that hot, hot heat. The PS5 doesn't use a vapor chamber like the Series X, but Sony claims its combination of copper heat pipes and heatsinks is just as effective.**



**Just like the DualShock 4 and DualShock 3 before it, the DualSense battery has a tough plastic shield and is not glued in place.**



**The trigger button sensors—R1 on the left and R2 on the right. R2 seems to use a 'two-stage' sensor to differentiate partial and full trigger pulls, while R1 is a plain-Jane digital switch. A circuit board to brings it all together. There are two ribbon cable connections: one to the buttons, and one to the motherboard.**

The only real sticking point with this teardown is discs and storage. Neither console will allow you to replace their optical drive without some tricky board swapping and soldering, for piracy and cheating prevention reasons we do not agree with and are actively fighting. And, for the moment at least, you're going to have a tricky time finding and partitioning a replacement for your Xbox or PS5 internal storage. But, for what more people will need to do over their console's lifetime, these cutting-edge platforms score a 7 out of 10. <http://canada.ifixit.com>



These findings are from **iFixit**, a wiki-based site that teaches people how to fix almost any electronic device. Anyone can create a repair manual for a device or edit the existing guides to improve them. iFixit empowers individuals to share their technical knowledge and teach the rest of the world how to fix their stuff <https://canada.ifixit.com>

Photo: iFixit

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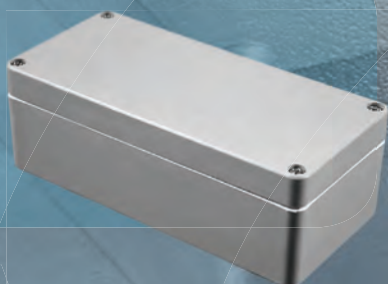


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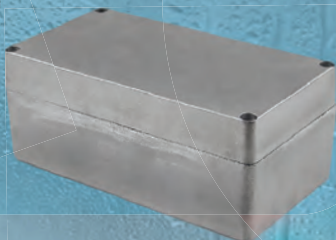
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