Capitalizing on the sustainable benefits of the IoT

Observations from the Living Progress Exchange
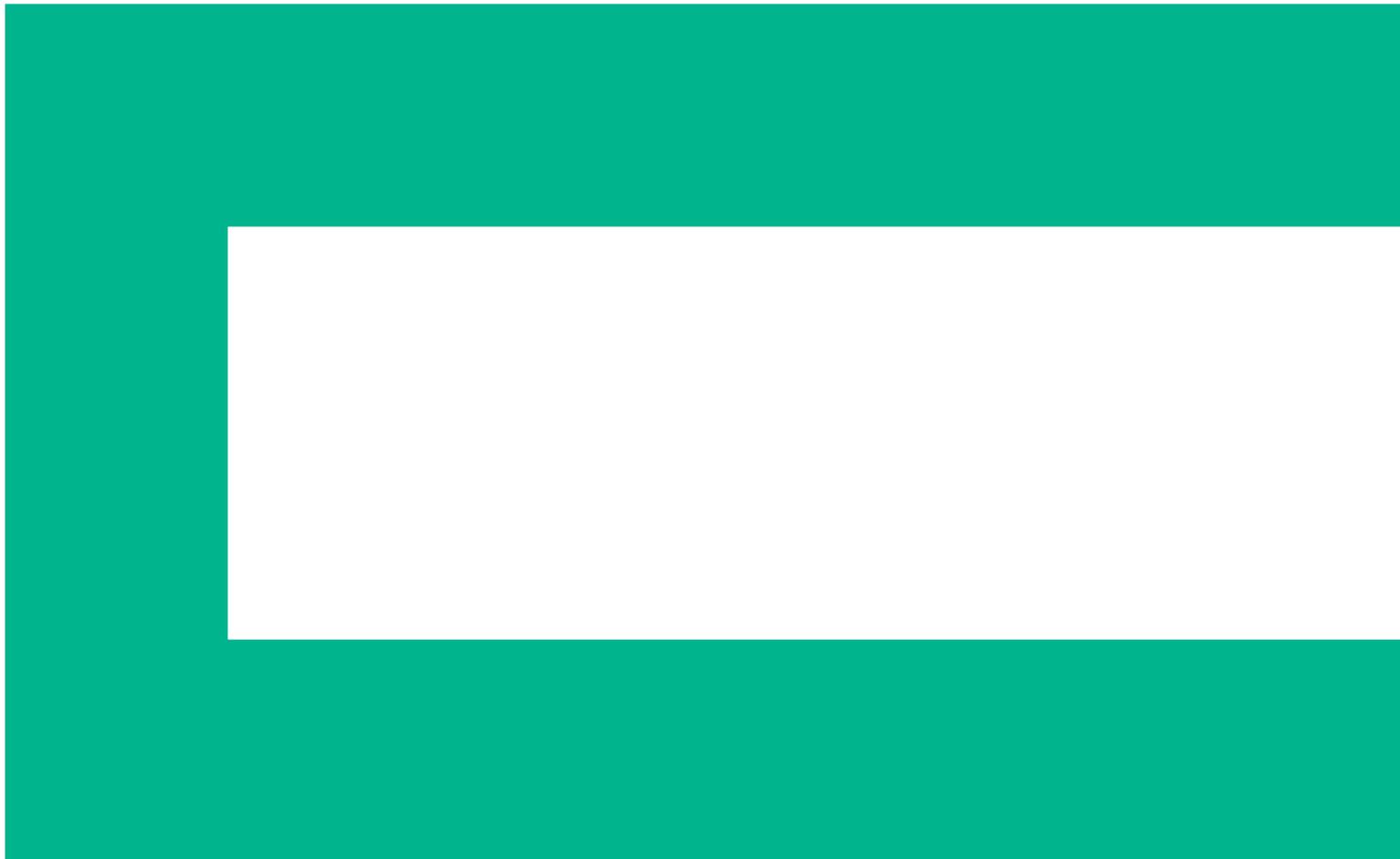
The fourth Living Progress Exchange (LPX), a stakeholder dialogue hosted by **Hewlett Packard Enterprise** and GlobeScan, took place online and at the GreenBiz VERGE conference in September 2016. In this discussion, experts, practitioners, and opinion leaders joined us to discuss the opportunities and challenges in leveraging the **Internet of Things (IoT)** to advance sustainability.

This summary presents the key themes emerging from the dialogue, including specific ways IoT can interact with existing systems, influence device and system design, automate decision-making, and bring about new ways of collaboration. Participants in the dialogue were not only enthusiastic about the great potential in IoT but also highlighted some of the challenges encountered as both users and implementers of IoT for sustainable benefits.

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What does IoT offer for sustainability?

As energy-efficient devices become the new standard, IoT can be the next frontier of sustainability in making whole systems more efficient as they network together and exchange information. In thinking about the most exciting opportunities in IoT, participants highlighted two important ways IoT can add sustainable benefits:

• Systems and device design: Beyond making technology efficient, entire systems can be designed to harness the power of IoT, equipped with smart sensors that can track data and can respond to information at the edge (meaning, right where the data is collected).

• Data collection and insights: Information collected through IoT technologies can yield new insights about how resources are used and lead to wider sharing of information and human means to interpret it.

"We like to think of IoT (or the Intelligence of Things as we put it) in two dimensions: we can make devices smarter to reap benefits, e.g., in healthcare, efficient agriculture, or autonomous vehicles; we can collect, sort, and analyze data in ways that will helpfully make us smarter."

– Bruce Klafter, Flex

Opportunities in environmental management

Tracking resources—especially water and energy—through IoT-capable smart sensors can reveal hidden costs, and ultimately gives organizations the license to set ambitious goals and make informed decisions to drive highest impact.

"Many organizations embark on energy initiatives but fail due to a lack of visibility, lack of baselining, and inability to quantify the benefits from the energy reduction initiatives."

– Gerry Lagro, OSIsoft LLC

The technical innovation that is being driven by IoT can be utilized in a number of situations to advance environmental sustainability efforts, including advancing agricultural efficiency, reducing food waste, and managing transportation impacts, especially through implementing IoT in smart cities.

Smart cities: Many urban areas are embracing the idea of **smart cities**, where IoT is embedded in public infrastructure to automate efficiency and track data for applications from traffic light sensors, to waste management, to paving the way for driverless cars.

Smart cities are ultimately being designed for efficiency, but the total benefits will also rely on the IoT systems being efficient and sustainable themselves. Many smart cities are still in early stages, and those that have already seen successes can scale benefits by sharing their models for other cities looking to innovate.

"City of San Jose just published a great smart city vision that outlines their framework for how they would like IoT to be part of the solution to city-scale challenges."

– Clinton Moloney, PwC

Many of the systems in smart cities rely on analytics, meaning decisions on data are automated in real time as it is collected. These systems can respond to information dynamically as environments change, and in smart cities, this can improve public infrastructure, traffic management, and provide a wealth of other solutions. There is great transformative potential for edge analytics across industries—from reducing waste in manufacturing, to helping grocers manage surplus food, to changing the way data centers are used. Ultimately, more automated decision-making at the edge means that less data is sent to data centers, which in turn helps to reduce the need for data storage and cut down on energy and emissions costs.

Sustainability in the design phase

"Sustainability is a conversation about design, fundamentally."

– Gil Friend, City of Palo Alto

Designing for IoT: Designing for sustainability is a critical component of furthering the IoT, and LPX participants discussed how sustainable benefits of IoT must be considered at the design phase. This means fitting devices and systems with smart sensors that can track data on the use of resources, and designing technology that can interact with them to enable IoT and scale up its capacities.

From data to design: Data gathered through IoT-enabled systems over a product lifecycle is already providing insights into more efficient and sustainable device design, and designers now have a wealth of information to help create more sustainable systems. Participants agreed that, for this data to be effective and influential in design, collaboration with data scientists will be critical to interpret the information and enable designers to design for sustainable benefits.

"We talk a lot in design about how you need a data scientist at the table while you're designing your products…. The amount of stakeholders involved in the design process today has widened massively, so not only do you have your data scientists but also your IT department, systems integrators, all these other people. Collaboration and partnerships are so key."

– Morgan Fabian, Autodesk

Circularity: An example of creating products for sustainability and IoT enablement is circular design. LPX participants highlighted the need for IoT sensors and hardware to reduce waste and promote circularity, where a product's materials can be reclaimed for reuse at end of life, having been tracked throughout the lifecycle by utilizing IoT. Transitioning toward circular design—and other new business models, such as products as a service and reverse logistics—at a larger scale can be a path to more systemic change.

"There are interesting potential connections between IoT and the circular economy—in terms of tracking goods along the supply chain and continuing to capture value (and enabling collaborative consumption) throughout the lifecycle of goods."

– Kate Daly, New York City Economic Development Corporation

Challenges for capitalizing on the sustainable benefits of IoT

While the potential of IoT is promising, participants in the LPX recognized that there are some significant barriers to scaling up its applications. IoT can cast a wide and powerful network, but ultimately it can only touch those with access to the Internet. Once connected, a new concern arises: Are systems and data secure on IoT networks?

Reaching underserved communities: IoT design innovations are changing the face of cities and technology systems, but LPX participants discussed the challenge of including rural, less connected communities in implementation. The ability for IoT to gather data and provide insights depends on users being connected to the right networks and having the hardware to participate in what IoT can offer. Does entry into the IoT sphere of possibility have a high cost that might be out of reach for some communities? This is one challenge facing wider IoT implementation.

"(One barrier is) underserved population access—do you need an expensive smart device to participate?"

– Robert ter Kuile, Fossil Group

Data security: Another major challenge lies in security, an issue increasingly affecting companies in today's data-rich environment. LPX participants were emphatic that security issues need to be resolved in order to earn greater support for IoT applications. Can IoT collect user and system data while respecting individuals' privacy and complying with regulations?

Collaboration

Collaborating at scale: Such big challenges can't be conquered alone: participants agreed that partnerships across and between sectors and industries, involving public and private entities, will be crucial in working toward the sustainable benefits of IoT. In fact, IoT was mentioned as a major enabler of collaboration across industries and sectors. IoT's sustainability potential is not something companies or governments can unlock alone, but rallying around these possibilities can bring collaboration at unprecedented levels.

"We're about to see an era of massive disruption…. The critical enabling capability of IoT is going to fuel that, to enable a level of coordination we've never seen before."

– Gil Friend, City of Palo Alto

In order to communicate and work together across systems, infrastructure needs to be standardized across industry actors. LPX participants noted that IoT is currently siloed as a competitive advantage for companies, and therefore not an area where companies are as willing to collaborate and share knowledge.

"Every major tech company has an IoT division. For me the question is more about partnerships, business cases, and having base layer technology (like city-scale sensors) in place."

– Clinton Moloney, PwC

Collaboration over competition: Imagine the possibilities if every major tech company could combine their IoT knowledge to society's wider benefit. LPX participants strongly agreed that collaboration within the IT industry will be the key to unlocking IoT's potential for sustainability. Progress will rely on productive collaborations between technology companies, and there was a clear call for businesses to work together to transcend the competitive aspect of IoT in favor of its potential for sustainability. Participants also called for more open systems and information sharing, so data is available and actionable at scale.

"It's finding the sweet spot between innovation among competitors, and then standardizing for scale."

– William Hall, Fiat Chrysler Automobiles

Collaboration in the practical world: Ultimately, IoT systems need to be adaptable to address important national and global challenges. Governments and public entities are already applying IoT in smart cities, which can serve as models for other cities to follow. Such systems need to be able to communicate and operate with each other—and this means the data they exchange needs to be in a standardized format.

"Compatibility comes to mind. Will all of the IoT technologies be able to talk to each other or are we inherently self-limiting?"

– Robert ter Kuile, Fossil Group

In considering government's role in progressing IoT for sustainability, LPX participants discussed how governments can help standardize systems and information for interoperability, through policy decisions that include input from a wide range of stakeholders. Participants acknowledged that government regulation, based on meaningful input from NGOs and industry leaders, is a critical step, but it will take time to implement.

"We need national support to avoid state-based fragmentation. But we need NGO and industry to lead the regulatory frameworks."

– William Hall, Fiat Chrysler Automobiles

Deploying IoT strategically

These challenges are long-term and participants acknowledged that IoT development may be outpacing society's capacity to address them. While IoT's possibilities are exciting for those involved in sustainability, these challenges suggest that a more measured, targeted approach may be needed in deploying IoT. To drive sustainable benefits, stakeholders can build on and communicate ongoing successes (like the example of smart cities) to attract collaborators in co-creating solutions for common challenges. A more measured and collaborative approach to IoT has implications across all elements, from design to data collection, to application and insight development.

"For those in the (sustainability) profession who are on the business side, IoT can provide the foundation for many things we imagined we could do. If we can, inside companies, prove the business case by getting very narrow and specific, it could give a lot of lift to mainstream businesses."

– Angela Nahikian, Steelcase

As companies innovate IoT solutions for sustainability, there is a lot of **learning by experience** to be done. Some LPX participants had different opinions about the best ways to deploy IoT, but there was a consensus that sharing knowledge can help these innovators arrive at the best models for industries, consumers, and public sectors to capitalize on sustainability of IoT in the years to come.

> "For the early adopters out there, the onus is on us to approach this in a smart way and to...make investments in a prioritized manner with the data that we need to drive really big outcomes."
>
> – Libby Wayman, GE

HPE response

Fifteen years ago, **Hewlett Packard Labs** had an interesting idea—blanket our data center in Bangalore, India, with 7,500 sensors to gather deep intelligence about its total operation. Data from those sensors was then fed back into one centralized data pool in Palo Alto, California, where it was analyzed in near real time. About every 30 seconds, insight gleaned from these sensors was shared back to the data center in Bangalore and select adjustments were made, such as increasing or decreasing the cooling system in certain areas.

This was one of our earliest proof of concepts that connected IoT and sustainability; it's a concept we've continued to advance through leading IoT innovations, such as the HPE Universal IoT Platform and **HPE Edgeline IoT Systems**.

But despite the explosive growth of IoT, much of the industry conversation around sustainability and IoT today still focuses on efficiency—smarter homes, smarter cars, smarter factories, smarter buildings, smarter cities, all doing more while using fewer resources. While critically important, this narrow framing of sustainability, we believe, misses a world of opportunity.

That's why we curated our fourth global LPX to expand the conversation around using IoT to enable the triple bottom line—driving human, economic, and environmental progress on a global scale. By engaging diverse perspectives from both private and public sector, we wanted to gain a deeper understanding of the opportunities, as well as the challenges, of scaling IoT to address some of the world's toughest social and environmental problems.

The opportunities are abundant. As this report recounts, LPX participants were quick to imagine the possibilities. IoT not only helps drive performance improvements, it can transform entire systems touching every aspect from design through material reclamation at end of life. Perhaps one of the greatest opportunities we explored is the possibility for IoT to replicate the most effective tools we have as humans—intuition, imagination, and experience—thus enabling human potential to scale. At Hewlett Packard Enterprise, we believe the strength of IoT isn't in taking humans out of IoT (what some refer to as replacing humans with a digital twin), but instead putting humans into IoT so that people's unique expertise can be amplified to serve an infinite number of locations all across the globe.

The challenges associated with scaling IoT for good, however, are also abundant, as LPX participants were also eager to point out. Privacy and security are of top concern—concerns we share and prioritize at Hewlett Packard Enterprise.

IoT challenges the traditional privacy notions of individual participation and consent. Machines collecting and sharing large volumes of data without user knowledge and interface, even with the very best of intentions, creates a quandary for people, business, and society that we cannot ignore. Coupled with the emerging and fragmented IoT marketplace (which has few, if any, common security standards), puts IoT devices at risk of cyber attacks.

So what is Hewlett Packard Enterprise doing in response to address these opportunities and threats? First is innovation. Earlier this year HPE launched a whole new product category **Converged IoT Systems**, and with it, we brought to market the HPE Edgeline Systems. HPE Edgeline enables compute to happen at the source—on the edge—where the **things** (tools, manufacturing machines, energy grids, and so on) actually are located. This enables faster, more efficient, and more reliable processing of data, since the data is not traveling back and forth through the cloud to a centralized data center.

Another innovation specific to addressing the security issue head-on is from Aruba, a Hewlett Packard Enterprise company. **Aruba ClearPass** gives operators a simple way to build a foundation for enterprise-wide policies, strong enforcement, and an enhanced user experience. From a single ClearPass policy and Authentication, Authorization, and Accounting (AAA) platform, contextual data is leveraged across the network to ensure that users and devices are granted appropriate access privileges, regardless of access method or device ownership.

These are just two examples from our full portfolio of solutions helping companies leverage the power of IoT for business—and ultimately, for the good of society. However, innovations alone aren't going to get us the societal scale we're looking for. Nor is each technology company going down its own unique path. We believe, and the LPX discussion participants affirmed, that advancing IoT for good is a collective effort. We must work in close collaboration with others within our industry and across sectors, and with government policy makers to enable the full development and positive potential of IoT technologies.

Hewlett Packard Enterprise is a strong advocate for government policies that

1. Encourage public pilot and large-scale IoT projects

2. Ensure spectrum availability, promote development of industry-led and technology-neutral global standards

3. Address IoT security concerns

4. Provide robust privacy and data protection frameworks

These are all in support of the opportunities expressed by the LPX participants, as well as addressing the security and privacy concerns that we all agreed hamper more rapid-scale execution of IoT for social good.

The conversation doesn't end with this fourth LPX. In fact, it's only just beginning. The **corporate social responsibility** opportunities for IoT in driving human, economic, and environmental progress are only limited by our imagination and our willingness to come together to collectively drive solutions for the good of society and business. We're all in—are you?

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