

AS SMARTER

INTERNET OF THINGS readies itself to change the way things are done

Rising on the technology horizon is the Internet of Things - a vast network of interconnected machines and interconnected devices communicating with each other in real-time. It promises to be as transformative as the original Internet in boosting productivity and changing the ways things are done. The Milwaukee Business Journal recently assembled a panel of experts to explore the challenges and opportunities in this rapidly evolving world.

TABLE of EXPERTS



ADEL NASIRI
University of Wisconsin-Milwaukee
Adel Nasiri is the Associate Dean for Research and a professor of Electrical Engineering in the College of Engineering & Applied Science at the University of Wisconsin-Milwaukee (UWM). He leads the IoT activities at UWM.



NANCY OLSON
City of Milwaukee
Nancy Olson was appointed Chief Information Officer for the City of Milwaukee by Mayor Tom Barrett in May, 2008 after 25 years experience in both the public and private sectors. As CIO, Nancy is responsible for IT Policy, Telecommunications, Applications, Internet, GIS, Help desk and the City Call Center. A native of Milwaukee, Wisconsin, Ms. Olson is a graduate of the University of Wisconsin.



ALAN PERLSTEIN
Midwest Energy Research Consortium's
Mr. Perlstein was a founder of the M-WERC, its first Chairperson, and remains on the M-WERC Board of Directors. Alan draws upon 35 years of experience in ship building, power electronics, design development and program management for navy nuclear, ship controls, propulsion, and power distribution technology programs. Alan has worked extensively at building effective Public-Private partnerships.



ERICK SHAMBARGER
City of Milwaukee
Erick Shambarger leads the City of Milwaukee's Environmental Collaboration Office (ECO). Appointed by Mayor Tom Barrett in 2015 as Director of Environmental Sustainability, Erick oversees implementation of the City's ReFresh Milwaukee Sustainability plan and innovative programs like the Better Buildings Challenge, Water Centric City initiative, HOME GR/OWN, and PACE financing.



SCOTT T. VANDERSANDEN
AT&T
A 28-year veteran of AT&T, Scott T. Vandersanden was appointed to the Wisconsin president's position in November 2006. He worked closely with the Wisconsin State Legislature on Act 42, the Video Competition bill. Vandersanden led AT&T's efforts to support the Telecommunications Modernization Act of 2011. With this legislation, the Wisconsin Legislature further modernized the industry in an effort to adapt to the realities of today's commerce.



JUSTIN WEBB
Reinhart Boerner Van Deuren
Justin P. Webb is an attorney in Reinhart's Litigation and Data Privacy & Security Practice Groups. He advises clients on data privacy and security matters, and litigates cases across the subject matter spectrum in both federal and state court.

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ER WORLD?

MODERATOR: THERE'S BEEN A LOT OF DISCUSSION ABOUT THE INTERNET OF THINGS AND CONNECTED SYSTEMS, BUT I AM NOT SURE EVERYONE UNDERSTANDS WHAT THOSE TERMS MEAN. HOW WOULD YOU DESCRIBE THEM AND CAN YOU PROVIDE SOME EXAMPLES OF HOW THEY'RE ALREADY IMPACTING PEOPLE'S LIVES?

JUSTIN WEBB: The Internet of Things integrates the physical world with the virtual world, allowing devices to communicate with individuals and with each other. It will greatly facilitate the aggregation of information, data analytics, automation and communication.

“Young people are growing up with technology so cities need to be moving in that direction if they want to be relevant.”

ERICK SHAMBARGER, City of Milwaukee

ERICK SHAMBARGER: Let me give you some examples of how rapidly this technology is changing things. Take Milwaukee's Bublr bike system. Ten years ago, the bike-sharing infrastructure it relies on would not have been possible. Under Mayor Barrett's leadership, technology is being advanced throughout city government. When I parked my car today, I punched my meter number into my MKE Park app on my smartphone. The police use ShotSpotter to locate the source of gun shots. You can pull a building permit from your own home instead of having to come down to City Hall.

ALAN PERLSTEIN: The Internet of Things connects what were disparate parts to give you a systems view that covers the full spectrum of the value stream.

SCOTT VANDERSANDEN: I would agree with all of that and add that the Internet of Things is in its infancy. It will really take off when we are able to marry it with big data and the artificial intelligence that comes from big data. That is when we will go from just metering things to making decisions and changes in real time. And that's when you will see massive productivity improvements.

NASIRI: That's right. There are several stages to the Internet of Things. First you apply sensors and gather the results, which is basically asset management. The next step is to add an enterprise management system that will allow you to aggregate and analyze the data you have collected. The third and ultimate stage is to do everything online with real-time decision making.

aggregation of information, data analytics, automation and communication.

ADEL NASIRI: It's a very big concept that impacts everything - energy systems, water systems, transportation systems and infrastructure. By connecting devices through enterprise systems you can improve efficiency, reduce capital expenditures and do on-time maintenance for all of your assets - whether it be a bridge or a washing machine.

MODERATOR: HOW MUCH OF A ROLE WILL THESE CONNECTED SYSTEMS PLAY IN A CITY OR REGION'S ABILITY TO COMPETE ECONOMICALLY AND TO BE A DESIRABLE PLACE TO LIVE AND WORK?

SHAMBARGER: Residents and businesses have come to expect faster services, more convenience and lower costs. Young people are growing up with technology so cities need to be moving in that direction if they want to be relevant. We have to compete for the young talent who have the skills and ability to live anywhere they want.

PERLSTEIN: We are blessed in Wisconsin because we have depth of talent, industry leaders in automation

and controls, and great universities that understand the importance of linking the multiple parts of a value stream together to improve efficiency and affordability. That is our region's sweet spot and we need to leverage that strength.

VANDERSANDEN: We are in kind of an arms race because every major urban area is trying to do this as well. But there also is a huge capital cost. Our communications infrastructure has been in place for a very long time and it is very expensive to update that. And, by the way, this is a discussion that is occurring at the state level as well. What does Wisconsin have to do to not fall behind to Minnesota? Iowa? North Dakota?



Networking matters

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NASIRI: There is some low-hanging fruit that you can go after to get fast and significant returns on your investment, especially in the area of energy. For example, the military has been able to install smart, interconnected devices that have returned

their investment costs in a few weeks. There also are considerable energy savings to be realized through smart devices in residential homes, especially in rural areas.

MODERATOR: INTERMS OF THE INTERNET OF THINGS, HOW DOES MILWAUKEE COMPARE TO OTHER CITIES AND REGIONS? WHAT DO WE HAVE GOING FOR US? WHAT ARE OUR CHALLENGES?

SHAMBARGER: I think we are ahead of the curve. M-WERC is connecting private-sector players with the City to come up with strategies and solutions. It is important to stay ahead of the curve, but there is a risk of investing in fads that technology will later leapfrog, leaving

you behind.

NASIRI: UWM is establishing an institute that will do both research and education in connected systems. On the education side, we are focused on educating and training the workforce in all elements of the Internet of Things – the hardware, the software and the systems management – that will be needed to make it work.

WEBB: Marquette University recently announced that the math and science departments will now offer programs on cybersecurity. That is very encouraging because security is one of the fundamental issues of the Internet of Things. There is a talent gap right now and it is going to grow as the Internet of Things expands. Putting

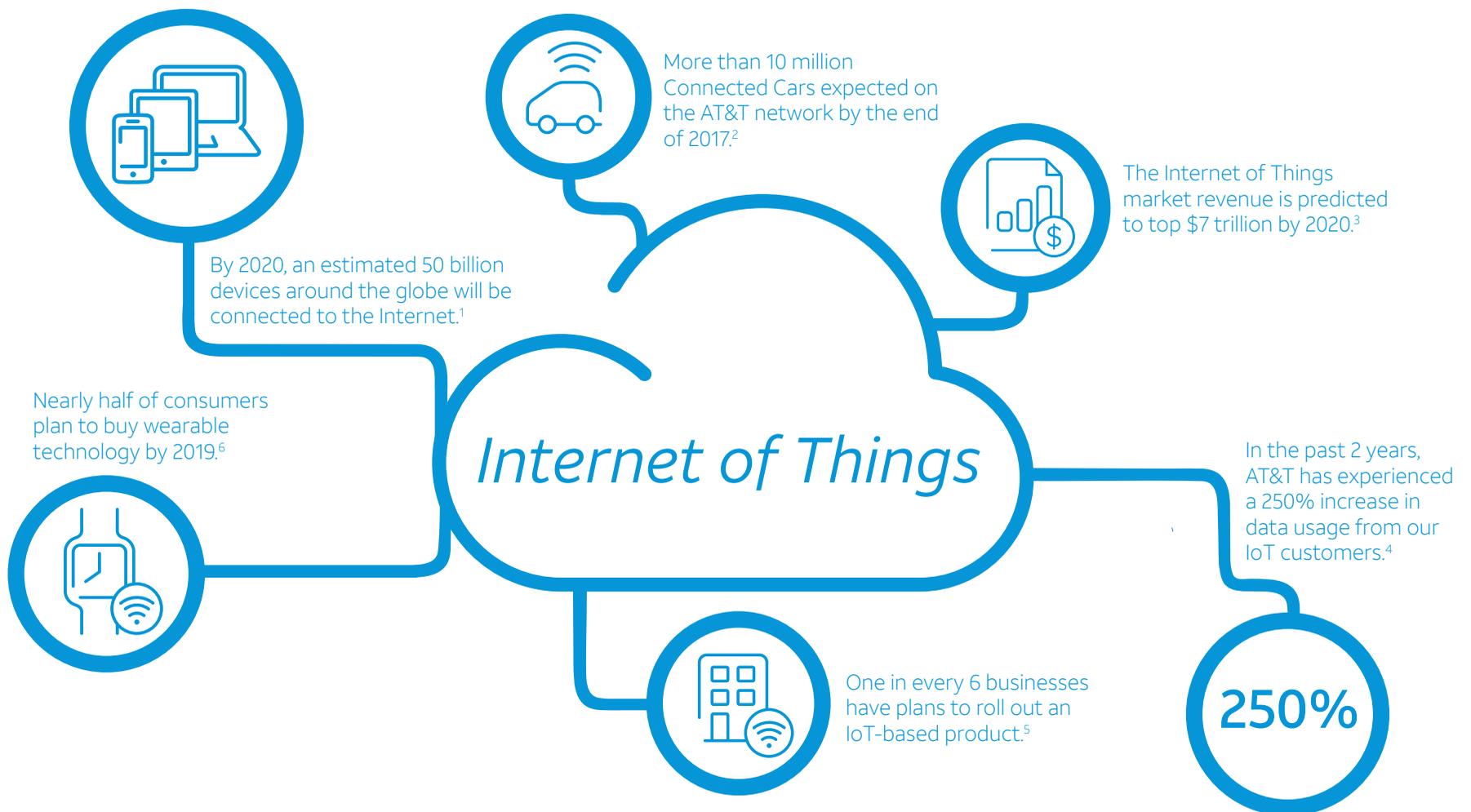


these types of things in place keeps us on the forward edge.

PERLSTEIN: One of the cultural advantages that makes this region

“There also are considerable energy savings to be realized through smart devices in residential homes, especially in rural areas.”

ADEL NASIRI, University of Wisconsin–Milwaukee



¹ Cisco, The Internet of Everything Connections Counter, accessed 27 May 2015.
² What you need to know about IoT, AT&T Report, January 2016.
³ IDC, Worldwide and Regional Internet of Things 2014-2020 Forecast: A Virtuous Circle of Proven Value and Demand, November 2014.
⁴ What you need to know about IoT, AT&T Report, January 2016.
⁵ Frank Burkitt, A Strategist's Guide to the Internet of Things, Strategy+Business Magazine, 10 November 2014.
⁶ Acuity Group, "The Acuity Group 2014 State of the Internet of Things Study".

special is the ability to collaborate. When people come from other cities, they are shocked at how well city government works with academic institutions and industry. Milwaukee also is well-positioned because our fastest-growing sectors –

“The Internet of Things can increase autonomy but it also reduces privacy.”

JUSTIN WEBB, Reinhart Boerner Van Deuren

automation, industrial controls, energy, and water technology – are mainstays of the Internet of Things.

MODERATOR: WHAT ROLE DOES THE GOVERNMENT HAVE IN THE DEVELOPMENT OF THE CONNECTED SYSTEMS?

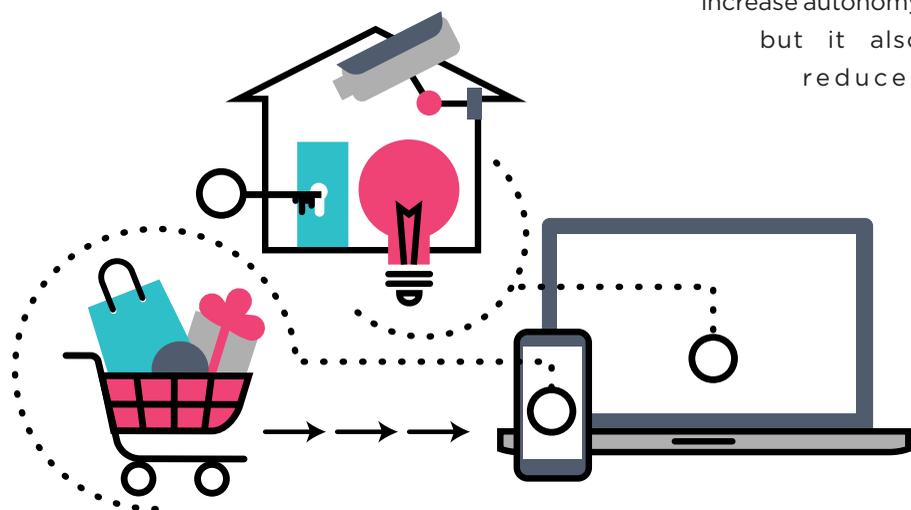
VANDERSANDEN: It’s really tricky when you start talking about government and regulations. You don’t want the government to be picking technology winners and losers. But there is clearly a role for governments in managing the security of the security of the system. The problem is that hackers don’t play by the rules of the road. The truth is that advances and innovation in security are going to have to come from internet service providers and, in fact, that is one of the ways that we differentiate ourselves.

WEBB: Recent denial-of-service attacks have been premised on devices that have poor security protection. At a minimum, there has to be some regulation or guidance as to the minimum expectations for securing devices connected to the network. Too many companies right now are focusing on innovating new devices and getting them into the market. Security is too often treated as an afterthought. In reality, every device should be developed around the principals of security.

MODERATOR: IT SEEMS TO FOLLOW THAT YOU INCREASE SYSTEMIC RISK AS YOU INCREASE CONNECTIVITY BECAUSE YOU ARE EXPONENTIALLY ADDING POINTS OF ENTRY THAT HACKERS CAN PENETRATE. WHAT IS BEING DONE, AND WHAT CAN BE DONE, TO MINIMIZE THE THREAT OF HACKING?

WEBB: At a recent Internet security conference I attended, at least two of the presentations were on the Internet of Things and portable devices. The general takeaway was the critical importance of security and privacy. The Internet of Things can

increase autonomy
but it also
reduces



privacy. As I said before, information security must be the first principle of the Internet of Things and all of the devices connected to it. As these devices become more ubiquitous, they pose a risk to the internet infrastructure because they can be hacked. It’s a very important issue and there is a lot of work that has

to be done to secure those devices.

NANCY OLSON: I absolutely agree. It is the end devices that have to be secured. Malware can lay dormant for weeks and years. You may not know it’s there until it is activated. Our universities are going to have to be pumping out security-educated graduates because this isn’t going to go away. We have to remain vigilant when it comes to cybersecurity.

MODERATOR: HOW WILL EXPANDING



CONNECTIVITY IMPACT OUR INTERNET INFRASTRUCTURE?

VANDERSANDEN: The Internet of Things will depend on a network that is much faster and can handle much larger volumes of data than what we have today. Today’s Internet relies on macro towers. The next generation is going to rely on small cells, which will be placed on streetlights or other existing poles throughout an area. Over

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time, these small cells will allow for 1-gig network speeds. When you reach that plateau, you can really leverage cloud computing to automate your systems based on real-time feedback from sensors and sophisticated data analytics.

WEBB: Another important change that's coming is the switch

from Internet Protocol Version 4 to Internet Protocol Version 6, which will allow for the exponentially more IP addresses. We need that because every device on the Internet of Things has to have a unique IP address. We're also going to have to address issues related to broadband access, especially in rural areas, and upgrading our urban infrastructure to minimize latency.

VANDERSANDEN: Latency is the important word here.

“Latency is how much time it takes a packet of data to get from point A to point B... Right now, our existing networks are just too slow..”

SCOTT T. VANDERSANDEN, AT&T

Latency is how much time it takes a packet of data to get from point A to point B. It is what allows us to make real-time, informed decisions. Right now, our existing networks are just too slow to provide the latency we need. We are much faster than we were 15 years ago, but we are still not fast enough.

OLSON: We are going to have a wide range of needs due to the variety of devices that will be connected to the Internet of Things. Some applications will have very low latency demands. For example autonomous vehicles and other applications will have low latency and high reliability demands and will require lots of bandwidth and lots and lots of sensors.

WEBB: There is a power component to this as well - how you power all of these small, interconnected devices. There is research going on how you can do this without having to connecting devices to an electrical source.

VANDERSANDEN: You are right. That's out there and it's coming. And when it does, there will be huge parts of this country and the world that will benefit beyond belief. A smartphone is very cool, but if you cannot charge it every day, it becomes an expensive paperweight.

MODERATOR: DO WE HAVE THE TALENT AND EDUCATIONAL APPROACH WE NEED TO SOLIDIFY AND GROW OUR LEADERSHIP ROLE?

NASIRI: Today's educational system is based on the silo approach. We train electrical engineers, civil engineers, mechanical engineers and computer scientists. They are very good in their areas, but they are not necessarily connected to each other or to the enterprise level that makes the decisions regarding devices, cybersecurity and the systems approach critical to the Internet of Things. That's what we have set out to address at UWM. We started with Rockwell Automation and a couple of courses in connected enterprises. What do you need on the hardware side, on the software side and on the enterprise side? Soon we will have a slew of courses and a certificate in connected systems. M-WERC is helping to connect us with industry, which is very excited about this.

PERLSTEIN: The city sponsored our participation in the Envision

America program, which is focused on developing partnerships, implementing best practices and leveraging technology to create smart cities. A major focus is talent development. Our Smart Cities working group is helping us to define requirements, create action plans and help our area build on the best practices that other communities have developed.

MODERATOR: WILL THE INTERNET OF THINGS FURTHER THE DIVIDE BETWEEN RURAL AND URBAN AREAS? IS ANYTHING BEING DONE TO ENSURE RURAL AREAS ARE NOT LEFT BEHIND?

NASIRI: The Internet of Things will likely improve the quality of life more in rural areas than in urban areas because it will be able to provide services that are now only available in cities. Older people and veterans, who make up a large segment of the rural population,

won't have to go to the city as much for health care if you can provide them with remote health monitoring. You can also reduce energy costs, which as I said before, is a very important issue in rural areas.

VANDERSANDEN: The challenge for rural areas is connectivity and the challenge for network providers is the cost of providing that connectivity. Our engineers have come up with a way to use M-wave technology to move a signal down existing power lines. That's very promising, because there are power lines already running to every community, but it won't be in the market for several years.

SHAMBARGER: As much as there is a concern about the division between rural communities and cities, there is an equal concern about a digital divide within the city - between the downtown and the outlying neighborhoods. We are working to address that as well. ●



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