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PUTTING *IoT* TO WORK

FIVE CASE STUDIES SHOWING HOW **COMPANIES** ARE
BENEFITING FROM THE **INTERNET OF THINGS**

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AUTO PARTS SUPPLIER HAS BIG PLANS FOR ITS NASCENT IoT EFFORT

Early benefits include a better understanding of what is happening on the shop floor, but automation is the goal. And there are organizational implications for IT.

THINKSTOCK



BY JON DIX

Hirotec America recently embarked on its first IoT effort and, as new as it is, the effort is already paying dividends, says Justin Hester, Research & Development Project Manager. Hirotec is a \$1.4 billion tier one parts and tooling supplier to automakers, specializing in closures (such as doors and hoods) and exhaust systems. Hester was instrumental in getting the IoT effort off the ground at the company's US headquarters in Auburn Hills, Michigan, but has since moved to Japan to work on Hirotec's global IoT efforts from the company's global headquarters in Hiroshima.

How did the IoT conversation start at your company?

Hirotec is mainly a tier one production company for the automotive space, but we also sell tooling to produce the same assemblies, so what we learn from internal production we implement on the tooling side and what we learn from tooling we implement in production, so both businesses benefit. Once we started thinking about that same model for the data side, we started to see the potential benefit of what data and data analytics could give us for both our tooling and production customers.

In our opinion, IoT isn't just about receiving information. IoT really is a closed loop automated system where we're collecting data from all our devices, whether in our production facility or our customer's production facility, automatically analyzing the data, automatically tying it to other datasets — whether they're public or private — then making at least

automated suggestions if not taking automated action.

For example, our system could theoretically look at our production schedule for the day, look at the weather, look at traffic patterns, and predict a traffic back-up on a main delivery highway. Knowing that will delay our truck for an hour, the system could automatically rework the production schedule to optimize for the trucks that will be available. That gives you an idea about where we want to go and the potential that we see.

If that is the nirvana vision, how do you get there from here?

We knew we couldn't get there right away, so we started looking at how we could do this in little chunks. What we realized was our CNC shop here in metro Detroit, which is the manufacturing headquarters where we make production tooling we sell to the North American automotive industry, was a perfect area to start — it



JUSTIN HESTER,
Research & Development Project
Manager, Hirotec

has machines of different ages, so we have to connect them differently, and they spit out various data types. And while the machines themselves are very complex,

the data we need to collect isn't very complex. Is the machine running or not? Is the machine being set up or is the machine turned off? Very basic data points that we can pull.

So that was a great place to start because it's a small area, it's local, it exposes us to variation between machines and it will bring some value to the organization. We're actually in the midst of the project right now. We are connecting eight CNC machines to a server from Kepware that collects data using various protocols and sends it up to the cloud where PTC ThingWorx does the analytics and the data visualization for us.

Are you looking to collect more information than you would have historically?

Yes, and to be clear, the new dataset is a small portion of where we think we'll be in the long term. Again, it's the idea of small projects, six-week sprints, adding

incremental value and providing us with a proof of concept. But one of things we found was that uptime data, cutting data, etc., was available, but not in a usable sense. It couldn't be consumed in real time with relevant context around it. That's really where the value is. So even with this small project we're bringing value to the organization because the data is available in a quick, labor-free or real time fashion.

A lot of scheduling in the CNC shop is based on after-the-fact analysis and conjecture. Now we're going to be able to give our manufacturing leadership real time data on what's actually happening on the floor, which is helpful in itself, and start giving great data to help streamline schedules and help understand our asset and resource allocation. Do we maybe need to add more resources? Are we overtaxing the resources? You can make those decisions without this tool, but it is harder and not as accurate. The immediate value we can bring is providing that

data upfront in real time.

And as we continue to grow, we're going to use that as our basis to add more and more value. The next step in North America is to tie this data into our scheduling ERP system so we can start doing real time scheduling of parts to our CNC machines. If we know when the machines are running and we know how often they can be on and manned, then it's very easy for a computer to take the hours of the jobs coming in and optimize the schedule.

The Kepware server you mentioned helps you get over the initial hump of just connecting the various piece parts?

Exactly. We call it our universal translator. We don't have to worry about what protocols our machines use, whether it Ethernet/IP, PROFINET, Modbus, DeviceNet, any of those industrial communication protocols. With Kepware, I don't have to force my machine builders or my production teams to support a certain protocol

that might not fit their application. They may have a legacy machine that requires a legacy protocol. They may need high speed communication which requires a different protocol. It's not our place to make the business conform to the tool. This IoT tool should conform to the business, and that's where Kepware plays a huge, but behind the scenes, role.

It's one of those roles that's not big and fancy, but it is essential to get things talking. That's why we're so excited about it. It's one of the few tools we haven't put much effort into, not because it's not important, because we don't have to. It just works.

**And you're using Kepware to pass data off to ThingWorx?
(Ed note: PTC acquired Kepware in January, 2016.)**

Right. ThingWorx is really the IoT platform. I love the name ThingWorx because the software does exactly what they call it.

It just makes things work together.

At its core it is really a relational database, but a very open-ended one. We use ThingWorx as a scalable, flexible IoT platform that gives us customized visualization of our data and customized analytics of our data. ThingWorx doesn't care what kind of data it's getting in. It conforms to our business processes. At its core there's a lot of computing power being used to allow these different connections and data points to relate to each other, but from a user standpoint, it's conforming to us.

In the first project we're using it as a visualization tool to give us this real time look into our CNC shop, but within the next couple of years we'll potentially be using it to do things like rescheduling the line in real time and for predictive maintenance, telling us a machine is going to break before it breaks, those kinds of things.

You called it a platform, so I presume you're building on top of it.

Absolutely, and we are using their interface to do it. They call any type of screen you create a mashup because you take these different data types and put them wherever you want on a screen and it does all the hard coding in the background.

That's another thing that drew us to this ecosystem — I don't need hardcore professional programmers. I can take engineers or business leaders who understand their section and with limited training they can get what they need out of the system quickly. That was very important to us, because Hirotec's expertise lies in automotive manufacturing and automotive production. We're not programming experts.

There are so many "IoT platforms" emerging now, do you think you'll end up with multiple platforms or will you strive like hell just to have one?

One of the key things we've determined is the need to stay flexible. We always understand that the market brings new

technologies and new solutions and we're evaluating them all the time. That being said, when we did this initial evaluation we said we needed an ecosystem that's scalable and flexible because you can run into a lot of trouble if you start having multiple solutions across multiple business functions because then you have to create custom connectors and it gets confusing and convoluted.

We need an umbrella that has different flexible tools under it. We're not interested in getting a separate tool for each function; one IoT platform for production, a different one for tooling, a third one for our back office, a fourth for our service division. To us, that's just asking for problems down the road.

I imagine, however, that you'll eventually want to integrate your systems with other suppliers at some point, so will you end up running into this problem anyway?

I think the industry definitely has that challenge. But again, that was a reason we went the route we did. As long as we stay flexible in our ability to connect to things, we can bring them in.

Right now everyone sees the value of platforms and there are a lot of vendors trying to bring solutions to the market, and I think over the next five years we'll see consolidation and some standardization. That's one of the benefits of working with a leader like PTC with ThingWorx and Kepware, because they're a leader that understands the manufacturing space, and you know they are helping to set some of those standards.

Did you evaluate many other platforms?

We did. We started with our traditional automation partners, Siemens and Rockwell, Mitsubishi, all these companies, and they all have interesting solutions. We also looked at nontraditional suppliers like Microsoft. We think of Microsoft

as a business software provider, but we looked at them and some of the other major players. They all have great solutions. But no one other than PTC, in our opinion, was able to bring this robust ecosystem to the floor. Everyone had a solution for a portion of our business, but they couldn't give us that overarching toolset to solve all our problems.

I want to change gears a bit to consider organizational change. You're in R&D, but has this new IoT push changed the way you work with IT?

It absolutely has, and I think it's very exciting. IT in an engineering company really was the superman in the background that kept the business running, but it was really more a request and fulfillment role. The business or the engineering side would come and say, "I have a request to do this." Then IT would say, "Okay, we'll execute that."

Now we're seeing — and this has us

very excited – that IT is starting to play a more vision-setting role up front. So we're engaging IT on jobs earlier, whereas previously they would have had no visibility into our roadmap and strategic goals. Even in this small-scale project, our R&D engineering team engages with IT on a daily basis. From an R&D and IT standpoint, we've engaged with them more in the last six months than probably the entire history of the company.

And what we found is that, not only do you get better answers to the questions you're trying to solve, but that additional perspective is really helping all of us improve across the business, not even just in this space we're working in. When you're dealing with other teams on a daily basis, it's amazing how those benefits go outside of the projects you're working on because we better understand each other's daily life which helps us support each other better on a daily basis.

Do you think this may eventually lead to some larger scale IT/R&D organizational overhaul at some point?

The way I put it is, I don't think the standard business's org chart will look the same in five to ten years. As the world marches down this IoT path, this smart manufacturing path, we're going to start seeing the lines blur between the traditional kinds of reporting structure we've had. We don't have an answer today, but we can see that something is going to change. We don't know what, exactly, so right now we're just dealing with cross-functional teams.

In the interconnected world of IoT, the question of data ownership gets interesting, especially considering your business as a tool supplier. Will you be collecting data about the performance of your tools in other people's operations, and will they permit that?

That's an ongoing conversation that we're

having internally, and then will to start to have it externally. How do two companies share data? Who owns it? How do you put it in the proper sandboxes? These are all great questions, and the honest answer is we don't have a solution today. But what's great is the industry is starting to recognize this challenge and we're starting to brainstorm answers. It's just a matter of us all coming to the table and finding a solution that fits everyone's needs.

Anything else you think is critical to this whole IoT movement?

When it comes to IoT in the industrial space, two things, and they tie together.

One, I'm passionate about the six-week sprint idea. I've seen more creative and lower-cost solutions come out quicker than I've seen on other projects, larger or smaller. Six weeks in, people can see the light. I've seen our team present new solutions that we've never come up with before, just because of the sprint model.

And I think that ties into the big fascination I have with IoT, which is, I don't necessarily think we're waiting on technology to solve any of our challenges. I think what we're doing is understanding culturally in business how to implement these solutions. The sensor data is there. The communication protocols are there. The tools like Kepware and ThingWorx are there. It's more a matter of what does that look like in my business? It's all very much cultural and human things that we need to solve, not so much technology challenges anymore.

Technology will continue to move forward and give us even better solutions, which is great, but the reality is it's more of a business/human transformation than anything else. ■

OTIS ELEVATOR LOOKING TO IoT, DIGITAL TRANSFORMATION TO PROVIDE A BUSINESS LIFT

A large infusion in R&D and IT will be used to network field technicians and develop advanced capabilities for newly connected elevator cars

OTIS ELEVATOR/THINKSTOCK



Fig. 1.—THE OTIS ELEVATOR PASSENGER CAR.



BY JON DIX

Marcus Galafassi was named VP of Information Technology and CIO at Otis Elevator last October, joining the company at a critical time as the venerable firm is looking to make a large investment in technology to improve customer service and pave the way for new capabilities. Network World Editor in Chief John Dix recently talked to Galafassi about the big picture plans.

I understand Otis has some big digital transformation and IoT plans in the works. Tell us about that.

I've been with United Technologies for 23 years, but when I had the opportunity in late October to come to Otis to lead IT I was excited because of the transformations that will be made possible by the biggest investment in engineering and information technology in the 160 years of Otis' existence.

In R&D we are looking at a 25%-30% increase in spending, and for the information technology to support the transformation we are investing a considerable amount over the next five years. I cannot disclose the figures, but on a year-to-year basis I would say the investment in R&D and IT together is 40%-50% more. It is a considerable amount of money that the leadership has dedicated to the transformation and digitalization strategy, to support the product evolution, to support the evolution of the customer experience.

We have 31,000 technicians servicing two million elevators across the globe and these elevators are transporting around two billion people every single day. So we have two main goals to address: One, improve productivity by instrumenting our 31,000 technicians worldwide, and two, connect our elevators so we we can offer new capabilities to customers and so we can apply data science to improve service.

Are any of your elevators connected today?

Yes. Out of the two million elevators more than 300,000 are connected today with a technology called REM (Remote Elevator Monitoring). We collect several pieces of data, including information about how far the cars have traveled and information about malfunctions ... like a door failing to close or open all the way. That signals an alarm, of course, but once you have collected this data you can apply data science and start to create a model to predict future

failures and send a technician to fix a problem that isn't even evident yet. We can also do that for elevator wire ropes, although that is more complicated to predict. But what you want to do is collect data about the health of all the electronic and mechanical components so you can anticipate failure and service requirements.

What changes going forward?

We're collaborating with AT&T to move to a global SIM card for wireless connectivity of our elevators, creating a machine-to-machine (M2M) network that replaces the connectivity we have today. All of these will be managed by AT&T's portal, giving us full control of the elevators.

Also AT&T and Microsoft have several APIs that will facilitate the extraction of data so we can design more apps to take advantage of the information collected. That's pretty much why we selected these two companies — AT&T gives us network coverage on a global basis, Microsoft is our

CRM partner and can help us build apps, and they partner with each other, too.

Do you start by upgrading the connected elevators to SIM cards, or use the tech to pull new machines into the network?

We don't have a precise roadmap yet, but we'll probably start where we don't have connectivity today. We're going to have a proof of concept (POC) in North America and move to Japan as well. I don't want to network them just to connect elevators. We need to have an additional portfolio opportunity. We need to prepare a roadmap along with our marketing strategy, sales strategy and of course engineering, but from a future products standpoint we are already designing elevators to be connected through M2M. This product evolution is going to play out in the years going forward.

Can you give us a glimpse at the capabilities you expect to enable?

End-to-end connectivity makes many things possible. In Europe, for example, we have already launched eView, which is an interactive, multi-display system in the elevator that can be used to broadcast information and also support interaction with elevator occupants. If a person is trapped, we can use the system to communicate with them. This is a new product and obviously it relies on connectivity.

So if my car is stuck I hit a button and you can open up a video connection with me?

Exactly. And we can also use the system to support marketing purposes in each car. You can broadcast the weather, broadcast news, whatever.

Is that a potential new revenue stream for the building owner? A way for them to charge advertisers that want to reach these captive audiences?

That's revenue the building owner can col-

lect. That's an extra for them. But of course there is more. Another capability we're working on is eCall, which is a smartphone app that can be used to call an elevator. So this, again, is interactive and requires connectivity to the elevator.

How do I benefit using an app to request an elevator?

You don't need to go to the wall and press the button; you can use the app while you are walking. That's one thing. But what you're really looking for is the ability to predict. The elevator is going to know you are going to floor five because you're a subscriber and always go to the same floor. So, in the future, it's going to see you approach and know where you want to go without you pushing any button. That's the technology that's going to evolve.

So it will use some form of near-field communications to see I'm approaching?

That's the idea. It's John coming and he

goes to the fifth floor every day. The phone is going to communicate to the elevator and drop you at the fifth floor.

eView was launched in late March and we are now ramping up for customers. We're pretty much targeting eView and eCall at the European market first because we've had some contract erosion there and this is one of the tools we are using to fight back.

Ok, so that's the connected elevator. You said you're also teaming with AT&T to connect your 31,000 technicians? Are they connected in any fashion today?

Only 8,000 out of the 31,000 technicians have phones today, so it's a massive change of management in the field. We are issuing smartphones to all of them as part of our strategy. The goal is to increase productivity and improve customer stickiness.

By putting technology in their hands it will improve productivity by giving them fast access to spare parts lists, understand

part numbers, and even help with visualization by taking a picture of a part that is broken and then issuing it back over the supply chain to be sorted out. There are a lot of things we will be able to do.

And then on the customer stickiness front, we will have apps to improve customer experience, like improving basic communications so they know where their technician is. We actually have 12 apps planned that have to be sorted out in the next year in terms of strategy. All of them are related to productivity or customer experience.

So you start with connectivity by giving them a device and you build on that platform?

Correct. Our goal is to get everything ready by the end of next year. It is a big undertaking because we have to build the apps and we have to have the right content management system in place. We operate in more than 200 countries and territories, so we

cannot just have an app in English. Technicians don't speak English in Italy, France, Spain, etc. And we have logistic centers in Europe, in North America, in Asia, and we have to have the right part numbers for the right parts in each location, so it's complex.

We call it the global Web from a technology standpoint, but there has to be local content management, there has to be support for the local language. That is why it takes a while to implement this technology.

That sounds like a nightmare. So you update it in one location, then you have to replicate that around the world?

Exactly. It's a global challenge. ■

IoT CATCHES ON IN NEW ENGLAND FISHING TOWN

Businesses in and around New Bedford, Massachusetts, discover the power of IoT-enabled sensors to improve farming, fishing and even winemaking

THINKSTOCK



BY MICHELLE DAVIDSON

Fifty miles south of Boston, the Internet of Things is taking hold in the City of New Bedford, Massachusetts. It isn't something you'd expect in this fishing and agricultural area. But thanks to [INEX IoT Impact Labs](#), [Dell](#) and the companies' many IoT partners, small and midsize enterprises here are discovering the power of IoT-enabled sensors and monitoring—and the data that comes from them.

There's a type of industrial revival taking place among those types of businesses—taking current infrastructure and renovating it with new technol-

ogy, says Christopher Rezendes, founder of INEX. They're recognizing how this technology can help them solve real business problems and do it without having to spend a lot of money.

"Most of this planet is made up of individuals and small and midsize businesses just trying to make their way, not Fortune 500 companies," he said. "We want to make sure the little folks aren't locked out from getting and using the technology—and the data collected from it. We have to figure out how to do this the right way in places that don't have all of the resources of big cities—in resource-strapped locations."

INEX is like an IoT incubator. It partners with startup IoT tech companies, helps them develop the technology in the lab, then finds small and midsize enterprises to pilot the projects in the field. Farms and fishing businesses are the living labs.

To date, INEX and its partners have

25 living labs in the New Bedford area. The IoT technology monitors environmental conditions so they can improve operations, better manage resources, and grow better and more product.

"Robots are not the answer for all things," Rezendes said. "We want to help businesses become more stable so they can hire more people. A positive impact from this will be felt down the line—in the canning business, plumbers, HVAC, production, banking, website design and more. At the end of the day, boots go in a truck and screwdrivers have to be turned."

The ultimate goal is to help the businesses become stronger and more profitable so they can hire more workers—and create healthier cities and towns.

INEX isn't alone in this venture. The state of Massachusetts is helping with projects around the state, including in New Bedford, and is investing \$60 million to get technology out of the labs, deploy it in

cities and towns, and make the technology in the state, said Katie Stebbens, assistant secretary for technology innovation and entrepreneurship for the state.

"We forget that towns and cities have to be profitable," she said. "Towns are going to be here no matter what. Businesses may leave, but towns and cities will still be here."

IoT living labs in the New Bedford area

INEX, with cooperation with Dell and its IoT partners, have IoT living labs operating at 25 small and midsize enterprises. Some of the field-based pilots, include the following:

Port of New Bedford

The [Port of New Bedford](#) has a blind spot. It cannot adequately see all activity coming in. This creates a security issue, but also a revenue issue because fish houses might under report landings and private boats

might come in and not pay landing fees.

The solution is an IoT-enabled sensor powered by a Dell V5 gateway on the lighthouse. The gateway is like a data center in a box and can operate on its own—using Bluetooth, Wi-Fi, ZigBee wireless technology, and its own power source. Sensors can be added to the gateway to monitor a number of things.

Currently, the gateway on the lighthouse has a motion sensor. When the sensor detects a boat, it triggers an optical curtain in front of the blind spot in the port and video cameras start running, says Edward C Anthes-Washburn, executive director of the Harbor Development Commission.

This provides persistent security for fish houses, while also ensures the boats entering comply with the port's rules and regulations.

"It's a security service at night," Rezendes said. "Think of it as ADT for your boat."



PORT OF NEW BEDFORD

IoT-enabled sensors monitor nighttime activity in the Port of New Bedford, providing persistent security for fish houses.

In the future, the video created could be used to eliminate the paper invoicing fishing companies have to submit.

The project also has the capabilities to provide Chemical, Biological, Radiological and Nuclear (CBRN) sensors in multiple points, Rezendes said.

Salt Creek Vineyard, South Dartmouth, Mass.

The Salt Creek Vineyard uses IoT-enabled weather sensors and a Dell V5 gateway to remotely monitor humidity, sunlight hours, moisture and wind speed.

MICHELLE DAVIDSON

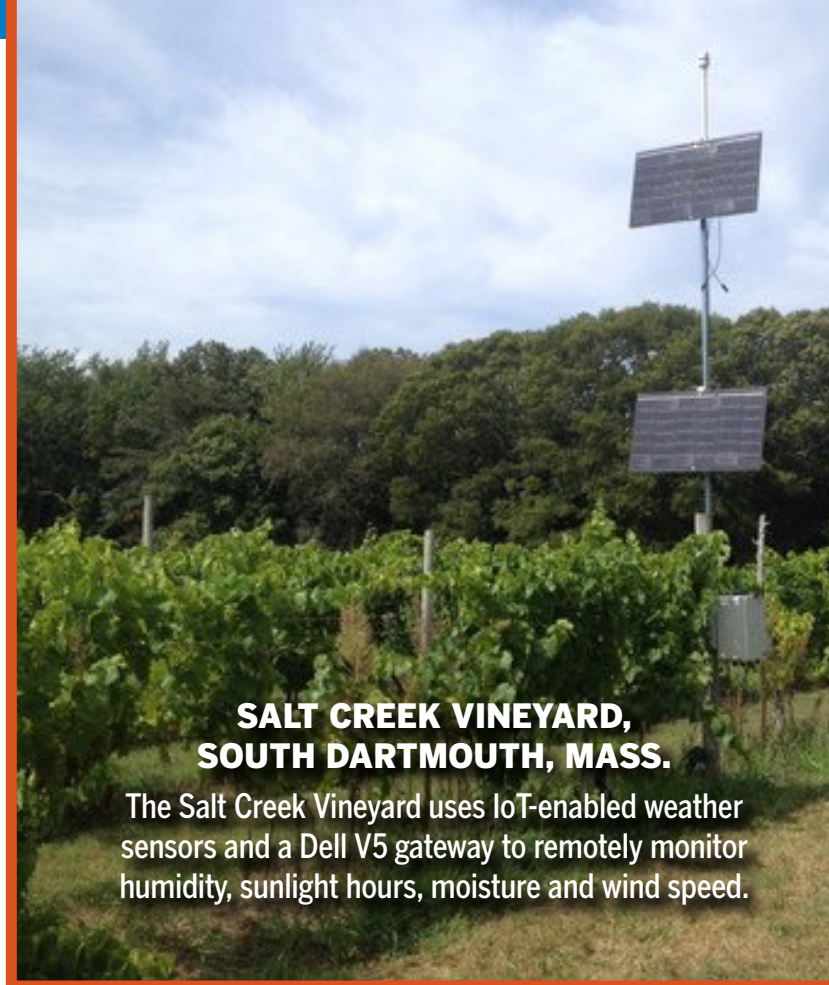
Farms like Salt Creek Vineyard have to manage several unique microclimates. The conditions in one field can be completely different from conditions in another. The wind, moisture and soil can all be different, which means crops must be cared for differently.

Plus, the water level and quality of the vineyard's well water must continuously be monitored to provide proper watering to the vines. One mistake could destroy the grapes and ruin the vines.

To help with this, Salt Creek, which is a 20-acre vineyard within a 130-acre farm, uses Dell's V5 gateway and IoT technology in two locations.

LOCATION 3:

Field 3 has a solar-powered Dell V5 gateway that has weather monitoring sensors.



SALT CREEK VINEYARD, SOUTH DARTMOUTH, MASS.

The Salt Creek Vineyard uses IoT-enabled weather sensors and a Dell V5 gateway to remotely monitor humidity, sunlight hours, moisture and wind speed.

MICHELLE DAVIDSON

It's like a data center in a box—able to remotely monitor humidity, sunlight hours, moisture and wind speed.

Skott Rebello, production manager at Salt Creek, says knowing the amount of sunlight hours determines when the vineyard can begin its harvest, and

knowing the wind speed determines whether conditions are good enough to spray pesticide.

The vineyard plans to add soil monitoring sensors and would like to add leaf analysis to help with preventive care of the vines.

LOCATION 2:

At the location where Salt Creek plans to put its wine making facility, the vineyard monitors the quality of its water supply: pH level and temperature.

Knowing the correct pH level allows Rebello to accurately treat the water before spraying onto the vines. Spraying improperly treated water could destroy the vines.

All of the data is transferred into software—a dashboard—where it can be monitored and tracked.

Once wine making production begins, the vineyard will use sensors in

the tanks to measure temperature, pH and other conditions.

**Quansett Nurseries,
South Dartmouth, Mass.**

Growing plants year-round in New England is a tricky business. Changing seasons means nurseries have to constantly monitor their growing environments and adjust them. Plus, they need to monitor their water supply, which during a dry summer can drop to unnerving levels.

At [Quansett Nurseries](#), a wholesale grower, Fred Dabney uses sensors in each of his two wells to monitor water levels. By knowing the levels, he can decide which well to use to water the plants. He can adjust and switch between wells so he doesn't stress either of them.

The nursery uses sensors with a Dell V5 gateway in its greenhouse that grows microgreens. The sensors measure light, moisture and heat in the many different zones in the building. Each plant has



**QUANSETT NURSERIES,
SOUTH DARTMOUTH, MASS.**

Quansett Nurseries use IoT-enabled sensors and Dell V5 gateway to measure light, moisture and heat in the many different zones of the greenhouse used to grow microgreens.

different needs, and the sensors help the nursery ensure they provide the perfect climate for them.

The sensors control venting. When it gets too hot, the vents open and a curtain covers the inside of the roof. When it gets too cool, the vents close and the curtain remains off.

Under the microgreen beds, there are water tubes. If warmth is needed to germinate the seeds, they run hot water through the tubes.

The nursery also uses sensors in its hoop houses – sensors to monitor activity (motion), temperature, humidity, UV and sunlight.

The data, which is transmitted to a dashboard, helps Dabney provide optimal growing environments for the plants. ■

Other IoT living labs INEX and Dell have in operation:

- **[Island Creek Oysters in Duxbury, Mass.](#)**
The oyster farm uses sensors to monitor water quality to help breed oysters.
- **[Triple S Farm in Westport, Mass.](#)**
The cattle farm uses sensors monitor groundwater, livestock, and barns and facilities.
- **[Ivory Silo Seed Project in Westport, Mass.](#)**
The organic vegetable farm and seed saving program uses sensors to monitor soil conditions, bees and traceability.
- **[Buzzards Bay Brewing in Westport, Mass.](#)**
The brewery uses sensors to monitor micro-climates, soil conditions, water level and water quality, and keg tracking efforts from the company's global headquarters in Hiroshima.

PUTTING **IoT** TO WORK

STORAGE TANK OPERATOR TURNS TO IoT FOR ENERGY SAVINGS

Granular insight into energy usage at the sprawling facility,
and emerging predictive capabilities, could lead to savings of up to 25%

VOPAK



BY JON DIX

Royal Vopak N.V. is a leading independent tank storage provider for the oil and chemical industries, operating 67 terminals in 25 countries. Chris Sheldon, Terminal Manager for the company's operation in Savannah, GA, recently oversaw the implementation of an Internet of Things deployment that is enabling the terminal to minimize energy usage, which should lead to significant cost savings. Sheldon shared the story with Network World Editor in Chief John Dix.

Let's start with a thumbnail description of Vopak.

We are a liquid bulk third-party terminaling business. We store liquids for customers — chemicals, tropical oils, biodiesels, asphalt, many different types of commodities — and distribute them by truck, rail, pipeline and vessel. We're headquartered in the Americas out of Houston, Texas and globally out of Rotterdam, the Netherlands.

Here at the Savannah terminal we have 54 tanks in four tank farms. A little over half of those are insulated, meaning that we have product in them that we heat and agitate. The total capacity of the facility is 1.4 million barrels. Our largest tank is 80,000 barrels and our smallest is 5,000 barrels.

What problem were you trying to solve when you went looking at Internet of Things technology?

It started with our global innovation

group, which is out of the Rotterdam office. They had contacted IoT company Atomiton and visited the terminal in Savannah last year to see if IoT made sense to help us solve problems. Together we brainstormed ideas on problems we had, like the lack of visibility into and the ability to change the way we utilized electrical energy at the terminal. We have substations throughout the terminal that house different types of equipment and are all fed by the Georgia Power Company.

We had very little real time visibility into what equipment was running when — what tank was being heated or mixed or what pumps were being used to load or unload a truck or railcar — so we had difficulty knowing when we had multiple pieces of equipment running at one time,



CHRIS SHELDON,
Terminal Manager,
Vopak Terminal
Savannah, Inc.

which would drive up our peak electrical demand and that peak demand determines our billing rate.

Everything that we had tried to do in the past to address energy usage was very after the fact. By the time we were able to get the information from the power company, synthesize it in a spreadsheet and try to determine what path we should take to reduce our consumption, it was

too late. We couldn't make a model that would sustain conservation efforts.

One thing Atomiton and its operating stack of things brought to the table was an ability to talk to these different electrical devices and understand the data that's coming from them and put it in a format that we could use to make decisions.

Because we had tried a few things in the past, I didn't believe they could do it

at first. But the more I spoke about the details of the equipment in the substation, the more I could see they knew what they were talking about. They were quickly able to mock up and develop a solution that kind of blew our minds.

Did you have any visibility into that equipment before?

The devices come into our Programmable Logic Controller network, but our PLC just reads the data. It wasn't doing anything with it. We have different field devices that talk in Modbus or Ethernet and they've each got a different parameter or bits of information they can send to us. Some of them are very rudimentary, such as on/off. Some are more technical and can give us real time amps. It just depends on the device.

Atomiton was able to take parameters from each field device and slot them into classes — mixers, pumps, etc. — and then put that in a format where we could

see where our energy was being used in real time.

Now we can not only see the pumps, the mixers, but also the levels in the tanks and the temperature of the tanks. They even take the external temperature from a weather station and use that to predict when a tank is going to reach a given set point. That allows us to shift activities accordingly. We can say, "Okay, this tank is heating right now. Maybe it can wait two hours to heat so let's turn the mixer off." Or, "We have a pump that's going to start in two hours, let's go ahead and either bring that up or delay that activity in to minimize our demand."

So staggering operations that consume a lot of electricity adds up to what kind of savings?

We're still early in the process so we don't have a hardline number, but we expect around 25% percent savings on our peak and 10% on our usage.

I get how you can reduce peak demand, but how do you realize usage savings?

Because we didn't have visibility, there were times we were heating pipelines that had little planned activity. We didn't have the information needed to make smart decisions. Now we have a tool that lets us say, "Hey, we're not using this piece of equipment for the next two days. Let's just turn it off."

How long did it take to roll out this IoT system?

It took about three months, and then about another two to three months of monitoring, making sure the data coming over was the data we expected, looking for interruptions in that data stream. Sometimes interruptions were because of a power blip or because of communication issues between devices.

Are you the first terminal in the

Vopak system to adopt this technology and does it scale from here to other operations?

We're the first. There has been a great deal of interest in this and I've given several presentations concerning the technology to organizations in Europe and elsewhere. We're the proof of concept. And even within our own terminal we're moving towards expanding this to other electrical substations.

How many terminals in the Vopak network?

Sixty-five terminals in 25 countries.

Wow. Ok, so if I understand it right, IoT is giving you better visibility/monitoring so you can manually intercede. Is there any automation coming down the pipe?

Yes, it is planned. There are certain activities we want to have the software manage and control, such as the heating and agita-

tion of tanks. But there are certain tasks and activities we still want to maintain control of. But yes, in the pilot phase we do have plans for it to predict and also send bits back to the PLC network to tell equipment to turn off or on. There are some noncritical operations that could be managed better by automation with certain criteria and constraints or conditions.

Anything else I didn't think to ask about that would be important to share?

I've had the privilege of working on a lot of projects at Vopak and I can say that working with Atomiton has been very easy. They are very agile and very attentive to our needs. The project went a lot faster than I expected, mainly because their development was quick. They were able to speak to our field devices. They wanted to understand the problem and they actually brought some features to us that we had not even asked for but have

since become very relevant.

What kind of stuff?

Just in terms of things we didn't think we could do. I was happy to get information to my dashboard so I could make decisions, and they said, "Hey, with this information we can look at the variables and make predictions that will help you." That's something we didn't ask for but it's something they saw once they dove into the problem. ■

HOW PHILIPS IS TURNING TOOTHBRUSHES AND MRI MACHINES INTO IoT DEVICES

Connected toothbrushes and MRI machines collect data and send it to AWS's cloud for analysis



PHILIPS



BY BRANDON BUTLER

The Philips FlexCare Platinum Connected toothbrush is more than just a device for keeping your mouth clean – it’s an IoT machine. Wireless sensors measure the location, pressure and scrubbing patterns of the 31,000 strokes-per-minute vibrating bristles. The data is transferred via Bluetooth to a mobile app that provides a three-dimensional post-brush analysis of coverage, recommending areas of the mouth that should be “touched up” or given extra attention. There’s an

option to send a month-long history of brushing patterns to your dentist to keep them informed of your brushing habits.

And all of this data, along with many of Philips' other connected device efforts, run out of Amazon Web Services' cloud. It's a new era of Internet of Things-enabled machines, and Philips wants to be on the cutting edge of offering its consumer and business customers access to more data, which they hope will help keep patients more healthy and the machines running more smoothly.

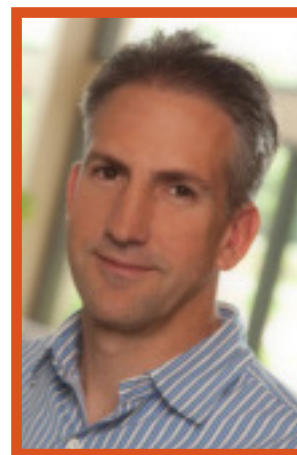
Philips is tapping into the burgeoning IoT market, which research firm IHS [says comprised 15.4 billion connected devices](#) in 2015 and predicts will double by 2020. [IDC estimates](#) IoT was a \$737 billion market last year and will undergo a 15.6% compound annual growth rate to reach \$1.29 trillion by 2020.

Dale Wiggins is vice president and general manager of the Philips HealthSuite Digital Platform and is responsible

for the company's health suite digital platform, which developed the FlexCare toothbrush's connected functionality. "It feeds into our goal of improving overall health care," he says. "By connecting our devices and modalities in the hospital or consumer environment, it provides more data that can be used to benefit our customers."

Another major effort has been to enable connectivity in the company's imaging devices, specifically Magnetic Resonance Imaging (MRI) machines. The key advantage in this use case is reduced maintenance costs.

Traditional MRI machines that are not "connected" record their vital statistics – how efficiently the machine is running, status of various components and reporting of any errors. In the past it has



DALE WIGGINS,
Vice President and
General Manager
of the Philips
HealthSuite Digital
Platform.

required a trained technician to tap into the machine, read the log files, then schedule a maintenance repair based on parts that need to be ordered.

With connected machines, those log files can be securely uploaded into Philips' IoT cloud, which is housed in AWS. The machine, using backup computing capacity in the cloud, can now self-analyze how it's performing, what the levels of various fluids are,

and cycle times for moving parts. Philips collects this data and aggregates it across many machines from all around the country. When one machine shows an issue, Philips can look for warning signs that may have predicted it, then flag those as alarms in other machines. Instead of specialized technicians making hospital calls for checkups, they can now respond

only when they're actually needed – making their work more efficient, and less expensive for customers.

“What this is really doing is pulling information much quicker and making it actionable through analytics and algorithms,” Wiggins says.

IoT from the cloud

The back-end system to enable the connected functionality of the MRI machine runs largely out of the AWS cloud. The log data is collected as it normally would be, but newer machines and retrofitted older ones have a set of receivers that can securely transfer the data into AWS's cloud.

Using a series of Lambda functions (that's [AWS's serverless computing platform](#)), the data is collected then organized, processed and stored. Philips uses predictive algorithms and data analysis tools to monitor activity, identify trends and report abnormal behavior.

Philips uses a combination of AWS



We're transforming from mainly a device-focused business to a health technology company focused on the health continuum of care and service.”

Dale Wiggins, VP and General Manager of the Philips HealthSuite Digital Platform

services, including the company's IoT platform, along with about 10,000 Elastic Compute Cloud (EC2) and various database instances, Wiggins says. Tools like Amazon's CloudWatch (for alerting) and Cloud Formation (for automatic scheduling and execution of tasks) are used. Philips has moved 19 petabytes of medical imaging data, partially using [Amazon's Snowballs](#), from hardware-based systems into the cloud. Images are stored in databases, Amazon's Simple Storage Service (its scale-out block storage platform) and Glacier, its long-term “cold” storage service. All data is encrypted by Philips, which holds the keys.

What's the hardest part about the whole process?

“It's a highly competitive market,” Wiggins said. “We have to stay on top of our game, which means educating our workers, recruiting new workers and rewarding them appropriately.”

He added: “Philips as a company has decided this is going to be a significant skill area for us. We're transforming from mainly a device-focused business to a health technology company focused on the health continuum of care and service. Connectivity is a big part of that, which is requiring us to transform as we go through this process.” ■