

# Port of Hamburg Relies on IoE Capabilities to Improve Management of Waterways, Roads, and Rail



## EXECUTIVE SUMMARY

### Objectives

- Develop a strategy to maintain, modernize, and constantly improve HPA's infrastructure
- Enhance the quality of life for citizens in the vicinity of the Port of Hamburg

### Strategy

- Develop a more intelligent harbor operation through implementation of an Internet of Everything model

### Solutions

- Extensive systems for waterway, train, and road traffic management

### Impact

- Sensors enable HPA to make smarter decisions: people receive data at the right time so they can invoke the proper processes when needed
- Integrated traffic management system (waterways, roads, rail) allows port to manage bridge closures and the roadway congestion that tends to increase when ships are offloading

## Background

In January 2014, Cisco released the results of an in-depth analysis of the economic benefits of the Internet of Everything (IoE) for the public sector. Cisco's model revealed that some \$4.6 trillion in "Value at Stake" would result from the adoption of IoE capabilities across 40 key public sector use cases over the next 10 years, including smart water, smart buildings, smart energy, smart parking, and more (<http://bit.ly/1aSGlzn>).

As a next phase of its analysis, Cisco engaged Cicero Group, a leading data-driven strategy consulting and research firm, to undertake a global study of IoE capabilities across these 40 use cases – how the best public sector organizations are "connecting the unconnected," as Cisco terms it. To that end, Cicero Group conducted interviews with dozens of leading public sector jurisdictions – federal, state, and local governments; healthcare organizations; educational institutions; and non-governmental organizations (NGOs) – to explore how these global leaders are leveraging IoE today.

The research examined real-world projects that are operational today, are being delivered at scale (or through pilots with obvious potential to scale), and that represent the cutting edge of public sector IoE readiness and maturity. The aim of the research was to understand what has changed in terms of the jurisdictions' people, processes, data, and things, and how other public sector organizations can learn from (and replicate) the trail blazed by these global IoE leaders. In many cases, these jurisdictions are Cisco customers; in others, they are not. The focus of these jurisdictional profiles, therefore, is not to tout Cisco's role in these organizations' success, but rather to document IoE excellence, how public sector entities are putting IoE into practice today, and to inform a roadmap for change that will enable the public sector to address pressing challenges on multiple fronts by drawing on best practices from around the globe.

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Dr. Sebastian Saxe,  
Chief Information Officer,  
Hamburg Port Authority

## About the Hamburg Port Authority

Hamburg, Germany, is inconceivable without its port. In the middle of the city, the port occupies about one-tenth of the total city area (7,145 hectares, or 17,655 acres) and is the backbone of business in Hamburg. The Port of Hamburg is creating jobs, income security, and growth in the region. The port benefits not only the city and the metropolitan region, but the entire German economy as well. The numbers speak for themselves: about 261,000 jobs are dependent upon the port throughout Germany. The Port of Hamburg is also an important pillar of exports and an infrastructure hub of cross-macroeconomic importance.

Since 2005, the Hamburg Port Authority (HPA) has been providing future-oriented port management services that offer one face to the customer. As an institution under public law, the HPA is in charge of paving the way for the efficient, resource-friendly, and sustainable implementation of infrastructure projects in the port. The HPA is the contact point for all kinds of questions concerning waterside and landside infrastructure, the navigational safety of vessel traffic, port railway facilities, port property management, and economic conditions within the port area. The HPA ensures the provision of land as required, carries out all statutory duties placed on it, and provides port industry services.

Dr. Sebastian Saxe is chief information officer for the Hamburg Port Authority. He has a background in mathematics and has worked in the healthcare sector previously. Dr. Saxe initially entered the public sector by working in geographical systems, then entered several IT roles. His current focus is looking into innovative ways the government can use technology – including everything from voice over IP (VoIP) to core networks and beyond – to improve people’s lives. He also functions as the IT procurement executive for HPA and deals with compliance issues. He has been at HPA for five years, since the beginning of its smartPORT project.

HPA IT Director Ulrich Baldauf works with Dr. Saxe on smartPORT strategy. Together, they oversee the smartPORT logistics project for the Port Authority and the city of Hamburg.

## Objectives

Dr. Saxe’s primary objective is to develop a strategy to maintain, modernize, and constantly improve HPA’s IT infrastructure. Efficiency is a core objective for HPA, as an efficient port and transport network promotes economic development and pleases the citizenry. “We have to make sure trains and vessels are running, and streets are not blocked; we have to make sure everything runs efficiently,” Dr. Saxe explained.

Improving the quality of life for citizens around the Port of Hamburg is another priority. “The reality is this,” continued Dr. Saxe. “The reason we would look for [a] holistic model is that we have all this business going through the city, but it impacts the citizens. To create a model where we are able to do this without negatively impacting the citizens and the city itself is our goal.”

According to Dr. Saxe, years ago the city realized that efficient port operations weren't just a question of IT architecture – there was a need to improve the overall process. That generated the push toward implementing the concept of connectivity and sensors. In 2009 and 2010, HPA started to build the foundation for connectivity implementation.

Growth and planning for growth are extremely important to the port. According to Dr. Saxe, one of his major objectives is to anticipate and keep pace with growth in the number of containers coming into the city through its port. He looks not only at capacity, but also at business process and augmentation to make sure what works today can be scaled for the future.

Ultimately, the long-term goal is to have a more intelligent harbor operation, and to have more proactive control through implementation of an Internet of Everything model. "We'd like to be able to be more proactive with our traffic-control systems," said Dr. Saxe, "so we evolve to have more intelligent systems based on what we have our systems telling us now. We are striving for a smartPORT Hamburg so the whole ecosystem and operation is more intelligent."

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## Strategy

Starting in 2009, Hamburg Port Authority began upgrading its core information technology infrastructure, a move that has allowed the port to develop sensor-based applications to monitor traffic coming in and out of the port area, including both land- and water-based traffic. The initial IP-based sensor project started in 2011 and included sensors in roadways and bridges. Currently, HPA is working to include smart lighting applications to help HPA management in their decision-making capacity. Additionally, much of the information gathered is now being transmitted publicly to improve traffic flow and citizen awareness throughout the city.

## Solution

For Hamburg Port Authority, the journey began with the internal IP network infrastructure. As HPA thought about connecting things and building intelligent systems, it became clear that the organization was missing the core network on which to build. With assistance from private-sector network technology and energy management firms, HPA developed a fiber-optic backbone by consolidating four distinct networks.

According to Dr. Saxe, 2011 was when HPA really entered the Internet of Everything era. That year, HPA built its first higher-level, broad-based application that leveraged the initial network upgrade: a traffic management system. HPA installed 300 roadway sensors to monitor traffic across major roadways in the port area. Based on its accumulated knowledge and experience, HPA is now expanding and installing new sensors in the port area for different purposes.

HPA is currently piloting a solution that would integrate with roadway traffic data to help manage traffic disruptions that may occur when ship traffic requires bridge closures around the port area.

The initial network has since been expanded to include a broader network throughout the port area, as well as Wi-Fi hotspots in strategic locations, with the assistance of a network firm and a local telco. In the future, HPA plans to expand and upgrade the system so that all the information – sensor data, video, photos, and other pieces of data – feeds into a central management hub. Once a robust volume of data has been accumulated, HPA anticipates building an intelligent system that can quantify what is going on and help analyze the best way to manage the different systems of transport.

### Road System

All of the road sensors are connected via an IP network to monitor traffic flow. The Port Road Management Center receives the data, which is then analyzed via algorithms to determine traffic speed, congestion, and significant issues. The system does not provide active traffic management, but currently serves as a monitor of what is happening on the roads and bridges. The system also monitors vehicle weight, which helps determine how much traffic has crossed a bridge, informing bridge design, maintenance, and renovation schedules.

HPA then installed large digital billboards to communicate with drivers about delays and traffic patterns. Sensors also provide parking information to drivers via mobile applications that take advantage of GPS-enabled location data. This system has reduced the time drivers spend on the roads looking for parking.

### Waterway System

The Nautical Office manages data collection for waterways, which includes radar and AIS (Automatic Identification System) to monitor incoming ship traffic. This data is fed to relevant departments to alert and prepare them for each incoming ship. HPA is currently piloting a solution that would integrate with roadway traffic data to help manage traffic disruptions that may occur when ship traffic requires bridge closures around the port area.

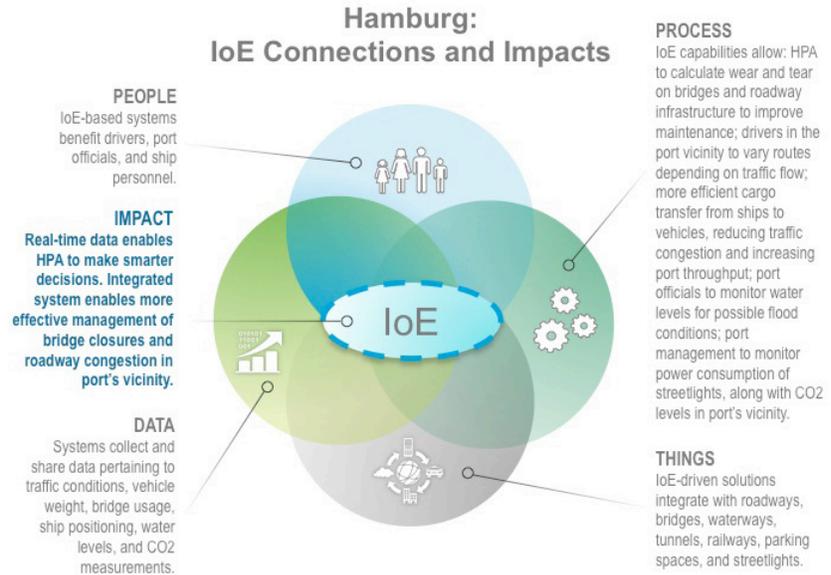
### Rail System

Finally, the Rail Supervision Headquarters oversees management of the rail network within the port area. According to Dr. Saxe, HPA recently implemented a service-oriented architecture (SOA)-based system that is common to the port industry.

HPA also utilizes collaboration technology to facilitate internal video conferences as well as video conferences with customers and partners. Dr. Saxe feels that this technology has added significant value, allowing HPA to collaborate in more effective ways.

According to Dr. Saxe, the Internet of Everything enables people in Hamburg to make smart decisions due to the sensors and systems HPA has in place. For example, when a ship comes into the harbor, HPA's systems indicate that it is approaching. This allows HPA to get real-time information to those who need it, including ship pilots, cargo handlers, environmental monitors, and so forth. People receive data at the right time so they can invoke the proper processes at the right time.

Figure 1. Hamburg Port Authority: New and Better Connections.



Source: Cisco Consulting Services, 2014

## Impact

According to Dr. Saxe, the Internet of Everything enables people in Hamburg to make smart decisions due to the sensors and systems HPA has in place. For example, when a ship comes into the harbor, HPA's systems indicate that it is approaching. This allows HPA to get real-time information to those who need it, including ship pilots, cargo handlers, environmental monitors, and so forth. People receive data at the right time so they can invoke the proper processes when needed.

Dr. Saxe indicated that Hamburg's integrated traffic management system allows relevant individuals to begin looking at how, for example, a ship's arrival will impact street and train traffic. When large container ships pull into port, this often requires the raising of bridges, which, depending on the bridge, will stop vehicle or train traffic, or both. Given the added lead time and transport network visibility that the sensor system provides, port officials can manage bridge closures and the roadway congestion that tends to increase when ships are offloading.

Due to HPA's strategic vision and contribution to economic growth, in the last five years, city officials and residents have paid more attention to the technology and programs that HPA has implemented. Technology has now become part of the strategic effort to improve the city's growth and quality of life.

“For me, the Internet of Things is just too simplistic. Internet of Things means that we don’t bring people and process into the equation of what we are trying to do. Internet of Things for me is just pure technology. It’s Wi-Fi, embedded systems, the technology that is out there. The Internet of Everything, on the other hand, incorporates the technology, tries to build a control process, and includes people in this process in order to build more intelligent systems. If you try to approach this type of model and you leave out processes and people, you are going to be left with half-truths, or an incomplete solution.”

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## Lessons Learned / Next Steps

One of the biggest challenges has been demonstrating tangible results of technology, and communicating them in terms the general public will understand. One strategy to address this has been to build small prototypes to show incremental benefits. It is a less comprehensive approach, but allows HPA to highlight project results to generate momentum and support larger implementations.

Another challenge cited by Dr. Saxe has been integrating various technologies and initiatives. Different systems, if kept separate, provide a fragmented picture. Pulling the systems together is a critical step in building overall perspective on port operations. Finding heterogeneous technologies, and integrating technologies into the overall plan, has been more difficult than originally anticipated.

“I have an Oracle database here, a network there, and Microsoft technologies here – getting them to talk to each other can be very difficult at times,” Dr. Saxe stated. “For me, candidly, that has been the biggest challenge. I would like to have a blueprint so that I know that the pieces of the blueprint can work with one another. I would like to be able to go to the IT manufacturers that are on my blueprint and ask them how they are supposed to integrate with one another. I would like to incorporate into my plans the trends of social networking and Big Data – how do I understand these trends and how do I incorporate them into my approach so they are not overlooked. If you don’t pay attention to all of these, you constantly have to revise your blueprint.”

When asked about the Internet of Things and the Internet of Everything, Dr. Saxe stated, “For me, the Internet of Things is just too simplistic. Internet of Things means that we don’t bring people and process into the equation of what we are trying to do. Internet of Things for me is just pure technology. It’s Wi-Fi, embedded systems, the technology that is out there. The Internet of Everything, on the other hand, incorporates the technology, tries to build a control process, and includes people in this process in order to build more intelligent systems. If you try to approach this type of model and you leave out processes and people, you are going to be left with half-truths, or an incomplete solution.”

As for next steps, HPA is attempting to integrate additional sensors into its systems based on initial findings. It wants to place additional and more capable sensors in key hotspots to gain a deeper understanding of what is taking place. HPA also wants to learn more about who is moving where, and when they are moving. According to Dr. Saxe, this will bring HPA into the realm of Big Data. For this step, HPA is currently looking at auto registrations using sensors and images. According to Dr. Saxe, these sorts of higher-level intelligent applications are the future for HPA and are already in the planning phases.

Lastly, among various pilots and test cases that are ongoing, the environment is an area that HPA is beginning to explore, including a smart streetlighting program. HPA views this as another infrastructure building block necessary before moving into higher-level intelligent systems.

## More Information

For more information, visit <http://www.hamburg-port-authority.de/en>



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