

Amsterdam Uses IoE-Driven Capabilities to Cut Energy Usage, Improve Electric Grid's Reliability, and More



EXECUTIVE SUMMARY

Objective

- Drive economic development and global city investment competitiveness, while improving the lives and livelihoods of Amsterdam residents

Strategy

- Encourage local telecommunications provider and electricity company to develop infrastructure that would support citywide applications
- Develop pilot projects to provide new data and access to help improve service efficiencies and resource reductions
- Build large-scale projects that capitalize on new infrastructure
- Convince city-run and affiliated entities to make procurements with an open-architecture and smart-capability focus

Solutions

- Initiatives include smart energy grid systems, smart lighting, a smart parking application, smart work centers, public Wi-Fi, and smart building management

Impact

- 9 to 14 percent savings on energy bills due to apps that provide greater insight into individual energy usage
- Sensors on electric grid have improved the network's reliability, minimizing outages and downtime

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/1aSGIzn>).

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.

About the Amsterdam Smart City Initiative

The Amsterdam Smart City Initiative is a citywide effort to develop capabilities and information flows that enhance city operations and quality of life. The initiative currently includes 47 separate projects that contribute to these objectives by providing increased data access, data transparency, data monitoring, and distributed computing. The Internet of Everything concept forms a core element of the initiative, providing increased access, monitoring, and control capabilities through open-architecture computer and network platforms, and by engaging disparate elements of the city to provide for common improvements.

Specific initiatives undertaken within Amsterdam include smart energy grid systems, smart lighting, a smart parking application, smart work centers, public Wi-Fi, smart building management, and more. Many of these projects have been developed as pilot projects in certain parts of the city, with the anticipation that successful projects will be deployed broadly. Projects include Nieuw-West Smart Grid, a smart electric grid project in the Nieuw-West district that includes the addition of sensors and smart monitoring technology on the district's electricity grid; and Flexible Street Lighting, which involves placement of cameras, Wi-Fi routers, and environmental monitors on streetlights on Hoekenrodeplein.

In March 2014, Ger Baron took up the newly created role of chief technology officer for the City of Amsterdam. The job was created to help coordinate citywide ICT efforts and the overall Amsterdam Smart City initiative. In this role, he oversees Amsterdam Smart City efforts and development of a strategic approach to utilizing technology to improve the lives of Amsterdam residents. Previously he served as cluster manager for ICT and e-Science at the Amsterdam Economic Board (AEB), a nonprofit organization focused on creating public-private partnerships. In that capacity, Mr. Baron's key initiatives focused on innovation, and he played a crucial role in developing Amsterdam's Smart City initiative from the beginning.

Prior to his current role, Mr. Baron worked with one of the local political parties in Amsterdam and prior to that he worked as an IT consultant with Accenture. He has a university degree in Literary Criticism and he also worked in computing during his undergraduate study.

Annelies van der Stoep works with the Amsterdam Economic Board and is currently serving as area manager for the Nieuw West Living Lab and as local coordinator for the City-zen program under the Amsterdam Smart City initiative. She has a background in urban planning, real estate development, and sustainability, and undergraduate and graduate degrees in architecture.

Objectives

Amsterdam's Smart City initiative started in 2007 as the city considered proposals by tech companies on how city government could improve overall city operations utilizing Internet of Things (IoT) technologies. Concurrently, city officials managing both the city's IT infrastructure and the electricity grid were contemplating upgrades to their infrastructure. Recognizing that implementing citywide applications was more complicated politically than just adopting a new technology, the city decided

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to focus efforts on building open architecture platforms that could be used for future IoT projects.

Economic development and global city investment competitiveness have been two primary motivators of Amsterdam's Smart City initiative. The third key driver has been improving the lives and livelihoods of Amsterdam residents.

Strategy

The Amsterdam Economic Board (AEB), a public-private partnership organization that focuses on economic development and improved quality of life for Amsterdam residents, has been the primary champion and driver of smart tech initiatives throughout the city.

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Chief Technology Officer,
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“We saw two developments: the city telco had an ambition to speed up its broadband network, and the local (electric) grid operator wanted more energy grids,” Mr. Baron explained. “Basically, we said to them, ‘You are investing a billion dollars in new infrastructure, and it would make sense to also think about the application of the infrastructure and who is going to use it and when.’ In this way, we decided to take more of a ‘city as a platform’ approach.” With this discussion, Mr. Baron and the AEB members encouraged both the local telecommunications provider and the electricity company to develop infrastructure that would support citywide applications.

These two infrastructure investments formed the basis to Amsterdam's Smart City initiative. The projects took approximately two to three years to implement, from 2008-2010.

Once the architecture of both the city's telecommunications network and the electric grid had been opened up, the city started developing pilot projects to provide new data and access to help improve service efficiencies and resource reductions. Because these network upgrades involved the installation of IP-based hardware, they enabled the addition of new technological layers that could interoperate on the network backbone.

Since that time, the city has started to build large-scale projects that capitalize on the new infrastructure. One of the key projects has been a smart streetlighting project that includes cameras, environmental sensors, Wi-Fi connections, and other technology in the light posts. As the project is launched, the city is testing various models of access and control, to include allowing business owners and residents to view camera information and control lighting levels in their vicinity.

According to Mr. Baron, the key in public messaging is not to focus on “smart cities,” or becoming a smart jurisdiction, but rather to focus on what the implications are for improving one's quality of life. “What we want to do is to talk about people living in the city,” he said. “We don't believe that people want to live in a ‘Smart City’ per se. We do believe that people want good healthcare, good education, good traffic flow, to live in an efficient city, and so on. So we don't have campaigns about being a ‘Smart City.’”

In the current second wave of initiatives, much of the work is based on convincing city-run and affiliated entities – including schools, healthcare institutes, grid operators, energy companies, housing agencies, and so on – to make procurements with an open-architecture and smart-capability focus. According to Mr. Baron, this is the key to ensure projects are scalable to meet the needs of a much larger population.

With regard to engaging the public sector and the business community, Mr. Baron indicated his efforts have focused on getting people to think about solutions to problems, and then to use technology as the facilitator of the solutions. In many cases, much effort has been required to get technology on the agenda. Since that foundation was established, it has been integrated into processes in ways that keep innovative thought and technology within the planning process.

Ms. van der Stoep indicated that data privacy is a significant concern in the Netherlands, and that this is affecting how the city goes about collecting and distributing data. In the case of smart electric meters, Ms. van der Stoep indicated that the city and the electric utility are both prohibited from publishing individual household-level data, and that all data that is published must be anonymized to ensure it cannot be traced to a particular resident or household.

According to Mr. Baron, most of the pilot projects were privately funded, with some government support in terms of facilitation. These projects laid the groundwork and helped establish the business case for future, larger-scale initiatives.

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The AEB, which oversees many of the city’s IT initiatives, has played the lead coordination and motivation role in establishing IT initiatives throughout the city. Recognizing that there was no other entity to provide such coordination, the Board asked both the city and the local infrastructure operators (telco, electricity) to provide some funding. The entities agreed and now, while the infrastructure operators manage the infrastructure, they rely on the Board to coordinate open innovation projects. In this regard, the AEB’s ICT objectives include bringing partners together and sharing insights and knowledge. The ICT team is funded by the telecom company, the electric company, and the city. It has a core staff of 12, and receives additional staff from partners when projects dictate.

According to Mr. Baron, both the telecommunications infrastructure and electricity company investments that initially started the Smart City initiative were joint venture projects that involved both the city and the respective infrastructure management companies. The telecommunications company and electricity company are partly city government-owned as well.

Solution

From the telecom and electricity infrastructure foundation, the AEB reached out to organizations throughout the city to develop pilot projects that utilized the new infrastructure to improve efficiencies and operations. The city attempted 25 pilots initially with healthcare organizations, schools, energy companies, and other similar

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organizations that may not have been thinking about IT at the time. “We wanted to do it as a pilot and put it on their agenda,” Mr. Baron explained. “So for the first two years, until the end of 2011, what we did was basically a bunch of pilots to practice collaboration and implementation of smart solutions. We put together over 100 partners in the first three years, just thinking of smart solutions and concepts.”

Out of those initial partnerships and pilot projects have grown a number of other projects; 47 are running currently. These include smart building projects, smart work collaboration centers, a smart parking application, smart traffic management, and public Wi-Fi, to name a few. Other key projects include an open-data initiative that has spurred development of grassroots data analysis organizations and companies, and promotion of smart building technologies in public sector office buildings.

One large-scale project includes smart electric grid installation by the electric grid provider Liander. In the Nieuw West District, a grid that encompasses approximately 10,000 residences has been upgraded to include computers and sensors placed throughout the grid to monitor activity, current, voltage, and maintenance requirements. This has reduced power outages and better enabled the grid to accept energy back from consumers who install electric generation technologies such as solar panels.

The city has also been active in piloting smart lighting technology in various areas, and is about to go live with another streetlighting system that incorporates cameras, sensors, and Wi-Fi technology on Hoekenrodeplein. Data will be used to monitor public safety, environmental conditions, and lighting conditions. The system will also provide public Wi-Fi.

The AEB continues to fill a primary role of bringing partners together to design and implement additional projects. Mr. Baron leads this responsibility for the AEB, a process that he characterizes as an ongoing brainstorm session. “What we do is make a little funnel and have criterion for projects: they should improve the quality of life, should be technologically feasible, and they should be something innovative and new. A fourth [criterion] we have since added is that they should also be resource-efficient, meaning energy-efficient and contributing to CO₂ reductions.”

As the initial pilot projects have matured, Mr. Baron indicates that additional criteria are also being applied, due partly to public and press influence. “Nowadays,” Mr. Baron said, “we look less at things like technical feasibility, because we already have the platform and we can provide people to come up with new solutions. Now we look at things such as scalability, and the business case for new projects. We believe that we are out of the testing stage, and that first period was literally just to put things on the agenda of the organizations and to practice collaboration. Now we are in the phase where we are looking at scalability, so it is a bit of a different scope of the things we do.”

According to Mr. Baron, the system utilizes the Wi-Fi network to collect data from the sensors and cameras located on the streetlights. Ten percent of the network bandwidth is dedicated to this internal use, while the remaining 90 percent is used to provide public Wi-Fi access. The project has involved a consortium of private technology suppliers, as well as a handful of related small and medium-sized local enterprises.

Mr. Baron described the city’s parking application as highly algorithm- and predictive modeling-based. Rather than placing sensors in each parking spot, the system keeps track of how many have paid and for which time periods. Based on this information, it indicates the availability of parking in areas throughout the city. “What we see right now is that it is not about installing as many sensors as possible, but rather about creating the right algorithm to do the proper analytics.” Residents can access parking information and pay parking fees via a smartphone app.

In the district of Nieuw West, the local electric grid operator capitalized on a project to upgrade the grid by installing computers and sensors throughout the grid network. “In the Nieuw West area, this was [an electric] network that needed to be updated,” Ms. van der Stoep explained. “So facing those conditions, they decided to add sensing capability to the electricity grid and improve the grid’s ability to manage both the upload and download of electricity. This is in the main infrastructure now, and we are starting a new EU Summit project to see what effect, for example, electric vehicles will have on the stability of the grid.” The sensors and control system also allow for remote management of the grid, something that has eased operations at the energy company.

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The city has also begun a project to make city data more readily available, including real-time data such as public transport information, traffic information, and employment flows. The city is starting to use this information to predict future traffic flow, city usage, employment levels, and so on. This has been made possible, not via a large-scale integration, but rather by amalgamating large amounts of data provided by sensors placed throughout the city. The city is using real-time dashboards to collect and display this data in easily readable formats. This information is also shared publicly to allow private individuals to develop applications.

Amsterdam is dealing with questions about who controls or has access to new data and resources. For instance, a newly deployed streetlighting system could allow building owners to access camera information and control streetlighting levels.

Figure 1. Amsterdam: New and Better Connections.



Source: Cisco Consulting Services, 2014

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Impact

According to Mr. Baron, one of the key ideas initially proposed with the Smart City Initiative was to create insight into city operations. “When we started, we realized that the most important thing about a Smart City was creating insight, giving people insight into the things that are happening in the city. Meaning, when you talk about energy, give people insight into the use of energy. So we started to work with a few companies in the energy grid space and developed energy apps. Remarkably, by giving people insight into their energy bills on a real-time basis, they are saving 9 to 14 percent on the residential side.”

Ms. van der Stoep indicated there have been other benefits for the electric companies as well. Speaking of the Nieuw West smart electric grid system, she indicated that sensors placed on the grid have made improvements in the reliability of the network. Because they are better equipped to monitor grid conditions, grid operators have been able to take necessary steps to minimize outages and grid downtime.

Outside of the electric grid space, Mr. Baron indicated there are other benefits as well – although sometimes there are winners and losers when it comes to results. For instance, due to mobility initiatives, usage of office space has decreased in the past three years, despite a 7 percent increase in employment. While this has had a positive impact on traffic levels and energy usage, it has negatively impacted owners of office buildings and associated businesses.

More difficult to quantify has been the generation of new businesses spurred by the Smart City Initiative. Mr. Baron indicated that more than 40 grassroots initiatives have developed in the energy space alone, such as solar and wind energy projects and electric vehicle sharing.

Lessons Learned / Next Steps

According to Mr. Baron, coordinating projects across multiple government agencies is not easy. Initially, some of the technology partners believed that all they needed to do was present the mayor with a proposal and convince him that it was worth doing. They did not understand that the city of Amsterdam does not work that way. Different offices have different equities and different interests that need to be addressed. “You’re talking about infrastructures that have a write-off period of 20 years, departments that have specialists and all types of interesting KPIs (key performance indicators),” Mr. Baron explained. “Politics means that some things are top of mind, and it is not always about numbers.” For example, Mr. Baron indicated that a traffic accident involving smart-traffic applications can, in the political world, set back an initiative five years, even if it makes economic sense. This challenge is partly why the city of Amsterdam has decided to create a chief technology officer position, which Mr. Baron assumed in March 2014.

“There are quite a few processes that are pretty specific for cities,” Mr. Baron explained. “There is not a company in the world that has ever managed the [city’s complex] planning process from A to B, including the political aspects, the people aspects, the legal aspects. You have rules and regulations you have to comply with,

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including the subcontracting of different companies in the planning process. The real assets we are now sharing are not only the knowledge the city has of its own processes, but also the specific products and services the city can offer.”

Cybersecurity is another challenge with which city officials are just beginning to grapple. According to Mr. Baron, it is not something that politicians have normally considered, although as the architecture of the city’s infrastructure has become increasingly open, it is an issue that will have to be addressed.

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According to Mr. Baron, the city is also grappling with questions of tax revenue and collecting taxes on Internet transactions and grassroots businesses that operate across governmental borders. Generally speaking, the city is still trying to adjust its operational processes to the new business environment.

Mr. Baron indicated that there have been three critical lessons learned in Amsterdam’s process. First is that technology changes so quickly that officials should not think too much about the technology. The focus should be on the challenges and the solutions needed. The technology will then follow.

The second lesson is that an open architecture is essential. According to Mr. Baron, everything in Amsterdam is open, and the city has made a specific effort to avoid proprietary software. “We want to be open in the things that we do – open software, open infrastructures, and open knowledge.”

The third lesson is that there are winners and losers in this new business model. So you need the ability to address failure cases in addition to straightforward business cases, and you must organize new types of collaborations. According to Mr. Baron, it is not a one-company game anymore. You need nearly 100 companies for certain solutions, and five or six for many of them. It is a bigger playing field, with complex effect on residents and businesses, and that needs to be addressed. You need mechanisms and organizations to accomplish this.

The city of Amsterdam put out a tender in 2012 to solicit entities interested in starting a new technology institute focused on Smart City applications. A consortium that includes two Dutch universities, MIT, and a number of private companies was awarded the contract to develop the institute, a project in which the city is also intimately involved by providing data and platforms for research. The city is also providing \$50 million to the project.

“I think we are now at a moment that the organizational change is going to happen,” Mr. Baron stated. “We’ve been placing [IT] on the agenda, and now is when things are really going to change, and at a speed that I think will be mind boggling. Think about healthcare and health at home, energy, real-time traffic data – all of these things are more or less there. And I think within the next years, we will really commoditize this information.”



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