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SMART CITY INFOCUS 2017:
SMART GOVERNANCE, LIFE AND INDUSTRY

Partnered with:

中国·银川 YINCHUAN·CHINA

ZTE

TM FORUM AWARDS RECOGNIZE SMART CITY INNOVATION

TM Forum presented awards recognizing "breakthrough urban innovation" achievements from cities, solution providers and national/international bodies.

The head of the awards jury was Eddie Bet Hazavdi, Head of Smart Cities, State of Israel.

The winners are...

International City Leadership and Adoption Award

This award is for the city that best demonstrates a combination of intellectual leadership and vision, along with execution and deployment of innovative smart solutions.

Awarded to:

City of Melbourne

The jury said:

"The city has established an adaptive, data-driven process to satisfy and surprise its residents. It has embraced the need to put the citizen at the heart of every decision. The human element is strong in this city. Through its CityLab, residents are made a part of projects through co-design and experimentation. While many cities have technology solutions that rival that of this city, few have put the people front and center as successfully."

International Solution Provider Innovation Award

This award recognizes the solution provider that has created and deployed the most innovative new solutions, addressing citizen value, business needs or sustainability.

Awarded to:

Indra

The jury said:

"Indra has demonstrated a consistent track record of creating a platform business model that helps the city to deliver meaningful city services, inviting third parties to innovate within its ecosystem."

International Body Impact Award

This award is for the national or international body that has most influenced a large group of cities or solution providers to improve liveability for citizens, workability for businesses or sustainability for the environment.

Awarded to:

Open and Agile Smart Cities (OASC)

The jury said:

"OASC has based its approach on a simple and pragmatic framework, tying together like-minded cities in its network. The organization is led by a devoted team of people who are not only the leaders today, but likely leaders of tomorrow."

Domestic Solution Provider Innovation Award

This award recognizes the Chinese solution provider that has created and deployed the most innovative new solutions, addressing citizen value, business needs or sustainability.

Awarded to:

ANT Financial (AliPay)

The jury said:

"This company has more than 500 million subscribers and handles more than 200 million transactions per day. Citizens can easily pay electricity bills and water and gas bills via the service. Cities around China work with this company to simplify transactions for citizens."

Two certificates were also awarded:

International Spirit and Merit Certificate

Awarded to: Vice Mayor of Yinchuan, Mr. Guo Baichun.

Honorary Smart City Certificate

Given to: City of Yinchuan.

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WELCOME!

Welcome to this unique collection of articles and takeaways, drawn from presentations by smart city experts from all over the world.

I had the privilege of chairing the TM Forum Smart City InFocus 2017 event (September 19-21), held in beautiful Yinchuan, one of China's smartest cities. It was our third event held there in partnership with Smart Yinchuan and ZTE, and our largest and most successful to date.

GLOBAL COLLABORATION

Source: TM Forum

Recognizing excellence

Against a spectacular backdrop, surrounded by millions of flowers, Yinchuan's Mayor, Bai Shangcheng, launched the event with an outdoor banquet under the stars, followed by spectacular fireworks and local and international entertainment.

TM Forum also presented our first smart city awards, recognizing breakthrough urban innovation achievements from cities, solution providers and national/international bodies (see inside front cover for details of the winners).

It's clear from these examples and the presentations we saw throughout the conference that we are moving from one-off initiatives to a more holistic approach, not only within individual cities but also across regions, countries and the globe.

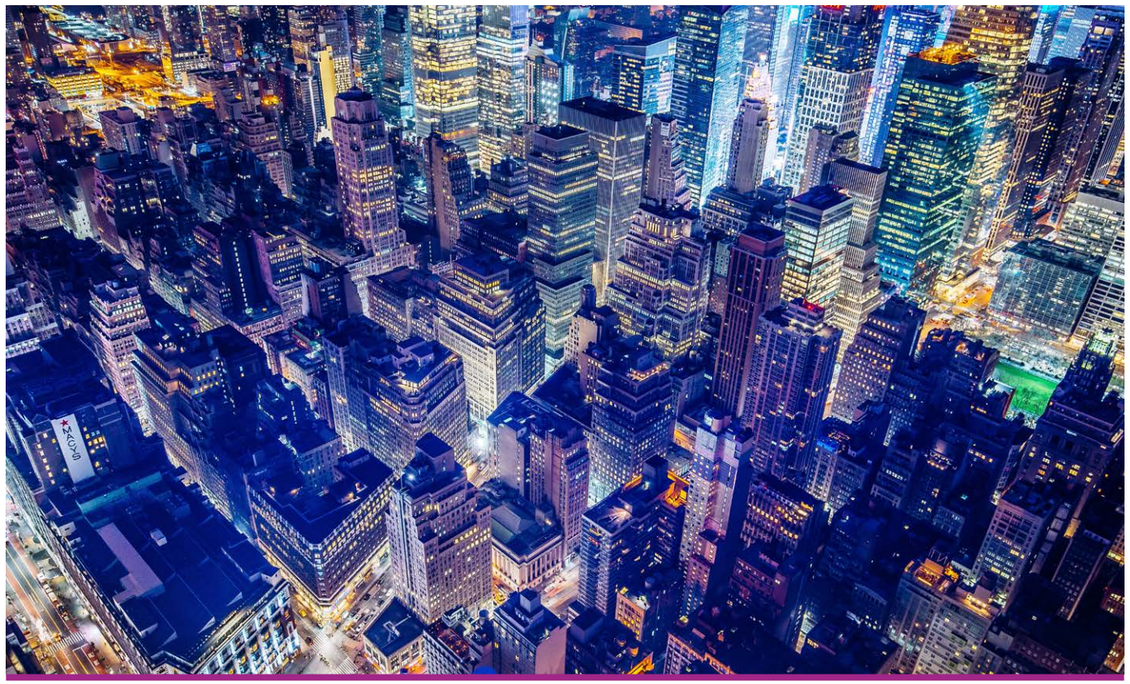
City as a platform

Another major trend is that cities increasingly view themselves as enablers of digital services, and are interested in exploring platform-based technology and business models to make this a reality. Examples of first steps were demonstrated throughout the event, from the art of curating the right ecosystem of partners to making data available as the fuel of innovation.

At TM Forum, we launched our City as a Platform Manifesto (see page 52) which outlines ten common principles for city platforms. The principles act as a guide to those setting public policy, and a design philosophy to unite the many organizations involved in smart city initiatives, including large and small technology companies. It was a proud moment when over 50 cities and technology companies joined me on the stage in Yinchuan as the first to support the movement. There are now over 80 signatories.

This was a clear demonstration that together, through events like Smart City InFocus and ongoing collaboration, we can create change in our cities and make them better places to live. Join us!

Carl Piva,
VP, Strategic Programs and Head of the Smart City Forum,
TM Forum



5 FUNDAMENTALS THAT WILL MAKE OR BREAK SMART CITIES

At the event, 65 city leaders and technology companies gathered for a practical VIP workshop to figure out how to advance smart city transformation and move from open data platforms to true data economies.

Carl Piva, Vice President, Strategic Programs and Head of the Smart City Forum, TM Forum, kicked off the half-day symposium saying, "We are all under pressure in cities – we don't have the funds to do everything we want. That's part of the reason TM Forum is bringing cities together with industry to find new ways to do things – moving away from transactional approaches to focusing on outcomes."

He added: "We think the solution lies in collaborating ecosystems – it's the key to smartness."

These were some of the key takeaways from the session:

Smart city success stories have ingredients in common

Five important fundamentals emerged:

1. a city can't be smart unless it has an agreed vision
2. inclusive leadership
3. data-driven decision-making
4. a focus on residents
5. collaboration between city and enterprises.

In addition, delegates stressed the importance of a public-private partnership model that is inclusive and a funding model that works.

Michael Mulquin, Principal Architect, Smart City Benchmark & Maturity Model, TM Forum, introduced the Maturity Model as a tool to get the agreed vision in place and set clear targets. (See page 78)

Invest in people

Unsurprisingly, cities varied widely on how mature they think they are but there was broad agreement on what's required to make the transformation go faster – and it's mostly about people. These two decisions were seen as likely to have the most impact: Cities must empower the right team to drive the transformation, and invest in cultural change and upgrading skills.

The other major challenge is funding, further highlighting the need to foster public-private partnerships (not forgetting the fourth 'P' – people!) and incentivize start-ups and developers to create services which benefit citizens, tackle urban challenges and have viable business models.

One thing that will attract this development is enabling developers to develop once, deploy multiple times across other cities – as Juanjo Hierro, CTO, FIWARE Foundation, put it, "One city is not a market." We need to build things in an open and standardized way so that innovation can be ported from one city to another – using common architecture, information models and open APIs.

Getting to the next data level

City leaders agreed there's a way to go before we get to true data economies. Perhaps surprisingly, not all cities have even opened their data yet. For those that have, it is often trapped in vertical silos which don't 'talk' to each other and much of it is static. A lot of data isn't searchable or standardized. The goal is to embrace a curated ecosystem approach, with 'right-time' holistic data from multiple sources to fuel innovative services that will address the challenges cities face.

Platforms will support this shift. They power some of the most successful companies in the world and could bring about the same 'network effect' in cities by connecting producers with consumers at a scale unforeseen before.

However, as one delegate noted, "We need to talk more about the emerging economy of data." This includes establishing a value model for data, and having more ethical debates about data and its ownership.

It's clear, and TM Forum has also recognized, that's not about implementing the platform model directly from the private sector, as cities have a very different mission to businesses – with their primary focus on providing good services to citizens.

Carl Piva announced the launch of TM Forum's City as a Platform Manifesto, which offers 10 key principles for creating a meaningful local data economy and succeeding with a platform model in a city context. More than 70 cities and companies have already signed up. (See page 80)

Proof and experimentation

As one delegate noted, "nobody really cares about platforms" in and of themselves. We need compelling success stories to prove the case for investment. Leaders cited national disasters, health outcomes, events such as the Olympics, increased capital, reduced congestion and improved air quality as examples of use cases that would really turn their heads.

Our smart cities app contains global success stories. Got a success story from your city? Send it in!

A look to the future

Cities have their eye on the progress of a number of emerging and advancing technologies they see as likely to have the biggest impact. Artificial intelligence (AI) is the runaway leader here, followed by IoT, autonomous transport solutions, big data, blockchain, data analytics and open APIs. Some of these might not be strictly new – such as APIs – but their importance is growing.

What were your takeaways if you attended?

Thanks to our expert speakers and panelists at the VIP Symposium, including:

- Guo Baichun, Vice Mayor, City of Yinchuan
- Professor Song Junde, Beijing University of Post & Telecommunications
- Dr. Wang Chuan, Director, General, Yinchuan Municipal Bureau of Big Data Management and Service
- Francois Coallier, Professor, École de Tech. Supérieure
- Susan Salkind, Residential Fellow, Stanford
- Masoud Ghandehari, Professor, New York University
- Simon Scerri, Member of the Board, Fraunhofer IAIS
- Prasun Argawal , Founder, Gaia Smart Cities
- Juanjo Hierro, CTO, FIWARE Foundation
- Professor An Xiaomi, Beijing Renmin University

"It's not about platforms in and of themselves. We need compelling success stories to prove the case for investment."

DO YOUR FIREWORKS DELIVER VALUE?

The journey to digital transformation is all about harmony and orchestration, according to TM Forum's Chairman, David Pleasance. He opened the conference saying that the Smart City Awards presented the evening before demonstrate how fast things are progressing.

Digital transformation is a challenge for two reasons, according to Pleasance. It is highly complex and it needs to be fast: "It requires the public and private sectors to think differently about how to serve customers and citizens, and it touches everyone in those organizations."

He continued, "Pace is critical – organizations need to keep pace with the market, and collaboration is what enables organizations to deal with these dual challenges of complexity and pace."

Pleasance explained that collaboration applies in multiple ways – including working with customers and citizens, in ecosystems and within organizations – but it is often much more difficult than people realize. "There has to be discipline between organizations about how they interact. This includes how they share infrastructure and their relationships," he said.

Fireworks and ecosystems

Referring to the spectacular firework display put on by the City of Yinchuan the previous evening as the finale to a splendid gala dinner amidst a wildflower meadow, he said, "What went into last night's display was a lot of machines launching fireworks at the same time and in different directions, but all synchronized and to music – there was harmony.

"That is a very interesting analogy between the amazingly well coordinated firework display and digital ecosystems, because in ecosystems, companies need collaboration with multiple moving parts. Careful orchestration is essential for all parties to come together, in harmony, to achieve common goals and produce the best experience for the customer."

He alluded to the TM Forum Smart City Maturity & Benchmarking Model and its potential as an accelerator, and concluded, "I'd like to leave you with two challenges as we think about collaboration to build ecosystems. The first is how are we creating value for our customers? Do we have a clear line of sight to that, whether commercial or social? Secondly, how do we scale that value through the connection of ecosystems? How do we innovate, leverage data, and derive insights from data to create value for citizens and customers?"

"Collaboration is what enables organizations to deal with these dual challenges of complexity and pace."

A DAY IN THE LIFE OF A SMART CITY

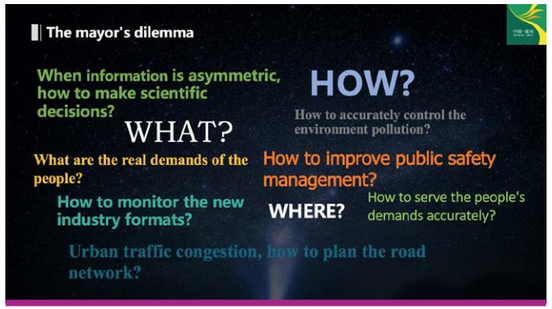
Guo Baichun, the Vice Mayor of the City of Yinchuan, gave some personal insights into the pressures of being in office in a smart city. He said that people often ask what the motivation is behind making this relatively small city in the western region of China into one of the country's showcase smart cities.

Baichun noted that it's not a motivation, so much as the result of the daily pressures of his job and the need to find solutions to serve citizens better. He outlined how his day starts with lines of people waiting at his office with documents for him to sign and expecting immediate decisions. He said it is too difficult to make the right decisions in a short time and some mayors control risk by circulating the documents to the relevant departments for comment, but typically they come back a couple of months later with little that is of help.

More immediate problems

He said the second difficult problem he had to grapple with was that of traffic and congestion, "There is a lot of congestion and my concern is that if we don't make a good plan – if we get the predictions about traffic wrong – then roads in future will be too narrow with not enough capacity."

The traditional way to control the congestion and pollution hiding the blue sky was by limiting access to the city based on cars' registration plates on different days, but he said citizens complained about this.



Source: City of Yinchuan

Another issue, he noted, was figuring out where the pollution came from – traffic, construction sites or factories in the surrounding areas. He said, "We had to make a one-stop decision to stop all the factories or plants for a few days to get the blue sky back," but again, that led to a lot of complaints.

He added that increasing urbanization offered greater potential to criminals, so then you have to look at the

police force. Hospitals also face new problems because of urbanization.

The Vice Mayor stated, "We don't know how to make the rules." He pointed out that for ordinary hospitals there are documented rules, but suddenly, "there are 15 e-hospitals that should follow the rules too, but I don't have the documents for them and who will check them? I need supervisory bodies to follow up."

He asserted, "The purpose of government is to serve citizens – we need to know their demands and complaints… We want to solve the problem of providing accurate answers." This is why Yinchuan is looking to technology, information development and exposing information, because the city needs a sustainable way of working instead of firefighting.

He concluded, "We are looking at making it active and for a new way of management – this is one of my worries of being a mayor. We need support with data and so on, hence Office of Big Data here in Yinchuan to help us solve [the] problem of data management."

Data is the solution

Wang Chuan, Director General, Bureau of Big Data Management & Services, Yinchuan, is there to help the mayor look after citizens better. He said there are three goals for smart cities that will help the mayoral office solve its problems and six supporting systems.

The goals are to:

- improve the city's management;
- benefit and serve the citizen as a priority; and
- promote industrial development.

To these ends, the Bureau is working on the following initiatives:

Smart governance based on better data collection, storage and analysis, through ten major systems and associated

Source: City of Yinchuan

sub-nodes, various IT, a 12345 hotline platform (so that the city can better understand its citizens), and breaking down barriers to information sharing.

Regarding traffic and congestion, he said smart transport is the answer, which means comprehensive monitoring, sharing data about traffic, refining traffic management and integrating services to benefit people.

Smart environmental protection will improve the level of environmental governance through real-time monitoring by controlling sources of pollution, such as chemical factories. Monitoring will also help improve the behavior of many organizations by correlating and analyzing directional governance and compliance with it.

The Director General added that smart safety – innovative urban safety management – involved putting technology (including facial recognition) into bus stations, airports and commercial areas. So far more than 3,000 surveillance video monitoring and feature retrieval systems have been deployed in Yinchuan.

More smarts

He stated that a smart industry approach would resolve the worries about the supervision of industries and that his office is constructing new supervision models to promote new formats for manufacturing smart city equipment. That is, using new technologies to promote the upgrading of traditional operations. Or to put it another way, "Opening data to our authorities means we can use big data for IoT and artificial intelligence to innovate our traditional industries such as textiles."

The Bureau of Big Data Management & Services has plans for a smart life initiative, building 100 smart communities around the city with 11 public services facilities and three service platforms. They will support amenities such as smart express cabinets for shopping, smart bins and smart medical systems. And on that note, there will be five medical systems, ranging from mobile medical terminals to community hospitals for simpler problems and first referrals.

They will be complemented by e-hospitals, which, through the internet, can help the community and other hospitals. Then there are regional, triple A hospitals for more serious medical problems, plus large specialist hospitals, such as in Beijing and other big cities.

The Director General said the Yinchaun model for innovative city management will help solve the mayor's dilemmas, but its true purpose was not to ease the mayor's worries, but to improve people's lives.

MOVING CITY AS A PLATFORM FROM VISION TO REALITY

TM Forum's CEO, Nik Willetts, used his keynote to look at cities as a collection of ecosystems and how platform-based business models could make the ecosystems work for everyone.

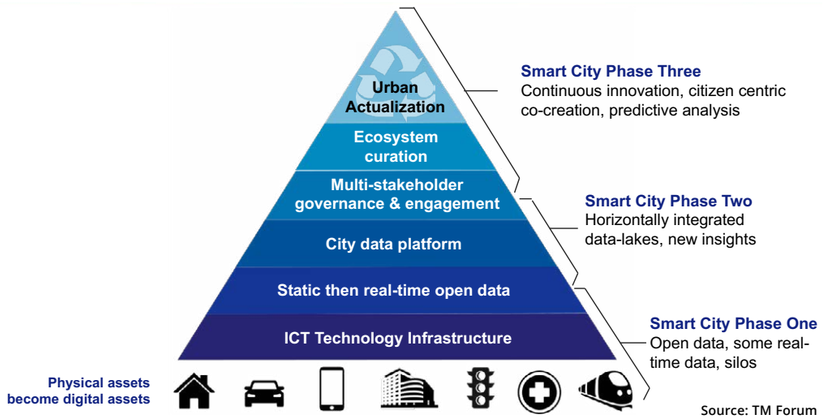
Willetts said, "In the digital world, everything is structured as ecosystems and as we connect them, we can see patterns. This is because everything that can be digitalized is being and everything else is being connected. Yet ecosystems are complex."

The vision for smart cities enabled by ecosystems is that they are dynamic and can flex to accommodate citizens' changing needs, in the short, middle and long term. The measure of success for a city ultimately is the happiness of citizens. Willetts said, "This sounds simplistic, but it is hard to do."

He applied the logic of Maslow's hierarchy of needs to smart cities to show how they need to evolve to realize what he describes as 'urban actualization' (see graphic). In Maslow's original pyramid about people, the bottom layer is about securing basic physical needs (food, water, shelter), the middle layers are about psychological needs (loving and being loved, belonging and self-esteem) and the top about self-fulfillment, which is only possible when the lower levels have been attained.

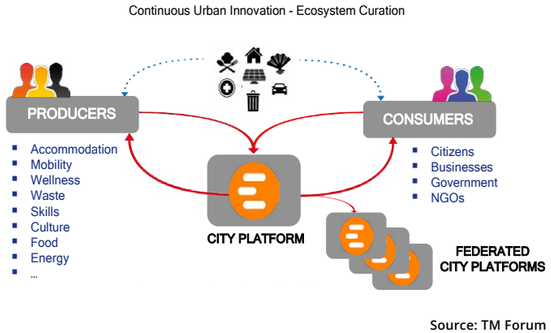
According to Willetts, when applied to a smart city the bottom layers represent a city's various ecosystems – things already digitalized that are still in silos. He continued, "Then we need the ICT infrastructure on top of that to unite these ecosystems, first enabling static open data, then real-time open data. They can be combined with other sources of data for all kinds of private, public or hybrid applications that are permanent or short-lived."

THE SMART CITY HIERARCHY OF NEEDS



Source: TM Forum

PHYSICAL TO DIGITAL CITY PLATFORM



Source: TM Forum

He warned, "Combining data can provide a data platform for the city, but it's only useful if all the stakeholders are engaged and the right governance is in place regarding its proper use. Once that is done, you can curate ecosystems then achieve urban actualization – the self-reinforcing, co-creation of innovative improvements to city life."

Platform is the answer

We make this happen by federating the city's many, disparate systems to present a third party-facing platform (partners of all kinds and citizens) which exposes data and assets from the various systems it unites through application program interfaces (APIs) for them to interact through the platform. This is how platform-based businesses from Alibaba to Uber work

They replaced the linear supply/value chain with a triangular schema, with themselves at the apex; the platform owner has the most power because it is where the interested parties interact. The graphic to the left shows the classic platform model, adapted for smart cities.

How to achieve it?

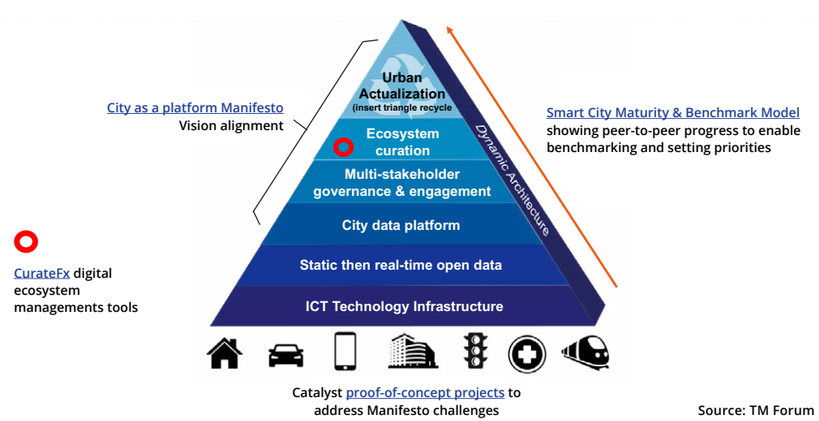
Earlier this year TM Forum launched its City as a Platform Program, which brings together more than 70 organizations – public, private and academic, to gain a rounded view and deep understanding. Willetts said, "Over last ten months the Forum has brought together many stakeholders to develop pragmatic and practical tools for use by everyone around the world. We have looked at the challenges of creating platforms, and gathered detailed use cases and business canvasses. We have broken platforms down into the necessary underlying capabilities, then started to look at technology from this view point.

He stressed, "You have to do it in that order – we must understand the link between the goal and the technology to get the right outcome.

Click on the interactive links of the graphic below to access information about the many tools, guidelines and other assets developed by TM Forum with its many partners, which include FiWARE, the European Union and the United Nations.

Willetts concluded, "We are now at the end of the first decade of smart cities which was largely about technology. Now we need a new vision, to think further ahead and look at where we are going and what needs to change for us to get there. We're here to be part of that journey."

THE SMART CITY'S HIERARCHY OF NEEDS



Source: TM Forum

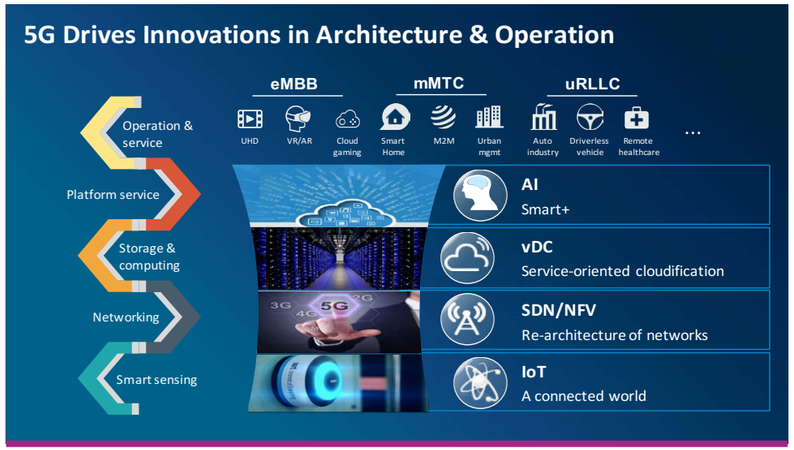
"We are now at the end of the first decade of smart cities which was largely about technology. Now we need a new vision, to think further ahead."

5G WILL IMPACT SMART CITIES

Zhu Jinyun, Senior Vice President, ZTE, has some intriguing insights into smart cities in the era of 5G. His company has been working closely with the Chinese city of Yinchuan for three years, and two years ago developed a wider smart city strategy. It is now deploying city as a platform, and looking to what's coming next.

The first and most important stage of transforming to a smart city is data collection. Now 5G is needed for augmented and virtual reality applications, autonomous driving and for many vertical industries – for example, low latency for telemedicine.

"The combination of 5G and platform will be smarter and embrace many more scenarios," Zhu Jinyun said. "We will transfer the concept to our reality – we have already deployed much of this in Yinchuan... It can better support a lot of different scenarios, especially in real-time, which at



Source: ZTE

the moment is not that easy with LTE" – where latency and availability are not guaranteed. 5G has a lot of new features too.

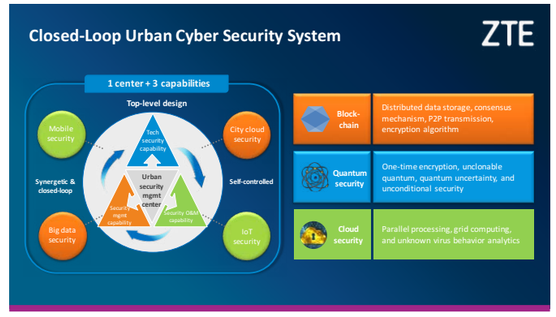
Driving innovation with 5G

He said the big challenges now are diversified targets, evolving scenarios and new applications – and the only way these things could be accommodated is by upgrading the enabling communications with 4G and 5G. This is driving innovations in architecture and operations – see diagram above.

ZTE is developing rapid and massive connectivity through pre-5G deployment, enabling end-to-end IoT with more than 68,000 nodes in action now.

ZTE will leverage 5G for intelligent data analytics through a data resource center, data management service, applications and algorithms, computing capability, and AI-based smart service. He pointed out that, "You need [a] lot of data to get [the] full picture" and looked forward to artificial intelligence-based applications, such as voice recognition for answers to simple questions posed by tourists and citizens.

"Blockchain allows the sharing of government data in a way that is secure, reliable, traceable and cannot be tampered with."



Source: ZTE

Security data with blockchain

A closed loop cybersecurity system, which ZTE worked with Yinchuan to develop, is shown above. Security is in everyone's interest as data is so important, Zhu Jinyun said, adding that blockchain is necessary for data management. ZTE has employed it in other cities, but not yet in Yinchuan.

He said it can be managed by government as a decentralized data platform as a service. In the closed loop system, blockchain allows the sharing of government data in a way that is secure, reliable, traceable and cannot be tampered with. This will ensure that data from different departments can be trusted and fully shared, facilitate data collection and searching, and verify certificates online.

Regarding ecosystems, Zhu Jinyun said that many CEOs greatly fear sharing data from applications, but by using blockchain along with quantum security and cloud security, "we can make everything secure and we want to work with everyone via open APIs."

THE CITY AS TECHNOLOGY

Anthony Behan, Worldwide Industry Solutions Leader in IBM's Watson Internet of Things (IoT) Division, examines the concept, and realities, of the city as 'our most fundamental technology'.

Technology is tools, sure, but it is also a set of artifacts that humans have designed to help engage with the world around us. Technology mediates between people and the environment, allowing us to shelter from its excesses, and profit from its bounty, and to express ourselves as human beings and build functioning societies that support our families and our tribes.

Technology is deeply personal. Chief Justice of the US Supreme Court John Roberts famously said of smartphones that the "proverbial visitor from Mars might conclude they were an important feature of human anatomy," such was the extent to which they had become a "pervasive and insistent part of daily life."

Think about the concept of a cyborg, an enhanced human. We picture the Terminator, the BORG from Star Trek, or something similar. Yet, my glasses give me enhanced vision; my clothes enhance the capacity of my skin to protect my body and vital organs from the weather and other hazards; and of course, there are those who have titanium hips and pacemakers. We are all in some way cyborgs. We are each of us extending our sensory capability with technology, and the smartphone extends our capacity to know things; it extends our intelligence, our range of communications, our cognition.

Crucially, at the center of all of this, is the city itself, perhaps our most fundamental technology. The buildings and roads all play a part in allowing us to achieve the things we desire. At a basic level, this is in the form of shelter and protection, but in more advanced terms to relate with our fellow man, raise families and produce art. Before we consider improving our cities with technology, therefore, we need to recognize that the city itself is a technology, and not some kind of mere neutral platform upon which technologies can be deployed.

As we consider then how cities can better serve the ambitions, dreams and desires of their inhabitants, it is important to think about how personal city technologies can be. This isn't just about personalization, though that's certainly a part of it. This is about figuring out how to build strongly empathetic cities, deploying technologies that are sensitive to the aspirations of the people they serve. These cities will need to grow with people as aspirations change.

Using AI and data for empathetic cities

Cognitive and artificial intelligence (AI) technologies are fundamentally different from technologies we have deployed in the past. They understand like humans do, in multifaceted ways – sensing, listening, reading and feeling their way through problems. They reason like humans do, and not just in a sense-and-respond structure; they interpret the sensory cues and assess and evaluate alternate potential interpretations.

AI systems learn like humans do, though they are less likely to make the same mistake twice (yes, they do make mistakes, like humans do). And, they keep learning, growing and evolving – like humans do. They interact in human ways – through natural language interfaces, with idioms, colloquialisms and high-quality communications.

There's no AI without data, of course. These are complex, dynamic models of environment and context. The data sources in the city – enhanced by recent developments in the IoT, both in terms of the available low-cost silicon and numerous local and wide-area communications architectures, provide extraordinary resources to feed the models. From state and city sources in the public infrastructure, to private and commercial sources from business, academic and non-governmental organizations (NGOs) – plus, of course, the citizens themselves contributing to a symbiotic data environment – there is more than enough data, properly curated and observed, to deliver extraordinary modern solutions to city challenges.

Getting there

These fantastic solutions come with their own responsibilities. We are all learning as a global society about how these technologies should be deployed and how we should use them. At IBM earlier this year, we adopted three principles to help guide us on this path.

1 **Purpose**
Our purpose is to augment human intelligence rather than replace it. We live in the real world, not that of science fiction, and our belief is that cognitive systems will not realistically achieve consciousness or independent agency.

2 **Transparency**
We will always be clear about when and for what purposes AI is being deployed; we'll be clear about the data we use; and our clients will always own their own intellectual property.

3 **Skills**
We recognize that we need to train people to use AI systems in new ways, and we need to train the AI systems themselves. These are new ways of working, and there are exciting, powerful new roles coming for people.

So the city is itself a technology, and must become more empathetic in order to be successful. Our future as human beings in cities, our potential in this world, is dependent in so many ways on this relationship with our city technology. This is obvious in fundamental ways – like improved healthcare, reduced travel times and a cleaner environment. But the subtle ways in which a city can allow us to breathe, to grow and to flourish as people are just as important. We have more time to ourselves and our families, our education is better, and our opportunities are improved. These are the markers of a truly smart city.

COGNITIVE SYSTEMS ARE FUNDAMENTALLY DIFFERENT

UNDERSTAND

Adapt and make sense of data; **read** text, **see** images with context like **humans do.**

REASON

Interpret information, organize it, and offer explanations as to what it means, with **rationale for the conclusions.**

LEARN

With each data point, interaction and outcome, they develop and sharpen their expertise, so **they never stop learning.**

INTERACT

With abilities to see, talk and hear, Cognitive systems **interact with humans in a natural way.**

Source: IBM

ENSURING SMART CITIES CREATE URBAN EFFICIENCY

Kanwaljeet Singh Kukreja works for Schneider Electric in the Indian region. He started out by saying that in today's money, the Taj Mahal would cost $5.1 billion to build. As it was, starting in 1631 it took 22 years to build this world-famous, marble-faced mausoleum at Agra, India, on the order of the Mughal Emperor, in memory of his favorite wife.

It took seven years to figure out where to build it so it was safe from earthquakes, and to take into account factors such as the color of the stone in the moonlight. Its wooden foundations took 15 years to complete, but have sustained the structure for almost 400 years.

On time, on budget

By comparison, India now wants to create 100 smart cities in the next few years, which like the Taj Mahal need to be both safe and beautiful, but without the luxury of time or unlimited budget. Also, as Kukreja said, "You can't just copy and paste between them; each city is unique." For example, often infrastructure has to be retrofitted to make it suitable, sustainable and safe for a vast population that is urbanizing fast.

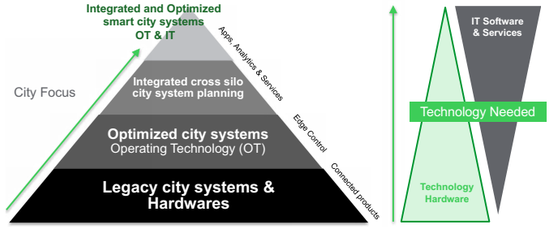
The speed and scale of this urbanization brings all kinds of large-scale problems, such as water leakage, waste management, and cabling and wiring for both communications and electricity.

Kukreja said, "There is no single answer to 'being smart', you have to start at the beginning." He explained that cities are systems of systems and asked, "When they are becoming a mess, who is going to run it? There are so many use cases where there are many departments that need to work together, but who is in charge?".

Source: Schneider Electric

He added that now there are elected mayors in cities and CEOs, they are becoming more like businesses and should have the following goals or approaches:

- Efficiency (profitability),
- Livability (the most important key performance indicator)
- Sustainability (futuristic) and,
- Collaboration, no one can do everything.



Source: Schneider Electric

The three founding capabilities

The mantra for urban efficiency is to build a smart city foundation. Kukreja stated, "My key message is that we strongly believe that as cities become smarter, they can drive sustainable economic growth and prosperity for their citizens. Citizens want to live in cities that have a good quality of life, they want to work in cities where there is economic opportunity, and they want to visit cities that are desirable and safe."

He claimed all leaders, all cities and all organizations demand these three capabilities:

- tools to make better decisions by analyzing massive amounts of data to derive insights and drive actions;
- to anticipate problems because being reactive is not good enough; and
- to coordinate resources because things happen, and when they do, cities need to coordinate resources, people, processes and systems to meet different circumstances.

Kukreja said, "[Schneider Electric] enables these three capacities, based on our learnings from thousands of client engagements, and the assets and best practices that we have harvested are for use by all city leaders in their quest to become smarter."

The shift to smart can start anywhere

He continued, "These capacities are vital to any city leader, from the mayor to the chief of police or the head of transportation, and increasingly, to all of them in an integrated fashion.

The point here is that a smarter city can begin in any part of the city, led by any functional city leader, and we are building our own capability to address where they choose to go, where they'd like to begin."

He focused on Schneider's electric utility customers as the company has worked with them for over a century, collaborating with power producers, network operators and increasingly with energy service providers. Kukreja said the company had delivered more than 250 smart city projects around the world, and highlighted the Naya Raipur Smart City in India.

This is a greenfield site and the first fully integrated one, with roads, buildings, pumping stations and so on retrofitted to automate water distribution and management. There are sensors in buildings and surveillance systems are managed via apps.

Highlighting cost of wasted energy

He said that at home, to make his wife understand the cost – in every sense – of wasted electricity, he had converted it into how many dresses she could buy for the equivalent each month. His company is striving to bring that kind of awareness to everyone about saving energy and resources via dashboards that use real-time information.

For example, as soon as someone registers to live in the city of Naya Raipur the smart grid's geographical identification system alerts the supervisory control and data acquisition (SCADA) system to check that the home has water. If not, the system can find and identify the problem so that an item can be replaced.

Kukreja commented, "There are a lot of cross-function synergies in this city." For example, if there is an accident at a junction in Naya Raipur, the next automated action is to send a police officer and have an emergency response system check if an ambulance, bomb squad or fire engine is needed."

SMART TRANSPORT MAKES LIFE BETTER IN YINCHUAN

Tang Lei, Deputy General Manager, Smart Transportation Product Line, ZTEsoft, described the construction and operation of smart transportation in Yinchuan, including three new, important factors.

Yinchuan is one of China's smartest cities, and ZTEsoft has worked closely with the city authorities and mayor. He explained, "Terrible city traffic has brought trouble to people's lives" and added, "the current situation has to change to improve people's lives." As Lei explained, there are many components to a smart transportation system and, in combination, bring many advantages.

Data is the key

Lei said, "Data is the most important – without analysis of it we can't act on micro, meso and macro levels" – see below.

The General Process of Urban Transportation Management (Source: ZTEsoft)

Hence in Yinchuan, a big data platform integrates data from multiple sources and enables the sharing of traffic data. To have an accurate picture of traffic flow, it must be monitored in real time. Lei said they looked at solutions that were technically advanced, affordable and efficient, and chose radio frequency identity (RFID) e-plates which enable many applications.

Better regulated traffic signals have reduced the 'stop' time in journeys by 20 percent, increased driving speed by 10 percent and reduced congestion mileage by a third. The condition plan for the traffic signals can take weather, emergencies, traffic flow and holidays into consideration.

Green waves – coordinating a series of traffic lights to give a green light to a particular lane or lanes of traffic to keep it/them moving – have reduced travel time by 40 percent.

Tidal flow lane – traffic direction can be switched at peak times on a 1.4km segment of road, improving traffic efficiency north to east by 30 to 40 percent. The capacity of the entire section has improved by 15 percent.

Charging for road use at specific times and places to discourage drivers and encourage people to adopt better habits, such as using public transport instead, or walking.

Smart parking – providing information to help people find parking places faster has cut the time taken to find parking spaces by 70 percent. This has had a big impact on traffic flow, as cars driving round and round looking for parking were contributing greatly to congestion and pollution.

Information about traffic and civic services is drawn from the integrated data and made available to citizens via various channels, including Yinchuan's Tong app, the city's website, touch-screen electronic bus stop boards and more.

Dynamic, optimized use of the road network, for example, temporarily banning left or right hand turning at a junction (because an accident is causing congestion) via electronic road signage. Also, looking at traffic in 3D (taking other transport systems into account) helps optimize space and ease congestion.

Planning for new transportation, based on the most complete and detailed information the city has ever had available for the new cloud railway and subway.

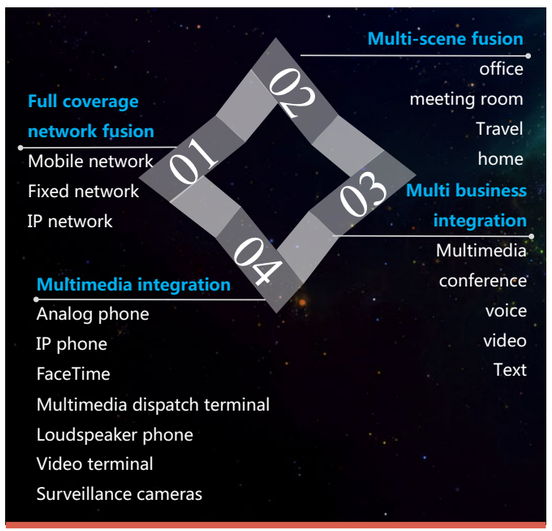
New factors to consider

First, Yinchuan's data platform provides greater insight into traffic than was ever possible before, providing important input to new administration and control systems. Online simulation technology makes solutions more accurate and credible. In future it will use data from additional ways of monitoring such as drones, automatic control, man-machine interchanges, new sorts of vehicles and control signals.

Second, the smart transportation systems give a new, economic understanding of traffic and how smooth flow contributes to many things, such as efficiency and air quality (which impacts health) etc. It also helps understand how different modes of transport can work together better. The information could also be used for smart businesses and to create more intelligent organizations.

Third, the intelligence gained from the transportation systems assures city security and is being used to create a new emergency response system. This includes the four-stage integration of resources to ensure a comprehensive and appropriate response – see graphic.

Lei ended by saying that these are three major new concepts – and it looks like there will be many more in future.



Intelligent vision – Create new emergency response (Source: ZTEsoft)

MILTON KEYNES MAPS A ROUTE TO MOBILITY AS A SERVICE

Cities globally are trying to move the focus away from cars to a shared approach and 'mobility as a service'. Geoff Snelson, Director of Strategy & Futures, Milton Keynes Council, outlined the details of how the City of Milton Keynes plans to get there.

Like many cities, Milton Keynes was designed with car travel in mind as the major mode of transport. Now, as the population expands, infrastructure is approaching capacity. The city is using a combination of approaches to improve mobility, including data, artificial intelligence (AI), autonomous vehicles and mass transit.

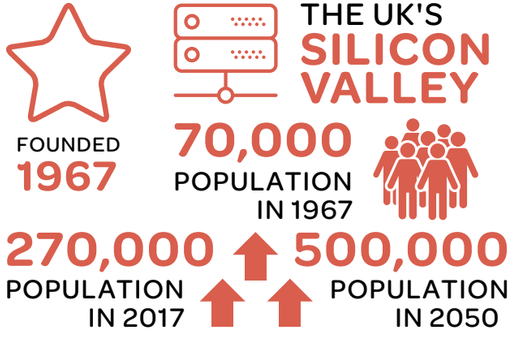
"Every city starts its smart city journey from a different place and looks to address different challenges," Snelson said. "But there's often an application or a challenge which forges a path and starts to reveal the opportunities and drive investment. In our situation, that is mobility."

Data enables mobility

At the heart of Milton Keynes' smart city initiative, MK:Smart, is the MK Data Hub. It was developed as part of a TM Forum proof-of-concept Catalyst project and won an award for

PLANNING FOR POPULATION GROWTH

Fast facts about the City of Milton Keynes



its commercial potential and innovation. This city-scale data hub allows onboarding of data from multiple sources, including live data feeds, to support IoT innovation. The data hub pulls in data about movement in the city, including pedestrian and vehicle flow, and bus occupancy levels, etc. This data is used in various ways – for example, in a route-planning app (MotionMap) for citizens.

"It also provides us as a city with strategic insight and ultimately allows us to work to move forward to integrate different transportation systems," Snelson said.

Artificial intelligence

Milton Keynes is now working with a partner called Vivacity Labs to introduce AI sensors across the whole city for transportation purposes.

These video sensors detect what's going on in the environment, perform analysis and send a data package back to a platform. They are deployed at key junctions to provide a real-time view of movement across the whole city. This aims to help with issues such as more efficient use of available parking spaces. There are 23,000 non-multi-story car parking spaces in Milton Keynes. These sensors can scan the area for spaces (an individual sensor is not needed for each parking space) and can even detect the difference between cyclists, pedestrians and cars.

"You get a very rich set of analytics," Snelson said. Ultimately there is potential to connect this technology with traffic signals to provide a real-time demand-responsive signaling system.

Intelligent vehicles

Milton Keynes has also been doing a lot of work around autonomy with its trials of a small fleet of 40 autonomous 'autopods'. These are designed as a 'last mile' solution to take passengers from the train station, for example, to their final destination. From next year, the city will be running them as a small-scale public transport service to understand the economics and logistics of using this kind of technology.

The pods use a 3D digital template to understand their environment and sensors to detect movement. They can then 'decide' how to interact and avoid collisions. As they learn more, they will grow less risk averse and move more freely.

"It's truly an intelligent transit system," Snelson said.

The city is also working with motor manufacturers on how systems might evolve from driverless systems to full autonomy and how they might interact and work collectively with other modes of transport to form a holistic service.

To support this, the city is using technology such as radar sensors, which communicate with the autopods and vehicles about traffic, movement and potential collisions. Snelson commented: "You can see how this kind of system can be enabled by platform technology and how you can start creating an environment across the whole city to enable transport to move more freely and respond to events in an agile and intelligent way."

Mass transit, city design

Investment in infrastructure such as trams is not viable for Milton Keynes at the moment. At the same time, the city has a lot of 'hard assets' such as good highways, etc. The mass transit option it is looking for "doesn't really exist" – yet. Leaders are working with the cities of Oxford and Cambridge to develop a new type of transit vehicle which will provide the equivalent of trams but use existing road infrastructure.

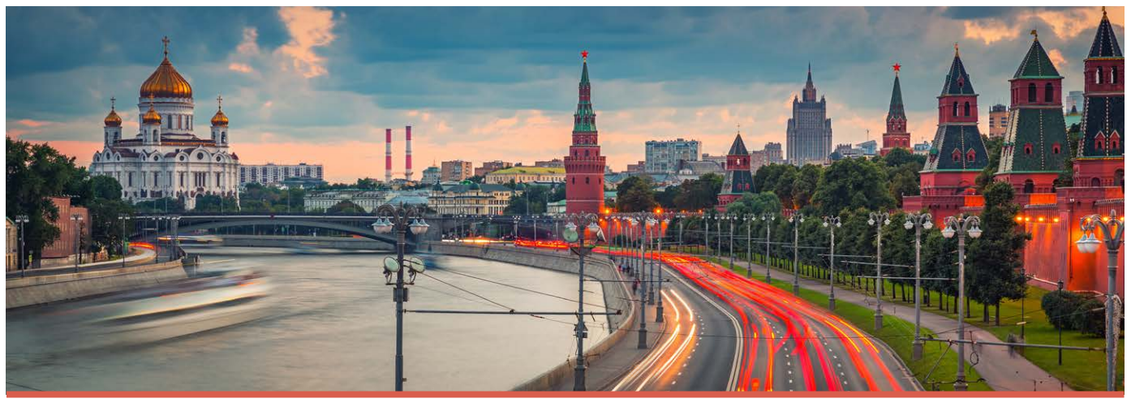
An autopod in Milton Keynes (Source: Milton Keynes Council)

Looking ahead at the city's design is also important – it's about "designing the next stage of the city's development to better enable these technologies and help people move around in ways which will matter to them in the future," Snelson explained.

Getting there

He added: "With a proper integrated transport system with comfortable and convenient transportation that is wrapped around the needs of users, we believe people will be interested in a more human walkable, greener city center environment."

He concluded: "I am not pretending we are there but I hope this is going to come together into something quite magnificent. We think there is a route through to make mobility as a service a reality."



MOSCOW'S STRATEGY HAS TURBO-CHARGED TRANSFORMATION

Eldar Tuzmukhametov, Head of Smart City Lab, Moscow City Government, gave an inspirational presentation on what has been and can been achieved through smart city initiatives.

He explained that Moscow's smart city initiative has three primary aims:

- quality of life through providing a better environment for citizens and businesses;
- efficient government through data-driven decisions and strategy; and
- solid infrastructure to provide high capacity to meet the needs of people and machines.

The scope of the initiative is impressive. It involves more than 2,000 public institutions, including kindergartens and schools, clinics and hospitals, city administration departments, providers of municipal services, traffic police offices, rescue services and public transport. These institutions collectively serve 12.5 million citizens.

In 2011, the city created a cross-functional structure to oversee technology development and procurement for the whole metropolis to benefit from economies of scale, better planning and interoperability. The city's IT budget is $600 million plus $450 million investment from private companies.

Moscow saw that 'e-readiness' is critical to achieving its smart city aims – see infographic opposite. By having an e-ready city, there have been big improvements and savings in many areas.

Source: City of Moscow

The flow of e-documents

Switching to from paper to electronic or e-documents, and streamlining how they flow between the necessary parties and stages means documents are better coordinated and approved faster. It has also speeded up decision-making, reduced labor costs and the documents are safely stored. By making the 2,000 public institutions e-ready, the city has saved 700 million rubles ($12.15 million) on processing 14 million documents a year.

Cloud accounting – by linking together 1,400 systems, the city now has a unified accounting system that enables one-click reporting, real-time billing and reporting and big data analytics. It provides transparency for the supervisory authorities and saved 14 million rubles in 2015.

Procurement – in 2016 Moscow spent 9.5 billion rubles, but saved 0.75 billion through its new government procurement system. It provides all suppliers with equal access to the city's requests for tender, and has driven prices down through 'reverse' auctions (suppliers undercutting each other's prices to win contracts). There are built-in barriers for overall transparency and to stop corruption. In total, 176,000 suppliers registered on the procurement portal to access the 61,000 tenders the city published there in 2016.

Housing and public utilities – the aim here is to improve the use of resources. There are now 3,500 smart metering systems in 3,500 governmental institutions, which provides real-time resources accounting, water pressure and control of the grid's integrity. There is also smart metering and control systems deployed across the city for 33,000 residential buildings. Again, this supports real-time resources accounting, water pressure and ensures the grid's integrity.

The city has also deployed a unified vehicle tracking system for 126 municipalities which monitor routes, speed, fuel consumption and operational mode for 32,000 vehicles. These range from buses and public transport, to street sweepers, snowplows, waste trucks, water carts and tractors.

Safety – a citywide, centralized system includes 140,000 CCTV cameras, which can be accessed by 3,500 police officers and 10,000 local officials. Some 70 percent of all police investigations involve CCTV footage, and 45,000 traffic fines are issued automatically every day. The system also gives 24/7 monitoring and control of the city's services and infrastructure. All of this consumes 15 petabytes of archive storage to cater to the 1.2 billion hours of video that is generated annually.

Emergency services – there is a single management system and personal tablets for each member of 750 fire crews. Reports of accidents via a helpline are fed straight into the system, along with video from the city's CCTV cameras. The system provides the best routes for vehicles to get to the scene. Collectively these innovations have speeded up travel time to emergencies by 20 percent.

Public services – some 200 (around 75 percent of) public services are available online and via mobile through an online portal, 10 apps and 20 SMS and USSD-based services. They collectively deal with 650 million requests in a year.

Digital health – The unified health and resource monitoring system covers 9 million patients, 660 clinics and laboratories, and 21,000 physicians. It controls the flow of patients, handling 187 million e-appointments per year. The system relies on cloud-based e-health records to issue 25 million e-prescriptions annually and the accounting system is cloud-based.

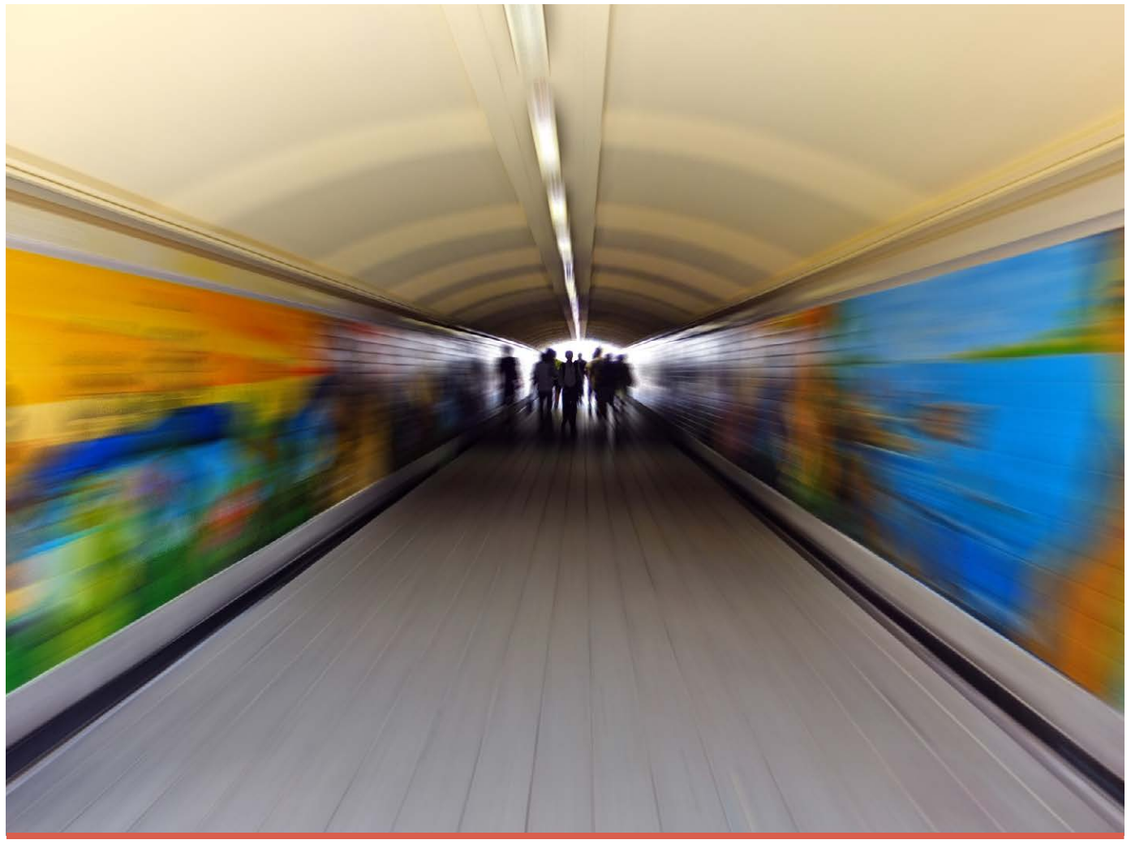
Education – the city has a digital learning environment for teachers, parents and pupils. It connects 52,000 academics and 1.6 million pupils. It hosts school diaries, assignments, modular presentations for tutorials that can be customized, and alerts and notifications for parents. All pupils and teachers are equipped with personal laptops and tablets, and 30Mbps broadband is ubiquitous in 1,840 school buildings.

Citizen engagement – one aspect is to handle online complaints and feedback, to improve the quality of city infrastructure. The system has been used by 1 million citizens to fix 1.6 million problems. Citizens log complaints online. The complaint is automatically assigned to the relevant sub-contractor who fixes it. The system is connected to 120,000 buildings and other elements.

The citywide voting app is also designed to improve citizens' engagement with their city. There are weekly polls regarding development issues, which can concern specific districts and streets. The government should then act on the voters' decisions. There are 1.5 million citizens registered to use the app, which has carried out been 2,000 polls so far – see infographic below for examples.

Voted against:	Voted for:
Additional speed limit in city center	**Stricter rules for urban works in the nighttime**
	Limitation of sales of alcohol energy drinks

Source: City of Moscow



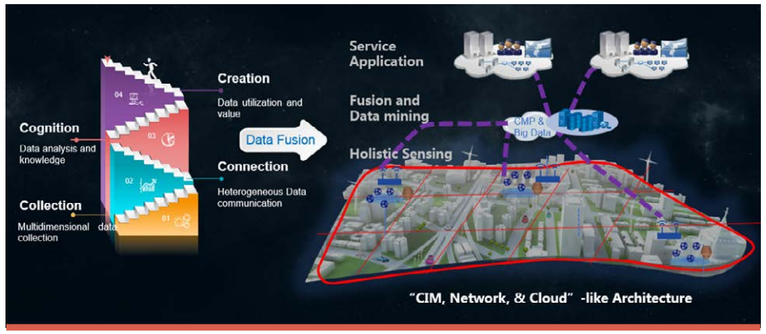
DATA CONVERGENCE FOR SMART AND SAFE CITIES

"Security is a basic need for human beings," Xu Ming, Chairman and President, ZNV, noted. If cities are not safe and secure they will not be attractive for tourism, business or investment so as well as being a fundamental for people, safety is also essential for economic development.

Ming discussed the work his company, ZNV, is doing in the area of 'data fusion' to promote public security in cities, particularly in China. He outlined the five core information elements of urban security: Information about people, events, location, things and organizations.

However, he said, currently, especially in China, data fusion and data mining methods are still not deep enough. For example, there is a tendency to focus on one source only (government data) and one dimension (over-emphasizing data from industry verticals). Further, analysis has typically been mostly based on statistics, for example, logic regression and linear regression (single fusion method).

He explained, in the context of public security, "If we only focus on the visual data but ignore the data about things, we cannot have a smart city....If the data is more vertical than horizontal, the value from mining data is not big enough."



Source: ZNV

How can we change this? By having a deep fusion of multi-dimensional data, according to Ming.

Static and dynamic
Static and dynamic data fusion

IoT and video
IoT sensing and video sensing fusion

Time and space
Time and spatial data fusion

ZNV proposes a top-level design idea: A City Information Model (CIM), Network and Cloud architecture. (See graphic at top of page)

This design, he said, connects the physical world and the vertical world and records it in data. "Hopefully this can better describe the city itself," he said.

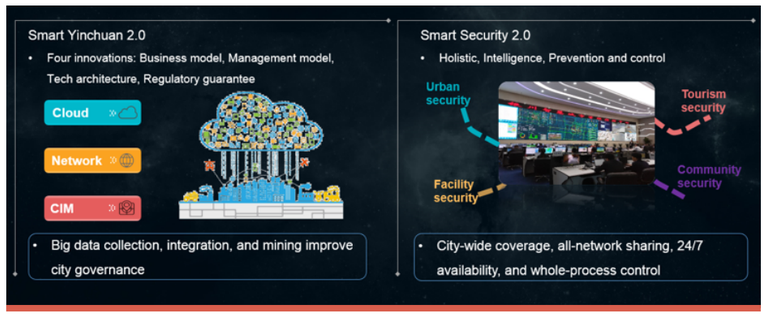
At the forefront of this top-level design is holistic sensing. In the middle is fusion and convergence, and the next level is service application. This can be integrated organically with the architecture and can connect with more data systems in future. It also combines video data and IoT data, in space and time.

Ming added that the architecture alone is not enough, hence ZNV has developed a number of solutions and products to build a fuller picture and improve security.

ZNV's model is being implemented in Yinchuan (See graphic below).

Looking to the future of urban security, Ming concluded:

- There will be heterogeneous and multi-dimensional data which will offer more potential and bigger value for the data to be mined. It will also make public security operations smarter.
- It will be important to Integrate all the data on one platform to unleash its full value.
- Besides the internet giants, we have few examples of companies profiting from data commercially, but they could in the future.
- We need to extend urban security from the physical to the virtual world, where there is even more data activity.
- Smart security will rely on advances in artificial intelligence and cognitive computing.



Source: ZNV

"ZNV proposes a top-level design idea: A City Information Model (CIM), Network and Cloud architecture."

FUTURE MOBILITY: PLANNING AHEAD, ACTING NOW

It might have seemed incongruous for the Future Mobility panel to begin with a clip from 80's British comedy *Yes Minister*, featuring politicians endlessly debating the best mode of transport to prioritize in the transport strategy.

However, while many things are in flux, including social attitudes, technology and population growth, the core debates around cost-efficiency, longevity and political popularity remain constant.

Panelist Ted Ross, CIO, City of Los Angeles, said, "In many ways the issues are the same. There are many types of transportation, so which one is right?"

However, there are key differences making things "exponentially more complicated now" and the major one is digitalization, which is disrupting every industry, not least transportation.

Geoff Snelson, Director of Strategy & Futures, Milton Keynes Council in the UK, agreed that he recognized many of the arguments around engineering, design and different modes of transport. However, he said the agenda is increasingly moving from "creating a system and expecting people to [use it]" towards demand-based and responsive systems, which are often data-driven, where the city provides the best conditions for people to get to where they want to go.

This, though, raises new questions about roles and responsibilities. Who provides and orchestrates the platforms for those systems? What's the role of private companies in this? And how do we regulate it? Cities are still working on these issues.

Universal truths

Dr. Ryan Falconer, Director, Transportation Consulting, Arup, said that when it comes to transport, "Everyone is an expert and we spend too much time talking about the means as opposed to the end."

In his experience, he said, there are typically "four universal truths" about transport: exceedingly high user expectations; congestion; governance and its complexity; and inequity.

He noted, however, that not all traffic is bad, commenting, "In some ways, congestion can be a sign of economic activity and a city being successful. We need to find the proper metrics."

For Ron Zimmer, President & CEO, CABA, the "real debate" to be had now is preparing for the future in the wake of autonomous vehicles. He said, "This will disrupt municipalities in a number of ways with regard to land use and planning, for example."

Changing culture

Managing transportation is politically tricky. As Ross put it, "The reality is, if people feel it, politicians hear about it."

Acting on this isn't always so simple, though. Snelson explained, "One challenge is finding ways of making investment in alternative modes of transport at a time when taxation of motor vehicles and raising parking revenues is very difficult as that is all wrapped up in a car-based system."

He added, "It does come down to the politics again — there's enough value in the mobility market to create some exciting opportunities but the way of realizing that value will often mean constraining car use… Those are often the painful discussions."

The City of Los Angeles is looking at interesting ways to change ingrained behavior. It is known for being a 'driving city'. Gas is relatively cheap, parking is ample and there are very few toll roads so there are few incentives to not drive. The city recently launched the Go LA app with Xerox. The app provides methods of getting from A to B with a choice of going faster, greener or cheaper.

Ross said, "It starts to impart the idea that there are many ways to get from A to B. Just because you have a car doesn't mean you have to drive."

Planning for the unknown

We are seeing many concurrent shifts: For the younger generation, car ownership has nowhere near the appeal it once had, although we are not seeing the full effects of that yet. Technology is moving fast and exponentially. Forecasts vary and we don't know exactly what impact autonomous vehicles will have and therefore the knock-on impact on infrastructure. How do you plan around all that?

Ross said, "I feel like I am the CEO of a company in the face of massive disruption. We are preparing for a future that is very much unknown."

LA's approach? "Putting everything on the table and going with it." That means improving public transport, building dense housing and the right types of amenities along public transportation lines, as well as investing in public transport and autonomous vehicles.

Falconer's advice for dealing with this uncertainty is to use pilot tests but warned they're "only useful if you are collecting the data" to assess how well solutions are working.

He commented: "Inevitably cities are going to get things wrong." 'Wrong' could mean, for example, being left behind on a particular trend or technology and having to react to it. "It's going to happen, though," he said, but urged cities to focus on identifying challenges and looking for solutions, and to avoid "knee-jerk reactions".

The big picture

TM Forum's Carl Piva, who chaired the Smart City InFocus event and moderated the panel, summed up, noting that smart transport is connected to every other aspect of a smart city and cannot be looked at in isolation.

For example, Milton Keynes is looking at how neighborhoods might be designed to be more healthy and better support walking and cycling.

Snelson said, "We are thinking about all aspects of the city's design and operation. Mobility is a good way of thinking about all this in a very creative way."

Ross sees a growing link between transportation and public safety – for example, in the case of an emergency using smart transport to reduce dispatch times for emergency vehicles or to manage traffic in the city better during an emergency scenario such as an earthquake.

TENCENT: USING DATA AND AI TO IMPROVE HEALTH

Tencent's Xuan Zhou explained how new technology such as AI and platforms have the power to revolutionize the healthcare industry and benefit everyone, especially patients.

"With the application of internet technology we can provide more convenient medical services," said Xuan Zhou, Senior Product Director, Internet Plus Healthcare Department, Tencent.

Since it was founded 18 years ago, Tencent has become a leading internet giant with a market capitalization of over $300 billion. Tencent started out as an internet service provider but in 2011, shifted strategy and opened its platform.

Through its *Internet Plus Healthcare* concept, Tencent creates, "Internet technology and solutions [that] promote the development of the medical industry" through four key capabilities:

- **Interconnection** – improving connectivity between parties;
- **Intelligence**, such as big data and artificial intelligence;
- **Service** by connecting industry to the people; and
- **Ecology** as Tencent has its own ecosystem and lots of partnerships.

Zhou shared examples of these capabilities in action.

Medical payment via WeChat

WeChat, Tencent's social media platform in China, has over 963 million monthly active users. It is known as China's 'app for everything', including making payments.

Allowing people to pay their medical bills via WeChat has advantages for everyone in the ecosystem.

- **Medical insurance payments:** WeChat connects MOHRSS (Ministry of Human Resources and Social Security), hospitals and patients. Especially at major hospitals, the queues can be long. Patients have to pay and queue at various stages – to register, following treatment and for prescription, etc. Allowing patients to pay via their smartphone with WeChat saves as much as 46 minutes per patient.
- **New Co-operative Medical Scheme (NCMS) payments**: WeChat connects NHFPC [National Health and Family Planning Commission], hospitals and patients, reducing the financial pressure for rural patients. Traditionally, rural patients must set up a transfer treatment bill from where they are registered for social security and take it to the hospital where they receive the treatment. After they pay all the expenses, they have to take the bill back to their home town for reimbursement. This is time-consuming and they don't know how much will be reimbursed. Using WeChat the patient can see the detail of the medical expenses and simply click to fulfil all the payments.
- **Commercial insurance payments:** WeChat connects insurance companies, hospitals and patients, making it easier for patients to apply for reimbursement. In just a few steps, users can fulfil the reimbursement of commercial insurance.

Artificial intelligence

Zhou noted, "Artificial intelligence is significant for [Tencent's] strategy and we will continue to invest in it for the long term."

The company is working on several AI tools. Its photo recognition technology has been used for the identification and removal of pornographic or violent images on WeChat, for example. It has also been used to identify missing people.

Earlier this year, Tencent's AI, Fine Art, won the Tenth Computer Go UEC [University of Electro-Communications] Cup in Tokyo.

In August, Tencent released its AI-assisted medical imaging product, MIAIS, targeting early detection of esophageal cancer.

Detecting and curing cancer

New technology to screen for esophageal cancer uses a capsule that patients swallow, instead of inserting a tube in the throat. The 'capsule camera' takes around 80,000 photos – while this reduces suffering for the patient and improves results, doctors don't have time to read all the photos without the assistance of AI.

The medical research team that is working with Tencent classified hundreds and thousands of esophageal endoscopy images. The doctors gave them to Tencent's AI team for image processing and enhancement. MIAIS screens suspected esophageal cancer using deep learning techniques.

In trials, the early esophageal cancer recognition rate of MIAIS is 90 percent, which is great news, as up to 90 percent of patients who are diagnosed early can be cured, needing only a short stay in hospital. For late-stage diagnosis the cure rate drops to 40 percent, the treatment is more invasive and, of course, the cost is higher.

AI assistance has benefits for patients, hospitals, doctors, social security and more but it does not replace doctors. "MIAIS needs professional guidance and close collaboration from doctors," Zhou said.

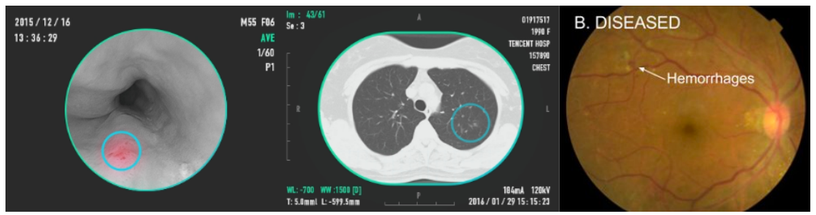
Spreading the success

In the future, Tencent's AI-aided screening product will also support early screening for lung cancer, diabetes retinopathy, breast cancer and other diseases.

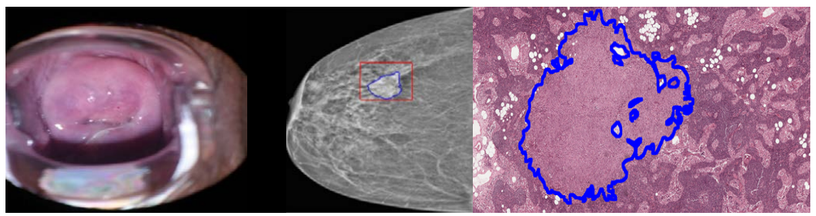
Zhou said "We can energize the medical industry in the following ways":

1. We can work together with hospitals working on scientific research to find new ways to recognize diseases.
2. We can address the shortage of doctors by supporting them with AI.
3. We can bring AI technology to remote areas to screen a lot of people, quickly, for cancer, for example.

"In the future, Tencent's AI-aided screening product will also support early screening for lung cancer, diabetes retinopathy, breast cancer and other diseases."



Early esophageal cancer screening | Early lung cancer screening | Diabetic retinopathy screening



Cervical cancer screening | Breast cancer screening | Breast cancer screening by lymph node biopsy

AI-aided screening (Source: Tencent)

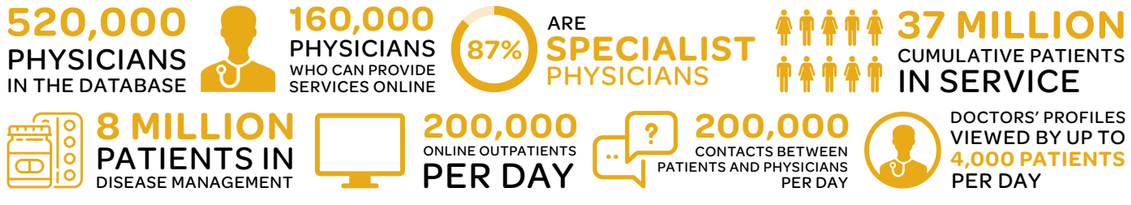
CHANGING DISEASE PATTERNS NEED A NEW APPROACH TO HEALTHCARE

During its 11 years in the digital health field, Haodf.com has learned many lessons about delivering medical services online and the future of healthcare. Wang Hang, CEO, Haodf.com, shared some of them.

Hang noted the key trends that are changing the way healthcare is delivered:

- In **2006** Haodf developed an online platform for patients to share their experience of seeing a doctor to help other patients choose the best-rated doctor and the doctor most suited to them.
- In **2008**, the system evolved to include an online triage system to cope with demand outstripping supply, as the doctors with the best ratings and reviews were the most popular with patients. The platform matches physicians with patients online so that junior doctors can deal with minor and common ailments, leaving top doctors and experts free for more serious and specialist issues.

HAODF.COM



- In **2010** Haodf saw that disease patterns were changing and some chronic diseases were becoming mainstream. In response, it established a disease management system and tools.
- In **2013** as usage of mobile access to the internet grew, the number of people using the platform scaled rapidly.
- In **2016** Haodf signed a smart internet hospital contract with the City of Yinchuan as part of Yinchuan's smart city program.

Online medical care: Where are we?

According to Hang, online medical care has entered the '2.0 era'. We have moved from breaking down medical information barriers online and facilitating interaction between patients and doctors to enabling diagnosis and "treatment process reengineering". As Hang put it, we've advanced from "medical peripheral services to access and core areas of diagnosis and treatment."

As Haodf began working with the City of Yinchuan, it realized that, like other cities, chronic disease has become the major type of ill health. For example, in 1990, diarrhoea and malaria were in the top ten disease mortality rankings in China. They no longer appear, but diabetes and Alzheimer's, for example, are both in the top ten now.

"If we do not change the medical care process it's impossible for governments, patients and doctors to be satisfied," Hang said.

As was noted in other presentations such as the one by Tencent (see page 30), in China and other countries, patients attending medical appointments often have to stand in line a great deal. Typically, first to see the doctor, then to have tests, the results, the diagnoses and the treatment, etc. It can easily take up to two hours.

This might be bearable if you rarely have a medical appointment. However, with the increase in chronic diseases such as diabetes, people may have to visit their doctor every two months or even weeks. This becomes stressful and disruptive for the patient and places additional strain on doctors and healthcare services.

"For smart medical care, we need to solve these problems," Hang said. "To meet the demands of chronic disease we need to set up a completely new diagnosis and treatment process."

From physical to digital

In many countries, the traditionally 'offline' process of seeing the doctor is being shifted online. This will enable the diabetes patient, for example, to spend most of their time at home or wherever they need to be. While doctors will still be based at hospitals and medical centers, the main platform for them to contact each other and patients will be through the internet, unless an in-person visit is deemed necessary.

Doctors can send prescriptions to the patient online and patients can upload their blood sugar results to the doctor.

Hang says, "The communication between patients and doctors would be long term and if intervention is necessary, the doctor and the patient can make an appointment to have more in-depth testing, diagnosis and treatment."

The future of digital health

Here's how Hang sees things evolving from here:

- **A shift to services** – previously much of the cost of treating patients has been for drugs, devices, testing etc. China, and other countries, are changing their pricing mechanism and service will gradually become the most important thing provided by doctors. Services will become more expensive and drugs will get cheaper.
- **Establishing doctors' personal brands** is becoming more important, especially in China. Through online 'word of mouth' platforms, patients and physicians can be better matched and as awareness grows, more doctors and patients will move online. One hospital president said that he invited a doctor to work in his hospital because they had such a good reputation online. When the doctor joined the department, which was not so well regarded before, it attracted a lot more patients. "We can see the role played by the 'branded doctor'," Hang said.
- **Remote consultation** is important for areas, such as Yinchuan which only has a relatively small population. It is hard to attract and nurture specialist doctors because there are few people with the same rare diseases in such a small population. When a patient has a rare illness or condition though, increasingly the patient will have a remote consultation with a specialist doctor, along with their local doctor. The solution will be provided by the specialist and implemented by the local doctor so patients get a national-level service locally and neither they, nor the doctors, have to travel. It creates a nationwide network.
- **Artificial intelligence (AI) and robotics** are moving fast, especially with more data becoming available to 'train' them. "I believe robot doctors will play a very important role in hospitals and they will replace some of the doctors' work -- for diagnosis of simple and minor diseases," Hang said.

PARTNERSHIPS ARE KEY TO SCALABLE SMART CITY SOLUTIONS

In the next decade, the City of Utrecht's population is set to grow from 340,000 to around 440,000.

"This has to be accommodated within the existing urban fabric – we need to maintain good access, improve air quality, reduce noise pollution and create attractive public spaces. We want to be a city that enables residents to enjoy urban life to the fullest, without placing a burden on limited resources," Frans Jorna, Director, Smart City, Utrecht, told delegates. "[These challenges] necessitate that we adopt digitalization and urban platforms."

Jorna noted that Utrecht is convinced that health lies at the heart of an urban development strategy that makes people happier, the environment healthier and the economy more sustainable.

"We prioritize public health in all fields of policy, and we urge residents and other stakeholders in the city to do the same because we cannot achieve this by ourselves," he said.

For example, Utrecht has already seen that mobility patterns are changing, and tools such as TomTom, Google, etc., have a large impact. This highlights the importance of cities forging partnerships and urging private sector companies such as these to do their part in making Utrecht a healthier place to live.

FAST FACTS

Data drives it all

Leaders understand that data is at the heart of all this and have put the collection of data at the center of Utrecht's economic strategy – not just city data but data from national government and private companies too.

Utrecht established a data lab, based on FIWARE, along with regional partners. It is inviting private companies and other cities to develop software and data architecture in an open source laboratory environment, based on standards.

Several services have already been built on the platform, such as a tool to monitor groundwater and an application that tracks the movement of bicycles and helps cyclists find somewhere to park their bike – Utrecht is a city with a lot of bikes.

Privacy by design

One of the concerns people have about increasingly data-driven cities is the 'Big Brother' risk. "It is not our intention to become big data agents," Jorna said. "We are also a progressive city."

Privacy by design and data minimization are at the core of the platform, he said, and this means they are part and parcel of any product that is developed on it.

"We all see how data platforms are transforming our economy. It is our firm conviction that platforms play a crucial role in tackling social issues that confront cities," Jorna said.

For example, a mobility application has been built to help with shifting the transportation focus away from private cars towards shared cars and shared bikes, and prioritizing cyclists and pedestrians.

Along with other cities including Nice and Gothenburg, Utrecht is taking part in the EU's IRIS project. The cities will work together using open innovation, again based on FIWARE, to speed up the development of replicable and scalable applications and solutions around five key challenges:

- energy-positive districts
- smart energy management
- smart e-mobility
- digital city innovation platforms
- citizen engagement and co-creation

Scaling it

Based on the work Utrecht has done so far, Jorna said, "partnership is key to achieving 'bankable', scalable, replicable solutions – not just on a regional, national and European scale, but internationally as well."

He added, "TM Forum is a good example of an international partnership between industry, academia and government where important work is being done on technological and business standards, specifically in regard to 'cities as platforms'."

"Heart and brains of the Netherlands" (Source: City of Utrecht)

City Innovation Platform (Source: City of Utrecht)

SMART WATER WORKS FOR EVERYONE

Shi Zhaohui, Chairman, Smart Water (Yinchuan) Co. Ltd. talked about how innovative technology for water infrastructure, the Internet of Things, new business models and partnerships have proved a success for everyone. Now many other cities are looking to adopt the same approach.

He explained, "Our company was established by Tsinghua Holdings...We have [taken] four to five years to transition from a traditional R&D company to a smart water industry investment company. Our success cannot be separated from the support of Yinchuan city."

It is the only provider of overall solutions for drinking water pipelines in smart cities in China. The company uses technical invention, combining internet and big data technologies with intelligent manufacturing to supply people with safe drinking water.

The company has four main fields:

- **Aerodynamic water purification system** brings dramatic change because traditionally the process used many filters to screen out impurities. The new technology reversed and improved this, removing 99 percent of the impurities before filtration, improving efficiency ten-fold.
- **Filters** then provide further purification, again improving efficiency ten-fold.
- **Pipeline technology** – many water systems use polypropylene random copolymer pipes which cause secondary pollution. Smart Water (Yinchuan) replaced them with a stainless-steel pipeline, but the connection technology for stainless steel is a big headache. How can you connect 8mm diameter pipes to households? The company claims to be the only one in world that can do it.
- **Internet of Things (IoT) water meters** – the company has developed its own technology because it needs real-time data transmission. Previously, all water meters, whether for remote transmission or not, used batteries.

The collection, mining and analysis of big data regarding drinking water helps the government to innovate the urban management model, because the data produces an audit trail to deal with any queries. Future data can also be analyzed to optimize government administration.

The table below compares the new and old drinking water technologies.

Smart drinking water system		Traditional drinking water system
Separating	**Model**	Interception
6-10 sq. m	**Space needed**	60-100 sq. m
>10 years	**Filter life**	3 months
Online in real time	**Monitoring**	Simulation
Pre-payment	**Payment**	Post-paid
≤20%	**Waste water**	≤80%
≈0.37KWh	**Power**	≤10KWh
Automatic control	**Operation**	Manual

Source: Smart Water (Yinchuan) Co. Ltd.

New operating models

Drinking water only accounts for 1 percent of all water usage, but of course it needs to be 100 percent safe. Instead of incepting all water for collection together, the new technology and infrastructure separates different qualities of water that will be used for different purposes. A mobile terminal can be attached to the drinking water outlet to monitor it and for payment.

New business models

As the comparison of payment highlights, not only are the technologies different, but so are the business models. With the new system, drinking water is provided by the city using a public-private partnership (PPP) model. It is delivered in four phases: Planning and design, manufacturing, project investment and operation.

From the consumers' side, payment for water is in advance and delivered through a franchise.

Zhaohui said that his company had been set up to meet the requirements of Yinchuan, and his firm had had to transform from simply being a technology company to also being an investor. He said, "Big data has let us grow up to copy the Yinchuan model in other cities and we have received a number of requests from South East Asia, African and West Asian companies to use this model."

> "Drinking water is provided by the city using a public-private partnership (PPP) model."

He added, "Without the [big data] platform provided by Yinchuan we couldn't apply this model. The R&D takes a long time and lot of capital, without visible market, and three to five years for a company to make profits. Yinchuan offered its market first and we have signed a 30-year usage contract with the local government, so it will be operated by us and local partners until then. This means we can do R&D with sufficient funding.

"Over the last year, there have been many media reports about Yinchuan's smart water right across China, and just last week five provinces sent delegations to Yinchuan."

Everyone wins

Zhaohui described the combination of technical innovation hitched to 'internet thinking' to develop new business models as "a win-win result for government, the community, citizens and enterprises". This is because for:

- **government** – it improves citizens' lives and promotes local economic development while reducing financial pressure on public spending;
- **community** – it provides a better living environment (the entire water infrastructure takes up much less space and resources, and massively reduces the amount of waste water);
- **enterprises** – franchise rights help businesses to develop rapidly, with innovation and the internet hugely reducing costs; and
- **citizens** – have a reliable supply of safe drinking water which saves them money and increases the value of their homes. Prepayment could be enabled via a mobile app for convenience.

HOW BIG DATA REFASHIONED THE CLOTHING INDUSTRY

Yu Hengxing, Chairman, Yinchuan Binhe Ruyi Clothing Co. Ltd., explains how when "enterprise is the main body of innovation…[and] masters first-class technology, conventional industries also can become sunrise industries". This 45 year-old company is leveraging 3D imaging and analytics to revolutionize its operations and business.

The company was established in 1972 and became known around the world as an innovation-oriented textile enterprise. Shandong Ruyi Group has two public listed companies: a Domestic A Share Company and Tokyo Mainboard Company. In 2002, it won Second Prize for National Progress in the Science and Technology Award for Sirofil Spinning Technology.

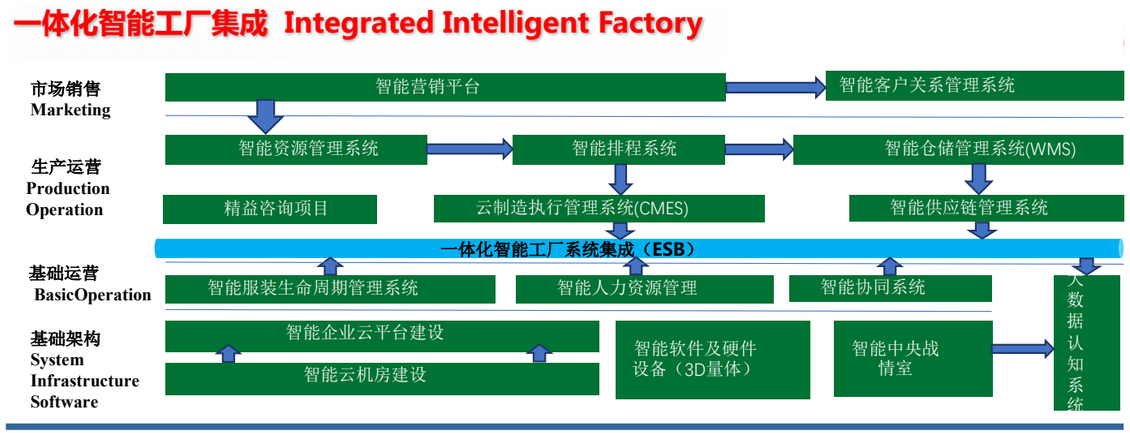
In 2009, it went one better, winning the First Prize for the National Science and Technology Progress Award for High Efficiency and Short Process Embedded Composite Spinning Technology. It produces 3 million high-quality suits and 30 million shirts a year.

Applying big data

The enterprise service business (ESB – see graphic opposite) sits between production and basic operations. It analyzes the difference between the input and output of both to standardize output. The systems' interactive control center integrates all the variations of different projects.

Just in time, made-to-measure

The company establishes the exact details of a customers' shape and size using a 3D Body Measurement Machine (see picture). There are 70 HD cameras and four Optoma projectors, which enable these machines to shoot images from 360 degrees and collect about 200 different



Source: Yinchuan Binhe Ruyi Clothing Co. Ltd

measurements. This information is then sent to the big data center, where the 'human skin texture' data can be collated to simulate a full 3D model.

In the meantime, using an app, the customer can select the style and fabric they want for their clothes, right down to details such as having three or four buttons on a sleeve. the width of a lapel and so on.

Hengxing said, "During the process, we can record their choices and how long it took them to decide on individual elements, so that our data will be enriched over time and designers will be able to come up with more refined choices." Once the customer has chosen, they confirm the order and upload the data. Customers can select which factory their clothes are made at from outlets all over the world.

He said, "Big data enables customized clothes for customers the world over."

Intelligent manufacture

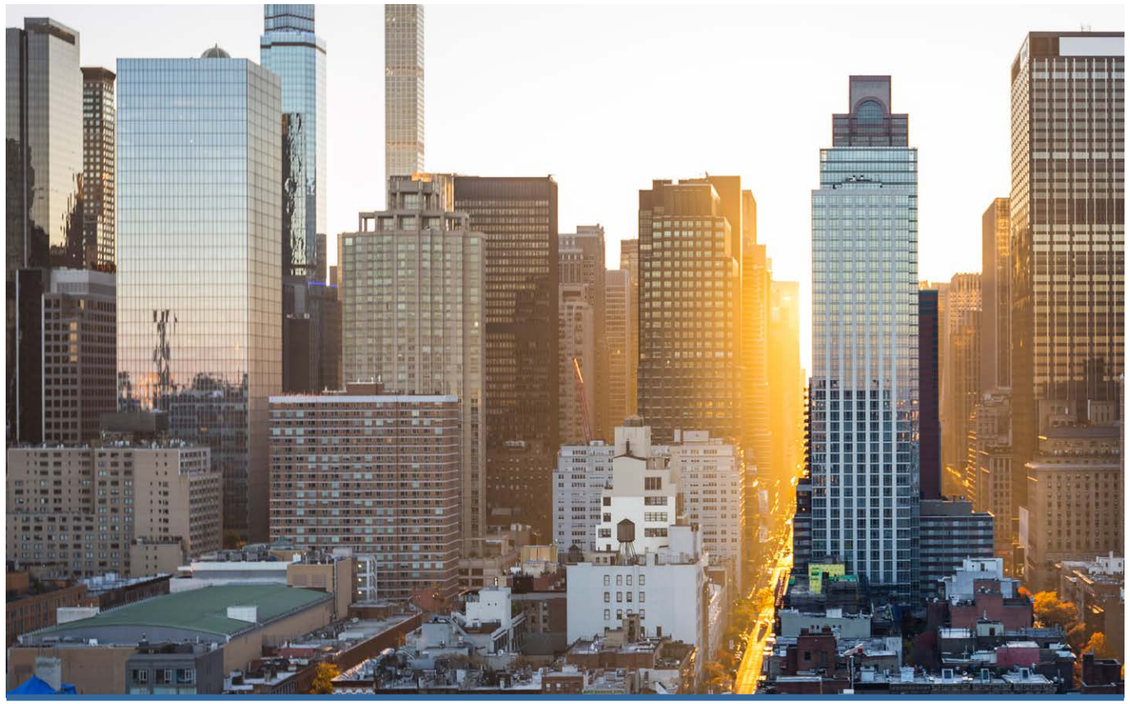
Once in the system, the customers' data generates a production order, which enters the manufacturing process and includes an intelligent organizing system. This highly advanced production line assigns an integrated circuit chip to each item on the hanger for each item of clothing. The chip records the sizes and special requirements, which ensures they are transferred to right place in the manufacturing system.

There are ID stations for each unit of clothing that track it throughout the entire manufacturing process. This includes the end cycles of ironing, packing, inspection, storage, sales and logistics for dispatch.

The progress of all the garments can be seen, in real time, as they are tracked on a big data dashboard at the heart of the smart plant. Information about the workshop and whether it is busy, but smooth-running, or overloaded is sent to the front desk terminals where staff can adjust the flow to maintain efficiency.

According to Hengxing, this 'just in time' approach to clothes manufacture has improved productivity by 50 percent. He ended saying, "As a traditional industry, we've integrated big data and smart industry and we want to share this with other traditional industries."

3D Body Measurement Machine (Source: Yinchuan Binhe Ruyi Clothing Co. Ltd.)



LEVERAGING BIG DATA ANALYTICS TO TRANSFORM CITIES

Four experts joined TM Forum's CMO, Paul Wilson, to debate this red-hot topic. The panel gave some great examples of what cities are doing in this area and how they are tackling challenges.

What do you want to achieve?

Erin Walsh, Future Cities Catapult, said the most fundamental question before cities embark on using data and analytics for smart city purposes is to be clear about what they want to achieve.

The company became involved with Smart Belfast, Northern Ireland and she soon discovered there was a lot of uncertainty about the city's goals. Walsh commented, "We worked with the city council to define challenges, as although they often recognize there's a problem, they don't always understand it."

Walsh helped the team put a Smart Belfast framework in place that included 50 actors/roles from across the city, ranging from small- and medium-sized enterprises (SMEs) to citizens and local government. The framework was launched in late September.

Belfast is now looking to SMEs across the UK to come up with new ways to boost revenue from business rates. The city has opened the challenge of developing innovative ways to maximize income from rate-paying businesses and data analytics companies through a Small Business Research Innovative (SBRI) competition.

Her advice is, "Start small and demonstrate what you can do."

Put a sensor on it

Remco Duivesteijn, Advisor and Information Architect, Municipality of The Hague in the Netherlands, talked about building an infrastructure for sensors that could extend to landlords of city properties. He said, "Put a sensor on it [a building] and send the data to a hub, where it can be shared, and puts lots of tools on the hub." He said if smart cities have such an infrastructure, anyone can join and take part.

The Hague wants to make traffic more efficient and generate economic benefits, and embarked on an eight-year project to do this. The first phase was mainly research and development for the technology including security. He added, "There is a lot to figure out, such as looking at public-private partnerships, but it looks promising."

The Hague also looked at traffic moving into and out of the city, as well as within it. Its annual firework festival attracts 400,000 visitors. Duivesteijn said, "What we wanted to see is that by making adjustments from data analysis, how traffic control could reduce time to get in and out of the city...We have had real results."

Scaling up and down

Tengku Mohd Azrul Bin Tg Azhar is Head of Innovation and Commercialization at Cyberjaya – a town with a science park as its core – a key part of the Malaysia's Multimedia Super Corridor.

He explained he is now working with startups having previous worked with large companies like HP and Dell. He said, "but then we looked at ecosystems with SMEs to solve more issues in cities."

"The whole city is a living lab for these startups to test their products and solve common issues using citizens' and government data. We give the data back to citizens by using it to help them."

His organization has collaborated with cities regarding traffic problems, such as looking at how to mitigate jams in cities with large Muslim populations, who flock to the main mosque for Friday Prayers. He agreed sensors help with traffic management systems, but said he was seeking a wider collaboration model to work with cities to solve problems together.

Public private partnerships

China is working with public and private sector partnerships (PPP) to develop smart cities fast.

Wu Yaping is Director at the Investment Research Institute, part of the National Development and Reform Commission. He said economic conditions in recent years had given impetus to PPPs in China, adding, "My understanding of smart city is as an investment opportunity, maybe for new business models and new sectors based on big data and internet technology."

He added, "We want to give full play to social capital – drawing on strengths – not just infrastructure for public service." He pointed to smart lighting projects that could be provided through partnerships and big data, so that the color of the light can be changed, Wi-Fi base stations can be added to lampposts, which can also have screens built in for many purposes including advertising, plus surveillance cameras for public safety and much else.

Security strategies

Duivesteijn outlined the Netherlands' national-level smart city strategy, and that the five biggest cities cooperate in teams. The Hague is the International City of Justice which attracts many companies, so there is an emphasis on building infrastructure and IT services to address cybersecurity and crime. He said, "We simulate [the] effects of a cyberattack and build 3D models to see the cascade effect."

How to succeed with data analytics? "Start small and demonstrate what you can do."

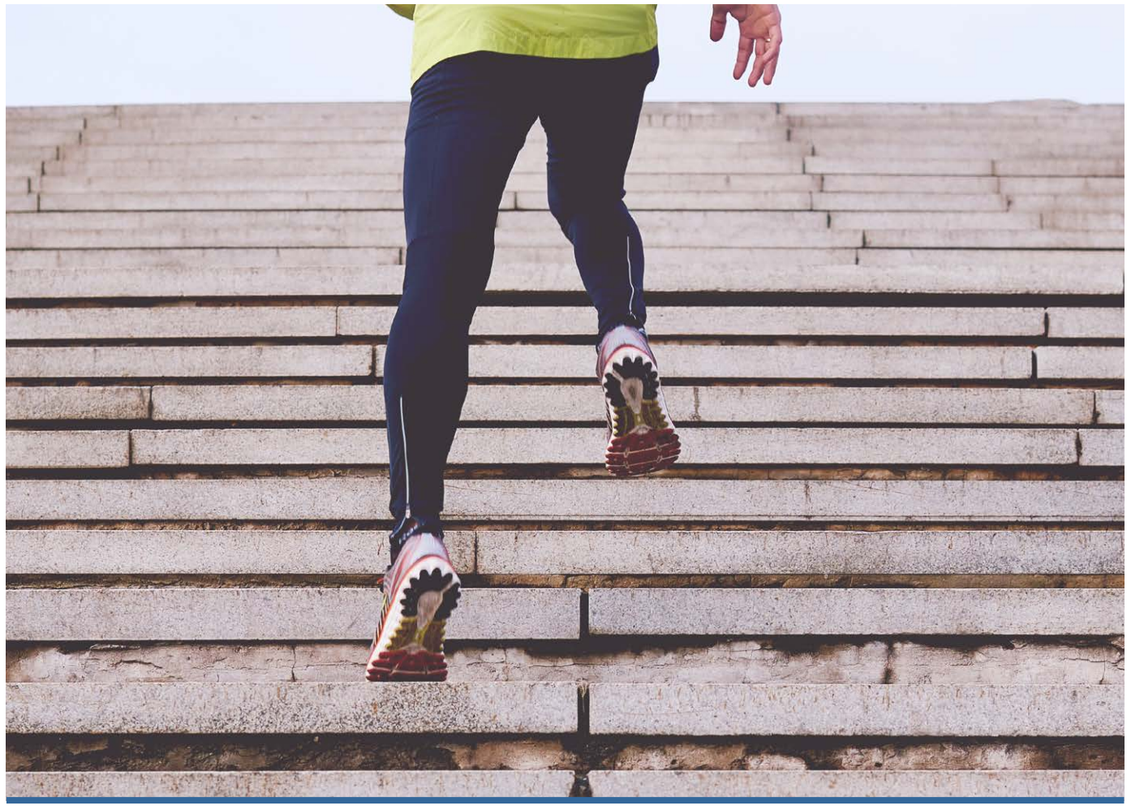
Bin Tg Azhar noted the increasing use of facial recognition; "that info is good if in right hands, in wrong hands it is something else. We have an agency in government around security and the open data policy...We need very strong policy [in place] before we can embark on using this data."

On the big data challenges they are stopping management teams from using the data, Bin Tg Azhar said one issue is how the city's management or council can make data open to startups, SMEs and enterprises, and whether they should be allowed to pinpoint what they want and use it. Yet without access to open data," how will they even know how many people [are] passing through – certain data sets can [show] that."

Wu said a big issue is, "how can we cooperate between government and enterprises to provide a better solution to protecting data privacy and at same time crack down on data theft?"

Walsh wrapped up the session saying there are business models under development in this space, but we haven't yet fully understood how we use them to develop data models and long-term sustainability."

Wilson recommended using CurateFX to visualize data models quickly.



TM FORUM ISSUES A CHALLENGE TO CITIES

The last ten years have been a "voyage of discovery" for smart cities, Nik Willetts, TM Forum's CEO, said during his keynote speech. The next ten years are about "navigating the journey".

He outlined a number of tools that TM Forum has developed to help cities navigate this journey to becoming smarter, including the new City as a Platform Manifesto [a set of principles for deploying city platforms], the Smart City Maturity & Benchmarking Model [a tool to assess the 'as is' situation and outline a goal-driven city strategy]and CurateFx [a visual tool to map smart city business models and the corresponding business and technical capabilities, as well as the Open APIs to implement them.]

However, Willetts noted that while these are all useful tools, in the end it comes down to "getting something done" and with that, he issued a series of concrete challenges to cities globally:

Challenge #1: Business model innovation and city ecosystem management modeling

Participants will use the CurateFx ecosystem management tool to model their city ecosystem with the goal of igniting a local data economy. This will include business model canvas design with commercial third parties, mission model canvas design with city agencies, and platform model canvas design with the platform owner. Key types of relationships between ecosystem partners will be modeled in the tool (contractual, data, financial, operational and service) and the end result will be a model that can inform decision-makers on how to unleash local data economies.

Challenge #2: Federated city platforms

This challenge requires two cities who wish to share city data or city services. By using a subset of the City as a Platform business and technical architecture model, these cities will find a way to share common assets for mutual benefit. It is TM Forum's firm belief that cities that learn early on how to share and benefit from one another will emerge as the winners 5 to 10 years from now.

Challenge #3: Artificial intelligence and resident services

This challenge is based the promise of AI (artificial intelligence). Participants will explore the positive benefits of AI, and at the same time identify the privacy challenges we need to safeguard for. A city will team up with an AI provider for a service that typically requires a lot of manual work for the city. This challenge will identify cost savings and offer insights as to where service quality can be improved by AI.

"The last ten years have been a voyage of discovery for smart cities. The next decade is about navigating the journey."

Challenge #4: Submit your own challenge

Propose your own challenge.

Willetts said cities have two choices in tackling challenges like these: Go it alone and make the same mistakes in parallel with everyone else, or take the path to success, tackle it together and share the journey.

TM Forum is a platform to facilitate this collaboration and a key mechanism to respond to these challenges is through a TM Forum Proof of Concept Catalyst. These projects bring together stakeholders such as cities, telcos and technology companies, academia and more, to tackle a specific problem and find a solution in 3-4 months.

"Cities that learn early on how to share and benefit from one another will emerge as the winners 5 to 10 years from now."

A number of these Catalyst projects demonstrated their latest findings at the Smart City InFocus event:

Connected citizen: Life in a clean, green city

Looking at ways to commercialize the platform the team has developed to co-create replicable business models for smart cities all around the world.

Companies taking part: NTT, Orange, Infonova/ BearingPoint, Esri, Amdocs, Symantec.

Smart city service optimization

Based around the orchestrated selection and assignment of key workforce assets in the smart city ecosystem.

Companies taking part: Smart Dublin, Smart Liverpool, Galileo Software, AssureNow, Liverpool John Moores University.

Smart city on the edge

Applies edge and fog computing principles to smart city data hubs to improve the efficiency of city operations. It uses situational, de-centralized decision-making, pushing intelligence from the central data hub to a local loop of programmable edge devices, such as IoT gateways and sensors.

Companies taking part: Milton Keynes Council, Agile Fractal Grid, Dublin City Council, BT, CloudSoft, Infonova/ BearingPoint, Exfo.

Logical factory: Virtualizing manufacturing for agility

Shows the development of a platform underpinned by Industry 4.0 philosophies which integrate and connect numerous digital manufacturing systems across disparate facilities.

Companies taking part: BT, TIM, TWI, Infosim, Infosys, EnterpriseWeb.

Summing up, Willetts said, "We need to create a new vision for the smart city. We need to think about where we are on this very long journey so far...Now is the time to move further ahead, looking at where we are going and what needs to change."

LARGE-SCALE SIMULATIONS HELP SHAPE SMART CITIES

Wan Biyu is Chief Scientist, National Smart City Joint Laboratory in China, which undertakes large-scale computer-generated, urban simulations looking at sustainable development. This is a critical subject, as every year, millions of rural dwellers move to China's cities.

This brings problems of congestion on roads, overcrowding and not enough accommodation. In addition, more electricity is needed plus water and waste management, among many other things.

Smart cities, sustainable development

On September 25, 2015, countries adopted a set of goals drawn up by the United Nations to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years: The eleventh is specifically about sustainable cities and communities.

Biyu said the valuation model of smart cities devised by Vienna Industry University in 2009 shows how smart cities are an important way to promote a new, national kind of urbanization from the top down.

The aim of China's National New-Type Urbanization Planning 2014-2020 is to comply with trends of modern urban development, promote urban green development, improve the level of intelligence, enhance the charm of history and culture, and improve the inner quality of the city. The purpose of the plan is to provide guidance on how to achieve those aims.

The national smart city pilot project involves 277 cities, towns and districts, in partnership with cities from all over the world to develop smart cities. The Lab's simulations are to help predict the consequences of that urbanization, which happens in four phases: planning, development, management and operation.

Source: www.un.org

Large-scale urban simulation

Why is urban simulation necessary? It is designed to answer questions including how to ensure city planning reflects future needs, ranging from development of the city itself, provision for ecological spaces, intelligent systems, population and industry predictions and so much more.

The first phase of urban simulation began back in 2000, the second in 2010. The Data Space Model was completed in 2016. The construction of standard systems and information security is led by the Smart City Construction Leading Group. It has begun major infrastructure projects, such as a public information platform, public data library, electronic government affairs, smart medical treatments, smart education, smart parks and so on.

City planning, according to Biyu, is the blueprint and regulation of city development in a certain period; it is also an important part of city construction and is the basis of city construction and management, which is also the premise for the three stages of city management: planning, construction and operation.

Three big urbanization problems

One of the problems of urbanization is water pollution caused by flooding. By July 21, 2017 some 98 Chinese cities had been waterlogged this year, with economic losses amounting to about RMB 22.933 billion ($3.456 billion). By August, in total, 59.32 million people had suffered from floods.

Air pollution is a very serious problem. The Chinese government is committed to improving air quality; three years ago pollution levels in parts of China hit 498.

Natural disasters also have serious consequences for urban areas with dense populations as the table below shows.

	Typhoon Hato	Typhoon Pakhar
Disaster victims in tens of thousands	74.1	8.3
People killed	12	8
Houses damaged/rooms	7,400 (6,600)	200
Crop damage in thousands of hectares	68.2	4.1
Total crop failure in thousands of hectares	1.1	0.1
Economic losses in millions of yuan	121.8	3.2

Applying simulation techniques

Biyu gave the example of using simulation to model and predict the effect of strong winds on an area of a whole city (45 square kilometers). The main functions in this application are:

- planning green buildings and support for design data, program analysis, monitoring the performance of wind-proof design;
- predicting typhoons and other natural disasters, helping with design of contingency plans; and
- locating powerful wind.

The target buildings for this simulation are within about 23 square kilometers of the area. The Lab wanted to understand the influence of the surrounding buildings, rivers, roads and the natural environment. The calculations focused on a detailed description of the effects on five typical buildings out of the 7,726 in the city.

Simulations are also done for water. Two years ago there were serious floods in southern China and Beijing, so the Lab has modeled water depth over time at particular locations. Overall, it is looking at flooding, waterlogging, 'sponge cities' and drainage.

There is a project in Shanghai simulating air pollution and diffusing atmospheric pollutants.

Combining simulation techniques

The real power of simulation will come from combining simulations of these and other factors to better study demography, hydrology, planning, economics, transportation and computational fluid dynamics.

The Smart City Joint Lab is supporting China's pilot smart cities as a service organization. It has many partners, including private companies, and involves science and research, standardization, planning, consultancy, testing and evaluation. So far, Biyu said, "We have established 19 different labs that cover various fields, from smart city solutions to spatial information, information security, media and promotion, big data and city operations, water management projects, green building, smart infrastructure, smart tourism, smart community etc.".

China is also playing key roles in international efforts to standardize and coordinate smart city efforts, including with the International Standards Organisation (TM Forum contributed to ISO66SO1), the International Electrotechnical Commission and the International Telecommunication Union. Five Chinese cities are also working closely with the cities of London, Copenhagen and Barcelona in Europe, Yokohama in Japan and Boston in the US.

Biyu acknowledged that is it still early days for smart cities, quoting Vincent Guallart, author of the highly influential book, *The Self-sufficient City*, who wrote, "The internet has changed our life, but it hasn't changed our cities, yet". He said the five years from 2008 to 2013 were all about intentions and theory around smart cities, while the next five will be how to use data and combined city simulations and applications.

LIVERPOOL'S STRENGTHS HELP REDUCE POLLUTION AND GET SMART

A global port city with a strong history in manufacturing, the City of Liverpool is at the start of its journey to develop a smart city platform. An important part of this strategy includes reducing carbon emissions and harmful air pollution.

"We've long held ambitions that Liverpool should be a place where people can experiment and treat the city as a place to innovate," says Counselor James Noakes, Assistant Mayor for Energy and Smart City.

The city is using tools from TM Forum including the City as a Platform Manifesto, CurateFx and proof-of-concept Catalyst projects to take a structured approach to building a smart city platform. The structure these tools provide is essential, Noakes says.

During Smart City InFocus, he and Professor Paul Morrissey, Chair of Smart Liverpool, discussed how Liverpool is undertaking low-carbon initiatives to support urban regeneration, and the city's approach to becoming smart.

Assessing the environmental threat

The City of Liverpool sits at the center of the UK's second largest regional economy with access to 6 million customers. The economy, supported by 266,000 businesses, is worth an estimated £149 billion ($197 billion).

"We're strongly connected to global markets," Noakes says. "We're famous for our iconic river [the Mersey], our windswept coastline and international manufacturers. We're known as a global gateway to the Atlantic and beyond."

Liverpool at a glance

Past: Was a major slaving port in the second half of the 18th century, which laid the foundations for the prosperity of the dock and the city – this bleak part of the city's history is commemorated in the International Slavery Museum.

City of firsts: New means of mass transport, ways of harnessing and distributing services, and construction techniques; hometown of The Beatles and many other 1960's music icons

Present: UK's second-largest economy (after London) worth an estimated £149 billion ($197 billion)

Future: Developing a smart city platform to improve quality of life, in many dimensions, for citizens

The city's rich manufacturing and trade history has also had serious consequences for the environment and the city's prosperity. During the 1970s, changing global patterns of trade and economic decline led to environmental challenges including contamination, siltation, dereliction of whole neighborhoods and social deprivation. Liverpool sought to address these during the 1980s through a series of governmental programs executed in conjunction with private sector companies.

Carbon reduction has become a key priority, with reductions coming from a mix of new technologies, materials, practices and applications, according to Noakes.

"There is a large volume of technology transfer from sectors such as materials, smart systems and sensors, and energy generation, transmission and storage," he says. "The Liverpool city region is home to a cluster of companies developing innovative low-carbon vehicle solutions."

The city is also home to world-class low-carbon university research centers including the Logistics Offshore and Marine Research Institute (LOOM), Low Carbon Innovation Hub (LoC), The Stephenson Institute for Renewable Energy and The National Oceanography Centre (NOC). These companies and universities are drawing on the region's natural resources to manage carbon output (see bullet points below).

Harnessing offshore wind

- 1 of 6 designated Centres for Offshore Renewable Engineering (CORE) in the UK and the only one on the west coast
- 270 offshore turbines in Liverpool Bay, including the first deployment of the world's biggest offshore turbines
- 330 offshore turbines in the Southern Irish Sea.
- 1st commercial deployment of next-gen turbines from Mitsubishi Heavy Industries Vestas and Siemens.
- $6.3 million live marine energy project pipeline

Exploiting the rising tide

- River Mersey has the second-highestt tidal range in Europe
- Mersey Tidal Power project will deliver annual energy yield of 920 gigawatts – life expectancy of the project = 120 years
- River Mersey is equidistant from four other west coast river systems that are suitable for generating tidal energy

Making Liverpool smart

While reducing pollution is an important piece of Liverpool's smart city strategy, it's not the only focus.

"Our approach to developing a smart city encompasses many areas, but we intend to place people at the heart of it," Noakes says.

Improving broadband connectivity is a key goal, along with understanding how to plan for a 5G future. Looking for areas where technology can improve efficiency, working on a platform to make city council and other public service data available, and trying to determine appropriate governance for smart city initiatives are also important goals.

City of Liverpool smart city strategy

"We see the city very much as a lab where people can come and try out technology and approaches," Noakes says.

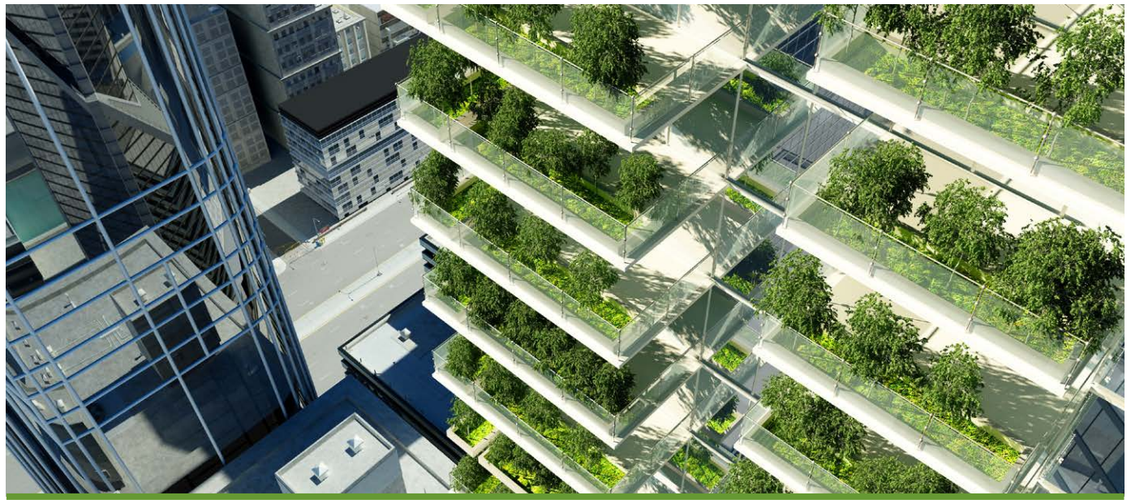
The city is taking a multi-pronged approach to building its platform including using the Smart City Maturity & Benchmarking Model app and participating in Catalyst projects; performing a full city analysis; and coordinating with partners including Smart Liverpool and the Low Carbon Eco Inventory, which is part of the University of Liverpool.

"The TM Forum benchmarking tool has helped us get a better understanding of where we are," Noakes says, adding, however, that it has been difficult to take the exact approach the tool suggests because of challenges in coordinating among all the key players.

Smart Liverpool's Morrissey outlined several key smart city initiatives in Liverpool including:

- **Sensor City,** a collaboration between the city's two main universities, which seeks to develop the next generation of sensors and related applications.
- **SciTech Daresbury,** which houses one of the UK's supercomputers and offers businesses and cities the opportunity to investigate and visualize big data challenges alongside data science.
- **Mobile phone tracking** to understand how people walk around the city center – "We hope this will lead to better decision-making," says Morrissey.
- **Green Wave,** an innovative project to improve traffic flow for emergency response ambulances, altering traffic flows to improve response times and reduce accidents en route.
- **ACORN,** a partnership that brings innovators together with investors and implementers in the city's recently built Children's Hospital, the biggest in northern Europe.
- Participation in TM Forum's Catalyst program working on a project to address issues and optimize assets around air quality, visitor experience, autonomous vehicles and social services support.

"I'm all about problems, not solutions," Morrissey says. "That's the approach we're taking in Liverpool: We're looking to identify problems, not what we can do with solutions."



HOW SMART APPROACHES AND TECH CAN IMPROVE URBAN ENVIRONMENTS

The human factor is critical if life in our cities is to be improved, but engaging citizens and changing human behavior are not simple things. Still, it seems we have much to be hopeful about.

Erik Caldwell, Economic Development Director, City of San Diego, started the discussion, outlining his city's aggressive carbon reduction goals, which are the most ambitious in California and therefore possibly the world. Two years ago, the mayor mandated action on climate and the use of a smart city approach to achieve it, as well as promoting economic development in parallel.

The plan includes "moving the entire city – every bus and home, business, hotels and more –to clean renewable energy by 2035." San Diego also wants a 50 percent shift away from travel by car to walking and mass transit by 2035.

Caldwell said, "The city is already beginning to see that 100 percent renewable could save us money."

Nudge thoughtfully

But for such policies to be successful, they need the public's support. Gyorgi Galik, Senior Design Researcher, Future Cities Catapult, said progress was "all about changing behavior, about aiming to change people's minds instead of looking at environments and systems." She suggested that people could be more engaged through a nudge approach and gave healthcare as an example. Galik warned that some nudge techniques over-simplify and fail.

Biggest waterfront on the West Coast

Dennis Gakunga, Chief Sustainability Officer, City of Chula Vista, said his city has the biggest waterfront development on the US West Coast, although it doesn't have "instant name recognition". It is just 15 minutes from San Diego, north of the Mexican border. Most of the city is in San Diego county and Chula Vista has the biggest piece of land for redevelopment in the county.

He continued, "We have many unique things working for us – the lowest ratio of city staff in California…I manage sustainable conservation and am the smart city champion too; the two are inextricably linked. The crown jewel in the master plan is the redevelopment plan for the bay front which covers 535 acres." It will be built out in phases, with some 220 acres of conservation and open parks. There will also be retail space, hotels, and more. To get approval for the redevelopment, the city and port had to enter agreements with environmental groups.

Design and retro-fitting old cities

Daniel Fletcher, CIO, Madrid and Associate Professor, IE School of Architecture and Design, researches how real estate and urban development impact sustainability goals. He said that sustainability goals should start at the urban design level so the master plan if you are designing a new district, such as Aspern [a former airfield] in Vienna, "which will be born with low carbon emission goals".

However, he noted, "In Europe we have many cities that have a long history and so there are many problems with their design that impacts their sustainability." But the Europeans are working on it, such as the Paris 2050 plan, a key element of which is bringing ever more greenery into the city (see main picture). Fletcher also reminded us that, " Urban planning was already working on sustainability goals before digital."

Getting rid of contamination

Massoud Ghandehari is from the Center for Urban Science and Progress New York University, founded after an initiative by Mayor Bloomberg. Its mission is to make cities and data work for each other. A notable success of this joint effort is the banning of number 6 fuel that was used in older buildings and boilers, and contaminates everything around it. There was a campaign to measure emissions and analysis that resulted in it being banned within five years, and down to undetectable levels.

Cities move faster than states

San Diego's Caldwell agreed that cities can make policies faster than states and roll them out as legislation that is legally binding. He said, "We can't solve the world's problems, but we can do our little part and act as an example of how to do it – and bring economic growth and prosperity too.

He added, "You can work with GE [say] – the role of technology is getting good data whether from street lights at a neighborhood, block or even street level to change behaviors and meet energy goals." Caldwell stressed that changes in behavior are essential, along with renewable sources. He pointed out that San Diego imports almost all its water, "from hundreds or thousands of miles away". It takes immense amounts of energy to pump it to the city, hence recycling and conserving water is also an effective way of saving a huge amount of energy. He described getting people out of their cars as "a cultural shift".

Better engagement narratives

Galik agreed, saying that technology to measure and monitor the environment is amazing, but you need the will of the public to improve environment: "Convincing people these things are so important in the first place is about communications. We need better narratives as the language we use can be a barrier; people can't see the benefit or that it applies to them."

Caldwell stated, "We need that data. We are getting it now at a micro-level on energy and transportation. There will be years when we are not over-performing and we must be able to explain why; our defense is that the measures do have promote efficacy. We've also got good accountability – we didn't have to make the [targets] legally binding. We decided to do it."

Where will we be in five years' time?

Gakunga: "Chula Vista will continue on…to assure we meet our energy efficiency goals. We have funding and can address some challenges around infrastructure to support solutions. We also have regional cooperation thanks to the Mayor of San Diego – you can't make distinctions between which part of coast you are on and the air you breathe."

"Technology to measure and monitor is amazing, but you need the will of the public to improve the environment."

Fletcher: "Madrid is suffering from bad decisions made 30 years ago, but we will have a huge impact on pollution. We are about to launch one of the biggest transformations in Europe to address congestion and pollution working with IBM and data to do it the best way."

Caldwell: In San Diego, we want to look at how to move away from cities deploying sensors to how we use them better – for example, getting information from sensors on citizens' smart phones and from utilities and from other government institutions – and influence employees and citizens." In other words, both top down, and bottom-up action.

Gorki: "Sensors are good, but urban planning is more important, for example, in London to allow more walking and cycling."

Ghandehari: "Better understanding the connection between environment and health. We want to measure the aggregated effect of the environment on people and will work with other universities and institutions in New York on the Kavli HUMAN Project – that will track the lives of 10,000 New Yorkers in 4,000 families over the span of decades, looking at factors like indoor air quality, diet, socio-economic grouping and so on."

BARCELONA WANTS TO CAPTURE CITIZENS' KNOWLEDGE

Carles Agustí i Hernàndez is Open Government Director, Diputació de Barcelona, which is the capital city of Catalonia, currently embroiled in a struggle to secede from Spain and become an independent state.

He said, "Smart city governance is my field – to innovate and modernize our administration." He believes that citizens collectively have a huge amount of knowledge and that the politicians and administrators need to put channels in place to access this knowledge for the city (that is all its citizens) to profit from it. This also means empowering people.

The concept of smart citizens is to change government models. This is an opportunity to change communications between governments and citizens, and among people inside government administrations.

Need to rebuild trust

Hernàndez said his presentation must be looked at in the context of a general political crisis where there is a lack of trust between people and politicians. He pointed specifically to Barcelona, as the capital city of Catalonia. He said in recent years, there has been a big gap between politicians and people, with the media in the middle. The concept of smart city offers the chance to change this.

As an example of how this could happen, he talked about communication shifting from a model where the government provides limited information, failing to take advantage of the technological tools available, to accelerating to a model where the information flows via many channels from citizens to the administration so that they can influence public policy. This would change society in the following ways:

- shift from passive to active;
- more studies (to gain better understanding);
- more information on many areas of city life;
- more globalized by sharing the information garnered with other smart cities;
- the city becomes more conscious/aware of itself and its possibilities; and
- citizens will want more transparency and explanations about what is happening in government and its implications.

Open everything

Hernàndez showed how trust between the people of Catalan and the administration has fallen sharply since 2004. He said, "Open government is the answer to the people's demands for change in governance and politics. It's the unification into a single strategy of transparency, citizen participation and open data, affecting transversely across the [city] organization."

He continued, "There is not [just] a web page, [it] is a change of paradigm in the relationship between government and citizens; it's an internal and external cultural change based on openness, transparency, education and citizens' involvement."

Transparency can only be achieved by putting laws in place and enforcing them, enabling citizens to gain information, understand it and come up with ideas. The threats to transparency, he argued, are that people don't believe the information or that organizations don't make enough or the right information available, or there is no 'transversality' -- that is, information or understanding about how things intersect and affect each other.

DIFFERENCES BETWEEN TRANSPARENCY AND OPEN DATA

Hernàndez said, "People confuse transparency and open data – transparency means the whole cake; open data is just part of that, the ingredients."

So 'open' means being entirely open, and revealing the relationships between different issues or policies or departments, for example; not providing only part of the story. The same principles are applicable to open companies, to improve their image and reputation, communications and efficiency.

Employees within all kinds of organizations must be prepared to make cultural changes for the organization to become open. Hernàndez said, "People confuse transparency and open data – transparency means the whole cake; open data is just part of that, the ingredients."

Risks of open data

The risks of open data are that people don't believe it, or the data isn't well managed. There is also the threat of 'infoxication' – that is, information overload, which renders making decisions difficult or impossible, plus a lack of follow-up after data is released.

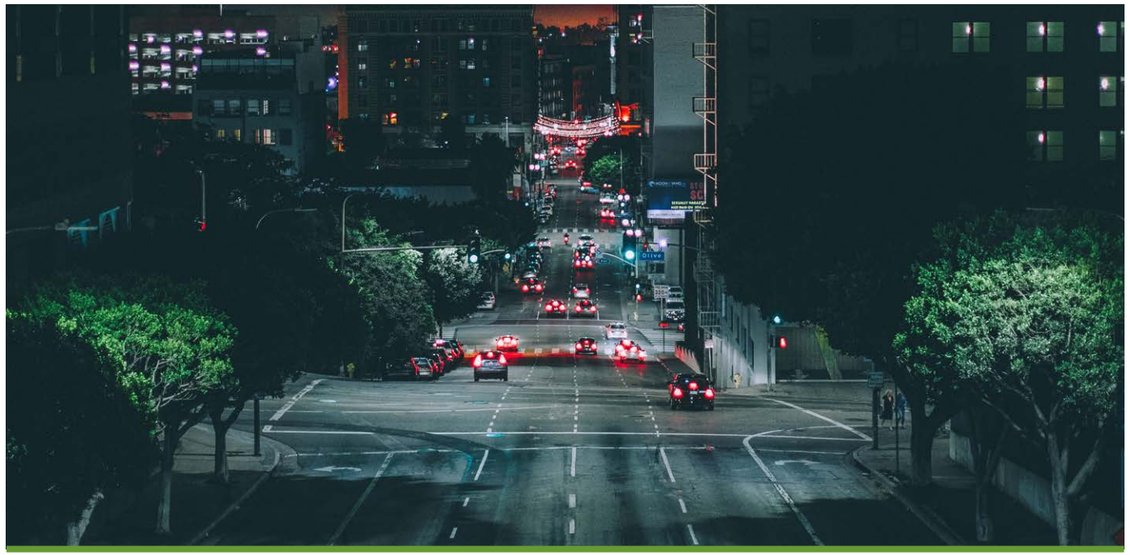
"Open government is the answer to the people's demands for change in governance and politics."

According to Hernàndez, there are three ways of getting citizens involved and tapping their knowledge, which are through channels (such as associations, e-participation, through other citizens and by presentations); internalization; and by answering their questions.

It is critical that in their dealings with citizens, administrations include transversality, as well as being proactive and innovative technologically.

The hazards of citizens' participation include a lack of belief in their information, the same few citizens participate who are not necessarily representative, quantity not quality, too much participation from the professional classes and that the whole process is too slow.

Barcelona Regional DIBAOBERTIA plan (which has 16 internal initiatives) is all about open government and was set up, at the start of 2016, to help municipalities become open. Most of the initiatives are on schedule, so overall Barcelona had completed between 60 and 70 percent of the plan in September 2017.



CITY AS A PLATFORM MANIFESTO: 10 COMMON PRINCIPLES DRIVING SMART CITY SUCCESS

Cities are where digital ecosystems collide, and all signatories to TM Forum's City as a Platform Manifesto are primed and prepared to help shape the future of these ecosystems. Signatories have agreed to follow ten common principles as they delve into the smart city market which alone is estimated to be worth $1.5 trillion by 2020.

"As the world's population expands and cities become denser, smart city programs are contributing to a better quality of life. However, technology by itself will not solve the challenges facing urban centers around the world," said Carl Piva, VP, Strategic Programs and Head of the Smart City Forum, TM Forum.

"Instead a shared, collaborative approach between the public and private sectors is needed in the development of local data economies to create services that will improve lives."

As well as a relentless focus on citizens, there is a huge untapped economic agenda to consider for city governments. Cities are, and always have been, the largest marketplaces on earth, and this a crucial time for cities to also develop digital marketplaces that benefit people living in cities.

At Smart City InFocus, 50 major cities and government organizations signed the Manifesto including: Atlanta, Belfast, Chicago, Dublin, Las Vegas, Leeds, Limerick, Liverpool, Medellin, Miami, Milton Keynes, Tampere, Utrecht, Wellington, Yinchuan, the European Commission; as well as global communications service providers and technology firms including Orange, Tele2, NEC; and associations and other institutions such as CABA, FIWARE Foundation, Fraunhofer, Future Cities Catapult, Leading Cities and the OASC.

Jamie Cudden, Head of Smart Dublin commented, "The manifesto's focus on collaboration and openness will help cities to realize this ambition [of improving life in the city]. In Dublin, we see the City as a Platform as a key enabler to develop evidence-based solutions that will enhance city living."

The principles

The principles act as a guide to those setting public policy, and a design philosophy to unite the many organizations involved in each smart city program, including large and small technology companies:

- City platforms must enable services that improve the quality of life in cities; benefiting residents, the environment, and helping to bridge the digital divide.
- City platforms must bring together both public and private stakeholders in digital ecosystems.
- City platforms must support sharing economy principles and the circular economy agenda.
- City platforms must provide ways for local start-ups and businesses to innovate and thrive.
- City platforms must enforce the privacy and security of confidential data.
- City platforms must inform political decisions and offer mechanisms for residents to make their voices heard.
- City platforms must involve the local government in their governance and curation, and be built and managed by the most competent and merited organizations.
- City platforms must be based on open standards, industry best practices and open APIs to facilitate a vendor-neutral approach, with industry-agreed architecture models.
- City platforms must support a common approach to federation of data or services between cities, making it possible for cities of all sizes to take part in the growing data economy.
- City platforms must support the principles of the UN Sustainable Development Goal 11 – "Making cities and human settlements inclusive, safe, resilient and sustainable."

Source: IBM

Open APIs

The FIWARE foundation, an independent technology body, worked with TM Forum to deliver the Manifesto's platform architecture and Open API definitions, which Thierry Souche, Senior Vice President of Orange Labs Services and Group CIO, said would, "unleash innovation and help cities to become truly smart."

"Open Standard APIs are crucial to foster a sustainable investment by solution providers, particularly SMEs and start-ups, who can target a digital market where their solutions can be interoperable with others' and portable across cities," stated Ulrich Ahle, Chief Executive Officer, FIWARE.

FIWARE is also collaborating with TM Forum to deliver the components that support the transition from traditional open data approaches to advanced data economy concepts. Access to this level of information will be key in helping to transform cities into engines of growth.

Supporting these comments, and the Manifesto overall, Martin Brynskov, Chair of Open & Agile Smart Cities (OASC) added: "A thriving global market that really caters for local needs is only wishful thinking without a strong common ground: open standards, open APIs, open architectures."
Join the movement

TM Forum's City as a Platform Manifesto can be found and signed here.

DXY'S DATA-DRIVEN APPROACH TO 'MORE HEALTH, LESS ILLNESS'

DXY is an online community for physicians, healthcare professionals, pharmacies and medical facilities. CEO, Stanley Li, a former doctor, shared how the company is using data to improve health.

DXY's vision is to focus on "more health, less illness", Li said. "If people can have a healthy lifestyle, especially chronic disease patients, the benefit could be equivalent to drugs."

To help achieve this, DXY has three main aims:

- **connect all stakeholders** along the digital healthcare value chain, including insurers, pharmaceutical firms, government and device companies, etc. because "healthcare is very complicated; we cannot do this alone";
- build a **data-driven** service model; and
- provide the **most trusted healthcare** service.

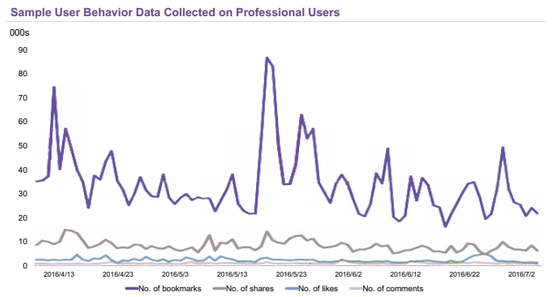
Healthcare data deficiencies

"The first thing you need to do is provide high quality data," Li said. He highlighted some obstacles to this in China which DXY has set out to solve:

- fragmented healthcare data, both online and offline;
- lack of access to hospital data;
- not enough third-party data sources; and
- contaminated therapy data.

DXY collects data about doctors in a number of ways, from assuring their correct name and identity, to their social likes, shares, comments, etc. on the platform.

DXY DOCTOR BEHAVIOR DATA

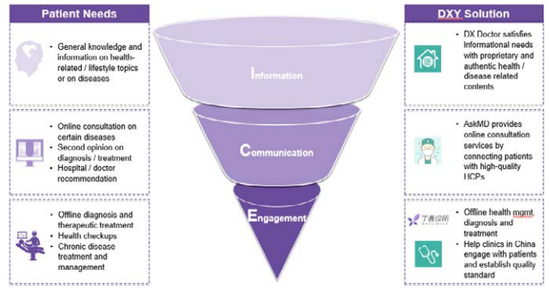


Source: DXY

It uses several ICE (information, communication, engagement) solutions to collect data about patients.

DXY

ICE – OUR TRUSTED SOLUTIONS TO COLLECT PATIENT DATA



Source: DXY

Battling rumors with ICE

Li noted the importance of ICE in healthcare, saying, "Our competitor is not other companies who provide similar services... It is rumors."

For example, people don't always understand that diabetes is a complex condition which will not just go away. They don't realize sugar is present in many everyday foods, such as rice and bread. Some people even claim poppy powder can cure diabetes."

DXY uses information collected from doctors and delivers it online via highly targeted WeChat accounts. Many people who receive it become users and can be connected with a doctor online for a consultation via AskMD, where they can ask specific questions, such as how to manage their weight or blood sugar.

Engagement is through offline health management, diagnosis and treatment. DXY helps clinics in China engage with patients and establish quality standards.

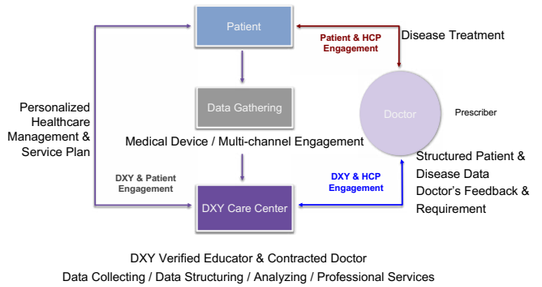
The company has also opened internet-supported bricks-and-mortar clinics and developed its own cloud-based clinical information system, DX CIS, to help clinics manage medical records, clinical pathways, evidence-based treatment and follow-up visits.

Li shared two examples of DXY's approach in action.

Diabetic patient care

Over 100 million people in China have diabetes. DXY is working with Tencent, insurers and pharmaceutical companies to support them. The patient uses a device to test their blood sugar at home. The data from it is transmitted through WeChat. All the caregivers can monitor this data in real time and engage with the patient through WeChat or phone calls/texts. They can ask the patient to monitor their blood sugar and suggest lifestyle changes.

CORE METHODOLOGY OF DXY CHRONIC DISEASE MANAGEMENT



Source: DXY

DXY noted a correlation between the frequency of patients' interaction with medical professionals and their frequency of blood glucose monitoring. When patients monitor more often, there is a decrease in the proportion of abnormal blood sugar levels.

"This is all about education," Li said. "It's not just about drugs. You have to engage with these patients over and over."

AI-assisted skin disease diagnosis

DXY is working with the Second Xiangya Hospital of Central South University and DANA on diagnosing skin diseases. With skin complaints, such as those caused by the auto-immune disease Lupus, similar symptoms can present, but be caused by a different disease. Conversely, the same disease may show different symptoms in different patients. This makes diagnosis hard.

The hospital provides a huge amount of clinical image data. DANA provides advanced image recognition models and algorithms. DXY is focused on service to doctors and patients.

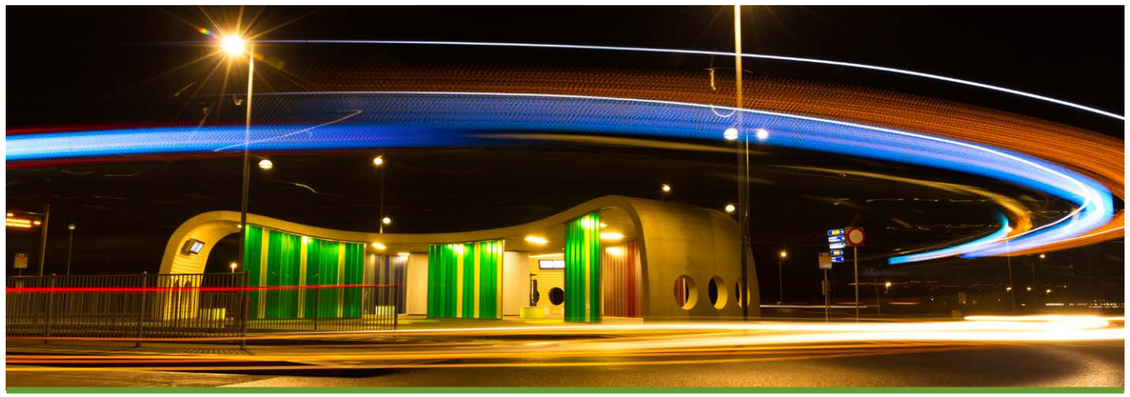
There will be three phases and the work is now in phase 1.

1. Build an intelligent diagnosis engine (Second Xiangya Hospital and DANA)
2. Improve diagnosis and treatment pathway (Second Xiangya Hospital)
3. Build successful commercial model (DXY)

The takeaways

Li summed up what DXY has learned so far:

- The key point of acquiring high quality data is to empower the patients.
- Baseline medical service is the best scenario for mHealth and internet health.
- Continuous and connected healthcare services will become popular in China.

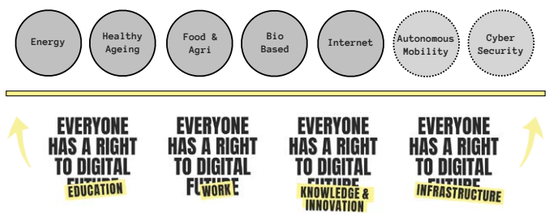


GRONINGEN DIGITAL CITY HAS PLANS FOR SMART MOBILITY

Nick Stevens, Chief Digital Officer for the Dutch city of Groningen, asks how we can put ourselves in the position to exploit the opportunities offered by technology, while mitigating the risks? By learning how to move towards an uncertain, if exciting, digital future.

Stevens says that Groningen's first principle is that everyone has a right to a digital future, which means many different things, affecting all aspects of life and living, see infographic below (the broken line around the two circles on the right indicate they are work in progress).

KNOW YOUR RIGHTS



Source: Groningen Digital City

So how is Groningen, a small city, two hours north of Amsterdam, going to achieve a digital future for all its citizens? Transport is a key area and the one that Stevens focused on. The origins of the modern city are medieval; hence many streets are narrow and the population is dense, packed into a relatively small area. Also, it is a young city (for Europe) – the average age is 37 and there are 60,000 students, but that doesn't mean older people can or should be ignored.

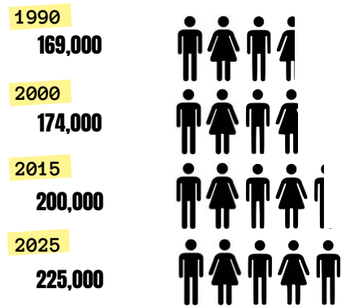
Transport now

Today, 3 percent of daily journeys are taken by public transport, 36 percent by car and 61 percent by bike. Cycling has been encouraged by making it hard for car drivers in the city, where it is not possible to move from one square to another – it is exactly 40 years since the city authorities did this. At the time it was highly controversial, as most cities were planning around cars. It has been a big advantage though as, unlike most cities, Groningen doesn't have to worry about getting cars out of the center as they aren't in it.

For future transport needs, the city is looking at whether it should encourage greater use of public transport or bicycles. Another factor to consider is the rapidly rising population, up from 169,000 in 1990 to 200,000 in 2015. It is expected to reach 225,000 by 2025 (see graphics opposite). Hence, one of the city's biggest concerns is avoiding gridlock in future and it believes that multi-modal transport is the default way to make a city livable and have a sound economic future.

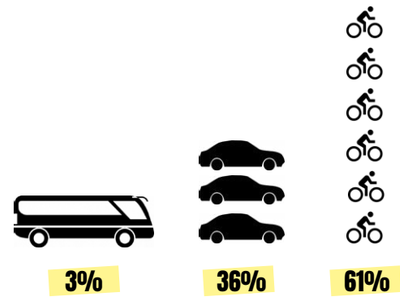
Stevens said, "We need to think more about getting people out of their cars, looking after older people and less able people for whom bikes aren't the answer, and especially how they get into the city from the extensive, surrounding rural areas: Accessibility is a key part of a city's livability."

GRONINGEN'S GROWING POPULATION



Source: Groningen Digital City

DAILY JOURNEYS IN GRONINGEN BY VEHICLE



Source: Groningen Digital City

CLUSTERS AND EXPERTISE

Source: Groningen Digital City

Where to start?

The big question is, where to start? The city is looking at intelligent, connected transport. As Stevens commented, "If you can't control the flow of traffic, there is no point connecting it and it won't be intelligent. We've had smart traffic lights that change to let ambulances through safely and that give bikes priority in wet weather for three or more years."

Now the city is looking at how those extended periods at traffic lights for some traffic affects the rest of the city, and taking more elements into consideration – for example, looking at weather forecasts as part of traffic planning, including which direction the wind will be blowing, etc.

The city is still fine-tuning its traffic management plans in readiness for autonomous cars. It is looking to collect near real-time, open data on bikes, which is harder to collect than on cars and buses.

It is also looking to use Google Maps and anonymous data from citizens' mobile phones via the carriers. Stevens said, "So we are working on this platform and intend to harness the capabilities of 5G."

Already two Dutch Ministries have formed a partnership, called Talking Traffic, with local and international businesses to improve everyday traffic flow. Stevens said the idea is that the data from traffic regulates traffic.

He explained, "The partners are looking at three things – how we get bigger data, how will we use the cloud and what information services we can provide from the data.

Testing autonomous mobility

There is collaboration and cooperation between the government, education and businesses on autonomous vehicles. The plan is to do this country-wide. At the moment, Groningen is working on a Dutch-level standard but wants to upgrade to a European Union-level standard. In future, people will be able to deploy solutions knowing they will work because they are standardized. The work Groningen is doing now will save many development years later across Europe.

You have to look at systems and services, vehicles and users and you have to listen to people, Stevens said. If you don't, all of this will be for nothing. Users' anxieties about implementing data-driven control and, in future, solutions such as self-driven cars, include:

- privacy;
- loss of jobs;
- questions about liabilities; and
- worries about cybercrime.

Land, water, air

Test regions for autonomous mobility include:

- highways, rural, city and provincial roads – cars, buses and trucks, bikes, pedestrians;
- national and local rail lines – trains, passengers and bikes (put on trains);
- airport and drone center – aircraft and drones; and
- canals and the harbor – boats, ships and port equipment.

Stevens stated, "You need vision and to understand where you are today. Groningen has the only rural 5G 'field lab' [that is using the real world as a laboratory] in the world and hopes to be the first 5G city in Europe, offering Wi-Fi, LoRa and 5G." This work too is a partnership between many organizations, including the city, KPN, Vodafone, Ericsson and Huawei.

The plan is to test autonomous mobility, then test 5G in a rural area, then build a full 5G-enabled city. Stevens issued an invitation to everyone to go to Groningen and learn with the city.

CITY OF LA COULD LOSE $11.8 MILLION A YEAR – AND IT SHOWS THE POWER OF DATA

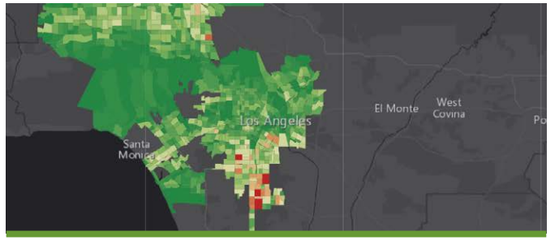
"Data is fueling the digital economy," Ted Ross, General Manager and CIO, City of Los Angeles, told delegates. He likened it to coal, steam power and silicon chips, in terms of disruptive power to change the entire landscape of society and industry.

Ross commented: "The greatest companies on this planet are those that have been able to master and are effectively leveraging data. And in the same way data is completely transforming industry and private sector, data will transform government, and we're seeing it today. Data will fuel smart cities."

He shared a number of clear examples of how data is helping LA transform government, engage citizens and tackle some of the specific challenges it faces.

Cleaning up the city

Like many cities, LA has an app, hotline and online service which allows citizens to report issues 24 hours a day, such as trash dumped in the street, for example.



Source: City of Los Angeles

However, the city soon realized it had an "inequity" problem, which it was also criticized for in the media.

"Lo and behold, wealthier communities were more aggressive; less affluent communities were less aggressive [in reporting issues]," Ross said.

He explained: "Really what we ran into was an issue with our data. We were responding to crowdsourcing, in many ways. Yet, there was a fundamental flaw in this approach because the people who were engaging in the crowdsourcing model weren't representative of every community, even though we pushed very hard to leverage things like a mobile app."

The city launched the Clean Streets program (see left). There are 22,000 miles of road in Los Angeles – sanitation crews began to drive around each one and categorize them as 'clean', 'somewhat clean' or 'unclean'. Since January 2016 there has been an 82 percent reduction in 'unclean' areas and an 84 percent reduction in 'somewhat unclean' areas.

"We only have finite resources, like every other city and every other organization...when we get that laser precision focus, we can [get results]. But the key [was] the data and the intelligence," Ross said.

LA is now starting to automate the process with machine learning and sanitation crews using dash-cams as they drive the streets.

"What you're going to find in the future is truck after truck assessing the cleanliness of our streets and allowing us to reallocate our resources properly," he said.

Keeping LA moving

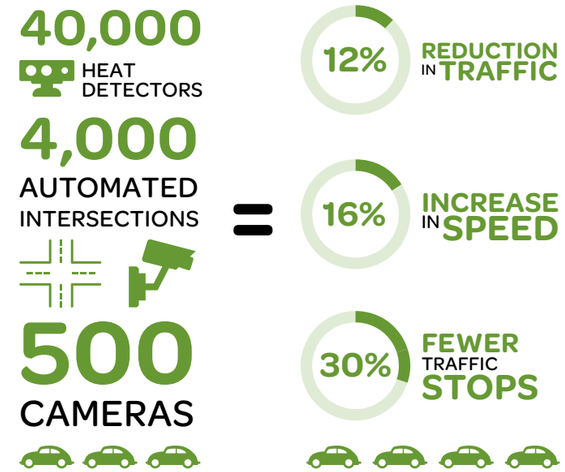
LA has an automated traffic surveillance system, including 40,000 heat detectors, 4,000 pilot, automated intersections and 500 cameras. Through this, the city is seeing a 12 percent percent reduction in traffic as well as a 16 percent increase in vehicle speeds, and a 20-30 percent reduction in traffic stops.

"You can just 'go through algorithm'," Ross said, noting that machine-to-machine communication enables the management of traffic patterns in real-time with no delays. The next step is integration with other smart city verticals.

Parking

In LA, two hours each week on many streets is blocked off for street sweeping. During this time, the street is unavailable for parking. Even if the street sweeping is complete within the first five minutes of the closure period, the street will remain closed. If people park there they will receive a ticket.

DATA GETS TRAFFIC FLOWING



Source: TM Forum, 2017

The city is piloting an initiative that uses the GPS in the street sweeping vehicles. Residents are notified via mobile app when the work is complete so that they can park. Traffic officers are notified too so they know not to issue parking tickets.

Ross said, "We estimate the City of Los Angeles will be losing $11.8 million dollars of revenue per year [if the initiative is rolled out across the city]. Well, good for us. Because when it's all said and done, government is not there to raise revenues; government is there to deliver a service."

Jumping ahead of an earthquake

The threat of an earthquake looms large for LA due to its proximity to the San Andreas fault line. By the end of 2018, the city plans to have an app-based earthquake warning system in place.

Source: City of Los Angeles

Residents, schools, businesses, etc., will receive a 30- to 45-second advance warning, depending on their location. The system detects an earthquake's up-and-down p-wave, which travels faster and precedes the destructive horizontal s-wave, and converts that signal into a warning.

"That data intelligence gives us the ability to jump ahead of an earthquake with precious seconds to make a difference," Ross said.

Everything comes in threes

Ross concluded with three key points about how LA approaches data:

- **Reimagine the customer experience using data.** Leverage data to completely change the way that we're operating.
- **Optimize internal-data sharing.** If you don't have a data-driven culture, you're not going to leverage it through your community.
- **Empower staff to seize data opportunities.** "The great power is in my staff. They're empowered to identify opportunities and to seize what we call 'business onus' so that we can then deliver on that and empower it. There is so much intelligence and wisdom in the people in the organization. If we tap into that, we can be that much more effective."

BUILDING THE RIGHT CULTURE FOR SUCCESSFUL SMART CITIES

Changing organizational culture is recognized as an essential element of a successful smart city, but it is much easier said than done. This panel of experts have achieved considerable success through outstanding leadership, and shared some insights.

Bala Mahendran, former CEO of Basildon in the UK, and local government consultant, said, "Empowering staff and communities is how can we make a difference. Good leadership is inclusive and brings people together. You need a roadmap – we can't do it on our own – and we need a platform."

Jamie Cudden, Smart City Programme Manager, Dublin, agreed. He said that much of a city's administration and operations are broken into many silos, which has been exacerbated by the big economic crisis of the last ten years. He said, "We need strong leadership from the CEO and Mayor to cut across departmental divides. The people inside them don't know what's going on regarding the bigger picture, but they get very excited when you talk to them about the possibilities, and you get champions."

Power to the people

Kaine Thompson is from the Office of the Chief Executive, Wellington, New Zealand. For him, although both leadership and governance are key factors, he argued, "to quote a traditional New Zealand saying, 'What is the most important thing in life?'. The answer is, 'People, people, people'. Any change, if driven by people first, has a much greater chance of success."

He added, "For leaders that means being ecosystem-literate, understanding the things that matter; understanding the fundamental issues that people face every day."

Creating America's top digital city

The moderator, TM Forum's Head of the Smart City Forum, Carl Piva, asked, "How do we get these things into people's heads?"

Ted Ross, General Manager and CIO, City of Los Angeles, commented, "I was previously in the private sector. Management in government is very hard, it's not the same toolkit as you need in the private sector. When I came into the City of Los Angeles Technology Agency, my department had 40 percent lower resources than it had had in 2008. It was about keeping the lights on while everyone else innovating.

"We needed to shift the culture, but with not enough people or money to compete…We needed to define our mission and we had to reset and get motivation going too. We asked, 'What are our goals?' and 'Why are we here?'. In the past, the answer was to deliver technology. Now it's to deliver services to people, visitors and businesses in Los Angeles."

Ross continued, "Everyone is motivated by something, but the average person in my organization went into technology because they wanted to do cool things and we've been very effective at tapping into that, with people really rolling up their sleeves and doing hard work. We are impressed with the results. in 2014 and 2016, Los Angeles was named as America's top digital city [of cities with a population of over half a million]."

Making civil servants dream

Hans Schnitzer, Smart Cities Director, Graz Council in Austria, said that the work to create a vision for smart cities started in Austria seven years ago and "I was happy to lead this in city of Graz, but it is relatively difficult to get people to dream about the future – maybe not for scientists who deal in facts, but it can be harder for civil servants who deal with problems. And also when it involves a years' long process and 300,000 people."

"Any change, if driven by people first, has a much greater chance of success."

He said, "We started with large cities and now we have a new call for small cities, but the culture is different in small cities."

Making big changes

Piva asked what big shifts are we still missing in smart cities?

Dublin's Cudden suggested that, "Procurement is the biggest opportunity and challenge. People think they know what they're looking for, but they are not engaged with the market. That is the biggest issue."

"People come to the public sector because they want to make a difference," stated Mahendran, echoing Ross' experience. "To go from surviving to thriving, you need to believe. The last six years have been very tough in the public sector in the UK. So, you can do salami slices [incremental changes] or take your destiny into your own hands through transformational change, and then you begin to look at issues differently. It's about improving life chances of citizens and motivation – you have the knowledge and experience."

Shifting ourselves

Piva pondered, "How do we, as city leaders, make the shift within ourselves?".

Ross of Los Angeles commented, "The tragedy of management is you're very busy managing but the number one priority is to spend time with staff, where they are, and with citizens wherever they are. We refurb old computers and give them away to low income families and I try to attend every one being handed over. We need to keep our feet on the ground."

Kaine concluded, "The things that are missing…I agree on procurement, but also encouraging investors, funders and decision-makers to have faith towards outcomes rather than challenges, and accept sometimes we might be wrong. The flip side is engagement – I do not mean radical stakeholder groups, but a mandate from the people of the city. Success comes back to understanding their fundamental problems."

HOW RENNES CUT THE COST OF COLLECTING WASTE BY 40%

Antoine Kassis is Managing Partner, Kurrant, a consultancy specializing in clean-tech, Internet of Things (IoT), smart cities and Industry 4.0. He shared examples of how cities can leverage smart technologies to optimize waste management, save money, provide better services – and maybe more.

Kassis highlighted the growing waste management challenges that cities face.

WASTE MANAGEMENT CHALLENGES

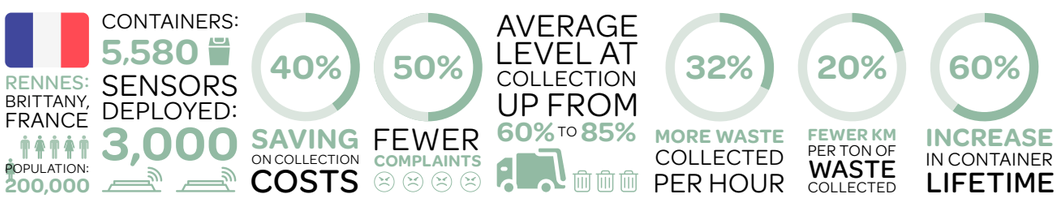
Source: Kurrant

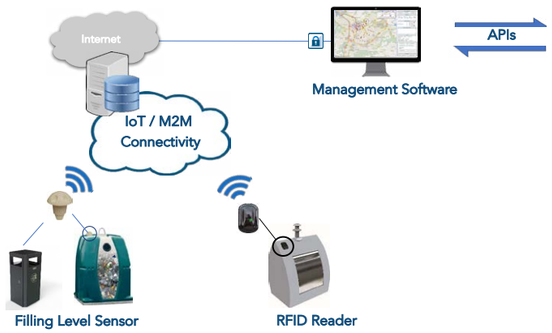
Waste management strategies have typically focused on bins and containers. There has been innovation around legacy assets, such as side- (versus rear-) loading containers, radio frequency identity (RFID) tags and readers/access control and solar-powered compactors. However, they have not addressed the most significant challenge that cities face – optimizing routes for garbage collection.

Waste containers are typically collected either too early (they're not full) or too late (they're overflowing and a health hazard). It's difficult to collect them at just the right time, but better timing means cities can optimize costs, manage the number of trucks on the road, reduce gas emissions and offer a better service.

Kassis shared an example of a French city tackling waste management successfully.

CASE STUDY: CITY OF RENNES





Solution Overview (Source: Kurrant)

The deployment uses sensors on bins and containers, an RFID reader, as well as machine to machine communications (M2M). "Having sensors that are just giving you information is not enough," Kassis said. You need analysis and insights too. That's where the importance of management software comes in. Application Program Interfaces (APIs) are also key, so that the data can be pulled into and from other platforms.

Software

Most smart waste solutions are offered as software as a service (SaaS), Kassis said, because the volume of sensors deployed is usually quite small. At the software level, he explained, cities should integrate data collected from sensors with operational information, such as how many trucks are on the road, what type of trucks, volume of waste, weight, routes, schedules, staff, hours etc.

"If you can mix this data with that you collect from the field, you can optimize waste collection," Kassis said.

Communication

Today most of the systems are based on 2G/3G cellular-technology, but we are seeing more low power wide area networks (LPWAN) deployed, such as LoRA, Sigfox and narrow band internet of things (NB-IoT). LPWANs offer much lower energy consumption and have a lifespan of ten years or more. Kassis said he expects further growth in this area.

Sensors

There are two types of sensors:

- **Filling sensor:** Measuring density of waste, temperature and acceleration – automated alerts can be sent via text or email in the case of fire or theft.
- **Access control:** Which also includes an RFID reader for information on who is using the bin or container, and when.

Insights to action

Information about waste is not useful if you can't act on it. "All the value is in the software, not the sensor," Kassis noted.

The city may receive information that a bin is 70 percent full, but what does it mean? It doesn't clarify whether the bin needs to be collected immediately, in three days or in a week. More data is required, such as the location of the bin, the day of the week, etc. Information about waste density/weight is also required because trucks have weight limits.

All this information has to be managed at the software level for effective route optimization. Dispatching can be via a member of staff or automated via GPS.

The more waste projects the software works on over time, the better the results will be due to self-learning algorithms. Data analytics adds extra value, enabling better decision-making through pinpointing trends, such as:

- Number of collections during a period
- Average filling level when collected
- Overflowing frequency
- Distance covered/volume collected
- Distance covered/weight collected
- Total distance covered
- Waste collected per hour
- Area-related trends

Based on this data, cities could add or remove bins in certain areas, for example.

Key features of success

Kassis highlighted the key features for the successful choice of smart waste management solutions:

- Multi-container bins, which can be retrofitted to existing bins
- LPWAN connectivity – can reduce the cost of connectivity by up to 10X
- Durability and lifespan – guaranteed for at last 10 years
- Advanced analytics

Kassis added: "I hate to recommend to use fully proven solutions because that goes against innovation." However, he advises opting for something that has already been rolled out and running for at least one or two years.

Who will 'Uber-ize' waste collection?

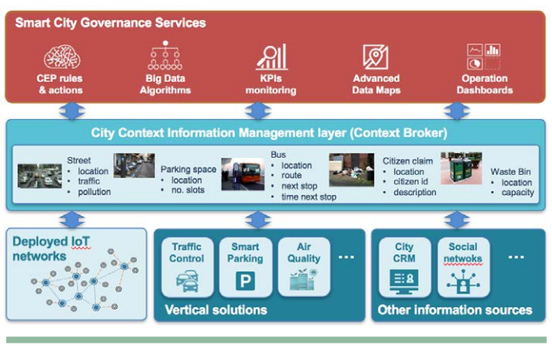
Kassis identified this as the most important question for the future of smart waste collection. He said the waste issue is largely viewed in terms of an IoT/smart city solution to reduce cost and improve service. However, he concluded there's an opportunity to do much more than this and be a real "game-changer" – whether it is the cities themselves, vendors or collectors, it will come down to who own the data.

THE ECONOMY OF DATA STARTS WITH 'WHAT IF...?'

FIWARE's work on the development of standards for smart cities began with a dream of how data could be used more effectively and several 'what if...?' questions, Juanjo Hierro, the company's CTO said.

What if...we could integrate information from different sources within the city in a common context information layer?
Data from social media, sensor networks, etc. pulled together could create a holistic picture of what's going on in the city in real-time, and help with management of city services.

A common context information layer breaks the vertical silos of information that exist in many cities today and enables more valuable insights to be drawn from data, including predictive and preventative alerts.



Source: FIWARE

What if...this city context information layer were accessible through a common open API [application program interface], using common information models?
This would enable portable governance solutions and avoid vendor 'lock in'. It would also make cities and their challenges attractive to developers because they could create their solutions once and deploy them in multiple cities instead of making individual versions each time.

Source: FIWARE

Further, sharing of best practices is made easier – this approach creates the foundations for [KPIs] key performance indicators] across cities.

"Benchmarking is the way you improve," Hierro said.

What if... part of the city context information was available on a 'right time' basis to third parties?
This would also help spur innovation and the curation of ecosystems – not just around individual cities, but across many.

As Hierro explained, "Entrepreneurs need to be able to test not only that they will be successful in the first market they approach, but that there is a large market. One city is not a big enough market for start-ups and entrepreneurs."

What if... the city could deploy a data platform which also allows third parties to share their data and get something in return?
Cities don't have all the data that describes what is going on in the city. More data from others means better insights. Allowing third parties to share their data in this way makes the city the enabler of the economy of data.

In FIWARE's vision, shared with TM Forum, cities play a key role in sharing the infrastructure that allows third parties to input their data and monetize it. In the future, cities may want to trade or charge for their data too but even if they don't, the innovation and applications that can be unleashed by allowing others to do so is likely to make the investment worth it for cities.

"Creating and transforming open data communication platforms into a kind of data marketplace would allow real levels of innovation and new business models where revenue share models can take place," Hierro said.

The data economy dream

"This has been our dream," Hierro said. TM Forum and FIWARE have joined forces to make this dream a reality. The resulting open source technology, reference architecture and open APIs are now available for cities to use and for solution providers to incorporate.

He said: "This journey will transform cities so they not only have smarter services; it will allow cities to transform themselves into engines of growth, fostering a local economy and realizing the vision of the data economy."

Joining the dots

This work is not going on in isolation. Hierro was involved in the launch of the Open and Agile Smart Cities (OASC) consortium in 2015. It started with 15 cities and now has over 100 city members in 22 countries. OASC has adopted the principles of the ongoing work carried out by TM Forum and FIWARE

This includes a common context information management infrastructure and the NGSI [next generation service interface] API, which is part of TM Forum's Smart City API Reference Architecture. The use and management of data coming from the Internet of Things (IoT – such as from sensors, actuators and other devices) is a complex process, as there are many different protocols in the IoT sphere. FIWARE simplifies this by providing a set of generic enablers allowing access to relevant information through only one API (NGSI).

This extended collaboration between the Forum and FIWARE is a natural extension of FIWARE's original support for TM Forum's Open APIs, which are widely used in the communications industry, and are available as part of the Business Framework components of the FIWARE platform.

Connecting Europe, then the world?

The European Commission's Connecting Europe Facility, an organization that is driving open source technologies as the basis for creating digital infrastructures across Europe, has also adopted FIWARE's open source context broker technology.

GSMA and ETSI are also among the other organizations that are leveraging the work TM Forum and FIWARE have done.

What's next?

FIWARE and TM Forum are now joining forces with cities to drive the next steps, including the definition of common information models. They also plan to begin piloting concepts related to the data economy. Hierro explained the aim is to engage cities that share the vision, have the resources to execute and believe it is important to standardize the information that describes what is happening in a city.

"We have the vision, we have the technology and it has been developed and tested," Hierro said. "Now is the time to scale up and engage more and more cities." The plan is to work around defined challenges that affect many cities and work together to solve them, in a coordinated way.

SAN DIEGO'S LIGHTBULB MOMENT: WHAT WOULD AMAZON DO?

Street lighting is the backbone of San Diego's smart city initiative. That came about by asking the question: What would Amazon do?

"I like to think of cities as the operating systems on which we run our lives," Erik Caldwell, Economic Development Director, City of San Diego, told delegates. "But cities are more than that, too. We're also very similar to companies like Amazon. We're both in the service business."

However, a crucial difference in the way tech giants like Amazon and Alibaba deliver services is that they are paperless. In many cities, including San Diego, paper is still the main form of communication – people have to fill in forms, post or deliver them and often wait in line to do so.

When buying from tech companies like Amazon and Alibaba, we wouldn't dream of, or accept, going through such manual processes.

"But as cities, even though we're in the service business, that's what we make our customers do," Caldwell said. "So in San Diego, we started asking ourselves this question, and it became the driving question behind how we built the smart city. We asked ourselves: 'What would Amazon do?'"

A light went on

Working back from this focal question highlighted that San Diego needed more information about how its citizens interacted with the city, and where, as well as how they ideally want to interact in the future. The question then was: How can the city gather this information, pull it back to a central location, and use it to reduce operating costs (which helps with putting money back into services and providing better services)? In fact, these conversations began around 2006 and weren't initially focused on the route to becoming a smart city; they were focused on how to avoid bankruptcy, which the city was in danger of at the time.

San Diego leaders concluded that to capture the required information, they needed to invest in inexpensive sensors throughout the city.

"We started looking for the right infrastructure and asking: What do we own in the urban environment that we could use as the platform on which to put those sensors?" Caldwell said. The common denominator was streetlights.

We did it anyway

General Electric (GE) presented San Diego with a lighting solution that offered more than just money-saving LEDs. The system could be controlled centrally – a certain area could have the lights dimmed or brighter, for example. The lights gave predictive maintenance alerts too.

This began to dovetail with San Diego's early smart city plans. Again, the city was asking: What would Amazon do? They realized, through the partnership with GE, that sensors on the 30,000 streetlights, which already had power, could provide the network they required.

GE had never implemented a deployment like this before, so, "we did what any good smart city would," Caldwell said. "We did it anyway," using a pilot project of 49 streetlights.

Together, GE and San Diego learned a number of important lessons. They could put microphones on the streetlights to detect gunshots, triangulate the location and automatically deploy law enforcement in real-time to a potential crime in progress. They also could use cameras to detect traffic and pedestrian flow, and use sensors to check the quality of the air.

This pilot program has become the basis for GE's CityIQ solution.

Spotlight on data

As Caldwell noted: "Of course, what we're really here talking about isn't streetlights. Or infrastructure. We're talking about sensors and data, and using those sensors and data to improve service, delivery and community. For San Diego, streetlights are the answer. At the end of the day, streetlights may not be the right answer for your particular community."

The city is deploying almost 10 percent of its streetlight network as intelligent streetlights over the next 18 months. It estimates this will save $2.3 million a year, which is enough to pay for the infrastructure deployment, as well as avoiding $30 million in costs over the next five years.

"But," Caldwell said, "that's not big enough for us. We're asking ourselves again, what would Amazon do? How would it leverage those 3,400 intelligent streetlights to provide better services?"

Sensors on streetlights can detect gunshots (Source: City of San Diego)

One idea is using the streetlights to avoid parking tickets – the camera in the streetlight could see when a car has parked illegally, read the license plate and text the owner to let them know that they need to move their vehicle or pay for additional time using their smartphone. Another idea is using cellphone accelerometer data and reporting when and where users hit potholes, so that they can be fixed and road assessments reduced. This data could also be used to help other drivers avoid identified potholes.

The infrastructure is just the beginning of the conversation – San Diego is talking to its citizens about the possibilities of the sensors and data, and getting feedback on the services that could be improved. It's also teaming up with local students, developers and engineers to see how they can use the data from the streetlights to develop software and services to help the city solve its challenges, and create new products and revenue streams for themselves.

Learning from each other

"We did a lot of things right, and we did a lot of things wrong [during the pilot phase]," Caldwell said. "Today we have what we believe is a world-class deployment of IoT."

He concluded, "Other cities in this room are working on other things. If we share those ideas, a year from now, we will be sitting in this room, watching some amazing things that have happened.

"That's what I get from this conference, and that's the exciting thing about smart cities. We can accelerate the deployment of IoT in the urban environment by working collaboratively together."

I-CLOUDBIN CLEANS UP WITH WASTE CLASSIFICATION

Environmental protection has become one of the most important issues for the public, as awareness of climate change and the environment increases. This is creating a growing market for waste classification, said Ni Guosheng, Managing Director, I-Cloudbin.

He explained how his company is tapping into this opportunity to solve waste management and environmental challenges. The plan is to create a business model around waste classification without needing government investment, but instead offering franchise rights to private companies.

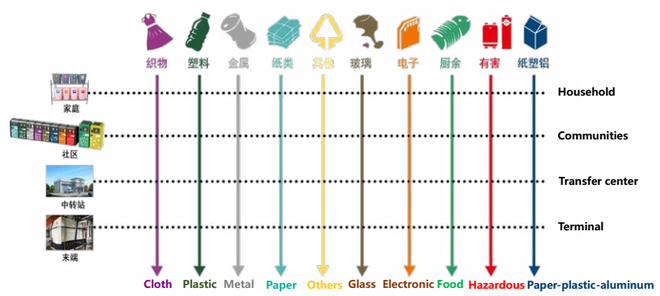
The investment model

I-Cloudbin's model is based on a four-point investment approach:

- **Family** as the I-Cloudbin provides ten trash cans for residents, one for each of the classified waste types.
- **Community** – ten large litterbins, one for each waste category, are provided in public places or shared buildings that can weigh, scan QR codes and allocate redeemable points to the community.
- In the **Middle**, the government provides a transfer center, which I-Cloudbin upgrades to meet the requirements of waste reclassification, transfer, disposal and checking.
- **Terminal** is the destination for the trash and I-Cloudbin invests to ensure harmless waste disposal.

Ten classes of waste

I-Cloudbin provides vehicles for communities to take waste to the transfer center. It also provides 'matching services' at the transfer station to ensure waste ends up in the right categories, plus marketing, device installation, after-sale service, waste transfer, disposal and staffing. The ten classes of waste points system, rather than the traditional four, is to make it clearer and easier for people to sort their waste and to reduce labor costs when it comes to processing the trash.



Source: I-cloudbin

How it works: Residents

- Residents receive their ten trash cans along with stickers to clearly show the designated type of waste it can receive.
- When full, the resident sticks a QR code that identifies them onto the waste bag – this unlocks the communal unit.
- Resident deposits the bag in the communal waste bin for collection.
- A points 'score' is displayed on the screen.

How it works: Recycling

1. **Collection and transfer** – staff receive a notification via mobile phone when litter bins are full. They collect the classified waste and deliver it to the transfer center.
2. **Secondary classification** – the waste bags are sorted and checked at the classification center
3. **Examine scores** – residents who have not followed the rules for sorting the rubbish will have points deducted. A camera is installed on the bins.
4. **Open and precise** – violation scores are pushed to the public via WeChat to encourage residents to classify the waste properly.

Reward or deduct?

Residents pay a standard monthly charge to be part of the I-Cloudbin scheme. If they break the rules, they have to pay additional charges. If they abide by the waste classification rules, they receive rewards and bonuses, as well as public recognition.

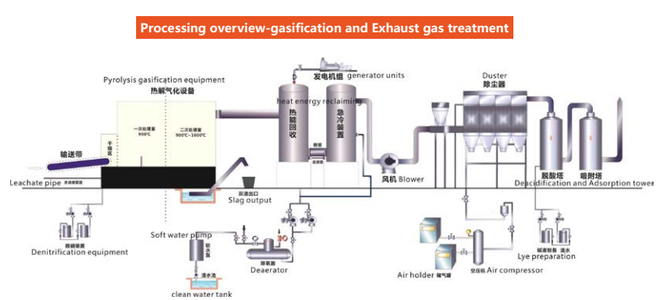
Source: I-cloudbin

The goal of I-Cloudbin is to reduce waste incineration by at least 70 percent. As much waste as possible is recycled and re-used – this is enabled by the fact that the waste is 'purer' because it has been sorted properly.

The remainder goes to I Cloudbin's 'harmless waste disposal system'.

There are many benefits to I-Cloudbin's system, Guosheng said:

- It eliminates waste from the source, relieves traffic pressure (as bins are only emptied when necessary) and reduces carbon emissions.
- It offers solutions for cities with a lot of waste and reduces secondary pollution and odor.
- It promotes the use of recycling, saving resources.
- The waste that cannot be recycled is converted into heat and power for use by local industry.
- The whole process can be monitored online in the cloud.



Source: I-cloudbin

"The goal of I-Cloudbin is to reduce waste incineration by at least 70 percent."

OFO OPTIMIZES OPERATIONS WITH BIG DATA

Ofo is a fast-growing bike-sharing company with big ambitions. Co-founder Yu Xin shares the business vision as well as how it uses big data to get the right number of bikes in the right place at the right time.

Ofo describes itself as "the first non-docking, bike-sharing platform in the world," allowing users to find and park a bike 'anytime, anywhere'.

Since launching a little over two years ago, Ofo now operates in 170 cities in nine countries. It has 10 million bikes, serves 4 billion people and sees 25 million transactions each day. This is just the beginning, Yu Xin, Co-founder, OFO, told delegates.

By the end of next year, the company aims to cover 200 cities and 20 countries and to eventually become the household brand name associated with bike-sharing.

"We [hope] our small yellow bicycles can one day become like Starbucks, McDonald's or KFC, to cover the whole world," Xin said.

An example of this global vision is Ofo's nifty logo – three simple letters which together look like a bicycle. "A common language [across] the world, no national boundaries," Xin explained.

He said the time is right for the growth of a company like Ofo because it offers a green, low-cost, environmentally friendly mode of urban transport and "will solve the problem of the last mile". It can also help better manage city operations and maintenance.

How many bicycles?

One of the challenges Ofo has to manage is: how many bikes to deploy?

"This cannot be decided by the mayor or our CEO, but by big data analysis," Xin said. The company analyzes bicycle density over a certain period of time, alongside the usage efficiency of the bikes.

OFO GOES FOR GLOBAL growth

ofo 小黄车 LAUNCHED 2015

2017: 170 CITIES · 9 COUNTRIES · 10 MILLION BIKES · 4 BILLION CUSTOMERS · 25 MILLION TRANSACTIONS PER DAY

2018: 200 CITIES · 20 COUNTRIES

"At the beginning, the efficiency does not increase dramatically, but when we reach a certain level of bicycles there is a turning point," he explained. "Then we have a second turning point…when the number of bicycles reaches a certain level the average time of use for each bicycles is reduced, which means we don't need to deploy any more."

It is also important to put bicycles where they are most needed, which is also supported by Ofo's big data platform. In the image below, for example, the red spots mean there is a lack of supply; green spots mean it's very easy to find a bicycle.

Additional data, such as road conditions, holidays, weather, etc., helps with even more precise predictions about the requirement for bikes.

Ofo also works with cities and their transport authorities to track and share real-time information on bicycle parking. Dynamic maps show the location of bicycles and highlight areas where there are more bicycles as well as the moving direction of bicycles.

"This is very helpful for our maintenance and also very helpful for enhancement of the transport system," Xin said.

Maintaining millions of bikes

Ofo encourages users to report damaged bicycles by offering incentives, such as vouchers. Big data and GPS can help to pinpoint inaccurate or false damage reports – for example, if a bicycle is reported damaged but then someone rides away on it. If a bike isn't used for a certain amount of time, Ofo is alerted that there may be a problem with it and sends an operator out to check.

When bikes are damaged, Ofo says it can typically have a maintenance operator out within 15 to 20 minutes in a big city, minimizing downtime.

Creating jobs

Xin highlighted the role shared bicycle schemes can play in creating jobs. He said Ofo has created over 100,000 jobs so far, including 70, 000 this year. They vary from roles in the lock industry to manufacturing, maintenance, logistics and more.

In China, there is a problem with a large number of unregistered taxis, which the government is eager to stop, but has found it difficult to do so. "Many of the unregistered taxi drivers have become the maintenance people for our shared bicycles," Xin claimed. "Whenever we enter a new country we will create more jobs and employ local staff for work such as maintenance, administration, software development, etc."

He added: "We believe whenever we enter a new city or country, we can complement the local transport infrastructure. There is the public transport system, metro system – but the public bicycle system is not complete." And public bikes can provide that last-mile transportation.

Ofo grows up

Many cities already have shared bike schemes in place, although a lot of them are based on fixed collection and drop-off points. Xin said: "Our kind of bicycle is more flexible and we believe this will be the trend in the future… Even if you already have a scheme, we can also launch a partnership. We are not only competitors."

He concluded, "We plan to set up various centers overseas like R&D centers, data centers and logistic centers. As Ofo grows up, we will cover the whole world."

Source: Ofo

"We [hope] our small yellow bicycles can one day become like Starbucks, McDonald's or KFC, to cover the whole world."

12 TRENDS IN SMART TOURISM

Daniel Fletcher, CIO, Comunidad de Madrid, and Associate Professor, IE School of Architecture & Design, looks at how cities are tackling the related issues of sustainable travel and digital disruption.

Growth in tourism over the last 12 to 15 years has put additional strain on the most popular destinations, in areas such as sustainability, infrastructure and liveability. These cities need to become smarter if they are to remain attractive places to live and visit.

Fletcher defined a smart tourism destination as one that uses ICT and data:

- to provide a great travel experience;
- to foster a sustainable tourism model; and
- as part of a wider smart city strategy.

TRAVEL BOOMS

TOURIST ARRIVALS:

1995: 528 MILLION

2010: 940 MILLION

2016: 1.23 BILLION

GLOBAL TOP 20 DESTINATION CITIES 2016 (million international visitors)

1	BANGKOK **21.5**	2	LONDON **19.9**	3	PARIS **18**	4	DUBAI **15.3**	5	NEW YORK **12.8**
6	SINGAPORE **12.1**	7	KUALA LUMPUR **12**	8	ISTANBUL **12**	9	TOKYO **11.7**	10	SEOUL **10.2**
11	HONG KONG **8.4**	12	BARCELONA **8.2**	13	AMSTERDAM **8**	14	MILAN **7.7**	15	TAIPEI **7.4**
16	ROME **7.1**	17	OSAKA **7**	18	VIENNA **6.7**	19	SHANGHAI **6.1**	20	PRAGUE **5.8**

Source: Mastercard

WHY THE TRAVEL INDUSTRY MATTERS TO CITIES

Source: 2017 – United Nations' Year of Sustainable Tourism

Following are some trends – both challenges and opportunities – affecting the cities trying to make this a reality.

1. Focus on customer experience

Customers in the travel industry are changing and so are their preferences. This is being driven by a number of factors, such as a growing middle class in developing countries, digital disruptors who have changed the market (for example, Airbnb and Booking.com) and low-cost travel operators enabling more people to travel.

The travel industry needs to be able to understand these new customers through customer journeys in order to personalize and improve their experience. The challenge here is that many operators have lost the data on the customer journey to 'middlemen'.

Looking for inspiration and taking the decision on the destination are key stages in the customer journey. The post-trip experience is gaining more importance too as travelers increasingly share their experiences on review sites, potentially influencing others' choices.

2. New business models

Digital technologies are opening up new business opportunities and models in the tourism industry. Booking.com, TripAdvisor and Airbnb are the obvious ones, but there are other examples too, such as companies that are building augmented reality applications for use at tourist hotspots and historic destinations.

3. Accelerating digital transformation

Many hotels and other tourism industry operators are investing heavily in digital transformation.

"They know for sure that they have to compete with new players and they have to have a data strategy," Fletcher said.

4. Integrated digital infrastructures

In Spain the smart tourism destination plan is part of the national smart cities initiative and integrated into wider smart city programs. Using FIWARE infrastructure allows the integration of information from traffic, health or air quality, etc.

5. Co-creation of travel experiences

Cooperation between travel operators and public administration is gaining momentum to provide better experiences for visitors.

6. Policies to foster inbound travel

Inbound travel initiatives (attracting travelers from abroad) is an area of growing importance for many destinations. There are initiatives around it in the UK, for example.

7. Leveraging the value of traveler data

Right now it is difficult for any player to have a complete view of customer journey data.

"Here cooperation is going to be key," Fletcher commented. "The solutions that can be obtained from integrating all this data will be much more powerful."

8. Open innovation and city labs

Cities are increasingly using open innovation and city labs to test solutions for travelers. We have yet to see the real results, according to Fletcher, "but some of the ideas in these labs are very interesting [for the future]."

9. City branding

City branding is very important for tourism, Fletcher said, but there is work to do here. The use of social networks in public administration is still very low, for example.

10. Campaigns based on events

This is one of the elements of city branding – Barcelona, for example, hosts many events each year such as Smart City World Expo Congress and Mobile World Congress, as well as music festivals, etc. These events can bring a significant amount of money into a city.

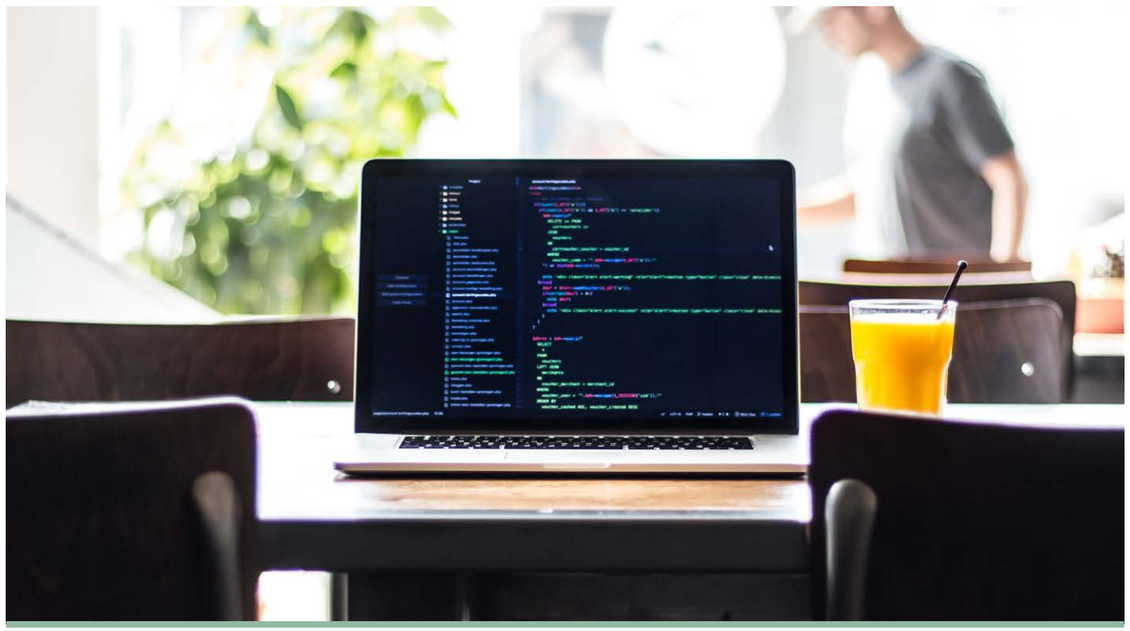
11. Real-estate investment

With the success of platforms like Airbnb, investors are looking at buying apartments to capitalize. However, this is becoming an issue in many cities and they are starting to regulate it.

12. Risks and concerns

These interlocking trends are also raising fresh concerns for cities and the travel industry to consider. The primary issues being:

- personal data and privacy;
- security;
- digital monopolies; and
- long-term feasibility.



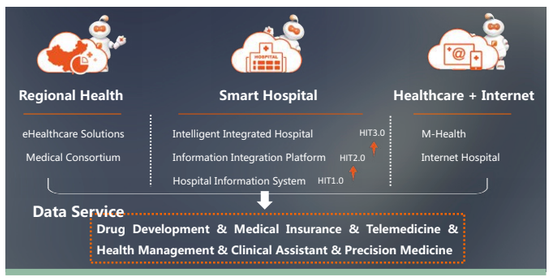
SHARING DATA DELIVERS SMARTER HEALTHCARE

Sun Qi, Consultant, PKU Healthcare, outlined a solution for establishing a new kind of data-driven healthcare system.

"In traditional smart city construction, we often focus on the technology but neglect applications," Qi said, discussing moving to a "new type of smart city". We need to overcome challenges that include eliminating information silos, protecting cybersecurity and ensuring a sustainable flow of data.

Qi put forward PKU Healthcare's proposal that fits this new type of smart city because "[it] is based on informatization but goes beyond it". The proposal centers on building a set of "industry systems" around a big data platform, that collects, stores, integrates and shares data to operate the whole city.

He highlighted the importance of a people-oriented approach, focused on good data governance and generating convenient public services. Qi used a case study of smart healthcare, outlining three scenarios to form the "closed-loop data acquisition of lifecycle data." This approach enables the creation of new, more convenient services.

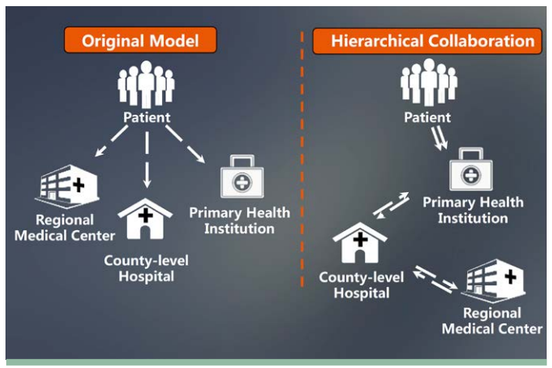


Source: PKU Healthcare

Smarter healthcare

There are two key goals:

- **Innovate service models** to enable remote consultation and dual referral of appointments based on big data and artificial intelligence (AI) technology; and
- Realize the **sharing of resources, information and knowledge.**



Source: PKU Healthcare

This gives patients a better choice of hospital, based on the severity of their illness. The remote consulting system improves the consultative collaboration between primary, regional and country-level health centers.

Qi said, "The core is using data sharing to promote business co-operation. This is what I mean by 'based on informatization and also beyond informatization'."

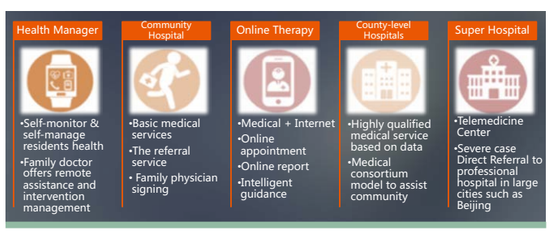
Architecture and platform

There is **one platform** with **three domains.**

One platform: The public health information platform is the big data center which supports data sharing. All the residents' health data will be centralized in this platform. There are three domains: public health, medical service, health governance. There are then five types of service which will be allocated, based on the severity of patients' illness.

Qi said, "We are developing a vision ...for the big data era – we not only emphasize healthcare but also health so hopefully we can make the shift from treatment to disease prevention."

He shared PKU's technical architecture which he described as a "brain for our data application and data integration." Qi emphasized the importance of government support to establish "this integrated operations system."



Source: PKU Healthcare

He explained: "This process is not only beneficial to the community, but also to other sectors because we could create new sectors and new output to promote the whole industrial chain."

Yinchuan's new service

Qi outlined the work PKU is doing in Yinchuan. It began with establishing the data-sharing platform to unify healthcare standards in Yinchuan and to connect the healthcare institutions.

Next was to ensure that all institutions were using the same information systems and platforms to enable collaboration between different hospitals on things like remote consultation and referral.

"We don't only open the system to healthcare institutions but also to individuals," Qi explained. "So the residents can use the health portal to review their records and medical history."

> "In traditional smart city construction, we often focus on the technology but neglect applications."

The system in Yinchuan offers primary healthcare, with the emphasis on prevention of illnesses and their escalation. Yinchuan's new system has three approaches or stages:

- health monitoring, either undertaken at home or in local community clinics;
- self-management of a condition through monitoring and reporting results to medical staff; and
- if necessary, intervention by the community health center.

If a patient's case becomes more serious, a telehealth service platform connects the primary care hospitals in Yinchuan to hospitals in Beijing, providing access to high-end medical consultations and services.

Better care, optimizing resources

Qi said: "We are promoting consultation among different doctors to provide the best services to the patient." If patients are very ill they don't have to travel to different cities and resources are optimized. Further, the "family doctor system service" enables doctors with different specialities to work as a team, meeting the needs of the family without them having to travel.

Qi said, "Medical care is a long-term task. We are just making a starting point." To progress this work, he highlighted the importance of collaboration with partners such as technology companies, government, medical institutions and academia, as well as data sharing.

SENSORS GO UP IN THE AIR FOR CLEANER, SAFER CITIES

Unique Aero-Tech looks at why and how we should build aerial information infrastructure for smarter cities.

On April 15, 2013, two homemade bombs detonated 12 seconds and 210 yards apart at 2:49 p.m. near the finish line of the annual Boston Marathon, killing three people and injuring several hundred others, including 16 who lost limbs. An man-hunt ensued and eventually police were able to confirm and monitor one of the suspects (the other had already died) from the air using infra-red cameras on a police helicopter. The State Police confirmed the camera images were a crucial part of the operation.

Liu Bin, General Manager, Unique Aero-Tech, reflected that we can find sensors all over our cities but they are missing from the air. And clearly, as the example above shows, they can bring great benefits.

He said he wanted to find out how we can use air sensors to "get a better perspective and gather more information to serve our city." Bin had considered the pros and cons of various types of aircraft to achieve this.
For example, helicopters have low requirements for take-off and landing, they are highly maneuverable and they don't need a changing of nose direction at low altitude and speed. However, they are also expensive, noisy and generally fly within a radius of only 300 km.

Eyes in the sky: UAVs

So, Bin started to think about UAVs (unmanned aerial vehicles) and compared the advantages and disadvantages of multi-rotor UAVs and fixed-wing UAVs.

Multi-rotor UAV

- Advantages – no restrictions for take-off and landing, easily operated.
- Disadvantages – short range (can only fly 20 mins at most), low speed and small payloads.

Fixed wings UAV

- Advantages – long range, electric-powered, high speed and large payloads.
- Disadvantages – greater demands for take-off and landing (requires a long runway), more complicated for operation (needs a specialist).

"We continually tried to find a solution," Bin said. The team began to think about the impact of integrating multi-rotor UAVs and fixed wing UAVs. The first solution was a vertical take-off and landing (VTOL) UAV from the US, the only 'plane' of its kind. The advantage is that it is not restrained by the location of take-off and landing.

However, the main challenge here was that the plane's main rotor is above the body of the plane, causing 'downwash airflow' and pressure from above, reducing efficiency.

The next solution solved this problem but introduced a new one. This time, vertical wings meant that high winds could cause the aircraft to deviate from its course.

Introducing the VSTOL

Unique Aero-Tech came up with a VSTOL (vertical short take-off and landing) UAV, which managed to solve all the issues with previous aircraft. There is no restriction on landing and take-off; it has very long range and high efficiency; and the issues of downwash and high winds have been eradicated.

A platform

Bin said, "According to our understanding the UAV is just a platform. It can load different kinds of sensors." The important thing is not the platform itself but the insights you can glean from it.

Unique Aero-Tech did a test in Yinchuan using this UAV with a camera to analyze traffic congestion. The UAV flies over the city and at each crossing can see the traffic situation that is causing any congestion.

It can report on the layout of the road, the design of the crossing and when people are not following the traffic rules and laws.

"Traffic regulation officers can better optimize crossings and intensify efforts of law enforcement based on our analysis," Bin said.

Pinpointing pollutants

Air pollution is another use case. An air sensor on the UAV picks up eight indicators of pollution/types of pollutants in the air. The UAV can fly around the city and send the information back to the data center in real time. The location can also be reported.

"By integrating these readings together and plotting them on a map, we can see where high levels of pollution are," Bin explained.

The company deployed some sensors on the ground. Using the information on air quality from the sensors in the air, then matching and comparing it with information from sensors on the ground, highlights the causes of poor air quality, such as a specific factory. This can then be addressed.

Bin said, "I believe that in the future the sensors will get smaller and smaller and if we can put them on UAVs we can receive a lot more information in smart cities. [So] we can have very precise management of the city and environment to make sure everyone can enjoy clean air."

HOW TO CREATE A SMART CITY ROADMAP: A STEP-BY-STEP GUIDE

Michael Mulquin, Principal Architect, TM Forum Smart City Maturity & Benchmark Model, shared the ethos behind the model and how cities can quickly pick it up and run with it to speed transformation.

Mulquin opened his presentation by sharing his personal definition of a smart city:

"A city that exploits the transformative power of data and technology to better serve the people who live and work there, and the interests of future generations."

The key thing about a smart city, he said, "is it uses technology and data in a transformational way…to change things completely."

Another important fundamental is that a truly smart city brings people, resources, buildings and infrastructure together to make the city work better for everybody.

He gave the analogy of an airport. In order to keep people moving smoothly and safely:

- many **processes** have to be managed – how passengers get to and from their plane, how luggage is moved around, how fuel is provided, how planes are serviced, how security is managed, etc.;
- huge amounts of **data and information** need to be gathered, analyzed and circulated; and
- many **infrastructures** need to be managed – electricity, telecoms, water, heating, moving walkways, etc. in order to support the different processes.

All the resources, infrastructure and processes must be tightly linked together. A traditional way of understanding how a complex enterprise such as an airport works is to think of it in three layers:

- **Business architecture** – how the enterprise's activities and processes are organized to achieve its objectives
- **Information architecture** – how information systems (applications and data) support those objectives
- **Technology and infrastructure architecture** – how technology and infrastructures support those objectives

A city, though, is even more complicated than an airport or a large company because it contains many different systems and kinds of infrastructures, all of which are managed by separate organizations with individual goals and targets. Further, a city is there to serve the interests of the many citizens and visitors that use it.

"It's a very complicated system where everything has to somehow work together without anyone having absolute control of all of it," Mulquin explained.

So, to understand a city, we have to add another layer:

- **Collaboration/citizen focus architecture** – how the citizens and organizations in the city work together to support their common objectives

To put all this in a city context, we have to think about leadership and governance; partnerships and citizen focus; effective use of data; and ICT infrastructure.

Mulquin added: "We also need to think about how these are all integrated together to form a consistent platform throughout the city. Each of these different areas of city life have to be managed effectively and in balance – so that the city as a whole will work well. The challenges are: how to evaluate these different areas fairly, and how to gain agreement on priorities."

TM Forum Smart City Maturity & Benchmark Model

This is where TM Forum's Smart City Maturity & Benchmark Model comes in. It has three key functions:

- It enables the city to **assess** itself in a reliable, helpful, practical way, to understand its strengths and weaknesses.
- It makes it simple to **set clear targets** to achieve, which makes it much easier to work through a roadmap of how to become smarter.
- It becomes easier to **benchmark** against other cities to learn from others and find the most relevant collaborators.

Each of these different areas of city life have to be managed effectively and in balance - so that the city as a whole will work well.

The challenges are: how to evaluate these different areas fairly, and how to gain agreement on priorities.

Source: City Building Blocks

How it works

The model presents four key areas of the city. Each area is divided into five sub-domains, which are tested using five statements of good practice. There are a total of 100 assessment statements that cover every aspect of smart city management.

Examples of statements that need to be rated include:

"The city has a smart city vision developed by all stakeholders."

"All stakeholders have agreed on common terminology relating to smart cities and the use of a common reference model."

The scoring is clear and unambiguous with 0 meaning the task has not been started and there are no discussions taking place, and 7 meaning the solution is delivering maximum impact.

Kick-start change in two weeks

TM Forum has developed a handy phone and iPad app to make the model easy to use. Here's how Mulquin recommends cities approach the task – it can realistically be completed within two to three weeks.

- Smart city leader takes control of leading the process or delegates this.
- Internal 'evidencers' gather local evidence and load scores into the app.
- Stakeholders internally and externally (for example, invited partners and citizen organizations) assess those scores – areas of divergence stimulate discussion – and come to a consensus on the 'as is' state.

The city then has a document of where its capabilities are right now in particular areas, the priority level of that area and the target to reach within two years.

"At end of the process, you come up with clear targets that you can then build into a solid roadmap to take things forward," Mulquin says.

He adds, "In addition, if TM Forum is able to get a sense of what cities are doing well already, and where they are struggling [through looking at the aggregate data], it will be easy to drive the collaborative development of tools, examples and models, to help all the cities and the wider community to move forward."

Benchmark your city and create a roadmap for transformation now.

Start your smart city journey
with the **Smart City Forum**.

www.tmforum.org/smart-city-forum

Or write to Carl Piva,
Head of the Smart City Forum,
at **cpiva@tmforum.org**

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ARE YOU READY TO BE CHALLENGED?

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