Perspectives*

CIVICA

Volume 05

{ Connect to the future

Connected devices.
Connecting communities.

Inspired by
CIVICA NorthStar*

It's a pleasure to introduce this volume of Perspectives*, in which Civica explores how connected devices (commonly referred to as the Internet of Things, or IoT), can be leveraged within the public sector to have positive societal impact and drive operational efficiency.

We are in the midst of the information age, and the number of connected devices is growing exponentially. Given the prevalence of such devices in our lives, and the power of IoT platforms in the cloud, organisations are better placed than ever to create value for the benefit of all, by integrating data and capabilities from different areas to meet broad business requirements.

The range of potential applications is vast and can be highly impactful. I personally find it exciting to see organisations building IoT solutions with us addressing the likes of environmental sustainability, improved healthcare, vulnerable citizens support, or enhanced public safety.

Even services such as Amazon's Alexa, while perhaps sometimes viewed as a tool of personal convenience, can form part of solutions supporting mobility impaired citizens, or enabling elderly citizens to remain independent for longer.

The use of connected devices already provides many benefits within the public sector; I look forward to the further development of innovative solutions to generate even greater social value in the future.

I hope you enjoy this volume of Perspectives*, and take inspiration to explore and experiment leveraging this technology to drive positive outcomes.

As always, please do share your reflections on social media using #PerspectivesFromCivica

Martin

Martin Bishop
Chief Technologist,
UK Public Sector, AWS

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Executive summary

From reporting the temperature on a Coca-Cola can, to Marty McFly's smart home in the future - connected devices have come a long way. While it's not necessarily a new technology, it's one with untapped potential.

There's no doubt that there is sustained interest in connecting more data or devices to build a smarter society. The 'tech-celeration' of our society, combined with cheaper devices, is increasing adoption and therefore opportunities. The promise of better services will encourage those who might have otherwise ignored the technology in the past to now engage.

The rise in remote working and interest in personal health monitoring due to COVID-19 have driven an explosion in wearable and smart devices. Indeed, connected devices such as contact tracing, health-monitoring wearables and smart thermal cameras, played a key role in helping societies to contain the pandemic.

Today, data about how we move around cities is supporting city planners to optimise mobility networks and community infrastructure. Smart metering, and automated environmental controls are helping ensure homes are warm while also meeting net zero ambitions.

Despite all these use cases, we've not yet realised the full potential of this technology. We believe a lot of added value will come from connecting wider networks of devices from the individual, their home and the wider community, to create what we call the 'internet of us'. Much of this will come from articulating the value proposition and crucially building citizen trust in sharing their data for their and our community's benefit.

We all have a role to play in shaping the future for connected services. Strengthening citizen trust is a significant barrier to fully realising the benefits this capability can deliver. If we can establish trusting partnerships between provider and user then we will create new sources of value.

While the devices themselves may be smart, connecting them to deliver actionable insights is where we can all become smarter. If this untapped potential can be realised, it will bring even more value to our society.

90%

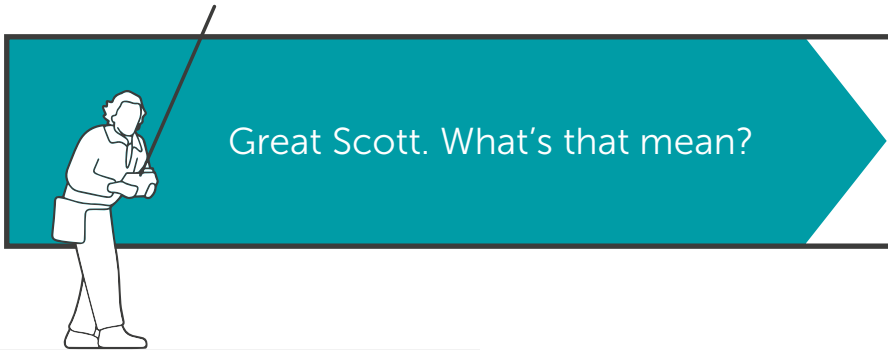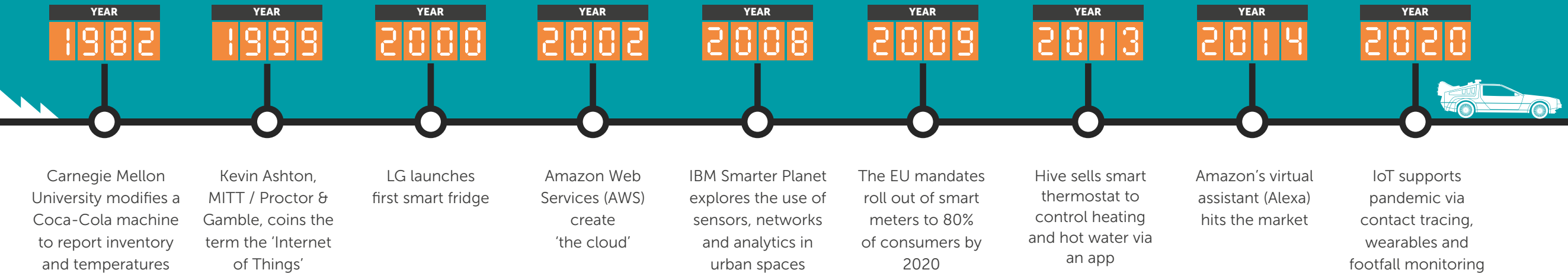of public sector leaders confirm connected devices can benefit their sector. Civica

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{Generate 1.21 gigawatts

Before we go forward, we need to go back. So strap yourself in as we push past 88mph.

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Know your history?

As we travel back to the 1980s, let's not disrupt the space time continuum.

YEAR 1982	YEAR 1999	YEAR 2000	YEAR 2002	YEAR 2008	YEAR 2009	YEAR 2013	YEAR 2014	YEAR 2020
Carnegie Mellon University modifies a Coca-Cola machine to report inventory and temperatures	Kevin Ashton, MITT / Proctor & Gamble, coins the term the 'Internet of Things'	LG launches first smart fridge	Amazon Web Services (AWS) create 'the cloud'	IBM Smarter Planet explores the use of sensors, networks and analytics in urban spaces	The EU mandates roll out of smart meters to 80% of consumers by 2020	Hive sells smart thermostat to control heating and hot water via an app	Amazon's virtual assistant (Alexa) hits the market	IoT supports pandemic via contact tracing, wearables and footfall monitoring

Great Scott. What's that mean?

Connected devices - a device that is connected to the internet and can send and receive data and instruction.

Device - anything with one or more sensors that can be connected to the internet. Includes personal wearables, home appliances, medical equipment and urban infrastructure.

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If I could turn back time

Good news, we can. So why not take a trip back to 1989 and see how we thought our homes would look like today. Whoa, this is heavy.
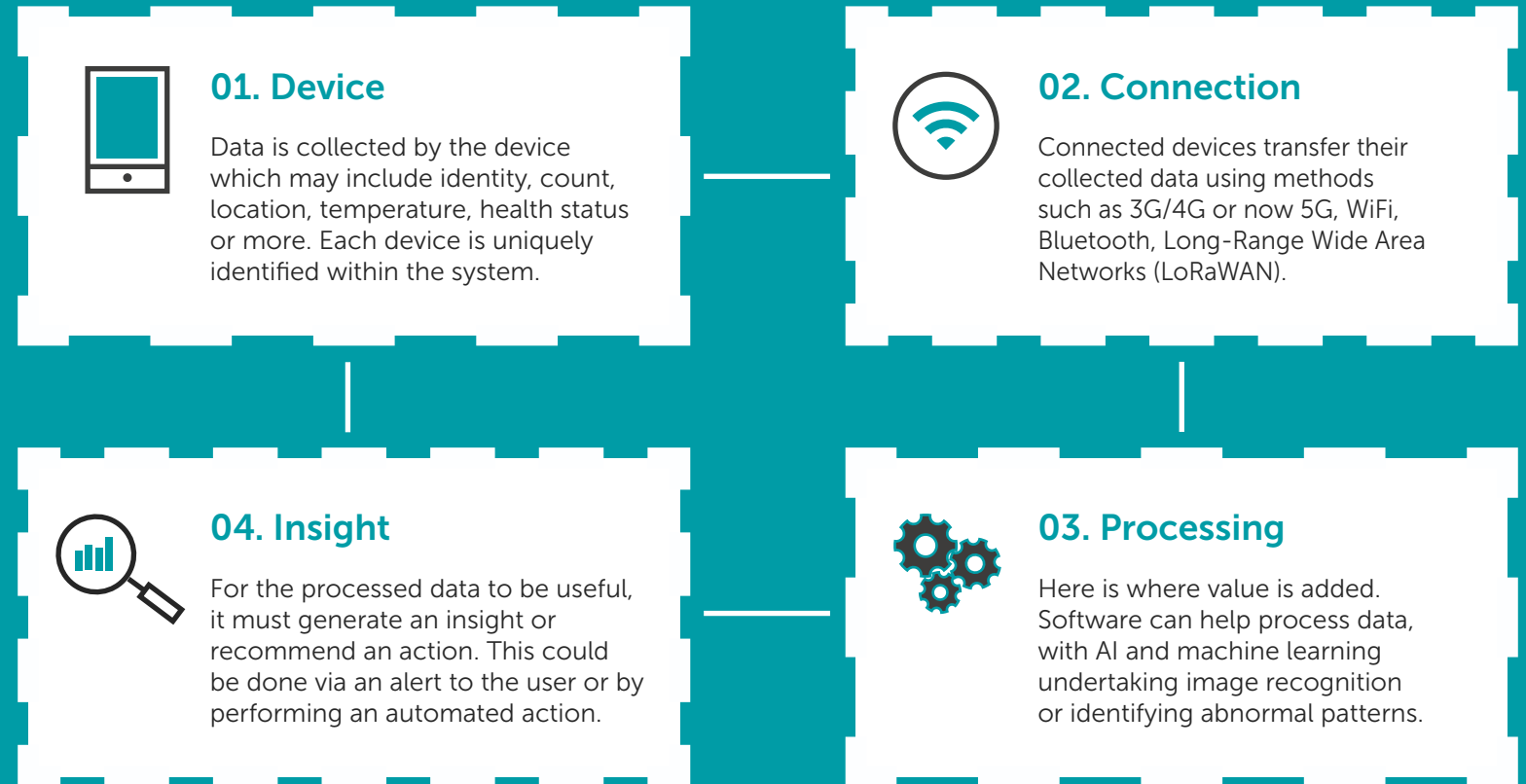
SCAN ME

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{Under the hood

Let's get under the bonnet and learn...

• How connected devices work
• How they can create the 'internet of us'
• And how they're helping

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So doc, how does it work?

At a simple level, connected devices 'talk' to a central hub, where their data is processed, and in some cases a suggestion or decision is made about performing an action.

01. Device

Data is collected by the device which may include identity, count, location, temperature, health status or more. Each device is uniquely identified within the system.

02. Connection

Connected devices transfer their collected data using methods such as 3G/4G or now 5G, WiFi, Bluetooth, Long-Range Wide Area Networks (LoRaWAN).

04. Insight

For the processed data to be useful, it must generate an insight or recommend an action. This could be done via an alert to the user or by performing an automated action.

03. Processing

Here is where value is added. Software can help process data, with AI and machine learning undertaking image recognition or identifying abnormal patterns.

Life on the edge

Poor connectivity can sometimes mean sending data to the cloud is not the best option. An alternative approach is to process on the device itself. This is called 'edge computing'.

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{ The internet of us

Meet Doc Brown, or Ellis to her friends. Ellis is a junior doctor at Hill Valley General. She rents a smart home, and wants to show you how connected devices help her every day.

To help, we've grouped the devices into three areas...

PEOPLE
Devices on or around ourselves

SPACES
Devices in our homes and workplaces

PLACES
Devices in the wider community

1. Dr Brown loves her smart home

2. It helps with her pollen related asthma

3. Her air purifier turns on while she sleeps

4. When she wakes up, Alexa notifies about her inhaler medicine

5. Oh no, supplies are low

6. Time to order a repeat prescription

7. To reduce carbon, delivery is combined with a grocery order

PHARMACY DELIVERY
☑ ADD TO GROCERY ORDER
REPEAT PRESCRIPTION
INHALER

8. The Pharmacy processes the new order

REPEAT PRESCRIPTION
INHALER

9. Her health app recommends a bus to work today

LATER...
POLLEN ALERT...
DON'T WALK TODAY
> GET BUS

10. At the bus stop, she is kept informed of the latest departures

NEXT BUS TO: HILL VALLEY 10 MINS

11. But her bus gets delayed by road works

DELAY...
BUS 54
YOU
11.43 ESTIMATED ARRIVAL
54

12. She informs work and auto reassigns her team

REASSIGNED TO WARD 6

13. After her shift, she gets home to clean air

14. Five stars for her 'smart' landlord

SEND FEEDBACK
★★★★★
REVIEW

PEOPLE   SPACES   PLACES

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How are connected devices helping?

Connected devices have been around for a while. They're monitoring our wellbeing, our environment and delivering value. But we've boiled it down to three main things they help us do, and have illustrated using some household names.

When you see a QR code, click it to learn more. Or why not immerse yourself by scanning it with the camera on your smart device.

Inform
Gaining insight to help make informed choices and improve standards of living.

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Improving personal health

Fitbit

SCAN ME

See and interact with your visitors

Google Nest

Predict
Using information from devices to provide early alerts and optimise maintenance.

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Predicting production downtimes

BMW

SCAN ME

Responsible printing with 70% cost saving

HP

Control
Interacting with devices to help us control our surroundings.

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Simplifying our everyday routines

Amazon Alexa

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Keeping our lawns nicely trimmed

Husqvarna

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Mind the gap or it could be...

GAME OVER

...for some

Many of us are embracing smart devices, but inequalities, whether financial, infrastructural or educational, can limit access to this technology, and widen the digital divide.

High quality connectivity is now vital to access crucial services. Yet, it is often overlooked, leaving people and communities isolated. In just the UK alone, 1.5m households still do not have internet access.

There is a role for methods beyond broadband to ensure all can connect. Targeted investment in 'place-based' connectivity infrastructure such as cellular (4G/5G), satellite and radio based (LoRaWan) methods can deliver economic and social opportunities and close the digital gap.
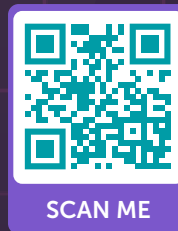
LoRaWan connects communities in Norfolk

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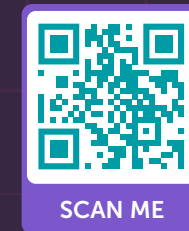
Starlink connects the unconnected in Canada

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Now is the time

Connected devices are part of our daily lives, and are already providing benefits for the public sector. But there is potential to go further.

To help, we've examined the impact across five sectors, with the aim to inspire further conversations.

12bn

connected devices in the world. IOT Analytics

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{ Local
government

"The gathering of data from IoT applications in public spaces has the potential to generate considerable societal benefit. Already, there are numerous government initiatives to collect and make smart city data, such as air-quality and traffic-flow data, publicly available."

World Economic Forum: The State of the Connected World

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What's driving the opportunity?

91%
of local government leaders confirmed connected devices have the potential to benefit their sector. Civica

$190bn
Forecast worldwide spend on smart city initiatives in 2023 - an increase of 134% from 2018. Statista

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Making a positive impact

We've hand-picked a few examples to show where connected devices are making an impact. But what else is possible? Continue the conversation and share your perspective.

Inform

Parking management ●
One of the original deployments of connected devices by local government; helping citizens find parking in the city.

Supporting vulnerable citizens ●
Connected devices can enable independent living in council owned social housing. Notifications of potential illness or accident as well as fuel poverty risk can provide the opportunity for early intervention. See our Housing and Health and Care sectors for more similar use cases.

Managing open spaces ●
Belfast City Council created an IoT network to track footfall and better understand the flow of citizens through city parks.

Smart poles ●
The lamppost is evolving into a smart pole fitted with sensors and cameras to collect and analyse real-time information about traffic flow, environmental conditions, and crowded spaces.

Predict

Optimised waste management ●
Sensors in bins can measure fill levels and waste management officers can set-up 'smart schedules' for emptying them when full. Upcoming digital waste tracking legislation in the UK is likely to stimulate more use cases of IoT for waste management.

Proactive asset maintenance ●
From sensors on waste trucks to monitor road conditions to drain management and monitoring of urban trees, data from multiple connected devices can help predict maintenance requirements and make efficient use of resources.

Crowdsourcing cities ●
Placemaking outcomes can be reached by involving citizens in the widespread collection and sharing of environmental and sentiment data. Collating this information can help predict where new or improved services are needed.

Control

Smart traffic management ●
Combined with AI, connected traffic light systems can prioritise cyclists over motorists before they even arrive at a junction. Cities like Wolverhampton and Melbourne have implemented networks of devices to control city traffic systems; monitoring pollution levels, journey times and vehicle counts.

Supporting buildings ●
Connected devices can automatically control heating, lighting and ventilation; improving efficiency, reducing costs and helping meet net zero targets. They can also manage access and security. See our Housing sector for examples of smart buildings.

Controlling air quality ●
Coventry City Council is using connected devices to improve air quality in the city. When pollution levels are breached, sensors trigger messaging that suggests alternative routes to motorists and pedestrians until the levels are reduced.

● **Established:** already making an impact   ● **Emerging:** starting to make an impact

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"The pilot will explore how technology could help tackle inequalities, such as how smart homes could help ease fuel poverty. REPLICATE offers an opportunity for people in Bristol to test tomorrow's technology today, learning about and becoming familiar with new technologies that will become increasingly commonplace."

Bristol City Council

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Connecting citizens and neighbourhoods

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{Health and care

"The traditional one-model-fits-all approach to outpatient care is not able to keep up with growing demand... evidence indicates patients are accepting of technology and are willing to use it to self-monitor."

Royal College of Physicians, Outpatients: the future
– adding value through sustainability

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What's driving the opportunity?

92% of health and care leaders confirmed connected devices have the potential to benefit their sector. Civica

57% of citizens are open to remote monitoring of ongoing health issues through at-home devices. Accenture

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Making a positive impact

We've hand-picked a few examples to show where connected devices are making an impact. But what else is possible? Continue the conversation and share your perspective.

Inform

Wellness tracking ●
A range of other wellness data can be provided by commercial wearable devices such as Fitbit and Apple watch. This informs individuals about their sleep patterns, exercise performance and fitness levels, helping individuals make more informed choices.

Remote patient care ●
Connected devices, including electronic skin patches, can collect and share data about heart rate, blood pressure, oxygen levels and mobility; helping monitor conditions from home and to prevent unnecessary visits to the surgery.

Assisted living ●
Connected devices can unobtrusively monitor activity levels and wellbeing for dementia patients; alerting carers, or emergency services to any changes so that an emergency visit or call can be made as soon as possible.

Predict

Asset management ●
Being able to track the location and status of medical devices and materials can help hospitals to predict maintenance needs and manage inventory to optimise control and reduce costs.

Condition management ●
Devices like AI driven heart monitors and connected inhalers are able to monitor use and alert individuals if their condition is worsening to help them take preventative action. Predictive algorithms could provide environmental alerts so individuals can take action to reduce risk.

Predictive health ●
Sharing data from connected devices - such as wearables and biosensors - can enable the future of personalised, preventative care. By analysing data, decisions can be made to proactively reduce or mitigate risk before individuals get sick.

Control

Smart beds ●
Hospital beds can use sensors to automatically adjust the angle and pressure to provide optimised support for patients without the need for a nurse to intervene.

Automated medication ●
Medical wearables can now monitor conditions such as diabetes and control devices such as automated insulin dosing systems.

Enabling independence ●
Devices such as Amazon Alexa can enable older adults to retain independent living, helping to easily access information and communicate. As part of a connected home, voice activated devices can also control lighting and heating.

● **Established:** already making an impact   ● **Emerging:** starting to make an impact

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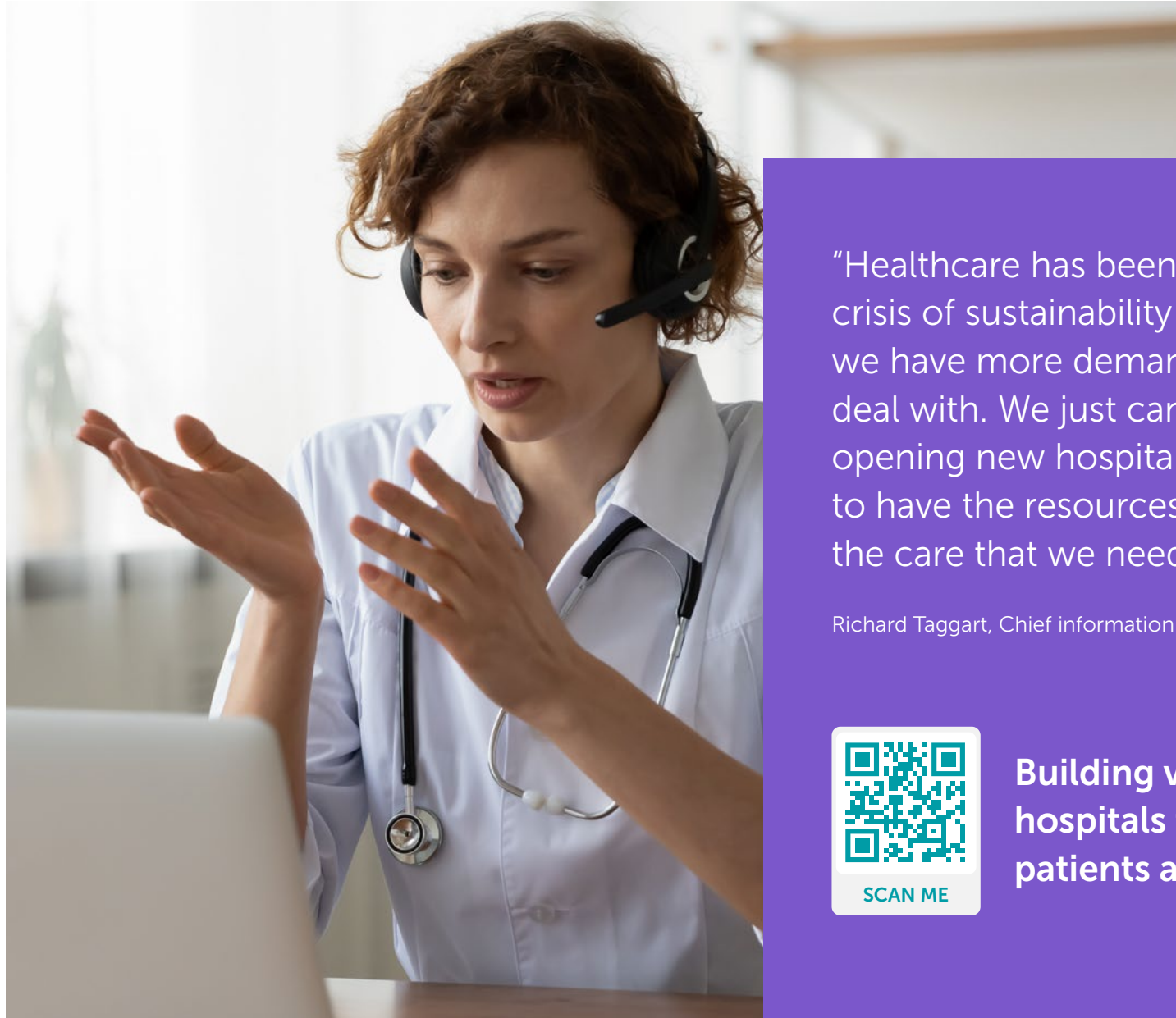
"Healthcare has been lurching towards this crisis of sustainability for so many years where we have more demand than we can possibly deal with. We just can't keep building beds and opening new hospitals because we're not going to have the resources to fill them and provide the care that we need to."

Richard Taggart, Chief information Officer, Sydney Local Health District
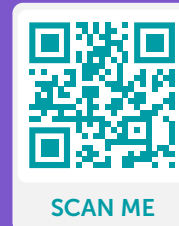
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Building virtual hospitals for patients and carers

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{Government and justice

"Reflecting on the challenges of 2020, IoT could help us monitor environmental disasters, support pandemic management and enhance the delivery of services to regional and remote populations."

Dr Alan Finkel AO FAA FTSE FAHMS,
Australia's Chief Scientist

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What's driving the opportunity?

86% of government leaders confirmed connected devices have the potential to benefit their sector. Civica

74% of IoT projects are working towards clean energy and responsible consumption. NOF

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Making a positive impact

We've hand-picked a few examples to show where connected devices are making an impact. But what else is possible? Continue the conversation and share your perspective.

ⓘ Inform

Environmental disaster response ●
Networks of connected sensors can provide insight into the environment and identifying opportunities for early intervention, providing early warning to citizens and accelerating disaster response time.

Action on climate change ●
From smart metering of electricity and water to the monitoring of woodland environments, connected sensors can be used to assess and monitor actions to mitigate climate change.

Protecting people ●
Connecting alerts from networked CCTV cameras into police vehicles can speed up response in the event of potential criminal activity. Connected devices can also help prisons track assets and identify inmates, and have even been used to detect time of death in murder cases.

⚠ Predict

Crowd management ●
Tracking the location of mobiles and analysing real-time data collected can identify how crowds are building and moving, and predict additional need for security, transportation or facilities.

Improving the passenger experience ●
Belfast City Airport's award winning IoT solution, is helping improve the passenger experience by using real-time data to speed up security clearance by automatically classify baggage.

Infrastructure management ●
Using sensors, cameras and lasers to monitor infrastructure such as rail tracks, reduces the resource burden of routine physical inspections. Combining collected data with AI algorithms enables a predictive maintenance approach.

⏱ Control

Next generation highways ●
Connected cars offer potential to reduce congestion and improve safety. Links between cars and roadside infrastructure can share data such as traffic density and dangerous road conditions with the data driving automated decisions about speed limits and route planning.

Protecting front-line officers ●
Wearable devices can monitor heart rate and blood pressure of police officers and automatically dispatch support if there are signs of trouble. Sensors on firearms can be used for authentication and can automatically trigger recording on the officer's body-worn camera when removed from the holster.

● **Established:** already making an impact   ● **Emerging:** starting to make an impact

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"We are always working towards zero deaths on our roadways...
I feel that connected and autonomous technology is the way we are going to get as close to that number as possible."

Leslie Richards, Secretary,
Pennsylvania Department of Transportation

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Keeping emergency responders safe

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{Housing

"Social landlords have a key role to play in supporting their residents to feel safe in their homes. For residents, knowing you live in a safe, secure building is of paramount importance, for your physical safety and for your mental health."

The Charter for Social Housing Residents, Social Housing White Paper

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What's driving the opportunity?

95% of housing leaders confirmed connected devices have the potential to benefit their sector. Civica

2/3 of Australian homes now contain a smart device, compared to 57% in the UK.
Telsyte Australia & Smart Home Week

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Making a positive impact

We've hand-picked a few examples to show where connected devices are making an impact. But what else is possible? Continue the conversation and share your perspective.

Inform

Home security ●
Sensors can be used to monitor illegal parking and unexpected activity in vacant properties. They can also provide notifications of intruders in the home or communal areas.

Supporting vulnerable residents ●
Sensors around a property can send information about patterns of activity or medication adherence, helping older adults to live independently and feel more secure. Alerts can be set when unusual behaviour is detected.

Safe and decent homes ●
Connected devices can be used to monitor temperature, humidity and CO2 levels in homes to help improve the welfare and safety of residents.

Predict

Housing management ●
Connected home appliances (e.g. boilers) can send data that, when combined with analytics, predict the need for maintenance, avoiding costly routine and invasive inspections.

Resource efficiencies ●
Connected devices can help residents and landlords to predict the cost of energy use and take steps to improve efficiency and reduce fuel costs. In Australia, connected devices are also helping to manage and reduce water demand.

Control

Remote access support ●
Smart locks can be operated remotely using a smart phone to grant access for repairs. If keys are lost, residents can be granted access to their home remotely.

Leak detection ●
Sensors placed on pipes or in bathrooms can detect water escape or overflowing baths and activate connected stop-cocks before major damage is caused. Smart smoke alarms and carbon monoxide detectors can issue alerts and contact emergency services or landlords.

Improving experiences ●
Some housing associations have added Amazon Alexa devices to properties to enable tenants to remain in contact and get 24/7 advice and information.

● **Established:** already making an impact   ● **Emerging:** starting to make an impact

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"This has been an extremely ambitious collaborative project which uses [connected] technology to increase digital participation, reduce the risk of fuel poverty, enhance fire safety and make further improvements to the lives of people living in our properties."

Roger Popplewell, Chair, Maryhill Housing

Keeping residents safe at home

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{Education

"IoT allows schools to improve the safety of their campuses, keep track of key resources, and enhance access to information in the learning environment. Teachers can even use this technology to create smart lesson plans."

Insider Intelligence: Report on IoT in Education

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What's driving the opportunity?

87% of education leaders confirmed connected devices have the potential to benefit their sector. Civica

83% of all 12 to 17-year-olds have or own a smartphone. eMarketer

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Making a positive impact

We've hand-picked a few examples to show where connected devices are making an impact. But what else is possible? Continue the conversation and share your perspective.

Inform

School security ●
Connected devices can enhance security and minimise unwanted intruders. Devices can also be used to track and locate assets to reduce theft. In the case of fire, sensors can activate alarms and notify emergency services of the exact location.

Attendance recording ●
Wearable and mobile devices can support teachers to note attendance of students in classes. Devices could be self-scanned on entry or tracked automatically within a geofenced location.

Asset management ●
Connected devices can help schools to track loaned equipment and books; ensuring the availability of assets to students and members of staff as well as avoiding duplicate costs.

Predict

Student wellbeing ●
Wearable devices have the potential to share data about health indicators that could give early indication of depression or stress.

Optimising school catering ●
Connected devices can help ensure that food is stored at proper temperatures reducing spoiled food. They can also enable preventative maintenance on freezers.

Control

Energy efficient schools ●
Sensors can help reduce the energy consumption of schools; switching off lights and heating/cooling in rooms.

Interactive and remote learning ●
Mobile apps and smart boards offer interactive and engaging learning environments. Vital during the COVID-19 pandemic, personal mobile devices connected via the cloud allowed students and teachers to share and collaborate.

Accessibility ●
Devices on wheelchairs connected to smart doors can make it easier to move around with limited mobility. Connected devices can create classrooms to support students with special education needs. Voice activated devices can aid communication and control of systems.

● **Established:** already making an impact   ● **Emerging:** starting to make an impact

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"The sensor network will introduce the secure and safe use of connected IoT sensors in the taught curriculum, and play a crucial role in aiding the development of data literacy in schools."

Simon Chapple, Head of Data Technology, University of Edinburgh

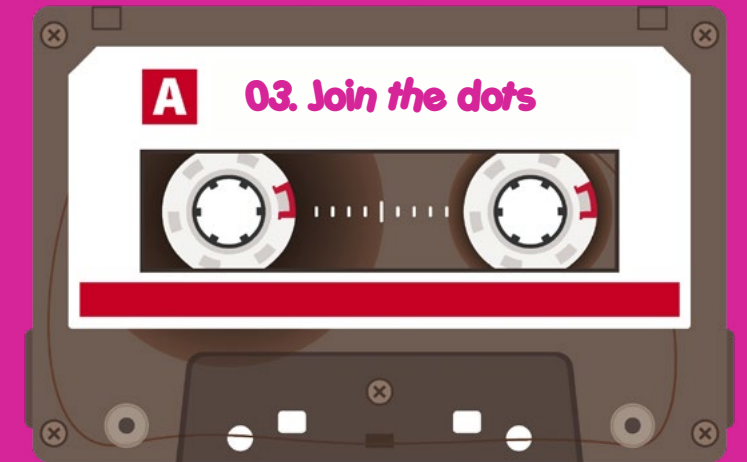**SCAN ME**

Improving learning in the classroom

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{ Ideas into action

We've put together our mix tape to help you unlock the full potential of connected devices. So go ahead and grab that stereo blaster.

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Connected devices have the potential to improve the quality of life for all of us.

They can help us make informed decisions about our health and our environment. They can empower older people and those with disabilities to participate autonomously in everyday life. They can lower costs and maintain assets more effectively. Here are three ways we can maximise their value today.

A 01. Use existing devices

stereo cassette   2 x 45 min **90**

1   1

B 02. Establish trust

☐ IN
☐ OUT

STEREO cassette   **60** 2 x 30 min

AUDIO TAPE

A 03. Join the dots

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01. Use existing devices

It's not just about building new devices. A lot of the hardware is already in place and ready to be used today.

Older devices can be re-purposed for new uses, by thinking differently and connecting up systems. In addition, many citizens are already using commercially available devices; from fitness trackers and mobile phones, to in home heating sensors and voice assistants.

If we can find a way to enable people to share data from their own devices it will reduce the scale of capital investment by the wider society as well as increasing engagement.

This type of data crowdsourcing may also improve the quality and diversity of data collected. Widely used in 'smart cities', it can help planners identify demand for infrastructure like cycle routes. There is opportunity to extend this approach into the housing and health sectors to gather greater insights at the community level.
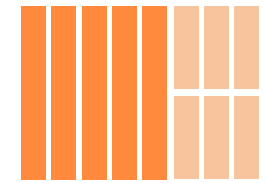
534m

wearables were shipped in 2021, an increase of 20% from 2020. IDC

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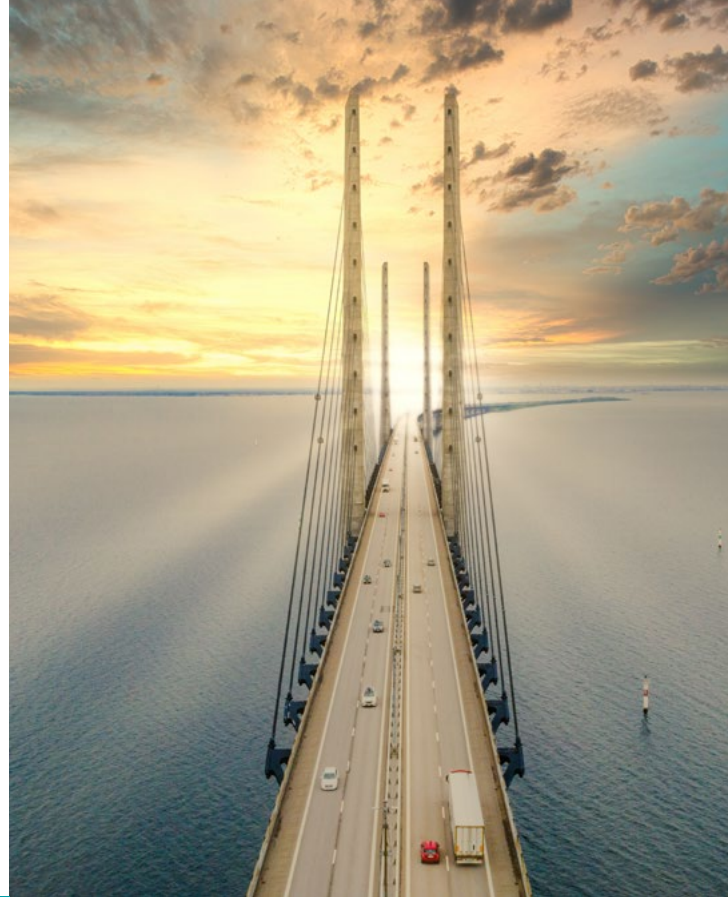
02. Establish trust

53%

of consumers do not trust their connected devices to protect their privacy and handle their information in a respectful manner.
The Internet Society

Failure to establish trust will limit the impact of this technology, especially for the older generation and the vulnerable to whom they may offer the most benefit.

Ultimately, trust comes down to clarity on the value proposition. Whether we're a citizen, resident or patient, connected services must explain why we're being asked to share data, provide a choice on whether to share identifiably or anonymously, and deliver an identifiable improvement in return.

Establishing strong relationships where providers work together with users will be critical to fully realise the benefits that connected devices can offer. They must be safe and fair to use. Consent must be timely and meaningful. No one should have to choose between maintaining their privacy and accessing the convenience that connected devices can deliver. It should be possible to have both.

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03. Join the dots

Many current use cases for connected devices focus on enhancing existing products and processes rather than rethinking them. We are living in a world where everything could be connected.

Finding ways to safely link data insights from wearables with data from our homes and wider communities, offers potential for truly personalised services as well as population level insights that can enable targeted support for those who are most vulnerable.
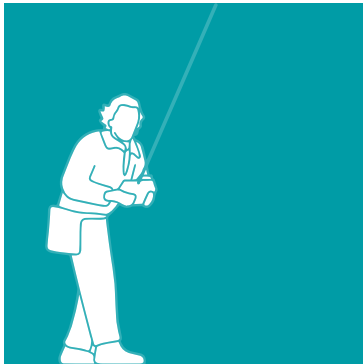
This linkage of our data, combined with data from others plus other sources of open data, will help us become a smarter society.

$12.6tn

potential economic value IoT could unlock by 2030. McKinsey

CIVICA

Created by...

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| Kelly Gibbs | Mark Owens | Simon Perrins | Tracey Cotterill |
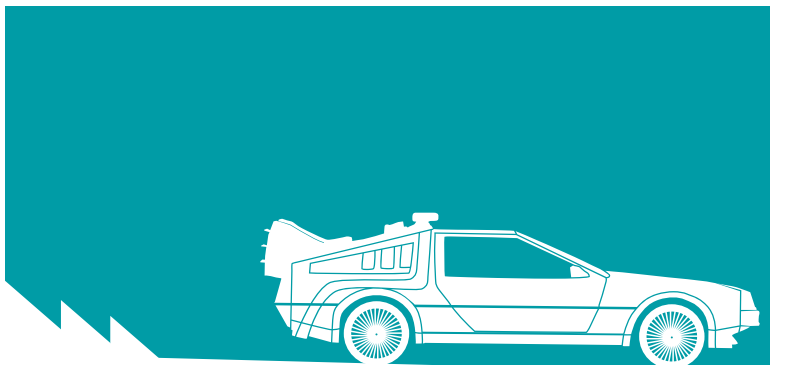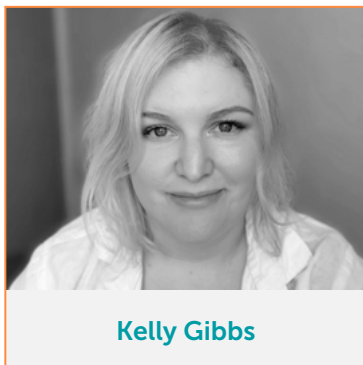
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{ Continue the conversation

Are you an innovator, a thinker or a leader driving change in public services? If so, we'd love to hear your perspective.

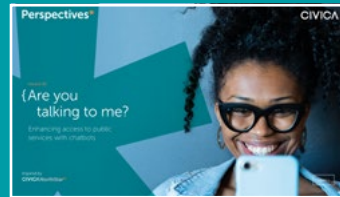Learn more and get involved at civica.com/perspectives

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Our world continues to evolve and remains as fast-paced as ever. To help, our Perspectives* series explores how emerging technologies can help us build more innovative public services for today, and tomorrow.

Download our latest volumes:

1. Immersive technologies
(download volume 01)

2. Conversational AI
(download volume 02)

3. Machine learning
(download volume 03)

4. Tech trends: 2022
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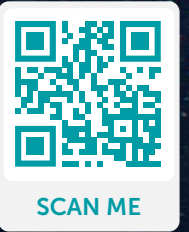
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At Civica, innovation is in our DNA. We take great pride in putting together exceptional teams and a genuine, purpose-driven culture to help everyone be an innovator.

Our innovation lab, Civica NorthStar, is focused on creating enhanced outcomes for public services by applying fresh ideas around data, automation and new technologies.

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