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Smart Cities Can Only Happen Via Smart Technology

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Biography

Emil Eifrem is CEO and co-founder of Neo Technology (http://neo4j.com/). Previously Chief Technology Officer of Sweden's Windh AB, where he headed up the development of highly complex information architectures for Enterprise Content Management Systems, Emil famously sketched out what today is known as the property graph model on a flight to Mumbai in 2000.

Since then Emil has devoted his professional life to building and evangelising graph databases, and jokes that as a result he plans to save the world through graphs and own Larry Ellison's yacht by the end of the decade.

He is a frequent conference speaker and a well-known author and blogger on NoSQL and graph databases, as well as co-author of the agreed Bible on graph databases, O'Reilly's Graph Databases (http://graphdatabases.com/).

Keywords Smart Cities, Internet of Things, IoT, Graph databases
Paper type Research

Abstract

Smart cities offer the promise of elegant, real-time operational control of a modern city, something emerging as a clear practical goal for many global politicians. In this article, the author looks at why the Internet of Things is emerging as the foundation of urban smart futures.

Introduction

In Copenhagen, half the street lights now have sensors and are connected to a network to provide centralized auto-dimming, based on time of day or the presence of a full moon, plus the ability to increase the brightness when they sense people or traffic passing by.

Meanwhile, the New York State Energy Research and Development Authority has announced a new Real Time Energy Management programme, which combines embedded sensors and an extensive network of smart meters backed by big data analytics to optimize energy usage of commercial buildings.

Again in America, Houston was losing about 15 billion gallons of water per year, 15% of the entire supply, from leaky pipes. But by a smart city move to embed sensors and intelligent pump control systems, its city managers now have a way to regulate the flow of water and control issues.

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What links all these examples is the use of the Internet of Things (IoT). Indeed, IoT looks set to transform municipal life, with government officials surveyed by the US non-profit IT trade association CompTIA[1] just one among many converts.

Small wonder. Smart cities offer the promise of elegant, real-time operational control of the modern city. However, there is a big technology and management challenge with realizing these great public safety, energy, traffic management and other environmental goals.

The challenge is that our cities are so much larger and more complex than Industrial Revolution era cities – a complex synergy of multiple sensors, networks, devices, CCTV cameras, power grids, utility frameworks, traffic lights and smart water and power meters. It is clear that this is a connected Internet (network) of many things (devices) – an IoT structure.

What's more, connected 'things'. In other words, what you're working with is complex data structures of many nodes, as that's the only conceivable way of capturing all that density and inter-connectedness – and that involves data – data constantly in renewal, flux and transmission.

After all what is behind all of these sensors in smart parking meters, smart traffic lights or the cameras in the hospital driveways? Multiple municipal or outsourced databases, capturing data continuously.

At the same time the connections between devices and other entities can change faster than the data describing each thing. In a smart city setting when a new piece of equipment or sensor comes online, it seeks any relevant local controllers or other devices that it needs to listen to or send data to. The powering up or down of a device may, in turn, make or break dozens of connections.

Connections between entities at scale

Most IoT smart city applications therefore require leveraging one or more data sets that are each highly connected in their own right, and linked to one another. Connections are more than lines between entities; they each include a richness of information, such as direction, type, quality, weight, and more – all of which can be best represented in a new form of database, a graph database, as an integral part of each relationship object.

Graph databases are the ideal option for IoT as they process complex, multidimensional networks of connections very fast. While it's true that simple graph problems could be handled by a relational database, they are not a very satisfactory fit, as they represent data as tables, not networks, and such queries strain a data structure not designed to map connections. As analysts Ovum recently notes, "Graph technology will allow the Internet of Things to be represented transparently, without the need to force fit into arbitrary relational models."

Given the overwhelming amount of data and connections that accumulate over even the shortest period of time in any IoT-powered smart city scenario, traditional

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databases will struggle to get any coherent, overarching view on what's going on, which is precisely what the smart city administrator and her teams will demand.

As a result, it's becoming clearer that it's only by graph-powered IoT delivered smart city management that great projects like the ones in Denmark, NYC and Houston will come to your city.

Reference	
1	https://www.comptia.org/resources/building-smarter-cities?cid=download