Smart Cities and the Internet of Things

Conquering Complexity in a New World
“We live in a world of cities”
Tokio
San Francisco
Amsterdam
Barcelona
“We need a new model for urbanism; the existing one simply does not work!”
Joan Clos, UN-Habitat, Dec’12.
Cities share cars, technologies and citizens.....
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City Anatomy – (physiology)
a common language for cities
City Physiology - The Urban Metabolism

“With the growing concern of climate change and atmospheric degradation, the use of the urban metabolism model has become a key element in determining and maintaining levels of sustainability and health in cities around the world.”

from Wikipedia ‘Urban Metabolism’

World Bank effort to measure the Urban Metabolism of the top 100 cities in the world.
Estimated U.S. Energy Use in 2013: ~97.4 Quads

Source: LLNL. 2014. Data is based on DOE/EIA-0035(2014-03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL--MI--410527
1 Quad ~ 8 Billion Gallons of gas

Estimated U.S. Carbon Emissions in 2013: ~5,390 Million Metric Tons

Source: LLNL 2014. Data is based on DOE/EIA-0035(2014–03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Carbon emissions are attributed to their physical source, and are not allocated to end use for electricity consumption in the residential, commercial, industrial and transportation sectors. Petroleum consumption in the electric power sector includes the non-renewable portion of municipal solid waste. Combustion of biologically derived fuels is assumed to have zero net carbon emissions - the lifecycle emissions associated with producing biofuels are included in commercial and industrial emissions. Totals may not equal sum of components due to independent rounding errors. LLNL-MF-410527
City Dashboard against the new City Anatomy
What is the Internet of Things?

“"The network of physical objects that contain embedded technology to communicate and interact with their internal states or the external environment."

Source: Gartner
The 4th Revolutionary Wave of Technology

*Internet has changed our life but it hasn’t changed our cities, yet*
The Internet of Things is complex

It’s Big
So many devices and so much data...

It’s Noisy
So many opinions...

It’s Confusing
So many possible decisions...

How (where) do we get started?
Who can really help us?
Do we need to start over?
Should we wait?
What technology do we need?
Logic chip, radio transmitter, LED's, and battery source would be positioned here.

Broken wires indicate an open circuit which is evaluated to indicate a consumed dose.

New Opportunities
From http://www.popularmechanics.com/technology/engineering/infrastructure/smart-everything-even-lamp-posts-are-now-connected

Intellistreets System

Ordered by: Philadelphia and Chicago
Cost: $1000 to $2000 (not including lamp posts)
Price varies by options.
Data

Protect

Security Information

Communication

Social Number

People Network

SSN
What is Open Data?

Making public data broadly accessible and usable by humans and machines, free of any technological, legal, or usability barriers. Based on the principles of:

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<th>Transparency</th>
<th>Participation</th>
<th>Collaboration</th>
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<td>Enable greater accountability, efficiency, and economic opportunity by making government data more open.</td>
<td>Through direct involvement of citizens and developers to deliver better and more cost-effective government-based services.</td>
<td>Generate new ideas for problem solving by fostering cooperation across levels of government, agencies, and with the public.</td>
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Open Data typically does not contain personal or identifiable information about private citizens that is not otherwise available through existing government services.
“Release of public sector information creates opportunities for innovative use and reuse of data, and allows the commercial, research, and community sectors to add value.”
Australian Government [2013]

“The next generation of innovation in… academic research or public services will be possible because we find new ways to harness and learn from data.”
World Economic Forum [December 2013]

“It enables data-driven decision making: parliamentarians, policy makers, civil society organizations and individuals can see progress and make accurate, informed decisions on issues that affect people’s lives.”
Kenya Open Data Initiative [2013]

“Openness will strengthen our democracy and promote efficiency and effectiveness in Government.”
Barack Obama, President of the United States [January 2009]

“It makes the government more accountable to citizens and strengthens our democracy. It brings us better public services and it feeds economic and social growth.”
Data.gov.uk [2013]

“By opening up more data, and through innovative use of technology, we can crowd-source ideas and co-create applications with the wider community.”
Tharman Shanmugaratnam, Singapore Deputy Prime Minister [April 2013]

“Not only are we making more effective decisions through improved use of data, but also involving communities, making them more informed and empowering them to deal with future challenges.”
World Economic Forum [January 2013]
Common city patterns

City Artifacts Management
- Device-generated
- Service-generated
- User-generated
- Storage
- Enrichment
- Discovery
- Aggregation

City Analytics
- Predictions and business intelligence
- Real-time processing and complex event processing

Services Management
- Publication
- Discovery
- Brokering
- Life-cycle management

Information Dissemination
- Push – notification & alert
- Pull – browse & query
- Visual rendering

City Internet of Things

Profiles of Population & City Infrastructure

Urban Models

City Service Repository

City Administration & Business Insights

City Services

Citizens' Devices

City Infrastructure Sensors

Citizens

Workers

Leaders
Monitor, Early Warning, Check Compliance

Source: Huggies

Source: Proteus

Source: Botanicalls

Source: Big Belly

Smart Dust
Hitachi RFID
New Business Models

Creative Public Private Partnerships to meet big challenges & spark new opportunities
Global City Teams Challenge
5. **Interoperability**

San Francisco Emergency

**Response Times**

- Users
- Medical Professional
- Consumer

Who will develop the app?

**Response Time**

Down to 2 minutes

Resources:

- False Point
- Look at Data
- App
- Responsive Design

Consider intelligent pre-position

13. **Nudging Behavior**

With Smart Data

**How much do you know?**

If you had all the info, would you do things differently?

Rewards:

- Personal
- Communal

Education:

- One point of access
- Move to save
- Move to learn
1. Pilot in Annapolis
   Human Population Mapping
   Natural & Built Environments
   How do they relate?
   Who are they?

   A Visual for Improved Disaster Response
   Visibility of Human Capital

7. Connecting People with Data...
   Get people connected

   Smart Emergency Response
   Where are they?
   Where should they go?

   And Beyond
   Anticipate the needs of people...

   Unlock in case of disaster
   Bandwidth when needed
“Cities are power plants of human energy which creates jobs through innovation”

Jim Clifton
Chairman, Gallup

The laboratories of our future