**“the great enemy is complexity, measured in lines of code, or interactions.”**

**Smart Cities:**

**“What is a smart city?”** It’s a hard question to answer. “Smart” is a problematic word that has come to mean a million things. Soon, it may take its place alongside the handful of international cognates — vaguely evocative terms like “sustainability” and “globalization” — that no one bothers to translate because there’s no consensus about what they actually mean. When people talk about smart cities, they often cast a wide net that pulls in every new public-service innovation from bike sharing to pop-up parks. The broad view is important, since cities must be viewed holistically. Simply installing some new technology, no matter how elegant or powerful, cannot solve a city’s problems in isolation. But there really is something going on here — information technology is clearly going to be a big part of the solution. It deserves treatment on its own. I take a more focused view and define smart cities as places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems.

**“what do you want a smart city to be?”**

We need to focus on how we shape the technology we employ in future cities. There are many different visions of what the opportunity is. Ask an IBM engineer and he will tell you about the potential for efficiency and optimization. Ask an app developer and she will paint a vision of novel social interactions and experiences in public places. Ask a mayor and it’s all about participation and democracy. In truth, smart cities should strive for all of these things.

Today’s cities are facing many common challenges in the areas of safety, mobility, emissions, accessibility, and congestion. Innovation is an important mechanism to pro-actively address the challenges facing cities and identify opportunities for new business models.

**“Challenges?”:**

The sheer size of city-scale smart systems comes with its own set of problems. Cities and their infrastructure are already the most complex structures humankind has ever created. Interweaving them with equally complex information processing can only multiply the opportunities for bugs and unanticipated interactions.

**Smart City Applications:**

**Open-data initiatives** and hackathons, like New York City's [BigApps](http://nycbigapps.com/" \t "_blank) competition, which produce useful and resource-saving [apps to improve cities](http://mashable.com/2012/11/07/open-data-city-apps/) and keep citizens informed. Things like air quality, restaurant sanitation scores, building inspection scores and impending legislation should be readily available for all citizens.

**Environmental Monitoring** – a typical city has a handful of expensive monitoring stations for pollution or weather conditions, most of which cannot be monitored in real time. New systems are emerging that allow cities to monitor the environment with many more sampling points and in real time. This will help pinpoint the source of potential problems that can then be quickly and efficiently dealt with, as well as providing invaluable data for planning.

**Information Beacons** – enabled by Apple’s iBeacon and Google’s Eddystone, many city assets are now becoming location-aware information portals. New services are emerging that enable consumers to receive real time transport information or special offers from local businesses.

**Smart Street Lighting** – this has always been the leading smart city application cited by analysts due to its impressive early growth and clear business case. Smart street lighting is increasing its importance by reusing the lighting column as a communications hub.

**Smartphone Detection**  
Detect iPhone and Android devices and in general any device which works with WiFi or Bluetooth interfaces.

**Smart Roads**  
Intelligent Highways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

**Traffic Congestion**  
Monitoring of vehicles and pedestrian levels to optimize driving and walking routes.

**Carpooling or public transport enabling apps:**

**Smart Journey Planning** – we are seeing a growing number of systems that utilise open city data in order to suggest how individuals can best get from A to B. The systems are now becoming more sophisticated, taking into account personal preferences such as cost, safety concerns and CO2 footprint.

**Carbon Footprint** – Greenhouse gas emissions

**Transport Sharing** – city bike schemes, whilst great for flat city centres, don’t really work over large areas or in hilly communities. We are seeing the emergence of new bike sharing schemes that allow people to share access to better bikes that are not tied to a few expensive bike stations. **Electric vehicles**, this will be a key enabler for wider adoption of city centre car sharing.

**Smart Parking** – the initial focus of parking was on reducing congestion but this only had a clear business case in a limited number of cities. New advances are emerging that save costs whilst encouraging citizens to change behaviour in order to make city centres an enjoyable place to visit.

**Parking apps**

 that show drivers where the nearest available parking spot it. These will save commuters time, gas, emissions and money, while also easing the flow of traffic.

All-digital and easy-to-use [**parking payment systems**](http://mashable.com/2012/07/18/parking-tech/) — think EZ-pass for parking. We don't want to put receipts on the dashboard or be confined to time limits that make us run out to put more coins in the meter (if you're going to keep money meters, at least let us add money via an app). It's fine that you charge for parking, but improve the system.

**City guide app**, with information about museums, parks, landmarks, public art, restaurants and real-time traffic data.

**Traffic rerouting apps**

Widespread use of [**traffic rerouting apps**](http://mashable.com/2012/08/22/traffic-apps/), such as [Greenway](http://greenway2012.wordpress.com/) and [Waze](http://waze.com/). The average person spends 60 hours in traffic each year, according to Greenway; these apps calculate the best route for each driver to speed up traffic flow and reduce CO2 emissions. They also ensure that a traffic jam on one boulevard doesn't just get displaced to another area.

Dynamic kiosks that display **real-time information**, concerning traffic, weather and local news, like [Urbanflow](http://helsinki.urbanflow.io/" \t "_blank) in Helsinki.

More public transit, **high-speed trains**, and bus rapid transit (BRT) to help citizens traverse the city with speed and low emissions.

**Wi-Fi**

in subway stations and on trains, along with weather information at every station

**Energy consumption monitoring systems and technologies:**

High-tech waste management systems Pay As you Throw (PAYT) garbage disposal would encourage people to recycle more and waste less, while using tools like RFID could improve sorting so recyclable plastic bottles don't end up in landfills.

**Smart Environment Apps:**

**Structural health**  
Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.

**Noise Urban Maps**  
Sound monitoring in bar areas and centric zones in real time.

**Electromagnetic Field Levels**  
Measurement of the energy radiated by cell stations and and WiFi routers.

**Earthquake Early Detection**  
Distributed control in specific places of tremors.

**Snow Level Monitoring**  
Snow level measurement to know in real time the quality of ski tracks and allow security corps avalanche prevention.

**Potable water monitoring**  
Monitor the quality of tap water in cities.

**Swimming pool remote measurement**  
Control remotely the swimming pool conditions.

**Intelligent recycling disposal:**

The adoption of innovative and smart technologies can help increase efficiency and productivity in the waste management and recycling industry and reduction in the manpower and transportation costs.

**Waste Data Analysis:**

Smart technologies are being developed to help government officials in cities to better analyse and manage their waste data. An example is IBM Research, which partnered with the Nairobi City County using big data, analytics and mobile technology to develop a pilot program in mounting smart devices to the city's waste management trucks, so that they can collect data about the fleet, trucks and drivers, while also tracking problems on the roadways.  
  
The pilot program provided analytics-based indicators and alerts to improve the performance of the entire fleet and will help the city design a more efficient system for picking up waste. Besides the improvements to waste management, road blockages, accidents and potholes could also be reported back to city officials for tracking urban infrastructure more efficiently.

**Waste Bins and Collection:**

Innovative and smart technologies are also available for monitoring waste bins and optimizing waste collection. Wireless sensors are placed in waste bins that are able to measure how full a bin is, generate schedules and optimize routes for waste collection. Instead of waste collection trucks going to every location to collect waste on fixed schedules, regardless of whether the bins are full or not, the smart technology enables the waste collection company to better plan the utilization of manpower and trucks. This could result in increased efficiency and productivity, **reduced logistics costs** and **lower carbon emissions** from the trucks.

In **Singapore**, new HDB housing estates are fitted with Pneumatic Waste Conveyance Systems. These innovative systems efficiently convey waste by air suction through an underground network of concealed pipes to a central location. Odours, pest infestations and exposed waste will be reduced allowing residents to enjoy a more pleasant living environment. This process will also reduce the need for workers to collect refuse, as well as lessen refuse truck traffic.

**Intelligent remote monitoring with Smart Bins**

Features

* Container Intelligence
* Fill-level Sensors
  + Updating the wastage fill levels via a link protocols.
* Smart Bin live
  + Monitoring the Containers and planning optimized routes from anywhere

**Management of Specific Waste:**

**Example: Food, Plastic Waste**

 There can be **automated food waste tracking systems** to help food companies and restaurants monitor and reduce waste. The **food waste tracking system** typically includes **a built-in scale, camera, and a touchscreen user interface**. Before disposing food waste, employees would weigh the food, and a picture of the waste would be taken. Employees would record the type of food being thrown away and the reasons for its disposal. An **online reporting dashboard** will churn insightful charts to allow the company to view all their food waste and discover the most actionable opportunities to prevent wastage.

**Mobile apps** allow retailers to post unsold and edible food items for sale at a discount instead of throwing them away. Consumers can locate the nearest retailer on their mobile phone and enjoy the discounted food items. Other available apps allow retailers to launch a surplus food redistribution scheme, which allows food charities to register and receive food from the retailers, while the retailer will be able to centrally monitor what products are resulting in surplus and manage how this can be reduced.

**Billing the Customers:**

**Food Waste Disposal Bill:**

Residents have to deposit food waste into a special bin by scanning their card(like a radio frequency identification card for example) to open the bin lid. The weight of the disposed food waste amount is recorded and analysed via a wireless data system as the lid closes. The system accumulates the fee on a monthly basis and each household receives a monthly food waste disposal bill. The food waste is taken to sorting facilities, where it is converted to animal feed, fertiliser, or used to generate electricity.

**Plastics Waste:**

For plastics waste, the availability of innovative technologies such as an automated and advanced optical scanning technology can help in sorting mixed plastics into separate plastic streams for further processing into resins of higher purity, thus increasing the value of the recycled product. Other innovative technologies include the conversion of waste plastics into fuel using pyrolysis, where plastics is heated in the absence of oxygen and is broken down into liquid fuel, gases and solid char. The liquid fuel can be refined into a variety of different fuels such as diesel and petroleum.