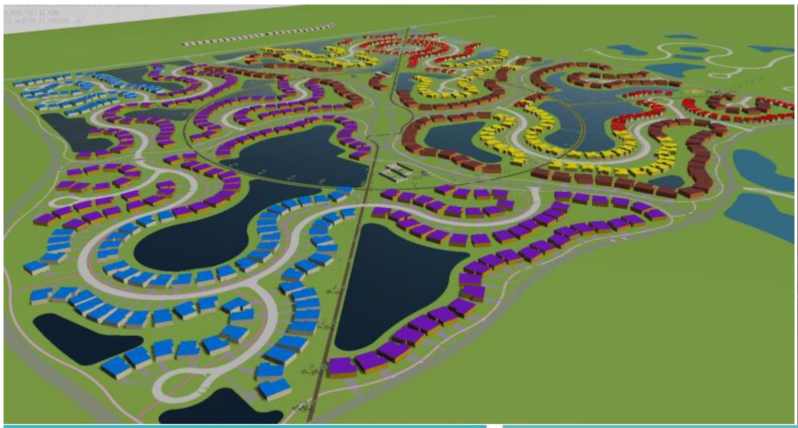
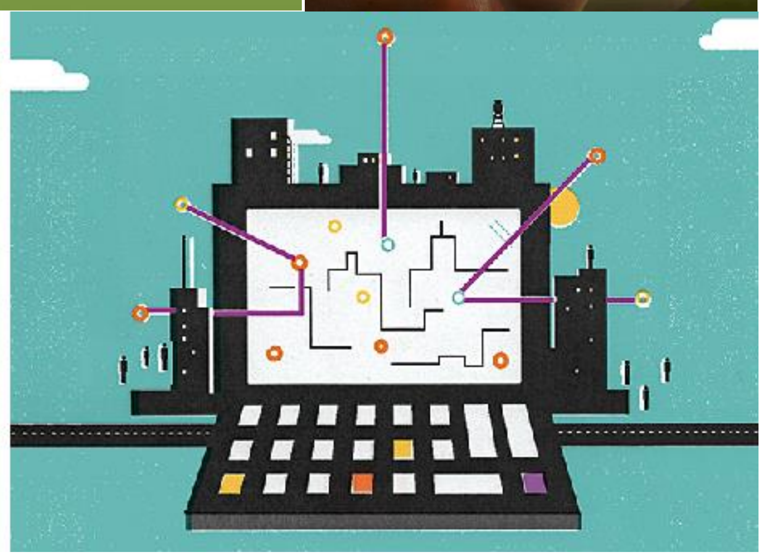
GLOSSARY OF SMART CITIES AND URBAN COMPUTING TERMS





Terms and definitions extracted from several science and technology papers, essays and articles. See references at the end.

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GLOSSARY OF SMART CITIES AND URBAN COMPUTING TERMS
(In order of meaning and relevance)

URBAN COMPUTING - SCIENCE TERMS:

Urban Computing:

Urban computing is an interdisciplinary field where computer sciences meet conventional city-related fields, like transportation, civil engineering, environment, economy, ecology, and sociology, in the context of urban spaces. It is also a process of acquisition, integration, and analysis of big and heterogeneous data generated by a diversity of sources in urban spaces, such as sensors, devices, vehicles, buildings, and human, to tackle the major issues that cities face, e.g. air pollution, increased energy consumption and traffic congestion. Urban computing connects unobtrusive and ubiquitous sensing technologies, advanced data management and analytics models, and novel visualization methods, to create win-win-win solutions that improve urban environment, human life quality, and city operation systems. Urban computing also helps us understand the nature of urban phenomena and even predict the future of cities.

Urbanization's rapid progress has modernized many people's lives, and also engendered big issues, such as traffic congestion, energy consumption, and pollution. Urban computing aims to tackle these issues by using the data that has been generated in cities, e.g., traffic flow, human mobility and geographical data. Urban computing connects urban sensing, data management, data analytics, and service providing into a recurrent process for an unobtrusive and continuous improvement of people's lives, city operation systems, and the environment.

Examples and Case Studies: See References at the end of this document, i.e.: papers and articles about San Francisco, Chicago, Guadalajara, Songdo, Amsterdam, and other references.

Urban Informatics:

Urban informatics is a science that uses data to better understand how cities work. This understanding can remedy a wide range of issues affecting the everyday lives of citizens and the long-term health and efficiency of cities — from morning commutes to emergency preparedness to air quality. The solutions it creates will make the cities more productive, livable, equitable, and resilient. City administrators are using urban informatics science and technology to better deliver services, improve planning processes, and increase public engagement.

Examples and Case Studies: See References at the end of this document, i.e.: papers and articles from the New York University (NYU)'s Center for Urban Science Progress (CUSP) and McKinsey & Co.

Ubiquitous Computing:

Ubiquitous Computing (or Ubicomp) is that one where we can harness data using everyday objects and interfaces (Ambient Informatics, Ambient Intelligence), which some refer to as "Everyware." Like the atmosphere itself, if something is everywhere it becomes nowhere; we cease to notice it. In contrast to desktop computing, ubiquitous computing can occur using any device, in any location, and in any format. A user interacts with the computer, which can exist in many different forms, including laptop computers, tablets and terminals in everyday objects such as a fridge or a pair of glasses. The underlying technologies to support ubiquitous computing include Internet, advanced middleware, operating system, mobile code, sensors, microprocessors, new I/O and user interfaces, networks, mobile protocols, location and positioning and new materials.

Pervasive Computing:

Pervasive Computing, also referred to as Transparent Computing, is the idea that almost any device, from clothing to tools to appliances to cars to homes to the human body to your coffee mug, can be imbedded with chips to connect the device to an infinite network of other devices. The goal of pervasive computing, which combines current network technologies with wireless computing, voice recognition, Internet capability and artificial intelligence, is to create an environment where the connectivity of devices is embedded in such a way that the connectivity is unobtrusive and always available. Pervasive Computing is commonly used as an equivalent term to Ubiquitous Computing, since they share similar concepts and applications.

Street Computing:

Street Computing is a research initiative setting out to explore and redefine the relationship between people and their increasingly digitalized urban environments. It is also a City OS for open data, social media, and urban sensor networks.

Cities generate increasingly vast sets of digital information. This trend is driven by a set of interrelated developments. First, real-time sensors allow us to monitor and predict many aspects of urban living, such as traffic flow, local air quality, building performance, household electricity usage, public transport reliability and so on, with increasing accuracy. Second, the availability of sensors in mobile devices has led to a surge of location-based data, often in conjunction with social information, making people increasingly producers as well as consumers of data. Lastly, regulatory frameworks that implement open data standards are increasingly resulting in the release of government data to the wider public. In parallel with the availability of real-time data is the availability of semi-static data about the environments in which the real-time data is generated. This semi-static data describes the buildings, roads, engineering infrastructure, etc., which make up the environments in which the real-time data is generated. This semi-static data is updated much more infrequently than real-time data, but it provides an important context for understanding and interpreting the real-time data.

The possibilities afforded by the availability of real-time and semi-static data are significant. Understanding the interconnections between data will play a substantial role in addressing challenges to urban environments, such as congestion, pollution, sustainability and resilience.

Social Computing:

Social Computing refers to the use of social software, i.e. systems which support collective gathering, representation, processing and dissemination of information. Social software (also called social networking software) enables social computing, i.e. it enables people to rendezvous, connect or collaborate through computer-mediated communication and to form online communities.

Social Navigation:

Social navigation is a form of social computing or part of social computing applications. It refers to situations in which a user's navigation through an information space is guided and structured by the activities of others within that space. For example: getting around with the help of others (avoiding traffic, for example) and then checking in with your friends when you get to your destination.

Smart Urbanism:

Smart Urbanism is a conceptual movement that advances an evolution in the planning, design and delivery of cities. Drawing on urban theorists, new science and systems thinking, it is designed to work with the complexity of the city. It integrates systems thinking with responsive environments to make cities and towns that are capable of sustaining life in a continuously changing environment. Smart Urbanism shows how cross-over thinking can translate into the “choice architecture” of practical solutions for the built environment, and demonstrate relevant thinking on planning, ethics, precedent, learning and adaptation mechanisms, protocols, and environmental and cultural tests for success, amongst others.

Principles of Intelligent Urbanism (PIU):

Principles of Intelligent Urbanism (PIU) is a theory of urban planning composed of a set of ten axioms intended to guide the formulation of city plans and urban designs. They are intended to reconcile and integrate diverse urban planning and management concerns. These axioms include environmental sustainability, heritage conservation, appropriate technology, infrastructure-efficiency, placemaking, "Social Access," transit oriented development, regional integration, human scale, and institutional-integrity.

Examples and Case Studies: See References at the end of this document, i.e.: papers and articles about PIU, smart cities, smart urbanism, Garden Cities and other topics.

Human-Computer Interaction:

Human–computer interaction (HCI), sometimes referred to as human–machine interaction (HMI), man–machine interaction (MMI) or computer–human interaction (CHI), involves the study, planning, design and uses of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study. The term connotes that, unlike other tools with only limited uses (such as a hammer, useful for driving nails, but not much else), a computer has many affordances for use and this takes place in an open-ended dialog between the user and the computer.

Because human–computer interaction studies a human and a machine in conjunction, it draws from supporting knowledge on both the machine and the human side. On the machine side, techniques in computer graphics, operating systems, programming languages, and development environments are relevant. On the human side, communication theory, graphic and industrial design disciplines, linguistics, social sciences, cognitive psychology, social psychology, and human factors such as computer user satisfaction are relevant. Engineering and design methods are also relevant. Due to the multidisciplinary nature of HCI, people with different backgrounds contribute to its success.

URBAN COMPUTING – ENGINEERING, TECHNOLOGY AND DESIGN TERMS:

Internet of Things (IoT):

The Internet of things (IoT) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking. Devices can connect to the internet/web via low-power radio and other means. Today, the term Internet of things (also called Internet of Everything or IoE) denotes advanced connectivity of devices, systems, and services that goes beyond the traditional Machine-to-Machine (M2M) and covers a variety of protocols, domains and applications. A true Internet of Things is also considered to be coordination between multiple devices.

Equipping all objects in the world with minuscule identifying devices or machine-readable identifiers could transform daily life. For instance, business may no longer run out of stock or generate waste products, as involved parties would know which products are required and consumed. A person's ability to interact with objects could be altered remotely based on immediate or present needs, in accordance with existing end-user agreements. For example, such technology could enable much more powerful control of content creators and owners over their creations by better applying copyright restrictions and digital restrictions management, so a customer buying a Blu-ray disc containing a movie could choose to pay a high price and be able to watch the movie for a whole year, pay a moderate price and have the right to watch the movie for a week, or pay a low fee every time she or he watches the movie.

According to Gartner, there will be nearly 26 billion devices on the Internet of Things by 2020. According to ABI Research, more than 30 billion devices will be wirelessly connected to the Internet of Things (Internet of Everything) by 2020. Cisco created a dynamic "connections counter" and methodology to track the estimated number of connected things from July 2013 until July 2020.

Seamless Interfaces:

Seamless computer interfaces are those whose visibility encourages users to interact directly with systems. Their design concept is to place as much control as possible in the hands of the end-user by making interfaces evident. They are also referred to as "interfaces that disappear."

Even though interfaces we design may become normalized in use, effectively invisible over time, that will only happen if we design them to be legible, readable, understandable and to foreground culture over technology. To build trust and confidence in an interface in the first place, enough that it can comfortably recede into the background.

Augmented Reality:

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. In AR, physical space is overlaid with virtual data, and it is related to a more general concept called Mediated Reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one’s current perception of reality. Augmentation is conventionally in real-time and in semantic context with environmental elements, such as sports scores on TV during a match. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable. Artificial information about the environment and its objects can be overlaid on the real world.

A good example are the versions of AR that work in conjunction with webcams, special eyewear and game consoles such as Microsoft's Xbox 360 via Kinect; the Augment 3D French mobile app; and also Streetmuseum, a Museum of London app that can overlay an archive photo of a street scene onto the same scene as shown through your smartphone’s camera.

Mediated Reality:

Computer-Mediated Reality refers to the ability to add to, subtract information from, or otherwise manipulate one's perception of reality through the use of a wearable computer or hand-held device such as a smart phone. Typically, it is the user's visual perception of the environment that is mediated. This is done through the use of some kind of electronic device, such as an EyeTap device or smart phone, which can act as a visual filter between the real world and what the user perceives.

Computer-mediated reality has been used to enhance visual perception as an aid to the visually impaired. It has also been used for interactive computer interfaces. The use of computer-mediated reality to diminish perception, by the removal or masking of visual data, has been used for architectural applications, and is an area of ongoing research.

Virtual Reality:

Virtual reality (VR), sometimes referred to as immersive multimedia, is a computer-simulated environment that can simulate physical presence in places in the real world or imagined worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback in medical, gaming and military applications.

Furthermore, virtual reality covers remote communication environments which provide virtual presence of users with the concepts of telepresence and telexistence or a virtual artifact (VA) either through the use of standard input devices such as a keyboard and mouse, or through multimodal devices such as a wired glove, the Polhemus, and omnidirectional treadmills. The simulated environment can be similar to the real world in order to create a lifelike experience—for example, in simulations for pilot or combat training—or it can differ significantly from reality, such as in VR games.

Amplified reality:

Amplified reality is a concept complementary to that of augmented reality. To amplify reality is to enhance the publicly available properties of persons and physical objects, by means of using wearable or embedded computational resources. For example: where extra data is built into an object from the get-go, such as the embedding of radio-frequency identification or near-field communication technologies in street objects which enables the creation of locative media (also called location-based media).

Wearable Technology:

Wearable technology, wearable devices, tech togs, or fashion electronics are clothing and accessories incorporating computer and advanced electronic technologies. The designs often incorporate practical functions and features, but may also have a purely aesthetic agenda. Wearable technology is related to both the field of ubiquitous computing and the history and development of wearable computers. With ubiquitous computing, wearable technology shares the vision of interweaving technology into the everyday life, of making technology pervasive and interaction friction-less.

Flexible Electronics:

Flexible electronics, also known as flex circuits, is a technology for assembling electronic circuits by mounting electronic devices on flexible plastic substrates. Flex circuits are often used as connectors in various applications where flexibility, space savings, or production constraints limit the serviceability of rigid circuit boards or hand wiring. A common application of flex circuits is in computer keyboards; most keyboards use flex circuits for the switch matrix. Flex circuits is often a key component of wearable technology and ubiquitous computing.

Urban Annotation:

Urban annotation is a type of filtering practice, where users of mobile technology are given the option to spend more time with stories instead of information. They can tag geographical locations with personal stories and observations that can only be deposited and accessed in the virtual space.

To understand this in practical terms, consider how Yellow Arrow (http://en.wikipedia.org/wiki/Yellow_Arrow) worked: Cell phone User #1 visits a location that is special to her; perhaps it's where she once ran into a long-lost high school friend or where she recently learned a bit of local history. She places a sticker on a nearby surface. The sticker is a yellow arrow, and it has a code on it. On her cell phone, User #1 creates a text message beginning with that code that tells her story. She sends the message to the Yellow Arrow phone number. Her text message is stored on their server. Sometime later, User #2 walks by, sees the yellow arrow, and stops. He sends a text message query that includes the code on the sticker. He receives User #1's text message in return. User #2 now knows User #1's story. Equipped with Yellow Arrow stickers that he acquired online, he may choose to place a few of his own.

Other developers are creating ways to turn more advanced data technologies into urban annotation tools. Urban Tapestries (http://urbantapestries.net) is one such project. Users of mobile technologies can seed an urban space with their own stories, stories that might be accessed by a wide variety of users - tourists, new residents, long-term residents seeking to discover new space within their familiar locations. As with Yellow Arrow, the stories are grounded in specific locations. Unlike Yellow Arrow, they are completely unseen without the aid of a technological device.

Situated Technology:

Situated Technology is a framework that enables an "intelligent terrain" and facilitates a local design commons in the city. The development of 'interactive instruments' becomes primary if we are to enable the public to get involved and develop a design commons. This points toward using the urban condition as an operative situation for collaborative, participatory, and sociable design.

Today's urban situation is a constantly shifting one—a nexus of material and immaterial flows, systems, and processes. Situated Technologies provision a framework to evolve "intelligent terrain" that is participatory, social, and enabling.

Locative Media:

Locative media or Location-based media (LBM) are media of communication functionally bound to a location. The physical implementation of locative media, however, is not bound to the same location to which the content refers.

Location-based media delivers multimedia and other content directly to the user of a mobile device dependent upon their location. Location information determined by means such as mobile phone tracking and other emerging Real-time locating system technologies like Wi-Fi or RFID can be used to customize media content presented on the device. Locative media are digital media applied to real places and thus triggering real social interactions.

Curatorial Media:

Curatorial Media occurs where content is produced by the many in a social way from the bottom-up and is then mediated, filtered or curated by some old-media-like gatekeeper. There is an important space between old and new media. This is the grey area between (1) the top-down gatekeeping of old media that separates producers and consumers of content and (2) the bottom-up nature of new, social media where producers and consumers come from the same pool (i.e., they are "prosumers").

There are three models of media all covering the same event in vastly different ways: old media relying on gatekeepers, new media on the crowd, and curatorial media utilizing both. Social media content curation goes beyond news events.

Some examples: the service Storify lets users curate different social media content to tell whatever type of story they wish; Quakebook allows users to pull together different on-the-ground stories from the recent Earthquake in Japan; there are participatory and curated film projects; Iceland's crowdsourcing of their new constitution is not pure wiki-style legislation, but instead a highly curated selection of ideas pulled from the citizenry.

Civic Tech:

Civic Tech is technology that's spurring civic engagement, improving cities and making government more effective. The field includes a range of private and public organizations, from groups designated as "P2P local sharing" (Airbnb) to "community organizing" (Change.org) to "data access and transparency" (Open Data Institute).

Examples: Airbnb, a lodging platform that can seem more commercial than community, is allowing people to be able to unlock some of the assets that they themselves own and provides new kinds of ways for individuals to share their own goods, and in the case of Hurricane Sandy, it also helped displaced people find available housing within nearby communities; Knight Foundation Civic Tech data visualization initiative allows users to explore civic tech through a bubble treemap data visualization, sorting by themes, communities and companies. Investments are color-coded as either private investments or public grants and the size of the bubbles depends on the size of investments. As you explore each section, you can see the investment types and amounts as well as several other data points.

Reality Browser:

Reality browser is a search engine that enables the city dweller to "surf" urban objects.

Read/Write Urbanism:

Read/Write Urbanism is a paradigm where cities are conceived, for some limited purposes, as software under active object-oriented development, with public and private urban objects that have properties and attributes. We can treat the things we encounter in urban environments as system resources, rather than a mute collection of disarticulated buildings, vehicles, sewers and sidewalks. One prospect that seems fairly straightforward is letting these resources report on their own status. Information about failures would propagate not merely to other objects on the network but reach you and me as well, in terms we can relate to, via the provisions we've made for issue-tracking, for example a citizen pressing a button that reads "Tap here to report a problem with this bus shelter."

In order for anything like this scheme to work, public objects would need to have a few core qualities, qualities often described as making them "addressable, queryable, and even potentially scriptable."

Networked City:

Networked Cities is a collection of urban nuclei that operate as nodes of a world economic network. This is possible thanks to telematic networks, which have permitted the connection of cities between themselves. The Networked City seeks the generation of synergies and is based on the complementarity between its various components, which makes them interdependent. If traditionally cities' hierarchies within the economic system were based on internally structured power centers, the current role of cities within the global economy depends on their connectivity as to the transport and telecommunication networks.

The concept of the Networked City occurs on three different scales. The first of these, refers to the connection of a series of cities on a global level. In these cases what makes up the Networked City is not complete cities but rather key areas such as business centers, airports, logistic areas, etc. The second refers to the connection of cities on a metropolitan level.

For example: the city of Montpellier has established a network of broadband lines that connects it to the main cities of its surrounding area. It is a case of their complementing each other so that the urban region is more competitive on a global level. Finally, urban networks within a single city are also generated. For example: Kawasaki is carrying out a plan based on the creation of 18 "smart squares," quarters that are perfectly equipped from the technological point of view, specialize in a specific type of industry, and are interconnected among themselves. The idea is to create the first "online city" on the planet.

The connectivity of the city has become an important aspect of the contemporary world (its prosperity depends on its situation on the network), which some consider that should be included among the priorities of town planning.

Cyburg:

Cyburg is a smart city built-from-scratch, also called “Post-Carbon City.” Future cities will create a built environment that is based on a different logic than today. Humans started to construct cities thousands of years ago, as shelter for survival and as centres of housing, trading and recreation. In the future, cities will themselves be like organisms; sensitive and responsive to interaction, self-constructing “cyburgs.” They are foreseen to emerge as self-sufficient isles for energy, food, and comfort in the urban archipelago.

Examples: Songdo in South Korea, Masdar City in the United Arab Emirates, and the proposed, pedestrian-only Great City in China. These cities are planned for efficiency and are wired for data and services—cityware—all controlled by an urban operating system. Citizen access to these services is networked and ubiquitous, thanks to the implementation of civic tech.

Digital City:

Digital City or Digital Community (Smart Community, information city and e-city are also used) refers to a connected community that combines broadband communications infrastructure; flexible, service-oriented computing infrastructure based on open industry standards; and innovative services to meet the needs of governments and their employees, citizens and businesses.

Smart City:

Smart Cities is a term that has gained traction in academia, business and government to describe cities that, on the one hand, are increasingly composed of and monitored by pervasive and ubiquitous computing and, on the other, whose economy and governance is being driven by innovation, creativity and entrepreneurship, enacted by smart people. Smart City is a strategic device to encompass modern urban production factors in a common framework and to highlight the growing importance of Information and Communication Technologies (ICTs), social and environmental capital in profiling the competitiveness of cities.

A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement. The smart city concept essentially means efficiency based on the intelligent management and integrated ICTs, active citizen participation, and the premise that cities are not just places in which people live, but important platforms for innovation.

Smart cities are defined by their innovation and their ability to solve problems and use of ICTs to improve this capacity. The intelligence lies in the ability to solve problems of these communities linked to technology transfer for when a problem is solved.

City-as-a-Service:

City-as-a-Service is a paradigm that leverages and combines Infrastructure-as-a-Service (IaaS) and Software-as-a-Service (SaaS) offerings in a common platform, to allow cities to deploy new smart-city services to citizens in a rapid, and perhaps cost efficient manner. That includes solutions that help with environmental, health and safety, traffic, and even transportation challenges for cities. For example: The company Silver Spring Networks is offering up its services to deploy, manage, and operate smart city networks on behalf of the cities; current project include networking 20,000 street lights in Copenhagen, and providing city of Paris lighting and traffic control smart services.

The goal is to allow cities to essentially self-fund their smart-city network. Such a platform introduces the idea of entrepreneurs or developers being able to provide additional value, using the platform, to the cities. Developers are starting to target the city with new and innovative ideas. However, getting cities to open up their APIs to hobbyists isn't always an appealing option.

Example: an App Challenge in conjunction with the U.S. Dept. of Energy, where developers tapped into open-data sets in order to create some very powerful apps. What came of it were great app ideas for healthcare, auto, and more. At our Connected World Conference coming this February we put even greater emphasis on start-ups with a special Start-Up Pavilion right on our show floor. The vision is that some of these start-ups are in the realm of developing smart parking or lighting control for cities—or even things we haven't yet imagined, and may have a way to approach cities with their ideas in a way that might seem far more cost-effective than ever before.

U-Cities (Ubiquitous Cities):

U-Cities (Ubiquitous Cities) are those that use the help of information technology systems and sensors all over the place (inside and outside the houses,) and where all information systems are linked, and virtually everything is linked to an information system through technologies such as wireless networking and RFID tags. In order to create a complete U-city, we need to create new sensors for water management, traffic and even health care.

Applications example: sensors that detect a heart attack; automatically call an ambulance and unlock your house front door just when the emergency people get there; a traffic system that automatically adjusts the traffic light timers according to the current traffic conditions or change the traffic flow by “blocking” some routes with the traffic lights or some signals just after an accident has occurred. Geo-tagging and augmented reality with currently available smartphones will facilitate the implementation of U-City projects and ideas.

Transphysical City:

Transphysical City is the one that uses a transmissible architecture, to provide urban intelligence, where sensors and effectors will be ubiquitous and will be linked everywhere with information utilities as common as running water. A Transphysical City is designed as a sum of "intelligent environments."

Transmitting Architecture:

Transmitting Architecture is a discipline that extends the conditions for virtual community within a nonlocal electronic public realm to a physical distributing space and place. The transmission of architecture and public space alters all the familiar issues of architecture and urbanism. All at once, theory, practice, and education are confronted with questions that have no precedent of consideration within the discipline, necessitating that we turn elsewhere for guidance.

Learning from software supersedes learning from Las Vegas, the Bauhaus, or Vitruvius: the discipline of replacing all constants with variables, necessary for good software engineering, leads directly to the idea of liquid architecture. The language and metaphors of networked, distributed computing apply even greater torque to the straining conventional definitions of architecture: not only is real time now an active concern of the architect, but the logistics of sustainable, transmissible illusion become as real as the most physical material constraints. An economy of bits replaces the economy of sticks and stones.

Real-Time City:

Real-Time City is a paradigm where cities are being instrumented with digital devices and infrastructure that produce ‘big data’, which smart city advocates argue enables real-time analysis of city life, new modes of urban governance, and provides the raw material for envisioning and enacting more efficient, sustainable, competitive, productive, open and transparent cities.

The implications of big data and smart urbanism have emerging areas of study and concerns, such as: big urban data utilization, technocratic governance and city development, city governance and technological lock-ins, security protection for hackable cities, and the panoptic city.

City 2.0:

City 2.0 is a sustainable model for cities that takes full advantage of the technologies of the Information Age. Every aspect of City 2.0—from energy, water and waste to buildings and transportation systems is designed with the life cycle in mind. It seeks integrating IT into the fabric of cities to better match supply with demand.

It includes deploying systems of resource micro-grids, a widespread, interconnected IT network made up of sensors, handheld devices and data centers, to deliver resources according to the ebb and flow of urban needs. These intelligent technologies would ensure precise availability where and when resources are needed, reducing unused surplus and waste.

Soft Cities (e-Cities):

A city is “soft” to the extent that it can be characterized as a meta-network of data flows and personal communication, operating to some extent independently of the “hard” infrastructure of buildings and roads. It is one whose physical elements are functionally augmented by cameras and other sensors that feed data to everything from ventilation equipment to command-and-control centers for surveillance, emergency response, and day-to-day operation of public services.

Piggybacking on this infrastructure, is another layer of softness that includes buildings and streets acting as urban informatics systems, displaying real-time public transit data and parking availability, as well as innovations like smart meters in private homes. In the new soft city, people are offered “awareness,” governments obtain “intelligence,” and planners, architects and engineers get lots of rich new “data mines.”

Garden City Movement:

The garden city movement is a method of urban planning where cities are intended to be planned, self-contained communities surrounded by "greenbelts", containing proportionate areas of residences, industry and agriculture. An ideal garden city would house 32,000 people on a site of 6,000 acres (2,400 ha), planned on a concentric pattern with open spaces, public parks and six radial boulevards, 120 ft (37 m) wide, extending from the centre.

The garden city would be self-sufficient and when it reached full population, another garden city would be developed nearby. Its proposers envisaged a cluster of several garden cities as satellites of a central city of 50,000 people, linked by road and rail. Many cities and neighborhoods in the US and UK follow this model. The Principles of Intelligent Urbanism derive from this movement, and subsequent intelligent urban paradigms such as smart cities.

Smart Meters:

Smart meters are digital utility service meters (e.g.: electricity meters) that unlike conventional service meters that can only measure the total amount of service (e.g.: Kilowatts) used over a billing period, can also record how much and when the service is used, typically hourly, and transmit this information automatically. A smart meter will typically record the customer's total service consumption hour by hour and send that information to the utility billing through a wireless communications network. Electronic bills are typically based on Automated Meter Reading (AMR).

Smart meters are used to electronically track how much electricity a home or small business uses and when it is used. With that information, electricity prices can vary at different times of the day, encouraging you to think more about how and when you use electricity. Smart meters make it possible to introduce time-of-use pricing to homes and small businesses.

Smart Pricing:

Prices change based on the day as well as the time of day (Time-of-Use Prices) or real-time demand (Demand-Responsive). Time-of-use pricing is a rate structure that reflects the costs associated with utility service production throughout the day. Prices rise and fall over the course of the day and tend to drop overnight and on weekends, depending on demand and the availability of supply.

Demand-Responsive pricing is based on real-time use volume, for example in smart parking meters environments, when the parking fees are based on usage and demand, location and time of the day.

Smart Grid:

A smart grid is a modernized electrical grid that uses analog or digital information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

Examples and Case Studies: See References at the end of this document, i.e.: papers and articles about San Francisco, Ontario, Smartgrid.gov, Dominion, HydroOne, and other references.

PlanIT Urban OS:

The PlanIT Urban Operating System or PlanIT OS is a standards-based middleware product that provides real time sensing, control, spatial analytics, data integration, security, support and provisioning of ubiquitous context relevant applications for the Internet of Things. The PlanIT OS provides the infrastructure for solutions across a broad range of vertical markets from manufacturing through mining exploration.

The PlanIT Urban Operating System (UOS) is the implementation of the PlanIT OS for smart city and urban development markets. Although the PlanIT OS is increasingly being adopted around the world for new markets, Living PlanIT originally developed the PlanIT OS focusing primarily on two key markets which constitute subsets of the 'Internet of Things': Living Cities / Smart Urban Developments – the emerging market for increasingly intelligent, sustainable buildings and infrastructure, whether deployed in new cities, major regeneration projects in existing cities, or individual developments; and Machine-to-Machine (M2M) Communications - the ‘connected device’ market, based on increasingly pervasive networks and providing remote sensing and interaction with a wide array of embedded and mobile devices, ranging from smartphones to vehicles, to robotic devices, to sensor ‘motes’.

Sound Garden:

Tactical Sound Garden is a concept of interactive GIS online applications and data contexts where designers assign sounds to public places, which users can then listen to using Wi-Fi–enabled devices.

CloudStore:

CloudStore is an online marketplace where suppliers offer their services to the public sector via the G-Cloud framework. Public sector bodies can review and buy these services on CloudStore. Cloud computing lets you access internet-based computing, reducing the need for cities to invest in their own hardware and software, and allowing them to avoid long contracts, buy the exact amount of computing resources they need, save money on maintenance and physical storage, and avoid custom-built solutions which take a long time to create, are expensive and difficult to upgrade.

For example: CloudStore has an online catalogue containing details of suppliers and their services. It offers more than 1,200 suppliers and more than 13,000 services across all types of cloud service models, with offerings under 4 categories (‘Lots’): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Specialist Cloud Services (SCS).

G-Cloud:

The G-Cloud is a City-as-a-Service framework that aggregates agreements with suppliers that set out terms and conditions under which purchases can be made throughout the term of the agreement. The G-Cloud allows cities to pay for services as they use them.

Linked Open Government Data (LOGD):

Linked open government data (LOGD), pioneered by Data.gov and Data.gov.uk, is emerging on the linked-data Web as a way of facilitating opening, linking, and reusing OGD. Linked data offers minimal consensus on data representation (using URIs and the Resource Description Framework) and data access (via HTTP), aligned with the "5 star deployment scheme for Open Data (http://5stardata.info/)."

A roadmap of linked open government data was established, based on community consensus from the 2011 AAAI Fall Symposium on Open Government Knowledge. The LOGD three data-processing stages model enhances the raw open government data from data providers using the combination of machine power and human power and deliver higher-quality data to a wide range of data consumers via visualizations, mashups, and more.

Public-sector bodies produce and collect government data that records authoritative information about government activities (such as spending and service provision) and regional statistics (such as economic indicators). The emerging open government data (OGD) movement demands proactive release of government data on the Web, free of charge and with minimal constraints on reuse. Key benefits of OGD include facilitating the reuse of government data, opening up new business opportunities, enhancing government transparency and citizen engagement, and distributing the cost of government data processing to communities.

Examples: Data.gov, the US national OGD portal (www.data.gov), was launched in May 2009. A few months later, in January 2010, the British government launched Data.gov.uk (http://data.gov.uk). The European Commission encourages OGD through the 2003 Public Sector Information Directive and the 2011 Open Data Package (http://ec.europa.eu/information_society/policy/psi). As of January 2012, more than 700,000 OGD datasets have been put online by national and local governments from more than 30 countries (http://logd.tw.rpi.edu/demo/international_dataset_catalog_search).

One of the major challenges for OGD is the costly integration of government data across domains and political boundaries, because OGD datasets are published in various formats, use different vocabularies, and are accompanied by metadata of varying quality. LOGD is recognized as a Web-based open ecosystem that organically interconnects the original data owners (such as government agencies), dataprocessing service providers (such as entity resolution services), and data consumers (enterprises and citizens).

Civic Data:

Civic Data is an Open Data initiative that intends to simplify how open data is published and managed, provide standard, cross-jurisdictional data in one place, enable developers to build and deploy civic apps across multiple jurisdictions, address the needs of agencies large and small, and make these capabilities free and easy.

The open data movement mission is to impact governing, civic engagement and government business. An increasing number of agencies are actively providing open data, even though it's complex and costly for them, and there are very few implemented standards—datasets are described in very different ways.

Cityware:

The cityware project is a pilot initiative to instrument, electronically, some of the mobile phone-based phenomena that take place without us being aware of them. It uncovered significant cultures of Bluetooth usage that weren't generally known about. It used fixed devices capturing Bluetooth radio signals transmitted from devices such as mobile phones, laptops and digital cameras, and gathering data to study how people move around cities.

Big Data:

Big data is the Data Sciences term for a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. The challenges include capture, curation, storage, search, sharing, transfer, analysis and visualization.

The trend to larger data sets is due to the additional information derivable from analysis of a single large set of related data, as compared to separate smaller sets with the same total amount of data, allowing correlations to be found, for example: to spot business trends, determine quality of research, prevent diseases, link legal citations, combat crime, and determine real-time roadway traffic conditions, etc.

Examples and Case Studies: See References at the end of this document, i.e.: papers and articles about New York City big data and business intelligence initiatives, and other references.

Data Visualization:

Data visualization is the creation and study of the visual representation of data, meaning information that has been abstracted in some schematic form, including attributes or variables for the units of information. The main goal of data visualization is to communicate information clearly and effectively through graphical means.

Crowdsourcing Technology:

Crowdsourcing is an online, distributed problem-solving and production model, where organizations use the Internet to outsource work to individuals. Crowdsourcing is also the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers.

Civic Hacker:

A Civic Hacker is one who collaborates with others to create, build, and invent open source solutions using publicly-released data, code and technology to solve challenges relevant to their neighborhood, city, state, or country.

Some examples of Civic Hacker initiatives are the ones in the Code for America organization.

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