SMART CITIES AND THE FUTURE INTERNET
Innovation for All within Smart Environments

Nicos Komninos
URENIO Research, Aristotle University
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The Urban and Regional Innovation Research is a University Lab of Aristotle University of Thessaloniki for the promotion of applied research and the supply of technological services in the field of innovation ecosystems and intelligent cities.

URENIO is mainly involved in competitive projects of the European R&D framework programmes (FP), the CIP, the innovative actions of the ERDF, and the programmes of Territorial Cooperation.

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Intelligent City Strategies

Watch: Intelligent Cities – Smart Cities – Innovation Ecosystems

N.Y.C. has Fastest-Growing Tech Industry in U.S
Riding a wave of start-ups, New York has emerged a national leader in fields that leverage the Internet and mobile technologies—a development that has provided a key economic boost and left the city well positioned for future tech growth. Continue reading...

Posted at 14 May 2012 in Virtual Clusters / Digital Ecosystems

A European Architecture Model for Smart Grids
With the Smart Grid Architecture Model (SGAM), Siemens Infrastructure & Cities has developed a method whereby power supply companies and industry can display aspects of smart grid systems. The model can be used for the visualization, validation, and configuration of smart grid projects, and also for standardization within smart grids. Continue reading...

Posted at 14 May 2012 in Intelligent / Smart Cities Solutions

Smart City Market Growing Fast
According to a new market research report, the Smart City market is growing at an amazing pace, at 14.2% annual growth rate, and it is expected to reach more than $1 trillion in a few years. Continue reading...

Posted at 13 May 2012 in Intelligent Cities / Smart Cities

Vienna: A City on the Cutting Edge of the “Smart City” Movement?
“Smart cities” is the urban buzz phrase of the moment, and Vienna is in the forefront of European efforts to model future urban communities. Continue reading...

Posted at 13 May 2012 in Intelligent / Smart Cities Strategies

Categories
- INNOVATION
- Knowledge Economy
- Innovative Companies
- Innovation Measurement
- INNOVATION ECOSYSTEMS
- Innovation Clusters
- Technology Parks
- Incubators
- Living Labs
- Innovative Cities & Regions
- Regional Systems of Innovation
- Innovation Strategies
- Virtual Innovation Environments
- Digital ecosystems
- INTELLIGENT CITIES / SMART CITIES
- Digital / Cyber Cities
- Videos on Intelligent Cities
- Drivers of City Intelligence
- Strategic Intelligence
- Collective Intelligence
- Technology Transfer-Leaders
- Collaborative Innovation
- Marketing and Promotion
- Intelligent / Smart Cities Strategies
- Smart Cities Solutions
- Business Models
- IntelCities Measurement
Applications

An Open Source Community for Intelligent / Smart Cities

ICOS website supports a community offering open source solutions in the field of intelligent cities / smart cities. The community will serve to showcase existing projects, provide a forum for discussing projects and processes, and guide developers' groups in open source creation, contribution, and release.

Featured open source applications for:

**Innovation Economy of Cities**

**Virtual City Market**
Empowers the city local marketplace by bringing together customers and merchants.

**City Infrastructure – Quality**

**Improve my City**
Improve my city allows citizens to report, vote and track non-emergency issues.

**City Governance**

**OpenBlock**
OpenBlock is a hyper-local news & data platform.

About The Intelligent Cities Open Source Community

<table>
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<th>Who can participate</th>
<th>Benefits</th>
<th>How to contribute</th>
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<td>ICOS is addressed to anyone interested on</td>
<td>The continuous evolution of web technologies</td>
<td>Developers can upload open source applications</td>
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The Centre
The Greek Benchmarking Center is an activity of URENIO research unit, which aims at popularizing Benchmarking in corporations and organizations. More »

Other Organizations
DTI - BenchmarkIndex
The Department of Trade and Industry in Great Britain has developed the BenchmarkIndex, a tool for the application of Benchmarking in businesses. BenchmarkIndex service is provided in Greece by the Greek Benchmarking Center.

The technique of Benchmarking
It involves the comparative evaluation of technologies, production processes and products of a corporation/organization, compared to the leading organizations in the field. Benchmarking is achieved through carefully chosen indicators and allows the corporation to reorganize itself successfully, via an understanding of its strengths and weaknesses. More »

Target group

<table>
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<th>Enterprises</th>
<th>Certified Consultants</th>
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<td>On-line applications for company benchmarking:</td>
<td>The benchmarking service for corporations is provided by a network of certified consultants.</td>
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<td>Manufacturing</td>
<td>See the network of certified consultants</td>
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Regions
Monitoring of regional performance in specific areas. More »
Publications

Watch: Intelligent Cities – Smart Cities – Innovation Ecosystems

Publications on Intelligent Cities / Smart Cities

Books, Special Issues of academic journals, articles, and conference presentations dealing with theories, concepts, strategies, and applications of intelligent cities and smart cities.

BOOKS
Link: Routledge

Link: Taylor and Francis

JOURNAL SPECIAL ISSUES
Link: IJIRD, Inderscience

Link: JKEC, Springer

ARTICLES


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- Smart Cities Solutions
- Business Models
- IntelCities Measurement
1. Intelligent Cities and the Future Internet
The smart city concept is multi-dimensional. It is a future scenario (what to achieve), even more it is an urban development strategy (how to achieve it). It focuses on how (Internet-related) technologies enhance the lives of citizens.

This should not be interpreted as drawing the smart city technology scenario. Rather, the smart city is how citizens are shap[ing] the city in using this technology, and how citizens are enabled to do so. The smart city is about how people are empowered, through using technology, for contributing to urban change and realizing their ambitions. The smart city provides the conditions and resources for change. In this sense, the smart city is an urban laboratory, an urban innovation ecosystem, a living lab, an agent of change.

Much less do we see a smart city in terms of a Ranking. This ranking is a moment in time, a superficial result of underlying changes, not the mechanism of transformation. The smart city is the engine of transformation, a generator of solutions for wicked problems, it is how the city is behaving smart.”
Intelligent Cities: Internet supported Innovation Ecosystems

Part I: Clusters: Innovation as Spatial Proximity.

Part II: Innovating Regions: Innovation as an Institution.


Smart city: An agglomeration of Urban Innovation Ecosystems

Layer 1: City Districts
People, Activities, Infrastructure

Layer 2: Innovation Ecosystems of Districts
4 Fundamental Processes: Watch – Learn – Innovate – Market

Layer 3: Apps + Embedded Systems + Social Media
4 Types of Applications
- Intelligence
- E-Learning
- Co-Creation
- Marketplace
**Innovation Economy**
- City sectors: Manufacturing, commerce, business services, financial services, education, research, health, tourism, primary sector activities
- Clusters: Various groups of interconnected organisations and activities specific to the city

**City Infrastructure – Utilities**
- Mobility, transport and parking
- Energy networks, saving, smart grid
- Water networks management and saving
- Broadband, wired and wireless

**Living in the city**
- Quality of life
- Social and digital divides
- Environment
- Social care services
- Safety and security

**City Governance**
- Decision making / citizens participation / democracy
- Government services to citizens
- City planning / city management
- Monitoring and benchmarking
Sensor networks allow monitoring of any environment that seems inaccessible and hidden. They consist of a group of small electronic devices that capture data from outside via sensors, processes these data, and generate and send alerts.
Cloud: Economies of scale and scope

Augmented reality

Interactive services everywhere
Source: Urbanscale
IBM Smart City concept
Creating a Smarter Planet, One Collaboration at a Time
Dr. Matthias Kaiserswerth, Vice President and Director of IBM Research - Zurich
CISCO: Urban Operation System

CISCO Intelligent X
INNOVATION ECOSYSTEMS supported by INTERNET TECHNOLOGIES

Smart cities: Connecting two stories – HOW???

Urban Operating System (UOS™)
Living PlanIT's Urban Operating System (UOS) provides a unified platform for the instrumentation, control, and optimization of urban environments, based on Cisco network and data center hardware. UOS software allows a Cisco ISR router to supplant traditional building controllers, which are normally single-purpose devices. The building benefits from a shared infrastructure that supports deep sensing, responsive real-time control, and high-speed flexible networking.

A wide range of sensors and actuators, supplied by Living PlanIT and Cisco partners, communicate over IPv6 and allow a complete picture of building state, usage, and operations to be continually maintained, allowing constant optimization of energy, resources, environment, and occupant support and convenience systems. The UOS provides near-real-time communication of events across an entire city and beyond, meeting multi-level control needs via applications such as energy generation / storage / distribution / demand shaping and traffic and transportation management.
2. Current Trends:
Towards glocal and hybrid innovation ecosystems
INNOVATION

TECHNOLOGY EVOLVES

Sustaining Mastery
Over a Technology:
Building of firm foundations;
improving, augmenting, applying

Diminishing Returns

THE BREAKTHROUGH!

Pioneering
Engineering & Science:
Prospecting for new possibilities;
exploring, evaluating, inventing

MEASURE OF ADVANCEMENT

NEW TECHNOLOGY CURVE

EXISTING TECHNOLOGY CURVE

MEASURE OF APPLIED EFFORT

The diffusion of innovations according to Rogers. With successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level.

Technology Adoption

Source: Forbes Magazine
Schumpeter’s theory of innovation

Mark I model (1934): Introduced the distinction between ‘invention-discovery’ and ‘innovation-commercialization’. The separation of invention from innovation characterized the typical innovation model of the late nineteenth century, in which independent inventors provided new product and process inputs to entrepreneurial firms.

Mark II model (1943): Schumpeter became aware of the rise of in-house R&D departments in large companies. Innovation was seen envisaged as a more routinised process within large companies.

Source: http://www.affinnova.com/blog/bid/65223/The-Innovation-Funnel-Bringing-Ideas-To-Life
Griliches (1979) innovation input-output model:
\[ \ln \text{PATs} = \beta_1 \ln \text{IR&Ds} + \beta_2 \ln \text{UR&Ds} + \beta_3 \ln \text{Cs} + \text{POPs} + \varepsilon_s \]

Nelson and Winters (1982) evolutionary metaphor: (1) Companies follow organizational routines, (2) Innovation starts by search activities, which challenge established routines leading their modification and/or replacement, (3) **The modification of routines is influenced by an external selection environment**, which is formed by organizations that affect the transformation of knowledge to products (consulting, marketing, finance).

‘National Innovation Systems’ Freeman (1987): ‘The rate of technological change in any country ... does not depend simply on the scale of their R&D... The national system of innovation may enable a country with limited resources.... to make progress through appropriate combination of imported technology and local adaptation and improvement.’
Innovation is rapidly becoming democratized. Users, aided by improvements in computer and communications technology, increasingly can develop their own new products and services. These innovating users—both individuals and firms—often freely share their innovations with others, creating user-innovation communities and a rich intellectual commons. In *Democratizing Innovation*, Eric von Hippel looks closely at this emerging system of user-centered innovation. He explains why and when users find it profitable to develop new products and services for themselves, and why it often pays users to reveal their innovations freely for the use of all.
The Open Innovation Marketplace

The Open Innovation Marketplace, published in the Spring of 2011, introduces groundbreaking strategies and models for leveraging the world’s best innovation sources to drive far more value from new products, services, and business models – and do it with far less risk. Drawing on their experience building InnoCentive, authors Alpheus Bingham and Dwayne Spradlin show how to dramatically increase the flow of high-value innovations your organization can discover—and deliver.

Through detailed case studies, from leading innovators such as Procter & Gamble, Eli Lilly, and NASA, Bingham and Spradlin demonstrate open innovation at work in pharmaceuticals, consumer products, software, aeronautics, and beyond. They show how to construct Challenges that focus innovation on critical business needs, can attract breakthrough strategies and solutions, and how to transform your enterprise to do it over and over again.

Alpheus Bingham, Innocentive founder &
Dwayne Spradlin, InnoCentive CEO
INNOVATION ECOSYSTEMS become GLOCAL + HYBRID

Innovation Network partners belong to four categories

Inventors
- Intellectual powerhouses (like MIT, Oxford, HP Labs) that conduct basic research and design products and services that result in patentable inventions.

Transformers
- Multifunction production and marketing companies (like Dell, IBM, Infosys) that convert inputs from Inventors and other Transformers into innovations.

Financiers
- Funding sources (VCs, Vulcan, ICICI Bank) for Innovation Network service providers especially Inventors and start up Transformers.

Brokers
- Market makers (yet2.com, InnoCentive) that find and connect Innovation Network service providers, buying and selling or enabling service delivery.

RESEARCH AND TECHNOLOGICAL DEVELOPMENT
- Research institutes
- University research
- R&D in large companies
- Innovative SMEs

INNOVATION FINANCE
- Venture capital funds
- Technology incentives
- Regional incentives and aids
- Spin-offs/start-ups

TECHNOLOGY TRANSFER
- Co-operation between universities and companies
- Technology brokerage
- Licensing

NEW PRODUCT DEVELOPMENT
- Provision of management, product, market, and quality services
- Specialised centres
- Business consultants

PROCESS INNOVATION
- Clusters and networks
- Technology co-operation
- Supply chains
- Alliances
- Distribution & Promotion
3. Innovation Ecosystems into the Future Internet
INNOVATION ECOSYSTEMS into the INTERNET: micro NETWORKS meet digital mega NETWORKS

Semantic Web Services
- e-challenges
- Semantic Driven Development
- Monitoring Services
- Composing Services
- Discovering Services
- Sharing Knowledge
- Managing Knowledge

QR CODES – AUGMENTED REALITY

CLOUD

INTERNET OF THINGS
1. ECOSYSTEMS DEVELOP HUNDREDS OF NODES

The power of crowdsourcing!

CROWD-R&D

Issues the award amount to the winning scientist/Solver.

CROWD-SOURCING

CROWD-FUNDING

CROWD-TASKS
2. ECOSYSTEMS OF USER-DRIVEN INNOVATION: From passive to active nodes - Consumers turn to producers

Product Development 2.0:
Using the Web to Put Users in Control and Co>Create Better, Richer Products Faster

Web 2.0 NPD

Living Labs

Source: http://web2.0
3. INNOVATION ECOSYSTEMS BECOME HYBRID:
Digital identities drive innovation / commercialization!

**All products become hybrid:**
*Physical - virtual (web) presence*

- Spread of augmented reality solutions
- Internet-of-Things
- All objects become hybrid: physical – virtual identity
- Generation of a sea of digital identities

**Web presence becomes key factor of innovation / commercialization**

- Web applications + apps on smart phone / social media guide commercialization / innovation diffusion
- Few platforms / Thousands of developers
- Common technology base
- Common marketplace
- Low developers control
- **Low intellectual property protection**
4. TRACKING OF INNOVATION NODES AND IDENTITIES: Location and profile aware ecosystems and strategies

INTELLIGENCE-LED STRATEGIES

LOCATION-AWARE SYSTEMS

- **Research Lab**
- **Inventor**
- **Financier**
- **Producer**
- **Supplier**
- **Broker**
- **Customer**

**IDEATION**
- Gather customer insights and analyze customer needs and segment customer base
- Conduct market research
- Scout new technologies
- Map emerging technologies and analyze trends

**PROJECT SELECTION**
- Rigorously manage return on innovation investment
- Maintain strong process discipline
- Manage risks
- Test rigorously for quality

**PRODUCT DEVELOPMENT**
- Design products that respond to customers' priorities
- Bring products quickly to market with an emphasis on increased modularity and simplicity
- Test rigorously for quality
- Carefully manage product life cycle and retirement

**COMMERCIALIZATION**
- Successfully launch, position, and price wholly new products

**NEED SEEKERS**
- Identify unmet customer needs through direct feedback and strive to be the first to market with breakthrough products. Example: DeWalt (power tools)

**MARKET READERS**
- Focus on incremental changes to products and use a second-mover strategy to keep risk low. Example: Pfanstiehl (audio equipment)

**TECHNOLOGY DRIVERS**
- Rely on technological breakthroughs from internal R&D efforts and seek to meet their customers' unarticulated needs. Example: Siemens (engineering and electronics)

Source: Booz Allen Hamilton
Cloud computing: **Three service models** (software as a service-SaaS, platform as a service-PaaS, and infrastructure as a service-IaaS), **four deployment modes** (private, community, public and hybrid clouds), **five essential characteristics** (on-demand self service, ubiquitous network access, metered use, elasticity, and resource pooling), (Mell and Grance 2011)
4. Innovation-for-ALL: BOWE Systems
NEW INNOVATION MODEL COMPONENTS:
Knowledge base (WEB) – Funding (CLOUD) – Markets (FIRE)
KNOWLEDGE / TECHNOLOGY BASE
Web 1.0 -> Intelligent Web

- Web technology as basic training for all science and technology disciplines
- Web technology + sector specific technology sustaining innovation in any sector
Virtualization and lowering entry costs
Self service on demand
Metered use
Scalability of costs and charging
Platform-based innovation
Direct access to global market
Open entry, low cost, hyper competition, low IP protection
MARKETS
Future Internet based global services

- **Creative users**: new tools to allow final users to create and share personalised services (not only contents, but also applications)
- **Semantically tagged content and knowledge**: applications not only provide information but also intelligently process information
- A **world-wide network of uniquely addressable and interconnected objects**, based on standard communication protocols.
- A **multitude of connected IT services**, which are offered, bought, sold, used, repurposed, and composed by a worldwide network of service providers, consumers, aggregators, and brokers
A New Industry Ecosystem to Change the Effect:

- Merck
- Coca-Cola
- Texaco
- Computer Sciences Corp.

Collaborative Commerce Network < 25 users
Joint Data Network < 500 users
Information & Sensor Network > 1000 users

World Economic Forum
International Council for Science

Design Management Team:
Shared Vision, Planning, and Implementation Strategy

"Intense Collaboration"

Ecosystem Design & Coordination

Ecosystem Management & Marketspace Awareness

Keystone Players
Niche Players (E.g., Orkin, MMV, World Bank, Clinton Foundation, McKesson, GE Healthcare, Health Ministries)
Government, Public Health, Science Mediators

Source: Blue Spoon Consulting