TOPIC

TRANSPORTATION - SENSORS - AND THE SMART CITY
GEOG 491/591 ADVANCED GIS

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

- **THE SMART CITY**
  A working knowledge of “smart cities”
- **SENSORS**
  The role that “sensors” play in a smart city
- **TRANSPORTATION/MOBILITY**
  Opportunities to address issues/challenges of transportation / mobility within a smart city
- **LOCATION, LOCATION, LOCATION**
  The role GIS / Mapping / Geospatial Technologies will play in smart cities
- **PRACTICE**
  Complete you own project using multiple sensor-fed data streams to examine the topic of bicycle transportation at the University of Oregon.

TOPIC

GOALS - OBJECTIVES - OUTCOMES

DATE	4-1-15	LECTURE	#2 - THE SMART CITY

- **SMART CITIES OF THE FUTURE**
  THE EUROPEAN PHYSICAL JOURNAL

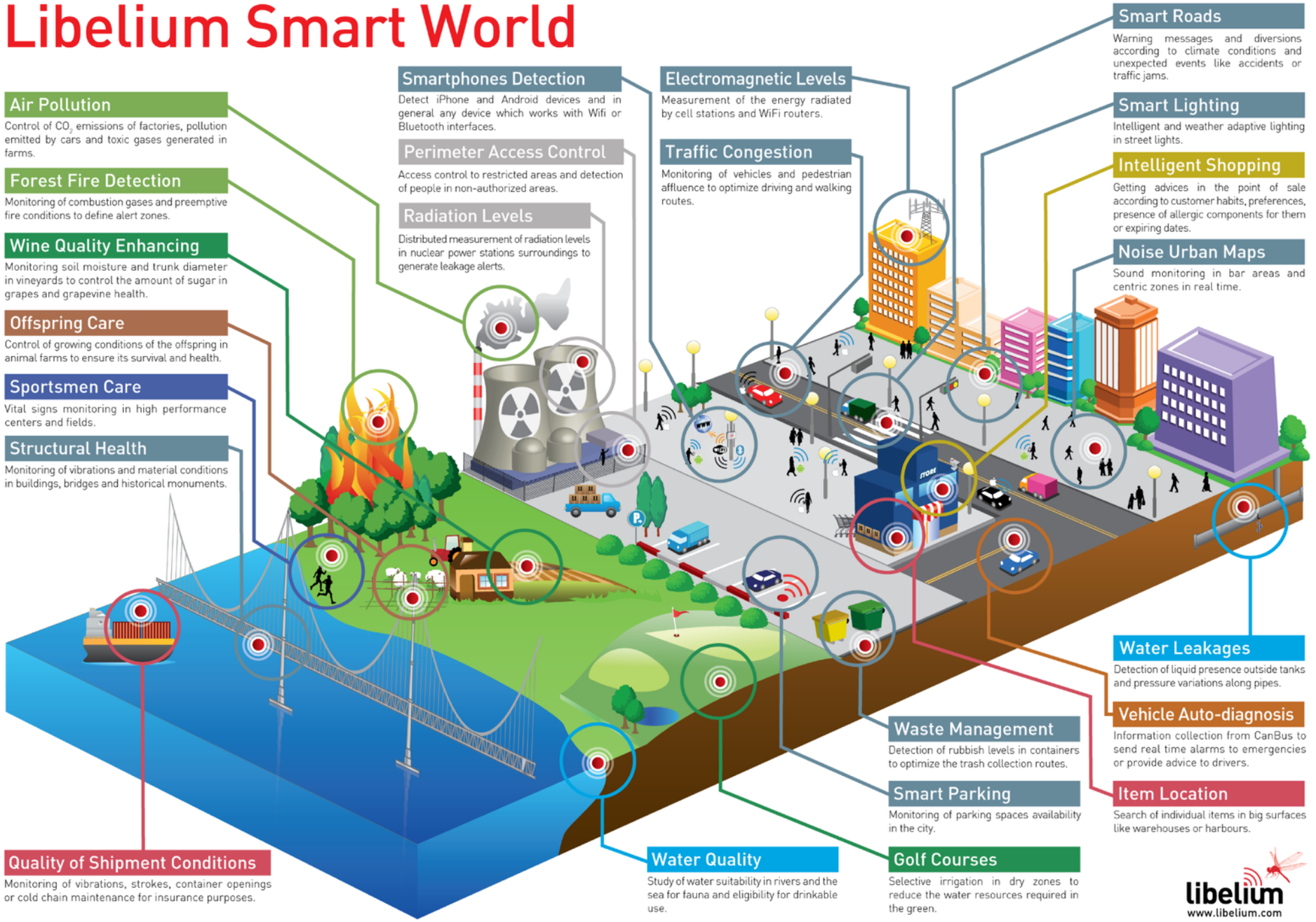
- **CAN WE TRUST SMART CITIES?**
  govtech.com

TOPIC

ASSIGNED READINGS FOR TODAY

DATE	LECTURE
4-1-15	#2 - THE SMART CITY

Libelium Smart World



TOPIC

THE SMART CITY - IMAGES AND INFOGRAPHICS

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

SENSORS AND CITIES

SMARTER OPERATIONS:

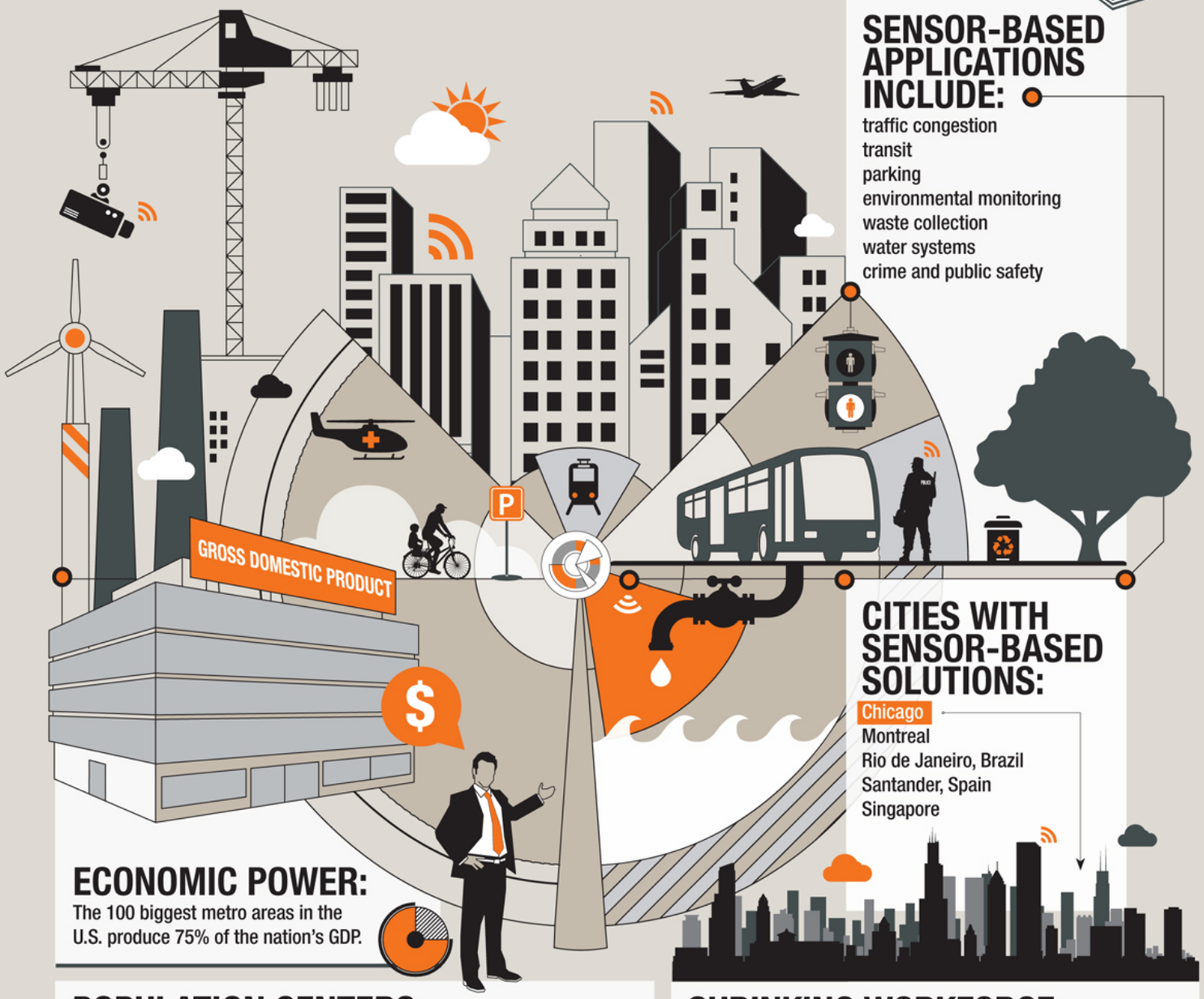
Sensors can measure, track and locate a wide variety of factors in the urban environment. Data from sensors can be analyzed and used to run systems more efficiently and effectively, improving services for citizens while reducing the cost of government operations.

BIG BUSINESS:

By 2020, cities are expected to spend $20 billion on sensor technology.

SENSOR-BASED APPLICATIONS INCLUDE:

traffic congestion
transit
parking
environmental monitoring
waste collection
water systems
crime and public safety



CITIES WITH SENSOR-BASED SOLUTIONS:

Chicago
Montreal
Rio de Janeiro, Brazil
Santander, Spain
Singapore

ECONOMIC POWER:

The 100 biggest metro areas in the U.S. produce 75% of the nation's GDP.

POPULATION CENTERS:

By 2030, six out of 10 people in the world will live in cities; the number will reach seven out of 10 by 2050.

SHRINKING WORKFORCE:

U.S. cities have cut more than 500,000 jobs from their payrolls. City revenue declined every year between 2006 and 2012.

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Libelium Smart World

Air Pollution
Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.

Forest Fire Detection
Monitoring of combustion gases and preemptive fire conditions to define alert zones.

Wine Quality Enhancing
Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

Offspring Care
Control of growing conditions of the offspring in animal farms to ensure its survival and health.

Sportsmen Care
Vital signs monitoring in high performance centers and fields.

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

Quality of Shipment Conditions
Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.

Smartphones Detection
Detect iPhone and Android devices and in general any device which works with Wifi or Bluetooth interfaces.

Perimeter Access Control
Access control to restricted areas and detection of people in non-authorized areas.

Radiation Levels
Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.

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

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

Smart Roads
Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

Smart Lighting
Intelligent and weather adaptive lighting in street lights.

Intelligent Shopping
Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.

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

Water Leakages
Detection of liquid presence outside tanks and pressure variations along pipes.

Vehicle Auto-diagnosis
Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.

Item Location
Search of individual items in big surfaces like warehouses or harbours.

Waste Management
Detection of rubbish levels in containers to optimize the trash collection routes.

Smart Parking
Monitoring of parking spaces availability in the city.

Water Quality
Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.

Golf Courses
Selective irrigation in dry zones to reduce the water resources required in the green.

libelium
www.libelium.com

www.libelium.com

www.iotphils.com

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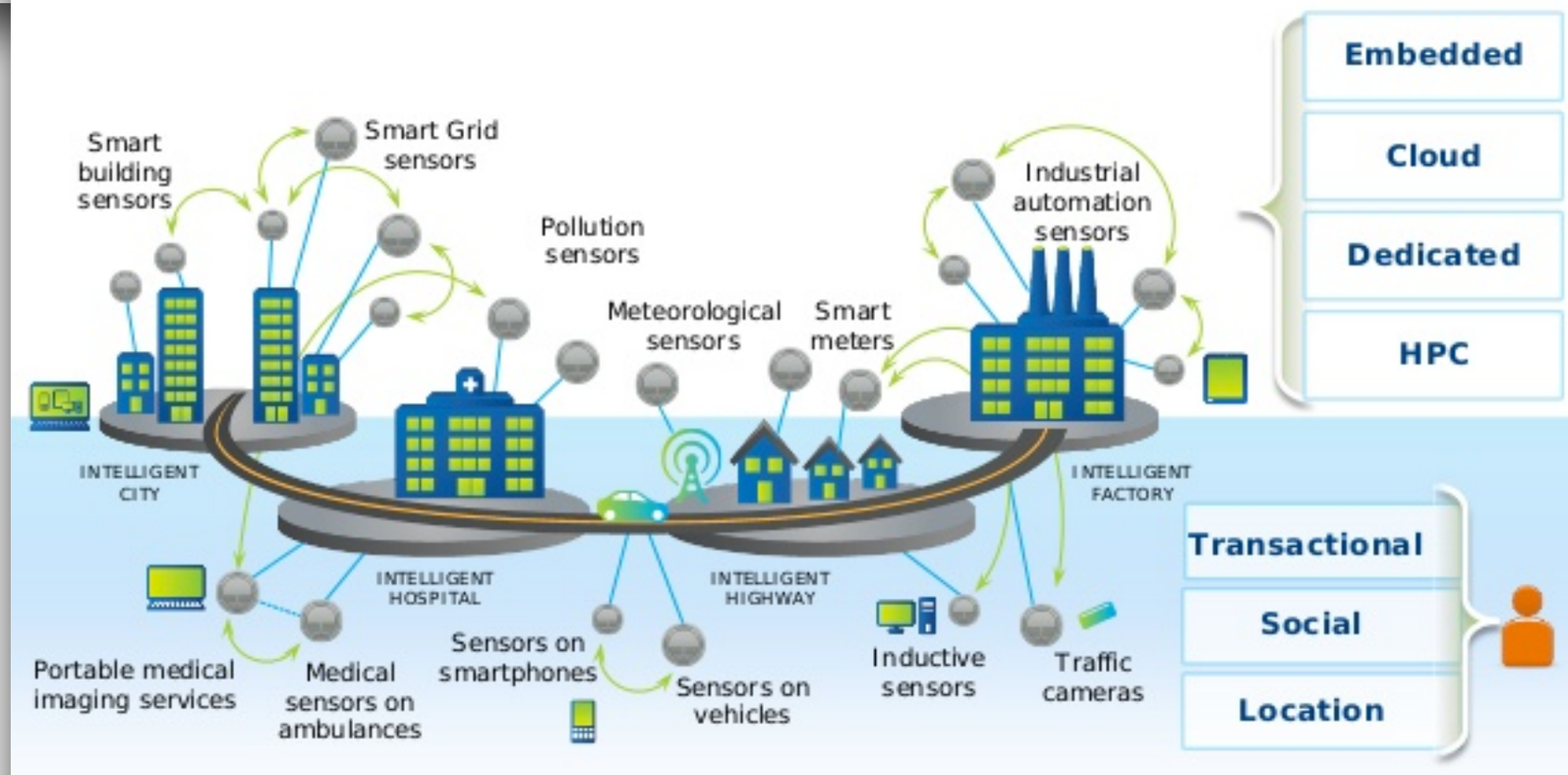
Smart City Sensor Model



www.slideshare.net

IDF2013
INTEL DEVELOPER FORUM

SMARTER SMART CITIES

The "smart cities" agenda is mainly focused on top down technological initiatives (embedded sensors, data integration and analytics).
The real smart cities of the future will mobilise human intelligence as well as artificial intelligence, bottom up creativity as well as top down control.

1. TOP DOWN SMART CITIES

City planners and corporations use IT infrastructure to optimise the flows of people and goods and deliver public services more efficiently

smartcity barcelona

Barcelona
Has embedded sensors in the city's infrastructure to monitor and manage water use

IBM

IBM
Has designed a centralised Intelligent Operations Centre to coordinate and manage all of a city's services

PlanIT's Urban Operating System
Is marketed as a way to manage the entire urban landscape

2. CONNECTING TOP AND BOTTOM

People use open data released by local authorities and companies to create services, and local authorities collect data from citizens to improve their services

FixMyStreet

Fixmystreet
Allows citizens to map local issues from potholes to confusing signage and bring it to the attention of local authorities

STREET BUMP

Streetbump
An app that identifies potholes by recording "bump" data, providing the city with real-time data on road conditions

BetriReykjavik

Betri Reykjavik
A platform which crowdsources opinions on city legislation, with the most popular ideas debated by the council

3. BOTTOM UP SMART CITIES

Citizens generate and share data to improve the way their city works, they act collectively and connect with each other to share resources

SMART CITIZEN

Smart Citizen Kit
The Smart Citizen project uses low cost sensors and a web platform to enable citizens to capture, share and make sense of environmental data about their city

Change by Us NYC

Changebyus
A place for citizens to put ideas into action to make their city a better place to live

BlindSquare

Blindsquare
Uses crowdsourced information and GPS to help blind people navigate the city

Peerby
Promotes collaborative consumption by allowing neighbours to share or rent their possessions

rippleffectgroup.com

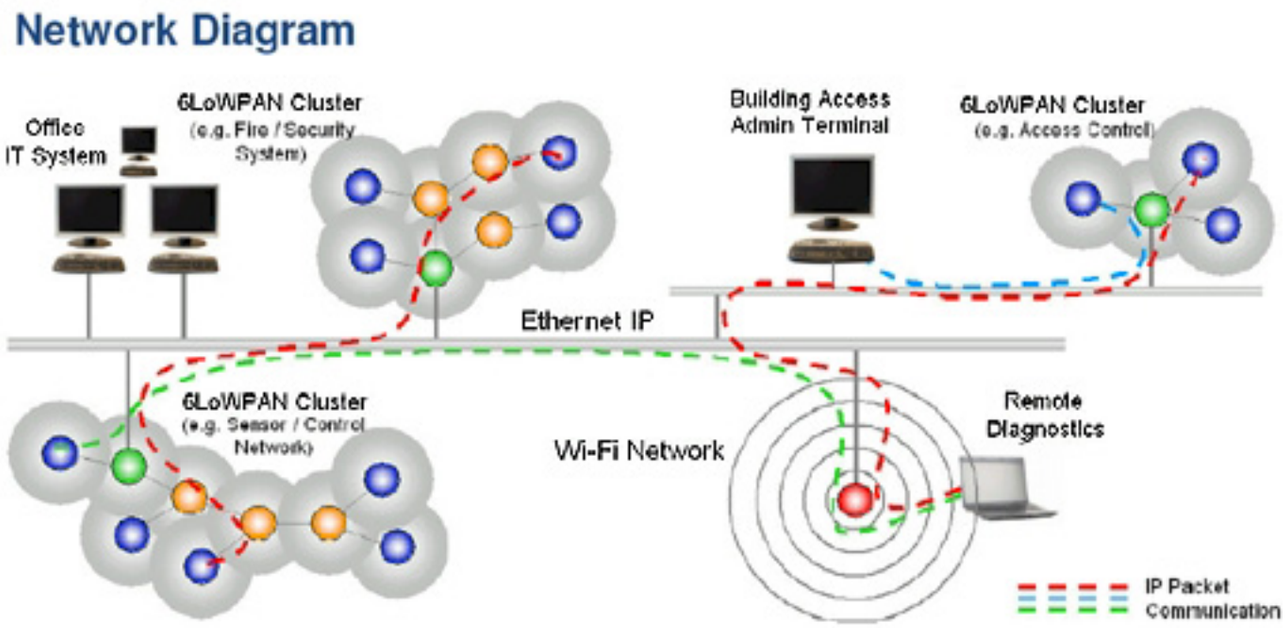
labs.sogeti.com

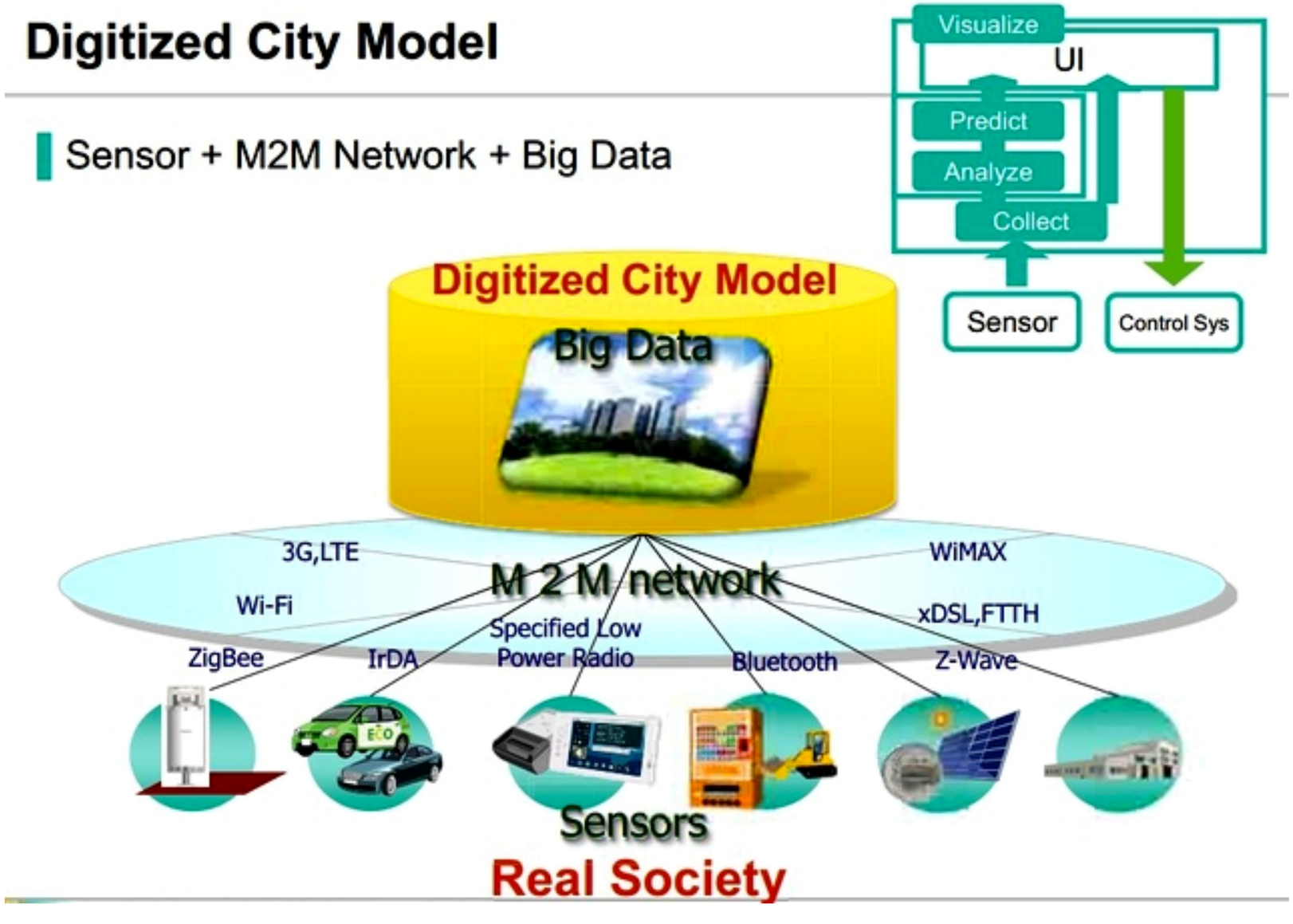
www.fiware.org

www.ponrec.it

futureeverything.org

www.digikey.com





www.viewsline.com

- **SMART CITIES OF THE FUTURE**
  THE EUROPEAN PHYSICAL JOURNAL

- **CAN WE TRUST SMART CITIES?**
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TOPIC

ASSIGNED READINGS FOR TODAY

DATE	LECTURE
4-1-15	#2 - THE SMART CITY

WHAT IS THE PROBLEM SPACE THAT BINDS THEM?

RAPID URBANIZATION

GLOBALLY - In 2010, just more than half of all people in the world lived in an urban area. By 2030, six out of every 10 people will live in a city; by 2050 the proportion will rise to seven out of 10, according to the World Health Organization. Likewise, global cities control a greater share of the world's economic power. An estimated 40 urban metro areas produce two-thirds of the world's economic output and are highly innovative, according to the New America Foundation, a Washington, D.C.-based think tank. (GovTech)

NATIONALLY - census estimates showed the population increasing in large cities faster than the nation as a whole, and the growth is accelerating. At the same time, economic activity in urban metro areas has grown in importance. The 388 metro areas in the United States make up 84 percent of the nation's population and 91 percent of gross domestic product (GDP); the 100 biggest metro areas generate 75 percent of the GDP, according to the Brookings Institution. (GovTech)

TOPIC

THE SMART CITY

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

- **BATTY**

  a city in which ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies.

  a smart city is a synthesis of hard infrastructure (or physical capital) with the availability and quality of knowledge communication and social infrastructure

  smart cities are also instruments for improving competitiveness in such a way that community and quality of life are enhanced. Cities that are smart only with respect to their economy are not smart at all if they disregard the social conditions of their citizenry.

  Smart Cities are equitable cities.

- **SHAFFERS**

  a city may be called ‘smart’ “when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory government” [Caragliu, A., Del Bo, C., Nijkamp, P.: Smart cities in Europe. Series Research Memoranda 0048. VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics (2009)] until now the role of cities and regions in ICT-based innovation mostly focused on deploying broadband infrastructure, the stimulation of ICT-based applications enhancing citizens’ quality of life is now becoming a key priority.
  Hans Schaffers, Nicos Komninos, Marc Pallot, Brigitte Trousse, Michael Nilsson, Alvaro Oliveira

- **GOV TECH**

  A smart city is a dynamic city that makes living in a dense urban environment more civil and more rewarding. A smart city is not only attractive to people who want to live there, but also to companies that want to do business there.

TOPIC

THE SMART CITY - SAMPLE DEFINITIONS

DATE 4-1-15

LECTURE #2 - THE SMART CITY

WHAT IS A SMART CITY?

Box: A New Spatiality of Cities - Multiple Concepts

Cyber cities, from cyberspace, cybernetics, governance and control spaces based on information feedback, city governance; but also meaning the negative / dark sides of cyberspace, cybercrime, tracking, identification, military control over cities.

Digital cities, from digital representation of cities, virtual cities, digital metaphor of cities, cities of avatars, second life cities, simulation (sim) city.

Intelligent cities, from the new intelligence of cities, collective intelligence of citizens, distributed intelligence, crowdsourcing, online collaboration, broadband for innovation, social capital of cities, collaborative learning and innovation, people-driven innovation.

Smart cities, from smart phones, mobile devices, sensors, embedded systems, smart environments, smart meters, and instrumentation sustaining the intelligence of cities.

Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation
Hans Schaffers, Nicos Komninos, Marc Pallot, Brigitte Trousse, Michael Nilsson, Alvaro Oliveira

TOPIC

THE SMART CITY

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

- **BATTY**

  The convergence of information and communication technologies is producing urban environments that are quite different from anything we have experienced hitherto.
  … are intelligence functions that are able to integrate and synthesise this data to some purpose, ways of improving the efficiency, equity, sustainability and quality of life

- **GOVTECH**

  Some have called the smart city trend the most transformative thing to happen to cities since the urban renewal movement of the 1960s. It's happening in large part because of demographic, economic and fiscal changes affecting cities in America and around the globe. Since 2009, cities have cut more than a half million jobs from their payrolls. At the same time, however, the cost of doing government business keeps growing, putting pressure on budgets that have seen declines in revenue for every year between 2006 and 2012

TOPIC

ASSIGNED READINGS FOR TODAY - THE CALL TO ARMS!

DATE	LECTURE
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- **COST BENEFIT**

  Is it worth the cost to install/embed sensors and eventually scale up other infrastructure to support it?

- **BORING STUFF**

  Addressing governance models prior to running full steam ahead with projects

- **OVER RELIANT ON SOFTWARE**

  Purely rational decision making? (Batty touches as well). Can skirt ethical issues.

- **HACKED**

  Open to being hacked

- **CATASTROPHIC FAILURE**

  Will a sensor-based system react (ex shut down) correctly in a crisis or will it fail?

- **PRIVACY**

  Even if you can technically ensure it… public/citizen perception is key

- **EQUITY**

  Presumption that all aspects of city life can be measured/monitored to treat as technical problems

TOPIC

THE SMART CITY - CHALLENGES (GOVTECH ARTICLES)

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

- A NEW UNDERSTANDING OF URBAN PROBLEMS
- EFFECTIVE AND FEASIBLE WAYS TO COORDINATE URBAN TECHNOLOGIES
- MODELS AND METHODS FOR USING URBAN DATA ACROSS SPATIAL AND TEMPORAL SCALES
- DEVELOPING NEW TECHNOLOGIES FOR COMMUNICATION AND DISSEMINATION
- NEW FORMS OF URBAN GOVERNANCE AND ORGANISATION
- DEFINING CRITICAL PROBLEMS RELATING TO CITIES, TRANSPORT, AND ENERGY
- RISK, UNCERTAINTY AND HAZARD IN THE SMART CITY

TOPIC

THE SMART CITY - KEY ELEMENTS (BATTY ARTICLE)

DATE 4-1-15

LECTURE #2 - THE SMART CITY

- **PLANNING**

  This is changing the way we are able to plan across multiple time scales, raising the prospect that cities can be made smarter in the long term by continuous reflection in the short term.

  Longer term planning itself faces the prospect of becoming continuous as data is updated in real time.

- **CONNECTIVITY - INTEROPERABILITY**

  Coupling
  Coordination
  Integration

- **PARTICIPATION - CITIZEN SCIENCE**

  small definition
  big definition

- **MEASURING & MINING URBAN DATA**

  Interesting interplay of transportation/mobility and mapping/GIS

TOPIC

THE SMART CITY - KEY ELEMENTS (BATTY ARTICLE)

DATE	4-1-15	LECTURE	#2 - THE SMART CITY

- # TRANSPORTATION AND MOBILITY

  These big mobility data provide a powerful social microscope, which may help us understand human mobility, and discover the hidden patterns and models that characterize the trajectories humans follow during their daily activity. In such research, privacy is always considered but is rarely in danger for the data is anonymised through several levels of scrutiny and confidentiality.

  … capable of supporting the decisions of mobility and transportation managers, thus revealing the striking analytical power of big mobility data. Analysts reason about these high-level concepts, such as systematic versus occasional movement behaviour, purpose of a trip, and home-work commuting patterns.

  What are the most popular itineraries followed by individual travel and what is the spatio-temporal distribution of such travel? How do people behave when approaching a key attractor, such as a big station or airport? How do people reach and leave the site of an extraordinary event, such as an important football match? How can we predict areas of dense traffic in the near future? How can we characterize traffic jams and congestion?

  Explanations of why traffic significantly varies from one day to another even if demand profiles are similar is extremely weak and we consider that new ICT will provide us with dramatically new data sets that will inform this problem.

TOPIC

THE SMART CITY - KEY ELEMENTS (BATTY ARTICLE)

DATE	LECTURE
4-1-15	#2 - THE SMART CITY

SMART ECONOMY (Competitiveness)	SMART PEOPLE (Social and Human Capital)	SMART GOVERNANCE (Participation)
▪ Innovative spirit ▪ Entrepreneurship ▪ Economic image & trademarks ▪ Productivity ▪ Flexibility of labour market ▪ International embeddedness ▪ *Ability to transform*	▪ Level of qualification ▪ Affinity to life long learning ▪ Social and ethnic plurality ▪ Flexibility ▪ Creativity ▪ Cosmopolitanism/Open-mindedness ▪ Participation in public life	▪ Participation in decision-making ▪ Public and social services ▪ Transparent governance ▪ *Political strategies & perspectives*
SMART MOBILITY (Transport and ICT)	**SMART ENVIRONMENT (Natural resources)**	**SMART LIVING (Quality of life)**
▪ Local accessibility ▪ (Inter-)national accessibility ▪ Availability of ICT-infrastructure ▪ Sustainable, innovative and safe transport systems	▪ Attractivity of natural conditions ▪ Pollution ▪ Environmental protection ▪ Sustainable resource management	▪ Cultural facilities ▪ Health conditions ▪ Individual safety ▪ Housing quality ▪ Education facilities ▪ Touristic attractivity ▪ Social cohesion

Fig. 2. A typology of smart city functions.

Hans Schaffers, Nicos Komninos, Marc Pallot, Brigitte Trousse, Michael Nilsson, Alvaro Oliveira

TOPIC

THE SMART CITY - FRAMEWORKS

DATE 4-1-15

LECTURE #2 - THE SMART CITY

Innovation Economy

- 1- Intelligent city clusters: manufacturing, business services, health, tourism
- 2- Intelligent city districts: CBD, techno park, mall, university campus, port area, airport city
- 3- New companies creation / intelligent incubators

City Infrastructure and Utilities

- 4- Smart transport, mobility and parking
- 5- Broadband, DSL, FTTH, wi-fi, embedded systems
- 6- Energy saving / smart grid
- 7- Environment monitoring, real time alert, safety

Governance

- 8- Government services to citizens
- 9- Decision making / participation / direct democracy
- 10- Monitoring & measurement: The city as database

Fig. 1. Smart city key application areas

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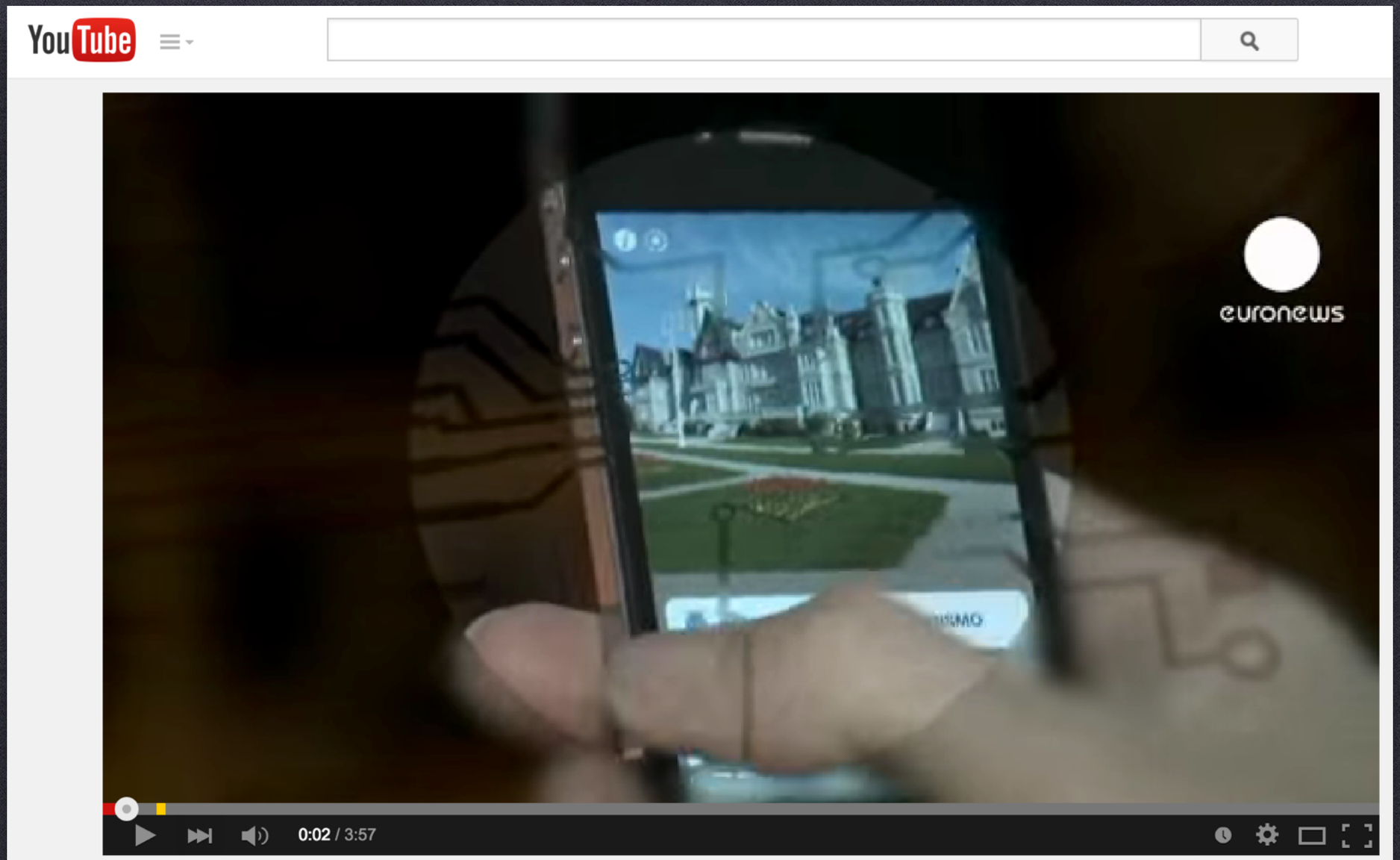


TOPIC

THE SMART CITY - VIDEO CLIPS AND MEDIA

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**

- **THE REAL-TIME CITY? BIG DATA AND SMART URBANISM**
  GEOJOURNAL
- **BIG DATA BASIC CONCEPTS AND BENEFITS EXPLAINED**
  TechRepublic

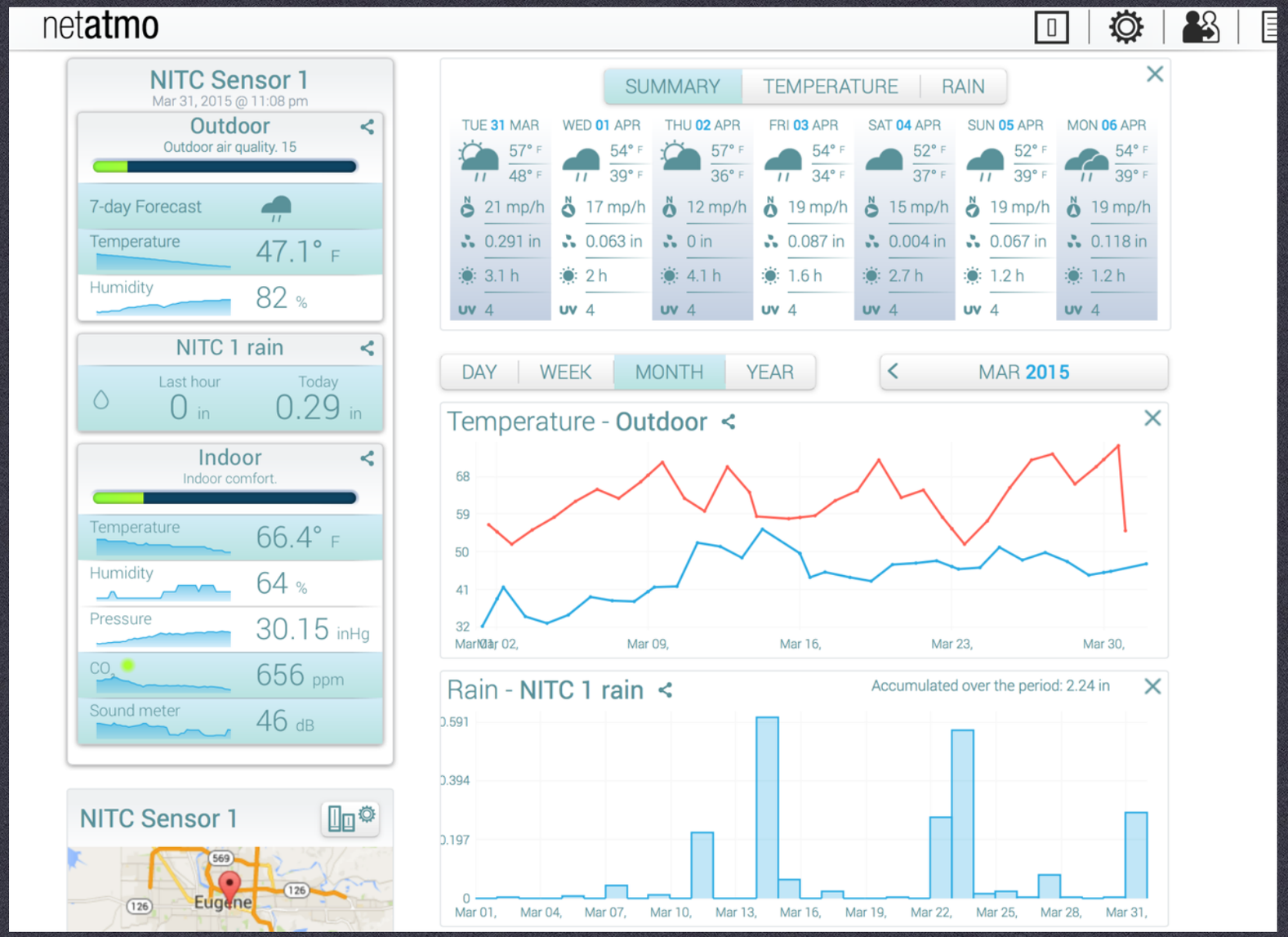
TOPIC

ASSIGNED READINGS FOR NEXT LECTURE

DATE	LECTURE
4-1-15	#2 - THE SMART CITY

MAPPING YOUR LOCATION SENSOR DATA

Run Keeper



TOPIC

NEXT WEEK'S LAB

DATE **4-1-15**

LECTURE **#2 - THE SMART CITY**