

Smart Cities

Practical challenges of
ambitious innovation partners

Dr.ir. Elke den Ouden

TU/e Fellow

KIVI / IEEE IoT event 21 September 2015



**INNOVATION
TECHNOLOGY
ENTREPRENEURSHIP &
MARKETING GROUP**

TU/e Technische Universiteit
Eindhoven
University of Technology

**Intelligent Lighting
Institute**

TU/e Technische Universiteit
Eindhoven
University of Technology

**Data Science Center
Eindhoven**



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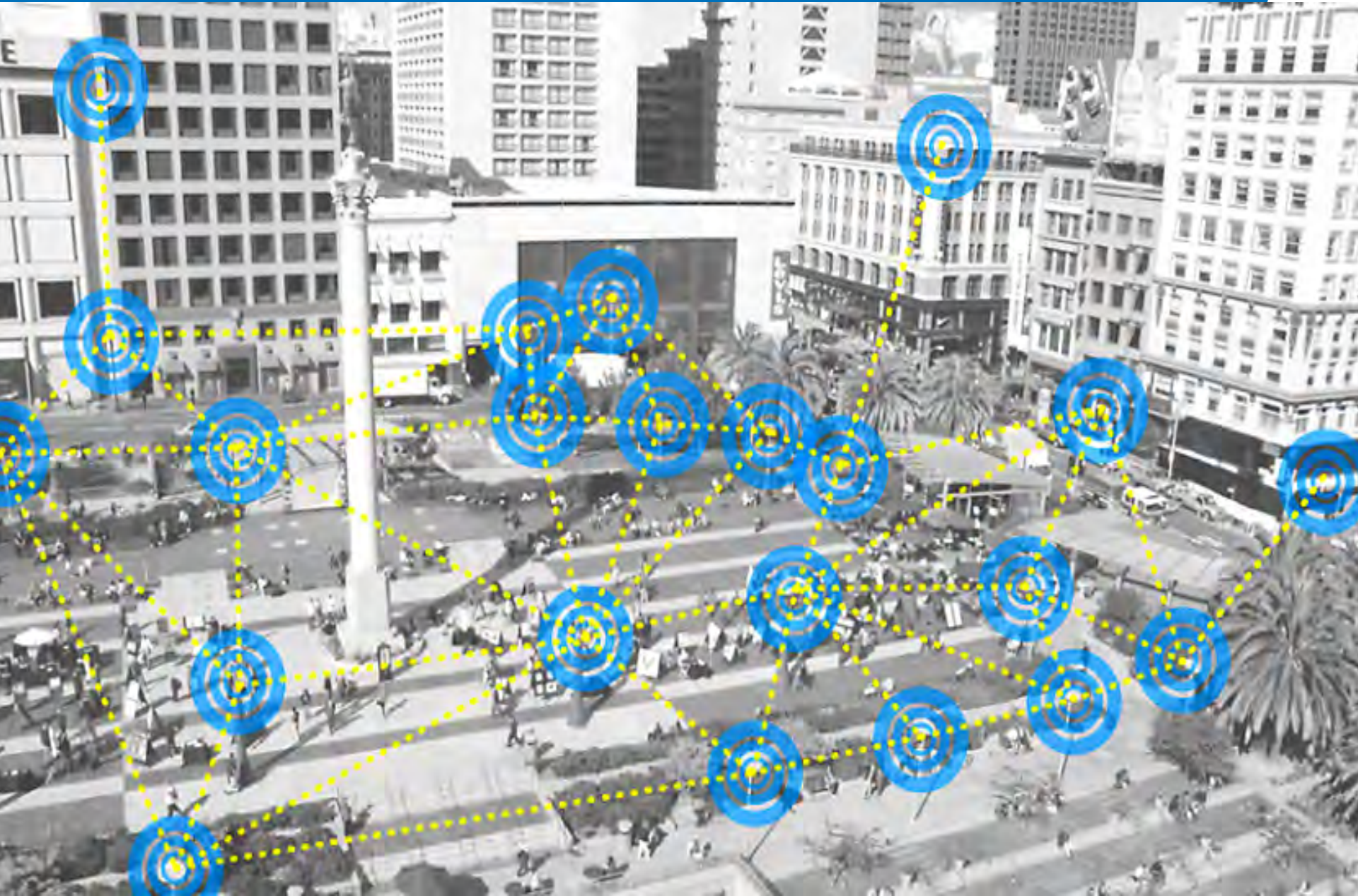
Department of Industrial Engineering & Innovation Sciences

New business development in public-private value networks

Smart lighting & smart cities

TU/e Innovation Lab - Valorisation projects for external clients

Cities are being covered in sensor networks..



Building a Smarter City and State

The Commonwealth of Massachusetts, The City of Boston and IBM are working together to transform the region's physical infrastructure, engage citizens, reduce costs and improve efficiency. Do you know where technology is at work where you live?



1 — Buildings:

The state of Massachusetts owns 72 million square feet of property. Software helps improve maintenance, space and management across public sector buildings.

2 — Traffic:

Approximately 1.9 million commuters travel by car a day in Boston. Officials examine how Big Data technology makes transportation more efficient and reduce pollution.¹

3 — Airport:

Tens of millions of travelers pass through Logan Airport every year. Software helps the Port Authority better manage maintenance operations for equipment such as air conditioning, doors and escalators at Terminal A.²

4 — Physical Assets:

Boston has more than 60,000 streetlights³ and 13,000 fire hydrants.⁴ Software helps city officials better manage and maintain physical assets.

5 — Special Events:

More than half a million people attend events such as the Boston Marathon and July 4th fireworks every year. Software can integrate and visualize critical information across city departments including fire, police and emergency responders to help coordinate and plan special events.⁵

6 — Water:

Massachusetts Water Resource Authority (MWRA) serves 2.5 million people in 61 communities.⁶ Using software, MWRA decreased corrective maintenance and project work orders by 38 percent.

¹ "Boston ranked fifth most traffic-prone city in nation," Daily Free Press: <http://dailyfreepress.com/2013/02/11/boston-ranked-fifth-most-traffic-prone-city-in-nation/>

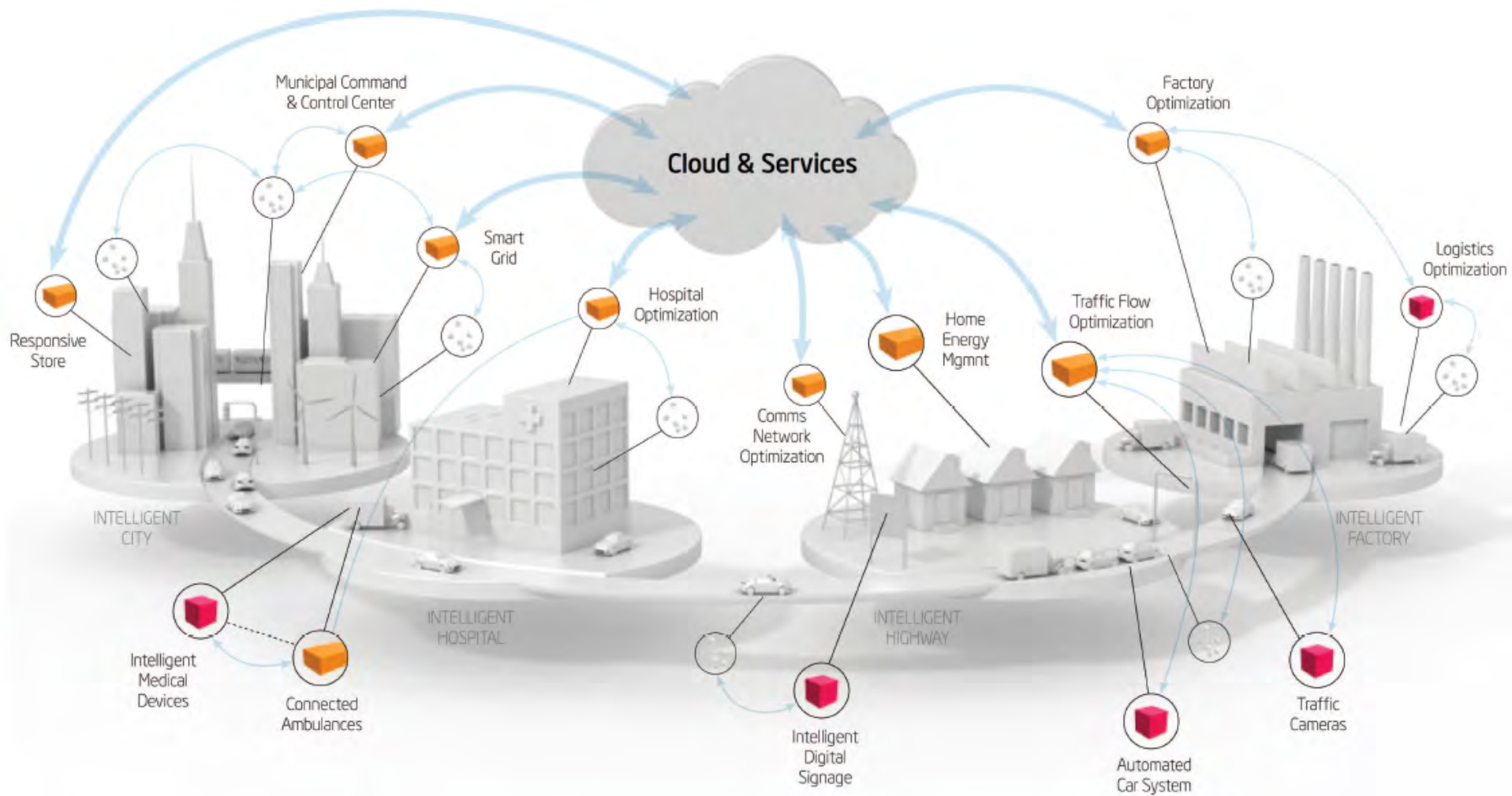
² About Logan International Airport: <http://www.massport.com/logan-airport/about-logan-airport/default.aspx>

³ Street Lighting Division for the City of Boston

⁴ Currents Newsletter, July-August 2011: http://www.btwsc.org/holdings/public_notices/COUR_2011_A_JUL_AUG.pdf

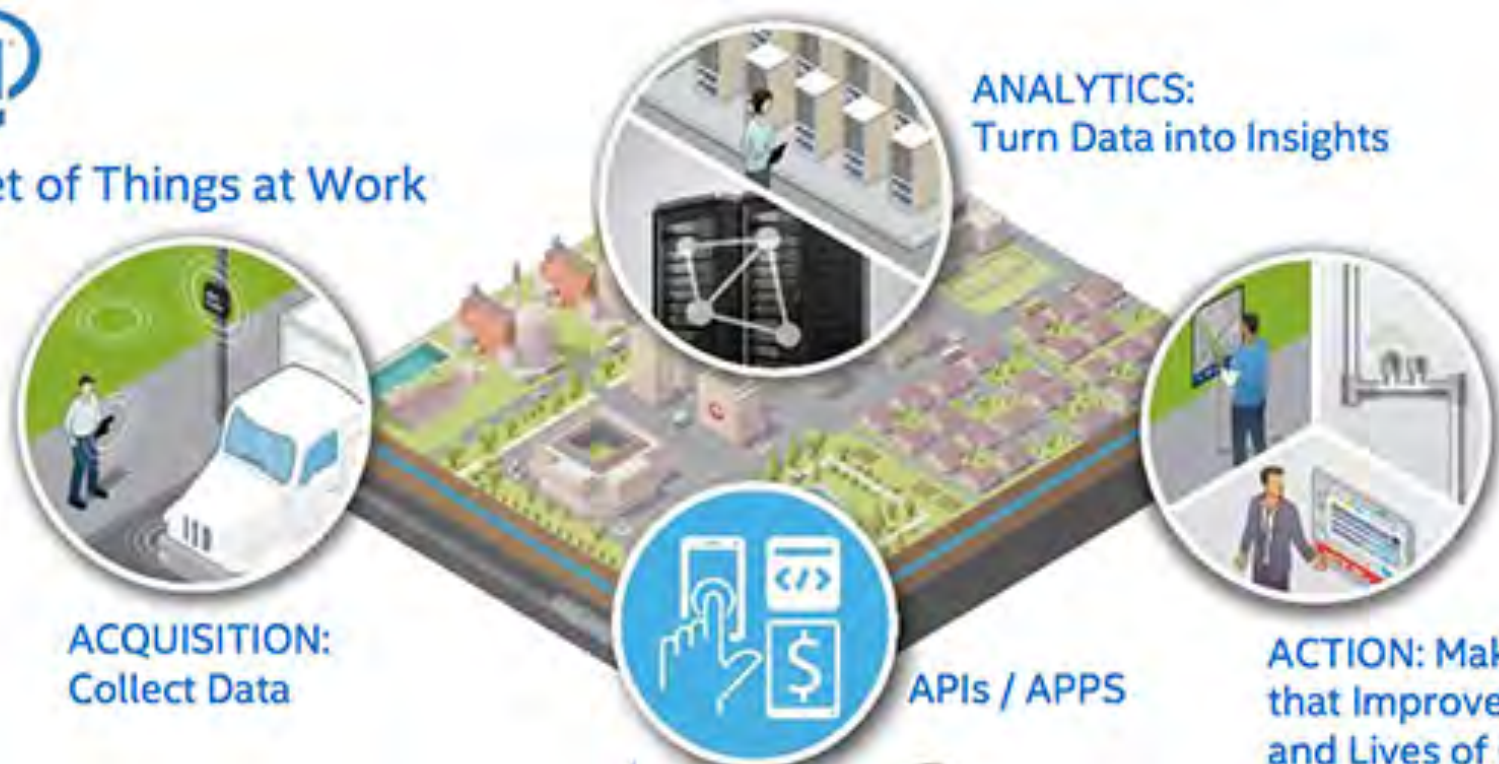
⁵ BAA Offers Runner Deferral: Wait till Next year, Boston.com: http://www.boston.com/sports/marathon/articles/2012/04/17/baa_offers_runners_deferral_wait_till_next_year/

⁶ About Massachusetts Water Resource Authority: <http://www.mwra.state.ma.us/02org.html#what.htm>





Internet of Things at Work

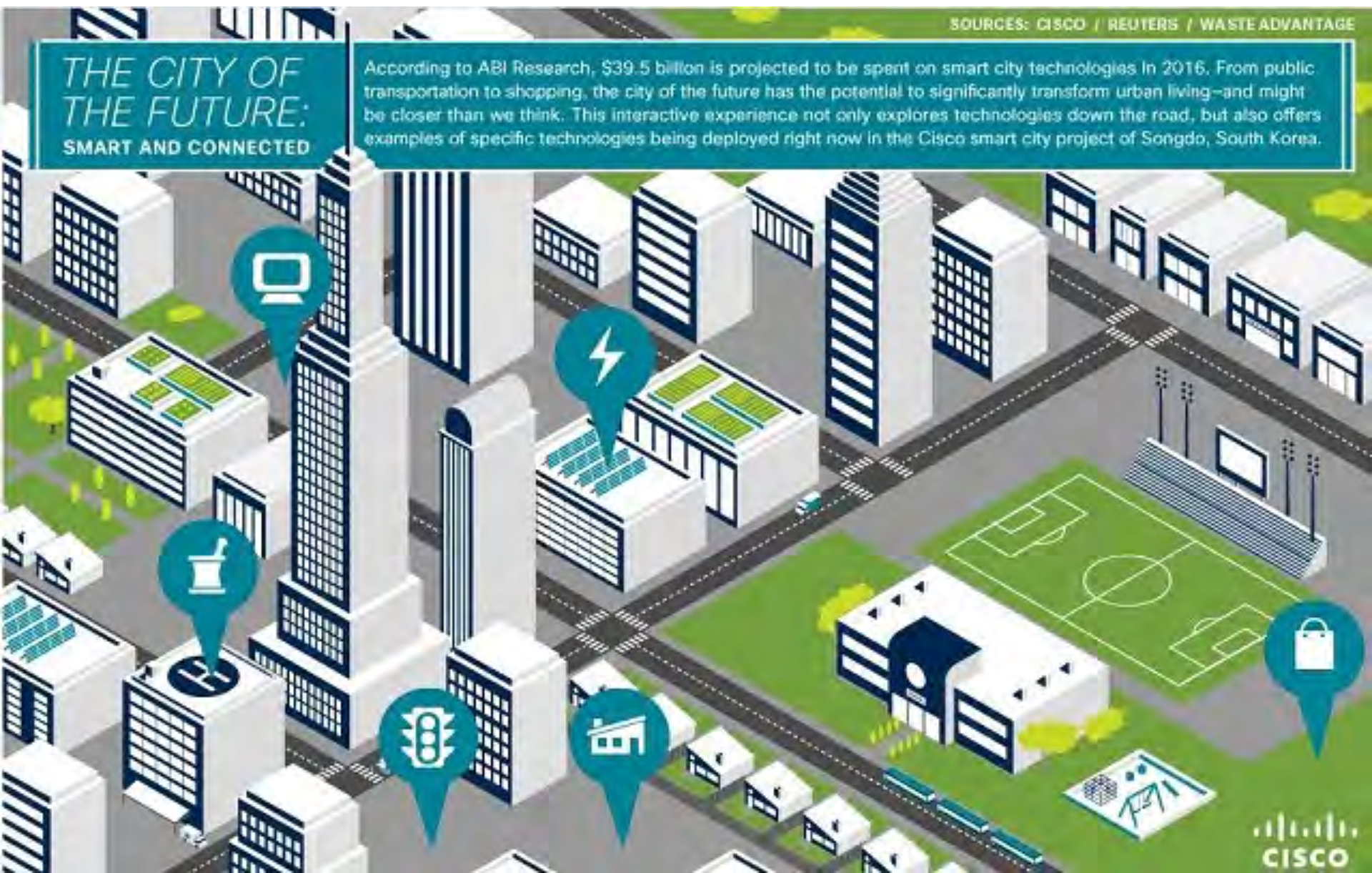


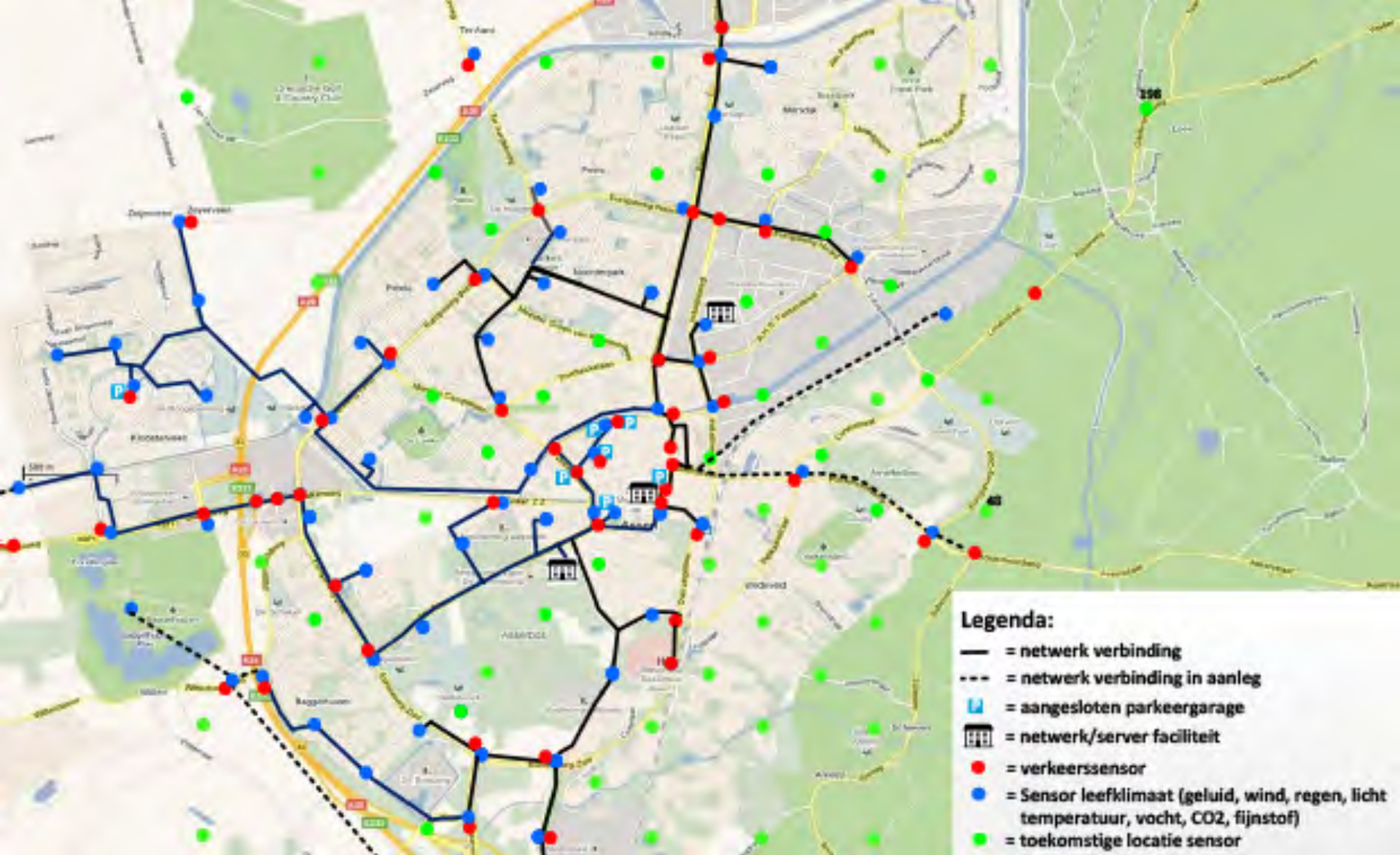
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Citizens & Community
- 
Health & Wellbeing
- 
Transport & Logistics
- 
Energy Systems
- 
Environmental Monitoring
- 
Water & Waste
- 
Built Environment
- 
Economy & Innovation



THE CITY OF THE FUTURE: SMART AND CONNECTED

According to ABI Research, \$39.5 billion is projected to be spent on smart city technologies in 2016. From public transportation to shopping, the city of the future has the potential to significantly transform urban living—and might be closer than we think. This interactive experience not only explores technologies down the road, but also offers examples of specific technologies being deployed right now in the Cisco smart city project of Songdo, South Korea.





... but how does it contribute to quality of life?



How can technology serve the needs of people?
What services will increase quality of life?

Disruptive technologies enable smart solutions



Improve **functionality**:

- Technological development enable new possibilities

Improve **livability**:

- A vibrant and sustainable city for its citizens

Layered model for smart urban solutions

Societal Needs



Services: for societal stakeholders



ICT: data and application



Devices: sensors, lights



Infrastructure: dense network

Meaningful applications

Technology enablers

Shift happens
CHECK YOUR PARADIGM

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A shift in focus: from products to service

Amsterdam Smart Light - Hoekenrodeplein

am **smart** erdam
city



Identified needs

Sustainability:

- Reduction light pollution
- Light on demand
- Flexibility for different use of area

Safety:

- Image of the Bijlmer / ZuidOost area
- Crime prevention
- Crowd management @ events

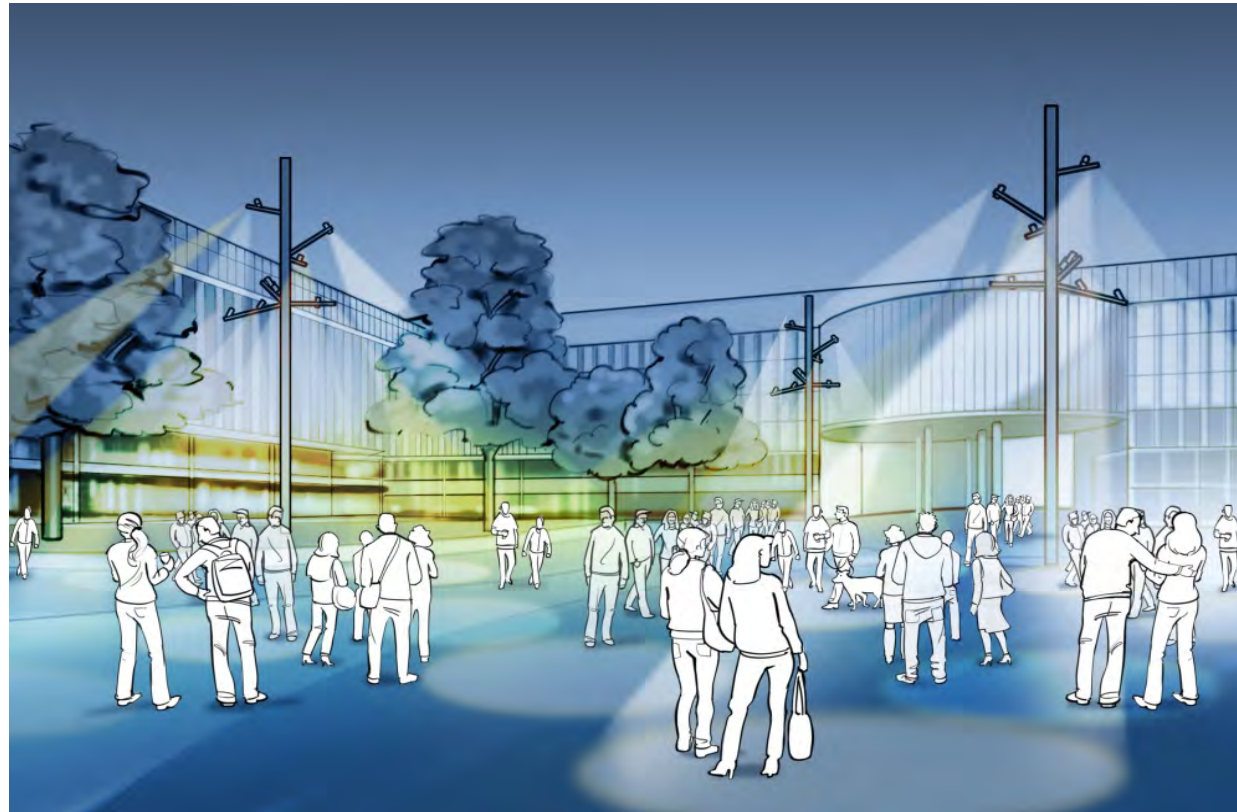
Hospitality:

- Social safety & social cohesion
- Attracting people
- Triggers to stay

Adaptive light

Adaptive Light

- Attractive atmosphere in any circumstance
- Adaptive to the use of the square; commuting or leisure.
- Involvement in various areas through high lighting
- Safety through calamity lighting
- Reduced light pollution
- Reduced energy use through LED and adaptive light.



Amsterdam Smart Light - Hoekenrodeplein

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city

Shift from product to service:

1. Lighting, camera's, sensors, wifi – enable new design opportunities
2. Creating any desired ambiance for any moment
3. Turning ambiance creation into a meaningful application: explore scenarios and impact on sustainability, safety and hospitality with stakeholders in co-creation

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**A shift in focus: from technology to people
and societal needs**

Understanding the different stakeholders' needs



How to identify the needs of different stakeholders?
How do they relate to quality of life?

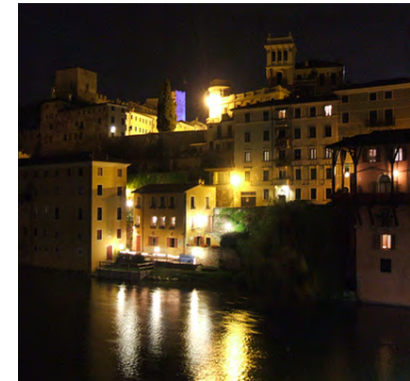
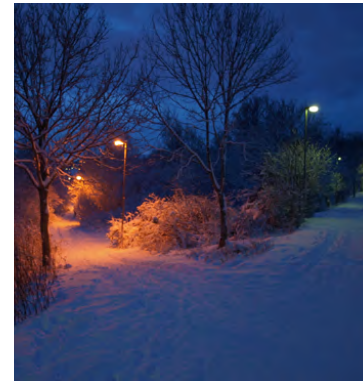
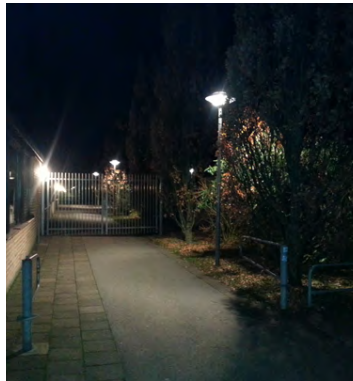
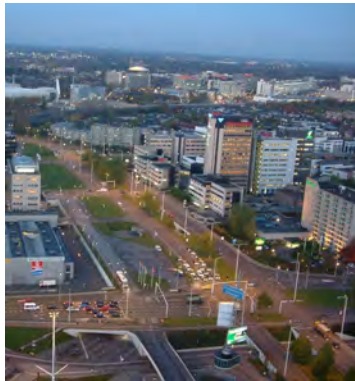


ENIGMA

ENLIGHTENMENT AND INNOVATION, ENSURED THROUGH PRE-COMMERCIAL PROCUREMENT IN CITIES



A joint transnational pre-commercial procurement project for smart lighting.



Intelligent Lighting
Institute



Goal of the ENIGMA project

Public lighting infrastructure as a carrier to improve societal health

ENIGMA Common challenge

To upgrade the public lighting infrastructure and system, using ICT solutions, to enable cities to offer a wide range of intelligent and integrated services benefitting society and individual citizens and bringing cities closer to the ambition of becoming smart cities.





Becoming smart cities

What do cities mean with 'smart city'?

A vibrant city

A vibrant city that is enjoyable to live in with all the activities, facilities and urban environment and where economic situation is good if not thriving.

Active & healthy citizens

Good economic climate

Strong social networks

A sustainable city

A sustainable city where the environment is respected and preserved without compromising the quality of life of the citizens and the economic climate.

Social wealth

Caring for the environment

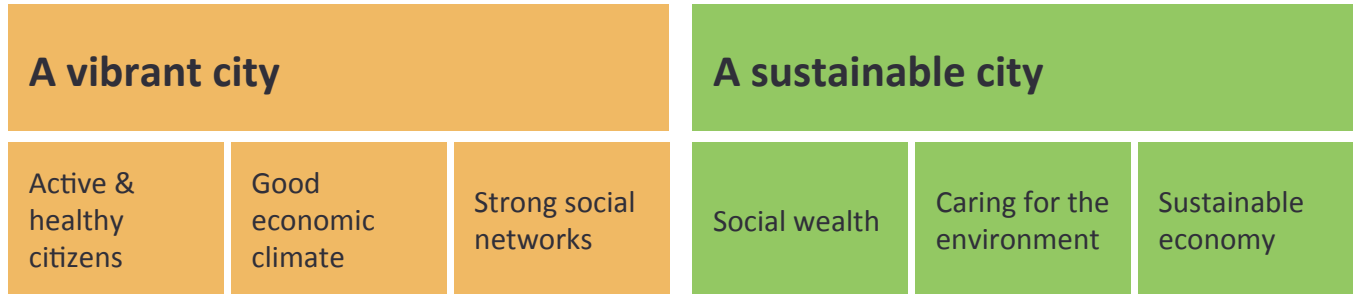
Sustainable economy



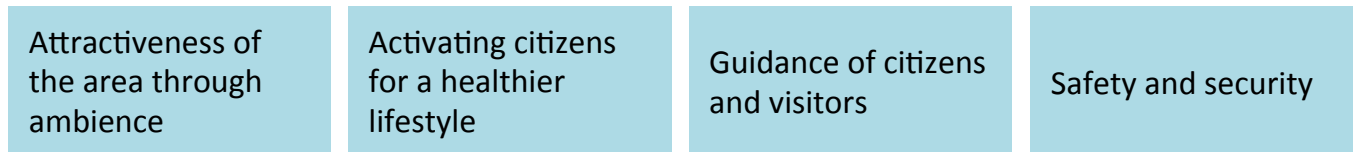


Common & specific needs & ambitions

Common ambitions



Common societal needs



Specific societal needs for pilot areas



ENLIGHTENMENT AND INNOVATION, ENSURED THROUGH PRE-COMMERCIAL PROCUREMENT IN CITIES





The challenge

From:

- Procuring lighting systems by specifying functional aspects (light levels, light distribution, colour temperature, light source technology, etc)

To:

- Identifying societal needs
- Allowing creativity in the process



3

A shift from individual products to adaptive platforms

Amsterdam Smart Light - Hoekenrodeplein

am **smart** erdam
city

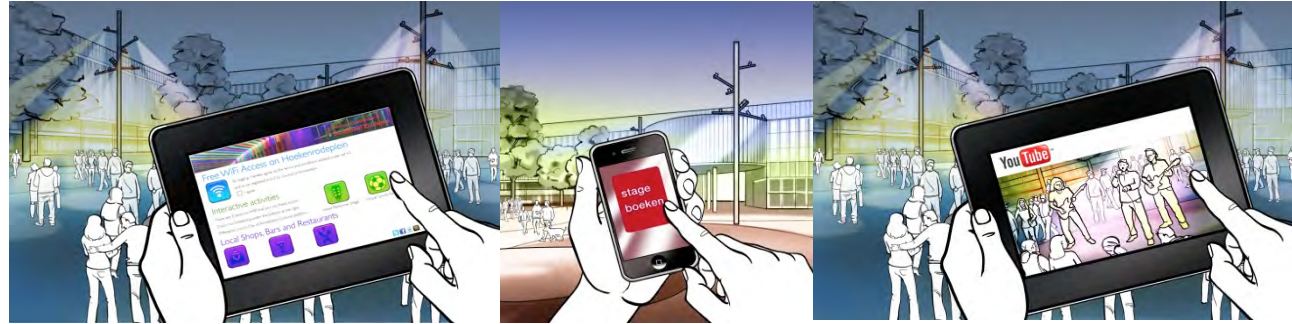
What else can we do with the adaptive lighting system to increase hospitality?



The context of Hoekenrodeplein

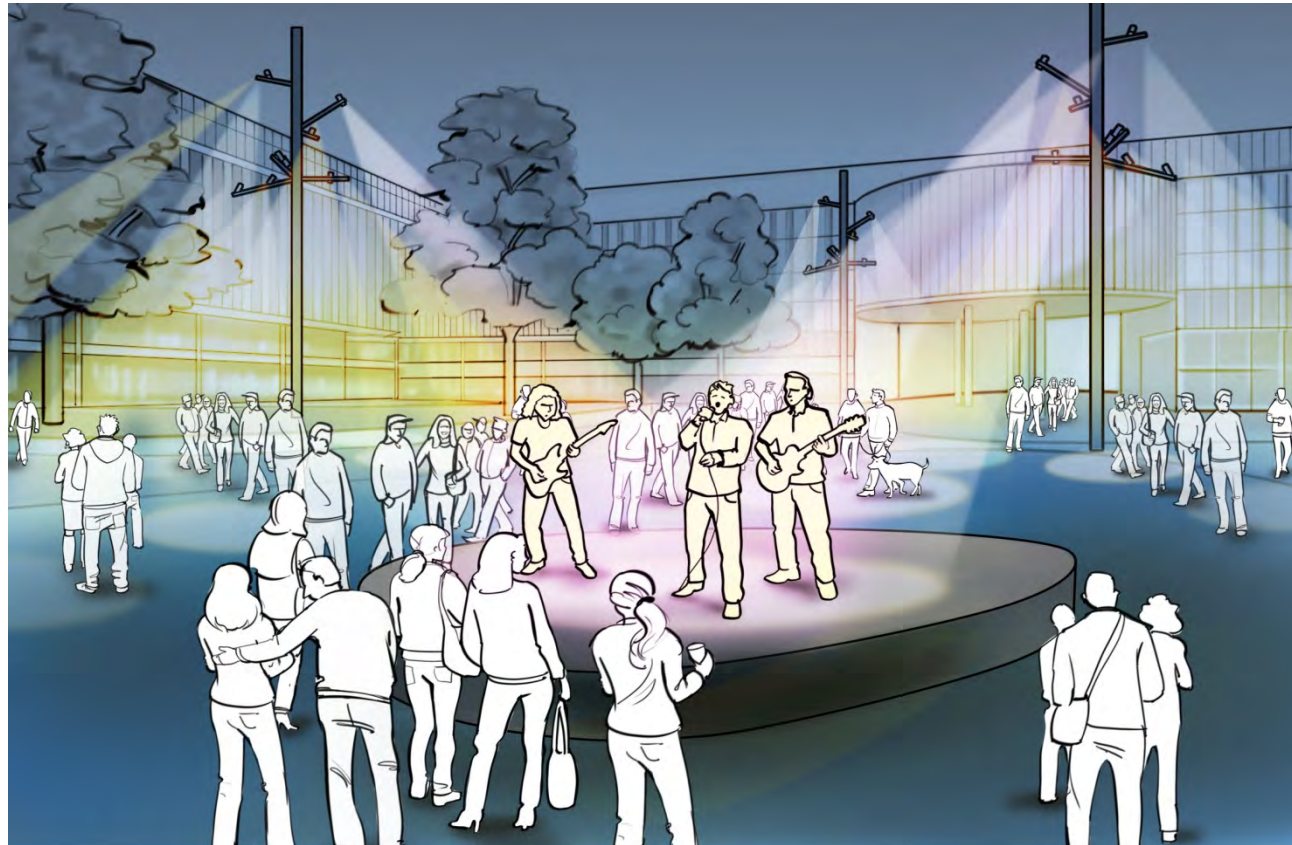


Street Performer Stage



Virtual stage

- Several stages for performers
- Dedicated spot lights and video camera's
- Online promotion of content
- Real time viewing on display of beacon
- Airtime booked on App or portal
- Link to events
- Stage for local talent
- Increased attractiveness of the area
- Prolonged stay of crowd



New business models

- From physical products to services



New business models

- More stakeholders = more customers?
- Recurring, smaller income from services?

- Other parties and entrepreneurs required
- The role of the municipality to spark and promote development and exploitation of new and innovative services

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A shift from a one-off result to continuous innovation



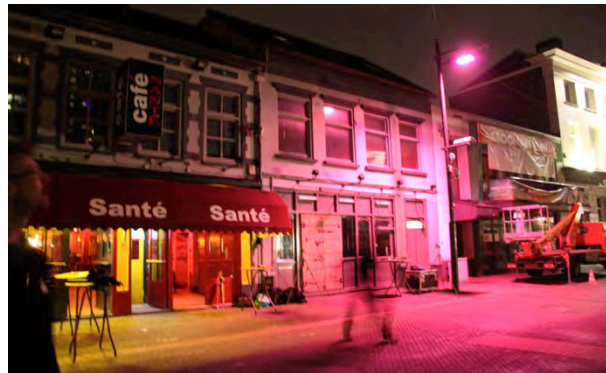
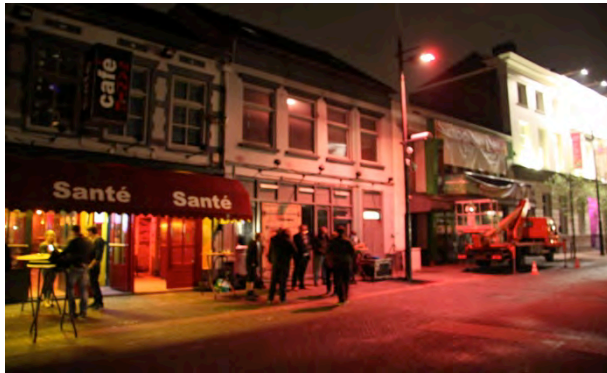
Stratumseind

DE-ESCALATE: Light as mediator



Stratumseind:

Defusing escalating behaviour through the use of interactive light scenarios

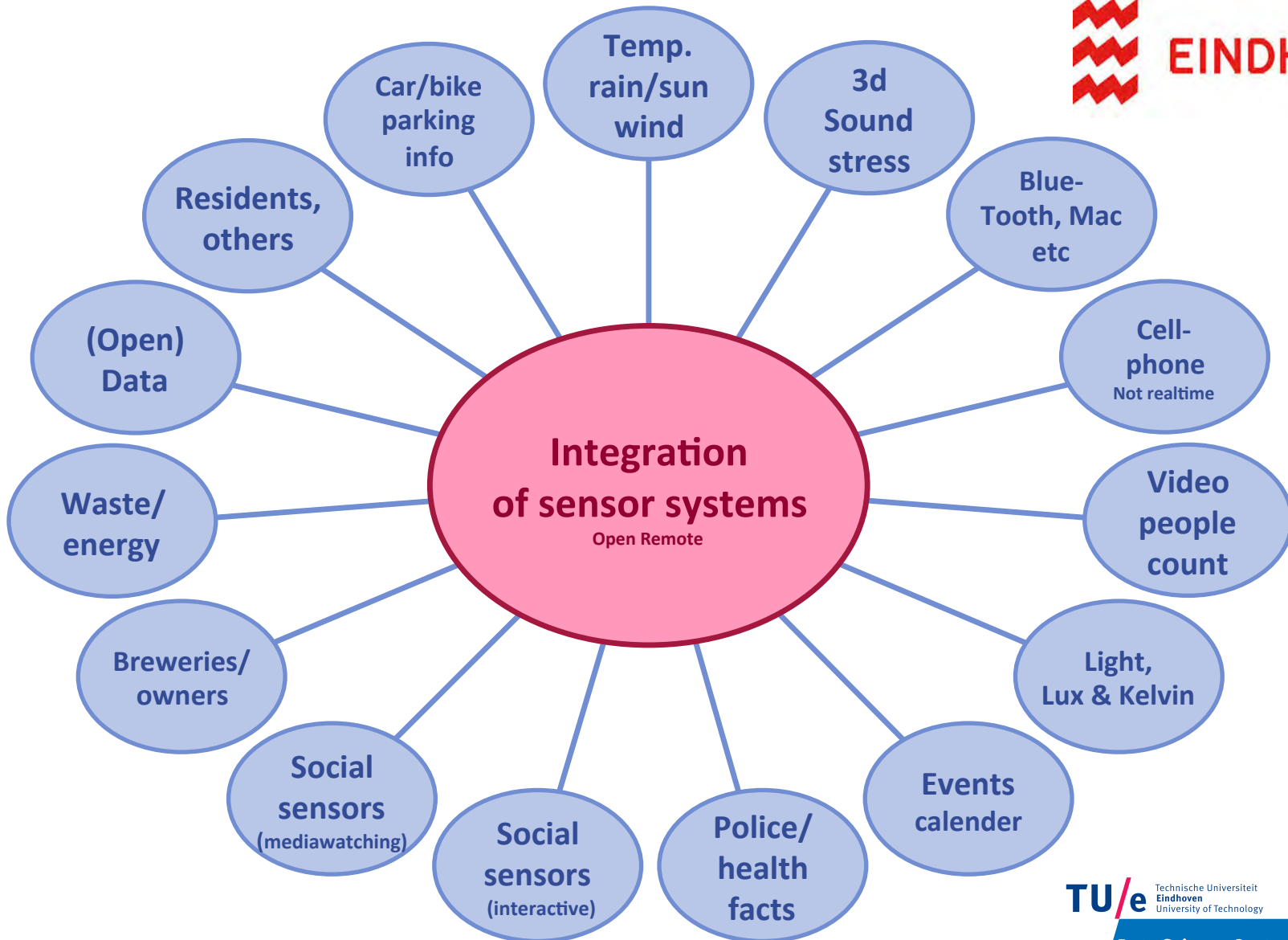


Living Lab – Base Camp

- Collecting data from various sources
- Analysis & visualisation



Living Lab - Sensor system integration

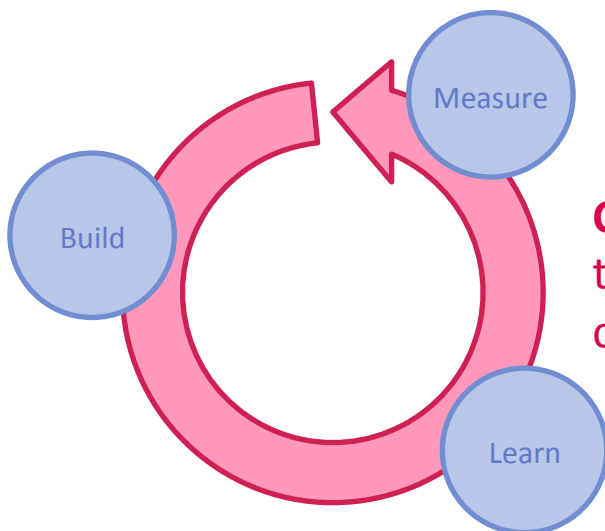
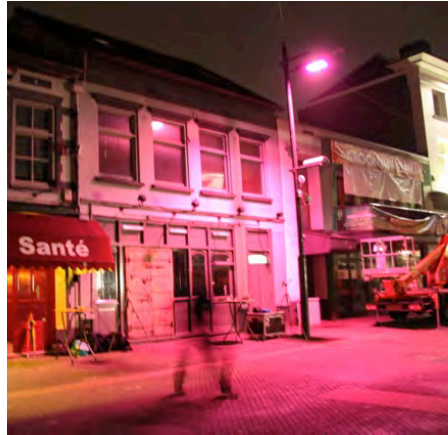
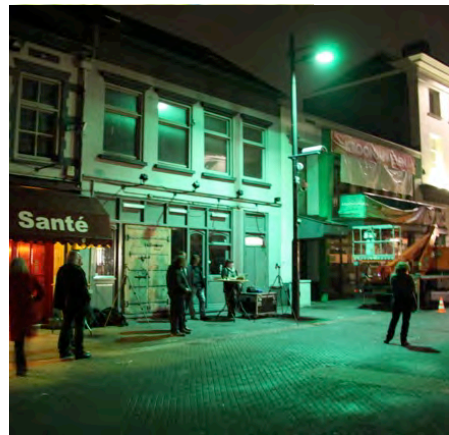


Real time data visualisation



Stratumseind Living Lab

Monitoring impact on the longer term to secure continuity in service delivery



Continuous Innovation
to adapt to changing
context & possibilities

Platforms for continuous service innovation

Innovation cycle



Services: for societal stakeholders

Weeks



ICT: data and application

Months



Devices: sensors, lights

Years



Infrastructure: dense network

Decades


Shift happens
CHECK YOUR PARADIGM

- Disruption in technology



- Disruption in cooperation

Co-creating ecosystem

- 
- All partners are in a change process – internal challenge
 - Changing cooperation between all partners in the ecosystem – external challenge
 - New mindset, new organisational practices

The City of Eindhoven's changing role



To be leading in innovations to increase quality of life in the city

A changing role for the city council:

Lead-user

(putting the city forward as a test bed for suppliers)



2015 Provider of infrastructure
(the infrastructure as an enabler for innovation)



2030 Full partner
(safeguarding public interests through collaboration in quadruple helix structure)

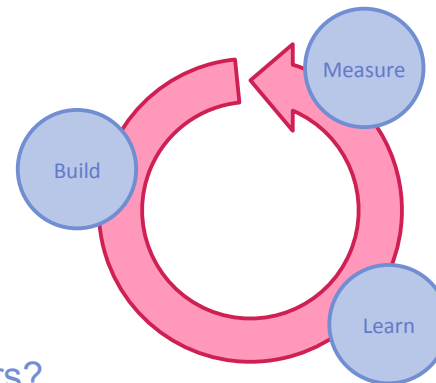
A changing role for industry

- From physical products to open platforms and services
- That continuously change over time (adapting to changing needs, adapting to new technology)



New business models

- More stakeholders = more customers?
- Recurring, smaller income from services?



Continuous Innovation
to adapt to changing
context & possibilities

- Requires new partners (e.g. system integrator) and an entrepreneurial ecosystem

A changing role for knowledge institutes

2nd generation university

- Education
- Scientific research

3rd generation university

- Education
- Scientific research
- **Exploitation of knowledge**

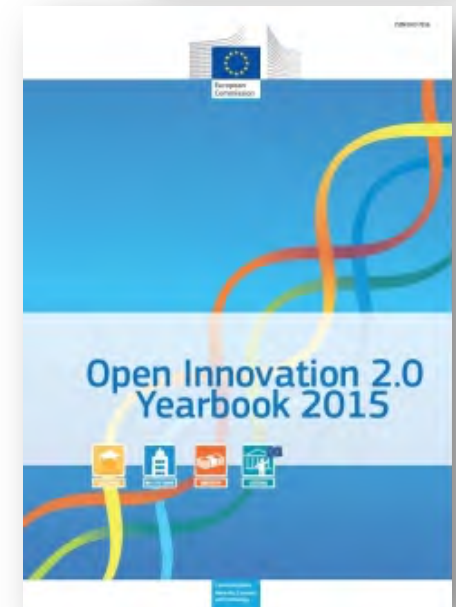
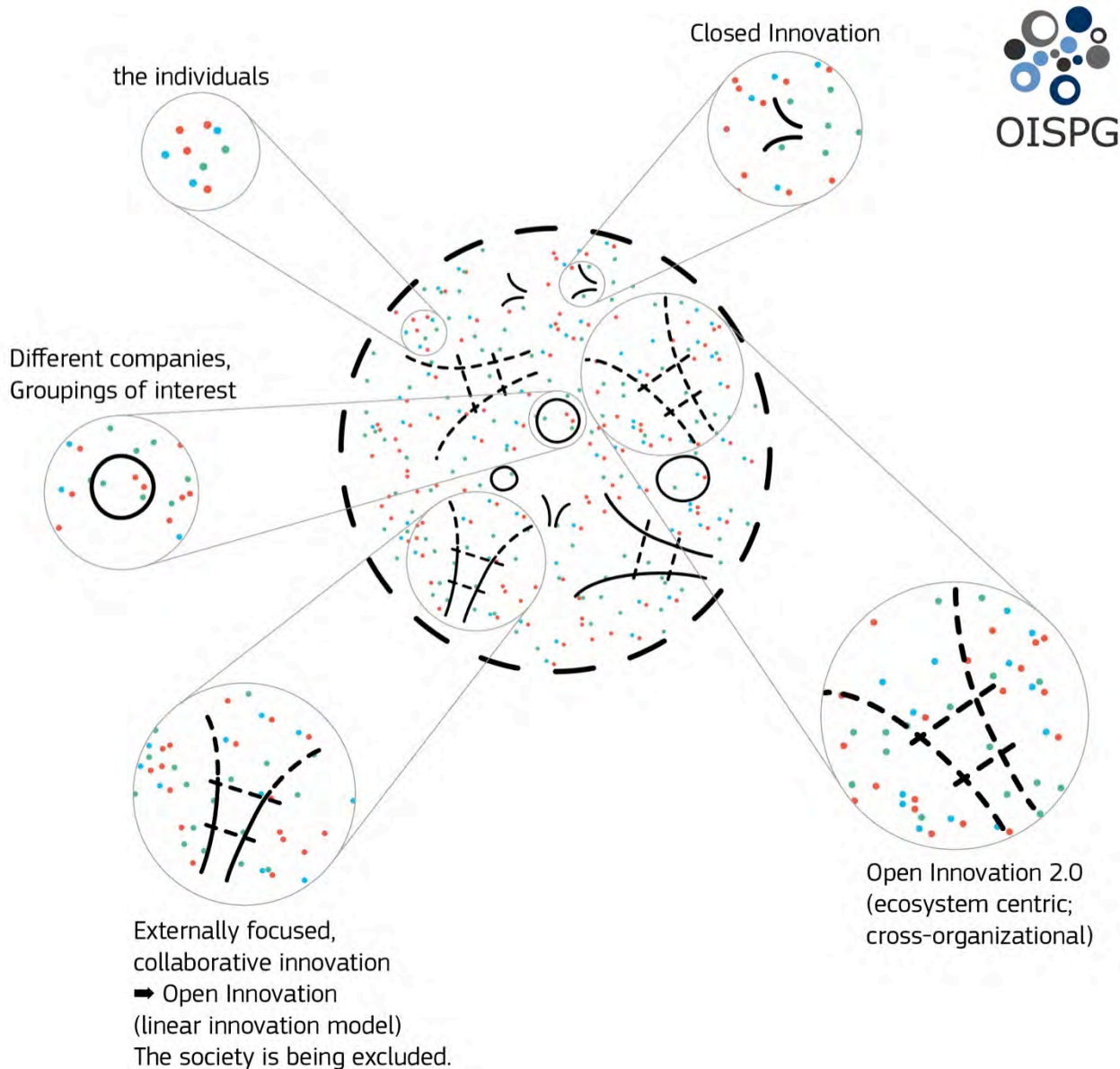


Living Labs: research in 'the wild'
Co-creating & serving society with
meaningful solutions

Ethics in using living lab data of urban
contexts

Scientific rigor!

Open Innovation 2.0 for Smart Cities



More info:

www.tue-lighthouse.nl

@TUE_LightHouse

e.d.ouden@tue.nl

Questions?