



Smart cities, smart buildings, smart users

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About myself

- Professor at Buskerud and Vestfold University College, where I started as Associate Professor in 2002
- Academic background: Information Systems
- Research: Public Sector Innovation, e-Government, e-Participation, User-centricity



Background

- ➔ In November 2010, I was asked by the Norwegian Ministry of Climate and Environment to make a presentation on citizen participation in the context of smart cities at a national conference on “Future cities”. Later, in March 2011, I held a similar presentation for the Directorate for Cultural Heritage.



Background

- In November 2011, I spoke at “U-homes-2011: Smart Living with Automation” in Hefei, China
Topic: Assisted Living through Self-support Networks.
- Upcoming book-chapter in book on “Smart Cities” to be published by Springer later this year.
- BUT: Most of what I will be talking about is based on experience from real projects with real municipalities



Outline

- Discuss the concept of “smart cities”
- Discuss the concept of “smart buildings”
- Discuss citizen participation in context of smart cities
- Present some cases and projects
 - Welfare technology, The Innovatory
 - Digital planning dialog



Smart cities



Why “smart” cities?

- More and more people live in cities
- UN has predicted that the world’s urban population will grow by 75% by 2050
- Cities occupy only 2% of planet, but account for 60-80% of energy consumption
- Environmental impact of cities are high
- Obvious need to be smart!



Source: Barrionueovo, J., Berronne, P., and Ricart, J. Smart Cities, Sustainable Progress. IESE Insight, Issue 14, 2002.

Research on smart cities

- Multidisciplinary field
- Economists, sociologists, engineers, urban planners
- But Information and Communication Technologies are central to development of smart cities



What is a smart city?

Smart cities are places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems.

Anthony B. Townsend. (2014) Smart Cities, W.W.Norton & Company



What is a smart city?

"A smart sustainable city (SSC) is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects".

ITU-T Focus Group on Smart Sustainable Cities (2014) Smart sustainable cities: An analysis of definitions



Participation

- Many authors (and organizations) have pointed out the important role of citizen participation in development and governance of smart cities.
- *“Projects of smart cities have an impact on the quality of life of citizens and aim to foster more informed, educated, and participatory citizens. Additionally, smart cities initiatives allow members of the city to participate in the governance and management of the city and become active users”*

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., Pardo, T.A., Scholl, H.J.: (2012) Understanding Smart City Initiatives: An Integrative And Comprehensive Theoretical Framework. In: Proceedings Of The 45th Hawaii International Conference On System Sciences, Pp. 2289–2297



Data management

- Big Data + Smart City = true
- When we can get data on everything...
- How can we use these data?



Traffic

- Use data to make better traffic flow
- Examples:
 - Where is traffic jams, alternative routes?
 - Use traffic data to control traffic lights
 - Where to find an available parking spot?
 - Avoid driving around to find a free one
- Real time information on public transport



Environment

- When to enforce traffic restrictions (control pollution levels)
- Better public transport solutions (to reduce car use)
- Smart street lights (to conserve energy)
- Teleworking (to reduce car use)



Safety and security

- Improved emergency response services
- Surveillance cameras, sound detection
- Send messages or do automated phone calls to alert citizens of emergencies.



Company presentation: Locus

- Located in Sandefjord, Vestfold
- Delivers public safety solutions
- State of the art solutions for fleet management of emergency vehicles and a system to communicate patient data to hospital (e.g, EEG)
- Faster response, better information, better personnel safety
- Electronic maps / GPS



<http://www.locus.no/english-summary/welcome-to-locus-article198-185.html>

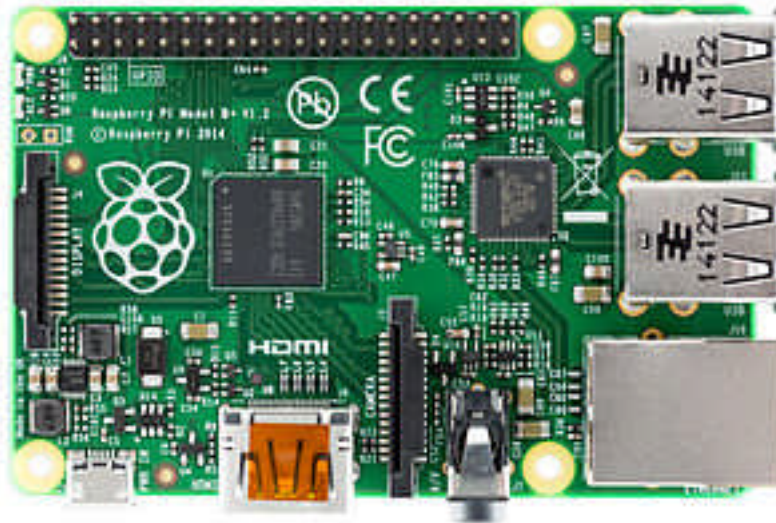
Sidestep: Cheap technology

- Technology is becoming very affordable
- Data can be collected from devices with another primary function, e.g., smartphones
- But also from cheap, dedicated devices
- Internet of Things



Raspberry Pi

- Low cost computer
- US \$ 35,-



900 MHz quad-core
1 GB memory
Network interface
HDMI

Support for multiple
operating systems



Data aggregation

- Cheap computers with sensors
- Software to aggregate collected data
- Visualization



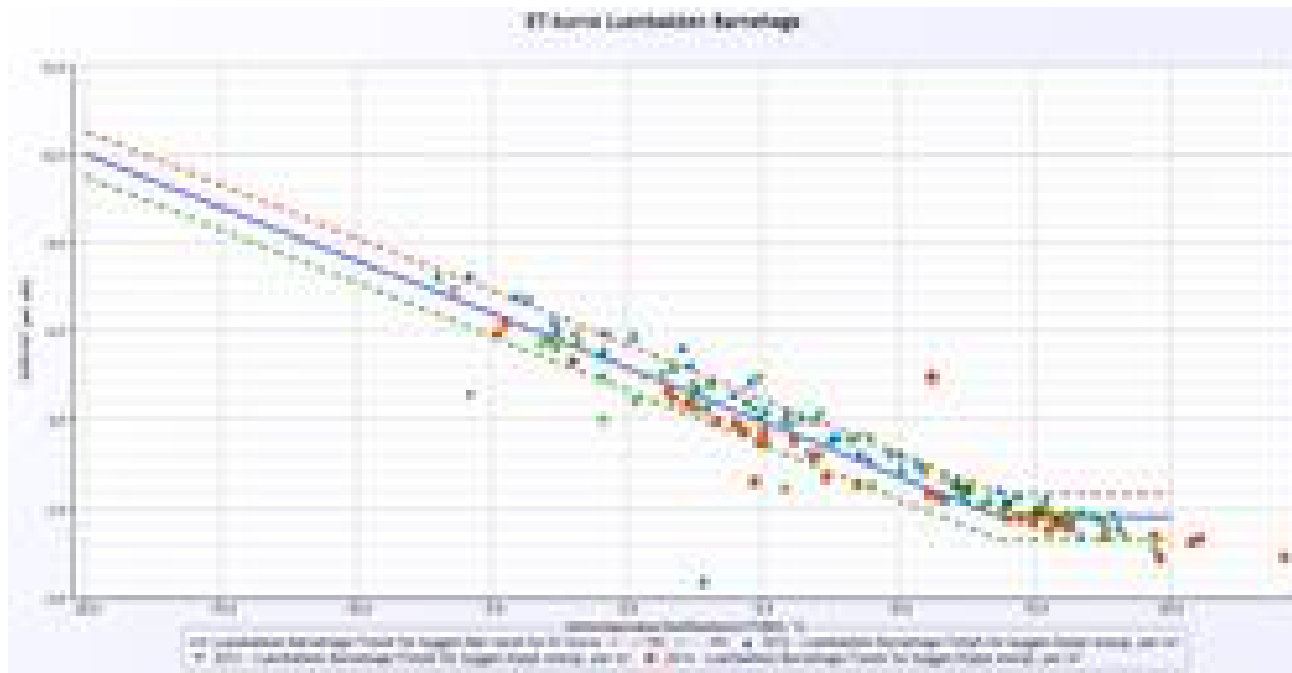
Company presentation: Gurusoft

- Located in Sandefjord, Vestfold
- State-of-the-art data collection, aggregation and visualization
- Delivers solutions to municipalities and cities
- Energy, water supply, sewers

<http://www.gurusoft.no>



Visualization



Visualization

Trafikklys - avvik fra ET-kurvenes b rverdi

Sted	Uke 12	Uke 1	Uke 2	Uke 3
K�llesvingepunkt 22 Barne	11.25	10.25	10.25	11.25
Str�ngel�ttelokk 21. Akers/Dovre/�stlandet	11.25	11.25	11.25	11.25
Olavsgate 27 Oslo	11.25	11.25	11.25	11.25
Ing. R�fsegge 188 Drammen	11.25	11.25	11.25	11.25
St. H�kars veg 18 Oslo	11.25	11.25	11.25	11.25
Skovveien 14 Oslo	11.25	11.25	11.25	11.25
Brennstovveien 27 Oslo	11.25	11.25	11.25	11.25
Skovveien 181 Oslo	11.25	11.25	11.25	11.25
Skovveien 4 Oslo	11.25	11.25	11.25	11.25
Skovveien 25 Oslo	11.25	11.25	11.25	11.25
Castellgaten 5, �stlandet	11.25	11.25	11.25	11.25
Ullensaker Veg 6, �stlandet/�st-�stlandet	11.25	11.25	11.25	11.25
Heggenes 25, �stlandet	11.25	11.25	11.25	11.25



Smart homes / smart buildings



Smart homes / Smart buildings

Four identified areas:

- Safety and security
- Entertainment
- Energy management
- Welfare

[“U-homes-2011: Smart Living with Automation” in Hefei, China]



Safety and security

- Intrusion alarms
- Fire alarms
- Moisture/flood alarms
- Video surveillance



Entertainment

- Broadband
- TV / Audio
- Communication



Energy management

- Intelligent temperature control
- Heat exchangers
- Solar panels
- Reuse of hot water



Welfare technology

- Sensors
- Alarms
- Devices

(More on Welfare Technology later..)



Infrastructure

- Cabling system that makes it easy to upgrade
- Dedicated room for infrastructure



Integration

- Buildings needs infrastructure
- Infrastructure can support applications
- But we have silos
 - Lack of integration across the four areas
- The challenge is integration
 - How many remote controllers do you have?



Smart cities of smart buildings

- Smart buildings can help building smart cities
- Smart grid for energy
- Buildings as sensors

Lee, E-K, Chu, P., Gahd, R. (2013) Fine-Grained Access to Smart Building Energy Resources. IEEE Internet Computing, Special issue on Smart Cities, Nov/Des 2013



Smart devices? Smart people!



Smart devices

- Smartphones
- Smart TVs
- But neither phones nor TVs are smart
- The use can be smart
- The users are the smart ones



Smart people

- Cities are not smart
- Buildings are not smart
- Devices are not smart
- Unless the people are using the cities, buildings and devices in a smart way



Smart use

- To use technology for
 - A simpler and better life
 - To reduce environmental footprint



Simpler and better life

- Don't you want to spend more time with friend/family?
- Don't you want to participate in society in a most effective way?



Smart governance



What is e-Government?

- The use of ICT within government to provide better services to its citizens
- Improve government efficiency and quality
 - Externally
 - Internally



Early e-Government

- Provide electronic services for citizens 24 hours / 7 days a week
- Self-service
- Transactions through forms
 - Applying for Kindergarten
 - Tax return statements through Internet
- Technology, not organization



e-Government today

- Focus on backoffice integration
- Process engineering
- Multiple channel service delivery
- Portals and customization
- Organization, not technology



Multi-channel interaction

- New opportunities to interact with citizens
 - Phone
 - E-mail
 - SMS
 - Chat
 - Social media



Efficiency and self service

- City of Copenhagen, Denmark
- Average costs of citizen contact:
 - Personal appearance: 10 Euro
 - Telephone: 5 Euro
 - Digital self-service: 40 Cent
- Note:
 - Investments is not calculated
 - User experience/satisfaction is not discussed



Use of social media

- Why use social media?
- Effective way of interaction
- Questions and answers are disseminated to all users, not the one that asked the question



Municipalities on Facebook

- The number of municipalities using Internet as a communication channel with their citizens is steadily increasing
- Data collected by the author in November 2009 showed that 26 Norwegian municipalities were actively using Facebook to interact with and inform their citizens.
- Alltogether 73 municipalities were present on Facebook, but the remaining profiles were either established by third-parties or used for employees
- In January 2013, 107 municipalities had pages on Facebook



Municipalities on Facebook

- Presence is one thing, interaction is another story
- Most municipalities use Facebook for news announcements
- Maturity model:
 1. Presence (news)
 2. Mobilization (asking citizens to mobilize)
 3. Interaction (dialog with citizens)



Municipalities on Facebook

- Best practice: City of Sarpsborg
- Facebook monitored by the same people handling first-line interactions
- Short response time



Social media

- Social media is also a data source, to be analyzed and used
- Can provide information on sentiments of citizens
- And give early warnings when something is wrong



Company presentation: eMind

- Located in Larvik, Vestfold
- State-of-the-art data mining, predicative analysis and text mining from social media
- Mostly used for e-commerce, but has made some interesting demonstrations for policy making

<http://www.emind.no>



Participation



Three types of participation

- Citizen competence and experience,
- Data collection through citizens' use of technology,
- Participation as democratic value



Citizens' competence and experience

- First, citizens have a lot of experience that can aid development of better plans, solutions and services
- Some citizens may even have important competence that the city does not possess
- By listening to the citizens, potential problems can be addressed early, and thereby reduce the risk of failure



Citizens as data collectors

- Citizens can help collecting environmental and other data by using smartphones and other technologies. One example is “FixMyStreet.com”, a web application to report problems with roads and other infrastructure
- Another example is the Green Watch project. The project distributed 200 smart devices to citizens of Paris. The devices sensed ozone and noise levels as the citizens lived their normal lives, and the results where shared through a mapping engine
- The project showed how a grassroots-sensing network could reduce monitoring costs dramatically, and at the same time engage citizens in environmental monitoring and regulation



Citizens as democratic participants

- Finally, active participation enhances democracy, especially on the local level
- Participation is not only about taking part in decision making processes, but also to build sustainable local communities, where citizens care for each other



Preconditions for participation



This model was presented at ICDS 2010
Berntzen, L. & Karamagioli, E.
Regulatory Measures to Support eDemocracy
IEEE Computer Society

*Preconditions for user
participation and involvement*



Digital Planning Dialog



The project

- Grant from Norwegian Research Council (Høykom)
- Project with partners:
 - 12 Vestfold municipalities
 - Vestfold County Municipality
 - The County Governors' office,
 - Vestfold University College (now Buskerud and Vestfold University College)
 - Norwegian Mapping and Cadastre Authority



The project

- *Digital plandialog* (Digital Planning Dialogue) facilitates digital communication with the municipalities by parties affected by area plans
- Digital plandialog may strengthen the democratic process through improved transparency and access to information in planning cases, increased access to documentation, opportunities for greater citizen involvement, etc.
- This project may also generate a better basis for making decisions, which may result in fewer conflicts and faster case processing



https://www.regjeringen.no/globalassets/upload/fad/kampanje/dan/regjeringensdigitaliseringsprogram/digit_prg_eng.pdf

The project

- The Digital plandialog project was initially a collaboration between 12 municipalities in the County of Vestfold, and is now used actively in several of the municipalities in the county
- The county municipalities and county governors of Oppland and Hedmark have been pushing for use of Digital plandialog by all municipalities



https://www.regjeringen.no/globalassets/upload/fad/kampanje/dan/regjeringensdigitaliseringsprogram/digit_prg_eng.pdf

The planning and building act

- Municipal planning is regulated by the Norwegian Planning and Building Act (Planning and Building Act 1985). The stated purpose of this act is to:
- *Facilitate coordination of national, county and municipal activity and provide a basis for decisions concerning the use and protection of resources and concerning development and to safeguard aesthetic considerations*
- *By means of planning, and through special requirements concerning individual building projects, the Act shall promote a situation where the use of land and the buildings thereon will be of greatest possible benefit to the individual and to society*



Area plans

- The area plan gives more details on the utilization of certain geographical areas. In particular, the area plan identifies different kinds of land-use:
- Building areas including areas for dwellings with associated facilities, shops, offices, industry, buildings for leisure purposes (leisure cabins with connected outhouses), as well as sites for public (State, county and municipal) buildings with a specified purpose, other buildings of specifically defined use to the general public, hostels and catering establishments, garages and petrol stations
- Agricultural areas
- Public traffic areas including roads, railways, harbors, airports, parking areas



Area plans

- Public outdoor recreation areas, including parks and areas used for play and sport
- Danger areas, including installations which may represent hazard to the public, e.g. high voltage installations
- Special areas, including buildings and installations to be preserved based on historical value, green belts in industrial areas, nature conservation areas and many others
- Common areas including parking areas, playgrounds and other areas common to several properties
- Areas for renewal



Stakeholders

- The Planning and Building Act identifies different stakeholders that have their right to submit comments on a zoning proposal. Examples of stakeholders are:
 - The county government, with a responsibility for coordinating regional planning.
 - The county governors' office has responsibilities regarding environmental issues, agricultural issues, and the preservation of historical valuables.
 - The public road administration and the railway administration have responsibilities to take care of future public transport needs
 - Property owners
 - Existing users of properties
 - Civic organizations
 - General public

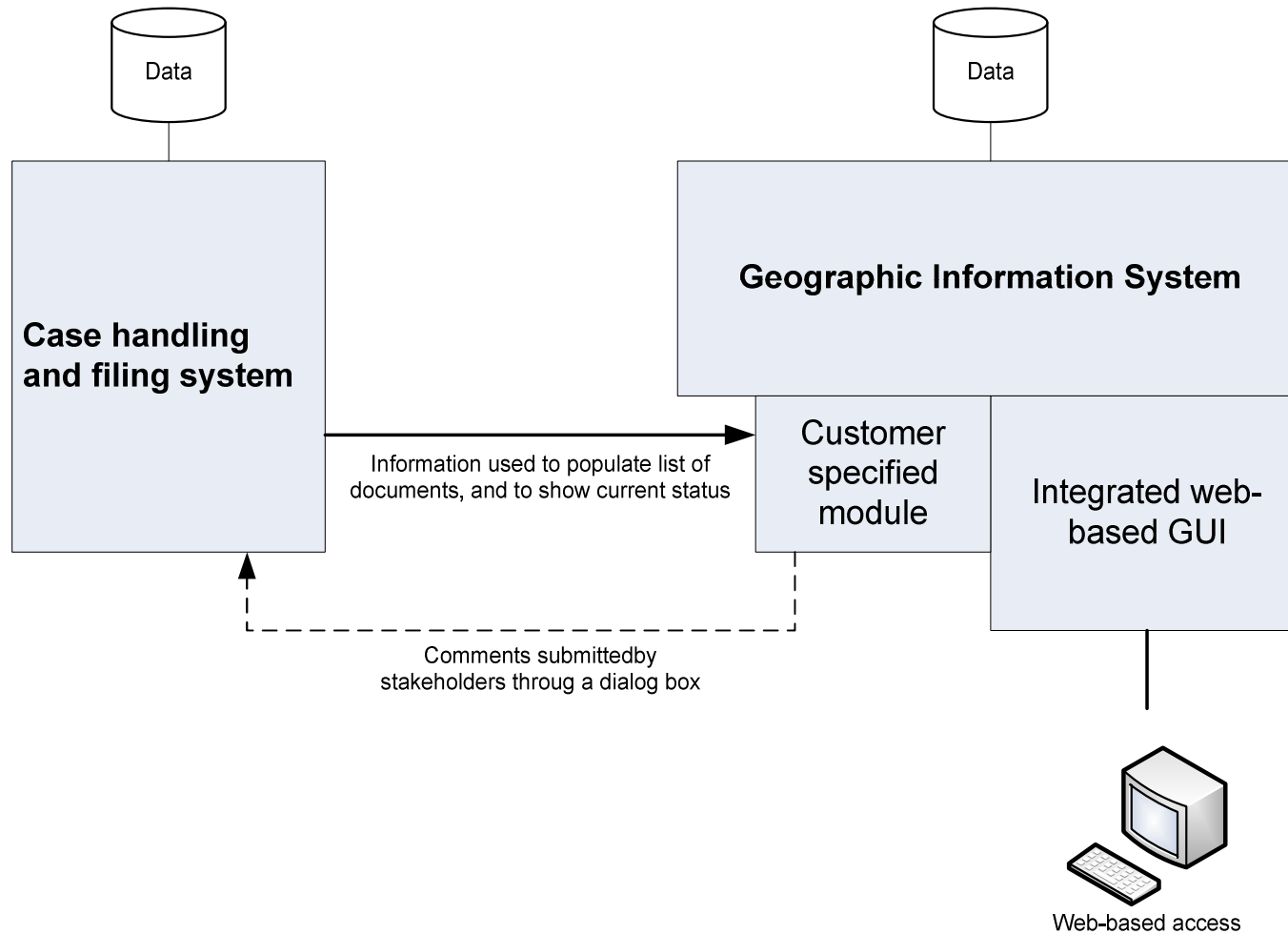


Project aims

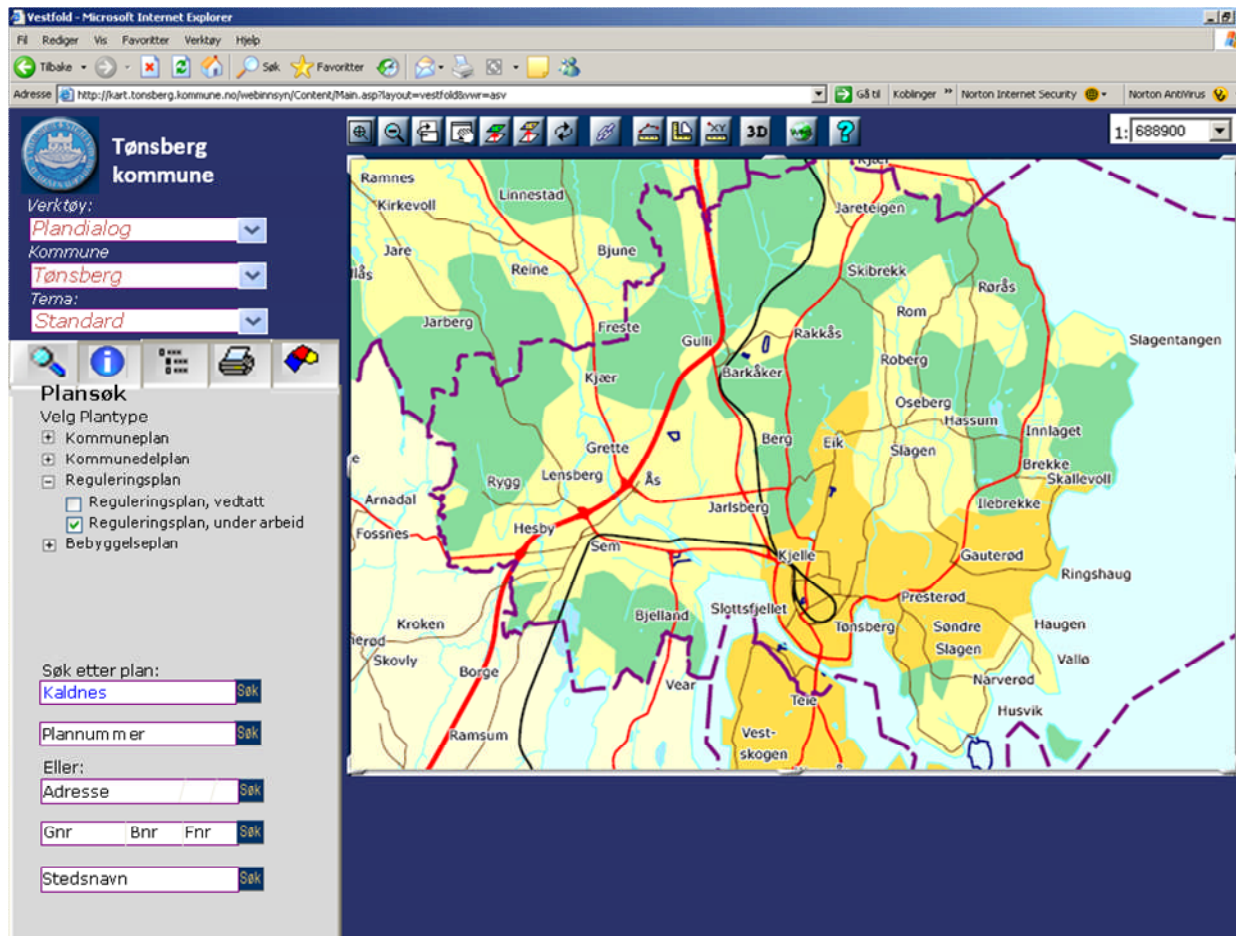
- The scope of the “Digital Planning Dialog” was to improve development of area plans by use of information and communication technology
- The development of area plans is a complex process which includes high amounts of document interchange between stakeholders and the municipality



Integration of systems



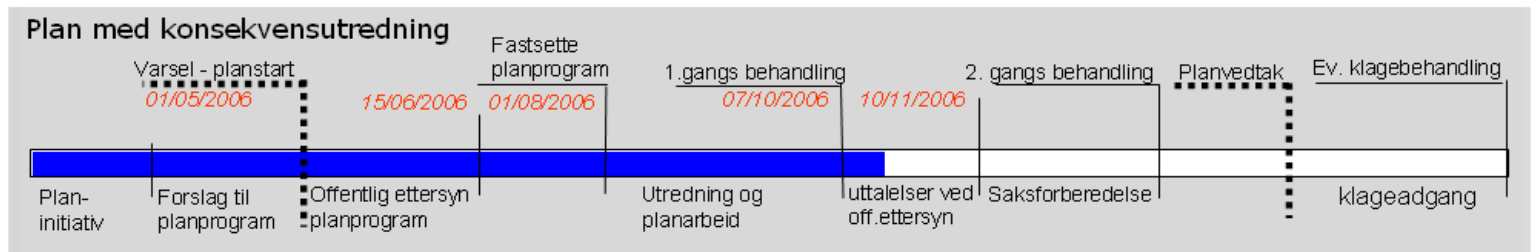
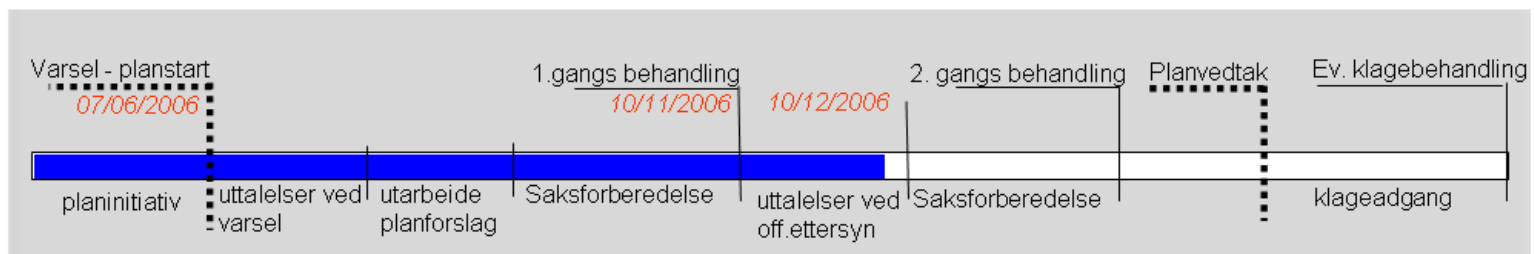
User interface



GIS is used to provide user interface



Timeline



User interface

The screenshot displays a web browser window with the URL `http://kart.tonsberg.kommune.no/webinnryk/Content/Main.asp?layout=vestfold&svr=aspv`. The interface is for the Tønsberg kommune planning system. On the left, there is a navigation pane with the following elements:

- Tønsberg kommune** logo and name.
- Verktøy:** A dropdown menu set to *Plandialog*.
- Kommune:** A dropdown menu set to *Tønsberg*.
- Tema:** A dropdown menu set to *Standard*.
- Icons for search, information, and printing.
- Planinformasjon:**
 - Reguleringsplan
 - Kaldnes industriområde**
 - Status i saksbehandling: **Offentlig ettersyn**
 - Frist for uttalelser: **10.12.2006**
 - Gjennomskinnelig plan
 - Progress bar: 0% to 100%
 - Links: [Reg. bestemmelser](#), [Plankart \(PDF\)](#), [Illustrasjoner](#), [Saksframlegg](#)
 - Andre Saksdokumenter:**
 - Innkommne uttalelser
 - [Nabo 1](#)
 - [Statens vegvesen](#)
 - [Fylkesmannen](#)
 - Tidligere saksdokumenter
 - Send uttalelse** button

The main area features a map with various colored overlays (pink, blue, green, yellow) and labels such as *Oseberg kulturhus* and *Kaldnes*. A scale of 1:4070 is shown in the top right. At the bottom, a horizontal timeline illustrates the process stages:

Stage	Start Date	End Date
Varsel - planstart	07/06/2006	-
1. gangsbehandling	10/11/2006	10/12/2006
2. gangsbehandling	-	-
Planvedtak	-	-
Ev. klagebehandling	-	-

Below the timeline, a bar chart shows the duration of each stage: *planinitiativ*, *uttalelser ved varsel*, *utarbeide planforslag*, *Saksforberedelse*, *uttalelser ved offentlig ettersyn*, *Saksforberedelse*, *klageadgang*.



Results

- ICT-based application for municipal area planning.
- The aim of the project is to make the planning process more transparent to all stakeholders, facilitate participation and improve administrative efficiency
- Digital Planning Dialog is a practical example on integration of e-government application, and uses an innovative user interface including a timeline to show progress of area plan development
- The project also includes a democratic dimension (citizens have access to all documents, and can submit comments online)



Case: Welfare Technology



In Norway, municipalities are responsible for care.

Care is provided at appropriate level;

- Patient lives at home, visits doctor when needed
 - Personal home care
 - Residential care centres
 - Nursing homes (24x7)



New challenges for the municipalities

- Citizens live longer
 - More complex medical conditions
- Shortage of manpower
 - Problems of recruitment
- High expectations of the welfare society to provide professional care
- Increased costs



Welfare technology

- Citizens prefer to stay at home if they feel safe
- Welfare technology examples
 - Sensors
 - Devices
 - Alarms



Welfare technology

- Buildings and welfare technology
- Trend: Older people move from houses to apartments
- Technical infrastructure (broadband/fiber) makes it easier to implement welfare technology
- Smart buildings connects with smart city



Current state

- Technology is immature
- Many developments, but also many failures
- Often focus on technology



The Innovatory



How we contribute



- Buskerud and Vestfold University College has established an Innovatory. This is some kind of a laboratory, an arena where stakeholders can meet and innovate
- Opened March 2014



Innovatory

- Currently, focus is on welfare/assistive technology
- Vendors and manufacturers are invited to show their products
- Visitors: Both groups and individuals visit
- Students, health care professionals, users
- More than 1000 visitors in 2014 (8 months)



Status as of 01.01.2015

- More than 1000 visitors in 2014 (8 months)
- 1/3 students and faculty, 2/3 external visitors
- 40 vendors (26 domestic / 14 foreign)
- 114 products and solutions. All products are in production



Innovatory



Innovatory



Innovatory



Innovatory



Innovatory



Innovatory



Innovatory



Innovatory



Conclusion



Concluding remarks

- Neither cities, buildings nor devices are smart
- But they can be used in smart ways
- The users, the citizens, can be smart by using information technology for various purposes
- Security and safety, environment and welfare
- But also active participation to make their local community prosper





Thank you for listening!



Show the benefits

- For the individual
- For society
- Visualization



Smart Cities

- Policy
- Technology to support policy making
- Technology to show users the advantages of making alternative choices
- How much to save?



The responsibility

- As technologists, we should try to help the development of smartness, on city level, on building level, but in the end, it is about educating people on how to use the technology.

