Potential future AESS-Conasense Challenges

by

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First proposal meant for further "brainstorming

BoG of IEEE-AESS
Seattle, May 2017

Discussed earlier in BoG:

Predicting earthquakes, tsunami, severe weather

Sensing Climate Change effects

Conasense in security:

Through-Wall-Radar, Emergency Networks

Various future ICT-AESS networks and applications:

Transport, …

Neuro-rehabilitation, Quality of Life

Ethics in Conasense

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Members AESS Adhoc Committee on Future Directions

Future areas of AESS (in-/Outside AES Technical Panels)

        Leo Ligthart, chairman (new civil AES/Conasense areas)

        Bob Lyons, initiator

        Alfonso Farina (industrial relations)

        Marina Ruggieri (multi-disciplinary organizations)

        Joe Fabrizio (all areas)

Future areas of AES Technical Panels

        Roy Streit

        Mike Wicks

        Hugh Griffiths

        Vince Socci

        Walt Downin*g*

        Garrett Hall (Space Situational Awareness)

Leo's vision on future ICT/Internet/AES services for QoL

When we ask the people "What is most important in life?" the top 2
answers are "Happiness in the family" and "Health"
Success of Skype, FaceTime, Whatsapp, Wechat, ..

- New services needed for contributing positively to our "Health" and "Well-Being"
- Most initiatives on health care and means for non-healthy (and/or elderly) persons   *Examples: Obisitas and , Alzheimer, Stroke, Orthopedic means, …*
- Largest group is healthy and wants to stay healthy by physical exercising at all ages
- Prevention of illness and diseases using "Advanced Services" is not yet been discovered as large market potential
- Integrated Navigation, Sensing and Communications are important in many new applications and use integrated technology, systems and networking approaches.
- AESS is the Society in IEEE which has a focus is on the mentioned approach.

IEEE
Advancing Technology
for Humanity

Summary of future ICT/Internet/AES (Conasense)   services for healthy persons who wants to stay   healthy

Advanced services should include:

       Real-time individual health monitoring

       On-line video and speech communications

       On-line advise for precise navigation (incl. places to rest, ..)

       On-line advise for stimulating actions on what and how to do

       On-line connection with data bases

Services requires:

       New broadband wireless sensors

       New "on-body personal network" with wireless interfacing

       New "app's" which match between the best individual actions and

       Stimulating programs on staying active

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AESS and Conasense are important in "Solving the Aging problem of our Society"

There is the expectation that the present young generation will have an eduction phase up to the age of 25 years (or even more), a working phase of around 40 to 45 years and a phase after retirement of more than 30 years.

When people retire they expect QoL and they consider health as most important. However, there exists a big need to lower the costs for health care because the present on-going growth in health care costs makes clear that it will lead to unsolvable problems.

My vision: in-body networks needed which make use of "nano-scale intelligent vehicles" with sophisticated "Artificial Intelligence"

Intra-body network at nano-scale (1)
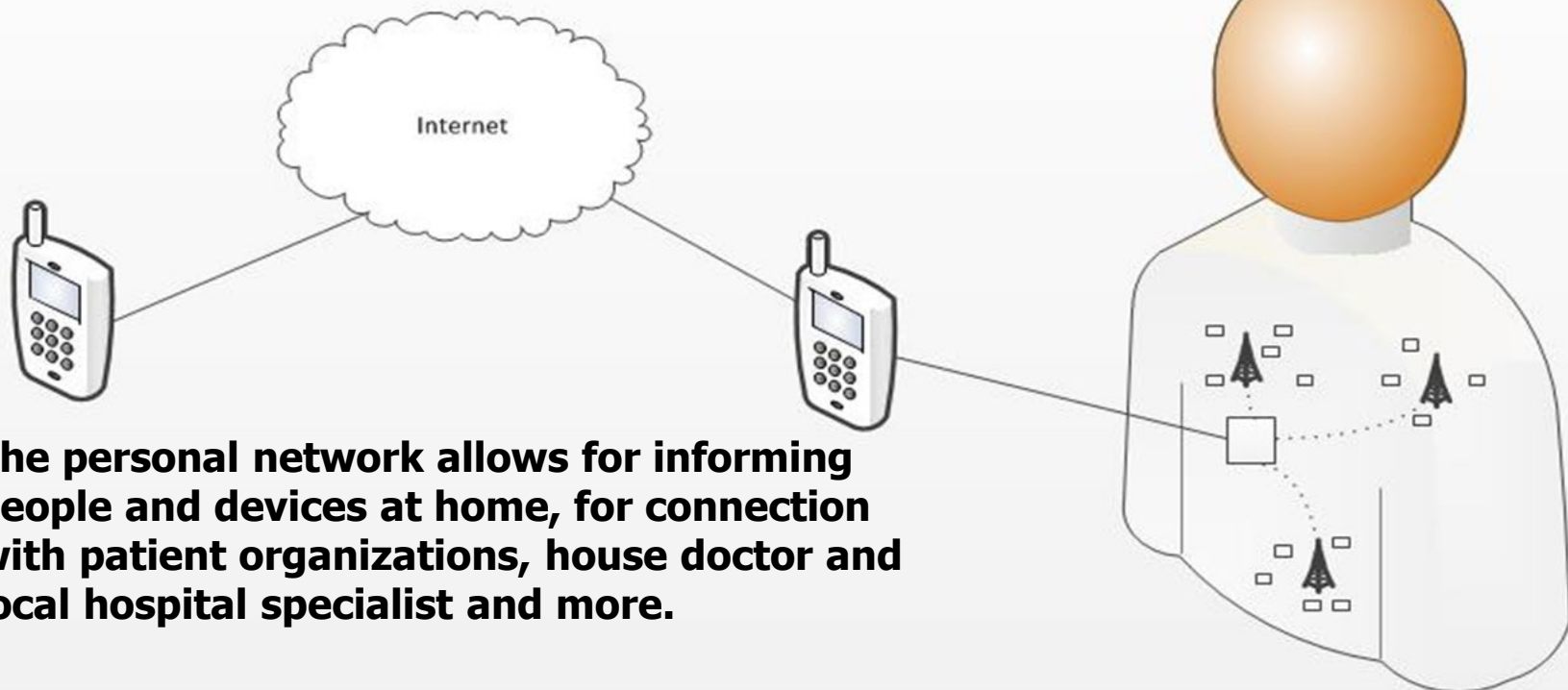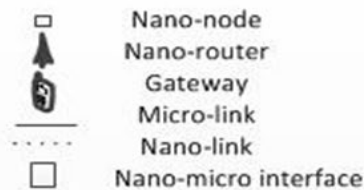
The personal network allows for informing people and devices at home, for connection with patient organizations, house doctor and local hospital specialist and more.

Future intra-body network will make use of "nano-scale intelligent vehicles" with sophisticated AI. The "self steering" vehicle has "self-navigation" and goes via blood vessels to all vital parts in the body.
The vehicle monitors, senses, collects and does inspections on the status conditions of the "healthy" person and communicates with external devices so that changes over time correlates with changes in health.

Nano Vehicles

Professor Ben Feringa received for his research on Nano-vehicles the Nobel Prize for Chemistry in 2016. The Nano vehicle looks like a frame with 4 wheels.
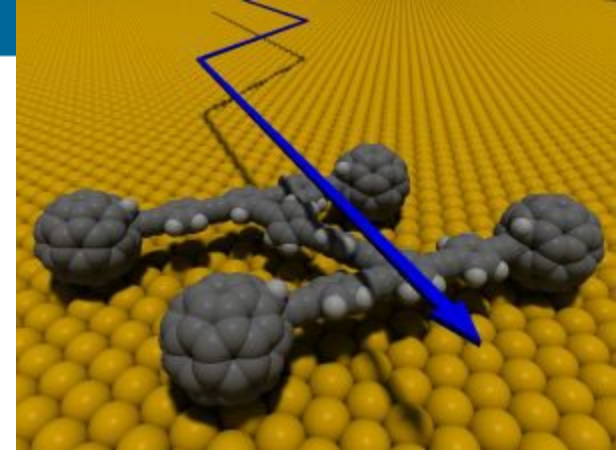
Potential future applications:

Accurate transport of medicines in human body

Extracting individual molecules

Molecular robots for building micro-electronics at Nano-scale

Vehicle principle: some atomic parts of an asymmetric molecule can rotate (as wheels) by an external pulsed energy source and let move the vehicle in a wanted direction.

Present a. Nano vehicle demonstrated just above 0Kelvin and on a metal layer and b. vehicle at micro-scale using enzyme on Si layer

Enzyme decomposes hydrogen-peroxide into water and oxygen. Research is on placing 2 enzymes on the Si layer where one enzyme makes hydrogen peroxide from glucose.

Future (20-40 years from now): Nano vehicle at room temperature using light as external energy source

Research on Integrated Navigation, Sensing and Communications of the Micro-scale and Nano-scale vehicles is needed.

Intra-body network at nano-scale (3)

The vehicle is "parked" after its mission until it gets new instruction for a new inspection. Intelligence means that the vehicle learns how conditions change.

The person should decide if information is transferred to others. Due to privacy, the person has a first option to receive detailed information and/or to decide on suggested "problem solving".
After this the person can choose to give permission that data are transferred to other parties.

In case non-positive info (for example in case of early recognition of a disease) comes above, it is most important for the person and at the same time may affect the costs for health care substantially.

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Intra-body network at nano-scale (4)

Foreseeable issues
a. Legal aspect (extra laws needed)
b. Support from policy/decision makers national and international
c. Privacy (protection, authority, ethics and morality: vehicle has no ethics)
d. Companies are traditional and not much interested in long-term developments
e. Necessity of broad research between (alpha/betta/gamma) Medical/Non-Medical institutes
f. Scale of economics is big (some percent of future health care)
g. Development of self steering vehicles at Nano-scale with on-board intelligence and advanced interfaces to home and professional organizations

   a. Product developments in the various stages (proto type, pre-product, product)

   b. Wireless networks
   c. Standardizations
   d. Software (big data)

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Smart Cities and AESS/Conasense

Subject is discussed everywhere
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My vision

- Smart cities do not exist

- Consequence of urbanization over the last 20 years
    - population of cities increased a factor of 10 to 20
    - Appartment/house prices increased a factor of 10 to 20
    - Congestions
    - Air quality
    - …
- Growth is not smart
- Governments let grow cities but were not prepared fully on the negative aspects

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Smart Cities (2)

- In Asian countries (especially China and India) many cities grow to populations above 5 million inhabitants per city
- Depending on meteorological conditions, the always worsening traffic jams cause big effect on air quality
- In smart city programs ample attention is paid to smart roads, smart (self driving) cars hoping on improvements of traffic jams and air quality
- So far impact is too little
- More drastic approaches for better distribution of traffic over the day
  - NL: use road pricing (paying per km when driving in the city, paying more in the rush hours)
  - China: forbid (odd/even numbered) cars to drive in the city on certain days
  - Still more effective approaches are needed

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Smart Cities (3)

- Less cars may improve the situation
    - Make it attractive to have no private car
    - Stimulate use of self driving cars conform market conditions
    - Large-scale integration of self driving cars require a dense wireles "network of networks"
    - Individual request (via internet) for a self driving car
        - Place to start (special nearby locations), place to go (special nearby locations)
        - Car availabe in .. minutes (shorter is more expensive)
        - Sharing is cheaper

- Costs per km should be cheaper than in case the person buys and drives a private car

Science fiction? No, it is science where the laws of economy of scale are important to be considered

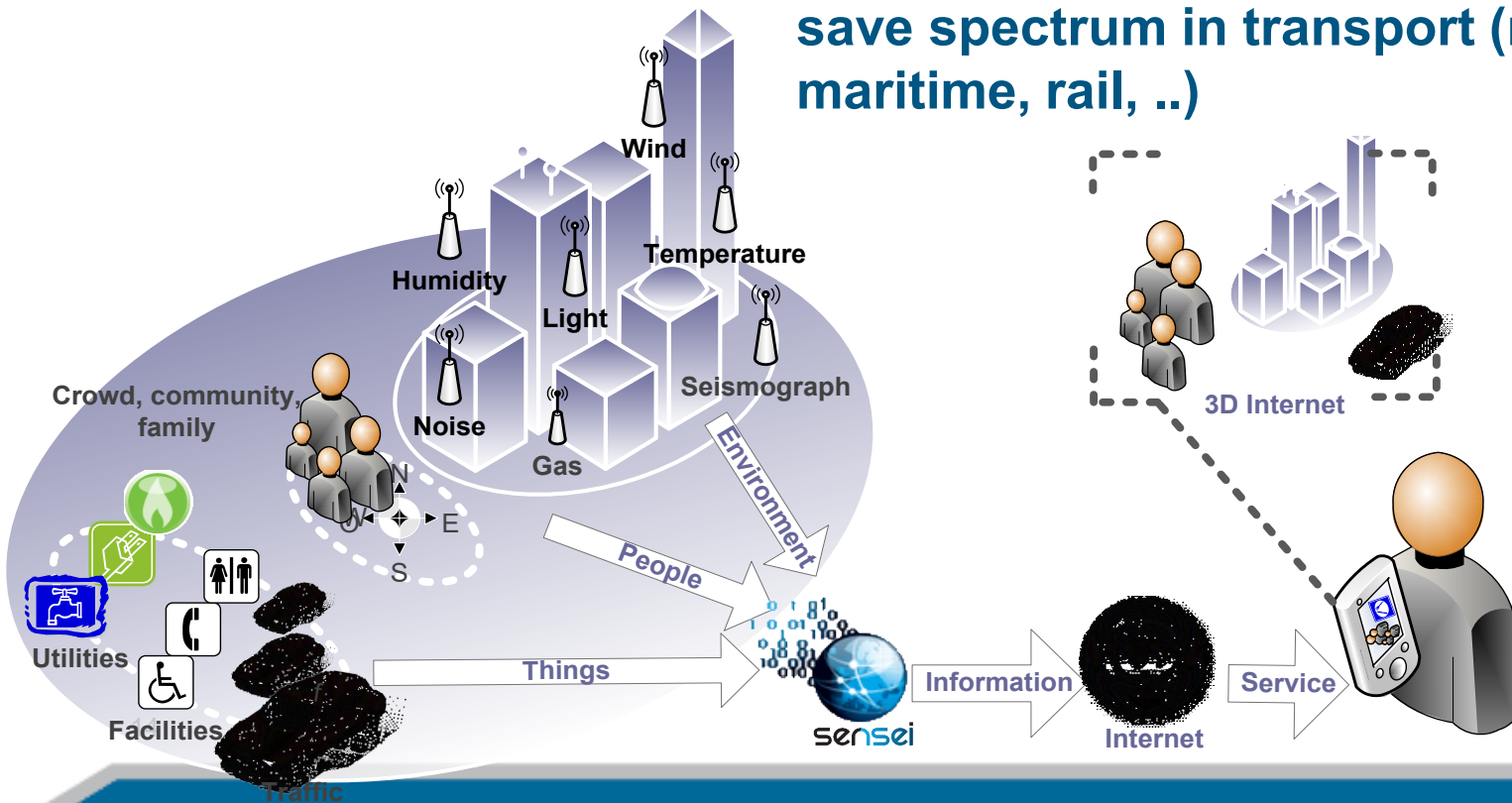8/8/2022
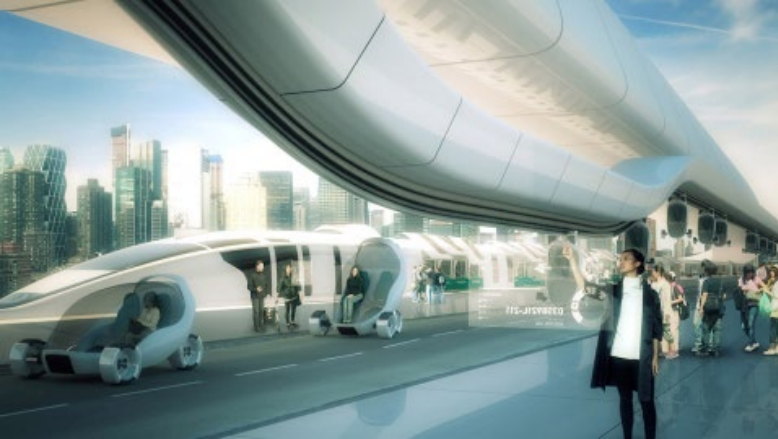
Smart Cities need CoNaSenSe

Supporting Technologies
Sensor, radar, navigation, communications, RFID
Cloud computing, Big data, IoT
Virtual reality, 3D imaging
Speech recognition, …
Future: Integrated wireless and GNSS to save spectrum in transport (road, maritime, rail, ..)

Smart Cities need Co-Na-Sen-Se

and Smart Transportation

Smart Cities (6)

Drastic approach for improving air quality (AQ) in big cities
- **We know**
  - **AQ affects dayly life of inhabitants (mouth caps are used by hundred thousands of people in Beijing)**
  - **Air is not clean**
- **For improving AQ we need a 3D Air cleaners**
  - **Assumptions: City 250 km^2**
  - **Area for 100 cleaners 1 km^2 (0.4% of city area; 100mx100m per cleaner)**
  - **Total volume to clean 2.5 10^{11} m^3 (up to 1000m above ground)**
  - **Air flow per cleaner 10 m/s gives cleaner capacity of 10^5 m^3/s**
  - **Total air inlet becomes 3.6 10^{10} m^3/hr or 8.5 10^{11} m^3/day**
  - **Conclusion: 3.4 times per day all dirty air above the city is collected for cleaning**
  - **Extra needed: Sensor network to measure air flow above city and communications network between sensors and cleaners**
- **My estimation on investments (including 10% of development costs) minimum 130 Meuros per city**

Science fiction? No, it is science where the laws of economy of scale are important to be considered

Conclusion:
Good opportunities for AESS to play a significant role in

- Future areas of AES Technical Panels
- Areas directed to solving problems in Society:
> **Future ICT services in QoL and Smart Cities**
> **Predicting by sensing**
> **Security airports, shopping malls, and many more places**
> **Ad-hoc networks**

Question May 2017:
How to structure the activities of the
AESS Adhoc Committee on Future Directions of AESS?

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