

Workshop participants:

Complementary background:

tag developers, antennae, integration, systems/applications, alternative tag technologies etc.

Good basis for brainstorming!

21 participants from:

- ~ 30% large companies*
- ~ 30% universities and other research institutions*
- ~25% SME*
- ~ 15% other (commission, EPOSS, standardization bodies...)*

General statement during workshop:

Starting ...

with different understanding of the aim of workshop

...

... resulting in ...

fruitful and constructive brainstorming ... but

hard to conclude a common sense ... (lack of time)

- *Introduction*
- *Self introduction of participants*
- *1st brainstorming round “Topics to address during workshop”*
- *2nd brainstorming round “Separation of issues into “Technology Roadblock towards the IoT”*
- *- - - - End of 1st day (end at ~18.00) and a lot of fruitful follow up discussions during dinner - - - -*
- *- - - Wrap up 1st day - - -*
- *3rd brainstorming round: “Shared Vision for the IoT”*
- *Conclusion: Recommendations for the next calls*

1st round: Topics to address during workshop:

Participants stated their view about important topics to address

Inputs are grouped in following categories:

- *Functionality*
- *Requirements*
- *Communication*
- *Standardization*
- *Other*

Outcome/collection of 1st brainstorming

Workshop – “Technology”

1st round: Topics to address during workshop

■ *Functionality:*

- *Multifunctional (sensors)*
- *Seamless integration security measure, to allow integration*
- *Sensors and actuator integration*
- *Scalable upgradable systems*
- *New Applications ->> new technological requirements*
- *Level / distribution of intelligence in nodes*
- *Power generation / Energy harvesting/ storage*

Outcome/collection of 1st brainstorming

Workshop – “Technology”

1st round: Topics to address during workshop

■ *Requirements:*

- *Low power systems*
- *Security measures / seem-less*
- *Manufacturing process*
- *Environmental issues*
- *Relation application vs. function vs price.*
- *Harsh environment (robustness, reliability)*
- *Lifetime*
- *Autonomous systems / self healing / fail proof / distributed / grace-full degradation*

1st round: Topics to address during workshop

■ *Communication:*

- *Impact of architecture (centralization/ decentralization)*
- *Different tag technologies*
- *Distributed reader infrastructure.*
- *Hybrid networks of active and passive components*
- *Physical layer – silicon technology polymer and SAW technologies*
- *Global scalable / agile well governed infrastructure complex infrastructure for ambient intelligence /*

Outcome/collection of 1st brainstorming

Workshop – “Technology”

1st round: Topics to address during workshop

■ *Standardization*

- *Multi frequencies multi standard multi-protocol.*
- *Inter linkage between communication standards*
- *Higher frequencies (standardization)*
- *Multi-standard / multi-protocol*

■ *Other*

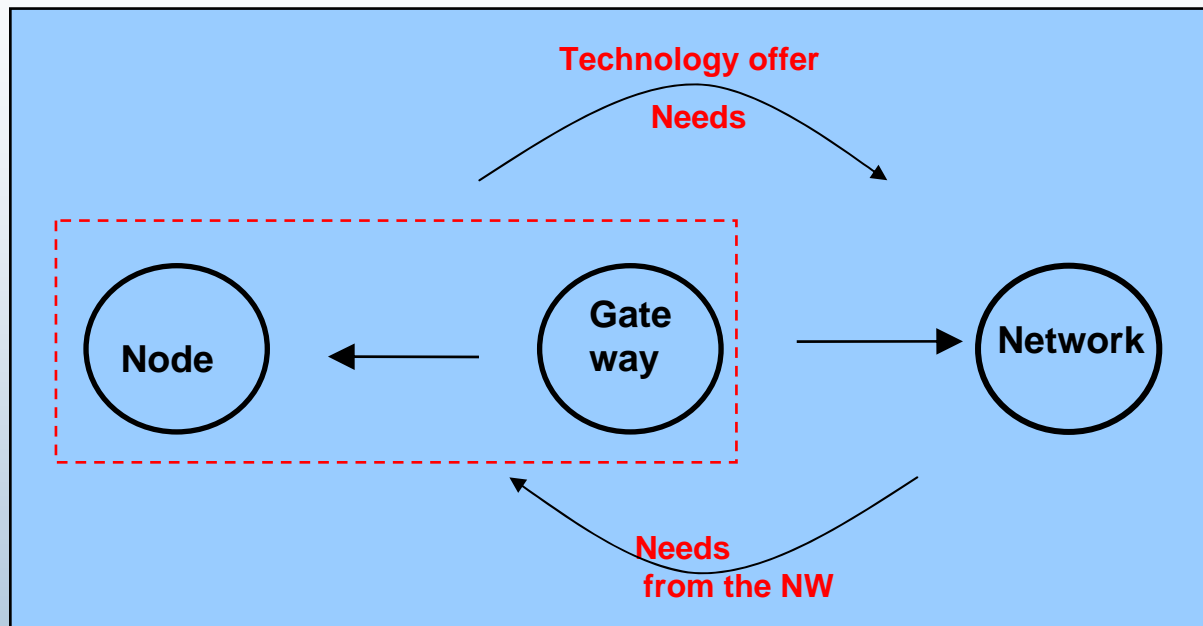
- *What is a smart tag?*
- *IPR*
- *Integration aspects*
- *European aspects*
- *Costs*
 - *Miniaturization / cost*
 - *Silicon is not the cost driver any more*

Road blocks: Overall picture

Workshop – “Technology”

Technology roadblocks:

Suggestion: Structure discussion along following picture



■ *Nodes - General Issues:*

- *Sensor / actuator integration*
- *Hybrid integration*
- *Energy scavenging*
- *Security topics (protection of data & PET)*
- *Costs / affordable costs*
- *Reliability (system reliability)*
- *Energy conversion efficiency*
- *Standardization*
- *IPR*

Nodes – Technology Issues:

➤ *Alternative node techniques:*

- *Printed electronics*
 - *Reading distance, data transfer rate*
- *SAW (surface acoustic wave)*
 - *Coding space, manufacturing, anti-collision*

➤ *Silicon based nodes:*

- *Leakage / power (efficiency of circuit devices)*
- *Packaging*
- *Harsh environment*
- *On-chip antennas*

Needs

- ... defined/given by infrastructure
 - *Harsh environment*
 - *Security / safety*
 - *EMC / EMI (electromagnetic compliance)*
 - *Localization & positioning (real time)*
 - *Reading speed (fast moving speed)*
 - *Reader authentication & data protection*
- ... to the infrastructure
 - Data fusion
 - Database architecture
 - Centralized vs. de-centralized NW approaches
 - RFID enabled service
 - “Plug & play”

Vision:

- Ambient Intelligence
- Smartness (e.g. interaction with the environment)
- Adaptability
- Ubiquity
- Configurability, Scalability
-

→ “Shared vision”

- **Follow up workshop** including other stakeholders active in the field (ETPs, ARTEMIS, ENIAC, eMOBILITY, NESSI)
- To enable the vision Smart Systems will need research in following categories:
 - Energy
 - Processing / Intelligence / Memory
 - Communication Interface
 - Integration
 - Interoperability
 - Manufacturing

Energy issues:

- Energy Harvesting
- Low Power implementations
- Energy storage (Battery, SuperCaps, etc)
- Efficiency
- Size
- (could be solved by using passive tags)

Intelligence issues:

- Context awareness capabilities
- Multifunctional sensors & actuators
- Integration of memory / processing power
- Architecture that allow machine to machine com.
Plug and play & multi standards
- Security (affordable)
- HMI
- Localization (real time)
- Robust (also for harsh environment), adaptive, scalable

Communication issues:

- Antenna integration (on chip)
- Smart antennas (tunable)
- New materials
- Manufacturing methods
- API – standardized, secure
- Tunable frontends
- Modulation schemes, transmission, speed
- Alternate technologies

Integration issues:

- Packaging (also no package devices)
- Integration into product/ device
- Hybrid integration

Interoperability issues:

- Multi tag integration
- Inter tag communication
- Centralized and de-centralized
- With other communication networks

Manufacturing issues:

- Environmental friendly
- Testing
- Self assembly
- High speed/ high volume
- Costs