

*Knut och Alice
Wallenbergs
Stiftelse*

Wallenberg Autonomous Systems Program – WASP

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Lund University



Background

- In Oct 2014 the Knut and Alice Wallenberg Foundation (KAW) decided to issue a large initiative on Autonomous Systems and Software
- Based on lobbying from companies in the Wallenberg group, spec. SAAB and Ericsson
 - Autonomous Systems
 - Software
 - Materials and Nano
 - MIMO and antennas/radio
- Invited LiU, LU, Chalmers and KTH to submit a joint application
 - Umeå University added later
- Time frame: 2016-2025 starting Fall 2015
- Application approved May 2015

2015-05-27

Miljardsatsning på forskning om autonoma system

Knut och Alice Wallenbergs Stiftelse storsatsar på grundforskning för att främja ett teknikskifte som av många beskrivs som den fjärde industriella revolutionen. Det handlar om autonoma



Dagens industri TORS
Endag

NYHETER

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0 kommentarer

Wallenberg finansierar robotforskning

Foto: Jack Mikrut

VÄRNAR SAMARBETE. Peter Wallenberg Jr., ordförande i Knut och Alice Wallenbergs stiftelse och Millie Millinert, ansvarig för forskningsprogrammet med en total budget på 1,8 miljarder kronor.

Foto: Jan-Olof Yxell

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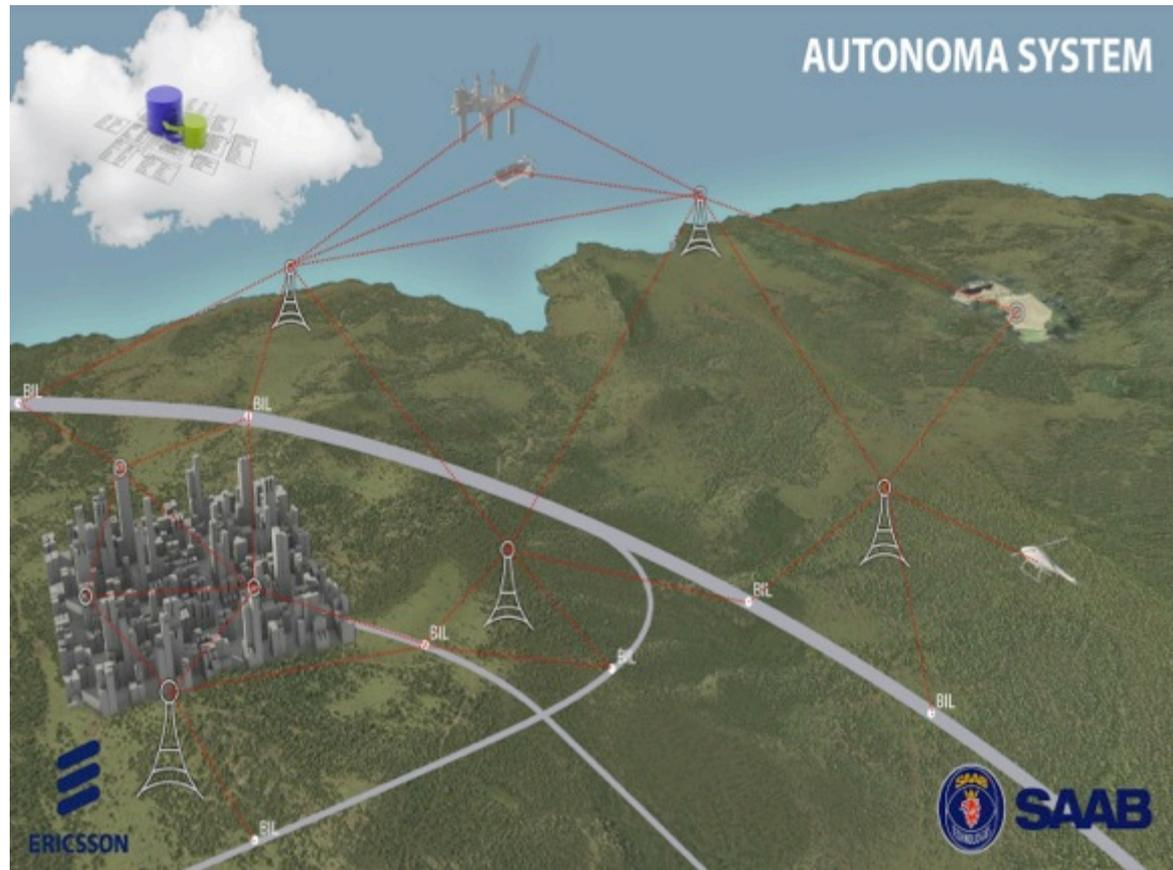
Miljardsatsning från Wallenberg ska koppla upp svensk industri

Background

- Budget:
 - KAW – 1 300 MSEK
 - Universities – 200 MSEK (co-financing)
 - Industry – 300 MSEK
 - Industrial PhDs – 100 MSEK
 - Demonstrator arenas – 200 MSEK
 - Primarily companies in the Wallenberg/Investor circle

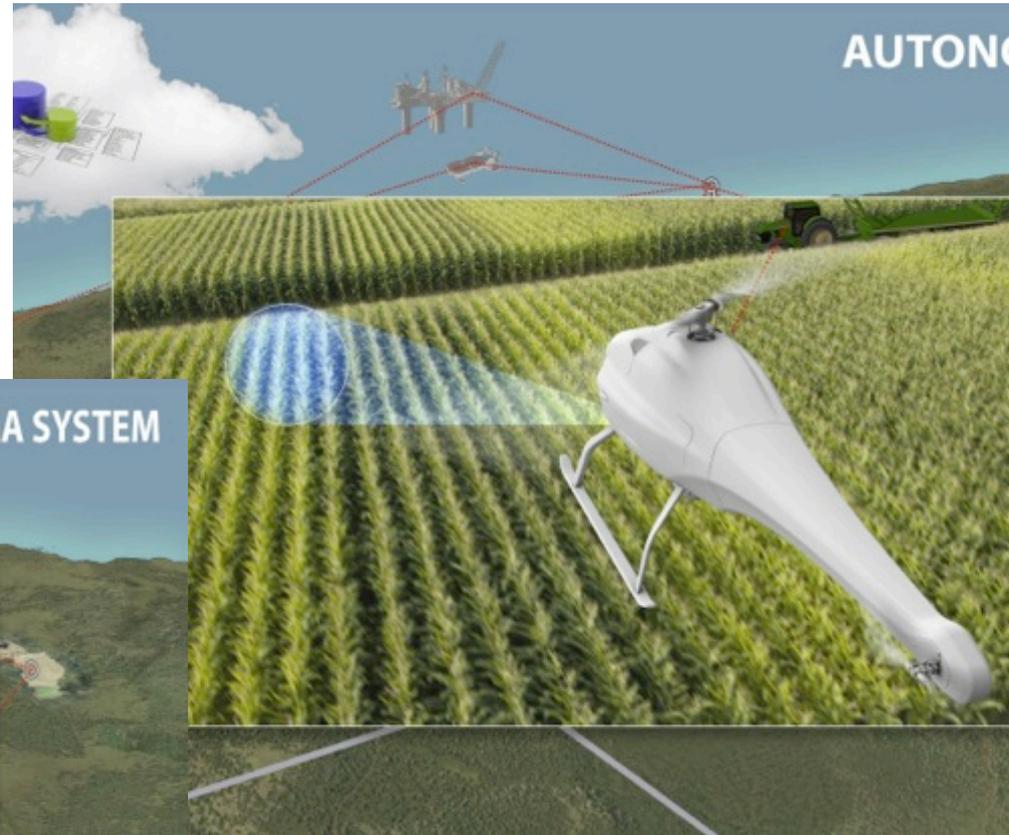
Research on software development and autonomous systems

In the future everything will be connected.
That's why systems has to be self-organizing and capable of independent decision making



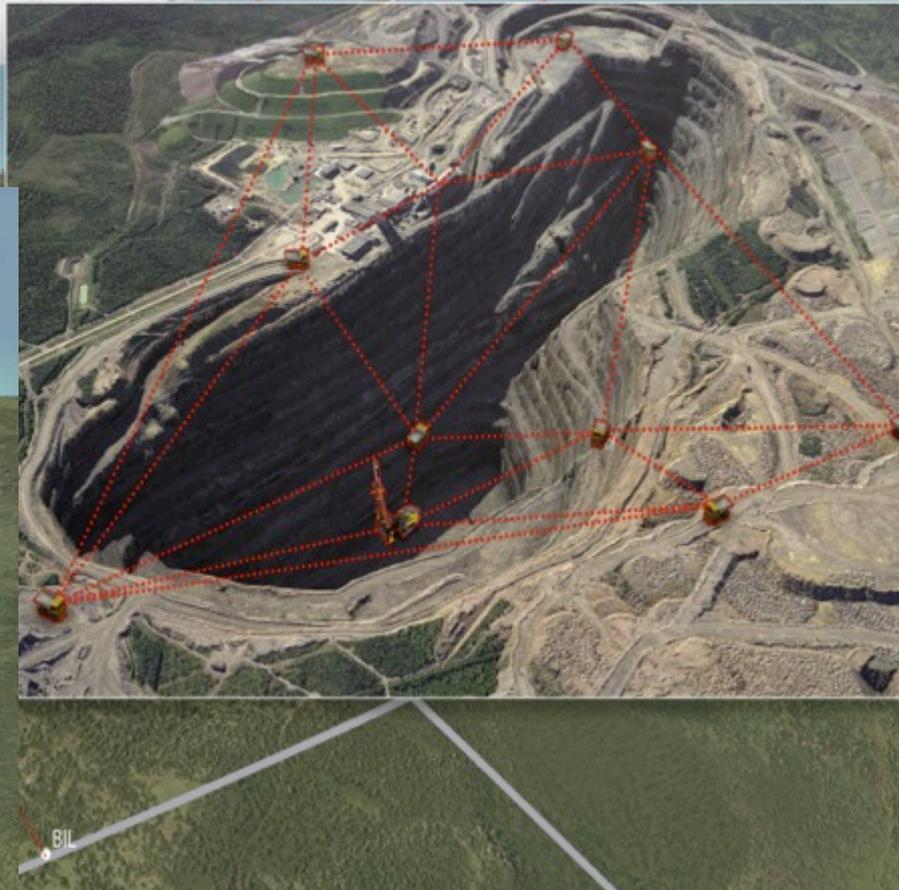
Research on software development and autonomous systems

A vision is independent vehicles with artificial intelligence allowing a substantial degree of independence



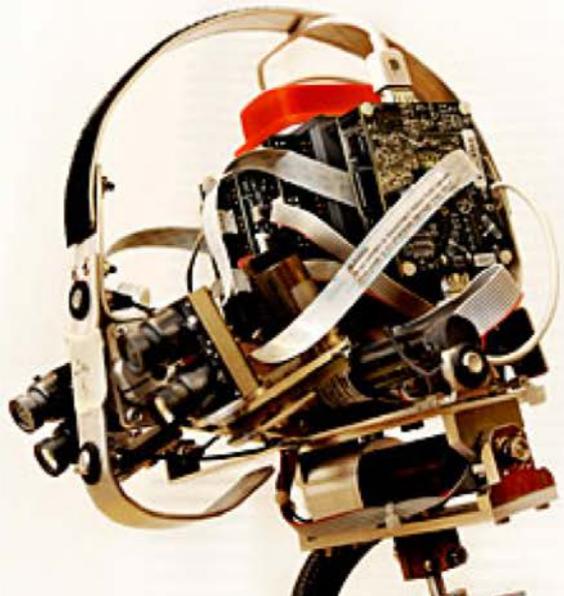
Research on software development and autonomous systems

It also includes independent machine to machine systems as exemplified in harsh environments like a mine



Research on software development and autonomous systems

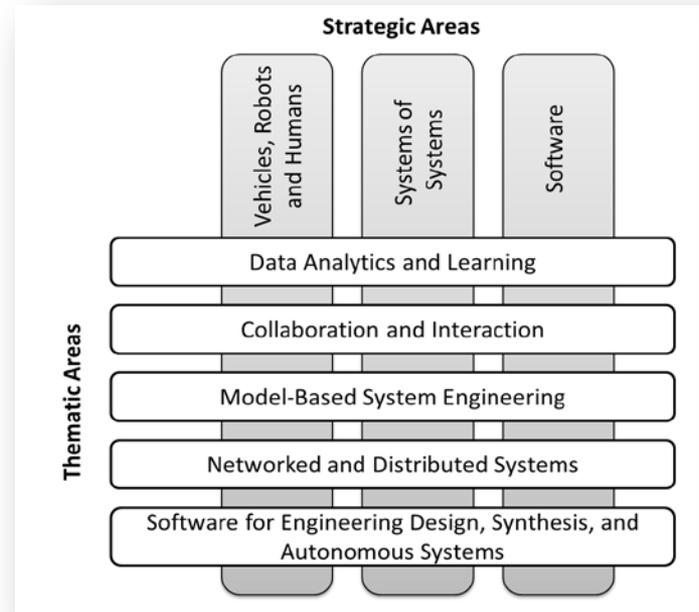
And of course also
Robot development



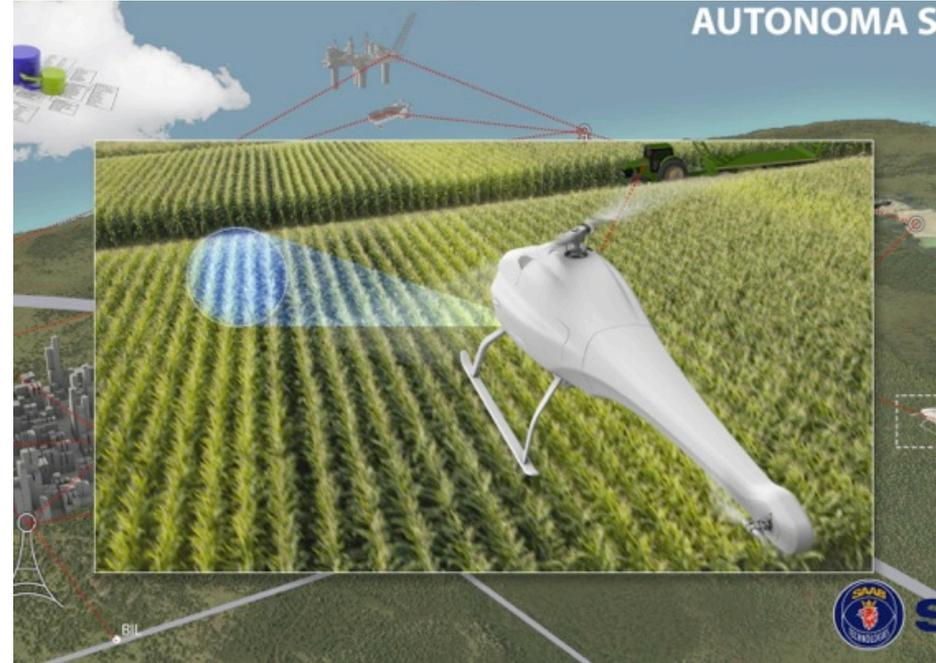
Focus

Three strategic areas:

- Vehicles, Robots, and Humans
- Systems of systems
- Software



Area 1: Vehicles, Robots, and Humans



Area 1: Vehicles, Robots, and Humans

Basic research questions:

- Collaborative and Multi-Agent Frameworks
- Distributed Mission Specification and Execution
- Mixed Initiative Interaction and Symbiotic Autonomy
- Knowledge Intensive Planning
- Semantic Cognitive Maps for Situational Awareness
- Real-time Learning & Adaptation



Area 1: Vehicles, Robots, and Humans

Basic research questions (continued):

- Maneuver feasibility
- **Human factors** in symbiotic and sliding autonomy
- Scalable **distributed optimization**



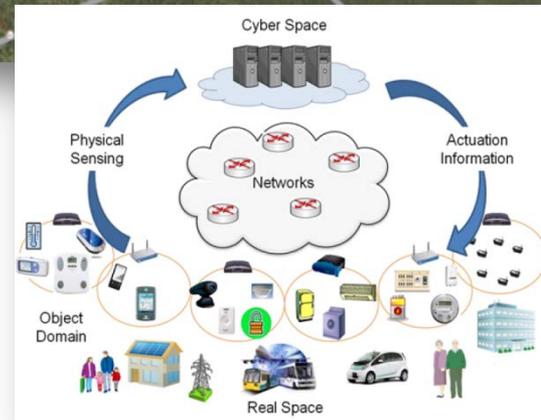
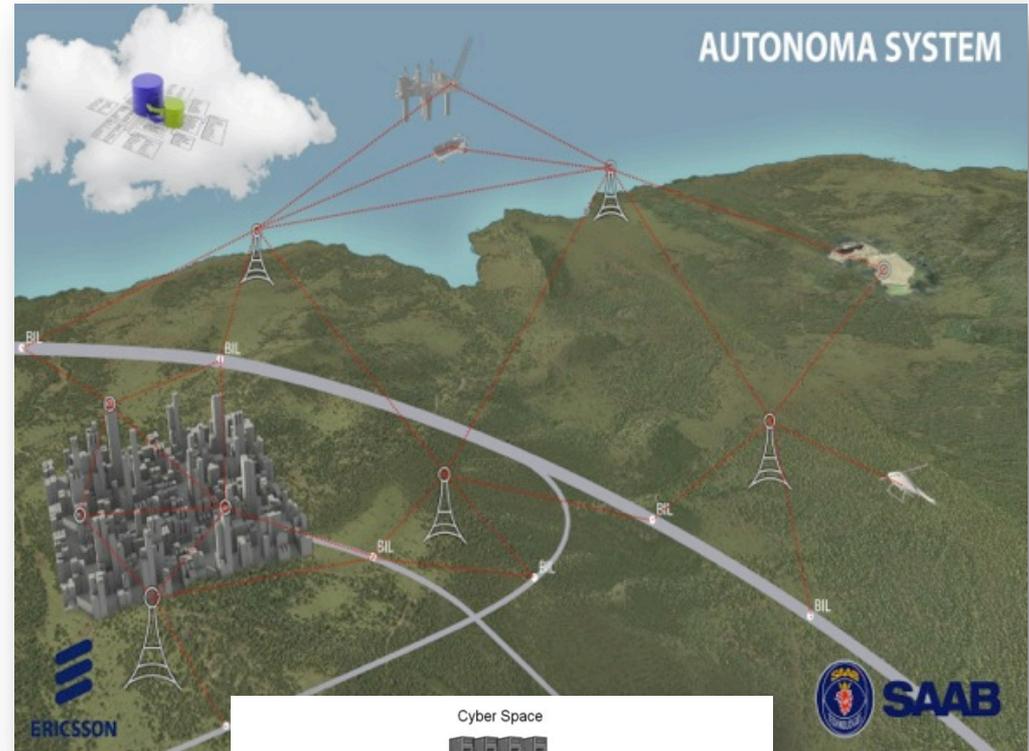
Area 2: Systems of Systems

In the networked society everything is connected.

From low-level sensor and actuator devices (IoT) to entire infrastructure systems (e.g., power, water, traffic, transportation, finance, ...) and industrial production systems

Systems of Systems (SoS)

To manage the complexity the SoS has to have a certain level of autonomy, i.e., be self-organizing and capable of independent decision making



Area 2: Systems of Systems

Example:

- Smart cities
- Smart buildings
- Intelligent traffic solutions
- Transportation syst.
- Industry 4.0
- Cloud infrastructure
-

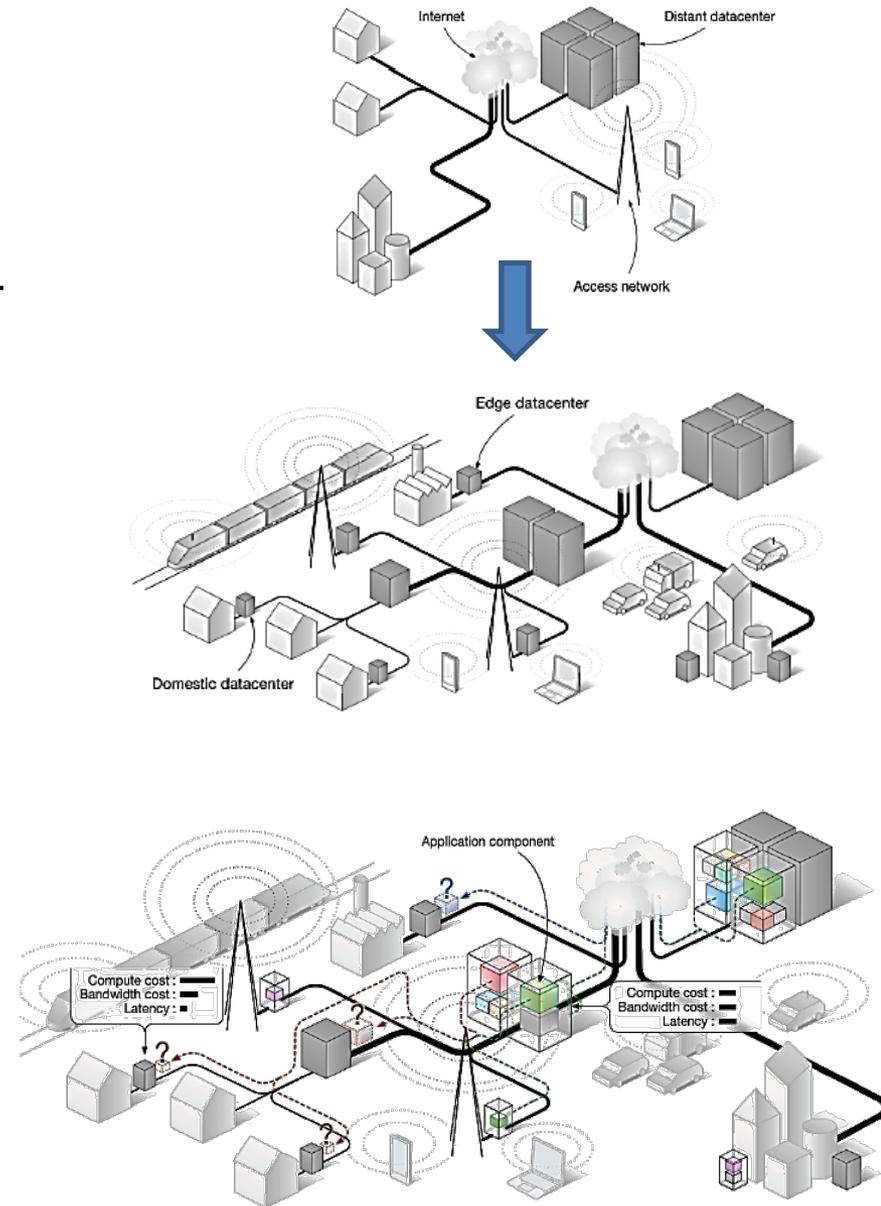


Basic topics:

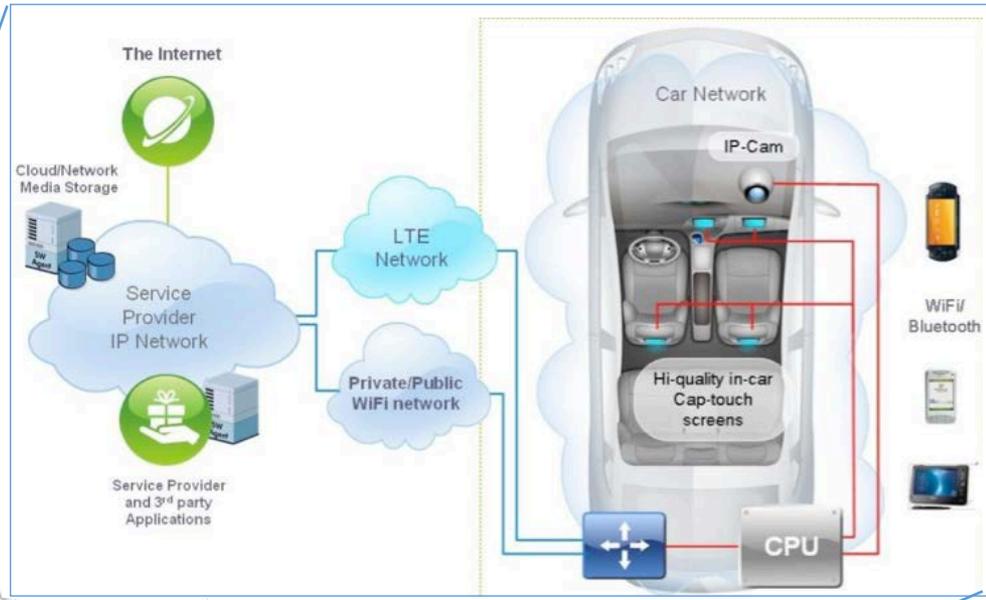
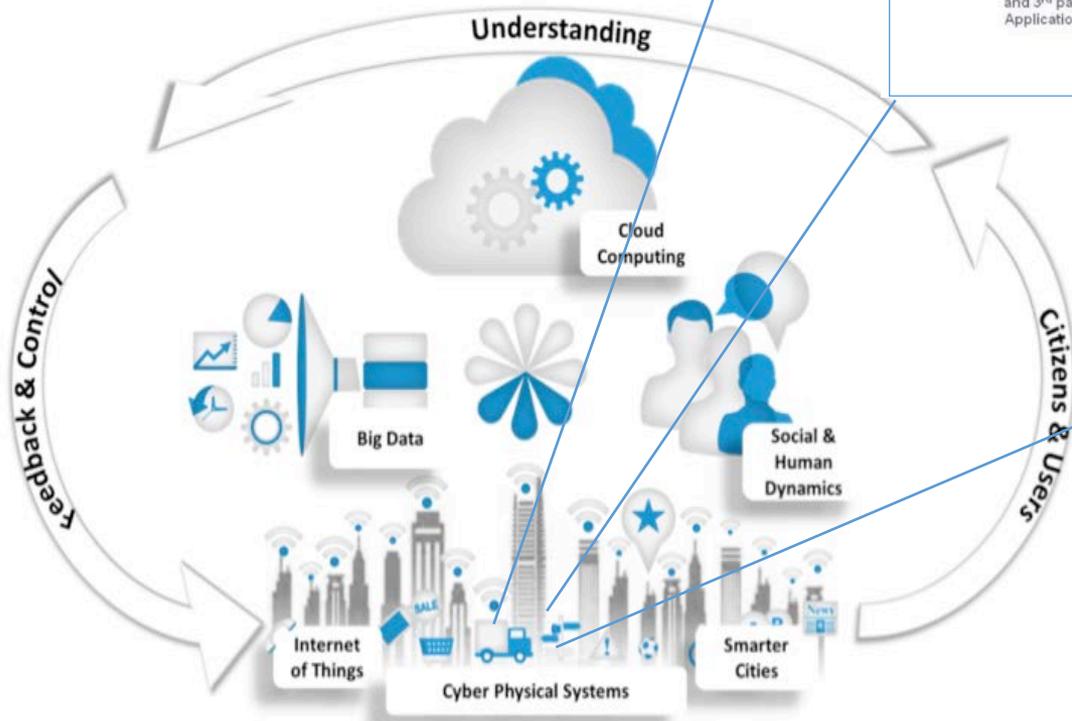
- Apply techniques for autonomy to systems of systems
- Learning, collaboration, planning, distributed decision making,
- Tools from control, AI, machine learning/analytics, big data,
- However, **not** a research programme on Smart-X

Area 2: Systems of Systems

- **Autonomous cloud**
- Network and cloud convergence
- Apply distributed control and real-time analytics to the cloud
- Improve predictability and reduce resource consumption
- Autonomous dynamic resource management – autonomic computing
- What and how much resources to allocate and when and where to deploy them.



Area 3: Software



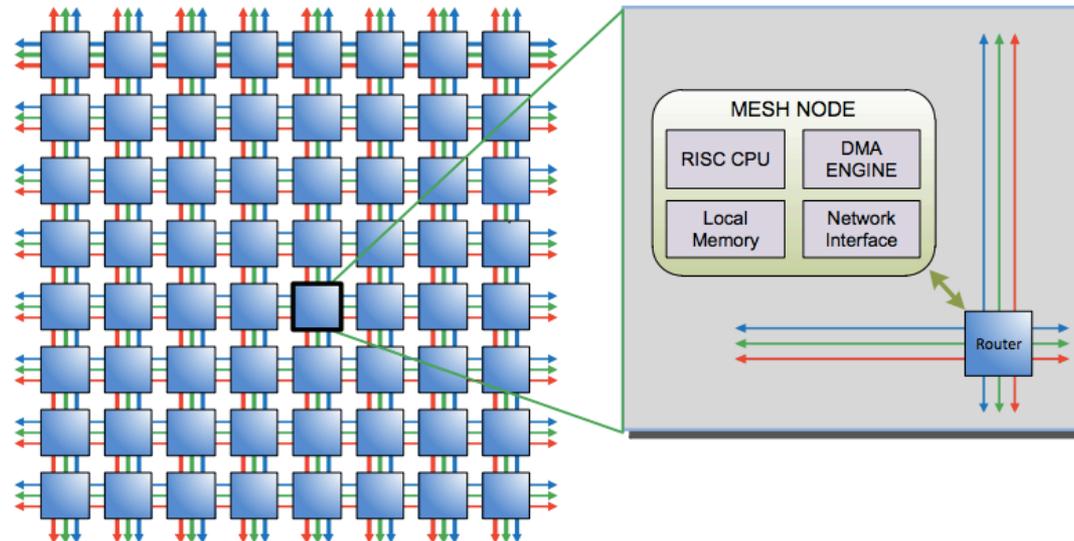
Software – Main enabler:

- New functionalities
- Integration & Communication
- Intelligence and adaptation
- Knowledge provision
- Quality Assurance

Area 3: Software – new concerns

New paradigms

- Increasing complexity, diversity, and distribution - IOT
- Dynamic Software Architecture and ad-hoc system integrations
- Heterogeneous hardware platforms (multi/manycores, GPU, FPGA), High parallelism



Area 3: Software – new concerns

New constraints

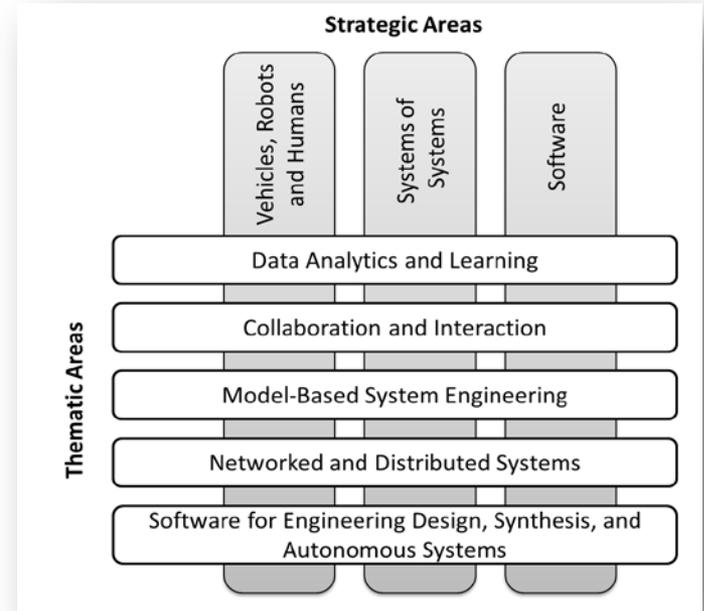
- Resources (energy, execution resources)
- Safety, security, reliability
- Real-time requirements, high performance, big data



Focus

Five thematic areas:

- Data Analytics and Learning
- Collaboration and Interaction
- Model-Based System Engineering
- Networked and Distributed Systems
- Software for Engineering Design, Synthesis, and Autonomous Systems



What is part of WASP and what is not?

- Part of WASP
 - Robotics, perception, learning, big data, distributed control and optimization, human-machine interactions, autonomous systems, task automation, autonomic computing, distributed cloud and IoT, software technology, software engineering,
- What is not part of WASP
 - Electronics, massive MIMO, antennas, radio, process automation, manufacturing automation,
- Decided by KAW and by a consensus process

Demonstrator Arenas

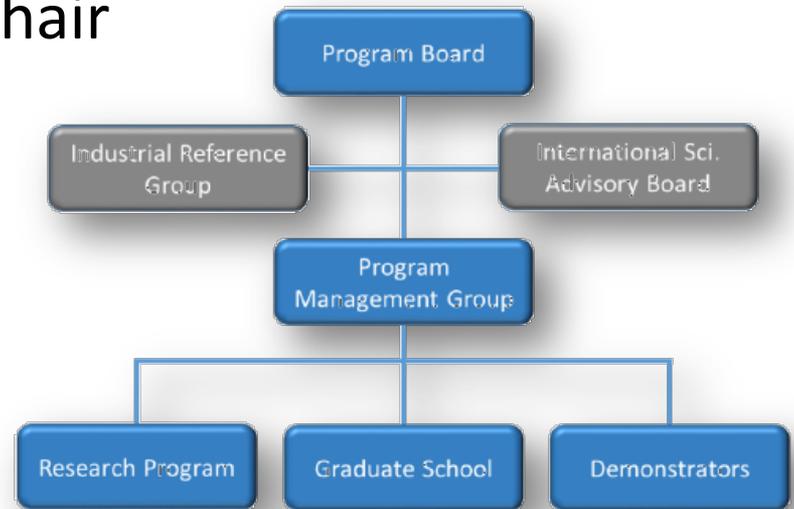
- Involved industries open up their test site facilities to WASP
- WASP funding to ease the integration
- Example
 - a combined Saab and Ericsson arena physically located in Linköping

Focus

- Common projects within the strategic and thematic areas
 - Several sites collaborate in each project
- National graduate school
 - At least 50 PhDs +
 - At least 50 Industrial PhDs
- Competitive recruitment packages
 - 16 positions (packages) – 4 per large university
 - 4.75 MSEK / year during four years
 - International recruitments

Approach

- Linköping University is the leading site
 - Lars Nielsen program director
- Board
 - Mille Millnert, chair
 - Sara Mazur, Ericsson, deputy chair
 - Pontus de Laval, Saab
 - Alf Isaksson, ABB
 - Viktor Öwall, LU
 - Arne Johansson, KTH
 - Mats Viberg, Chalmers
 - Ulf Nilsson, Linköping Univ



Applicants

Main PIs (Members of the Program Management Group)



L. Nielsen



D. Sands



B. Wahlberg



K-E. Arzén

Co-PIs



J. Bosch



P. Doherty



F. Gustafsson



G. Hedin



K. H. Johansson



L. Kovács



D. Kragic



A. Proutiere



A. Rantzer



P. Stenström



F. Tufvesson



A. Ynnerman

Budget Split

- At LTH automatic control, computer science, EIT and Math will be involved
 - Who and to what extent is not yet decided
 - Less money than what could be expected
- Ramp up 2015-2018
 - Only 6 PhDs + 5 industrial PhDs to LTH during 2016 and 2017
 - From 2017 also two recruitment packages
 - Possibly around 20 + 4 PhDs from 2019/20

Questions?