Networked Embedded and Control Systems

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Research Opportunities in the ICT Theme of the 7th Framework Programme

ECRTS'07 – Pisa, 6 July 2007

WP2007-08 ICT Call 2
Objective ICT-2007.3.7

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Networked Embedded and Control Systems

Objective 3.7: Networked Embedded and Control Systems

- *Networked + Embedded + Control + Systems*

- *Application-driven*

- *Control, Computer and Communication communities -> Excellence*

Three target (overlapping) Outcomes:

1) **Middleware** for seamless connectivity and inter-working

2) **Cooperating Objects and Wireless Sensor Networks**

3) **Control of large-scale, complex distributed systems**

1st Target Outcome: Middleware (1/3)

- New **Middleware platforms** that
  - support composability, scalability, minimal power consumption
  - provide open interfaces to third parties for application development
  - Priority only on selected application domains, i.e. :
  - Private/home/building, Nomadic, Manufacturing

- **Emphasis is on :**
  - programmability,
  - dynamic reconfiguration and ontologies
  - Services enabling privacy, security and trust
  - Predictable connectivity and QoS

- **Support** in addition to STREPS also CSAs for
  - Industry-driven initiatives for sharing software source code
  - Standardisation in broader embedded systems domain

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2nd Target Outcome: Cooperating Objects and Wireless Sensor Networks (2/3)

- **Broad definition : "Objects" are entities that**
  - cooperate spontaneously / jointly execute a given task
  - operate under severe resource constraints

- **Requiring:**
  - New methods and algorithms to support cooperation schemes
  - HW/SW platforms including OS, kernels
  - Programming abstractions to facilitate application development
  - Support/tools for commissioning, deployment, maintenance

o-existence-> (ad-hoc) communication -> cooperation-

and control/coordination (if needed) - > common goal
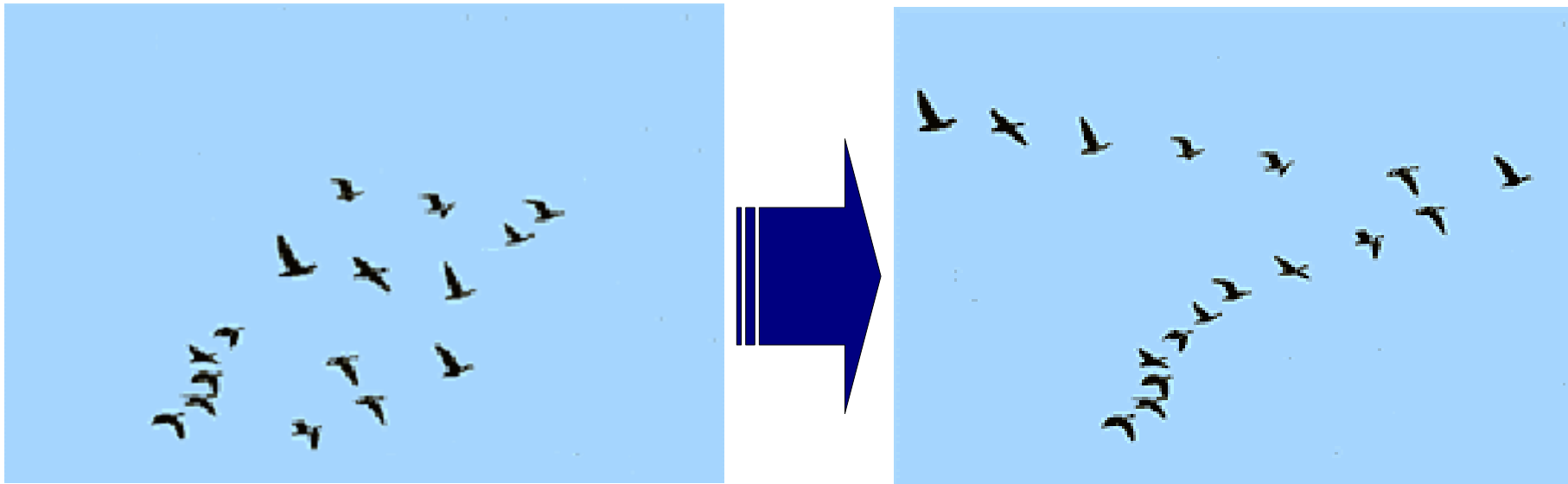
Gain efficiency through coordinating efforts

2nd Target Outcome: Cooperating Objects and Wireless Sensor Networks (2/3)

- **Further research challenges** :
  - scalability, dynamic resource recovery
  - semantics for object/service definition
  - incorporating advanced control aspects
  - security and privacy-relevant features

- **Type of research**
  - generic, BUT driven by an entire class of real-world applications. Projects should 'prove' feasibility and scaling

- **International cooperation** with USA and other countries is encouraged (via STREPS)

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3rd Target Outcome : Control of large-scale complex distributed systems   (3/3)

- ## New engineering approaches ensuring:

  - **-** Efficient, robust, predictable, safe and secure behavior

  - - for large scale infrastructures like

    - – Manufacturing and process plants

    - – Distributed energy production

    - – Energy distribution

    - – Airports or seaports,…

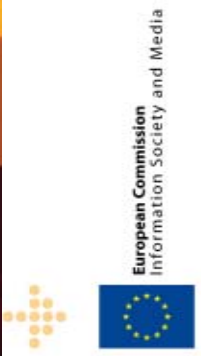European Comm
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Public

Public and/or Private

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3rd Target Outcome: Control of large-scale complex distributed systems (3/3)

- **Key challenges include:**
  - Modeling and design methods, reconfigurable architectures, and scalable algorithms
  - Mastering complexity and uncertainty
    - *e.g. delays, bandwidth limitations in communication links, fading/distorted links, unavailability of nodes*
  - Closing the control loop over (wireless) sensor networks

- **Interdisciplinary consortia required**
  - Applying computer, systems, control and communications science and engineering to *large-scale complex systems*

- Support in addition to STREPS also CSAs for
  - **International cooperation with the USA, Russia, Western Balkans**

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Expected Overall Impact

- Control of 10 times more complex systems at 10% of today's effort
- 100% available plants whilst reducing maintenance cost by 50% and reducing accidents by 30%
- Seizing new markets by providing new services tailored to customer needs
- More efficient, flexible, secure, easier to maintain and more productive large infrastructures
- Easy and low cost deployment for monitoring of the environment and natural resources

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Instruments and *Budget*

- Focus 1: **Middleware**
  - STREPs only
  - CSA for **coordination** aimed at source code sharing and standardisation initiatives

- Focus 2: **Cooperating Objects and WSNs**
  - STREPs only
  - NoE

- Focus 3: **Control of large-scale systems**
  - STREPs only
  - CSA for **coordination** aimed at international cooperation

- **Total for this objective in call 2 : 47 M€**
- **STREPS: 41 M€   -   NoE: 4 M€   -   CSAs: 2 M€**

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Related areas in FP7

- Middleware :

- Cooperating objects and sensor nets:
  - **ICT-2007.2.1/2.2**: Cognitive Systems, Interaction, Robotics (Call 3)
  - **ICT-2007.6.2**: ICT for Cooperative Systems (transport)
  - **ICT-2007.3.6:** Micro/Nanosystems

- Large scale systems and control :

  - **ICT-SEC-2007.1.7**: Critical Infrastructure Protection (Joint Call)
  - **ICT-2007.2.1/2.2**: Cognitive Systems, Interaction, Robotics (Call 3)
  - **ICT-2007.6.3**: ICT for Environmental Management and Energy Efficiency
  - **ICT-2007.8.x** : FET (e.g. embodied intelligence, complex systems) (Call 3)

- Outside ICT :
  - Manufacturing (NMP programme, MANUFUTURE platform),
  - Energy, production & distribution (Smart GRIDS and construction platforms)

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- Info Day 22/23 May:
  http://cordis.europa.eu/fp7/ict/programme/events3-20070522_en.html

- ICT:
  http://cordis.europa.eu/fp7/ict/

- General info on FP7:
  http://ec.europa.eu/research/fp7/