Mechatronics

ICOMES, 17 March 2007, Brussels

Chris Decubber, AGORIA

Interpretations, definitions of ‘mechatronics’

- **Mechatronics** is the synergistic combination of mechanical engineering ("mecha" for mechanisms, i.e., machines that 'move'), electronic engineering ("tronics" for electronics), and software engineering.
- Prof. Van Brussel: “Mechatronics encompasses the knowledge base and the technologies required for the flexible generation of **controlled motion**“
- **Biomechanics**? **Optomechatronics**?...
- **Indisciplinarity** is key

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The ‘sector’ Mechatronics within AGORIA: Machines – systems - components

The sector mechatronics

Technologie en innovatie

Samenwerking de sleutel tot succes

Conclusie

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Resarch & Innovation should provide answer to challenges:

- Higher performance requirements at competitive prices (due to growing international competition)
- Personalised and customised solutions
- Adaptive productions systems
- Environment –Energy consumption issues
  (Increasing regulations, corporate responsibility)
- Total solutions and additonal services
  (new business models)

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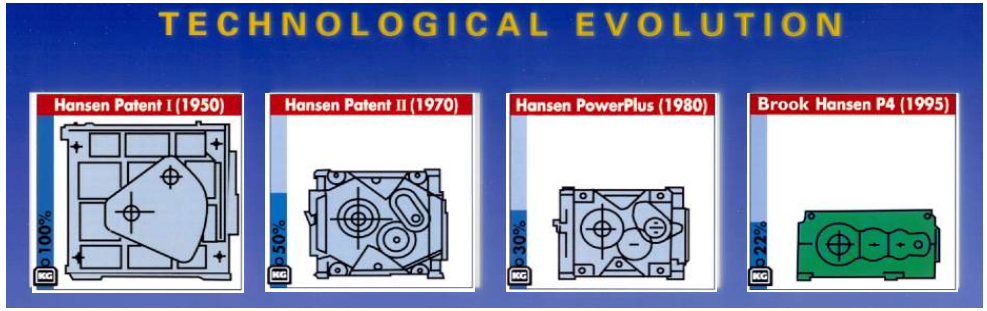
Higher performance

- Ever more compact transmissions for same Power range



- From 100 KW to 5 MW power transmission and beyond

Higher performance

Customised

Adaptive

Environment

Total solutions - services

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Personalised and customised solutions: modular design (1) (Pattyn - Packaging)

Higher performance

Customised

Adaptive

Environment

Total solutions - services

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Personalised and customised solutions: modular design (2) (CNH, agricultural machinery)

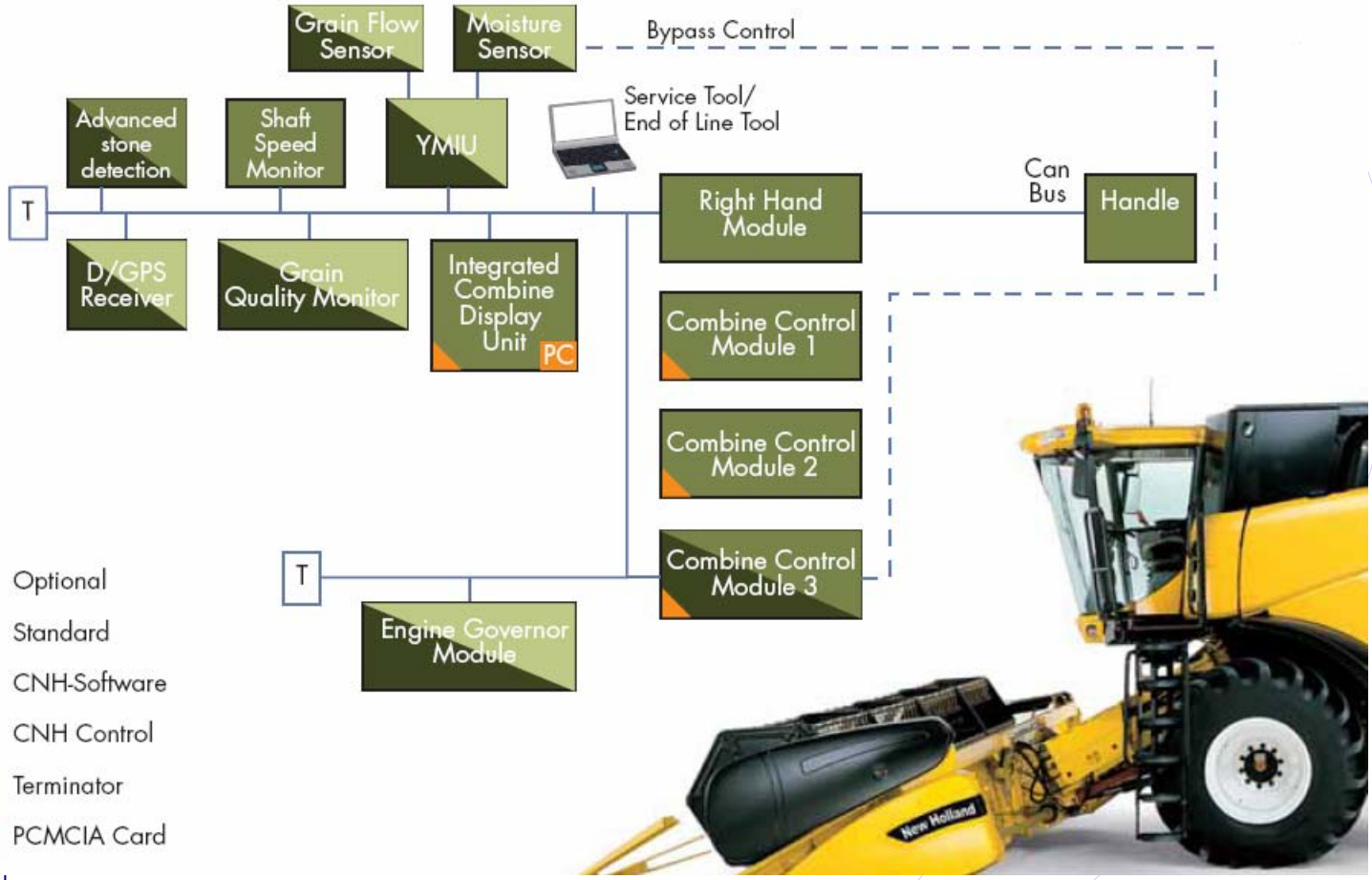
Higher performance

Customised

Adaptive

Environment

Total solutions - services



Design: good looking machines (LVD)

Higher performance

Customised

Adaptive

Environment

Total solutions
- services

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Adaptive production systems through introduction of new technologies

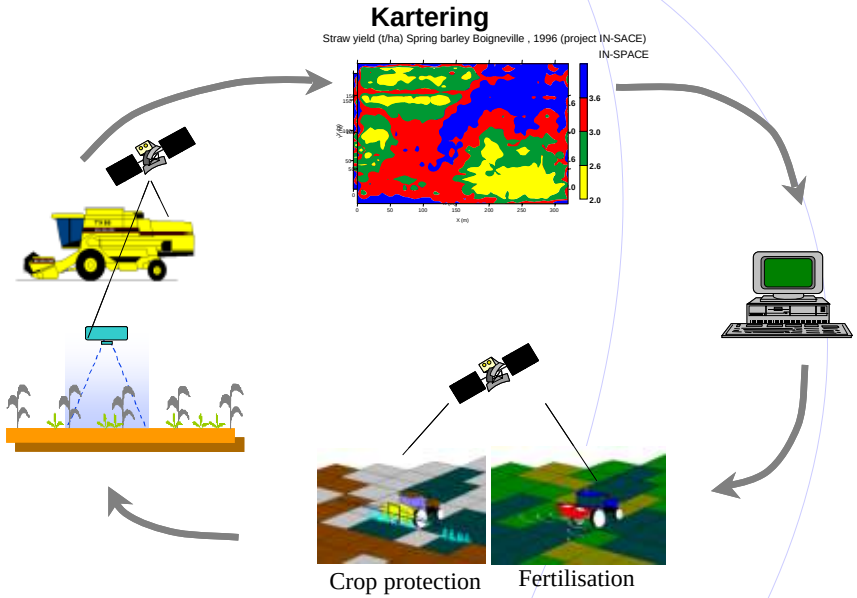
Higher performance

Customised

Adaptive

Environment

Total solutions
- services



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Total solutions (Atlas Copco)

Higher performance

Customised

Adaptive

Environment

Total solutions - services

?

WorkPlace Air System™

Full feature “all in one package” + VSD Energy consumption + air condensation treatment — **1995**

Air quality (dry, pure) + heat recovery — **1985**

Low noise + oil-free air — **1975**

‘Naked’ compressor — **1965**

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Total solutions and services (Arcomet)

- From crane supplier to supplier of entire installation for construction site

Higher performance

Customised

Adaptive

Environment

Total solutions - services

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Trends, issues

- Interdisciplinary design methods and tools
- High performance
- Reliability
- User friendliness
- Sustainable systems
- Adaptive machines and systems

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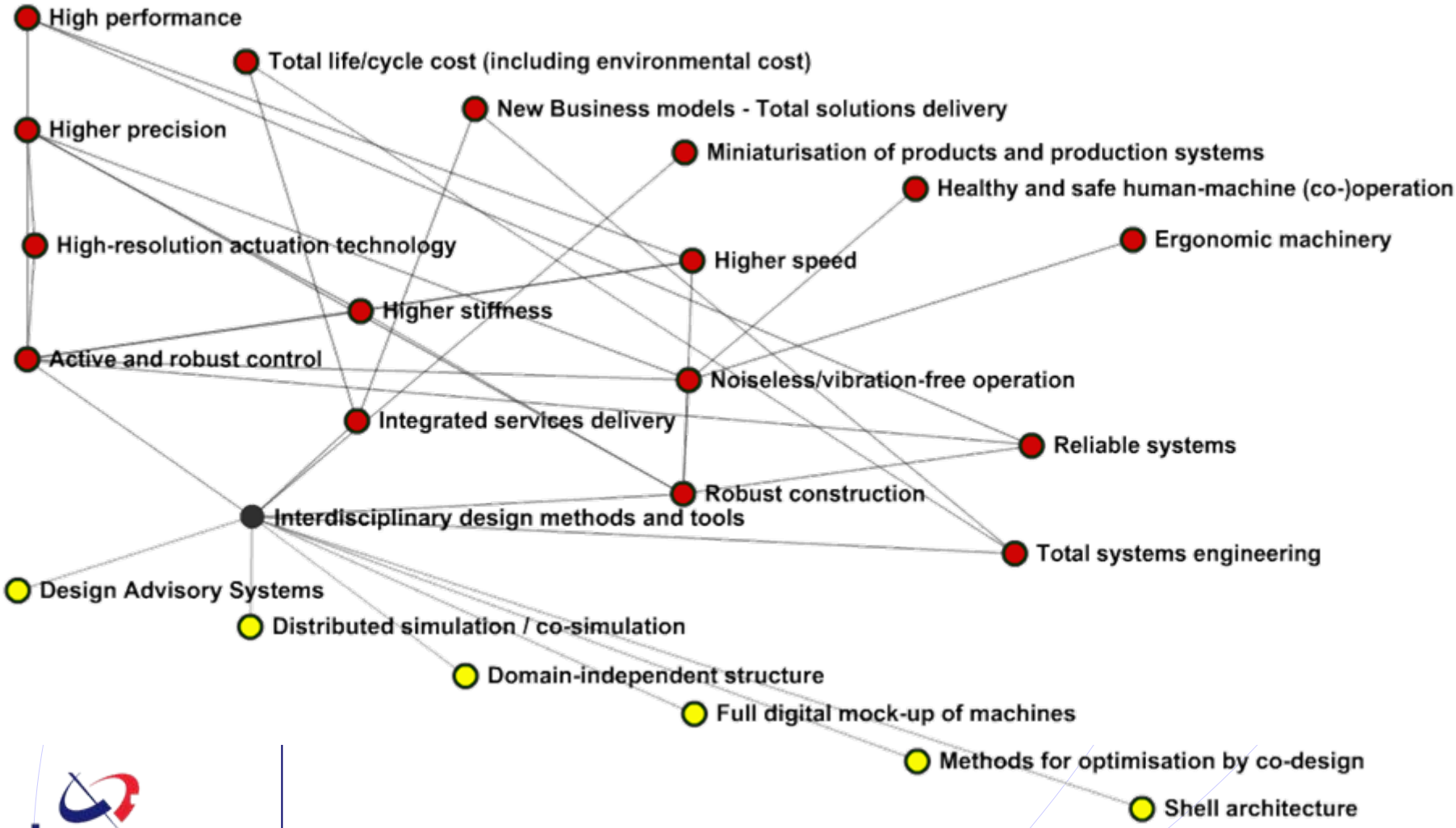
Interdisciplinary design methods and tools



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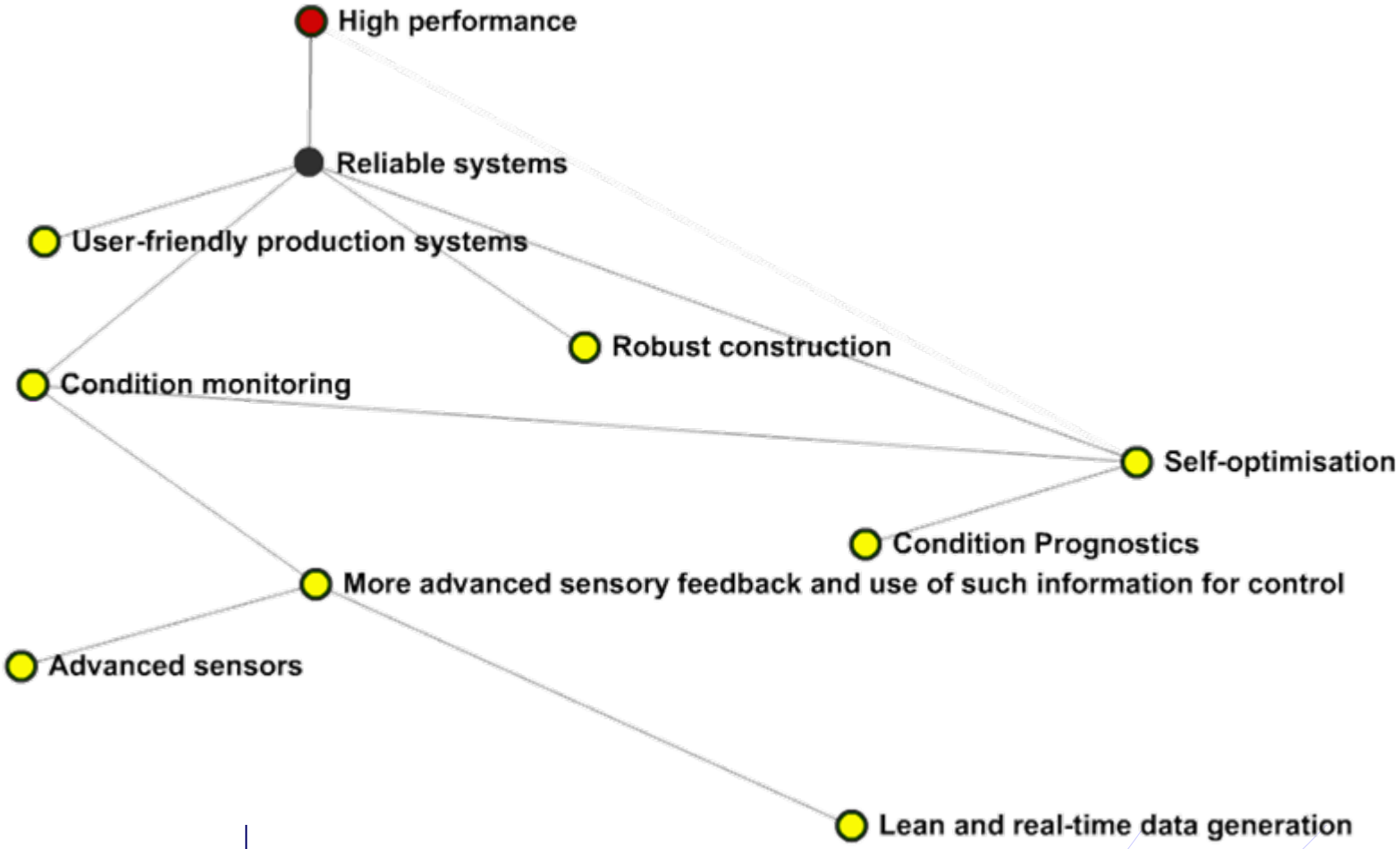
Reliable systems



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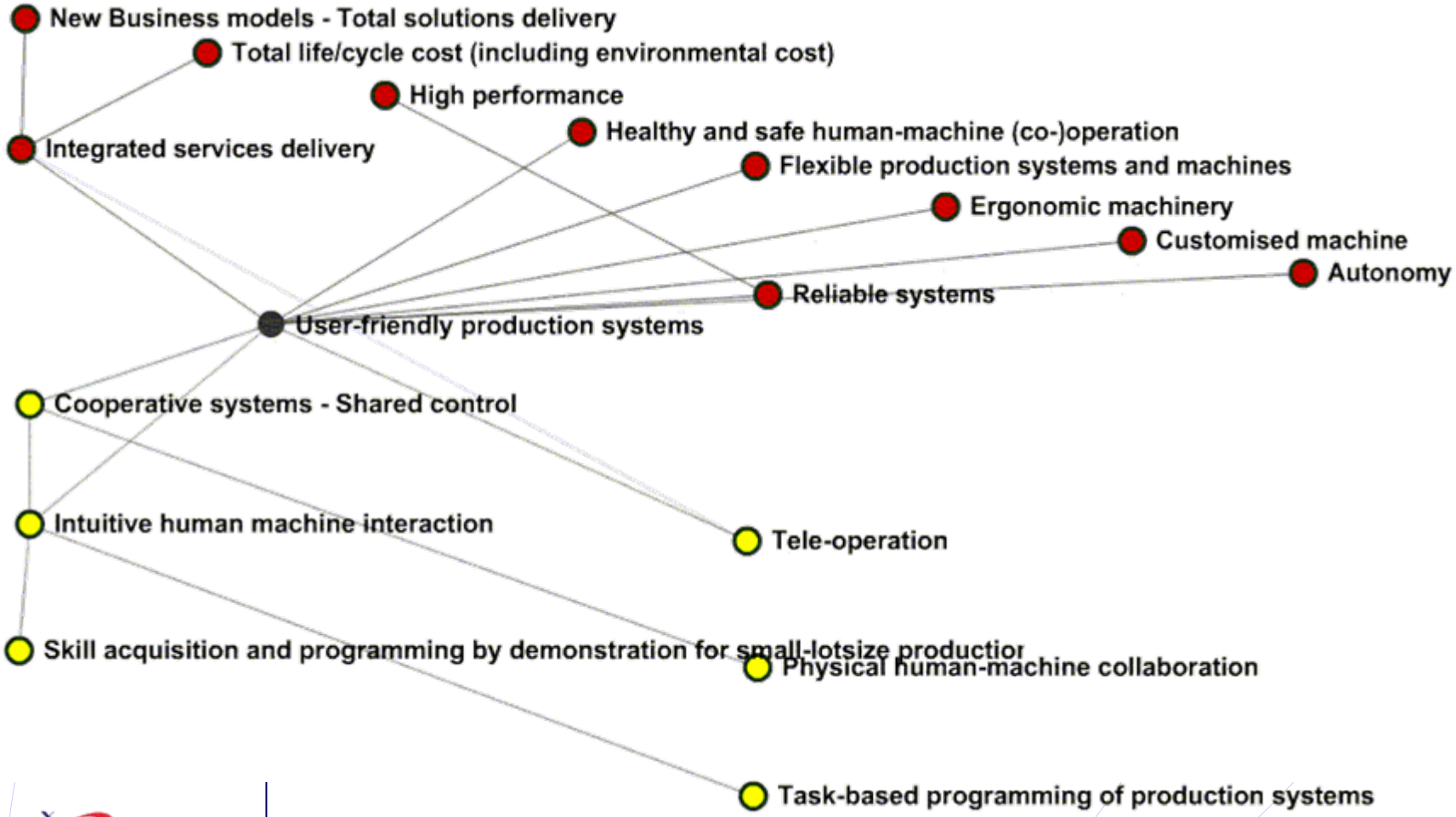
User friendly systems



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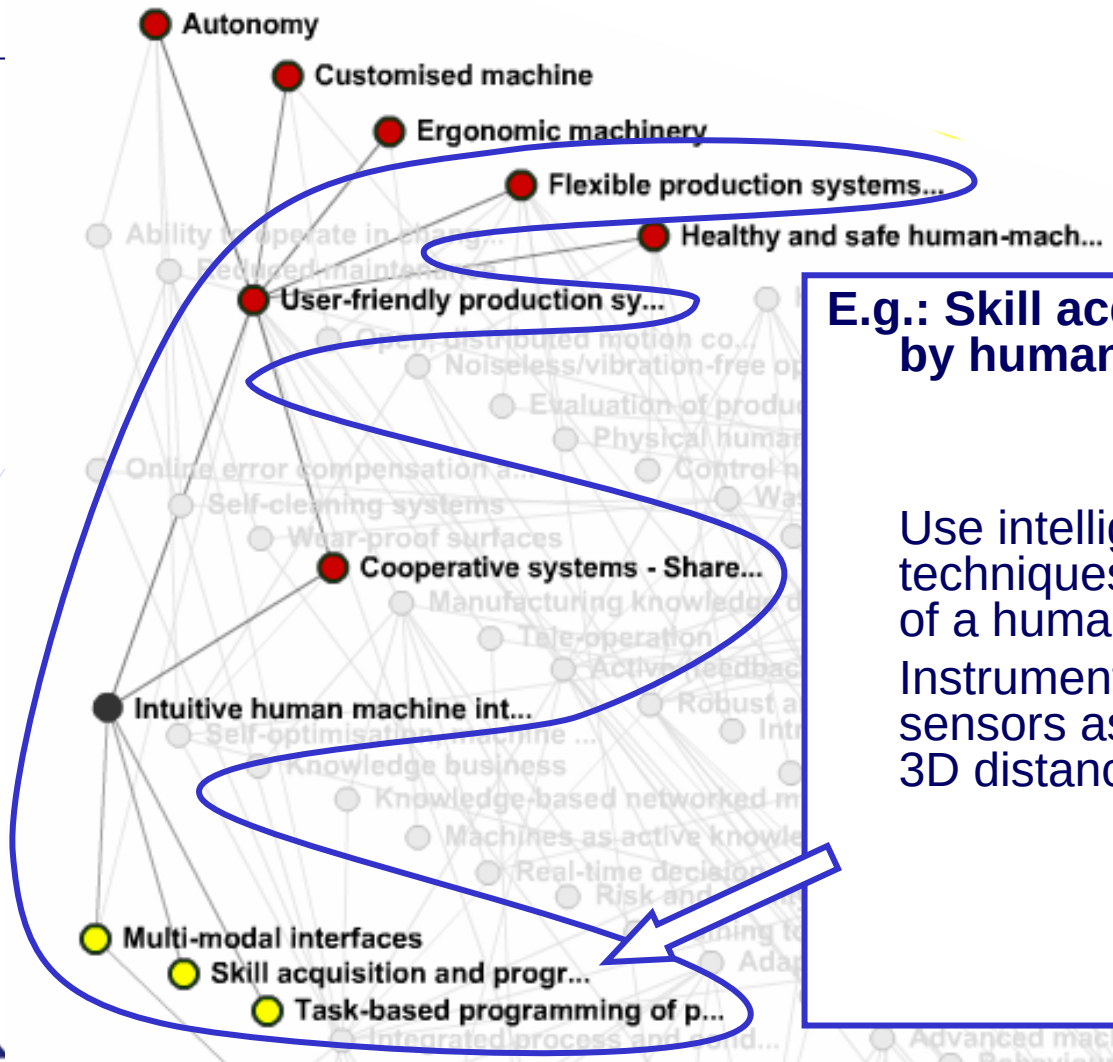
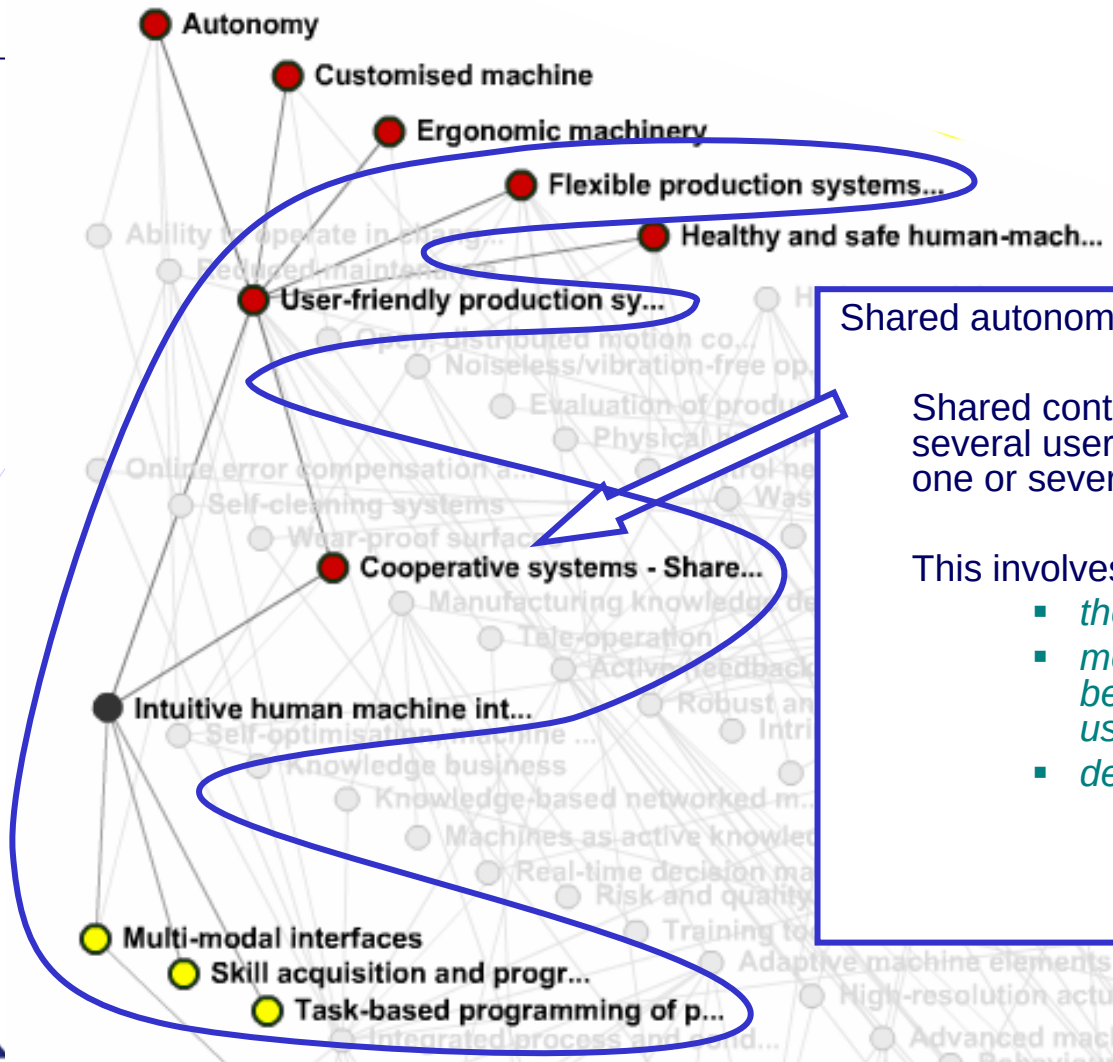


E.g.: Skill acquisition and programming by human demonstration

Use intelligent sensor-processing techniques to capture the essential parts of a human demonstrating a task.

Instrument the human with similar sensors as the robots: vision, force, and 3D distance measurements.



Shared autonomy in machine control

Shared control occurs in applications where one or several users control a machine in co-operation with one or several computers.

This involves several research topics:

- *the design of intuitive user interfaces*
- *modelling and prediction of user behaviour, plan recognition (estimating user intents)*
- *decision making under uncertainty.*

Augmented Reality: Industrial Application Areas

Automotive Service

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Total solutions and services through Augmented Reality

Higher performance

Customised

Adaptive

Environment

Total solutions - services

Virtual Reality:

- Artificial, computer-generated world
- Substitutes real environment completely
- 2 types:
  - User completely integrated in the environment
  - User sees VR scene from outside

Augmented Reality:

- User sees real environment
- Overlap of the reality with virtual objects
- Supplement, not substitute

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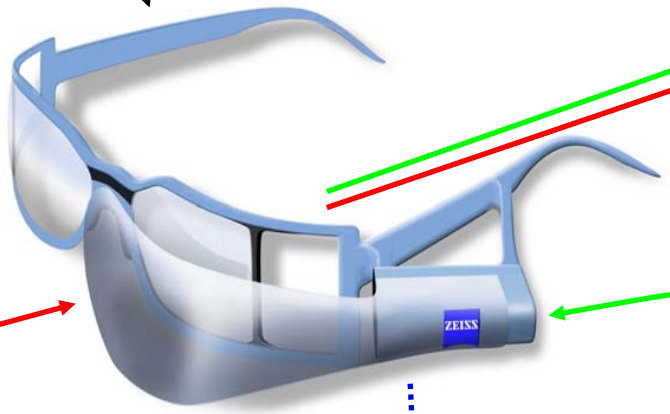
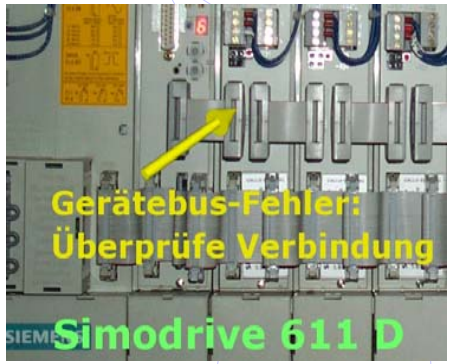
Basic Principles of Augmented Reality

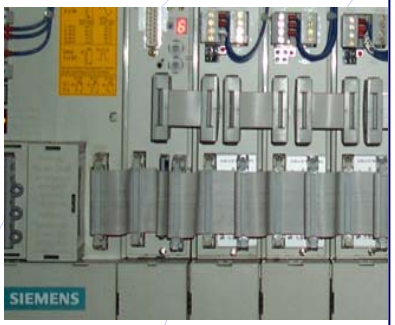
Audio in/out

Optical see-through HMD

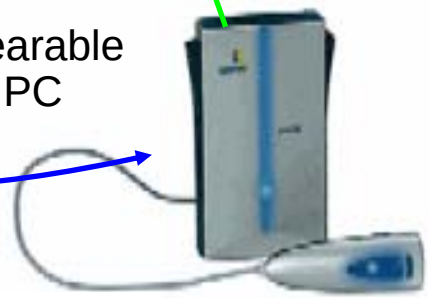




Augmented Scene



Orginal Scene



Wearable
PC

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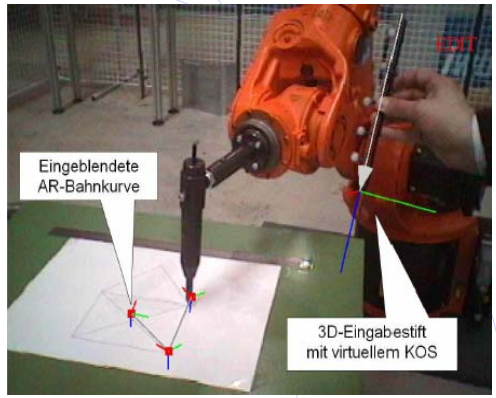
Augmented Reality: Industrial Application Areas

Automotive Service

Machinery Service



Robot Programming

Factory Planning

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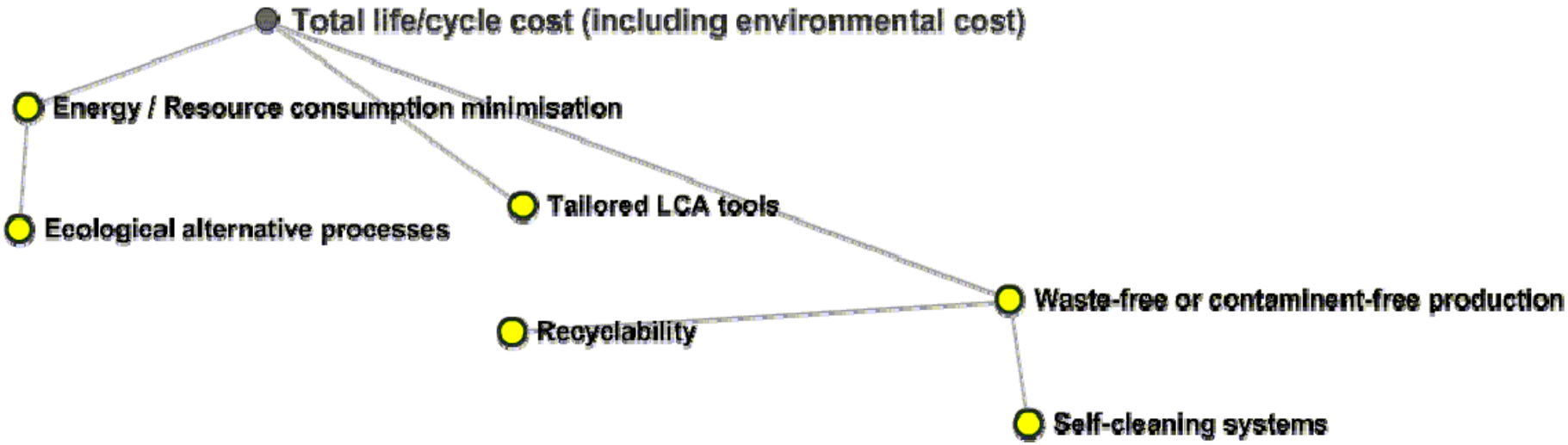
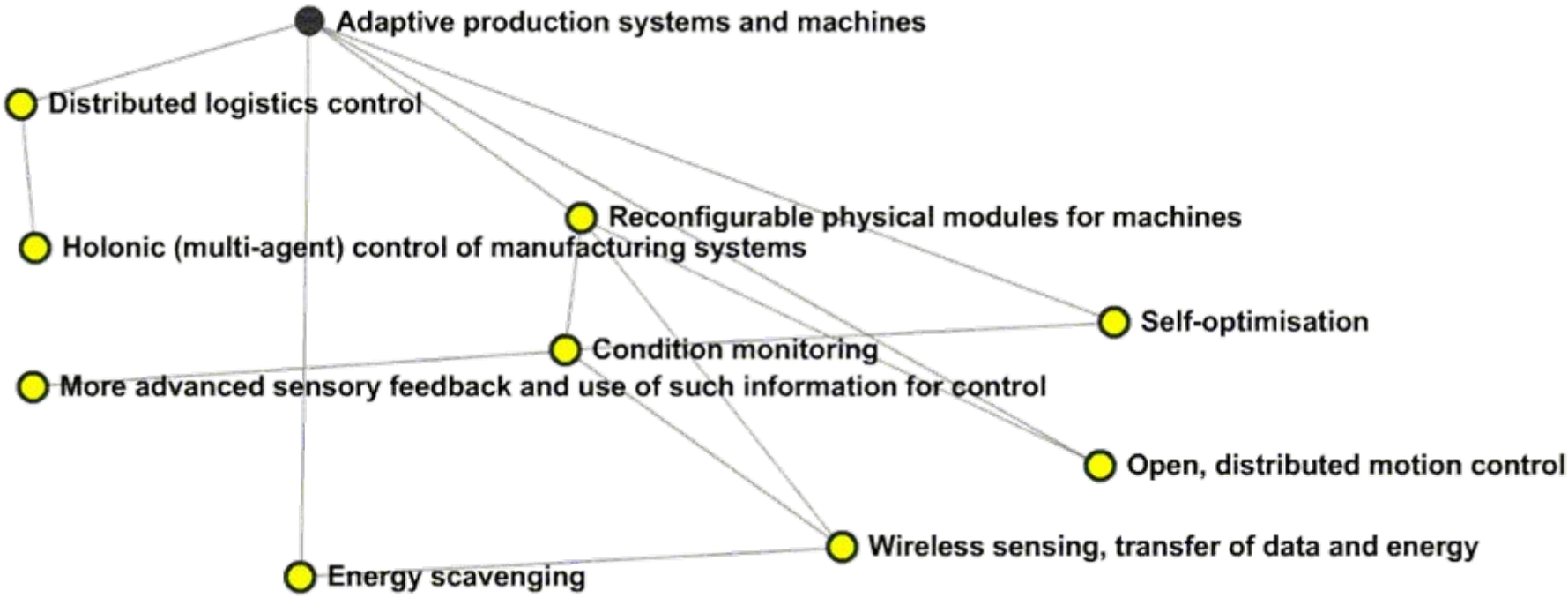
Environmental issues



Adaptive production systems



Software / communication architectures

Flexible production systems...

User-friendly production sy...

Open, distributed motion co...

Active (feedback) robust mo...

Integrat

Networked manufacturing

Reconfigurable physical mod...

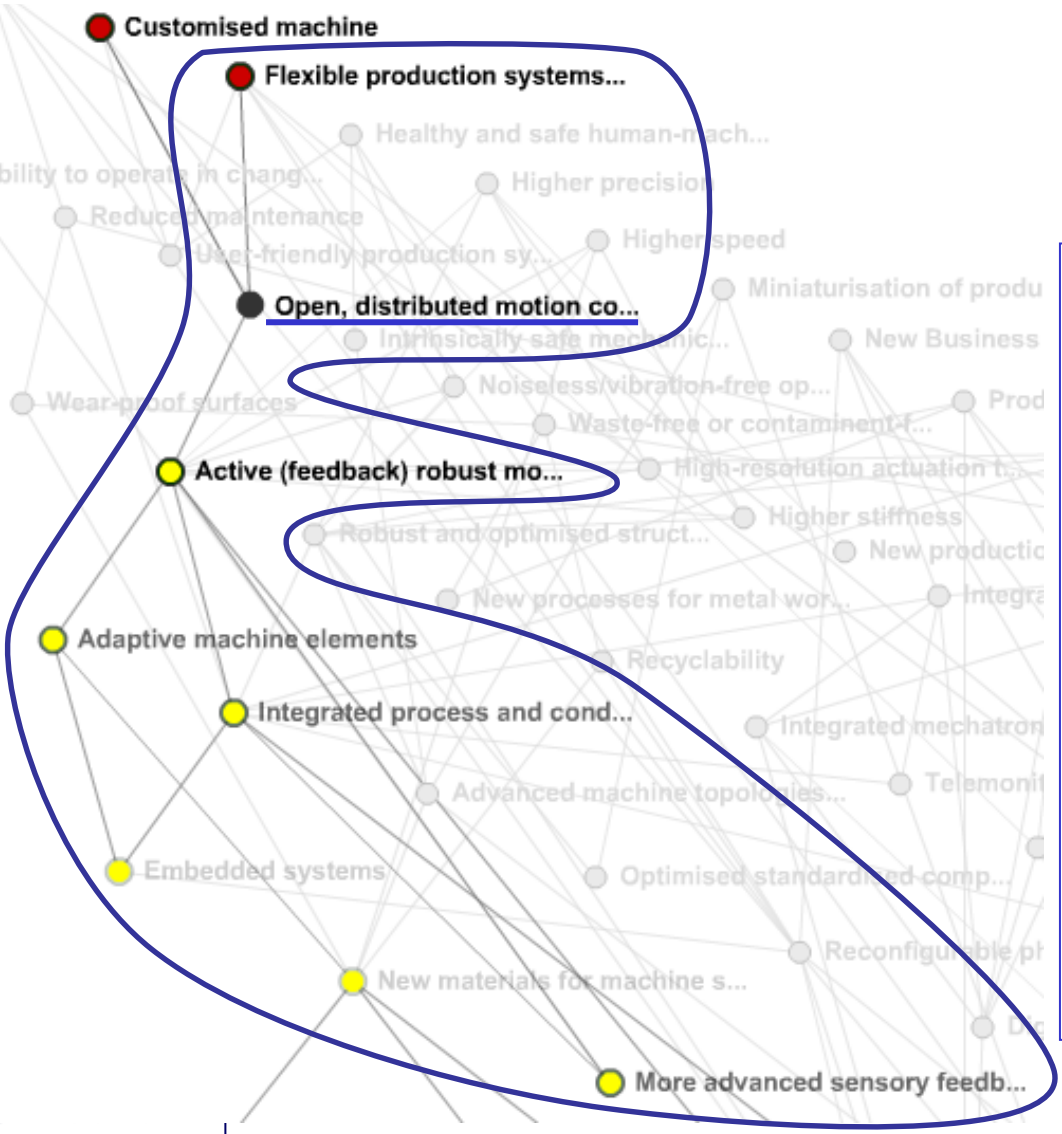
Self-optimisation, machine ...

Digital manufacturing, ICT ...

Design of flexible software architectures for real-time control with a high degree of reusability.

Communication techniques between different machine modules, allowing both to retrieve the maximum amount of information out of the machines and to maximize the communication capabilities between the machine modules

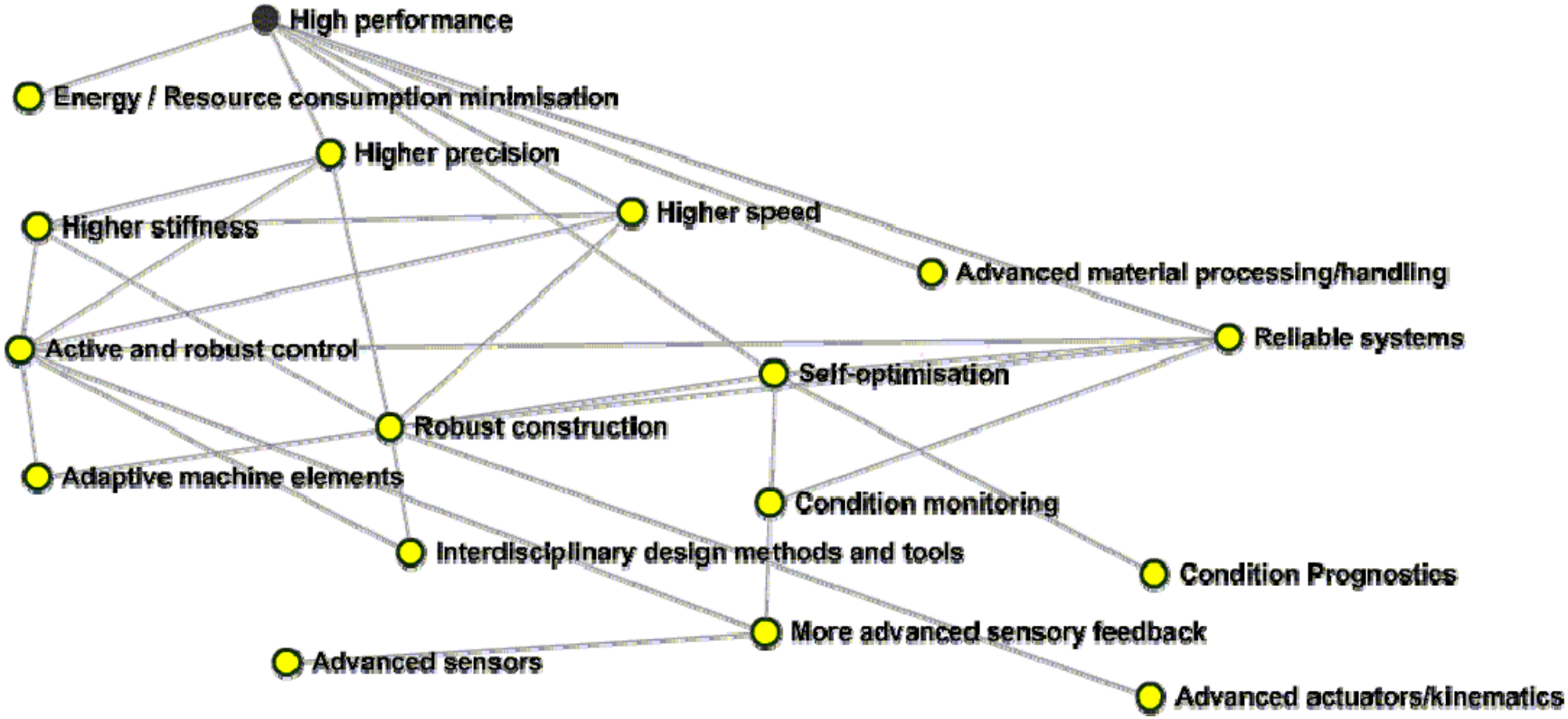
Software / communication architectures



Open source control platform (OROCOS)

- Reduce the initial effort for adopting the open source control platform OROCOS. In addition establish an active user community.
- **Industrial potential:** The open source control platform reduces cost and increases the flexibility of embedded control in machines. As a consequence, OROCOS is considered an enabler for more advanced control techniques in applications.

High performance



Thank you for you attention

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