ALPEN-ADRIA
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Lakeside Labs

Lakeside Research Days 2011

Engineering Self-Organizing Systems

Welcome

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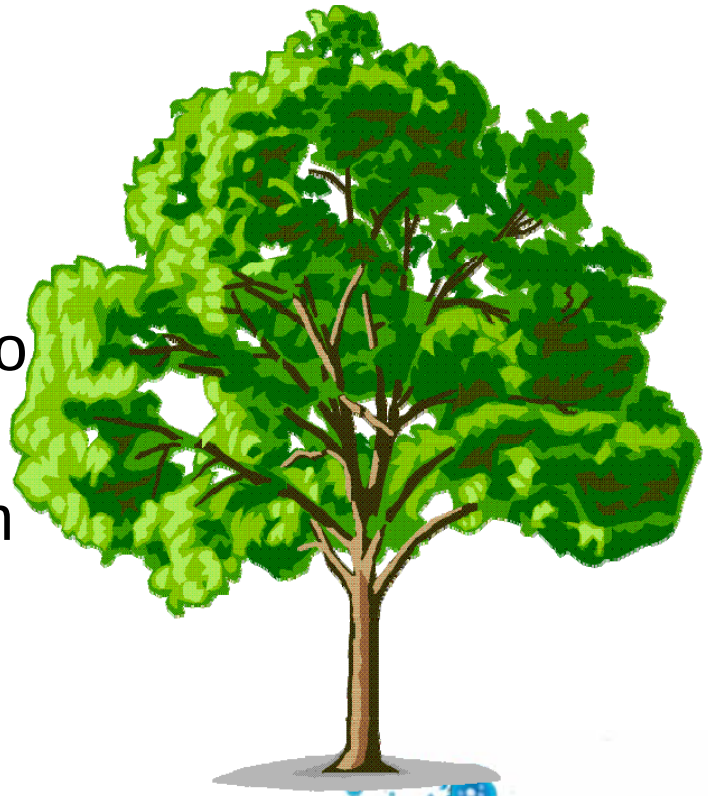
Goals of Research Days 2011

- Exchange (or even create) knowledge on ***applications of self-organizing systems***
- Discuss current research problems (e.g. in various projects)
- Enable local and international contacts
- Encourage collaborations

Some Observations…

- In nature, almost every system (living being) is self-organizing
- Tree
  - Wood reacting to local stress
  - Distributed networked design
  - Trees evolved 300 Mio yrs ago
  - Cutting out a piece does usually not destroy the system
  - Decentralized and robust

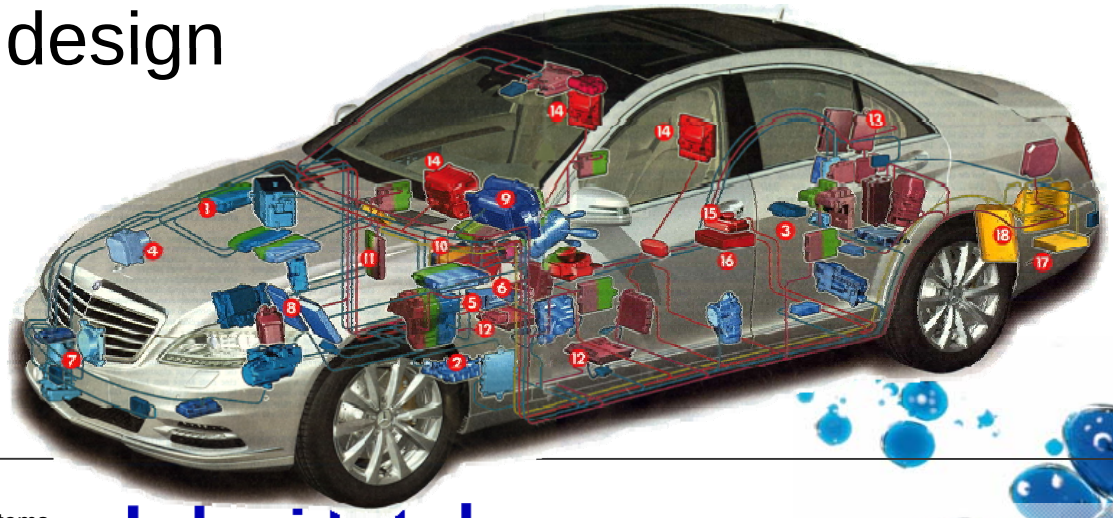


A mammal…

- Physical and mental abilities react to training
- System is distributed, but has a central nervous system
- Evolved in the last ~120 Mio years
- Cutting out a piece does affect the system, but often can be repaired/adapted itself
- Less robust than a tree, but more features

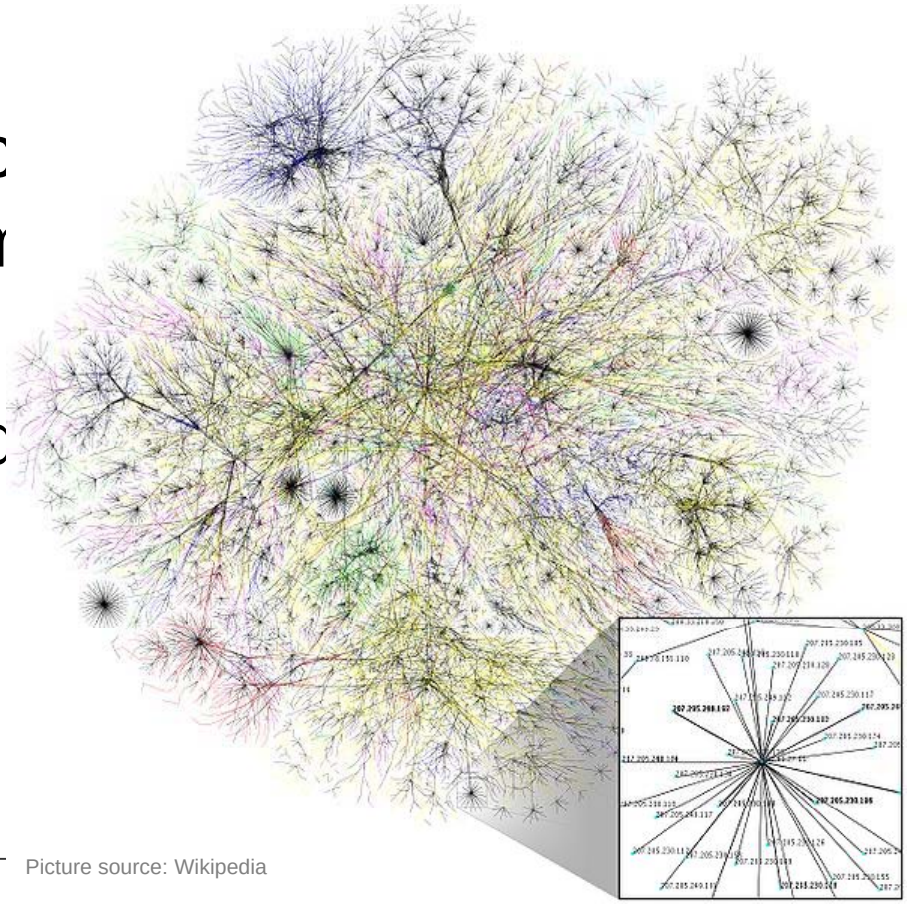
A man-made system…

- No training ability, system continously degrades
- Designed in the last ~100 years
- System is distributed but hierarchically
- Cutting out a piece affects the system, needs immediate repair by external entity
- Claim: Too few complex system researchers are involved in the design



What about the internet?

- System grows and gets better over time
- Designed in the last ~50 years
- System is distributed and
- Cutting out a random piec
  does not affect the systen
- A lot of complex system
  stuff has been contributec
- A success story for us?



Picture source: Wikipedia

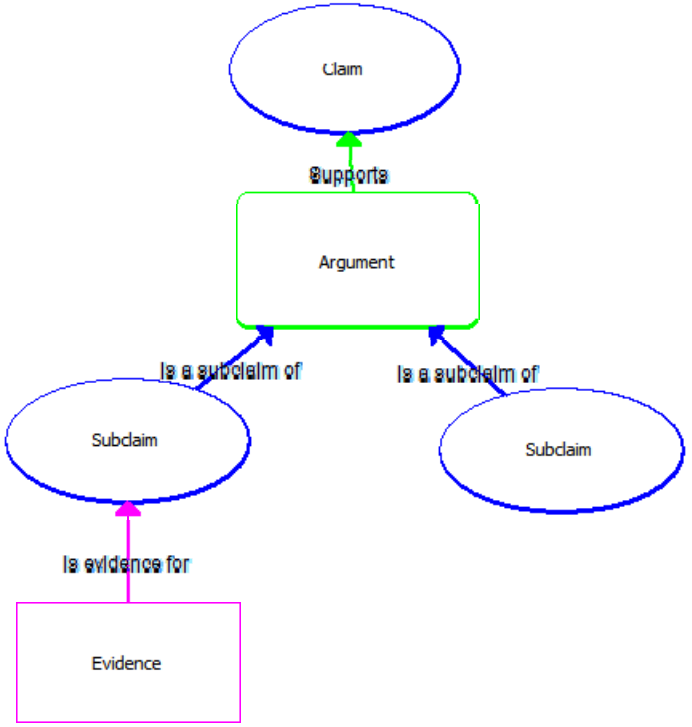
Current and future technical systems

- Typically networked, interactive -> falls into domain of complex systems
- But
  - System designers come from traditional fields: Electrical/Mechanical/Software Engineering
  - Hierarchically controlled systems are preferred
  - No trust in distributed loosly coupled systems
  - Complex systems guys are only called when everything else has failed

Picture source: Wikipedia

Example: The Automotive Domain

- Adelard Safety Case Editor
- Certified compilers
  - Certified but not error-free
- Updating a design is costly
- Solution
  - Self-organizing approach
  - Model-based design
    - Automatizes steps: design – implementation - verification



Picture source: Wikipedia