Science Base for Enterprise Interoperability

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A new Grand Challenge in the EI research roadmap

- Today they are:
  - GC1: Interoperability Service Utility
  - GC2: Future Internet and Enterprise Systems
  - GC3: Knowledge-Oriented Collaboration and Semantic Interoperability
  - **GC4: Enterprise Interoperability Science Base**

- Why this new Grand Challenge?
  - Recognition that EI must not be considered only from a technical point of view
  - EI should be developed and drove as a science, in the various dimensions of EI

- Foundations for a Science Base for Interoperability (EI)
  - In spite of this effort, it was not yet established
  - Closely related to complementary well established scientific areas
Motivations for the work in course

- During last decade
  - Enterprise Interoperability
    - has been discussed and investigated widely
  - Sound technological frameworks and engineering proposals
    - were developed, validated and are available nowadays

- Foundations for a Science Base for Interoperability (EI)
  - In spite of this effort, it was not yet established

- Systems Theory one fundamental theory
  - Much probably grounded in complementary well established scientific areas.
Expected results from this work

- In the EI research roadmap
  - a new Grand Challenge was added focusing on “Science Base for EI”
  - reason to introduce this new Grand Challenge
    - recognized EI must not be considered only from a technical point of view
    - EI should be developed and drove as a science, in the various dimensions of EI.

- Under the Science Task Force
  - get advances in concrete proposal towards the establishment of this new science
  - embracing scientific concepts, theories and principles
    - derived from established and emerging theories
    - together with associated methods, techniques and practices for solving general Enterprise Interoperability problems

- Expected results
  - Strategy for systematic decoupling from particular methods, solutions and technologies
  - towards a scientific characterization of EI.
Process for the definition of the EI Science Base

- Focus so far has been concentrated on the first 4 steps.
1. Identify established scientific domains

- Search for recognized sources of scientific information
  - Science Magazine
  - Association for Computing Machinery
  - IEEE Computer Society
  - American Mathematical Society
  - European Science Foundation
  - Enterprise Interoperability Research Roadmap 2008
  - … and Wikipedia
Interoperability

- Stand alone domain
  - Engineering
    - Yet another system
    - Yet another methodology

- An enabler
  - For developing complex systems
Science and Engineering

- We got results by engineering (short term). We got results by scientific research (long term). We die without short term results. We decline without long term results.
- Clear separation between engineering, technology and research.

Scientific evaluation:
Academic need to clearly specify what is the research domain and what he intends to explore and do differently and better and how can you evaluate and measure the work (assessment).
Judgement by peers at an earlier stage.

Engineering:
Working better (whatever)
Complex Systems

- Non-Linear
- Feedback
- Evolutive
- Adaptative
- Self-monitoring
- Learning capabilities

**CAUSAL systems vs FEEDBACK based systems**

**STEADY STATE vs TRANSIENT RESPONSE (non-linear)**

**STABILITY vs INSTABILITY added value**

Study of systems based on performance Whatever it has interoperability or not
System’s dynamics (non linear behaviour)

- **COMPONENTS**
  - New components
  - Modified components
  - Killed components

- **Relations**
  - New relations
  - Modified relations
  - Ended relations

- **Instability of the system**
- **Dynamics**
  - New
  - Modified
  - Killed/Ended
Dynamics behaviour

- How to monitor
- How to cope with interoperability
- How to do conformance testing
- How to do interoperability checking

New challenges

- How to learn/know about systems evolution (dynamics) ?
- How to monitor ?
- How to adjust ?
2. Classify and describe

High Level Classification

- Inspired on classical sciences:
  - Natural Sciences
  - Earth, Life and Space
  - Physical Sciences
  - Chemistry, Physics, Mathematics, Computer Science, etc.
  - Social Sciences
- From a mix of sources:
  - Science Magazine
  - European Science Foundation
  - Wikipedia

Extended classification

- Focused on Mathematical and Computer Science disciplines
- Sources:
  - Association for Computing Machinery
  - IEEE Computer Society
  - American Mathematical Society

Emerging Sciences

- Systems/Complexity science
- Network science
- Information science
- Web science
- Services science
3. Identify relationship with EI

- Match the Enterprise Interoperability Key terms with the scientific domains of complementary disciplines
  - Identify scientific grounds
  - Identify “uses / is used by” relationships
4. Build EI Ontology

- Initial ontology structure based on the scientific domains identified
- Complemented with EI key terms

- EI relationships with the scientific domains provide the ontology extra knowledge to:
  - Narrow it down until only the most relevant scientific grounds remain
5. Further steps

- Are the first 4 steps in practice solid enough to have a science base?
- The relationships of the scientific disciplines with EI should be further formalized?
- Did you check and commented the document provided with the scientific areas identified?
Strategy in execution

- Look at previous implementations
- Try to convert them making them evolutive
- Creating self-monitoring mechanisms
- Optimizing according selected criteria
- Studying dynamics
- Existing science is probably enough
- Join forces with Systems Complexity community