

PI-HoIS@HoloMAS'2007

Towards Industrial Strength Business Performance Management

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Outline

No universal Silver Bullets – Engineering Design
in Microelectronics and Integrated Circuits

- **Motivation**
Performance is:
 - Important?
 - Challenging?
 - Holonic?
- What is **Performance**?
- **Performance Management** and Problem Solving
- **Performance Ontology**
- Performance Measurement and Management
Methodology – if time allows
- **Conclusions** and **Outlook**

Mainly the results which are not in the paper

Motivation

Is Performance Assessment and Management Important? Challenging? Holonic?



Performance is Important

- **Performance** is everywhere and in everything one does
 - cradle-to-grave ...
- Search for word combinations with **Performance**:

high-performance
baby wipes



Cradle

- ...
- Performance kindergarten
- Performance school
- Performance university
- Performance poetry
- Performance car
- Performance objectives
- Performance appraisal
- ...
- Computer performance
- Environmental performance
- Network performance
- ...

~9,000

grave performance



Grave

Performance is Important

- Different aspects of performance in Pi-HoS papers:
 - Performance analysis in engineering design systems
 - Factory Performance in die-casting industry
 - Team Performance in collaborative manufacturing
 - Subpopulation Performance in disaster response
 - Manufacturing process monitoring Performance
- Not mentioned – even more:
 - Grid Performance
 - Chip Performance
 - Software Performance
 - Network Performance
 - ...

Performance is Challenging

- A growing multi-billion market
- Everybody is exited – esp. BA
- Extensive research activities – pointing to dissatisfaction in industry
- Formalizing Performance using engineering approaches is hard:
 - Highly interdisciplinary
- Managing Performance:
 - In manufacturing – relatively easy:
 - E.g., produce MB SLK-class spending € 1,000 less is better performance
 - Goals are fixed: MB SLK is always SLK
 - In innovative business (e.g., design) – challenging:
 - E.g., design McLaren aiming to be No1 in F1 ...
 - Goals are changing, requirements are vague and contradictory
 - Solutions may not exist ...

Engineering Design or Another World of “Death March Projects”*



* Coined by Edward Yourdon, Death March, Prentice Hall, 2003

Faster!

Cheaper!

Smaller!



Performance is Well Modeled by Holons

- **Koestler:** A **holon** is a ... structure that is stable, coherent and that consists of several holons as sub-structures and is itself a part of a greater whole
- Performance is very adequately modeled by holons in any domain – cradle to grave
- In Engineering Design a Design System (a holon):
 - Performs designs, supports design processes, manages design performance
 - Coordinates its processes
 - Comprises Design Teams (holons), Design Tools (holons), Resources (holons), Design Technologies (holons)
 - Produces (hopefully) Design Artifacts (holons)
 - Is stable (as a mess could be)

Definition

What is Performance?



Literature Study: the Notion of Performance

- Analysis of existing definitions in PSI project:
 - Many definitions exist and new ones are continuously added
 - Lack of rigor and consensus:
 - Donell & Duffy: “the research in performance has been hindered by a lack of clarity on its meaning”
- Different Authors hint about different desired features of Performance:
 - Tightly linked to carrying out tasks in an optimal way
 - An organization requires that tasks (job duties or beyond) are well-performed to optimize its own performance
 - Various sorts of Performance aspects, e.g.:
 - A Level of Skill characterizes the performance of an actor
 - Productivity - an integral performance characteristic of a process.
 - A methodology of performance assessment needs to be based on a sort of a problem solving methodology
 - ...
 - **Activities directed towards the (desired) outcome**

Literature Study: the Features of Performance

- Denoted “EXPLICITLY”:
 - Cordero: Effectiveness
 - Dwight: The level to which a GOAL is attained (effectiveness again)
 - Neely: Efficiency and Effectiveness of purposeful action
- Denoted in terms of its key dimensions (metrics) primarily in the areas of:
 - Time, Cost, Quality
 - Rolstadas: A complex interrelationship between SEVEN criteria: Effectiveness, Efficiency, Quality, Productivity, Quality of Work Life, Innovation, Profitability/Budgetability

What is Performance? an Action vs a Characteristic

Performance

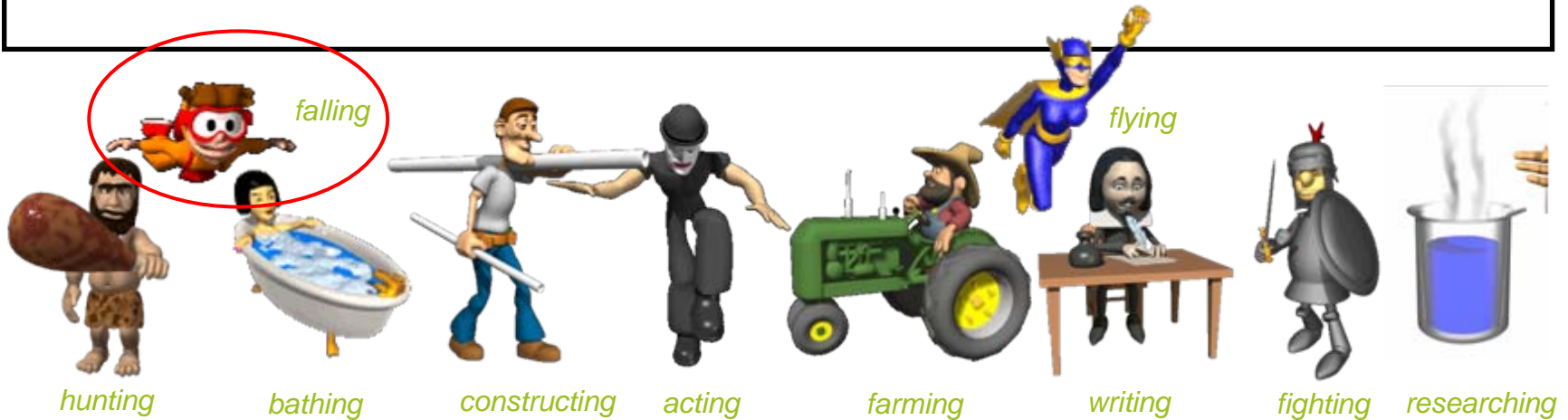


```
graph TD; Performance[Performance] --> Left[• A Characteristic of a Purposeful Action]; Performance --> Right[• √An Intentional Action];
```

- A Characteristic of a Purposeful Action
 - Integral
 - Influenced by ...
 - Factors and Indicators (lagging and leading)
 - Descriptive vs Prescriptive
 - Process vs Artifact
- √An Intentional Action
 - Tangible characteristics to be denoted

What is Performance?

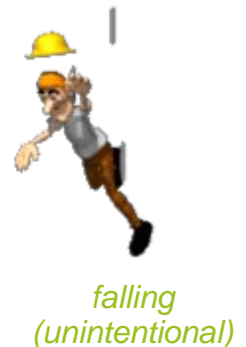
Definition: intentional coordinated action targeted to pro-actively reaching the goals



Notes

- Action: intentional vs. accidental/unintentional
- Performance of something is always context based
- All Performance-related concepts have to be defined as specializations of the above root-concept
- Goals pursued by different Actors may be coherent or conflicting

The parties: (i) to reach agreements on their goals
(ii) to coordinate their actions for improving
Performance



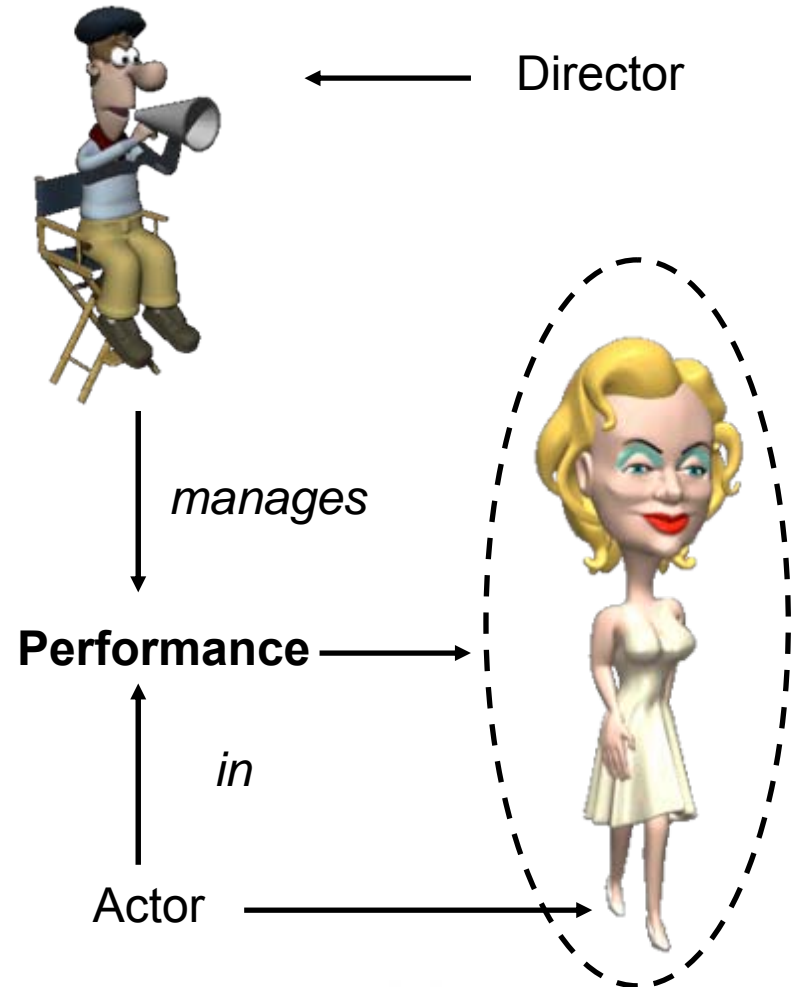
Management

What is Performance Management?
Problem Solving?

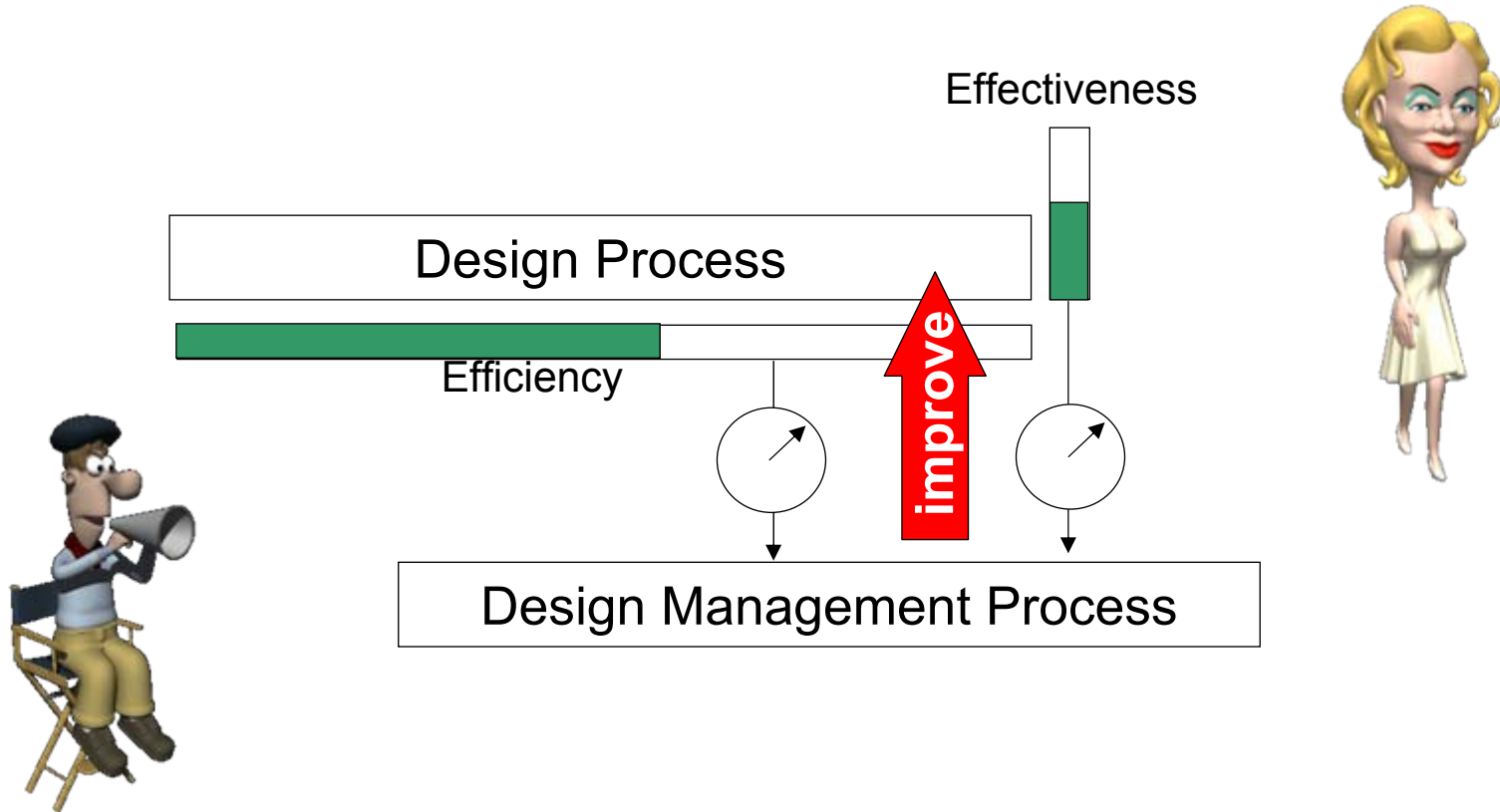


Performance Management

- How to assess and improve the implementation of intentions?
- Perform a parallel action
- Coordinated with Performance
- Performance Management



Performance to be Managed ...

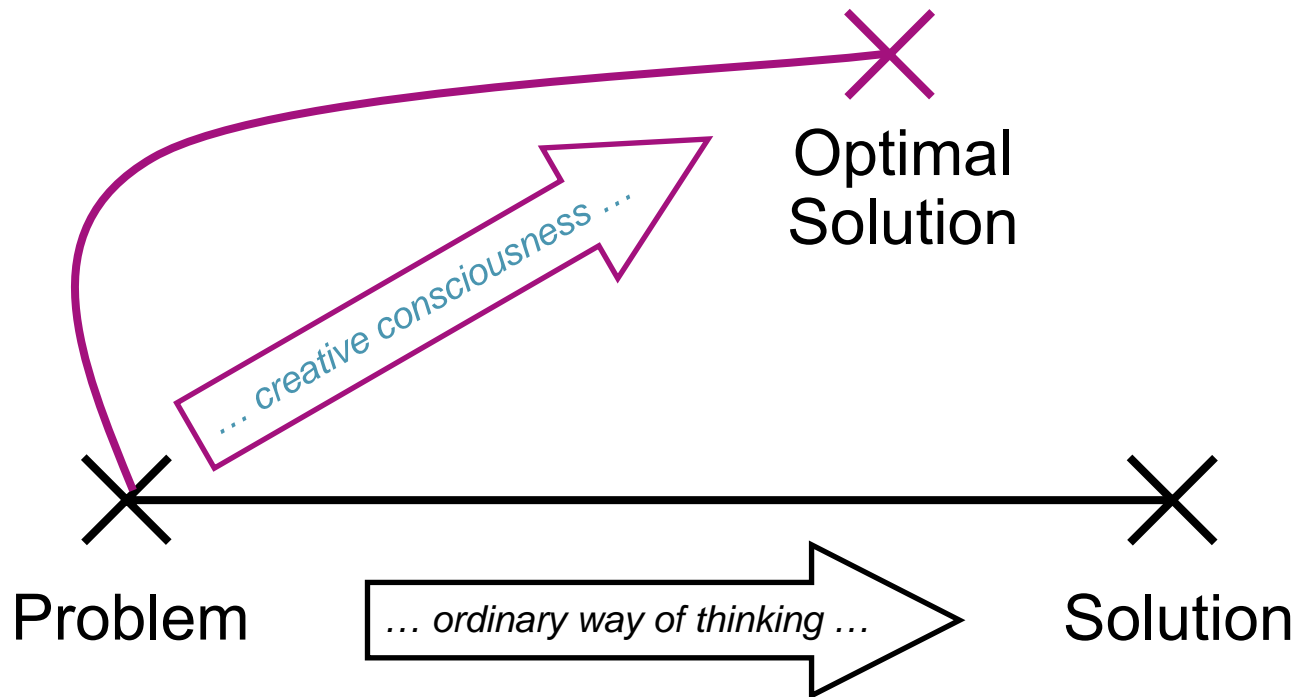


Design MANAGEMENT actions should be properly accounted for

Performance Management in Innovation to be Non-Linear – managing the mess

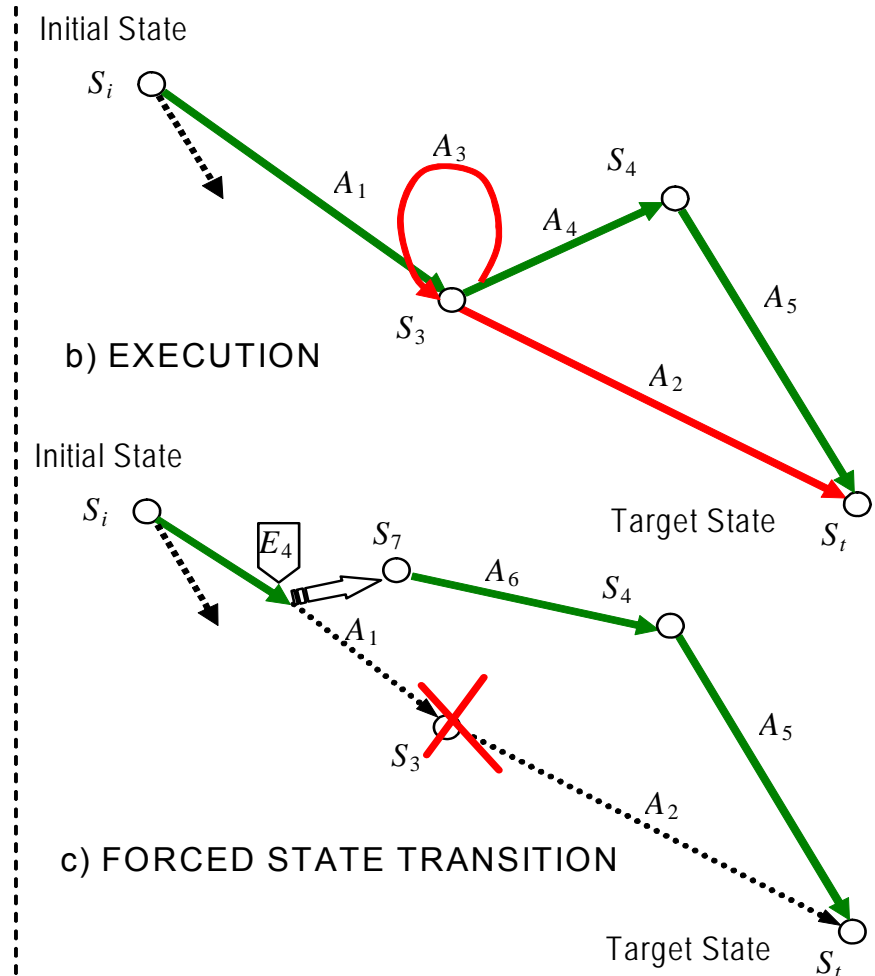
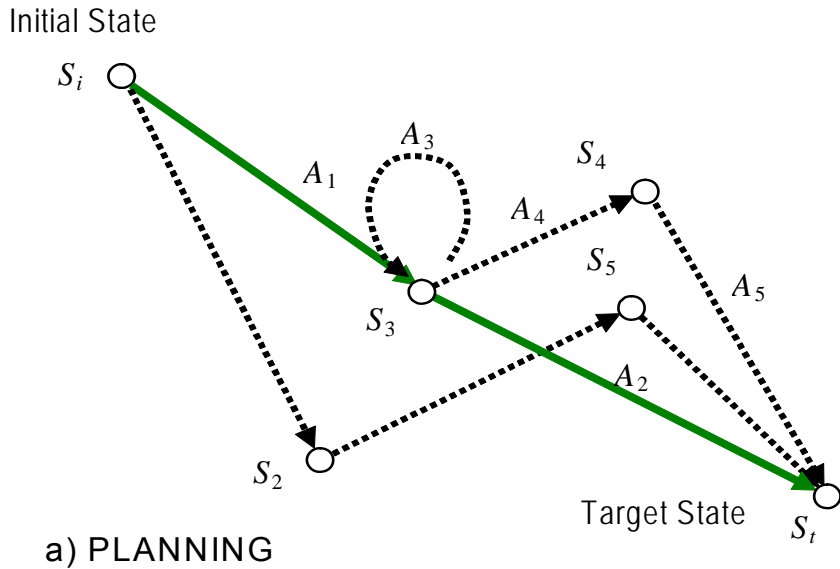
Metaphor to describe difference between
linear and non-linear management

(see Ubbesen: http://www.aaa.dk/aaa/ledelse-og_organisationsudvikling.eng.pdf)

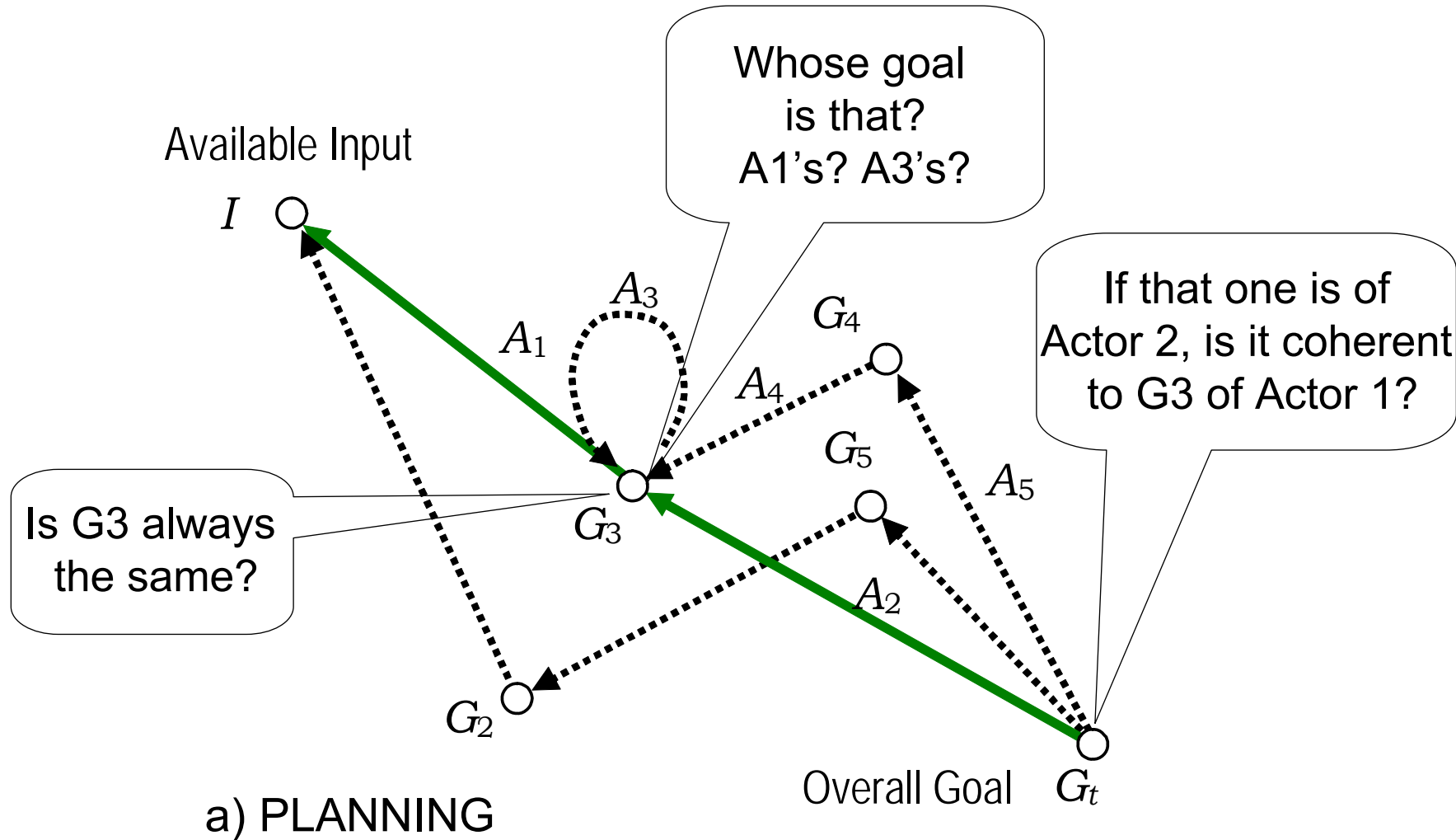


The Shortest Path may NOT Lead to the Best Performance

Plan-pushed doesn't work:



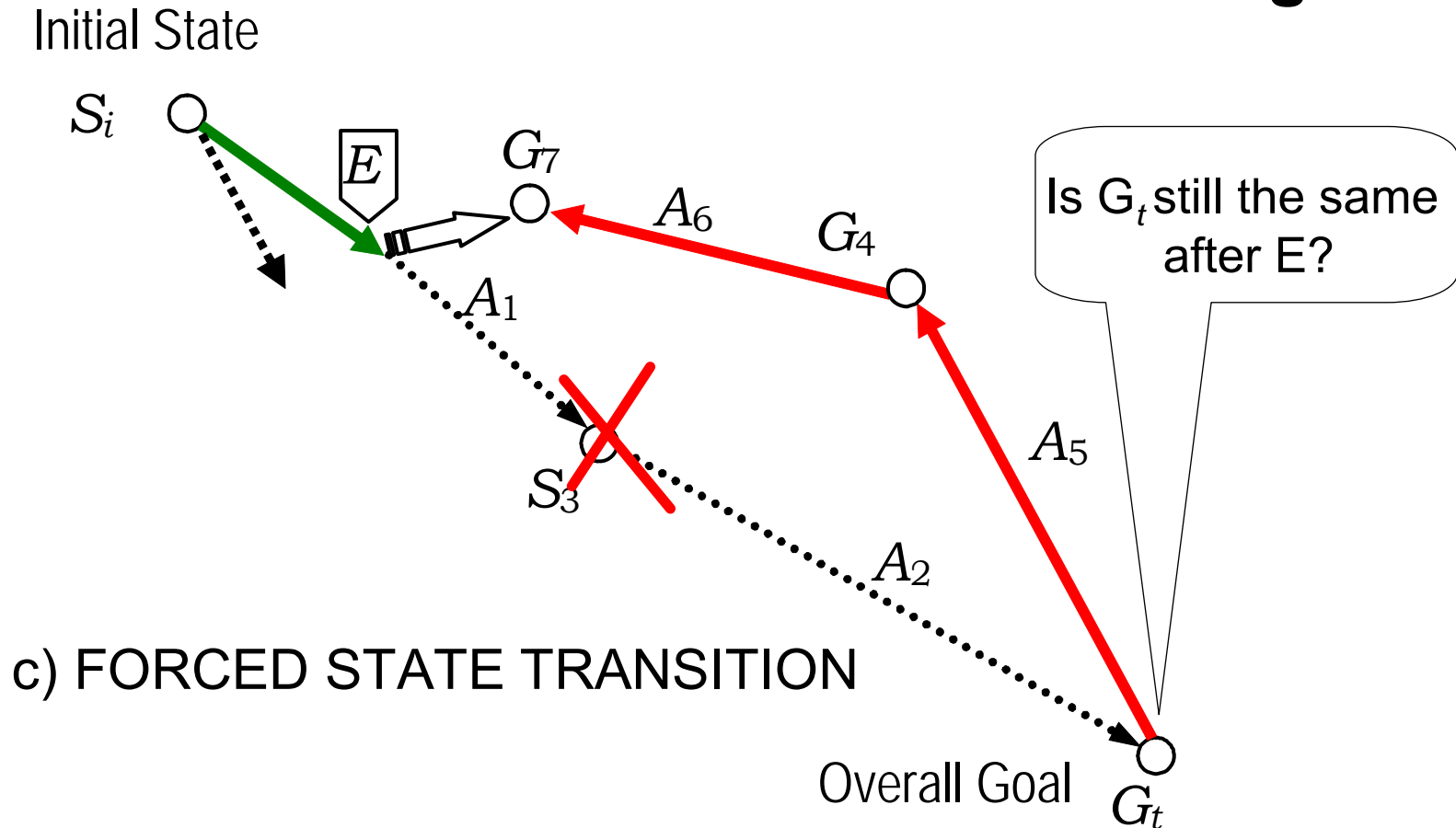
Goals to be Aligned – “Shaker” Planning



... Reaching Agreements ...

Goal Achievement

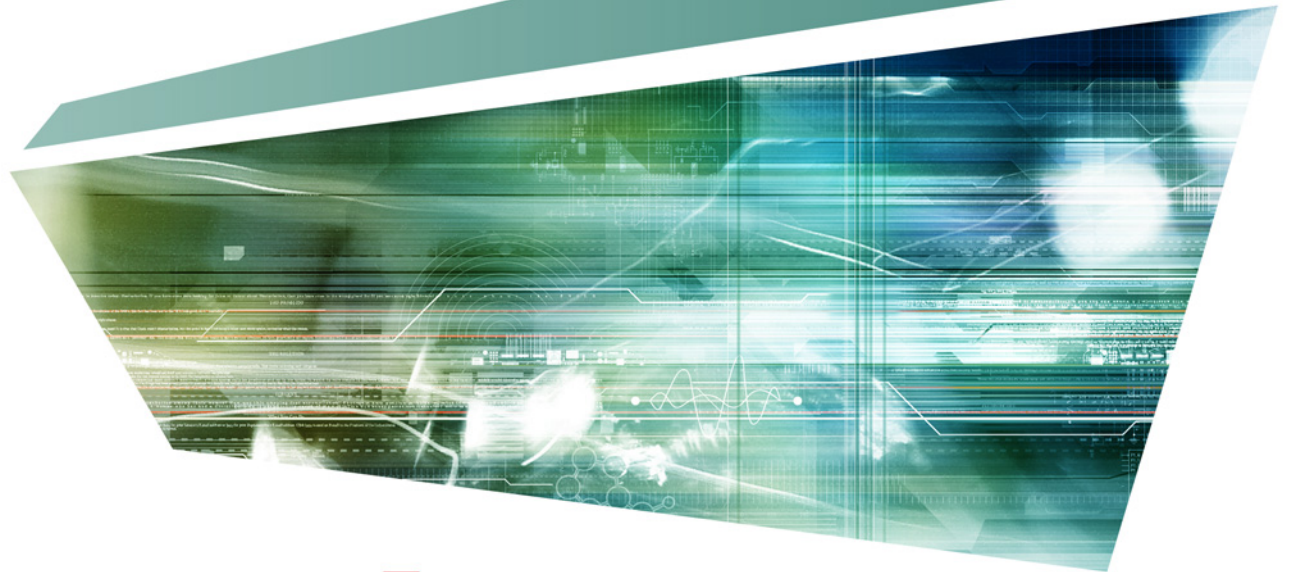
to be Monitored and Managed



To make sure that the work done is still “useful”

Performance Ontology

A Formal Descriptive Theory of Performance.
Engineering Design.



Ontology Engineering Methodology

METHONTOLOGY (Gomez Perez & Co) + DILIGENT (SEKT)

- Bottom-Up used to prove the completeness of the Top-Down
 - Linguistic research result used at the requirements analysis phase (bottom-up)
 - Terminology thesaurus and a draft theory are built (top-down)
- Competency questions collected
 - Where to take the questions? – Interviews, brainstorming, questionnaire
 - Answers to be systematically analysed
- Design Rationale – agreed upon
- Further METHONTOLOGY steps result in:
 - Draft Conceptual Model (UML, v.1.0)
 - Its implementation in OWL-DL ontology
- ...
- Initial Build Phase of DILIGENT – done
- Now giving partners and letting them use and adapt ...
 - They do – e.g., Bosch

Bottom-Up: Linguistic Research

- A Linguistic Context for Performance is defined
 - Performance co-locations: word combinations with Performance
 - Selected: ~9,000 (Internet search)
 - Filtered by Subject Experts (Engineering Design): ~600
 - Definitions found and recorded

A	B	C	D	E	F	G
446 performance standard	Performance standards set an objective performance level that must be achieved. For example, such a standard may impose emission limits that specify the amount and type of pollutant that may be discharged. Unlike design standards, which mandate the use of a particular design or technology, emission standards allow regulated entities to utilize any technology or design they choose to meet the emission limit. www.epa.gov/epaospr/airquality/glossary.html	In the context of wetland mitigation, a performance standard states in quantifiable terms the level and extent of the attribute necessary to reach a goal or objective. Sustainability of the attribute over time should be a part of every performance standard. www.coastal.ca.gov/web/wet/wetwet1/zales.html	A statement of the expectations or requirements established by the supervisor/managerial chain for a performance element at a particular rating level. For example, "finished correspondence almost never needs revision to correct spelling, grammar or format" could be a performance standard for a particular level (eg. Fully Successful) for the USA government's glossary.htm.	A standard that references one or more test methods and stipulates the results required. www.doh.gov/surveillance/standards/gradables/glossary.htm	A criterion to all matters of general welfare including, but not limited to, control, noise, appearance, traffic, general housekeeping, odor, smoke, fumes or noxious matter, vibration, fire and explosive hazards, or glare or heat generated by or infrared in uses of land or buildings. www.cityofhouston.gov/development/section155/section155.htm	A narrative or measurable number specifying the minimum acceptable outcome for a facility or practice. www.dnr.state.wi.us/org/its/strmtrng/strmtrngwtrwrdr/strm.htm
448 performance status	A measure of how well a patient is able to perform ordinary tasks and carry out daily activities. www.stjude.org/glossary	The performance status semi-quantifies the ability of a patient to perform daily activities. This semi-quantification is very helpful in clinical trials in assessing the state of health of patients under treatment. If one group has a significant difference in their performance status, the interpretation of treatment results will be influenced. The performance status also plays a role in determining whether a patient can tolerate intensive therapy. http://www.uci.edu/glossary.htm	In medicine (oncology) and other fields, performance status is an attempt to quantify cancer patients' general wellbeing. This measure is used to determine whether they can receive chemotherapy, whether dose adjustment is necessary, and as a measure for the required intensity of palliative care. It is also used in oncological randomized controlled trials as a measure of quality of life. en.wikipedia.org/wiki/Performance_status			
449 performance summary						
450 performance test	A performance test gives the student the opportunity to illustrate, perform, or demonstrate what they know and can do. www.angelika.com/wa2/buildingcathedral/strategies/strategies03.htm					
451 performance technology	Techniques designed to enhance human performance and capabilities in the workplace. Also referred to as human performance technology, it is a systematic process of integrating practices from a vast breadth of fields such as instructional technology, organizational development, motivation, feedback, human factors, and employee selection. www.natu.edu/~dbahchofer40@glass.ryu.htm					
452 performance theory						
454 performance tracing						
455 performance tracking						

Top-Down: Ontology Engineering

- The Glossary of Terms
- Competency Questions
- Performance Questionnaire
- Design Rationale
- PSI @ PRODUKTIV+ Onto as a core
- Concept Map (UML)

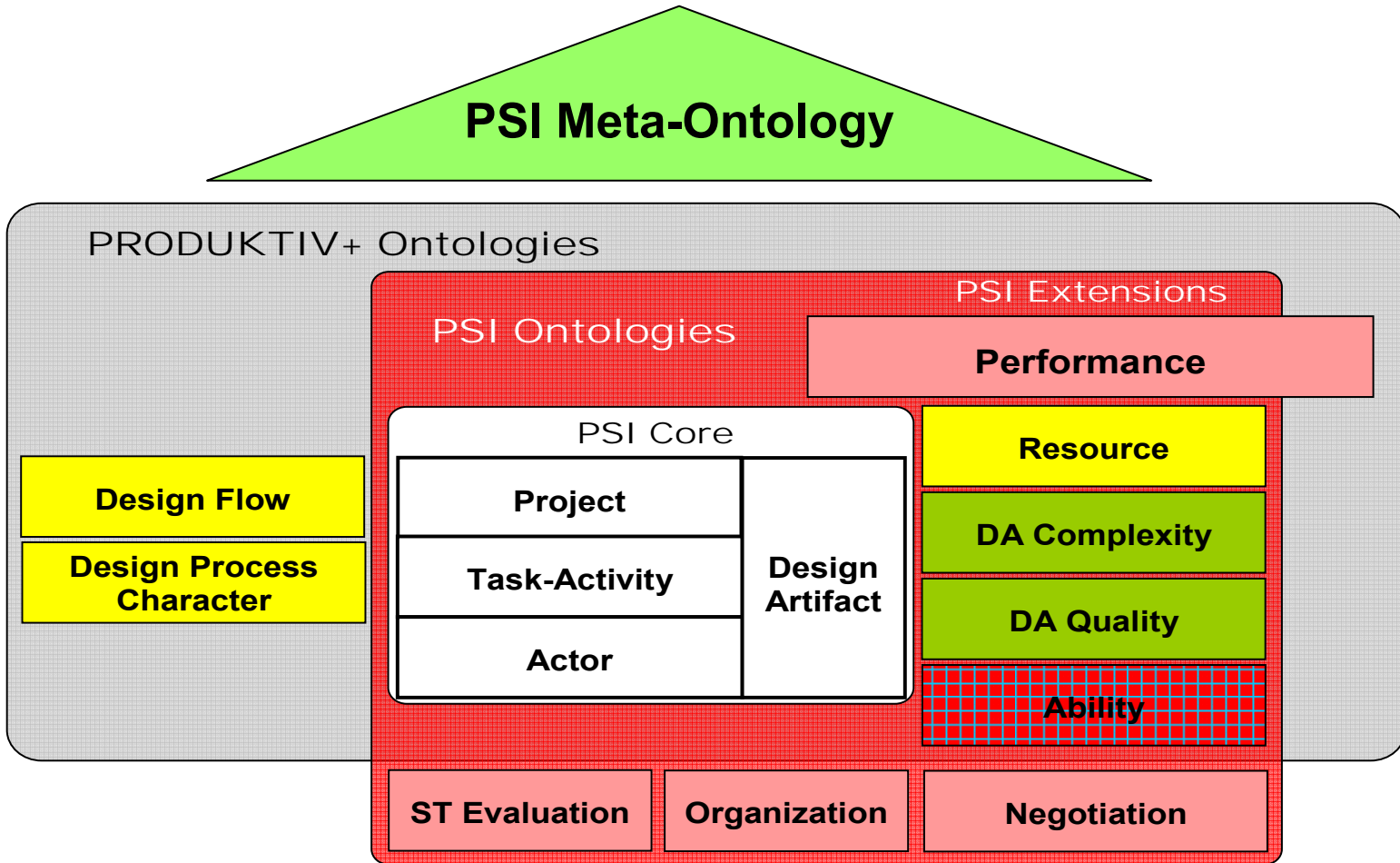
Microsoft Excel - PSI-PO-Glossary of Terms-Top-Down draft 12-07-2007.xls

PSI Performance Ontology
Glossary of Terms

Color legend: Seems to be wrong or inappropriate not relevant to PSI

Term	Domain	Hypernym(s)	Synonyms or Terms in context	Antonym(s) disjoint with ...	Acronym(s)	Type	Description	Composition/Aggregation	Assosiativ
IBM (re)defined Business Integration						Instance of BPM Software Tool			
Business Profitability						Concept			
Shareholder Value						Concept			
Performance Measurement						Concept			
Proactive Influence						Concept			
Business Intelligence					BI	Concept	Business intelligence (BI) is a key enabler of BPM. Business intelligence (BI) applications gather information about business processes and activities to make it available to business users, enabling them to make more informed decisions and take more effective action. Increasingly, BI is the key to business success and is becoming a key component of almost all new business initiatives.		Any BI implementation is turning available data into and putting it into the hand makers.
BPM Framework						Concept	The BPM framework is an enabler for the integration of business and IT processes. The underlying technology then enables the operations and information flow, providing the capability for you to make the decisions required to best manage the business.		The BPM framework can map to the processes: Monitor, Analyse, Act in customization cycle.
Model-based Approach to BPM						Concept	The approach is represented by a cycle of integrated processes, as depicted in the Figure. It is through the execution and refinement of this process cycle that we can optimize business performance. The BPM framework components map to the processes: Monitor, Deploy, Monitor, Analyse, Act in the BPM customization cycle shown in the Figure.		The processes of BPM in cycle receive mappings from Framework components.
Process of BPM Customization Cycle			Core BPM Process			Concept			
Modeling Process		Process of BPM Customization Cycle	Modeling			Concept			
Deployment Process		Process of BPM Customization Cycle	Deployment			Concept			
Monitoring Process		Process of BPM Customization Cycle	Monitoring			Concept			

Relationship to PSI and PRODUKTIV+ Ontology Suites

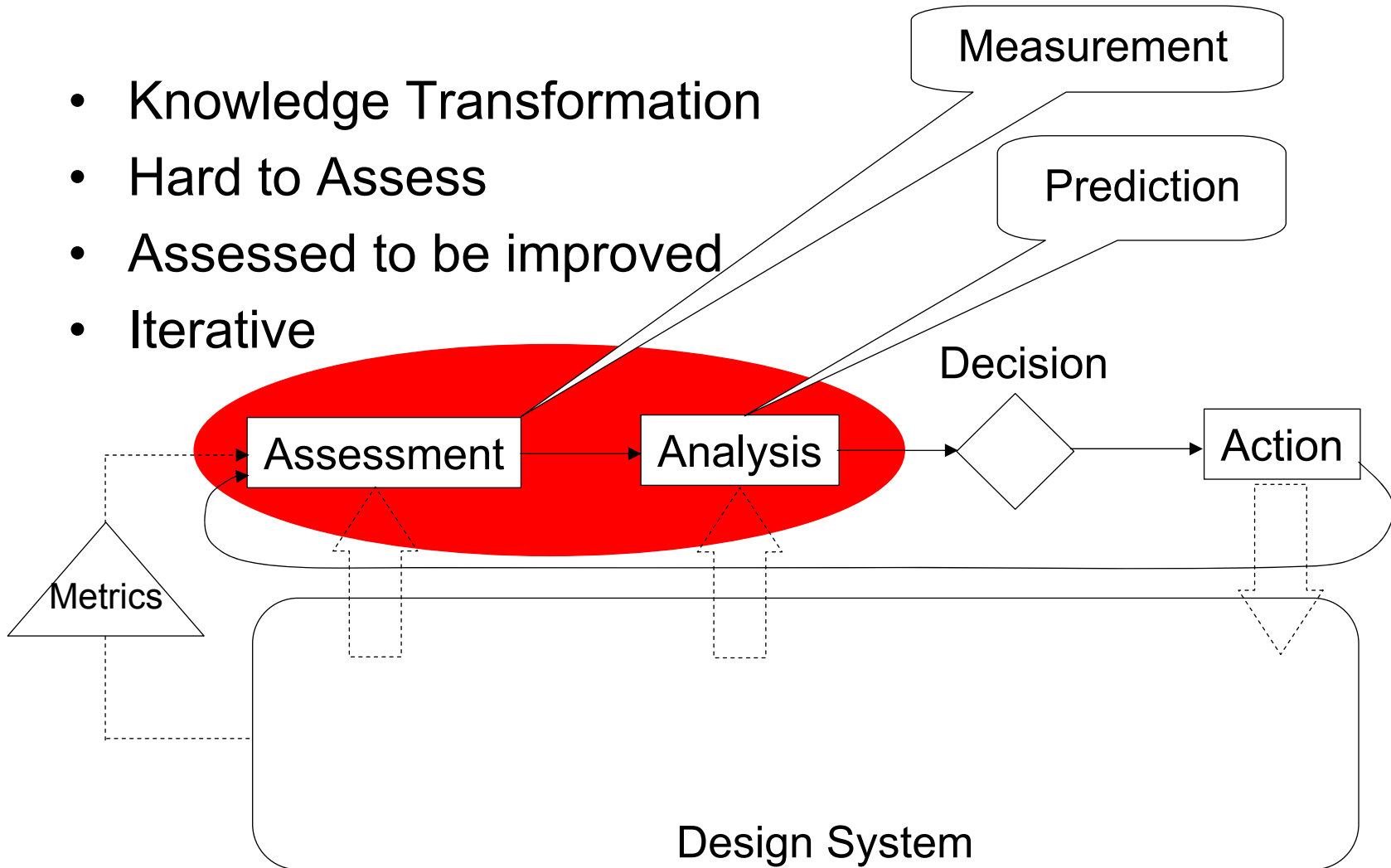


Developed by/used in: – PRODUKTIV+ project, – PSI project

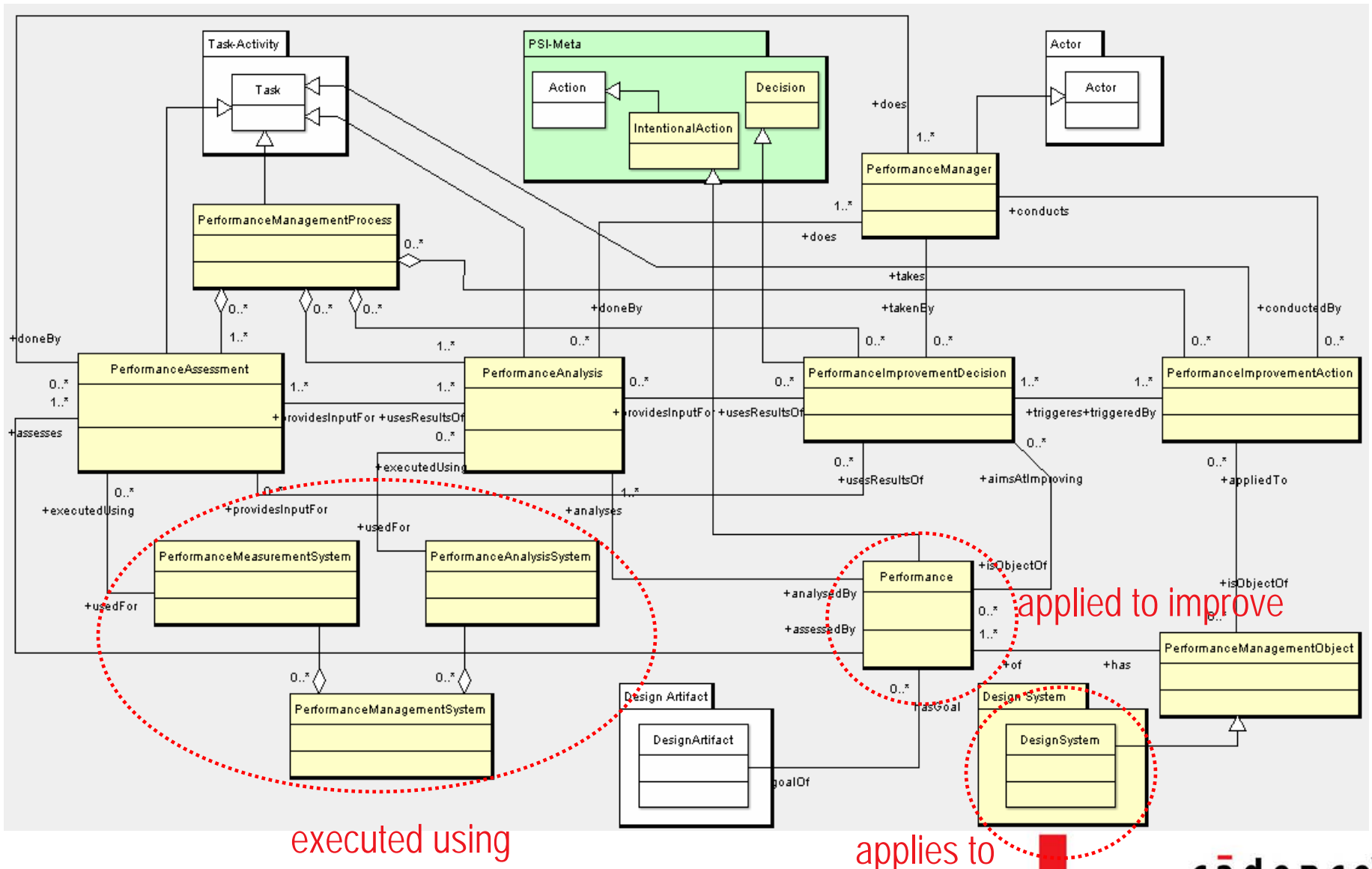
Developed by: – Cadence, – Cadence and FSU-metheval, – IMS, – OFFIS (DADpecific)

Performance Management Process

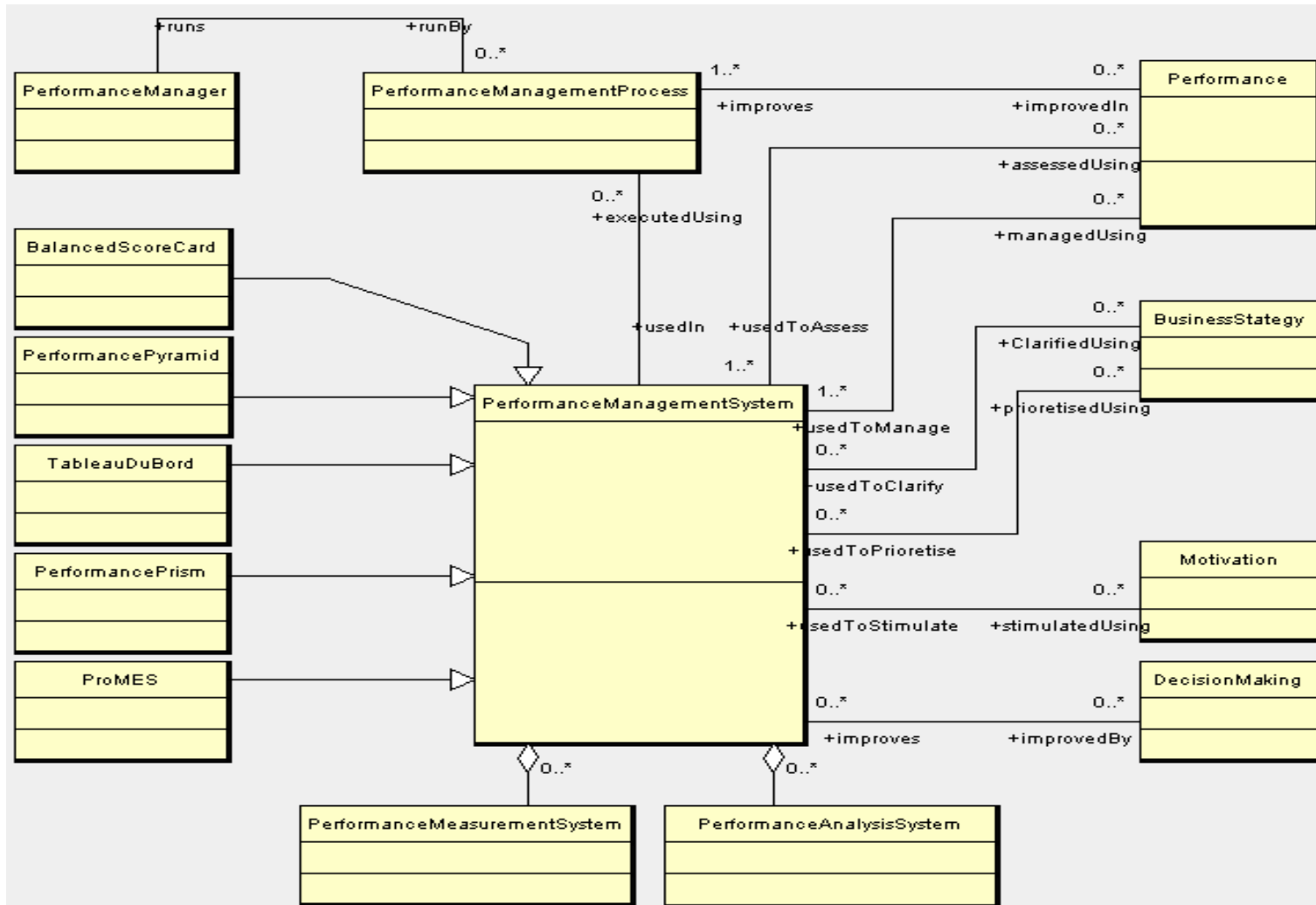
- Knowledge Transformation
- Hard to Assess
- Assessed to be improved
- Iterative



More Details: Performance Management Process



More Details: Performance Management System BA viewpoint

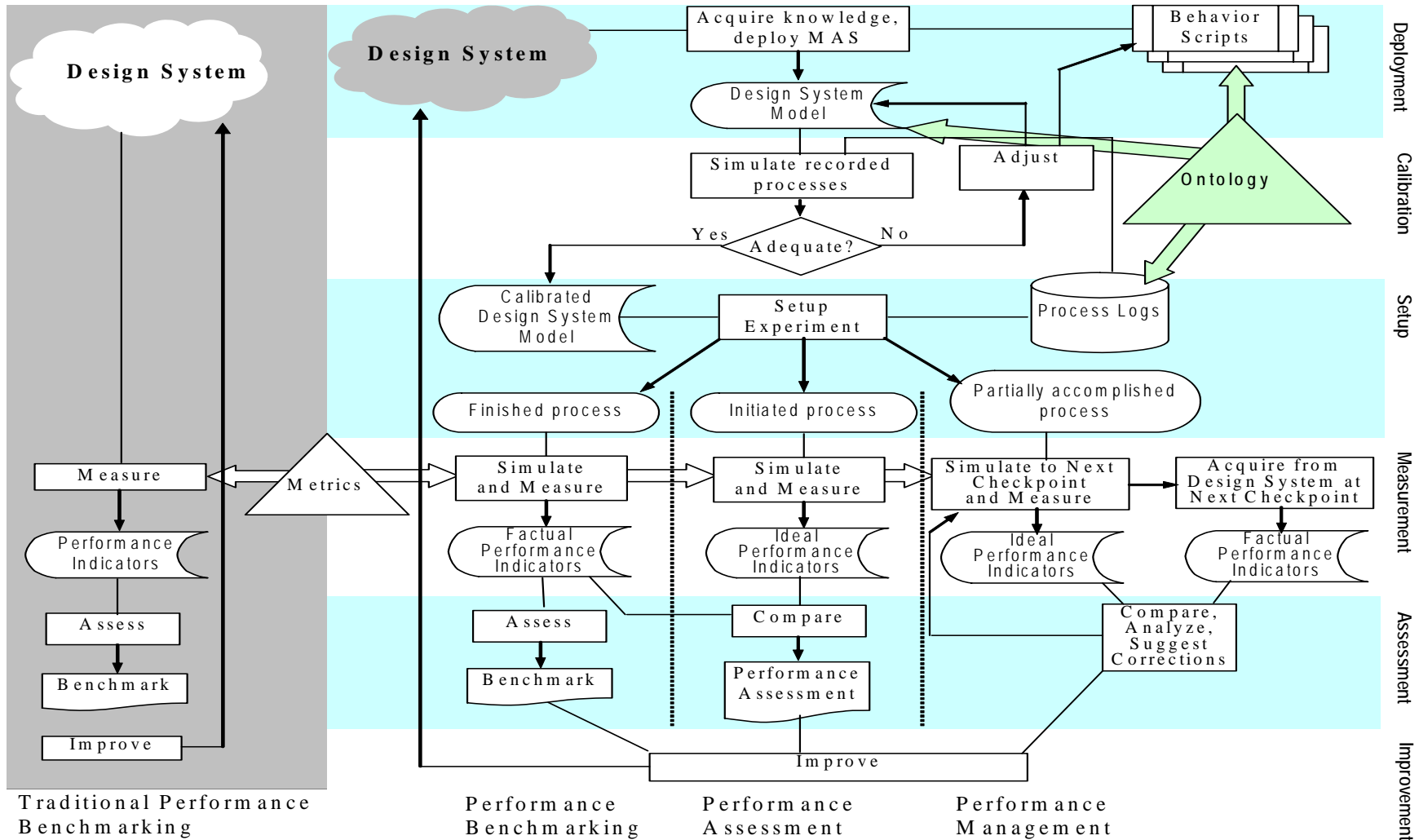


Methodology (PM3)

How to access and manage Performance?
In Engineering Design practice ...



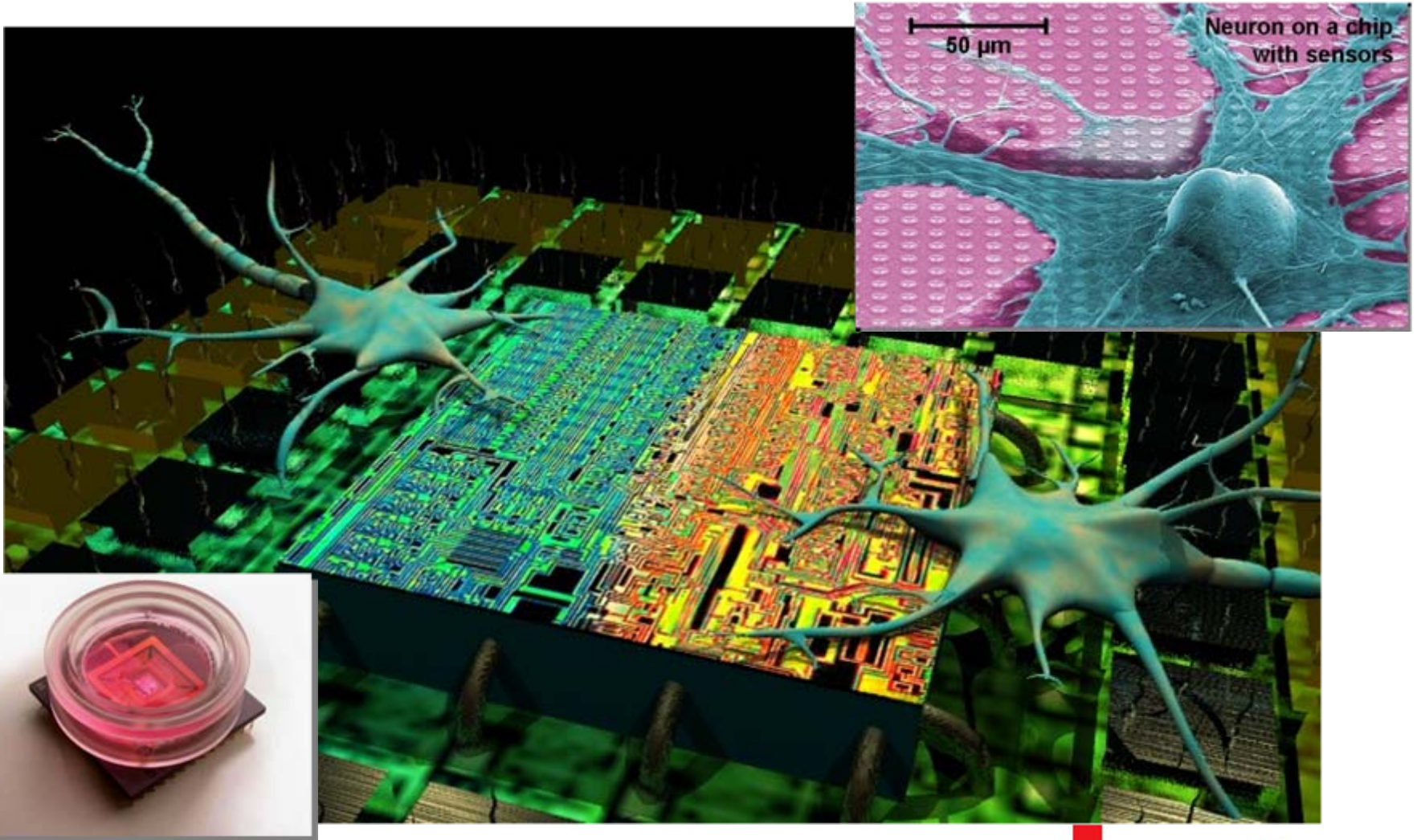
How to Access and Manage Performance?



Concluding Remarks

- Performance ontology – Formal Descriptive Framework
 - Based on Holonic principles
 - Integrates available Performance Management Systems
 - Applies to Engineering Design Systems
 - Needs to be specialized for particular cases
- To be used and specialized in PSI and PRODUKTIV+
- Software Tool for Performance Management in Engineering Design
 - To be presented later today

Questions Please



Supporting Slides

Anticipating your questions on the following ...



Efficiency Measures ...

- Efficiency: ratio of “useful” work performed to the total “energy” expended (Oxford Dict.)
- Useful work?
 - Knowledge gain ...
- Energy expended?
 - Resources consumed + ...
- Time-based, cost-based ... => UTILITY-based
- **Domain-dependent Details** are required to make things tangible
 - **List???**

Effectiveness Measures ...

- Being **Effective**: possess a Desired Effect (to some extent)
 - The EXTENT is of interest
- Design (activity, task, process) **Goal**
- Design (activity, task, process) **Output**
- 100% meeting the Goal means 100% EFFECTIVE
 - UTILITY-based again ...
- **Domain-dependent Details** are required to make things tangible
 - List???

Compare

Beyond E2?

- What is the performance of a Design Endeavour which:
 - Spent 100MY
 - Ended in total FAILURE
 - BUT, proved that the approach taken is wrong
- Can performance be fully accessed by:
 - Efficiency and
 - (positive) Effectiveness
- Other topical factors to account for?

Action and Artifact Performance

- Action Performance – e.g., E2+
- Artifact Performance – different:
 - Does the result of a Design Process meets the requirements?
 - Similar to Action Effectiveness
- Effectiveness of the Design Process -> Artifact Performance
 - May be used for predictions ...

Performance: Objective vs Subjective ...

- Performing very well subjectively is not always good
 - May cause under-performance of the related peers in the context
- Best achievable performance – means GOALS COHERENCE
 - Trade-offs should be rationally reached (SUPER-additivity)