

Large-scale integrating project (IP) proposal
ICT Call 10
FP7-ICT-2012-10

**Ubiquitous Complex Event Processing
in Exocortex Applications**

uCepCortex

ICT Proposers' Day, Warsaw September 26-27, 2012

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Definition of an Artificial Cognitive System and the mission of uCepCortex

uCepCortex defines an **ACS** as a system

- (i) which is artificially made by humans
- (ii) in order to enhance the cognition or abilities of humans
- (iii) for one or more aims which have to be defined explicitly
- (iv) to recognize or even predict or foresee complex events (like environmental situations, natural catastrophes, economical or political forecasts, health hazards, etc.) and
- (v) to react on such complex events as a self-contained system if possible or to notify affected humans and advise a helpful decision-making

The **main idea of the uCepCortex** project is

to enhance human abilities by a complex cognitive system which adds and supplements senses and integrates the information of these senses for an optimal output, thereby overcoming the limitations of the human brain. Its typical limitations are:

- the **amount** of events that can be processed at any one time: The human brain can only process around 120.000 events per second unconsciously and less than ten consciously;
- the **number of event types** we can consciously integrate at any one time: integrating of multiple information sources requires **tracking**, **memorizing** and **retrieving** of past, recent and current events;
- the **performance** and **scalability** of the **event processing** and the **correlation** of actually meaningless basic events to senseful complex events;
- the **sensitivity ranges** (modalities) of the five senses what a human can hear, see, smell, taste and feel;
- the degeneration of the **number and the sensitivity of senses**: loss or damage due to aging, illness or accident and the feasibility and **manageability is missing to substitute or add additional senses**.

What is new in uCepCortex 2G:

How to build, influence and modify a matrix

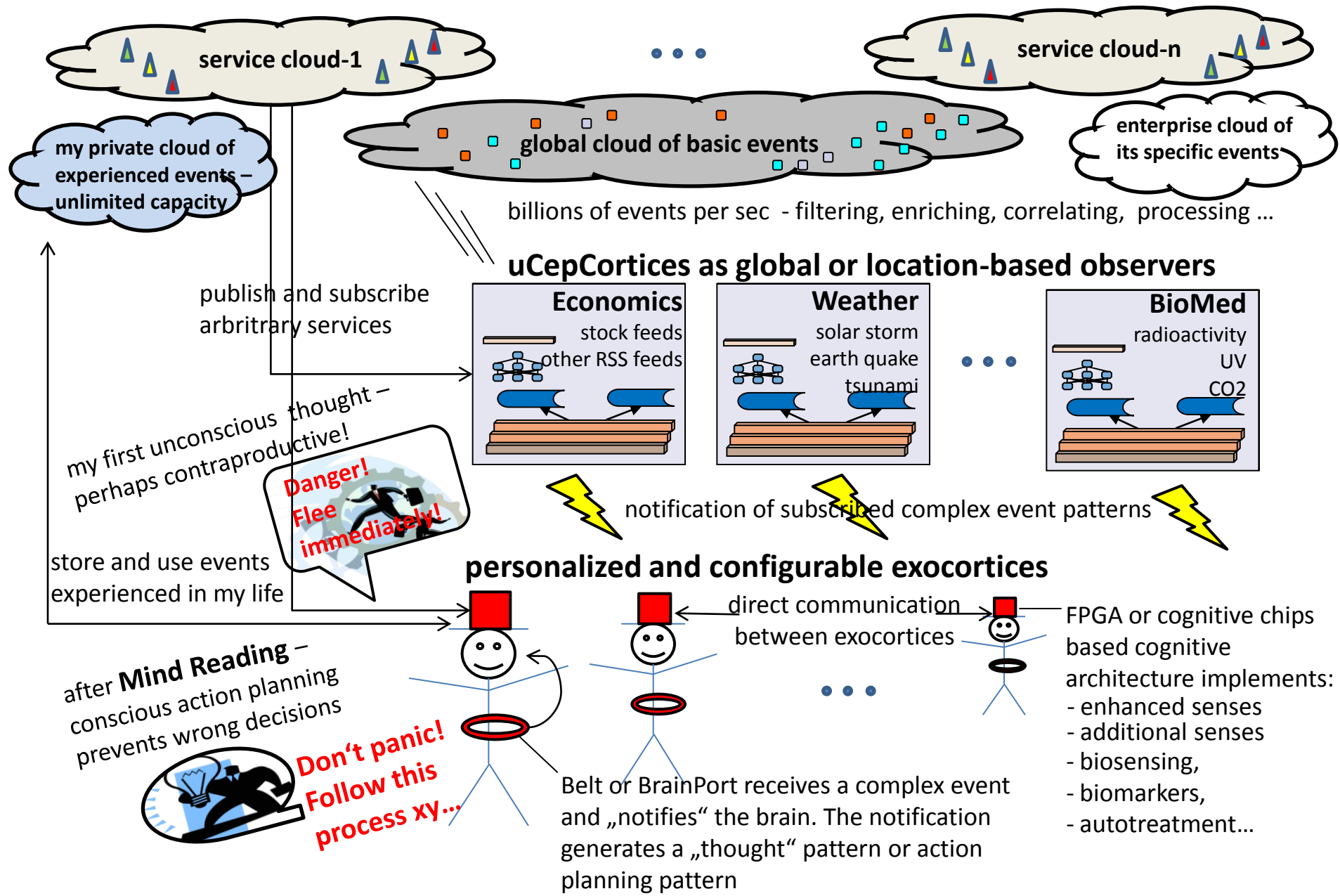
- applications and demonstrators -
clinical applications,
human enhancements,
autonomous robots and swarms of robots with their own matrix,
robot companions for humans

We will in addition to the project proposal for Call-9 investigate how an **autonomous robot** or Cyborg would be started with a basic modeling of its special matrix according to what this Artificial Cognitive System (ACS) respectively Cyborg should do and how it would **autonomously learn and enhance its matrix or world model**.

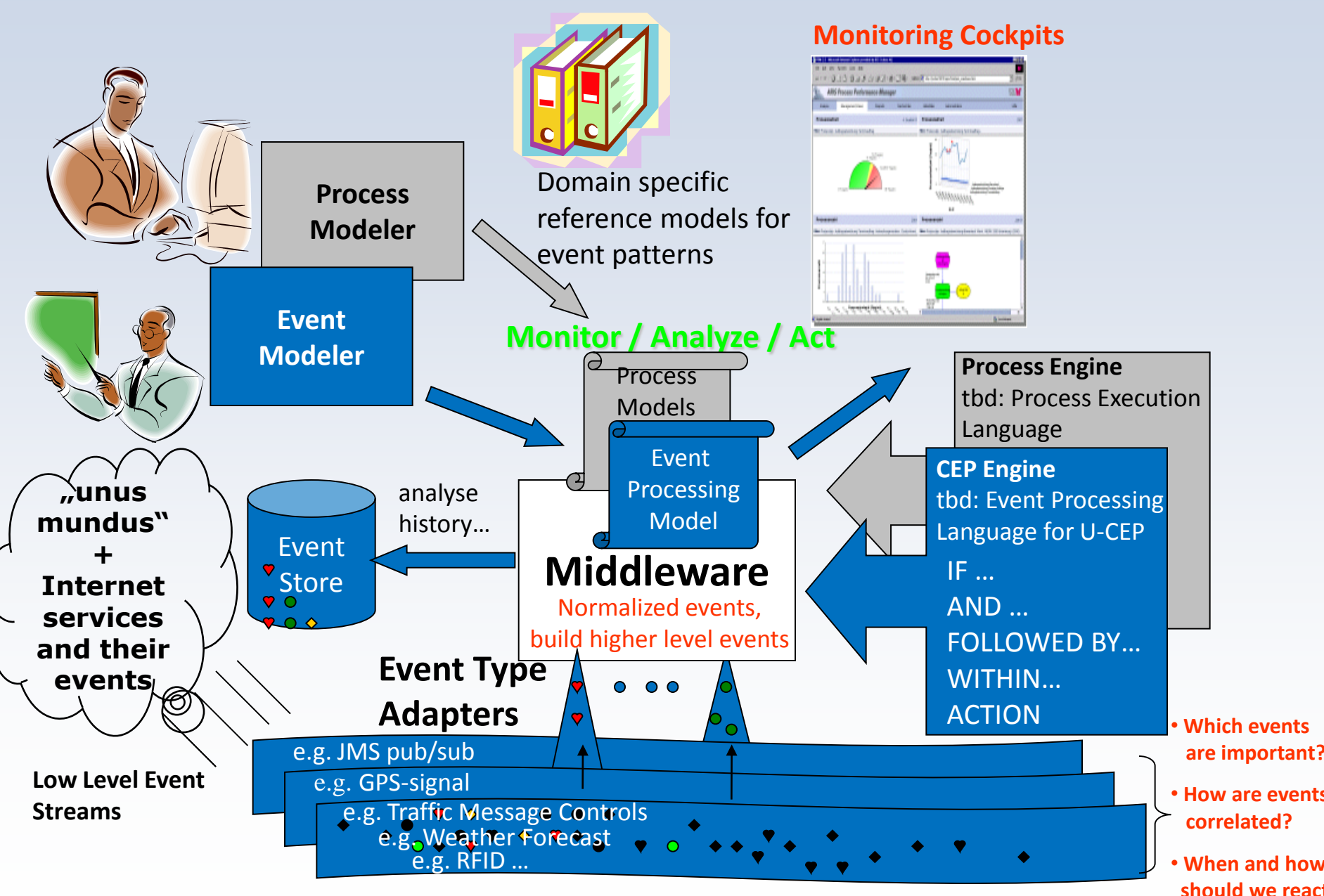
We will also explore how a swarm of robots would mutually exchange information according to the theory of quantum information
(see as the first C.F. von Weizsäcker <http://www.scilog.de/kosmo/blog/astronomers-do-it-at-night/wissenschaft-fur-alle/2009-11-14/quanten-und-information-anton-zeilinger-in-hamburg-carl-friedrich-von-weizs-cker-vorlesungen-2009>, Görnitz http://iopscience.iop.org/1742-6596/237/1/012011/pdf/jpconf10_237_012011.pdf, David Bohm, John Wheeler, David Deutsch or nowadays Dieter Lüst <http://www.chbeck.de/Luest-Quantenfische/productview.aspx?product=8552073>, Vlatko Vedral <http://www.amazon.co.uk/Decoding-Reality-Universe-Quantum-Information/dp/019969574>; see also Nick Bostrom and his formula on page 7 <http://www.simulation-argument.com/simulation.pdf>).

Such a swarm would remodel the swarm's matrix more and more complex, according to the Entropy or the second law of thermodynamics. Question is whether such autonomous robot swarms would build a parallel, own "reality" and act or "live" in it, and how the mankind would guarantee the control for a **symbiotic coexistence and cooperation** (see the flipside of the coin of HET as it is presently discussed <http://forum.complexevents.com/viewtopic.php?f=13&t=261&p=1463#p1463>).

The basic idea of the uCepCortex project as a Cognitive System

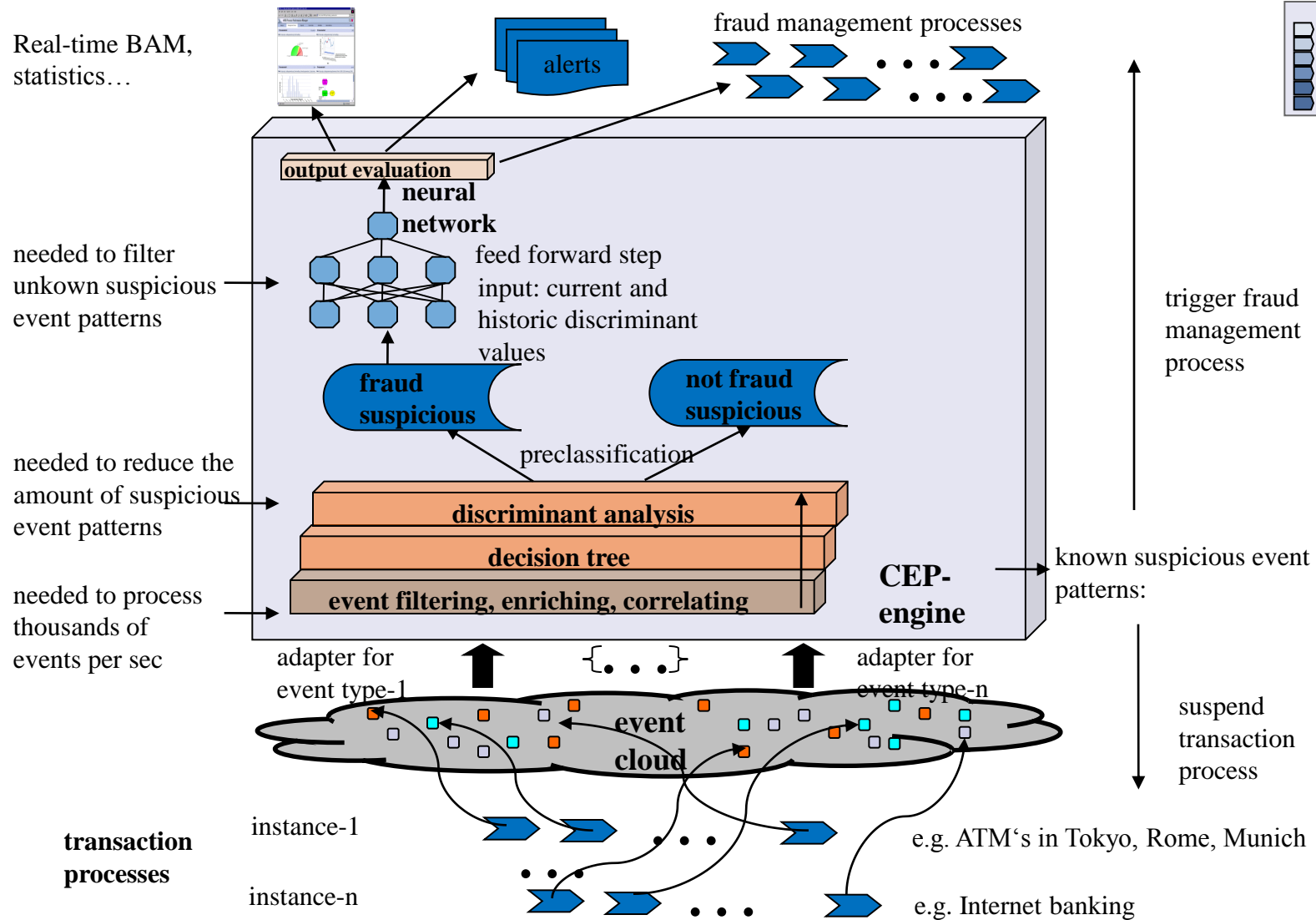


The Principle of U-CEP – Reference Model – basic components of a uCepCortex



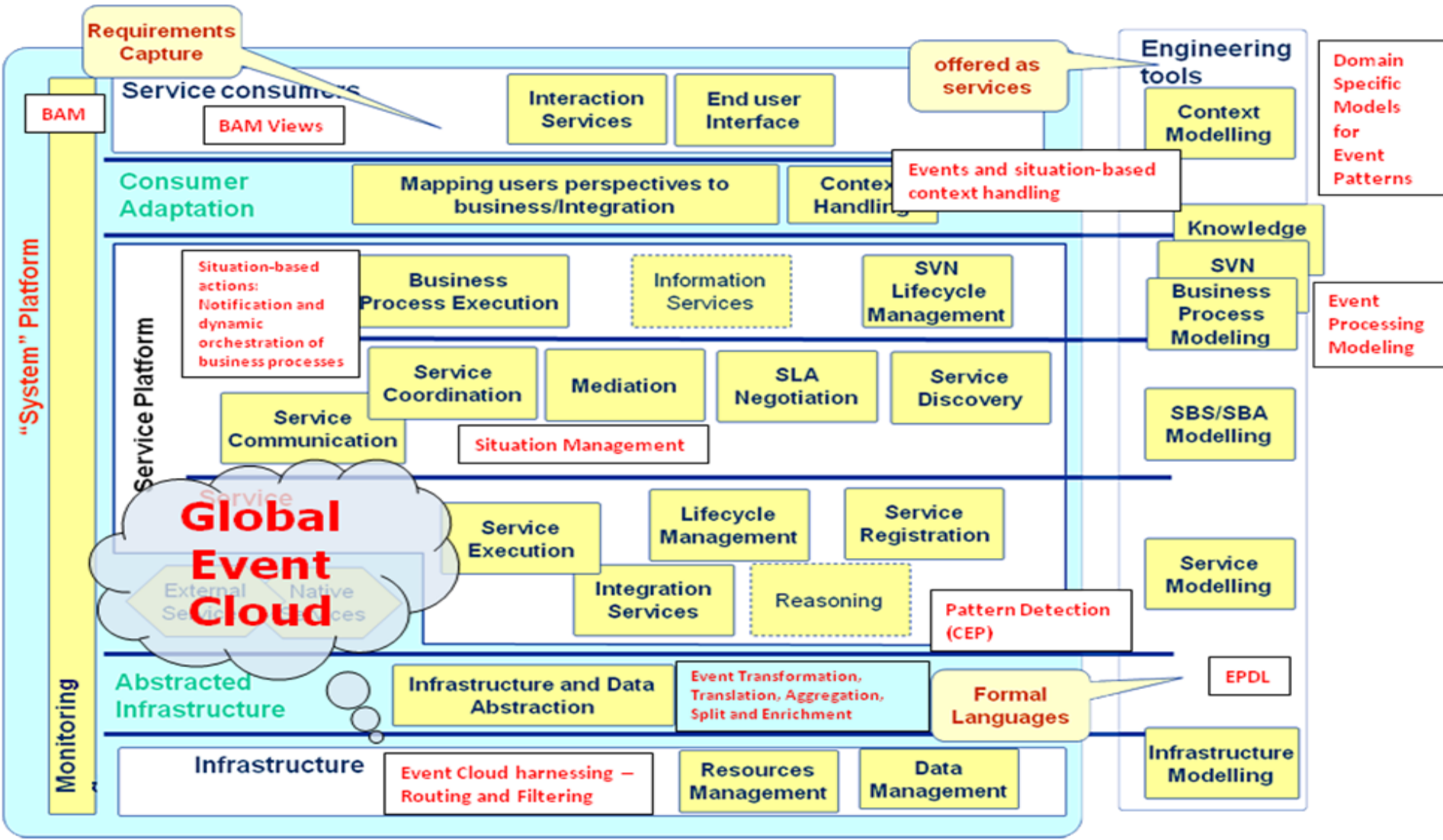
A Reference Model of non-deterministic uCepCortex

example of Fraud Management, simply to be adapted for e.g. Emergency Management, etc.



NEXOF-RA to be enhanced by ED-BPM and U-CEP

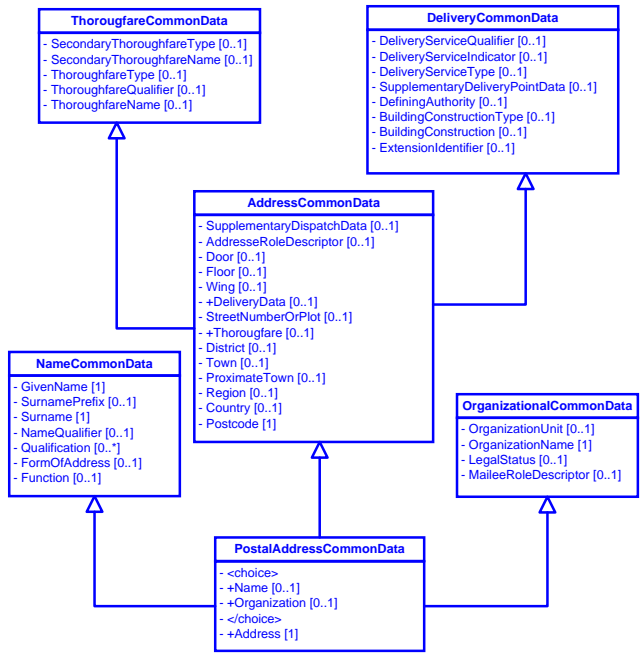
(red marked = enhancements)



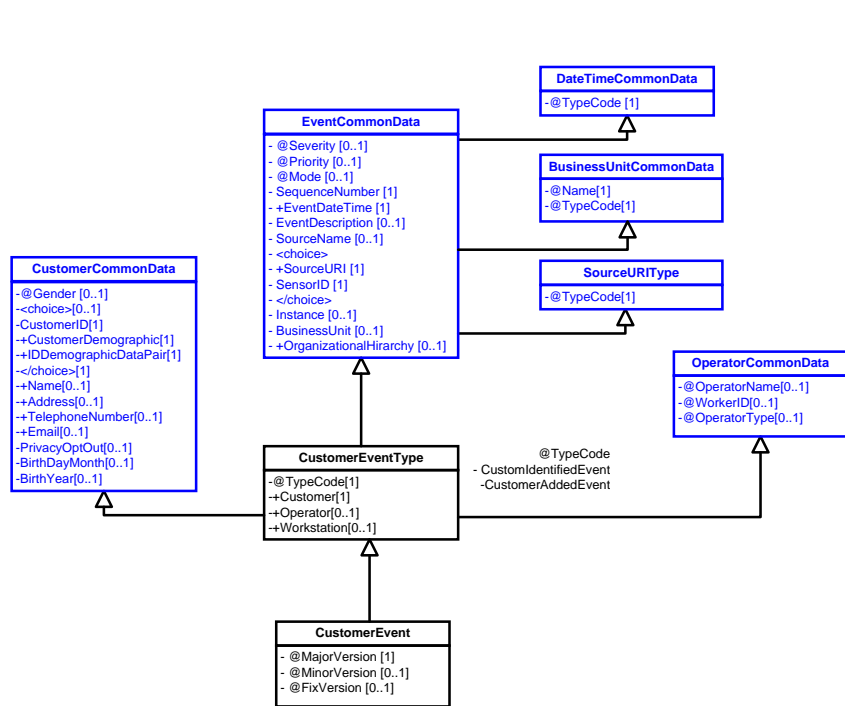
Domain-specific Notification Event Architecture for Thought –

NEAR(etail) could be used as template for a probably complex class diagram of „Thought“ as a NEAT standard for a Brain-Machine-Brain interface and communication in the field of Mind Reading

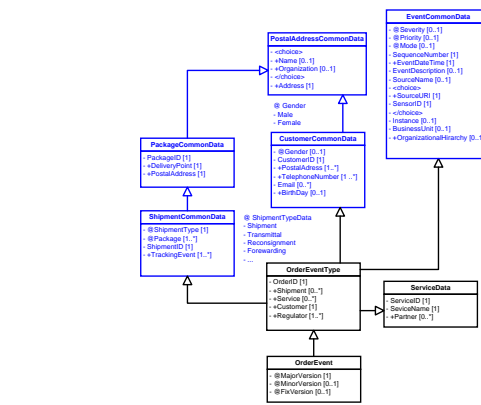
(More about NEAR see http://www.nrf.com/modules.php?name=News&op=viewlive&sp_id=155)



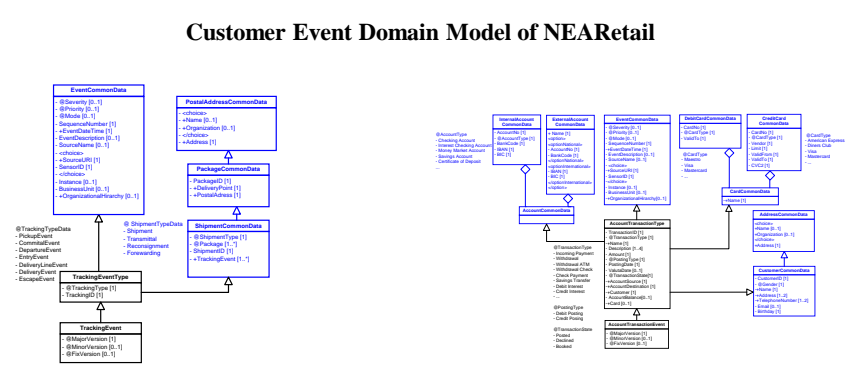
“Common Postal Address” Architecture of NEALogistics



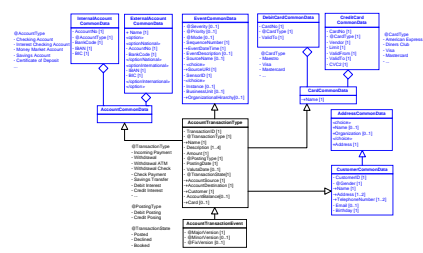
Customer Event Domain Model of NEARetail



Order Event Architecture



Tracking Event Architecture



Model of the “AccountTransactionEvent” of NEAFinance

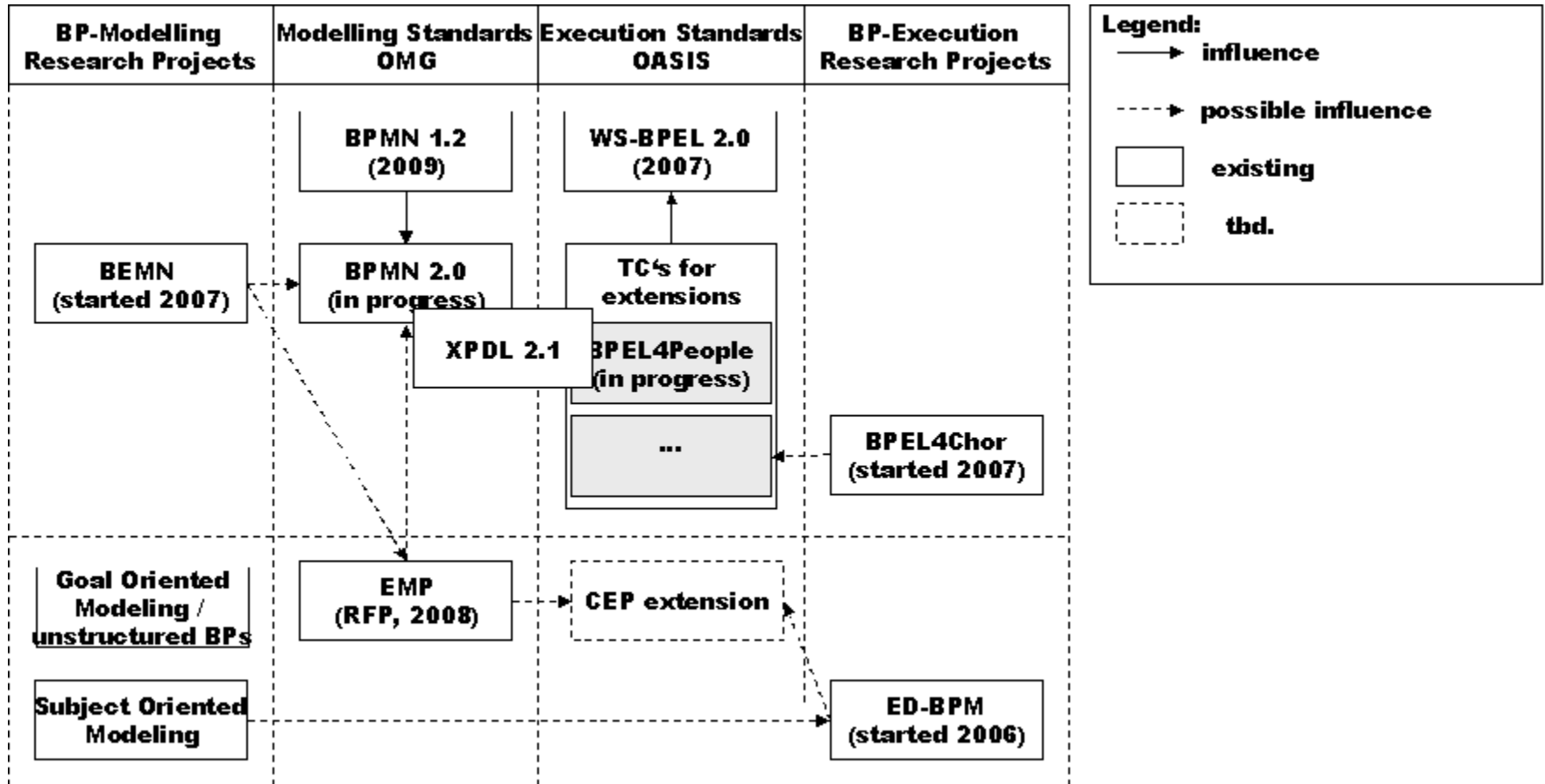
Standardizing Event Processing Languages?

A controversial discussion until today

Different types of users for different monitoring-views and needed skills
(from 2007, a lot has changed in the meantime)

EPL-Approaches	CEP-Platform	Usability / User Type
Pseudo-SQL	<ul style="list-style-type: none">- Coral8 (CCL)- StreamBase (StreamSQL)- Esper (EQL)- Aleri- ?Oracle (CQL)?	<ul style="list-style-type: none">- skilled EPL-programmers- not the community of SQL-programmers?!
Special Rules Languages	<ul style="list-style-type: none">- AMiT- ?Apama?- Tibco- ?Oracle?	<ul style="list-style-type: none">- skilled proprietary EPL-programmers- will never be a community
Java- or other 3GL generated Code	<ul style="list-style-type: none">- Tibco- Apama- Esper?- Aleri Studio- ?Oracle?	<ul style="list-style-type: none">- community of Java-programmers
Proprietary 4GL-based approaches	<ul style="list-style-type: none">- ?Aleri XML?- ?	<ul style="list-style-type: none">- skilled proprietary 4GL-programmers- will never be a community
GUI-based approaches (graphical editors) and code generation	<ul style="list-style-type: none">- ?AMIT?- ?Apama?- AptSoft- StreamBase	<ul style="list-style-type: none">- C-level managers?- marketing employees?- appropriate for all requirements of applications?- only GUI or additionally to a EPL?

Existing standards and current research projects related to edBPM and to be enhanced by U-CEP



How to build, influence and modify a matrix

- applications and demonstrators -

clinical applications,

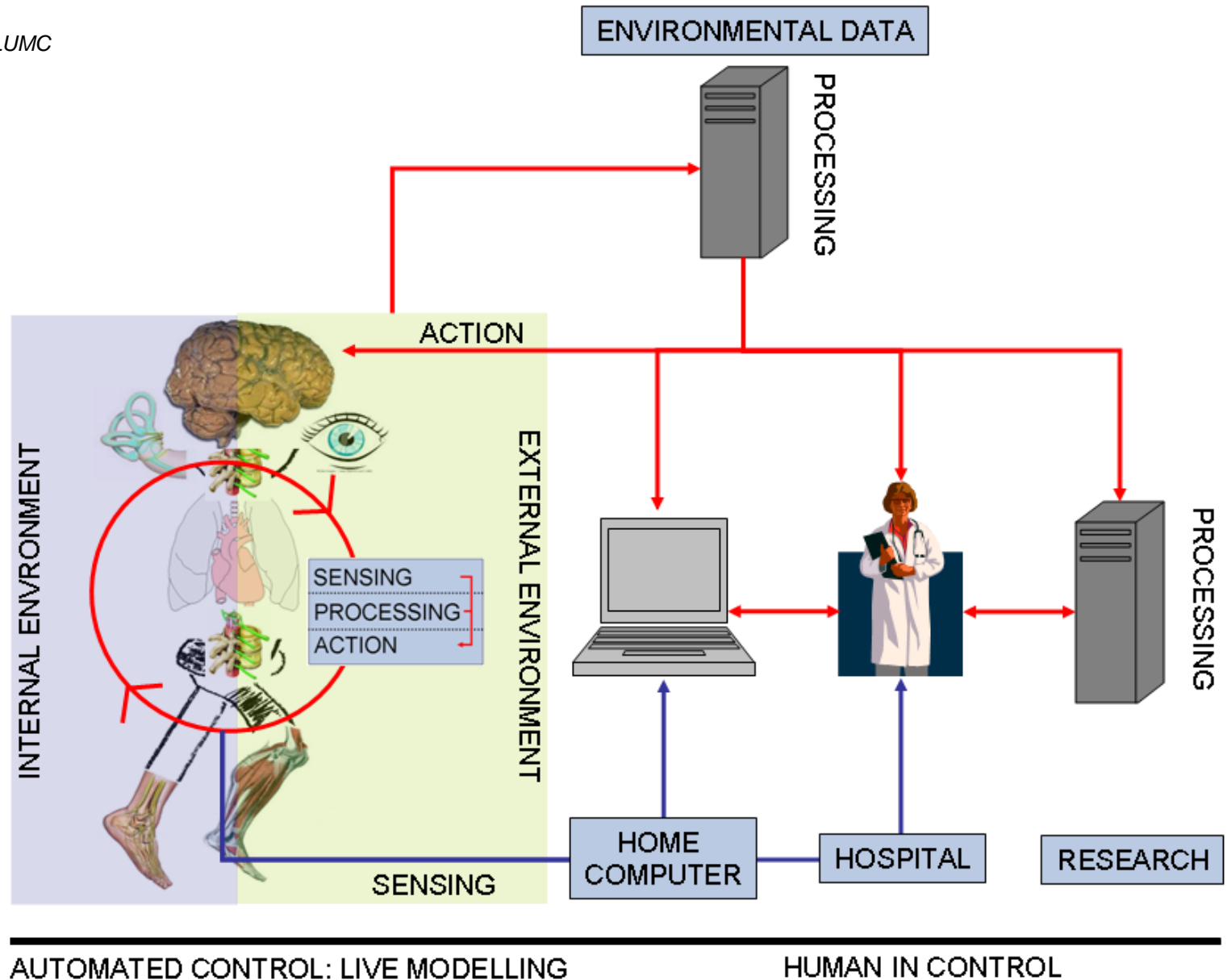
human enhancements,

autonomous robots or swarms of robots with their own matrix,

robot companions for humans

uCepCortex and clinical applications

Carel Meskers/LUMC



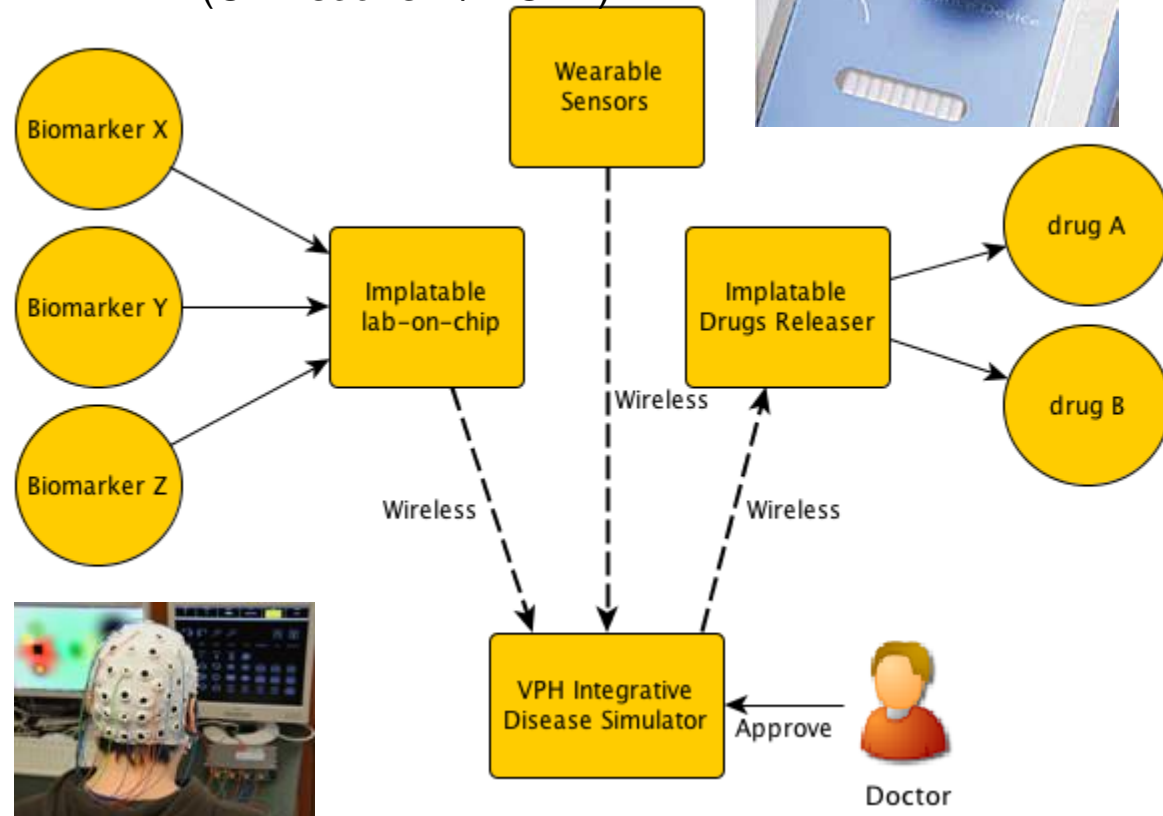
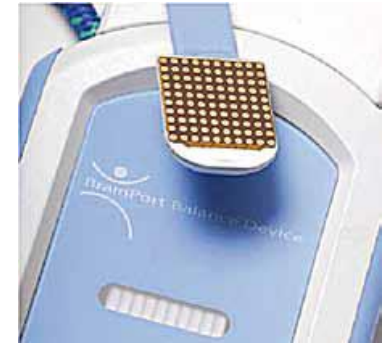
uCepCortex and clinical applications – U-CEP based automatic treatment

- Biomarkers as complex event patterns, and therapeutics as (pre-) modelled processes
- „Understanding“ and „rebooting“ the brain
- Mind reading for clinical applications and for HETs

Biosensors and biomarkers, e.g.



BrainPort and CN-NINM
BCI as **interface** to the brain
(U Wisconsin / TCNL)



Mind reading – based on
(complex) event patterns
BCI as **interface from** the brain
U Würzburg, U Tübingen,
MPI Leipzig, UCLA, MIT, IBM...

http://www.silicon.de/technologie/mobile/0,39044013,41556997,00/gedanken_malen_am_computer_bilder.htm,

Enhancing human intelligence and cognitive or physical abilities

connect humans to more events of the universe (resp. Internet services)

- e.g. Ray Kurzweil: Singularity is Near
- e.g. Bruce H. Lipton: Epigenetics – Intelligent cells
- e.g. Kevin Warwick: Brain Computer Interface - Cyborg



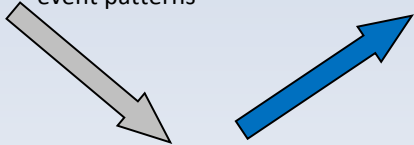
Process Modeler



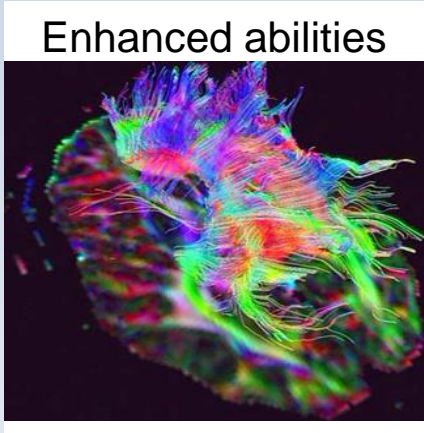
Event Modeler



Domain specific reference models for event patterns



Monitor / Analyze / Act



Enhanced abilities

realize scenario process instances
set parameters

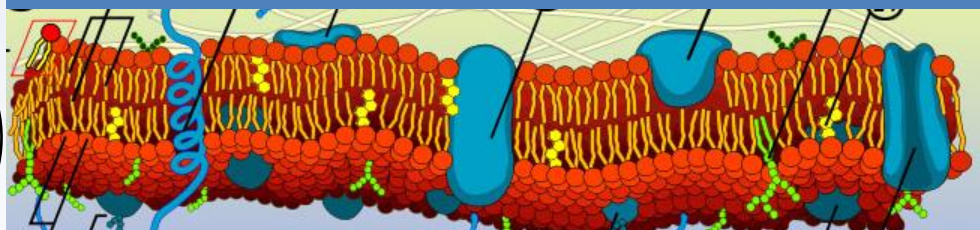
Intracellular effectors = Event Processing Agents

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Protein machinery

Protein machinery



Extracellular receptors = event adapters

e.g. RFID, topics or Pub/Sub, ...

e.g. JMS pub/sub

e.g. GPS-signal

e.g. Traffic Message Controls

e.g. Weather Forecast

e.g. RFID ...

e.g. payments

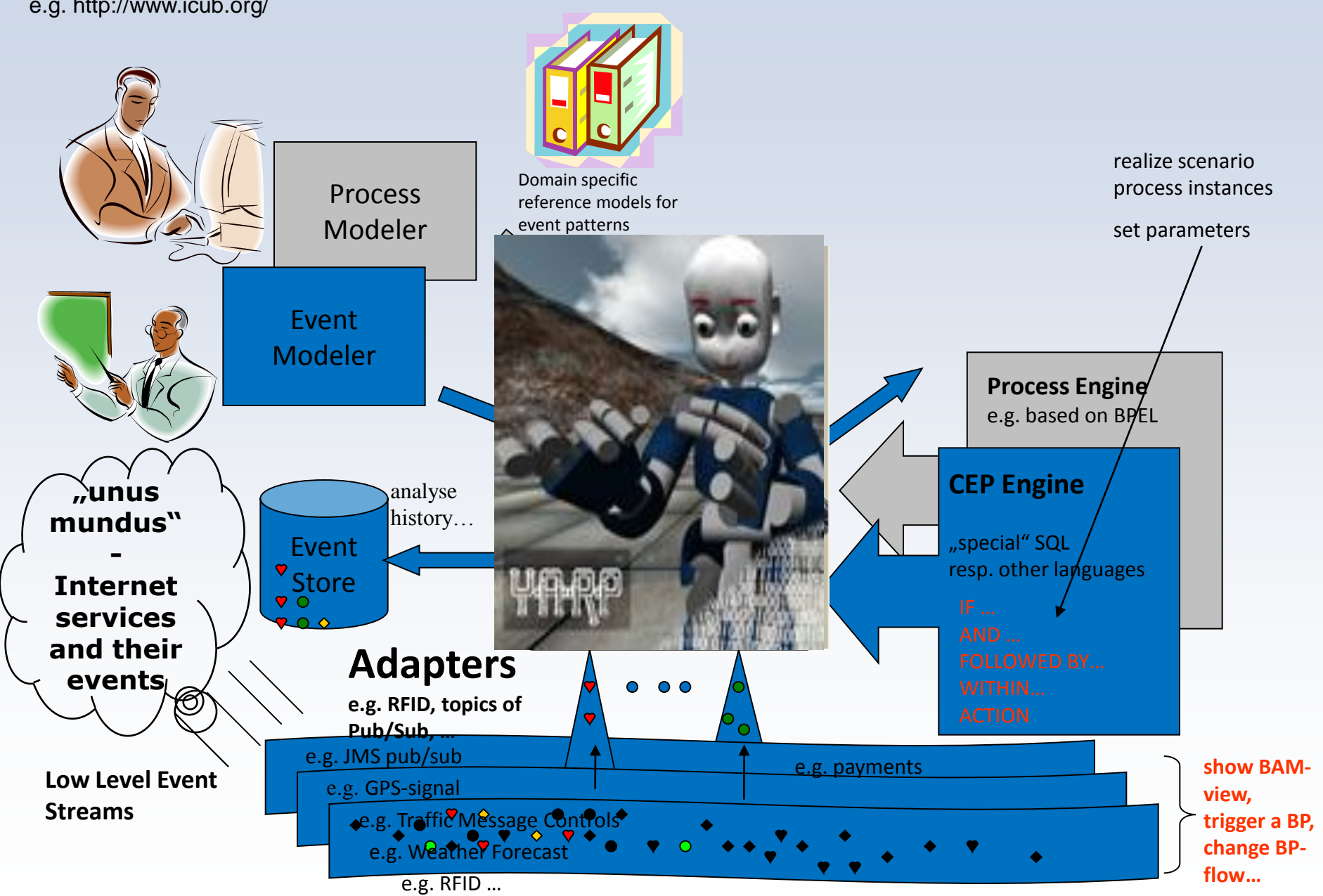
„unus mundus“
- Internet services and their events

Low Level Event Streams

show BAM-view, trigger a BP, change BP-flow...

Robot Companions for Citizen – Cyborgs, driven by Event Processing

e.g. <http://www.icub.org/>



The basic workpackage structure of uCepCortex - to be revised -

WP1 uCepCortex reference model and reference architecture	
WP2 Analysis and modeling of complex event patterns, cognitive processes and process management	
WP 3 Implementation of a „beyond senses“ BCBI and exocortex integration	
WP3.1 Sensitivity range / substitution	WP3.2 Additional senses
WP 4 Real-world applications - demonstrators	
WP4.1 Impaired subjects	WP4.2 Emergency management
WP5 Psychological impacts of and strategies for a cooperation between an exocortex and a human	
WP6 Value-sensitive design and ethical, legal and societal impact	
WP7 Training for research and professional development	
WP8 Dissemination and exploitation of exocortex applications	
WP9 Management	

Schematic of the WPs and their main interdependencies

- to be revised -

