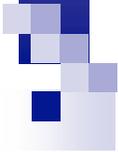
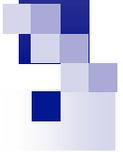
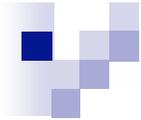


SMART INFORMATION AND KNOWLEDGE MANAGEMENT IN COMPLEX SYSTEMS: SOME ISSUES AND CHALLENGES

Prof E Szczerbicki

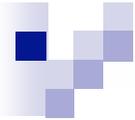
San Sebastian, May 2009





Information and Network Society

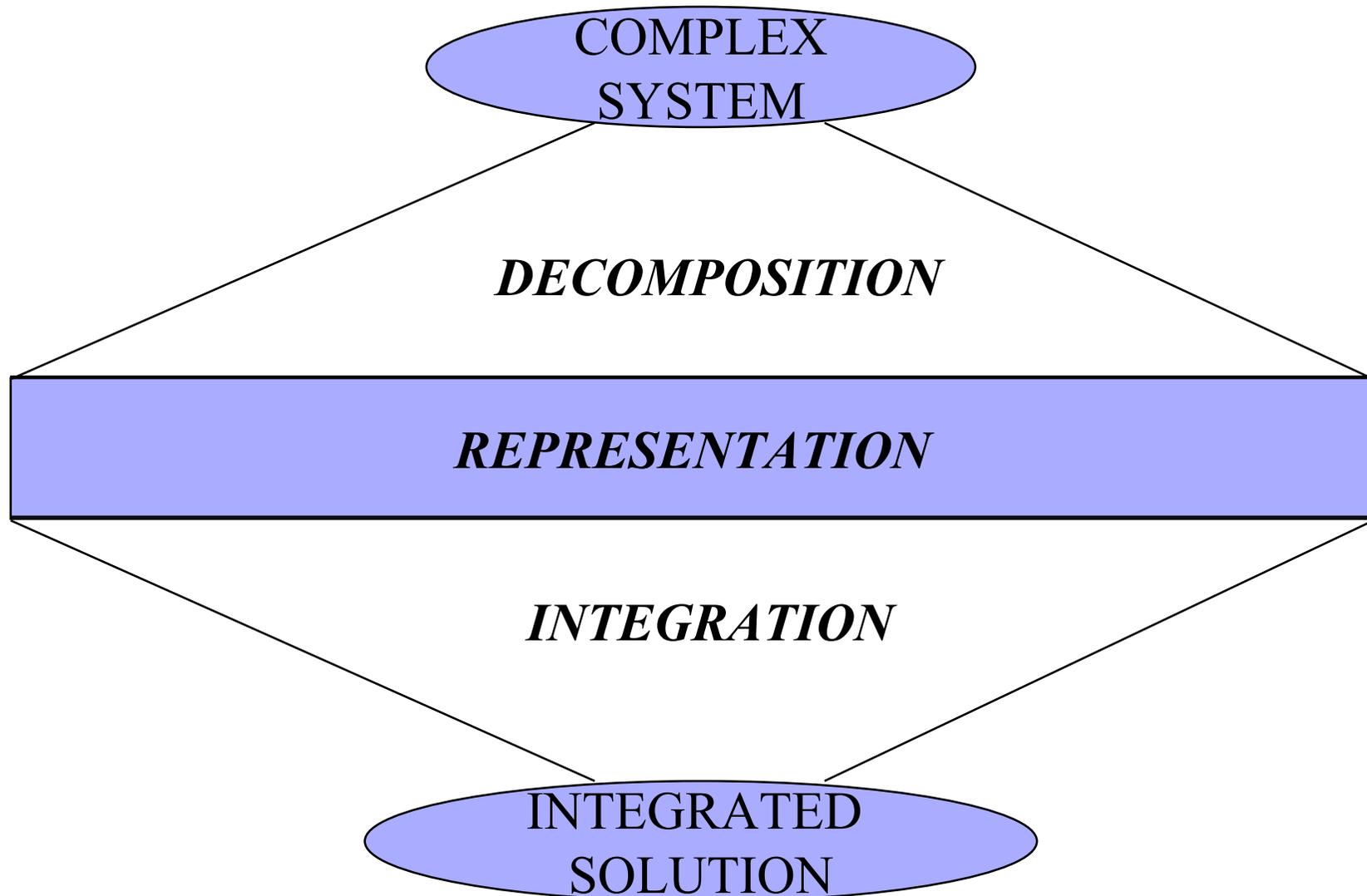
San Sebastian, May 2009



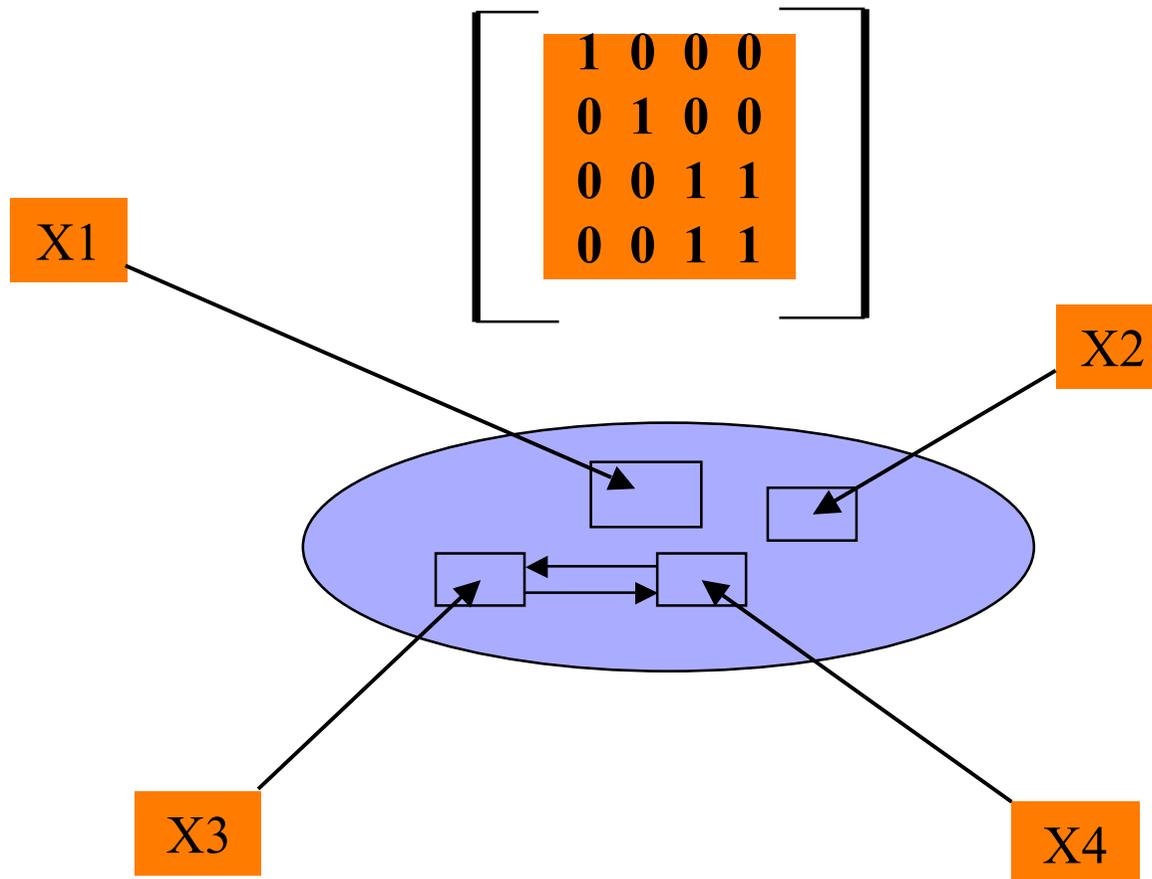
SIGNIFICANCE OF COMMUNICATION

- If all the N elements of a system are required to communicate, the amount of information transfer is likely to become unmanageable.
- The above has been the reason why systems that are divided into smaller subsystems (called atomized or multi-agent or multi-component systems) are recently gaining considerable attention.
- In atomized approach efficiency of components depends on quality and quantity of information flow

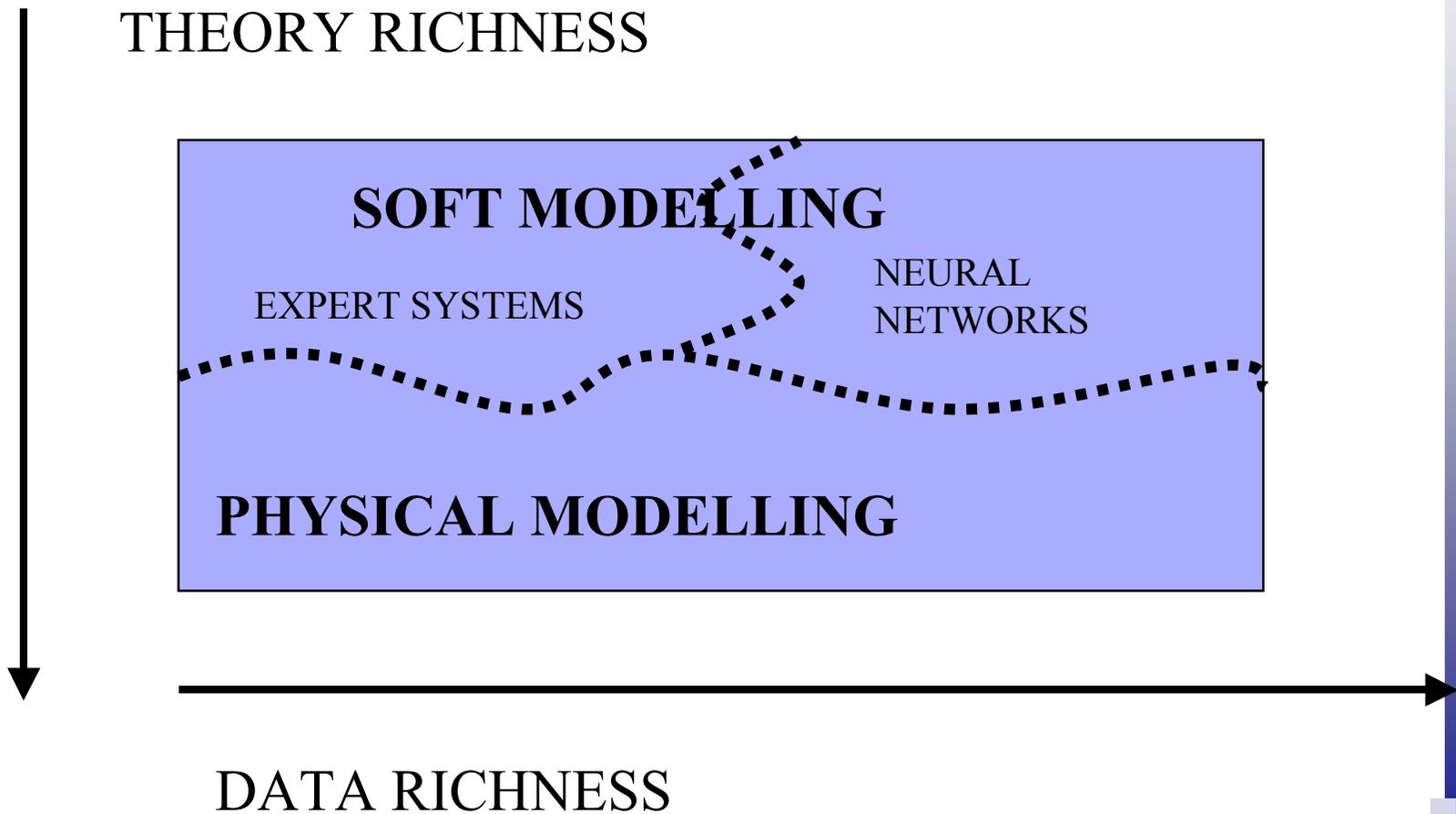
SOLVING COMPLEX PROBLEMS



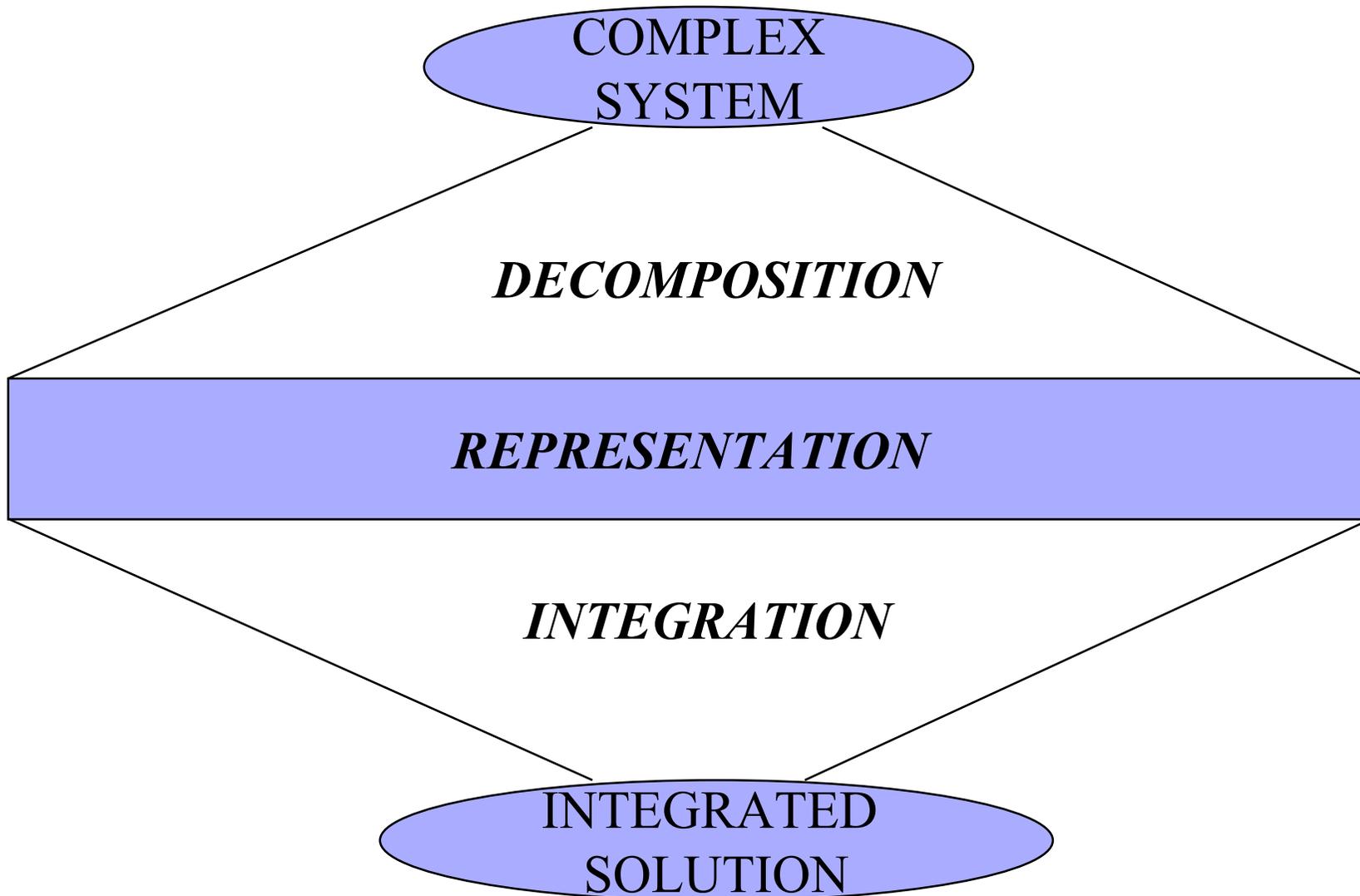
INFORMATION STRUCTURE C



SOFT VS HARD MODELLING



SOLVING COMPLEX PROBLEMS



INTEGRATION.....

OBJECT ORIENTED DESIGN SYNTHESIS				System Browser
ADD MODEL	MODIFY MODEL	DELETE MODEL	LIST MODEL BASE	INTELLIGENT MANUFACTURING LABORATORY DEPARTMENT OF INDUSTRIAL ENGINEERING THE UNIVERSITY OF IOWA
RUN SYNTHESIS	SAVE OVERALL MODEL	RETRIEVE OVERALL MODEL	HELP	


```

graph TD
    1[1] --- 2[2]
    1 --- 3[3]
    1 --- 4[4]
    1 --- 6[6]
    1 --- 7[7]
    2 --- 9[9]
    3 --- 9
    4 --- 9
    5[5] --- 12[12]
    9 --- 12
    6 --- 13[13]
    10[10] --- 13
    12 --- 14[14]
    13 --- 14
    8[8] --- 15[15]
    14 --- 15
    
```

Selected element IS CONNECTED to the basic element.

Since element 8 is the only element in the model base IT IS INCLUDED in the model base for the next design iteration.

DESIGN ITERATION 3

Element 12 has only boundary inputs and IS SELECTED as a basic element. Element 13 IS SELECTED as a candidate for connection with the basic element. Selected element IS CONNECTED to the basic element.

Since element 8 is the only element in the model base IT IS INCLUDED in the model base for the next design iteration.

DESIGN ITERATION 4

Element 14 has only boundary inputs and IS SELECTED as a basic element. Element 8 IS SELECTED as a candidate for connection with the basic element. Selected element IS CONNECTED to the basic element.

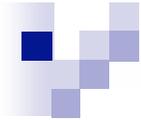
THE OVERALL CONCEPTUAL MODEL IS:

.....

NAME : '15'

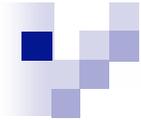
ELEMENTS : '14' and '8'

.....



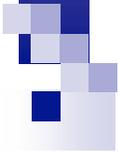
SUPPORT FOR INTEGRATION TECHNOLOGY

**EMBODIMENT OF INTEGRATED
APPROACH TO INFORMATION
PROBLEMS GENERALLY AND
INFORMATION SYSTEMS DESIGN
SPECIFICALLY**

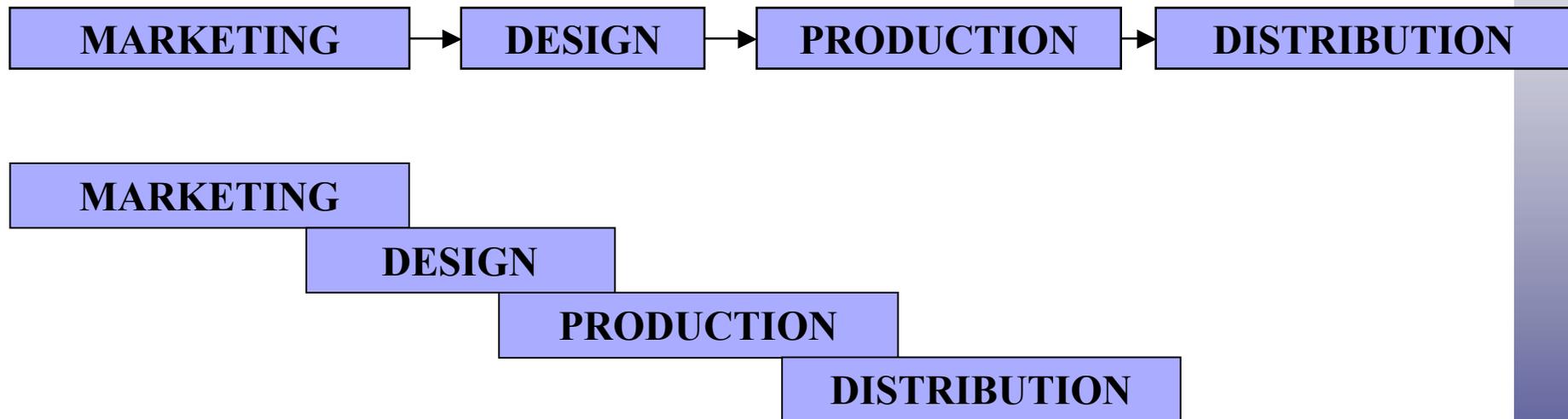


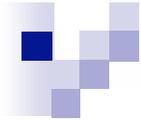
Concurrency Challenge

San Sebastian, May 2009



SEQUENTIAL PRODUCT DEVELOPMENT PROCESS VS CONCURRENCY





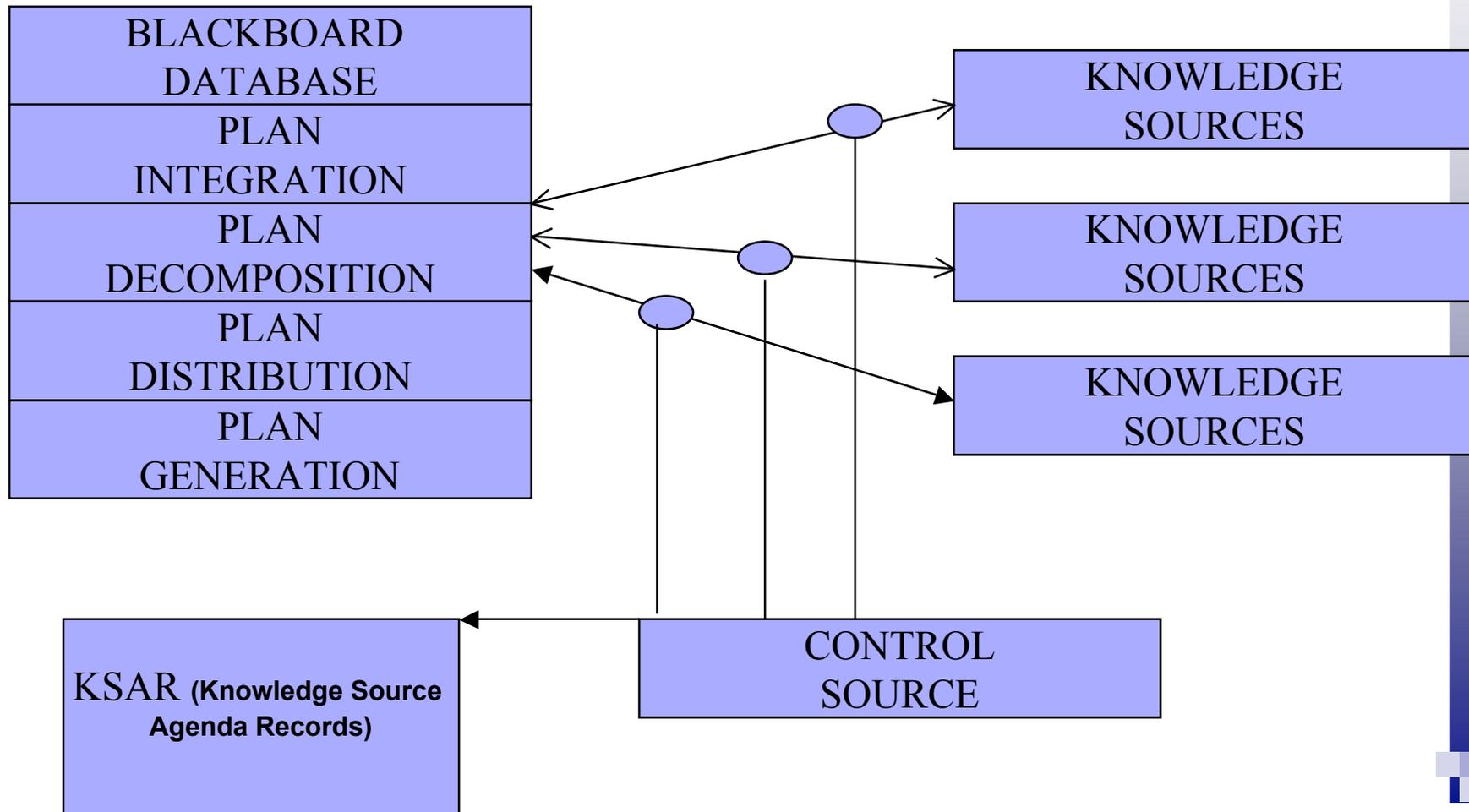
THE MAIN ELEMENTS OF CE MANAGEMENT

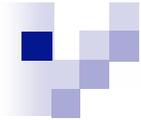
- **COLLABORATION**
- **COMMUNICATION**
- **COORDINATION**
- **CONTROL**

INFORMATION AND KNOWLEDGE

DEPENDENT SYSTEM

BLACKBOARD DATABASE CONTROL STRUCTURE



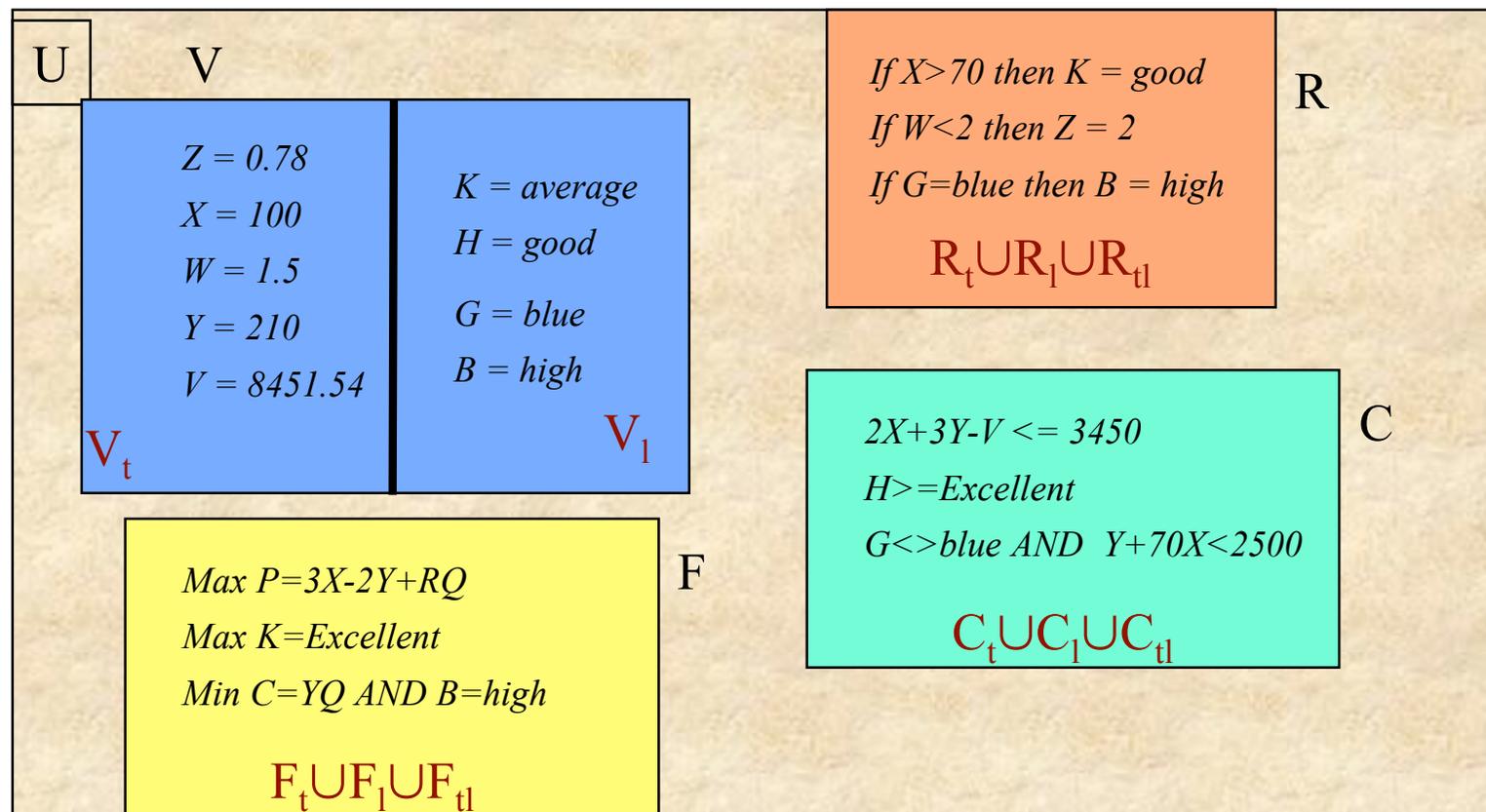


Knowledge and Experience

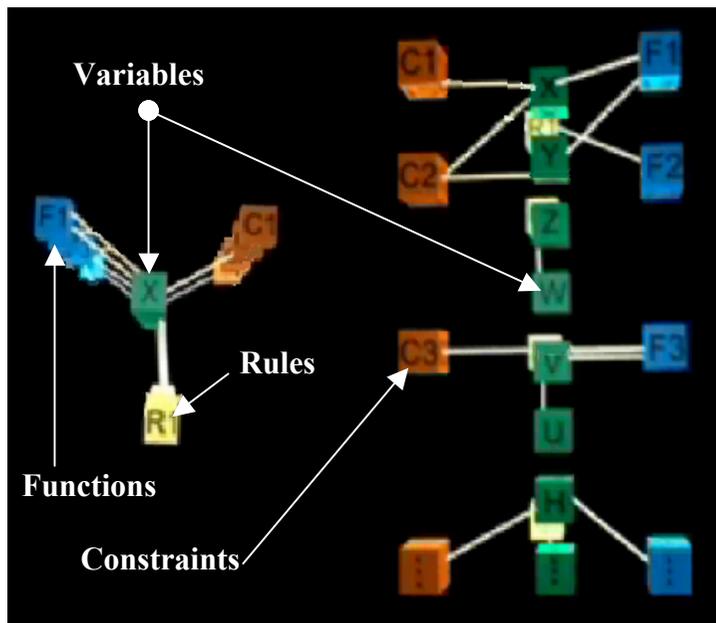
- Knowledge is “the fact or condition of knowing something with familiarity gained through **experience or association**” (Merriam-Webster Dict. 2004).

Formal Decision Events

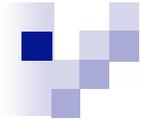
The four components are **variables**, **functions**, **constraints**, and **rules**, and constitute the basis for the knowledge structure.



Set of Experience - SOE



SOE comprises a series of mathematical concepts (a **logical component**), together with a set of rules (a **ruled based component**), and built upon a specific event of decision-making (a **frame component**).

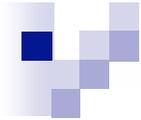


Applicable and Usable SOE

A Shareable Set of Experience

Set of experience knowledge structure is able to be implemented in XML.

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<!-- Set of Experience Knowledge Structure -->
-<set_of_experience xmlns: xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="set of experience
model.xsd">
  <date>2004-11-11</date>
  <hour>14:10:00</hour>
  <creation>
    <application> Excel </application>
    <application> System </application>
    <filename> payroll.xls </filename>
    <filename> payroll.ces </filename>
    <comment> Example of set of experience </comment>
    <comment> Company Expert System </comment>
  </creation>
  <category>
    <!-- Category encloses this set of experience into a determined chromosome of the company -->
    <area>Human Resources</area>
    <subarea>Salary Office</subarea>
    <subject>Payment Level</subject>
    <subject>Worker's Morale</subject>
  </category>
```



Extending SOE as a KR

Extending SOE as a KR

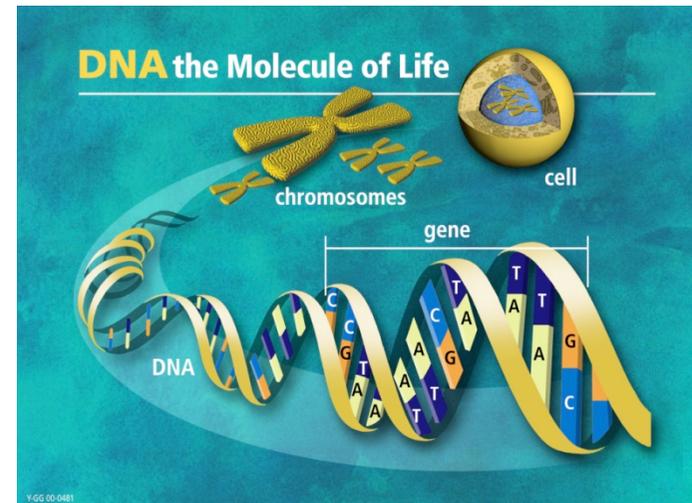
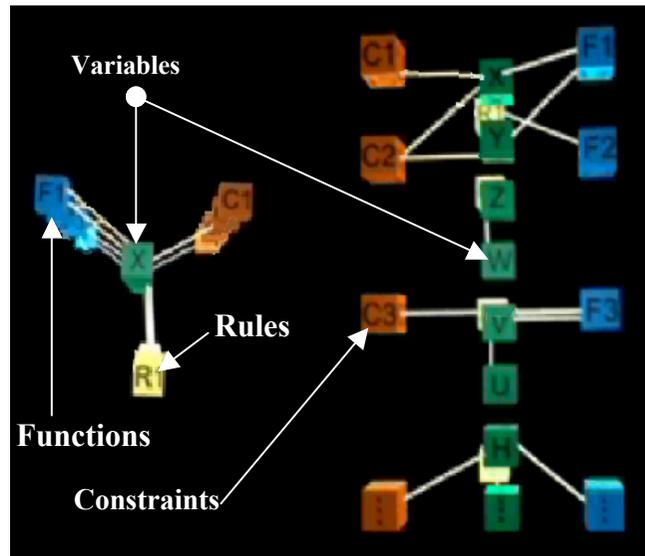
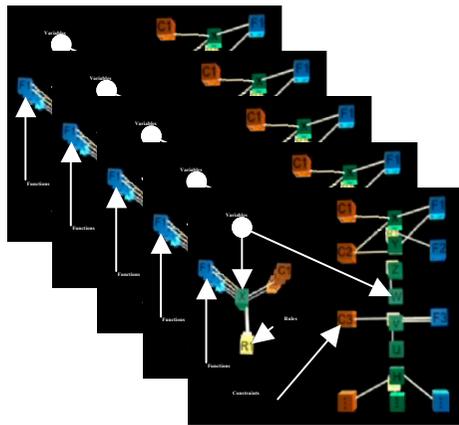


Image credit U.S. Department of Energy Human Genome Program (<http://www.ornl.gov/hgmis>).

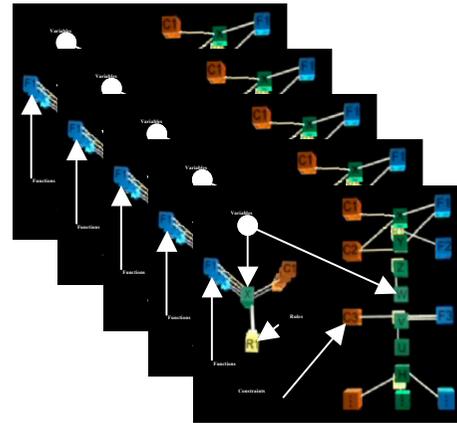
- ✓ Each SOE provides a value
- ✓ Categorized according to type of decision

- ✓ Gene provides a Phenotype
- ✓ Categorized → Chromosomes

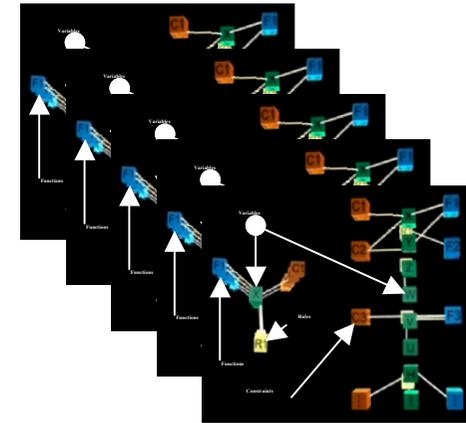
Extending SOE as a KR



AREA 1 (marketing)



AREA 2 (finances)



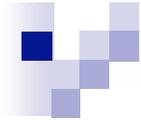
AREA 3 (design)

- Groups of SOE by area are:

Decisional Chromosomes

- Groups of chromosomes are =

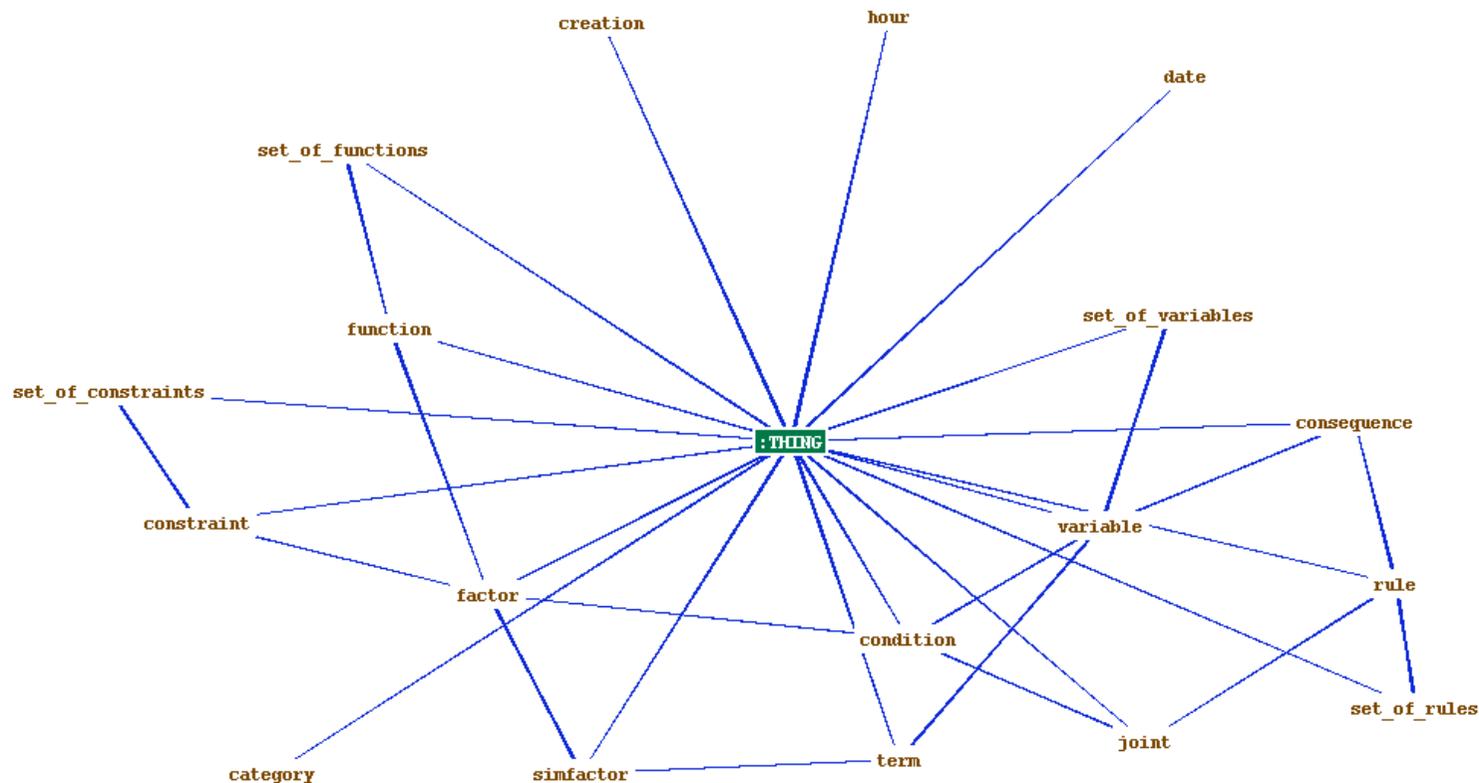
DECISIONAL DNA



Decisional DNA Ontology- based

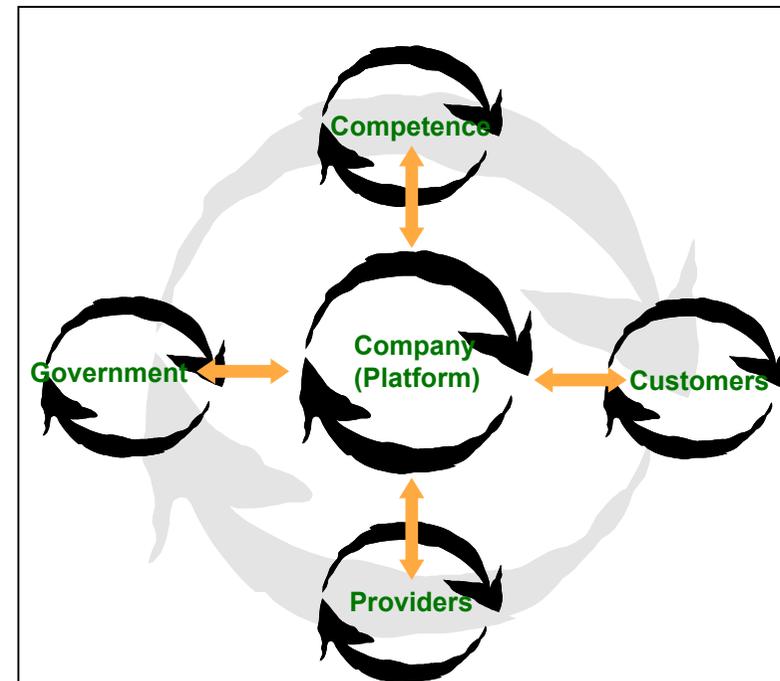
Modeling Set of Experience Ontology-based

Relationships among the different classes of the Ontology can be seen using a plug-in for Ontology visualization.

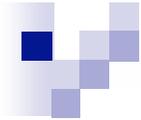


Growing System

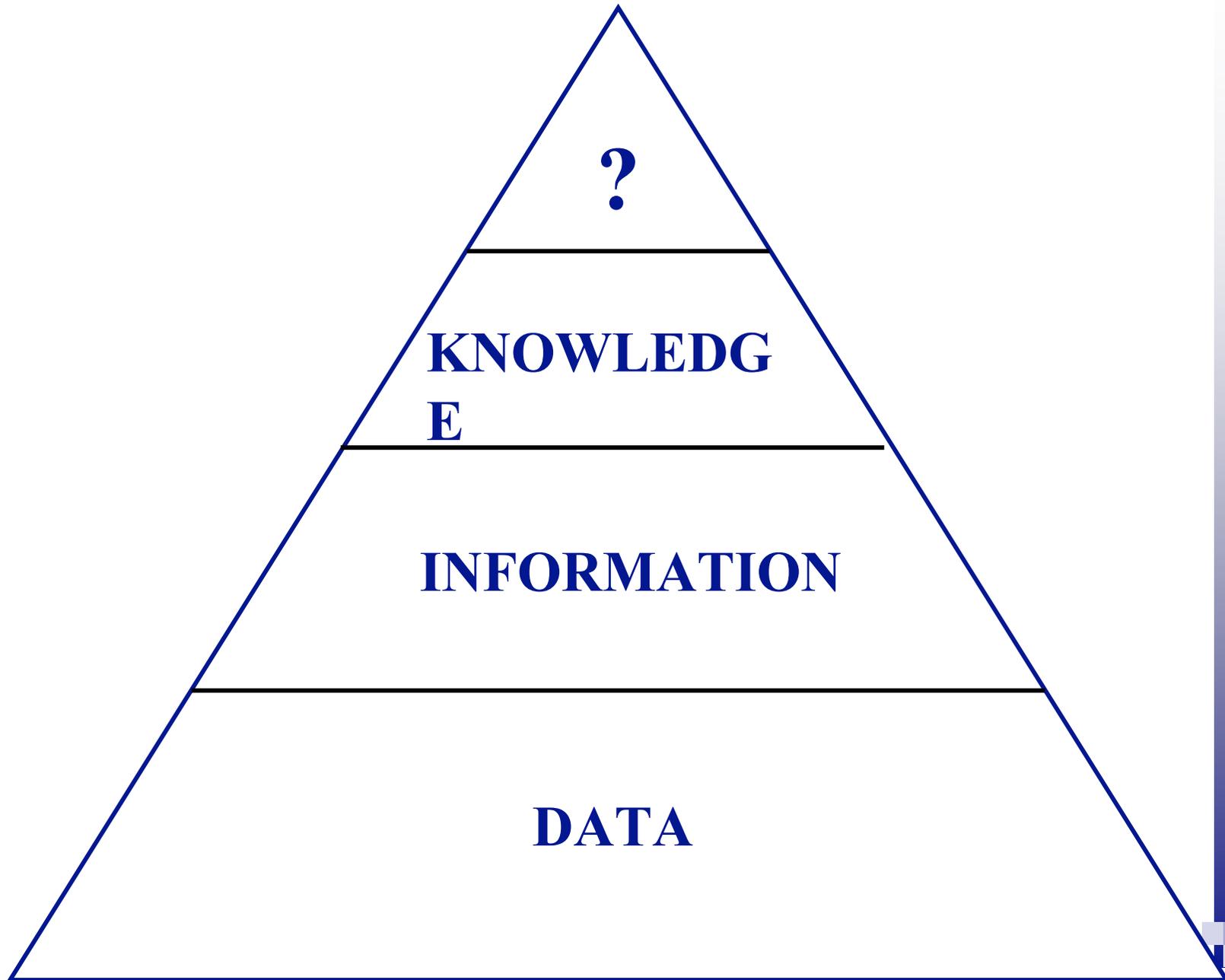
- Decisional DNA is shared in this system
- It is Community of Practice distributing knowledge
- Development based on ontology web technology



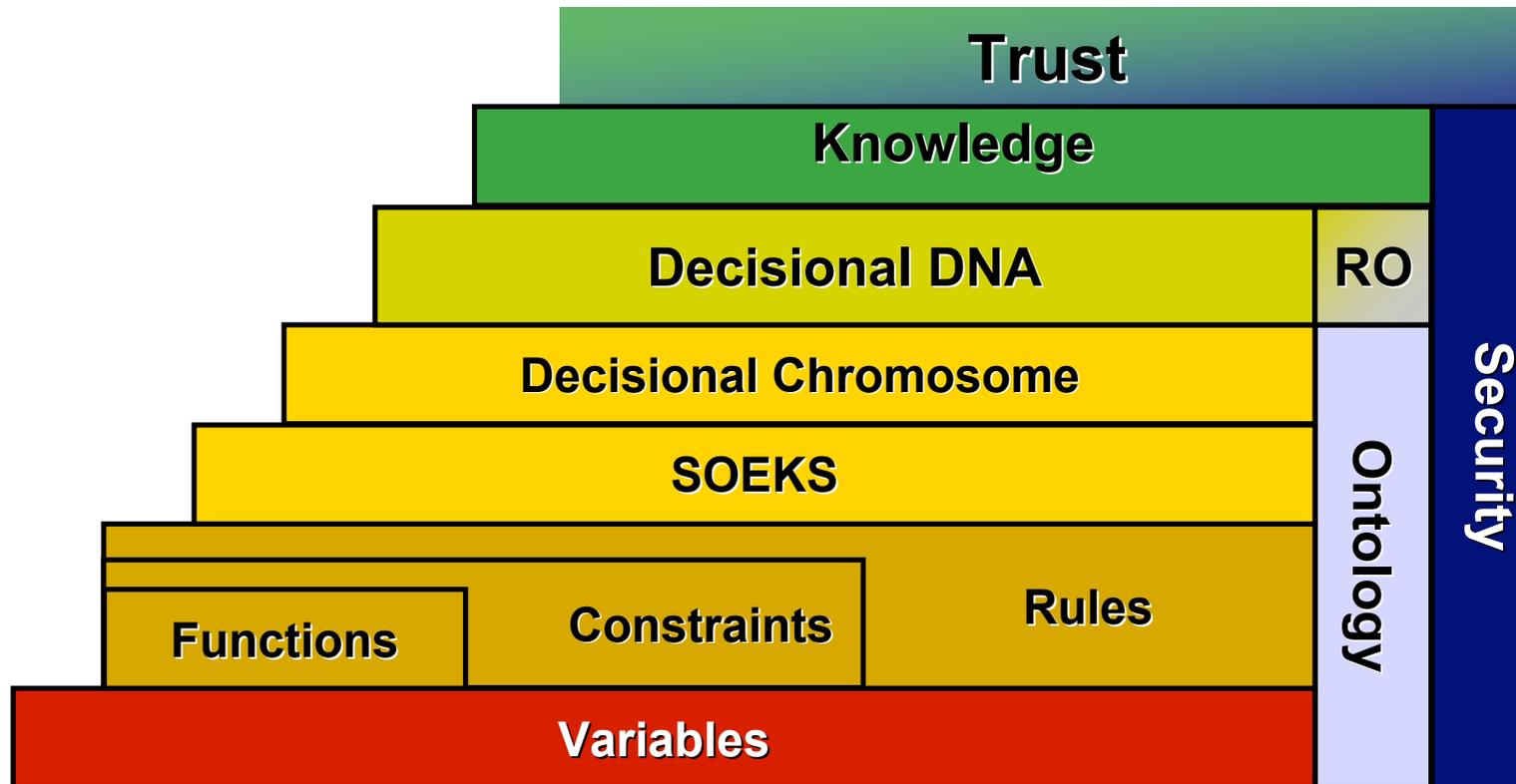
e-Decisional Community

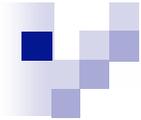


Where to from here?



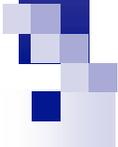
Decisional Trust





APPLICATIONS

- steel processing
- manufacturing
- hospital operation
- mining
- preventive maintenance
- green energy knowledge base
- banking sector
- virtual communities



THANK YOU

San Sebastian, May 2009