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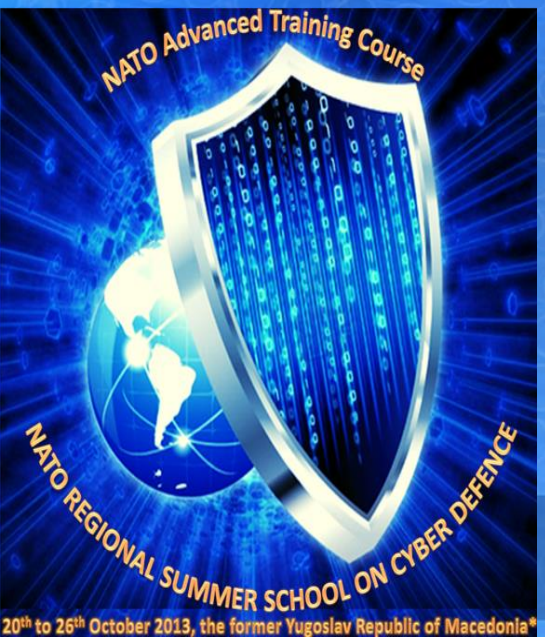
Cyber Risks & Threats. State of the art & future trends

A Comprehensive Methodological Overview with Examples



Assoc. Prof. Dr. Zlatogor Minchev
IICT

Contents

- Nowadays Cyberworld
- Cyberthreats & Risks Identification
- Context Generation
- Extracted knowledge analysis
- Psychophysiological Validation
- Some Implementation Examples
- Discussion

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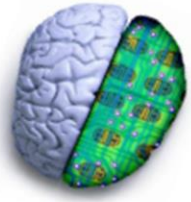
NOWADAYS CYBERWORLD













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Technological Challenges

2000

Web 1.0

Web 2.0

Web 5.0

Web 3.0

2050

Web 4.0

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Cyberthreats & Risks Identification

Human-Machine Interaction

Methodological Analysis Framework

- ❑ Context Generation
- ❑ Analysis
- ❑ Validation

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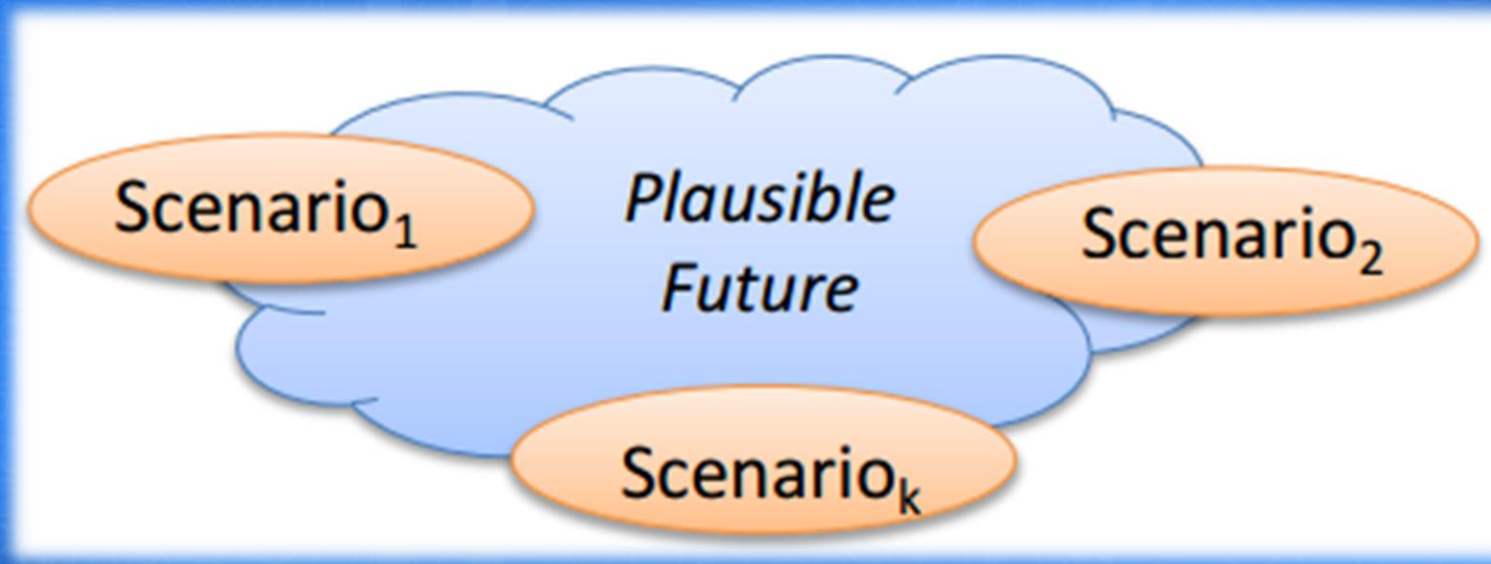
Context Generation



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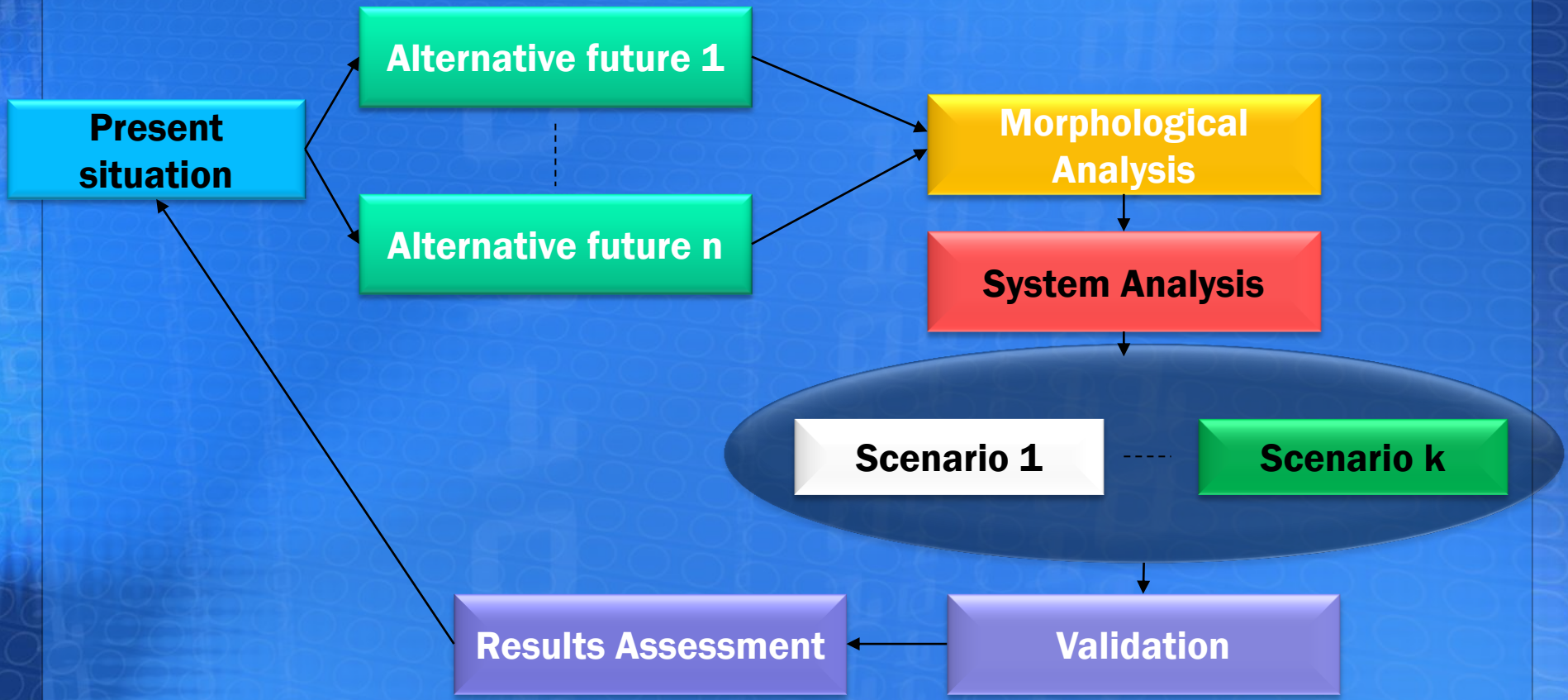
The Scenario Generation Process



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EXPERTS' KNOWLEDGE EXTRACTION

- BRAINSTORMING
- DISCUSSIONS
- DELPHI METHOD BASED ON QUESTIONNAIRES

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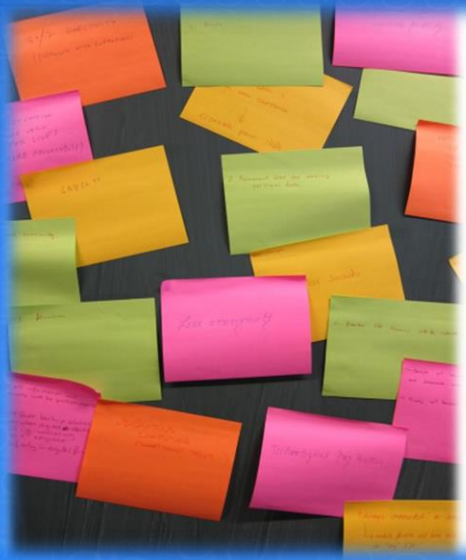
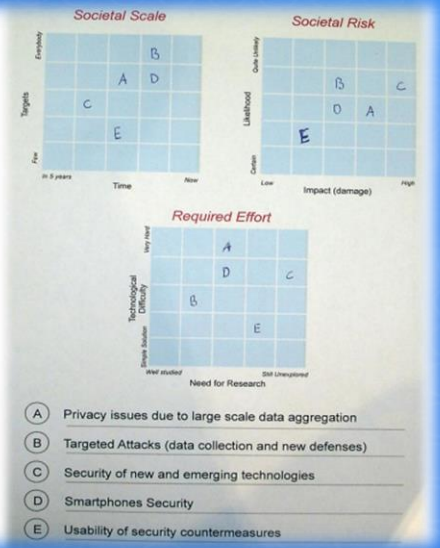
SOME DATA AGGREGATION EXAMPLES





Questionnaire

Smart Homes User Based Cyber Threats Evaluation
* Required

What kind of smart devices you are currently using in your everyday life? *

- [ ] Smart Phone
- [ ] Tablet
- [ ] Laptop/Ultrabook
- [ ] Smart TV
- [ ] Companion Robot
- [ ] Automated everyday life systems
- [ ] Gamming consoles
- [ ] Other:

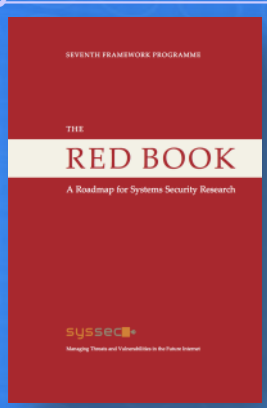
What usually do you do with smart devices in your everyday life?

- [ ] Entertainment
- [ ] Everyday work support
- [ ] Household support
- [ ] Communications/Contacting

Cyberthreats 2012

Threat source \ Dimension	Threats weight	R&D Role	Time & Users
Privacy information aspects in system security			
Targeted attacks			
Emerging Technologies			
Mobile devices security			
Usable security			

Cyberthreats 2013



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Key Problems

- Experts selection
- Proper understanding
- Noise reduction
- Human subjectiveness
- Software support necessity
- Validation Difficulties

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Threats Identification & Contextualization

- Proper threats identification is context dependable;
- Ranking is inevitable;
- Overlapping is difficult to surmount.

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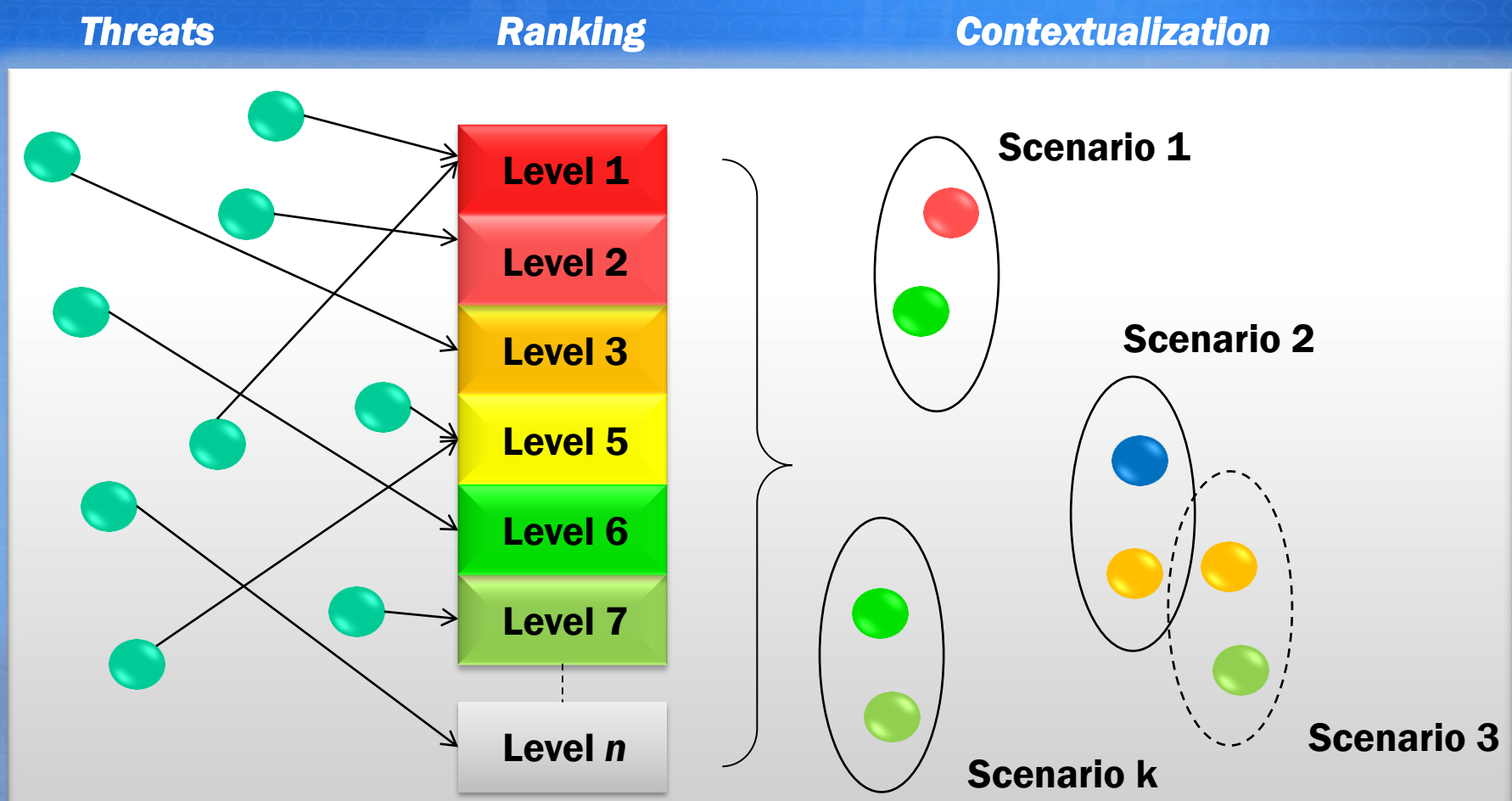
Ranking & Contextualization



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Extracted knowledge analysis

Techniques:

Morphological analysis;

System analysis;

Working environment:

MS Office/OpenOffice;

Intelligent Scenario Computer Interface Program (I-SCIP).

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MORPHOLOGICAL ANALYSIS

- COMPLETE TASK CONSIDERATION;
- WIDE USED FOR CLASSIFICATION TASKS;
- FAMILIAR TO THE SECURITY & SOCIAL SCIENCES.

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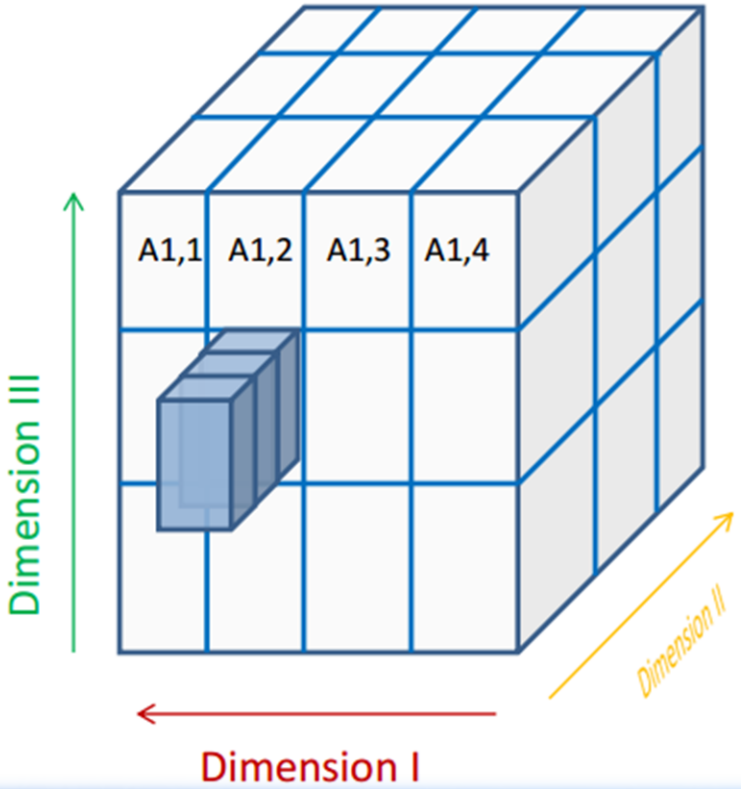
The Key Idea of Morphological Analysis

Dimensions

Alternatives	Dimension I	Dimension II	Dimension III
	A1,1	A2,1	A3,1
	A1,2	A2,2	A3,2
	A1,3	A2,3	A3,3
	A1,4		



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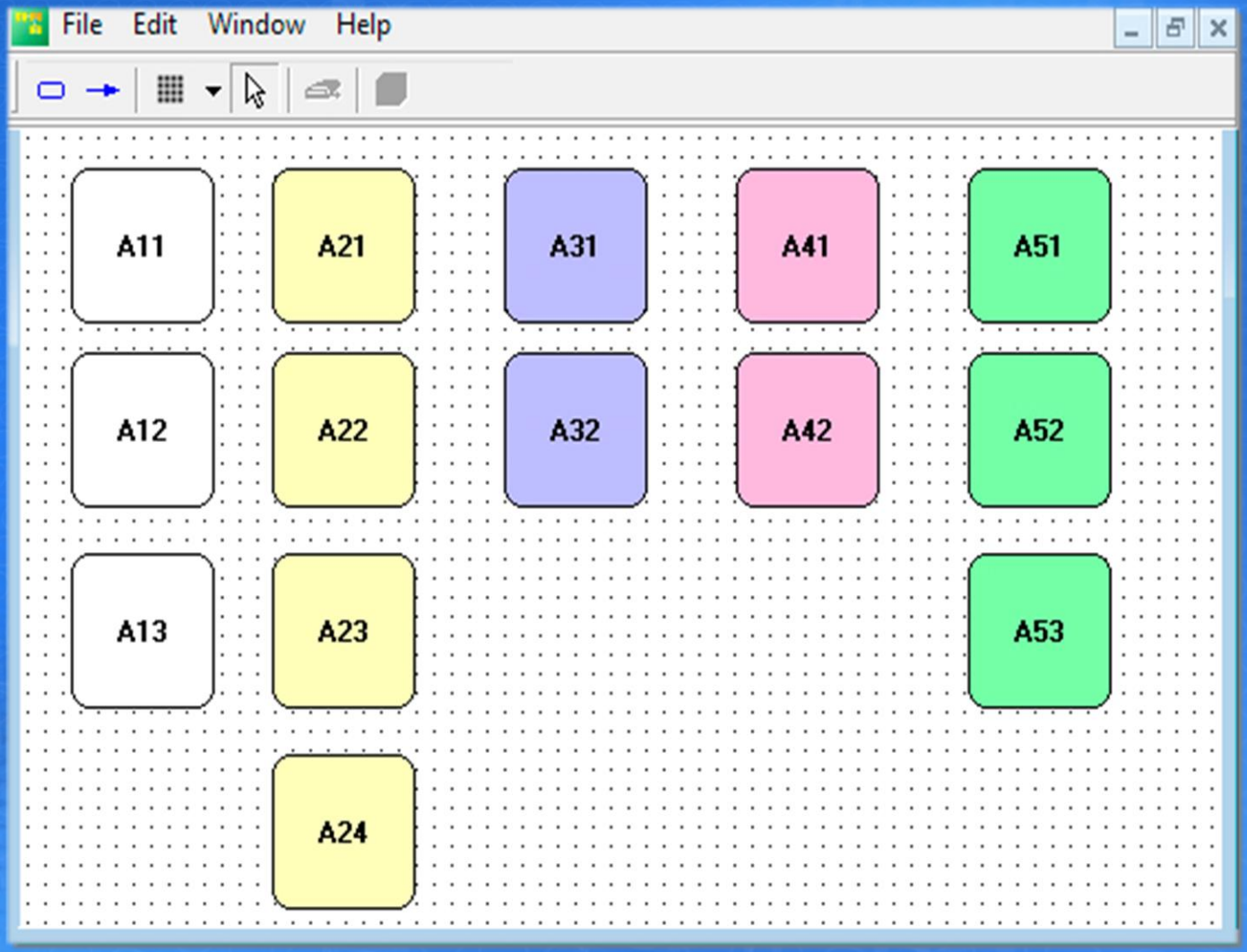
Step 1 Dimensions & alternatives definition



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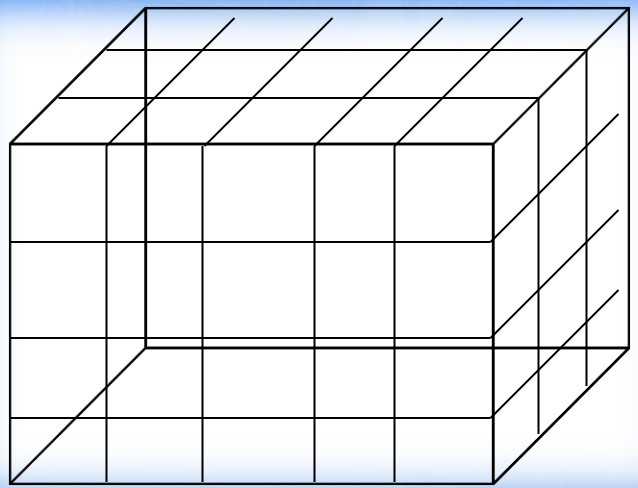
General problem volume

Possible combinations: 3 X 4 X 2 X 2 X 3 X 5 = 720



Driving factors are extremely necessary, otherwise you can not really optimize your resources!!!

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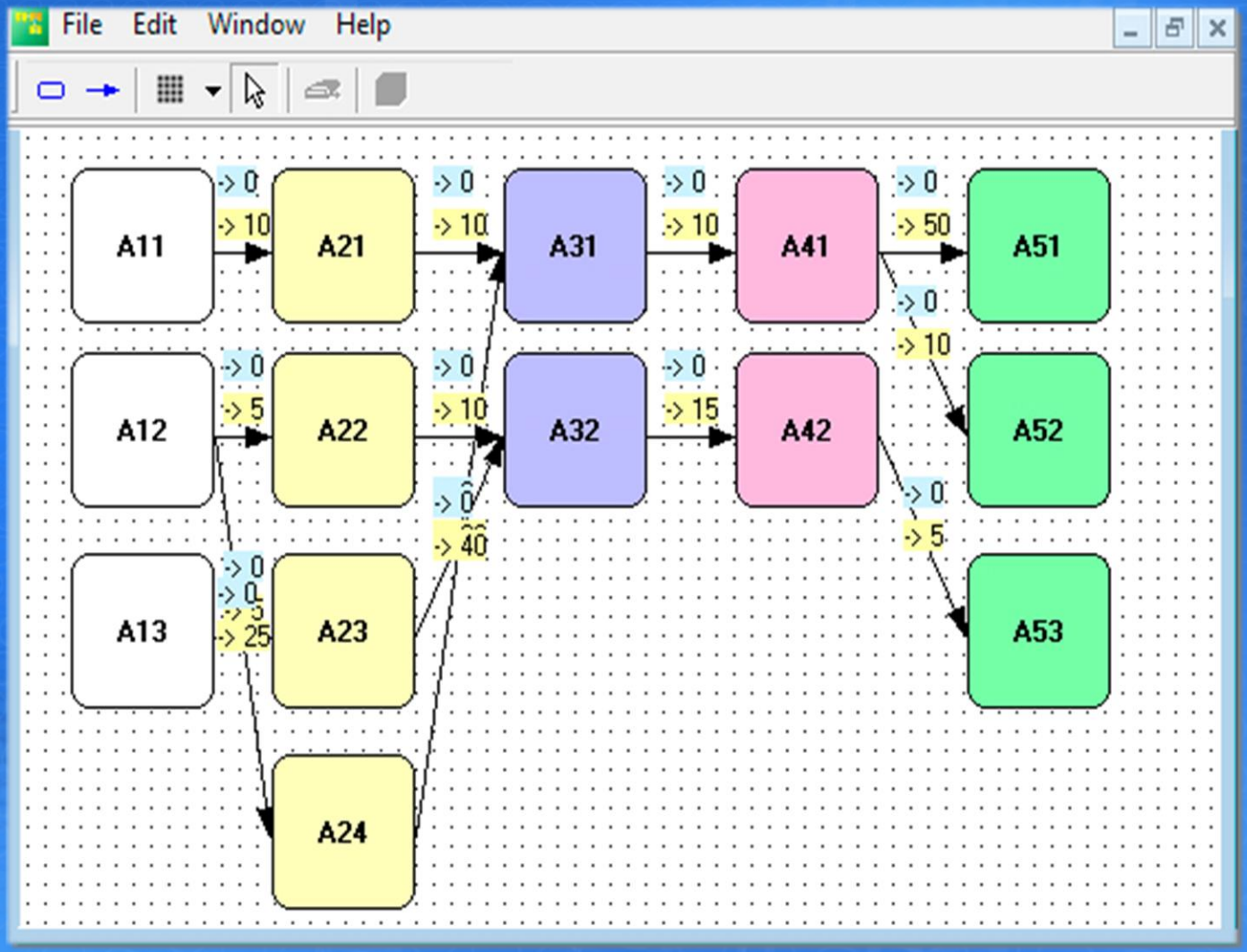
Step 2 Alternatives binding



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Cross-consistency matrix

I	II	III	IV	V
A11	A21	A31	A41	A51
A12	A22	A32	A42	A52
A13	A23			A53
	A24			

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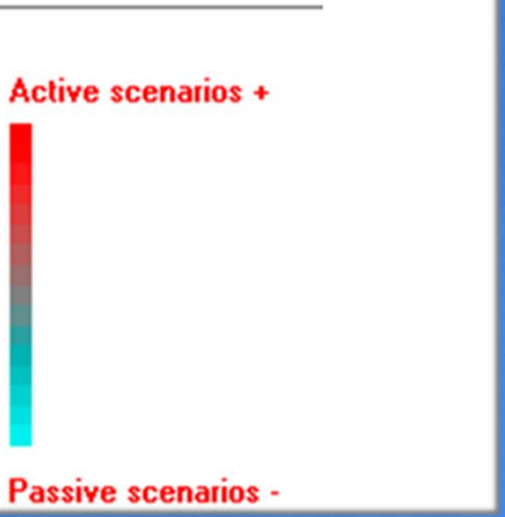
Step 3 Scenario building, ranging & naming

I	II	III	IV	V
A11	A21	A31	A41	A51
A12	A22	A32	A42	A52
A13	A23			A53
	A24			

Index	Length	Weight	Name
1	5	40	Scenario1
2	5	35	Scenario2
3	5	85	Scenario3
4	5	45	Scenario4
5	5	80	Scenario5
6	5	125	Scenario6



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SYSTEM ANALYSIS

- INTUITIVE ENTITY-RELATIONSHIP NOTATION;
- DETAILS' CONSIDERATION;
- FAMILIAR TO THE MILITARY & SCIENTIFIC WORLD.

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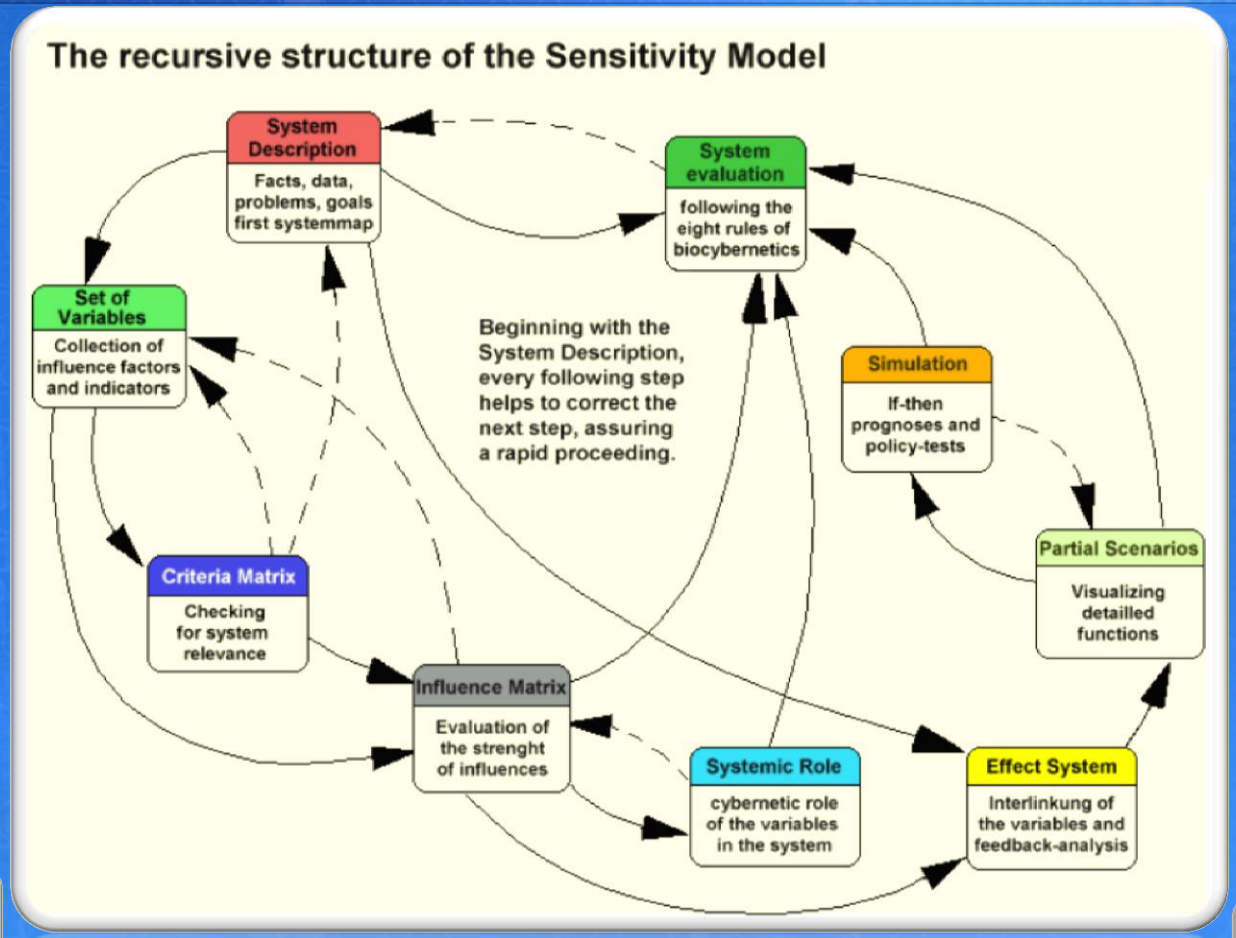
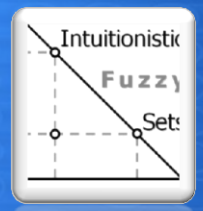
Implemented Ideas

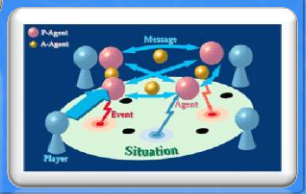




IFS decision support

General System Theory

Multiagent representation



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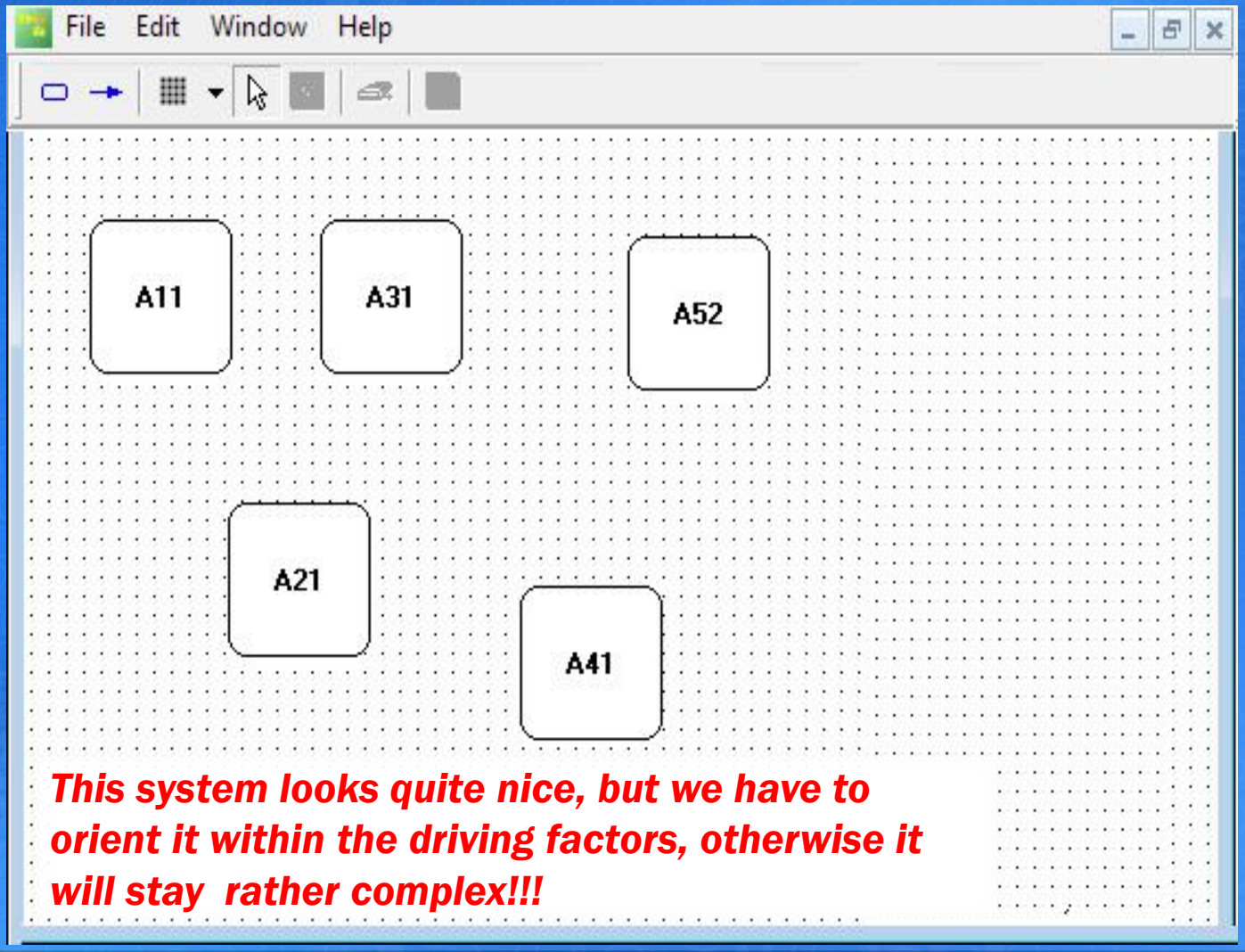
Step 1 Entities definition



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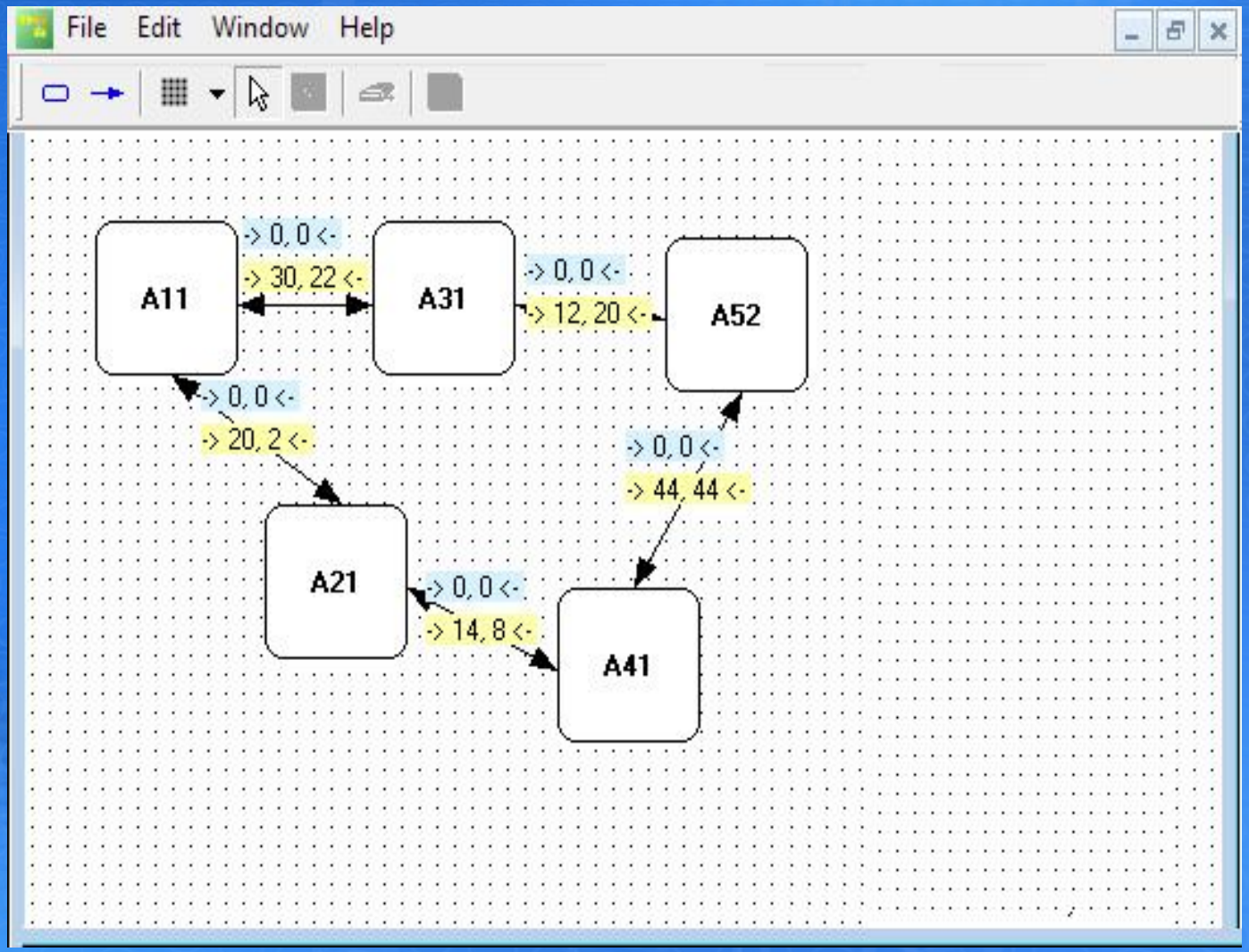
Step 2 Entities binding



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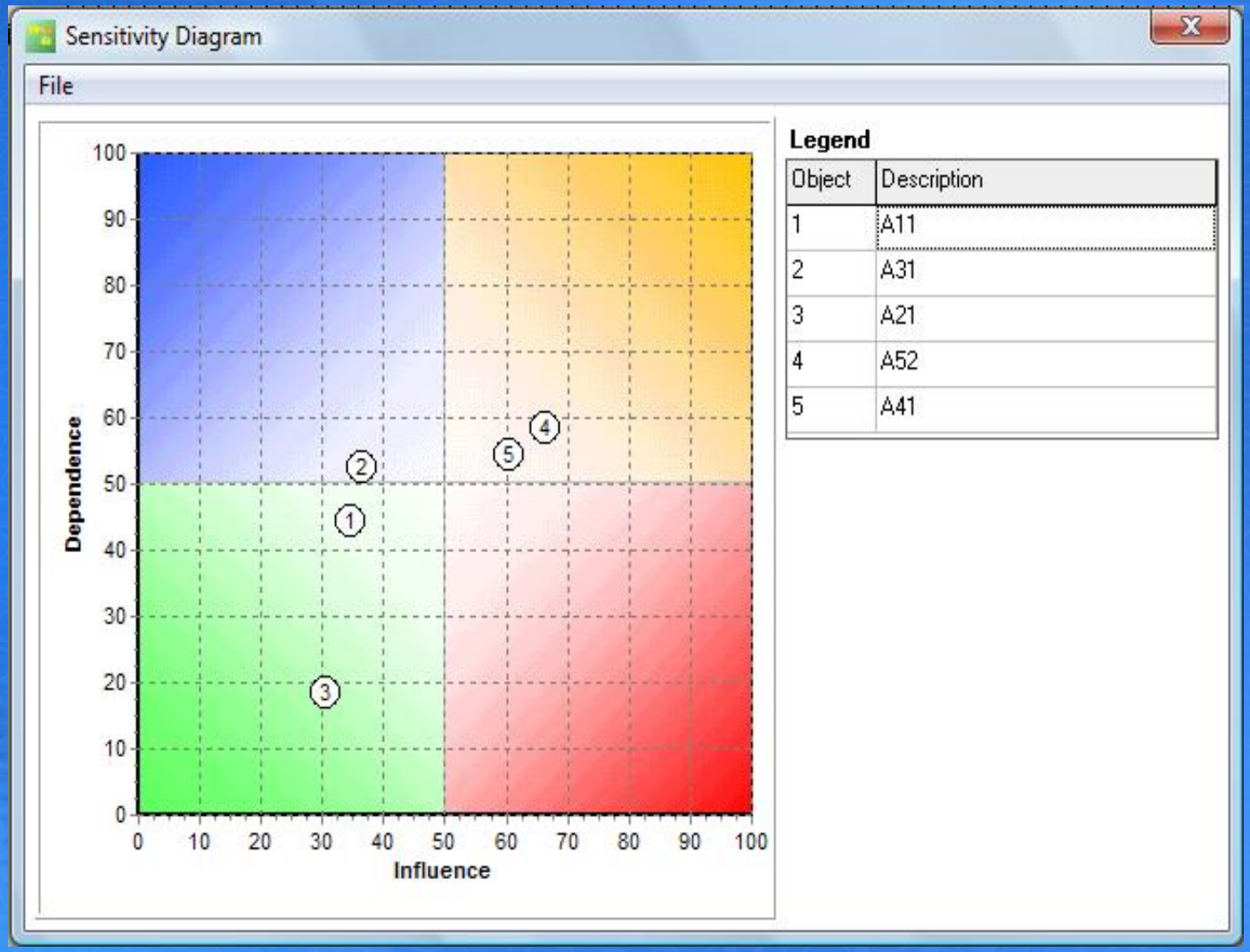
Step 3 Entities classification



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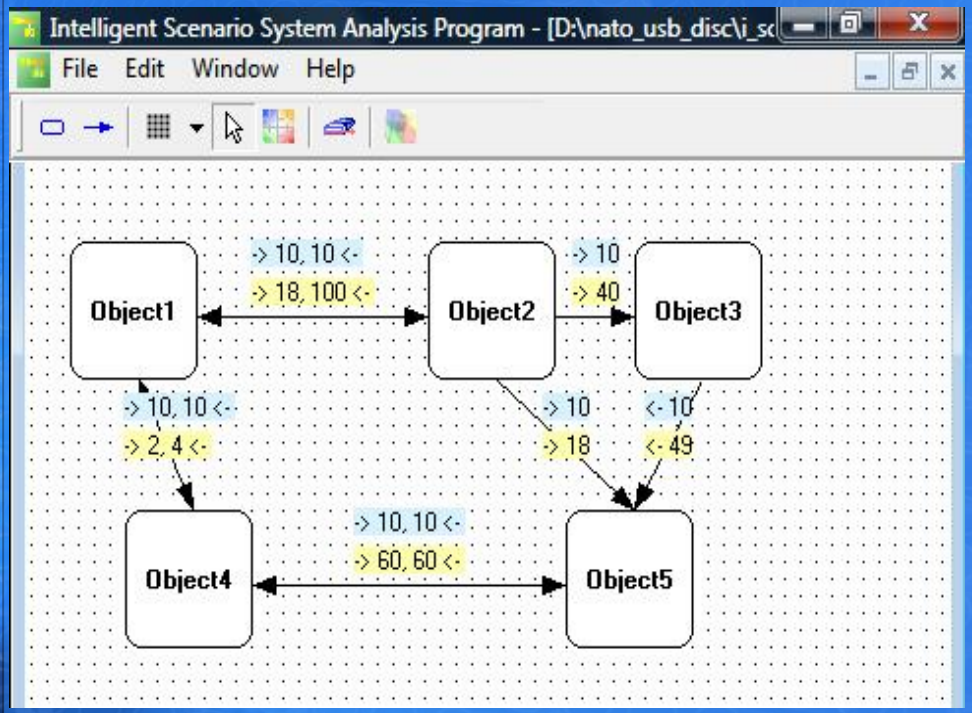
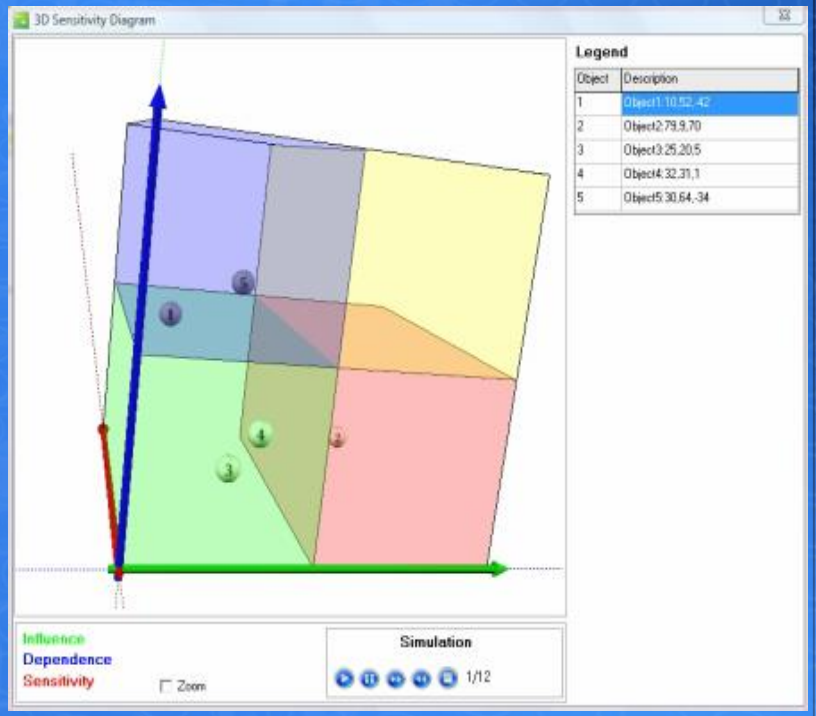
SENSITIVITY ANALYSIS IN 4D





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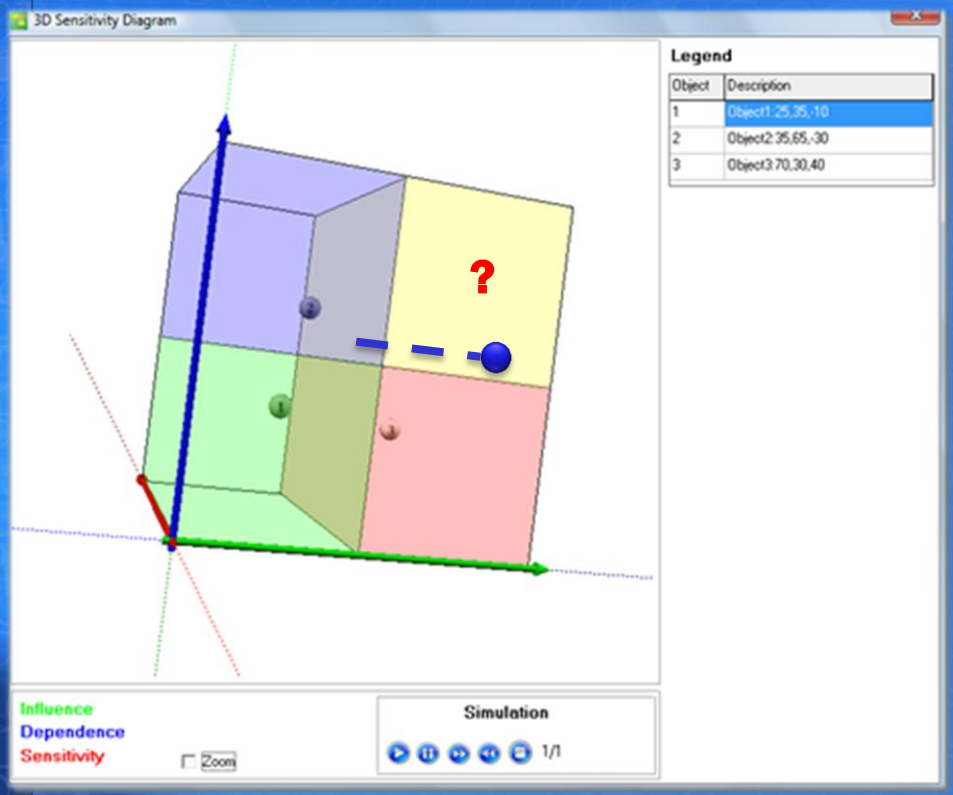
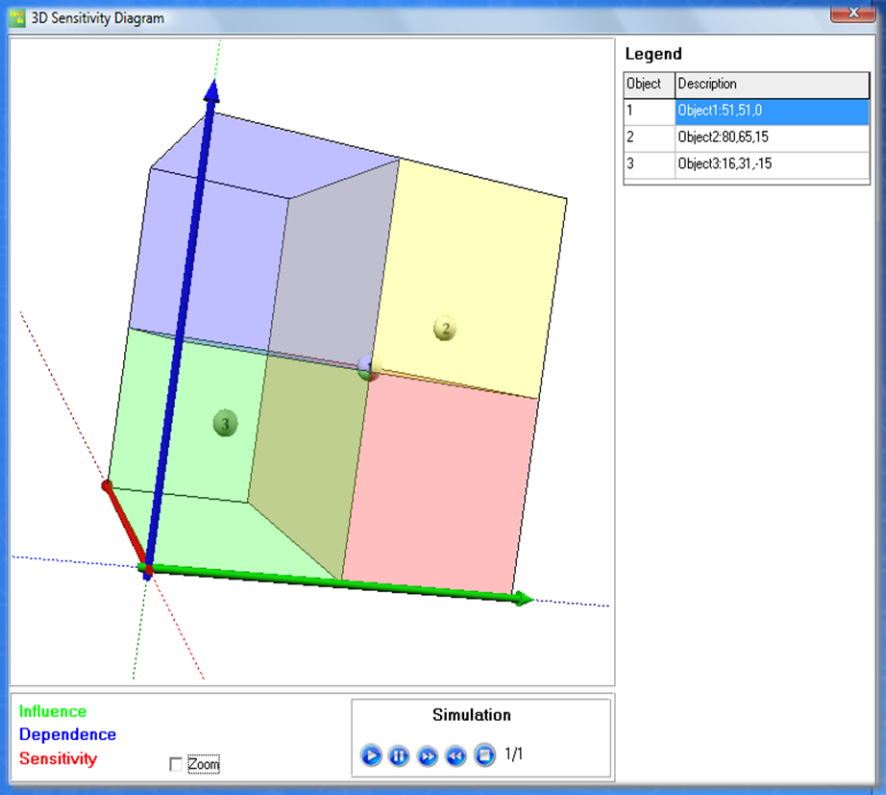
But can we change the experts' believes with I-SCIP SD?



Initial Configuration



New Configuration after Q optimization

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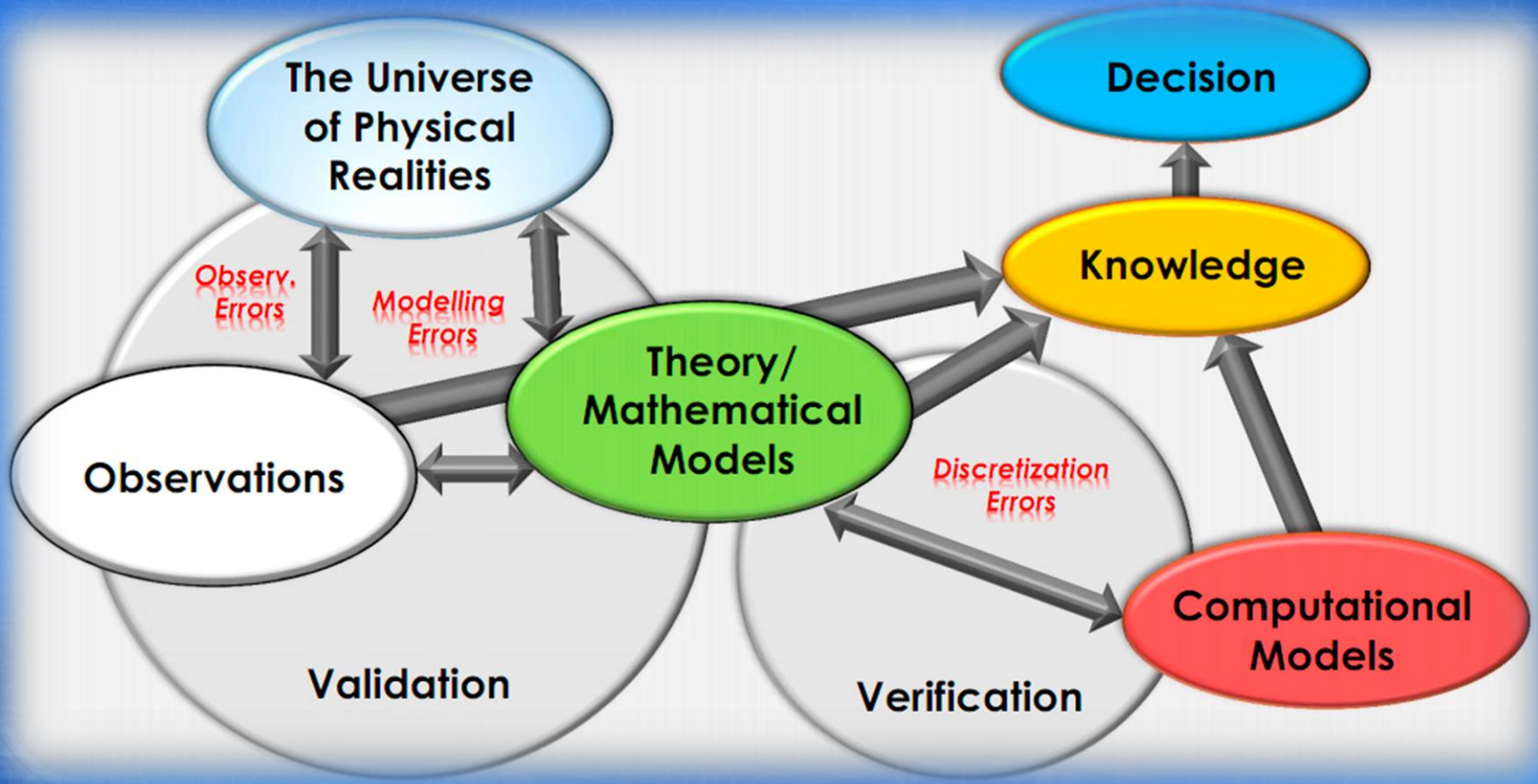
And how certain we are?



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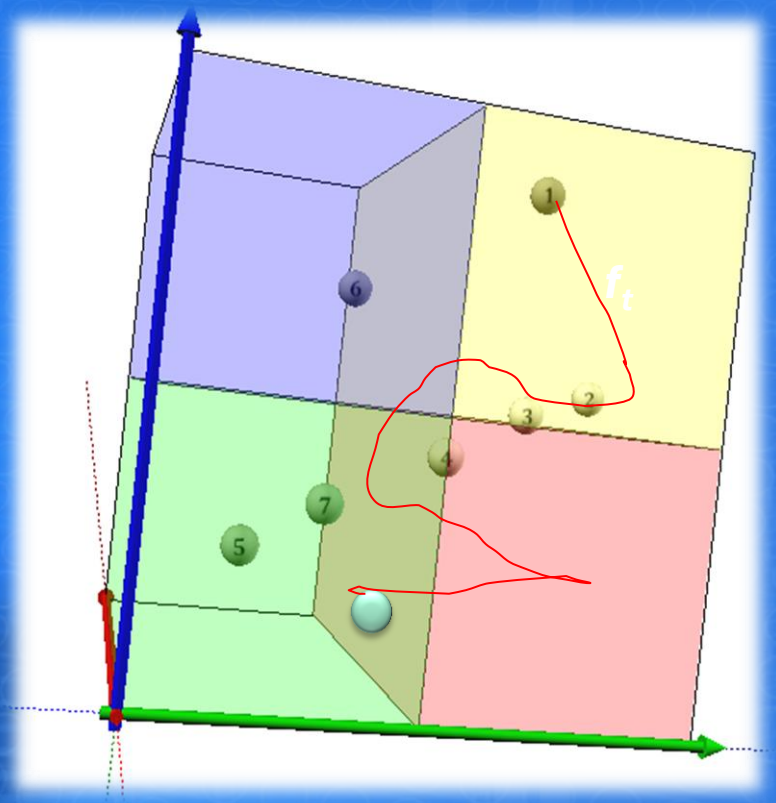
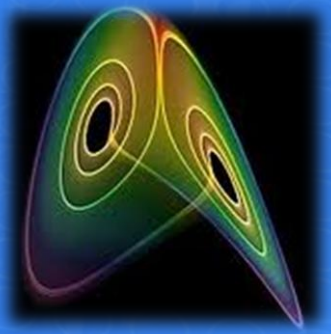
THE TRANSITION FUNCTION IMPORTANCE & UNCERTAINTY



Example: f_t ~ **Lorenz system**



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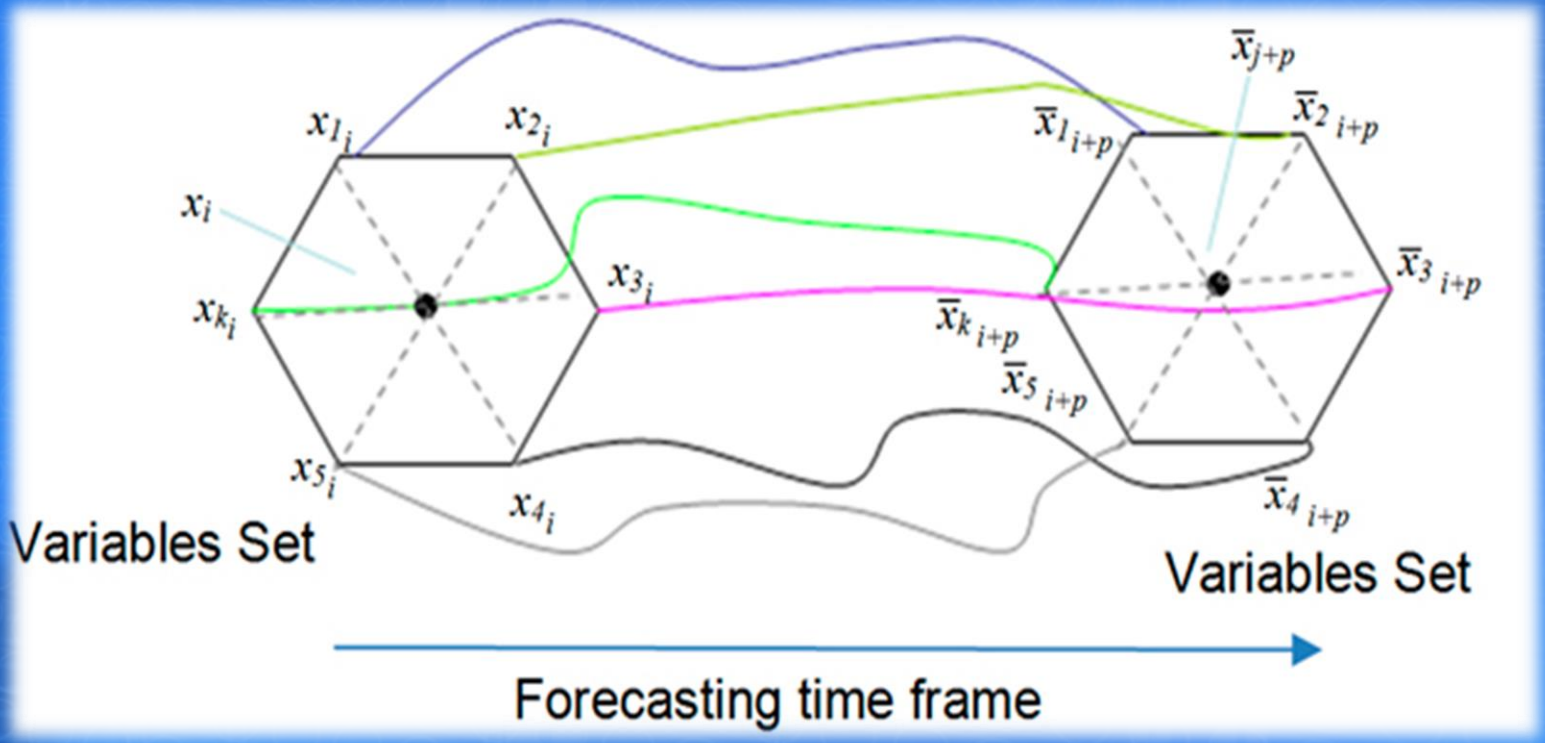
Mathematical Scenario Validation & Uncertainty Dynamics Monitoring



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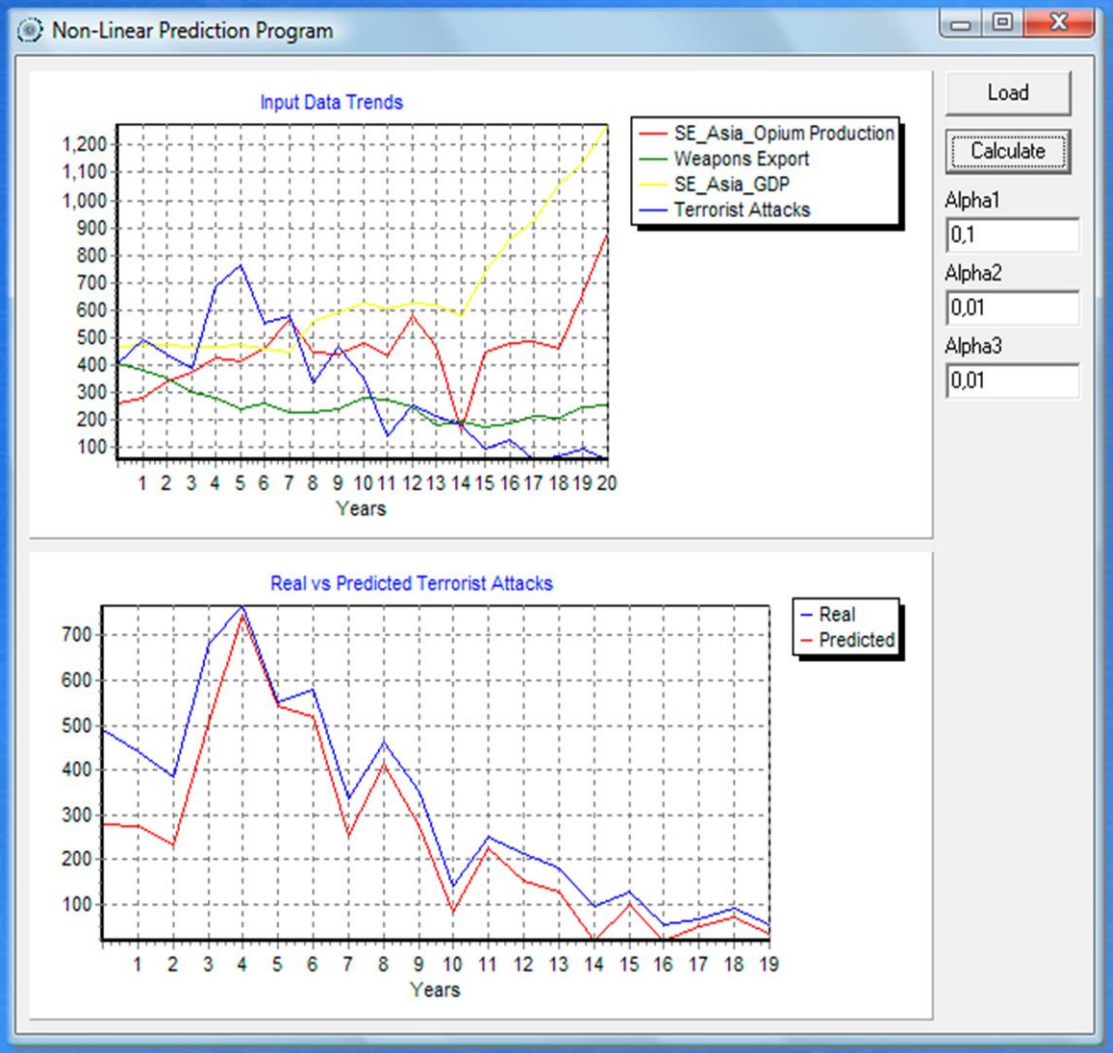
SOFTWARE SUPPORT



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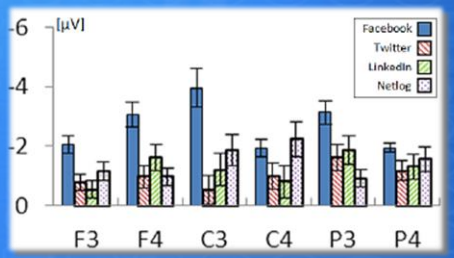
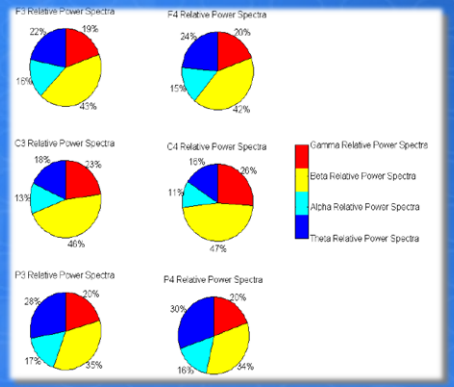
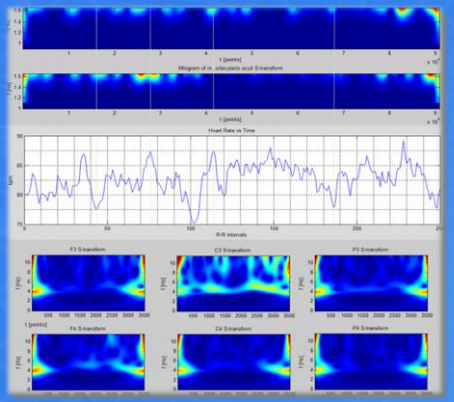
Psychophysiological Validation







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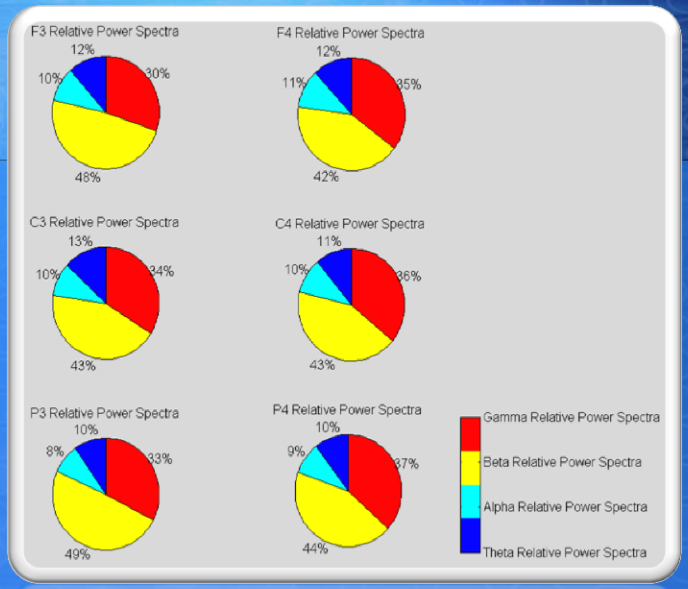
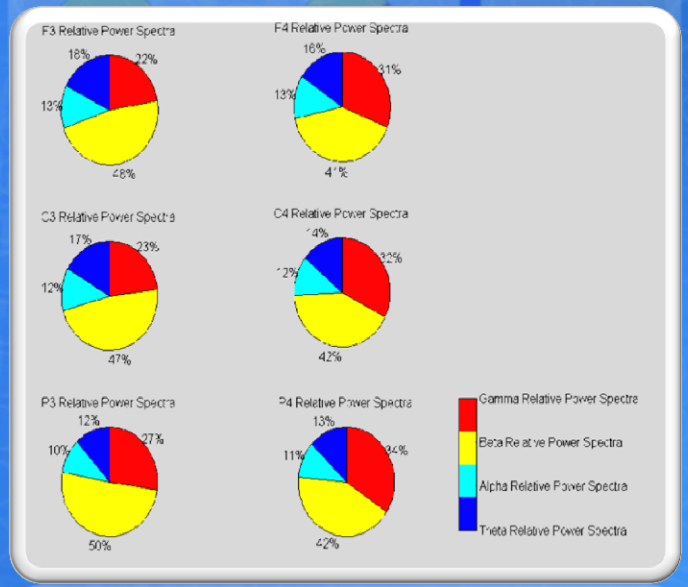
2D



3D



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Some Implementation Examples

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A Study on IT Threats and Users Behaviour Dynamics in Online Social Networks, DMU03/22, 2011-2014

www.snfactor.com

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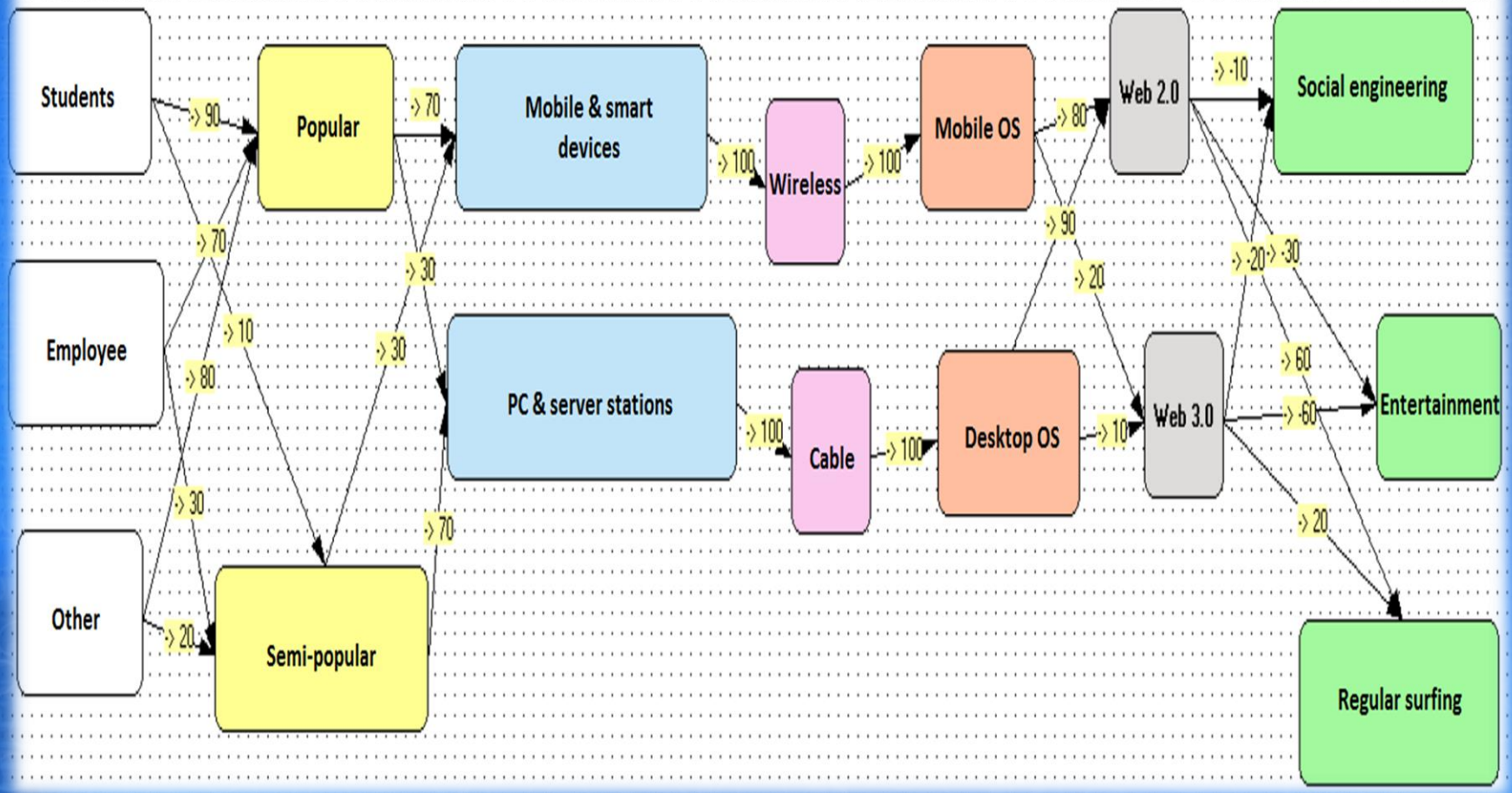
Social networks context MA

Maximum scenario combinations: 7 X 3 X 2 X 2 X 2 X 2 X 2 X 3 = 2016



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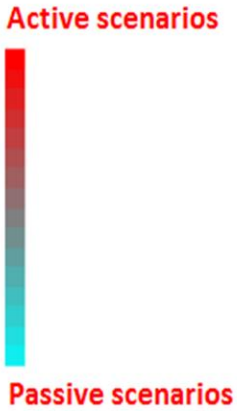
Resulting Scenarios

Morphlogical analysis

Users	*Social networks*	*Hardware technologies*	*Comms*	*Software platforms*	*Web standards*	*Activities*
Students	Popular	Mobile & smart devices	Wireless	Mobile OS	Web 2.0	Social Engineering
Emploee	Semi-popular	PC & server stations	Cable	Desktop OS	Web 3.0	Entertainment
Other						Regular surfing

Index	Length	Weight	Name
53	7	460	Scen.53
54	7	510	Scen. 54
55	7	490	Scen.55
56	7	470	Scen. 56
57	7	480	Scen.57
58	7	400	Scen.58
59	7	420	Scen. 59
60	7	410	Scen. 60



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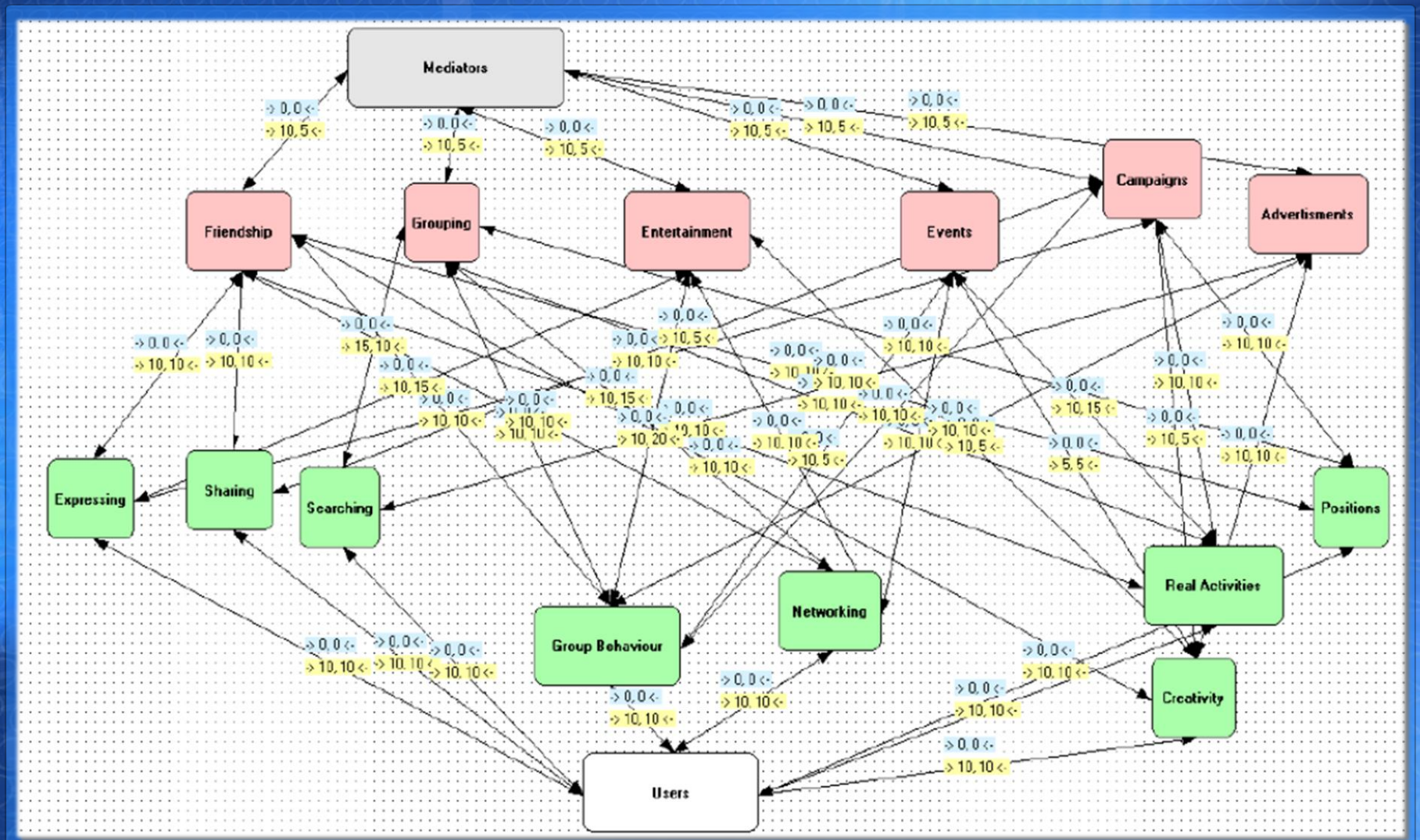
Social Engineering SA



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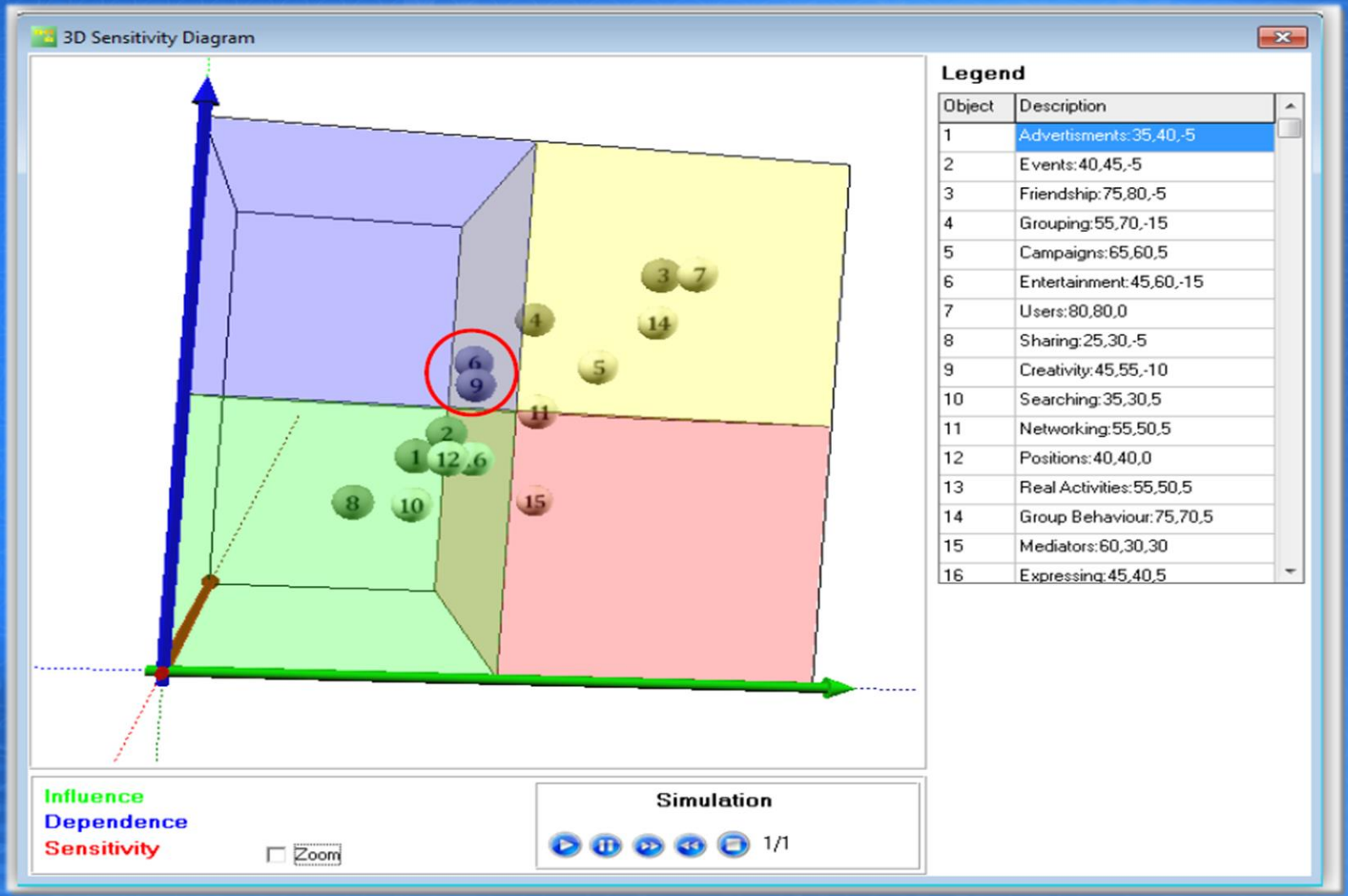
Sensitivity Diagram



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A Feasibility Study on Cyber Threats Identification and their Relationship with Users' Behavioural Dynamics in Future Smart Homes, DFNI-T01/4, 2012-2014

www.smarthomesbg.com

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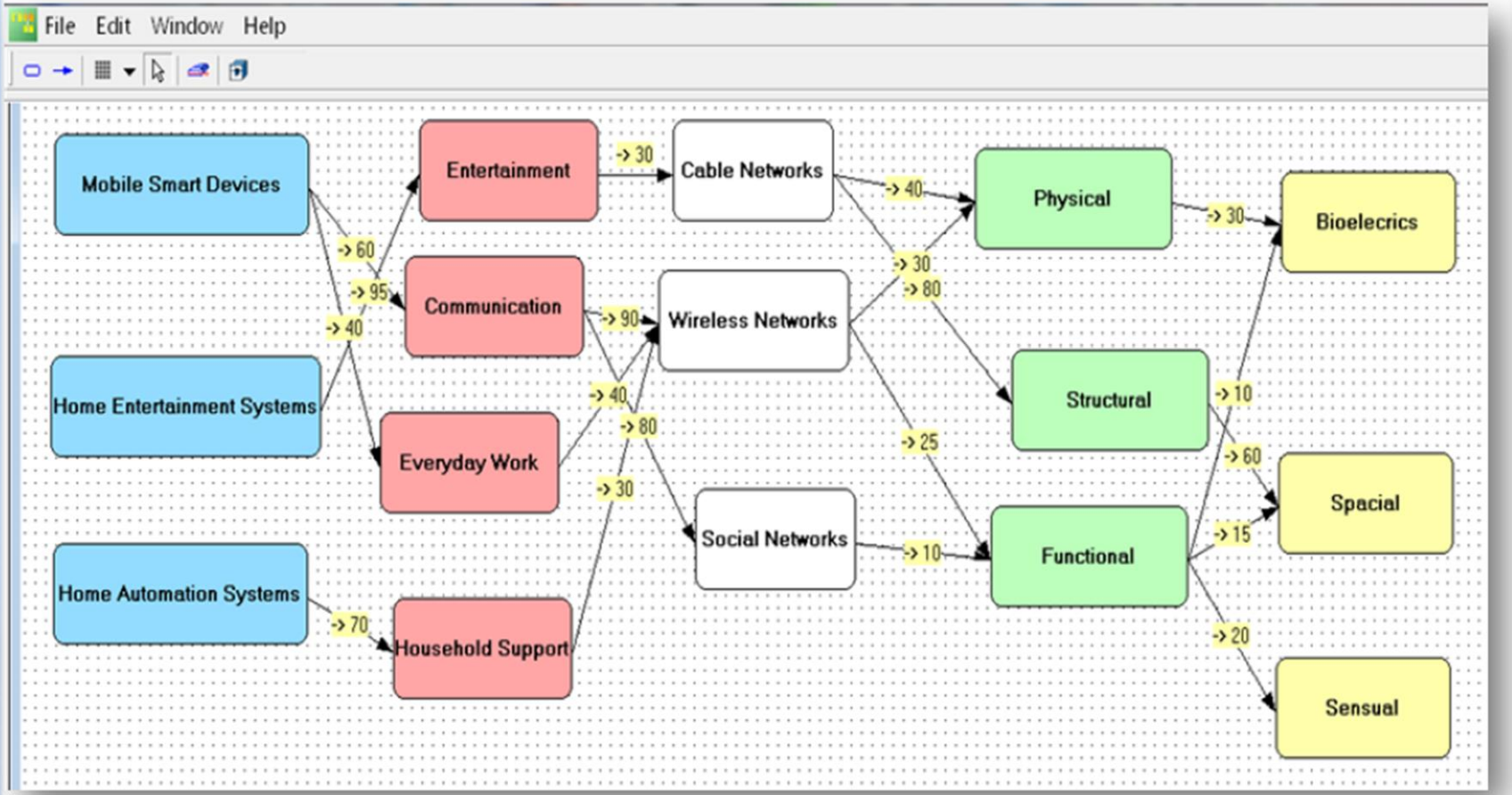
Smarthomes context MA

MAXIMUM SCENARIO COMBINATIONS: 5x3x4x3x3x3 = 1620



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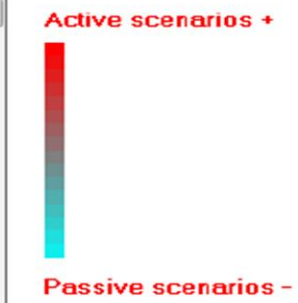
Resulting Scenarios

Selected Scenarios Set

Morphological Analysis

Devices	Activities	Communication Medium	Environment Characteristics	Human Factor Characteristics
Mobile Smart Devices	Entertainment	Cable Networks	Physical	Bioelectrics
Home Entertainment Systems	Communication	Wireless Networks	Structural	Spacial
Home Automation Systems	Everyday Work	Social Networks	Functional	Sensual
	Household Support			

Index	Length	Weight	Name
1	5	170	Scenario1
2	5	125	Scenario2
3	5	265	Scenario3
4	5	145	Scenario3
5	5	195	Scenario4
6	5	195	Scenario5
7	5	140	Scenario6
8	5	160	Scenario7
9	5	210	Scenario8
10	5	165	Scenario9
11	5	120	Scenario10
12	5	140	Scenario11



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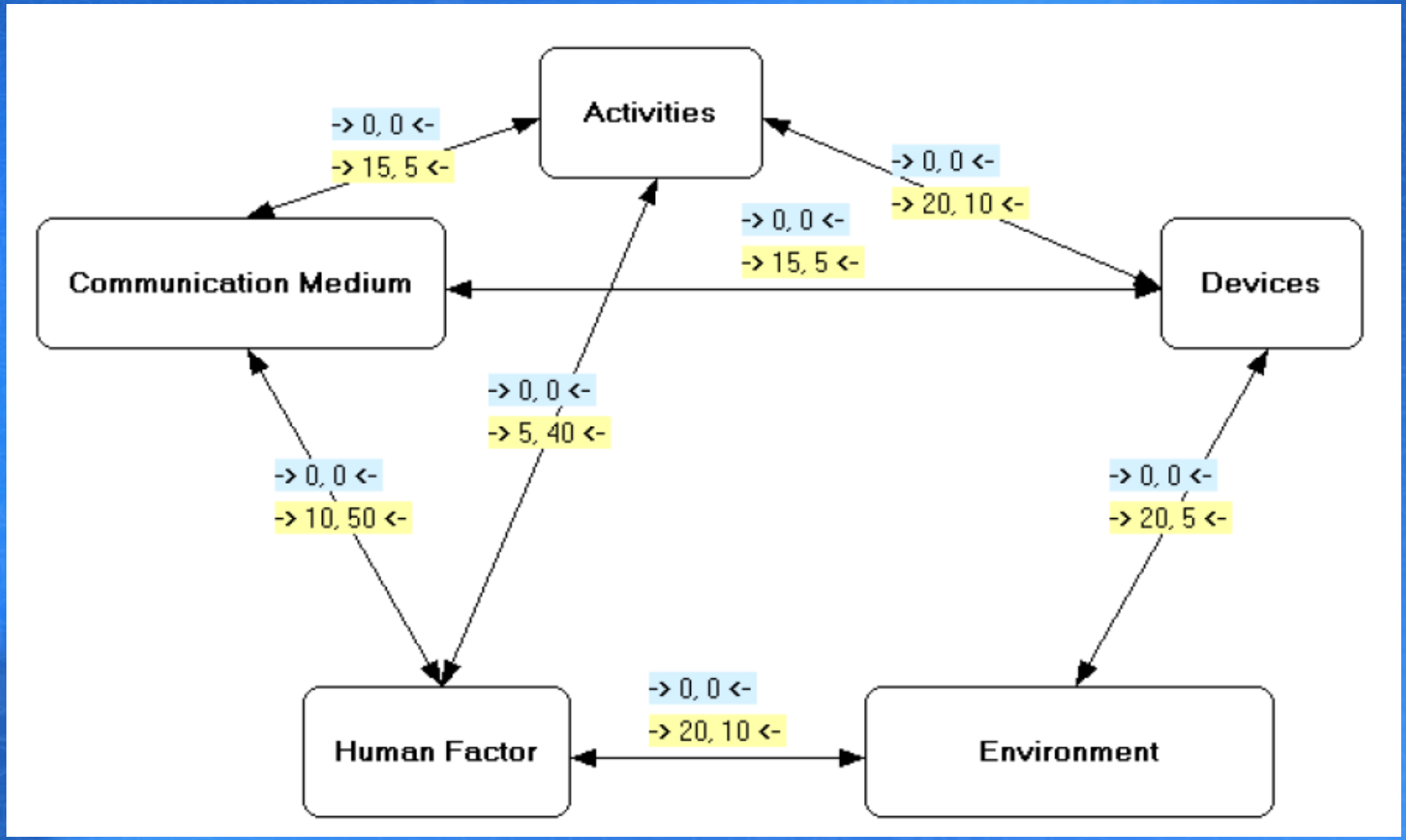
General SA



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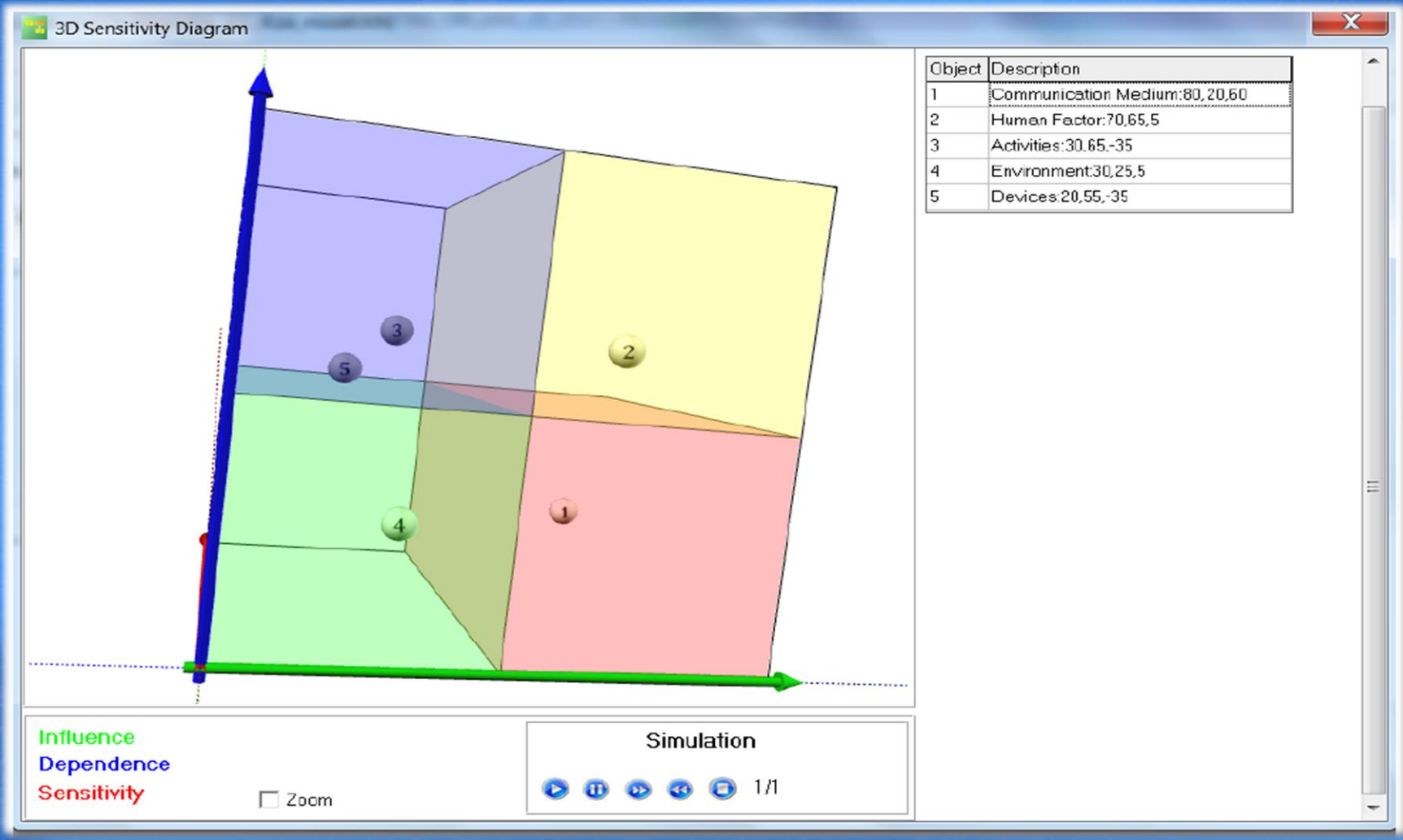
Sensitivity Diagram



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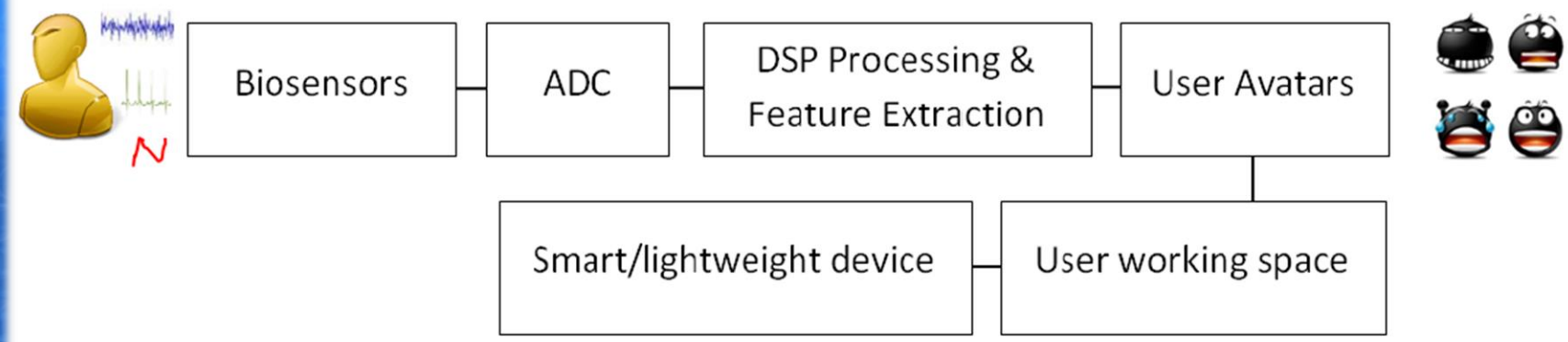
Biofeedback & Profiling



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Other Examples

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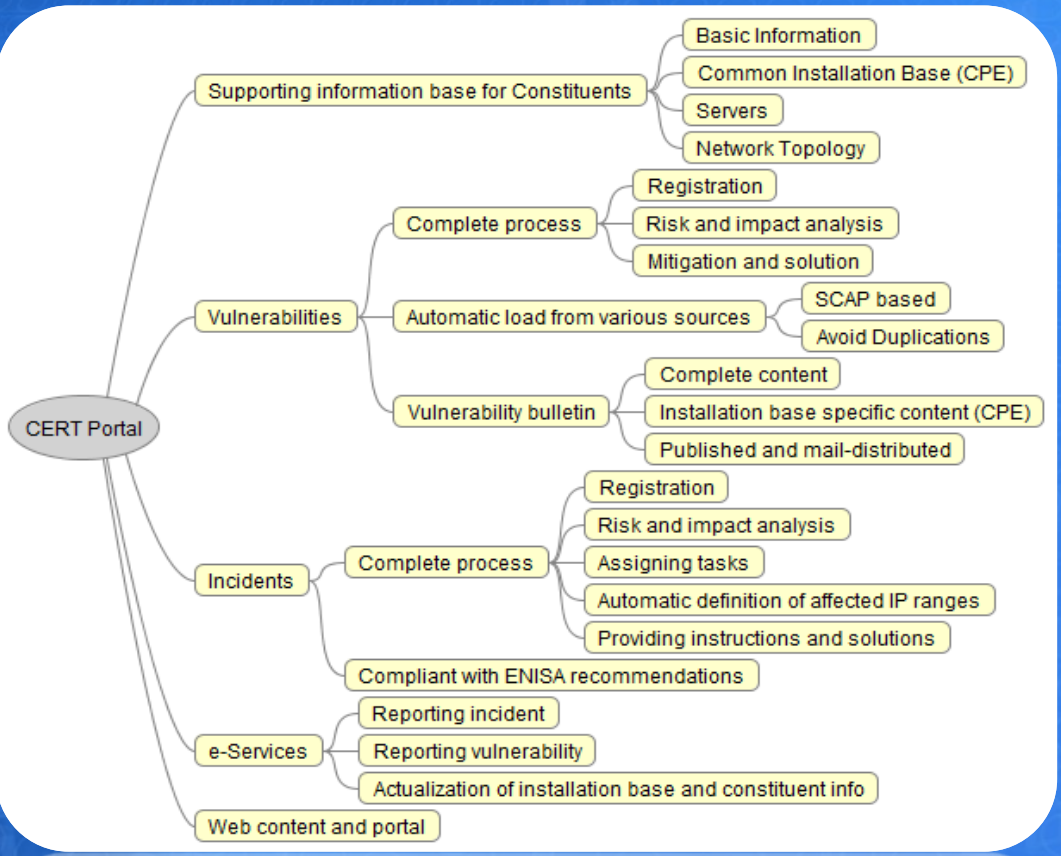
Bulgarian Cert Portal



www.govcert.bg

STEMO Computer Systems & Software

ESF Bulgaria
European Social Fund
Investing in people

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A European Network of Excellence in Managing Threats and Vulnerabilities for the Future Internet, SysSec, 2010-2014

- WP0: Management
- WP1: Dissemination
- WP2: Education
- WP3: Threats on the Future internet
- WP4: Malware and Fraud
- WP5: Smart Environments
- WP6: Cyberattacks

syssec

www.syssec-project.eu

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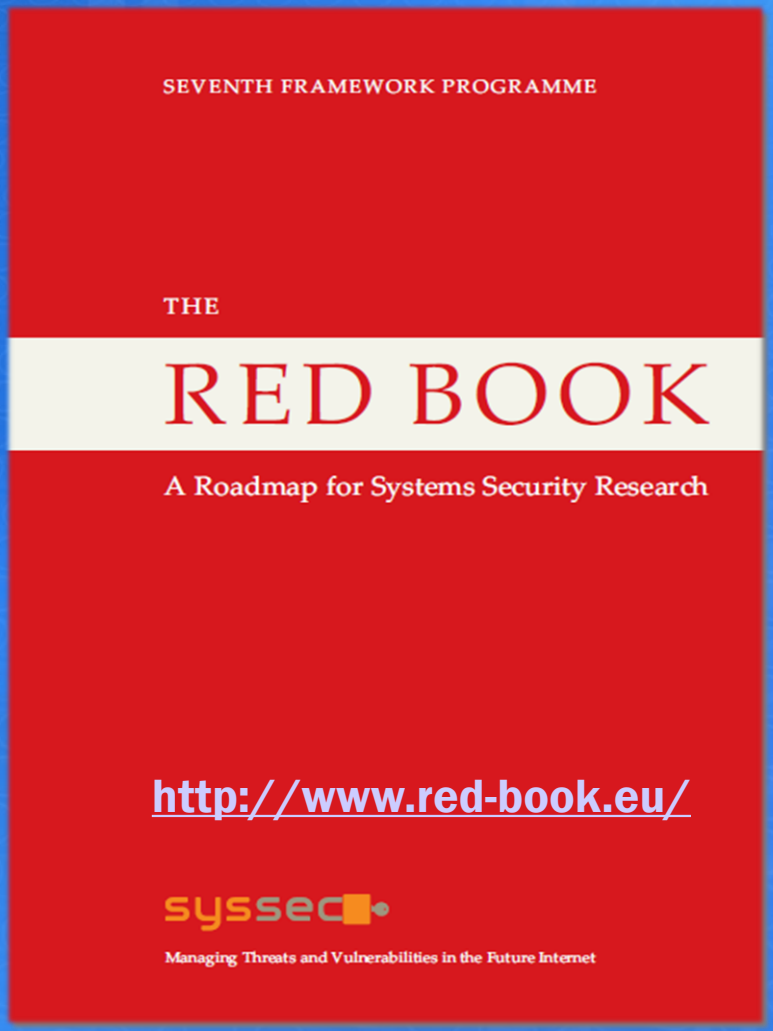
A Roadmap for System Security Research 2013



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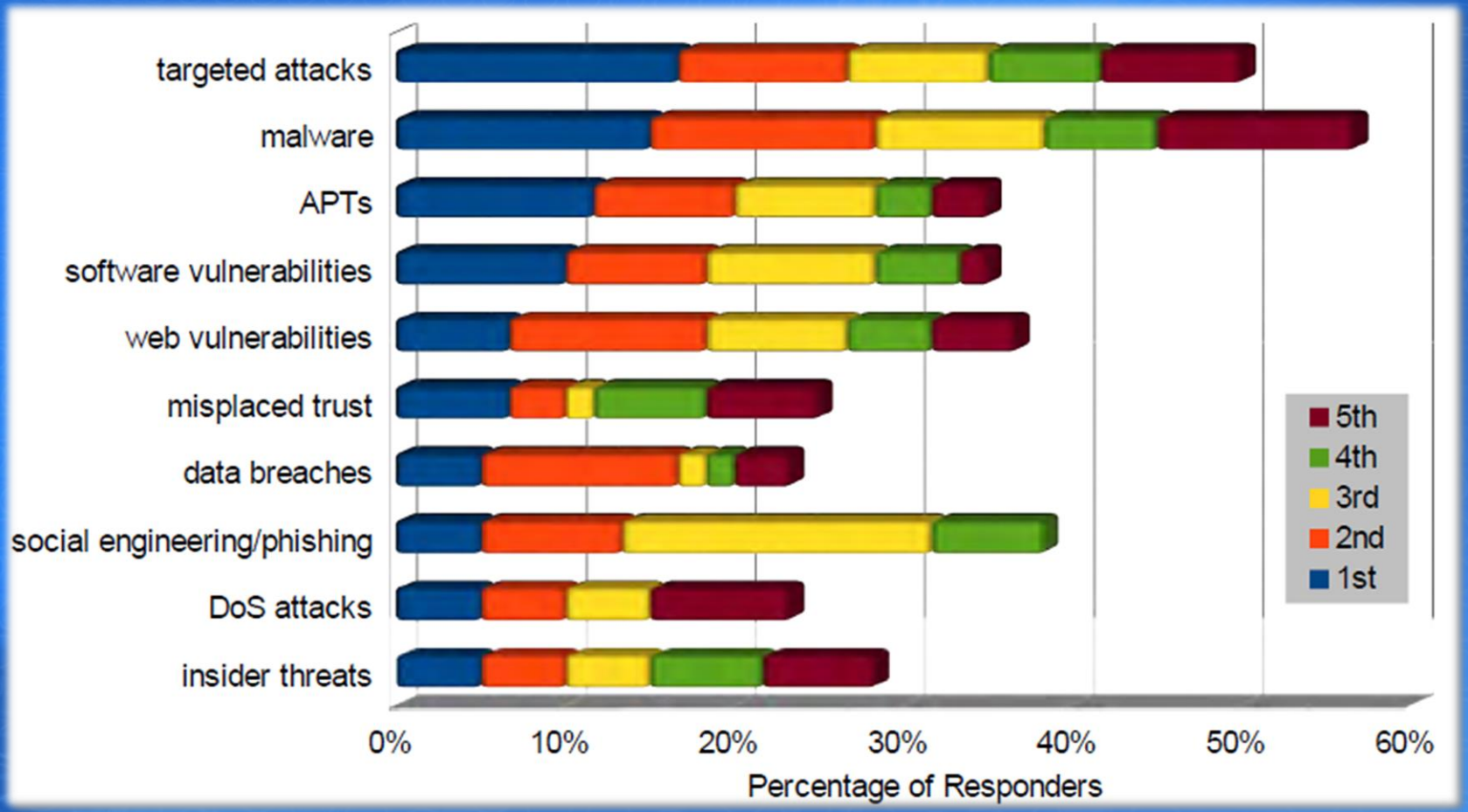
Mapping the threats we fear



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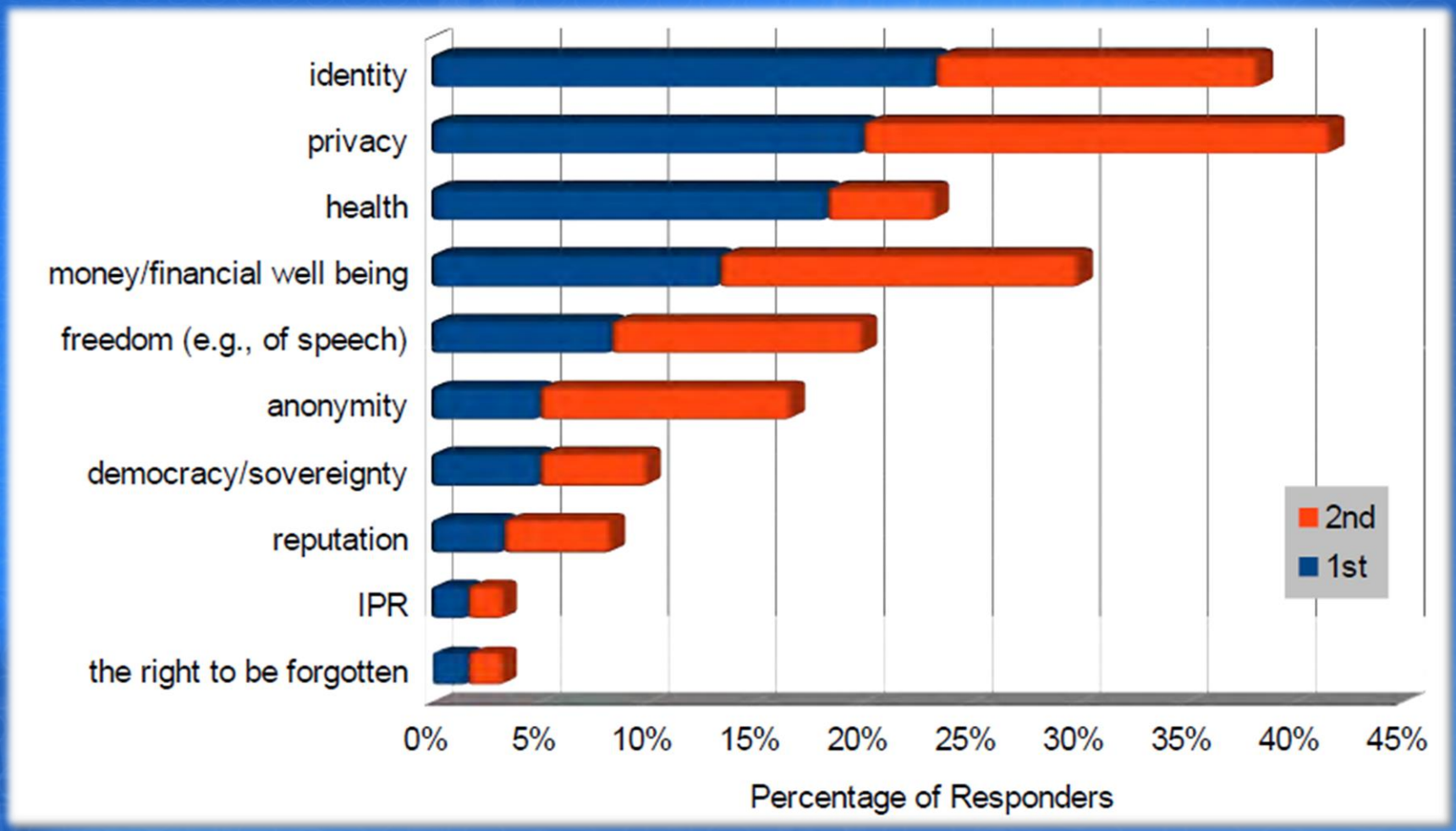
Listing the assets we value



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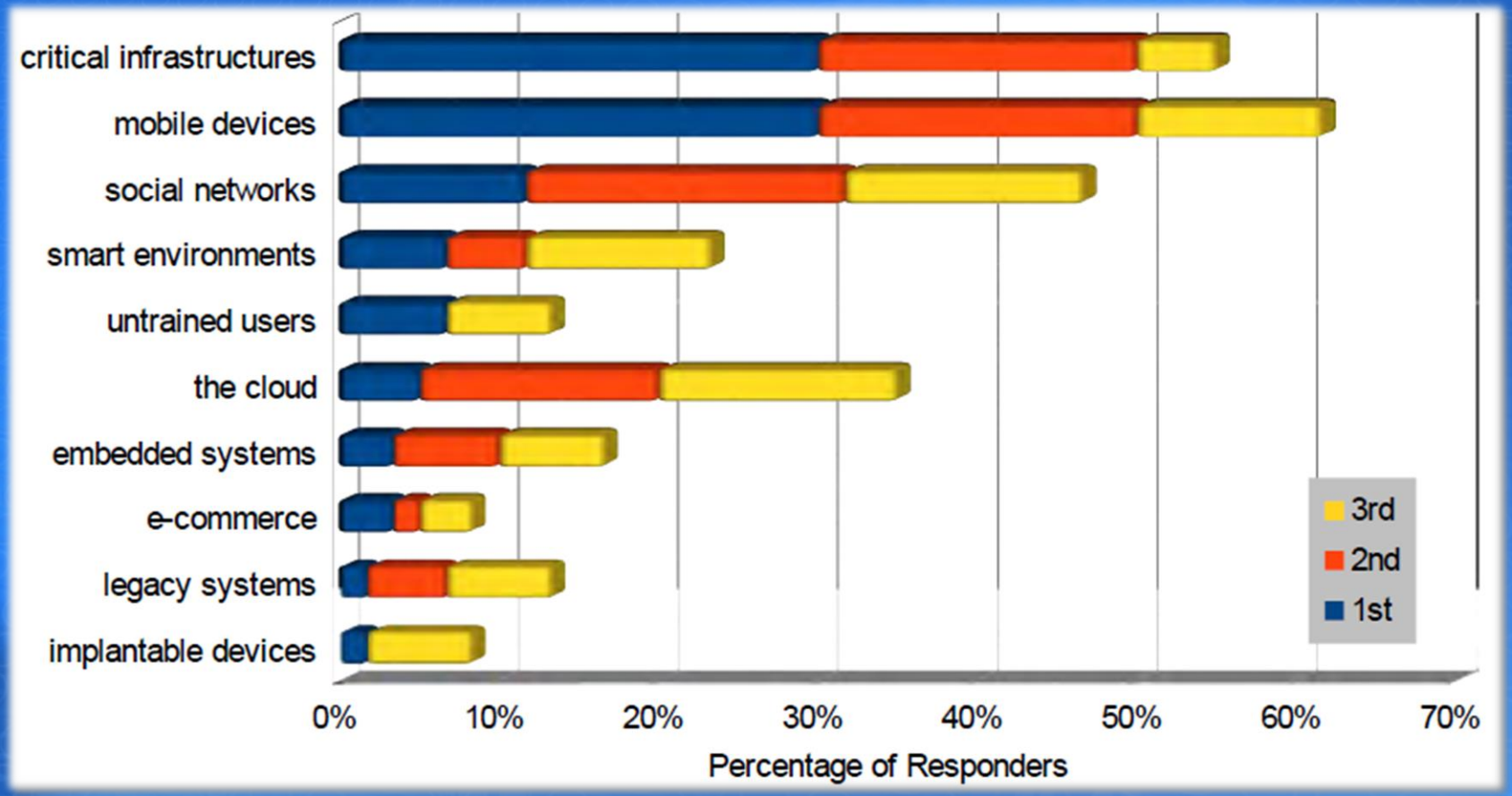
Domains of the game



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In Summary

Threats

- Malware
- Targeted Attacks
- Social Engineering - Phishing

Domains

- Mobile Devices
- Social Networks
- Critical Infrastructures

Challenges

- No Device Should Be Compromisable
- Give Users Control Over Their Data
- Provide Private Moments in Public Places
- Develop Compromise-Tolerant Systems

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Experimental Cyberthreats Brainstoriming

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WHAT-IF SCENARIOS:

ROBOTS ENTER OUR EVERYDAY LIFE

HUMANS CAN ENTER THE VIRTUAL REALITY AND FEEL COMPLETELY THERE

HUMAN-MACHINE INTERACTION IS ALREADY AVAILABLE ON MENTAL LEVEL

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THREATS & RISK BRAINSTORMING:

THREATS WE FEAR:

.....

DOMAINS:

.....

CHALLENGES:

.....

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Discussion

Obviously, the identification of cyber risk and threats is not quite a trivial task. The presented methodological framework claims comprehensiveness by means of both the technological and human factor involvement. The analysis however is context dependent but at least manageable through validation!

So, there is no a universal solution but only a feasible one, because future forecasting has always been and still stays a challenge ☺

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QUESTIONS?

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