



DISCCO: Generic Support for C2 and Decision-Making

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Outline



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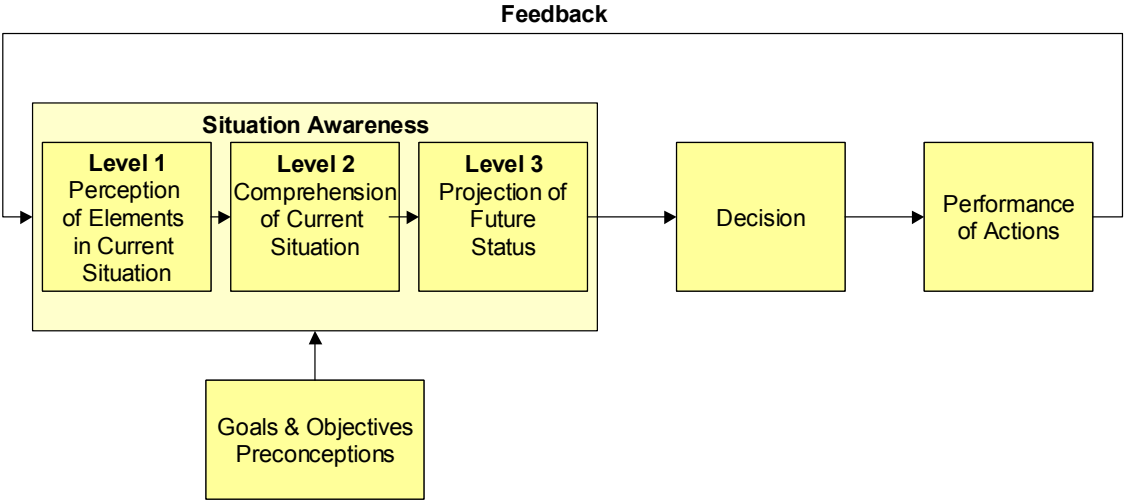
- Background
 - Command and Control
 - Data Fusion and Situation Awareness
 - Decision-Making
- DISCCO – Decision Support for Command and Control
- Conclusions and further work

C2 - Command and Control

- An interpretation from a decision-making perspective:
 - Make optimal use of available resources to solve the task.
 - The act of making decisions for subordinated resources regarding tasks and organization
- Similar to “Management”
- How to develop technical tools supporting C2?

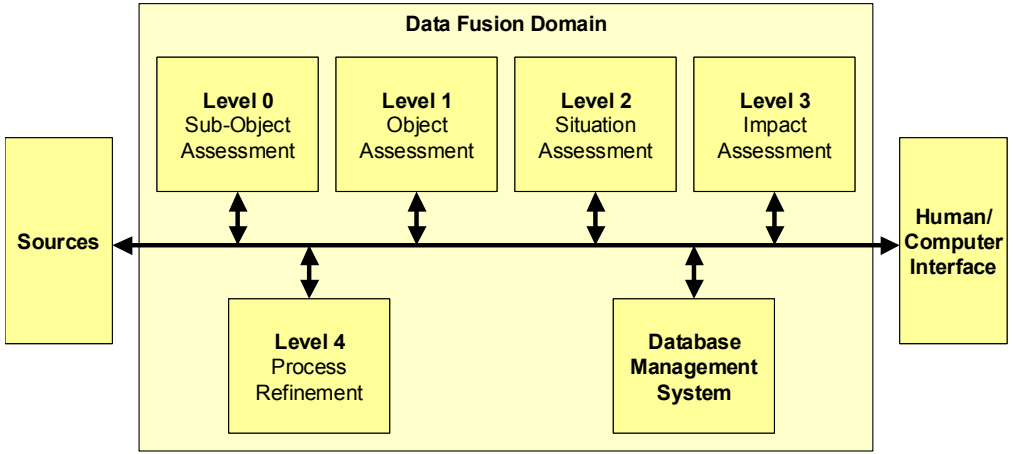


Situation Awareness and the JDL Model

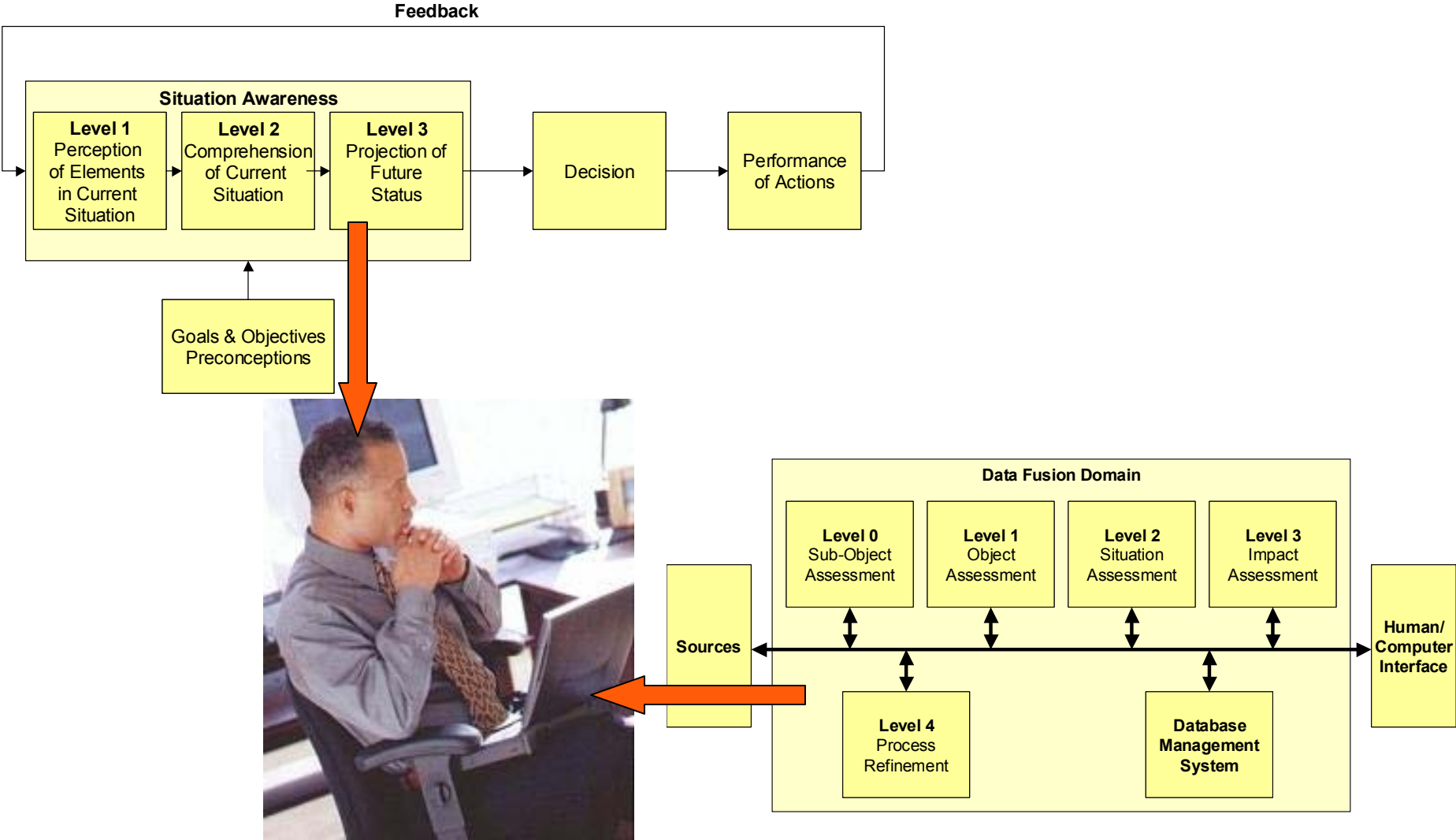


- Mica Endsley (1985)

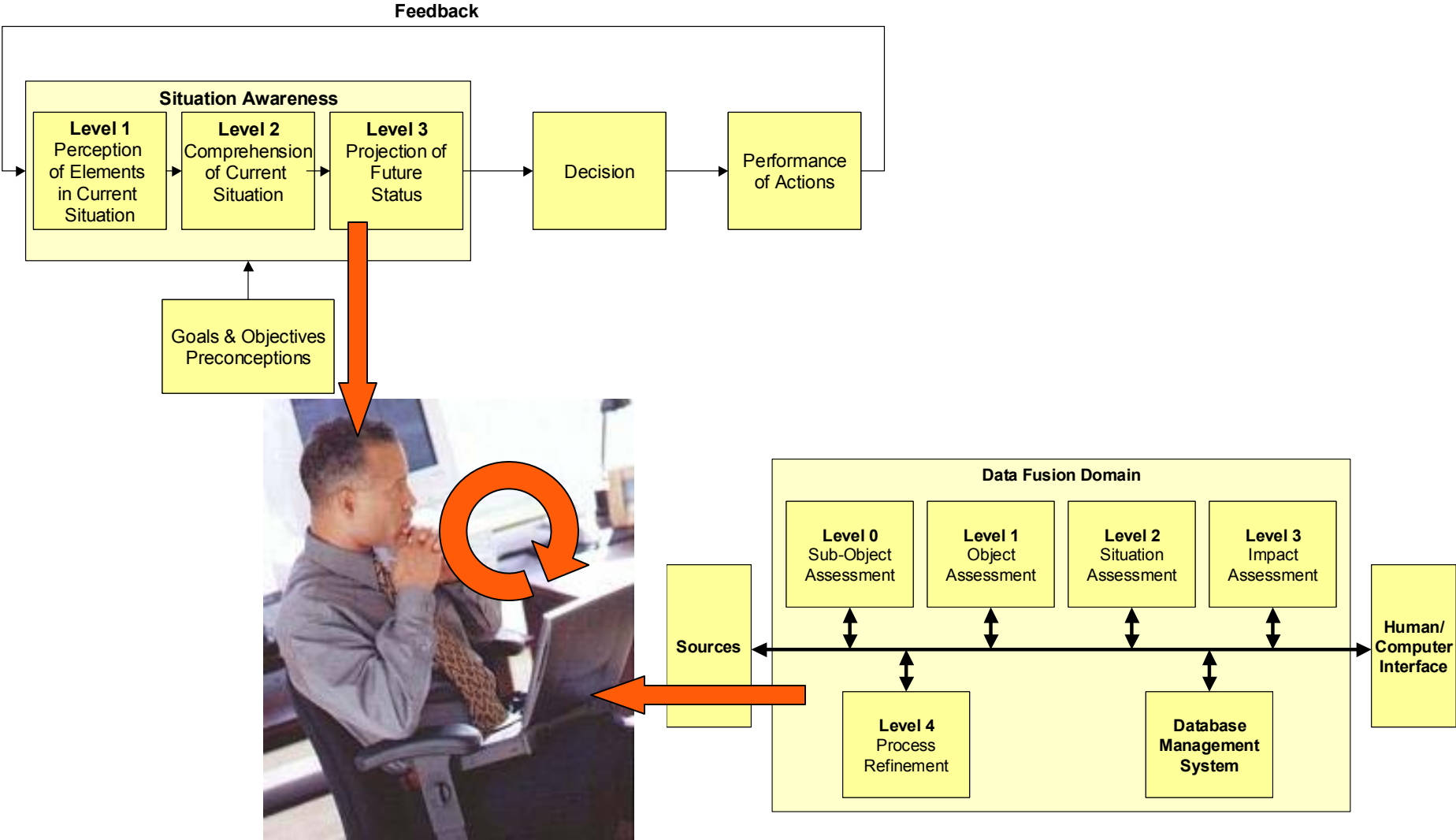
- Joint Directors of Laboratories



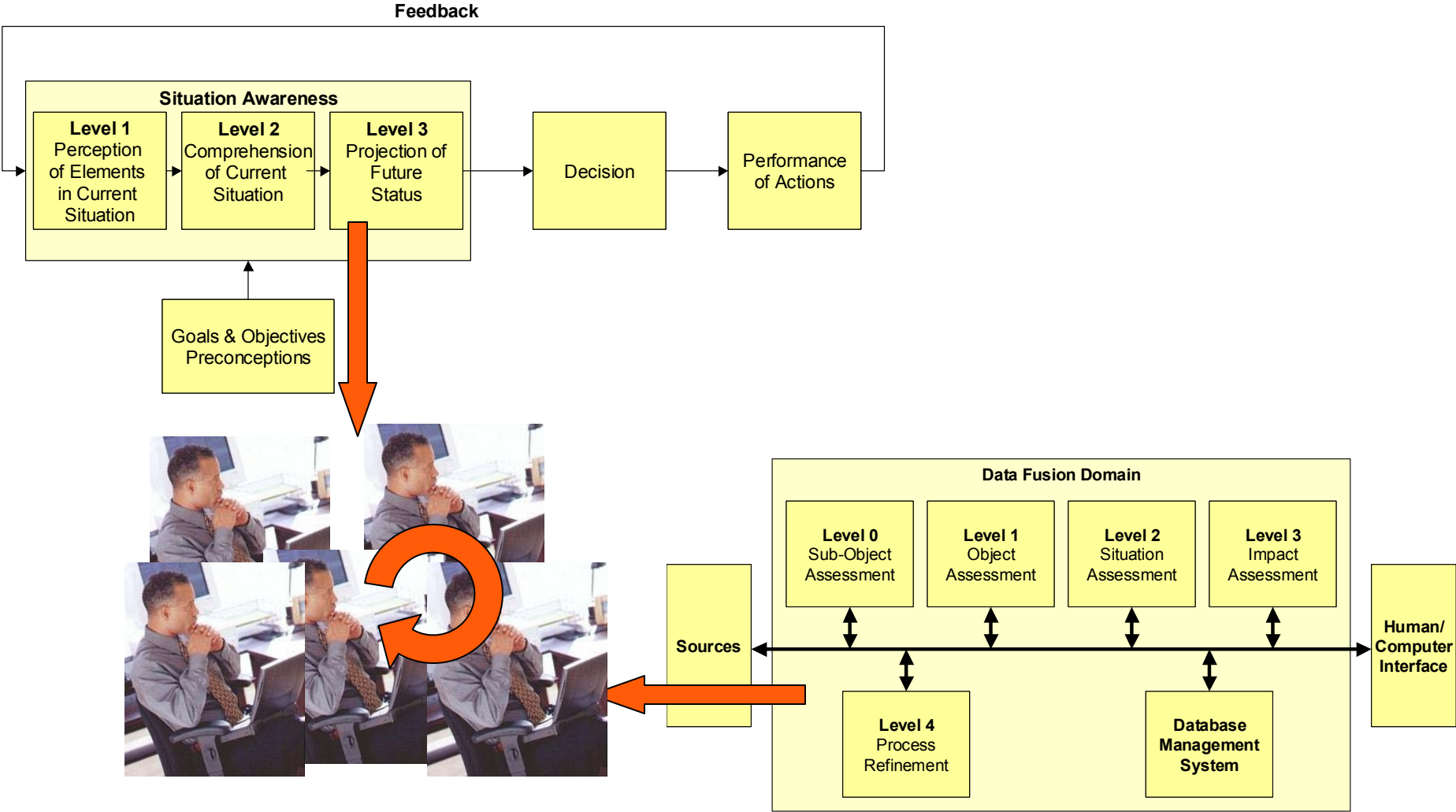
Situation Awareness and the JDL Model



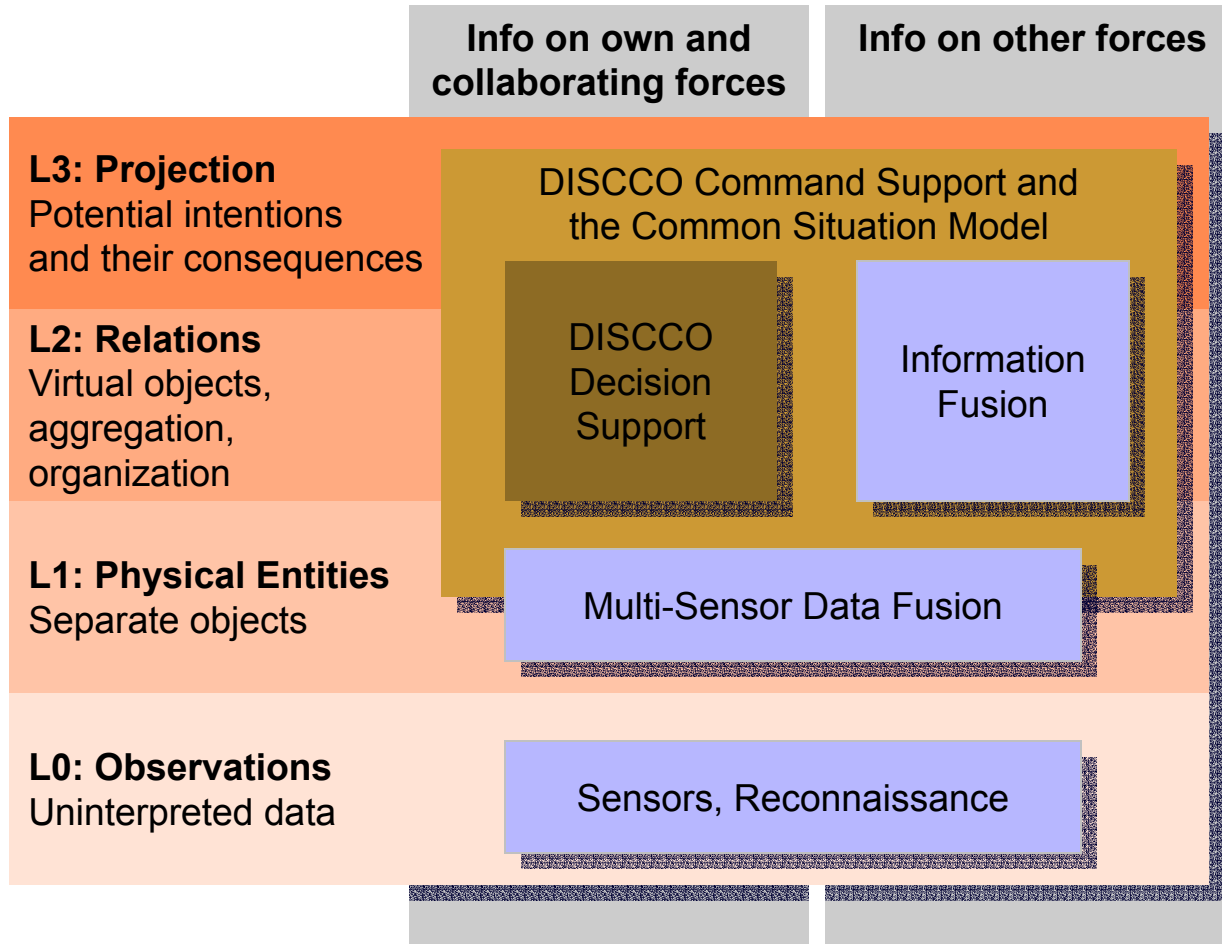
Situation Awareness and the JDL Model



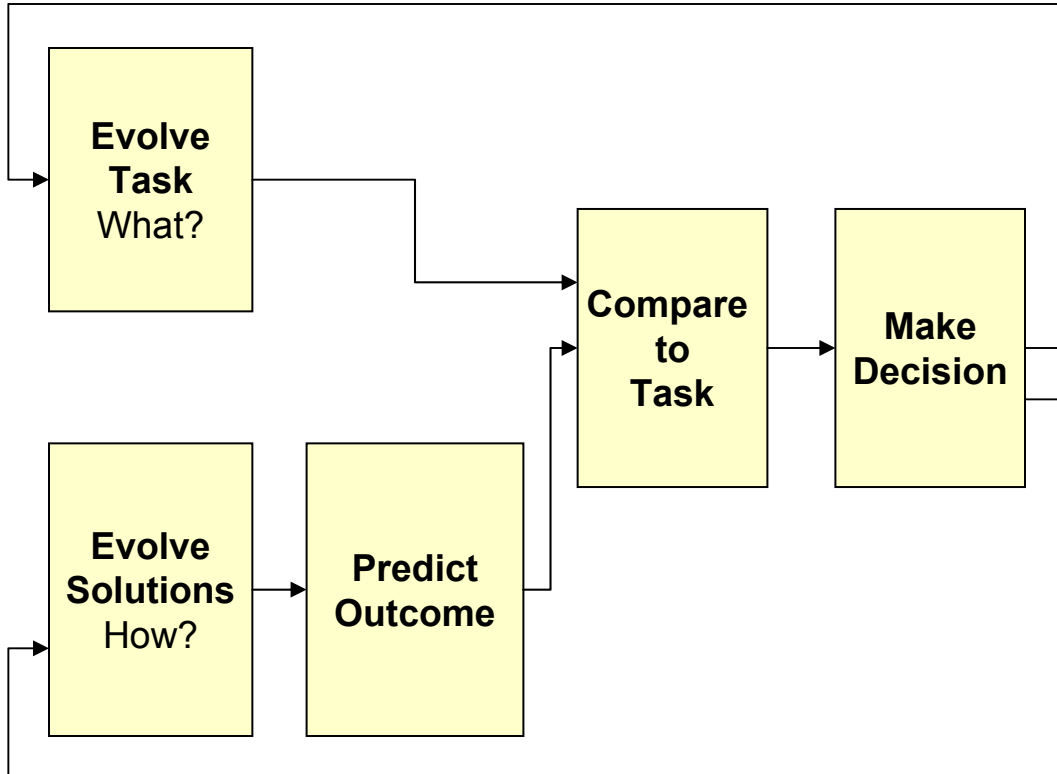
Situation Awareness and the JDL Model



Levels of Information and Tools Supporting Shared SA

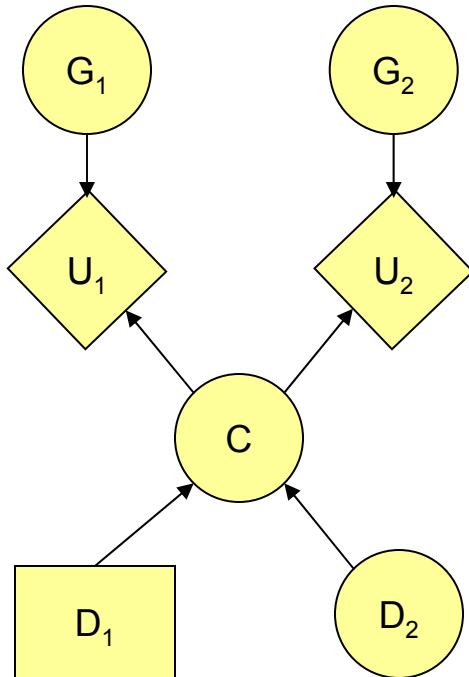


Decision-Making Theories



- Prescriptive Theories
 - Decision Theory
 - Game Theory
 - Bayesian Approaches
- Descriptive Theories
 - Cognitive Psychology
 - Distributed Cognition
 - Naturalistic Decision-Making (Klein, 1989)
- Military Decision-Making Methods
 - “Guide-Lines for Operational Planning” (GOP)
 - “Bedömandemallen”
 - “Planning under Time Pressure” (Thunholm, 2003)
- All these models can be represented by a single model

The Game Situation



- Models the decision-making of agents with conflicting goals
- Can be solved by game theoretical approaches
 - Combinations of decisions that are Nash equilibria are more probable

Outline



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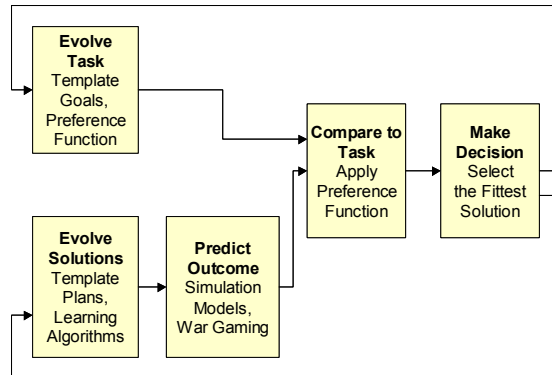
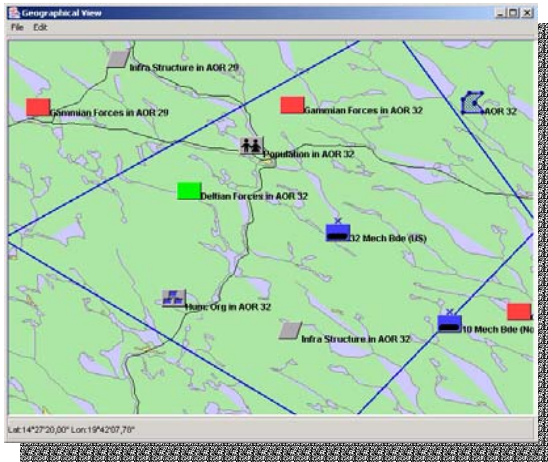


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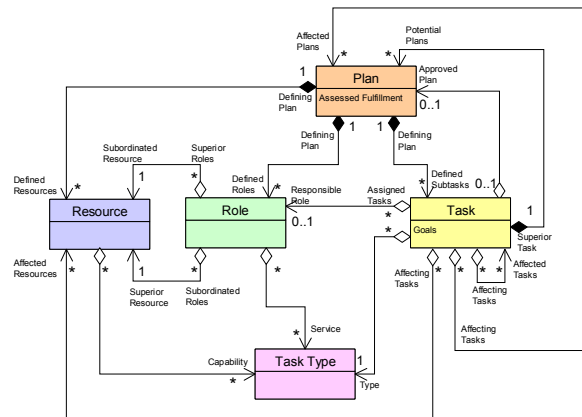
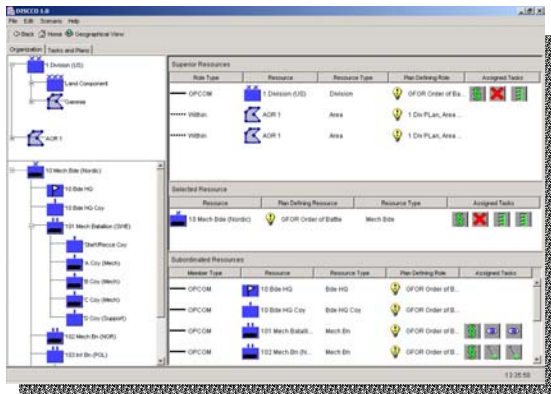


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DISCCO – Decision Support for Command and Control



- A Common Situation Model
- Command Support
- Decision Support



A Generic Framework

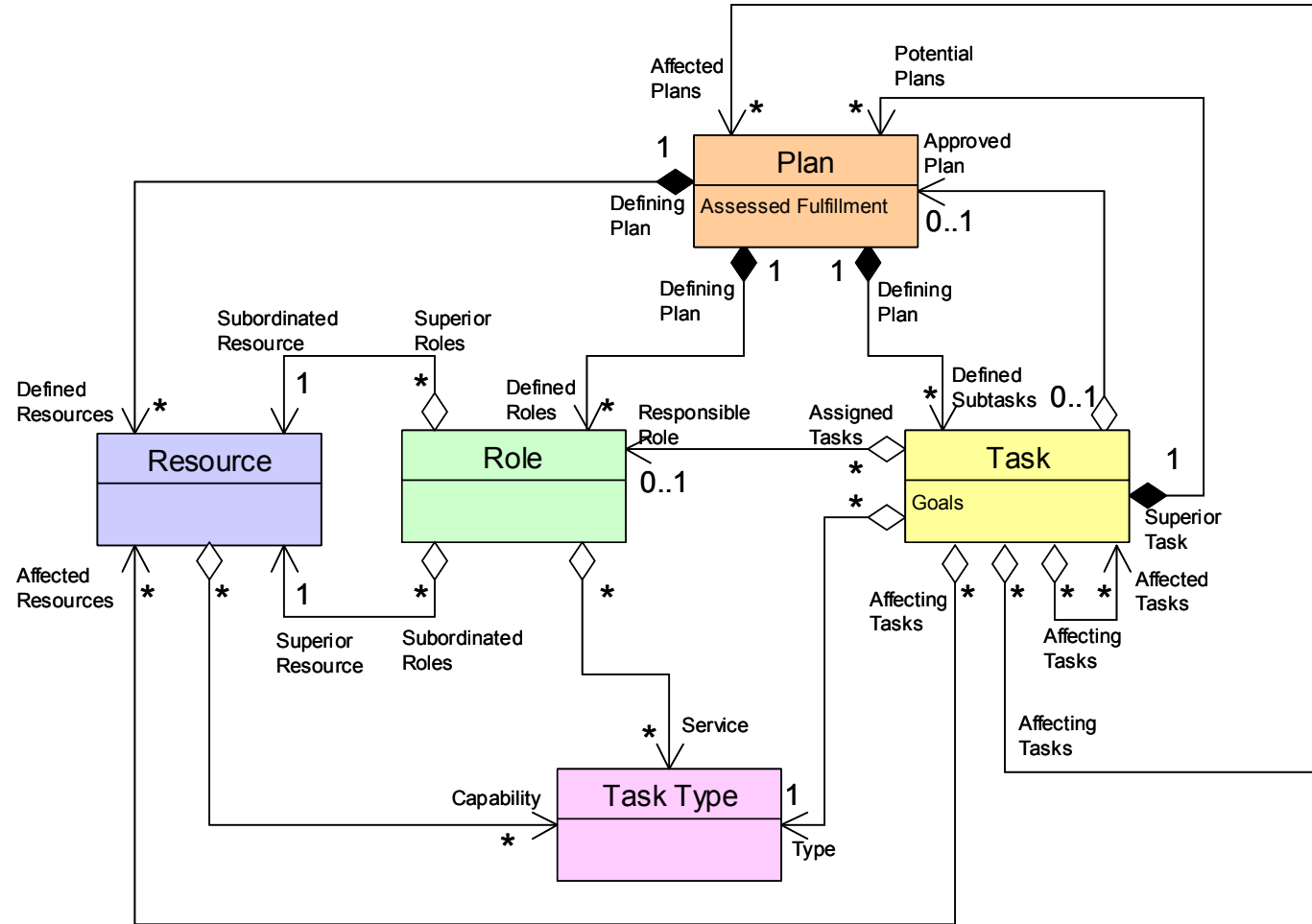
- Goals, tasks, resources, are relevant concepts, irrespective of managed domain
- Similar tools, methods, and info, across the dynamic organization
- Adaptable to specific tasks
- Facilitates flexible interoperability and cost-effective solutions
- Complementary to specialized applications
 - Open problem space
 - More time
 - From the human perspective
- Applicable for both civilian and military applications



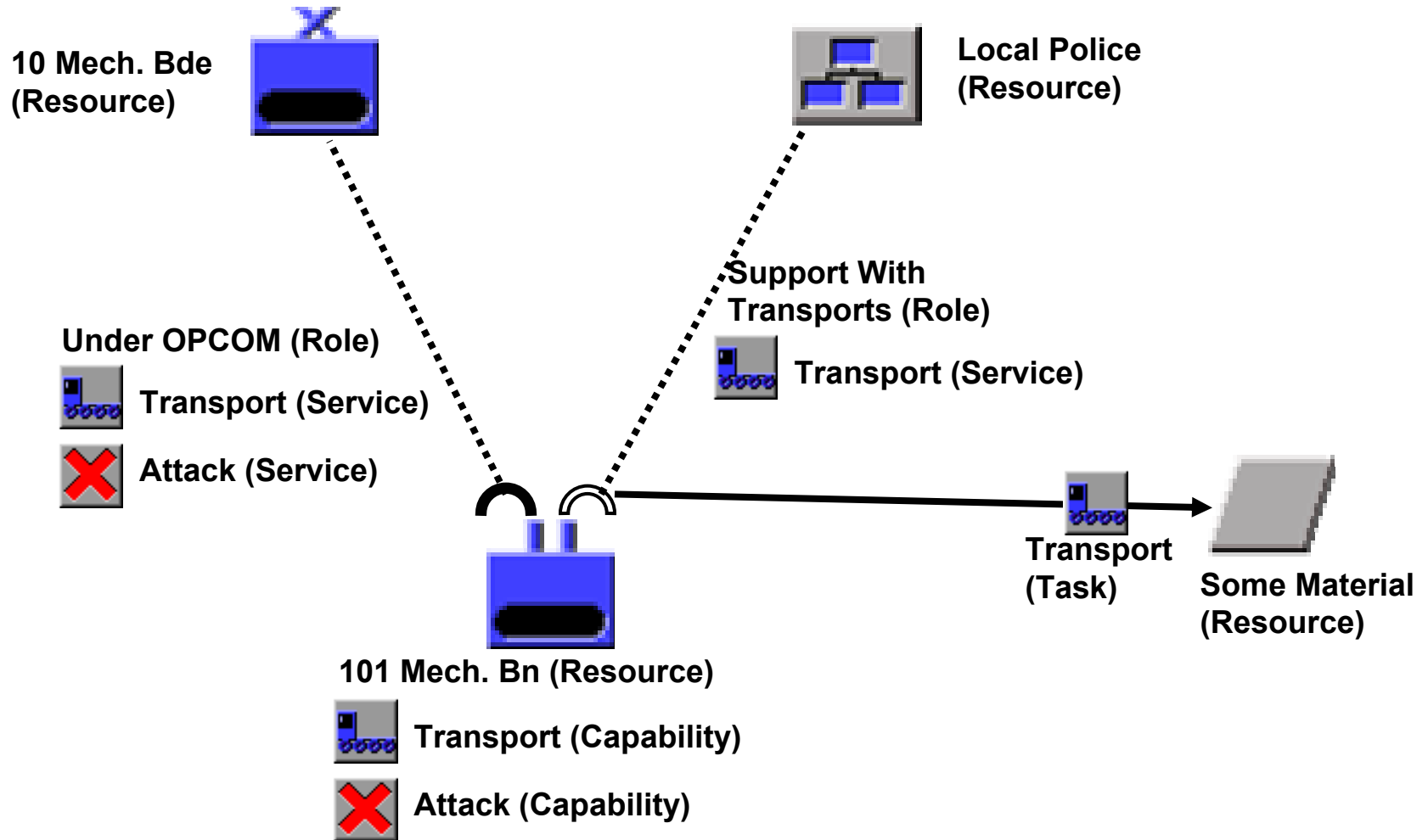
The Ontology: A Vocabulary for Describing Situations

Represents

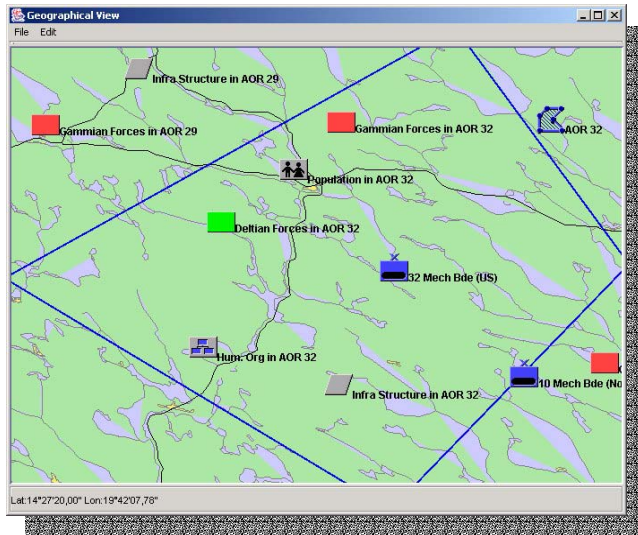
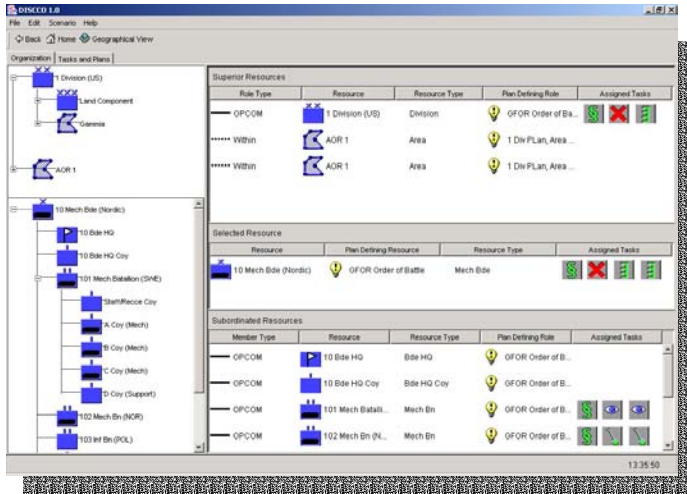
- The dynamic networked based organization of resources, tasks and plans
- What is known of friendly and other forces
- From highest to lowest decision levels



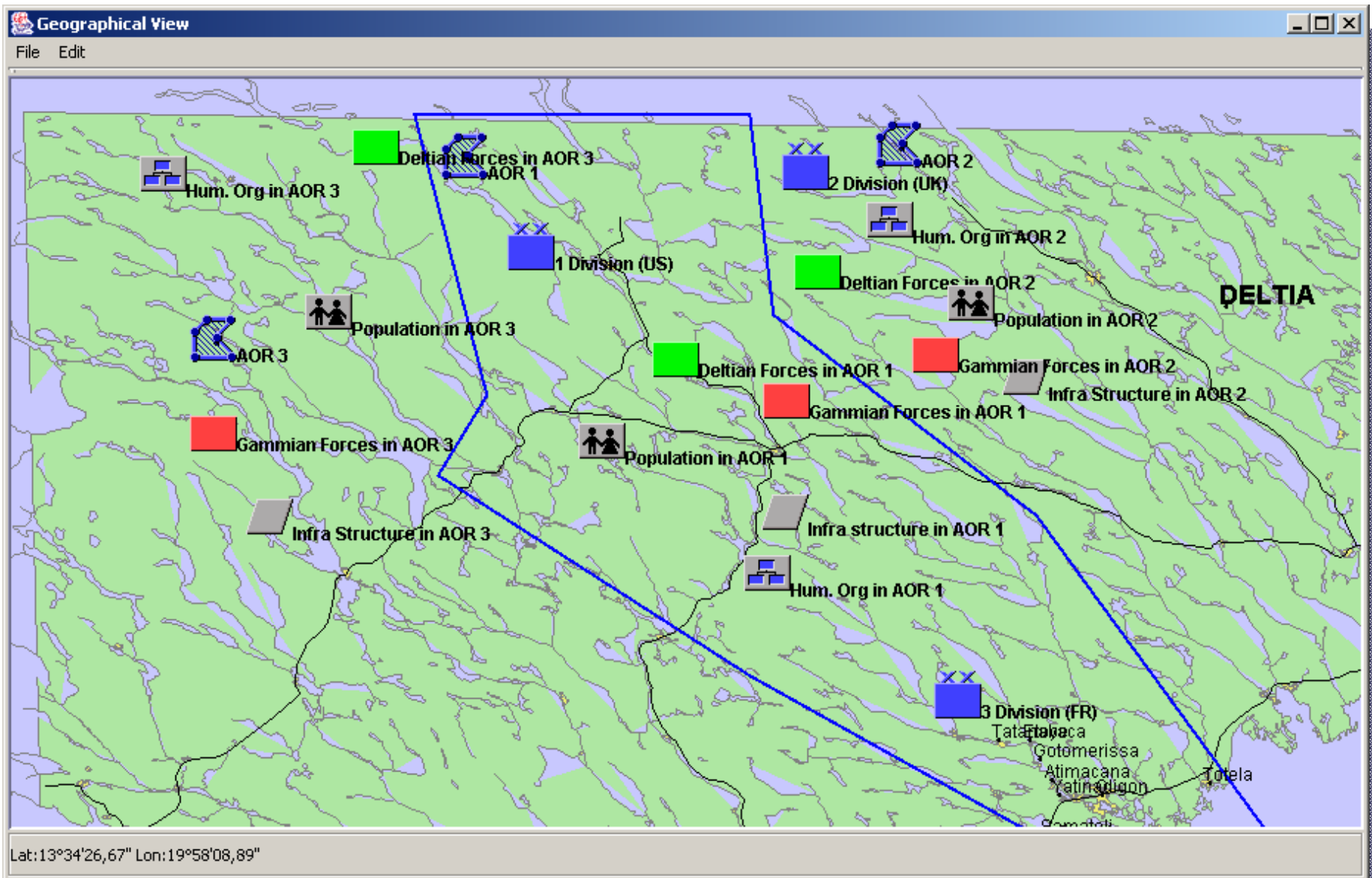
An Example



Command Support Tools



- Support for navigating and maintaining the common model of the situation
- Provide support to describe and visualize problems and solutions in different views
- Once a solution (= a plan) is described it could be the subject for evaluation, as well as the baseline for an execution order
- Integrates planning and execution phases



Example: A geographical view of the situation

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File Edit Scenario Help

Back Home Geographical View

Organization Tasks and Plans

Maintain International Peace

UN Resolutions

- Humanitarian Support of Population
- Harassment of Population
- Support Population
- Confront Deltian Forces
- Establish Peace in Gammia

Selected Plan

Plan	Status
UN Resolutions	Planning

Defined Subtasks

Task	Scope1	Responsible Resource
Humanitarian Support of Population	Population in Eastern Gammia	Humanitarian Organisati...
Harassment of Population	Population in Eastern Gammia	Gammian Forces
Support Population	Population in Eastern Gammia	Deltian Forces
Confront Deltian Forces	Gammian Forces	Deltian Forces
Establish Peace in Gammia	In Gammia	GFOR

Defined Resources and Objects

Resource	Resource Type
Deltian Forces	Green Unit
Epsilon	Area

Defined Roles and Relations

Role Type	Superior Resource	Subordinated Resource
..... Within	Agammi Region	Humanitarian Organisations In G...

UN Resolutions 11:48:49

Example: A tree view of the situation

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Back Home Geographical View

Organization Tasks and Plans

1 Division (US)

- Land Component
- Gammia
- AOR 1

10 Mech Bde (Nordic)

- 10 Bde HQ
- 10 Bde HQ Coy
- 101 Mech Battalion (SWE)
 - Staff/Recce Coy
 - A Coy (Mech)
 - B Coy (Mech)
 - C Coy (Mech)
 - D Coy (Support)
- 102 Mech Bn (NOR)
- 103 Inf Bn (POL)
- 104 Tank Coy (DAN)

Superior Resources

Role Type	Resource	Resource Type	Plan Defining Role	Assigned Tasks
OPCOM	1 Division (US)	Division	⚠ GFOR Order of B...	§ ✖ 📋
..... Within	AOR 1	Area	⚠ 1 Div PLan, Area ...	
..... Within	AOR 1	Area	⚠ 1 Div PLan, Area ...	

Selected Resource

Resource	Plan Defining Resource	Resource Type	Assigned Tasks
10 Mech Bde (Nordic)	⚠ GFOR Order of Battle	Mech Bde	§ ✖ 📋 📋

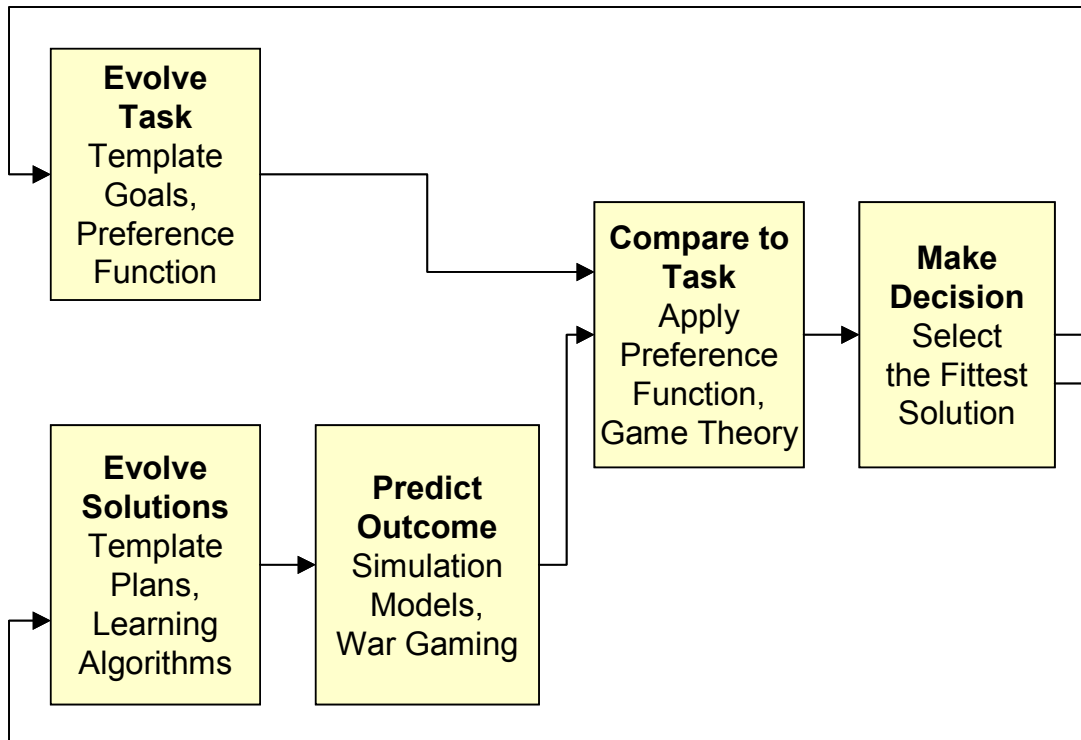
Subordinated Resources

Member Type	Resource	Resource Type	Plan Defining Role	Assigned Tasks
OPCOM	10 Bde HQ	Bde HQ	⚠ GFOR Order of B...	
OPCOM	10 Bde HQ Coy	Bde HQ Coy	⚠ GFOR Order of B...	
OPCOM	101 Mech Batalli...	Mech Bn	⚠ GFOR Order of B...	§ 👁 👁
OPCOM	102 Mech Bn (N...	Mech Bn	⚠ GFOR Order of B...	§ 🛠 🛠
OPCOM	103 Inf Bn (POL)	Inf Bn	⚠ GFOR Order of B...	§
OPCOM	104 Tank Coy (D...	Tank Coy	⚠ GFOR Order of B...	
OPCOM	105 Pioneer Bn (...)	Pioneer Bn	⚠ GFOR Order of B...	

10 Mech Bde (Nordic) 11:42:53

Example: A tree view of the organization

Decision Support Tools



- Enhance the human process to generate and evaluate solutions
- Support evaluation also during execution
- Gradual development of simulation and AI technology

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File Edit Scenario Help

Back Home Geographical View

Organization Tasks and Plans

10 Bde Battle Plan, Prevent Confront.
Prevent Confrontation in AOR 10

Establish Surveillance of AOR 101

Stationary Surveillance

Mobile Surveillance

Selected Task

Task	Scope1	...	Sco...	Responsible Resource	Status	Asses...
Establish Surveillance of AOR 101	Of AOR 101			101 Mech Battalion (SWE)		

Preferences and Plan Evaluation

Approved	Total Assessment	Area Coverage	Fuel Consumption	Own Casualties	Find illegal activity
Preferences					
Requirement	>50	<50	<Very Low	> High	
Unit/Dimension	%	m3 / day	Probability	Probability	
Significance	Important	Important	Very Import...	Important	
Plans					
Stationary Surveillance	Not OK	90	0	Very Low	Medium
Mobile Surveillance	Not OK	90	24	Low	High

Gammia 12:49:43

Example: Evaluation of two potential plans

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Further Development of DISCCO

Command Support
(Methodology and HMI)

Support for describing situation, tasks.
Issuing orders

Evaluation and monitoring of plans through all phases

Support for generating excellent plans

Dependent actions, uncertain information

Decision Support
(Technology)

Situation model: ontology and distributed database

Embedded agent-based simulation

Learning Algorithms

Bayesian networks and game theory

Integration with other services

Situation picture
GIS

Security
Authentication

Plan Generation

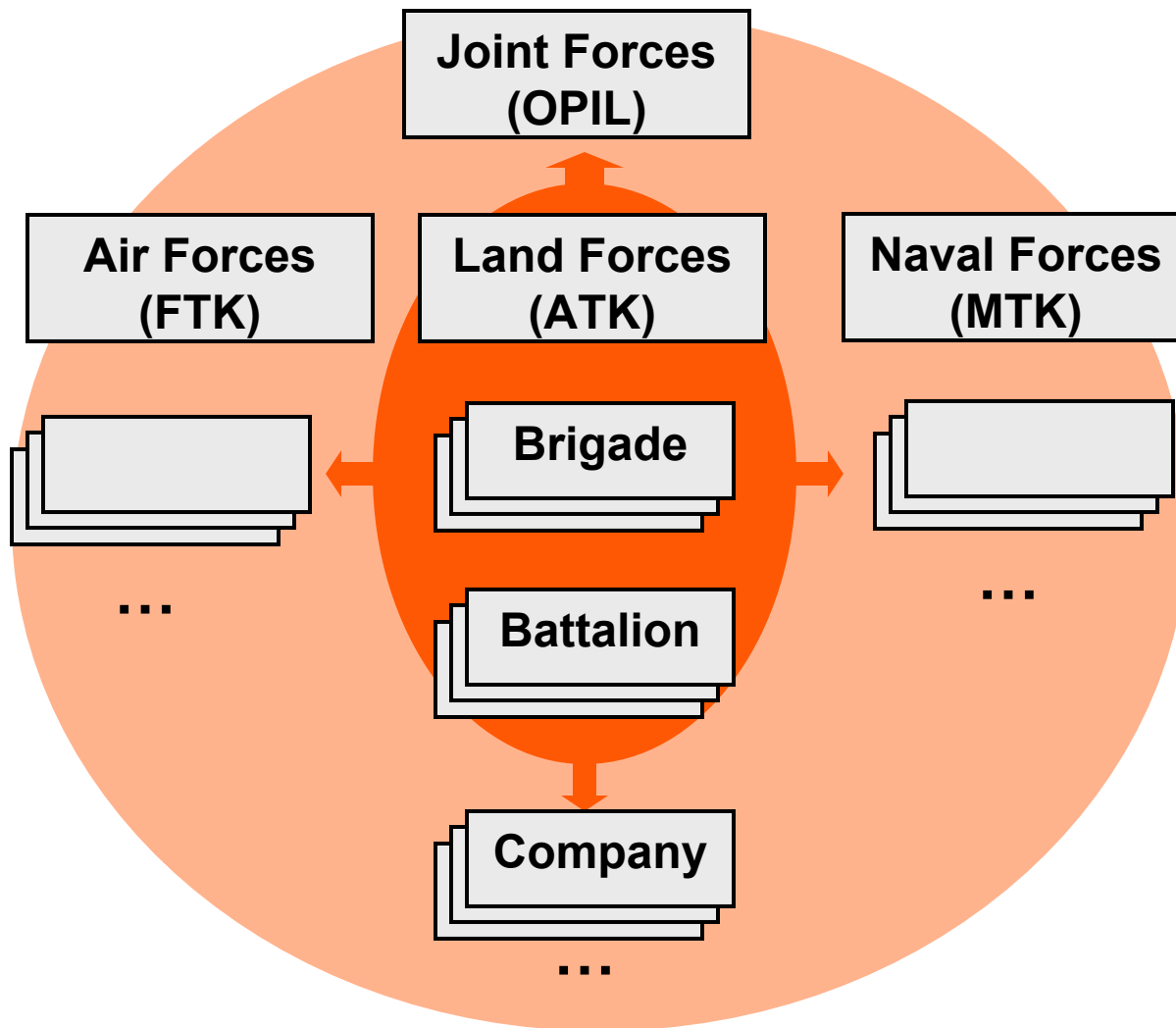
Risk Assessment

Graphical Planning

Plan Evaluation

Information Fusion
LOTS

The Extending Scope



- Adaptable to different tasks
- Supports interoperability in a changing organization
- Successively evolving automation
- The human process as a baseline

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Thank you!