DISCCO: Generic Support for C2 and Decision-Making

Klas Wallenius, klasw@nada.kth.se

- Nada, Royal Institute of Technology
- Parallel and Scientific Computing Institute
- Saab Systems

KTH VETENSKAP OCH KONST

KTH Numerisk analys och datalogi

SAAB TECHNOLOGIES

SAAB

Outline

KTH Numerisk analys och datalogi

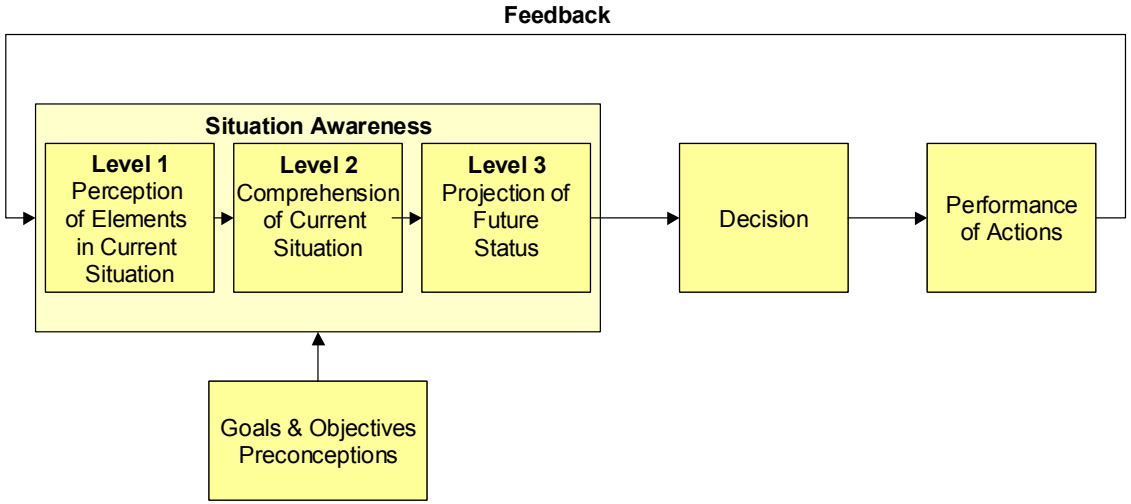
SAAB

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

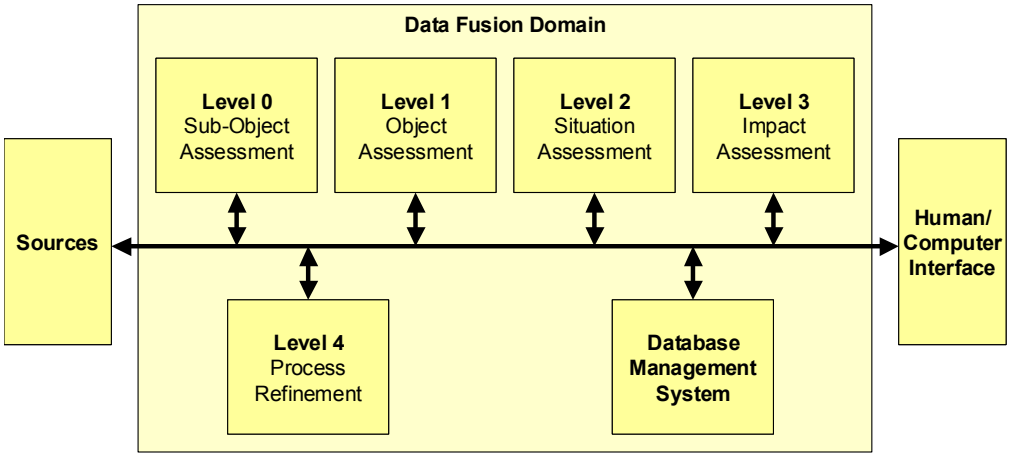
C2 - Command and Control

- 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?

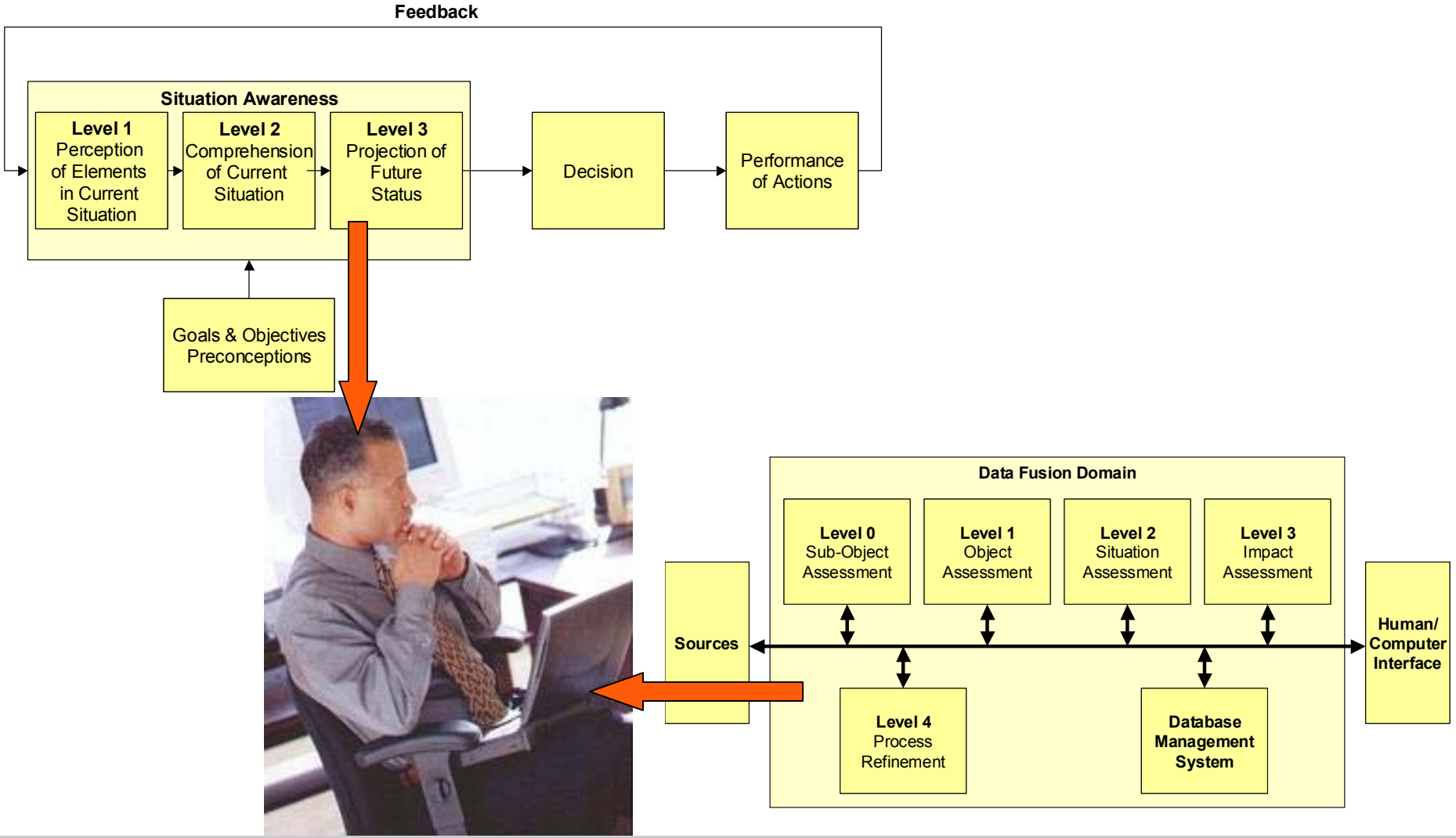
Situation Awareness and the JDL Model



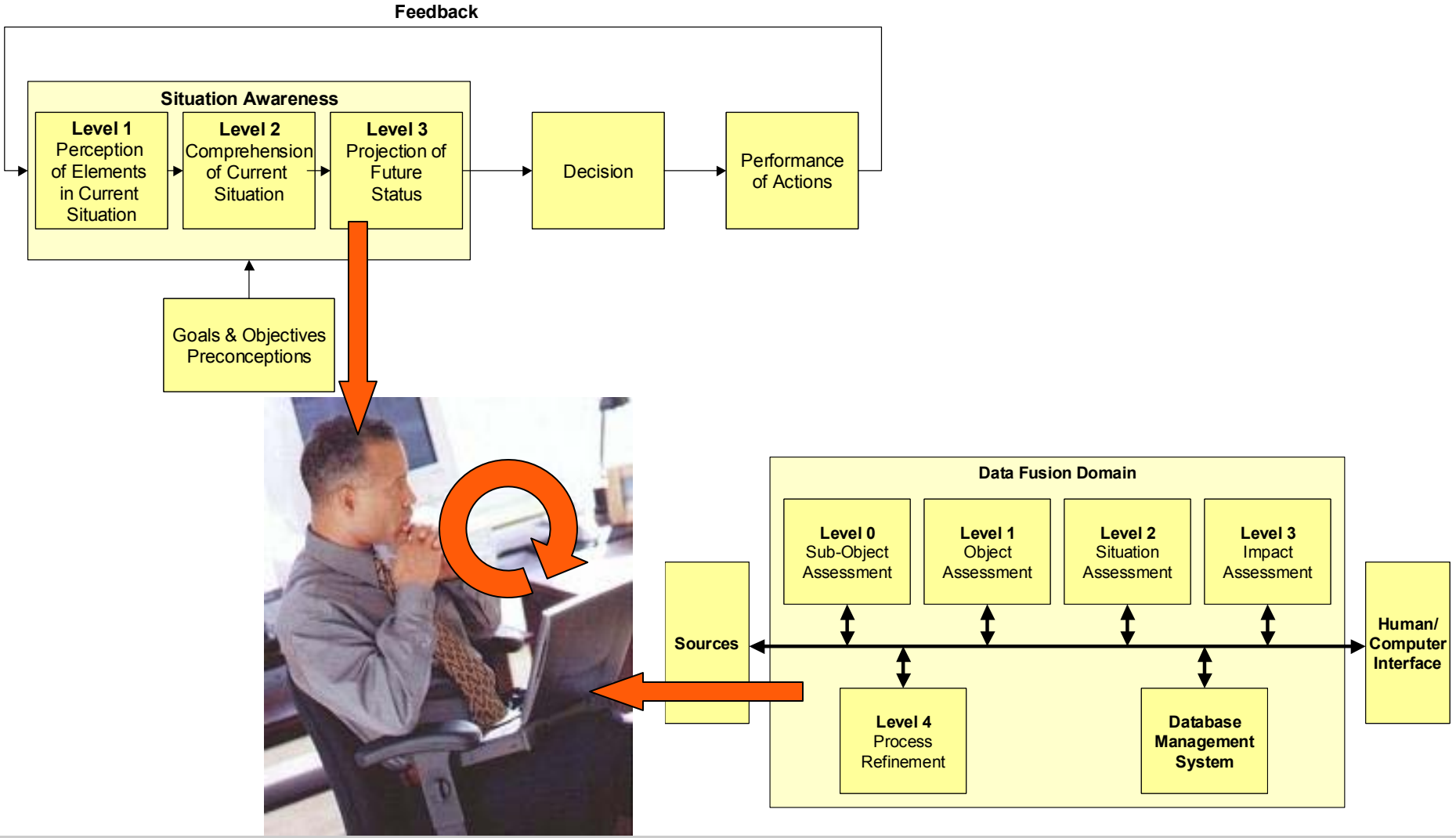
- Mica Endsley (1985)
- Joint Directors of Laboratories



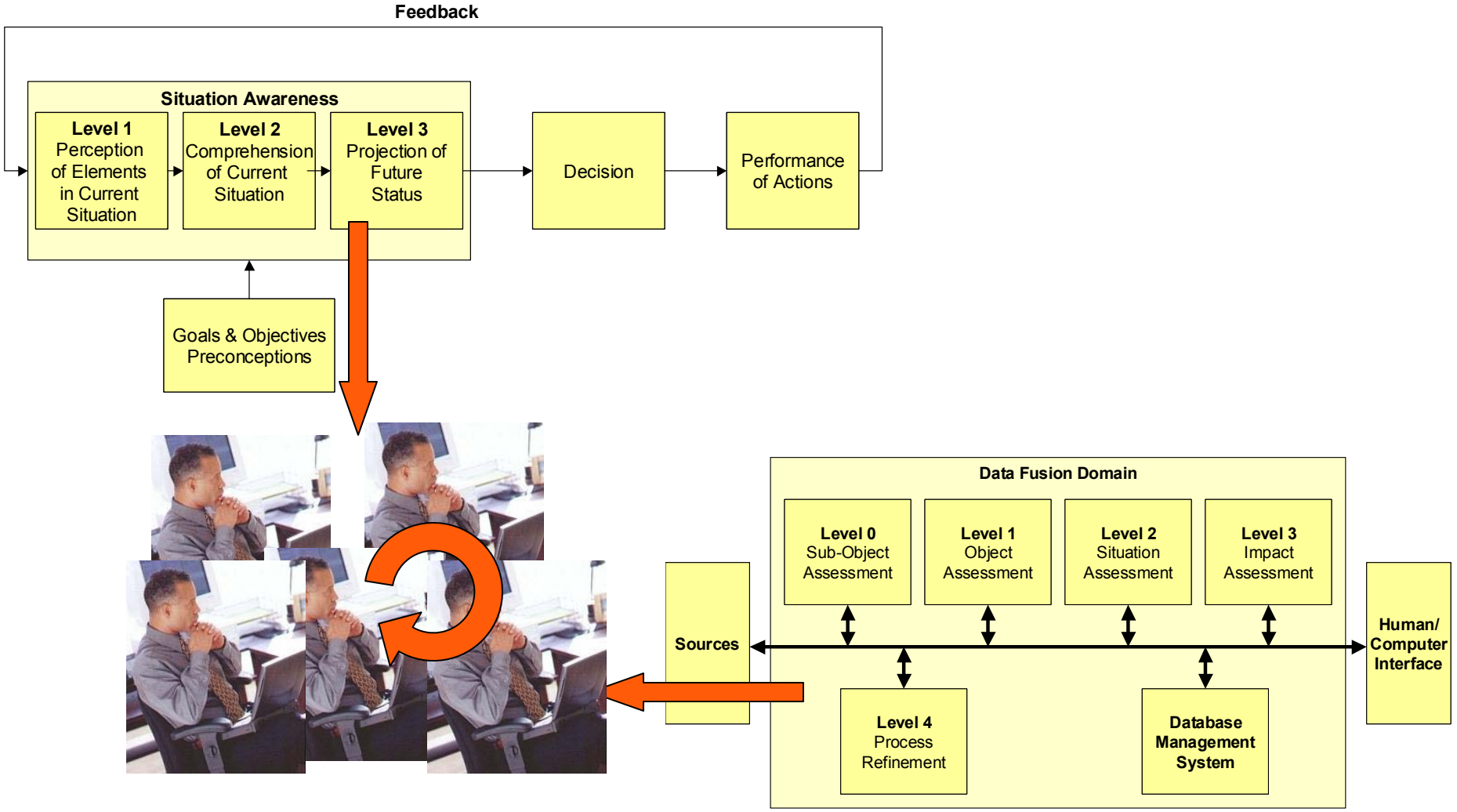
Situation Awareness and the JDL Model



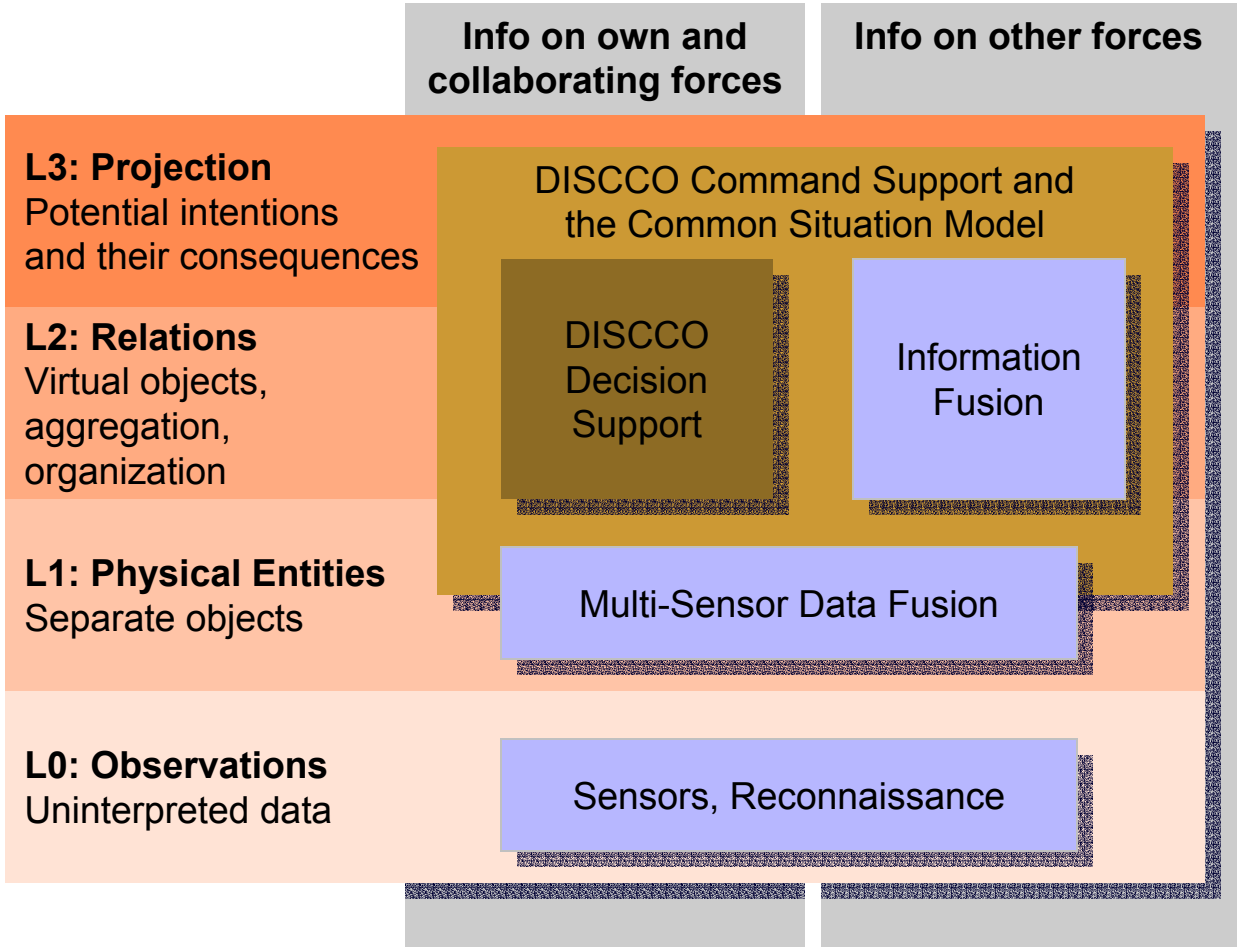
Situation Awareness and the JDL Model



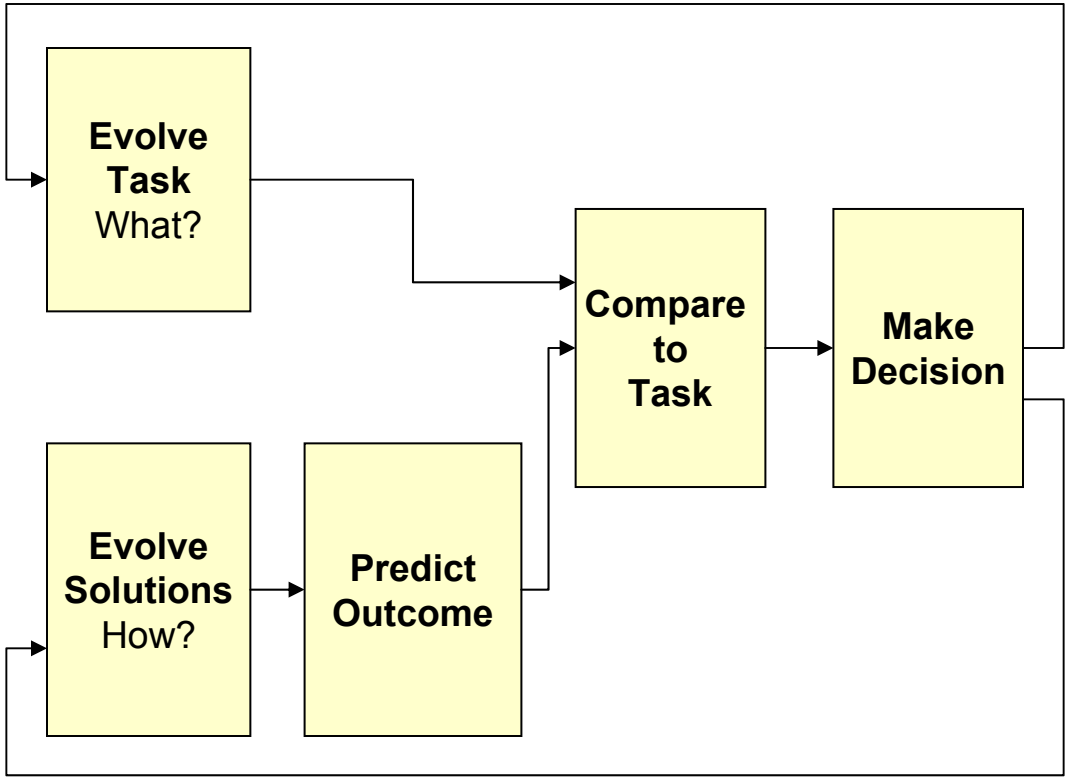
Situation Awareness and the JDL Model



Levels of Information and Tools Supporting Shared SA

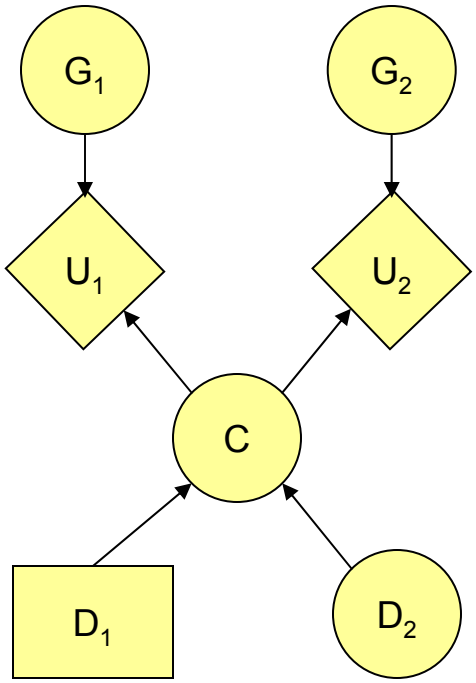


Decision-Making Theories



- 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

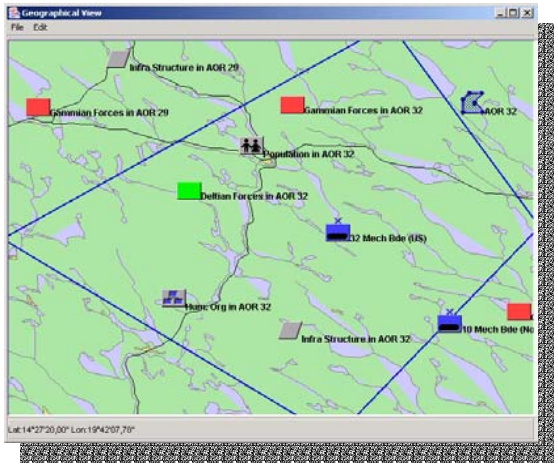
Outline

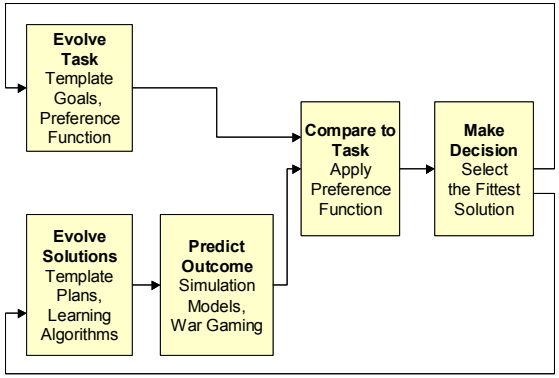
KTH Numerisk analys och datalogi

SAAB

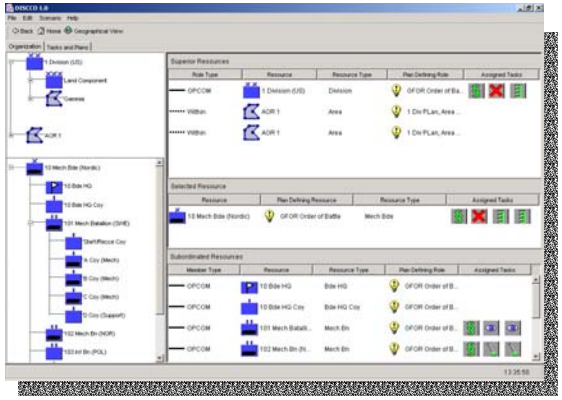
- Background
  - Command and Control
  - Data Fusion and Situation Awareness
  - Decision-Making
- DISCCO – Decision Support for Command and Control
- Conclusions and further work

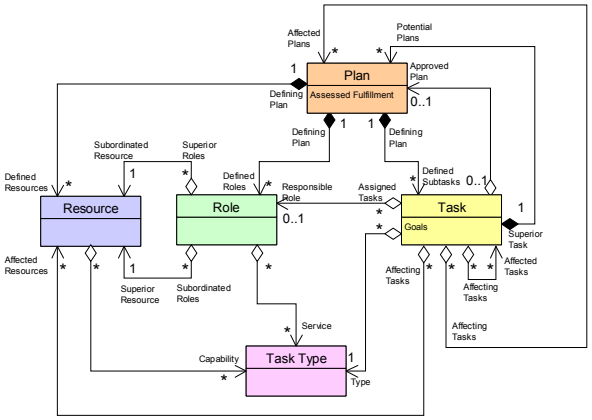
DISCCO –
Decision Support for Command and Control





- A Common Situation Model
- Command Support
- Decision Support





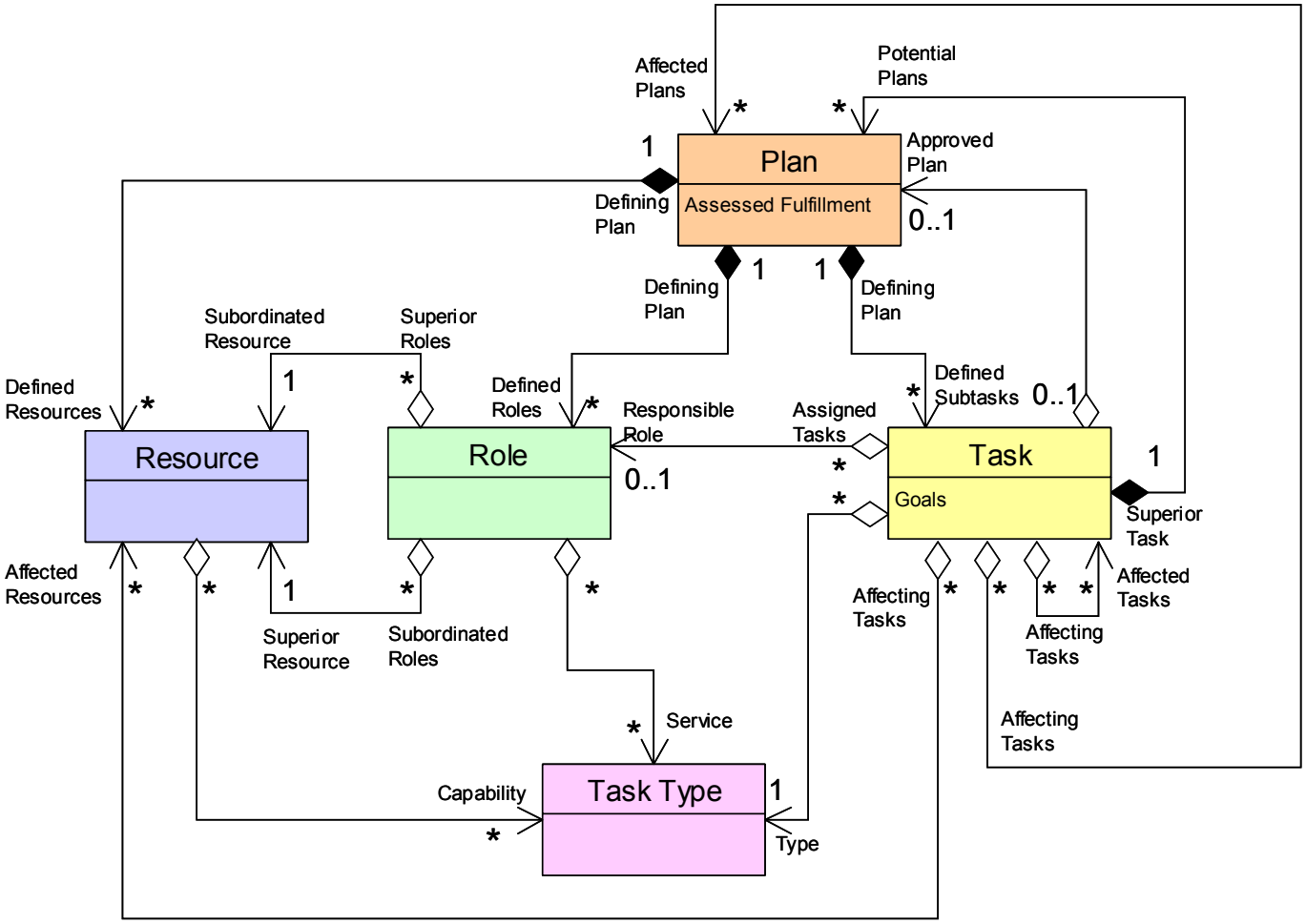
A Generic Framework

- 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

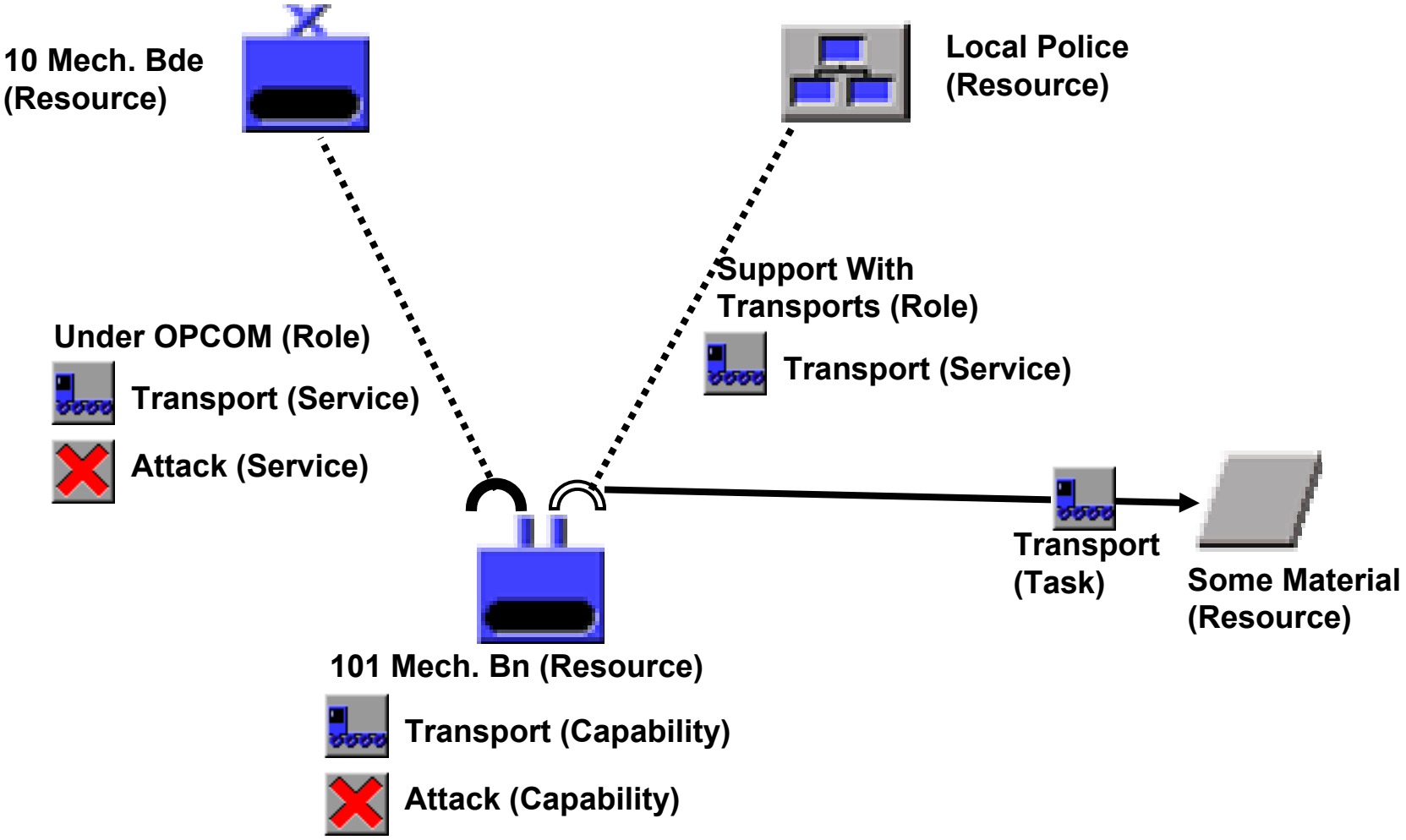
The Ontology: A Vocabulary for Describing Situations

Represents

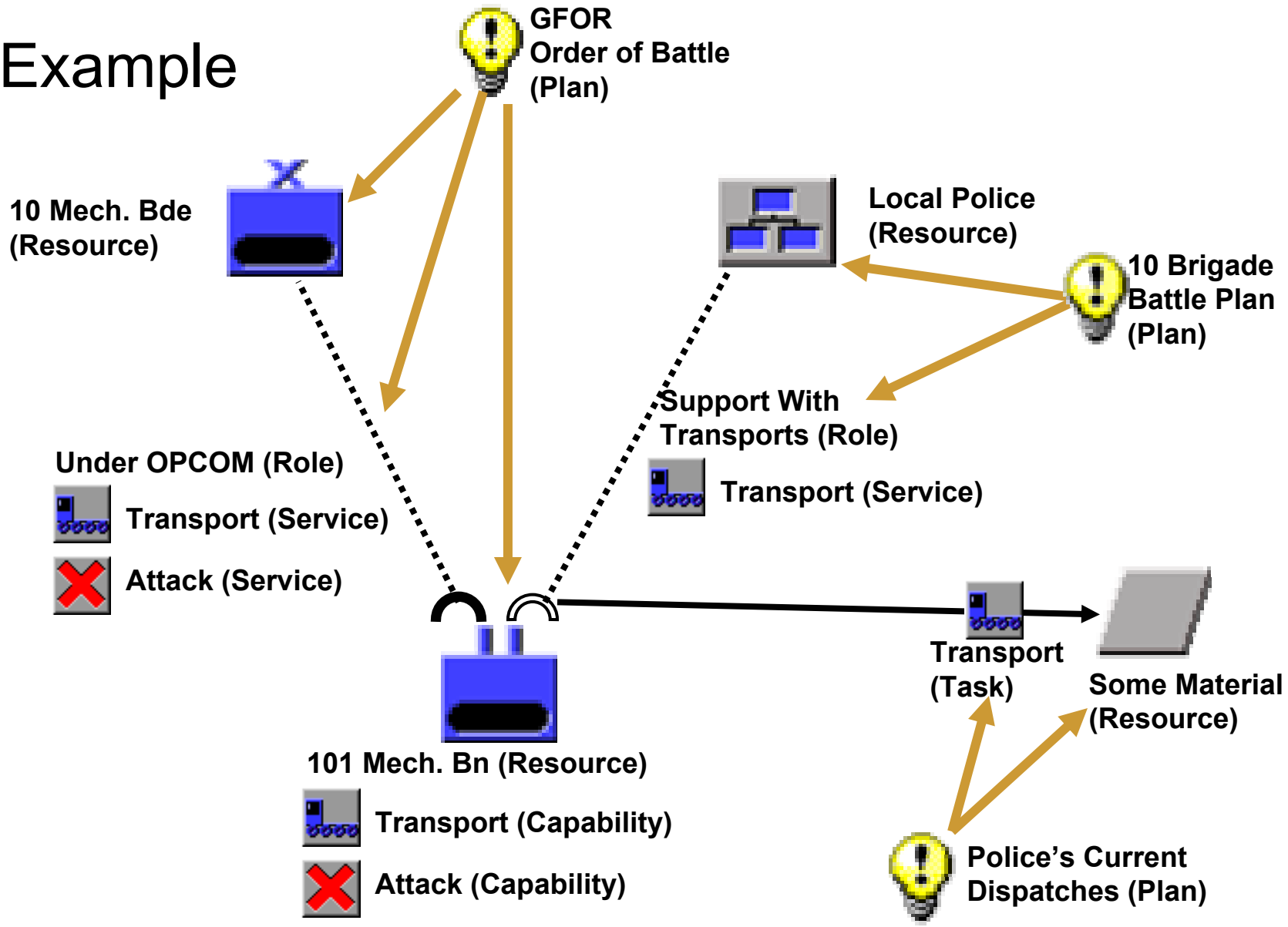
- The dynamic networked based organization of resources, tasks and plans
- What is known of friendly and other forces
- From highest to lowest decision levels

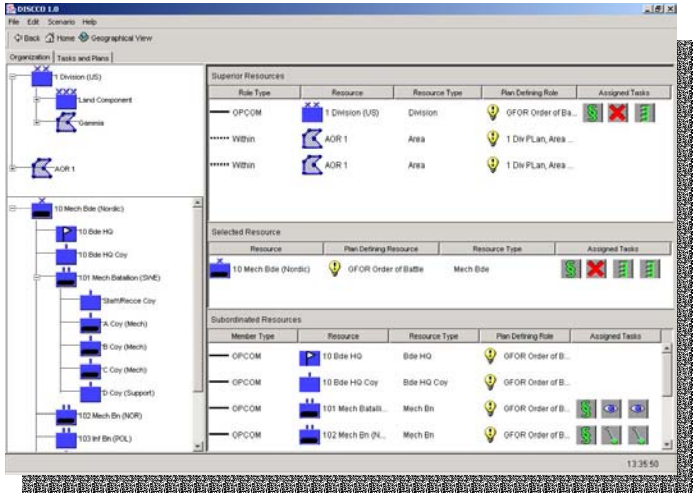


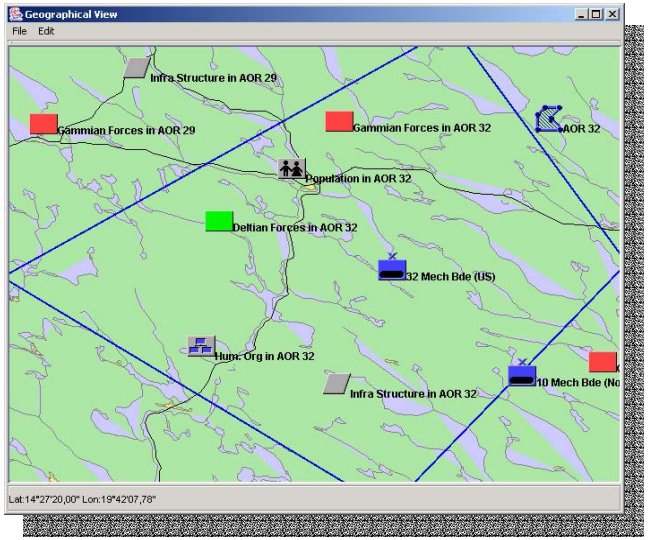
An Example


10 Mech. Bde
(Resource)
Local Police
(Resource)
Support With
Transports (Role)
Transport (Service)
Under OPCOM (Role)
Transport (Service)
Attack (Service)
Transport
(Task)
Some Material
(Resource)
101 Mech. Bn (Resource)
Transport (Capability)
Attack (Capability)

An Example

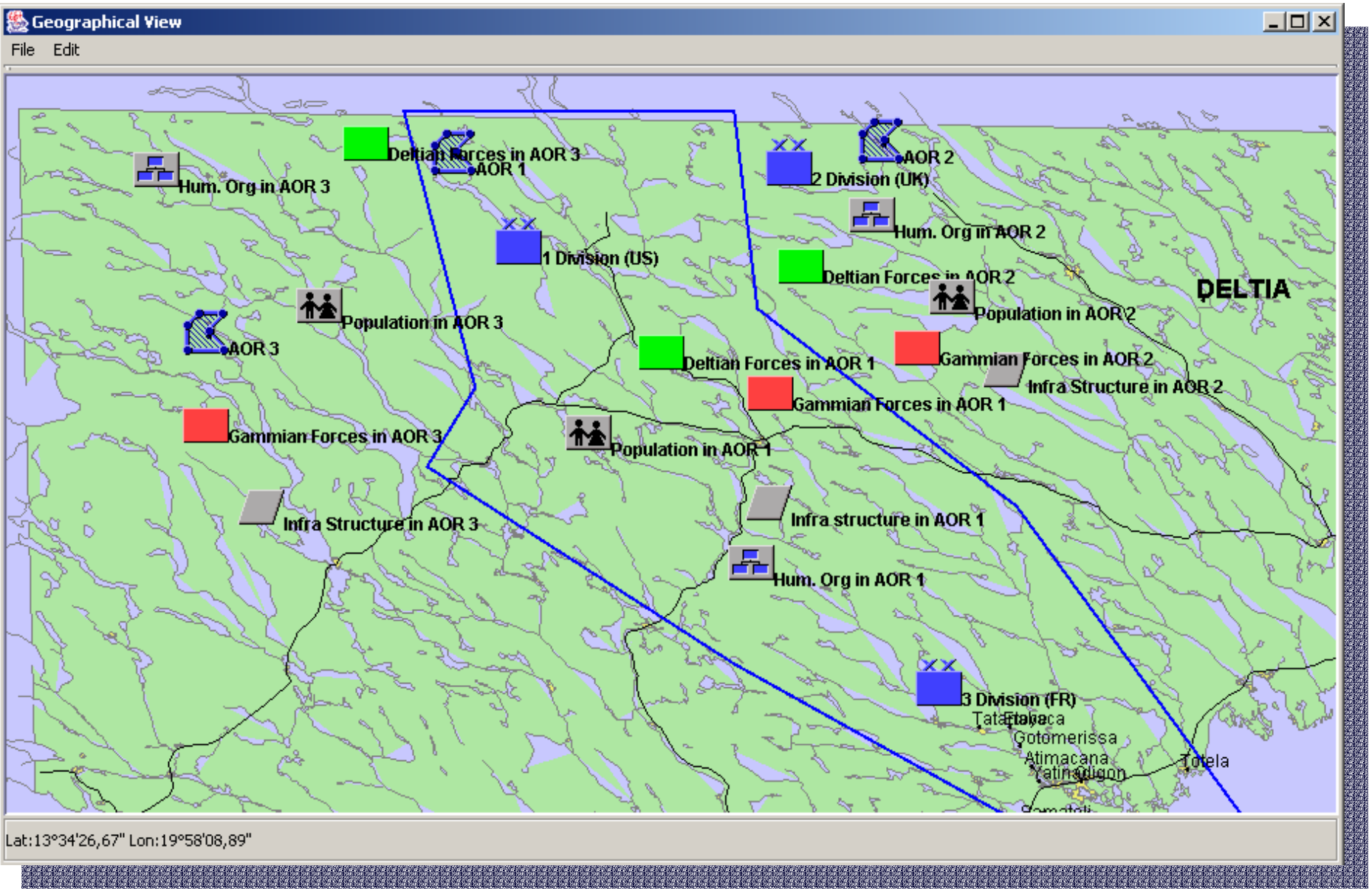

GFOR
Order of Battle
(Plan)
10 Mech. Bde
(Resource)
Local Police
(Resource)
10 Brigade
Battle Plan
(Plan)
Support With
Transports (Role)
Transport (Service)
Under OPCOM (Role)
Transport (Service)
Attack (Service)
Transport
(Task)
Some Material
(Resource)
101 Mech. Bn (Resource)
Transport (Capability)
Attack (Capability)
Police's Current
Dispatches (Plan)



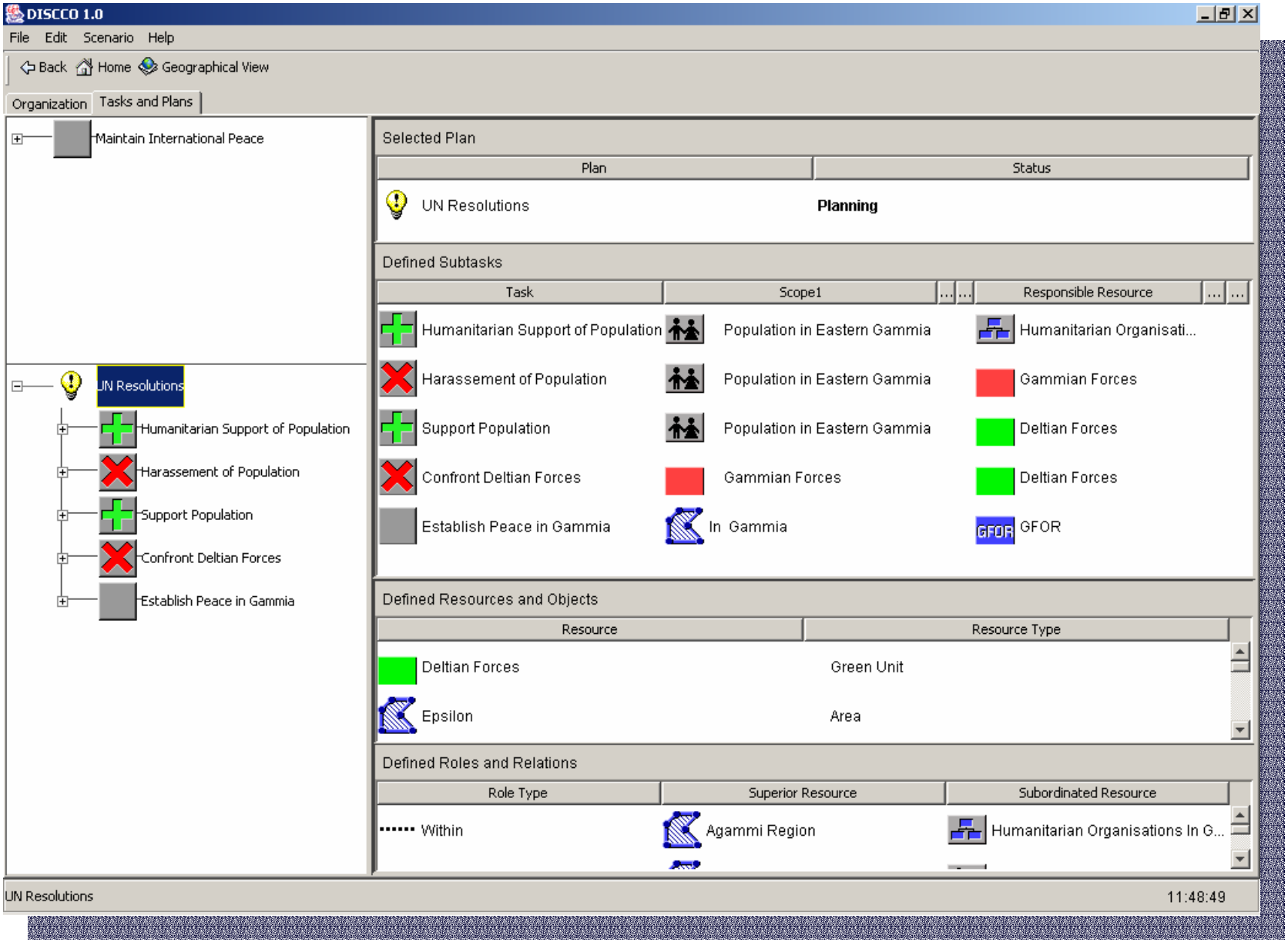


Command Support Tools

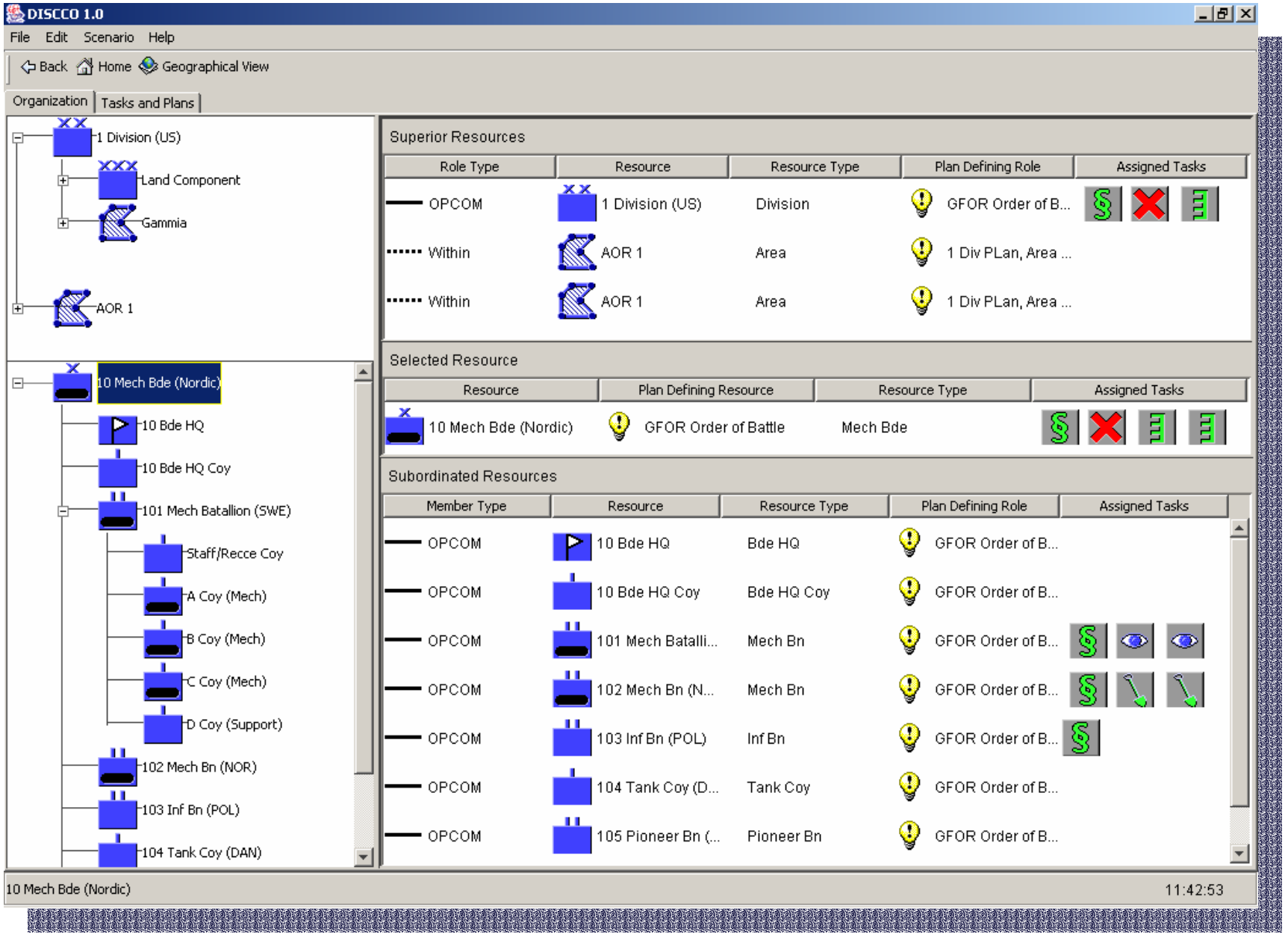
- Support for navigating and maintaining the common model of the situation
- Provide support to describe and visualize problems and solutions in different views
- Once a solution (= a plan) is described it could be the subject for evaluation, as well as the baseline for an execution order
- Integrates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



Example: A geographical view of the situation

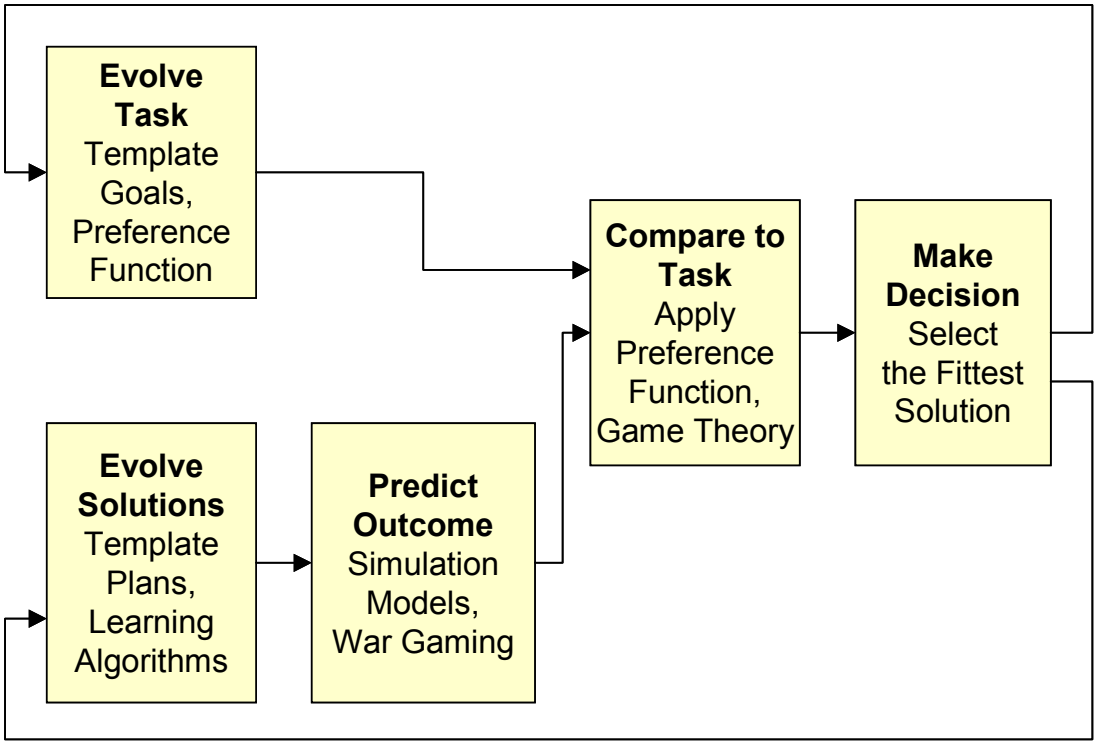


Example: A tree view of the situation

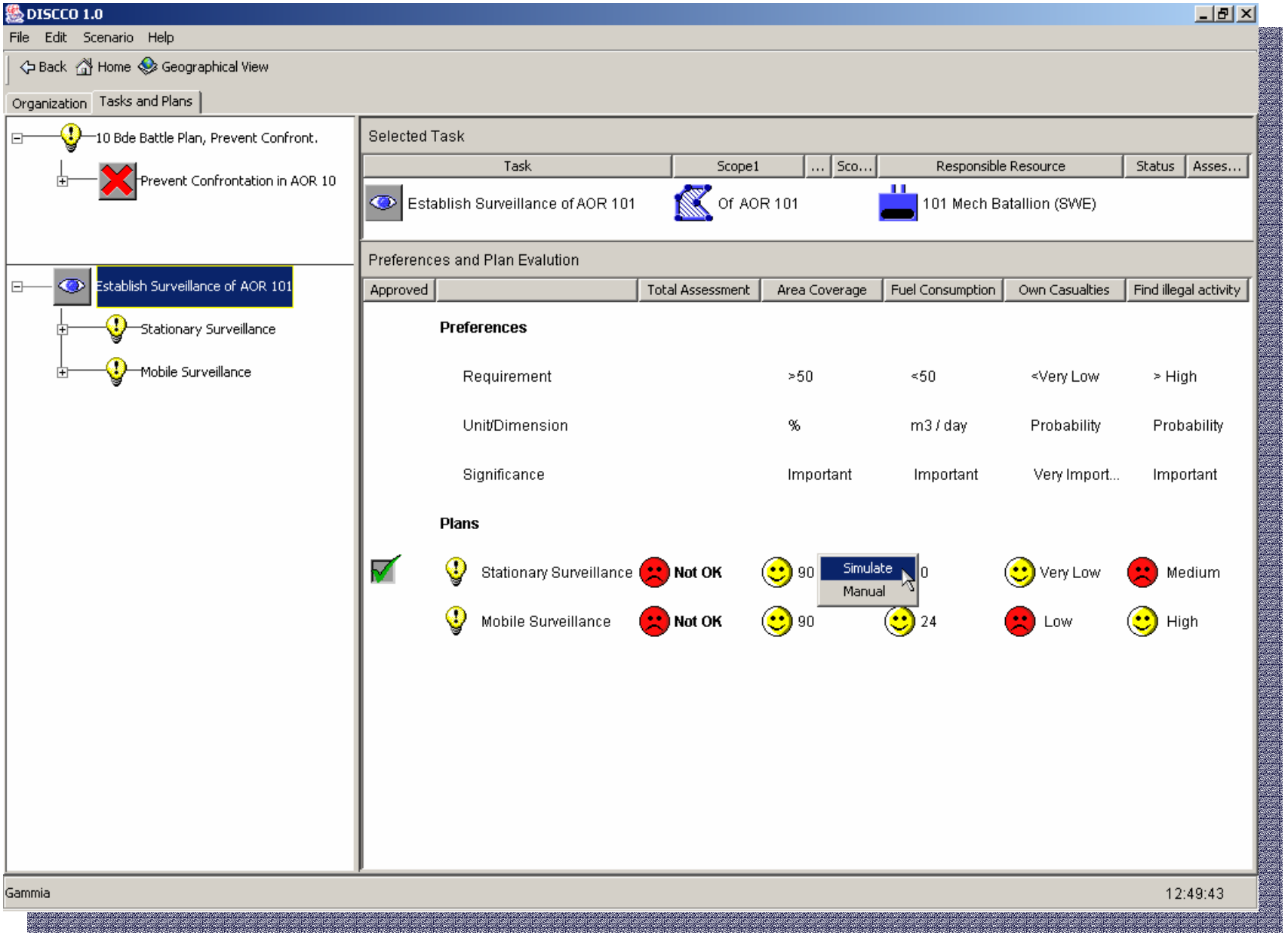


Example: A tree view of the organization

Decision Support Tools



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



Example: Evaluation of two potential plans

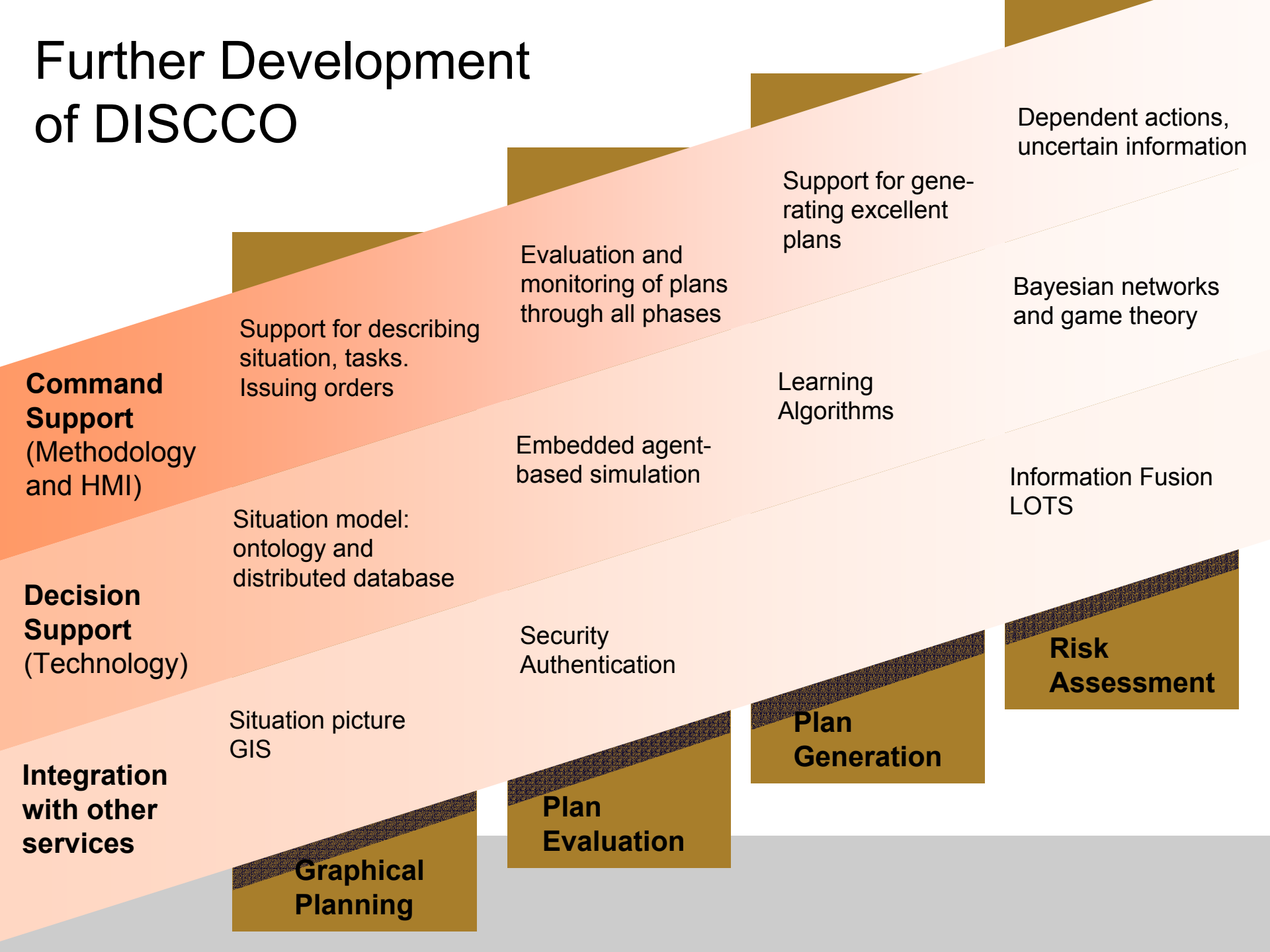
Outline

KTH Numerisk analys och datalogi

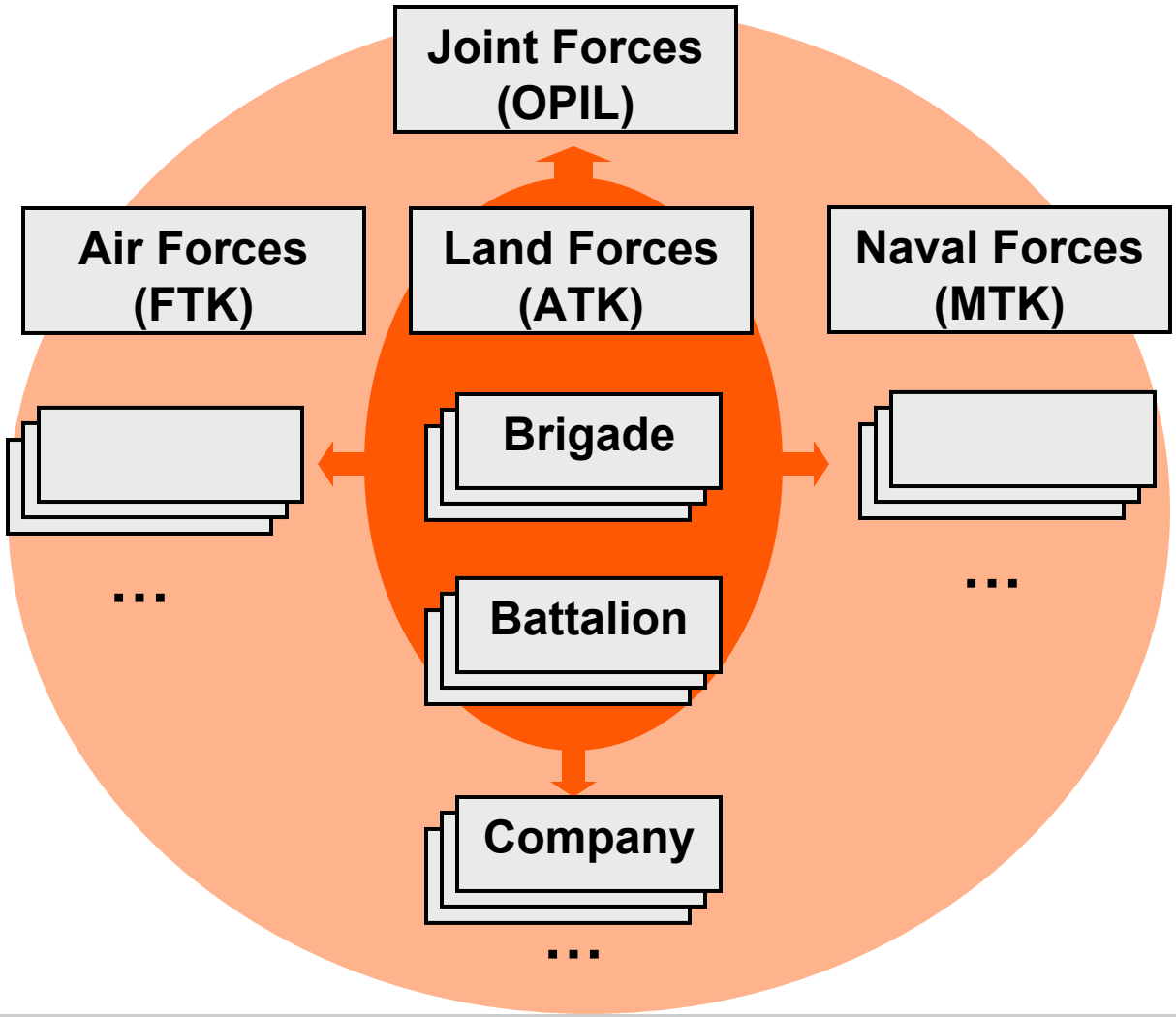
SAAB

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

Further Development of DISCCO



The Extending Scope



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

Outline

KTH Numerisk analys och datalogi

SAAB

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

Thank you!