

AT2AI-4

From Agent Theory to Agent Implementation

VIE-CDS

**Improving upon the TÆMS/DTC framework
in the context of coordinated scheduling**

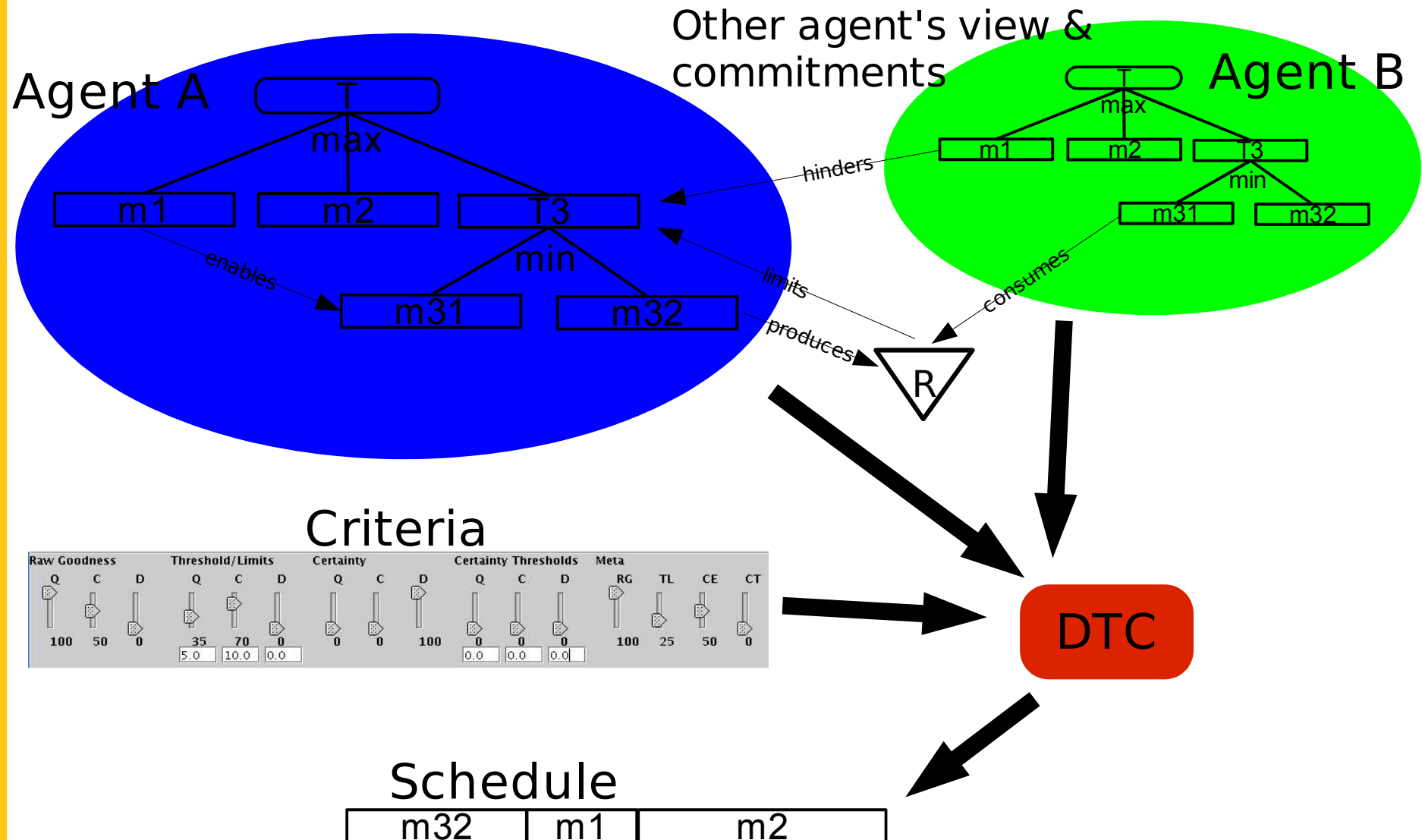
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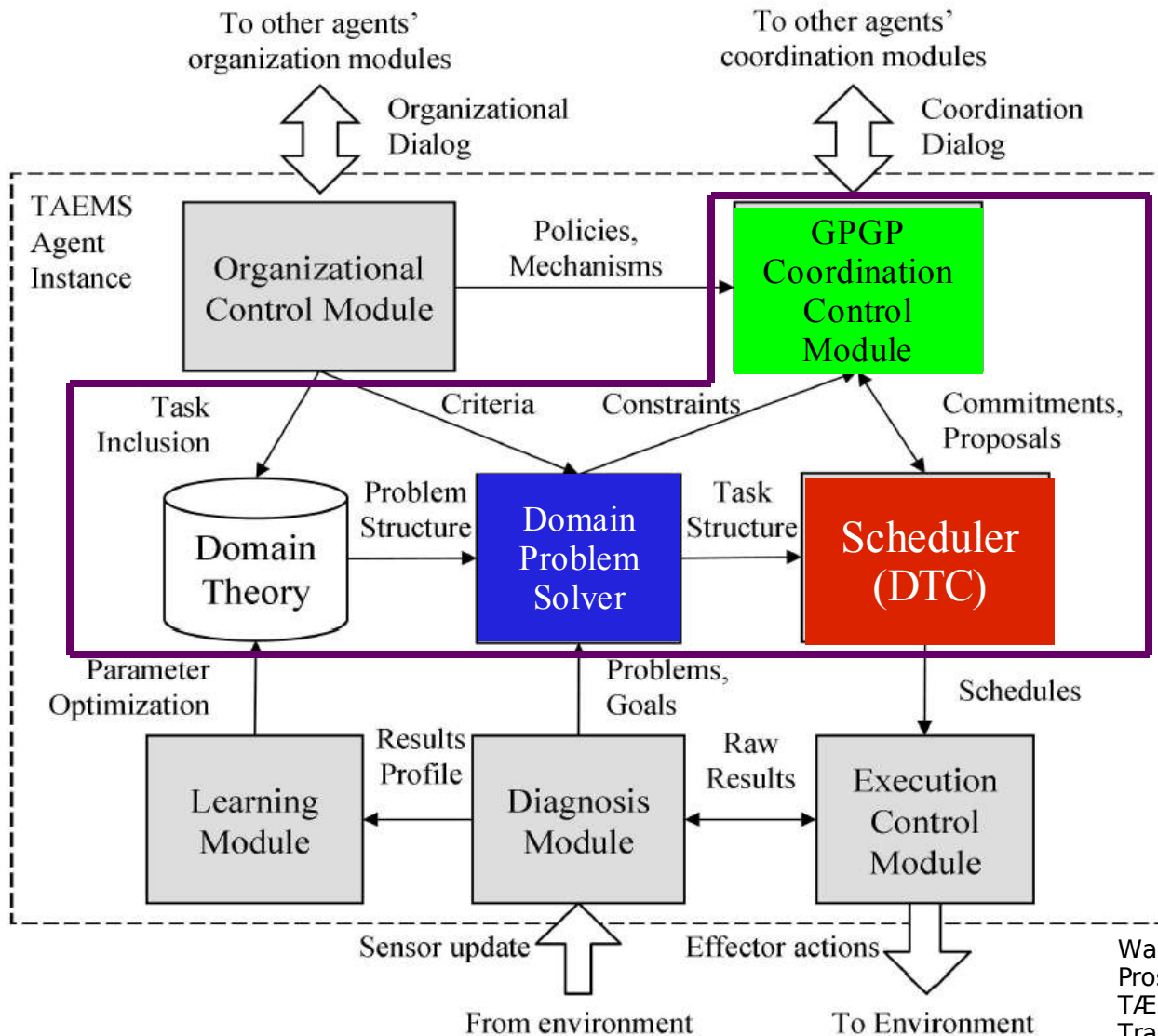
Outline

- Introduction
 - TÆMS/DTC example
- TÆMS/DTC details
 - TÆMS-based agent architectures
 - Key features & TÆMS elements
 - DTC base algorithm
- Issues
 - Implementation, theory, design
- VIE-CDS
 - Requirements
 - Architecture
 - Future work
- Related work
 - Coordination based upon activity theory
 - Subjective vs. objective coordination
- Conclusion & Discussion

A short TÆEMS/DTC example



TÆMS-based agent architectures



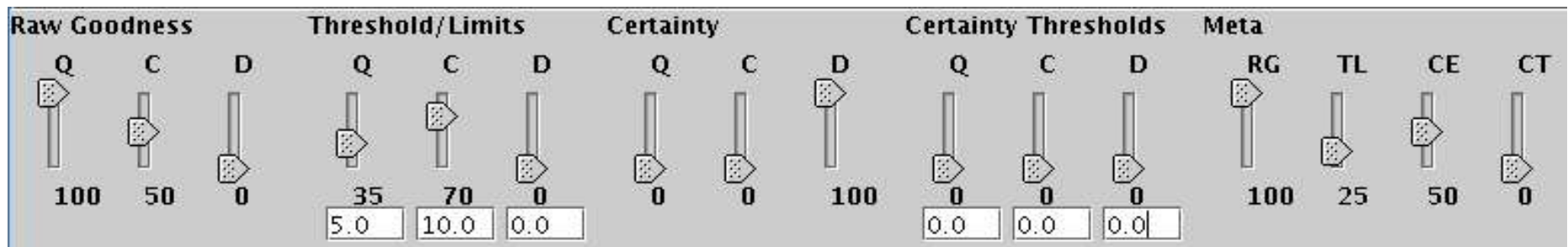
Wagner et al., The Struggle for Reuse: Pros and Cons of Generalization in TÆMS and Its Impact on Technology Transfer, 2003.

TÆMS key features & elements

- Hierarchical task structures:
Tasks, Methods, QAFs
- Resources
- Interrelationships (non-local effects)
- Quantitative and uncertain descriptions
- Commitments
- Single & multi-agent views
- Domain-independence
- Plain-text, lisp-like notation

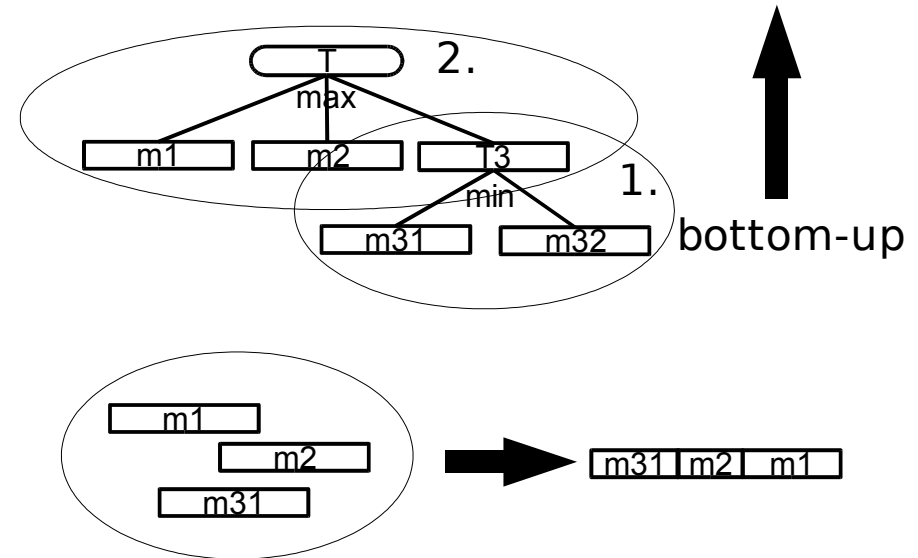
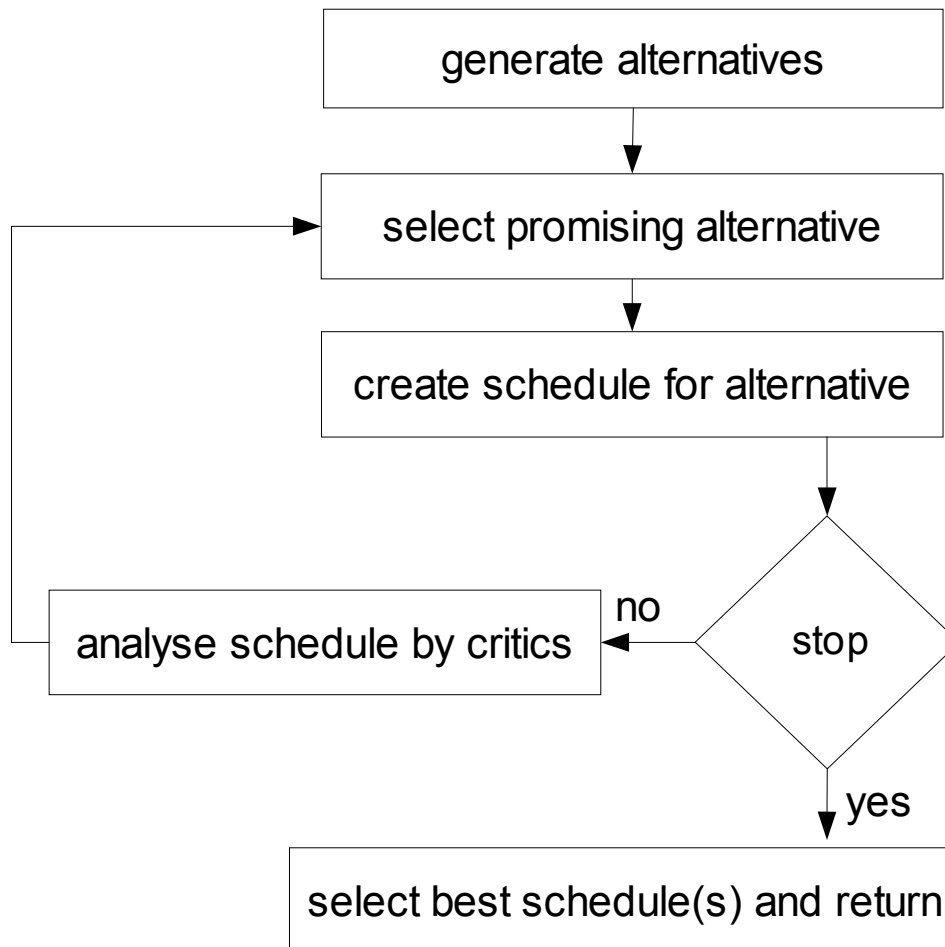
DTC key features

- Planning & scheduling of TÆMS task structures
- Criteria (slider metaphor)



- Satisficing approach
- Soft-real time, anytime characteristics

DTC base algorithm



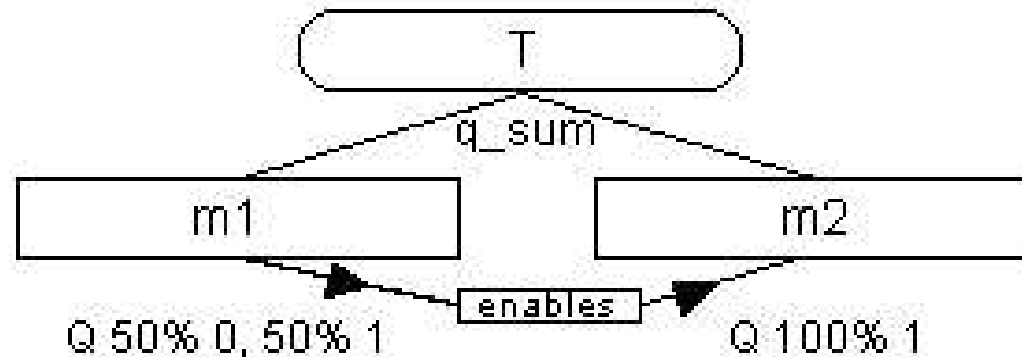
Implementation issues

- Wrong source factor scaling
- „Over“-facilitation
- Negative duration, cost and quality
- Distribution compaction inaccuracy and errors
- Inconsistent results on different platforms
- Lack of documentation of implemented semantics

Theory issues

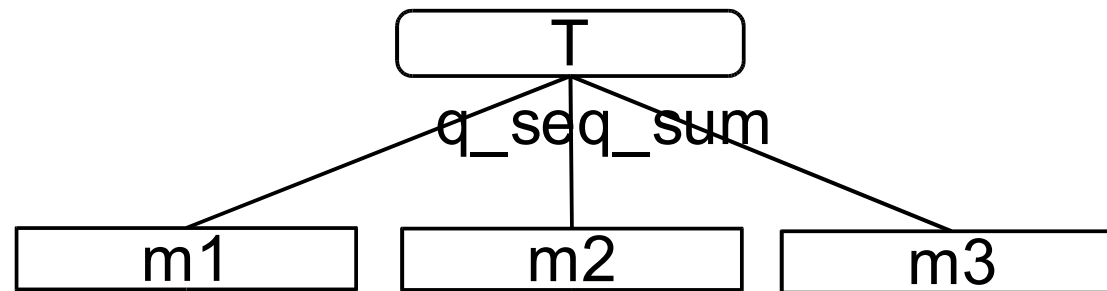
- Ambiguities & Inconsistencies
 - Incompatible resource models
 - Undefined quality accumulation time and time of IR activation
 - Inconsistent source factor scaling for IRs
 - No clear IR to task semantics
- Approximations
 - Too simple for specific problems/domains
 - Inconsistent approximations

Theory issue: Independence assumption



- Actual quality of m2 due to IR: Q 50% 0, 50% 1
- Local view of T on m1 and m2 ignoring the interrelationship: Q 25% 0, 50% 1, 25% 2
- Correct calculation requires dependency graphs:
Q 50% 0, 50% 2
- Dependencies not restricted to task-subtask structure but also time, qualities, ...

Theory issue: QAF aspects



QAFs combine three aspects:

- Quality accumulation
- Ordering restrictions on subtasks
- Time of quality accumulation

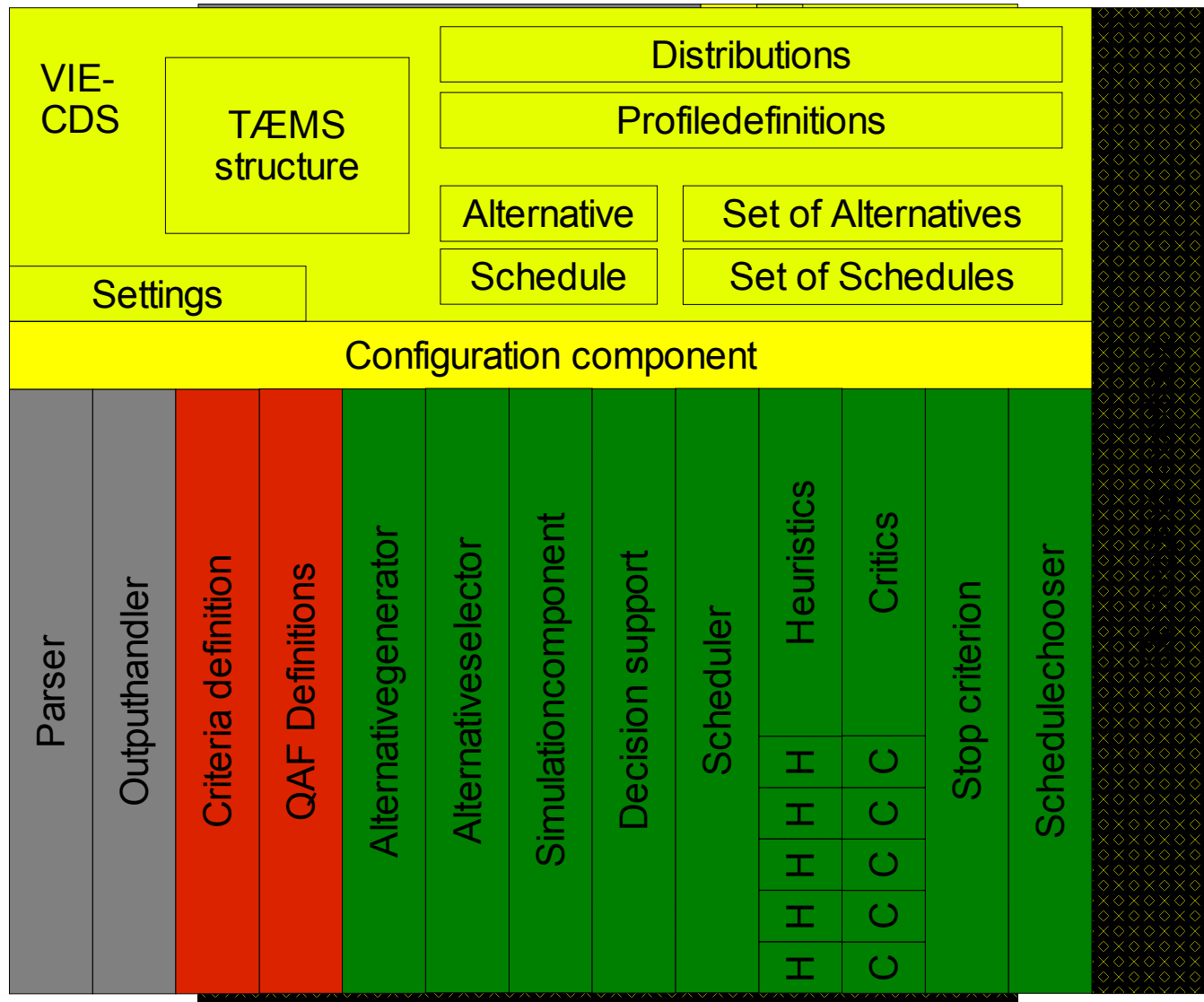
Design issues

- Software design: monolithic, grown C/C++ code
- No extensibility
- Lack of meta-language

VIE-CDS requirements

- Support for complex QAFs
- Consistent IR effects
- Variable complexity of resource simulation
- Flexible profile definition
- User-defined criteria
- Simplification of TÆMS object descriptions
- Modular, extensible design
- Dynamic configuration
- Debugging support

VIE-CDS architecture



Future work

- Integration, test and evaluation in agent middleware & challenging domains
- Improvements based on external feedback
- X-TÆMS
- Domain-dependent contextual decisions
- Complex QAF modelling support
- Negotiation interface & execution support
- Track TÆMS development at UMASS

➡ Construction kit for a criteria-driven scheduler and scheduler service

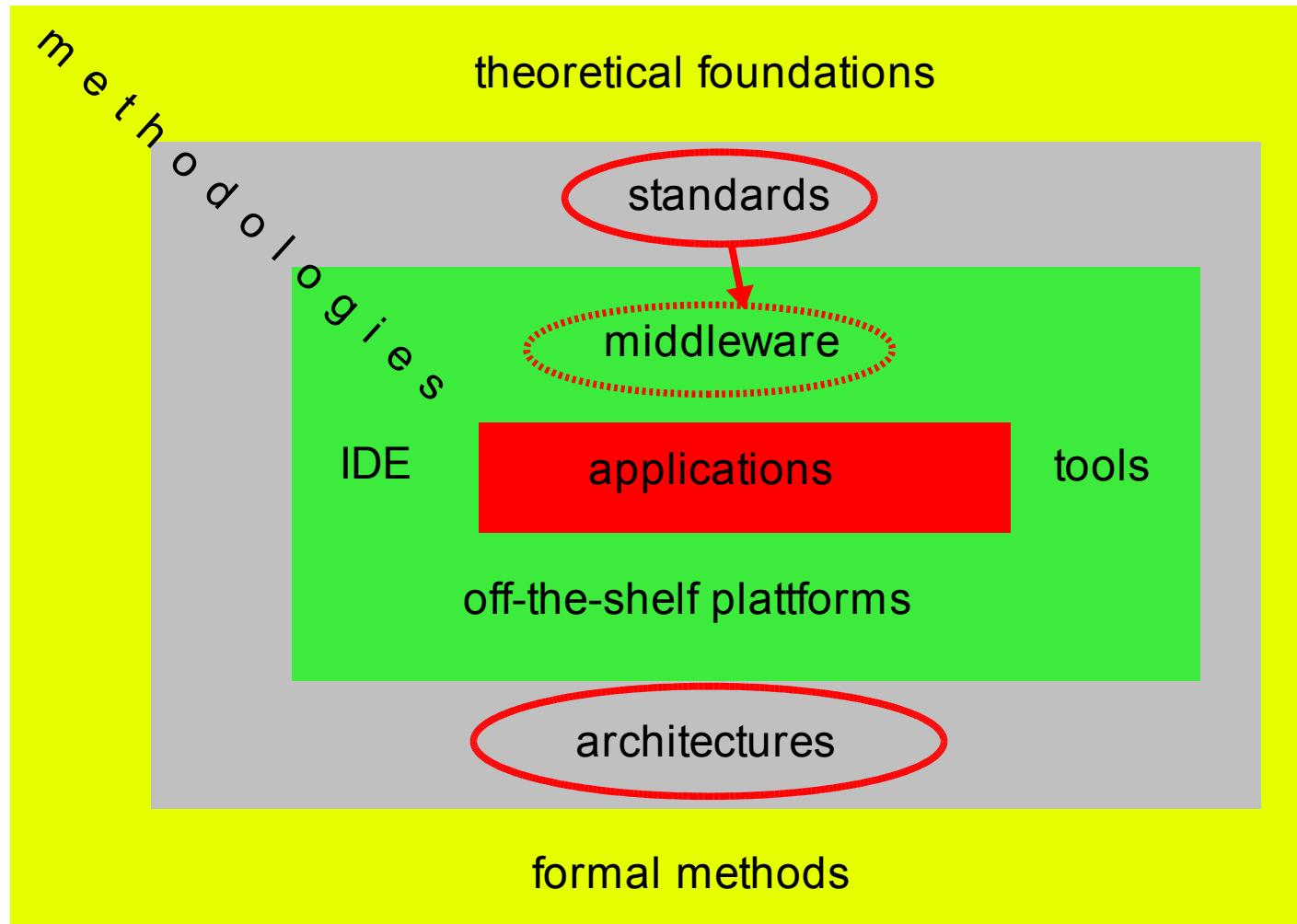
Coordination and activity theory

- Coordination artefact: Task structures, organisational knowledge, (partial) schedules
- Co-construction: Construction of a (partial) global view, analysis of inter-agent dependencies
- Co-operation: Forming of commitments, refining of task structures, results in coordinated schedule
- Co-ordination: Execute and monitor schedule, trigger rescheduling

Subjective vs. objective coordination

- TÆMS/DTC appears to be typical for subjective coordination, but ...
- ... a scheduler-as-a-service can provide schedules for agents integrating overall system information unknown to (or unrecognised by) a single agent, e.g. by
 - reducing schedule effort when rescheduling happens too often
- Scheduler-as-a-service can be designed for individual agents, agent task groups (teams), system-wide (general monitoring service)

TÆMS/DTC in the context of AT2AI



Summary

- Semantic disambiguation
- Towards a meta-language of TÆMS with complex QAFs and dynamic profile and criteria definitions
- Construction-kit for criteria-driven scheduling (by extensible plug-in architecture)
- Rethinking TÆMS/DTC in context of recent work on coordination

Get VIE-CDS!!!

Looking forward to your experience reports:
Thank you for your kind attention!