GPGP and TÆMS

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Abstract

Chapter 9
Overview

- **TÆMS**: language for representing task hierarchy.
- **GPGP**: scheduling and negotiation algorithm.
- Used by Lesser and students for decades on different problems.

GPGP and TÆMS

TÆMS

and

G₀

G₁

G₂

G₂₁

G₂₂

G₂₃

G₃

G₃₁

or

and

data

and

data

and

resource

enables

enables

quality

(cost: (1,0))

duration: (1,2)

q: (.1,0)(.9,5)

c: (1,10)

d: (.4,2)(.6,5)
data₁, data₂, resource₁, resource₂
GPGP and TÆMS

TÆMS

and

enables

and

or

data1

data2
resource1
resource2

enables

cost: (1, 0)
duration: (1, 2)
q: (.1, 0)(.9, 5)
c: (1, 10)
d: (.4, 2)(.6, 5)
GPGP and TÆMS

G₀

G₁

G₂

G₃

quality: (.2,0)(.8,8)
cost: (1,0)
duration: (1,2)

G₂₁

G₂₂

G₂₃

G₃₁

data₁

data₂

resource₁

resource₂

enables

and

or

q: (.1,0)(.9,5)
c: (1,10)
d: (.4,2)(.6,5)
Quality Accumulation Functions

$q_{\text{min}}$ minimum quality of all subtasks
$q_{\text{max}}$ maximum quality of all subtasks
$q_{\text{sum}}$ aggregate quality of all subtasks
$q_{\text{last}}$ quality of most recently completed subtask
$q_{\text{sum\_all}}$ as with $q_{\text{sum}}$ but all subtasks must be completed
$q_{\text{seq\_min}}$ as with $q_{\text{min}}$ but all subtasks must be completed in order
$q_{\text{seq\_max}}$ as with $q_{\text{max}}$ but all subtasks must be completed in order
GPGP and TÆMS

GPGP

Agent Architecture

Design-to-Criteria Scheduler

TÆMS Structure and Goal Criteria

Non-Local Commitment Database

GPGP Coordination

Task Assessor

Schedule

Execution
GPGP and TÆMS

GPGP

Agent Architecture

**Design-to-Criteria Scheduler**

**Schedule**

**TÆMS Structure and Goal Criteria**

**Task Assessor**

**Execution**

**Non-Local Commitment Database**

**GPGP Coordination**

Uses:
- State Updates
- Reschedule Requests
- Coordination Msgs.

Uses:
- Uses
- Produces
GPGP and TÆMS

GPGP

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Uses TÆMS Structure and Goal Criteria

Uses GPGP Coordination


Produces Reschedule Requests

Uses State Updates

Uses Reschedule Requests

Uses Coordination Msgs.

Execution

Task Assessor
**GPGP and TÆMS**

**GPGP**

**Agent Architecture**

**Design-to-Criteria Scheduler**
- Produces Schedule
- Uses Execution
- Uses TÆMS Structure and Goal Criteria
- Uses Non-Local Commitment Database

**TÆMS Structure and Goal Criteria**
- Uses GPGP Coordination

**Task Assessor**
GPGP and TÆMS

GPGP

Agent Architecture

Design-to-Criteria Scheduler

Produces

Uses

Schedule

Uses

Execution

Produces

Uses

TÆMS Structure

Uses

and Goal Criteria

Uses

Non-Local Commitment Database

Uses

Task Assessor

Uses

Action/Sense Domain Info. Msgs.

Uses

GPGP Coordination
GPGP and TÆMS

GPGP

Agent Architecture

**Design-to-Criteria Scheduler**

- Produces Schedule
- Uses Execution

- Uses TÆMS Structure and Goal Criteria
- Uses Reschedule Requests
- Updates State
- Uses Non-Local Commitment Database

- Uses Task Assessor

**TÆMS Structure and Goal Criteria**

**GPGP Coordination**
GPGP and TÆMS

GPGP

Agent Architecture

Design-to-Criteria Scheduler

Produce Schedule

Uses Execution

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Uses Task Assessor


Uses Updates

Uses Reschedule Requests

Uses Updates

Uses Schedule

Uses Schedule
GPGP and TÆMS

GPGP

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Uses

Reschedule Requests

Updates

Action/Sense Domain Info. Msgs.

Updates

GPGP Coordination

Updates

Coordination Msgs
Coordination Relationships

\[ G_0^1 \]

\[ G_1^{1,2} \]

\[ G_2^2 \]
Coordination Relationships

Diagram showing relationships between different nodes labeled $G_0$, $G_1$, $G_2$, $G_3$, and $G_4$. The diagram illustrates coordination relationships such as $G_1^*$ connecting to $G_2^2$ and $G_3^1$.
Coordination Relationships

Diagram showing coordination relationships between groups $G_0$, $G_1$, $G_3$, $G_1$, $G_2$, and $G_4$.
Coordination Relationships

GPGP and TÆMS
GPGP
Coordination

Diagram showing coordination relationships between different groups labeled as $G_0^1$, $G_1^1$, $G_1^2$, $G_2^2$, $G_3^1$, and $G_4^2$.
Coordination Relationships

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GPGP

Coordination

Diagram:

- Nodes: $G_0^1$, $G_1^1$, $G_3^1$, $G_4^2$, $G_1^2$, $G_2^2$, $G_0^1$
- Edges: CR connections between nodes
A non-local effect in the original graph now starts in one graph and ends in another, or

a non-local effect or a subtask relationship has one end in one subgraph but the other end in both subgraphs.
Commitment Messages: from 1 to 2

- Commit \((\text{Do}(G_1))\)
- Commit \((\text{Do}(G_3))\)
Uses search and heuristics. Complex.

Needs to create schedules for the coordination module: what if? scenarios.

Must find best schedule if many are possible.
Key Concepts

- Coordination as distributed optimization—quantitative view of coordination.
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- Multiple goals of varying worth. Different deadlines and alternative ways of being solved.
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- Coordination as distributed optimization—quantitative view of coordination.
- Family of coordination mechanism for situation-specific control.
- Domain-independent representation of agent tasks, using TÆMS.
- Quantitative coordination relationships among tasks.
- Multiple goals of varying worth. Different deadlines and alternative ways of being solved.
- Modular interface between local agent control (planning and scheduling) and coordination mechanisms.