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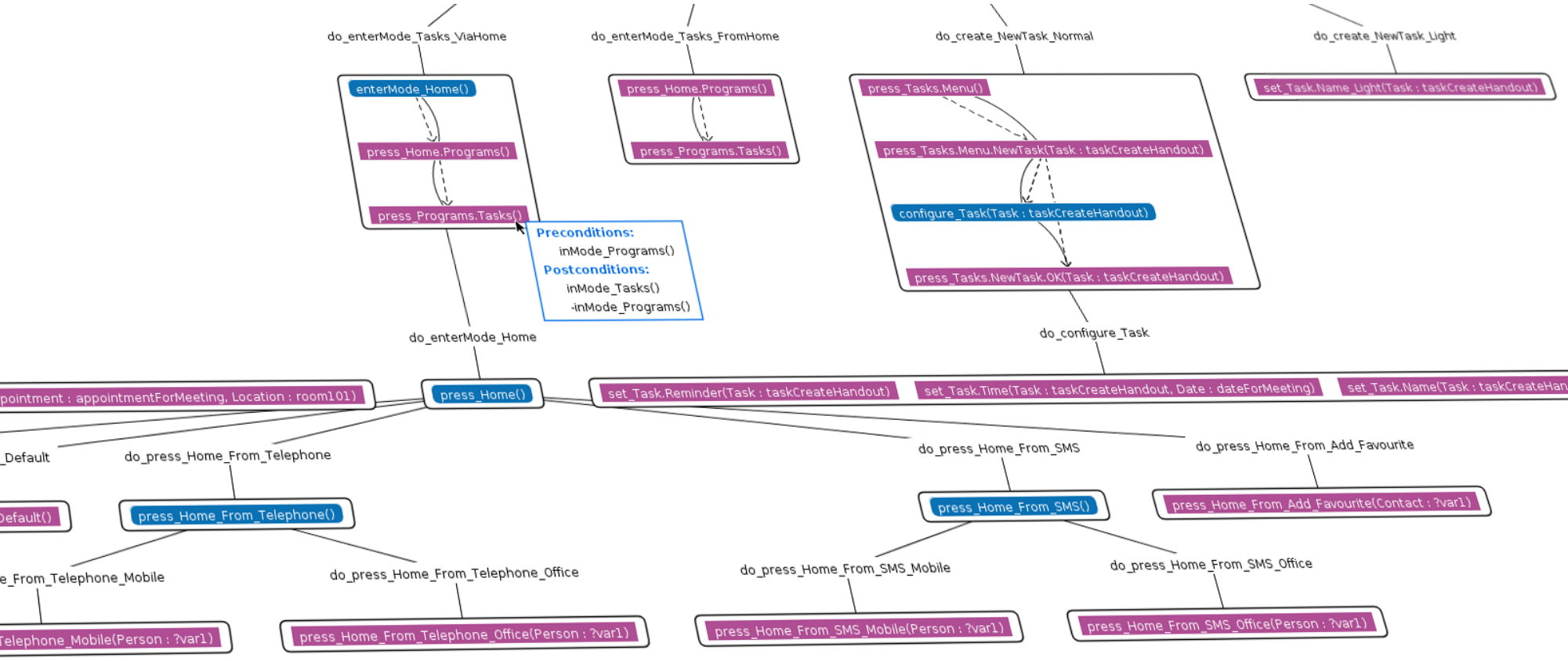

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November 8, 2012

Visualization of Hierarchical Domain Models

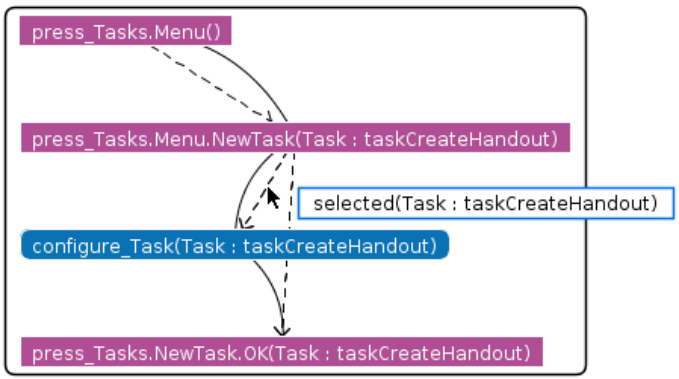
Outline

- Hybrid Planning
- Motivation
- Overview
- Task Decomposition Tree
- Live Demo
- Summary

Hybrid Planning

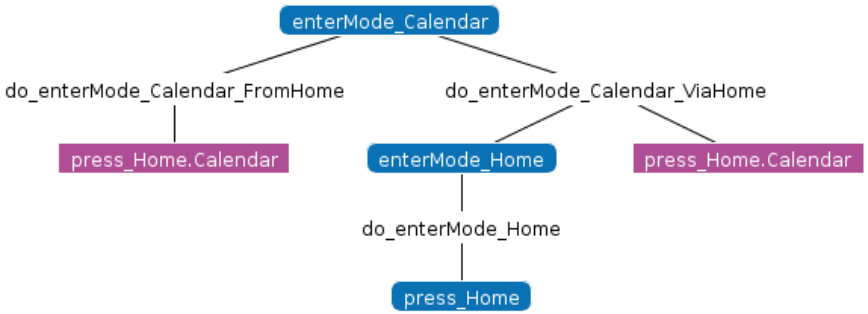
POCL-Planning

Causal reasoning



Hierarchical Planning

Abstraction



- Powerful technology for solving complex real world problems
- Suitable for humans

Motivation

What do we mean by visualization?

- Display domain graphically
- Show all necessary information
  - Tasks
  - Hierarchy (Decomposition methods)
  - Planstructure
  - Variables and constants

Motivation

Why do we need visualization?

- Intuitive
- Automatic generation (for papers, articles, presentations, etc.)

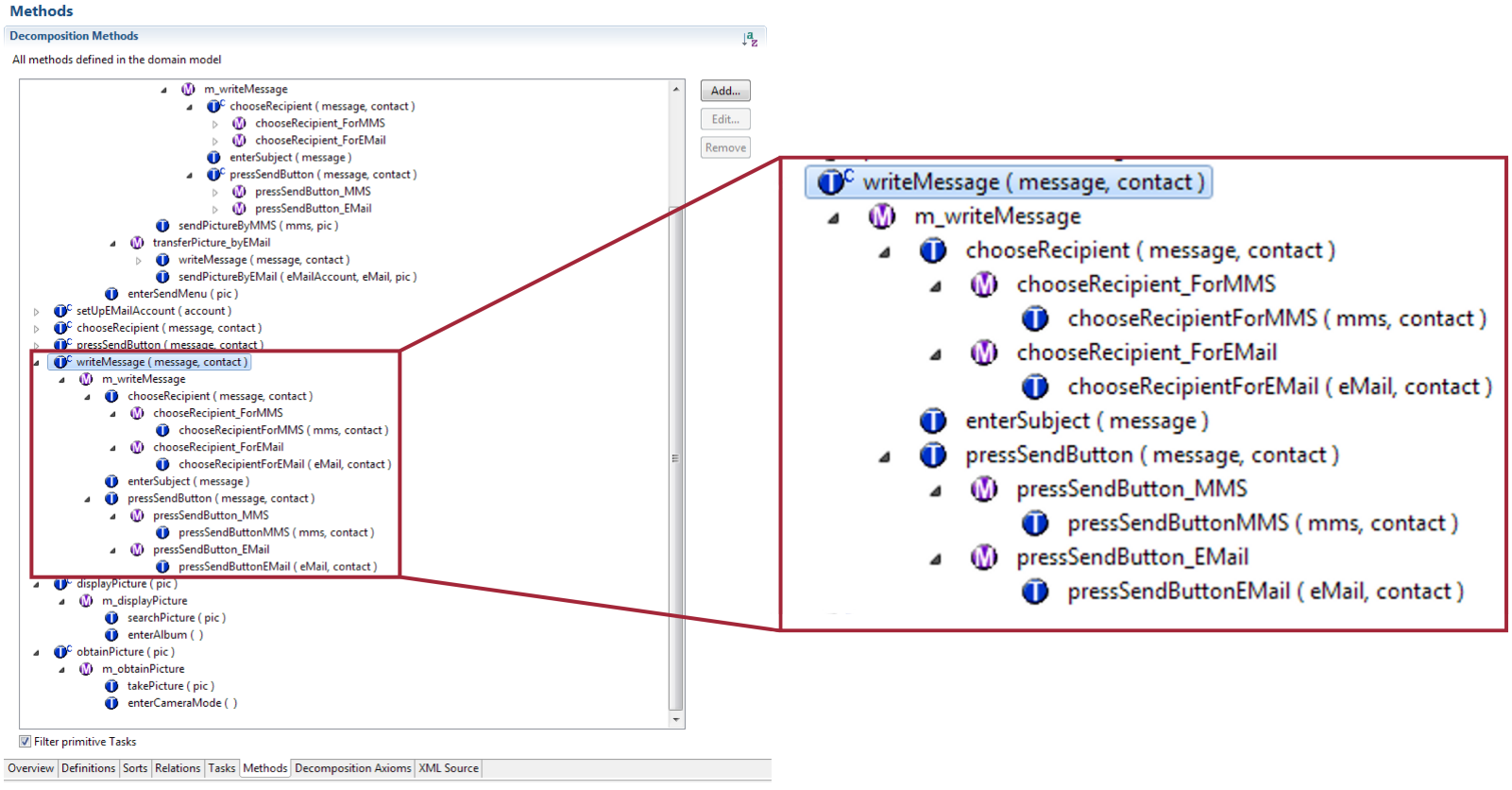
Motivation

PANDA-Editor:

- Powerful tool to create domains
- Boosts efficiency
- Lists
  - Relations
  - Tasks
  - Decomposition methods
  - etc . . .
- Can be “abused” to inspect domain

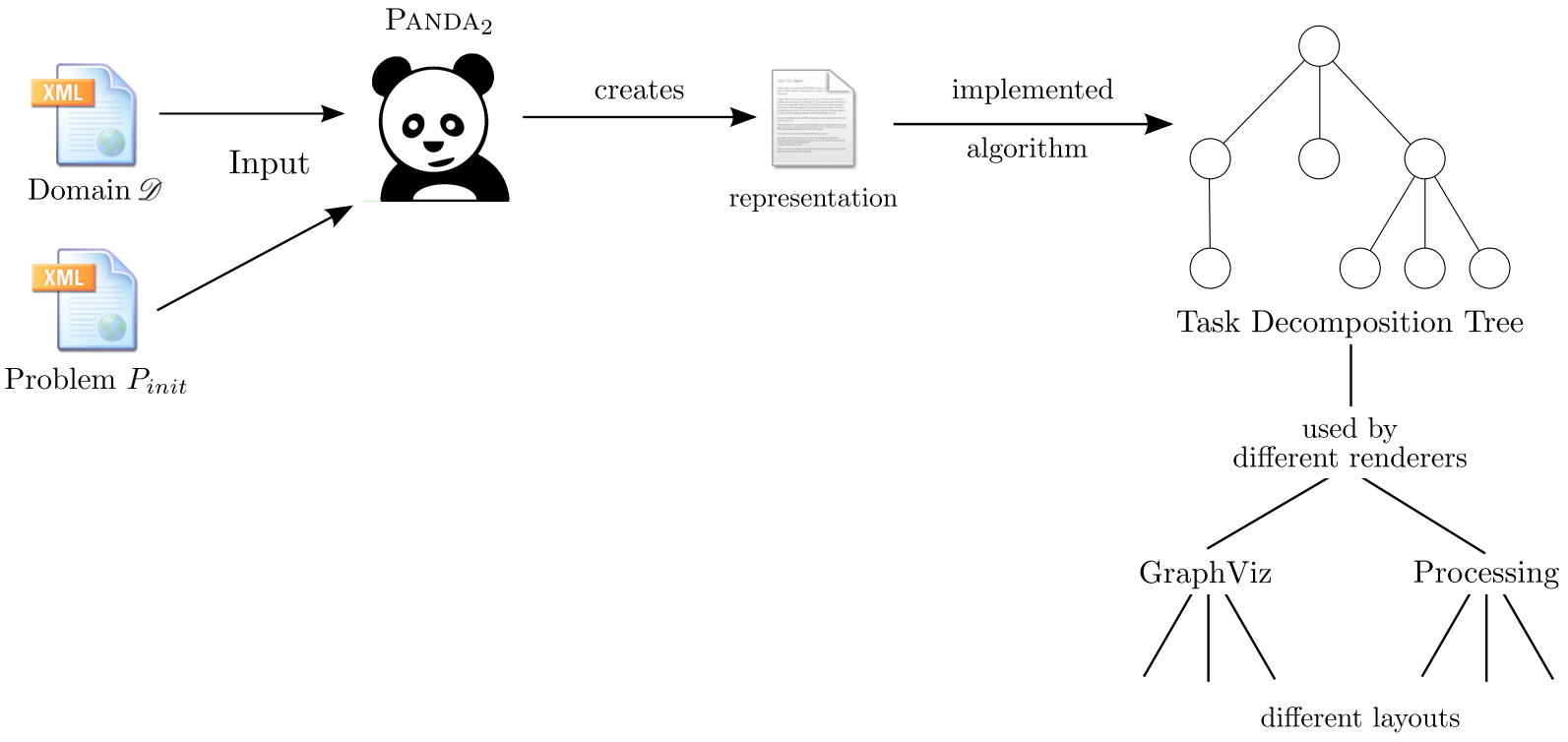
$\Rightarrow$ We need a better solution!

Motivation



Screenshot of PANDA Editor

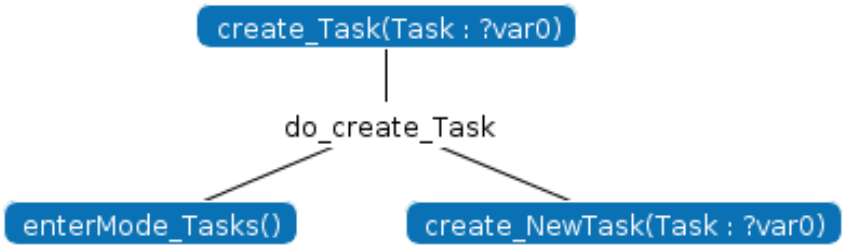
Overview


PANDA2
XML
Domain $\mathscr{D}$
Input
XML
Problem P_{init}
creates
representation
implemented
algorithm
Task Decomposition Tree
used by
different renderers
GraphViz
Processing
different layouts

Task Decomposition Tree

Datastructure for visualization

- More than a 1:1 mapping of domain



Task Schema in domain

- Display every possible decomposition of a task
- Has to be calculated

Task Decomposition Tree

Technical requirements:

- Fast calculation
- Compatibel with PANDA$_2$
  - Can later be grounded and pruned
  - This can improve search performance (see Appendix)
- Independent of used renderer

Task Decomposition Tree

Visual requirements:

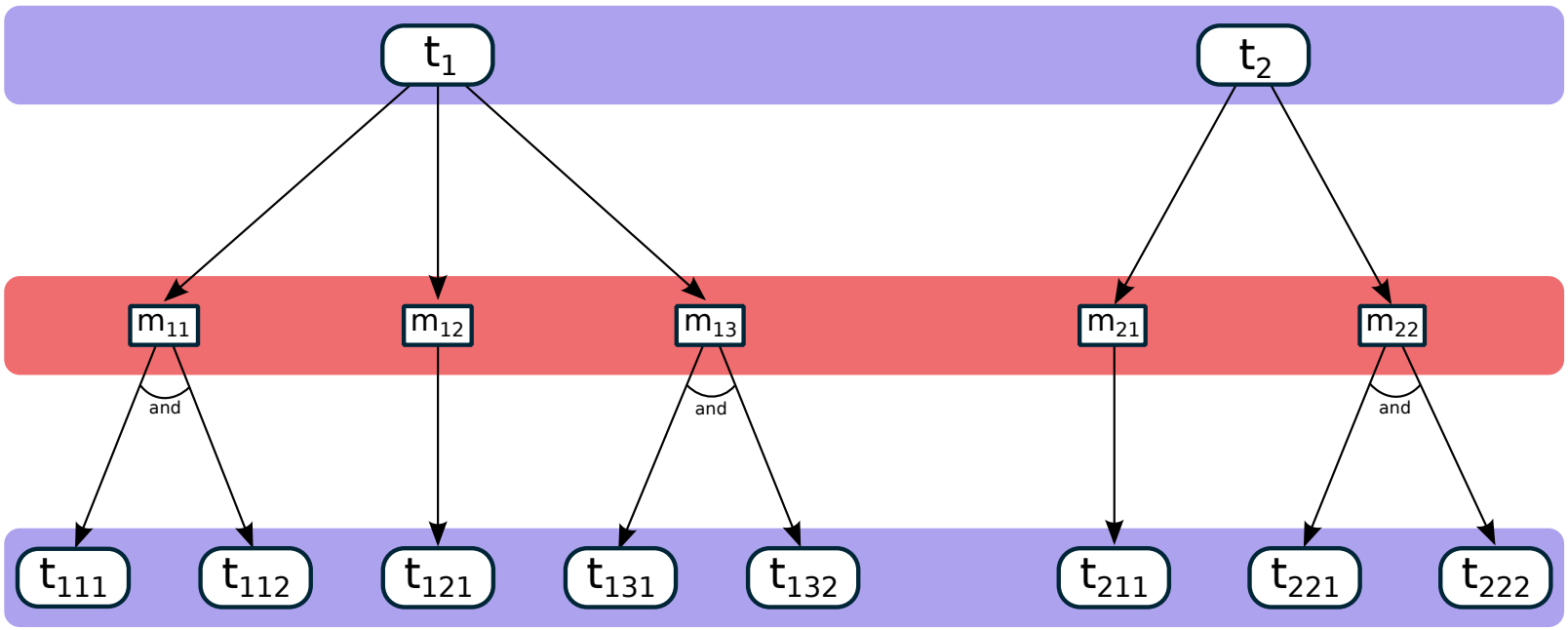
- Display only domain
- Display domain with given problem
- Different layouts
- Plan structure (ordering constraints, causal links)
- Show variables and their domains

Task Decomposition Tree

Emerged data model:

- AND/OR-Tree (TDT, bipartite)
- Consisting of
  - Method nodes (representing a decomposition method)
  - Task nodes (representing a task)
- Relies on PANDA$_2$ data structures for variables, ordering constraints, causal links

Task Decomposition Tree



Structure of Task Decomposition Tree

Live demo

Live demo of the tool

Summary

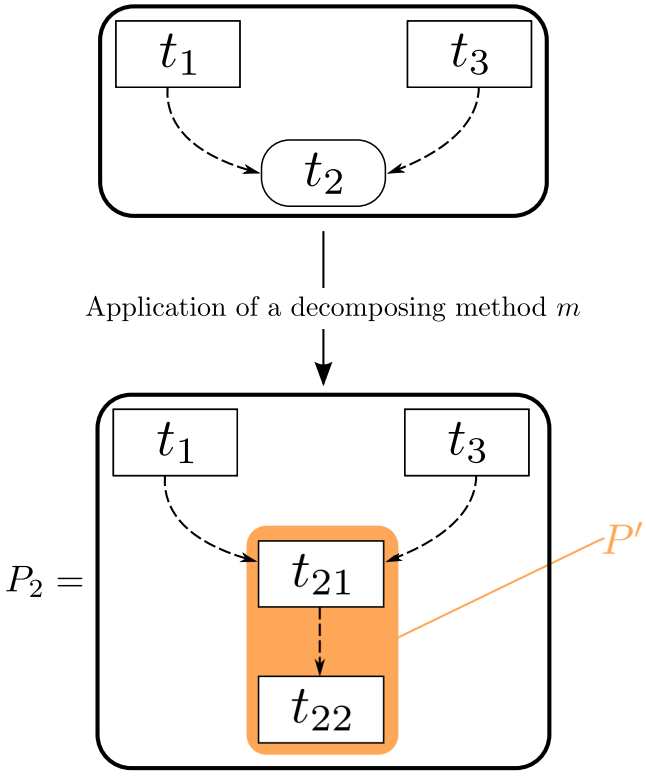
Accomplished Goals:

- Created datastructure which meets all requirements
- Implemented two renderers (GraphViz,Processing) with different layouts
- Incorporated the domain visualization into PANDA$_2$ Planvis Tool

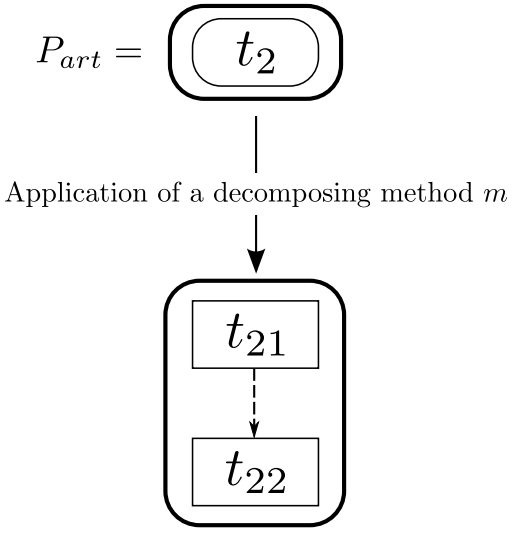
Thanks for your attention!

Appendix

PANDA$_2$ Algorithm vs. TDT-Algorithm



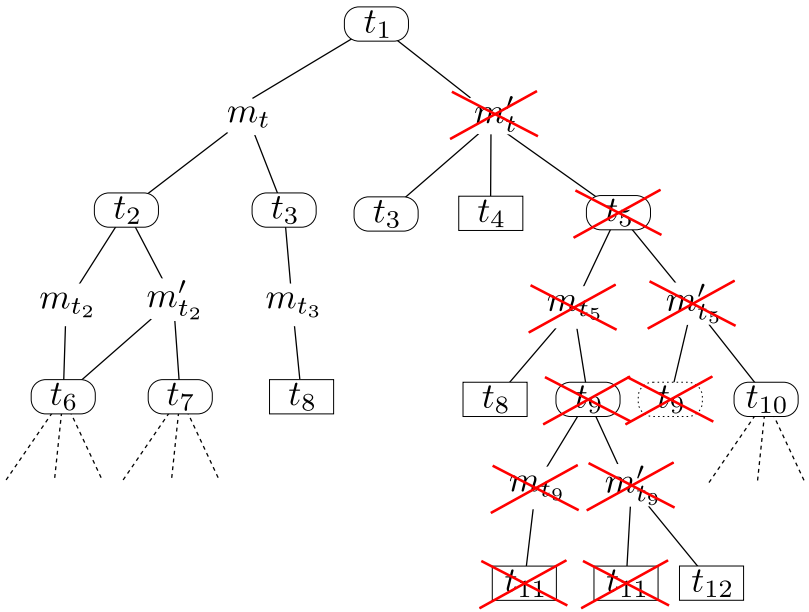
(a) Application of a decomposing method



(b) Decomposing an artificial, partial plan

Application of decompositions

Landmark-Technique



(a) Task Decomposition Graph

Task t	$M(t)$	$O(t)$
t_1	$\{t_2, t_3\}$	$\emptyset$
t_2	$\{t_6\}$	$\{\emptyset, \{t_7\}\}$
t_3	$\{t_8\}$	$\emptyset$

(b) Landmark table

An example of a landmark table