Entwicklung einer Methode zur graphischen Darstellung von Planerklärungen

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Hybrid Planning

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▶ Hybrid Planning combines POCL and HTN Planning

A hybrid plan \( P \)

\[
P = \langle TE, \prec, VC, CL \rangle
\]

\(TE\) is a set of tasks, \(\prec\) is a set of ordering constraints, \(VC\) is a set of variable constraints, \(CL\) is a set of causal links
Hybrid Planning - An example from the smartphone domain
Motivation

▸ A plan is presented to the user as a list or a graph
▸ User could question the plan
▸ Formal explanations are used to justify elements of a plan
▸ A formal explanation is hard to understand
Formal Explanation

The formal Explanation ends with a basic argument

- $\text{Necessary}(\text{initialTask})$
- $\text{Necessary}(\text{goalTask})$
- $\forall t : \text{Task}.[\text{Necessary}(t) \leftarrow \text{Addition}(t, \text{initialTaskNetwork})]$
Formal Explanation

(Basic) \( \forall t, t' : Task; \phi : Formula. [CausalRelation(t, \phi, t') \iff \\
\exists cl : CausalLink. [t = producer(cl) \land t' = \\\nconsumer(cl) \land \phi = condition(cl)]] \)

(Basic) \( \forall t, t' : Task; m : Method. [DecompositionRelation(t, m, t') \iff \\
\exists te : TaskExpansion. [Addition(t, te) \land Deletion(t', te) \land \\
Usage(m, te)]] \)
Formal Explanation

(C-Ch) \( \forall t : Task. [Necessary(t) \iff \exists t' : Task; \phi : Formula. [CausalRelation(t, \phi, t') \land Necessary(t')]] \)

(D-Ch) \( \forall t : Task. [Necessary(t) \iff \exists t' : Task; m : Method. [DecompositionRelation(t, m, t') \land Necessary(t')]] \)
Formal Explanation

(C-Prop) \( \forall t, t' : \text{Task}; \phi : \text{Formula}. [\text{CausalRelation}(t, \phi, t') \iff \exists t'' : \text{Task}. [\text{CausalRelation}(t, \phi, t'')] \land \exists m : \text{Method}. [\text{DecompositionRelation}(t'', m, t')] ] \)

(P-Prop) \( \forall t, t' : \text{Task}; \phi : \text{Formula}. [\text{CausalRelation}(t, \phi, t') \iff \exists t'' : \text{Task}. [\text{CausalRelation}(t'', \phi, t')] \land \exists m : \text{Method}. [\text{DecompositionRelation}(t'', m, t')] ] \)
Visualization

- Presentation integrated into a plan or separated
- Animated or static
Visualization - Example of a formal explanation

1. Necessary(press_newAppointment)
2. CausalRelation(press_newAppointment, $\phi$, set_Name)
3. DecompositionRelation(set_Name, $m$, configure_Appointment)
4. CausalRelation(press_newAppointment, $\phi$, configure_Appointment)
5. Necessary(configure_Appointment)
6. CausalRelation(set_Time, isSet_TimeAppointment, Date, press_OK)
7. DecompositionRelation(set_Time, $m$, configure_Appointment)
8. CausalRelation(configure_Appointment, isSet_TimeAppointment, Date, press_OK)
9. Necessary(press_OK)
10. CausalRelation(press_OK, createdAppointment, goalTask)
11. Necessary(goalTask)

C-CH 4,5
Basic
Basic
C-Prop 2,3
C-Ch 8,9
Basic
Basic
P-Prop 6,7
C-CH 10,11
Basic
Basic
Visualization - Visual elements

- Task t
- Necessary primitive Task
- Task t
- Necessary abstract Task
- Partial Order
- Causal Relation
- Causal Relation from Propagation
- Decomposition Relation
Visualization

Using a decomposition structure for an explanation
Visualization

Group abstract tasks to their primitive tasks in a plan for an explanation

There can be many ways to anchor an abstract task to his primitive tasks in a plan
Presentation of the Framework
Future Work

- Other types of formal explanations
- Dynamic decomposition structure for a given formal explanation
Thanks !!!