TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Informatik » Institut für Software- und Multimediatechnik » Lehrstuhl Softwaretechnologie

Development of a User Interface for the Graphical Specification of Complex Rewrite Rules for the Reference Attribute Grammar Controlled Rewriting Library RACR

Adam Misiuda

Supervisor: Dipl.-Inf. Christoff Bürger

DRESDEN concept
Exzellenz aus Wissenschaft und Kultur

Dresden, 24. Okt 2013

Outline

1. Project description
2. System architecture
3. Code generation and pattern matching
4. GUI
5. Conclusions

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1. **Project description**
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Project description

Main task:

- Development of a GUI for the specification of rewrite rules for RACR

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- Development of a GUI for the specification of the left hand's sided pattern matching for RACR

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- Development of a GUI for the specification of rewrite rules for RACR

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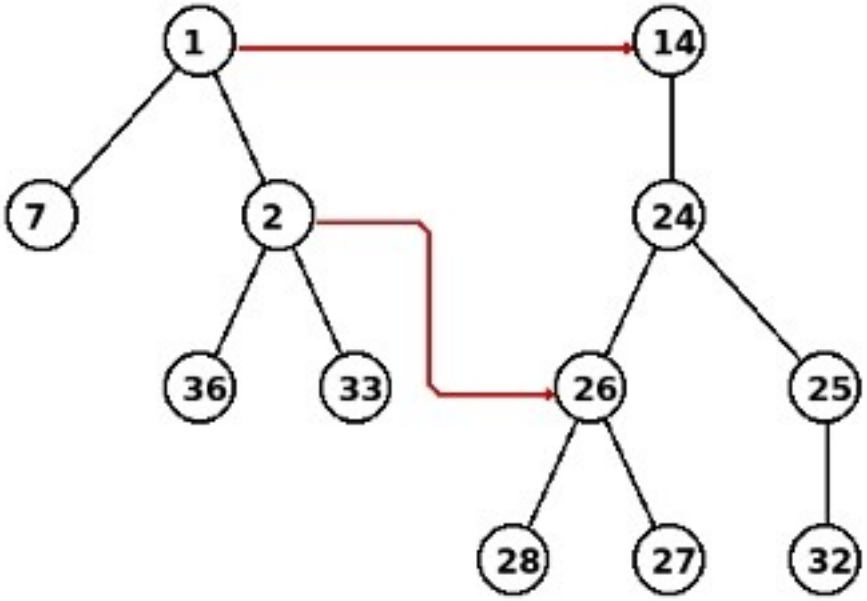
- Development of a GUI for the specification of the left hand's sided pattern matching for RACR

Technology:

- Scheme R6RS
- Racket 5.3.3
- RACR (Reference Attribute Grammar Controlled Rewriting) scheme library

Left hand's sided pattern

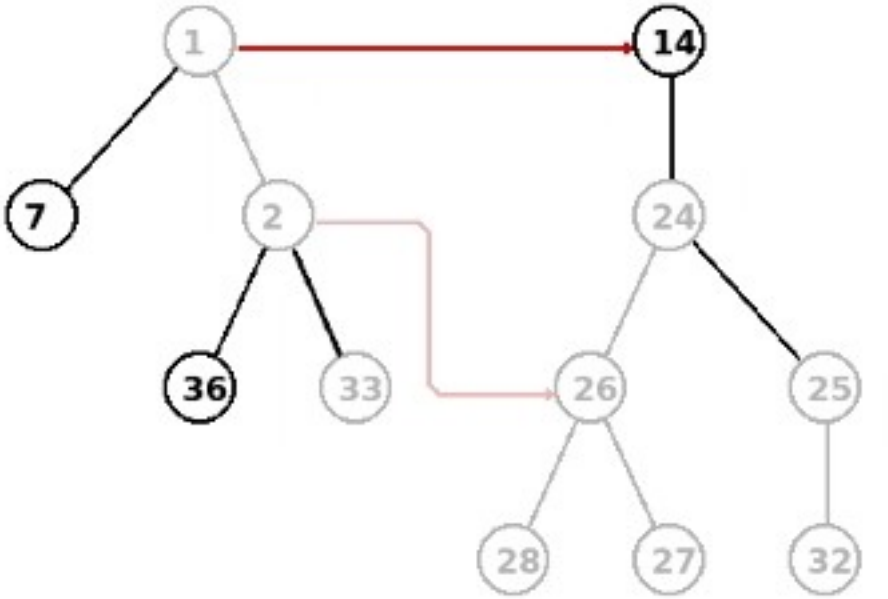
L-Side



R-Side

Left hand's sided pattern

L-Side



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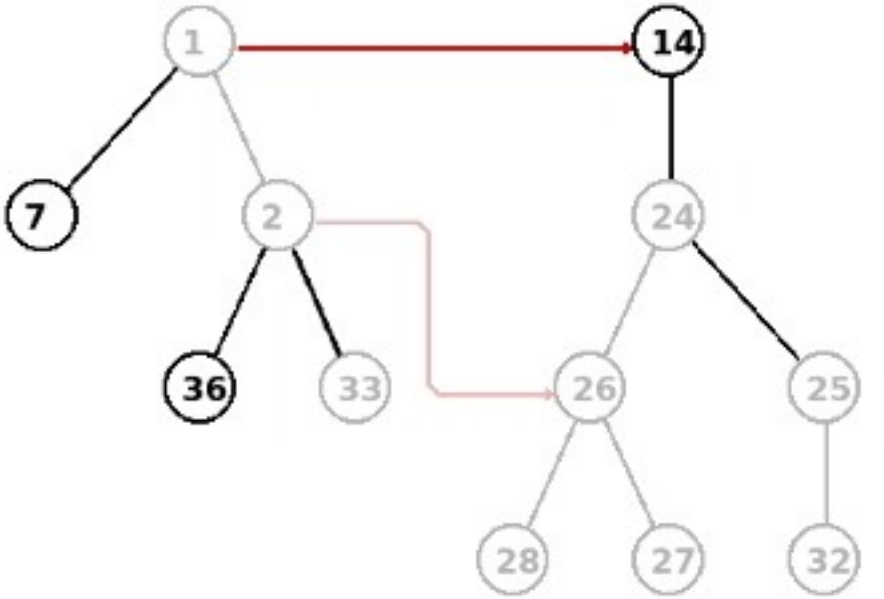

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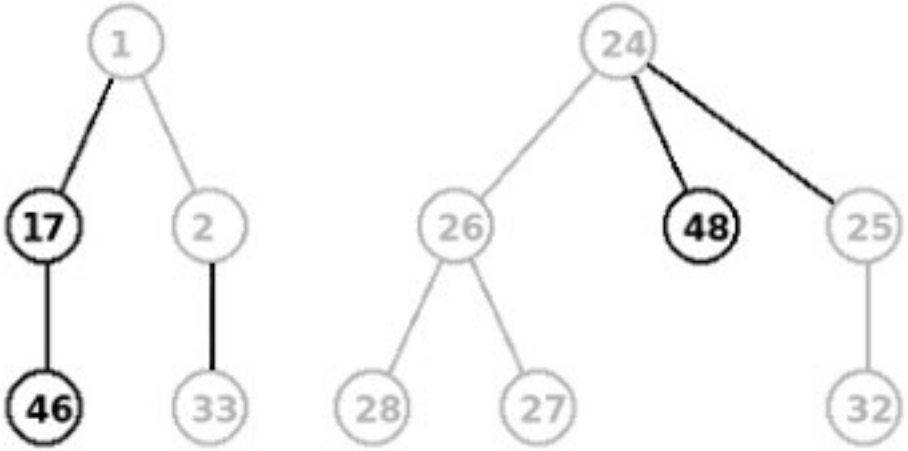

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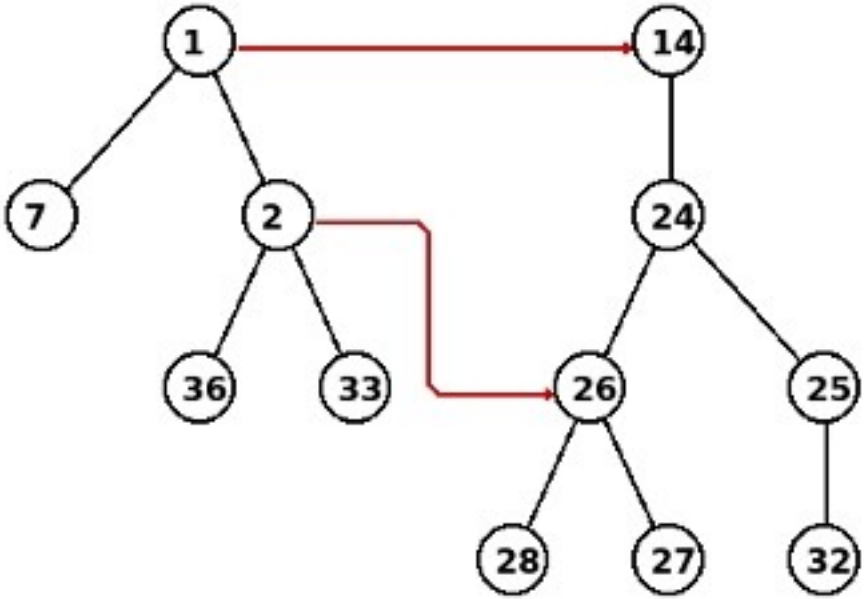

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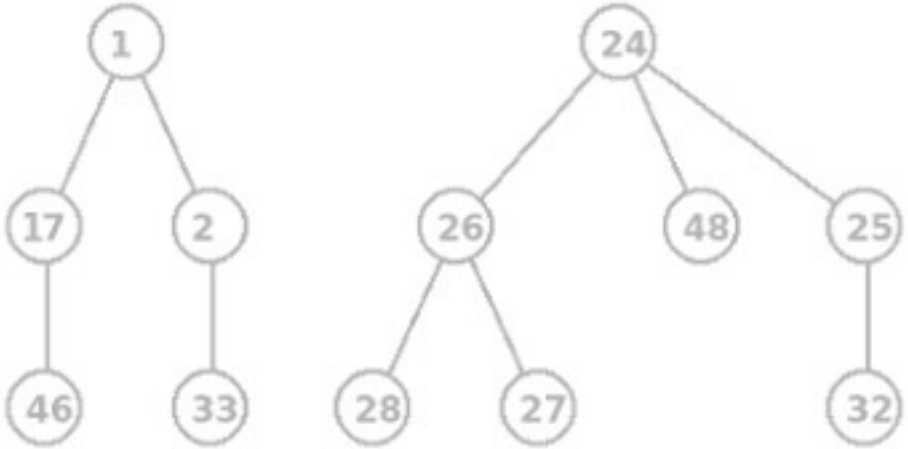
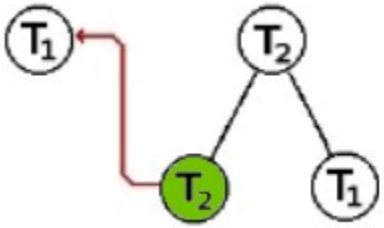


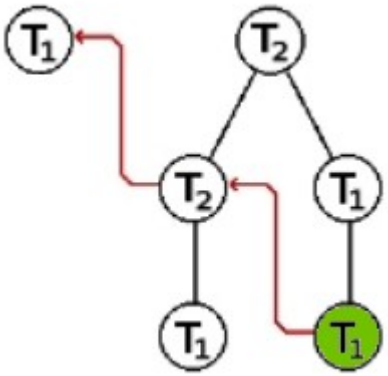
The project focuses only on the matching of the L-Side.

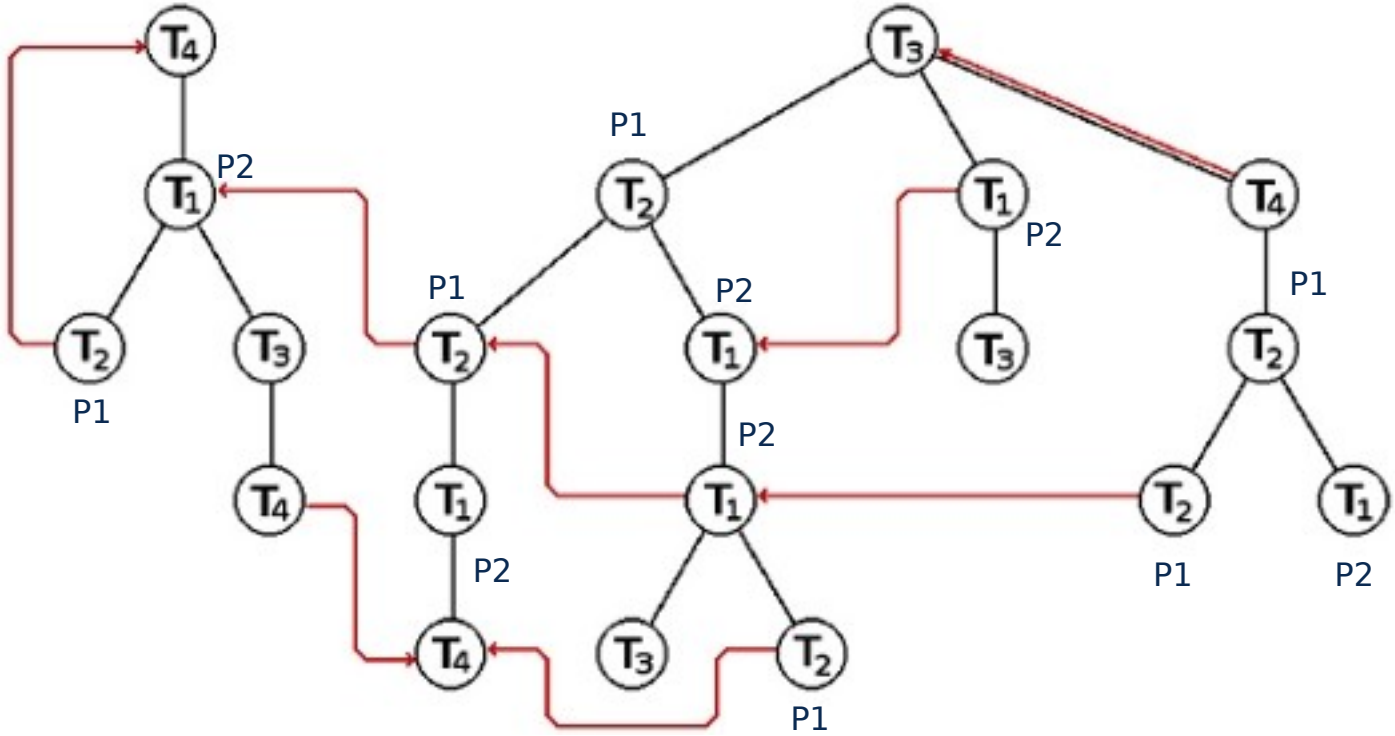
Pattern maching

Pattern 1 (P1)



Pattern 2 (P2)





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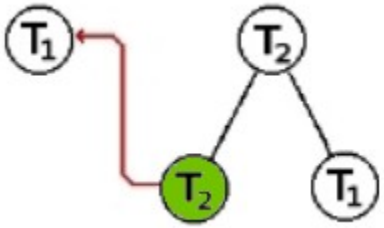

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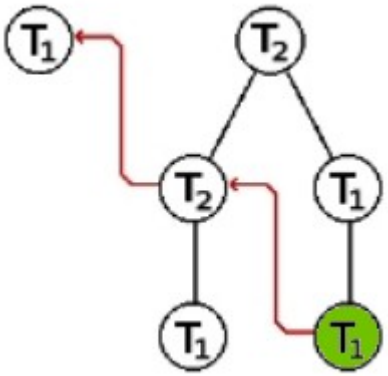

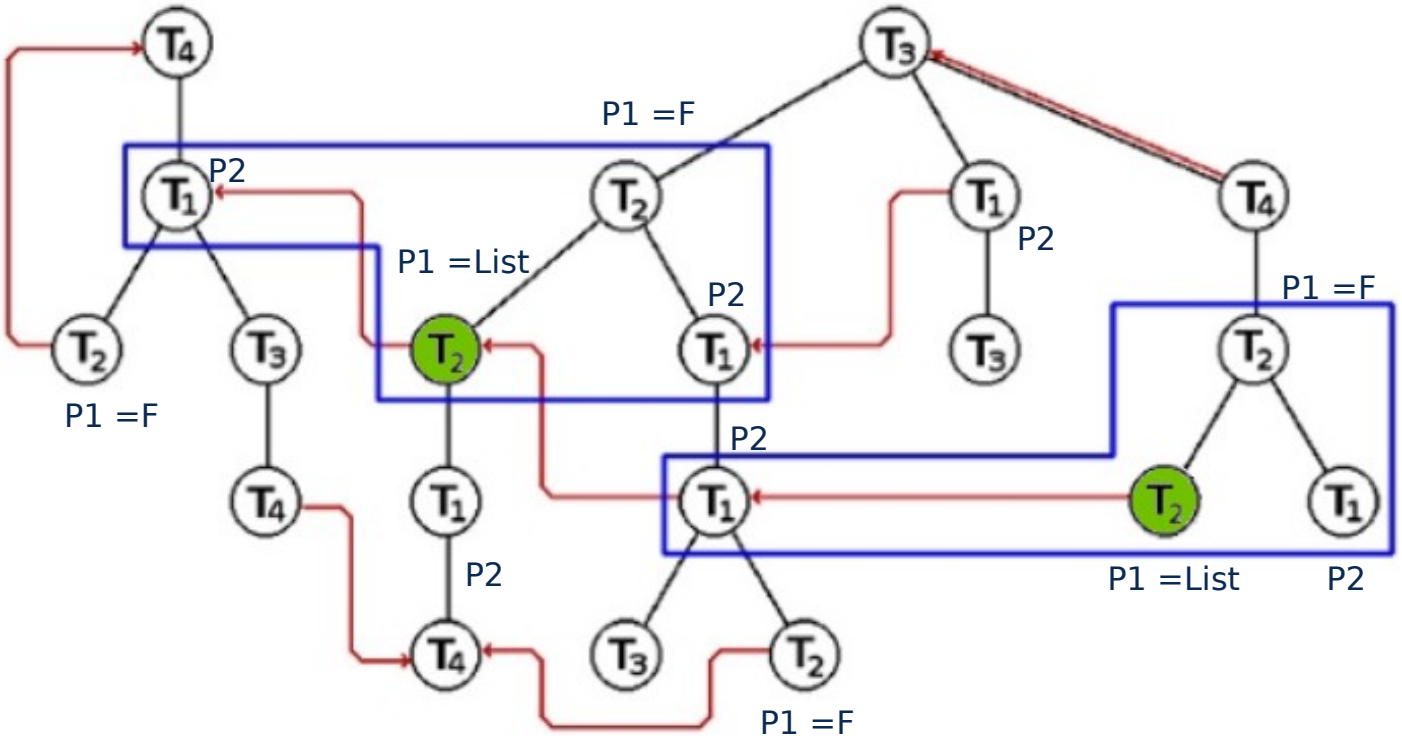

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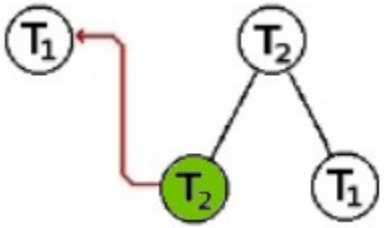

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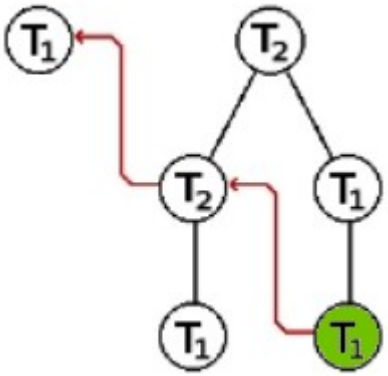

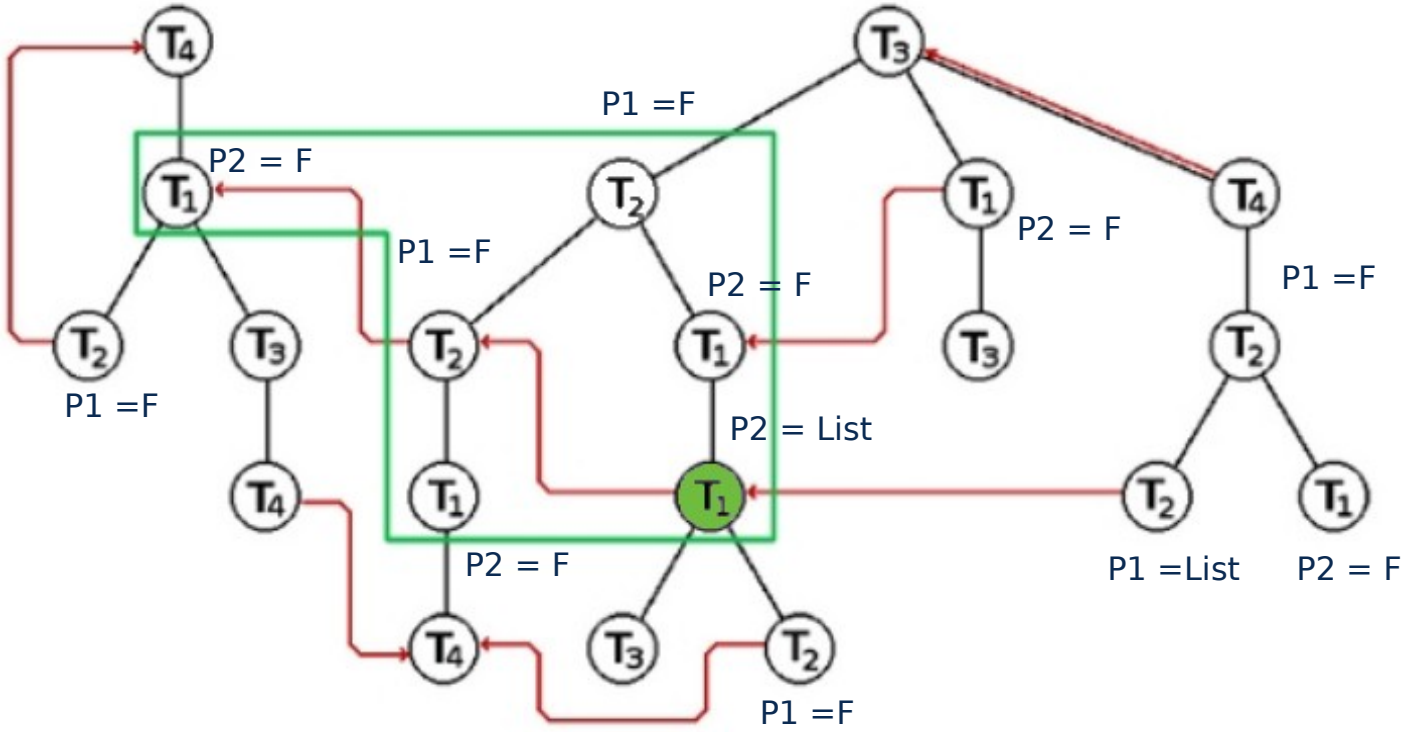

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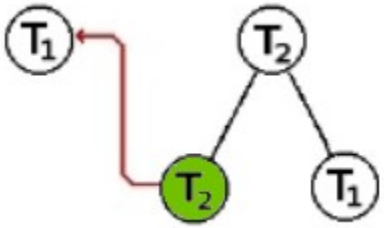

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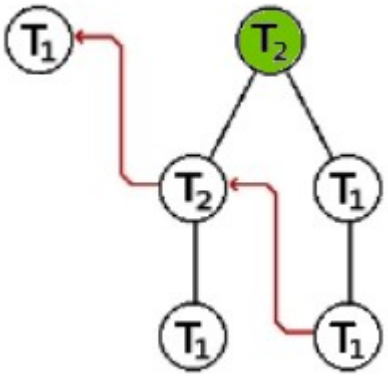

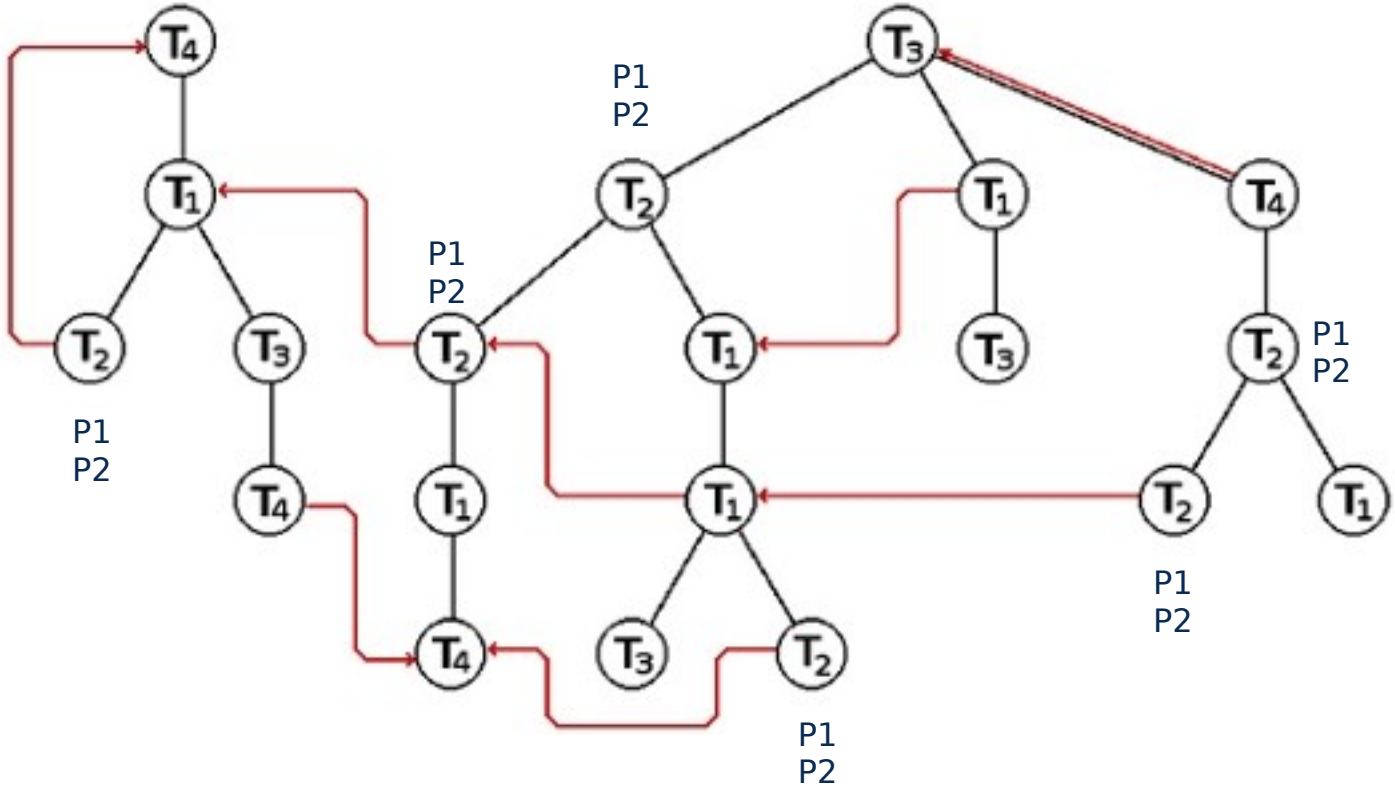

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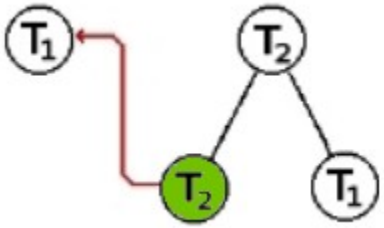

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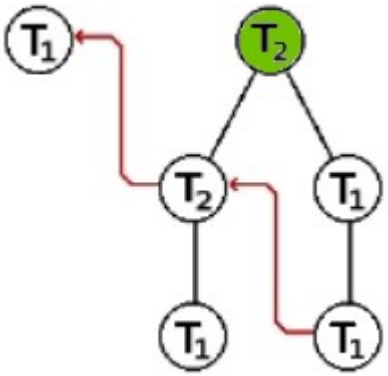

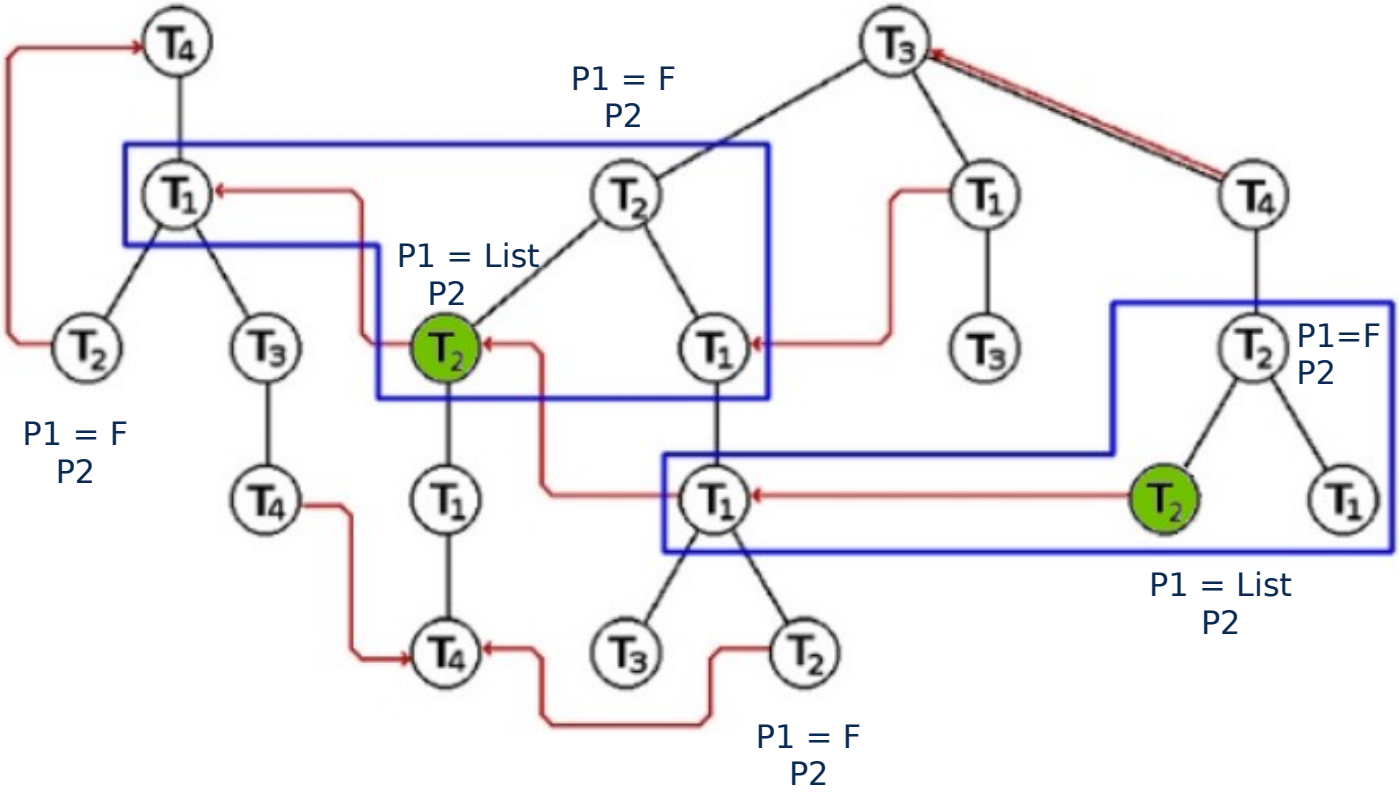

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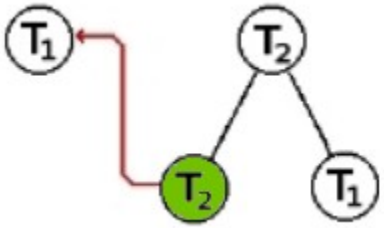

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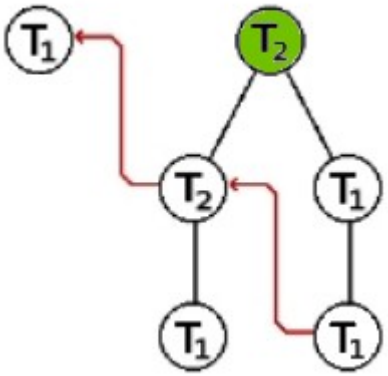

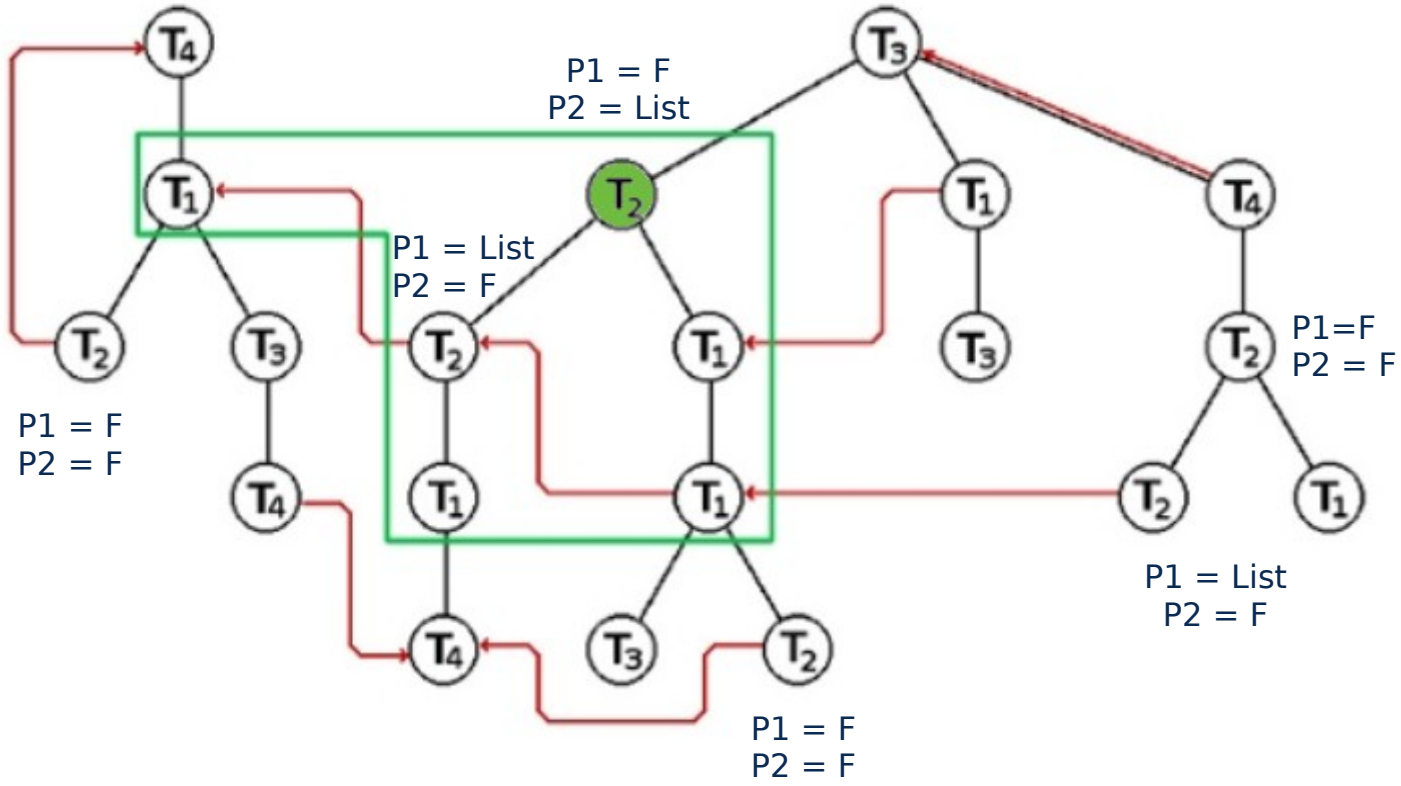

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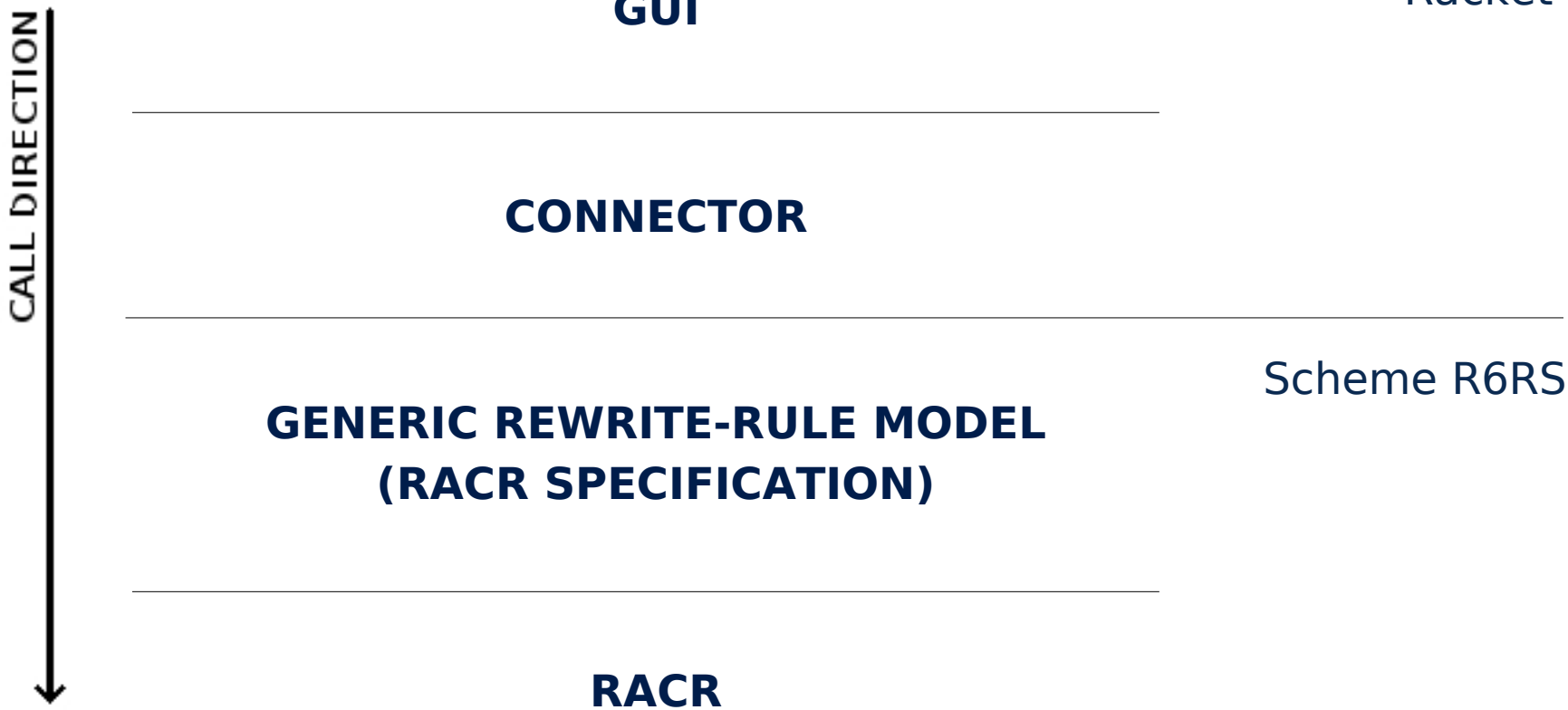
System architecture: layers



RACR description

- Scheme attribute grammar library

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- Scheme attribute grammar library
- Provides functions to:
  - specify abstract syntax tree (AST) schemes
  - specifies and queries AST's attribution
  - rewrites AST's attribution
  - Dynamic Attribute Dependency Analyses for efficient incremental attribute evaluation

System architecture: Semantics

- Well-formedness
  - Distinguished node test
  - Reachability test
  - Fragment types correctness

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Semantics have been implemented using RACR

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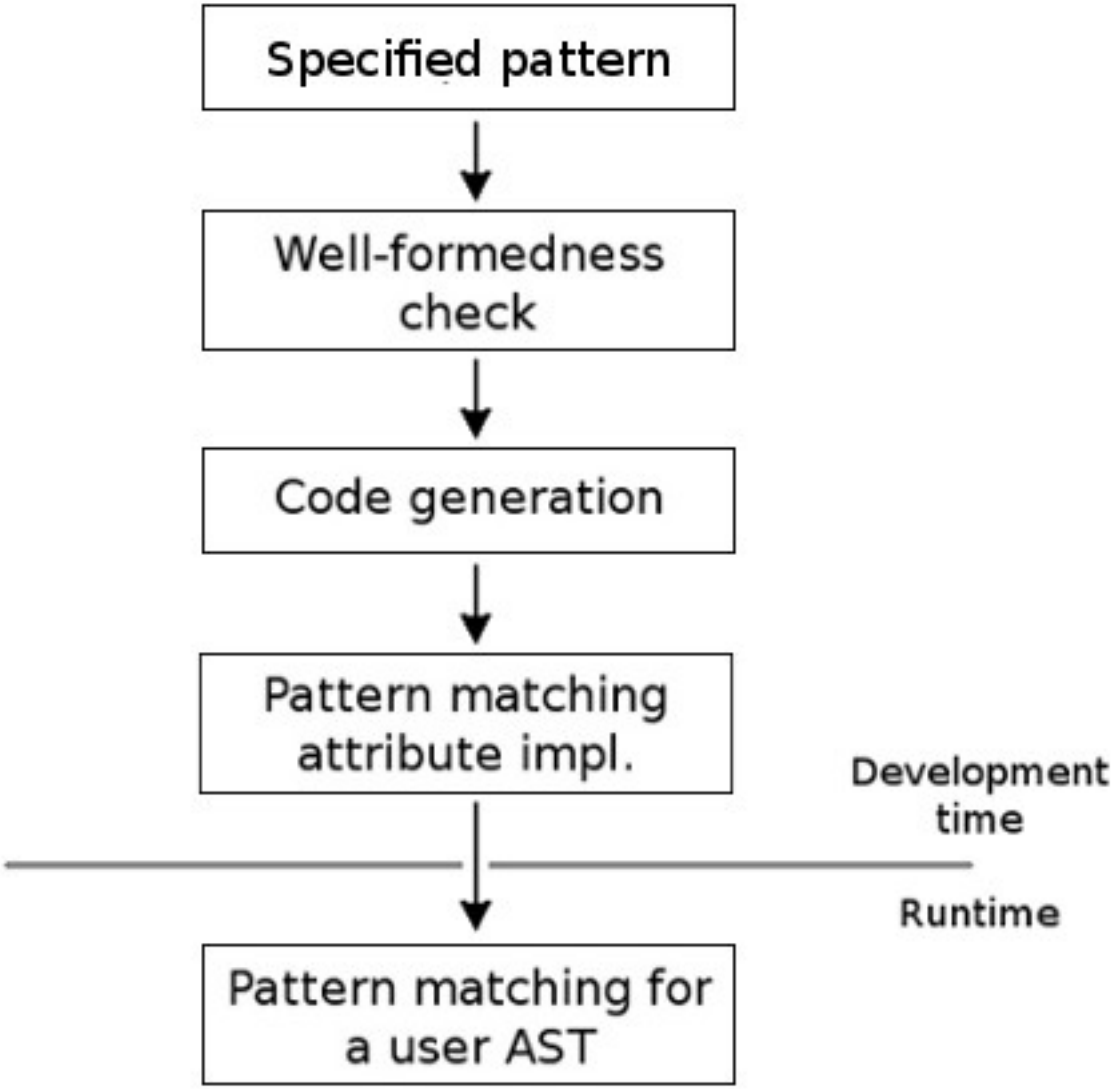
Workflow


Specified pattern
Well-formedness check
Code generation
Pattern matching attribute impl.
Development time
Runtime
Pattern matching for a user AST

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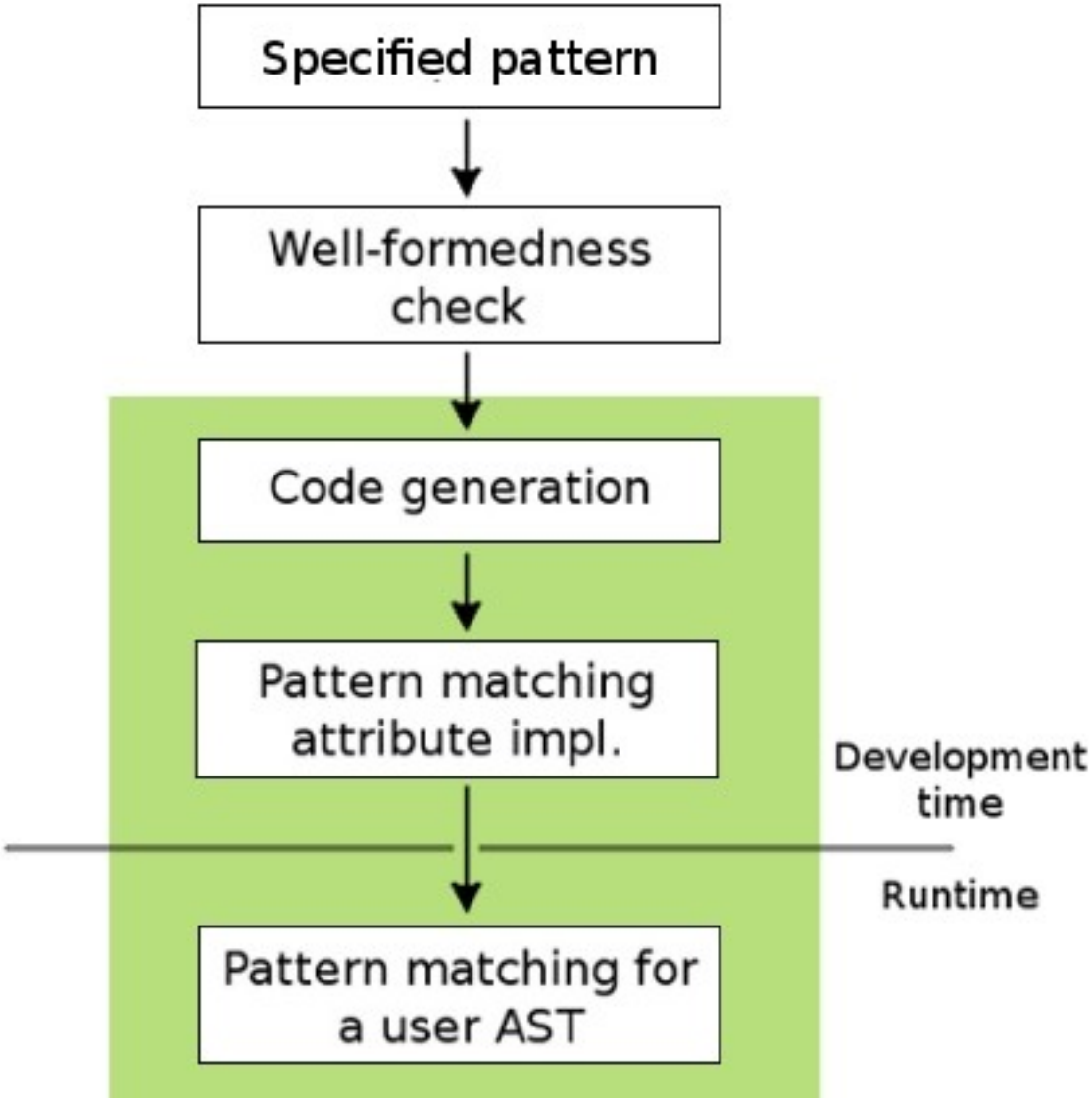
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Code generation

- Performed on a well-formed specified pattern

Code generation

- Performed on a well-formed specified pattern
- Generates an implementation of the matching attribute for RACR
  - contains a list of the matching commands
  - specified only for a rule represented by the distinguished node's type

Matching commands

- Generated for:
  - pattern roots search
  - structure analysis
  - references consistency analysis

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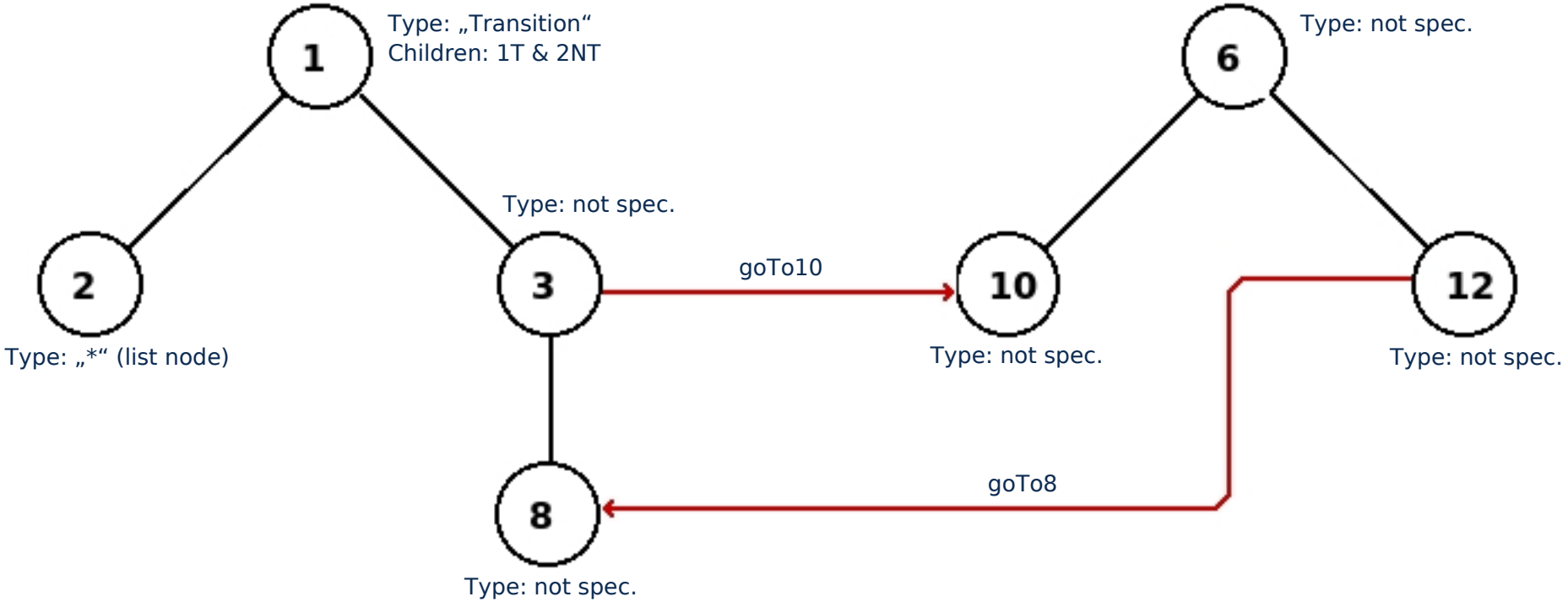
- Executed command returns T or F value
  - aborts further commands execution on false

Pattern matching

- Currently availabe set of commands:
  - chType(str) — check node's Type
  - cR(id) — compare current node with one of the the nodes saved as roots
  - gCh(pos) — get child on given position
  - gR(id) — get root with specified number
  - numCh(num) — check number of node's children
  - p — go to the parent node
  - pCh(pos) — check node's position
  - r(str) — follow the specified reference
  - sName(str) — save node's name (binding)
  - sR(id) — save node as root

Matching commands generation



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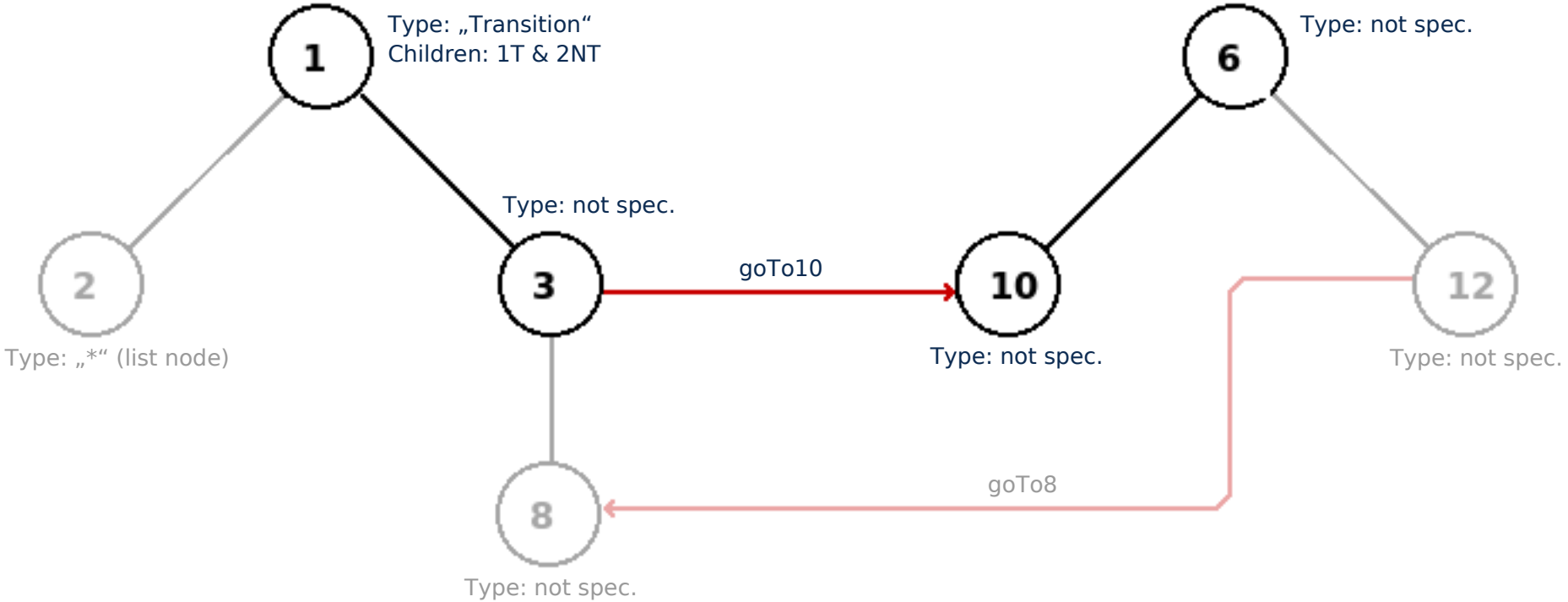
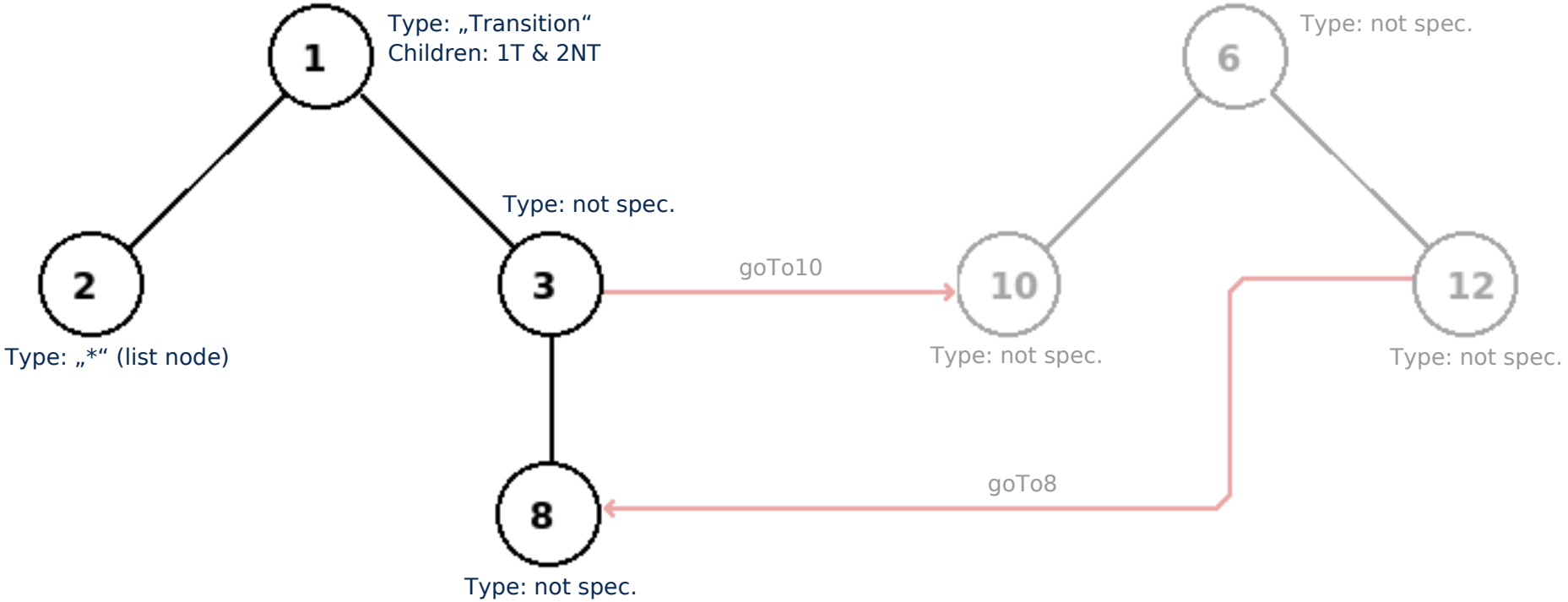


('sR 1)	save root
('gR 1)	get root
('numCh 3)	num. of children
('gCh 3)	get child

('r "goTo10")	follow the reference
('pCh -1)	children position
('p "")	go to parent node
('sR 6)	

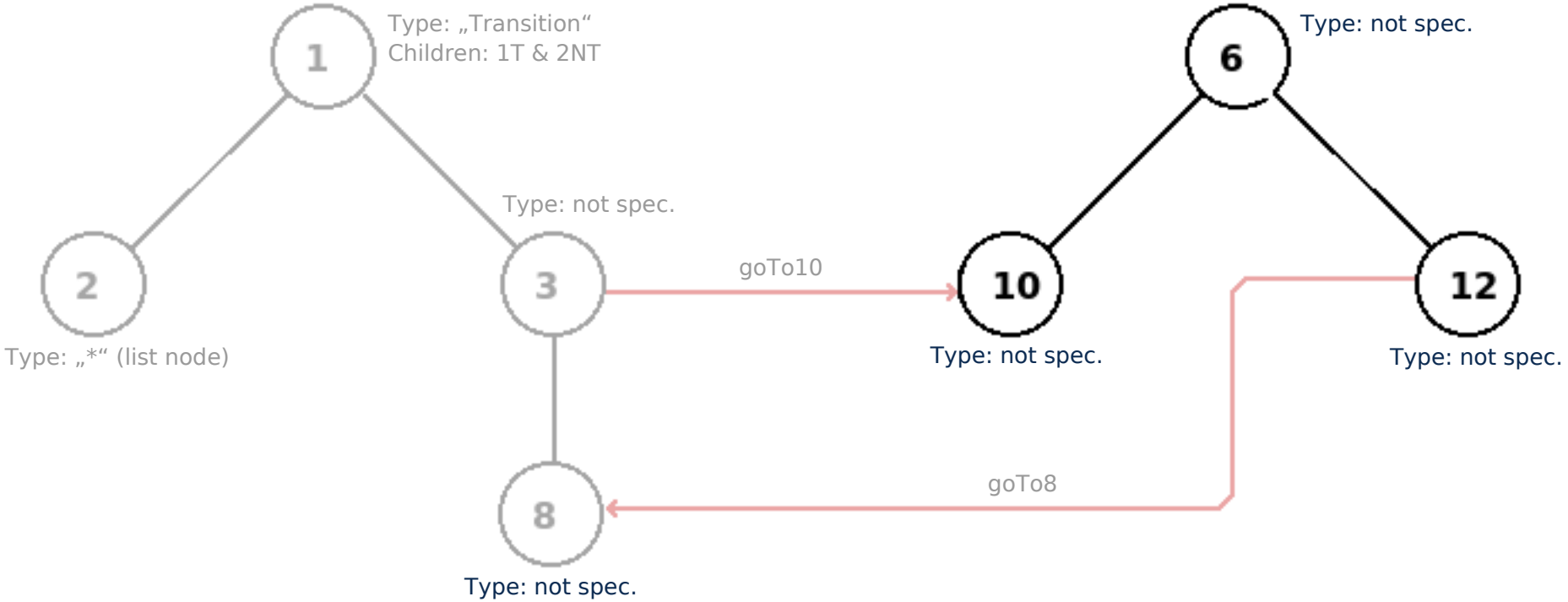
Matching commands generation



('gR 1)	get root
('chType "Transition")	check type
('numCh 3)	num. of children
('gCh 2)	get child
('chType "*")	

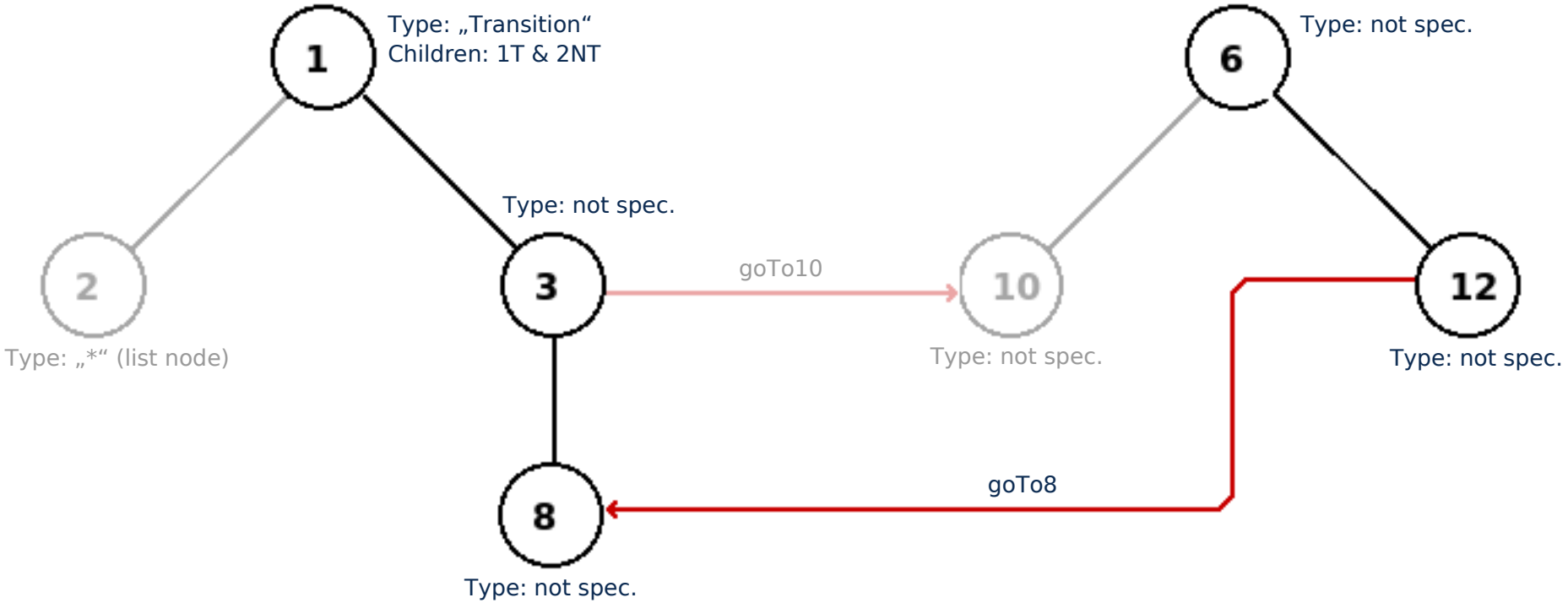
('p "")	go to parent node
('gCh 3)	
('numCh -1)	
('gCh -1)	

Matching commands generation



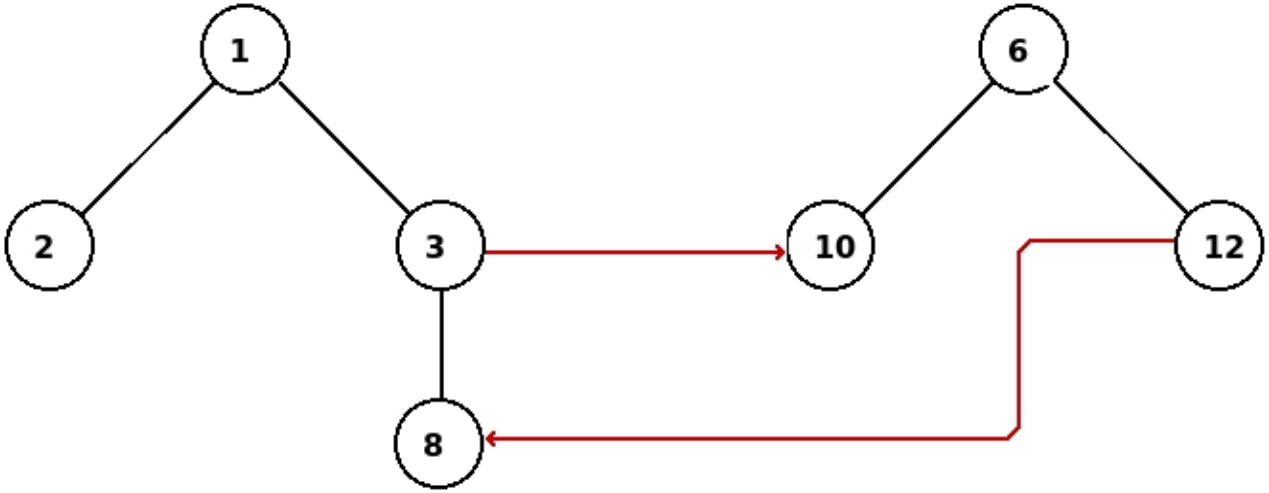
(cons 'gR 6)	get root
(cons 'numCh -2)	num. of children
(cons 'gCh -1)	get child
(cons 'p "")	go to parent node
(cons 'gCh -2)	

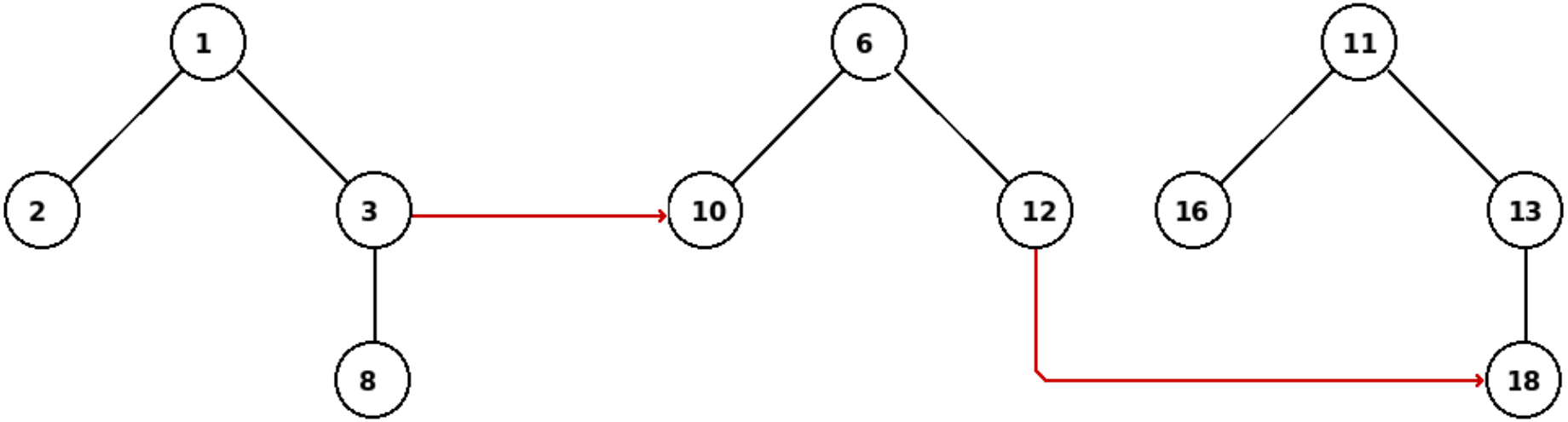
Matching commands generation



('gR 6)	get root	('p "")	go to parent node
('numCh -2)	num. of children	('pCh 3)	
('gCh -2)	get child	('p "")	
('r "goTo8")	follow the reference	('cR 1)	compare root
('pCh -1)	child position		

Matching commands generation





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  - returns false on execution abort
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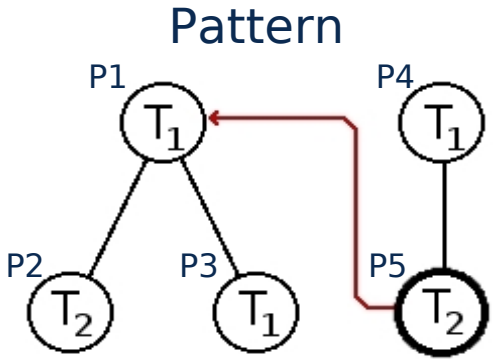
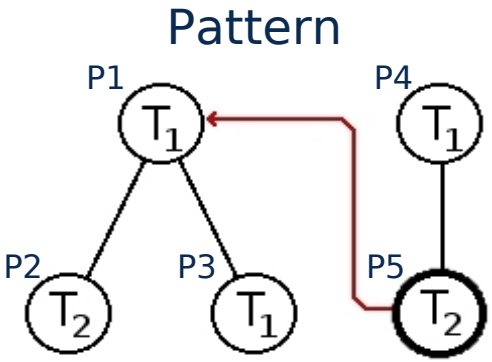
  - execution time depends only on the commands list size
- Easy commands list extension
  - new types of commands require only interpreter extension
  - backward compatibility

Pattern matching example



Where:
P2 name = „node2“
P4 name = „root2“

Pattern matching example



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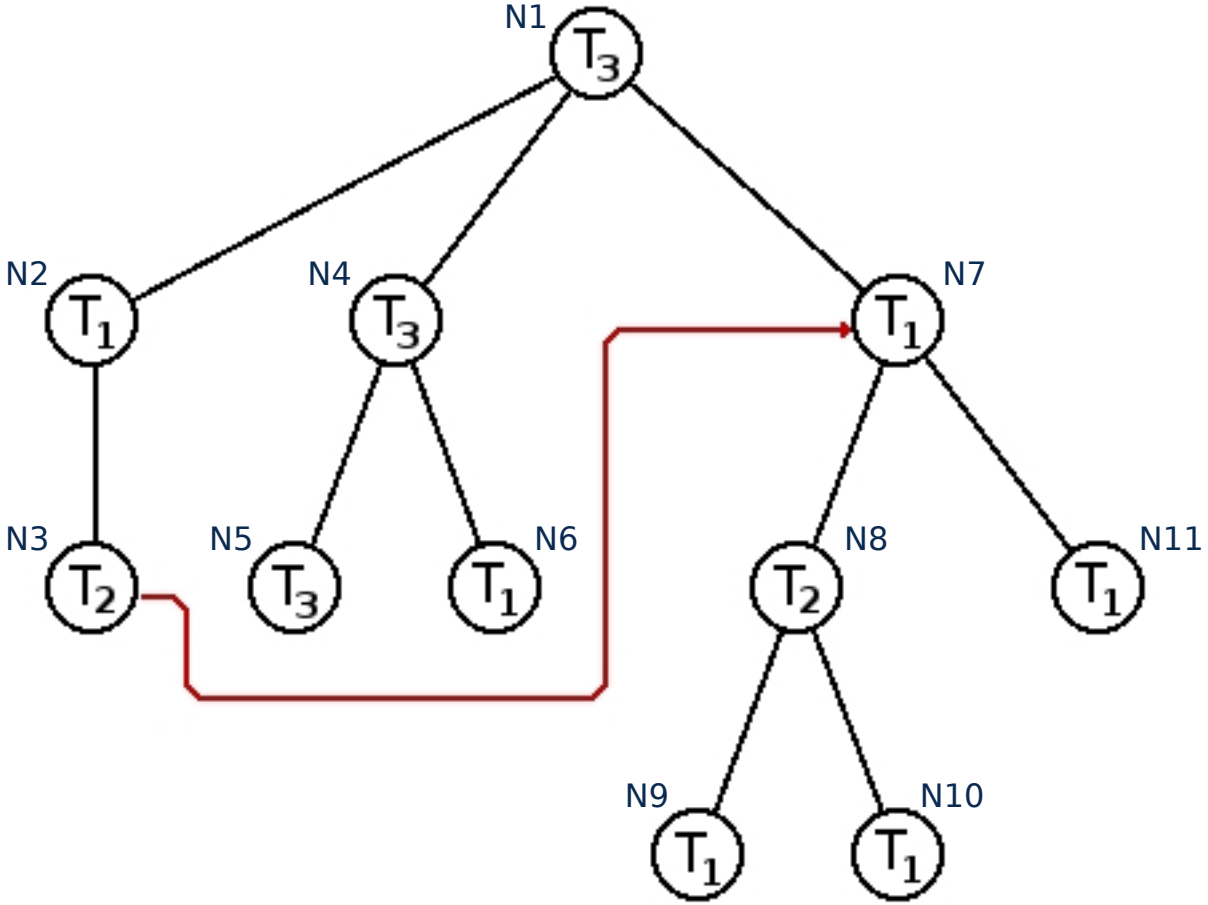

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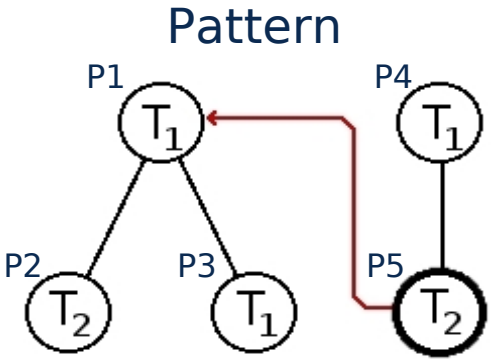

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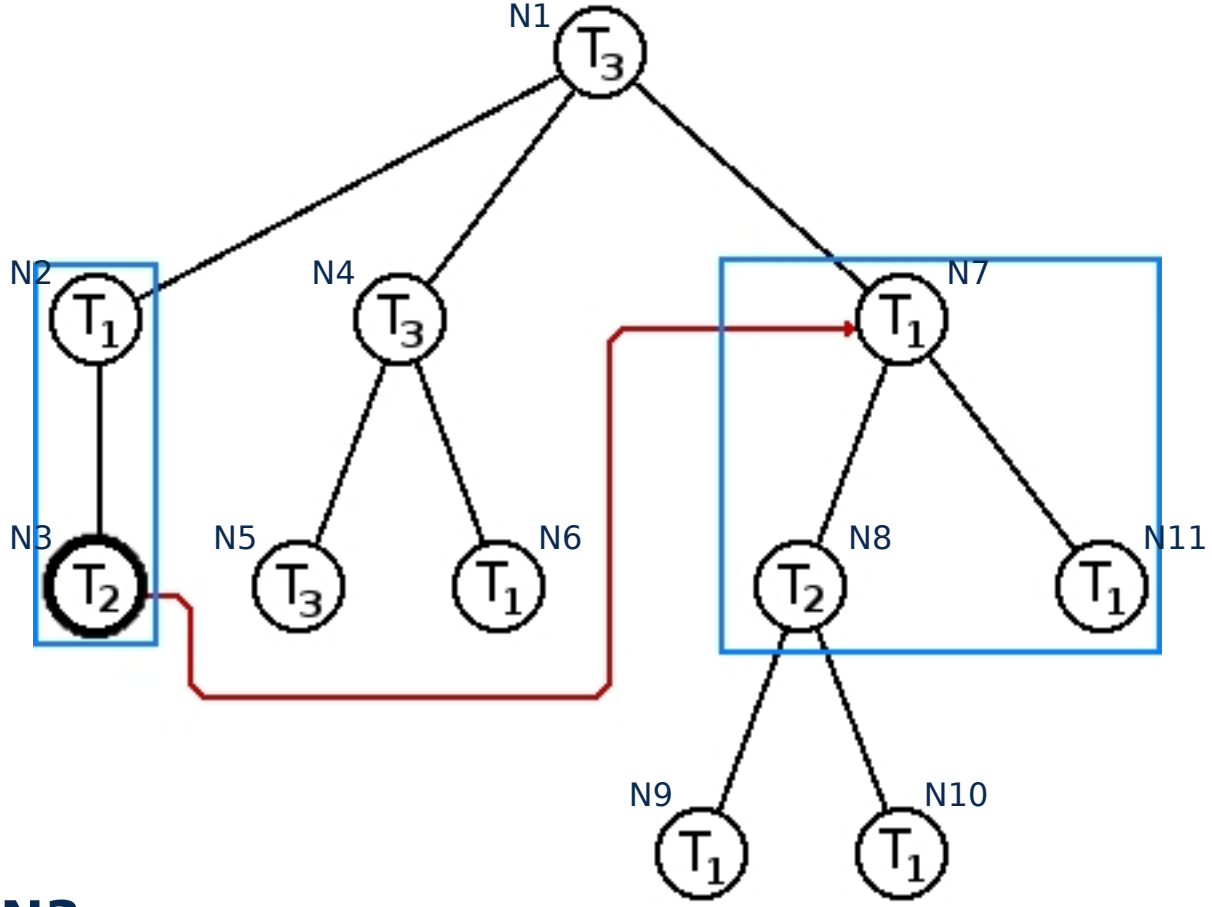
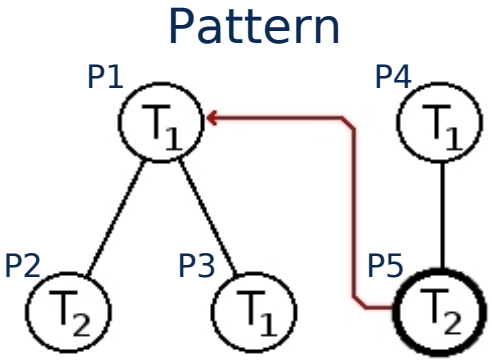


Matching found for N3

Pattern matching example



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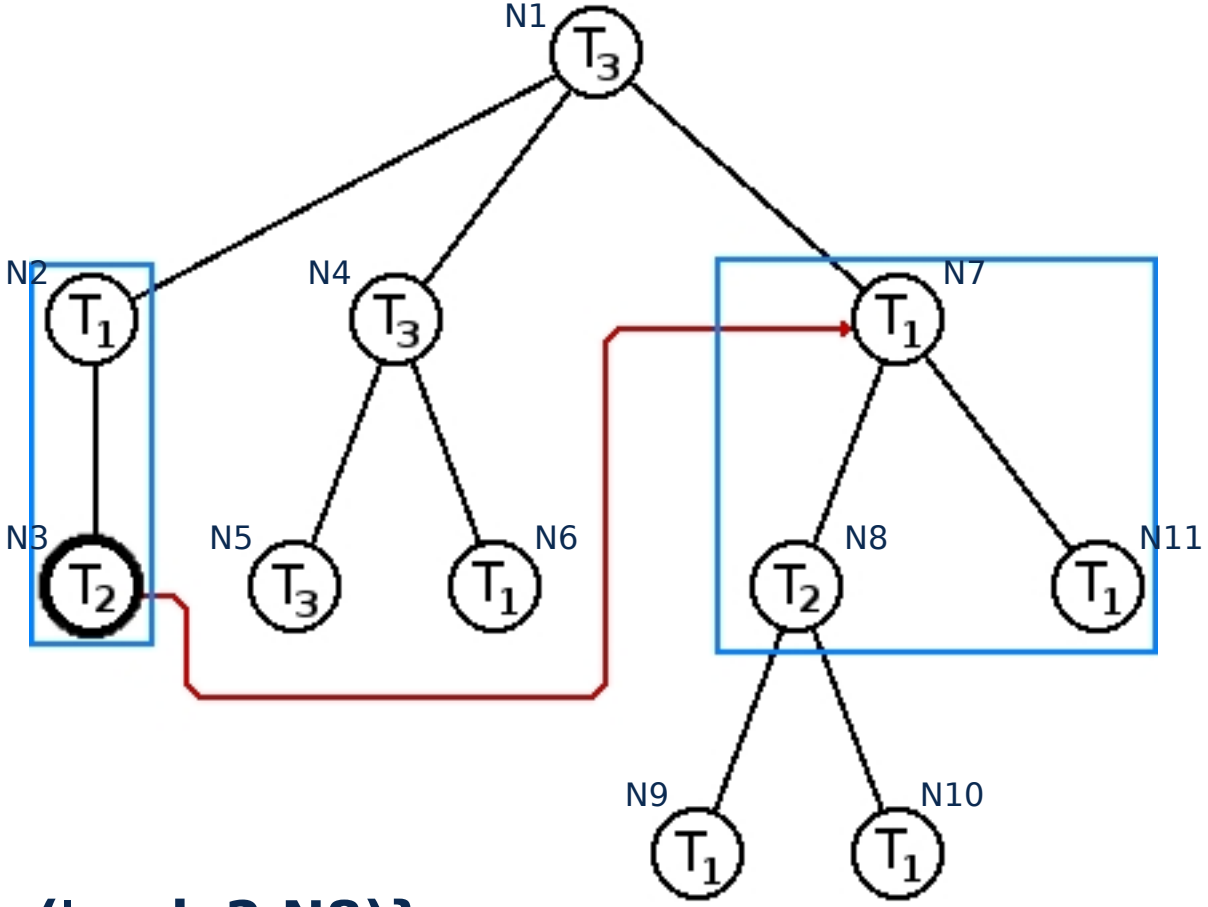

Result: {('root2 N2), ('node2 N8)}

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DEMO

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- Easy generation of the pattern matching attributes thanks to the GUI
- Commands list provides easy extendability
- Next step: specification of rewrite rules for RACR

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Fakultät Informatik » Institut für Software- und Multimediatechnik » Lehrstuhl Softwaretechnologie

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Adam Misiuda

Supervisor: Dipl.-Inf. Christoff Bürger

DRESDEN concept
Exzellenz aus Wissenschaft und Kultur

Dresden, 24. Okt 2013