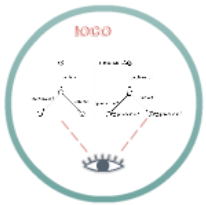
Decomposition in Input Output Conformance Testing

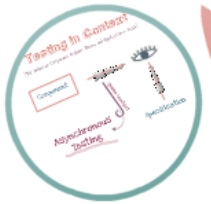
Neda Noroozi,
Mohammad Reza Mousavi,
Tim Willemse

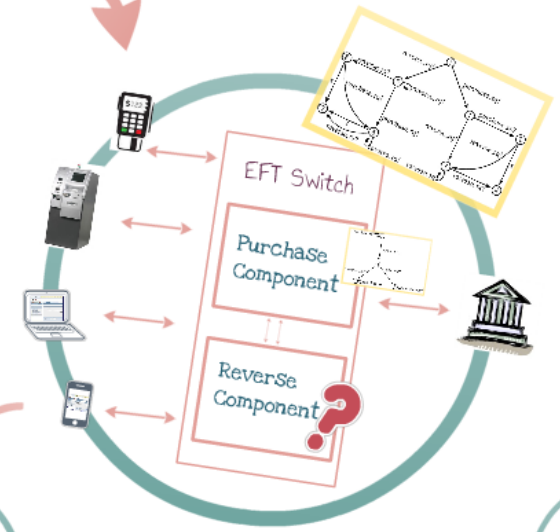
MBT 2013

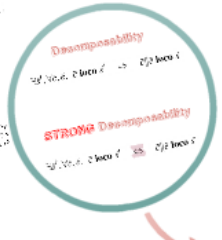
TU/e Technische Universiteit Eindhoven University of Technology

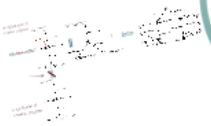
HALMSTAD UNIVERSITY

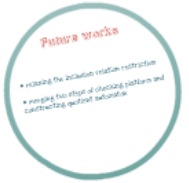


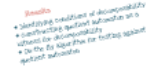












Decomposition in Input Output Conformance Testing

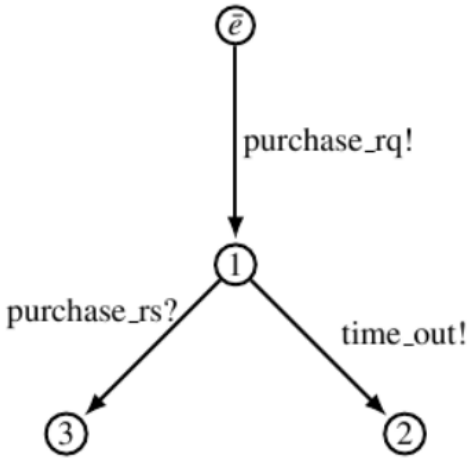
Neda Noroozi,
Mohammd Reza Mousavi,
Tim Willemse

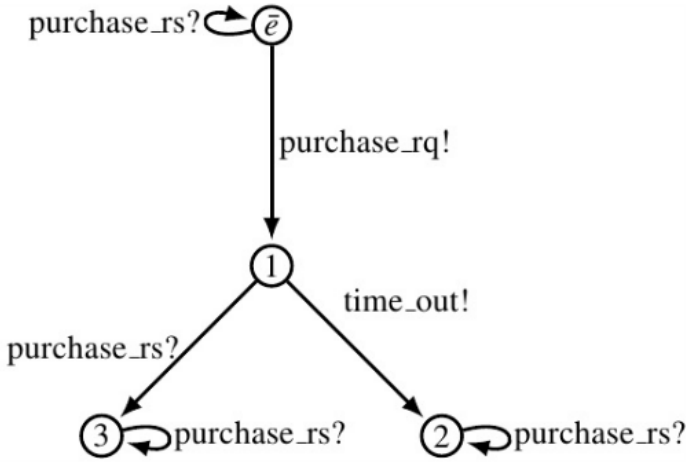
MBT 2013

TU/e Technische Universiteit Eindhoven University of Technology

HÖGSKOLAN HALMSTAD HALMSTAD UNIVERSITY
For the Development of Organisations, Products and Quality of Life

ioco

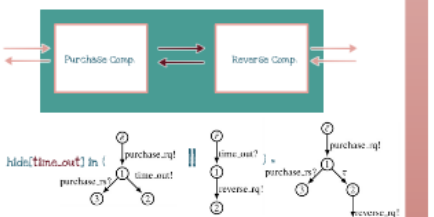

$\bar{e}$
purchase_rq!
1
purchase_rs?
time_out!
3
2


purchase_rs?
$\bar{e}$
purchase_rq!
1
time_out!
purchase_rs?
3
purchase_rs?
2
purchase_rs?

Related works

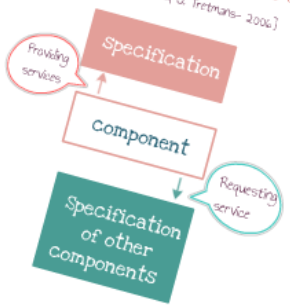
Compositional Testing with ioco

[M. van der Bijl, A. Rensink & J. Tretmans -2003]



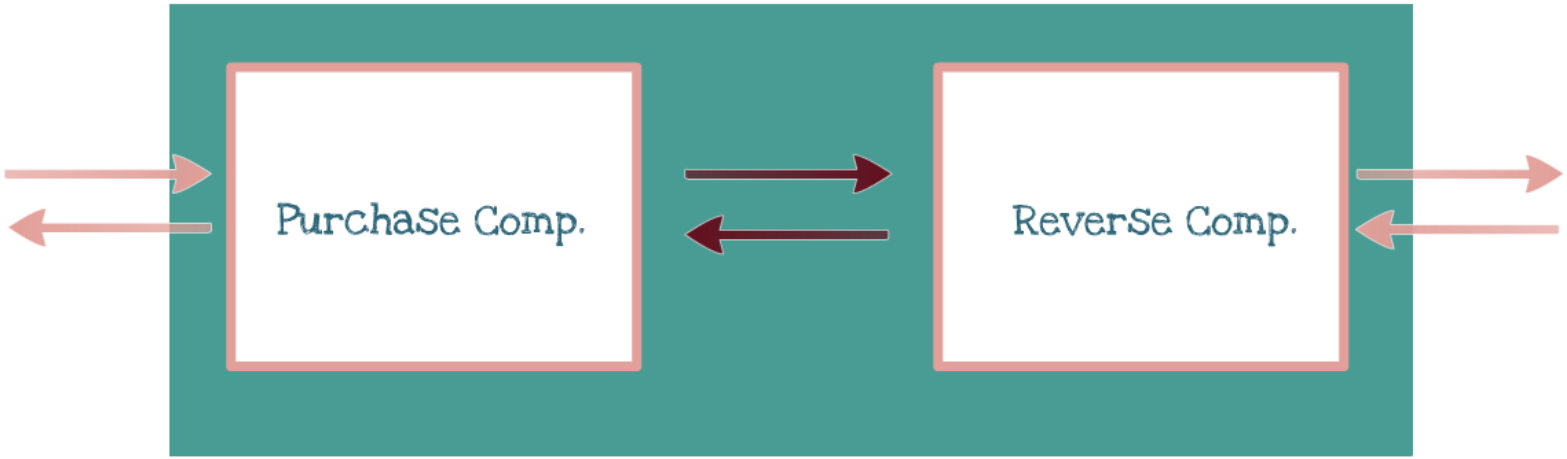
Model-Based Testing of Environmental Conformance of Components

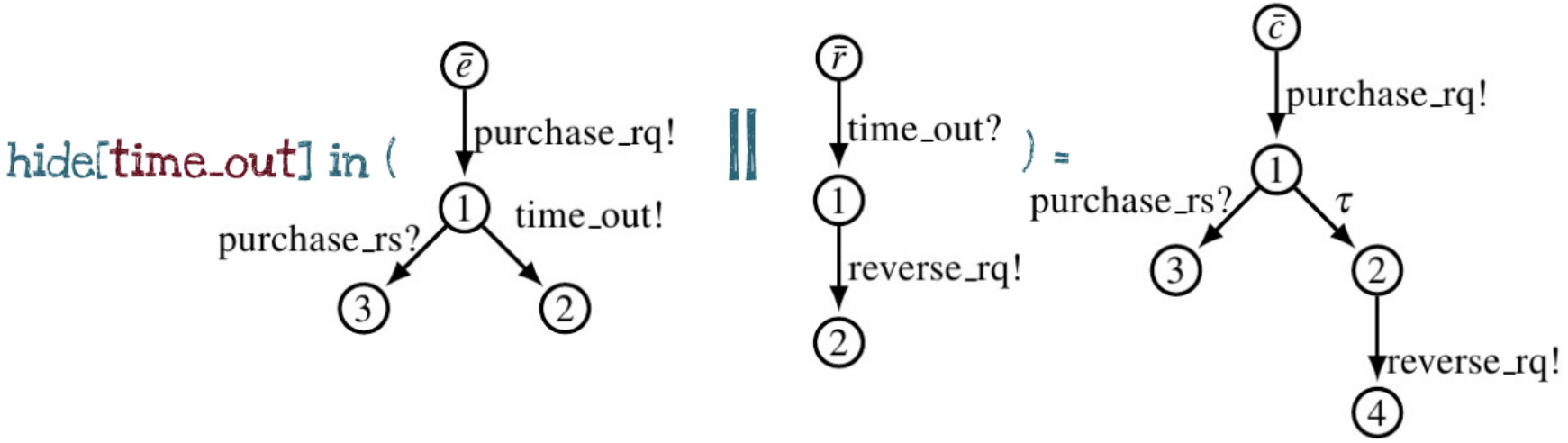
[L. Frantzen & J. Tretmans- 2006]



Compositional Testing with ioco

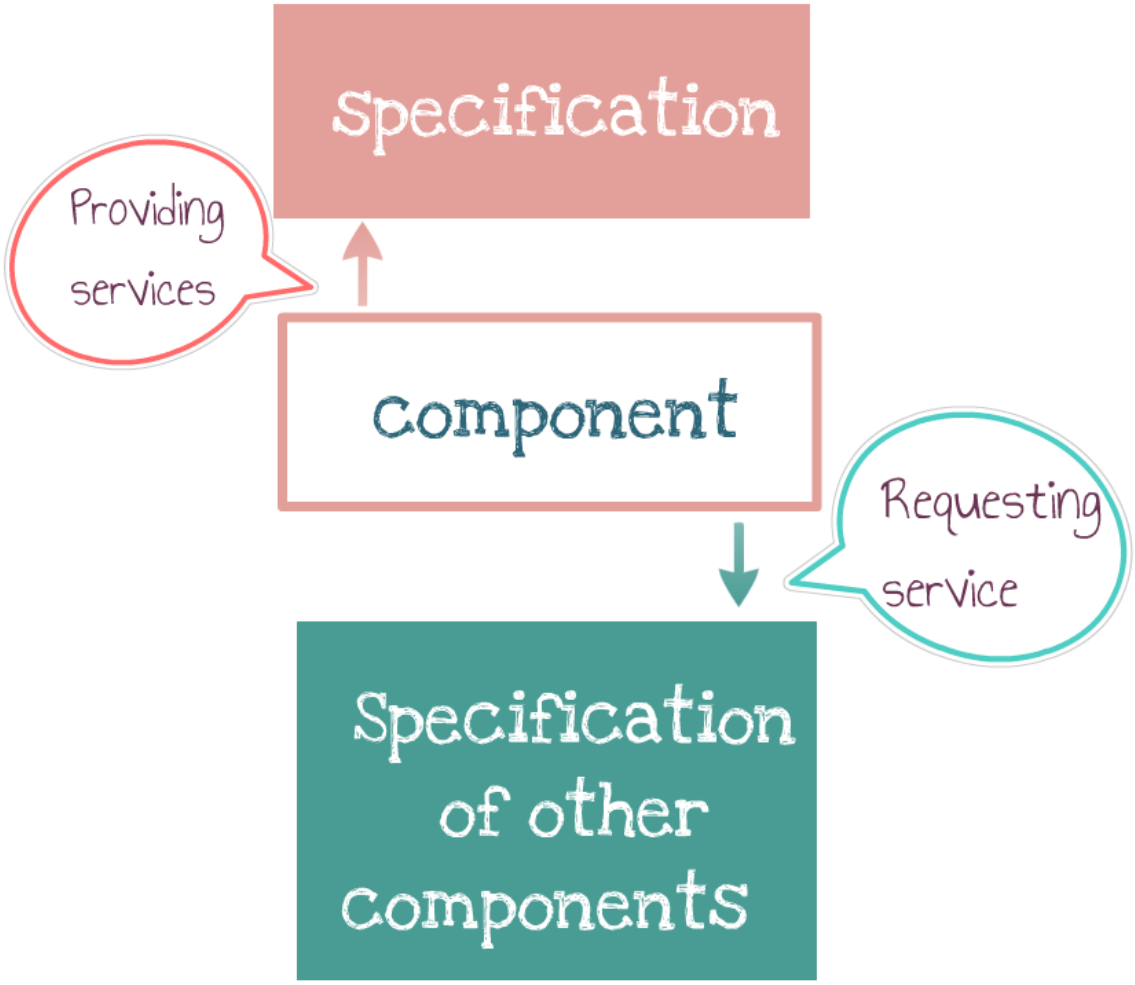
[M. van der Bijl, A. Rensink & J. Tretmans -2003]





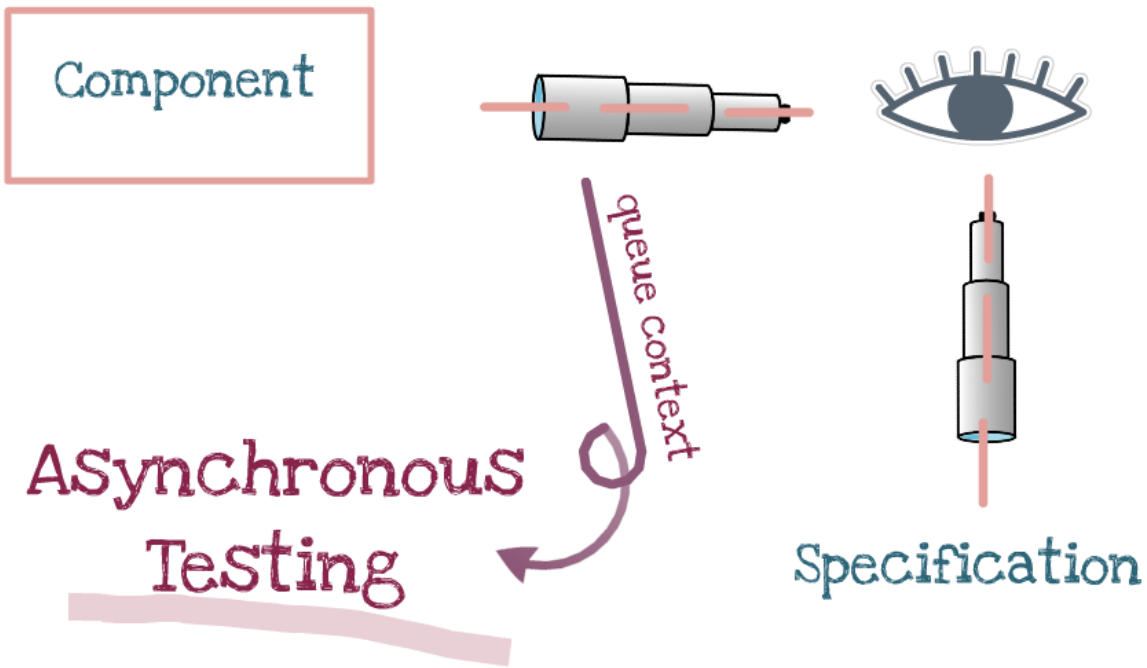
Model-Based Testing of Environmental Conformance of Components

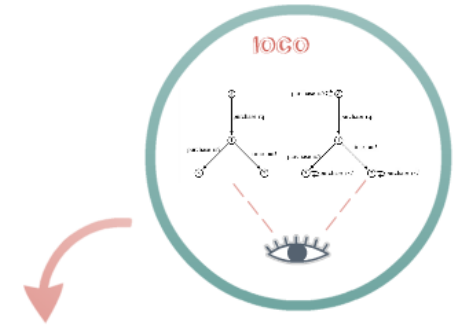
[L. Frantzen & J. Tretmans- 2006]

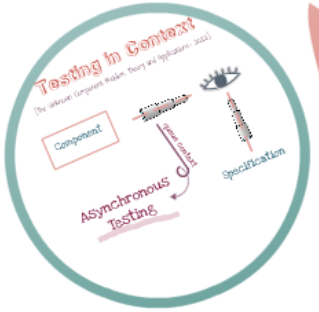


Testing in Context

[The Unknown Component Problem, Theory and Applications- 2012]







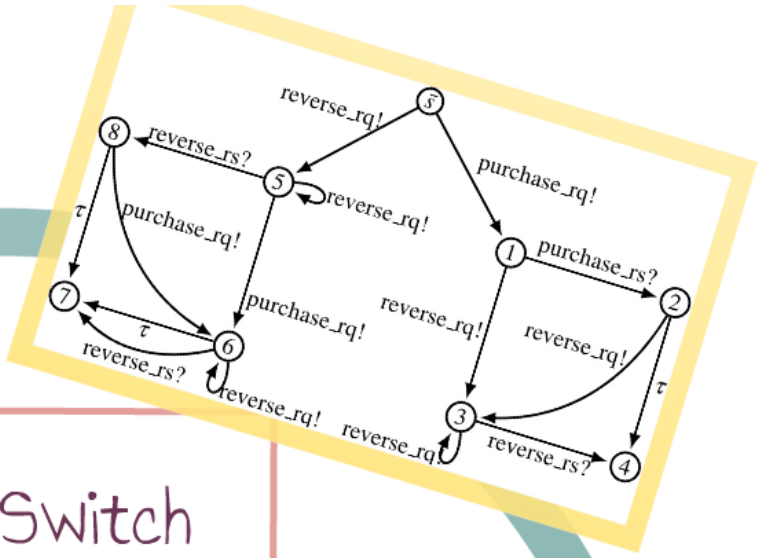
Decomposition in Input Output Conformance Testing

Neda Noroozi,
Mohammd Reza Mousavi,
Tim Willemse

MBT 2013

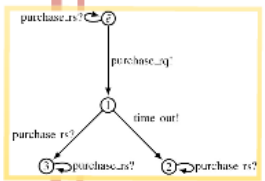
TU/e Technische Universiteit Eindhoven University of Technology

HÖGSKOLAN HALMSTAD HALMSTAD UNIVERSITY
For the Development of Organisations, Products and Quality of Life

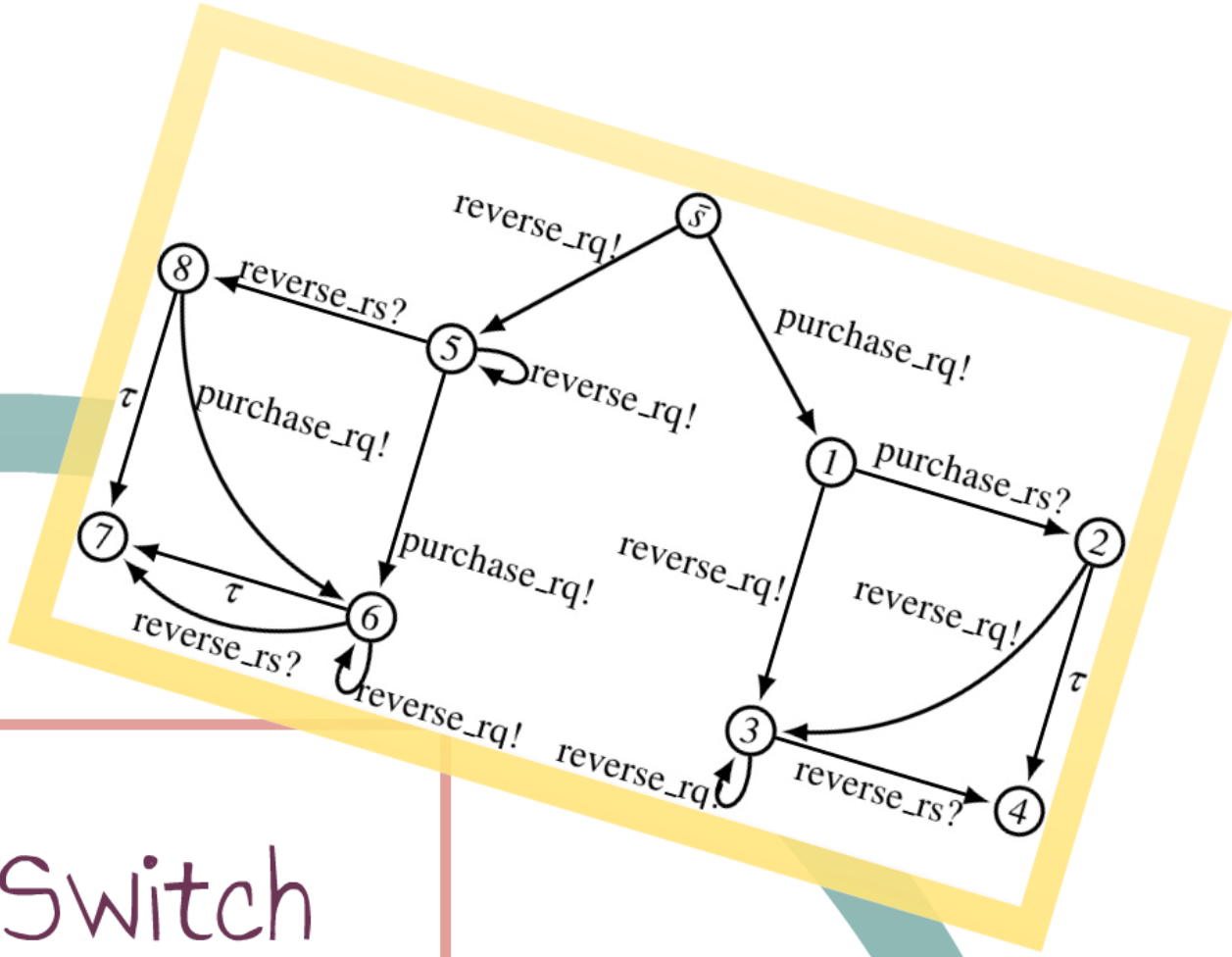


EFT Switch

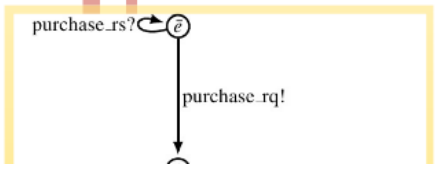
Purchase Component

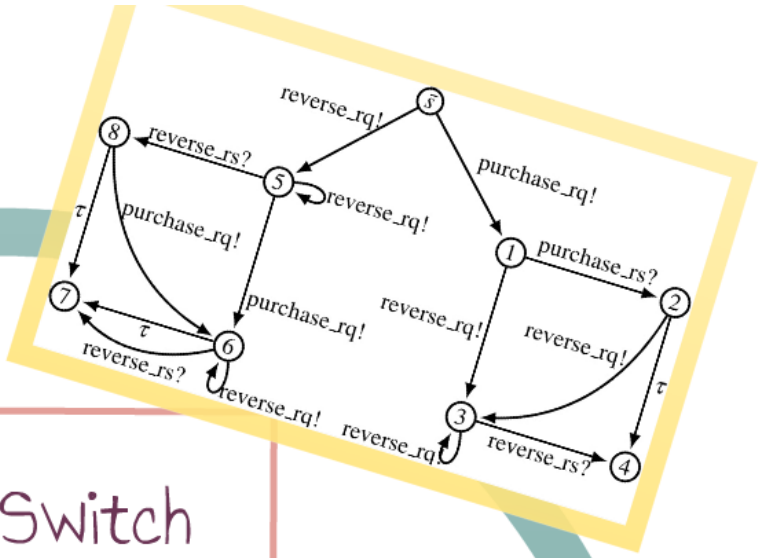


Reverse Component


reverse_rq!
$\tilde{s}$
8
reverse_rs?
5
reverse_rq!
purchase_rq!
τ
purchase_rq!
1
purchase_rs?
2
7
purchase_rq!
reverse_rq!
reverse_rq!
τ
6
reverse_rs?
reverse_rq!
3
τ
reverse_rq!
reverse_rq!
reverse_rs?
4

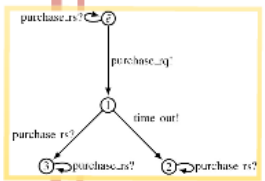
EFT Switch


purchase_rs?
$\tilde{e}$
purchase_rq!



EFT Switch

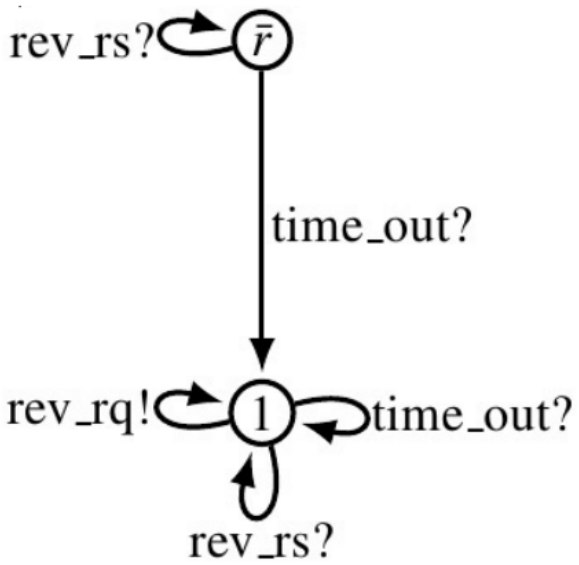
Purchase Component



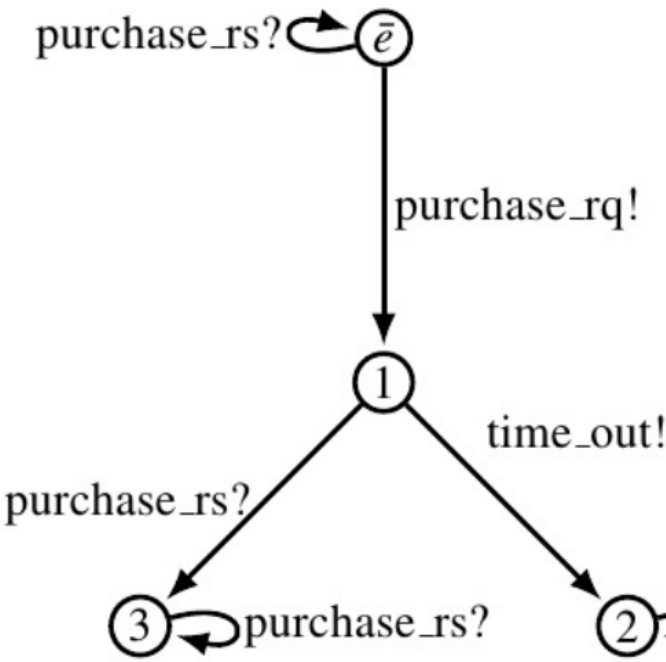
Reverse Component

an implementation of
a reverse component

hide[time_out]in(

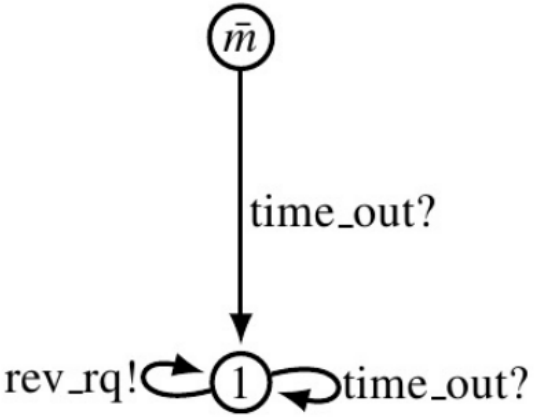


||



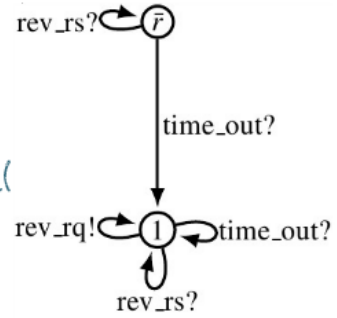
ioco

a specification of
a reverse component

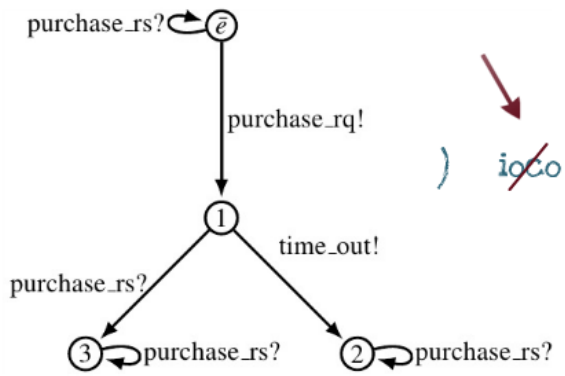


an implementation of
a reverse component

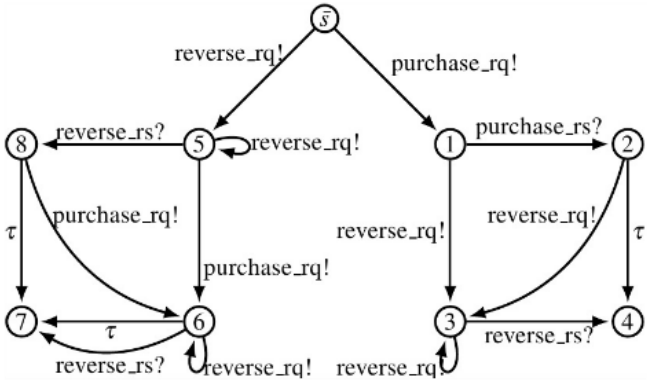
hide[time_out]in(



||

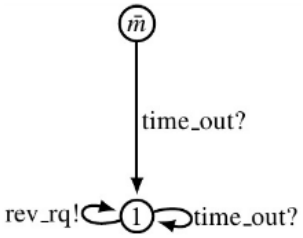


) ioco



ioco

a specification of
a reverse component



ime_out?

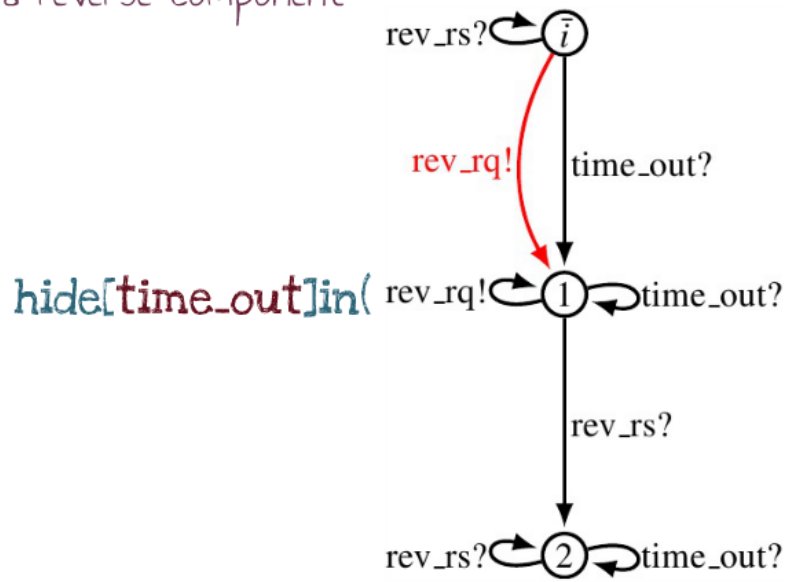
time_out?

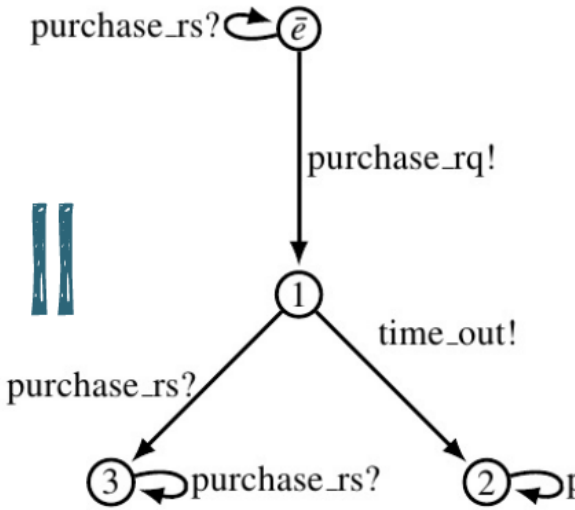
Decomposability

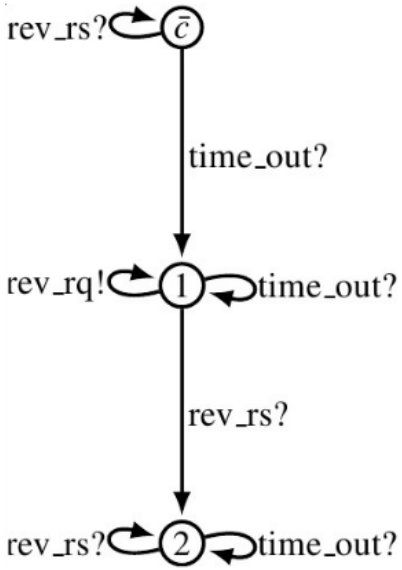
$$\exists \bar{s}', \forall \bar{c}, \bar{e}.\ \ \bar{c}\ \textbf{ioco}\ \bar{s}' \quad \Rightarrow \quad \bar{c} \| \bar{e}\ \textbf{ioco}\ \bar{s}$$

an implementation of

a reverse component





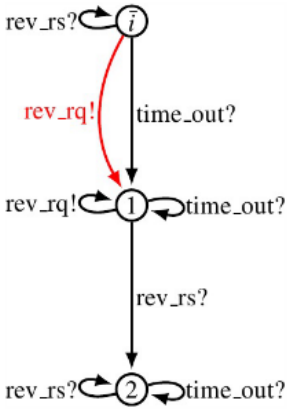


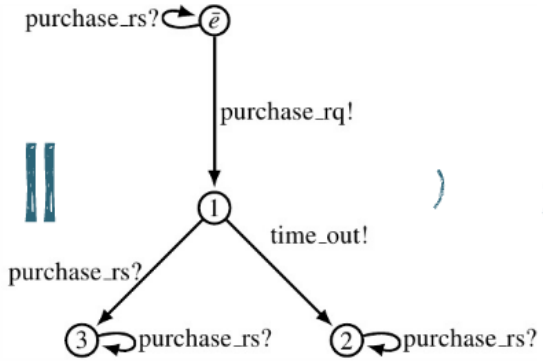
a specification of

a reverse component

an implementation of
a reverse component

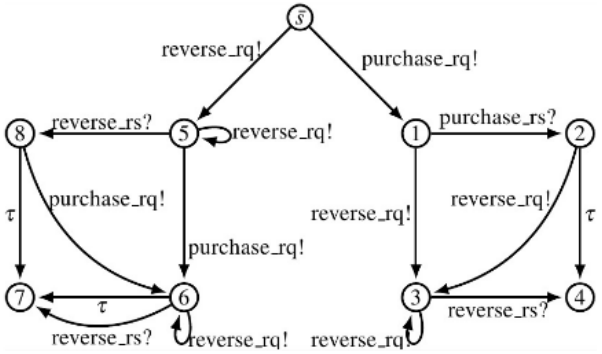
hide[time_out]in(



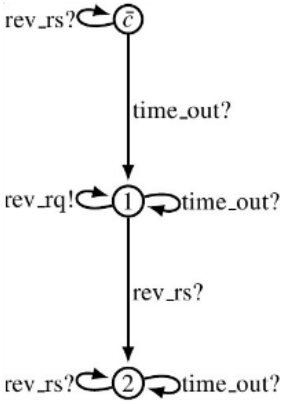


)

ioco



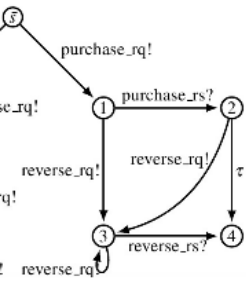
ioco



specification of
reverse component

Decomposability

$$\exists \bar{s}', \forall \bar{c}, \bar{e}.\ \ \bar{c}\ \mathbf{ioco}\ \bar{s}' \quad \Rightarrow \quad \bar{c} \| \bar{e}\ \mathbf{ioco}\ \bar{s}$$

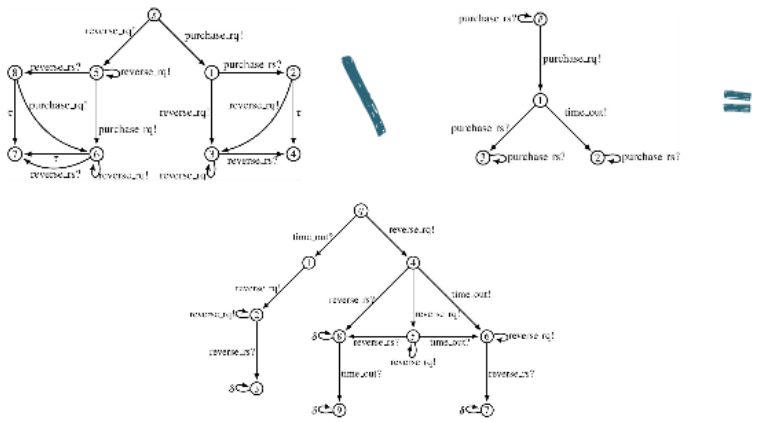


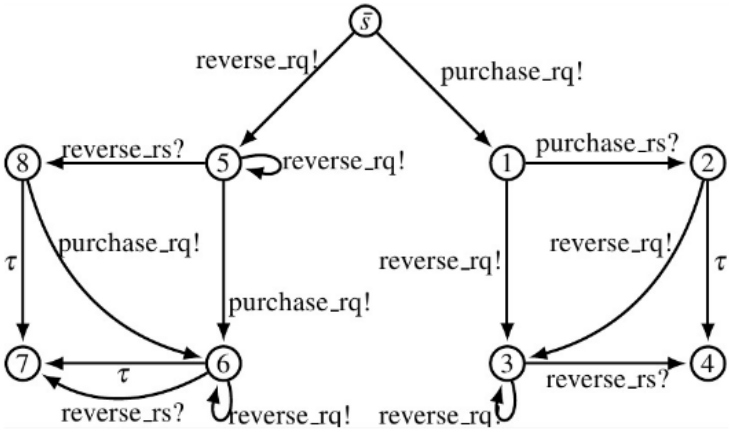
STRONG Decomposability

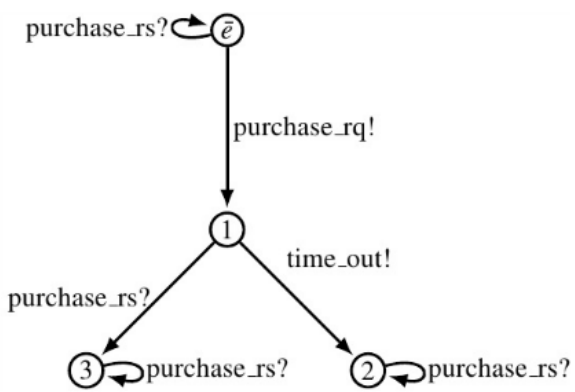
$$\exists \bar{s}', \forall \bar{c}, \bar{e}.\ \ \bar{c}\ \mathbf{ioco}\ \bar{s}' \quad \Leftrightarrow \quad \bar{c} \| \bar{e}\ \mathbf{ioco}\ \bar{s}$$

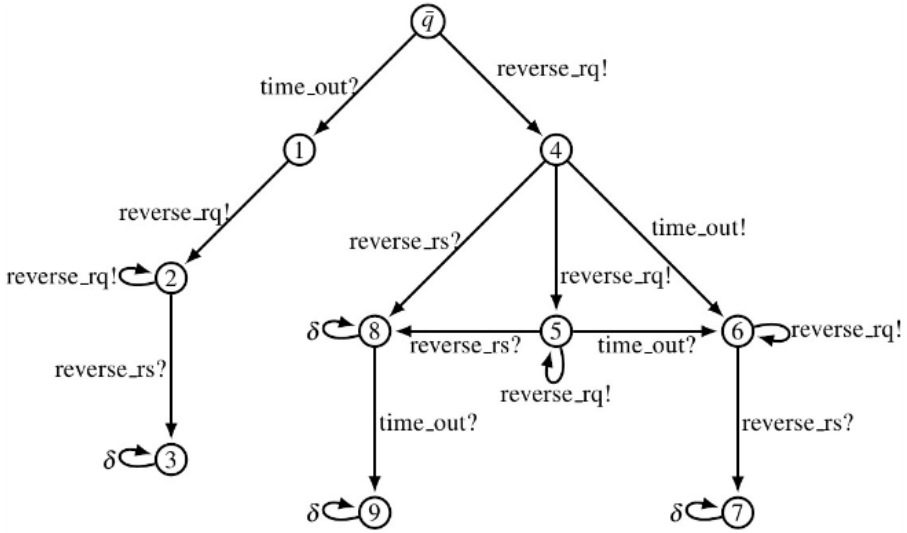
Identifying decomposability

- Checking the correctness of platform
  - > inclusion relation
- Quotient Automaton




$\bar{s}$
reverse_rq!
purchase_rq!
8
reverse_rs?
5
reverse_rq!
1
purchase_rs?
2
τ
purchase_rq!
purchase_rq!
reverse_rq!
reverse_rq!
τ
7
τ
6
3
reverse_rs?
4
reverse_rs?
reverse_rq!
reverse_rq!

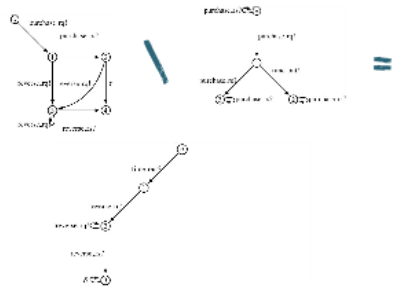

purchase_rs?
$\bar{e}$
purchase_rq!
1
time_out!
purchase_rs?
3
purchase_rs?
2
purchase_rs?


$\bar{q}$
time_out?
reverse_rq!
1
4
reverse_rq!
reverse_rs?
time_out!
reverse_rq!
2
reverse_rq!
δ
8
reverse_rs?
5
time_out?
6
reverse_rq!
reverse_rs?
reverse_rq!
time_out?
reverse_rs?
δ
3
δ
9
δ
7

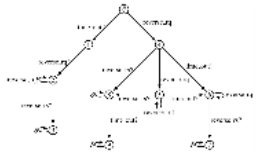
Sufficient conditions

Decomposability

> Valid quotient automaton

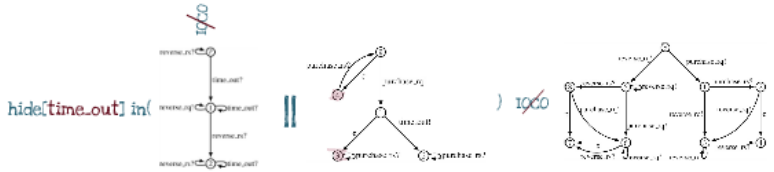


Strong Decomposability



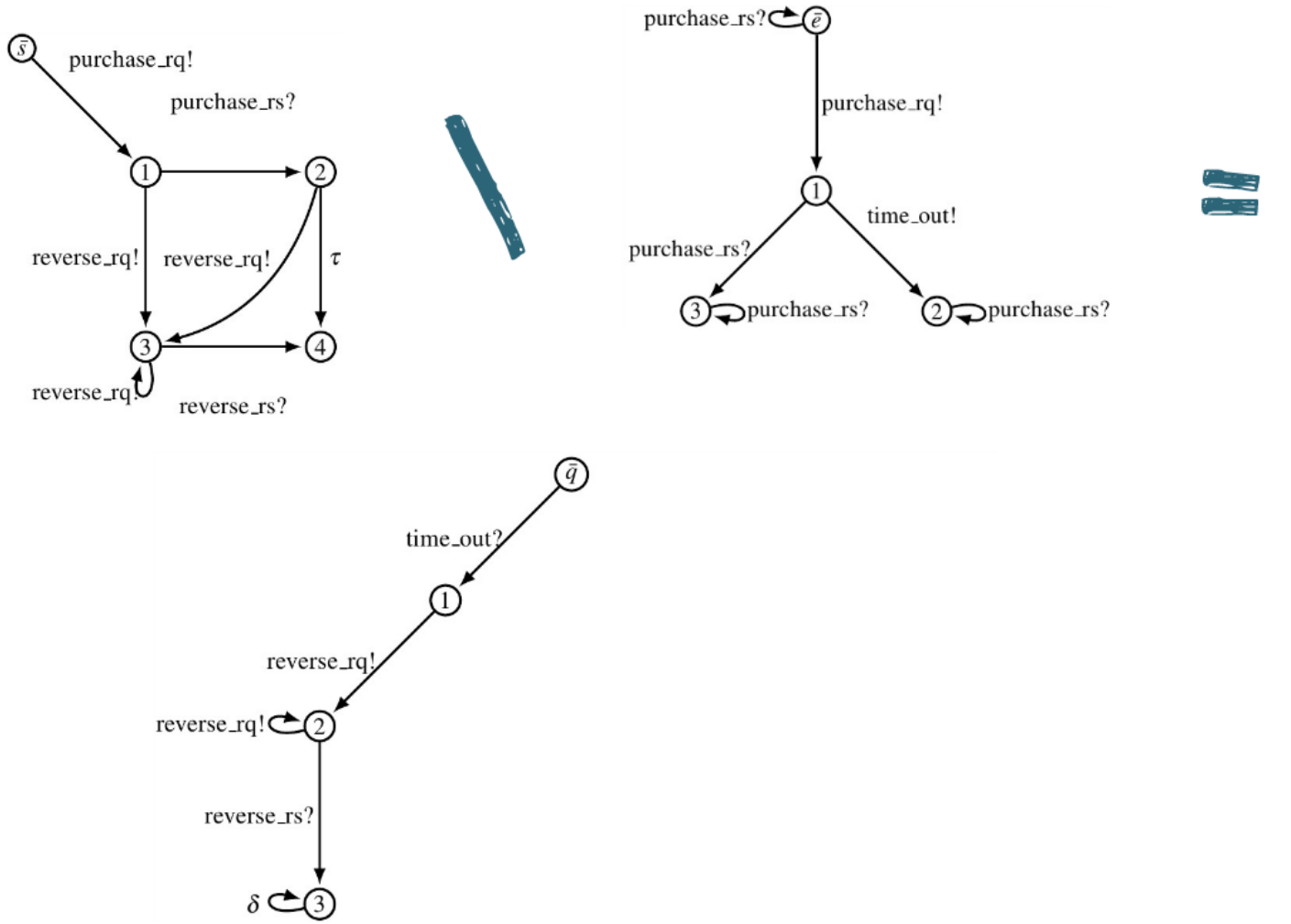
> Valid quotient automaton

> internal choice platform [M. Weighofer and F. Wotawa- 2009]

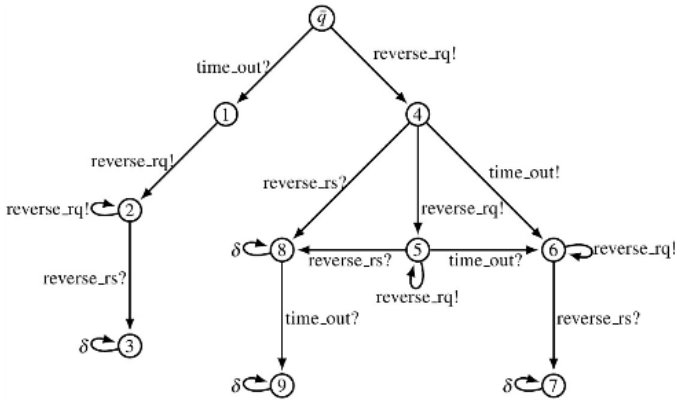


Decomposability

> Valid quotient automaton



Strong Decomposability

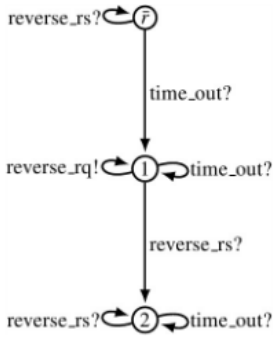


> Valid quotient automaton

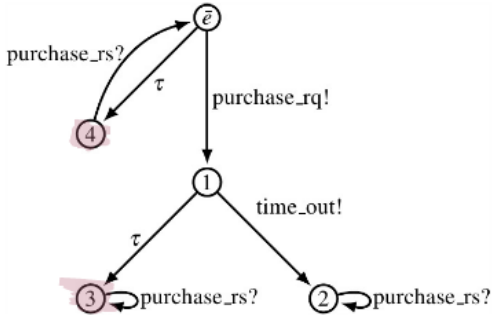
> internal choice platform [M. Weiglhofer and F. Wotawa- 2009]

ioco

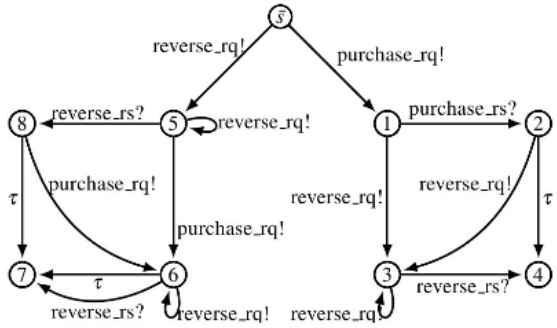
hide[time_out] in(



||



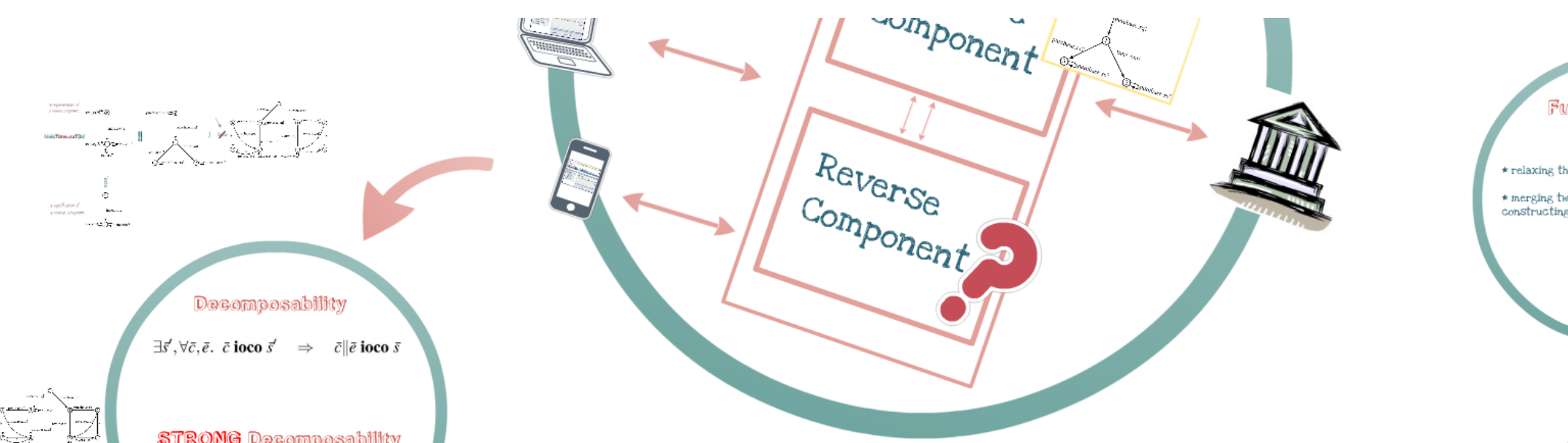
) ioco



Complextity

- ⋆ constructing QA has a exponential complexity
- ⋆ generating complete ioco test cases is hard

On-the fly testing algorithm
for
quotient automaton



Decomposability

$\exists \vec{s}', \forall \bar{c}, \bar{e}.\ \ \bar{c}\ \mathbf{ioco}\ \vec{s}' \quad \Rightarrow \quad \bar{c} \| \bar{e}\ \mathbf{ioco}\ \bar{s}$

STRONG Decomposability

$\exists \vec{s}', \forall \bar{c}, \bar{e}.\ \ \bar{c}\ \mathbf{ioco}\ \vec{s}' \quad \Leftrightarrow \quad \bar{c} \| \bar{e}\ \mathbf{ioco}\ \bar{s}$

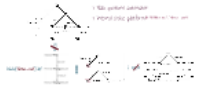
Identifying decomposability

* Checking the correctness of platform
  - inclusion relation
* Quotient Automaton

Sufficient conditions

Decomposability

Strong Decomposability



Complexitity

* constructing QA has a exponential complexity
* generating complete ioco test cases is hard

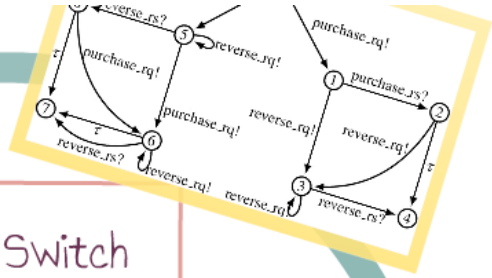
On-the fly testing algorithm
for
quotient automaton

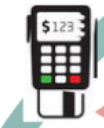
Fu

* relaxing th
* merging tw
constructing

Future works

- relaxing the inclusion relation restriction
- merging two steps of checking platform and constructing quotient automaton





EFT Switch

Purchase Component

Reverse Component

Future works

* relaxing the inclusion relation restriction
* merging two steps of checking platform and constructing quotient automaton

Results

* identifying conditions
* constructing quotien
witness for decompose
* On-the fly algorithm
quotient automaton

Complexity

* constructing QA has a exponential complexity
* generating complete ioco test cases is hard

On-the fly testing algorithm for quotient automaton

Sufficient conditions

Decomposability

Strong Decomposability

Identifying decomposability

* Checking the correctness of platform
  - inclusion relation
* Quotient Automaton

Decomposability

$\exists \bar{s}', \forall \bar{c}, \bar{e}.\ \bar{c}\ \mathbf{ioco}\ \bar{s}' \Rightarrow \bar{c}\|\bar{e}\ \mathbf{ioco}\ \bar{s}$

STRONG Decomposability

$\exists \bar{s}', \forall \bar{c}, \bar{e}.\ \bar{c}\ \mathbf{ioco}\ \bar{s}' \Leftrightarrow \bar{c}\|\bar{e}\ \mathbf{ioco}\ \bar{s}$