







### Resolving Inconsistencies and Redundancies in Declarative Process Models

Claudio Di Ciccio, Fabrizio Maria Maggi, Marco Montali and Jan Mendling

8th International Workshop on Enterprise Modeling and Information Systems Architectures (EMISA 2017) Essen, Germany

claudio.di.ciccio@wu.ac.at

Di Ciccio, C., Maggi, F. M., Montali, M., Mendling, J. (2017). Resolving inconsistencies and redundancies in declarative process models. *Information Systems*, *64*, 425–446. https://doi.org/10.1016/j.is.2016.09.005

### **Foreword**

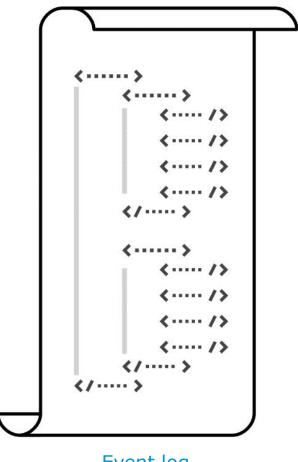


(Declarative) process discovery Declarative constraints as automata

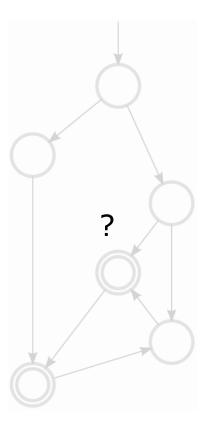


## **Process discovery**







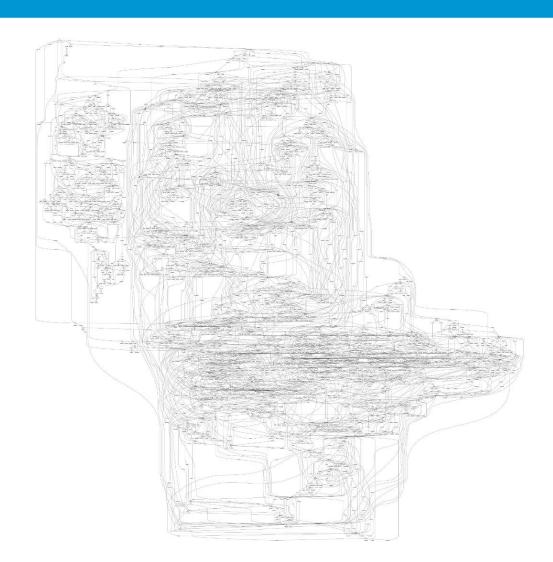


Process model



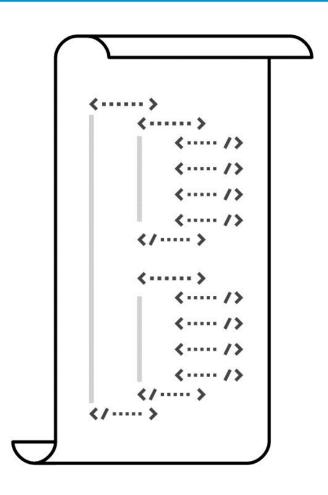


## Mining flexible processes





### **Declarative process discovery**



?

Objective: understanding the **constraints** that best **define the allowed behaviour** of the process behind the event log



## Declarative modelling of processes



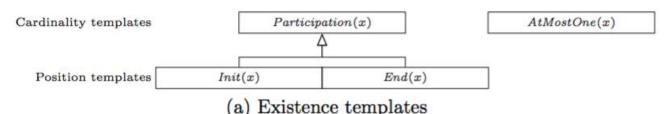
- Usage of constraints
  - "Open model"
- Declare
  - state-of-the-art language

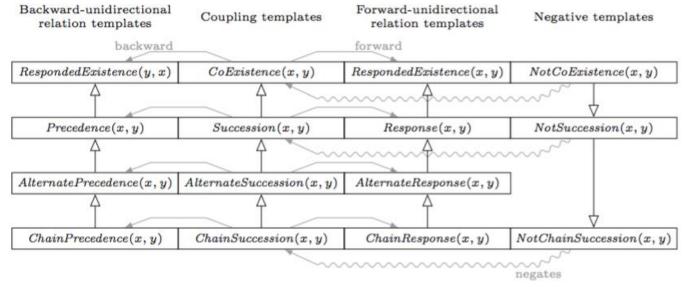
- Init(c)
  - c is always the first executed activity
- End(d)
  - d is always <u>the last</u> executed activity
- RespondedExistence(a,b)
  - If a is executed, b has to be executed
- Response(a,b)
  - If a is executed, b has to be executed afterwards
- ChainResponse(a,b)
  - If a is executed, b has to be executed immediately afterwards
- Precedence(a,b)
  - If b is executed, a must have been executed beforehand
- ChainPrecedence(a,b)
  - If b is executed, a has to be executed immediately beforehand
- NotChainSuccession(a,b)
  - If a is executed, b <u>cannot</u> be executed immediately afterwards



## **Subsumption hierarchy of relation Declare templates**





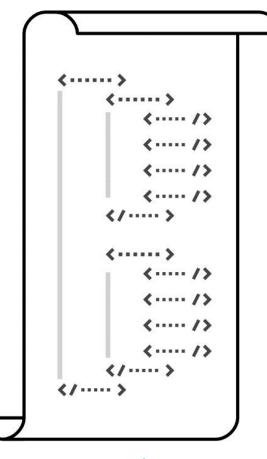


(b) Relation templates



## Mining declarative processes: ingredients

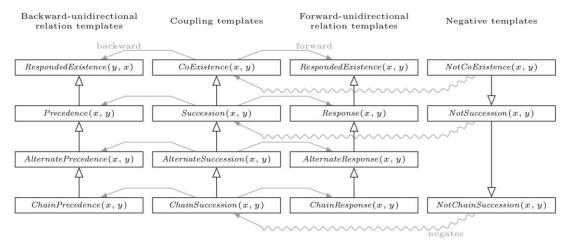




"Submit draft", a,
"Write deliverable", b,
"Organise agenda", c,
...

#### **Activities**

#### Process alphabet

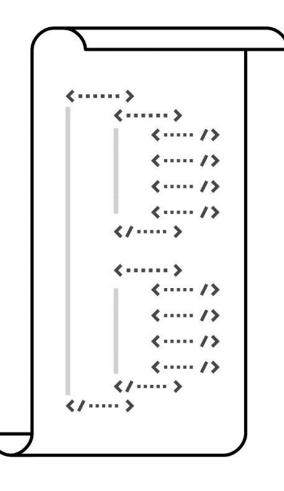






# WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

## Mining declarative processes



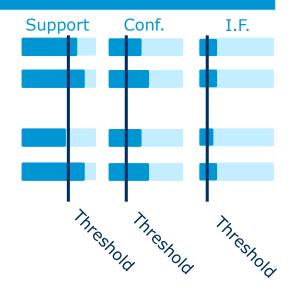
RespondedExistence(a,b) ?
RespondedExistence(a,c) ?

..

Response(a,b)

Response(a,c)

...



Support:

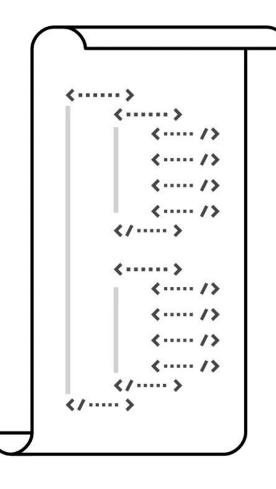
fraction of cases fulfilling the constraint

- Confidence:
  - support scaled by fraction of traces in which the activation occurs
- Interest factor:

confidence scaled by fraction of traces in which the target occurs







RespondedExistence(a,b)

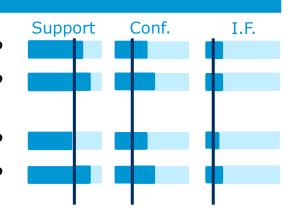
RespondedExistence(a,c) ?

. .

Response(a,b)

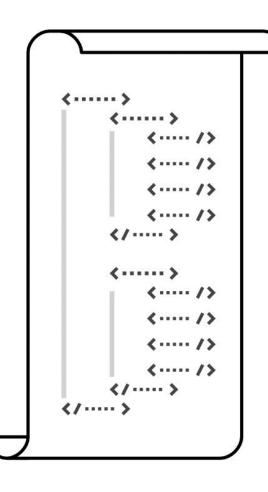
Response(a,c)

...









RespondedExistence(a,b) 

RespondedExistence(a,c) ?

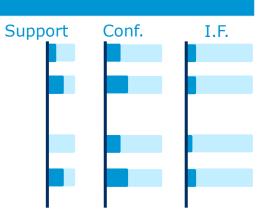
. . .

Response(a,b)

 $\overline{\mathbf{V}}$ 

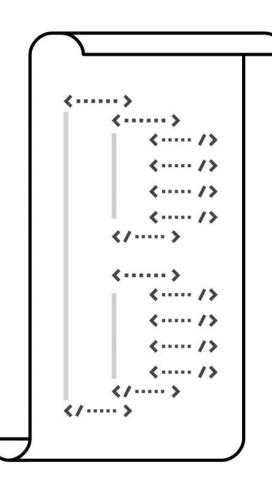
Response(a,c)

...









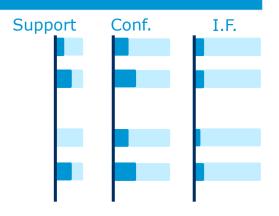
RespondedExistence(a,b) RespondedExistence(a,c) ?

X

 $\overline{\mathbf{V}}$ 

Response(a,b)
Response(a,c)

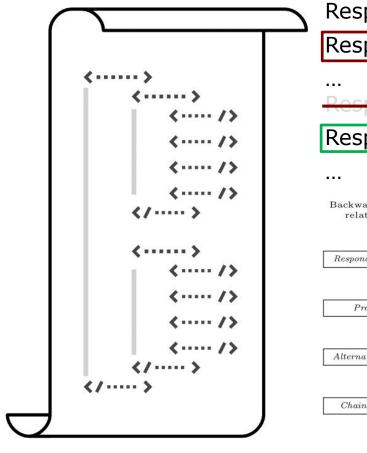
...

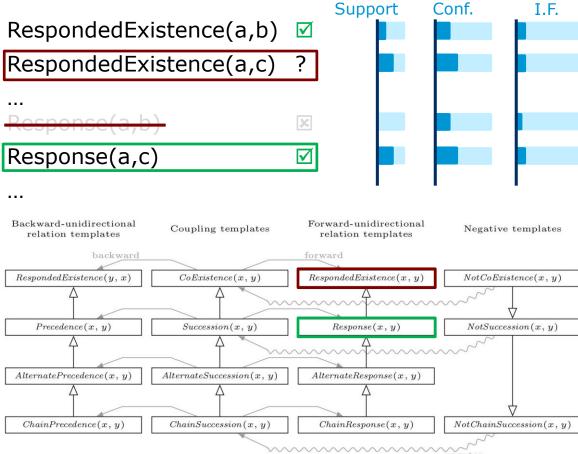




# WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

## Mining declarative processes

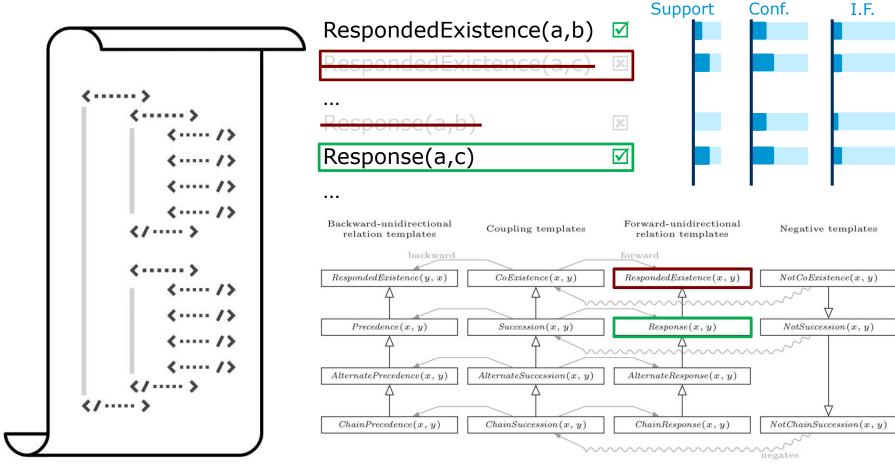






# WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

### Mining declarative processes







#### RespondedExistence(a,b)

RespondedExistence(a,c)

and

esponse(a,b)

Response(a,c)

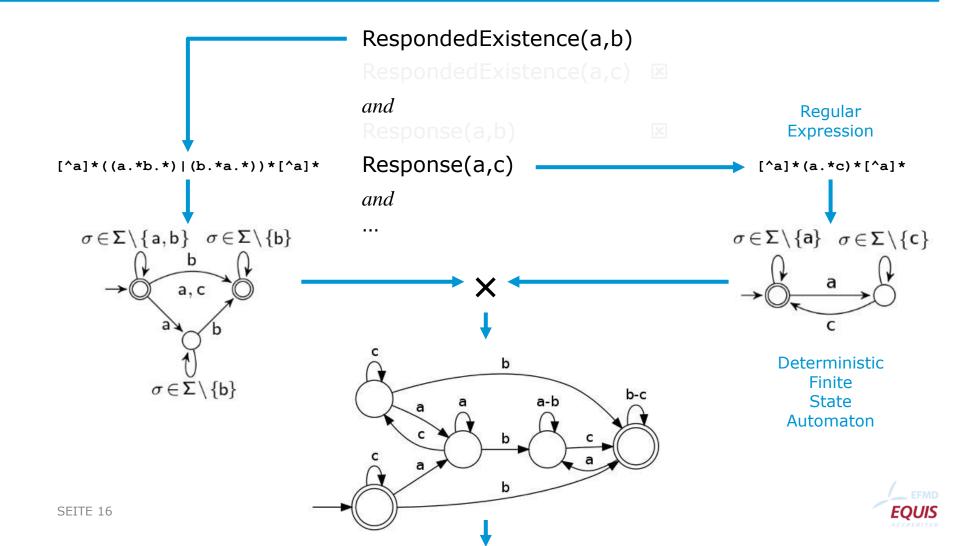
and

. . .



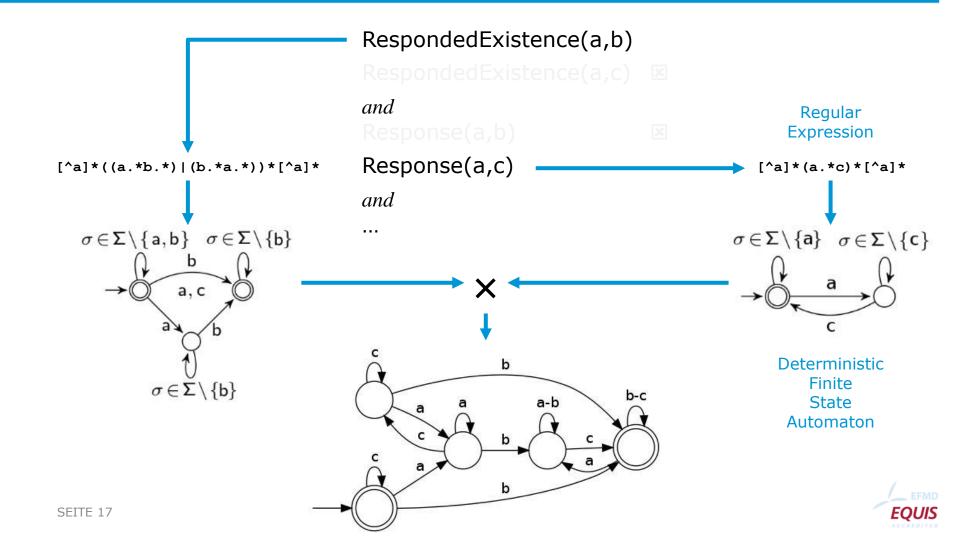
## From constraints-based model to FSA







### To be kept in mind



## So far, so good



What is the problem?



#### WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

## While mining a real-life log...

```
- <log xes.version="1.0" xes.features="nested-attributes" openxes.version="1.0RC7">
   <extension name="Lifecycle" prefix="lifecycle" uri="http://www.xes-standard.org/lifecycle.xesext"/>
   <extension name="Time" prefix="time" uri="http://www.xes-standard.org/time.xesext"/>
   <extension name="Concept" prefix="concept" uri="http://www.xes-standard.org/concept.xesext"/>
   <classifier name="Event Name" keys="concept:name"/>
   <string key="concept:name" value="Email Log"/>
   <string key="lifecycle:model" value="standard"/>
 - <trace>
     <string key="concept:name" value="dc.claudio@gmail.com/SM4All"/>
   - <event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send agenda"/>
       <date key="time:timestamp" value="2009-07-09T17:44:59Z"/>
     </event>
   - <event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send meeting"/>
       <date key="time:timestamp" value="2009-07-14T22:24:43Z"/>
       <string kev="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send draft"/>
       <date key="time:timestamp" value="2009-09-11T17:05:50Z"/>
   - <event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send draft"/>
       <date key="time:timestamp" value="2009-09-14T10:21:42Z"/>
     </event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send draft"/>
       <date key="time:timestamp" value="2009-10-12T21:31:49Z"/>
     </event>
   - <event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="write deliverable"/>
       <date key="time:timestamp" value="2010-01-12T23:16:34Z"/>
     </event>
   - <event>
       <string key="lifecycle:transition" value="complete"/>
       <string key="concept:name" value="send report"/>
       <date key="time:timestamp" value="2010-01-13T16:00:58Z"/>
```

- Support threshold: 0.85
- Confidence threshold: 0.25
- Interest factor threshold: 0.25

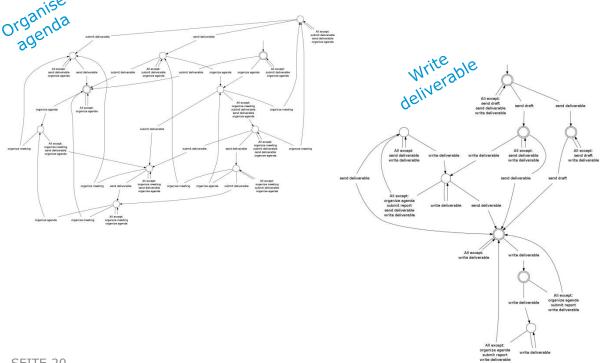
```
100.000% Precedence(send draft, organize meeting)
100.000% Precedence(write deliverable, organize meeting)
 [send agenda] == {
    sonome respondedExistence(send agenda, organize agenda)
    sonome respondedExistence(send agenda, organize agenda)
    100.000% NotChainSuccession(send agenda, organize meeting)
    100.000% RespondedExistence(send agenda, send deliverable)
    100.000% RespondedExistence(send agenda, send draft)
    100.000% RespondedExistence(send agenda, send draft)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.675; int'f:
0.500; int'f:
0.750; int'f:
0.750; int'f:
0.750; int'f:
0.750; int'f:
0.750; int'f:
0.750; int'f:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               0.338;
0.375;
0.563;
0.563;
0.750;
0.750;
0.750;
                                                                                                                                                                                                                                                                                                                                                           100.000%
                                         100,000% CoExistence(send agenda, send meeting)
                                                                                                                                                                                                                                                                                                                                                           100.000%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        0.750:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        int'f:
                                       100.000% Coexistence(send agenda, send meeting)
100.000% MotChainSuccession(send agenda, send report)
100.000% Coexistence(send agenda, submit deliverable)
100.000% MotChainSuccession(send agenda, submit deliverable)
90.000% RespondedExistence(send agenda, submit report)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.750;
0.750;
0.750;
0.750;
0.675;
0.719;
0.750;
0.679;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        int'f:
int'f:
int'f:
int'f:
                                                                                                                                                                                                                                                                                                                                                           100.000%
                                                                                                                                                                                                                                                                                                                                                           100.000%
100.000%
33.333%
                                            95.918% NotChainSuccession(send agenda, submit report)
                                                                                                                                                                                                                                                                                                                                                               72.789%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.540
                                       100.000% CoExistence(send agenda, write deliverable) 90.476% NotChainSuccession(send agenda, write deliverable)
                                   Heliverable] T (
100.000K Participation(send deliverable)
100.000K Northanfouccession(send deliverable, organize demo)
100.000K Northanfouccession(send deliverable, organize meeting)
100.000K Northanfouccession(send deliverable, send send)
100.000K Northanfouccession(send deliverable, send demo)
100.000K Northanfouccession(send deliverable, send draft)
100.000K Northanfouccession(send deliverable, send draft)
100.000K Northanfouccession(send deliverable, send draft)
100.000K Northanfouccession(send deliverable, submit deliverable)
100.000K Northanfouccession(send deliverable)
100.000
   [send deliverable] => {
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.250;
0.750;
0.682;
                                                                                                                                                                                                                                                                                                                                                             39.394%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.682
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.682;
0.250;
1.000;
1.000;
0.750;
0.750;
0.750;
0.250;
0.917;
0.662;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   0.250;
1.000;
1.000;
0.750;
                                                                                                                                                                                                                                                                                                                                                             100.000%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             conf.
conf.
conf.
conf.
                                                                                                                                                                                                                                                                                                                                                             100.000%
                                                                                                                                                                                                                                                                                                                                                           100.000%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          int'f:
                                              91,304% NotChainSuccession(send deliverable, write deliverable)
                                                                                                                                                                                                                                                                                                                                                             42.029%
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        0.685:
                                         100.000% Precedence(send draft, send deliverable)
 [send demo] => {
    100.000% AlternatePrecedence(send deliverable, send demo)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     0.250; int'f:
0.250; int'f:
0.250; int'f:
0.250; int'f:
0.250; int'f:
                                       100.000% AlternateResponse(send demo, send deliverable)
100.000% NotChainSuccession(send demo, send deliverable)
100.000% AlternateResponse(send demo, send draft)
                                         100.000% NotChainSuccession(send demo, send draft)
                                         100,000% AlternatePrecedence(send draft, send demo)
[send draft] => {
100.000% Participation(send draft)
                                   100.000% Farticipation(rend draft)
100.000% butchianiccession(send draft, organize agenda)
100.000% butchianiccession(send draft, organize agenda)
100.000% butchianiccession(send draft, organize meeting)
100.000% butchianiccession(send draft, send deliverable)
85.714% butchianiccession(send draft, send deliverable)
85.714% butchianiccession(send draft, send seeting)
92.000% butchianiccession(send draft, send report)
100.000% butchianiccession(send draft, send report)
100.000% butchianiccession(send draft, send report)
                                                                                                                                                                                                                                                                                                                                                                                                                                               0.500;
0.250;
0.750;
1.000;
0.857;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      0.500;
0.250;
0.750;
1.000;
0.857;
0.250;
0.643;
0.690;
0.750;
0.250;
0.868;
0.694
```

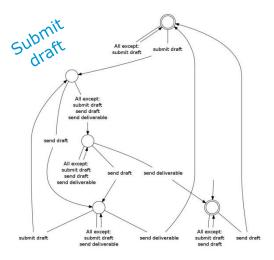




### While mining a real-life log...

```
[submit draft] => {
        100.000% AlternatePrecedence(send draft, submit draft)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250; int'f:
                                                                                                                                         0.250;
        100.000% Response(submit draft, send deliverable)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250;
                                                                                                                                int'f:
                                                                                                                                         0.250;
        100.000% NotChainSuccession(submit draft, send deliverable)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250; int'f:
                                                                                                                                         0.250;
        100.000% AlternateResponse(submit draft, send draft)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250; int'f:
                                                                                                                                         0.250;
        100.000% NotChainSuccession(submit draft, send draft)
                                                                                                                        0.250; int'f:
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                                         0.250;
```



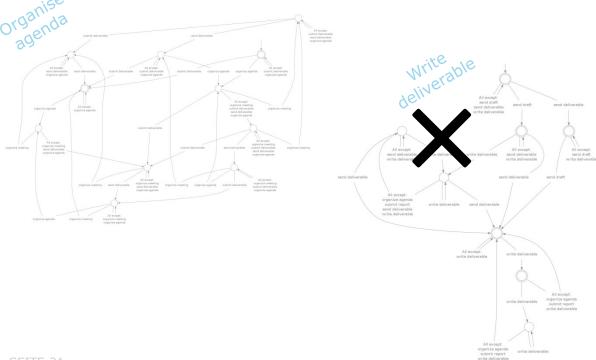


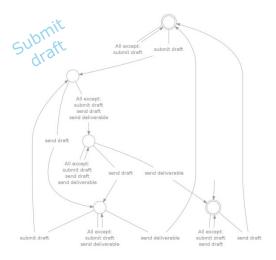




## Time to challenge the X

```
[submit draft] => {
       100.000% AlternatePrecedence(send draft, submit draft)
                                                                                100.000%
                                                                                                               conf.:
                                                                                                                        0.250;
                                                                                                                                int'f:
                                                                                                                                          0.250;
        100.000% Response(submit draft, send deliverable)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250;
                                                                                                                                 int'f:
                                                                                                                                          0.250;
       100.000% NotChainSuccession(submit draft, send deliverable)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250;
                                                                                                                                int'f:
                                                                                                                                          0.250;
        100.000% AlternateResponse(submit draft, send draft)
                                                                               100.000%
                                                                                                               conf.:
                                                                                                                        0.250;
                                                                                                                                int'f:
                                                                                                                                          0.250;
       100.000% NotChainSuccession(submit draft, send draft)
                                                                                                               conf.:
                                                                                                                        0.250; int'f:
                                                                                100.000%
                                                                                                                                          0.250;
```









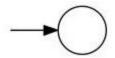
## Time to challenge the X



# Loading...

## The result







## The problems 1) inconsistency



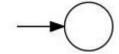
- When support threshold is lower than 100%,
   constraints can be valid through most of the log, though being in conflict
- Example: an event log consists of two traces:
  - 1. <a, b, a, b, a, b, c>
  - 2. <a, b, a, b, a, c>
- Support threshold: 0.7
  - a is always the first
    - $\Rightarrow$  Init(a)
  - c is always the last
    - $\Rightarrow$  End(c)
  - In 6 cases over 8 (75%), a and c do not directly follow each other
    - ⇒ NotChainSuccession(a,c)
  - In 5 cases over 7 (71.143%), b and c do not directly follow each other
    - ⇒ NotChainSuccession(b,c)



## The problems 1) inconsistency



- When support threshold is lower than 100%, constraints can be valid through most of the log, though being in conflict
- Example: an event log consists of two traces:
  - 1. <a, b, a, b, a, b, c>
  - 2. <a, b, a, b, a, c>
- Support threshold: 0.7
  - a is always the first
    - $\Rightarrow$  Init(a)
  - c is always the last
    - $\Rightarrow$  End(c)
  - In 6 cases over 8 (75%), a and c do not directly follow each other
    - ⇒ NotChainSuccession(a,c)
  - In 5 cases over 7 (71.143%), a and b do not directly follow each other
    - ⇒ NotChainSuccession(b,c)



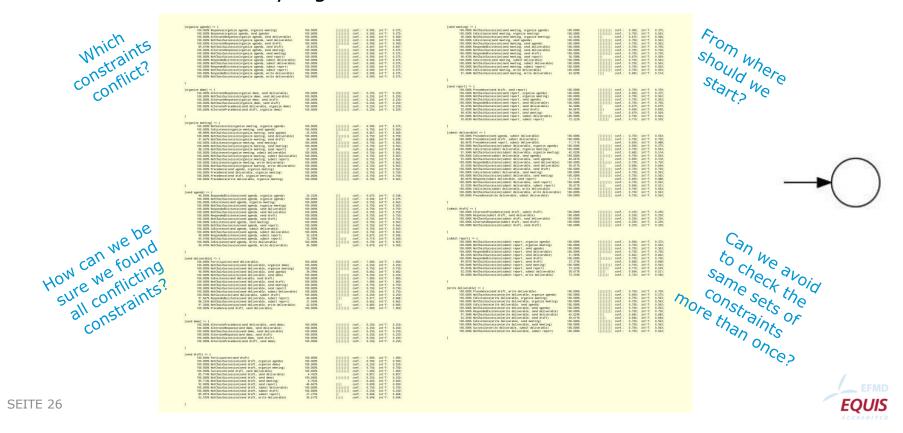
- Question: what can be done right before c?
  - ⇒ inconsistency!



## The problems 1) inconsistency



- When support threshold is lower than 100%,
   constraints can be valid through most of the log, though being in conflict
- How to trust a discovery algorithm that can return inconsistent models?





- Many constraints may be fulfilled 100% of times yet not add a bit of information to other already discovered ones
- Example: an event log consists of two traces:
  - 1. <a, b, a, b, a, b, c>
  - 2. <a, b, a, b, a, c>
  - a is always the first
    - $\Rightarrow$  Init(a)
  - c is always the last
    - $\Rightarrow$  End(c)
  - Before c, a precedes
    - $\Rightarrow$  Precedence(a,c)
  - Before b, a precedes
    - $\Rightarrow$  Precedence(a,b)
  - After a, c eventually follows
    - $\Rightarrow$  Response(a,c)
  - After b, c eventually follows
    - $\Rightarrow$  Response(b,c)





- Many constraints may be fulfilled 100% of times yet not add a bit of information to other already discovered ones
- Example: an event log consists of two traces:
  - 1. <a, b, a, b, a, b, c>
  - 2. <a, b, a, b, a, c>
  - a is always the first
    - $\Rightarrow$  Init(a)
  - c is always the last
    - $\Rightarrow$  End(c)
  - Before c, a precedes
    - ⇒ Precedence(a,c)
  - Before b, a precedes
    - $\Rightarrow$  Precedence(a,b)
  - After a, c eventually follows
    - $\Rightarrow$  Response(a,c)
  - After b, c eventually follows
    - $\Rightarrow$  Response(b,c)

Of course! a is always the first





- Many constraints may be fulfilled 100% of times yet not add a bit of information to other already discovered ones
- Example: an event log consists of two traces:

```
1. <a, b, a, b, a, b, c>
```

a is always the first

$$\Rightarrow$$
 Init(a)

• <u>c is always the last</u>

$$\Rightarrow$$
 End(c)

• Before c, a precedes

 $\Rightarrow$  Precedence(a,c)

• Before b, a precedes

 $\Rightarrow$  Precedence(a,b)

After a, c eventually follows
 ⇒ Response(a,c)

After b, c eventually follows

⇒ Response(b,c)

Of course! a is always the first

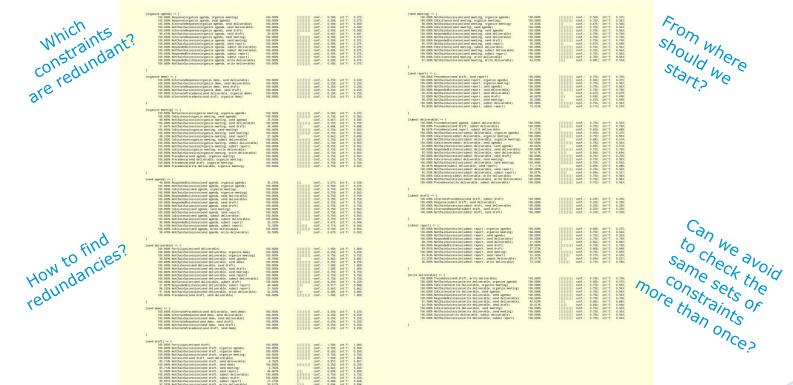
Of course! c is always the last

• Question: can't we avoid stating the obvious?





- Many constraints may be fulfilled 100% of times yet not add a bit of information to other already discovered ones
- How to reduce the number of unnecessary returned constraints?





### The solution



Automata-product monoid

Algebraic structure with composition operator  $(\Box)$  holding the properties of

- commutativity
- associativity

and bearing



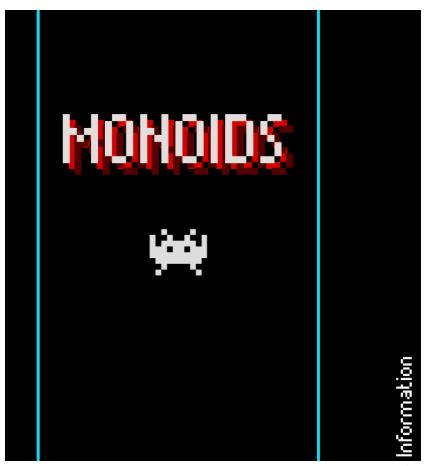
- identity element →
- and absorbing element →○



### The solution



Automata-product monoid

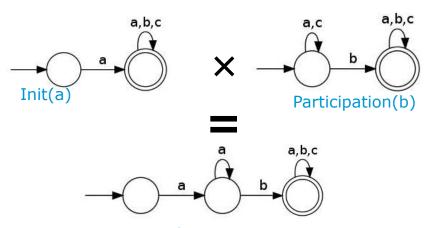


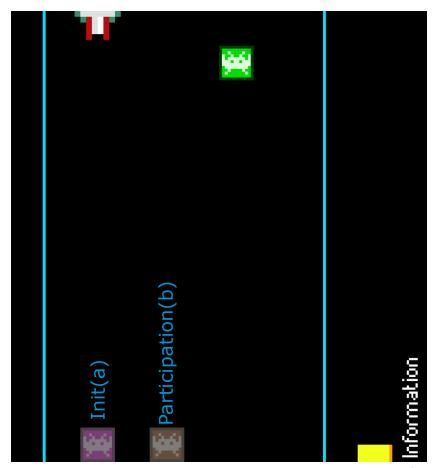


## Rules of the game



 Intersect the product automaton with the newly visited constraints, one at a time





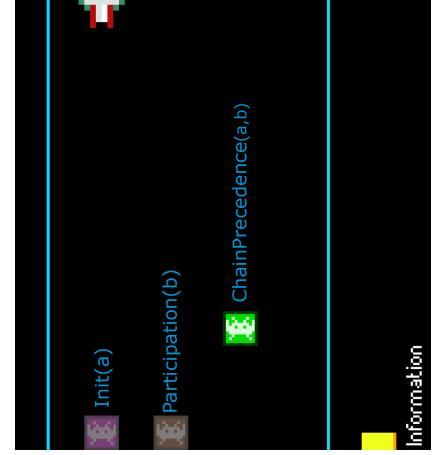


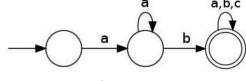
### Rules of the game



 Intersect the product automaton with the newly visited constraints, one at a time

ChainPrecedence(a,b)



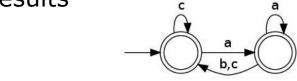




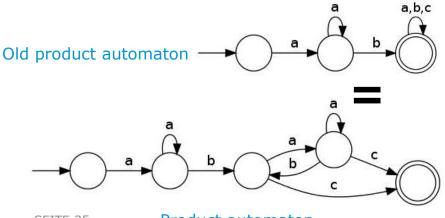
# WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BLISINESS

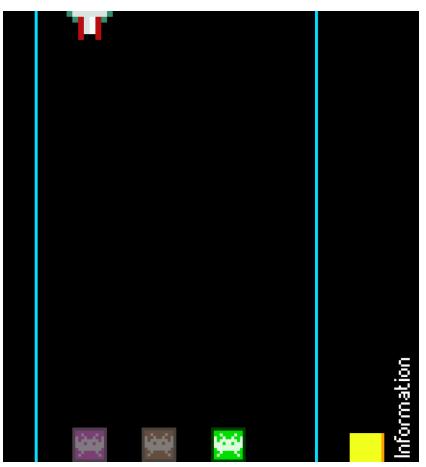
## **Exploiting formal properties**

- We take advantage of
  - 1. associativity
    - allows for "storage" of results



ChainPrecedence(a,b)



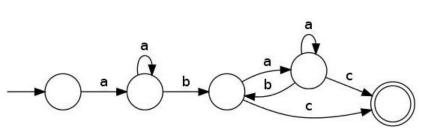


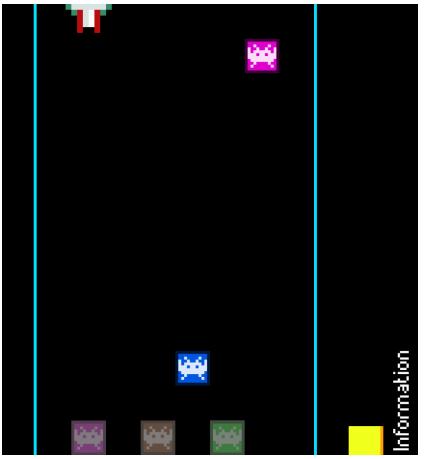


## WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND DUISINESS

## **Exploiting formal properties**

- We take advantage of
  - 1. associativity
    - allows for "storage" of results
  - 2. commutativity
    - allows for priority sorting of constraints



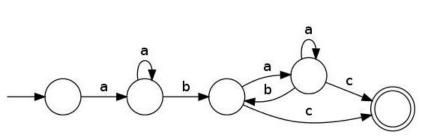


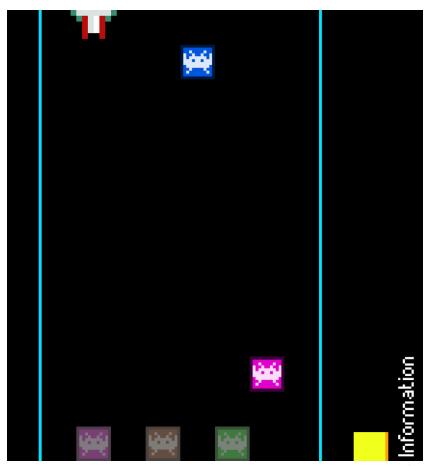


# WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND DUISINESS

## **Exploiting formal properties**

- We take advantage of
  - 1. associativity
    - allows for "storage" of results
  - 2. commutativity
    - allows for priority sorting of constraints



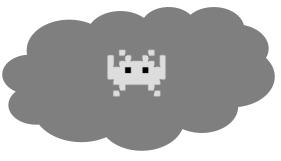


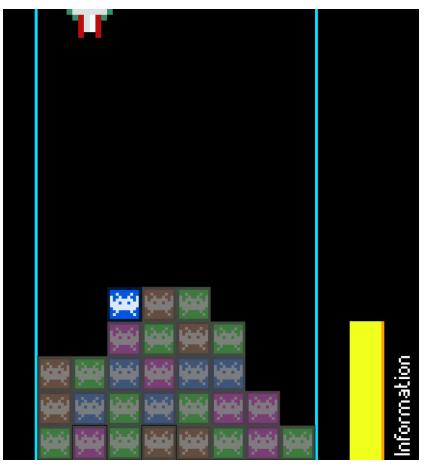


## Playing the game



 Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)





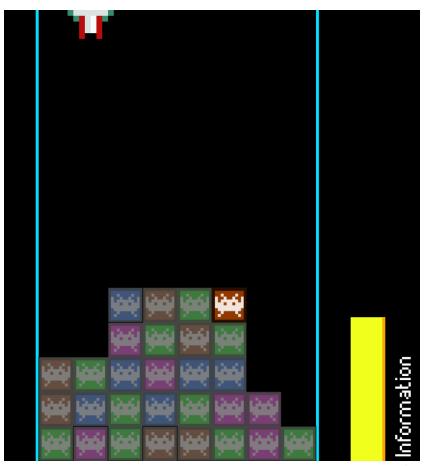


## Playing the game



Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)





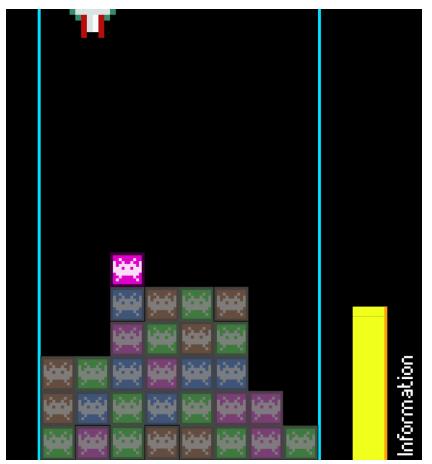


## Playing the game



 Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)



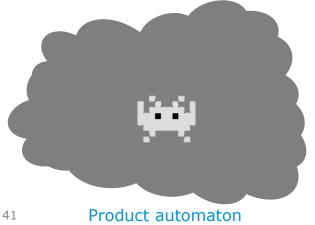


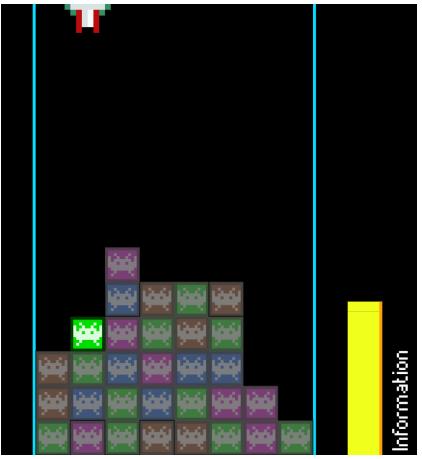


## **Inconsistency!**



- Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)
- Conflict:









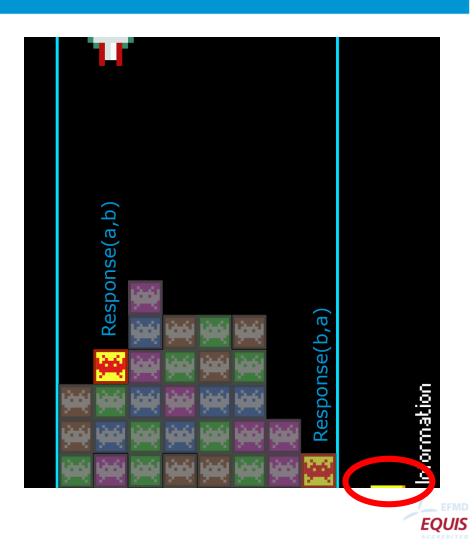


#### Conflict:

The product automaton becomes



(empty language)







#### Conflict:

The product automaton becomes



(empty language)



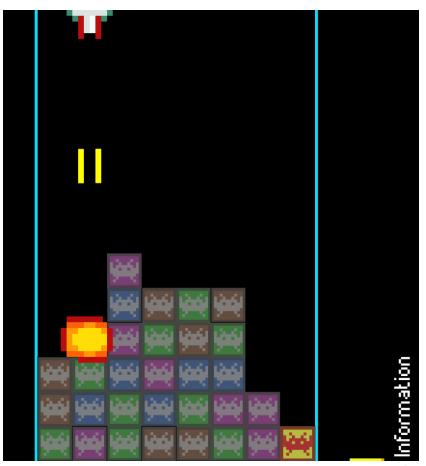






#### Conflict:

Remove the constraint, in case

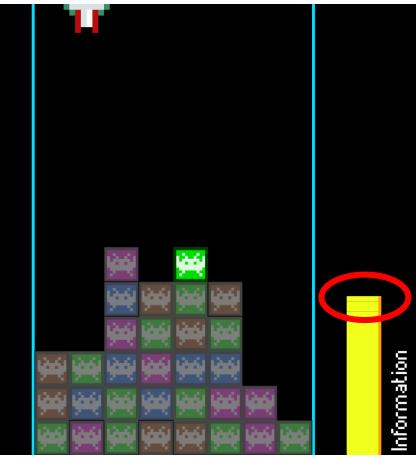








- Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)
- Redundancy:



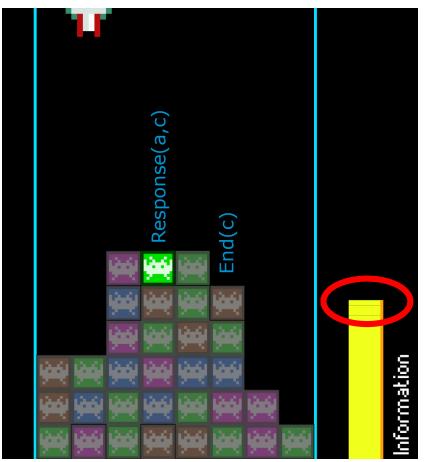






### Redundancy:

 The new product automaton accepts the same strings as before (language inclusion)





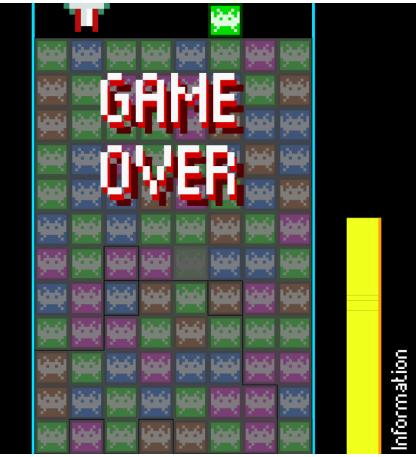
## Redundancy!



 Newly visited constraints add information to the knowledge on the process model if they reduce the number of possible traces (accepted strings)

### Redundancy:

 The new product automaton accepts the same strings as before (language inclusion)



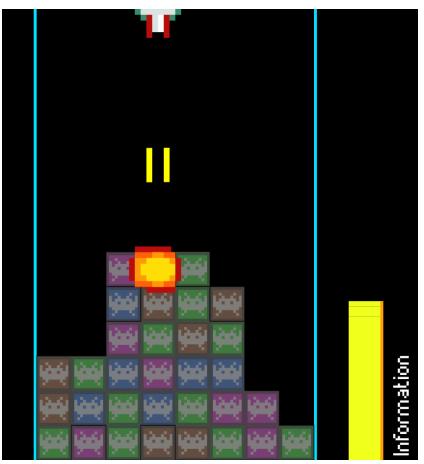






### Redundancy:

Remove the constraint, in case

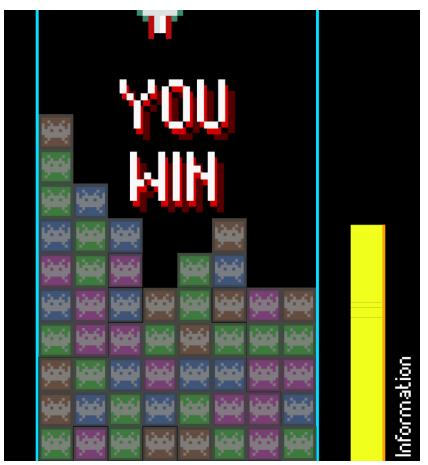




## **Objectives**



- Remove inconsistencies
- Minimise redundancies
- Analyse each constraint once





# The solution: Inconsistency detection



#### Rationale:

- 1. How to **find** inconsistencies among constraints?
  - Use the automaton-based model for constraints
  - Does the cross-product automaton recognise the empty language?
- 2. How to **search** the inconsistencies?
  - Exploit:
    - a) The product operation between automata
    - b) The sorting of Declare templates

#### • Guideline:

- Preserve the most meaningful constraints
  - The sorting prioritises constraints



# The solution: Redundancy detection



#### Rationale:

- 1. How to **find** redundancies among constraints?
  - Use the automaton-based model for constraints
  - Does the cross-product automata recognise the same language as before?
- 2. How to **search** the inconsistencies?
  - Exploit:
    - a) The product operation between automata
    - b) The sorting of Declare templates

#### • Guideline:

- Preserve the most meaningful constraints
  - The sorting prioritises constraints



### **Conclusion**



Which were the conflicting constraints in the log? How does the redundancy removal perform?

What is more in the paper?

Limitations and future work



```
[organize agenda] => {
   100.000% Response(organize agenda, organize meeting)
                                                                                                                           100.000%
             100.000% Response(organize agenda, send agenda)
100.000% AlternateResponse(organize agenda, send deliverable)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.500:
                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                    0.375
                                                                                                                                                                           conf.
                                                                                                                                                                                                       int'f
             100.000% NotChainSuccession(organize agenda, send deliverable) 100.000% AlternateResponse(organize agenda, send draft)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.500:
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.500
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.500;
                                                                                                                                                                                                      int'f:
             89.474% NotChainSuccession(organize agenda, send draft)
100.000% AlternateResponse(organize agenda, send meeting)
                                                                                                                            29.825%
                                                                                                                                                                            conf.
                                                                                                                                                                                         0.447:
                                                                                                                                                                                                                    0.447
                                                                                                                            100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.500;
                                                                                                                                                                                                     int'f:
             100.000% NotChainSuccession(organize agenda, send meeting) 100.000% NotChainSuccession(organize agenda, send report)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.500:
                                                                                                                                                                                                                    0.375
                                                                                                                            100.000%
                                                                                                                                                                            conf.
                                                                                                                                                                                          0.500;
                                                                                                                                                                                                      int'f:
int'f:
             100.000% RespondedExistence(organize agenda, submit deliverable)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.500;
                                                                                                                                                                                                                    0.375
             100.000% NotChainSuccession(organize agenda, submit deliverable)
100.000% RespondedExistence(organize agenda, submit report)
                                                                                                                            100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.500;
                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                           100.000%
                                                                                                                                                                                         0.500;
                                                                                                                                                                                                                    0.375
             100.000% NotChainSuccession(organize agenda, submit report)
100.000% RespondedExistence(organize agenda, write deliverable)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.500;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.375
             100.000% NotChainSuccession(organize agenda, write deliverable)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.500;
[organize demo] => {
   100.000% AlternateResponse(organize demo, send deliverable)
                                                                                                                           100.000%
                                                                                                                                                                                         0.250; int'f:
                                                                                                                                                                                                                    0.250
             100.000% NotChainSuccession(organize demo, send deliverable)
100.000% AlternateResponse(organize demo, send draft)
                                                                                                                           100.000%
                                                                                                                                                                           conf.:
                                                                                                                                                                                         0.250;
                                                                                                                                                                                                    int'f:
int'f:
                                                                                                                                                                                                                    0.250
                                                                                                                                                                                                                    0.250
             100.000% NotChainSuccession(organize demo, send draft)
100.000% AlternatePrecedence(send deliverable, organize demo)
                                                                                                                           100 000%
                                                                                                                                                                           conf.:
                                                                                                                                                                                         0.250;
                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                   0.250
                                                                                                                                                                           conf.:
             100.000% AlternatePrecedence(send draft, organize demo)
                                                                                                                           100.000%
                                                                                                                                                                          conf.:
                                                                                                                                                                                         0.250: int'f:
                                                                                                                                                                                                                   0.250
[organize meeting] => {
   100.000% NotSuccession(organize meeting, organize agenda)
                                                                                                                                                                                         0.500;
0.750;
0.667;
                                                                                                                           100.000%
                                                                                                                                                            ||||||| conf.:
             100.000% Coststener(organize meeting, organize agenda)
100.000% Coststener(organize meeting, send agenda)
100.000% Coststener(organize meeting, send adenda)
100.000% NotThainSuccession(organize meeting, send deliverable)
191.667% NotThainSuccession(organize meeting, send draft)
100.000% Coststenec(organize meeting, send meeting)
                                                                                                                           100.000%
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.563
                                                                                                                                                                                                      int'f:
                                                                                                                            25.926%
                                                                                                                                                                            conf.
                                                                                                                                                             ||||||||| conf.
                                                                                                                           100.000%
                                                                                                                                                                                          0.750:
                                                                                                                                                                                                                    0.750
                                                                                                                            44.444%
                                                                                                                                                                          conf.
                                                                                                                                                                                          0.688;
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                     0.688
                                                                                                                                                                                         0.750;
0.750;
0.662;
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.563
             100.000% Aberthalment utganize meeting, setim meeting enting)
88.235% NotChainSuccession(organize meeting, sent general peopri)
100.000% CoExistence(organize meeting, submit deliverable)
100.000% NotChainSuccession(organize meeting, submit deliverable)
100.000% NotChainSuccession(organize meeting, submit deliverable)
100.000% CoExistence(organize meeting, submit deliverable)
100.000% CoExistence(organize meeting, submit report)
                                                                                                                                                                                                      int'f:
                                                                                                                           100.0009
                                                                                                                                                              |||||| conf.
                                                                                                                                                                                                                     0.563
                                                                                                                            21.569%
                                                                                                                                                                            conf.
                                                                                                                                                                                                                    0.496
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.750;
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.563
                                                                                                                            100.000%
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                           100 000%
                                                                                                                                                                                                                    0.563
                                                                                                                            100.000%
                                                                                                                                                                                                                    0.563
             100.000% NotChainSuccession(organize meeting, write deliverable)
100.000% Precedence(send agenda, organize meeting)
                                                                                                                                                                           conf.:
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                           100 000%
                                                                                                                                                                                                                    0.563
                                                                                                                            100.000%
                                                                                                                                                                                                                    0.563
             100.000% Precedence(send deliverable, organize meeting)
                                                                                                                           100.000%
                                                                                                                                                                           conf.:
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                                                                                                                    0.750
              100.000% Precedence(send draft, organize meeting)
                                                                                                                           100.000%
             100.000% Precedence(write deliverable, organize meeting)
                                                                                                                           100.000%
                                                                                                                                                                          conf.:
                                                                                                                                                                                         0.750; int'f:
                                                                                                                                                                                                                   0.563
[send agenda] => {
                                                                                                                                                                                         0.675;
0.500;
0.750;
0.750;
              90.000% RespondedExistence(send agenda, organize agenda)
                                                                                                                                                                                                      int'f:
int'f:
             100.000% NotChainSuccession(send agenda, organize agenda)
100.000% CoExistence(send agenda, organize meeting)
                                                                                                                                                                                                                    0.375
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                      int'f:
                                                                                                                            100.000%
                                                                                                                                                                            conf.
             100.000% NotChainSuccession(send agenda, organize meeting)
100.000% RespondedExistence(send agenda, send deliverable)
100.000% NotChainSuccession(send agenda, send deliverable)
                                                                                                                           100,000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                                    0.563
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.750
                                                                                                                           100.000%
             100.000% RespondedExistence(send agenda, send draft)
100.000% NotChainSuccession(send agenda, send draft)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                                                                                                                    0.750
                                                                                                                           100.000%
                                                                                                                           100.000%
             100.000% CoExistence(send agenda, send meeting)
100.000% NotChainSuccession(send agenda, send report)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.563
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.563
             100.000% CoExistence(send agenda, submit deliverable)
100.000% NotChainSuccession(send agenda, submit deliverable)
                                                                                                                                                                          conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                     int'f:
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.563
                                                                                                                           100.000%
                                                                                                                                                                                                                    0.563
             90.000% RespondedExistence(send agenda, submit report)
95.918% NotChainSuccession(send agenda, submit report)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.675;
                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                            33.333%
                                                                                                                                                                                                                    0.506
                                                                                                                            72.789%
                                                                                                                                                                                                                    0.540
             100.000% CoExistence(send agenda, write deliverable)
90.476% NotChainSuccession(send agenda, write deliverable)
                                                                                                                           100.000%
                                                                                                                                                                          conf.:
                                                                                                                                                                                         0.750; int'f:
0.679; int'f:
                                                                                                                                                                                                                    0.563
                                                                                                                            36.508%
             100.000% Participation(send deliverable)
                                                                                                                           100.000%
                                                                                                                                                                                          1.000:
                                                                                                                                                                                                                    1.000
                                                                                                                                                                          conf.
                                                                                                                                                                                          0.250;
                                                                                                                                                                                                      int'f:
             100.000% NotChainSuccession(send deliverable, organize demo)
                                                                                                                            100.000%
             100.000% NotChainSuccession(send deliverable, organize meeting) 90.909% NotChainSuccession(send deliverable, send agenda) 100.000% NotChainSuccession(send deliverable, send demo)
                                                                                                                                                                                                                    0.750
                                                                                                                           100,000%
                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                            39.394%
                                                                                                                                                                            conf.
                                                                                                                                                                                          0.682;
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                          0.250:
                                                                                                                                                                                                                    0.250
             100.000% CoExistence(send deliverable, send draft)
                                                                                                                            100.000%
                                                                                                                                                                            conf.
                                                                                                                                                                                          1.000;
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                     1.000
             100.000% NotChainSuccession(send deliverable, send draft)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                                    1,000
             100.000% NotChainSuccession(send deliverable, send meeting)
100.000% NotChainSuccession(send deliverable, send report)
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                     int'f:
                                                                                                                           100 000%
                                                                                                                                                                            conf.
                                                                                                                                                                                                                    0.750
                                                                                                                            100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                                    0.750
             100.000% NotChainSuccession(send deliverable, submit deliverable)
100.000% NotSuccession(send deliverable, submit draft)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                   0.750
                                                                                                                           100.000%
                                                                                                                           100.000%
              91.667% RespondedExistence(send deliverable, submit report)
88.235% NotChainSuccession(send deliverable, submit report)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.917;
                                                                                                                                                                                                     int'f:
                                                                                                                            44 444%
                                                                                                                                                                                                                    0.688
                                                                                                                            21.569%
                                                                                                                                                                                                                    0.662
             91.304% NotChainSuccession(send deliverable, write deliverable)
100.000% Precedence(send draft, send deliverable)
                                                                                                                           42.029%
100.000%
                                                                                                                                                                         conf.:
                                                                                                                                                                                         0.685;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                                                                                                                    0.685
             100.000% AlternatePrecedence(send deliverable, send demo)
100.000% AlternateResponse(send demo, send deliverable)
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.250;
                                                                                                                           100.000%
                                                                                                                            100.000%
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.250
             100.000% NotChainSuccession(send demo, send deliverable) 100.000% AlternateResponse(send demo, send draft)
                                                                                                                                                                                         0.250;
0.250;
0.250;
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                                    0.250
                                                                                                                            100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                    0.250
             100,000% NotChainSuccession(send demo, send draft)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                                                    0.250
              100.000% AlternatePrecedence(send draft, send demo)
                                                                                                                           100.000%
                                                                                                                                                             ||||||| conf.:
                                                                                                                                                                                          0.250;
             100.000% Participation(send draft)
                                                                                                                           100.000%
                                                                                                                                                                                          1.000; int'f:
                                                                                                                                                                                                                    1.000
                                                                                                                                                                           conf.
             100.000% NortChainSuccession(send draft, organize agenda)
100.000% NortChainSuccession(send draft, organize demo)
100.000% NortChainSuccession(send draft, organize meeting)
100.000% NortChainSuccession(send draft, organize meeting)
100.000% NortChainSuccession(send draft, send deliverable)
100.000% NortChainSuccession(send draft, send deliverable)
100.000% NortChainSuccession(send draft, send demo)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.500;
                                                                                                                                                                                                    int'f:
int'f:
                                                                                                                                                                                                                    0.500
                                                                                                                                                                                                                    0.250
                                                                                                                           100.000%
                                                                                                                                                                          conf.
                                                                                                                                                                                          0.750;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                                                                                                                    0.750
                                                                                                                           100.000%
                                                                                                                                                                                                                    1.000
                                                                                                                                                         conf.
                                                                                                                           4.762%
                                                                                                                                                                                          0.857;
                                                                                                                                                                                                      int'f:
int'f:
                                                                                                                                                                                                                    0.857
                                                                                                                                                                                          0.250;
                                                                                                                                                                                                                    0.250
                                                                                                                                                                                                      int'f:
int'f:
int'f:
int'f:
              85.714% NotChainSuccession(send draft, send meeting)
92.000% NotChainSuccession(send draft, send report)
                                                                                                                            4.762%
46.667%
                                                                                                                                                                            conf.
                                                                                                                                                                                          0.643;
                                                                                                                                                                                                                    0.643
                                                                                                                                                                            conf.
             100.000% NotChainSuccession(send draft, submit deliverable)
100.000% NotChainSuccession(send draft, submit draft)
89.091% NotChainSuccession(send draft, submit report)
                                                                                                                           100.000%
                                                                                                                                                                           conf.
                                                                                                                                                                                         0.750;
                                                                                                                                                                                                                    0.750
                                                                                                                            100.000%
                                                                                                                                                                                                                     0.250
                                                                                                                            27.273%
                                                                                                                                                                            conf.
                                                                                                                                                                                          0.668:
                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                    0.668
               92.593% NotChainSuccession(send draft, write deliverable)
                                                                                                                                                                                          0.694;
                                                                                                                                                                           conf.
```

<pre>[send meeting] =&gt; {     100.000% NotChainSuccession(send meeting, organize agenda)     100.000% NotChainSuccession(send meeting, organize meeting)     90.000% NotChainSuccession(send meeting, organize meeting)     90.000% NotChainSuccession(send meeting, send agenda)     100.000% NotChainSuccession(send meeting, send agenda)     100.000% NotChainSuccession(send meeting, send deliverable)     100.000% NotChainSuccession(send meeting, send deliverable)     100.000% NotChainSuccession(send meeting, send draft)     90.476% NotChainSuccession(send meeting, send draft)     100.000% Cochiidence(send meeting, send draft)     100.000% NotChainSuccession(send meeting, summit deliverable)     100.000% NotChainSuccession(send meeting, sumit deliverable)     91.304% NotChainSuccession(send meeting, write deliverable)     91.304% NotChainSuccession(send meeting, write deliverable) }</pre>	100.000% 100.000% 33.333% 100.000% 100.000% 100.000% 100.000% 100.000% 36.508% 100.000% 100.000% 100.000% 100.000%		0.750; int'f; 0.675; int'f; 0.750; int'f; 0.750; int'f; 0.750; int'f; 0.750; int'f; 0.750; int'f; 0.679; int'f; 0.750; int'f; 0.750; int'f; 0.750; int'f; 0.750; int'f;	0.375; 0.563; 0.506; 0.563; 0.563; 0.750; 0.750; 0.750; 0.509; 0.563; 0.563; 0.563; 0.563;
[send report] => {				
100.000% Precedence(send draft, send report) 100.000% NorthainSuccession(send report, organize agenda) 100.000% NorthainSuccession(send report, organize meeting) 100.000% NorthainSuccession(send report, send agenda) 100.000% NorthainSuccession(send report, send deliverable) 90.476% NorthainSuccession(send report, send deliverable) 92.000% NorthainSuccession(send report, send draft) 90.476% NorthainSuccession(send report, send draft) 90.476% NorthainSuccession(send report, send draft) 90.400% NorthainSuccession(send report, send draft) 93.433% NorthainSuccession(send report, send treport)	100.000% 100.000% 100.000% 100.000% 100.000% 36.508% 46.667% 36.508% 100.000% 72.222%		0.500; int'f: 0.750; int'f: 0.750; int'f: 0.750; int'f: 0.679; int'f: 0.690; int'f: 0.679; int'f: 0.750; int'f:	0.750; 0.375; 0.563; 0.563; 0.750; 0.679; 0.690; 0.509; 0.563; 0.539;
}				
[submit deliverable] => { 100.000% Precedence(send agenda, submit deliverable) 100.000% Precedence(send draft, submit deliverable) 100.000% Precedence(send draft, submit deliverable) 100.000% NotChainSuccession(submit deliverable, organize agenda) 100.000% NotChainSuccession(submit deliverable, organize meeting) 91.304% NotChainSuccession(submit deliverable, organize meeting) 100.000% Cotxistence(submit deliverable, send agenda) 100.000% NotChainSuccession(submit deliverable, send deliverable) 92.593% NotChainSuccession(submit deliverable, send deliverable) 100.000% NotChainSuccession(submit deliverable, send deliverable) 100.000% NotChainSuccession(submit deliverable, send dering) 100.000% NotChainSuccession(submit deliverable, send dereing) 86.667% Nesponse(submit deliverable, send report) 92.593% NotChainSuccession(submit deliverable, send report) 92.593% NotChainSuccession(submit deliverable, send report) 100.000% NotChainSuccession(submit deliverable, submit report) 100.000% NotChainSuccession(submit deliverable, submit report) 100.000% NotChainSuccession(submit deliverable, write deliverable)	100.000% 100.000% 11.111% 100.000% 42.025% 100.000% 42.025% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000%		0.750; int'f; 0.650; int'f; 0.750; int'f; 0.685; int'f; 0.685; int'f; 0.750; int'f;	0.563; 0.750; 0.488; 0.375; 0.563; 0.514; 0.563; 0.750; 0.694; 0.750; 0.663; 0.663; 0.563; 0.563; 0.563; 0.563;
		THE PERSON NAMED IN COLUMN		
<pre>} [submit draft] ⇒ {     100.000% AlternatePrecedence(send draft, submit draft)     100.000% Response(submit draft, send deliverable)     100.000% NotChainSuccession(submit draft, send deliverable)     100.000% AlternateResponse(submit draft, send draft)     100.000% NotChainSuccession(submit draft, send draft)</pre>	100.000% 100.000% 100.000% 100.000% 100.000%	conf.        conf.        conf.        conf.	0.250; int'f: 0.250; int'f: 0.250; int'f:	0.250; 0.250; 0.250; 0.250; 0.250;
}				
[submit report] => { 100.000% NotChainSuccession(submit report, organize agenda) 100.000% NotChainSuccession(submit report, organize meeting) 100.000% NotChainSuccession(submit report, send agenda) 100.000% NotChainSuccession(submit report, send deliverable) 88.235% NotChainSuccession(submit report, send deliverable) 88.235% NotChainSuccession(submit report, send deliverable) 89.091% NotChainSuccession(submit report, send meeting) 95.833% NotChainSuccession(submit report, send meeting) 95.833% NotChainSuccession(submit report, submit deliverable) 96.000% NotChainSuccession(submit report, submit deliverable) 96.000% NotChainSuccession(submit report, submit deliverable)	100.000% 100.000% 100.000% 100.000% 21.569% 100.000% 27.273% 100.000% 72.222% 50.617% 73.333%		0.750; int'f: 0.750; int'f: 0.750; int'f: 0.662; int'f: 0.668; int'f: 0.668; int'f: 0.750; int'f: 0.719; int'f:	0.375; 0.563; 0.563; 0.750; 0.662; 0.750; 0.668; 0.563; 0.539; 0.521; 0.540;
}				
And a first three departments of the control of the				
<pre>(write deliverable) ⇒ { 100.000% Precedence(send draft, write deliverable) 100.000% Precedence(send draft, write deliverable, organize agenda) 100.000% NotChainSuccession(write deliverable, organize meeting) 100.000% NotChainSuccession(write deliverable, organize meeting) 100.000% NotChainSuccession(write deliverable, send agenda) 100.000% NotChainSuccession(write deliverable, send agenda) 100.000% NotChainSuccession(write deliverable, send deliverable) 91.304% NotChainSuccession(write deliverable, send deliverable) 22.535% NotChainSuccession(write deliverable, send draft) 100.000% (Octaitence(write deliverable, send meeting) 100.000% WotChainSuccession(write deliverable, send meeting) 100.000% NotChainSuccession(write deliverable, send meeting) 100.000% NotChainSuccession(write deliverable, sommit report)</pre>	100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 100.000% 42.02% 50.617% 100.000% 100.000% 100.000% 100.000%		0.500; int'f: 0.750; int'f: 0.750; int'f: 0.750; int'f: 0.750; int'f: 0.750; int'f: 0.685; int'f: 0.684; int'f: 0.750; int'f: 0.750; int'f: 0.750; int'f:	0.750; 0.375; 0.563; 0.563; 0.563; 0.563; 0.750; 0.685; 0.694; 0.563; 0.563; 0.563;
}				

# Which were the conflicting constraints in the log?



- NotSuccession(send meeting, organize agenda)
- 2. NotChainSuccession(send draft, send deliverable)
- 3. Succession(send draft, submit report)

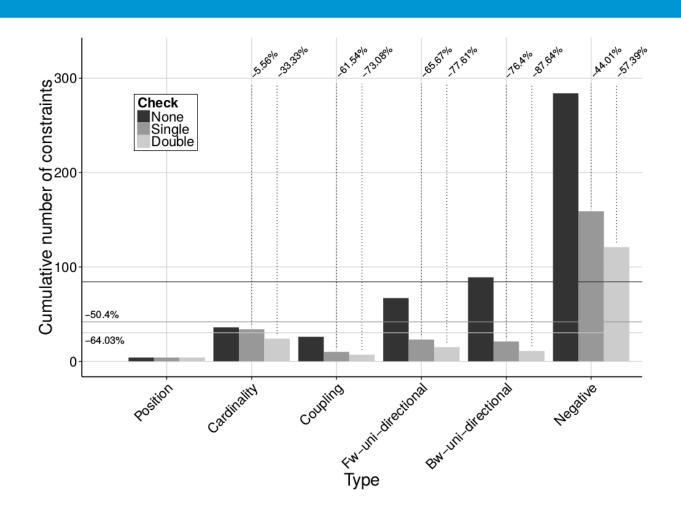


```
[organize agenda] => {
   100.000% Response(organize agenda, organize meeting)
                                                                                                                              100.000%
              100.000% Response(organize agenda, send agenda)
100.000% AlternateResponse(organize agenda, send deliverable)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500:
                                                                                                                                                                                                          int'f
                                                                                                                                                                                                                        0.375
                                                                                                                                                                               conf.
              100.000% NotChainSuccession(organize agenda, send deliverable)
100.000% AlternateResponse(organize agenda, send draft)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500:
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.500
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                         int'f:
              89.474% NotChainSuccession(organize agenda, send draft)
100.000% AlternateResponse(organize agenda, send meeting)
                                                                                                                               29.825%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.447:
                                                                                                                                                                                                                        0.447
                                                                                                                               100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
              100.000% NotChainSuccession(organize agenda, send meeting) 100.000% NotChainSuccession(organize agenda, send report)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500:
                                                                                                                                                                                                         int'f
                                                                                                                                                                                                                        0.375
                                                                                                                               100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                          int'f:
int'f:
              100.000% RespondedExistence(organize agenda, submit deliverable)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                                        0.375
              100.000% NotChainSuccession(organize agenda, submit deliverable)
100.000% RespondedExistence(organize agenda, submit report)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                                        0.375
              100.000% NotChainSuccession(organize agenda, submit report)
100.000% RespondedExistence(organize agenda, write deliverable)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                          int'f:
int'f:
                                                                                                                             100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                                        0.375
              100.000% NotChainSuccession(organize agenda, write deliverable)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500;
[organize demo] => {
   100.000% AlternateResponse(organize demo, send deliverable)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.250;
                                                                                                                                                                                                                        0.250
              100.000% NotChainSuccession(organize demo, send deliverable)
100.000% AlternateResponse(organize demo, send draft)
                                                                                                                              100.000%
                                                                                                                                                                              conf.:
                                                                                                                                                                                            0.250;
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                                                                                                                        0.250
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.250
              100.000% NotChainSuccession(organize demo, send draft)
100.000% AlternatePrecedence(send deliverable, organize demo)
                                                                                                                              100 000%
                                                                                                                                                                               conf .
                                                                                                                                                                                             0.250:
                                                                                                                                                                                                          int'f.
                                                                                                                                                                                                                        0.250
                                                                                                                                                                               conf.:
                                                                                                                                                                                             0.250;
                                                                                                                                                                                                          int'f:
              100.000% AlternatePrecedence(send draft, organize demo)
                                                                                                                             100.000%
                                                                                                                                                                             conf ·
                                                                                                                                                                                             0.250 int'f
                                                                                                                                                                                                                        0.250
[organize meeting] => {
   100.000% NotSuccession(organize meeting, organize agenda)
                                                                                                                              100.000%
                                                                                                                                                                                             0.500;
             100.000% Coststener(organize meeting, organize agenda)
100.000% Coststener(organize meeting, send agenda)
100.000% Coststener(organize meeting, send adenda)
100.000% NotThainSuccession(organize meeting, send deliverable)
191.667% NotThainSuccession(organize meeting, send draft)
100.000% Coststenec(organize meeting, send meeting)
                                                                                                                                                                ||||||| conf.
                                                                                                                              100.000%
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f
                                                                                                                                                                                                                        0.563
                                                                                                                                                                                                          int'f
                                                                                                                               25.926%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.667;
                                                                                                                                                                ||||||||| conf.
                                                                                                                              100.000%
                                                                                                                                                                                             0.750:
                                                                                                                                                                                                                        0.750
                                                                                                                               44.4449
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.688;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                         0.688
                                                                                                                              100.0009
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750:
                                                                                                                                                                                                                        0.563
             100.000% Aberthalment utganize meeting, setim meeting enting)
88.235% NotChainSuccession(organize meeting, sent general peopri)
100.000% CoExistence(organize meeting, submit deliverable)
100.000% NotChainSuccession(organize meeting, submit deliverable)
100.000% NotChainSuccession(organize meeting, submit deliverable)
100.000% CoExistence(organize meeting, submit deliverable)
100.000% CoExistence(organize meeting, submit report)
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                              100.0009
                                                                                                                                                                              conf.
                                                                                                                                                                                                                         0.563
                                                                                                                               21.569%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.496
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                              100.000%
                                                                                                                                                                                                                         0.563
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.563
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                              100 000%
                                                                                                                                                                                                                        0.563
                                                                                                                               100.000%
                                                                                                                                                                                                                        0.563
              100.000% NotChainSuccession(organize meeting, write deliverable)
100.000% Precedence(send agenda, organize meeting)
                                                                                                                              100 000%
                                                                                                                                                                               conf
                                                                                                                                                                                             0.750:
                                                                                                                                                                                                         int'f
                                                                                                                                                                                                                        0.563
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.563
              100.000% Precedence(send deliverable, organize meeting)
100.000% Precedence(send draft, organize meeting)
                                                                                                                             100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.750
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                          int'f:
              100.000% Precedence(write deliverable, organize meeting)
                                                                                                                             100.000%
                                                                                                                                                                              conf.:
                                                                                                                                                                                             0.750; int'f:
                                                                                                                                                                                                                       0.563
[send agendal => {
               90.000% RespondedExistence(send agenda, organize agenda)
                                                                                                                               33.333%
             JO. UDUNA RESpondenexistence(send agenda, organize agenda) 100.000% NotChainSuccession(send agenda, organize agenda) 100.000% CoExistence(send agenda, organize meeting) 100.000% NotChainSuccession(send agenda, organize meeting) 100.000% NotChainSuccession(send agenda, organize meeting) 100.000% RespondedExistence(send agenda, send deliverable) 00.000% NotChainSuccession(send agenda, send deliverable)
                                                                                                                                                                                                          int'f
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.500:
                                                                                                                                                                                                                        0.375
                                                                                                                                                                                                         int'f:
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                              100,000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.750:
                                                                                                                                                                                                                        0.563
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.750
                                                                                                                                                                               conf.
                                                                                                                              100.000%
              100.000% RespondedExistence(send agenda, send draft)
100.000% NotChainSuccession(send agenda, send draft)
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                                                                                                                        0.750
                                                                                                                              100.000%
                                                                                                                              100.000%
              100.000% CoExistence(send agenda, send meeting)
100.000% NotChainSuccession(send agenda, send report)
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.563
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.563
             100.000% CoExistence(send agenda, submit deliverable)
100.000% NotChainSuccession(send agenda, submit deliverable)
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
                                                                                                                              100 000%
                                                                                                                                                                                                                        0.563
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.563
              90.000% RespondedExistence(send agenda, submit report)
95.918% NotChainSuccession(send agenda, submit report)
                                                                                                                                                                                             0.675;
                                                                                                                                                                                                         int'f:
                                                                                                                               33.333%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.506
                                                                                                                               72.789%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.540
              100.000% CoExistence(send agenda, write deliverable)
90.476% NotChainSuccession(send agenda, write deliverable)
                                                                                                                              100.000%
                                                                                                                                                                              conf.
                                                                                                                                                                                            0.750; int'f:
0.679; int'f:
                                                                                                                                                                                                                        0.563
                                                                                                                               36.508%
                                                                                                                                                                               conf.:
              100.000% Participation(send deliverable)
                                                                                                                              100.000%
                                                                                                                                                                                             1.000:
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        1.000
                                                                                                                                                                                                          int'f:
              100.000% NotChainSuccession(send deliverable, organize demo)
                                                                                                                               100.000%
                                                                                                                                                                               conf.
              100.000% NotChainSuccession(send deliverable, organize meeting) 90.909% NotChainSuccession(send deliverable, send agenda) 100.000% NotChainSuccession(send deliverable, send demo)
                                                                                                                                                                                             0.750:
                                                                                                                              100,000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.750
                                                                                                                                                                                                         int'f:
                                                                                                                               39.394%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.682;
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.250:
                                                                                                                                                                                                                        0.250
              100.000% CoExistence(send deliverable, send draft)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             1.000;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                         1.000
              100.000% NotChainSuccession(send deliverable, send draft)
                                                                                                                                                                                             1.000:
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                         1,000
              100.000% NotChainSuccession(send deliverable, send meeting)
100.000% NotChainSuccession(send deliverable, send report)
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
                                                                                                                              100 000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.750
                                                                                                                                                                               conf.
                                                                                                                              100.000%
                                                                                                                                                                                                                        0.750
              100.000% NotChainSuccession(send deliverable, submit deliverable)
100.000% NotSuccession(send deliverable, submit draft)
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
                                                                                                                                                                                                                       0.750
                                                                                                                              100.000%
                                                                                                                              100.000%
              91.667% RespondedExistence(send deliverable, submit report)
88.235% NotChainSuccession(send deliverable, submit report)
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.917;
                                                                                                                                                                                                         int'f:
                                                                                                                               44 444%
                                                                                                                                                                                                                        0.688
                                                                                                                               21.569%
                                                                                                                                                                                                                        0.662
              91.304% NotChainSuccession(send deliverable, write deliverable)
100.000% Precedence(send draft, send deliverable)
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                                                                                                                        0.685
                                                                                                                               42.029%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.685
                                                                                                                              100.000%
                                                                                                                                                                             conf.
                                                                                                                                                                                             1.000;
                                                                                                                                                                                                                        1.000
             100.000% AlternatePrecedence(send deliverable, send demo)
100.000% AlternateResponse(send demo, send deliverable)
                                                                                                                                                                                             0.250;
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.250
             100.000% NotChainSuccession(send demo, send deliverable)
100.000% AlternateResponse(send demo, send draft)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.250:
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.250
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.250;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.250
                                                                                                                                                                                                          int'f:
              100.000% NotChainSuccession(send demo. send draft)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                        0.250
              100.000% AlternatePrecedence(send draft, send demo)
                                                                                                                              100.000%
                                                                                                                                                                                             0.250;
              100.000% Participation(send draft)
                                                                                                                              100.000%
                                                                                                                                                                                             1.000; int'f:
                                                                                                                                                                                                                        1.000
                                                                                                                                                                               conf.
             100.000% Narticipation(send draft) organize agenda 
100.000% NotChainSuccession(send draft, organize demo) 
100.000% NotChainSuccession(send draft, organize meeting) 
100.000% NotChainSuccession(send draft, organize meeting) 
100.000% Succession(send draft, send deliverable) 
85.714% NotChainSuccession(send draft, send deliverable) 
100.000% NotChainSuccession(send draft, send demo)
                                                                                                                              100.000%
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.500;
                                                                                                                                                                                                         int'f:
                                                                                                                                                                                                                        0.500
                                                                                                                              100.000%
                                                                                                                                                                                             0.250;
                                                                                                                                                                                                                        0.250
                                                                                                                              100.000%
                                                                                                                                                                              conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                         int'f:
int'f:
                                                                                                                                                                                                                        0.750
                                                                                                                                                                                                                         1.000
                                                                                                                              100.000%
                                                                                                                                                            conf.
                                                                                                                                 4.762%
                                                                                                                                                                                             0.857;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.857
                                                                                                                              100.000%
                                                                                                                                                                                             0.250;
                                                                                                                                                                                                                        0.250
              85.714% NotChainSuccession(send draft, send meeting)
92.000% NotChainSuccession(send draft, send report)
                                                                                                                               4.762%
46.667%
                                                                                                                                                                               conf
                                                                                                                                                                                             0.643;
                                                                                                                                                                                                           int'f
                                                                                                                                                                                                                        0.643
                                                                                                                                                                               conf.
                                                                                                                                                                                                          int'f
                                                                                                                                                                                                                        0.690
                00.000% NotChainSuccession(send draft, submit deliverable)
00.000% NotChainSuccession(send draft, submit draft)
89.091% NotChainSuccession(send draft, submit report)
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.750;
                                                                                                                                                                                                          int'f:
                                                                                                                                                                                                                        0.750
                                                                                                                              100.000%
                                                                                                                                                                               conf.
                                                                                                                                                                                                                         0.250
                                                                                                                               27.273%
                                                                                                                                                                               conf.
                                                                                                                                                                                             0.668:
                                                                                                                                                                                                           int'f
                                                                                                                                                                                                                        0.668
                92.593% NotChainSuccession(send draft, write deliverable)
                                                                                                                                                                                              0.694;
                                                                                                                                                                               conf.
```

```
eeting] => {
100.000% NotChainSuccession(send meeting, organize agenda)
                                                                                                                                                          100.000%
               100.000% CoExistence(send meeting, organize meeting)
90.000% NotChainSuccession(send meeting, organize meeting)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750:
                                                                                                                                                                                                                                                      int'f
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                          33.333%
                                                                                                                                                                                                                                      0.675;
                                                                                                                                                                                                                     conf.
               30.0000 m. Consideration of the consideration of th
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750
                                                                                                                                                                                                                                                      int'f
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                          100.0009
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                                                                                     conf.
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.750
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750:
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                                                                        0.750
                                                                                                                                                          36.508%
                                                                                                                                                                                                                                      0.679;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.509
               30.4/06 NOthAlanuccession(send meeting, submit deliverable) 100.000% CoExistence(send meeting, submit deliverable) 100.000% NotChainusccession(send meeting, submit report) 100.000% NotChainusccession(send meeting, submit report) 100.000% CoExistence(send meeting, write deliverable) 31.304% NotChainusccession(send meeting, write deliverable)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                       0.563
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                    int'f:
int'f:
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                                       0.563
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                          42.029%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.685;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                       0.514
[send report] => {
               eport] => {
100.000% Precedence(send draft, send report)
100.000% NotChainSuccession(send report, organize agenda)
100.000% NotChainSuccession(send report, organize meeting)
100.000% NotChainSuccession(send report, send agenda)
                                                                                                                                                         100 000%
                                                                                                                                                                                                                    conf
                                                                                                                                                                                                                                      0.750
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.500;
                                                                                                                                                                                                                    conf.
                                                                                                                                                         100.000%
                                                                                                                                                                                                                     conf
                                                                                                                                                                                                                                                      int'f
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                         100.0009
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                                        0.563
                100.000% RespondedExistence(send report, send deliverable)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750
                                                                                                                                                                                                                                                      int'f
                                                                                                                                                                                                                                                                        0.750
                 90.476% NotChainSuccession(send report, send deliverable)
92.000% NotChainSuccession(send report, send draft)
                                                                                                                                                           36.508%
                                                                                                                                                                                                                                       0.679;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                                        0.679
                                                                                                                                                          46.667%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.690
                                                                                                                                                                                                                                                      int'f
                                                                                                                                                                                                                                                                       0.690
                90.476% NotChainSuccession(send report, send meeting)
100.000% NotChainSuccession(send report, submit deliverable)
                                                                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                                                                                                                                                                       0.509;
                                                                                                                                                          36.508%
                                                                                                                                                                                                                                      0.679;
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750
                   95.833% NotChainSuccession(send report, submit report)
                                                                                                                                                          72.222%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.719;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                                        0.539
[submit deliverable] => {
100.000% Precedence(send agenda, submit deliverable)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750:
                100.000% Precedence(send draft, submit deliverable)
86.667% Precedence(send report, submit deliverable)
                                                                                                                                                        100.000%
                                                                                                                                                                                                                   conf.
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                    int'f:
                                                                                                                                                                                                                                                                       0.750;
                                                                                                                                                                                                                     conf.
                100.000% NotChainSuccession(submit deliverable, organize agenda)
100.000% CoExistence(submit deliverable, organize meeting)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf .
                                                                                                                                                                                                                                      0.500
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.375
                                                                                                                                                          100.000%
                                                                                                                                                                                                                   conf.
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                      int'f:
                91.304% NotChainSuccession(submit deliverable, organize meeting)
100.000% CoExistence(submit deliverable, send agenda)
                                                                                                                                                          42.029%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.685
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                                                                       0.514
                                                                                                                                                          100.0009
                                                                                                                                                                                                                    conf
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.563
                 92.000% NotChainSuccession(submit deliverable, send agenda)
                                                                                                                                                          46.667%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.690
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.518
                 100.000% RespondedExistence(submit deliverable, send deliverable)
                                                                                                                                                                                                    іінш
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.750
                92.593% NotChainSuccession(submit deliverable, send deliverable)
100.000% NotChainSuccession(submit deliverable, send draft)
                                                                                                                                                          50.617%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.694
                                                                                                                                                                                                                                                     int'f
                                                                                                                                                                                                                                                                       0.694
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                                       0.750;
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                       int'f:
                100.000% CoExistence(submit deliverable, send meeting)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                      int'f:
                100.000% NotChainSuccession(submit deliverable, send meeting)
100.000% NotChainSuccession(submit deliverable, send meeting)
86.667% Response(submit deliverable, send report)
100.000% NotChainSuccession(submit deliverable, send report)
92.593% NotChainSuccession(submit deliverable, submit report)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                          11.111%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                                                        0.488
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                          50.617%
                                                                                                                                                                                                                                                                        0.521
                                                                                                                                                                                                                     conf.
                100.000% CoExistence(submit deliverable, write deliverable)
100.000% NotChainSuccession(submit deliverable, write deliverable)
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                                                          100.000%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                                       0.563
                100.000% Precedence(write deliverable, submit deliverable)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.563
[submit draft] => {
    100.000% AlternatePrecedence(send draft, submit draft)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                      0.250:
                                                                                                                                                                                                                                                                       0.250
                100.000% Response(submit draft, send deliverable)
100.000% NotChainSuccession(submit draft, send deliverable)
                                                                                                                                                        100.000%
                                                                                                                                                                                                                   conf.:
                                                                                                                                                                                                                                     0.250;
                                                                                                                                                                                                                                                    int'f:
                                                                                                                                                                                                                                                                      0.250;
                100.000% AlternateResponse(submit draft, send draft)
100.000% NotChainSuccession(submit draft, send draft)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.250;
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                                                                       0.250
                                                                                                                                                          100.000%
[submit report] => {
                100.000% NotChainSuccession(submit report, organize agenda)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.500:
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                                                                        0.375
                100.000% NotChainSuccession(submit report, organize meeting)
100.000% NotChainSuccession(submit report, send agenda)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                                       0.563
                100.000% RespondedExistence(submit report, send deliverable)
88.235% NotChainSuccession(submit report, send deliverable)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                                                       0.750;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                      0.662:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                          21.569%
                                                                                                                                                                                                                     conf.
                100.000% RespondedExistence(submit report, send draft)
89.091% NotChainSuccession(submit report, send draft)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                                       0.750;
                                                                                                                                                                                                                    conf.:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                                                                                    conf.
                100.000% NotChainSuccession(submit report, send meeting)
95.833% NotChainSuccession(submit report, send report)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                    int'f:
                                                                                                                                                                                                                                                                       0.563;
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                    conf.
                  92.593% NotChainSuccession(submit report, submit deliverable)
96.000% NotChainSuccession(submit report, write deliverable)
                                                                                                                                                                                                                                     0.694;
                                                                                                                                                                                                                                                    int'f:
int'f:
                                                                                                                                                          50.617%
                                                                                                                                                                                                                    conf.:
                                                                                                                                                                                                                                                                        0.521
                                                                                                                                                                                                                                                                       0.540;
                                                                                                                                                          73.333%
                                                                                                                                                                                                                    conf.:
[write deliverable] => {
                100.000% Precedence(send draft, write deliverable)
100.000% NotChainSuccession(write deliverable, organize agenda)
                                                                                                                                                         100.000%
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.750
                                                                                                                                                                                                                                      0.500;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.375
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf.
                100.000% CoExistence(write deliverable, organize meeting)
100.000% NotChainSuccession(write deliverable, organize meeting)
                                                                                                                                                                                                                                                     int'f:
int'f:
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                      0.750
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                       0.750;
                                                                                                                                                                                                                     conf.
                100.000% CoExistence(write deliverable, send agenda)
100.000% NotChainSuccession(write deliverable, send agenda)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.750:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                                        0.563
                100,000% RespondedExistence(write deliverable, send deliverable)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                    conf.
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.750:
                  91.304% NotChainSuccession(write deliverable, send deliverable)
92.593% NotChainSuccession(write deliverable, send draft)
                                                                                                                                                          42.029%
                                                                                                                                                                                                                                      0.685;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                        0.685
                                                                                                                                                          50.617%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                      0.694:
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                       0.694
                100.000% CoExistence(write deliverable, send meeting)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                     conf.
                                                                                                                                                                                                                                     0.750;
                                                                                                                                                                                                                                                      int'f:
                                                                                                                                                                                                                                                                       0.563;
                100,000% NotChainSuccession(write deliverable, send meeting)
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf .:
                100.000% Succession(write deliverable, submit deliverable)
100.000% NotChainSuccession(write deliverable, submit report)
                                                                                                                                                          100.000%
                                                                                                                                                                                                                                      0.750;
                                                                                                                                                                                                                                                       int'f:
                                                                                                                                                                                                                                                                        0.563
                                                                                                                                                                                                                                                     int'f:
                                                                                                                                                         100.000%
                                                                                                                                                                                                                    conf .:
                                                                                                                                                                                                                                      0.750:
```









# Conclusions, limitations and future work



We have presented an algorithm which automatically finds inconsistencies and redundancies in mined Declare models

- The checks are purely based on operations over automata (remember: monoids)
- http://github.com/cdc08x/minerful

#### More in the paper:

- The order in which the constraints are checked deeply affects the returned result
  - Comparative studies prove different sorting strategies to affect
    - computation time
    - fitness of the returned model
    - size

#### Limitations:

Performances are heavily affected by the interplay of constraints

#### Future work:

- Users/analysts involvement
- http://www.promtools.org/prom6/nightly











## Resolving Inconsistencies and Redundancies in Declarative Process Models

Claudio Di Ciccio, Fabrizio Maria Maggi, Marco Montali and Jan Mendling

8th International Workshop on Enterprise Modeling and Information Systems Architectures (EMISA 2017) Essen, Germany

claudio.di.ciccio@wu.ac.at

Di Ciccio, C., Maggi, F. M., Montali, M., Mendling, J. (2017). Resolving inconsistencies and redundancies in declarative process models. *Information Systems*, *64*, 425–446. https://doi.org/10.1016/j.is.2016.09.005











## Resolving Inconsistencies and Redundancies in Declarative Process Models

Claudio Di Ciccio, Fabrizio Maria Maggi, Marco Montali and Jan Mendling

8th International Workshop on Enterprise Modeling and Information Systems Architectures (EMISA 2017) Essen, Germany

claudio.di.ciccio@wu.ac.at

Di Ciccio, C., Maggi, F. M., Montali, M., Mendling, J. (2017). Resolving inconsistencies and redundancies in declarative process models. *Information Systems*, *64*, 425–446. https://doi.org/10.1016/j.is.2016.09.005





# **Computational time complexity**

