Cloud-based Healthcare Apps

Process-aware Systems

29. November, 2023

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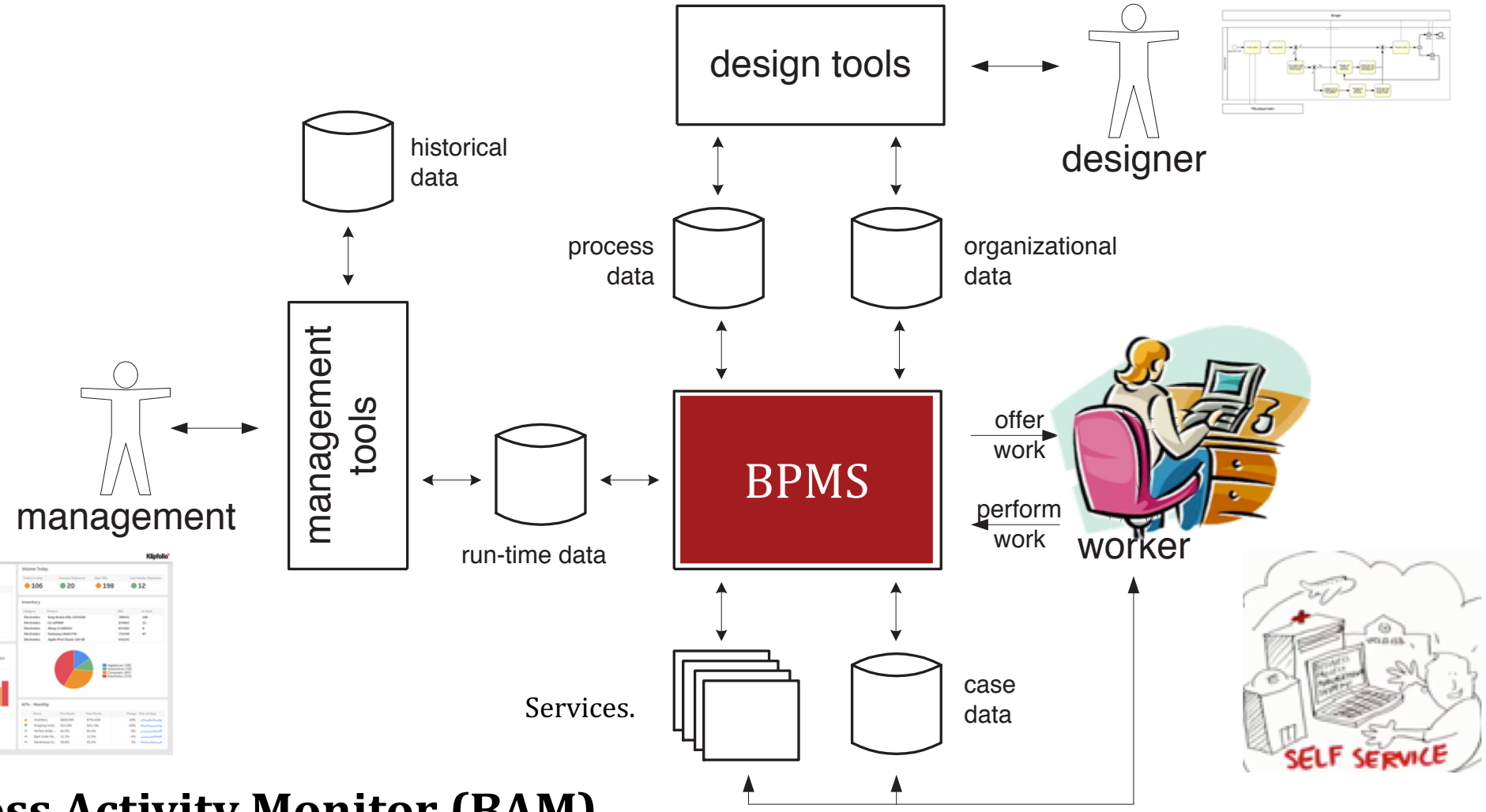
KØBENHAVNS UNIVERSITET

Proces-Aware Information System (PAIS) & Service-Oriented Architecture (SOA)

Signavio.com or DCRSolutions.net



Business Activity Monitor (BAM)

Process-aware systems – why and what

What ?

- Systems based on explicit process models that can be designed by domain-experts and updated when needed
- Process models are either complied to standard code or interpreted by a process engine
- Imperative (e.g. BPMN and state machines) and declarative (e.g. DMN, CMMN and DCR) model languages

Why ?

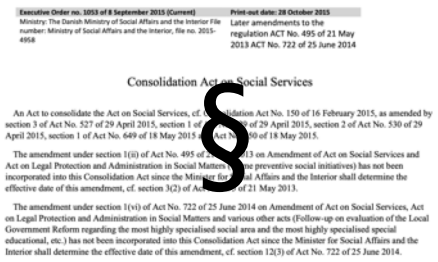
- Avoid the translational gap from domain knowledge to code
- Easier and cheaper to update

A Societal Challenge:
Expensive & faulty manual digitalization (in particular of law)

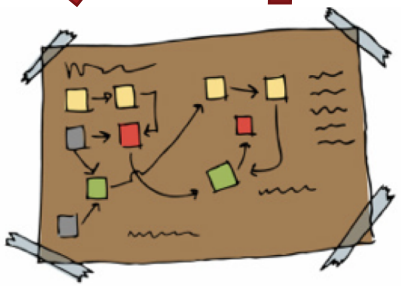
Manual Translation

Manual Translation

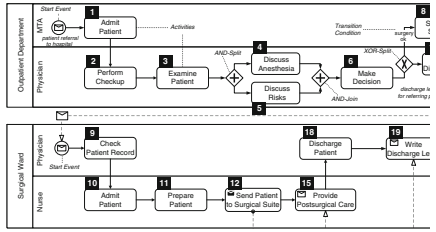
Manual Translation



Law

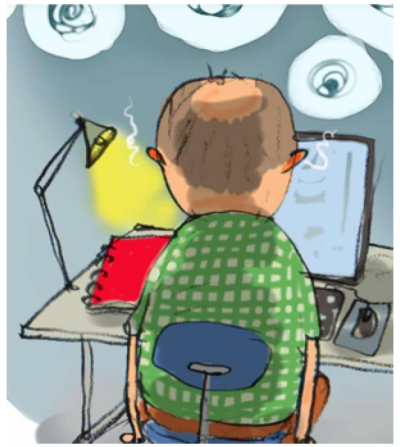


Procedures & guidelines



Software requirements

Code



Frequent changes! 4.686 paragraphs changed in social service law (2007-2019)

More than one change every day - require expensive changes in the IT Systems!

Illegal process flow in KY social service system estimated to take 6 months to fix

Huge Societal Costs

Det ene af to it-projekter i Landbrugsstyrelsen der er i gang på grund af den nye EU-landbrugsreform er forsinket og bliver 50 procent dyrere end antaget. Nu antyder ministeren, at der er risiko for, at det andet - og større - it-projekt i forbindelse med reformen også kan gå hen at blive forsinket.

"Lad mig igen beklage. Det er ikke tilfredsstillende".

FOLKETINGETS OMBUDSMAND

Ombudsmanden: Bekymrende at borgere blev trukket i kontanthjælp på grund af mangler ved it-system

12.6.2023 11:00:00 CEST | Folketingets Ombudsmand

It-fejl presser kommune til flere ansættelser: »Vi har sat bemandingen op, så vi kan følge bedre med«

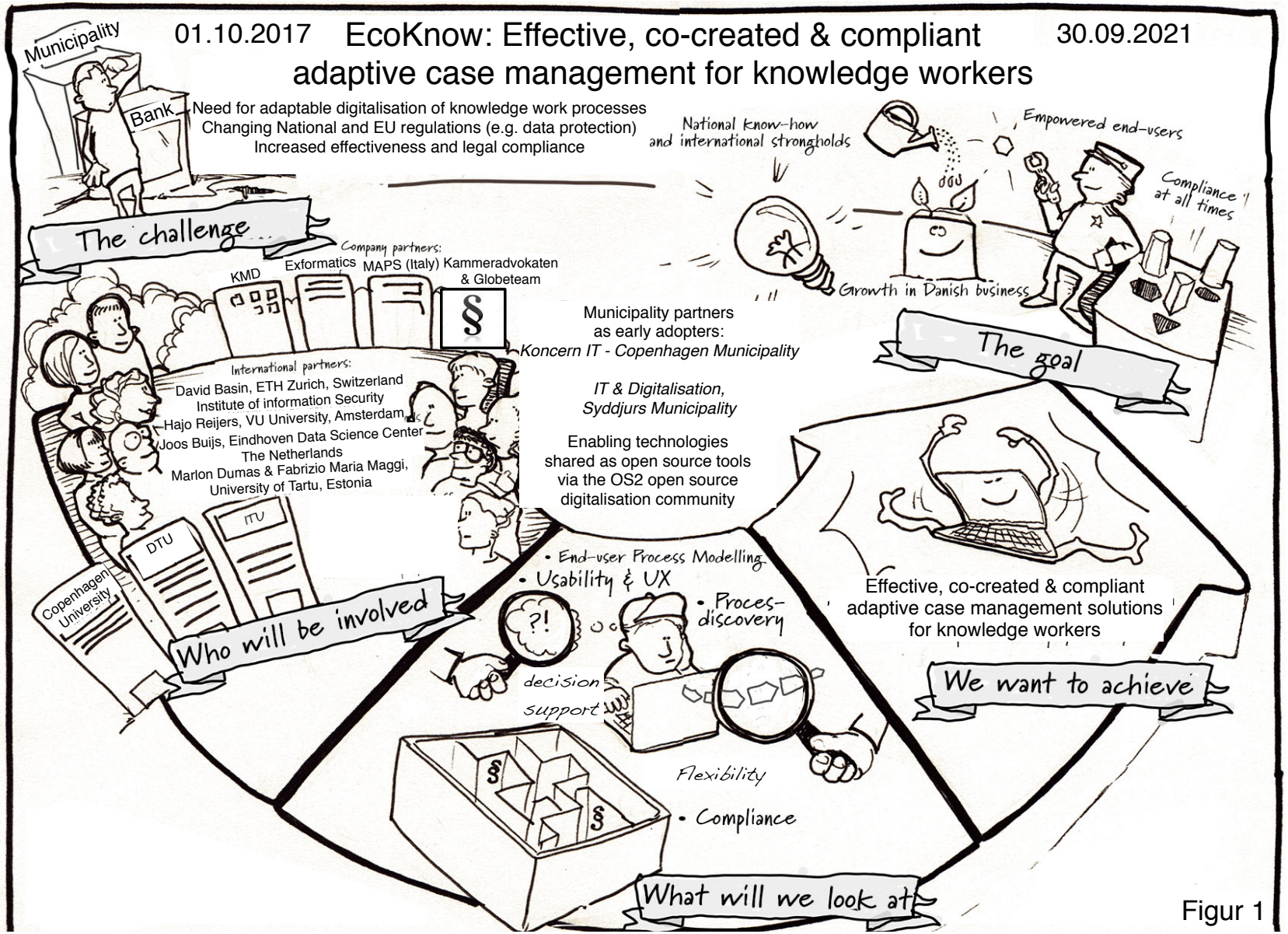
Offentlig it | 22. september 2021 kl. 06:00

DEBAT

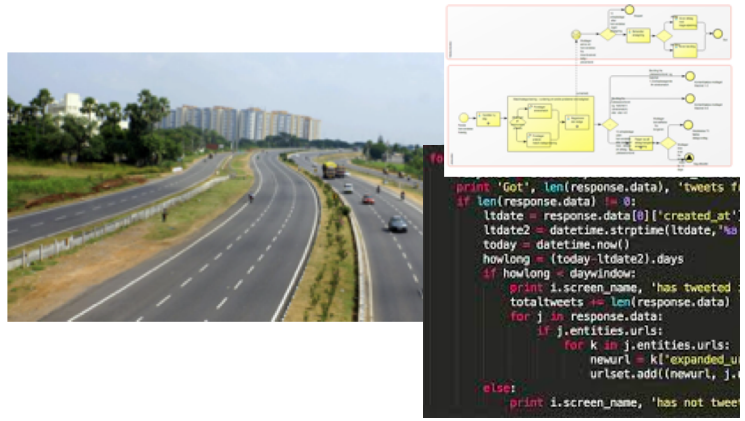
“ Offentlige it-fejl er ikke et it-problem – de er et samfundsproblem

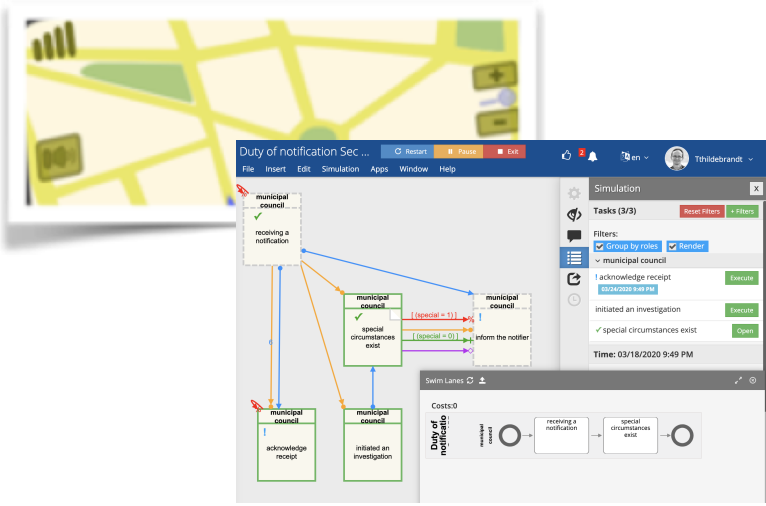
Torsdag 5. okt. 2023 kl. 20:05

Morten Marquard, stifter og CEO, DCR Solutions. Thomas Troels Hildebrandt, professor i softwareudvikling, Københavns Universitet

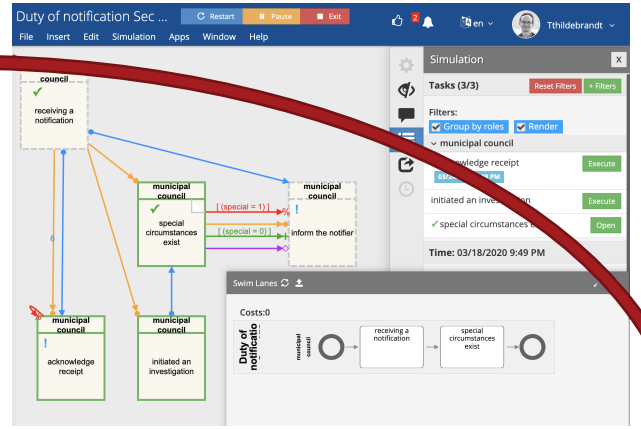

01.10.2017
EcoKnow: Effective, co-created & compliant adaptive case management for knowledge workers
30.09.2021
Municipality
Bank
Need for adaptable digitalisation of knowledge work processes
Changing National and EU regulations (e.g. data protection)
Increased effectiveness and legal compliance
The challenge
Company partners:
KMD
Exformatics
MAPS (Italy)
Kammeradvokaten & Globeteam
§
International partners:
David Basin, ETH Zurich, Switzerland
Institute of information Security
Hajo Reijers, VU University, Amsterdam
Joos Buijs, Eindhoven Data Science Center
The Netherlands
Marlon Dumas & Fabrizio Maria Maggi,
University of Tartu, Estonia
DTU
ITU
Copenhagen University
Who will be involved
Municipality partners
as early adopters:
Koncern IT - Copenhagen Municipality
IT & Digitalisation,
Syddjurs Municipality
Enabling technologies
shared as open source tools
via the OS2 open source
digitalisation community
National know-how
and international strongholds
Empowered end-users
Compliance at all times
Growth in Danish business
The goal
• End-user Process Modelling
• Usability & UX
• Proces-discovery
?!
decision support
Flexibility
• Compliance
What will we look at
Effective, co-created & compliant
adaptive case management solutions
for knowledge workers
We want to achieve

Figur 1




Duty of notification Sec ...
Simulation
Tasks (3/3)
municipal council
receiving a notification
special circumstances exist
inform the notifier
acknowledge receipt
initiated an investigation
Swim Lanes
Costs:0

Process design and engine as a service



App development in Python (Kivy)

Asynchronous communication

Process repository & engine as a service

Workflow design tools

Legal aspects

DS Dansk standard

Informationsteknologi – Sikkerh teknikker – Ledelsessystemer fc informationssikkerhed – Krav

Information technology – Security technique Information security management systems – Requirements (ISO/IEC 27001:2013 includir Cor 1:2014 and Cor 2:2015)

digital tryghed

Database access service

Data storage in cloud (AWS) and security

Cloud storage

DCR Solutions workflow design and execution tools

Login

More than 35 end-customers are using DCR today!

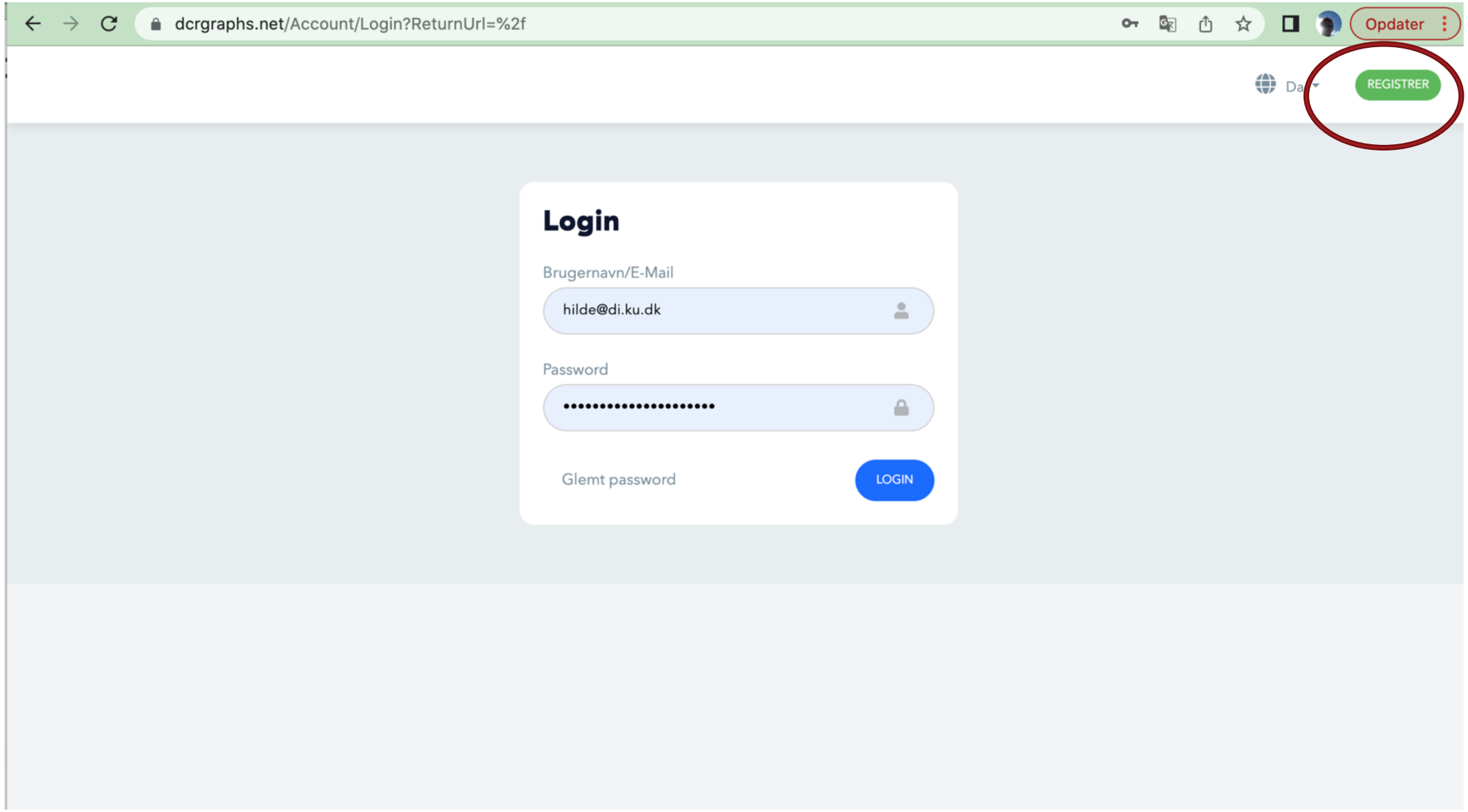
KRIMINALFORSORGEN
memox multietnisk mentorordning & familiebehandling
FH FAGBEVÆGELSENS HOVEDORGANISATION
NEC NEC Software Solutions UK
Fiskeristyrelsen
Skatteforvaltningen
SKATTE STYRELSEN
TOLD STYRELSEN
VURDERINGS STYRELSEN
GÆLDS STYRELSEN
MOTOR STYRELSEN
UDVIKLINGS OG FORENKLINGS STYRELSEN
ADMINISTRATIONS OG SERVICE STYRELSEN
STYRELSEN FOR PATIENTKLAGER
SUNDHEDSDATA-STYRELSEN
Styrelsen for Dataforsyning og Infrastruktur
Skatteankestyrelsen
Færdselsstyrelsen
RIGSPOLITIET POLITI
DEN UAFHÆNGIGE POLITIKLAGEMYNDIGHED
Trafikstyrelsen Danish Civil Aviation and Railway Authority
AARHUS KOMMUNE
Ministeriet for Fødevarer, Landbrug og Fiskeri Fødevarestyrelsen
atp=
REGION Region Hovedstaden
FINANSTILSYNET
SUNDHEDSMINISTERIET
JUSTITSMINISTERIET
KØBENHAVNS UNIVERSITET
AARHUS UNIVERSITY
AALBORG UNIVERSITY
SDU Syddansk Universitet
JUSTITSMINISTERIET CIVILSTYRELSEN

COMUNE DI GENOVA

digital tryghed

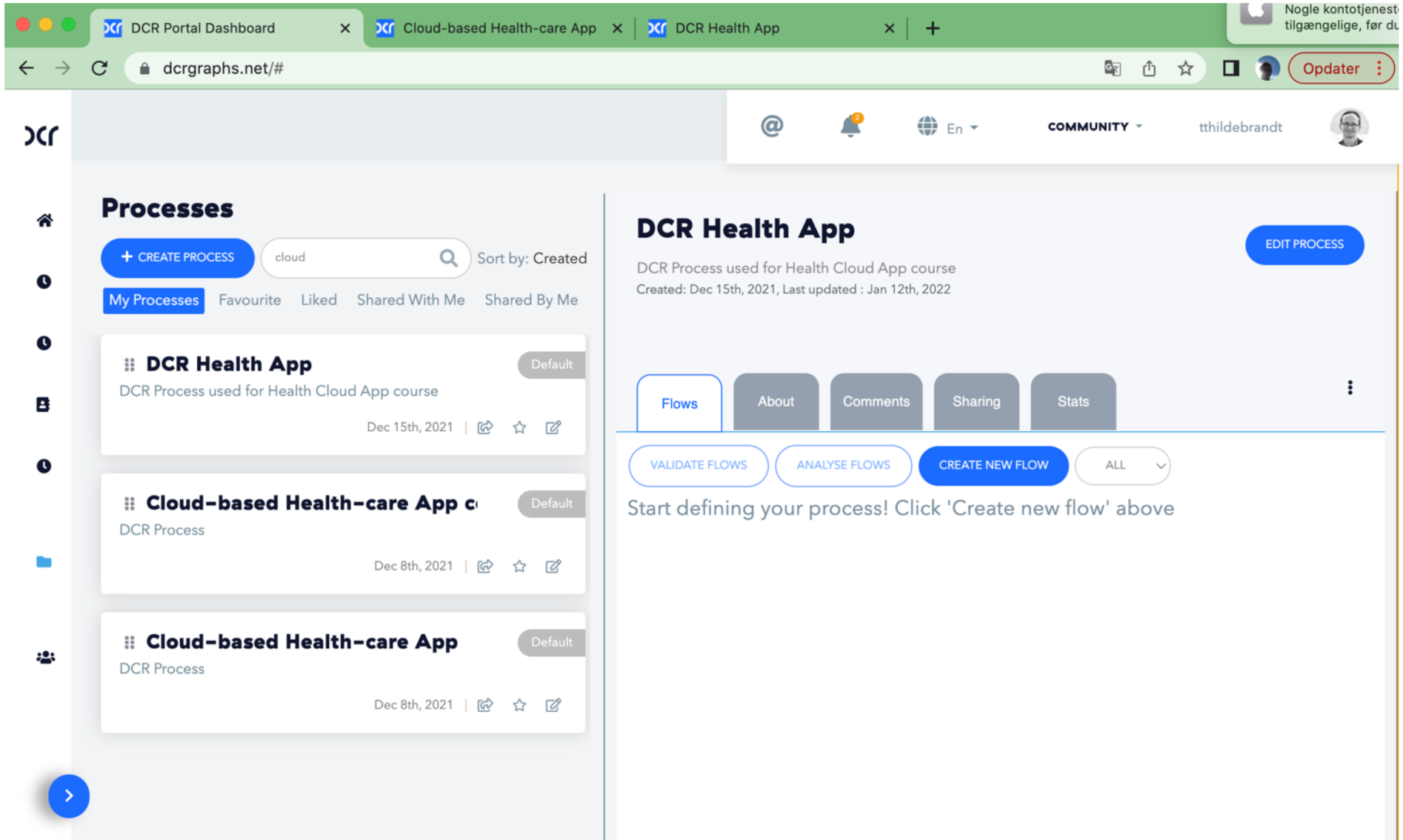
exformatics
RUDOLPH ALS FONDET
DREYERSFOND
Velliv Heinrich og Laurine Jessens Fond

Register to make a free account



Register

DCR Solutions process overview

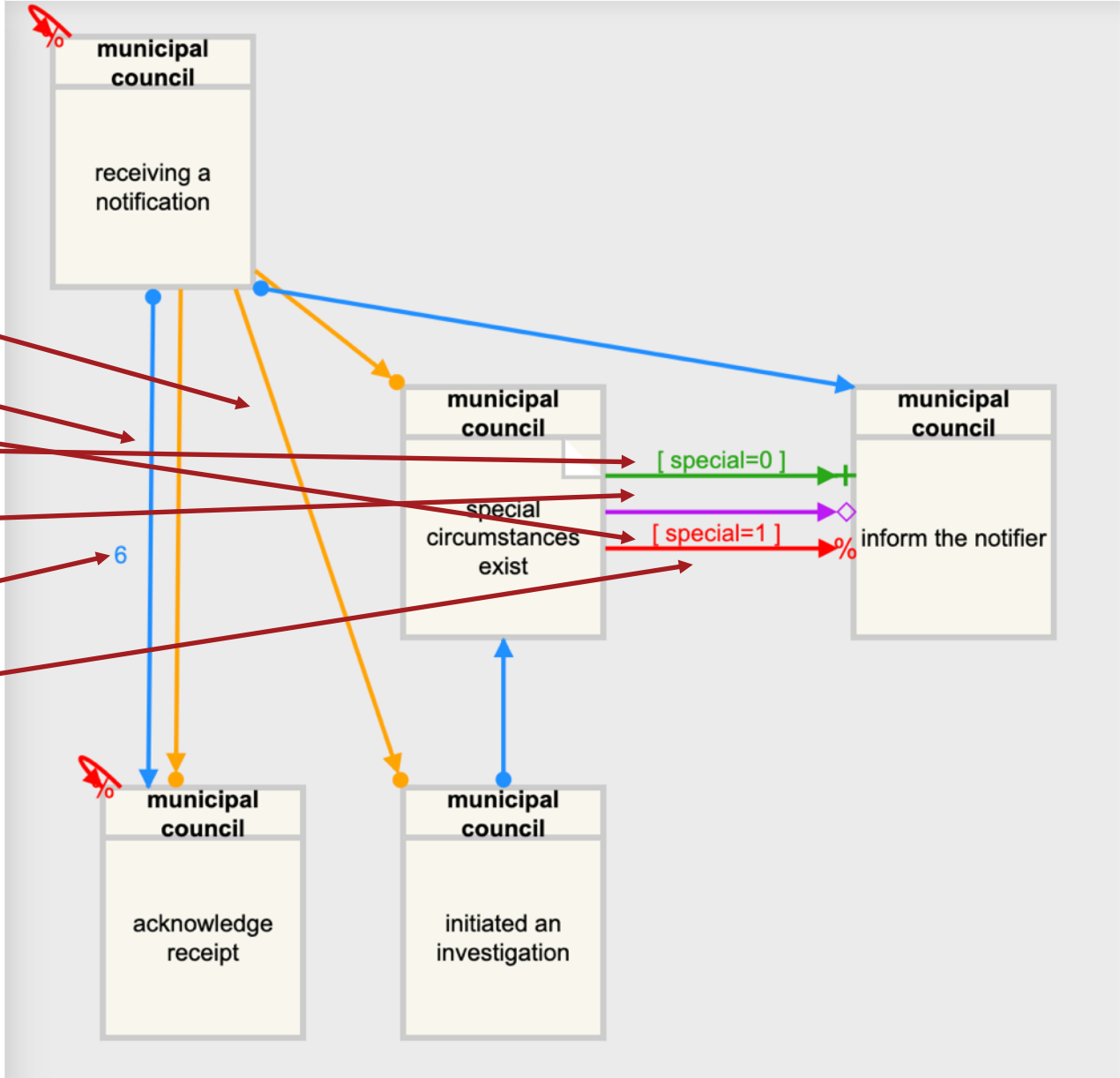


Five basic rules of DCR

- Condition
- Response
- Exclusion
- Inclusion
- Milestone

More advanced:

Time &, Data



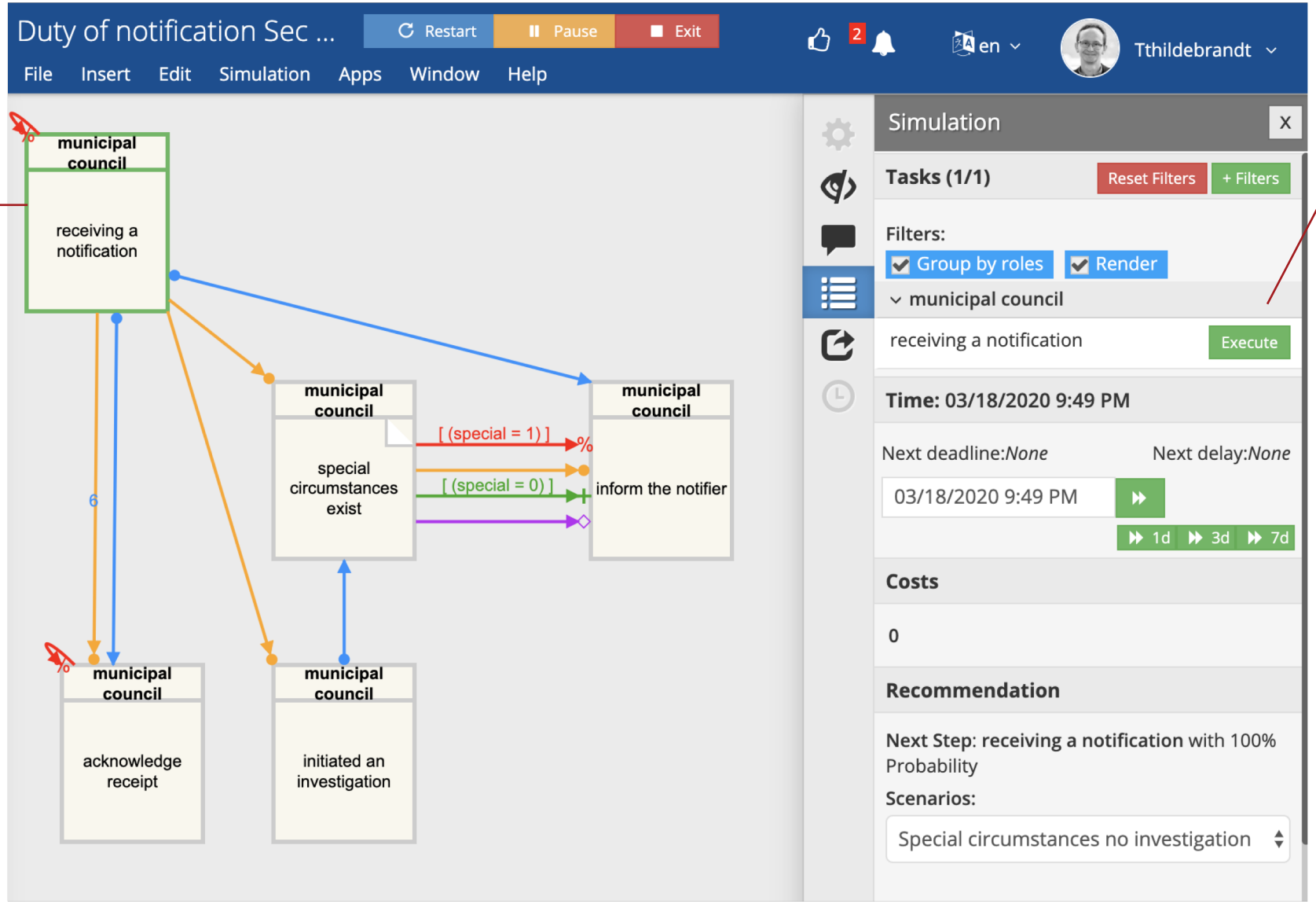
Research paper:

EcoKnow: Engineering Effective, Co-created and Compliant Adaptive Case Management Systems for Knowledge Workers

ICSSP '20, October 10–11, 2020, Seoul, Republic of Korea
© 2020 Association for Computing Machinery.
ACM ISBN 978-1-4503-7512-2/20/10…$15.00
https://doi.org/10.1145/3379177.3388908

Execution of and instance of a DCR process in the simulator

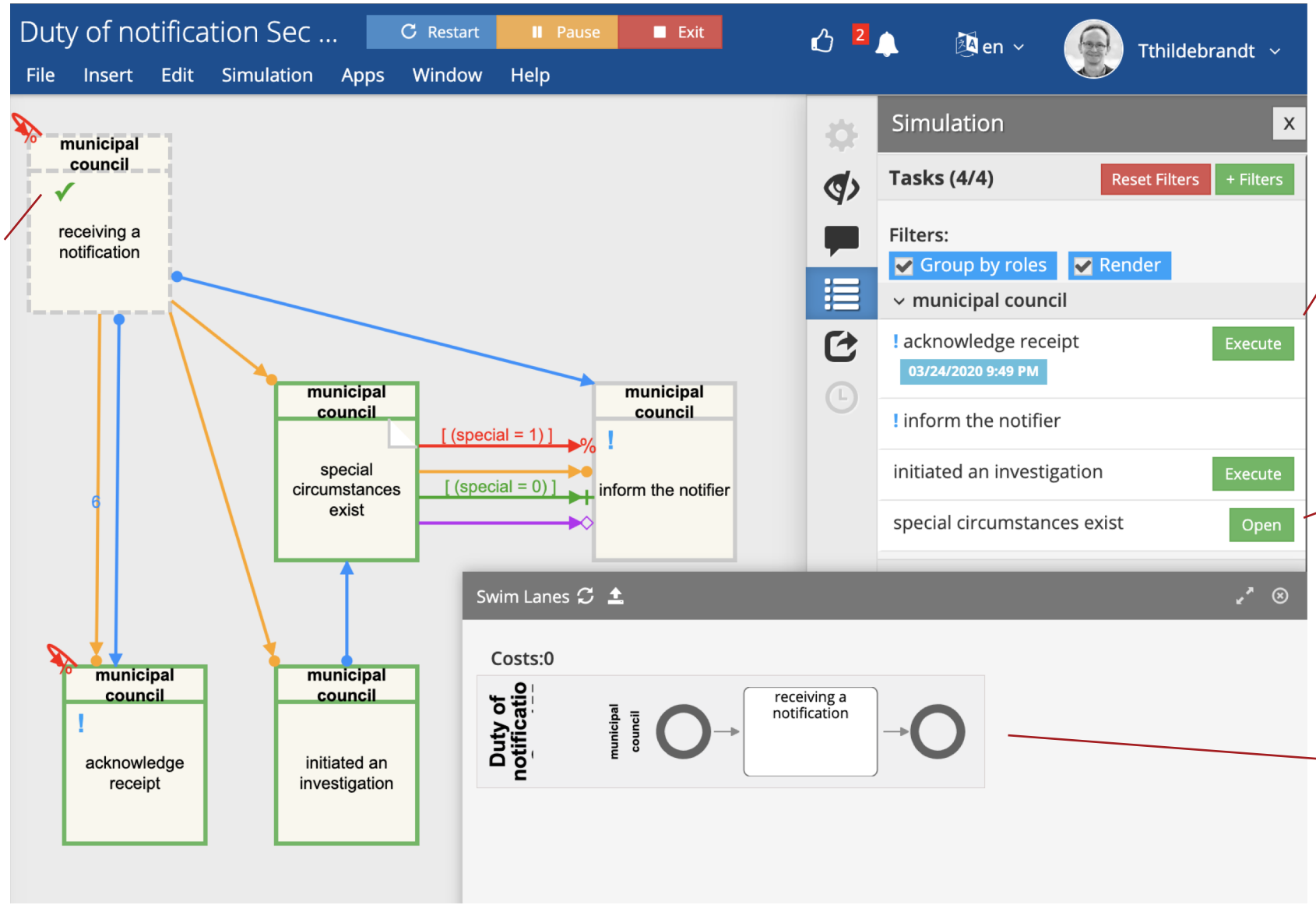
Only one enabled activity initially (due to condition relations)



We can execute the activity in the task list of the simulator

After executing "receiving a notification"

The activity state is executed (checkmark) and excluded (dashed border)

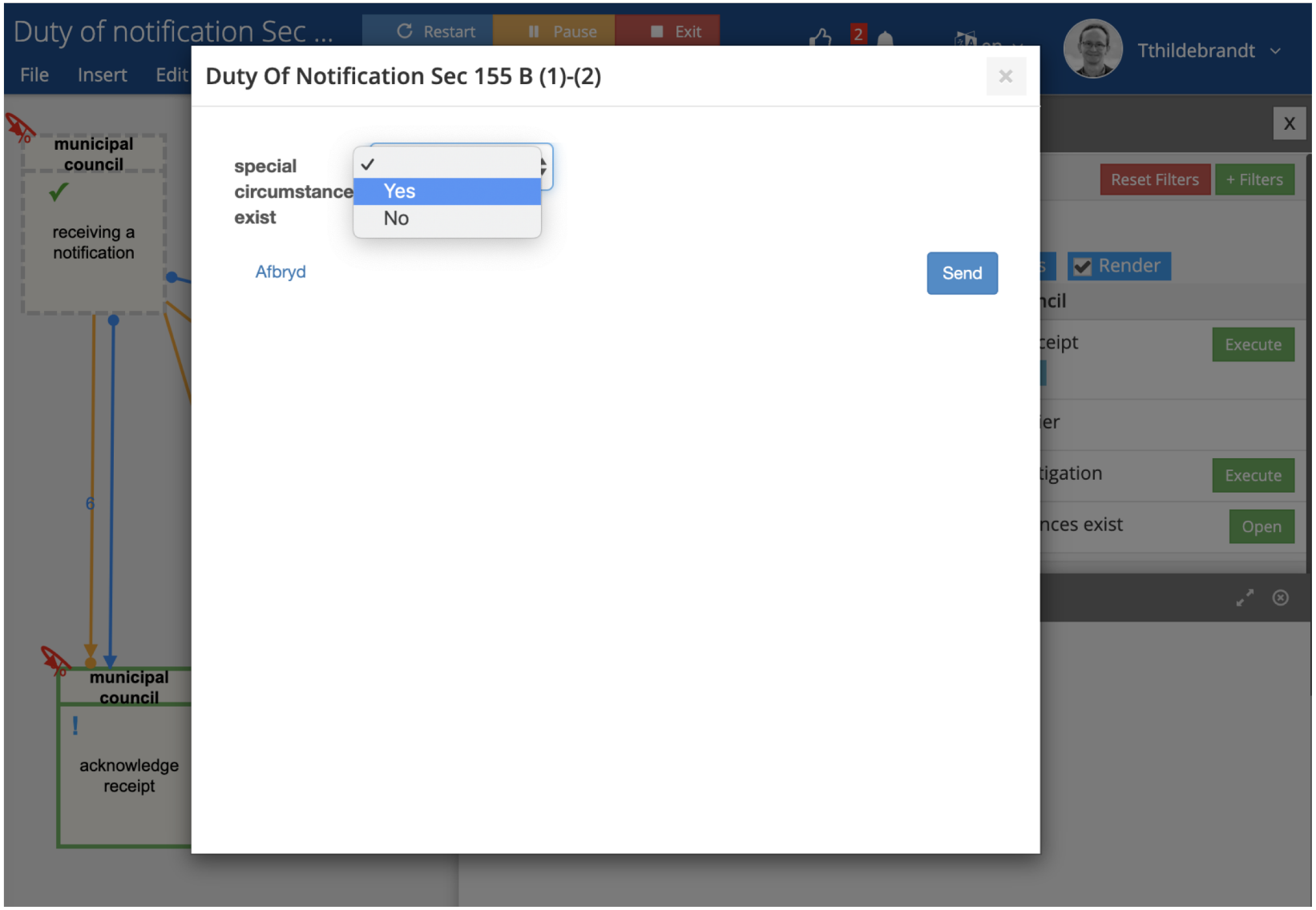


Three new events are enabled and two are pending

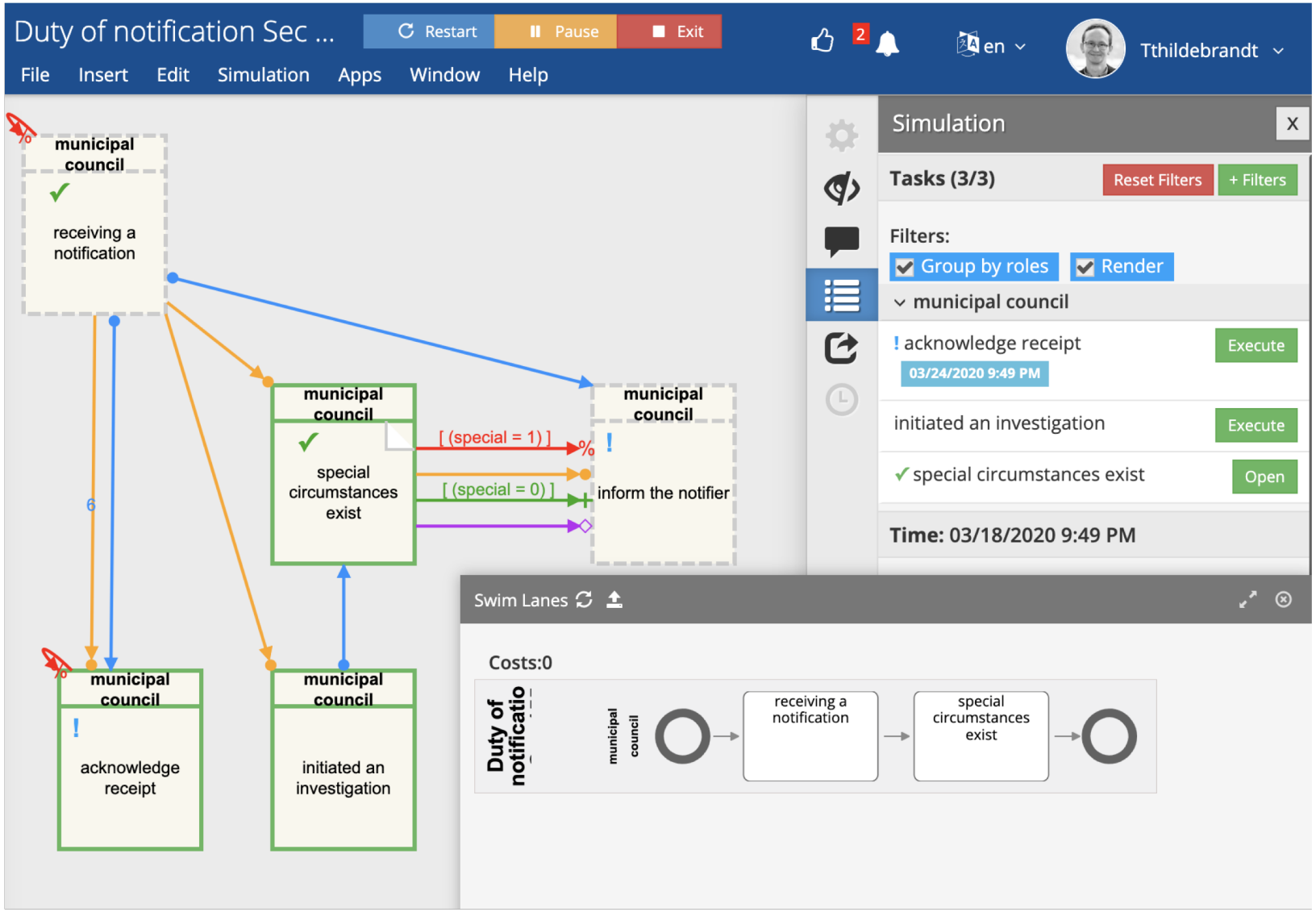
Data events open a form for entering data

The execution trace can be viewed in a swimlane

Executing data event (special circumstances) with value Yes (1)



After executing special circumstances with value Yes (1)



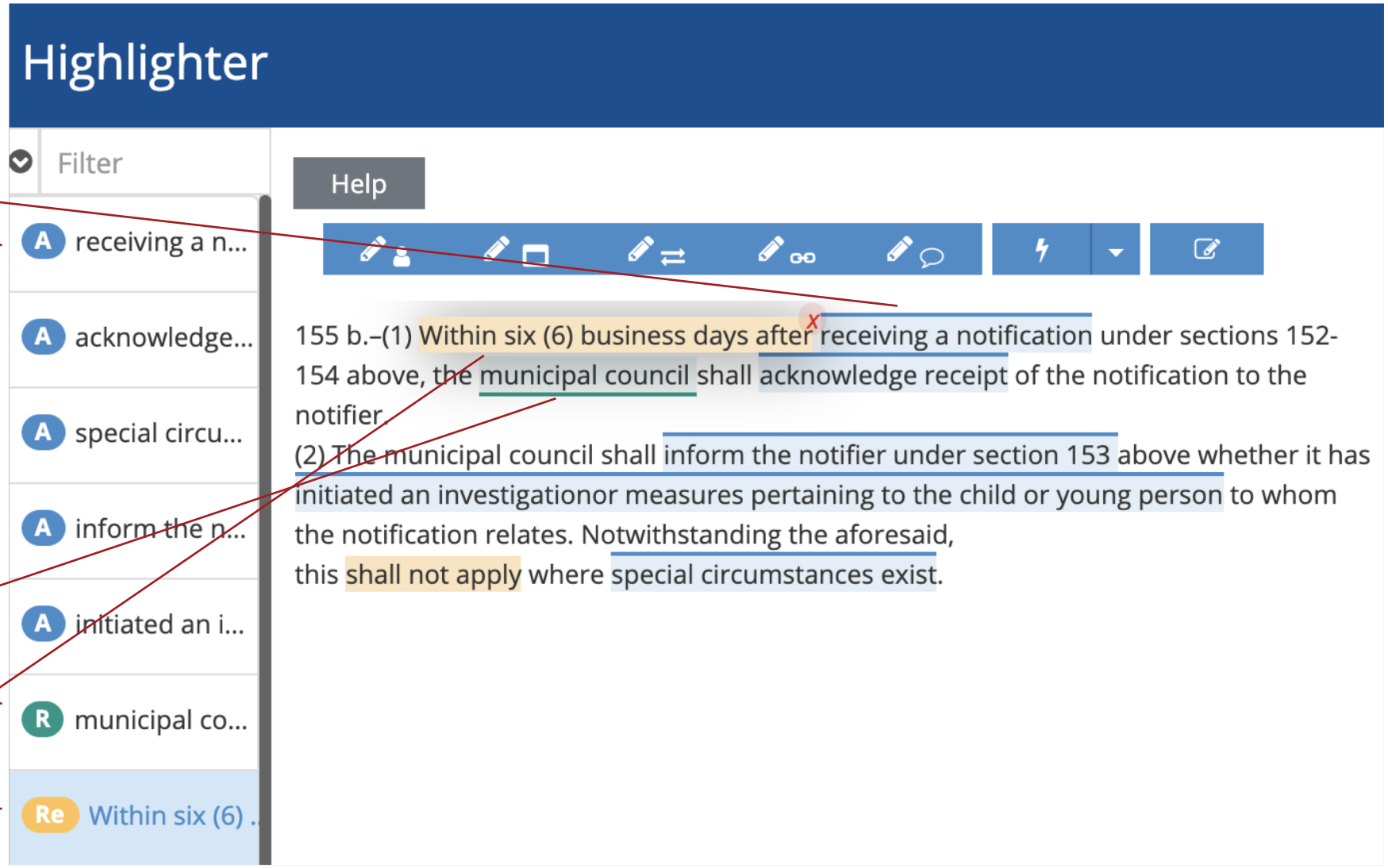
Let us try it out at: https://dcrgraphs.net/Tool?id=15491

Mapping textual requirements to DCR graphs

Activities can be often be identified as verbs

Roles can be often be identified as nouns or pronouns

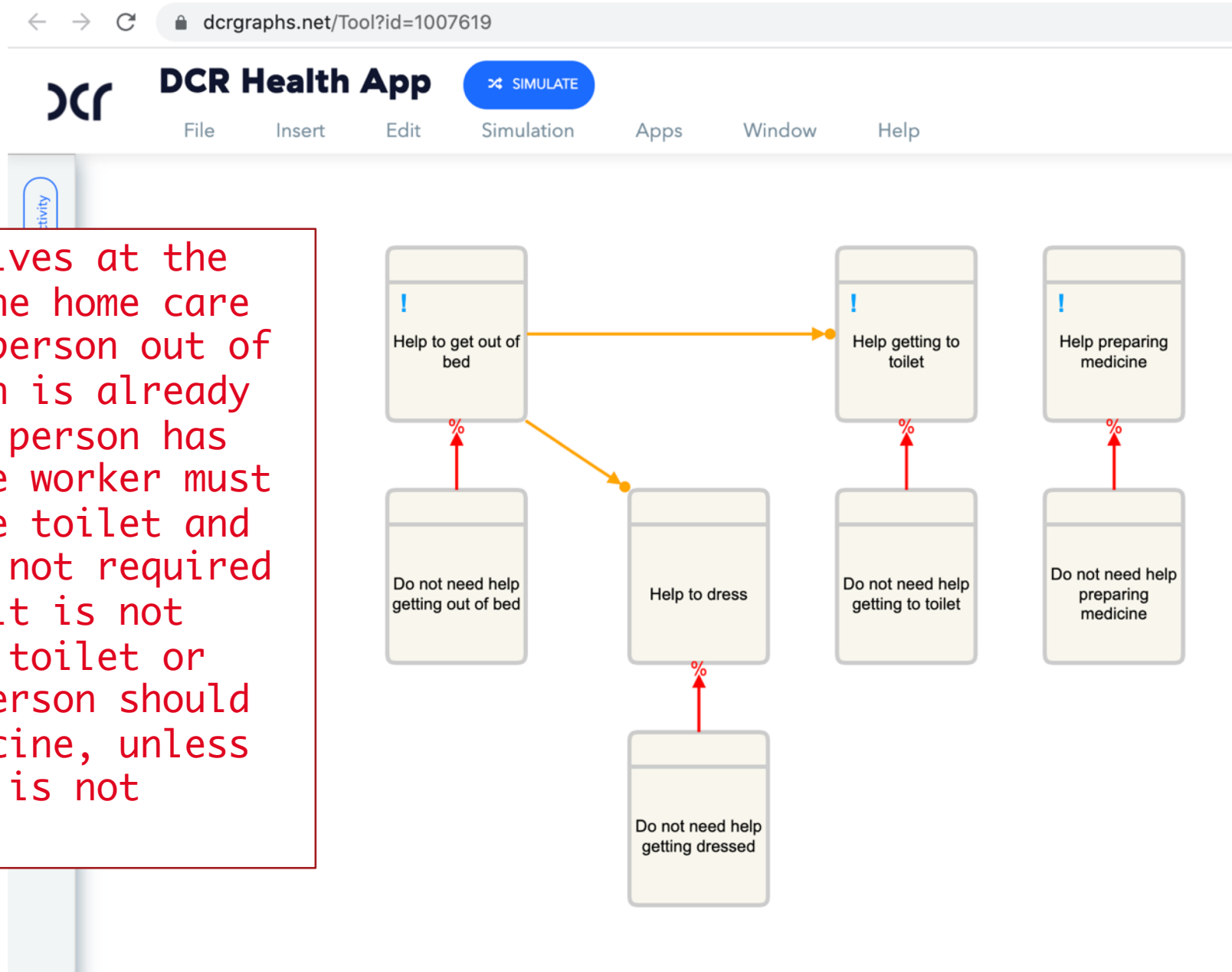
Rules are a bit more tricky



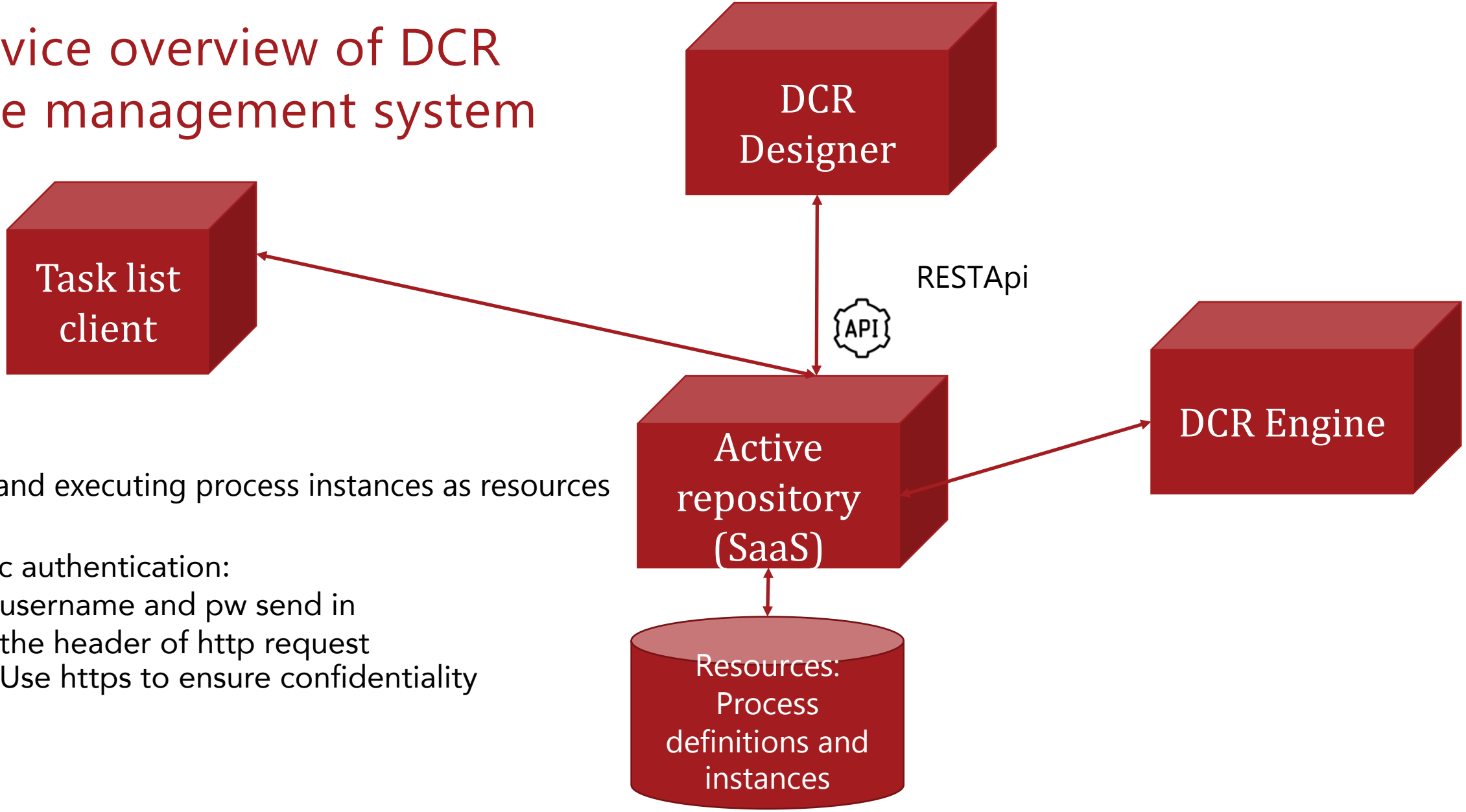
Example healthcare process (exercises class)

When the home care worker arrives at the home of the elderly person, the home care worker must help the elderly person out of bed, unless the elderly person is already out of bed. After the elderly person has come out of bed, the home care worker must help the elderly person to the toilet and help to dress. Again, this is not required if the elderly person states it is not necessary to be helped to the toilet or helped to dress. The ederly person should also get help to prepare medicine, unless the elderdly person states it is not necessary.

https://dcrgraphs.net/Tool?id=1007619#



Service overview of DCR case management system



RESTApi
creating and executing process instances as resources

http basic authentication:
username and pw send in
the header of http request
Use https to ensure confidentiality

https://documentation.dcr.design/documentation/dcr-active-repository/

Getting all your graphs

Password

URL

HTTP command

HTTP Basic Authorization

Home Workspaces API Network Explore Upgrade

Overview | GET https://repository.dcrg | No Environment

Collections
Environments
History

https://repository.dcrgraphs.net/api/graphs Save

GET https://repository.dcrgraphs.net/api/graphs Send

Params Auth Headers (6) Body Pre-req. Tests Settings Cookies

Type
Basic Auth

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username tthildebrandt

Password {{password}}

Body 200 OK 618 ms 47.87 KB Save as example

Pretty Raw Preview Visualize XML

```
1 <graphs>
2     <graph id="1004897" title="103 - If you sign up for Spanish Beginner you must
        complete it"></graph>
3     <graph id="1004892" title="103 - Select  one language"></graph>
4     <graph id="1004893" title="104 - You can only choose one foreign language course"></
```

The key REST operations you may use - replace id with the id of your graph (e.g. 1007619)

POST
https://repository.dcrgraphs.net/api/graphs/id/sims

Create new instance ressource

GET
https://repository.dcrgraphs.net/api/graphs/id/sims/

Get id of instances

GET
https://repository.dcrgraphs.net/api/graphs/id/sims/simid/events

Get events

GET
https://repository.dcrgraphs.net/api/graphs/id/sims/simid/events?filter=only-enabled

Get enabled events

POST
https://repository.dcrgraphs.net/api/graphs/id/sims/simid/events/ActivityID

Execute event (Activity)

Creating a new instance

Home | Workspaces | API Network | Explore | Upgrade

Overview | POST https://repository.dcr | No Environment

Collections | Environments | History

https://repository.dcrgraphs.net/api/graphs/1007619/sims | Save

POST https://repository.dcrgraphs.net/api/graphs/1007619/sims | Send

Params | Auth | Headers (7) | Body | Pre-req. | Tests | Settings | Cookies

Type: Basic Auth

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username: tthildebrandt

Password: {{password}}

Headers | 201 Created | 1120 ms | 381 B | Save as example

Key	Value
Transfer-Encoding	chunked
Location	repository.dcrgraphs.net/api/graphs/1007619/sims/193...
Server	Microsoft-IIS/10.0
WWW-Authenticate	Basic
simulationID	1933053

Get events of new instaces

Home Workspaces API Network Explore Upgrade

Overview | GET https://repository.dcrg | No Environment

Collections
Environments
History

https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events Save

GET https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events Send

Params Auth Headers (6) Body Pre-req. Tests Settings Cookies

Type
Basic Auth

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username tthildebrandt

Password {{password}}

Body 200 OK 984 ms 3.43 KB Save as example

Pretty Raw Preview Visualize JSON


```
1  "<events nextDelay=\"None\" nextDeadline=\"None\"  isAccepting =\"False\" currentTime
     =\"2023-11-28T22:58:34.7181466+00:00\"  currentPhase =\"\" ><event id=\"Activity0\"
     included=\"true\" enabled=\"true\" pending=\"true\" EffectivelyPending=\"true\"
     EffectivelyIncluded=\"true\" executed=\"false\" fullPath=\"Activity0\" roles=\"\"
     groups=\"\" description=\"\" label=\"Help to get out of bed\" eventType=\"\"
     phases=\"\" deadline=\"\" sequence=\"1\" parent=\"\" type=\"\" referId=\"\"
     ><eventTypeData></eventTypeData></event> <event id=\"Activity1\" included=\"true\"
     enabled=\"false\" pending=\"true\" EffectivelyPending=\"true\"
```

Get only enabled events

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Home | Workspaces | API Network | Explore | Search Postman | Upgrade

Overview | GET https://repository.dcrg | No Environment

Collections | Environments | History

https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events?filter=only-ena... | Save

GET https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events?filter=only-enabled | Send

Params | Authorization | Headers (6) | Body | Pre-request Script | Tests | Settings | Cookies

Type: Basic ...

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username: tthildebrandt

Password: {{password}}

Body | Cookies | Headers (6) | Test Results | 200 OK | 514 ms | 2.64 KB | Save as example

Pretty | Raw | Preview | Visualize | JSON


```
1  "<events nextDelay=\"None\" nextDeadline=\"None\"  isAccepting =\"False\" currentTime
     =\"2023-11-28T22:58:34.7181466+00:00\"  currentPhase =\"\" ><event id=\"Activity0\"
     included=\"true\" enabled=\"true\" pending=\"true\" EffectivelyPending=\"true\"
     EffectivelyIncluded=\"true\" executed=\"false\" fullPath=\"Activity0\" roles=\"\" groups=\"\"
     description=\"\" label=\"Help to get out of bed\" eventType=\"\" phases=\"\" deadline=\"\"
     sequence=\"1\" parent=\"\" type=\"\" referId=\"\" ><eventTypeData></eventTypeData></event> <event
     id=\"Activity3\" included=\"true\" enabled=\"true\" pending=\"false\" EffectivelyPending=\"false\"
     EffectivelyIncluded=\"true\" executed=\"false\" fullPath=\"Activity3\" roles=\"\" groups=\"\"
```

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Executing Activity0

Home Workspaces API Network Explore Search Postman Upgrade

Overview | POST https://repository.dcr | No Environment

Collections
Environments
History

https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events/Activity0 Save

POST https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events/Activity0 Send

Params | Authorization | Headers (7) | Body | Pre-request Script | Tests | Settings | Cookies

Type: Basic ...

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username: tthildebrandt

Password: {{password}}

Body | Cookies | Headers (4) | Test Results — 204 No Content 1067 ms 140 B Save as example

Pretty | Raw | Preview | Visualize | Text

1

KØBENHAVNS UNIVERSI

Getting enabled events again

Home | Workspaces | API Network | Explore | Search Postman | Upgrade

Overview | GET https://repository.dcrg | No Environment

Collections | Environments | History

https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events?filter=only-ena... | Save

GET https://repository.dcrgraphs.net/api/graphs/1007619/sims/1933053/events?filter=only-enabled | Send

Params | Authorization | Headers (6) | Body | Pre-request Script | Tests | Settings | Cookies

Type: Basic ...

The authorization header will be automatically generated when you send the request. Learn more about authorization

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment,we recommend using variables. Learn more about variables

Username: tthildebrandt

Password: {{password}}

Body | Cookies | Headers (6) | Test Results | 200 OK | 536 ms | 3.43 KB | Save as example

Pretty | Raw | Preview | Visualize | JSON


```
1  "<events nextDelay=\"None\" nextDeadline=\"None\"  isAccepting =\"False\" currentTime
     =\"2023-11-28T22:58:34.7181466+00:00\"  currentPhase =\"\" ><event id=\"Activity0\"
     included=\"true\" enabled=\"true\" pending=\"false\" EffectivelyPending=\"false\"
     EffectivelyIncluded=\"true\" executed=\"true\" fullPath=\"Activity0\" roles=\"\" groups=\"\"
     description=\"\" label=\"Help to get out of bed\" eventType=\"\" phases=\"\" deadline=\"\"
     sequence=\"1\" parent=\"\" type=\"\" referId=\"\" ><eventTypeData></eventTypeData></event> <event
     id=\"Activity1\" included=\"true\" enabled=\"true\" pending=\"true\" EffectivelyPending=\"true\"
     EffectivelyIncluded=\"true\" executed=\"false\" fullPath=\"Activity1\" roles=\"\" groups=\"\"
```


Now Activity1 is also enabled

Summary

- Process Aware systems let you separate the process logic from the code
- Can be modelled and maintained by domain experts
- DCR tools allow domain experts to model and simulate and to map textual requirements to process graphs
- DCR is used by more than 35 customers (e.g. in the KMD WorkZone Enterprise Information System)
- The DCR active repository can be used as a webservice for creating graphs, instances and executing events
- We can test this using the Postman tool – next time we see how to connect from you Python app