

# › BDI PROTOTYPE V0.2 PRESENTATION TO MINIENW DECEMBER 2022

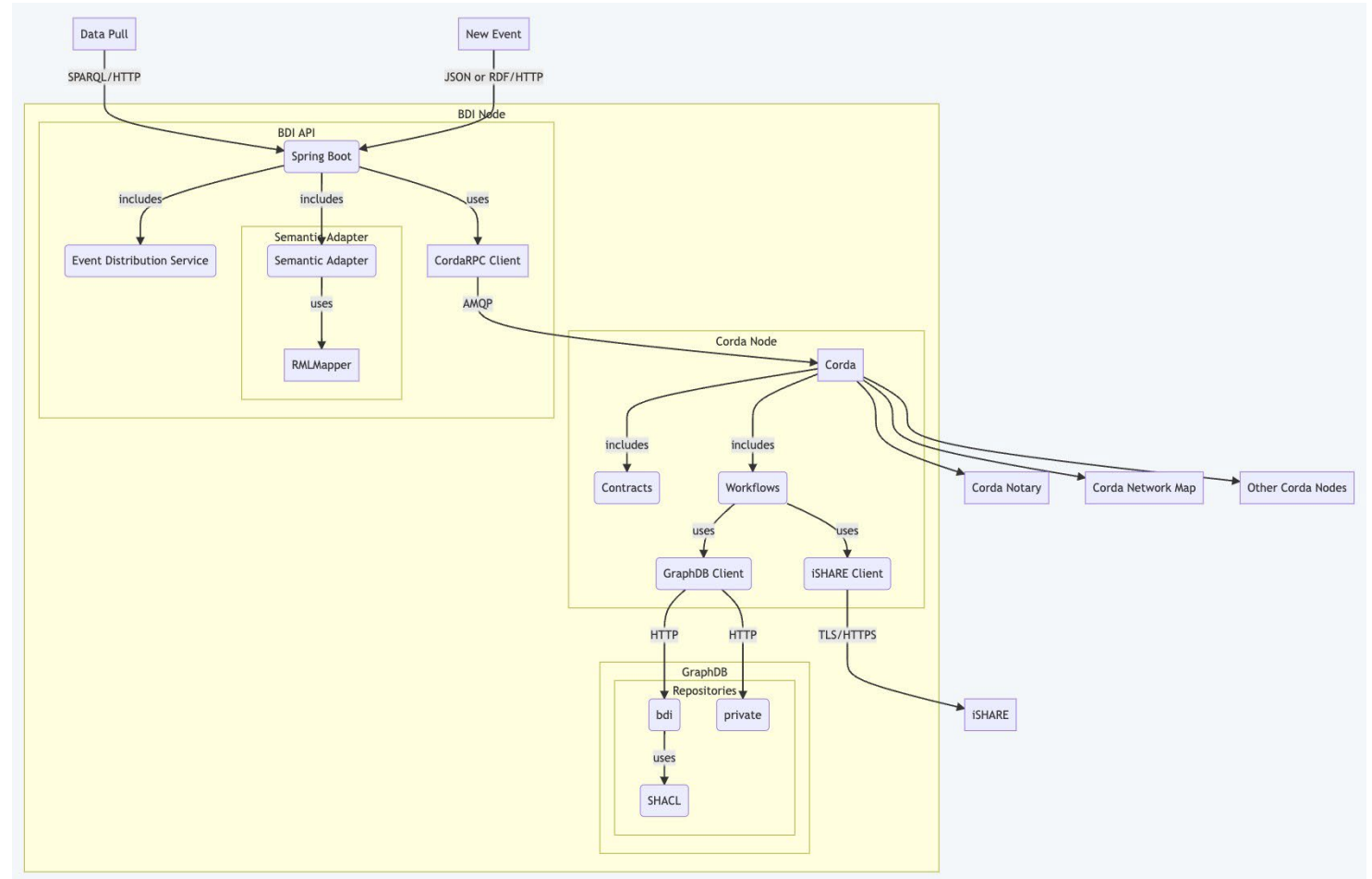
Walk through: <https://github.com/TNO/FEDeRATED-BDI>

What we want to show with this prototype?

- › Multi-event, multi-node, query obv multi events
- › Major ingrediënt: the distribution algorithm
- › Additionalr:
  - › Improvement concerning stability
  - › Software updates prototype
- › Documentation and publication

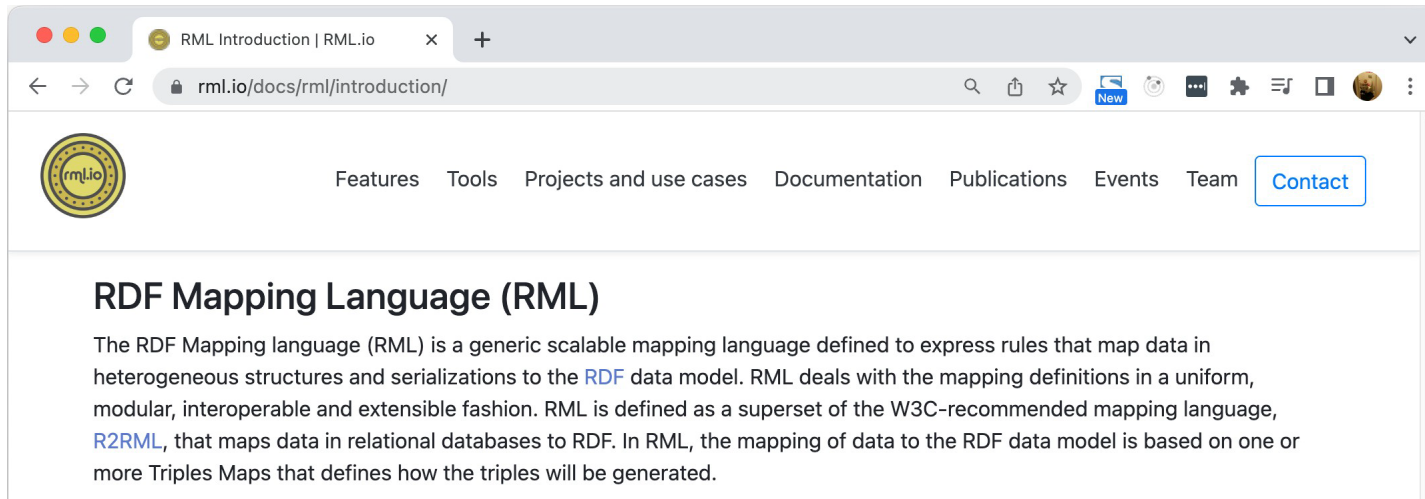
# › BDI ARCHITECTURE (PROTOTYPE V0.2)

- › Modulair
- › Extensible



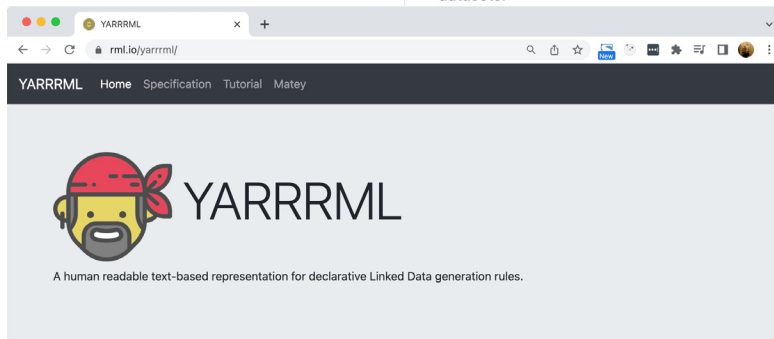
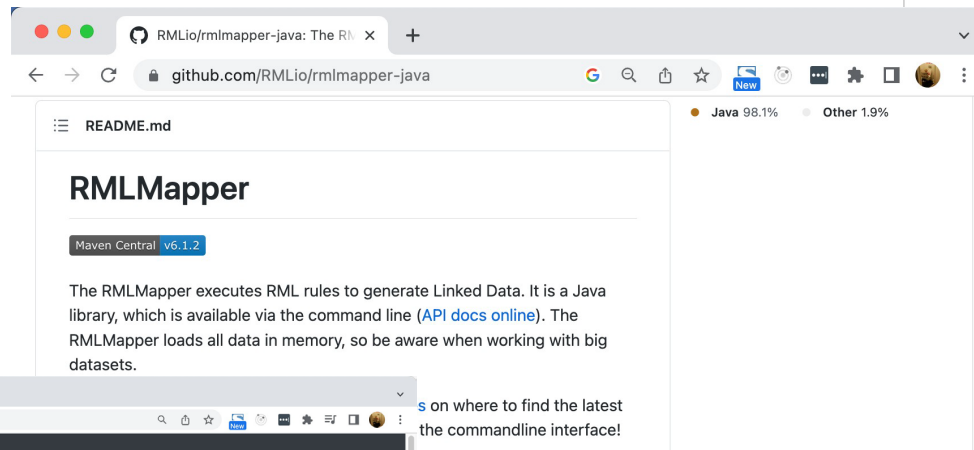
# › SEMANTIC ADAPTER

- › Responsibility: Mapping JSON to turtle RDF (using RML)
- › Improved robustness
- › Can now be used as a library or a standalone Microservice
- › Documentation added



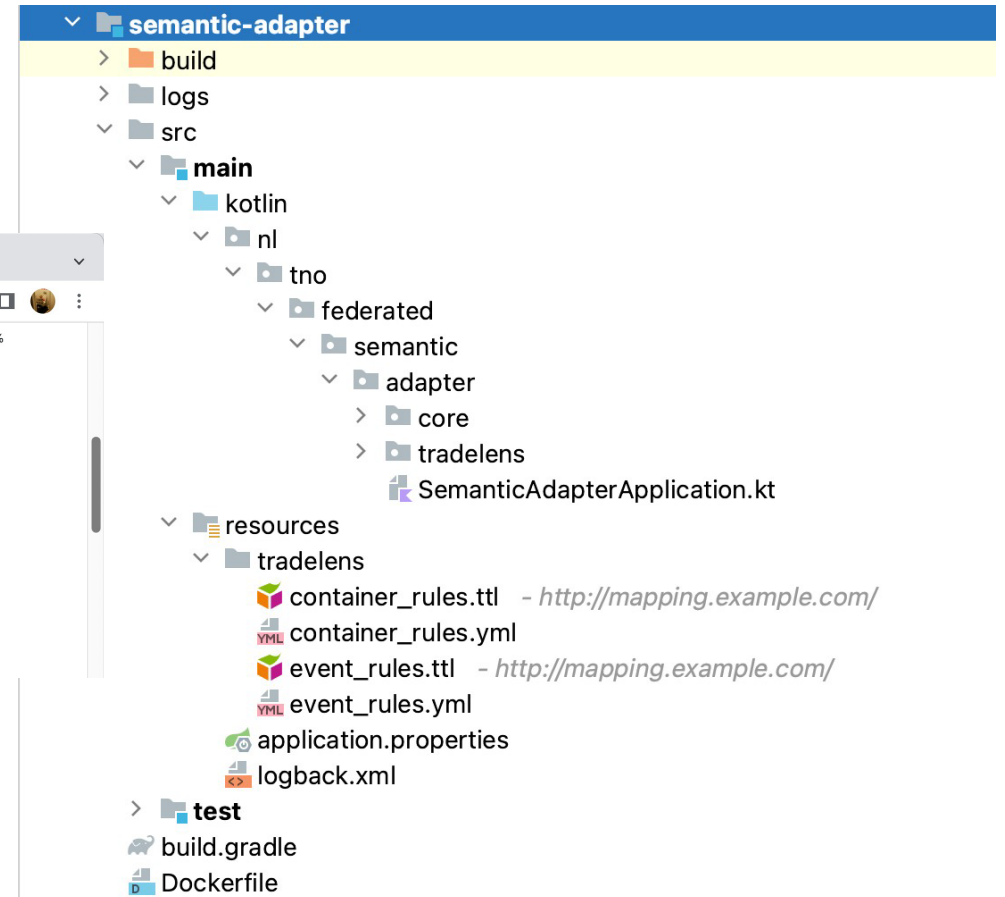
# SEMANTIC ADAPTER

## Extending the semantic adapter



### What is it?

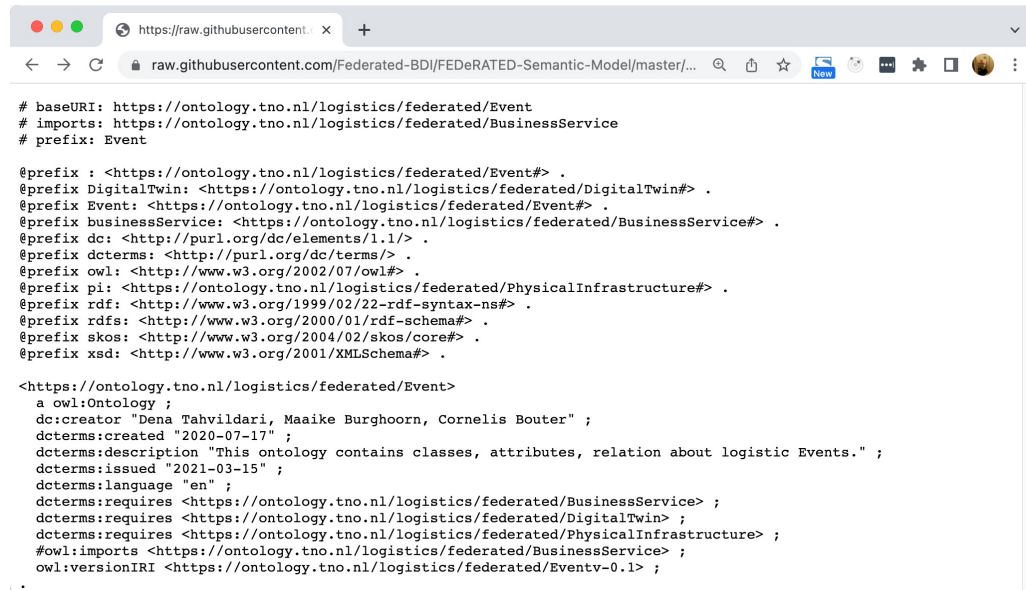
YARRRML is a human readable text-based representation for declarative Linked Data generation rules. It is a subset of YAML, a widely used data serialization language designed to be human-friendly. It can already be used to represent R2RML and RML rules.



# › ONTOLOGY AND SHACL

## GITHUB.COM/FEDERATED-BDI/FEDERATED-SEMANTIC-MODEL

- Ontology provides a standard how input data should look like
- SHACL validation ensure input data conforms the ontology?
  - SHACL validation: hand-written rules that determine if data can be input in the database
  - Customizable, extendable based on possible additional business rules



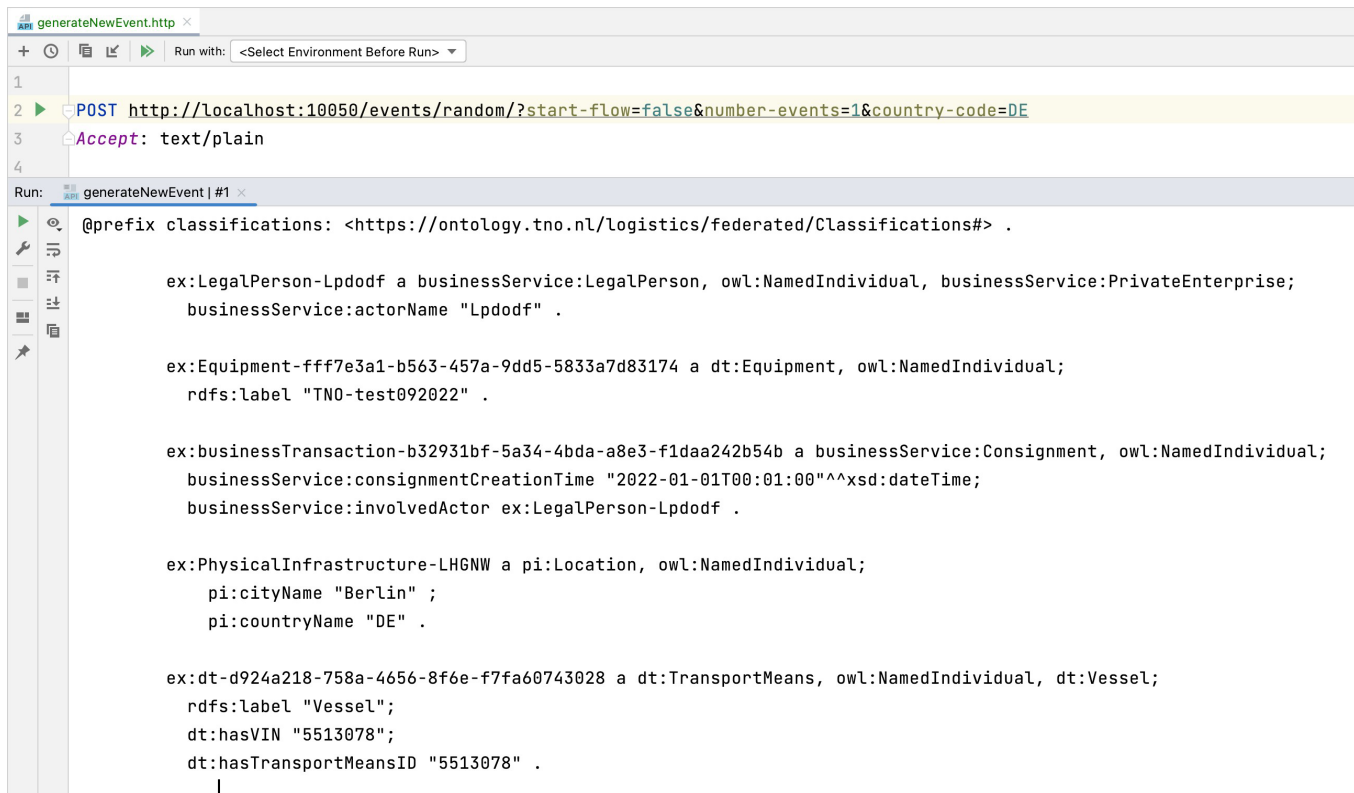
```
# baseURI: https://ontology.tno.nl/logistics/federated/Event
# imports: https://ontology.tno.nl/logistics/federated/BusinessService
# prefix: Event

@prefix : <https://ontology.tno.nl/logistics/federated/Event#> .
@prefix DigitalTwin: <https://ontology.tno.nl/logistics/federated/DigitalTwin#> .
@prefix Event: <https://ontology.tno.nl/logistics/federated/Event#> .
@prefix businessService: <https://ontology.tno.nl/logistics/federated/BusinessService#> .
@prefix dc: <http://purl.org/dc/elements/1.1/> .
@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix pi: <https://ontology.tno.nl/logistics/federated/PhysicalInfrastructure#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

<https://ontology.tno.nl/logistics/federated/Event>
  a owl:Ontology ;
  dc:creator "Dena Tahvildari, Maaïke Burghoorn, Cornelis Bouter" ;
  dcterms:created "2020-07-17" ;
  dcterms:description "This ontology contains classes, attributes, relation about logistic Events." ;
  dcterms:issued "2021-03-15" ;
  dcterms:language "en" ;
  dcterms:requires <https://ontology.tno.nl/logistics/federated/BusinessService> ;
  dcterms:requires <https://ontology.tno.nl/logistics/federated/DigitalTwin> ;
  dcterms:requires <https://ontology.tno.nl/logistics/federated/PhysicalInfrastructure> ;
  #owl:imports <https://ontology.tno.nl/logistics/federated/BusinessService> ;
  owl:versionIRI <https://ontology.tno.nl/logistics/federated/Eventv-0.1> ;
```

# › BDI EVENT GENERATOR

- › Not being dependant on data coming from external parties for testing the prototype
- › Generates basic events in turtle RDF format
- › Possible to generate all Event types defined in the ontology (we implemented only 1)



```
1  
2 ▶ POST http://localhost:10050/events/random/?start-flow=false&number-events=1&country-code=DE  
3   Accept: text/plain  
4  
Run: generateNewEvent | #1 ×  
  @prefix classifications: <https://ontology.tno.nl/Logistics/federated/Classifications#> .  
  
  ex:LegalPerson-Lpdodf a businessService:LegalPerson, owl:NamedIndividual, businessService:PrivateEnterprise;  
    businessService:actorName "Lpdodf" .  
  
  ex:Equipment-fff7e3a1-b563-457a-9dd5-5833a7d83174 a dt:Equipment, owl:NamedIndividual;  
    rdfs:label "TNO-test092022" .  
  
  ex:businessTransaction-b32931bf-5a34-4bda-a8e3-f1daa242b54b a businessService:Consignment, owl:NamedIndividual;  
    businessService:consignmentCreationTime "2022-01-01T00:01:00"^^xsd:dateTime;  
    businessService:involvedActor ex:LegalPerson-Lpdodf .  
  
  ex:PhysicalInfrastructure-LHGNW a pi:Location, owl:NamedIndividual;  
    pi:cityName "Berlin" ;  
    pi:countryName "DE" .  
  
  ex:dt-d924a218-758a-4656-8f6e-f7fa60743028 a dt:TransportMeans, owl:NamedIndividual, dt:Vessel;  
    rdfs:label "Vessel";  
    dt:hasVIN "5513078";  
    dt:hasTransportMeansID "5513078" .
```

## › DISTRIBUTION ALGORITHM

- › Determines which events are sent to what BDI node(s)
- › Two use cases supported
  - › External algorithm: specify the receiver(s) of an event explicitly, by BDI node organisation/location/country
  - › Internal algorithm: detect the receivers of an event based on the event contents and automatically distribute
- › Internal algorithm can be adjusted to specific use case(s)
  - › Current implementation is able to determine receiver(s) based on content of a single event
  - › Possible to extend for more complex use cases, for example determining the receiver(s) based on more than one event



# › DISTRIBUTION ALGORITHM: DEMO

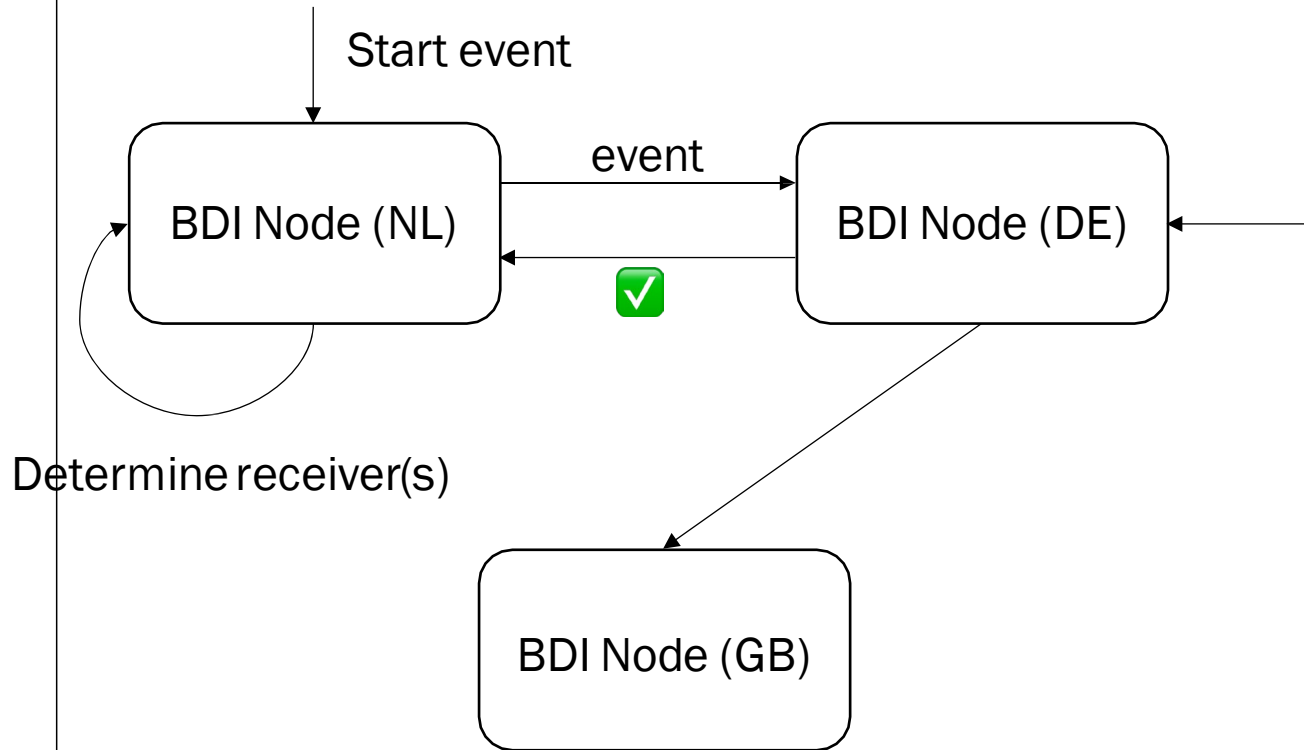
## USE CASE

- › What: Vessel going from NL to DE
- › Trigger: BDI Node (NL) receives 'start' event
- › Expected: Distributing algorithm should send 'start' event to BDI Node (DE)

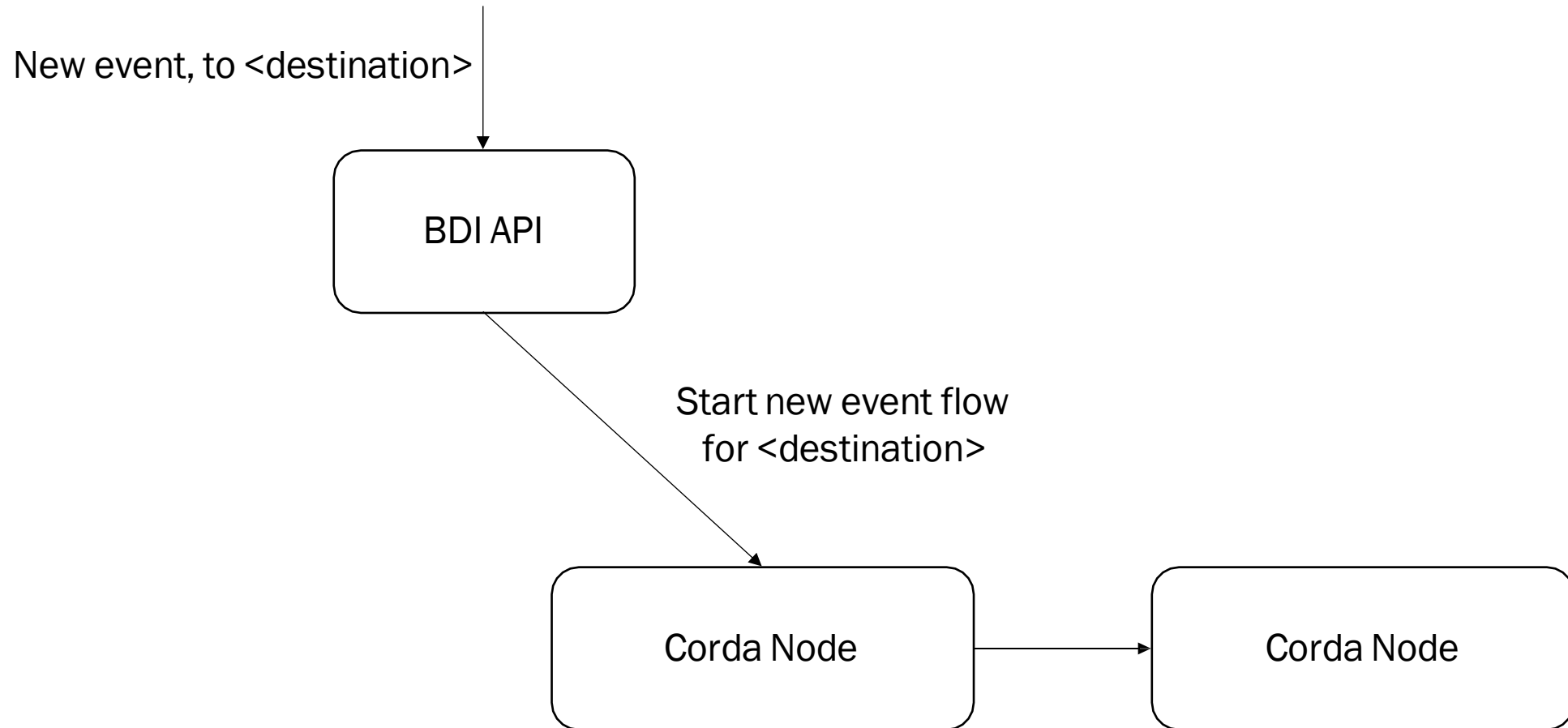




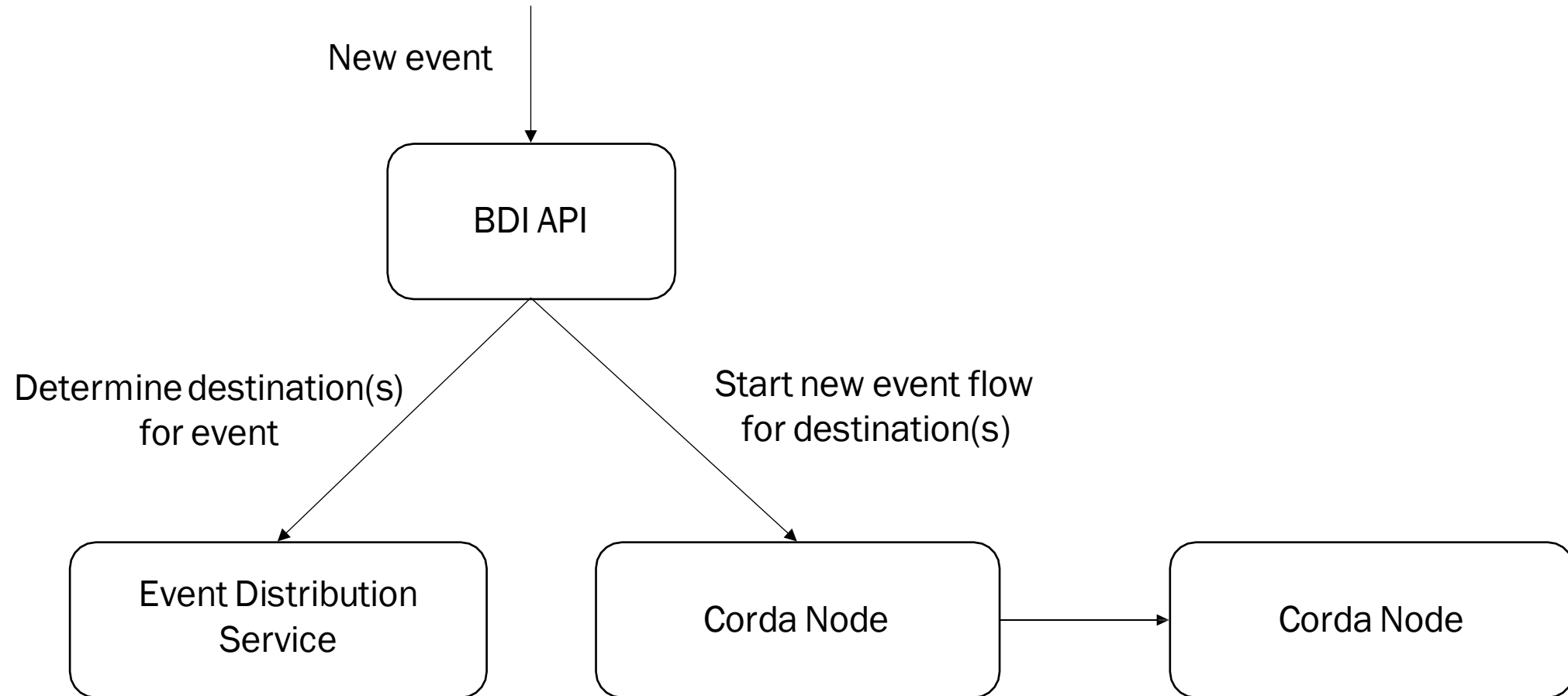
# › DISTRIBUTION ALGORITHM: DEMO



## › DISTRIBUTION ALGORITHM: 0.1

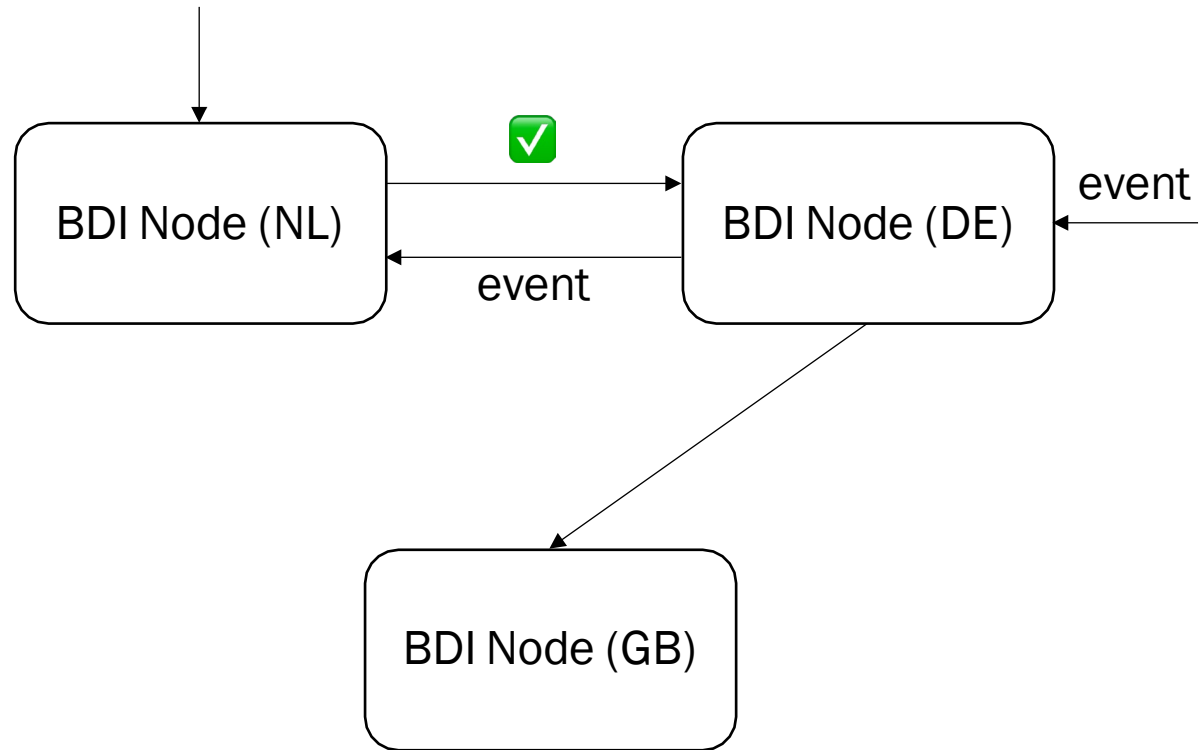


## › DISTRIBUTION ALGORITHM: 0.2



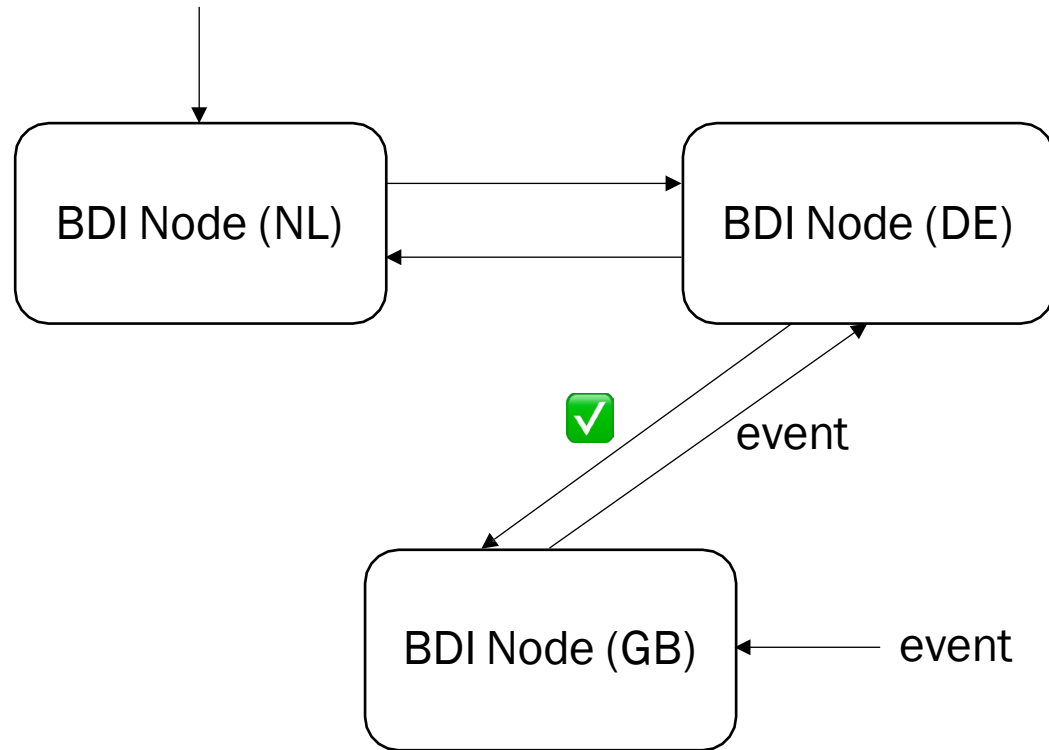
# › DISTRIBUTION ALGORITHM: DEMO

## MULTI-EVENT

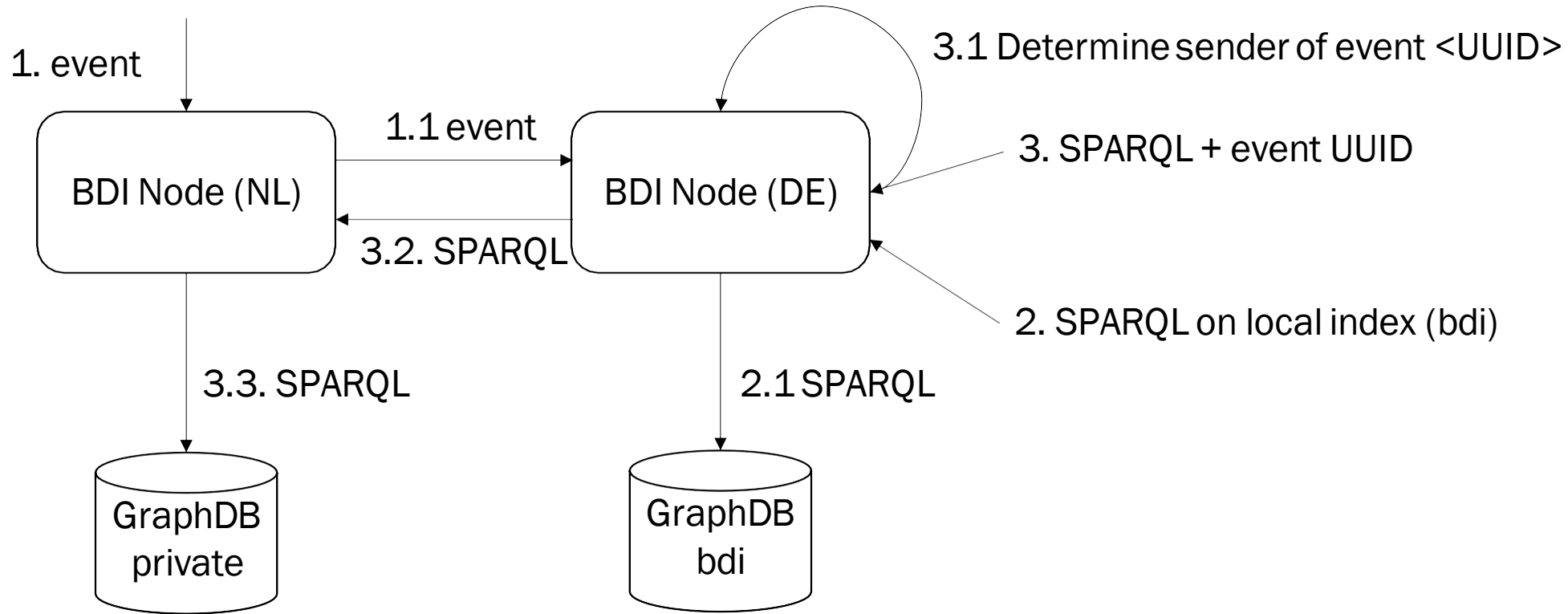


# › DISTRIBUTION ALGORITHM: DEMO

## MULTI-EVENT



## DATA PULL: 0.2



# › ISHARE INTEGRATION WITH CORDA



Why iSHARE?

› Current BDI-node prototype uses Corda Corda supports IAA

iSHARE is a product developed in the NL, integrate with current BDI concept

› development iSHARE is support by a legal basis

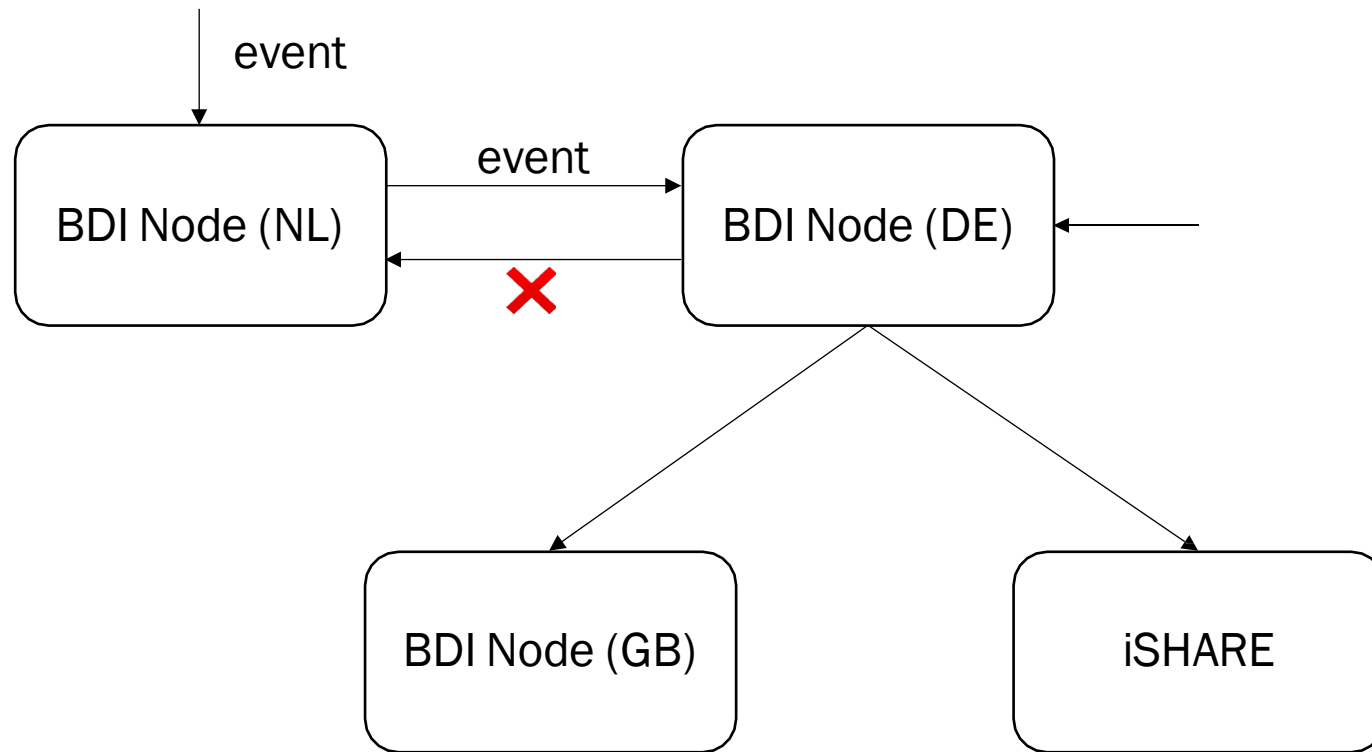
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➔ Duplication: both iSHARE and Corda support IAA

IAA Communication protocol of iShare in combination with workflow Corda can be used for event distribution and data pull

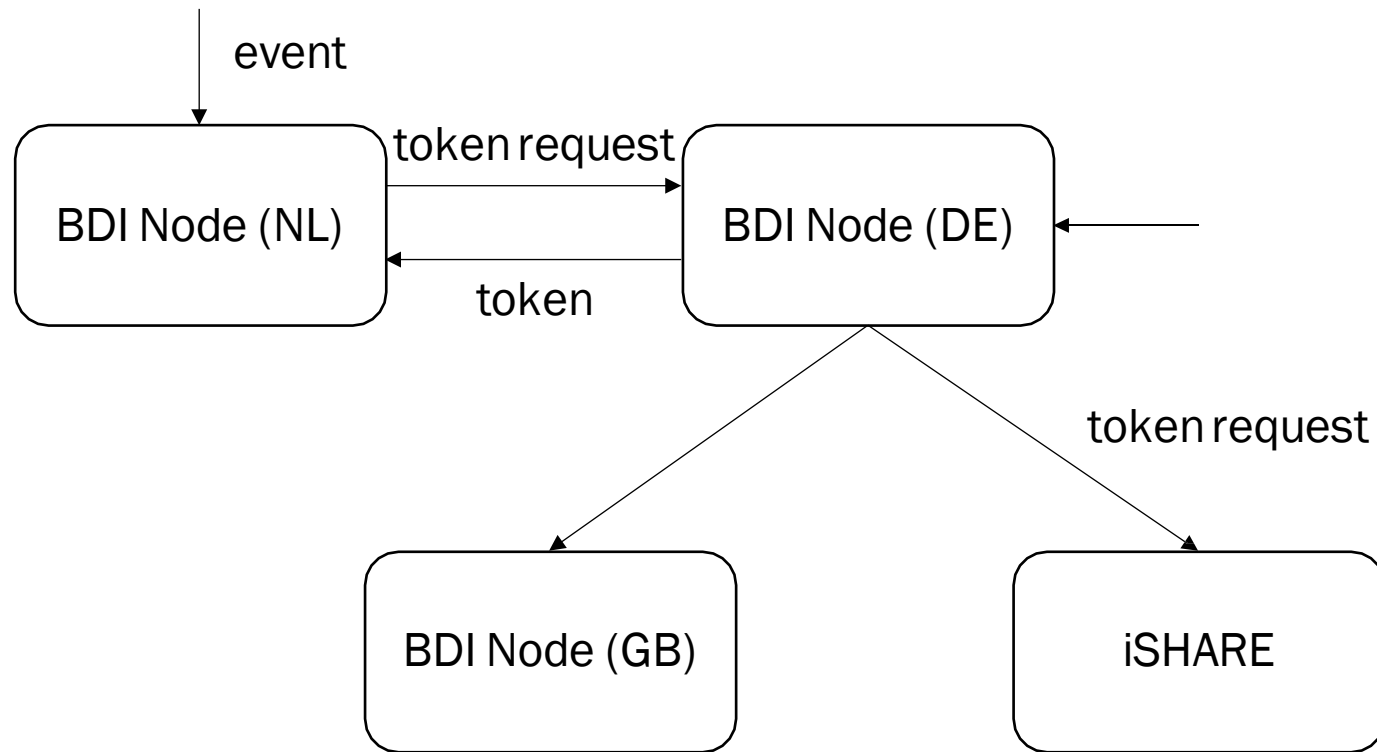
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# › ISHAREFLOW

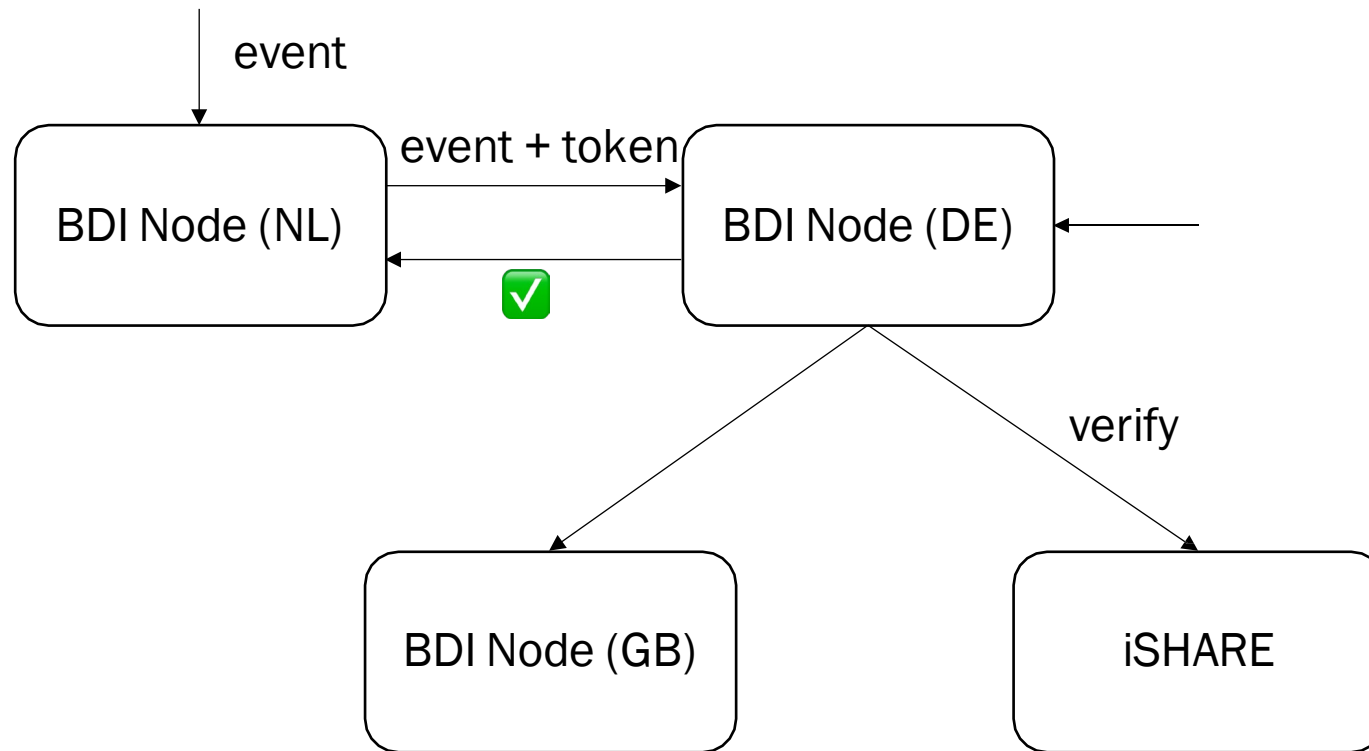




# › ISHAREFLOW



# › ISHAREFLOW



## › ISHARE CONCLUSION



- › Solution works with minimal impact on both systems as
    - › much as possible both modular
    - › No adaptations to Corda en/of iSHARE
      - Technical fundamental Corda adaptations required
  - › Technical compliant
    - › Usage iSHARE scheme en communication protocol
  - › Full iSHARE compliant between BDI nodes?
    - › we use TLS not HTTP?
    - › Corda uses message queues
      - Advanced Message Queuing Protocol (AMQP)
- instead of HTTP
- In iSHARE specifications/requirements inclusion?

# › GITHUB WALK-THROUGH

Available:

- › Documentation
  - › Readme (installatie)
  - › Server/environment
- › requirements

Software

- › Versions
- › Source code

1st use (test/user example)



# › FEDERATED BDI SOURCE CODE

## GITHUB.COM/TNO/FEDERATED-BDI

The screenshot shows a web browser displaying the GitHub repository page for TNO/FEDERATED-BDI. The browser's address bar shows the URL `github.com/TNO/FEDERATED-BDI/blob/main/README.md`. The GitHub navigation bar includes a search field, links for Pull requests, Issues, Codespaces, Marketplace, and Explore, along with notification and user profile icons. The repository header shows the name **TNO / FEDERATED-BDI** (Public), with 6 watchers, 0 forks, and 0 stars. Below the header, navigation tabs for Code, Issues, Pull requests, Actions, Projects, Security, and Insights are visible. The current file is `main / FEDERATED-BDI / README.md`. A commit by MasX (Version 0.2) is shown, with the latest commit `cc3a25c` made 23 minutes ago. The file details indicate it is 46 lines (32 sloc) and 1.75 KB. The README content includes the title **FEDeRATED BDI prototype** and the text: "This repository contains the FEDeRATED BDI prototype implementation."

# › **FEDERATED BDI SOURCE CODE**

## **GITHUB.COM/TNO/FEDERATED-BDI**

- › Contains source code
- › Technical documentation
- › Unit and integration tests
- › Gitlab CI pipeline

Walk through: <https://github.com/TNO/FEDeRATED-BDI>

# › FEDERATED DOCKER BDI NODE

## GITHUB.COM/FEDERATED-BDI/DOCKER-BDI-NODE

The screenshot shows a web browser window displaying the GitHub repository page for `Federated-BDI/Docker-BDI-Node`. The browser's address bar shows the URL `github.com/Federated-BDI/Docker-BDI-Node/blob/...`. The repository page header includes the GitHub logo, a search bar, and navigation links for `Pulls`, `Issues`, `Codespaces`, `Marketplace`, and `Explore`. Below the header, the repository name `Federated-BDI / Docker-BDI-Node` is displayed as `Public`, along with statistics for `Watch` (1), `Fork` (0), and `Star` (0). A secondary navigation bar contains links for `Code`, `Issues`, `Pull requests`, `Actions`, `Projects`, `Security`, and `Insights`. The main content area shows the selected file `main Docker-BDI-Node / README.md` with a `Go to file` button. A commit history entry by `Stephan Oudmaijer` is visible, dated `2 weeks ago`. Below the commit, it lists `2 contributors`. The file details show `160 lines (110 sloc)` and `7.93 KB`. The file content begins with the heading `Docker BDI Node` and the introductory text: `This repository contains the necessary files to configure a BDI node and run it via docker compose.`

# › FEDERATED KUBERNETES BDI NODE

## GITHUB.COM/FEDERATED-BDI/KUBERNETES-BDI-NODE

The screenshot shows a web browser displaying the GitHub repository page for `Federated-BDI/Kubernetes-BDI-Node`. The browser's address bar shows the URL `github.com/Federated-BDI/Kubernetes-BDI-Node/blob/main/README...`. The GitHub navigation bar includes a search field, links for Pull requests, Issues, Codespaces, Marketplace, and Explore, along with notification and user profile icons. The repository header shows the name `Federated-BDI / Kubernetes-BDI-Node` with a 'Public' badge, and statistics for Watch (2), Fork (0), and Star (0). Below the header, navigation tabs for Code, Issues, Pull requests, Actions, Projects, Security, and Insights are visible. The main content area shows the selected file `Kubernetes-BDI-Node / README.md` on the `main` branch. A commit by `abhishekmaha-tno` is highlighted, with the message 'Update instructions and NMS truststore' and the latest commit hash `d920012` on Sep 27. The file details show 110 lines (78 sloc) and a size of 9.22 KB. The README content begins with the title `Kubernetes BDI Node (In progress)` and a description: 'Helm scripts for deploying BDI node on a Kubernetes cluster with/without GraphDB and/or Corda Client API'.

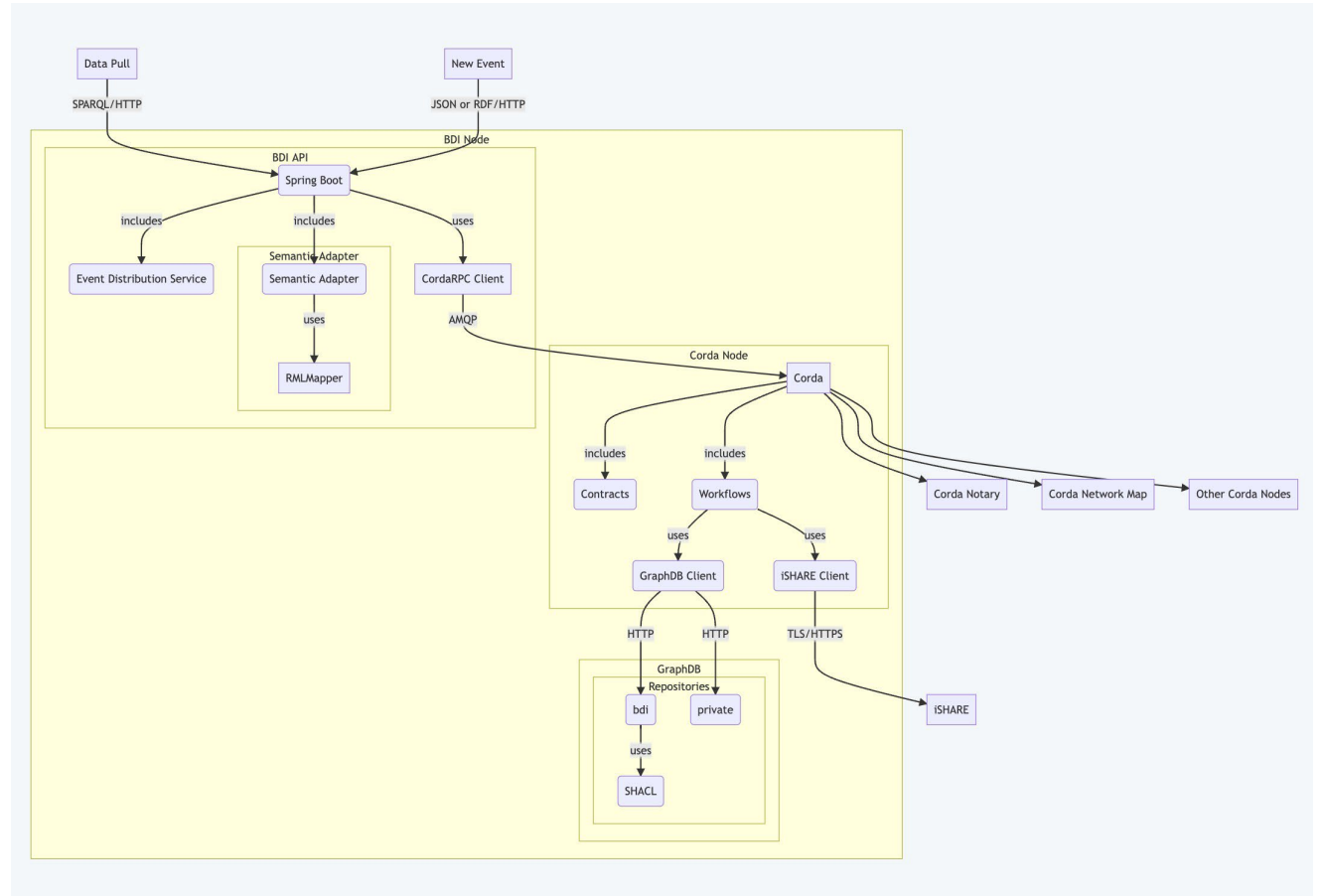


# › OPENSTAANDE VRAGEN EN UITDAGINGEN

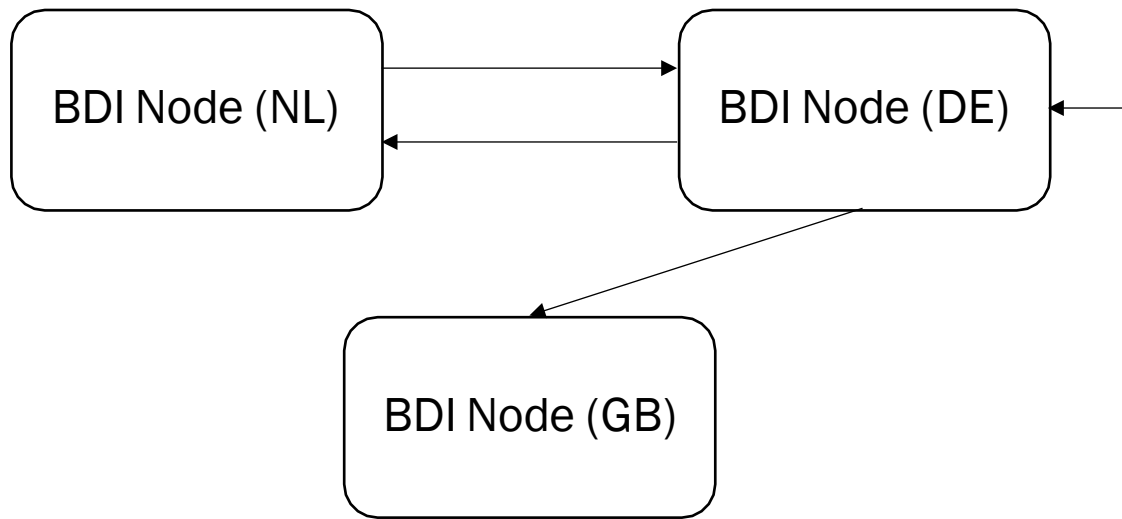
- › De twee prototypen leggen het BDI-fundament
- › Geen (nieuwe) blocking issues geïdentificeerd

Openstaande uitdagingen:

1. Event-based access control
2. Externe interface zonder triple store
3. Corda onafhankelijk
4. iShare full compliancy
5. Non-functionals:
  - a. Schaalbaarheid
  - b. Performance
  - c. QoS
  - d. Security
  - e. Governance
  - f. Gebruikersvriendelijkheid



# VO.2, WAT KUNNEN WE ERMEE?



Van generiek naar specifiek:

1. Check semantisch model of use case wordt ondersteund. Werkt door tot diep in geïmplementeerde logica.
2. Check/definieer de benodigde digital twins.
3. Uitbreiden semantic adapter met nieuwe externe data modellen.
4. Definieer de benodigde events, distributie algoritme, queries, etc.
5. Check de fysieke interfaces en infrastructuur: triple store?, bruikbare API's?, etc.

