FIWARE Data Spaces

Integration with IDSA Data Space Protocol

Stefan Wiedemann - Senior Software Engineer

SEAMWARE

IDSA Data Space Protocol

1. IDSA Data Space Protocol
    a. Catalog Protocol
    b. Contract Negotiation Protocol
    c. Transfer Process Protocol
    d. Eclipse Data Space Connector
2. Integration with the FIWARE Data Space Connector
    a. Catalog Protocol
    b. Transfer Process Protocol
    c. Demo
3. Integration with the Contract Negotiation Protocol

IDSA Data Space Protocol

- Data Exchange between different Data Space Implementations requires a common understanding of data models and exchange protocols
- DSSC Blueprint separates into
  - Data Models - define and use shared semantics
  - Data Exchange - capabilities for the actual exchange of data
  - Provenance & Traceability - tracking and tracing of the sharing process
- Data Exchange focuses on mechanisms for the actual transmission of data and closely follows the IDSA Data Space Protocol

IDSA Data Space Protocol

- a set of specifications designed to facilitate interoperable data sharing
- includes schemas and protocols required to publish data, negotiate agreements and access data
- initially created and maintained by the International Data Spaces Association(IDSA)
- now an Eclipse Specification project, targeting to become an ISO standard
- consists of 3 elements:
  - Catalog Protocol
  - Contract Negotiation Protocol
  - Transfer Process Protocol

Catalog Protocol

- describes the interface for offering Data Sets and Services as part of a Catalog
- uses DCAT-3 to describe the Data Objects
- specifies the information flow between participants when exchanging catalog informations
- defines an HTTP-Rest binding

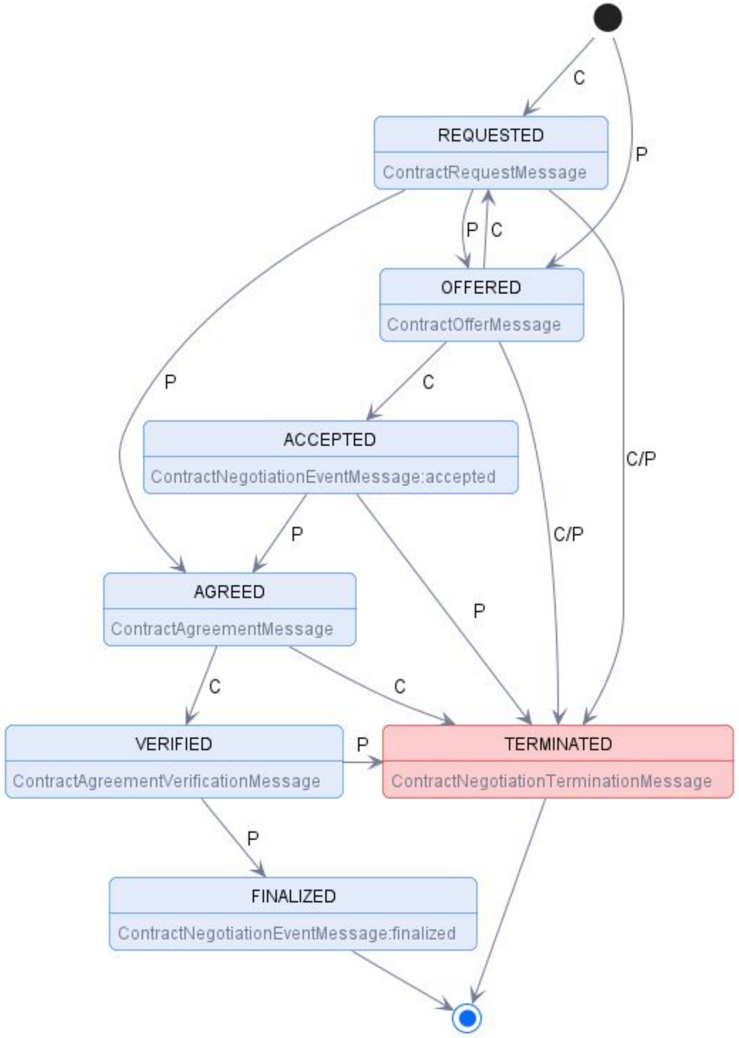
Catalog Protocol

- example catalog:

```
{
        “@context”: “https://w3id.org/dspace/2024/1/context.json”,
        “@type”: "dcat:Catalog”,
        “@id”: "urn:ngsi-ld:catalog:5b33f5bc-65e7-40b4-a71c-b722da52a919”,
        “dct:identifier”: "urn:ngsi-ld:catalog:5b33f5bc-65e7-40b4-a71c-b722da52a919",
        “dct:issued”: "2025-01-15T07:25:19.779168",
        “dct:title”: "Test Catalog",
        “odrl:hasPolicy: [ ],
        “dcat:service”:  [{
                        “@context”: “https://w3id.org/dspace/2024/1/context.json”,
                        “@type”: "dcat:DataService”,
                        “@id”: "urn:ngsi-ld:product-offering:96eaae6d-1615-41b0-b721-91c6a2e36551”,
                        “dcat:keyword”: "data-service",
                        “dcat:endpointDescription”: "The Test Service”,
                        “dcat:endpointURL”: "https://the-test-service.org”,
                        “dct:identifier”: "urn:ngsi-ld:product-offering:96eaae6d-1615-41b0-b721-91c6a2e36551”,
                        “dct:issued”: "2025-01-15T07:25:31.220506”,
                        “dct:title”: "Test Service”,
                        “dct:description”: [ "Some information about the service” ],
        }]
}
```

Contact Negotiation Protocol

- describes process of a Provider and a Consumer of one or more Data Set / Services coming to an agreement
- iterates through a series of states through defined exchange of messages
- based on Catalog Entries, to be referenced in the process
- defines an HTTP-Rest binding to be supported by Provider and Consumer

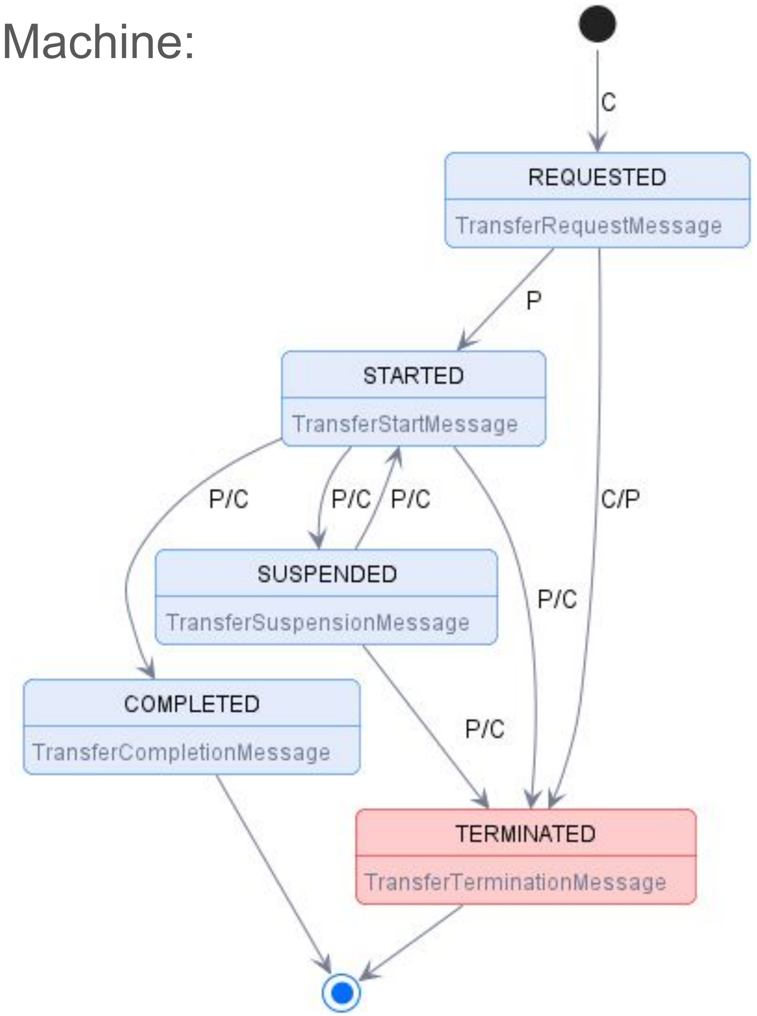

C
P
REQUESTED
ContractRequestMessage
P
C
OFFERED
ContractOfferMessage
P
C
C/P
ACCEPTED
ContractNegotiationEventMessage:accepted
P
C/P
AGREED
ContractAgreementMessage
P
C
C
VERIFIED
ContractAgreementVerificationMessage
P
TERMINATED
ContractNegotiationTerminationMessage
P
FINALIZED
ContractNegotiationEventMessage:finalized

Transfer Process Protocol

- describes process of a Provider and a Consumer of one or more Data Set / Services interacting in a concrete data exchange
- iterates through a series of states, controlling the flow of data by Consumer and Provider through defined messages
- supports Pull and Push transfers, with data being finite or non-finite
- specifies the information flow between participants when exchanging catalog informations
- defines an HTTP-Rest binding

Transfer Process Protocol

- Transfer Process Protocol State Machine:



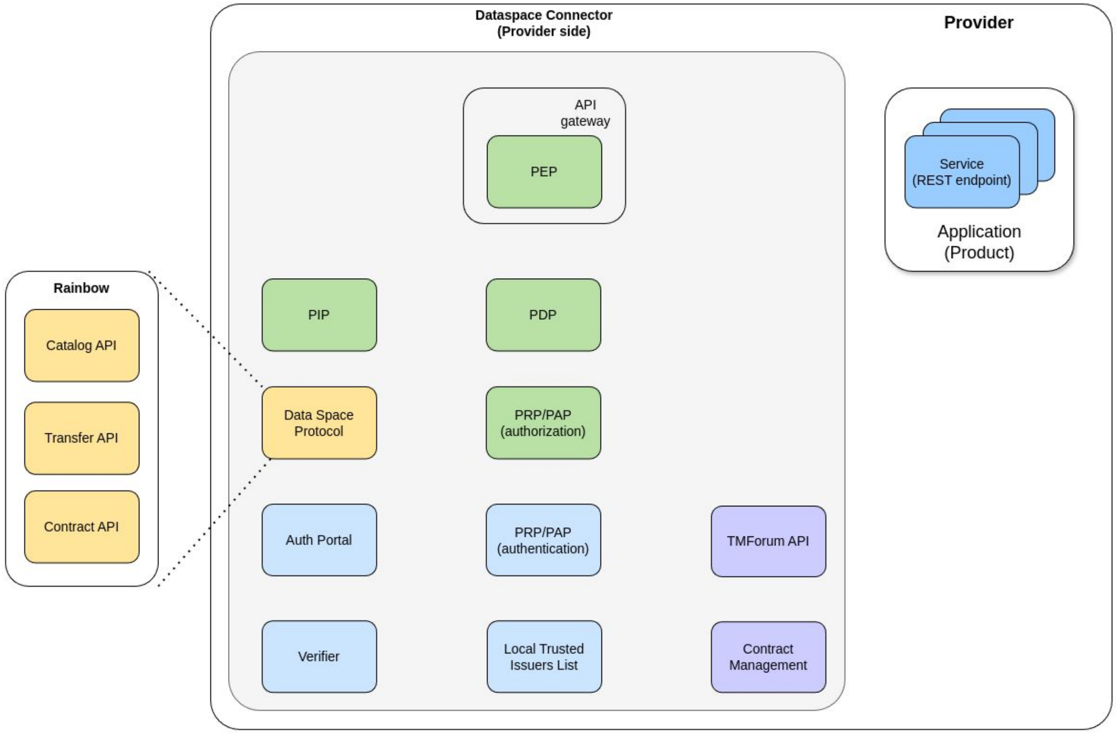
SEAMWARE

Eclipse Data Space Connector

- Open Source Framework by the Eclipse Foundation for building data-sharing services
- provides components for control planes, data planes, data catalogs and decentralized identity
- focused on M2M data exchange
- implements the IDSA Data Space Protocol & Eclipse Decentralized Claims Protocol(EDCP)
- Decentralized Claims Protocol:
  - authentication protocol based on Verifiable Credentials for M2M Authentication
  - maintained by the Eclipse Foundation, but incompatible with the OID4VC protocols
  - often seen as once, but EDCP and IDSA Data Space Protocol are independent specifications

Integration with the FIWARE Data Space Connector

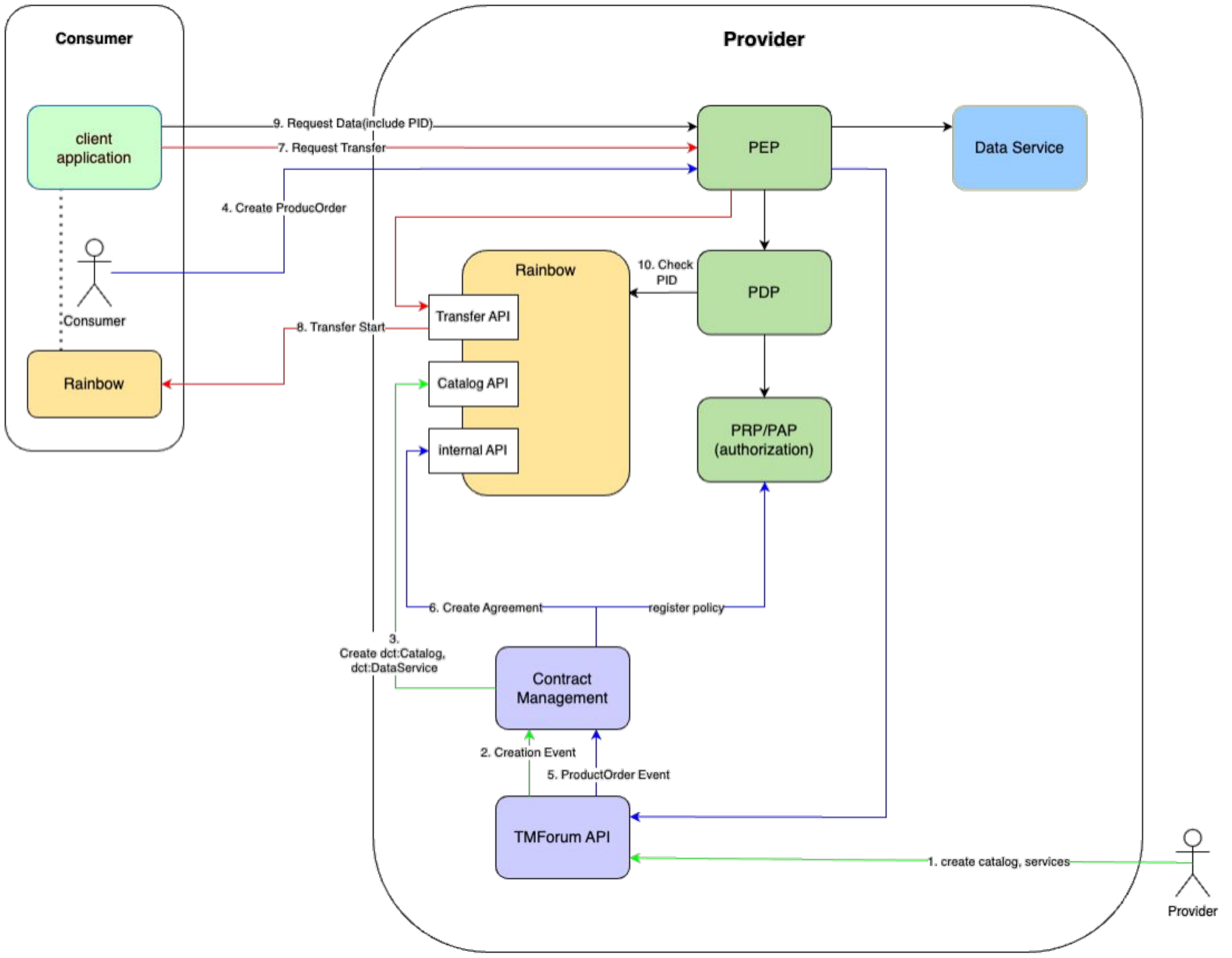
- FIWARE Data Space Connector covers the functionality through TMForum APIs
- for interoperability, IDSA Data Space protocol is also implemented in connection with TMForum
- Data Space Protocol APIs are offered by Rainbow



Integration of the Catalog Protocol

Setup Products and Offerings:

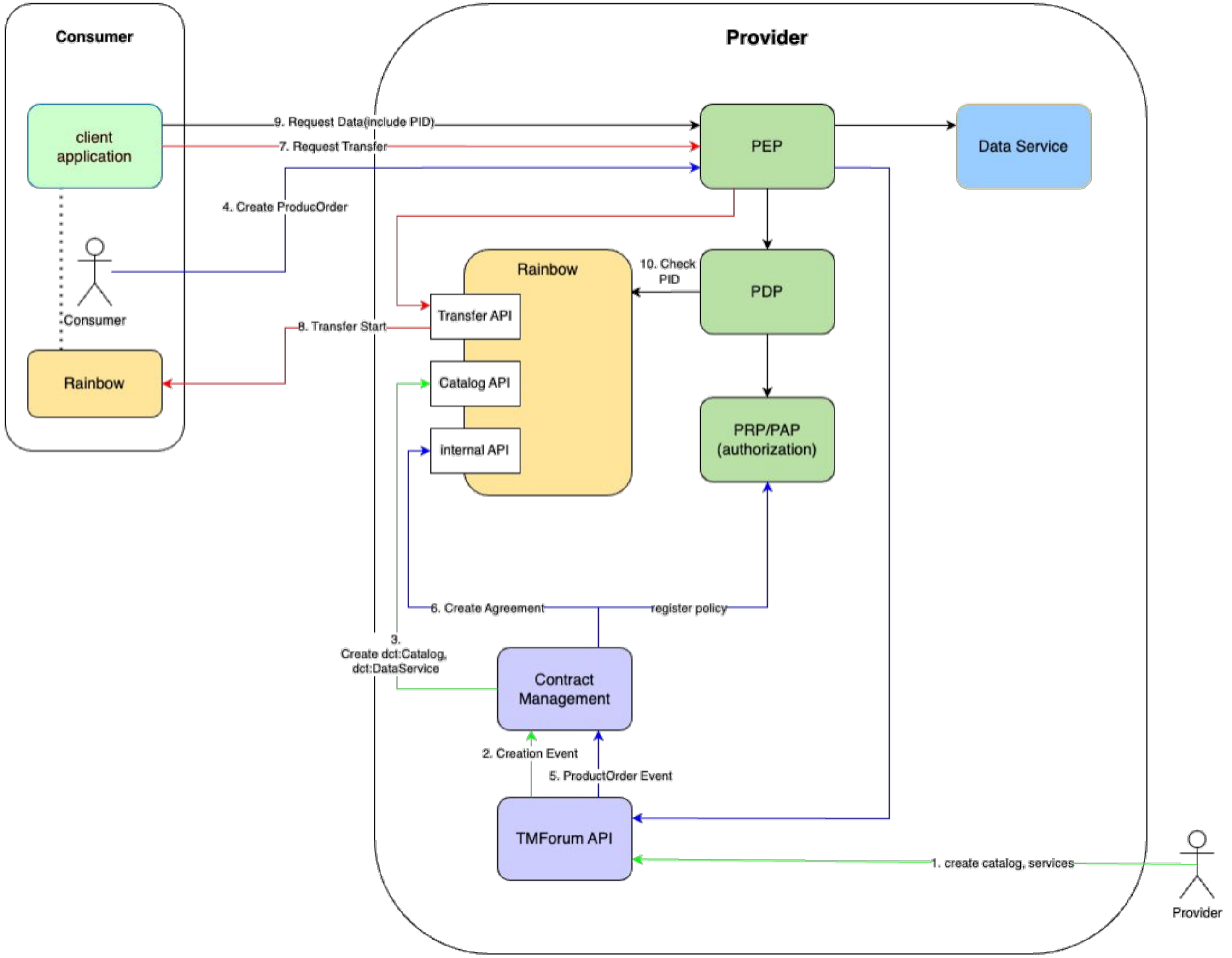
1. Data Provider creates Catalog, Service and Offerings through the TMForum API
2. TMForum API sends creation event to the Contract Management module
3. Contract Management translates the objects and creates relevant DCAT entries in Rainbow(Catalog API)



Integration of the Transfer Process Protocol

Consumer acquires access to the data service:

4. Consumer creates Product Order at TMForum API
5. TMForum API sends Product Order Event to the Contract Management
6. Contract Management translates the objects
    a. creates and Agreement at Rainbow
    b. (optional) creates Policies at the Policy Administration Point



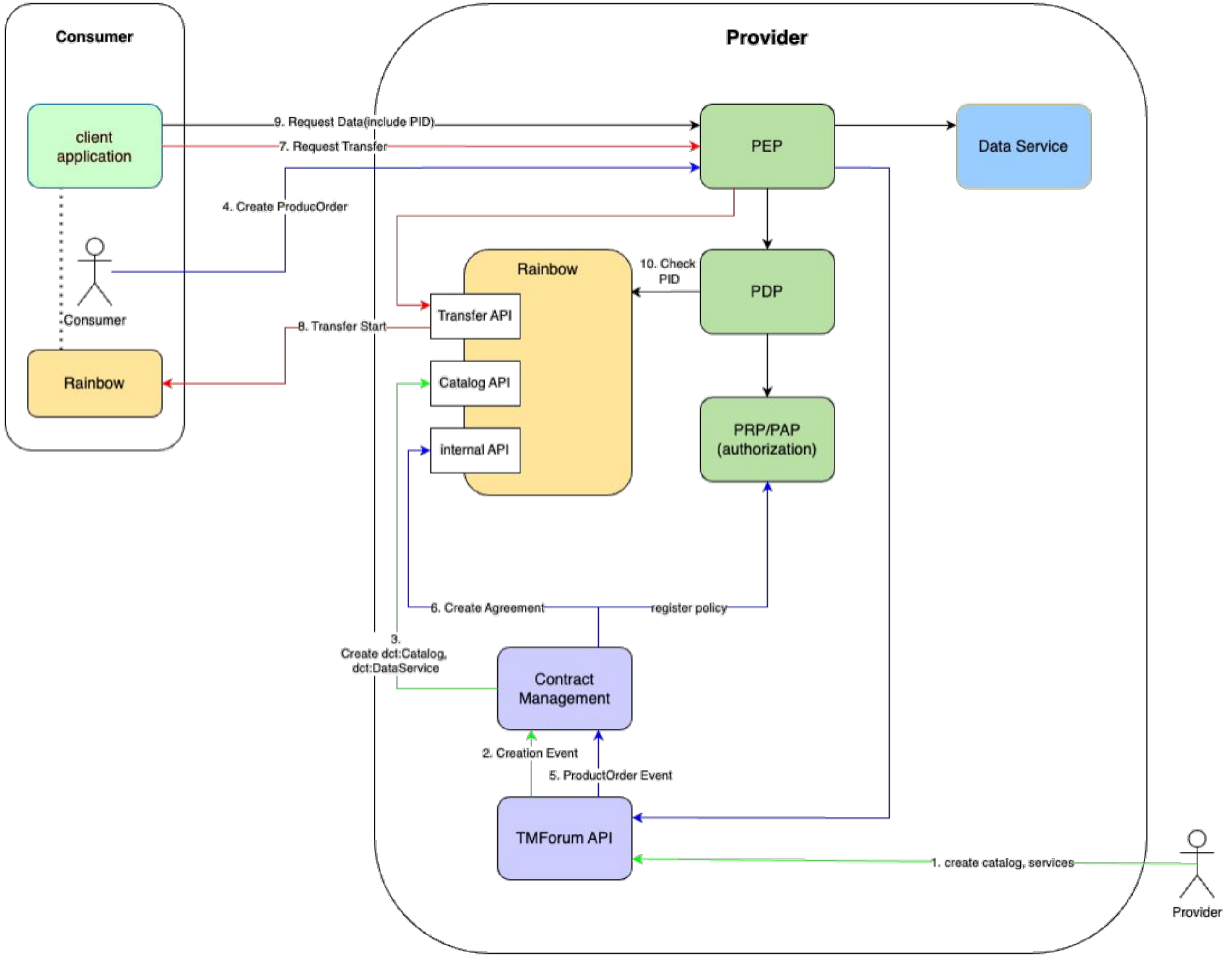
SEAMWARE

Integration of the Transfer Process Protocol

Consumer accesses the data service:

7. Client Application sends Transfer RequestMessage
8. Rainbow checks:
   a. connected Agreement
   b. connected Participants

   and sends back a TransferStartMessage
9. Consumer requests the Data(with the Transfer Process ID in the header)
10. PEP/PDP checks the PID at Rainbow
11. Request is forwarded to the Data Service



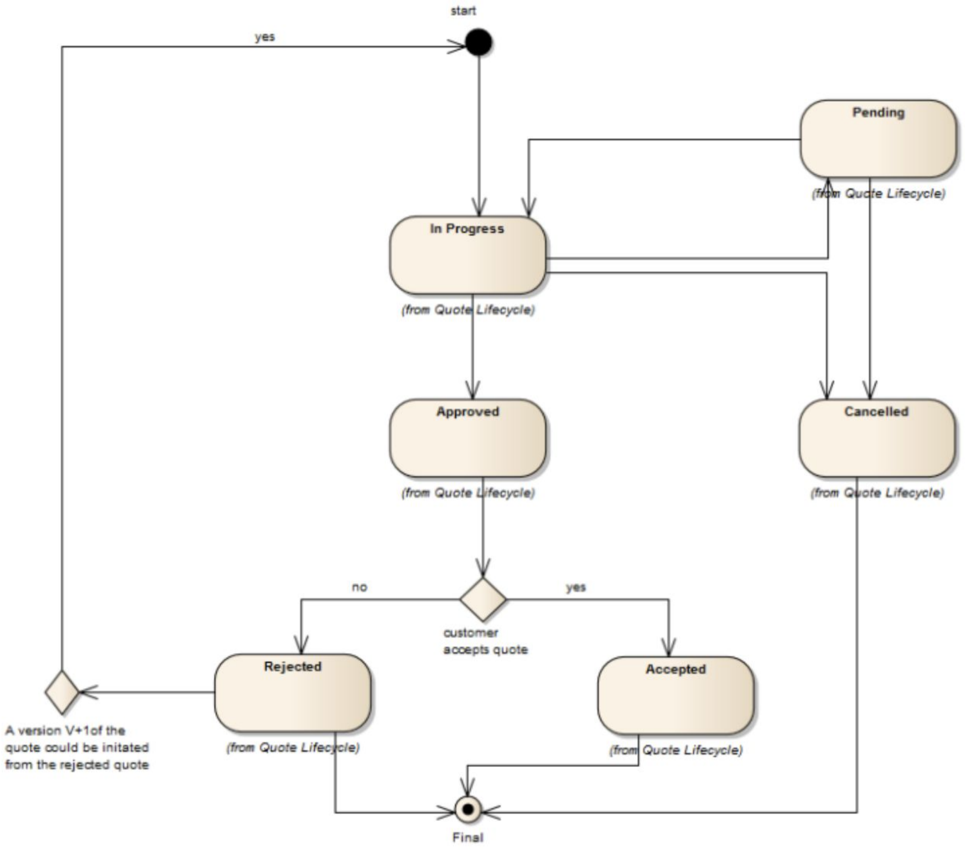
SEAMWARE

Integration of the Transfer Process Protocol

Demo: FIWARE Data Space Connector

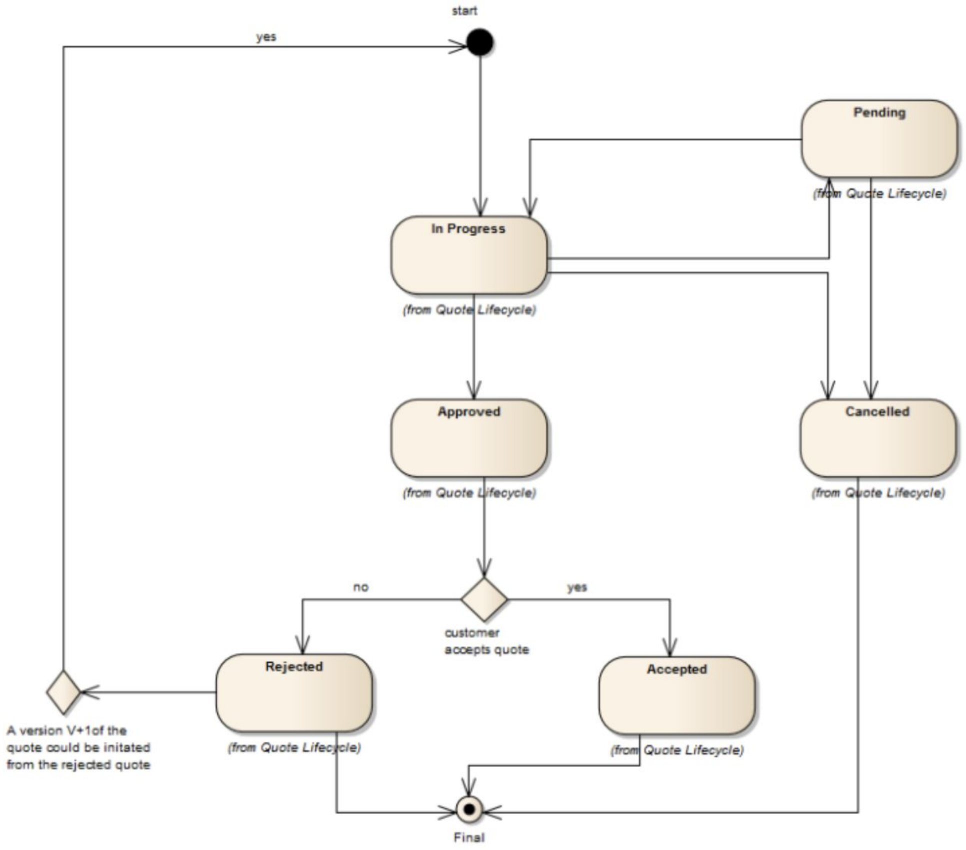
Integration of the Contract Negotiation Protocol

- TMForum Quote API provides stnadardized mechanism for customers to place a Quote and negotiate it with the Provider
- a Quote comprises a number of QuoteItems, bringing a description of requested action(add, modify, remove…) on a given ProductOffering
- based on the Provider response, the Customer can agree or issue new Quotes
- the agreed Quote will be passed as input to the ProductOrder issued by the Customer as result of a successful negotiation



Integration of the Contract Negotiation Protocol

- TMForum Quote API provides stnadardized mechanism for customers to place a Quote and negotiate it with the Provider
- a Quote comprises a number of QuoteItems, bringing a description of requested action(add, modify, remove…) on a given ProductOffering
- based on the Provider response, the Customer can agree or issue new Quotes
- the agreed Quote will be passed as input to the ProductOrder issued by the Customer as result of a successful negotiation



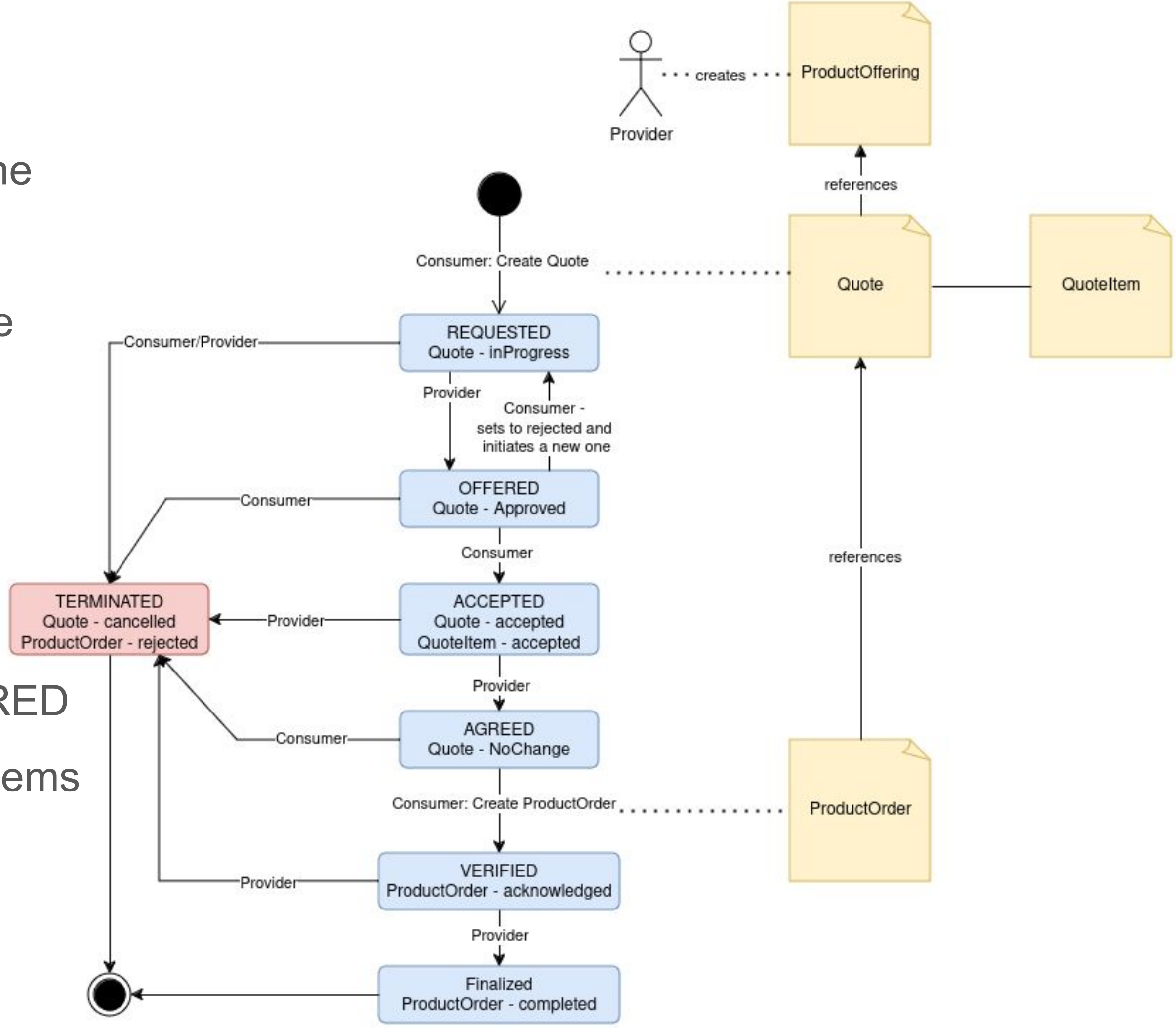
Integration of the Contract Negotiation Protocol

- allows to express the specific parts of an ProductOffering that the customer wants to change
- IDSA's ODRL-Offerings would require full processing to be understood by the provider

```
{
        “description”: “Request for Test Offering”,
        “relatedParty”: [{
                “id”: "Requesting Consumer",
                “role”: “Consumer"
        }],
        “version”: “1”,
        “state”: "inProgress”,
        “quoteItem”: [{
                “id”: "item-id",
                “productOffering”: {
                        “id”: "urn:ngsi-ld:product-offering:id"
                },
                “action”: "modify",
                “state”: "inProgress”,
                “note”: {
                        “id”: "First note",
                        “text”: "We would prefer weekly payment and discount"
                },
                “priceAlteration”: {
                        “name”: "Alternative price",
                        “priceType”: "recurring",
                        “recurringChargePeriod”: "weekly",
                        “price”:  {
                                “unit”: "EUR",
                                “value”: 2.0
                }
                }
        }]
}
```

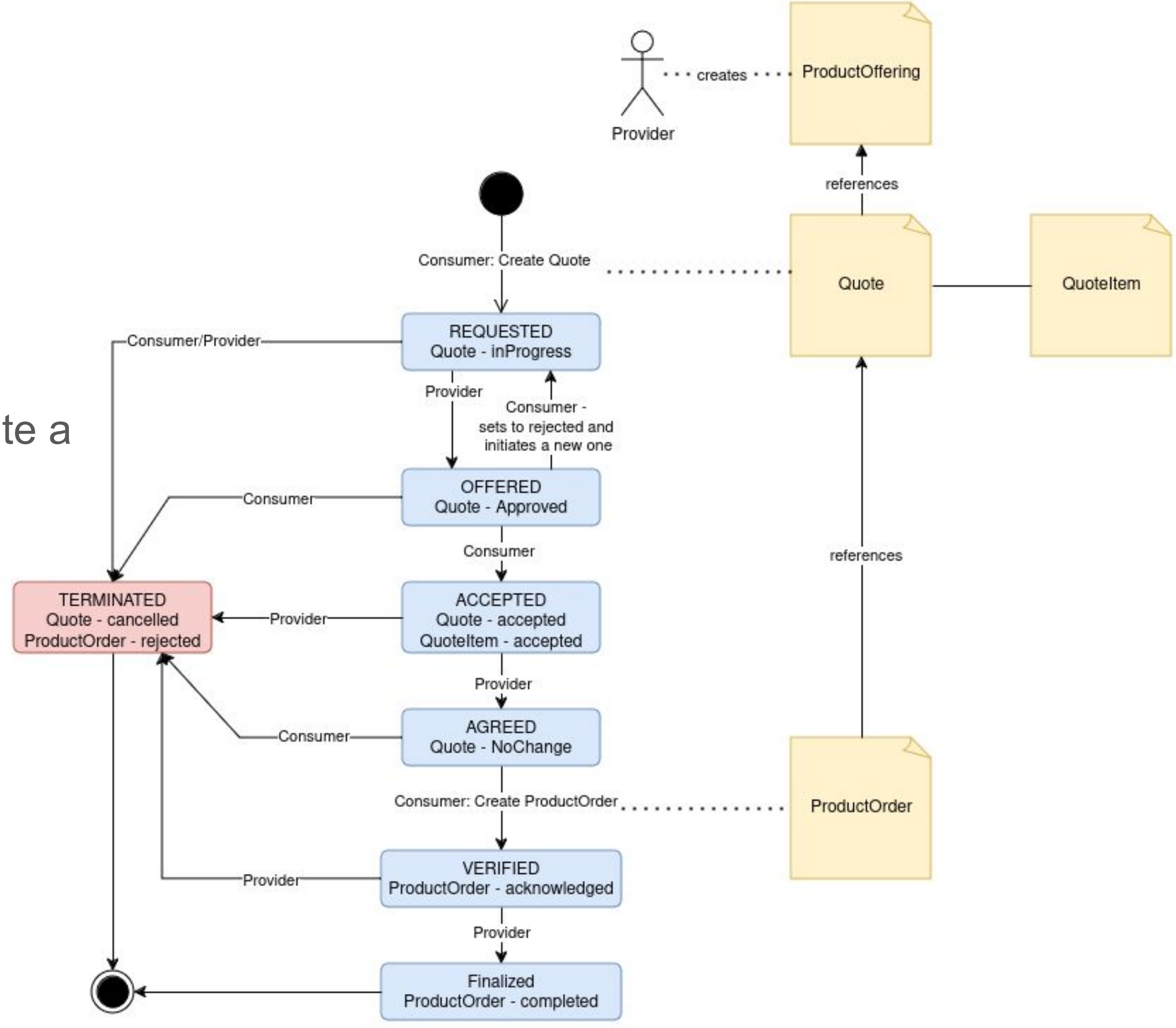
Integration of the Contract Negotiation Protocol

- Start the negotiation process:
  - Consumer has to select a ProductOffering from the provider's catalog
  - issues a Quote referencing the offer, providing the change request in form of QuoteItems
  - Quote is created in state “InProgress” -> State REQUESTED
- in state REQUESTED, the Provider can:
  - change Quote-State to Approved -> State OFFERED
  - change to Approved, but incorporate new QuoteItems and reject/approve the existing once -> State OFFERED



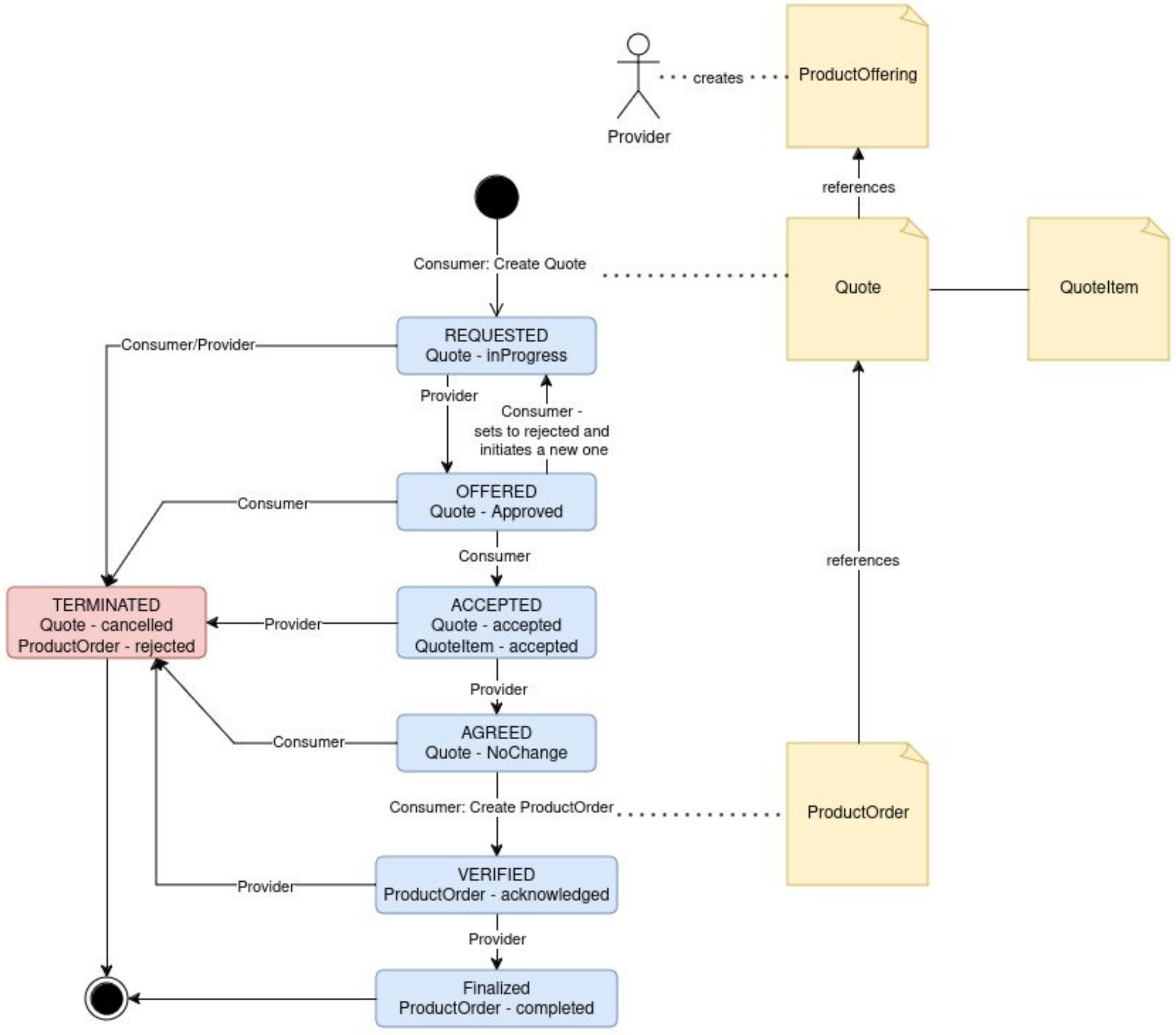
Integration of the Contract Negotiation Protocol

- in state OFFERED, the Consumer can:
  - change Quote-State to Accepted -> State ACCEPTED
  - change Quote-State to Rejected and send a create a new Quote -> State REQUESTED
- in state ACCEPTED, the Provider can:
  - respond OK to the Consumers Quote-Change Request -> State AGREED
  - set Quote to cancelled -> State TERMINATED



Integration of the Contract Negotiation Protocol

- in state AGREED, the Consumer can:
  - create a ProductOrder, referencing the agreed on Quote -> State VERIFIED
  - set Quote to cancelled -> State TERMINATED
- in state VERIFIED, the Provider can:
  - respond OK to the Consumers ProductOrder-Creation Request -> State FINALIZED
- TERMINATED: The negotiation process can be terminated by both sides at any time by setting the Quote to “cancelled” or rejecting the Product Order



Integration of the Contract Negotiation Protocol

Interaction flow: Data Space Connector - Contract Negotiation

Integration of the Contract Negotiation Protocol

- Slides:
  - https://github.com/wistefan/presentations
- FIWARE Data Space Connector:
  - https://github.com/FIWARE/data-space-connector

FIWARE
Global
Summit

HOSTED BY

Rabat Smart City

Shaping Sustainable, Innovative and Secure Smart Cities

22-23 May, 2025

Rabat Smart City, Morocco

#FIWARESummit25

FIWARE

UM6P