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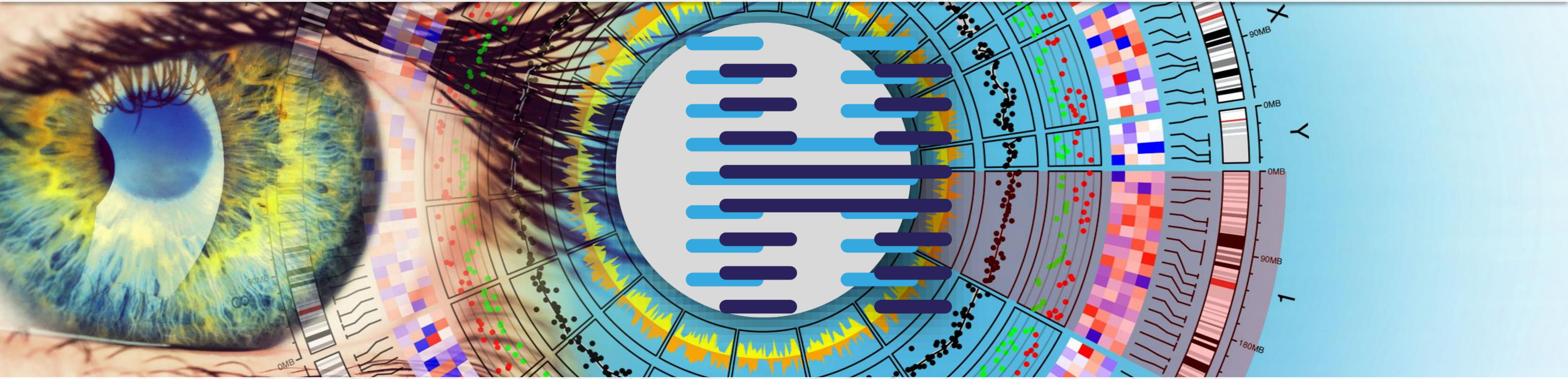
Tutorial: Creating Process Plugins for the Data Sharing Framework



H. Hund, R. Wettstein

GMDS / TMF 2022 | 21.08.2022

Welcome

Prerequisites for the tutorial

Data Sharing Framework (DSF) and Process Plugins

5 and ½ exercises

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@wetret @wettsteinreto

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Prerequisites for the Tutorial

GitHub account

git

Java 11

Maven 3.8

Docker / docker-compose

Java IDE (e.g. IntelliJ, Eclipse)

BPMN Editor (Camunda Modeler)

≥ 16 GB RAM

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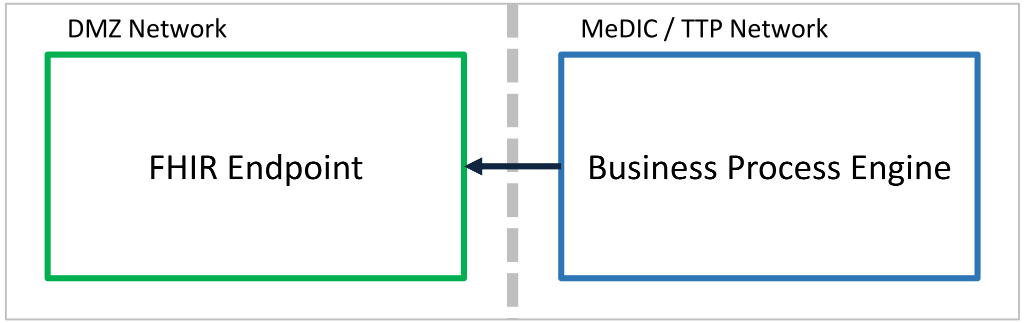
Architecture and Components

Architecture: Distributed, individual Nodes



Data Model: FHIR R4

Process Model: BPMN 2.0

Applications: FHIR Endpoint, Business Process Engine

Synchronization: Websocket between Internal and DMZ Network

Authentication: X.509 Client- and Server-Certificates, allow list

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License / Distribution / Installations

Source Code / Releases: https://github.com/highmed/highmed-dsf

License: Open Source, Apache License Version 2.0

Current Release: 0.7.0

Deployment: Docker Images published via GitHub

Installations: 34 University Hospitals an other organizations in Germany

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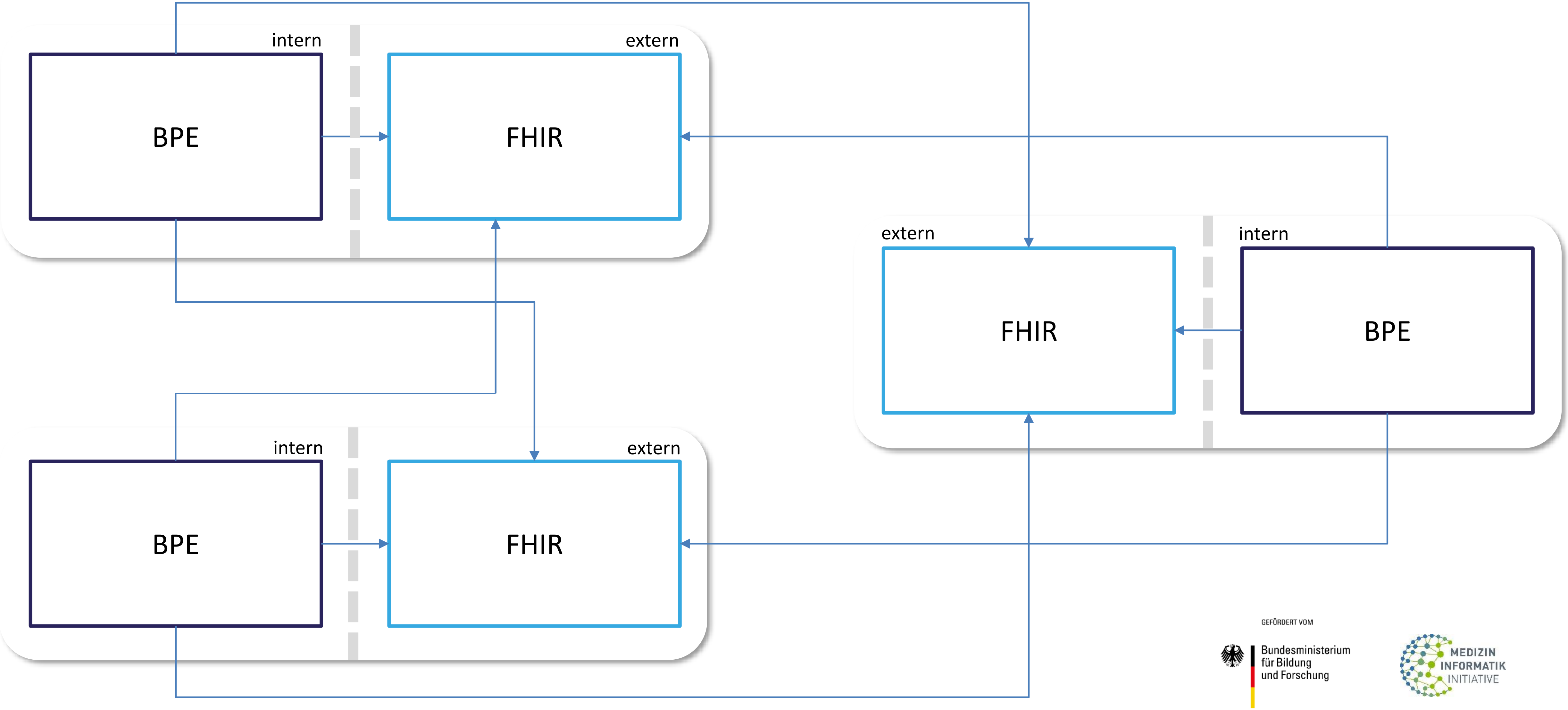
"Shared Nothing" Architecture



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Typical Deployment

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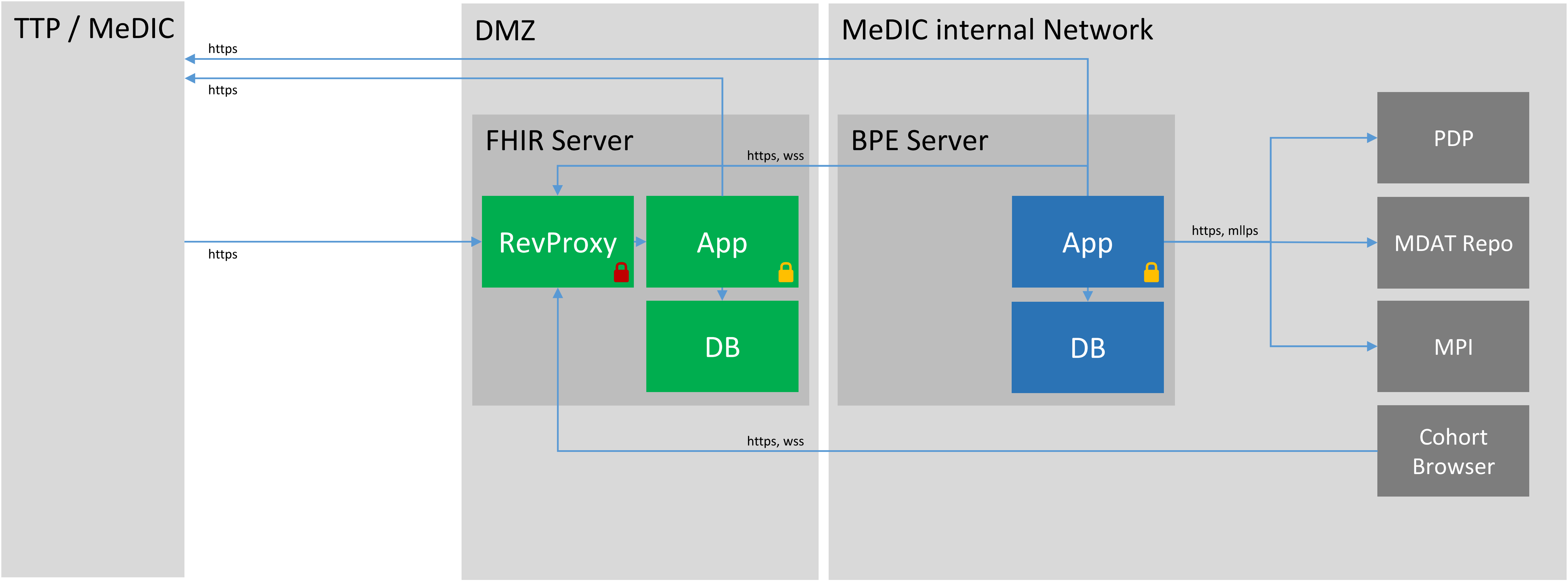

🔒 1. Certificate (DFN-Profile: Web Server) 🔒 2. Certificate (DFN-Profile: 802.1X Client)

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Authentication / Allow List

Authentication

- Machine to Machine / Mutual TLS
- Organizations not Users
- X.509 Client and Server Certificates, DFN PKI / GÉANT CTS / D-Trust

Allow List / “Service Provider Index”

- Organization
  - Client Certificate Thumbprint
- Endpoint
  - URL
- OrganizationAffiliation
  - Role of the organization in a consortium or project

https://ttp-fhir-test.gecko.hs-heilbronn.de/fhir/Bundle?_page=1&_count=20

FHIR R4 and BPMN 2.0

FHIR R4 resources

ActivityDefinition, Binary, Bundle, CodeSystem, DocumentReference, Endpoint, Group, Library, Measure, MeasureReport, NamingSystem, Organization, Practitioner, PractitionerRole, ResearchStudy, StructureDefinition, Subscription, Task and ValueSet

ActivityDefinition

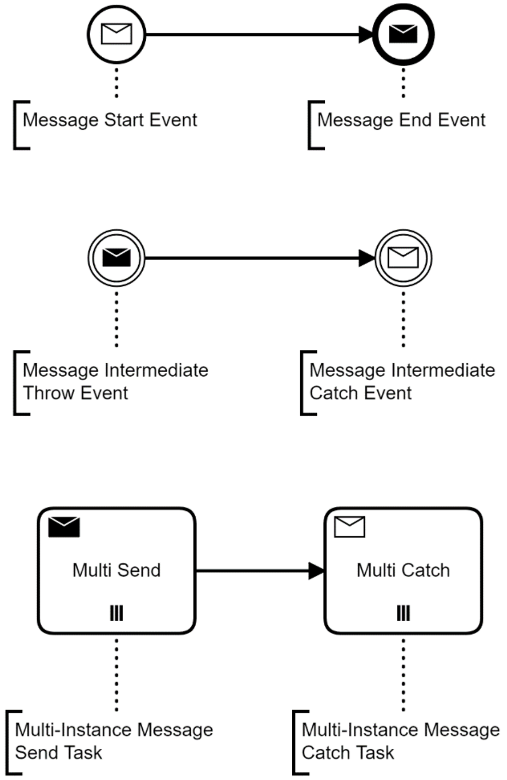
Process description with authorization

Task

Process synchronization

Status: requested, in-progress, completed, failed

BPMN 2.0 messaging


Message Start Event
Message End Event
Message Intermediate Throw Event
Message Intermediate Catch Event
Multi Send
Multi Catch
Multi-Instance Message Send Task
Multi-Instance Message Catch Task

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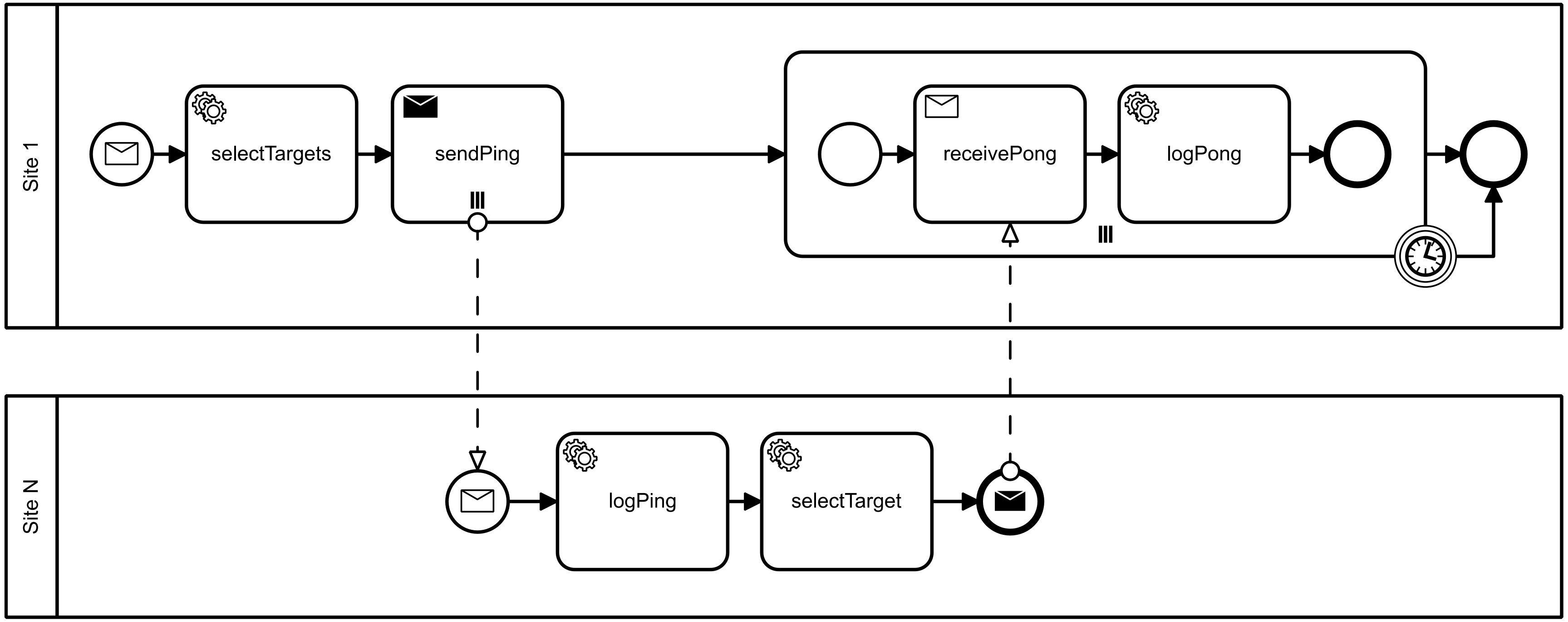
Example: Ping/Pong Process



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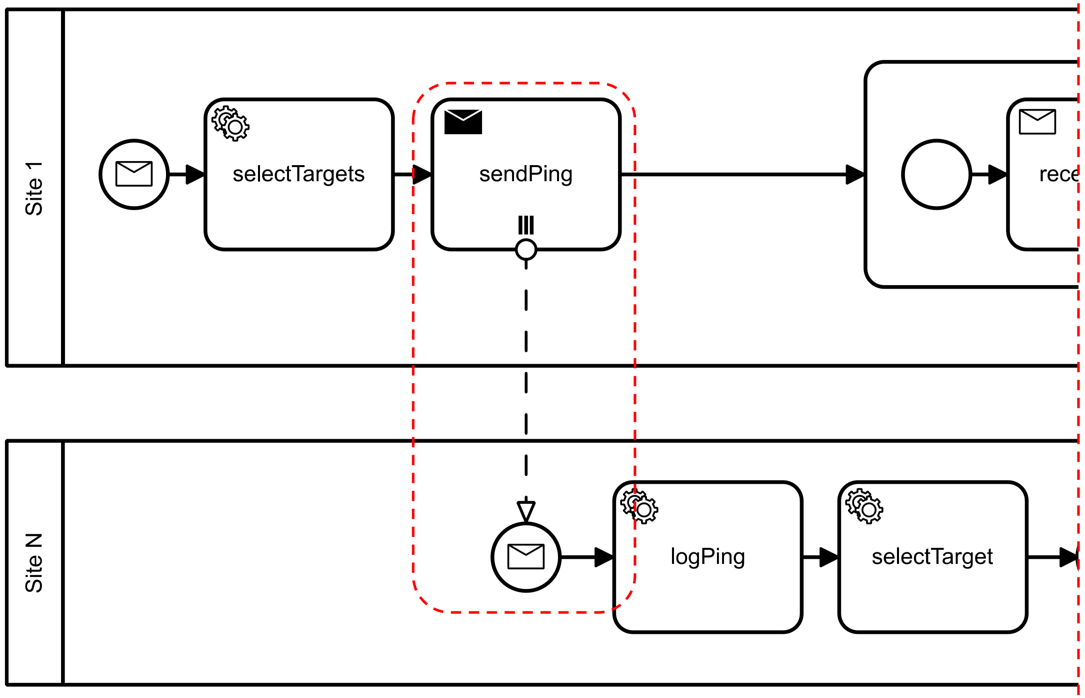
Example: Ping/Pong Process



```
<Task xmlns="http://hl7.org/fhir">
  <meta>
    <profile value="http://highmed.org/fhir/StructureDefinition/task-ping"/>
  </meta>
  <instantiatesUri value="http://highmed.org/bpe/Process/pong/0.6.0"/>
  <status value="requested"/>
  <intent value="order"/>
  <authoredOn value="2022-08-20T16:35:27+02:00"/>
  <requester><type value="Organization"/><identifier>
    <system value="http://highmed.org/sid/organization-identifier"/>
    <value value="TTP"/>
  </identifier></requester>
  <restriction><recipient><type value="Organization"/><identifier>
    <system value="http://highmed.org/sid/organization-identifier"/>
    <value value="MeDIC 1"/>
  </identifier></recipient></restriction>
  <input><type><coding><system value="http://highmed.org/fhir/CodeSystem/bpmn-message"/>
    <code value="message-name"/></coding></type>
    <valueString value="ping"/>
  </input>
  <input><type><coding><system value="http://highmed.org/fhir/CodeSystem/bpmn-message"/>
    <code value="business-key"/></coding></type>
    <valueString value="0593468f-0994-46e1-aeba-46463bdd7d3d"/>
  </input>
  <input><type><coding><system value="http://highmed.org/fhir/CodeSystem/bpmn-message"/>
    <code value="correlation-key"/></coding></type>
    <valueString value="13396519-1448-4ec0-8268-27b395d64ce7"/>
  </input>
  <input><type><coding><system value="http://highmed.org/fhir/CodeSystem/ping"/>
    <code value="endpoint-identifier"/></coding></type>
    <valueReference><type value="Endpoint"/><identifier>
      <system value="http://highmed.org/sid/endpoint-identifier"/>
      <value value="endpoint.target.org"/>
    </identifier></valueReference>
  </input>
</Task>
```

Process Plugin
Components

Components

- BPMN process models (aka .bpmn files)
  - One process per bpmn file, no collaboration diagrams allowed
- FHIR resources
  - ActivityDefinition, CodeSystem, NamingSystem, StructureDefinition, ValueSet
  - Minimum: 1 ActivityDefinition, 1 StructureDefinition
- Java Source Code
  - ProcessPluginDefinition – Specification for the DSF BPE
  - Service Task and Message Send implementations

Packaging / Rollout

- Single Jar file, copy to: `/opt/bpe/process/plugin-name.jar`
- Archive of multiple Jar files, extract into: `/opt/bpe/process/plugin-name`

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Process Plugin
Class Loading and Process Deployment

Separate Java Class-Loader

- No naming conflicts between process plugins
- Multiple versions of the same process plugin can be deployed at the same time

Separate Spring Context

- Services (Spring Beans) can not be accessed between process plugins

Process Deployment

- Hook to execute code in process plugins during BPE Startup: e.g. connection tests
- Synchronization of FHIR resources during BPE Startup with DSF FHIR server

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Process Plugin
SNAPSHOT vs. Release

SNAPSHOT

- FHIR resources with status “draft”, updated in DSF FHIR server on every BPE startup
- BPMN processes replaced on every BPE startup

Regular Release

- FHIR resources with status “active”, created on DSF FHIR server if they do not exists
- BPMN processes loaded if they do not exists

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Process Plugin

Excluded and Retired Processes

Env-Variable ORG_HIGHMED_DSF_BPE_PROCESS_EXCLUDED

- Processes listed will not be deployed
- Processes listed will be removed if necessary

Env-Variable ORG_HIGHMED_DSF_BPE_PROCESS_RETIRED

- Unseen processes listed will not be deployed
- Existing processes will be retired and can not be instantiated

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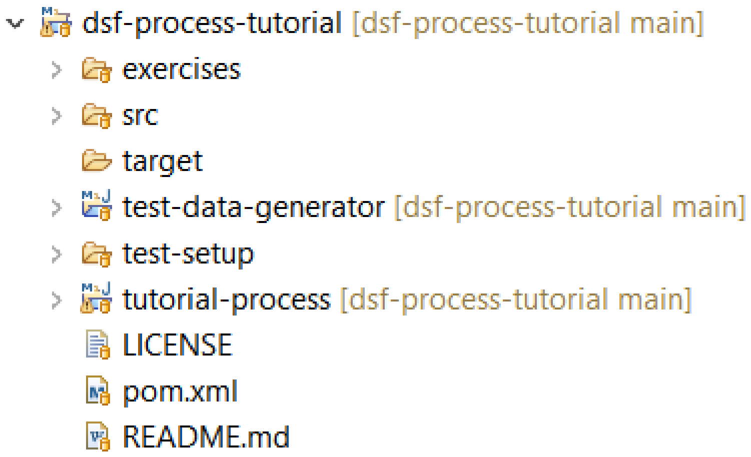
Tutorial
Development Environment

Maven parent project

- test-data-generator
  - Certificate / FHIR resources generator for test-setup
- test-setup
  - docker-compose environment with 3 DSF instances
- tutorial-process
  - Process plugin resources



```
dsf-process-tutorial [dsf-process-tutorial main]
  exercises
  src
  target
  test-data-generator [dsf-process-tutorial main]
  test-setup
  tutorial-process [dsf-process-tutorial main]
  LICENSE
  pom.xml
  README.md
```

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Tutorial
Maven Setup for DSF Dependencies

Username/Password for GitHub Packages

.m2/settings.xml

```
<settings xmlns="http://maven.apache.org/SETTINGS/1.0.0"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xsi:schemaLocation="http://maven.apache.org/SETTINGS/1.0.0
                        http://maven.apache.org/xsd/settings-1.0.0.xsd">

  <!-- ... -->

  <servers>
    <server>
      <id>github</id>
      <username>USERNAME</username>
      <password>TOKEN</password>
    </server>
  </servers>
</settings>
```

Your GitHub username

Your token (scope: read:packages)

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Tutorial
Content and procedure

https://github.com/highmed/dsf-process-tutorial

1. Fork
2. Checkout your fork
3. Branch `main` -> `solution`

5 and ½ exercises with solutions in branch: `origin/solutions/exercise-X`

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Further Reading

Multi-instance messaging

HiGHmed Ping/Ping Process

https://github.com/highmed/highmed-processes

Encrypted data transfer with Binary resources

Offline FHIR validation

NUM-CODEX Data Transfer Process

https://github.com/num-codex/codex-processes-ap1

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End

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Thank you for participating !

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Leave a ☆ on GitHub

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