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# Agenda:

- Introduction to Ontoserver
  - What is Ontoserver?
  - Interoperability
  - Syndication

Access to Central Instance @ Cologne

- Deployment at Cologne
- Accessing the server
- Authentication mechanism
- Troubleshooting technique
- Demo

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# Introduction to Ontoserver

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# What is Ontoserver

- Turnkey, high performance HL7 FHIR Terminology Service
- Access to all FHIR CodeSystems, SNOMED CT, and LOINC
- Support all those operations on
  - FHIR Resources
  - LOINC
  - SNOMED CT {with support of ECL (Expression Constraint Language)}

- Ontoserver API examples:
- https://documenter.getpostman.com/view/634774/TVsuBmc9
- Implementation examples: https://aehrc.github.io/fhir-ts-exemplars/

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# Deployment at Uniklinik Köln

## Local Deployment

- Deploys as a pair of Docker containers
  - Ontoserver and Database (& http caching proxy)
  - *docker-compose* file to configure
  - Deployed at Uniklinik Koeln data center

## • Central Deployment

- Deploys as a pair of Docker containers
  - Ontoserver and Database (& http caching proxy)
  - Read-Only access
  - *docker-compose* file to configure
  - Deployed at Uniklinik Koeln data center

PostgreSQL

# Interoperability! A Solution

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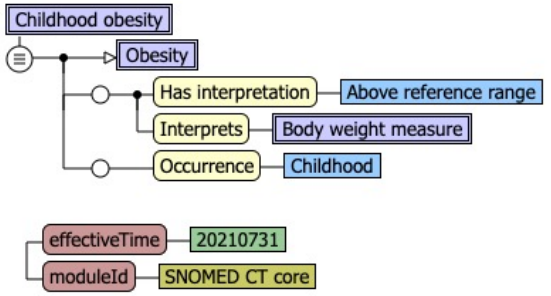
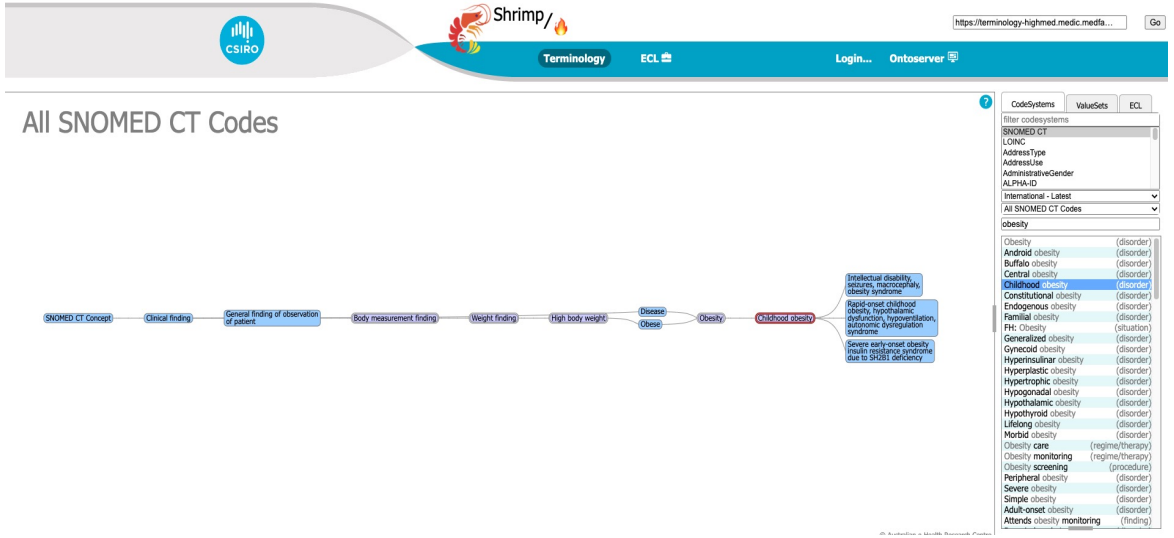
Terminology Use: Problem

- Each clinical providers use their own interpretation of a patient condition
- Multiple type of documentation
- Several terms used to describe Patient condition
- Cause confusion at the end!




Bigger Picture: how to make this communication interoperable?

- By using Standard Code and Code Systems
- Independent of language
- Consistent across systems

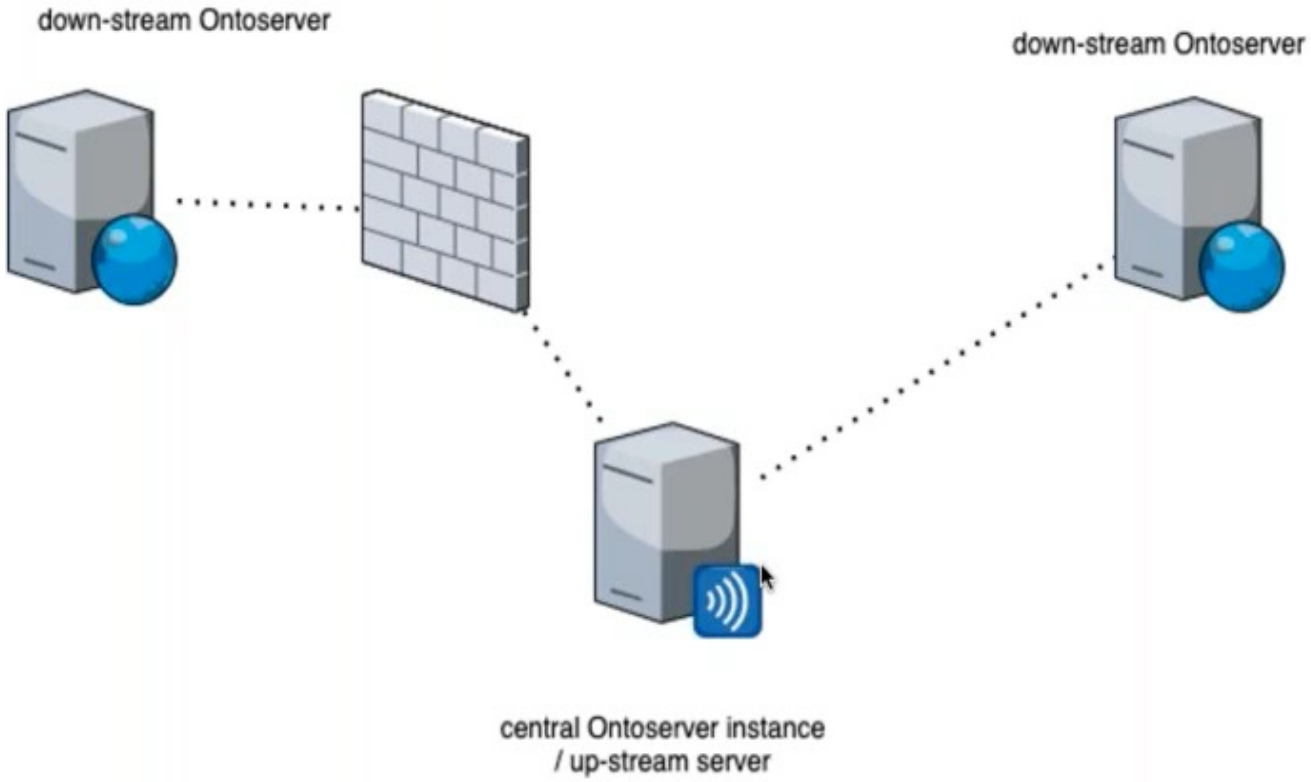


# Syndication

- Definition:
- Syndication refers to the process of distributing and updating content from a central source to multiple endpoints.
- Ontoserver can advertise that it allows other servers to fetch Codesystems from it

- These are then made available for the down-stream servers

- Do note that you trigger syndication manually



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# Key Features of Ontoserver Syndication

**Syndication API**:
Ontoserver's Syndication API allows it to connect to upstream syndication feeds and import terminology content. This API supports various FHIR resources and binary indexes, making it easy to deploy and access the latest terminologies.

**Importing and Updating Terminologies**:
With Ontoserver, you can import content from syndication sources using its built-in syndication client. This process can be configured to occur at startup, manually, automatically when new content is available, or on a schedule.

**Configuring Syndication Feeds**:
Administrators can configure Ontoserver with multiple upstream syndication feeds. These feeds can be set up to require authentication, ensuring secure and controlled access to terminology updates.

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# Why syndicate? Benefits?

**Ensuring Consistency and Accuracy**:
By using syndication, Ontoserver ensures that all connected systems have consistent and accurate terminology data, reducing the risk of errors and discrepancies.

**Reducing Administrative Overhead**:
Syndication automates the process of updating terminologies, significantly reducing the administrative burden on healthcare providers and IT staff.

**Enhancing Interoperability:**
With up-to-date terminologies, Ontoserver enhances interoperability between different healthcare systems, facilitating seamless data exchange and improving patient care

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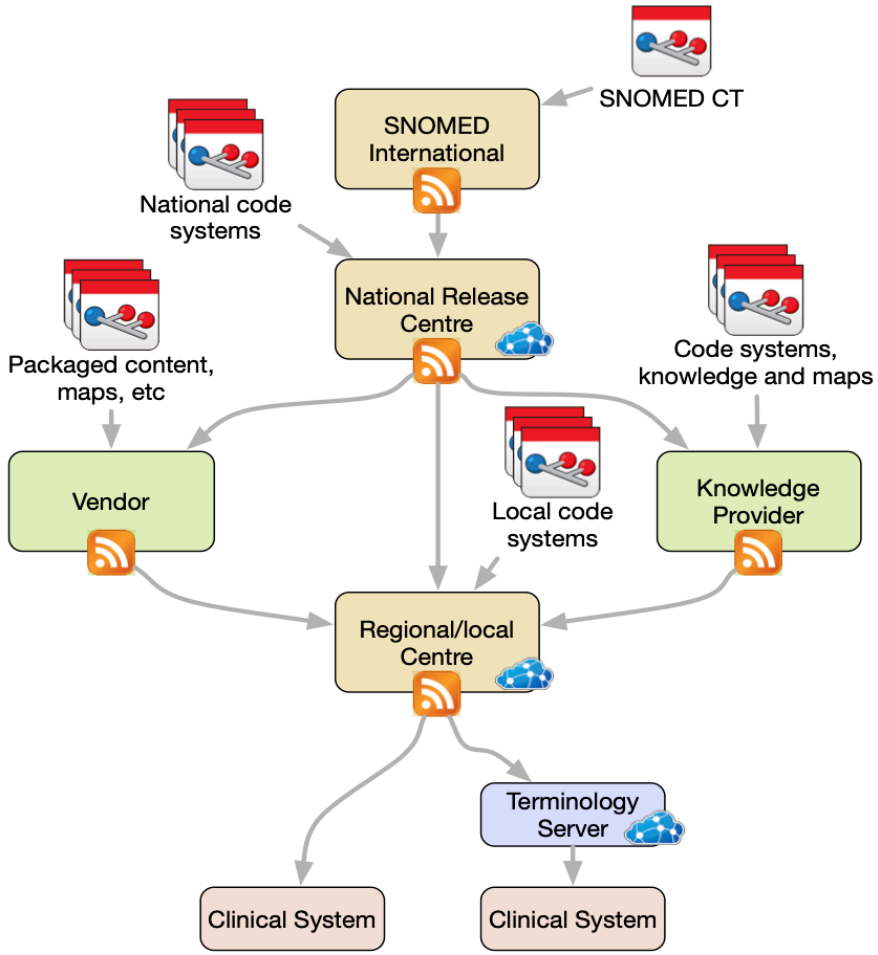
# Important Configuration!

- Initial setup of up-stream (source):
- Feed location

  atom.syndication.feedLocation=file://syndication.xml
- Enable security
  - Ontoserver.security.enabled
  - Ontoserver.security.readOnly.fhir=true
  - Ontoserver.security.readOnly.api=true
  - Ontoserver.security.readOnly.synd=true
- Config memory
  - JAVA_OPTS=-Xmx16G
- Syndication base URLs
  - Ontoserver.sysd.base={{source_url}}/synd
  - Ontoserver.fhir.base={{source_url}}/fhir



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# Syndication workflow

- Disable Security of source
- **Upload** a new CodeSystem to source
  - FHIR CodeSystem:
  - PUT {{source_url}}/fhir/CodeSystem/{{CodeSystemId}}

- SNOMED/LOINC:
  - POST {{source_url}}/fhir/CodeSystem/$x-uploadexternal?system={{System}}&version={{Version}}

- also set SyndicationStatus:
  - POST {{source_url}}/synd/setIndexSyndicationStatus?codeSystemId={{System}}&syndicate=true&codeSystemVersion={{Version}}
- Enable Security on source

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# Syndication workflow

- Import from source:
  - FHIR CodeSystem:
  - GET {{client_url}}/synd/fetchSyndicatedContentEntry?resourceType=CodeSystem&url={{CodeSystemUrl}}&version={{Version}}

  - SNOMED/LOINC:
    - POST {{client_url}}/api/indexCodeSystem?codeSystemId={{CodeSystemId}}&validate=false&codeSystemVersion={{Version}}

  - OntoCommand:
  - Dashboard (GUI) available at
    - https://ontoserver.csiro.au/ui

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# Encountered issues

CodeSystem with broken IndexStatus

- Solution: re-index CodeSystem

Timeout during syndication

- Potential cause: many CodeSystems/ValueSets on the server
- Solution: configure higher timeouts in clients

Unable to syndicate with Ontoserver behind Proxy

- Potential cause: base URL(s) are set explicitly and incorrectly
- Solution: remove those settings, let Ontoserver auto-detect

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# Access to Central Instance of Terminology Server

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# Deployment at Uniklinik Köln

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# Authentication mechanism

1

Mutual TLS – GÉANT PKI

GÉANT User certificate

GÉANT 802.1X Client certificate
- clientAuth, serverAuth

2

IP Allowed-list

Dedicated / Static IP Address

Admission form signed by PI or Site representative

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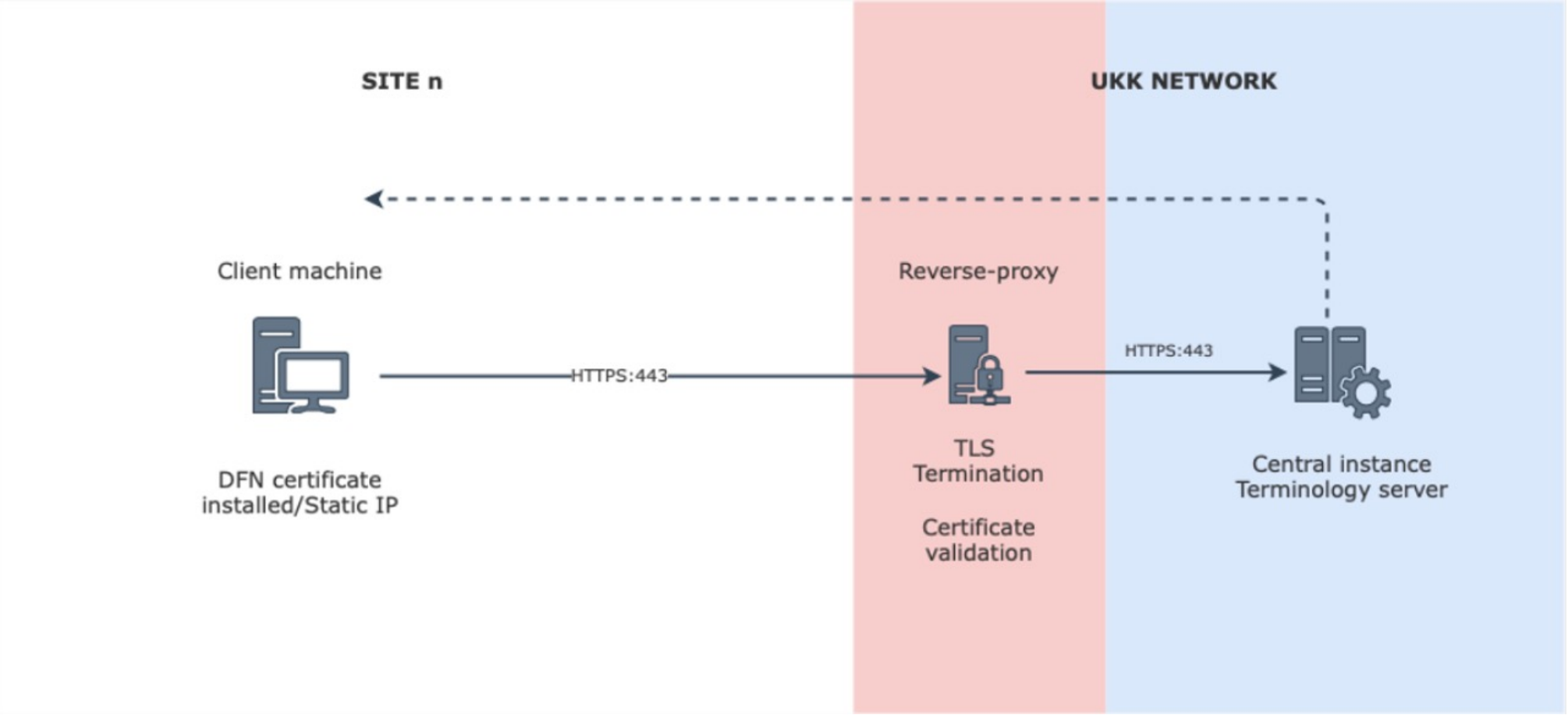
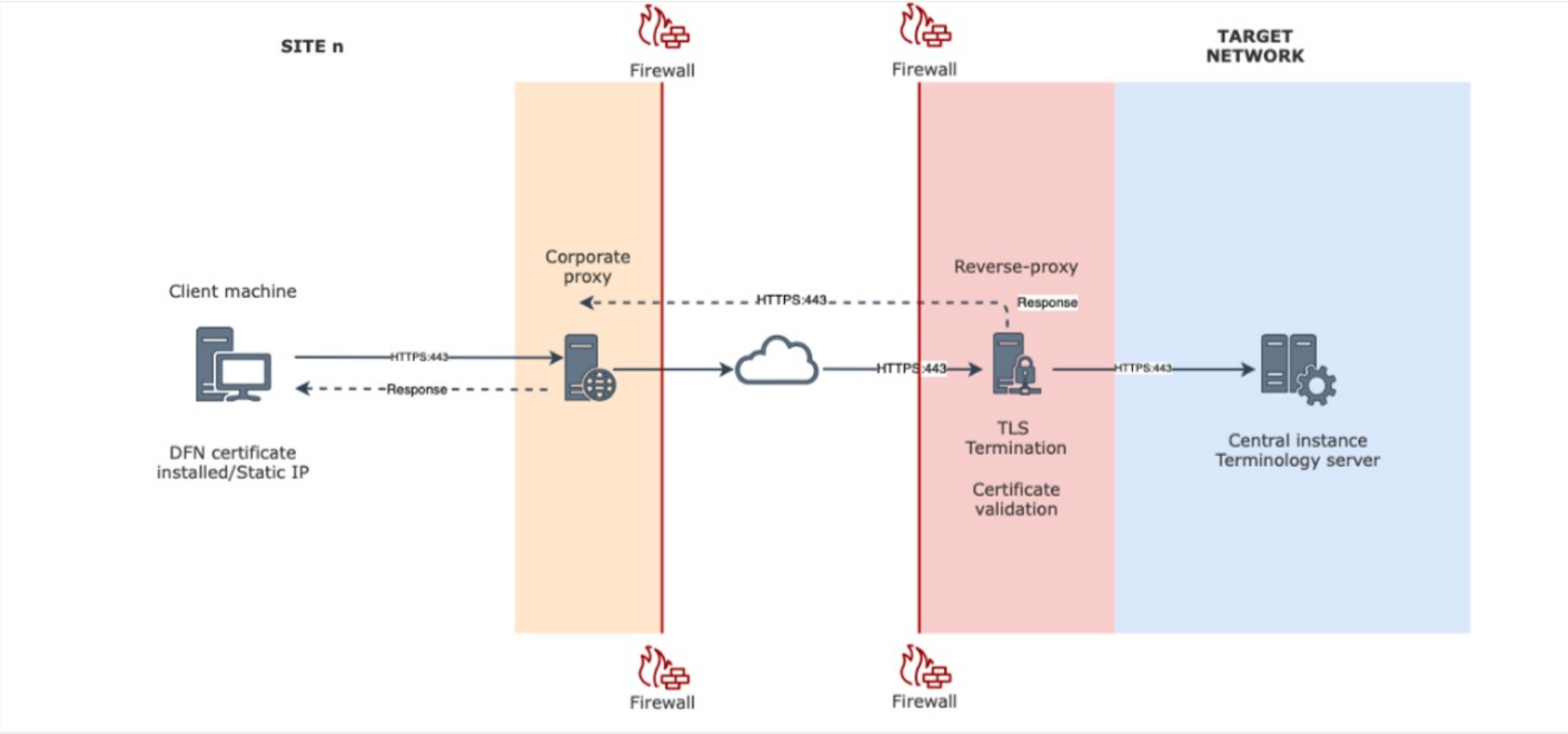
# Network architecture

Scenario 1: Direct communication without corporate proxy



# Network Architecture!

Scenario 2: Communication through corporate proxy



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# Accessing the CTS

Access as User

- Obtain appropriate GÉANT certificate from your institution

- Convert the certificate to a PKCS (.pfx or p12) format

```
openssl pkcs12 -export -out certificate.p12 -in certificate.pem -inkey privateKey.pem
```

- Upload certificate to browser or client

- https://terminology-highmed.medic.medfak.uni-koeln.de/fhir/metadata

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# Accessing the CTS

**Acess as CLIENT**

1. Obtain appropriate GÉANT certificate from your institution
2. Load client certificates using a reverse-proxy like Apache or Nginx
3. Enable SSL verify (for mutual TLS)
4. Configure proxy pass

https://terminology-highmed.medic.medfak.uni-koeln.de:443

```
location /koeln/ {
    proxy_pass https://terminology-highmed.medic.medfak.uni-koeln.de:443/;
    proxy_ssl_certificate /etc/pki/ontoserver/certs/cert-with-chain.pem;
    proxy_ssl_certificate_key /etc/pki/ontoserver/certs/private.pem;
    proxy_ssl_protocols TLSv1.2 TLSv1.3;
    proxy_ssl_ciphers HIGH:!aNULL:!MD5;
    proxy_ssl_trusted_certificate /etc/pki/ontoserver/chain/chain.pem;
    proxy_ssl_verify on;
    proxy_ssl_verify_depth 5;
```

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# Troubleshooting techniques

- Use the right certificate
- For browsers use .pfx or .p12
  - Try *icognito* mode
- Preferred configuration for client machine – Use a proxy like Nginx to load complete certificates chain (.pem, .crt format)

- Contact support team: support-medic@uni-koeln.de

# Working with FHIR Terminology Service – Developer’s Perspective

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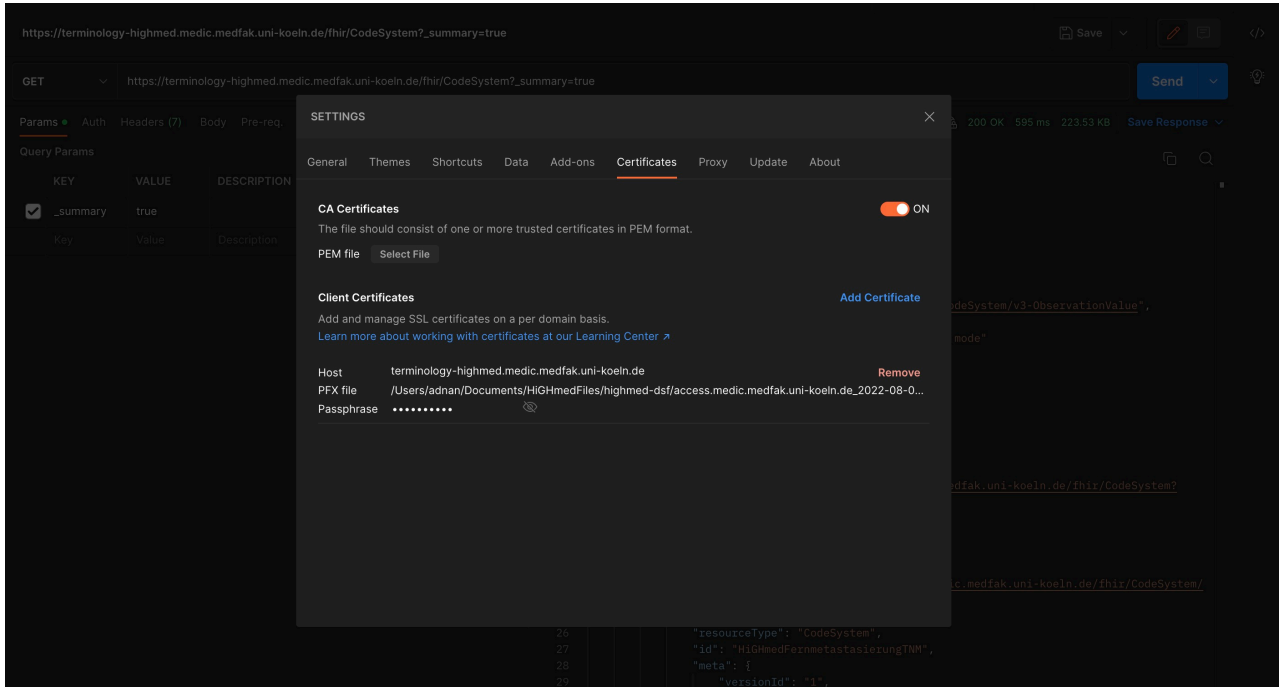
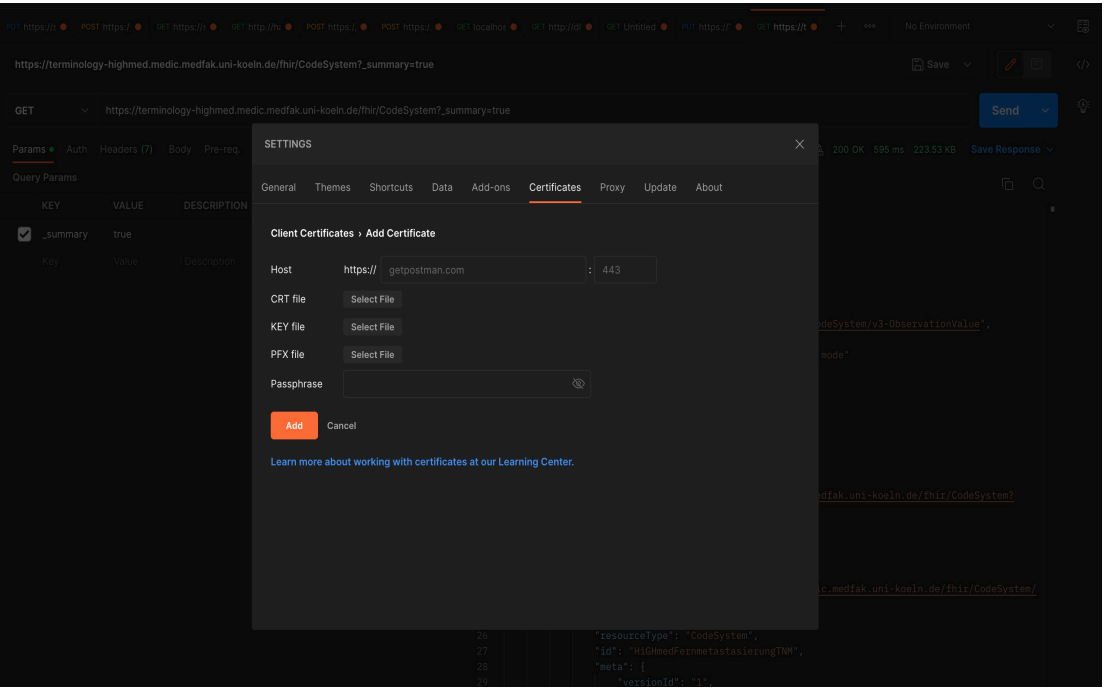
- Our partners from Lübeck are actively contributing to the development of Ontoserver
- Some tools for accessing FHIR API’s , implementation via Python and Java

  https://github.com/itcr-uni-luebeck/fhir-term-samples



- SNOMED CT (Available on Onterserver)
- ORDO (Orpha.net) / ORPHAcodes
- OMIM (OMIM (Online Mendelian Inheritance in Man)
- HGNC-NR
- HPO (Human Phenotype Ontology)
- ICF (International Classification of  Functioning, Disability and Health)
- HGVS
- ICD10GM (Available on Onterserver)
- AlphaID (Available on Onterserver)
- LOINC (Available on Onterserver)

# DEMO