psHEALTH eRM

Technical Architecture

**Reference: PDS Integration**

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Document Control

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Reviewers

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Related Documents

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# Document Scope

This document describes the Technical Architecture of psLink to support eRM that satisfies requirements and implements the functionality and technical, operational and transitional requirements described in the Functional Specification.

The goal of this Technical Architecture is to define the technologies, products, and techniques necessary to develop and support the system, and to ensure that the system components are compatible and comply with the enterprise-wide standards and direction defined by psHEALTH.

This document will also:

* Identify and explain the risks inherent in this Technical Architecture;
* Define baseline sizing, archiving and performance requirements;
* Identify the hardware and software specifications for the Development/QA, UAT and Production environments;
* Define procedures for both data and code migration among the environments.

The Document Scope narrative also provides an overview of the efforts conducted to understand the existing technical environment and IT strategic direction and to determine how the system’s proposed technical architecture fits into them.

# Overall Technical Architecture

## System Architecture Context Diagram

psLink is a system integration system facilitating PDS requests from ART to Spine. It is built on apache Camel and deployed in JBoss fuse CentOS environment. Figure 2.1 is a high level architecture diagram, illustrating how the system’s hardware and software platforms fit into the existing environment.



Figure 2.1

## System Architecture Model

The psLink System Architecture Model represents the various architecture components that comprise the system, and shows their interrelationships.

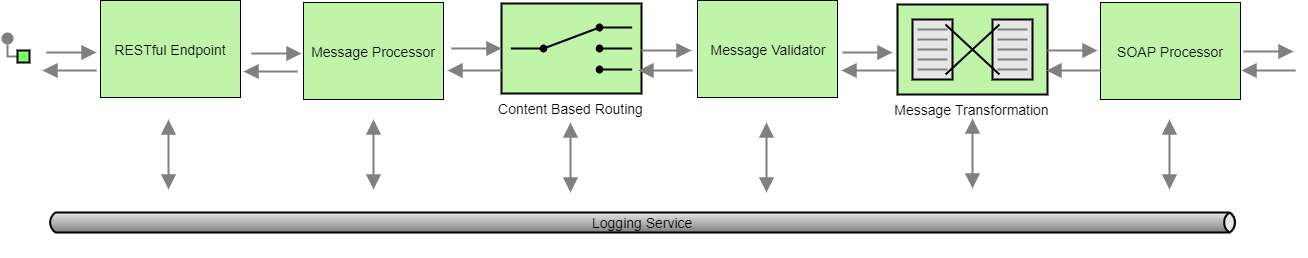


Figure 2.2

### Overall Architectural Considerations

• Security Strategy. Both RESTful and SOAP APIs are secured by two-way TLS authentication.

• Performance requirements. Request from ART returns around 240ms.

• Accessibility. psLink client needs to install certificate signed by psHealth.

• Database sizing. No database in current version but can be added in future release if needed.

• Transaction volumes. Around 300,000 requests annually.

• Concurrent user. Multiple users supported.

• Data import and export. No data import export.

• Data encryption and decryption. Application data encrypted

• Disaster recovery. Single server non-cluster system.

• Since only simple PDS lookup supported in current release, Smart Card features will not be applied. Element author under ControlActEvent will not be included in Simple Trace Query and Retrieval Query.

• Smartcard authentication is not being used in this release. psLink ASID and role id will be hard coded in SOAP message to Spine.

## System Architecture Component Definitions

This section gives a brief description of each component in Figure 2.2. Section 3 provides more detailed information of certain components when necessary.

### RESTful Handler

This is a RESTful Endpoint exposed to ART as access point to Spine PDS service.

### Message Processor

Parameters are added into Camel Exchange header such as current timestamp, message UUID and message interaction id. Timestamp and UUID are embedded into SOAP request message to identify each request. Interaction id is required for internal message routing.

### Message Routing

Apache Camel allows messages to be routed to correct destination based on message exchanges. Interaction id is used as a message identifier in psLink for the following operations like message validation and transformation.

### Message Validator

Incoming XML request message is validated against corresponding schema for early message failure rather than later. For example family name in simple trace query and NHS number in Retrieval Query should not be null.

### Message Transformation

This component constructs XML SOAP request message body that conforms to HL7 standard. Current timestamp and UUID generated in message processor will be added into SOAP message.

### SOAP Processor

This component calls Spine SOAP web service by SAAJ and passes response back to ART.

### Smartcard

Since only simple patient lookup is sent to NHS Spine, user identification info within query control can be ignored in outbound request message which means element ControlActEvent/ author won’t be included. Other elements including ControlActEvent/author1 and ControlActEvent/query still present.

### Certificate management

Spine requires two-way SSL connection to establish a secured web service. The same approach is adopted between ART and psLink. Key store and trust store are built to store these certificates.

* Certificates between psLink and Spine are issued by NHS.
* Self-signed Certificates between ART and psLink are issued by psLink, there is no third party involved during this process.
* Connections will not be established if any of these certificates are not installed properly.

# System Architecture Design

The System Architecture Design section provides detailed descriptions of product implementing architecture components in Figure 2.2 and explains the rationale for product selection.

## RESTful Handler

### Component Functions

RESTful handler defines RESTful web service Endpoints, it serves incoming Simple Trace Query and Retrieval Query POST requests and passes PDS result back to ART.

### Technical Considerations

Incoming RESTful request format is XML. Request and response will be marshalled and unmarshalled to or from java object. Exception message and error details should be returned to ART for logging and auditing purposes.

### Selected Product

Apache CXF

### Selection Rationale

Apache CXF is selected as it is a built in product in JBoss Fuse 6.3. Features can be installed through JBoss fuse console on the fly and easy to maintain and extend. Other REST implementations such as JERSEY is doable as well but may cause conflict and require external libraries and offline maven repository, which makes Apache CXF is a better choice.

### Architecture Risks

The following high level risks have been identified:

* Security – Security risks have been a main consideration with psLINK. All internal traffic is secured via TLS in addition to NHS Digital / IG requirements.
* Awareness – A risks around technical understanding of psLINK has been identified, to mitigate this this document as well as deployment guides & product explainers have been document in the psHEALTH Knowledge Library.
* psLink is a single-node server in current release. If server goes down, a manual task will be generated by ART to proceed workflow, a future look-up message will be issued to psLink once server recovers.

### Logging

Each web service request and response will be recorded to a local file. Log files are generated on a daily basis named pslinkDaily.log. Date will be appended to older files, e.g. pslinkDaily.log.2018-03-23. These files will be archived by a cron job and copied to a remote drive inside N3 and will never be copied outside of N3.

### Monitoring

Web console Hawtio is shipped with JBoss Fuse by default. It provides a lot of useful plug-ins for system administrator such as Apache Camel, Jetty, logs configuration, OSGi terminal, thread pool status etc.

### Stress Testing

A Stress testing has been performed by JMeter, a report is attached as appendix A.

### Error Handling

psLink handles various exceptions and returns corresponding error message to ART when necessary.

* Timeout exception will be thrown by psLink to ART after 2 redelivery failed to Spine.
* Message validation failed exception will be sent to ART if message validation fails against corresponding schema.

### Product roadmap

* A cluster will be set up should high availability and high volume needed.
* Apache camel can be easily extended to connect to other components like JMS database if needed.
* Smart card will be adopted if ART needs to send advanced operation to Spine such as PDS General Update Request.

## Message Transformation

### Component Functions

This component retrieves query parameters from incoming XML request and produces SOAP request message complies with HL7 standard.

### Technical Considerations

Both RESTful and SOAP web service is synchronous, transformation from XML request to HL7 format should be done in timely fashion. Business logic needs to be taken into account to filter out or add extra elements.

### Selected Product

XQuery

### Selection Rationale

Both XQuery and XSLT have been the main XML technology for transformation. XSLT is more of a processing engine that automatically goes through document tree and applies templates as it fines nodes, whereas XQuery has to direct the whole process. In psLink, output SOAP skeleton can be defined beforehand. XQuery also provides features like FLWOR which facilitates business logic in transformation.

### Architecture Risks

None.

## SOAP Processor

### Component Functions

SOAP processor acts as a SOAP client component that initiates SOAP request to Spine and pass PDS result back to ART.

### Technical Considerations

Spine is a synchronous SOAP web service that requires immediate response from an HTTPS connection.

Key store and trust store need to be loaded to pass TLS handshake.

Request soapAction header should be set to correct interaction id to find the appropriate Spine Endpoint.

### Selected Product

SAAJ

### Selection Rationale

With the SAAJ API, you can create XML messages that conform to the SOAP specification and prescribe format of messages.

WSDL should not be used with Spine services under any circumstances. The reason is that WSDL is aimed at defining a method interface on an object that is exposed over network. Programming languages like java provide stubs which handle the network stuff, application code can be put at either side of the stub. HL7 may produces several possible types of output which confuses WSDL tooling.

## SDS Lookup

This is a standalone command line tool which is not depicted in figure 2.2.

### Component Functions

This component queries SDS by LDAP service and retrieves Spine information like Messaging URL, Spine Party Key and ASID values.

### Technical Considerations

Spine values like Messaging URL, Party Key and ASID values are very static, a LDAP request to retrieve these values during each PDS request is too much for synchronous service and likely to cause timeout, therefore they are hard coded in property file. But these system details are subject to change from time to time. A mechanism should be in place to check them are valid through time.

### Selected Product

Java 1.8

### Selection Rationale

A java POJO command line app to connect SDS is easy to run and maintain.

### Architecture Risks

System connection failure may be observed if these values are outdated.

# System Construction Environment

## Development Environment

### Local Developer WorkStation Configuration

CPU: Intel i5-6200U

Memory: 12.0 GB

### Supporting Local Development Infrastructure Configuration

Windows 10, java 1.8, Maven 3, JBoss Fuse 6.3, Red Hat JBoss Developer Studio, Postman

## N3 Dev/QA Environment

### N3 Dev/QA Workstation Configuration

CPU: Intel E5-2640

Memory: 8GB

### Supporting N3 Dev/QA Infrastructure Configuration

CentOS, VPN, java 1.8, JBoss Fuse 6.3

## N3 UAT Environment

### N3 UAT Workstation Configuration

CPU: Intel E5-2640

Memory: 8GB

### Supporting N3 UAT Infrastructure Configuration

CentOS, VPN, java 1.8, JBoss Fuse 6.3

# Appendix

JMeter is running on windows box 192.168.16.22

psLink is running on Linux box 192.168.16.23

Following is JMeter thread properties:

Number of threads: 100

Ramp-Up period(in seconds): 1

Loop count: 10

