



PCS (Path Coordination System, formerly
PATHFINDER) Integration Platform
WHITE PAPER (v0.5)

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1. Introduction

This document contains the functional and technical overview of the special communication module of the RailNetEurope (RNE) system PCS (Path Coordination System, formerly known as Pathfinder), called PCS Integration Platform (PCS-IP). The reference documentation of PCS, guidelines for the usage of PCS for railway undertakings (RU) and railway infrastructure managers (IM) and Allocation Bodies (AB) companies and the XML format description (WSDL and XSDs for PCS-IP) can be downloaded on RNE homepage (<http://www.railneteuropa.com/index.php/pathfinder.50.html>, <http://www.railneteuropa.com/index.php/Downloads/items/68.html>).

2. About this document

Prerequisites for reading of this document are:

- basic knowledge of PCS and its functions
- basic knowledge of timetable process in PCS
- understanding of UML (Unified Modelling Language) diagrams

The document contains:

- description of the functional architecture of PCS Integration Platform
- technical architecture – overview and basic facts
- notes about the further development
- project specific glossary of the terms which are used

3. Functional Architecture

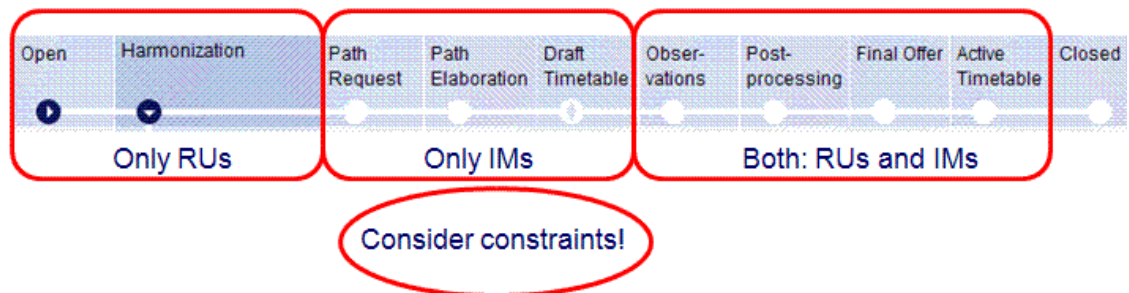
PCS system contains of the following functional modules:

(1) PCS Core system

The web application for workflow support for timetabling process, referenced in further text and diagrams as PCS-Core. PCS-Core system is accessed in the standard way by logging into the system with the username, password and matrix card identification. It is suitable for direct and manual processing of international path requests for individual users. In this document we will not focus on this module since there is already sufficient documentation provided for download on RNE homepage as well as in the corresponding eLearning System (<http://elearning.railneteuropa.info>).

Nevertheless, for the further reading it is necessary to mention a few basic facts about PCS-Core. PCS-Core is the module responsible for timetable coordination workflow

support. The main processing object in PCS-Core is called “dossier”. The dossier contains the data about international path request. The dossier is handled within the PCS-Core corresponding to the rules given by the international timetabling coordination process. This process foresees specific phases which have to be executed successively and have constraints that have to be considered when using the system (see PCS Orange Book reference manual and elearning platform for more details).



• Figure 1

Furthermore, PCS-Core is responsible for authentication on PCS system – the credentials for usage of PCS-Core are valid for authentication via PCS Integration Platform. The single difference is that the matrix card is not needed for authentication via web services of PCS Integration Platform.

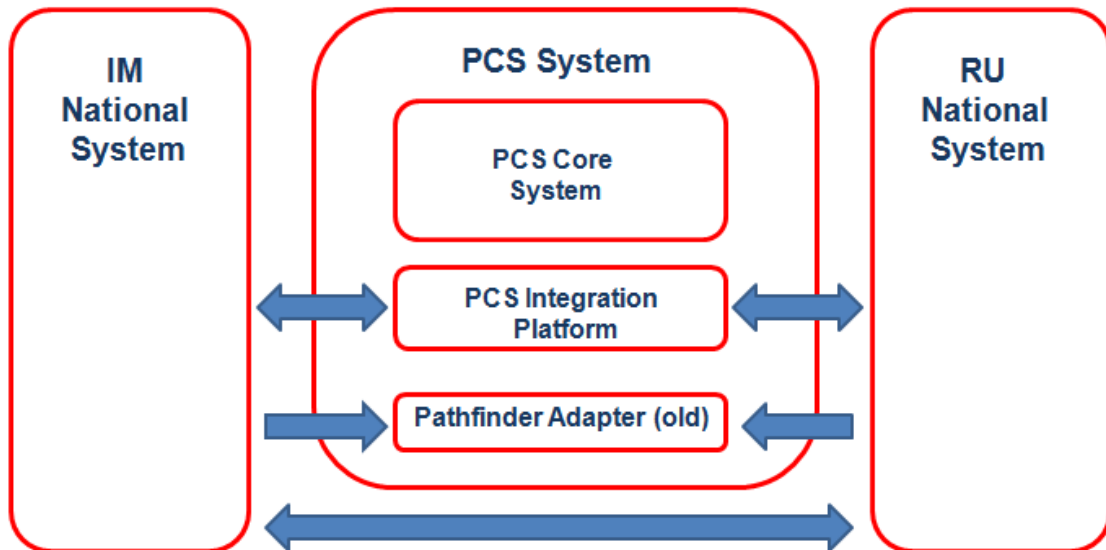
(2) PCS Integration Platform

The middleware for communication between PCS Core system and national systems of RUs and IMs, in further text referenced as PCS-IP. This module enables two-way communication between PCS-Core and IMs/ABs company systems (ordering and/or planning) corresponding to SOA (Service Oriented Architecture) standards.

(3) Pathfinder Adapter

The old (deprecated) communication module between PCS-Core and company planning systems of RUs and IMs/ABs. This module enabled the one way communication, i.e. data import from national planning systems to PCS-Core.

The functional overview of the PCS system is given in figure 2 below.



• Figure 2

The PCS-IP is based on SOA principles, it is able to accept the calls via web services and to send out the messages via web services, mail or ftp.

1.1 Input: web services

Data input from external systems (company systems of RUs and IMs/ABs) to PCS-IP is done only via web services (for technical standards see **1.5 Communication protocols**). There are two kinds of web services for PCS-IP:

- (i) Web services for creating and updating of objects in PCS-Core authenticate

Serves for authentication creation of session in PCS-Core for further processing.

The following operations are made for PCS dossier processing:

createDossier
createSingleDossier
updateDossier
updateSingleDossier
updateDossierRUIMPair
removeDossier

The next web services serve for maintenance of station data by IMs directly in PCS.

importOperationPoints
updateOperationPoint

- The IMs can define the traffic periods (and calendar items) themselves and reference them in their dossiers.
- importTrafficPeriods
getCalendarItemId
- (ii) Web services that serve as help functions (“read only” – the calls on these web services does not cause the change on any system object):

getDossier
getAllAgencies
getAllBrakeTypes
getAllProgressStatuses
getAllDossiers
getUserAgency
getOperationPointByName
getImParameters
getOperationPointById
getDossierPhases
getDossierProcessPhases
getSupportedDossierProcessTypesMatrix
getCalendarItemId
getCargoBrakeTypes
getCargoRemarks
getGoodsTypesByCargoTypeEneeld
getGoodsTypesByDescription
getTimetablePeriods
getStopTypes
getOperationPointByReferenceld
getAgencyTypes
getAlignmentDirections
getTrafficPeriodsForAgencyGroup
getDossierWithReferencelds
getRUIMPairsForDossier
getRUIMPairsForDossierWithUiclds

The full description of all web services can be found on RNE homepage in the download area, in the document “Handbook for communication with Pathfinder Integration Platform and Testing”.

1.2 Output: multi-channel notification service

PCS Integration Platform is able to notify the company systems that participate in the timetable coordination process in several ways. Railway Undertaking (RU) agencies are notified about each change of the dossier where they are participating during the “Harmonization” phase. Infrastructure Manager (IM) and Allocation Body (AB) agencies are notified after each update of the particular dossier (where the agency is participating) in “Path Elaboration” phase. Additionally, the PCS Integration Platform always notifies the leading IM/AB agency when a dossier is switched to Path Request phase by the corresponding leading RU. Hence, all agencies participating in the process are notified about the changes of a dossier accordingly. **With this approach, consistency of the data between PCS and company systems can be ensured, if the national system regularly broadcasts the dossier updates to PCS.**

In order to execute the notification, PCS Integration Platform needs to know the preferred communication channel for the particular company system. The organizations that want to use the connection to PCS Integration Platform are advised to specify the communication channel. This can be done by contacting the RNE IT Service Desk for PCS at support.pathfinder@railneteuropa.info. The notification service is executed on a regular basis every 5 minutes. Hence, all changes on the dossier where your company is involved are broadcasted to your system every 5 minutes. If no changes to your dossiers have been made, no notification is produced. The system PCS-IP tracks the changes and provides you also with the monitoring possibility of all services which are executed between your system and PCS.

PCS Integration Platform is able to communicate with other systems using following communication channels:

- **Web Service:** the organization specifies web service end point of the company system and user credentials for communication; RNE configures PCS Integration Platform to call the corresponding Web Services with content filled with dossier data.
- **E-Mail:** the organization specifies e-mail address for communication; RNE configures Integration Platform to send the corresponding dossiers to the given e-mail address.
- **FTP:** the organization specifies FTP server address and user credentials for communication; RNE configures Integration Platform to upload the corresponding dossiers to the given FTP server
- **File System of the PCS Integration Platform Server:** the updated dossiers are saved to a directory on the server, the particular agency takes the document via SSH (sFTP). For this purpose, the organization has to announce the outgoing IP address; RNE provides user credentials for sFTP access. This communication channel is recommended only for test purposes, in the PCS Integration Platform test

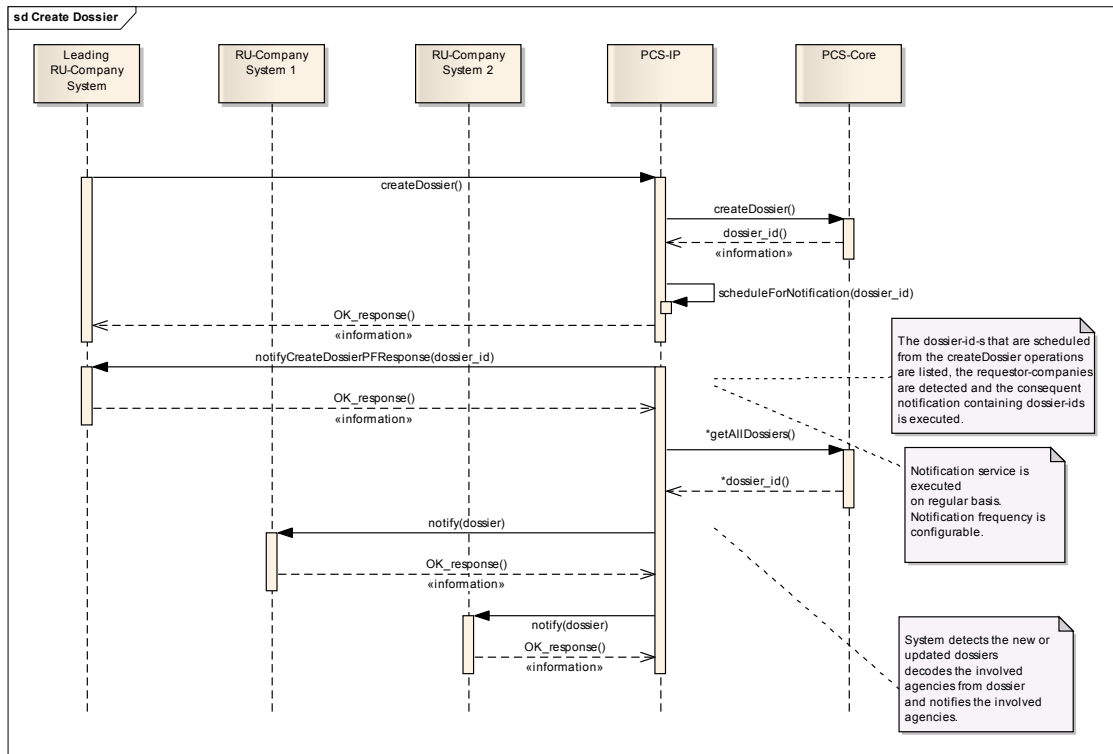
environment. For productive purposes, one of the first three above mentioned communication channels should be used.

1.3 Scenarios for the usage of PCS-IP

The dossier is the central object of processing in PCS system. Therefore, creating and updating of dossiers are the most frequently used operations on the PCS-IP. In the following sequence diagrams we will shortly describe the system behavior when a dossier is created and updated from company systems.

1.3.1 Create dossier

This scenario is based on an example of the business process where three RU companies are agreed about issuing the international path request and have also agreed which one of them should be the leading RU (the one that “owns” the request and is responsible for process control).

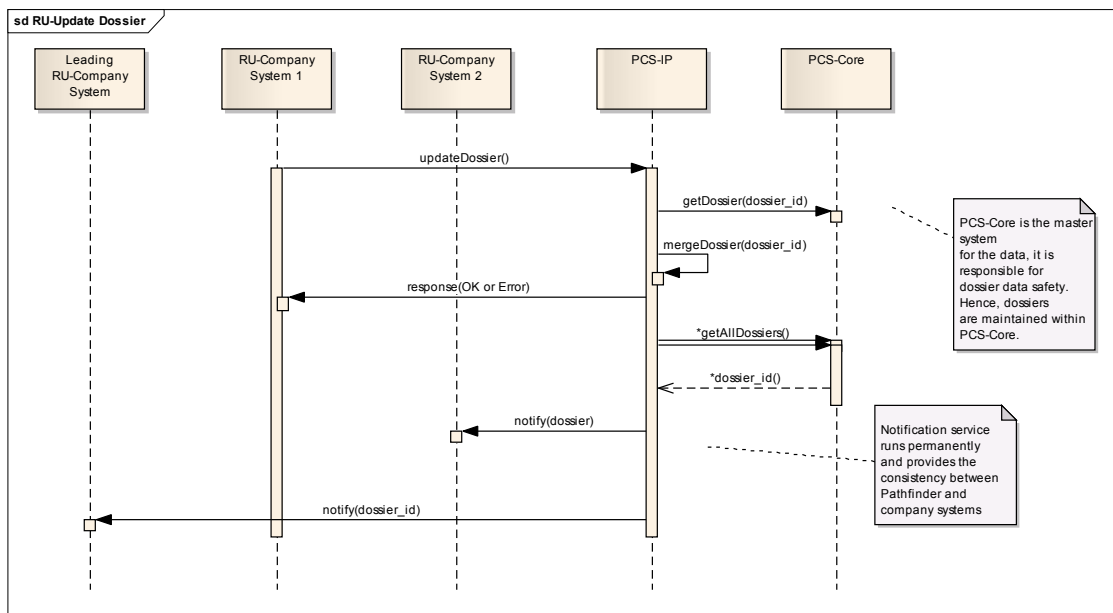


• Figure 3

It is important to note that the notification service of PCS-IP is running on a regular basis and *tracks* the creating and updating of the dossiers by using the PCS versioning system which is implemented in PCS-Core. Each change on a dossier (i.e. saving of the dossier record) is registered as a new dossier version. Consequently, the notification service is able to detect the version change of the dossier and react accordingly, i.e. send the changed dossier to the agencies which are involved in the dossier, however, considering the access constraints shown

on Fig 1. The dossier_id is returned if createDossier operation was successfully executed. This is the unique identifier of the dossier, and should be used for the further referencing of the newly created dossier. We recommend “Pathfinder Integration Platform testing handbook” for reading, where the web services are described in more detail.

1.3.2 Update dossier by RUs

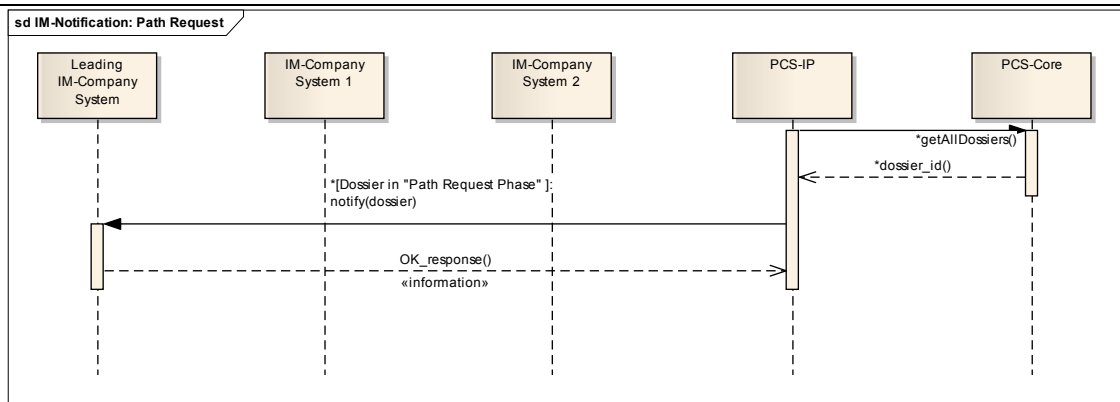


• Figure 4

Dossier data sent from a company system is checked by PCS-IP, and the system PCS-IP takes care that only the data of the company that sends the dossier is changed, and, additionally, merges with the newest version of the dossier from the PCS-Core system. In other words, the system PCS-IP protects the data sections in the dossier that are belonging to the other companies, and keeps the dossier up to date by merging with the latest version from PCS-Core. Moreover, we could replace any of the company systems with a normal user who manually updates the dossier directly in PCS-Core via web application – also these changes are registered, and the company systems are notified and, in the case of the automatic update like shown above, these changes are considered by the dossier merging process.

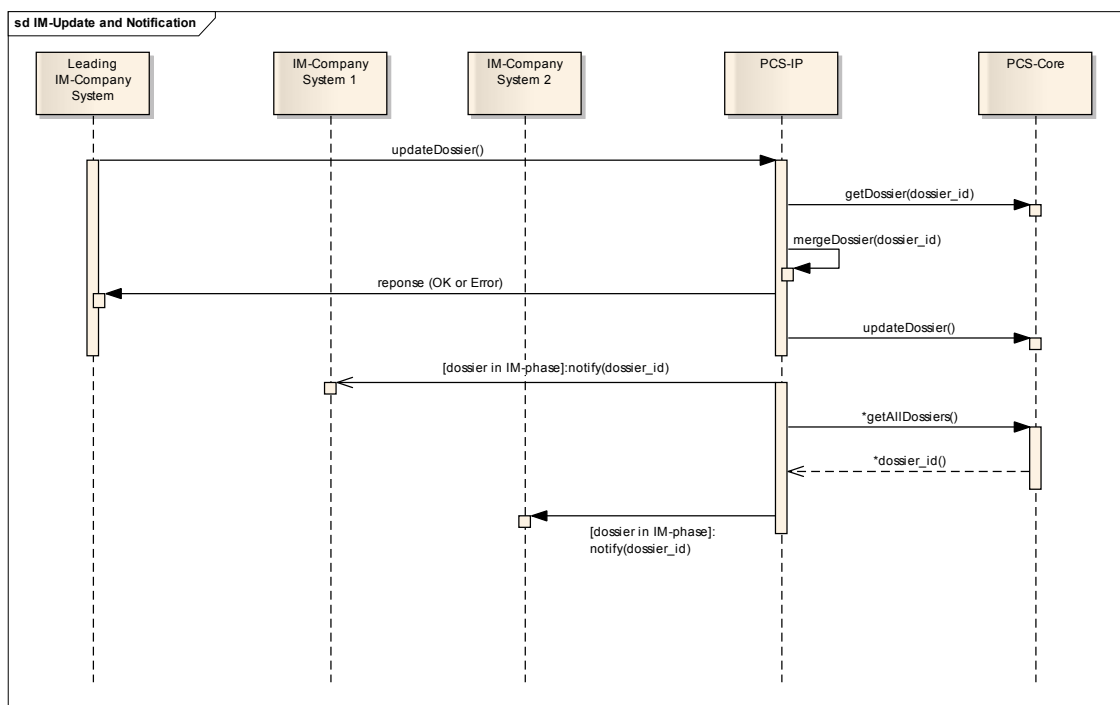
1.3.3 Update dossier by IMs/ABs

As it was already mentioned in the chapter 1.3.1 **Create dossier**, PCS-IP’s notification service regularly checks the dossier dataset of PCS-Core and *tracks* the changes. This is how the PCS-IP detects that a path request has come for the IMs/ABs – it analyses the state of the dossier and if it finds a dossier that has been put to the phase “Path Request”, it notifies the leading IM about the request immediately.



• Figure 5

As the timetabling coordination process foresees, the leading IM should always transfer all dossiers that it gets as “Path Request” to the IM-reserved phase “Path Elaboration”, i.e. to make the dossier available for all involved IMs/ABs. This is also done with updateDossier operation.

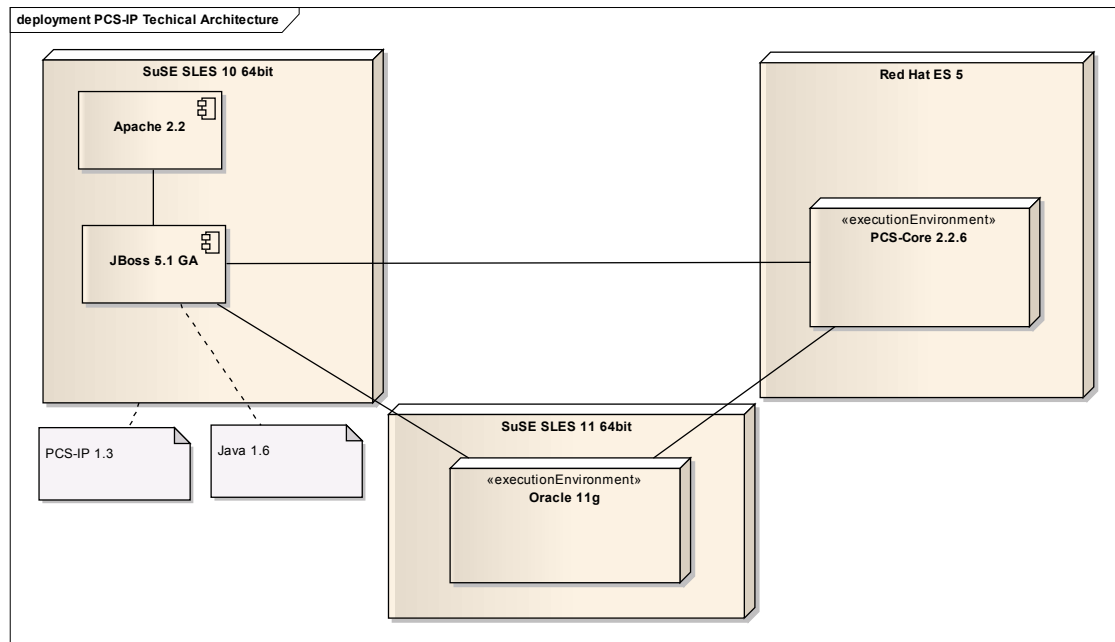


• Figure 6

Similarly as in the case for RUs, the notification process of PCS-IP detects the dossiers in the IM-specific phase and notifies the involved IMs/ABs on a regular basis (the notification

frequency is configurable - the PCS-IP administrator can change the number of minutes for notification frequency).

4. Technical Architecture



• Figure 7 All these systems are placed in the same IT-virtualized environment in RNE Data Centre

The module PCS-IP, as well as the complete system PCS is based on JEE (Java Enterprise Edition) technology, which is already proven in many applications on high availability and scalability.

1.4 System overview

Operating System: *SuSE Linux ES 10, 64bit*

Web server: *Apache 2.2*

Application server: *JBoss 5.1 GA (CXF)*

Java version: *1.6*

Database: *Oracle 11g*

PCS Core system version: *PCS-Core 2.2.6*

1.5 Communication protocols

As mentioned in previous chapters, PCS-IP is enabled for two-way communication. Incoming web services are executed using following standards

- HTTPS (http communication with secure socket layer (SSL))

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- WSDL 1.1 (web service definition language, version 1.1)
 - SOAP 1.1 (simple object access protocol, version 1.1)

Default web service end point is:

<https://<PCS-IP Server>/pathfinderintegration/webservices/IProxyIntegration?wsdl>

For notification service the following protocols can be used:

- HTTP
- HTTPS
- SMTP (mail)
- FTP

Web service end-points and the explanation how to use notification service via web services with an example can be found in “Handbook for Communication with PCS Integration Platform and Testing”.

1.6 Security and authentication

Authentication and access account management is placed in PCS-Core. PCS-IP only forwards the credentials to PCS-Core. More precisely, the user accounts made for PCS-Core can also be used for communication with PCS-IP.

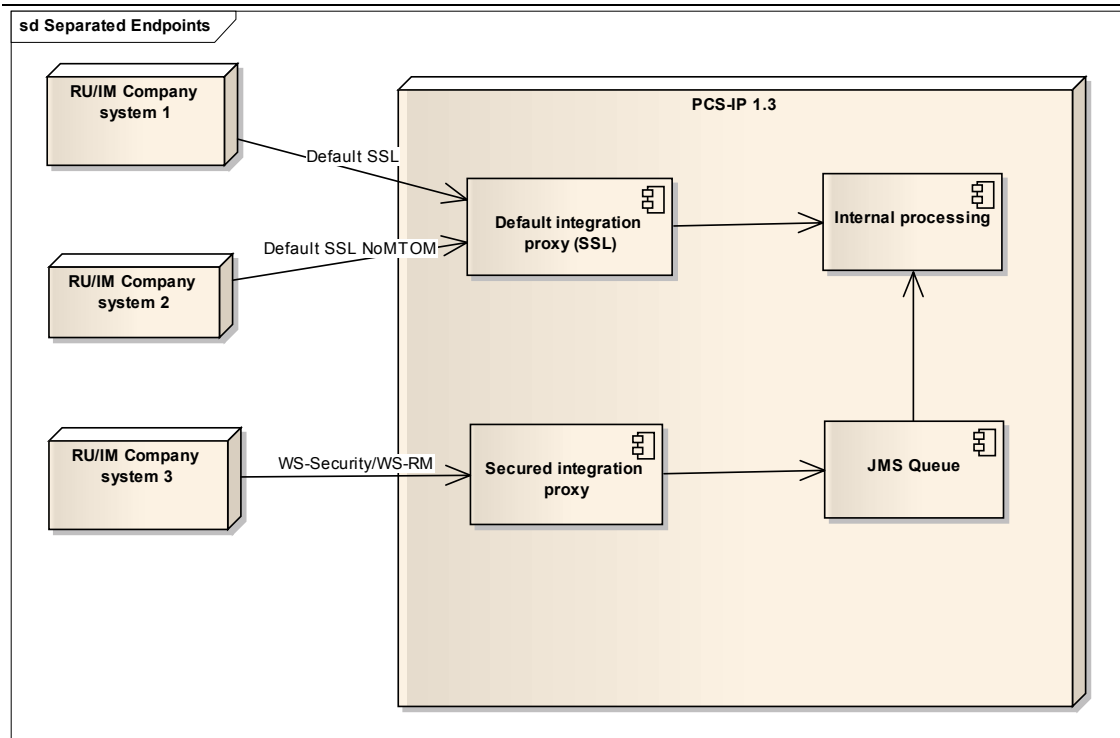
PCS-IP corresponds to the web service security standard “Web Services Security 1.1”. For this purpose, a separated web service end point is provided:

<https://<PCS-IP Server>/pathfinderintegration/webservices/ISecuredProxyIntegration?wsdl>

For the compatibility reasons with the company systems that already use the default web service end point and have SSL as security level, the separated web service end point for WS-Security was introduced.

1.7 Reliability

PCS-IP corresponds to the web service reliability standard “WS-RM 1.0” (WS-Reliable Messaging). Also in this case and for the same reason as for WS-Security, the same separated web service end point is used as for WS-Security.



• Figure 8

1.8 Transactional behaviour

PCS-IP has the atomic transactional behaviour, i.e. it does not support external transaction context.

1.9 Safety

The dossiers are saved and archived in PCS systems for 10 years.

1.10 Concurrency

PCS-IP is currently dimensioned for 100 concurrent calls, but, since it is based on a scalable JEE (Java Enterprise Edition platform), this is a subject to change and/or upgrade.

1.11 Load

Currently, the PCS-IP is tested for 200k pro request XML payload, and, similarly as for the concurrency, this is a subject to change and/or upgrade.

5. Further development

The PCS system, especially the module PCS-IP, is aimed to be the timetabling coordination and order tracking application corresponding to TAF-TSI specification for processes and messaging for Short Long Term Path Request (and, surely, for long term planning as well). Since the PCS-

IP is capable of messaging and notification about any step in the timetabling coordination process, it is quite natural that it will support all process specifications and messaging given by TAF-TSI for path request processes.

6. Glossary

AB	Allocation Body (AB): independent organisation responsible for train path allocation to RUs. In most cases, the AB is the same organisation as the IM. But if the rail operator is not independent from the IM, then path allocation must be carried out, by an independent allocation body.
Agency	PCS specific term: common name for the organisation that participates in PCS in request processing: it can only be RU or IM/AB
Company system	own system of an involved RU or IM/AB
Dossier	PCS specific term: Dossier is the main electronic document in the international train path agreement process supported by PCS
Leading IM	PCS specific term: Leading Infrastructure Manager – the IM/AB which leads the request process in PCS for all participating IMs/ABs in the Dossier
Leading RU	PCS specific term: Leading Railway Undertaking – the RU which leads the request process in PCS for all participating RUs in the Dossier
Harmonization	Timetable-process specific term: a phase in request process which serves for coordination about operation points and time between RUs as well as IMs/ABs. It is a phase in each timetable process type supported by PCS
PCS	Path Coordination System, formerly Pathfinder
PF	Pathfinder
Pathfinder	RNE-owned system for coordination of international paths with international timetable between RUs and IMs/ABs. The new name for the system is PCS (Path Coordination System).

IM	Infrastructure Manager in Railway: the company which takes care of railway infrastructure
RU	Railway Undertaking
RNE	RailNetEurope
TAF-TSI	Telematic Applications for Freight – Technical Specification for Interoperability