Digital Prescribing & Dispensing Pathways Programme

Solution Architecture Description

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DPDP Solution Architecture Description

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DPDP Solution Architecture Introduction

Introduction

Purpose

The purpose of this document is to describe the solution architecture of the digital prescribing and dispensing pathways (DPDP) service, referencing an overview of the business architecture that the solution must support and realise in order to successfully deliver the DPDP programme objectives.

The solution is presented as a series of perspectives, each containing a number of views. Each perspective broadly groups together related views that describe particular areas of architectural concern.

Audience

The primary audience of this document are those stakeholders and other parties who have interests related to the overall technical solution. These stakeholders include internal NSS and NES teams, potential and incumbent suppliers, technical team members from organisations with system dependencies on DPDP or ePharmacy, and Scottish Govt technical strategists.

The secondary audience of this document are those stakeholders with an interest in the overall delivery of DPDP or services with a cross-dependency on the programme. This includes programme leads, business stakeholders, healthcare leads, sponsors, external agencies, suppliers and Scottish Govt healthcare strategists.

Scope

The scope of this document covers the technical solution, including how it realises the business capabilities. It does not include the business capabilities or processes with the context of the DPDP programme; these are described in a separate document. Other services outwith the DPDP domain may be referenced within the context of the solution if there is a dependency between the process/service/system in question and digital prescribing.

In scope for the DPDP solution architecture are:

- Advanced Electronic Signature (AES) signing of prescriptions.
- Public Key Infrastructure (PKI).
- API-centric integration of services and components within DPDP, including orchestration and choreography of underlying services, data transformation, service resilience.
- Notifications service for alerting patients of prescription events.
- API access control and management.
- New integration routes ("pipelines") into existing systems as part of intermediate transition architectures.
- User registration and authentication for AES.
- Public access via a portal (possibly as a mobile app) for prescription-related information.
- Direct messaging between prescribers and dispensers.

Out of scope

- Network or domain authentication
- Changes to 3rd party systems, such as PMR's, GP IT, beyond identifying the API operations needed to support those services
- Changes to downstream systems other than to provide pipelines to feed data into those systems.

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- Identity and access management (IAM) beyond the core requirements to authenticate prescribers for AES.
- Analysis of the incumbent ePharmacy (aka ePMS) messaging-based prescription service from Atos. This analysis is available in the document DPDP - Analysis of ePMS.docx [1].
- Design of the business architecture required for the successful delivery of the DPDP programme. The business architecture is available in the document DPDP Business Architecture.docx [2].

Structure of Architecture Documents

The architecture documents are broken down as follows:

Section	Purpose
Introduction	This section contains the purpose, audience and scope of the document.
Business Architecture	Contained within a separate document [2]. That document contains the capability, actor and process views of the business architecture, including a breakdown into activities and value streams.
Solution Architecture	This section contains the logical views of the solution architecture, including overall vision and contextual views, the more detailed description of each subdomain and its services, and dynamic views showing collaborative behaviour between services where appropriate, within the solution domain.
Physical Solution Architecture	Contained within a separate document [9]. That document contains the physical views of the solution architecture, including the reference architecture that all new services within the DPDP will be expected to adhere to. The implementation technologies and platforms are described within the physical domain.
Solution Architecture Mapping to Business Architecture	This section maps the logical solution architecture to the capabilities, value streams, functions and processes within the business architecture [2].
Data Architecture	Contained within a separate document [10]. That document section contains the logical and physical views of the data architecture, including data flows, state models, data schema and data-tier integration platforms.
Integration Architecture	This section contains views of the integration architecture where additional information is required beyond the descriptions in the preceding sections.
Deployment and Infrastructure Architecture	Contained within a separate document [11]. That document section contains the deployment views, including availability and service continuity aspects, as well as the environment chain to be used within the DevOps delivery pipeline.
Delivery Phases	This section contains views of the logical architecture for the known delivery releases from MVP to target end-state architecture.
Appendices	This section contains supporting information and further detailed breakdowns.

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References

[1]   Analysis of the incumbent ePMS service: DPDP - Analysis of ePMS.docx (Sharepoint permissions required), current version

[2]   DPDP Business architecture design: DPDP Business Architecture.docx, (Sharepoint permissions required), current version

[3]   DPDP Architecture Decision Log: DPDP Architecture Decision Log.xlsx, (Sharepoint permissions required), current version

[4]   DPDP Overall Architectural Options Proposal: DPDP Overall Solution Architecture Options v1.2.docx, (Sharepoint permissions required), version

[5]   DPDP NFR Requirements Log (draft): DPDP NFR requirements.xlsx, (Sharepoint permissions required), current version

[6]   Gartner DPDP AES Report: NSS Digital Signatures Final Report v1.0 – *Note that the Gartner report has limited distribution rights and might not be available to all readers of this document. It MUST NOT be circulated nor copied, wholly or partially, without the express permission of DPDP programme management*

[7]   DPDP Architecture Principles: DPDP Architecture Principles v1.0.docx, (Sharepoint permissions required), version 1.0

[8] DPDP Business Glossary: Business Glossary.xlsx, (Sharepoint permissions required), current version

[9]   DPDP Physical Architecture Description: DPDP Physical Architecture Description.docx (Sharepoint permissions required), current version

[10]   DPDP Data Architecture Description: DPDP Data Architecture Description.docx (Sharepoint permissions required), current version

[11]   DPDP Deployment and Infrastructure Architecture Description: DPDP Deployment and Infrastructure Architecture Description.docx (Sharepoint permissions required), current version

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Solution Architecture

Solution Architecture

Solution Architecture Vision

The following diagram and descriptions outline the proposed target end-state solution architecture for DPDP. This is shown at a context level to show the key architectural platforms and services within DPDP and their impact and dependencies within the overall scope of digital prescribing. Subsequent sections of this document drill down into those key components in more detail. Note that this diagram shows the DPDP architecture vision, however it does not show the incremental delivery phases required to reach that target view. It is also to be expected that this will change over the lifetime of the programme.
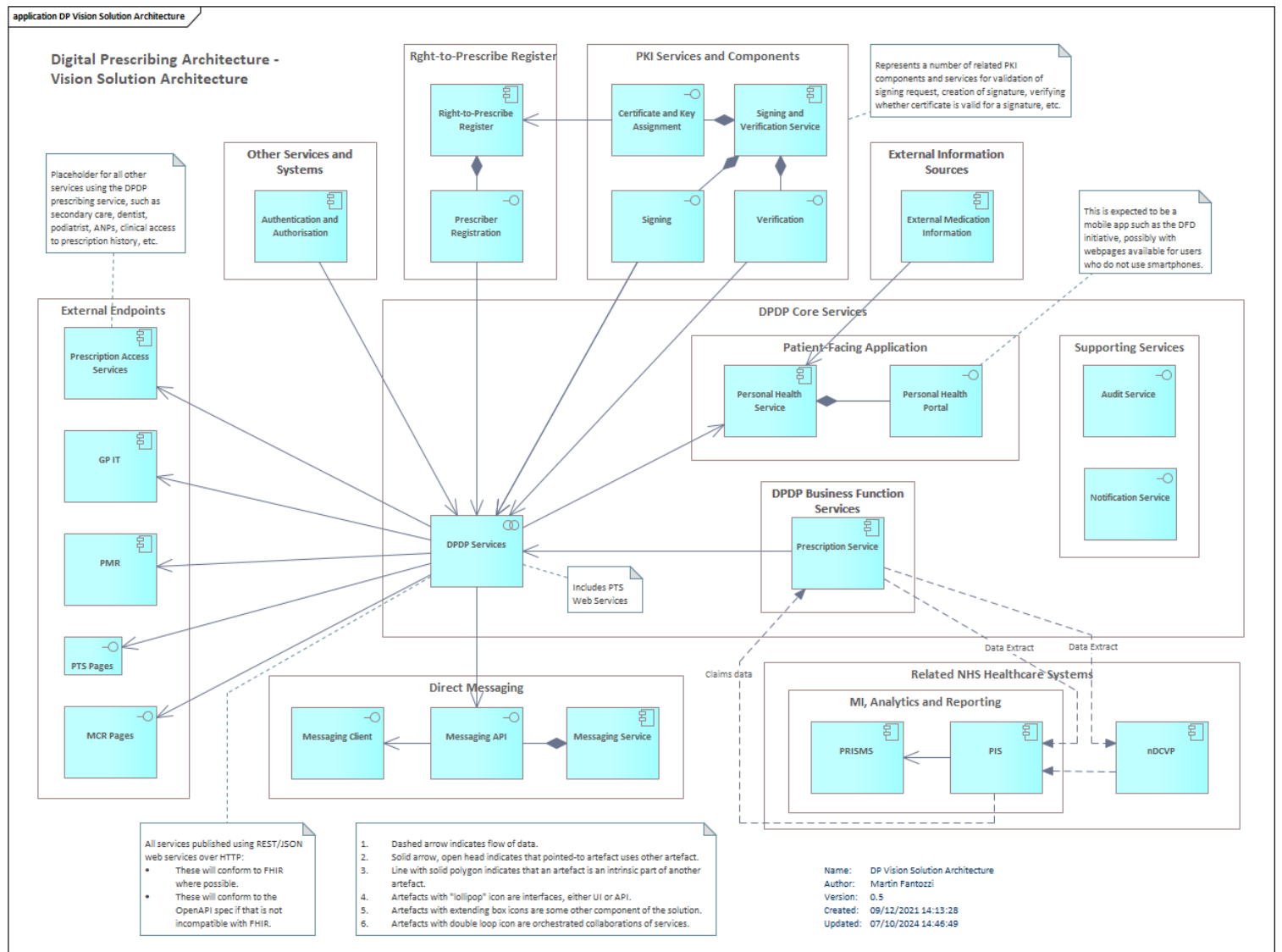
There are a number of architectural decisions to be made in order to realise this architectural vision, and those will be the subjects of several options papers in due course. Refer to [3] for the current record of all such decisions. It is also expected both that it will take several major delivery phases in order to deliver the programme and that the needs of NHS Scotland will evolve over time. Consequently this vision is expected to be delivered as coherent sets of services grouped into a number of delivery phases, with the vision itself being modified and updated with each major drop to reflect the changing emphasis and needs. The known delivery phases are described in the Delivery Phases section, however this information will necessarily only accurately reflect the known content of past and current releases along with the content for any releases that are in late planning or active development stages of their lifecycles.

The solution architecture is aligned to the programme architectural principles [7]. Business terms are defined in a central business glossary [8].

The services and components in the following diagram are grouped based on core areas of responsibility.

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Vision Diagram

The following diagram shows the overall architecture vision for the DPDP service, including external dependencies both within and outwith NHS Scotland.

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Service Descriptions

Service / *Grouping*	Description
DPDP Services	Overall grouping for digital prescribing services.
DPDP Services	External facing service built on an NHS Scotland common access platform and integration capabilities, providing digital prescribing business services. This includes orchestration of synchronous and choreography of asynchronous services. This will implement a number of narrow APIs and use a micro-service architecture wherein the only business logic will be the execution of underlying services.
DPDP Business Function Services	This represents a number of business functional services. There will be a number of micro-services **however only the Prescription Service** is shown in the diagram above.
Prescription Service	Prescription functionality and persistent data store to receive, store, forward and provide historical prescription item, dispensed medication, claims, organisations, short-term reporting information, status information, and searching based on prescription identifier/CHI/etc.
Right-to-Prescribe Register	
Prescriber Registration Service	The Prescriber Registration Service contains a unique, secured entry for each prescriber, along with their private key. Access to this will be via a form of strong authentication (ie, MFA). This does not currently exist in the NSS application landscape.
Right-to-Prescribe Register	This is the secured API access to the prescriber registration service to allow registration of prescribers and checking on their right-to-prescribe status.
PKI Services and Components	The PKI infrastructure is necessarily more complex than shown here with only the significant PKI services of relevance within DPDP in the diagram.
Certificate and Key Assignment API	Assignment of private key and x.509 certificate to an authenticated prescriber
Signing API	Creation of a digital signature using a submitted message digest (hash) for an authenticated user.
Verification API	Verification of a signature using a submitted certificate. This will also check that the certificate is valid, has not expired, was issued by the PKI CA, and is not on the certificate revocation list.
Certificate and Signing Service	This is the realising service that provides the capabilities for the Signing and Verification APIs.
Other Services and Systems	
Authentication and Authorisation	This service represents the user directory that contains the user account information for both authentication and authorisation. In addition, there will be extensions to the authentication for users who have the role of prescriber, enforcing strong (aka multi-factor or MFA) authentication in order to allow the signing of prescription items.
External Endpoints	
GP IT	Placeholder for external GP IT systems
PMR	Placeholder for external CP PMR systems
PTS Pages	Prescription Tracker Service – simple prescription status checks. Will use authenticated API access offered by the DP services.

Service / *Grouping*	Description
Prescription Access Services	Collective placeholder for access point for access to prescribing functionality outwith GP IT and offered via other applications. This covers actors such as opticians, podiatrists, paramedics.
MCR Pages	This covers any additional browser-based dependencies on DPDP prescription information not covered by the above.
Supporting Services	
Audit Service	Audit service for recording all significant events associated with the prescription service.
Notification Service	Notification service used to inform people of their prescription status and other significant events. Underlying notification mechanisms yet to be decided but likely to include in-application notifications, possibly emails and SMS.
Related NHS healthcare systems	
nDCVP	This is the latest generation of the payments and counter-fraud processing platform. It will be fed with prescription data by a data integration layer utilising an ETL platform.
PIS / PRISMS	This is the Prescription Information Service (PIS or PIS DWH) datastore and PRISMS reporting platform used to access the PIS. The PIS will be fed with prescription data by a data integration layer utilising an ETL platform.
Patient-Facing Application	
Personal Health Service	Public NHS service allowing authenticated personal access to health information, including prescriptions, nominated pharmacy, links to medicines information, notifications, etc.
Personal Health Portal	Public NHS portal allowing authenticated personal access to the personal health service.
External Information Sources	
Medication Information	Medication information links published by NHS Scotland or by medication item suppliers, supplementing current in-pack leaflets.
Direct Messaging	
Messaging API	Messaging service API accessed by DP services
Messaging Service	The direct messaging service enables direct messaging between prescriber and dispenser.
Messaging Client	Direct messaging client.

Logical Solution Architecture

This section first introduces the overall solution architecture, also referred to as the end-to-end architecture, followed by a breakdown of the core architectural areas within the overall context, and then describes the architectural approach to the key delivery phases, particularly the initial MVP deliverable.

The overall DPDP programme will be split into a number of major delivery phases. At the time of drafting this document the only agreed delivery is for the minimum viable product. The remaining delivery phases described herein are based on specific aspects of the architecture and grouping of related capabilities. These may be consolidated into combined deliveries dependent on business priorities and NHS Scotland or Scots Govt need

### Overall Logical Solution Architecture

The following section describes the end-to-end solution architecture. The diagram breaks each of the major architectural domains down further into discrete sets of related components and services. These are described in greater detail in subsequent subsections, detailing the key architectural artefacts and, where appropriate, dynamic behaviours.

Removal of Legacy Interfaces and ePMS

The programme architectural principles [Appendix A] stipulate that re-use should be considered before the acquisition or building of new services, however the incumbent ePMS system fails to meet many of the other principles, in particular those for being component-based, using data as an asset, having security designed in from the outset and being flexible, extensible and scalable. Consequently the decision was taken to replace ePMS with components for the DPDP and business services. The options and recommendation for this decision are presented in [4] and the SDA and TDA decisions based on this have been recorded in the decisions log [3]. Refer to [1] for an overall analysis of the ePMS service.

Target End-State Solution Architecture for the DPDP Service

The following architecture diagram shows the intended target end-state solution architecture for the DPDP service. This is likely to change and evolve significantly over the course of the delivery phases.

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Digital Prescribing Architecture - Target End State Logical Architecture
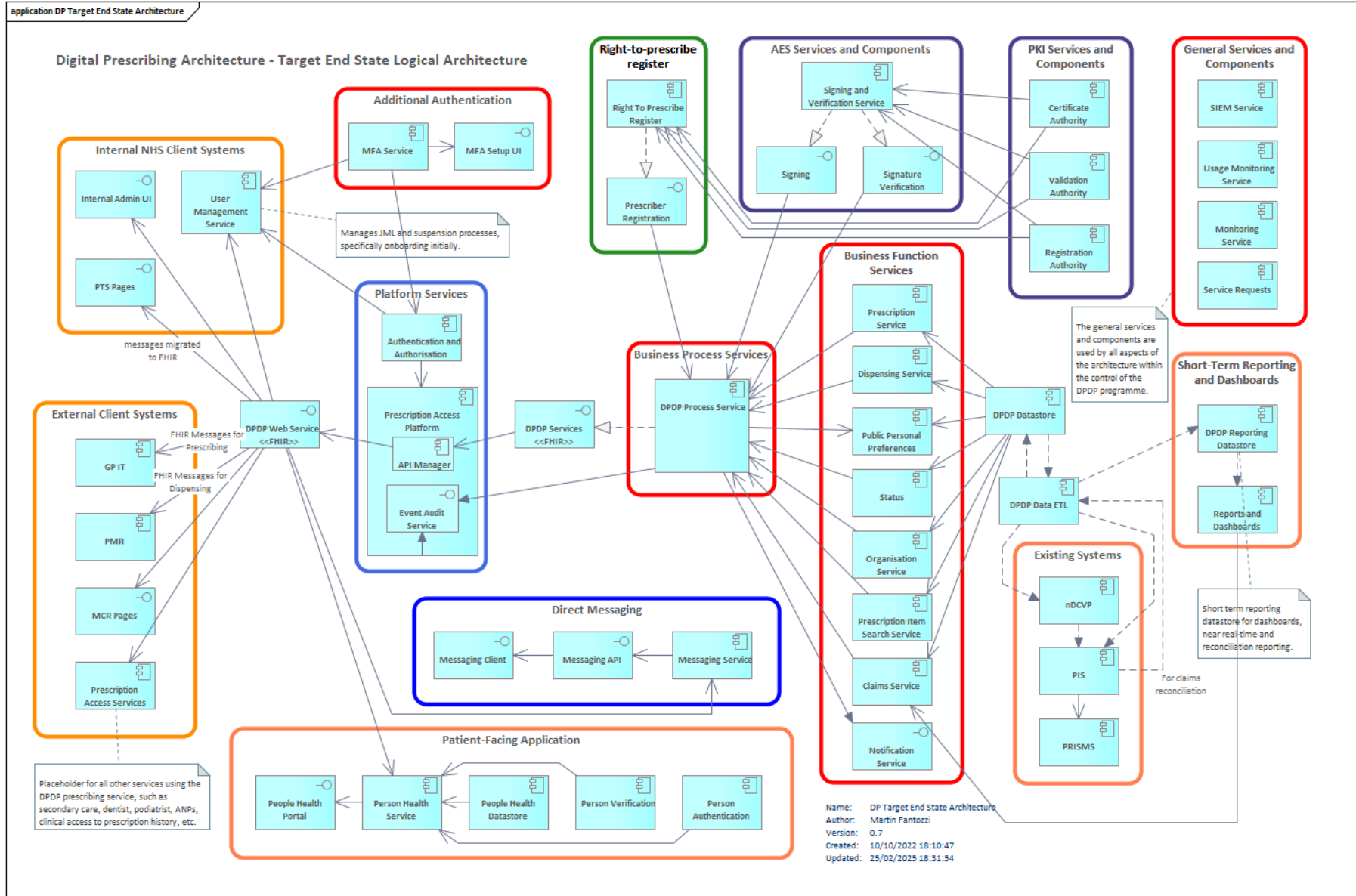
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The following table provides an outline description of each of the architectural domains in the preceding diagram. Those domains are further broken down into components in subsequent sections. These sections will be added to on an incremental basis as each domain's architecture is taken down to the lowest appropriate level and the implementation technologies and platforms are decided upon.

Domain	Description
Platform Services	The platform services publish the web-facing set of APIs for consuming systems to use. They provides a set of URLs for each environment (production, integration, etc) that DPDP will offer, and provide integration with the authentication and audit services. They will provide URL redirection to enable the DPDP services to be hosted within a different environment to the platform services themselves.
DPDP Business Process Service	This represents a number of business process services, one for each API request, implementing business process flow. These will be a number of micro-services.
Business Function Services	Prescription and related functionality and persistent data store to receive, store, forward, provide historical prescription item information, status information, organisation information, claims, etc, along with searching based on prescription identifier/CHI/etc.
AES Signing Services	The AES signing services will digitally sign or verify the signature on prescription items on request.
PKI Services and Components	The PKI services and components are the underpinning components providing the keys and x.509 certificates, along with intrinsic PKI services such as certification validation, for the AES signing and verification services
Right-to-Prescribe Register	The register contains a unique entry for each registered prescriber within Scotland. It ensures that a prescriber has a current 'right to prescribe' and therefore can digitally sign a prescription item. It is managed as part of the Joiners-Movers-Leavers (JML) process for prescribers.
Short-Term Reporting and Dashboards	This will provide local dashboard and near realtime reporting capabilities. It will be relatively short-lived data and not duplicate the MI and analytics capabilities of the PIS/PRISMS platforms.
IAM	The IAM service will be integrated with the healthcare platform and be based on the use of Microsoft B2C and AAD products. This will also enable further extension to use additional authentication factors for strong authentication.
Additional Authentication	The use of Microsoft B2C to manage IAM requests will enable an additional layer of authentication for prescribers, providing strong (MFA) authentication for anyone who has the prescriber role.

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Domain	Description
Internal NHS Client Systems	The internal NHS client systems are user interfaces provided by the DPDP programme either for use by enrolled users of the DPDP service, such as the prescription tracker service (PTS) or for internal administration and data management, such as maintaining dispenser organisations.
External Client Systems	The external client architecture represents the external systems that access the DPDP service. Those that are known are the GP IT and PMR systems, however it is expected that other systems will use the DPDP services as further phases of DPDP are delivered.
Patient-Facing Application	The patient-facing application will provide members of the public with access to their personal prescription information. It will probably be provided via the Digital Front Door initiative from Scots govt. All users will require to verify their identity to enrol, and must authenticate to use the app.
Direct Messaging	The direct messaging service will allow direct, "chat" style messaging from one user of DPDP to another. All conversations will be retained based on defined policies and directly linked to prescription items.
General Services and Components	These components are used by a number of different services within the DPDP set of services. They cover service-, security-, privacy-monitoring and service request capabilities.
Existing Systems	The existing systems require feeds of prescription data from the DPDP service. This will be done using platforms within the data integration tier.

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Solution Architecture Domains

The following sections contain a number of views of the solution architecture and show specific domains as indicated by the boundaries specified in the diagram above. These areas are further elaborated upon with detailed architectural breakdowns where appropriate.

Note that there are a number of critical architectural decisions within the overall DPDP solution architecture. Where they have been made the logical architecture will reflect any impact of that decision and references made to the decision log that contains a record of that decision and the relevant options paper that supports it if one exists. Otherwise, the logical architecture will be a generic representation that may be subject to change.

As the architecture of each domain evolves, the physical architecture and logical deployment architecture will be added to the appropriate architecture description documents. The physical architecture is described within [9] and the overall deployment architecture is provided within [11].

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Platform Services

The platform services provide the common endpoint for all access to the DPDP services. They provide a set of URLs for each published environment, along with direct integration to a simple authentication and authorisation service. They will provide API management capabilities and map the published endpoints to internal endpoints elsewhere within the overall DPDP service landscape. All requests and authentication events handled by the platform will be stored in an audit service.

Architecture Diagram
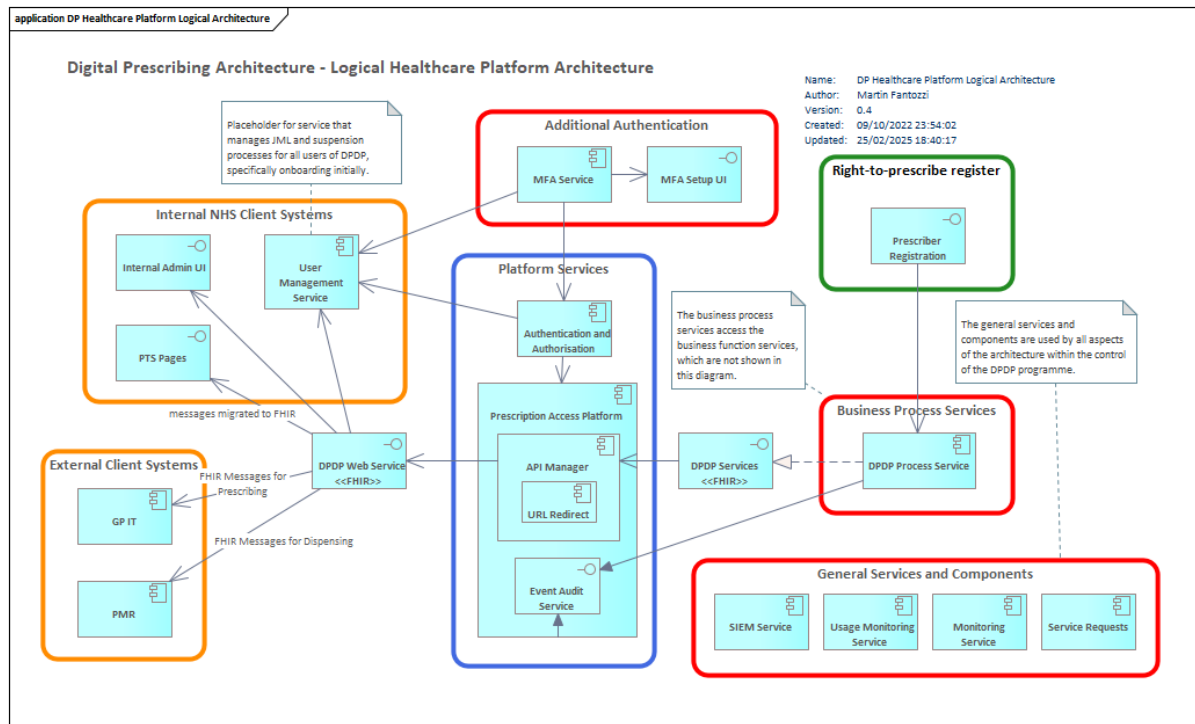
Component Descriptions

Prescription Access Platform

The prescription access platform is a service that provides the external-facing set of APIs for consuming systems to use. It provides a set of URLs for each environment (production, integration, etc) that DPDP will offer.

API Manager

The API manager service publishes the DPDP URL's as sets of abstracted endpoints for each environment that is to be provided for external access. The API manager will control access and manage the versions of the published endpoints. No URL will be accessible except via the API manager, and no other access to the DPDP services will be possible

URL Redirect

The incoming requests received by the healthcare platform must, once authenticated, authorised and audited, be redirected to the hosting environment for that service. The URL redirect service provides that capability. It is expected to be a standard platform component from the cloud provider.

Audit Service

The audit service will record all access attempts for DPDP services, whether successful or not. The audit service will also contain the audit information for prescription and dispensing events linked to

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prescribed and dispensed items, as well as auditing any change to reference data such as enrolled organisations and users.

The audit retention policy is described in the appropriate non-function requirements [5].

(Note if the NDP platform is used, then we will still need to assess the suitability of its audit service separately).

Integration with Amazon AWS Cognito and AAD

The platform will integrate with the IAM service. The IAM service will be the NSS Microsoft 365 IAM (aka MS Entra) service, accessed via the Amazon Cognito platform. There will be configurable rules such that specific roles, specifically prescribers in this case, will need to provide some form of additional authentication.

Refer to IAM and the Prescriber Registration Service section for more details regarding IAM.

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Business Process Services and Integration

The business process services are the implementation of the business processes defined and elaborated upon by the business analysis team. These services are workflow-based and will invoke the underlying functional services. These do not directly implement the individual functions nor do they access persisted data; their role is to orchestrate and choreograph synchronous and asynchronous tasks respectively that will perform those roles.

These services will provide the FHIR-based interface endpoints for the delivery platform to publish.

The core implementation technology used for the business processes will be the underlying integration platforms used within DPDP, and as such they are intrinsically linked to the integration capabilities of those platforms. Refer to the Integration Architecture section for more information regarding the overall integration architecture.

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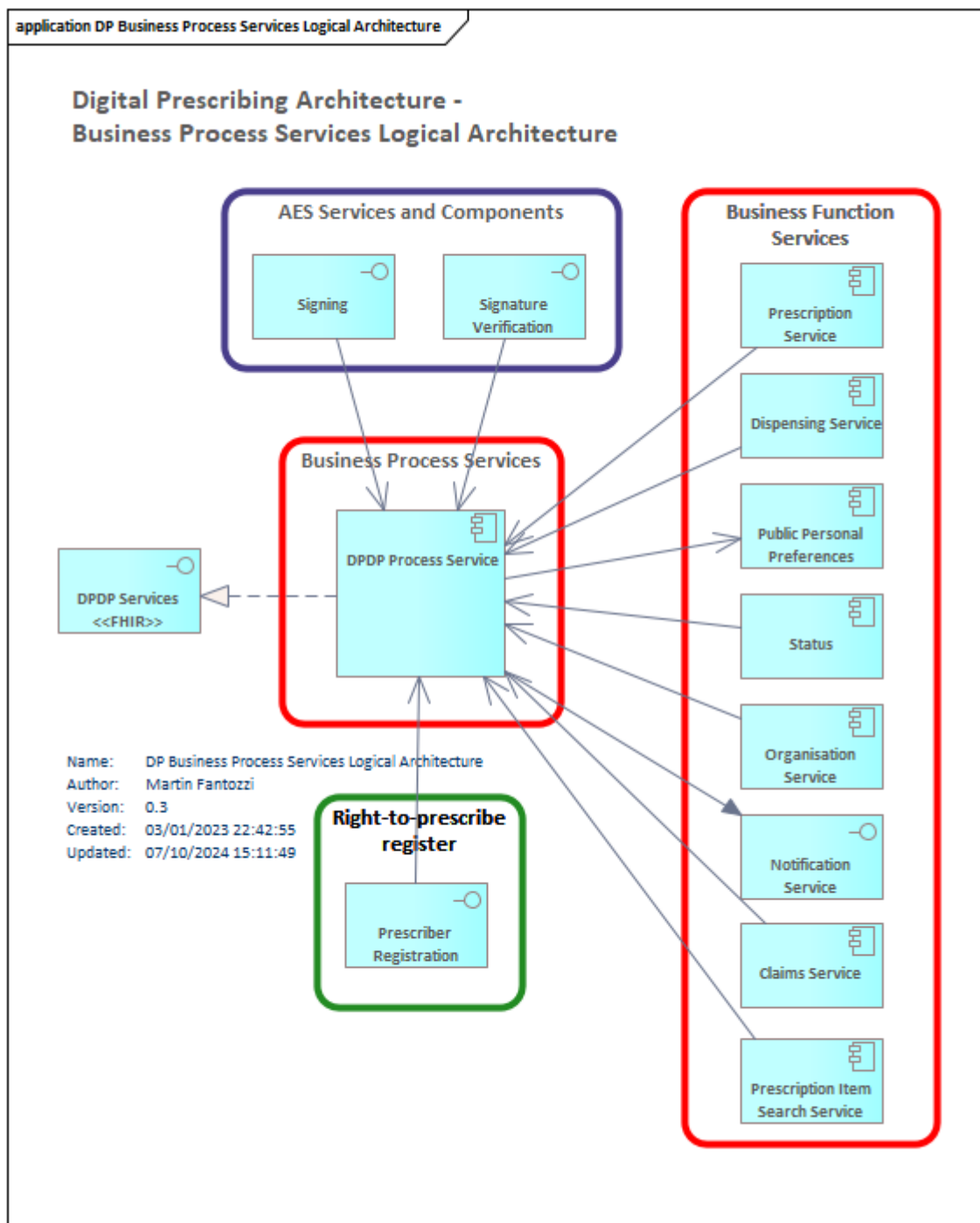
Note that some of the referenced function services will not be provided in the initial MVP release.

Business Process Services

The business process services will provide the individual processes for each request received by the DPDP service API. Each service will be unique to the process that it is implementing, for example the "Create Prescription" service shown in the diagram below does the following:

- invoke the prescriber registration service to verify that a prescriber is registered and active;

- invoke the prescription service to validate the prescription and items conform to the applicable data rules;
- invoke the organisation service to validate the organisation code associated with the prescriber;
- invoke the signing service to sign each prescription item;
- invoke the prescription service again, this time to store the prescription and items;
- invoke the prescription status service to update the status of the prescription and items;
- ***Post-MVP***
  - invoke the patient service to retrieve the patient's chosen contact method and details for notifications, if available;
  - invoke the notify service to inform the patient that their prescription is on its way;
- invoke the audit service to audit the outcome of the request;
- create the service response to return a "Prescription successfully signed" message to the prescriber's client system (usually the GP IT system).

These collaborative interactions – the dynamic view of the architecture – are shown in the following diagrams.

Business Process Dynamic Logical Architecture

The following collaborative interactions – the dynamic view of the architecture – show the expected realisations of two different business processes, highlighting the interactions in each. These are the "Create Prescription" service described above and the "Prescriber Onboarding" processes. These are both represented as sequence diagrams.

The services will be invoked using a combination of synchronous (request-response) and asynchronous (publish-subscribe or pub-sub) invocations based on the specific behaviours required.

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Create Prescription Collaboration Diagram

sd DP Service Collaboration - Create Prescription

DP Service Collaboration - Create Prescription

Column	
External Client	ROL001 - Prescriber, GP IT
Health Platform	Prescription Access Platform, Authentication and Authorisation, Event Audit Service
Additional Authentication	MFA Service
Business Processes	DPDP Process Service
Business Functions	Prescription Service, Organisation Service, Status, Public Personal Preferences, Notification Service
Signing and Verificati...	Signing
Prescriber Registration	Prescriber Registration

Name: DP Service Collaboration - Create Prescription
Author: Martin Fantozzi
Version: 0.2
Created: 18/01/2023 10:43:50
Updated: 07/10/2024 15:15:28

Prescriber sends prescription()
via DPDP Web Service API
createPrescription(Prescription)
authenticate(User)
[If prescriber]:authenticatePrescriber()
auditRequest()
via DPDP Services API
createPrescription(Prescription)
canISign(Prescriber): boolean
validatePrescription(Prescription)
ref
DP Service Collaboration - canIPrescribe
checkOrganisationValid(Location)
signItems(Items): SignedItems
storePrescription(Prescription)
updateStatus(Prescription)
getContactDetails(Patient): ContactDetails
notify(ContactDetails, Message)
auditRequest()

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Prescriber Onboarding Collaboration Diagram

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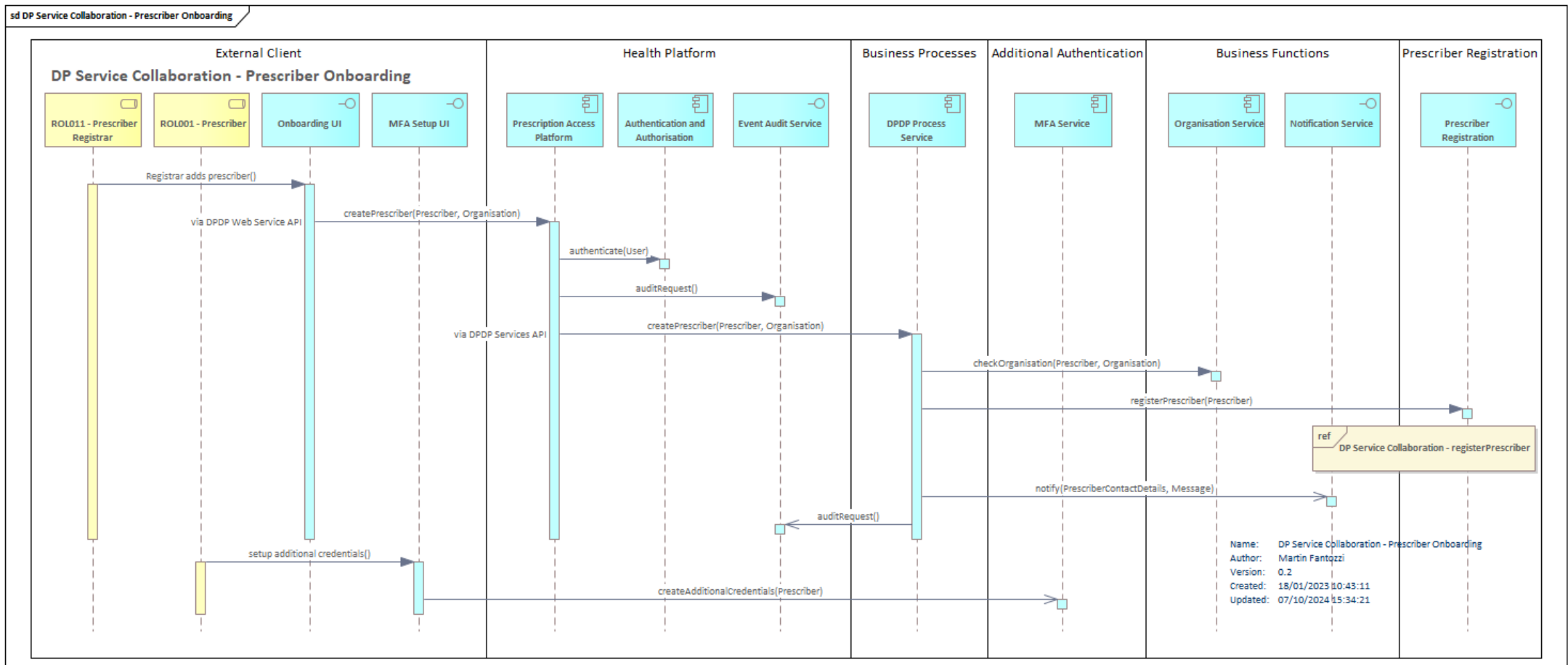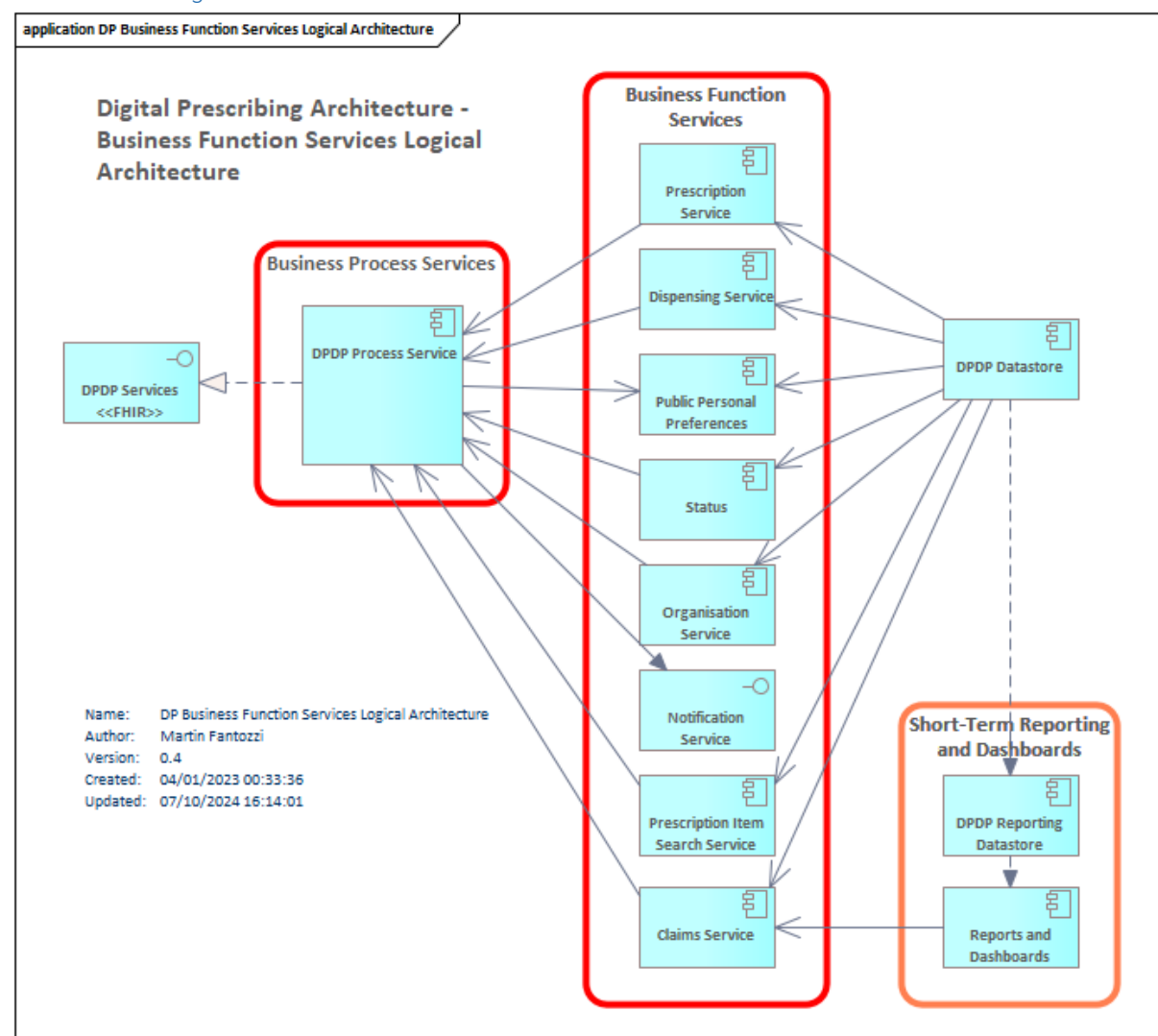
Business Function Services

The business function services are the implementation of the business functions that realise individual process steps and, in some cases, specific low-level capabilities. These services directly implement the individual functions such as validating and storing a prescription.

These services will each provide their own interfaces for the business process services to use. The services will use a mix of synchronous and asynchronous invocation models. Their internal architecture will be tier-based, with bounded contexts and each having its own data service, which will not be directly available to other services. There will be a reference architecture to describe this service architecture.

The core implementation technology used for the business processes will be micro-service based, using an appropriate MSA technology platform. These services will each have a bounded context and incorporate data versioning; this will have a direct implication for the data architecture. Refer to the Data Architecture section.

Not all the functional services will be delivered as part of the MVP release; those services will be developed as part of subsequent product releases of DPDP.

Architecture Diagram

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Component Descriptions

Prescription Service

The prescription service will provide the business functions for adding, changing, cancelling and annotating a prescription or prescription item. It will also provide the necessary functions for retrieving prescription information, specifically to realise the capabilities for:

- retrieving a full prescription;
- retrieving a patient's prescription history;
- more complex queries of prescription data.

In addition, it will provide functionality for retrieving a list of prescriptions and items to be sent to a pharmacy PMR system, as well as accepting an item back from a PMR system that cannot be dispensed for reasons such as a low stock level.

Prospective flexible repeat prescribing models including the ability for a CP to order repeat items, more flexible intervals and durations for repeat items, and the ability for a pharmacist or for surgery staff to approve some repeat requests, will be part of this service. However these capabilities have not yet been finalised and more complex repeat prescribing – beyond the current capabilities of the previous ePMS system – will be provided in later releases of DPDP.

Dispensing Service

The dispensing service will provide the business functions for recording dispensed items for a patient, using the prescribed items as the basis for dispensing. This will include changing the dispensed item from that which was originally prescribed, and annotating an item. In the former scenario, the dispensing service will not attempt to enforce rules about what changes are acceptable – it is up to the PMR system and the pharmacist to decide when changes are legally and clinically appropriate. The dispensing service will also provide the necessary functions for retrieving dispensed item information, specifically to realise the capabilities for:

- retrieving a patient's dispensed items' history;
- more complex queries of dispensed item data.

Status Service

This service will provide the business functions to retrieve and change the status of a prescribed or dispensed item.

The current status of an item is a critical piece of information that controls the allowable changes and operations that can be carried out on that item. It also provides important contextual information to the prescriber and dispenser as to whether something has been dispensed, collected, claimed for, etc. The capabilities to retrieve the status of a prescription or item and to update that status will be provided as part of this service.

Organisation Service

This service provides the registration capabilities for prescribing and dispensing organisations using the DPDP service. At the time of production of this document some aspects of ensuring secured, authorised communication are still being finalised. At a minimum the organisation within which a prescriber or dispenser works must be registered, with at least the following information recorded:

- a basic description of the prescribing organisation and their organisation code;
- a basic description of the dispensing organisation, their organisation code and location information;

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- technical, networking and security information for an organisation such as which endpoints are authorised to send and receive prescription data.

Prescription Item Search Service

The prescription item search service will provide a discrete service for complex searches over the prescribed and dispensed items for a patient. It will provide a number of ways to search, which are detailed in the appropriate user stories. A search will return a result set of patients, prescriptions or items based on the entered search arguments. Data contents will be based on the type of search requested, for example just a status, or a full medication item record, or the item and its audit history

Note that executing a search and returning a result set will not result in the changing of the status of any items nor marking an item as being transferred to a CP. Search services can be used by a variety of actors in different settings, such as a GP surgery, CP, etc.

Claims Service

This service will provide the business functions to receive claims from the PMR system, update the status as appropriate, and transfer the claims information to the nDCVP system operated by the PSD group within NHS NSS. It will also provide PMR access to the claims items reconciliation report. See the Existing NHS Systems section for details of the existing PSD systems.

Patient Personal Preferences Service

This service the holds the specific preferences for an individual for whom prescriptions are issued. These preferences include:

- the contact details for notifications;
- their nominated pharmacy if they have one;
- a nominated collector if they have one.

Note that this will not be implemented within the MVP release of the overall service. Refer to the Delivery Phases section for more information.

Notifications Service

The notification service will provide the business function for sending notifications to members of the public regarding the current status of a prescription. The type of notification will be configurable based on an individual's preferred notification mechanism. This will include in-app notifications and SMS messaging choices.

The notification service will use at least one, and probably more than one, COTS or govt-supplied service to provide its capabilities. Each notification channel may have its own implementation service.
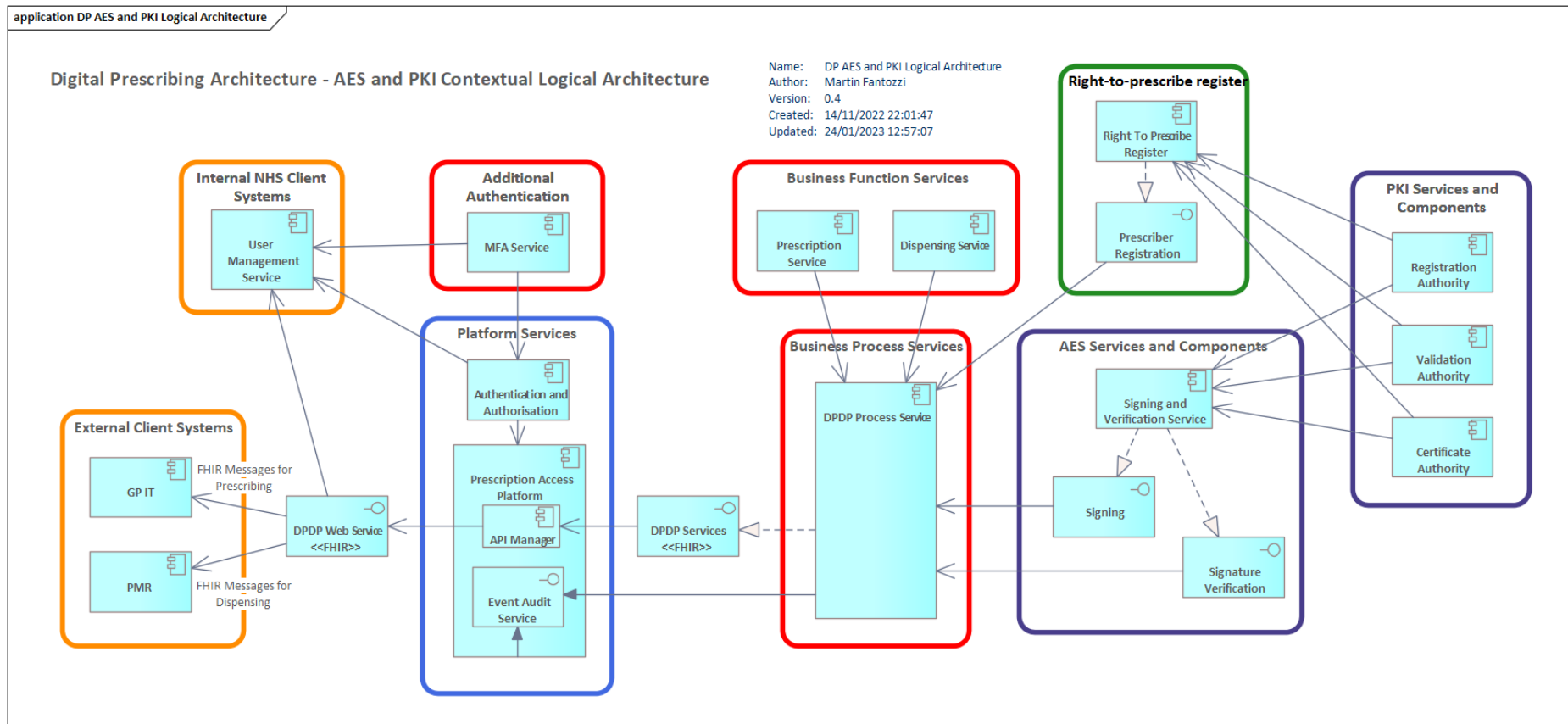
Note that this will not be implemented within the MVP release of the overall service. Refer to the Delivery Phases section for more information.

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AES and PKI Services

The AES service is fundamental to the paperless prescribing process and uses a set of public key infrastructure (PKI) components to provide a certificate-based encryption service with non-repudiable digital signatures for each prescribed item. The use of PKI to provide the appropriate certificate issuance, management and verification was mandated by Gartner as part of their report into the use of AES within the context of DPDP [6].

The Registration Authority and its dependency on the Prescriber Registration service will be further broken down with detailed architecture and collaboration diagrams once the DPDP onboarding process has been agreed and the PKI supplier chosen. However the PKI and AES signing services will be sourced externally and their internal architecture will not be further elaborated upon within this section. The Gartner study commissioned by the DPDP programme provides an effective overview of PKI architecture if more detail is required [6].

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Architecture Diagram

Digital Prescribing Architecture - AES and PKI Contextual Logical Architecture

application DP AES and PKI Logical Architecture

Name: DP AES and PKI Logical Architecture
Author: Martin Fantozzi
Version: 0.4
Created: 14/11/2022 22:01:47
Updated: 24/01/2023 12:57:07

DPDP Solution Architecture Description

Component Descriptions

PKI Components

The following components are intrinsic to PKI and will be provided by the selected PKI vendor. A brief description of each is included. Note that these are just the three main components of interest and that there are a number of other critical and non-critical components in a typical PKI deployment.

Registration Authority (RA)

The RA validates the identity of the registered entity, in this case the registered user of the DPDP service. This will work in conjunction with the prescriber registration service, which will hold details of the named prescriber. Registration with the RA will trigger the creation of a key pair and certificate for the prescriber.

Certificate Authority (CA)

The CA issues certificates based on the information held by the RA.

Validation Authority (VA)

The VA will perform validation of the prescriber using their public key, checking that and the prescriber's certificate against the directory of active certificates and the list of revoked certificates as well. This will be part of the verification of an AES signature.

AES Services and Components

Signing and Verification Service

The signing and verification service will provide the AES signature generation and signature verification operations. These will both use the services of the CA and VA to ensure that certificate for the prescriber remains valid and has not been placed on the revoked certificate list. The signing service will generate the AES for the provided prescription item. The signature verification service will check that an AES signature for an item is valid and that the prescriber's certificate remains valid.

Signing API

The signing service will only be available to business processes via this signing API.

Signature Verification API

The signature verification service will only be available to business processes via this signature verification API.

DPDP Solution Architecture Description

IAM and the Prescriber Registration Service

The identity and access management (IAM) platforms and prescriber registration service are intrinsic to the security and non-repudiation capabilities of the solution. These are linked in terms of the business process needed to onboard users, which must cover adding a DPDP user to the core user directory service, enrolling users with the role of prescriber within the additional authentication service, and adding prescribers to the register of allowed prescribers. The registration of prescribers within DPDP will also trigger the creation of an entry within the AES registration authority (RA) and the generation of an x.509 certificate and key pairs.

Architecture Diagram
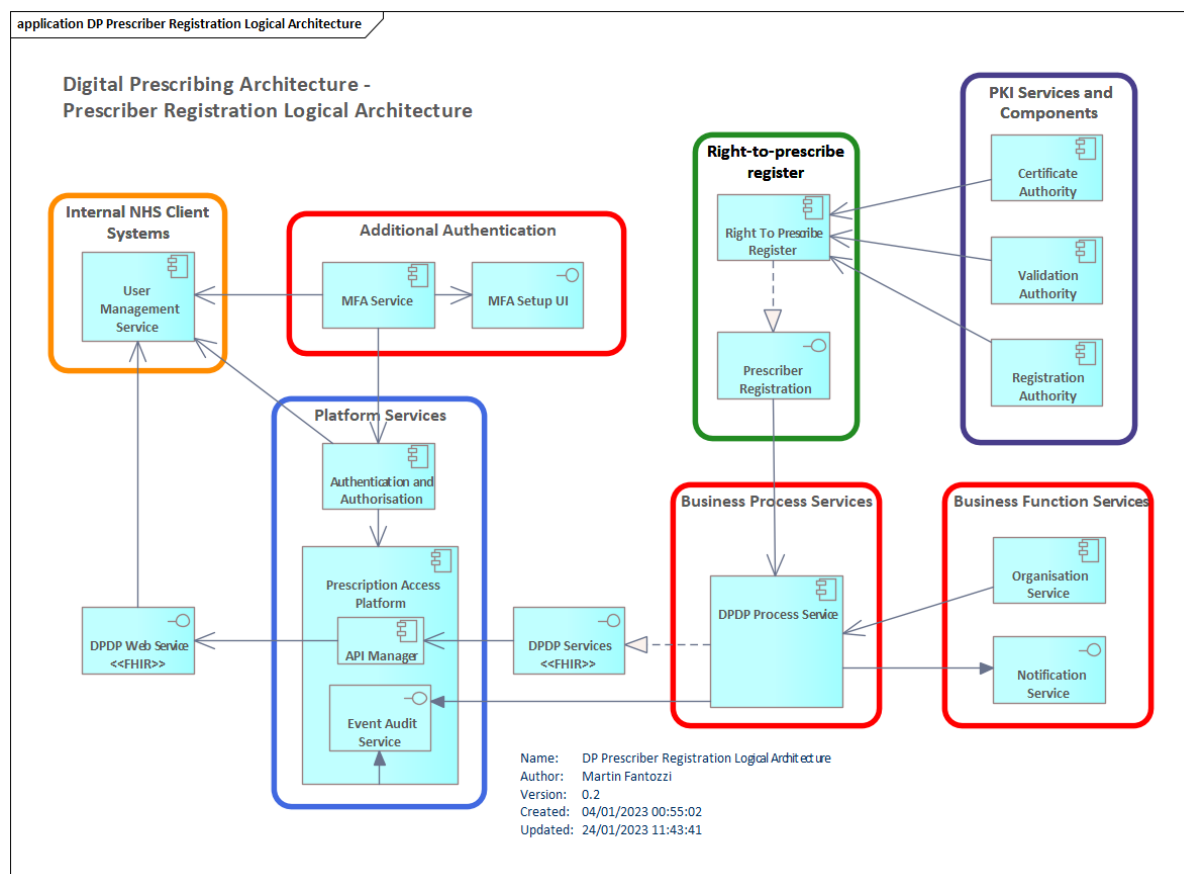
Component Descriptions

Authentication and Authorisation

The authentication and authorisation service is directly integrated with the healthcare platform and is the core element of IAM. The specific will be the Microsoft 365 IAM service. This will be accessed via Amazon AWS Cognito. All users will require to be enrolled using an nhs.scot domain user name, and will have one or more roles attached to them. These roles will be used by the Role-Based-Access-Control (RBAC) aspect of the healthcare platform to ensure that users can only attempt to perform activities for which their role(s) have authority.

Refer to the Integration with Amazon AWS Cognito and AAD subsection for more details regarding the integration of the healthcare platform with IAM.

MFA Service – Additional Strong Authentication

Users who are defined as prescribers will have the prescriber role associated with themselves. This role will allow access to the ability to digitally sign prescription items amongst other capabilities.

DPDP Solution Architecture Description

Those users will be required to authenticate using strong, multi-factor authentication (MFA). The IAM service will be configured to ensure that there is an appropriate policy stipulating that prescribers must provide the additional authentication factor in order to be able to access the digital signing service.

The form of MFA to be used will be based on a security risk assessment, a set of observations from Gartner, and an options study of the products and services available. It is possible that there will be some form of notification sent to the prescriber to inform them to set up their additional authentication factor, along with an additional MFA setup user interface and service to enable them to do this.

Prescriber Registration Service

The prescriber registration service will be used to contain the details of a prescriber and their professional, legal registration status. It will be used in conjunction with the RA to verify that an authenticated prescriber has the right to digitally sign prescription items.

The prescriber registration service is responsible for all aspects of registering the prescriber for DPDP, including adding Active Directory entries, adding the prescriber to the PKI RA, requesting an x.509 certificate from the PKI CA, and storing the additional registration information needed by DPDP. The information held includes:

- Their current status as a prescriber, which will be at least;
    - Active,
    - Suspended,
    - Inactive;
- Professional registration body and number, such as NMC and associated PIN number;
- Prescriber code as used by the PSD services;
    - This prescriber code is intrinsically linked to the organisation within which the prescriber works, such as a GP surgery or the Scots ambulance service.
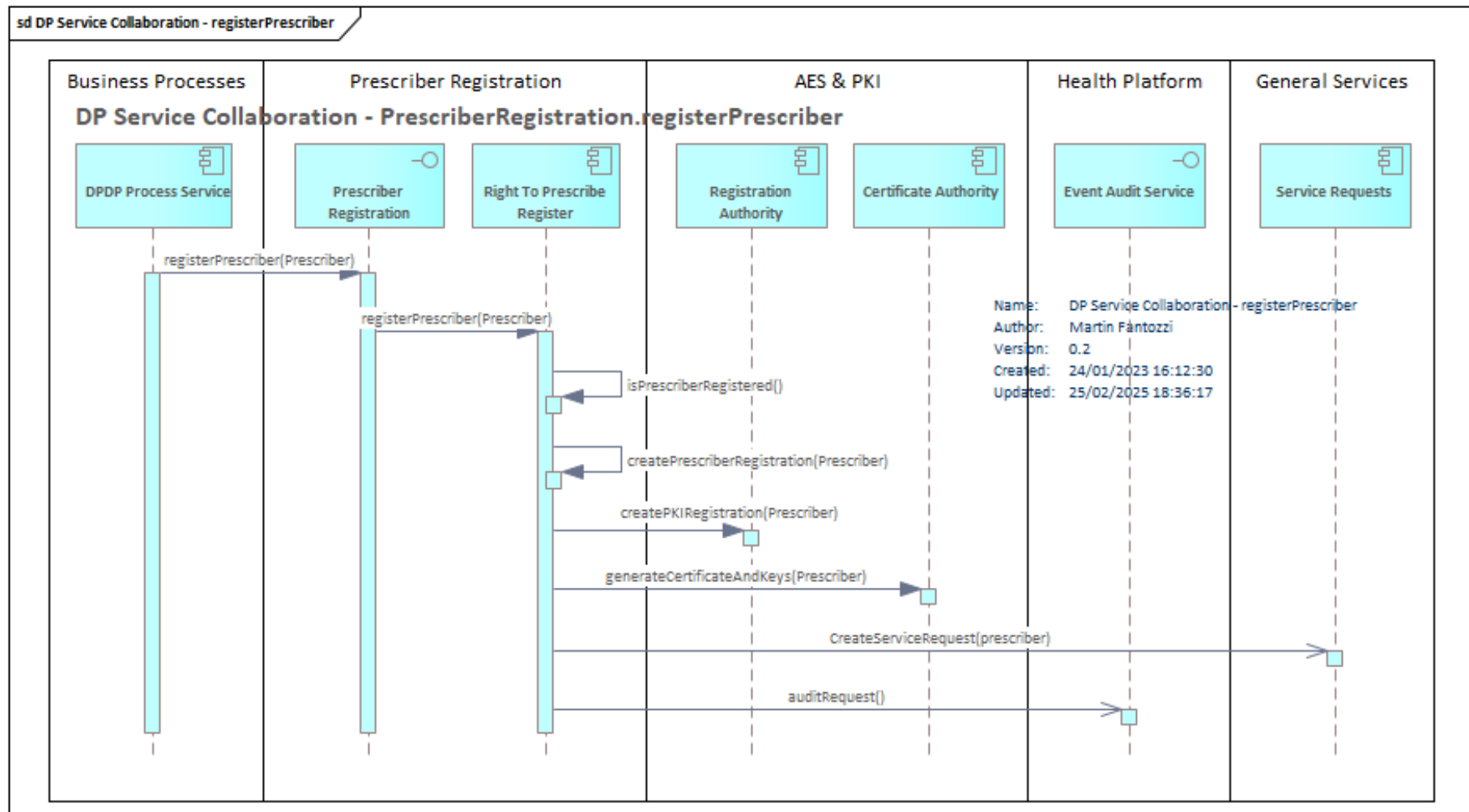
The prescriber registration service will be populated and maintained as part of the prescriber onboarding process and Joiners/Movers/Leavers (JML) processes used within NHS Scotland health boards.

Prescriber Registration Dynamic Logical Architecture
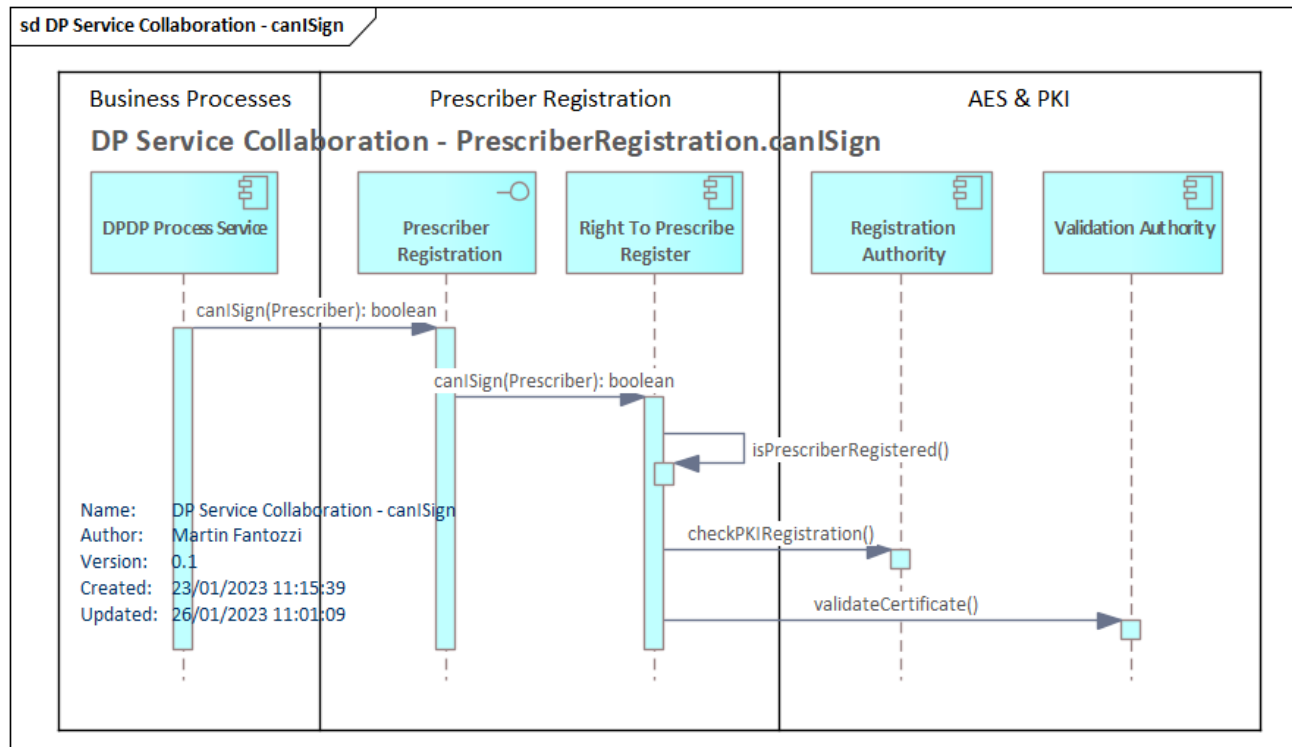
The following collaborative interactions – the dynamic view of the architecture – show the expected realisations of both the prescriber onboarding and the "Can I sign?" service operations as sequence diagrams.

The services will be invoked using a combination of synchronous (request-response) and asynchronous (publish-subscribe or pub-sub) invocations based on the specific behaviours required.

Register Prescriber Collaboration Diagram

sd DP Service Collaboration - registerPrescriber

DP Service Collaboration - PrescriberRegistration.registerPrescriber

Business Processes	Prescriber Registration		AES & PKI		Health Platform	General Services
DPDP Process Service	Prescriber Registration	Right To Prescribe Register	Registration Authority	Certificate Authority	Event Audit Service	Service Requests

registerPrescriber(Prescriber)

registerPrescriber(Prescriber)

Name: DP Service Collaboration - registerPrescriber
Author: Martin Fantozzi
Version: 0.2
Created: 24/01/2023 16:12:30
Updated: 25/02/2025 18:36:17

isPrescriberRegistered()

createPrescriberRegistration(Prescriber)

createPKIRegistration(Prescriber)

generateCertificateAndKeys(Prescriber)

CreateServiceRequest(prescriber)

auditRequest()

DPDP Solution Architecture Description

Can I Sign? Collaboration Diagram

DPDP Solution Architecture Description

Prescriber Registration Architectural Dependencies

The prescriber registration (RtP) service, whose physical architecture is primarily defined in [9], is dependent on the AES and PKI services in order to fully register a prescriber and generate appropriate RA entries, key pairs, certificates, etc. In addition it will have a dependency on the organisation service to define which health boards a prescriber is authorised to prescribe on behalf of. The prescriber must be set up to use MFA and have an appropriate MS Entra prescriber role associated with their account, which must be performed by the appropriate security administrator, so there is an additional dependency on the programmatic capability to raise a service request to that team. It will also use a relational database platform (RDBMS) rather than a data platform that is optimised for message-style data entities.

Post-MVP it is intended that the RtP service will use provided APIs from professional healthcare workers' registration bodies, such as the GMC, NMC, etc, to verify whether an individual has a current right to prescribe based on their registration details, subject to such a body offering that service.

DPDP Solution Architecture Description

Client Architecture

The DPDP service is based on an API-centric architecture, with very few user interfaces of its own. The majority of interactions with the service occur via a FHIR API and are initiated within external client systems. Public access will be via a mobile app, probably based on the Digital Front Door initiative. There are some master data update capabilities that are provided by internal, browser-delivered pages, and it is also expected that some external client user interfaces will be provided by third-party vendors for MFA setup and direct messaging capabilities.

The API interface used by most of the clients will be published via a common endpoint within the Prescription access platform using FHIR-based message data standards. The operations available via the API will be secured and utilise role-based authorised access based on the roles defined within the Actors and Roles section of this document.

Architecture Diagram
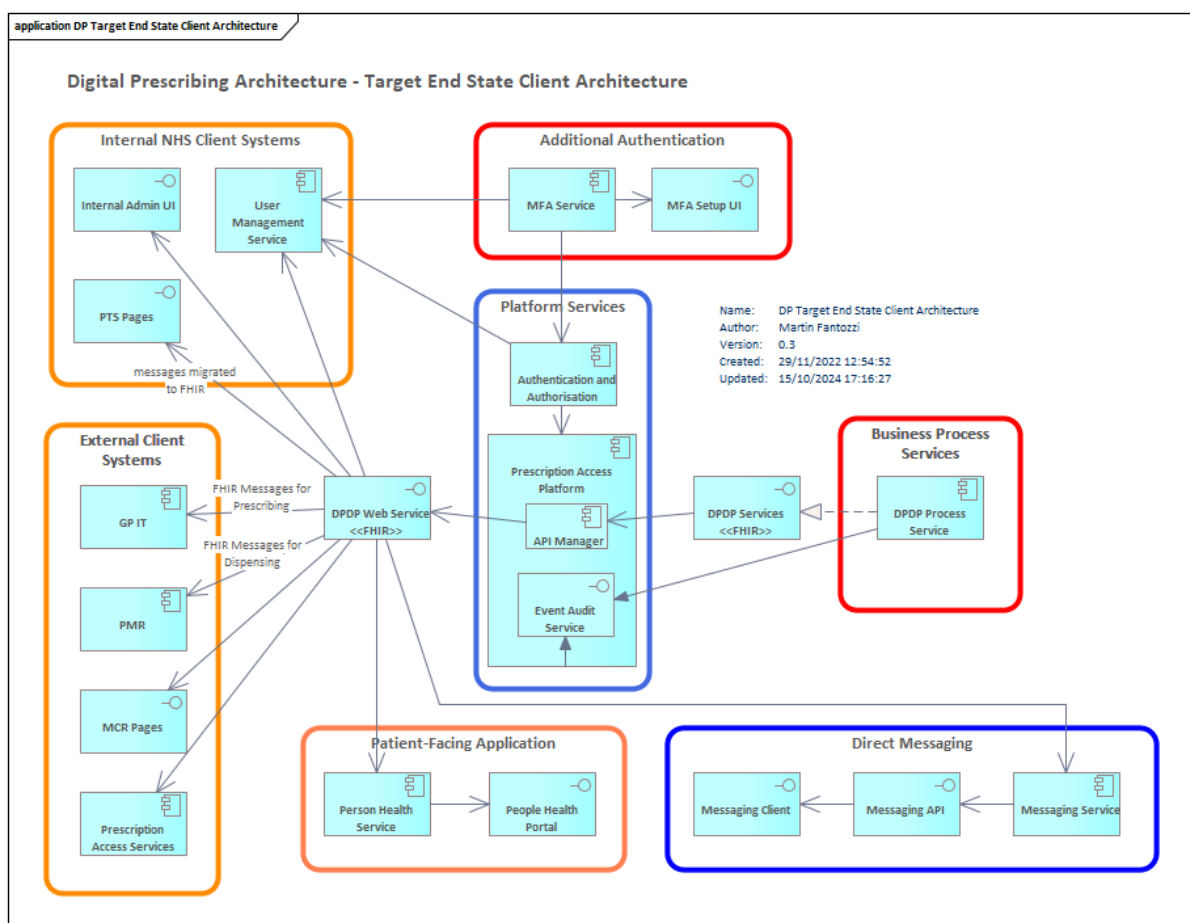
Component Descriptions
Internal NHS Client Architecture

The internal NHS client systems are user interfaces provided by the DPDP programme either for use by enrolled users of the DPDP service, such as the prescription tracker service (PTS) or for internal administration and data management, such as maintaining dispenser organisations.

The internal NHS clients will provide:

- Management capabilities for maintaining data about enrolled prescribing and dispensing organisations;

DPDP Solution Architecture Description

- External user onboarding for all such users, assigning roles such as prescriber, dispenser;
  - An additional API interface is expected to be used to allow the registration of prescribers with a strong (MFA) authentication service;
- A Prescription tracking service with basic status enquiry capabilities.

These clients will be simple and browser-delivered. The prescription tracker operation on the DPDP API will also be available for external client systems to allow direct integration into an external client UI if desired.

External Client Architecture

The external client architecture represents the external systems that access the DPDP service. The major external systems that are currently known are the GP IT and PMR systems, however it is expected that other systems will use the DPDP services as further phases of DPDP are delivered.

Whilst the external clients in the External Client domain in the diagram above are shown as very simple service consumers, in reality they are complex and provide a large set of capabilities and processes to their respective end-users. The DPDP service will provide a relatively simple interface that must be integrated into their respective prescribing, dispensing and related workflows.

Note that the legacy ePMS adapter – necessary for connecting to the old ePMS service from external systems – is not part of the DPDP service architecture.

Additional Authentication

The additional authentication domain has been included within the description of the external clients as there will be a setup UI for the additional authentication factors for the MFA solution, as well as the UI component for a user to enter their additional authentication secret during the authentication process. These client UI components will almost certainly be provided by a third-party vendor.

Refer to the IAM and the Prescriber Registration Service subsection for information.

Patient-Facing Application

This domain represents the public's access point for:

- Prescription information;
- Current prescription status, such as whether it is ready to be collected;
- Capabilities to allow them to change preferred pharmacy, notification preferences, etc;
- Links to online versions of information regarding their prescribed medication or items, such as the suppliers' websites and NHS websites.

The user interface will be delivered as a mobile app in the first instance and is likely to be based on the Digital Front Door initiative and therefore should access DPDP services via the NDP platform. The architecture does not preclude the additional creation of a website more suitable for PC and laptop users.

Refer to the Patient-Facing Application subsection for information.

Direct Messaging

The requirement for direct messaging is that it should allow direct, "chat" style messaging from one user of DPDP to another. This is driven by the requirement for dispensers to be able to talk directly to prescribers when resolving queries with a prescription, rather than relying on email communication or being routed via a surgery switchboard, and is intended to complement rather

than replace those communication routes. The direct messaging client user interface will probably be provided by a third-party vendor.

Refer to the Direct Messaging Service subsection for information.

DPDP Solution Architecture Description

Patient-Facing Application

The patient-facing application domain contains the services, components and platforms necessary for the general public to have access to DPDP services and additional externally-sourced information. This access will be, at a minimum, via a mobile app, however this could be extended to include a website suitable for PCs and desktops at some point.

Access to the app will require a member of the public to download the app to a compatible mobile device, register to use the app by verifying their identity and setting up a user account, then sign into the app. It is likely that this will be an extension of the Scots govt Digital Front Door initiative.

Architecture Diagram
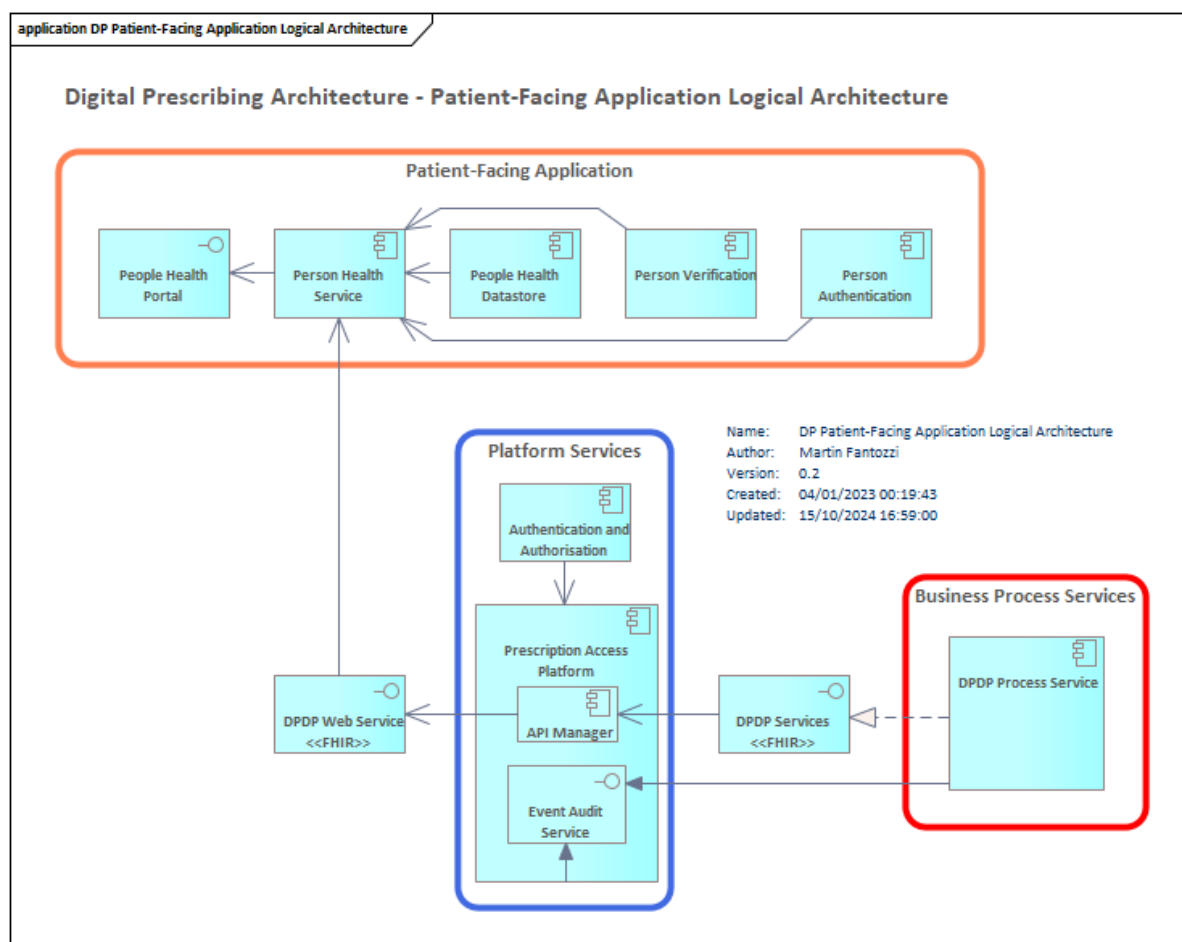
Component Descriptions

Note that the components below are theoretical components that implement the overall architecture and business requirements, and do not directly map to the diagram. Most of the intrinsic capabilities will be embedded within the 'Person Health Service' component above.

Mobile Device App

This will largely realise most of the components in the patient-pacing box above. The mobile device app will be allow a member of the public to access to their prescription history, including items, links to the online patient information leaflet, NHS website, and the status of all recent prescriptions. It must be compatible with the major mobile platforms for the commonly used releases of their operating systems.

The app will provide:

DPDP Solution Architecture Description

- in-app notifications for prescription notification messages sent by DPDP, such as the notification that prescription items are ready for collection;
- the ability for the public to change specific personal preferences, such as selecting their preferred pharmacy using a maps-based control to find their nearest CP.

The current assumption is that the primary channel for the public to access their own prescription information will be part of a wider public enablement of access to personal healthcare information held by NHS Scotland. This will probably be based on the Scots govt (SG) digital front door initiative.

The app will need to apply appropriate security and information governance (IG) protocols, such as encrypting any locally-held data. The app will also need to conform to WCAG and Digital First accessibility and service design guidelines (refer to Appendix A – Architectural Principles).

All access to the mobile app will be authenticated with all users having been identity-verified.

Website for Prescription Information

It is possible that there will also need to be a browser-delivered website suitable for PCs and laptops for those that will not or cannot access information via a smart mobile device. This will provide the same prescription information as provided by the mobile app.

At the time of production of this document it is not known if this can be delivered as part of the SG digital front door nor what measures could be taken to verify users' identity via a browser-based user interface.

Verification Service

It is assumed that the digital front door platform will include an appropriate user verification service to allow members of the public to prove their identity as part of the account setup process. This will not be developed as part of the DPDP programme but is an essential part of the IG controls that must be in place to allow the public to access their healthcare information.

Authentication Service

The authentication service will be provided as part of digital front door. This will not be developed as part of the DPDP programme but is an essential part of the IG controls that must be in place to allow the public to access their healthcare information.

Separated Public API

The app will use a separate, public API tailored to the needs of the healthcare app. This API will access the DPDP services via the same healthcare platform as the other DPDP APIs and clients.

Direct Messaging Service

The requirement for direct messaging is that it should allow direct, "chat" style messaging from one user of DPDP to another. This is driven by the requirement for dispensers to be able to talk directly to prescribers when resolving queries with a prescription, rather than relying on email communication or making phone calls routed via a surgery switchboard. It is intended to complement rather than replace those communication routes.

The direct messaging service will be a simple instant messaging solution allowing prescribers and dispensers to communicate directly, and it is expected that this will be provided in its entirety by a third-party vendor. The direct messaging platform is shown at a conceptual level in this diagram. Key characteristics will be:

- the ability to chat to other enrolled users of DPDP in a secure and confidential manner;
- resilient message storage with retention of messages based on appropriate NHS Scotland and DPDP policies;
- each conversation being linked to a specific prescription or item to allow for full traceability.

The last point will allow retrieval of a conversation based on criteria such as the prescription identifier or CHI number. Retention, archival and deletion of the conversation for a specific item or prescription will be based on appropriate data storage policies and protected in line with Information Governance policies.

Architecture Diagram

Note that this is a high-level, conceptual architectural representation that assumes certain aspects of a generic, centralised and API-centric architecture. The actual physical architecture will be based entirely on a chosen vendor's product or service.
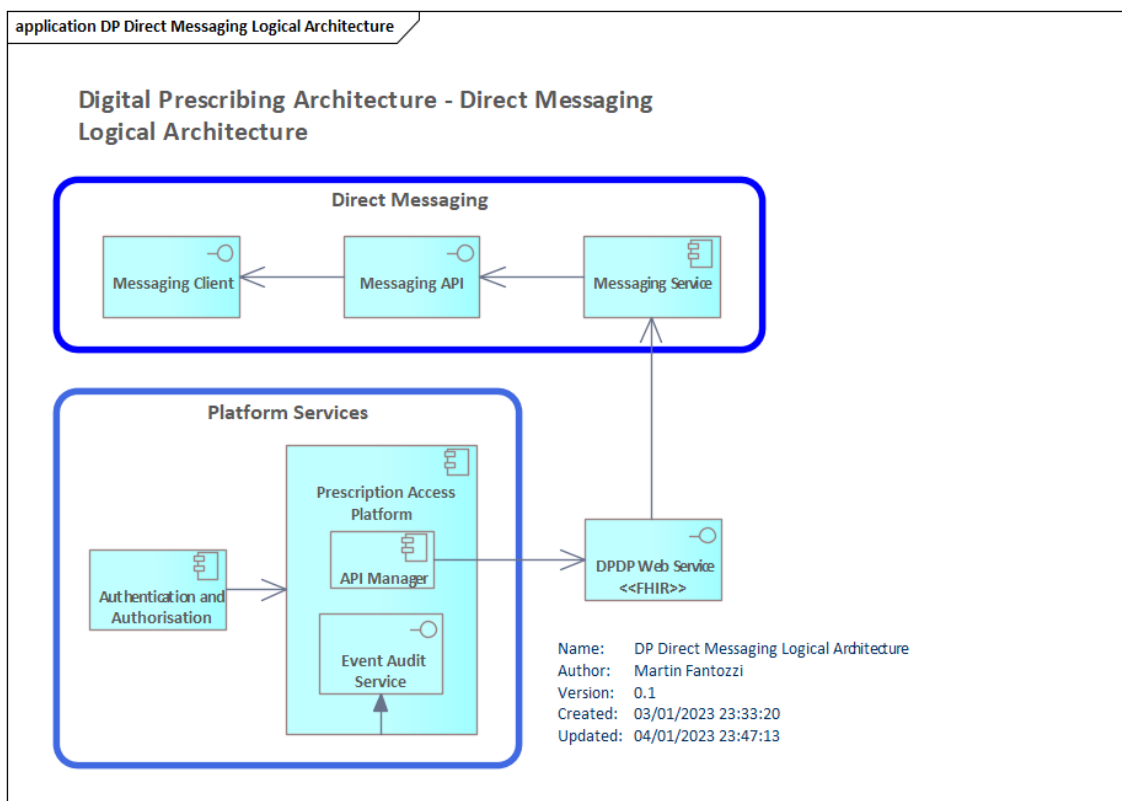
Component Descriptions

Direct Messaging Service

This is the centrally deployed direct messaging service. It will provide the messaging capabilities as well as persisting the message conversations in line with the appropriate retention policies. It is possible that this will be provided on a SaaS basis by the vendor of the service.

Direct Messaging API

This is the API that will provide controlled access to the direct messaging service.

It is currently assumed that this will integrate in some way with either an existing NHS Scotland IAM solution or allow some form of single-signon (SSO) based on authenticated access to the DPDP services.

Direct Messaging User Interface

This is the user interface provided for the users of the direct messaging service. It is expected that this will be provided by the vendor of the service.

Link to Prescription Items

The direct messaging service will require the ability to retrieve or receive the internal unique prescription item identifier and use it in such a way as to create a durable, persisted link from a specific conversation to the prescribed item. This will allow direct traceability from an item to any conversation that has occurred between the prescriber and dispenser with regards to the item.

DPDP Solution Architecture Description

General Services and Components

This section contains the "side-bar" components that will be used by all new services and components within the overall DPDP service. Those components are principally focused on common functions such as service health, security event monitoring and alerting, appropriate usage monitoring. They are also common services used across the broader technology landscape and are not restricted to use within DPDP.

Architecture Diagram
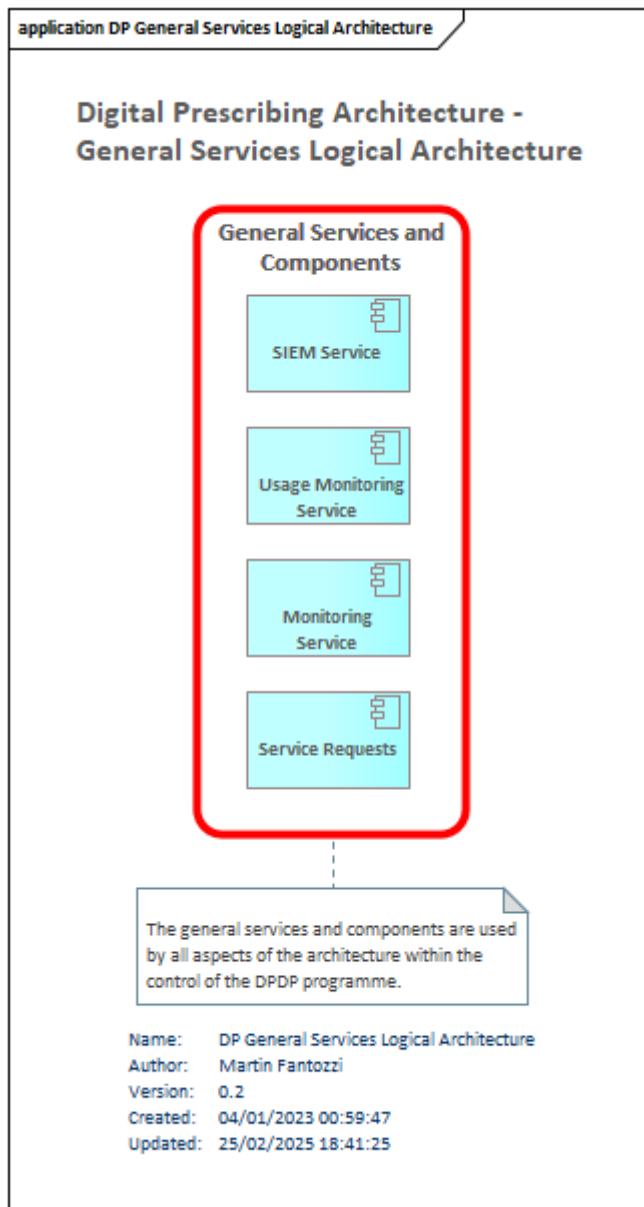
Component Descriptions

Service Monitoring

Service health monitoring provides key metrics and alerting capabilities for service performance. It is expected that this will be enabled by default for all cloud-deployed DPDP services as part of the hosting cloud provider toolset.

The configuration of the service monitoring platform will be based on existing NSS and NES policies.

Security Information and Event Management (SIEM)

Security information and event management provides key security event alerting and management capabilities, integrating the SIEM events into a security operations centre (SOC). It is expected that this will be enabled by default for all cloud-deployed DPDP services as part of the hosting cloud provider toolset, with direct integration to the NSS SOC.

The configuration of the SIEM platform will be based on existing NSS and NES policies

Appropriate Use Monitoring

The appropriate use monitoring service will monitor access patterns and also access to particularly sensitive patient data such as high profile politicians and celebrities. Inappropriate use of the service to attempt to access medical data will result in warning alerts being generated and sent to specified endpoints. This service is likely to be the FairWarning platform that is already in use elsewhere within NHS Scotland.

Service Requests

The service requests service is the incumbent application used for raising service requests for the security and general IT admin teams to accept and act upon. At the time of this update of this document (February 2025) it is realised by the ServiceNow product, however that is under review and may be replaced before the DPDP is deployed. Service requests will be raised programmatically by the DPDP Right-to-Prescribe service for security administrators to add or change prescribers' accounts within MS Entra.

DPDP Solution Architecture Description

Existing NHS Systems

This subsection contains the specific NHS Scotland systems and services that currently are fed by ePMS file transfers and which will ultimately be replaced by direct DPDP data integration. This data integration will use common, flexible and resilient ETL (or ELT) platform technology.

Architecture Diagram
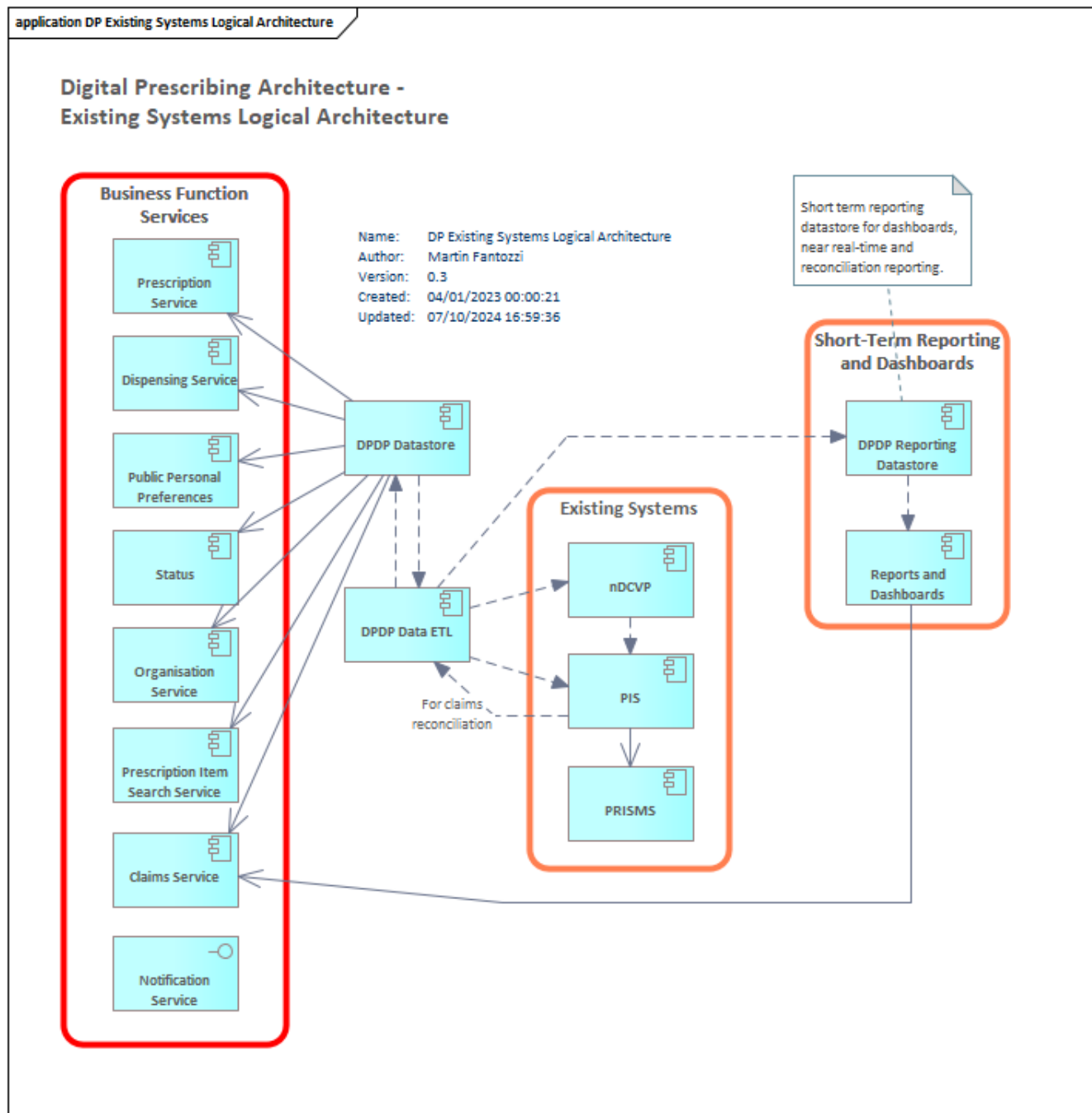
Component Descriptions

nDCVP

The new Data Capture, Validation and Pricing (nDCVP) system is a core system within the Practitioner Services Division (PSD) group of NSS. Post-MVP, within the context of digital prescribing, it will receive claims requests from the DPDP service directly from the DPDP datastores, using a COTS Extract-Transform-Load (ETL) driven process. This will use a data-tier ETL platform to

directly extract and send the data to the nDCVP datastore on a near real-time or scheduled basis, transforming that data from the DPDP format to a format appropriate to the target database platform.

Prescription Information Service (PIS) and PRISMS

These components are the existing reporting datastore (PIS) and BI/Reporting platform (PRISMS). The PIS data warehouse (DWH) is deployed within the Seer 2.0 platform, which is built on the Snowflake DBMS.

For MVP the following will be in place:

- existing systems will continue to be populated via ePMS;
- a data extract will be taken from the PIS DWH and used to supplement the claims data held by DPDP – this data will then be used to generate the claims reconciliation reports required by pharmacies.

Post-MVP the datastore will be populated directly from the DPDP datastores using an ETL driven process, which will allow the removal of the Atos external data file extracts and the SFTP data integration path.

DPDP Solution Architecture Description

Reporting, Dashboards and Analytics Architecture

This subsection contains the short-term reporting and dashboarding architecture, including the data sources that feed into it at the data tier level. The data tier will use data level integration capabilities provided by a common, flexible and resilient ETL (or ELT) platform technology.
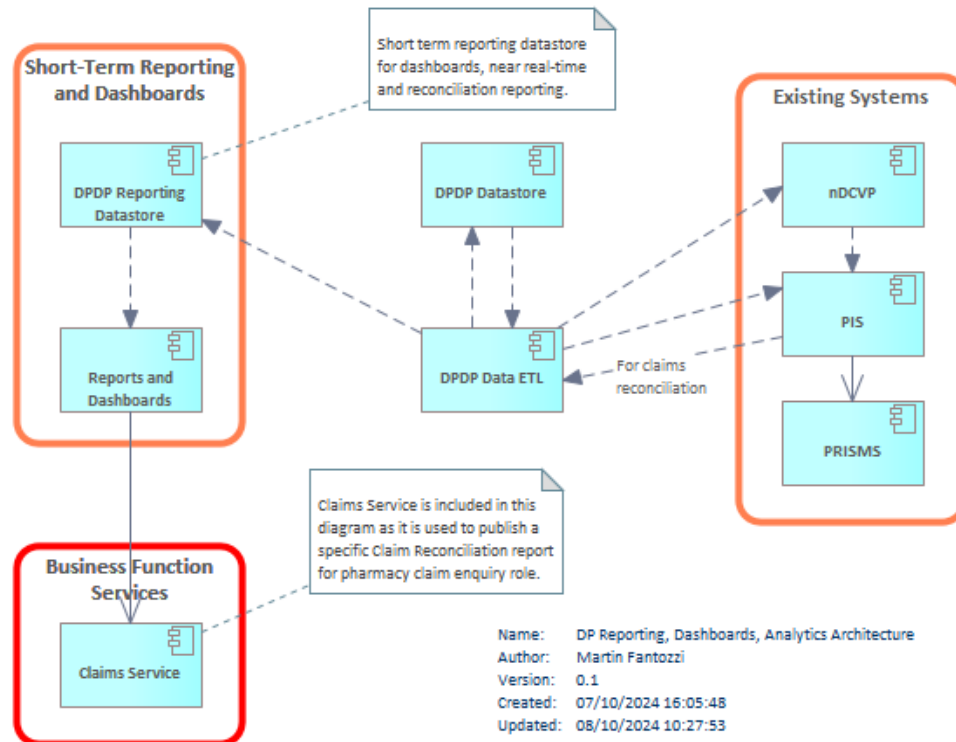
Data is written to the DPDP datastore by DPDP microservices, and will transferred using the ETL platform to the PIS DWH and the DPDP reporting datastore. Claims data is also fed from the DPDP datastore to nDCVP for claims payment processing. Processed claim data is fed from nDCVP into the PIS DWH using existing processes, then will be extracted to the DPDP reporting datastore using the ETL platform for claim reconciliation reporting.

Strategic analysis and reporting still handled by PIS and PRISMS, with that data containing both prescribed and dispensed item information.

In the long term it is expected that short-term reporting might be transferred to Seer 2.0, however there is no such capability for this within that platform at this point in time.

This subsection has some crossover architectural points with the DPDP Data Architecture [10], specifically around chosen implementation technologies for the short-term reporting datastore and ETL/ELT platform.

application DP Reporting, Dashboards, Analytics Architecture

**Digital Prescribing Architecture -
Reporting, Dashboards, Analytics Architecture**

Short term reporting datastore
for dashboards, near real-time
and reconciliation reporting.

**Short-Term Reporting
and Dashboards**

DPDP Reporting
Datastore

DPDP Datastore

Existing Systems

nDCVP

Reports and
Dashboards

DPDP Data ETL

For claims
reconciliation

PIS

PRISMS

Claims Service is included in this
diagram as it is used to publish a
specific Claim Reconciliation report
for pharmacy claim enquiry role.

**Business Function
Services**

Claims Service

Name: DP Reporting, Dashboards, Analytics Architecture
Author: Martin Fantozzi
Version: 0.1
Created: 07/10/2024 16:05:48
Updated: 08/10/2024 10:27:53

Component Descriptions

DPDP Reporting Datastore

The DPDP reporting datastore will contain short-term and aggregated data suitable for dashboard and localised reporting. The primary source of this data will be the DPDP datastore, however the reporting datastore will include summary claim data sourced in part from the PIS DWH.

The data architecture is defined in more detail in [10].

Reports and Dashboards

The reports and dashboards consist both of a number of reports and also graphical dashboard devices showing short-term views of data from within the reporting datastore. This component

DPDP Solution Architecture Description

includes both the definitions of the reports, dashboard devices, etc, and the presentation mechanism for displaying the data.

The data architecture is defined in more detail in [10].

nDCVP

Refer to the Existing NHS Systems above for a brief overview of the source nDCVP system for the processed claim data in the PIS DWH.

Prescription Information Service (PIS) and PRISMS

In the context of DPDP reporting, the PIS DWH is the source of processed claim data that is transferred to the DPDP reporting datastore.

The PIS data warehouse (DWH) contains long-term analytical, aggregated and other forms of data relating to prescribing and dispensing throughout NHS Scotland. Post-MVP it will be populated directly using the DPDP ETL platform. For MVP it will continue to be populated via ePMS extract files.

Refer to the Existing NHS Systems above for a brief overview of the PIS DWH data repository for the PSD-processed claim data.

DPDP Solution Architecture Description

Solution Architecture Mapping to Business Architecture

Solution Architecture – Mapping Services and Components to Business Processes and Functions

tbc

Solution Architecture – Mapping Key Business Interfaces to Roles

Tbc based on mapping spreadsheet.

Integration Architecture

(Diagram)

(check notes on options - [Options](#))

Overall diag of integration framework

API endpoint management options

Refer to use of NDP

Workflow

Refer to use of processes defined in MSA

Asynch and events

Refer to EDA and use of event streaming

Service Mapping

Data Tier Integration

ETL options and tools – brief options paper??

DPDP Solution Architecture Description

Architectural Dependencies

Delivery Phases

The overall DPDP programme will be split into a number of major delivery phases. At the time of drafting this document the only agreed delivery is for the minimum viable product. The remaining delivery phases described herein are based on specific aspects of the architecture and grouping of related capabilities. These may be consolidated into combined deliveries dependent on business priorities and NHS Scotland or Scots Govt need.

The following diagrams show the architecture of the MVP delivery followed by the other delivery areas. The MVP deliverable has been defined based on the capabilities that are within scope for this specific delivery, principally enabling paperless prescribing and dispensing for prescriptions within an in-hours surgery setting. Subsequent deliveries will include the remaining capabilities, however the contents of a specific deliverable package are not defined here.

## Domain Architectural Variances within Deliveries

Some domains will undergo significant architectural change over the course of several deliveries. For those domains, the intermediate architectures are shown within this subsection.

As an example, the ePMS service will remain in place for prescribing until all client GP IT and PMR instances have been updated to use DPDP. The consequence of this is that there must be a degree of data synchronisation between DPDP and ePMS until ePMS is retired. This requires some changes to ePMS for all interim releases, and a final change to DPDP once ePMS is no longer in use. The architecture of this will be elaborated upon in the relevant subsection below.

Initial Delivery of the Minimum Viable Product (MVP)

The following diagram shows the architecture of the MVP delivery. The MVP deliverable has been defined based on the capabilities that are within scope for this specific delivery. Subsequent deliveries will include the remaining capabilities, which will be subject to amendment and prioritisation based on factors from both within and outwith the programme

DPDP Solution Architecture Description

Digital Prescribing Architecture - MVP Logical Architecture

DPDP Solution Architecture Description
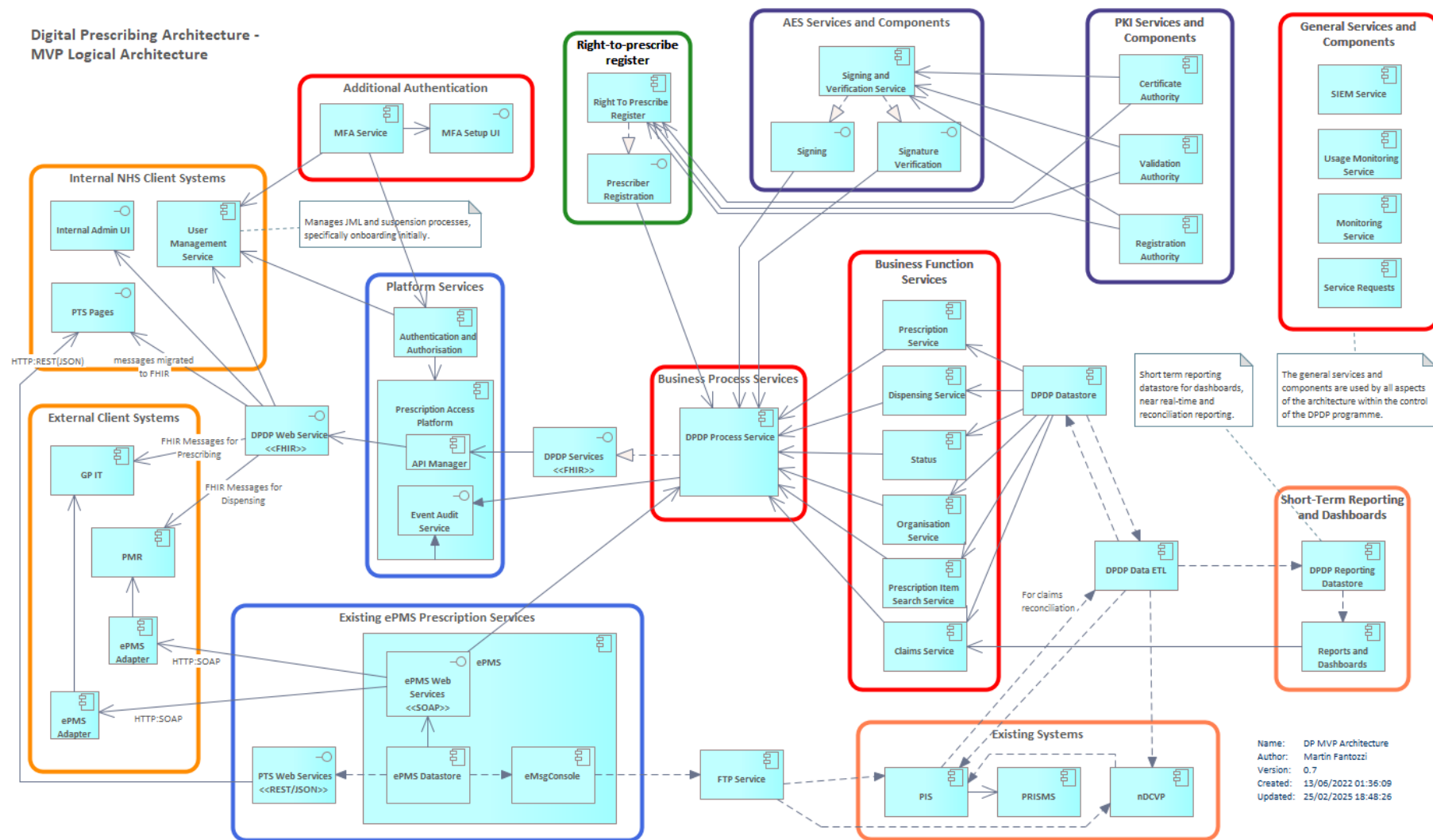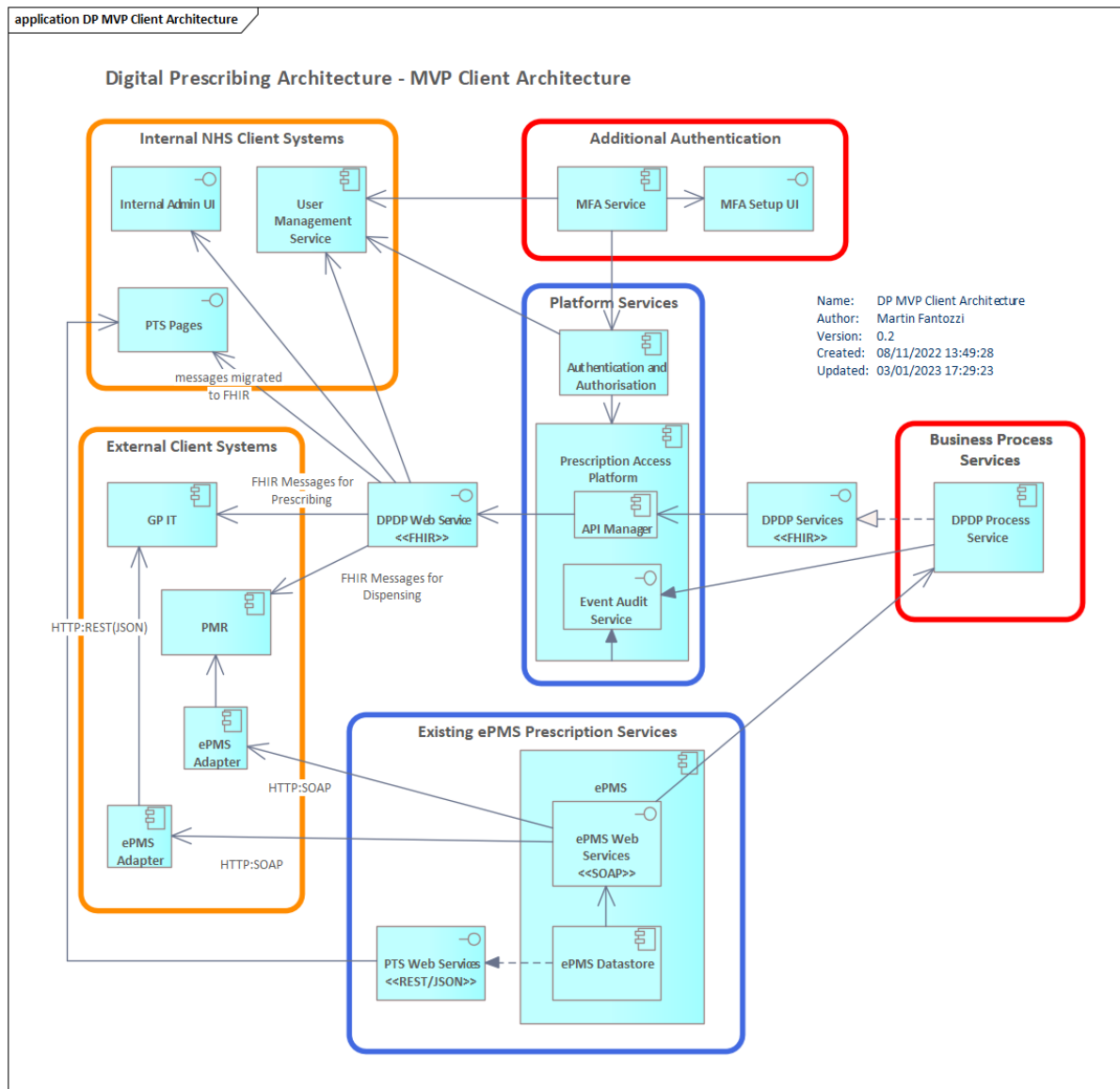
Parallel Running of the DPDP Service and ePharmacy (ePMS)

The decision was taken to replace ePMS with components for the DPDP and business services as a phased transition, with both ePMS and DPDP services running in parallel with service and data synchronisation ensuring both systems contain the full prescription dataset. The options and recommendation for this decision are presented in [4] and the SDA and TDA decisions based on this have been recorded in the decisions log [3].

Diagram for // running and service/data synch

Subsequent Deliverables

DPDP Solution Architecture Description

Note the following are potential sets of features within subsequent deliveries

- Serial prescribing; possible enhancements to repeats to hold repeat list within DPDP
- Public Access to Personal Medical Prescribing Information and Preferences
- Primary Care Prescribing outwith Clinical Settings and Secondary Care Access and Prescribing
- PFS registration and population

DPDP Solution Architecture Description

Appendices

Appendix A – Architectural Principles

The following architectural principles have been agreed for the programme and are aligned with the overall strategic architectural aims of NSS:

#	Principle	Description
1	Cloud-First	Presumption of Cloud-first for selecting deployment options. SaaS and PaaS approaches should be considered as appropriate in preference to IaaS.
2	Re-use First	Services, platforms and components will be sourced by considering, in priority order, re-using, repurposing, acquiring and building. Where we are not re-using an existing aspect then consideration should be given to ensuring there is potential for appropriate re-use of anything that is repurposed, acquired or built.
3	API-Centric	Solution architectures will be API-centric and allow for integration with mature and older systems.
4	User-needs Driven	The service architecture will be focussed on user needs and be driven by service design.
5	Componentised Architecture	The solution will utilise an n-tier, componentised architecture
6	Real-time Integration	The solution will use real-time integration patterns as appropriate
7	Open Standards	Open standards for data, interactions and technology will be used throughout where practical.
8	Security, reliability and IG Designed-in	Security, reliability and information governance will be designed and built into the solution by default.
9	Scalable, extensible, flexible	Long term scalability, extensibility and flexibility are key architectural goals.
10	Data as an Asset	Data is of significant value to the enterprise and the data architecture will reflect the need to be able to store, retrieve and analyse that data.
11	Digital First	Where applicable and appropriate, the SG Digital First principles will be applied to the service.

DPDP Solution Architecture Description

Appendix B – Significant NFRs

Just the key NFRs that have significant impact on arch

Appendix C – Suppliers and Systems

Prescriber systems

- Gp it
  - Cegedim vision anywhere
  - ~~Emis~~
- Adastra
- Hosp systems
- Non-clinical systems

Pmr systems

- List from spreadsheet

Existing epms

- atos

DPDP Solution Architecture Description