MMIV Research PACS/RIS Project Implementation

Hauke Bartsch, Dr. rer. nat.

Projects and data

December 05, 2019

Overview

This document describes the implementation of rDMA at Helse-Vest. This implementation was chosen to allow the full support of all use cases outlined in the "Target workflows" document from November 25th (last updated December 05).

The current implementation provides the basic functionality required to create new projects, import image data and give rDMA users access to their projects data. Three projects are actively importing. We have identified a list of 10 additional projects that can start forwarding data into rDMA.

A project is the top unit of control relevant for the data collection in the research PACS. A project specification shall contain:

- A unique and short more than 2 letter project specifier such as 'BICAM', 'ECTMRI' (capitalized, alpha-numeric).
- A unique project number[1] with the following pattern: P20_01 where 'P' is for project, '20' is for the year of project creation and '01' is a two character project number. Project year and project number should be separated by an underscore character. The assumption is that we will not have more than 99 projects per year. A realistic number of projects is approximately 20-30 per year.
- The REK approval number with start and end-date of the project.

[1] The short letter project specifier and the unique project number can be used interchangeable with a preference of the letter specifier to be used towards the research user and the project number to be used by the supporting hospital staff. The reason for having two identifiers is that the project number can be assigned without prior communication with the project owner.

- The pattern used to assign de-identified patient identifiers to study data. This is usually related to the letter project identifier and a numbering scheme. This identifier might also contain a numeric site code. Sections in the naming can be separated by underscore characters ('BICOM123').

Projects are collections of all imaging data related to a particular funded research project. In the Sectra PACS each project appears as a separate role worklist based on the InstitutionName. The setup of these worklists is part of the setup of a new project in Sectra together with the setup of a project role.

A user in the research PACS has a username and password. If a user has an account in the clinical PACS both username and password are assumed to be the clinical PACS username and password (LDAP). A user shall have access to a set of projects. This includes access to the image data in PACS and access to the patient meta-data in the research RIS.

Imaging research data that belongs to a project is organized by DICOM identifiers as study (unique study instance uid), series (unique series instance uid) and image (unique image instance uid). Further image data identifiers include the anonymized patient name, patient id and assigned project.

As we want to allow the reuse of data across projects (see target workflows) imaging data should be stored using the DICOM uids. The Sectra naming scheme for background storage of image data suggests that instance uids are not used to separate storage locations for image data. Instead the patient ID/patient name field appears in the storage path. This should be changed to allow the storage of study data for multiple projects. Submitting multiple versions of the image data of the same patient and study date seem to result in a single copy of the image data being stored (the first version). Changing the image data and generating new storage instance UIDs does not result in a new copy of the data (need to be fixed).

Anonymization procedure on image data involves the change of a number of imaging associated DICOM tags in the data. The anonymization is implemented by importing study data into the rDMA (see import of study data). The following table lists the currently used black-list scheme for anonymization based on the recommendations of the cancer imaging archive project.

```
{"0008", "0050", "AccessionNumber", "hash"},
{"0018", "4000", "AcquisitionComments", "keep"},
{"0040", "0555", "AcquisitionContextSeq", "remove"},
{"0008", "0022", "AcquisitionDate", "incrementdate"},
{"0008", "002a", "AcquisitionDatetime", "incrementdate"},
{"0018", "1400", "AcquisitionDeviceProcessingDescription", "keep"},
{"0018", "9424", "AcquisitionProtocolDescription", "keep"},
{"0008", "0032", "AcquisitionTime", "keep"},
{"0040", "4035", "ActualHumanPerformersSequence", "remove"},
{"0010", "21b0", "AdditionalPatientHistory", "keep"},
{"0038", "0010", "AdmissionID", "remove"},
{"0038", "0020", "AdmittingDate", "incrementdate"},
{"0008", "1084", "AdmittingDiagnosesCodeSeq", "keep"},
{"0008", "1080", "AdmittingDiagnosesDescription", "keep"},
{"0038", "0021", "AdmittingTime", "keep"},
{"0010", "2110", "Allergies", "keep"},
{"4000", "0010", "Arbitrary", "remove"},
{"0040", "a078", "AuthorObserverSequence", "remove"},
{"0013", "0010", "BlockOwner", "CTP"},
{"0018", "0015", "BodyPartExamined", "BODYPART"},
{"0010", "1081", "BranchOfService", "remove"},
{"0028", "0301", "BurnedInAnnotation", "keep"},
{"0018", "1007", "CassetteID", "keep"},
{"0040", "0280", "CommentsOnPPS", "keep"},
{"0020", "9161", "ConcatenationUID", "hashuid"},
{"0040", "3001", "ConfidentialityPatientData", "remove"},
{"0070", "0086", "ContentCreatorsIdCodeSeq", "remove"},
{"0070", "0084", "ContentCreatorsName", "empty"},
{"0008", "0023", "ContentDate", "incrementdate"},
{"0040", "a730", "ContentSeq", "remove"},
{"0008", "0033", "ContentTime", "keep"},
{"0008", "010d", "ContextGroupExtensionCreatorUID", "hashuid"},
{"0018", "0010", "ContrastBolusAgent", "keep"},
{"0018", "a003", "ContributionDescription", "keep"},
{"0010", "2150", "CountryOfResidence", "remove"},
{"0008", "9123", "CreatorVersionUID", "hashuid"},
{"0038", "0300", "CurrentPatientLocation", "remove"},
{"0008", "0025", "CurveDate", "incrementdate"},
{"0008", "0035", "CurveTime", "keep"},
{"0040", "a07c", "CustodialOrganizationSeq", "remove"},
```

```
{"fffc", "fffc", "DataSetTrailingPadding", "remove"},
{"0018", "1200", "DateofLastCalibration", "incrementdate"},
{"0018", "700c", "DateofLastDetectorCalibration", "incrementdate"},
{"0018", "1012", "DateOfSecondaryCapture", "incrementdate"},
{"0012", "0063",
  "DeIdentificationMethod {Per DICOM PS 3.15 AnnexE. Details in 0012,0064}"},
{"0012", "0064", "DeIdentificationMethodCodeSequence",
  "113100/113101/113105/113107/113108/113109/113111"},
{"0008", "2111", "DerivationDescription", "keep"},
{"0018", "700a", "DetectorID", "keep"},
{"0018", "1000", "DeviceSerialNumber", "keep"},
{"0018", "1002", "DeviceUID", "keep"},
{"fffa", "fffa", "DigitalSignaturesSeq", "remove"},
{"0400", "0100", "DigitalSignatureUID", "remove"},
{"0020", "9164", "DimensionOrganizationUID", "hashuid"},
{"0038", "0040", "DischargeDiagnosisDescription", "keep"},
{"4008", "011a", "DistributionAddress", "remove"},
{"4008", "0119", "DistributionName", "remove"},
{"300a", "0013", "DoseReferenceUID", "hashuid"},
{"0010", "2160", "EthnicGroup", "keep"},
{"0008", "0058", "FailedSOPInstanceUIDList", "hashuid"},
{"0070", "031a", "FiducialUID", "hashuid"},
{"0040", "2017", "FillerOrderNumber", "empty"},
{"0020", "9158", "FrameComments", "keep"},
{"0020", "0052", "FrameOfReferenceUID", "hashuid+PROJECTNAME"},
{"0018", "1008", "GantryID", "keep"},
{"0018", "1005", "GeneratorID", "keep"},
{"0070", "0001", "GraphicAnnotationSequence", "remove"},
{"0040", "4037", "HumanPerformersName", "remove"},
{"0040", "4036", "HumanPerformersOrganization", "remove"},
{"0088", "0200", "IconImageSequence", "remove"},
{"0008", "4000", "IdentifyingComments", "keep"},
{"0020", "4000", "ImageComments", "keep"},
{"0028", "4000", "ImagePresentationComments", "remove"},
{"0040", "2400", "ImagingServiceRequestComments", "keep"},
{"4008", "0300", "Impressions", "keep"},
{"0008", "0012", "InstanceCreationDate", "incrementdate"},
{"0008", "0014", "InstanceCreatorUID", "hashuid"},
{"0008", "0081", "InstitutionAddress", "remove"},
{"0008", "1040", "InstitutionalDepartmentName", "remove"},
{"0008", "0082", "InstitutionCodeSequence", "remove"},
```

```
{"0008", "0080", "InstitutionName", "remove"},
{"0010", "1050", "InsurancePlanIdentification", "remove"},
{"0040", "1011", "IntendedRecipientsOfResultsIDSequence", "remove"},
{"4008", "0111", "InterpretationApproverSequence", "remove"},
{"4008", "010c", "InterpretationAuthor", "remove"},
{"4008", "0115", "InterpretationDiagnosisDescription", "keep"},
{"4008", "0202", "InterpretationIdIssuer", "remove"},
{"4008", "0102", "InterpretationRecorder", "remove"},
{"4008", "010b", "InterpretationText", "keep"},
{"4008", "010a", "InterpretationTranscriber", "remove"},
{"0008", "3010", "IrradiationEventUID", "hashuid"},
{"0038", "0011", "IssuerOfAdmissionID", "remove"},
{"0010", "0021", "IssuerOfPatientID", "remove"},
{"0038", "0061", "IssuerOfServiceEpisodeId", "remove"},
{"0028", "1214", "LargePaletteColorLUTUid", "hashuid"},
{"0010", "21d0", "LastMenstrualDate", "incrementdate"},
{"0028", "0303", "LongitudinalTemporalInformationModified", "MODIFIED"},
{"0400", "0404", "MAC", "remove"},
{"0008", "0070", "Manufacturer", "keep"},
{"0008", "1090", "ManufacturerModelName", "keep"},
{"0010", "2000", "MedicalAlerts", "keep"},
{"0010", "1090", "MedicalRecordLocator", "remove"},
{"0010", "1080", "MilitaryRank", "remove"},
{"0400", "0550", "ModifiedAttributesSequence", "remove"},
{"0020", "3406", "ModifiedImageDescription", "remove"},
{"0020", "3401", "ModifyingDeviceID", "remove"},
{"0020", "3404", "ModifyingDeviceManufacturer", "remove"},
{"0008", "1060", "NameOfPhysicianReadingStudy", "remove"},
{"0040", "1010", "NamesOfIntendedRecipientsOfResults", "remove"},
{"0010", "2180", "Occupation", "keep"},
{"0008", "1070", "OperatorName", "remove"},
{"0008", "1072", "OperatorsIdentificationSeq", "remove"},
{"0040", "2010", "OrderCallbackPhoneNumber", "remove"},
{"0040", "2008", "OrderEnteredBy", "remove"},
{"0040", "2009", "OrderEntererLocation", "remove"},
{"0400", "0561", "OriginalAttributesSequence", "remove"},
{"0010", "1000", "OtherPatientIDs", "remove"},
{"0010", "1002", "OtherPatientIDsSeq", "remove"},
{"0010", "1001", "OtherPatientNames", "remove"},
{"0008", "0024", "OverlayDate", "incrementdate"},
{"0008", "0034", "OverlayTime", "keep"},
```

```
{"0028", "1199", "PaletteColorLUTUID", "hashuid"},
{"0040", "a07a", "ParticipantSequence", "remove"},
{"0010", "1040", "PatientAddress", "remove"},
{"0010", "1010", "PatientAge", "keep"},
{"0010", "0030", "PatientBirthDate", "empty"},
{"0010", "1005", "PatientBirthName", "remove"},
{"0010", "0032", "PatientBirthTime", "remove"},
{"0010", "4000", "PatientComments", "keep"},
{"0010", "0020", "PatientID", "Re-Mapped"},
{"0012", "0062", "PatientIdentityRemoved", "YES"},
{"0038", "0400", "PatientInstitutionResidence", "remove"},
{"0010", "0050", "PatientInsurancePlanCodeSeq", "remove"},
{"0010", "1060", "PatientMotherBirthName", "remove"},
{"0010", "0010", "PatientName", "Re-Mapped"},
{"0010", "2154", "PatientPhoneNumbers", "remove"},
{"0010", "0101", "PatientPrimaryLanguageCodeSeq", "remove"},
{"0010", "0102", "PatientPrimaryLanguageModifierCodeSeq", "remove"},
{"0010", "21f0", "PatientReligiousPreference", "remove"},
{"0010", "0040", "PatientSex", "keep"},
{"0010", "2203", "PatientSexNeutered", "keep"},
{"0010", "1020", "PatientSize", "keep"},
{"0038", "0500", "PatientState", "keep"},
{"0040", "1004", "PatientTransportArrangements", "remove"},
{"0010", "1030", "PatientWeight", "keep"},
{"0040", "0243", "PerformedLocation", "remove"},
{"0040", "0241", "PerformedStationAET", "keep"},
{"0040", "4030", "PerformedStationGeoLocCodeSeq", "keep"},
{"0040", "0242", "PerformedStationName", "keep"},
{"0040", "4028", "PerformedStationNameCodeSeq", "keep"},
{"0008", "1052", "PerformingPhysicianIdSeq", "remove"},
{"0008", "1050", "PerformingPhysicianName", "remove"},
{"0040", "0250", "PerformProcedureStepEndDate", "incrementdate"},
{"0040", "1102", "PersonAddress", "remove"},
{"0040", "1101", "PersonIdCodeSequence", "remove"},
{"0040", "a123", "PersonName", "empty"},
{"0040", "1103", "PersonTelephoneNumbers", "remove"},
{"4008", "0114", "PhysicianApprovingInterpretation", "remove"},
{"0008", "1048", "PhysicianOfRecord", "remove"},
{"0008", "1049", "PhysicianOfRecordIdSeq", "remove"},
{"0008", "1062", "PhysicianReadingStudyIdSeq", "remove"},
{"0040", "2016", "PlaceOrderNumberOfImagingServiceReq", "empty"},
```

```
{"0018", "1004", "PlateID", "keep"},
{"0040", "0254", "PPSDescription", "keep"},
{"0040", "0253", "PPSID", "remove"},
{"0040", "0244", "PPSStartDate", "incrementdate"},
{"0040", "0245", "PPSStartTime", "keep"},
{"0010", "21c0", "PregnancyStatus", "keep"},
{"0040", "0012", "PreMedication", "keep"},
{"0013", "1010", "ProjectName", "always"},
{"0018", "1030", "ProtocolName", "keep"},
{"0054", "0016", "Radiopharmaceutical Information Sequence", "process"},
{"0018", "1078", "Radiopharmaceutical Start DateTime", "incrementdate"},
{"0018", "1079", "Radiopharmaceutical Stop DateTime", "incrementdate"},
{"0040", "2001", "ReasonForImagingServiceRequest", "keep"},
{"0032", "1030", "ReasonforStudy", "keep"},
{"0400", "0402", "RefDigitalSignatureSeq", "remove"},
{"3006", "0024", "ReferencedFrameOfReferenceUID", "hashuid+PROJECTNAME"},
{"0038", "0004", "ReferencedPatientAliasSeq", "remove"},
{"0008", "0092", "ReferringPhysicianAddress", "remove"},
{"0008", "0090", "ReferringPhysicianName", "empty"},
{"0008", "0094", "ReferringPhysicianPhoneNumbers", "remove"},
{"0008", "0096", "ReferringPhysiciansIDSeq", "remove"},
{"0040", "4023", "RefGenPurposeSchedProcStepTransUID", "hashuid"},
// {"0008", "1140", "RefImageSeq", "remove"},
{"0008", "1120", "RefPatientSeq", "remove"},
{"0008", "1111", "RefPPSSeq", "remove"},
{"0008", "1150", "RefSOPClassUID", "keep"},
{"0400", "0403", "RefSOPInstanceMACSeq", "remove"},
{"0008", "1155", "RefSOPInstanceUID", "hashuid+PROJECTNAME"},
{"0008", "1110", "RefStudySeq", "remove"},
{"0010", "2152", "RegionOfResidence", "remove"},
{"3006", "00c2", "RelatedFrameOfReferenceUID", "hashuid+PROJECTNAME"},
{"0040", "0275", "RequestAttributesSeq", "remove"},
{"0032", "1070", "RequestedContrastAgent", "keep"},
{"0040", "1400", "RequestedProcedureComments", "keep"},
{"0032", "1060", "RequestedProcedureDescription", "keep"},
{"0040", "1001", "RequestedProcedureID", "remove"},
{"0040", "1005", "RequestedProcedureLocation", "remove"},
{"0032", "1032", "RequestingPhysician", "remove"},
{"0032", "1033", "RequestingService", "remove"},
{"0010", "2299", "ResponsibleOrganization", "remove"},
{"0010", "2297", "ResponsiblePerson", "remove"},
```

```
{"4008", "4000", "ResultComments", "keep"},
{"4008", "0118", "ResultsDistributionListSeq", "remove"},
{"4008", "0042", "ResultsIDIssuer", "remove"},
{"300e", "0008", "ReviewerName", "remove"},
{"0040", "4034", "ScheduledHumanPerformersSeq", "remove"},
{"0038", "001e", "ScheduledPatientInstitutionResidence", "remove"},
{"0040", "000b", "ScheduledPerformingPhysicianIDSeq", "remove"},
{"0040", "0006", "ScheduledPerformingPhysicianName", "remove"},
{"0040", "0001", "ScheduledStationAET", "keep"},
{"0040", "4027", "ScheduledStationGeographicLocCodeSeq", "keep"},
{"0040", "0010", "ScheduledStationName", "keep"},
{"0040", "4025", "ScheduledStationNameCodeSeq", "keep"},
{"0032", "1020", "ScheduledStudyLocation", "keep"},
{"0032", "1021", "ScheduledStudyLocationAET", "keep"},
{"0032", "1000", "ScheduledStudyStartDate", "incrementdate"},
{"0008", "0021", "SeriesDate", "incrementdate"},
{"0008", "103e", "SeriesDescription", "keep"},
{"0020", "000e", "SeriesInstanceUID", "hashuid+PROJECTNAME"},
{"0008", "0031", "SeriesTime", "keep"},
{"0038", "0062", "ServiceEpisodeDescription", "keep"},
{"0038", "0060", "ServiceEpisodeID", "remove"},
{"0013", "1013", "SiteID", "SITEID"},
{"0013", "1012", "SiteName", "SITENAME"},
{"0010", "21a0", "SmokingStatus", "keep"},
{"0018", "1020", "SoftwareVersion", "keep"},
{"0008", "0018", "SOPInstanceUID", "hashuid+PROJECTNAME"},
{"0008", "2112", "SourceImageSeq", "remove"},
{"0038", "0050", "SpecialNeeds", "keep"},
{"0040", "0007", "SPSDescription", "keep"},
{"0040", "0004", "SPSEndDate", "incrementdate"},
{"0040", "0005", "SPSEndTime", "keep"},
{"0040", "0011", "SPSLocation", "keep"},
{"0040", "0002", "SPSStartDate", "incrementdate"},
{"0040", "0003", "SPSStartTime", "keep"},
{"0008", "1010", "StationName", "remove"},
{"0088", "0140", "StorageMediaFilesetUID", "hashuid"},
{"3006", "0008", "StructureSetDate", "incrementdate"},
{"0032", "1040", "StudyArrivalDate", "incrementdate"},
{"0032", "4000", "StudyComments", "keep"},
{"0032", "1050", "StudyCompletionDate", "incrementdate"},
{"0008", "0020", "StudyDate", "incrementdate"},
```

```
{"0008", "1030", "StudyDescription", "keep"},
{"0020", "0010", "StudyID", "empty"},
{"0032", "0012", "StudyIDIssuer", "remove"},
{"0020", "000d", "StudyInstanceUID", "hashuid+PROJECTNAME"},
{"0008", "0030", "StudyTime", "keep"},
{"0020", "0200", "SynchronizationFrameOfReferenceUID", "hashuid"},
{"0040", "db0d", "TemplateExtensionCreatorUID", "hashuid"},
{"0040", "db0c", "TemplateExtensionOrganizationUID", "hashuid"},
{"4000", "4000", "TextComments", "remove"},
{"2030", "0020", "TextString", "remove"},
{"0008", "0201", "TimezoneOffsetFromUTC", "remove"},
{"0088", "0910", "TopicAuthor", "remove"},
{"0088", "0912", "TopicKeyWords", "remove"},
{"0088", "0906", "TopicSubject", "remove"},
{"0088", "0904", "TopicTitle", "remove"},
{"0008", "1195", "TransactionUID", "hashuid"},
{"0013", "1011", "TrialName", "PROJECTNAME"},
{"0040", "a124", "UID", "hashuid"},
{"0040", "a088", "VerifyingObserverIdentificationCodeSeq", "remove"},
{"0040", "a075", "VerifyingObserverName", "empty"},
{"0040", "a073", "VerifyingObserverSequence", "remove"},
{"0040", "a027", "VerifyingOrganization", "remove"},
{"0038", "4000", "VisitComments", "keep"},
```

The above specification is taken from the github project of the accelerated anonymizer project of the MMIV (github.com/MMIV-CENTER/DICOMAnonymizer). Special care is taken to hash the DICOM identifiers for the study, series and image levels. The hash is specific to each project (hashid+PROJECTNAME) so that images for the same study or series can be merged by the PACS even if they are forwarded out of sequence. The PACS is using a uniform offset value for the date stamps.

Any tag not mentioned in the above list is kept at its original value. This includes all private tags as they might be relevant for data analysis tasks such as distortion correction and diffusion data analysis. As private tags are contained specialized structured used by vendors such as Siemens CSA header information need to be analyzed and sanitized if they contain additional copies of the items listed above.

There are variations in the anonymization that have been requested by projects. Sometimes these variations relate to the radiology reading workflow and blinding. IDS7 has build-in support for a temporary randomization of patient information to image data. This capability should be demonstrated to interested projects to evaluate its usefulness.

A further variation in the anonymization scheme is the storage of site information for multi-site projects. As we are using the InstitutionName tag to indicate the project a tag such as 0012,0031 “ClinicalTrialSiteName” or 0008,1010 “StationName” can be used to store the information.

Implementing GDPR workflows

For the right to be informed the REDCap system can generate a report that contains for each original study’s participant ID (or study instance UID) a list of projects that got access to the data. Further detailed information is available in the audit logs of REDCap that list the users that accessed and changed the meta-data of the studies or image series. These reports can be exported from the REDCap interface as PDF documents. The right to be forgotten can be implemented in conjunction with the Sectra system given the list of generated study instance UIDs available in REDCap for each study participant across projects. A separate removal of image data from Sectra PACS is required to allow the removal of images.

Import procedure for study data

Image data is processed before importing into the rDMA by a staging system called FIONA. This computer system (VM running on hospital premises) contains software components to act as a DICOM node. The node receives data from the clinical PACS (Impax and Sectra) and communicates with an electronic data capture system (EDC) implemented by a FIONA local REDCap installation. The REDCap projects mimic the project specification mentioned above in this document. All arriving images are classified and key elements of the DICOM meta-data are extracted by FIONA in a directory tree by received study instance UID followed by directories representing image series that contain links to the individual DICOM files. Next to each series directory a JSON encode metadata file is created by FIONA. At regular intervals the FIONA

system will parse the list of JSON files found in all sub-directories and update the REDCap structures for incoming data.

REDCap can be used to mark for each image study the project the data belongs to. This is done by creating a Transfer Request. Each request contains the project name and the patient ID (same as patient name) to be used in the research PACS. The FIONA system will parse these REDCap transfer requests in regular intervals and for all new requests the anonymization procedure is called and the resulting images are forwarded to the research PACS. The process adds the project name as the DICOM tag InstitutionName. In the Sectra research PACS this structure is used to identify the project. As users are assigned to project roles they will be able to access the projects data.

The above process of import data and anonymizing and forwarding data is fully automated. Only the transfer request needs to be created to trigger the import process. This allows this system to be operated by non-technical personnel such as project administrators.

There are two modes the FIONA system can operate in. A) Legacy data from the existing research PACS is forwarded in bulk into the system. This works using the above outlined procedure. A second mode B) is in related to the continued submission of new data to the research PACS for ongoing and new projects. In this case single studies are forwarded from the modality stations to FIONA. In this mode the sending modality uses individual project identifiers as AETitels to indicate to FIONA that data belongs to a particular project. It is therefore sufficient to send data to FIONA with a AETitle related to the project to import the data and to make it available in the research PACS. An assumption of this mode is that data is acquired in a de-identified manner removing the need to assign a new patient ID and patient name tag. FIONA processes are used to apply all other anonymization steps during import.

To support the import of legacy data a web-based data upload process is available (inside the hospital).

System components

The rDMA consists of the following user visible components:

Sectra PACS (IDS7) responsible for storage and viewing of image data

The Sectra PACS access is separate from the clinical PACS access. A user role has to be assigned to each user to allow access to the “Sectra DMA Forskning” ("C:\Program Files (x86)\Ivanti\Workspace Control\pwrgate.exe" 12816).

REDCap electronic data capture system for all study metadata (tracking)

The REDCap system is web-based and available at: https://10.94.209.30:4444. It requires an account (should be linked to LDAP) and has its own role based permission system for project owners, project administrators, data managers and users.

Webpage with overview (web-based import of data)

The overview webpage is available at: http://10.94.209.30/ and shows a calendar with the study dates.

Source code for the FIONA system components, the anonymization engine and the system services are available in separate GitHub repositories:

- https://github.com/mmiv-center/DICOMAnonymizer
- https://github.com/ABCD-STUDY/FIONASITE
- System services are in preparation

Known limitations, open issues and TODOs

(Known limitation:) A specific circular area intensity measurement tool functionality is missing in IDS7. In Impax this tool has been used to define a circular measurement area *with a fixed radius* (using mouse-wheel adjustments). An equivalent functionality seems not to be available in IDS7.

(Closed issue - Sectra:) Unclear how data can be deleted in IDS7. A permission for deleting data is available (and enabled in the role) but no functionality in the interface.

This has been fixed now with the installation of a different license for Sectra. The Administration/Delete Study or delete series functionality is now available.

(Open issue - Sectra/Hauke:) Unclear how data can be changed in IDS7. Tests involve the forwarding of a study with wrong anonymization (InstitutionName wrong) and unique study,

series, and image SOPs. Sending same patient name/ID/date data with new sets of study, series, and image SOPs did not result in a duplicate series. This might be related to the storage path using patient ID and study date but no SOP instance uid.

Update: The w_store settings have been changed to “Overwrite” images on existing SOPInstanceUIDs. Needs to be tested if this allows us to change existing images.

After reviewing the setting in the Sectra Enterprise Manager we discovered that two DICOM entries are used by Sectra as study and examination IDs. The first is StudyID (empty in our current anonymization scheme) and the second is the AccessionNumber (always ANONYMIZED) in our current scheme. The anonymizer needs to be changed to include at least the StudyID as a copy of the StudyInstanceUID + project name hash-code. This needs to be tested.

Has been tested and seems to be working (two studies can be added to two different projects). If the StudyID is different they show up as different accessions. It is a little bit confusion as it is not possible to display the InstitutionName tag for image series in the Information Window. The user needs to add the “Station Name” tag to the series table in the Information Window. That will list the project the study belongs to.

(TODO - Hauke:) Web-based DICOM import for externally acquired DICOMs with selection of project, existing patient ID and site.

(TODO - Hauke:) Implement “trusted” DICOM senders allowed to trigger automatic forwards from FIONA to IDS7. Those senders will be power users and modality stations. Image series will be assumed to contain anonymized patient IDs. Images will be anonymized again but patient ID and patient name will not be replaced.
This has been implemented now. A separate “routing” project in REDCap can be used to specify incoming data rules for forwarding. Either the sender or addressed AETitle (full string) and one of the PatientName or PatientID strings (regular expression) can be used to identify image data as it comes into the system. For those images a new transfer request (project incoming) is created that forwards the data to IDS7. The routing rules can be enabled or disabled. The FIONA’s processing user’s bin/populateIncoming.py script has a boolean setting for processing all cases (instead of the newly incoming). This setting can be used to forward all data from a project to IDS7.

(TODO - Hauke:) Implement export page that creates project wide anonymized (no-coupling list) exports of image data and demographic information. Target system for this functionality is FIONA.

(TODO - Hauke:) Implement a DICOM tag summary function that per study displays all non-trivial and unique DICOM tags. This backend functionality should be used to audit the anonymization process for data generated from unknown sources.

(TODO - Hauke:) Detection and anonymization of burn-ed in image information. Plan is to use a standard machine learning (fastai/pytorch) module to test for burned in image information. To flag them for inspection (REDCap) and to change the pixel data (replace with black frame). It has to be evaluated if study/series and modality level information can be used to predict the likelihood of burned in text. It has to be evaluated if the detected (OCR) text can be classified (likelihood of containing patient identifying information). It has to be evaluated if the detected text can be retained in a sanitized version.

(TODO - Hauke:) DICOM sequences are used in Impax to store measurements as overlays. Anonymizing such information requires a recomputation of the sequence length values at different sequence hierarchy levels. Currently the overlays do not show up in IDS7 because of this limited replacement of UIDs (they are part of the overlay sequences). As an option we could limit the hashuid+PROJECTNAME entries to the length of the original UIDs - which requires a recomputation of all existing images. In that case the UIDs and DICOM header information stay intact. But, it would be better to recompute the sequence length! This has to be done in the github.com/MMIV-CENTER/DICOMAnonymizer project soon before more data is entered into the system (https://github.com/mmiv-center/DICOMAnonymizer/issues/4).

This has been implemented now. TODO: We need to re-push the data from the AIM study to have overlays show up for all of them.