1.54 Document Subscription for Mobile (DSUMs)

1.54.1 DSUMs Actors, Transactions, and Content Modules

In this section, the following actors and transactions are introduced:

- Actors
  - Document Subscriber
  - Resource Notification Subscriber
  - Resource Notification Publisher
  - Resource Notification Recipient
- Transactions
  - Subscribe Request [ITI-110]
  - Notify [ITI-111]
  - Resource Subscribe [ITI-112]
  - Resource Notify [ITI-113]
  - Resource Subscribe Response [ITI-114]
  - Resource Notify Response [ITI-115]
- Content Modules
  - Subscribe Request Parameters
  - Subscribe Response Parameters
  - Notification Payload
  - Resource Notification Payload

Figure 1.54.1-1: DSUMs Actor Diagram

Table 1.54.1-1 lists the transactions for each actor directly involved in the DSUMs Profile. To claim compliance with this profile, an actor should support all required transactions (labeled "R") in addition to all optional transactions (labeled "O") specified in this profile.

Table 1.54.1-1: DSUMs Profile - Actors and Transactions

Actors	Transactions	Initiator or Responder	Optionality
Document Subscriber	Subscribe Request [ITI-110]	Initiator	R
	Notify [ITI-111]	Responder	R
	Resource Notify [ITI-113]	Responder	O
	Resource Notify Response [ITI-115]	Initiator	O
Resource Notification Subscriber	Resource Subscribe [ITI-112]	Initiator	R
	Resource Notify [ITI-113]	Responder	R
	Resource Subscribe Response [ITI-114]	Initiator	O
	Resource Notify Response [ITI-115]	Initiator	O
Resource Notification Publisher	Subscribe Request [ITI-110]	Responder	R
	Notify [ITI-111]	Initiator	R
	Resource Subscribe [ITI-112]	Responder	O
	Resource Subscribe Response [ITI-114]	Responder	O
Resource Notification Recipient	Resource Notify [ITI-113]	Responder	O
	Resource Notify Response [ITI-115]	Initiator	O

1.54.1.1 Actors

The following actors are defined in this section and in the following sections:

1.54.1.1.1 Resource Notification Subscriber

A Resource Notification Subscriber is a Document Subscriber that requests notifications concerning a particular resource in a publication subscription. A Resource Notification Subscriber may be an application or a service, including the data store of subscriptions. Based on the subscription criteria, the Resource Notification Subscriber will receive notifications when resources that meet the criteria are created, updated, or deleted. The Resource Notification Subscriber may also request a notification be sent when a resource is about to be deleted.

The Resource Notification Subscriber may also request a notification be sent when a resource is about to be deleted.

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Document Metadata Subscription for Mobile Updates option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Mobile Notification option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Mobile Notification option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Mobile Notification option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Mobile Notification Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Mobile Notification Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Mobile Notification Update option

1.54.1.1.2 Resource Notification Publisher

A Resource Notification Publisher is a Document Sharing Actor that supports the Resource Notification Transactions. It can perform a Resource Subscribe Request transaction, receive Resource Notify messages, and send Resource Notify messages to Resource Notification Subscribers and Resource Notification Recipients.

The following Supplements/Profiles with the actor capabilities grant the actors options:

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Subscribe option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Resource Notification Subscribe option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Resource Notification Subscribe option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Resource Notification Subscribe option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Subscribe Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Resource Notification Subscribe Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Resource Notification Subscribe Update option

1.54.1.1.3 Resource Notification Recipient

A Resource Notification Recipient is a Document Sharing Actor that supports the Resource Notification Transactions. It can receive Resource Notify messages and send Resource Notify Response messages.

The following Supplements/Profiles with the actor capabilities grant the actors options:

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Recipient option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Resource Notification Recipient option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Resource Notification Recipient option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Resource Notification Recipient option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Recipient Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Resource Notification Recipient Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Resource Notification Recipient Update option

1.54.1.2 Transactions

The following transactions are defined in this section and in the following sections:

1.54.1.2.1 Subscribe Request

This transaction is used by a Document Subscriber to request a subscription.

1.54.1.2.2 Notify

This transaction is used by a Document Sharing Actor to notify a Document Subscriber of a change in a subscription.

1.54.1.2.3 Resource Subscribe

This transaction is used by a Resource Notification Subscriber to request a subscription.

1.54.1.2.4 Resource Notify

This transaction is used by a Resource Notification Publisher to notify a Resource Notification Subscriber of a change in a subscription.

1.54.1.2.5 Resource Subscribe Response

This transaction is used by a Resource Notification Publisher to respond to a Resource Subscribe Request.

1.54.1.2.6 Resource Notify Response

This transaction is used by a Resource Notification Subscriber to respond to a Resource Notify.

1.54.1.3 Content Modules

The following Content Modules are defined in this section and in the following sections:

1.54.1.3.1 Subscribe Request Parameters

This Content Module defines the Subscribe Request parameters.

1.54.1.3.2 Subscribe Response Parameters

This Content Module defines the Subscribe Response parameters.

1.54.1.3.3 Notification Payload

This Content Module defines the Notification payload.

1.54.1.3.4 Resource Notification Payload

This Content Module defines the Resource Notification payload.

1.54.2 Actor Options

The following actor options are defined in the implementation guide as listed in Table 1.54.2-1 below. Implementation Guidance options when applicable are specified in notes.

Table 1.54.2-1: Actor Options

Actors	Option Name	Reference
Resource Notification Subscriber	Resource Subscribe Request Option	Section 1.54.2.1.1 Resource Subscribe Request Option
	Resource Notify Option	Section 1.54.2.1.2 Resource Notify Option
	Resource Subscribe Update Option	Section 1.54.2.1.3 Resource Subscribe Update Option
Resource Notification Publisher	Resource Subscribe Request Option	Section 1.54.2.1.1 Resource Subscribe Request Option
	Resource Notify Option	Section 1.54.2.1.2 Resource Notify Option
	Resource Subscribe Update Option	Section 1.54.2.1.3 Resource Subscribe Update Option
Resource Notification Recipient	Resource Notify Option	Section 1.54.2.1.2 Resource Notify Option

1.54.2.1 Actor Options

1.54.2.1.1 Resource Subscribe Request Option

This option provides the ability to request a subscription using the Resource Subscribe Request transaction.

1.54.2.1.2 Resource Notify Option

This option provides the ability to receive a Resource Notification Recipient related to a subscription.

1.54.2.1.3 Resource Subscribe Update Option

This option provides the ability to request a subscription update using the Resource Subscribe Request transaction.

1.54.3 Process Flow

1.54.3.1 Subscribe Request/Notify [ITI-110]

This transaction is used by a Document Subscriber to request a subscription.

1.54.3.2 Resource Subscribe/Notify [ITI-112]

This transaction is used by a Resource Notification Subscriber to request a subscription.

1.54.3.3 Resource Subscribe Response/Resource Notify [ITI-114]

This transaction is used by a Resource Notification Publisher to respond to a Resource Subscribe.

1.54.3.4 Resource Notify Response [ITI-115]

This transaction is used by a Resource Notification Subscriber to respond to a Resource Notify.

1.54.4 Security Considerations

None

1.54.5 Cross Profile Considerations

Table 1.54.5-1 lists the actors directly involved in the DSUMs Profile and the relevant transactions between them.

Table 1.54.5-1: DSUMs Actors and Transactions

Actors	Transactions
Document Subscriber	Subscribe Request [ITI-110]
	Notify [ITI-111]
	Resource Notify [ITI-113]
	Resource Notify Response [ITI-115]
Resource Notification Subscriber	Resource Subscribe [ITI-112]
	Resource Notify [ITI-113]
	Resource Subscribe Response [ITI-114]
	Resource Notify Response [ITI-115]
Resource Notification Publisher	Subscribe Request [ITI-110]
	Notify [ITI-111]
	Resource Subscribe [ITI-112]
	Resource Subscribe Response [ITI-114]
Resource Notification Recipient	Resource Notify [ITI-113]
	Resource Notify Response [ITI-115]

1.54.6 Actors

The following actors are defined in this section and in the following sections:

1.54.6.1 Resource Notification Subscriber

A Resource Notification Subscriber is a Document Subscriber that requests notifications concerning a particular resource in a publication subscription. A Resource Notification Subscriber may be an application or a service, including the data store of subscriptions. Based on the subscription criteria, the Resource Notification Subscriber will receive notifications when resources that meet the criteria are created, updated, or deleted. The Resource Notification Subscriber may also request a notification be sent when a resource is about to be deleted.

The Resource Notification Subscriber may also request a notification be sent when a resource is about to be deleted.

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Document Metadata Subscription for Mobile Updates option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Mobile Notification option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Mobile Notification option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Mobile Notification option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Mobile Notification Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Mobile Notification Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Mobile Notification Update option

1.54.6.2 Resource Notification Publisher

A Resource Notification Publisher is a Document Sharing Actor that supports the Resource Notification Transactions. It can perform a Resource Subscribe Request transaction, receive Resource Notify messages, and send Resource Notify messages to Resource Notification Subscribers and Resource Notification Recipients.

The following Supplements/Profiles with the actor capabilities grant the actors options:

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Subscribe option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Resource Notification Subscribe option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Resource Notification Subscribe option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Resource Notification Subscribe option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Subscribe Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Resource Notification Subscribe Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Resource Notification Subscribe Update option

1.54.6.3 Resource Notification Recipient

A Resource Notification Recipient is a Document Sharing Actor that supports the Resource Notification Transactions. It can receive Resource Notify messages and send Resource Notify Response messages.

The following Supplements/Profiles with the actor capabilities grant the actors options:

- ITI-65: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Recipient option
- ITI-66: Cross-enterprise Document Metadata Subscription (XDS MetaData Subscription) that supports the Resource Notification Recipient option
- ITI-67: Cross-enterprise Document Sharing-c (XDS.c) that supports the Resource Notification Recipient option
- ITI-68: Cross-enterprise Document Metadata Notification (XDS MetaData Notification) that supports the Resource Notification Recipient option
- ITI-69: Cross-enterprise Document Sharing-b (XDS.b) that supports the Resource Notification Recipient Update option
- ITI-70: Cross-enterprise Document Metadata Update (XDS MetaData Update) that supports the Resource Notification Recipient Update option
- ITI-71: Cross-enterprise Document Metadata Subscription Update (XDS MetaData Subscription Update) that supports the Resource Notification Recipient Update option

1.54.7 Transactions

1.54.7.1 Transactions Descriptions

The following transactions are defined in this section:

- Subscribe Request [ITI-110]
- Notify [ITI-111]
- Resource Subscribe [ITI-112]
- Resource Notify [ITI-113]
- Resource Subscribe Response [ITI-114]
- Resource Notify Response [ITI-115]

1.54.7.2 Subscribe Request [ITI-110]

This transaction is used by a Document Subscriber to request a subscription.

1.54.7.2.1 Trigger Events

The Document Subscriber wishes to request a subscription.

1.54.7.2.2 Message Semantics

The Subscribe Request message is based on the Subscribe Request Parameters Content Module. The Subscribe Request Parameters Content Module defines the following parameters:

- Subscribe Request [ITI-110]
  - Subscribe Response [ITI-111]
  - Resource Subscribe [ITI-112]
  - Resource Subscribe Response [ITI-114]

The Subscribe Request Parameters Content Module

1. The mobile app performs a patient-dependent DocumentReference subscription specific for reports by specifying a list of possible confidentiality codes, based on the community accordance, in this case, equal to "N". ([ITI-110] Resource Subscription).
2. When the doctor makes the report, not visible to the patient, a document is produced on the Repository and the metadata are sent to the Central Infrastructure, in this case with a confidentiality code different from "N" ([ITI-42] Register Document Set-b).
3. The Central Infrastructure, having stored the metadata of the report, generates a message to inform the broker about the publication event. ([ITI-111] Resource Publish), but since the publication event doesn't match any active subscription criteria, any notification is sent.
4. After the consultation, the confidentiality code metadata of the report is updated "N" to the Central Infrastructure ([ITI-57] Update Document Set)
5. The Central Infrastructure, having updated the metadata of the document, generates a message to inform the broker about the update event. ([ITI-111] Resource Publish).
6. Since the metadata update event meets the subscription criteria, the Central Infrastructure will send a notification to the mobile app. ([ITI-112] Resource Notify)
7. When the user sees the notification on his app it is possible to retrieve the document. The app will try to retrieve the resource by sending a Retrieve Document [ITI-68] to the XDS FHIR interface.
8. Upon receiving the Retrieve Document [ITI-68] the XDS FHIR interface tries to retrieve the document from the XDS Repository. Retrieve Document Set [ITI-43].
9. Downloaded the document, Ms. Fox can view the report.

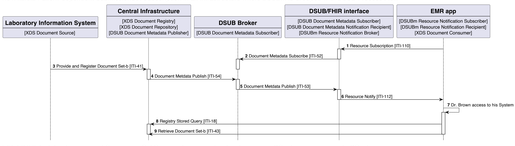
1:54.4.2.8 Use Case #8: SubmissionSet Subscription in a XDS Environment where DSUBm is Grouped with DSUB

In this use case, a system desires to subscribe to a submissionSet with a specific intended recipient of clinical information. A source of clinical content can identify the intended target for a submissionSet using the XDSSubmissionSet.IntendedRecipient metadata attribute.

1:54.4.2.8.1 Patient-dependent SubmissionSet Subscription in an Infrastructure where DSUBm is Grouped with DSUB Use Case Description

Dr. Brown is a clinician and can request exams for many patients. He works in multiple hospital and due to his obligations he is not always connected and available to review the document that are produced from other hospitals. So the doctor uses a mobile app in order to get notifications for documents produced from other hospital that are intended for him (the subscription created has the intendedRecipient as subscition criteria). Mr. White attends a consultation with Dr. Brown, who requests a Laboratory Report for the patient. The app that the doctor is using creates a mobile subscription with an intendedRecipient of Dr. Brown. This mobile subscription is replicated by a middleware (DSUB/FHIR interface) in order to intercept XDS documents with the same filter criteria of the mobile subscription created by the app. The patient receives the exam in a Clinical Laboratory. The Laboratory Information System produces a report and submits the document in the Document Sharing Infrastructure identifying Dr. Brown as the intended Recipient for the submission. This publishing event matches the existing subscription performed by the middleware and a notification is sent to the middleware. The middleware converts the notification in a mobile notification that is sent to Dr. Brown's mobile system (identified as the Resource Notification Recipient in the mobile subscription created). Dr. Brown, after seeing the notification on his app, can access to the EMR system and retrieve the laboratory report and can quickly analyze the report published and can make other clinical decisions in an efficient way.

1:54.4.2.8.2 Patient-dependent SubmissionSet Subscription in an Infrastructure where DSUBm is Grouped with DSUB Process Flow



1:54.4.2.8.2-1: Patient-dependent SubmissionSet Subscription in a infrastructure where DSUBm is grouped with DSUB

Pre-conditions:

The assumption is that systems share the information in an XDS Environment where a DSUB and DSUBm are used a the same time. In the central infrastructure, the XDS Registry is grouped with XDS document Repository and the Document Notification Publisher. The DSUB Document Metadata Subscriber and the DSUB Document Metadata Recipient are grouped with a DSUBm Resource Notification Broker.

Main Flow:

1. The mobile app performs a patient-dependent SubmissionSet subscription specific for document produced for Mr.White that have Dr.Brown as the intended Recipient. ([ITI-110] Resource Subscription)
2. When the DSUB/FHIR interface receives the Subscription creates a DSUB subscription with equivalent filter criteria. ([ITI-52] Document Metadata Subscribe)
3. The Laboratory Information System produce the report for Mr. White exams ([ITI-41] Provide and Register Document Set-b)
4. The Central Infrastructure propagates to the DSUB Broker a Publication Event. ([ITI-54] Document Metdata Publish)
5. The DSUB Broker matches the publication with all the available subscriptions and a notification is triggered for the subscription created at step 2 ([ITI-53] Document Metdata Notify).
6. The DSUB/FHIR interface receives the notification and the subscription created at step 1 is triggered since the document had Dr.Brown as the intended recipient. ([ITI-112] Resource Notify)
7. When Dr.Brown receives the notification he access to his system in order to consult the new document produced.
8. From his system Dr.Brown searches for the document that has been submitted with the submissionSet that he has been notified. ([ITI-18] Registry Stored Query)
9. The doctor can now retrieve the document and consult it.([ITI-43] Retrieve Document Set-b)

1:54.5 Security Considerations

This profile requires actors to audit the transactions that create subscriptions and send notifications, grouping with an ATNA Secure Node or Secure Application is strongly recommended in order to track the subscriptions and the notification sent. For further considerations about Audit record refer to BALP profile. User authentication/authorization represents another important factor to consider in order to avoid malicious creation/updating of subscriptions. Grouping DSUBm actors with actors in the Internet User Authorization (IUA) Profile enables deployments to mitigate these security issues. See ITI TF-2x: Appendix Z.8 "Mobile Security Considerations".

The reader should also consider the indication included in Safety and Security section.

1:54.6 Cross-Profile Considerations

The DSUBm actor and transaction model is very flexible. Integration with other IHE profiles is possible and highly recommended in order to utilize the subscription/notification mobile feature in different types of environments. In this section, some information about possible cross-profile interaction is presented.

1:54.6.1 MHDS - Mobile Health Document Sharing

Within a RESTfull infrastructure that is implementing the MHDS model there are two possible groupings.

1:54.6.1.1 MHDS - Mobile Health Document Sharing Grouping 1

In the first proposed grouping:

- MHDS Document Registry will most likely be grouped with a Resource Notification Publisher because all publication events are submitted to the MHDS Document Registry.
- The MHD Document Consumer will most likely be grouped with a Resource Notification Recipient. This grouping makes sense since the receiver of the notification is most likely the user of the information.

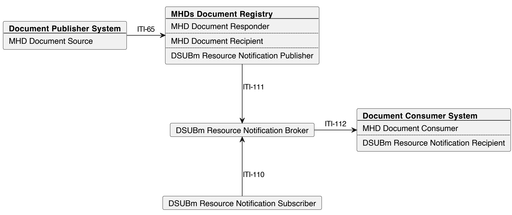


Figure 1:54.6.1.1-1: DSUBm actors grouped with MHDS actors showing the first of the two possible groupings.

1:54.6.1.2 MHDS - Mobile Health Document Sharing Grouping 2

In the second proposed grouping:

- MHDS Document Registry will likely be grouped with a Resource Notification Broker.
- The MHD Document Consumer, will likely be grouped with a Resource Notification Subscriber.

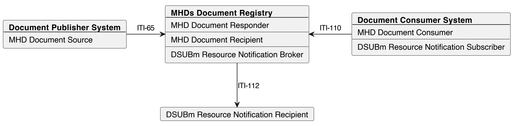


Figure 1:54.6.1.2-1: DSUBm actors grouped with MHDS actors showing the second of the two possible groupings.

1:54.6.2 XDS.b - Cross-Enterprise Document Sharing

Within an XDS infrastructure there are two possible groupings.

1:54.6.2.1 XDS.b - Cross-Enterprise Document Sharing Grouping 1

In the first proposed grouping:

- XDS Document Registry will most likely be grouped with a Resource Notification Publisher because all publication events are submitted to the XDS Document Registry.
- XDS Document Consumer will most likely be grouped with a Resource Notification Recipient. This grouping makes sense since the receiver of the notification is most likely the user of the information.

If in the infrastructure is also implemented the "XDS on FHIR Option" of MHD for a mobile interface:

- MHD Document Consumer will most likely be grouped with a Resource Notification Recipient. This grouping makes sense since the receiver of the notification is most likely the user of the information.
- MHD Document Consumer will likely be grouped with a Resource Notification Subscriber.

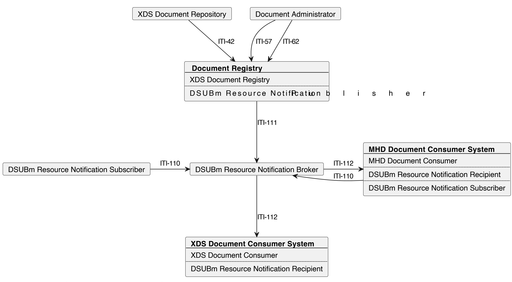


Figure 1:54.6.2.1-1: DSUBm actors grouped with XDS actors and MHD actors

Note that in this scenario, developers should be aware about what events on DocumentEntry, Folder, Association, and SubmissionSet Objects could determine events on DocumentReference, Folder type List, and SubmissionSet type List resources and the supporting of "Updates to document sharing resources" option.

1:54.6.2.2 XDS.b - Cross-Enterprise Document Sharing Grouping 2

In the second proposed grouping:

- XDS Document Registry will likely be grouped with a Resource Notification Broker.
- XDS Document Consumer will likely be grouped with a Resource Notification Subscriber.

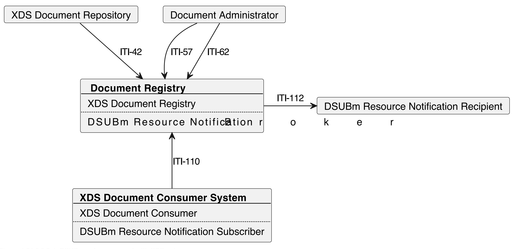


Figure 1:54.6.2.2-1: DSUBm actors grouped with XDS actors

Note that in this scenario, developers should be aware about what events on DocumentEntry, Folder, Association, and SubmissionSet Objects could determine events on DocumentReference, Folder type List, and SubmissionSet type List resources and the supporting of "Updates to document sharing resources" option.

1:54.6.3 DSUBm as an Interface for DSUB

Document Metadata Subscriber and the Document Metadata Notification Recipient will most likely be grouped with a Resource Notification Broker creating the mobile DSUB interface that translates Resource Subscription [ITI-110] into Document Metadata Subscribe [ITI-52] and Document Metadata Notify [ITI-53] into Resource Notify [ITI-112]. The existing DSUB Document Metadata Notification Broker is unaware of the presence of the functionality introduced by the DSUBm profile and therefore can maintain its already implemented logic.

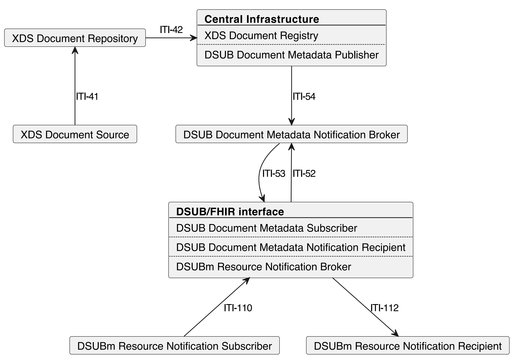


Figure 1:54.6.3-1: DSUBm actors grouped with DSUB: DSUBm as an interface for DSUB

Note that in this scenario, developers should be aware about the usage of `status` parameter in the Subscriptions and about implementation of DSUB supplement Folder Subscription Option and Patient-Independent Subscription Option.

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