Use Cases for XDR (Cross-Enterprise Document Reliable Interchange)

A Technical Whitepaper

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INTRODUCTION

Electronic data exchange in healthcare is commonly utilized via network environments based on the SOAP-based Web Services protocols with detailed metadata. They utilize a family of IHE profiles, each applied to a different type of use case, which have a common metadata model and make use of Web Services in a common way. Implementation of data exchange in these environments is based on the XDR (Cross-Enterprise Document Reliable Interchange) and XDM (Cross-enterprise Document Media Interchange) specifications.

- XDR is a SOAP-based standard protocol for the description and encoding of data. It uses a web based point-to-point push network communication permitting Direct interaction between healthcare systems.
- XDM specification describes the format of the XML-based payload utilized to transfer documents and metadata using email attachments and physical media. It also supports the use of web services to transfer data.

XDR protocol with XDM payloads is utilized in the EHR systems deployed by major vendors such as Epic and MEDITECH, and predate the Direct Project by many years.

In order to provide a uniform data delivery mechanism for the healthcare industry, such environments need to interoperate with the more recently introduced Direct Project that uses SMTP (RFC 5322) protocol as the primary content delivery mechanism.

This paper covers the use cases associated with utilizing the XDR protocol for Direct Secure Messaging and its interoperability with SMTP for transferring healthcare-related documents between the following endpoints:

- A Direct HISP sending SMTP+S/MIME messages to an EHR that uses XDR.
- An EHR sending XDR messages to a Direct HISP that uses SMTP+S/MIME.
- An EHR sending XDR messages to another EHR that uses XDR via a single Direct HISP.
- An EHR sending XDR messages to another EHR that uses XDR via multiple Direct HISPs. For this use case, the paper also covers the topic of packaging conversion between XDR to XDM and back.

USE CASES FOR CONVERSION BETWEEN DIRECT AND XDR

CONVERSION FROM DIRECT SMTP+S/MIME MESSAGES TO XDR

In this case, an SMTP message is sent from a Direct user to an EHR system, which supports a SOAP endpoint. The HISP converts the message from an SMTP+S/MIME to SOAP/XML.

A Direct Secure Message with files is sent from a provider's desktop to the Direct HISP. The HISP then converts the message to an XDM ZIP format. The necessary metadata is extracted from the XDM message by the XDR protocol, converted to a SOAP XML format, and sent to an Epic or MEDITECH system. The recipient then downloads the message from the EHR System.

What happens inside the HISP

The following use case is illustrated in the diagram below:

- ◼ A message is delivered via SMTP+S/MIME to a HISP; the received message is decrypted via a private key store.
- ◼ The intended recipient's address is verified via an address book database.
- ◼ The metadata from the XDM is extracted and converted to an XDR format.
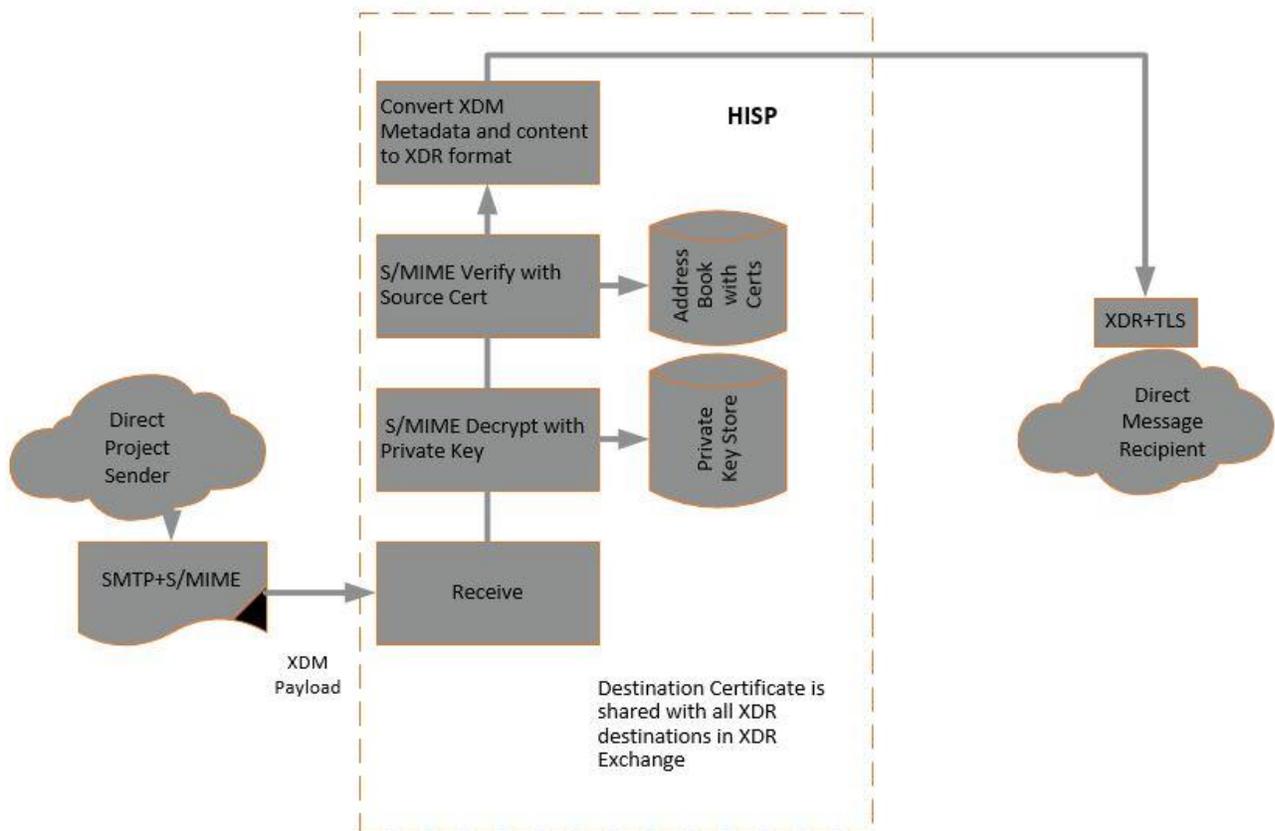- ◼ This message is then sent over TLS to an EHR, which then delivers it to a Direct Message Recipient.

Convert XDM Metadata and content to XDR format

HISP

S/MIME Verify with Source Cert

Address Book with Certs

XDR+TLS

Direct Project Sender

S/MIME Decrypt with Private Key

Private Key Store

Direct Message Recipient

SMTP+S/MIME

Receive

XDM Payload

Destination Certificate is shared with all XDR destinations in XDR Exchange

Figure 1 - SMTP+S/MIME message sent to an EHR

CONVERSION FROM XDR TO SMTP+S/MIME

In this case an XDR/SOAP message is sent through an EHR system. Upon receiving the message, the HISP converts it to an SMTP+S/MIME message which is then delivered securely to the recipient.

The following use case is illustrated in the diagram below:

- An XDR formatted message is sent from an EHR to a receiving HISP.
- The XDR metadata is converted to an XDM message with a ZIP file, and the destination address is extracted from the XDR metadata.
- The destination address certificate is located from an address book.
- The S/MIME message is signed with a private key from a private key store.
- The S/MIME message is then encrypted with the destination certificate and sent encrypted to a Direct Message recipient.
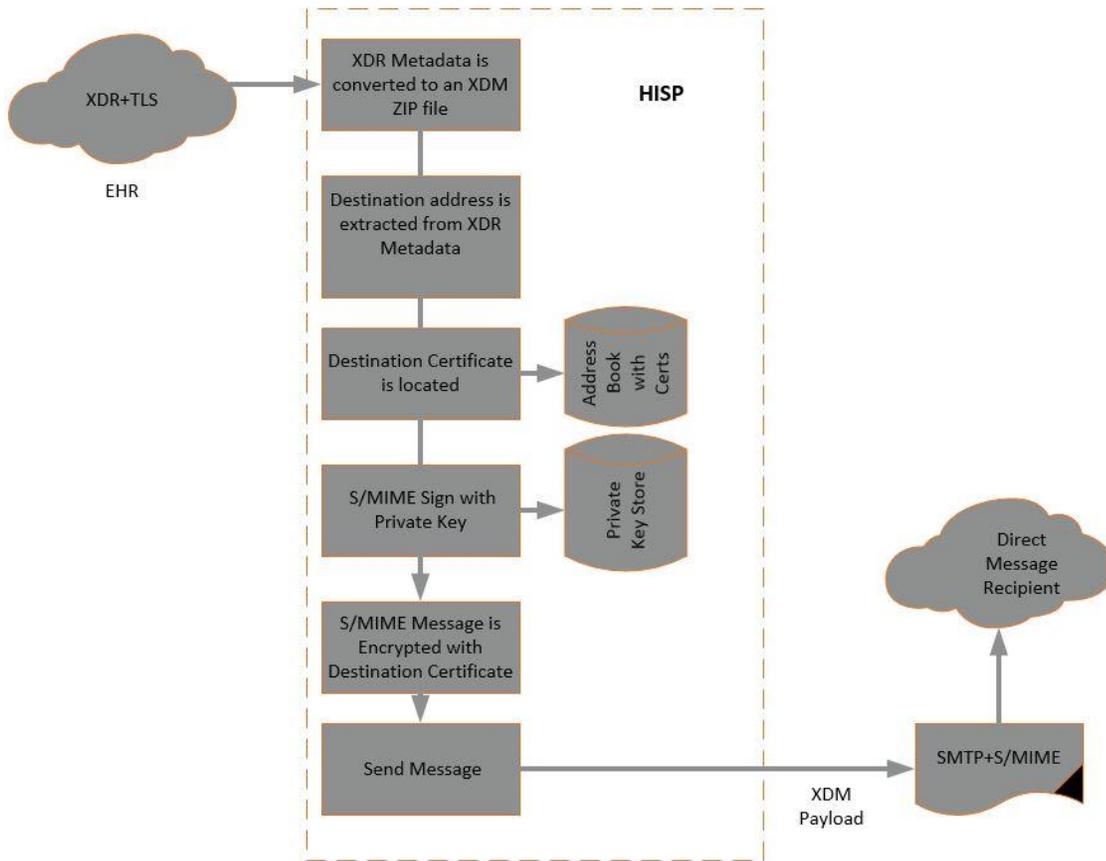
Figure 2 - XDR formatted message sent from an EHR to a Direct Message Recipient

DATA TRANSMISSION BETWEEN TWO EHRs THAT USE XDR

There are two (2) different delivery scenarios when data is transmitted from one EHR to another EHR:

- When both EHRs are on the same HISP, a C-CDA message is encoded to an XDR message. The message is sent using SOAP web services over TLS to the HISP. The HISP will then send the message to the receiving EHR over TLS and the EHR will convert it back to a C-CDA formatted message. This is illustrated in Figure 3.
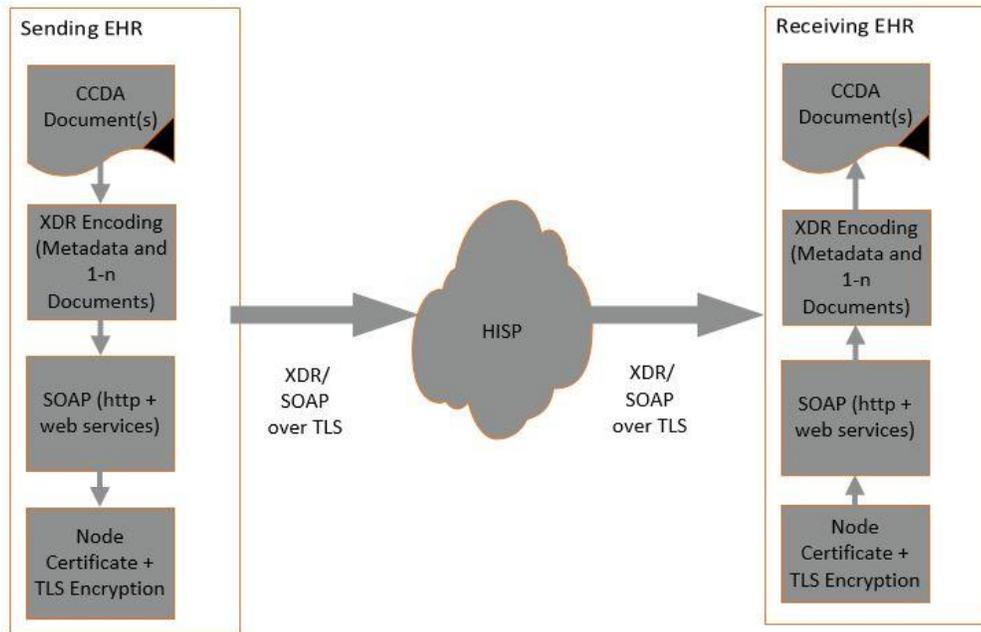

Figure 3 - EHR- delivery using the same HISP

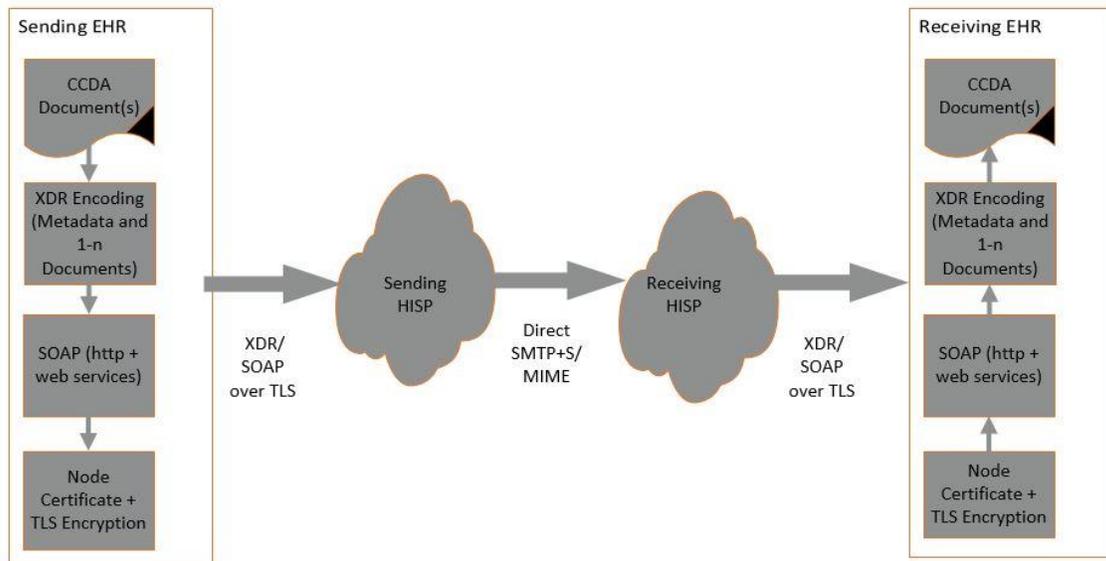- If the EHRs are parts of two (2) different HISPS, the delivery between these two (2) EHRs is different:

Figure 4 - EHR-EHR delivery using different HISPs

XDM TO XDR HANDOFF

While the above uses cases cover end-to-end delivery of a direct message through various different methodologies, there have been some lingering questions as to the specific message format of the XDM to XDR handoff when the data is converted from XDR into SMTP with XDM payload and back.

The Direct Project Wiki http://wiki.directproject.org/XDR+and+XDM+for+Direct+Messaging+Working+Version Section 5.2 ("Packaging Conversion from XDM to XDR") provides detailed guidelines as to how the conversion should take place.

Typically, the contents of an XDM message are sent as a zip file, and the EHR will accept the message, extract the ZIP file and the XML, and deliver the message as shown in Figure 1. The IHE specification does not specify how the zip files are attached.

The specified guideline is: if there are several zip attachments, each one of them has to be tested for compliance with XDM before being implemented.

From the above referenced document: "An XDM zip package contains a root directory, which includes a set of manifest content, and an IHE_XDM directory, which contains a set of subdirectories, each of which contain a packaged context with a metadata file equivalent to that provided in a XDR transaction."

A single XDR transaction has to be constructed for each XDM subdirectory that has a metadata file.

Additional details for the conversion are referenced at the end of Section 5.2 in the cited document.

The table below is adopted from the educational material on the topic of XDR/XDM conversion provided by the ONC. http://www.healthit.gov/sites/default/files/soapdeepdive.pdf summarizes the payload conversions that take place in these scenarios.

Table 1

	Receivers		
Senders	RFC5322+MIME	RFC5322+XDM	SOAP+XDR
RFC5322+MIME	■ No conversion	■ No conversion ■ Receiver expected to be able to handle MIME packages	■ Transport Conversion ■ Metadata created
RFC5322+XDM	■ No conversion ■ Receiver expected to be able to handle XDM packages	■ No conversion	■ Transport Conversion ■ Metadata simply transformed
SOAP + XDR	■ Transport Conversion ■ Metadata simply transformed ■ Package delivered as XDM	■ Transport Conversion ■ Metadata simply transformed ■ Package delivered as XDM	■ No conversion

The cell highlighted in the table represents the use case of transmission from XDR sender to SMTP recipient as illustrated in the diagram below.

DATAMOTION XDR IMPLEMENTATION

As an EHNAC-accredited HISP, DataMotion participates in the DirectTrust bundle and can enable exchanging of Direct Secure Messages between the users of DataMotion and other HISPs. When the DataMotion client (typically an ACO) has an EHR that utilizes the XDR protocol for communicating with other healthcare entities, DataMotion bridges the gap between XDR protocols to Direct Addresses as illustrated in Table 1. The diagram below illustrates an example of sending an XDR message to a recipient that uses SMTP represented in the crossover of the last row and first column in Table 1 above. The recipient can be a user of DataMotion or of another HISP.
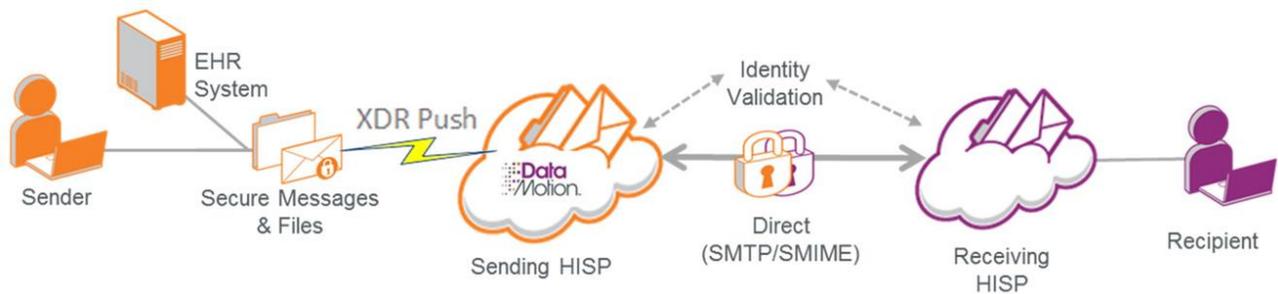
Figure 5 –Illustration of DataMotion XDR implementation

GLOSSARY OF TERMS

ACO	Acute Care Organization
CCDA	Continuing Care Document Architecture which allows healthcare entities to efficiently exchange patient information between points of care
EHR	Electronic Health Record- health related information that conforms to nationally recognized interoperability standards
HISP	Health Information Service Provider is an email service provider that follows the Direct Project standards for providing users with a secure email address for secure communication.
Metadata	It is defined as 'data about data'. It identifies the creator, time and date, purpose, etc. of the data.
ONC	The Office of the National Coordinator of Health Information Technology
S/MIME	Secure/Multipurpose Internet Mail Extensions is a standard for encryption and signing MIME data. It is widely used in healthcare email communications.
SOAP	Simple Access Object Protocol is a web services protocol used quite a bit in the healthcare industry to exchange information across enterprises.
TLS	Transport Layer Security
XDM	Cross-enterprise Document Media Interchange: specification that describes the format of the XML-based payload utilized to transfer documents and metadata using email attachments and physical media.
XDR	Cross-enterprise Document Reliable Interchange is a standard protocol for the description and encoding of data. It uses a web based point to point push network communication permitting direct interaction between healthcare systems.