Integrating the Healthcare Enterprise

IHE IT Infrastructure
Technical Framework Supplement

Add RESTful Query to ATNA

Draft for Public Comment

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Please verify you have the most recent version of this document. See here for Trial Implementation and Final Text versions and here for Public Comment versions.

Foreword

This is a supplement to the IHE IT Infrastructure Technical Framework V12.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on May 27, 2016 for public comment. Comments are invited and can be submitted at http://www.ihe.net/ITI_Public_Comments. In order to be considered in development of the trial implementation version of the supplement, comments must be received by June 26, 2016.

This supplement describes changes to the existing technical framework documents.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

Amend Section X.X by the following:

Where the amendment adds text, make the added text **bold underline**. Where the amendment removes text, make the removed text **~~bold strikethrough~~**. When entire new sections are added, introduce with editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

General information about IHE can be found at: http://ihe.net.

Information about the IHE IT Infrastructure domain can be found at: http://ihe.net/IHE_Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at: http://ihe.net/IHE_Process and http://ihe.net/Profiles.

The current version of the IHE IT Infrastructure Technical Framework can be found at: http://ihe.net/Technical_Frameworks.

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Introduction to this Supplement

Event logging is a system facility that is used by healthcare applications and other applications.

This supplement updates the Audit Trail and Node Authentication (ATNA) Profile. ATNA defines a standardized way to create and send audit messages; however, it does not identify a standardized way to retrieve audit messages collected by an Audit Record Repository.

This supplement adds Retrieve capabilities to the Audit Record Repository (ARR) Actor, defines a new actor -- the Audit Consumer, and two new transactions:

1. [ITI-81] Retrieve ATNA Audit Event is a transaction that allows an Audit Consumer to retrieve ATNA Audit Events stored within a target Audit Record Repository. This transaction is based on a FHIR®[1] RESTful search operation on AuditEvent resources.
2. [ITI-82] Retrieve Syslog Event is a transaction that allows an Audit Consumer to search syslog messages stored in an Audit Record Repository. This transaction is defined as a RESTful operation. The search parameters are based on syslog metadata.
3. Note that ATNA Audit Events are syslog events, so the transaction [ITI-82] Retrieve Syslog Event enables search of ATNA events based on syslog metadata values.

Open Issues and Questions

1. Readers are asked to evaluate to what extent filters should be specified and required within the Filter and Forward Option. Do they seem to be applicable to any implementation that claims this option?
2. There is the possibility to extend this filter capability requirement aligning the type of mandatory filters with mandatory query parameter defined for Audit Record Query transaction (see Section 9.3.2).
3. Only a JSON return format is specified for Retrieve Syslog Messages [ITI-82]. It delivers a slightly parsed form of the syslog message that makes JSON attributes in a structure that corresponds to the structure define by syslog. Should other forms be supported? Should the unparsed syslog message be returned?
4. Should there be retrieve methods to get “most recent N events”? This would be a non-deterministic and constantly varying response in most cases.
5. Should a server information query be specified? There are various RFCs from the IETF that specify aspects of server information.
6. Should support of the “/.well-known/” path RFC5785 be required or described in transactions ITI-81 and ITI-82? (This can be an alternative to more complete server

[1] FHIR is the registered trademark of Health Level Seven International.

information.) For example, PACS servers providing restful access to DICOM®[2] objects may respond to "/.well-known/DICOM" in addition to a fully specified URL path.

7. Should the server be required to error for lack of a time period in ITI-81 and ITI-82 or should this be weakened to "should" or "recommend" or "may"?

8. Transaction ITI-81 is based on a FHIR query operation. Not all the search parameters defined in this transaction are actually standard FHIR search parameters. A CP to FHIR is submitted to add "outcome" and "role" as standard search parameters (CP #9919 http://gforge.hl7.org/gf/project/fhir/DSTU2/tracker/?action=TrackerItemEdit&tracker_item_id=9919).

9. The start-time and stop-time in <date> search parameters shall be in RFC 3339 format. Do we need to further constrain the format of this parameter? Is this precise enough? Doesn't it allow for date and month only? For 6 digit fractions of seconds? Or for date-time with timezones? How is matching done then (e.g., Z vs +00:00)? Right now we leverage on FHIR matching criteria.

10. Tech cmte has documented the query to patient.identifier, starting from a search parameter of type "reference". Does this reflect the FHIR requirements in the correct way?

Closed Issues

1. This supplement is being written as additions to the ITI TF-1:9, ATNA, which was written to an older outline template. Rather than redocument ATNA entirely, these section are added using that outline, not the new template. The new sections all fit appropriately into either outline.

   The Report Audit Event Transaction [ITI-20] is completely rewritten to the current template outline. It was old and written to a very different outline than the current template structure. Merging in the options and their effect on this transaction became very confusing.
   The Node Authentication Transaction [ITI-19] is not affected by this supplement.

2. What audit event log sources should be defined to be supported by the query transaction? The table below is a partial list of event sources. This list is the combination of event sources supported by a variety of event management software.

   Decision: this version will only mandate support for the IHE ATNA formats and the generic SYSLOG format. The many other formats and transports can be added later as options or by vendors as product options.
   Examination of a variety of event reporting and logging products resulted in the following list of sources. After discussion and given scope concerns, no additional sources or encodings will be described.

[2] DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

Partial List of event sources/codecs considered

Name of source	Decision
IHE ATNA	Support
Collectd	No (perhaps future)
Elasticsearch	No (perhaps future)
Eventlog	No (perhaps future)
Imap	No (perhaps future)
Log4j	No (perhaps future)
Lumberjack	No (perhaps future)
S3	No (perhaps future)
Snmp	No (perhaps future)
Syslog	Support
Twitter firehose	No (perhaps future)
Xmpp	No (perhaps future)
Zeromq	No (perhaps future)
Edn	No (perhaps future)
Fluent	No (perhaps future)
Json	No (perhaps future)
Spool	No (perhaps future)
FHIR	No (perhaps future)

3. Event transports were selected as part of the planning decision for this work item. Technical evaluation found no issues with it.

Name of source	Short Description	Issues
IHE ATNA	Covered in this supplement	None
Syslog	Covered in this supplement	None

4. Candidate Query “standards”

   A variety of existing event management products and standards were examined. Most of the existing system use product specific plug-ins, direct database access, or other methods for providing query access.
   After review, four candidates were considered worth further evaluation.

Name of source	Short Description	Decision
DCM4CHE	Open Source implementation of PACS archive including ARR as well as much else. At least 5,000 operational downloads, but most probably not for ARR use.	Evaluate

Name of source	Short Description	Decision
Tiani Spirit EHR (awaiting formal name)	EU Public specification. Implementation underway.	Evaluate
Connect / Healtheway/ ?	Published specification. Need to determine license, etc., but probably suitable.	Evaluate
FHIR Security Event Report	Query of a FHIR resource	Evaluate
Plug-in style (multiple)	A variety of product specific mechanisms to write plug-ins for that product.	Reject, too product specific, subject to change at will by product vendor
Direct access to database (multiple)	A variety of product specific mechanisms that document the format and access methods for the internal database used by the product.	Reject, too product specific, subject to change at will by product vendor
Direct access to flat files (multiple)	A variety of product specific mechanisms that document the format and access methods for flat files of messages created by the product.	Reject, too product specific, subject to change at will by product vendor

The surviving four were evaluated against the ITI list of evaluation criteria. The general spreadsheet was reviewed and the following table is the result.

Evaluation Criteria Results

Criteria	DCM4CHE	Tiani Spirit EHR	Connect/Healtheway	FHIR (SecurityEvent)
Stability		Early development	Has been deprecated	DSTU
From an SDO	No	Govt specification	Govt specification	Yes
Licensing restrictions	LGPL v2		?	CC 0
Implementation Experience	Approx 5K installations			Hackathons, Connectathons
Ease of adoption	Open Source			Will be easy
RESTful/SOAP/other	RESTful	SOAP		RESTful
ATNA specific query	Yes	Yes	Yes	Kind-of
Generic SYSLOG query	No	No	No	No
Phase 1 decision	Continue evaluation	Drop	Drop	Continue evaluation
Acceptance by Intrusion Detection/ Security Analysis vendors	?	n.a.	n.a.	?

205 **Decision:**

FHIR was selected as the standard to be used to profile the Query transaction. The FHIR event report is managed as a joint effort among HL7®[3] FHIR, IHE, and DICOM. This makes coordination of the necessary resource changes fairly straightforward.
In order to use FHIR the following modification/extension/addition to the query will be needed:

- We need the same functional capabilities as DCM4CHE. The large installed base of DCM4CHE indicates that the functionality is widely needed. Adapting this functionality to use a FHIR query is a reasonable change if the functional capabilities do not need to change significantly.
- The generic Syslog query will not fit a FHIR query. This was made optional and a simple query that is similar to FHIR was defined.

The major risk item is coordinating release and preparation schedules. In order to fit HL7 publication schedule a reasonable version of the resource and query are needed by 22 March 2015. Revisions based upon public comment and TI experience can be handled during the FHIR DSTU cycle.

5. Should we define an actor and transaction for the other syslog messages that are not ATNA schema compliant? Should we mandate support for this kind of message from any secure actor? From any secure node? Or, should these filtering these messages only be mandated when originating on an ATNA compliant node, and support for other nodes be left as a product option?

   Decisions: The Filter and Forward transaction explicitly state that syslog messages not compliant with ATNA schema can be received. Those messages should be sent using the same protocol requirement defined for ATNA. This was addressed in the ITI-20 rewrite. The query for generic syslog messages was defined and is similar to FHIR in some respects. It is made optional.

6. Should Audit Record Repository always be required grouping with secure node/application or only when it does forwarding? ARR often have lots of PHI, so secure node may be generally appropriate. What about all the other syslog uses?
   Decision: Not needed the SN/SA grouping for the store/forward option. The text in the options section is sufficient. We have the need to track the Query event without using all the requirements introduced by the SN grouping, so there is no requirement to send the audit to another repository via TLS.

7. The Retrieve Syslog Message [ITI-82] only mandates support for query to return all syslog messages with timestamps within a time window. Should any other queries be mandated? **Decision:** NO

8. The query option is silent about how the Audit Record Repository determines which syslog messages are stored for later query, how long messages remain available for query, etc. Should there be any requirements put on this? The motivation for this is the

[3] HL7 is the registered trademark of Health Level Seven International.

wide range of real world situations, ranging from sites that must process tens of thousands of syslog messages per second to sites that manage a few hundred per day. Some sites deal only with major level ATNA security events. Some sites deal with syslog reports of every network connection, ping, firewall warning, etc. **Decision:** New ITI-20 makes it clear that these issues are decided during implementation and deployment.

9. Have two endpoints - one for syslog, one for ATNA? Have one and let parameters separate? Have two and permit ATNA parameters on syslog? Have two and permit syslog parameters ATNA (FHIR will generate 400 - bad request unless there is a FHIR extension defined)? **Decision:** two endpoints, one FHIR based and one for generic syslog.
10. Should Audit Record Repository always be required grouping with secure node/application or only when it does forwarding? ARR often have lots of PHI, so secure node may be generally appropriate. What about all the other syslog uses?

Considerations: The logging of the query event is clearly appropriate. However, there are requirements introduced by the ATNA Secure Node that are not applicable to our scenario where the Audit Source IS the Audit Record Repository itself: the ARR is required to send audit messages via UDP or TLS. We SHOULD mandate the creation of audit messages structured in accordance to ATNA structure and no other transport requirements. There is another point to take in consideration: once the ATNA query is made, an audit message is created. Should this audit be returned into the same transaction (query Response)?

Answer: This is a very important implementation decision, and IHE cannot define requirement for this.

General Introduction

Appendix A - Actor Summary Definitions

Add the following actors to the IHE Technical Frameworks General Introduction list of actors:

Actor	Definition
Audit Consumer	Search for syslog and ATNA audit messages based upon queries using Syslog metadata and ATNA audit message content. Subsequent processing is not defined.

Appendix B - Transaction Summary Definitions

Add the following transactions to the IHE Technical Frameworks General Introduction list of Transactions:

Transaction	Definition
ITI-81 Retrieve ATNA Audit Event	Retrieve Audit Messages. Search ATNA audit messages based upon queries using ATNA audit message content.
ITI-82 Retrieve Syslog Event	Retrieve Syslog Messages. Search syslog messages based upon using the syslog metadata.

Glossary

Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:

Glossary Term	Definition
Syslog metadata	Attributes that classifies the audit message defining: severity of the event, facility and application that sent the message. These are defined in RFC-5424.
Syslog message	Any message that complies with RFC-5424, regardless of the format of the message body. An ATNA audit log message is a specific kind of syslog message that has a specific format for the message body.
Audit message	A syslog message that complies with the DICOM PS3.15 schema.

Volume 1 – Profiles

Editor: Update Section 9 adding the following text at the end of that section:

9 Audit Trail and Node Authentication (ATNA)

The ATNA Profile also defines optional capabilities to retrieve messages stored in an Audit Record Repository (ARR) using the Audit Consumer and transactions:

1. **[ITI-81] Retrieve ATNA Audit Event is a transaction that enables an Audit Consumer to retrieve ATNA Audit Events stored within a target Audit Record Repository. This transaction is based on a FHIR RESTful search operation on AuditEvent resources.**
2. **[ITI-82] Retrieve Syslog Event is a transaction that enables an Audit Consumer to search syslog messages stored in an Audit Record Repository. This transaction is defined as a RESTful operation. The search parameters are based on syslog metadata.**
3. **Note that ATNA Audit Events are syslog events, so the transaction [ITI-82] Retrieve Syslog Event enables retrieval of ATNA events based on syslog metadata values.**

Editor: Update Figure 9.4-1. Note that in the figure below, the existing actors and transactions are shown in dashed lines. The figure should be updated by adding the actors and transactions in solid lines.

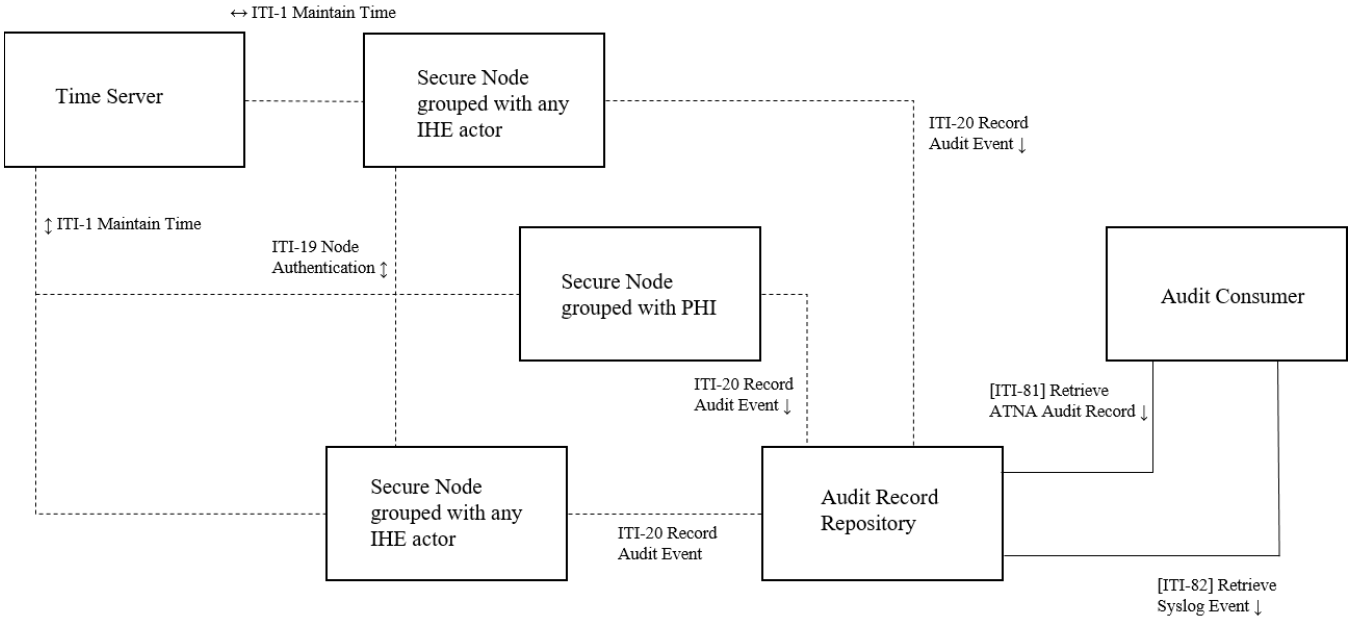

Figure 9.4-1: Audit Trail and Node Authentication Diagram

Editor: In Section 9.4, Update Table 9.4-1

Table 9.4-1: ATNA Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Audit Record Repository	Record Audit Event [ITI-20]	R	ITI TF-2a: 3.20
	Retrieve ATNA Audit Event [ITI-81]	**O**	**ITI TF-2c: 3.81**
	Retrieve Syslog Event [ITI-82]	**O**	**ITI TF-2c: 3.82**
Audit Consumer	**Retrieve ATNA Audit Event [ITI-81]**	**O**	**ITI TF-2c: 3.81**
	Retrieve Syslog Event [ITI-82]	**O**	**ITI TF-2c: 3.82**
Secure Node	Authenticate Node [ITI-19]	R	ITI TF-2a: 3.19
	Record Audit Event [ITI-20]	R	ITI TF-2a: 3.20
	Maintain Time [ITI-1]	R	ITI TF-2a: 3.1
Secure Application	Authenticate Node [ITI-19]	O	ITI TF-2a: 3.19
	Maintain Time [ITI-1]	O	ITI TF-2a: 3.1
	Record Audit Event [ITI-20]	O	ITI TF-2a: 3.20

Editor: Update ITI TF-1:9.5 as shown, including the note under Table 9.5-1.

9.5 ATNA Integration Profile Options

Options that may be selected for this Integration Profile are listed in the Table 9.5-1 along with the actors to which they apply. Dependencies between options when applicable are specified in notes.

Table 9.5-1: ATNA - Actors and Options

Actor	Option Name	Vol. & Section
Audit Record Repository	**Retrieve Audit Message**	**ITI TF-1: 9.5.3**
	Retrieve Syslog Message	**ITI TF-1: 9.5.4**
Audit Consumer	**Retrieve Audit Message (Note 1)**	**ITI TF-1: 9.5.3**
	Retrieve Syslog Message (Note 1)	**ITI TF-1: 9.5.4**
Secure Node	Radiology Audit Trail	RAD TF-1: 2.2.1; RAD TF-3: 5.1
Secure Application	Radiology Audit Trail	RAD TF-1: 2.2.1; RAD TF-3:5.1

Note 1: The Audit Consumer shall support at least one of the two options defined.

Editor: Add new Sections 9.5.3 and 9.5.4 to ITI TF-1:9.5

9.5.3 Retrieve Audit Message Option

The Retrieve Audit Message Option enables search requests for audit messages based upon message contents.

An Audit Consumer or Audit Record Repository that supports this option shall implement the Retrieve ATNA Audit Event [ITI-81] transaction.

The [ITI-81] transaction is profiled as a RESTful search from an Audit Consumer to an Audit Record Repository (ARR) using FHIR resources. The search response will reflect the contents of the data storage at the time of the search. IHE does not specify the criteria for message selection, archival, retention interval, etc. These are set by local policy and are often different for different Audit Record Repositories.

9.5.4 Retrieve Syslog Message Option

The Retrieve Syslog Message Option enables search requests for syslog messages based upon syslog metadata.

An Audit Consumer that supports this option is able to initiate [ITI-82] Retrieve Syslog Event transactions. ([ITI-82] is a required transaction for the Audit Record Repository).

The [ITI-82] transaction is profiled as a RESTful search operation that searches syslog messages of any format or schema. The search request uses the syslog metadata only.

Editor: Make the following changes in Section 9.6

…

In the following paragraphs three typical process flows **in Sections 9.6.1, 9.6.2, and 9.6.3** are described for situations in which authorized users, unauthorized users, and unauthorized nodes attempt to gain access to protected health information (PHI).

Sections 9.6.4, 9.6.5, 9.6.6, 9.6.7, and 9.6.8 describe use cases related to the retrieve capabilities of the Audit Record Repository.

Editor: Add new Sections 9.6.4, 9.6.5, 9.6.6, 9.6.7, 9.6.8, and 9.6.9

9.6.4 Study Change Tracking Process Flow

PACS administrators may need to gather a complete change history of data for a specific patient/study/series (e.g., from applying changes from received HL7 messages, performed during Quality Control (QC) operations) to identify who has changed what in case of uncertainty if "something went wrong", in most cases accidental wrong QC of data.

This use case describes a situation in which an erroneous merge of patient identities is applied.

9.6.4.1 Studies Change Tracking use case

Mr. White is a PACS administrator for the Hope Clinic. Hope Clinic has created a Quality Control system to ensure consistent data display in order to identify problems before they become clinically significant (patient demographic data analysis, patient identifiers merge, access/order information reconciling, etc.). QC operations are performed by many hospital systems and affect different objects (studies, reports, patient demographic record, etc.). Each operation is tracked as an audit event in the Hospital Audit Record Repository. Hope Clinic provides Mr. White with a change tracking system able to him identify who has changed what in case of uncertainty if "something went wrong".

The QC system identifies an attempted merge of two patient identities, and this event is propagated to the PACS. However, due to a bug in the Patient Identity Source (that is part of the QC system itself), the merge could not be applied. This merge involves the updates of many reports and studies. After the patient discharge the error is discovered, because unrelated reports and studies are returned to the patient.

Using retrieved audit events, Mr. White identifies erroneous operations and subsequent events occurred receiving the merge request. This can be done by analyzing, the creation of audit messages related to operations performed on patient reports and studies during a specific time frame. My White can collect additional information by searching for syslog events produced by the QC system.

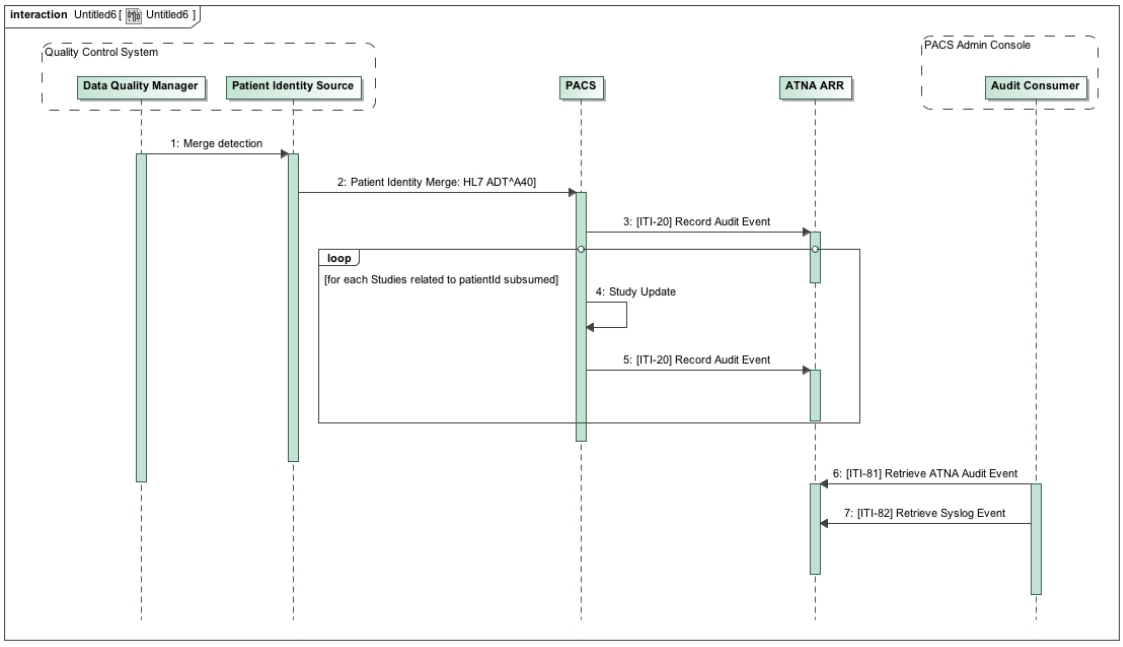

Figure 9.6.4.1-1: Studies Change Tracking process flow

9.6.5 Clinician Personal History of Study views process flow

This use case describes the scenario in which a clinician would gather the history of studies he accessed during his clinical activity using different devices (EHR system, WebApp, Mobile device). This information allows the clinician to:

- Discover unexpected accesses made that can be related to the disclosing of its access credentials;
- Revaluate clinical decisions taken;
- Consolidate to a unique device a complete picture of complex clinical cases.

9.6.5.1 Clinician Personal History of Study views use-case

Dr. White usually performs his clinical activity using multiple devices. Mr. Brown is a patient who is home-monitored. Dr. White collects results of home visits using a tablet, and he monthly performs a detailed visit with Mr. Brown in his office. During home visits Dr. White analyzes tele-monitoring data collected by some devices (scales, blood pressure devices, etc.) and adjusts drugs therapies in accordance with those data. Every action performed is tracked as an ATNA audit event. Both views and documents creation are logged, tracking the user that performed the transaction (e.g., using an XUA identity assertion).

During the monthly visit, Dr. White would consolidate within his EHR system the whole history of data analyzed and collected using multiple devices. This process allows Dr. White to keep track of his clinical activities and revaluate clinical decisions made in the past.

To do that, the EHR system can query for audit events related to transactions performed by Dr. White during a specific time frame.

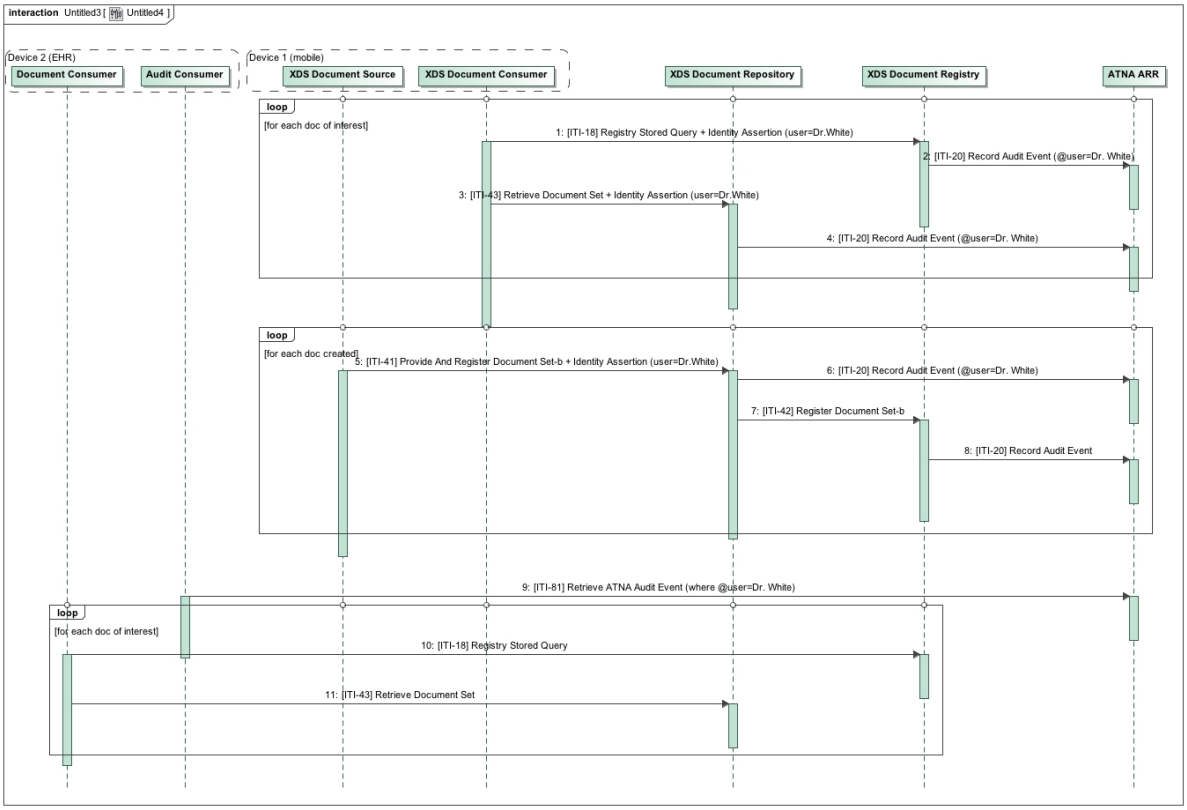

Figure 9.6.5.1-1: Clinician Personal History of Study views process flow

9.6.6 Data Export Monitoring for administrative and efficiency purposes process flow

This use case describes the scenario in which a user, responsible for data exporting would check if a specific study has been already exported by other systems (e.g., via Web Access or General Practitioner system). This check provides the important information about whether a study performed for outpatient has been already consulted or not.

9.6.6.1 Exporting Data Monitoring for administrative and efficiency purposes use-case

The Hope Clinic provides many ways to export imaging studies and reports created for outpatients:

- Web Application
- WS for GP's EHR systems
- ATM
- Desk staff

Mr. Green is a hospital employee and he is in charge of monitoring of the reporting status for every document / image produced for outpatients. Reports and Studies not delivered or withdrawn by outpatient lead additional cost to the hospital (archiving costs, administrative staff, etc.) and could increase clinical risks such as unreported results could affect subsequent clinical decisions.

Due to the fact that there are many applications that allow patients and clinicians to withdraw reports, Mr. Green needs to monitor audit events produced in a heterogeneous environment:

- Desk staff and ATM could use a Portable Media Creator system able to store on a portable media (e.g., CD-Patient images using the [RAD-47] Distribute Imaging Information on Media transaction).
- A Web Application and GP's EHR systems could interact with an XDS-I infrastructure to retrieve images (e.g., using a [RAD-69] Retrieve Imaging Document Set transaction).

Each transaction requires the creation of audit messages tracking the "Export" and "Import" event. These messages are stored within the same ATNA Audit Record Repository.

Mr. Green can monitor the reporting status related to every study querying the ATNA ARR system. Using the data collected, the application used by Mr. Green can highline pending reports/studies and the operator can undertake other actions to deliver these studies.

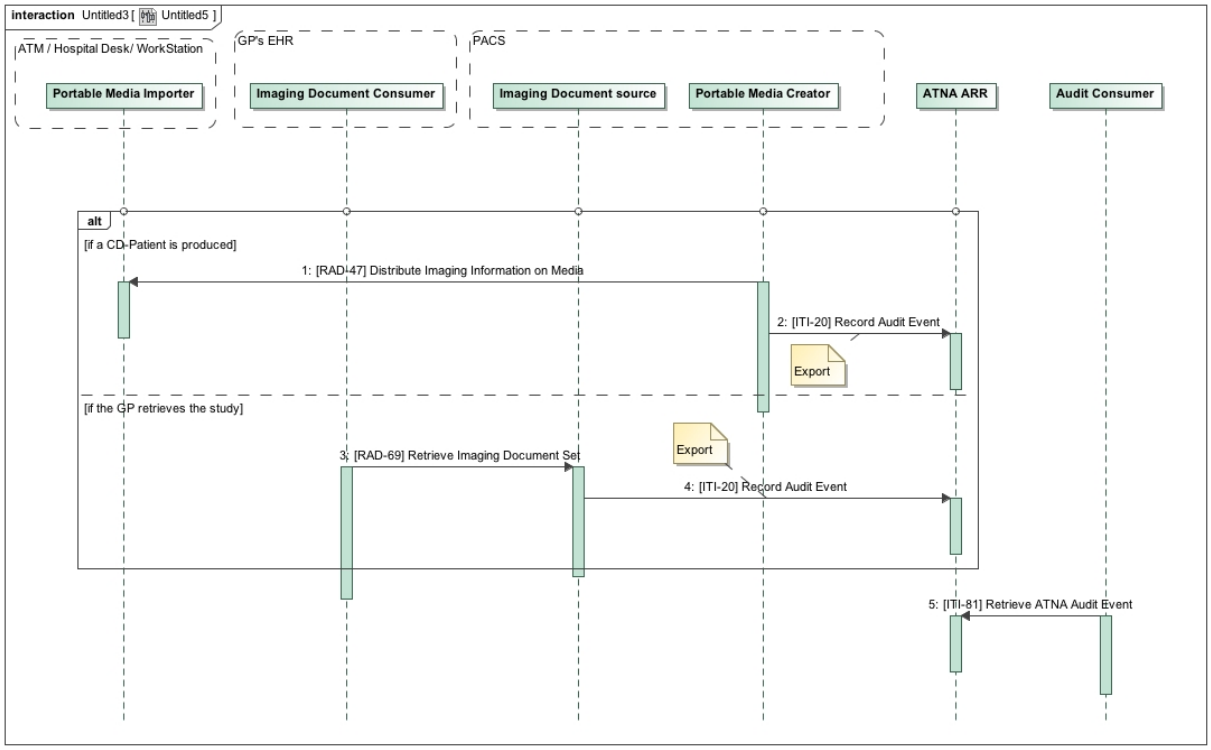

Figure 9.6.6.1-1: Exporting Data Monitoring for administrative and efficiency purposes Process flow

9.6.7 Patient access to his audit records process flow

This use case describes the scenario in which the patient would discover the list of people that accessed a specific study. Using those data, the patient should be able to understand if privacy consents he expressed were applied.

9.6.7.1 Patient access to his audit records use case

During a hospitalization Mr. Brown was asked to subscribe a consent document aimed to share documents produced during that clinical event with a research facility. Mr. Brown does not provide this consent because he is worried that his data could be used for marketing purposes. A nurse collects the patient's consent document but forgets to trace it using the HIS system.

All the data collected during Mr. Brown's hospitalization are used by the research facility to analyze the efficiency of the applied treatment. These accesses are tracked as "Export" or "Disclosure" events for a "Research" purpose. Every access to the same data requested by clinicians involved in the care of the Mr. Brown are tracked as "Export" or "Disclosure" events for a "Treatment" purpose

The healthcare facility that Mr. Brown belongs to provides on-line access to health information. Mr. Brown can use a web app to access this data (shared using and XDS or XCA infrastructure). The web app can also collect audit information related to those documents/studies. Audit records are collected by many ATNA Audit Record Repositories, but local policies or system configurations allows the web app to identify the right Audit Record Repository service that stores relevant records. Using the document/study identifiers, the web app can query the identified ATNA Audit Record Repository.

The web app reports to Mr. Brown that his documents/studies have been disclosed/exported for treatment and research purposes.

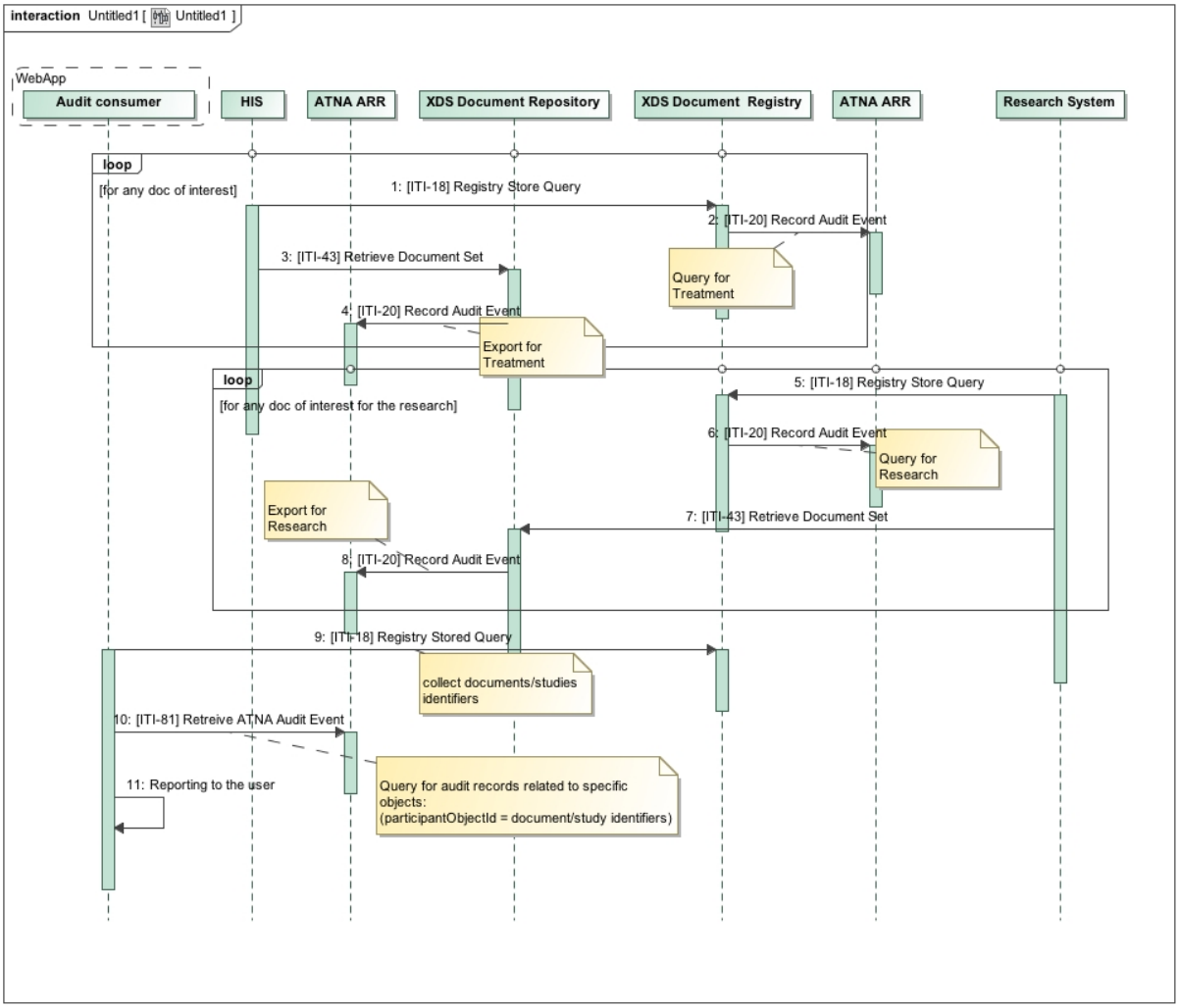

Figure 9.6.7.1-1: Patient access to his audit records Process Flow

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9.6.8 Statistical Analysis and Monitoring of EHR Usage process flow

Many Local Health Authorities need to monitor the usage of Electronic Health Record systems during clinician's daily activities. EHR usage can be evaluated by monitoring transactions started by specific users.

465 EHR usage details can be used to improve workflow, procedure compliance, and other aspects of patient treatment. The audit records provide an indication of activity without exposing as much patient private information.

For example, data collected by users that demonstrate high confidence with Electronic Health Record and its functionalities may be considered more reliable compared to data provided

470 manually.

9.6.8.1 Statistical Analysis and Monitoring of EHR Usage use-case

A Local Health Authority has identified a list of indicators useful to evaluate clinician activity. Among them, the level of digitalization has an important role in identifying the quality of data produced by clinicians. Dr. White has a lot of expertise in using EHR systems. He produces ePrescriptions, he monitors patients engaged in tele-monitoring services, and he views and produces digital clinical reports. All these operations are based on IHE transactions that require the creation of Audit records.

Local Health Authority administrators can gather statistical usage information querying for audit records related to transactions initiated by Dr. White. Audit records are stored in many different ATNA Audit Record Repositories because Dr. White operates on patients belonging to many different enterprises.

Analyzing number and type of transactions performed by Dr. White, administrators can identify the level of digitalization of the doctor. Due to that evaluation, clinical data collected by Dr. White are considered highly reliable.

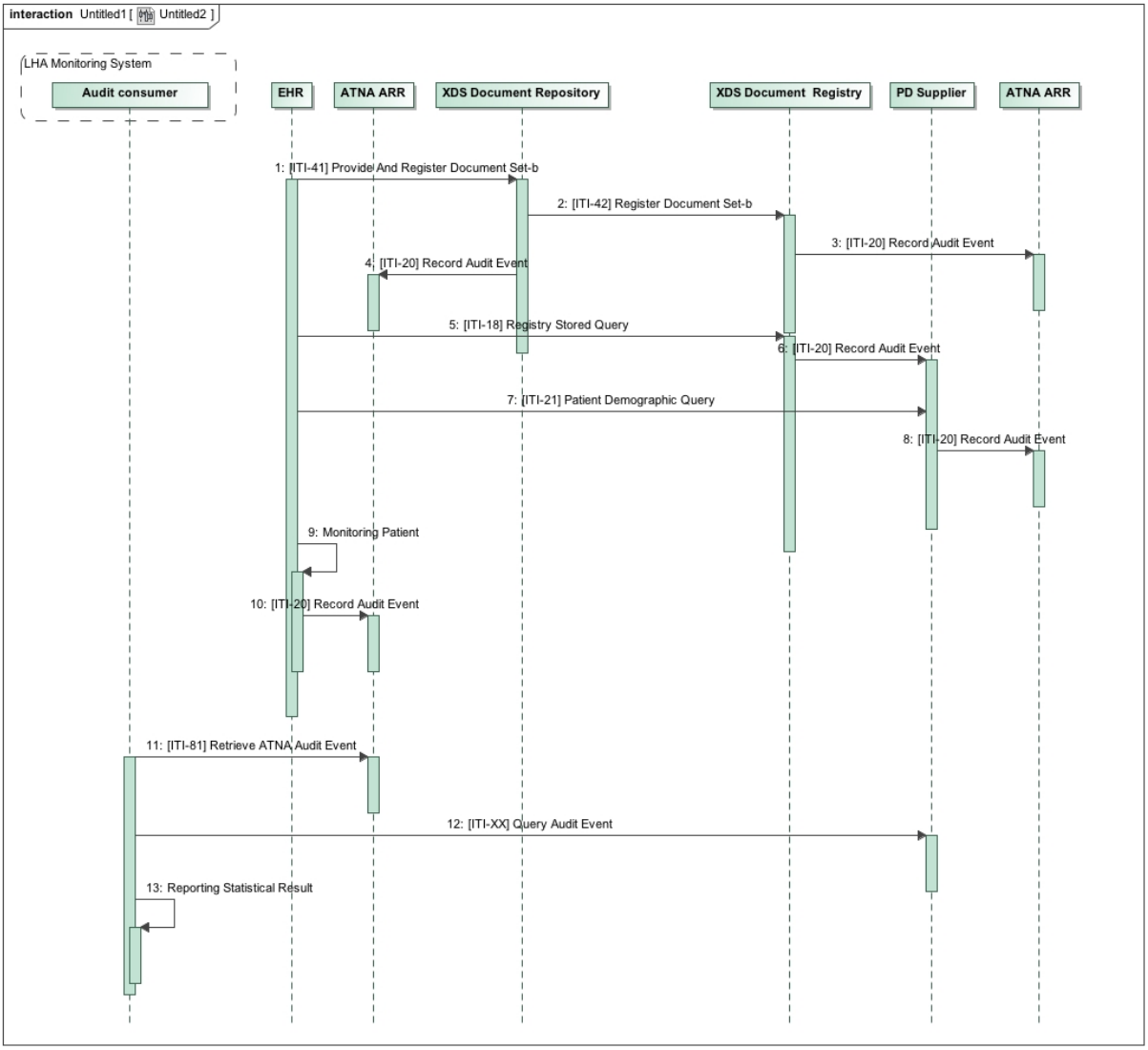


Figure 9.6.8.1-1: Statistical Analysis and Monitoring of EHR Usage Process Flow

9.6.9 Technical Approach to Query use cases

There are a wide variety of specific reports and analyses that may be needed. It is assumed that there will be a reporting and analysis system that has extensive database and programmability features. The interoperability need is to search suitable subsets of the total ARR, and the results will then be combined and analyzed to determine a final result.

Rather than support a highly complex query capability, ATNA defines simple search transactions that can be combined to fit real-world needs.

The ATNA Retrieve Audit Event transaction support searches based on:

- **Patient identifier**: this search parameter allows discovering all the events occurred related to a specific patient;
- **User identifier**: this search parameter allows discovering all the actions performed by a specific user
- **Object identifier**: this search parameter allows discovering each event occurred related to a specific object (like study, reports, image, etc.).
- **Time frame**: this search parameter allows discovering all the events occurred during a specific time frame.
- **Event type**: this search parameter allows discovering all the occurrences of a specific event (like Data Export, Data Import, Query, Authentication, etc.).
- **Application identifier**: this search parameter allows discovering all the events started by a specific application or system.
- **Event Outcome Indicator**: this search parameter allows discovering all events characterized by a specific outcome (Success, Failure, etc.) of the related event.

For additional analysis beyond that which is fulfilled by the above parameters, the Audit Consumer can perform a search for the time frame expected and then perform more detailed analysis locally.

Further details about message semantic are defined in Section ITI TF-2c: 3.81.

Editor: Add new Sections 9.8 and 9.9 to ITI TF-1:9 as shown.

9.8 Required Actor Groupings

An actor from this profile (Column 1) shall implement all of the required transactions and/or content modules in this profile ***in addition to*** all of the transactions required for the grouped actor (Column 2).

Table 9.8-1: ATNA - Required Actor Groupings

ATNA Actor	Actor to be grouped with	Reference	Content Bindings Reference
Audit Record Consumer	ATNA Secure Node or Secure Application	ITI TF-1: 9.1	--
Secure Node	Consistent Time / Time Client	ITI TF-1: 7.1	--
Secure Application	Consistent Time / Time Client	ITI TF-1: 7.1	--
Audit Record Repository	Consistent Time / Time Client	ITI TF-1: 7.1	--

9.9 ATNA Query Security Considerations

ATNA defines transactions for the Audit Record Repository that enables sharing of sensitive information related to patients and systems.

Audit Record Repositories have been considered in many implementations and projects as a "black-box" able to store relevant information for security and monitoring purposes. Those systems have not historically been designed to provide external access to stored records. Security Officers and System Architects should consider this and analyze the risks of disclosing data stored in the Audit Record Repository. The Retrieve ATNA Audit Event [ITI-81] and Retrieve Syslog Event [ITI-82] transactions define how to search audit records grouped in two categories:

- messages related to IHE transactions or compliant with DICOM Audit Message Schema (DICOM PS3.15 Section A.5) http://medical.nema.org/medical/dicom/current/output/chtml/part15/sect_A.5.html
- other syslog messages compliant with RFC 5424.

Security analysis should include consideration of the content of the other syslog messages. The content of those messages is not profiled by IHE or DICOM, and may include PHI or other sensitive information.

Accordingly, access control mechanisms on the ATNA Actors and queries are strongly recommended. The IUA Profile should be considered for the authorization controls. The ATNA Audit Record Repository can be grouped with an IUA Resource Server to enforce policies and authorization decisions. The Audit Consumer Actor can be grouped with an IUA Authorization Client to provide authorization information to the ATNA Audit Record Repository. Access controls should appropriately restrict access to audit messages.

The Retrieve ATNA Audit Event and Retrieve Syslog Event transactions may involve the disclosure of sensitive information. The logging these retrieve transactions as a query event is appropriate. However, ATNA Profile does not mandate the grouping of the Audit Record Repository with a Secure Node because that grouping introduces requirements that are not applicable to this scenario. In particular, it is reasonable that an audit message is not sent to another system using Syslog over TLS protocol; rather, it is directly stored within the ARR database. Also, mandating a grouping of the Audit Record Repository with a Secure Node could lead to audit record feedback loops. The Record Audit Event [IT-20] already includes some the audit requirements for the ATNA Audit Record Repository, such as reporting accesses to the ARR.

Volume 2c – Transactions

Editor: Add new Section 3.81 Retrieve ATNA Audit Event and 3.82 Retrieve Syslog Event to Volume 2c

3.81 Retrieve ATNA Audit Event [ITI-81]

This transaction supports the retrieval of ATNA audit messages from the Audit Record Repository in accordance with a set of search parameters that determine the retrieved event reports. This transaction enables an Audit Consumer to search audit events that an Audit Record Repository created via transaction [ITI-20] Record Audit Event.

This transaction is a profiling of a standard FHIR search of the audit event.

3.81.1 Scope

The Retrieve ATNA Audit Event transaction is used to search ATNA events recorded in an ATNA Audit Record Repository. The result of this retrieval is a FHIR bundle of AuditEvent resources that match with a set of search parameters.

3.81.2 Actor Roles

Table 3.81.2-1: Actor Roles

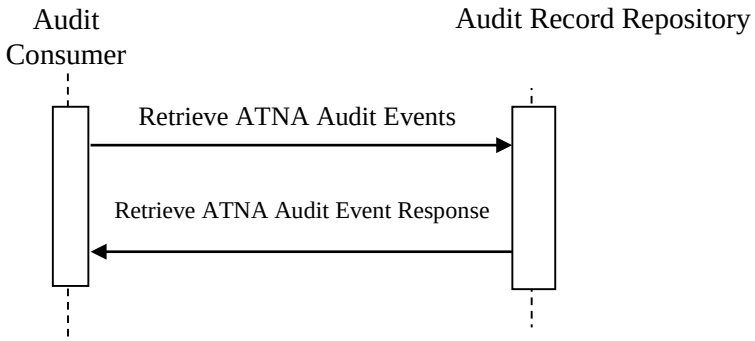
Actor:	Audit Record Repository
Role:	Provides storage for ATNA audit events, and responds to queries for a portion of the stored records.
Actor:	Audit Consumer
Role:	Queries for ATNA audit records.

3.81.3 Referenced Standards

RFC 2616	IETF Hypertext Transfer Protocol –HTTP/1.1
RFC 4627	The application/json Media Type for JavaScript Object Notation (JSON)
RFC 6585	IETF Additional HTTP Status Codes
RFC 5424	The Syslog Protocol
RFC 3339	Date and Time on the Internet: Timestamps

HL7 FHIR DSTU 2 version 1.0.2 (Oct 2015)
(http://hl7.org/fhir/DSTU2/DSTU2/index.html)

3.81.4 Interaction Diagram



3.81.4.1 Retrieve ATNA Audit Events Message

This is an HTTP GET parameterized search from an Audit Consumer to an Audit Record Repository that has stored ATNA audit messages received via [ITI-20] Record Audit Event transactions. Those messages that are stored within a datastore can be retrieved in accordance to specific search parameters. The response to this search will reflect the contents of the audit messages stored on the Audit Record Repository at the time of the search initiation.

3.81.4.1.1 Trigger Events

The Audit Consumer sends a Retrieve ATNA Audit Events message when it needs ATNA audit messages to process or analyze.

3.81.4.1.2 Message Semantics

The Retrieve ATNA Audit Event message is an HTTP GET request sent to the RetrieveATNAAuditEvent URL on the Audit Record Repository. This is the “search” target is formatted as:

<scheme>://<authority>/<path>/AuditEvent?date=ge[start-time]&date=le[stop-time]>&<query>

where:

- **<scheme>** shall be either http or https. The use of http or https is a policy decision, but https is usually appropriate due to confidentiality of ATNA audit messages stored on the Audit Record Repository;

- **<authority>** shall be represented as a host (either IP address or DNS name) followed optionally by a port.
- The Audit Record Repository may use **<path>** to segregate the RetrieveATNAAuditEvent RESTful service implementation from other REST-based services.
- Two **<date>** search parameters are required. They define a time period for the search. It enables an Audit Consumer to search for AuditEvent resources created during a specific time frame. See Section 3.81.4.1.2.1
- **"&"** is a conditional parameter that shall be present if **<query>** parameter is present.
- **<query>**, if present, represents a series of encoded name-value pairs representing filters for the search. See Section 3.81.4.1.2.2.

3.81.4.1.2.1 Date Search Parameters

The two **<date>** parameters shall be present in every search by the Audit Consumer and shall be supported by the Audit Record Repository. These parameters allow the Audit Consumer to specify the time frame of creation of audit messages of interest and enable the Audit Consumer to constraint the number of audit messages returned. The start-time and stop-time shall be in RFC 3339 format.

Note: RFC 3339 format is the format mandated by Syslog for time stamps and is a sub-set of the XML date-time data format used by FHIR.

This search parameter shall be encoded as shown below:

```
date=ge[STARTING_DATETIME]&date=le[ENDING_DATETIME]
```

For example, to search AuditEvents resources created during the whole day: 2013-01-01

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-01
```

The Audit Record Repository shall apply matching criteria to AuditEvents resources characterized by AuditEvent.event.dateTime field valued within the time frame specified in the Request message.

The Audit Record Repository shall apply other date matching criteria following rules defined by FHIR Section 2.1.1 (http://hl7.org/fhir/DSTU2/search.html).

3.81.4.1.2.2 Additional ATNA Search Parameters

The search parameters in this section may be supported by the Audit Consumer and shall be supported by the Audit Record Repository. These parameters can be used by the Audit Consumer to refine search requests.

The Audit Consumer shall encode all search parameters per RFC 3986 "percent" encoding rules. Although FHIR allows unconstrained use of AND OR operators to make queries of unlimited complexity, this transaction constrains the queries allowed. Multiple search parameters shall only be combined using AND "&" operators. The OR "," operator shall be used only within a single search parameter that has multiple values.

Additional search parameters are listed below:

- **address** is a parameter of `string` type. This parameter specifies the identifier of the network access point (NetworkAccessPointID) of the user device that creates the audit message (This could be a device id, IP address, or some other identifier associated with a device).

  The value of this parameter shall contain the substring to match.

  For example:
  `http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-01&date=le2013-01-02&address=192.168.0.1`

  The Audit Record Repository shall match this parameter with the AuditEvent.participant.network.address.

- **patient.identifier** is a parameter of `token` type. This parameter specifies the identifier of the patient involved in the event as object. The value of this parameter shall contain the namespace URI (that represents the assigned authority for the identifier) and the identifier.

  For example:
  `http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-01&date=le2013-01-02&patient.identifier=urn:oid:1.2.3.4|5678`

  The Audit Record Repository shall match this parameter only with the AuditEvent.object.identifier field. A match with other fields SHALL NOT be reported in search responses (the patient identifier can be used in other audit event fields. The objective of this constraint is to force the repository to respond only with audit messages related to a specific patient, and not with all the audit messages that involves this patient in other roles).

- **identity** is a parameter of `token` type. This parameter specifies unique identifier for the object. The parameter value should be identified in accordance to the object type; however the value shall carry, at minimum, one of namespace URI (as defined in RFC 3986), or identifier, or both.

  For example:


```
?identity=urn:oid:1.2.3.4.5| , ?identity=urn:oid:1.2.3.4.5|123-203-FJ
or ?identity=|123-203-FJ.
```

The Audit Record Repository shall match this parameter with the AuditEvent.object.identifier field that is of type identifier (ParticipantObjectID in DICOM schema).

- **object-type** is a parameter of `token` type. This parameter specifies the type of the object (e.g., Person, System Object, etc.). The parameter value shall contain the namespace URI http://hl7.org/fhir/DSTU2/valueset-object-type.html defined by FHIR and a coded value. See http://hl7.org/fhir/DSTU2/valueset-object-type.html for available codes.

  The Audit Record Repository shall match this parameter with the AuditEvent.object.type field that is of code type.

- **role** is a parameter of token type. This parameter specifies the role played by the object (e.g., Report, Location, Query, etc.). The parameter value shall contain the namespace URI http://hl7.org/fhir/DSTU2/object-role defined by FHIR and a coded value. See http://hl7.org/fhir/DSTU2/object-role for available codes.

  For example, to search all the audit messages related to the document object (Report="3") with the unique id 12345^1.2.3.4.5 a fully specified request would be:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&role=http://hl7.org/fhir/DSTU2/object-
role|3&identity=urn:oid:1.2.3.4.5|12345
```

  The Audit Record Repository shall match this parameter with the AuditEvent.object.role field

- **source** is a parameter of `token` type. This parameter identifies the source of the audit event (DICOM AuditSourceID).

  For example, to search AuditEvent resources produced by the audit source application characterized by id 1.2.3.4:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&source=urn:oid:1.2.3.4|
```

  The Audit Record Repository shall match this parameter with the AuditEvent.source.identifier field.

- **type** is a parameter of `token` type. This parameter represents the identifier of the specific type of event audited. The parameter value shall contain the namespace URI http://nema.org/dicom/dcm and a coded value. Codes available are defined by DICOM and IHE (see ITI TF-1: Table 3.20.6-1: Audit Record trigger events)

  For example, to search AuditEvent resources related to PHI Export Events:


```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&type=http://nema.org/dicom/dicm|110106
```

The Audit Record Repository shall match this parameter with the AuditEvent.type field (DICOM EventID).

- **user** is a parameter of `token` type. This parameter identifies the user that participated in the event that originates the audit message.

  For example, to search AuditEvent resources related to the user “admin”:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&participant=admin
```

  The Audit Record Repository shall match this parameter with the AuditEvent.participant.userId field.

- **subtype** is parameter of `token` type. This parameter identifies the specific IHE transaction that originates the audit message. The parameter value shall contain the namespace URI urn:ihe:event-type-code. Each IHE transaction specifies an associated audit message that defines a specific code identifying the transaction itself, and assigns this code to the EventTypeCode element within the [ITI-20] audit message.

  For example, to search AuditEvents resources related to Retrieve Document Set [ITI-43] transactions:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&subtype=urn:ihe:event-type-code|ITI-43
```

  The Audit Record Repository shall match this parameter with the AuditEvent.subtype field (DICOM EventTypeCode).

- **outcome** is a parameter of `token` type. This parameter represents whether the event succeeded or failed. The parameter value shall contain the namespace URI http://hl7.org/fhir/DSTU2/audit-event-outcome and a code taken from the related value set. Codes available can be found at http://hl7.org/fhir/DSTU2/audit-event-outcome.

  To search AuditEvents resources related to failed events:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&outcome=http://hl7.org/fhir/DSTU2/audit-event-
outcome|4,8,12
```

  The Audit Record Repository shall match this parameter with the AuditEvent.event.outcome field (DICOM EventOutcomeIndicator).

FHIR standard provides additional search parameters. This transaction does not define specific behavior on this parameters (such as _sort, _include , etc.). See Section "2.1.1 Search" in FHIR standard for details about available parameters.

3.81.4.1.2.3 Populating Expected Response Format

The FHIR standard provides encodings for responses as either XML or JSON. The Audit Record Repository shall support both message encodings. The Audit Consumer shall support either and may optionally support both. The Audit Consumer may indicate the desired response format using the http "Accept" header or may provide a `_format` parameter carrying at least one of the values in Table 3.81.4.1.2.3-1. Multiple values in the accept header or `_format` parameter indicate the Audit Consumer is capable of processing responses in either response encoding. If the `_format` parameter is used, it has to convey one of the values provided by the http "Accept" headers. For Desired Response Encoding see ITI TF-2x: Z.6..

3.81.4.1.3 Expected Actions

The Audit Record Repository (ARR) maintains a database of security events. The Audit Record Repository is required to return all the security events stored in that database that match query parameters and for which the requester is authorized. The Audit Record Repository retains data in accordance to local policies and some data may be deleted.

When performing matching based on the search parameters, the Audit Record Repository shall:

- Select all audit messages that have a time interval specified in the request URL. If these search parameters are missing, the Audit Record Repository may return a 400 Bad Request HTTP status code.
- If search parameters not defined in Section 3.81.4.1.2.2 (e.g., _sort, _include FHIR search result parameters) are specified in the request URL, then
    1. If the Audit Record Repository does not support the parameter, it shall be ignored;
    2. If the Audit Record Repository supports the parameter, the matching shall comply with the matching rules for its datatype in FHIR.
- All matching resources shall be returned.

The Audit Record Repository shall return matching resources using the Retrieve ATNA Audit Event Response Message. See Section 3.81.4.2.

The Audit Record Repository shall return an empty result and a 200 HTTP status code if no matching resources are found.

The Audit Record Repository shall return a 400 Bad Request HTTP status code if the Request format does not fulfill the requirements defined in Section 3.81.4.1.2.

3.81.4.2 Retrieve ATNA Audit Event Response Message

The Audit Record Repository shall return a HTTP Status code appropriate to the processing and may return AuditEvents resources in the message body.

3.81.4.2.1 Trigger Events

The Audit Record Repository creates this message when it receives and processes a Retrieve ATNA Audit Event message.

3.81.4.2.2 Message Semantics

When the search request is successfully processed, the Audit Record Repository shall return the AuditEvent resources that match the search parameters, encoded as a FHIR bundle of AuditEvent resources. See ITI TF-2x: Z.1 in for further details.

The "Content-Length" entity-header field shall be returned, unless this is prohibited by the rules in RFC 2616 Section 4.4, or subsequent versions of the HTTP specification.

Note: RFC 2616 specifies that this field should be returned. This transaction strengthens that requirement.

The "Content-Type" of the response will depend upon the requested response format indicated by Audit Consumer via the `_format` parameter.

Table 3.81.4.2.2-1: Response Type related to Requested format

_format parameter value	Bundle Format	Content-Type
application/json+fhir	FHIR JSON Bundle	application/json+fhir; charset=UTF-8
application/xml+fhir	FHIR XML Bundle	application/xml+fhir; charset=UTF-8

If one of the "`date`" search parameters is missing (see Section 3.81.4.1.2.1), the Audit Record Repository shall return HTTP response code 400 - Bad Request.

If the specified search parameters do not result in any matching audit message, the Audit Record Repository shall return HTTP response of success 200, with an empty FHIR bundle.

If the requested data size is considered excessive by the Audit Record Repository, it may respond with HTTP 206 Partial Content. If the response is 206 Partial Content, then the response body may contain a subset of the messages that match the search request.

Other HTTP response codes may be returned by the Audit Record Repository, indicating conditions outside of the scope of this transaction, for example, 401 – Authentication Failed might be returned if Audit Record Repository is grouped with the Kerberized Server Actor in the EUA Profile. See ITI TF-2x: Z.7 for further details.

The Audit Record Repository should complement the returned error code with a human readable description of the error condition.

Audit Record Repository may return HTTP redirect responses (responses with values of 301, 302, 303 or 307) in response to a request. Audit Consumers must follow redirects, but if a loop is detected, it may report an error.

830 Table 3.81.4.2.2-2 describes the mapping rules between AuditEvent FHIR resources and DICOM audit message format. This table is not normative. The normative content of this table is defined and maintained in FHIR Table 6.5.7.2, http://hl7.org/fhir/DSTU2/auditevent-mappings.html. The AuditEvent resource shall encode all the data within the DICOM format of the syslog Audit Message.

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Table 3.81.4.2.2-2: FHIR AuditEvent resource Mapping VS. DICOM

AuditEvent	DICOM Message
event	EventIdentification
type	EventId
subtype	EventTypeCode
action	EventActionCode
dateTime	EventDateTime
outcome	EventOutcomeIndicator
outcomeDesc	EventOutcomeDescription
purposeOfEvent	EventPurposeOfUse
participant	ActiveParticipant
role	RoleIdCode
reference	
userId	UserId
altId	AlternativeUserId
name	UserName
requestor	UserIsRequestor
location	
policy	ParticipantRoleIDCode
media	MediaType
network	
address	NetworkAccessPointID
type	NetworkAccessPointTypeCode
purposeOfUse	
source	AuditSourceIdentification
site	AuditEnterpriseSiteId
identifier	AuditSourceId
type	AuditSourceTypeCode
object	ParticipantObjectIdentification
identifier	ParticipantObjectID and ParticipantObjectIDTypeCode
reference	ParticipantObjectID
type	ParticipantObjectTypeCode
role	ParticipantObjectTypeCodeRole
lifecycle	ParticipantObjectDataLifeCycle

AuditEvent	DICOM Message
securityLabel	ParticipantObjectSensitivity
name	ParticipantObjectName
description	ParticipantObjectDescription
query	ParticipantObjectQuery
detail	ParticipantObjectDetail
type	ParticipantObjectDetail.type
value	ParticipantObjectDetail.value

3.81.4.2.2.1 FHIR encoded bundle of Audit Events Messages

When the search is successful, the message shall carry a HTTP response status code of 200, and its body shall contain a FHIR bundle of AuditEvent FHIR resources.

Example XML format:

```
<Bundle>
    <type>searchset</type>
    <total>3</total>
  <link>
       <relation value=”self”/>
       <url value=” http://188.125.99.228:9080/ARRservice/AuditEvent?date=&gt;2013-01-
01&date=&lt;2013-01-02”/>
  </link>
    <entry>
        <fullUrl value="http://188.125.99.228:9080/ARRservice/AuditEvent/23#"/>
        <resource>
            <AuditEvent>
                .....
            </AuditEvent>
        <resource>
    </entry>
    <entry>
        <fullUrl value="http://188.125.99.228:9080/ARRservice/AuditEvent/564#"/>
        <resource>
            <AuditEvent>
                .....
            </AuditEvent>
        <resource>
    </entry>
    <entry>
        <fullUrl value="http://188.125.99.228:9080/ARRservice/AuditEvent/3446#"/>
        <resource>
            <AuditEvent>
                .....
            </AuditEvent>
        <resource>
    </entry>
</Bundle>
```

3.81.4.2.3 Expected Actions

The Audit Consumer may further analyze the data received within the FHIR bundle of AuditEvent resources.

3.81.5 Security Considerations

See the general Security Considerations in ITI TF-1:9.8.

3.81.5.1 Security Audit Considerations

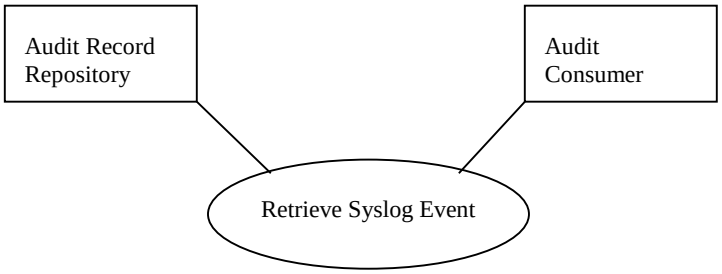
This transaction does not require the Audit Record Repository to be able to send audit messages using [ITI-20] Record Audit Event transaction. However it shall create and store an audit event structured in accordance to requirements defined in DICOM PS3.15 Section A.5.3.2 “Audit Log Used”. DICOM PS3.15 defines a specific structure for an audit message that may be created when an Audit Log is used. See http://dicom.nema.org/medical/dicom/current/output/chtml/part15/sect_A.5.3.2.html DICOM PS3.15 Section A.5.3.2 “Audit Log Used” for further details.

3.82 Retrieve Syslog Event

This transaction supports the retrieval of syslog messages from the Audit Record Repository subject to parameters that limit the retrieval.

3.82.1 Scope

The Retrieve Syslog Event transaction is used to search events recorded.



3.82.2 Use-case Roles

Actor: Audit Record Repository

Role: Provides storage for syslog messages, and responds to queries for a portion of the stored messages.

Actor: Audit Consumer

Role: Queries for audit records.

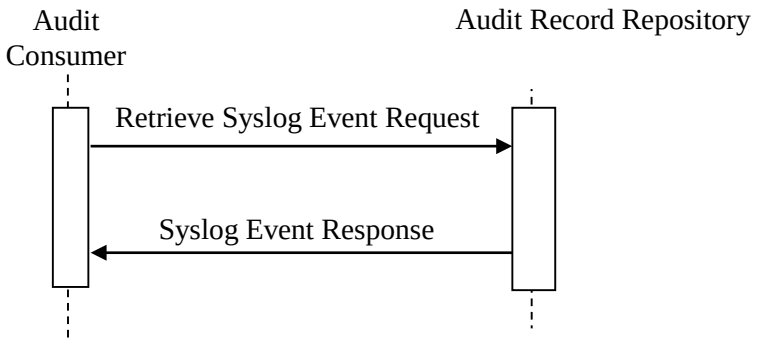
3.82.3 Referenced Standard

RFC 2616	IETF Hypertext Transfer Protocol –HTTP/1.1
RFC 4627	The application/json Media Type for JavaScript Object Notation (JSON)
RFC 6585	IETF Additional HTTP Status Codes

RFC 5424 The Syslog Protocol

RFC 3339 Date and Time on the Internet: Timestamps

3.82.4 Interaction Diagram



3.82.4.1 Retrieve Syslog Event Request Message

This is an HTTP GET parameterized search from an Audit Consumer to an Audit Record Repository. The Audit Record Repository is maintaining a database of syslog messages that have been received. This database may be a subset of all messages received and it may include messages that do not adhere to the IHE Audit Trail format or to the IHE Provisional Audit Record format. The Audit Record Repository may have selection criteria for what kinds of messages are kept for later search, how long different kinds of messages are kept, etc. The response to this search will reflect the contents of the syslog messages stored on the Audit Record Repository at the time of the search.

3.82.4.1.1 Trigger Events

This message is sent when the Audit Consumer needs syslog messages to process.

3.82.4.1.2 Message Semantics

The Retrieve Syslog Event Request message is an HTTP GET request sent by the Audit Consumer to the RetrieveSyslogEvent URL on the Audit Record Repository. The “search” target is formatted as:

<scheme>://<authority>/<path>/syslogsearch?date=le[start-time]&date=ge[stop-time]&<query>

Where:

- **<scheme>** shall be either http or https. The use of http or https is a policy decision, but https is usually appropriate due to confidentiality of content stored in ATNA audit records;
- **<authority>** shall be represented as a host (either IP address or DNS name) followed optionally by a port.
- The Audit Record Repository may use **<path>** to segregate the RetrieveATNAAuditEvent RESTful service implementation from other REST-based services.
- "**syslogsearch**" is a required part of the URL that allows the Audit Consumer to asks for syslog messages stored in the Audit Record Repository.
- Two **<date>** search parameters are required. They define a time period for the search**.** See Section 3.82.4.1.2.1.
- **"&"** must be present if at least one among Additional Search Parameters (see Section 3.82.4.1.2.2) is used;
- **<query>** – if present, represents additional search parameters. See Section 3.82.4.1.2.2 Additional Search Parameters.

The Audit Consumer may indicate in the Accept acceptance of JSON (i.e., application/json). In the absence of an Accept preference, JSON shall be used. The Audit Record Repository shall support JSON format. The Audit Record Repository may support other response format if negotiated with the Accept header set by the Audit Consumer.

3.82.4.1.2.1 Date Search Parameters

The two **date** parameters shall be present in every search by the Audit Consumer and shall be supported by the Audit Record Repository. These parameters allow the Audit Consumer to specify the time frame of creation of syslog messages of interest and enable the Audit Consumer to constraint the number of syslog messages returned. The start-time and stop-time shall be in RFC 3339 format.

Note: RFC 3339 format is the format mandated by Syslog for time stamps and is a sub-set of the XML date-time data format used by FHIR.

To search AuditEvents resources created during the whole day: 2013-01-01 the search URL is:

```
http://188.125.99.228:9080/ARRservice/syslogsearch?date=ge2013-01-
01&date=le2013-01-01
```

3.82.4.1.2.2 Additional Search Parameters

The search parameters in this section may be supported by the Audit Consumer and shall be supported by the Audit Record Repository.

The Audit Consumer may include additional search parameters. These search parameters shall be encoded in accordance with RFC 2616 for encoding GET queries.

The search string is encoded as a list of search parameter/value pairs, using the parameter names in column 2 of Table 3.82.4.1.2.2-1 to indicate the syslog message element being matched. There is a search parameter assigned for each syslog metadata. In all cases:

- The search values shall be encoded as strings.
- The Syslog message is considered to match if the value string is a sub-string found in the specified message element.

Table 3.82.4.1.2.2-1: Retrieve Syslog Event search parameters mapping with syslog metadata

Syslog RFC 5424 element	Retrieve Syslog Event Search Parameter
PRI	pri
VERSION	version
HOSTNAME	hostname
APP-NAME	app-name
PROCID	procid
MSG-ID	msg-id
MSG	msg

HTTP allows for multiple instances of a parameter to be requested with different values. Multiple values of the same parameter name shall be treated as an OR relationship for string matches. The Audit Consumer may combine different search parameters.. The matching of different search parameters is combined with an AND relationship. Some examples of how this works are:

- To search for “hostname=Frodo” and “hostname=Bilbo” will return the combination of all event reports from either host Frodo or Bilbo during the time interval:

```
http://188.125.99.228:9080/ARRservice/syslogsearch?date=ge2013-01-
01&date=le2013-01-02&hostname=Frodo&hostname=Bilbo
```

- To search for “hostname=Frodo” and “proc-id=system” it means all events from the host “Frodo” with proc-id of “system” during the time interval:

```
http://188.125.99.228:9080/ARRservice/AuditEvent?date=ge2013-01-
01&date=le2013-01-02&hostname=Frodo&proc-id=system
```

- To search for “hostname=Frodo”, “hostname=Bilbo”, and “proc-id=system” will return the combination of all event reports from either host Frodo or Bilbo that have the proc-id of “system” during the time interval:

```
http://188.125.99.228:9080/ARRservice/syslogsearch?date=ge2013-01-
01&date=le2013-01-02&hostname=Frodo&hostname=Bilbo
```


This form of search is not a substitute for additional processing by the Audit Consumer. The Audit Record Repository can return large blocks of syslog messages. The Audit Consumer may need to perform further processing to select the information needed for a report.

The Audit Record Repository shall document in its IHE Integration Statement any additional parameters supported..

3.82.4.1.3 Expected Actions

The Audit Record Repository (ARR) maintains a database of syslog messages. The Audit Record Repository is required to return all the syslog messages stored in that database that match query parameters and for which the requester is authorized. The Audit Record Repository retains data in accordance to local policies and some data may be deleted.

The Audit Record Repository shall respond with a Syslog Event Response message described in Section 3.82.4.2.

The matching process shall be:

- Select all messages that have a time interval specified in the request URL. If these search parameters are missing, the Audit Record Repository shall return a 400 Bad Request HTTP status code.
- If the "Accept" header provided in the Request is not supported by the Audit Record Repository may send a 415 "Unsupported Media Type" error.
- If search parameters not defined in Section 3.82.4.1.2.2 are specified in the request URL, then if the parameter is not supported, it shall be ignored;
- All matching resources shall be returned. String parameter matching is applied as a literal, sub-string match.

3.82.4.2 Syslog Event Response Message

The Audit Record Repository shall return a HTTP Status code appropriate to the processing and may return syslog messages in the message body.

3.82.4.2.1 Trigger Events

The Audit Record Repository creates this message when it receives and processes a Retrieve Syslog Event Request message.

3.82.4.2.2 Message Semantics

The Content-Length entity-header field shall be returned, unless this is prohibited by the rules in RFC 2616 Section 4.4, or subsequent versions of the HTTP specification.

Note: RFC 2616 specifies that this field should be returned. This transaction strengthens that requirement.

In case of success, the Audit Record Repository shall return the syslog messages that match the search parameters, encoded as a JSON entries array. The Syslog Event Response message shall

carry a HTTP response status code of 200, and its body shall contain a JSON Array of Syslog messages.

Each syslog message shall be encoded as described in Table 3.38.4.2.2-1:

Table 3.38.4.2.2-1: Syslog Message Encoding

Syslog Metadata	JSON element	dataType
PRI	Pri	<string>
VERSION	Version	<string>
TIMESTAMP	Timestamp	see RFC 5424 (sec. 6.2.3)
HOSTNAME	Hostname	<string>
APP-NAME	App-name	<string>
PROCID	Procid	<string>
MSG-ID	Msg-id	<string>
MSG	Msg	<string>
STRUCTURED_DATA	Structured_data	<string>

If the date parameters are missing, the Audit Record Repository shall return HTTP response code 400 - Bad Request.

If the specified parameters do not result in any matching syslog messages, the Audit Record Repository shall report a Response of Success (HTTP 200) with an empty JSON entries array.

If the requested data size is excessive, the Audit Record Repository may respond with HTTP 206 Partial Content. If the response is 206 Partial Content, then the response body may contain a subset of the syslog messages that match the search.

Note: Other HTTP response codes may be returned by the Audit Record Repository, indicating conditions outside of the scope of this transaction, for example, 401 – Authentication Failed might be returned if Audit Record Repository also supports the IUA Profile and is given an expired authorization token or is grouped with the EUA Profile Kerberized Server.

The Audit Record Repository should complement the returned error code with a human readable description of the error condition.

Audit Record Repository may return HTTP redirect responses (responses with values of 301, 302, 303 or 307) in response to a request. Audit Consumers must follow redirects, but if a loop is detected, it may report an error.

3.82.4.2.2.1 JSON encoded array of Syslog Messages

Example:

```
{
      {
      Pri : “string”,
```



```
        Version: “string”,
        Timestamp: “2015-03-17T00:05”
        Hostname: “string”
        App-name: “string”
        Procid: “string”
        Msg-id : “string”
        Structured-data : “string”
        Msg : “string1”
        Structured_data: “string”
        }
        {
        Pri : “string”,
        Version: “string”,
        Timestamp: “2015-03-17T00:05”
        Hostname: “string”
        App-name: “string”
        Procid: “string”
        Msg-id : “string”
        Msg : “string2”
        }
        {
        Pri : “string”,
        version: “string”,
        Timestamp: “2015-03-17T00:05”
        Hostname: “string”
        App-name: “string”
        Procid: “string”
        Msg-id : “string”
        Msg : “string3”
        }

}
```

Each individual Syslog message is encoded by parsing the message elements defined in RFC 5424 as strings identified by the element name in RFC 5424. If an element is absent from the syslog message, this element is not included in the JSON encoding.

3.82.4.2.3 Expected Actions

The Audit Consumer shall processes the response according to the capabilities of its application. The processing is not constrained by IHE

3.82.5 Security Considerations

See the general Security Considerations in ITI TF-1:9.8.

3.82.5.1 Security Audit Considerations

This transaction does not require the Audit Record Repository to be able to send audit messages using [ITI-20] Record Audit Event transaction. However it shall create and store an audit event

structured in accordance to requirements defined in DICOM PS3.15 Section A.5.3.2 “Audit Log Used”. DICOM PS3.15 defines a specific structure for an audit message that may be created when an Audit Log is used. See http://dicom.nema.org/medical/dicom/current/output/chtml/part15/sect_A.5.3.2.html DICOM PS3.15 Section A.5.3.2 “Audit Log Used” for further details.

