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A **Literature Survey** for

**BUILDING A WEB SERVICE FRAMEWORK (STOW-RS) FOR MEDICAL IMAGING (DICOM)**

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**LITERATURE SURVEY**

**I. INTRODUCTION**

STOW – RS (Store Over the Web – Restful Service) is a service to facilitate third party clients to post DICOM (Digital Imaging and Communication in Medicine) files (all scans are in compliance with the DICOM standard) to the PACS (Picture Archival and Communication System).

Most medical organizations, be it hospitals, diagnostic centers, etc. cannot own modalities (imaging equipment) for all the innumerable types of medical examinations. Also, in order to undergo the medical exam recommended by his general physician, it is inconvenient for a patient to again consult a physician in different medical organization that operates the modality required for his medical exam. The patient should be able to take a quick exam at the foreign hospital and have his reports available to his general physician without him performing this task manually. This way he saves valuable time, avoids having to pay consultation fees twice fold, and can be assured of getting diagnosed from his physician who is well versed with his medical history. Also, all his medical exams reports can be consolidated and stored at a single location – his host hospital, for a quick reference in the future. Thus, there is a need for a hassle free mechanism for a patient to undergo medical examinations (such as CT, MRI, etc.) at medical organizations other than the one hosting his referring physician and have his reports available to his physician. This is what STOW-RS aims to achieve.

The ultimate and only reference for STOW-RS is the Digital Imaging and Communication in Medicine (DICOM) Standard. This standard was established by the National Electrical Manufacturers Association (NEMA) which recognized the emerging need for a standard method for transferring images and associated information between devices manufactured by various vendors. The DICOM Standard is an evolving standard and it is maintained in accordance with the Procedures of the DICOM Standards Committee. Proposals for enhancements are forthcoming from the DICOM Committee member organizations based on input from users of the Standard. These proposals are considered for inclusion in future editions of the Standard. A requirement in updating the Standard is to maintain effective compatibility with previous editions.

The DICOM standard specifies a web-based service i.e. STOW-RS for storing DICOM persistent objects (e.g., images, medical imaging reports). This service is intended for distribution of results and images to healthcare professionals. It provides a simple mechanism for storing a DICOM persistent object, through HTTP/HTTPS protocol, using DICOM UIDs (Unique Identifiers). Data may be retrieved either in a presentation-ready form as specified by the requester (e.g., JPEG or GIF) or in a native DICOM format using a web-based service called WADO-RS. This standard relates only to DICOM persistent objects (not to other DICOM objects or to non-DICOM objects). Access control beyond the security mechanisms generally available to web applications is outside the scope of this standard.

The 2016 release of the DICOM standard is being referenced for STOW-RS. The DICOM standard is a multipart document. Specifically, the part 3.18 of the standard provides implementation details for STOW-RS. The releases of the DICOM standard are open source.

The definitions of some important terms are a below:

* Digital Imaging and Communications in Medicine (DICOM)

DICOM is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol. The storage and retrieval of images in PACS occurs in DICOM. It is also the protocol used by a system to interact with the PACS and modality.

* A study is set of images associated with an exam. Images in a study can be grouped into a series when - the images obtained are from the same modality and they contain the same series information. Finally, each series is composed of several DICOM instances.
* Unique Identifiers are the identifiers used to identify study, series, and images.
* STOW-RS (Store Over the Web - Restful Service)
* This service enables to store a DICOM file in PACS using RESTful Services. For every new DICOM file, this service creates a new resource if it doesn’t already exist.

**II. MAIN BODY**

The only reference for STOW-RS is the DICOM NEMA standard.

**PREMISE:**

The DICOM standard defines STOW-RS as a restful web service that creates new resources for the input SOP Instances on the Server or appends them to the existing resources on the Server.

All request messages are defined to be HTTP/1.1 multipart messages.

The organization of SOP Instances into message parts is said to be dependent on whether the SOP Instances are structured as binary instances, or metadata and bulk data.

The HTTP Request field Content-Type is used in the header lines by the client in an HTTP/1.1 transaction to indicate the type of data being sent to the STOW-RS. All lines are RFC822 or RFC7230 format headers. All HTTP header fields whose use is not defined by STOW-RS are assumed to have the meaning defined by the HTTP standard.

The premise gives a high level picture of the type of service STOW-RS has to be, the type of request messages for the service, and how the store objects have to be organized into HTTP request messages sent by the client.

**METHODOLOGY**:

The DICOM standard includes details of the following:

The URL format to be used by the client to access the STOW-RS service.

* The header format of the Http Request Message – the method (POST), and the content types for storing binary instances, XML metadata and bulk data, and DICOM JSON metadata and bulk data.
* The format of the DICOM request message body for DICOM instances, JSON, and XML objects including the content-type, and the organization of objects into HTTP request messages.
* The response (i.e. the response status line and the response body) of the RESTful Service as a HTTP status line, including a status code and associated textual phrase for the entire set of stored SOP Instances.
* A clear tabulation of HTTP response codes to be issued by STOW-RS.
* Sample HTTP response status lines and response message bodies.

However, the accurate implementation methodology for STOW-RS has not been explicitly stated in the DICOM standard. Specifically, some of the critical aspects that are vaguely described in the DICOM standard:

* The security of STOW-RS.
* A concise mechanism for validation of incoming files from third party clients.
* The mechanism to validate and dynamically update the record of trusted AE\_Titles (AE\_Titles are used to identity the modality sending the files to STOW-RS).
* Precise implementation details of storing DICOM, Dicom + xml, and JSON objects.

**III. CONCLUSION**

The DICOM standard is the only reference for STOW-RS. Hence, it has been studied and followed rigorously during the STOW-RS implementation. The aspects not clearly described in the standard are implemented as per the team’s best expertise. Hence, it could be improved in the areas mentioned earlier thereby to form a more definitive guide.

**IV. REFERENCE**

Digital Imaging and Communication (DICOM) standard 2015 published by National Electrical Manufacturers Association.