Reducing Complexity and Increasing Flexibility of Biorepository Systems by Utilizing Web Services

Matthew L. Clement, Ying Jin, Kerry Wiles, Dr. Kay Washington

Department of Pathology, Vanderbilt University Medical Center

Nashville, Tennessee

Introduction

Biorepository solutions are often large monolithic applications, incorporating functionality for all business functions required to collect, manage and distribute different types of human specimens and associated clinical data at a particular institution for cancer research. Responding to the challenges and complexity of biospecimen data management, the CHTN Donor 2 application was built to cover all aspects of a tissue procurement workflow. This was accomplished by utilizing many existing informatics systems by leveraging Web Services technology. Traditional methods for integrating to other systems are typically tightly coupled, resulting in rigidity and difficulty in adapting rapidly to changing conditions. Web Services provide a mechanism to integrate with external systems in a loosely coupled manner, allowing functionality to be replaced, optimized or consumed in various ways without impacting the core functionality of the repository system.

Materials and Methods

The Donor 2 Web Services, developed for the CHTN Western Division at VUMC, make use of two leading Web Service standards to integrate the Donor 2 application with other systems, regardless of platform or programming language.

SOAP: XML representation of requests and responses.

RESTful: Incorporates standard HTTP Methods to respond to requests. REST responses can be XML, JSON (JavaScript Object Notation), Plain Text and other various representations.
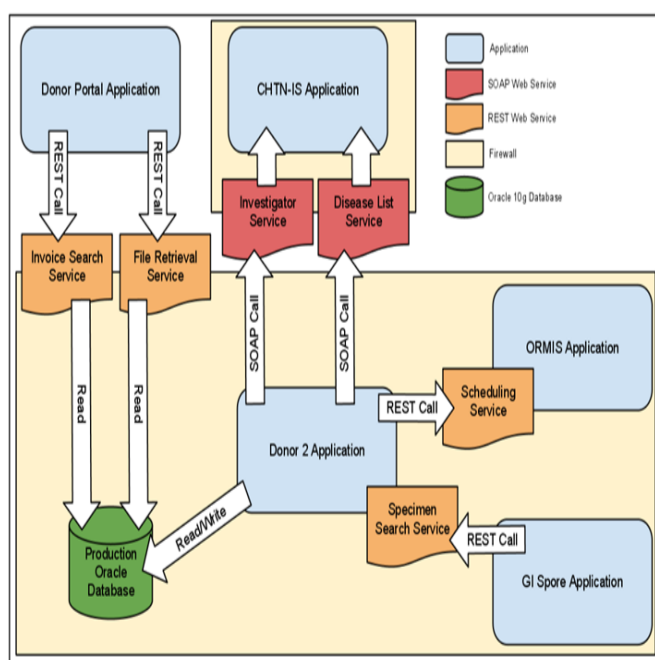
The Donor 2 **RESTful Services** provide REST interfaces to the **Donor Portal** Application, **GI Spore LIMS** (Laboratory Information Systems) and **ORMIS** (VUMC Operating Room System).

- **Invoice Search Service** provides a search for Investigator Invoices based on the Investigator Id, Invoice Id or Shipment Date Range. This service returns a list of Invoices matching the given parameters.

- **File Retrieval Service** accepts an Invoice Id and has endpoints to return Pathology Reports, Chart Reviews and Packing Slips. All data returned is anatomized.

- **Specimen Search Service** allows the **GI Spore Application** to retrieve specimen data collected by the CHTN-WD.

- **Scheduling Service** is an interface developed to isolate the Donor 2 application from the underlying details of any scheduling system.

In addition to providing functionality through Web Services, the Donor 2 Application uses Web Services to retrieve information from third party resources as well. The **CHTN Investigator System** provides two SOAP Web Services, the **Investigator Service** and the **Disease List Service**.

- The **Investigator Service** provides a list of active investigators for a CHTN division and information associated with each investigator.

- The **Disease List Service** returns a list of diagnosis, categories, anatomic sites and anatomic subsites. A list of valid combinations of these list items is also available.

Results

As difficult as it is to provide connectivity for diverse internal systems, the complexity escalates when the Biospecimen management system needs to connect to multiple external systems as well. The CHTN-WD Donor 2 Application utilizes Web Services to reap significant business benefits, more flexibility and more leverage in terms of accessing third party resources providing functionality that may not have been possible due to time and money constraints. By consuming external Web Services, the Donor 2 Application can easily integrate with CHTN Investigator information, CHTN Disease List Vocabulary and VUMC Scheduling System. More broadly, functionality behind a Web Service interface can be replaced or changed without affecting the Donor System itself.

The Donor 2 Application consumes SOAP services provided by the **CHTN Investigator System**, which was developed to provide an application for all CHTN divisions to manage investigators. This includes, but is not limited to, investigator requests, addresses, billing information and investigator status. A common disease list vocabulary is also managed by the **CHTN-IS**. The CHTN-IS provides two SOAP Web Services, the **Investigator Service** and the **Disease List Service**.
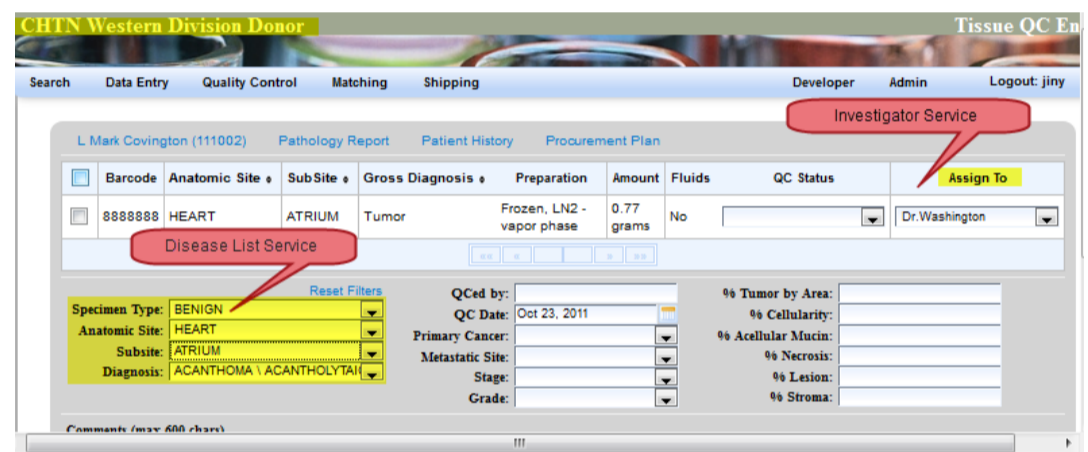
The Donor 2 Application provides **RESTful Services** to the **Donor Portal** Application which is exposed outside of the Vanderbilt network. **Donor Portal** provides a Web Application interface for CHTN-WD served investigators to retrieve files associated with specimens they have received. It makes use of the **Invoice Search** and **File Retrieval** services. The investigator is provided a login and password to retrieve pathology reports and clinical information regarding their orders. This alleviates the need to transmit huge files through email or physical media and allows for data integration with their own LIMS in real time.
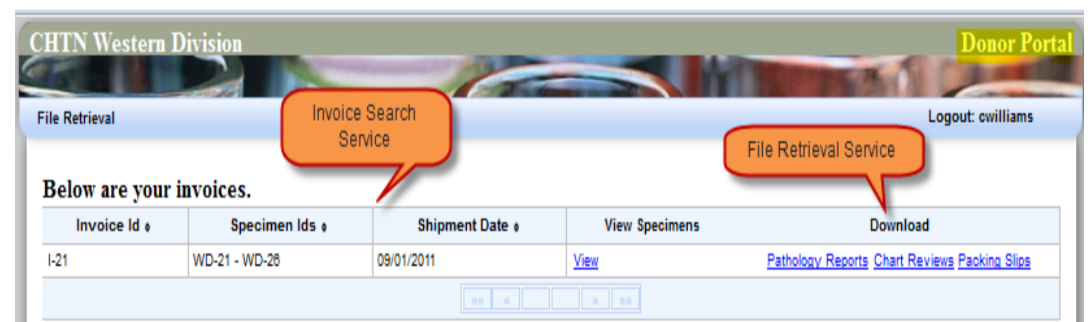
Conclusion

Today, the ability to seamlessly exchange information effectively is vital for success. Existing investments in systems development and infrastructure can be combined to add additional value to mission-critical applications. Web Services automate connections across applications offering an alternative approach far more flexible than traditional methods. The Donor 2 application is a state of the art application providing a level of functionality that would not have been possible without leveraging many existing systems. Donor 2 also provides a level of integration for clients that would not be possible without Web Services. Web services hold the promise of integrating software applications from heterogeneous platforms in a simple, standardized manner. The resulting Donor 2 Biorepository management system will allow the end-user to be shielded from all the complexity of interacting with the various resources and also allow organizations to quickly reap the benefits of this powerful technology.

Acknowledgements

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