

CS6440

Deliverable #4: Final Project Presentation

December 4, 2016

Team Phoenix FHIR

Name	Primary Team Role	GT Username	Preferred Email
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Our Final Proejct presentation can be viewed at the following link:

<https://youtu.be/xSWntV39ul4>

Please select 720p video quality on Youtube viewing options to assure highest quality playback of this final presentation video! (YouTube "Settings=>Quality")

A PDF of the power point is appended to this document.

A PDF of the Gantt chart is also appended to this document (and can be found in the last 2 pages of this overall document)

CDC Population Health Informatics Framework: FHIR Identity Masking and Re-Linking Services

Team Phoenix FHIR
Final Project Presentation
December 4, 2016

Mentors:
John Loonsk, MD, FACMI
Jason Bonander, MA

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Project Overview

- The CDC's Center for Chronic Disease Prevention and Health Promotion is currently working on a Population Health Informatics Framework to identify and establish standard, interfaces, and the interactions needed to support population health management.
- The sharing of data for population health management purposes has a significant dependence on protecting the privacy of the patients included in the population data. All shared data must be deidentified; however, in some cases there will also be a subsequent need to reidentify data.
- Pseudonymization: each patient is given a unique identifier and the method for generating this identifier is maintained and protected separate from the healthcare data itself.

Project Objectives: Help develop RESTful FHIR services that protect patient identity and confidentiality through the support of dynamic identity masking, pseudonymization, and relinking.

Research

- Business cases
- HIPPA deidentification
- Lookup table vs. dynamic solution
- Encryption
- SMART on FHIR

Sources:

Lablans, Martine et al. "A RESTful interface to pseudonymization services in modern web applications." *BMC Medical Informatics and Decision Making* 15.2 (2015): <http://www.biomedcentral.com/1472-6947/15/2>.

Somolinos, Roberto, et al. "Service for the pseudonymization of electronic healthcare records based on ISO/EN 13606 for the secondary use of information." *IEEE journal of biomedical and health informatics* 19.6 (2015): 1937-1944.

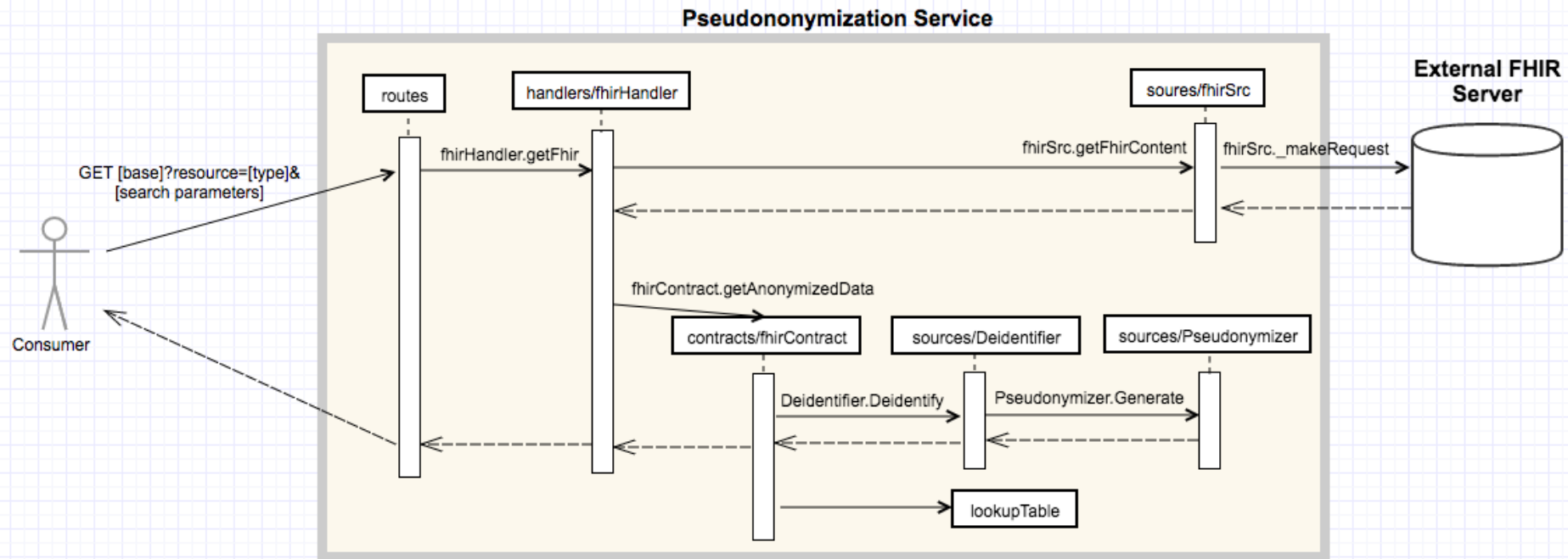
Kho, Abel N., et al. "Design and implementation of a privacy preserving electronic health record linkage tool in Chicago." *Journal of the American Medical Informatics Association* (2015): <http://dx.doi.org/10.1093/jamia/ocv038>.

Garfinkel, Simson L. "De-identification of personal information." *National Institute of Standards and Technology, Gaithersburg, MD, Tech. Rep. IR-8053* (2015): <http://nvlpubs.nist.gov/nistpubs/ir/2015/NIST.IR.8053.pdf>.

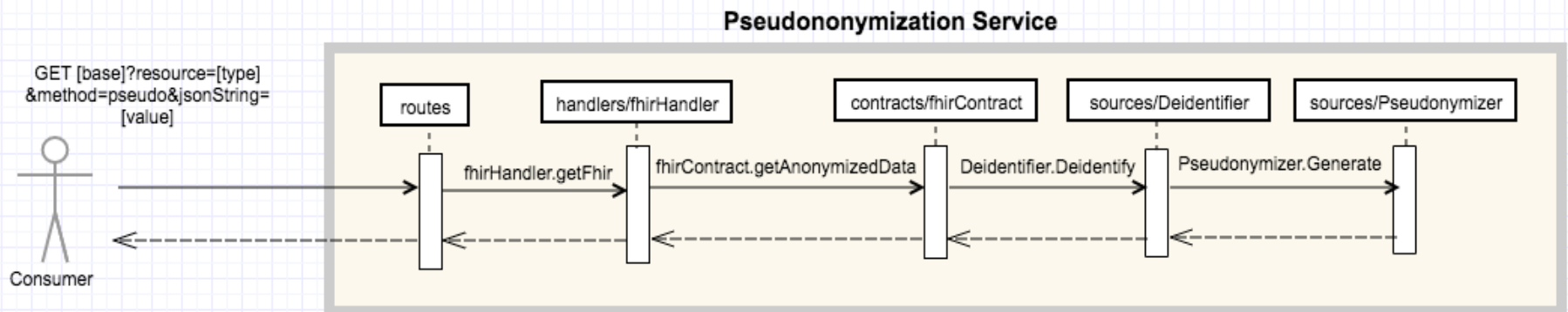
Solution

- Create node.js app that can be installed and connected to an HER/HIE.
- Utilize a Swagger interface to demonstrate the capabilities of the app.
- Use HMAC-SHA-1 encryption to generate a pseudonymous ID; store this in a lookup table with identifying information
- Support three use cases:
 - 1) Pseudonymize and return the results of a FHIR request
GET [base]?resource=[type]&[search parameters]
 - 2) Pseudonymize and return data sent to the service
GET [base]?resource=[type]&method=pseudo&jsonString=[value]
 - 3) Return identifying information for previously pseudonymized data
GET [base]?resource=Patient&pseudoID=[value]

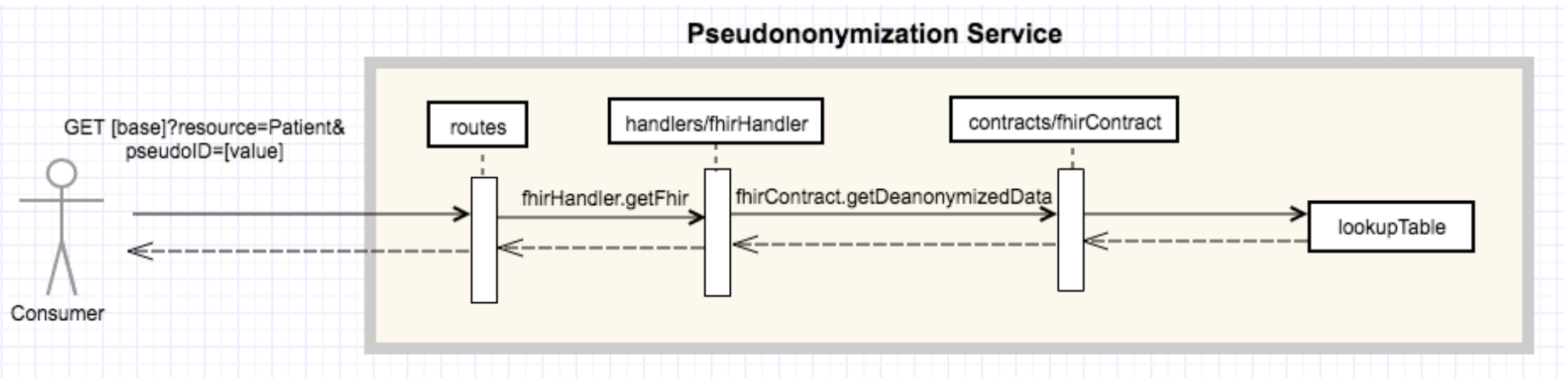
Usage Case #1



Usage Case #2

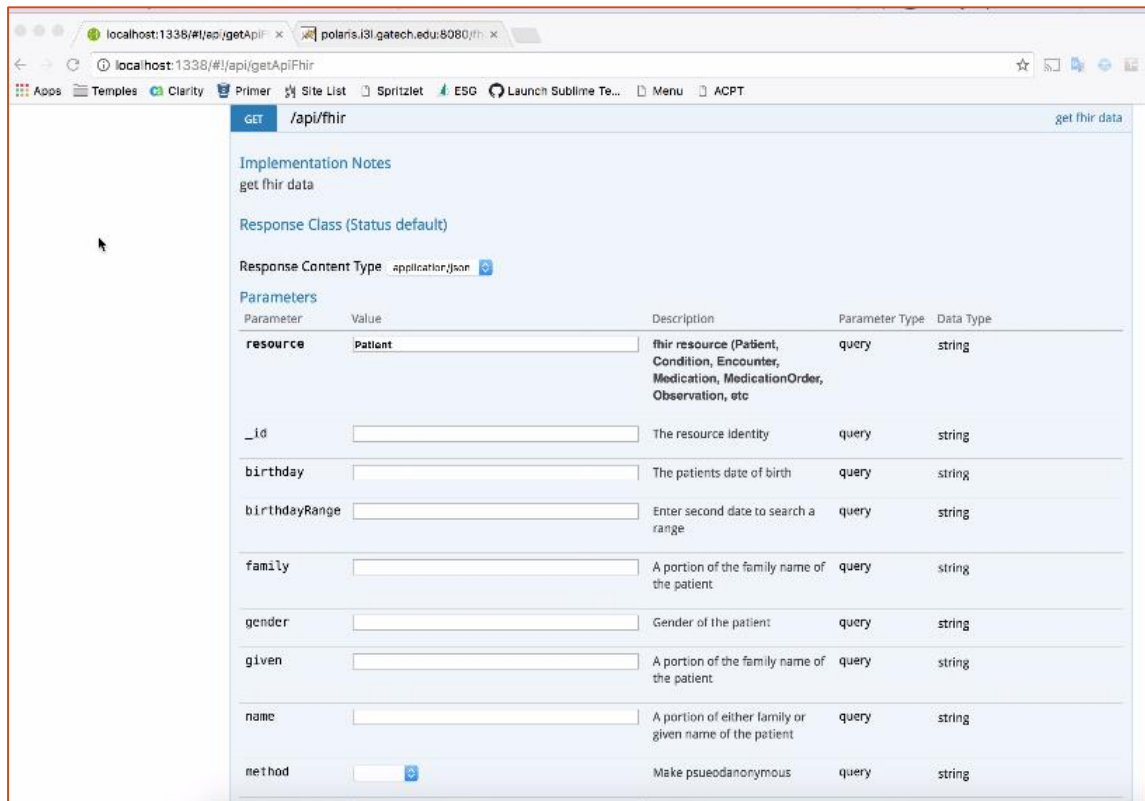


Usage Case #3



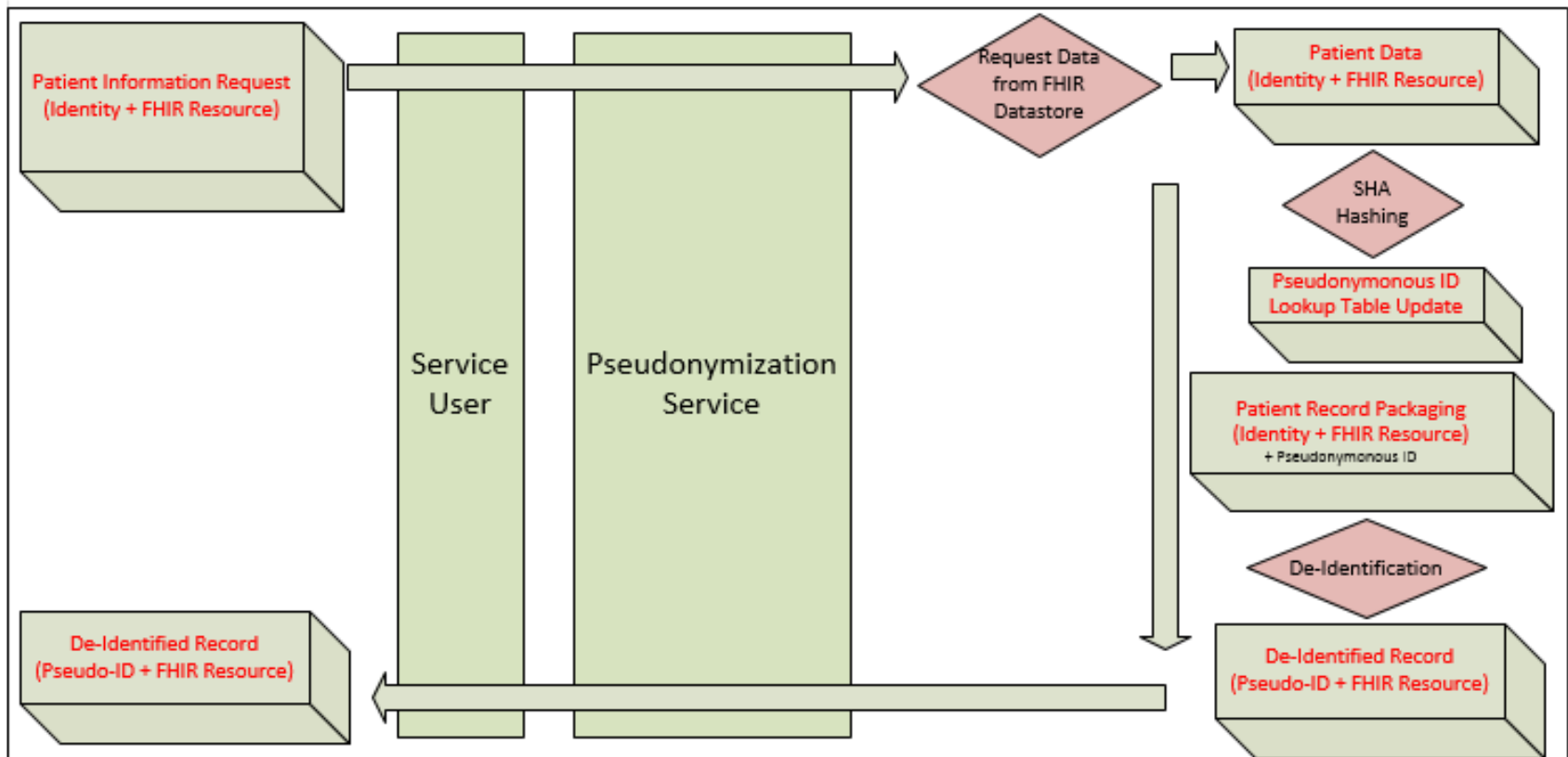
Project Demonstration

- We created a service that provides pseudo-anonymization related features;
- Our demo uses Swagger to demonstrate the functionality of this service.
- The following video demonstrates the usage of our server and shows the related content on the GT FHIR Data Server (GT FHIR Data server utilized for demonstration of Usage Case #1)



Requesting Pseudo-Anonymous Patient Data

- ### Usage #1: Requesting Pseudo-Anonymous Patient Data

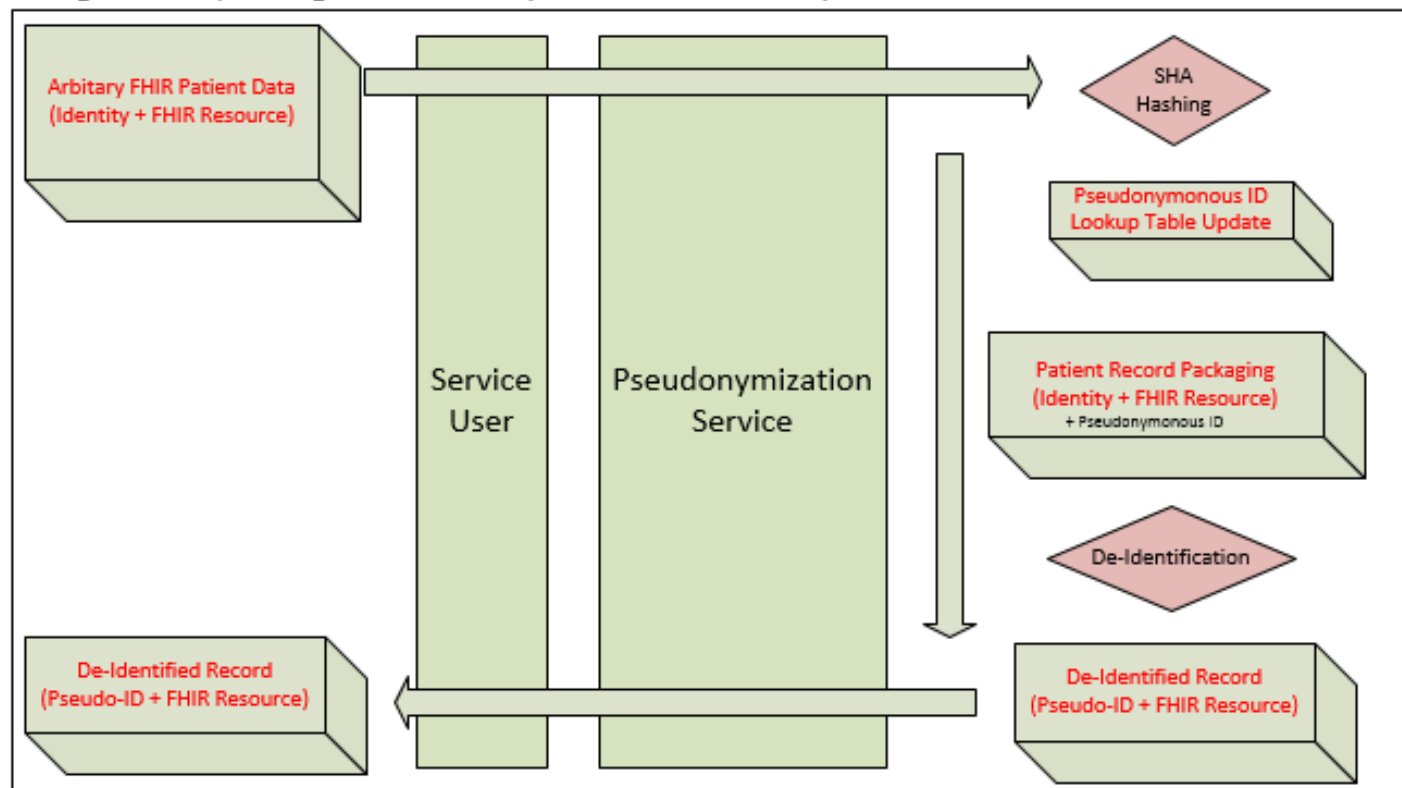


Usage Case #2

Sending Arbitrary FHIR Data for Pseudo-Anonymization

- This usage case involves an entity sending specific data for pseudo-anonymization. This usage case does not require access to a FHIR Datastore
- Our service strips out identifying information and inserts a unique hash. This data is then considered pseudo-anonymous and is returned to the requester

Usage #2: Requesting Pseudo-Anonymization of Arbitrary FHIR Patient Data

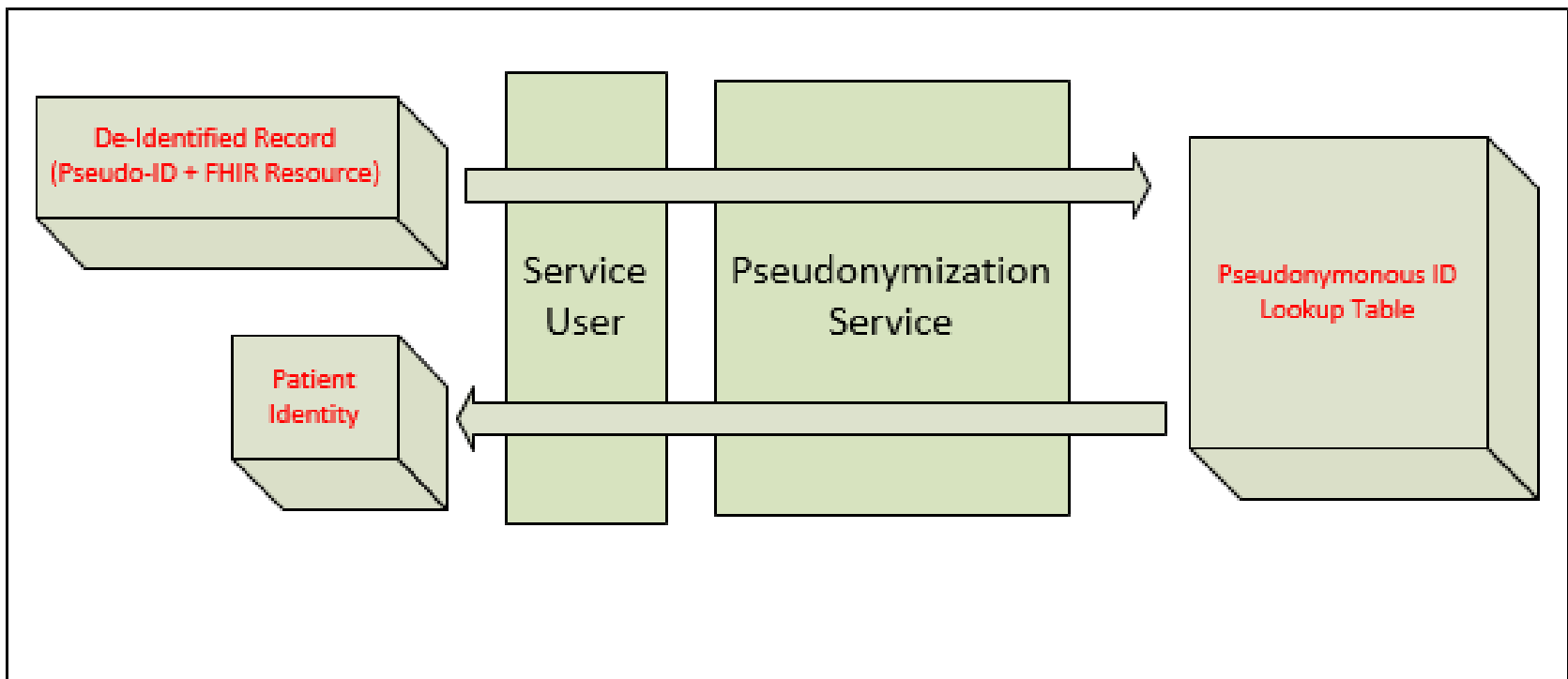


Usage Case #3

Re-linking Pseudo-Anonymization Data with Real Patient ID

- This usage case involves an entity requesting a re-linking of pseudo-anonymous information with the Real Patient's ID
- Our service checks the unique hash stored in the pseudo-anonymous information and returns the linked Real Patient ID

Usage #3: Relinking based on Pseudonymous ID



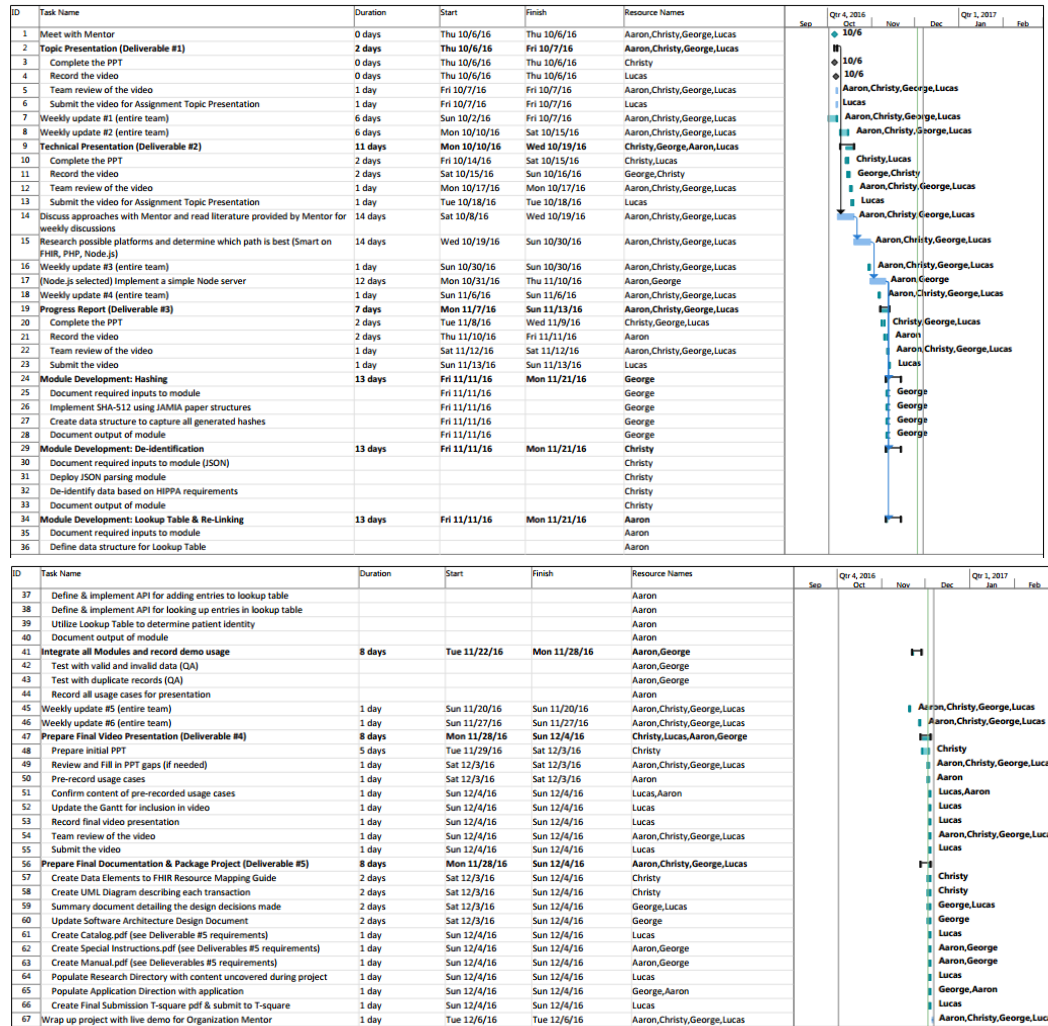
Remaining Elements / Further Developments

- We have implemented the key usage cases for this project and that there are no remaining elements within the scope of our project goals.
- For a production-level deployment, there are several other modules which will need to be developed to make this platform viable (These were considered outside the scope of our project)

Element	Description
Authentication	Our server does not concern itself with authenticating valid users. Since the service maintains a secret lookup table, it is vitally important that Authentication / Access Control be implemented on a production deployment
Batch Processing	Our server processes 1 record at a time. For a production deployment it is likely that a method of batch processing be implemented to speed up overall execution time on large data sets
De-duplication of Records	Our server cannot create more uniqueness in records than already exists in those records. If the incoming records are non-obvious duplicates, then our server will treat them each as unique. It is suggested that a method of de-duplication can be added to this service to aid in identifying duplicate records
De-Identification of Unstructured Data	Our server currently handles that which follow FHIR data structures. FHIR also has a facility for unstructured data. This data commonly holds identifying information and should be processed as well.
Installer or Configuration File	Our server currently installs via command line, and defaults to the GT FHIR server. An installer or Configuration file can be created which allows further automation and configurability

Project Gantt

Please reference Project Presentation PDF for more readable Gantt Chart!



Plans for Deployment

Our project is a server/service which would exist in a larger FHIR based ecosystem. Many auxiliary components will need to be developed to make that overall ecosystem viable.

Our intended deployment is to serve as a element in the development of those auxiliary components. The most direct component which may be developed would be an application which makes use of our service.

Full source code, documentation, project details, and notes are captured on our team's Georgia Tech Github repository. This information is accessible for any entity which desires to further development of auxiliary components for the FHIR ecosystem.

ID	Task Name	Duration	Start	Finish	Resource Names	Sep	Qtr 4, 2016	Oct	Nov	Dec	Qtr 1, 2017	Jan	Feb	
37	Define & implement API for adding entries to lookup table				Aaron									
38	Define & implement API for looking up entries in lookup table				Aaron									
39	Utilize Lookup Table to determine patient identity				Aaron									
40	Document output of module				Aaron									
41	Integrate all Modules and record demo usage	8 days	Tue 11/22/16	Mon 11/28/16	Aaron,George									
42	Test with valid and invalid data (QA)				Aaron,George									
43	Test with duplicate records (QA)				Aaron,George									
44	Record all usage cases for presentation				Aaron									
45	Weekly update #5 (entire team)	1 day	Sun 11/20/16	Sun 11/20/16	Aaron,Christy,George,Lucas									
46	Weekly update #6 (entire team)	1 day	Sun 11/27/16	Sun 11/27/16	Aaron,Christy,George,Lucas									
47	Prepare Final Video Presentation (Deliverable #4)	8 days	Mon 11/28/16	Sun 12/4/16	Christy,Lucas,Aaron,George									
48	Prepare initial PPT	5 days	Tue 11/29/16	Sat 12/3/16	Christy									
49	Review and Fill in PPT gaps (if needed)	1 day	Sat 12/3/16	Sat 12/3/16	Aaron,Christy,George,Lucas									
50	Pre-record usage cases	1 day	Sat 12/3/16	Sat 12/3/16	Aaron									
51	Confirm content of pre-recorded usage cases	1 day	Sun 12/4/16	Sun 12/4/16	Lucas,Aaron									
52	Update the Gantt for inclusion in video	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
53	Record final video presentation	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
54	Team review of the video	1 day	Sun 12/4/16	Sun 12/4/16	Aaron,Christy,George,Lucas									
55	Submit the video	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
56	Prepare Final Documentation & Package Project (Deliverable #5)	8 days	Mon 11/28/16	Sun 12/4/16	Aaron,Christy,George,Lucas									
57	Create Data Elements to FHIR Resource Mapping Guide	2 days	Sat 12/3/16	Sun 12/4/16	Christy									
58	Create UML Diagram describing each transaction	2 days	Sat 12/3/16	Sun 12/4/16	Christy									
59	Summary document detailing the design decisions made	2 days	Sat 12/3/16	Sun 12/4/16	George,Lucas									
60	Update Software Architecture Design Document	2 days	Sat 12/3/16	Sun 12/4/16	George									
61	Create Catalog.pdf (see Deliverable #5 requirements)	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
62	Create Special Instructions.pdf (see Deliverables #5 requirements)	1 day	Sun 12/4/16	Sun 12/4/16	Aaron,George									
63	Create Manual.pdf (see Delieverables #5 requirements)	1 day	Sun 12/4/16	Sun 12/4/16	Aaron,George									
64	Populate Research Directory with content uncovered during project	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
65	Populate Application Direction with application	1 day	Sun 12/4/16	Sun 12/4/16	George,Aaron									
66	Create Final Submission T-square pdf & submit to T-square	1 day	Sun 12/4/16	Sun 12/4/16	Lucas									
67	Wrap up project with live demo for Organization Mentor	1 day	Tue 12/6/16	Tue 12/6/16	Aaron,Christy,George,Lucas									
Project: Simple Project Plan Date: Sat 12/3/16		Task	<div></div>	Project Summary	<div></div>	Manual Task	<div></div>	Start-only	<div></div>	Deadline	<div></div>			
		Split	<div></div>	Inactive Task	<div></div>	Duration-only	<div></div>	Finish-only	<div></div>	Progress	<div></div>			
		Milestone	<div></div>	Inactive Milestone	<div></div>	Manual Summary Rollup	<div></div>	External Tasks	<div></div>	Manual Progress	<div></div>			
		Summary	<div></div>	Inactive Summary	<div></div>	Manual Summary	<div></div>	External Milestone	<div></div>					
Page 2														