Newborn Screening Data

Final Presentation

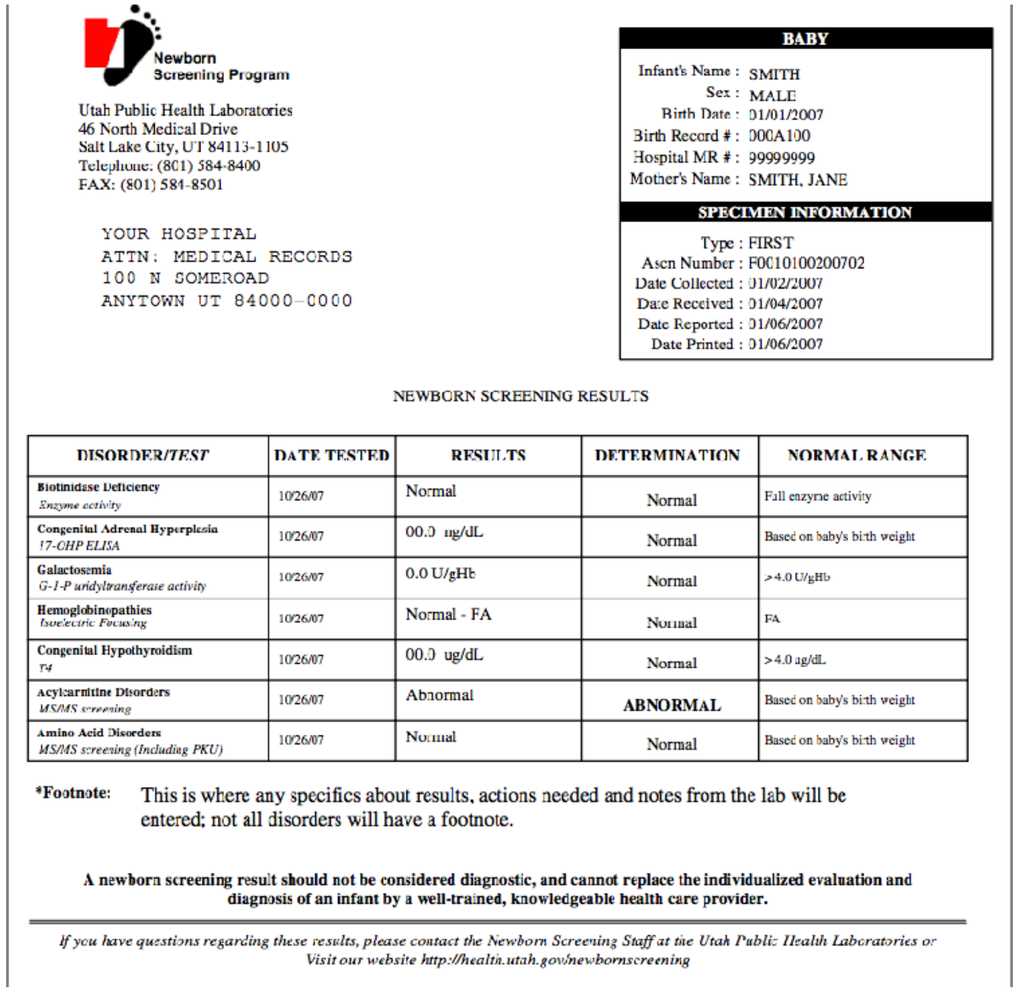
FHIRfighters

Agenda

- The Problem at Hand
- Our Solution: Artemis
- Demo
- Deployment
- Next Steps

Background

- Utah Newborn Screening Program
- Legally mandated screening
- Over 100K per year are processed
- Samples on specially-designed cards
- http://health.utah.gov/newbornscreening



Newborn Screening Program

Utah Public Health Laboratories
46 North Medical Drive
Salt Lake City, UT 84113-1105
Telephone: (801) 584-8400
FAX: (801) 581-8501

YOUR HOSPITAL
ATTN: MEDICAL RECORDS
100 N SOMEROAD
ANYTOWN UT 84000-0000

BABY

Infant's Name : SMITH
Sex : MALE
Birth Date : 01/01/2007
Birth Record # : 000A100
Hospital MR # : 99999999
Mother's Name : SMITH, JANE

SPECIMEN INFORMATION

Type : FIRST
Ascn Number : F0010100200702
Date Collected : 01/02/2007
Date Received : 01/04/2007
Date Reported : 01/06/2007
Date Printed : 01/06/2007

NEWBORN SCREENING RESULTS

DISORDER/*TEST*	DATE TESTED	RESULTS	DETERMINATION	NORMAL RANGE
Biotinidase Deficiency *Enzyme activity*	10/26/07	Normal	Normal	Full enzyme activity
Congenital Adrenal Hyperplasia *17-OHP ELISA*	10/26/07	00.0 ng/dL	Normal	Based on baby's birth weight
Galactosemia *G-1-P uridyltransferase activity*	10/26/07	0.0 U/gHb	Normal	>4.0 U/gHb
Hemoglobinopathies *Isoelectric Focusing*	10/26/07	Normal - FA	Normal	FA
Congenital Hypothyroidism *T4*	10/26/07	00.0 ug/dL	Normal	>4.0 ug/dL
Acylcarnitine Disorders *MS/MS screening*	10/26/07	Abnormal	**ABNORMAL**	Based on baby's birth weight
Amino Acid Disorders *MS/MS screening (Including PKU)*	10/26/07	Normal	Normal	Based on baby's birth weight

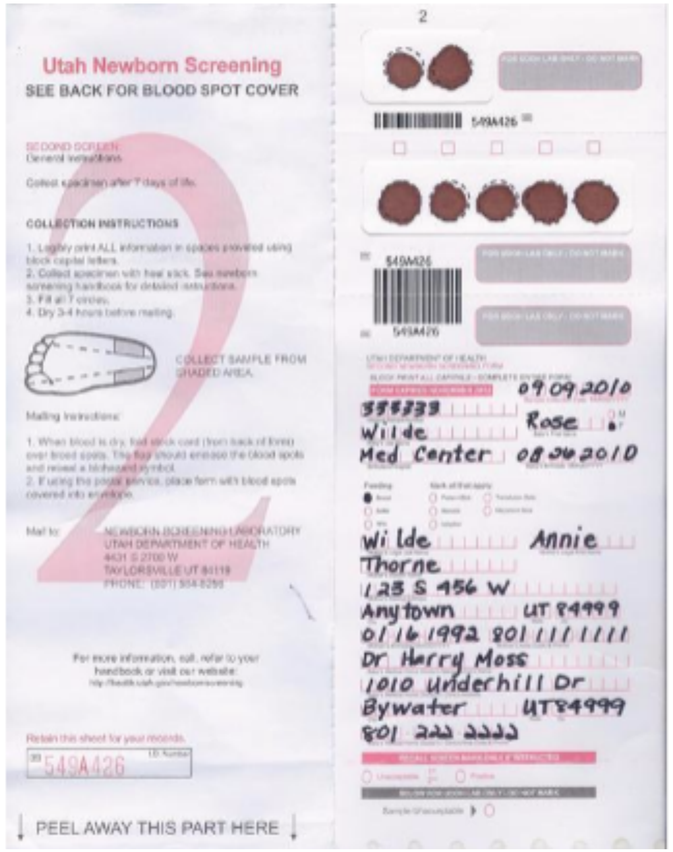
***Footnote:** This is where any specifics about results, actions needed and notes from the lab will be entered; not all disorders will have a footnote.

A newborn screening result should not be considered diagnostic, and cannot replace the individualized evaluation and diagnosis of an infant by a well-trained, knowledgeable health care provider.

If you have questions regarding these results, please contact the Newborn Screening Staff at the Utah Public Health Laboratories or Visit our website http://health.utah.gov/newbornscreening

Problems

- Cards are filled by hand
- Parents are given cards at birth
- A second sample needs to be collected
- Cards get lost
- Information may be incorrect



The Current Solution

- Use Utah Office of Vital Records and Statistics to verify data
- Data from both systems pulled into access DB monthly
- Manually identify discrepancies to fix

Artemis

- Portable
- Simple to use
- Enables future improvements
- Scalable

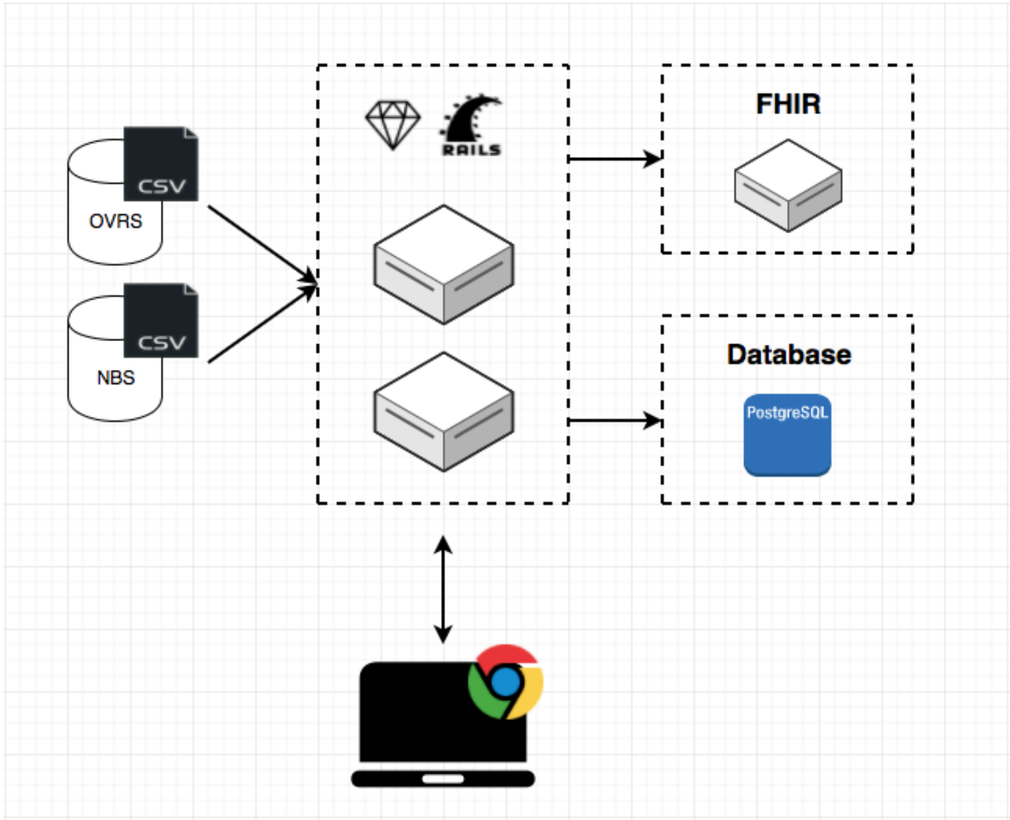
Discrepancy Report

Created 2017-11-30 04:32:38 UTC

#	Kit ID	Attribute	NBS	OVRS
1	UT850A001	First Name Last Name	[blank] [blank]	James Kirk
2	UT850A020	Mothers Last Name Birth Weight	Adams 2807	[blank] [blank]
3	UT850A010	Mothers Birthdate	[blank]	1989-10-09
4	UT850A006	Kit Sex	UT850A006 M	[blank] [blank]
5	UT850A018	Sex	F	M
6	UT850A086	Multiple Birth First Name Last Name	1 James Adams	[blank] [blank] [blank]
7	UT850A007	First Name Last Name	[blank] [blank]	Boy Tester
8	UT850A098	Mothers Last Name First Name	Maine Leslie	[blank] [blank]
9	UT850A044	Birthdate	2015-08-11	[blank]
10	UT850A093	Birth Weight First Name	2200 Early	[blank] [blank]
11	UT850A008	Birthdate	[blank]	2015-11-01
12	UT850A002	Mothers Birthdate Birth Weight	[blank] [blank]	1985-01-08 2881

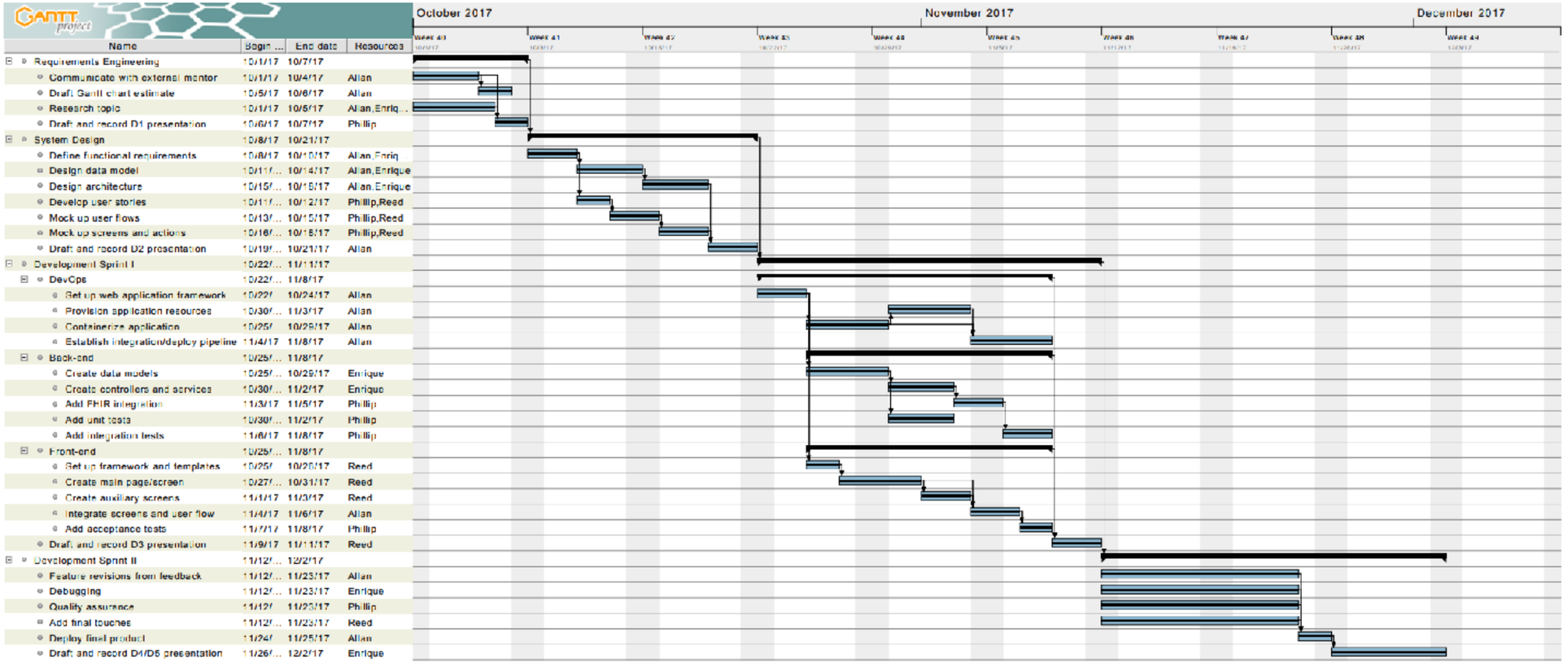
Technical Details

- Ruby on Rails
- PostgreSQL
- FHIR



On FHIR

- Data producer
- Patient: newborn
- RelatedPerson: mother
- Observation: birth weight and length



Name	Begin ...	End date	Resources
Requirements Engineering	10/1/17	10/7/17	
Communicate with external mentor	10/1/17	10/4/17	Allan
Draft Gantt chart estimate	10/5/17	10/6/17	Allan
Research topic	10/1/17	10/5/17	Allan,Enriq...
Draft and record D1 presentation	10/6/17	10/7/17	Phillip
System Design	10/8/17	10/21/17	
Define functional requirements	10/8/17	10/10/17	Allan,Enriq
Design data model	10/11/...	10/14/17	Allan,Enrique
Design architecture	10/15/...	10/16/17	Allan,Enrique
Develop user stories	10/11/...	10/12/17	Phillip,Reed
Mock up user flows	10/13/...	10/15/17	Phillip,Reed
Mock up screens and actions	10/16/...	10/18/17	Phillip,Reed
Draft and record D2 presentation	10/19/...	10/21/17	Allan
Development Sprint I	10/22/...	11/11/17	
DevOps	10/22/...	11/8/17	
Get up web application framework	10/22/	10/24/17	Allan
Provision application resources	10/30/...	11/3/17	Allan
Containerize application	10/25/	10/29/17	Allan
Establish integration/deploy pipeline	11/4/17	11/8/17	Allan
Back-end	10/25/...	11/8/17	
Create data models	10/25/...	10/29/17	Enrique
Create controllers and services	10/30/...	11/2/17	Enrique
Add FHIR integration	11/3/17	11/5/17	Phillip
Add unit tests	10/30/...	11/2/17	Phillip
Add integration tests	11/6/17	11/8/17	Phillip
Front-end	10/25/...	11/8/17	
Get up framework and templates	10/25/	10/26/17	Reed
Create main page/screen	10/27/...	10/31/17	Reed
Create auxiliary screens	11/1/17	11/3/17	Reed
Integrate screens and user flow	11/4/17	11/6/17	Allan
Add acceptance tests	11/7/17	11/8/17	Phillip
Draft and record D3 presentation	11/9/17	11/11/17	Reed
Development Sprint II	11/12/...	12/2/17	
Feature revisions from feedback	11/12/...	11/23/17	Allan
Debugging	11/12/...	11/23/17	Enrique
Quality assurance	11/12/	11/25/17	Phillip
Add final touches	11/12/...	11/23/17	Reed
Deploy final product	11/24/	11/25/17	Allan
Draft and record D4/D5 presentation	11/26/...	12/2/17	Enrique

Project Status

Gantt Chart

Demo

Deployment

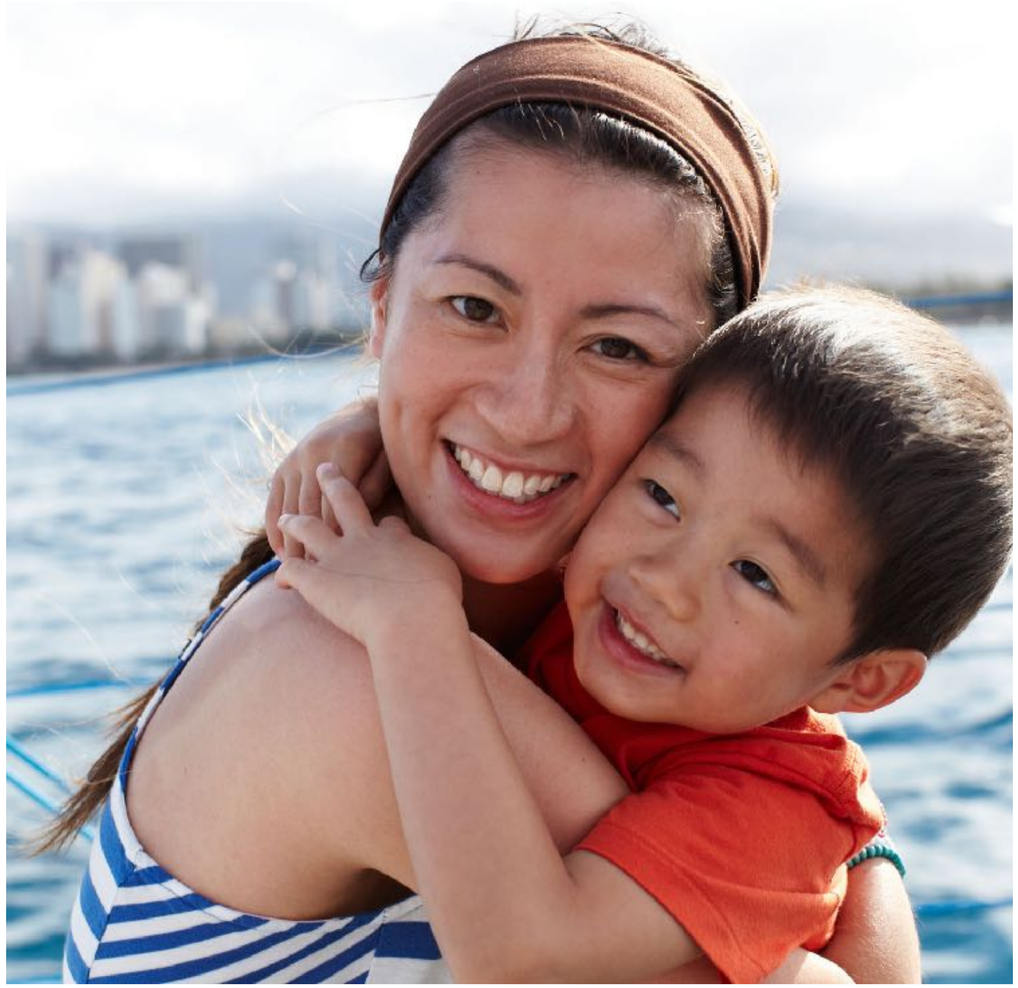
- On-Premise
- Run a local web server
- Simple deploy with Docker
- But we had to compromise…

The Cloud

- Deployed to a small Heroku Dyno
- Accessible at: http://artemis-fhirfighters.herokuapp.com
- Great for validating

User On-Boarding

- Keep interface simple
- Provide detailed documentation
- Good error handling



Next Steps

- Deploy application locally
- Integrate Artemis into automated feeds
- Push notifications on discrepancy
- Machine learning to automate discrepancy fix

Final Thoughts