Prototype TLD Application

TLD WorkerBee
Mentor: Austin Sanders

Austen Christensen
Morgan Lovato
Wei Song

Harlan Mitchell

- Graduated from NAU in 1997 with a degree in Computer Science
- Systems Technical Manager at Honeywell

Honeywell
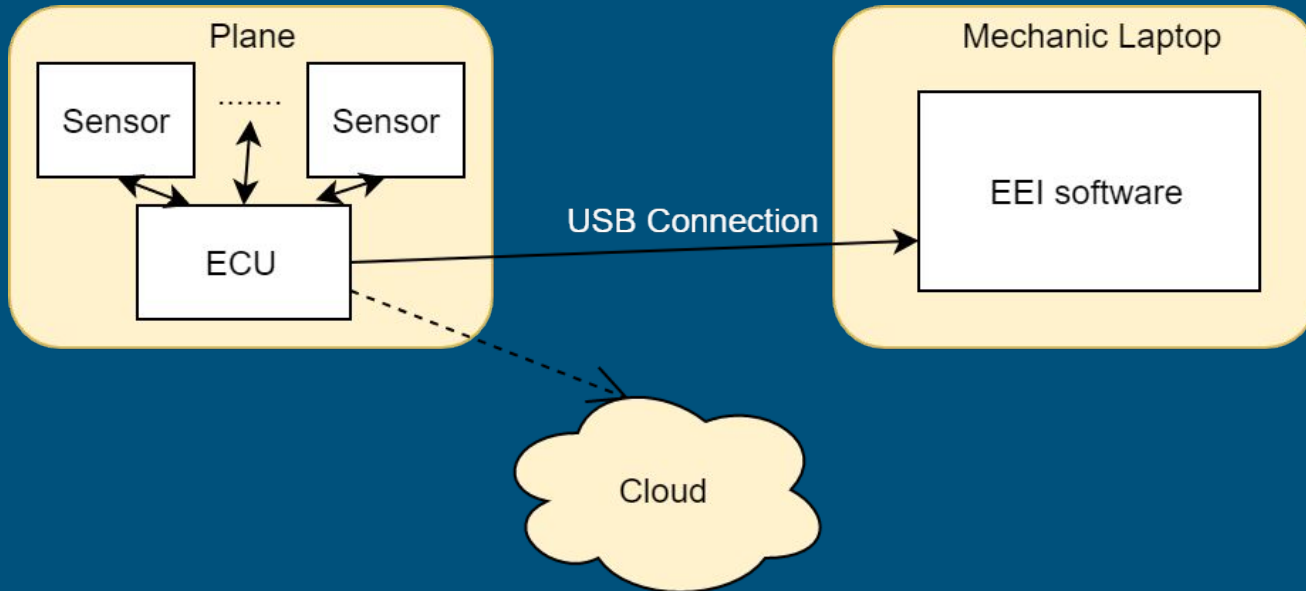THE POWER OF **CONNECTED**

Introduction

- Time Limited Dispatch
  - Engine Control Unit
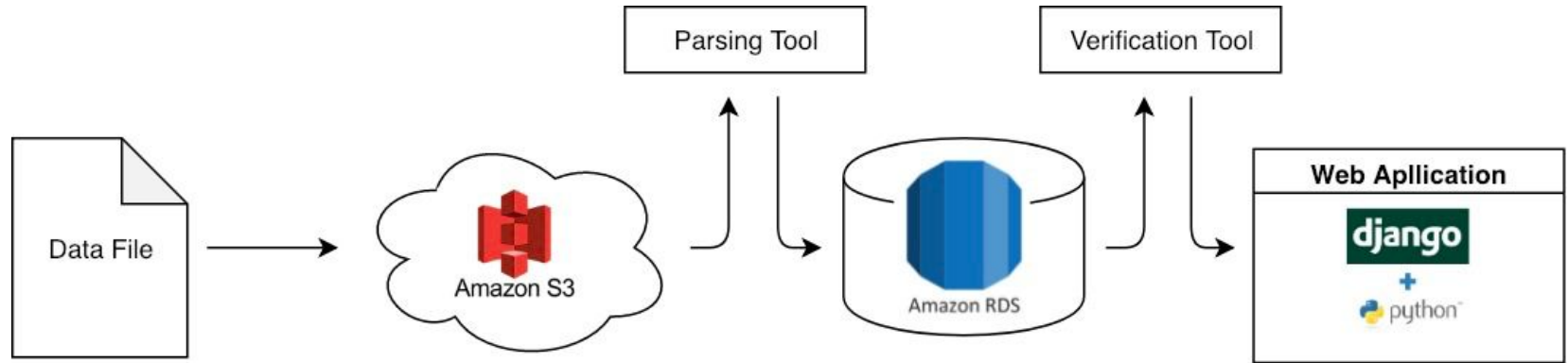 - Data Dump

- Preventative Maintenance

Current Process

Problems

- Too Physical

- Time Consuming

- Costly

- Outdated Software

- No current way of viewing data in cloud

Proposed Solution

Solution Continued

Problems

- Time Consuming

- Costly

- Outdated Software

- Can't view data in cloud

Solutions

- Convenient Access to Data

- Fast Access to Data

- Web App Based Software

- Web App Data Viewing Tool

Requirements

[P-SYS3] The web viewer tool shall create a MD5 hash value based on the data after receiving it from the cloud.

[P-SYS4] The web viewer tool shall validate the data by comparing MD5 hash values

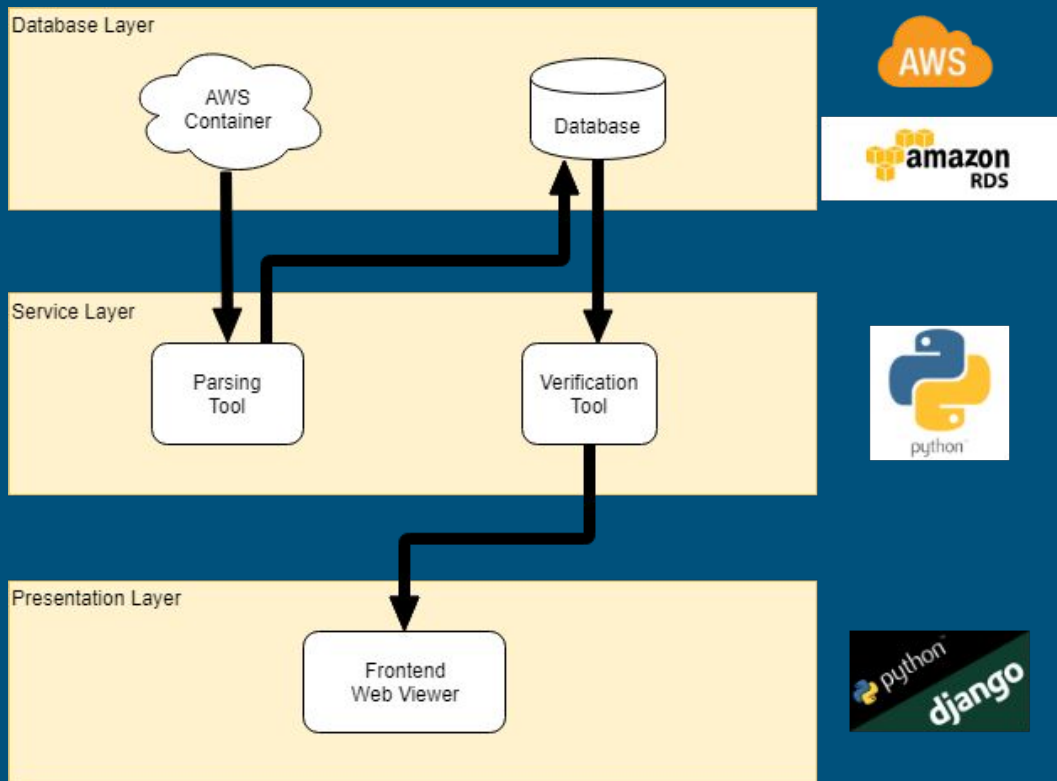[F-SYS1] The web viewer tool shall download the raw data file from the cloud to the user's computer upon user's request.

Architectural Overview
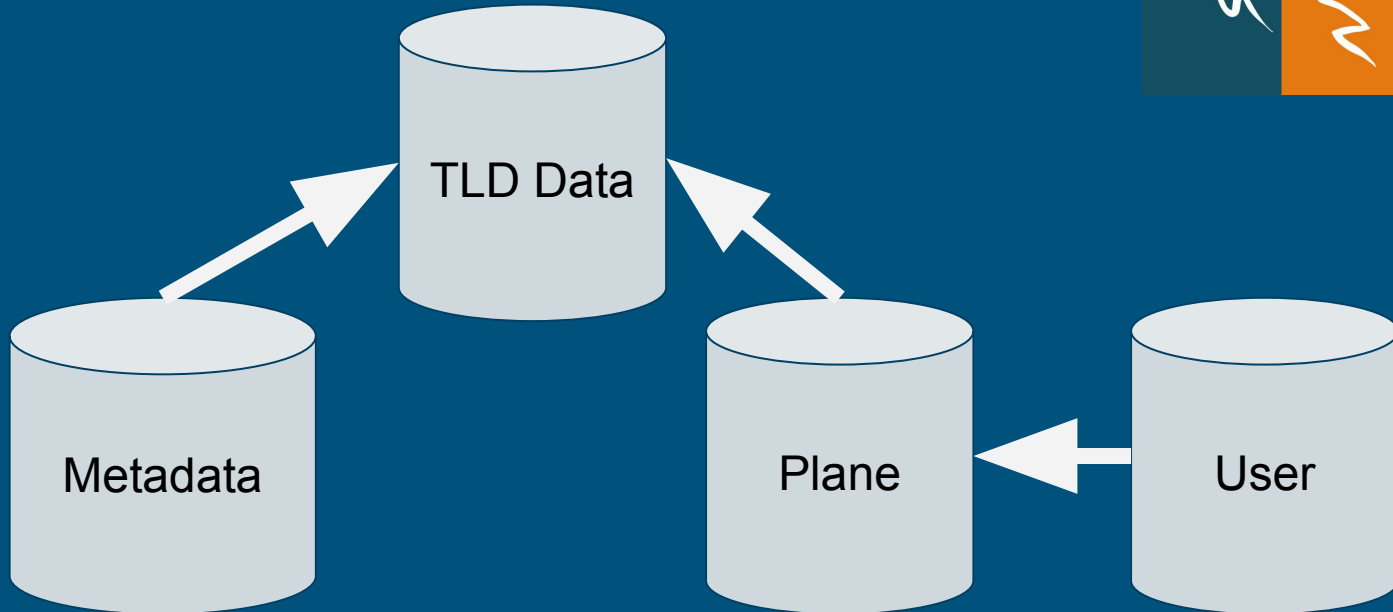
Model View Presenter:

- Database Layer (Model)

- Service Layer (Presenter)

- Presentation Layer (View)

Database Layer

Service Layer
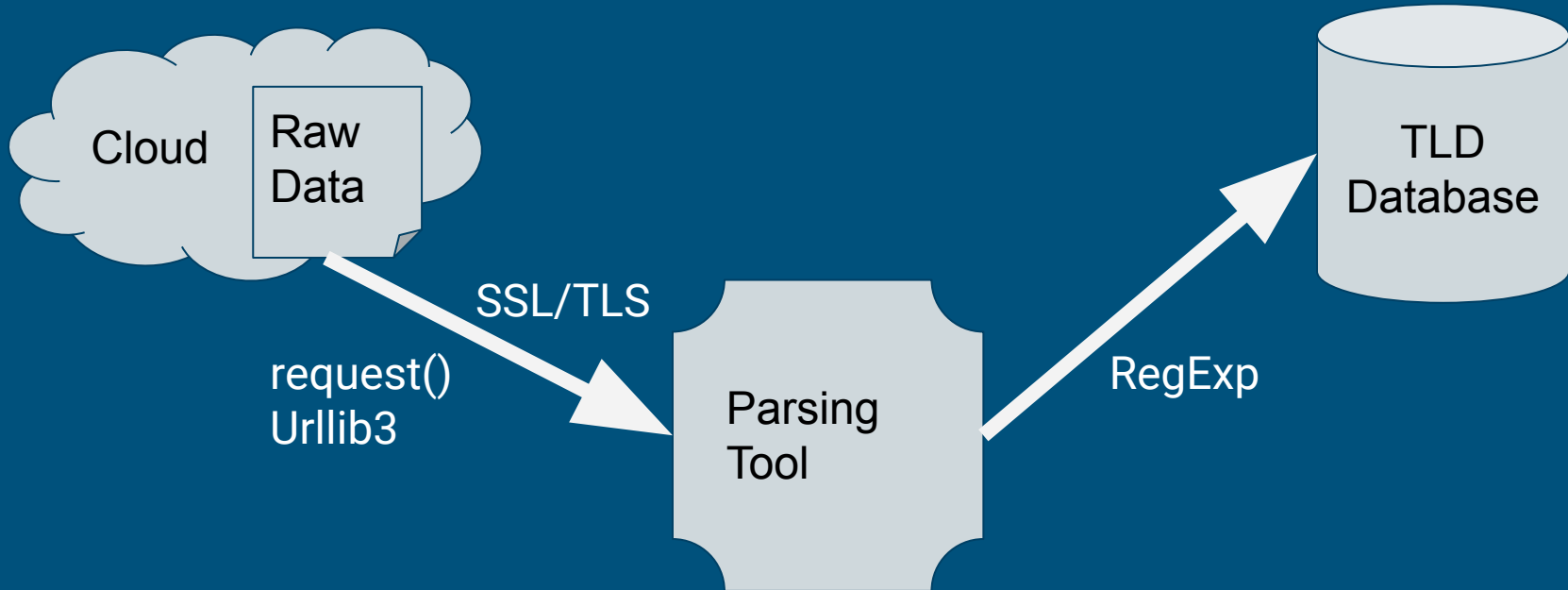
Presentation Layer
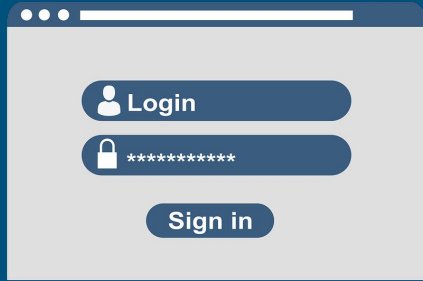
Table View

Django
Administrator
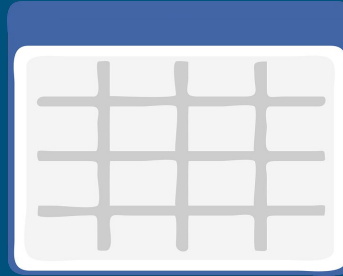
Chart View

MD5
Verification

TLD
Database
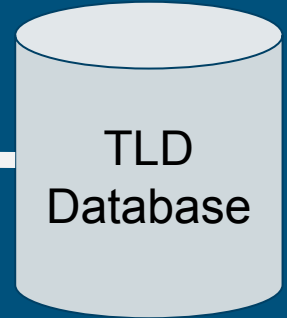
Demo

SIGN IN

Don't have an account? Sign up

Forgot password?

User Authentication

Username:

[   ]

- This field is required.

Password:

[   ]

- This field is required.

[Submit]

Don't have an account? Sign up   Forgot password?

TLD application

Sign up

Username:

[   ]

Required. 30 characters or fewer. Letters, digits and @/./+/-/_ only.

Email address:

[   ]

Password:

[   ]

Password confirmation:

[   ]

Enter the same password as before, for verification.

[Sign up]

Already have an account? Sign in here.

User Authentication

Username:

david

- This field is required.

Password:

••••••••••

- This field is required.

Submit

Don't have an account? Sign up   Forgot password?

TLD application

Sign up

Username:

Required. 30 characters or fewer. Letters, digits and @/./+/-/_ only.

Email address:

Password:

Password confirmation:

Enter the same password as before, for verification.

Sign up

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Dashboard

YOUR PLANE

plane 53465

plane 14936

Setting

Hello, david

<-- Please select a plane on the left to view the TLD data.

Honeywell is currently developing a product to allow engine downloads to be completed autonomously with the data uploaded wirelessly to the cloud where it will then be accessible remotely. The software that communicates to the ECU and does the download to a secure cloud server will be hosted on a small embedded computer located on the aircraft.

The data that will be captured and saved to the cloud falls into three distinct categories: Real time data collected while the A/C is in flight, snapshot data that is collected at various events and flight transitions, and fault data. Fault data can further be broken down into Time Limited Dispatch (TLD) faults and all otherfaults. The data file will include a CRC but additional mechanisms may be required to be carried with the data to ensure validity.

Engine control systems can be allowed to operate with faults for a specified period of time provided:

- Resulting system operation and overall average reliability is adequate
- Operating exposure, in this less redundant state, is appropriately limited

TLD is only concerned with faults that affect the loss of thrust control. TLD is specified in the following periods of time:
- Short time (ST) – typically 125 hrs. before performing maintenance
- Long time (LT) – typically 500 hrs. before performing maintenance
- No Dispatch (ND) – fault must be corrected before next flight

Using the existing EEI tool, users can evaluate faults and determine the A/C TLD status and make the appropriate maintenance decisions. Because EEI is used to make maintenance decisions it has to be a qualified tool per the FAA software development process.

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Setting

Plane Data: 53465

ECFR 1hour data dump

Download Rawdata | Chart View | Table View | Delete

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Plane Data: 53465

Refreh

Choose ...

Search

Plane Data: 53465

Refreh

✓ Choose ...
Event 1 ECU Operating Time
Event 1 Leg Number
Event 1 N1
Event 1 N2
Event 1 EGT
Event 1 ITT
Event 1 ECU TT2
Event 1 ECU PS
Event 1 CGV position
Event 1 Power Lever Angle
Event 1 Vibration Average
Event 1 Oil Temperature
Event 1 Oil Pressure
Event 1 Fuel Temperature
Event 1 Main Metering Valve
Event 1 Fuel Usage
Event 1 P3
Event 1 Reserved
Event 1 Mach
Event 1 wfcmd_tm_total
Event 1 engine_status
Event 1 engine_status_2
Event 1 engine_status_3
Event 1 engine_status_4
Event 1 GMT Date
Event 1 GMT Time
Event 1 Latitude
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Event 1 event_type

Search

Plane Data: 53465

Refreh

Event 1 Fuel Usage

Event 1 Fuel Usage

Plane Data: 53465

Refreh

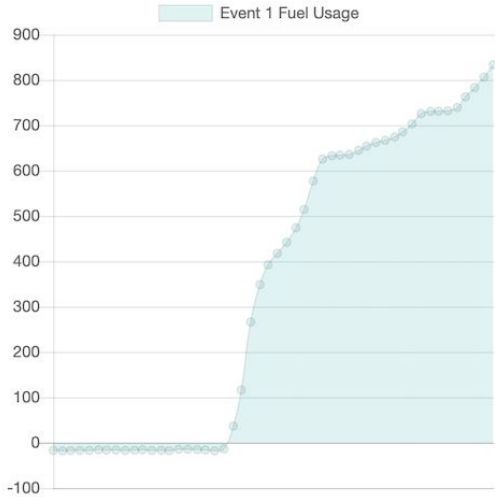| id	block num	MD5	Event 1 ECU Operating Time	Event 1 Leg Number	Event 1 N1	Event 1 N2	Event 1 EGT	Event 1 ITT	Event 1 ECU TT2	Event 1 ECU PS	Event 1 CGV position	Event 1 Power Lever Angle	Event 1 Vibration Average	Event 1 Oil Temperature	Event 1 Oil Pressure	Event 1 Tempera
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2	11	match	27.924999999998768	0	0	0	3	0.0	0.0	62.625	0.96875	17.0703125	13.353515625	215.203125	7.890625	0.0
3	11	match	28.92499999999871	0	0	0	3	0.0	0.0	62.625	0.98046875	17.0625	13.353515625	215.953125	7.890625	0.0
4	11	match	29.924999999998654	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625	215.6875	7.890625	0.0
5	11	match	30.924999999998597	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
6	11	match	31.92499999999854	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0859375	13.353515625	215.390625	7.890625	0.0
7	11	match	32.924999999998484	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
8	11	match	33.92499999999843	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625	215.765625	7.890625	0.0
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11	11	match	36.924999999998256	0	0	0	3	0.0	0.0	62.625	0.98046875	17.09375	13.353515625	215.765625	7.890625	0.0
12	11	match	37.9249999999982	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
13	11	match	38.92499999999814	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.35546875	215.390625	7.890625	0.0
14	11	match														

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Plane Data: 53465

Refreh

id	block num	MD5	Event 1 ECU Operating Time	Event 1 Leg Number	Event 1 N1	Event 1 N2	Event 1 EGT	Event 1 ITT	Event 1 ECU TT2	Event 1 ECU PS	Event 1 CGV position	Event 1 Power Lever Angle	Event 1 Vibration Average	Event 1 Oil Temperature	Event 1 Oil Pressure	Event 1 Tempera
1	11	match	26.924999999998825	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625	215.4375	7.890625	0.0
2	11	mat		0	0	0	3	0.0	0.0	62.625	0.96875	17.0703125	13.353515625	215.203125	7.890625	0.0
3	11	match	28.92499999999871	0	0	0	3	0.0	0.0	62.625	0.98046875	17.0625	13.353515625	215.953125	7.890625	0.0
4	11	match	29.924999999998654	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625	215.6875	7.890625	0.0
5	11	match	30.924999999998597	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
6	11	match	31.92499999999854	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0859375	13.353515625	215.390625	7.890625	0.0
7	11	match	32.924999999998484	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
8	11	match	33.92499999999843	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625	215.765625	7.890625	0.0
9	11	match	34.92499999999837	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625	215.765625	7.890625	0.0
10	11	match	35.92499999999831	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0859375	13.353515625	215.765625	7.890625	0.0
11	11	match	36.924999999998256	0	0	0	3	0.0	0.0	62.625	0.98046875	17.09375	13.353515625	215.765625	7.890625	0.0
12	11	match	37.9249999999982	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
13	11	match	38.92499999999814	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.35546875	215.390625	7.890625	0.0

cloud MD5:705261389264197fd03d38be7c971e60, local MD5:705261389264197fd03d38be7c971e60

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Search

Plane Data: 53465

id	block num	MD5	Event 1 ECU Operating Time	Event 1 Leg Number	Event 1 N1	Event 1 N2	Event 1 EGT	Event 1 ITT	Event ECU TT
1	11	match	26.924999999998825	0	0	0	3	0.0	0.0
2	11	mat		0	0	0	3	0.0	0.0
3	11	match	28.92499999999871	0	0	0	3	0.0	0.0
4	11	match	29.924999999998654	0	0	0	3	0.0	0.0
5	11	match	30.924999999998597	0	0	0	3	0.0	0.0

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Plane Data: 53465

id	block num	MD5	Event 1 ECU Operating Time	Event 1 Leg Number	Event 1 N1	Event 1 N2	Event 1 EGT	Event 1 ITT	Event 1 ECU TT2	Event 1 ECU PS	Event 1 CGV position	Event 1 Power Lever Angle	Event 1 Vibration Average	Event 1 Oil Temperature	Event 1 Oil Pressure	Event 1 Tempera
1	11	match	26.924999999998825	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625	215.4375	7.890625	0.0
2	11	match	27.924999999998768	0	0	0	3	0.0	0.0	62.625	0.96875	17.0703125	13.353515625	215.203125	7.890625	0.0
3	11	match	28.92499999999871	0	0	0	3	0.0	0.0	62.625	0.98046875	17.0625	13.353515625	215.953125	7.890625	0.0
4	11	match	29.924999999998654	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625	215.6875	7.890625	0.0
5	11	match	30.924999999998597	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
6	11	match	31.92499999999854	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0859375	13.353515625	215.390625	7.890625	0.0
7	11	match	32.924999999998484	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
8	11	match	33.92499999999843	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625	215.765625	7.890625	0.0
9	11	match	34.92499999999837	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625	215.765625	7.890625	0.0
10	11	match	35.92499999999831	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0859375	13.353515625	215.765625	7.890625	0.0
11	11	match	36.924999999998256	0	0	0	3	0.0	0.0	62.625	0.98046875	17.09375	13.353515625	215.765625	7.890625	0.0
12	11	match	37.9249999999982	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625	215.390625	7.890625	0.0
13	11	match	38.92499999999814	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.35546875	215.390625	7.890625	0.0

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	Leg Number	Event 1 N1	Event 1 N2	Event 1 EGT	Event 1 ITT	Event 1 ECU TT2	Event 1 ECU PS	Event 1 CGV position	Lever Angle	Vibration Average
825	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625
768	0	0	0	3	0.0	0.0	62.625	0.96875	17.0703125	13.353515625
71	0	0	0	3	0.0	0.0	62.625	0.98046875	17.0625	13.353515625
654	0	0	0						7.0625	13.353515625
597	0	0	0						7.078125	13.353515625
54	0	0	0						7.0859375	13.353515625
484	0	0	0	3	0.0	0.0	62.625	0.9765625	17.078125	13.353515625
43	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0546875	13.353515625
37	0	0	0	3	0.0	0.0	62.625	0.9765625	17.0625	13.353515625

Warning! This operation will fetch the newest data from the cloud and rewrite the database, which will process for a while.
Proceed or not?

取消　　好

Challenges and Resolutions

- Cloud and database failure
  - Introduce a backup mechanism
  - Medium severity
- Network connectivity
  - Keep using the current EEI solution as a backup plan
  - High severity
- Network security
  - Techniques to avoid SQL injections
  - Medium severity

Unit Testing Plan

Test Units (8 units & 47 test cases)

- Sign in & Sign up
- getAircraft(String Aircraft_ID)
- getChartView(String Aircraft_ID, String Search_Field)
- getTableViewData(String Aircraft_ID)
- MD5Generator(String TLD_Data)
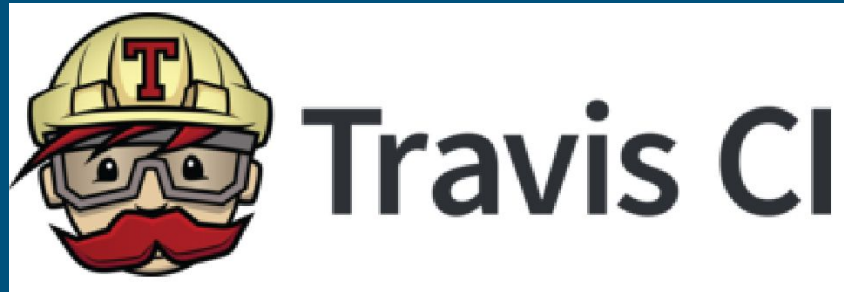- MD5Checker(String localMD5, String cloudMD5)
- parsingTool(File RawDataFile.txt)

Test Framework

Integration Testing Plan

- Travis CI to provide continuous integration and testing environment

- Use Pytest with Travis CI to automate our tests

- Test interactions between modules

Usability Testing Plan

- Group of Certified Aircraft Technicians
  - Categorical Acceptance
  - Live Usability

Team Schedule

ID	Task Name	Duration	Jan 2019		Feb 2019				Mar 2019				Apr 2019				May 2019				Jun 2
			3W	4W	1W	2W	3W	4W	1W	2W	3W	4W	1W	2W	3W	4W	1W	2W	3W	4W	1W
1.0	Requirement Revisions	2	2 Weeks 100 %																		
2.0	Understand Test file format	1			1 Week 100 %																
3.0	Database Layer	2					2 Weeks 100 %														
4.0	Service Layer	3					3 Weeks 100 %														
5.0	Presentation Layer	3					5 Weeks 100 %														
6.0	Test Planning	2											2 Weeks 100 %								
7.0	Unit Testing	2													2 Weeks 25 %						
8.0	Integration Testing	3														3 Weeks 20 %					
9.0	Usability Testing	2																2 Weeks 0 %			

Future Work

- Back-up Database/Files

- Automatic Refresh

- Specific Graph View

- CRC values

Conclusion

- Project Overview
  - Current process - slow and inefficient
  - Proposed solution - fast and secure
- Solution Overview
  - Database Layer - AWS Cloud Container and Databases
  - Service Layer - Parsing and Verification Tools
  - Presentation Layer - Web App Data Viewing Tool

- Poster Session: 2 pm - 4 pm at Location 10C