



Intern Final Report



08.26.2023 | Paul Khayet

Agenda

- 01 Introduction
- 02 Project Overview
- 03 Demo
- 04 What I learned
- 05 Special Thanks
- 06 Q&A



Introduction



Name: Paul Khayet

School: University of California - Irvine

EG Team: FSE – Rockies

Manager: Lavanya Tiruvanampalli



Problem Statement

Generic Problem Statement:

- AP Invoice creation process is currently manual for some Corp business use cases, making it **time consuming and error prone**. Automation should be used wherever possible, to **limit human error**.
- **Example:** Someone could input the incorrect site, resulting in payments being made from the incorrect bank account, or an incorrect amount, etc.

Solution Options:

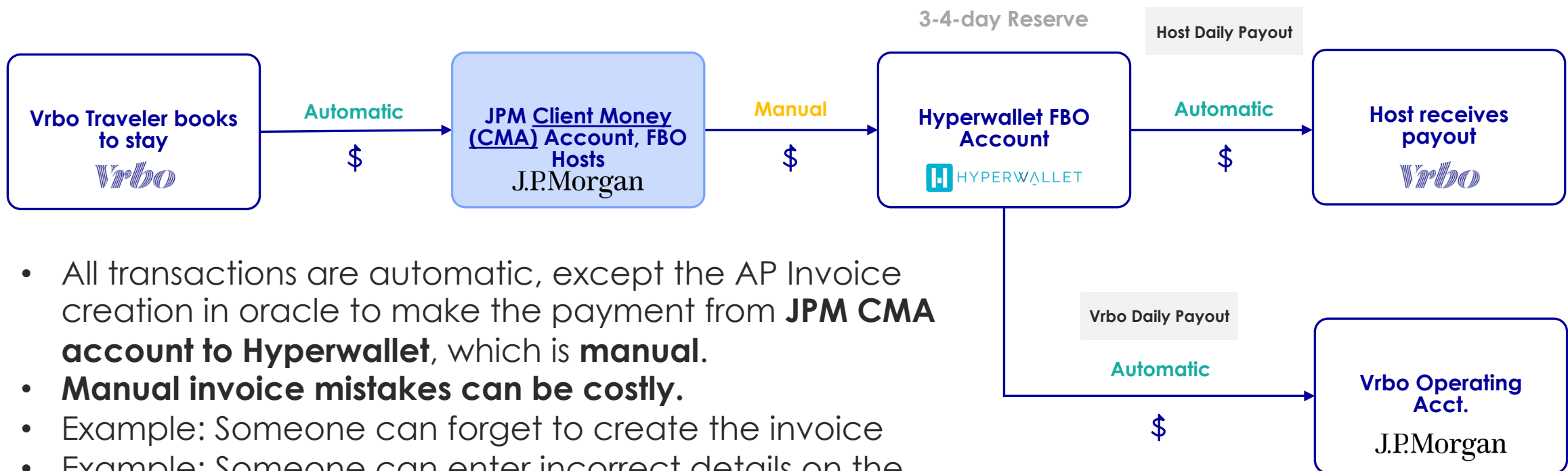
- | | |
|---|-----------------|
| • Web ADI (Applications Desktop Integrator) Spreadsheets:
Excel Sheet that can upload multiple invoices at once to oracle (Still requires human intervention) | Semi-Automatic |
| • Generic File-based invoice import system: Allows any source system to create invoices in oracle, without human intervention | Fully Automatic |

PAYINS

MANAGEMENT OF FUNDS

PAYOUTS

Mistakes can be made while making oracle invoice



- All transactions are automatic, except the AP Invoice creation in oracle to make the payment from **JPM CMA account to Hyperwallet**, which is **manual**.
- **Manual invoice mistakes can be costly.**
- Example: Someone can forget to create the invoice
- Example: Someone can enter incorrect details on the invoice, resulting in more rework

VRBO Solution Expansion



New Vrbo Considerations				New JPMC Considerations			Additional Details	
Currency	Country	Local Entity	Vrbo Entity (Collections)	JPMC Entity (Collections)	Payment Options	ECR Credit	Hyperwallet Account	Operating Account
EUR	Ireland	Yes	EG Vacation Rentals Ireland Ltd	J.P. Morgan SE – Dublin Branch	Wire, SEPA	Yes	Paypal Europe	EG Vacation Rentals Ireland Limited
GBP	UK	No	EG Vacation Rentals Ireland Ltd	JPMorgan Chase Bank, N.A, London Branch	Wire, BACS	Yes	Paypal Europe	EG Vacation Rentals Ireland Limited
CAD	Canada	No	EG Vacation Rentals Ireland Ltd	JPMorgan Chase Bank, N.A, Toronto Branch	Wire, ACH	Yes	Hyperwallet Systems	EG Vacation Rentals Ireland Limited
AUD	Australia	Yes	Stayz Pty. Ltd.	JPMorgan Chase Bank, N.A, Sydney Branch	Wire, ACH	Yes	Hyperwallet Australia	Stayz Pty, Ltd.

Glossary



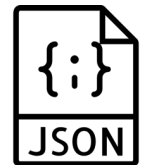
- **S3 Bucket** – AWS's version of a directory



- **Lambda** – A piece of code that operates once it is "triggered" by an event



- **CSV** – File format, similar to Excel, that is used to make tables



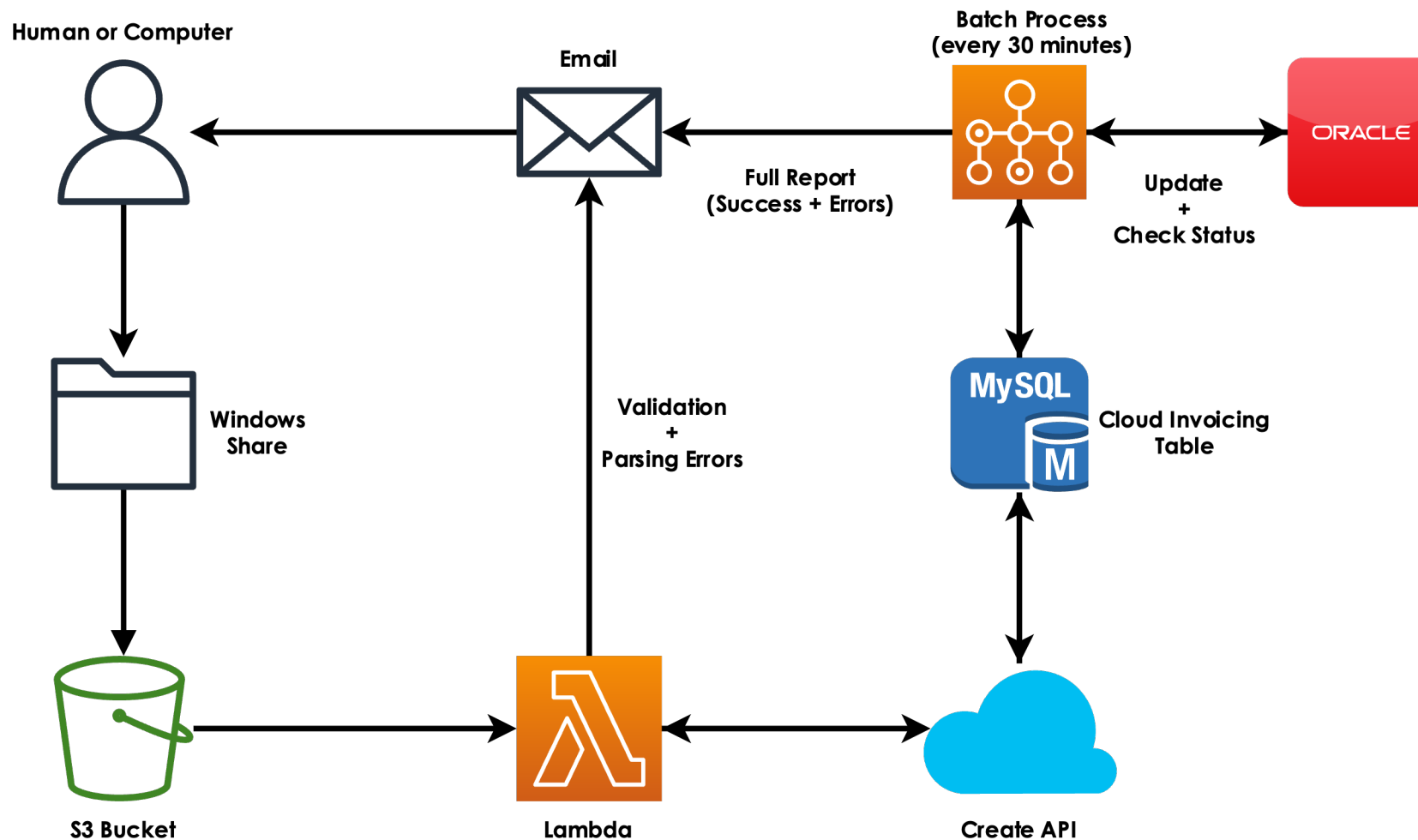
- **JSON** – File format that is easily parse-able



- **SQS** – Message queueing service, typically used to retry services

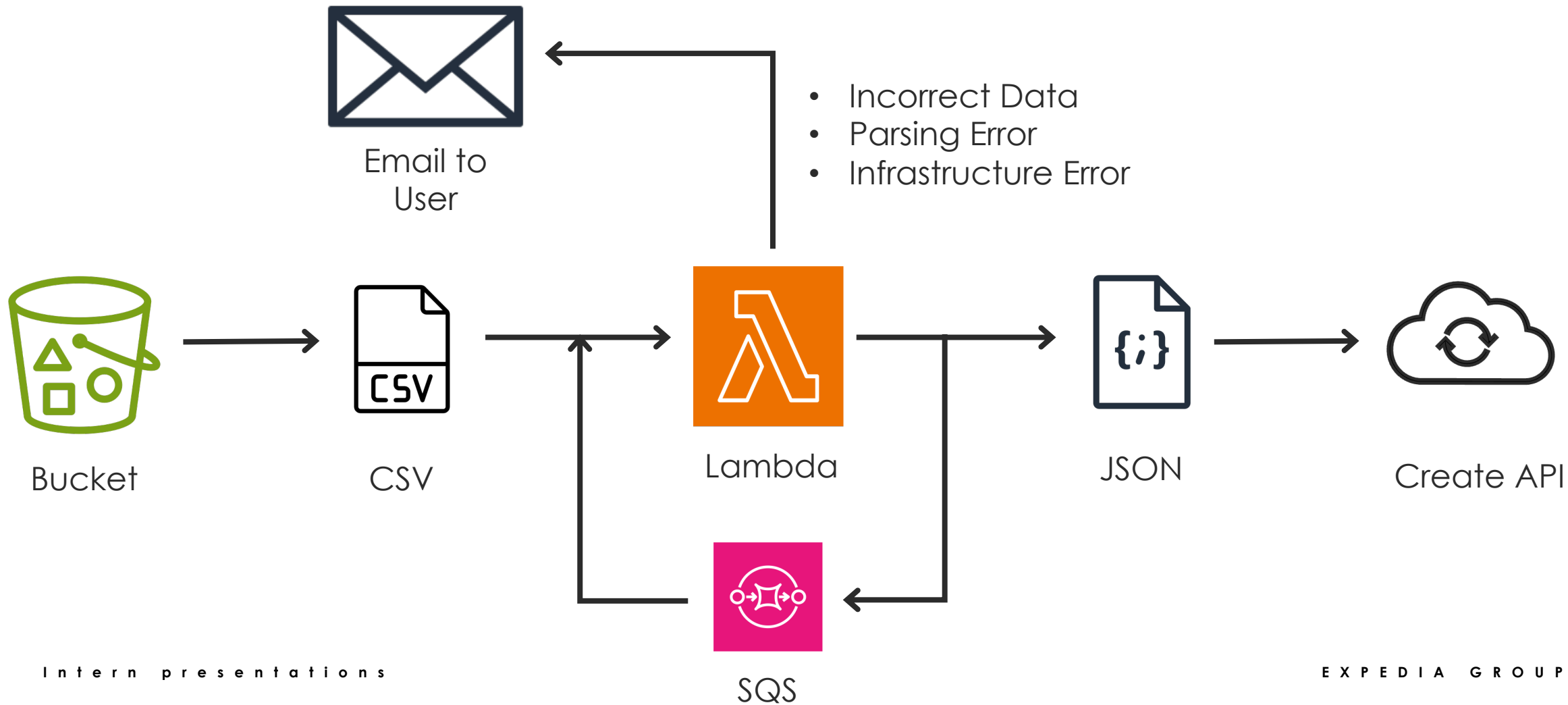


Generic Invoice Automation Process





My portion





CSV File – Simple Spreadsheet

HeaderNames

Helvetica Regular

Invoice Headers:

- Source
- Invoice Number
- PO Number
- Vendor Number
- Vendor Name
- Vendor Site Code
- Vendor Site ID
- Invoice Date
- Invoice Amount
- Invoice Currency Code
- Requester First Name
- Requester Last Name
- Source GUID
- Source Reference Number
- Invoice Type
- Exchange Rate
- Exchange Rate Date
- Exchange Rate Type
- Description
- Organization ID
- Operating Unit Name
- GL Date
- Requester Employee Number
- Pay Group
- Pay Alone
- Terms ID
- Terms Name
- Payment Method Code
- Payment Currency Code
- Payment Group Code

Invoice Lines:

- Line-Line Number
- Line-Line Amount
- Line-PO Line
- Line-PO Number
- Line-Line Type
- Line-Accounting Date
- Line-Description
- Line-PO Distribution Number
- Line-PO Distribution ID
- Line-Concatenated Distribution Code
- Line-Distribution Code Combination ID
- Line-Amount Includes Tax Flag
- Line-Product Type
- Line-Product Category
- Line-TRX Business Category

Column Headers

Column Values

Column Headers

Column Values

```
test_file1_Positive1Inv1Line-8.csv — Edited
Source|Invoice Number|PO Number|Vendor Number|Vendor Name|Vendor Site Code|Vendor Site ID|Invoice
Date|Invoice Amount|Terms Id|Invoice Currency Code|Requester First Name|Requester Last Name|Source
GUID|Source Reference Number|Invoice Type|Exchange Rate|Exchange Rate Date|Exchange Rate Type|
Description|Organization ID|Operating Unit Name|GL Date|Requester Employee Number|Pay Group|Pay
Alone|Terms ID|Terms Name|Payment Method Code|Payment Group Code|Line-Line Number|Line-Line
Amount|Line-PO Line|Line-PO Number|Line-Line Type|Line-Accounting Type|Line-Description|Line-PO
Distribution Number|Line-Concatenated Distribution Code|Line-Distribution Code Combination ID|
Line-Amount Includes Tax Flag|Line-Product Type|Line-Product Category|Line-TRX Business Category
VRBO|MGk468870|41101000066| 453168 |PayPal Inc|HWUSDFUNDING||8-10-23|100|00|USD|STANDARD|
Testing Inv|||||1|$100|1| 41101000066 | ITEM | Inv Line 1|||||
```

Source	Invoice Number	PO Number	Vendor Number	Vendor Name	Vendor Site Code
VRBO	MGA 468771	41101000066	453168	PayPal Inc	HWUSDFUNDING
VRBO	MGA 468772	41101000067	987119	Microsoft	MCRSFT



S3 Bucket

Amazon S3 > Buckets > awsdev-fsp-fin-ap-invoice-ingestion

awsdev-fsp-fin-ap-invoice-ingestion [Info](#)

[Objects](#) | [Properties](#) | [Permissions](#) | [Metrics](#) | [Management](#) | [Access Points](#)

Objects (4)
Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly...

[Refresh](#) [Copy S3 URI](#) [Copy URL](#) [Download](#) [Open](#) [Delete](#) [Actions](#) [Create folder](#) [Upload](#)

Find objects by prefix

<input type="checkbox"/>	Name	Type	Last modified	Size
<input type="checkbox"/>	archive/	Folder	-	
<input type="checkbox"/>	failure/	Folder	-	
<input type="checkbox"/>	new/	Folder	-	
<input type="checkbox"/>	success/	Folder	-	

CSV File dropped here

Triggers (2) [Info](#)

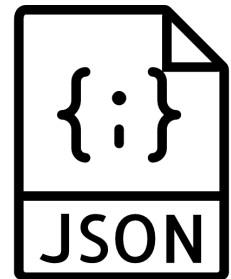
Find triggers

- Trigger**
- SQS: fin-ap-invoice-ingestion-retry-queue**
arn:aws:sqs:us-west-2:785458642171:fin-ap-invoice-ingestion-retry-queue
state: **Enabled**
[Details](#)
- S3: awsdev-fsp-fin-ap-invoice-ingestion**
arn:aws:s3::awsdev-fsp-fin-ap-invoice-ingestion
[Details](#)
 - Bucket arn: **arn:aws:s3::awsdev-fsp-fin-ap-invoice-ingestion**
 - Event types: **s3:ObjectCreated:***
 - Notification name: **8e2b4ba2-2905-47f5-9ce0-addd07f621c8**
 - Prefix: **new/**
 - Service principal: **s3.amazonaws.com**
 - Source account: **785458642171**
 - Statement ID: **FSP-dev-fin-ap-invoice-ingestion-bucket-BucketPermission-qfFluo3aRQhw**
 - Suffix: **.csv**

Sets off Lambda Trigger



File Processing Flow



Mapping CSV



```
for (int i = 0; i < data.length - 1; i++) {
    if (findColumn(data, target: "Source") != -1) {
        String sourceSystem = data[1 + i][findColumn(data, target: "Source")];
        if (!sourceSystem.isEmpty()) {
            invoice.setSourceSystem(sourceSystem);
        }
    }
}
```

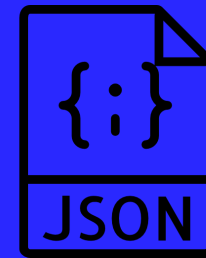
Example: "Source" header is searched for, grabs the value i spaces below it, and inserts it into the invoice object

```
138 usages 1 |repp +1
public static int findColumn(String[][] data, String target) {
    // Try and understand why the first run through causes an issue (Solved: It was a zero width space)
    int columnNum = -1;
    int occurrence = 0;
    target = target.trim(); // Trim the target string
    for (int row = 0; row < data.length; row++) {
        for (int column = 0; column < data[row].length; column++) {
            if (data[row][column] != null && data[row][column].trim().equalsIgnoreCase(target)) {
                columnNum = column;
                occurrence++;
            }
        }
    }
    if(occurrence < 2) {
        return columnNum;
    }
    else{
        throw new RuntimeException("Duplicate columns of [" + target + "]);
    }
}
```

- Locations are not hard-coded, meaning order doesn't matter and columns can be skipped
- Also, if there are duplicate columns it returns an error



JSON File



```

{
  "headerId": null,
  "source_system": "VRB0",
  "po_number": "41101000066",
  "requester_first_name": null,
  "requester_last_name": null,
  "source_system_guid": null,
  "source_system_ref": null,
  "source_profile_name": "UiPath",
  "invoice_number": null,
  "invoice_type": "STANDARD",
  "invoice_date": "2023-08-09",
  "vendor_id": null,
  "vendor_number": "453168",
  "vendor_name": "PayPal Inc",
  "vendor_site_id": null,
  "vendor_site_code": "HMUSDFUNDING",
  "invoice_amount": 200,
  "invoice_currency_code": "USD",
  "exchange_rate": null,
  "exchange_rate_type": null,
  "exchange_rate_date": null,
  "terms_id": null,
  "terms_name": null,
  "terms_date": null,
  "description": "Testing Inv",
  "org_id": null,
  "operating_unit": null,
  "payment_method": null,
  "payment_currency_code": null,
  "pay_group": null,
  "pay_alone": null,
  "gl_dates": null,
  "requester_id": null,
  "invoice_upload_file_name": "test_lrepp_no_invoice_number.csv",
  "invoice_lines": [ {
    "lineId": null,
    "amount": 100,
    "lineDescription": "Inv Line 1",
    "status": null,
    "po_line_number": "1",
    "header_id": null,
    "line_number": "1",
    "line_type": "ITEM",
    "accounting_date": null,
    "po_number": "41101000066",
    "po_distribution_num": null,
    "po_distribution_id": null,
    "distribution_code_concatenated": null,
    "distribution_code_combination_id": null,
    "amount_includes_tax_flag": null,
    "product_type": null,
    "product_category": null,
    "trx_business_category": null,
    "error_code": null,
    "error_message": null
  }, {
    "lineId": null,
    "amount": 100,
    "lineDescription": "Inv Line 2",
    "status": null,
    "po_line_number": "1",
    "header_id": null,
    "line_number": "2",
    "line_type": "ITEM",
    "accounting_date": null,
    "po_number": "41101000066",
    "po_distribution_num": null,
    "po_distribution_id": null,
    "distribution_code_concatenated": null,
    "distribution_code_combination_id": null,
    "amount_includes_tax_flag": null,
    "product_type": null,
    "product_category": null,
    "trx_business_category": null,
    "error_code": null,
    "error_message": null
  }
]
}

```

```

"source_system" : "VRB0",
"po_number" : "41101000066",
"requester_first_name" : null,
"requester_last_name" : null,
"source_system_guid" : null,
"source_system_ref" : null,
"source_profile_name" : "UiPath",
"invoice_number" : null,
"invoice_type" : "STANDARD",
"invoice_date" : "2023-08-09",

```

```

"invoice_lines" : [ {
  "lineId" : null,
  "amount" : 100,
  "lineDescription" : "Inv Line 1",
  "status" : null,
  "po_line_number" : "1",
  "header_id" : null,
  "line_number" : "1",
  "line_type" : "ITEM",
  "accounting_date" : null,
  "po_number" : "41101000066",

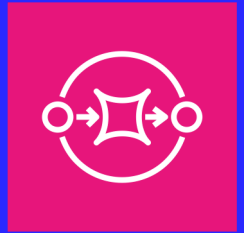
```

The Lambda maps values from the CSV file onto the JSON file. If formatting is correct, the file will be sent to the "Create API".

A sub-object called an "Invoice Line" is created for every invoice; an invoice can have many "Invoice Lines".



SQS – Retry Service



SQS has the permission to trigger the Lambda

Triggers (2) [Info](#)

Find triggers

Trigger
<input type="checkbox"/> SQS: fin-ap-invoice-ingestion-retry-queue arn:aws:sqs:us-west-2:785458642171:fin-ap-invoice-ingestion-retry-queue state: Enabled Details
<input type="checkbox"/> S3: awsdev-fsp-fin-ap-invoice-ingestion arn:aws:s3::awsdev-fsp-fin-ap-invoice-ingestion Details Bucket arn: arn:aws:s3::awsdev-fsp-fin-ap-invoice-ingestion Event types: s3:ObjectCreated:* Notification name: 8e2b4ba2-2905-47f5-9ce0-addd07f621c8 Prefix: new/ Service principal: s3.amazonaws.com Source account: 785458642171 Statement ID: FSP-dev-fin-ap-invoice-ingestion-bucket-BucketPermission-qfFluo3aRQhw Suffix: .csv

Allows for the entire Lambda to be retried in the case that the connection to the API cannot be made or when the API responds with a 500 error for any of the invoices, implying an internal server error. The SQS will retry up to five times, then it will send out an email informing the user of an infrastructure error.



Emailing Service



ABC profile_name	start_date	end_date	ABC contact_email
UiPath	[NULL]	[NULL]	t-pkhayet@expediagroup.co

Email list grabbed from SQL Database

500 - Infrastructure failure email

400 - Failure response from API email (Incorrect data)

```

if (apiResponses.isContainsInfrastructureFailure()) {
    if (event.getAttemptNumber() > MAX_RETRIES) {
        logger.log( s: "Number of retries exceeded. Sending a failure email..");
        emailService.sendApiExceptionEmail(objectKey, apiResponses.getFailureResponses(), profileName, source);
        logger.log( s: "Archiving file..");
        AmazonS3Helper.moveObject(bucketName, objectKey, bucketName, destinationKey: "archive/" + source + "/" + profileName + "/" + fileName);
        logger.log( s: "File archived.");
    } else {
        logger.log( s: "sending event to be retried");
        sqsService.sendFailureMessage(event);
    }
    logger.log( s: "infra failure. exiting.");
    return "infra failure";
} else if (!apiResponses.getFailureResponses().isEmpty()) {
    logger.log( s: "Sending email due to validation errors...");
    emailService.sendApiExceptionEmail(objectKey, apiResponses.getFailureResponses(), profileName, source);
    logger.log( s: "Archiving file..");
    AmazonS3Helper.moveObject(bucketName, objectKey, bucketName, destinationKey: "archive/" + source + "/" + profileName + "/" + fileName);
    logger.log( s: "File archived.");
}

```

```

} catch (RuntimeException e) {
    var invoices = new ArrayList<InvoiceHeader>();
    System.out.println("FAILED PARSING!");
    System.out.println(e);
    e.printStackTrace();
    String exceptionMessage = e.toString().replace( target: "java.lang.RuntimeException:", replacement: "").trim();
    emailService.sendCsvFormatErrorEmail(fileName, exceptionMessage, profileName, source);
    return invoices;
}

```

Parsing Error Email (Ex: Duplicate Columns, incorrect delimiter)



DEMO



What I learned



Concepts/Tools Used

- Java
- Scrum
- ObjectMapper
- Maven
- REST API
- Git
- Software Decomposition
- Lombok
- OpenCSV
- Dependency Injection
- Unit Testing

AWS Tools Used

- Lambda
- SQS/ DLQ
- S3
- IAM
- Amazon Simple Email Service
- CloudFormation Deployment
- VPC Configuration

Prior to Internship:

-  = Very Comfortable
-  = Some Experience
-  = No Experience



Special Thanks

- Landon Repp – Helped with emails, SQS service, and Unit Testing
- Ankit Bhardwaj – Answered all questions I had
- And my entire team!





Q&A