

# Intern Final Report

08.26.2023 | Paul Khayet



# Agenda

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01 **Introduction**

02 **Project Overview**

03 **Demo**

04 **What I learned**

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# 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)
- **Generic File-based invoice import system:** Allows any source system to create invoices in oracle, without human intervention

Semi-Automatic

Fully Automatic

# VRBO Use Case

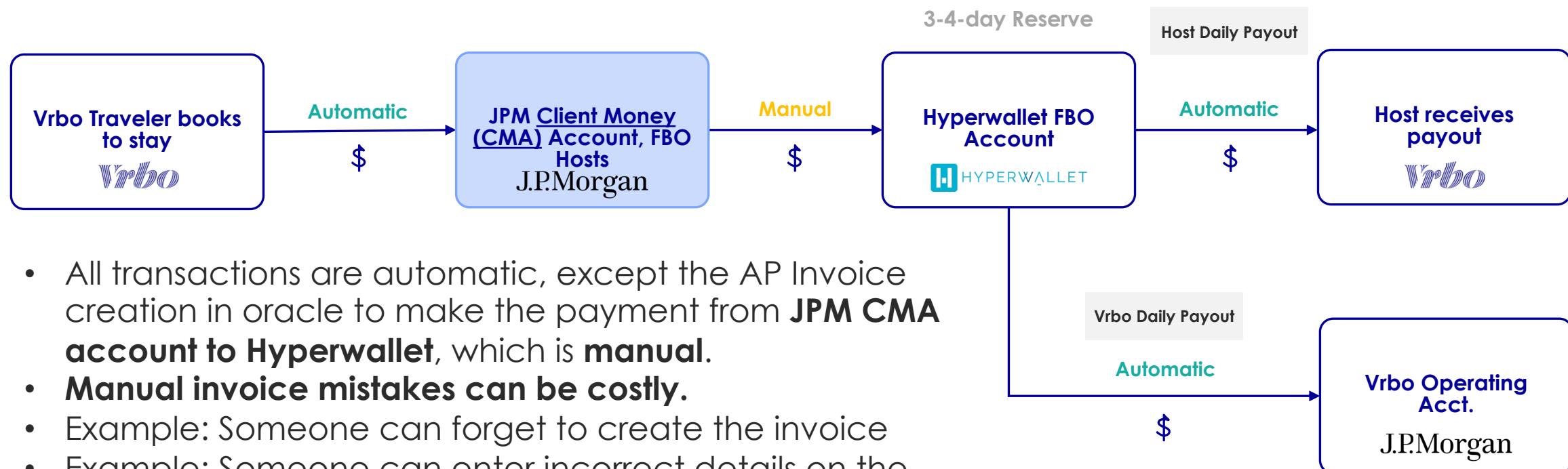


PAYINS

## 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



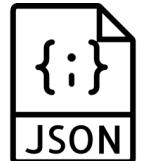
- **S3 Bucket** – AWS's version of a directory



- **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

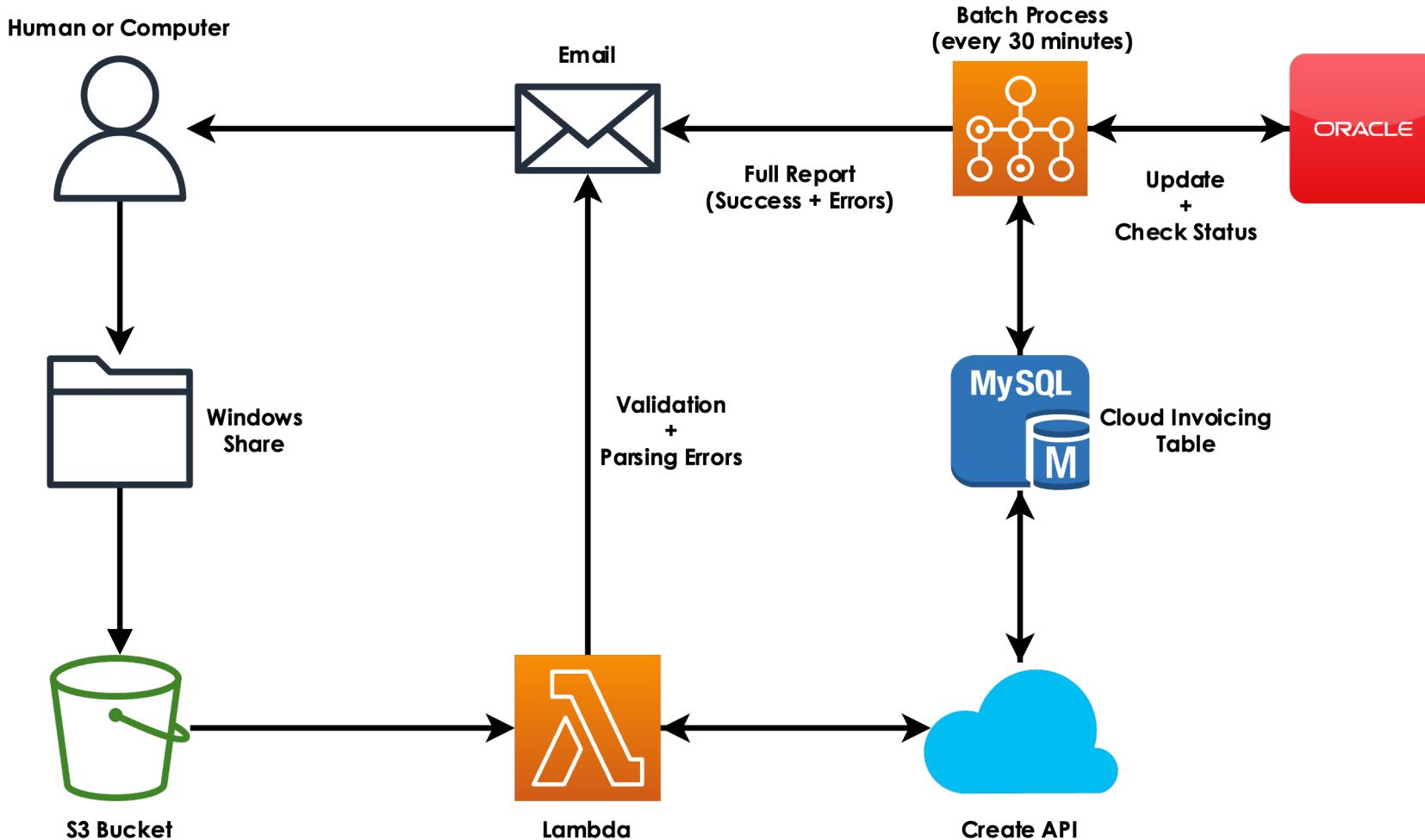


- **JSON** – File format that is easily parse-able

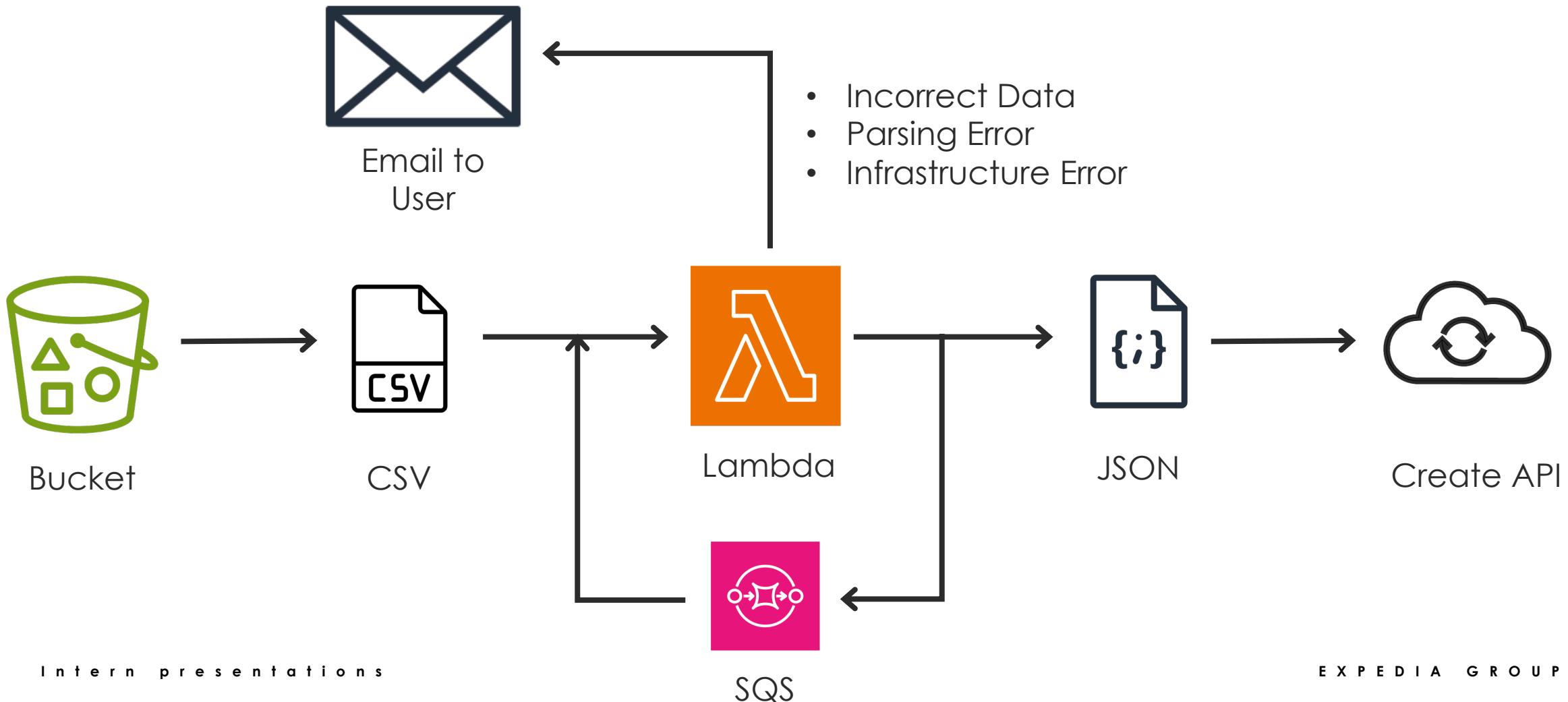


- **SQS** – Message queueing service, typically used to retry services

# 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

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|VRB0|MGK468870|41101000066| 453168 |PayPal Inc|HWUSDFUNDING||8-10-23|100|00|USD|||||STANDARD||||Testing Inv|||||||||1|\$100|1| 41101000066 | ITEM | |Inv Line 1|||||||

## Column Headers

## Column Values

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

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 checked="" 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

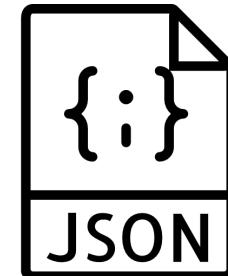
Sets off Lambda Trigger

# File Processing Flow

Lambda grabs  
CSV file from  
S3 bucket

CSV gets  
parsed and  
mapped to a  
Java Object

Java Object is  
mapped to a  
JSON file via  
an "Object  
Mapper"



# 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);  
        }  
    }  
}
```

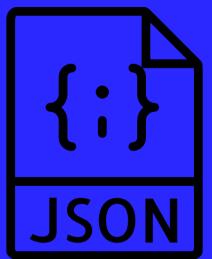
Example: “Source” header is searched for, grabs the value i spaces below it, and inserts it into the invoice object

```
138 usages ± lrepp +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" : "4110100066",
    "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": "43168",
    "vendor_name": "PayPal Inc",
    "vendor_site_id": null,
    "vendor_site_code": "HANUSDFOUNDING",
    "invoice_amount": 200,
    "invoice_currency_code": "USD",
    "exchange_rate": null,
    "exchange_rate_type": null,
    "terms_id": null,
    "terms_name": null,
    "terms_date": null,
    "description": "Testing Inv",
    "tax_flag": 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_lrep_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": "4110100066",
            "po_distribution_id": 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": "2",
            "header_id": null,
            "line_number": "2",
            "line_type": "ITEM",
            "accounting_date": null,
            "po_number": "4110100066",
            "po_distribution_id": 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
        }
    ]
}
```

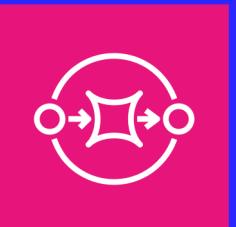
"source\_system" : "VRB0",  
"po\_number" : "4110100066",  
"requester\_first\_name" : null,  
"requester\_last\_name" : null,  
"source\_system\_guid" : null,  
"source\_system\_ref" : null,  
"source\_profile\_name" : "UiPath",  
"invoice\_number" : null,  
"invoice\_type" : "STANDARD",  
"invoice\_date" : "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" : "4110100066",  
 "po\_distribution\_id" : 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" : "2",  
 "header\_id" : null,  
 "line\_number" : "2",  
 "line\_type" : "ITEM",  
 "accounting\_date" : null,  
 "po\_number" : "4110100066",  
 "po\_distribution\_id" : 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  
}]

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
 <b>SQS: fin-ap-invoice-ingestion-retry-queue</b> arn:aws:sqs:us-west-2:785458642171:fin-ap-invoice-ingestion-retry-queue state: Enabled <a href="#">Details</a>
 <b>S3: awsdev-fsp-fin-ap-invoice-ingestion</b> arn:aws:s3:::awsdev-fsp-fin-ap-invoice-ingestion <a href="#">▼ Details</a> 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

```
if (apiResponses.isContainsInfrastructureFailure()) {
    if (event.getAttemptNumber() > MAX_ATTEMPTS) {
        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.");
```

400 - Failure response from API email  
(Incorrect data)

```
} 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

IncorrectDuplicateColumns.csv

Q~ Terms id

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|4110100066| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD|STANDARD||||Testing Inv|||1|\$100|1| 4110100066 | ITEM | |Inv Line 1|||||||

Testing Inv|||||||1|\$100|1| 4110100066 | ITEM | |Inv Line 1|||||||

IncorrectVendorSite.csv

Q~ Find

Source|Invoice Number|PO Number|Terms Name|Vendor Number|Vendor Name|Vendor Site Code|Invoice Date|Invoice Amount|Invoice Currency Code|Invoice Type|Requester Employee Number|Requester First Name|Requester Last Name|Description|Line-Line Number|Line-Line Amount|Line-PO Line|Line-PO Number|Line-Line Type|Line-Description

VRBO|MwA568771|4110100066|00| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD|STANDARD||||Testing Inv|1|\$100|1| 4110100066 | ITEM | |Inv Line 1

VRBO|MwA568771|4110100066|00| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD|STANDARD||||Testing Inv|2|\$100|1| 4110100066 | ITEM | |Inv Line 2

CorrectMultipleInvoices.csv

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 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|HGA468237|4110100066| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD||||STANDARD||||Testing Inv|||1|\$100|1| 4110100066 | ITEM | |Inv Line 1|||||||

VRBO|HGA468237|4110100066| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD||||STANDARD||||Testing Inv|||2|\$100|1| 4110100066 | ITEM | |Inv Line 2|||||||

VRBO|HGA468238|4110100066| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|100|USD||||STANDARD||||Testing Inv|||1|\$50|1| 4110100066 | ITEM | |Inv Line 1|||||||

VRBO|HGA468238|4110100066| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|100|USD||||STANDARD||||Testing Inv|||2|\$50|1| 4110100066 | ITEM | |Inv Line 1|||||||

CorrectSingleLine.csv

Source|Invoice Number|PO Number|Terms Name|Vendor Number|Vendor Name|Vendor Site Code|Invoice Date|Invoice Amount|Invoice Currency Code|Invoice Type|Requester Employee Number|Requester First Name|Requester Last Name|Description|Line-Line Number|Line-Line Amount|Line-PO Line|Line-PO Number|Line-Line Type|Line-Description

VRBO|MwA568771|4110100066|00| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD|STANDARD||||Testing Inv|1|\$100|1| 4110100066 | ITEM | |Inv Line 1

VRBO|MwA568771|4110100066|00| 453168 |PayPal Inc|HWUSDFUNDING|8-10-23|200|USD|STANDARD||||Testing Inv|2|\$100|1| 4110100066 | ITEM | |Inv Line 2

Test Files

Name	Date Modified	Size	Kind
CorrectMultipleInvoices.csv	Aug 24, 2023 at 11:25 AM	1 KB	CSV Document
CorrectSingleLine.csv	Today at 3:21 PM	614 bytes	CSV Document
IncorrectDuplicateColumns.csv	Aug 15, 2023 at 9:38 AM	934 bytes	CSV Document
IncorrectVendorSite.csv	Today at 3:06 PM	616 bytes	CSV Document



# 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