Project NOVA Monitoring – Walkthrough of the interface between Connective Integrated Database Repository (CIDR) and Clearwater
Client Contact(s): Rajesh Bodapaty, Investments IT Senior Data Engineer

On February 20, 2018, Christopher Daly, Amongin Ogbeide, and Omar Barrero from the Internal Audit Group (IAG) met with Rajesh Bodapaty, Investment IT Senior Data Engineer, to understand the Project Nova future state of the interface between the Connective Integrated Database Repository (CIDR), which sources data from third-party loan servicer Cenlar, and Clearwater. Project Nova involves the decommissioning of the Portfolio Accounting Management (PAM) system and several other IT applications supporting Investment Accounting and Investment Operations. The future state will utilize the third party Clearwater platform, resulting in several newly formed application interfaces with Clearwater, including CIDR. The purpose of this walkthrough is to document how the following elements of the CIDR to Clearwater interface works:

- Configurable controls to account for completeness and security of the data feed (e.g., FTP vs. sFTP, header/trailer counts for completeness, error notifications, etc.)
- The method by which personal information is masked before processing to Clearwater
- The extent to which the CIDR to Clearwater interface is included in the ongoing parallel testing procedures

Future state
IAG obtained the diagrams below showing the future state of the interface between CIDR and Clearwater:

Figure 1a: Future state of the interface between Clearwater and IDR (1 of 2)

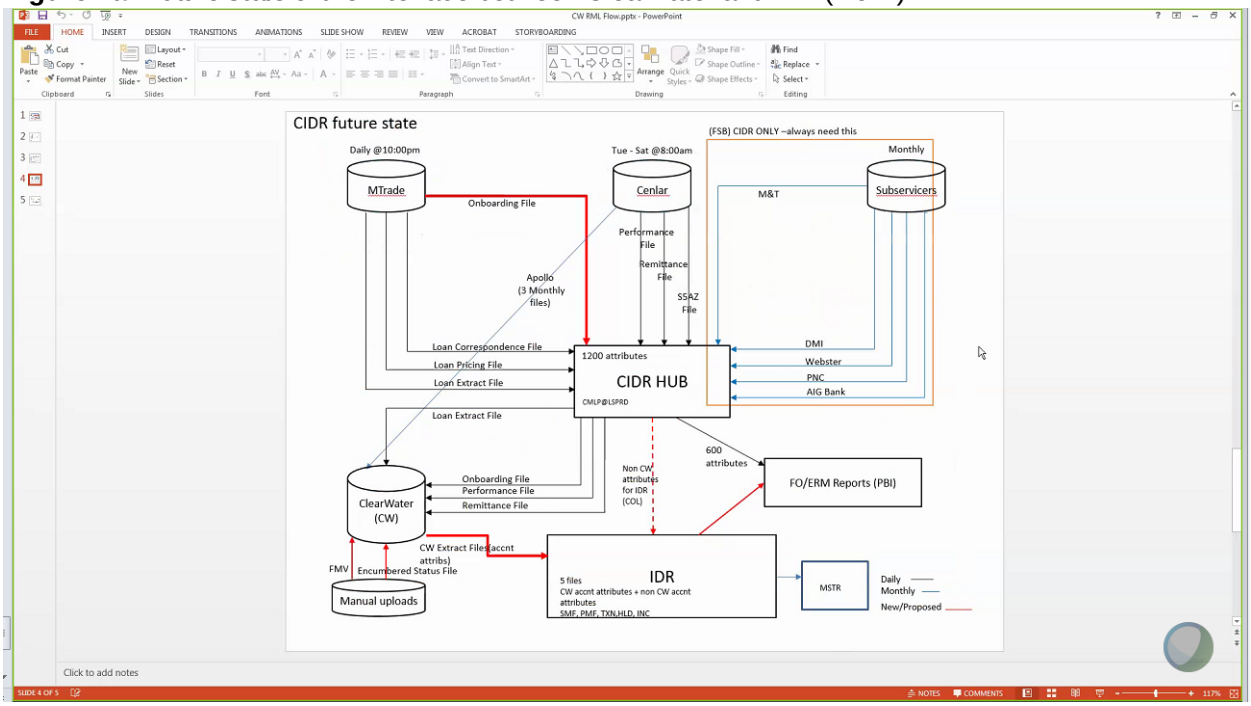
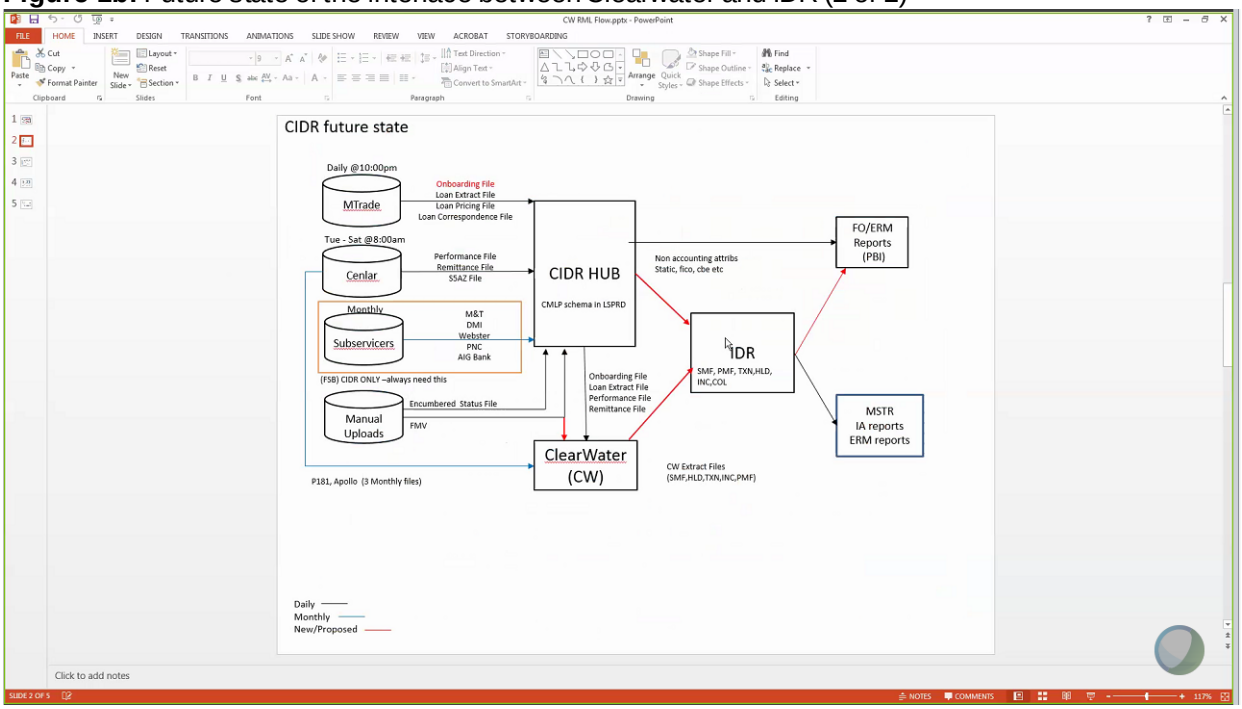
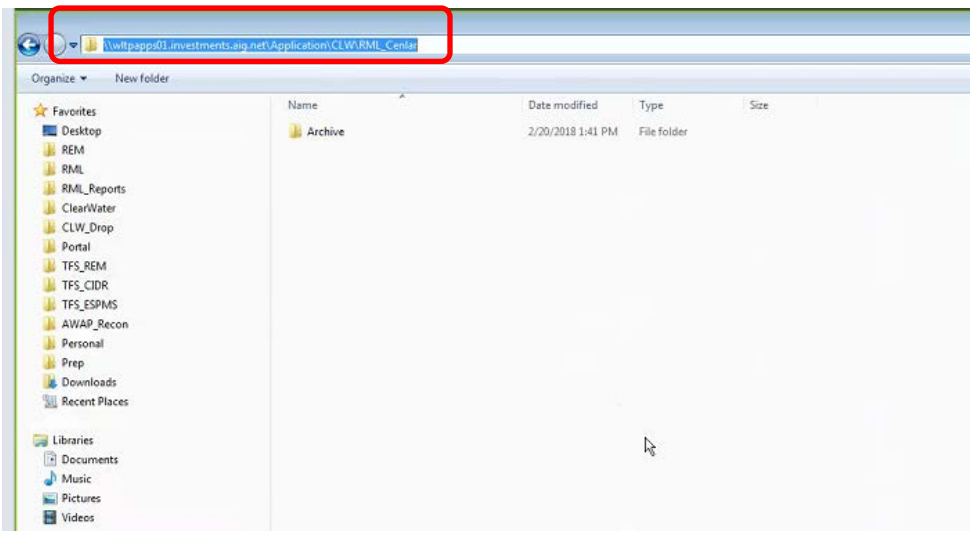


Figure 1b: Future state of the interface between Clearwater and IDR (2 of 2)



As part of the Project Nova future state process, Resident Mortgage Lending (RML) information (i.e., Loan Correspondence File, Loan Pricing File, and Loan Extract File) will be sent to Clearwater via the CIDR hub. The CIDR system will create a file and load it into a shared AIG folder (see **Figure 2** below). An Autosys job will then transfer the file via SFTP to Clearwater (**CLW_RML_CENLAR_SFTP_DLY**).

Figure 2: AIG shared folder location of CIDR file extract



After the data has been successfully processed, Clearwater will drop the file in an AIG shared folder (see **Figure 3a** below) and another Autosys job will transfer the file to a local AIG folder for archiving (see **Figure 3b** below). (**CLW_RML_CENLAR_MOVE_DLY**).

Figure 3a: Shared folder where Clearwater places the file after processing.

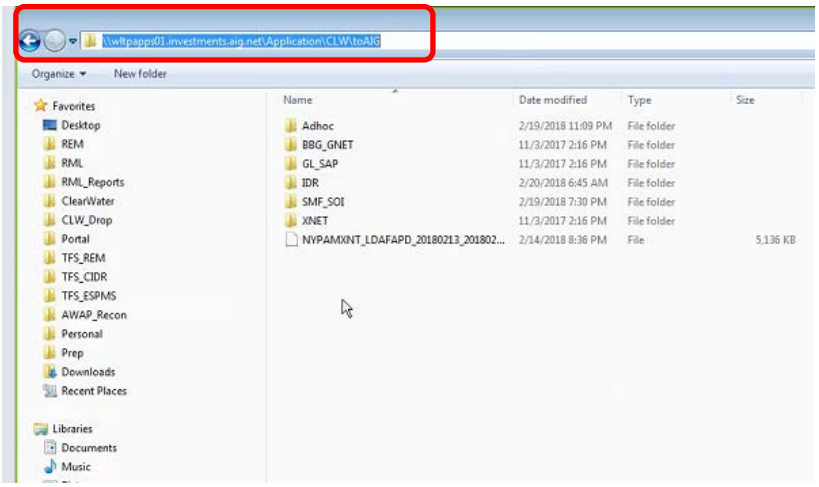
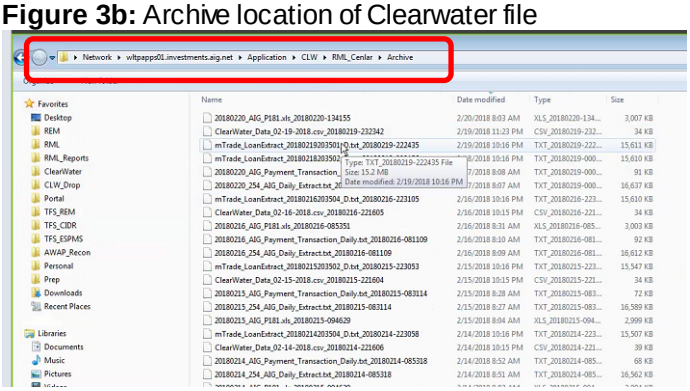
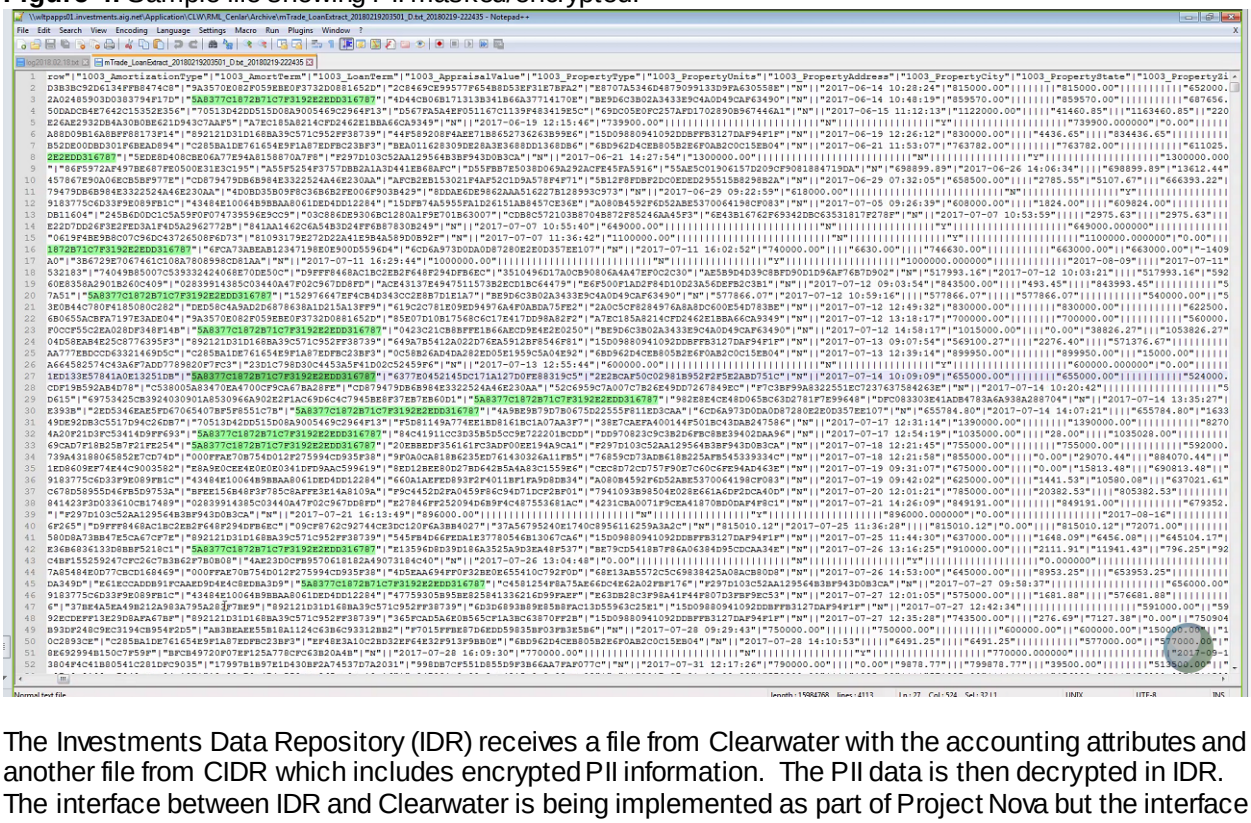


Figure 3b: Archive location of Clearwater file



CIDR currently performs the encryption and masking of certain personal identifiable information (PII) fields within the source file (e.g., borrower details such as zip code, state, etc.) and sends only relevant loan information to Clearwater (e.g., Loan ID, Loan Amount, etc.) for accounting purposes (see **Figure 4** below for an example of the encrypted fields within the file).

Figure 4: Sample file showing PII masked/encrypted.

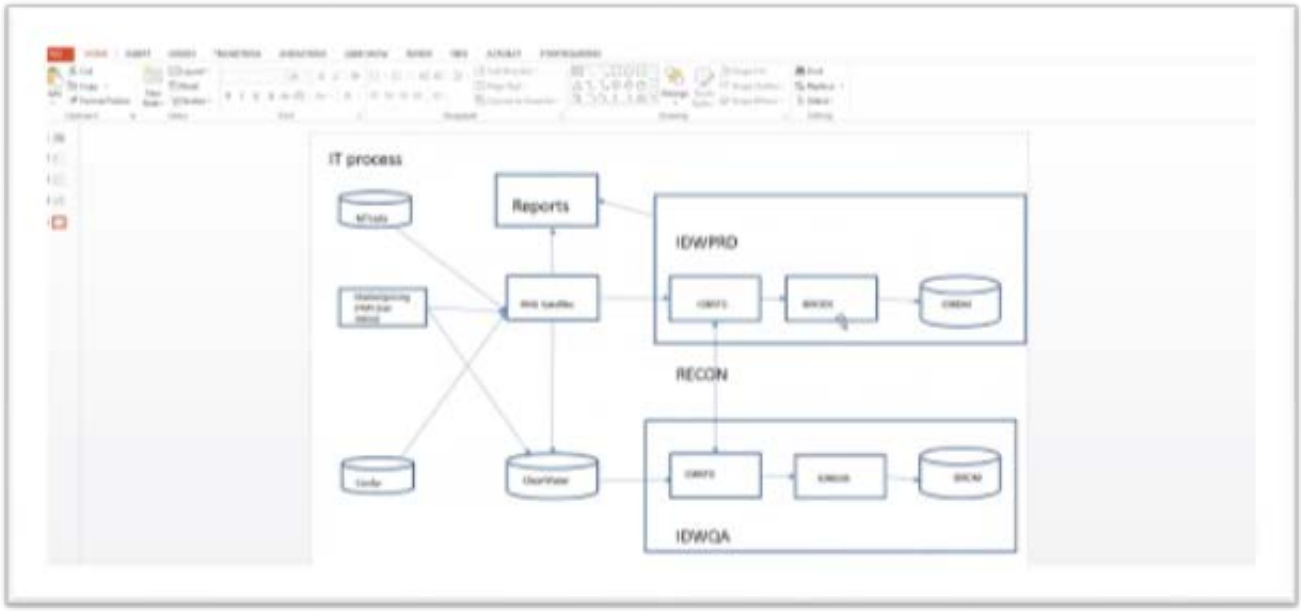


The Investments Data Repository (IDR) receives a file from Clearwater with the accounting attributes and another file from CIDR which includes encrypted PII information. The PII data is then decrypted in IDR. The interface between IDR and Clearwater is being implemented as part of Project Nova but the interface between CIDR and IDR already exists.

IAG confirmed that the following reconciliations (see **Figure 5** below) will be incorporated into the RML data feed process in order to confirm the completeness and accuracy of information transmitted between CIDR, Clearwater, and IDR:

1. CIDR to IDR reconciliation – reconciliations will be performed at various levels using Microstrategy reports.
2. Clearwater to IDR reconciliation

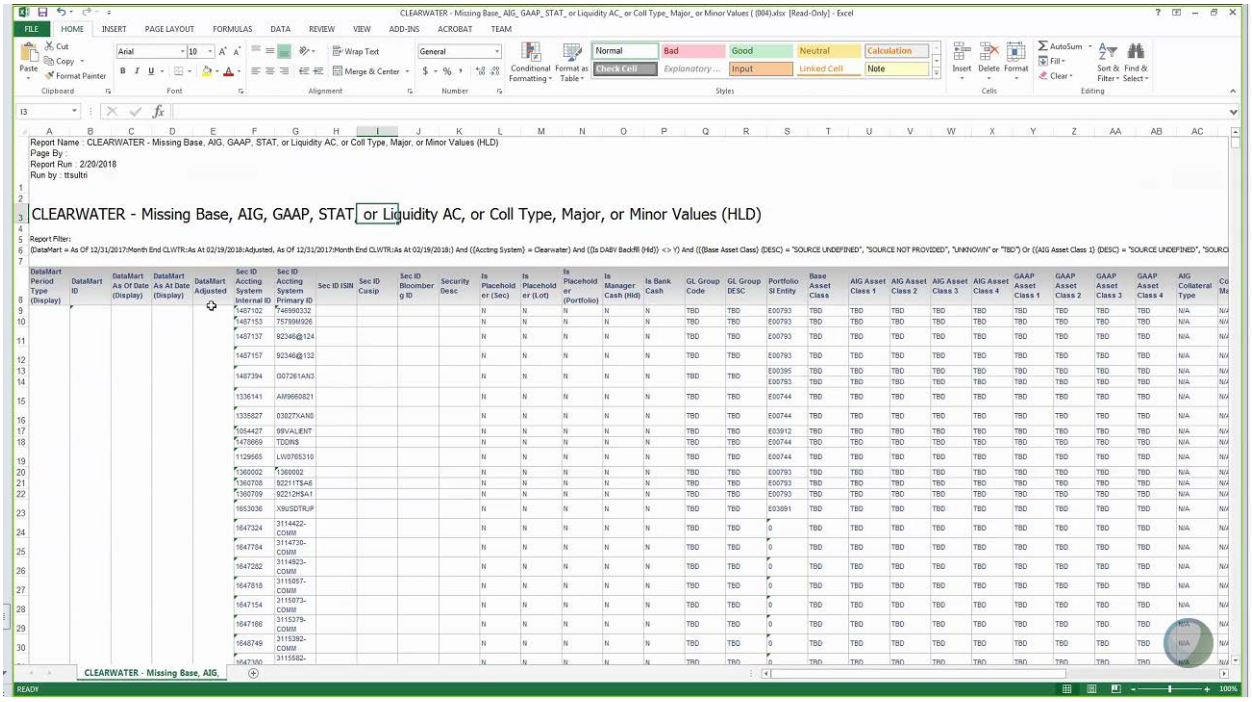
Figure 5: Reconciliations to be performed in future state



The reconciliations that will be performed in IDR in the future state will be automated and script based with the aim of confirming that IDR receives the same number of records from both CIDR and Clearwater. Currently, there is a manual reconciliation between CIDR and IDR exist but the reconciliation between Clearwater and IDR is in the process of being developed as part of Project Nova.

Prior to go-live, a completeness check will be performed as a part of the Field Mapping which maps every field from PAM to IDR and compares this to a mapping between Clearwater and IDR. This will be performed in order to ascertain that the information from PAM is completely imported into Clearwater. The Data Governance team will be responsible for investigating missing data. IAG obtained a sample Microstrategy report of the reconciliation being performed between Clearwater and IDR (see **Figure 6** below).

Figure 6: Reconciliation between Clearwater and IDR



Refer to w/p: Test Matrix - Project Nova Interfaces for testing of automated interface controls between CIDR and Clearwater.

Conclusion:
IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted.** Refer to w/p: FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthrough meetings as of 4/26/2018, IAG determined that the automated interface controls between CIDR and Clearwater were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.

Project NOVA Monitoring – Walkthrough of the interface between Appian - PMF and Clearwater
Client Contact(s): Keith Montgomery, Dublin Portfolio Administration Team, and Jonathan Lawless, VP of Investment Operations

On February 12, 2018, Christopher Daly, Amongin Ogbeide, and Omar Barrero from the Internal Audit Group (IAG) met with Keith Montgomery, Dublin Portfolio Administration Team, and Jonathan Lawless, VP of Investment Operations, to understand the Project Nova future state of the interface between Appian Portfolio Master File (PMF) and Clearwater. Project Nova involves the decommissioning of the Portfolio Accounting Management (PAM) system and several other IT applications supporting Investment Accounting and Investment Operations. The future state will utilize the third party Clearwater platform, resulting in applications that previously interfaced with PAM now interfacing with Clearwater, including Appian PMF. The purpose of this walkthrough is to document how the following elements of the Appian PMF to Clearwater interface works:

- Automated notifications sent in the event of transfer failures
- Shared folders and / or drives used to store data in transit
- Transmission of source data through a secure protocol with encryption (e.g., SFTP, HTTPS, etc.)
- Destination system validations to ensure accuracy of data (e.g., hash total check, checksum, etc.)

Appian PMF is a portfolio master data management application which contains details of AIG, Inc. and AIG's insurance company affiliates portfolio data for both trading and accounting portfolios. PMF has its own independent schema within the Investment Data Repository (IDR) warehouse. Requests to change the PMF data (i.e., portfolio information) are managed through the Appian workflow tool. Within Appian, changes/updates to portfolio data are requested, reviewed, and approved by relevant teams (e.g., PMF Administration Team, Middle Office, Investment Accounting) prior to committing the changes to the PMF data. Appian PMF data was updated via a manual process in PAM as the result of system limitations.

Future State
Appian PMF will continue to serve as the front-end workflow tool to facilitate changes to the portfolio master data. Appian PMF will not have a direct connection to Clearwater but instead a manual process will be utilized to make updates directly within the Clearwater environment. An email with a link containing the fields that need to be updated will be generated by AIG and sent to the Clearwater team to update the necessary information. The link will only be sent to Clearwater after all appropriate approvals have been received from PMF Administration, Middle Office, and Investment Accounting via the Appian PMF application. Upon making the requested updates, Clearwater will send an email notification back to AIG (i.e., Investment Accounting, PMF Administration) indicating that the updates have been completed. The PMF Administration Team will be required to upload the email from Clearwater to the Appian PMF application as part of the workflow process.

Current PAM portfolios will be invalidated as Clearwater needs only one account per custody account, therefore PAM portfolios will be collapsed. The existing manual reconciliation via email of PMF information to PAM will be replaced by a manual reconciliation between PMF and Clearwater. Clearwater will generate a report to be used in the reconciliation of PMF tables in order to determine whether unauthorized accounts have been created; the report will be developed and releases as part of the Day 1 go-live.

Conclusion:
IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted** – Refer to w//p:
FW Project Nova IAG Assessment as of 3/19/18

Furthermore, IAG noted that the Appian PMF to Clearwater process is not an automated interface but a manual e-mail-based process. Therefore, it was deemed not applicable for interface testing purposes.

Project NOVA Monitoring – Walkthrough of the interface between Golden Source Security Master File (SMF) and Clearwater Client Contact(s): Jeyarajadurai Nagendran, IT Senior Developer, and Carol Kilbey, Security Master IT Manager

On February 9, 2018 and February 13, 2018, Stephen Lin, Chris Daly, Amongin Ogbeide, and Omar Barrero from the Internal Audit Group (IAG) met with Jeyarajadurai Nagendran, IT Senior Developer, and Carol Kilbey, Security Master IT Manager, to understand the Project Nova future state of the security administration process, including the interface setup between AIG's SMF Hub and Clearwater. Project Nova involves the decommissioning of the Portfolio Accounting Management (PAM) system and several other IT applications supporting Investment Accounting and Investment Operations. The future state will utilize the third party Clearwater platform and involve the creation of a new SMF Hub, resulting in the decommissioning of the SMF GoldenSource application which previously fed PAM and interfaced with the Investments Data Repository (IDR).

SMF GoldenSource is the global security master application which creates, maintains, and publishes a standardized reference data repository for all financial instruments. SMF GoldenSource contains security information such as the ticker symbol, security ID, coupon rate, dated date, interest payment cycle, put and call schedules and other dynamic data essential for trade processing and security valuation. The Security Master File is essential to the daily processing for the Portfolio Accounting Management (PAM) application which is used to maintain investment portfolio accounting. All securities created in SMF and any additional Securities of Interest (SOI) needed in PAM is processed nightly via a batch job.

Currently, all new securities originate from SMF GoldenSource while historic security information is available in the SMF Datapub, a dataset within the IDR database ("IDW") that is sourced from SMF GoldenSource. The characteristics and terms and conditions for the securities are obtained from Bloomberg. The SMF Datapub is used by IDR to build the master data based on data pushed daily from Bloomberg and the SOIs.

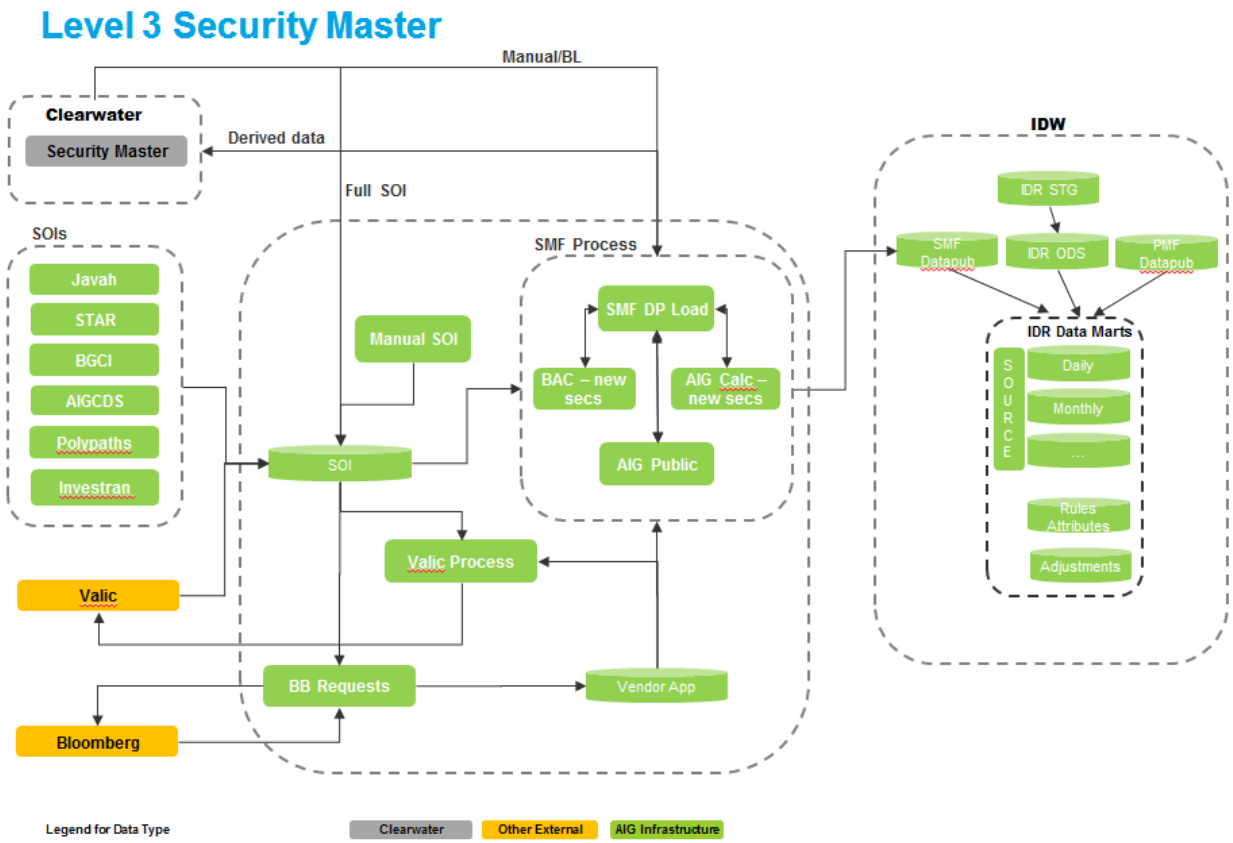
Future State

As part of Project Nova, the SMF GoldenSource application will be decommissioned, and the security maintenance process will be facilitated through the Clearwater platform. In order to ensure that Clearwater reflects AIG's security master data inventory (e.g., all securities including securities from new trades, privates, bank loans, etc.), AIG is in the process of developing an SMF Hub, which will serve as the central engine for AIG to gather all SOI data from various sources (e.g., Javah, Investran, etc.) and sending that derived data to Clearwater to help build and establish its instance of the security master. The SMF Hub will be used as the central engine by which all SOI data will be gathered and sent to the SMF Datapub within the IDR database environment. Clearwater will be configured to send a total of three feeds to the SMF Hub on a nightly basis as follows:

1. All securities that are currently on the SOI list
2. All HIC (Hold In Custody) securities on the SOI list
3. Terms and conditions for all bank loans
4. Terms and conditions for all private placements

Once the above feeds to the SMF Hub are complete, the SMF Hub feeds downstream to IDR's SMF Datapub to maintain historic security master file information (refer to **Figure 1** below for a diagram of the overall data flow).

Figure 1:



During the assessment of the Clearwater platform as a tool to be utilized by AIG, it was noted that Clearwater's security data attributes primarily come from Reuters. AIG's data is primarily Bloomberg-based, and AIG is not contracted with Reuters which prevents AIG from feeding Reuters data directly into our environment. As a result, a file containing all the security attribute values (e.g., coupon, maturity date, etc.) will be manually extracted from Clearwater on a daily basis and uploaded into the SMF Hub to perform a reconciliation of security attribute values in Clearwater (i.e., from Reuters) against AIG's SMF Datapub (i.e., from Bloomberg). The differences identified will be challenged by Investment Accounting with and updates will be made via an adjustments module built into the SMF Hub. The adjustments module will capture all changes via an audit log, and will also offer maker/checker functionality for all updates. SMF GoldenSource will be decommissioned only upon go-live for Project Nova which requires the completion of all SMF Hub development tasks.

Refer to w/p: Test Matrix - Project Nova Interfaces for testing of automated interface controls between SMF and Clearwater.

Conclusion:
IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted -** Refer to w/p:
FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthrough meetings as of 4/26/2018, IAG determined that the automated interface controls between SMF and Clearwater were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.

Walkthrough / Bloomberg AIM Interface with Clearwater
Client Contact: Jamie Roberts, Vice President/IT – CBIT Investments – Data Intelligence
February 8, 2018

On February 8, 2018 Christopher Daly (CD), IAG Senior Manager, and Omar Barrero (OB), IAG Analyst, met with Jamie Roberts, Vice President/IT – CBIT Investments – Data Intelligence, and Rajesh Vijayaraghavan, Application Manager - Back Office/IT - CBIT Investments Analytics, to obtain a better understanding of how the Bloomberg AIM application will transfer information to Clearwater as part of Project Nova and test the following application control elements:

- Generation of automated error notifications
- Transmission of source data is occurring through a secure protocol (e.g., SFTP, HTTPS)
- Validations are in place to ensure data is accurate (e.g., hash total check, checksum)

The Bloomberg AIM to Clearwater feed is broken down into two parts. In the first leg of the feed, Bloomberg AIM transfers the file to the AIG server "wltvspdstage2.investments.aig.net" (refer to **Figure 1, TM1** below). In the second leg of the feed, the Autosys job "CLW_F984_OUT_SFTP_DLY" (refer to **Figure 1, TM2** below) utilizes the secure transfer protocol SFTP (refer to **Figure 2, TM5** below) to upload the Bloomberg file into the Clearwater server "sftp2.Clearwateranalytics.com" (refer to **Figure 2, TM4** below). IAG also noted that the "sysauto" system account is the only AIG account with access rights to the AIG SFTP server and the Clearwater SFTP server (refer to **Figure 2, TM6** below). Furthermore, for an AIG employee to use the "sysauto" account they have to use the command "sudo su" to authenticate to their identity, and all of their actions are logged and stored (refer to **Figure 2, TM7** below).

IAG also noted that the SFTP protocol provides a completeness and integrity check. The SFTP protocol works by breaking a file into smaller pieces called data "packets". The size and number of packets depends on the size of the original file. After breaking a file into packets it does a checksum and assigns a value to each packet before it is sent to Clearwater. When the packets are sent to Clearwater each packet has the checksum value attached. Once Clearwater receives the packets and decrypts the data it calculates and verifies the checksum values for each of the packets to ensure that they are the same as the original checksum values. Matching checksum values from each end of the transfer process for each packet means that the integrity and completeness of the original file was maintained and that there is no need for additional checks.

Clearwater receives an hourly file from Bloomberg throughout each day. The transfer process starts at 10:59 AM and ends at 11:59 PM. During that time window, Clearwater receives a file containing all trades made during the hour before the file was sent and all trades submitted in previous hourly files (i..e, an aggregate file). As a result, this lowers the likelihood of not capturing all trades during the day, as the cumulative list of daily trades is shared every hour.

Finally IAG noted that the Job "CLW_F984_OUT_SFTP_DLY" is configured to send out a notification alert in the case of an error during the transfer process between Bloomberg and Clearwater (Refer to **Figure 4** and **Figure 5** below). IAG obtained a copy of an error notification e-mail containing a description of the error and the day the error occurred on. Depending on which part of the transfer the error occurred the e-mail is sent to the Bloomberg, Clearwater or AIG support team.

Additionally IAG performed testing to verify the existence of controls that ensure the security, completeness, integrity of the data transmitted in this feed. IAG noted that automatic generation of notifications will alert the AIG Autosys and Production Support teams to troubleshoot any problems during the transmission session. Refer to w/p: Test Matrix - Project Nova Interfaces

Walkthrough / Bloomberg AIM Interface with Clearwater
Client Contact: Jamie Roberts, Vice President/IT – CBIT Investments – Data Intelligence
February 8, 2018

Figure 1: Screenshot showing Daniel Edwin (Manager/IT – Production Ops NYC) accessing AIG server

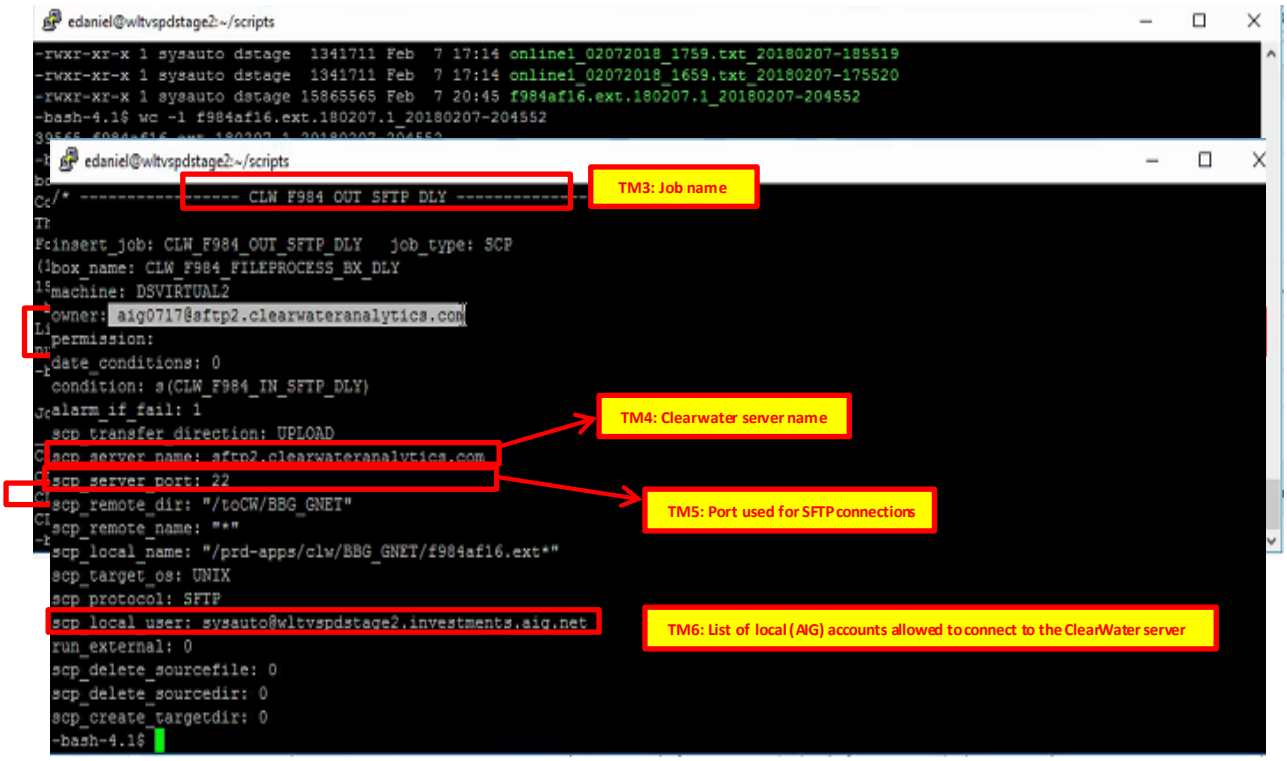


Figure3: Sudo-su configuration screenshot

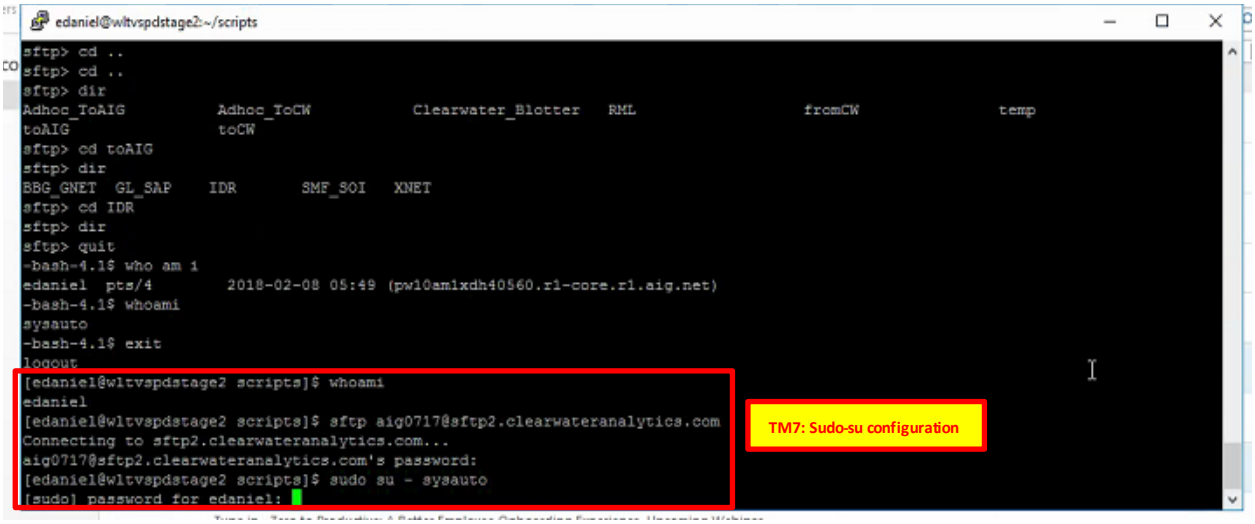


Figure 4: Sample error notification e-mail

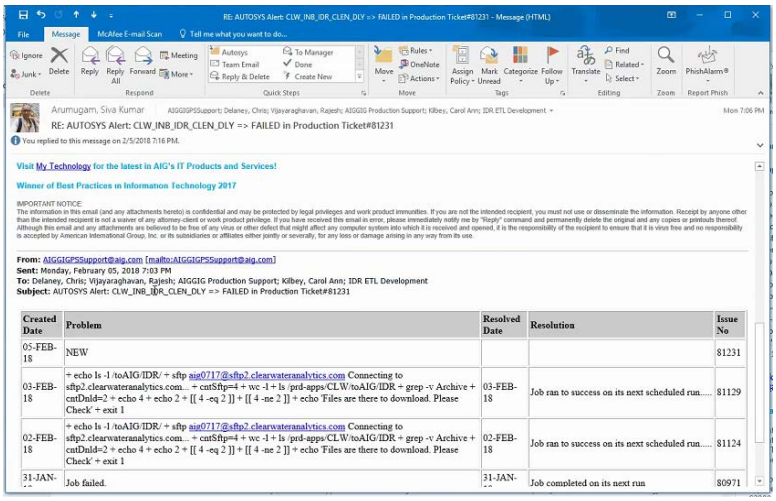
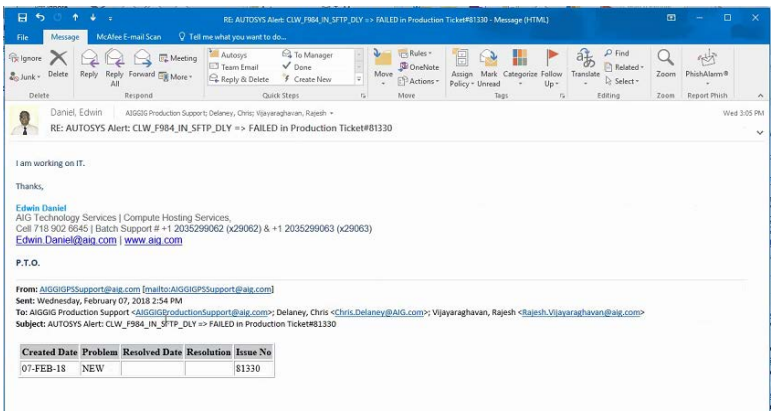


Figure 5: Sample error notification e-mail



Please refer to: Test Matrix - Project Nova Interfaces for the test procedures performed.

Conclusion:
IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted -** Refer to w/p:
FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthroughs as of 4/26/2018, IAG determined that the automated interface controls between Bloomberg and Clearwater were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.

Walkthrough / Clearwater feed into IDR

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

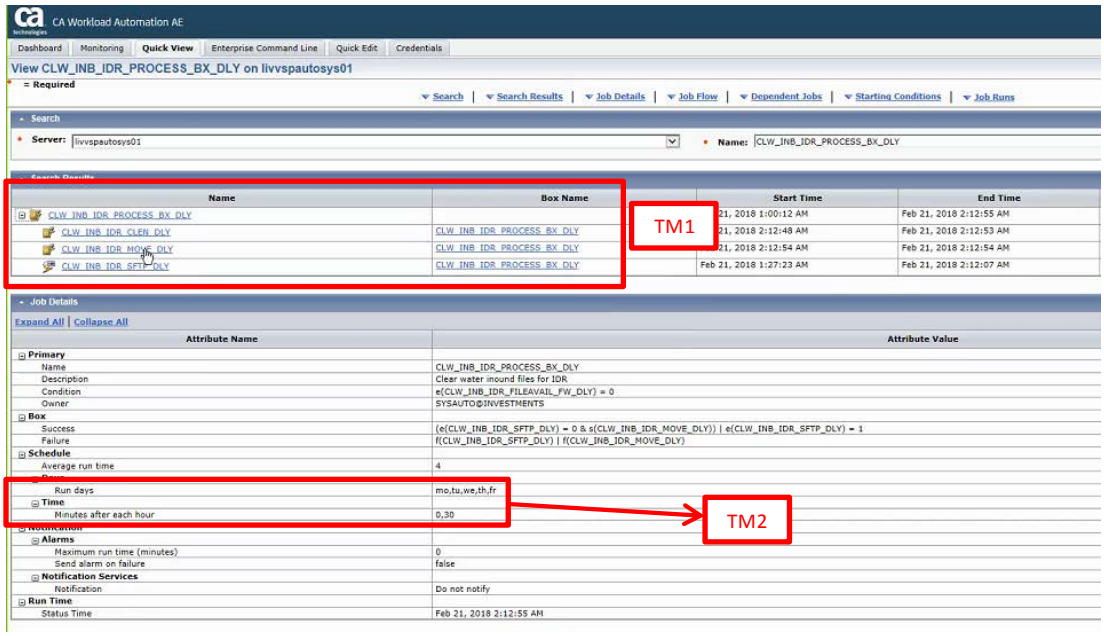
February 21, 2018

On February 21, 2018, Christopher Daly (CD), IAG Senior Manager, Amongin Ogbeide (AO), IAG Manager, and Omar Barrero (OB), IAG Analyst, met with Linga Tekula (LT), AVP & Global Leader Innovation Knowledge & Idea Mgmt/IT, to obtain a better understanding of how the Clearwater application will transfer information to IDR as part of the future state of Project Nova.

In the current processing environment, there are 17 flat data file feeds between PAM and IDR. PAM communication with IDR starts with an Autosys FTP job that transfers PAM flat files to the IDR staging folder. Once PAM's flat files are copied to the staging folder a second job transfers the files from the staging folder into the inbound IDR folder. In the inbound folder, a third Autosys job initiates the transfer to the DataStage environment in which IDR ingests the data into the Oracle IDR database ("IDW"). When Clearwater is fully implemented, there will be 24 flat files being uploaded into the Oracle IDR database by six Autosys jobs.

As part of the testing procedures for this feed, the Autosys job box "CLW_INB_IDR_PROCESS_BX_DLY" and the sub-jobs "CLW_INB_IDR_CLE_DLY", "CLW_INB_IDR_MOVE_DLY", and "CLW_INB_IDR_SFTP_DLY" (refer to **Figure 1, TM1** below) were created to move Clearwater files to the IDR database. Currently the jobs in charge of the transfer process are configured to run every 30 minutes on Monday through Friday (refer to **Figure 1, TM2** below).

Figure 1: Autosys Box job



During the transfer process, the job "CLW_INB_IDR_SFTP_DLY" accesses the Clearwater sFTP "sftp2.clearwateranalytics.com" server in order to extract and move the files into the IDR staging location "/prd-apps/CLW/toAIG/IDR" (refer to **Figure 2, TM3** below). If there are any errors during the Clearwater sFTP and IDR staging location transfer, Autosys job "CLW_INB_IDR_MOVE_DLY" will generate an error notification which is sent to the ETL team (refer to **Figure 3, TM4** below).

Figure 2: Job in charge of the error notification

Walkthrough / Clearwater feed into IDR

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

February 21, 2018

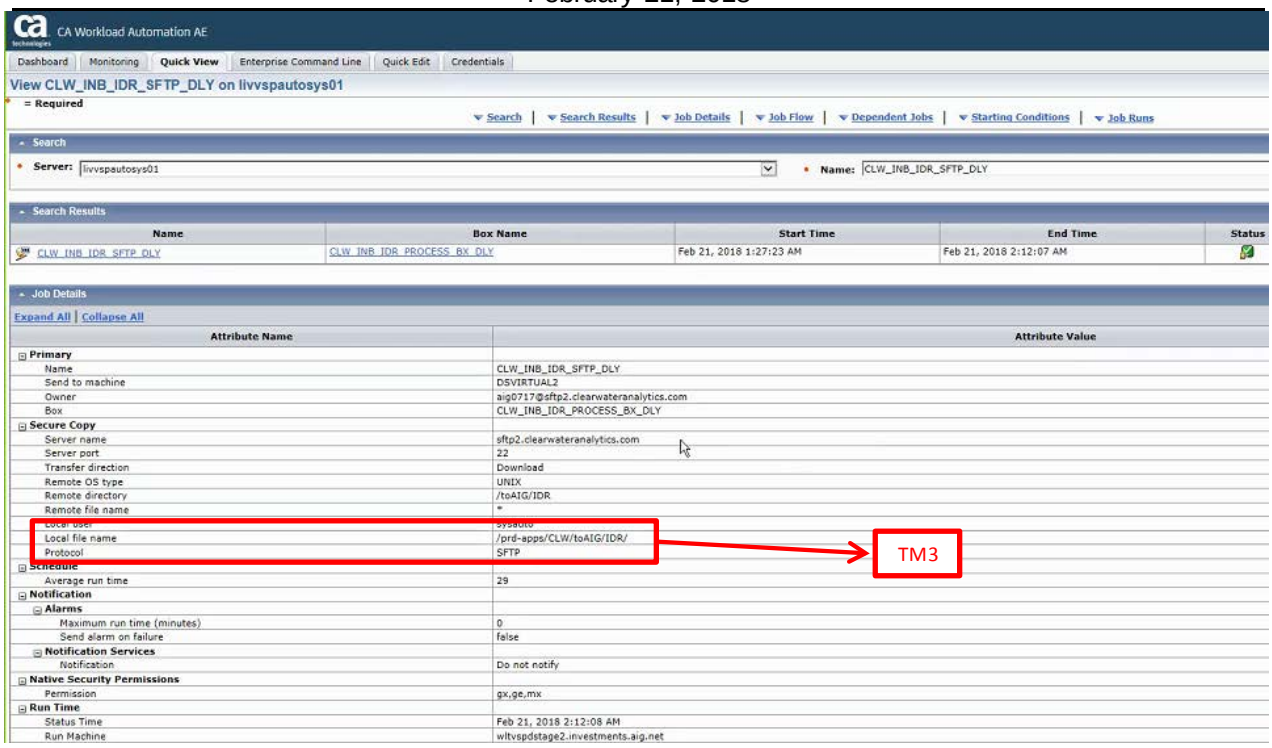
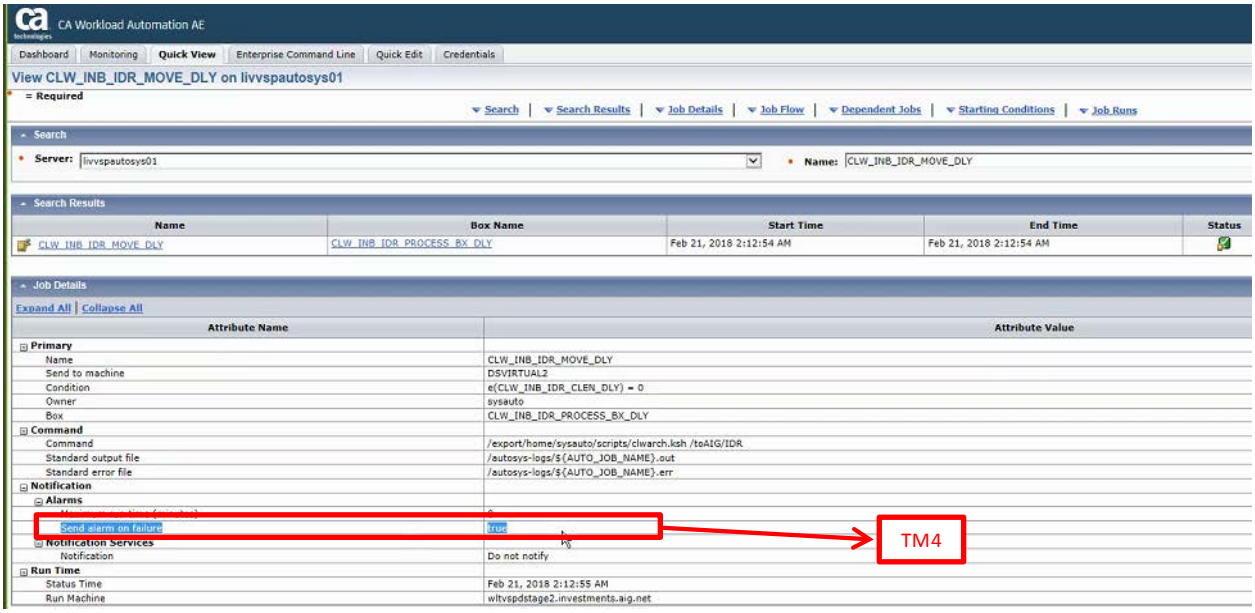


Figure 3: Job in charge of moving the Clearwater file into an AIG SFTP location



Once Clearwater's flat files (refer to **Figure 5, TM5** below) are copied to the staging folder, the "CLWTR_IDR_HLD_MTH_DS_JOB_C" Autosys job initiates the transfer of the files to the IDR database. If any types of errors occur during this process, the Autosys jobs in charge of the loading process will generate an error notification alerting the ETL team of the error (refer to **Figure 6, TM6** below).

Figure 4: Test files used during the test scenarios

Walkthrough / Clearwater feed into IDR

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

February 21, 2018

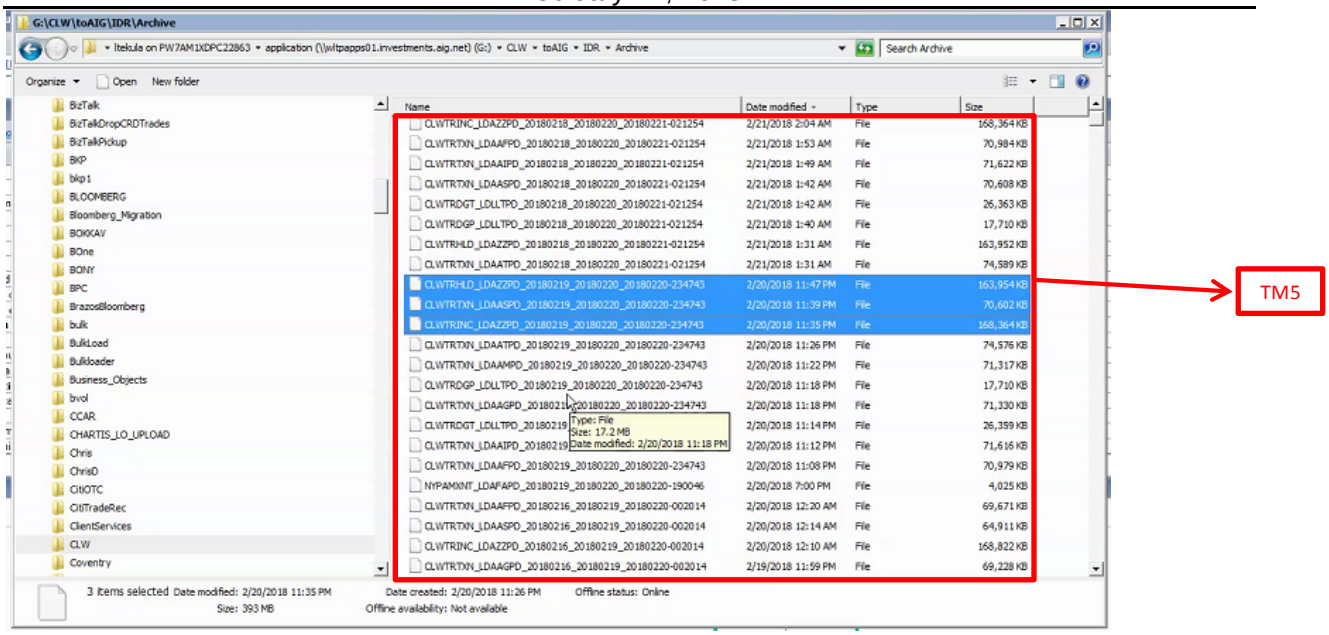
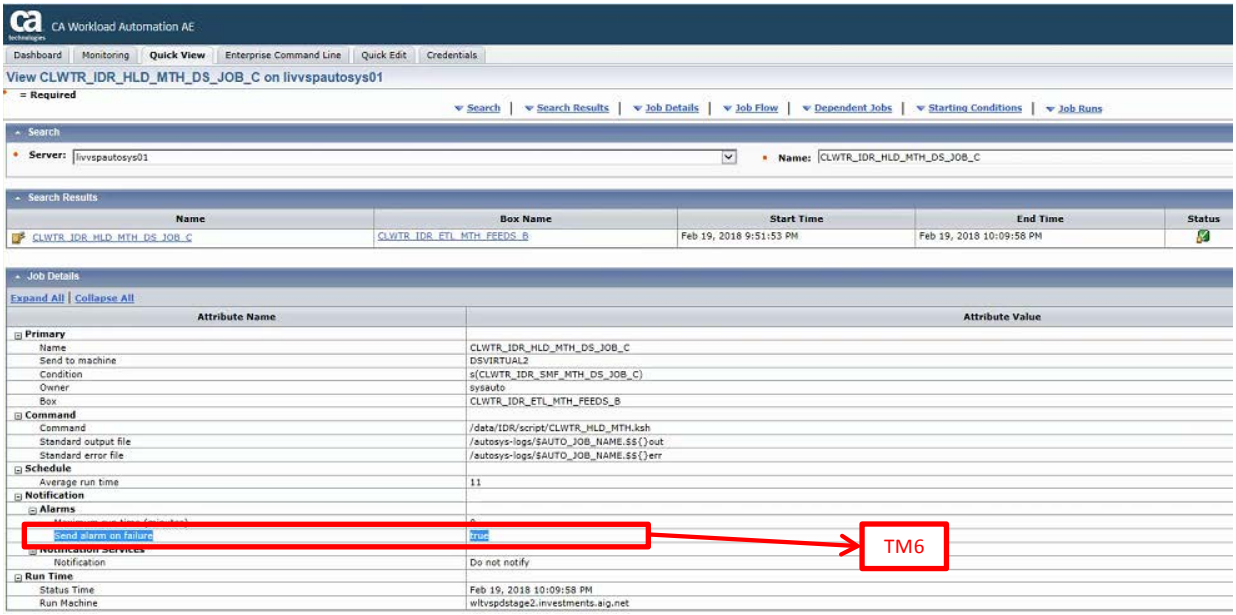


Figure 5: Job in charge of initiating the file data transfer onto the IDR database.



LT also indicated that for three test files important for investment accounting (i.e., income, holdings and tax), all of the fields in the Clearwater flat files have already been mapped to specific fields in the IDR database (refer to **Figure 6** and **Figure 7, TM7** and **TM8** below).

Figure 6: Loading process

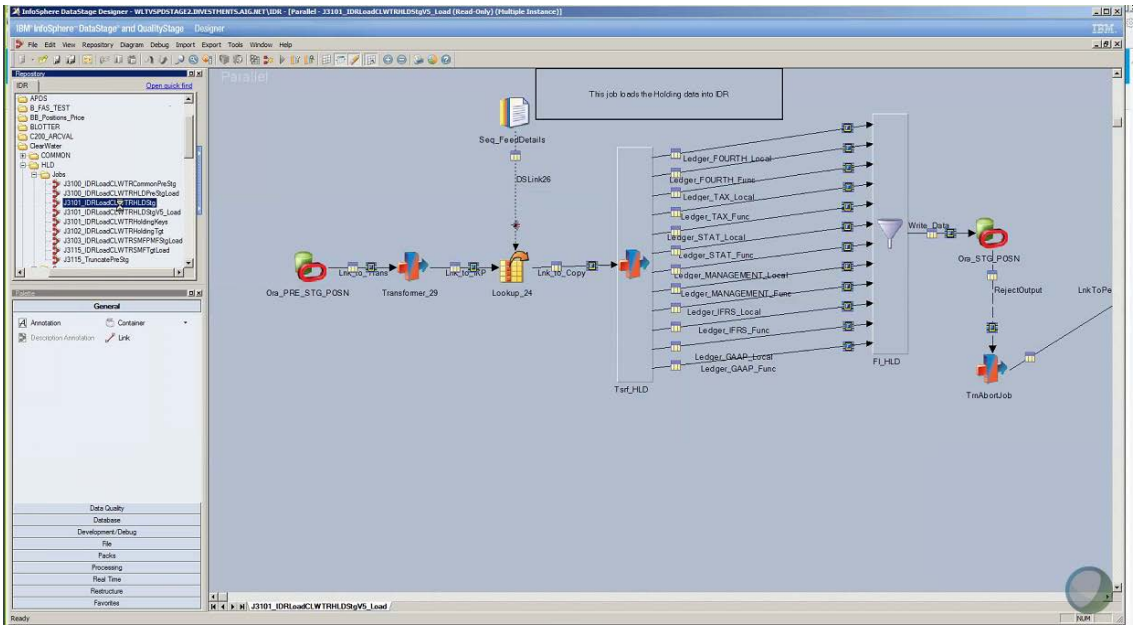
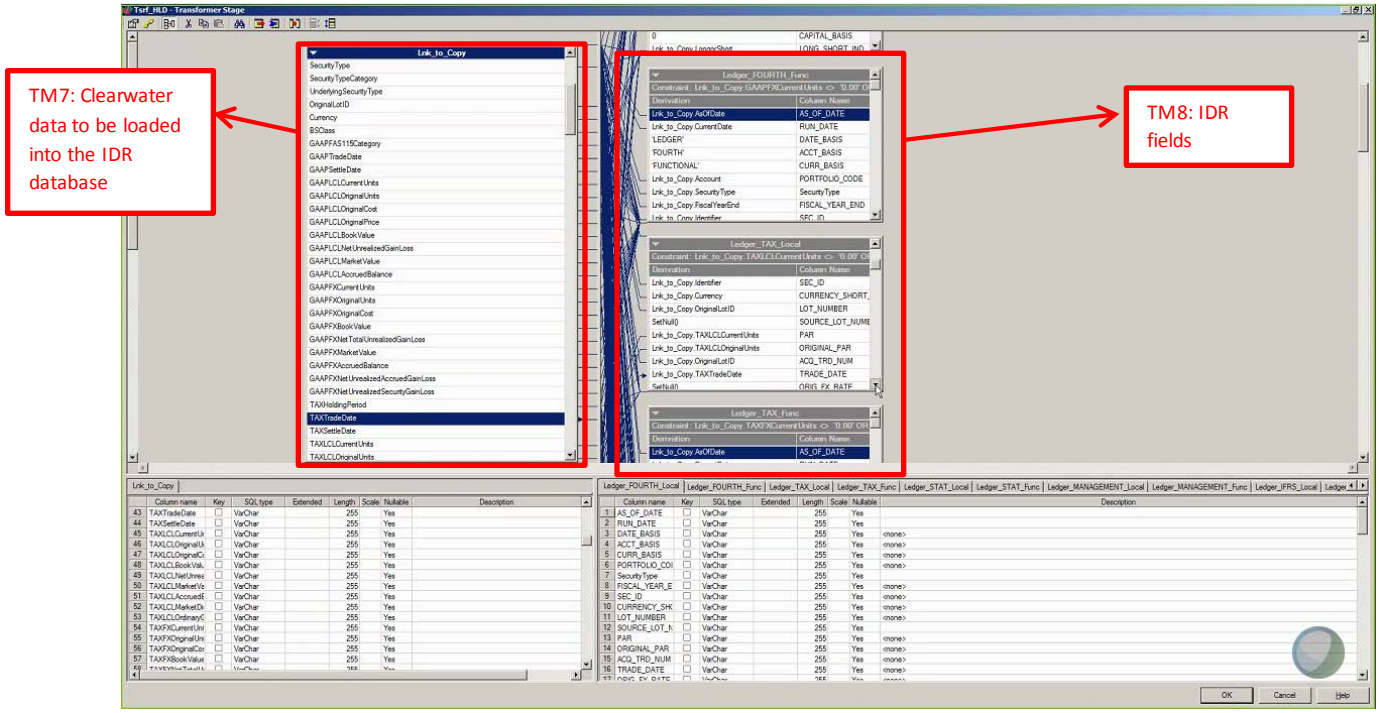


Figure 7: Clearwater data fields mapped to IDR fields



Finally, in order to validate that the test file was successfully processed, the IDR database uses a file header and trailer record to validate that all the records are processed during the file loading process into the IDR database (refer to **Figure 8** and **Figure 9, TM9** and **TM10** below).

Figure 8: Header record

Walkthrough / Clearwater feed into IDR

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

February 21, 2018

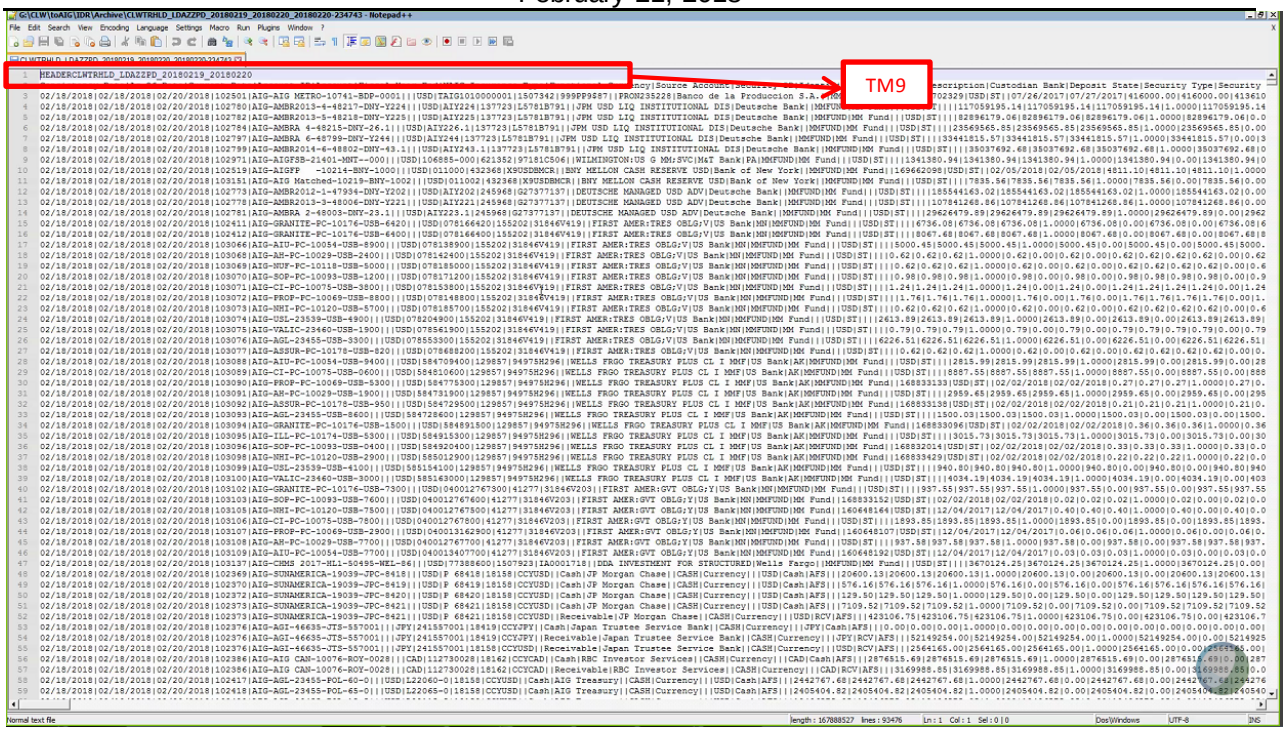
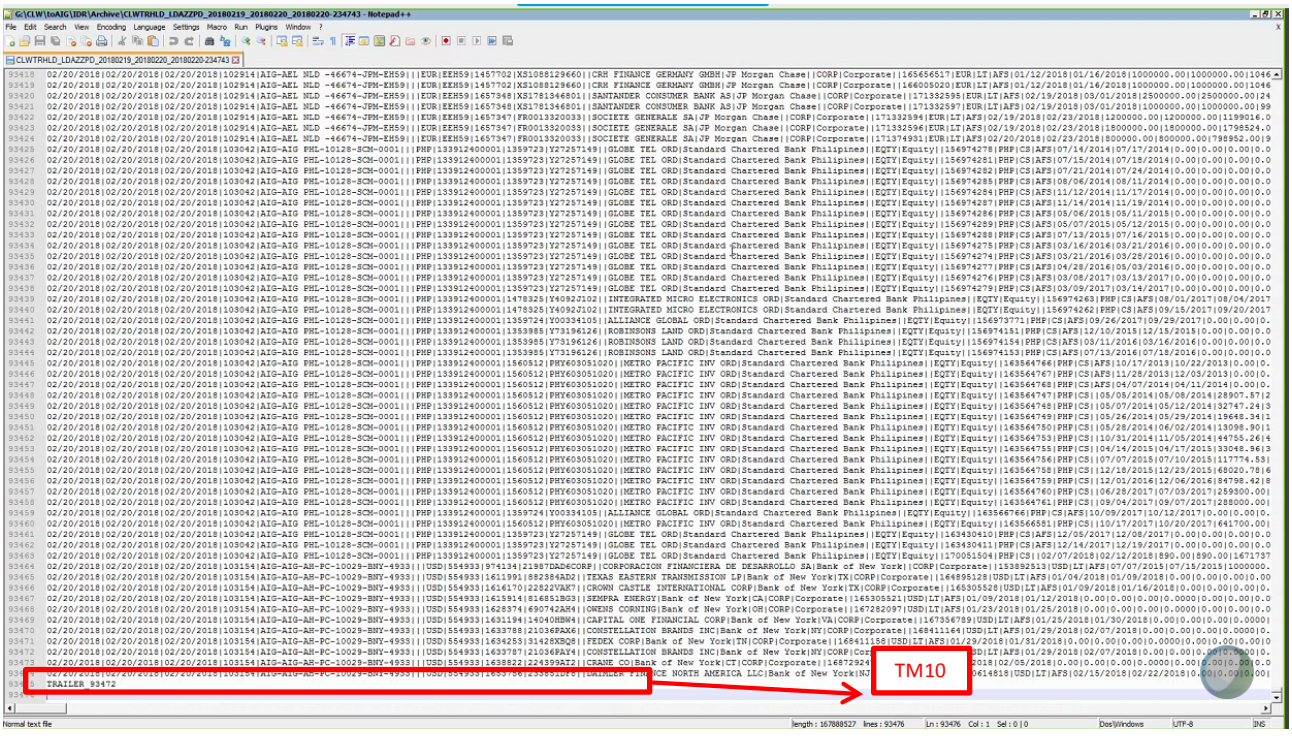


Figure 9: Trailer record



Please refer to: Test Matrix - Project Nova Interfaces for the test procedures performed.

Walkthrough / Clearwater feed into IDR

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

February 21, 2018

Conclusion:

IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted -** Refer to w/p:

FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthrough conversations as of 4/26/2018, IAG determined that the automated interface controls between Clearwater and IDR were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.

Walkthrough / Clearwater feed into SAP

Client Contact: James Chen, Senior Director -Accounting/Finance and Frank Abbate, Design Devmt IT Tech Consultant II

February 16, 2018

On February 16, 2018, Christopher Daly (CD), IAG Senior Manager, Amongin Ogbeide (AO), IAG Manager and Omar Barrero (OB), IAG Analyst, met with James Chen (JC), Senior Director - Accounting/Finance, and Frank Abbate (FA), Design Devmt IT Tech Consultant II, to obtain a better understanding of how the Clearwater application will transfer information to SAP as part of Project Nova.

In the current state SAP (P&C and L&R) receives journals (e.g., cash transactions, valuations) from PAM through the IDR GL module. The built-in GL module takes the journal files from PAM and formats them into the proper SAP interface format for each respective ledger. In the future state Clearwater will automatically generate the journal files in the proper SAP interface format for each respective ledger. The journal files generated by Clearwater will then be distributed into an AIG folder and transferred to two SAP staging locations created for each SAP ledger (P&C and L&R). At this point a job or multiple jobs will extract the journal files in the sFTP locations and upload them into the respective SAP ledger instance.

FA stated that he has been feeding Clearwater journal files with P&C and L&R data into SAP in order to test the format of the files. After completing several testing scenarios Clearwater was able to generate journal files in the correct format. It should be noted that the testing scenarios used only a handful of accounts. FA and JC stated that the next testing step is to request Clearwater to generate journal files for all the accounts inside AIG and feed the journal files into SAP again.

The journal files created by Clearwater contain header and trailer records that are being used to verify the completeness and integrity of the data transferred from Clearwater to SAP (Refer to "PH20.BAL.CLW.TXT", **TM1** – w/p: CW to SAP - Support evidence - PH20-BAL-CLW-TXT , "PH20.CGI.GL.TXT", **TM1**– w/p: CW to SAP - Support evidence - PH20-CGI-GL-TXT "i_CLRUSG_20180207100118.dat", **TM1** and **TM2**– w/p: CW to SAP - Support evidence - test Chartis journal file). If the data stored in the header and trailer records does not match the data in the journal files SAP rejects the file and generates an error notification. The Clearwater journal files are going to be sent on a monthly basis.

Please refer to: Test Matrix - Project Nova Interfaces for additional test procedures performed.

Conclusion:

IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted -** Refer to w/p: FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthrough conversations as of 4/26/2018, IAG determined that the automated interface controls between Clearwater and SAP were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.

Walkthrough / Private Placement Valuation interface with Clearwater
Client Contact: Daniel Powers, CBIT Investments - Portfolio Accounting Analytics - NY
February 12, 2018

On February 12, 2018, Christopher Daly (CD), IAG Senior Manager, and Omar Barrero (OB), IAG Analyst, met with Daniel Powers, CBIT Investments - Portfolio Accounting Analytics – NY, and Aaron Derosier, Sr. Net Developer – GIS NY TECH XFR, to obtain a better understanding of how the Private Placement Valuation (PPV) application will transfer information to Clearwater in the future state as part of Project Nova.

PPV will have two connection points with Clearwater. The first connection point will be through a web service (i.e., a user interface or UI) currently being developed by Clearwater which will allow a user to upload prices or yields from PPV into Clearwater. Additionally, the transfer protocol that will be utilized for the feed from PPV to Clearwater will be HTTPS. This protocol will ensure that the connection between PPV and Clearwater is secure by encrypting the data in transit.

Clearwater provided an initial specifications e-mail containing details about the structure of the HTTP file to be used to communicate price and yield data to Clearwater. The HTTP file contains an HTTP header with a value called "authToken" (Refer to **Figure 1, TM1** below) that will be used by Clearwater to identify the incoming request as an AIG request. The HTTP file also contains the security ID, evaluation date and the yield or price depending on the user request (Refer to **Figure 1, TM2** below). The response file from Clearwater contains all the previous information provided by AIG in addition to the price or yield calculated by Clearwater and a message status field stating the status of the request (Refer to **Figure 2, TM3** below).

The second connection point between PPV and Clearwater is a monthly feed in which a file containing all the final M/E prices is dropped to a specific location where it will be ingested by Clearwater. Currently, the final M/E price file is ingested by Global Pricing System (GPS), a system that will be decommissioned as part of Project Nova, which applies pre-configured price hierarchy rules to derive the best price by using automated pricing feeds from multiple vendors (i.e., Bloomberg, IDC and MarkIt). GPS then transfers the results to PAM to store the calculated values. In the future state, the file containing the final M/E prices will be captured by an Autosys job which sends the data to Clearwater instead of GPS (Refer to **Figure 3** below). Clearwater will replace the pricing hierarchy calculation function handled by GPS. The transfer protocol utilized to transfer the final M/W Prices file will be SFTP. This protocol will ensure that the connection between PPV and Clearwater is secure by encrypting the data in transit.

Walkthrough / Private Placement Valuation interface with Clearwater
Client Contact: Daniel Powers, CBIT Investments - Portfolio Accounting Analytics - NY
February 12, 2018

Figure 1: Screenshot Clearwater http configuration details Part 1

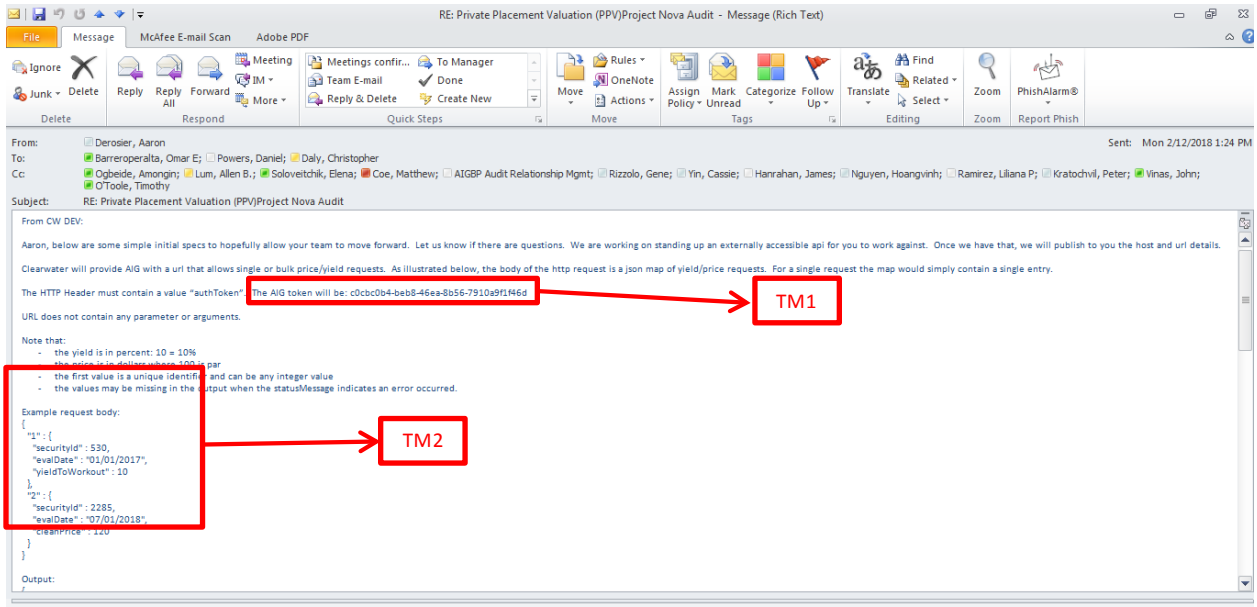


Figure 2: Screenshot Clearwater http configuration details Part 2

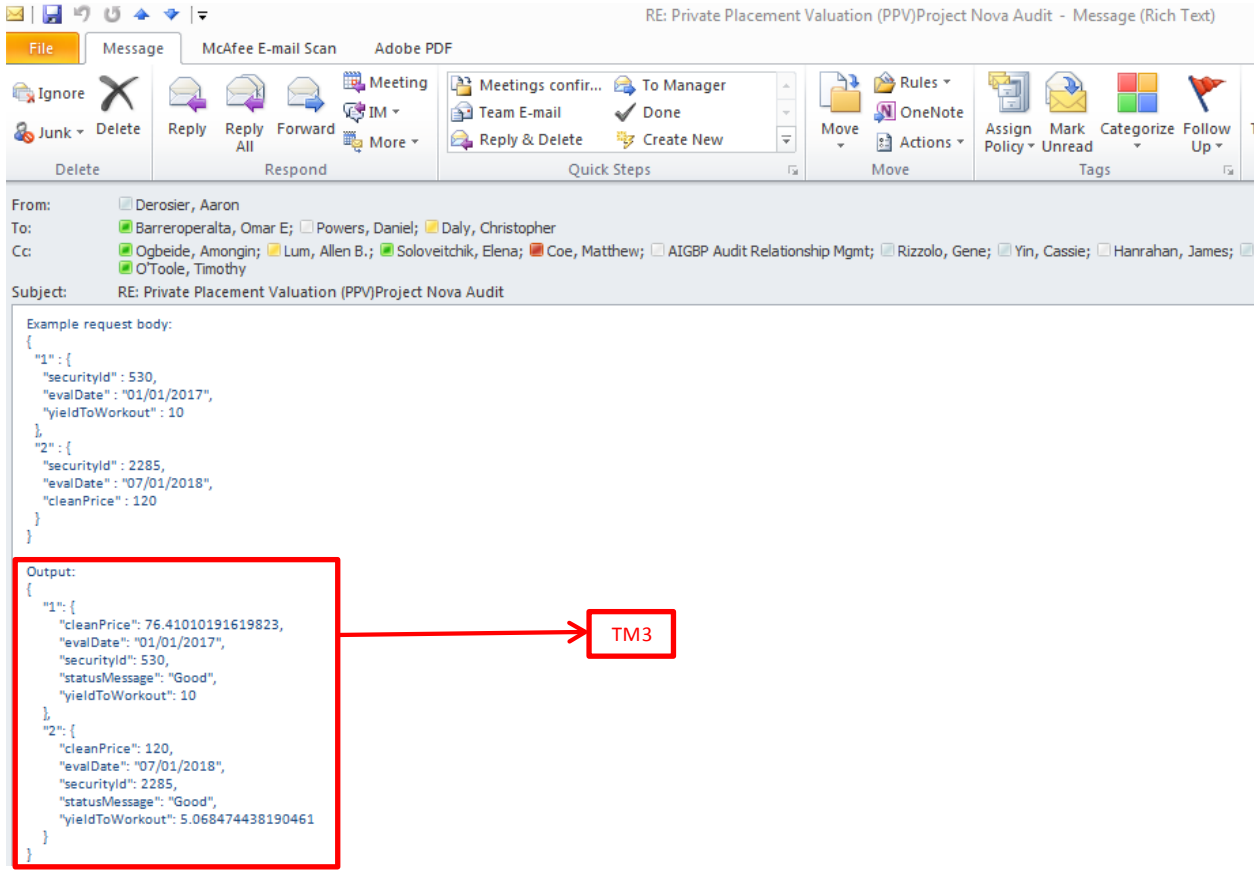
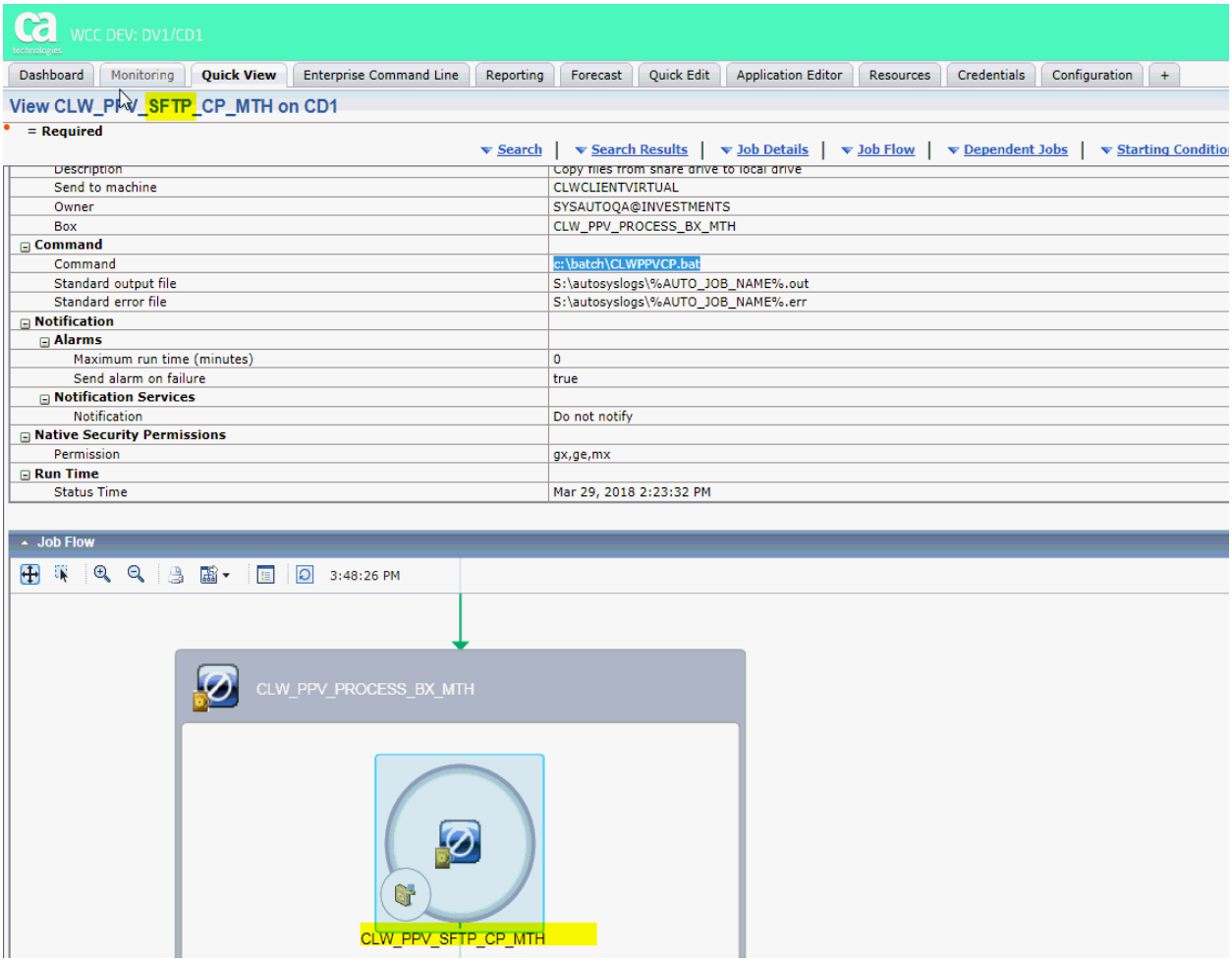


Figure 3: Screenshot of Autosys job



Please refer to: Test Matrix - Project Nova Interfaces for the test procedures performed.

Conclusion:
IAG noted during walkthrough discussions that neither business nor IT requirements were prepared to document the agreed upon stakeholder requests to be included in the development process for this interface. A lack of business and technical requirements could lead to insufficient user testing, development setbacks, and delays in implementation. **Exceptions Noted -** Refer to w/p:
FW Project Nova IAG Assessment as of 3/19/18

However, as a result of the evidence collected and walkthrough conversations as of 4/26/2018, IAG determined that the automated interface controls between PPV and Clearwater were designed and operating effectively with respect to completeness, accuracy and error alerts attributes.