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### HIGH SPEED MAINFRAME APPLICATION TOOL

#### Abstract

Computer-implemented systems and methods for analyzing applications include, obtaining user data records from a server, constructing an instruction template, the instruction template includes main streams, the instruction template adding the user data records as user parameters corresponding to the main streams, transmitting the user data records to a file transfer connection, inputting the instruction template and a first command into the file transfer connection, the file transfer connection executes the first command, inputting the file transfer connection and a second command into the script file, the script file executes the second command, opening each of the main streams through the pre-defined driver program by using variable records to retrieve a plurality of in-streams of each of the main streams, aggregating the main streams and the in-streams associated with the user parameters resulting a final output, transmitting the final output to the server.

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## Background/Summary

### TECHNICAL FIELD

[0001] The present disclosure generally relates to computerized systems and methods for processing data and providing analysis and insights generated through mainframe systems and models.

### BACKGROUND

[0002] A mainframe is a computer used by many large organizations for critical applications, bulk data processing (such as the census and industry and consumer statistics, enterprise resource planning, and large-scale transaction processing. Generally, mainframe computers may be a large, centralized machine that contains a large amount of memory, a large amount of storage space, and multiple processors, so it has ultra-processing power comparing to standard computer systems.

[0003] The importance of mainframe computers is increasing for large scale organization, scientific research, consumer statistics, and census data, because it is capable to execute multiple complex programs concurrently at high speed. Mainframe computers can be used in many different areas, such as health insurance processing, retail, e-commerce, and airline reservation systems.

[0004] Organizations from different industries offer a variety of services and products. Many of these products offer different incentives or features. Mainframe computers analyze these products in a closed system with highly secure and high performance capabilities.

[0005] For example, financial services provided by a financial institution, ticket reservation systems for railways and airlines, inventories for retail companies, etc., can use mainframe systems to execute massive transactions in short duration. Mainframe systems can also run in a batch mode overnight processing of scheduled programs.

[0006] Mainframe systems would generally consist of more than hundreds or close to thousand instructions, also referred to as “job control languages” (JCLs), depending on the size of the application. Further, these JCLs have many input and output files which take a long period of time to analyze an entire application on mainframe.

[0007] Difficulties associated with analyzing one application on a mainframe can cause high analysis time and may require more support for complex applications. These and other technological problems have complicated advances to analyze an application on mainframe. Moreover, existing mainframe systems analyzing simple applications can take at least more than a week.

[0008] Therefore, a need exists for high-speed analysis of applications on mainframes. The present disclosure is directed to addressing these and other challenges.

### SUMMARY

[0009] One aspect of the present disclosure is directed to a computer-implemented system. The

system comprises a non-transitory computer-readable medium configured to store instructions and at least one processor configured to execute the instructions to perform operations. The operations include obtaining, from at least one data store, at least one user data record from a server, constructing an instruction template, the instruction template comprises a plurality of main streams, the instruction template adding the at least one user data record as a plurality of user parameters corresponding to the main streams, transmitting the at least one user data record to a file transfer connection, inputting the instruction template and a first command into the file transfer connection, the file transfer connection being configured to execute the first command, inputting the file transfer connection and a second command into the script file, the script file being configured to execute the second command, transmitting the main streams into a pre-defined driver program, opening each of the main streams through the pre-defined driver program by using pre-defined variable records to retrieve a plurality of in-streams of each of the main streams, aggregating the main streams and the in-streams associated with the user parameters resulting a final output, transmitting the final output to the server; and receiving a visualization from the server, created by processing the final output.

[0010] Other aspects of the present disclosure are directed to computer-implemented methods for performing the functions of the computer-implemented systems discussed above.

[0011] Other systems, methods, and computer-readable media are also discussed herein.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a schematic diagram of an example system for processing or analyzing a processing application, consistent with the disclosed embodiments.

[0013] FIG. 2 is a block diagram of an example server computer system for processing or analyzing a processing application, consistent with the disclosed embodiments.

[0014] FIG. 3 is a block diagram of an example mainframe application tool used across the system shown in FIG. 1, consistent with the disclosed embodiments.

[0015] FIG. 4A-4B are schematic diagrams of an example mainframe application tool used in the system shown in FIG. 1, consistent with the disclosed embodiments.

[0016] FIG. 5 is a block diagram of an example of inside a mainframe application tool for processing a list of processing application inventory shown in FIG. 4A-4B, consistent with the disclosed embodiments.

[0017] FIG. 6 depicts an example of a mainframe application tool for analyzing processing application captured using the system shown in FIG. 1, consistent with the disclosed embodiments.

[0018] FIG. 7 is a flowchart of an example process for analyzing user data in the system shown in FIG. 1, consistent with the disclosed embodiments.

[0019] FIG. 8 is a flowchart of an example process for transmitting user data in the system shown in FIG. 1, consistent with the disclosed embodiments.

### DETAILED DESCRIPTION

[0020] The disclosed embodiments include systems and methods for analyzing applications. Before explaining certain embodiments of the disclosure in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The disclosure is capable of embodiments in addition to those described and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as in the accompanying drawings, are for the purpose of description and should not be regarded as limiting.

[0021] As such, those skilled in the art will appreciate that the conception upon which this

disclosure is based may readily be utilized as a basis for designing other structures, methods, and systems for carrying out the several purposes of the present disclosure.

[0022] As used herein, unless specifically stated otherwise, the term “or” encompasses all possible combinations, except where infeasible. For example, if it is stated that a component may include A or B, then, unless specifically stated otherwise or infeasible, the component may include A, or B, or A and B. As a second example, if it is stated that a component may include A, B, or C, then, unless specifically stated otherwise or infeasible, the component may include A, or B, or C, or A and B, or A and C, or B and C, or A and B and C.

[0023] Reference will now be made in detail to the present example embodiments of the disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0024] Mainframes, in some embodiments, are a type of computer that generally are known for their large size, amount of storage, processing power and high level of reliability. Large organizations primarily use mainframes for critical applications requiring high volumes of data processing. In general, most mainframes have the ability to run multiple operating systems. In addition, mainframes can add or swap system capacity without disruption and handle very high volume input and output. Even one single mainframe can replace dozens or small hundred servers.

[0025] FIG. 1 is a schematic diagram illustrating an example system **100** for processing an analysis of a service application, consistent with the disclosed embodiments. As shown in FIG. 1, system **100** includes service provider **110**, and mainframe system **130**. In FIG. 1, service provider **110** may provide processing service to mainframe system **130**, such as a service application system **132** or an operating system **134**. Consistent with the present disclosure, service provider **110** receives one or more requests for processing analysis from mainframe system **130**. In the disclosed embodiments, mainframe system **130** may be developed and operated by a third-party service provider authorized by service provider **110** to process analysis. In other embodiments, mainframe system **130** may be associated with one or more service provider **110** for processing financial analysis.

[0026] Service provider **110** may be an entity that provides services in any type of industries. For example, service provider **110** may be a bank, a health insurance center, airline company, retail company, or another type of entity that configures, offers, provides, and/or manages data information, such as users' identification and passwords of a bank, policy holder's earnings, past history records, passengers' personal information to reserve the tickets from airline company, etc. These data information can also be provided by user **120** to mainframe system **130**. Service provider **110** may include one or more components that perform processes consistent with the disclosed embodiments. The computer systems of service provider **110** may be communicatively connected to service application system **132** and operating system **134** in mainframe system **130**. In some embodiments, one or more components in service provider **110** may cooperate to perform processes consistent with the disclosed embodiments.

[0027] Mainframe system **130** may include one or more of service application system **132** or operating system **134**. Service application system **132** may be implemented as a computer or other electronic device operable to receive an analysis request from service provider **110**. In some embodiments, service application system **132** may include as a bank application, a ticket reserved application, or retail inventory application configured to receive data associated with user **120**. In other embodiments, service application system **132** may include one or more other service applications. Service application system **132** may receive a user data record (e.g., a user's identification/password for a bank account or personal information to reserve tickets) from service provider **110**. For example, the analysis is to understand existing application components of a mainframe environment to list detail and summary of the components and know inter-dependency between components in the application. Service application system **132** may be configured to receive instructions from service provider **110** or user **120** for transmitting user data records to

operating system **134**. Mainframe system **130** can store information about application analysis requests for later, real-time, or near real-time analysis.

[0028] Operating system **134** may be a computer system for completing an application analysis using software. For example, operating system **134** can be z/OS, z/virtual machine (z/VM), z/virtual storage extended (z/VSE), or z/transaction processing facility (z/TPF), HPE NonStop, Linux, Unisys OS 2200, OpenVMS, or any other operating systems.

[0029] In some embodiments, operating system **134** is operatively connected to, and controls the operations in, one or more applications in service application system **132**. Operating system **134** may monitor specific instructions that are executed in the mainframe system **130**. In some embodiments, operating system **134** is used to monitor the activity in a service application system **132** while a build of a software program is being executed by a process or processes under the control of operating system **134**. In response to a particular service application in service application system **132**. When executed, the operating system **134** would record information about the particular service application (e.g., about the instruction that was executed against a particular file or files in service application system **132**) and would return the recorded information to the process that initiated the particular service application.

[0030] FIG. 2 is a block diagram of an example server computer system **200** (referred to as “server **200**” hereinafter) used in system **100**, consistent with the disclosed embodiments. For example, service provider **110** may comprise server **200**. Server **200** may be one or more computing devices configured to execute software instructions stored in memory to perform one or more processes consistent with the disclosed embodiments. For example, server **200** may include one or more memory devices for storing data and software instructions and one or more hardware processors to analyze the data and execute the software instructions to perform server-based functions, operations, or analysis of data

[0031] In FIG. 2, server **200** includes a hardware processor **210**, an input/output (I/O) device **220**, a memory **230**, and database **240**. It should be noted that server **200** may include any number of those components and may further include any number of any other components. Server **200** may be standalone, or it may be part of a subsystem, which may be part of a larger system. For example, server **200** may represent distributed servers that are remotely located and communicate over a network.

[0032] Processor **210** may include or one or more known processing devices, such as, for example, a microprocessor. In some embodiments, processor **210** may include any type of single or multi-core processor, mobile device microcontroller, central processing unit, etc. In operation, processor **210** may execute computer instructions (e.g., program codes) and may perform functions in accordance with techniques described herein. Computer instructions may include routines, programs, objects, components, data structures, procedures, modules, and functions, which may perform particular processes described herein. In some embodiments, such instructions may be stored in memory **230**, processor **210**, or elsewhere. Consistent with the disclosed embodiments, processor **210** may include instruction template module **212** configured to include a plurality of main streams. In some embodiments, each of the main streams is a job stream that includes a sequence of job control language statements (JCLs). For example, the job stream consists of a sequence of jobs to be run, together with times, priorities, and other dependencies that determine the order of processing. The JCL informs operating system **134** what to do in order to process data. The JCL is configured by a JCL statement that contains a series of rules. The operating system can be indicated by JCL statements which processes needed to be operated, i.e., which program need to be executed, or which resources are needed by the programs.

[0033] For example, instruction template module **212** includes a job control language file which has a set of JCL statements which instruct the processor **210** what work to perform. For example, processor **212** can transmit a job control language file from instruction template module **212** to file transfer connection module **214**. File transfer connection module **214** uses job control language file

as an input to further connect to the server **200**. Script file module **216** includes a series of commands to be executed to process and read the job control language file from file transfer connection module **212**.

[0034] The processor **210** also includes file transfer connection module **214**, and script file module **216** for processing the analysis request. In other embodiments, instruction template module **212**, file transfer connection module **214**, and/or script file module **216** may be organized or arranged separately from instruction template module **212**. In further embodiments, file transfer connection module **214** and script file module **216** may be combined into one module serving the functions of both modules.

[0035] I/O device **220** may be one or more devices configured to allow data to be received and/or transmitted by server **200**. I/O device **220** may include one or more customer I/O devices and/or components, such as those associated with a keyboard, mouse, touchscreen, display, etc. I/O device **220** may also include one or more digital and/or analog communication devices that allow server **200** to communicate with other machines and devices, such as other components of system **100**. I/O device **220** may also include interface hardware configured to receive input information and/or display or otherwise provide output information. For example, I/O device **220** may include a monitor configured to display a customer interface.

[0036] Memory **230** may include one or more storage devices configured to store instructions used by processor **210** to perform functions related to disclosed embodiments. For example, memory **230** may be configured with one or more software instructions associated with programs and/or data.

[0037] Memory **230** may include a single program that performs the functions of the server **200**, or multiple programs. Additionally, processor **210** may execute one or more programs located remotely from server **200**. Memory **230** may also store data that may reflect any type of information in any format that the system may use to perform operations consistent with disclosed embodiments. Memory **230** may be a volatile or non-volatile (e.g., ROM, RAM, PROM, EPROM, EEPROM, flash memory, etc.), magnetic, semiconductor, tape, optical, removable, non-removable, or another type of storage device or tangible (i.e., non-transitory) computer-readable medium.

[0038] Server **200** may also be communicatively connected to one or more databases. For example, server **200** may be communicatively connected to database **240**. Database **240** may be a database implemented in a computer system (e.g., a database server computer) in service provider **110**.

Database **240** may include one or more memory devices that store information and are accessed and/or managed through server **200**. By way of example, database **240** may include Oracle™ databases, Sybase™ databases, or other relational databases or non-relational databases, such as Hadoop sequence files, HBase, or Cassandra. The databases or other files may include, for example, data and information related to the source and destination of a network request, the data contained in the request, etc. Systems and methods of disclosed embodiments, however, are not limited to separate databases. In one aspect, server **200** may include database **240**. Alternatively, database **240** may be located remotely from the server **200**. Database **240** may include computing components (e.g., database management system, database server, etc.) configured to receive and process requests for data stored in memory devices of database **240** and to provide data from database **240**.

[0039] FIG. 3 depicts an example mainframe application tool **300** used in mainframe system **130**, consistent with the disclosed embodiments. Mainframe tool **300** can represent a central data repository or a hub that may permit an organization to use this platform to support their core applications. Mainframe application tool **300** can include data store **310**. Data store **310** can include at least one user data record from server **320**. Instruction template **312** may add at least one user data record from data store **310**. In some embodiments, instruction template **312** uses user data records as user parameters (i.e., user identification or user password). It should be noted that instruction template **312** can add any other type of information and not limited to the above

examples. Mainframe tool **300** includes an instruction file **314**, a file transfer connection **316**, and a script file **318**. Instruction template **312** may include main streams. In some embodiments, each of the main streams is a job stream that includes a sequence of job control language statements (JCLs) corresponding to user parameters. Mainframe application tool **300** creates instruction file **314** from the instruction template **312** to include the main streams and user parameters. Instruction file **314** may be inputted into the file transfer connection **316** along with a first command. File transfer connection **316** can be used to execute the first command, and then quit from file transfer connection **316**. In some embodiments, the first command may be a job entry subsystem (“JES”) command. For example, file transfer connection **316** uses a JES command to receive main streams (i.e., JCLs) into the file transfer connection **316**, to schedule JCLs for processing by file transfer connection **316**, and to control output processing. Mainframe application tool **300** then creates script file **318** after exiting from file transfer connection **316**.

[0040] Script file **318** may be used to input file transfer connection **316** along with a second command. For example, script file **318** may also include main streams corresponding to the user parameters as same as file transfer connection **316**. In some embodiments, script file **318** may pause for a period of time (i.e., from 10-15 minutes) after adding main streams and user parameters. The second command can be used to execute script file **318**. In some embodiments, the second command may be a shell command. For example, the shell command reads the input file transfer connection **316** into the script file **318**, then executes the file transfer **316** to establish the connection to server **320**.

[0041] Mainframe application tool **300** transmits instruction file **314** to the server **320** through file transfer connection **316** and script file **318**. Different institutions (e.g., service provider **110** of system **100**) can offer a variety of different types of central data repository or a hub with different incentives or features. Each of these different central data repositories may be assigned one or more file transfer connections **316** and one or more script files **318**. Instruction file **314** is obtained from server **320** again for using with a particular driver program **324**. In some embodiments, driver program **324** can be a common business-oriented language (COBOL) program, restructured extended executor (REXX) program, or Easytrieve program to be created as a pre-defined driver program for instruction template **312**. It should be noted that driver program **324** is not limited to the above examples and may be any other source codes which can use environment variables to open JCLs. For example, a driver program **324** is stored in the mainframe application tool **300** even before instruction template **312** receiving the at least one user data records. Driver program **324** is used to open each of the main streams by using pre-defined variable records to retrieve in-streams of each of the main streams. For example, in-streams are the procedures inside a single JCL to perform a particular function. When the procedure is coded within the same JCL, it is an in-stream procedure. A procedure can achieve parallel execution of one program, when one program using multiple input files. Final output **326** includes main streams and in-streams aggregating associated with user parameters to transmit back to server **320**. In some embodiments, server **320** processes final output **326** to create a visualization of final output **326**.

[0042] FIG. 4A is a block diagram of an example of across mainframe application tool **400** used in mainframe system **130**, consistent with the disclosed embodiments. For example, the mainframe application tool **400** may use spreadsheet software to analyze the entire application. As shown in FIG. 4, mainframe application tool **400** may include an input data **410**, spreadsheet **411**, and scripting code **412**. In some embodiments, mainframe application tool **400** may use other programs to replace spreadsheet **411** along with scripting code **412**. In some embodiments, mainframe application tool **400** may include additional components. In some embodiments, the components of mainframe application tool **400** can be split among additional components, can be part of the same component, or can be separated across a network such as a LAN or WAN. In some embodiments the components of mainframe application tool **400** can be part of, for example, mainframe system **130** of system **100**. In other embodiments, mainframe application tool **400** can be implemented as

part of service provider **130** of system **100**.

[0043] The elements of mainframe application tool **400** can also be implemented on server **200**. For example, mainframe ftp **417** of mainframe application tool **400** can be the same as processor **210** of server **200**. In some embodiments, input data **410** can be the same data as saved in database **240** of server **200**. For example, input data includes information as for mainframe user id, mainframe user password, management system, management sub-system. In some embodiments, input data includes other types of information such as patients' medical records, customers' transactions in the retail industry, and passengers' tickets reservation in railway and airlines. The components of mainframe application tool **400**, such as input data **410**, spreadsheet **411**, and scripting code **412**, may be implemented as software (e.g., program codes stored in memory **230**), hardware (e.g., a specialized chip incorporated in or in communication with processor **210**), or a combination of both.

[0044] Spreadsheet **411** may be a high availability or highly scalable program or set of programs that can receive and process analysis requests and communications of service provider **110**, such as those originating from service application system **132**. In some embodiments, spreadsheet **411** with scripting code **412** may request user for a list of parameters including one or more of information: mainframe user id, passwords, management system, and management sub-system. For example, spreadsheet **411** can be Microsoft Excel and scripting code **412** can be Microsoft Visual Basic for Applications code (i.e., VBA code). It should be noted that spreadsheet **411** and scripting code are not limited to the above examples, and mainframe application tool **400** can use other programs and code to receive and process analysis. Job control language (JCL) template **413** adds the input data **410** of one of the applications from the spreadsheet **411**. In some embodiments, JCL template **413** may also implemented as instruction template **312** in mainframe application tool **300**. Spreadsheet **411** may also receive analysis requests to from user **120** or other components of system **100**.

[0045] JCL template **413** processes user data records from input data **410** and create a driver as JCL file **414**. For example, the driver JCL file **414** includes a series of application JCLs corresponding to at least one or more parameters of mainframe user id or passwords. JCL template **413** can also use any other data related to analysis of service applications which requested by other types of the service providers or users.

[0046] File transfer connection (FTP) script file **415** is coded to use JCL file **414** as an input to receive a list of parameters of mainframe user identification, mainframe password, and a special mainframe command. For example, the special mainframe command is a JES command. The JES command in the FTP file **415** specifies the input parameters to be accessed and the output parameters to be created or updated. The FTP script file **415** is executed by using the JES command to trigger the driver JCL file **414** and establish the connection to the mainframe FTP **417**.

[0047] Mainframe application tool **400** then creates batch script file **416** after exiting from the FTP file **415**. In some embodiments, Batch script file **416** is coded to use the FTP file **415** as an input to receive the list of parameters of mainframe user identification, mainframe password, and a Shell command. The Shell command in the Batch script file **416** reads the FTP file as an input. For example, Batch script file **416** is then executed on mainframe FTP **417** by using the Shell command. In some embodiments, mainframe application tool **400** issues FTP file **415** to transmit the driver JCL file **414** to the mainframe FTP **417**. The components of JCL file **414**, FTP file **415**, Batch script file **416** may be implemented as modules (e.g., instruction template module **212**, file transfer connection module **214**, script file module **216**) incorporated into a processor **210**. It should be noted that spreadsheet **411** and scripting code **412** can be any other user interface tool as long as it can execute the FTP file **415** and Batch script file **416** by taking user inputs, such as FTP address, mainframe user id, mainframe user password.

[0048] FIG. **4B** is a schematic diagram of an example of across mainframe application tool **400** following the JCL file **414**, FTP file **415**, and Batch script file **416** are executed on mainframe FTP **417**. Driver program **418** is stored in the mainframe application tool **400** before input data



transmitting to spreadsheet **411**. Mainframe application tool **400** transmits driver program **418** as an input to the JCL file **414**. Mainframe application tool **400** submits JCL file **414** to job entry subsystem **419** and JCL file **414** is executed in job entry subsystem **419**. Source code management system **420** incorporates in a batch mode for the JCL file **414** to process a list of application JCLs of the JCL file **414**. Mainframe application tool **400** returns the list of application JCLs of the source code management system **420** and the job entry subsystem to driver program **418**. For example, driver program **418** can be a COBOL program, REXX program, Easytrieve program, or any other program can use environment variables to open JCLs. Source code management system **420** can be an Endeavor system, Panvalet system, Changeman system, or any other system can generate reports that list JCLs for an application. It should be noted that driver program **418** and source code management system **420** are not limited to the above examples, mainframe application tool **400** may implement any type of program or source code system to process JCL file **414**.

[0049] In some embodiments, driver program **418** opens each of the list of application JCLs of JCL files **414** to retrieve procedures from each of the application JCLs. Driver program **418** generates a comma-separated value (CSV) file **421** as a final output. For example, driver program **418** is a COBOL program which consists of many programming languages that execute business processes. The programming languages have one or more data input file and one or more output files. Further, each of the input/output files has own corresponding layouts which known as copybooks (e.g., xml, json). The COBOL program can be executed from the JCL file **414**. The JCL file **414** has the following details: the location of the COBOL program binary file, the path to the location of the input data file, the path to the location of the output data, and the path to the location of the copy books can be found. Each application JCL in the JCL file **414** has more than one procedure, and each of the procedures has more than one program. Each of the programs includes input files/output files which have own corresponding layouts as copybooks. When driver program **418** opens each of JCL files **414**, driver program **418** initiates the processing of JCL files **414** to retrieve more than one application JCL in each of the JCL files **414** and retrieve more than one procedure of each of the application JCL.

[0050] Mainframe application tool **400** sends CSV file **421** back to the mainframe FTP **417**. For example, spreadsheet **411** receives the CSV file **421** from mainframe FTP **417** after CSV file **421** back to the mainframe FTP **417**. In some embodiment, spreadsheet **411** waits for a period of time to receive the CSV file **421**. Further, scripting code **412** processes CSV file **421** to communicate with a diagrammatic system **422**. Spreadsheet **411**, driver program **418** and diagrammatic system **422** may be implemented as software (e.g., program codes stored in memory **230**), hardware (e.g., a specialized chip incorporated in or in communication with processor **210**), or a combination of both.

[0051] Diagrammatic system **422** generates visualizations of the aggregated data from CSV file **421** for display on any type of dashboard. For example, the CSV file **421**, described in more detail below in reference to FIGS. 5 and 6, can provide insight of the application. In some embodiments, the visualization can further provide a summary of each application that user's needs. For example, diagrammatic system **422** can be a Visio program to generate visualization of the aggregated data from CSV file **421**. It should be noted that, diagrammatic system **422** is not limited to the above example, mainframe application tool **400** may implement any other type of diagrammatic programs to generate visualizations from the CSV file **421**.

[0052] FIG. 5 is a block diagram of an example of inside a mainframe application tool **500** used in mainframe system **130** or server **200**, consistent with the disclosed embodiments. Mainframe application tool **500** sends driver JCL file **510** to the job entry subsystem **520** to execute. Then, job entry subsystem **520** communicates with source code management system **530** by providing the application name from driver JCL **510**. In some embodiments, source code management system **530** receives a list of JCLs corresponding to a specific application name from the driver JCL file **510**. Source code management system **530** returns a complete list of JCLs correspond to the

specific application. In some embodiments, multiple application names can be processed between driver JCL file **510** and source code management system **530**. For example, source code management system **530** can return each list of JCLs from each of the application names. Driver program **512** inside the driver JCL file **510** receives a complete list of application JCLs **532**. Mainframe application tool **500** transmits environment variables **533** into driver program **512**. Driver program **512** opens each JCL **534** to retrieve procedures **536** by using environment variables **533**. Subsequently, driver program **512** opens each procedure **536** to retrieve each program **538**. In some embodiments, driver program **536** further open each procedure **536** to retrieve a list of input files, output files, and control cards. Driver program **512** can open each program **538** to retrieve a list of copybooks which are the corresponding layout of input files and output files. Application inventory **540** includes a list of all JCLs **534**, procedures **536**, and programs **538**. For example, application inventory **540** can be in CSV format. In some embodiments, application inventory **540** further includes a list of input/output files, copybooks, and control cards.

[0053] FIG. **6** is an example of another mainframe application tool **600** used in mainframe system **130** or server **200**, consistent with the disclosed embodiments. A list of JCLs **610** are entered into main processing program **620**. In some embodiments, a main processing program **620** can be a COBOL program. It should be noted that main processing program **620** is not limited to the above example and may be a REXX program, Easytrieve program, or any other programs have capability to use environment variables **630**. Main processing program **620** uses environment variables **630** to open each JCL **610** to retrieve a list of procedures **640**. When the main processing program **620** encounters procedures **640**, main processing program **620** opens and execute the procedures **640**. Procedure file **660** includes a list of executed procedures **640** used in each JCL **610** and a list of input files, output files, and controls cards used in each of the executed procedures **640**. When main processing program **620** further encounters programs **650**, main processing program **620** opens and execute the programs **650**. Program file **670** includes a list of all executed programs **650** used in each procedure **640** and a list of all copybooks, corresponding layout of input/output files, referenced in each executed program **650**. CSV file **680** is created to include both procedure file **660** and program file **670** as application inventory.

[0054] FIG. **7** is a flowchart of an example process **700** for analyzing user data in mainframe **130** or server **200**, consistent with the disclosed embodiments. Process **700** may be a process performed by a process performed by a computer-implemented system (e.g., server **200**) or in mainframe system **130**. The computer-implemented system may include a memory (e.g., memory **230**) that stores instructions and a processor (e.g., processor **210**) programmed to execute the instructions to implement process **700**. For example, process **700** may be implemented as one or more software modules stored in memory **230** and executable by processor **210**. Process **700** can also be performed by mainframe application tool **300** in FIG. **3**.

[0055] Referring to FIG. **7**, at step **710**, the processor obtains user data record from multiple data sources and from various component in system **100**. The data may be stored in, for example, memory **230**, database **240**, data store **310**, mainframe FTP **417**, or other components described above. The data include, among other things, retail inventory data, policy holder's information data, or user's identification/password data.

[0056] Referring to FIG. **7**, at step **720**, the processor may construct an instruction template to include a plurality of main streams from the data sources. Because the data may originate from different systems, the data can be normalized so that common information has the same format and structure. For example, at step **720**, the processor may construct all account holder data to include user identification and user passwords. In some embodiments, other data may be constructed such as addresses, organizations' names, date formats, or similar types of information. Additional examples of data construction for the instruction template that the processor can apply to the input data includes, for example, such as details of the source code management system or source code management sub-system, dates, phone numbers, and social security numbers into a standard

format. After constructing the instruction template to add user data records from the various data sources, the processor may transform the user data records as user parameters corresponding to the main streams so that related data records can be analyzed. For example, data that contains the user identification, user passwords, and the details of the source code management system and subsystem can create a driver file (e.g., JCL file **414**) and associated with, for example, other data sources that have information on the different service applications by the institution. The processor may further transmit user data record to a file transfer connection at step **730**.

[0057] Referring to FIG. 7, at step **740**, the processor inputs the instruction template and a first command into the file transfer connection. The processor executes the first command embedded in the file transfer connection. For example, the first command can be a JES execution command. The file transfer connection is executed using the JES execution command to establish the connection to the server.

[0058] Referring to FIG. 7 at step **750**, the processor inputs the file transfer connection and a second command into a script file. The processor executes the second command embedded in the script file. For example, the second command can be a Shell command. As described above, the processor executes the script file by using the Shell command. After step **750**, once the script file being executed, the processor transmits the instruction template into a driver program at step **760**.

[0059] Referring to FIG. 7 at step **770**, the processor opens each of the main streams through the pre-defined driver program by using pre-defined variable records to retrieve a plurality of in-streams of each of the main streams. For example, main streams may be a plurality of JCLs and in-streams may be a plurality of procedures. The processor can execute the driver program by using JCLs and procedures.

[0060] Referring to FIG. 7 at step **780**, the processor can utilize the output of the driver program applied to the data and use the aggregated data to generate visualizations of the data. The processor aggregates the main streams and the in-streams associated with the user parameters resulting a final output.

[0061] At step **790**, the processor transmits the final output to the server and receive the visualization, created by processing the final output, from the server. As shown above in FIGS. **4A-4B**, the visualizations can be created through a diagrammatic system. Additionally, the visualization may be provided as data, images, rendered form, or in another data format through a software Visio or remote procedure call that allows a third-party system to display the visualizations. The visualizations can include one or more of data visualizations described above or may include additional views of the data and predictive models not otherwise described.

[0062] FIG. **8** is a flowchart of an example process **800** for transmitting the main streams into a pre-defined driver program in mainframe system **130** or server **200**, consistent with the disclosed embodiments. Process **800** may be a process performed by a process performed by a mainframe system **130** or a computer-implemented system (e.g., server **200**). The computer-implemented system may include a memory (e.g., memory **230**) that stores instructions and a processor (e.g., processor **210**) programmed to execute the instructions to implement process **800**. For example, process **800** may be implemented as one or more software modules stored in processor **210** and executable by processor **210**.

[0063] Referring to FIG. **8**, at step **810**, the processor implements an entry system and a management system as part of server **200**. The information of systems may be stored in, for example, memory **230**, database **240**, mainframe FTP **417**, or other components described above. For example, the entry system may be a job entry subsystem and the management system can be a source code management system. For example, the job entry subsystem which uses to receive jobs into the operating system, schedule jobs for processing by operating system, and control job's output processing. For example, the source code management system provides control of jobs as individual elements.

[0064] Referring to FIG. **8**, at step **820**, the processor transmits the main streams to the entry

system, for example, the system that executes the main streams.

[0065] At step **830**, the processor obtains the main streams by the management system, the main streams corresponding to the user data records requested from the server **200**. For example, the main streams can be executed in the entry system and further provide the application name along with the list of main streams. In some embodiments, the management system can be in batch mode and return the list of main streams for the one of the applications. Referring to FIG. **8**, at step **840**, the processor returns the main streams of the requested user data record to the pre-defined driver program **324**.

[0066] A non-transitory computer-readable medium may be provided that stores instructions for a processor (e.g., processor **210**) for processing user data according to the example flowcharts of FIGS. **7-8** above, consistent with embodiments in the present disclosure. For example, the instructions stored in the non-transitory computer-readable medium may be executed by the processor for performing processes **700**, **800** or in part or in entirety. Common forms of non-transitory media include, for example, a floppy disk, a flexible disk, hard disk, solid-state drive, magnetic tape, or any other magnetic data storage medium, a Compact Disc Read-Only Memory (CD-ROM), any other optical data storage medium, any physical medium with patterns of holes, a Random Access Memory (RAM), a Programmable Read-Only Memory (PROM), and Erasable Programmable Read-Only Memory (EPROM), a FLASH-EPROM or any other flash memory, Non-Volatile Random Access Memory (NVRAM), a cache, a register, any other memory chip or cartridge, and networked versions of the same.

[0067] While the present disclosure has been shown and described with reference to particular embodiments thereof, it will be understood that the present disclosure can be practiced, without modification, in other environments. The foregoing description has been presented for purposes of illustration. It is not exhaustive and is not limited to the precise forms or embodiments disclosed. Modifications and adaptations will be apparent to those skilled in the art from consideration of the specification and practice of the disclosed embodiments.

[0068] Computer programs based on the written description and disclosed methods are within the skill of an experienced developer. Various programs or program modules can be created using any of the techniques known to one skilled in the art or can be designed in connection with existing software. For example, program sections or program modules can be designed in or by means of .Net Framework, .Net Compact Framework (and related languages, such as Visual Basic, C, etc.), Java, C++, Objective-C, R, Python, HTML, HTML/AJAX combinations, XML, or HTML with included Java applets.

[0069] Moreover, while illustrative embodiments have been described herein, the scope of any and all embodiments having equivalent elements, modifications, omissions, combinations (e.g., of aspects across various embodiments), adaptations and/or alterations as would be appreciated by those skilled in the art based on the present disclosure. The limitations in the claims are to be interpreted broadly based on the language employed in the claims and not limited to examples described in the present specification or during the prosecution of the application. The examples are to be construed as non-exclusive. Furthermore, the steps of the disclosed methods may be modified in any manner, including by reordering steps and/or inserting or deleting steps. It is intended, therefore, that the specification and examples be considered as illustrative only, with a true scope and spirit being indicated by the following claims and their full scope of equivalents.

## Claims

**1.-20.** (canceled).

**21.** A computer-implemented system for transmitting a plurality of main streams into a pre-defined driver program in a server, comprising: a non-transitory computer-readable medium configured to store instructions; and at least one processor configured to execute the instructions to perform

operations comprising: implementing an entry system and a management system; transmitting a plurality of main streams to the entry system; obtaining, by the management system, the plurality of main streams corresponding to at least one user data record requested from a server; and returning the plurality of main streams of the requested at least one user data record to a pre-defined driver program.

**22.** The computer-implemented system of claim 21, wherein: the entry system is a job entry subsystem; and the management system is a source code management system.

**23.** The computer-implemented system of claim 21, wherein the entry system is configured to execute the plurality of main streams.

**24.** The computer-implemented system of claim 21, wherein: the management system is configured to operate in batch mode; and the management system is configured to return a list of the plurality of main streams.

**25.** The computer-implemented system of claim 21, wherein each of the plurality of main streams is a job stream that includes a sequence of job control language statements (JCLs) that corresponds to the requested at least one user data record.

**26.** The computer-implemented system of claim 21, wherein the pre-defined driver program is a common business-oriented language (COBOL) program, a restructured extended executor (REXX) program, or an Easytrieve program.

**27.** The computer-implemented system of claim 21, wherein the operations further comprise: opening, by the pre-defined driver program, each of the plurality of main streams by using pre-defined variable records to retrieve in-streams of each of the plurality of main streams.

**28.** A computer-implemented method for transmitting a plurality of main streams into a pre-defined driver program in a server, comprising: implementing an entry system and a management system; transmitting a plurality of main streams to the entry system; obtaining, by the management system, the plurality of main streams corresponding to at least one user data record requested from a server; and returning the plurality of main streams of the requested at least one user data record to a pre-defined driver program.

**29.** The computer-implemented method of claim 28, wherein: the entry system is a job entry subsystem, and the management system is a source code management system.

**30.** The computer-implemented method of claim 28, wherein the entry system executes the plurality of main streams.

**31.** The computer-implemented method of claim 28, wherein: the management system operates in batch mode; and the management system returns a list of the plurality of main streams.

**32.** The computer-implemented method of claim 28, wherein each of the plurality of main streams is a job stream that includes a sequence of job control language statements (JCLs) that corresponds to the requested at least one user data records.

**33.** The computer-implemented method of claim 28, wherein the pre-defined driver program is a common business-oriented language (COBOL) program, a restructured extended executor (REXX) program, or an Easytrieve program.

**34.** The computer-implemented method of claim 28, further comprising: opening, by the pre-defined driver program, each of the plurality of main streams by using pre-defined variable records to retrieve in-streams of each of the plurality of main streams.

**35.** A non-transitory computer-readable medium storing instructions that, when executed by at least one processor, cause the at least one processor to perform operations for transmitting a plurality of main streams into a pre-defined driver program in a server, the operations comprising: implementing an entry system and a management system; transmitting a plurality of main streams to the entry system; obtaining, by the management system, the plurality of main streams corresponding to at least one user data record requested from a server; and returning the plurality of main streams of the requested at least one user data record to a pre-defined driver program.

**36.** The non-transitory computer-readable medium of claim 35, wherein: the entry system is a job

entry subsystem, and the management system is a source code management system.

**37.** The non-transitory computer-readable medium of claim 35, wherein: the management system is configured to operate in batch mode; and the management system is configured to return a list of the plurality of main streams.

**38.** The non-transitory computer-readable medium of claim 35, wherein each of the plurality of main streams is a job stream that includes a sequence of job control language statements (JCLs) that corresponds to the requested at least one user data records.

**39.** The non-transitory computer-readable medium of claim 35, wherein the pre-defined driver program is a common business-oriented language (COBOL) program, a restructured extended executor (REXX) program, or an Easytrieve program.

**40.** The non-transitory computer-readable medium of claim 35, wherein the operations further comprise: opening, by the pre-defined driver program, each of the plurality of main streams by using pre-defined variable records to retrieve in-streams of each of the plurality of main streams.

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