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(54) **SYSTEMS AND METHODS FOR MESSAGE CONVERSION AND VALIDATION**

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(57) **ABSTRACT**

A computer-implemented method for validating and converting a data message is provided. The method is implemented using a data message validation and conversion (DMVC) computer device in communication with a memory. The method includes receiving from a client device a first data message in a first communication protocol. The first data message includes a plurality of data elements that include a format and a content. The method also includes converting the first data message into a second communication protocol, determining if the format and the content of each data element of the plurality of data elements is valid, if the determination is that at least one of the format and the content of at least one data element is not valid, generating a detailed report about the first data message and providing the detailed report to the client device, and otherwise transmitting the converted first data message.

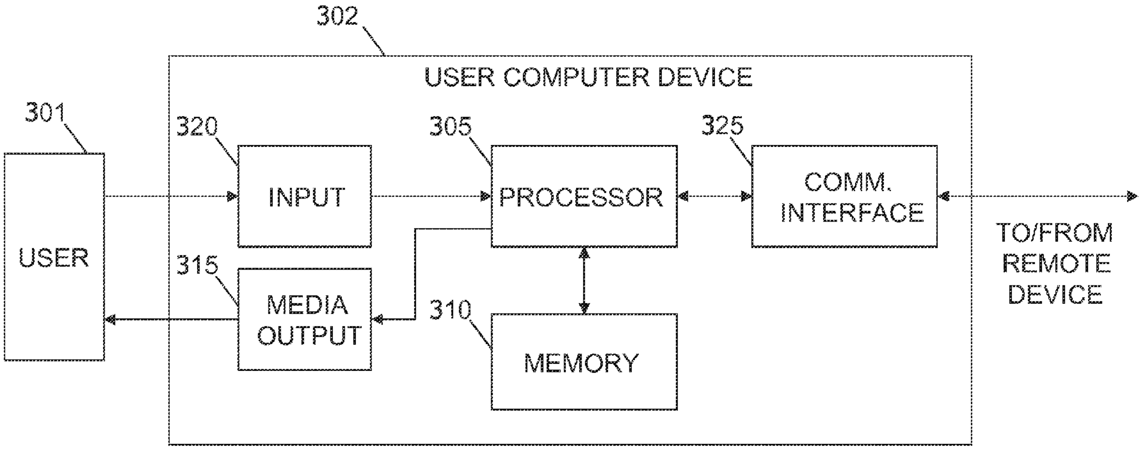
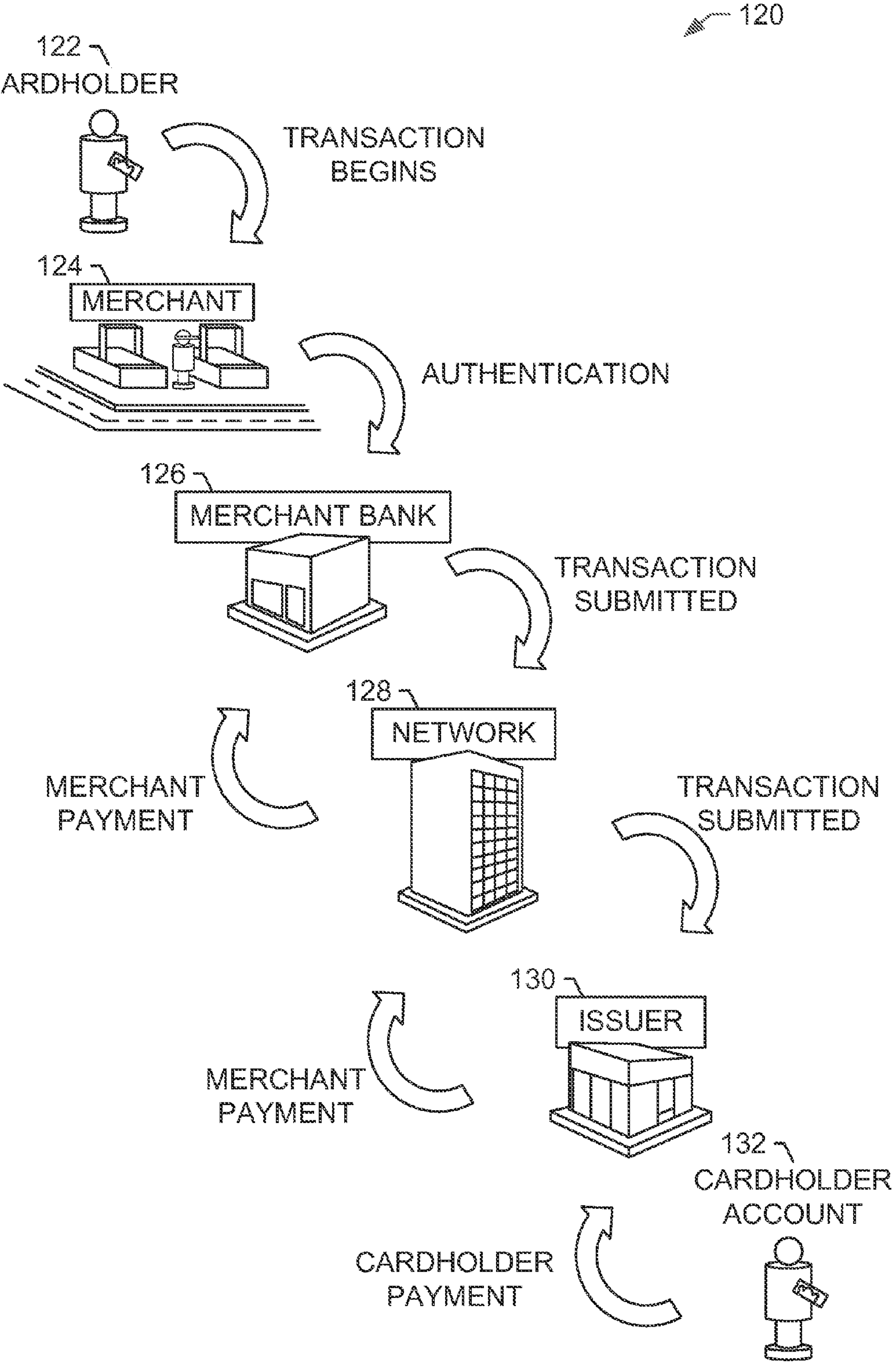


FIG. 1


120
122
CARDHOLDER
TRANSACTION BEGINS
124
MERCHANT
AUTHENTICATION
126
MERCHANT BANK
TRANSACTION SUBMITTED
128
NETWORK
MERCHANT PAYMENT
TRANSACTION SUBMITTED
130
ISSUER
MERCHANT PAYMENT
132
CARDHOLDER ACCOUNT
CARDHOLDER PAYMENT

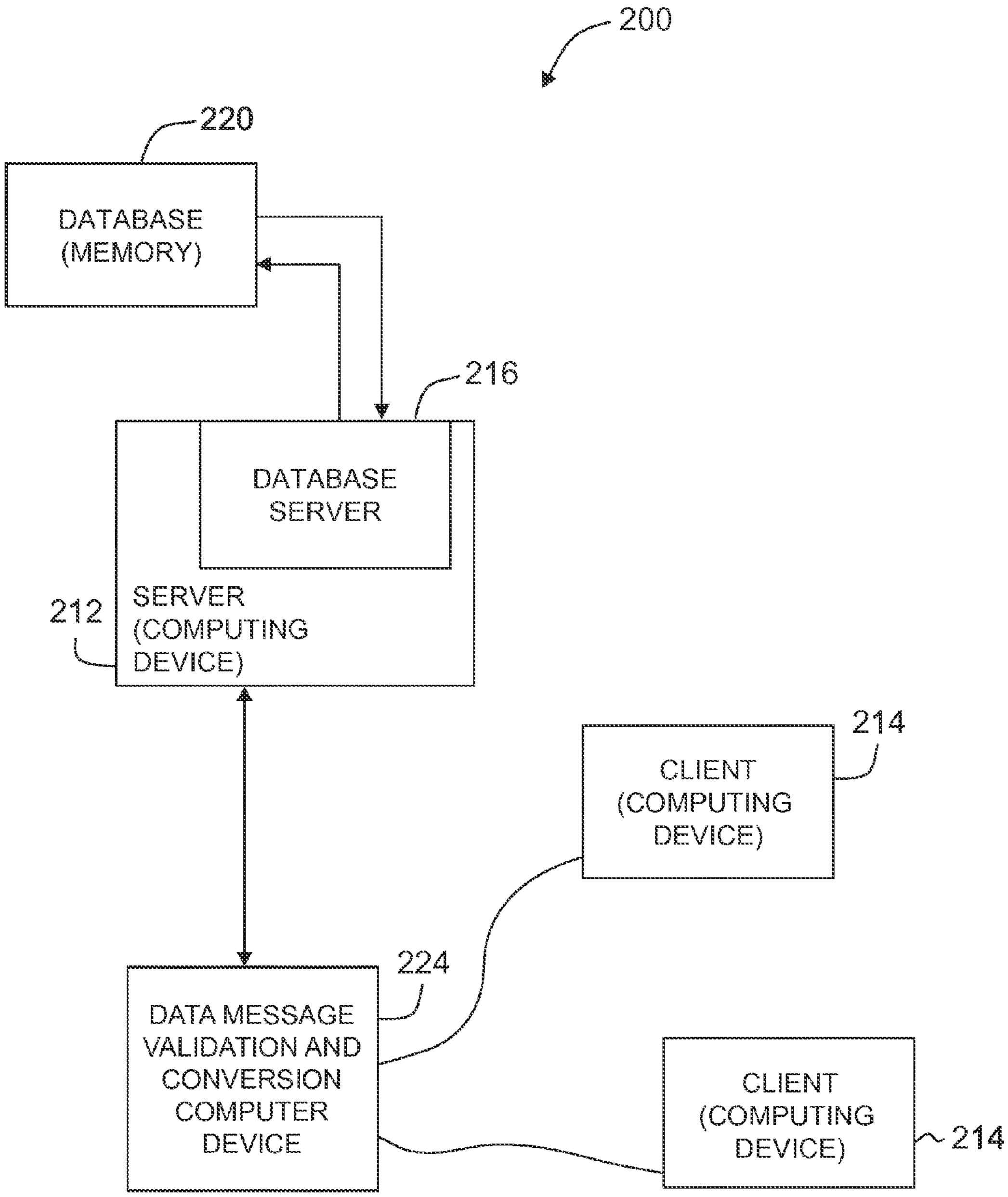

200
220
DATABASE
(MEMORY)
216
DATABASE
SERVER
212
SERVER
(COMPUTING
DEVICE)
214
CLIENT
(COMPUTING
DEVICE)
224
DATA MESSAGE
VALIDATION AND
CONVERSION
COMPUTER
DEVICE
CLIENT
(COMPUTING
DEVICE)
214

FIG. 2

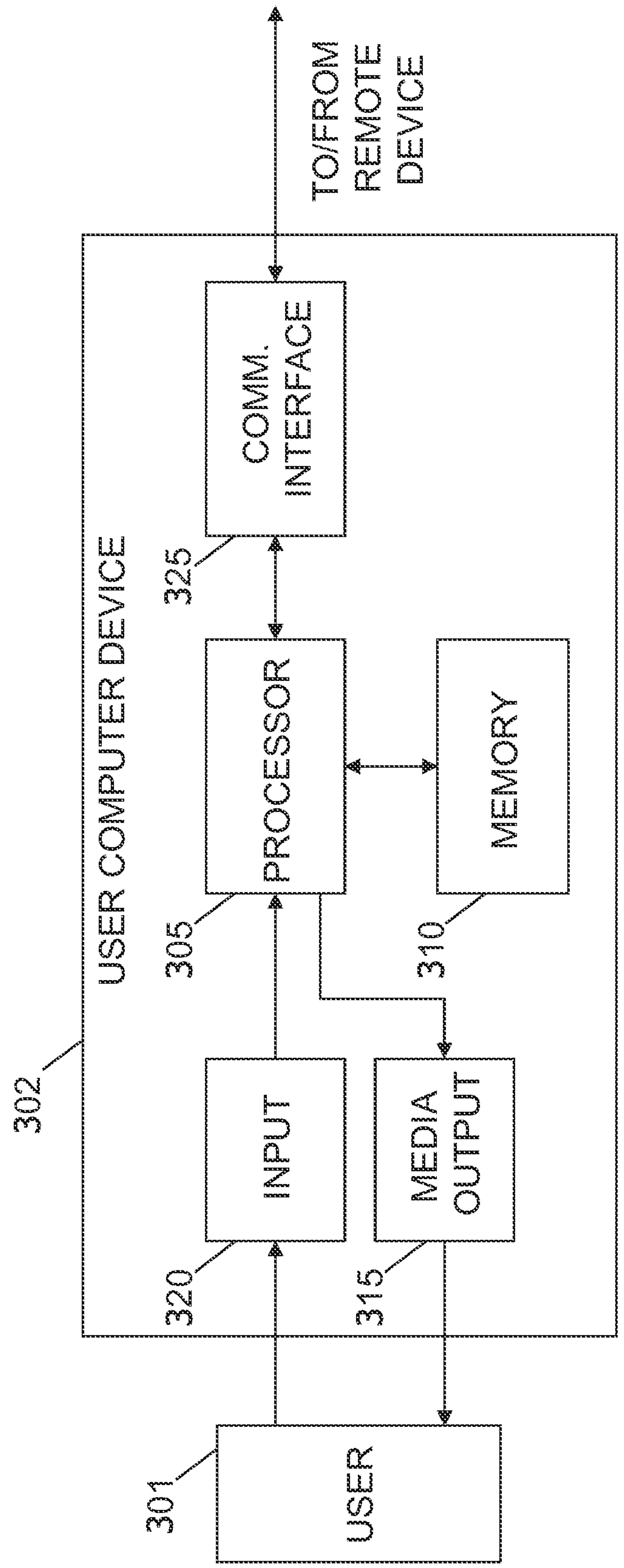

301
USER
302
USER COMPUTER DEVICE
320
INPUT
315
MEDIA OUTPUT
305
PROCESSOR
310
MEMORY
325
COMM. INTERFACE
TO/FROM REMOTE DEVICE

FIG. 3

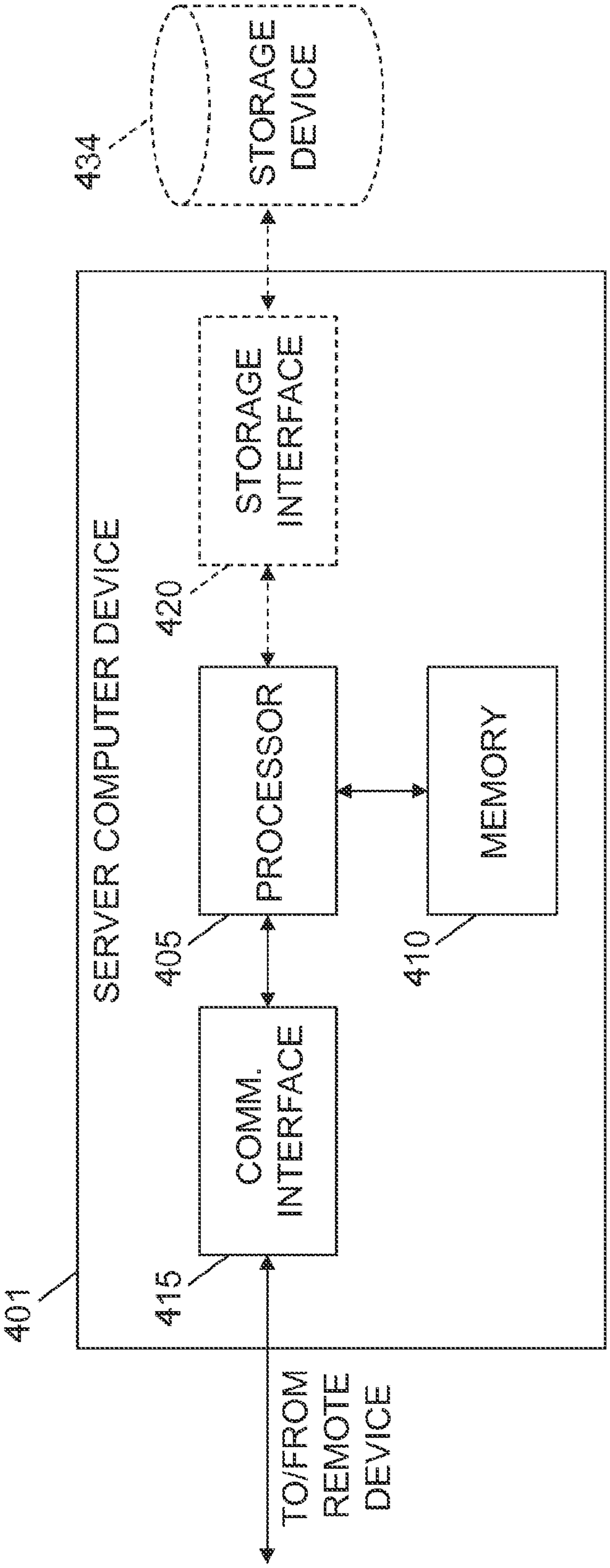

434
STORAGE DEVICE
SERVER COMPUTER DEVICE
420
STORAGE INTERFACE
PROCESSOR
405
MEMORY
410
401
COMM. INTERFACE
415
TO/FROM REMOTE DEVICE

FIG. 4

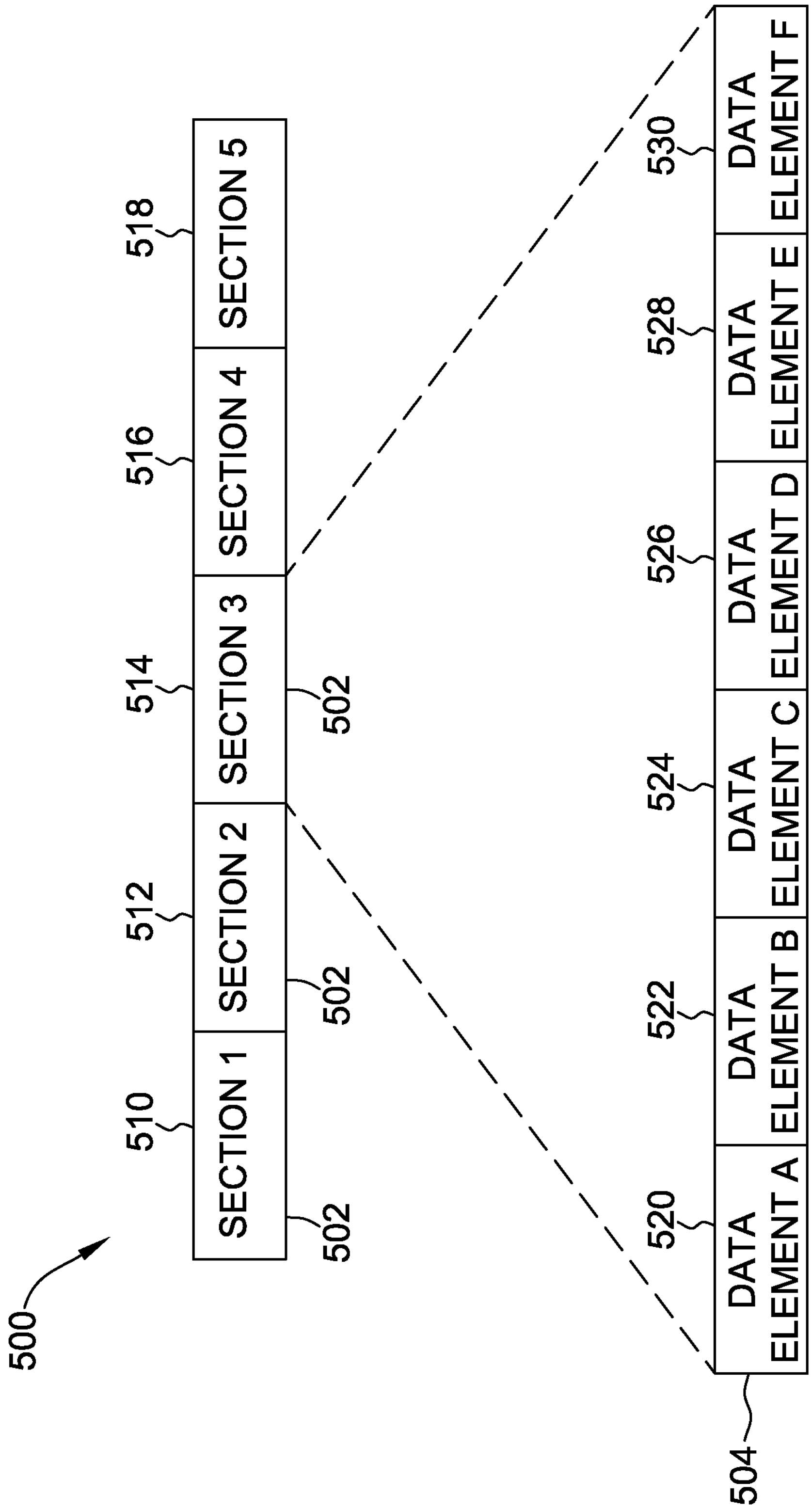

500
510
SECTION 1
502
512
SECTION 2
502
514
SECTION 3
502
516
SECTION 4
518
SECTION 5
504
520
DATA ELEMENT A
522
DATA ELEMENT B
524
DATA ELEMENT C
526
DATA ELEMENT D
528
DATA ELEMENT E
530
DATA ELEMENT F

FIG. 5

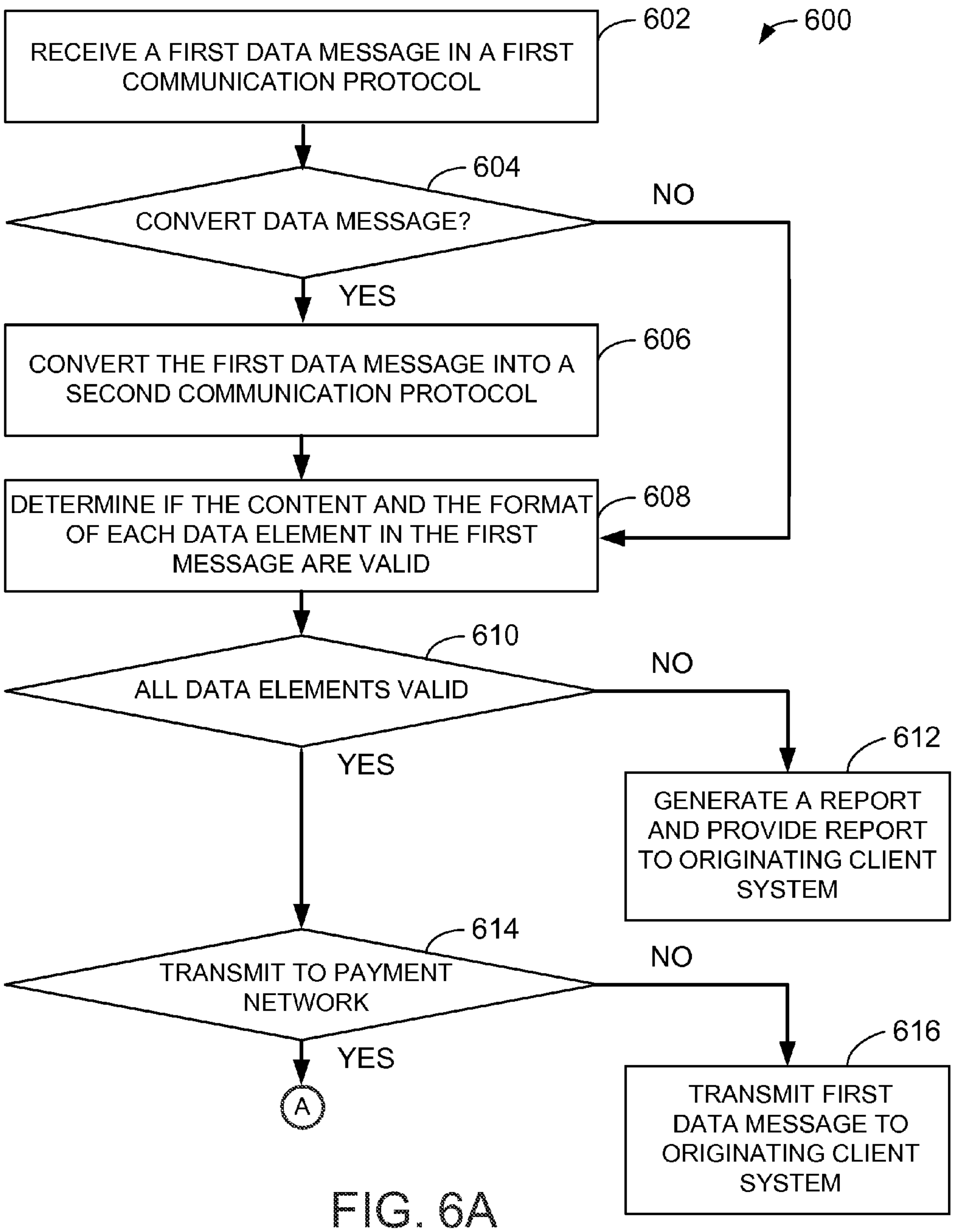

600
602
RECEIVE A FIRST DATA MESSAGE IN A FIRST COMMUNICATION PROTOCOL
604
CONVERT DATA MESSAGE?
NO
YES
606
CONVERT THE FIRST DATA MESSAGE INTO A SECOND COMMUNICATION PROTOCOL
608
DETERMINE IF THE CONTENT AND THE FORMAT OF EACH DATA ELEMENT IN THE FIRST MESSAGE ARE VALID
610
ALL DATA ELEMENTS VALID
NO
YES
612
GENERATE A REPORT AND PROVIDE REPORT TO ORIGINATING CLIENT SYSTEM
614
TRANSMIT TO PAYMENT NETWORK
NO
YES
A
616
TRANSMIT FIRST DATA MESSAGE TO ORIGINATING CLIENT SYSTEM

FIG. 6A

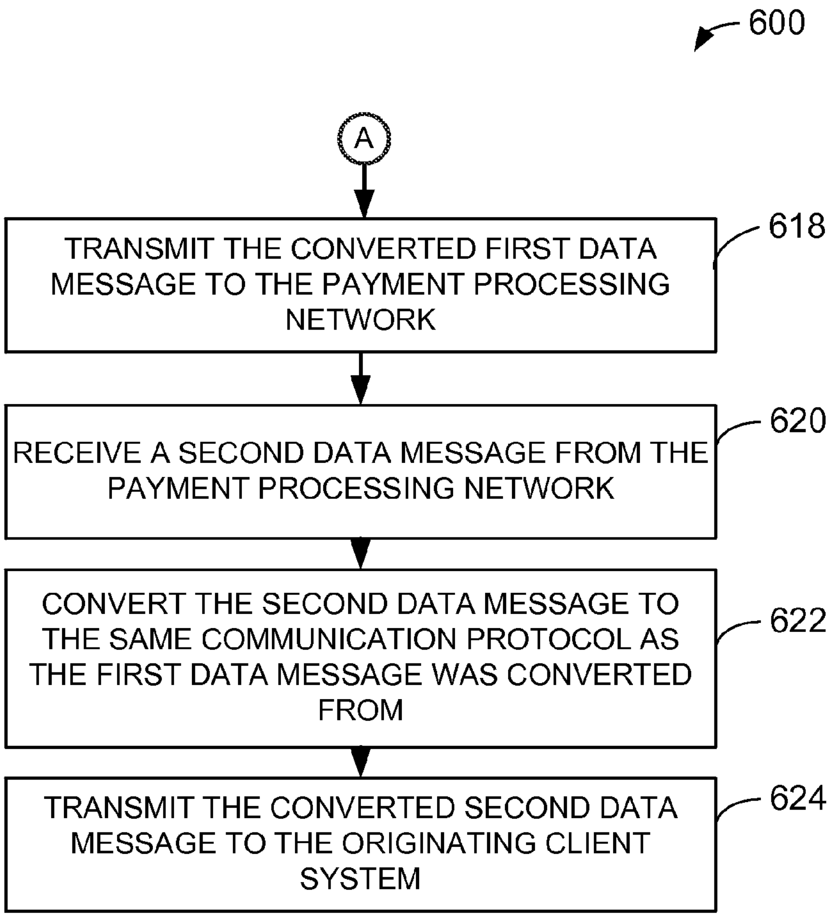

600
A
TRANSMIT THE CONVERTED FIRST DATA MESSAGE TO THE PAYMENT PROCESSING NETWORK
618
RECEIVE A SECOND DATA MESSAGE FROM THE PAYMENT PROCESSING NETWORK
620
CONVERT THE SECOND DATA MESSAGE TO THE SAME COMMUNICATION PROTOCOL AS THE FIRST DATA MESSAGE WAS CONVERTED FROM
622
TRANSMIT THE CONVERTED SECOND DATA MESSAGE TO THE ORIGINATING CLIENT SYSTEM
624

FIG. 6B

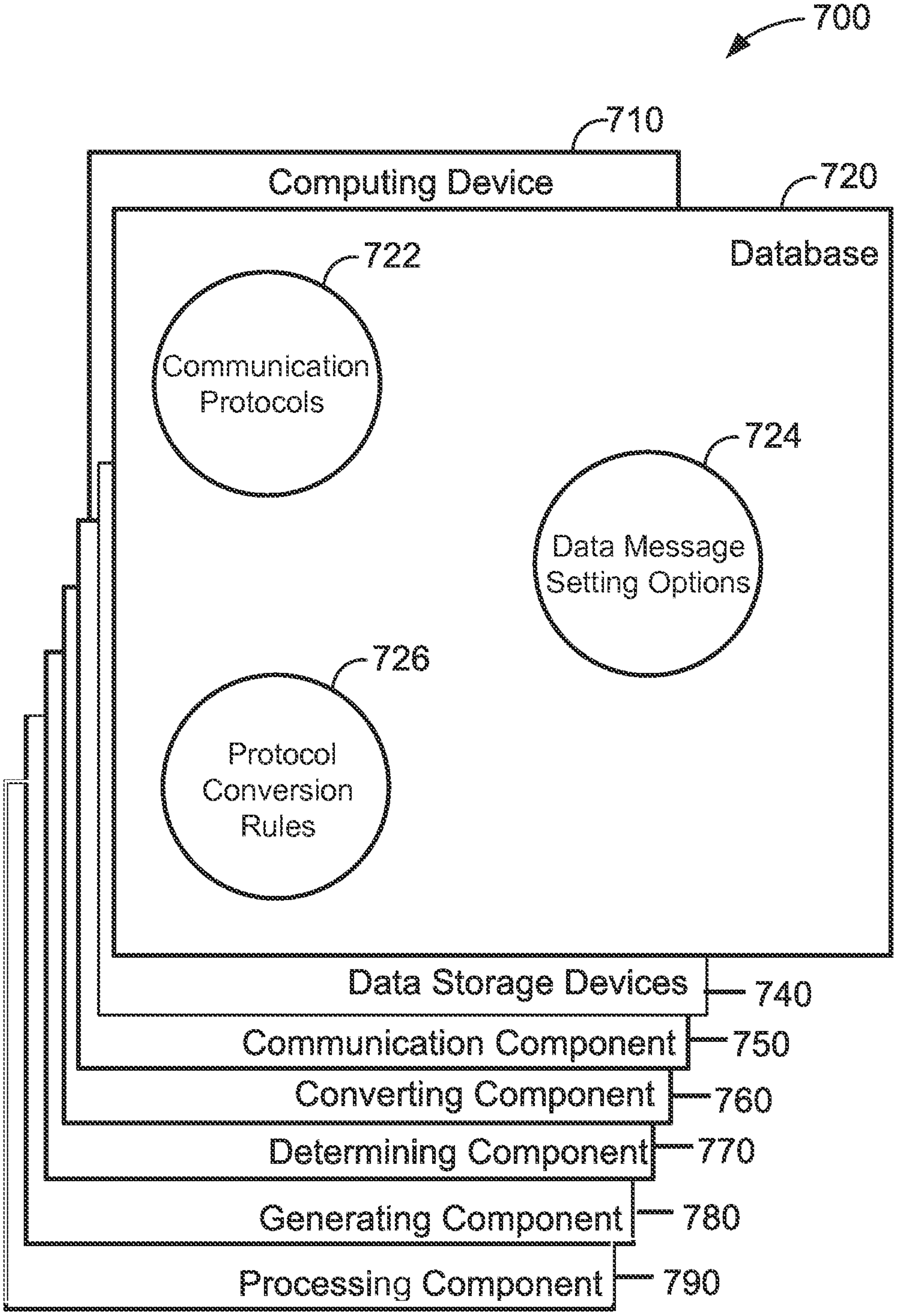

700
710
Computing Device
720
Database
722
Communication Protocols
724
Data Message Setting Options
726
Protocol Conversion Rules
Data Storage Devices
740
Communication Component
750
Converting Component
760
Determining Component
770
Generating Component
780
Processing Component
790

FIG. 7

SYSTEMS AND METHODS FOR MESSAGE CONVERSION AND VALIDATION

BACKGROUND OF THE DISCLOSURE

[0001] The field of the disclosure relates generally to data messages, and more specifically to methods and systems for validating and converting data messages between communication protocols.

[0002] Computer networks include numerous computing devices that send messages from one computing device to another. These data messages include multiple data fields, with each data field including at least one data element. In at least some cases, these data messages must follow a formal communication protocol or format so that the data elements within the data message can be understood by the computing device receiving the data message. In some additional cases, different computer networks communicate through different communication protocols, requiring conversion from one communication protocol to another to allow computing devices from different computer networks to communicate with each other.

[0003] Converting from one communication protocol to another protocol so that computer devices on different computer networks are able to communicate with one another is time consuming and oftentimes requires specialized computer training. It would be advantageous to have a system and method configured to easily allow computer devices operating under different communication protocols to be able to validate and convert messages for transmitting between the different communication protocols without requiring users with significant expertise.

BRIEF DESCRIPTION OF THE DISCLOSURE

[0004] In one aspect, a computer-implemented method for validating and converting a data message is provided. The method is implemented using a data message validation and conversion (DMVC) computer device in communication with a memory. The method includes receiving from a client computer device a first data message in a first communication protocol. The first data message includes a plurality of data elements, where each data element of the plurality of data elements includes a format and a content. The first data message also includes at least one setting option. The method also includes converting by the DMVC computer device the first data message into a second communication protocol based on the at least one setting option, determining by the DMVC computer device if the format and the content of each data element of the plurality of data elements is valid, if the determination is that at least one of the format and the content of at least one data element is not valid, generating a detailed report about the first data message and providing the detailed report to the client computer device, and if the determination is that the format and the content of the plurality of data elements is valid, transmitting the converted first data message to a destination based on the at least one setting option.

[0005] In another aspect, a data message validation and conversion (DMVC) computer device used to validate and convert data messages is provided. The DMVC computer device includes a processor communicatively coupled to a memory device. The processor is programmed to receive from a client computer device a first data message in a first communication protocol. The first data message includes a plurality of data elements, where each data element of the plurality of data elements includes a format and a content. The first data message also includes at least one setting option. The processor is also programmed to convert the first data message into a second communication protocol based on the at least one setting option, determine if the format and the content of each data element of the plurality of data elements is valid, if the determination is that at least one of the format and the content of at least one data element is not valid, generate a detailed report about the first data message and provide the detailed report to the client computer device, and if the determination is that the format and the content of the plurality of data elements is valid, transmit the converted first data message to a destination based on the at least one setting option.

[0006] In a further aspect, at least one non-transitory computer-readable storage media having computer-executable instructions embodied thereon is provided. When executed by a data message validation and conversion (DMVC) computer device having at least one processor coupled to at least one memory device, the computer-executable instructions cause the processor to receive from a client computer device a first data message in a first communication protocol. The first data message includes a plurality of data elements, where each data element of the plurality of data elements includes a format and a content. The first data message also includes at least one setting option. The computer-executable instructions also cause the processor to convert the first data message into a second communication protocol based on the at least one setting option, determine if the format and the content of each data element of the plurality of data elements is valid, if the determination is that at least one of the format and the content of at least one data element is not valid, generate a detailed report about the first data message and provide the detailed report to the client computer device, and if the determination is that the format and the content of the plurality of data elements is valid, transmit the converted first data message to a destination based on the at least one setting option.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIGS. **1-7** show example embodiments of the methods and systems described herein.

[0008] FIG. **1** is a schematic diagram illustrating an example multi-party transaction card industry system for enabling payment-by-card transactions in which merchants and card issuers do not need to have a one-to-one special relationship.

[0009] FIG. **2** is a simplified block diagram of an example system used for validating and converting data messages between communication methods in accordance with one example embodiment of the present disclosure.

[0010] FIG. **3** illustrates an example configuration of a client system shown in FIG. **2**, in accordance with one embodiment of the present disclosure.

[0011] FIG. **4** illustrates an example configuration of a server system shown in FIG. **2**, in accordance with one embodiment of the present disclosure

[0012] FIG. **5** is a graphical representation of an example data message transmitted and received in the system as shown in FIG. **2**.

[0013] FIGS. **6**A and **6**B are a flowchart of a process of validating and converting a data message using the system shown in FIG. **2**.

[0014] FIG. **7** is a diagram of components of one or more example computing devices that may be used in system shown in FIG. **2**.

[0015] Although specific features of various embodiments may be shown in some drawings and not in others, this is for convenience only. Any feature of any drawing may be referenced and/or claimed in combination with any feature of any other drawing.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0016] The following detailed description of the embodiments of the disclosure refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements. Also, the following detailed description does not limit the claims.

[0017] Acquiring banks may transmit messages, such as authorization request messages, to payment processing networks. These authorization request messages may contain a plurality of data elements. The data elements may include sub-elements and each sub-element may contain sub-fields. Each data element, sub-element, and sub-field may have their own format and range of allowable content. Additionally, many of the data elements are interconnected based on dependencies, where the content of one data element dictates the content of a different data element. If the data elements are not setup and filled in correctly, then the payment processing network responds by notifying the acquiring bank that the message failed. Debugging the failed message to determine which data element(s) were rejected and why is typically done manually and can be a very time-consuming process. For example, the response from the payment processing network about the failed message may include a three digit code, which requires the user debugging the message to look-up the three digit code. The code may point out that a specific field is incorrectly formatted. However, if the error is in a sub-field or sub-element, the response may not indicate where or how the field is incorrectly formatted.

[0018] In addition, some acquiring banks receive messages, such as the aforementioned authorization request message, in one communication protocol and have to convert the message into a different communication protocol for communication with the payment processing network.

[0019] The system and method described herein includes a data message validation and conversion (DMVC) computer device. The DMVC computer device (1) receives a data message in a communication protocol; (2) converts the data message to a different communication protocol; (3) determines if the converted data message is valid; (4) if the data message is determined to be valid, then the DMVC computer device transmits the converted data message; and (5) if the data message is determined to be invalid, the DMVC computer device generates a detailed report about the data message and transmits the detailed report to the originating computer device. In the example embodiment, acquiring banks transmit data messages such as an authorization request message to a payment processing network. The payment processing network requires the data to be transmitted in a particular communication protocol, while the acquiring banks may receive the data for the authorization request message in a different communication protocol.

[0020] In the example embodiment, the DMVC computer device receives a data message from a client computer device associated with an acquiring bank. For example, the data message may be an authorization request message. The data message is in a first communication protocol. The DMVC computer device converts the data message to a second communication protocol. In other embodiments, the first and second communication protocols may include, but are not limited to, American Standard Code for Information Interchange (ASCII), Web Services Description Language Extensible Markup Language (WSDL XML), Extended Binary Coded Decimal Interchange Code (EBCDIC) Binary, HyperText Markup Language (HTML), and JavaScript Object Notation (JSON). The DMVC computer device determines if the data message is valid by comparing the format and the content of the data elements in the data message to rules for proper format and content stored in a database. If the DMVC computer device determines that the data message is valid, then the DMVC computer device transmits the converted data message to the payment processing network or back to the client system for consumption. If the DMVC computer device determines that at least one data element of the data message is invalid, then the DMVC computer device generates a detailed report including reasons that why the data message is invalid. In the detailed report, the DMVC computer device describes each data field (or data element), sub-element, and sub-field that is invalid in the message. The detailed report includes verbose details about the affects data elements, sub-elements, and subfields. The DMVC computer device transmits the report to the client computer device that originated the data message.

[0021] In the example embodiment, the data message includes setting options. These setting options instruct the DMVC computer device on how to handle the data message. In the example embodiment, the setting options include the communication protocol that the data message is received in, the communication protocol that the data message is to be converted to, and where the converted and validated data message is to be transmitted to. In one example, the DMVC computer device may determine from the setting options that the data message is in WSDL XML, that the data message is to be converted to EBCDIC, and to be transmitted to the payment processing network. In another example, the DMVC computer device may determine from the setting options that the data message is in EBCDIC, is not to be converted, and will be returned to the computer that the data message was received from. In some other embodiments, the setting options may indicate that the data message only contains a subset of data elements of a complete authorization request message for validation, and possibly conversion, by the DMVC computer device.

[0022] In other embodiments where the DMVC transmitted the converted data message to the payment processing network, the DMVC computer device receives a reply data message from the payment processing network. The DMVC computer device converts the reply data message to the communication protocol in which the DMVC computer device received the original data message from the client computer device, or a different communication protocol if indicated by the setting options. The DMVC computer device transmits the reply data message to the client computer device from which the original data message was received from.

[0023] In some other embodiments, the DMVC computer device receives the data message in a first communication protocol from a client computer device. The DMVC computer device converts the data message to a different communication protocol. The DMVC computer device validates the converted data message. The DMVC computer device transmits the converted data message to the client computer device. In some embodiments, the DMVC computer device also generates and transmits a report about the conversion and validation of the data message to the client computer device.

[0024] In some embodiments, the DMVC computer device is configured to receive individual data elements or data fields for validation. For example, the DMVC computer device may receive, from the client computer device, a data message containing a single data element and information indicating where in an authorization request message the data element is located. The DMVC computer device uses the stored rules about the proper format and content for that data element to validate the received data element. The DMVC computer device generates a detailed and verbose report about the format and the content of the data element and returns the detailed verbose report to the client computer device.

[0025] The methods and systems described herein may be implemented using computer programming or engineering techniques including computer software, firmware, hardware, or any combination or subset. As disclosed above, at least one technical problem with known systems is it is difficult and time consuming to test individual data elements of a long data message with many interconnected data elements. The systems and methods described herein address that technical problem. The technical effect of the systems and processes described herein is achieved by performing at least one of the following steps: (a) receiving, from a client computer device, a first data message in a first communication protocol, wherein the first data message includes a plurality of data elements, wherein each data element of the plurality of data elements includes a format and a content, and wherein the first data message includes at least one setting option; (b) converting, by the DMVC computer device, the first data message into a second communication protocol based on the at least one setting option; (c) determining, by the DMVC computer device, if the format and the content of each data element of the plurality of data elements is valid, by (1) storing a plurality of format and content information for a plurality of potential data elements; (2) comparing each data element in the first message to the plurality of format and content information to determine if the format and the content of the corresponding data element is valid; and (3) for each data element where at least one of the format and the content is determined to be not valid, marking the corresponding data element as invalid; (d) if the determination is that at least one of the format and the content of at least one data element is not valid, (1) generating a detailed report about the first data message by (i) for each data element marked as invalid, determining one or more errors in at least one of the format and the content of the corresponding data element; (ii) for each data element marked as invalid, determining a proper format and content for the corresponding data element; and (iii) generating the detailed report based on the one or more errors and the proper format and content for each data element marked as invalid, and (2) providing the detailed report to the client computer device; and (e) if the determination is that the format and the content of the plurality of data elements is valid, (1) transmitting the converted first data message to a destination based on the at least one setting option, wherein the destination is a payment processing network, and wherein the second communication protocol allows communication between the DMVC computer device and the payment processing network (2) receiving, from the payment processing network, a second data message in response to the first data message, wherein the second data message is in the second communication protocol; (3) converting, by the DMVC computer device, the second data message into the first communication protocol; and (4) transmitting, to the client computer device, the converted second data message. The resulting technical effect is that the time to debug the data elements of a data message is reduced. An additional technical effect is that data messages are converted to setup communication with payment processing networks more quickly.

[0026] Described herein are computer systems such as DMVC computer devices and related computer systems. As described herein, all such computer systems include a processor and a memory. However, any processor in a computer device referred to herein may also refer to one or more processors wherein the processor may be in one computing device or a plurality of computing devices acting in parallel. Additionally, any memory in a computer device referred to herein may also refer to one or more memories wherein the memories may be in one computing device or a plurality of computing devices acting in parallel.

[0027] As used herein, a processor may include any programmable system including systems using micro-controllers, reduced instruction set circuits (RISC), application specific integrated circuits (ASICs), logic circuits, and any other circuit or processor capable of executing the functions described herein. The above examples are example only, and are thus not intended to limit in any way the definition and/or meaning of the term “processor.”

[0028] As used herein, the term “database” may refer to either a body of data, a relational database management system (RDBMS), or to both. As used herein, a database may include any collection of data including hierarchical databases, relational databases, flat file databases, object-relational databases, object oriented databases, and any other structured collection of records or data that is stored in a computer system. The above examples are example only, and thus are not intended to limit in any way the definition and/or meaning of the term database. Examples of RDBMS’s include, but are not limited to including, Oracle® Database, MySQL, IBM® DB2, Microsoft® SQL Server, Sybase®, and PostgreSQL. However, any database may be used that enables the systems and methods described herein. (Oracle is a registered trademark of Oracle Corporation, Redwood Shores, Calif.; IBM is a registered trademark of International Business Machines Corporation, Armonk, N.Y.; Microsoft is a registered trademark of Microsoft Corporation, Redmond, Wash.; and Sybase is a registered trademark of Sybase, Dublin, Calif.)

[0029] In one embodiment, a computer program is provided, and the program is embodied on a computer readable medium. In an example embodiment, the system is executed on a single computer system, without requiring a connection to a sever computer. In a further embodiment, the system is being run in a Windows® environment (Windows is a registered trademark of Microsoft Corporation, Redmond, Wash.). In yet another embodiment, the system is run on a mainframe environment and a UNIX® server environment (UNIX is a registered trademark of X/Open Company Limited located in Reading, Berkshire, United Kingdom). The application is flexible and designed to run in various different environments without compromising any major functionality. In some embodiments, the system includes multiple components distributed among a plurality of computing devices. One or more components may be in the form of computer-executable instructions embodied in a computer-readable medium.

[0030] As used herein, an element or step recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural elements or steps, unless such exclusion is explicitly recited. Furthermore, references to "example embodiment" or "one embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features.

[0031] As used herein, the terms "software" and "firmware" are interchangeable, and include any computer program stored in memory for execution by a processor, including RAM memory, ROM memory, EPROM memory, EEPROM memory, and non-volatile RAM (NVRAM) memory. The above memory types are example only, and are thus not limiting as to the types of memory usable for storage of a computer program.

[0032] As used herein, the terms "transaction card," "financial transaction card," and "payment card" refer to any suitable transaction card, such as a credit card, a debit card, a charge card, a membership card, a promotional card, a frequent flyer card, an identification card, a prepaid card, a gift card, and/or any other device that may hold payment account information, such as mobile phones, Smartphones, personal digital assistants (PDAs), key fobs, and/or computers. Each type of transaction card can be used as a method of payment for performing a transaction. In addition, consumer card account behavior can include but is not limited to purchases, management activities (e.g., balance checking), bill payments, achievement of targets (meeting account balance goals, paying bills on time), and/or product registrations (e.g., mobile application downloads).

[0033] Furthermore, as used herein, the term "real-time" refers to at least one of the time of occurrence of the associated events, the time of measurement and collection of predetermined data, the time to process the data, and the time of a system response to the events and the environment. In the embodiments described herein, these activities and events occur substantially instantaneously.

[0034] The systems and processes are not limited to the specific embodiments described herein. In addition, components of each system and each process can be practiced independent and separate from other components and processes described herein. Each component and process also can be used in combination with other assembly packages and processes.

[0035] The following detailed description illustrates embodiments of the disclosure by way of example and not by way of limitation. It is contemplated that the disclosure has general application to validating and converting data messages between communication methods.

[0036] FIG. **1** is a schematic diagram illustrating an example multi-party transaction card industry system **120** for enabling payment-by-card transactions in which merchants **124** and card issuers **130** do not need to have a one-to-one special relationship. Embodiments described herein may relate to a transaction card system, such as a credit card payment system using the MasterCard® interchange network. The MasterCard® interchange network is a set of proprietary communications standards promulgated by MasterCard International Incorporated® for the exchange of financial transaction data and the settlement of funds between financial institutions that are members of MasterCard International Incorporated®. (MasterCard is a registered trademark of MasterCard International Incorporated located in Purchase, N.Y.).

[0037] In a typical transaction card system, a financial institution called the "issuer" issues a transaction card or electronic payments account identifier, such as a credit card, to a consumer or cardholder **122**, who uses the transaction card to tender payment for a purchase from a merchant **124**. To accept payment with the transaction card, merchant **124** must normally establish an account with a financial institution that is part of the financial payment system. This financial institution is usually called the "merchant bank," the "acquiring bank," or the "acquirer." When cardholder **122** tenders payment for a purchase with a transaction card, merchant **124** requests authorization from a merchant bank **126** for the amount of the purchase. The request may be performed over the telephone, but is usually performed through the use of a point-of-sale terminal, which reads cardholder's **122** account information from a magnetic stripe, a chip, or embossed characters on the transaction card and communicates electronically with the transaction processing computers of merchant bank **126**. Alternatively, merchant bank **126** may authorize a third party to perform transaction processing on its behalf. In this case, the point-of-sale terminal will be configured to communicate with the third party. Such a third party is usually called a "merchant processor," an "acquiring processor," or a "third party processor."

[0038] Using an interchange network **128** (also known as a payment network), computers of merchant bank **126** or merchant processor will communicate with computers of an issuer bank **130** to determine whether cardholder's **122** account **132** is in good standing and whether the purchase is covered by cardholder's **122** available credit line. Based on these determinations, the request for authorization will be declined or accepted. If the request is accepted, an authorization code is issued to merchant **124**.

[0039] When a request for authorization is accepted, the available credit line of cardholder's **122** account **132** is decreased. Normally, a charge for a payment card transaction is not posted immediately to cardholder's **122** account **132** because bankcard associations, such as MasterCard International Incorporated®, have promulgated rules that do not allow merchant **124** to charge, or "capture," a transaction until goods are shipped or services are delivered. However, with respect to at least some debit card transactions, a charge may be posted at the time of the transaction. When merchant **124** ships or delivers the goods or services, merchant **124** captures the transaction by, for example, appropriate data entry procedures on the point-of-sale terminal. This may include bundling of approved transactions daily for standard retail purchases. If cardholder **122** cancels a transaction before it is captured, a "void" is generated. If cardholder **122** returns goods after the transaction has been captured, a "credit" is generated. Interchange network **128** and/or issuer bank **130** stores the transaction card information, such as a category of merchant, a merchant identifier, a location where the transaction was completed, amount of purchase, date and time of transaction, in a database **220** (shown in FIG. **2**).

[0040] After a purchase has been made, a clearing process occurs to transfer additional transaction data related to the purchase among the parties to the transaction, such as merchant bank **126**, interchange network **128**, and issuer bank **130**. More specifically, during and/or after the clearing process, additional data, such as a time of purchase, a merchant name, a type of merchant, purchase information, cardholder account information, a type of transaction, itinerary information, information regarding the purchased item and/or service, and/or other suitable information, is associated with a transaction and transmitted between parties to the transaction as transaction data, and may be stored by any of the parties to the transaction.

[0041] For debit card transactions, when a request for a personal identification number (PIN) authorization is approved by the issuer, cardholder's account **132** is decreased. Normally, a charge is posted immediately to cardholder's account **132**. The payment card association then transmits the approval to the acquiring processor for distribution of goods/services or information, or cash in the case of an automated teller machine (ATM).

[0042] After a transaction is authorized and cleared, the transaction is settled among merchant **124**, merchant bank **126**, and issuer bank **130**. Settlement refers to the transfer of financial data or funds among merchant's **124** account, merchant bank **126**, and issuer bank **130** related to the transaction. Usually, transactions are captured and accumulated into a "batch," which is settled as a group. More specifically, a transaction is typically settled between issuer bank **130** and interchange network **128**, and then between interchange network **128** and merchant bank **126**, and then between merchant bank **126** and merchant **124**.

[0043] FIG. **2** is a simplified block diagram of an example system **200** used for validating and converting data messages between communication methods in accordance with one example embodiment of the present disclosure. In the example embodiment, system **200** may be used for processing cardholder transactions. In some embodiments, system **200** is a payment processing system that includes a data message validation and conversion ("DMVC") computer device **224** configured to validate and convert data messages between communication methods. In other embodiments, system **200** is a standalone system for testing data messages and includes DMVC computer device **224** to validate and convert test data messages between communication methods. As described below in more detail, DMVC computer device **224** is configured to receive a data message via a first communication protocol, convert the data message to a different communication protocol, and determine if the data message is valid. If the data message is determined to be invalid, DMVC computer device **224** is configured to generate a detailed report about the data message and transmit the detailed report to the originating computer device, and if the data message is determined to be valid, DMVC computer device **224** is configured to transmit the converted data message.

[0044] In the example embodiment, client systems **214** (also known as client computing devices) are computers that include a web browser or a software application, which enables client systems **214** to access server system **212** using the Internet. More specifically, client systems **214** are communicatively coupled to the Internet through many interfaces including, but not limited to, at least one of a network, such as the Internet, a local area network (LAN), a wide area network (WAN), or an integrated services digital network (ISDN), a dial-up-connection, a digital subscriber line (DSL), a cellular phone connection, and a cable modem. Client systems **214** can be any device capable of accessing the Internet including, but not limited to, a desktop computer, a laptop computer, a personal digital assistant (PDA), a cellular phone, a smartphone, a tablet, a phablet, or other web-based connectable equipment.

[0045] A database server **216** is communicatively coupled to a database **220** that stores data. In one embodiment, database **220** includes content and format rules for multiple different communication protocols, rules for converting messages between the different communication protocols, and a list of setting options sent with each data message by each client system **214** from which DMVC computer device **224** has received data messages from. In the example embodiment, database **220** is stored remotely from server system **212**. In some embodiments, database **220** is decentralized.

[0046] DMVC computer device **224** is communicatively coupled with server system **212** and client systems **214**. DMVC computer device **224** can access server system **212** to store and access data. In some embodiments, DMVC computer device **224** may be associated with, or is part of, payment card system **120**, or in may be communication with payment card system **120**, shown in FIG. **1**. In other embodiments, DMVC computer device **224** is associated with a third party and is merely in communication with payment card system **120**. In some embodiments, DMVC computer device **224** may be associated with, or be part of, at least one of merchant bank **126**, interchange network **128**, and issuer bank **130**, all shown in FIG. **1**.

[0047] In some embodiments, server system **212** may be associated with a financial transaction interchange network **128**, shown in FIG. **1**, and may be referred to as an interchange computer system. Server system **212** may be used for processing transaction data and analyzing for the transaction data for fraudulent transactions. In addition, at least one of client systems **214** may include a computer system associated with an issuer of a transaction card. Accordingly, server system **212** and client systems **214** may be utilized to process transaction data relating to purchases a cardholder **122** (shown in FIG. **1**) makes utilizing a transaction card processed by interchange network **128** and issued by associated issuer **130**. At least one client system **214** may be associated with a user or a cardholder seeking to register, access information, or process a transaction with at least one of interchange network **128**, issuer **130**, or merchant **124**. In addition, client systems **214** may include point-of-sale (POS) devices associated with a merchant and used for processing payment transactions. In the example embodiment, client systems **214** may be associated with merchant bank **126** and transmit transactions originating from merchant **124**, while server system **212** may be interchange network **128**. At least one client system **214** may be used for testing data messages.

[0048] FIG. **3** illustrates an example configuration of client system **214** shown in FIG. **2**, in accordance with one embodiment of the present disclosure. User computer device

302 is operated by a user **301**. User computer device **302** may include, but is not limited to, client systems **214** and DMVC computer device **224** (both shown in FIG. **2**). User computer device **302** includes a processor **305** for executing instructions. In some embodiments, executable instructions are stored in a memory area **310**. Processor **305** may include one or more processing units (e.g., in a multi-core configuration). Memory area **310** is any device allowing information such as executable instructions and/or transaction data to be stored and retrieved. Memory area **310** may include one or more computer readable media.

[0049] User computer device **302** also includes at least one media output component **315** for presenting information to user **301**. Media output component **315** is any component capable of conveying information to user **301**. In some embodiments, media output component **315** includes an output adapter (not shown) such as a video adapter and/or an audio adapter. The output adapter is operatively coupled to processor **305** and operatively coupleable to an output device such as a display device (e.g., a cathode ray tube (CRT), liquid crystal display (LCD), light emitting diode (LED) display, or "electronic ink" display) or an audio output device (e.g., a speaker or headphones). In some embodiments, media output component **315** is configured to present a graphical user interface (e.g., a web browser and/or a client application) to user **301**. A graphical user interface may include, for example, an online store interface for viewing and/or purchasing items, and/or a wallet application for managing payment information. In some embodiments, user computer device **302** includes an input device **320** for receiving input from user **301**. User **301** may use input device **320** to, without limitation, select and/or enter one or more items to purchase and/or a purchase request, or to access credential information, and/or payment information. Input device **320** may include, for example, a keyboard, a pointing device, a mouse, a stylus, a touch sensitive panel (e.g., a touch pad or a touch screen), a gyroscope, an accelerometer, a position detector, a biometric input device, and/or an audio input device. A single component such as a touch screen may function as both an output device of media output component **315** and input device **320**.

[0050] User computer device **302** may also include a communication interface **325**, communicatively coupled to a remote device such as server system **212** (shown in FIG. **2**). Communication interface **325** may include, for example, a wired or wireless network adapter and/or a wireless data transceiver for use with a mobile telecommunications network.

[0051] Stored in memory area **310** are, for example, computer-readable instructions for providing a user interface to user **301** via media output component **315** and, optionally, receiving and processing input from input device **320**. A user interface may include, among other possibilities, a web browser and/or a client application. Web browsers enable users, such as user **301**, to display and interact with media and other information typically embedded on a web page or a website from server system **212**. A client application allows user **301** to interact with, for example, server system **212**. For example, instructions may be stored by a cloud service, and the output of the execution of the instructions sent to media output component **315**.

[0052] Processor **305** executes computer-executable instructions for implementing aspects of the disclosure. In some embodiments, processor **305** is transformed into a special purpose microprocessor by executing computer-executable instructions or by otherwise being programmed. For example, processor **305** is programmed with instruction such as illustrated in FIGS. **6**A and **6**B.

[0053] FIG. **4** illustrates an example configuration of server system **212** shown in FIG. **2**, in accordance with one embodiment of the present disclosure. Server computer device **401** may include, but is not limited to, server system **212**, DMVC computer device **224**, and database server **216** (shown in FIG. **2**). Server computer device **401** also includes a processor **405** for executing instructions. Instructions may be stored in a memory area **410**. Processor **405** may include one or more processing units (e.g., in a multi-core configuration).

[0054] Processor **405** is operatively coupled to a communication interface **415** such that server computer device **401** is capable of communicating with a remote device such as another server computer device **401**, client systems **214** (shown in FIG. **2**), or DMVC computer device **224**. For example, communication interface **415** may receive requests from client systems **214**, as illustrated in FIG. **2**.

[0055] Processor **405** may also be operatively coupled to a storage device **434**. Storage device **434** is any computer-operated hardware suitable for storing and/or retrieving data, such as, but not limited to, data associated with database **220** (shown in FIG. **2**). In some embodiments, storage device **434** is integrated in server computer device **401**. For example, server computer device **401** may include one or more hard disk drives as storage device **434**. In other embodiments, storage device **434** is external to server computer device **401** and may be accessed by a plurality of server computer devices **401**. For example, storage device **434** may include a storage area network (SAN), a network attached storage (NAS) system, and/or multiple storage units such as hard disks and/or solid state disks in a redundant array of inexpensive disks (RAID) configuration.

[0056] In some embodiments, processor **405** is operatively coupled to storage device **434** via a storage interface **420**. Storage interface **420** is any component capable of providing processor **405** with access to storage device **434**. Storage interface **420** may include, for example, an Advanced Technology Attachment (ATA) adapter, a Serial ATA (SATA) adapter, a Small Computer System Interface (SCSI) adapter, a RAID controller, a SAN adapter, a network adapter, and/or any component providing processor **405** with access to storage device **434**.

[0057] FIG. **5** is a graphical representation of an example data message **500** transmitted and received in system **200** as shown in FIG. **2**. Data message **500** is read by computer devices such as DMVC computer device **224** and server system **212** (both shown in FIG. **2**). In the example embodiment, data message **500** includes a plurality of sections **502** (i.e. section **1 510**, section **2 512**, section **3 514**, section **4 516**, and section **5 518**). Each section **502** includes a plurality of data elements **504**. For example, section **3 514** includes six data elements **504** (i.e., data element A **520**, data element B **522**, data element C **524**, data element D **526**, data element E **528**, and data element F **530**). In some embodiment, each section **502** includes differing numbers of data elements. For example, section **1 510** may include seven data elements **504**, while section **2 512** includes 25 data elements **504**. Each data element **504**, includes a format and a content. In the example embodiment, the format is the length and the position of data element **504** and the content is the data that data element **504** contains. For example, if data message **500** is an authorization request message for payment system **120** (shown in FIG. **1**) then data element A **520** may contain a transaction amount. In this example, the format of data element A **520** may be four bytes long and located at bytes **45** through **48** in an authorization request message. Additionally, the content of data element A **520** may be a signed integer from −2,147,483,647 to 2,147,483,647, where the right-most two digits represent numbers to the right of the decimal point. In another example, the four bytes of transaction amount may be divided up so that the right-most byte may represent an amount to the right of the decimal, while the other three bytes represent the left of the decimal.

[0058] In some embodiments, the format and the content of data element **504** may change based on a previous or later data element. For example, data element A **520** may be a transaction amount with four bytes, while data element B **522** may be currency type and only occupy one byte. While one currency type may require data element A **520** to be formatted as three bytes and one byte, for the left and the right of the decimal point respectively, another currency type may require data element A **520** to be formatted as four bytes, or as 1 bit, 24 bits, and 7 bits.

[0059] Additionally, the content of data element **504** may indicate if another data element **504** is used. For example, data element D **526** may be a country code and element E **528** may be a postal code for originating merchant **124** (shown in FIG. **1**). In some countries such as Ireland, postal codes are not used. When DMVC computer device **224** reads data element D **526**, DMVC computer device **224** may determine that the contents of data element D **526** represent the country of Ireland. In the example embodiment, data element D **526** contains a number. DMVC computer device **224** compares the number in data element D **526** to a list of country codes stored in database **220** (shown in FIG. **2**) and determines that the number in data element D **526** represents the country of Ireland. DMVC computer device **224** confirms that data element E **528** is empty (i.e., filled with zeros).

[0060] In the example embodiment, data elements **504** may have different formats and content requirements in different communication protocols. For example, in a first communication protocol, transaction amount and currency type are located in data element A **520**, and data element B **522**, respectively. In a second communication protocol, data element A **520** may contain currency amount, and data element B may contain transaction amount. In a third communication protocol, transaction amount may be stored in a data element **504** in section **2** **512**, while currency type is stored in data element C **524** in section **3** **514**. Additionally, the size of data elements **504** for the same item may change between communication protocols. For example, currency type may be one byte long in a first communication protocol, two bytes long in a second communication protocol, and seven bits long in a third communication protocol. In the example embodiment, different communication protocols may include, but are not limited to, American Standard Code for Information Interchange (ASCII), Web Services Description Language Extensible Markup Language (WSDL XML), Extended Binary Coded Decimal Interchange Code (EBCDIC) Binary, HyperText Markup Language (HTML), and JavaScript Object Notation (JSON).

[0061] FIGS. **6**A and **6**B are a flowchart of a process **600** of validating and converting a data message using system **200** shown in FIG. **2**. In the example embodiment, process **600** is performed by DMVC computer device **224** (shown in FIG. **2**).

[0062] DMVC computer device **224** receives **602** a first data message in first communication protocol. In the example embodiment, the first data message includes a plurality of data elements **504** (shown in FIG. **5**) and at least one setting option. In the example embodiment, the at least one setting option includes the communication protocol that the data message is received in, the communication protocol that the data message is to be converted to, and where the converted and validated data message is to be transmitted to. In the example embodiment, DMVC computer device **224** receives **602** the first data message from client system **214** (shown in FIG. **2**), where first data message originated from merchant **124** (shown in FIG. **2**). DMVC computer device **224** determines **604** whether to convert the first data message to a second communication protocol based on the at least one setting option. If the determination is yes, DMVC computer device **224** converts **606** the first data message into the second communication protocol based on the at least one setting option. If the determination is no, DMVC computer device **224** skips the conversion step **606** and proceeds to Step **608**. DMVC computer device **224** determines **608** if the format and the content of each data element **504** in the first data message are valid. DMVC computer device **224** determines **608** if the first data message is valid by comparing the format and the content of each of data elements **504** in the first data message to rules for proper format and content of the corresponding communication protocol stored in database **220** (shown in FIG. **2**).

[0063] If DMVC computer device **224** determines that one or more data elements **504** are invalid, DMVC computer device **224** marks those data elements as invalid. Following the example in FIG. **5**, if DMVC computer device **224** determines that the number in data element D **526** (shown in FIG. **5**) represents the United States of America, DMVC computer device **224** analyzes data element E **528** (shown in FIG. **5**) to determine if data element E **528** is properly formatted for a ZIP+4 code. Additionally, DMVC computer device **224** analyzes the content of the resulting ZIP+4 code to determine if it matches the address of merchant **124**. The address of merchant **124** may be retrieved from database **220** or may be based on the address data transmitted in other data elements **504** of the first data message.

[0064] DMVC computer device **224** checks **610** if any data elements **504** are marked as invalid. If at least one data element **504** is marked invalid, DMVC generates **612** a detailed report about invalid data elements **504** and provides the report to originating client system **214**. In some embodiments, the report is transmitted to the originating client system **214**; in other embodiments, the report is transmitted to a different client system **214**, such as via an e-mail to merchant bank **126**. In the example embodiment, the report is generated to provide verbose debugging information about the invalid data elements **504**. For example, the report may contain a listing of all of data elements **504** included in data message **500**, an indication of each invalid data element, and detailed information about the proper format and content for the invalid data elements. Detailed information about the proper format and content may be stored in database **220** for each potential data message **500**. In some embodiments, the report may contain corrected content for invalid data elements **504** or examples.

[0065] If none of the data elements **504** are invalid, DMVC computer device **224** determines **614** where to transmit the first data message based on the at least one setting option. In the example embodiment, DMVC computer device **224** determines **614** whether or not to transmit the first data message to a part of payment card processing network **120**, such as interchange network **128** (shown in FIG. **1**). If the determination is no, then DMVC computer device **224** transmits **616** the first data message to client system **214** that originally sent first data message. If the determination is yes, DMVC computer device **224** transmits **618** the converted first data message to the desired part of payment processing network **120**, for example interchange network **128**. DMVC computer device **224** receives **620** a second data message from payment processing network **120** in response to the first data message. DMVC computer device **224** converts **622** the second data message to the communication protocol that client system **214** desires based on the at least one setting option. DMVC computer device **224** transmits **624** the converted second data message to originating client system **214**.

[0066] In the example embodiment, the first data message is an authorization request message transmitted by merchant bank **126** and originating from merchant **124** for a transaction conducted with cardholder **122**. DMVC computer device **224** transmits the first data message to server system **212**, which is a part of interchange network **128**. The second data message is an authorization response message transmitted by server system **212** from interchange network **128** in response to the authorization request message.

[0067] In the example embodiment, DMVC computer device **224** converts **606** the first data message before determining **608** if the format and the content of each data element **504** are valid. However, in other embodiments, DMVC computer device **224** converts **606** the first data message after checking **610** that none of data elements **504** in the first data message are invalid. In these other embodiments, the conversion may be done at a later step to ensure that the plurality of data elements **504** in the first data message are valid. In the example embodiment, performing the converting **606** step done before the determining **608** step allows DMVC computer device **224** to determine whether the plurality of data elements **504** in the first data message were in the proper format and content to allow for conversion to the second communication protocol.

[0068] In some other embodiments, DMVC computer device **224** receives the first data message in a first communication protocol from client system **214**. DMVC computer device **224** converts the first data message to a different communication protocol. DMVC computer device **224** validates the converted first data message. DMVC computer device **224** transmits the converted first data message to client system **214**. In some embodiments, DMVC computer device **224** also generates and transmits a detailed report about the conversion and validation of the first data message to client system **214**.

[0069] In some embodiments, DMVC computer device **224** is configured to receive individual data elements **504** or a subset of the data elements in data message **500** for validation and or/conversion. For example, DMVC computer device **224** may receive a data message **500** containing a single data element **504** and information indicating where in data message **500** that data element **504** is located from client system **214**. DMVC computer device **224** uses the stored rules about the proper format and content for that data element **504** to validate the received data element **504**. DMVC computer device **224** generates a detailed and verbose report about the received data element **504** and transmits the detailed and verbose report to client system **214**. In some embodiments, the individual data element **504** or the partial data message **500** is converted to a different communication protocol and transmitted to client system **214**.

[0070] FIG. **7** is a diagram **700** of components of one or more example computing devices that may be used in system **200** shown in FIG. **2**. In some embodiments, computing device **710** is similar to server system **212**; computing device **710** may also be similar to DMVC computer device **224** (both shown in FIG. **2**). Database **720** may be coupled with several separate components within computing device **710**, which perform specific tasks. In this embodiment, database **720** includes communication protocols **722**, data message setting option **724**, and protocol conversion rules **726** for converting between the different communication protocols. In some embodiments, database **720** is similar to database **220** (shown in FIG. **2**).

[0071] Computing device **710** includes database **720** as well as data storage devices **740**. Computing device **710** also includes a communication component **750** for receiving **602** a first data message, providing **612** a report, transmitting **616** the first data message to originating client system, transmitting **618** the converted first data message to the payment processing network, receiving **620** a second data message from the payment processing network, and transmitting **624** a converted second data message, all shown in FIGS. **6**A and B. Computing device **710** also includes a converting component **760** for converting **606** the first data message (shown in FIG. **6**A) and converting **622** the second data message, shown in FIG. **6**B. Computing device **710** further includes a determining component **770** for determining **608** if the content and format of each data element in the first data message are valid, as shown in FIG. **6**A. Moreover, computing device **710** includes a generating component **780** for generating **612** a report, as shown in FIG. **6**A. A processing component **790** assists with execution of computer-executable instructions associated with the system.

[0072] As used herein, the term "non-transitory computer-readable media" is intended to be representative of any tangible computer-based device implemented in any method or technology for short-term and long-term storage of information, such as, computer-readable instructions, data structures, program modules and sub-modules, or other data in any device. Therefore, the methods described herein may be encoded as executable instructions embodied in a tangible, non-transitory, computer readable medium, including, without limitation, a storage device and/or a memory device. Such instructions, when executed by a processor, cause the processor to perform at least a portion of the methods described herein. Moreover, as used herein, the term "non-transitory computer-readable media" includes all tangible, computer-readable media, including, without limitation, non-transitory computer storage devices, including, without limitation, volatile and nonvolatile media, and removable and non-removable media such as a firmware, physical and virtual storage, CD-ROMs, DVDs, and any other digital source such as a network or the Internet, as well as yet to be developed digital means, with the sole exception being a transitory, propagating signal.

[0073] This written description uses examples to disclose the embodiments, including the best mode, and also to enable any person skilled in the art to practice the embodiments, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the disclosure is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial locational differences from the literal languages of the claims.

What is claimed is:

1. A computer-implemented method for validating and converting a data message, the method implemented using a data message validation and conversion (DMVC) computer device in communication with a memory, the method comprising:

receiving, from a client computer device, a first data message in a first communication protocol, wherein the first data message includes a plurality of data elements, wherein each data element of the plurality of data elements includes a format and a content, and wherein the first data message includes at least one setting option;

converting, by the DMVC computer device, the first data message into a second communication protocol based on the at least one setting option;

determining, by the DMVC computer device, if the format and the content of each data element of the plurality of data elements is valid;

if the determination is that at least one of the format and the content of at least one data element is not valid, generating a detailed report about the first data message and providing the detailed report to the client computer device; and

if the determination is that the format and the content of the plurality of data elements is valid, transmitting the converted first data message to a destination based on the at least one setting option.

2. A method in accordance with claim **1**, wherein the destination is a payment processing network, and wherein the second communication protocol allows communication between the DMVC computer device and the payment processing network.

3. A method in accordance with claim **2**, further comprising:

receiving, from the payment processing network, a second data message in response to the first data message, wherein the second data message is in the second communication protocol;

converting, by the DMVC computer device, the second data message into the first communication protocol; and

transmitting, to the client computer device, the converted second data message.

4. A method in accordance with claim **1**, wherein the destination is the client computer device.

5. A method in accordance with claim **1**, wherein determining if the format and the content of each data element is valid further comprises:

storing a plurality of format and content information for a plurality of potential data elements;

comparing each data element in the first message to the plurality of format and content information to determine if the format and the content of the corresponding data element is valid; and

for each data element where at least one of the format and the content is determined to be not valid, marking the corresponding data element as invalid.

6. A method in accordance with claim **5**, wherein generating a detailed report further comprises:

for each data element marked as invalid, determining one or more errors in at least one of the format and the content of the corresponding data element;

for each data element marked as invalid, determining a proper format and content for the corresponding data element; and

generating the detailed report based on the one or more errors and the proper format and content for each data element marked as invalid.

7. A method in accordance with claim **1**, wherein the first data message is an authorization request message.

8. A method in accordance with claim **3**, wherein the second data message is an authorization response message.

9. A method in accordance with claim **1**, wherein the first communication protocol and the second communication protocol include at least one of American Standard Code for Information Interchange (ASCII), Web Services Description Language Extensible Markup Language (WDSL XML), and Extended Binary Coded Decimal Interchange Code (EBCDIC) Binary.

10. A method in accordance with claim **1**, wherein the first data message contains a subset of the data elements in an authorization request message, and wherein method further comprises generating a report that contains information about the format and the content of each data element of the subset of data elements.

11. A data message validation and conversion (DMVC) computer device used to validate and convert data messages, said DMVC computer device comprising a processor communicatively coupled to a memory device, said processor programmed to:

receive from a client computer device a first data message in a first communication protocol, wherein the first data message includes a plurality of data elements, wherein each data element of the plurality of data elements includes a format and a content, and wherein the first data message includes at least one setting option;

convert the first data message into a second communication protocol based on the least one setting option;

determine if the format and the content of each data element of the plurality of data elements is valid;

if the determination is that at least one of the content and the format of at least one data element is not valid, generate a detailed report about the first data message and provide the detailed report to the client computer device; and

if the determination is that the format and the content of the plurality of data elements is valid, transmit the converted first data message to a destination based on the at least one setting option.

12. A DMVC computer device in accordance with claim **11**, wherein the destination is a payment processing network, and wherein the second communication protocol allows communication between the DMVC computer device and the payment processing network.

13. A DMVC computer device in accordance with claim **12**, wherein said processor is further programmed to:

receive a second data message in response to the first data message from the payment processing network, wherein the second data message is in the second communication protocol;

convert the second data message into the first communication protocol; and

transmit the converted second data message to the client computer device.

14. A DMVC computer device in accordance with claim **11**, wherein the destination is the client computer device.

15. A DMVC computer device in accordance with claim **11**, wherein said processor is further programmed to:

store a plurality of format and content information for a plurality of potential data elements;

compare each data element in the first message to the plurality of format and content information to determine if the format and the content of the corresponding data element is valid; and

for each data element where at least one of the format and the content is determined to be not valid, mark the corresponding data element as invalid.

16. A DMVC computer device in accordance with claim **15**, wherein said processor is further programmed to:

for each data element marked as invalid, determine one or more errors in at least one of the format and the content of the corresponding data element;

for each data element marked as invalid, determine a proper format and content for the corresponding data element; and

generate the detailed report based on the one or more errors and the proper format and content for each data element marked as invalid.

17. A DMVC computer device in accordance with claim **11**, wherein the first data message is an authorization request message.

18. A DMVC computer device in accordance with claim **13**, wherein the second data message is an authorization response message.

19. At least one non-transitory computer-readable storage media having computer-executable instructions embodied thereon, wherein when executed by a data message validation and conversion (DMVC) computer device having at least one processor coupled to at least one memory device, the computer-executable instructions cause the processor to:

receive from a client computer device a first data message in a first communication protocol, wherein the first data message includes a plurality of data elements, wherein each data element of the plurality of data elements includes a format and a content, and wherein the first data message includes at least one setting option;

convert the first data message into a second communication protocol based on the at least one setting option;

determine if the format and the content of each data element of the plurality of data elements is valid;

if the determination is that at least one of the format and the content of at least one data element is not valid, generate a detailed report about the first data message and provide the detailed report to the client computer device; and

if the determination is that the format and the content of the plurality of data elements is valid, transmit the converted first data message to a destination based on the at least one setting option.

20. The computer-readable storage medium of claim **19**, wherein the destination is a payment processing network, wherein the second communication protocol allows communication between the DMVC computer device and the payment processing network, wherein the first data message is an authorization request message, and wherein the computer-executable instructions further cause the processor to:

receive a second data message in response to the first data message from the payment processing network, wherein the second data message is in the second communication protocol, and wherein the second data message is an authorization response message;

convert the second data message into the first communication protocol; and

transmit the converted second data message to the client computer device.

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