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(54) **CLOSED LOOP WORKFLOW**

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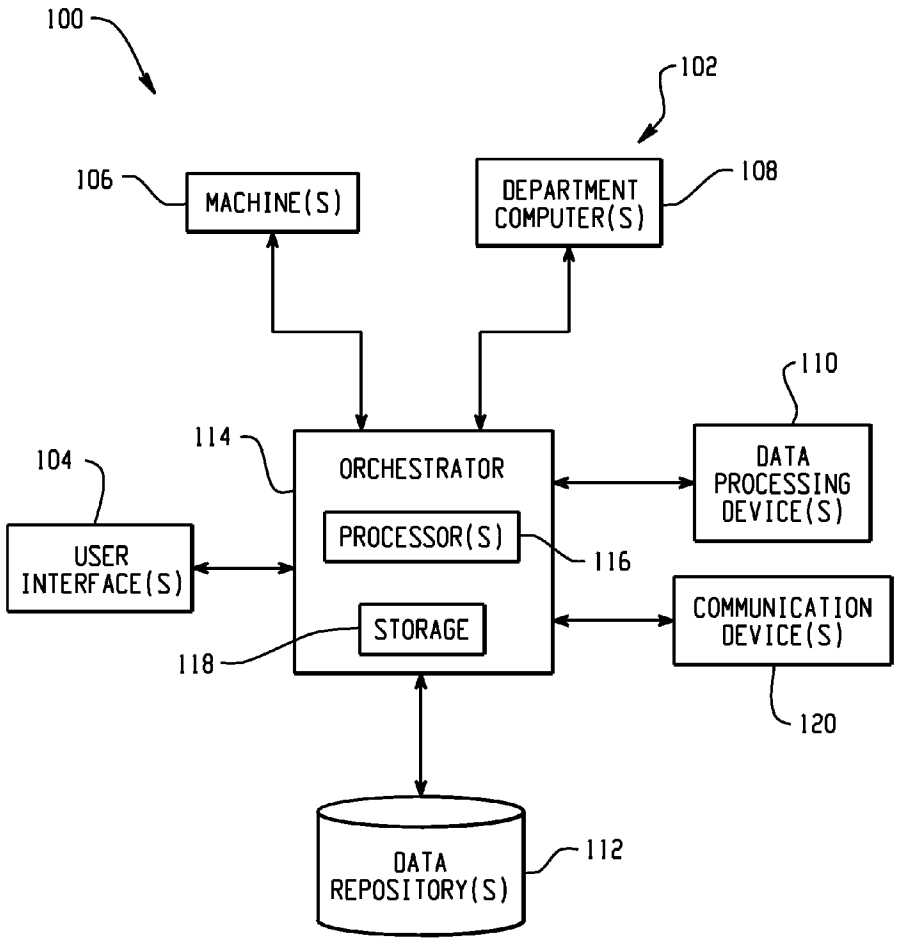
(57) **ABSTRACT**

A system includes an orchestrator with a processor and a plurality of processing actors in connection therewith. The processor orchestrates closed-loop implementation of a healthcare imaging workflow plan by the plurality of processing actors.



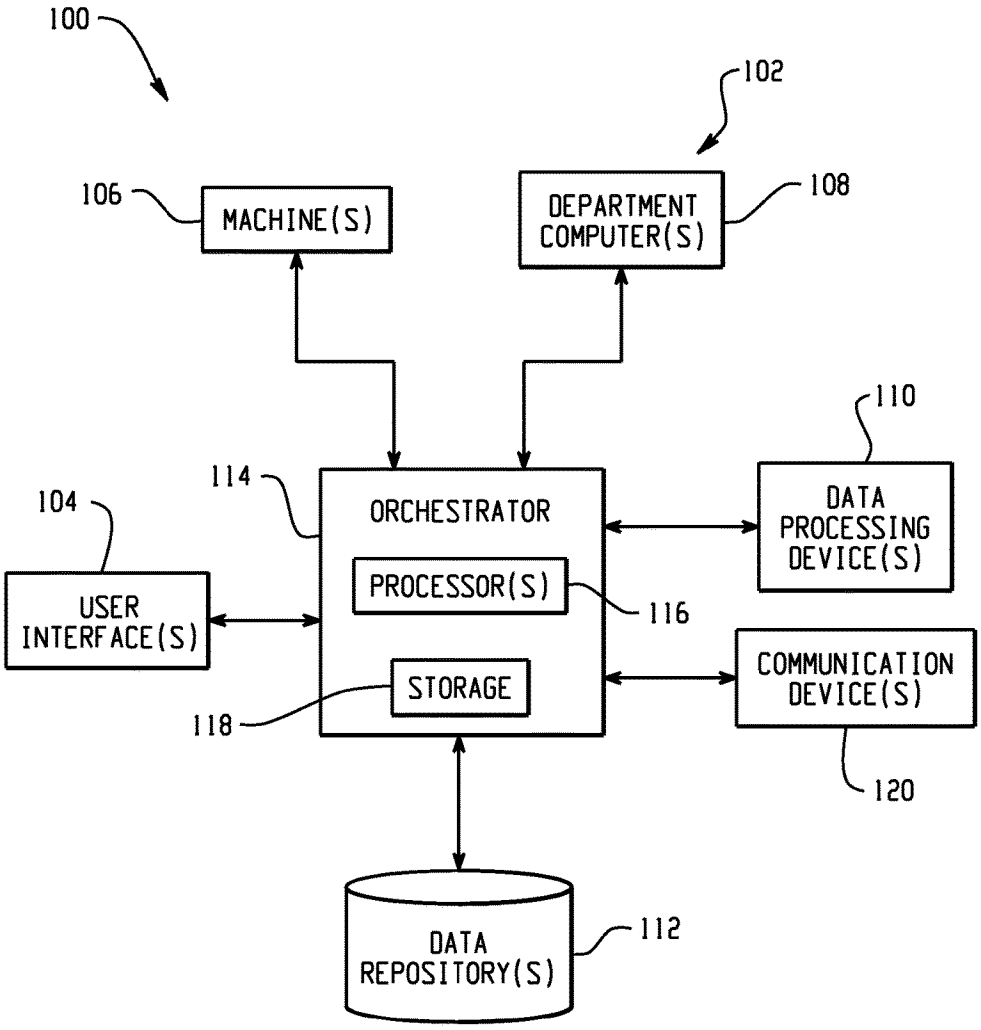

100
102
106
MACHINE(S)
DEPARTMENT COMPUTER(S)
108
110
114
ORCHESTRATOR
104
DATA PROCESSING DEVICE(S)
USER INTERFACE(S)
PROCESSOR(S)
116
STORAGE
COMMUNICATION DEVICE(S)
118
120
DATA REPOSITORY(S)
112

Fig. 1

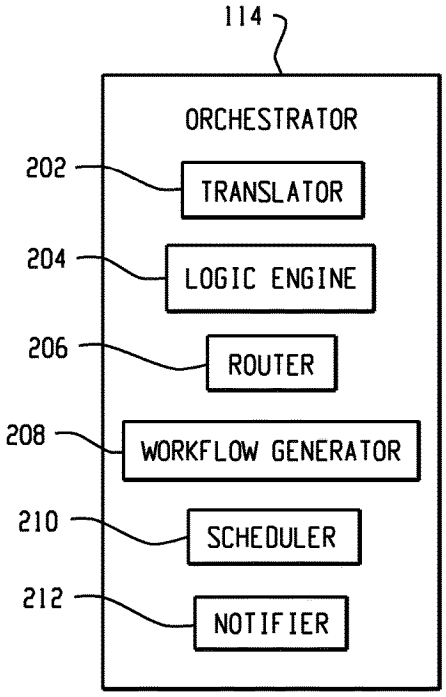


Fig. 2

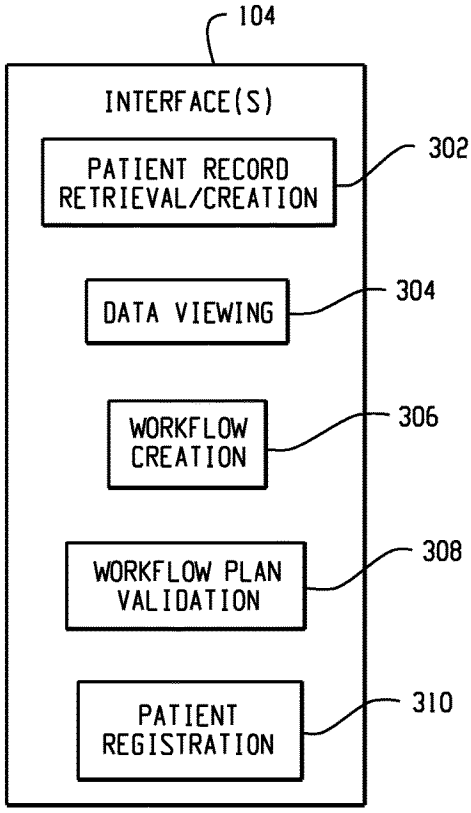


Fig. 3

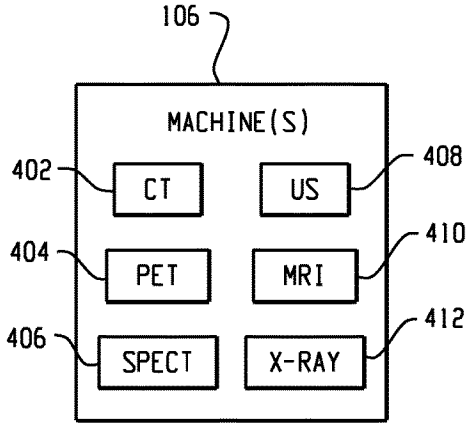


Fig. 4

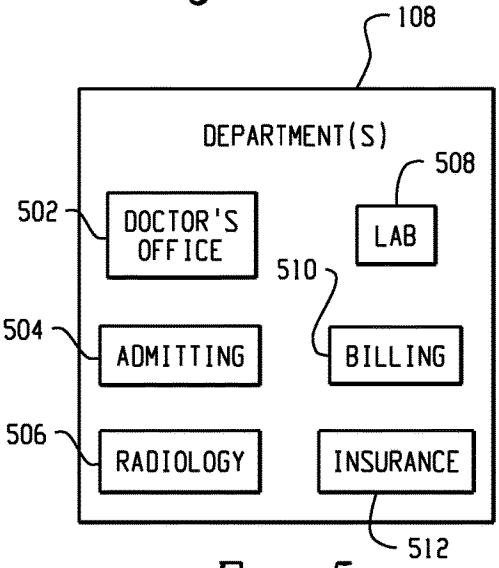


Fig. 5

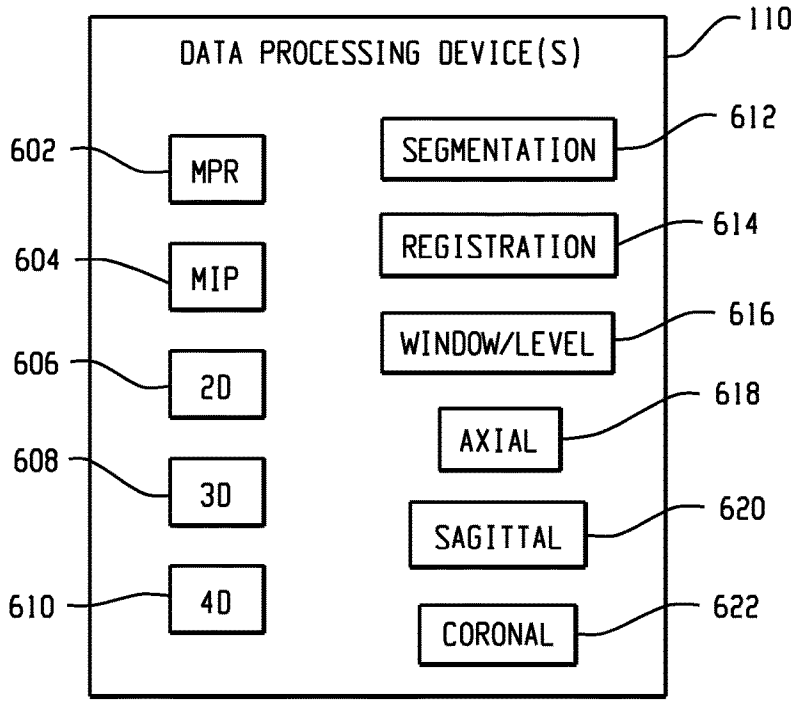


Fig. 6

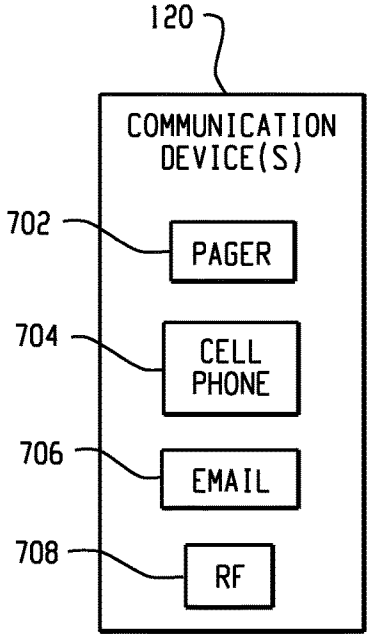


Fig. 7

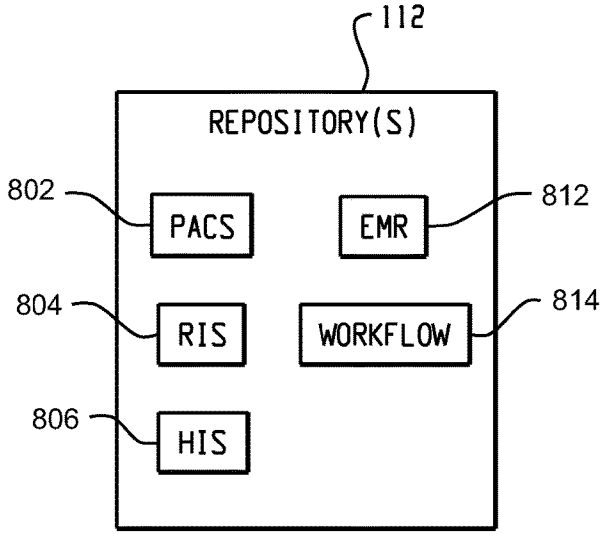


Fig. 8

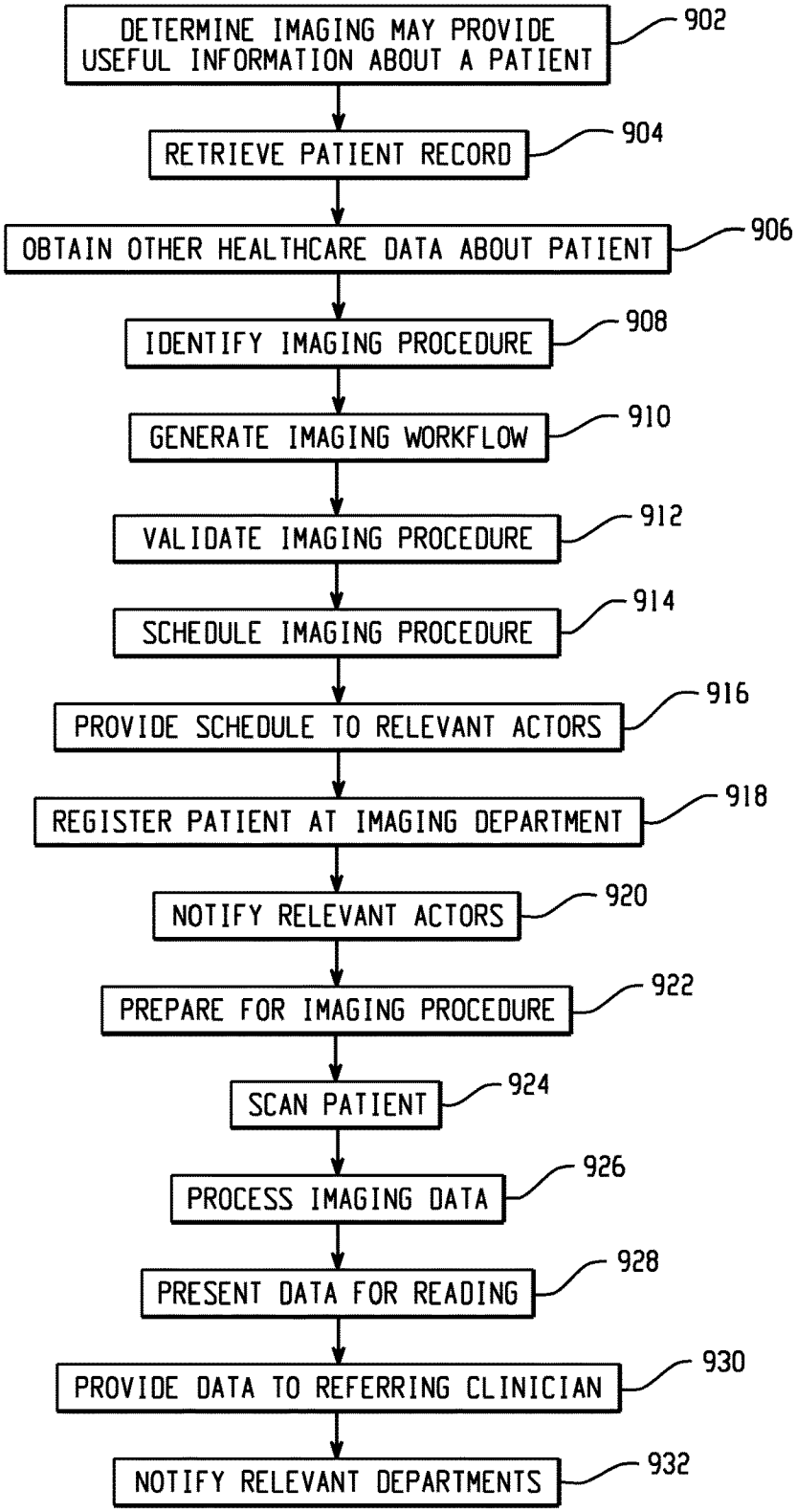

DETERMINE IMAGING MAY PROVIDE USEFUL INFORMATION ABOUT A PATIENT
902
RETRIEVE PATIENT RECORD
904
OBTAIN OTHER HEALTHCARE DATA ABOUT PATIENT
906
IDENTIFY IMAGING PROCEDURE
908
GENERATE IMAGING WORKFLOW
910
VALIDATE IMAGING PROCEDURE
912
SCHEDULE IMAGING PROCEDURE
914
PROVIDE SCHEDULE TO RELEVANT ACTORS
916
REGISTER PATIENT AT IMAGING DEPARTMENT
918
NOTIFY RELEVANT ACTORS
920
PREPARE FOR IMAGING PROCEDURE
922
SCAN PATIENT
924
PROCESS IMAGING DATA
926
PRESENT DATA FOR READING
928
PROVIDE DATA TO REFERRING CLINICIAN
930
NOTIFY RELEVANT DEPARTMENTS
932

Fig. 9

CLOSED LOOP WORKFLOW

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application Ser. No. 13/378,054 filed Dec. 14, 2011, which is the U.S. National Phase application under 35 U.S.C. § 371 of International Application No. PCT/IB2010/052715 filed Jun. 16, 2010, which claims the benefit of U.S. Provisional Patent Application No. 61/222,132 filed Jul. 1, 2009 and U.S. Provisional Patent Application No. 61/263,054 filed Nov. 20, 2009. These applications are hereby incorporated by reference herein.

DESCRIPTION

[0002] The following generally relates to healthcare workflow and is described with particular application to imaging workflow; however, it is also amenable to other healthcare workflow applications and to non-healthcare applications.

[0003] Generally, the process for medical imaging starts when a clinician decides that a patient should be imaged to facilitate answering a clinical question about the patient and ends once the imaging results are communicated to the clinician. The process can be broken down from initial scheduling by clinician, pre-imaging procedure preparation, imaging suite preparation, post procedure preparation, report generation by a radiologist, and forwarding of the report to the clinician. The foregoing process can be complex, involving multiple people and non-integrated computer systems that must be choreographed into harmonization in order to achieve quality and efficiency. A contributor to the complexity is the amount of communication between people and computer systems.

[0004] Examples of communication by personnel include: filling out and submitting requests for patient information; determining the imaging procedure by the referring clinician and communicating the "clinical question" to the radiologist; scheduling the imaging exam; checking the patient in for the exam; determining suitable processing of the imaging results; following up with referring clinician, etc. Examples of communication with computing systems include requesting information from a hospital information system (HIS); providing scheduling information to a radiology information system (RIS); providing examination information to the billing department; configuring an imaging system for scanning; performing the scan; storing and viewing imaging data in a picture archiving and communication system (PACS), etc. The complexity of the above-noted communication may result in inefficiently using healthcare personnel (e.g., personnel entering data, filing out and submitting requests for information, etc.), unnecessarily consuming patient time (e.g., having the patient wait while personnel retrieve and enter information and set up equipment, etc.), selecting an imaging procedure without some relevant patient information (e.g., due to the difficulty in obtaining information, non-compatible electronic format, unknown data, etc.), tracking implementation of workflow, etc.

[0005] Aspects of the present application address the above-referenced matters and others. According to one aspect, a system includes an orchestrator with a processor and a plurality of processing actors in communication therewith. The processor orchestrates closed-loop implementation of a healthcare imaging workflow plan by the plurality of processing actors. In another embodiment, a method includes implementing a healthcare workflow plan for a patient via a processor of an orchestrator in communication with a plurality of processing actors that process subportions of the workflow plan via closed-loop orchestration.

[0006] In another embodiment, a computer readable storage medium with computer executable instructions, which, when executed by a processor of a computer, cause the computer to orchestrate implementation of a healthcare imaging workflow plan with a plurality of workflow processing actors.

[0007] The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating the preferred embodiments and are not to be construed as limiting the invention.

[0008] FIG. **1** illustrates an example system including an orchestrator for orchestrating workflow via a plurality of actors.

[0009] FIG. **2** illustrates an example orchestrator.

[0010] FIG. **3** illustrates an example interface(s).

[0011] FIG. **4** illustrates an example machine(s).

[0012] FIG. **5** illustrates an example department(s).

[0013] FIG. **6** illustrates an example data processing device(s).

[0014] FIG. **7** illustrates an example communication device(s).

[0015] FIG. **8** illustrates an example repository(s).

[0016] FIG. **9** illustrates example workflow.

[0017] The following describes closed-loop workflow in connection with an imaging application. In this context, closed-loop workflow generally relates to computing system orchestration of events (and changes, additions and deletions thereto) that occur from about the point in time at which an imaging procedure is prescribed until at least the imaging procedure is performed. The workflow may further extend until the report of the findings from the image data from the procedure is generated and/or conveyed to the appropriate physician. Although described below in connection with an imaging application, it is to be appreciated that closed-loop workflow can also be employed in connection with other applications.

[0018] FIG. **1** illustrates an example system **100** with a plurality of processing components actors **102** that contribute to the implementation of a workflow.

[0019] The actors **102** include one or more user interfaces **104**, which, at least, receive input corresponding to the workflow from a user. The one or more user interfaces **104** may include web, console, mobile phone, and/or other applications, executed by a processor(s), and including graphical and/or command line interfaces. The actors **102** also include one or more machines **106**, which obtain and/or process information related to the workflow. At least one of the machines **106** may be hardware and/or software based.

[0020] The actors **102** further include one or more department computing devices **108**. Examples of such a device **108** include the computer in a billing department that stores patient billing information associated with the workflow, the computer in an admitting department that stores patient information associated with the workflow, the computer in a laboratory department that stores patient laboratory information associated with the workflow, etc.

[0021] The actors **102** further include one or more data processing devices **110** that process data from one or more

other actors **102** and/or provide processed data to one or more of the other actors **102**. The actors **102** further include a data repository **112** that stores information used by and/or provided by the one or more of the other actors **102**. The data repository **112** can be a single data storage device or a plurality of data storage devices, including distributed data storage.

[0022] The actors further include an orchestrator **114** that orchestrates implementation of a workflow via one or more of the other actors **102**. The orchestrator **114** may include one or more processors **116** and computer readable storage medium (storage) **118** for storing computer executable instructions. The orchestrator **114** can be centralized or distributed across multiple platforms. The illustrated orchestrator **114** is also configured to communicate with one or more communication devices **120** such as a pager, a cell phone, a radio frequency identification (RFID) tag, email, a text message, an instant message, and/or other communications.

[0023] It is to be appreciated that in one instance, using the orchestrator **114** to orchestrate workflow implementation via the actors **102** allows for mitigating workflow implementation inefficiencies, improving workflow quality, and/or increasing actor interoperability, relative to a configuration in which the orchestrator **114** is omitted. By way of non-limiting example, in one instance where the orchestrator **114** is omitted, at least two of the actors **102** lack connectivity with each other, and a human or other intermediary manually transfers information between the two actors **102**, which consumes times and is subject to introducing error in the transfer of the information.

[0024] Turning first to FIG. **9**, example workflow employing the system **100** of FIG. **1** is illustrated. This example is described in the context of a healthcare imaging workflow for sake of brevity and clarity, and is not limiting. However, other workflows, including non-healthcare imaging application and/or non-healthcare applications are contemplated herein. In addition, the acts and the ordering of the acts are not limiting. As such, other embodiments may include more or less and/or similar or difference acts, and one or more of the acts may occur in a different order.

[0025] At **902**, it is determined that an imaging procedure may provide useful information with respect to a patient. For example, it may be determined that imaging data may facilitate diagnosing, or answering a clinical question about, the patient. This decision may be rendered based on various information such as, but not limited to, findings from imaging, laboratory and/or health related information, a diagnosis, patient history, genetics, etc. In addition, the imaging procedure may be a first imaging procedure for a new imaging workflow or part of or an extension to an existing workflow.

[0026] At **904**, a patient record for the patient is retrieved, for example, from the data repository **112** via the orchestrator **114**. An example patient record may include demographic information, patient history, family history, a list of previous medical procedures scheduled and/or performed, results of previous medical procedures (e.g., imaging procedure and non-imaging procedures), whether the patient has been a patient at the particular healthcare facility, etc. If no record exists, then a patient record can be created for the patient.

[0027] At **906**, other healthcare information about the patient is obtained from the data repository **112** via the orchestrator **114**. Such information may include information regarding the patient's health care insurance provider (e.g., provider name, plan, deductible, deductible met, maximum coverage, co-pay, etc.), whether the patient has any outstanding bills, the patient employer, dietary information, allergies, etc. As noted herein, this information may be retrieved from various different sub-repositories employing various different communication protocols.

[0028] At **908**, one or more imaging procedures for the patient is identified based at least in part on imaging and/or non-imaging healthcare information from the repository **112**. One or more of the imaging procedures may include the same imaging modality and/or different imaging modalities. Examples of such modalities include, but are not limited to, CT, PET, SPECT, US, X-ray, MRI, combination scanners, etc. The particular one or more imaging procedures may be selected based on various information such as, but not limited to, patient availability, urgency of study, efficiency, image modality image, throughput, prioritization, optimization, etc. Again, the imaging data may facilitate diagnosing, or answering a clinical question about the patient.

[0029] At **910**, the orchestrator **114** orchestrates generation of an imaging workflow for the imaging procedure. This may include entering a particular imaging procedure, the anatomy of interest to be scanned, and/or the clinical question via an interface **104**. This information is provided to the orchestrator **114**, which generates the imaging workflow plan, which generally includes the acts or events to be implemented for the imaging procedure.

[0030] The workflow can be generated based on a default workflow, a previous workflow for the patient, a workflow for another patient, and/or newly generated. The workflow may also be generated based on the health insurance provider, whether or not the patient has any outstanding invoices, etc. The workflow may also consist of multiple child workflows, be a child workflow of one or more parent workflows, be a sibling workflows with one or more other workflows. The imaging workflow can be stored in the data repository(s) **112**.

[0031] At **912**, the orchestrator **114** notifies the radiologist regarding the imaging workflow, and the radiologist validates the imaging procedure in the imaging workflow. By way of example, the radiologist can determine whether the identified imaging procedure is suitable for addressing the clinical question or if another imaging procedure would likely result in more useful information. If the identified plan is suitable, the radiologist confirms or validates the imaging procedure. Otherwise, the radiologist identifies an alternative plan and/or updates the workflow, or rejects the workflow. One or more additional or alternative actors (e.g., the referring physician, an on-call physician, a specialist, etc.) may likewise be notified and/or render similar types of responses. The imaging workflow can be updated to reflect that the imaging procedure has been validated or changed.

[0032] The orchestrator **114** also facilitates making any changes to the workflow before or during implementation of the workflow. Suitable changes include, but are not limited to, extending the workflow plan to include one or more additional imaging procedures (e.g., the same and/or different imaging modalities), cancelling an imaging procedure, splitting an imaging procedure into two or more imaging procedures, adding one or more non-imaging procedures such as a laboratory (e.g., blood, urine, etc.) test, a stress test, an ECG, including child workflows, adding the workflow to

another workflow, etc. based on one or more of the sources noted herein and/or other sources.

[0033] At **914**, the orchestrator **114** schedules the imaging procedure based at least on the availability of the patient, the availability of the scanner, and/or the availability of the radiologist. In one instance, healthcare personnel (e.g., staff at the clinician's office) interact with the orchestrator **114** to schedule the imaging procedure. For example, the healthcare personnel may enter the patient's availability or select one or more days and times when the patient is expected to be free. In another instance, the patient interacts with orchestrator **114** to schedule the procedure, for example, via a home or other computer.

[0034] The orchestrator **114** also facilitates making any changes to the schedule. Suitable changes include, but are not limited to, changes to the date and/or time based on the patient, radiology department personnel, imaging system availability and/or prioritization, information from the billing department, laboratory results, etc. The orchestrator **114** also facilitates making other changes to the workflow such as one or more of the changes noted above. The imaging workflow can be updated to reflect that the scheduled imaging procedure.

[0035] At **916**, the orchestrator **114** provides the schedule, via the communication device(s) **120**, to the patient, referring clinician, the radiology department, the scanner, the radiologist, and/or other relevant person. The orchestrator **114** may also be configured to send reminders to these actors when a predetermined time interval prior the imaging procedure is reached. The orchestrator **114** may also be used to communicate any changes to the scheduled procedure date or time to the relevant actors. Such changes may be due to patient findings determined after the schedule has been created, a change in available personnel and/or system resources, an intervening higher priority, etc. The orchestrator **114** further can notify the patient, the technician, the radiologist, etc. regarding any pre or post-procedure instructions (e.g., no eating after midnight, drink contrast one hour prior to procedure, lie flat after the procedure for at least 1 hr, etc.)

[0036] At **918**, assuming the scheduled day has arrived, the patient registers with the imaging department for the imaging procedure. In one instance, the patient notifies imaging department personnel, and the personnel confirm the appointment and log the patient in as ready to be scanned. In another instance, the patient logs him/herself in via a registration computer console. In another instance, wireless technology is used to automatically identify the patient's presence. In this instance, the patient can be automatically registered and/or notified to confirm their registration via the wireless technology. The imaging workflow can be updated to reflect that the patient has arrived for the imaging procedure.

[0037] At **920**, the orchestrator **114** notifies the technician assigned to perform the imaging procedure, the radiology department computer system, the radiologist, and the scanner that the patient has arrived. The radiology department computer system **108** may include this information in an electronic "dashboard" or mechanism used to manage the scanning and/or technician resources in the department. In instances where the patient is carrying a communications device **120** such as a pager or like, the orchestrator **114** can notify the patient about various information such as when the patient should ingest contrast, when the patient should go to the exam room, if the procedure will be delayed and by how long, and/or other pre-imaging procedure information.

[0038] In instances in which the availability of the imaging system has changed, a higher priority event occurs, a more efficient workflow has been determined, the workflow has been cancelled, a pre-procedure event has not occurred, the workflow has been interrupted by facility personnel, the imaging procedure has been delayed, the imaging system or modality has changed, etc., the orchestrator **114** facilitates the changing the workflow and/or apprising relevant parties of the change and coordinating implementation of the change workflow. The imaging workflow can be updated to reflect the current status of the imaging procedure.

[0039] At **922**, the scanner is configured to perform the imaging procedure. For example, the orchestrator **114** can identify an imaging protocol for the imaging procedure to the scanner. In instances where the patient is carrying a communications device **120** such as an RFID tag, the orchestrator **114** and/or the scanner can sense when the patient is approaching the scanner and invoke the scanner at that point to load the protocol in preparation for scanning the patient. Of course, the technician can modify the protocol and/or one or more parameters. In another instance, the technician notifies the imaging system that the patient is ready to be imaged and then the imaging system automatically loads the appropriate protocol.

[0040] At **924**, the patient is scanned. This includes performing one or more scans (e.g., one or multi-slice) using one or more imaging modalities. The imaging workflow can be updated to indicate that the imaging procedure has been performed. Other imaging and/or non-imaging procedures that still need to be scheduled and/or performed are still in the workflow plan.

[0041] At **926**, the orchestrator **114** transfers the imaging data to the data processing device(s) **110**, which processes the imaging data. The data processing device(s) processes the imaging data based on various processing algorithms including, but not limited to 2D, 3D, 4D, MIP, MPR, etc. algorithms. Additionally or alternatively, the data processing device(s) **110** processes the imaging data based on the type of scanner and/or scan. Additionally or alternatively, the data processing device(s) processes the imaging data based on predetermined preference of the radiologist reading the imaging data. The imaging workflow can be updated to indicate that the imaging data has been processed.

[0042] At **928**, the orchestrator **114** employs the communication device(s) **120** to notify the radiologist that the processed imaging data is available for viewing. The orchestrator **114** can also employ the communication device(s) **120** to notify other actors regarding the availability of the imaging data. The imaging workflow can be updated to reflect the processed data is ready to be read.

[0043] At **930**, the orchestrator **114** employs the communication device(s) **120** to notify the referring clinician and/or other actors that the processed imaging data and radiologist report is ready for viewing. The imaging workflow can be updated to indicate that the image data and the report are ready to be reviewed.

[0044] At **932**, the orchestrator **114** communicates with various actors. For example, the orchestrator **114** can communicate with a billing department, an admitting department, a patient records department, a laboratory department, an insurance company, a pharmacist, an imaging system,

and/or other actor(s). It is to be appreciated that such communication can occur before, during, and after a workflow has been implemented.

[0045] By way of example, in this instance the orchestrator **114** communicates billable scheduled appointments such as the scheduled imaging procedure, a laboratory test, a stress test, an ECG, etc., and completion thereof to the billing department. The billing department can use such information to automatically generates and send out invoices to the patient, the patient health care insurance provider, a third party, and/or other actor. The billing department may also use such communication to trigger re-sending of outstanding invoices, notify a collection agency, notify the orchestrator **114** and/or other actor about any outstanding invoices, update the status of an invoice, change the amount of an outstanding invoice, etc.

[0046] The orchestrator **114** may employ a set of rules in a rules bank to determine an appropriate action (including an action of no action) for the information received from the billing department. In one instance, the information invokes the orchestrator **114** to notify the patient regarding the outstanding the invoice. Additionally or alternatively, the orchestrator **114** may notify a department schedule to run a test on the patient. The department may also remind the patient of the outstanding invoice. The department may also delay or cancel the scheduled procedure (depending, for example, on an urgency or importance of the procedure) until the invoice has been partially paid or paid in full.

[0047] FIGS. **2-8** describe the actors **102** in the context of an example healthcare imaging procedure workflow. Similar to FIG. **9**, however, it is to be appreciated that the actors **102** may include actors for implementing other imaging and/or non-imaging healthcare workflows and/or non-healthcare workflows.

[0048] Referring to FIG. **2**, the orchestrator **114** includes a translator **202**, a logic engine **204**, a router **206**, a workflow generator **208**, a scheduler **210**, and a notifier **212**, which can be implemented by the processor **116** executing instructions stored in the storage **118**.

[0049] The translator **202** allows the orchestrator **114** to electronically communicate with the various different actors **102** configured to communicate using various different and/or non-compatible communication protocols. The translator **202** allows the orchestrator **114** to receive, read, write, repackage, reformat, send, and/or otherwise process data formatted in Digital Information Imaging and Communications in Medicine (DICOM), Health Level 7 (HL7), proprietary, and/or other formats.

[0050] The logic engine **204** responds to communication from one or more of the other actors **102**. Such communication may include information related to retrieving or creating a patient record, obtaining stored and/or storing newly received healthcare information about the patient (e.g., image data, laboratory test results, family history, etc.), etc. Generally, the logic engine **204** is notified when information becomes available from one of the actors **102** and/or when one of the actors **102** can use information from the other actors **102**.

[0051] The logic engine **204** invokes the router **206** to route data to and/or from the various actors **102**. This may include facilitating retrieving information requested by one of the actors **102** from another one of the actors **102**, such at the data repository **112**, one of the machines **106**, etc. This may also include sending data received from one of the actors **102** to one or more of the other actors **102**, for example, from one of the machines **106** to one of the data processing devices **110**.

[0052] The workflow generator **208** facilitates generating the workflow for a patient. The workflow may include the various acts to be performed, for example, from the scheduling of a patient for an imaging procedure to providing the results of the imaging procedure, including the radiologist report, to the referring clinician. Workflows can be stored in the data repository **112** and updated as the various acts of the workflow are completed and/or change.

[0053] The scheduler **210** facilitates scheduling the imaging procedure in the imaging workflow. In one instance, the scheduler **210** schedules an imaging procedure based on the availability of the patient, the scanner, the operator of the scanner, the radiologist reading the resulting images, the referring physician, and/or other information. The scheduler **210** can also be used to re-schedule an imaging procedure.

[0054] The notifier **212** notifies the various actors **102** of events related to the workflow. For example, once a schedule is created, the scheduler **210** can send the schedule and/or reminders to the relevant actors **102** using the various communication devices **120**. The notifier **212** can also notify the actors **102** of any schedule changes and/or conflicts.

[0055] Turning to FIG. **3**, the user interfaces **104** includes a patient record retrieval/creation user interface **302**. This interface can be employed by authorized healthcare personnel to identify a current patient of interest. This may include providing the patient's name, a unique identifier (UID) (e.g., patient social security number), and/or other patient information to the interface **302** via an input device such as a keyboard, a mouse, keypad, executing voice recognition software, a touch screen, etc.

[0056] The input information is provided to the orchestrator **114**, which queries, via the router **206**, the data repositories **112** for a patient record corresponding to the identified patient. Where a record is located, a confirmation signal and/or the patient record are presented via the patient record retrieval/creation user interface **302**. Where a record for the patient is not found in the data repository, a message indicating this is presented via the patient record retrieval/creation user interface **302**. In the latter case, the patient record retrieval/creation user interface **302** can be used to generate a record for the patient that is stored in the data repository **112**.

[0057] The patient record retrieval/creation user interface **302** may be employed at a doctor's office, an admitting department at a health care facility, etc. As briefly noted above, the patient record retrieval/creation user interface **302** can be implemented as a web and/or console application.

[0058] A data viewing interface **304** allows the clinician to view healthcare information (e.g., images, reports, medical history, etc.) stored in the data repository **112** corresponding to the patient of the received or created record. The viewed information can be variously employed, for example, for facilitating determining whether the patient should undergo an imaging procedure(s) and which imaging procedure(s).

[0059] A workflow creation interface **306** facilitates generating an imaging workflow plan that includes the imaging procedure(s), in connection with the workflow generator **208**.

[0060] A workflow validation interface **308** facilitates validating the imaging procedure(s) prior to the imaging

procedure(s). This may entail determining whether another imaging procedure is more likely to provide information that is more useful. In one instance, a radiologist employs the workflow validation interface **308** to review the imaging procedure and either confirm or change the imaging procedure.

[0061] A patient registration interface **310** is used to log the patient in at the imaging department on the day of the imaging procedure.

[0062] Turning to FIG. **4**, the machine(s) **106** includes various imaging scanners such as computer tomography (CT) **402**, positron emission tomography (PET) **404**, single photon emission tomography (SPECT) **406**, ultrasound (US) **408**, magnetic resonance imaging (MRI) **410**, x-ray **412**, and/or other scanners. The orchestrator **114** can communicate with the various scanners, determine their capabilities and availability based on an electronic calendar, load protocols, and/or otherwise communicate with the scanners. The machine(s) **106** may also include one or more non-imaging devices.

[0063] Turning to FIG. **5**, the departments(s) **108** includes the various different departments that may contribute to the implementing the workflow. Examples of such departments include, but are not limited to, a doctor's office **502**, an admitting department **504**, a radiology department **506**, a laboratory department **508**, such as, for example, a pathology department, a billing department **510**, an insurance department **512**, etc.

[0064] Turning to FIG. **6**, the data processing device(s) **110** includes various algorithms for processing data. Such processing may include processing imaging data based on the workflow plan, clinician preferences, etc. Examples of suitable processing algorithms include, but are not limited to, multi-planar reformatting (MPR) **602**, maximum (or minimum) intensity projection (MIP) **604**, 2D **606**, 3D **608**, 4D **610**, segmentation **612**, image registration/fusing **614**, window/level **616**, axial slices **618**, sagittal slices **620**, coronal slices **622**, and/or other processing. The data processing device(s) may include a desktop computer or workstation computer with one or more processors and memory for variously processing the data.

[0065] Turning to FIG. **7**, the communication device(s) **120** provide various types of communication including, but not limited to, pagers, cell phones, email, radio frequency identifications (RFID) tags, etc. The notifier **212** can use the various communication channels to notify relevant actors about the schedule, pre-imaging procedure acts (e.g., dietary constraints, ingestion of contrast agent, etc.), imaging procedure acts, post-imaging procedure, and/or other acts.

[0066] Turning to FIG. **8**, the repository(s) **112** includes one or more sub-repositories, including imaging data repositories such as a picture archiving and communication system (PACS), a radiology information system (RIS), and/or the like, and non-imaging data repositories such as a hospital information system (HIS), an electronic medical record (EMR), and/of the like. Non-imaging data includes, but is not limited to, patient history, laboratory results, patient questionnaires, family history, and/or other non-imaging data. The repository(s) **112** also includes a workflow repository **814**.

[0067] The above may be implemented by way of computer readable instructions, which when executed by a computer processor(s), cause the processor(s) to carry out the described acts. In such a case, the instructions are stored in a computer readable storage medium associated with or otherwise accessible to the relevant computer.

[0068] The invention has been described herein with reference to the various embodiments. Modifications and alterations may occur to others upon reading the description herein. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

1. A system configured to orchestrate workflow implementation for a plurality of different processing actors, the system comprising:

a memory device that stores computer executable instructions and one or more communication protocols; and

a processor configured to execute the computer executable instructions to orchestrate the workflow implementation, including:

generate a workflow plan employing the plurality of different processing actors, wherein the workflow plan includes at least scheduling acts to be performed by one or more of the plurality of different processing actors and storing results of acts performed by the one or more of the plurality of different processing actors in the memory device,

communicate with an actor of the plurality of different processing actors using a communication protocol of the one or more communication protocols corresponding to the actor based on the workflow plan, including providing a sub-portion of the workflow plan with acts to be performed by the actor to the actor and a sub-portion of the schedule for the acts to the actor, and

transmit electronic information to a second of the plurality of different processing actors, which invokes the second of the plurality of different processing actors to perform a second scheduled act of the workflow plan, wherein the electronic information is transmitted in response to the processor receiving electronic information from a first of the plurality of different processing actors that indicates the first of the plurality of different processing actors completed a first scheduled act of the workflow plan.

2. The system of claim **1**, wherein the processor receives the communication from the first of the plurality of different processing actors.

3. The system of claim **1**, wherein the processor receives the communication from the second of the plurality of different processing actors.

4. The system of claim **1**, wherein the processor is configured to process the received electronic information and transmit the processed electronic information.

5. The system of claim **1**, wherein the processor is configured to repackage or reformat the received electronic information and transmit the repackaged or reformatted electronic information.

6. The system of claim **1**, wherein the processor is configured to receive at least one of a patient record, image data, a laboratory test result, and a family history.

7. The system of claim **1**, wherein the processor is configured to update the workflow plan in response to the communication indicating an act has been completed.

8. The system of claim **1**, wherein the processor is configured to update the schedule in response to the communication indicating an act has been completed.

9. The system of claim **1**, wherein the processor is configured to provide a notification to one of the plurality of different processing actors indicating that information is available to be received by the processor from another of the plurality of different processing actors.

10. The system of claim **1**, wherein the processor is configured to receive a notification from one of the plurality of different processing actors indicating that information is available to be received from the one of the plurality of different processing actors.

11. The system of claim **1**, wherein the processor is configured to query one of the pluralities of different processing actors to determine if information is available from the one of the plurality of different processing actors.

12. The system of claim **1**, wherein the processor is configured to receive a query by one of the plurality of different processing actors to determine if information is available for the one of the plurality of different processing actors from the processor.

13. The system of claim **1**, wherein the processor is configured to one of add or delete an act from the workflow plan in response to the communication.

14. The system of claim **1**, wherein the processor is configured to add or remove a scheduled act from the schedule in response to the communication.

15. The system of claim **1**, wherein the processor is configured to orchestrate the plurality of different processing actors until the workflow plan is completed.

16. The system of claim **1**, wherein the processor is configured to report results of an act after completion of the act and receiving the results.

17. The system of claim **1**, wherein the processor is configured to generate the workflow plan based on a default workflow, a previous workflow for a subject, or a workflow for another subject.

18. The system of claim **1**, wherein the processor is configured to schedule one of the pluralities of different processing actors based on an availability of the actor.

19. The system of claim **1**, wherein the processor is configured to notify an actor of the plurality of different processing actors of a scheduled event for a subject in response to the communication indicating the subject has registered for the act.

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