(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 August 2008 (21.08.2008)

PCT

(10) International Publication Number
WO 2008/100148 A2

(51) International Patent Classification:
G05B 23/02 (2006.01) *G06Q 10/00* (2006.01)

(21) International Application Number:
PCT/NO2008/000046

(22) International Filing Date: 8 February 2008 (08.02.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

20070886	15 February 2007 (15.02.2007)	NO
11/708,085	15 February 2007 (15.02.2007)	US
20076583	20 December 2007 (20.12.2007)	NO

(71) Applicant *(for all designated States except US)*: **EPSIS AS** [NO/NO]; Kokstadflaten 31, Postboks 27, N-5863 Bergen (NO).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **NORDTVEDT, Jan-Erik** [NO/NO]; Kokstadflaten 31, Postboks 27, N-5863 Bergen (NO). **MIDTTUND, Mons** [NO/NO]; Kokstadflaten 31, Postboks 27, N-5863 Bergen (NO).

(74) Agent: **ACAPO AS**; Strandgt. 198, P.O. Box 1880_Nordnes, N-5817 Bergen (NO).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

WO 2008/100148 A2

(54) Title: DATA HANDLING SYSTEM

(57) Abstract: There is described a data handling system (700, 710) for controlling a configuration of support software products for monitoring and/or managing a complex system (200a, 250a, 310a; 200b, 250b, 310b; 200c, 250c, 310c). The handling system (700, 710) comprises computing hardware (700) operable to execute the support software products (750) for assimilating information and/or data from the complex system (250a, 310a; 250b, 310b; 250c, 310c) and for sending information and/or data thereto for monitoring and/or managing the complex system (250a, 310a; 250b, 310b; 250c, 310c). The handling system (700, 710) is provided with interface software products (800) executable on the computing hardware (700) for implementing a data interface (400, 420) between personnel (70) and the support software products (750) and/or directly to the complex system (250a, 310a; 250b, 310b; 250c, 310c). The interface software products (800) implement workflows defined in a top-down strategy. The workflows define data filters and/or aggregators for selectively filtering and/or aggregating information and/or data provided from the complex system (250a, 310a; 250b, 310b; 250c, 310c) and/or from the support software products (750) for presenting to the personnel (70) via the interface software products (800) for selectively reducing a quantity of data to be interpreted by the personnel (70). The data handling system (700, 710) is pertinent to oil and/or gas exploration and/or production, and is also relevant to healthcare systems, transport, systems, and renewable energy systems for example.

DATA HANDLING SYSTEM

Field of the invention

The present invention relates to data handling systems, for example to data handling systems operable to control configurations of subordinate software products operable to process measurement data acquired from hardware and database data to provide signals indicative of status of the hardware and thereby provide a tool for managing the hardware; optionally, the hardware is a complex configuration of at least one of oil wells, gas wells, wind turbines, solar cells, geothermal sites, aquatic wave energy units, hospital facilities, road transport systems, railway transport systems, aircraft traffic control systems, aquatic cargo shipping systems, harbour facilities, manufacturing facilities, educational facilities such as colleges and/or schools, retailing systems and similar. Moreover, the invention also relates to methods of controlling configurations of subordinate software products for processing measurement data from hardware and database data in such data handling systems to provide signals indicative of hardware status and thereby provide a tool for managing the hardware. Furthermore, the invention also concerns software products executable on computing hardware for implementing such methods and associated data handling systems.

Background of the invention

Control and optimization of complex systems is a frequently encountered contemporary technical problem. For example, in a European Patent Office appeal decision T26/86 relating to a European patent application EP78101198, an invention pertaining to a control computer coupled to a known type of X-ray tube for controlling operating parameters of the X-ray tube is described. The invention concerns a control computer configured to execute software for rendering the computer operable to control the X-ray tube for achieving an optimum exposure whilst providing adequate protection against overloading the X-ray tube. In the aforesaid decision T26/86, the European Patent Office deemed subject matter claimed in claims of the patent application EP78101198 to be potentially patentable in view of the subject matter being directed towards solving a technical problem and not relating solely to software as such.

Moreover, in a European Patent Office appeal decision T6/83 relating to a European patent application no. EP79101907, another invention is described concerning co-ordination and control of internal communication between programs and data files held at different processors in a data processing system having a plurality of interconnected data processors in a telecommunication network. The invention is not concerned with the nature of data communicated within the data processing system, but rather with coordination of internal basic functions of the data processing system for permitting a plurality of software programs for specific applications to be executed. The invention was deemed by the European Patent Office to be solving a problem which was essentially technical in nature, thereby rendering the claimed invention patentable.

From the foregoing, a principle has evolved that software executable on computing hardware for solving a problem having a technical nature is considered to relate to potentially patentable subject matter.

Software products executable on computing hardware for controlling logistics within complex systems are known. For example, in a granted Norwegian patent no. NO 320468B1 (National Oilwell Norway AS), there is described a software tool for managing a specific group of tasks relating to maintaining hardware, for example supervising installation of replacement parts and coordinating maintenance routines in relation to an oil production installation. Moreover, such software products for controlling logistics are used, for example, to control movements of containers on maritime cargo ships between various seaports. Alternatively, such software products can be used to control movements of vehicles distributing goods over a geographical area, wherein operational problems can arise such as breakdown of the vehicles, traffic accidents delaying movements of the vehicles, adverse weather conditions and so forth. The software products are capable of dynamically adapting to problematic situations arising in systems for which they are configured to control and manage.

A problem arises when proprietary software products have been incrementally brought into use to monitor and control extremely complex systems. A spatially extensive complex facility indicated generally by **10** in Figure 1 comprises many thousand component parts **20**, **30** which operate together to provide a service and/or product.

For example, the complex facility **10** corresponds to an oil and/or gas field which comprises many thousands of oil and/or gas wells from which oil and/or gas is substantially continuously extracted; in such an example, an oil and/or gas well is denoted by **20**. The complex facility in certain situations includes in an order of eleven thousand oil and/or gas wells. Oil and/or gas extraction and handling equipment represented by the component parts **30** associated with each of the oil and/or gas wells is prone to exhibiting imperfect reliability, namely occasionally subject to breakdowns and thereby requiring maintenance. Moreover, physical conditions, for example well-pressure for oil and/or gas wells, can be dynamically varying in each of the oil and/or gas wells, thereby affecting a yield of oil and/or gas obtainable therefrom. A control centre **50** including computing hardware **60** operable to execute software products is coupled in communication with arrays of sensors **40** included in the extraction and handling equipment **30** of the wells **20** of the oil and/or gas field **10**. The control centre **50** is operated by a group of personnel denoted by **70**, the group **70** employing the computing hardware **60** to monitor and manage operation of the oil and/or gas wells **20** by way of signals supplied from the arrays of sensors **40** to the computing hardware **60**.

Alternatively, for example, the complex facility **10** corresponds to a configuration of hospitals distributed in a region of one or more countries wherein the hospitals have specialist competences, for example certain hospitals specialize in cardiac treatment, whereas other hospitals specialize in oncology. The configuration of hospitals comprises many hundreds of wards with corresponding many thousands of patient beds as well as specialist treatment equipment such as X-ray machines, magnetic resonance imaging (MRI) machines, operating theatres, blood banks, and medicine stores denoted by **20**, **30**. The specialist treatment equipment is prone to exhibiting imperfect reliability, namely occasionally subject to breakdowns and thereby requiring maintenance. Moreover, physical conditions of patients can be dynamically varying in practice, thereby affecting a requirement for patient care required in order to ensure patient recovery. A control centre **50** including computing hardware **60** operable to execute software products is coupled in communication with arrays of sensors and/or data entry equipment **40** included in the hundreds of wards of the hospitals. The control centre **50** is operated by a group of personnel denoted by **70**, the group **70** employing the

computing hardware **60** to monitor and manage operation of the configuration of hospitals.

The computing hardware **60** is itself illustrated schematically in Figure 2. The computing hardware **60** comprises, for example, data memory **90** for storing a plurality of databases **100** and computers **110** with one or more associated display monitors **120**. The one or more display monitors **120** are spatially disposed to be viewed by the group of personnel **70**. The computers **110** are operable to receive the aforesaid signals and store data derived therefrom in the databases **100**. Moreover, the computers **110** are operable, under control of the aforementioned software products, to selectively extract data from the databases **110** and/or the aforesaid signals from the arrays of sensors **40** for visually presenting various categories of information to the group of personnel **70**.

A technical problem which is encountered in practice in the control centre **50**, for example implemented in a spatial locality such as a control room whereat the group of personnel **70** are present, is that the group of personnel **70** are often overwhelmed by a huge volume of data from the arrays of sensors and/or data entry equipment **40** such that it is difficult for the group of personnel **70** to derive a clear overall indication of functioning of the complex facility **10** quickly for making decisions. For example, data stored in the databases **100** is often not cross-related on account of an incremental manner in which the software products executing on the computing hardware **60** have been brought into operation during development of the complex facility **10**. Moreover, a further problem arises in that the software products are often from more than one vendor and are thereby not designed to mutually interoperate. Such incremental software products include, for example, a software product of a type as described in the aforementioned Norwegian published patent no. NO 320468B1.

A further issue is that the group of personnel **70** is subject to human characteristics such as impatience and limited concentration time span which renders it difficult for them to handle a vast amount of information being presented to them by the computing hardware **60** wherein the computing hardware **60** executes various support software products. The group of personnel **70** can optionally simply chose to ignore certain information presented to them but then risk overlooking important issues which prevent the complex facility **10** from being operated in an efficient manner. For example, the

group of personnel **70** ignores certain information and thereby misses an opportunity to extract greater quantities of oil from certain oil and/or gas wells exhibiting unusually high well pressures by ignoring pressure measurement data pertaining to the certain oil and/or gas wells. Alternatively, for example, the group of personnel **70** ignores certain information and thereby misses an opportunity to provide emergency health care to a patient who subsequently dies prematurely and/or unnecessarily.

Thus, a conventional approach to addressing the technical problem as described in the foregoing is to execute several contemporary proprietary software products on the computing hardware **60** to process measurement data and/or data input by personnel from the complex facility **10** to generate several diverse sets of processed measurement output data, and to rely on the group of personnel **70** to manually correlate the sets of output data to extract pertinent information therefrom for managing operation of the complex facility **10**.

Although the technical problem addressed by the present invention has been elucidated in the foregoing, for example in relation to the complex facility **10**, it will be appreciated that similar technical problems arise when controlling other types of complex systems, for example control systems including one or more of solar cell arrays, wind farms comprising arrays of wind turbines, arrays of coastal wave energy collectors, arrays of geothermal bore holes and so forth.

Summary of the invention

A first object of the invention is to provide a data handling system which is operable to manage a configuration of support software products operable to interface to a complex array of hardware, for example an oil and/or gas field comprising a plurality of oil and/or gas wells although not limited thereto, already provided with associated computing hardware operable to execute one or more already installed software products, and/or one or more subsequently installed software products, for collecting data from the complex array of hardware and for managing the complex array of hardware.

A second object of the invention is to provide a software product executable on computing hardware for interoperating with one or more already installed support software products, and/or one or more subsequently installed support software products, for collecting data from a complex array of hardware, for example an oil and/or gas field comprising a plurality of oil and/or gas wells although not limited thereto, and for managing the complex array of hardware.

A third object of the invention is to provide a method of interoperating with one or more already installed support software products, and/or one or more subsequently support installed software products, executable on computing hardware for collecting data from a complex array of hardware, for example an oil and/or gas field comprising a plurality of oil and/or gas wells although not limited thereto, and for managing the complex array of hardware.

One or more of these objects of the invention are capable of being addressed by the present invention as defined by the appended claims.

According to a first aspect of the invention, there is provided a data handling system for controlling a configuration of one or more support software products for managing and/or monitoring a complex system, the data handling system comprising computing hardware operable to execute the one or more support software products for assimilating data and/or information from the complex system and for sending information and/or data thereto for monitoring and/or managing the complex system,

characterized in that

the data handling system is further provided with one or more interface software products executable on the computing hardware for providing in operation a data and/or information interface between one or more personnel and at least one of: the one or more support software products, directly to the complex system,

the one or more interface software products being operable to implement one or more workflows defined in a top-down strategy, the one or more workflows defining one or more data filters for selectively filtering and/or aggregating information and/or data

provided from the complex system and/or from the one or more support software products for presenting to the one or more personnel via the one or more interface software products for selectively reducing a quantity of data and/or information to be interpreted by the one or more personnel.

The invention is of advantage in that use of workflows and associated selective filtering of information is capable of reducing an amount of data that the one or more personnel are required to interpret in operation for monitoring and/or managing the complex system.

In the foregoing, "data filtering" is to be construed, for example, to mean making a selection of a subset of data and/or information from a set of data and/or information; for example, a set of data corresponds to oil and/or gas well pressures of all oil and/or gas wells in an oil and/or gas field, and a filtered subset thereof corresponds to oil and/or gas well pressures of oil and/or gas wells producing 80% of total oil and/or gas from the oil and/or gas field. Moreover, "data filtering" also is to be construed, for example, to mean making a selection of a subset of support software products which are operable to handle particular types of data or information, thereby indirectly making a selection of a subset of data and/or information from a set of data and/or information, Moreover, in the foregoing, "data aggregation" corresponds to a selection of data from more than one data set; for example, a data aggregate corresponds to a collection of data including 3-D views of oil and/or gas wells producing most oil and/or gas from an oil and/or gas field together with their operating procedures together with 3-D layered views of geological structures beneath the oil and/or gas wells producing most oil and/or gas; optionally, the 3-D layered views of geological structures can be computed prior to such aggregation, for example stored in a database for reference. Similar considerations pertain *mutatis mutandis* to information pertaining to the oil and/or gas field. It will be appreciated that such data and/or information filtering as well as such data and/or information aggregation can potentially be implemented in numerous different ways as directed using the one or more interface software products pursuant to the present invention. "Monitoring" is to be construed to include functions of measurement gathering, sensing and associated data communication and data conditioning for presentation. "Managing" is to be construed to include directing and controlling at a higher cognitive level than

simple feedback control, although optionally not excluding simpler feedback control as a part of such managing when appropriate.

As will be elucidated later, filtering and/or aggregating of data and/or information is executed in the present invention as defined by one or more workflows, or steps included in such workflows. For example, a workflow includes one or more steps, wherein each step is susceptible to having one or more support software products defined to be associated therewith; as the steps of the workflow are executed in practice, appropriate software products are thereby automatically invoked, for example data gathering software products which present specific selections of data for one or more personnel using the data handling system; such selection is analogous to providing data filtering. Such filtering is capable to selectively presenting the one or more personnel with an optimal amount of information to avoid stressing such personnel. Moreover, data aggregation is susceptible to combining information from diverse sources as defined by one or more workflows, so that pertinent data and/or information are presented in combination to the one or more personnel at an appropriate opportunity without the one or more personnel needing to use time searching for the data and/or information in amongst complex databases and such like.

Optionally, in the data handling system, the one or more interface software products are operable to render the data and/or information interface to be at least partially viewable and/or at least partially controllable from a site which is remote from a location whereat the one or more personnel are spatially concentrated. Yet more optionally, the one or more interface software products are operable to employ one or more of the support software products to provide a communication route from the site which is remote from the location whereat the one or more personnel are spatially concentrated.

Optionally, in the data handling system, the one or more interface software products are provided when executing on the computing hardware with access to at least one dedicated database, the at least one dedicated database being used by the one or more interface software products to store data supplied by the one or more support software products subject to data filtering and/or aggregating as defined by the one or more workflows. Use of the dedicated database is capable of improving responsiveness of the

data handling system when presenting results and related information to the one or more personnel.

Optionally, in the data handling system, the one or more interface software products are operable to communicate presentation data to an array of one or more screens viewable by the one or more personnel in operation, the presentation data being derived from at least one of:

(a) intermediate data and/or information computed by the one or more support data products from measurement data provided from the complex system;

(b) measurement data supplied directly from the complex system to the one or more interface software products; and

(c) selectively-filtered and/or selectively-aggregated stored data which has been generated by the one or more interface software products in operation from data provided from the one or more supportive data products and/or directly from the complex system.

For example, aggregated data can relate to patient data in a medical organisation, and/or data relating to success of diverse treatments when attempting to heal a given class of illness, for example a potential pandemic illness such as acute respiratory syndrome (SARS) or methicillin-resistant Staphylococcus aureus bacterium infection (MRSA); optionally, aggregated data can constitute an appropriate summation of such data.

Optionally, in the data handling system, the one or more interface software products when executed on the computing hardware are operable to enable the one or more personnel to define one or more workflows in a top-down strategy, the one or more workflows defining one or more filter parameters for use in filtering and/or aggregating data and/or information to be presented to the one or more personnel in operation. Use of a top-down strategy for devising the workflows is capable of specifically identifying data which is relevant to the workflows for avoiding the one or more personnel being presented with irrelevant information to interpret in potentially stressful situations.

Optionally, in the data handling system, the one or more interface software products are operable when executed on the computing hardware to render the one or more workflows to be invoked in response to at least one of:

(a) one or more invoking instructions generated from one or more other workflows;

(b) one or more physical conditions arising within the complex system; and

(c) one or more instructions entered by the one or more personnel to the computer hardware via the one or more interfacing software products.

Such automatic or semi-automatic invoking of workflows potentially reduces a workload of monitoring processes undertaken by the one or more personnel in operation. Conveniently, when one or more workflows are automatically or semi-automatically invoked, the data handling system is said to be "event driven".

Optionally, in the data handling system, the one or more interface software products are operable to enable the one or more workflows to be configured in a mutually-dependent hierarchical manner; for example, certain workflows are hierarchically higher and their steps are susceptible when being executed to invoke one or more workflows which are hierarchically relatively lower. Optionally, such a mutually-dependent hierarchical manner of workflow arrangement can be an "event driven" and/or "work flow driven" construction. Such hierarchical dependence is necessary when managing convoluted processes occurring in the complex system, especially processes susceptible to exhibiting many potentially complex operating states; such states can, for example, correspond to high production, medium production, low production and emergency states.

Optionally, in the data handling system, the one or more interface software products are operable to enable the one or more workflows to be configured to be executed in a mutually concurrent manner. In the complex system, many processes are potentially occurring concurrently which need to be monitored and managed. The one or more interface software products when executed on the computing hardware are capable of coping with monitoring and assisting in managing such numerous parallel processes as represented by mutually parallel workflows.

Optionally, in the data handling system, the array of one or more screens includes a plurality of screens and/or display regions comprising:

(a) a first screen or first display region for presenting a spatial representation of the complex system;

(b) a second screen or second display region for presenting one or more workflows facilitated by the one or more interface software products;

(c) a third screen or third display region for presenting filtered data which is pertinent to the one or more workflows facilitated by the one or more interface software products;

(d) a fourth screen or display region for presenting a one or more operating procedures relevant to the one or more workflows presented on the second screen.

Such a configuration of screens is found to function ergonomically favourably when implementing the present invention for a group of personnel, namely for generating a working environment exhibiting a reduced operating stress level. More optionally, the first screen or display region is spatially located centrally relative to the second, third and fourth screens or display regions.

Optionally, in the data handling system, the one or more interface software products include a data integration service software product for defining a data interface between the one or more interface software products and the one or more support software products, the one or more data interface software products being operable to function as a data filter and/or data aggregator for reducing a volume of data to be presented to the one or more personnel in connection with one or more associated workflows being presented thereto. An information filter is thereby provided which is capable of reducing a volume of information needed to be presented to the one or more personnel for monitoring and/or managing the complex system.

More optionally, to enhance usefulness of the data handling system, the data integration service software product is operable to being edited to adapt the one or more interface software products for operating with a variety of types of the complex system. Yet more optionally, the data handling system is configurable by way of the one or more interface software products for being used to monitor and/or manage the complex system when the complex system is implemented as at least one of:

(a) a configuration of oil and/or gas wells;

(b) a configuration of off-shore oil and/or gas platforms;

(c) a configuration of wind turbines operable to generate electricity;

(d) a configuration of solar cells operable to generate electricity;

(e) a nuclear electrical power generating installation;
(f) an electricity distribution network;
(g) a configuration of marine wave energy units operable to generate electricity from marine wave motion;
(i) a configuration of dams and/or sluices;
(j) a convention fossil-fuel burning electricity generating facility;
(k) a configuration of coal mines for mining coal;
(l) a configuration of geothermal sites for collecting geothermal energy;
(m) a logistics configuration for distributing goods;
(n) a water distribution network;
(o) a configuration of hospital facilities;
(p) a railway network;
(q) a configuration of airport facilities;
(r) an educational facility;
(s) an emergency relief services deployment in disaster zones; and
(u) in space exploration facilities.

Such configurations for the complex system are susceptible to behaving in complex and convoluted manners which are potentially stressful for one or more personnel to monitor and/or manage. The present invention is susceptible to render such monitoring and/or management easier to implement.

According to a second aspect of the invention, there is provided a software product stored or communicated via a data carrier, the software product being executable on computing hardware for implementing a data handling system pursuant to the first aspect of the invention.

According to a third aspect of the invention, there is provided a method of handling data in a data handling system for controlling a configuration of one or more support software products for monitoring and/or managing a complex system, the data handling system comprising computing hardware operable to execute one or more support software products for assimilating information and/or data from the complex system and for sending control information thereto for monitoring and/or managing the complex system,

characterized in that

the method includes steps of:

(a) installing into the data handling system one or more interface software products executable on the computing hardware for providing in operation a data interface between one or more personnel and at least one of: the one or more support software products, directly to the complex system;

(b) applying the one or more interface software products to implement one or more workflows defined in a top-down strategy, the one or more workflows defining one or more filters and/or aggregators for selectively filtering and/or aggregating information and/or data provided from the complex system and/or from the one or more support software products for presenting to the one or more personnel via the one or more interface software products for selectively reducing a quantity of data to be interpreted by the one or more personnel.

Optionally, the one or more interface software products are operable to communicate with the complex system substantially via the one or more support software products.

As elucidated in the foregoing, "data filtering" is to be construed, for example, to mean making a selection of a subset of data and/or information from a set of data and/or information; for example, a set of data corresponds to oil and/or gas well pressures of all oil and/or gas wells in an oil and/or gas field, and a filtered subset thereof corresponds to oil and/or gas well pressures of oil and/or gas wells producing 80% of total oil and/or gas from the oil and/or gas field. Moreover, "data filtering" also is to be construed, for example, to mean making a selection of a subset of support software products which are operable to handle particular types of data or information, thereby indirectly making a selection of a subset of data and/or information from a set of data and/or information, Furthermore, in the foregoing, "data aggregation" corresponds to a selection of data from more than one data set; for example, a data aggregate corresponds to a collection of data including 3-D views of oil and/or gas wells producing most oil and/or gas from an oil and/or gas field together with their operating procedures together with 3-D layered views of geological structures beneath the oil and/or gas wells producing most oil and/or gas. Similar considerations pertain *mutatis mutandis* to information pertaining to the oil and/or gas field. It will be appreciated that such data and/or information filtering as well as such

data and/or information aggregation can potentially be implemented in numerous different ways as directed using the one or more interface software products pursuant to the present invention. "Monitoring" is to be construed to include functions of measurement gathering, sensing and associated data communication and data conditioning for presentation. "Managing" is to be construed to include directing and controlling at a higher cognitive level than simple feedback control, although not excluding simpler feedback control as a part of such managing when appropriate. The method is also optionally applicable to technical fields other than oil and/or gas exploration and/or extraction, for example to hospitals, educational systems, renewable energy generation system such as wind and/or solar generators, civil nuclear power facilities, and so forth.

As will be elucidated later, filtering and/or aggregating of data and/or information is executed in the present invention as defined by one or more workflows, or steps included in such workflows. Such filtering is capable to selectively presenting the one or more personnel with an optimal amount of information to avoid stressing such personnel. Moreover, data aggregation is susceptible to combining information from diverse sources as defined by one or more workflows, so that pertinent data and/or information are presented in combination to the one or more personnel at an appropriate opportunity without the one or more personnel needing to use time searching for the data and/or information in amongst complex databases and such like.

Optionally, the method is implemented such that the one or more interface software products are operable to render the data and/or information interface to be at least partially viewable and/or at least partially controllable from a site which is remote from a location whereat the one or more personnel are spatially concentrated. Yet more optionally, the one or more interface software products are operable to employ one or more of the support software products to provide a communication route from the site which is remote from the location whereat the one or more personnel are spatially concentrated.

Optionally, the method includes a step of:

(c) providing the one or more interface software products when executing on the computing hardware with access to one or more dedicated databases, the one or more

dedicated databases being used by the one or more interface software products to store data supplied by the one or more support software products subject to data and/or information filtering and/or aggregating as defined by the one or more workflows.

Optionally, the method includes a further step of:

(d) communicating via the one or more interface software products presentation data to an array of one or more screens viewable by the one or more personnel in operation, the presentation data being derived from at least one of:

- intermediate data computed by the one or more support data products from measurement data provided from the complex system;
- measurement data supplied directly from the complex system to the one or more interface software products; and
- selectively-filtered and/or selectively-aggregating stored data which has been generated by the one or more interface software products in operation from data and/or information provided from the one or more supportive data products and/or directly from the complex system.

Optionally, the method includes a step of:

(e) enabling the one or more interface software products when executed on the computing hardware for the one or more personnel to define one or more workflows in a top-down strategy, the one or more workflows defining one or more filter parameters and/or aggregating parameters for use in filtering and/or aggregating data and/or information to be presented to the one or more personnel in operation.

Optionally, the method includes a step of:

(f) configuring the one or more interface software products to be operable to render the one or more workflows to be invoked in response to at least one of:

- one or more invoking instructions generated from one or more other workflows;
- one or more physical conditions arising within the complex system; and
- one or more instructions entered by the one or more personnel to the computer hardware via the one or more interfacing software products.

Optionally, the method includes a step of:

(g) arranging the one or more interface software products to be operable to enable the one or more workflows to be configured in a mutually-dependent hierarchical manner.

Optionally, the method includes a step of:

(h) arranging the one or more interface software products to be operable to enable the one or more workflows to be configured to be executed in a mutually concurrent manner.

More optionally, when implementing the method, the array of one or more screens includes a plurality of screens and/or a plurality of screen regions comprising:

(a) a first screen or first screen region for presenting a spatial representation of the complex system;

(b) a second screen or second screen region for presenting one or more workflows facilitated by the one or more interface software products;

(c) a third screen or third screen region for presenting filtered data which is pertinent to the one or more workflows facilitated by the one or more interface software products;

(d) a fourth screen or fourth screen region for presenting one or more operating procedures relevant to the one or more workflows presented on the second screen or second screen region.

Optionally, when implementing the method, the first screen or first screen region is spatially located centrally relative to the second, third and fourth screens or screen regions.

Optionally, when implementing the method, the one or more interface software products include a data integration service software product for defining a data interface between the one or more interface software products and the one or more support software products, the data interface software product being operable to function as a data filter and/or data aggregator for reducing a volume of data to be presented to the one or more personnel in connection with one or more associated workflows being presented thereto.

More optionally, when implementing the method, the data integration service software product is operable to being edited to adapt the one or more interface software products for operating with a variety of types of the complex system. Yet more optionally, in respect of the method, the one or more interface software products are configurable for being used to monitor and/or control the complex system when the complex system is implemented as at least one of:

(a) a configuration of oil and/or gas wells;
(b) a configuration of off-shore oil and/or gas platforms;
(c) a configuration of wind turbines operable to generate electricity;
(d) a configuration of solar cells for operable to generate electricity;
(e) a nuclear electrical power generating installation;
(f) an electricity distribution network;
(g) a configuration of marine wave energy units operable to generate electricity from marine wave motion;
(i) a configuration of dams and/or sluices;
(j) a convention fossil-fuel burning electricity generating facility;
(k) a configuration of coal mines for mining coal;
(l) a configuration of geothermal sites for collecting geothermal energy;
(m) a logistics configuration for distributing goods;
(n) a water distribution network;
(o) a configuration of hospital facilities;
(p) a railway network;
(q) a configuration of airport facilities;
(r) an educational facility;
(s) an emergency relief services deployment in disaster zones; and
(u) in space exploration facilities.

According to a fourth aspect of the present invention, there is provided an information portal including a computer network comprising first and second groups of computers operable to exchange data therebetween, wherein the first group of computers is included in an installation to be monitored and controlled, and the second group of computers is operable to function as one or more control centres, and wherein the second group of computers is operable to present data on at least one visual display of the one or more control centres,

characterised in that

(a) the second group of computers is operable to present an information portal image on the at least one visual display, the image being spatially representative of the installation;

(b) the image includes one or more graphic symbols representative of one or more corresponding structures present in the installation;

(c) interrogating the one or more graphic symbols is operable to cause one or more subsidiary data fields to be presented providing information associated with the one or more corresponding structures respectively; and

(d) the first and second groups of computers are operable to update in real-time the one or more graphic symbols and/or the one or more subsidiary data fields in response to one or more events occurring in the installation.

Optionally, when implementing the informational portal, the information portal image is presented as a 3-dimensional representation. More optionally, the portal is operable to enable a viewing angle of the 3-dimension representation and/or a zoom towards or away from the 3-dimensional representation to be user-adjustable.

Optionally, when the information portal is in operation, data presented in the one or more subsidiary data fields is linked to its corresponding structure by an associated probability parameter, the probability parameter being dynamically updated in response to a frequency with which the data is requested concurrently with the structure, the probability parameter determining a manner in which the data is presented in the one or more subsidiary data fields. More optionally, the data is presented in order of frequency with which the data is accessed in comparison to other data associated with the corresponding structure.

Optionally, in association with the information portal, the installation is a gas and/or oil installation.

Optionally, the information portal is implemented such that the one or more control centres are operable to receive information from the installation and to send commands to control operation of the installation.

According to a fifth aspect of the present invention, there is provided a method of providing an information portal, the method including steps of:

(a) providing an information portal including a computer network comprising first and second groups of computers operable to exchange data therebetween, wherein the first group of computers is included in an installation to be monitored and controlled, and the second group of computers is operable to function as one or more control centres; and

(b) using the second group of computers to present data on at least one visual display of the one or more control centres,

characterised in that the method includes additional steps of:

(c) using the second group of computers to present an information portal image on the at least one visual display, the image being spatially representative of the installation;

(c) including in the image one or more graphic symbols representative of one or more corresponding structures present in the installation;

(d) arranging for interrogation of the one or more graphic symbols to cause one or more subsidiary data fields to be presented providing information associated with the one or more corresponding structures respectively; and

(e) using the first and second groups of computers to update in real-time the one or more graphic symbols and/or the one or more subsidiary data fields in response to one or more events occurring in the installation.

According to a sixth aspect of the invention, there is provided a software product stored on a data carrier, the computer product being executable on computer hardware for implementing a method pursuant to the fifth aspect of the invention.

It will be appreciated that features of the invention are susceptible to being combined in any combination with departing from the scope of the invention as defined by the appended claims.

Description of the diagrams

Embodiments of the invention will now be described, by way of example only, with reference to the following diagrams wherein:

Figure 1 is a schematic illustration of a complex facility, for example an oil and/or gas field including an array of oil and/or gas wells, monitored and managed from a contemporary control centre coupled in communication with the complex facility;

Figure 2 is a schematic illustration of computing hardware included within the contemporary control centre shown in Figure 1, the computing hardware being operable to execute support software products for receiving signals obtained from the complex facility and processing such signals to generate information indicative of operation of complex facility, and for generating and conveying control signals to be communicated back to the complex facility;

Figure 3a is a schematic illustration of an integrated operation representing a manner of working in an oil and/or gas industry pertinent to the present invention;

Figure 3b is a schematic illustration of an integrated operation representing a manner of working in a hospital facility pertinent to the present invention;

Figure 3c is a schematic illustration of an integrated operation representing a manner of working in a renewable energy facility pertinent to the present invention;

Figure 4 is an environment created by the present invention for a group of personnel monitoring and controlling the integrated operation of Figures 3a, 3b, 3c;

Figure 5 is a qualitative graph illustrating performance of the group of personnel in Figure 4 under various working conditions;

Figure 6 is a qualitative graph indicating a relationship between number of measurements from the integrated operation which are potentially obtainable in comparison to a quantity of measurements needed for optimally managing and monitoring the integrated operation of Figures 3a, 3b, 3c;

Figure 7 is an illustration of bottom-up processing of information generated by the integrated operation of Figures 3a, 3b, 3c pursuant to known contemporary practice, and also top-down processing of such information as utilized pursuant to the present invention;

Figure 8 is a schematic layout of an array of screens employed in generating the environment depicted in Figure 4;

Figure 9 is an illustration of a configuration of computing hardware and software products employable to implement an embodiment of the present invention, the software products being a combination of earlier known proprietary support software products and novel interface software products pursuant to the present invention;

Figure 10 is an illustration of software products constituting a software suite for implementing the present invention;

Figure 11 is an illustration as in Figure 9 with a further addition of one or more remote members who are enabled to view and/or control the configuration of hardware and software from one or more remote locations relative to the configuration;

Figure 12 is a schematic representation of the integrated operation of Figure 3a;

Figure 13a is an illustration of a presentation provided on an array of one or more display screens;

Figure 13b is an illustration of an alternative presentation on the array of one or more display screens;

Figure 14 is an illustration of a portion of the presentations of Figures 13a, 13b;

Figure 15 is an illustration of a computer configuration required for generating the environment of Figure 4.

In the accompanying diagrams, a number accompanied by an associated arrow is used to generally indicate a given item. Moreover, an underlined number is employed to denote an item onto which it is overlaid. A number associated with a connecting line is used to denote an item at which an end of the connecting line remote from the number terminates.

Description of embodiments of the invention

In overview, the present invention is concerned with a data handling system for use in controlling a configuration of one or more support software products for managing and/or monitoring complex systems, for example complex arrays of hardware; such arrays of hardware are, for example:

(a) an array of oil and/or gas wells included in an oil and/or gas field;
(b) an array of wind turbines in a wind farm;
(c) an array of marine wave-power electricity generators;
(d) a distributed array of steerable solar cells;
(e) nuclear power plant facilities;

(f) an array of medical facilities, such as X-ray machines, surgical operating theatres, magnetic resonance imaging (MRI) machines, pharmaceutical stores, patient beds, patient databases and so forth;

to mention a few examples.

In contemporary implementations, such complex systems are provided with sensors and/or data entry apparatus distributed therearound for sensing or receiving various operating parameters of the systems, the sensors and/or data entry apparatus providing measuring signals which are conveyed, for example by telemetry, to control centres associated with the systems. Such control centres in contemporary implementation each includes one or more computers for receiving the measurement signals from their associated sensors and/or data entry apparatus. The one or more computers are configured to execute one or more software products which are operable when executed to cause the one or more computers to perform various functions such as:

(f) receiving the measurement signals, processing the measurements signals for storage in computer memory, for presentation or for use as feedback for managing the associated complex system;

(g) receiving instructions from a group of personnel comprising one or more persons, such instructions for directing operation of the complex system;

(h) providing a communication link to personnel who are working in amongst the complex system, for example field personnel, nurses, doctors, and administrators.

It often occurs in contemporary practice that the software products executable on the one or more computers at the control centre are diverse proprietary software products which have been coupled together to enable the control centre to function. It is potentially highly uneconomical to develop software products specifically customized to each complex system. Moreover, software support for a wide range of customized software products represents an expensive solution. Moreover, the use of contemporary software products tends to result in the group of personnel at the control centre being overwhelmed with data so that they are unable to respond in an optimal manner. Moreover, many contemporary software products are unable to provide sufficiently rapid data processing for real-time presentation to the group of personnel on account of a volume of measurement data provided from the complex system to be processed.

In overview, the present invention is capable of addressing such technical problems by providing one or more interfacing software products which enable management and associated measurement signal information gathering from the complex system to be implemented in a "top-down" manner in contradistinction to a conventional "bottom-up" approach as depicted in Figure 1 of configuring contemporary software products to work in cooperation to process measurement signals and present corresponding information to the group of personnel. By adopting such a novel "top-down" approach, the group of personnel are able to define in a "top-down" manner a series of processes (P), for example process steps, to occur in the complex system, together with:

(i) defining associated information to be extracted in a manner of a data filter and/or data aggregator from the measurement signals and/or data entry for generating filtered and/or aggregated information for supporting execution of the series of processes (P);

(ii) defining a manner in which the filtered and/or aggregated information is to be visually and/or aurally presented to the group of personnel; such filtration is optionally achievable by invoking one or more support software products for executing specific types of filtering of information and/or data;

(iii) defining subsidiary data to be extracted from a data base at the control centre to be associated with the filtered information, for example by way of data aggregation; and

(iv) defining how the filtered information is to be used as automatic or semiautomatic feedback for managing operation of the complex system.

An importance of points (i) to (iv) in the foregoing will be appreciated in the context of well-known Chernobyl and Three Mile Island nuclear reactor incidents in Russia and United States of America respectively. In each of these incidents, a group of personnel responsible for controlling their respective nuclear reactors were allegedly not provided with sufficiently clear information quickly enough to appreciate technical processes which were occurring in their respective reactors. Consequently, actions to shut down their respective reactors were not executed sufficiently rapidly to avert an occurrence of operating problems and ensuing disasters. The present invention is capable of addressing such operating problems. In the context of oil and/or gas fields for example, equipment breakdown can occur as well as exceptional oil and/or gas field pressures can be encountered requiring rapid attention.

The invention will now be further elucidated by describing embodiments of the invention.

In Figure 3a, there is shown an illustrative representation of an integrated operation pertinent for oil and/or gas industries. The integrated operation is indicated generally by **200a** and comprises a land area **210a** including an operation centre **220a**, vendor offices **230a**, company offices **240a**, and specialist resources **250a**. Moreover, the integrated operation **200a** further comprises an off-shore marine area **300a** including a plurality of off-shore oil and/or gas platforms **310a**. The integrated operation **200a** constitutes a complex system for exploration and production of oil and/or gas which requires management and coordination of many contributing components as denoted by encircling arrows **350a**. In order for the integrated operation **200a** to function, a complex interaction of technology denoted by **360a**, persons denoted by **370a** and processes denoted by **380a** occurs in operation. As denoted by **390a**, the operation centre **220a**, the vendor offices **230a**, the company offices **240a**, the specialist resources **250a** and the oil and/or gas platforms **310a** are all mutually connected in a complex manner so that the integrated operation **200a** is capable of functioning. Moreover, functioning of the integrated operation **200a** involves complex interactions between certain personnel with other personnel, and personnel with technical equipment. The integrated operation **200a** is directed from the operation centre **220a** pursuant to general directives communicated to the operation centre **220a** from the company offices **240a**, for example expected production yields, oil and/or gas extraction rates required and so forth.

The oil and/or gas platforms **310a** are equipped with a vast array of sensors, for example temperature sensors, fluid flow sensors, drill-bit rotation rate sensors, chemical sensors, seismic sensors, strain gauge sensors, to mention a few examples. Signals from the sensors are relayed by telemetry via local data processing provided at the oil and/or gas platforms **310a** back to the operation centre **220a.** In consequence, the operation centre **220a** is provided with a vast spectrum of data. An operational problem which the present invention seeks to address is to provide a method of handling the vast spectrum of data provided to the operation centre **220a** in combination with, for example, inputs from the specialist resources **250a**, inputs from the vendor offices **230a**, and guideline instructions from the company offices **240a**.

In Figure 3b, there is shown an illustrative representation of an integrated operation pertinent for a hospital facility. The integrated operation is indicated generally by **200b** and comprises a land area **210b** including an operation centre **220b**, vendor offices **230b**, administration offices **240b**, and specialist resources **250b**. Moreover, the integrated operation **200b** further comprises a patient treatment area **300b** including a plurality of care facilities denoted by **310b**, for example operating theatres, medicine dispensaries, recovery facilities and so forth. The integrated operation **200b** constitutes a complex system for delivering treatment to patients which requires management and coordination of many contributing components as denoted by encircling arrows **350b**. In order for the integrated operation **200b** to function, a complex interaction of technology denoted by **360b**, persons denoted by **370b** and processes denoted by **380b** occurs in operation. As denoted by **390b**, the operation centre **220b**, the vendor offices **230b**, the administration offices **240b**, the specialist resources **250b** and the care facilities **310b** are all mutually connected in a complex manner so that the integrated operation **200b** is capable of functioning. Moreover, functioning of the integrated operation **200b** involves complex interactions between certain personnel with other personnel, and personnel with technical equipment. The integrated operation **200b** is directed from the operation centre **220b** pursuant to general directives communicated to the operation centre **220b** from the administrative offices **240b**, for example expected patient handling yields, treatment success rates required and so forth.

The care facilities **310b** are equipped with a vast array of sensors and/or data entry units, for example temperature sensors, breathing monitors, blood monitors, heart rate monitors, cameras for remote monitoring of patients to mention a few examples. Signals from the sensors and/or data entry units are relayed by data networks via local data processing provided at the care facility **310b** back to the operation centre **220b.** In consequence, the operation centre **220b** is provided with a vast spectrum of data. An operational problem which the present invention seeks to address is to provide a method of handling the vast spectrum of data provided to the operation centre **220b** in combination with, for example, inputs from the specialist resources **250b**, inputs from the vendor offices **230b**, and guideline instructions from the administration offices **240b**.

In Figure 3c, there is shown an illustrative representation of an integrated operation pertinent for renewable energy facilities. The integrated operation is indicated generally

by **200c** and comprises a land area **210c** including an operation centre **220c**, vendor offices **230c**, company offices **240c**, and specialist resources **250c**. Moreover, the integrated operation **200c** further comprises an equipment deployment area **300c** including one or more of electricity-generating wind turbines, tidal electricity power generation apparatus, geothermal electrical power generating stations, solar electricity generating apparatus, ocean-wave electricity-generating apparatus, thorium-burning thermonuclear facilities denoted generally by **310c**. The integrated operation **200c** constitutes a complex system for collection and/or generation of energy which requires management and coordination of many contributing components as denoted by encircling arrows **350c**. In order for the integrated operation **200c** to function, a complex interaction of technology denoted by **360c**, persons denoted by **370c** and processes denoted by **380c** occurs in operation. As denoted by **390c**, the operation centre **220c**, the vendor offices **230c**, the company offices **240c**, the specialist resources **250c** and power generating facilities represented by **310c** are all mutually connected in a complex manner so that the integrated operation **200c** is capable of functioning. Moreover, functioning of the integrated operation **200c** involves complex interactions between certain personnel with other personnel, and personnel with technical equipment. The integrated operation **200c** is directed from the operation centre **220c** pursuant to general directives communicated to the operation centre **220c** from the company offices **240c**, for example expected electric production rates, weather conditions, predicted forthcoming energy demand and so forth.

The power generating facilities denoted by **310c** are equipped with a vast array of sensors, for example pressure sensors, anemometers, temperature sensors, fluid flow sensors, rotation rate sensors, chemical sensors, strain gauge sensors, to mention a few examples. Signals from the sensors are relayed by telemetry via local data processing provided at the power generating facilities denoted by **310c** back to the operation centre **220c.** In consequence, the operation centre **220c** is provided with a vast spectrum of data. An operational problem which the present invention seeks to address is to provide a method of handling the vast spectrum of data provided to the operation centre **220c** in combination with, for example, inputs from the specialist resources **250c**, inputs from the vendor offices **230c**, and guideline instructions from the company offices **240c**.

Referring next to Figure 4, the present invention provides an environment indicated generally by **400** which is more conducive for the group of personnel **70** to receive messages and information indicative of the state of the off-shore oil and/or gas platforms or facilities **310a, 310b, 310c** as appropriate; the off-shore oil and/or gas platforms **310a** can be considered generally equivalent to the oil and/or gas field **10** shown in Figure 1. The environment **400** illustrated includes the group of personnel **70** seated at a console **410** or similar desk arrangement in a control room disposed to view an array of one or more display screens indicated generally by **420**. In one embodiment of the invention, the array **420** comprises a single extensive screen in which one or more sub-areas or sub-regions thereof can be selectively allocated to present specific types of associated information; the sub-areas or sub-regions are beneficially definable under software control, for example in response to mouse control or cursor control at the console **410.** In another embodiment of the invention, the array of screens **420** includes a relatively larger central screen **450**, right-hand-side (RHS) upper and lower screens **460U, 460L** respectively, and left-hand-side (LHS) upper and lower screens **470U, 470L** respectively. Optionally, in one example embodiment of the present invention, the central screen **450** is implemented by using a screen projector **480**, for example implemented as a liquid crystal display or actuated micromirror array projection unit. The right-hand-side screens **460U, 460L** and the left-hand-side screens **470U, 470L** are optionally in the example embodiment implemented as panel plasma display screens or panel liquid crystal display (LCD) screens. The screens **420, 460U, 460L, 470U, 470L** are beneficially disposed in an arrangement as illustrated in Figure 4, although other arrangements for the screens are within the scope of the present invention. Such an arrangement of screens as shown in Figure 4 has been devised by the inventors to provide an ergonomically satisfactory presentation for the group of personnel **70.** Moreover, the screens **420, 460U, 460L, 470U, 470L** are beneficially operable to present certain specific categories of information as will be described in greater detail later.

Referring to Figure 5, there is shown a graph including an abscissa axis **500** denoting inspiration or personal motivation (In) of the group of personnel **70**, and an ordinate axis **510** representing operating performance (Pr) of the group **70**. There is also shown a vertical line **520** parallel to the ordinate axis **510** denoting a condition of optimal performance of the group **70**. Moreover, a curve **530**, at least in qualitative measure,

denotes a performance achievable by the group **70**. A first region denoted by **540** to a right-hand-side of the vertical line **520** corresponds to a situation wherein the group **70** is provided with excess information, for example by being unsustainably over-motivated, resulting in a stressful situation and hence, over a period of time, sub-optimal performance in terms of monitoring and managing the integrated operation **200a, 200b, 200c** as appropriate. Conversely, a second region denoted by **550** to a left-hand-side of the vertical line **520** corresponds to a situation wherein the group **70** is not provided with sufficient information, for example by being poorly motivated or inattentive, such that decisions in monitoring and managing the integrated operation **200a, 200b, 200c** as appropriate are not fully considered resulting also in sub-optimal performance of the group **70**. A compromise between the first and second regions **540, 550** represents an optimal performance which the present invention seeks to provide and maintain when generating the environment **400** as illustrated in Figure 4. In achieving the aforesaid optimal performance, the inventors have appreciated in devising the present invention that the group **70** needs to be provided with an optimal amount of information for any given process being monitored and/or managed. Such optimal amount of information is, for example, temporally dynamically varying in response to events occurring in the integrated operation **200**.

Referring next to Figure 6, there is shown a graph comprising an abscissa axis **560** denoting time (T) from left to right, and an ordinate axis **570** defining possibilities or opportunities (MUL) provided to the group **70** for monitoring and managing the integrated operation **200a, 200b, 200c** as appropriate; the possibilities or opportunities increase from bottom to top along the ordinate axis **570**. A first curve **580** (MEA) denotes a cumulative number of measurements which are potentially susceptible to being collated with time from the integrated operation **200a, 200b, 200c** to the operation centre **220a, 220b, 220c** respectively whereat the group **70** is located. Moreover, a second curve **590** (OBS) denotes an optimal cumulative number of observed measurements needed for optimally monitoring and managing the integrated operation **200a, 200b, 200c**. It will be appreciated from Figure 6 that a degree of selective filtering of measurement data and/or input data provided from the integrated operation **200a, 200b, 200c** is needed for the group **70** to be able, in view of their human limitations such as concentration and attention span, to optimally monitor and manage the integrated operation **200a, 200b, 200c**. Generation of a filter for providing such selective filtering of

measurement data is a complex task when the integrated operation **200a, 200b, 200c** is highly convoluted in nature. The present invention provides an approach to realizing such a filter.

The inventors of the present invention have appreciated that understanding and definition of processes and associated work-flow within the integrated operation **200a, 200b, 200c** is of prime importance. Referring to Figure 7, there is shown a hierarchy of steps as defined in Table 1.

Table 1: hierarchy of steps in Figure 7

Reference no.	Mnemonic abbreviation	Definition
600	DSC	Discussion, for example within the group of personnel **70** during functioning of the integrated operation **200**
610	PS-WF	Process steps and work flow
620	KOP	Knowledge of processes; knowledge of workflows
630	DATA	Data for presentation to the group of personnel **70**
640	MM	Measurement model

A conventional hitherto employed approach to monitoring and managing the integrated operation **200a, 200b, 200c** corresponds to a bottom-up (BU) approach as denoted by an arrow **650** and described in the foregoing with reference to Figures 1 and 2. In such a conventional approach, measurements are collated from the integrated operation **200a, 200b, 200c** in the step **640** (MM) and then processed in a standard manner to provide data **630** (DATA) for presentation to the group of personnel **70**. Some portions of this data **640** (DATA) are relevant for managing the integrated operation **200a, 200b, 200c** at any given instance of time whereas other portions of the data **640** (DATA) are irrelevant, or potentially confusing; sorting out irrelevant from relevant data at the given instance of time is susceptible to causing the group **70** to function in the stressful region **540** illustrated in Figure 5. By knowledge **620** of processes (KOP), namely workflows, occurring within the integrated operation **200a, 200b, 200c**, for example personal experience of certain personnel in the group **70**, it is possible to interpret the data **630** (DATA) to identify which process step in a work flow as denoted by **610** (PS-WF) has been achieved in any given part of the integrated operation **200a, 200b, 200c**. When a corresponding relevant work flow has been identified, a discussion as denoted by **600** (DSC) can then occur within the group **70** to determine a correct course of action for

managing and monitoring the integrated operation **200a, 200b, 200c**. Such a conventional approach as denoted by the arrow **650** (BU) is not only stressful for the group **70**, but also potentially open to sub-optimal decisions occurring, for example in a similar manner to those which occurred at Chernobyl and Three Mile Island nuclear facilities. The bottom-up approach as denoted by the arrow **650** arises on account of an incremental manner in which proprietary software products are configured together to provide a conventional type of tool for managing the integrated operation **200a, 200b, 200c**.

In contradistinction, as denoted by an arrow **660** (TD) in Figure 7 representing a top-down approach, the inventors have appreciated that it is more efficient to design the environment **400** so that it is more conducive to efficient monitoring and management of the integrated operation **200a, 200b, 200c**, for example under generally normal production conditions. The present invention is capable of being implemented by one or more software products executable on computer hardware for providing the aforesaid top-down approach. The top-down approach represented by the arrow **660** in Figure 7 involves a discussion and subsequent decision within the group of personnel **70** regarding how the integrated operation **200a, 200b, 200c** should be monitored and managed. When an appropriate approach to execute such monitoring and management has been decided, process-steps and a corresponding work-flow are then user-defined *a priori* to being employed in practice; a work-flow is defined as a temporally implemented sequence of process-steps. The process-steps are optionally user-entered via the aforesaid one or more software products implementing the invention, or are user-selected from a predefined list presented by the one or more software products implementing the invention. From experience and knowledge of the user, for example one or more personnel of the group **70**, categories and types of data **630** necessary for supporting the process steps and associated workflow **610** are then defined, for example in an *a priori* manner. Such categories can represent one or more of:

(a) a selection of a subset of data derived from a given set of data;

(b) an aggregate of a plurality of subsets of data derived from a plurality of corresponding sets of data;

(c) a selection of a given set of data;

(d) an aggregate of a plurality of given sets of data; and

(e) an aggregate of at least a first set of data with at least a subset of data derived from a second set of data.

The categories and types of data **630** are susceptible, for example, of being invoked by way of defining one or more support software products which are operable to acquire, collate, processor and/or analyse data. Thus, the sets and subsets of data can be derived from a given support software product. Alternatively, the sets and subsets can be generated from a plurality of support software products.

When the categories and types of data **630** have been defined, measurements necessary for generating such data are then determined, for example automatically by the one or more software products from information supplied thereto regarding structure of the integrated operation **200a, 200b, 200c** as appropriate.

By adopting such a top-down approach as facilitated by the one or more software products pursuant to the present invention, the group of personnel **70** are able to manage and monitor functioning of the integrated operation **200a, 200b, 200c** in terms of process steps and work-flows without having to consider, on a real-time basis when invoking workflows, what data and associated measurements are required to be accessed; such a manner of operation potentially greatly reduces stress to the group of personnel **70**. For example, when there are large number of off-shore platforms **310a**, or oil and/or gas wells, the group of personnel **70** in the environment **400** are thereby pursuant to the present invention not overwhelmed with information and are therefore optimally capable of monitoring and managing the integrated operation **200a** as denoted by the axis **520** (Op) in Figure 5. By such optimal operation, a risk of equipment accidents and such like can be potentially greatly reduced and output production of oil and/or gas can be substantially optimized by employing the present invention.

In the environment **400** illustrated in Figure 4, a central region of the array of one or more screens **420** as illustrated in Figure 8 is beneficially used to present a spatial map of the integrated operation **200a, 200b, 200c**; for example, the central screen **450** can be used beneficially for such purpose. Optionally, the spatial map is spatially movable amongst the array of screens **420**. Such a map is advantageously a three-dimensional (3-D) perspective view as will be elucidated in greater detail later. Symbols and/or sub-regions of the perspective view can be highlighted by the one or more personnel **70**, for

example in a manner of a 3-D portal, to invoke one or more of workflows, operating procedures, measurement data, analysis results and so forth pertaining the highlighted symbols and/or sub-regions. One or more workflows, operating procedures, measurement results, analysis results and so forth can be presented on mutually different screens or screen regions of the array **420**. Such workflows, operating procedures, measurement results, analysis results as presented graphically can themselves function as portals to further information and/or data; for example, clicking a mouse and/or cursor on given data results can invoke information regarding sensors employed to derive the data results together with a measurement procedure adopted when using the sensors.

An upper left-hand-side region of the array **420**, for example the upper left-hand-side screen **470U**, is beneficially employed to present process flow information to the group of personnel **70**. Moreover, a lower left-hand-side region of the array **420**, for example the lower left-hand-side screen **470L**, is beneficially used for presenting data being used by the one or more software products executing on computing hardware to implement the present invention in the environment **400**. Furthermore, a lower right-hand-side region of the array **420**, for example the lower right-hand-side screen **460L**, is optionally employed to present a given selected operating procedure. An upper tight-hand-side region of the array **420**, for example the upper right-hand-side screen **460U**, is optionally employed for diverse purposes, for example presenting points of a selected agenda to the group of personnel **70**. However, it will be appreciated that the screens **450, 460U, 460L, 470U, 470L** are susceptible to being user-respecified with regard to information that they present during operation when creating the environment **400**. Beneficially, the side screens **460U, 460L, 470U, 470L** present information invoked by moving a cursor or similar around graphic symbols and images presented on the central screen **450**, for example in a manner of the aforementioned 3-D portal. As elucidated in the foregoing, invoking a given region or screen of the array **420** beneficially invokes corresponding computational results and/or data pertinent thereto in operation without the group of personnel **70** needing to consider in real-time from which data base or files the results and/or data are stored; such details are provided when defining given workflows being invoked.

Examples of implementation of one or more software products executable on computing hardware at the operation centre **220a, 220b, 220c** will now be described with reference to Figure 9. The operation centre **220a, 220b, 220c** includes the console **410** and the array of screens **420** as described earlier. Moreover, the operation centre **220a, 220b, 220c** includes, or has associated therewith, computing hardware **700** including one or more computers. The computing hardware **700** is coupled, either indirectly or directly, via a data communication link **720** to other parts of the integrated operation **200a, 200b, 200c**, for example to the off-shore oil and/or gas platforms **310a**. Moreover, the computing hardware **700** is also coupled to data storage **710** including databases **770, 830**; the databases **770, 830** are physically located at one or more of: locally at the operation centre **220a, 220b, 220c**, remote from the operation centre **220a, 220b, 220c**. The computing hardware **700** is operable to execute one or more proprietary support software products denoted by **750**; beneficially, the one or more proprietary support software products **750** are existing software which has, prior to implementing the present invention, been used for controlling functioning of the integrated operation **200a, 200b, 200c** in a sub-optimal manner. The one or more proprietary software products **750** are operable to employ a data link **760** for accessing the databases **770** for storing computational results, logging data, accessing pre-computed information and so forth.

One or more software products denoted by **800** represent an embodiment of the present invention. The one or more software products **800** are configured to be executed on the computing hardware **700** concurrently with the one or more earlier proprietary support software products **750** and also to interface therewith via a data link denoted by **780**. Moreover, in operation, the one or more software products **800** are operable to access their own special database **830** via a data link **820**. Furthermore, the one or more software products **800** are operable to selectively communicate data to the one or more proprietary support products **750** for having data processing performed therein, wherein results of such data processing are returned to the one or more software products **800** for subsequent handling therein, for example for storage in the database **830** or for presentation to the group of personnel **70** via the array of one or more screens **420**.

The one or more software products **800** are operable to create the environment **400** as depicted in Figure 4. Moreover, the one or more software products **800** are designed to be beneficially added to the one or more earlier proprietary support software products

750 so that introduction of the one or more software products **800** of the invention does not beneficially result in disruption in operation of the integrated operation **200a, 200b, 200c**. Such disruption is not only potentially costly, but also potentially dangerous if, for example, safety services for the integrated operation **200a, 200b, 200c** are temporarily disrupted during installation of the one or more software products onto the computing hardware **700**. The present invention is susceptible to avoiding occurrence of any such disruption whilst maintaining optimal normal production.

As elucidated in the foregoing, the one or more software products **800** create the environment **400** for enabling the group of personnel **70** to adopt the aforesaid top-down approach to management and/or monitoring of the integrated operation **200a, 200b, 200c** as depicted in Figure 7. The one or more software products **800** will next be elucidated in greater detail with reference to Figure 10.

The one or more software products **800** are, in one example embodiment of the present invention, configured as shown in Figure 10. Components in Figure 10 are defined in Table 2.

Table 2: definition of component parts of the one or more software products **800**

Reference number	Mnemonic abbreviation	Definition
900	DIS	Data Integration Service
910	ERAS	ERA Services
920	WSS	Work Space Service
930	ERA 3D	ERA 3D service
940	COLS	Collaboration Service
950	WEBS	Web services
960	RTAS	R-T Analysis Service
1000	ERAC	ERA Client
1010	ERA-WC	ERA Workflow Composer
1020	ERA-WF	ERA Workflow Facilitator

The database **830** is beneficially referred as being an "ERA database" for supporting the one or more software products **800** which are conveniently referred to as an ERA software suite. The software suite **800** includes an ERA client **1000** which is a software product executable on the computing hardware **700** to facilitate data communication to the array of one or more screens **420**, and to the console **410** for receiving keyboard-

entered instructions therefrom in operation. The ERA client **1000** includes an ERA Workflow Composer **1010** which is a software product executable on the computing hardware **700** to present the group of personnel **70** with a graphical user interface (GUI), for example on the upper left-hand-side screen **470U**, for composing, namely defining and/or entering, a new work flow for use for controlling the integrated operation **200a, 200b, 200c** as appropriate. Moreover, the ERA client **1000** also includes an ERA Workflow Facilitator **1020** which is a software product executable on the computing hardware **700** for accessing a given workflow defined by the group of personnel **70** using the workflow composer **1010** and for implementing the given workflow within the integrated operation **200a, 200b, 200c**. The ERA Workflow Facilitator **1020** beneficially provides a mechanism by which event-driven workflows can be invoked at appropriate times. A workflow can be of diverse nature, for example one or more of:

(a) performing maintenance on one or more of the offshore platforms **310a**;

(b) installing one or more new items of equipment on one or more of the off-shore platforms **310a**;

(c) modifying one or more rates of oil and/or gas production on one or more of the aforesaid offshore platforms **310a** for optimally controlling wellhead pressure;

(d) modifying an operating routine or operating procedure at one or more of the offshore platforms **310a**;

(e) performing one or more non-routine special measurements or tests at one or more of the off-shore platforms **310a**, for example: a series of seismic measurements, a series of bore-hole pressure or flow rate measurements, a chemical analysis of bore-hole substances and so forth;

(f) transporting personnel to and/or from one or more of the offshore platforms **310a**;

(g) arranging for oil and/or gas collection from one or more of the offshore platforms **310a**;

and so forth.

The ERA client **1000** within the ERA software suite **800** is operable to communicate with one or more ERA services software products **910**. The ERA services software products **910** include one or more of: a work space service **920**, an ERA 3D service **930,** a collaboration service **940**, Web services **950**, and R-T analysis services **960**. The work space service **920** is invoked by the ERA client **1000** when the group of personnel **70** are desirous to view a given workspace, for example a plan view of one of the off-shore

platforms **310a** to be shown on the central screen **450**; the work space service **920** is thus tasked with creating a graphical environment as viewed by group of personnel **70** when viewing the array of one or more screens **420**. Invoking a given workspace on the array **420** optionally specifically invokes databases, computed results, measurement data, background information, operating procedures and so forth associated with the given workspace. Moreover, the ERA 3D service **930** is invoked when the ERA client **1000** requires a 3-D image, namely perspective 3-D view in a two-dimensional format, to be generated for presentation to the group of personnel **70**, for example a 3-D image of layers of geographical strata lying beneath a given off-shore platform **310a** through which a borehole is to be drilled, a perspective map view of a facility to be monitored and/or managed; the ERA 3D service **930** is operable to provide, for example, the aforesaid 3-D portal. The collaboration service **940** is invoked when the group of personnel **70** need to communicate with other groups of personnel when implementing a given workflow, for example communicating with relevant specialist resources **250a, 250b, 250c**; for example, in connection with implementing a new borehole drilling operation, specialist knowledgeable geologists need to be contacted to be available on a given off-shore platform **310a** whilst drilling of the new borehole is executed in case of complications arising during drilling. The collaboration service **940** is optionally operable to establish a video conference without the group of personnel **70** needing to expend effort during operation in find telephone numbers and such like for the geologists. Moreover, the collaboration service **940** is susceptible to being invoked from a defined step of an *a priori* submitted workflow.

The Web services **950** are invoked by the ERA client **1000** when implementing a given workflow or invoking a given workspace on the array **420**, for example when access is needed to external data communication networks such as remote information databases, web-sites and similar accessible via the Internet. Furthermore, the R-T analysis services **960** are invoked by the ERA client **1000** when specific types of data processing are required when implementing a given workflow selected by the group of personnel **70** in operation; such data processing is potentially invoked when a given workflow and/or workspace is selected by the group of personnel **70**, for example when the workflow requires graphical analytical results to be presented to the group of personnel **70**.

The ERA client **1000** is preferably written, at least in part, in contemporary computer languages such as contemporary C++ and C#.

It will be appreciated that the ERA client **1000** is capable of supporting execution of several workflows concurrently. Moreover, the ERA client **1000** enables progress on each of the concurrently executing workflows to be monitored and managed, for example in a mutually independent manner. Furthermore, a given workflow executing via the ERA client **1000** is susceptible to invoking several of the services **920, 930, 940, 950, 960** concurrently; for example, seismic measurements executed in a data acquisition stage of a given workflow need in a subsequent step of the workflow to be processed by the R-T analysis service **960** and analysis results generated thereby processed into 3-dimensional graphical format using the ERA 3D service **930** for generation of an image for presentation on the array of screens **420**. Certain of the services **920, 930, 940, 950, 960** potentially require access to data processing provided by the one or more earlier proprietary software products **750** for performing various computational tasks, for example data analysis and statistical computation, provided by way of the aforesaid link **840**.

Optionally, the workflows entered into the ERA client **1000** can be hierarchical in nature, namely certain workflows being subordinate parts of other higher-order workflows. The subordinate workflows are beneficially invoked via execution of higher-order workflows. Alternatively, workflows can be defined in a top-down in isolation of other workflows for the integrated operation **200a, 200b, 200c** as appropriate. Optionally, execution of certain workflows can be automatically initiated by the ERA software suite **800** in response to certain physical conditions, for example excess well oil and/or gas pressure or excess oil flow conditions, occurring with the integrated operation **200a**; such automatic initiation is conveniently referred to as being event-driven initiation of workflows. In such situations, the ERA software suite **800** is operable to automatically visually and/or aurally highlight, namely "flag up", to the group of personnel **70** the workflows which have been conditionally automatically invoked. Alternatively, or additionally, certain workflows can be automatically terminated by the ERA software suite **800** in an event that physical conditions causing the workflows to be invoked are no longer prevalent, for example reduction in oil-well pressure or certain equipment unexpectedly coming back into function.

The database **830** associated with the software suite **800** is of special benefit in that operation of the one or more earlier software products **750** is not interrupted or compromised by way of installation and subsequent operation of the ERA software suite **800**; the ERA software suite **800** is thereby potentially capable of being installed in a substantially seamless manner. Moreover, for rapid presentation of information on the array of one or more screens **420**, the ERA software suite **800** is operable to access data rapidly from the database **830** which is beneficially not accessed by the one or more earlier proprietary software products **750**. Such an arrangement of providing the ERA software suite **800** with its own database **830** renders the ERA software suite **800** prompt and responsive to instructions and requests entered by the group of personnel **70** at the console **410**. Such prompt presentation potentially reduces working stress for the group of personnel **70**.

It will be appreciated that the ERA software suite **800** is not only susceptible to being used as described by way of example for the integrated operation **200a**, but is also susceptible of being used to control other types of complex system as elucidated in the foregoing, for example wind turbine energy farms, solar array panel systems and so forth in the integrated operation **210c**. The present invention is thus highly appropriate for addressing problems associated with "peak oil", namely that World oil and gas production has peaked circa year 2005 and that remaining oil and gas reserves need careful management, as well as alternative energy sources need to be promptly introduced and managed to avoid economic collapse in many technically advanced countries of the World in the near future.

Although use of the ERA software suite **800** in the operation centre **220a** is described, the software suite **800** is, for example, susceptible to being alternatively, or additionally, employed at one or more of the platforms **310a**; such application pertains mutatis mutandis for the integrated operations **200b**, **200c**. The software suite **800** is thus susceptible to being used at a plurality of spatial locations in a hierarchical manner within the integrated operation **200a, 200b, 200c**. Yet more optionally, the ERA software suite **800** when employed a plurality of times in a complex system can be operable to define its own hierarchy in a manner of a peer-to-peer network by mutual communication between the plurality of co-executing software suites **800**.

Such versatile adaptation of the ERA software suite **800** is possible by way of a data integration service software product **900** forming a part of the ERA software suite **800**, wherein definitions are submitted for data exchange between the one or more earlier proprietary support software products **750** and the ERA software suite **800**. Optionally, the data integration service software **900** can be automatically self-adjusting to accommodate introduction of new support software into the operation centre **220a, 220b, 220c** and/or at one or more of the platforms **310a** or facilities **310b, 310c**. When adapting the ERA software suite **800** to a given task, for example for managing a specific type of integrated operation, definitions of interfaces are entered, for example by skilled computing personnel, via the data integration service **900**. In an event of the one or more proprietary software products **750** being later upgraded with additional software products, the data integration service **900** can be optionally invoked so that an additional definition can be input so that the ERA software suite **800** is operable to access such additional software products.

The data integration service **900** is susceptible to receiving configuration instructions or configuration data entered in a high-level control language, for example via Java, Javascript or similar. Use of such high-level language enables the data integration service **900** to be applied to adapt the software suite **800** to diverse applications as elucidated in the foregoing by using instruction code which is readily intelligible to computing personnel.

When a given step of workflow is entered via the ERA workflow composer **1010** which needs access to measurements and/or earlier measurement data stored in the one or more databases **770**, the given step, for example, will define that it requires a given service **910** to be invoked, for example the R-T analysis service **960**. The R-T analysis service **960** has access to certain processing facilities in one or more of the software products **750** which it achieves via the link **840**, the link **840** also being defined via the aforesaid data integration services **900**. Moreover, the data integration services **900** are also used to define which data is to be copied from the one or more databases **770** and stored in the database **830** for rapid access by the R-T analysis service **960**; in this respect, the data integration services **900** are operable to establish a selective data filter. By employing such an approach, the ERA software suite **800** is rendered highly

responsive to the group of personnel **70** and capable of promptly presenting them with relevant information indicative of conditions within the integrated operation **200a, 200b, 200c**, for example in response to the group **70** invoking a given workflow for consideration. Use of the ERA software suite **800** is potentially capable of ensuring substantially optimal performance in normal operating conditions. Moreover, the ERA software suite **800** can, for example, be optionally used to avert undesirable technical incidents from occurring when managing and monitoring complex systems, for example incidents such as occurred at Chernobyl and Three Mile Island nuclear plants.

A manner of presentation provided by the software suite **800** on the central screen **450** is also beneficially arranged to reduce stress experienced by the group of personnel **70**. For example, the central screen **450** is beneficially employed, as elucidated in the foregoing, to present spatial map information in perspective format. Optionally, the spatial map is relocatable amongst the array of screens **420**, for example under mouse-based or curser-based or similar screen control. Colored regions and/or symbols are beneficially overlaid by the ERA client software products **1000** onto geographical regions of the map information, for example an increased well pressure at a given off-shore platform **310a** needing attention via a workflow defined for high-production conditions. For example, it is normal that in a range of 1% to 5% of the oil and/or gas platforms **310a** are responsible for in a range of 20% to 40% of total oil and/or gas production from the integrated operation **200a**; attention to optimize production from highly productive platforms **310a** is of great importance. However, it will be appreciated that the integrated operation **200a** is a dynamically changing system such that certain oil and/or gas platforms **310a** whose oil and/or gas production was initially low can later become highly productive and vice versa. Complex conditions can potentially arise in operation, for example boreholes can become blocked due to decomposition and/or deposition of gas hydrates therein.

Such colored regions and/or overlaid symbols are beneficially used to indicate safety zones, for example 150 metre radius safety zones, around one or more facilities, for example off-shore platforms **310a**, whereat an incident has occurred such as highly enhanced oil and/or gas well pressure. Alternatively, such colored regions and/or symbols can be used to present information to the group of personnel **70** indicative of current yield of oil being obtained from the off-shore platforms **310a**, or indicative of

energy being generated by wind turbines comprising a wind farm for example, or power flows occurring at various locations in an electricity distribution network and so forth.

The aforesaid collaboration services software product **940** is also susceptible to enabling one or more regions of the array of one or more screens **420**, for example one or more of the screens **450, 460U, 460L, 470U, 470L,** to be operable to support video conferencing, for example when the group of personnel **70** need to be in rapid communication with specialist resources **250a** in an event of a high-production situation arising. In dealing with the high-production situation, a workflow defined via the ERA client software products **800** has as one of its steps to invoke a video conference with the specialist resources **250a** and will establish such a conference, for example by pre-calling the specialist resources **250a** to warn them of occurrence of the video conference as well as establishing data communication links from the operation centre to the specialist resources **250a** at an appropriate time. Such operation of the ERA software products **800** is capable of greatly reducing personnel stress in the environment **400**, thereby providing for more efficient operation and/or reduced risk of accidents or similar incidents occurring.

In the foregoing, a "work flow" is beneficially defined as comprising a series of steps to be executed in a defined temporal sequence. Moreover, the steps can be diverse in nature relating to processing activities necessary to support the environment **400** as well as activities to be executed in various parts of the integrated operation **200a, 200b, 200c**. For example, an example workflow relating to installation of an item of equipment on a given off-shore oil and/or gas platform **310a** of the integrated operation **200a** can involve workflow steps of:

(a) automatically flagging up at an appropriate instance of time t_0 within the environment **400** when installation of the equipment is required on the given oil and/or gas platform **310a**;

(b) presenting to the group of personnel **70** corresponding operating procedures which need to be taken into consideration when installing the equipment;

(c) automatically arranging a video conference with specialist resources **250a** responsible for installing the equipment;

(d) retrieving information, for example operating procedures, from the database **830** pertinent to installation of the equipment and presenting the information to the group of personnel **70** and/or to the specialist resources **250a**;

(e) sending a specification of the equipment to the vendor offices **230a** for procurement;

(f) subsequently selectively collating measurements from monitoring sensors at the given oil and/or gas platform **310a**, for example cameras located at various spatial locations, and filtering the measurements to generate corresponding monitoring data during installation of the given equipment on the given oil and/or gas platform **310a** and storing the monitoring data in the database **830**;

(g) accessing the database **830** to extract the monitoring data to automatically report back at defined intervals to the group of personnel **70** and/or to the specialist resources **250a** regarding progress of installation of the equipment;

(h) when the equipment has been brought into operation at the given oil and/or gas platform **310a**, collating operating measurements from sensors associated with the equipment, selectively filtering the operating measurements for generating operating data, storing the operating data in the database **830**, and subsequently accessing the database **830** at a time instance t_1 defined in the workflow, to present operating results derived from the operating data to the group of personnel **70**; and

(i) optionally invoking a subordinate workflow for initiating a maintenance process or a trouble-shooting process in an event that the equipment installed on the oil and/or gas platform **310a** is not performing according to defined specifications.

Such considerations pertain mutatis mutandis to the integrated operations **200b, 200c**.

The example workflow is submitted in a top-down manner using the ERA software suite **800** prior to procurement of the given equipment. The example workflow defined in steps (a) to (i) includes a diverse range of steps to be executed in temporal sequence wherein information presented to the group of personnel **70** is defined *a priori* in a workflow devised in a top-down manner.

It will be appreciated that workflows submitted to the ERA software suite **800** can have one or more operating procedures associated therewith. Optionally, the operating procedures are stored on the database **830**. Moreover, specific types of data relevant to

the workflows are also susceptible to being defined by the group of personnel **70**. In consequence, the given workflows are presented on the array of one or more screens **420**, their corresponding procedures and associated relevant data are optionally simultaneously presented. A graphical representation of the data can optionally be overlaid onto the spatial representation as provided in operation on the central screen **450**. One or more workflows can be optionally simultaneously presented on the array of screens **420**, together with a mutual relationship between the workflows, for example their hierarchical dependence and/or their relationship to various potentially relevant procedures.

The present invention is not limited to being applied solely in respect of the integrated operation **200a, 200b, 200c** as elucidated in the foregoing, for example a complex configuration of off-shore oil and/or gas platforms **310a**. It is, for example, potentially susceptible to being adapted for one or more of the following:

(a) a configuration of oil and/or gas wells;

(b) a configuration of offshore oil and/or gas platforms;

(c) a configuration of wind turbines operable to generate electricity;

(d) a configuration of solar cells for operable to generate electricity;

(e) a nuclear electrical power generating installation;

(f) an electricity distribution network;

(g) a configuration of marine wave energy units operable to generate electricity from marine wave motion;

(i) a configuration of dams and/or sluices;

(j) a convention fossil-fuel burning electricity generating facility;

(k) a configuration of coal mines for mining coal;

(l) a configuration of geothermal sites for collecting geothermal energy;

(m) a logistics configuration for distributing goods;

(n) a water distribution network;

(o) a configuration of hospital facilities;

(p) a railway network;

(q) a configuration of airport facilities;

(r) an educational facility, for example academic faculties of a university;

(s) for emergency relief services deployment in disaster zones, for example for famine aid during a drought;

(u) in space exploration facilities, for example when launching satellites into Earth orbit;

although not limited thereto.

It will be appreciated that the ERA software suite **800** as described in the foregoing is capable of being furnished with additional facilities without departing from the scope of the invention as defined by the appended claims. Thus, modification to embodiments of the invention described in the forgoing is feasible without departing from the scope of the invention as defined by the appended claims.

Optionally, the array of one or more screens **420** can be implemented as a single expansive screen, for example an expansive projection screen, with sub-areas spatially allocated to present information substantially in a manner as described for the screens **450, 460U, 460L, 470U, 470L** and variants therefore as elucidated in the foregoing. Optionally, work-spaces presented on the array of one or more screens **420** can be flexibly moved around in relative juxtaposition in response to preferences of the group of personnel **70**, for example by way of one or more mouse devices or cursor devices at the console **410**.

The ERA software suite **800** is beneficially operated on a Linux, Microsoft or similar highly stable computer platform forming a part of the one or more proprietary software products **750**.

Referring next to Figure 11, one or more members **1500** of the group of personnel **70** operable to manage the integrated operation **200a, 200b, 200c** as appropriate via the environment **400** are potentially required to work from time-to-time remotely from the environment **400**. The ERA software suite **800** is beneficially provided with a remote monitoring and control functionality for enabling the one or more members **1500** to remotely view at least a portion of the one or more screens **420,** or optionally all of the one or more screens **420**, from a remote location; such remote control is susceptible to being provided, for example, from a remote portable computer coupled via a communication network, for example via the Internet or a telecommunications network. Such functionality enables a technical expert, for example, spatially at an item of plant or equipment of the integrated operation **200a, 200b, 200c** to participate in discussion

occurring within the environment **400**, for example during discussions concerning deployment of the item of plant or equipment. Moreover, the ERA software suite **800** is optionally further provided with a remote control functionality such that the one or more members **1500** are optionally able to be provided with remote control of at least a portion of the one or more screens **420**, or optionally for all of the one or more screens **420**. The remote control functionality enables a technical expert located remotely from the environment **400** to be able to both visually follow images being presented on at least a portion of the one or more screens **420** in addition to remotely controlling cursers and similar pointing devices for at least in part steering operation of the ERA software suite **800**. These functionalities enable the environment **400** to be dynamically flexible, namely extending out to remote members **1500** in response to need and/or events occurring within the integrated operation **200a, 200b, 200c**.

Such remote control functionality is susceptible to being dynamically invoked or cancelled depending on events occurring within the integrated operation **200a, 200b, 200c** as appropriate. Moreover, the remote control avoids a need for personal to have to physically travel to be present at premises whereat the one or more screens **420** are housed, thereby avoiding a need for personnel to travel. When the integrated operation **200a, 200b, 200c** is spatially disposed over several continents, for example a hospital facility with specialist medical departments in various countries such as an oncology department in the United Kingdom and a neural illness department for treatment of schizophrenia in Denmark, an avoidance of a need for such travel is a considerable benefit, especially in view of the future implications of "Peak Oil" in the World that postulates that peak oil and gas production occurred in year 2005 and that declining World production of oil and gas ensures thereafter.

Optionally, the ERA software suite **800**, namely interfacing software, is operable to employ one or more support software products to provide a communication route from the one or more remote members **1500** which are remote from the location whereat the one or more personnel are spatially concentrated as depicted in Figure 4.

It will be appreciate from the foregoing that the present invention is concerned with a network of computing devices which is configured using appropriate software to provide real-time dynamic information gathering from a complex installation and to present to

one or more personnel a representation, for example a three-dimensional representation, of the complex installation on one or more two-dimensions screens in a manner known as a "3-dimensional portal" or "3-D portal". The representation on the one or more screens is optionally at an oblique angle, namely a perspective view. The oblique angle of the representation is optionally continuously variable so that the one or more personnel are able to view the representation from above and beneath.

The one or more personnel are also able to selectively activate one of more categories of main symbols of the representation corresponding to equipment, plant, buildings, personnel or similar within the complex installation and receive subsidiary symbols, for example symbols representative of an underlying geological formation. The one or more personnel are then able to interrogate the subsidiary symbols to obtain further information, for example technical data regarding characteristics of a geological layer, drill bits being used to bore through a geological layer, likely oil air/or gas yield in a given geological layer, one or more names of technical experts who can be contacted who are specifically knowledgeable regarding the given geological layer, relevant Internet sites and so forth. The main symbols as well as the subsidiary symbols together with associated data are continuously, in real-time, updated on the one or more screens, for example as personnel are moving about within the installation, as equipment is installed and/or decommissioned from the installation, and/or as one or more events are developing in the installation. Beneficially, the installation is:

(a) an oil and/or gas prospecting installation; and/or

(b) an oil or gas production installation,

although the installation can be of other types, for example mining installations, geothermal electricity generation facilities, a subterranean nuclear waste repository, a hospital system, a transport system, a goods distribution system, even a financial control system.

Referring to Figure 12, the integrated operation **200a** is shown. In the integrated operation **200a**, there are included the computing hardware **700** including a plurality of computers which are operable to exchange data therebetween. Data flow between a first portion of the integrated operation **200a**, for example including the off-shore marine area or extensive land-based oil and/or gas facility denoted by **300a**, and a second portion of the integrated operation **200a** included in the environment **400** is executed via

the communication link **720**. The communication link **720** includes at least one of: wireless communication, optical fibre communication, electrical wire communication, physical exchange of data carriers (for example data loggers). The environment **400** is optionally included spatially as an integral part of the offshore marine area or extensive land-based oil and/or gas facility **300a**. Similar considerations pertain mutatis mutandis to the integrated operations **200b, 200c** in their respective technical specialities.

The offshore marine area or extensive land-based oil and/or gas facility denoted by **300a** includes one or more facilities, for example aforementioned one or more oil and/or gas platforms **310a**. Moreover, there are also personnel such as aforementioned specialist resources **250a**, vehicles, vessels and similar dynamically moving within the integrated operation **200a**. The one or more facilities and the personnel are beneficially each provided with computer-based communication apparatus for providing them with an interface via the communication link **720** to the environment **400**.

The environment **400** is implemented at one or more spatial locations. More optionally, the environment **400** is located on a ship, on an oil platform, on a gas platform, or on land. Moreover, the environment **400** includes the ERA software suite **800** implemented in the computing hardware **700** for receiving and sending in operation data from and to the communication link **720** respectively. The environment **400** also includes aforementioned one or more databases **770, 830**, and/or a communication connection to one or more external databases **770, 830**, for example via the Internet or similar data communication network. Moreover, the computing hardware **700** is coupled to the aforesaid array of one or more display screens **420**. The one or more screens **420** are beneficially implemented as an array of wall-mounted plasma or liquid crystal display (LCD) pixel displays; alternatively, the one or more screens **420** are implemented as projection screens as elucidated in the foregoing.

The computing hardware **170** is also provided with a data entry arrangement by way of the aforesaid console **410**. As elucidated in the foregoing, the console **410** is beneficially implemented as one or more of:

(a) one or more keyboards and/or pointing accessories such as a computer mouse or a tracker-ball;

(b) voice recognition hardware and/or software for interpreting speech of one or more personnel and converting the speech to corresponding data to instruct the computing hardware **700**;

(c) a wireless interface for receiving instructions from a wireless device; and

(d) an image data entry, for example in response to hand and arm movements performed by the one or more personnel.

Referring next to Figure 13a, there is shown an example form for a 3-dimensional image presented on the array of one or more screens **420**; the example form is indicated generally by **2000**. There is presented a perspective view **2010** of the offshore marine area or extensive land-based oil and/or gas facilities **300a** including graphical icons **2020**, **2030** representing various equipment and technical plant of the offshore marine area or extensive land-based oil and/or gas facilities **300a**. Moreover, there is also presented one or more icons **2040** representing personnel, emergency vehicles, vessels, service vehicles and such like present in real-time in the marine area or land-based facilities **300a**; one or more positions of the one or more icons **2040** respectively in the view **2010** are representative of a corresponding spatial distribution of their corresponding structures present in the offshore marine area or extensive land-based oil and/or gas facilities **300a**. The computing hardware **700** is susceptible to being user-configured to selectively show one or more preferred categories of these graphical icons in the perspective view **2010.** For example, the computing hardware **700** is susceptible to being user-configured to selectively show only icons representing wellheads, only icons representing interconnecting pipelines, or a combination of wellheads, pipelines and personnel.

There is also presented a pointing icon **2050**, for example in a form of an arrow or cross, which the one or more personnel are operable to manipulate using the console **410**. When the pointing icon **2050** is overlaid or in close proximity on the one or more screens **420** to one of the icons representative of an entity in the marine area or land-based facilities **300a**, the computing hardware **700** is operable to show a subsidiary field **2100**. The subsidiary field **2100** is optionally shown adjacent to its corresponding icon as shown in Figure 13a, or alternatively on a side screen adjacent to the perspective view **2010** remote from its corresponding icon as shown in Figure 13b. The subsidiary field **2100** is beneficially representative of geological strata beneath the entity, for example

providing physical information regarding strata characteristics, oil and gas yielding properties of the strata, porosity of the strata and so forth; beneficially, other information is simultaneously provided in the subsidiary field **2100**, for example names of experts and specialists who can be consulted who are knowledgeable regarding strata types. Alternatively, when the pointing icon **2050** is overlaid or in close proximity to an icon **2040** representing one or more members of personnel, the subsidiary field **2100** beneficially includes details of competences of the one or more personnel, contact details, to which team or group the one or more personnel belong, details when the one or more personnel are available to execute tasks within the installation and so forth.

The pointing icon **2050** is beneficially susceptible to being manipulated by the one or more personnel effectively to zoom towards or away from features of the perspective view **2010** in an manner superficially similar in appearance to flying towards or away from the perspective view **2010**, for example from either above or below the one or more entities shown in the perspective view **2010**. When the entities are wellheads, the one or more personnel are thereby able to view the entities from various angles and use the pointing icon **2050** to invoke subsidiary information by invoking icons corresponding to the entities. The subsidiary information is, for example, obtained by using the pointing icon **2050** to invoke one or more icons causing associated software applications to be executed in the computing hardware **700** for seeking relevant data from the one or more databases **770**, **830**, and/or real-time data from one or more sensors included in the offshore marine area or extensive land-based oil and/or gas facilities **300a**.

In Figure 14, an example of the subsidiary field **2100** is shown, wherein the subsidiary field **2100** corresponds to a view of a vertical section including geological layers **3010** to **3060** which are presented progressing from a most shallow layer **3010** to a deepest layer **3060**. There is also shown a subterranean reservoir **3040** beneath a layer **3030**, the reservoir **3040** including oil and/or gas which is being extracted via a borehole 3**400**. Moving the pointing icon **2050** to overlay onto one of the layers **3010** to **3060** causes a sub-subsidiary field **3450** to appear providing further information regarding composition and mechanical characteristics of the layer. Moving the pointing icon **2050** onto the reservoir **3040** provides data regarding the reservoir **3040**, for example: volume of the reservoir **3040**, rate of oil and/or gas extraction from the reservoir **3040**, measured composition of oil and/or gas extracted from the reservoir **3040**. Moreover, moving the

pointing icon **2050** over the borehole **3400** representation results in the sub-subsidiary field **3450** showing details of bore size, one or more tools employed to generate the borehole **3400**, a depth of the borehole **3400**, whether or not the borehole **3400** is lined and so forth.

As elucidated earlier, data for generating the subsidiary field **2100** and the sub-subsidiary field **3450** are derived from the one or more databases **770, 830** where data is stored in a relational manner, wherein data content items are mutually associated by relational links defining a Euclidean probability of association between the various data content items. The computing hardware **700** is operable to monitor how often the one or more personnel at the environment **400** move the pointer icon **2050** to a given symbol on the one or more screens **420** in order to find a particular data content item. The computing hardware **700** is operable to associate greater Euclidean probabilities to symbols and data content items which are often invoked in combination. By such an approach, the integrated operation **200a** is able to provide information in a most efficient and rapid manner to the one or more personnel at the environment **400**; similar consideration pertain mutates mutandis for the integrated operations **200b, 200c**. Although only the subfield **2100** and the sub-subfield **3450** are illustrated in Figure 14, it will be appreciated that further levels of sub-fields, for example sub-sub-subfields, are possible in a multiplayer subfield system. Sub-subfields are invoked by the pointing icon **2050** being moved over specific items listen or graphically presented in the subfield **2100**. Data content items which are invoked frequently are optionally operable to progress from lower-order subfields to higher-order subfields approaching eventually the subfield **2100** in response to how frequently they are invoked.

The integrated operation **200a** is operable to communicate data in a continuous manner. During operation, the computing hardware **700** sends, as denoted by an arrow **4500** in Figure 15, instructions generated by the one or more personnel at the environment **400** to the offshore marine area or extensive land-based oil and/or gas facilities **300a**, for example for instructing personnel working in the installation **200a**, for directly remotely controlling equipment in the offshore marine area or extensive land-based oil and/or gas facilities **300a** and so forth. Equipment present in the offshore marine area or extensive land-based oil and/or gas facilities **300a** includes computing hardware locally thereat. Moreover, the computing hardware **700** is also operable to acquire data as denoted by

an arrow **4510**, for example real-time data, from the offshore marine area or extensive land-based oil and/or gas facilities **300a**, for example status of equipment at the installation, positions and identities of personnel in the offshore marine area or extensive land-based oil and/or gas facilities **300a** and so forth; such acquired data is suitably stored in the database **110** together with Euclidean probability data associating the acquired data with other data present in the database **770, 830**.

The computing hardware **700** with its array of one or more screens **420** operating in collaboration with the offshore marine area or extensive land-based oil and/or gas facilities **300a** is susceptible to providing an information portal for the one or more personnel present in the environment **400**. On account of software products conveyed on one or more data carriers and executing in operation on the computing hardware **700** providing the environment **400** as experienced by the one or more personnel, the software products are capable of providing visually a 3-dimensional representation and are conveniently then referred to as creating in operation a "3-D portal".

The present invention is susceptible to being defined in a manner as in priority-founding patent applications for the present invention, such definition now being provided for completeness.

There is provided a data handling system for managing and/or monitoring a complex system, the data handling system comprising computing hardware operable to execute one or more support software products for assimilating data and/or information from the complex system and for sending information and/or data thereto for monitoring and/or managing the complex system,

characterized in that

the data handling system is further provided with one or more interface software products executable on the computing hardware for providing in operation a data and/or information interface between one or more personnel and at least one of: the one or more support software products, directly to the complex system,

the one or more interface software products being operable to implement one or more workflows defined in a top-down strategy, the one or more workflows defining one or more data filters for selectively filtering and/or aggregating information and/or data provided from the complex system and/or from the one or more support software products for presenting to the one or more personnel via the one or more interface software products for selectively reducing a quantity of data and/or information to be interpreted by the one or more personnel.

There is also provided a software product stored or communicated via a data carrier, the software product being executable on computing hardware for implementing a data handling system as claimed in any one of the preceding claims.

There is also provided a method of handling data in a data handling system for monitoring and/or managing a complex system, the data handling system comprising computing hardware operable to execute one or more support software products for assimilating information and/or data from the complex system and for sending control information thereto for monitoring and/or managing the complex system,

characterized in that

the method includes steps of:

(a) installing into the data handling system one or more interface software products executable on the computing hardware for providing in operation a data interface between one or more personnel and at least one of: the one or more support software products, directly to the complex system;

(b) applying the one or more interface software products to implement one or more workflows defined in a top-down strategy, the one or more workflows defining one or more filters and/or aggregators for selectively filtering and/or aggregating information and/or data provided from the complex system and/or from the one or more support software products for presenting to the one or more personnel via the one or more interface software products for selectively reducing a quantity of data to be interpreted by the one or more personnel.

Expressions such as "comprise", "include", "contain", "incorporate", "is", "have" and similar are intended to be construed in a non-exclusive manner, namely allowing for other items or components which are not explicitly defined to be present. Reference to the singular shall also be construed to refer to the plural.

Numerals included within parentheses within the appended claims are intended to assist understanding of claimed subject matter and are not intended to determine scope of the claims.

CLAIMS

1. A data handling system (700, 710) for controlling a configuration of one or more support software products for managing and/or monitoring a complex system (200a, 250a, 310a; 200b, 250b, 310b; 200c, 250c, 310c), said data handling system (700, 710) comprising computing hardware (700) operable to execute said one or more support software products (750) for assimilating data and/or information from the complex system (250a, 310a; 250b, 310b; 250c; 310c) and for sending information and/or data thereto for monitoring and/or managing said complex system (250a, 310a; 250b, 310b; 250c, 310c),

characterized in that

said data handling system (700, 710) is further provided with one or more interface software products (800) executable on said computing hardware (700) for providing in operation a data and/or information interface (400, 420) between one or more personnel (70) and at least one of: said one or more support software products (750), directly to said complex system (250a, 310a; 250b, 310b; 250c, 310c),

said one or more interface software products (800) being operable to implement one or more workflows defined in a top-down strategy, said one or more workflows defining one or more data filters for selectively filtering and/or aggregating information and/or data provided from said complex system (250a, 310a; 250b, 310b; 250c, 310c) and/or from said one or more support software products (750) for presenting to said one or more personnel (70) via said one or more interface software products (800) for selectively reducing a quantity of data and/or information to be interpreted by said one or more personnel (70).

2. A data handling system (700, 710) as claimed in claim 1, wherein said one or more interface software products (800) are operable to render said data and/or information interface to be at least partially viewable and/or at least partially controllable from a site which is remote from a location whereat the one or more personnel (70) are spatially concentrated.

3. A data handling system (700, 710) as claimed in claim 1 or 2, wherein said one or more interface software products (800) are provided when executing on said computing hardware (700) with access to at least one dedicated database (830), said at least one dedicated database (830) being used by said one or more interface software products (800) to store data supplied by said one or more support software products (750) subject to data filtering and/or aggregating as defined by said one or more workflows.

4. A data handling system (700, 710) as claimed in claim 1, 2 or 3, wherein said one or more interface software products (800) are operable to communicate presentation data to an array of one or more screens (420) viewable by said one or more personnel (70) in operation, said presentation data being derived from at least one of:

(a) intermediate data and/or information computed by said one or more support data products (750) from measurement data provided from said complex system (250a, 310a; 250b, 310b; 250c, 310c);

(b) measurement data supplied directly from the complex system (250a, 310a; 250b, 310b; 250c, 310c) to the one or more interface software products (800); and

(c) selectively-filtered and/or selectively-aggregated stored data which has been generated by said one or more interface software products (800) in operation from data provided from said one or more supportive data products (750) and/or directly from said complex system (250a, 310a; 250b, 310b; 250c, 310c).

5. A data handling system (700, 710) as claimed in any one of the preceding claims, wherein said one or more interface software products (800) when executed on said computing hardware (700) are operable to enable said one or more personnel (70) to define one or more workflows in a top-down strategy, said one or more workflows defining one or more filter parameters for use in filtering and/or aggregating data and/or information to be presented to said one or more personnel (70) in operation.

6. A data handling system (700, 710) as claimed in any one of the preceding claims, wherein said one or more interface software products (800) are operable when executed on said computing hardware (700) to render said one or more workflows to be invoked in response to at least one of:

(a) one or more invoking instructions generated from one or more other workflows;

(b) one or more physical conditions arising within said complex system (250a, 310a; 250b, 310b; 250c, 310c); and

(c) one or more instructions entered by said one or more personnel (70) to said computer hardware (700) via said one or more interfacing software products (800).

7. A data handling system (700, 710) as claimed in any one of the preceding claims, wherein said one or more interface software products (800) are operable to enable said one or more workflows to be configured in a mutually-dependent hierarchical manner.

8. A data handling system (700, 710) as claimed in any one of the preceding claims, wherein said one or more interface software products (800) are operable to enable said one or more workflows to be configured to be executed in a mutually concurrent manner.

9. A data handling system (700, 710) as claimed in claim 4, wherein said array of one or more screens (420) includes a plurality of screens (450, 460U, 460L, 470U, 470L) and/or display regions comprising:

(a) a first screen (450) or first display region for presenting a spatial representation of the complex system (250a, 310a; 250b, 310b; 250c, 310c);

(b) a second screen (470U) or second display region for presenting one or more workflows facilitated by said one or more interface software products (800);

(c) a third screen (470L) or third display region for presenting filtered data which is pertinent to said one or more workflows facilitated by said one or more interface software products (800); and

(d) a fourth screen (460L) or display region for presenting a one or more operating procedures relevant to said one or more workflows presented on said second screen (470U).

10. A data handling system (700, 710) as claimed in claim 9, wherein said first screen (450) or display region is spatially located centrally relative to said second, third and fourth screens or display regions.

11. A data handling system (700, 710) as claimed in any one of the preceding claims, wherein said one or more interface software products (800) include a data integration service software product (900) for defining a data interface between said one or more interface software products (800) and said one or more support software products (750), said one or more data interface software products (800) being operable to function as a data filter and/or data aggregator for reducing a volume of data to be presented to said one or more personnel (70) in connection with one or more associated workflows being presented thereto.

12. A data handling system (700, 710) as claimed in claim 11, wherein said data integration service software product (900) is operable to being edited to adapt said one or more interface software products (800) for operating with a variety of types of said complex system.

13. A data handling system (700, 710) as claimed in claim 12, wherein said one or more interface software products (800) are configurable for being used to monitor and/or manage said complex system (200a, 250a, 310a; 200b, 250b, 310b; 200c, 250c, 310c) when said complex system is implemented as at least one of:

(a) a configuration of oil and/or gas wells;
(b) a configuration of off-shore oil and/or gas platforms;
(c) a configuration of wind turbines operable to generate electricity;
(d) a configuration of solar cells operable to generate electricity;
(e) a nuclear electrical power generating installation;
(f) an electricity distribution network;
(g) a configuration of marine wave energy units operable to generate electricity from marine wave motion;
(i) a configuration of dams and/or sluices;
(j) a convention fossil-fuel burning electricity generating facility;
(k) a configuration of coal mines for mining coal;
(l) a configuration of geothermal sites for collecting geothermal energy;
(m) a logistics configuration for distributing goods;
(n) a water distribution network;
(o) a configuration of hospital facilities;
(p) a railway network;

(q) a configuration of airport facilities;

(r) an educational facility;

(s) an emergency relief services deployment in disaster zones; and

(u) in space exploration facilities.

.

14. A software product (800) stored or communicated via a data carrier, said software product (800) being executable on computing hardware (700) for implementing a data handling system (700, 710) as claimed in any one of the preceding claims.

15. A method of handling data in a data handling system (700, 710) for controlling a configuration of one or more support software products for monitoring and/or managing a complex system (200a, 250a, 310a; 200b, 250b, 310b; 200c, 250c, 310c), said data handling system (700, 710) comprising computing hardware (700) operable to execute one or more support software products (750) for assimilating information and/or data from the complex system (250a, 310a; 250b, 310b; 250c, 310c) and for sending control information thereto for monitoring and/or managing said complex system (250a, 310a; 250b, 310b; 250c, 310c),

characterized in that

said method includes steps of:

(a) installing into said data handling system (700, 710) one or more interface software products (800) executable on said computing hardware (700) for providing in operation a data interface (400, 420) between one or more personnel (70) and at least one of: said one or more support software products (750), directly to said complex system (250a, 310a; 250b, 310b; 250c, 310c);

(b) applying said one or more interface software products (800) to implement one or more workflows defined in a top-down strategy, said one or more workflows defining one or more filters and/or aggregators for selectively filtering and/or aggregating information and/or data provided from said complex system (250a, 310a; 250b, 310b; 250c, 310c) and/or from said one or more support software products (750) for presenting to said one or more personnel (70) via said one or

more interface software products (800) for selectively reducing a quantity of data to be interpreted by said one or more personnel (70).

16. A method as claimed in claim 15, wherein said one or more interface software products are operable to render said data and/or information interface to be at least partially viewable and/or at least partially controllable from a site which is remote from a location whereat the one or more personnel are spatially concentrated.

17. A method as claimed in claim 15 or 16, including a step of:

(c) providing said one or more interface software products (800) when executing on said computing hardware (700) with access to one or more dedicated databases (830), said one or more dedicated databases (830) being used by said one or more interface software products (800) to store data supplied by said one or more support software products (750) subject to data and/or information filtering and/or aggregating as defined by said one or more workflows.

18. A method as claimed in claim 17, including a further step of:

(d) communicating via said one or more interface software products (800) presentation data to an array of one or more screens (420) viewable by said one or more personnel (70) in operation, said presentation data being derived from at least one of:

- intermediate data computed by said one or more support data products (750) from measurement data provided from said complex system (250a, 310a; 250b, 310b; 250c, 310c);
- measurement data supplied directly from the complex system (250a, 310a; 250b, 310b; 250c, 310c) to the one or more interface software products (800); and
- selectively-filtered and/or selectively-aggregating stored data which has been generated by said one or more interface software products (800) in operation from data and/or information provided from said one or more supportive data products (750) and/or directly from said complex system (250a, 310a; 250b, 310b; 250c, 310c).

19. A method as claimed in any one of claims 15 to 18, including a step of:

(e) enabling said one or more interface software products (800) when executed on said computing hardware (700) for said one or more personnel (70) to define one or more workflows in a top-down strategy, said one or more workflows defining one or more filter parameters and/or aggregating parameters for use in filtering and/or aggregating data and/or information to be presented to said one or more personnel (70) in operation.

20. A method as claimed in any one of claims 15 to 19, including a step of:

(f) configuring said one or more interface software products (800) to be operable to render said one or more workflows to be invoked in response to at least one of:

- one or more invoking instructions generated from one or more other workflows;
- one or more physical conditions arising within said complex system (250a, 310a; 250b, 310b; 250c, 310c); and
- one or more instructions entered by said one or more personnel (70) to said computer hardware (700) via said one or more interfacing software products (800).

21. A method as claimed in any one of claims 15 to 20, including a step of:

(g) arranging said one or more interface software products (800) to be operable to enable said one or more workflows to be configured in a mutually-dependent hierarchical manner.

22. A method as claimed in any one of claims 15 to 21, including a step of:

(h) arranging said one or more interface software products (800) to be operable to enable said one or more workflows to be configured to be executed in a mutually concurrent manner.

23. A method as claimed in claim 18, wherein said array of one or more screens (420) includes a plurality of screens (450, 460U, 460L, 470U, 470L) and/or a plurality of screen regions comprising:

(a) a first screen (450) or first screen region for presenting a spatial representation of the complex system (250a, 310a; 250b, 310b; 250c, 310c);

(b) a second screen (470U) or second screen region for presenting one or more workflows facilitated by said one or more interface software products (800);

(c) a third screen (470L) or third screen region for presenting filtered data which is pertinent to said one or more workflows facilitated by said one or more interface software products (800);

(d) a fourth screen (460L) or fourth screen region for presenting a one or more operating procedures relevant to said one or more workflows presented on said second screen (470U) or second screen region.

24. A method as claimed in claim 23, wherein said first screen (450) or first screen region is spatially located centrally relative to said second, third and fourth screens or screen regions.

25. A method as claimed in any one of claims 15 to 24, wherein said one or more interface software products (800) include a data integration service software product (900) for defining a data interface between said one or more interface software products (800) and said one or more support software products (750), said data interface software product being operable to function as a data filter and/or data aggregator for reducing a volume of data to be presented to said one or more personnel (70) in connection with one or more associated workflows being presented thereto.

26. A method as claimed in claim 25, wherein said data integration service software product (900) is operable to being edited to adapt said one or more interface software products (800) for operating with a variety of types of said complex system.

27. A method as claimed in claim 26, wherein said one or more interface software products (800) are configurable for being used to monitor and/or control said complex system (200a, 250a, 310a; 200b, 250b, 310b; 200c, 250c, 310c) when said complex system is implemented as at least one of:

(a) a configuration of oil and/or gas wells;

(b) a configuration of off-shore oil and/or gas platforms;

(c) a configuration of wind turbines operable to generate electricity;

(d) a configuration of solar cells for operable to generate electricity;

(e) a nuclear electrical power generating installation;

(f) an electricity distribution network;

(g) a configuration of marine wave energy units operable to generate electricity from marine wave motion;

(i) a configuration of dams and/or sluices;

(j) a convention fossil-fuel burning electricity generating facility;

(k) a configuration of coal mines for mining coal;

(l) a configuration of geothermal sites for collecting geothermal energy;

(m) a logistics configuration for distributing goods;

(n) a water distribution network;

(o) a configuration of hospital facilities;

(p) a railway network;

(q) a configuration of airport facilities;

(r) an educational facility;

(s) an emergency relief services deployment in disaster zones; and

(u) in space exploration facilities.

28. An information portal including a computer network comprising first and second groups of computers operable to exchange data therebetween, wherein the first group of computers is included in an installation (300a; 300b; 300c) to be monitored and controlled, and the second group of computers (700) is operable to function as one or more control centres (400), and wherein the second group of computers (700) is operable to present data on at least one visual display (420) of said one or more control centres (400),

characterised in that

(a) said second group of computers (700) is operable to present an information portal image (2010) on said at least one visual display (420), said image (2010) being spatially representative of said installation (300a; 300b; 300c);

(b) said image (2010) includes one or more graphic symbols (2020, 2030) representative of one or more corresponding structures (310a, 250a; 310b, 250b; 310c, 250c) present in said installation (300a; 300b; 300c);

(c) interrogating said one or more graphic symbols (2020, 2030) is operable to cause one or more subsidiary data fields (2100) to be presented providing information

associated with said one or more corresponding structures (310a, 250a; 310b, 250b; 310c, 250c) respectively; and

(d) said first and second groups of computers are operable to update in real-time said one or more graphic symbols (2020, 2030) and/or said one or more subsidiary data fields (2100) in response to one or more events occurring in said installation (300a; 300b; 300c).

29. An informational portal as claimed in claim 28, wherein said information portal image (2010) is presented as a 3-dimensional representation.

30. An information portal as claimed in claim 29, wherein said portal is operable to enable a viewing angle of said 3-dimension representation and/or a zoom towards or away from said 3-dimensional representation to be user-adjustable.

31. An information portal as claimed in claim 28, 29 or 30, wherein data presented in said one or more subsidiary data fields (2100) is linked to its corresponding structure by an associated probability parameter, said probability parameter being dynamically updated in response to a frequency with which said data is requested concurrently with said structure, said probability parameter determining a manner in which said data is presented in said one or more subsidiary data fields (2100).

32. An information portal as claimed in claim 31, wherein said data is presented in order of frequency with which said data is accessed in comparison to other data associated with said corresponding structure.

33. An information portal as claimed in any one of claims 28 to 32, wherein said installation (300a) is a gas and/or oil installation.

34. An information portal as claimed in any one of claims 28 to 33, wherein said one or more control centres (400) are operable to receive information from said installation (300a; 300b; 300c) and to send commands to control operation of said installation (300a; 300b; 300c).

35. A method of providing an information portal, said method including steps of:

(a) providing an information portal including a computer network (200a; 200b; 200c) comprising first and second groups of computers operable to exchange data therebetween, wherein the first group of computers is included in an installation (300a; 300b; 300c) to be monitored and controlled, and the second group of computers (700) is operable to function as one or more control centres (400); and

(b) using the second group of computers (700) to present data on at least one visual display (420) of said one or more control centres (400),

characterised in that said method includes additional steps of:

(c) using said second group of computers (700) to present an information portal image (2010) on said at least one visual display (420), said image (2010) being spatially representative of said installation (300a; 300b; 300c);

(c) including in said image (2010) one or more graphic symbols (2020, 2030) representative of one or more corresponding structures (310a, 250a; 310b, 250b; 310c, 250c) present in said installation (300a; 300b, 300c);

(d) arranging for interrogation of said one or more graphic symbols (2020, 2030) to cause one or more subsidiary data fields (2100) to be presented providing information associated with said one or more corresponding structures (310a, 250a; 310b, 250b; 310c, 250c) respectively; and

(e) using said first and second groups of computers to update in real-time said one or more graphic symbols (2020, 2030) and/or said one or more subsidiary data fields (2100) in response to one or more events occurring in said installation (300a; 300b; 300c).

36. A software product stored on a data carrier, said computer product being executable on computer hardware for implementing a method as claimed in claim 35.

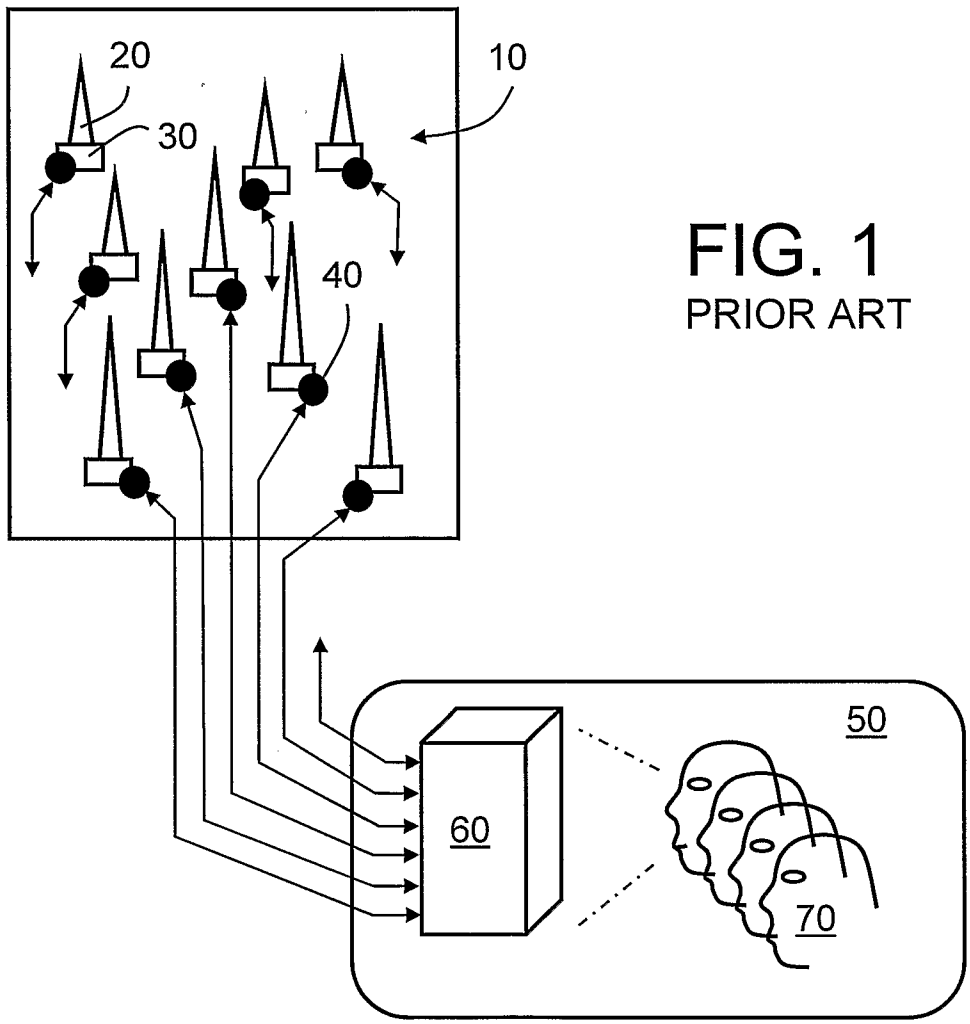

FIG. 1
PRIOR ART

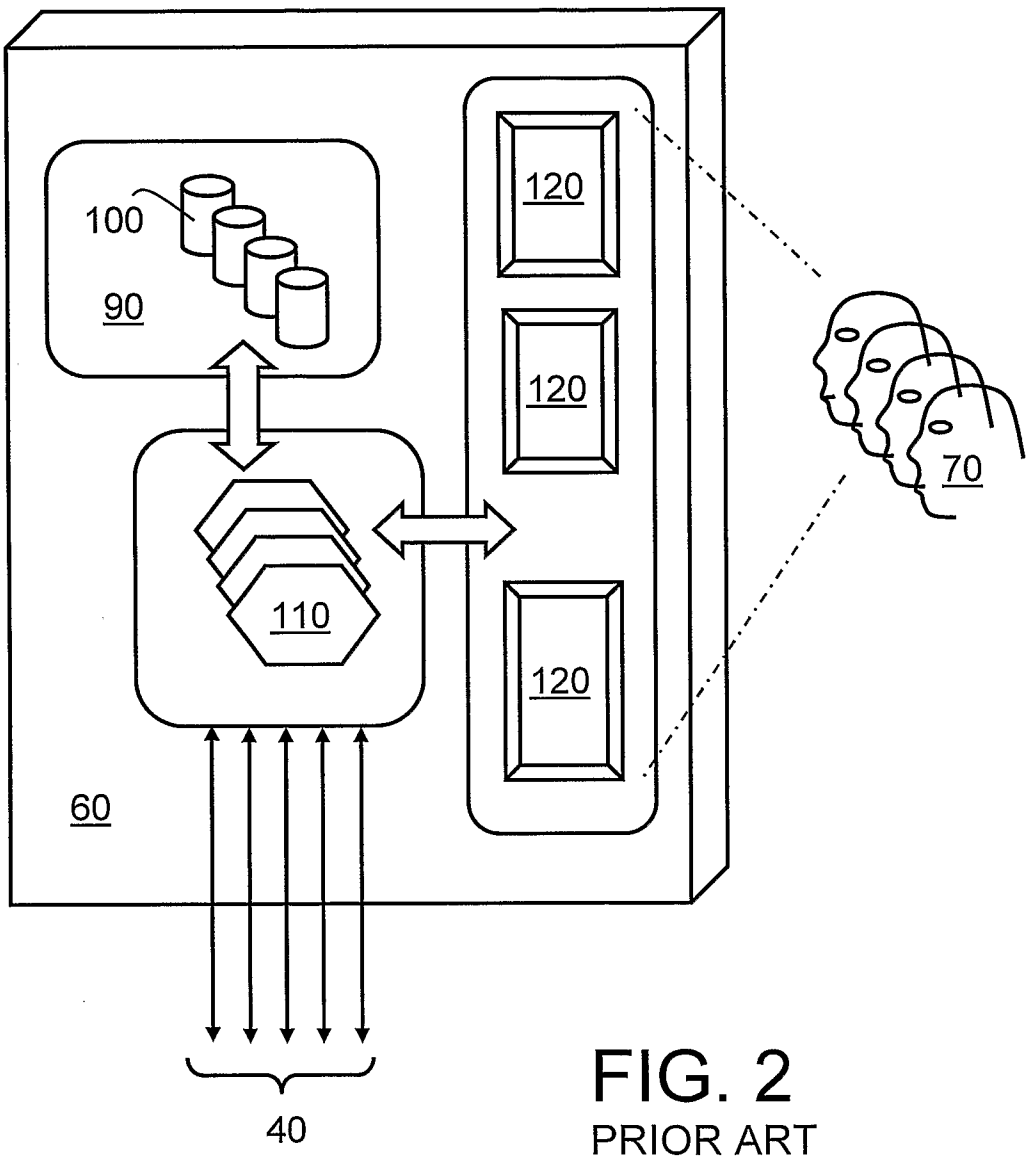

FIG. 2
PRIOR ART

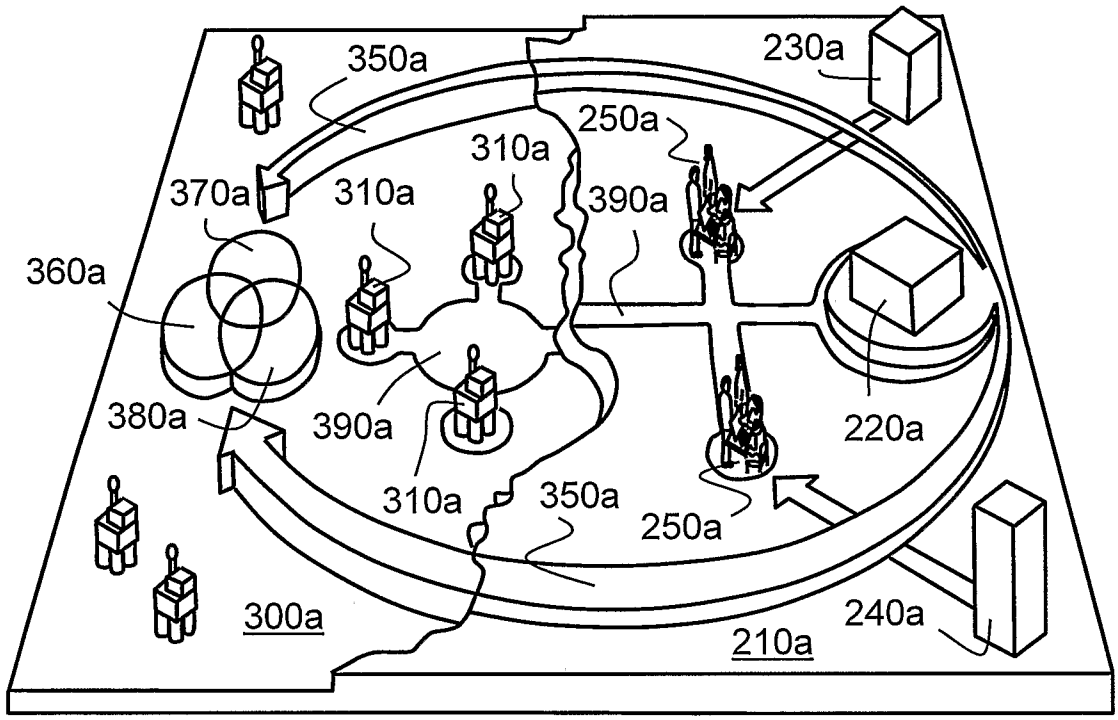
350a
230a
250a
310a
370a
310a
390a
360a
380a
390a
220a
310a
350a
250a
300a
240a
210a
200a

FIG. 3a

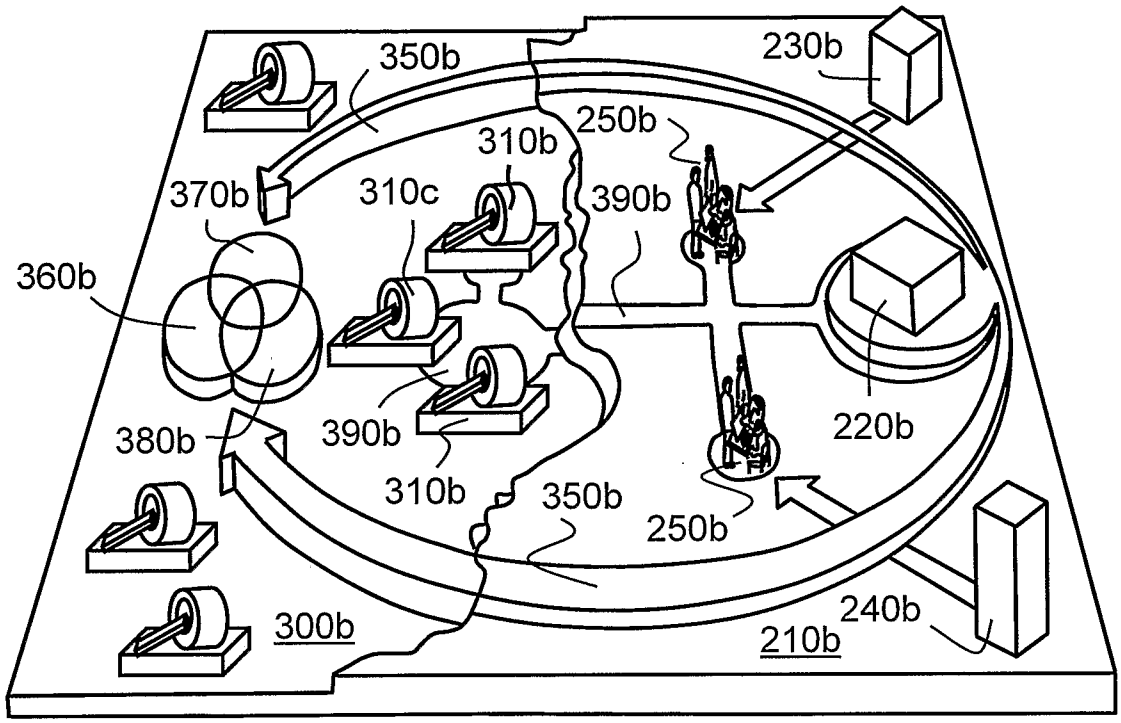
350b
230b
250b
310b
370b
310c
390b
360b
380b
390b
220b
310b
350b
250b
300b
240b
210b
200b

FIG. 3b

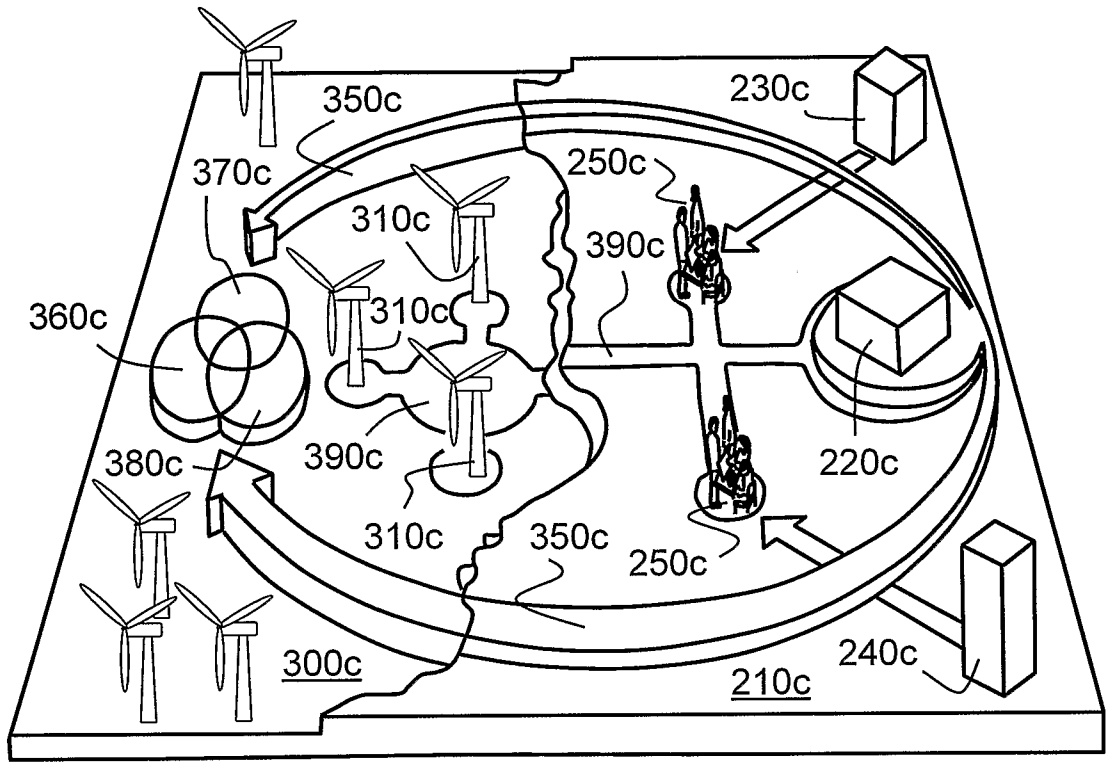
350c
230c
370c
250c
310c
390c
360c
310c
390c
220c
380c
310c
350c
250c
300c
210c
240c
200c

FIG. 3c

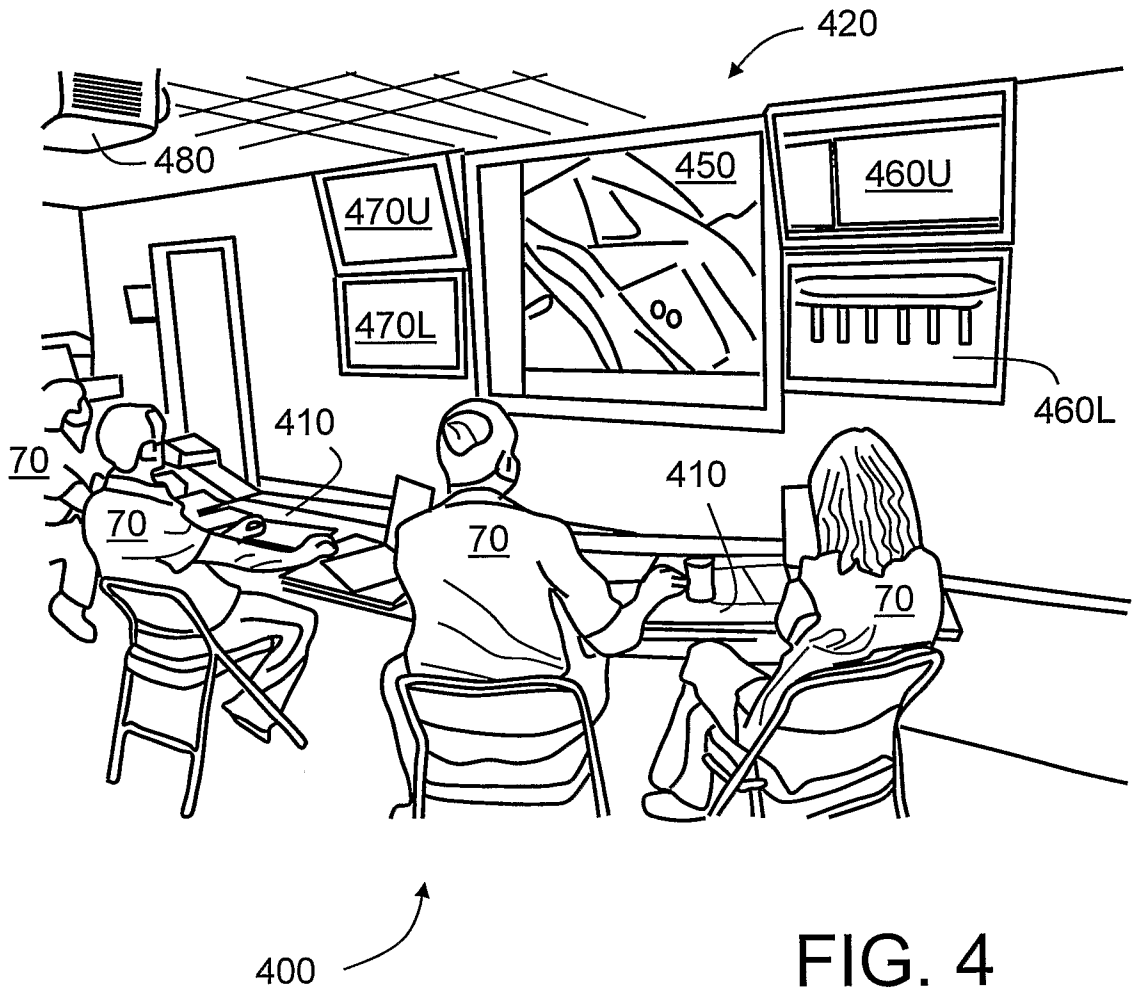

FIG. 4

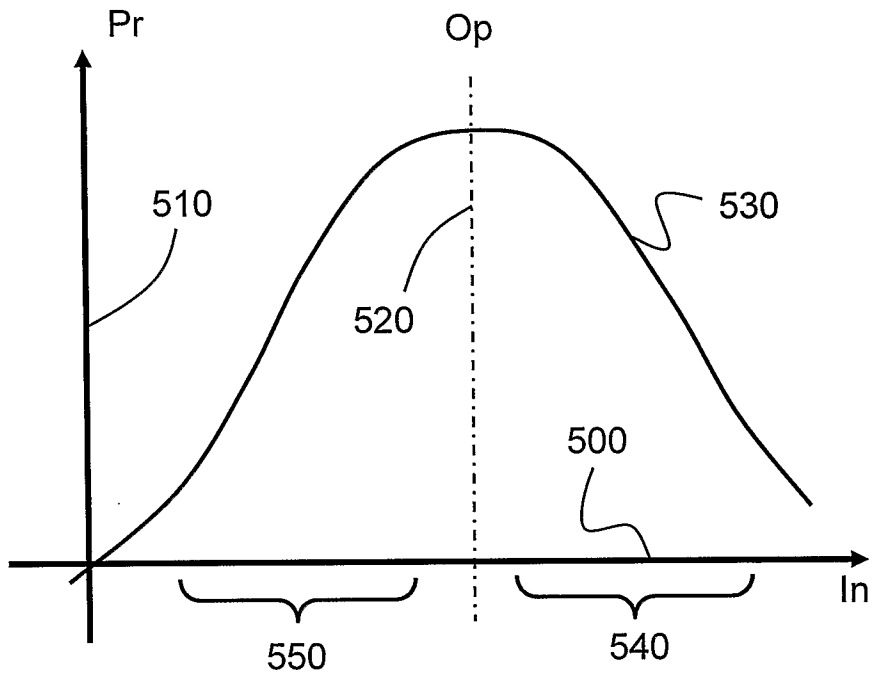

FIG. 5

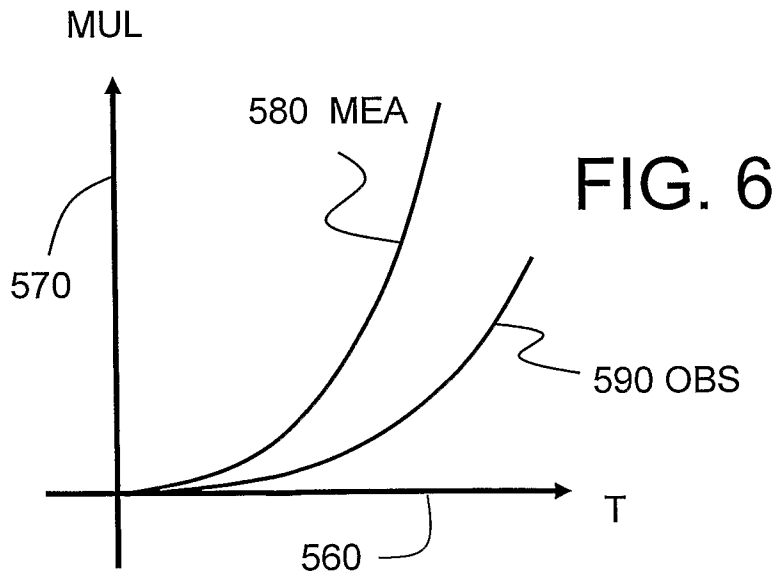

FIG. 6

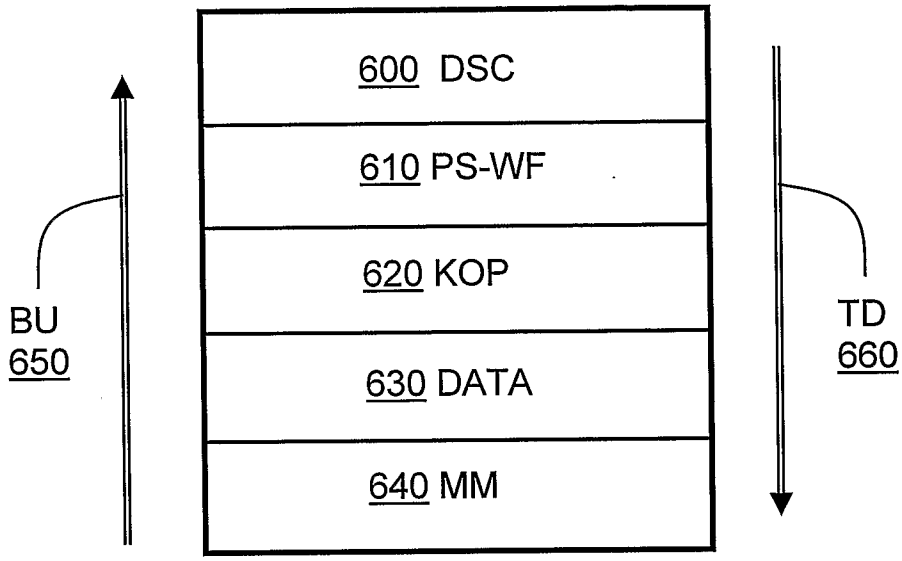
600 DSC
610 PS-WF
620 KOP
630 DATA
640 MM
BU
650
TD
660

FIG. 7

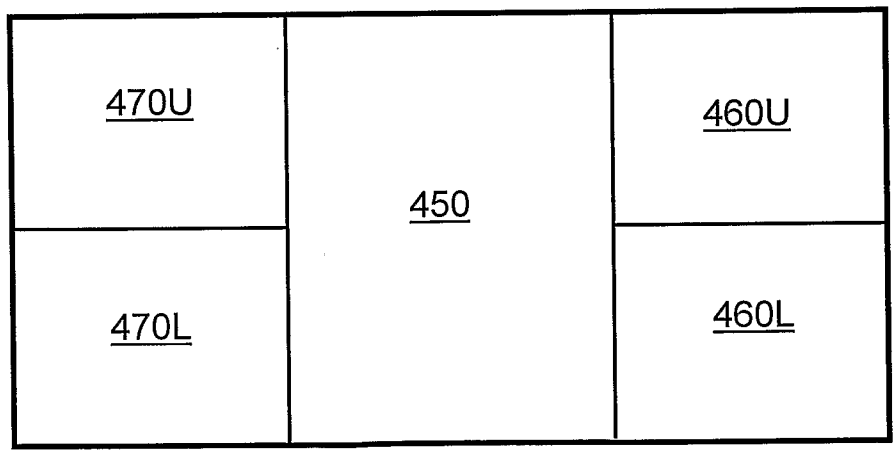
470U
450
460U
470L
460L

FIG. 8

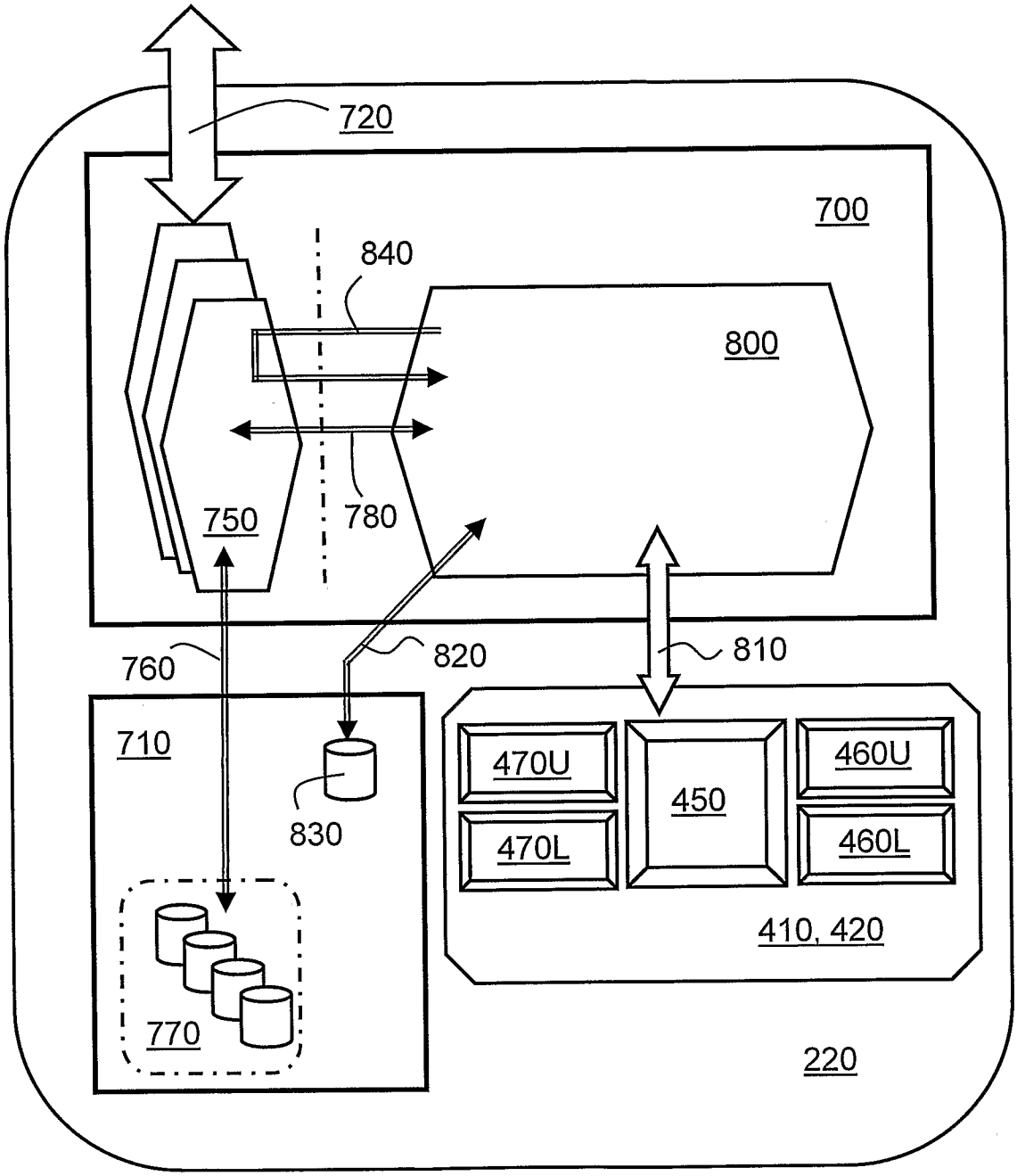
720
700
840
800
750
780
760
820
810
710
830
470U
450
460U
470L
460L
410, 420
770
220

FIG. 9

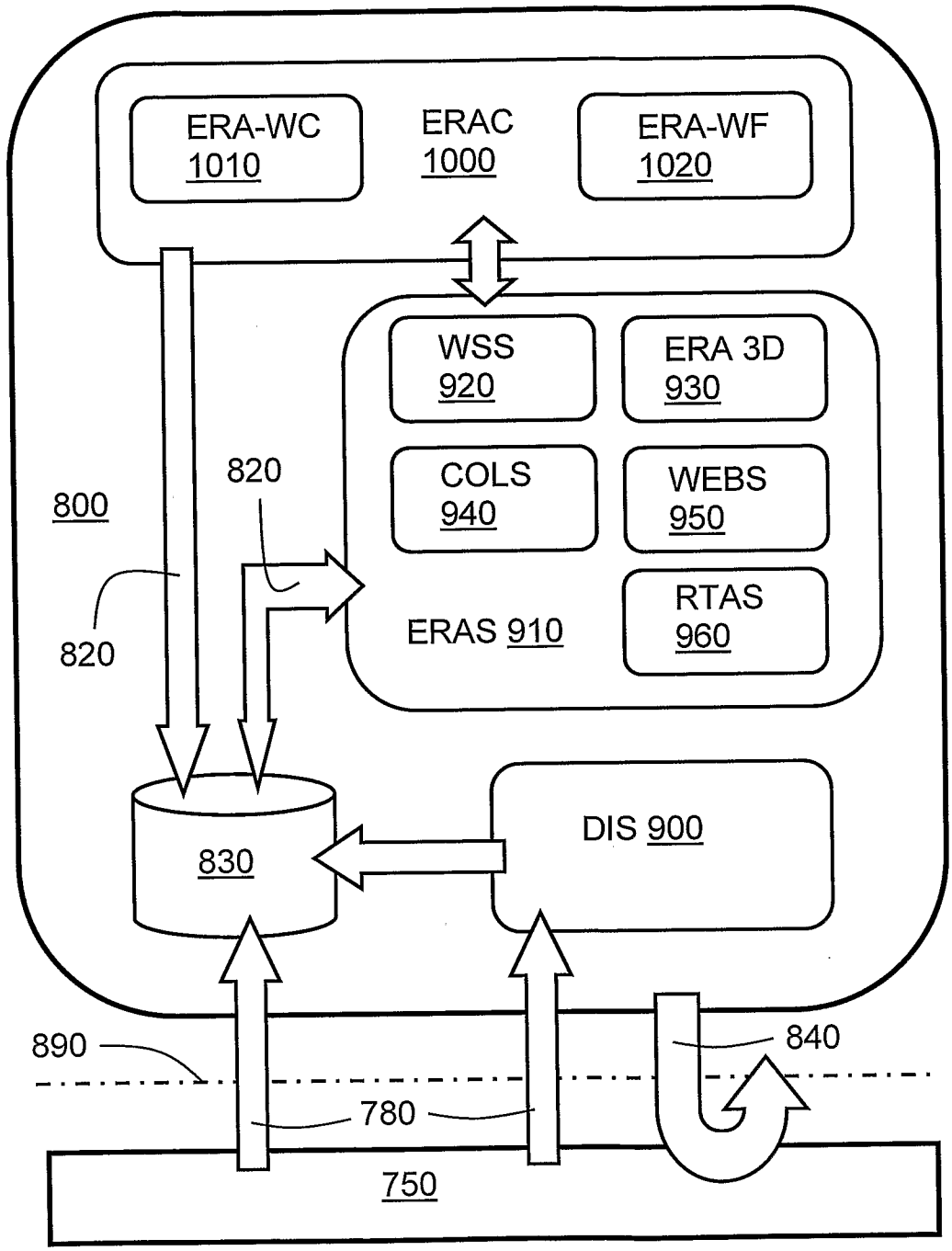
ERA-WC
1010
ERAC
1000
ERA-WF
1020
WSS
920
ERA 3D
930
COLS
940
WEBS
950
RTAS
960
ERAS 910
800
820
820
830
DIS 900
890
780
840
750

FIG. 10

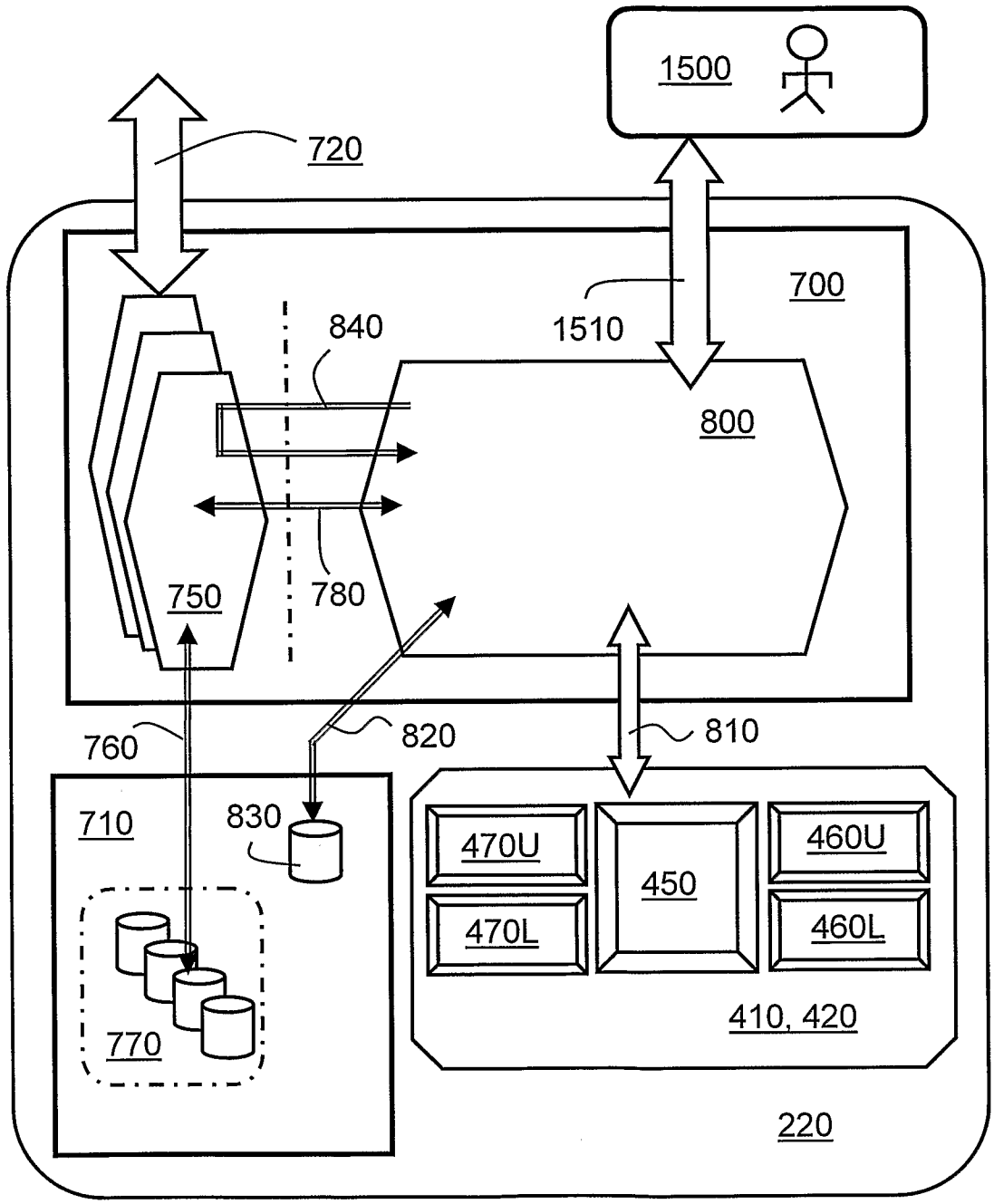
1500
720
700
840
1510
800
750
780
760
820
810
710
830
470U
450
460U
470L
460L
410, 420
770
220

FIG. 11

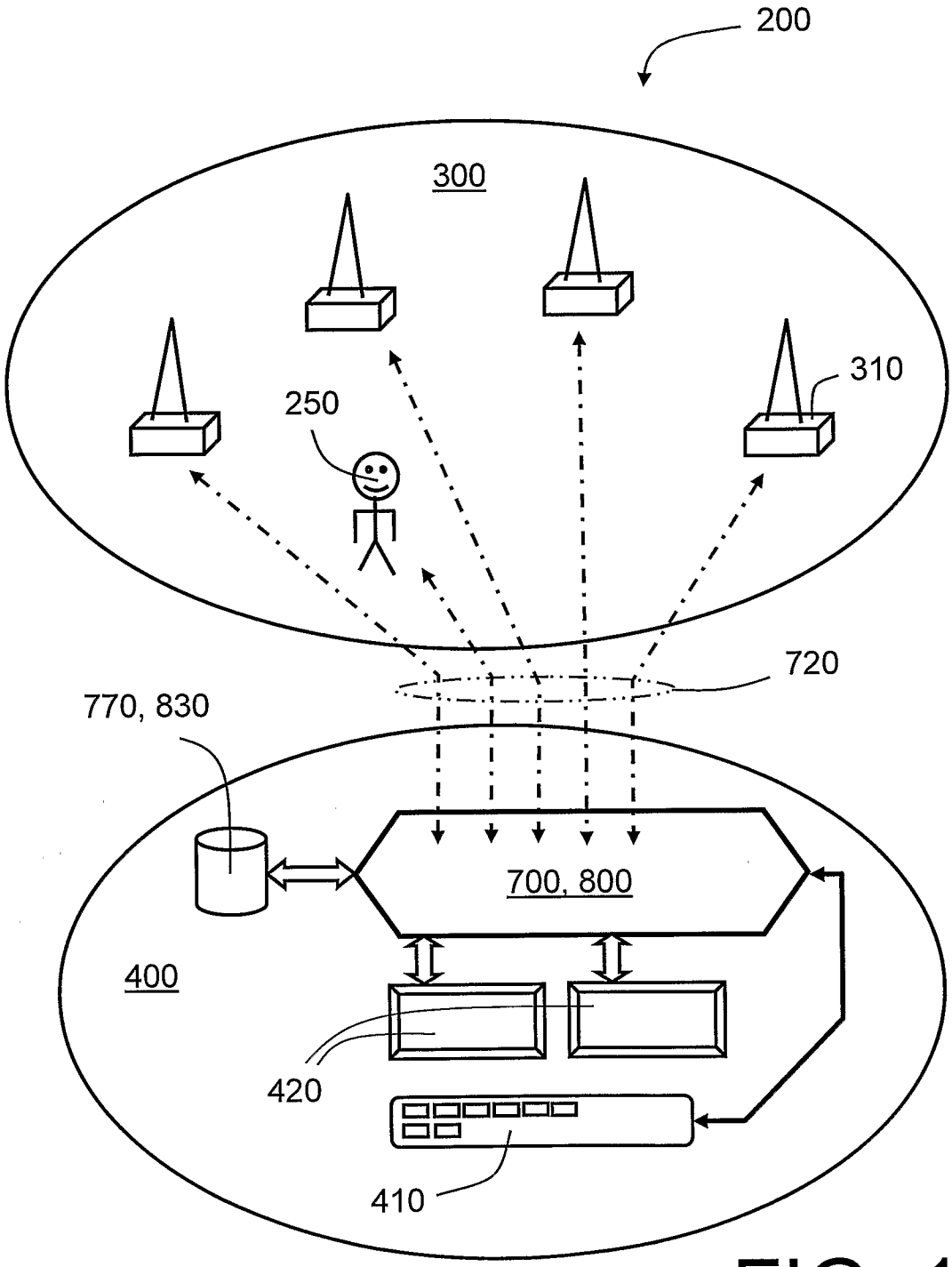

FIG. 12

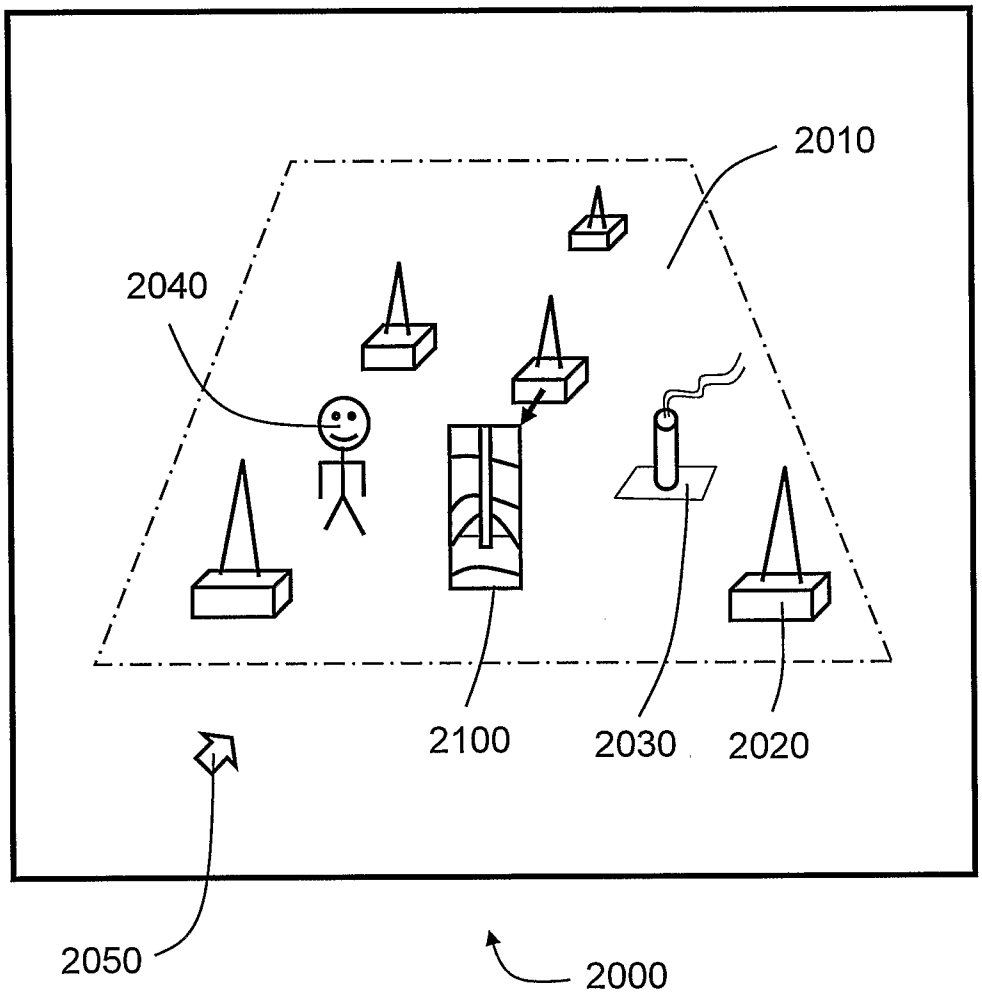

FIG. 13a

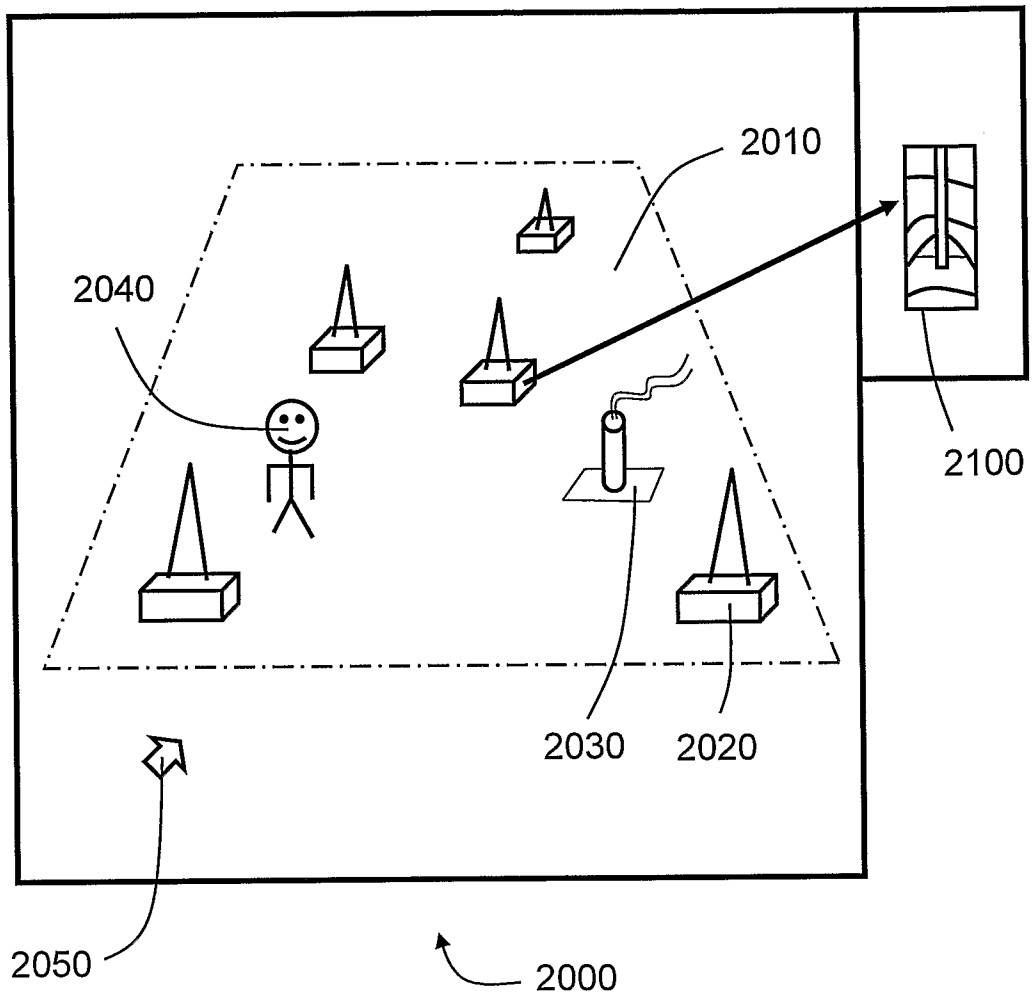

FIG. 13b

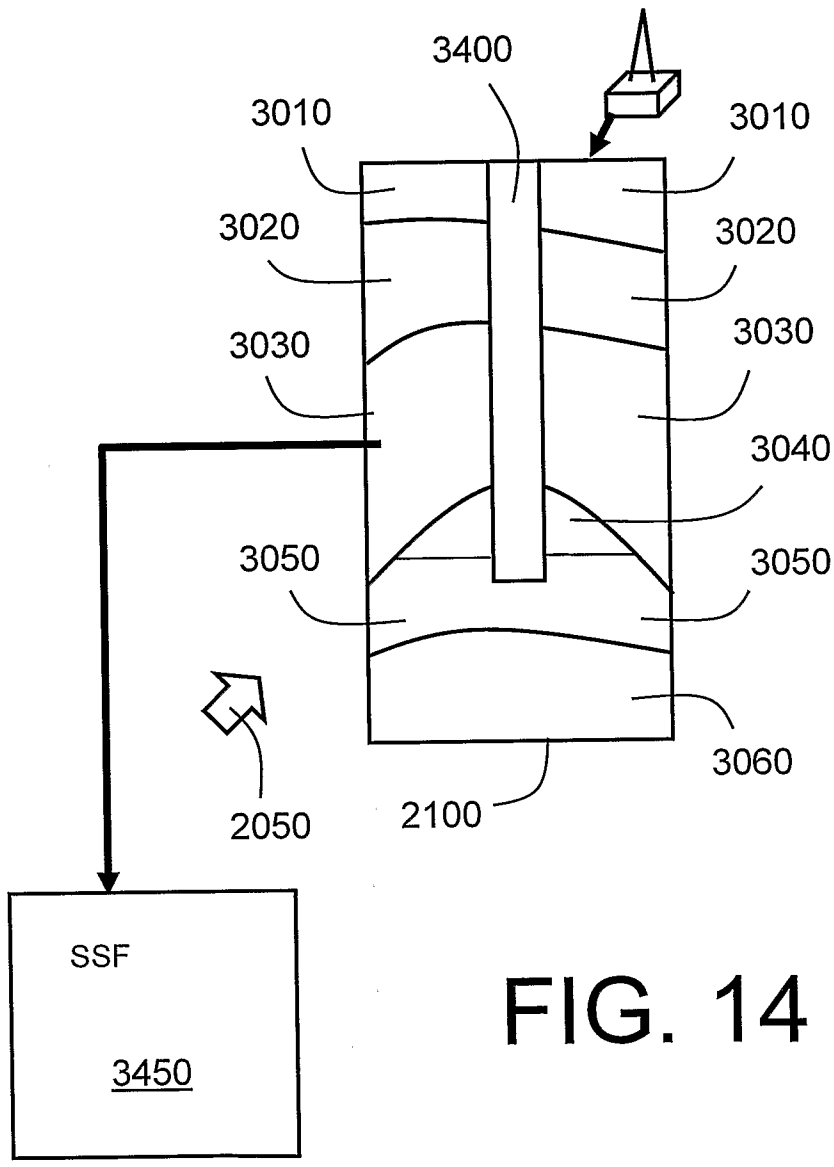
3400
3010
3010
3020
3020
3030
3030
3040
3050
3050
3060
2050
2100
SSF
3450

FIG. 14

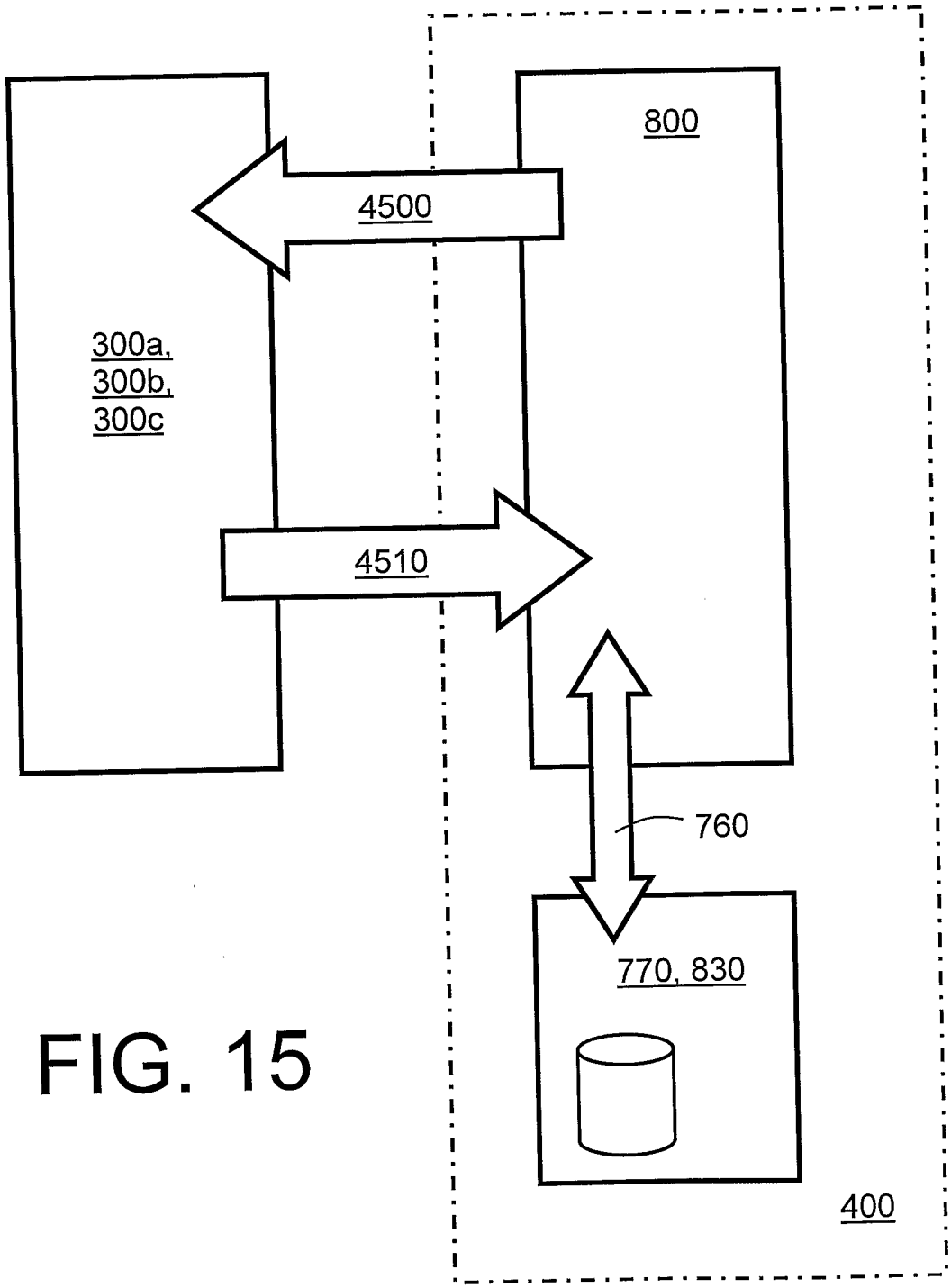

FIG. 15