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(54) CORRELATED TESTING SYSTEM

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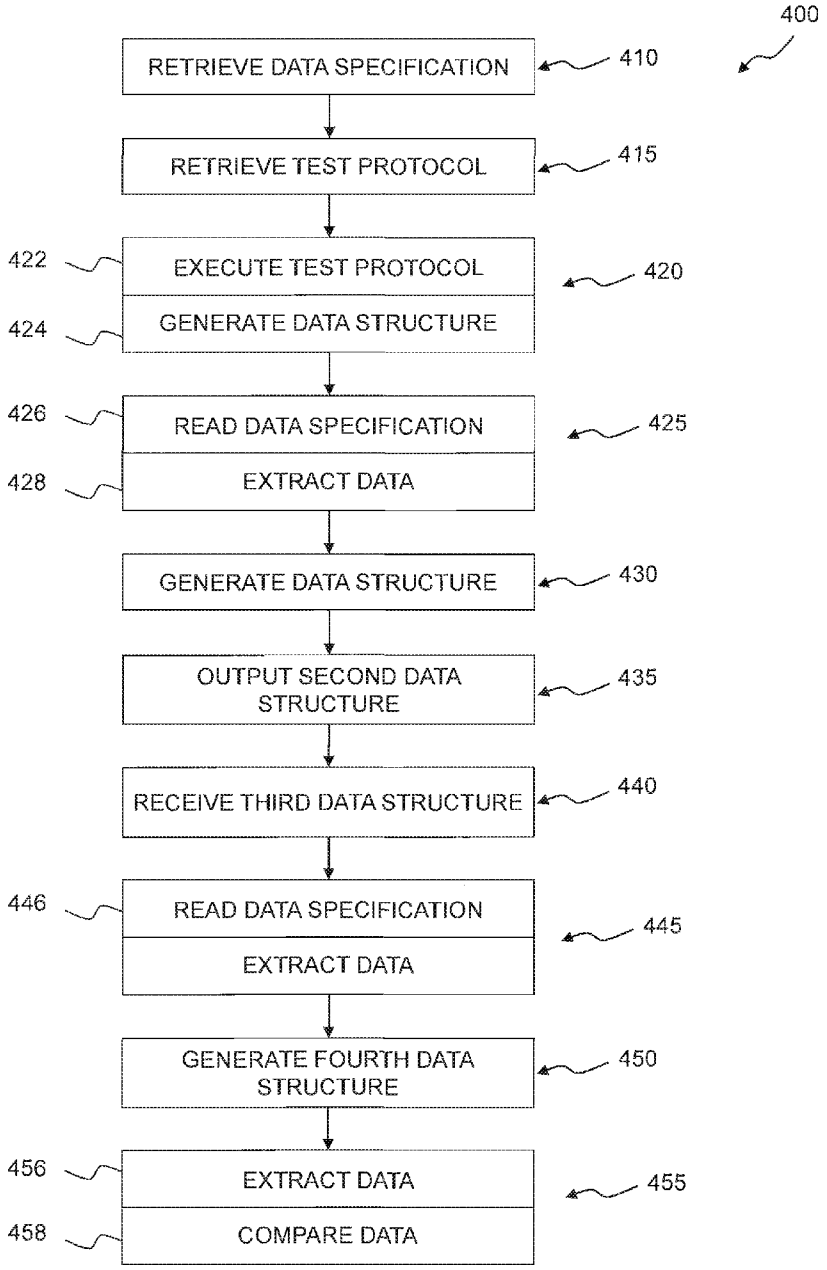
(57) ABSTRACT

A computer implemented system for testing electronic equipment where test inputs, test outputs, test applied environmental conditions, and test processes are recorded and correlated.



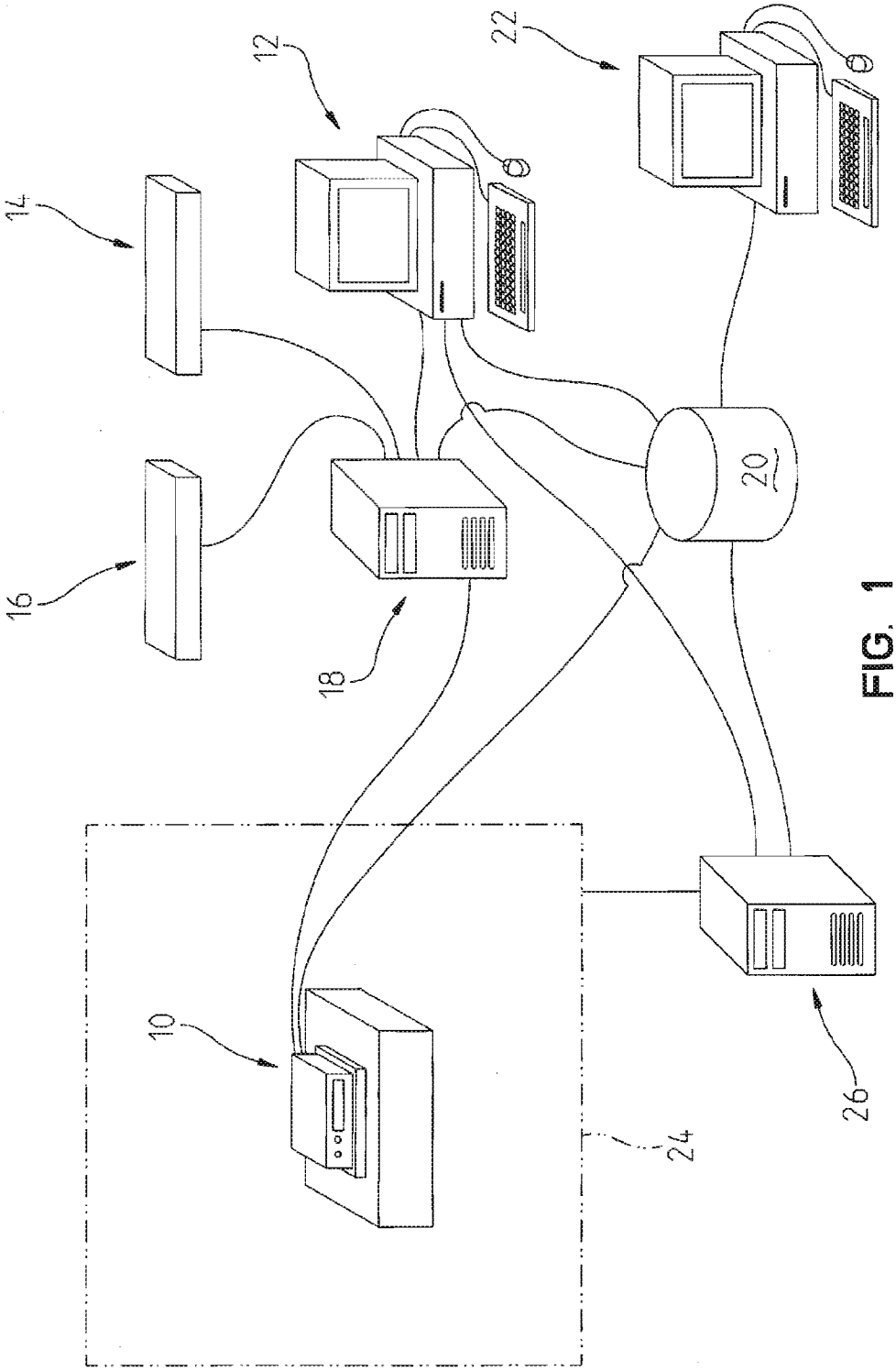


FIG. 1

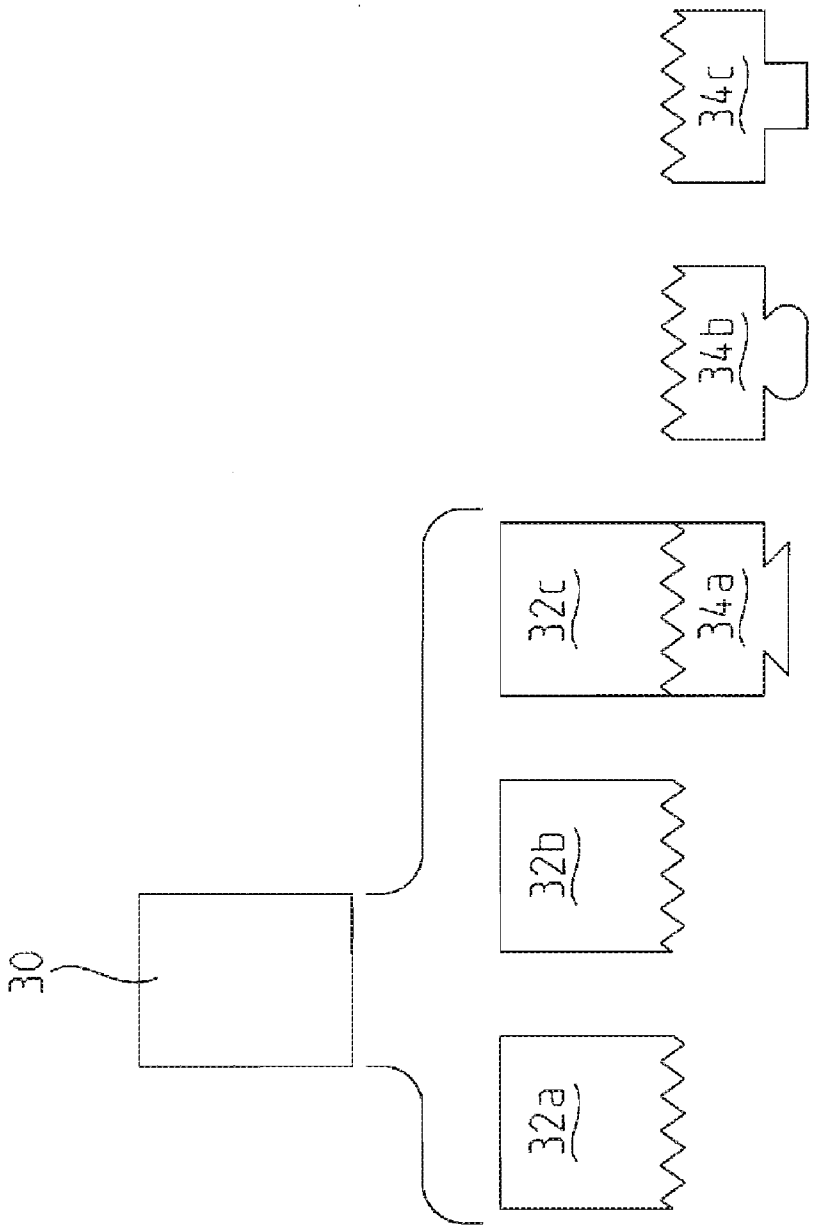


FIG. 2

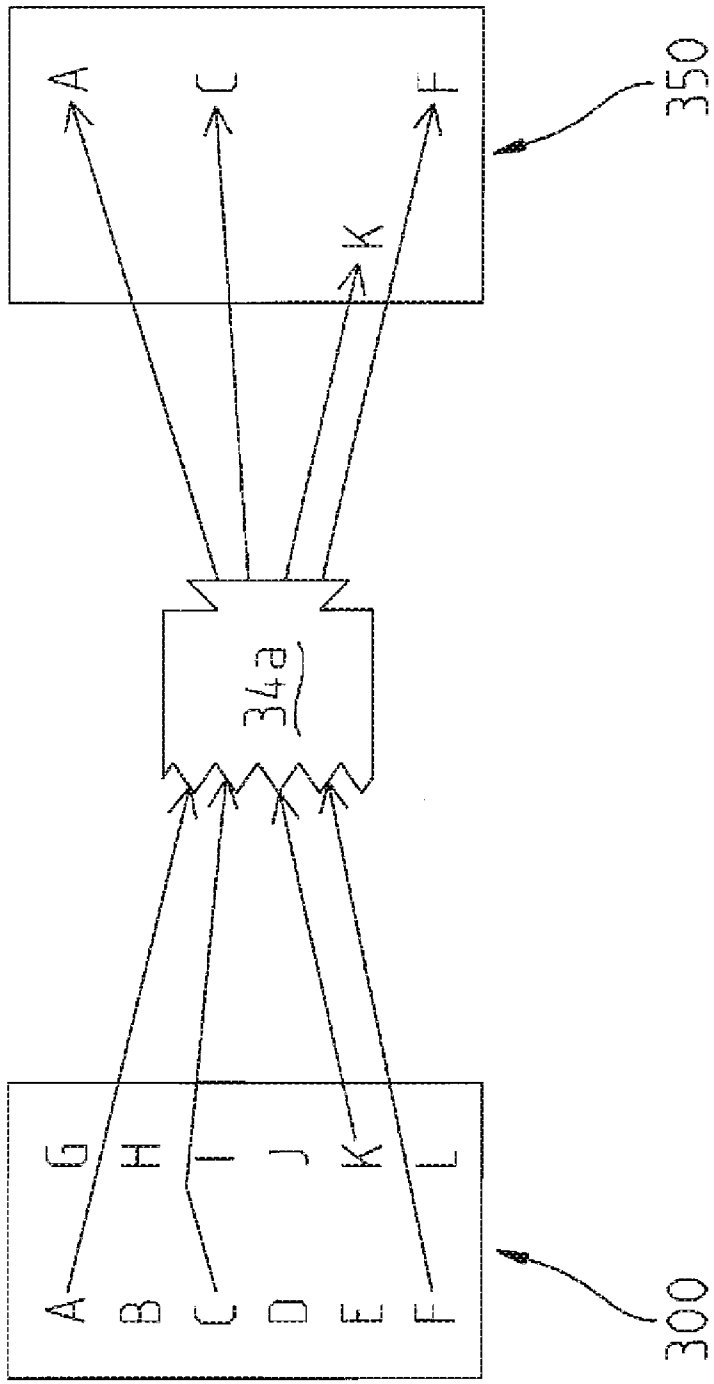


FIG. 3

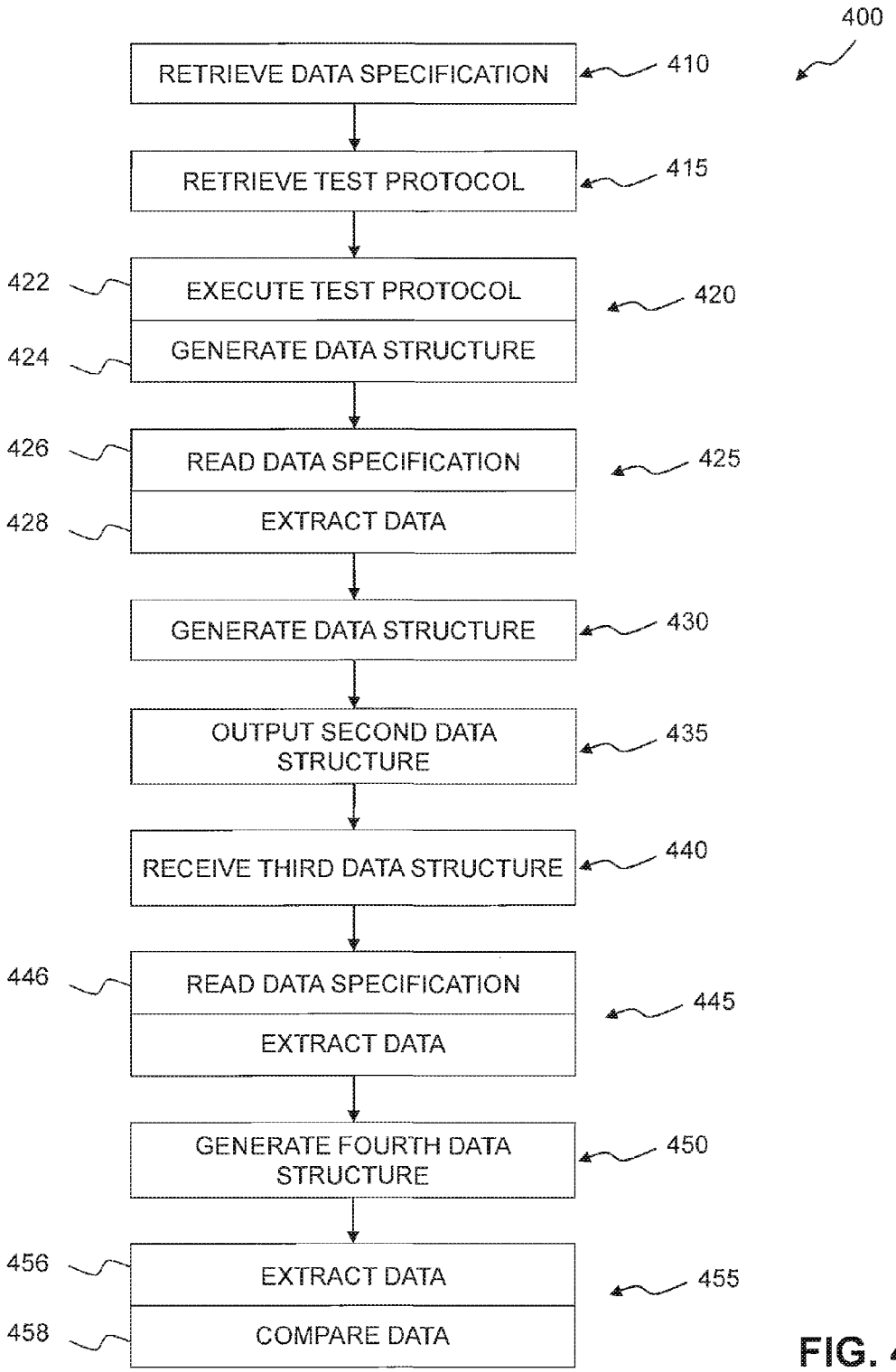

400
RETRIEVE DATA SPECIFICATION
410
RETRIEVE TEST PROTOCOL
415
422
EXECUTE TEST PROTOCOL
420
424
GENERATE DATA STRUCTURE
426
READ DATA SPECIFICATION
425
428
EXTRACT DATA
GENERATE DATA STRUCTURE
430
OUTPUT SECOND DATA STRUCTURE
435
RECEIVE THIRD DATA STRUCTURE
440
446
READ DATA SPECIFICATION
445
EXTRACT DATA
GENERATE FOURTH DATA STRUCTURE
450
456
EXTRACT DATA
455
458
COMPARE DATA

FIG. 4

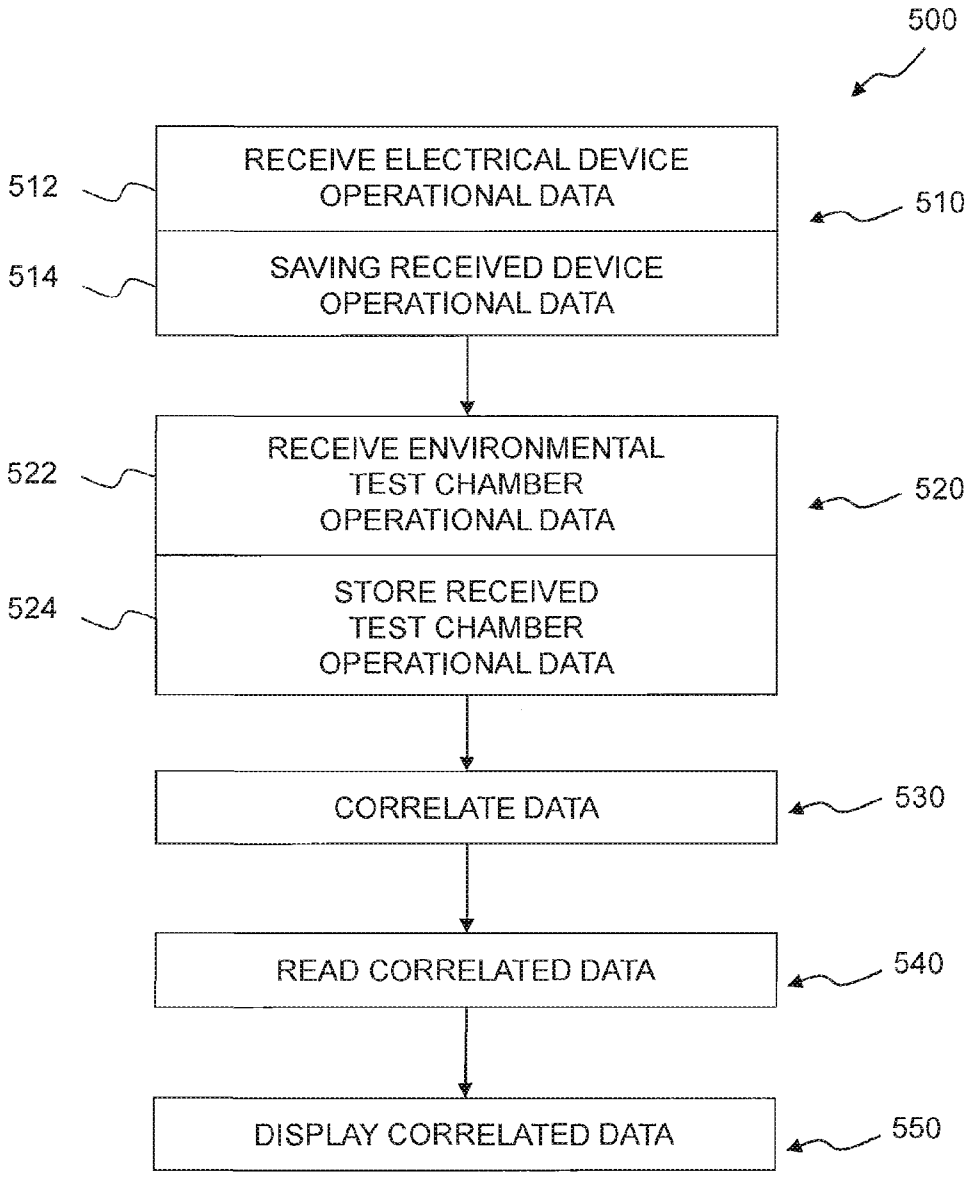

500
RECEIVE ELECTRICAL DEVICE OPERATIONAL DATA
512
510
SAVING RECEIVED DEVICE OPERATIONAL DATA
514
RECEIVE ENVIRONMENTAL TEST CHAMBER OPERATIONAL DATA
522
520
STORE RECEIVED TEST CHAMBER OPERATIONAL DATA
524
CORRELATE DATA
530
READ CORRELATED DATA
540
DISPLAY CORRELATED DATA
550

FIG. 5

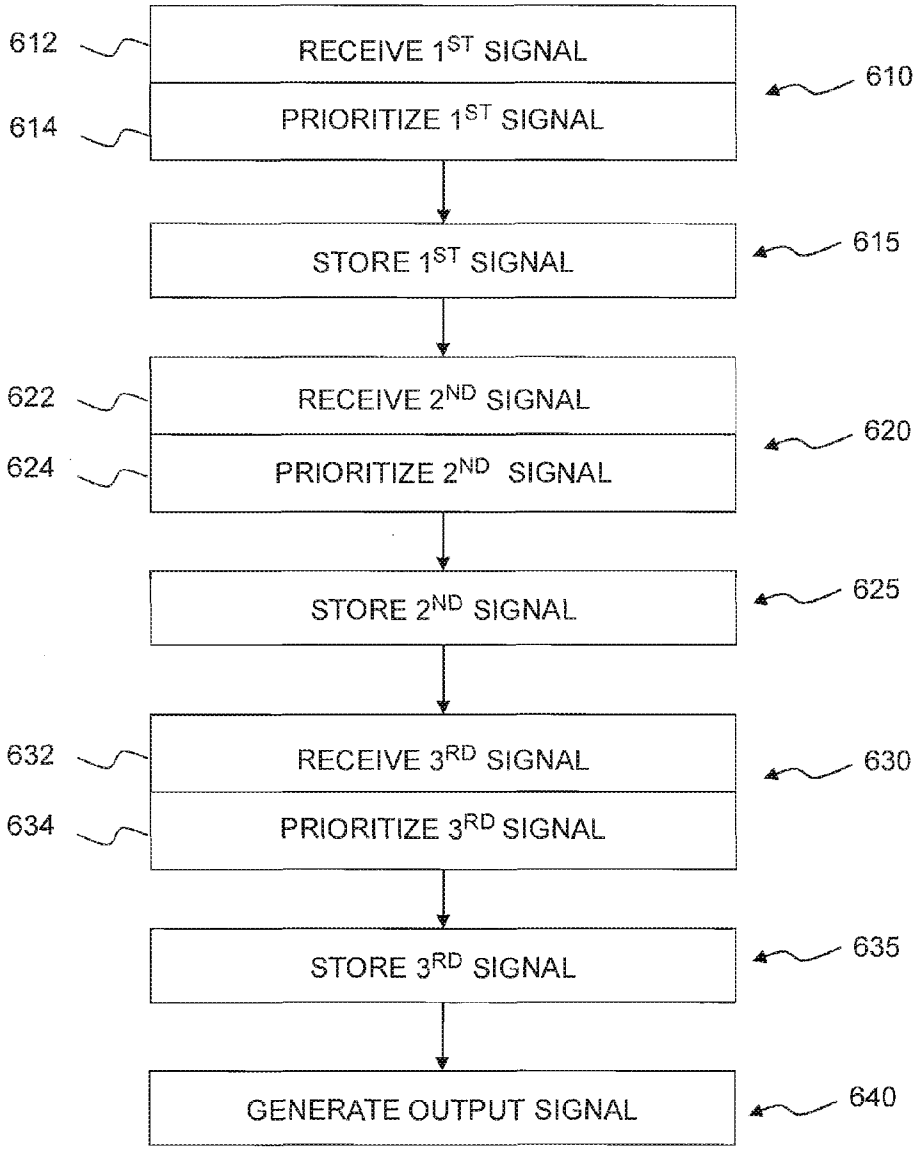

612
RECEIVE 1ST SIGNAL
614
PRIORITIZE 1ST SIGNAL
610
STORE 1ST SIGNAL
615
622
RECEIVE 2ND SIGNAL
624
PRIORITIZE 2ND SIGNAL
620
STORE 2ND SIGNAL
625
632
RECEIVE 3RD SIGNAL
634
PRIORITIZE 3RD SIGNAL
630
STORE 3RD SIGNAL
635
GENERATE OUTPUT SIGNAL
640

FIG. 6

Fig. 7a

Sample Output

```
;-----------------------------------------------------------------------------
; TRIB                                                          Version 6.66a
;-----------------------------------------------------------------------------
;                        Written by Dave Hill
;                    Code 6058 NSWC Crane Division
;                        Crane, Indiana 47522
;
;
;
;-----------------------------------------------------------------------------
;c:\projects\trib\trib.ini
;
;[TRIB]
;Delay=1
;Seconds=15
;Errors=100
;Verbose=1
;
;[1]
;Trial=sift c:\trib.tmp 1000000 | abyss
;Iterations=1
;
;[2]
;Trial=sift d:\trib.tmp 1000 | abyss
;Iterations=1
;
;[3]
;Trial=sift \\SP-HILLDT\shared\trib.tmp 1000 | abyss
;Iterations=1
;
;[4]
;Trial=satan \\SP-HILLDT\HPLJ4 SATAN\x20\T\f\Ez | abyss
;Delay=300
;Iterations=1
;
;-----------------------------------------------------------------------------
;Day and Hour Trial  Mark War's Err's Source
;------------ ----- ----- ----- ----- ----------------------------------------
 329 08:17:56     1     .     0     0 sift
!329 08:17:56     2    44     0     1 sift
;    Application Error
;    Wed Nov 26 08:17:56
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:17:56     3     .     0     1 sift
~329 08:17:56     1    26     1     1 Application Popup
;    System Information
;    Wed Nov 26 08:17:56
;    mkfault.exe - Application Error
;    The instruction at "0x0000000b" referenced memory at "0x0000000b". The me
;    mory could not be "read".
;    Click on OK to terminate the program
;    Click on CANCEL to debug the program
!329 08:17:57     2    19     1     2 sift
;    Application Error
;    Wed Nov 26 08:17:57
;    sift d:\trib.tmp 1000 | abyss
;    Invalid argument.
 329 08:17:57     3     .     1     2 sift
 329 08:17:58     1     .     1     2 sift
```

710 720 730 740 750 760

Fig. 7b

```
!329 08:17:58     2    44     1     3 sift
;    Application Error
;    Wed Nov 26 08:17:58
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:17:58     3     .     1     3 sift
 329 08:17:59     1     .     1     3 sift
!329 08:17:59     2    44     1     4 sift
;    Application Error
;    Wed Nov 26 08:17:59
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:17:59     3     .     1     4 sift
~329 08:18:00     1    27     2     4 E1000
;    System Information
;    Wed Nov 26 08:18:00
;    Intel(R) PRO/1000 MT Network Connection
;    - 0000 00 00 04 00 02 00 58 00 ......X.
;    - 0008 00 00 00 00 1B 00 04 40 .......@
;    - 0010 00 00 00 00 00 00 00 00 ........
;    - 0018 00 00 00 00 00 00 00 00 ........
;    - 0020 00 00 00 00 00 00 00 00 ........
;    - 0028 1B 00 04 40             ...@
!329 08:18:00     2    44     2     5 sift
;    Application Error
;    Wed Nov 26 08:18:00
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:00     3     .     2     5 sift
 329 08:18:01     1     .     2     5 sift
!329 08:18:01     2    44     2     6 sift
;    Application Error
;    Wed Nov 26 08:18:01
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:01     3     .     2     6 sift
~329 08:18:01     1    26     3     6 E1000
;    System Information
;    Wed Nov 26 08:18:01
;    Intel(R) PRO/1000 MT Network Connection
;    - 0000 00 00 04 00 02 00 58 00 ......X.
;    - 0008 00 00 00 00 1A 00 04 40 .......@
;    - 0010 00 00 00 00 00 00 00 00 ........
;    - 0018 00 00 00 00 00 00 00 00 ........
;    - 0020 00 00 00 00 00 00 00 00 ........
;    - 0028 1A 00 04 40             ...@
~329 08:18:01     1  4201     4     6 Tcpip
;    System Information
;    Wed Nov 26 08:18:01
;    Intel(R) PRO/1000 MT Network Connection
;    - 0000 00 00 00 00 02 00 50 00 ......P.
;    - 0008 00 00 00 00 69 10 00 40 ....i..@
;    - 0010 02 00 00 00 00 00 00 00 ........
;    - 0018 00 00 00 00 00 00 00 00 ........
;    - 0020 00 00 00 00 00 00 00 00 ........
!329 08:18:02     2    44     4     7 sift
;    Application Error
;    Wed Nov 26 08:18:02
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:02     3     .     4     7 sift
 329 08:18:03     1     .     4     7 sift
```

Fig. 7c

```
!329 08:18:03     2    44     4     8 sift
;    Application Error
;    Wed Nov 26 08:18:03
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:03     3     .     4     8 sift
 329 08:18:04     1     .     4     8 sift
!329 08:18:04     2    44     4     9 sift
;    Application Error
;    Wed Nov 26 08:18:04
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:04     3     .     4     9 sift
 329 08:18:05     1     .     4     9 sift
!329 08:18:05     2    44     4    10 sift
;    Application Error
;    Wed Nov 26 08:18:05
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:05     3     .     4    10 sift
 329 08:18:06     1     .     4    10 sift
!329 08:18:06     2    44     4    11 sift
;    Application Error
;    Wed Nov 26 08:18:06
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:06     3     .     4    11 sift
 329 08:18:07     1     .     4    11 sift
!329 08:18:07     2    19     4    12 sift
;    Application Error
;    Wed Nov 26 08:18:07
;    sift d:\trib.tmp 1000 | abyss
;    Invalid argument.
 329 08:18:07     3     .     4    12 sift
 329 08:18:08     1     .     4    12 sift
!329 08:18:08     2    44     4    13 sift
;    Application Error
;    Wed Nov 26 08:18:08
;    sift d:\trib.tmp 1000 | abyss
;    Resource busy.
 329 08:18:08     3     .     4    13 sift
```

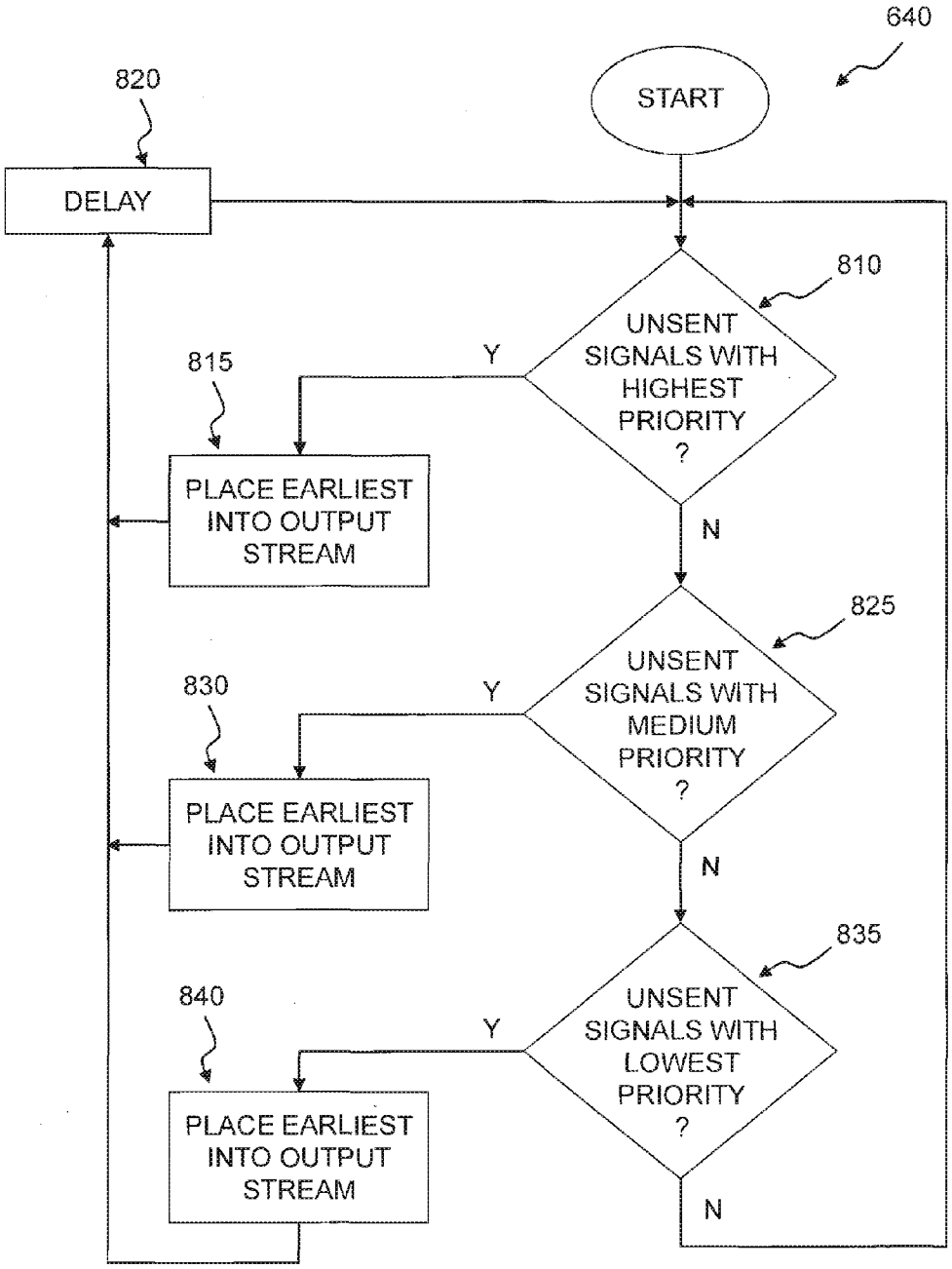

640
START
820
DELAY
810
UNSENT SIGNALS WITH HIGHEST PRIORITY ?
Y
815
PLACE EARLIEST INTO OUTPUT STREAM
N
825
UNSENT SIGNALS WITH MEDIUM PRIORITY ?
Y
830
PLACE EARLIEST INTO OUTPUT STREAM
N
835
UNSENT SIGNALS WITH LOWEST PRIORITY ?
Y
840
PLACE EARLIEST INTO OUTPUT STREAM
N

FIG. 8

CORRELATED TESTING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application 61/350,319 filed Jun. 1, 2010, the disclosure of which is expressly incorporated herein by reference. Additionally, this application is being co-filed with applications bearing the titles of EXTENSIBLE TESTING SYSTEM (Attorney Docket No. NC 99,905), BINARY DEFINITION FILES (Attorney Docket No. NC 99,903), and GPS EMBEDDED INTERACTIVE NETWORK INTERFACE (Attorney Docket No. NC 99,902), the disclosures of which are also expressly incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] The invention described herein was made in the performance of official duties by employees of the Department of the Navy and may be manufactured, used and licensed by or for the United States Government for any governmental purpose without payment of any royalties thereon.

FIELD OF THE DISCLOSURE

[0003] The present disclosure relates generally to methods and systems for testing electronic equipment, and more particularly to methods and systems for testing electronic equipment where test inputs, test outputs, test applied environmental conditions, and test processes are recorded and correlated.

BACKGROUND AND SUMMARY OF THE DISCLOSURE

[0004] In a variety of different contexts, it is desirable to test electronic equipment and collect data from the tests for evaluation and analysis. Tests can return indications of a successful test or a test failure. However, such results can fail to tell the whole story regarding expected sustained performance of the electronic items when placed in the field.

[0005] The present disclosure provides a computer implemented system for monitoring a testing environment. The system includes a first processing sequence that receives and stores operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures; a second processing sequence that receives and stores operational data related to a test chamber that imparts environmental conditions upon the electrical device under test; a third processing sequence that correlates the data received in the first and second processing sequences; a fourth processing sequence that reads the correlated operational data; and a fifth processing sequence that displays the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

[0006] A second embodiment of the present disclosure provides a computer implemented method for monitoring a testing environment. The method including receiving and storing operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures; receiving and storing operational data related to a test chamber that imparts environmental conditions upon the electrical device under test; correlating the data received from the electrical device under test and the test chamber; reading the correlated operational data; and displaying the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

[0007] Yet another embodiment of the present disclosure provides a computer readable medium storing code for monitoring a testing environment. The code includes instructions to: receive and store operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures; receive and store operational data related to a test chamber that imparts environmental conditions upon the electrical device under test; correlate the operational data received from the electrical device under test and the test chamber; read the correlated operational data; and display the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

[0008] These and other features of the present disclosure will become more apparent and the subject matter of the disclosure will be better understood by reference to the following description of embodiments of the disclosure taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is an illustrative system for testing an electronic device;

[0010] FIG. **2** is a conceptual diagram of program parts that operate in the system of FIG. **1**;

[0011] FIG. **3** is a conceptual diagram of the programatical operation of a part of the program of FIG. **2**;

[0012] FIG. **4** is a flowchart showing the operation of a testing interface program and terminal of FIG. **1**;

[0013] FIG. **5** is a flowchart showing the operation of a data collection and serving program;

[0014] FIG. **6** is a flowchart showing the operation of a data collation and output program;

[0015] FIG. **7** is a sample output generated as part of the program of FIG. **5**; and

[0016] FIG. **8** is a flowchart showing the operation of a portion of the program of FIG. **6**.

[0017] Although the drawings represent embodiments of various features and components according to the present disclosure, the drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the present disclosure. The exemplifications set out herein illustrate embodiments of the disclosure, and such exemplifications are not to be construed as limiting the scope of the disclosure in any manner.

DETAILED DESCRIPTION

[0018] For the purposes of promoting an understanding of the principles of the disclosure, reference will now be made to the embodiments illustrated in the drawings, which are described below. It will nevertheless be understood that no limitation of the scope of the disclosure is thereby intended. The disclosure includes any alterations and further modifications in the illustrated system and described method and further applications of the principles of the disclosure, which would normally occur to one skilled in the art to which the disclosure relates. Moreover, the embodiments were selected for description to enable one of ordinary skill in the art to practice and implement the principles described herein.

[0019] The method and system of the present disclosure are configured to test and report on functionality of an electronic device **10** under various conditions. The system includes a plurality of networked devices including testing interface computer **12**, first automated data source **14**, second automated data source **16**, collating server **18**, reporting database **20**, reporting display computer **22**, and environmental chamber **24** including chamber control computer **26**.

[0020] Interface computer **12** is a general purpose computer capable of operating a command line shell program **30**. Shell program **30** is a command interpreter that facilitates the development of device independent test procedures. Shell program **30** includes a plurality of testing protocol data files **32***a-c*. Each testing protocol file includes instructions therein to produce a data file that effects a different test for electronic device **10**. Shell program **30** further includes a plurality of binary definition files **34***a-c*. Each binary definition file **34***a-c* is specific to a particular model of electronic device **10**.

[0021] Testing protocol data files **32***a-c* are created by a user fluent in the programming language and by a subject matter expert who is an expert in what needs to be tested in the electronic devices. The expertise of the subject matter experts includes knowledge of what commands and inputs need to be delivered and in what order they are delivered as well as knowledge of required outputs. Testing protocol data files **32***a-c* generate generic data files that encapsulate the necessary input data for electronic device **10** under test. The fact that the output is generic is illustrated by the consistent saw edge of each test protocol data file **32***a-c*. Accordingly, testing protocol data files **32***a-c* are generic with respect to the class, or genus, of devices **10** that the system is designed to test. For example, a class or genus of devices could include, motherboards, DVD players, GPS devices (professional or consumer grade), cell phones, DBS receivers, or most anything that accepts electronic input and generates an output. Thus, for a system designed to test cell phones, test protocol data files **32***a-c* are designed to and capable of testing any cell phone.

[0022] However, all devices within a genus of devices, such as cell phones, do not contain the same hardware or operate identically. Accordingly, commands suitable for generating a desired response in one species of the genus of devices may not work for a different species of device within the genus. Accordingly, testing interface computer **12** utilizes binary definition files **34***a-c*. It should be appreciated that while only three binary definition files **34** (and only three test protocols **32**) are shown, an unlimited number thereof are envisioned.

[0023] Binary definition files **34***a-c* are each specific to a particular species of device **10** within the genus of devices (this specificity is illustrated by the individualized lower end of binary definition files **34***a-c*). Each binary definition file **34***a-c* can receive the output from any protocol data file **32***a-c* (as illustrated by matching saw pattern upper edge) and then transform the generic test protocol file into a specific data file for the specific device **10** under test. Binary definition files **34***a-c* process data within the generic test protocol file bitwise. Each bit of information within the generic test protocol is individually handled by the relevant binary definition file **34***a-c* to generate the relevant specific data file. Like the test protocol files **32***a-c*, the specific device under test, and thus the binary definition file **34***a-c* to be used are specified by a user at user interface computer **12**. In this way, the programming of testing interface computer **12** provide an extensible testing platform that is easily extended to not-yet-conceived species of electronic devices **10**. Similarly, new test protocols **32***a-c* can be developed for all species of electronic devices **10** without having to create a new test file for every species of electronic device **10** on which the test is desired to run.

[0024] Each test protocol data file **32***a-c* of the present disclosure share the characteristic of having a fixed format for arranging the raw data produced thereby for output (previously described as being generic with respect to all species within the genus). FIG. **3** provides an example of a portion of one such raw data file **300**. As shown, data file **300** includes a plurality of information blocks or data sets **102**, (shown as blocks A-L).

[0025] Binary definition file **34***a*, shown in FIG. **3**, receives raw data file **300** and unpacks it. Binary definition file **34***a*, being specific to a particular species of device **10**, knows both the generic format of raw data file **300** and also the specific format of data file **350** that is required by the identified species of device **10**. Accordingly, binary data file **34***a* constructs data file **350** by pulling data from raw data file **300** and placing the information into the format of data file **350**. Data file **350** is subsequently compiled and output to device **10** under test. While specific test protocol data files **32***a-c* and specific binary definition files **34***a-c* may be discussed herein, it should be appreciated that any other test protocol data file **32***a-c* and/or binary definition file **34***a-c* could be used when different tests and or species of device are desired.

[0026] Referring now to FIG. **4**, there is depicted a diagram of the various processing sequences and data structures employed by the present system and method in software/utility **400**.

[0027] In general, a computer implemented system according to the principles of the present disclosure includes a first data specification retrieving sequence **410**, a first test protocol retrieving sequence **415**, a test protocol executing sequence **420**, a data specification interpreting sequence **425**, a second data structure generating sequence **430**, a second data structure outputting sequence **435**, a third data structure receiving sequence **440**, a data specification interpretation and data extraction sequence **445**, a fourth data structure generating sequence **450**, and a data extraction and comparison sequence **455**.

[0028] First data specification retrieving sequence **410** includes code for execution by a processor of testing interface computer **12** for retrieving a first data specification for a first electronic device species. Sequence **410** is initiated via the entering of commands by a user of testing interface computer **12**. The first data specification, in the present example, takes the form of binary definition file **34**. Binary definition file **34** includes information therein about the data requirements for the first electronic device that has been identified by the user.

[0029] First test protocol retrieving sequence **415** includes code for execution by a processor of testing interface computer **12** for retrieving a first data test protocol for a genus of electronic devices, of which the first electronic device species is a member. Sequence **415** is initiated via the entering of commands by the user of testing interface computer **12**.

[0030] Test protocol executing sequence **420** includes code for execution by a processor of testing interface computer **12** for performing a plurality of functions. More specifically, as depicted at **422** test protocol executing sequence **420** executes the test protocol. Additionally, as depicted at **424**, test protocol executing sequence **420** generates raw data file/first data structure **300**. Raw data file/first data structure **300** is a test file that is generic with respect to all species within the selected genus of electronic devices.

[0031] Data specification interpreting sequence **425** includes code for execution by a processor of testing interface computer **12** for performing a plurality of functions. More specifically, as depicted at **426**, data specification interpreting sequence **425** reads the first data specification **34**. Additionally, as depicted at **428**, data specification interpreting sequence **425** extracts data from the raw data file/first data structure **300** according to the instructions present within the first data specification **34**. This sequence is also illustrated in FIG. **3**.

[0032] Second data structure generating sequence **430** includes code for execution by a processor of testing interface computer **12** for generating a second data structure **350** that is species specific. As also illustrated in FIG. **3**, sequence **430** takes the data that was extracted in sequence **425** and reconstitutes it as a new data structure **350** that is in a format specific to the particular species of electronic device **10** being tested. Second data structure **350** is formed according to the instructions contained in binary definition file/data specification **34**.

[0033] Second data structure outputting sequence **435** includes code for execution by a processor of testing interface computer **12** for outputting second data structure **350** to electronic device **10**. It should be appreciated that embodiments are envisioned where second data structure **350** is not output directly to electronic device **10**. Rather, in such embodiments, as shown in FIG. **1**, testing interface computer **12** outputs second data structure **350** to collating server **18** which then after processing, forwards the data structure to electronic device **10**.

[0034] Once the second data structure **350** is provided to electronic device **10**, the electronic device **10** acts upon the input as appropriate. Electronic device **10** then generates an output in response to receiving and processing the second data structure **350**. This output is in the form of a third data structure.

[0035] Third data structure receiving sequence **440** includes code for execution by a processor of testing interface computer **12** for receiving the third data structure output by electronic device **10**. Again, it should be appreciated that embodiments are envisioned where the third data structure is not transmitted directly from electronic device **10** to testing interface computer **12**, but rather is transmitted through an intermediary device, such as collating server **18**.

[0036] Data specification interpretation and data extraction sequence **445** includes code for execution by a processor of testing interface computer **12** for performing a plurality of functions. More specifically, as depicted at **446**, data specification/binary definition file **34** is again invoked/read and interpreted. Additionally, as depicted at **448**, data is extracted from third data structure according to the interpretation of the data specification/binary definition file **34**.

[0037] Fourth data structure generating sequence **450** includes code for execution by a processor of testing interface computer **12** for taking the data extracted from the third data structure and generating a fourth data structure that uses the data extracted from the third data structure. The fourth data structure is generic with respect to the genus of electronic devices. The fourth data structure is in a standardized format that is readily understood and expected by the test protocol being executed by testing interface computer **12**.

[0038] Data extraction and comparison sequence **455** includes code for execution by a processor of testing interface computer **12** for performing a plurality of functions. More specifically, as depicted at **456**, data is extracted from the fourth data structure as directed by the test protocol. Additionally, as depicted at **458**, the extracted data is compared to expected result data. If the extracted data meets the passing criteria, such as by matching the expected passing result, then the response data embodied in the third and fourth data structures is held to have passed the test. If the extracted data does not meet the passing criteria, the response data is held to have failed the test. It should be appreciated that the entire data structure can but need not be evaluated as a whole, rather pieces of data within the response data structures can be held to pass the test while other pieces can be held to fail. Furthermore, rather than only categorizing the data into pass and fail, it is envisioned to have multiple gradations of passing and failing such as full pass, qualified pass, pass with poor performance, etc. Passing criteria, or the criteria for categorizing the output, is held in a interface control document that provides a listing of various output possibilities and categorization for each output possibility. In the present example, the first and fourth data structures are comma delimited files. The second and third data structures may also be comma delimited files, but are dependent upon the electronic device **10** being tested and the data structure required thereby. Additionally, second and third data structures may be in a format suited for collating server **18**. Additional processing of second and third data structures may occur at collating server **18**.

[0039] It should be appreciated that the system of the current disclosure can be readily adapted to perform a second test on electronic device **10** by having the user of testing interface computer **12** call a different test protocol. Similarly, the first test can be performed on a different species of electronic device **10** by having the user of testing interface computer **12** identify the different electronic device **10** and calling the first test protocol. Even further, the second test can be performed on a different species of electronic device **10** by having the user of testing interface computer **12** identify the second test and different electronic device **10** via testing interface computer **12**.

[0040] Referring back to FIG. **1**, first and second automated data sources **14**, **16** are provided. First and second automated data sources **14**, **16** are data sources that device **10** is in communication with during normal operation thereof. Such data sources **14**, **16** in the case of device **10** being a DBS receiver can be signals from one or more DBS transponders. In the case of a stereo receiver, data sources **14**, **16** can be an audio source. In the case of a motherboard or any integrated circuit, automated data sources **14**, **16** can be any number of automated data streams that typically interface therewith. In the case of professional GPS devices, automated data sources **14**, **16** can be aiding data sources. Each of the aforementioned data sources are provided as examples and not to limit the possibilities of automated data sources **14**, **16**.

[0041] Collating server **18** is a general purpose server having utility/software **600** thereon for collating data streams from testing interface computer **12**, first automated data source **14**, and second automated data source **16** into a single output data stream suitable for being received by electronic device **10**. Software **600** thereby transforms server **18** into collating server **18**. Software **600** essentially operates as an abstraction layer for device **10**. All input/output is controlled through a command interpreter via a network socket connection on an embedded processor. Test protocols **32** are written independently of the device **10** using only the functionality published through the command interpreter which creates an

abstraction layer for the device **10**. Changes and revisions to device **10** can be made and recompiled without altering the command interface that is the basis of the associated test protocols **32**.

[0042] In general, a computer implemented system according to the principles of the present disclosure includes first message receiving and prioritizing sequence **610**, first message storing sequence **615**, second message receiving and prioritizing sequence **615**, second message storing sequence **620**, third message receiving and prioritizing sequence **625**, third message storing sequence **630**, and output data stream generation sequence **635**.

[0043] First message receiving and prioritizing sequence **610** includes code for execution by a processor of collating server **18** for performing a plurality of functions. More specifically, as depicted at **612**, a first signal is received from a first source such as first automated data source **14**. Additionally, as depicted at **614**, a priority is assigned to the first signal. The priority assigned is, in the present example, assigned at least partially because the signal comes from first automated data source **14**. Signals from first automated data source **14** are given the highest priority. In the example where electronic device **10** is an embedded GPS device, an aiding server provides an example of first automated data source **14** that would result in signals therefrom being assigned the highest priority. Any incoming signal that is the product of an interrupt handler is given either the highest or middle priority.

[0044] First message storing sequence **615** includes code for execution by a processor of collating server **18** for storing the first signal data. The storage of the first signal may be for an extremely short amount of time if the data of the signal is ready to be output as described below. The first signal data, because it is assigned the highest priority, is stored in an active/inactive buffer scheme until it is called for output. Accordingly, the storage of the data is dependent on the priority assigned to the data.

[0045] Second message receiving and prioritizing sequence **620** includes code for execution by a processor of collating server **18** for performing a plurality of functions. More specifically, as depicted at **622** a second signal is received from a second source such as second automated data source **16**. Additionally, as depicted at **624**, a priority is assigned to the second signal. The priority assigned is, in the present example, assigned at least partially because the signal comes from second automated data source **16**. Signals from second automated data source **16** are given a medium priority. In the example where electronic device **10** is an embedded GPS device, a timing server provides an example of second automated data source **16** that would result in signals therefrom being assigned the medium priority. Additionally, a log service output message is given a medium priority.

[0046] Second message storing sequence **625** includes code for execution by a processor of collating server **18** for storing the second signal data. The second signal data, because it is assigned the medium priority, is stored in an active/inactive buffer scheme until it is called for output. Again, the storage of the data is dependent on the priority assigned to the data.

[0047] Third message receiving and prioritizing sequence **630** includes code for execution by a processor of collating server **18** for performing a plurality of functions. More specifically, as depicted at **632** a third signal is received from a third source such as testing interface computer **12**. Additionally, as depicted at **634**, a priority is assigned to the third signal. The priority assigned is, in the present example, assigned at least partially because the signal comes from testing interface computer **12**. Signals from testing interface computer **12** are given the lowest priority.

[0048] Third message storing sequence **635** includes code for execution by a processor of collating server **18** for storing the third signal data. The third signal data, because it is assigned the lowest priority, is stored in a circular queue until it is called for output. Again, the storage of the data is dependent on the priority assigned to the data.

[0049] Output generating sequence **640** includes code for execution by a processor of collating server **18** for generating an output of collating server **18**. The generation of the output sequence is performed according to a plurality of rules embodied in a plurality of sub-sequences, as shown in FIG. **8**.

[0050] The computer implemented output generation sequence **640** according to the principles of the present disclosure includes first priority signal detection sequence **810**, first priority signal output sequence **815**, delay sequence **820**, second priority signal detection sequence **825**, second priority signal output sequence **830**, third priority signal detection sequence **835**, and third priority signal output sequence **840**.

[0051] First priority signal detection sequence **810** includes code for execution by a processor of collating server **18** for detecting if any unsent signals are stored in the active/inactive buffer scheme having the highest priority. If unsent highest priority signals are found, the processor of collating server **18** invokes first priority signal output sequence **815**. If no unsent highest priority signals are found, the processor of collating server **18** invokes second priority signal detection sequence **825**.

[0052] First priority signal output sequence **815** includes code for execution by the processor of collating server **18** for placing the earliest received stored signal having the highest priority into an output stream of collating server **18**. Once first priority signal output sequence **815** concludes, the processor of collating server **18** continues to delay sequence **820**.

[0053] Delay sequence **820** includes code for execution by the processor of collating server **18** for inserting a delay between signals in the output stream from collating server **18**. The amount of time prescribed by delay sequence **820** is set, or pre-defined, by the programmer. The programmer sets the delay time to allow the quickest output of adjacent signals while still conforming to the input needs of electronic device **10** to maintain a desired reliability thereof. For example, electronic device **10** may require a separation of adjacent signals of 20 ms to achieve the desired reliability, otherwise known as a message interrupt constraint. Signals received in violation of this 20 ms spacing can result in disabling of a message interrupt system of electronic device **10**. Such disabling of the message interrupt system can cause loss of data, instability of electronic device **10**, and test failure.

[0054] As previously noted, if no unsent highest priority signals are found in first priority signal detection sequence **810**, the processor of collating server **18** invokes second priority signal detection sequence **825**. Second priority signal detection sequence **825** includes code for execution by a processor of collating server **18** for detecting if any unsent signals are stored in the active/inactive buffer scheme having the middle priority. If unsent middle priority signals are found, the processor of collating server **18** invokes second priority signal output sequence **830** followed by delay sequence **820**. If no unsent middle priority signals are found, the processor of collating server **18** invokes third priority signal detection sequence **835**.

[0055] Second priority signal output sequence **830** includes code for execution by the processor of collating server **18** for placing the earliest received stored signal having the middle priority into an output stream of collating server **18**. Once second priority signal output sequence **830** concludes, the processor of collating server **18** continues to delay sequence **820**.

[0056] As previously noted, if no unsent middle priority signals are found in second priority signal detection sequence **825**, the processor of collating server **18** invokes third priority signal detection sequence **835**. Third priority signal detection sequence **835** includes code for execution by a processor of collating server **18** for detecting if any unsent signals are stored in the circular queue having the lowest priority. If unsent lowest priority signals are found, the processor of collating server **18** invokes third priority signal output sequence **840**. If no unsent lowest priority signals are found, the processor of collating server **18** returns to step first priority signal detection sequence **810**. It should be appreciated that in this case, the processor need not go through delay sequence **820** because no message has been placed in the output stream since the last time the delay sequence **820** was invoked.

[0057] It should be appreciated that while three levels of priority are discussed and shown in FIG. **8**, additional levels of priority can be assigned, additional priority signal detection sequences can be employed, and additional signal output sequences can be used as appropriate.

[0058] Reporting database **20** is a standard database suitable for storing and organizing quantities of data from testing systems **12**, **14**, **16**, **18**, **26** and monitored devices **10**. While database **20** is depicted as a standalone database, it should be appreciated that database **20** may be any storage medium capable of carrying out the functions ascribed thereto. Database 20 runs and/or facilitates a monitoring utility **500** designed to detect failures (and operations generally) induced through environmental test conditions by invoking tasks typical to the intended working environment and monitoring the system for warnings and errors. Utility **500** quietly records any exceptions encountered by electronic device **10** to an event log. This event log can later be viewed and addressed by the test administrator. Additionally, utility **500** records inputs provided to electronic device **10** from testing interface computer **12**, automated data sources **14**, **16**, and collating server **18** with time stamps. Utility **500** likewise records outputs provided by device **10** and conditions imposed on device **10** by environmental chamber **24** with time stamps. In this way, the stability of the entire system is constantly being checked and any pertinent information is time stamped and recorded into a user-specified log file which can later be compared against a timeline of environmental conditions, provided by chamber **24** or otherwise, for evaluation. Utility **500** is invoked from a command line by inputting the name of the executable utility **500** with the pathname of a valid data monitoring profile and optional pathnames of log files to which output will be appended. File specifications may contain universal naming convention references allowing output to be logged to a remote machine or database **20**.

[0059] Monitoring profiles include a plurality of variables that can be set by a user. Some of these variables/settings include settings that allow controlling a collection of trials as a set. Such settings include "Delay," which defines a minimum delay in seconds between trial sets (the default is zero). "Iterations" sets a maximum number of iterations permitted for the trial set (the default is unlimited). "Seconds" sets a maximum number of seconds to consecutively run the trial set (the default is unlimited). "Errors" sets a maximum number of errors before disabling the trial set (the default is unlimited). "Verbose" sets the output type to include more detail (the default is to output errors only). "[N]" is a value between 1 and 255 (inclusive) and identifies the trial number. "Trial" is a command-line invoking the desired trial utility.

[0060] The output of utility **500** consists of lines of text prefixed by one of four possible character identifiers. A sample output is provided in FIGS. **7***a-c*. In the output, a semicolon ";" indicates a comment, a blank indicates a success, a tilde "~" indicates a warning, and an exclamation "!" indicates an error. With the exception of comments, each output line consists of data broken across six fields. The six fields include "Day an Hour" **710**, "Trial" **720**, "Mark" **730**, "War's" **740**, "Err's" **750**, and "Source" **760**. "Day an Hour" **710** indicates the day and time of the trial. This data is retrieved from the timestamps of the provided data. "Trial" **720** indicates a trial ID for the associated command. "Mark" **730** indicates the trial result. A numerical value for "Mark" **730** represents an error code, a period "." represents a success. "War's" **740** indicates the cumulative warnings. Warnings are system generated events that indicate a situation that is not immediately problematic or significant with respect to present system operation but that may indicate a future problem. "Err's" **750** indicates the cumulative errors. Errors are system generated events that are indicative of a significant present operational problem, such as loss of data. "Source" **760** indicates the source that generated the output line. Sources may include any support program run by utility **500**, discussed below.

[0061] In addition to recording the various inputs, processes, outputs, and conditions related to device **10**, all of this data is accessible to reporting display computer **22**. Reporting display computer **22** can retrieve the stored data to re-create the events of the testing session by reading the output of utility **500**. Additionally, display computer **22** can display the various pieces of data as received to generate a substantially real-time display of the data. Additionally, by recording errors/exceptions in addition to overall operational failures, utility **500** can be used to find errors such as necessary computing retries that slow down the computing process but don't cause the overall operation to fail. Thus, a different test that only checks to determine if a correct response is returned may miss that substantial errors are being generated and that the computing is operating in an inefficient manner due to significant retries or otherwise.

[0062] Environmental chamber **24** provides a controlled environment in which to test electronic device **10**. Environmental chamber **24** is controlled by chamber control computer **26**. Via chamber control computer **26**, environmental chamber **24** can impart various environmental conditions upon electronic device **10**. Such conditions include, but are not limited to, temperatures, atmospheric pressures, humidity, and vibrations. Additionally, test protocols invoked on testing interface computer **12** can include instructions that when transmitted to chamber control computer **26** invoke desired environmental conditions to be applied to electronic device **10** as part of the test protocol.

[0063] Referring now to FIG. **5**, there is depicted a diagram of the various processing sequences and data structures employed by the present system and method in utility **500**. In general, a computer implemented system according to the principles of the present disclosure includes an electrical device operational data receiving and storing sequence **510**, an environmental chamber operational data receiving and storing sequence **520**, a data correlation sequence **530**, a correlated data reading sequence **540**, and a data displaying

sequence **550**. The functions of these processing sequences involve the use of user interfaces and command sets that are described in more detail herein.

[0064] Operational data receiving and storing sequence **510** includes code for execution by a processor in communication with database **20** for performing a plurality of functions. More specifically, as depicted at **512**, operational data receiving and storing sequence **510** receives operational data from electronic device **10**, testing interface computer **12**, first automated data source **14**, second automated data source **16**, and collating server **18**. This received data is at least partially based on user input via input devices coupled to testing interface computer **12** (e.g. tests chosen and identification of electronic device **10**). Furthermore, as depicted at **514**, the operational data is saved in a format that groups it with other data from the same test session.

[0065] Environmental chamber operational data receiving and storing sequence **520** includes code for execution by a processor in communication with database **20** for performing a plurality of functions. More specifically, as depicted at **522**, environmental chamber operational data receiving and storing sequence **520** receives operational data from chamber control computer **26**. This received data is indicative of the environmental conditions provided by environmental chamber **24** and experienced by electronic device **10**. Furthermore, as depicted at **524**, the environmental operational data is saved in a format that groups it with other data from the same session.

[0066] Data correlation sequence **530** includes code for execution by a processor in communication with database **20**. The code calls for the correlation of the electrical device operational data with the test chamber operational data. This correlation takes the form of being associated with the same test sequence and also by comparing timestamps of the data to organize it into an order that is consistent with the order in which the events represented by the data points occurred.

[0067] Correlated data reading sequence **540** includes code for execution by a processor, such as a processor within reporting display computer **22**. The code calls for the reading of the correlated data from within reporting database **20**. It should be appreciated that while the correlation of data correlation sequence **530** can occur within reporting database **20** and then be subsequently read out of reporting database **20** during correlated data reading sequence **540**, other embodiments are contemplated where data correlation sequence **530** occurs within reporting display computer **22** and correlated data reading sequence **540** involves the processor within reporting display computer **22** reading the data previously correlated by the processor within reporting display computer **22**.

[0068] Data displaying sequence **550** includes code for execution by a processor, such as the processor within reporting display computer **22**. The code calls for the displaying of the correlated operational data. This displaying occurs on a display such as the display that is part of reporting display computer **22**. The displaying may take a plurality of forms as desired and requested by a user of reporting display computer **22**. One such form includes a display of the correlated data such that a substantially real-time representation of the data is provided.

[0069] The foregoing description of the invention is illustrative only, and is not intended to limit the scope of the invention to the precise terms set forth. Although the invention has been described in detail with reference to certain illustrative embodiments, variations and modifications exist within the scope and spirit of the invention as described and defined in the following claims.

What is claimed is:

1. A computer implemented system for monitoring a testing environment, including:

a first processing sequence that receives and stores operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures;

a second processing sequence that receives and stores operational data related to a test chamber that imparts environmental conditions upon the electrical device under test;

a third processing sequence that correlates the data received in the first and second processing sequences;

a fourth processing sequence that reads the correlated operational data; and

a fifth processing sequence that displays the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

2. The system of claim **1**, wherein the electrical device operational data includes an indication of operation failure where the operation failure fails to result the device under test failing any component of the test.

3. The system of claim **1**, wherein the electrical device operational data includes an indication of called process retries.

4. The system of claim **1**, wherein the environmental conditions include vibration.

5. The system of claim **1**, wherein the environmental conditions include humidity.

6. The system of claim **1**, wherein the first processing sequence further stores test input data provided to the electrical device under test.

7. The system of claim **1**, wherein the operational data includes all exceptions encountered by the electrical device under test.

8. The system of claim **1**, wherein each piece of data received as part of the first and second processing sequence is time-stamped.

9. The system of claim **8**, wherein the third processing sequence utilizes the time stamps to correlate the data.

10. The system of claim **1**, wherein the first processing step includes receiving and storing data that was input to the electrical device under test and receiving and storing output data generated by the electrical device under test in response to the input data.

11. The system of claim **10**, wherein the data that was input to the electrical device includes a data stream that is a collation of prioritized data from a plurality of sources.

12. The system of claim **1**, wherein the first processing step includes receiving and storing data from an aiding data source.

13. A computer implemented method for monitoring a testing environment, including:

receiving and storing operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures;

receiving and storing operational data related to a test chamber that imparts environmental conditions upon the electrical device under test;

correlating the data received from the electrical device under test and the test chamber;

reading the correlated operational data; and

displaying the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

14. The computer implemented method of claim **13**, wherein the electrical device operational data includes an indication of operation failure where the operation failure fails to result the device under test failing any component of the test.

15. The computer implemented method of claim **13**, wherein the electrical device operational data includes an indication of called process retries.

16. The computer implemented method of claim **13**, wherein the environmental conditions include vibration.

17. The computer implemented method of claim **13**, wherein the environmental conditions include humidity.

18. The computer implemented method of claim **13**, wherein the step of receiving and storing operational data from an electrical device under test further stores test input data provided to the electrical device under test.

19. The computer implemented method of claim **13**, wherein the operational data includes all exceptions encountered by the electrical device under test.

20. The computer implemented method of claim **13**, wherein each piece of data received is time-stamped.

21. The computer implemented method of claim **20**, wherein the third processing sequence utilizes the time stamps to correlate the data.

22. The computer implemented method of claim **13**, wherein the step of receiving and storing operational data from an electrical device under test includes receiving and storing data that was input to the electrical device under test and receiving and storing output data generated by the electrical device under test in response to the input data.

23. The computer implemented method of claim **22**, wherein the data that was input to the electrical device includes a data stream that is a collation of prioritized data from a plurality of sources.

24. The computer implemented method of claim **13**, wherein the step of receiving and storing operational data from an electrical device under test includes receiving and storing data from an aiding data source.

25. A computer readable medium storing code for monitoring a testing environment, the code including instructions to:

receive and store operational data from an electrical device under test, the electrical device operational data including information regarding processor operation successes and failures;

receive and store operational data related to a test chamber that imparts environmental conditions upon the electrical device under test;

correlate the operational data received from the electrical device under test and the test chamber;

read the correlated operational data; and

display the correlated operational data such that a substantially real-time representation of the correlated operational data is provided.

26. The computer readable medium of claim **25**, wherein the electrical device operational data includes an indication of operation failure where the operation failure fails to result the device under test failing any component of the test.

27. The computer readable medium of claim **25**, wherein the electrical device operational data includes an indication of called process retries.

28. The computer readable medium of claim **25**, wherein the environmental conditions include vibration.

29. The computer readable medium of claim **25**, wherein the environmental conditions include humidity.

30. The computer readable medium of claim **25**, wherein the step of receiving and storing operational data from an electrical device under test further stores test input data provided to the electrical device under test.

31. The computer readable medium of claim **25**, wherein the operational data includes all exceptions encountered by the electrical device under test.

32. The computer readable medium of claim **25**, wherein each piece of data received is time-stamped.

33. The computer readable medium of claim **32**, wherein the third processing sequence utilizes the time stamps to correlate the data.

34. The computer readable medium of claim **25**, wherein the step of receiving and storing operational data from an electrical device under test includes receiving and storing data that was input to the electrical device under test and receiving and storing output data generated by the electrical device under test in response to the input data.

35. The computer readable medium of claim **25**, wherein the data that was input to the electrical device includes a data stream that is a collation of prioritized data from a plurality of sources.

36. The computer readable medium of claim **25**, wherein the step of receiving and storing operational data from an electrical device under test includes receiving and storing data from an aiding data source.

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