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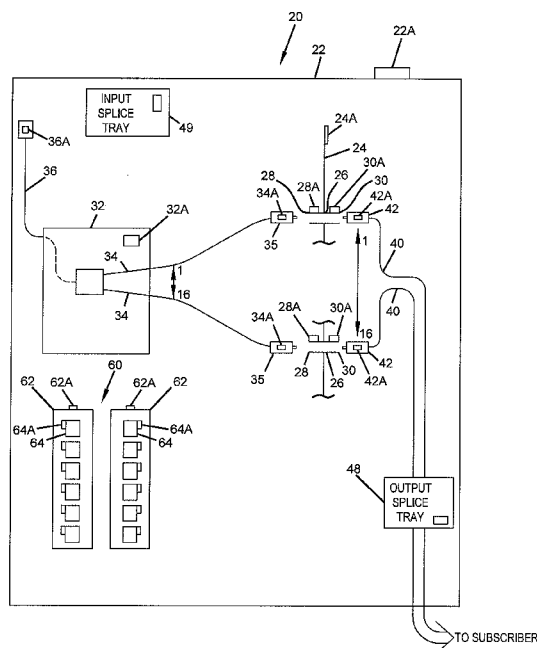
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(54) Title: COMPONENT IDENTIFICATION AND TRACKING SYSTEMS FOR TELECOMMUNICATION NETWORKS

FIG. 1



(57) Abstract: Identification elements (e.g., tracking elements, tracing elements, locating elements, etc.) (22A, 100) are provided on various communication components (20, 24, 26, 28, 30, 32, 34, 35, 36, 40, 42, 48, 49, 60, 62, 64, 120) provided within a communication network such as a fiber optic network or a copper network. Fiber optic hubs 20 can be identified and/or managed. Data centers (110) with patch panels (120) can also be identified and/or managed. Example passive identification elements include bar codes (e.g., 2d barcodes) and radio frequency identification (RFID) tags. In certain embodiments, RFID tags and the bar codes can include network information included therein. In certain embodiments, bar codes can be used to direct technicians to network links at which additional information stored elsewhere is provided. In certain embodiments, identification elements can be provided on communication components through an application downloaded to a mobile device by scanning the bar code. Such application on the mobile device can then be used to manage the network connections, change the network connections, or check the status of the network connections. Multiple mobile devices can be used and synchronized together with a central application, website or network. One example bar code useful for reading information from a network device and linking to a management application is a QR code (100).



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COMPONENT IDENTIFICATION AND TRACKING SYSTEM FOR TELECOMMUNICATION NETWORKS

This application is being filed on 16 May 2012, as a PCT International Patent application in the name of ADC Telecommunications, Inc., a U.S. national
5 corporation, and Tyco Electronics Raychem BVBA, a Belgium national corporation, applicants for the designation of all countries except the U.S., and, Trevor D. Smith, a citizen of the U.S., and Danny Ghislain Thijs, a citizen of Belgium, applicants for the designation of the U.S. only, and claims priority to U.S. Patent Application
Serial No. 61/487,178 filed on 17 May 2011 and U.S. Patent Application Serial No.
10 61/591,576 filed on 27 January 2012, the disclosures of which are incorporated herein by reference in their entirety.

BACKGROUND

Telecommunication systems typically employ a network of
15 telecommunication cables capable of transmitting large volumes of data and voice signals. The signals can be transmitted over relatively long distances in a wide area network or a local network. The signals can also be part of a data communications network, such as in a data center of a building or a campus. The
telecommunications cable can include fiber optic cables, electrical cables, or
20 combinations of electrical and fiber optic cables. A typical long distance telecommunications network also includes a plurality of telecommunications enclosures integrated throughout the network of telecommunications cables. The telecommunications enclosures are adapted to house and protect telecommunication components such as splices, splice trays, termination panels, power splitters and
25 wave length division multiplexers. Data centers include telecommunications equipment, storage systems, power supplies, and other equipment.

SUMMARY

The present disclosure relates to providing identification elements (e.g.,
30 tracking elements, tracing elements, locating elements, etc.) on various telecommunication components provided within a telecommunication network, such as a fiber optic network or a copper network. Example passive identification elements include bar codes (e.g., 2d barcodes) and radio frequency identification (RFID) tags. In certain embodiments, RFID tags are preferred over bar codes

because they typically allow for significantly more information to be included therein. In certain embodiments, bar codes can be used to direct technicians to internet links at which additional information of the type described herein is provided. In certain embodiments, identification elements can be provided on
5 telecommunication components through an application downloaded to a mobile device, such as handheld device, by scanning the bar code. Such application on the handheld device can then be used to manage the network connections, change the network connections, or check the status of the network connections. Multiple handheld devices can be used and synchronized together with a central application,
10 website, or network. One example bar code useful for reading information from a network device and linking to a management application is a QR code.

A telecommunications system comprises a telecommunications component; and an identifying element on the telecommunications component, wherein the identifying element includes at least one of: information about connectivity of the
15 telecommunications component, information about the telecommunications component, a link to a website, or a link to an application for downloading to a handheld device for managing the information about connectivity of the telecommunications component.

A method of using a telecommunications system comprises providing a
20 telecommunications component; providing an identifying element on the telecommunications component, wherein the identifying element includes at least one of: information about connectivity of the telecommunications component, information about the telecommunications component, a link to a website, or a link to an application for downloading to a handheld device for managing the
25 information about connectivity of the telecommunications component; and scanning the identifying element.

The above noted systems and methods can also be used with any supporting hardware, such as hardware which supports, houses, or checks the equipment, including frames, racks, screens, cameras.

30 The above noted systems and methods and as further described and claimed can also be used with any type of network (copper or fiber) and whether the network is localized, or used or a wide area. The systems and methods can be used by the system operator for the equipment, the connections, and/or the supporting hardware, as desired.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is an example of a fiber distribution hub including a component identification system in accordance with the principles of the present disclosure;

Figure 2 shows steps for using a component identification element in one
5 implementation of the present disclosure;

Figure 3 shows various steps in additional implementations of the present disclosure using a component identification element;

Figure 4 is an example telecommunications rack including the plurality of patch panels.

10

DETAILED DESCRIPTION

Some telecommunication networks include a large number of components distributed over a large area. Often, the as-built configuration of a telecommunications network (e.g., a passive fiber optic network) differs from the configuration of the telecommunication network as originally planned. Because
15 components of a given telecommunication network are spread out over a relatively large area, it can be difficult to track and confirm the as-built configuration of the telecommunications network. Similar problems exist in local networks, such as in data centers, where high density is desired.

20 The present disclosure relates to various systems and methods for maximizing the amount of data available for defining the as-built configuration of a telecommunication network. The present disclosure also relates to various methods and systems for utilizing as-built data to improve the reliability of telecommunication systems, to improve the ability to efficiently maintain
25 telecommunication systems, and to improve the ability to efficiently upgrade telecommunication systems.

Certain aspects of the present disclosure relate to providing identification elements (e.g., tracking elements, tracing elements, locating elements, etc.) on various telecommunication components provided within a telecommunication
30 network such as a fiber optic network or copper network. Example passive identification elements include bar codes (e.g., 2d barcodes) and radio frequency identification (RFID) tags. In certain embodiments, RFID tags are preferred over bar codes because they typically allow for significantly more information to be included therein. In certain embodiments, bar codes can be used to direct

technicians to network links, such as internet links at which additional information of the type described herein is provided. In certain embodiments, identification elements can be provided on passive telecommunication components such as: splitter modules; fiber optic connectors; fiber optic adapters; individual fiber optic
5 adapters provided at a termination region; termination panels themselves; power splitter modules; individual outputs of power splitter modules (e.g., either connectorized outputs or non-connectorized outputs); multiplexers such as wavelength division multiplexers; individual outputs of multiplexing devices; fiber distribution hub housings; adapters used to interconnect with plug and play splitters;
10 drop terminals; individual ports corresponding to drop terminals; ruggedized connectors that plug into drop terminals or elsewhere; single fiber ruggedized connectors; multi-fiber ruggedized connectors; individual fiber optic splices; splice trays; splice enclosures; parking modules; individual parking ports; fiber optic trays and drawers; wall boxes; receptacles for receiving parking modules; MTP/MFC
15 connectors; and/or on other structures. Identification elements can be provided on active component as well.

Example parking modules are disclosed in United States Patent No. 7,809,233 which is hereby incorporated by reference in its entirety. An example network interface device is disclosed in United States Patent Application Serial No.
20 11/607,676 which is hereby incorporated by reference in its entirety. An example single fiber ruggedized connector is disclosed at United States Patent Application Serial No. 12/203,508 which is hereby incorporated by reference in its entirety. An example splice tray is disclosed at United States Application Serial No. 12/425,241 which is hereby incorporated by reference in its entirety. Example fiber optic
25 drawer/trays are disclosed at United States Patent Application Serial Nos. 12/840,834 and 61/378,710 which are hereby incorporated by reference in their entireties. Example fiber optic enclosures are disclosed at United States Patent No. 7,715,679; 7,756,379; and 7,869,682, which are hereby incorporated by reference in their entireties. An example aerial splice enclosure is disclosed at United States
30 Patent App. Serial No. 12/350,337 that is hereby incorporated by reference in its entirety. Example plug and play splitters are disclosed at United States Patent Nos. 7,376,322; 7,593,614; 7,400,813; 7,376,323; and 7,346,254, which are hereby incorporated by reference in their entireties. An example drop terminal is disclosed in United States Patent No. 7,512,304, which is hereby incorporated by reference in

its entirety. An example ruggedized multifiber connector is disclosed at United States Patent No. 7,264,402, which is hereby incorporated by reference in its entirety. Example fiber distribution hubs are disclosed in United States Patent No. 7,873,255; 7,720,343; 7,816,602; 7,728,225; and United States Patent Application
5 Serial No. 12/827,423, the disclosures of which are hereby incorporated by reference in their entireties. An example splice closure is disclosed in United States Provisional Patent Application Serial No. 61/468,405, which is hereby incorporated by reference in its entirety. In accordance with the principles of the present disclosure, identification elements can be incorporated into the various components
10 of the systems disclosed in the above-identified patents and patent applications.

Figure 1 shows an example fiber distribution hub (FDH) 20 having a component identification element in accordance with the principles of the present disclosure. The fiber distribution hub 20 includes an outer housing 22. An FDH identifying element 22A is provided on the housing 22. In one embodiment, the
15 identifying element 22A is an RFID tag or a bar code. In the case of an RFID tag, the RFID tag can include various embedded information such as a photo of the FDH, an installation manual, information regarding FDH accessories, reorder information, and a specific identifying number for identifying the particular FDH.

The FDH 20 includes a termination field/panel 24 supporting a plurality of
20 fiber optic adapters 26. Each of the fiber optic adapters 26 includes first and second ports 28, 30. The termination field 24 has an identifying element 24A corresponding to the field as a whole. Additionally, each of the fiber optic adapters 26 includes identifying elements corresponding to each of the first and second ports 28, 30. For example, each of the first ports 28 includes its own identifying element 28A and
25 each of the second ports includes its own identifying element 28A.

The FDH 20 also includes a splitter module 32 containing a splitting component, such as power splitter or wave length splitter components. The splitting module 32 has its own identifying element 32A. The splitting module 32 includes a plurality of outputs 34 (e.g., 16 pigtail outputs, 32 pigtail outputs, etc.). Each of the
30 outputs 34 can include its own identifying element 34A. If the outputs 34 are connectorized, the identifying elements 34A can be provided on connectors 35 terminated to the ends of the outputs 34. If the outputs 34 are not connectorized, the identifying elements 34A can be provided directly on the pigtails routed out from the splitter module 32. The splitter module 32 can also include an input 36 which can

have its own identifying element 36A. The input 36 can be connectorized or connectorized. In the case of a connectorized input, the identifying element 36A can be provided on the connector. It will be appreciated that the splitter module includes components for providing a one to many optical connection. In the case of a power
5 splitter, a signal input to the splitter module 32 by the input 36 is split in power and divided equally to the various outputs 34. In the case of a splitting component in the form of a wave length division multiplexer, a signal input through the input 36 is split or divided based on wave length and signals within predefined wave length ranges are transmitted to the various outputs 34.

10 Referring still to Figure 1, the FDH 20 also includes a plurality of optical fibers 40 having ends that are connectorized by connectors 42. The optical fibers 40 can be optically connected to various subscriber locations via distribution or drop cables. Each of the connectors 42 can include its own identifying element 42A.

It will be appreciated that the outputs 34 of the splitting module 32 can be
15 plugged into the first ports 28 of the fiber optic adapters 26 and the connectors 42 corresponding to the optical fibers 40 can be inserted into the second ports 30 of the fiber optic adapters 26. In this way, the fiber optic adapters 26 are used to optically connect the outputs 34 of the splitter module 32 to the optical fibers 40. This allows subscribers to be optically connected to the fiber optic network.

20 In certain embodiments, the identifying elements corresponding to the fiber optic connectors can include various information about the connectors. Example information includes: a unique identification number; test results from final factory validation testing (e.g., end face geometry, insertion loss information, return loss information), warranty information, installation information, accessories
25 information, re-order information, or other information.

In certain embodiments, the FDH 20 can include a splicing region 48 including one or more splice trays. Each of the splice trays can include its own identifying element. It will be appreciated that splices are held within the splice tray. It will be appreciated that each of the splices can have its own identifying
30 element. Similarly, each of the fibers connected by a given splice can have there own identifying element. The splicing region 48 can be used to splice the fibers 40 to outgoing distribution cables routed to subscriber locations. A further splice region 49 can be provided for splicing the feeder fibers to the splitter inputs.

Identifiers can be provided at each of the splice trays and can also be provided for each of the incoming and outgoing fibers routed to the spliced trays.

The FDH 20 also includes a connector storage location 60 having parking modules 62 with module identifiers 62A. The parking modules include
5 ports/receptacles 64 for receiving individual connectors (e.g., connectors 35). The modules and each of the ports can include individual identifying elements 64A.

In practice, the FDH 20 is installed by a technician in the field. During the installation process, a technician can use a handheld scanner to scan the FDH identifying element 22A. The scanning element can also access positioning data
10 (e.g., global positioning coordinates) corresponding to the location the FDH 20 is being installed. In this way, by scanning the FDH identifying element 22A, the exact geographic position at which the FDH has been installed can be saved and later downloaded into a database recording the as-built configuration of the telecommunications system. Scanning of the identifying element 22A can also
15 provide the technician with necessary installation information, such as installation manuals or other materials. The scanning ties a unique identifying number assigned to the FDH 20 with a particular geographic position at which the FDH 20 has been installed. Information relating to the technician (e.g., identification, training record) can also be saved and linked to the given installation at the time of the scan.

20 As the technician continues the installation process, the technician plugs the outputs 34 into the first ports 28 and also plugs the connectors 42 into the second ports 30. During this installation process, the technician can scan the identifying elements 34A corresponding to the splitter outputs and the identifying elements 28A corresponding to the first port. In this way, information can be saved into the as-
25 built database showing exactly which outputs 34 are plugged into exactly which first ports 28. Specifically, specific identifying numbers corresponding to each of the outputs 34 are tied to corresponding identifying numbers corresponding to each of the first ports 28. In certain embodiments, the identifying elements 34A and the identifying elements 28A are scanned separately. In other embodiments, the
30 identifying elements 34A and the identifying elements 28A are required to be scanned together or can be scanned together to reduce the likelihood of error in the scanning process. In a similar way, the technician can scan each of the identifying elements 42A and each of the identifying elements 30A to record a record of exactly which connectors 42 are inserted into which second ports 30. In this way,

identification numbers corresponded to each of the connectors 42 are linked to corresponding identification numbers corresponding to each of the second ports 30 so that an accurate as-built data base can be generated. Similarly, information linking specific storage ports 64 to specific outputs 34 can be scanned and saved.

5 In certain embodiments, the scanner/RFID reader can be a separate piece of equipment. In other embodiments, the scanner/RFID reader can be incorporated into a cellular phone or tablet, or can be an add-on to a cellular phone or tablet. Other information that can be recorded includes: the name of the technician conducting the installation; technician training records; and the time at which each operation
10 was conducted.

Example information that can be included in the identification elements (e.g., RFID tags) which would be available to the customer/technician upon accessing the information on the identification element include:

Information List No. 1

- 15 • Test results (IL, RL, geometry, etc.)
- User manuals and videos
- Re-order information
- Ancillary products
- Product pricing and availability
- 20 • Warranty information
- Product recall notices
- Extended warranty offers
- LSL information
- Installation date and technician

25

Scanning the identification elements can generate the following information:

Information List No. 2

- Installation rates - actual consumption
- End user information
- 30 • Installation locations - GPS coordinates
- Actual installer name and training records
- Verify improper use of LSL items
- Frequency of use/visit

- Automated record keeping

At least some of the information outlined above can be used for implementing product warranties. For example, warranties could be started by the product seller when the product is actually installed in the field. The information
5 derived from the scanning operation can be used to confirm that all product was be installed by a certified installer and suitably scanned upon installation. Violation of this could void the warranty. An application (e.g., a Smartphone application) can be developed that verifies training records of installer, records installation location;
10 determines installation rate used an input to demand prediction, as a locator for any warranty concerns; and to bring extended warranty information to customers as records indicate warranty runs out. Registered users can become part of a seller database of customer contacts – allows follow-up on ease of use.

The above-description includes an example implementation of component
15 identification elements included in a fiber distribution hub (FDH) 20. Various other telecommunications equipment and cable management systems and networks are anticipated for use with one or more component identification elements. For example, the identifying elements can be utilized in a data center including an identifying element associated with each patch panel. Identifying elements can be
20 associated with each port of the patch panel and each patch cord connected to the patch panel if desired. Fiber or copper cables can be used in the data center. One example copper patch panel is disclosed in United States Patent No. 6,504,726 which is hereby incorporated by reference in its entirety.

With reference to Figure 2, one specific implementation of an identifying
25 element, which is useful in a data center, on a fiber distribution hub, or in other telecommunications systems and networks, is a 2d bar code in the form of a QR code. The QR code can be scanned at step 202 by a handheld device (e.g., cell phone) by the technician, which can then direct the technician to a company's website at step 204. The company's website can be the product manufacturer's
30 website or the user's website. The QR code can also link to one or more of the items in the Information List No. 1 above. The QR code could also be coded to include one or more of the items in the Information List No. 1 above.

The QR code can also direct the technician to download an application for use with the handheld device in managing the telecommunications equipment at step 206. At the same time the technician downloads the application, the technician can also request or enter a company identification code and/or user specific
5 identification code at step 208. These steps are illustrated in Figure 2.

Referring now to Figure 3, once the handheld device includes the application, the QR code 100 of the network device (e.g., patch panel) can be scanned and the technician can enter the company ID, and the password if necessary, at step 302, to begin implementation of the application. If the handheld device is
10 already linked to the user, the user can begin the application to manage the network device at step 304.

The QR code gives the technician a tool to maintain connection information for their network connections in a data center, such as the network connections between patch panels 120, of the type shown in Figure 4. Instead of scanning all of
15 the connections, the technician can enter them manually into the handheld device to document the network connections.

Each patch panel 120 will be labeled with a unique QR code 100. In one preferred embodiment, the QR code will contain a URL and a unique ID. The URL will bring the technician to a website where the technician can see installation
20 instructions or other information about the network. The application will give the technician the possibility to maintain the port 122 connections for all the patch panels 120 adjacent to the scanned panel 120.

The first time that the technician starts the application, the application preferably requests a company identification and a password at step 302 of Figure 3.
25 Once the handheld device is linked to the website, the technician will be able to identify the panel at step 304. In one implementation, the panel information can include information such as: 1) a room number, 2) a row number, 3) a rack number, and 4) a panel number as shown in steps 306 and 308. Together with the unique ID, and the QR code of the panel, this information will be stored locally on the handheld
30 device. This information can be uploaded to the network or main storage device.

At a later date, when the technician reads the QR code on the patch panel 120, the technician will see the port information on the handheld device. The port information can be updated if the technician makes a change in the connections

between the ports 122 at step 310. Scanning the QR code and/or updating the information can update the items in the Information List No. 2 above.

In one application, the technician can view existing connections between ports 122 to make a manual check and verification of the connections.

5 The technician can also synchronize the handheld device with other handheld devices and also to the home network database so that the full network information is current.

A further application of the component identification and tracking system for telecommunication networks includes situations where internet and/or cell service is
10 unavailable. The technician can utilize the QR code to access information stored on a handheld device. If the technician then makes changes to the network connections, the information can be entered on the handheld device and later synchronized with the main network or other handheld devices for updating the main database.

A still further application of the present invention includes situations where
15 the QR code includes the actual connection data of the network connections. Such information might be useful when there is no internet or cell coverage where the technician is accessing the network. If the technician reads the QR code and reads the network connections, the technician is able to see a current status of the network connections. If a change is made by the technician, the technician can enter the
20 change on the handheld device, and print out a new QR code on a portable printer. The new QR code is left on the network device, and the previous code is removed or covered up since it is now out-of-date. In this manner, a technician can access network information merely by reading the QR code, and updating the QR code to reflect changes.

25 Within the present invention, various passive identification elements can be utilized including the noted barcodes and the radio frequency identification (RFID) tags. Barcodes can be one dimensional or two dimensional. More information is capable of being stored on the two dimensional bar codes, such as the noted QR codes. The information can be transferred to other network devices for network
30 management, especially for larger networks where multiple technicians may be managing the network connections.

Parts List

20	fiber distribution hub
22	outer housing
22A	identifying element
24	termination field/panel
24A	identifying element
24	splitter module
26	fiber optic adapters
28	first ports
28A	identifying element
30	second ports
30A	identifying elements
32	splitter module
32A	identifying element
34	outputs
34A	identifying element
35	connectors
36	input
36A	identifying element
40	optical fibers
42	connectors
42A	identifying element
48	splicing region
49	splice region
60	connector storage location
62	parking modules
62A	module identifiers
64	ports/receptacles
64A	individual identifying elements
100	identifying element
110	data center
120	patch panel
122	port

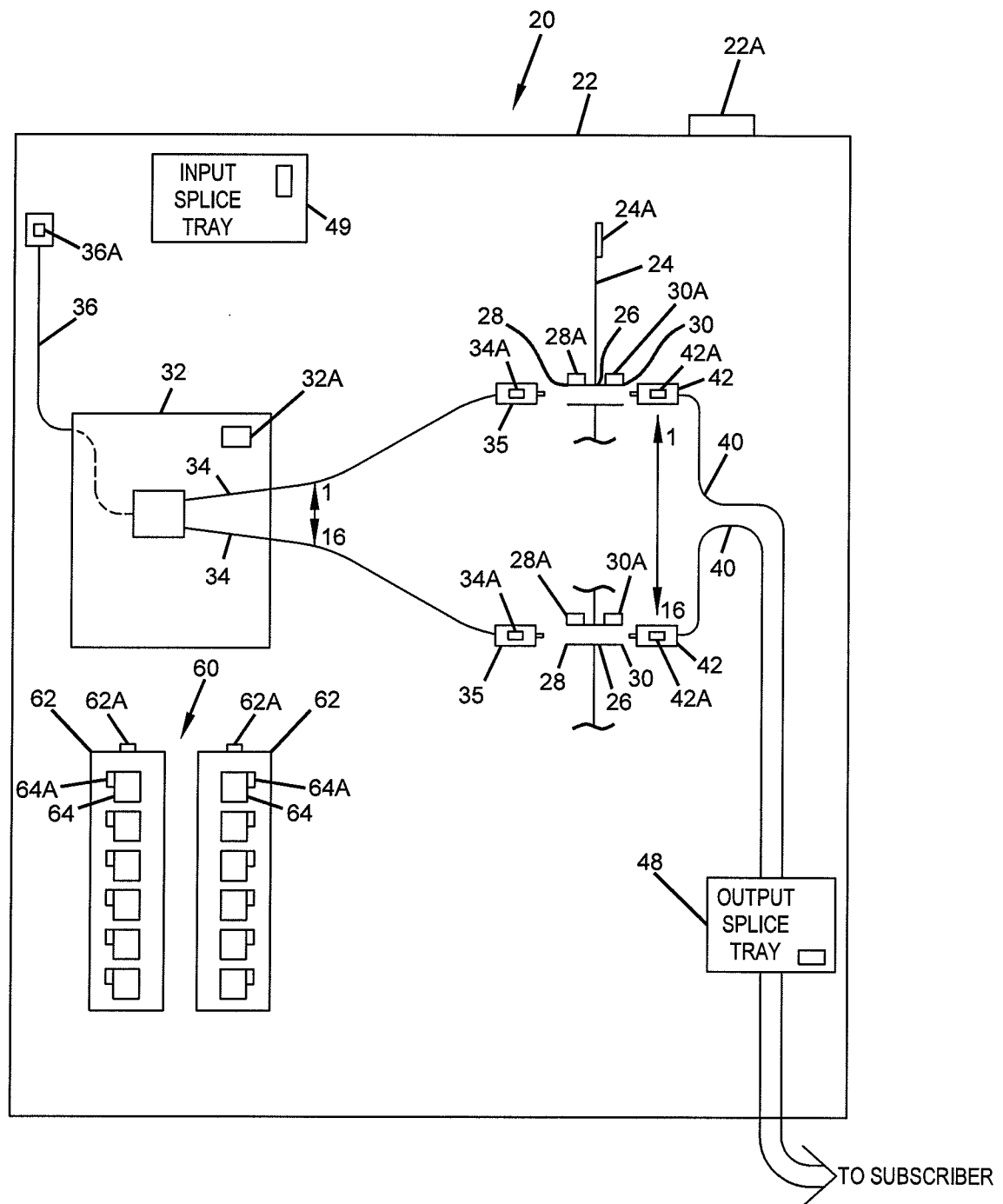
200	handheld device
202-208	initiation steps
302-310	usage steps

CLAIMS:

1. A communications system comprising:
a communications component;
an identifying element on the communications component;
wherein the identifying element includes at least one of: information about connectivity of the communications component, information about the communications component, a link to a website, or a link to an application for downloading to a mobile device for managing the information about connectivity of the communications component.
2. The communications system of claim 1, wherein the identifying element is an RFID tag.
3. The communications system of claim 1, wherein the identifying element is a bar code.
4. The communications system of claim 3, wherein the bar code is a two dimensional barcode.
5. The communications system of claim 4, wherein the two dimensional barcode is a QR code.
6. A method of using a communications system comprising:
providing a communications component;
providing an identifying element on the communications component;
wherein the identifying element includes at least one of: information about connectivity of the communications component, information about the communications component, a link to a website, or a link to an application for downloading to a mobile device for managing the information about connectivity of the communications component;
scanning the identifying element.
7. The method of claim 6, wherein the identifying element is an RFID tag.

8. The method of claim 6, wherein the identifying element is a bar code.
9. The method of claim 8, wherein the bar code is a two dimensional barcode.
10. The method of claim 9, wherein the two dimensional barcode is a QR code.
11. The method of claim 10, wherein scanning the identifying element results in downloading of an application to a mobile device for managing the information about connectivity of the communications component.

FIG. 1



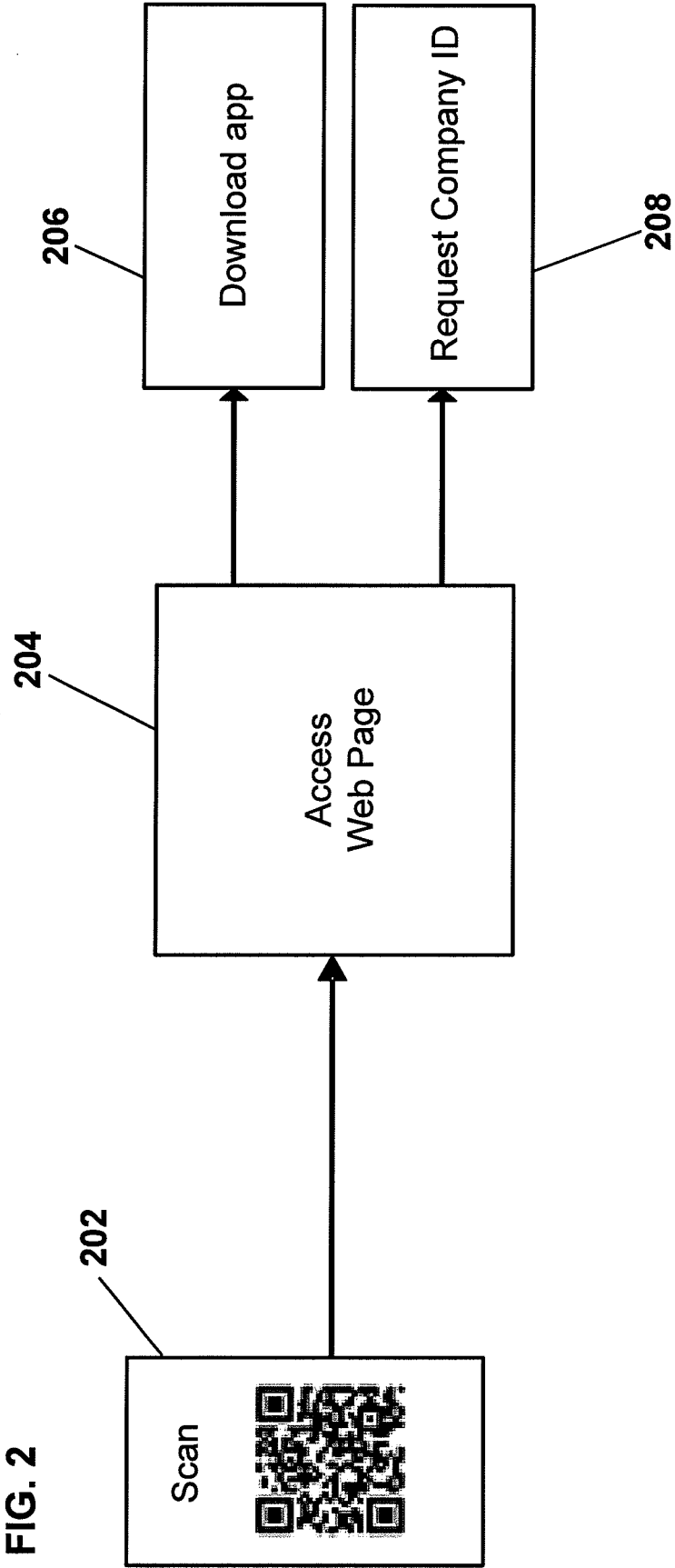


FIG. 3

