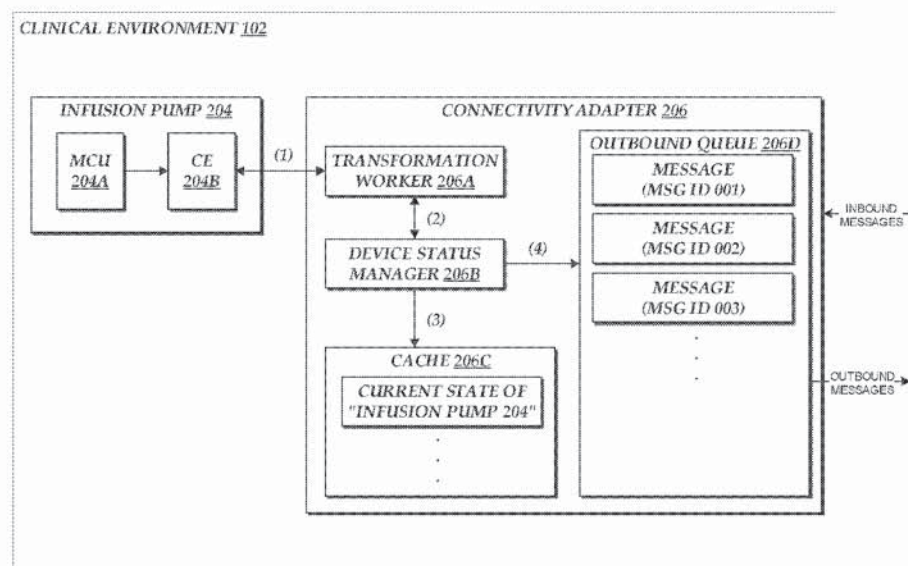




- (51) **International Patent Classification:**
G06F 3/12 (2006.01) *H04L 12/741* (2013.01)
- (21) **International Application Number:**
PCT/US2019/041706
- (22) **International Filing Date:**
12 July 2019 (12.07.2019)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
62/699,499 17 July 2018 (17.07.2018) US
- (71) **Applicant:** **ICU MEDICAL, INC.** [US/US]; 951 Calle Amanecer, San Clemente, California 92673 (US).
- (72) **Inventors:** **XAVIER, Ben**; 951 Calle Amanecer, San Clemente, California 92673 (US). **KRABBE, Dennis**; 951 Calle Amanecer, San Clemente, California 92673 (US). **ENGER, Larry**; 951 Calle Amanecer, San Clemente, California 92673 (US). **DEOSTHALE, Chaitanya**; 951 Calle Amanecer, San Clemente, California 92673 (US).
- ISENSEE, Anthony**; 951 Calle Amanecer, San Clemente, California 92673 (US). **PATIAG, Lito**; 951 Calle Amanecer, San Clemente, California 92673 (US).
- (74) **Agent:** **ALTMAN, Daniel, E.**; Knobbe, Martens, Olson & Bear, LLP, 2040 Main Street, 14th Floor, Irvine, California 92614 (US).
- (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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,

(54) **Title:** SYSTEMS AND METHODS FOR FACILITATING CLINICAL MESSAGING IN A NETWORK ENVIRONMENT**FIG. 3**

(57) **Abstract:** Various techniques for facilitating communication with and across a clinical environment and a cloud environment are described. These techniques may include converting pump messages into standardized dataset messages, merging the messages into a cache, transmitting the messages to a cloud server, detecting network outages, clearing an outbound queue, detecting missing messages, authenticating a connectivity adapter for cloud access, providing a segmented data structure, among others.



UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

- *with international search report (Art. 21(3))*



Australian Government

IP Australia

Thank you. Your submission was successful. The official receipt for this transaction is available to be viewed for up to 6 months within your eServices History.

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Note: Amounts shown include GST where applicable. Under Division 81 of *A New TAX System (Goods and Services Tax) ACT 1999*, GST is not payable on the purchase of any statutory items from IP Australia.

IP Australia batch reference	SPBI-0002223766
Submitted by	connienuckels
Customer number	BCT3547982362
Your cart reference	ICUH.222WO
Date/Time submitted	16/05/2020 10:07 AM
Bank reference	385729184
Payment Identifier	0000000001417253
Amount paid (AU)	\$944.00
Card type	Mastercard
Card holder's name	Brent Sandberg
Card expiry	11/20
Card number	552832XXXXXX2549

List of Service Requests

IP RIGHT NUMBER	APPLICANT NAME	SERVICE REQUEST TYPE	YOUR REFERENCE	PHYSICAL MEDIA	FEE	ACTION
PCT/AU2019/041706		File a Demand for International Preliminary Examination		No	\$944.00	View

Total Fee (AU): **\$944.00**



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IP Australia

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Note: Amounts shown include GST where applicable. Under Division 81 of *A New TAX System (Goods and Services Tax) ACT 1999*, GST is not payable on the purchase of any statutory items from IP Australia.

Service Request type File a Demand for International Preliminary Examination
Application number PCT/AU2019/041706
IP Australia batch reference SPBI-0002223766
Submitted by Mrs Connie F. Nuckels
Customer number BCT3547982362
Your reference ICUH.222WO
Date/time submitted 16/05/2020 10:07 AM
Amount paid (AU) \$944.00
Physical media No

Service Requests

SERVICE REQUEST TYPE	PHYSICAL MEDIA	FEE
File a Demand for International Preliminary Examination	No	\$944.00

Total Fee (AU): **\$944.00**

Attachments

SERVICE REQUEST/APPLICATION NUMBER	TYPE	FILE NAME	SIZE
PCT/AU2019/041706	Other	2020_05_15_Demand_ICUH.222WO.pdf	208KB
PCT/AU2019/041706	Other	2020_05_15_Response_w_Demand_ICUH.222WO.pdf	175KB
PCT/AU2019/041706	Other	2020_05_15_Article_34 Amendments_w_Demand_ICUH.222WO.pdf	126KB
PCT/AU2019/041706	Other	ICUH POA.pdf	597KB

The attachments above have been submitted with this application.

IPEA/ AU

CHAPTER II

For International Preliminary Examining Authority use only

Form PCT/IPEA/401 (first sheet) (July 2019)

See Notes to the demand form

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative
 and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.
☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)*

Daniel E. Altman
 Knobbe Martens
 2040 Main Street
 14th Floor
 Irvine, CA 92614
 US

Telephone No.

949 760-0404

Facsimile No.

949 760-9502

Agent's registration No. with the Office

34,115

E-mail authorization: Marking one of the check-boxes below authorizes the International Bureau and the International Preliminary Examining Authority to use the e-mail address indicated in this Box to send notifications issued in respect of this international application if those offices are willing to do so.

☐ as advance copies followed by paper notifications; or ☒ exclusively in electronic form (no paper notifications will be sent).
 E-mail address: instructions@knobbe.com

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION**Statement concerning amendments:***

1. The applicant wishes the international preliminary examination **to start on the basis of:**

the description ☒ as originally filed, or

☐ as amended under Article 34

the sequence listing (if any) ☐ as originally filed, or

☐ as amended under Article 34:

☐ in the form of an Annex C/ST.25 text file

☐ on paper or in the form of an image file

the claims ☐ as originally filed, or

☐ as amended under Article 19, and/or

☒ as amended under Article 34

the drawings (if any) ☒ as originally filed, or

☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ Where the IPEA wishes to start the international preliminary examination at the same time as the international search in accordance with Rule 69.1(b), the applicant requests the IPEA **to postpone** the start of the international preliminary examination until the expiration of the applicable time limit under Rule 69.1(d).

4. ☐ The applicant expressly requests **to postpone** the start of the international preliminary examination until the expiration of the applicable time limit under Rule 54bis.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | | |
|---|---|----|--------|
| 1. translation of international application | : | | sheets |
| 2. amendments under Article 34 | : | 30 | sheets |
| 3. letter accompanying the amendments under Article 34 (Rule 66.8) | : | 36 | sheets |
| 4. copy (or, where required, translation) of amendments under Article 19 | : | | sheets |
| 5. copy of the letter accompanying the amendments under Article 19 (Rules 46.5(b) and 53.9) | : | | sheets |
| 6. copy (or, where applicable, translation) of any statement under Article 19 (Rule 62.1(ii)) | : | | sheets |
| 7. other (<i>specify</i>) | : | | sheets |

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received	not received
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☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

The demand is also accompanied by the item(s) marked below:

- | | |
|--|--|
| 1. ☒ fee calculation sheet | 5. ☐ sequence listing in the form of an Annex C/ST.25 text file |
| 2. ☐ original separate power of attorney | 6. ☐ other (<i>specify</i>): _____ |
| 3. ☐ original general power of attorney | _____ |
| 4. ☐ copy of general power of attorney; reference number, if any: | _____ |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

/Daniel Altman Reg No 34115/

Daniel E. Altman
Reg. No. 34,115
Agent of Record

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rules 82 or 82quater.

6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply.

7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.

8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rules 82 or 82quater.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/US2019/041706	For International Preliminary Examining Authority use only																
Applicant's or agent's file reference ICUH.222WO	Date stamp of the IPEA																
Applicant ICU Medical, Inc.																	
CALCULATION OF PRESCRIBED FEES <i>(Applicants may be entitled to a reduction of the preliminary examination fee and the handling fee as indicated in the PCT Fee Tables (www.wipo.int/pct/en/fees.pdf))</i> <table style="width: 100%;"> <tr> <td style="width: 60%;">1. PRELIMINARY EXAMINATION FEE</td> <td style="width: 10%; text-align: center;">AUD</td> <td style="width: 15%; text-align: right;">590</td> <td style="width: 15%; text-align: center;">P</td> </tr> <tr> <td>2. HANDLING FEE</td> <td style="text-align: center;">AUD</td> <td style="text-align: right;">354</td> <td style="text-align: center;">H</td> </tr> <tr> <td>3. TOTAL OF PRESCRIBED FEES Add the amounts entered at P and H and enter total in the TOTAL box</td> <td style="text-align: center;">AUD</td> <td style="text-align: right;">944</td> <td></td> </tr> <tr> <td></td> <td colspan="3" style="text-align: center;">TOTAL</td> </tr> </table>		1. PRELIMINARY EXAMINATION FEE	AUD	590	P	2. HANDLING FEE	AUD	354	H	3. TOTAL OF PRESCRIBED FEES Add the amounts entered at P and H and enter total in the TOTAL box	AUD	944			TOTAL		
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2. HANDLING FEE	AUD	354	H														
3. TOTAL OF PRESCRIBED FEES Add the amounts entered at P and H and enter total in the TOTAL box	AUD	944															
	TOTAL																
MODE OF PAYMENT <i>(Not all modes of payment may be available at all IPEAs)</i> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> ☒ credit card <i>(details should not be included on this sheet)</i> ☐ authorization to charge deposit or current account with the IPEA (see below) ☐ bank transfer ☐ cash </td> <td style="width: 50%; vertical-align: top;"> ☐ postal money order ☐ check ☐ revenue stamps ☐ other <i>(specify)</i>: _____ </td> </tr> </table>		☒ credit card <i>(details should not be included on this sheet)</i> ☐ authorization to charge deposit or current account with the IPEA (see below) ☐ bank transfer ☐ cash	☐ postal money order ☐ check ☐ revenue stamps ☐ other <i>(specify)</i> : _____														
☒ credit card <i>(details should not be included on this sheet)</i> ☐ authorization to charge deposit or current account with the IPEA (see below) ☐ bank transfer ☐ cash	☐ postal money order ☐ check ☐ revenue stamps ☐ other <i>(specify)</i> : _____																
AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT OR CURRENT ACCOUNT <i>(This mode of payment may not be available at all IPEAs)</i> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> ☒ Authorization to charge the total fees indicated above. ☐ <i>(This check-box may be marked only if the conditions for deposit or current accounts of the IPEA so permit)</i> Authorization to charge any deficiency or credit any overpayment in the total fees indicated above. </td> <td style="width: 50%; vertical-align: top;"> IPEA/ <u>AU</u> Deposit or Current Account No.: <u>n/a</u> Date: <u>15 May 2020</u> Name: <u>ALTMAN, Daniel E. / 34,115</u> Signature: <u>/Daniel Altman/</u> </td> </tr> </table>		☒ Authorization to charge the total fees indicated above. ☐ <i>(This check-box may be marked only if the conditions for deposit or current accounts of the IPEA so permit)</i> Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.	IPEA/ <u>AU</u> Deposit or Current Account No.: <u>n/a</u> Date: <u>15 May 2020</u> Name: <u>ALTMAN, Daniel E. / 34,115</u> Signature: <u>/Daniel Altman/</u>														
☒ Authorization to charge the total fees indicated above. ☐ <i>(This check-box may be marked only if the conditions for deposit or current accounts of the IPEA so permit)</i> Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.	IPEA/ <u>AU</u> Deposit or Current Account No.: <u>n/a</u> Date: <u>15 May 2020</u> Name: <u>ALTMAN, Daniel E. / 34,115</u> Signature: <u>/Daniel Altman/</u>																

15 May 2020

Attention: Authorized Officer Dr. Yogeshwar Ranga

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606,
AUSTRALIA

Re: **RESPONSE TO WRITTEN OPINION WITH DEMAND FOR PRELIMINARY EXAMINATION**

Title: SYSTEMS AND METHODS FOR FACILITATING CLINICAL
MESSAGING IN A NETWORK ENVIRONMENT

Int'l Application No.: PCT/US2019/041706

Int'l Filing Date: 12 July 2019

Applicant: ICU MEDICAL, INC.

Our Ref. No.: ICUH.222WO

Dear Officer Ranga:

This communication is in response to the Written Opinion, mailed 05 November 2019, for the international application identified above.

The Written Opinion alleges that Claims 1-74 lack an inventive step in view of the following references:

D1: US 2005/0102167 A1 (KAPOOR)

D2: US 2014/0254598 A1 (PRAKASH KUMAR ARVIND JHA et. al)

With this response, Applicant submits a demand for preliminary examination, and provides an amended claim set in replacement pages 61-90, in place of original pages 61-91 of the international application. Additionally, for the Authority's convenience, Applicant has attached hereto a marked-up copy of the amended claim set showing the changes as compared to the originally-filed claims as **Appendix A**. Deletions are shown in strikethrough (example of deletion) or with brackets ([[deletion]]) and additions are shown in underline (example of addition).

1. Discussion of Novelty (Box No. V)

The Written Opinion states that Claims 1-74 are novel and therefore comply with PCT Article 33(2).

2. Discussion of Inventive Step (Box No. V)

Independent Claims 1, 11, and 21

The Written Opinion alleges that independent Claims 1, 11, and 21 lack an inventive step in view of D1 and D2. Applicant respectfully disagrees. However, without agreeing with these allegations and to expedite prosecution of this application, Applicant has amended these claims to include further distinguishing features. For example, the cited art fails to disclose or suggest at least the following features recited in amended Claim 1 (emphasis added):

wherein the connectivity adapter is configured to:

receive a first pump message from a first infusion pump of the plurality of infusion pumps over the first network, the first pump message including information that is new to the connectivity adapter;

generate a first standardized dataset message based on the information in the first pump message;

store the first standardized dataset message in an outbound queue for transmission **to the remote server** over the second **network different from the first network**;

subsequent to storing the first standardized dataset message in the outbound queue, receive a second pump message from the first infusion pump over the first network, the second pump message including additional information that is new to the connectivity adapter;

generate a second standardized dataset message based on the additional information in the second pump message;

store the second standardized dataset message in the outbound queue for transmission **to the remote server** over the second **network different from the first network**;

remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message **to the remote server** over the second **network different from the first network over which the first pump message was received**; and

transmit the second standardized dataset message in the outbound queue **to the remote server** over the second **network different from the first network over which the second pump message was received**.

Page 4 of the Written Opinion acknowledges that D1 fails to disclose these features. However, the Written Opinion contends that D2 teaches these features. More specifically, the Written Opinion states that paragraphs [0102]-[0105] and FIG. 8 of D2 teach most of the features reproduced above.

FIG. 8 of D2 illustrates a layer flow diagram that shows the flow of data within the various layers. However, D2 says nothing to suggest that the illustrated layers cause any messages in an outbound queue to be **transmitted to a remote server over a network**, while causing one or more other messages to be **removed from the same outbound queue**.

Indeed, D2 is silent as to any remote server, much less transmitting any messages to such a remote server “over the second network different from the first network over which the second pump message was received,” as recited in amended Claim 1.

Additionally, the pending claims are directed to a technical problem that does not seem to be appreciated or addressed by D1 or D2. In the event of a network outage or interruption, messages in an outbound queue configured to send messages to a remote server may not be able to be sent to the remote server. If the network outage or interruption continues, the messages stored in the outbound queue may become stale or overload the network, as described in paragraphs [0045] and [0046] of the present application. To address this issue, the system may begin removing at least some of the messages stored in the outbound queue. For example, in Claim 1, the first standardized dataset message is **removed from the outbound queue without being transmitted** to the remote server, while the second standardized dataset message is **indeed transmitted to the remote server**.

Further, neither D1 nor D2 appreciates the concept of receiving and transmitting **two different types of messages over two different networks**, where pump messages are received over one network, and the standardized dataset messages are transmitted to the remote server over another network.

If the Examiner wishes to maintain the inventive step rejections, Applicant would appreciate it if the Examiner **specifically pointed out** which elements of D2 are being equated to the first standardized dataset message, second standardized dataset message, remote server, first network, and second network, respectively.

For at least these reasons, D1 and D2 fail to disclose or suggest, alone or in combination, every feature recited in Claims 1, 11, and 21, and Claims 1, 11, and 21 are novel and inventive over the cited art.

Independent Claims 35, 42, 50, 55, 61, and 68

The Written Opinion alleges that independent Claims 35, 42, 50, 55, 61, and 68 lack an inventive step in view of D2 and D1. Applicant respectfully disagrees. However, without agreeing with these allegations and to expedite prosecution of this application, Applicant has amended these claims to include further distinguishing features. For example, the cited art fails to disclose or suggest at least the following features recited in amended Claim 35 (emphasis added):

- storing a plurality of messages in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

- transmitting at least some of the plurality of messages, **over a network, to a remote server** configured to receive messages generated in the clinical environment; subsequent to the transmission, detecting a network outage, wherein the network outage prevents transmission of messages to the remote server;

- determining, **during the detected network outage that prevents transmission of messages to the remote server**, that the first message in the

message queue satisfies a **condition for being removed** from the message queue without being successfully transmitted to the remote server;

removing the first message from the message queue such that the first message is removed from the message queue prior to being received by the remote server;

determining that the network outage has been resolved; and

transmitting the second message to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

Page 6 of the Written Opinion acknowledges that D2 fails to disclose detecting a network outage, determining that such a network outage has been resolved, or transmitting the second message to the remote server. However, the Written Opinion contends that D1 teaches these features. More specifically, the Written Opinion states that paragraphs [0100]-[0103] and FIG. 8 of D1 teach these features.

In the referenced section, D1 provides that in the event that the server is not available for a period beyond a certain limit as described above, or upon receiving a user prompt (step 850), TCC takes over the role of a server and forms a BSS (basic server set) with the bedside WTUs while the patient is being moved. Further, D1 provides that the TCC keeps storing all the data in the storage unit associated with it (step 854), and that TCC connects to the network and allows the care provider to access the stored data after authentication (step 862).

However, D1 is silent as to removing any messages. To the contrary, D1 provides that “[t]he WTUs transmit all the data to the server when the network becomes available,” and that “[t]he TCC keeps storing all the data in the storage unit associated with it.”

Further, D1 also fails to disclose or suggest determining, during a detected network outage, whether a message satisfies a condition for being removed.

Additionally, the pending claims are directed to a technical problem that does not seem to be appreciated or addressed by D1 or D2. In the event of a network outage or interruption, messages in an outbound queue configured to send messages to a remote server may not be able to be sent to the remote server. If the network outage or interruption continues, the messages stored in the outbound queue may become stale or overload the network, as described in paragraphs [0045] and [0046] of the present application. To address this issue, the system may begin removing at least some of the messages stored in the outbound queue. For example, in Claim 35, the first message is **removed from the message queue without being transmitted** to the remote server, while the second message is **indeed transmitted to the remote server**.

If the Examiner wishes to maintain the inventive step rejections, Applicant would appreciate it if the Examiner **specifically pointed out** which elements of D1 are being equated to the first message that is removed and the second message that is transmitted, respectively.

For at least these reasons, D1 and D2 fail to disclose or suggest, alone or in combination, every feature recited in Claims 35, 42, 50, 55, 61, and 68, and Claims 35, 42, 50, 55, 61, and 68 are novel and inventive over the cited art.

Dependent Claims

Each of the dependent claims incorporates by reference the limitations of the claim to which it refers, the dependent claims are deemed novel and inventive for at least the same reasons described above.

Conclusion

For the reasons indicated above, the pending claims are novel and provide an inventive step over the cited art. Applicant respectfully urges reconsideration of the previous determination accordingly. If any questions remain, the Examiner is invited to contact the undersigned attorney at the number provided below.

Respectfully submitted,

/Chang Lim/

Chang Lim
Attorney of Record
Tel.: +1.949.721.5391

cc: Andrew Kimmel

Appendix A – Copy of Marked-Up Claims

1. A system configured to facilitate messaging during a network outage, the system comprising:

a plurality of infusion pumps configured to deliver medication to patients, each infusion pump of the plurality of infusion pumps comprising a memory configured to store operational software and a processor configured to generate pump messages;

a connectivity adapter comprising computer hardware and in communication with the plurality of infusion pumps over a first network; and

a remote server comprising computer hardware and in communication with the connectivity adapter over a second network different from the first network,

wherein the connectivity adapter is configured to:

receive a first pump message from a first infusion pump of the plurality of infusion pumps over the first network, the first pump message including information that is new to the connectivity adapter;

generate a first standardized dataset message based on the information in the first pump message;

store the first standardized dataset message in an outbound queue for transmission to the remote server over the second network different from the first network;

subsequent to storing the first standardized dataset message in the outbound queue, receive a second pump message from the first infusion pump over the first network, the second pump message including additional information that is new to the connectivity adapter;

generate a second standardized dataset message based on the additional information in the second pump message;

store the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

transmit the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

2. The system of claim 1, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

3. The system of claim 1, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

4. The system of claim 1, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

5. The system of claim 4, wherein the second parameter is associated with one of a null value or a default value.

6. The system of claim 1, wherein the connectivity adapter is further configured to store the information in the first pump message in a cache.

7. The system of claim 6, wherein the connectivity adapter is further configured to receive a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refrain from storing the information in the third pump message in the cache.

8. The system of claim 1, wherein the connectivity adapter is further configured to update a parameter stored in a cache based on the information in the first pump message.

9. The system of claim 1, wherein the connectivity adapter is further configured to, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receive a request for the first pump message from the remote server.

10. The system of claim 9, wherein the connectivity adapter is further configured to, in response to the request for the first pump message, transmit a request for the first pump message to the first infusion pump.

11. A method of facilitating messaging during a network outage, the method comprising:

- receiving a first pump message from a first infusion pump over a first network;
- generating a first standardized dataset message based on the information in the first pump message;

- storing the first standardized dataset message in an outbound queue for transmission to a remote server over a second network different from the first network;

- subsequent to storing the first standardized dataset message in the outbound queue, receiving a second pump message from the first infusion pump over the first network;

- generating a second standardized dataset message based on the additional information in the second pump message;

- storing the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

- removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

- transmitting the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

12. The method of claim 11, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

13. The method of claim 11, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

14. The method of claim 11, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

15. The method of claim 14, wherein the second parameter is associated with one of a null value or a default value.

16. The method of claim 11, further comprising storing the information in the first pump message in a cache.

17. The method of claim 16, further comprising receiving a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refraining from storing the information in the third pump message in the cache.

18. The method of claim 11, further comprising updating a parameter stored in a cache based on the information in the first pump message.

19. The method of claim 11, further comprising, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receiving a request for the first pump message from the remote server.

20. The method of claim 19, further comprising, in response to the request for the first pump message, transmitting a request for the first pump message to the first infusion pump.

21. A system configured to facilitate messaging during a network outage, the system comprising:

a plurality of infusion pumps configured to deliver medication to patients, each infusion pump of the plurality of infusion pumps comprising a memory configured to store operational software and a processor configured to generate pump messages;

a connectivity adapter comprising computer hardware and in communication with the plurality of infusion pumps over a first network; and

a remote server comprising computer hardware and in communication with the connectivity adapter over a second network different from the first network,

wherein the connectivity adapter is configured to:

receive a first pump message from a first infusion pump of the plurality of infusion pumps over the first network, the first pump message including information that is new to the connectivity adapter;

generate a first standardized dataset message based on the information in the first pump message;

store the first standardized dataset message in an outbound queue for transmission to the remote server over the second network different from the first network;

subsequent to storing the first standardized dataset message in the outbound queue, receive a second pump message from the first infusion pump, the second pump message including additional information that is new to the connectivity adapter;

generate a second standardized dataset message based on the additional information in the second pump message;

store the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

determine whether a removal condition for removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server is satisfied; ~~and~~

subsequent to determining whether the removal condition is satisfied, ~~removing~~ remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

subsequent to removing the first standardized dataset message, transmit the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

22. The system of claim 21, wherein the connectivity adapter is further configured to, subsequent to determining that the removal condition is satisfied, remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server.

23. The system of claim 21, wherein the connectivity adapter is further configured to, subsequent to determining that the removal condition is not satisfied, remove the first standardized dataset message from the outbound queue and transmit the first standardized dataset message to the remote server.

24. The system of claim 22 or 23, wherein determining whether the removal condition is satisfied comprises determining whether the first standardized dataset message has been in the outbound queue for a time period greater than a threshold time period.

25. The system of claim 22 or 23, wherein determining whether the removal condition is satisfied comprises determining whether the outbound queue includes a number of messages that is greater than a threshold number of messages.

26. The system of claim 22 or 23, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

27. The system of claim 22 or 23, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

28. The system of claim 22 or 23, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

29. The system of claim 28, wherein the second parameter is associated with one of a null value or a default value.

30. The system of claim 22 or 23, wherein the connectivity adapter is further configured to store the information in the first pump message in a cache.

31. The system of claim 30, wherein the connectivity adapter is further configured to receive a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refrain from storing the information in the third pump message in the cache.

32. The system of claim 22 or 23, wherein the connectivity adapter is further configured to update a parameter stored in a cache based on the information in the first pump message.

33. The system of claim 22, wherein the connectivity adapter is further configured to, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receive a request for the first pump message from the remote server.

34. The system of claim 33, wherein the connectivity adapter is further configured to, in response to the request for the first pump message, transmit a request for the first pump message to the first infusion pump.

35. A method for providing messaging in a clinical environment, the method comprising:

storing a plurality of messages in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

transmitting at least some of the plurality of messages, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, detecting a network outage, wherein the network outage prevents transmission of messages to the remote server;

determining, during the detected network outage that prevents transmission of messages to the remote server, that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

removing the first message from the message queue such that the first message is removed from the message queue prior to being received by the remote server;

determining that the network outage has been resolved; and

transmitting the second message to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

36. The method of claim 35, further comprising detecting the network outage based at least on not having received an acknowledgement from the remote server during a specific time window.

37. The method of claim 35, further comprising detecting the network outage based at least on receiving a message from the remote server that a connection to the remote server is terminated.

38. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

39. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

40. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the message queue being full.

41. The method of claim 35, further comprising attempting, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determining that the first message was not received by the remote server.

42. An apparatus configured to provide messaging in a clinical environment, the apparatus comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

- cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

- subsequent to the transmission, determine that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

- cause the first message to be removed from the message queue such that the first message is removed from the message queue prior to being received by the remote server; and

- cause the second message to be transmitted to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

43. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect a network outage that prevents transmission of messages to the remote server.

44. The apparatus of claim 43, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the network outage based at least on not having received an acknowledgement from the remote server during a specific time window.

45. The apparatus of claim 43, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the network outage based at least on receiving a message from the remote server that a connection to the remote server is terminated.

46. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

47. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

48. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message satisfies the condition based at least on the message queue being full.

49. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to attempt, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

50. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, determine that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

cause the first message to be removed from the message queue such that the first message is removed from the message queue prior to being received by the remote server; and

cause the second message to be transmitted to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

51. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect a network outage that prevents transmission of messages to the remote server.

52. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

53. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

54. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to attempt, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

55. A method for providing messaging in a clinical environment, the method comprising:

storing a plurality of messages in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

transmitting at least some of the plurality of messages, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, detecting a temporary interruption in a network connection to the remote server, wherein the temporary interruption prevents transmission of messages to the remote server;

determining, during the detected temporary interruption in the network connection to the remote server, that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server;

determining that the temporary interruption has been resolved; and

transmitting the first message to the remote server such that the first message is received by the remote server.

56. The method of claim 55, further comprising detecting the temporary interruption based at least on not having received an acknowledgement from the remote server during a specific time window.

57. The method of claim 55, further comprising detecting the temporary interruption based at least on receiving a message from the remote server that a connection to the remote server is terminated.

58. The method of claim 55, further comprising determining that the first message does not satisfy the condition based at least on the first message being associated with an infusion pump event that is not older than a threshold amount of time.

59. The method of claim 55, further comprising determining that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

60. The method of claim 55, further comprising attempting, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determining that the first message was not received by the remote server.

61. An apparatus configured to provide messaging in a clinical environment, the apparatus comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, determine that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server; and

cause the first message to be transmitted to the remote server such that the first message is received by the remote server.

62. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect an interruption in a network connection between the apparatus and the remote server that prevents transmission of messages from the apparatus to the remote server.

63. The apparatus of claim 62, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the interruption based at least on not having received an acknowledgement from the remote server during a specific time window.

64. The apparatus of claim 62, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the interruption based at least on receiving a message from the remote server that the network connection between the apparatus and the remote server is terminated.

65. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message does not satisfy the condition based at least on the first

message being associated with an infusion pump event that is not older than a threshold amount of time.

66. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

67. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to attempt, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

68. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, determine that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server; and

cause the first message to be transmitted to the remote server such that the first message is received by the remote server.

69. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect an interruption in a network connection to the remote server that prevents transmission of messages to the remote server.

70. The non-transitory physical computer storage of claim 69, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the interruption based at least

on not having received an acknowledgement from the remote server during a specific time window.

71. The non-transitory physical computer storage of claim 69, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the interruption based at least on receiving a message from the remote server that the network connection to the remote server is terminated.

72. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message does not satisfy the condition based at least on the first message being associated with an infusion pump event that is not older than a threshold amount of time.

73. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

74. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to attempt, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

75. A method for detecting missing messages from a clinical environment, the method comprising:

processing a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, wherein the plurality of messages includes a first message having a first message identifier value and a second message having a second message identifier value;

determining that one or more messages are missing between the first message and the second message based on (i) receiving the second message after the first message without receiving any other message therebetween and (ii) determining that

there is at least one message identifier value between the first message identifier value and the second message identifier value in a predetermined sequence; and

transmitting a message request to the network device residing in the clinical environment, wherein the message request identifies the one or more messages that should have been received from the network device but have not been received.

76. The method of claim 75, further comprising, in response to the message request, receiving one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more messages.

77. The method of claim 76, further comprising updating, based at least on the one or more additional messages received in response to the message request, a cache to include additional information about the one or more infusion pumps residing in the clinical environment.

78. The method of claim 75, further comprising causing the network device to request additional information from the one or more infusion pumps that would have been included in the one or more messages.

79. The method of claim 75, further comprising, in response to determining that the one or more messages has reached a threshold count, transmitting the message request to the network device residing in the clinical environment.

80. A system configured to detect missing messages from a clinical environment, the system comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

process a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment;

detect one or more missing messages that should have been received from the network device have not been received; and

cause a message request to be transmitted to the network device residing in the clinical environment, wherein the message request identifies the

one or more missing messages that should have been received from the network device have not been received.

81. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to receive, in response to the message request, one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more missing messages.

82. The system of claim 81, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause, based at least on the one or more additional messages received in response to the message request, a cache to be updated to include additional information about the one or more infusion pumps residing in the clinical environment.

83. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the one or more missing messages based at least on message identifier information associated with one or more of the plurality of messages.

84. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the one or more missing messages based at least on a first message in the plurality of messages having a message identifier that does not immediately follow another message identifier of a second message of the plurality of messages that immediately follows the first message.

85. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the network device to request additional information from the one or more infusion pumps that would have been included in the one or more missing messages.

86. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause, in response to determining that the one or more missing messages has reached a threshold count, the message request to be transmitted to the network device residing in the clinical environment.

87. The system of claim 80, wherein the message request includes a flag having a value indicating that the message request is a log retrieval request and not live data.

88. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

process a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment;

detect one or more missing messages that should have been received from the network device have not been received; and

cause a message request to be transmitted to the network device residing in the clinical environment, wherein the message request identifies the one or more missing messages that should have been received from the network device have not been received.

89. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to receive, in response to the message request, one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more missing messages.

90. The non-transitory physical computer storage of claim 89, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause, based at least on the one or more additional messages received in response to the message request, a cache to be updated to include additional information about the one or more infusion pumps residing in the clinical environment.

91. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the one or more missing messages based at least on message identifier information associated with one or more of the plurality of messages.

92. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the one or more missing messages based at least on a first message in the plurality of messages having a message

identifier that does not immediately follow another message identifier of a second message of the plurality of messages that immediately follows the first message.

93. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause the network device to request additional information from the one or more infusion pumps that would have been included in the one or more missing messages.

94. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause, in response to determining that the one or more missing messages has reached a threshold count, the message request to be transmitted to the network device residing in the clinical environment.

95. A method for generating a user interface based on messages from a clinical environment, the method comprising:

- processing a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

- determining that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

- updating the cache to include at least some of the information included in the message from the network device;

- receiving a request for a user interface from the computing device residing in the clinical environment;

- accessing, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and

- outputting instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

96. The method of claim 95, wherein the message includes information indicating a current state of the one or more infusion pumps.

97. The method of claim 95, wherein the cache stores information associated with two or more infusion pumps residing in different medical facilities.

98. The method of claim 95, wherein the user interface information includes user interface data previously generated and stored in the cache.

99. The method of claim 95, further comprising updating user interface data stored in the cache, and outputting the instructions based at least on the updated user interface data.

100. The method of claim 95, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

101. The method of claim 95, further comprising causing the user interface to be outputted on a display of the computing device.

102. A system configured to detect missing messages from a clinical environment, the system comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- process a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

- determine that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

- cause the cache to be updated to include at least some of information included in the message from the network device;

- process a request for a user interface from the computing device residing in the clinical environment;

access, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and
output instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

103. The system of claim 102, wherein the message includes information indicating a current state of the one or more infusion pumps.

104. The system of claim 102, wherein the cache is configured to store information associated with two or more infusion pumps residing in different medical facilities.

105. The system of claim 102, wherein the user interface information includes user interface data previously generated and stored in the cache.

106. The system of claim 102, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause user interface data stored in the cache to be updated, and output the instructions based at least on the updated user interface data.

107. The system of claim 102, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

108. The system of claim 102, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the user interface to be outputted on a display of the computing device.

109. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

process a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

determine that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

cause the cache to be updated to include at least some of information included in the message from the network device;

process a request for a user interface from the computing device residing in the clinical environment;

access, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and

output instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

110. The non-transitory physical computer storage of claim 109, wherein the message includes information indicating a current state of the one or more infusion pumps.

111. The non-transitory physical computer storage of claim 109, wherein the cache is configured to store information associated with two or more infusion pumps residing in different medical facilities.

112. The non-transitory physical computer storage of claim 109, wherein the user interface information includes user interface data previously generated and stored in the cache.

113. The non-transitory physical computer storage of claim 109, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause user interface data stored in the cache to be updated, and output the instructions based at least on the updated user interface data.

114. The non-transitory physical computer storage of claim 109, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

115. A method for converting messages having one message format from infusion pumps residing in a clinical environment into messages having another message format, the method comprising:

detecting a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining the first message format;

generating a message converter configured to convert a pump message having the first message format into a standardized dataset message having a second

message format different from the first message format and including at least some additional data or metadata not included in the pump message;

receiving a first pump message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate pump messages using the first pump protocol;

converting the first pump message into a standardized dataset message having the second message format using the message converter, wherein the standardized dataset message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first pump message; and

transmitting the standardized dataset message to a remote server configured to receive standardized dataset messages.

116. The method of claim 115, wherein the standardized dataset message includes one or more key-value pairs that are not included in the first pump message.

117. The method of claim 116, wherein the one or more key-value pairs are each set to a default value or a null value.

118. The method of claim 115, wherein the standardized dataset message includes identification data that identifies one or more portions of the standardized dataset message that include new information.

119. The method of claim 115, further comprising detecting the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers.

120. The method of claim 119, further comprising subsequent to detecting the first pump protocol, adding the protocol identifier associated with the first pump protocol to the predetermined list of protocol identifiers.

121. The method of claim 115, wherein the message converter comprises a software module that is configured to receive a pump message in the first pump protocol as input and output a standardized dataset message based on the pump message.

122. The method of claim 115, wherein the message converter is a configuration file downloaded from the remote server.

123. An apparatus configured to convert messages having one message format from infusion pumps residing in a clinical environment into messages having another message format, the apparatus comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

detect a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining a first message format;

generate a message converter configured to convert a pump message having the first message format into another message having a second message format different from the first message format and including at least some additional data or metadata not included in the pump message;

receive a first message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate messages using the first pump protocol;

cause the first message to be converted into a second message having the second message format using the message converter, wherein the second message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first message; and

cause the second message to be transmitted to a remote server configured to receive messages having the second message format.

124. The apparatus of claim 123, wherein the second message includes one or more key-value pairs that are not included in the first message.

125. The apparatus of claim 124, wherein the one or more key-value pairs are each set to a default value or a null value.

126. The apparatus of claim 123, wherein the second message includes identification data that identifies one or more portions of the second message that include new information.

127. The apparatus of claim 123, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers.

128. The apparatus of claim 123, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to, subsequent to detecting the first pump protocol, cause the protocol identifier associated with the first pump protocol to be added to the predetermined list of protocol identifiers.

129. The apparatus of claim 123, wherein the message converter comprises a software module that is configured to receive a pump message having the first message format as input and output another message having the second message format based on the pump message.

130. The apparatus of claim 123, wherein the message converter is a configuration file downloaded from the remote server.

131. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

- detect a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining a first message format;

- generate a message converter configured to convert a pump message having the first message format into another message having a second message format different from the first message format and including at least some additional data or metadata not included in the pump message;

- receive a first message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate messages using the first pump protocol;

- cause the first message to be converted into a second message having the second message format using the message converter, wherein the second message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first message; and

- cause the second message to be transmitted to a remote server configured to receive messages having the second message format.

132. The non-transitory physical computer storage of claim 131, wherein the second message includes one or more key-value pairs that are not included in the first message, the one or more key-value pairs each having a default value or a null value.

133. The non-transitory physical computer storage of claim 131, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers, and subsequent to detecting the first pump protocol, cause the

protocol identifier associated with the first pump protocol to be added to the predetermined list of protocol identifiers.

134. The non-transitory physical computer storage of claim 131, wherein the message converter comprises a software module that is downloaded from the remote server, the message converter being configured to receive a pump message having the first message format as input and output another message having the second message format based on the pump message.

135. A method for authenticating a network device residing in a clinical environment using a token, the method comprising:

- processing an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

- identifying login credentials to be used to authenticate the network device residing in the clinical environment;

- transmitting the login credentials to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

- receiving a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

- transmitting the security token to the network device residing in the clinical environment via the first network connection.

136. The method of claim 135, wherein the first network connection is a WebSocket connection.

137. The method of claim 135, wherein the first network connection is secured and authenticated.

138. The method of claim 135, further comprising causing the network device residing in the clinical environment to transmit a signed request to the authentication system.

139. The method of claim 135, wherein the first network connection and the second network connection are both established over a wide area network.

140. The method of claim 135, further comprising receiving a message from the network device residing in the clinical environment via the first network connection, wherein the messages include information associated with the one or more infusion pumps in communication with the network device.

141. The method of claim 140, wherein the network device is configured to communicate with the one or more infusion pumps over a local area network.

142. A system configured to authenticate a network device residing in a clinical environment using a token, the system comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- process an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

- identify login credentials to be used to authenticate the network device residing in the clinical environment;

- cause the login credentials to be transmitted to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

- receive a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

- cause the security token to be transmitted to the network device residing in the clinical environment via the first network connection.

143. The system of claim 142, wherein the first network connection is a WebSocket connection.

144. The system of claim 142, wherein the first network connection is secured and authenticated.

145. The system of claim 142, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the network device residing in the clinical environment to transmit a signed request to the authentication system.

146. The system of claim 142, wherein the first network connection and the second network connection are both established over a wide area network.

147. The system of claim 142, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to receive a message from the network device residing in the clinical environment via the first network connection, wherein the messages include information associated with the one or more infusion pumps in communication with the network device.

148. The system of claim 147, wherein the network device is configured to communicate with the one or more infusion pumps over a local area network.

149. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

- process an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

- identify login credentials to be used to authenticate the network device residing in the clinical environment;

- cause the login credentials to be transmitted to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

- receive a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

- cause the security token to be transmitted to the network device residing in the clinical environment via the first network connection.

150. The non-transitory physical computer storage of claim 149, wherein the first network connection is a secured and authenticated WebSocket connection.

151. The non-transitory physical computer storage of claim 149, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause the network device residing in the clinical environment to transmit a signed request to the authentication system.

152. The non-transitory physical computer storage of claim 149, wherein the first network connection and the second network connection are both established over a wide area network.

153. The non-transitory physical computer storage of claim 149, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to receive a message from the network device residing in the clinical environment via the first network connection, wherein the messages include information associated with the one or more infusion pumps in communication with the network device.

154. The non-transitory physical computer storage of claim 149, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

155. A method for tagging messages from infusion pumps residing in a clinical environment, the method comprising:

- processing a pump message including information about an infusion pump residing in the clinical environment;

- tagging the pump message with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the hierarchical structure includes one or more intermediate levels that are between the facility and the account in the hierarchical structure; and

- transmitting the tagged pump message to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response the facility being moved within the hierarchical structure.

156. The method of claim 155, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

157. The method of claim 155, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

158. The method of claim 155, further comprising determining, in a priority order, whether one or more facility detection indicators correspond to one of a plurality of facility identifiers stored in a database.

159. The method of claim 158, further comprising, in response to determining that none of the one or more facility detection indicators corresponds to any of the plurality of facility identifiers stored in the database, tagging the pump message with a default facility identifier indicating that the pump message originated from an infusion pump that is not associated with a known facility.

160. The method of claim 155, further comprising tagging the pump message with a first intermediate identifier indicative of a first intermediate level of the one or more intermediate levels such that the tagged pump message includes the facility identifier, the account identifier, and the first intermediate identifier.

161. The method of claim 160, in response to determining that the facility is no longer associated with the first intermediate level in the hierarchical structure, updating the first intermediate identifier, such that the tagged pump message includes the updated first intermediate identifier.

162. The method of claim 155, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

163. An apparatus configured to tag messages from infusion pumps residing in a clinical environment, the apparatus comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- process a pump message including information about an infusion pump residing in the clinical environment;

cause the pump message to be tagged with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the message is not tagged with at least one other identifier indicative of an intermediate level that is between the facility and the account in the hierarchical structure; and

cause the tagged pump message to be transmitted to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response to the facility being moved within the hierarchical structure.

164. The apparatus of claim 163, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved within the hierarchical structure.

165. The apparatus of claim 163, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

166. The apparatus of claim 163, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

167. The apparatus of claim 163, wherein the computer-executable instructions further configure the one or more processors to cause the pump message to be tagged with a first intermediate identifier indicative of a first intermediate level of the one or more intermediate levels such that the tagged pump message includes the facility identifier, the account identifier, and the first intermediate identifier.

168. The apparatus of claim 167, wherein the computer-executable instructions further configure the one or more processors to, in response to determining that the facility is no longer associated with the first intermediate level in the hierarchical structure, cause the first intermediate identifier to be updated, such that the tagged pump message includes the updated first intermediate identifier.

169. The apparatus of claim 163, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

170. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

- process a pump message including information about an infusion pump residing in the clinical environment;

- cause the pump message to be tagged with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the message is not tagged with at least one other identifier indicative of an intermediate level that is between the facility and the account in the hierarchical structure; and

- cause the tagged pump message to be transmitted to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response the facility being moved within the hierarchical structure.

171. The non-transitory physical computer storage of claim 170, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

172. The non-transitory physical computer storage of claim 170, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

173. The non-transitory physical computer storage of claim 170, wherein the intermediate level in the hierarchical structure is a system associated with the infusion pump or a region associated with the infusion pump.

174. The non-transitory physical computer storage of claim 170, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

WHAT IS CLAIMED IS:

1. A system configured to facilitate messaging during a network outage, the system comprising:

a plurality of infusion pumps configured to deliver medication to patients, each infusion pump of the plurality of infusion pumps comprising a memory configured to store operational software and a processor configured to generate pump messages;

a connectivity adapter comprising computer hardware and in communication with the plurality of infusion pumps over a first network; and

a remote server comprising computer hardware and in communication with the connectivity adapter over a second network different from the first network,

wherein the connectivity adapter is configured to:

receive a first pump message from a first infusion pump of the plurality of infusion pumps over the first network, the first pump message including information that is new to the connectivity adapter;

generate a first standardized dataset message based on the information in the first pump message;

store the first standardized dataset message in an outbound queue for transmission to the remote server over the second network different from the first network;

subsequent to storing the first standardized dataset message in the outbound queue, receive a second pump message from the first infusion pump over the first network, the second pump message including additional information that is new to the connectivity adapter;

generate a second standardized dataset message based on the additional information in the second pump message;

store the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

transmit the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

2. The system of claim 1, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

3. The system of claim 1, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

4. The system of claim 1, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

5. The system of claim 4, wherein the second parameter is associated with one of a null value or a default value.

6. The system of claim 1, wherein the connectivity adapter is further configured to store the information in the first pump message in a cache.

7. The system of claim 6, wherein the connectivity adapter is further configured to receive a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refrain from storing the information in the third pump message in the cache.

8. The system of claim 1, wherein the connectivity adapter is further configured to update a parameter stored in a cache based on the information in the first pump message.

9. The system of claim 1, wherein the connectivity adapter is further configured to, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receive a request for the first pump message from the remote server.

10. The system of claim 9, wherein the connectivity adapter is further configured to, in response to the request for the first pump message, transmit a request for the first pump message to the first infusion pump.

11. A method of facilitating messaging during a network outage, the method comprising:

- receiving a first pump message from a first infusion pump over a first network;
- generating a first standardized dataset message based on the information in the first pump message;

- storing the first standardized dataset message in an outbound queue for transmission to a remote server over a second network different from the first network;

- subsequent to storing the first standardized dataset message in the outbound queue, receiving a second pump message from the first infusion pump over the first network;

- generating a second standardized dataset message based on the additional information in the second pump message;

- storing the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

- removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

- transmitting the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

12. The method of claim 11, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

13. The method of claim 11, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

14. The method of claim 11, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

15. The method of claim 14, wherein the second parameter is associated with one of a null value or a default value.

16. The method of claim 11, further comprising storing the information in the first pump message in a cache.

17. The method of claim 16, further comprising receiving a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refraining from storing the information in the third pump message in the cache.

18. The method of claim 11, further comprising updating a parameter stored in a cache based on the information in the first pump message.

19. The method of claim 11, further comprising, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receiving a request for the first pump message from the remote server.

20. The method of claim 19, further comprising, in response to the request for the first pump message, transmitting a request for the first pump message to the first infusion pump.

21. A system configured to facilitate messaging during a network outage, the system comprising:

- a plurality of infusion pumps configured to deliver medication to patients, each infusion pump of the plurality of infusion pumps comprising a memory configured to store operational software and a processor configured to generate pump messages;

- a connectivity adapter comprising computer hardware and in communication with the plurality of infusion pumps over a first network; and

- a remote server comprising computer hardware and in communication with the connectivity adapter over a second network different from the first network,

- wherein the connectivity adapter is configured to:

- receive a first pump message from a first infusion pump of the plurality of infusion pumps over the first network, the first pump message including information that is new to the connectivity adapter;

- generate a first standardized dataset message based on the information in the first pump message;

- store the first standardized dataset message in an outbound queue for transmission to the remote server over the second network different from the first network;

- subsequent to storing the first standardized dataset message in the outbound queue, receive a second pump message from the first infusion pump,

the second pump message including additional information that is new to the connectivity adapter;

generate a second standardized dataset message based on the additional information in the second pump message;

store the second standardized dataset message in the outbound queue for transmission to the remote server over the second network different from the first network;

determine whether a removal condition for removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server is satisfied;

subsequent to determining whether the removal condition is satisfied, remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server over the second network different from the first network over which the first pump message was received; and

subsequent to removing the first standardized dataset message, transmit the second standardized dataset message in the outbound queue to the remote server over the second network different from the first network over which the second pump message was received.

22. The system of claim 21, wherein the connectivity adapter is further configured to, subsequent to determining that the removal condition is satisfied, remove the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server.

23. The system of claim 21, wherein the connectivity adapter is further configured to, subsequent to determining that the removal condition is not satisfied, remove the first standardized dataset message from the outbound queue and transmit the first standardized dataset message to the remote server.

24. The system of claim 22 or 23, wherein determining whether the removal condition is satisfied comprises determining whether the first standardized dataset message has been in the outbound queue for a time period greater than a threshold time period.

25. The system of claim 22 or 23, wherein determining whether the removal condition is satisfied comprises determining whether the outbound queue includes a number of messages that is greater than a threshold number of messages.

26. The system of claim 22 or 23, wherein the first pump message includes a first message identifier (ID), and the second pump message includes a second message ID that immediately follows the first message ID in value.

27. The system of claim 22 or 23, wherein the first standardized dataset message includes a first message identifier (ID), and the second standardized dataset message includes a second message ID that immediately follows the first message ID in value.

28. The system of claim 22 or 23, wherein the first pump message includes a first parameter indicative of a status of the first infusion pump, and the first standardized dataset message includes (i) the first parameter and (ii) a second parameter that is not in the first pump message and indicative of another status of the first infusion pump.

29. The system of claim 28, wherein the second parameter is associated with one of a null value or a default value.

30. The system of claim 22 or 23, wherein the connectivity adapter is further configured to store the information in the first pump message in a cache.

31. The system of claim 30, wherein the connectivity adapter is further configured to receive a third pump message from the first infusion pump, and based on determining that the third pump message does not include information new to the connectivity adapter, refrain from storing the information in the third pump message in the cache.

32. The system of claim 22 or 23, wherein the connectivity adapter is further configured to update a parameter stored in a cache based on the information in the first pump message.

33. The system of claim 22, wherein the connectivity adapter is further configured to, subsequent to removing the first standardized dataset message from the outbound queue without transmitting the first standardized dataset message to the remote server, receive a request for the first pump message from the remote server.

34. The system of claim 33, wherein the connectivity adapter is further configured to, in response to the request for the first pump message, transmit a request for the first pump message to the first infusion pump.

35. A method for providing messaging in a clinical environment, the method comprising:

storing a plurality of messages in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

transmitting at least some of the plurality of messages, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, detecting a network outage, wherein the network outage prevents transmission of messages to the remote server;

determining, during the detected network outage that prevents transmission of messages to the remote server, that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

removing the first message from the message queue such that the first message is removed from the message queue prior to being received by the remote server;

determining that the network outage has been resolved; and

transmitting the second message to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

36. The method of claim 35, further comprising detecting the network outage based at least on not having received an acknowledgement from the remote server during a specific time window.

37. The method of claim 35, further comprising detecting the network outage based at least on receiving a message from the remote server that a connection to the remote server is terminated.

38. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

39. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

40. The method of claim 35, further comprising determining that the first message satisfies the condition based at least on the message queue being full.

41. The method of claim 35, further comprising attempting, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determining that the first message was not received by the remote server.

42. An apparatus configured to provide messaging in a clinical environment, the apparatus comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, determine that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

cause the first message to be removed from the message queue such that the first message is removed from the message queue prior to being received by the remote server; and

cause the second message to be transmitted to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

43. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect a network outage that prevents transmission of messages to the remote server.

44. The apparatus of claim 43, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the network outage based at least on not having received an acknowledgement from the remote server during a specific time window.

45. The apparatus of claim 43, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the network outage based at least on receiving a message from the remote server that a connection to the remote server is terminated.

46. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to

determine that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

47. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

48. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message satisfies the condition based at least on the message queue being full.

49. The apparatus of claim 42, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to attempt, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

50. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

- cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message and a second message;

- cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

- subsequent to the transmission, determine that the first message in the message queue satisfies a condition for being removed from the message queue without being successfully transmitted to the remote server;

- cause the first message to be removed from the message queue such that the first message is removed from the message queue prior to being received by the remote server;
- and

- cause the second message to be transmitted to the remote server such that the second message is received by the remote server and the first message is not received by the remote server.

51. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure

the one or more computing devices to detect a network outage that prevents transmission of messages to the remote server.

52. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message satisfies the condition based at least on the first message being associated with an infusion pump event that is older than a threshold amount of time.

53. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message satisfies the condition based at least on the first message being the oldest message in the message queue.

54. The non-transitory physical computer storage of claim 50, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to attempt, prior to determining that the first message satisfies the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

55. A method for providing messaging in a clinical environment, the method comprising:

storing a plurality of messages in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

transmitting at least some of the plurality of messages, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, detecting a temporary interruption in a network connection to the remote server, wherein the temporary interruption prevents transmission of messages to the remote server;

determining, during the detected temporary interruption in the network connection to the remote server, that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server;

determining that the temporary interruption has been resolved; and

transmitting the first message to the remote server such that the first message is received by the remote server.

56. The method of claim 55, further comprising detecting the temporary interruption based at least on not having received an acknowledgement from the remote server during a specific time window.

57. The method of claim 55, further comprising detecting the temporary interruption based at least on receiving a message from the remote server that a connection to the remote server is terminated.

58. The method of claim 55, further comprising determining that the first message does not satisfy the condition based at least on the first message being associated with an infusion pump event that is not older than a threshold amount of time.

59. The method of claim 55, further comprising determining that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

60. The method of claim 55, further comprising attempting, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determining that the first message was not received by the remote server.

61. An apparatus configured to provide messaging in a clinical environment, the apparatus comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

- cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

- subsequent to the transmission, determine that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server; and

- cause the first message to be transmitted to the remote server such that the first message is received by the remote server.

62. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect an interruption in a network connection between the apparatus and the remote server that prevents transmission of messages from the apparatus to the remote server.

63. The apparatus of claim 62, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the interruption based at least on not having received an acknowledgement from the remote server during a specific time window.

64. The apparatus of claim 62, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the interruption based at least on receiving a message from the remote server that the network connection between the apparatus and the remote server is terminated.

65. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message does not satisfy the condition based at least on the first message being associated with an infusion pump event that is not older than a threshold amount of time.

66. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to determine that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

67. The apparatus of claim 61, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to attempt, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

68. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

cause a plurality of messages to be stored in a message queue, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, the plurality of messages stored in the message queue including at least a first message;

cause at least some of the plurality of messages to be transmitted, over a network, to a remote server configured to receive messages generated in the clinical environment;

subsequent to the transmission, determine that the first message in the message queue does not satisfy a condition for being removed from the message queue without being successfully transmitted to the remote server; and

cause the first message to be transmitted to the remote server such that the first message is received by the remote server.

69. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect an interruption in a network connection to the remote server that prevents transmission of messages to the remote server.

70. The non-transitory physical computer storage of claim 69, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the interruption based at least on not having received an acknowledgement from the remote server during a specific time window.

71. The non-transitory physical computer storage of claim 69, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the interruption based at least on receiving a message from the remote server that the network connection to the remote server is terminated.

72. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message does not satisfy the condition based at least on the first message being associated with an infusion pump event that is not older than a threshold amount of time.

73. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to determine that the first message does not satisfy the condition based at least on the first message not being a time-sensitive message.

74. The non-transitory physical computer storage of claim 68, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to attempt, prior to determining that the first message does not satisfy the condition, to transmit the first message to the remote server, and determine that the first message was not received by the remote server.

75. A method for detecting missing messages from a clinical environment, the method comprising:

processing a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment, wherein the plurality of messages includes a first message having a first message identifier value and a second message having a second message identifier value;

determining that one or more messages are missing between the first message and the second message based on (i) receiving the second message after the first message without receiving any other message therebetween and (ii) determining that there is at least one message identifier value between the first message identifier value and the second message identifier value in a predetermined sequence; and

transmitting a message request to the network device residing in the clinical environment, wherein the message request identifies the one or more messages that should have been received from the network device but have not been received.

76. The method of claim 75, further comprising, in response to the message request, receiving one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more messages.

77. The method of claim 76, further comprising updating, based at least on the one or more additional messages received in response to the message request, a cache to include additional information about the one or more infusion pumps residing in the clinical environment.

78. The method of claim 75, further comprising causing the network device to request additional information from the one or more infusion pumps that would have been included in the one or more messages.

79. The method of claim 75, further comprising, in response to determining that the one or more messages has reached a threshold count, transmitting the message request to the network device residing in the clinical environment.

80. A system configured to detect missing messages from a clinical environment, the system comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

process a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment;

detect one or more missing messages that should have been received from the network device have not been received; and

cause a message request to be transmitted to the network device residing in the clinical environment, wherein the message request identifies the one or more missing messages that should have been received from the network device have not been received.

81. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to receive, in response to the message request, one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more missing messages.

82. The system of claim 81, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause, based at least on the one or more additional messages received in response to the message request, a cache to be updated to include additional information about the one or more infusion pumps residing in the clinical environment.

83. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the one or more missing messages based at least on message identifier information associated with one or more of the plurality of messages.

84. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the one or more missing messages based at least on a first message in the plurality of messages having a message identifier that does not immediately follow another message identifier of a second message of the plurality of messages that immediately follows the first message.

85. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the network device to request additional information from the one or more infusion pumps that would have been included in the one or more missing messages.

86. The system of claim 80, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause,

in response to determining that the one or more missing messages has reached a threshold count, the message request to be transmitted to the network device residing in the clinical environment.

87. The system of claim 80, wherein the message request includes a flag having a value indicating that the message request is a log retrieval request and not live data.

88. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

process a plurality of messages from a network device residing in the clinical environment, wherein the plurality of messages contain information about one or more infusion pumps residing in the clinical environment;

detect one or more missing messages that should have been received from the network device have not been received; and

cause a message request to be transmitted to the network device residing in the clinical environment, wherein the message request identifies the one or more missing messages that should have been received from the network device have not been received.

89. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to receive, in response to the message request, one or more additional messages from the network device, wherein the one or more messages include information that would have been included in the one or more missing messages.

90. The non-transitory physical computer storage of claim 89, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause, based at least on the one or more additional messages received in response to the message request, a cache to be updated to include additional information about the one or more infusion pumps residing in the clinical environment.

91. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the one or more missing messages based at least on message identifier information associated with one or more of the plurality of messages.

92. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the one or more missing messages based at least on a first message in the plurality of messages having a message identifier that does not immediately

follow another message identifier of a second message of the plurality of messages that immediately follows the first message.

93. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause the network device to request additional information from the one or more infusion pumps that would have been included in the one or more missing messages.

94. The non-transitory physical computer storage of claim 88, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause, in response to determining that the one or more missing messages has reached a threshold count, the message request to be transmitted to the network device residing in the clinical environment.

95. A method for generating a user interface based on messages from a clinical environment, the method comprising:

- processing a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

- determining that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

- updating the cache to include at least some of the information included in the message from the network device;

- receiving a request for a user interface from the computing device residing in the clinical environment;

- accessing, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and

- outputting instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

96. The method of claim 95, wherein the message includes information indicating a current state of the one or more infusion pumps.

97. The method of claim 95, wherein the cache stores information associated with two or more infusion pumps residing in different medical facilities.

98. The method of claim 95, wherein the user interface information includes user interface data previously generated and stored in the cache.

99. The method of claim 95, further comprising updating user interface data stored in the cache, and outputting the instructions based at least on the updated user interface data.

100. The method of claim 95, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

101. The method of claim 95, further comprising causing the user interface to be outputted on a display of the computing device.

102. A system configured to detect missing messages from a clinical environment, the system comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- process a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

- determine that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

- cause the cache to be updated to include at least some of information included in the message from the network device;

- process a request for a user interface from the computing device residing in the clinical environment;

- access, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and

output instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

103. The system of claim 102, wherein the message includes information indicating a current state of the one or more infusion pumps.

104. The system of claim 102, wherein the cache is configured to store information associated with two or more infusion pumps residing in different medical facilities.

105. The system of claim 102, wherein the user interface information includes user interface data previously generated and stored in the cache.

106. The system of claim 102, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause user interface data stored in the cache to be updated, and output the instructions based at least on the updated user interface data.

107. The system of claim 102, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

108. The system of claim 102, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the user interface to be outputted on a display of the computing device.

109. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

process a message from a network device residing in the clinical environment, wherein the message includes information about one or more infusion pumps in communication with the network device in the clinical environment;

determine that the information included in the message satisfies a condition for updating a cache to include at least some of the information included in the message, wherein the cache stores information usable to generate user interfaces in response to a request from a computing device residing in the clinical environment;

cause the cache to be updated to include at least some of information included in the message from the network device;

process a request for a user interface from the computing device residing in the clinical environment;

access, from the updated cache, user interface information to be used to generate the user interface, wherein the user interface information includes at least some of the information that the cache was updated to include; and

output instructions for displaying the user interface on the computing device, wherein the instructions are based at least on the user interface information accessed from the updated cache.

110. The non-transitory physical computer storage of claim 109, wherein the message includes information indicating a current state of the one or more infusion pumps.

111. The non-transitory physical computer storage of claim 109, wherein the cache is configured to store information associated with two or more infusion pumps residing in different medical facilities.

112. The non-transitory physical computer storage of claim 109, wherein the user interface information includes user interface data previously generated and stored in the cache.

113. The non-transitory physical computer storage of claim 109, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause user interface data stored in the cache to be updated, and output the instructions based at least on the updated user interface data.

114. The non-transitory physical computer storage of claim 109, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

115. A method for converting messages having one message format from infusion pumps residing in a clinical environment into messages having another message format, the method comprising:

detecting a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining the first message format;

generating a message converter configured to convert a pump message having the first message format into a standardized dataset message having a second message format different from the first message format and including at least some additional data or metadata not included in the pump message;

receiving a first pump message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate pump messages using the first pump protocol;

converting the first pump message into a standardized dataset message having the second message format using the message converter, wherein the standardized dataset

message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first pump message; and

transmitting the standardized dataset message to a remote server configured to receive standardized dataset messages.

116. The method of claim 115, wherein the standardized dataset message includes one or more key-value pairs that are not included in the first pump message.

117. The method of claim 116, wherein the one or more key-value pairs are each set to a default value or a null value.

118. The method of claim 115, wherein the standardized dataset message includes identification data that identifies one or more portions of the standardized dataset message that include new information.

119. The method of claim 115, further comprising detecting the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers.

120. The method of claim 119, further comprising subsequent to detecting the first pump protocol, adding the protocol identifier associated with the first pump protocol to the predetermined list of protocol identifiers.

121. The method of claim 115, wherein the message converter comprises a software module that is configured to receive a pump message in the first pump protocol as input and output a standardized dataset message based on the pump message.

122. The method of claim 115, wherein the message converter is a configuration file downloaded from the remote server.

123. An apparatus configured to convert messages having one message format from infusion pumps residing in a clinical environment into messages having another message format, the apparatus comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

detect a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining a first message format;

generate a message converter configured to convert a pump message having the first message format into another message having a second message

format different from the first message format and including at least some additional data or metadata not included in the pump message;

receive a first message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate messages using the first pump protocol;

cause the first message to be converted into a second message having the second message format using the message converter, wherein the second message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first message; and

cause the second message to be transmitted to a remote server configured to receive messages having the second message format.

124. The apparatus of claim 123, wherein the second message includes one or more key-value pairs that are not included in the first message.

125. The apparatus of claim 124, wherein the one or more key-value pairs are each set to a default value or a null value.

126. The apparatus of claim 123, wherein the second message includes identification data that identifies one or more portions of the second message that include new information.

127. The apparatus of claim 123, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to detect the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers.

128. The apparatus of claim 123, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to, subsequent to detecting the first pump protocol, cause the protocol identifier associated with the first pump protocol to be added to the predetermined list of protocol identifiers.

129. The apparatus of claim 123, wherein the message converter comprises a software module that is configured to receive a pump message having the first message format as input and output another message having the second message format based on the pump message.

130. The apparatus of claim 123, wherein the message converter is a configuration file downloaded from the remote server.

131. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

detect a first pump protocol used by one or more infusion pumps in the clinical environment, the first pump protocol defining a first message format;

generate a message converter configured to convert a pump message having the first message format into another message having a second message format different from the first message format and including at least some additional data or metadata not included in the pump message;

receive a first message from an infusion pump in the clinical environment, wherein the infusion pump is configured to generate messages using the first pump protocol;

cause the first message to be converted into a second message having the second message format using the message converter, wherein the second message includes information associated with the infusion pump and includes at least some additional data or metadata not included in the first message; and

cause the second message to be transmitted to a remote server configured to receive messages having the second message format.

132. The non-transitory physical computer storage of claim 131, wherein the second message includes one or more key-value pairs that are not included in the first message, the one or more key-value pairs each having a default value or a null value.

133. The non-transitory physical computer storage of claim 131, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to detect the first pump protocol based on a protocol identifier associated with the first pump protocol not being on a predetermined list of protocol identifiers, and subsequent to detecting the first pump protocol, cause the protocol identifier associated with the first pump protocol to be added to the predetermined list of protocol identifiers.

134. The non-transitory physical computer storage of claim 131, wherein the message converter comprises a software module that is downloaded from the remote server, the message converter being configured to receive a pump message having the first message format as input and output another message having the second message format based on the pump message.

135. A method for authenticating a network device residing in a clinical environment using a token, the method comprising:

processing an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

identifying login credentials to be used to authenticate the network device residing in the clinical environment;

transmitting the login credentials to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

receiving a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

transmitting the security token to the network device residing in the clinical environment via the first network connection.

136. The method of claim 135, wherein the first network connection is a WebSocket connection.

137. The method of claim 135, wherein the first network connection is secured and authenticated.

138. The method of claim 135, further comprising causing the network device residing in the clinical environment to transmit a signed request to the authentication system.

139. The method of claim 135, wherein the first network connection and the second network connection are both established over a wide area network.

140. The method of claim 135, further comprising receiving a message from the network device residing in the clinical environment via the first network connection, wherein the messages include information associated with the one or more infusion pumps in communication with the network device.

141. The method of claim 140, wherein the network device is configured to communicate with the one or more infusion pumps over a local area network.

142. A system configured to authenticate a network device residing in a clinical environment using a token, the system comprising:

one or more processors; and

one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

process an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

identify login credentials to be used to authenticate the network device residing in the clinical environment;

cause the login credentials to be transmitted to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

receive a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

cause the security token to be transmitted to the network device residing in the clinical environment via the first network connection.

143. The system of claim 142, wherein the first network connection is a WebSocket connection.

144. The system of claim 142, wherein the first network connection is secured and authenticated.

145. The system of claim 142, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to cause the network device residing in the clinical environment to transmit a signed request to the authentication system.

146. The system of claim 142, wherein the first network connection and the second network connection are both established over a wide area network.

147. The system of claim 142, wherein the computer-executable instructions, when executed by the one or more processors, further configure the one or more processors to receive a message from the network device residing in the clinical environment via the first network connection, wherein the messages include information associated with the one or more infusion pumps in communication with the network device.

148. The system of claim 147, wherein the network device is configured to communicate with the one or more infusion pumps over a local area network.

149. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

process an authentication request from the network device residing in the clinical environment via a first network connection, wherein the authentication request includes identifying information associated with the clinical environment, and wherein the clinical environment includes one or more infusion pumps in communication with the network device;

identify login credentials to be used to authenticate the network device residing in the clinical environment;

cause the login credentials to be transmitted to an authentication system configured to authenticate requests from the network device residing in the clinical environment via a second network connection different from the first network connection;

receive a security token from the authentication system, the security token being usable by the network device to transmit requests to the authentication system via the second network connection; and

cause the security token to be transmitted to the network device residing in the clinical environment via the first network connection.

150. The non-transitory physical computer storage of claim 149, wherein the first network connection is a secured and authenticated WebSocket connection.

151. The non-transitory physical computer storage of claim 149, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to cause the network device residing in the clinical environment to transmit a signed request to the authentication system.

152. The non-transitory physical computer storage of claim 149, wherein the first network connection and the second network connection are both established over a wide area network.

153. The non-transitory physical computer storage of claim 149, wherein the computer-executable instructions, when executed by the one or more computing devices, further configure the one or more computing devices to receive a message from the network device residing in the clinical environment via the first network connection, wherein the messages

include information associated with the one or more infusion pumps in communication with the network device.

154. The non-transitory physical computer storage of claim 149, wherein the condition is satisfied based on the information in the message being usable to generate one or more user interfaces in response to a request from the clinical environment.

155. A method for tagging messages from infusion pumps residing in a clinical environment, the method comprising:

processing a pump message including information about an infusion pump residing in the clinical environment;

tagging the pump message with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the hierarchical structure includes one or more intermediate levels that are between the facility and the account in the hierarchical structure; and

transmitting the tagged pump message to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response the facility being moved within the hierarchical structure.

156. The method of claim 155, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

157. The method of claim 155, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

158. The method of claim 155, further comprising determining, in a priority order, whether one or more facility detection indicators correspond to one of a plurality of facility identifiers stored in a database.

159. The method of claim 158, further comprising, in response to determining that none of the one or more facility detection indicators corresponds to any of the plurality of facility identifiers stored in the database, tagging the pump message with a default facility identifier indicating that the pump message originated from an infusion pump that is not associated with a known facility.

160. The method of claim 155, further comprising tagging the pump message with a first intermediate identifier indicative of a first intermediate level of the one or more intermediate levels such that the tagged pump message includes the facility identifier, the account identifier, and the first intermediate identifier.

161. The method of claim 160, in response to determining that the facility is no longer associated with the first intermediate level in the hierarchical structure, updating the first intermediate identifier, such that the tagged pump message includes the updated first intermediate identifier.

162. The method of claim 155, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

163. An apparatus configured to tag messages from infusion pumps residing in a clinical environment, the apparatus comprising:

- one or more processors; and

- one or more memories in communication with the one or more processors and storing computer-executable instructions that, when executed by the one or more processors, configure the one or more processors to:

- process a pump message including information about an infusion pump residing in the clinical environment;

- cause the pump message to be tagged with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the message is not tagged with at least one other identifier indicative of an intermediate level that is between the facility and the account in the hierarchical structure; and

- cause the tagged pump message to be transmitted to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response the facility being moved within the hierarchical structure.

164. The apparatus of claim 163, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved within the hierarchical structure.

165. The apparatus of claim 163, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

166. The apparatus of claim 163, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

167. The apparatus of claim 163, wherein the computer-executable instructions further configure the one or more processors to cause the pump message to be tagged with a first intermediate identifier indicative of a first intermediate level of the one or more intermediate levels such that the tagged pump message includes the facility identifier, the account identifier, and the first intermediate identifier.

168. The apparatus of claim 167, wherein the computer-executable instructions further configure the one or more processors to, in response to determining that the facility is no longer associated with the first intermediate level in the hierarchical structure, cause the first intermediate identifier to be updated, such that the tagged pump message includes the updated first intermediate identifier.

169. The apparatus of claim 163, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

170. Non-transitory physical computer storage storing computer-executable instructions that, when executed by one or more computing devices, configure the one or more computing devices to:

- process a pump message including information about an infusion pump residing in the clinical environment;

- cause the pump message to be tagged with a facility identifier indicative of a facility associated with the infusion pump and an account identifier indicative of an account associated with the infusion pump, wherein the facility is below the account in a hierarchical structure, and wherein the message is not tagged with at least one other identifier indicative of an intermediate level that is between the facility and the account in the hierarchical structure; and

- cause the tagged pump message to be transmitted to a remote server such that the facility identifier of the tagged pump message and the account identifier of the tagged message need not be changed by the remote server in response the facility being moved within the hierarchical structure.

171. The non-transitory physical computer storage of claim 170, wherein the facility identifier and the account identifier are permanent identifiers that are not changed in response to the facility being moved to another system or region in the hierarchical structure.

172. The non-transitory physical computer storage of claim 170, wherein the infusion pump is configured to generate pump messages without determining the facility associated with the infusion pump or the account associated with the infusion pump.

173. The non-transitory physical computer storage of claim 170, wherein the intermediate level in the hierarchical structure is a system associated with the infusion pump or a region associated with the infusion pump.

174. The non-transitory physical computer storage of claim 170, wherein processing the pump message comprises converting a message in a first format received from the infusion pump into the pump message in a second format different from the first format.

PATENT COOPERATION TREATY

General Power of Attorney

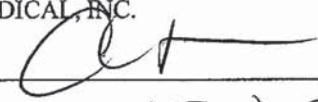
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Dated: FEB, 5, 2010

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