VITAL Telehealth
A Home and Assisted Living Monitoring System for Large-Scale Patient Populations

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What is VITAL Telehealth?

- Intercommunication links with and assistance linking patients and devices.
- Interoperability with H.323 and SIP-enabled devices used by clinicians.
- As shown in Figure 1, provide support the following call scenarios:
  1. MS patient outside of VA to provider outside of VA network.
  2. MS patient outside of VA to provider within VA network.
  3. MS patient within VA network to provider within VA network.
- Transmit medical data from a patient to a provider without requiring installation of any extra software on the provider’s computer.

Why telemedicine with VITAL Telehealth?

- Improving patients’ experience of care, self-management skills and education, reaching populations of patients in non urban areas, and reducing hospitalization rates are some of the benefits provided by remote patient monitoring (RPM) that increase the overall patients’ quality of life and decrease the cost of healthcare [1, 2]. Yet, these home and assisted living monitoring systems introduce new security and privacy challenges that range from protecting against adversaries at home to withstanding attacks over the communication links when transferring electronic medical records (EMRs) [3].

What is VITAL Telehealth?

VITAL Telehealth includes three primary components: VITAL Web, VITAL Home, and VITAL Infrastructure. VITAL Web is a web-based, real-time collaboration platform and portal designed to serve as an information hub for patients and devices. VITAL Home, shown in Figure 3, is a Windows-based, multitouch tablet for Bluetooth medical device telemetry, disease management protocols administration, medicine intake tracking, and secure transmission of H.323 audio and video between patients’ tablets and physicians’ H.323 or SIP-enabled devices. VITAL Infrastructure supports multiple video call scenarios between patients and health-care providers, where calls received and initiated from the medical video (MeVi) application in the tablet are secure using FIPS PUB 140-2 compliant cryptographic modules.

References

Case Study: U.S. Department of Veteran Affairs — Pilot for Multiple Sclerosis Patients

Overview
- Sponsored by the Department of Veteran Affairs (VA) Office of Rural Health (ORH) and the Multiple Sclerosis (MS) Program.
- Initially, 50 MS patients and 2-3 physicians over a 12-month period. Ultimate target population, 44,000 MS patients.
- Initial locations, North Florida/South Georgia Veterans Health System and Maine Veterans Services.

Main Challenges
- Interoperability with H.323 and SIP-enabled devices used by clinicians.
- As shown in Figure 1, provide support the following call scenarios:
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Connectivity Evaluation
- Call routing and firewall traversal, tested by simply calling diverse Cisco phones while replicating all required call scenarios.
- Initial focus, six (6) coastal communities in Maine—Kittery, York, Ogunquit, Wells, Kennebunk, and Biddeford; and three (3) communities in North Florida—Gainesville, Jacksonville, and Lake City.
- Measure uplink/download speed and latency at each location, also recording the number of signal bars (1 to 5) available.

Lessons Learned so Far
- Replication of the VA video infrastructure is a must to achieve proper call routing and firewall traversal.
- Connectivity tests for rural areas and remote locations require road testing with possible remapping of data coverage published by services providers such AT&T and Verizon.
- By connecting directly to the Internet, VITAL Home tablets with built-in 4G LTE provide better connectivity than tablets connected through WiFi 3G or 4G modem/router devices.
- Implementation of an automatic diagnostic tool to determine connection status is another must.
- User interface design requires not only considering mobility impairment of patients and use of the accessibility support provided by the operating system, but gathering feedback from actual patients through prototyping.

Why the Department of Veteran Affairs (VA) Office of Rural Health (ORH) and the Multiple Sclerosis (MS) Program.

1. An MS patient using a VITAL Home tablet registers with the Cisco VCS Expressway residing within the VITAL Telehealth Private Cloud Infrastructure through a Wi-Fi 802.11 a/b/g/n network or a Mobile Broadband (AT&T, Verizon, Sprint, etc.) network connection.
2. A clinician or service provider using an H.323 or SIP video device (e.g. Cisco, Polycom, Tandberg, etc.) or a software client also registers with the Cisco VCS Expressway.
3. Once the MS patient and the clinician or service provider have registered, the VCS Expressway is used to support firewall traversal to allow the video call to connect through the firewall.
4. The MS patient uses the VITAL app to securely call the clinician or service provider, whose option to accept or reject the video call.

Location Downlink Uplink Latency Signal Bars
Kittery, ME 0.91 Mbps 0.93 Mbps 99 ms 3 bars
York, ME 3.66 Mbps 1.25 Mbps 124 ms 4 bars
Ogunquit, ME 13.05 Mbps 10.44 Mbps > 150 ms 5 bars
Wells, ME 1.99 Mbps 0.99 Mbps 120 ms 3 bars
Kennebunk, ME 1.46 Mbps 1.14 Mbps 152 ms 4 bars
Biddeford, ME 2.88 Mbps 1.89 Mbps > 150 ms 5 bars
North Florida—
Gainesville, ME 4.31 Mbps 0.64 Mbps 152 ms 4 bars
Jacksonville, ME 3.14 Mbps 0.91 Mbps 115 ms 3 bars
Lake City, ME 3.93 Mbps 0.69 Mbps 147 ms 4 bars

Figure 1. A Typical Call Scenario used by the VA ORH and the MS Program. 1) An MS patient using a VITAL Home tablet registers with the Cisco VCS Expressway residing within the VITAL Telehealth Private Cloud Infrastructure through a Wi-Fi 802.11 a/b/g/n network or a Mobile Broadband (AT&T, Verizon, Sprint, etc.) network connection. 2) A clinician or service provider using an H.323 or SIP video device (e.g. Cisco, Polycom, Tandberg, etc.) or a software client also registers with the Cisco VCS Expressway. 3) Once the MS patient and the clinician or service provider have registered, the VCS Expressway is used to support firewall traversal to allow the video call to connect through the firewall. 4) The MS patient uses the VITAL app to securely call the clinician or service provider, whose option to accept or reject the video call.

Figure 2. Results of Connectivity Tests for the Maine Veterans Services. Green area – sufficient connectivity, yellow area – connectivity may be sufficient, red area – insufficient connectivity.

Figure 3. A Sample VITAL Home Kit. A Windows-based tablet computer with a set of devices depending on the assigned DMP that acts as information and communication hub for patients and devices.