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Community Health Center Case Study: Infrastructure & Integration in Implementing an Electronic Health Record

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Introduction

In late 2008, an urban Community Health Center (hereinafter "CHC") realized it needed a new, state of the art, clinical management system. CHC had ample reason to take action: the health center wanted to implement an electronic health record system to enhance patient care and improve operating efficiency; a new practice management system to improve billing and collections; AND, the health center wanted to address a myriad of problems with its current technology systems.

About CHC Primary Health Care

CHC is a not-for-profit healthcare provider whose principal site is in New York City. CHC provides comprehensive primary care as well as a full range of specialty services to a multi-ethnic community. OB/GYN services and some pediatric services are provided at satellite sites.

Growth at CHC is ongoing. The number of satisfied patients increases annually and often includes several generations of the same family.

The CHC's board certified physicians provide pediatrics, internal medicine, dental, and a variety of specialty services 7 days a week, 365 days a year, and office on-call availability 24 hours a day.

About STIGroup Ltd.

Secure Technology Integration Group, Ltd. (STIGroup) is an Information Security Consulting firm that provides a full suite of Information Security services. STIGroup designs, implements, and maintains the systems and procedures that permit businesses to utilize technology productively while maintaining the confidentiality,

integrity, and availability of mission-critical information. STI provides infra-structure design, implementation consulting and managed security and support services.

Problem Statement

Many problems existed with CHC's IT technology in use at the time STI began its engagement. Some of their existing legacy systems, including Medical Master (based on DOS), were about to come off support permanently. Most systems did not integrate well, if at all, with each other, such as the LanTalk application for instant messaging. Other issues compounded support problems, including older Windows 9x machines on non-standard hardware platforms, non-standard desktop configurations, and lack of control over desktops, etc., making support of the environment a challenge.

These problems became apparent over time as systems were put together piecemeal, as needed, utilizing various system types, network hubs, lower end firewalls, and basically any applications that the business units thought were appropriate. A single over-burdened server was being used for all services. Users were sharing files from their desktops, which prevented proper backup by the central system. The connection to the Internet was protected by a low end, unmanaged, commodity firewall. These are just a few examples of the issues requiring corrective action.

STIGroup's Solution

It was obvious a new technology environment was needed. A hands-off approach was essential for CHC staff, as their focus and skill sets revolve around delivering medical care for their patients. The new system needed to be designed from the ground up to be EnergyStar compliant, standards based, secure, and leveraging the latest technologies available.

Starting with the functional requirements of the core application of the business (the clinical system), and considering the future computing needs of the organization, with an eye towards being "green", CHC went out and searched for a solution. After a thorough review of available systems, various discussions with medical institutes and organizations, and consultation with the Primary Care Development Corporation (PCDC), CHC selected eClinicalWorks (eCW) as the ideal solution for an integrated electronic health record and practice management system.

Based on the design requirements of the eCW system, and CHC's back office requirements, CHC contracted with STIGroup, Ltd. to implement the new technology environment. STIGroup was selected thru an RFP process that required the vendor to specify, design, implement, and support the solution. STIGroup proposed an entirely new IT infrastructure including the eCW system utilizing VMware and a SAN (Storage Area Network), a new messaging email system complete with Antivirus, Antispam, and BlackBerry integration, Microsoft Office, Windows Active Directory and File and Printer servers, Dell workstations, HP thin clients, IBM Lenovo laptops and tablets, HP printers and scanners, and a new redundant Cisco LAN/WAN and wireless network, all in a secure, compliant, integrated configuration.

(See Glossary on page 6 for definition of terms.)

For the examination rooms, the eCW application was the only application required, and therefore thin client machines were used to provide seamless connectivity to eCW using redundant Windows Terminal Servers, yielding a significant cost saving and ease of management over standard desktop machines.

For Internet connectivity, the wireless ISP vendor Towerstream's highly reliable WiMAX service was selected, since Verizon FiOS and other mainstream broadband ISPs were not available at the location. JNet's DSL service was also used to provide fault tolerance and redundancy. Load sharing for email and other Internet based applications was achieved by using dynamic routing and advanced load balancing features with new Fortinet firewalls.

Implementation Highlights

- Leading-edge, high-availability clustering, SAN, and replication technologies for reliability and scalability without interruption of services
- SAN for VMware's high availability shared storage, eliminating downtime and increasing the performance of the virtual environment.
- Best of breed VMware for increased efficiency, reliability, performance, reduced power and air conditioning consumption
- Thin clients for simplified image management, application streaming, centralized

provisioning, synchronized and automated patches, and lower total cost of ownership. One disadvantage: thin clients did not allow for transmission of data from interfaceable medical devices (e.g. digital scales, digital vital sign monitors, etc.) to the EHR.

- Custom login scripts developed to address roaming users and their printing needs
- Roaming desktop profiles and quotas
- Security in depth through high-availability firewalls, embedded anti-spam and anti-virus systems, and web-browsing protection
- RIS deployment technology for desktop standardization, quality, and repeatability
- Secure remote connectivity to emails, files and applications using redundant terminal servers over SSL VPN
- Point-to-Point connections between locations with automatic failover to IPsec VPN to maximize uptime
- Fully redundant Cisco network using Layer 3 switching and routing
- Dynamic protocols for automatic failover between ISPs and full utilization of the dedicated Internet connections
- Top-of-the-line hardware and software
- 24x7x365 systems monitoring and datacenter environmental monitoring
- APC UPS to provide uninterruptable power to all the core network devices and servers for up to 2 hours
- Complete onsite and offsite Backup
- Ongoing IT management and end user support.

Summary

On a highly aggressive schedule, STIGroup's team collaborated with CHC to:

- Architect, design, and implement a completely fault-tolerant LAN/WAN and computing environment
- Plan, coordinate, oversee, and implement new systems (Servers, Desktops, Applications, etc.)
- Provide timely, client-focused 8 a.m. to 8 p.m. help desk support plus emergency weekend support for all IT issues
- Maximize efficiency and uptime of all systems
- Implement a highly available IT infrastructure

Glossary (source: Wikipedia)

Clustering - the technique of linking a number of computers together in a cluster to act as though they are a single computer

DSL – is a family of technologies that provides digital data transmission over the wires of a local telephone network

Fault Tolerance – is a design that enables a system to continue operation, possibly at a reduced level, rather than failing completely, when some part of the system fails

IPSec – is a protocol suite for securing Internet Protocol (IP) communications by authenticating and encrypting each IP packet of a data stream.

ISP – an Internet service provider is a company that offers its customers access to the Internet.

LAN – is a computer network covering a small physical area, like a home, office, or small group of

buildings, such as a school, or an airport. The defining characteristics of LANs, in contrast to wide-area networks (WANs), include their usually higher data-transfer rates, smaller geographic area, and lack of a need for leased telecommunication lines.

Load balancing – is a technique to distribute workload evenly across two or more computers, network links, CPUs, hard drives, or other resources, in order to get optimal resource utilization, maximize throughput, minimize response time, and avoid overload

Redundancy – is the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or fail-safe

RIS – Microsoft Remote Installation Services is used to install a local copy of the operating system to other computers from remote locations

Roaming desktop profiles – is a concept in the Microsoft Windows NT family of operating systems that allows a user with a computer joined to a Windows Server domain to log on to any computer on the same network and access their local files and settings

SAN – is an architecture to attach remote computer storage devices (such as disk arrays, tape libraries, and optical jukeboxes) to servers in such a way that the devices appear as locally attached to the operating system

SSL VPN – is a kind of VPN that runs on Secure Socket Layers technology and is accessible via https over web browsers

Terminal servers – is Microsoft's implementation of thin-client terminal server

computing, where Windows applications, or even the entire desktop of the computer running terminal services, are made accessible to a remote client machine

Thin Client – is a computer or a computer program which depends heavily on some other computer (terminal server) to fulfill its traditional computational roles

UPS – An Uninterruptible Power Supply, also known as a battery backup, provides emergency power and, depending on the topology, line regulation as well to connected equipment by supplying power from a separate source when utility power is not available

VMware – is a piece of software/hardware platform-virtualization software that allows multiple operating systems to run on a host computer concurrently

VPN – is a computer network that is implemented in an additional software layer (overlay) on top of an existing larger network for the purpose of creating a private scope of computer communications or providing a secure extension of a private network into an insecure network such as the Internet

WAN – is a computer network that covers a broad area (i.e., any network whose communications links cross metropolitan, regional, or national boundaries)