SESSION 2: Quality Assurance in the Digital Practice

Tools to Manage the Enterprise-Wide Picture Archiving and Communications System Environment

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The presentation will focus on the implementation and utilization of a central picture archiving and communications system (PACS) network-monitoring tool that allows for enterprise-wide operations management and support of the image distribution network. The MagicWatch (Siemens, Iselin, NJ) PACS/radiology information system (RIS) monitoring station from Siemens has allowed our organization to create a service support structure that has given us proactive control of our environment and has allowed us to meet the service level performance expectations of the users. The Radiology Help Desk has used the MagicWatch PACS monitoring station as an applications support tool that has allowed the group to monitor network activity and individual systems performance at each node. Fast and timely recognition of the effects of single events within the PACS/RIS environment has allowed the group to proactively recognize possible performance issues and resolve problems. The PACS/operations group performs network management control, image storage management, and software distribution management from a single, central point in the enterprise. The MagicWatch station allows for the complete automation of software distribution, installation, and configuration process across all the nodes in the system. The tool has allowed for the standardization of the workstations and provides a central configuration control for the establishment and maintenance of the system standards. This report will describe the PACS management and operation prior to the implementation of the MagicWatch PACS monitoring station and will highlight the operational benefits of a centralized network and system-monitoring tool.

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THE PICTURE archiving and communications system (PACS)/radiology information system (RIS) environment at The Cleveland Clinic Foundation (CCF) encompasses a central main campus Medical Center, four partner hospitals, and eight Family Health Centers that utilize the radiology systems infrastructure to acquire, distribute, and store digital images and patient information. Patient information from the radiology system is interfaced with multiple hospital information systems, and patient care systems. There are approximately 45 diagnostic radiology viewing stations and more than 100 additional viewing stations for referring physicians spread across a 100-mile radius in northeast Ohio tied to a

main campus's image storage systems. Proactive management in a geographically distributed health-care system presents a difficult and costly task with the availability and efficient use of system and application monitoring tools and an operations center that actively monitors, troubleshoots, and responds to problems and events.

The operational structure within the Radiology Informatics Groups prior to the creation of a central operations center (OP-Center) and the implementation of system monitoring tools was divided into three separate service groups. The PACS group was responsible for the image distribution and archiving environment. The System Support group was responsible for the RIS applications and dictation systems. The Help Desk Service Group provided hardware maintenance and end-user desktop support. Together these groups provided the technical support and project management throughout the entire healthcare enterprise. Working closely with the Radiology Informatics Group was the CCF Information Technology Division (ITD), which managed the network infrastructure, the Hospital Information and Patient Care Systems at the main campus and regional sites.

Service calls from end-users were triaged through the Help Desk Group, who would assign the service call and/or problem to the appropriate analyst or computer technician. In this environment, the Informatics Group was constantly "putting out fires" identified by the end-user. In this mode of "critical" event support, the users were always the first to recognize when there was a problem with system response of information flow and would inform the Help Desk after the event affected the availability of the systems

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and hampered the business operations of the Radiology Division.

Once an event or problem was uncovered by the end-user and reported to the Help Desk, troubleshooting the problems without the appropriate tools and monitors was difficult and often time-consuming. Therefore, our primary goal was to increase the level of support and improve the quality of service by utilizing software application tools that would allow the Informatics Group to proactively monitor the mission critical systems.

OPERATIONAL ISSUES

With the goal of increasing both the level and quality of support service to the Radiology Division, there were a number of operational issues to be addressed.

Timely Problem Identification and Resolution

The Informatics teams and the Radiology Division wanted better control of the systems and problem events. The group needed to acquire the tools and develop methods to identify problems sooner and to resolve the incidents of system events before they became major system failures.

System Availability

The availability of all the systems has always been a major concern within the healthcare setting. It is essential that the information and PACS systems are on-line and that scheduled and unscheduled system downtime be reduced so that patient care is not affected. Within the CCF environment, PACS/RIS system failures can affect multiple hospitals and other healthcare facilities.

Software Upgrades and Installation

Since the PACS/RIS environment was geographically distributed over a wide area, it became essential that software upgrades and distribution became automated through a central distribution center.

MONITORING TOOLS

In defining a strategy for PACS/RIS service management and operational support, the Radiology Informatics Group looked for monitoring tools and applications that would assist us in reaching our operational goals. Vendor-supplied software applications, such as IDX (Burlington, VT) moni-

toring tools and the MagicWatch (Siemens, Iselin, NJ) product would allow the support groups to proactively monitor the PACS/RIS devices and processes in real-time.

MagicWatch Management Tool

The MagicWatch PACS Monitoring application uses the Hewlett-Packard (Palo Alto, CA) Open-View Software Management application to poll the statuses of all the nodes in the network. This includes the digital acquisition devices, viewing stations, and the image archiving systems. The MagicWatch station also monitors the network switches and routers, as well as the operating systems and PACS application running on the workstations. This central monitoring and alarm system displays the status of all of the nodes and alerts the operators of potential problem events (Fig 1).

Software upgrades and installations are always a difficult task in a widely distributed enterprise. The software application also provides system configuration standardization through the central distribution and installation of software. This has allowed the Informatics Group to manage the software upgrades in a systematic rollout, as well as automatically document each node within the system.

RIS Monitoring Tools

The IDX RIS software product has many applications that enable the user to monitor the information systems environment, which includes the RIS database, system parameters, security features, and interfaces within the RIS application.

Figure 2 is an example of the IDX Imaging Suite Toolbox that displays the status of the Connect R (IDX, Burlington, VT) interface and provides a list of system interfaces that are not functioning. In this specific example, there are 955 transactions to be processed in the queue and all of the interfaces are currently up and running.

Threshold levels have been established for each interface, and procedures have been written to take appropriate actions such as restarting an interface and alerting users of possible performance issues.

OPERATIONS CENTER

The implementation of these products has helped the Radiology Informatics Group to develop strategies for defining, controlling, and maintaining PACS/RIS services throughout an ever-expanding and com-

Fig 1. Typical display of the Operational View of the events monitored and displayed by the MagicWatch Operations Console. The message text, network node, severity of the event, and the date and time of the incident are displayed on a central console in the OP-Center).

plex medical environment. The products themselves are mere display tools without the implementation of a support infrastructure that can utilize the information to provide better service to the users.

The continued development and implementation of the MagicWatch product and other software tools in conjunction with the creation of a Radiology Enterprise Operations Center (OP-Center) has allowed us to both monitor systems applications and troubleshoot problem processes and events throughout the Enterprise. The Radiology OP-Center is staffed from 7:30 AM to 11:00 PM Monday through Friday and has the responsibility for actively monitoring all the software application in the PACS/RIS/network environment. Using the application monitoring tools developed by the RIS and PACS vendors, the personnel in the OP-Center monitor all of the PACS viewing stations, PACS storage devices, RIS interfaces, system servers, and network components.

Managing Mission Critical Applications Throughout the Enterprise

The goal of the OP-Center was to develop a central area that is continually updated with a picture of the events and systems within our environment. This real time "snapshot" of all mission critical devices and applications allows the operations personnel to identify events within the environment that may negatively affect system performance and availability.

Managing the application also includes identifying and troubleshooting potential problems. The OP-Center works closely with the Radiology and ITD Help Desks to fix hardware and network problems. Coordinating the troubleshooting and maintenance functions is a prime responsibility of the OP-Center as they continually monitor all radiology mission critical applications.

Fig 2. Example of the Imaging Suite Toolbox shows there are 955 transactions to be processed in the queue and all of the interfaces are currently up and running.

Communication Protocols

It is not enough to merely monitor the systems and applications within the Radiology business unit; it is also essential to establish effective communications protocols and systems that alert the users to changes and problems. Alerting all key users within a widely distributed enterprise of a potential problem or to schedule temporary disruption of service was a difficult task. The Operations Group has developed alert protocols that define events and the people who should be notified when those events occur. There are currently six Alert Groups:

- PACS Alert Group—notified in the event of problems in the PACS
- RIS Group—notified of events of problems in the RIS or dictation systems
- Informatics Alert Group—alerts all Informatics personnel of system problems
- Radiologist Alert Group
- Technical Alert Group—includes all lead technicians, supervisors, and managers

- Hospital Alert Group—each affiliated hospital and medical center has a defined group that will be notified of problems specific to their institution.

The OP-Center notifies the Alert Groups using Group Alpha Paging, E-mail, and in some cases phone calls to specific Radiology reading locations.

CONCLUSION

Most PACS solutions and RIS systems provide software tools and applications that allow users to monitor the information and image flow and distribution within the Radiology environment. How an institution or enterprise utilizes these tools can have an impact on the level of service. Combining the pro-active monitoring of systems and operations with effective policy and procedures that specifically detail the steps to be taken when thresholds are exceeded or problems identified will have a positive outcome on service support levels. The Radiology

Informatics Group at CCF has taken the available monitoring tools and created a central OP-Center that can identify problem events, assist in troubleshooting problems, and effectively communicate PACS/RIS/network information to the users.

We will continue to acquire the tools that are

necessary to display in real-time all of the systems, applications, and events that are part of the PACS/RIS infrastructure within our enterprise. Troubleshooting and event management procedures will constantly be reviewed and revised as lessons are learned in maintaining appropriate service levels.