DDL Systems, Inc.

ACO PAGER™: Managing your System i (or AS/400) using wireless devices

Technical White Paper

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Introduction

Managing the complexities of today's operating systems, business applications, and networks challenges even the most knowledgeable IT professionals. The cost to an enterprise of unplanned downtime, loss of human expertise during sick leave or vacation, and system/application or environmental failure can be devastating. Today's systems management applications monitor all critical tasks and make increasing use of your existing expertise and technology to maximize system availability, improve productivity, and increase customer service.

Wherever business takes them, today's IT professional has to stay connected to the people and information they need to ensure system/application availability. Virtually everyone has a cellular phone these days and most devices are equipped with text (and two-way) messaging features. This whitepaper discusses how ACO PAGER™'s advanced monitoring and alert facilities (used in conjunction with built-in OS/400 services) and your two-way messaging device can provide you with a more efficient (and secure) way to remotely manage your System i (or AS/400®) system (hereinafter System i).

What is Two-Way Messaging?

Simply put, two-way messaging is a service (provided by your paging or cellular phone company) that allows you to send electronic text messages to another user or system. Two-way capable devices can significantly enhance remote systems management capabilities and can ensure that the right technical resources are managing the problem regardless of their proximity to the data center. Most major paging and cellular service providers offer some form of two-way messaging (or e-mail) support.

System i Messaging Applications

ACO PAGER™ is a systems management solution for the System i midrange computer system that monitors message queues (including QHST), job queues, output queues, spool files, IFS objects, active jobs, TCP/IP network devices, and much more. Specifically, it is designed to assist with automated computer operations by providing sophisticated message control, filtering, routing, auto-reply, and notification facilities in response to System i system events. ACO PAGER™ manages your System i 24-hours a day and notifies you immediately when problems occur. In order to integrate our systems management agents with the two-way messaging capabilities of your cellular phone, pda, or two-way pager, we rely on built-in components of OS/400 known as Simple Mail Transfer Protocol (SMTP) and the Anymail/400 framework. SMTP is easy to configure and everything you need is already included in OS/400 (V4R1 or higher).

Simple Mail Transfer Protocol (SMTP)

Simple Mail Transfer Protocol (SMTP) is the protocol that allows System i to send and receive e-mail. The SMTP protocol is essentially an end-to-end delivery of mail from one mail server to another. SMTP on System i supports the distribution of notes, messages, and ASCII text documents. SMTP can support formats other than plain text by using the Multipurpose Internet Mail Extensions (MIME) protocol. Refer to the "Parsing a Two-Way Reply (E-mail) Message" section in this document for more information.

System i E-mail API's

There are many ways to send e-mail on the System i. This whitepaper will focus on only two of them: 1) using the Send Distribution Command (SNDDST); and/or 2) the QtmmSendMail API. Both methods are used by the ACO PAGER Message Alert System to send event messages to your two-way device.

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Send Distribution Command

The Send Distribution Command (SNDDST) can be used to send e-mail from a "green-screen" or an System i program. The sender of the e-mail must be a local SNADS user and therefore, must be defined in the System i system distribution directory. The SNDDST command supports long message format and internet addressing; in other words, users can send e-mail to the Internet by entering a normal Internet e-mail address on the command.

QtmmSendMail API

The Send MIME Mail (QtmmSendMail) API allows you to send e-mail from an System i program. About the only difference between the SNDDST command and this API is that the QtmmSendMail API supports sending multiple attachments on the same e-mail message. It also requires that a formatted message exist on the System i Integrated File System (IFS) containing the body of the e-mail message.

ACO PAGER™ Systems Management Agents

Today's systems management solutions not only manage unsolicited messages from operating systems, applications, networks, and e-business application servers; but, they can also proactively monitor virtually any aspect of your System i. ACO PAGER™ consists of a set of monitors (agents) that continuously monitor "system health" and initiate corrective action when your System i needs assistance. Each monitor (listed below) is capable of communicating with ACO PAGER™'s notification engine based on user-defined instructions.

Message Queue Monitor

ACO PAGER™ monitors any system, user, or workstation message queue (including QHST) and performs the following user-defined actions based on the specific/generic message id and/or message text received:

- Message filtering
- Automatic or delayed message replies
- Processes two-way message replies and commands
- Performs reply confirmation and acknowledgment functions
- Message routing and forwarding
- Performs message threshold and/or dependent messaging functions
- Runs a user-defined command, program, or automation script
- Routes/copies messages to IBM's Tivoli® and BMC's Patrol Enterprise Manager®

RePage (escalation) Monitor

RePage Monitor allows paging (and other messaging functions) to be performed repetitively for messages that have NOT been replied to by a specific time in a monitored message queue. The RePage Monitor (ACOREPAGE) will re-send messages (based upon a user-defined time period) to an individual or the next person in the group (if group distribution was specified) if any inquiry messages go unanswered.

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Job Event Monitor

Would you like to know if a particular job is consuming excess CPU? Do you have a job that absolutely must run between the hours of 3:00 A.M. to 4:00 A.M.? Or, maybe you would like to monitor the size of a library, file, or IFS object? ACO PAGER™'s event monitors interrogate your system, identify potential problems, and respond before they become critical. Routine tasks are automated and important events are escalated to ensure fast and efficient problem resolution.

TCP/IP Monitor

ACO PAGER™ TCP/IP monitor detects the up/down status of devices connected to your TCP/IP network. If your System i 400 is connected to the Internet, you can detect the status of virtually any device in the world. "No response from host" event messages are immediately sent if network hosts cannot be located on the network.

Windows Monitor

ACO PAGER™'s Windows® monitor manages the system, application, and security event logs created by the Windows operating system. These logs contain similar information to the System i system operator message queue (QSYSOPR) and are vital in managing the "health" of these systems.

Enterprise Monitor

ACO PAGER™ is fully integrated with enterprise automation systems (like IBM's Tivoli® and BMC's Patrol Enterprise Manager®) and provides "end-to-end" monitoring for your System i system(s) in a heterogeneous platform data center.

Unattended Monitor

Like a job scheduler, ACO PAGER™'s Unattended Operations Monitor executes your commands and application programs based on user-defined instructions. However, unlike IBM's job scheduler, this scheduling engine can perform even while the system is in a *restricted* state. Use this monitor during restricted or non-restricted state processing to perform "lights-out" operations.

Two-Way Monitor

Use ACO PAGER™'s two-way monitor to remotely manage your System i system. This feature uses the capabilities of two-way pagers, pda's, and digital cellular phones (equipped with two-way messaging capabilities) to receive and respond to System i system/application messages and events. This monitor, in conjunction with System i electronic mail capabilities, is the focus of this whitepaper.

Sending a Two-Way Message from System i

ACO PAGER™'s message router accepts transactions from each monitor application previously listed. Based on user-defined instructions, the message transaction is delivered to the notification engine and subsequently, to your two-way messaging device. The process by which messages are delivered could be thought of as synchronous; a message is sent and a response is expected in return from the two-way device. However, the process is really an asynchronous transaction that expects a timely response to the sent message. In other words, the message is sent to the two-way device without the sending program waiting for a direct response. Instead, the message is sent as a "one-way" transaction to the device and the notification engine continues to process other requests.

Mail Flow from System i to the Internet

Figure 1 (below) illustrates the flow of a System i inquiry message (as processed by ACO PAGER™'s message queue monitor, router, and notification engine) that is being sent to a two-way messaging device:

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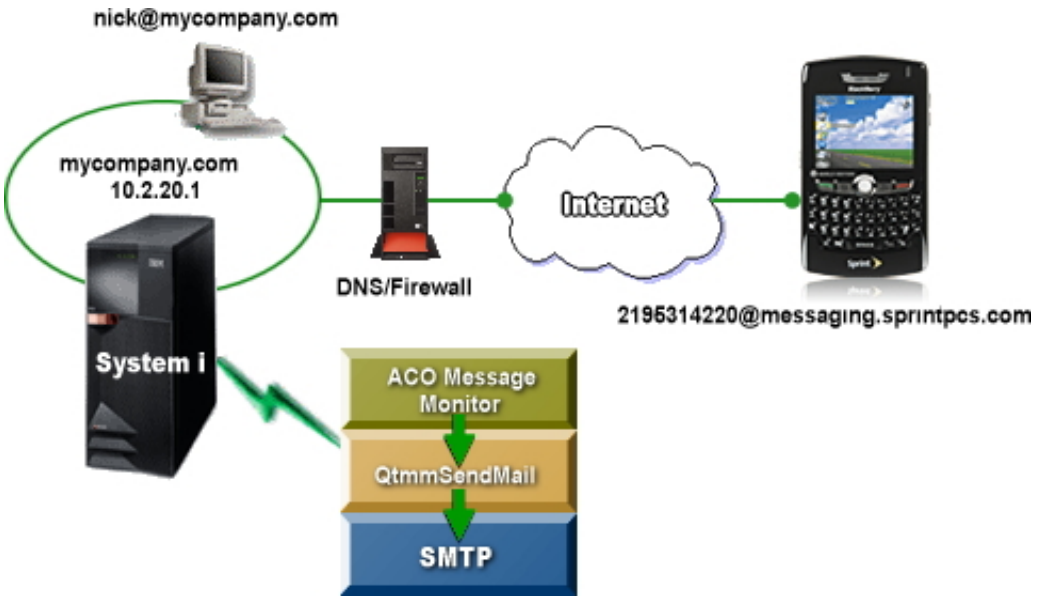

Figure 1. Mail Flow from System i to the Internet

First, the message is prefixed with any user-defined parameters (e.g. system name, queue name, job name/user id, message id, etc.) from the originating System i job. The length of the message is calculated and trimmed according to the service provider message length limitations (if any).

Second, the ACO notification engine encrypts the message to ensure security. The encrypted code is unique to the event being processed and will be used later on to match the two-way reply with the original message that was received in the System i message queue.

Next, the appropriate System i distribution directory entry is accessed to extract the sending (System i) systems e-mail address (aco2way@mycompany.com); this becomes the "From:" address of the e-mail message. The Send MIME Mail (QtmmSendMail) API is invoked and the message is sent (via SMTP) to the two-way e-mail address (2195314220@messaging.sprintpcs.com) that was extracted from ACO PAGER™'s internal tables.

Finally, SMTP checks to see if the e-mail addressee (2195314220@messaging.sprintpcs.com) is a user on the local server. If so, the message is sent to the user's mailbox on the local system. Since this is not a local address, SMTP resolves the host's address by using a domain name server (DNS) or a mail router (exchange server). Once the host address is resolved, SMTP sends the message to the two-way service provider via the Internet. Then, the service provider forwards the message to the two-way device. Refer to the "Network components" section in this whitepaper for more information on DNS and/or mail router options.

Receiving a Two-Way Reply Message on the System i

Once the message is received on the two-way device, the user simply enters a reply. The reply message is automatically sent back to the service provider network for processing. By default, the service provider system will forward the reply message to the "From:" address (aco2way@mycompany.com) on the e-mail message via the Internet. In order for your System i to receive e-mail, an MX entry is required (on your DNS server) to direct e-mail (based on the domain

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name) back to your System i system. Refer to the “Network components” section in this whitepaper for more information on how your DNS server uses MX records.

Mail Flow from the Internet to System i

Figure 2 (below) illustrates the flow of the two-way reply message back to your System i. All incoming mail from SMTP for local users (users with mail accounts on this System i) is processed by the AnyMail/400 framework. The mail server framework is a mail distribution structure that allows for the distribution of e-mail on your System i.

If you recall, ACO PAGER™’s notification engine packages all outbound messages (sent to the two-way device) with the same “From:” e-mail address (aco2way@mycompany.com). By doing so, the service provider routes all reply messages (regardless of the recipient that responded) to a single mailbox on the System i. This makes it relatively simple for the ACO PAGER™ two-way monitor to process all reply messages without having to scan all (or many) mailboxes on the system.

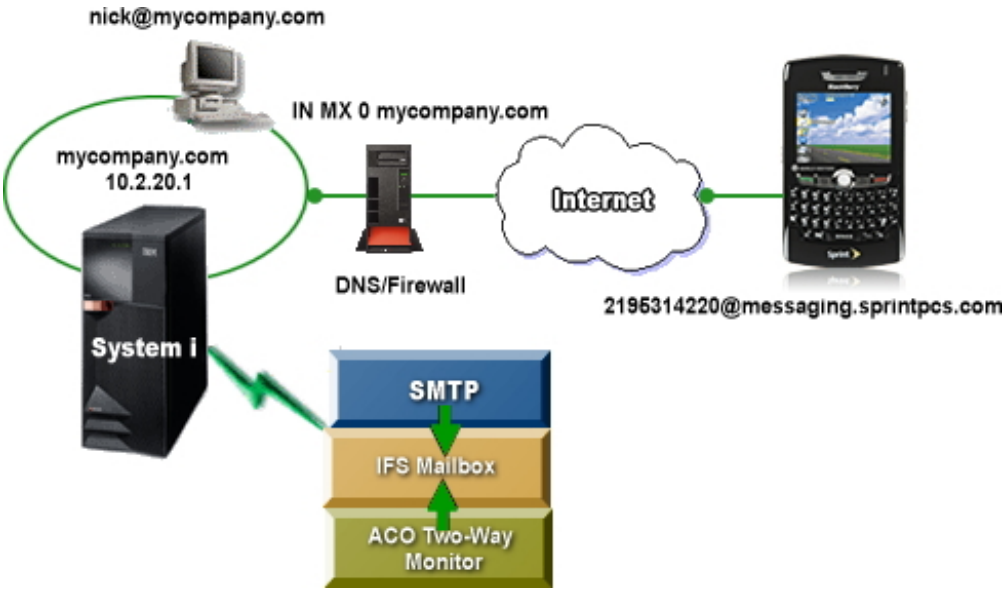

Figure 2. Mail Flow from the Internet to System i

Processing Two-Way Reply Messages

Now that the two-way reply messages are being routed back to the System i SMTP server, ACO PAGER™’s two-way monitor can process all incoming mail for the aco2way user id. ACO’s two-way monitor reads each mail message from the aco2way mailbox on the System i Integrated File System (IFS). Then, message reply/confirmation processing is conditionally initiated based on the contents of each received message.

Parsing a Two-Way Reply (E-mail) Message

ACO PAGER™’s two-way monitor identifies a valid reply message by parsing the individual e-mail messages that are sent to the aco2way user mailbox. The message is then scanned for the encrypted key information (appended to the original message) and automatically invokes the reply engine if the encrypted key matches a message needing a reply in ACO PAGER™’s internal tables. If so, it continues parsing the e-mail message to locate the actual two-way reply value that was entered on the

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device. If not, it simply discards the message and continues with the next available mailbox entry (if any).

The intent of this whitepaper is to present the flow of e-mail to/from the System i and the Internet. Therefore, this document does not identify specific instructions for parsing a SMTP/MIME message. However, the following information is available on the Internet (as defined by the IAB) to assist you with this process. The combination of three standard protocols defines the format of an SMTP message: RFC 821, RFC 822/RFC 1049, and RFC 974 (Request For Comment, a protocol recommended by the Internet Architecture Board). However, the base SMTP protocol has limitations; therefore, the MIME (Multipurpose Internet Mail Extensions) specification was defined (in RFC 1521 and 1522) to extend the capabilities of SMTP and let different mail systems communicate with each other without loss of content.

Replying to an System i Inquiry Message

Now that the two-way reply message has been properly parsed, ACO PAGER™'s two-way monitor is ready to reply to the original inquiry message. During the parsing process, the encrypted key information (from the two-way reply message) was matched against ACO PAGER™'s internal tables and a matching inquiry message was found. The database information (e.g. originating message queue, library, and internal message key) is then used to construct a special reply message that will be sent (internally) to the ACO PAGER™ message monitor that is responsible for managing the originating message queue. Once received by the message monitor, a reply is sent to the inquiry message via the Send Reply (SNDRPY) command.

The ACO PAGER™ message monitor verifies if the reply was successful. If so, a confirmation message is sent back to the two-way device (recipient) that sent the reply and a history record is created that includes all of the details regarding the original message and the reply. If the reply was not successful, a negative confirmation message is sent to the two-way device and the user is prompted to reply again. This process is repeated until a valid reply is received and the inquiry message has been successfully responded to.

Network Components

Various network components (hardware and software) work in conjunction to support electronic mail on the System i. The following topics review a few of the fundamental concepts.

Domain Name System (DNS)

Domain Name System (DNS) is a distributed database system for managing host names and their associated Internet Protocol (IP) addresses. DNS servers work together to allow computers to communicate across the Internet and Simple Mail Transfer Protocol (SMTP) uses DNS for sending electronic mail by using mail exchanger (MX) information. If the network is using DNS, SMTP queries the DNS server to find out which host servers can be used to deliver the message.

Mail Exchanger (MX) Records

Your System i must have a unique (or sub) domain name by which this System i system is known to the TCP/IP network. In order for your System i to receive e-mail, a mail exchanger (MX) entry is required (on the DNS server) to direct inbound e-mail (based on the domain name) back to your System i system. MX records map a domain name to a host name and IP address. Normally, your "in-house" mail (e.g. mail sent to anyone@mycompany.com) is directed to an internal exchange (or Domino) server and stored in a POP mailbox. The messaging scenario presented in this whitepaper requires that all two-way reply messages be sent back directly to the System i; not an exchange (or Domino) mailbox. The MX record defined in the DNS server provides the needed e-mail message routing back to the System i SMTP server.

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Exchange Server

If the System i is not configured to use DNS, it must be configured to use a mail router (usually a local exchange server). SMTP determines the name of the mail router (if configured) from addressing information that is found in SMTP and the message is sent to the exchange server for distribution to the Internet.

Security Considerations

Securing your System i is a complex subject that will not be addressed in detail by this whitepaper. Many resources are available that discuss methods for securing your System i. Refer to the IBM System i Information Center (on the web) at http://publib.boulder.ibm.com/pubs/html/as400/ or the IBM Redbook SG24-4929-00 "AS/400 Internet Security: Securing Your AS/400 from HARM in the Internet," for more information. Today, most company networks utilize firewalls, proxy servers, and NAT so only a few pertinent security topics are discussed below.

Message Encryption

As previously mentioned, ACO PAGER™'s notification engine encrypts each message transaction prior to being sent to the Internet and the two-way service provider. The encrypted value is based on the received message and is used (during reply processing) to match two-way reply messages with the original message that was received in the System i system. The encryption process prevents erroneous e-mail (received on the System i) from being processed by the ACO PAGER™ two-way message monitor.

Network Address Translation (NAT)

In order to communicate on the Internet, your System i must have a unique, registered IP address. Network address translation (NAT) allows your system to access the Internet safely without having to change your private network IP addresses. Just as the name implies, NAT is a mechanism that translates one IP address into another. In most cases, you will want private IP addresses on your internal network; however, you must use public IP addresses to communicate with Internet hosts. Therefore, you use NAT to convert your private IP addresses to public addresses. This ensures that IP traffic (e.g. SMTP messages) from your System i is routed through the Internet.

Performance Factors

There are many different factors that address performance. Given the diversity of your System i system, applications, workload mix, network speed, and the performance of connected systems, some of the recommendations may or may not be applicable. There are typically trade-off's in providing better performance; therefore, it's important that the costs and benefits are understood prior to making any changes.

CPU, Disk, Utilization Factors

SMTP requires some free disk space to operate. When the ASP threshold is reached, sending and receiving mail using SMTP is halted. Keep your system as clean as possible and secure your system to prevent spamming or other attacks that could flood your system with unwanted objects. If necessary, you can adjust the run-time priority of the SMTP and/or the Mail Server Framework jobs to minimize CPU impact of these jobs on the System i. Refer to the IBM Redbook SG24-4929-00 "AS/400 Internet Security: Securing Your AS/400 from HARM in the Internet," for more information on this topic.

Network Factors

System i mail can be routed through any number of network hosts before being delivered to the recipient. Because of this, SMTP is extremely dependent on the overall speed of the network. Network

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speed, traffic, and message volume are all key components of performance. Many cost-effective options are available today to improve the speed, efficiency, and reliability of your network.

Avoid Unnecessary Messages and Reduce Message Size

Certainly, one way to minimize network traffic is to reduce the number of repetitive (or duplicate) transactions over the network. ACO PAGER™'s message monitors can perform different user-defined actions based on the *frequency* of a specific message (in the System i message queue) within a user-defined time duration. For example, a TCP/IP device failure could flood your system with duplicate network failure messages. ACO's message monitors eliminate these situations and thereby increase network efficiency. In addition, ACO PAGER™'s notification engine formats (or compresses) e-mail messages based on a set of user-defined parameters. Only the most pertinent information is packaged (from the original message) and sent over the network; thereby, decreasing network transmission time.

Summary

In today's competitive global economy, businesses need to get the most out of their people and systems. Systems management solutions allow your business to leverage people skills while minimizing downtime, thereby improving productivity, and increasing customer service levels. Today's IT professional is responsible for managing complex heterogeneous data centers, mission-critical business applications, and e-business infrastructures that demand mobility and access to people and systems regardless of their physical proximity to the data center. Using ACO PAGER™'s advanced messaging features in conjunction with a two-way capable Smartphone, cellular phone, pda, or pager simplifies remote systems management and improves the productivity of your personnel.

ACO PAGER™ is easy to use and surpasses the competition in its ability to proactively monitor and respond to complex problems before they reach critical status. No other system lets you control your System i system(s) with the same depth of automation, consistency, accuracy, and convenience as the ACO PAGER™ Message Alert System. More than a paging system, ACO PAGER™ is a complete systems management solution for your System i.

About DDL Systems

DDL Systems, Inc. is committed to developing software products that increase the efficiency, reliability, and productivity of the data center. We are a leading global provider of IBM System i Systems Management and Paging products that help our customers achieve these goals. We are focused on continuous improvement and on building strategic partnerships with industry providers to ensure that our customers receive the most powerful, integrated, and efficient solutions possible.

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