Launch Control System Message Reduction

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System Monitoring and Control (SMC) message browsers receive many messages daily that operators do not need to see. My job is to reduce the number of messages so that warning and emergency messages can be seen easily and therefore, responded to promptly. There are two methods to reduce messages: duplicate and state-based message correlations. With duplicate message correlation, SMC display the message the first time it shows up. The next times it occurs, a duplicate number will count the number of times the message appears. State-based message correlation is a process in which more informative messages acknowledge less useful ones and send them to history. I also work on correcting the severity level and text formats of messages. I follow two SMC message filtering tenets as I'm working on this project. Firstly, before filtering an offending message, a non-conformance (NC) must be created in order to attempt fixing that message through hardware or software. Only after the NC assessment states that it cannot fix an offending message, it can be filtered by SMC. Secondly, per Launch Control System (LCS) Coding Standards, SMC does not send information messages to the active message browser unless it's a response to an operator action.

Nomenclature

LCS	=	Launch Control System
SMC	=	System Monitoring and Control
DA	=	Development Activity
PWS	=	Portal Workstation
LDA	=	Launch Control System Development Set A
HP	=	Hewlett-Packard Company
OMU	=	HP Operations Manager for UNIX
NNM	=	HP Network Node Manager
COTS	=	HP Commercial-Off-The-Shelf
NC	=	Non Conformance
CMS	=	Common Services and Framework

I. Introduction

THE System Monitoring and Control (SMC) is responsible for controlling, configuring, and monitoring various LCS hardware and software during launching events. SMC uses HP Commercial-Off-The-Shelf (COTS) software to maintain communication between the SMC components. SMC agents analyze the health and status of numerous machines and summarize it in the form of messages. The SMC agent then forwards this information to the SMC Management Server, where it will be stored, processed, and displayed to the operators via the SMC message browser. Messages can be formatted, correlated, and duplicated by using the HP Operations Manager for UNIX (OMU) and the HP Network Node Manager (NNM).

II. Testing

I spent the first few weeks in the firing room to observe messages that might cause problems. The operators were doing validation dry-runs and system tests. I compiled a list of messages from these two sets, along with the messages that the operators wanted to fix. I also ran some tests in the LCS Development Set A (LDA) to ensure that the changes I made last semester were successfully implemented.

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III. Development Activity (DA) Assignment

My whole project centers around a single DA which was written to improve SMC messages. The DA has five parts. The first part addresses the problem with time delays in displaying messages. The second part mentions the incorrect severity and inconsistent verbiage in messages. The third part is about timestamp replacement when messages correlate. The fourth part states that failure messages are not displayed in the message browser. The fifth part talks about too many messages.

A. Time Delay

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Emergency		--X--X-	19:24:03 03/31/14	ldapws001	HP Operation...	OpC	Node ldapws001 is probably down. Contacting it with ping packages failed. (OpC40-436)
Emergency		--X--X-	19:20:16 03/31/14	ldapws001	HP Operation...	OpC	Failed to contact node ldapws001 with BBC. Probably the node is down or there's a network problem. (OpC40-191
Emergency	1	--X--X-	19:21:47 03/24/14	ldapws009	SNMPTraps	SMC_TRAP	Node or Connection Down
Emergency	1	--X--X-	19:21:27 03/24/14	ldands001	SNMPTraps	SMC_TRAP	Interface Down

Figure 1. Emergency messages took a few minutes to appear.

When a node or a network is turned off, emergency messages are supposed to appear in the message browser, like those shown in Fig. 1. The operators did receive messages that provided sufficient information about the nonfunctioning node. In case these messages are not received, NNM is configured to send secondary messages. I observed during a validation testing that on average, secondary messages took about 1 or 2 minutes to appear where the messages should only take a few seconds to appear. This is a NNM COTS software configuration error and is now fixed in 15-1 Iteration 5 development baseline.

B. Incorrect Severity and Inconsistent Verbiage

The operators want to change the alarm level of the two messages shown in Fig. 2. The network message comes from a switch. Its severity is advisory. The host message comes from a portal workstation (PWS). Its severity is warning.

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Advisory	1	-----X-	12:29:29 04/01/14	ldands001	smc_netconf...	SMC_AUTO	NETWORK UTIL IF DOWN: switch=ldands001 port=1:1 ifindex=1001
Warning	1	-----X-	12:29:29 04/01/14	ldapws001	smc_netconf...	SMC_AUTO	HOST UTIL IF DOWN: switch=ldands001 port=1:1 ifindex=1001

Figure 2. Messages with incorrect severity.

Upon operators' request, I changed the network message from advisory to warning because it indicates a problem that can impede normal operations. Likewise, I changed the host message from warning to emergency because it indicates a problem that requires immediate action. When the host is down, it can affect other services. I also changed the severity of system server message from advisory to emergency. I'm still in the process of working on this message because the correlation did not work correctly. When the switch from a system server was pulled, an emergency message did appear. However, a normal message failed to show up after the switch was put back in. The timestamps on both messages were the same, causing NNM to send them to SMC at the same time. For the rest of the internship, I will work on solving this issue.

Inconsistent and vague verbiage also makes it hard for the operators to keep track of messages. There are several generic messages that are formatted differently but have the same meaning. For an example, "Node or Connection Down" and "Interface Down" generally state that a node is down but they do not provide any valuable information. The messages in Fig. 2 should replace those two messages because they provide more useful information like the switch number, the port number, and the interface index.

C. Correlation

To improve readability, I changed the wording of the message in Fig. 3. This message is generated when the hardware map of the host is missing or incorrect. Therefore, the message should show unknown host, rather than link event. The first two messages in Fig. 4 are the modified versions of the message in Fig. 3. The last two messages in Fig. 4 are generated from the trap. They are there to ensure that an up message and a down message are received in case SMC fails to send unknown host messages. However, the trap messages do not provide enough information. The only messages that the operators need to see are the unknown host messages. As a result, I created two correlation conditions to send "…Interface Up…" and "…Interface Down…" to history.

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Advisory		-------	20:18:57 03/31/14	ldasmc001	smc_netconf...	SMC_AUTO	LINK EVENT (PID-541) ABORT: Failed to find ldancs001 9046 in hardware configuration map (/lcs/hwid/lda_hardware.x

Figure 3. Message's wording needs to be revised.

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Normal	1	-----X-	19:32:01 03/26/14	ldasmc001	smc_netconf...	SMC_AUTO	UNKNOWN HOST IF UP: switch=ldands002 ifindex=1007 failed to be found in set hardware configuration map (/lcs/hwid/lda_hardware.xml)
Emergency	7	-----X-	16:26:05 03/24/14	ldasmc001	smc_netconf...	SMC_AUTO	UNKNOWN HOST IF DOWN: switch=ldands002 ifindex=1005 failed to be found in set hardware configuration map (/lcs/hwid/lda_hardware.xml)
Normal		--XF-X-	14:09:45 03/20/14	ldancs002	SNMPTraps	SMC_TRAP	9026 Interface Up (linkUp Trap)
Emergency	6	--XF-X-	14:09:43 03/20/14	ldancs001	SNMPTraps	SMC_TRAP	9023 Interface Down (linkDown Trap)

Figure 4. Correlated messages.

D. Timestamp Replacement

The operators complained that message correlation replaced timestamps of older messages, making it unable to determine the exact sequence of events and exact time of failures. This can be solved by clicking on message properties, shown here in Fig. 5. Under Annotation section, it will list the acknowledged messages, their IDs and timestamps.

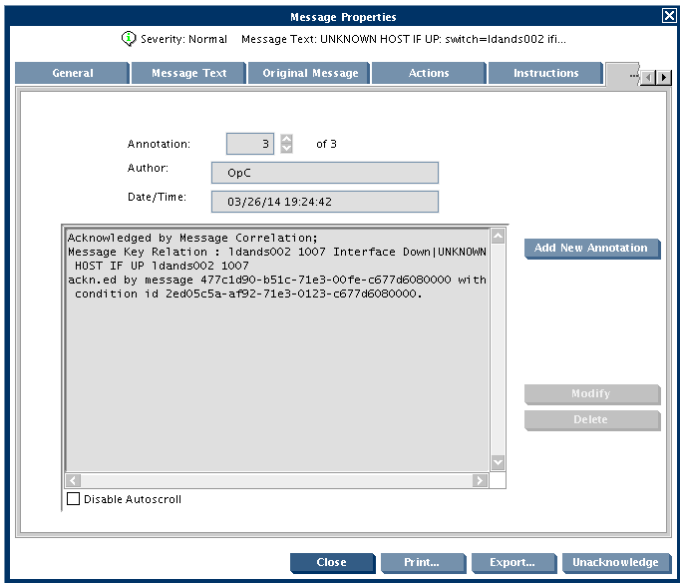

Figure 5. Date/Time box shows the timestamp of the acknowledged message.

E. Failure Messages

The operators also stated that a failure message was marked as normal and sent to history, instead of appearing in the browser. The message is "…Input voltage to AC power supply in slot 3 is off". Normal messages are often automatically acknowledged because they do not indicate an abnormal activity. To send the message back to the browser, I unchecked the box "On Server Log Only", which is shown in Fig. 6. I also created two new conditions for the on and off messages so that they can acknowledge each other, shown here in Fig. 7. The severity of the off message was changed to advisory.

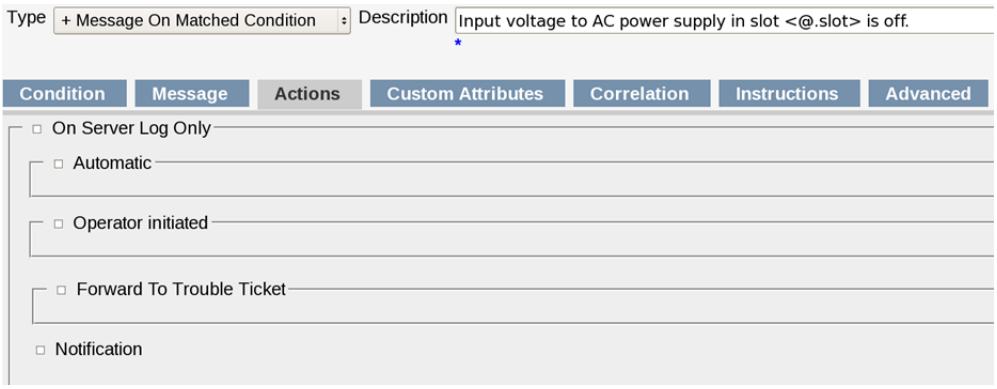

Figure 6. Uncheck "On Server Log Only" to send the message to the browser.

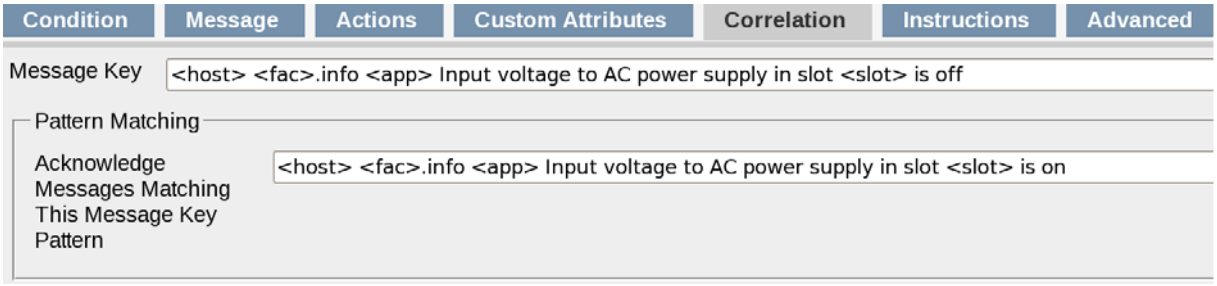

Figure 7. On and off messages acknowledge each other.

F. Message Overload

The final part of the DA talks about message overload. The ultimate goal of my internship is to reduce the number of messages displayed in the message browser. So I asked the operators to give me a list of messages that I could fix during my internship. Some of these messages come from sendmail application. Sendmail is not used by either the operators or the SMC group. Therefore, it was strange that we found it in the browser. I found out that an application called LogWatch caused sendmail to execute. LogWatch is not configured to run, so it uses its default setting by sending out emails. Sendmail is not configured to run either so it sends out error messages to syslog-ng, another application. SMC picks up messages from syslog-ng and display them on the browser. LogWatch will be removed to solve this problem.

I also needed to resolve one message from Common Services and Framework (CMS) application. After talking to the CMS group, I found out that this advisory message reports a single packet drop. It could not be removed from the message browser because it was necessary. The message is generated when the transmitting end sends more samples than the receiving end can accept. During normal operation, the transferring rate between the transmitter and the receiver should not differ but these messages only appeared during performance testing. Originally, these messages appeared as separate messages even though they came from the same node. As a result, they quickly occupied a lot of spaces in the browser, as shown in Fig. 8. To solve this problem, I implemented duplicate message correlation so every time the message from node ldasm001 appears, the number in column Dup. in Fig. 9 increases by one. If the operators wish to see the number of times that the message occurred, they only need to look at the duplicate number, instead of going through millions of repetitive messages.

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Advisory		-------	17:28:54 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:28:50.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611262
Advisory		-------	17:29:00 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:28:56.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611298
Advisory		-------	17:29:10 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:29:02.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611328
Advisory		-------	17:29:13 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:29:08.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611370
Advisory		-------	17:29:20 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:29:14.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611394
Advisory		-------	17:29:24 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:29:20.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611436
Advisory		-------	17:29:30 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:29:26.000 CMSSUB:ReaderListener: 1 Sample(s) Rejected on topic MEASUREMENT, reason = 2, total_count = 611472
Advisory		-------	17:31:20 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:14.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585525
Advisory		-------	17:31:24 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:20.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585579
Advisory		-------	17:31:27 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:26.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585585
Advisory		-------	17:31:40 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:32.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585639
Advisory		-------	17:31:44 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:38.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585693
Advisory		-------	17:31:50 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:44.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585699
Advisory		-------	17:31:53 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:50.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585753
Advisory		-------	17:31:59 07/16/14	ldasmc002	CMS	SMC_SYSLOG	Jul 16 17:31:56.000 CMSSUB:ReaderListener: 1 Sample(s) Lost on topic MEASUREMENT, total_count = 585775

Figure 8. The same messages from the same node appear multiple times on the browser.

Severity	Dup.	SUIAONE	Time Last Received	Node	Application	MsgGrp	Message Text
Advisory	1215	-----X-	18:17:28 07/16/14	ldasmc001	CMS	SMC_SYSLOG	Jul 16 18:17:22.000 CMSSUB:ReaderListener: Sample(s) Rejected on topic MEASUREMENT, reason = 2
Advisory	318	-----X-	18:16:54 07/16/14	ldasmc001	CMS	SMC_SYSLOG	Jul 16 18:16:46.000 CMSSUB:ReaderListener: Sample(s) Lost on topic MEASUREMENT
Advisory	32	-----X-	18:15:10 07/16/14	ldasmc001	CMS	SMC_SYSLOG	Jul 16 18:15:06.000 CMSSUB:ReaderListener: Sample(s) Rejected on topic EVENT, reason = 2

Figure 9. Duplicate numbers count the number of times the messages appear.

One of the messages that the operators asked me to investigate was "Authentication failure". The operators saw a lot of them in the message browser and they did not know the cause. I found out that this message appears when someone tries to access the switches with an invalid password. It should not be blocked since the message is a warning of potential attacks. The message can also be generated during security scans. If the operators see this in the future, they need to report to security group.

The operators also liked to turn off certain messages in history browser, like the ones shown in Fig. 10. After some investigation, I informed them that these messages cannot be turned off. They are there to notify if something

is wrong with the network. Usually, the messages are generated when Record and Retrieve Servers are down or the system is looking for the IP address.

From talking to various people, I obtained the NC numbers for the redundant messages. Other groups were working on these problems. The NC numbers will be given to the operators as references.

Severity	Dup.	SUIA0NE	Time Last Received	Node	Application	MsgGrp	Message Text
Normal		-------	00:06:02 07/13/14	ldarfs001	mountd	SMC_SYSLOG	Jul 12 20:05:58.000 authenticated unmount request from 10.44.0.15:1008 for /rruf (/rruf)
Normal		-------	00:06:02 07/13/14	ldarfs001	mountd	SMC_SYSLOG	Jul 12 20:05:58.000 authenticated unmount request from 10.44.0.15:703 for /rrdata (/rrdata)
Normal		-------	23:55:02 07/13/14	ldarfs001	mountd	SMC_SYSLOG	Jul 13 19:55:00.000 authenticated mount request from 10.44.0.11:838 for /rruf (/rruf)
Normal		-------	23:55:02 07/13/14	ldarfs001	mountd	SMC_SYSLOG	Jul 13 19:55:00.000 authenticated mount request from 10.44.0.11:843 for /rrdata (/rrdata)

Figure 10. Messages in history that the operators would like to turn off.

IV. Conclusion

I've learned a lot from this internship. I learned that messages come from different sources. When an event occurs, several messages are sent to SMC. Sending several messages for a single event may seem redundant. However, it is important that the messages successfully reach the operators. For an example, whenever a PWS is turned off, there should be three messages sending to SMC Agent. One is from NNM Server; the other is from OMU; and the third one is from the switch. In case one of the three fails to send the message, we still have the other two.

I also learned that it's better to solve a problem from the source. If the problem is not solved from the source, it may return later and is harder to fix than before. For an example, if a message from the switch is not behaving correctly, I should trace to the root of the problem and ask the network group to fix it. Only if they cannot fix it, then SMC group can mask the message.

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