

Application Triage

Final Findings Report

Compuware Solution Delivery Group

Compuware
Vantage™



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EXECUTIVE SUMMARY

Description

Acme Corporation contracted Compuware Performance Solutions for an Application Triage service to assess the performance problems with Acme Corporation's Leasepro application. The Application Triage service combines the expertise of Compuware Performance Solutions consultants with the strengths of Vantage, Compuware's premier performance management technology, to deliver independent, rapid troubleshooting services.

Objectives

The engagement was focused on understanding and correcting issues related to the operation of Leasepro in the Citrix Metaframe XP environment. The most critical issue occurred when instances of Leasepro ran out of control on the host Citrix servers. If left unchecked, these instances would eventually consume all available processing resources on the Citrix server. Ultimately, all user activity on the server would be affected, and the server would be in danger of failing due to lack of resources. Several (minor) other issues related to Leasepro operation were also diagnosed during the engagement.

Findings

The monitoring provided by Compuware Vantage tools quickly revealed that the Acme Corporation's network and Sybase database were not causing the aforementioned Leasepro issues. Therefore, attention was directed toward the operation of the actual application in the Citrix environment. The information provided to Leasing Systems (the Leasepro vendor) aided in their finding an endless loop in their code. Correcting this issue appears to have corrected the most critical issue. Also discovered were several minor issues which are problematic for individual users but are not liable to affect other users' performance or general server health.

Issues and Recommendations

Issue #1 - Leasepro Client Caught in Endless Loop - This critical issue resulted in orphaned Leasepro processes utilizing CPU resources on Citrix servers. Information provided to Leasing Systems aided in tracking down an endless code execution loop. Before the end of the engagement, an updated dynamic linked library (dll) provided by Leasing Systems had solved this issue. Compuware recommends that Acme Corporation consider using a server monitoring tool such as ServerVantage to alert administrators when these types of issues arise. This would also enable administrators to verify that deployed software continues to use server resources correctly.

Issue #2 - "Lease Selection" Causes Application to Freeze - When a user chooses "Lease Selection" from the dropdown menu, the Leasepro application crashes. Since this selection is not used by Leasepro users, Compuware recommends that this item be removed from the application menu.

Issue #3 - Interactions Between Leasepro and Davox Cause One or Both to Crash - There are some instances when the communication between the Davox predictive dialer and Leasepro will fail. This results in Leasepro looping endlessly as it waits for communication from the Davox application. Compuware recommends that Acme Corporation work with Leasing Systems to establish a DDE timeout setting that will allow Leasepro to continue functioning in the event that Davox communication is interrupted.

Issue #4 - Changing User Password Causes Leasepro to Crash or Freeze - The feature that allows changing user passwords is not functioning. When a user selects this option, Leasepro crashes and/or presents an error message. Compuware recommends that Acme Corporation work with Leasing Systems to understand the cause of this issue.

Conclusions

In conclusion, Compuware believes that most of the issues with the Leasepro application performance lie in the application itself as opposed to the supporting network, database, and/or server infrastructure. The issues do not seem to be a function of application architecture, but rather several isolated bugs that must be addressed individually with Leasing Systems.



ENVIRONMENTAL DESCRIPTION

Method of Data Capture

Data capture was performed with using Compuware's suite of Vantage Application Performance Monitoring software. The software was installed strategically as follows:

End User Transactions

End user transactions were captured by placing Compuware ApplicationVantage Agents on the Citrix servers where Leasepro is installed. This allowed the capture of all network traffic between the Sybase database and the Lpadriver application running on the UNIX server.

Servers

Server data was captured by installing Compuware ServerVantage Agents on a test server as well as a single production server. This allowed the logging of server resource utilization during the length of the engagement.

Databases

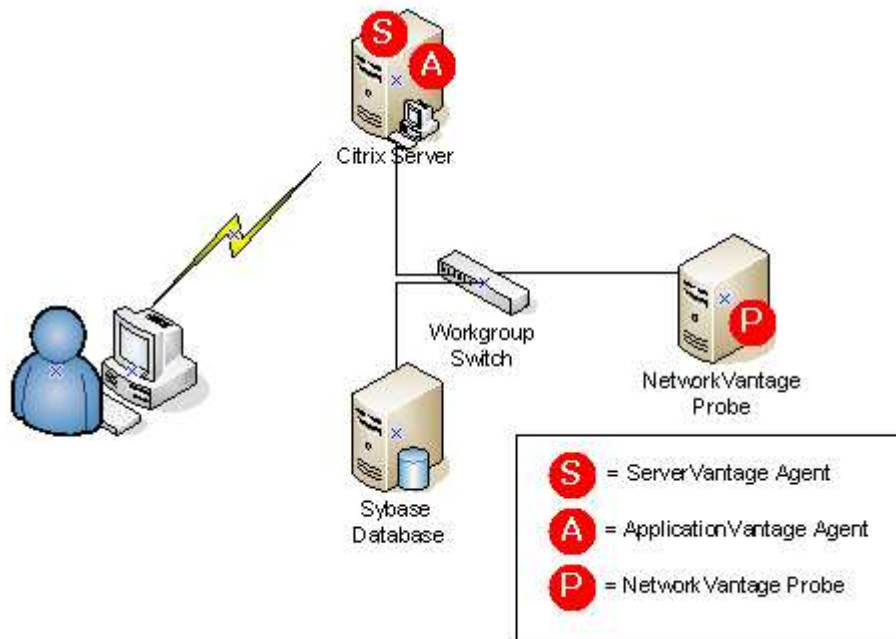
Database traffic was analyzed using Compuware ApplicationVantage to monitor conversations between Leasepro and the Sybase database. This allowed ApplicationVantage to reveal the response time of the database in production use.

Network

Network utilization was monitored over the length of the engagement using Compuware NetworkVantage. Network traffic was mirrored from the switch port location of the application server to the port where the NetworkVantage probe was listening. This allowed NetworkVantage to characterize application network utilization.

Topology

The monitoring environment is depicted below



FINDINGS

End User Transaction Findings

- Individual end user transactions are generally responsive.
- The "Save a Note" transaction was the transaction most liable to cause Leasepro to freeze. This was revealed through monitoring and discussions with end users.
- There are transactions (Lease Selection, Change Password) that will always cause Leasepro to freeze, crash, or display errors.

Server Findings

- Without intervention, the Citrix servers would trend toward 100% CPU utilization by orphaned Leasepro processes. This happened on every server in the Citrix before the Leasing Systems provided an updated dll. Long Citrix connection timeout values (enabled by design) serve to further aggravate this issue by maintaining the orphaned processes for hours after the user disconnects.
- Disk Utilization, Memory, and Network Utilization were all within reasonable levels on the production Citrix servers.

Database Findings

- In general, database operations were fast. The response time component attributable to database time is very low. Improvements to database performance would not likely improve end user response time perception.
- There were no database operations that appeared related to application issues. In other words, the application issues detailed in this document are not likely related to any database issues.
-

Network Findings

- LAN utilization of application servers is within reasonable levels.
- There were no application issues that were related to network bandwidth or latency. In other words, the application issues mentioned in this document are not related to network capacity or architecture.

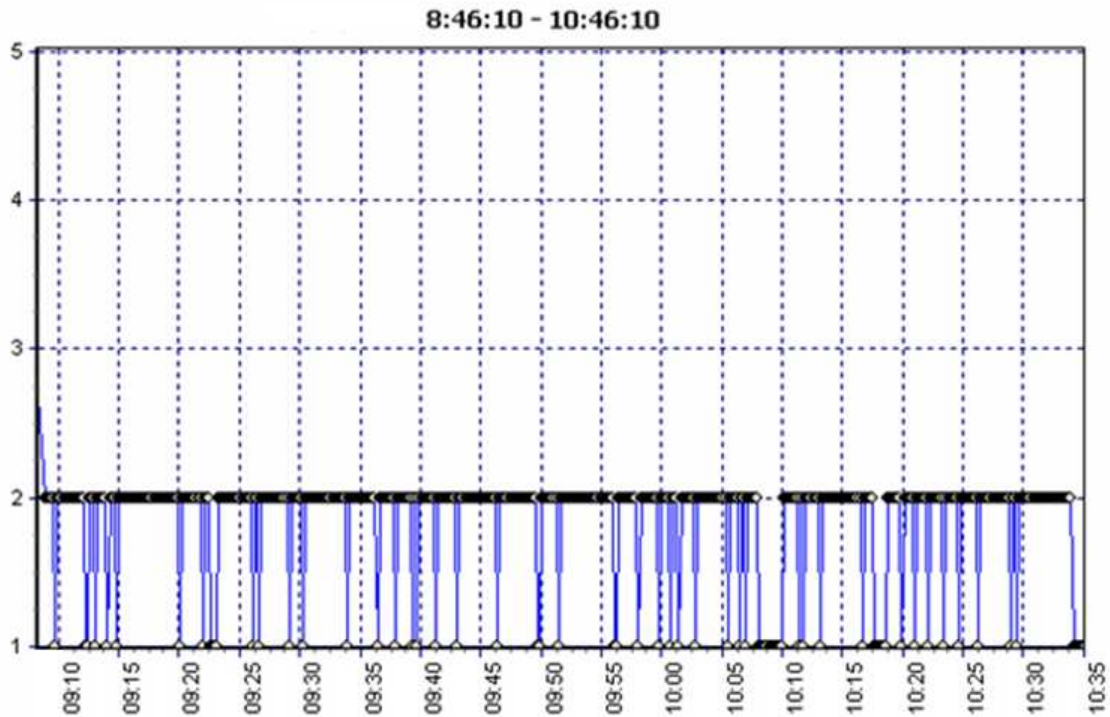
ISSUES AND RECOMMENDATIONS

Issue #1 - Leasepro Client Caught in Endless Loop

Description

A sequence of user actions causes the Leasepro application to either crash or stall. This seems to be occurring most often when a user saves a note. After the application stalls, the user forcibly exits and restarts. This leaves an orphaned process running on the Terminal Server (as well as the newly executing process). This consumes nearly all available processing capacity (25% of total processing available to a dual CPU, hyper-threaded server).

A closer examination shows that the single thread spends nearly all of its time in the **RUN State** (State 2). This accounts for the high level of CPU utilization.



- **DESCRIPTION:** ServerVantage chart showing Thread State of Leasepro thread.
- **OBSERVATIONS:** This chart shows the Thread State of the running Leasepro thread. Since the thread is almost always in Run Mode (Thread State=2), the thread is continuously using CPU time.

The orphaned process remains until the user's Citrix session is terminated (or the user's computer is rebooted). As various users experience this condition, the orphaned processes accumulate on a given server as shown below in the Window Task Manager. Ultimately, this causes a nearly 100% utilization of the server's CPU resources. The following screenshot shows Leasepro.exe processes consuming 95% of a server's CPU time.



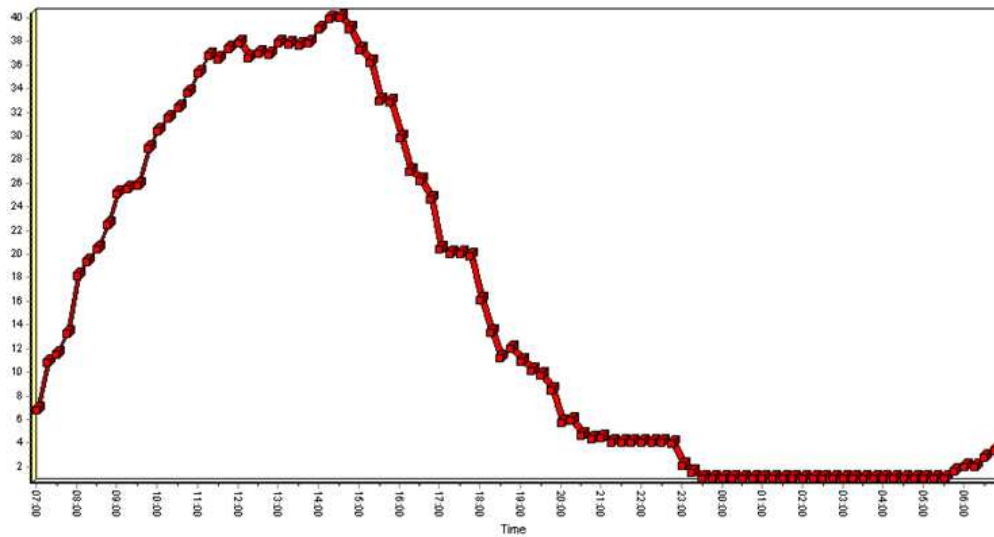
Image Name	PID	User Name	CPU	CPU Time	Mem Usage	VM Size
leasepro.exe	22560	hanlonl	24	2:51:23	22,564 K	16,996 K
leasepro.exe	7172	cervanr	24	0:09:48	22,656 K	15,460 K
leasepro.exe	10692	holienc	23	0:34:28	18,352 K	11,484 K
leasepro.exe	2008	petersk	23	2:20:44	18,812 K	12,104 K
ACLIENT.EXE	1436	SYSTEM	02	10:03:25	11,976 K	13,604 K
javaw.exe	16376	svcuser	01	0:49:06	27,296 K	36,708 K
ssonsvr.exe	24488	hanlonl	00	0:00:00	1,624 K	348 K
vcipop.exe	24444	holienc	00	0:00:02	1,920 K	2,108 K
csrss.exe	24044	SYSTEM	00	0:00:03	3,164 K	1,016 K
leasepro.exe	23908	coolm	00	0:00:06	17,084 K	10,768 K
wfshell.exe	23832	holienc	00	0:00:00	7,272 K	3,952 K
wfshell.exe	23736	garciade	00	0:00:00	7,172 K	3,972 K
winlogon.exe	23552	SYSTEM	00	0:00:02	4,068 K	3,544 K
ssonsvr.exe	23416	stortod	00	0:00:00	1,624 K	348 K
wfshell.exe	23412	sfeirj	00	0:00:00	7,072 K	3,972 K
ctfmon.exe	23332	blanchi	00	0:00:00	2,544 K	532 K
naPrdMgr.exe	23240	SYSTEM	00	0:08:19	2,224 K	14,440 K
csrss.exe	23156	SYSTEM	00	0:00:01	3,024 K	992 K
icabar.exe	23140	patelssa	00	0:00:00	4,788 K	1,800 K
leasepro.exe	22960	martinro	00	0:00:08	18,228 K	11,840 K
rdpclip.exe	22956	svcuser	00	0:00:00	2,704 K	856 K
winlogon.exe	22936	SYSTEM	00	0:00:06	3,828 K	3,496 K
Appromnu.exe	22904	nerdirn	00	0:00:00	7,860 K	3,988 K
HPROTD.FXF	22844	SYSTEM	00	0:00:00	2,372 K	528 K

Processes: 297 CPU Usage: 100% Commit Charge: 1935M / 4901M

- **DESCRIPTION:** Windows Task Manager showing several runaway Leasepro processes.
- **OBSERVATIONS:** At this point, the available CPU resources are almost completely consumed by these four Leasepro processes.

The following chart shows the number of active Terminal Services sessions on one of the production Citrix servers (CITRIXSVR04) during an entire day.

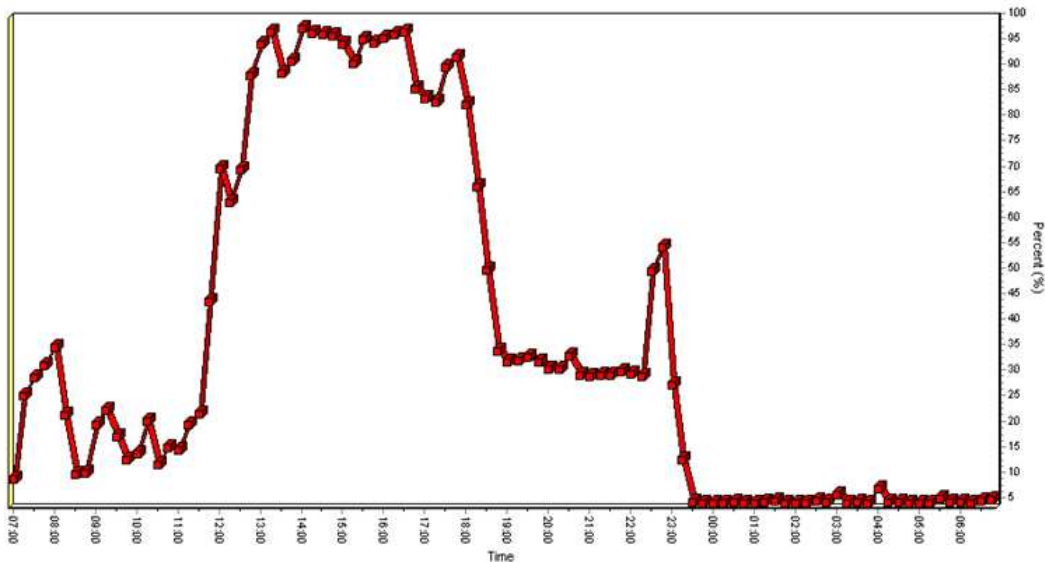
BAD - TS Sessions



- **DESCRIPTION:** ServerVantage chart showing Terminal Services Active Sessions
- **OBSERVATIONS:** This chart shows the number of active users logged into the Citrix Terminal Server (CITRIXSVR04) during an average day.

In order to see the effect of the orphaned Leasepro processes, consider the following chart which shows CPU Utilization during the same time period. In this case, the CPU is quite heavily utilized between 12 PM and 7PM. Between 1 PM and 6PM, the average utilization is close to 95%.

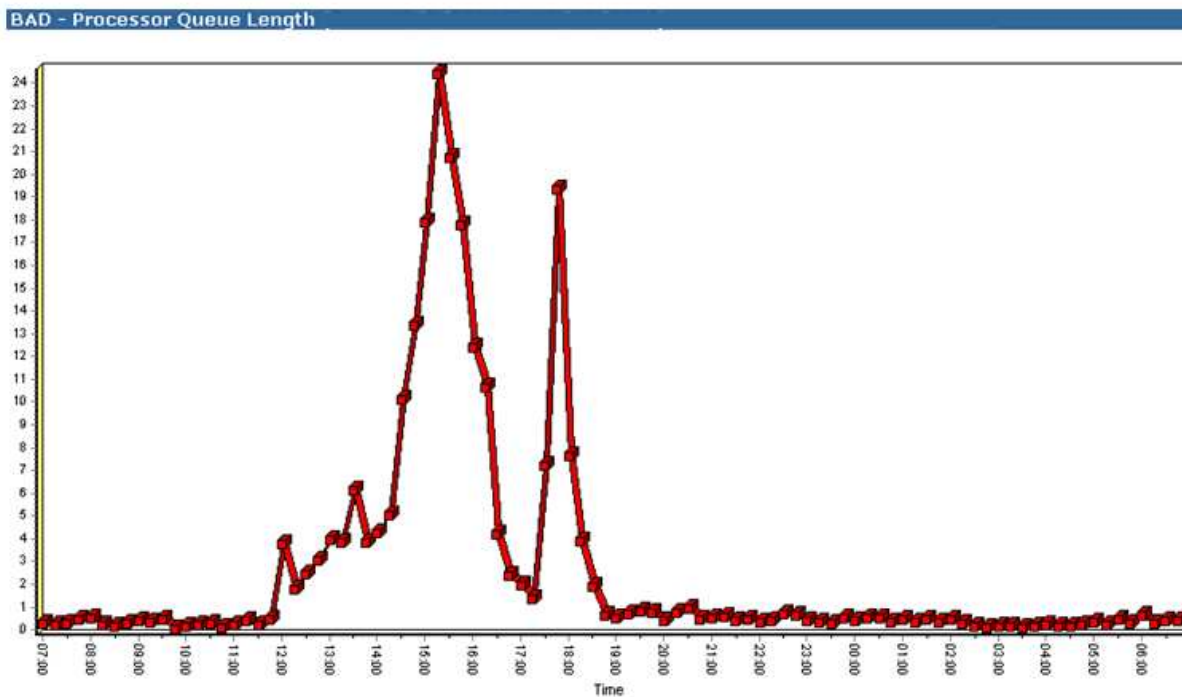
BAD - CPU Utilization



- **DESCRIPTION:** ServerVantage chart showing Total CPU Utilization
- **OBSERVATIONS:** Note that CPU Utilization is nearly 100% for several hours between 12:00 and 19:00.



One additional performance metric should be examined to verify that this issue is causing a CPU bottleneck. **Processor Queue Length** is an indicator of the number of threads waiting to be processed by the CPUs. When the Processor Queue Length exceeds 1-2 per processor, the value is an indicator of a CPU bottleneck. Consider the Processor Queue Length for the same server during the identical time period as shown in the chart below.



- **DESCRIPTION:** ServerVantage chart showing Processor Queue Length
- **OBSERVATIONS:** This chart shows the Processor Queue Length for one of the Citrix Servers. Note that the high values (>2 per CPU) indicate a CPU bottleneck.

In this example (for same time period detailed above) Processor Queue Length exceeds 2 between 12PM and 7PM. For several hours in the middle of the day, Processor Queue length exceeds 10. This is a very strong indication that the orphaned Leasepro applications are causing performance issues with other users' processes.

It is very likely that this condition will ultimately degrade server performance to the point of crashing the running server. In order to avoid this, the Citrix administrators have resorted to manually deleting the orphaned processes. This has been a workable solution, but is not maintainable in the long term.

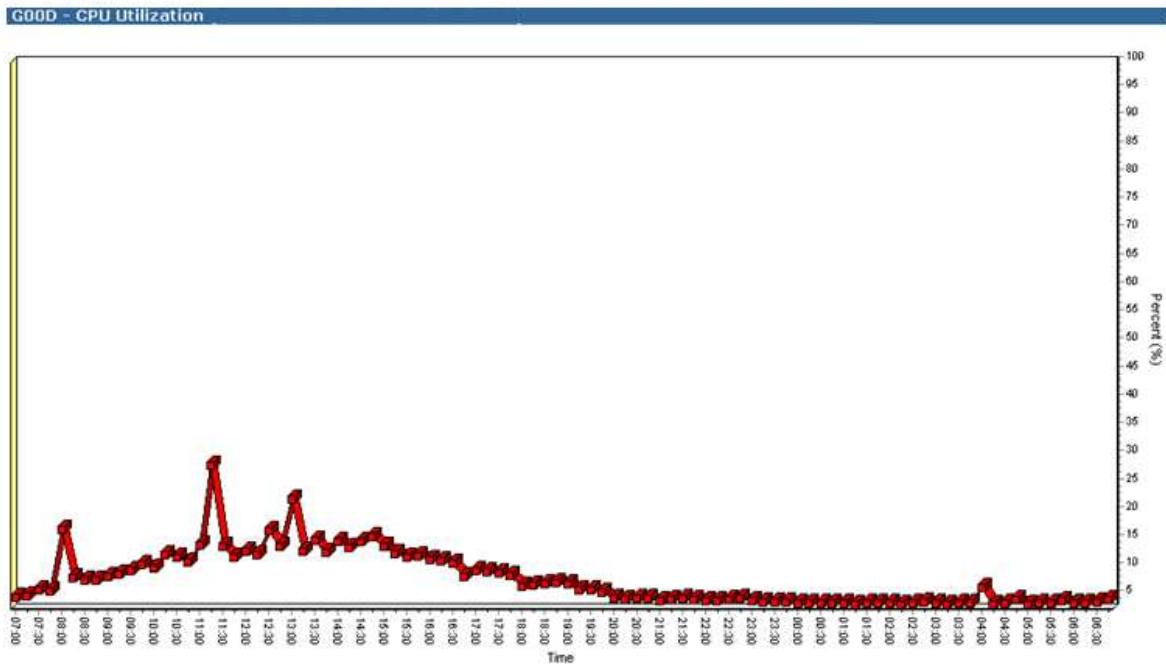
Recommendation

As previously stated, there appears to be an endless code loop in the Leasepro application. When provided with the above information, Leasing Systems (the Leasepro developers) were able to verify this issue by placing debug code in a Leasepro dynamically linked library, **blolib32.dll**. The code verified the loop where the application was deadlocked and wrote the information into a debug log.

Sample output from the debug log is shown below.



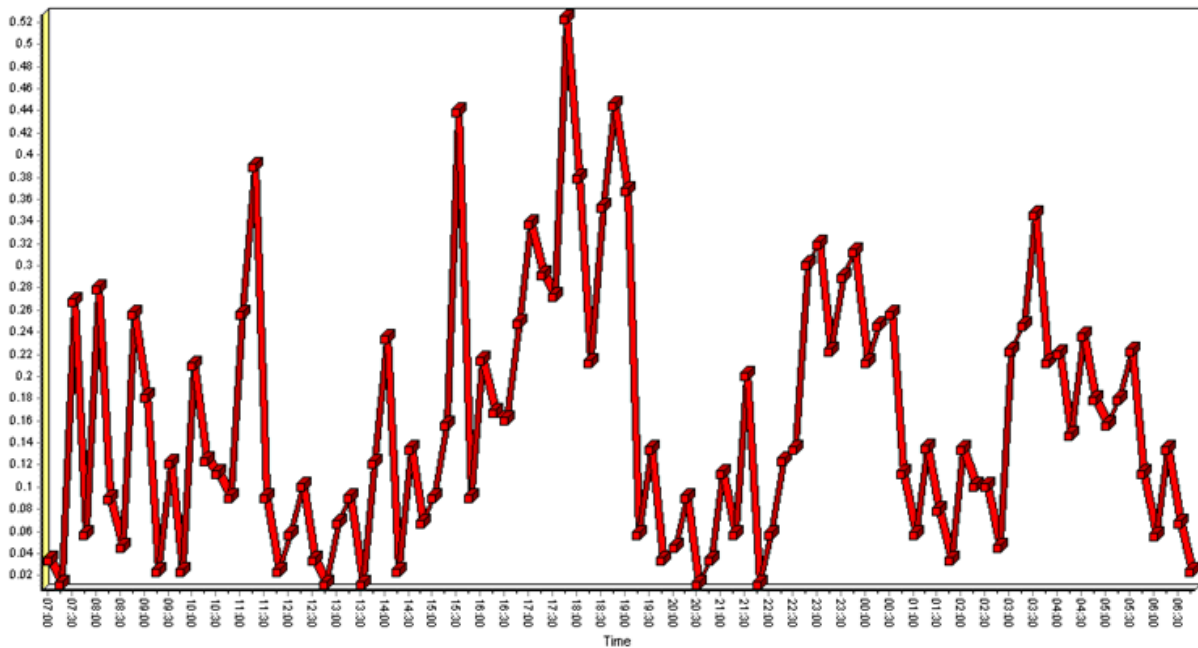
The following chart shows CPU utilization for **CITRIXSVR04** following the software fix from Leasing Systems. Note that there is only one 15 minute interval where average CPU utilization surpassed 25%.



- **DESCRIPTION:** ServerVantage chart showing CPU Utilization
- **OBSERVATIONS:** This chart shows the CPU Utilization for CITRIXSVR04, one of the Citrix Servers. Note that with the Leasepro fix, CPU utilization remains under 25% for the entire day.

In addition, as shown in the following chart, Processor Queue Length never exceeds 1 during the entire day.

G00D - Processor Queue Length



- **DESCRIPTION** ServerVantage chart showing Processor Queue Length on CITRIXSVR04.
- **OBSERVATIONS** Note that Processor Queue Length never approaches 1. This indicates that there no longer a CPU bottleneck.

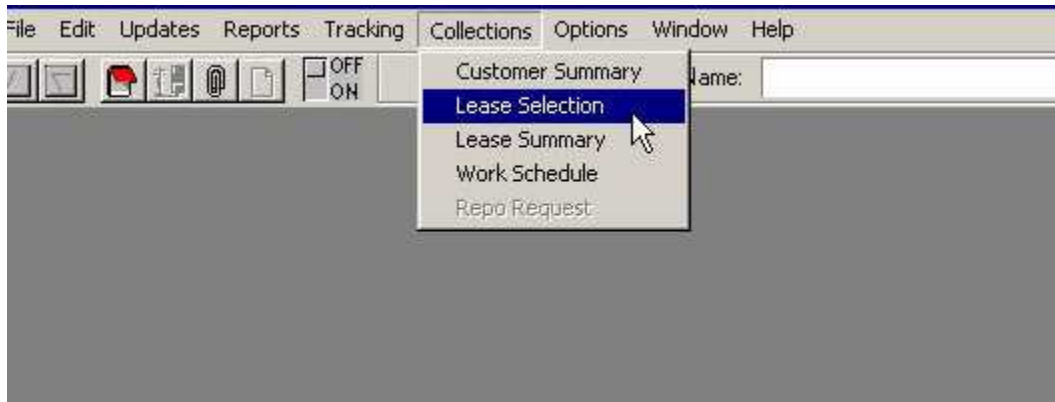
Based on observation during the final two days of the engagement and the above data, it should be evident that there are no Orphaned Leasepro processes left running on the Citrix server. This is a strong indication that the bug fix provided by Leasing Systems has **resolved the issue**.

The following issues were also found with Leasepro. These issues, however, did not seem to cause the orphaned process issue that was discussed above. Therefore, they are not likely to affect overall server health and/or the response time experienced by other users.

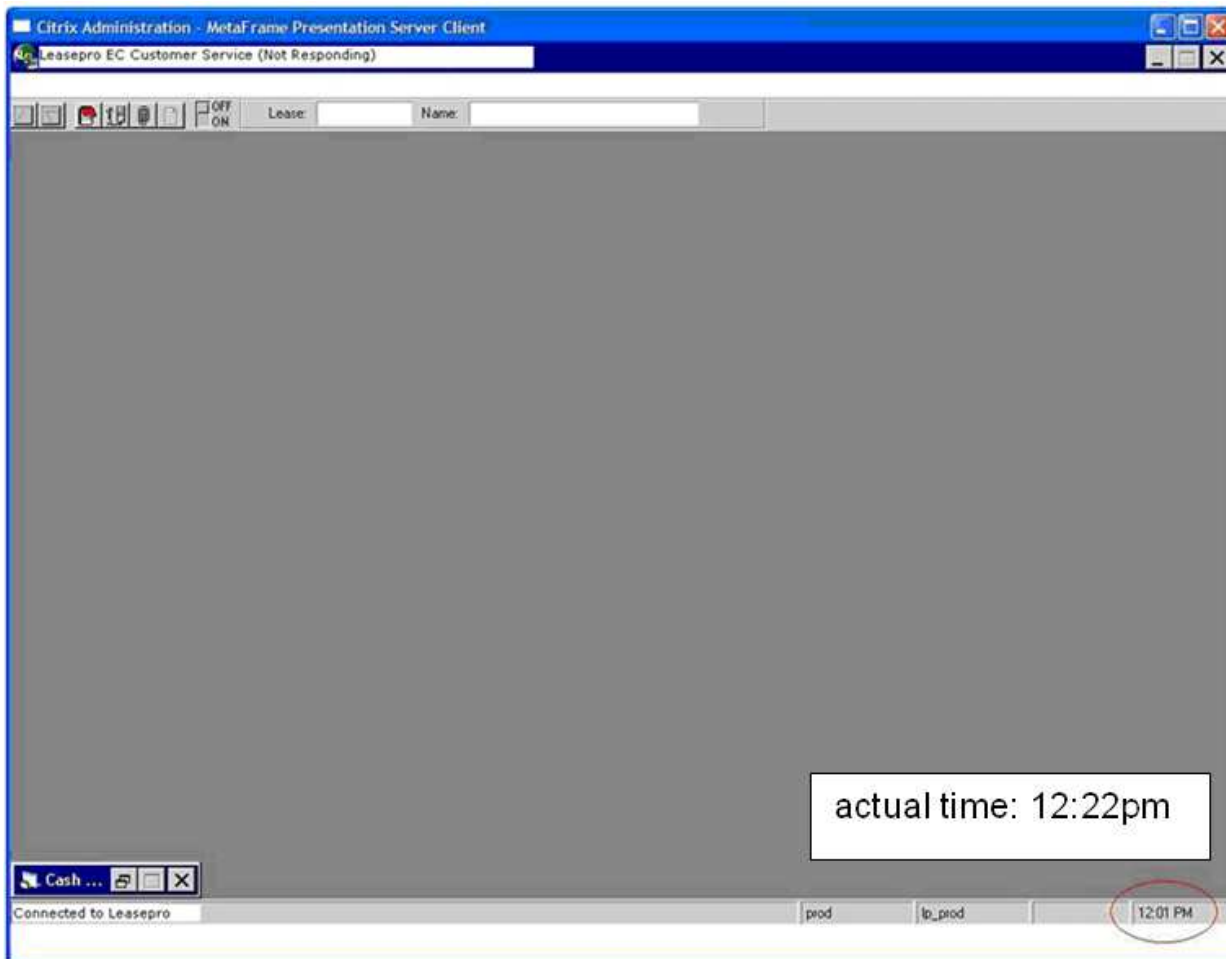
Issue #2 - Lease Selection Causes Application to Hang

Description

When a user selects "Lease Selection" from the Collections menu the Leasepro application hangs. This seems to be an issue with how the "Lease Selection" option queries the Sybase database.



➤ **DESCRIPTION:** Collections Menu showing "Lease Selection" menu item.



➤ **DESCRIPTION:** Screenshot of frozen Leasepro session induced by selecting "Lease Selection".

Recommendation

Discussions with Leasepro users revealed that the "Lease Selection" item is not needed or used by Acme Corporation. In addition, most users understand that selecting this item will cause their application to crash. Further exacerbating this issue is the fact the "Lease Selection" item is close to the "Lease Summary" menu item that users normally select. This increases the likelihood that users will accidentally select the wrong menu item.

Compuware recommends that Volkswagen instruct their vendor, Leasing Systems, to remove this menu item from the Leasepro application. This will prevent users from selecting this misbehaving feature.

Issue #3 - Failed Communication with Davox Cause Leasepro to Crash and/or Freeze

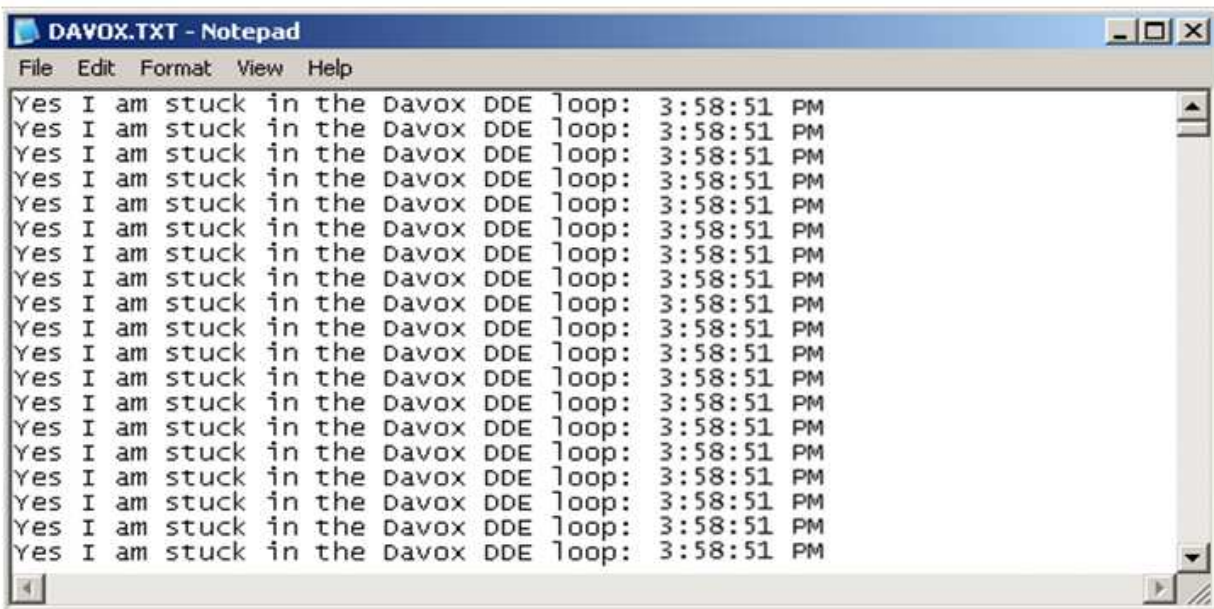
Description

There are at least two cases where the Leasepro application seems to hang waiting for input from the Davox predictive dialer. In the first case, a user closes the Davox predictive dialer application before closing Leasepro. In this instance, Leasepro will show an "hourglass" icon indicating that it is waiting for some input. The user will then have to forcibly quit the Leasepro application. On the Citrix server, the Leasepro process will show high utilization until the user quits.

In the second scenario, Leasepro will hang in between calls. In this case, Leasepro does not populate the correct information for that called user.

Recommendation

Discussions with Leasing Systems indicate that they are aware of some issues with the Davox predictive dialer. Leasing Systems provided a debug version of Leasepro.exe which logged the time that application spent caught in the Davox DDE loop.



```
DAVOX.TXT - Notepad
File Edit Format View Help
Yes I am stuck in the Davox DDE loop: 3:58:51 PM
Yes I am stuck in the Davox DDE loop: 3:58:51 PM
Yes I am stuck in the Davox DDE loop: 3:58:51 PM
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Yes I am stuck in the Davox DDE loop: 3:58:51 PM
Yes I am stuck in the Davox DDE loop: 3:58:51 PM
```

- **DESCRIPTION:** Screenshot showing debug output.
- **OBSERVATIONS:** This screenshot shows debug output from Leasepro indicating that Leasepro is stuck in a DDE communication loop. This corresponded with a frozen Leasepro session on the user's computer.

Acme Corporation should work with Leasing Systems to establish a more graceful way to handle Davox closing. Leasing Systems indicated that a DDE timeout value might provide a way for Leasepro to stop waiting for DDE communication if Davox is not responsive.

Before Leasing Systems is able to correct the issue, users should avoid closing the Davox dialer while the Leasepro application is running.

Issue #4 - Changing User Password Causes Leasepro to Crash

Description

Leasepro frequently crashes when a users tries to change their own password. After trying to make the change, the user is presented with the following screen.



DESCRIPTION: Screenshot showing failed Change Password.

This is exacerbated by the fact that new users are prompted to change their passwords when they first login.

Recommendation

It seems the many users realize that they should bypass the "Change Password" screens. Acme Corporation may wish to work with Leasing Systems to better understand and/or correct this issue.

CONCLUSIONS

In conclusion, the Compuware Application Triage engagement at Acme Corporation provided a successful performance assessment of the Leasepro application. During the engagement, a server impact analysis, network impact analysis, transaction analysis, and a database analysis was performed on the Leasepro application. From the analysis, the following conclusions can be made:

- Overall, the Leasepro end user experience is fairly responsive. When the application is behaving correctly, users can navigate relatively quickly through the application.
- Acme Corporation should continue to monitor production servers for CPU and other resource utilization. This is especially important when deploying new versions of Leasepro which may re-introduce old bugs into the production environment.
- Acme Corporation should also consider monitoring WAN utilization to remote offices. WAN utilization levels may cause applications such as Leasepro to perform differently at remote offices. Compuware's NetworkVantage would allow real-time alerting of high utilization as well as reporting on long term usage trends.
- Since Acme Corporation currently owns ApplicationVantage, it would be valuable to make the application available infrastructure and/or application teams. ApplicationVantage can be a powerful aid to focus and prioritize application troubleshooting efforts.
- Acme Corporation should use available tools to carefully document outstanding issues with Leasepro. Thorough investigation and reporting will help Leasing Systems target the remaining application bugs.