



SAP Scalability Analysis on Citrix MetaFrame Presentation Server 3.0

Citrix Systems, Inc.



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Introduction

SAP R/3 is a complete ERP (Enterprise Resource Planning) solution, allowing businesses to increase productivity, improve business insight, and gain the adaptability to accelerate business strategies. Bill McDermott, the CEO and President of SAP America had the following to say about the relationship between SAP and Citrix at Citrix iForum 2003, "Using Citrix, SAP reduced costs by 40%. SAP has over 15,000 [concurrent] users in over 120 countries and increased productivity by 35%. Citrix has earned trusted advisor status." Organizations that access SAP through the Citrix Access Suite enjoy the following benefits.

- **Time Savings:** Rapid deployment
- **Predictable Performance:** For remote and WAN users
- **Simplified Administration, Training and Support:** Through advanced MetaFrame Presentation Server features such as Shadowing
- **Controlled and Centralized Management Environment:** Minimal desktop management required for upgrades
- **Access from Anywhere:** From any device, over any network, wired or wireless
- **Reduce TCO (Total Cost of Ownership):** High performance from existing devices and connections
- **Application Integration:** Integrate any application into an SAP Enterprise Portal
- **Access for Business Continuity and Connectivity for Remote Offices:** Such as application development performed in other countries

The objective of this whitepaper is to provide scalability results when accessing the SAP client, also referred to as the SAPgui, via MetaFrame Presentation Server 3.0 on Hewlett Packard's (HP) Proliant DL360 G3 hardware. The results are obtained from the SAP Sales and Distribution Benchmark testing cycle, which is a component of the SAP Standard Application Benchmark suite. The target audiences for this whitepaper are MetaFrame Architects, System Integrators, and Project Managers looking to design and capacity plan a MetaFrame Presentation Server farm deploying SAPgui 6.20.



Executive Summary

The scalability study for SAP provides MetaFrame Architects, System Integrators, and Project Managers with data to help design and capacity plan a MetaFrame Presentation Server environment using HP Proliant DL360 G3 hardware. This study also provides a description of the testing environment as well as the workflow executed to gather the scalability numbers. Leveraging the methodology and workflows used in this analysis, similar testing scenarios can be performed to benchmark future or alternative hardware platforms.

During the scalability analysis, automated user sessions were launched on a MetaFrame Presentation Server that ran a benchmarking workflow from the SAP Standard Application Benchmark suite. During the testing cycle, the server exhibited a 0.88% total processor utilization increase and 29.8 MB memory consumption per user, resulting in a maximum of 74 users per server for this particular workflow and environment configuration.

As a best practice, Citrix recommends that MetaFrame administrators cap user load on a server when the average resource utilization reaches 80%. The 80% rule accounts for the periodic CPU spike experienced during normal system usage as well as providing a buffer for unexpected or scheduled server operations, such as virus scanning or backups. In some instances, Citrix may recommend that user load is capped at a greater percentage, such as 70%. This is to account for additional redundancy in the event that a MetaFrame Presentation Server is unexpectedly taken offline.

An average processor utilization of 80% for the SAP Sales and Distribution Benchmark testing cycle correlates to 74 active ICA sessions; an average memory consumption of 80% for the testing cycle correlates to 84 active ICA sessions. Therefore, the limiting factor that determined the maximum number of users per server was processor utilization. Throughout the test a manual user session was run to ensure the usability/performance of the system. At 74 users, there was minimal degradation in user experience.



Testing Environment

This section describes the elements of the testing environment used throughout the SAP Sales and Distribution Benchmark testing cycle.

Hardware Specifications

The following chart identifies the server names involved in the SAP Sales and Distribution Benchmark testing cycle, their role, and their hardware specifications.

Server Name	Server Role	Hardware
DC	Active Directory Domain Controller	HP Desktop EVO; 1.7GHz Processor; 256 MB RAM
Potato	SAP Database	HP Proliant DL560 G2; Quad 2.8 GHz Opteron Processor; 4 GB RAM; Raid 1; 10k RPM Drives
Citrix1	Citrix MetaFrame Presentation Server 3.0	HP Proliant DL360 G3; Dual 2.8 GHz Processor; 4 GB RAM; Raid 1; 10k RPM Drives
Citrix2	Citrix Data Store and Citrix License Server	HP Desktop EVO; 1.7GHz Processor; 256 MB RAM
MPSLoadRunner	Mercury LoadRunner 7.6 Controller	IBM Thinkpad; 1.2 GHz P3 Processor; 256 MB RAM
Mercury1	Load Generator	HP Proliant DL580; Quad 1.6 GHz Processor; 4 GB RAM; Raid 1; 10k RPM Drives
Mercury2	Load Generator	HP Proliant DL580; Quad 1.6 GHz Processor; 4 GB RAM; Raid 1; 10k RPM Drives

Windows 2003 Environment

All servers were built with Windows Server 2003, Enterprise Edition by the HP Solutions Center using an Altiris imaging solution. Server DC was configured as a Windows Server 2003 Active Directory Domain Controller. One hundred test user accounts were configured in the directory named User000 to User099. To provide the fastest login times during the SAP Sales and Distribution Benchmark testing cycle, each user was assigned a mandatory profile that resided on Citrix1. All Windows Server 2003 systems were updated using Microsoft Windows Update with all Critical Updates and Services Packs installed that were suggested by Microsoft Windows Update. Finally, anti-virus software was not installed on the servers in the testing environment.

MetaFrame Presentation Server Configuration

The servers Citrix1 and Citrix2 were both installed with MetaFrame Presentation Server 3.0 with Citrix2 designated as the Citrix Data Store and Citrix License Server for the MetaFrame Presentation Server farm. The data store was configured as an MS Access, indirect connect data store. MetaFrame Presentation Server was installed with default options; it was not customized or optimized for the SAP Sales and Distribution Benchmark testing cycle.



Mercury LoadRunner Configuration

The server MPSLoadRunner was installed with Mercury LoadRunner version 7.6, which was installed as a LoadRunner Controller. The servers Mercury1 and Mercury2 were both installed with the Load Generator option. The LoadRunner controller scenario ramped up 99 users, User001 to User099. As the users were logged on by the Load Generators, the users stepped through the LoadRunner Virtual User Script found in the Appendix titled [SAP Sales and Distribution Benchmark Script](#). The LoadRunner Virtual User Script is based on the SAP Sales and Distribution Benchmark workflow described in the [Workflow Configuration](#) section.

The ICA client version 8.00.24737 was installed on both Load Generators. This is the ICA client that ships with MetaFrame Presentation Server 3.0 and, at the time of this analysis, was the most current version of the ICA client. The Load Generators leverage the exposed ICA application programming interface (API) to properly connect to the MetaFrame Presentation Server servers and run the LoadRunner script.

The ICA API is exposed by the all 7.x and 8.x versions of the ICA client. The ICA API allows LoadRunner to connect to a MetaFrame Presentation Server and automate mouse clicks and keystrokes without the need to render the screen and interact with the application GUI. For further information on the integration of Citrix with Mercury LoadRunner, please reference the Citrix Consulting Whitepaper, *Mercury Interactive's LoadRunner for Citrix*, which can be found on the Citrix knowledgebase.

SAP Configuration

Server Potato was installed with SAP R/3 version 4.7. The database was populated with the SAP Standard Application Benchmark database obtained from SAP. Details on the SAP Standard Application Benchmark suite can be found at <http://www.sap.com/benchmark/>. SAPgui version 6.2 was installed on server Citrix1 and was used during the SAP Sales and Distribution Benchmark testing cycle.

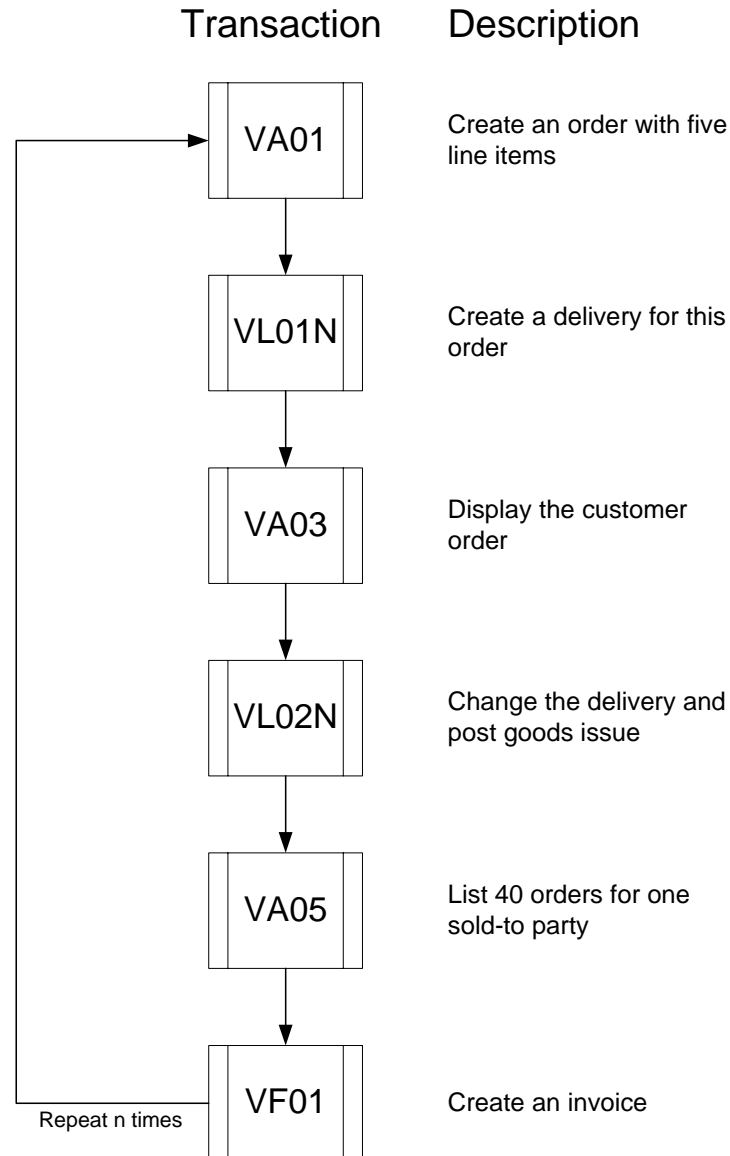
Workflow Configuration

The workflow used during testing is based on the SAP Sales and Distribution Benchmark workflow. Details on the SAP Sales and Distribution Benchmark workflow can be found at http://www.sap.com/benchmark/BM_description.htm#SD. The following steps outline the SAP Sales and Distribution Benchmark workflow.

- At the main SAP screen, the virtual user initiates the transaction VA01, Create Customer Order. The virtual user saves the transaction and initiates the transaction VL01N, Create a Delivery.
- The virtual user enters in the Shipping Point and the Selection Date. The Order Number will be automatically entered in from the previous transaction. The virtual user saves the transaction and initiates the transaction VA03, Display Customer Order.
- The virtual user presses **Enter** and then initiates the transaction VL02N, Change Delivery. The Order Number will be automatically entered in from the previous transaction.
- The virtual user presses **F20**, Posts Goods Issue, and initiates the transaction VA05, List Orders. The virtual user enters in the customer, the Document Date and the Document Date To.
- The virtual user presses **Enter** and initiates the transaction VF01, Create Invoice. The Voucher Number will be automatically entered in from the previous transaction.
- The virtual user saves the transaction and repeats the cycle, N number of times by initiating the transaction VL01N. The number of cycles varies per virtual user. LoadRunner will repeat the workflow for each virtual user allowing the MetaFrame Presentation Server to maintain a constant load for the user until the maximum number of users is simultaneously running the workflow.



SAP Sales and Distribution Workflow



The script is divided into several functions, the first function logs into the published SAPgui application, the second function logs into SAP, and the last function logs out of SAP and closes the published application. All of the other functions in the script correspond, on a one-to-one basis, to the transactions listed above. For full details of the actions taken in each transaction, please reference the script in the [SAP Sales and Distribution Benchmark Script](#) appendix.



SAPgui Scalability and Utilization

This section details the scalability results of the SAPgui on MetaFrame Presentation Server during the SAP Sales and Distribution Benchmark testing cycle. This section provides graphs and data that explicitly show the impact that each user had on the processor and memory while running SAPgui for Sales and Distribution entry and retrieval.

Measurements

Throughout the testing cycle, the server performance activity was monitored and recorded. During the entire testing cycle, an administrator remained logged into the MetaFrame Presentation Server via a RDP (Remote Desktop Protocol) console session. After every ten users logged onto the MetaFrame Presentation Server, the RDP console session was used to obtain qualitative measurements of the server, including application responsiveness of the SAPgui and screen refresh speed. During the testing cycle, even during periods of excessive usage, the SAPgui application remained responsive and screen refreshes did not diminish.

The Microsoft performance monitoring utility, Perfmon, was used to record the server performance activity throughout the testing cycle. The following list contains the performance counters that were recorded during the SAP Sales and Distribution Benchmark testing cycle[†].

- **Logical Disk:** % Disk Time
- **Logical Disk:** % Free Space
- **Memory:** Available Bytes
- **Memory:** Pages/Sec
- **Network Interface:** Total Bytes/Sec
- **Paging File:** %Usage
- **Processor:** % Interrupt Time
- **Processor:** % Processor Time
- **System:** Context Switches/Sec
- **System:** Processor Queue Length
- **Terminal Services:** Active Sessions

It is important to note that the utilizing Mercury LoadRunner to perform the test did not add an additional overhead to the MetaFrame Presentation Server. The scalability results directly correlate to 100 users logging into a MetaFrame Presentation Server and simultaneously following the SAP Sales and Distribution Benchmark workflow.

Processor Scalability Results

The percentage of Processor Time was logged throughout the SAP Sales and Distribution Benchmark testing cycle, with the results charted below. The amount of the total processor consumed increased steadily as user sessions

[†] Only the % Processor Time (Processor), Available Bytes (Memory), and Active Sessions (Terminal Services) performance counters were submitted for analysis.



increased on the MetaFrame Presentation Server. The trendline indicates an increase of approximately 0.88% processor utilization per active ICA session; and the baseline processor utilization during the testing cycle was 14.9%. The baseline processor utilization level is the amount of CPU consumed by the server without user load. The following figure illustrates the processor utilization as a function of user load.

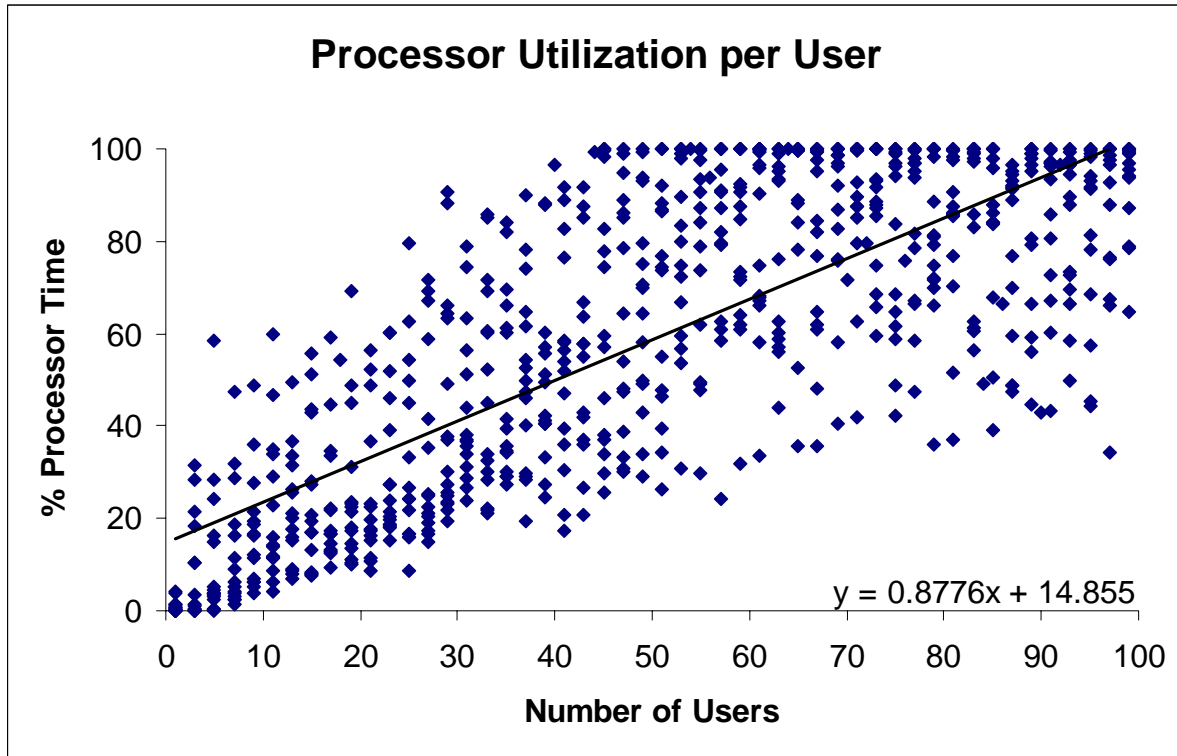


Figure 1: Processor Utilization Chart

Citrix Consulting recommends that MetaFrame administrators cap user load on a server when the average resource utilization reaches 80%. An average processor utilization of 80% for the SAP Sales and Distribution Benchmark testing cycle correlates to 74 active ICA sessions.

Memory Scalability Results

The amount of memory consumed on the MetaFrame Presentation Server was tracked throughout the testing cycle and is presented in the chart below. The following graph shows the amount of consumed memory, in megabytes, as active ICA sessions were added to the server by LoadRunner. As the number of ICA sessions was increased, the amount of memory consumed also increased; this was expected behavior. The trendline shows an increase of 29.8 MB per user with a baseline memory consumption of 632 MB. The baseline memory consumption level is the amount of memory consumed by the server without a user load.

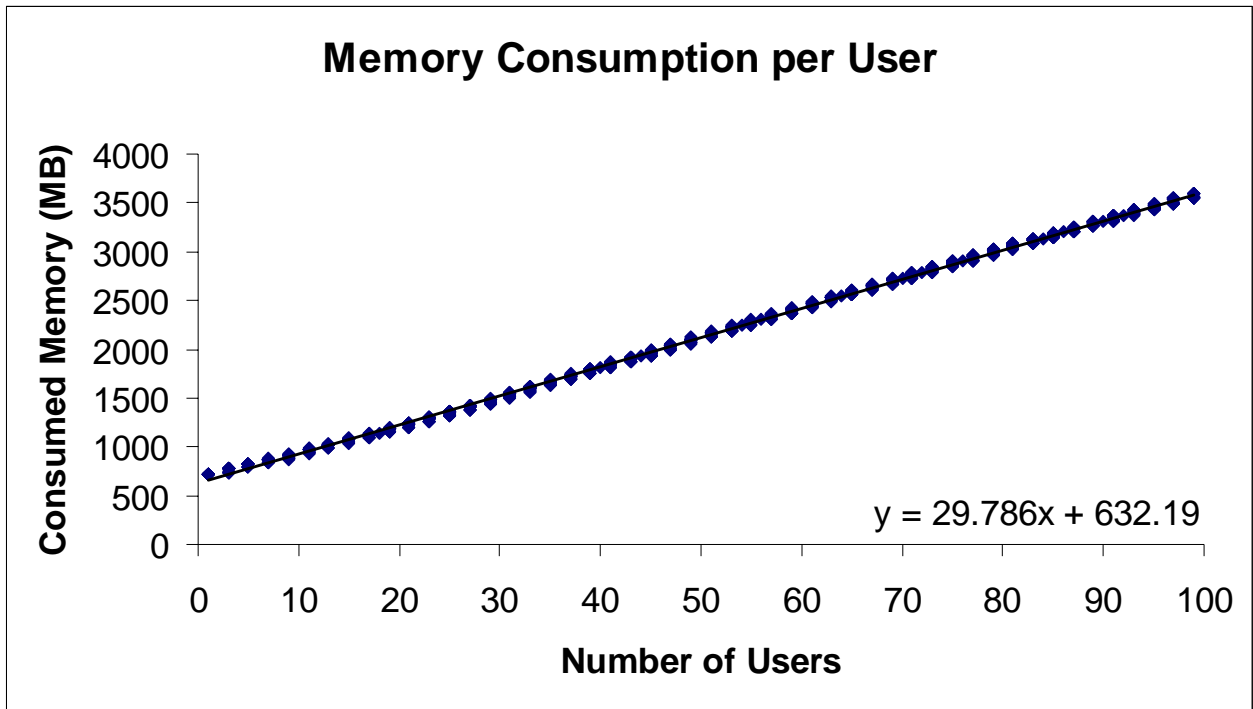


Figure 2: Memory Consumption Chart

Citrix Consulting recommends that MetaFrame administrators cap user load on a server when the average resource utilization reaches 80%. An average memory consumption of 80% for the SAP Sales and Distribution Benchmark testing cycle correlates to 84 active ICA sessions.

Results Conclusion

Data analysis for the SAP Sales and Distribution Benchmark testing cycle show each user consumed 0.88% of the processor and 29.8 MB of the available memory. The server should be limited to a maximum of 74 users, which follows the recommendation that MetaFrame administrators cap user load on a server when the average resource utilization reaches 80%. The results show that 80% processor utilization is reached with less users than 80% memory consumption. Therefore the processor utilization per user is the limiting factor and dictates a maximum of 74 users per MetaFrame Presentation Server.

Processor and memory utilization have the greatest overall affect on the performance of a MetaFrame Presentation Server. Sometimes there is a bottleneck in another server resource which can cause an artificial increase in processor and memory utilization. The other performance counters were monitored as they are the resources that are most likely to cause a bottleneck. The results of the performance counters measured during the testing cycle did not show signs of approaching a bottleneck and therefore will not be subject to further data analysis.



Summary

This whitepaper provided scalability results when accessing the SAPgui over MetaFrame Presentation Server on HP Proliant DL360 G3 hardware. The results were obtained from the SAP Sales and Distribution Benchmark testing cycle which is a component of the SAP Standard Application Benchmark suite. Using the results provided in the whitepaper, MetaFrame Architects and Project Managers can better plan capacity when deploying the SAPgui application via MetaFrame Presentation Server 3.0 on HP DL360 hardware.



Appendix: SAP Sales and Distribution Benchmark Script

The following LoadRunner script was created based off of the SAP Sales and Distribution Benchmark workflow found at http://www.sap.com/benchmark/BM_description.htm#SD. It was used during the SAP Sales and Distribution Benchmark testing cycle.

```
/* -----  
  
Script Title      : SAP Sales & Distribution Benchmark  
Script Description : Workflow Script for SAPgui 4.6c  
  
Recorder Version  : 792  
  
----- */  
  
vuser_init()  
{  
  
    ctrx_set_connect_opt(APPLICATION, "#SAP - Potato");  
    ctrx_set_connect_opt(NETWORK_PROTOCOL, "TCP/IP + HTTP");  
    ctrx_connect_server("10.51.1.4", "{UserID}", lr_decrypt("40cf4d8d896f3eab67a7127b5f"),  
"CITRIXTEST");  
  
    lr_think_time(1);  
    ctrx_wait_for_event("LOGON");  
    lr_think_time(3);  
    ctrx_set_window("SAP");  
    return 0;  
}  
  
sap_logon()  
{  
  
    lr_think_time(3);  
    ctrx_set_window("SAP");  
    lr_think_time(3);  
    ctrx_key("TAB_KEY", MODIF_SHIFT);  
    lr_think_time(1);  
    ctrx_type("900");  
    ctrx_key("TAB_KEY", 0);  
}
```



```
    lr_think_time(1);
    ctrx_type("sap_perf");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("obelix");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("EN");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window("SAP R/3 System");
    lr_think_time(3);
    ctrx_type("/nva01");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    return 0;
}

create_customer_order()
{
    lr_think_time(3);
    ctrx_set_window("Create Sales Order: Initial Screen");
    lr_think_time(1);
    ctrx_type("ta");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("0001");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("01");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("01");
    ctrx_key("ENTER_KEY", 0);
}
```



```
lr_think_time(3);
ctrx_set_window("Create: Overview");
lr_think_time(3);
ctrx_type("sdd00{SAPNumber}");
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
lr_think_time(3);
ctrx_type("perf46b");
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
lr_think_time(3);
ctrx_type("22.12.2009");
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
ctrx_key("TAB_KEY", 0);
lr_think_time(3);
ctrx_type("sd{SAPNumber}000");
ctrx_key("TAB_KEY", 0);
ctrx_type("1");
ctrx_key("TAB_KEY", 0);
lr_think_time(3);
ctrx_key("DOWN_ARROW_KEY", 0);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
lr_think_time(3);
ctrx_type("sd{SAPNumber}001");
ctrx_key("TAB_KEY", 0);
ctrx_type("1");
ctrx_key("TAB_KEY", 0);
```



```
lr_think_time(3);  
ctrx_key("DOWN_ARROW_KEY", 0);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
lr_think_time(3);  
ctrx_type("sd{SAPNumber}002");  
ctrx_key("TAB_KEY", 0);  
ctrx_type("1");  
ctrx_key("TAB_KEY", 0);  
lr_think_time(3);  
ctrx_key("DOWN_ARROW_KEY", 0);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
lr_think_time(3);  
ctrx_type("sd{SAPNumber}003");  
ctrx_key("TAB_KEY", 0);  
ctrx_type("1");  
ctrx_key("TAB_KEY", 0);  
lr_think_time(3);  
ctrx_key("DOWN_ARROW_KEY", 0);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
ctrx_key("TAB_KEY", MODIF_SHIFT);  
lr_think_time(3);  
ctrx_type("sd{SAPNumber}004");  
ctrx_key("TAB_KEY", 0);  
ctrx_type("1");  
ctrx_key("TAB_KEY", 0);  
lr_think_time(5);  
ctrx_key("ENTER_KEY", 0);  
lr_think_time(5);  
ctrx_key("ENTER_KEY", 0);  
lr_think_time(10);  
ctrx_key("s", MODIF_CONTROL);  
lr_think_time(10);
```



```
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
lr_think_time(3);
return 0;
}

create_delivery()
{
    lr_think_time(3);
    ctrx_type("/nv10ln");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window("Create Outbound Delivery with Order Reference");
    lr_think_time(1);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    lr_think_time(1);
    ctrx_type("0001");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("22.12.2009");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window(" Delivery note Create: Overview");
    lr_think_time(1);
    ctrx_key("s", MODIF_CONTROL);
    lr_think_time(3);
    ctrx_set_window("Create Outbound Delivery with Order Reference");
}
```



```
lr_think_time(1);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
lr_think_time(1);
return 0;
}

display_customer_order()
{
    lr_think_time(3);
    ctrx_type("/nva03");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window("Display Sales Order: Initial Screen");
    lr_think_time(1);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    lr_think_time(1);
    return 0;
}

change_delivery()
{
    lr_think_time(3);
    ctrx_type("/nv102n");
    ctrx_key("ENTER_KEY", 0);
```



```
lr_think_time(3);
ctrx_set_window("Change Outbound Delivery");
lr_think_time(3);
ctrx_key("F8_KEY", MODIF_SHIFT);
lr_think_time(3);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
ctrx_key("TAB_KEY", MODIF_SHIFT);
lr_think_time(1);
return 0;
}

list_orders()
{
    lr_think_time(3);
    ctrx_type("/nva05");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window("List of Sales Orders");
    lr_think_time(3);
    ctrx_type("sdd00{SAPNumber}");
    ctrx_key("TAB_KEY", 0);
    ctrx_key("TAB_KEY", 0);
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("01.10.1991");
    ctrx_key("TAB_KEY", 0);
    lr_think_time(1);
    ctrx_type("22.12.2009");
    ctrx_key("ENTER_KEY", 0);
}
```



```
    lr_think_time(3);
    ctrx_set_window("List of Sales Orders");
    lr_think_time(1);
    return 0;
}

create_invoice()
{
    lr_think_time(3);
    ctrx_type("/nvf01");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(3);
    ctrx_set_window("Create Billing Document");
    lr_think_time(3);
    ctrx_key("s", MODIF_CONTROL);
    lr_think_time(3);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    lr_think_time(3);
    ctrx_type("/nva01");
    ctrx_key("ENTER_KEY", 0);
    lr_think_time(1);
}
```



```
    return 0;
}

vuser_end()
{
    lr_think_time(3);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    ctrx_key("TAB_KEY", MODIF_SHIFT);
    lr_think_time(1);
    ctrx_type("/nex");
    ctrx_key("ENTER_KEY", 0);
    return 0;
}
```



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