Lotus knows.
Smarter software for a Smarter Planet.

BP204 “CSI Domino” -- Diagnostic Collection and Analysis

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About the presenter

- Daniel Nashed
  - Nash!Com – IBM / Lotus® Advanced Business Partner/ISV
  - Member of The Penumbra group
    - an international consortium of selected Business Partners pooling their talent and resources
  - focused on Cross-Platform C-API, Lotus Domino® Infrastructure, Administration, Integration and Troubleshooting
  - Platform Focus: Win32/Win64, Linux®, AIX® and Solaris®
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Agenda

- Introduction – What is „Serviceability“
- Diagnostic Collection / Monitoring
- Crash Analysis, Hang Analysis, Trappleaking
- Performance Analysis
- Q&A
What is Serviceability?

- **RAS = Reliability Availability Serviceability**
  - RAS is the effort to improve the Lotus Domino product suite so that:
    - Client/Server doesn't crash or hang as often (Reliability)
    - Client/Server performs well, Server is available to clients (Availability)
    - The ability to quickly pin-point and fix problems (Serviceability)

- **Ongoing effort in each incremental release**
  - Some features are even back-ported from Lotus Domino 8 to Domino 6&7

- **It's not just about NSD & Memcheck but all parts of Domino**
  - Logging, Debug Options, etc

- **Great help for Admins, Developers and Troubleshooters**
  - Too many features and options for a single session ... but we will try ...
Diagnostic Features in Lotus Domino

- Directory \IBM_TECHNICAL_SUPPORT
  - Single place of log files collection for all the various trace and debug options

- Automatic Data Collection / Configuration Collector
  - Server and Client mail self-acting, configuration snap-shot

- Domino Domain Monitoring (DDM)
  - Comprehensive Server Monitoring

- Dynamic Console Log
  - Log file containing all log and DEBUG information

- NSD
  - Notes System Diagnostics, Memcheck
  - Contains a lot of details about a crash, open databases, Domino and system configuration

- Fault Recovery
  - Generates NSD files and restarts servers automatically

- Memory Dumps, Trappleaking, Semaphore Debugging, ...
Fault Recovery

• Domino Server detects crash and restarts automatically
  - Panic routine calls fault recovery code
• Enabled in Server document
  - Run NSD To Collect Diagnostic Information: Enabled
  - Automatically Restart Server After Fault/Crash: Enabled
  - Mail Fault Notification to: LocalDomainAdmins

• How does fault recovery work
  - Run NSD + memcheck if configured
  - Cleans up resources
  - Restarts Server

• Very important to enable fault recovery and NSD collection!
  - Server is back online quickly and you have diagnostic data from every crash!
Automated Diagnostic Collection (ADC)

- Enables you to set up a mail-in database to collect the diagnostic information generated from the ND Client/Server crashes into central repositories.
  - Senddiag server task runs on startup to collect information like NSDs

- Server Configuration Doc / Diagnostics Tab
  - Fault-Recovery Database (Indfr.nsf) as Mail-in Database
    - Size for diagnostic data, retention days, ...
    - Filter pattern to add to data collection (file-patterns!)
    - Enable FaultAnalyzer (since D7) for Fault Database

- Fault Recovery Database and FaultAnalyzer are typically allocated on admin server
  - „FaultAnalyzer“ Servertask
  - Used to collect annotate, categorize NSDs
  - Similar call-stacks, Same Domino releases, Client or Server
  - Have separate databases for clients / servers
Domino Domain Monitoring (DDM)

- Comprehensive Monitoring
  - ddm.nsf contains focused monitoring results
  - Detailed error messages including names of resources
  - Suggestions for problem solution including actions!
- Based on the foundation build by event monitoring
  - Event categorization and severity defined in events4.nsf
- Additional build in probes into the code
  - Replication (detailed reporting for failing replication)
  - Agent Manager (long running agents, high memory/CPU usage, ...)
- You can also leverage statistics and platform statistics
- Helps to get focused information from all Domino servers in a central location
  - Build-in workflow to assign issues and keep track what has been already solved
- DDM would be a whole presentation of its own
Analysis Tools

- Domino Admin Client contains analysis Tools
  - Located in Server/Analysis Tab
    - Cluster Analysis
    - Log Analysis

- You should regularly analyze server logs in addition to daily DDM checks

- Activity logging can also help for troubleshooting
  - Needs to be enabled in Server Config Document
HTTP Diagnostic

- domlog.nsf
  - Response time in each request
  - Allows to filter requests (request-types etc, configured in the server doc)
- Tell http dump config
  - Writes HTTP config to IBM_TECHNICAL_SUPPORT/httpcfg.txt
- tell http debug session on|off
  - Session debug logs
- tell http debug thread on|off
  - Thread debug logs.
- Tell http debug postdata on|off
  - Post data to debug logs.
- Tell http debug respondedata on|off
  - Logging of response content to
- Tell http debug outputio on|off
  - logging of network output tracing
NSD

- Only invoked automatically when fault recovery is enabled on server
  - Can be started manually if server has already crashed but not yet recycled
  - Can also be used to terminating a hanging server ( nsd -kill )
    - e.g. remove shared memory, semaphores and other resources...

- Can be used on running servers for troubleshooting and server hang diagnostics
  - Does not crash a running server
    - If you have the right OS patchlevels!!!
    - Caution: Windows2003 Server SP1 or higher required for detaching from running processes!

- Invoked at server startup to take a snapshot of the current environment
  - Sysinfo NSD contains all details of your configuration
Major Sections of an NSD in Detail

- Header: Version and System
- Process Table / Active Users
- Call-Stacks of running Processes
- MEMCHECK: - Notes / Domino Memory Analyzer
- Shared memory handles and blocks
- Open Databases, Open Documents
- Performance Data
- notes.ini
- User OS-level Environment
Major Sections of an NSD in Detail

- Executable & Library Files
- Data Directory Full Listing
- Local Disks
- Memory Usage
- Network Stats
- Active Connections, Ethernet Stats, Active Routes, Protocol Stats
- Core File (in some cases)
- Sometimes NSD invokes a memory dump
- OS-Specific information
  - Installed software, Configuration, etc
NSD Update Strategy

- NSD & Memcheck are updated in each release

- Changes are incorporated into new releases and are available for older Domino releases thru special hotfix installer

- NSD/Memcheck Code is build independent from Domino release
  - See TN #1233676 - NSD Fix List and NSD Update Strategy
  - See TN #4013182 - Updated NSD for Domino releases
    - Contains FTP download links

- You should keep NSD up to date!

- Too many details to list on a single slide ...
  - Improvements and fixes in each dot release or fixpack
Run NSD as a Service

• New Feature in Lotus Notes/Domino 8 allows NSD to run as a service
  - Avoids issues with OS level users not having proper access to subdirectories or ability to attach to system processes
  - One instance of NSD will run in background continuously as a service
  - When a crash occurs, or NSD is run manually, dynamically created instance of NSD will proxy the request to start NSD Service
  - Specially important also on Citrix environments or other clients with limited OS level access

• Details in Domino 8 Admin Help and NSD HTML help
  - nsd
    - svcinst | svcuninst
    - svcstart | svcstop
    - svclog | svcreport
    - If NSD service is started it is used automatically
Why Server Freeze and Server Panic?

- Lotus Domino uses shared memory to allocate global resources to share between tasks and Domino core for different sub-systems
  - NIF, NSF, ... e.g. views are stored in memory ...
  - Corrupt Memory-Handle or other Handles can have impact on other running tasks and result in corrupted databases

- Lotus Domino "halts" the Server or Client with a PANIC or Freeze to avoid further damage
  - Freezing all tasks / threads
  - Diagnostics and Recycle Routines are called to restart
What can cause server crashes?

- Design Elements / LotusScript/Java™
- Third Party code
- Corrupt data
  - Corrupt documents, etc ...
- Memory Management issues
  - Overwrites, handle locking, memory leaks)
- Insufficient Memory
  - Often caused by „Memory Leaks“
First Steps Analyzing a Crash

- Find the crashing thread
  - "Fatal" is the most common indication of the crashing task
  - If you don't find fatal, look for "Panic", "Access Violation" or "Segmentation Fault", "Signal" messages on Unix/Linux
  - Tip: Last lines on console.log is helpful in most of the cases
    - Included in current versions of NSD as a separate section

- Analyze the calls in the call-stack
  - It is helpful to know about the C-API toolkit (SDK) to understand function names and parameters involved
  - Not all function calls are exposed
    - But the SDK (C-API Toolkit) gives you a good idea what to look for
Reproducible Call-Stack/Bug?

• Best case scenario: Reproducible call-stack on independent machines which does not occur on boxes with other releases

• But we are not always that lucky ...
  - If the call stack is similar at the end of the stack it could be a low-level API problem
  - If the call stack is similar at the higher level of the stack always in the same Servertask it could be the Servertask
  - If you see EM_Before, EM_After it might be an Extension-Manager problem
  - If it is always the same database it might be a data problem

• Find open databases
  - You can find open databases by matching the physical/virtual thread-ID with the memcheck section
More Information about Open Files/Documents

- Check "Resource Usage Summary" section
  - Lists all open DBs for every thread .. with handles and users

- Check "Open Database Table" section
  - Other open databases in the same task at the same time

- Check "NSF DB-Cache" section
  - Databases open in Cache

- Check "Open Documents" section
  - Open Documents with matching database handles
Lotus Notes Diagnostics

- Tool to annotate NSDs, semdebug files, memory dumps etc
- Current Version 2.8 downloadable from IBM
- Can be used to annotate crash NSDs

- Ships with notes database, plugs into Explorer

- Very helpful tool
  - Helps you to find crashing call-stack and categorizes the various NSD sections
  - Also matches the data section of the thread in memcheck
  - But you still have to know much about the background to interpret the results
Abnormal Process Termination
-- Also a Crash

• Server task simply disappears from the OS process list with no errors produced (very rare)
  - Domino Server console indicates the task is still running
  - Task cannot be shutdown cleanly from console
  - Unix/Linux: ChildDied Signal on also kicks in fault-recovery
  - If process monitor notices a sub-process not cleanly terminated fault-recovery is also invoked

• Must be treated as a crash
  - Background: Could cause major problems like semaphore hangs, resources that are not cleaned up etc...

• Troubleshooting:
  - Start/stop task debugging: debug_initterm=1
    - Logs start/stop of tasks
Next Steps

- Customer can only fix data problems, check/add server resources (e.g. memory) or install later versions

- IBM Support can look into SPR database and find matching call-stacks
  - Support needs all information available in IBM_TECHNICAL_SUPPORT directory
    - please ZIP files!
    - Every new version of Domino provides more diagnostic information (NSD, ADC, ...)

- Development or 3rd party software vendor can identify new problems and look into their source code
  - Take care: NSD also contains some sensitive information about your system and users.
  - Check the NSD before sending it to external people
  - Add-On Applications on Windows need to have own Domino formatted "SYM" files for call-stack annotation in NSD
Server Hang Symptoms

- Server (or specific task) is still running, but client receives error messages "Server not Responding"
  - No error is produced on the console but an error may be written to log.nsf

- Console does not accept keyboard commands

- Server task will not shutdown cleanly

- User report that other Domino server tasks have slowed down

- No NSD is generated and no Fault Recovery
What can cause hangs?

- **LotusScript/Java™**
  - Looping logic in code

- **Semaphore issues**
  - Deadlocks, low level looping

- **Permanent unavailability of a particular resource**

- **Third Party code (FT file-filters)**

- **General: OS-level calls which do not return to the calling Domino code**

- **Network issues (DNSLookup, port problems)**
How to troubleshoot Server Hangs?

- Check call-stacks for specific calls
  - e.g. a large number of Semaphore Calls, SpinLock Calls

- Use Semaphore Debugging
  - DEBUG_SHOW_TIMEOUT=1
  - DEBUG_CAPTURE_TIMEOUT=10
  - DEBUG_THREADID=1
  - Optional: DEBUG_SEM_TIMEOUT=X
    - (in milliseconds, default 30000)

- Run 3 nsd -nomemcheck in short sequence
  - plus one full NSD

- „Show stat Sem.Timeouts“ to check semaphores
  - Only works with semaphore debugging enabled and only gives you a quick summary
Analyzing Semaphore logs

- semdebug.txt in IBM_TECHNICAL_SUPPORT
  - contains semaphores locked for more than 30 seconds
  - Information about process/thread, semaphore, time, ...
  - Also contains information who is currently holding the semaphore
  - But just the process/thread.id – You have to annotate on your own via NSD
  - What is always important is the call-stack of the process requesting and olding the semaphore
  - Can only be done thru NSD

- Example:
  - ti="0025CA9C-C1257353" sq="00004CE8"
    THREAD [28208:00241-169659312]
    WAITING FOR SEM 0x0931 Task sync semaphore (@0F7711A4) (OWNER=28208:158743472) FOR 5000 ms

- ti is the internal representation of the timedate
  - You can use LND to annotate the ti values
Memory Consumption / Memory Leaks

• Domino has only a certain amount of addressable memory for
  - Shared Memory
  - Local Process memory

• The limit depends on the platform
• Combination of shared memory + local process memory is the limiting factor
  - For 32bit the total limit is 4GB at most
  - The larger part of memory used is shared memory

• You can run into peek memory situations

• Or run into memory leaks
  - Memory not released when the application does not need it
    - Certain Memory type (block) grows beyond reasonable numbers
Memory Dumps

• Domino uses an own Memory Management Layer
  - Different Memory types
  - Pooled memory (DPOOLS)
  - Direct memory allocations

• Memory is managed by Domino
  - Allocated Pool memory will be freed to Domino Memory Manager not Operating system
  - Memory Allocation can be tracked and troubleshooted

• Local and Shared Memory
  - Shared Memory for all Servetasks
  - Local Process Memory per tasks

• Different memory block types for each part of the server
  - Each block type (BLK Xxx) can be tracked separately
Memory Dumps

• You can dump memory
  - Run server -m
  - Or „show memory dump“

• Memory Dump contains
  - Shared/Local Process memory
  - Block Codes
  - Size

• Can be used to determine memory bottlenecks and leaks

• Memcheck output also provides details about memory
  - Check the „Top 10“ Sections in NSD as a quick info about memory allocations
Memcheck Top 10 Memory Section

- There is a TOP 10 Memory section for shared memory
- And a TOP 10 local memory section per server task

<table>
<thead>
<tr>
<th>Type</th>
<th>TotalSize</th>
<th>Count</th>
<th>Typename</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x82cd</td>
<td>535330816</td>
<td>136</td>
<td>BLK UBMBUFFER</td>
</tr>
<tr>
<td>0x8472</td>
<td>15733654</td>
<td>1</td>
<td>BLK DTRACE</td>
</tr>
<tr>
<td>0x82cc</td>
<td>9922560</td>
<td>136</td>
<td>BLK UBMBCB</td>
</tr>
<tr>
<td>0x8252</td>
<td>5242880</td>
<td>5</td>
<td>BLK NSF_POOL</td>
</tr>
<tr>
<td>0x834a</td>
<td>3670464</td>
<td>4</td>
<td>BLK GB_CACHE</td>
</tr>
<tr>
<td>0x8a05</td>
<td>3300000</td>
<td>1</td>
<td>BLK NET SESSION_TABLE</td>
</tr>
<tr>
<td>0x83e4</td>
<td>2097152</td>
<td>2</td>
<td>BLK LKMGR_POOL</td>
</tr>
<tr>
<td>0x8311</td>
<td>2097152</td>
<td>2</td>
<td>BLK NIF_POOL</td>
</tr>
<tr>
<td>0x93ad</td>
<td>1260162</td>
<td>138</td>
<td>BLK VA UNKDESC</td>
</tr>
<tr>
<td>0x826d</td>
<td>1048576</td>
<td>1</td>
<td>BLK NSF_DIRMANPOOL</td>
</tr>
</tbody>
</table>
Memory Trap Leak Debugging

- Once you figured out about a problematic Memory Block Type you can enable Trap Leak Debugging
  - Debug_Trapleaks=0x3A45
  - Debug_Trapleaks_ShowStack=1
  - DEBUG_SHOWLEAKS=1
  - DEBUG_DUMP_FULL_HANDLE_TABLE=1
  - DEBUG_DUMP_BLOCKCODES=1
  - DEBUG_TRAPLEAKS_NEW=1
    - Summarizes call-stacks

- Checks Memory allocations and dumps call-stacks
  - when task is shutdown (local memory)
  - when server is shutdown (shared memory)
Backup Memory Limitations

- It's not always a memory leak
- Shared Memory is limited to 2 – 3 GB depending on platform / configuration
  - For very large databases, the Backup Context can consume a lot of memory and overflows shared memory
  - Sample Crash Callstack
    - @[ 8] 0x6017aca8 nnotes.Panic@4+520 (60bb0c4f)
    - @[ 9] 0x6017ad2c nnotes.Halt@4+28 (107)
    - @[10] 0x60103e95 nnotes.AccessAllProtected@0+85 ()
    - @[11] 0x600469fe nnotes.AccessAll@8+46 (1,1)
    - @[12] 0x60047a83 nnotes.ProcessGlobalEvent@4+19 (1512ee4)

- Limit the amount of backup memory used
  - Block Type: 0x02e9 check TN #1211241 for details
  - Notes.ini
    - NSF_Backup_Memory_Constrained=1 (defaults to 20 MB)
    - NSF_Backup_Memory_Limit=200000000 (reasonable size: 200 MB)
Lotus Domino Statistics

• Valuable resource of information
  - Combines Domino Statistics and Platform statistics
  - Platform statistics depend on the OS platform but are sort of unified between platforms
    - Check events4.nsf for a description of each platform stat on each platform
  - You should collect Server stats at least every 15 minutes (default is 90 minutes)
  - Configure statistic events for important stats with the right thresholds
    - Keep long term data to compare current and historic data
  - You can also leverage SNMP to query stats
    - Limitation: Only works for one partition per OS instance on all platforms
  - C-API allows you to add own stats and also some Domino Probes generate own stats

• For a whole session about logging and statistics check
  - Lotusphere 2008 / BP112 In the Land of the Blind, Logs Make You King
    - http://www.nashcom.de/lotusphere
Client Clocking

• Can be used to track Notes Client/Server Transactions (NRPC)
  - Logs
    - transaction name
    - transaction data
    - response time (ms)
    - bytes send, received

• Example:
  - (15-78 [15]) OPEN_NOTE(REPC1256B16:0072BCBE-NT00000E3E,00400020): 0 ms. [52 +1454=1506]

• Enable on client via
  - client_clock=1
  - debug_console=1
    - Enables a debug text window -- never close this manual, causes a crash
  - debug_outfile=c:\debug_notes.log
    - Writes a debug log file
## Selected Transaction Types

<table>
<thead>
<tr>
<th>Transaction Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>START_SERVER</strong></td>
<td>Start User Session</td>
</tr>
<tr>
<td><strong>OPEN_DB/CLOSE_DB</strong></td>
<td>Open/Close a database</td>
</tr>
<tr>
<td><strong>OPEN_NOTE/NIF_OPEN_NOTE</strong></td>
<td>Open a Note</td>
</tr>
<tr>
<td><strong>UPDATE_NOTE</strong></td>
<td>Update a Note – there is no close transaction</td>
</tr>
<tr>
<td><strong>OPEN_COLLECTION/CLOSE_COLLECTION</strong></td>
<td>Open/Close a view/folder collection</td>
</tr>
<tr>
<td><strong>READ_ENTRIES</strong></td>
<td>Reads data from a view/folder</td>
</tr>
<tr>
<td><strong>UPDATE_COLLECTION</strong></td>
<td>Updates a view/folder collection</td>
</tr>
<tr>
<td><strong>FIND_BY_KEY</strong></td>
<td>Finds notes in a view/folder collection</td>
</tr>
<tr>
<td><strong>FINDDESIGN_NOTES</strong></td>
<td>Finds design notes</td>
</tr>
<tr>
<td><strong>SEARCH</strong></td>
<td>Search operation with formula</td>
</tr>
<tr>
<td><strong>GET_MODIFIED_NOTES</strong></td>
<td>Find table of modified notes</td>
</tr>
<tr>
<td><strong>GET_ALLFOLDERCHANGES_RQST</strong></td>
<td>Get changes in all folders</td>
</tr>
<tr>
<td></td>
<td>Unread count in mail folders</td>
</tr>
</tbody>
</table>
# Selected Transaction Types

<table>
<thead>
<tr>
<th>Transaction Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME_LOOKUP</td>
<td>Lookup information in Domino Directory</td>
</tr>
<tr>
<td>ALLOC_UPDATE_OBJECT</td>
<td>Create or update an object</td>
</tr>
<tr>
<td>READ_OBJECT</td>
<td>Read data from an object</td>
</tr>
<tr>
<td>WRITE_OBJECT</td>
<td>Write data to an object</td>
</tr>
<tr>
<td>READ REPLICATION HISTORY</td>
<td>Read Replication History</td>
</tr>
<tr>
<td>DB_INFO_GET</td>
<td>Get database info buffer</td>
</tr>
<tr>
<td>GET_NOTE_INFO</td>
<td>Get Note information</td>
</tr>
<tr>
<td>DB_MODIFIED_TIME</td>
<td>Get the modified date of DB</td>
</tr>
<tr>
<td>DB_REPLINFO_GET</td>
<td>Get Replication info</td>
</tr>
<tr>
<td>POLL_DEL_SEQNUM</td>
<td>Get Delivery Sequence Number</td>
</tr>
<tr>
<td>DB_GETSET_DEL_SEQNUM</td>
<td>Get or set Delivery Sequence Number</td>
</tr>
<tr>
<td>GET_SPECIAL_NOTE_ID</td>
<td>Get a special Note-ID by number</td>
</tr>
</tbody>
</table>
Nagle Algorithm on Unix/Linux

- The Nagle Algorithm (John Nagle) is designed to optimize small packets (like for telnet sessions)
  - Small packets are combined to larger packets – when the next packet to client is sent
  - In case of Domino this can cause delays because individual transactions might be delayed
    - The wait time is up to 200 ms!
    - Notes transactions are serialized, no other packets need to be send to client at the same time
  - The Nagle Algorithm should be disabled for Domino on all Unix/Linux platforms
    - Disabled by default in 8.5, Previous releases, notes.ini setting: debug_pd_nagle_off=1

- Example: 1000 Note Open Transactions
  - With Nagle Algorithm
    - Average: 62 ms
  - Disabled Nagle Algorithm
    - Average: 5 ms
  - Results in detail / Response time distribution
    - Before / After -->

```
[ 0] -> 547
[ 16] -> 102
[ 31] -> 23
...
[ 203] -> 15
[ 218] -> 71
[ 219] -> 48
[ 234] -> 59
[ 249] -> 12
[ 250] -> 15
[ 265] -> 10
...
```
Current Issue: Broken Design Collection

- Domino has an internal design cache in each database to find design notes
  - Used by NIFFindDesignNoteExt (Transaction: FINDDESIGN_NOTES)

- In some odd cases the design cache breaks
  - Without the design cache the client tries to find design elements the “old style” by opening and searching the design collection.
  - This causes quite a bit overhead – specially for WAN connections

- Design Collections is discarded when the internal cache table overflows
  - Happens when 40 or more design elements have the same name
    - This happens regularly with private on first use folders/view
    - Only work-around: Avoid private on first use folders/views and remove existing folders

  - Reference: SPR #RSTN7K2EM4, TN #1322578 Performance degradation using "Private on First Use" views or folders
### Borken Design Collection

#### Client_Clock Data Example

<table>
<thead>
<tr>
<th>Step</th>
<th>Code</th>
<th>Description</th>
<th>Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-299</td>
<td>[309]</td>
<td>OPEN_COLLECTION(REPC1256E62:004B8651-NTFFFF0020,0000,0000)</td>
<td>0 ms.</td>
<td>[42+34=76]</td>
</tr>
<tr>
<td>4-299</td>
<td>[310]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65148=65224]</td>
</tr>
<tr>
<td>5-299</td>
<td>[311]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>16 ms.</td>
<td>[76+65388=65464]</td>
</tr>
<tr>
<td>6-299</td>
<td>[312]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+63918=63994]</td>
</tr>
<tr>
<td>7-299</td>
<td>[313]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65506=65582]</td>
</tr>
<tr>
<td>8-299</td>
<td>[314]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65498=65574]</td>
</tr>
<tr>
<td>9-299</td>
<td>[315]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>15 ms.</td>
<td>[76+64920=64996]</td>
</tr>
<tr>
<td>10-299</td>
<td>[316]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+63688=63764]</td>
</tr>
<tr>
<td>11-299</td>
<td>[317]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+64522=64598]</td>
</tr>
<tr>
<td>12-299</td>
<td>[318]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65402=65478]</td>
</tr>
<tr>
<td>13-299</td>
<td>[319]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65478=65544]</td>
</tr>
<tr>
<td>14-299</td>
<td>[320]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>16 ms.</td>
<td>[76+65296=65372]</td>
</tr>
<tr>
<td>15-299</td>
<td>[321]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65238=65314]</td>
</tr>
<tr>
<td>16-299</td>
<td>[322]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+65366=65462]</td>
</tr>
<tr>
<td>17-299</td>
<td>[323]</td>
<td>READ_ENTRIES(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[76+9480=9556]</td>
</tr>
<tr>
<td>18-299</td>
<td>[324]</td>
<td>CLOSE_COLLECTION(REPC1256E62:004B8651-NTFFFF0020)</td>
<td>0 ms.</td>
<td>[12+0=12]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Code</th>
<th>Description</th>
<th>Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-507</td>
<td>[330]</td>
<td>FINDDESIGN_NOTES</td>
<td>31 ms.</td>
<td>[42+16=58]</td>
</tr>
</tbody>
</table>
Server_Clock & Show Trans

- The server keeps track of all transactions
  - Also used for LOADMON (part of SAI calculation)
- You can display transaction summary via “show trans”
  - And reset the summary counters via “show trans reset”

- Or you can display transactions via console log via server_clock=1

- Server_clock=1 has some limitations
  - Only shows transaction information but no user or database information
  - 38965515 ms 'OPEN_DB' 0 ms (0 ms NETIO) TCPIP 000403B1 Rcvd 0 Sent 216

- New server_clock options have been introduced in Domino 8.5.1
  - Have first been implemented thru hotfixes for SAI troubleshooting and finally helped fixing SAI :-}
Additional Server_Clock in Domino 8.5.1

- **Server_Clock=2**
  - Will dump more information
  - Username, Database, IP Address, and if transaction is used for LOADMON (Lm 1)

  39255671 ms 'OPEN_DB' 0 ms (0 ms NETIO) TCPIP 000403B1 Rcvd 0 Sent 254
  User 'Daniel Nashed/NashCom/DE' Db 'acl.nsf' Ip '192.168.100.3' Lm 1

- **Server_Clock=3, DEBUG_TRANSACTIOAN_TIME=n**
  - Dumps only transaction taking longer than the specified time
  - Can help to reduce the number of transactions dumped and only lists “slower” transactions
  - For example: 5000 ms
    - Take care: But some transaction like open view collections might take longer than 5 seconds without indicating a problem
SAI and LOADMON

- Domino uses a module called "LoadMon"
  - Routine calculating speed of 12 selected transactions
  - Checks current transaction performance, summarizes and compares them with previous intervals and minimum values (RunningAvgTime & MinAvgTransTime)
  - Unit: microseconds

- OPEN_DB
- OPEN_NOTE
- CLOSE_DB
- DB_INFO_GET
- DB_REPLINFO_GET
- GET_OBJECT_SIZE

- READ_OBJECT
- GET_SPECIAL_NOTE_ID
- DB_READ_HIST
- DB_WRITE_HIST
- SERVER_AVAILABLE_LITE
- NIF_OPEN_NOTE
Expansion Factor (XF)

- XF is calculated based on the performance values of current transactions in relation to minimum time for a transaction
  - It's the number of times the current transactions take longer than the minimum transaction time
  - XF values for different transactions build a overall XF
  - This XF is computed and converted into AI based on a Range to scale the XF

- SAI is calculated based on XF and the transinfo range (n)

- \( SAI = 100 \times \left(1 - \frac{\log (XF)}{\log (2)} / n\right) \)
  - Notes.ini Server_Transinfo_Range n is 6 by default and specifies the maximum Expansion Factor of a Domino Server. The XF is calculated 2 raised to the power n (64 by default)
Issues with SAI and LOADMON

- SAI was broken until Lotus Domino 8.5
  - There have been a couple of issues with LOADMON. The last one known has been fixed in D8.5

- SAI calculation on fast servers still might not work for you out of the box
  - LOADMON uses micro seconds
    - On a fast server at idle times transactions can take only a couple of micro seconds
    - Compared to normal performance e.g. 1 ms this can result in very high XF
    - Causes a low SAI for normal performing servers

- Tuning: D8.5 Set range of minimum and maximum values
  - notes.ini: Server_MinPossibleTransTime=1500
  - notes.ini: Server_MaxPossibleTransTime=20000000
  - Important: You have to delete loadmon.ncf when the server is shutodwn to delete old minimum values

- If LOADMON is configured correctly SAI can help to measure performance
  - E.g. Set the Server_MinPossibleTransTime to your expected response time
More LoadMon Notes.ini Settings

- **SERVER_TRANSINFO_MAX (default 5 / max 60)**
  - number of statistics collections stored in LoadMon

- **SERVER_TRANSINFO_UPDATE_INTERVAL (default 15)**
  - interval for statistics capturing & calculation

- **SERVER_MIN_TRANS (default 5)**
  - minimum transactions needed for a statistic value to be valid

- **SERVER_TRANSINFO_NORMALIZE (default 3000)**
- **SERVER_TRANSINFO_HTTP_NORMALIZE (12000)**
  - used to initialize empty statistics (zero in loadmon.ncf) on startup in Domino
Debugging LoadMon

- `debug_loadmon=1`
  - Enables LoadMon Debugging, writes additional information to server console
  - Loadmon: Domino AI = 100, XF = 1
  - Adds additional 46 statistics counters (server.loadmon.*)

- `loadmon.ncf`
  - `loadmon.ncf` in Domino data directory stores last information from loadmon before server is shutdown
  - loaded on server start to initialize statistics counters
Lotus Domino 8.5 I/O Statistics

• Domino records I/O data per process and database
  - Process Name, Database Name
  - NumFileWrites, NumFileReads
  - MBWritten, MBRead = MB written/read
  - NoteOpens, ProfileNoteOpens, DesignNoteOpens
  - NTUpdateAdd, NTUpdateUpdate, NTUpdateDelete
  - NTUpdateExpiredSoftDeletes, ProfileNoteUpdates, DesignNoteUpdates

• Provides detailed information about I/O operations in CSV Format
  - Show iostat writes a file into the IBM_TECHNICAL_SUPPORT directory

```bash
> sh iostat
[0AA4:0007-05DC] IOSTAT dumped to file C:\Lotus\Domino85\data\IBM_TECHNICAL_SUPPORT\iostat_nsh-d85-win-01_2009_12_20@11_15_18.csv
```

```
"nupdate","",327,6056,1,17,648,19,481,0,11,0,0,0,11
"","C:\Lotus\Domino85\data\statrep.nsf",1351,32266,10,160,8314,0,4406,183,35,0,0,0,142
```
Summary

• There are a lot of diagnostic features in Lotus Notes/Domino
  - Some features are designed for crash and failure analysis
    - There is much more than just NSD and Fault Recovery
    - Domino 8.x also has many features to troubleshoot performance issues on client and server side

• A 60 minute session can only give you ideas what to look into
  - Many areas could be a complete separate session
  - This session should give you ideas what to look for
  - And to help understand why IBM support is asking for certain data

• Not all troubleshooting information is easy to understand
  - Some is build from developers for developers ...
Links and Resources

• Technotes
  - TN #7007508 - Knowledge Collection: NSD for Notes Domino release 6 and 7
    - Many of those documents are still relevant for Domino 8.x/8.5.x
  - TN #4013182 - Updated NSD for Domino releases

• Lotus Developer Domain

• Also check Knowledge Base and Fixlist Database
Q&A

- I hope you enjoyed the session
- Please fill out your evaluations!
- Questions?

- Presentation Updates
  - http://www.nashcom.de/lotusphere

- Contact
  - nsh@nashcom.de
  - http://www.nashcom.de
  - http://blog.nashcom.de
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