Tuning U2 Databases on Windows

Nik Kesic, Lead Technical Support
Nik Kesic’s Bio

- Joined uniData in 1995
- ATS (Advanced Technical Support), U2 Common Clients and DB tools
- College degree in Telecommunications
- Provides consultancy, Level 3 support and training
- Published articles on web enablement using RedBack, Sockets, XML, SOAP, SSL and Encryption
- MCP (Microsoft Certified Professional) in networks
Complex Performance Analysis

- **HUMAN**
  - Money
  - Vacation
  - Nice Car
  - Nice Home

- **COMPUTER**
  - CPU Speed
  - Disk criteria
  - Tasks
  - Human Decides
Agenda

- Webinar origins
- Basic Windows architecture
- U2 and Windows interaction
- Windows tuning considerations
- U2 config parameters
- System Performance Tools
- Services Available
- Questions and Answers
Webinar Origins

- Microsoft releasing new products every few years
- Windows becoming more complex
- Customers reporting performance issues on Windows
- Arising need for Virtualization
• OS interacts directly with the hardware
• OS is called system kernel
Basic Windows Architecture

- **Operating system:** Manages the resources of a computer
- **Resources:** CPUs, Memory, I/O devices, Network
- **Kernel:** Memory resident portion of the Windows system
- **File system and process control system:** Two major components of Windows kernel
Basic Windows Architecture

- Major tasks of kernel
  - Process Management
  - Device Management
  - File Management

- Additional services for kernel
  - Virtual Memory
  - System Protection
  - Networking
  - Network File Systems
Process Control Subsystem

- Process synchronization
- Inter-process communication
- Memory management
- Scheduler
  - Process scheduling
  - Allocate CPU to processes
A directory is a collection of files and sub-directories on a disk or tape in standard Windows file system format.

The kernel’s file subsystem regulates data flow between the kernel and secondary storage devices.
Hardware Control

- Hardware control handles interrupts
- Networks, disks or terminal devices may interrupt the CPU
- Kernel resumes interrupted process
Windows API

- **Device Management:** DeviceIoControl, InstallNewDevice, RegisterDeviceNotification, UnregisterDeviceNotification

- **File I/O:** CopyFile, CreateFile, DeleteFile, OpenFile, ReadFile

- **Desktop Windows Mgr:** WM_DWMCOMPOSITIONCHANGED, WM_DWMSENDICONIC THUMBNAIL

- **Others:** GetCursor, Button, DNS_QUERY_COMPLETION_ROUTINE
“U2 products are not like bowls of fruit
They do not go bad over time…
But files can…”
U2 and Windows Interaction

- U2 databases and utilities are a series of ‘C’ and ‘C++’ programs
- U2 uses the NTFS file system for data storage
- U2 processes use the inherent Windows Device I/O Control
- U2 typically uses shared memory segments for:
  - Printer management
  - Program memory management
- U2 can leverage O/S level functionality
  - e.g. SAN Architectures and RAIDs
Larger L2 processor caches provide better performance

Two CPUs are not as fast as one CPU that is twice as fast

A dual core processor is not twice as fast as a single core processor
Amount of Physical Memory (RAM)

- When your computer is running low on memory and more is needed immediately, Windows Servers use hard drive space to simulate system RAM (virtual memory or paging file)
- Try to avoid having a pagefile on the same drive as the operating system files
- Avoid putting a pagefile on a fault-tolerant drive, such as a mirrored volume or a RAID-5 volume
- Don't place multiple pagefiles on different partitions on the same physical disk drive
File Servers cache frequently accessed files in memory; however, files that are not accessed frequently must come from disk.

- Handling large amounts of data with a high number of requests to a high number of files require good disk performance
  - RAID controller connected to a large number of disks

- Make sure the allocation unit size is appropriate for the size of the volume
PagedPoolSize
HKLM\System\CurrentControlSet\Control\SessionManager\MemoryManagement\(REG_DWORD)

- File cache space and paged pool space share a common area in system virtual address
- Limiting the paged pool allows for a larger system cache
  - Causes more content to be cached and allows faster serving of files
PagedPoolSize registry example
DISK I/O: NtfsDisable8dot3NameCreation

- **NtfsDisable8dot3NameCreation**
  HKLM\System\CurrentControlSet\Control\FileSystem\ (REG_DWORD)

  - Default is 0
  - Determines whether NTFS generates a short name
  - Change to 1 to disable short name creation
**DISK I/O: Disable last access**

- **Disable last access**
  HKLM\System\CurrentControlSet\Control\FileSystem\. (REG_DWORD)

- Not created by default
- Increases speed of access to a folder or file
- Can have significant impact with NTFS, high numbers of folders/files, frequent updates
- After you use this command and restart the computer, the Last Access Time is no longer updated
- For new files, Last Access Time remains the same as the File Creation Time
DISK I/O: NumTcbTablePartitions

- **NumTcbTablePartitions**
  
  HKLM\system\CurrentControlSet\Services\Tcpip\Parameters\ (REG_DWORD)

  - Not created by default
  - Controls the number of TransportControlBlock (TCB) table partitions
    - *Windows 2003 only; obsolete in Windows 2008*
  - Improves scalability on multiprocessor systems by reducing contention
**NTFS File System Setting**

HKLM\System\CurrentControlSet\Control\FileSystem\ is **NtfsDisableLastAccessUpdate** (REG_DWORD) 1.

- System-global switch
- Does not exist by default
- Reduces disk I/O load and latencies
- Effective when used with large data sets/number of hosts containing thousands of directories
- Use IIS logging instead for Web administration
- In Windows 2008 this is disabled by default
To check the current status of the TCP/IP parameters which can be tweaked

- **netsh interface tcp show global**

You will be presented with something like the following:

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
C:\Users\nkesic>netsh interface tcp show global
Querying active state...

TCP Global Parameters
-----------------------------------
Receive-Side Scaling State : enabled
Chimney Offload State : automatic
NetDMA State : enabled
Direct Cache Access (DCA) : disabled
Receive Window Auto-Tuning Level : normal
Add-On Congestion Control Provider : none
ECN Capability : disabled
RFC 1323 Timestamps : disabled

** The above autotuninglevel setting is the result of Windows Scaling heuristics overriding any local/policy configuration on at least one profile.**
```
- Set maximum size of TCP window
  - HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\TcpWindowSize=[wmax]

- Turn on window scaling option
  - HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\Tcp1323.opts=1

- TCPTimedWaitDelay
  - HKLM\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters
    - Determines the time that must elapse before TCP can release a closed connection and reuse its resources.
Virtualization

- Virtualized Servers provide the foundation for building and managing a virtualized IT infrastructure

- A single physical server can run several virtual machines simultaneously
  - Each of these machines believes it is running on its own dedicated hardware, as if it were separate from all the other machines

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>1024 MB</td>
</tr>
<tr>
<td>CPUs</td>
<td>1</td>
</tr>
<tr>
<td>CD/DVD Drive 1</td>
<td>[ISO] WIN2003-SP2.iso</td>
</tr>
<tr>
<td>Network Adapter 1</td>
<td>VM Network VLAN20</td>
</tr>
<tr>
<td>SCSI Controller 0</td>
<td>LSI Logic</td>
</tr>
<tr>
<td>Hard Disk 1</td>
<td>Virtual Disk</td>
</tr>
<tr>
<td>Parallel Port 1</td>
<td>[Baal-Local] Icefyre/par.txt</td>
</tr>
<tr>
<td>Hard Disk 2</td>
<td>Virtual Disk</td>
</tr>
<tr>
<td>Floppy Drive 1</td>
<td>Client Device</td>
</tr>
<tr>
<td>Serial Port 1</td>
<td>/dev/ttyS0</td>
</tr>
</tbody>
</table>
UVCONFIG Parameters

- MFILES
- T30FILE
- UVTEMP
- FLTABSZ
- FSEMNUM
- GSEMNUM
- GLTABSZ
- RLTABSZ
- RLOWNER
- MAXRLOCK
- UVTSORT
- TXMEM
- SELBUF
UDTCONFIG Parameters

- GLM_MEM_ALLOC
- NFILES
- SHMMAX
- SHMMIN
- SHM_GNPAGES
- SHM_GPAGESZ
- SHM_MAX_SIZE
- TMP
Connection Pools

Client / Server applications with non-persistent connections can improve performance by adopting U2 Connection Pools
Windows and U2 Performance Tools

- Process Monitor
- Process Explorer
- Windows Performance Monitor
- uvdiag
- udtdiag
### Process Monitor

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Process Name</th>
<th>PID</th>
<th>Operation</th>
<th>Path</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:01:48.561</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\uvt32.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.562</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\usnrvp32.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.563</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.564</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.565</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.566</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.567</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.568</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.569</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>ARP_MU_READ</td>
<td>C:\Windows\System32\User.dll</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.570</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>Buffer Overflow</td>
</tr>
<tr>
<td>3:01:48.571</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.572</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.573</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.574</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.575</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.576</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.577</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.578</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.579</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.580</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.581</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.582</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.583</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.584</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.585</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.586</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.587</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.588</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
<tr>
<td>3:01:48.589</td>
<td>ProcessMon64</td>
<td>3152</td>
<td>RegQueryValue</td>
<td>HKLM\System\CurrentControlSet\Control\WMI\Securiy\Base\Vad3241-1122-2f...</td>
<td>SUCCESS</td>
</tr>
</tbody>
</table>

Showing all 14,974 events. Backed by page file.
# Process Explorer

![Process Explorer](image)

<table>
<thead>
<tr>
<th>Process</th>
<th>PID</th>
<th>CPU</th>
<th>Private</th>
<th>Working Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Idle Process</td>
<td>0</td>
<td>93.19</td>
<td>0 K</td>
<td>24 K</td>
</tr>
<tr>
<td>System</td>
<td>4</td>
<td>0.15</td>
<td>192 K</td>
<td>1,892 K</td>
</tr>
<tr>
<td>Scripts</td>
<td>356</td>
<td>2.43</td>
<td>0 K</td>
<td>0 K</td>
</tr>
<tr>
<td>Services.exe</td>
<td>585</td>
<td>0.01</td>
<td>2,352 K</td>
<td>4,420 K</td>
</tr>
<tr>
<td>svchost.exe</td>
<td>6388</td>
<td>2.332</td>
<td>2,332 K</td>
<td>6,404 K</td>
</tr>
<tr>
<td>WiseCommm.exe</td>
<td>4860</td>
<td>0.01</td>
<td>24,392 K</td>
<td>18,164 K</td>
</tr>
<tr>
<td>FlashUtil10w_ActiveX.exe</td>
<td>585</td>
<td>0.01</td>
<td>2,352 K</td>
<td>4,420 K</td>
</tr>
<tr>
<td>WisePvSE.exe</td>
<td>6388</td>
<td>2.332</td>
<td>2,332 K</td>
<td>6,404 K</td>
</tr>
<tr>
<td>svchost.exe</td>
<td>932</td>
<td>5.684</td>
<td>6,648 K</td>
<td>6,648 K</td>
</tr>
<tr>
<td>MsMpEng.exe</td>
<td>1000</td>
<td>106.392</td>
<td>55,996 K</td>
<td>55,996 K</td>
</tr>
<tr>
<td>atesnx.exe</td>
<td>460</td>
<td>1.596</td>
<td>1,952 K</td>
<td>1,952 K</td>
</tr>
<tr>
<td>atesclx.exe</td>
<td>1396</td>
<td>2.332</td>
<td>3,956 K</td>
<td>3,956 K</td>
</tr>
<tr>
<td>svchost.exe</td>
<td>528</td>
<td>26.236</td>
<td>14,032 K</td>
<td>14,032 K</td>
</tr>
<tr>
<td>svchost.exe</td>
<td>484</td>
<td>123.904</td>
<td>114,872 K</td>
<td>114,872 K</td>
</tr>
</tbody>
</table>

CPU Usage: 6.81%  
Commit Charge: 52.91%  
Processes: 83  
Physical Usage: 81
Windows Performance Monitor
udtdiag ships with UniData in the `udtbin directory`
Latest version is also available in entitled tech note SFMA-9735
U2 technical support providers and customers use output to diagnose problems on a UniData (UD) system
Gets info from the UD log files, UD commands, and operating system commands and produces a snapshot

```
C:\$UDTBIN\udtdiag target_directory
C:\udthome\bin\udtdiag -h
```
uvdiag is available with UniVerse 11.1.0 and higher
Also available in public tech notes UNV-4 and UNV-8 for Windows respectively
Preserves data about the UniVerse (UV) system for future analysis
Only administrator can execute this script
Users can be active on the system

C:\.uvhome\bin\uvdiag target_directory
C:\.uvhome\bin\uvdiag -h
Conducting a Benchmark: Approach

- Create a benchmark indicative of functions being performed in the applications running on the U2 databases
- Determine the type of CPU and I/O load you want to sustain during benchmarking
- Generate good metrics to compare the environment before and after applying tuning parameters
- Use Windows utilities to monitor system activities during the benchmark
Identify Tuning Areas: Memory/CPU

- Review Memory Capacity
- Review CPU Capacity
- Check for paging
- Check for high CPU usage by a process
- Check Windows API calls
Identify Tuning Areas: Disk I/O

- Check parameters for tuning NTFS file system
- Check RAID configuration
  - RAID 10 is a good performer for U2 databases
- Turn NTFS file system logging off
- Spread files over multiple spindles in a LUN (Logical Unit Number)
Benchmark: Be Proactive

- Perform Windows health checks on at least a yearly basis
- Perform U2 health checks on a yearly basis
- Monitor the system using the Windows performance utilities
- Check logs on a regular basis
- Monitor I/O and CPU usage
- Make sure the system is not paging
Services Available

- **New System Optimization**
  - Make sure U2 is optimized for the new hardware

- **Ongoing Annual HealthCheck**
  - 40% of all down systems are caused by personnel errors
  - We review the system annually to try and avert problems

For more information about Health Checks
email: **U2Services@rs.com**
Questions & Answers

To ask a question:

- Click on hand icon with green arrow and we will call your name

Or you may email us your question later at:

U2Services@rs.com
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