# Environmental SQL Server Troubleshooting

Jeff Mlakar SQL PASS User Group - Raleigh

# Who am I?

- DBA/Developer about 15 years
- MS Information Science University of Pittsburgh
- Databases Security Privacy
- Escalation Engineer Tech Lead at Varonis



- Twitter: @jmlakar
- LinkedIn: <u>https://www.linkedin.com/in/jeffmlakar</u>
- Blog: <u>www.MlakarTechTalk.com</u>

# Agenda - Troubleshooting

- Environmental?
- SQL Server
- Windows Server
- VMware



	Microsoft
Microsoft SQL S	Server 2014
Management Stu	udio
	Powered by Visual Studio
	<b>m</b> ware ESXi

## **SQL** Server

#### SQL Server Configurations

- Resource Allocation
  - OPU
  - Memory
  - Disk
- Instance level configurations
- Database level configurations



# SQL Server – CPU



#### MAXDOP

- Max # of processors used for the execution of a query in a parallel plan
- Determines computing and thread resources

Select a page	S So	ript 💌 🚺 Help				
General Memory	1000					
Processors	[2]	001 0				
Security	4 FILESTREAM					
Connections		FILESTREAM Access Level	Disabled			
Uatabase Settings		FILESTREAM Share Name	MSSQLSERVER			
Contraction of the second	154	Miscellaneous				
2 Permissions		Allow Triggers to Fire Others	True			
		Blocked Process Threshold	0			
		Cursor Threshold	-1			
		Default Full-Text Language	1033			
		Default Language	English			
		Full-Text Upgrade Option	Rebuild			
		Max Text Replication Size	65536			
		Optimize for Ad hoc Workloads	False			
		Scan for Startup Procs	True			
		Two Digit Year Cutoff	2049			
		Network				
		Network Packet Size	4096			
Connection		Remote Login Timeout	20			
Connocator		Parallelism				
Server:		Cost Threshold for Parallelism	5			
		Locks	0			
Connection:		Max Degree of Parallelism	0			
soladmin	27	Query Wat	-1			

There are exceptions but this is a good starting place: <u>https://support.microsoft.com/en-us/kb/2806535</u>

### SQL Server – CPU

- The default is 0 i.e. use all cores
- For < 8 logical cores, assign the value to be the number of logical cores</p>
- For >= 8 logical cores, assign the value to be 8
- Exceptions exist good starting place
  - SharePoint, OLTP vs OLAP
- How do you know if there are MAXDOP problems?

### SQL Server – CPU

Cost threshold for parallelism

- Default is 5
- Based on estimated query cost
- Suggest 50
- Legend of CTP
  - <u>https://sqlstudies.com/2017/04/17/what-is-the-cost-in-cost-threshold-for-parallelism/</u>

Processor and I/O Affinity

- Controls CPU processors that SQL Server will use
- We typically want SQL to use all processors

https://blogs.msdn.microsoft.com/psssql/2010/11/19/how-it-works-io-affinity-mask-should-i-use-it/



- The default memory allocated to a SQL Instance is 0 for min server memory and 2147483647 for max server memory (i.e. all).
- Set the minimum server memory to 0

Select a page	Script ▼   Help
<ul> <li>Memory</li> <li>Processors</li> <li>Security</li> <li>Connections</li> <li>Database Settings</li> </ul>	Server memory options
Advanced Permissions	Minimum server memory (in MB): 0 Maximum server memory (in MB): 4096

- Set the maximum server memory depending on what else is running on the machine
- Typically leave Windows Server >= 4GB
- SSRS, SSIS, SSAS should have !< 4GB each</p>
- If other apps on machine add more memory
- Assign the rest to SQL Server

#### Examples:

Total RAM = 16GB						
Component Memory Allocated (GB)						
OS	4					
SSRS	1					
Арр	1					
Subtotal OS	6					
SQL	10					

Total RAM = 64GB							
Component Memory Allocated (GB)							
OS	8						
SSRS	4						
Арр	4						
Subtotal OS	16						
SQL	48						

Total RAM = 128GB					
Component	Memory Allocated (GB)				
OS	12				
SSRS	12				
Арр	8				
Subtotal OS	32				
SQL	96				

- Reserve 1 GB of RAM for the OS, 1 GB for each 4 GB of RAM installed from 4–16 GB, and then 1 GB for every 8 GB RAM installed above 16 GB RAM.
- Then monitor the Memory\Available MBytes performance counter in Windows to determine if you can increase the memory available to SQL Server above the starting value.

https://www.sqlskills.com/blogs/jonathan/how-much-memory-does-my-sql-server-actually-need/

#### CLR

- Starting with SQL Server 2012, CLR allocations are also included in memory limits that are controlled by max server memory (MB) and min server memory (MB).
- Prior it was addressed in the OS memory space
  - https://support.microsoft.com/en-us/kb/2663912



# SQL Server – Disk



- Separate DB files on different disks
  - Database files (system / user) MDF, NDF
  - Transaction logs LDF
  - Tempdb
  - Backups BAK
  - Trace files TRN
  - OS / SQL binaries / page file
- At a minimum data and xact log files separate
- What do you put on the fastest disk?

#### **SQL Server - Disk**



Storage Top 10 Best Practices: <u>https://technet.microsoft.com/en-us/library/cc966534.aspx</u>

Maximum worker threads

- Default is 0 leave it alone!
- <u>https://msdn.microsoft.com/en-us/library/ms190219(v=sql.110).aspx</u>
- Maximum # of concurrent connections
  - Default is 0 leave it alone!

https://docs.microsoft.com/en-us/sql/database-engine/configurewindows/configure-the-max-worker-threads-server-configuration-option

#### Boost SQL priority

Default is unchecked – leave alone!



FWIW marked for deprecation https://technet.microsoft.com/en-us/library/ms180943(v=sql.105).aspx

Allow remote connections to the instance

- Default is checked leave it alone
- Remote query timeout
  - Default is 0 (no timeout) leave it alone

#### Query wait

- Time in seconds that a query waits for resources before timing out
- Default is -1 leave it alone

#### TempDB

- 1 file per logical core up to 8 then evaluate
- Increase in sets of 4
- Initial size should be the same for all
- Autogrow in MB not %
- Trying to reduce allocation contention
- Trace Flags
  - ◎ 1117
  - 9 1118

https://support.microsoft.com/en-us/help/2154845/recommendations-to-reduceallocation-contention-in-sql-server-tempdb-d

# SQL Server – Database Level

# Configurations

- Auto Close
- Auto Shrink

Select a page	Script 👻 🚺 Help					
Files Filegroups	Collation:	SQL_Latin1	_General_CP1_CI_AS	•		
Options	Recovery model:	Simple		•		
Permissions	Compatibility level:	SQL Server	SQL Server 2008 (100)			
Extended Properties	Containment type:	None		+		
Transaction Log Shipping	Other options:					
	4 Automatic					
	Auto Close	Fa	ilse	10		
	Auto Create Incremental	Statistics Fa	lse			
	Auto Create Statistics	Tr	ue			
	Auto Shink	Fa	lse			
	Auto Update Statistics	Ir	ue			
	Auto Update Statistics As	which ronously Fa	lse			
	4 Cursor					
	Close Cursor on Commit E	Enabled Fa	lse	1011		
Connection	Default Cursor	G	OBAL			
	Miscellaneous	100	and the second			
Server.	Allow Snapshot Isolation	Fa	ilse			
	ANSI NULL Default	Fa	lse			
Connection:	ANSI NULLS Enabled	Fa	False False False False False			
sqladmin	ANSI Padding Enabled	Fa				
S View connection properties	ANSI Warnings Enabled	Fa				
	Arthmetic Abort Enabled	Fa				
Progress	Concatenate Null Yields N	Nul Fz				
O Ready	Auto Shrink					

MS Best Practice: Considerations for the "autogrow" and "autoshrink" settings in SQL Server Read this: http://support.microsoft.com/kb/315512

# **Operating System**

Windows Server

- General configurations
- Power settings
- Page file
- AV
- WSFC
- Firewall
- Scheduled tasks
- Disk Partition Alignment



# Windows Server – General Configs

#### Windows Update

- Disable automatic updates
- Otherwise there will be unmanaged downtime to the applications running on this machine
- Windows OS Roles
  - Only install and activate necessary roles
- Windows OS Features
  - Only install and activate necessary features
- What non-default software is running on a machine running a SQL Instance?

### Windows Server - Power



Default power setting is "Balanced".

- This is <u>not</u> acceptable
- Will throttle system resources globally to all applications and significantly hinder SQL performance
- ALWAYS set to HIGH performance!

\$	le Power Options						
G	Control Panel + Hardware + Power Options						
	Control Panel Home	Select a power plan					
	Require a password on wakeup	Power plans can help you maximize your computer's performance or conserve energy. Make a or choose a plan and customize it by changing its power settings. <u>Tell me more about power p</u>	a plan active by selecting it, <u>plans</u>				
	Choose what the power button does	Preferred plans					
	Create a power plan	C Balanced (recommended)	Change plan settings				
	Choose when to turn off the display	Automatically balances performance with energy consumption on capable hard	dware.				
۲	Change when the computer sleeps	• High performance	Change plan settings				
		Favors performance, but may use more energy.					
		Show additional plans	•				

# Windows Server - Power



#### Power Setting Trickery

- BIOS level power setting
  - HP ProLiant
  - Dell PowerEdge
- Group Policy level power setting
- vSphere power setting



Locale Services <ul> <li>Setting</li> <li>Settings</li> <li>Button Settings</li> <li>Net Logon</li> <li>Net Logon</li> </ul> Setting <ul> <li>Settings</li> <li>Hundration Settings</li> <li>Hundration Settings</li> </ul>						
Logon       Button Settings         Mitigation Options       Energy Saver Settings         Net Logon       Hereby Constructions		Locale Services	^	Setting	State	Comment
<ul> <li>Power Management</li> <li>Button Settings</li> <li>Energy Saver Settings</li> <li>Hard Disk Settings</li> <li>Sleep Settings</li> <li>Video and Display Settings</li> <li>Select an active power plan</li> <li>Not configured</li> <li>Not configured</li> <li>Not configured</li> <li>Not</li> </ul>	> °	<ul> <li>Logon</li> <li>Mitigation Options</li> <li>Net Logon</li> <li>Power Management</li> <li>Button Settings</li> <li>Energy Saver Settings</li> <li>Hard Disk Settings</li> <li>Notification Settings</li> <li>Sleep Settings</li> <li>Sleep Settings</li> <li>Video and Display Settings</li> <li>Recovery</li> <li>Remote Assistance</li> </ul>		<ul> <li>Button Settings</li> <li>Energy Saver Settings</li> <li>Hard Disk Settings</li> <li>Notification Settings</li> <li>Sleep Settings</li> <li>Video and Display Settings</li> <li>Specify a custom active power plan</li> <li>Select an active power plan</li> </ul>	Not configured Not configured	No No

#### Windows Server - Power



#### Power Setting Trickery: vSphere power setting

Summary	Monitor	Manage	Related Objects						
Settings	Networking	Storage	Alarm Definitions	Tags	Permis	ssions			
44			Power Managem	ent					Edit
Virtua	I Machines		Technology ACPI P-states, ACPI C-states						
<ul> <li>Syste</li> <li>Hardy</li> </ul>	m vare		Active policy			Custom			
Proce	ssors								
Memo	огу								
Graph	lics								
Powe	r Managemei	nt							
:Edit Power Policy Settings									
		<ul> <li>High per Do not us</li> <li>Balance Reduce</li> <li>Low pov Reduce</li> <li>Custom User-def</li> </ul>	formance se any power mana d energy consumptior ver energy consumptior ined power manage	gemen n with m n at the ement p	t feature iinimal ( risk of k	s performance cor pwer performanc	npromise :e		
							ОК	Cancel	

https://www.vmware.com/content/dam/digitalmarketing/vmware /en/pdf/techpaper/hpm-performance-vsphere55-white-paper.pdf

## Windows Server – Page Files

- Page files are a special kind of file used as a temp workspace for storing modified pages from disk still in use by a process
- Holds data which is in the process of being swapped in and out of physical memory
- Allows a larger virtual memory set
- Large page files deserve their own disk (like data, xact log, tempdb, etc.)
- What does lots of page file usage mean?

## Windows Server – Page Files

#### PerfMon counters

- Memory: Committed Bytes number of bytes of virtual memory that has been committed
- Memory: Commit Limit number of bytes of virtual memory which can be committed without having to extend the paging files
- Paging File: % Usage % of the paging file committed
- Paging File: % Usage Peak highest % of the paging file committed

## Windows Server – Page Files

What is the Page File for anyway

- <u>https://blogs.technet.microsoft.com/askperf/2007/12/14/w</u> <u>hat-is-the-page-file-for-anyway/</u>
- How to Determine the Appropriate Page File Size for 64-bit Versions of Windows
  - https://support.microsoft.com/en-us/help/2860880/howto-determine-the-appropriate-page-file-size-for-64-bitversions-of
- Page File The Definitive Guide
  - <u>https://blogs.technet.microsoft.com/motiba/2015/10/15/page-file-the-definitive-guide/</u>

### Windows Server – AV

#### Anti Virus – Exclusions

- If AV is running on SQL host then whitelist DB files
  - MDF –file extensions associated with SQL Server database files
  - LDF file extensions associated with SQL Server transaction log files
  - BAK file extensions associated with SQL Server backup files
  - TRN file extensions associated with SQL Server trace files

### Windows Server - WSFC

Windows Server Failover Cluster

- If the WSFC feature is installed and running then make sure the best practices are being employed
- Microsoft Windows Multi-Site Failover Cluster Best Practices (2012)
  - <u>https://blogs.technet.microsoft.com/meamcs/2013/11/09/microsoft</u> <u>-windows-multi-site-failover-cluster-best-practices/</u>
- Windows Server 2008 R2 Failover Clustering Best Practices Guide (2008 R2)
  - <u>https://blogs.technet.microsoft.com/aevalshah/2012/05/15/window</u> <u>s-server-2008-r2-failover-clustering-best-practice-guide/</u>

## Windows Server – Firewall



Windows Firewall with Advanced Security

Windows Server Firewall

If it is running then make sure there are port exclusions for necessary ports for application to communicate

Port	Protocol	Usage
135	TCP	SSMS T-SQL Debugger
80	TCP	SSRS: http requests
443	TCP	SSRS: https requests SSL
1433	TCP	Default SQL Server port
1434	TCP	DAC
1434	UDP	SQL Server Browser

https://docs.microsoft.com/en-us/sql/sql-server/install/configure-the-windows-firewallto-allow-sql-server-access

### Windows Server – Scheduled Jobs

#### Maintenance Jobs

- SQL Server backups
- SQL Server index maintenance
- SQL Server dbcc checkdb
- Disk space checks
- Make sure setup right and run off peak
- Monitor output and errors

# Windows Server – Disk Partition Alignment

#### Optimal disk configuration

- Windows default is 1,024 kb cluster
- Start at a more common sizing of 64 kb
- Greater chance of playing nice with disks, controllers, and cache
- Formatting disk to 64 kb cluster size can remediate suboptimal I/O performance

Disk Partition Alignment Best Practices for SQL Server https://technet.microsoft.com/en-us/library/dd758814(v=sql.100).aspx

# Virtualization

VMware – accept no substitute

- SQL Server on VMware best practices guide
- General Configurations
- CPU Ready
- Memory Ballooning
- Disk



#### VMware

Troubleshooting Guidelines

- Troubleshooting ESX/ESXi Virtual Machine Performance Issues
  - <u>https://kb.vmware.com/selfservice/microsites/search.do</u> <u>?language=en\_US&cmd=displayKC&externalId=2001003</u>
- Tips for Configuring Microsoft SQL Server in a Virtual Environment
  - <u>https://kb.vmware.com/selfservice/microsites/search.do</u> <u>?language=en\_US&cmd=displayKC&externalId=1002951</u>

# VMware

vSphere Key Performance Metrics

Table 9. Key Performance Metrics							
Resource	Metric (resxtop)	Metric (vSphere Client)	Host/Virtual Machine	Description			
CPU	%USED	Used	Both	CPU used over the collection interval (%).			
	%RDY	Ready	Virtual Machine	CPU time spent in ready state.			
	%SYS	System	Both	Percentage of time spent in the vSphere Server VMKernel.			
Memory	Swapin, Swapout	Swapinrate, Swapoutrate	Both	Memory vSphere host swaps in/out from/to disk (per virtual machine, or cumulative over host).			
	MCTLSZ (MB)	vmmemctl	Both	Amount of memory reclaimed from resource pool by way of ballooning.			
Disk	READs/s, WRITEs/s	NumberRead, NumberWrite	Both	Reads and Writes issued in the collection interval.			
	DAVG/cmd	deviceLatency	Both	Average latency (ms) of the device (LUN).			
	KAVG/cmd	KernelLatency	Both	Average latency (ms) in the VMkernel, also known as queuing time.			
	GAVG/cmd	TotalLatency	Both	Average latency (ms) in the guest. GAVG = DAVG + KAVG.			
Network	MbRX/s, MbTX/s	Received, Transimitted	Both	Amount of data transmitted per second.			
	PKTRX/s, PKTTX/s	PacketsRx, PacketsTx	Both	Packets transmitted per second.			
	%DRPRX, %DRPTX	DroppedRx, DroppedTx	Both	Dropped packets per second.			

- Overcommitting the VM Host CPU to Guest VMs
  - Can cause more trouble than benefit.
  - Hypervisor must keep track of CPUs and context switch between them across all guest VMs.
  - Try to "Right-Size" the guest machines rather than over commit.
- Recommend a CPU Ready of under 5%.
- The command "esxtop" can be run from the ESX host to get general statistics about the VM host.

Waits in CPU Ready below 10,000ms.

- A range of 5000-8000ms should be as high as they get.
- Reservations on CPU
- CPU Shares High
- Converting Between CPU Summation and CPU % Ready Values
  - <u>https://kb.vmware.com/selfservice/microsites/search.do?language=en US&cmd=displayKC&externalId=2002181</u>
- Determining if Multiple Virtual CPUs are Causing Performance Issues
  - <u>https://kb.vmware.com/selfservice/microsites/search.do?language=en</u> <u>US&cmd=displayKC&externalId=1005362</u>

Examples of calculating CPU % Ready

- Use the following formulas for the default chart update intervals
  - Realtime: CPU summation value / 200
  - Past Day: CPU summation value / 3000
  - Past Week: CPU summation value / 18000
  - Past Month: CPU summation value / 72000
  - Past Year: CPU summation value / 864000



#### CPU Ready %

- Min
- Average
  - ◎ 16850 / 18000 = 0.9361
- Max
  - 38067 / 18000 = 2.1148



https://kb.vmware.com/selfservice/microsites/search.do?language=en\_US&cmd=displayKC &externalId=2002181

# VMware – Memory Ballooning

#### Memory reservations

- If in place make sure there is enough memory in the lower bound for the guest machine to perform without excessive paging.
- Also make sure the VM host isn't stressed for memory and the hypervisor doesn't have to reclaim memory to service other guests.
- If memory is overcommitted then either increase memory to the host OR reduce memory to the guest VMs

### VMware – Memory Ballooning

arview Advanced			
U/Real-time, 8/27/2014 2:01 ph refreshes every 20 seconds	L:50 PM - 8/27/2014 3:01:50 PM Chart Options		Switch to:
2000	Customize Performance Chart		]
	Saved Chart Settings: Default	Always load these settings at startup	
1500	Chart Options	Chart Type	
- 1500	E-O CPU	(* Line graph C Stacked graph	
	Past day Past week	Objects	
	Past month Past year		
- 1000	Custom		
	Memory     Real-time	All None	
· · · · · · · · · · · · · · · · · · ·	Past day Past week	Counters	
- 500	Past month	Description Rollup Units Internal Name -	$\  - A \rangle$
	Custom E O Network	Memory saved by zpping Latest kilobytes zpsaved     Decompression rate Average KBps decompression	1W
		Swapped Average Kilobytes swapped	1
		W Balloon Average Kilobytes vmmemcti ↔	$ \sim $
2:05 PM	2:1	All None	2:50 PM
rformance Chart Legend	€ Last 1 ÷ Hour(s) ▼	Counter Description Rollup: Average Statistics Type: Absolute	
y Object Measu	C From 8/27/2014 3:01 PM	Amount of memory allocated by the virtual machine memory control driver	
1 Usage L69B-DV1 Usage	To: 8/27/2014 3:01PM		
L69B-DV1 Usage	inn	Manage Chart Settings Save Chart Settings	
	Help	OK Cancel Apply	Name Target or She

### VMware – Memory Ballooning

		2:05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	213000       210 PM       215 PM       220 PM       225 PM       230 PM       2235 PM       2240 PM       2245 PM       2250 PM       2255 PM       3100 PM         Time         mance Chart Legend         Object       Measurement       Rollup       Units       Setest       Maximum       Minimum       Average       Xilobytes       1195376       1195376       109740       173255.55         L698-DV1       Active       Average       Kilobytes       1295376       1195376       109740       173255.55         L698-DV1       Consumed       Average       Kilobytes       5289436       6289584       6289288       6289281       6289288       6289281       6289288       6289281       6289288       6289288       6289281       6289288       6289281       6289288       6289281       6289288       6289281       6289288       6289288       6289281       6289288 <td< th=""><th>1750000</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>	1750000												
		- 1750000 - 1750000 - 0 2:05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:45 PM 2:45 PM 2:56 PM 2:55 PM 3:00 PM	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 0 0 0 0 0 0 0 0 0 0 0							_						
		- 1750000 - 175000 -	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time mance Chart Legend 0bject Measurement Rollup Units batest Maximum Average L698-DVI Balloon Average Kilobytes 1195376 1195376 1195376 11952555 L698-DVI Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2													
		- 1750000 - 175000 - 1750000 - 175000 - 17500	50000 PM 2:10 PM 2:15 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 1750000 0 1750000 0 1750000 0 1750000 0 1750000 0 1750000 0 1750000 0 1750000 0 175000 1750000 1750000 175000 175000 1750000 175	3500000												
		- 330000 - 1750000 - 1750000 - 0 - 0 - 0 - 0 - 0 - 0 - 0	50000 50000 PM 2:10 PM 2:15 PM 2:25 PM 2:35 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:55 PM 2:55 PM 3:00 PM	330000       1750000         1750000       1750000         0       0         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       10         0       0         0       0         0       0         0       0         1980/V1       Balloon         Average       Kilobytes         11953/s       11953/s	2500000									-			
		350000 17500000 1750000000000 175000000000000000000000000000000000000	50000 50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	350000 3500000 35000000 35000000 3500000000 350000000000													
		350000 175000 0 0 5 5 5 5 5 5 5 5 5 5 5 5 5	20000 50000 50000 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	3500000       1 </td <td></td>													
		350000 175000	00000       0 <td>350000       350000         175000       1000</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>_</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	350000       350000         175000       1000						_	-						
		2110 PM 213 FM 2120 FM 2125 FM 2130 FM 2135 FM 2145 FM 2145 FM 2150 FM 2155 FM 3100 FP	2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:30 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	art tegend Measurement Balloon At rego Kilobytes Consumed Average Kilobytes Consumed Average Kilobytes Consumed Co	-												
25000	25000	500000 50000 500000 500000 500000	50000 50000 50000 PM 2:15 PM 2:25 PM 2:32 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	500000 5000000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000 500000	250000												
125000	/25000	150000 150000 150000 1750000 5 PM 2:15 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:49 PM 2:45 PM 2:45 PM 2:55 PM 3:00 PM	50000 50000 50000 PM 2:15 PM 2:25 PM 2:32 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	150000 150000	250000					_							
		1500000 1500000 1750000 5 PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:45 PM 2:45 PM 2:45 PM 2:55 PM 3:00 PM	20000 50000 50000 PM 2:15 PM 2:25 PM 2:32 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	150000 150000													
		1500000 17500000 17500000 175000000 175000000000000000000000000000000000000	20000 50000 50000 PM 2:15 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:45 PM 2:45 PM 2:45 PM 2:55 PM 3:00 PM	150000       100000       100000       10000       100000													
		1750000 17500000 17500000 175000000000 175000000000000000000000000000000000000	50000 50000 50000 FM 2:10 PM 2:25 PM 2:26 PM 2:35 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	550000       1 <td></td>													
		1550000 175000000000 175000000 175000000000000000000000000000000000000	50000 50000 50000 PM 2:15 PM 2:20 PM 2:25 PM 2:35 PM 2:40 PM 2:45 PM 2:55 PM 2:55 PM 3:00 PM	550000 550000 55 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Time Time Time													
		1750000 17500000 17500000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 1750000 17500000 1750000000000	10000       1 <td>3500000       1<!--</td--><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td>	3500000       1 </td <td>-</td> <td></td>	-												
		550000 17500000000 175000000 1750000000000000 1750000000000000000000000	20000 50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 175000 17													
		3500000 17500000 1750000000000	D0000       Image: Construction of the constru	350000 175000													
		3500000 1750000 05 PM 2:10 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:35 PM 2:45 PM 2:45 PM 2:55 PM 3:00 PM	20000 50000 50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	3500000 175000 17500													
		250000 1750000 0 0 0 0 0 0 0 0 0 0 0 0	20000 50000 PM 2:10 PM 2:15 PM 2:25 PM 2:35 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:55 PM 2:55 PM 3:00 PM	550000 175000000 1750000000 17500000 17500000 17500000000000 17500000	diame.												
		1750000 1750000 15 PM 2:10 PM 2:20 PM 2:32 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 1750000 15 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Nance Chart Legend Object Rollup Units bedest Maximum Minimum Average 5898-DV1 Balloon Average Kilobytes 115376 115376 115205 51 5898-DV1 Balloon Average Kilobytes 115376 115376 115205 51 5898-DV1 Consumed Average Kilobytes 115376 115376 115205 51	3500000												
		1750000 17500000 1750000000 175000000 1750000000000000 175000000000000000000000	50000 50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 15 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Tance Chart Legend Object Measurement Rollup Units Other Maximum Minimum Average Kilobytes 195376 195376 195376 195376 195376 195376	300000												
		1750000 17500000000 175000000 1750000000000000 175000000000000000000000	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 1750000 15 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Tance Chart Legend Diject Measurement Rollup Units Detect Maximum Minimum Average Kilobytes 0 0 0 0 L698-DV1 Balloon Average Kilobytes 1195376 1195376 1195376 1195376 125555 L698-DV1 Consumed Average Kilobytes 1195376 125555												1 1	
		1750000 17500000 17500000 1750000000 17500000000000000 175000000000000000000000000000000000000	50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 1750000 1750000 1750000 1750000 155 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Time Time Time Time		(i (i _(i						0					
		1750000 1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:50 PM 2:55 PM 3:00 PM Time nance Chart Legend Object Measurement Rollup Units Extent Maximum Minimum Average L698-DV1 Balloon Average Kilobytes 1195376 1195376 1263746 4525555 L698-DV1 Active Average Kilobytes 129576 1195376 1263746 4525555													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000       10													
		1750000 0- 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     1000       0     0       0 <td>1</td> <td></td>	1												
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:15 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 175000 1750000 1750000 1750000 1750000													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000       1750000         05 PM       2:10 PM       2:15 PM       2:20 PM       2:25 PM       2:30 PM       2:32 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         Object       Measurement       Rollup       Units       Detest       Maximum       Minimum       Average         L698-DV1       Balloon       Average       Kilobytes       1993/16       1793/16       1793/16       1793/25       155       1598/25         L698-DV1       Consumed       Average       Kilobytes       1993/26       1793/26								() (i) (i) (i) (i) (i) (i) (i) (i) (i) (			-		
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time nance Chart Legend 0bject Measurement Rollup Units bstest Maximum Minimum Average L698-0V1 Balloon Average Kilobytes 119537/6 119537/6 119537/6 129255.55 L698-0V1 Consumed Average Kilobytes 5289436 6289584 6289288 6289471.2													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time nance Chart Legend 0 bject Measurement Rollup Units totest Maximum Minimum Average L698-DV1 Balloon Average Kilobytes 1195376 1195376 1195376 11952555 L698-DV1 Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 6 1750000 6 1750000 6 1750000 105 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Tim													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 175000 1750000 1750000 1750000 1750000													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time Time Time Time Time Time													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 5 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time nance Chart Legend 0 bject Measurement Rollup Units Detext Maximum Minimum Average L698-DVI Balloon Average Kilobytes 1195376 1195376 179255.55 L698-DVI Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2								1					
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 0 0 0 0 0 0 0 0 0 0 0													
		1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	50000 PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	1750000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000000												
		0- 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	PM 2:10 PM 2:15 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0	1750000												
		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	PM 2:10 PM 2:25 PM 2:25 PM 2:35 PM 2:35 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0	1750000												
		0- 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0													
		0 0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       2:10 PM       2:15 PM       2:20 PM       2:25 PM       2:30 PM       2:35 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Image: Chart Legend         Object       Measurement       Rollup       Units       Datest       Maximum       Minimum       Average       Average       Kilobytes       11953/5       11953/5       109740       172555.55       I <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>													
		05 PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0								-					
		0 0 0 0 0 0 0 0 0 0 0 0 0 0	PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0	1												
		05 PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PP	PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       0	V I												
		D5 PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       2:10 PM       2:15 PM       2:20 PM       2:25 PM       2:30 PM       2:35 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         Object       Measurement       Rollup       Units       Estest       Maximum       Minimum       Average       Average       Kilobytes       0 <td></td>													
		0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:50 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:25 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	05 PM       2:10 PM       2:15 PM       2:20 PM       2:25 PM       2:30 PM       2:35 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         nance Chart Legend         Object       Measurement       Rollup       Units       Estest       Maximum       Minimum       Average       Average       Kilobytes       0 <t< td=""><td>- mar -</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>course of</td></t<>	- mar -												course of
		15 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0       2:10 PM       2:15 PM       2:20 PM       2:25 PM       2:30 PM       2:35 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         Mance Chart Legend         Object       Measurement       Rollup       Units       Estext       Maximum       Minimum       Average       Average       Kilobytes       0		-											
1       1		0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	Object         Measurement         Rollup         Units         Extest         Maximum         Minimum         Average         Sign of the system													
		0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	0 05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time nance Chart Legend Object Measurement Rollup Units totest Maximum Minimum Average L698-DV1 Balloon Average Kilobytes 0 0 0 0 L698-DV1 Active Average Kilobytes 1195376 1195376 100740 175255.55 L698-DV1 Consumed Average Kilobytes 5289436 6289584 6289288 6289471.2		1		Charles and the second se		- Val		1000	N	1.55			
		15 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	D5 PM         2:10 PM         2:15 PM         2:20 PM         2:25 PM         2:30 PM         2:35 PM         2:40 PM         2:45 PM         2:50 PM         2:55 PM         3:00 PM           Time           Nance Chart Legend           Object         Measurement         Rollup         Units         Estest         Maximum         Minimum         Average         Average         Kilobytes         0 <td></td>													
		35 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM	05 PM         2:10 PM         2:15 PM         2:20 PM         2:30 PM         2:35 PM         2:40 PM         2:45 PM         2:50 PM         2:55 PM         3:00 PM           Time           nance Chart Legend           Object         Measurement         Rollup         Units         Extent         Maximum         Minimum         Average	AL	380-0020-0	69922129	(Sanatas)	-1406-5-1674-1	Standard	28 5-32	22215	and the second	1903-195	a care	and the second	Hard Street
			entry sources and participant statistication statistic	Time       Object     Measurement     Rollup     Units     Estest     Maximum     Minimum     Average       L69B-DV1     Balloon     Average     Kilobytes     0     0     0       L69B-DV1     Active     Average     Kilobytes     11953/5     13951/5     13952/55.55       L69B-DV1     Consumed     Average     Kilobytes     6289584     6289584     6289471.2	05 PM	2:10 PM	2:15 PM	2:20 PM	2:25 PM	2:30 PM	1 2:	35 PM	2:40 PM	2:45 PM	2:50 PM	2:55 PM	3:00 PM
350000 175000	1750000 17500000 17500000 1750000000 175000000000000000000000000000000000000			Time       Object     Measurement     Rollup     Units     Extent     Maximum     Minimum     Average       L698-DV1     Balloon     Average     Kilobytes     0     0     0       L698-DV1     Active     Average     Kilobytes     11953/5     109740     175255.55       L698-DV1     Consumed     Average     Kilobytes     6289584     6289584     6289471.2	8703-1876		1122.121	10001207-010			CLOSED STATE	2.7.15.12 C	20.000.000	100 A 100 A 100 A		100000000000	
50000 500000 50000 50000 50000 50000 50000 50000 50000 50000 5	50000 5000 500000 500000 5	Time	Time	Aance Chart Legend Object Measurement Rollup Units Setest Maximum Average L698-DV1 Balloon Average Kilobytes 0 0 0 0 L698-DV1 Active Average Kilobytes 1195376 195376 18576 185255.55 L698-DV1 Consumed Average Kilobytes 5289436 6289584 6289288 6289471.2							Time						
00000 50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM Time	00000 50000 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:45 PM 2:50 PM 2:55 PM 3:00 PM			bject Measurement Rollup Units Estest Maximum Minimum Average 698-DV1 Balloon Average Kilobytes 0 0 0 0 698-DV1 Active Average Kilobytes 11953/6 11953/6 130740 175255.55 698-DV1 Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2													
50000 5000 500000 50000 50000 50000 50000 50	50000 5000 500000 500000 500000 500000 50000 50000 500000			Balloon     Average     Kilobytes     0     0     0       L698-DV1     Balloon     Average     Kilobytes     0     0     0       L698-DV1     Active     Average     Kilobytes     11953/6     189740     175255.55       L698-DV1     Consumed     Average     Kilobytes     6289584     6289588     6289471.2	et al.	20000000											
ISO000 ISO000				Object         Measurement         Rollup         Units         Extest         Maximum         Minimum         Average           L698-DV1         Balloon         Average         Kilobytes         0         0         0         0         0           L698-DV1         Active         Average         Kilobytes         11953/6         13953/6         12525555           L698-DV1         Consumed         Average         Kilobytes         6289584         6289288         6289471.2	nance Chart Le	egend											
1750000 175000 1750000 1750000 1750000 1750000 1750000 1750000	1750000 175000000 175000000 17500000 17500000 17500000 17500000000000	nance Chart Legend	nce Chart Legend	L698-DV1         Balloon         Average         Kilobytes         0	Object	Measurement	5	Rollun	Units	Intest	Maximum	Minimum	Average				
SS0000 SS000 SS0000 SS0000 SS0000 SS0000 SS0000 SS0000 SS0000 SS0000 SS0000	3500000 175000000 1750000000 17500000 17500000 175000000000000 175000	nance Chart Legend	nce Chart Legend	L698-DV1         Active         Average         Kilobytes         1195376         139376         179255.55           L698-DV1         Consumed         Average         Kilobytes         6289436         6289288         6289471.2	objett	Ralloon		Average	Kilobatar	- A	PRAMINUM	A I	0				
350000 35000 350000 350000 350000 350000 350000 350000 350000	350000 35000 350000 3500000 3500000 35000000 3500000 3500000 350000 350000 350000 350000 35000	mance Chart Legend Object Measurement Rollup Units batest Maximum Minimum Average	nce Chart Legend bject Measurement Rollup Units Estest Maximum Minimum Average	Leve-DVI Active Average Kilobytes 1195376 1195376 175255.55 L698-DVI Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2	A REPORT FRANK	Balloon		Average	KIIODytes	0	U	0	U				
350000 350000 175000 0 5 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM 2:35 PM 2:40 PM 2:45 PM 2:50 PM 2:35 PM 3:00 PM The The The The The The The The	3500000	mance Chart Legend Object Measurement Rollup Units Batest Maximum Average L698-DVI Balloon Average Kilobytes 0 0 0 0	nce Chart Legend bject Measurement Rollup Units betest Maximum Minimum Axerage 198-DVI Balloon Average Kilobytes 0 0 0 0	L69B-DV1 Consumed Average Kilobytes 6289436 6289584 6289288 6289471.2	L698-DV1												
350000       3500000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       350000       3500000       350000       350000	350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         350000       350000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         3590000       3230000         35900000       3230000         35900000       32300000         35900000       32300000         359000000       32300000         359000000000000000000000000000000000000	Mance Chart Legend     Measurement     Rollup     Units     Detest     Maximum     Minimum     Average       L69B-DV1     Balloon     Average     Kilobytes     0     0     0     0       L69B-DV1     Active     Average     Kilobytes     11953/6     11953/6     1953/5	nce Chart Legend bject Measurement Rollup Units betest Maximum Minimum Average 198-DV1 Balloon Average Kilobytes 0 0 0 0 198-DV1 Active Average Kilobytes 1195376 100740 475255.55		L698-DV1	Active		Average	Kilobytes	1195376	1195376	100740	17 92 55.55				
350000       350000         175000       10         0       10 </td <td>350000       350000         175000       10         05 PM       2:10 PM       2:15 PM       2:20 PM       2:30 PM       2:32 PM       2:32 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         Diject       Measurement       Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"Colspan="4"&gt;Colspan="4"C</td> <td>mance Chart Legend     Object     Measurement     Rollup     Units     Letest     Maximum     Minimum     Average       L698-DV1     Balloon     Average     Kilobytes     0     0     0     0       L698-DV1     Active     Average     Kilobytes     11953/5     11953/5     12025.55       L698-DV1     Consumed     Average     Kilobytes     12953/6     6289584     6289283     6289283</td> <td>noe Chart Legend bject Measurement Rollup Units betest Maximum Minimum Average 198-DV1 Balloon Average Kilobytes 0 0 0 0 198-DV1 Active Average Kilobytes 11953/6 11953/6 120740 173255.55 198-DV1 Consumed Average Kilobytes 5289384 5289284 5289284</td> <td></td> <td>L698-DV1 L698-DV1</td> <td>Active</td> <td></td> <td>Average</td> <td>Kilobytes</td> <td>1195376</td> <td>6289584</td> <td>6289288</td> <td>6289471.2</td> <td></td> <td></td> <td></td> <td></td>	350000       350000         175000       10         05 PM       2:10 PM       2:15 PM       2:20 PM       2:30 PM       2:32 PM       2:32 PM       2:40 PM       2:45 PM       2:50 PM       2:55 PM       3:00 PM         Time         Diject       Measurement       Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4"Colspan="4">Colspan="4"C	mance Chart Legend     Object     Measurement     Rollup     Units     Letest     Maximum     Minimum     Average       L698-DV1     Balloon     Average     Kilobytes     0     0     0     0       L698-DV1     Active     Average     Kilobytes     11953/5     11953/5     12025.55       L698-DV1     Consumed     Average     Kilobytes     12953/6     6289584     6289283     6289283	noe Chart Legend bject Measurement Rollup Units betest Maximum Minimum Average 198-DV1 Balloon Average Kilobytes 0 0 0 0 198-DV1 Active Average Kilobytes 11953/6 11953/6 120740 173255.55 198-DV1 Consumed Average Kilobytes 5289384 5289284 5289284		L698-DV1 L698-DV1	Active		Average	Kilobytes	1195376	6289584	6289288	6289471.2				

#### VMware – Disk

#### PVSCSI – Paravirtual SCSI adapter



<u>Configuring Disks to Use VMware Paravirtual SCSI (PVSCSI) Adapters</u> https://kb.vmware.com/selfservice/microsites/search.do?language=en\_US&cmd= displayKC&externalId=1010398

### Conclusions

- Defaults are often poor!
- Use best practices to configure SQL Server to minimize performance issues
  - Test, test, test!
- Know when to step outside the guidelines
  - Learn the exceptions

#### Q&A

