

Keeping Your Network at Peak Performance as You Virtualize the Data Center Share Orlando Session 9288



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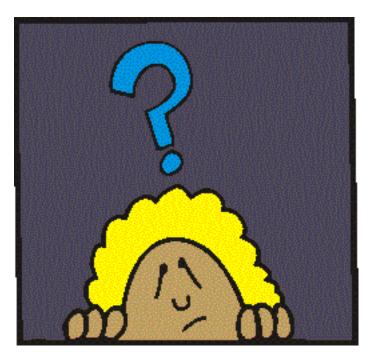


Background

The Physical Network

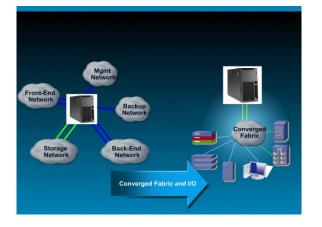
Inside the IP Stack

Summary



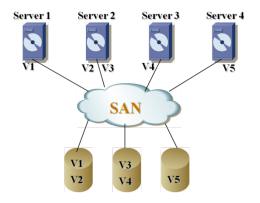


Right-Sizing IT Infrastructure



Consolidate... entire farms ofserversstorage...network....

...and dynamically optimize to only consume the resources you need!





...and dynamically optimize to move applications for high availability and performance!





Always On, Optimized, Energy Efficient Datacenter

Dynamic Resource Scheduling

- Balance workloads
 Right-size hardware
- Optimize real time

High Availability

- Restart immediately when H/W or OS fail
- > Protect all apps

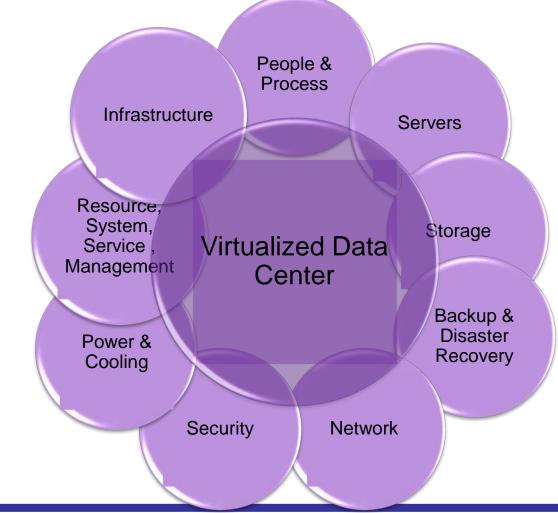
On-demand Capacity

- > Scale without disruption
- > Reconfigure on the fly
- > Save time





Virtualization Touches Everything





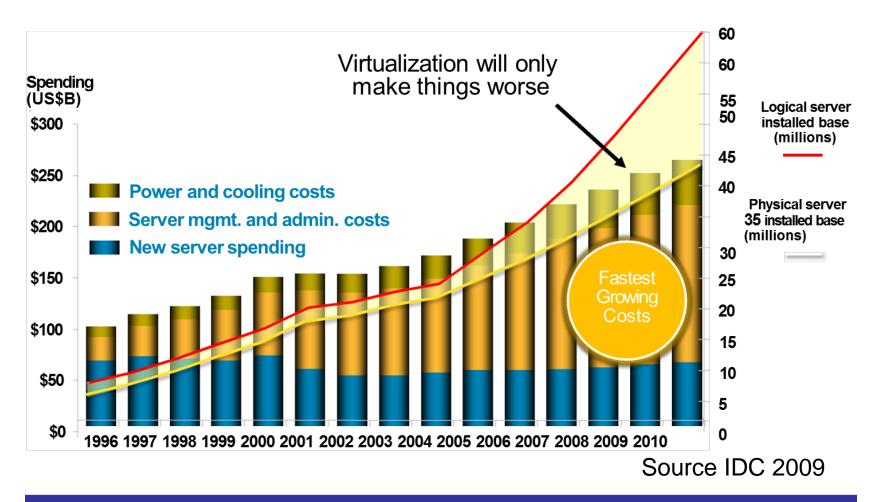
What's Breaking

- Infrastructure sprawl
- Scaling virtualization
- Sustainable energy efficiency
- Operational complexity
- Intolerance for downtime



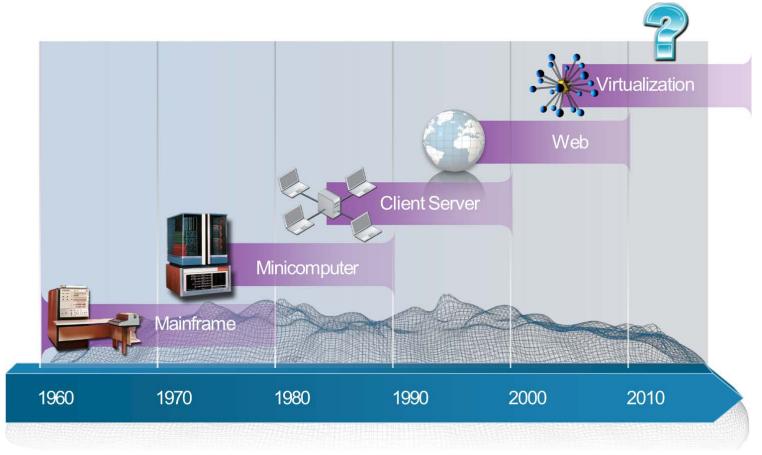


Operations and Maintenance Growth





Network Architecture Approach Evolution



Network is a system with applications as objects moving through it

07/11/2011

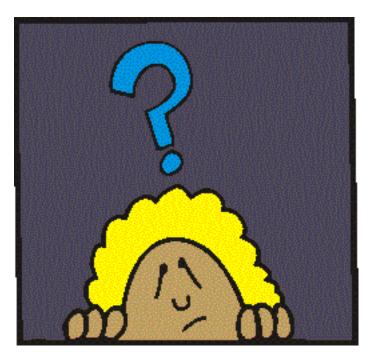


Background

The Physical Network

Inside the IP Stack

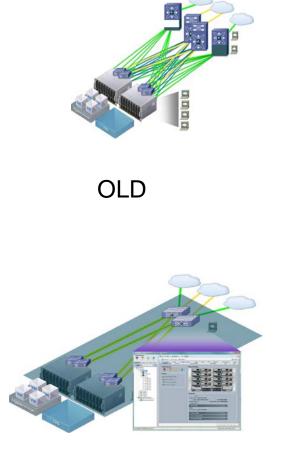
Summary





The Network as a System

- Embedded management and provisioning
- Comprehensive API for integration
- Visibility of network attributes
- Control of network attributes
- Portability of network attributes
- Wire once
- Virtualization aware (no matter what type of virtualization
- Reduce the number of components



New

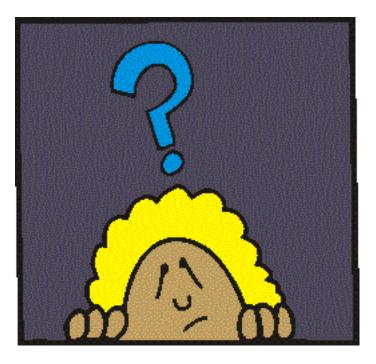


Background

The Physical Network

Inside the IP Stack

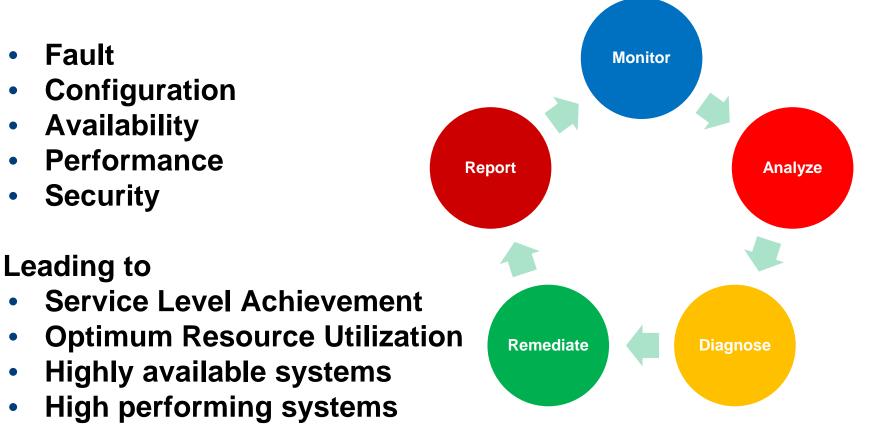
Summary





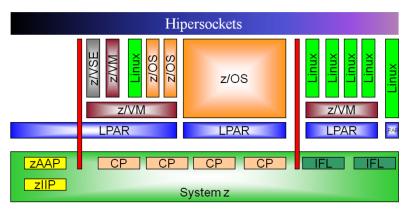
Managing Virtualized Data Center

<u>Fundamentals of management apply FCAPS</u>

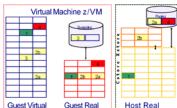


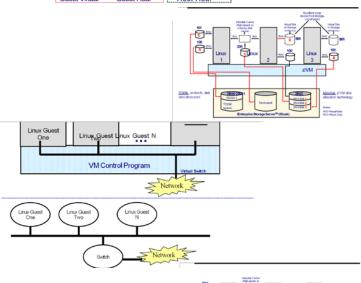


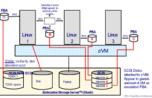
Advanced Virtualization on System z



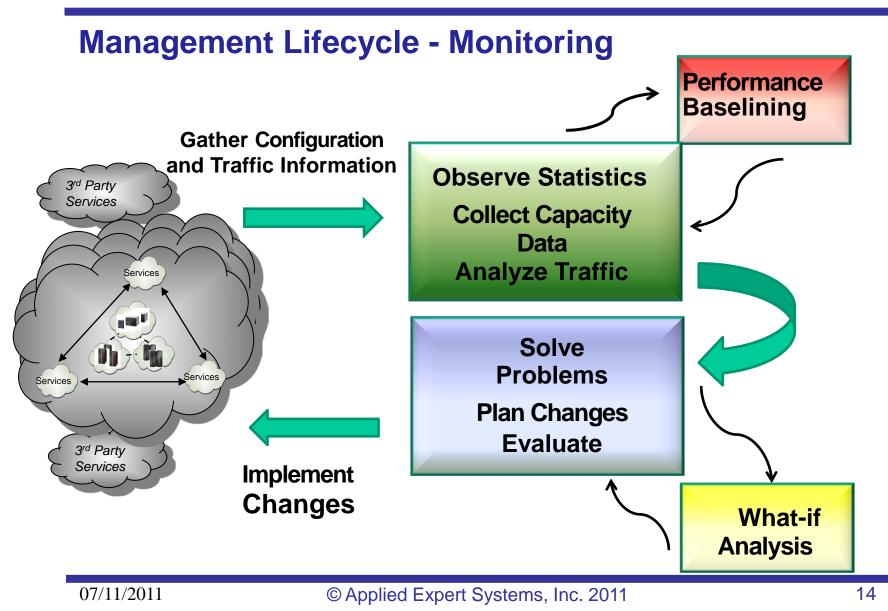
- MVS (Multiple Virtual Storage)
- VM (Virtual Machine)
- LPAR (Logical Partition)
- Load Balancing
- VIPA (Virtual IP Addressing)
- HiperSockets
- Enterprise Extender (Virtual SNA)
- Linux for z/Series
- VLAN's (Virtual LAN)
- VSwitch (Virtual Switch)











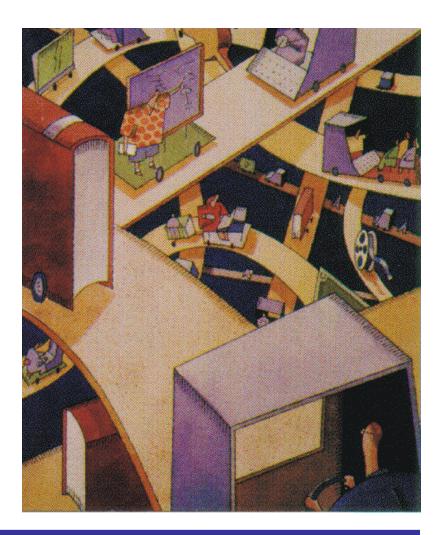


IP Resource Bottlenecks

CPU Memory Buffering, queuing, and latency Interface and pipe sizes Network capacity Speed and Distance Application Characteristics

Results in:

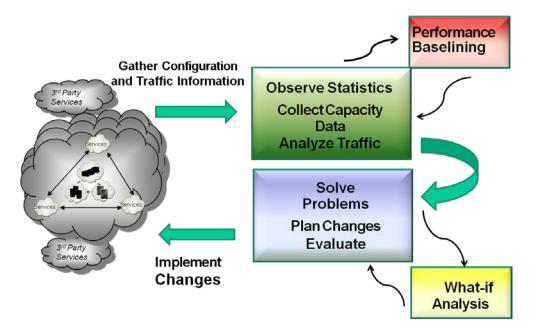
Network capacity problems Utilization overload Application slowdown or failure





Information to Collect

Link/segment utilization **CPU** Utilization Memory utilization **Response Time** Round Trip Time Queue/buffer drops Broadcast volumes Traffic shaping parameters **RMON** statistics Packet/frame drop/loss Environment specific





CPU Utilization

In Virtualized systems CPU utilization can be misleading

Running low on CPU any system can cause immediate application failure system slowdown impacting all applications need to restart system

Running low on CPU can cause immediate application failure domino effect on related resources and applications intermittent application oddities





Questions to Answer on CPU Utilization

How much CPU are the applications using?

What is the historical view of CPU usage in applications?

Server Port: 3306

Monitor Name : Linux SLES11PS2i586 Monitor IP Address : 137.72.43.204

Node Address Hour

Date: 03/01/2011 Start Hour:0

SLES11PS2i586 137.72.43.204 0

SLES11PS2i586 137.72.43.204 1

SLES11PS2i586 137.72.43.204 2

SLES11PS2i586 137.72.43.204 3

End Hour:23

Node Name

Connect Exp

		11.				Server:	137.72.4	3.204	Server Port: 3306 User ID: admin4								Logoff S	elect No	de Help
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	h							LinuxView	🖉 Cor	nnect Expert		9	LinkView	C	PinPoint				
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ır	Process ID	Process Type	Process Name	Process Status	CPU Centiseconds - Interval	CPU Centiseconds - Total	Storage Size (Bytes)	Process Run Path	Process R										
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07/11/2011

Server: 137.72.43.204

LinuxView

00

GAES

MIB Lookup

UDP

<u>Thru24 Links</u> <u>Thru24</u> <u>Processes</u>

Snapshot

Thru24 Response Time

Thru24 Workload
History

Thru99

SNMP

Response Time Thru99 Workload

Thru99 Links

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Scenario 1 – Linux CPU Usage High Situation

A client had a very successful beta with Linux on system z. As they added additional workloads onto the Linux systems overall CPU was increasing much higher then when the application was running on a standalone server.

Trouble Shooting

Using a Linux TCP/IP Monitor check the overall flow of information through both the IP and TCP layers. The CPU utilization was viewed over time. Verify that listeners are available for the applications. View alerts and determine if any would suggest the problem being seen. Check the buffer count. In this system the buffer count had never been raised and was still set at 16.

Solution

Increasing the buffer to 50 reduced the CPU utilization for this linux server as we added more applications.

As you increase the buffer additional memory will be used

SUSE SLES11: in /etc/udev/rules.d/51-qeth-0.0.f200.rules add ACTION=="add", SUBSYSTEM=="ccwgroup", KERNEL=="0.0.f200", ATTR{buffer_count}="128"



Response Time

No one is ever happy with what they get

External customers may go elsewhere

Where is the problem? Network? Router have long ques? Is the LAN to slow? Is the route long? Operating system? Too long to queue for transmit? Application? Protocol? Window size improperly set? MTU size improperly set?





Now and Historical Response Time

Server: 137.	72.43.204	Server Port: 3306	User ID: admin4)					Logoff	Select Nod	le Help		
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Autorever.com	LinuxView	(Y.	Connect Expert			c	PinPoint						
-		3	Connect Expert	Th	ru24 CriticalRe		PINPOIN		We	ed Mar 2 2011 0	7:16:16 UTC-		
😵 MIB Lookup							_	_					
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Thru24 Links	1												
Thru24 Links				Thru24	Summary for Crit	ical Resources							
Processes													
				Response		% Packet Loss							
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Resources													
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Response	A 1	• ×											
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Critical		Thru24	Monitor IP Address : 137.72.4										
Resources		Processes	Daily Report										
PortMon	i i	Thru24	Dates: 02/01/2011 to 03/02/2	011		11 ite	ms found, displayir	no all items 1					
🗄 Thru99		Response			Date Crit	ical Resource Name	IP Address	-	esponse Time	M Dacket Lose			
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Scenario 2– Slow Application Response

Situation

A client had a Linux on system environment and they were about ready to grow the production use of Linux. One of the applications accessed an outside website which was critical to the service the application provided. As they moved the application to a virtualized system they noticed a decline in response time. What was causing the added time?

Trouble Shooting

Using a Linux TCP/IP Monitor check the overall flow of information through both the IP and TCP layers. Since outside resources were required they were set up as critical resources and monitored for packet loss and response time. The response times were measured before the move and after the move.

Solution

It was determined that after the move the firewall in front of the virtualized server needed to be reconfigured in order to return the overall response time to normal.



System Utilization

Since you cannot over-provision your system (add as much memory as you want, as much DASD, etc) you need to optimize

Determining what is currently being used on the system will assist in determining how much you can grow the system

An application behaving poorly may be due to improper design, improper setting of system resources to use, or application configuration

Sluggishness of a system may be due to not enough CPU, I/O overloads, or queue latencies

Server: 137.7	2.43.204	Server Port	3306	Use	r ID: ad	mind											L	ogoff	Select No	le H
AES																Clever	View® f	or TCP	/IP on	Linu
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Resources PortMon	Node Name	Node Address	Link Alerts	Process Alerts	TCP Alerts	UDP Alerts	IP Alerts	ICMP Alerts	IP Datagrams In	IP Datagrams Out	TCP Connections	TCP Segments In	TCP Segments Out	TCP Retrans. Segments	TCP Active Open	TCP Passive Open	TCP Attempt Fails	TCP Errors In	CPU (centi sec)	Storag (KB)
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Scenario 3– Can I Add more Applications Situation

A task force was recommending adding additional applications to the virtualized mainframe. The initial move went well and they wanted to increase the usage of Linux and decrease their distributed servers. The task force approved the move without looking at any data to see if the system could handle the workload.

Trouble Shooting

Due to the environment OSA was inspected to see if it could handle the traffic. CPU utilization was investigated on both the VM and Linux partitions. On the Linux system the ethernet interface was checked to see how loaded it was. While the task force made a broad and quick decision a lot of worked followed to ensure a tuned system.

Solution

In order to prevent future fragmentation issues we reset the MTU size to 1492 and defined that as the standard for their linux systems. While this didn't cause an issue when the workload on Linux was small over time it could be a major problem.

Server: 13	.72.43.204 Server	Port: 3306	User ID:	admin4										Logoff Sel	lect Node Help
AES												CI	everView∉	ofor TCP/I	P on Linux
	LinuxView		🕫 Connect E	expert			ŝ	LinkView			Q PinPoint				
MIB Lookup								Thru99 Li	nks					Wed Mar	2 2011 07:28:03 UTC-
DNS Lookup	00														Refresh
	Monitor Name : Linux Monitor IP Address : Daily Report							Thru99 Links D	aily Report						
B History	Dates: 02/01/2011 to	03/02/2011				81 items fo	und, disp	laying 1 to 20.[F	irst/Prev] 1, 2, 3	3, 4, 5 (Ne	ext/Last]				
Thru99 Links		Node Name	Node Address	Date	Interface	Type	Speed	Admin Status	Oper Status	MTU	Thru-put In Bytes/Sec	Thru-put Out Bytes/Sec	Bytes In	Bytes Out	
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Overall Connections

Most Resources, applications, network components connect with either TCP or UDP

If a TCP listen is not available then a service will not be able to function

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Critical	0.0.0.0	111	0.0.0.0		161 0.0.0.0		0
esources	0.0.0.0	3306	0.0.0.0		627 0.0.0.0		0
inkView	0.0.0.0	6688	0.0.0.0		631 0.0.0.0		0
ortMon	127.0.0.1	25	0.0.0.0		37575 0.0.0.0		0
rocessView	127.0.0.1	199					
	127.0.0.1	631					
rotocols	127.0.0.1	6010					
ICMPv4	1			TCP Co	nnections		
<u>ICMPv6</u> <u>IPv4</u>			Local Address	Local Port	Rmt Address	Rmt Port	State
<u>IPv6</u>	1		0.0.0.0	22 0.			0 listen
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Connections

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Thru99	Node Name	Node Address	Date	Throughput - Segments In	Throughput - Segments Out	Segments In Errors	Retrans Segments	Num Connections	Max Connections	Active Open	Passive Open	Dropped Connections	Attempt Fails
Processes	SLES11PS2i586			17	17	0	0	8	0	75002	74281	5	182
🖻 Thru99	SLES11PS2i586			44	44	0	9	40	0	180730	179193	8	430
Response	SLES11PS2i586			55	55	0	6	152	0	230814	230558	89	
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	SLES11PS2i586			59	60	0	0	35	0	251860	249964	1	. 474
Critical	SLES11PS2i586			60	60	0	0	41	0	251810	249914	0	
Resources	SLES11PS2i586			60	60	0	15	150	0	250612	248781	84	
PortMon	SLES11PS2i586			61	61	0	185	157	0	249210	247219	11	
	SLES11PS2i586			58	59	0	71	134	0	236708	233963	15	
🖻 Thru99	SLES11PS2i586			60	60	0	24	103	0	252732	249165	12	
Workload	SLES11PS2i586			37	37	0	26	101	0	155014	153078	80	
ICMPv4	SLES11PS2i586			39	40	0	222	90	0	160446	158576	12	
ICMPv6	SLES11PS2i586			67	67	0	151	131	0	283711	280118	17	
	SLES11PS2i586			69	69	0	191	141	0	289421	286073	24	
<u>IPv4</u>	SLES11PS2i586			69	69	0	1	138	0	287813	284173	12	
IPv6	SLES11PS2i586			69	69	0	0	130	0	290268	286614	1	. 71
	SLES11PS2i586			68	68	0	0	142	0	288702	285053	0	
TCP E	SLES11PS2i586			67	68	0	0	127	0	284967	281319	0	
UDP	SLES11PS2i586			67	66	0	75	181	0	276108	273045	19	
	SLES11PS2i586	137.72.43.204	02/23/2011	68	68	0	143	151	0	275486	271875	13	710
SNMP						Export options: CSV	Excel XML PDF						
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Scenario 4– Excessive Segmentation

Situation

As you can see on the previous chart on 2/4/2011 there were a significant number of segmented TCP packets, dropped connections, and failed attempts. What was going on?

Trouble Shooting

Using a Linux TCP/IP Monitor check the overall flow of information through both the IP and TCP layers. The OSA adapter was inspected and traffic was moving through it smoothly. Look at the MTU settings on your links and the fragmentation on the IP stack. While there was not significant fragmentation, the MTU size was set at 1500. This wasn't a good value for IP fragments, but this would not impact TCP Segmentation.

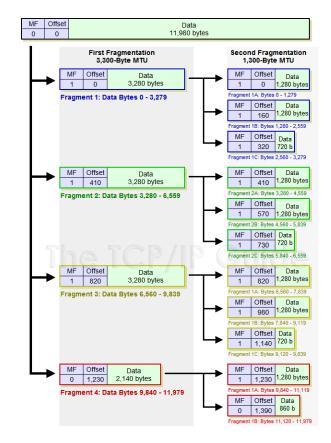
Solution

It was clear that this Linux system was not using 'Large-Send' The default for Linux is no. We changed this to TSO which now had segmentation done by the OSA adapter freeing up resources in the Linux system.



MTU Size

- Optimizing MTU size can provide optimum performance improvements
- Set the maximum size supported by all hops between the source and destination
- Traceroute can provide details on the MTU size but some router administrators block traceroute
- If you application sends
- frames <= 1400 bytes use an MTU size of 1492
- Jumbo frames use and MTU size of 8992
- TCP uses MTU size for window size calculation
- For VSWITCH an MTU of 8992 is recommended





Scenario 6– Excessive Fragmentation

Situation

A client had a Linux on system environment and they were about ready to grow the production use of Linux. While they did not have any major problems they new of they asked for an overall health check.

Trouble Shooting

Using a Linux TCP/IP Monitor check the overall flow of information through both the IP and TCP layers. Look at the MTU settings on your links and the fragmentation on the IP stack. While there was not significant fragmentation, the MTU size was set at 1500.

Solution

In order to prevent future fragmentation issues we reset the MTU size to 1492 and defined that as the standard for their linux systems

Server: 13	7.72.43.204	Serve	r Port 3306	User ID	admin5									Lo	ogotf Se	elect Node He
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nitor		1	ło	SLES11PS2686	137 72 43 204	15:00:30	softwareLoopback	10000000	up	up	16435	8063	8063	967613	967613	
apshot		2	esh0	SLES11PS2686	137,72,43,204	15:00:30	ethemetCsmacd	10000000	up	up	1500	1519	1112	182346	133544	
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Linux: OSA LAN Timer or Blocking Timer

OSA inbound blocking function

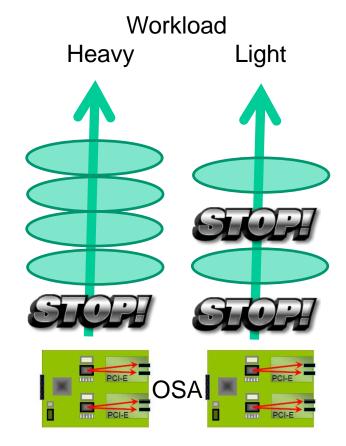
- Determines how long OSA will hold packets
- Indirectly affects
 - Frequency of host interrupt
 - Payload per interrupt

Linux has 3 potential values for OSA2

- For frames under 1536:Time between 2 incoming packets
- For Jumbo frames: Duration of inter-packet gap
- Total duration that OSA holds a single inbound buffer
- Default mode is NO LAN idle which is a good compromise for both transactional and streaming workloads

Linux behaves differently with OSAExpress3

 Using the default for OSA2 results in short latency but high CPU utilization





Scenario 7 – High CPU Utilization after move to OSA3

Situation

A system with an even mix of transactional and streaming workloads had a hardware upgrade and was now running with an OSA3 adapter. The Linux CPU became excessively high for no clearly visible reason.

Trouble Shooting

Historical data was viewed to ensure that the spike in CPU activity did occur when the OSA3 adapter was activated. In viewing the bytes in/out and other workload data no glaring inconsistencies were seen.

Solution

When the change was made the original OSA2 values for BLKT were used (inter=0, inter_jumbo=0, total=0). Due to the difference in OSA2 and OSA3 behavior these numbers were changed (inter=5, inter_jumbo=15, total=250). CPU utilization returned to normal OSA2 default value on OSA3 results in shortest latency and highest CPU utilization

Best to use MTU size of 1492 for OSA3

Supported in SLES10SP3+kernel update SLES 11 RHEL 5.5

Red Hat: /etc/sysconfig/networkscripts/ifcfg-eth0 add OPTIONS="blkt/inter=5 blkt/inter_jumbo=15 blkt/total=250"

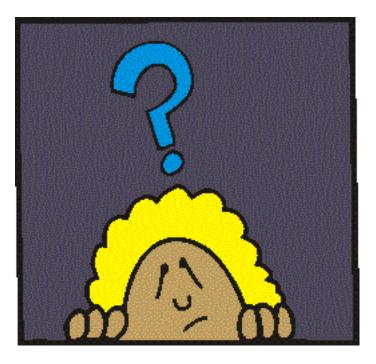


Background

The Physical Network

Inside the IP Stack

Summary





Steps to Effective Performance Management



Baseline

Baselines over a long period of time to develop utilization, resource. growth and shrinking trends

What-if analysis prior to deployment

Performance exception reporting

Analyze the capacity information

Review baseline, exception, and capacity information on a periodic bases







Murphy's Law

If anything can go wrong, it will

If anything just cannot go wrong it will

Left to themselves, things tend to go from bad to worse

If everything seems to be going well, you have obviously overlooked something





AES Sessions at Share

Aug 8, 2011: 1:30-2:30 9288: <u>Keeping Your Network at Peak Performance</u> as You Virtualize the Data Center

Aug 10, 2011: 8:00-9:00 9266: IPv6 Basics

Aug 10, 2011: 4:30-5:30 9270: <u>Managing an IPv6 Network</u>

Aug 11, 2011: 3:00-4:00 9273: <u>CSI Maui: Forensics in The Case of the</u> Attacked Browsers

Aug 11, 2011: 11:00-12:00 9277: Implementing IPv6 on Windows and Linux Desktop

Aug 11, 2011: 1:30-2:30 9290: <u>Network Problem Diagnosis with OSA</u> Examples

Aug 12, 2011: 8:00-9:00 9308: <u>TCP/IP Performance Management in a</u> Virtualized Environment



