Top 10 Tips for z/OS Network Performance Monitoring with OMEGAMON

Session 11899

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Agenda

- Best Practices in Monitoring
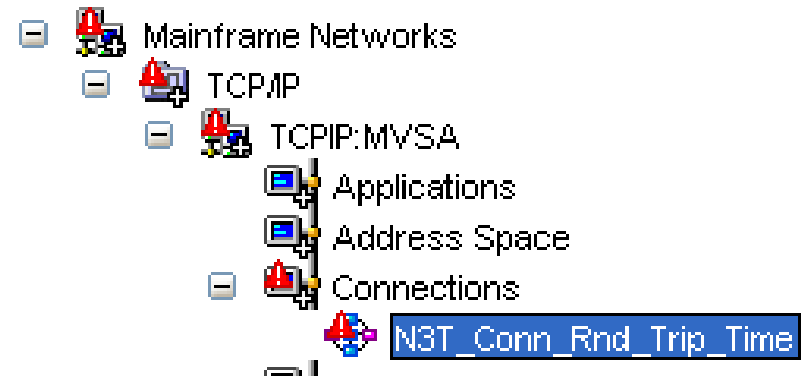
- Top 10 tips

- Scenarios

Preface

- This presentation highlights best practices from customers who use OMEGAMON XE for Mainframe Network to monitor their z/OS Networking environment

- Features custom Navigator view and workspaces created <u>for</u> customers <u>with</u> customers
  - Available on IBM Service Management Library: http://www.ibm.com/software/ismlibrary?NavCode=1TW10OM1K
  - OMEGAMON Dashboard Edition (DE) is required
  - YouTube: http://www.youtube.com/watch?v=jVjonG6Zfrw

Best Practices in Monitoring

– **Proactive** performance and availability monitoring of z/OS, network, applications

– Monitor and collect key performance and availability metrics across entire enterprise (System z and distributed)

– Proactive & predictive alerts (generate events)

– Automated actions on events (issue command or send e-mail notification)

– Enhanced trouble shooting with:

  • Side-by-side real-time and historical data provides rich context for problem identification

  • Historical locking to "stay" in the problem while navigating

– Dynamic thresholding enables thresholds to be customized per resource, date, day of week, etc

Situations
Identify potential problems, generate event, automate actions (e.g. command or e-mail)

Mainframe Networks
  TCP/IP
    TCPIP:MVSA
      Applications
      Address Space
      Connections
        N3T_Conn_Rnd_Trip_Time

View Thresholds
Highlight metrics in a table you are viewing

	Response Time	Origin Node	System ID
	15.19	TCPIP:MVSA	MVSA
	5.67	TCPIP:MVSA	MVSA

Response Time GE 5.00

Create a baseline

- Identify "normal" network profiles for your applications, interfaces, and TCP/IP stacks

- Analogous to blood pressure monitoring

  - At rest = after IPL or early in morning

  - Busiest = most active time of day

  - Quiet time = end of business day

- Start with:

  - Connection Rate
  - Concurrent conn
  - High water mark
  - Byte rate for eac

Which application is having a problem?

Collection Time	Application Name	Connection Count	Active Connections	Accepted Connections	Connection Rate	Active Connection High Water Mark	Time stamp for Active Connections High Water Mark
/XX10 9:44:55 AM	APP12345	4005	563	15108	3021	1270	10/29/2010 10:29
7/20XX 11:29:40 AM	XYW12345	3024	233	13304	2660	315	11/16/2010 15:49

Performance over time – historical data is important

Collection Time	Application Name	Connection Count	Active Connections	Accepted Connections	Connection Rate	Active Connection High Water Mark	Time stamp for Active Connections High Water Mark
11/1/2010 8:44	XXXXXXXXX	1017	999	129	25	1270	10/29/2010 10:29
11/1/2010 8:59	XXXXXXXXX	1041	1023	103	20	1270	10/29/2010 10:29
11/1/2010 9:14	XXXXXXXXX	1068	1050	102	20	1270	10/29/2010 10:29
11/1/2010 9:29	XXXXXXXXX	1115	1098	108	21	1270	10/29/2010 10:29
11/1/2010 9:44	XXXXXXXXX	4005	563	15108	3021	1270	10/29/2010 10:29

Create a front end to the Physical Navigator

– Example from one customer

- At-a-glance view of LPAR or TCP/IP status

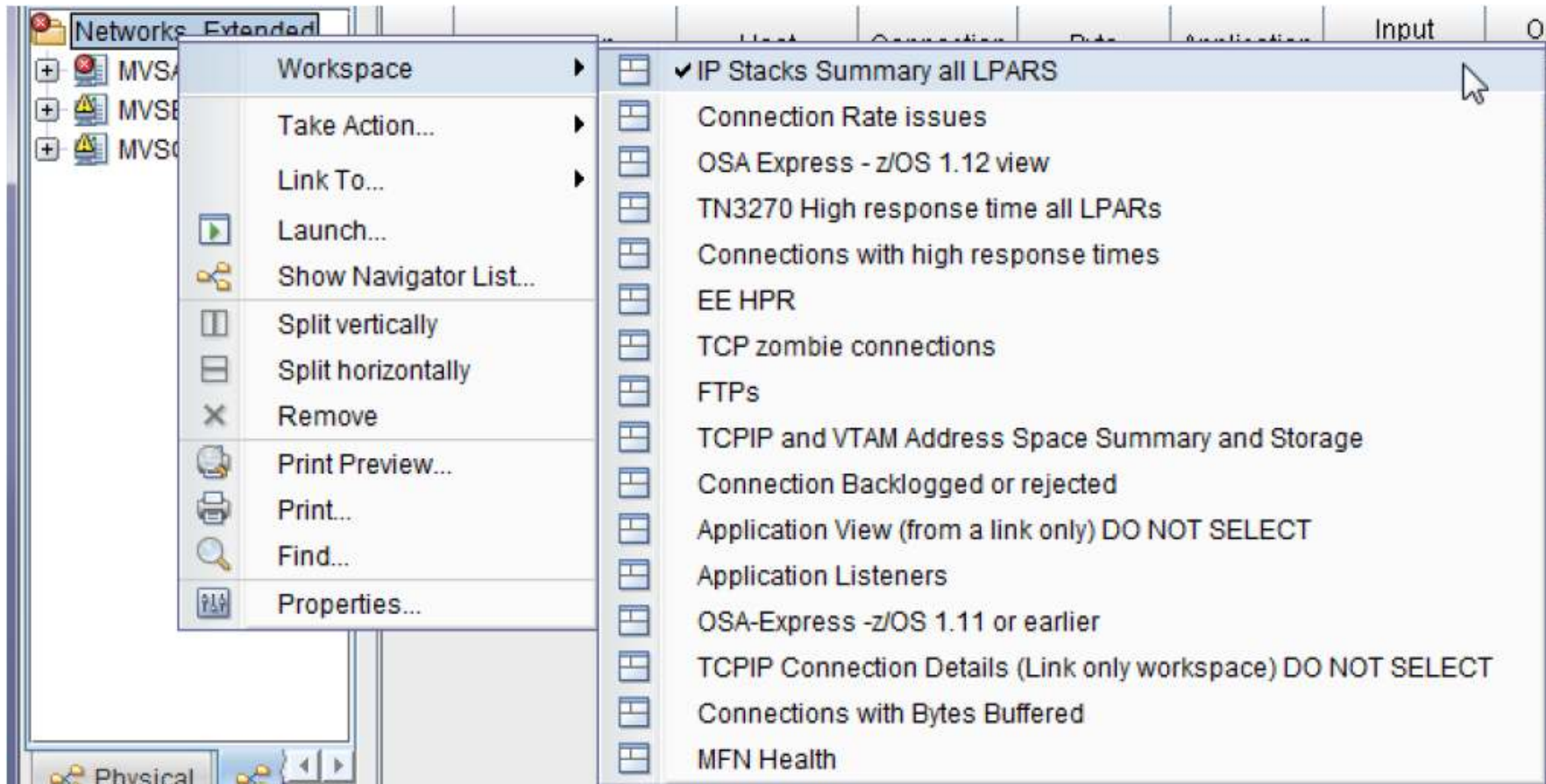- Navigate quickly to workspaces

Add a logical Navigator view

— Download and import Network Extended views and workspaces

Enable historical data collection

– Choose a set of tables that meet business needs

  • Initially to establish baseline

  • Diagnose intermittent problems

  • Periodically re-assess baseline and business needs

– Add other tables to historical collection when debugging specific problems

– Short term (24 hours) vs. long term (data warehouse)

VTAM Buffer Pools				
VTAM Buffer Pool Extents				
VTAM Buffer Usage by Category				
VTAM Buffer Usage by Address Space				
CSM Storage				
EE Connections				
EE Connections Details				
FTP Sessions	Started	15 minutes	TEMA	Off
TCPIP FTP	Started	15 minutes	TEMA	Off
HPR RTP Connections				
IPSec Status				
VTAM Summary Statistics	Started	15 minutes	TEMA	Off
TCPIP Applications	Started	15 minutes	TEMA	Off
TCPIP Address Space				
OSA-Express Channels	Started	15 minutes	TEMA	Off
TCP Listener				
TCPIP Connections				
TCPIP Details	Started	5 minutes	TEMA	Off
TCPIP Devices				
TCPIP Gateways				
OSA-Express3 Ports Control	Started	15 minutes	TEMA	Off
OSA-Express3 Ports Errors	Started	15 minutes	TEMA	Off
OSA-Express3 Ports Summary	Started	15 minutes	TEMA	Off
OSA-Express3 Ports Throughput	Started	15 minutes	TEMA	Off
Interfaces	Started	15 minutes	TEMA	Off
OSA-Express LPARS				
TN3270 Server Sess Avail				
OSA-Express Ports				
TCPIP Memory Statistics				
TCPIP Stack Layer	Started	15 minutes	TEMA	Off
OSA 10 Gigabit Ports Control				
OSA 10 Gigabit Ports Errors				
OSA 10 Gigabit Ports Summary				
OSA 10 Gigabit Ports Throughput				
UDP Connections				
VTAM Address Space	Started	15 minutes	TEMA	Off
VTAM SIO				

TCP/IP Key Metrics

Applications

SSL API

Sockets API

TCP/ UDP

IP /ICMP

Data Link

OSA-Express

OSA-Express
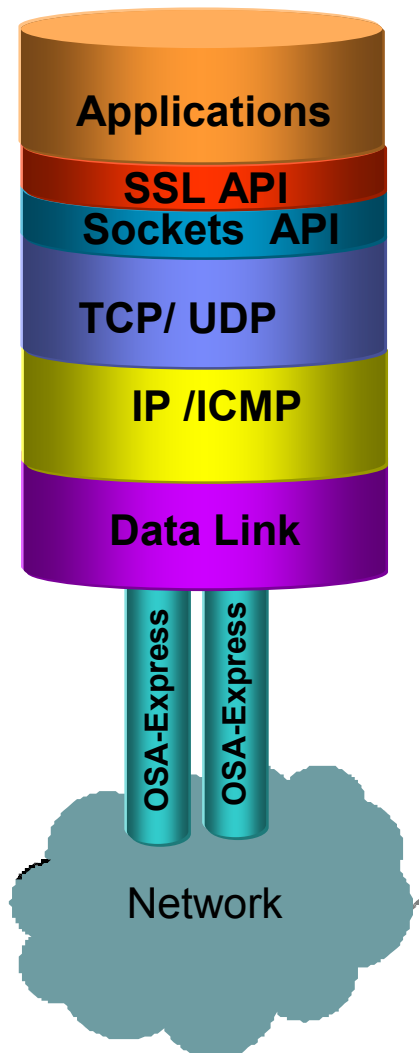
Network

- **Interfaces key metrics**
  - Status– Is the interface up or down?
  - Discards
    - Inbound– indicates possible problem w/ interface, adjacent node, or network
    - Outbound– indicates possible problem w/ interface, IP stack, or application
  - Throughput-- uneven distribution across defined interfaces indicates possible problems with path to gateway or lack of network availability

- **IP key metrics**
  - Discards
    - Inbound– checksum errors can be caused by problems w/ local interface or problem at adjacent node; security definition problems; routing errors
    - Outbound– security definition problems; routing errors
  - Throughput
    - Significant drop for extended time can indicate network problem
    - Significant increase for extended time can indicate application error.
  - Fragmentation/Reassembly: frequent fragmentation/reassembly can indicate an application problem or an error in a recent network configuration change

- **UDP key metrics**
  - Discards– checksum errors or no port
  - Throughput

TCP/IP Key Metrics (cont)

Applications

SSL API

Sockets API

TCP/ UDP

IP /ICMP

Data Link

OSA-Express OSA-Express
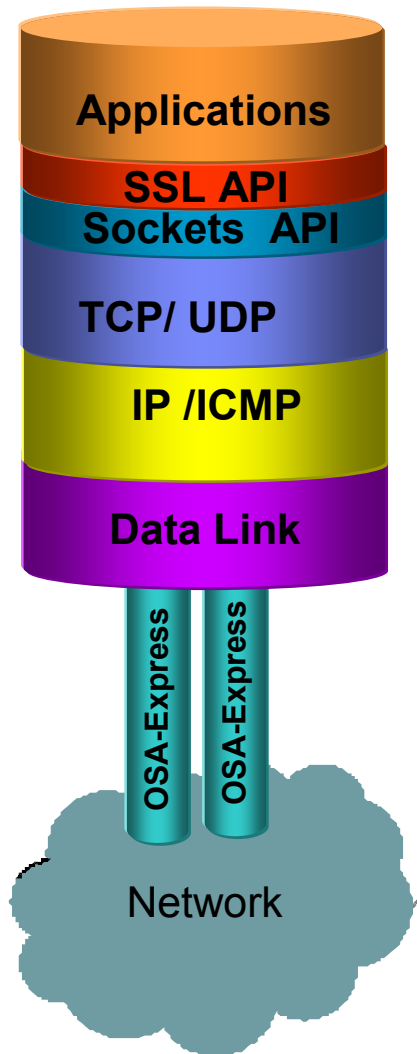
Network

- **TCP key metrics**

  – Session count– large change from typical value for a significant amount of time can indicate a problem w/ application, OS, or network

  – Connections dropped– large number during one or more consecutive intervals can indicate problems w/ application, OS, or network

  – Retransmits-- ACKs for data sent not being received

    • Is data being sent successfully and arriving at partner node?

    • Is partner generating ACKs and successfully sending them?

  – Duplicate ACKs– Data being sent is not being received by partner

    • Need to figure out whether data is being sent successfully, if so, then where is it being dropped?

  – Segment errors received – checksum errors indicate problem w/partner endpoint

  – Window probes– large numbers can indicate problem w/remote application

    • Partner has closed window (sent a 0 window) and no data can be sent

    • Window probe requests window be opened so data can be sent

    • If window probe threshold is reached connection is dropped

Monitor key metrics automatically using situations

• Analyze historical data to determine the appropriate situation thresholds for your enterprise

Interfaces
TCP/IP
— N3T_DLC_Accelerated_Bytes
— N3T_DLC_Max_Staging_Queue_Depth
— N3T_DLC_Read_Deferrals
— N3T_DLC_Reads_Exhausted
— N3T_IF_Rcv_Util
— N3T_IF_Util
— N3T_IF_Xmt_Util
— N3T_Interface_Bandwidth_Util
— N3T_Interface_Xmit_Rcv_Bytes
— N3T_Pct_IF_Err
— N3T_Pct_IF_In_Err
— N3T_Pct_IF_Out_Err
— N3T_Pct_IF_Pkt_Disc

TCPIP:4085
TCP/IP
— N3T_Connection_Count
— N3T_Fragmentation_Failure_Pct
— N3T_Fragmentation_Pct
— N3T_Input_Discard_Pct
— N3T_Output_Discard_Pct
— N3T_Reassembly_Failure_Pct
— N3T_Reassembly_Pct
— N3T_Retransmission_Pct
— N3T_Throughput_Rate
— N3T_UDP_Discard_Pct

TCP/IP Stack Layers
TCP/IP
— N3T_IP_Input_Discard_Pct
— N3T_IP_Out_Disc
— N3T_IP_Output_Discard_Pct
— N3T_Pct_IP_In_Disc
— N3T_Pct_TCP_OO_Segs
— N3T_TCP_Conn_Drop
— N3T_TCP_Flow_Controls
— N3T_TCP_In_Errs
— N3T_TCP_Probes

Top 10 Tips

OSA Express and Interfaces

Interfaces
- Device Inactive
- High bandwidth Utilization
- No traffic
- QDIO is Accelerating Bytes
- Max Staging queue depth
- DLC Read deferrals
- DLC Read Exhausted

OSA Express
- High PCI Utilization
- Channel utilization
- Missed packets
- Not Stored Frames

Connection in Backlog or Rejected

Listeners with Connections in Backlog or Rejected

	System ID	Application Name	Local Port	⚠ Connections in Backlog	ℹ Backlog Limit	Backlog Connections Rejected	⚠ Total Backlog Connections Rejected	Backlog Connections Rejected Time Stamp
🖉	MVSB	PORTMAP1	111	0	2	0	6	08/18/11 14:54:40
🖉	MVSB	DB2SDIST	5446	5	10	0	0	
🖉	MVSC	PORTMAP1	111	0	2	0	6	08/18/11 14:11:03
🖉	MVSA	CXEGDSST	1920	0	10	0	7	08/20/11 10:05:35
🖉	MVSA	PORTMAP1	111	0	2	0	6	08/18/11 14:35:27
🖉	MVCA	CICSV23	5139	0	4	0	22	08/18/11 14:57:13

Maximum connection requests Queued

Connections Queued Exceeded Backlog Limit

- •Increase Backlog Limit (TCPIP profile or in Application)
- •Stagger automatic logons, if possible.

Correlate Response Times with Errors
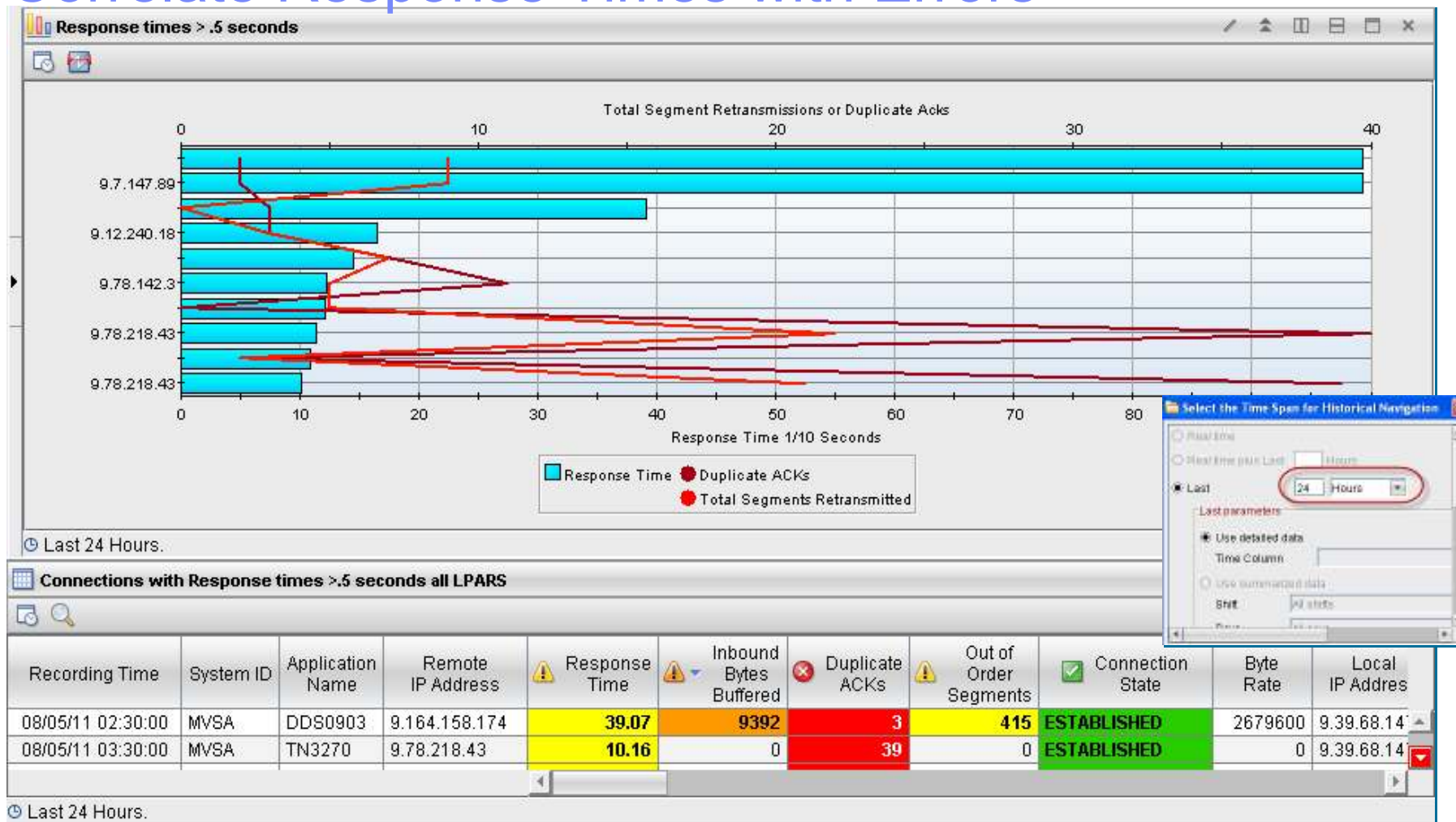
- See if poor response time correlates with any errors.
- Duplicate ACKs, out of Order Segments, Segments Retransmitted
- Turn on history to see when problems are occurring

Zombie connections

- Connection that do not get dropped

- Connection with no traffic for a long time

- Connection may be hung (not established)

Create Application Network Filtered Views

Examples:
- **Connect:Direct**
- **MQ**
- **CICS**
- **WebSphere**

Application

Client

Client

Client
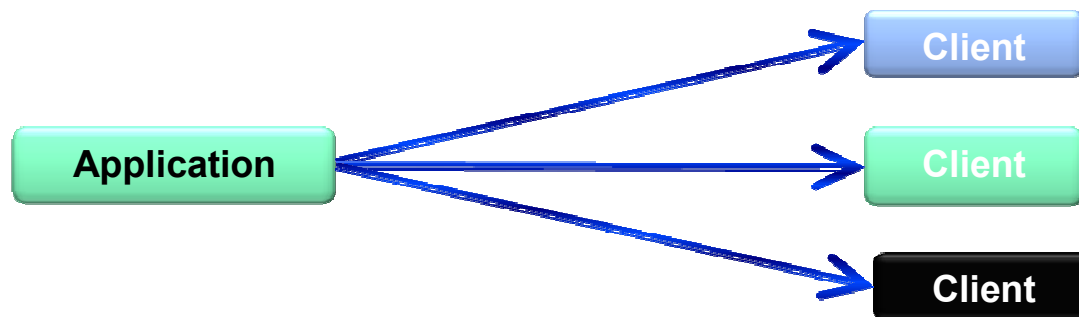
Address Space

- CPU
- Storage
- Priority

Application Listener

- Connection Rejections
- Backlog limit
- Number of Connections
- Connection Rate

TCP/IP Connections

- Response times
- Buffers queued
- Connection hangs
- Congestion
  - Reset windows
  - Retries,
  - Out of order

Monitoring Connect:Direct

- Status of the Connect:Direct Listeners (Default Ports 1363 & 1364)
- Notice we have bytes backing up for one of them
- Check the dataset response time (MSR)
- Connect:Direct address space CPU utilization with drill down to the current WLM

TN3270 high response time exception view

FTP sessions and transfers

EE and HPR

HPR all LPARS

Recording Time	System ID	Remote CP Name	Sessions	ARB Mode	Loca RTP Nam
08/05/11 21:00:00	MVSA	USIBMNR.NDCMVSB	11	Yellow	CNRC
08/05/11 18:00:00	MVSA	USIBMNR.NDCMVSB	11	Yellow	CNRC
08/05/11 19:00:00	MVSA	USIBMNR.NDCMVSB	11	Red	CNRC
08/05/11 18:00:00	MVSA	USIBMNR.NDCMVSC	6	Red	CNRC
08/05/11 20:00:00	MVSA	USIBMNR.NDCMVSB	11	Red	CNRC
08/05/11 19:00:00	MVSA	USIBMNR.NDCMVSC	2	Green	CNRC
08/05/11 19:00:00	MVSA	USIBMNR.NDCMVSB	1	Green	CNRC
08/05/11 19:00:00	MVSA	USIBMNR.NDCMVSB	1	Green	CNRC
08/05/11 20:00:00	MVSA	USIBMNR.NDCMVSC	6	Green	CNRC

Last 4 Hours.

HPR Topology

US IBMNR.T499
US IBMNR.NDCMVSC
US IBMNR.NDCMVSB
US IBMNR.NDCMVSA

Total: 4 Selected: 0

Last refreshed: 08/06/2

Enterprise Extender all LPARS

Origin Node	System ID	PU Name	Local IP Address	Remote IP Address	RTP Pipes	Sessions	Packets Retransmitted	Percent of Packets Retransmitted	Packet Retransmission Rate	Transmit Byte Rate	Receive Byte Rate	Bytes Sent	Bytes Received
VTAM:MVSA	MVSA	EX000012	9.39.68.12	9.65.189.66	1	2	0	0	0	33	33	33	33

TCP/IP and VTAM address spaces and storage

TCPIP Address Space all LPARS

View:

Networks_
*OMEG
*OMEG

System ID	Host IP Address	zOS Release	CPU Percentage	Paging Rate	CSA Usage Below 16MB	CSA Percent Below 16MB	Total CSA Usage	Total CSA Percentage	Connection Count	Byte Rate	Application Count
MVSB	9.39.68.146	zOS_1.12	0	0	136	0	26032	0	53	67999	15
MVSC	9.39.68.145	zOS_1.12	0	0	136	0	26032	0	73	118353	15
MVSA	9.39.68.147	zOS_1.12	0	0	136	0	34392	0	587	1299346	121

TCPIP Memory Statistics all LPARS

System ID	IP Address	ECSA Storage In Use	ECSA Storage Free		Percent ECSA Storage In Use	Authorized Private Storage In Use	Authorized Private Storage Free		Percent Authorized Private Storage In Use	64bit Common Storage In Use	64bit Comm Storage Free
MVSB	9.39.68.146	3,071,680	0		100	8,917,608	9,456		100	151,120	897,
MVSC	9.39.68.145	3,070,848	0		100	9,040,392	9,808		100	157,504	891,
MVSA	9.39.68.147	6,361,080	61,608		99	11,197,544	24,208		100	333,568	715,

Phy

VTAM Address Space all LPARS

System ID	CPU Percentage	Paging Rate	CSA Below	CSA Percent	CSA	CSA Percentage	DASD SIO Per Sec	NCP SIO Per Sec	CTC SIO Per Sec	Local SNA SIO Per Sec	Local Non-SNA SIO Per Sec	Other SIO Per Sec	SIO Rate Pct of System
MVSC	0		The paging rate when the most recent sampling interval ended.		9228	2	0	0	0	0	0	0	0
MVSA	0	0	84541	2	10213686	3	0	0	0	0	0	0	0

CSM Storage Statistics all LPARS

System ID	Percent ECSA In Use Storage	Percent ECSA Allocated Storage	Storage In Use Across ECSA Pools	Storage Free Across ECSA Pools	Storage Allocated Across ECSA Pools	Maximum ECSA Storage Allowed	Storage In Use Across DSP Pools	Storage Free Across DSP Pools	Storage Allocated Across DSP Pools	Storage In Use Across Pools
MVSC	0	2	248	1800	2383	122880	5208	1616	6824	5456
MVSA	1	3	812	2340	4160	122880	23008	5648	28656	23820

OMEGAMON XE for Mainframe Networks Agent Health

Displays status information about the agents running on your z/OS LPARs.

Display this view after installing OMEGAMON XE for Mainframe Networks to ensure that the monitoring agent is running, configured properly and connected to TEMS/TEPS.

Check the agent health view if data is not being displayed. Verify agent configuration settings, network connection, etc.

Scenarios

Scenario A:
Scheduled logons and "silent" failures

The setting:

A mainframe network systems programmer was building a baseline for network performance of his LPARs and applications. A very high number of rejected connections were being reported by OMEGAMON XE for Mainframe Networks just after 10 pm each evening. At first, the systems programmer thought he had found a problem with the monitoring software.

Scheduled logons and "silent" failures

1. Johann, the network systems programmer, enabled a situation that e-mails him when backlog connections are rejected.

Listeners with Connections in Backlog or Rejected

	System ID	Application Name	Local Port	⚠ Connections in Backlog	ℹ Backlog Limit	Backlog Connections Rejected	⚠ Total Backlog Connections Rejected	Backlog Connections Rejected Time Stamp
🖉	MVSB	PORTMAP1	111	0	2	0	6	08/18/11 14:54:40
🖉	MVSB	DB2SDIST	5446	5	10	0	0	
🖉	MVSC	PORTMAP1	111	0	2	0	6	08/18/11 14:11:03
🖉	MVSA	CXEGDSST	1920	0	10	0	7	08/20/11 10:05:35
🖉	MVSA	PORTMAP1	111	0	2	0	6	08/18/11 14:35:27
🖉	MVSA	CICSV22	5120	0	4	0	23	08/18/11 14:57:13

2. The e-mails confirmed that thousands of connection requests were being rejected before the FTP server was able to accept.

BacklogConnsRejected - The number of rejected backlog connections for FTPD1 on SYSXX is **6,842**: 11/16/09 22:07EST.

BacklogConnsRejected - The number of rejected backlog connections for FTPD1 on SYSXX is **8,045**: 11/17/09 22:06EST.

Scheduled logons and "silent" failures …

3. The backlog limit for the FTP server is 50, which is reasonable for expected activity

4. After looking at a packet trace on the listener port and consulting with a project manager, Johann determined that an application timer on 10000+ workstations triggered an FTP logon at 10 pm. The timer was adjusted to prevent the bursts.

Scenario B:
Slow response time in web service

The setting:

A company recently deployed a set of web services that replaced a very high profile application. The operations team monitors the performance closely. When performance degrades, its time to investigate…
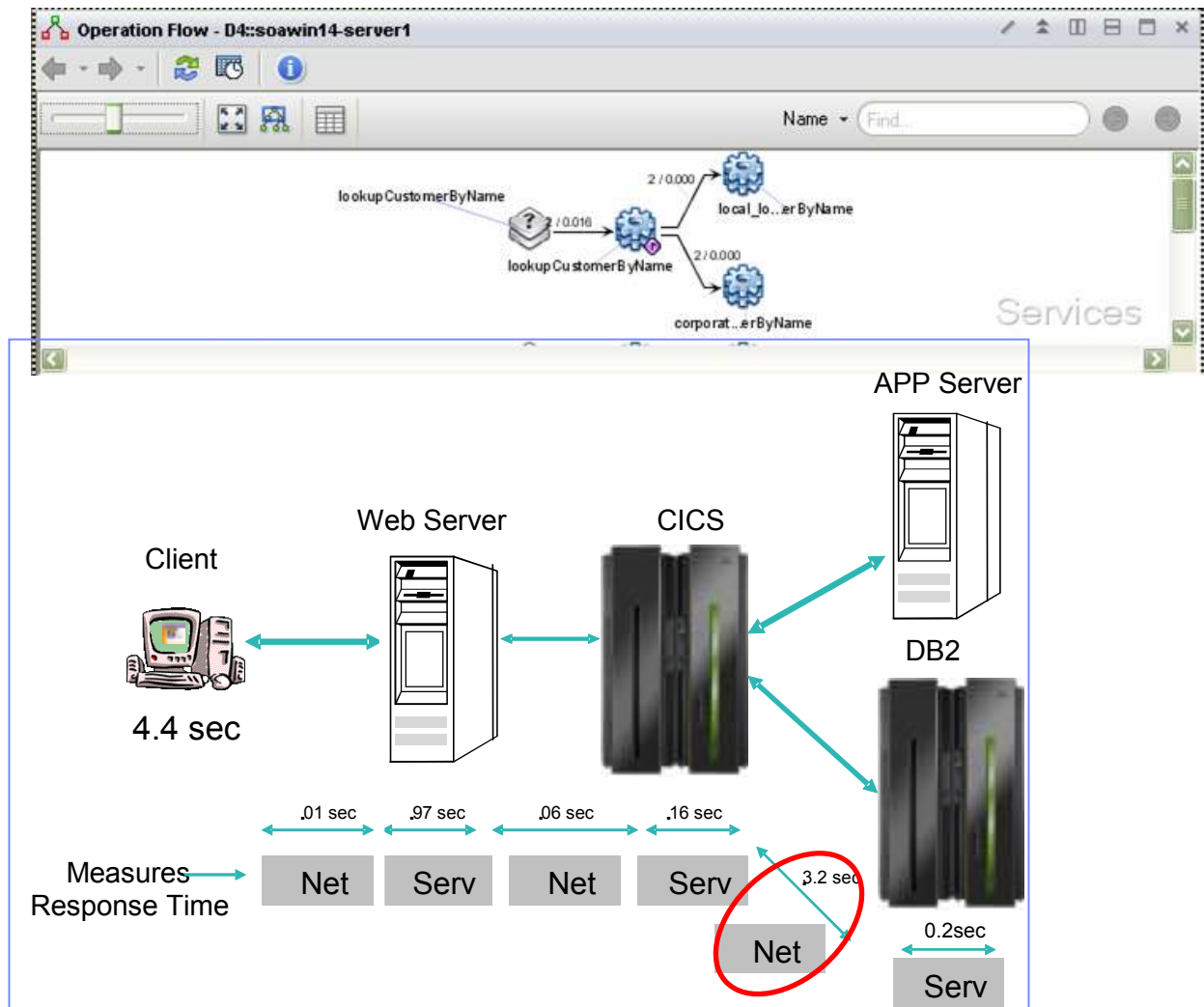
Slow response time in web service …

1. An alert identifies a response time problem. Annette, an operator, determines that slow response times are being recorded for the new web services.

2. Annette checks the number of requests and the message size and determines this is a normal volume of traffic. Annette passes the issue to Johann, a SME.
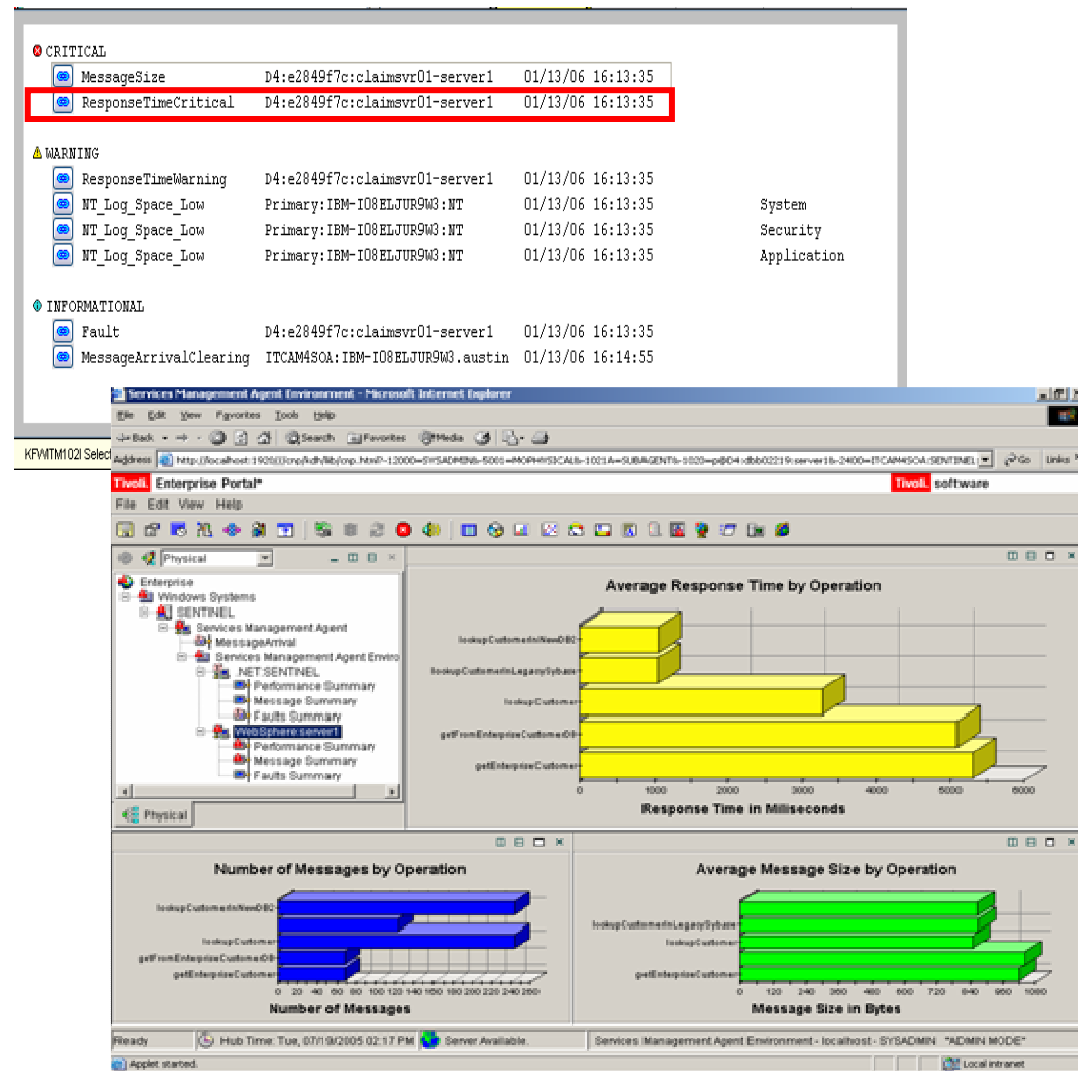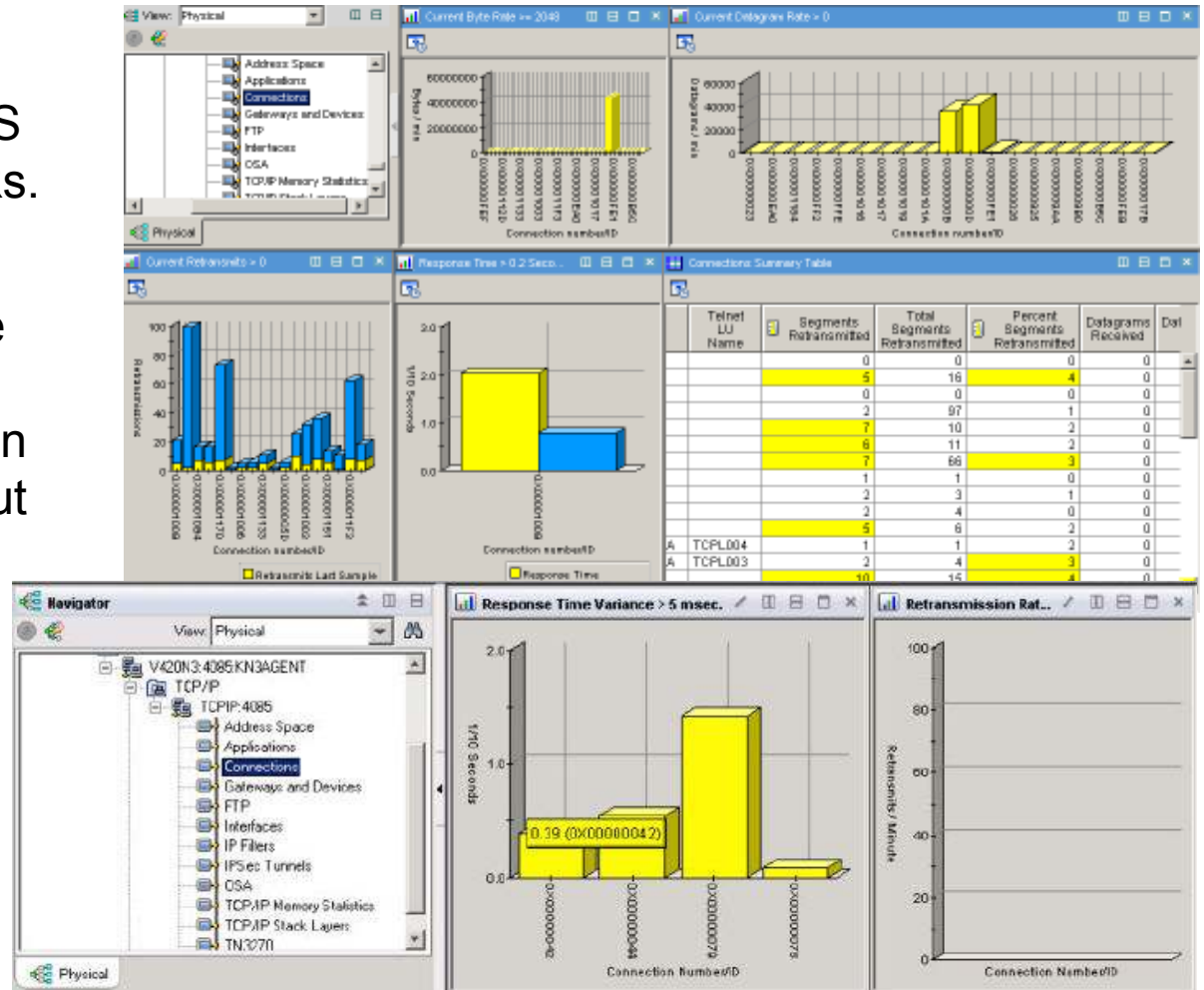
Slow response time in web service ...

3. Johann begins by looking closer at the web services. Identifies flows and response time for each step.

4. Problem appears to be with the network between the CICS and DB2 servers. These two LPARs are connected by a data center network.

Slow response time in web service …

5. Johann views metrics for connections between CICS and DB2 on the two LPARs.

6. Johann notices there have been retransmits and out-of-order segments between CICS and DB2 servers. But what is the root cause?

Slow response time in web service …

7. Johann checks the OSA cards and discovers the OSA on the DB2 server has high PCI and processor utilization.
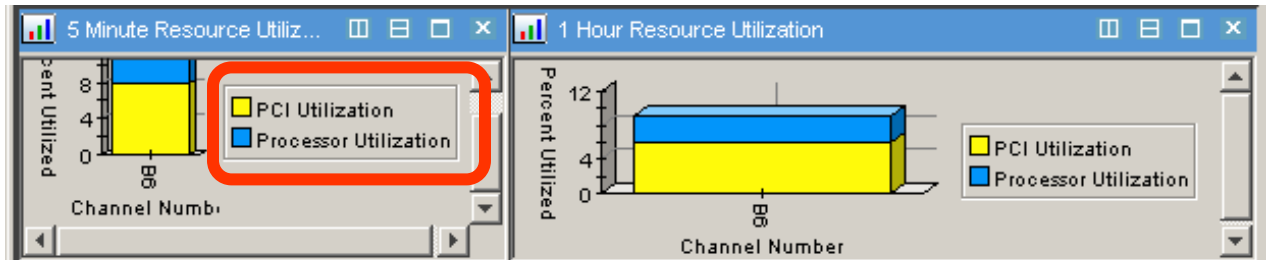
8. Further checks reveal contention on OSA with other LPARs in the CEC is causing the performance issues.

   Each OSA is dedicated to an LPAR, but also serves as backup OSA for a 2nd LPAR. Switch other LPAR to its primary OSA.

Scenario C:
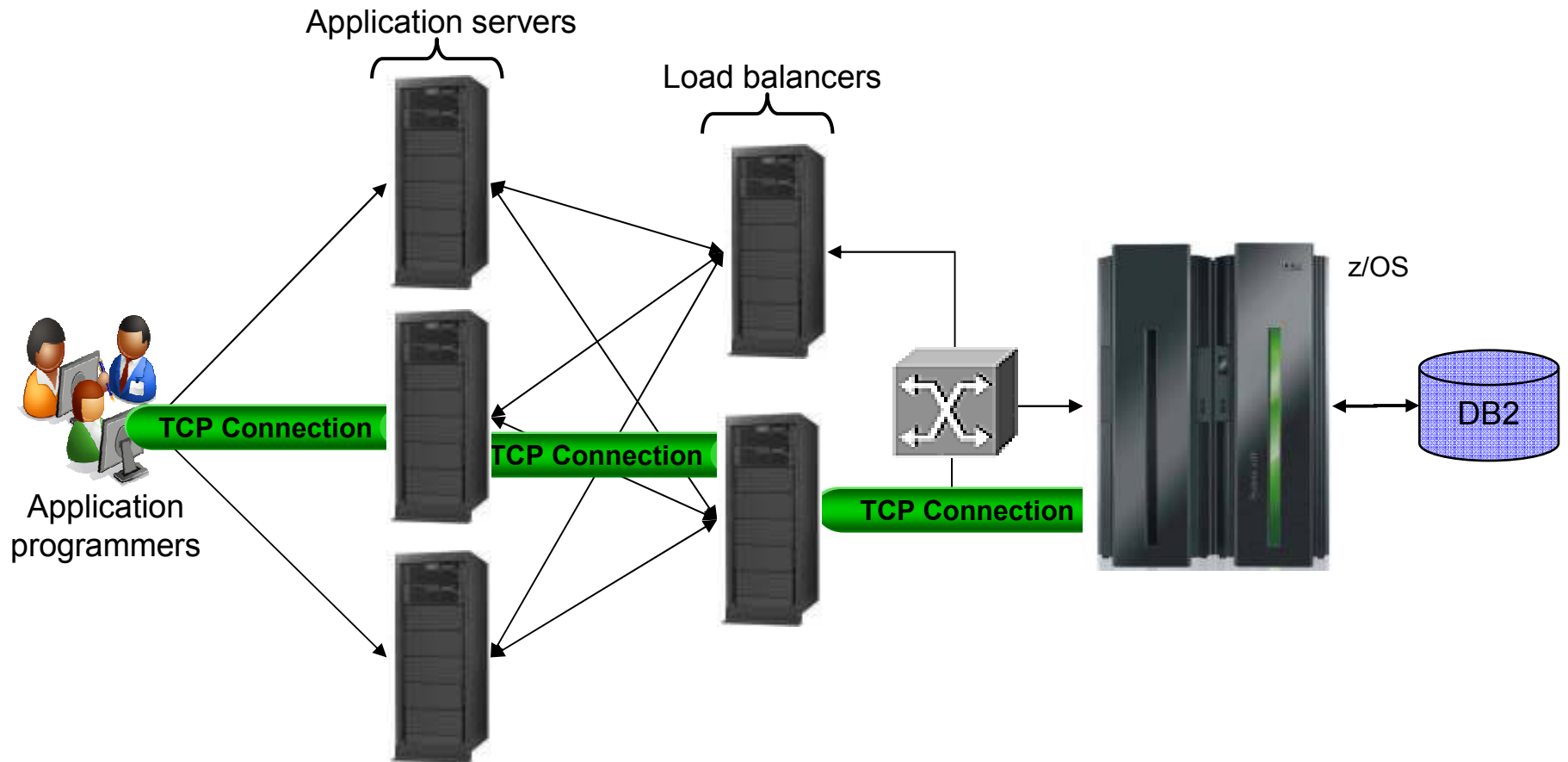## DB2 is working, it must be the network

The setting:

A multi-tier application framework is being used by a team of programmers to develop a Java application. The application is stored as large binary objects (BLOBs) in a DB2 on z/OS database. Each programmer retrieves, changes, and then saves a BLOB. Long delays that occur sporadically during the save are frustrating the application team.

DB2 is working, it must be the network …

Application servers

Load balancers

z/OS

TCP Connection

TCP Connection

TCP Connection

Application
programmers

DB2

DB2 is working, it must be the network …

1. Facing revolt from his team, the team leader asks the DB2 systems programmer to check for performance problems.

2. The DB2 systems programmer checks thread CPU time, lock contention, and query plan, among other things. He determines that DB2 is not the cause of the slowdown.
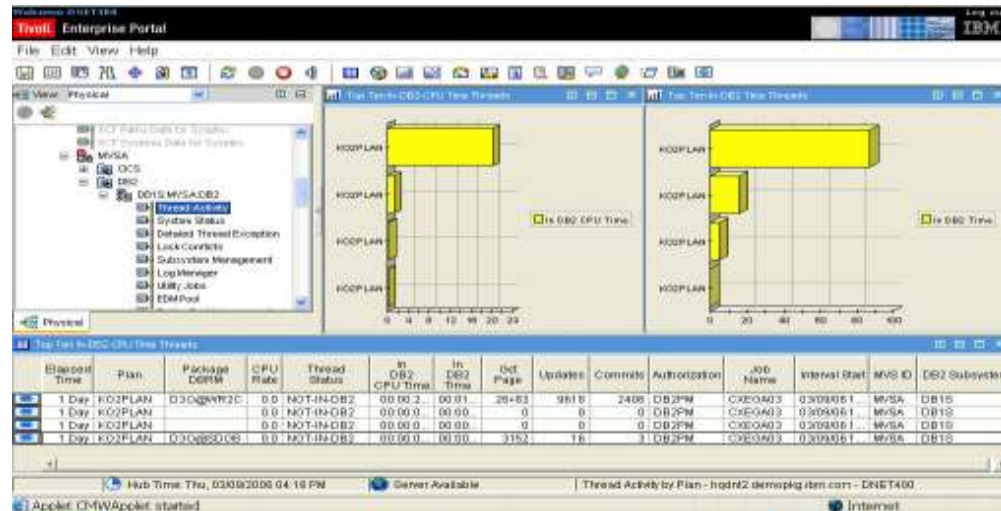
DB2 is working, it must be the network ...

3. Expecting that the problem may be due to an underlying network problem, the team leader turns to Johann for help.

4. Johann views the DB2 application and associated connections. Large amounts of data is being transferred over the DB2 connections with no retransmits or out of order segments.
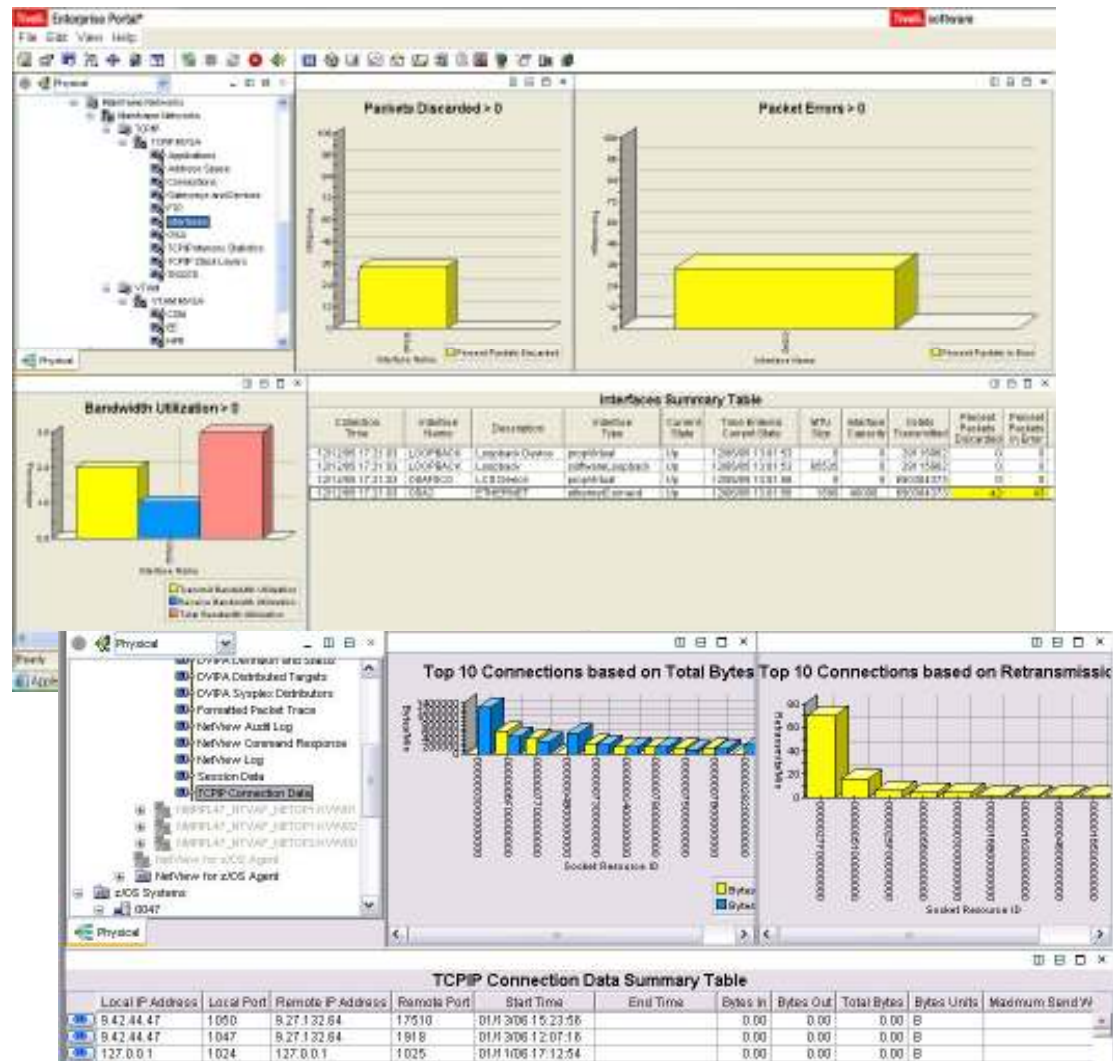
DB2 is working, it must be the network …

5. Interesting… Response time and response time variance are higher than expected (0.5+ sec, 0.5+). Also, much more data is being sent from DB2 than received from the remote system.
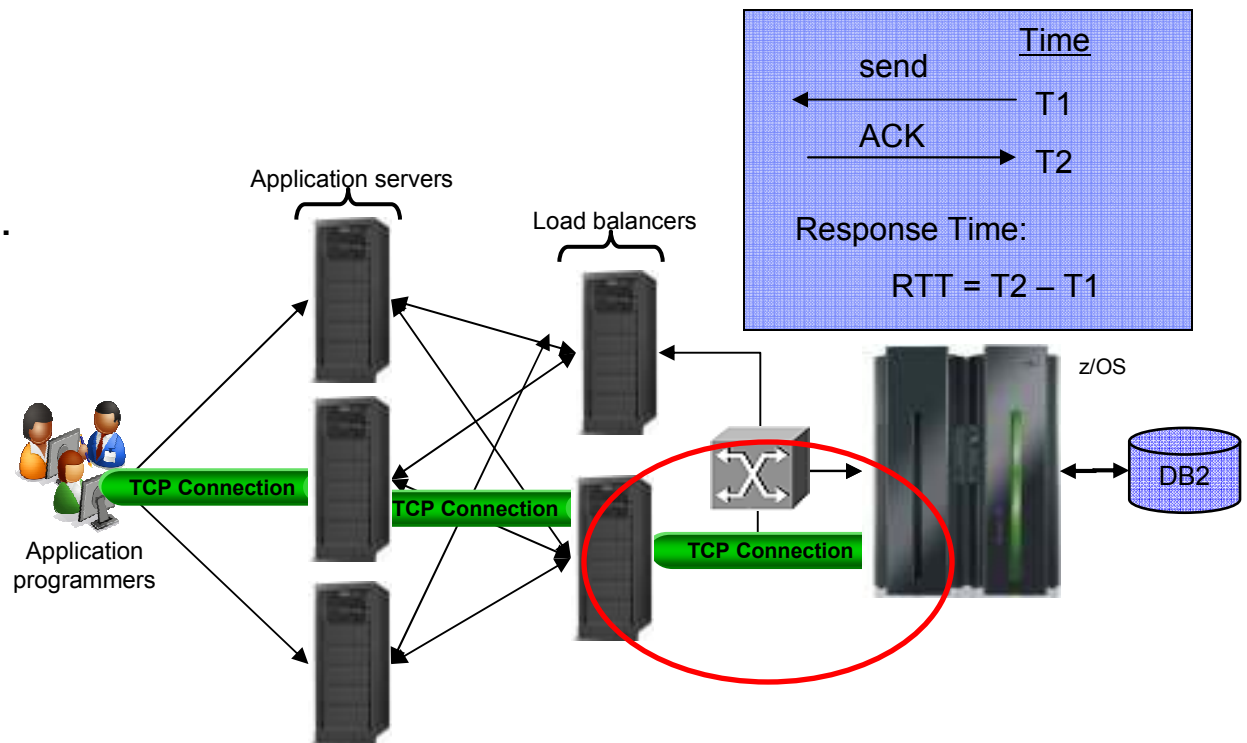
   Why is ACK from remote system taking so long?

6. Worked with distributed network and application server SMEs to identify and resolve.

Tivoli System z Sessions at SHARE

Monday

11:00	11207: Automating your IMSplex with System Automation for z/OS	Platinum 7
1:30	11832: What's New with Tivoli System Automation for z/OS	Elite 1
1:30	11896: Problem Solving with Consolidated Logs	Grand Salon A
3:00	11886: Improve Service Levels with Enhanced Data Analysis	Elite 1

Tuesday

9:30	11792: What's New with System z Monitoring with OMEGAMON	Elite 1
11:00	11791: Tuning Tips To Lower Costs with OMEGAMON Monitoring	Platinum 8
1:30	11900: Understanding Impact of Network on z/OS Performance	Grand Salon A

Wednesday

9:30	11835: Automated Shutdowns using either SA for z/OS or GDPS	Elite 1
1:30	11479: Predictive Analytics and IT Service Management	Grand Salon E/F
1:30	11899: Top 10 Tips for Network Perf. Monitoring w/ OMEGAMON	Platinum 9
4:30	11836: Save z/OS Software License Costs with TADz	Elite 1

Thursday

8:00	11887: Learn How To Implement Cloud on System z	Grand Salon E/F
9:30	11905: Using NetView for z/OS for Enterprise-Wide Mgmt and Auto	Grand Salon A
11:00	11909: Get up and running with NetView IP Management	Grand Salon A

Friday

9:30	11630: Getting Started with URM APIs for Monitoring & Discovery	Elite 1

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