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

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Overview of OMEGAMON for Mainframe Networks
FP3 and z/OS 1.12

1. OSA Express and Interface status and utilization
2. Show all IP Stacks in one view
3. TCP/IP Connection backlog and rejections
4. High TCP/IP Connection Rates
5. High TCP/IP Connection response times
6. Zombie Connections
7. Single Application Focused Network Monitor
8. TN3270 Response time analysis
9. FTP Logon and transfer failures
10. EE and HPR performance issues
This presentation will highlight best practices from customers who use OMEGAMON XE for Mainframe Network to monitor their z/OS Networking environment.

Some of these best practices will include hundreds of new metrics that came in with OMEGAMON MFN FP3 and new interface details from IBM Communications Server for z/OS 1.12.

I created a custom Navigator view to highlight the best practices discusses in this presentation.
Overview

• Solutions that Monitors IBM z/OS Network performance
• **IBM OMEGAMON XE for Mainframe Networks V4R2**
  • Performance monitoring
  • FP3 added hundreds of new metrics, see slide at the end for details
• **IBM NetView for z/OS V6R1**
  • TEP Feeds
    • DVIPA – Extensive monitoring
    • TCP/IP Connection awareness
      • Inactive Connections with termination code
  • Real Time Packet and OSA Traces with on the fly analysis
z/OS Network Performance Data Collection Points

• Collected using the TCP/IP NMI:
  • Applications, Connections, TCP/IP Memory Statistics, IPSec
  • FTP Sessions and Transfers, TN3270 Server Sessions, Interfaces (z/OS 1.12)

• Collected using the VTAM API:
  ▶ VTAM Summary, CSM Buffer Pools
  ▶ Enterprise Extender (EE), High Performance Routing (HPR)

• Collected using SNMP:
  ▶ Interfaces (z/OS 1.11 or before)
  ▶ OSA

• Collected using the “Session Awareness and trace” API:
  ▶ SNA Session Awareness and Trace

✓ Move from SNMP and NETSTAT COMMANDS to the NMI API
✓ Less overhead
✓ Scalable
Tivoli Enterprise Portal (TEP) Highlights

- **Common user interface**
  - Manage z/OS system and distributed resources - single user interface.
  - Displays real time and historical, and alerts at the same time.
  - All customization and admin through the same interface.
  - Define thresholds and generate events.

- **Out of the box Best Practices**
  - Workspaces.
  - Situations - Problem Signatures and Expert Advice (ALERTS).

- **Create your own views and situations**
  - To match responsibility and skill level.
View Thresholds TIP

- Highlight metrics in a table you are viewing
- Will bring out hidden problems
- Help collate metrics to probable cause of problem

Situations Notification, though the TEP or OMNIBUS or even an email
Situation Expert Advice

• Initial Situation Values: Captures metrics at timed triggers
• Current Situation Values: Compare current metrics with initial metrics
• Expert Advice: Provides suggested actions
• Take Action: Issue commands from TEP
• Reflex Automation: Automatically issue commands
• Event Forwarding: Can forwards alerts to OMNIBUS

Connection round trip time

The response time for the last TCP segment transmitted on the connection. It is the elapsed time, in tenths of a second, starting when the segment was sent and ending when the acknowledgment was received. Round trip time is not end-to-end response time since it does not account for application time. However in conjunction with the round trip variance, it is a good indication of the general health of the route.
OSA-Express and Interfaces

- Interface Status
  - (Enhancement with z/OS 1.12)
- Situation on OSA Interface Status.
- Alert of OSA Interface down.
- Check Microcode level
- Adjust MTU size to reduce fragmentation
- zEnterprise – Monitor new OSA types
- Put all OSA and interfaces on one workspace

Out of Box Expert Advice

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 BUS Utilization
- Channel utilization
- Missed packets
- Not Stored Frames

Next, a customized OSA WORKSPACE
Tip#1 Put all OSA and Interfaces Cross LPAR View

Next, DLC Queuing Details
Channel DLC Read/Write Workload Queue Priorities

Next, Monitoring Multiple IP Stacks

Tuning OSA Interfaces is now simpler with z/OS 1.12
Tip#2 Put all IP Stacks for all LPARs in one view

- Create Cross LPAR Stack view
- Number of Connections
- Errors
- Monitor DVIPA from NetView

Out of Box Expert Advice
- IP Stack
  - Input Discards
  - Output Discards

Next: a Connection Backlogs
Exceeding Backlog Connection Limit

Application will not be aware that connections are being rejected

Backload Limit

Backlog Connections Rejected

Out of Box Expert Advice

Application problems
- Backlog Connections Rejected
- Connections backlogged
- Not Accepting Connections
- Rejecting new connections

Next: a Connection Backlog WORKSPACE
Tip #3 Monitor Connection Backlog Rejections

- Application TCP Listeners workspace
- TCP Listeners workspace

Next a high connect / disconnect rate
Tip#4 Monitor High Connection Rates

A high connection rate with very few active connection may indicate a poor design and can cause excess z/OS overhead.
TCP/IP Connections Response times

- Retransmissions
- Discards
- Out of order segments
- Round trip time
- Round trip time variance

Out of Box Expert Advice

Connections
- Retransmissions
- Discards
- Out of order segments
- Round trip time
- Round trip time variance

- Retransmissions, discards and out of order segments
- Window Size set to zero (local or remote)
  - Can indicate congestion
- Inbound and outbound bytes buffered (new)
  - Can be used to avoid major outage!
  - Create situation off TCP Connections Workspace

Next: Visualization correlation of response time issues
Tip#5 Correlate Response Times with Errors

- View all connections with high response times across all LPARS
- Turn on history to see when problems are occurring
- See if poor response time correlates with any errors.
- Notice Inbound Bytes Buffered

Next : Why filters can be so dramatic
Filter Data from all z/OS LPARS

- Filter can be at TEPS Server or z/OS Agent
- Filtered Query is dynamically pushed to z/OS Agents
- Performance gain is dramatic and immediate

Next: Finding missing connections
Where are my Connections?

- OMEGAMON for MFN default filters can hide problems
- It is simple is to override these filters.

Next: Let's see filters can find zombie connections
Tip#6 Create custom query for zombie connections

- Connection that do not get dropped
- Connections could start to backlog
- Connections with no traffic for a long time.
- Filter out addresses like Loopback
- Also create situation on Bytes buffered

Next: Filter for zombies
How to create a filter in Query Editor

Connections with no activity for > 10 Mins (600 seconds)
Filter out addresses such as loopback
Filter will automatically be pushed out to the MFN Agents
Tip#7 Create Application Network Filtered Views

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

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

- Listener and connection feeds from OMEGAMON MFN
- Inactive connections feeds from NetView for Termination reasons
- Address Space feeds from OMEGAMON on z/OS

Next: Create filtered view on application
Application Monitor View

Here is one filtered on MQ

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Local Port</th>
<th>Active Connections</th>
<th>Accepted Connections</th>
<th>Connection Rate</th>
<th>Active Connections High Water Mark</th>
<th>Time Stamp for Active Connections High Water Mark</th>
<th>Idle Time Since Last Accept</th>
<th>Server Up Time</th>
<th>Connections in Backlog</th>
<th>Established Connections in Backlog</th>
<th>FRC Connects</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMQACHIN</td>
<td>1414</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>08/05/11 00:33:34</td>
<td>0.08</td>
<td>31.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Active Connections for: WMQACHIN

<table>
<thead>
<tr>
<th>Remote Port</th>
<th>ASID</th>
<th>Connection Start Time</th>
<th>Connection Duration</th>
<th>Connection State</th>
<th>Response Time</th>
<th>Time Since Last Activity</th>
<th>Duplicate ACKs</th>
<th>Total Segments Retransmitted</th>
<th>Total Out of Order Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>50331</td>
<td>0x0112</td>
<td>08/04/11 20:37:24</td>
<td>17530</td>
<td>ESTABLISHED</td>
<td>5.72</td>
<td>16,519.56</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>59953</td>
<td>0x0112</td>
<td>08/03/11 20:53:29</td>
<td>102965</td>
<td>ESTABLISHED</td>
<td>5.35</td>
<td>102,615.32</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>49405</td>
<td>0x0112</td>
<td>08/04/11 19:30:42</td>
<td>21532</td>
<td>ESTABLISHED</td>
<td>5.63</td>
<td>18,260.51</td>
<td>20</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

INACTIVE CONNECTIONS for: WMQACHIN

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Remote IP Address</th>
<th>Remote Port String</th>
<th>Termination Reason Code</th>
<th>Total Segments Retransmitted</th>
<th>Byte Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>/SA WMQACHIN</td>
<td>9.76.159.5</td>
<td>52107</td>
<td>Excessive_Retrans</td>
<td>50</td>
<td>1237</td>
</tr>
<tr>
<td>/SA WMQACHIN</td>
<td>9.39.66.103</td>
<td>39940</td>
<td>Client_Sent_Reset</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>/SA WMQACHIN</td>
<td>9.76.133.99</td>
<td>49761</td>
<td>Excessive_Retrans</td>
<td>17</td>
<td>9800</td>
</tr>
<tr>
<td>/SA WMQACHIN</td>
<td>9.39.66.103</td>
<td>34836</td>
<td>Client_Sent_Reset</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

JOB OVERVIEW

<table>
<thead>
<tr>
<th>Job Name</th>
<th>CPU Percent</th>
<th>Step Name</th>
<th>Proc Step</th>
<th>Type</th>
<th>SvcClass</th>
<th>SvcClass Period</th>
<th>ASID</th>
<th>JESJOBID</th>
<th>TCB Percent</th>
<th>SRB Percent</th>
<th>IFA Percent</th>
<th>IFA on CP Percent</th>
<th>zLP Percent</th>
<th>zLP on CP Percent</th>
<th>Independent Enclave C</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMQACHIN</td>
<td>0.0</td>
<td>WMQACHIN</td>
<td>MQ70</td>
<td>STC</td>
<td>OPSDEF</td>
<td>1</td>
<td>0x0112</td>
<td>STC05805</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

z/OS Job summary for: WMQACHIN

Next: TN3270
TN3270 High Response Time Exception View

- **TN3270 Response time**
  - SNA time is application
  - IP time is the network
    - Drill down to TCP connection to see errors
  - Response time distribution by buckets
    - Sliding window buckets set in Comm Server
- **TN3270 Server status from NetView**

**Out of Box Expert Advice**

TN3270 Response times
- Average IP response times
- Average SNA response times
- Average total response times
- High number of long responses

Next: Let’s see a how this looks
Tip#9 FTP View of Logon and Transfer Problems

- FTP Session logon failure reason codes
- FTP Transfers, How long it took
- Drill down to connection for performance issues

<table>
<thead>
<tr>
<th>User ID on Server</th>
<th>Session Start</th>
<th>Session End</th>
<th>Login Failure Reason Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS519</td>
<td>02/17/08 09:07:03</td>
<td>02/17/08 09:07:03</td>
<td>Password_not_valid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User ID on Server</th>
<th>Last Reply to Client</th>
<th>Transmission Duration</th>
<th>Bytes Transmitted</th>
<th>Command</th>
<th>Last Reply to Client Description</th>
<th>Dataset Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS519</td>
<td>250</td>
<td>1140</td>
<td>1965120</td>
<td>RETRIEVE</td>
<td>Requested_file...</td>
<td>MS519.ELVIS...</td>
</tr>
<tr>
<td>MS519</td>
<td>250</td>
<td>490</td>
<td>429056</td>
<td>RETRIEVE</td>
<td>Requested_file...</td>
<td>MS519.ELVIS...</td>
</tr>
<tr>
<td>MS519</td>
<td>250</td>
<td>1140</td>
<td>1965120</td>
<td>RETRIEVE</td>
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<td>Requested_file...</td>
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</tr>
<tr>
<td>MS519</td>
<td>250</td>
<td>1160</td>
<td>1965120</td>
<td>RETRIEVE</td>
<td>Requested_file...</td>
<td>MS519.ELVIS...</td>
</tr>
</tbody>
</table>
Out of Box Expert Advice

FTP Session Errors:
- Network or socket errors
- Error reply from server
- Invalid sequence from client
- Resource shortage (storage…)

FTP Transfer Errors
- File, system or network errors
Summary of Enterprise Extender and HPR

**Expert Advice**

**HPR**
- Low initial throughput rate
- Path Switches
- ARB Mode Red, Persistent*

**EE**
- High retransmissions
- Out of Sequence buffers

**UDP**
- High Discard Rates
- Long Queues exceeding Queue Limit*

*Simpler to create

<table>
<thead>
<tr>
<th>SNA</th>
<th>Path Switch Timeout</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL2</td>
<td>(LIVTIME 10 Seconds)</td>
</tr>
<tr>
<td>Network</td>
<td>1 Minute</td>
</tr>
<tr>
<td>High</td>
<td>$TP(2)$ 2 Minutes</td>
</tr>
<tr>
<td>Medium</td>
<td>$TP(1)$ 3 Minutes</td>
</tr>
<tr>
<td>Low</td>
<td>$TP(0)$ 8 Minutes</td>
</tr>
</tbody>
</table>
Tip#10 Show EE and HPR on one View for all LPARs
TCP/IP and VTAM Address Spaces, Storage and Buffers

Out of Box Expert Advice

VTAM and TCP Address Space

- CSA%, ECSA %, CPU %, Paging Rate, and Buffer Pool shortage
1. OSA Express and Interface status and utilization
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OMEGAMON Recommended Maintenance:

- OMEGAMON XE for MFN V4R2 Fix pack 3 4.2.0.3-TIV-KN3-IF0001
- Matching PTFs UA58835, UA59029, UA59138, UA59709
- IBM Tivoli Monitoring V6.2.2
- Fix Pack 6.2.2-TIV-ITM-FP0005
- Matching PTFs UA60941, UA60942, UA60943, UA60944

Pulse 2011 Session 1254: Solving Application and Network issues using IBM’s OMEGAMON Mainframe Networks by James T Sherpey II
Top 10 Tips for z/OS Network Performance Monitoring with OMEGAMON

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