Identifying and Solving Network Performance Problems on zEnterprise

Dean Butler (butlerde@us.ibm.com)
IBM’s Integrated Service Management (ISM) framework can optimize costs and streamline operations.

This session is focused on:

**VISIBILITY**

*See your business services*

*Understand health and performance of services across your enterprise infrastructure*

**CONTROL**

*Manage service risk and compliance*

**AUTOMATION**

*Optimize business service delivery*

*Govern and secure complex infrastructure and ensure regulatory compliance*

*Drive down cost, minimize human error and increase productivity*
Agenda

- Is this familiar?
  “A critical application is ‘broken’. We all get on a bridge line. My peers say ‘My stuff is okay. It must be the network.’ I need to be able to say it is not the network or at least not my part of the network.”

- Knowing the problem space
  – Configuration issues
  – Operational issues

- zEnterprise … Integrated Service Management

- Scenarios
Configuration Issues – examples

- **OSA**
  - OSA-Express Direct SNMP subagent (IOBSNMP) or OSA/SF application (IOAOSASF) and the OSA/SF sockets application (IOASNMP) – running?
  - RACF for OSA/SF SNMP sub-agent (IOASNMP) – security messages

- **SNMP**
  - Is it configured (SNMPD.CONF)?
  - Is OSNMP job running?
  - Are you using the right IP address (loopback address, 127.0.0.1)?
  - Do you have the right community name (check SNMPD.CONF)?
  - Are you using the right port (default is 161)?
  - SNMP requests are timing out?

- **IPSec**
  - IKE daemon started?
  - PAGENT daemon started?
  - IPSec Network Management Interface (NMI) access authorized?

- **TN3270 & FTP**
  - z/OS Communications Server real-time SMF NMI enabled?
  - Monitoring app authorized?
  - Sliding window or bucket count data – configured in Telnet server profile?
Configuration Issues – examples …

- SNA NMI
  - z/OS Communications Server SNA NMI enabled?
  - OMVS segment created for VTAM?
  - Monitoring app authorized?

- VTAM
  - Is major node running?
  - Is SNA data collection configured?
  - Is your monitoring app in the VTAMLST?
  - Is the PMI exit available to VTAM?
Configuration Issues – an approach

Status on:
- SNA NMI
- VTAM
- PMI
- PAGENTD
- IKED
- OSNMP
- ...

Situations/actions based on status
Operational Issues

- Divide into 3 “locations”
- Problem sources
TCP/IP Key Metrics

- **TCP/IP Error Handling**
  - UDP, IP, and interfaces discard transmission units
  - TCP retransmits unacknowledged segments and drops the connection if retransmission threshold is reached
  - Applications that use UDP may retransmit data

- **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)

- **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

• Metrics aggregated at the stack level are best high-level indicators for situations

• Historical data can be analyzed to determine the appropriate situation thresholds for your enterprise.
zEnterprise

... Integrated Service Management
zEnterprise with zBX (z Blade Extension)
ONE Service Management Engine - Leveraging the Strengths of ONE System

IBM Advantage

✓ Visibility. Control. Automation™ with a SINGLE POINT OF CONTROL on a common infrastructure

✓ Consolidated view of the IT infrastructure

✓ Lower training and maintenance costs

✓ Integrated, consolidated reporting

✓ Asset optimization
Scenarios
**Scenario A:**

*It's not the Network!*

The setting:
A company relies on batch FTP to copy files between a mainframe at headquarters and each of its retail stores every night (local store time). Sales and inventory data is uploaded and product and pricing changes are downloaded to the stores. One morning, a systems administrator notices that some of the files were not updated. He reports the problem to the IT help desk. The problem is routed to the mainframe networks systems programmer.
User reports batch FTP failures

- Start with checking current activity: FTP transfers & FTP sessions

**FTP Session Summary Table**

<table>
<thead>
<tr>
<th>Collection Time</th>
<th>Application Name</th>
<th>Remote IP Address</th>
<th>Remote Port</th>
<th>Local IP Address</th>
<th>Local Port</th>
<th>User ID on Server</th>
<th>Client User ID</th>
<th>Session Start</th>
<th>Session End</th>
<th>Session Duration</th>
</tr>
</thead>
</table>

**FTP Transfer Summary Table**

<table>
<thead>
<tr>
<th>Collection Time</th>
<th>Remote IP Address</th>
<th>Remote Port</th>
<th>Local IP Address</th>
<th>Local Port</th>
<th>User ID on Server</th>
<th>Client User ID</th>
<th>Transmission Start</th>
<th>Transmission End</th>
<th>Transmission Duration</th>
<th>Bytes Transmitted (in GB)</th>
<th>Bytes Transmitted</th>
</tr>
</thead>
</table>
Check Applications and Connections

Applications:
• Accepting connections?
  • Rate, Backlog, Rejections
• Last activity time
• Response Times
• Retransmissions
• Transmit / Receive Rates
• Out of order segments
• CICS, IMS, WAS, z/OS

Connections:
• Start time/duration
• Response Time
• Response Time Variance
• Retransmissions
• Transmit / Receive Rates
• Out of order segments
Check OSA and Interfaces

**OSA**
- Online Status
- Configuration
- Microcode Level
- Utilization
- Transmission Rates
- Unknown IP Frames
- By LPARS
- By Ports

**Interfaces**
- Packet Errors
- Bandwidth Utilization
- MTU Size

<table>
<thead>
<tr>
<th>Interface Name</th>
<th>Description</th>
<th>Interface Type</th>
<th>Current State</th>
<th>MTU Size</th>
<th>Transmit Packet Rate</th>
<th>Receive Packet Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCPIPLINK</td>
<td>IP Assist QDIO Ethernet</td>
<td>ethernetCsmacd</td>
<td>Up</td>
<td>1492</td>
<td>4312</td>
<td>74909</td>
</tr>
<tr>
<td>LOOPBACK</td>
<td>Loopback</td>
<td>softwareLoopback</td>
<td>Up</td>
<td>65535</td>
<td>890</td>
<td>890</td>
</tr>
<tr>
<td>LOOPBACK</td>
<td>Loopback Device</td>
<td>propVirtual</td>
<td>Up</td>
<td>0</td>
<td>890</td>
<td>890</td>
</tr>
<tr>
<td>OSA1</td>
<td>Multipath Channel IP Assist Device</td>
<td>propVirtual</td>
<td>Up</td>
<td>0</td>
<td>4312</td>
<td>74909</td>
</tr>
<tr>
<td>EZAXCFSA</td>
<td>Multipath Channel Point-to-Point</td>
<td>mnc</td>
<td>Down</td>
<td>55296</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

© 2011 IBM Corporation
Check TCP/IP Stack

• Retransmits - Network congestion
• Out of Order - Routing or network congestion
• Fragmentation - MTU size
• Discards - Resource constraints
• Timeouts - Connectivity
• UDP input Errors - Attack
• UDP Discards - Wrong Sockets
• High storage utilization - Could indicate Network congestion
  • This can result in requests backing up in storage
Network is OK, then where is the problem?

Check job logs, SYSLOG, and syslogd for clues.

Dataset access issue? FTP session login failure?
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, it's time to investigate…
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 2\textsuperscript{nd} 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 …
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.
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. Working with distributed network and other SMEs to identify and resolve.
Scenario D: Erratic response times for TN3270 application

The setting:
Users are becoming frustrated at response times with an SNA application. All access is through TN3270. The response times are on average very fast, but vary widely over the course of a day.
Erratic TN3270 response times ...

1. A user opens a trouble ticket. Annette contacts the user who identifies a TN3270 session (TCP00072) that exhibits the erratic behavior.

2. The average response time and average SNA response time are fairly high. In contrast, average IP response time is good, so does not appear to be a network problem.
Erratic TN3270 response times ...

3. Looking further, the bucket counts show that there have been a number of transactions with poor response time and a number with good response times but not much in between.

4. Annette passes the problem to the SNA application support team, which identifies and resolves the issue.

High average SNA response time?
Investigate:
• High application workload spike
• z/OS system resource constraints.
Scenario E:
Application Performance Problem

The setting:
A company is starting to protect more and more of its IP traffic using encryption. The deployment has gone well and the IT operations staff is trained and ready. A user calls the help desk because a file transfer is taking a long time.
Common Problems and Symptoms:

- Filter added in wrong order  
  - Loss of connectivity to applications
- Security policies at endpoints are incompatible  
  - Loss of connectivity to applications  
  - Tunnel activation failures
- Loss of network connectivity between security endpoints  
  - Loss of connectivity to applications  
  - Tunnel activation failures
- Cryptographic services unavailable, misconfigured, or insufficient  
  - Application performance is slow  
  - Loss of connectivity to applications  
  - Tunnel activation failures
Application performance problem ...

- End user calls help desk because the transfer of large files is taking a long time.
- The operator looks at the Applications workspace and sees that the user’s FTP client ID is experiencing retransmissions.
The systems programmer finds the IP filters for src/dst IP address, then finds the associated dynamic tunnels.

There are a high number of expired tunnels.

The tunnel associated with the user's transfer has data rates of 0 and there are many tunnels with the same tunnel ID indicating it has been refreshed many times.
Application performance problem …

- The systems programmer examines the tunnel refresh and expiration information.
- The tunnel is being refreshed every 2 to 10 seconds.
- The systems programmer corrects the refresh time for the tunnel, which fixes the performance problem.
Questions?

Identifying and Solving Network Performance Problems on zEnterprise

Dean Butler (butlerde@us.ibm.com)
IBM’s Integrated Service Management approach is recognized as best in class

Integrated Service Management

IDC Market Share rankings:
#1 Overall in Systems / Network Management
#1 in Overall Performance and Availability Mgt.
#1 Performance Management
#1 Event Automation
#1 Network Management
#1 Output Management
#1 Archiving
#1 Identity and Access Management
#1 Security and Vulnerability Management
#1 Enterprise Asset Management

<table>
<thead>
<tr>
<th>VISIBILITY</th>
<th>CONTROL</th>
<th>AUTOMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>See your business</td>
<td>Manage service risk</td>
<td>Optimize business service</td>
</tr>
<tr>
<td>services</td>
<td>and compliance</td>
<td>delivery</td>
</tr>
</tbody>
</table>