



IBM Software Group

Understanding The Impact Of The Network On z/OS Performance

Ed Woods - IBM Corporation

Session 12780

Tuesday, February 5th: 4:30 PM - 5:30 PM

Tivoli software



Agenda

- Introduction
- Looking at the application time line
- Examples of mainframe/network interaction
 - ▶ Analysis scenarios using commonly available commands
 - ▶ Optimization considerations for various subsystems
- Defining a consistent monitoring strategy

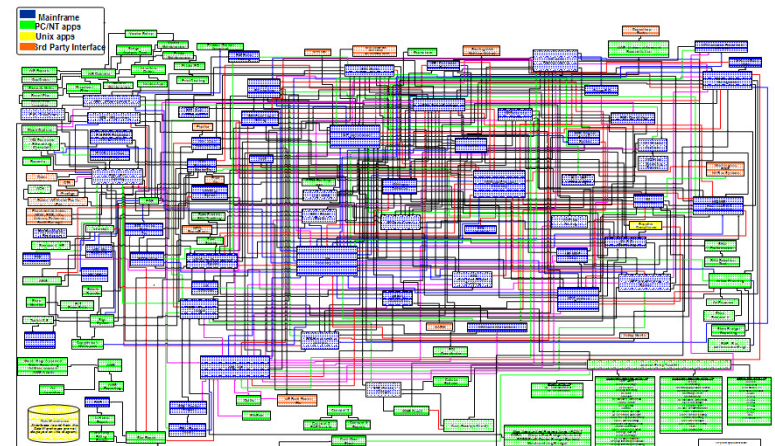


The Challenges Of Performance And Availability Management Of Complex Systems

- Most new applications are composite by design
 - ▶ Applications cross multiple subsystems and platforms
 - ▶ Integration and utilization of multiple core technologies
 - ▶ Pose challenges from a management and monitoring perspective

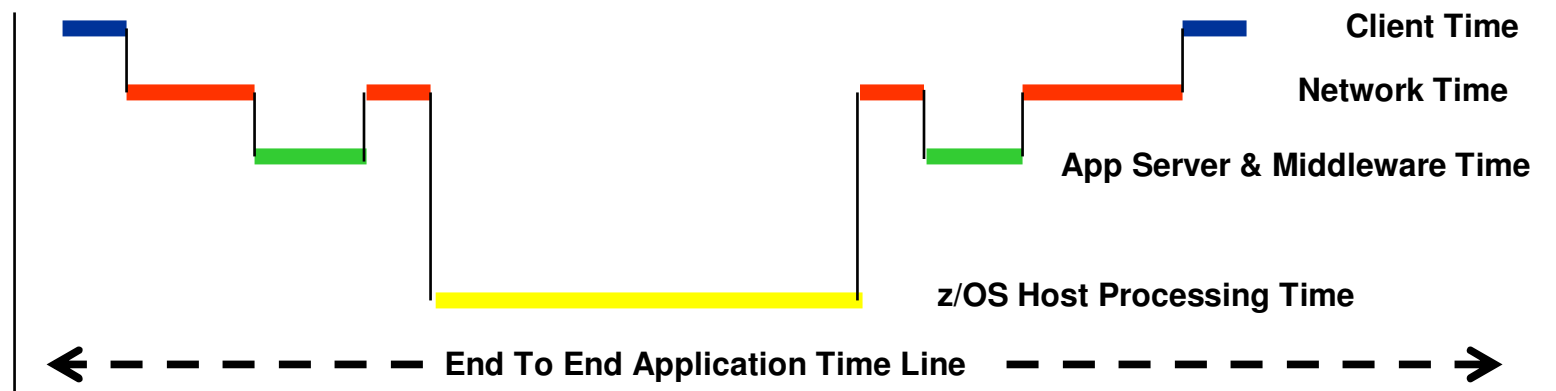
- Common Technical Challenges

- ▶ Multiple platforms
- ▶ Potentially multiple DB systems
- ▶ Middleware considerations
- ▶ One or multiple network hops



- *Is the problem the network, the host, the DB, the client, or somewhere in between?*

The Network And The Application Time Line



- Portions of response time may reside in any of the following
 - ▶ End user client processing, the application server or middleware level, the database, or other aspects of host z/OS application processing
 - ▶ Potential for bottlenecks at multiple points
- The network will impact the overall application time line
 - ▶ Time is required to send messages across the network
 - ▶ Overhead processing, including communication subsystem session management
 - ▶ Network hardware, traffic, connections, connection pools

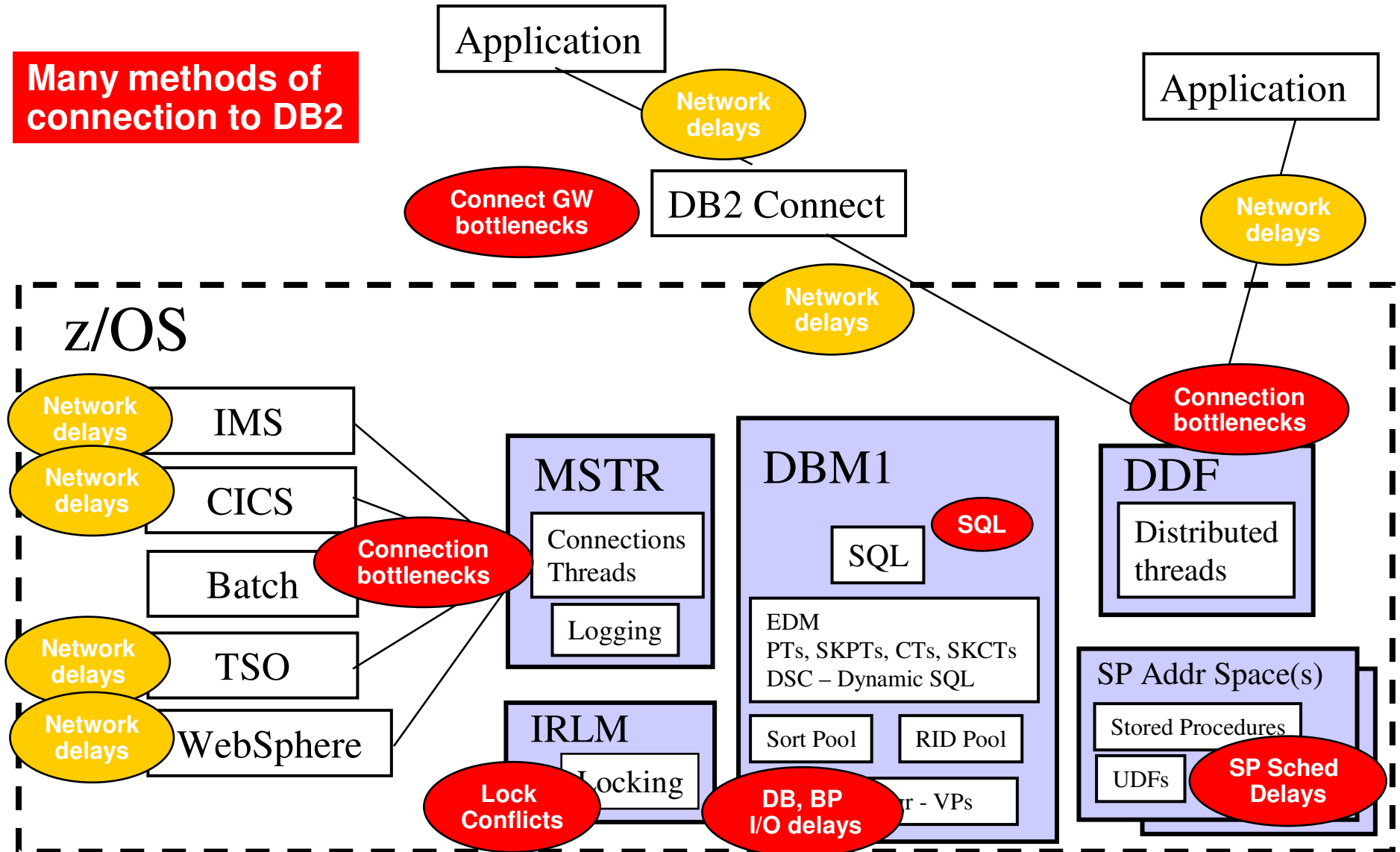
The Impact Of The Network On Critical z/OS Components

- The network has impact on z/OS workload in many ways
- Speed of the network – network congestion and bottlenecks
- Each z/OS application or component subsystem has unique network considerations
 - ▶ IMS, DB2, CICS, MQSeries, WebSphere, FTP
- Keep in mind that z/OS application/subsystem configuration and logic may also impact the network
 - ▶ Subsystem configuration options and settings impact network interaction
 - ▶ Application logic impacts network usage and performance
 - ▶ Be aware of the potential impact of SSL and IPSec



DB2 Has Several Potential Performance Bottlenecks

Many methods of connection to DB2



Network Analysis Tools

NETSTAT Command

- NETSTAT reports TCP/IP connections and protocol statistics
- Get status information on connections and statistics on packets sent, packets received, fragmentation, etc.....

C:\Documents and Settings\woodse>netstat

Active Connections

| Proto | Local Address | Foreign Address | State |
|-------|----------------------|-------------------------------------|-------------|
| TCP | IBM-1E47754C52F:4138 | demomvs.demopkg.ibm.com:telnet | ESTABLISHED |
| TCP | IBM-1E47754C52F:4251 | d01ml253.pok.ibm.com:1352 | ESTABLISHED |
| TCP | IBM-1E47754C52F:4255 | demomvs.demopkg.ibm.com:448 | ESTABLISHED |
| TCP | IBM-1E47754C52F:1035 | localhost:1036 | ESTABLISHED |
| TCP | IBM-1E47754C52F:1036 | localhost:1035 | ESTABLISHED |
| TCP | IBM-1E47754C52F:1920 | localhost:3416 | ESTABLISHED |
| TCP | IBM-1E47754C52F:1920 | localhost:3768 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3416 | localhost:1920 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3417 | localhost:3661 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3661 | localhost:3417 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3661 | localhost:3769 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3768 | localhost:1920 | ESTABLISHED |
| TCP | IBM-1E47754C52F:3769 | localhost:3661 | ESTABLISHED |
| TCP | IBM-1E47754C52F:1097 | 204.146.166.107:http | CLOSE_WAIT |
| TCP | IBM-1E47754C52F:1098 | 129.42.208.236:https | ESTABLISHED |
| TCP | IBM-1E47754C52F:1100 | rarcol01.attglobal.net:http | CLOSE_WAIT |
| TCP | IBM-1E47754C52F:1187 | www.live365.com:http | CLOSE_WAIT |
| TCP | IBM-1E47754C52F:1188 | ss32.live365.com:http | ESTABLISHED |
| TCP | IBM-1E47754C52F:4204 | 58.mtl-mg05.streamtheworld.net:http | ESTABLISHED |

NETSTAT command issued from client perspective.

Connection to DB2 on z/OS

NETSTAT Connection Detail

```
netstat all (port 448)
```

```

EZZ2350I MVS TCP/IP NETSTAT CS V1R10          TCPIP Name: TCPIP          19:16:24
EZZ2550I Client Name: DSNCDIST                Client Id: 0000C90E
EZZ2551I Local Socket: 9.39.68.147..448        Foreign Socket: 9.65.73.27..4255

EZZ2552I Last Touched: 19:14:58                State: Establish
EZZ2577I BytesIn: 0000006973                  BytesOut: 0008457981
EZZ2574I SegmentsIn: 0000003423                SegmentsOut: 0000006614
EZZ2553I RcvNxt: 3808791478                   SndNxt: 2538223807
EZZ2554I ClientRcvNxt: 3808791478             ClientSndNxt: 2538223807
EZZ2555I InitRcvSeqNum: 3808784504            InitSndSeqNum: 2529765825
EZZ2556I CongestionWindow: 0000017349         SlowStartThreshold: 0000002620
EZZ2557I IncomingWindowNum: 3808824236        OutgoingWindowNum: 2538289289
EZZ2558I SndWl1: 3808791478                   SndWl2: 2538223807
EZZ2559I SndWnd: 0000065482                   MaxSndWnd: 0000131070
EZZ2560I SndUna: 2538223807                   rtt_seq: 2538223753
EZZ2561I MaximumSegmentSize: 0000001310       DSField: 00
EZZ2563I Round-trip information:
EZZ2564I Smooth trip time: 184.000             SmoothTripVariance: 84.000
EZZ2565I ReXmt: 0000000002                   ReXmtCount: 0000000000
EZZ2572I DupACKs: 0000000284                 RcvWnd: 0000032758
EZZ2566I SockOpt: 8D                         TcpTimer: 00
EZZ2567I TcpSig: 04                         TcpSel: 40
EZZ2568I TcpDet: EC                         TcpPol: 00
EZZ2537I QOSPolicy: No
EZZ2542I RoutingPolicy: No
EZZ2570I ReceiveBufferSize: 0000016384        SendBufferSize: 0000065536
EZZ2538I ReceiveDataQueued: 0000000000
EZZ2539I SendDataQueued: 0000000000

```

Byte counts

Network segment counts

Network response time info

Retransmission count

An Example - Looking At The Numbers

DB2 Distributed Performance

Statistics Trace Data For The DB2 Subsystem

DISTRIBUTED DATA FACILITY STATISTICS

> DFST

+ Collection Interval: REALTIME

Start: 06/04 13:40:46

+ Report Interval: 4 sec

End: 06/04 13:40:49

+

+

OCDB203

DDF Status = ACTIVE

0% Dist Allied Threads = 0

Inactive DBATs = 0

+ Active DBATs = 3

DDF Receive Rate = 0K/sec

Resync Attempts = 0

Resync Successes = 0

+ Cold Start Connections = 0

Warm Start Connections = 0

+ DBAT Queued = 0

Conversations Dealloc = 0

+ HWM All DBATs = 5

HWM Active DBATs = 5

+ Max DB Access (MAXDBAT) = 500

HWM Inactive DBATs = 0

RDA REMOTE LOCS

+

+ Conversations Queued = 0

Binds for Remote Access = 0

+ Message Buffer Rows = 174874

Block Mode Switches = 0

+ Commits/Remote = 0

Rollbacks/Remote = 0

+ Indoubts/Remote = 0

+

| | Tran | SQL | Row | Message | Byte | Commit | Abort | Conv | Blocks |
|--------|------|------|--------|---------|----------|--------|-------|------|--------|
| + Sent | 0 | 0 | 174927 | 2486 | 43164569 | 0 | 0 | 0 | 1746 |
| + Recv | 55 | 1714 | 0 | 2285 | 238429 | 363 | 8 | 55 | 0 |

Thread creation queues?

HWM of DBAT usage

Is buffering occurring?

Recv – received into DB2

Sent – out to client/apps

Bytes and messages sent and received

Thread creation queues?

HWM of DBAT usage

Is buffering occurring?

 Recv – received into DB2
 Sent – out to client/apps

Bytes and messages sent and received

Looking At The Application DB2 Accounting Information Analysis

```

>
DISTRIBUTED THREAD DETAIL
PLAN
+ Thread: Plan=DISTSERV Connid=SERVER Corrid=db2bp.exe Authid=DNET581
+ Dist : Type=DATABASE ACCESS, Luwid=G941491B.PC10.090604182432=169
+ Location : 9.65.73.27
rsum
+
+ Distributed TCP/IP Data
+-----+-----+-----+-----+-----+-----+
+Location      IP Addr  Port  Ctbuser  Srvclsnam  Prod ID  Workstation Name
+-----+-----+-----+-----+-----+-----+
+9.65.73.27    0941491B  448  dnet581  NT         SQL09013  IBM-1E47754C52F
+
+ Transaction name: db2bp.exe
+ TCP/IP Userid:  dnet581
+
+
+ Statistics
+ Remote Location Luname =
+
+ Protocol Used      = Conversations Queued = 0
+ Block Mode Switches = 0 Message Buffer Rows = 33280
+ Bind Remote Access = 0 Max Allocated Conv = 0
+ Conv Allocated     = 0 Conv Deallocated = 0
+ Indoubt/Remote     = 0 Commit/Remote = 0
+ Rollback/Remote    = 0
+
+
+ Tran  SQL  Row Message  Byte  Commit  Abort  Conv  Blocks
+-----+-----+-----+-----+-----+-----+-----+-----+
+ Sent  0    0    33280    270    8457981  0     0     0     260
+ Recv  1    264    0      270    26329   2     0     1     0
+
+
+ 2-PHASE COMMIT Prepare Agent Commit Backout Forget Commit Backout
+ Sent 0 0 0 0 0 0 0 0
+ Recv 0 0 0 0 0 0 0 0
=====

```

Note the quantity of
data being sent

Note row versus
message/block counts
to determine blocking

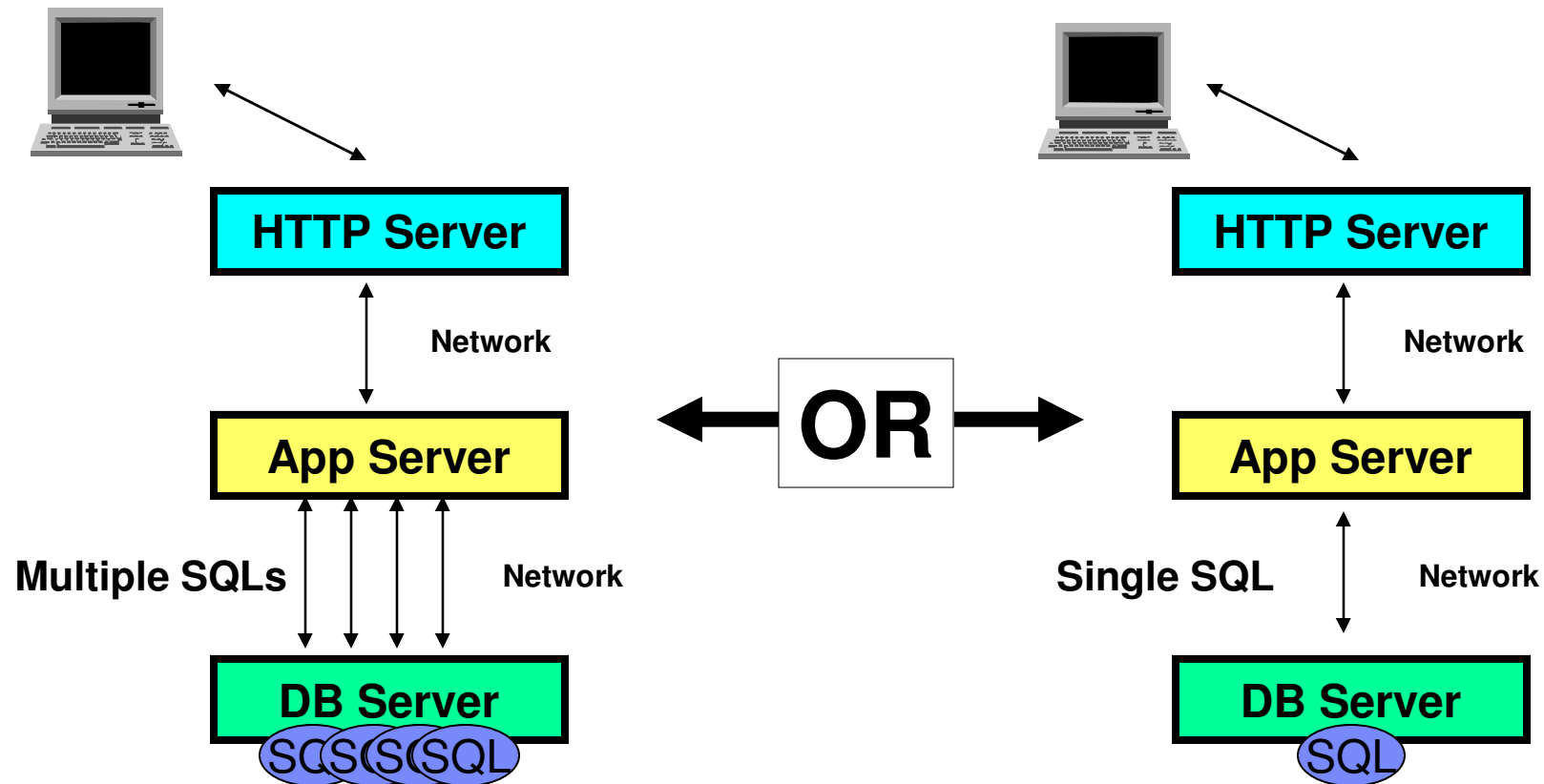
Recv – received into DB2
Sent – out to client/app

SQL calls

of messages sent

DRDA blocks for queries

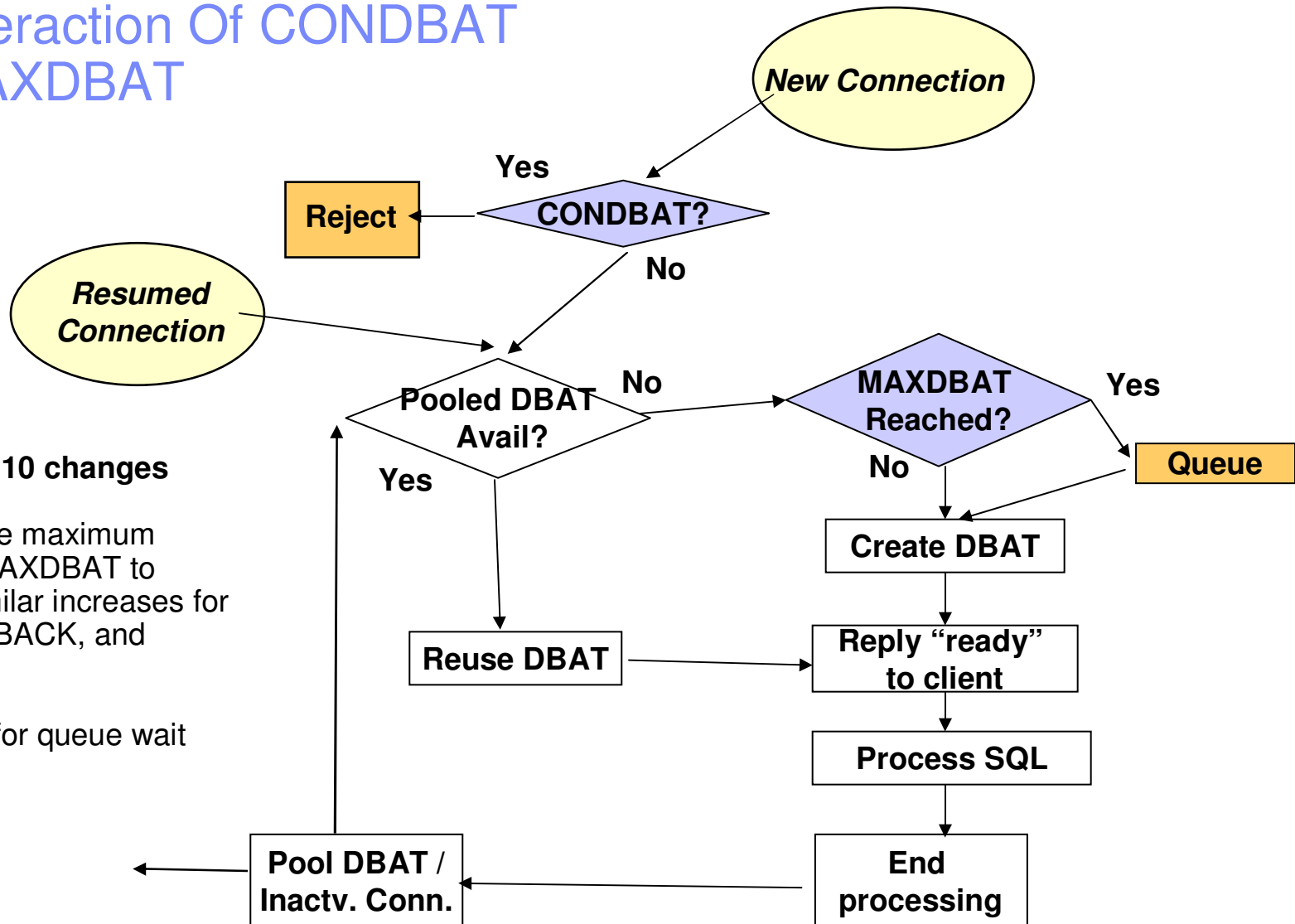
Example - Optimize DB2 Applications To Minimize Network Traffic



- Do more with SQL to eliminate redundant back/forth activity
- Crossing more layers will mean more overhead
- Don't put too much business logic in the DB layer

DB2 Subsystem Configuration

The Interaction Of CONDBAT And MAXDBAT

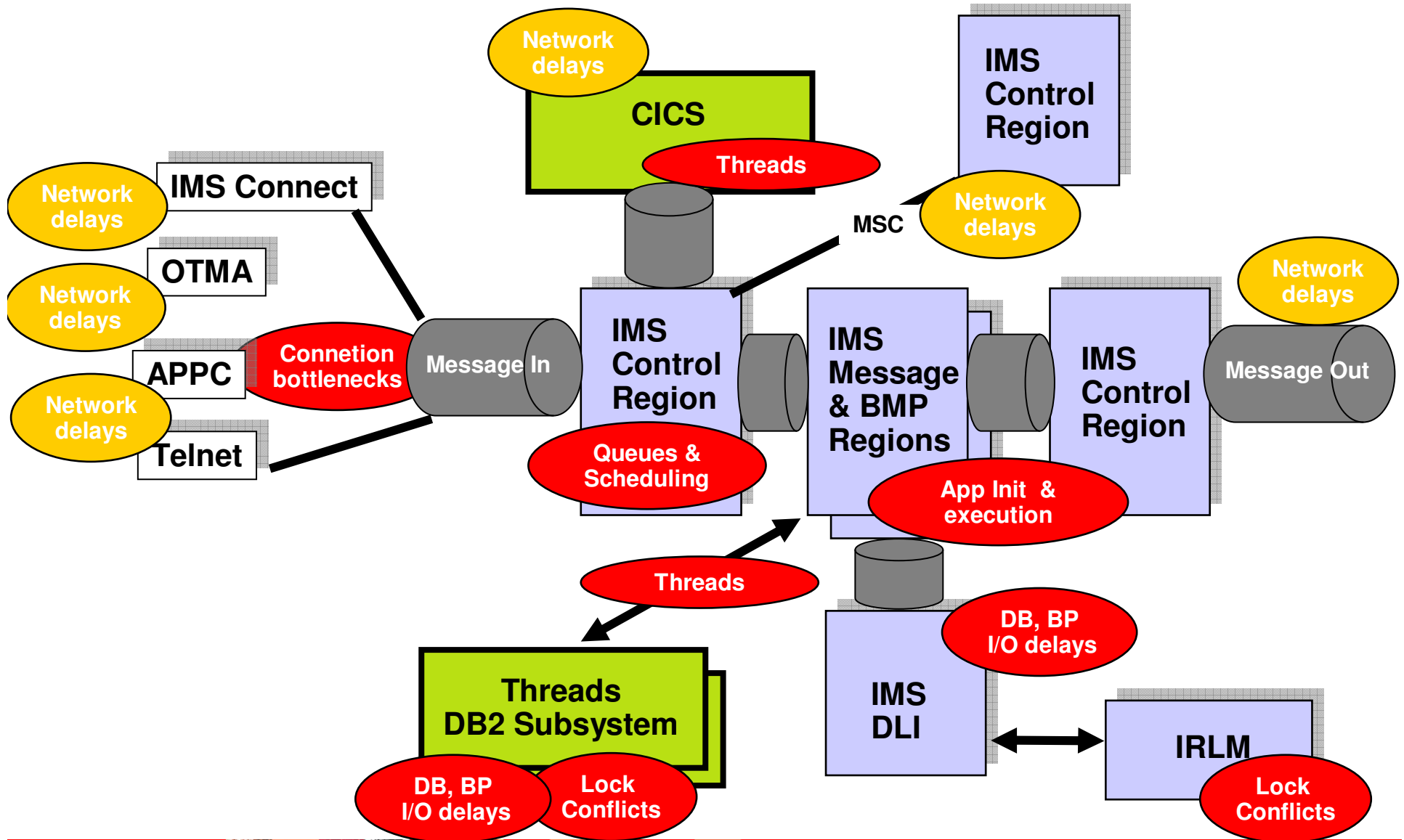


Note – DB2 10 changes

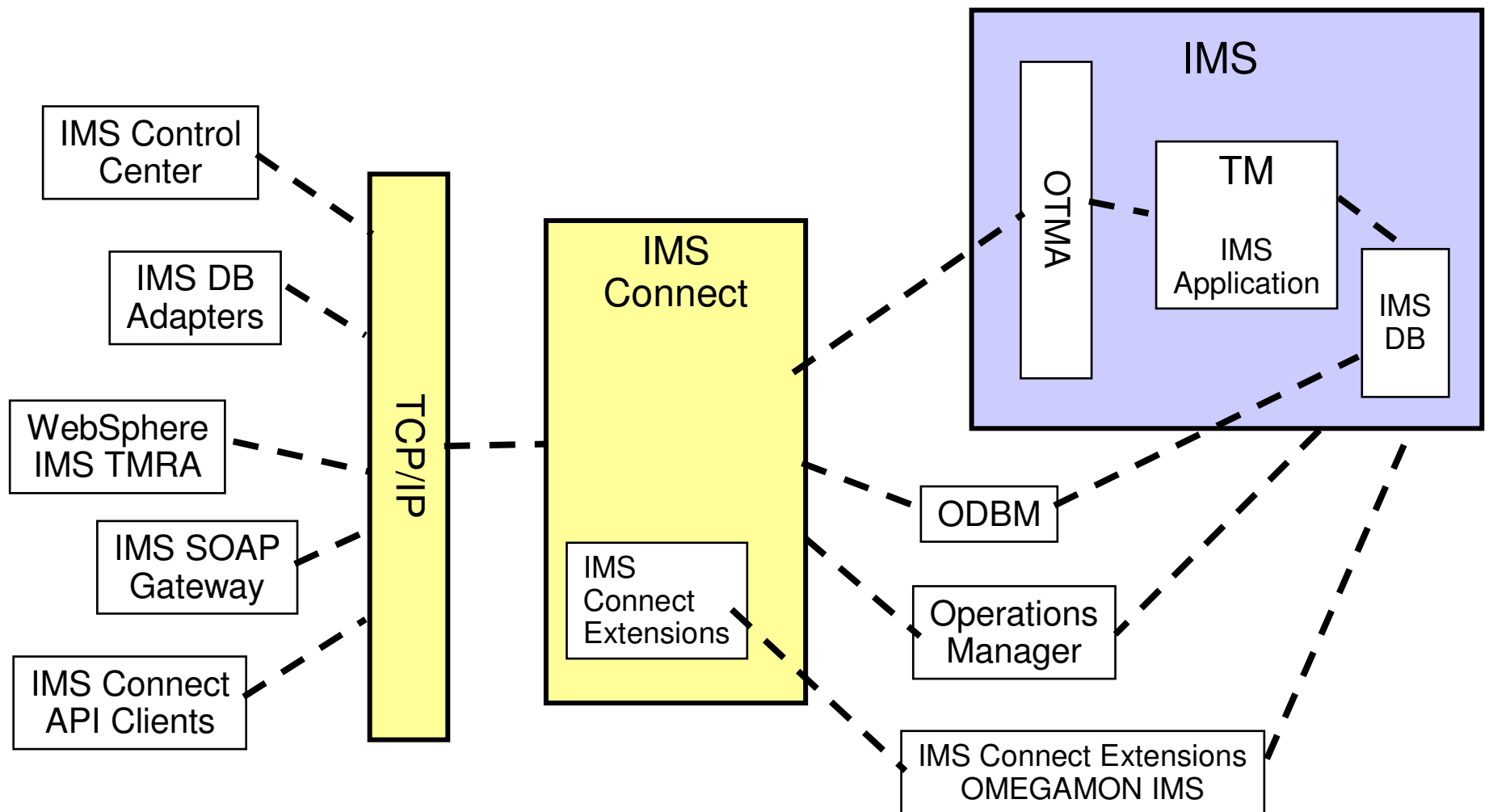
Increases the maximum setting for MAXDBAT to 19999. (Similar increases for IDFORE, IDBACK, and CTHREAD)

New zparm for queue wait time

IMS Has Many Potential Bottlenecks (Including Network)



IMS Connect And The Interaction With TCP/IP



IMS Connect

Types Of Connections & Message Considerations

- IMS Connect – types of connections
 - ▶ Non-Persistent socket
 - Closes after each send to the ICON client
 - ▶ Transaction socket
 - Close after each transaction or conversation - The default
 - Has connect/disconnect overhead for each message
 - ▶ Persistent socket
 - Multiple read/writes for multiple transactions
 - Typically more efficient
 - Will keep the socket open – make sure you have enough sockets
- Message considerations
 - ▶ General ROT – use one send for the entire message
 - ▶ If doing multiple writes then specify NODELAYACK on PORT statement in z/OS
 - If not specified then may wait up to 300ms for each transmission



IMS Network

Examples Of Relevant Options And Parameters

- PROFILE.TCPIP parameters
 - ▶ PORT
 - Reserve ports for IMS Connect
 - Include the NODELAYACK parameter for multi-message applications
 - Example benchmark
 - <http://www-01.ibm.com/support/docview.wss?uid=swg21079911>
 - ▶ SOMAXCONN
 - The number of connection requests that can be queued because IMS Connect has not yet issued the accept call - Default setting is 10
- IMS Connect parameter MAXSOC
 - ▶ Total number of sockets IMS Connect supports across all ports at the same time
 - Note - USS parameter MAXFILEPROC must be equal to or greater than the value of the IMS Connect parameter MAXSOC
 - ▶ IMS Connect issues warning message HWSS0772W when the number of sockets reaches the default warning threshold of 80 percent of MAXSOC



IMS Connect Monitoring

An Example

Response Time Detail for Transaction PART

Page: 1 of 144

| Tran Code | Target Datastore | Client ID | Port Number | User ID | Collection Level | Message Received Time | Response Time | Input Pre-OTMA Time | Input Read Socket Time | Input Read Exit Time | Input Read Exit Name | Input SAF Time | Process OTMA Time | Output Confirm Time | Output Post-OTMA Time | XMIT Exit Time | X |
|-----------|------------------|-----------|-------------|---------|------------------|-----------------------|---------------|---------------------|------------------------|----------------------|----------------------|----------------|-------------------|---------------------|-----------------------|----------------|----|
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000139 | 0.065653 | 0.000021 | 0.026154 | HWSIMSO0 | 0.000000 | 0.118476 | 0.000000 | 0.000629 | 0.000025 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000062 | 0.000110 | 0.000018 | 0.000039 | HWSIMSO0 | 0.000000 | 0.007838 | 0.000000 | 0.000342 | 0.000015 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000098 | 0.000089 | 0.000028 | 0.000013 | HWSIMSO0 | 0.000000 | 0.009208 | 0.000000 | 0.000587 | 0.000020 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000113 | 0.000124 | 0.000018 | 0.000016 | HWSIMSO0 | 0.000000 | 0.023006 | 0.000000 | 0.000614 | 0.000026 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000244 | 0.000117 | 0.000019 | 0.000016 | HWSIMSO0 | 0.000000 | 0.007549 | 0.000000 | 0.000588 | 0.000020 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000096 | 0.000123 | 0.000030 | 0.000016 | HWSIMSO0 | 0.000000 | 0.010288 | 0.000000 | 0.000622 | 0.000020 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000093 | 0.000124 | 0.000020 | 0.000018 | HWSIMSO0 | 0.000000 | 0.008585 | 0.000000 | 0.000601 | 0.000020 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000080 | 0.000108 | 0.000016 | 0.000016 | HWSIMSO0 | 0.000000 | 0.010068 | 0.000000 | 0.000550 | 0.000017 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000078 | 0.000115 | 0.000018 | 0.000014 | HWSIMSO0 | 0.000000 | 0.008033 | 0.000000 | 0.000620 | 0.000018 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000082 | 0.000105 | 0.000018 | 0.000014 | HWSIMSO0 | 0.000000 | 0.008343 | 0.000000 | 0.000542 | 0.000017 | HA |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | 0.000123 | 0.000124 | 0.000019 | 0.000018 | HWSIMSO0 | 0.000000 | 0.009186 | 0.000000 | 0.000647 | 0.000029 | HA |

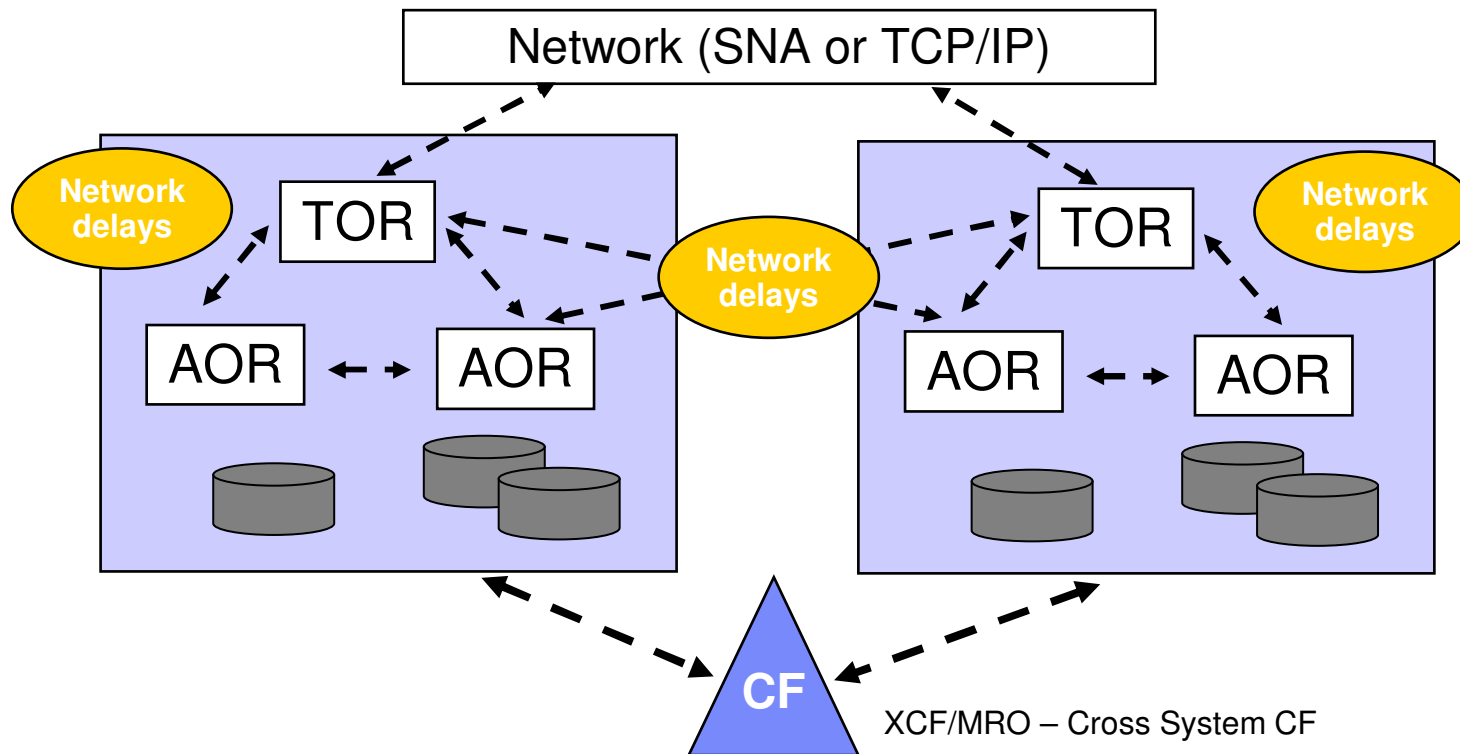
Response Time Detail for Transaction PART

Page: 1 of 144

| Tran Code | Target Datastore | Client ID | Port Number | User ID | Collection Level | Message Received Time | XMIT Exit Name | Time Outs | Commit Mode | Synchronization Level | NAK Count | OTMA NAK Sense Code | Client IP Address | Client IP Port | Timestamp | Sysplex Name |
|-----------|------------------|-----------|-------------|---------|------------------|-----------------------|----------------|-----------|-------------|-----------------------|-----------|---------------------|-------------------|----------------|-------------------|--------------|
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 2999 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3000 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3001 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3002 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3003 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3004 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3005 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3006 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3007 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3008 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3009 | 11/14/09 12:13:04 | LPAR400J |
| PART | 91Y | ICTDRVR | 4713 | JMAHE | Maximum | 01/14/09 12:08:06 | /SIMSO0 | 0 | CM1 | None | 0 | N/A | 9.42.46.28 | 3010 | 11/14/09 12:13:04 | LPAR400J |

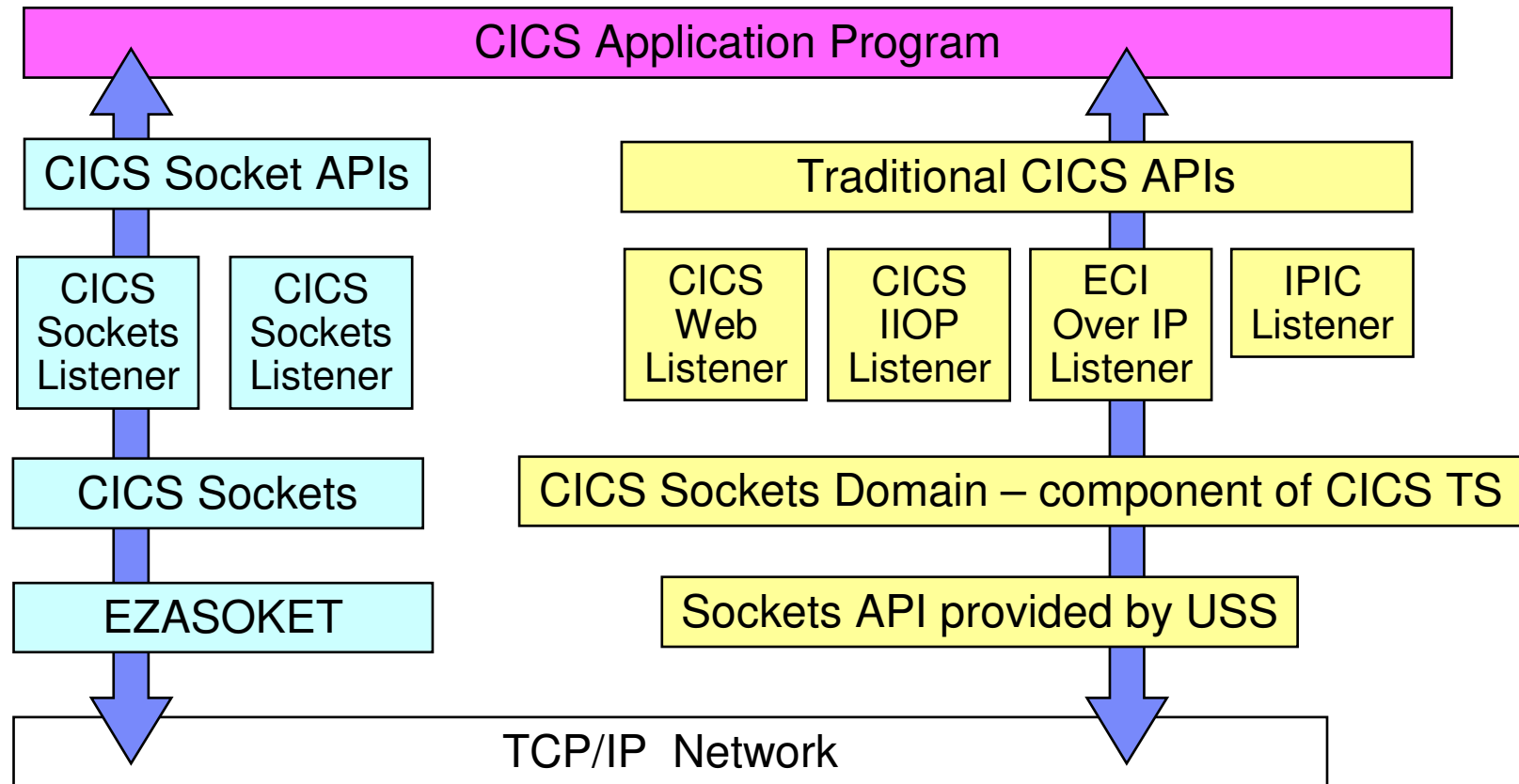
Note – This display requires IMS Connect Extensions And OMEGAMON IMS

The Network Impacts CICS Processing



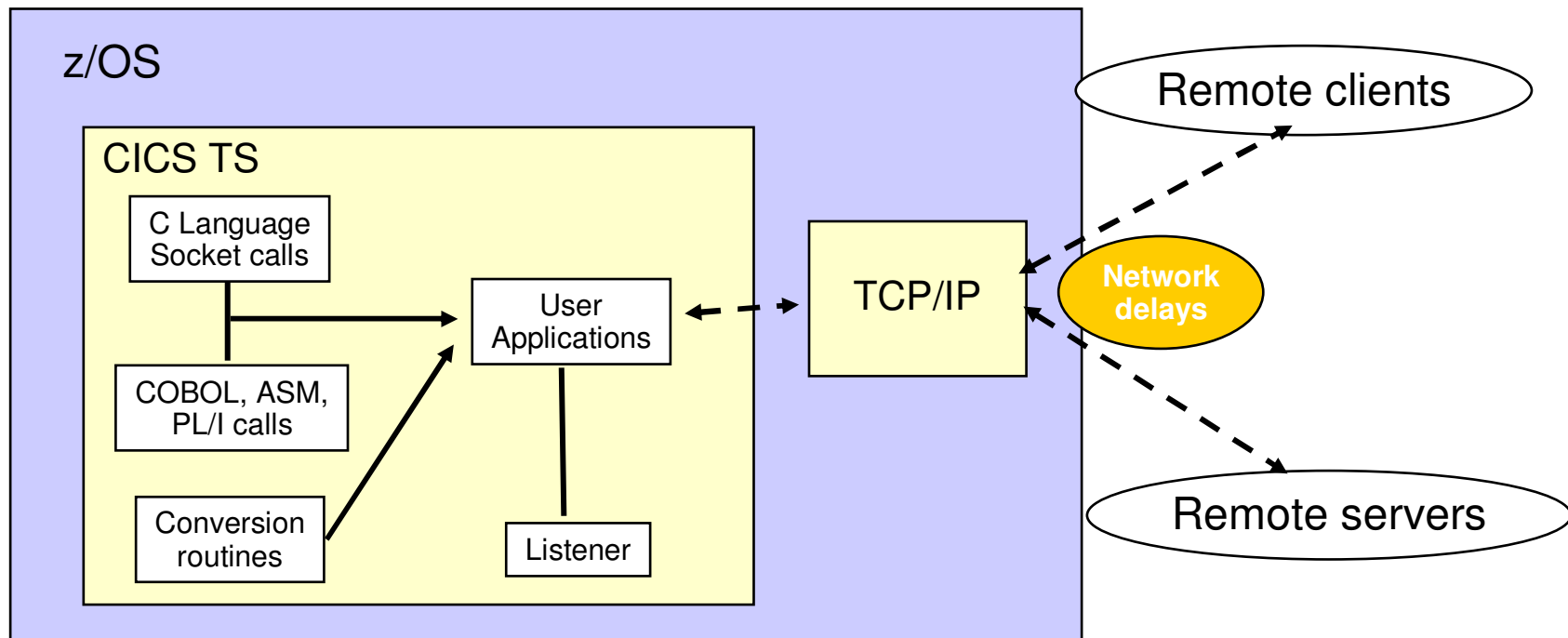
- Network potentially impacts CICS in a variety of ways
 - ▶ Connections to CICS – connections via a variety of means
 - ▶ Communication within CICS - ISC and MRO
 - InterSystems Communication - system to system, Multi-Region Operation - region to region, and IPIC – IP InterCommunications

CICS Sockets Versus CICS Sockets Domain



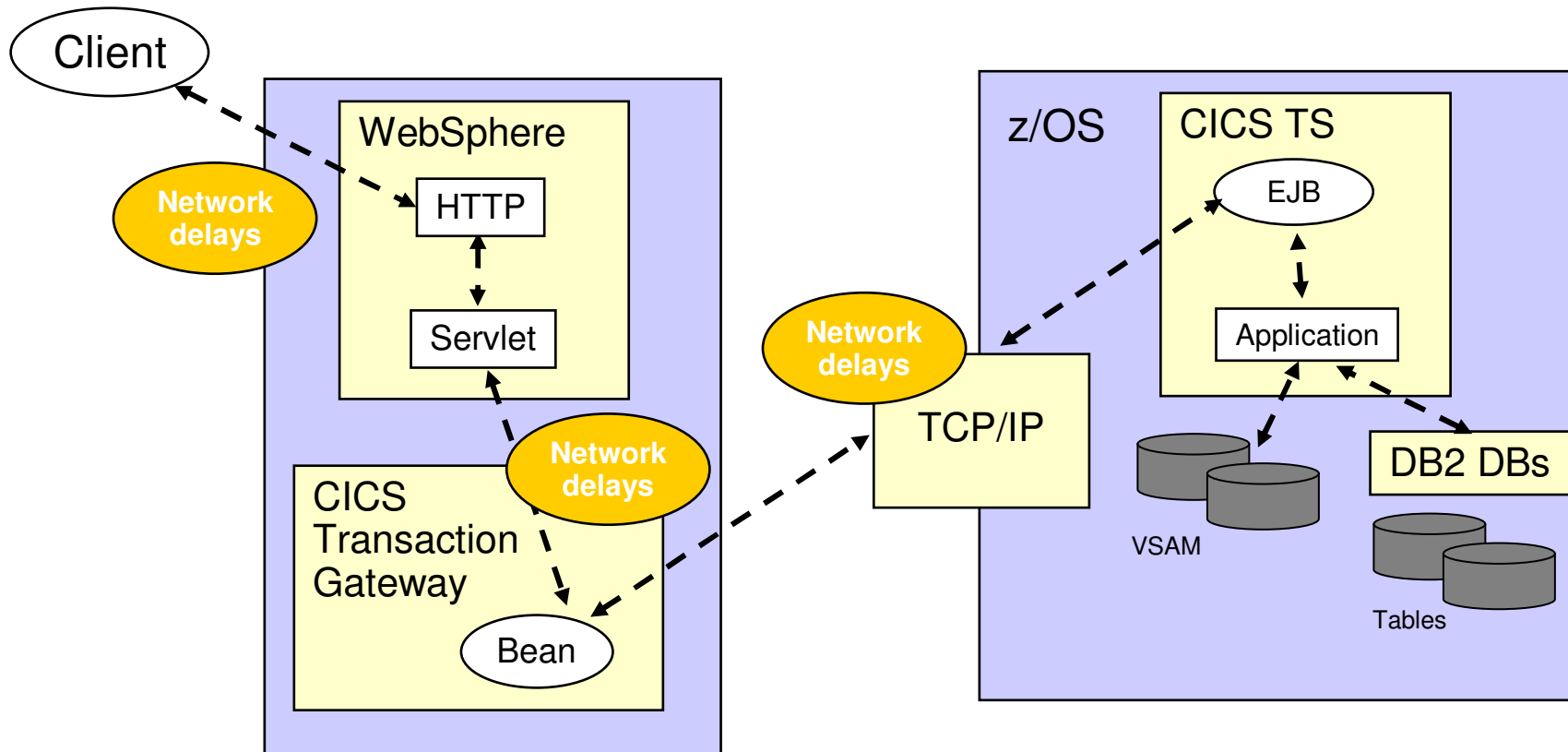
- **CICS Sockets – a component of Communications Server for z/OS**
 - ▶ General purpose socket API for use by CICS programmers
- **CICS Sockets Domain – a component of CICS TS**
 - ▶ Does not have direct access to the socket
 - ▶ Communicates with CICS Socket Domain Services

CICS Socket Interface Example



- Socket API available for C, COBOL, PL/I and ASM applications
- Listener is a CICS transaction
- Conversion routines – ASCII/EBCDIC

A WebSphere Example With CICS Transaction Gateway



CICS Network

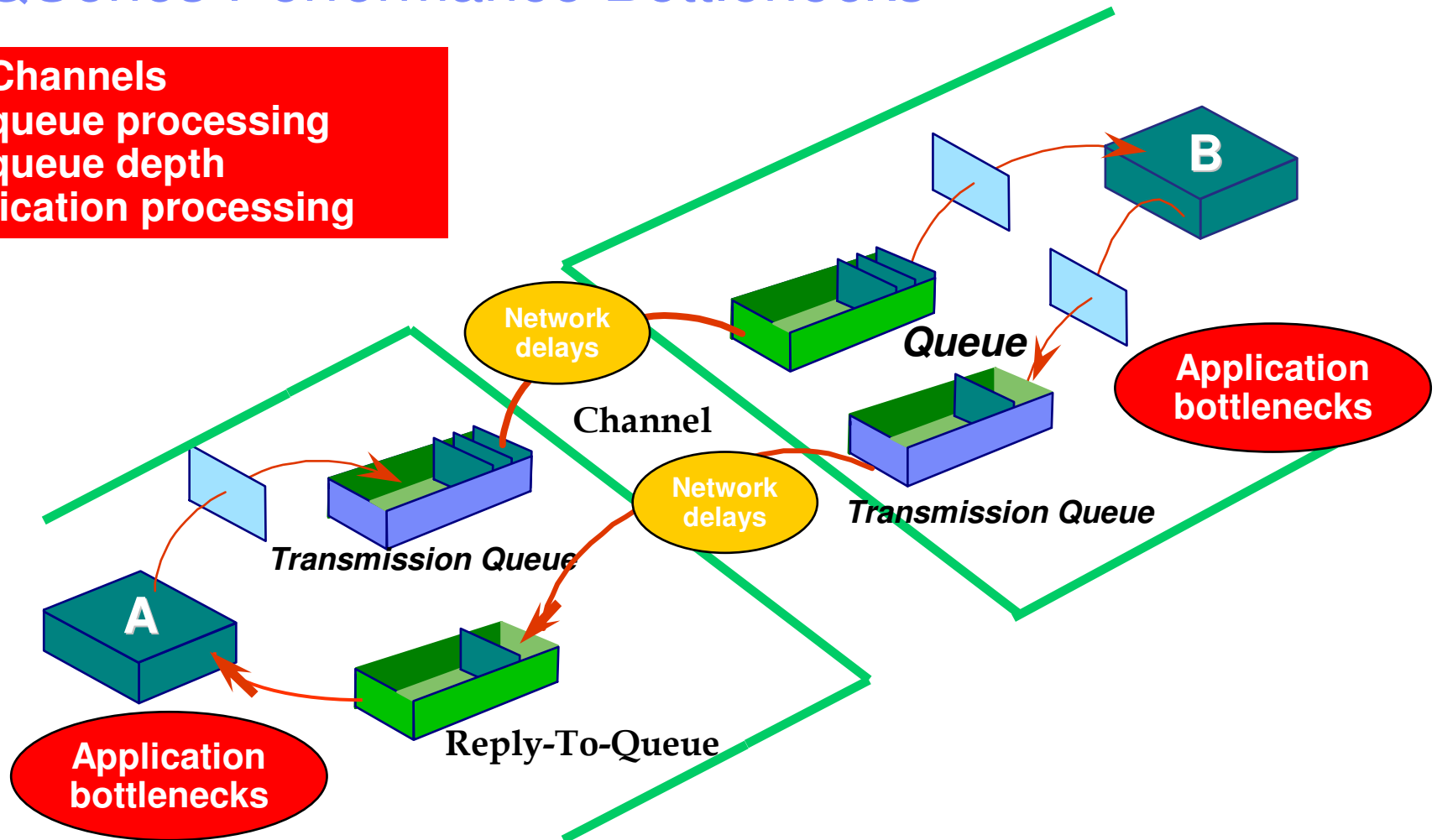
Examples Of Relevant Parameters

- TCPIPSERVICE parameter defines services
 - ▶ ECI over TCP/IP (for CICS Clients), IIOP, CICS Web support (HTTP), IPIC (ISC), or a user-defined protocol.
 - ▶ For use only with the CICS-provided TCP/IP services, and have nothing to do with the z/OS Communications Server IP CICS Sockets interface
- BACKLOG parameter
 - ▶ Specifies the maximum number of inbound TCP/IP connection requests that can be queued in TCP/IP for CICS processing
 - ▶ When the maximum number is reached, TCP/IP rejects additional connection requests
- MAXSOCKETS parameter
 - ▶ Maximum number of IP sockets that can be managed by the CICS sockets domain
 - ▶ If the CICS region userid does not have superuser authority, the maximum possible value is the value of the MAXFILEPROC parameter in SYS1.PARMLIB member BPXPRMxx.
 - ▶ MAXSOCKETS and maximum tasks (MXT)
 - Recommendation - MAXSOCKETS should not be a subset of MXT
 - <http://www-01.ibm.com/support/docview.wss?uid=swg21596250&myns=swgothor&mynp=OCSSGMGV&mync=R>



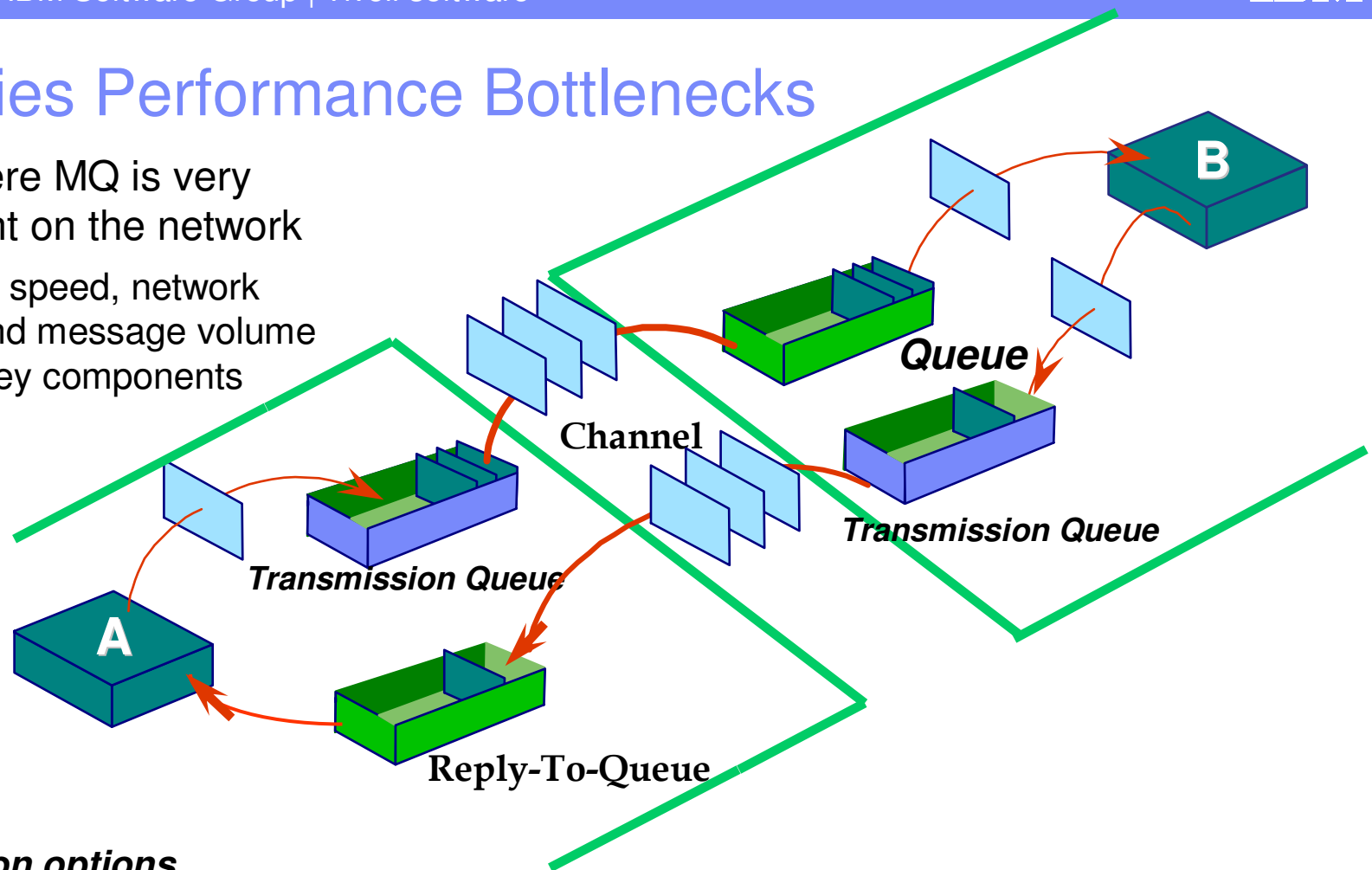
MQSeries Performance Bottlenecks

MQ Channels
MQ queue processing
MQ queue depth
Application processing



MQSeries Performance Bottlenecks

- WebSphere MQ is very dependent on the network
 - ▶ Network speed, network traffic and message volume are all key components



Optimization options

Increase network speed

Compress messages - decreases network transmission by reducing the size of the message.

Channel parameters

Batch size defines the maximum number of messages sent within a batch.

Reduces the amount of channel processing required.

Note – batching for small applications may result in delays and spikes

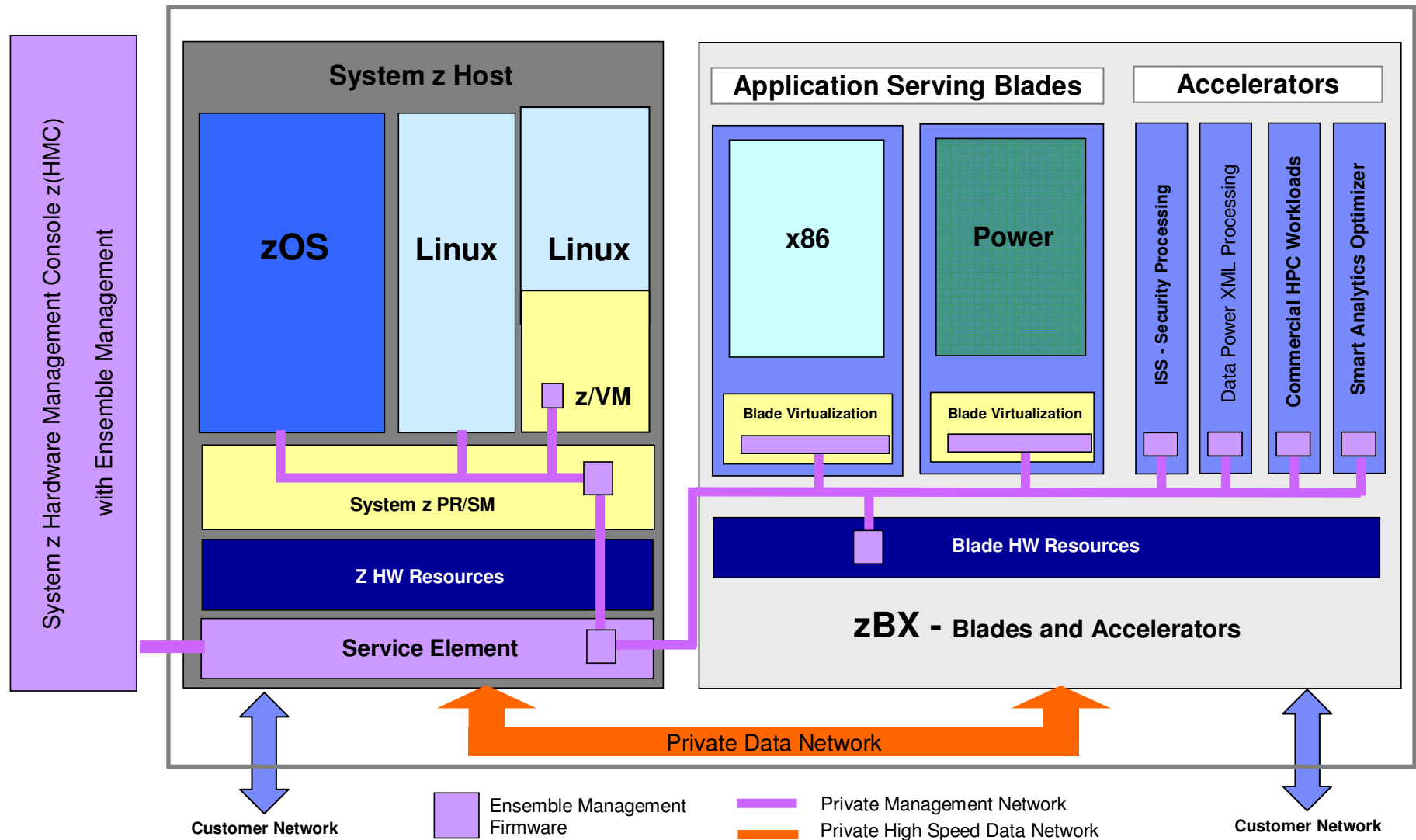
MQ Series

Configuration/Application Options And Network Impact

- Consider MQCONN and MQPUT patterns
 - ▶ MQCONN connects the application program to the MQ queue manager
 - Note - Cost of MQCONN high
 - ▶ MQPUT puts a message on a queue that was opened using MQOPEN
 - ▶ Similar to DB2 SQL call scenario
 - Consider cost of back and forth activity versus application logic
- Channel parameters
 - ▶ Batchsz – defines the maximum number of messages sent within a batch
 - Reduces the amount of channel processing required
 - ▶ Channel message compression
 - Some compression can be CPU heavy - how compressible is the data?
- Persistent versus non-persistent messages
 - ▶ Persistent messages are written to logs and queue data files
 - May be recovered by the queue manager after restart from failure
 - Persistent messages may have I/O and logging bottlenecks
 - ▶ Non-persistent messages are discarded after a failure
- Fast non-persistent messages
 - ▶ NPMSPEED – specifies speed at which non-persistent messages are sent



Address Network Latency Concerns With zEnterprise



Defining A Monitoring Strategy

Many Factors May Impact Response Time

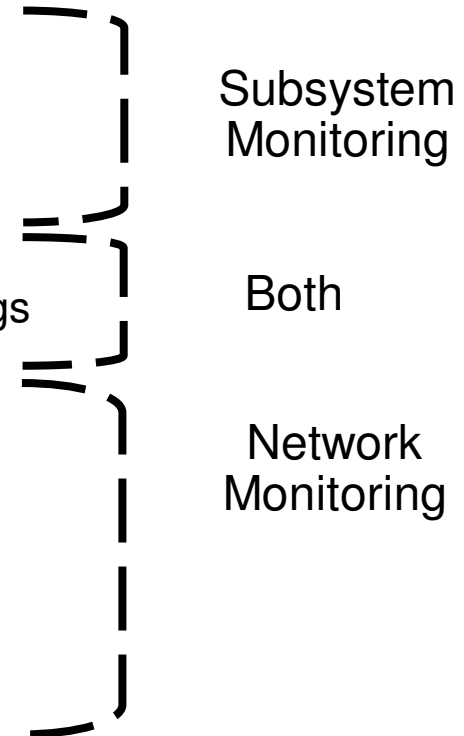
- Host processing bottlenecks
 - ▶ Transaction bottlenecks, application failures/stopped resources, high I/O and poor BP ratios, transaction/message queues, concurrency/lock conflicts
- Network performance
 - ▶ Network congestion, data fragmentation, data retransmission
- Network hardware issues
 - ▶ Adapter hardware errors, hardware configuration errors, hardware congestion issues
- Application subsystem connection issues
 - ▶ Application errors, subsystem configuration errors
- Application issues
 - ▶ Application design and logic problems



Defining A Monitoring Strategy

Monitoring At Multiple Levels

- Monitor at the host application subsystem level
 - ▶ IMS, CICS, DB2, WebSphere, WebSphere MQ
 - ▶ Response time, transaction rates, message rates, queues
- Monitor host application network connection activity
 - ▶ Connection activity, connection counts, connection backlogs
- Monitor at the interface level
 - ▶ OSA adapters, error counts, fragmentation counts, retransmission counts
- Monitor at the network connection level
 - ▶ Response time, traffic counts, error counts, fragmentation counts, retransmission counts
- Integrate host and network monitoring — — — — — Dashboard level monitoring
- Monitor from an end-to-end perspective — — — — — Composite level monitoring



Example - Understanding IMS Response Time

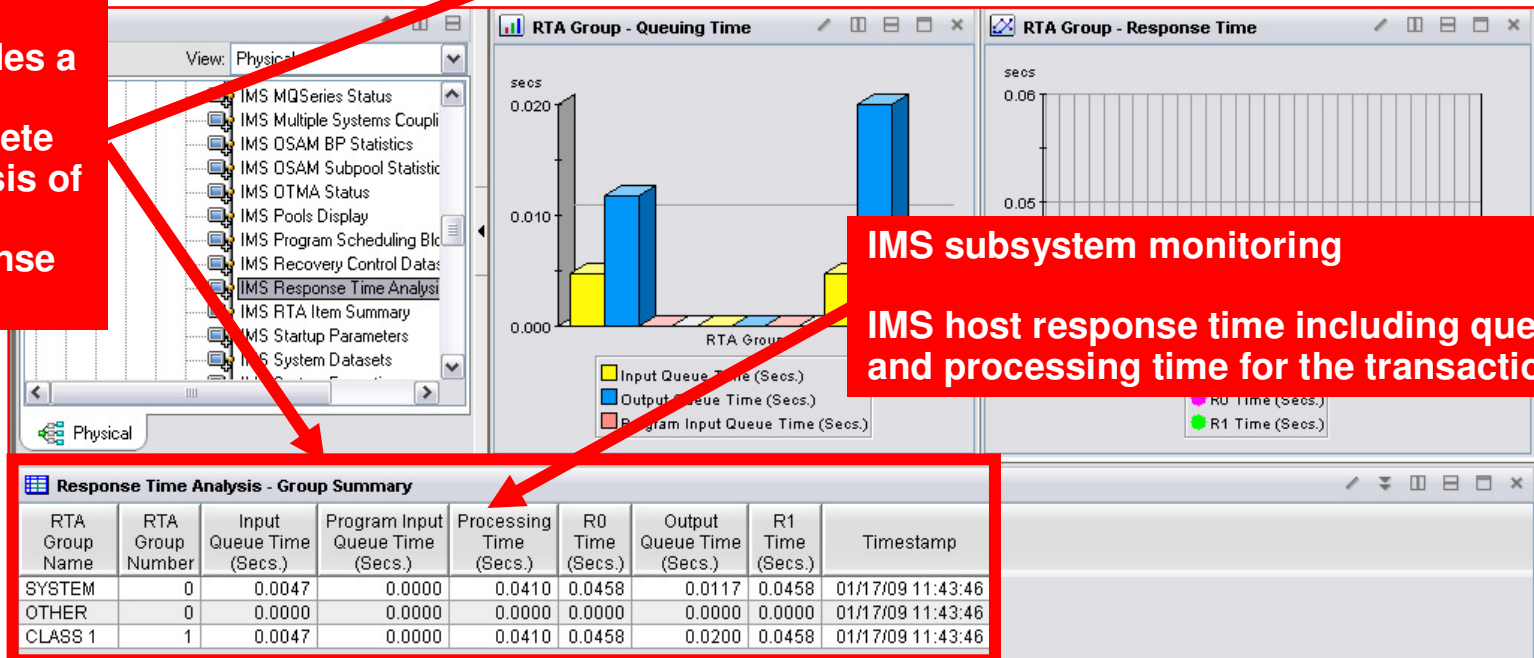
Mainframe network monitoring

Network time for IMS transactions

Connections Summary Table

| Total Bytes Received | Total Bytes Sent (in GB) | Total Bytes Sent | Total Bytes (in GB) | Total Bytes | Bytes Received | Bytes Sent | Bytes Sent or Received | Time Since Last Activity | Byte Rate | Response Time | Response Time Variance | Telnet Appl Name | Telnet LU Name | Seg Retra |
|----------------------|--------------------------|------------------|---------------------|-------------|----------------|------------|------------------------|--------------------------|-----------|---------------|------------------------|------------------|----------------|-----------|
| 670 | 0 | 6906 | 0 | 7576 | 291 | 2402 | 2693 | 14.00 | 53 | 0.98 | 0.02 | IMSACB | TCP00012 | |
| | | 298402 | 0 | 306704 | 105 | 5123 | 5228 | 80.66 | 104 | 1.13 | 0.11 | DDCTSO03 | TCP00010 | |
| | | 11737 | 0 | 815097 | 0 | 0 | 0 | 243,022.19 | | 0.01 | 0.01 | | | |
| | | 0 | 0 | 3 | 0 | 0 | 0 | 651,449.87 | 0 | 0.82 | 11.24 | | | |
| | | 0 | 0 | 3 | 0 | 0 | 0 | 759,051.09 | 0 | 1.03 | 11.24 | | | |

Including network monitoring detail provides a more complete analysis of IMS response time



IMS subsystem monitoring

IMS host response time including queue and processing time for the transaction

Another Example

Combining Host And Network Level Monitoring

Tivoli Enterprise Portal Welcome Ed Woods Log out IBM

File Edit View Help

Navigator View: Physical

- CAEONS.MVSA.NVSAGENT
 - TCP/IP
 - TCPIP.MVSA
 - Address Space
 - Applications
 - Connections**
 - Gateways and D
 - FTP
 - Interfaces

TCP Connections Summary Table

| Originating System ID | DB2 Subsystem | Enclave CPU Time | Current Period | Performance Index | Service Class | Authorization ID | Connection Type | Connection | Correlation ID |
|-----------------------|---------------|------------------|----------------|-------------------|---------------|------------------|-----------------|------------|----------------|
| DSNA.MVSA:DB2 | DSNA | 00:00:00.000 | | N/A | | DB2PM | RRSAF | RRSAF | |
| DSNA.MVSA:DB2 | DSNA | 00:00:00.000 | | N/A | | DB2PM | RRSAF | RRSAF | OMEGAMON |
| DSNA.MVSA:DB2 | DSNA | 00:00:00.000 | | N/A | | DB2PM | RRSAF | RRSAF | |
| DSNA.MVSA:DB2 | DSNA | 00:00:03.908 | 2 | 22 | DDFDEF | JAZZ | DBAccess | SERVER | db2jcc_appli |
| DSNA.MVSA:DB2 | DSNA | 00:00:00.000 | | N/A | | DB2ADM | RRSAF | RRSAF | BBOS0018 |
| DSNA.MVSA:DB2 | DSNA | 00:00:00.000 | | N/A | | DNET453 | RRSAF | RRSAF | BBOS0018 |
| DSNA.MVSA:DB2 | DSNA | 00:00:04.862 | 2 | 22 | DDFDEF | JAZZ | DBAccess | SERVER | db2jcc_appli |
| DSNA.MVSA:DB2 | DSNA | 00:00:00.449 | 2 | 22 | DDFDEF | JAZZ | DBAccess | SERVER | db2jcc_appli |
| DSNA.MVSA:DB2 | DSNA | 00:00:20.879 | 2 | 22 | DDFDEF | JAZZ | DBAccess | SERVER | db2jcc_appli |

DB2 thread level monitoring

DB2 Dist Thread Network

| Application Name | Local IP Address | Local Port | Remote IP Address | Remote Port | Connection State | Total Bytes Received | Total Bytes Sent | Total Bytes | Bytes Received | Bytes Sent | Bytes Sent or Received | Time Since Last Activity | Byte Rate | Response Time | Response Time Variance |
|------------------|------------------|------------|-------------------|-------------|------------------|----------------------|------------------|-------------|----------------|------------|------------------------|--------------------------|-----------|---------------|------------------------|
| DSNADIST | 9.39.68.147 | 4462 | 9.39.68.147 | 44891 | ESTABLISHED | 14,985,704 | 13,202,480 | 28,188,184 | 11250 | 8872 | 20122 | 7.97 | 2012 | 0.46 | 1.68 |
| DSNADIST | 9.39.68.147 | 4462 | 9.39.68.147 | 49868 | ESTABLISHED | 22,533,231 | 22,441,947 | 44,975,178 | 78805 | 76540 | 155345 | 3.17 | 15534 | 0.56 | 1.83 |

DB2 network level monitoring

Monitor Host Application Network Connection Activity

Tivoli Enterprise Portal Welcome Ed Woods Log out IBM

File Edit View Help

Applications Summary Table

| | 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 | Idle Time Since Last Accept | Time Since Last Activity | Server Up Time | Connections in Backlog | Backlog Connections Rejected | Total Backlog Connections Rejected |
|--|-------------------|------------------|------------------|--------------------|----------------------|-----------------|-----------------------------------|---|-----------------------------|--------------------------|----------------|------------------------|------------------------------|------------------------------------|
| | 03/08/12 12:32:21 | CICSAOR2 | 3 | 0 | 0 | 0 | 0 | | 3.18 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR3 | 9 | 2 | 0 | 0 | 2 | 02/29/12 12:14:56 | 172.51 | 575.94 | 172.51 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR4 | 4 | 0 | 0 | 0 | 1 | 03/07/12 12:22:21 | 456.94 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR5 | 7 | 0 | 0 | 0 | 1 | 03/05/12 20:16:20 | 67.36 | 0.00 | 67.36 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR6 | 3 | 0 | 0 | 0 | 0 | | 17.42 | 0.00 | 17.42 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR7 | 2 | 0 | 0 | 0 | 0 | | 0.23 | 0.00 | 17.41 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR8 | 3 | 0 | 0 | 0 | 0 | | 456.94 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR9 | 1 | 0 | 0 | 0 | 0 | | 456.94 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR10 | 1 | 0 | 0 | 0 | 0 | | 334.42 | 0.00 | 334.42 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSAOR11 | 2 | 0 | 0 | 0 | 0 | | 456.95 | 0.00 | 456.95 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSBPM1 | 3 | 0 | 0 | 0 | 2 | 02/22/12 20:04:55 | 311.78 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSBPM2 | 3 | 0 | 0 | 0 | 0 | | 456.94 | 0.00 | 456.94 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSCM | 6 | 0 | 0 | 0 | 2 | 02/28/12 14:27:56 | 19.18 | 0.00 | 456.95 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSILOG | 2 | 0 | 0 | 0 | 0 | | 404.84 | 0.00 | 404.84 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSPA01 | 6 | 2 | 0 | 0 | 2 | 03/06/12 00:07:21 | 60.41 | 5,876.35 | 60.41 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSPA02 | 6 | 2 | 0 | 0 | 2 | 03/06/12 00:13:21 | 60.32 | 5,476.38 | 60.32 | 0 | 0 | |
| | 03/08/12 12:32:21 | CICSPT01 | 9 | 4 | 0 | 0 | 4 | 03/06/12 00:13:21 | 60.32 | 5,476.38 | 60.41 | 0 | 0 | |

- Connection activity, connection counts, connection backlogs
 - Look for applications with connection failures and backlogs

Monitor At The Interface Level

Tivoli Enterprise Portal Welcome Ed Woods Log out IBM

File Edit View Help

Interfaces Summary Table

| | Interface Name | Interface Type | Current State | Transmit Packet Rate | Receive Packet Rate | Transmit Bandwidth Utilization | Receive Bandwidth Utilization | Bandwidth Utilization | Inbound Packets Discarded | Inbound Packet Discard Rate | Outbound Packets Discarded | Outbound Packet Discard Rate | Percent Packets Discarded | Outbound Packets in Error | Transmit Error Rate |
|--|------------------|-----------------------|---------------|----------------------|---------------------|--------------------------------|-------------------------------|-----------------------|---------------------------|-----------------------------|----------------------------|------------------------------|---------------------------|---------------------------|---------------------|
| | LOOPBACK | Loopback | Up | 76779 | 76779 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | LOOPBACK6 | Loopback | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EZ6OSM01 | OSA_QDIO_ethernet_OSM | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EZ6OSM02 | OSA_QDIO_ethernet_OSM | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EELINK1 | Static_virtual | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | OSAFBC0L | OSA_QDIO_ethernet OSD | Up | 611 | 524 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | OSX3200P | OSA_QDIO_ethernet_OSX | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | OSX3400P | OSA_QDIO_ethernet_OSX | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | HIPERLF5 | Hipersocket | Down | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EZASAMEMVS | MPC_ptp_samehost | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | IQDIOLNKC0A80193 | Hipersocket | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EZAXCFS2 | MPC_ptp_xcf | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | EZAXCFS3 | MPC_ptp_xcf | Up | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

- Monitor for interface status, bandwidth utilization, and errors
- Look for potential problems at the interface level

Dashboard Level Monitoring Creating An Integrated Performance Interface

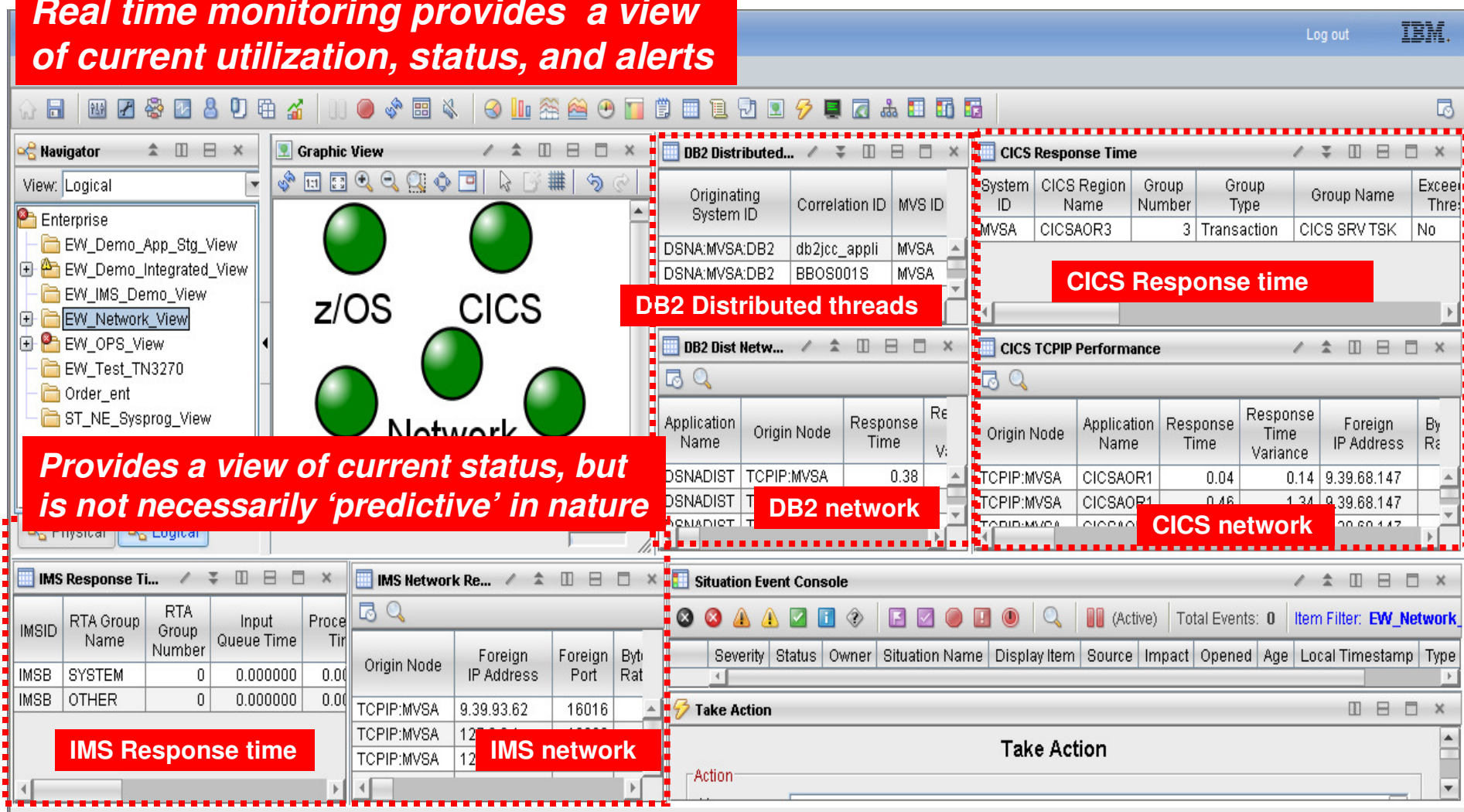
- Creating an integrated performance management display allows for the easy inclusion of network detail into various mainframe monitoring displays
- Integrated monitoring takes several forms
 - ▶ Integrated displays pulling together performance detail from multiple sources (host and network monitoring)
 - ▶ Integrated cross monitoring tool navigation
 - ▶ History integrated with real time performance information
 - ▶ Integrated alerts, alert correlation, and corrective actions



Dashboard Level Monitoring

Integrate Host And Network Monitoring

Real time monitoring provides a view of current utilization, status, and alerts



Provides a view of current status, but is not necessarily 'predictive' in nature

Collect History For Trending And Analysis

- Collect history data at multiple levels
 - System/LPAR level
 - Application level
 - Interface/adaptor level
 - Connection level
- Frequency and retention will vary by type
- Useful for trending and alert threshold analysis

History Collection Configuration

Select a product
OMEGAMON XE for Mainframe Networks V4.1.0

Select Attribute Groups

| Group | Collection | Collection Interval | Collection Location | Warehouse Interval | Summarize Yearly | Prune Yearly | SLQ |
|-------------------------|------------|---------------------|---------------------|--------------------|------------------|--------------|-----|
| TCPIP_FTP | | | | | | | |
| HPR_RTP_Connections | | | | | | | |
| VTAM_Summary_Statistics | | | | | | | |
| TCPIP_Applications | | 15 minutes | TEMS | 1 hour | | | |
| TCPIP_Address_Space | | 15 minutes | TEMS | | | | |
| TCPIP_Devices | | | | | | | |

Configuration Controls

Collection Interval: 15 minutes

Collection Location: TEMS

Warehouse Interval: 1 hour

Summarization

☐ Yearly
☐ Quarterly
☐ Monthly
☒ Weekly
☒ Daily
☒ Hourly

Pruning

☐ Yearly keep Years
☒ Quarterly keep Years
☐ Monthly keep Months
☐ Weekly keep Months
☐ Daily keep Days

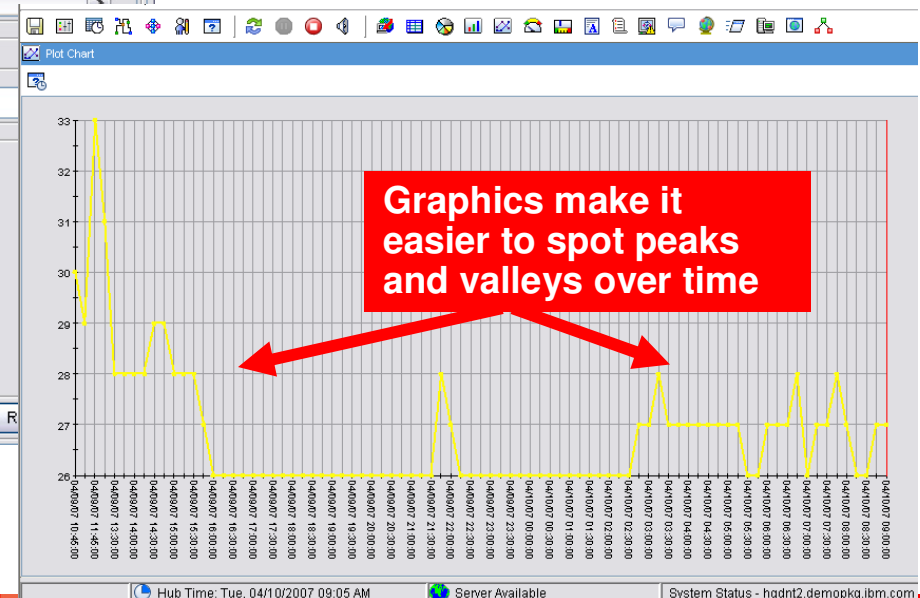
Configure Groups Stop Collection

Select desired group of information, collection interval, and destination

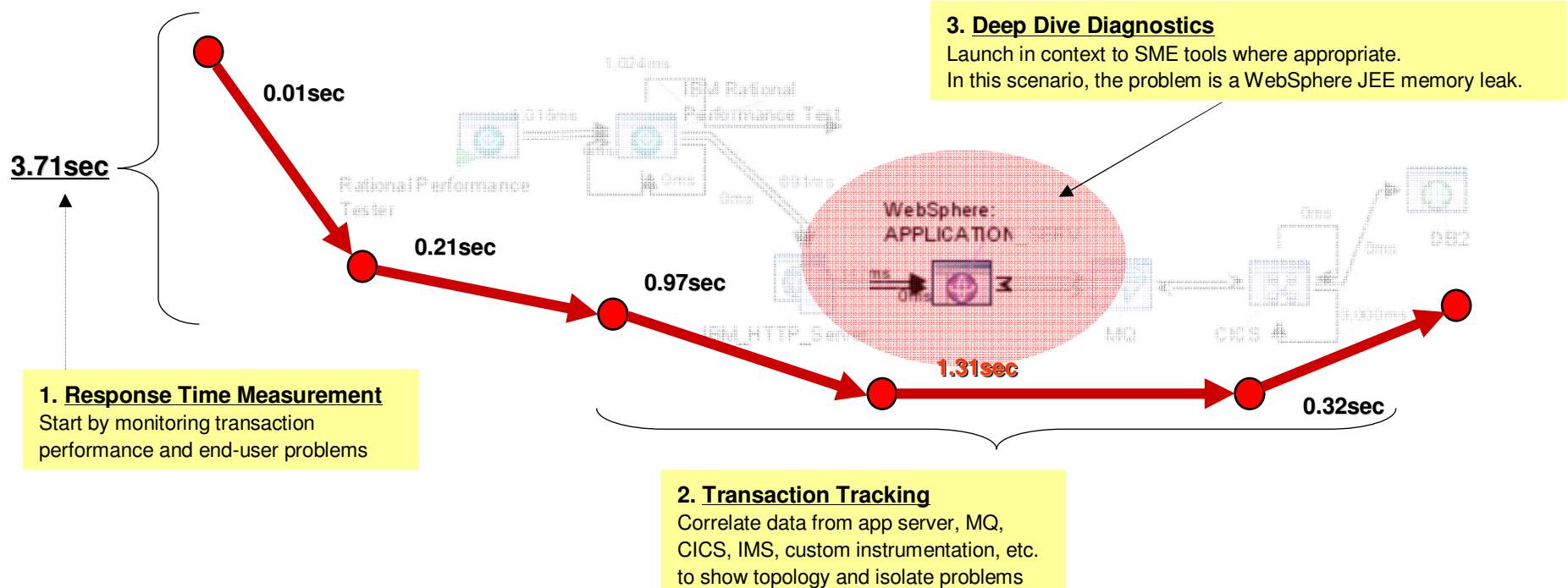
Collect at the TEMS or the TEMS

To warehouse or not to warehouse
Hourly, Daily, or not at all

Specify summarization and pruning along with collection interval



End-to-End Monitoring, Tracking and Diagnosis



Transaction Root Cause Analysis

- | | | |
|---|---|---|
| <p>1. Sense End User Experience and alert on threshold violation</p> | <p>2. Isolate by measuring performance data against baseline through entire infrastructure</p> | <p>3. Diagnose and repair through launch-in-context into deep-dive diagnostics</p> |
|---|---|---|

Summary

- The network is an essential part of the overall mainframe application time line
 - ▶ Each network application/subsystem has interactions with the network
- It's important to understand how the mainframe interacts with the network
 - ▶ Application/subsystem configuration and options
- It is useful to have an integrated monitoring strategy that pulls together core mainframe and network monitoring information
 - ▶ Integrated dashboard views, integrated analysis, integrated alerts and automated corrections
 - ▶ Defining an end to end analysis strategy




Thank You!




Check Out My Blog

http://tivoliwithaz.blogspot.com



Tivoli With Az


This is a blog to discuss what is happening in the area of IBM zSeries, Tivoli, OMEGAMON monitoring, System Automation, and other relevant IBM Tivoli technology for z/OS performance and availability management.



Ed Woods
IBM Corporation

Friday, February 5, 2010

OMEGAMON DB2 Near Term History




OMEGAMON DB2 has a very useful Near Term History (NTH) function. NTH provides an easy way to be able to retrieve and review DB2 Accounting and Statistics records from the past few hours of DB2 processing. The data is stored in a set of VSAM files allocated to the OMEGAMON collection task. How far back the history goes depends upon the size of the files and the amount of data being written to these files. Now some of the data volume is driven by the DB2 workload activity. Accounting records are typically written when a DB2 thread terminates processing, and it is the Accounting data that is often looked at by the analyst when studying what DB2 applications have been doing. Statistics records are created on a time interval basis. Usually, you will have much more accounting data than statistics data. Also, OMEGAMON has the ability to pull in additional trace IFCIDs to get information on things such as dynamic SQL activity.

To understand the amount of data being gathered by NTH, there are displays that show the number of records written to the NTH files, by type. In the example I show, you see an example of common NTH settings/options, and then you see the record count in the NTH record information display. If you look carefully you see that 'Perf-Dyn SQL' has a lot of records written relative to the other record types. This is a good way to understand the impact of enabling certain collection options, such as dynamic SQL collection, and see how many trace records are being gathered, as a result.

Posted by Ed Woods at 3:13 PM 0 comments

ED WOODS

I'm an IT Specialist with IBM Corporation supporting Tivoli Performance solutions on z/OS. Please note that comments made on this blog are my own, and do not necessarily reflect the position of IBM Corporation.

[View my complete profile](#)

Links To My Articles

- [DB2 Thread Situations](#)
- [OM XE For Mainframe Networks](#)
- [Situation usage and best practices](#)
- [Situation best practices - part 2](#)
- [Article on policy automation](#)
- [Article on monitoring DB2 dynamic SQL](#)
- [IMS historical performance analysis](#)

Useful Links

- [Link to IBM Tivoli product information](#)
- [Link To Tivoli User Group](#)
- [Link to OPAL](#)
- [Tivoli System z Blog](#)