z/OS Communications Server VTAM and TCP/IP Performance and Storage Considerations

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VTAM and TCP/IP performance problems can degrade the overall performance of an entire z/OS Sysplex.

Storage usage, by VTAM and TCP/IP, is a ‘major player’ affecting the z/System.

Customization parameter settings in VTAM and TCP/IP determine storage usage. Too small of a setting could lead to serious performance problems with VTAM as well as TCP/IP, or worse to a TCP/IP outage.

In this session we will discuss some of the key storage-related parameters, and direct you to the manuals in which they are described.
From Alfred Christensen Share presentation "Understanding zOS CS storage use"
Both TCPIP as well VTAM do have various storage needs.
In this presentation we focus on those are which are VTAM controlled and managed and used from both: CSM and VTAM buffers
S TSO
IRR812I PROFILE TSO.* (G) IN THE STARTED CLASS WAS USED 632
TO START TSO WITH JOBNAME TSO.
$HASP100 TSO ON STCINRDR
IEF695I START TSO WITH JOBNAME TSO IS ASSIGNED TO USER
$HASP373 TSO STARTED
IEF403I TSO - STARTED - TIME=09.18.58
V NET,ACT,ID=ATSO
IEE341I VTAM NOT ACTIVE

*2406 IKT003D TCAS UNABLE TO ACCEPT LOGONS, REASON CODE=0092 REPLY
'RETRY' OR 'TERM'

No surprise that for a VTAM application VTAM needs to be active, but VTAM
also needs to be active for TCPIP CSM usage and VTAM buffers
CSM is used for OSA, XCF but also for TCPIP application in IBM's documentation "z/OS V1R13 Communications Server Performance Summary" is an overview of the CSM need for some TCPIP applications.
VTAM buffers are needed for VTAM application no surprise. IBM's documentation "z/OS V1R13 Communications Server Performance Summary" has an overview of the VTAM Buffer usage for some TCPIP applications.

<table>
<thead>
<tr>
<th>Application</th>
<th>#users / clients</th>
<th>Workload Throughput</th>
<th>IO00 Buffer</th>
<th>LF00 Buffer</th>
<th>CRPL Buffer</th>
<th>TI00 Buffer</th>
<th>CRA4 Buffer</th>
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<tr>
<td>CICS Sockets</td>
<td>250</td>
<td>675.2 Trans/Sec</td>
<td>5</td>
<td>54</td>
<td>18</td>
<td>4</td>
<td></td>
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<tr>
<td>(200, transaction = 200)</td>
<td>500</td>
<td>1066.7</td>
<td>5</td>
<td>54</td>
<td>18</td>
<td>4</td>
<td></td>
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<tr>
<td>(1000)</td>
<td>1000</td>
<td>1589.1</td>
<td>5</td>
<td>54</td>
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<td>4</td>
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<tr>
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<td>266.5 Trans/Sec</td>
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<td>3</td>
<td>1934</td>
<td>304</td>
<td>12</td>
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<tr>
<td>(2196, with Think Time,</td>
<td>16000</td>
<td>533.4</td>
<td>389</td>
<td>3</td>
<td>1934</td>
<td>453</td>
<td>12</td>
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<td>SHARECB option,</td>
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<td>3</td>
<td>1934</td>
<td>620</td>
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<tr>
<td>Echo transactions,</td>
<td>64000</td>
<td>2133.6</td>
<td>500</td>
<td>3</td>
<td>1934</td>
<td>626</td>
<td>24</td>
</tr>
<tr>
<td>(100 / 600)</td>
<td>128000</td>
<td>4259.3</td>
<td>2283</td>
<td>3</td>
<td>1934</td>
<td>2614</td>
<td>25</td>
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<tr>
<td>(256000)</td>
<td>256000</td>
<td>6433.5</td>
<td>2283</td>
<td>3</td>
<td>1934</td>
<td>2614</td>
<td>25</td>
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<tr>
<td>FTP</td>
<td>1</td>
<td>1.30 MB/Sec</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<tr>
<td>Inbound Data</td>
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<td>2.56</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<td>Binary Put</td>
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<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<tr>
<td>(2196, with and without</td>
<td>8</td>
<td>10.41</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Think Time, transaction=</td>
<td>16</td>
<td>20.60</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<tr>
<td>2 MB / 1)</td>
<td>32</td>
<td>41.53</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>FTP</td>
<td>1</td>
<td>1.29 MB/Sec</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Outbound Data</td>
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<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<tr>
<td>Binary Get</td>
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<td>1</td>
<td>3</td>
<td>1</td>
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<td>4</td>
</tr>
<tr>
<td>(2196, with and without</td>
<td>8</td>
<td>10.24</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Think Time, transaction=</td>
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<td>20.45</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>1 / 2 MB)</td>
<td>32</td>
<td>49.92</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
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<td></td>
<td>44</td>
<td>86.69</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>128</td>
<td>157.95</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>
Check with D NET, BFRUSE, BUFFER=SHART the VTAM buffer usage as they are used by both part of z/CS and it is still true when VTAM Need a buffer expansion the system "waits".
CSM is a VTAM component that allows authorized host applications to share data with VTAM, TCP/IP and other CSM users without the need to physically copy the data.
How to set CSM parameters are defined in two (2) manuals:

1. z/OS V1R13.0 Communications Server: New Function
2. z/OS V1R1x.0 MVS Initialization and Tuning Reference
IVTPRM00 (communication storage manager)

The SYS1.PARMLIB member IVTPRM00 defines CSM
IVTPRM00 (communication storage manager)

CSM storage limits are located in the SYS1.PARMLIB member IVTPRMxx. The values you can allocate are:

- **ECSA MAX** - the maximum amount of ECSA storage that CSM can allocate.
- **FIXED MAX** - the maximum amount of fixed storage that CSM can allocate. This includes both fixed CSM ECSA and CSM data space storage.

If you do not specify values in the IVTPRMxx parmlib member, the system uses the default values of 100m ECSA and 100m FIXED. You can change these values dynamically with the MODIFY CSM command. If the limit specified by these values is reached, results are unpredictable. TCP/IP might not be able to continue. IVTxxxx messages will be issued if CSM is unable to obtain storage. Refer to z/OS MVS Initialization and Tuning Reference for additional information on the IVTPRMxx parmlib member.
IVTPRM00 (communication storage manager)

IVTPRM00 sets parameters for the Communication Storage Manager (CSM). IVTPRM00 is read during CSM initialization when the first IVTCSM REQUEST=CREATE_POOL macro is issued. (VTAM® issues this macro when started.) The parameters can be changed without a re-IPL by editing the IVTPRM00 member and issuing the MODIFY CSM command with no command parameters specified.

Syntax format of IVTPRM00

- FIXED MAX(maxfix)
- ECSA MAX(maxecsa)
- POOL(bufsize,bufsource,initbuf,minfree,expbuf)

Note:
FIXED MAX, ECSA MAX, and POOL must begin in column 1.
IVTPRM00 (communication storage manager)

Syntax rules for IVTPRM00

IVTPRM00 member of SYS1.PARNLIB - Only the 00 suffix is allowed but System symbols can be used. For more information, see "Using MVS™ System Symbols" in the z/OS Communications Server: SNA Network Implementation Guide.

IBM-supplied defaults for IVTPRM00

The following are the IBM-supplied defaults for the CSM buffer pools:

<table>
<thead>
<tr>
<th>Bufsize</th>
<th>initbuf</th>
<th>minfree</th>
<th>expbuf</th>
</tr>
</thead>
<tbody>
<tr>
<td>4K</td>
<td>64</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>16K</td>
<td>32</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>32K</td>
<td>16</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>60K</td>
<td>16</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>180K</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
IVTPRM00 (communication storage manager)

**FIXED MAX**
Defines the maximum amount of storage dedicated to fixed CSM buffers.

**ECSA MAX**
Defines the maximum amount of storage dedicated to ECSA CSM buffers.

**POOL**
One POOL definition can be specified for each CSM buffer pool of a particular bufsize and bufsource combination.

**bufsize**
The size of the buffers in the pool to be created. (Valid Range: 4K, 16K, 32K, 60K, 180K)
Default Value: None (valid range value required).

**bufsource**
The storage source from which buffers are allocated. The values are:
- **ECSA** Buffers are allocated from ECSA storage.
- **DSPACE** Buffers are allocated from data space storage. (Each dataspace uses 2GB in size - no further control)
- **Initbuf** The initial number of buffers created in the pool when the first IVTCMS REQUEST=CREATE_POOL macro is issued by an application.
- **minfree** The minimum number of free buffers allowed in the pool at any time. The storage pool is expanded the the value specified in expbuf if the number of free buffers falls below this limit.
- **expbuf** The number of free buffers by which the pool is expanded when the free buffers fall below the minfree value.

You must code only one blank between the keywords FIXED/ECSA and MAX. If more than one blank appears between these keywords, the system ignores the statement as a comment and no syntax error message is generated. In this case, the system uses the default.

The FIXED/ECSA MAX statement must be completed one line.

No blanks should be coded between the keyword MAX and "(".
**DISPLAY CSM command**

You can use this command to determine how much CSM storage is in use for ECSA and data space storage pools.

The sum of the total of the storage allocated to all users of a particular pool may be greater than the total amount of storage allocated to that pool. This is due to the existence of multiple instances of a buffer created when an application program issues the IVTCSM ASSIGN_BUFFER macro. The storage displayed for each OWNERID indicates the amount of storage that must be freed by the user to enable the storage to be returned to the buffer pool.

The owner ID is the ASID of a CSM buffer owner.
VTAM API64R start option

API64R=YES default

Notes:
1. API64R is only meaningful if the machine is operating in z/Architecture® mode.
2. API64R=NO for 31-bit CSM data space

Specifies whether 64-bit backed CSM data space storage can be passed to VTAM and TCP/IP application programs.

Storage that is 64-bit backed is storage that, when fixed, can be assigned to real storage frames on or above the 2 Gigabyte real storage bar. With only a few exceptions, all CSM data space storage acquired by VTAM and TCP/IP when operating in z/Architecture mode is 64-bit backed.

CSM 4KDS64 is used for:

SC31-8778-14  z/OS Communications Server: SNA Resource Definition Reference

When API64R=YES, application programs that accept CSM data space buffers for a receive operation will likely be given 64-bit backed CSM data space storage. If an application attempts to issue the LRA instruction (Load Real Address) against this storage, and the storage is resident on or above the 2 Gigabyte real storage bar, a special operation exception program interrupt will occur. Note that LRA is used primarily in preparation for I/O. There are no known application programs that perform I/O directly into or out of CSM data space storage.

Check if you have the default set.
The DISPLAY CSMUSE command allows to evaluate the use of storage managed by the communications storage manager (CSM). The display output provides detailed information about each CSM storage pool. The detailed information describes storage as it corresponds to an identifier, which is referred to as a monitor ID. Monitor IDs describe specific z/OS Communications Server components. When CSM storage is associated with (or isolated to) a specific monitor ID, then IBM service can correlate the monitor ID to a component (usage or function) of z/OS Communications Server. This information can be useful when evaluating how z/OS Communications Server is using system storage or to help diagnose storage growth. Refer to z/OS Communications Server: IP and SNA Codes for the complete description of monitor IDs.
```
D NET,CSMUSE,POOL=4KECSA
IVT5508I  DISPLAY ACCEPTED
IVT5574I  PROCESSING DISPLAY CSMUSE COMMAND - POOL SPECIFIED
IVT5584I  USAGE DETAILS - 4KECSA   POOL - POOL TOTAL = 3588K
IVT5532I  ------------------------------------------------------
IVT5576I  AMOUNT   MONITOR ID   OWNERID    JOBNAME
IVT5532I  ------------------------------------------------------
IVT5577I  2948K   21       0027      VTAM
IVT5579I  BUFFER USE FOR 21 : USECNT   USERDATA   MONITOR HISTORY
IVT5580I  45   E7C3C640     00000021
IVT5580I  44   F7F7F8F0     00000021
IVT5580I  44   F7F5F4F0     00000021
IVT5580I  44   F7F7C1F0     00000021
IVT5585I  DETAIL TOTAL FOR 4KECSA   POOL = 2948K
IVT5599I  END
```

For each CSM monitor ID, the user data field and monitor history field from the CSM buffer headers is provided. The user data field allows IBM service to correlate the current usage and monitor history to a specific resource, such as a device, connection, route, and so on.
D NET, CSMUSE, POOL=4KDS64
IVT5508I  DISPLAY ACCEPTED
IVT5574I  PROCESSING DISPLAY CSMUSE COMMAND - POOL SPECIFIED
IVT5584I  USAGE DETAILS - 4KDS64  POOL - POOL TOTAL = 42928K
IVT5532I  ------------------------------------------------------
IVT5576I  AMOUNT  MONITOR ID  OWNERID  JOBNAME
IVT5532I  ------------------------------------------------------
IVT5577I  24912K  23  002B  TCPIP
IVT5580I  BUFFER USE FOR 23 :  USECNT  USERDATA  MONITOR HISTORY
IVT5580I  3118  F0F4F4F2  00000023
IVT5580I  3110  F0F4F5F2  00000023
IVT5532I  ------------------------------------------------------
IVT5577I  17920K  21  0027  VTAM
IVT5579I  BUFFER USE FOR 21 :  USECNT  USERDATA  MONITOR HISTORY
IVT5580I  240  F7F8F6F0  00000021
IVT5580I  240  F7F5F3F0  00000021
IVT5580I  240  F6C5F2F4  00000021
IVT5580I  240  F7F5F1F0  00000021
IVT5585I  DETAIL TOTAL FOR 4KDS64  POOL = 42832K
IVT5599I  END
D NET,CSMUSE,POOL=16KDS64
IVT5508I DISPLAY ACCEPTED
IVT5574I PROCESSING DISPLAY CSMUSE COMMAND - POOL SPECIFIED
IVT5584I USAGE DETAILS - 16KDS64 POOL - POOL TOTAL = 64K
IVT5532I ------------------------------------------------------
IVT5576I AMOUNT MONITOR ID OWNERID JOBNAME
IVT5532I ------------------------------------------------------
IVT5577I 48K B1 002B TCPIP
IVT5579I BUFFER USE FOR B1 : USECNT USERDATA MONITOR HISTORY
IVT5580I 2 00000000 00000BB1
IVT5580I 2 46786DD0 00000BB1
IVT5585I DETAIL TOTAL FOR 16KDS64 POOL = 48K
IVT5599I END
## CSM Monitor IDs

<table>
<thead>
<tr>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X'00' – X'1F'</td>
<td>CSM Monitor IDs</td>
</tr>
<tr>
<td>X'20' – X'2F'</td>
<td>DLC Monitor IDs</td>
</tr>
<tr>
<td>X'30' – X'8F'</td>
<td>VTAM Unique Monitor IDs</td>
</tr>
<tr>
<td>X'90' – X'97'</td>
<td>TCP/IP IF Layer Monitor IDs</td>
</tr>
<tr>
<td>X'98' – X'9F'</td>
<td>TCP/IP IF Layer Monitor IDs</td>
</tr>
<tr>
<td>X'A0' – X'AF'</td>
<td>TCP/IP Transport Layer Monitor IDs</td>
</tr>
<tr>
<td>X'B0' – X'FF'</td>
<td>TCP/IP Misc Monitor IDs</td>
</tr>
</tbody>
</table>

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**SC31-8791-13**  
**z/OS Communications Server: IP and SNA Codes**  
▶ Chapter CSM Monitor IDs
For monitor ID X'21', the user field provide the EBCDIC subchannel read device unit address associated with this device. Some devices can configure how much read storage is used.

Storage associated with DLC monitor IDs can be influenced by both SNA and TCP/IP workloads.
## CSM Monitor IDs

<table>
<thead>
<tr>
<th>Hexadecimal value</th>
<th>Monitor ID description</th>
<th>Symbol</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X'B0'</td>
<td>Streams</td>
<td>streams</td>
<td></td>
</tr>
<tr>
<td>X'B1'</td>
<td>Storage</td>
<td>iStorage</td>
<td></td>
</tr>
<tr>
<td>X'B2'</td>
<td>XCF</td>
<td>xcf</td>
<td></td>
</tr>
<tr>
<td>X'B3'</td>
<td>PHS</td>
<td>phs</td>
<td></td>
</tr>
<tr>
<td>X'B4'</td>
<td>AFPA</td>
<td>afpa</td>
<td></td>
</tr>
<tr>
<td>X'B5'</td>
<td>Firewall IPSec</td>
<td>fwpisc</td>
<td></td>
</tr>
<tr>
<td>X'C0'</td>
<td>Application FTP</td>
<td>applFtp</td>
<td></td>
</tr>
<tr>
<td>X'C1'</td>
<td>Application SNALINK</td>
<td>applSNALINK</td>
<td></td>
</tr>
<tr>
<td>X'C2'</td>
<td>Application X25</td>
<td>applX25</td>
<td></td>
</tr>
<tr>
<td>X'C3'</td>
<td>Application IPSec</td>
<td>applIPSec</td>
<td></td>
</tr>
</tbody>
</table>
D NET,TRL,TRLE=OSAG6FA
IST097I DISPLAY ACCEPTED
IST075I NAME = OSAG6FA , TYPE = TRLE
IST1954I TRL MAJOR NODE = TRLOSA
IST486I STATUS= ACTIV , DESIRED STATE= ACTIV
IST087I TYPE = LEASED , CONTROL = MPC , HPDT = YES
IST175I MPCLEVEL = QDIO MPCUSAGE = SHARE
IST2263I PORTNAME = POSAG6FA PORTNUM = 0 OSA CODE LEVEL = 0c4b
IST2337I CHPID TYPE = OSD CHPID = FA
IST1577I HEADER SIZE = 4096 DATA SIZE = 0 STORAGE = ***NA***
IST1221I WRITE DEV = 0441 STATUS = ACTIVE STATE = ONLINE
IST1577I HEADER SIZE = 4092 DATA SIZE = 0 STORAGE = ***NA***
IST1221I READ DEV = 0440 STATUS = ACTIVE STATE = ONLINE
IST924I -------------------------------------------------------------
IST1221I DATA DEV = 0442 STATUS = ACTIVE STATE = N/A
IST1724I I/O TRACE = OFF TRACE LENGTH = *NA*
IST1717I ULPID = TCPIP
IST2310I ACCELERATED ROUTING DISABLED
IST2333I QUEUE QUEUE READ
IST2332I ID TYPE STORAGE
IST2333I RD/1 PRIMARY  4.0M(64 SBALS)
IST2333I RD/2 BULKDATA  4.0M(64 SBALS)
IST2333I RD/3 SYSDIST  4.0M(64 SBALS)
IST2305I NUMBER OF DISCARDED INBOUND READ BUFFERS = 0
IST1757I PRIORITY1: UNCONGESTED PRIORITY2: UNCONGESTED
IST1757I PRIORITY3: UNCONGESTED PRIORITY4: UNCONGESTED
IST1801I DEVICEID PARAMETER FOR OSAENTA TRACE COMMAND = 01-01-00-42
IST1801I UNITS OF WORK FOR NCB AT ADDRESS X'2CF3F010'
IST1802I    P1  CURRENT = 0  AVERAGE = 2  MAXIMUM = 7
IST1802I    P2  CURRENT = 0  AVERAGE = 1  MAXIMUM = 16
IST1802I    P3  CURRENT = 0  AVERAGE = 1  MAXIMUM = 2
IST1802I    P4  CURRENT = 0  AVERAGE = 2  MAXIMUM = 224
IST924I -------------------------------------------------------------
VTAM IQDIOSTG start option

Notes:
1 This option only affects iQDIO devices that use a MFS of 64k. The smaller frame sizes will always use 126 SBALs.
Specifies how much storage VTAM keeps available for read processing for all HiperSockets data devices that use a MFS (Maximum Frame Size) of 64k. The HiperSockets MFS is defined in HCD. The HiperSockets storage units are defined in QDIO SBALs (QDIO read buffers). Each SBAL is 64k. For most users, the default setting will be the most suitable option. The storage used for this read processing is allocated from CSM data space 4k pool, and is fixed storage.
HiperSockets devices that are defined with a smaller MFS (16k, 24k, or 40k) are not affected by this start option. Those devices will use 126 SBALs.
If you elect to define a specific value versus the recommended values, carefully evaluate your system storage and performance needs for your HiperSockets devices. The amount of storage used is (NNN x 64k) x number of active iQDIO data devices.
2. You can use VTAM tuning stats to evaluate your needs and usage. Under a sample (typical) workload, the NOREADS counter should remain low (close to 0). If this count does not remain low you might need to consider a higher setting for IQDIOSTG. RMF™ can also be used to evaluate the correct setting for your environment. RMF records send failures, which can be an indication that the target LP (logical partition) does not have enough storage (read SBALs).
3. You can override the IQDIOSTG value for a given HiperSockets device by using the READSTORAGE parameter on the IPAQIDIO LINK statement or the IPAQIDIO6 INTERFACE statement on the TCP/IP profile.
VTAM QDIOSTG start option

Notes:
1 QDIOSTG defaults to MAX for 64-bit (z/Architecture) machines and MIN for non 64-bit machines.
Specifies how much storage VTAM keeps available for read processing for all OSA QDIO data devices. Units are defined in QDIO SBALs (QDIO read buffers). Each SBAL is 64k.
The storage used for this read processing is allocated from CSM data space 4k pool, and is fixed storage.

The IBM recommended values can be configured by specifying MAX, AVG, or MIN, which are predefined constants (number of SBALs) that are most appropriate for this type of adapter.
   MAX allows for the best performance (for example, throughput), but requires more storage.
   MIN could be used for devices with lighter workloads or where system storage might be constrained.

Also users can instead define a specific value for QDIOSTG (the exact number of SBALs).

If you elect to define a specific value, carefully evaluate your system storage and performance needs for your QDIO devices. The following calculation is used to determine the amount of storage used: (NNN x 64K) x number of active inbound queues for each active QDIP data device. When QDIO inbound workload queueing (IWQ) is not enabled, only one inbound queue is active for each active device. When IWQ is enabled, one or more ancillary input queues might also be active. See QDIO inbound workload queueing in z/OS Communications Server: IP Configuration Guide to determine how many ancillary input queues are enabled for each QDIO data device.
VTAM QDIOSTG start option

You can use VTAM tuning stats to evaluate your needs and usage. Under a sample (typical) workload, the NOREADS counter should remain low (close to 0). If this count does not remain low you might need to consider a higher setting for QDIOSTG.

You can override the QDIOSTG value for a given OSA-Express QDIO device by using the READSTORAGE parameter on the IPAQENET LINK, the IPAQENET INTERFACE, or the IPAQENET6 INTERFACE statement in the TCP/IP profile.
IST1754I

noreadso is reads exhausted overflow. noreads is reads exhausted count. This value represents the accumulated number of times reads were exhausted on entry to the QDIO Program-Controlled Interrupt Exit for the QDIO READ data transfer point. This value is incremented by 1 each time the QDIO Program-Controlled Interrupt Exit is invoked and it detects that all the read buffers are full (the adapter has no place to move additional inbound data). A zero total is preferred because lack of read buffers may result in the adapter discarding inbound data. Examination of the read processing and read replenishment deferral counts may indicate the reason the QDIO device driver is not providing sufficient resources to accept the inbound data from the adapter.
IST1755I
sbalmax is the maximum number of active SBALs at the completion of the write initiation process for the QDIO WRITE priority level. This value will be in the range 0-128 (0 meaning the priority level had no outbound activity in the interval and 128 meaning that at one point in the interval ALL the SBALs for the priority level were active).

sbalavg is the average number of active SBALs at the completion of the write initiation process for the QDIO WRITE priority level. This value will be in the range 0-128 (0 meaning the priority level had no outbound activity in the interval and 128 meaning that every time the QDIO write initiator completed, all 128 SBALs were active).

IST1721I
sbalcnt is the SBAL count. This value represents the accumulated number of SBALs used for I/O on the QDIO WRITE priority level or the QDIO READ data transfer point.
VTAM QDIOSTG start option

Each active OSA-Express QDIO DATAPATH device consumes a large amount of fixed storage. Defining a large number (for example, 8 or more devices per z/OS image) of QDIO devices can cause z/OS Communications Server to consume a significant amount of fixed storage. This could lead to degradation of overall system performance. When configuring a large number of devices, it is important to use the controls provided to manage and tune the amount of fixed storage consumed by these devices. Review the following parameters with this in mind:

- VTAM QDIOSTG start option
- READSTORAGE specifications in the TCP/IP profile
- FIXED MAX specification in the IVTPRM00 parmlib member for Communication Storage Manager (CSM).

Complete your session evaluation online at SHARE.org/BostonEtal
CSM Usage

<table>
<thead>
<tr>
<th>Application</th>
<th>#users / clients</th>
<th>Workload Throughput</th>
<th>Max CSM (ECSA)</th>
<th>Max CSM (Dataspaces)</th>
<th>Max CSM (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICS Sockets</td>
<td>250</td>
<td>475.3 TransSec</td>
<td>760 KB</td>
<td>20.17 MB</td>
<td>28.04 MB</td>
</tr>
<tr>
<td>(210, transaction = 200 / 200)</td>
<td>500</td>
<td>965.1 TransSec</td>
<td>916 KB</td>
<td>20.26 MB</td>
<td>28.04 MB</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>1669.1 TransSec</td>
<td>1.12 MB</td>
<td>20.45 MB</td>
<td>29.09 MB</td>
</tr>
<tr>
<td>TN3270</td>
<td>6000</td>
<td>266.5 TransSec</td>
<td>800 KB</td>
<td>27.63 MB</td>
<td>33.64 MB</td>
</tr>
<tr>
<td>(2196, with Think Time,</td>
<td>16000</td>
<td>533.4 TransSec</td>
<td>896 KB</td>
<td>27.62 MB</td>
<td>34.04 MB</td>
</tr>
<tr>
<td>SHARE/ACB option,</td>
<td>32000</td>
<td>1065.7 TransSec</td>
<td>860 KB</td>
<td>27.27 MB</td>
<td>34.44 MB</td>
</tr>
<tr>
<td>Echo transactions,</td>
<td>64000</td>
<td>2133.0 TransSec</td>
<td>900 KB</td>
<td>28.00 MB</td>
<td>35.24 MB</td>
</tr>
<tr>
<td>(120 / 500)</td>
<td>128000</td>
<td>4259.3 TransSec</td>
<td>1.28 MB</td>
<td>30.12 MB</td>
<td>37.64 MB</td>
</tr>
<tr>
<td></td>
<td>256000</td>
<td>8433.5 TransSec</td>
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<td>40.44 MB</td>
</tr>
<tr>
<td>FTP</td>
<td>1</td>
<td>1.50 MB/Sec</td>
<td>606 KB</td>
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</tr>
<tr>
<td>Inbound Data</td>
<td>2</td>
<td>2.56 MB/Sec</td>
<td>856 KB</td>
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<td>30.76 MB</td>
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<tr>
<td>Binary Put</td>
<td>8</td>
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<td>862 KB</td>
<td>23.41 MB</td>
<td>32.53 MB</td>
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<tr>
<td>(2196, with and</td>
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<tr>
<td>without Think Time,</td>
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<td>39.80 MB/Sec</td>
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<td>transaction = 2 MB / 1</td>
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<td>864 KB</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td>164.04 MB/Sec</td>
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<tr>
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<tr>
<td>Outbound Data</td>
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<td>31.12 MB</td>
</tr>
<tr>
<td>Binary Get</td>
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<td>1.21 MB</td>
<td>22.24 MB</td>
<td>32.32 MB</td>
</tr>
<tr>
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<td>10.24 MB/Sec</td>
<td>560 KB</td>
<td>22.24 MB</td>
<td>32.73 MB</td>
</tr>
<tr>
<td>without Think Time,</td>
<td>16</td>
<td>20.43 MB/Sec</td>
<td>1.60 MB</td>
<td>22.68 MB</td>
<td>33.05 MB</td>
</tr>
<tr>
<td>transaction = 1 / 2 MB</td>
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<td>40.92 MB/Sec</td>
<td>2.00</td>
<td>22.86 MB</td>
<td>33.09 MB</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>80.69 MB/Sec</td>
<td>2.62</td>
<td>23.73 MB</td>
<td>42.10 MB</td>
</tr>
<tr>
<td></td>
<td>128</td>
<td>157.93 MB/Sec</td>
<td>3.74</td>
<td>24.67 MB</td>
<td>36.40 MB</td>
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</tbody>
</table>

CSM is used for OSA, XCF but also for TCPIP application in IBM's documentation "z/OS V1R13 Communications Server Performance Summary" is an overview of the CSM need for some TCPIP applications.
CSM Usage

- XCF
- OSA
- Hipersockets
- VTAM application
- TCP/IP application

- XCF uses CSM 4KECSA (as well VTAM TI00 BUFFER)
- If there is a XCF connection failure CSM 4KECSA and TI00 VTAM Buffer could increase and cause CSM problems.
CSM Error Messages

90% of CSM x storage limit value

IVT5562I CSM ECSA STORAGE AT CRITICAL LEVEL
IVT5563I CSM FIXED STORAGE AT CRITICAL LEVEL

Processing continues. Subsequent requests for CSM storage might fail. This could result in OSPF failure and even TCP/IP outage.

SC31-8790-12  z/OS Communications Server: SNA Messages

Issue the DISPLAY CSM command without the OWNERID operand to determine current storage limits and usage. Issue a DISPLAY CSM command with OWNERID=ALL to determine how much storage is in use by each application. Save the system log for the problem determination.

Verify the x storage limit value is correct. Increase storage as required using a MODIFY CSM command.

Following messages are issued when CSM fixed/ECSA storage usage has returned to normal level (at or below 80% of fixed/ECSA storage limit value).

IVT5564I CSM ECSA STORAGE SHORTAGE RELIEVED
IVT5565I CSM FIXED STORAGE SHORTAGE RELIEVED
IVTPRM00 best practice

Monitor system for one with DISPLAY CSM command to determine peak usage.

Adjust IVTPRM00 MAX ECSA and MAX FIXED values to 1.5 times the highest value indicated in DISPLAY CSM output.

Define the Pools

Set up notification for CSM IVT-messages.

Don't expect that the system will not change. Additional workload, a new application a new OSA could require a change in the definition.

And don't forget the VTAM Buffer

► NOTE: When coding IVTPRM00, FIXED MAX and ECSA MAX values must start in column one and only one space is allowed between fields.

► NOTE: If CSM MAX ECSA is coded higher than 90% of the allowable system ECSA (IEASYS00 ECSA), then CSM MAX ECSA will be adjusted to 90% of system ECSA.
z/OS Communications Server performance index:
Http://www.ibm.com/support/docview.wss?rs=852&uid=swg27005524

Alfred Christensen, Share Boston 2010:
Understanding z/OS Communications Server storage use

IBM z/OS CS Manuels
http://www-03.ibm.com/systems/z/os/zos/bkserv/r13pdf/#CS3

Thank You