DASD Performance

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"If you can't Measure it,
I am Just Not Interested ™"

DASD Performance Topics

- DASD Reports and Analysis
- Disk Performance – is it a problem?
- DASD I/O Overview, I/O Concepts
- Cache Controllers
- Tuning MDC
- Tuning DASD Cache
- Seek Analysis
- Other Functions
- Storage Processors

When is DASD Performance an Issue?

- When the workload is impacted
- When there is paging
- When there is contention for disk
- When there are high I/O workloads

Disk Performance History

Assumptions and “Rules of Thumb” based on technology:

DASD Assumptions on what is “good”:

- 3350 (1978): 30ms
- 3380 (1983): 20ms
- 3380J/K (1986): 18ms
- 3390 (1990): 15ms
- IBMDrive (2012): 73gb/5ms
- 600gb – 15,000rpm – 3.5ms seek – 2ms rotation

DASD Cached Assumptions:

- 3380-23 (1982) 3380: 15ms
- 3390-1 (1988) 3390 gray cable: 10ms
- 3390-3 (1995) ESCON: 5ms
- 3390-9 (2001) FICON: 2ms
- “3390” (2009) **sub 1ms**

Assumptions keep changing – current SSD is sub-ms

DASD Performance Focus Points

When there is poor DASD performance:

- Check high device utilization (queueing on a device)
- Check poor cache
- Check high write activity
- Check queueing on Non-Volatile Storage (NVS)
- Check channel contention (queueing on channels)
- Check SAP contention

DASD Instrumentation

Hardware Subchannel Measurement Block

- Pend
- Connect
- Disc

Cache statistics (storage controller)

Seek Analysis (CP I/O Subsystem)

- Seek by cylinder
- Seek by minidisk
- Seek by user

Channels

- VM sample, hardware measurements
- FICON

DASD Performance Report: ESADSD2

Hardware instrumentation provides metrics:

- Service components
- Rates
- Calculate busy

```
Report: ESADSD2      DASD Performance Analysis                    Velocity Software             ESAMAP
Monitor initialized: 05/22/08 at 14:00:00 on 2084 serial 15BAF    First record analyzed: 05/22/08 14:0
-------------------------------------------------------------------------------------------------------

                                                        <--------DASD Response times (ms)------>
 Dev        Device <--SSCH--> <%DevBusy> <SSCH/sec->        <--Service times--> <--Queueing-> QLengths
 No. Serial Type    Total  ERP  Avg  Peak   avg  peak  Resp  Serv Pend Disc Conn DASD Cntl THR  avg max
---- ------ ------ ------ ---  ---- ---- ----- ----- -----  ---- ---- ---- ---- ---- ---- --- ---- ---
14:01:00
***Top DASD by Device busy***
0C51 VME090 3390-3   8795   0   8.5  8.5 146.6 146.6   0.6   0.6  0.2  0.0  0.3    0  0.0   0    0   0
0B6E VME106 3390-3   7858   0   8.4  8.4 131.0 131.0   0.6   0.6  0.2  0.0  0.4    0    0   0    0   0
0E78 VME089 3390-3   4186   0   8.1  8.1  69.8  69.8   1.2   1.2  0.3  0.4  0.5    0    0   0    0   0
0E71 VME067 3390-3    989   0   7.5  7.5  16.5  16.5   4.6   4.6  0.4  3.3  0.9    0    0   0    0
0***End Top DASD by Device busy***
```

ECKD Service Time Components

Pend Time (Time to start the I/O)

- CPU channel connection
- Protocol (I/O / SAP processor)

Disconnect Time (Hardware delays)

- Rotational delay (not in the cache)
- Seek time (not in the cache)
- Internal controller contention

Connect Time (Channel time, disk rotation)

- Transmission time
- Data size/data rate

Device Queue Time

DASD Service Time	Pend + Disc + Conn
Device Busy	Rate * Service Time
DASD Response Time (MM1)	(Service Time) / (1 – Device Busy)
Queue Time	Response Time – Service Time

Device Disconnect Time

Disconnect Time (non-cache)

- Seek + Rotational Delay + RPS Misses

Disconnect Time (cache)

- (Seek + Rotational Delay + RPS Misses) * (CacheMiss / CacheTotal)

Cache – Reduce Disconnect time

- SSD was the original (non-IBM) cached paging device
- Read only - 3880-23 (1980)
- Write with non-volatile cache - 8mb (1985)
- Large write cache - 1gb (1990 – EMC)
- On board cache (device level – Storage Tech)
- RAID (meant for reliability, but slow)
- SSD is current technology

Device Connect Time

Connect Time – Data transmission

- Transmission time (Connect time)

If Channel Busy is high:

- Cause: High data transmission, large blocks
- Cause: Slow channels
- Delay: Queueing on the channel (I/O Processor/SAP)

Channels – Reduce Connect time

- VM/XA Multiple channels - can reconnect on any channel
- Grey Cables/3390 - 4.5mb/sec (up from 3mb/sec)
- ESCON – 17mb/sec (1995)
- FICON – 110mb/sec (2003)
- FICON Express – 200/400 mb/sec (2005/2007)

DASD Queue Time

Queue Time Types:

- Device Busy Contention (queue time is calculated)
- Channel Path Contention – Control Unit/Channel/SAP
- Throttle – operator command

Throttle: Only allow x number of I/Os per second

- Meant for shared DASD between LPAR situations
- Reduce activity to control contention for other systems
- Invented for z/OS shared disks to allow slower z/OS to IPL

PAV (Parallel Access Volumes) – Reduce

- Multiple definitions of device on multiple channels
- Data available from cache even when device is busy
- HyperPav (dynamic multi-channels)
- FCX…

Why Have Multiple Channels to a Device?

VM/XA allowed multiple channels to access the same device to reduce RPS MISS:

- If the 1st channel is busy, try the 2nd, and so on…
- Architecture supports up to 16 channels
- Four channels was considered minimum

Some controllers no longer support dynamic reconnect

Multiple channels now for PAV - Availability

The Reason for Dynamic Reconnect

RPS MISS (3380, XA)

- One channel: 17ms * (1 / (1 – ChanUtil * ChanUtil))

RPS MISS Times – 20% Channel Utilization

- Two channels: 17ms * (1 / (1 - .04)) – 17 = .4ms

Channel Utilization can be higher when more channels (used to matter)

Channel	RPS MISS TIME (3380)		
BUSy	1 Chan	2 Chan	4 Chan
20%	4ms	.7ms	0ms
40%	11ms	3ms	.4ms
60%	25ms	9ms	2ms
80%	68ms	30ms	12ms

Block sizes vary and impact assumptions

- 4k I/O
- MDC does full track I/O – higher connect times
- Linux does 4k I/O
- Linux can chain 1024 I/O
- Paging may be up to 40 * 4k pages

Channel Measurements

```
Report: ESACHAN
Monitor initialized:
--------------------------
        <Pct Channel>
Time/    Utilization
CHPID    LPAR Total  Shrd
-------- ---- -----  ----
16:26:00
26       28.3  10.0    No
27       27.7  20.0    No
2E       27.8  50.0    No
42        6.4  20.0    No
60       12.3  10.0    No
64       11.9  10.0    No
65       10.1  10.0    No
C2       11.7  20.0    No
D3        2.1  20.0    No
D6       28.2  40.0    No
D7       28.3  30.0    No
DD       28.1  20.0    No
DE       28.1  40.0    No
E8       10.1  10.0    No
E9       11.2  10.0    No
EC       10.2     0    No
ED       10.8  20.0    No
      -------- ---- -----
System:   337 370.0
```

Two measurements:

- LPAR (measured)
- TOTAL (physical channels)

Old Style:

- Sampled by CP (TestSubChannel)
- Measured by channel

Utilization sampled at Hi-Frequency rate

- Example is 6 second example
- The LPAR is “us”

Channel Measurements

```
Report: ESACHAN      Channel Performance Analysis                    Velocit
Monitor initialized: 06/30/03 at 13:21:34 on 2064 serial 5146B     First r
-------------------------------------------------------------------------
        <Pct Channel>              <---------------Data Units ------------>
Time/    Utilization      Chanl   <---Reads/Second-->  <--Writes/Second-->
CHPID    LPAR Total  Shrd Type    LPAR TOTAL Pct  Max  LPAR TOTAL pct  MAX
-------- ---- -----  ---- -----   ---- ----- --- ----  ---- ----- --- ----
13:31:53
16        5.1  14.4   Yes ESCON
18        9.9  18.3   Yes ESCON
20        3.9  19.4   Yes ESCON
25        5.3  12.2   Yes ESCON
27       10.3  10.6   Yes ESCON
30        3.7  16.1   Yes ESCON
34        5.3  12.8   Yes ESCON
36       10.0  14.4   Yes ESCON
43        5.1  15.6   Yes ESCON
45       10.4  15.6   Yes ESCON
52        5.6  20.0   Yes ESCON
53        1.9  31.1   Yes ESCON
54       10.0  14.4   Yes ESCON
63       10.4  14.4   Yes ESCON
70        5.3  10.6   Yes ESCON
71          .  11.7   Yes ESCON
72        9.8  15.0   Yes ESCON
77       18.1  21.7   Yes ESCON
7F        5.3  18.9   Yes ESCON
90       10.2  15.0   Yes ESCON
98        4.1  15.0   Yes ESCON
9D       53.6  56.7   Yes ESCON
```

Two measurements:

- LPAR (measured)
- “Total” (physical channels)

Newer Style:

- Sampled by CP (“Total”)
- Measured by Channel (LPAR)
- What is Channel Utilization?
- (EMIF)

DASD Performance – Is there a problem?

z/VM Virtual Machine SIO and Asynch I/O Wait

- Rule of thumb? Greater than CPU Wait?

```
Report: ESAXACT       Transaction Delay Analysis
Monitor initialized: 05/31/16 at 00:00:00ial 2F5A7
-------------------------------------------------------------
                      <-----Percent non-dormant (Wait states)
UserID    <-Samples->                          .    Tst <Asynch>
/Class    Total  In Q Run Sim CPU SIO Pag . CF Idl I/O Pag Ldg
-------- ----- ----- --- --- --- --- --- .--- --- --- --- ---
00:15:00  1101  1987  11   0  35   0 1.2 .  0  52   0   .   .
Hi-Freq:  143K  120K  11 0.1  29 0.1 1.2 .  0  57 0.0 0.6 1.2
 ***Key User Analysis ***                 .
TCPIP      900   198 1.0 2.5 5.6   0   0 .  0  91   0   0   0
 ***User Class Analysis***                .
Servers   8100     1   0   0   0   0   0 .  0 100   0   0   0
Velocity  9358  1479 3.0 0.5 3.2 5.2 0.6 .  0  87   0   0   0
LDXmno    9000  9000  13 0.2  40   0 1.3 .  0  45 0.0 0.2 0.1
LDXecs   14400 14400  24 0.2  51   0 0.2 .  0  24   0 0.1 0.1
LDXcii    1800  1800 7.7   0  23   0  33 .  0  27 0.1 0.1 8.6
LDXfrm    7200  7200 3.4 0.0  33   0 0.6 .  0  62   0 0.3 0.6
LDXlfe    8100  8100  13 0.1  31   0 1.2 .  0  53   0 1.2 1.2
TheUsrs  20700 13994 4.4 0.1  21   0 0.7 .  0  71 0.0 0.5 2.1
```

DASD Performance – Is it a problem?

Linux also measures I/O Wait time - ESALNXS

- Rule of thumb? Comparable to steal? Total CPU?

```
Report: ESALNXS      LINUX VSI System Analysis Report              Velocity Sof
Monitor initialized: 05/30/17 at 02:00:00 on 2827 serial 0168A7    First record
-------------------------------------------------------------------------------
Node/    <---Load Numbers--> CPU <Processor Pct Util> NICE <CPU Overhead%> IO
Time     Users Procs MaxProc NBR Total Syst User Idle Time Krnl IRQ  Steal Wait
-------- ----- ----- ------- --- ----- ---- ---- ---- ---- ---- ---- ----- ----
02:01:00
L21EP        0   448       0 Tot  27.2 13.2  9.0 38.1    0  0.7  4.3 127.3  7.4
                             1  16.5  7.8  5.1  4.2    0  0.4  3.2  76.7  2.6
                             2  10.7  5.4  3.9 33.9    0  0.3  1.1  50.6  4.7
L212P        0   252       0 Tot  10.9  3.6  3.6 75.0    0  0.5  3.3   9.1  5.0
L218P        0   552       0 Tot  18.3  4.1 13.3 20.8    0  0.4  0.4  58.1  2.8
L22AP        0   440       0 Tot  18.3  4.6 12.6  114    0  0.6  0.5  63.1  5.0
                             1  11.4  2.6  8.0 45.0    0  0.3  0.4  40.4  3.2
                             2   7.0  2.0  4.6 68.7    0  0.3  0.1  22.6  1.7
L220P        0   248       0 Tot  31.5 10.8 14.2 23.5    0  0.4  6.2 140.9  4.1
                             1  16.4  6.1  5.2  6.4    0  0.3  4.8  76.4  0.8
                             2  15.1  4.7  9.0 17.1    0  0.1  1.4  64.5  3.3
L21EP        0   446       0 Tot  24.6 14.1  3.4 55.0    0  0.8  6.2 114.7  5.7
                             1  13.0  6.3  1.7 24.3    0  0.4  4.5  60.5  2.3
                             2  11.6  7.9  1.7 30.7    0  0.3  1.7  54.3  3.4
L258P        0   244       0 Tot  21.0  5.0 13.4  0.2    0  0.4  2.1  77.9  0.9
```

z/VM DASD Subsystem Reports

DASD

- ESADSD1 – Configuration
- ESADSD2 – Disk Performance
- ESADSD6 – Disk Performance Extended

DASD Cache

- ESADSDC – DASD Cache Configuration
- ESADSD5 – DASD Cache Performance

Seek Analysis

- ESASEEK – Seeks by Minidisk
- ESAUSEK – Seeks by User

Channels

- ESACHNC – Channel Configuration
- ESACHAN – Channel Performance
- ESACHNH – HiperSockets
- ESAQDIO – QDIO 1
- ESAQDIO2 – QDIO 2
- ESAIOP – I/O Processor (SAP)

DASD Configuration Report – ESADSD1

Monitor configuration data needed for device number

- SysID is an internal value assigned by the system
- DevNo is what is externalized
- If DevNo = SysID then the configuration data is not captured
- Check channel paths online

```
Report: ESADSD1       DASD Configuration
Monitor initialized: 05/06/08 at 12:00:00 on 2094 serial AEA7D
Monitor period:          3600 seconds (   1:00:00)
-------------------------------------------------------------------
 Dev Sys          Device    <CHPIDS OnLn><-Cntrl Unit-> UserID   MDisk
 No. ID   Serial Type   SHR 01 02 03 04 OBR/CU Model   (if ded) Links
---- ---- ------ ------ --- -- -- -- -- ------ ------- -------- -----
C557 6177 LNXP5F 3390-9 YES 48 49 76 87  35/00 2105                0
                            95 96 D6 5A
C558 6178 LNXP55 3390-9 YES 48 49 76 87  35/00 2105                0
                            95 96 D6 5A
```

DASD Configuration Report – ESADSD1

DASD Page/Spool Extents, PAV, Cache Status/STGID

```
Report: ESADSD1       DASD Configuration
Monitor period:          3600 seconds (   1:00:00)
-------------------------------------------------
 Dev Sys          Device . <----Extent---->
 No. ID   Serial Type   . Type  Start Size
---- ---- ------ ------ . ----- ----- ----
C557 6177 LNXP5F 3390-9 . Page      0  10K
                        .
C558 6178 LNXP55 3390-9 . Page      0  10K
```

```
Report: ESADSD1       DASD Configuration
Monitor period:          3600 seconds (      05/06/08 13:00:00
-------------------------------------------------------------
 Dev Sys          Device    <. <--MDC Status--> <3990 Cache Status> PAV
 No. ID   Serial Type   SHR . Elig Def Now Shr Actv DFW NVS STGID Base
---- ---- ------ ------ --- . ---- --- --- --- ---- --- --- -----  ---
C557 6177 LNXP5F 3390-9 YES .  Yes Off   . Yes  Yes  On  On  9C50
                            .
C558 6178 LNXP55 3390-9 YES .  Yes Off   . Yes  Yes  On  On  9C50 .
```

DASD Performance Report – ESADSD2

Performance data provides:

- Interval Top DASD – Look for high device utilization
- Interval Control Unit – Look for channel/cache issues
- Summary – everything. Is Response Time good?

```
Report: ESADSD2      DASD Performance Analysis                    Velocity Software             ESAMAP
Monitor initialized: 05/22/08 at 14:00:00 on 2084 serial 15BAF    First record analyzed: 05/22/08 14:0
-------------------------------------------------------------------------------------------------------
                                                          <--------DASD Response times (ms)------>
 Dev         Device <--SSCH--> <%DevBusy> <SSCH/sec->        <--Service times--> <--Queueing-> QLengths
 No. Serial Type   Total  ERP  Avg  Peak   avg  peak  Resp  Serv Pend Disc Conn DASD Cntl THR  avg max
---- ------ ------ ------ ---  ---- ---- ----- ----- -----  ---- ---- ---- ---- ---- ---- --- ---- ---

14:01:00
***Top DASD by Device busy***
0C51 VME090 3390-3   8795   0   8.5  8.5 146.6 146.6   0.6   0.6  0.2  0.0  0.3    0  0.0   0    0   0
0B6E VME106 3390-3   7858   0   8.4  8.4 131.0 131.0   0.6   0.6  0.2  0.0  0.4    0    0   0    0   0
0E78 VME089 3390-3   4186   0   8.1  8.1  69.8  69.8   1.2   1.2  0.3  0.4  0.5    0    0   0    0   0
0E71 VME067 3390-3    989   0   7.5  7.5  16.5  16.5   4.6   4.6  0.4  3.3  0.9    0    0   0    0   0
***End Top DASD by Device busy***

0509 Control Unit    4166   0   0.1  0.1  69.4  69.4   1.2   1.2  0.3  0.2  0.6    0    0   0    0   0

0B00 Control Unit    8716   0   0.1  0.1 145.3 145.3   0.7   0.7  0.3  0.1  0.4    0    0   0    0   0
                    ------ ---  ---- ---- ----- ----- -----  ---- ---- ---- ---- ---- ---- --- ---- ---
System:             32137   0   0.1  0.1 535.6 535.6   1.0   1.0  0.3  0.3  0.5    0  0.0   0    0   0
```

DASD Cache Performance Report – ESADSD5

Cache statistics provides:

- Read/Hit percentage – depends on cache size and locality of reference
- Write/Hit percentage – depends on NVS (Non-Volatile Storage – persistent memory)
- NVS Full, Cache Inhibit and Cache Bypass – not good

```
Report: ESADSD5      3990-3 Cache Analysis                          Velocity Software            ESAMAP 3.7.4 05
Monitor initialized: 05/22/08 at 14:00:00 on 2084 serial 15BAF     First record analyzed: 05/22/08 14:00:00
-------------------------------------------------------------------------------------------------------------------
             Pct. <-------------------per second-------------------> <--------Write activity per second-------->
 Dev         Actv <------Total-------> <----Read----> <--Seq Read--> Total  DFW  DFW SEQ        NVS <--Cache--->
 No.  Serial Samp  I/O Hits Hit% Read%  I/O Hits Hit%  I/O Hits Hit%   I/O  I/O Hits  I/O Hit% Full Inhib Bypass
----  ------ ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ----- ------
14:01:00
***Top DASD by Device busy***
0C51  VME090  100  172  172  100 100.0 64.6 64.6  100  108  108  100     0    0    0    0    0    0     0      0
0B6E  VME106  100  131  131  100 100.0  100  100  100 31.3 31.3  100     0    0    0    0    0    0     0      0
0E78  VME089  100 74.0 72.2 97.6  97.9 58.4 56.7 97.1 14.0 13.9 99.3   1.5  1.5  1.5  1.5  100    0     0      0

***End Top DASD by Device busy***

0509 CtlUnit  100 1106 1052 95.1  92.9  283  231 81.5  744  743  100  78.5 77.8 77.8 23.0 99.1    0     0      0
0B00 CtlUnit  100  518  489 94.5  94.9  341  313 91.7  150  150  100  26.6 26.2 26.2  1.8 98.5    0     0      0
0C00 CtlUnit  100  233  230 98.7  91.7 88.5 88.5  100  125  124 99.1  19.4 17.4 17.4  4.8 89.9    0     0      0
0D00 CtlUnit  100  127  110 86.6  64.8 80.9 65.0 80.3  1.5  1.4 96.6  44.7 43.7 43.7  3.2 97.7    0     0      0
0E00 CtlUnit  100  316  294 93.1  48.8  139  125 90.3 15.6 15.5 99.2 161.7  153  153  103 94.8    0     0      0
----  ------ ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ----- ------
System:       100 2332 2206 94.6  84.8  941  831 88.3 1036 1034  100 355.1  341  341  152 96.0    0     0      0
-------------------------------------------------------------------------------------------------------------------
```

Channel Utilization is not obvious

- One fibre for read
- One fibre for write
- Data unit processing
- Channel bus

Channel balancing takes planning!

FICON Channel Measurements

Channel Metrics:

- Sampled by CP (“Total”)
- Measured by Channel – Data/second (“LPAR”)
- What is Channel Utilization?

```
Report: ESACHAN       Channel Performance Analysis                  Linux T
Monitor initialized: 05/09/03 at 10:53:54 on 2064 serial 31539      First r
-------------------------------------------------------------------------
        <Pct Channel>               <----------------Data Units ------------>
Time/    Utilization       Chanl   <---Reads/Second-->  <--Writes/Second-->
CHPID    LPAR Total   Shrd Type    LPAR TOTAL Pct  Max  LPAR TOTAL pct  MAX
-------- ---- -----   ---- -----   ---- ----- --- ----  ---- ----- --- ----
10:54:33
02        0.2   3.0    Yes FICON      0     0   0  82K     0     0   0  82K
03        0.2   3.0    Yes FICON      0     0   0  82K     0     0   0  82K
04          .   3.0    Yes FICON      0     0   0  82K     0     0   0  82K
C0          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
C1          .  12.3    Yes FICON      0     0   0  82K     0     0   0  82K
C2          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
C3          .  12.3    Yes FICON      0     0   0  82K     0     0   0  82K
C9       12.9  12.9    Yes FICON    28K 27550  24 117K    55    55 0.0 117K
CC          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
CD          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
CE          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
CF          .  12.2    Yes FICON      0     0   0  82K     0     0   0  82K
F4        1.3   3.9    Yes FICON      0     0   0  82K     0     0   0  82K
F5        3.7   3.9    Yes FICON      1     1 0.0  82K     1     1 0.0  82K
--------  ----  -----  ----
System:   20.8  142.5
```

FICON Channel Measurements

New Style:

- Sampled by CP (“Total”)
- Measured by Channel – Work per second
- What is Channel Utilization? The Peak of any component

```
Report: ESACHAN       Channel
Monitor initialized: 05/09/03
-------------------------------------------------------------------------
         <Pct Channel>              <----Work Unit---->  <-Bus Cycles>  Bytes
Time/     Utilization       Chanl   <-Rates / Second-->  <-per Second>  /Data
CHPID     LPAR Total   Shrd Type    LPAR TOTAL Pct  MAX   Used pct  Max   Unit
-------- ---- -----   ---- -----   ---- ----- --- ----   ---- --- ----   -----
10:54:33
02        0.2   3.0    Yes FICON     33   495 3.0  16K   1376 8.5  16K    1024
03        0.2   3.0    Yes FICON     31   495 3.0  16K   1290 7.9  16K    1024
04          .   3.0    Yes FICON      0   495 3.0  16K   1376 8.5  16K    1024
C0          .  12.2    Yes FICON      0  1993  12  16K   1440 8.8  16K    1024
C1          .  12.3    Yes FICON      0  1994  12  16K   1440 8.8  16K    1024
C2          .  12.2    Yes FICON      0  1992  12  16K   1441 8.9  16K    1024
C3          .  12.3    Yes FICON      0  1994  12  16K   1439 8.8  16K    1024
C9       12.9  12.9    Yes FICON    17K 16811  13 130K    10K  16  65K    1024
CC          .  12.2    Yes FICON      0  1993  12  16K   1345 8.3  16K    1024
CD          .  12.2    Yes FICON      0  1993  12  16K   1440 8.9  16K    1024
CE          .  12.2    Yes FICON      0  1993  12  16K   1344 8.3  16K    1024
CF          .  12.2    Yes FICON      0  1993  12  16K   1440 8.9  16K    1024
F4        1.3   3.9    Yes FICON    212   636 3.9  16K   2464  15  16K    1024
F5        3.7   3.9    Yes FICON    596   638 3.9  16K   2304  14  16K    1024
--------  ----  -----   ----
System:   20.8  142.5
```

FICON Channel Measurements

New Style:

- Channels are defined

```
Report: ESACHAN      Channel Performance Analysis                    Linux
-------------------------------------------------------------------------
        <Pct Channel>                 <----------------Data Units -------
Time/    Utilization      Channel     <---Reads/Second--->  <--Writes/Sec
CHPID    LPAR Total  Shrd Class/Type LPAR  TOTAL Pct  Max   LPAR  TOTAL p
-------- ---- -----  ---- ---------- ----- ----- --- ----   ----- ----- -
12:01:00
48        0.3   8.5   Yes FICON/FCS     36  7872 6.7 117K    294  2228 1
49        0.3   8.4   Yes FICON/FCS     35  7827 6.7 117K    315  2127 1
5A        0.4  11.6   Yes FICON/FCS     53 10570 5.4 195K    441  3312 1
76        0.3   8.5   Yes FICON/FCS     30  7984 6.8 117K    267  2284 1
87        0.3   8.4   Yes FICON/FCS     32  7568 6.5 117K    285  2078 1
95        0.5  12.6   Yes FICON/FCS     57 11393 5.8 195K    455  3583 1
96        0.5  12.4   Yes FICON/FCS     58 11495 5.9 195K    471  3466 1
D6        0.4  11.9   Yes FICON/FCS     52 11192 5.7 195K    471  3303 1


Report: ESADSD1      DASD Configuration                          Linux test
-------------------------------------------------------------------------------
 Dev Sys         Device     <CHPIDS OnLn><-Cntrl Unit-> UserID   MDisk <----Extent---->
 No. ID   Serial Type   SHR 01 02 03 04 OBR/CU Model   (if ded) Links Type  Start Size
---- ---- ------ ------ --- -- -- -- -- ------ ------- -------- ----- ----- ----- ----
C557 6177 LNXP5F 3390-9 YES 48 49 76 87  35/00 2105                0 Page      0  10K
                            95 96 D6 5A
C558 6178 LNXP55 3390-9 YES 48 49 76 87  35/00 2105                0 Page      0  10K
                            95 96 D6 5A
C559 6179 LNXP56 3390-9 YES 48 49 76 87  35/00 2105                0 Page      0  10K
                            95 96 D6 5A
C55A 617A LXPC22 3390-9 YES 48 49 76 87  35/00 2105                0     .     .    .
                            95 96 D6 5A
C55B 617B LNXP57 3390-9 YES 48 49 76 87  35/00 2105                0 Page      0  10K
                            95 96 D6 5A
C55C 617C LNXP58 3390-9 YES 48 49 76 87  35/00 2105                0 Page      0  10K
                            95 96 D6 5A
```

Channel Types – z/VM 5.2

```
class type description
CTC   CTC Channel-to-channel
CTC   CTP Channel-to-channel point-to-point
CTC   CTS Channel-to-channel swt-point-to-point
ESCON CBY Fiber extended (byte pacer)
ESCON CNC Serial-channel-path
ESCON CNP Serial-point-to-point channel
ESCON CNS Serial-switched-point-to-point channel
ESCON CVC Fiber extended (block pacer)
ESCON DSD Direct-system-device channel
ESCON EIO Emulated I/O channel
ESCON FCV Fibre-channel converted channel FCV
ESCON ISD Internal-system-device-channel
FCP   FCP Fibre-channel-protocol channel FCP
FICON FC  Fibre-channel point-to-point channel FC
FICON FC? Fibre channel
FICON FCS Fibre-channel switched channel
HIPER IQD Internal-queued-direct-communication channel IQD
OSA   OSA Open-Systems-adapter channel
OSA   OSC OSA 3270-console (OSC) channel
OSA   OSD Open-Systems-Adapter Direct-Express (OSD) channel
OSA   OSE Open-Systems-Adapter Express (OSE) channel
OSA   OSN OSA NCP (OSN) channel
PAR   BL  Reserved, no longer valid, previously Parallel-block
PAR   BY  Reserved, no longer valid, previously Parallel-byte
```

New Channel Reporting:

- Specific channel type now reported

Determine potential problems – Top DASD
Caching Characteristic? – No disk time?
What could be done to enhance this? (PAV?)

Report: **ESADSD2** DASD Performance Analysis Velocity Software,

			<%DevBusy>		<SSCH/sec->		<--------DASD Response times (ms					
Dev No.	Serial	Device Type	Avg	Peak	avg	peak	Resp	<--Service times--> Serv	Pend	Disc	Conn	<--Qu DASD
16:26:00												
***Top DASD by Device busy												
DE0E	VM984F	3390-3	**97.9**	**96.3**	403.6	396.9	**5.4**	2.4	0.4	0.0	2.0	3.0
D2F1	VM9C1B	3390-3	38.2	37.6	47.6	46.8	**8.0**	8.0	0.3	5.3	2.5	0
DE51	VMD11E	3390-3	32.8	32.3	66.6	65.4	4.9	4.9	0.3	0.2	4.4	0
D2EC	VM9C16	3390-3	27.9	27.4	59.7	58.8	4.7	4.7	0.3	0.4	4.0	0
D786	VMSPL1	3390-3	25.0	24.6	91.2	89.7	2.7	2.7	1.8	0.1	0.9	0
DE1F	VM9860	3390-3	21.4	21.1	30.2	29.7	7.1	7.1	0.3	0.1	6.7	0
D787	VMSPL2	3390-3	18.2	17.9	66.6	65.5	2.7	2.7	1.7	0.1	0.9	0
D2C7	VM9C02	3390-3	17.3	17.0	23.3	22.9	7.4	7.4	0.3	4.6	2.5	0
D2CB	VM9C00	3390-3	10.7	10.5	18.6	18.3	5.7	5.7	0.3	0.5	5.0	0
DE4E	VMD11B	3390-3	10.6	10.4	18.7	18.4	5.7	5.7	0.3	0.5	4.9	0
End Top DASD by device busy												

Cache Measurements

Evaluate the cache controller configuration
Each controller has a Device Address and Identifier
Size of the cache and non-volatile cache is shown

```
Report: ESADSDC      Cache Control Unit Configuration     Velocity Software, Inc.  ESAMAP 3.4.0
-------------------------------------------------------------------------------------------
<--Control-->  <-Storage--> <-Cache Storage in MB> <Non-volatile> Cache
<---Unit---->  <-Director->             Off  Not    Storage (MB)  Fast   <Channel Paths Online>
Dev#  Model    <ID/Status-> Size  Avail line Avail  Avail Pinned  Write  01 02 03 04 05 06 07 08
----  -------  ------------ ---- ------ ---- -----  ----- ------  -----  -- -- -- -- -- -- -- --

02CB  3990-3E  0053/OnLine  3742 3742.0    0     0   4.00      0  Active 33 3B B3  .  .  .  .  .
D2C0  3990-6E  7733/OnLine  3072 3072.0    0     0   1024      0  Active 60 61 64 65 E8 E9 EC ED
D780  3990-3E  0051/OnLine  3750 3750.0    0     0   4.00      0  Active 42 4A C2  .  .  .  .  .
DAA1  3990-3E  0058/OnLine  1702 1701.7    0     0   4.00      0  Active 23 2A 2C D3 D5 DA DC  .
DB40  3990-3E  005B/OnLine  2638 2637.6    0     0   4.00      0  Active 23 2A 2C D3 D5 DA DC  .
DD40  3990-3E  0075/OnLine  1702 1701.7    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
DDA0  3990-3E  0076/OnLine  1702 1701.7    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
DE00  3990-3E  0078/OnLine  2638 2637.6    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
DE40  3990-3E  0079/OnLine  2638 2637.6    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
DE80  3990-3E  007A/OnLine  2638 2637.6    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
DEC0  3990-3E  007B/OnLine  2638 2637.6    0     0   4.00      0  Active 26 27 2E D6 D7 DD DE  .
```

Cache Configuration

- NVS (Non-Volatile Storage can be a limiter with Linux)

```
Report: ESADSDC      Cache Control Unit Configuration
------------------------------------------------------------------------------------------------
------
<--Control-->  <-Storage--> <-Cache Storage in MB> <Non-volatile> Cache
<---Unit---->  <-Director->             Off  Not    Storage (MB)  Fast   <Channel Paths Online >
Dev#  Model    <ID/Status-> Size  Avail line Avail  Avail Pinned  Write  01 02 03 04 05 06 07 08
----  -------  ------------ ---- ------ ---- -----  ----- ------  -----  -- -- -- -- -- -- -- --
F000  2105     F000/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F100  2105     F100/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F200  2105     F200/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F300  2105     F300/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F400  2105     F400/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F500  2105     F500/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F600  2105     F600/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
F700  2105     F700/OnLine   51K  50627    0     0  192.0      0  Active A4 A5 B4 B5  .  .  .  .
```

Cache Performance

- Evaluate the value of cache and why
- Read Percent/Read Cache Hit Percent – should be high
- Write Percent/Write Cache Hit Percent – should be 100

```
Report: ESADSD5      3990-3 Cache Analysis                        Velocity Software, Inc.       ESAMAP 3.7.2 09/07/07  Pg  2241
Monitor initialized: 02/06/07 at 13:00:00 on 2094 serial 2BFBD    First record analyzed: 02/06/07 13:00:00
------------------------------------------------------------------------------------------------------------------------------------
             Pct. <-------------------per second------------------> <--------Write activity per second--------> <tracks/second>
 Dev         Actv <------Total-------> <----Read----> <--Seq Read--> Total  DFW  DFW SEQ        NVS <--Cache---> <Staged-> De-
 No.  Serial Samp  I/O Hits Hit% Read%  I/O Hits Hit%  I/O Hits Hit%   I/O  I/O Hits  I/O Hit% Full Inhib Bypass  Seq Nseq stged
---- ------ ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ---- ---- ----- ------ ---- ---- -----
13:15:00
***Top DASD by Device busy***
F794  VS2P52  100  9.7  5.4 55.4  83.8  8.1  3.8 46.8    0    0    0   1.6  3.2  1.6    0  100    0     0      0    0    0     1
F181  VS2P13  100 10.7  6.2 57.5  82.3  8.8  4.3 48.3    0    0    0   1.9  3.8  1.9    0  100    0     0      0    0    0     2
F4A8  VS2PB5  100 11.0  6.3 57.3  83.3  9.2  4.5 48.7    0    0    0   1.8  3.7  1.8    0  100    0     0      0    0    0     2
F2A6  VS2PA3  100 11.7  6.7 57.5  82.8  9.7  4.7 48.7    0    0    0   2.0  4.0  2.0    0  100    0     0      0    0    0     2
F598  VS2P66  100 11.0  6.3 56.9  82.0  9.0  4.3 47.4    0    0    0   2.0  4.0  2.0    0  100    0     0      0    0    0     2
F39C  VS2P78  100 10.9  6.1 56.6  83.3  9.0  4.3 47.9    0    0    0   1.8  3.6  1.8    0  100    0     0      0    0    0     2
F79F  VS2P95  100 10.1  5.6 55.3  83.4  8.5  3.9 46.3    0    0    0   1.7  3.4  1.7    0  100    0     0      0    0    0     1
F096  VS2P57  100 11.0  6.3 57.3  81.8  9.0  4.3 47.8    0    0    0   2.0  4.0  2.0    0  100    0     0      0    0    0     2
F3A6  VS2PA4  100 11.3  6.4 56.5  83.2  9.4  4.5 47.8    0    0    0   1.9  3.8  1.9    0  100    0     0      0    0    0     2
F0A9  VS2PB9  100 11.0  6.4 58.1  82.7  9.1  4.5 49.4    0    0    0   1.9  3.8  1.9    0  100    0     0      0    0    0     2
***End Top DASD by Device busy***
```

PAV – Parallel Access Volume

Base address and Parallel Volume configuration:

Report: **ESADSD1** DASD Configuration

Dev No.	Sys ID	Serial	Device Type	SHR	<CHPIDS OnLn> 01	02	03	04	<-Cntrl Unit-> OBR/CU	Model	**PAV Base**
6700	053D	TEST1	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	Base
6701	053E	CMSPAV	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	Base
6702	053F	CMSPV2	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	Base
6703	0540		3390-3	NO	2C	2E	.	.	35/1B	3990-6E	Base
67F0	062D		3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6703
67F1	062E		3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6703
67F2	062F		3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6703
67F3	0630		3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6703
67F4	0631	CMSPV2	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6702
67F5	0632	CMSPV2	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6702
67F6	0633	CMSPV2	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6702
67F7	0634	CMSPV2	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6702
67F8	0635	CMSPAV	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6701
67F9	0636	CMSPAV	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6701
67FA	0637	CMSPAV	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6701
67FB	0638	CMSPAV	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6701
67FC	0639	TEST1	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6700
67FD	063A	TEST1	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6700
67FE	063B	TEST1	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6700
67FF	063C	TEST1	3390-3	NO	2C	2E	.	.	35/1B	3990-6E	6700

HyperPAV

Allows multiple real addresses to point to one volume

- Allows multiple concurrent I/O
- One device is defined as the Base Address
- **Pool of alternate addresses**
- Alternate is assigned for the duration of the I/O
- Less alternates needed

ESADSD1 reports PAV Addressing

ESADSDx reports combine data and report as a base

- Option to report all addresses separately

HyperPAV Configuration

```
Report: ESADSD1      DASD Configuration                .3.1 05/18/17   Pg   142
Monitor initialized: 10/01/14 at 13:08:46 on 2817 seri9:00
Monitor period:          720 seconds (     12:00)     1:00
-------------------------------------------------------------------------------
 Dev Sys          Device    <CHPIDS OnLn><-Cntrl Unit-> Cache  PAV <-HiperPav>
 No. ID   Serial Type   SHR 01 02 03 04 OBR/CU Model   STGID BASE Type   Pool
---- ---- ------ ------ --- -- -- -- -- ------ ------- ----- ---- -----  ----

C801 2A39 VS4W03 3390-3 NO  4B B0 4D 6F  3C/00 2107     C801    .  Base  0005

C901 2B09 VS4W02 3390-3 NO  4B B0 4D 6F  3C/00 2107     C901    .  Base  0007

-------------------------------------------------------------------------------

Report: ESADSDC      Cache Control Unit  ZMAP 4.3.1 05/18/17   Pg   151
Monitor initialized: 10/01/14 at 13:08:414 13:09:00
Monitor period:          720 seconds (  14 13:21:00
-------------------------------------------------------------------------------
<--Control-->  <-Storage--> <-Cache Stor <-----HiperPav Devices----->
<---Unit---->  <-Director->              Pool <Number Devs> <Alias>
Dev#  Model    <ID/Status-> Size  Avail  Nmbr  Base  Alias  min max
----  -------  ------------ ---- ------  ----- ----  -----  --- ---

C800  2107     C801/OnLine  406K 405528     5   148    32   31  32
C900  2107     C901/OnLine  406K 405528     7   148    32   31  32
CA00  2107     CA01/OnLine  406K 405528    10   148    32   31  32
CB00  2107     CB01/OnLine  406K 405528     9   148    32   31  32
```

HyperPAV Performance

Rate going to alternate addresses is VERY low
Ensure the Device Utilization justifies the expense
If Serv = Resp, there is no queueing – PAV eliminated queuing

```
Report: ESADSD2    DASD Performance Analysis              TEST MAP      Pg   1504
Monitor initializedat 13:08:46 on 2817 serial 0CE0A6      First record
-------------------------------------------------------------------------------
                                          <--------DASD Response time/HiperPAV>
 Dev         Device <%DevBusy> <SSCH/sec->          <--Service times--> rate/Second->
 No. Serial Type     Avg  Peak   avg  peak  Resp   Serv Pend Disc Conn SSCH Alias
---- ------ ------   ---- ---- ----- ----- -----   ---- ---- ---- ---- ---- -----
13:21:00
***Top DASD by Devi
C801 VS4W03 3390-3    6.0 11.8 182.6 361.2   0.3    0.3  0.2    0  0.2 0.26     0
C901 VS4W02 3390-3    5.9 11.7 182.6 360.8   0.3    0.3  0.2  0.0  0.2 0.27     0
C507 VS4S06 3390-3    4.8  9.6  27.5  54.5   1.8    1.8  0.2  0.0  1.6    0     0
C701 VS4W06 3390-3    4.0  7.7  66.5 131.0   0.6    0.6  0.2  0.1  0.3 6.38     0
C601 VS4W07 3390-3    3.9  7.7  67.3 133.0   0.6    0.6  0.2  0.1  0.3 6.81     0
C201 VS4S01 3390-3    3.9  7.7  22.7  45.0   1.7    1.7  0.2  0.0  1.5    0     0
C60A VS4W05 3390-9    3.1  6.1  64.7 127.7   0.5    0.5  0.2  0.0  0.3 1.30     0
C101 VS4S02 3390-3    2.8  5.5  16.8  33.2   1.7    1.7  0.2  0.0  1.5    0     0
```

HyperPAV Performance

Rate going to alternate addresses is VERY low – as a percentage
Ensure the Device Utilization justifies the expense

```
Report: ESADSD2       DASD Performance Analysis              27/21   Pg   1670
Monitor initialized: 11/21/19 at 11:04:57 on 3906 serial 02
-------------------------------------------------------------------------------
                                                          <----- <-PAV/HiperPAV>
 Dev         Device <--SSCH--> <%DevBusy> <SSCH/sec->       <-Rate/Second->
 No. Serial Type   Total  ERP  Avg  Peak   avg  peak  Resp Q-d  SSCH Alias
---- ------ ------ ------ ---  ---- ---- ----- ----- ----- ---- ---- -----

11:06:00
***Top DASD by Device busy***
4F3B LF4F3B 3390-9  92509   0  18.4 18.1  1568  1542   0.1    0 10.5     0
4F3A LF4F3A 3390-9  91049   0  17.7 17.4  1543  1517   0.1    0 67.8     0
4F3C LF4F3C 3390-9  81521   0  16.4 16.2  1382  1359   0.1    0 14.2     0
4F3D LF4F3D 3390-9  73770   0  15.8 15.5  1250  1230   0.1    0 49.1     0
```

“Top DASD” Case Study

```
Report: ESADSD2      DASD Performance Analysis                    Linux Test
------------------------------------------------------------------------------

                                                    <--------DASD Response time
 Dev         Device <--SSCH--> <%DevBusy> <SSCH/sec->         <--Service times-->
 No. Serial Type    Total  ERP  Avg  Peak   avg  peak  Resp  Serv Pend Disc Conn
---- ------ ------ ------ ---  ---- ---- ----- ----- -----  ---- ---- ---- ----
14:24:00
***Top DASD by Device busy***
F68E VS2P12 3390-3    594   0  11.3 11.3  10.1  10.1  11.3  11.3  0.3  0.0 11.0
F490 VS2P11 3390-3    617   0  11.1 11.1  10.5  10.5  10.6  10.6  0.5  0.0 10.1
F49A VS2P71 3390-3    572   0  10.3 10.3   9.7   9.7  10.6  10.6  0.2  0.0 10.3
F38F VS2P39 3390-3    558   0  10.1 10.1   9.5   9.5  10.6  10.6  0.2  0.2 10.2
F1A0 VS2P97 3390-3    542   0   9.9  9.9   9.2   9.2  10.8  10.8  0.2  0.2 10.3
F78E VS2P40 3390-3    530   0   9.8  9.8   9.0   9.0  10.9  10.9  0.3  0.0 10.7
***End Top DASD by Device busy***
------------------------------------------------------------------------------
14:25:00
***Top DASD by Device busy***
F68E VS2P12 3390-3    316   0  74.2 74.2   5.4   5.4 138.5   139  0.3  127 10.7
F78E VS2P40 3390-3    353   0  74.2 74.2   6.0   6.0 123.9   124  0.3  112 11.3
F3A7 VS2PAC 3390-3    368   0  59.7 59.7   6.2   6.2  95.7  95.7  0.3 83.2 12.1
F491 VS2P15 3390-3    325   0  51.5 51.5   5.5   5.5  93.6  93.6  0.3 81.1 12.2
F6A6 VS2PA7 3390-3    316   0  39.7 39.7   5.4   5.4  74.1  74.1  0.3 60.3 13.5
***End Top DASD by Device busy***
```

Note the change in response time – why?

- Evaluate the components
- Which one is impacted?

“Top DASD” Case Study – The DASD Cache

```
Report:   ESADSD5      3990-3 Cache Analysis
Monitor ed: 06/02/07 at 13:00:00 on 2094 seriirst record analyzed: 06/02/07
----------------------------------------------------------------------------
         <--------------------per second------ <---------Write activity per se
 Dev     <-------Total-------> <----Read----> Total  DFW  DFW SEQ        NVS
 No.  Se  I/O Hits Hit% Read%  I/O Hits Hit%   I/O  I/O Hits  I/O Hit% Full
----  -- ---- ---- ---- ----- ---- ---- ---- ----- ---- ---- ---- ---- ----
System:  2325 1527 65.7  65.3 1519  721 47.5 806.0 1724  806    0  100    0
System:  2719 1723 63.4  67.0 1822  827 45.4 896.7 1910  896    0  100    0
System:  2498 1626 65.1  65.6 1639  767 46.8 859.2 1842  859    0  100    0
System:  2238 1504 67.2  65.1 1458  724 49.7 780.6 1667  781    0  100    0
System:  3057 2126 69.6  57.9 1771  840 47.5  1286 2704 1286    0  100    0
System:  2934 2013 68.6  63.3 1857  937 50.4  1076 2264 1076    0  100    0
System:  2383 1677 70.4  65.4 1558  852 54.7 824.8 3964  825    0  100    0
System:  1846 1268 68.7  62.1 1147  569 49.6 699.4 5423  699    0  100  274 <= 14:26
System:  1358  934 68.8  58.2  791  368 46.5 567.4 5047  567    0  100 1035
System:  1165  763 65.5  59.1  688  289 42.0 476.3 4753  474    0 99.4 1091
System:  1269  764 60.2  63.1  800  298 37.2 468.7 4255  467    0  100 1520
System:  1230  702 57.1  66.8  822  296 36.0 408.2 3684  406    0 99.4 1807
System:  1160  661 56.9  66.1  766  270 35.2 393.9 3198  391    0 99.2 2391
System:  1218  678 55.7  66.8  813  278 34.2 404.4 3228  400    0 99.0 2397
System:  1107  615 55.6  65.8  729  242 33.2 378.1 3153  373    0 98.6 2377
System:  1134  650 57.3  64.1  726  248 34.2 407.5 3214  402    0 98.6 2384
System:  3192 1751 54.9  73.5 2346  905 38.6 846.0 1864  846    0  100  106
System:  5660 2720 48.1  86.5 4899 1959 40.0 762.1 1605  761    0  100  5.2
System:  4454 2246 50.4  82.0 3651 1444 39.5 802.9 1732  802    0  100 54.8
```

Flags?

14:26 – DASD Cache?

What really happened?

- NVS filled up – writes go to disk (**Takes a LONG time**)
- Disks become highly utilized – everything slows down
- (Hardware design for z/OS track – not Linux records)

DASD Configuration Guidelines

Dedicate volumes for:

- Spool
- Paging
- T-disk
- SFS File Pools
- Linux shared disks
- Linux LVM (Logical Volume Manager)

Shows rates and errors:

```
Report: ESACHNH      HiperSocket Channel Report
Monitor initialized: 03/02/17 at 15:02:00 on 2964 serial 496067
-------------------------------------------------------------------------------
        <>                    <Messages-> <DataUnits>  Failed  <Failed Receives
Time/                Channel  <Sent/Sec-> <Sent/Sec->  Sends   <Unavail Buffers
CHPID     Shrd FCX Type        LPAR TOTAL  LPAR Total  /Sec     LPAR   Total
--------  ---- --- --------- ----- ----- ----- -----  ------    -----  -----
15:03:00
E4         Yes  No HIPER/IQD   0.4   3.1 103.2     0       0        0    0.7
E5         Yes  No HIPER/IQD     0     0     0     0       0        0      0
E7         Yes  No HIPER/IQD     0     0     0     0       0        0      0
E8         Yes  No HIPER/IQD     0   0.6     0     0       0        0      0
EA         Yes  No HIPER/IQD     0     0     0     0       0        0      0
-------------------------------------------------------------------------------
15:04:00
E4         Yes  No HIPER/IQD   0.3   2.9  48.7     0       0      0.3    1.1
E5         Yes  No HIPER/IQD     0     0     0     0       0        0      0
E7         Yes  No HIPER/IQD     0     0     0     0       0        0      0
E8         Yes  No HIPER/IQD     0   0.6     0     0       0        0      0
EA         Yes  No HIPER/IQD     0     0     0     0       0        0      0
-------------------------------------------------------------------------------
```

Storage Processor

Function has been moved to the Storage Processor (SAP)*

Internal architecture is important

Must often understand the limiting resource:

- Channel paths (CHPID)
- Host Adapters (should be one CHPID/HA)
- Ranks (one rank is one RAID-5 array of disks)
- Disks

Sequential devices are in one rank

- Concurrent I/O to devices in rank are delayed

*SAP – System Assistance Processor – executes internal code to provide information to the I/O subsystem for better performance.

SAP Case Study

Report: **ESADSD2** DASD Performance Analysis Velocity Sof

Dev No.	Serial	Device Type	<--SSCH--> Total	ERP	<%DevBusy> Avg	Peak	<SSCH/sec-> avg	peak	<--------DASD Response tim Resp	<--Service times--> Serv	Pend	Disc	Conn
21:19:00													
Top DASD by Device busy													
2218	**VLS053**	**3990**	**747**	**0**	**12.1**	**12.1**	**12.4**	**12.4**	**9.8**	**9.8**	**0.5**	**5.1**	**4.1**
E690	VLPPG7	3990	387	0	6.2	6.2	6.4	6.4	9.5	9.5	0.5	9.1	0.0
CE00	VLPPG1	3990	271	0	5.9	5.9	4.5	4.5	13.0	13.0	0.6	12.4	0.0
E691	VLPPG8	3990	306	0	5.1	5.1	5.1	5.1	10.0	10.0	0.5	9.5	0.0
1201	VLPPG5	3990	330	0	3.7	3.7	5.5	5.5	6.7	6.7	0.5	6.2	0.0
1202	VLPPG6	3990	314	0	3.6	3.6	5.2	5.2	6.9	6.9	0.5	6.4	0.0
1203	VLPPG3	3990	311	0	3.5	3.5	5.2	5.2	6.7	6.7	0.5	6.2	0
1334	VLPPG2	3990	332	0	3.3	3.3	5.5	5.5	6.0	6.0	0.5	5.5	0
1E07	VLS005	3990	426	0	2.5	2.5	7.1	7.1	3.5	3.5	0.5	1.4	1.7
1E08	VLS006	3990	116	0	1.6	1.6	1.9	1.9	8.3	8.3	0.6	4.5	3.2
End Top DASD by Device busy													
1CCC	Control Unit		1121	0	0.1	0.1	18.7	18.7	5.9	5.9	0.5	5.4	0.0
1DCC	Control Unit		2183	0	0.2	0.2	36.4	36.4	4.8	4.8	0.5	2.6	1.7
1FCB	Control Unit		923	0	0.1	0.1	15.4	15.4	3.3	3.3	0.5	1.4	1.4
20CB	Control Unit		311	0	0.0	0.0	5.2	5.2	1.6	1.6	0.5	0.1	1.0
21CB	Control Unit		3003	0	0.3	0.3	50.0	50.0	4.7	4.7	0.5	2.0	2.2
CE00	Control Unit		1506	0	0.1	0.1	25.1	25.1	4.9	4.9	0.6	3.1	1.2
E690	Control Unit		954	0	0.4	0.4	15.9	15.9	7.5	7.5	0.5	6.8	0.2
System:			12003	0	0.1	0.1	200.0	200.0	4.3	4.3	0.5	2.5	1.3

How to improve performance of top DASD?

High Connect time

- Check Channels

High Pend time

- Check IOP (I/Os per second)

High DISC time

- Check Cache

Check configuration:

- Channel paths
- Caching status

```
Report: ESADSD1      DASD Configuration Inc.       ESAMAP 3.4.0 01/25/04  Page 331
                                          03/25/03 21:17:00
Monitor period:         1260 seconds (    03/25/03 21:38:00
-------------------------------------------------------------------------------
 Dev Sys          Device    <CHPIDS OnLn> <--MDC Status--> <3990 Cache Status> PAV
 No. ID   Serial  Type   SHR 01 02 03 04  Elig Def Now Shr Actv DFW NVS STGID  Base
---- ---- ------ ------ --- -- -- -- --  ---- --- --- --- ---- --- --- -----  ----
2214 2214 VLS049 3990   NO  B5 B6 B7 C5   Yes  On  On  No  Yes  On  On  2F00     .
                           C6 C7
2215 2215 VLS050 3990   NO  B5 B6 B7 C5   Yes  On  On  No   .   .   .     .
                           C6 C7
2216 2216 VLS051 3990   NO  B5 B6 B7 C5   Yes  On  On  No   .   .   .     .
                           C6 C7
2217 2217 VLS052 3990   NO  B5 B6 B7 C5   Yes  On  On  No   .   .   .     .
                           C6 C7
2218 2218 VLS053 3990   NO  B5 B6 B7 C5   Yes  On  On  No  Yes  On  On  2F00     .
                           C6 C7
2219 2219 VLS054 3990   NO  B5 B6 B7 C5   Yes  On  On  No   .   .   .     .
                           C6 C7
```

SAP Case Study

Report: **ESACHAN** Channel Performance Analysis Veloci First

Time/ CHPID	<Pct Channel> Utilization LPAR	Total	Shrd	Chanl Type	<---Reads/Second--> LPAR	TOTAL	Pct	Max	<--Writes/Second--> LPAR	TOTAL	pct	MAX
21:19:00												
15	0.1	13.8	Yes	FICON	24	4610	3.9	117K	39	5172	4.4	117K
16	0.1	13.9	Yes	FICON	32	4759	4.1	117K	38	4889	4.2	117K
17	0.1	13.8	Yes	FICON	29	4476	3.8	117K	36	4961	4.2	117K
1F	.	96.7	Yes	ESCON								
35	0.1	14.1	Yes	FICON	29	4842	4.1	117K	39	4845	4.1	117K
36	0.1	13.9	Yes	FICON	23	4839	4.1	117K	26	5147	4.4	117K
37	0.1	13.9	Yes	FICON	23	4861	4.1	117K	47	5234	4.5	117K
3F	**.**	**85.0**	**Yes**	**ESCON**								
9F	**.**	**90.0**	**Yes**	**ESCON**								
B5	**1.0**	**1.1**	**Yes**	**FICON**	**273**	**274**	**0.2**	**117K**	**73**	**74**	**0.1**	**117K**
B6	**1.0**	**1.1**	**Yes**	**FICON**	**266**	**266**	**0.2**	**117K**	**72**	**72**	**0.1**	**117K**
B7	**1.0**	**1.1**	**Yes**	**FICON**	**260**	**260**	**0.2**	**117K**	**82**	**82**	**0.1**	**117K**
C5	**1.1**	**1.1**	**Yes**	**FICON**	**292**	**292**	**0.2**	**117K**	**81**	**81**	**0.1**	**117K**
C6	**1.1**	**1.1**	**Yes**	**FICON**	**278**	**278**	**0.2**	**117K**	**85**	**85**	**0.1**	**117K**
C7	**1.0**	**1.0**	**Yes**	**FICON**	**269**	**269**	**0.2**	**117K**	**81**	**81**	**0.1**	**117K**
D5	.	19.3	Yes	FICON	0	5143	4.4	117K	0	10296	8.8	117K
DF	.	81.7	Yes	ESCON								
E5	.	16.7	Yes	ESCON								
E7	.	15.0	Yes	ESCON								
E8	.	26.7	Yes	ESCON								
System:	14.6	603.2										

Check channel path busy:

- FICON channel paths
- Percent busy is ok
- The busy channels don’t belong to us
- Are they impacting the IOP?

SAP Case Study

Report: **ESAIOP** I/O Processor Analysis Velocity Softwa
First record an

Time	I/O Proc Nmbr	<Pct Util> Busy	Idle	<Rate/Second> SSCH	Intrpts	<-Percent of Strts busy-> chan	switch	CtlUnit	Device
21:18:00	0	81.1	18.9	2387	2038	2152	17.1	0.4	0.9
	1	76.9	23.1	2670	3417	1379	6.7	0.3	0.1
	2	76.7	23.3	1664	3121	2520	0.7	0.4	0.4
21:19:00	0	60.8	39.2	1990	1763	1888	12.3	0.3	1.7
	1	50.5	49.5	2241	2914	846	7.5	0.2	0.2
	2	50.8	49.2	1547	2754	1962	0.8	0.2	0.3
21:20:00	0	55.6	44.4	2885	2564	1081	12.3	0.1	1.7
	1	42.6	57.4	3106	3851	527	3.9	0.1	0.1
	2	39.1	60.9	1787	2957	1089	0.6	0.2	0.3

Check channel processor (SAP):

- Processors are very busy
- Lots of I/O Starts because of the channel busy
- Probably not impacting our data
- Other LPARs need more IOP power

SAP Case Study

```
Report: ESADSD5       3990-3 Cache Analysis
-----------------------------------------------------
             Pct. <-------------------per second------
 Dev         Actv <------Total-------> <----Read---->
 No.  Serial Samp  I/O Hits Hit% Read%  I/O Hits Hit%
---- ------ ---- ---- ---- ---- ----- ---- ---- ----
21:19:00
***Top DASD by Device busy***
2218  VLS053  100 12.2  2.0 16.6  86.1 10.5  0.3  3.2
E690  VLPPG7  100  6.1  2.9 47.5  75.7  4.6  1.4 30.7
CE00  VLPPG1  100  5.7  4.6 80.9  65.3  3.7  2.6 70.7
E691  VLPPG8  100  8.0  4.1 51.6  67.2  5.4  1.5 28.2
1201  VLPPG5  100  5.9  3.3 56.0  63.6  3.7  1.1 30.8
1202  VLPPG6  100  5.6  3.4 59.6  59.0  3.3  1.1 32.5
1203  VLPPG3  100  3.9  2.0 51.9  72.1  2.8  0.9 33.3
1334  VLPPG2  100  5.6  3.4 60.8  61.4  3.5  1.2 36.1
1E07  VLS005  100 10.5  8.3 79.0  24.5  2.6  0.4 14.3
1E08  VLS006  100  2.1  0.6 29.0  90.3  1.9  0.4 21.4
***End Top DASD by Device busy***
```

Check caching status:

- High read percent and low read hit – probably backups running?
- Page device – read percent about 65%, low hit percent
- Evaluate cache controller technology – “writes” do not enter cache
- Should reduce load on paging devices too…

Linux Logical Volume Manager

Two reasons for using LVM:

- I/O performance
- Large files

I/O Performance:

- Stripe volumes
- May not add volume/space to LVM

Large Files:

- May add volume/space if not striped
- All new writes go to the new volume
- Bad performance

FCP/SCSI

FCP eliminates 390 I/O CKD translation

Less processing to be done

- But done in the CPU, not in the IOP/SAP

Reportedly faster than FICON

Reportedly lower bandwidth than FICON

No way to effectively measure response times?

Linux I/O Analysis

Report: **ESASEEK** DASD Seeks Analysis Veloc
Monitor period: 1320 seconds (22:00) Last

Dev No.	Serial	Device Type	Ownerid /userid	Mdsk Addr	<Cylinder> Start	Stop	Total Seeks	<---Non-zero---> Seeks	Pct.	Dist.	Read Pct.
0491	VMR408	3990	Volume:	.	0	.	2644	1587	60.0	342	41.8
			LNX0036	0292	51	2963	708	549	77.5	640	0
			LNX0036				708	549	77.5	640	0
			LNX0036	0293	3140	3173	1936	1038	53.6	184	57.0
			LNX0036				1936	1038	53.6	184	57.0
			cylinders	.	0	99	30	24	80.0	2379	0
			cylinders	.	200	299	24	24	100	1882	0
			cylinders	.	400	499	26	14	53.8	812	0
			cylinders	.	700	799	46	36	78.3	866	0
			cylinders	.	900	999	30	29	96.7	402	0
			cylinders	.	1100	1199	**107**	58	54.2	504	0
			cylinders	.	1300	1399	28	27	96.4	311	0
			cylinders	.	1500	1599	61	50	82.0	782	0
			cylinders	.	1600	1699	**102**	92	90.2	340	0
			cylinders	.	1700	1799	22	22	100	447	0
			cylinders	.	1800	1899	47	45	95.7	749	0
			cylinders	.	2000	2099	61	32	52.5	515	0
			cylinders	.	2200	2299	57	29	50.9	294	0
			cylinders	.	2400	2499	23	23	100	207	0
			cylinders	.	2700	2799	24	24	100	365	0
			cylinders	.	2900	2999	20	20	100	247	0
			cylinders	.	3100	3199	1936	1038	53.6	184	57.0
System:							6719	4277	63.7	606	17.9

Seeks are not optimized in Linux

Most I/O is write I/O

Analyzing Linux Disks

Report: **ESAUSEK** User DASD Seeks Report

Userid /Time	Dev No.	Volume Serial	<--Minidisk-> Ownerid	Addr	<Cylinder> Start	Stop	Total Seeks
21:02:00							
LINUX2	01E7	LX0200	LINUX2	0200	1	3326	107
LINUX4	01BB	LX0407	LINUX4	0206	6	2982	82
	01A9	LX0401	LINUX4	0200	1	2265	61
	01B7	LX0403	LINUX4	0202	3180	3180	1
LINUX5	01C0	LX0501	LINUX5	0200	1365	1365	2
ESAWRITE	022D	ESALPS	ESAWRITE	0191	51	186	21

Analyzing Linux Disks

Dev No.	Serial	Device Type	Ownerid /userid	Mdsk Addr	<Cylinder> Start	Stop	Total Seeks	<---Non-zero---> Seeks	Pct.	Dist.	**Read Pct.**
21:02:00											
01E7	LX0200	3990	Volume:	.	0	.	107	84	78.5	1514	0
			LINUX2	0200	1	3326	107	84	78.5	1514	0
			LINUX2				107	84	78.5	1514	0
			cylinders	.	0	9	12	12	100	2831	0
			cylinders	.	10	19	24	12	50.0	2369	0
			cylinders	.	40	49	12	12	100	31	0
			cylinders	.	540	549	1	1	100	542	0
			cylinders	.	550	559	1	1	100	555	0
			cylinders	.	1720	1729	2	2	100	1719	0
			cylinders	.	1890	1899	2	2	100	948	0
			cylinders	.	2360	2369	12	12	100	1873	0
			cylinders	.	2490	2499	12	12	100	1870	0
			cylinders	.	2800	2809	1	1	100	2762	0
			cylinders	.	2910	2919	4	4	100	339	0
			cylinders	.	3060	3069	2	2	100	1791	0
			cylinders	.	3070	3079	18	7	38.9	610	0
			cylinders	.	3220	3229	1	1	100	309	0
			cylinders	.	3240	3249	2	2	100	333	0
			cylinders	.	3320	3329	1	1	100	104	0

Analyzing Linux Disks

```
Report: ESADSD5       3990-3 Cache Analysis
-------------------------------------------------------
             Pct. <-------------------per second------
 Dev         Actv <------Total-------> <-----Read---->
 No.  Serial Samp  I/O Hits Hit% Read%  I/O Hits Hit%
----  ------ ---- ---- ---- ---- ----- ---- ---- ----
21:02:00
***Top DASD by Device busy***
01E7  LX0200  100  1.8  1.8  100     0    0    0    0
01BB  LX0407  100  1.4  1.4  100     0    0    0    0
022D  ESALPS  100  0.7  0.7  100   5.0  0.0  0.0  100
01A9  LX0401  100  1.0  1.0  100     0    0    0    0
***End Top DASD by Device busy***

2000 CtlUnit  100  2.4  2.4  100     0    0    0    0
01E6 CtlUnit  100  1.8  1.8  100     0    0    0    0
2200 CtlUnit  100  0.7  0.7  100   5.0  0.0  0.0  100
----  ------ ---- ---- ---- ---- ----- ---- ---- ----
System:       100  4.9  4.9  100   0.7  0.0  0.0  100
```

0 Percent reads at the DASD cache level

Analyzing Linux Disks

Report: **ESAUSR3** User Resource Uti

UserID /Class	DASD I/O	DASD Block I/O	**MDisk Cache Hits**	Virt Disk I/O	Cache Hit Pct
21:02:00	289	0	13	0	4.5
User Class Analysis					
*Servers	35	0	12	0	34.3
*LINUX	254	0	1	0	0.4
Top User Analysis					
LINUX2	107	0	0	0	0
LINUX4	145	0	1	0	0.7
LINUX5	2	0	0	0	0
ESATCP	0	0	0	0	0
ESAWRITE	35	0	12	0	34.3

0 Percent MDC reads at the cache level

Linux I/O Problem? Turn off MDC?

```
Screen: ESADSD2  xxxxxxxxxxxxxxxxx                ESAMON V2.2  05/04 11:14-1
          Dev         Device %Dev <SSCH/sec-> <-----Response times (ms)--->
Time      No. Serial  Type   Busy   avg  peak  Resp  Serv  Pend  Disc  Conn
-------- *--- ------ ------ ---- *---- ----- ----- ----- ----- ----- -----
11:16:23 1007 LIN501 3390-3 80.8  31.0  31.0  26.1  26.1   0.2  15.1  10.8
         1008 LIN502 3390-3 98.7  36.1  36.1  27.3  27.3   0.2  16.1  11.0
         1009 LIN503 3390-3 45.5  18.9  18.9  24.1  24.1   0.2  13.4  10.5
11:17:23 1008 LIN502 3390-3 96.8  36.3  36.3  26.7  26.7   0.2  15.6  10.9
11:18:23 1008 LIN502 3390-3 99.2  37.1  37.1  26.8  26.8   0.2  15.7  10.8
11:19:23 1008 LIN502 3390-3 98.5  37.5  37.5  26.2  26.2   0.2  15.3  10.7
11:20:23 1007 LIN501 3390-3 28.8  13.4  13.4  22.7  21.5   0.2  12.1   9.1
         1008 LIN502 3390-3 41.7  17.0  17.0  24.5  24.5   0.2  14.0  10.3
11:30:23 1007 LIN501 3390-3 26.7  10.7  10.7  24.9  24.9   0.3  14.3  10.3 ==> MDC OFF
11:31:23 1007 LIN501 3390-3  8.0   5.2   5.2  15.3  15.3   0.2   3.5  11.5
         1008 LIN502 3390-3 10.7  20.6  20.6   5.2   5.2   0.2   1.3   3.6
12:00:23 1007 LIN501 3390-3 35.1 114.8 114.8   3.1   3.1   0.2   0.1   2.7
         1008 LIN502 3390-3 21.6  64.8  64.8   3.3   3.3   0.2   0.3   2.8
         1009 LIN503 3390-3 22.4  37.7  37.7   5.9   5.9   0.2   0.1   5.6
12:01:23 1007 LIN501 3390-3  4.5  13.0  13.0   3.5   3.5   0.2   0.7   2.6
         1008 LIN502 3390-3 35.6 160.0 160.0   2.2   2.2   0.2   0.1   1.9
12:06:23 1007 LIN501 3390-3  9.4  10.9  10.9   8.6   8.6   0.2   0.3   8.2
12:41:23 1007 LIN501 3390-3 24.3  20.3  20.3  12.0  12.0   0.2   1.4  10.4 ==> MDC ON
12:42:23 1007 LIN501 3390-3 61.0  47.1  47.1  13.0  13.0   0.2   1.8  10.9
         1008 LIN502 3390-3 81.8  65.2  65.2  12.5  12.5   0.2   1.3  11.0
         1009 LIN503 3390-3 30.0  27.0  27.0  11.1  11.1   0.2   0.3  10.7
12:43:23 1008 LIN502 3390-3 95.9  74.1  74.1  12.9  12.9   0.2   1.9  10.9
12:44:23 1008 LIN502 3390-3 34.8  27.3  27.3  13.4  12.7   0.2   2.0  10.6
```

If a backup, then MDC "reads ahead"

If a database, random 4k I/O, MDC wastes bandwidth

Basis for recommending "MDC OFF" by IBM

Linux I/O Problem? Turn off MDC?

Linux chains up to 128/1024 I/O

- Overflows the DASD non-volatile cache

MDC: Minidisk cache defaults to Track Level caching

- Read in one track for every read
- Linux writes 4k blocks, not synchronous
- Long connect times

MDC: Minidisk cache Block Level caching CAN BE USED!!!

- Requires diagnose I/O driver
- Reads one block per I/O

Watch MDC hits per device and per server

Linux I/O Options

DASD Cache: Choose a DASD cache algorithm

- tunedasd --get_cache - to get caching behavior
- tunedasd --cache sequential | normal | prestage | record | bypass
- io scheduler – noop or none for oracle…

DASD Drivers

- Diagnose – designed to assist virtualized environments
  - Proven more efficient
  - Allows MDC Record Level caching
- Non-Diagnose
  - Default

SCSI Devices

SCSI I/O is not instrumented as is ECKD

- Monitor data for FBA emulated devices
- Performance is measured by each Linux

QDIO

- Eliminates hardware interrupts
- Used for FCP, HiperSockets, FICON

ESAQDIO

- Provides traffic by user
- QDIO – Network traffic (if CP maintains Shadow Queues)
  - TCPIP uses DIAG98, no Shadow Queues and no QDIO monitor record
- FCP – Fiber Channel network
- HPER - HiperSockets

SCSI Device Analysis - ESAQDIO

Provides traffic by user:

- Virtual Device Number – is used to get to the channel
- QDIO Formats – FCP, HiperSockets, QDIO
- QDIO Instruction Rate
- QDIO Traffic

```
Report: ESAQDIO      Queued I/O Report                              Linux Test    ESAMAP 3.6.2 10/19/06  Page 233
Monitor initialized: 10/09/06 at 08:00:00 on 2096 serial 29EBD     First record analyzed: 10/09/06 08:00:00
-------------------------------------------------------------------------------------------------------------------
                                  Number <QDIO SIGA Instructions/Sec-> <-Throughtput / sec-> <--PCI Interupts--->
Date/    Dev.          Virt QDIO Queues <---Guest----> <----CP------> <Buffers> <--Bytes-->       Cause
Time     Nmbr owner    DevN Fmt  In Out Read Writ "s"  Read Writ "s"  Sent From  Sent  From Count Input Complete
-------- ---- -------- ---- ---- -- --- ---- ---- ---- ---- ---- ---- ---- ---- ----- ----- ----- ----- --------
08:15:00 0000 Totals   0000 QDIO  0   0    0  237  928    0  393    0  678  404   20M  297K     7     7        0
         0800 TSMSERV  0800  FCP  1   1    0    0   46    0   15    0   73   15 3843K     0     0     0        0
         0801 TSMSERV  0801  FCP  1   1    0    0    0    0    0    0    0    0   94      0     0     0        0
         0802 TSMSERV  0802  FCP  1   1    0    0   44    0   14    0   71   14 3733K     0     0     0        0
         0C11 SAP000   0C05 HPER  1   4    0   55  109    0   55    0   55   55 17907 35100     0     0        0
         0C14 SAP010   0C05 HPER  1   4    0   95  184    0   95    0   95   97 34264  107K     0     0        0
         3D02 TCPVSWC1 3D02 QDIO  1   1    0    0    0    0    6    0    7    7  9533  1430     7     7        0
         3D02 TCPVSWC1 3D02 QDIO  1   1    0    0    0    0    6    0    7    7  9533  1430     7     7        0
```

SCSI Device Analysis – ESADEV1

Provides configuration:

- Device Number – gives Channel Path ID (CHPID)
- Device Owner (dedicated to UserID) same as ESAQDIO
- Hipersocket devices are on Channel Path FC-FF

```
Report: ESADEV1       Device Configuration (non-DASD)
-------------------------------------------------------------------
 Dev       Device <CHPIDs OnLn> OBR <-Cntrl Unit-> UserID
 No. SysID Type   01 02 03 04   Code Code Model    (if ded)
---- ----- ------ -- -- -- --   ---- ---- -------  --------
0800 0002  1732-3 33 .  .  .     00   00  1731-3   TSMSERV
0801 0003  1732-3 33 .  .  .     00   00  1731-3   TSMSERV
0802 0004  1732-3 33 .  .  .     00   00  1731-3   TSMSERV

0C11 0021  1732-5 FF .  .  .     00   00  1731-5   SAP000
0C12 0022  1732-5 FF .  .  .     00   00  1731-5   SAP010
0C13 0023  1732-5 FF .  .  .     00   00  1731-5   SAP010
0C14 0024  1732-5 FF .  .  .     00   00  1731-5   SAP010
0C15 0025  1732-5 FF .  .  .     00   00  1731-5   SAP015
```

SCSI Device Analysis - ESACHAN

Provides:

- Start with “channel busy”
- Maximum value of Read, Write and BUS

```
Report: ESACHAN      Channel Performance Analysis     Linux Test                    ESAMAP 3.6.2 10/19/06  Page 210
Monitor initialized: 10/09/06 at 08:00:00 on 2096 serial 29EBD     First record analyzed: 10/09/06 08:00:00
-------------------------------------------------------------------------------------------------------------------
        <Pct Channel>            <---------------Data Units ------------>  <----Work Unit---->  <-Bus Cycles>  Bytes
Time/    Utilization      Chanl  <---Reads/Second-->  <--Writes/Second-->  <-Rates / Second-->  <-per Second>  /Data
CHPID    LPAR Total  Shrd Type   LPAR TOTAL Pct  Max  LPAR TOTAL pct  MAX  LPAR TOTAL Pct  MAX  Used pct  Max   Unit
-------- ---- -----  ---- -----  ---- ----- --- ----  ---- ----- --- ----  ---- ----- --- ----  ---- --- ----  -----
08:15:00
14        0.2   7.6   Yes FICON    37  3617 1.9 195K   198  1800 0.9 195K   285  9444 7.6 125K  1226 1.1 109K   1024
16        0.2   7.5   Yes FICON    35  3622 1.9 195K   188  1780 0.9 195K   284  9420 7.5 125K  1223 1.1 109K   1024
31          .   0.3   Yes FICON     0     0   0 123K     0     0   0 123K     0    19 0.3 7291     0   0 7291   2048
33        0.3   0.4   Yes FICON    10    10 0.0 123K  3948  3948 3.2 123K    21    30 0.4 7291    72 1.0 7291   2048
35        0.3   0.4   Yes FICON  2671  2671 2.2 123K    28    28 0.0 123K    21    29 0.4 7291    38 0.5 7291   2048
37          .   0.3   Yes FICON     0     0   0 123K     0     0   0 123K     0    19 0.3 7291     0   0 7291   2048
39        0.3   0.4   Yes FICON  2670  2670 2.2 123K    30    30 0.0 123K    23    30 0.4 7291    39 0.5 7291   2048
3B        0.1   0.3   Yes FICON     2     2 0.0 123K   785   785 0.6 123K     6    25 0.3 7291    14 0.2 7291   2048
-------- ---- -----
System:   1.9  36.4
```

SCSI Device Data

ESAQDIO – show rates, device number:

Date/ Time	Dev. Nmbr	owner	Virt DevN	QDIO Fmt	Number Queues In	Out	<QDIO SIGA Instructions/Sec-> <---Guest----> Read	Writ	"s"	<----CP------> Read	Writ	"s"	<-Throughtput / sec-> <Buffers> Sent	From	<--Bytes--> Sent	From	<--PCI Interrupts--> Cause Count	Input	Complete
08:15:00	0000	Totals	0000	QDIO	0	0	0	237	928	0	393	0	678	404	20M	297K	7	7	0
	0800	**TSMSERV**	**0800**	**FCP**	1	1	0	0	46	0	15	0	73	15	3843K	0	0	0	0
	0802	TSMSERV	0802	FCP	1	1	0	0	44	0	14	0	71	14	3733K	0	0	0	0
	0C14	SAP010	0C05	HPER	1	4	0	95	184	0	95	0	95	97	34264	107K	0	0	0

ESADEV1 – Shows channel path ID

Dev No.	SysID	Device Type	<CHPIDs OnLn> 01	02	03	04	OBR Code	Code	<-Cntrl Unit-> Model	UserID (if ded)
0800	**0002**	**1732-3 33**	.	.	.		00	00	1731-3	TSMSERV
0801	0003	1732-3 33	.	.	.		00	00	1731-3	TSMSERV
0802	0004	1732-3 33	.	.	.		00	00	1731-3	TSMSERV

ESACHAN – Shows channel path utilizations

Time/ CHPID	<Pct Channel> Utilization LPAR	Total	Chanl Shrd	Type	<---------------Data Units ------------> <---Reads/Second--> LPAR	TOTAL	Pct	Max	<--Writes/Second--> LPAR	TOTAL	pct	MAX	<----Work Unit----> <Rates / Second--> LPAR	TOTAL	Pct	MAX	<-Bus Cycles> <-per Second> Used	pct	Max	Bytes /Data Unit
08:15:00																				
33	0.3	0.4	Yes	FICON	10	10	0.0	123K	3948	3948	3.2	123K	21	30	0.4	7291	72	1.0	7291	2048
35	0.3	0.4	Yes	FICON	2671	2671	2.2	123K	28	28	0.0	123K	21	29	0.4	7291	38	0.5	7291	2048
System:	1.9	36.4																		

DASD Guidelines

Spread the load

- Across multiple channels and ranks
- Across devices
- Across internal SAP paths

Define many smaller devices (3390-3), not few larger devices (3390-9)

FICON can help

Reduce seek time

Utilize DASD cache

Utilize MDC

Block up

SET IOPRIORITY if queueing

SET SRM DSPSLICE 1 to favor I/O workloads