DASD Reports and Analysis

DASD I/O Overview

Modeling DASD, Historical Perspective

Cache Controllers

Tuning MDC

Tuning DASD Cache

Seek Analysis

OSA Analysis

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DASD Subsystem Reports

DASD

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

DASD Cache

- ESADSDC – DASD Cache configuration
- ESADSD5 – DASD Cache performance

Channels

- ESACHNC – Channel configuration
- ESACHAN – Channel Performance
- ESACHNH – Hypersockets
- ESAQDIO,ESAQDIO2 – Queued I/O analysis
- ESAIOP – I/O Processor (SAP)

Seek Analysis

- ESASEEK – Seeks by minidisk
- ESAUSEK – Seeks by user

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ESADSD1 show configuration, known information

```
Report: ESADSD1      DASD Configuration                                  Linux Test
Monitor initialized: 05/06/08 at 12:00:00 on 2094 serial AEA7D           First record analyze
Monitor period:         3600 seconds (   1:00:00)                        Last record:
-------------------------------------------------------------------------------------------
 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

 Report: ESADSD1      DASD Configuration            ESAMAP 3.7.4 06/06/08  Pg  2815
 Monitor initialized: 05/06/08 at 12:00:0ed: 05/06/08 12:00:00
 Monitor period:         3600 seconds (      05/06/08 13:00:00
 ------------------------------------------------------------------------------
  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
 ---- ---- ------ ------ --- -- -- -- --  . ---- --- --- --- ---- --- --- -----  ----
 C557 6177 LNXP5F 3390-9 YES 48 49 76 87  .  Yes Off   . Yes  Yes  On  On  9C50
                            95 96 D6 5A  .
 C558 6178 LNXP55 3390-9 YES 48 49 76 87  .  Yes Off   . Yes  Yes  On  On  9C50 .
                            95 96 D6 5A  .
```

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ESADSD2 provides

- **Interval top dasd**
- **Interval control unit**
- **Summary - everything**

```
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
```

ESADSD5 provides cache statistics

- **Read/Hit depends on cache size and locality of reference**
- **Write/Hit depends on NVS (Persistent Memory)**
- **NVS Full, Cache Inhibit, Cache Bypass are 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
------------------------------------------------------------------------------------------------------------------
```

Disk Performance history

Assumptions and rules of thumb based on technology:

DASD Assumptions on what is “good”:

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

DASD Cached Assumptions

- 3880-23 (1982), 3380: 15ms
- 3390-1 (1988), 3390, gray cable: 10ms
- 3390-3 (1995), ESCON: 5ms
- 3390-9 (2001), FICON: 2ms
- “3390” (2009) sub 1ms

FCP only “Recently measurable”

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The “Top DASD”

Note change in response time, explain?

```
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
F3A7 VS2PAC 3390-3    600   0   9.7  9.7  10.2  10.2   9.5   9.5  0.3  0.0  9.2
***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
F5A8 VS2PB6 3390-3    322   0  38.5 38.5   5.5   5.5  70.5  70.5  0.3 57.9 12.4
F795 VS2P56 3390-3    325   0  37.5 37.5   5.5   5.5  68.0  68.1  0.3 52.7 15.0
***End Top DASD by Device busy***
```

ECKD DASD I/O Components

PEND Time

- CPU Channel Connection
- Protocol

Disconnect Time

- Rotational Delay
- Seek time
- (Internal controller contention)

Connect Time

- Transmission time

Queue Time

- Control Unit
- Device
- Throttle

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Model: Response Time

DASD Response Time

= Service time + Queue Time

DASD Service Time

= (Pend + DISC + CONN)

Device Busy = rate * service time

DASD Response Time (queuing theory: MM1)

= (Service time) / (1 – Device Busy)

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Service Time

= (Pend + DISC + CONN)

DISCONNECT Time

= (Rotational Delay + Seek + RPS Miss + Internal contention)

Connect Time

= DataSize / DataRate (On ESCON and prior)

Ficon is different.

Pend

= Protocol / (1 - Channel Utilization)

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Model: Disconnect Time

DISCONNECT Time

= (Rotational Delay + Seek + RPS Miss)

Rotational Delay = ½ Rotation on average

Seek (3380) is 7ms on Average, Tuneable

RPS Miss

= Rotation * misses

= Rotation / (1 – Channel Utilization) – Rotation

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DASD I/O Enhancements (History Lesson)

Cache (Reduce disconnect time)

- Read only (3880-23, 1980)
- Write with non-volatile cache (8mb, 1985)
- Large Write cache (GB, 1990)
- On board cache (device level)
- MDC
- RAID

Channels (Reduce connect time)

- VM/XA Multiple Channels
- Grey Cables, 3390 (4.5mb/sec)
- XA Channels
- Escon (17mb/sec, 1995)
- Ficon (110mb/sec, 2003)
- Ficon Express (200/400 mb/sec) 2005/2007

PAV (z/VM 5.2) – Reduce queue time

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Model: RPS Miss, XA

VM/XA allowed multiple channels to access same device, reconnect on non busy channel

If 1st channel busy, try 2nd, and so on

Architecture supports up to 16 channels

Four channels should be considered minimum

Some controllers (IBM 6800) do not support dynamic reconnect

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Why do you care about channel utilization????

RPS Miss (3380, XA)

- 17ms * (1 / (1 – ChanUtil*ChanUtil))

RPS Miss Times – 20% Channel Util

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

Utilization can be higher when more channels

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

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Model: RPS Miss, Cache

Cache reduces “Hardware” DISConnect Time

DISConnect (non-cache)

= (Rotational Delay + Seek + RPS Miss)

DISConnect (cache)

= (Rotational Delay + Seek + RPS Miss)
* (CacheMiss / CacheTotal)

Rotational Delay + Seek with cache

= (17ms / 2 + 7ms) * (CacheMiss / CacheTotal)

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DASD I/O Characteristics

Block sizes vary and impact assumptions

- 4K I/O
- MDC does full track I/O
- Linux does 4k I/O
- Linux can chain 1024 I/O

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Storage “Control Units”

- Raid
- Storage Processors
- Multiple Internal Paths
- Logical Volumes vs Physical Volumes

PAV (2000)

- Z/OS Guest
- Linux Guest, dedicated devices

Linux

- LVM

Subchannel Measurement Block

- Pend
- Connect
- Disc

Seek Analysis

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

Channels

- VM Sample
- FICON

Channel Measurements

Old Style

- Sampled by CP
- Measured by Channel

Utilization Sampled at Hifrequency rate, example is 6 second sample

LPAR is total for all LPARs, measured.

```
Report: ESACHAN      Chann
Monitor initialized: 01/11
--------------------------
        <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
```

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New Style (z/VM 3.1)

- Sampled by CP (TOTAL)
- Measured by Channel (LPAR)
- What is Channel Utilization?
- (EMIF)

```
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
A8        4.5  17.8   Yes ESCON
B4       16.4  19.4   Yes ESCON
-------- ---- -----
```

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Channel Utilization not obvious

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

- Channel balancing takes planning

What is channel utilization?

- Sampled by CP
- Measured by Channel, data / second

```
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
F6          .   3.9   Yes FICON     0     0   0  82K      0     0   0  82K
F7          .   3.9   Yes FICON     0     0 0.0  82K      0     0   0  82K
--------  ----  -----  ----
System:   20.8  142.5
```

New Style

- Sampled by CP
- Measured by Channel, work per second
- What is Channel Utilization?

```
Report: ESACHAN      Channel Perest                    ESAMAP 3.3.0 Monitor
    initialized: 05/09/03 atecord analyzed: 05/09/03 10:54:03
-------------------------------------------------------------------------------
        <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
F6          .   3.9   Yes FICON      0   636 3.9  16K   2463  15  16K   1024
F7          .   3.9   Yes FICON      0   635 3.9  16K   2465  15  16K   1024
--------  ----  -----  ----
System:   20.8  142.5
```

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New Style

- Channels are defined

Report: ESACHAN Channel Performance Analysis Linux

Time/ CHPID	<Pct Channel> Utilization LPAR	Total	Shrd	Channel Class/Type	<---Reads/Second---> LPAR	TOTAL	Pct	Max	<--Writes/Sec 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

(<----------------Data Units -------)

Report: ESADSD1 DASD Configuration Linux test

Dev No.	Sys ID	Serial	Device Type	SHR	<CHPIDS 01	02	03	OnLn> 04	<-Cntrl OBR/CU	Unit-> Model	UserID (if ded)	MDisk Links	<----Extent 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							

New Channel reporting

- Specific channel type now reported:

```
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
```

VELOCITY SOFTWARE

Determine potential problems: Top dasd

What is caching characteristic? (no disc time?)

What could be done to enhance?

```
Report: ESADSD2    DASD Performance Analysis                Velocity Software,
Monitor initialized at 16:24:57 on 9021 serial 42105        First record analy
-------------------------------------------------------------------------------
                                                <--------DASD Response times (ms
 Dev          Device   <%DevBusy> <SSCH/sec->          <--Service times--> <--Qu
 No. Serial   Type       Avg  Peak   avg  peak  Resp  Serv Pend Disc Conn 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***
```

Evaluate cache controller configuration

Each controller has Device Address and Identifier

Size of cache, non-volatile cache 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  .
```

VELOCITY SOFTWARE

Cache Configuration

- NVS (Non-volatile store often 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   <Channell 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  .  .  .  .
```

VELOCITY SOFTWARE

Cache Performance

- Evaluate value of cache and why
- Read percent/Read cache
- Write percent/Write cache

```
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***
```

DASD Configuration Guidelines

Dedicate volumes for:

- Spool
- Paging
- Tdisk
- SFS File Pools
- Linux shared disk
- Linux LVM

VELOCITY SOFTWARE

Parallel Access Volumes: PAV

- Allows multiple real addresses to point to one volume
  - One device defined as Base address
  - Other addresses defined as Alternate
- ESADSD1 reports PAV Addressing
- ESADSDx reports combine data and report as base
  - Option to report all address separately
- Added to z/VM in release 5.1
- Linux support available, requires z/VM

VELOCITY SOFTWARE

```
Report: ESADSD1      DASD Configuration
-------------------------------------------------------------
 Dev Sys          Device    <CHPIDS OnLn><-Cntrl Unit->  PAV
 No. ID   Serial  Type   SHR 01 02 03 04 OBR/CU Model    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
```

Base address and parallel volume configuration shown on ESADSD1

VELOCITY SOFTWARE

Function has moved to Storage Processor

Internal architecture is important

Must often understand 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

How to improve performance of top DASD?

Connect time high

- Channels

Pend time

- IOP

DISC

- Cache

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

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
```

VELOCITY SOFTWARE

Check Channel path busy

- FICON Channel paths
- Percent busy ok
- The busy channels don't belong to us
- Are they impacting the IOP?

```
Report: ESACHAN      Channel Performance Analysis                    Veloci
                                                                     First
-------------------------------------------------------------------------------
        <Pct Channel>            <---------------Data Units ------------>
Time/    Utilization      Chanl  <---Reads/Second-->  <--Writes/Second-->
CHPID    LPAR Total  Shrd Type   LPAR TOTAL Pct  Max  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
```

VELOCITY SOFTWARE

Check Channel Processor (SAP)

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

```
Report: ESAIOP I/O Processor Analysis                    Velocity Softwa
                                                         First record an
-------------------------------------------------------------------------
          I/O  <-----------------I/O Processor-------------------->
          Proc <Pct Util> <Rate/Second>  <-Percent of Strts busy->
Time      Nmbr Busy  Idle  SSCH Intrpts  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 Caching status

- High read percent and low read hit: probably backup?
- 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….

```
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***
```

VELOCITY SOFTWARE

Two reasons for using LVM

- I/O Performance
- Large files

Performance:

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

Large files

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

VELOCITY SOFTWARE

FCP / SCSI

FCP eliminates 390 I/O CKD translation

Less processing to be done

- (but done in CPU, not the IOP/SAP)

Reportedly faster than FICON

Reportedly lower bandwidth than FICON

No way to effectively measure response times

VELOCITY SOFTWARE

Seeks are not optimized in Linux

Most I/O is write I/O

```
Report: ESASEEK      DASD Seeks Analysis                                Veloc
Monitor period:         1320 seconds (     22:00)                       Last
-------------------------------------------------------------------------------
 Dev        Device Ownerid  Mdsk <Cylinder> Total <---Non-zero---> Read
 No. Serial Type    /userid Addr Start Stop Seeks Seeks Pct. Dist. 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
```

```
Report: ESAUSEK      User DASD Seeks Report

-------------------------------------------------------
 Userid    Dev Volume <--Minidisk-> <Cylinder> Total
 /Time     No. Serial Ownerid  Addr Start Stop 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
```

VELOCITY SOFTWARE

Analyzing Linux Disks

Dev No.	Device Serial	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

VELOCITY SOFTWARE

0 Percent reads at DASD cache level, Linux caches everything?

```
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
```

VELOCITY SOFTWARE

0 Percent MDC reads at cache level

```
Report: ESAUSR3      User Resource Uti
---------------------------------------
                 DASD MDisk Virt Cache
UserID    DASD Block Cache Disk   Hit
/Class     I/O   I/O  Hits  I/O   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
```

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 backup, then MDC “reads ahead”,
if database, random 4k I/O, MDC wastes bandwidth

VELOCITY SOFTWARE

LINUX I/O Problem? Turn Off MDC???

Linux chains up to 128 / 1024 I/O

- Overflows the DASD Non-volatile cache

MDC: Minidisk cache Track Level Caching (Default)

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

Minidisk caching Block level

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

Watch MDC hits per device, per server

- Still research to do

VELOCITY SOFTWARE

DASD CACHE: choose dasd cache algorithm

- tunedasd --get_cache to get caching behaviour
- tunedasd --cache
  - sequential | normal | prestage | record | bypass

DASD Drivers

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

SCSI I/O is not instrumented as is ECKD

- Monitor data for FBA emulated devices

QDIO

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

ESAQDIO

- Provides traffic by user
- QDIO – Network traffic
- FCP – Fiber channel network
- HPER – HiperSockets

- “This record is emitted for only real QDIO devices for which z/VM CP is maintaining shadow queues. (If CP is not shadowing the queues, it doesn't see the I/O and therefore can't emit this record.) Typically Linux guests would use shadow queues but z/VM TCP/IP would not. z/VM TCP/IP drives its real QDIO devices using Diag X'98' and does not use shadow queues. “

ESAQDIO provides traffic by user

```
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
```

- Device Number - is used to get to get to channel
- QDIO Format – FCP, HiperSockets, QDIO
- QDIO Instruction rate
- QDIO traffic

VELOCITY SOFTWARE

ESADEV provides configuration

```
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
```

- Device Number – gives Channel Path ID
- Device owner (dedicated to userid) same as ESAQDIO
- Hipersocket devices are on Channel path ID FC-FF

VELOCITY SOFTWARE

ESACHAN

- No distinction on channel FICON vs FCP until z/VM 5.2
- What is device busy? Maximum value of (Read, Write, 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:

```
                                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
         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       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
```

ESACHAN – Shows channel path utilizations

```
       <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
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
```

Channel utilization on OSA is high, why?

```
Report: ESACHAN      Channel Performance
Monitor initialized: 06/10/19 at 00:00:0
---------------------------------------
        <Pct Channel>
Time/    Utilization          Channel
CHPID    LPAR Total  Shrd FCX Class/Type
-------- ---- -----  ---- --- ----------
00:15:11
78       18.1  18.1   Yes  No FCP  /FCP
7C       18.1  18.1   Yes  No FCP  /FCP
81        0.4  13.6   Yes  No OSA  /OSD
A1        2.3  16.1   Yes  No OSA  /OSD
DC       24.1  82.0   Yes  No OSA  /OSD
F8        5.8  18.8   Yes  No OSA  /OSD
-------- ---- -----
System:  79.4 189.1
---------------------------------------
00:30:11
78       18.4  18.4   Yes  No FCP  /FCP
7C       18.4  18.4   Yes  No FCP  /FCP
81        0.2  11.4   Yes  No OSA  /OSD
A1        3.0  14.0   Yes  No OSA  /OSD
DC       23.4  78.6   Yes  No OSA  /OSD
F8        3.5  12.4   Yes  No OSA  /OSD
-------- ---- -----
System:  74.8 166.1
---------------------------------------
00:45:11
78       18.5  18.5   Yes  No FCP  /FCP
7C       18.5  18.5   Yes  No FCP  /FCP
81        0.1  10.4   Yes  No OSA  /OSD
A1        2.7  13.0   Yes  No OSA  /OSD
DC       26.9  90.1   Yes  No OSA  /OSD
F8        3.0  11.3   Yes  No OSA  /OSD
-------- ---- -----
System:  76.3 170.3
```

What do we know?

- **OSA**
- **Virtual switch**
- **QDIO**

- **Channel is “90% BUSY”**

VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

```
Report: ESACHAN      Channel Performance Analysis                    CENTERS FOR
Monitor initialized: 06/10/19 at 00:00:00 on 2964 serial 13C7B7      First record
-------------------------------------------------------------------------------
        <Pct Channel>                        <----------------Data Units ----------
Time/    Utilization          Channel       <---Reads/Second--->  <--Writes/Second
CHPID    LPAR Total  Shrd FCX Class/Type LPAR  TOTAL Pct  Max   LPAR  TOTAL pct
-------- ---- -----  ---- --- ---------- ----- ----- --- ----   ----- ----- ---
-------------------------------------------------------------------------------
00:45:11
78       18.5  18.5   Yes  No FCP  /FCP    579 2210K 135   2M     670 3416K 208
7C       18.5  18.5   Yes  No FCP  /FCP    579 2209K 135   2M     670 3411K 208
81        0.1  10.4   Yes  No OSA  /OSD      0     2 0.0 128K       0     0   0
A1        2.7  13.0   Yes  No OSA  /OSD    120   433 0.3 128K      68   356 0.3
DC       26.9  90.1   Yes  No OSA  /OSD    164  3313 2.6 128K    3032  252K 197
F8        3.0  11.3   Yes  No OSA  /OSD     54   211 0.2 128K     205   560 0.4
-------- ---- -----
System:  76.3 170.3
```

Channel wire utilization

- **Utilization is rate / max**
- **As defined in monitor**
- **Note – this lpar is 27%....**

VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

```
Report: ESACHAN
Monitor initialized
------------------------------------------------------------------
        <Pct Channel>  <-----Work Unit---->  <-Bus Cycles>  Bytes
Time/    Utilization   <--Rates / Second-->  <-per Second>  /Data
CHPID    LPAR Total    LPAR  TOTAL Pct  MAX  Used pct  Max   Unit
-------- ---- -----    ----- ----- --- ----  ---- --- ----  -----
------------------------------------------------------------------
00:45:11
78       18.5  18.5      678  1381  19 7453  1381  19 7453   2048
7C       18.5  18.5      677  1378  18 7453  1378  18 7453   2048
81        0.1  10.4        0   746  10 7204     9 0.1 7204   2048
A1        2.7  13.0      195   933  13 7204     8 0.1 7204   2048
DC       26.9  90.1       89  6492  90 7204  1940  27 7204   2048
F8        3.0  11.3      216   815  11 7204    10 0.1 7204   2048
-------- ---- -----
System:  76.3 170.3
```

Channel utilization

- **OSA**
- **Virtual switch**
- **QDIO**

VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

```
Report: ESADEV1       Device Configuration (non-DASD)
Monitor initialized: 06/10/19 at 00:00:00 on 2964 serial 13
Monitor period:        86400 seconds (  24:00:00)
-------------------------------------------------------------
 Dev       Device <CHPIDs OnLn> OBR <-Cntrl Unit-> UserID
 No. SysID Type   01 02 03 04   Code Code Model    (if ded)
---- ----- ------ -- -- -- --   ---- ---- -------  --------
8106 3AFE  1732-1 81 .  .  .     00   00  1731-1   DTCVSW3
8400 3B1A  1732-1 F8 .  .  .     00   00  1731-1
8403 3B1D  1732-1 F8 .  .  .     00   00  1731-1   DTCVSW2
8406 3B20  1732-1 F8 .  .  .     00   00  1731-1   DTCVSW2

9000 3B5D  1732-1 A1 .  .  .     00   00  1731-1   DTCVSW1
9006 3B63  1732-1 A1 .  .  .     00   00  1731-1   DTCVSW1
9009 3B66  1732-1 A1 .  .  .     00   00  1731-1   DTCVSW3

9400 3B8B  1732-1 DC .  .  .     00   00  1731-1
9406 3B91  1732-1 DC .  .  .     00   00  1731-1   DTCVSW1
9409 3B94  1732-1 DC .  .  .     00   00  1731-1   DTCVSW2

9800 3BAC  1732-1 9C .  .  .     00   00  1731-1   DTCVSW3
```

VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

```
Report: ESAVSW2       Virtual Switch Report Part Two
Monitor initialized: 06/10/19 at 00:00:00 on 2964 serial 13C
-------------------------------------------------------------------
Date/Time           <-packets><---network lock requests---->
 Dev Sys  Control   <-/second><--Per Second-> waits/sec wait
 No. ID   Userid    Sent Rcvd Ntwrk send recv send recv time
---- ---- -------- ---- ---- ----- ---- ---- ---- ---- ----
-------------------------------------------------------------------
00:45:11
8106 3AFE DTCVSW3     0    0     0    0    0    0    0    0
8403 3B1D DTCVSW2     0    0     0    0    0    0    0    0
8406 3B20 DTCVSW2   691  563   367  651  365    0    0    0
8409 3B23 DTCVSW4     0    0     0    0    0    0    0    0
8700 3B4C DTCVSW4     0    0     0    0    0    0    0    0
9000 3B5D DTCVSW1     0    0     0    0    0    0    0    0
9006 3B63 DTCVSW1     0    0     0    0    0    0    0    0
9009 3B66 DTCVSW3   451  462   408  445  406    0    0    0
9406 3B91 DTCVSW1   206  200   190  205  190    0    0    0
9409 3B94 DTCVSW2  4188  936   372 3653  366    0    0    0
9800 3BAC DTCVSW3     0    0     0    0    0    0    0    0
```

VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

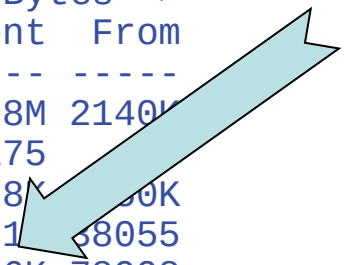
```
Report: ESATCP4      TCPIP Hardware Layer/Interfaces Report
-------------------------------------------------------------------
Date/          <Total Octets> Avg  <-Subnet packets / Sec->
Time           <-Per second->   Q  <-Unicast-> <NonUnicast>
Node      IFT Input  Output  Len  Input Outpt Input Output
-------- ---- -----  ------  ---- ----- ----- ----- ------
00:45:11
***Node Groups***
DB2      -   0  199K  233878     0 547.7 553.8 13.46      0
TheUsrs  -   0 2667K   9284K     0  4968  8432 178.3      0
*** Nodes *******
Z144105D -   1  1609  1608.7     0  6.77   6.8     0      0
         -   2 40.80       0     0     0     0  0.17      0
         -   3 94812  274917     0 587.3 588.1     0      0
         -   4 17762   2409K     0 339.0  1618  0.95      0
         -   5  3657  4010.0     0 22.55  22.6  0.91      0
         -   6  1967   18460     0 10.07  17.0  1.33      0
Z144106D -   1  1147  1147.2     0  4.98   5.0     0      0
         -   2 445.8  330.43     0  1.16   1.2  0.91      0
         -   3 40.80       0     0     0     0  0.17      0
         -   4 477.9  433.33     0  8.06   4.1     0      0
         -   5 161.8  1236.9     0  0.29   1.0  0.91      0
         -   6  1776   16303     0  9.59  15.4  1.25      0
```

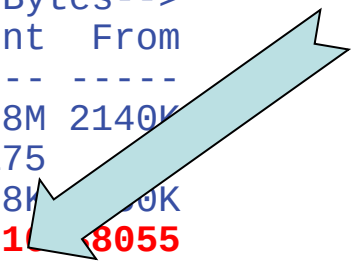
VELOCITY SOFTWARE

Channel utilization on OSA is high, why?

```
Report: ESAQDIO      Queued I/O R                CENTERS FOR MEDICAID AND
-------------------------------------------------------------------------
                                  structions/Sec-> <-Throughtput / sec->
Date/    Dev.          Virt QDIO > <----CP------> <Buffers> <--Bytes-->
Time     Nmbr owner    DevN Fmt    Read Writ "s"  Sent From  Sent  From
-------- ---- -------- ---- ---- - ---- ---- ---- ---- ---- ----- -----
00:45:11 0000 Totals   0000 QDIO 6  5.6 1805    0  12K 6512  158M 2140K
         8700 DTCVSW4  063C QDIO 0    0  0.2    0    0    0   175
         9009 DTCVSW3  0630 QDIO 0    0  396    0  445  410  158K  50K
         9406 DTCVSW1  061E QDIO 0    0  179    0  205  190 5191  58055
         9409 DTCVSW2  0618 QDIO 0    0  101    0 3652  376 6306K 78998

Report: ESAQDI2      Queued I/O Report
-------------------------------------------------------------
                                  Number <-Throughtput / sec->
Date/    Dev.          Virt QDIO Queues <Buffers> <--Bytes-->
Time     Nmbr owner    DevN Fmt  In Out Sent From  Sent  From
-------- ---- -------- ---- ---- -- --- ---- ---- ----- -----
00:45:11 0000 Totals   0000 QDIO  0   0  12K 6512  158M 2140K
         8700 DTCVSW4  063C QDIO  1   1    0    0   175
         9009 DTCVSW3  0630 QDIO  1   1  445  410  158K  50K
         9406 DTCVSW1  061E QDIO  1   1  205  190 5191  58055
         9409 DTCVSW2  0618 QDIO  1   1 3652  376 6306K 78998
```





VELOCITY SOFTWARE

DASD Guidelines

Spread load

- across multiple channels, RANKS
- across devices
- across internal SAP paths

Define many devices 3390-3, not few 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

VELOCITY SOFTWARE