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Linux on System z
zFCP Performance Analysis

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IBM

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13112

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Agenda

- Purpose
- Workflow Overview
- Collecting Data
  - Data Sources
  - Architecture
  - ziomon Usage
- Analyzing Data
  - ziorep_config
  - ziorep_utilization
  - ziorep_traffic
- Hints & Tips
- Data Analysis on Other Platforms

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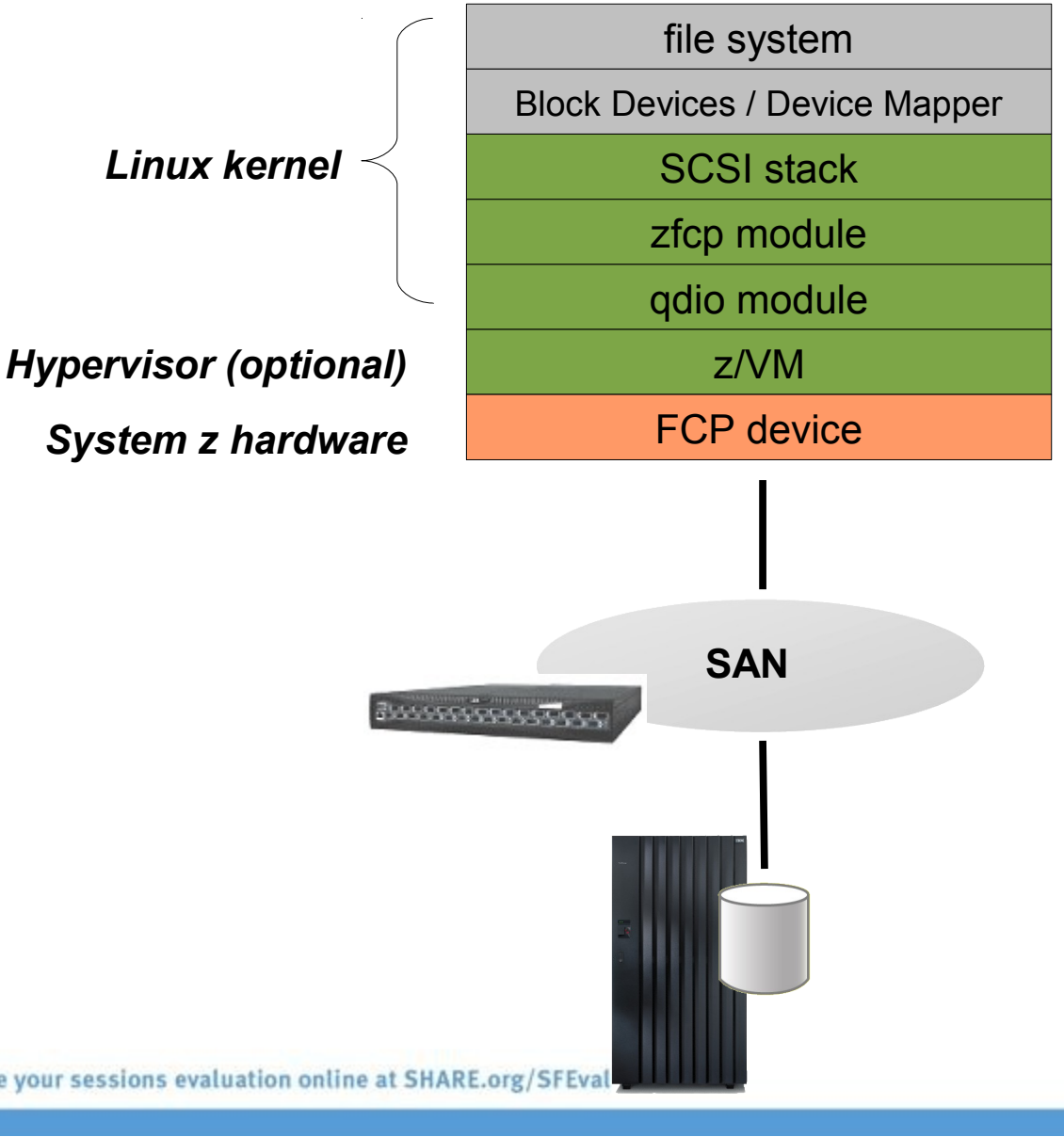
How files end up on Storage Devices



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Motivation

- Performance issues can potentially stem from multiple sources
- Focusing on a single component will not tell the whole story
- Holistic approach, considering all components involved (Linux, hypervisors, HBAs, SAN with storage devices) is required
- Requires advanced data analysis features, e.g. for filtering and aggregation
- *ziomon* tools aim at providing all of the above
- Availability:
  - SLES: Part of the *s390-tools* package starting with SLES10 SP3 and SLES11 SP1
  - RHEL: Part of the *s390utils* package starting with RHEL 5.4 and provided as *s390utils-ziomon* beginning with RHEL 6
- Dependencies: Requires the *blktrace* package as well as `CONFIG_BLK_DEV_IO_TRACE` enabled in the kernel config

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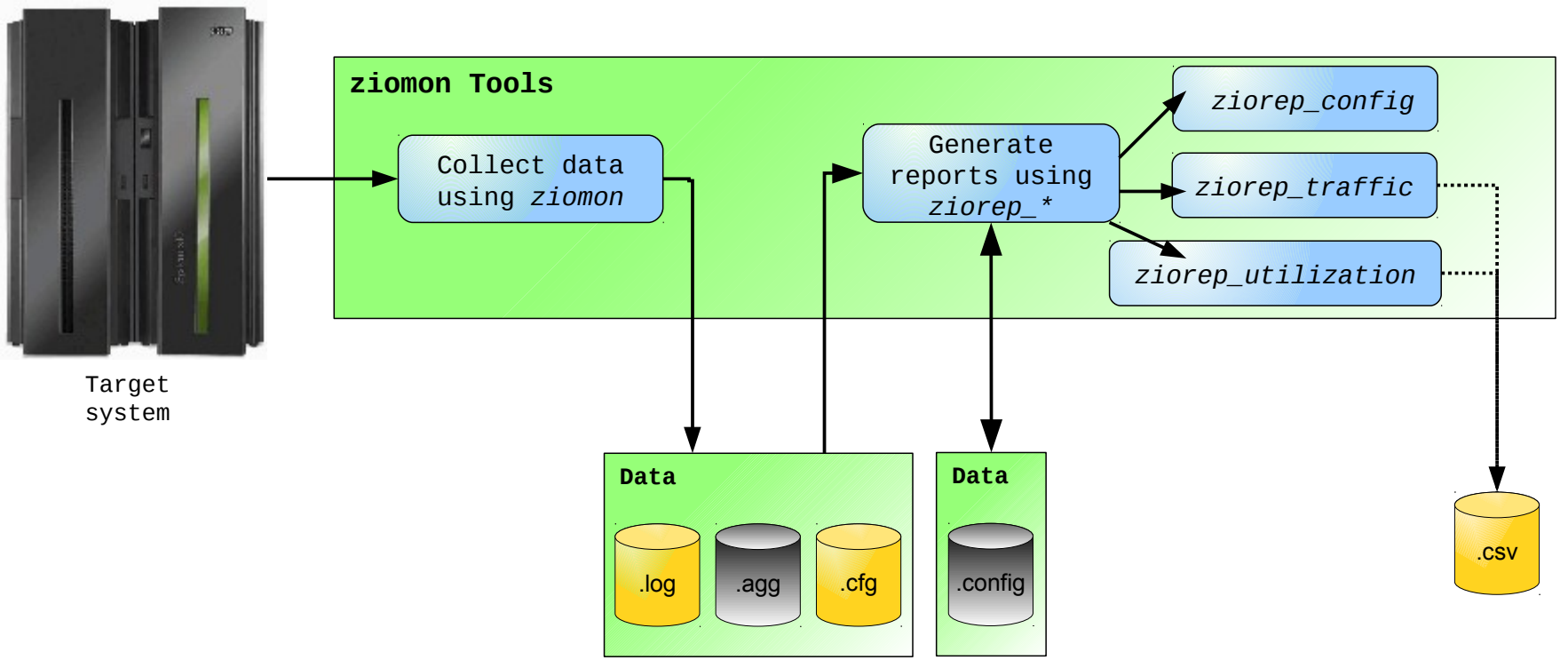
Workflow Overview

- Collect data using *ziomon*
- Yield resulting files (`.log`, `.agg` & `.cfg` - all required)
- Use reporting tools to analyze data



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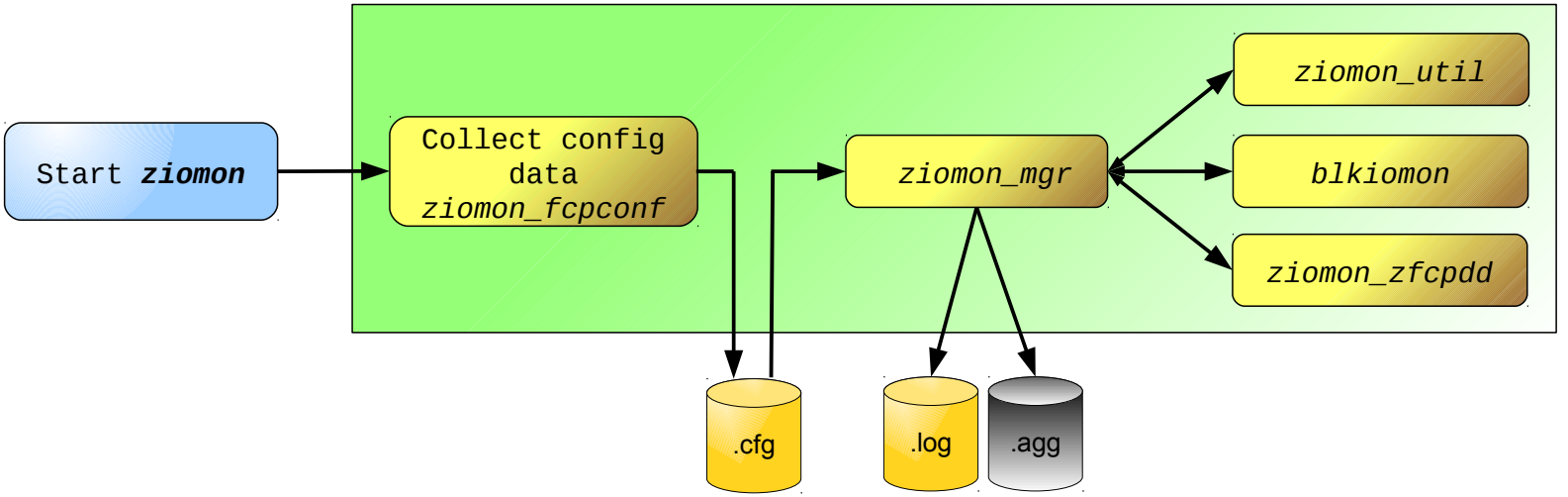
Collecting Data: Components



- Components used by ziomon to collect data:
  - *ziomon_fcpconf :* zfcp configuration
  - *ziomon_zfcpdd:* Channel & fabric latencies, QDIO outbound queue utilization
  - *ziomon_util*: zfcp adapter utilization
  - *blkiomon*: blktrace component for SCSI subsystem latencies
- Note: Data collection only starts after the configuration has been captured

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Collecting Data: Invocation

- Minimum invocation:

```
user@larsson:~> ziomon -d 5 -o data /dev/sda
```

- Mandatory parameters to use:
  - `-d` : total data collection duration in minutes
  - `-o` : output file – should be on a device not sampled by *ziomon*!
  - `<device>` : SCSI device to monitor
- *ziomon* will aggregate data during collection, defaults to 60 seconds. I.e. it will not collect data on individual I/O operations.
- Use '`-i`' to specify an arbitrary interval length for aggregation. E.g. to invoke with highest possible resolution (2 seconds) use

```
user@larsson:~> ziomon -d 5 -i 2 -o data /dev/sda
```

- Use '`-l`' to specify size limit for `.log` file.

```
user@larsson:~> ziomon -d 5 -l 137M -o data /dev/sda
```

  Will wrap around in case specified limit is too low (like in a ring buffer). The overwritten data is aggregated into a single (bigger) interval in a `.agg` file.

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Collecting Data: Specifying Devices

- Example:

```
user@larsson:~> multipath -ll
36005076303ffc56200000000000010cc dm-0 IBM,2107900
[size=5.0G][features=0][hwhandler=0]
\_ round-robin 0 [prio=2][active]
 \_ 1:0:0:1087127568 sdb   8:16  [active][ready]
 \_ 0:0:0:1087127568 sda   8:0   [active][ready]
```

- Multiple ways to specify devices for collecting data:
  - Provide a list of single path devices:

```
user@larsson:~> ziomon […] /dev/sda /dev/sdb
```

  - Specifying multipath devices will identify all underlying devices (recommended):

```
user@larsson:~> ziomon […] /dev/mapper/36005076303ff...
```

  - Mixing single path and multipath devices is possible

```
user@larsson:~> ziomon […] /dev/mapper/36005076303ff... \
/dev/sdc /dev/sdd
```


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Collecting Data: Specifying Devices (continued)

- Notes:
  - SCSI tape devices are supported, too
  - *blktrace* (as used by *ziomon*) requires 2MB vmalloc memory per device *and* processor
  - Check current configuration:

```
user@larsson:~> grep Vmalloc /proc/meminfo
```

  - Use kernel parameter vmalloc to increase, e.g. `vmalloc=512M`

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Data Analysis

- Use the *ziorep_** commands to generate reports and investigate data:
  - *ziorep_config*: Insight into the zfcp configuration
  - *ziorep_utilization*: Adapter utilization statistics
  - *ziorep_traffic*: Traffic statistics
- Note: Always pass on all files (`.log` and `.cfg`, and possibly `.agg`) when forwarding data to others for analysis

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Data Analysis: Configuration Report Overview

- *ziorep_config* can take a `.cfg` file as input

```
user@larsson:~> ziorep_config -i sample.cfg
```

- Displays information on zfcp-related hardware (HBAs, single and multipath devices) data was collected on.
- Skip the '`-i`' parameter for a report on the current system.
- 3 different report types available:
  - Adapter report (**default**, option '`-A`'): HBA details
  - Multipath report (option '`-M`'): Multipath/device mapper details
  - Devices report (option '`-D`'): SCSI device details
- Selection options to limit output to a subset only (can be combined):

`'-p <port>'`	limits output to specified WWPN, e.g. `'-p 0x5005123456789000'`
`'-l <lun>'`	limits output to specified LUN, e.g. `'-l 0x401040a600000000'`
`'-m <mdev>'`	limits output to specified multipath device, e.g. `'-m 36005076303ffc56200000000000010a6'`
`'-a <adapter>'`	limits output to specified adapter, e.g. `'-a 0.0.3c07'`
`'-s <scsi_host>'`	limits output to specified SCSI host, e.g. `'-s host0'`
`'-d <device>'`	limits output to specified device, e.g. `'-d sde'`

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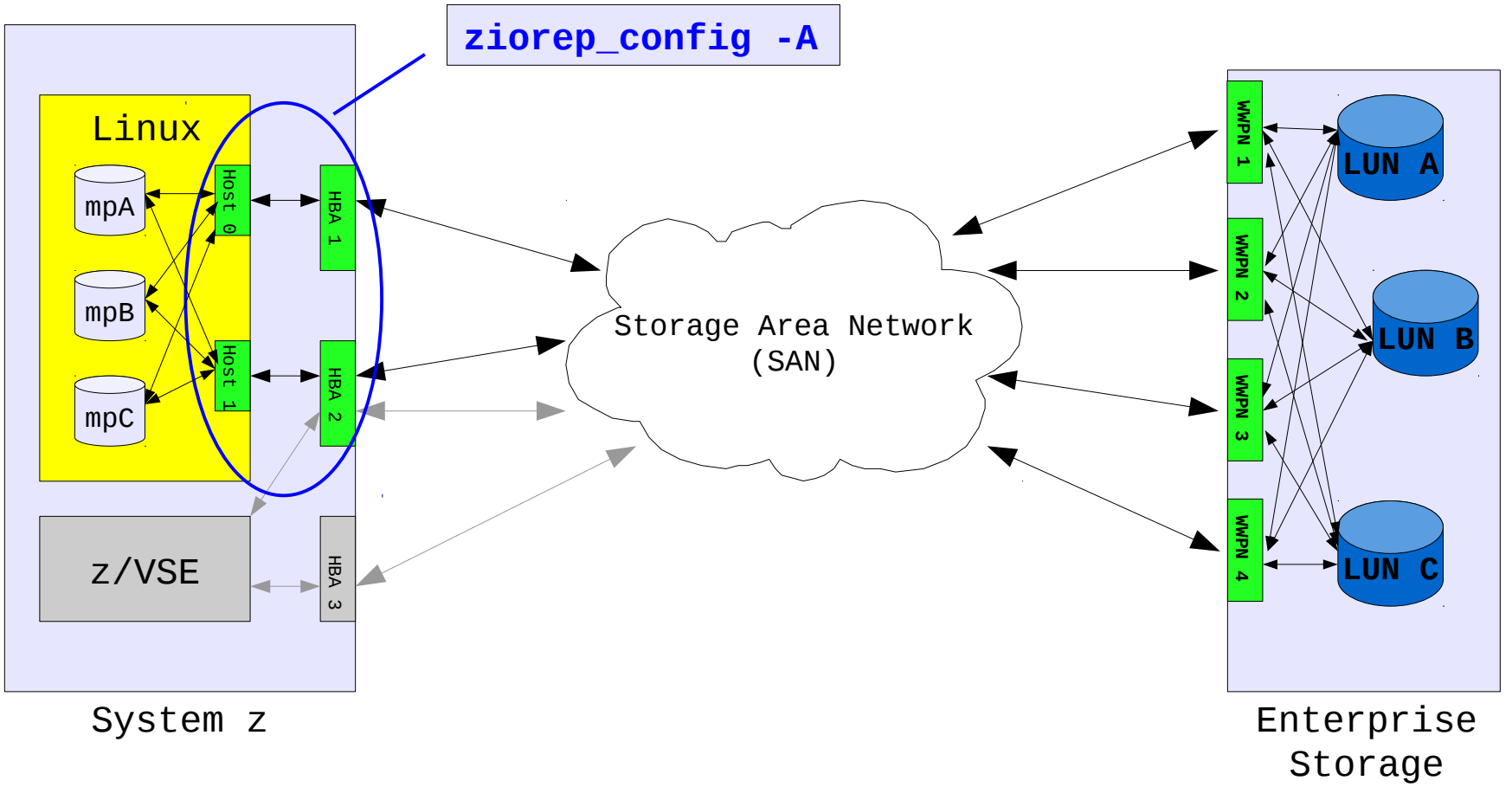
Data Analysis: Adapter Configuration Report



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Data Analysis: Adapter Configuration Report (continued)

```
user@larsson:~> ziorep_config -A -i sample.cfg \
-a 0.0.1800 -a 0.0.1820
Host:    host0
CHPID:   64
Adapter: 0.0.1800
Sub-Ch.: 0.0.0842
Name:    0xc05076ffe4805611
P-Name:  0xc05076ffe4805611
Version: 0x0005
LIC:     0x0000014c
Type:    NPort (fabric via point-to-point)
Speed:   8 Gbit
State:   Online

Host:    host2
CHPID:   66
Adapter: 0.0.1820
Sub-Ch.: 0.0.08a2
Name:    0xc05076ffe4805e11
P-Name:  0xc05076ffe4805e11
Version: 0x0005
LIC:     0x0000014c
Type:    NPort (fabric via point-to-point)
Speed:   8 Gbit
State:   Online
```


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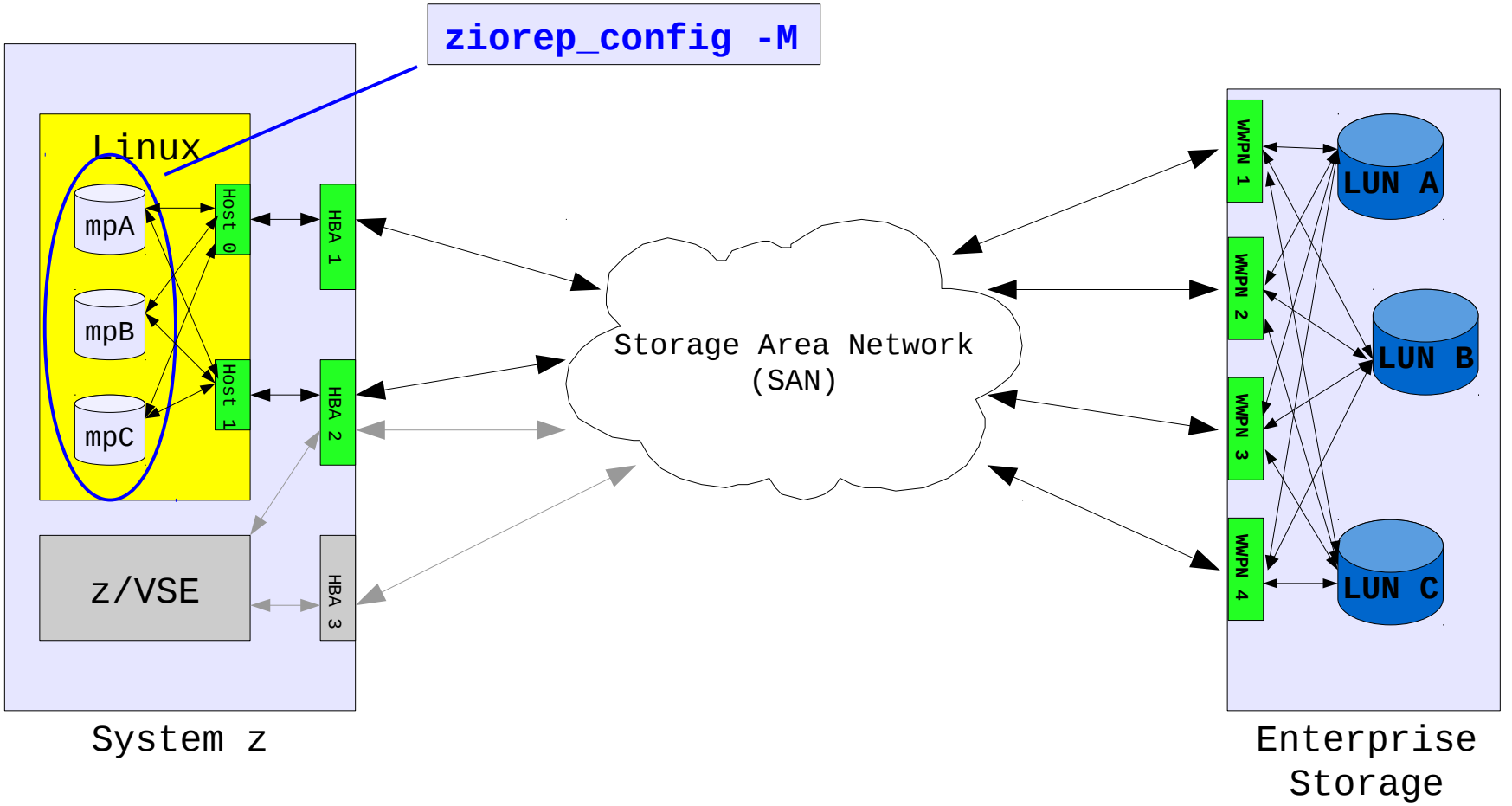
Data Analysis: Multipath Report



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Data Analysis: Multipath Report (continued)

```
user@larsson:~> ziorep_config -i sample.cfg -M \
-m 36005076303ffc52a0000000000005502
0.0.1800 0x500507630303c52a /dev/sda /dev/mapper/36005076303ffc52a0000000000005502
0.0.1810 0x500507630303c52a /dev/sde /dev/mapper/36005076303ffc52a0000000000005502
0.0.1820 0x500507630303c52a /dev/sdi /dev/mapper/36005076303ffc52a0000000000005502
0.0.1830 0x500507630303c52a /dev/sdm /dev/mapper/36005076303ffc52a0000000000005502
0.0.1800 0x500507630308c52a /dev/sdd /dev/mapper/36005076303ffc52a0000000000005502
0.0.1810 0x500507630308c52a /dev/sdh /dev/mapper/36005076303ffc52a0000000000005502
0.0.1820 0x500507630308c52a /dev/sdl /dev/mapper/36005076303ffc52a0000000000005502
0.0.1830 0x500507630308c52a /dev/sdp /dev/mapper/36005076303ffc52a0000000000005502
0.0.1800 0x500507630310c52a /dev/sdc /dev/mapper/36005076303ffc52a0000000000005502
0.0.1810 0x500507630310c52a /dev/sdg /dev/mapper/36005076303ffc52a0000000000005502
0.0.1820 0x500507630310c52a /dev/sdj /dev/mapper/36005076303ffc52a0000000000005502
0.0.1830 0x500507630310c52a /dev/sdo /dev/mapper/36005076303ffc52a0000000000005502
0.0.1800 0x500507630318c52a /dev/sdb /dev/mapper/36005076303ffc52a0000000000005502
0.0.1810 0x500507630318c52a /dev/sdf /dev/mapper/36005076303ffc52a0000000000005502
0.0.1820 0x500507630318c52a /dev/sdk /dev/mapper/36005076303ffc52a0000000000005502
0.0.1830 0x500507630318c52a /dev/sdn /dev/mapper/36005076303ffc52a0000000000005502
```


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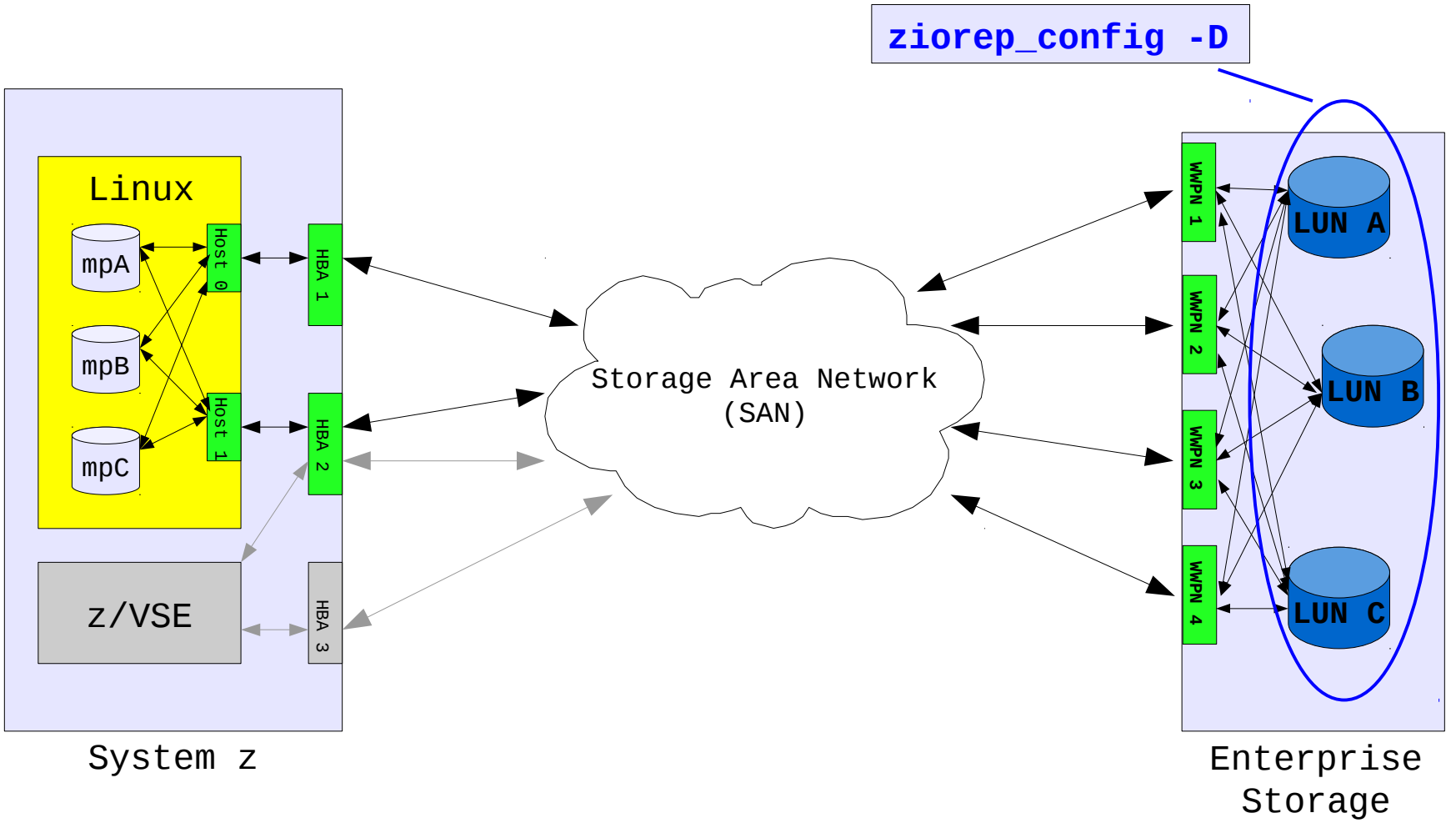
Data Analysis: Device Configuration Report



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Data Analysis: Device Configuration Report (continued)

```
user@larsson:~> ziorep_config -i sample.cfg -D \
-l 0x4055400500000000 -l 0x4055400000000000
0.0.1800 0x500507630303c52a 0x4055400000000000 host0 /dev/sg49  /dev/sdax  67:16  Disk 2107900 IBM 0:0:0:1073758293
0.0.1800 0x500507630303c52a 0x4055400500000000 host0 /dev/sg108 /dev/sdde  70:192 Disk 2107900 IBM 0:0:0:1074085973
0.0.1800 0x500507630318c52a 0x4055400000000000 host0 /dev/sg74  /dev/sdbw  68:160 Disk 2107900 IBM 0:0:1:1073758293
0.0.1800 0x500507630318c52a 0x4055400500000000 host0 /dev/sg118 /dev/sddo  71:96  Disk 2107900 IBM 0:0:1:1074085973
0.0.1800 0x500507630310c52a 0x4055400000000000 host0 /dev/sg56  /dev/sdbe  67:128 Disk 2107900 IBM 0:0:2:1073758293
0.0.1800 0x500507630310c52a 0x4055400500000000 host0 /dev/sg122 /dev/sdds  71:160 Disk 2107900 IBM 0:0:2:1074085973
0.0.1800 0x500507630308c52a 0x4055400000000000 host0 /dev/sg87  /dev/sdcj  69:112 Disk 2107900 IBM 0:0:3:1073758293
0.0.1800 0x500507630308c52a 0x4055400500000000 host0 /dev/sg89  /dev/sdcl  69:144 Disk 2107900 IBM 0:0:3:1074085973
0.0.1810 0x500507630303c52a 0x4055400000000000 host1 /dev/sg80  /dev/sdcc  69:0   Disk 2107900 IBM 1:0:0:1073758293
0.0.1810 0x500507630303c52a 0x4055400500000000 host1 /dev/sg113 /dev/sddj  71:16  Disk 2107900 IBM 1:0:0:1074085973
0.0.1810 0x500507630318c52a 0x4055400000000000 host1 /dev/sg103 /dev/sdcz  70:112 Disk 2107900 IBM 1:0:1:1073758293
0.0.1810 0x500507630318c52a 0x4055400500000000 host1 /dev/sg124 /dev/sddu  71:192 Disk 2107900 IBM 1:0:1:1074085973
0.0.1810 0x500507630310c52a 0x4055400000000000 host1 /dev/sg46  /dev/sdau  66:224 Disk 2107900 IBM 1:0:2:1073758293
0.0.1810 0x500507630310c52a 0x4055400500000000 host1 /dev/sg105 /dev/sddb  70:144 Disk 2107900 IBM 1:0:2:1074085973
0.0.1810 0x500507630308c52a 0x4055400000000000 host1 /dev/sg86  /dev/sdci  69:96  Disk 2107900 IBM 1:0:3:1073758293
0.0.1810 0x500507630308c52a 0x4055400500000000 host1 /dev/sg107 /dev/sddd  70:176 Disk 2107900 IBM 1:0:3:1074085973
0.0.1820 0x500507630303c52a 0x4055400000000000 host2 /dev/sg110 /dev/sddg  70:224 Disk 2107900 IBM 2:0:0:1073758293
0.0.1820 0x500507630303c52a 0x4055400500000000 host2 /dev/sg120 /dev/sddq  71:128 Disk 2107900 IBM 2:0:0:1074085973
0.0.1820 0x500507630310c52a 0x4055400000000000 host2 /dev/sg69  /dev/sdbr  68:80  Disk 2107900 IBM 2:0:1:1073758293
0.0.1820 0x500507630310c52a 0x4055400500000000 host2 /dev/sg71  /dev/sdbt  68:112 Disk 2107900 IBM 2:0:1:1074085973
0.0.1820 0x500507630318c52a 0x4055400000000000 host2 /dev/sg109 /dev/sddf  70:208 Disk 2107900 IBM 2:0:2:1073758293
0.0.1820 0x500507630318c52a 0x4055400500000000 host2 /dev/sg116 /dev/sddm  71:64  Disk 2107900 IBM 2:0:2:1074085973
0.0.1820 0x500507630308c52a 0x4055400000000000 host2 /dev/sg92  /dev/sdco  69:192 Disk 2107900 IBM 2:0:3:1073758293
0.0.1820 0x500507630308c52a 0x4055400500000000 host2 /dev/sg117 /dev/sddn  71:80  Disk 2107900 IBM 2:0:3:1074085973
0.0.1830 0x500507630303c52a 0x4055400000000000 host3 /dev/sg83  /dev/sdcf  69:48  Disk 2107900 IBM 3:0:0:1073758293
0.0.1830 0x500507630303c52a 0x4055400500000000 host3 /dev/sg125 /dev/sddv  71:208 Disk 2107900 IBM 3:0:0:1074085973
0.0.1830 0x500507630318c52a 0x4055400000000000 host3 /dev/sg97  /dev/sdct  70:16  Disk 2107900 IBM 3:0:1:1073758293
0.0.1830 0x500507630318c52a 0x4055400500000000 host3 /dev/sg99  /dev/sdcv  70:48  Disk 2107900 IBM 3:0:1:1074085973
0.0.1830 0x500507630310c52a 0x4055400000000000 host3 /dev/sg114 /dev/sddk  71:32  Disk 2107900 IBM 3:0:2:1073758293
0.0.1830 0x500507630310c52a 0x4055400500000000 host3 /dev/sg128 /dev/sddy 128:0   Disk 2107900 IBM 3:0:2:1074085973
0.0.1830 0x500507630308c52a 0x4055400000000000 host3 /dev/sg112 /dev/sddi  71:0   Disk 2107900 IBM 3:0:3:1073758293
0.0.1830 0x500507630308c52a 0x4055400500000000 host3 /dev/sg127 /dev/sddx  71:240 Disk 2107900 IBM 3:0:3:1074085973
```


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Data Analysis: Adapter Utilization Report

- Ficon Express card with FCP CHPIDs has a CPU, bus and adapter chip
- Utilization report provides two sections:
  - **FCP channel** report provides details on
    - CPU utilization
    - Bus utilization
    - Adapter utilization
  - **Virtual HBA** report provides details on
    - QDIO utilization, queue full and failure conditions
    - Throughput
    - I/O requests numbers
- Purpose: Identify potential bottlenecks within the adapter
- Note: Percentages reported are for entire FCP channel – no fraction according to utilization given when FCP channel is shared by multiple OS images!
  I.e. high utilization during phases of inactivity point to activity on other OS images sharing the same channel.

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Data Analysis: Adapter Utilization Report

- Use '-s' to get a quick overview of the available data

```
user@larsson:~> ziorep_utilization -s sample.log
Data Summary
------------
Aggregated range: none
Detailed range:   2012-12-11 10:51:55 to 2012-12-11 11:51:55
Interval length:  2 seconds
HBA/CHPID:        0.0.591d/42
                  0.0.5b1d/43
WWPN/LUN (dev):   0x5005076303000104/0x4021402100000000 (/dev/sdi)
                  0x5005076303000104/0x4021402100000000 (/dev/sdj)
                  0x50050763030b0104/0x4021402100000000 (/dev/sdk)
                  0x50050763030b0104/0x4021402100000000 (/dev/sdl)
                  0x5005076303100104/0x4021402100000000 (/dev/sdm)
                  0x5005076303100104/0x4021402100000000 (/dev/sdn)
                  [...]
```

- Use '-b <begin>' and '-e <end>' to limit output to specified timeframe
- Use '-i <length>' to aggregate data to bigger intervals
- Use '-c <chpid>' to limit output to specified adapter
- Notes:
  - Check the interval length to figure out available aggregation values
  - Aggregated range only listed in case of wrap-around in .log file (.agg exists)

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Data Analysis: FCP Channel Utilization Report

```
user@larsson:~> ziorep_utilization sample.log -b "2012-12-11
10:58:55"
CHP|adapter in %-|--bus in %---|--cpu in %---|
 ID min max   avg min max   avg min max   avg
2012-12-11 10:58:55
 42   3   3   3.0  20  20  20.0   2   2   2.0
 43   3   3   3.0  12  12  12.0   1   1   1.0
10:58:57
 42   3   3   3.0  18  18  18.0   2   2   2.0
 43   4   4   4.0  15  15  15.0   1   1   1.0
10:58:59
 42   2   2   2.0  16  16  16.0   2   2   2.0
 43   3   3   3.0  17  17  17.0   1   1   1.0
10:59:01
 42   3   3   3.0  16  16  16.0   2   2   2.0
 43   5   5   5.0  17  17  17.0   1   1   1.0
10:59:03
 42   1   1   1.0  16  16  16.0   2   2   2.0
 43   4   4   4.0  15  15  15.0   1   1   1.0
[...]
CHP Bus-ID  |qdio util.%|queu|fail|-thp in MB/s-|I/O reqs-|
 ID            max   avg full  erc     rd    wrt   rd  wrt
2008-12-11 10:58:55
 42/0.0.591d  99.2  14.0   12    0   1.0    2.7     5  692
 43/0.0.5b1d  91.4   9.3    0    0   0.5    3.3     4  517
[...]
```


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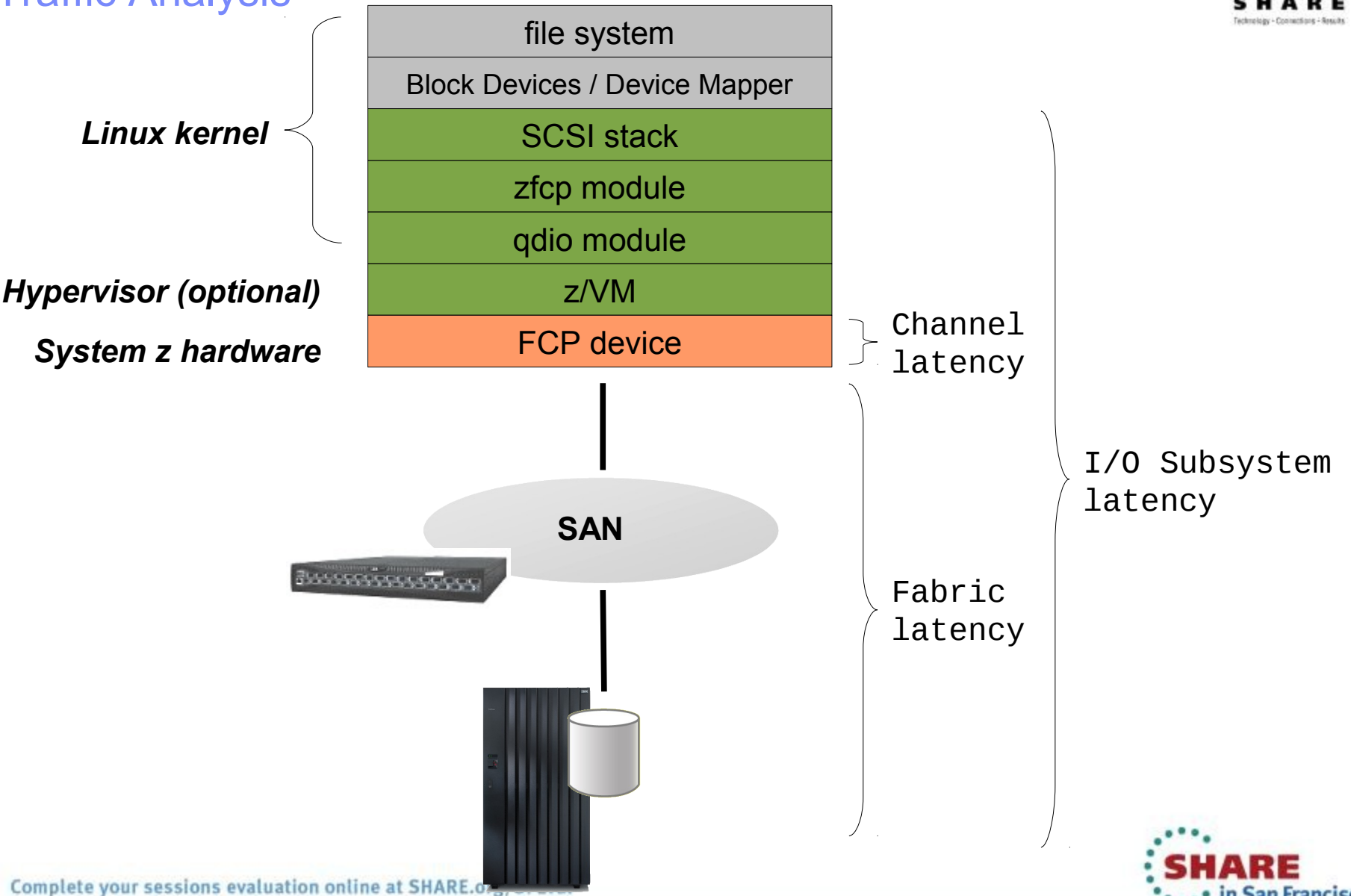
Data Analysis: Virtual HBA Utilization Report

```
user@larsson:~> ziorep_utilization sample.log -i 60 -c 43
[...]
CHP Bus-ID  |qdio util.%|queu|fail|-thp in MB/s-|I/O reqs-|
 ID            max   avg full  erc     rd    wrt   rd  wrt
2012-12-11 10:52:55
 43/0.0.5b1d  99.2  13.4  302    0   0.2    2.6   880  15K
10:53:55
 43/0.0.5b1d  98.4  10.0  203    0   0.3    3.1   163 1.3K
10:54:55
 43/0.0.5b1d  99.2  12.6  178    0   0.2    3.1  1.3K  10K
10:55:55
 43/0.0.5b1d  99.2   4.2   79    0   0.3    3.0   729 4.6K
10:56:55
 43/0.0.5b1d   0.0   0.0    0    0   0.0    0.0   168    0
10:57:55
 43/0.0.5b1d  99.2   8.9  136    0   3.7    1.9  2.9K  11K
10:58:55
 43/0.0.5b1d 100.0  12.6  177    0   0.6    2.8   335  15K
10:59:55
 43/0.0.5b1d  99.2  14.0  177    0   0.3    3.1   367  19K
11:00:55
 43/0.0.5b1d  99.2  13.9  188    0   0.3    3.8  1.5K  14K
11:01:55
 43/0.0.5b1d  99.2  14.1  162    0   0.4    3.4  1.8K  14K
11:02:55
 43/0.0.5b1d  99.2   8.5  150    0   0.3    3.1  1.1K 8.2K
[...]
```


Complete your sessions evaluation online at SHARE.org/SFEval

SHARE in San Francisco 2013

Traffic Analysis



Complete your sessions evaluation online at SHARE.org/

Data Analysis: Traffic Report

- *ziorep_traffic* aims at identifying latencies of all components involved
- Provides two views on data
  - Regular view listing min/max/avg/std (default)
  - Detailed view providing histograms
- Supports option '`-s`' for a data summary (just like *ziorep_utilization*)
- Supports device selection options '`-c/-u/-p/-l/-d/-m`' (similar to *ziorep_config*)
- Provides data aggregation capabilities
- **Notes**:
  - Numbers reported consider *serialized* traffic! I.e. parallelism of requests is not accounted for. Hence throughputs are likely to divert from what other tools will report!
  - *ziomon* has a performance impact of approx. 5 percent on CPU utilization

Complete your sessions evaluation online at SHARE.org/SFEval

Data Analysis: Traffic Report - Default View

```
user@larsson:~> ziorep_traffic sample.log -i 60 -l \
0x4021402f00000000 -l 0x4021402d00000000
```

WWPN	LUN	I/O rt min	I/O rt max	MB/s thrp avg	MB/s thrp stdev	I/O requests #reqs	I/O requests rd	I/O requests wrt	I/O requests bidi	I/O subs. lat. in us min	I/O subs. lat. in us max	I/O subs. lat. in us avg	I/O subs. lat. in us stdev	channel lat. in us min	channel lat. in us max	channel lat. in us avg	channel lat. in us stdev	fabric lat. in us min	fabric lat. in us max	fabric lat. in us avg	fabric lat. in us stdev
2012-12-11 10:52:55																					
10:54:55																					
0x5005076303000104	0x4021402d00000000	0.0	0.0	0.0	0.0	2	2	0	0	626	660	643.0	17.0	21	22K	4.009K	3.416K	124	271K	126.8K	69.29K
0x5005076303000104	0x4021402d00000000	0.0	65.3	2.9	1.162K	31	5	26	0	182	242K	108.5K	83.07K	22	21K	4.104K	3.522K	75	265K	124.4K	71.39K
0x50050763030b0104	0x4021402d00000000	0.0	45.6	2.8	1.168K	997	110	887	0	297	279K	126.1K	67.83K	20	19K	4.019K	3.537K	160	265K	120.2K	67.08K
0x50050763030b0104	0x4021402d00000000	0.0	32.8	3.3	1.256K	999	107	892	0	232	245K	110.1K	55.35K	20	22K	3.959K	3.673K	79	222K	104.4K	54.60K
0x5005076303100104	0x4021402d00000000	0.0	88.3	48.7	4.829K	14	2	12	0	559	13K	7.093K	3.963K	25	5.2K	1.603K	1.468K	78	8.1K	3.592K	2.943K
0x5005076303100104	0x4021402d00000000	0.0	0.0	0.0	0.0	2	2	0	0	179	270	224.5	45.5	23	28	26.2	5.3	75	573	175.2	181.5
0x50050763031b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	2	2	0	0	439	591	515.0	76.0	25	28	25.8	4.6	75	385	259.5	126.9
0x50050763031b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	2	2	0	0	184	416	300.0	116.0	21	23K	3.929K	3.669K	74	210K	108.9K	63.93K
0x5005076303000104	0x4021402f00000000	0.0	0.0	0.0	0.0	2	2	0	0	422	426	424.0	2.0	21	17K	3.656K	3.283K	109	656K	126.6K	70.67K
0x5005076303000104	0x4021402f00000000	0.0	62.3	2.9	1.179K	562	60	502	0	173	285K	123.9K	71.17K	20	20K	4.116K	3.833K	76	282K	121.9K	68.26K
0x50050763030b0104	0x4021402f00000000	0.0	10.3	2.8	1.168K	997	110	887	0	649	574K	128.1K	59.23K	20	17K	3.638K	3.328K	204	573K	122.3K	58.95K
0x50050763030b0104	0x4021402f00000000	0.0	4.2	2.9	1.177K	288	34	254	0	257	219K	123.1K	55.86K	20	19K	3.743K	3.798K	75	211K	116.1K	56.76K
0x5005076303100104	0x4021402f00000000	0.0	0.0	0.0	0.0	2	2	0	0	190	641	415.5	225.5	23	27	24.7	4.4	75	358	208.5	113.2
0x5005076303100104	0x4021402f00000000	0.0	0.0	0.0	0.0	2	2	0	0	199	985	592.0	393.0	24	27	25.0	4.4	71	858	270.3	297.1
0x50050763031b0104	0x4021402f00000000	0.0	0.0	0.0	0.0	2	2	0	0	514	972	743.0	229.0	24	28	26.0	5.0	76	864	344.0	263.7
0x50050763031b0104	0x4021402f00000000	0.0	0.0	0.0	0.0	2	2	0	0	184	999	591.5	407.5	21	23K	3.930K	3.601K	74	294K	112.0K	60.19K
10:55:55																					
0x5005076303000104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	180	234	212.7	23.5	24	26	25.0	5.7	75	82	78.0	2.9
0x5005076303000104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	183	726	370.0	251.8	25	30	27.7	5.6	75	521	224.3	209.8
0x50050763030b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	194	340	267.3	59.6	25	26	25.3	5.2	78	235	140.3	68.1
0x50050763030b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	186	729	370.0	253.9	24	25	24.3	4.2	86	622	268.0	250.3
0x5005076303100104	0x4021402d00000000	0.0	87.6	4.3	1.444K	737	80	657	0	178	262K	82.96K	65.64K	23	23K	3.930K	3.802K	73	251K	77.59K	64.65K
0x5005076303100104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	184	641	341.3	212.0	25	29	27.0	6.9	76	538	230.0	217.8
0x50050763031b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	178	330	236.7	66.7	24	27	25.3	5.7	76	79	77.7	1.2
0x50050763031b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	173	645	333.0	220.6	24	26	25.3	4.5	73	531	227.0	215.0
0x5005076303000104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	177	217	193.7	17.0	24	28	26.3	5.4	75	80	78.0	2.2
0x5005076303000104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	172	415	255.7	112.7	24	24	24.0	5.2	74	307	152.0	109.6
0x50050763030b0104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	181	311	236.3	54.8	24	30	26.7	5.4	75	185	123.0	46.0
0x50050763030b0104	0x4021402f00000000	0.0	9.6	3.0	1.205K	607	69	538	0	188	280K	117.3K	62.60K	20	22K	4.040K	3.986K	74	249K	111.3K	61.86K
0x5005076303100104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	171	188	182.0	7.8	24	26	25.0	4.1	77	78	77.7	0.5
0x5005076303100104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	174	691	347.3	243.0	24	25	24.3	6.8	74	582	243.7	239.2
0x50050763031b0104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	182	482	300.0	130.6	27	30	28.0	4.2	75	119	91.0	19.9
0x50050763031b0104	0x4021402f00000000	0.0	0.0	0.0	0.0	3	3	0	0	176	522	300.3	157.1	25	30	27.7	5.6	73	388	184.3	144.2
10:56:55																					
0x5005076303000104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	185	199	191.3	5.8	27	30	28.0	5.1	78	81	79.3	1.2
0x5005076303000104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	179	191	184.3	5.0	24	24	24.0	6.2	72	77	74.3	2.1
0x50050763030b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	192	205	200.3	5.9	24	25	24.3	4.2	75	102	87.7	11.1
0x50050763030b0104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	185	264	229.3	33.0	28	29	28.7	4.9	77	134	112.7	25.4
0x5005076303100104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	185	219	198.0	15.0	25	30	28.0	6.6	74	77	76.0	1.4
0x5005076303100104	0x4021402d00000000	0.0	0.0	0.0	0.0	3	3	0	0	177	183	180.7	2.6	24	25	24.3	5.2	74	78	76.3	1.7

[...]

Complete your sessions evaluation online at SHARE.org/SFEval

Data Analysis: Traffic Report – Data Filtering Options

- To focus on individual devices, use '-d'

```
user@larsson:~> ziorep_traffic sample.log -i 60 -d sdi
      WWPN               LUN       |I/O rt MB/s|thrp in MB/s-|----I/O requests----|-I/O subs. lat. in us--|--channel lat. in us---|---fabric lat. in us---|
                                       min   max    avg  stdev #reqs   rd  wrt bidi  min  max    avg  stdev  min  max    avg  stdev  min  max    avg  stdev
2012-12-11 10:52:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      2    2    0    0  544  562 553.0    9.0    21  23K 5.001K 4.371K  131 725K 135.1K 77.31K
10:55:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      3    3    0    0  173  340 229.0   78.5    24   27  25.3    5.3    77  236 131.0   74.3
10:56:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      3    3    0    0  196  211 203.0    6.2    24   30  27.3    5.4    78   86  82.0    3.3
10:57:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      3    3    0    0  185  464 278.7  131.1    25   28  26.7    5.0    81  321 161.3  112.9
10:58:55
0x5005076303000104:0x4021402100000000   0.0   6.9   2.7  1.159K   624   13  611    0  201 501K 109.5K 67.44K   25  19K 4.332K 3.588K   79 494K 103.5K 66.52K
10:59:55
0x5005076303000104:0x4021402100000000   0.0  12.2   2.8  1.182K   320    6  314    0  336 397K 116.0K 68.55K   25  19K 4.993K 4.443K  169 396K 109.1K 66.56K
11:00:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      3    3    0    0  183  969 449.7  367.3    24   27  25.7    5.7    79  866 341.7  370.8
[...]
```

- Specifying devices over a number of specifiers will use the union

```
user@larsson:~> ziorep_traffic sample.log -i 60 -d sdi -p
0x5005076303100104
      WWPN               LUN       |I/O rt MB/s|thrp in MB/s-|----I/O requests----|-I/O subs. lat. in us--|--channel lat. in us---|---fabric lat. in us---|
                                       min   max    avg  stdev #reqs   rd  wrt bidi  min  max    avg  stdev  min  max    avg  stdev  min  max    avg  stdev
2012-12-11 10:52:55
0x5005076303000104:0x4021402100000000   0.0   0.0   0.0    0.0      2    2    0    0  179  315 247.0   68.0    25   26  25.5    6.3    76  210 143.0   67.0
0x5005076303100104:0x4021402100000000   0.0   4.4   1.5  857.7    114    2  112    0  183 2.5M 196.1K 407.2K   24   12K 3.965K 3.247K   84 250K 94.80K 71.81K
0x5005076303100104:0x4021402100000000   0.0  14.5   2.7  1.151K   895   17  878    0  186 1.5M 119.3K 101.6K   21   20K 4.908K 4.167K   76 422K 100.6K 63.88K
0x5005076303100104:0x4021402200000000   0.0   4.8   1.5  850.5    144    6  138    0  171 2.7M 175.9K 351.2K   25   18K 4.155K 4.465K   75 254K 91.53K 74.27K
0x5005076303100104:0x4021402200000000   0.0  76.1   2.7  1.133K   907   12  895    0  185 1.8M 111.9K 111.8K   24   19K 4.867K 4.170K   78 265K 98.43K 69.61K
0x5005076303100104:0x4021402300000000   0.0   2.9   1.2  769.3    170    7  163    0  175 3.4M 281.8K 313.2K   24   13K 3.930K 3.370K   75 969K 224.1K 157.4K
0x5005076303100104:0x4021402300000000   0.0   8.4   2.5  1.112K   871   13  858    0  179 1.9M 123.1K 95.66K   26   20K 4.565K 3.862K   76 296K 109.3K 72.82K
0x5005076303100104:0x4021402400000000   0.0   1.9   1.1  742.5    116    4  112    0  177 1.4M 307.5K 234.0K   26   19K 2.490K 3.468K   75 504K 248.5K 152.6K
0x5005076303100104:0x4021402400000000   0.0  18.1   2.4  1.082K   896   11  885    0  190 2.7M 129.9K 164.8K   25   19K 4.469K 3.766K   79 313K 108.9K 72.26K
0x5005076303100104:0x4021402500000000   0.0   0.0   0.0    0.0      3    3    0    0  178  224 194.7   20.8    22   26  24.3    5.5    75  119  90.0   20.5
0x5005076303100104:0x4021402500000000   0.0   7.3   1.7  906.8    782   18  764    0  183 8.8M 185.6K 460.9K   24   17K 4.648K 3.825K   76 584K 142.5K 118.0K
0x5005076303100104:0x4021402600000000   0.0   0.0   0.0    0.0      3    3    0    0  171  447 264.7  128.9    24   26  25.0    5.3    76  339 163.7  124.0
[...]
```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Data Analysis: Traffic Report - Details View

```
user@larsson:~> ziorep_traffic sample.log -i 60 -l \ 0x4021402f00000000
-l 0x4021402d00000000 -D
                                |-----------------------I/O request sizes in KBytes---------------------------|
                                   0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  >8K
                                |-----------------------I/O subsystem latency in us-----------------------------------------------------------|
                                   0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
                                |-----------------------channel latency in us-------------------------------------------------------|
                                   0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K>128K
      WWPN                LUN   |-----------------------fabric latency in us--------------------------------------------------------------------------|
                                   0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
2012-12-11 10:52:55
0x5005076303000104:0x4021402d00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0x5005076303000104:0x4021402d00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    1    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    1    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0x50050763030b0104:0x4021402d00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    1    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0x50050763030b0104:0x4021402d00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    1    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    1    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0x5005076303100104:0x4021402d00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    1    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    1    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
0x5005076303100104:0x4021402d00000000    2    0    0   77    1    4    6   10   15   20  191    0    0    0    0    0
                                         0    0    0    0    0    0    1    0    1    1    0    1   14   25   60   63  137   20    2    1    0    0    0    0    0
                                         0    0    0    0    0    0    2   20    8    6    3   37   70   91   84   47    0    0    0    0
                                         0    0    0    0    0    1    0    0    1    2    0    2   16   59   69   64  137   17    0    0    0    0    0    0    0
0x50050763031b0104:0x4021402d00000000    2    0    0  243    6    4   11   23   29   63  522    0    0    0    0    0
                                         0    0    0    0    0    0    1    0    1    4    2    5   32  139  152  196  366    5    0    0    0    0    0    0    0
                                         0    0    0    0    0    0   13   67    4   11   11   86  143  239  252   87    7    0    0    0
                                         0    0    0    0    0    1    0    2    2    3    2    7   58  171  124  197  348    5    0    0    0    0    0    0    0
0x50050763031b0104:0x4021402d00000000    2    0    0   83    2    0    3    9   22   42  344    0    0    0    0    0
                                         0    0    0    0    0    0    1    0    6    8    6    5    7   23   51   92  308    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0   34    5    3    0    6   46   82  130  145   56    0    0    0    0
                                         0    0    0    0    0    1    0    0   17    6    6    2    6   26   49  103  291    0    0    0    0    0    0    0    0
0x5005076303000104:0x4021402f00000000    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    1    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    0    2    0    0    0    0    0    0    0    0    0    0    0    0    0
                                         0    0    0    0    0    1    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
[...]
```


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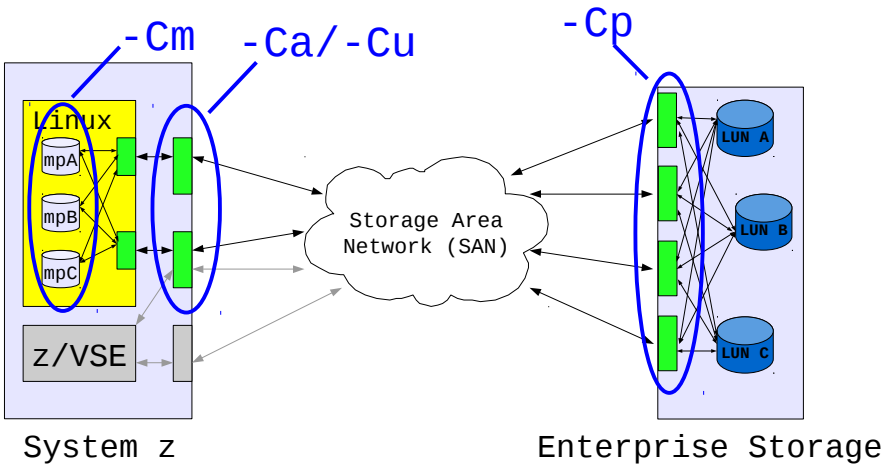
Data Analysis: Traffic Aggregation

- Use option '-C' to specify an aggregation level:
  - 'a'/'u' aggregates by CHPID / bus-ID
  - 'p' aggregates by WWPN
  - 'm' aggregates by multipath device
  - 'A' aggregates **all** data



- Can be combined with device selection options '`-c/-u/-p/-l/-d/-m`'
- Note: Don't confuse *device selection* with *aggregation* options:
  - **Device Selection**: restricts use of data records according to the scope specified (e.g. data records for specific LUNs only)
  - **Aggregation**: generates combined results for given level of detail (e.g. combined result for all I/O handled by specified adapter)

➡**Filtering** applies to *input* data, **aggregation** shapes the resulting *output*

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Data Analysis: Traffic Aggregation Examples

- Aggregate by bus-ID

```
user@larsson:~> ziorep_traffic sample.log -i 60 -Cu
 Bus-ID |I/O rt MB/s|thrp in MB/s-|----I/O requests----|-I/O subs. lat. in us--|--channel lat. in us---|---fabric lat. in us---|
          min   max    avg  stdev #reqs   rd  wrt bidi  min  max    avg  stdev  min  max    avg  stdev  min  max    avg  stdev
2012-12-11 10:52:55
0.0.591d   0.0 115.5   2.8  1.154K 12.8K  338  12K    0  169 6.7M 112.0K 126.9K   20  23K 3.877K 3.513K   72 969K 100.8K 74.16K
0.0.5b1d   0.0  76.1   2.6  1.112K 15.8K  880  15K    0  166 8.8M 127.1K 198.4K   20  23K 4.262K 3.668K   72 584K 110.7K 77.29K
10:53:55
0.0.591d   0.0 104.1   9.2  2.113K   183   20  163    0  272 191K 39.98K 51.86K   20  23K 4.460K 4.129K   73 387K 110.1K 67.69K
0.0.5b1d   0.0  12.4   3.1  1.224K  1496  163 1.3K    0  329 827K 115.6K 62.18K   20  16K 4.179K 3.406K   73 262K 108.4K 61.32K
10:54:55
0.0.591d   0.0 115.9   2.9  1.193K 14.1K 1.6K  12K    0  166 574K 120.9K 68.88K   20  24K 4.378K 3.793K   73 725K 119.8K 69.71K
0.0.5b1d   0.0  91.8   3.1  1.215K 11.7K 1.3K  10K    0  168 702K 116.6K 67.06K   20  24K 4.448K 3.916K   71 696K 116.4K 68.05K
[...]
```

- Aggregate all available devices in detailed traffic analysis mode

```
user@larsson:~> ziorep_traffic sample.log -i 60 -CA -D
   |-----------------------I/O request sizes in KBytes-----------------------|
      0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  >8K
   |-----------------------I/O subsystem latency in us-------------------------------------------------------|
      0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
   |-----------------------channel latency in us-------------------------------------------------------|
      0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K>128K
 * |-----------------------fabric latency in us-------------------------------------------------------|
      0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
2012-12-11 10:52:55
 *   293    0    0 7.0K  154  138  260  575  983 1.9K  17K    0    0    0    0    0
      0    0    0    0    0    0  208   84  111  130  116  245 1.1K 3.4K 4.3K 5.9K  12K  747   59   40   12    6    2    0    0
      0    0    0    0    0    0 1.0K 2.2K  266  224  404 2.4K 4.3K 6.9K 7.8K 3.9K  191    0    0    0
      0    0    0    0    0  214   77   60  253  124  126  359 1.6K 4.2K 4.2K 6.1K  11K  777    4    0    0    0    0    0    0
10:53:55
 *    0    0    0  261    6   10   24   40   66  128 1.1K    0    0    0    0    0
      0    0    0    0    0    0    0   20   33   48   27   32   69  115  163  317  852    2    1    0    0    0    0    0
      0    0    0    0    0    0  335  108   14   24   63  376  658  960 1.1K  664   53    0    0    0
      0    0    0    0    0   32  149   38  147   53   44   68  111  258  381  921 2.2K    2    0    0    0    0    0    0
[...]
```


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Data Analysis: Traffic Aggregation Examples (continued)

- Aggregate a selection of devices into a single interval

```
user@larsson:~> ziorep_traffic sample.log -i 0 -C A -d sdp \
-p 0x50050763030b0104 -c 42
 * |I/O rt MB/s|thrp in MB/s-|----I/O requests----|-I/O subs. lat. in us--|--channel lat. in us---|---fabric lat. in us---|
      min   max    avg  stdev #reqs   rd  wrt bidi  min  max    avg  stdev  min  max    avg  stdev  min  max    avg  stdev
2012-12-11 11:51:55
 *    0.0 115.9   2.9  1.181K  192K  42K 150K    0  154 315M 95.63K 1.048M   19  25K 3.725K 4.056K   68 969K 85.31K 109.5K
[...]
```

- Same selection, but detailed view

```
user@larsson:~> ziorep_traffic sample.log -i 0 -C A -d sdp \
-p 0x50050763030b0104 -c 42 -D
   |-----------------------I/O request sizes in KBytes---------------------------|
      0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  >8K
   |-----------------------I/O subsystem latency in us-------------------------------------------------------------------------|
      0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
   |-----------------------channel latency in us-----------------------------------------------------|
      0    1    2    4    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K>128K
 * |-----------------------fabric latency in us-------------------------------------------------------------------------|
      0    8   16   32   64  128  256  512   1K   2K   4K   8K  16K  32K  64K 128K 256K 512K   1M   2M   4M   8M  16M  32M >32M
2012-12-11 11:51:55
 *   13K    0    0  55K  614  663 1.6K 3.2K 5.8K  12K 100K    0    0    0    0    0
      0    0    0    0    0    0  12K 8.0K 2.1K 3.3K 6.1K 7.6K 5.5K  18K  23K  36K  70K  826  157   21    7    4    1    0    3
      0    0    0    0    0    0  38K  11K 1.0K  963 2.4K  13K  23K  36K  41K  25K 2.4K    0    0    0
      0    0    0    0    0  11K 8.4K 2.6K 2.2K 3.6K 6.3K 7.7K 7.2K  21K  20K  39K  64K  693  126    0    0    0    0    0    0
[...]
```


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Data Analysis: Hints & Tips

- Use '`-i 0`' to get a good starting point to identify anomalies quickly

```
user@larsson:~> ziorep_utilization sample.log -i 0
CHP|adapter in %-|--bus in %---|--cpu in %---|
 ID min max   avg min max   avg min max   avg
2012-12-11 11:51:55
 42   0   7   0.3   0  29   2.1   1   2   1.1
 43   0  10   0.4   0  32   2.3   0   2   0.1

CHP Bus-ID  |qdio util.%|queu|fail|-thp in MB/s-|I/O reqs-|
 ID            max   avg full  erc     rd    wrt   rd  wrt
2008-12-11 11:51:55
 42/0.0.591d  99.2   1.8 1.6K    0   0.5    2.9   33K 124K
 43/0.0.5b1d 100.0   1.9 1.8K    0   0.5    2.9   31K 126K
```

```
user@larsson:~> ziorep_traffic sample.log -i 0
      WWPN                LUN       |I/O rt MB/s|thrp in MB/s-|----I/O requests----|-I/O subs. lat. in us--|--channel lat. in us---|---fabric lat. in us---|
                                        min   max    avg  stdev #reqs   rd  wrt bidi  min  max    avg  stdev  min  max    avg  stdev  min  max    avg  stdev
2012-12-11 11:51:55
0x5005076303000104:0x4021402100000000   0.0  54.5   2.9  1.195K  3094  421 2.7K    0  165 731K 115.9K 73.45K   21  23K 4.934K 4.689K   72 725K 109.3K 71.47K
0x5005076303000104:0x4021402100000000   0.0  46.4   2.9  1.192K  3106  419 2.7K    0  170 558K 117.3K 73.41K   20  24K 5.140K 4.621K   72 513K 110.5K 71.49K
0x50050763030b0104:0x4021402100000000   0.0  17.1   2.8  1.182K  2218  336 1.9K    0  171 544K 112.7K 70.57K   20  22K 4.563K 4.364K   72 543K 106.2K 68.57K
0x50050763030b0104:0x4021402100000000   0.0  47.8   3.3  1.269K  1514  228 1.3K    0  172 333K 95.84K 65.99K   22  20K 4.190K 3.936K   74 323K 89.22K 63.65K
0x5005076303100104:0x4021402100000000   0.0  48.3   1.2  750.4   1784  797  987    0  163 178M 189.0K 4.210M   19  21K 3.192K 4.309K   72 717K 78.39K 98.46K
[...]
```

```
user@larsson:~> ziorep_traffic sample.log -i 0 -D
                                |-----------------------I/O request sizes in KBytes---------------------------|
                                   0   1   2   4   8  16  32  64 128 256 512  1K  2K  4K  8K >8K
                                |-----------------------I/O subsystem latency in us-----------------------------------------------------------|
                                   0   8  16  32  64 128 256 512  1K  2K  4K  8K 16K 32K 64K 128K 256K 512K  1M  2M  4M  8M 16M 32M >32M
                                |-----------------------channel latency in us-----------------------------------------------------------|
                                   0   1   2   4   8  16  32  64 128 256 512  1K  2K  4K  8K 16K 32K 64K 128K>128K
      WWPN                LUN   |-----------------------fabric latency in us------------------------------------------------------------|
                                   0   8  16  32  64 128 256 512  1K  2K  4K  8K 16K 32K 64K 128K 256K 512K  1M  2M  4M  8M 16M 32M >32M
2012-12-11 11:51:55
0x5005076303000104:0x4021402100000000 179   0   0 591  14   7  21  37 103 168 2.0K   0   0   0   0   0
                                       0   0   0   0   0   0 160  23  46  35  36  41  65 214 308 596 1.5K  40   1   0   0   0   0   0   0
                                       0   0   0   0   0   0 314 110   7   9  36 251 361 604 763 549  92   0   0   0
                                       0   0   0   0   0 160  38  14  75  38  32  37  61 240 282 671 1.4K  33   1   0   0   0   0   0   0
0x5005076303100104:0x4021402100000000 179   0   0 725   3   3  13  28  27  76 730   0   0   0   0   0
                                       0   0   0   0   0   0 178 431  24  11  18  48  56  97 125 176 578   9  29   0   3   0   0   0   1
                                       0   0   0   0   0   0 658 139  20  11  12  75 137 205 254 261  22   0   0   0
                                       0   0   0   0   0 163 451  15  18  10  21  55  56 123 118 185 545   8  26   0   0   0   0   0   0
[...]
```


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Data Analysis on Other Platforms

- Reporting tools do not depend on s390 architecture
- To compile on other platforms:
  - Extract source of *s390-tools* package, either from your distribution's source rpm, or download from http://www.ibm.com/developerworks/linux/linux390/s390-tools.html and extract via

```
user@larsson:~> tar xvfj s390-tools-1.17.0.tar.bz2
```

  - Change to *ziomon* subdirectory, build and install

```
user@larsson:~> cd s390-tools-1.17.0
user@larsson:~> make
user@larsson:~> sudo make install
```

- Run reporting tools on any given data

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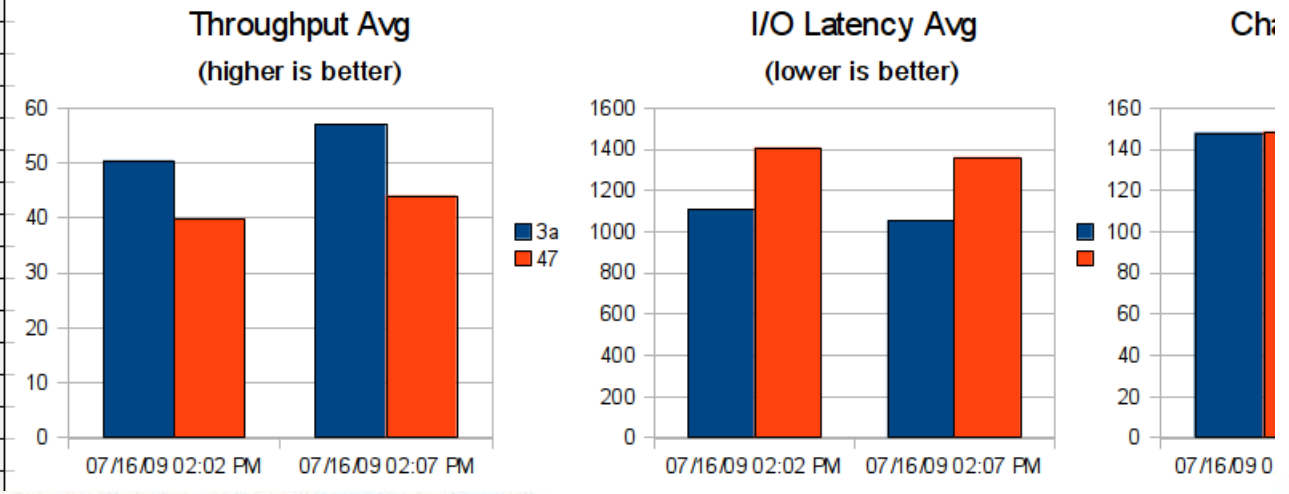
Data Analysis on Other Platforms (continued)

- Use option '-x' in *ziorep_utilization* and *ziorep_traffic* to export data to `.csv` format, e.g.

```
user@larsson:~> ziorep_traffic data.log -x -i 300 -b “2012-11-27 08:45:21” -C a
```

- All data filtering options specified will apply to exported data
- Import in spreadsheet and perform further processing

	A	B	C	D	E	F
1	timestamp	aggregated	CHPID	I/O rate in MB/s min	I/O rate in MB/s max	throughput in M
2	07/16/09 02:02 PM	0	3a	1.49	88.2	
3	07/16/09 02:02 PM	0	47	1.44	67.25	
4	07/16/09 02:07 PM	0	3a	0.53	103.14	
5	07/16/09 02:07 PM	0	47	0.27	68.86	



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References

- Linux on System z on DeveloperWorks
  http://www.ibm.com/developerworks/linux/linux390

- Linux on System z Documentation
  http://www.ibm.com/developerworks/linux/linux390/distribution_hints.html

  Specifically:

  – Device Drivers, Features, and Commands

  – How to use FC-attached SCSI devices with Linux on System z (chapters 11&12)

- Linux on System z – Downloads
  http://www.ibm.com/developerworks/linux/linux390/development_recommended.html

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Questions?

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