35 YEARS OF PERFORMANCE MANAGEMENT

z/VM7.4 and z17 Performance Metrics: Context and Analysis

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Hardware & software changes, metrics changes…

Topics

Channel and DPU Metrics

EQDIO Metrics

- **EQDIO VSwitches**
- **Dedicated EQDIO Devices**

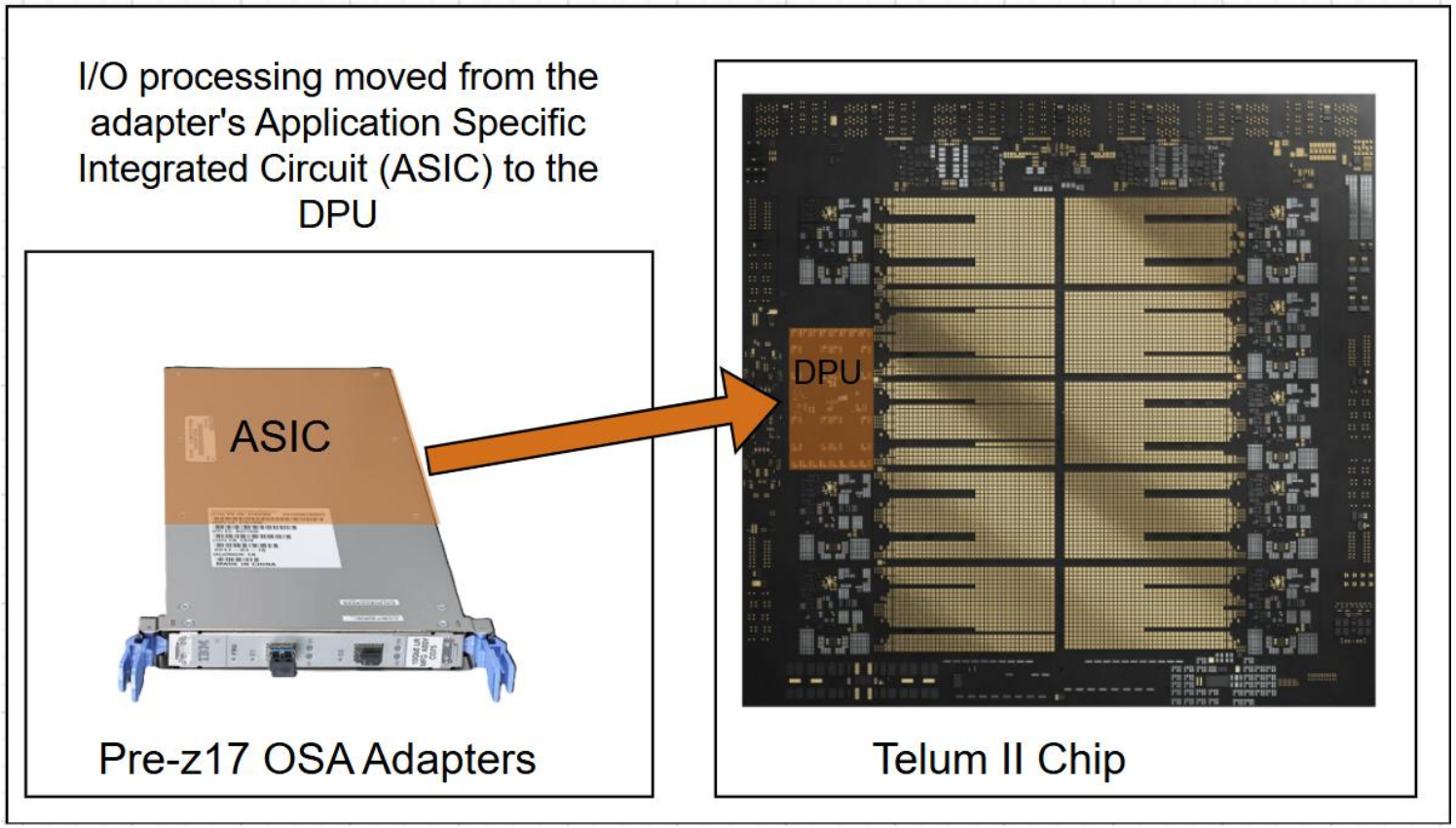
Power Consumption Metrics

Disclaimer: Metrics in testing phase, reports and analysis subject to change

Channel and DPU Metrics

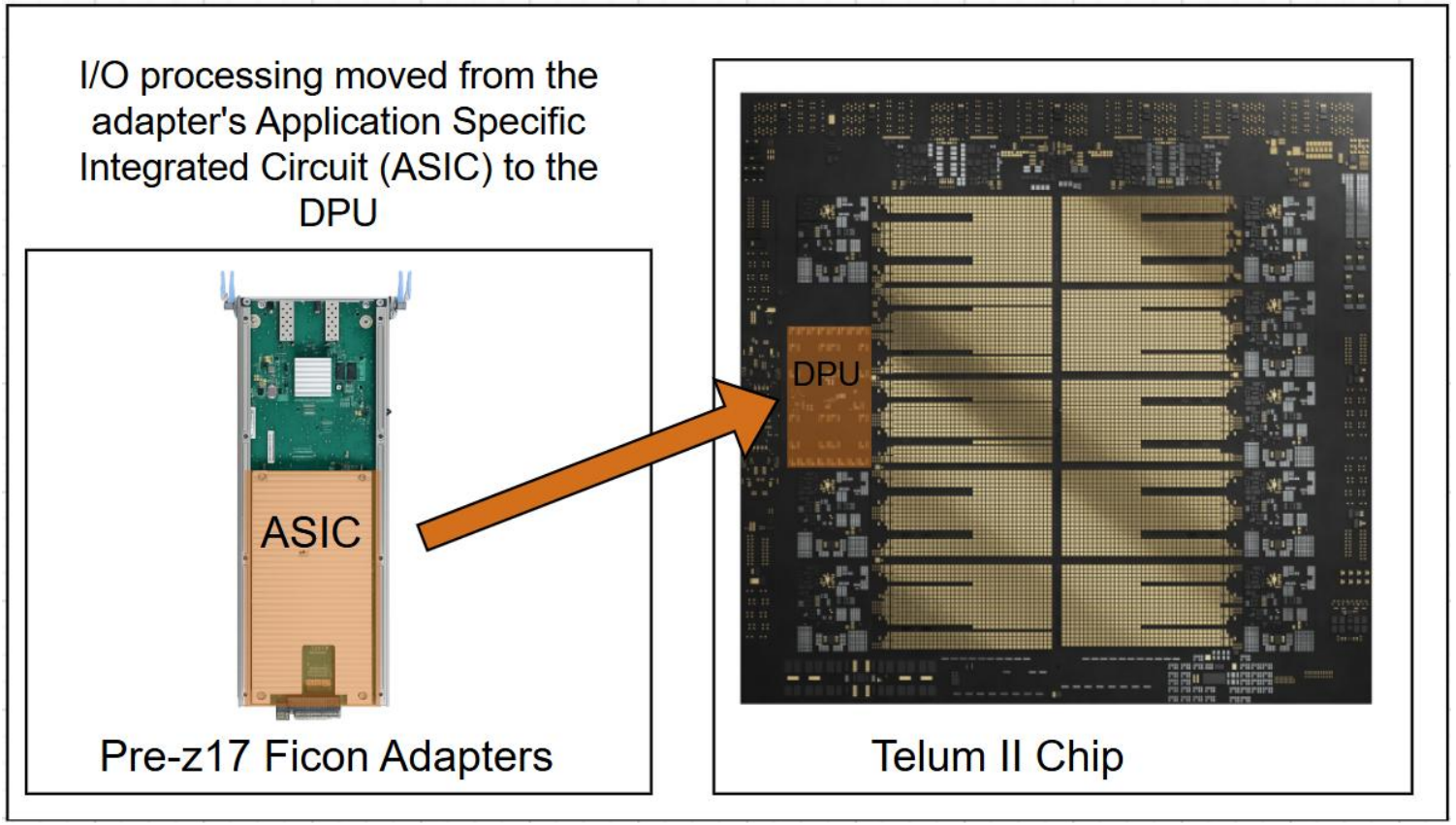
Network Express Adapter

- Similar functionality to OSA adapters as well as the RoCE
- ASICs removed
- I/O processing is performed on the Data Processing Unit (DPU) rather than the ASIC
- Uses EQDIO architecture

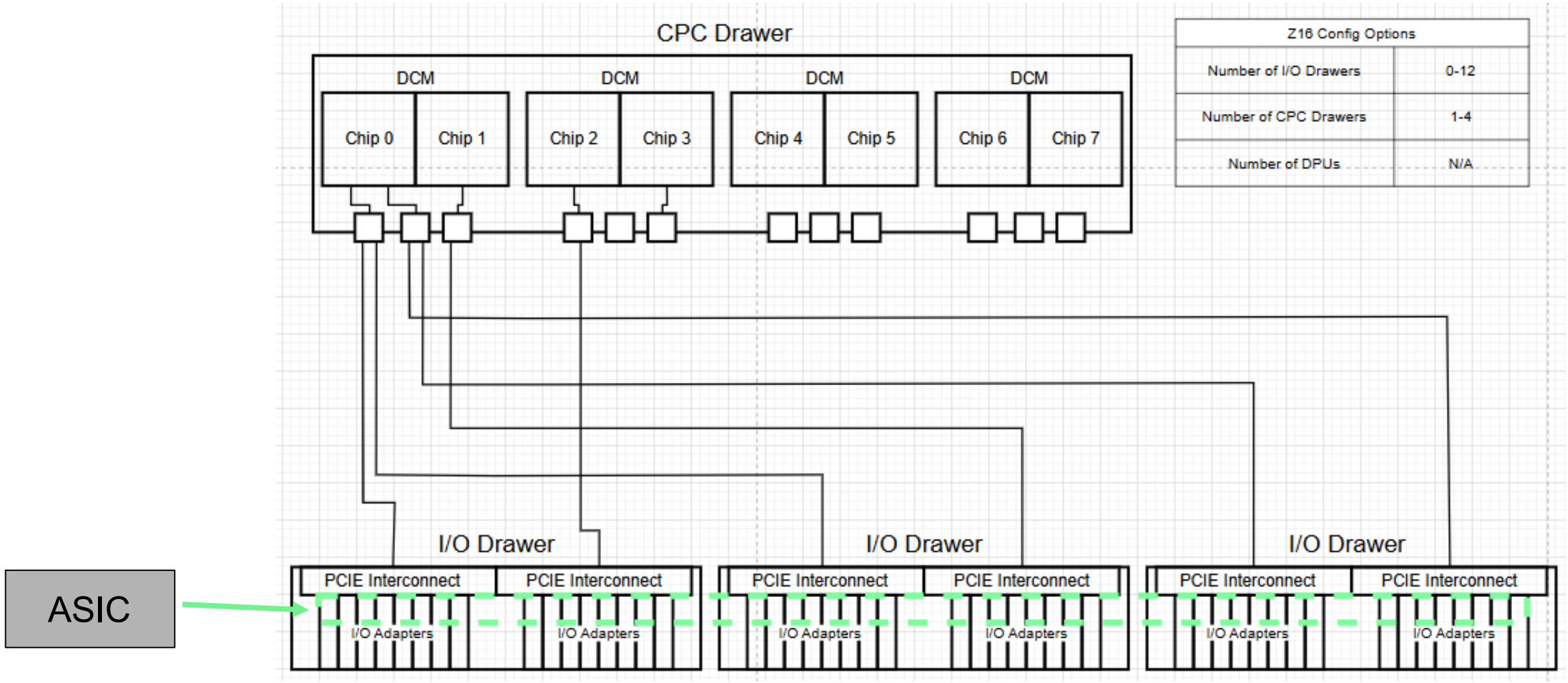


FICON Express 32-4P Adapter

- Same functionality as older FICON adapters
- ASICs removed
- I/O processing is performed on the DPU rather than the ASIC



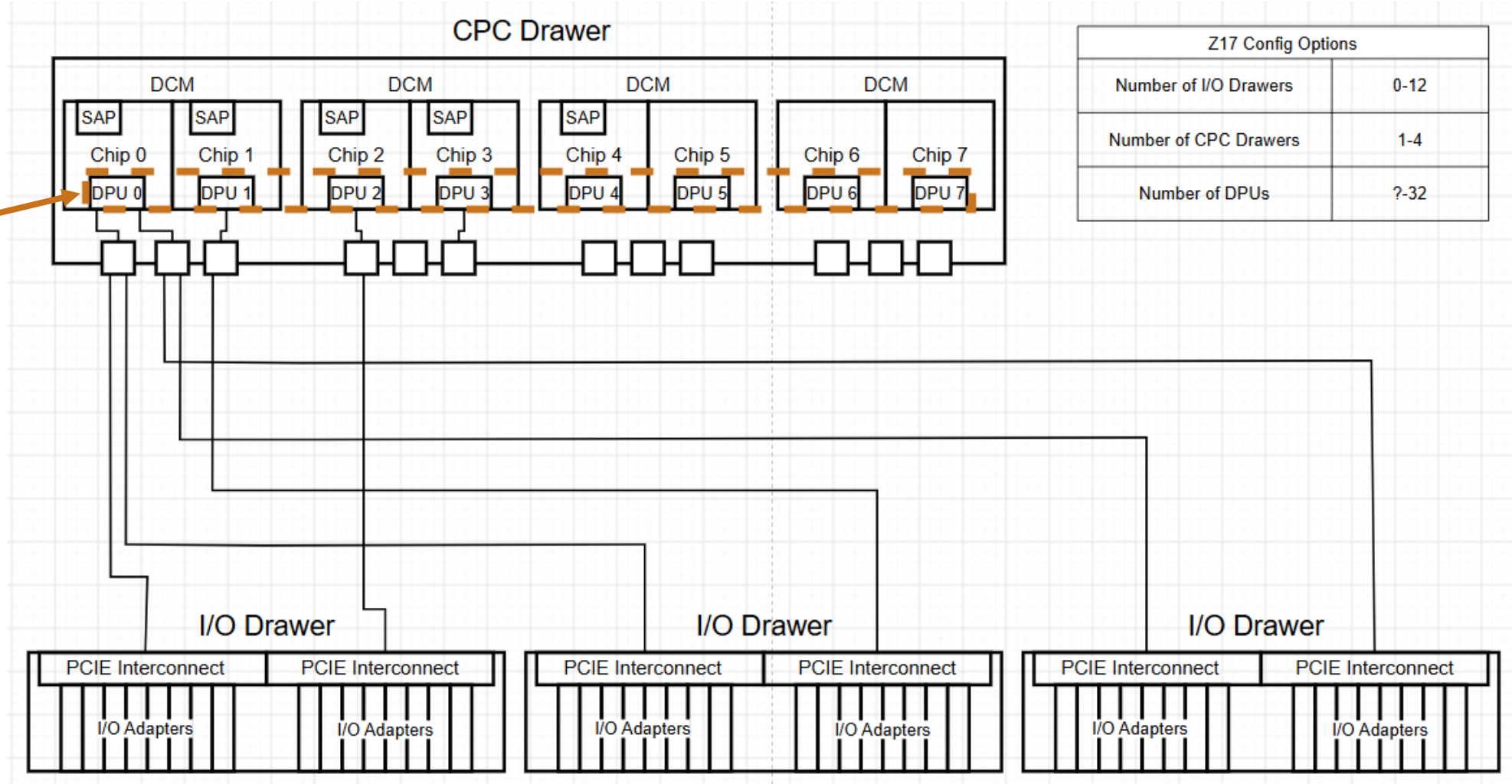
Pre-z17 I/O Processing Architecture



Sample z16 I/O drawer Configuration

Post-z17 I/O Processing Architecture

DPU

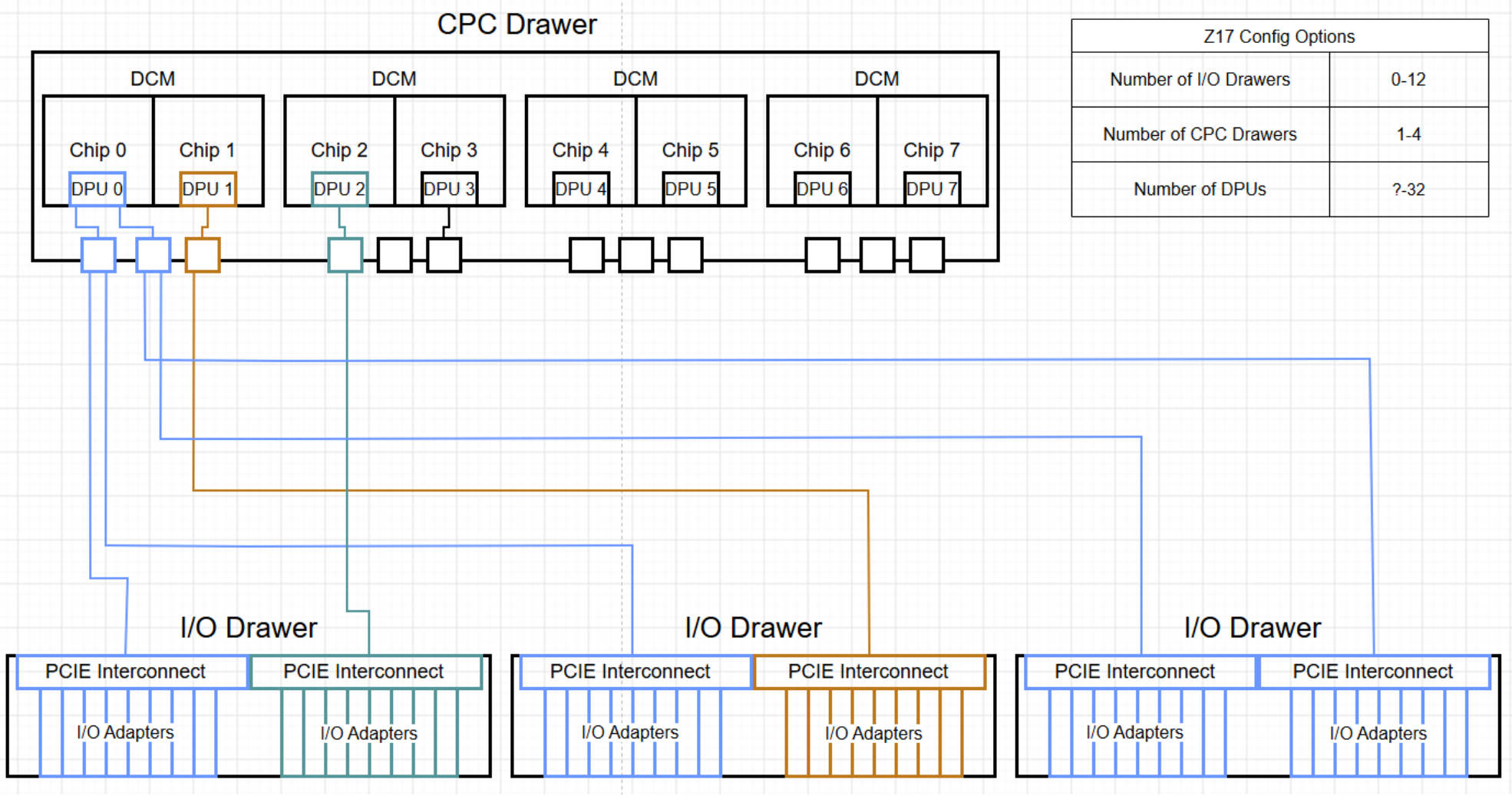


Z17 Config Options	
Number of I/O Drawers	0-12
Number of CPC Drawers	1-4
Number of DPUs	?-32

Sample z17 I/O drawer Configuration

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Which DPU is linked to which adapters?



Z17 Config Options	
Number of I/O Drawers	0-12
Number of CPC Drawers	1-4
Number of DPUs	?-32

Sample z17 I/O drawer Configuration

DPU Metrics

Relevant Performance Details

- Each channel is processed by a single DPU
- Each DPU can be linked to up to 128 channels
- The ONLY channels which use the DPU are the channels associated with the FICON Express 32-4P and the Network Express (using the OSH CHPID) adapters

Note: Full channel performance analysis requires additional metrics

Report: ESACHAN

Time/ CHPID	Chnl Type	<----DPU Util Pct-----> <-Channel-> LPAR	Total	<-Overall-> LPAR	Total	DPU Num
06:02:00						
20	FCS	0.000	0.005	0.003	0.064	22
21	FCS	0.000	0.005	0.002	0.045	30
22	FCS	0.000	0.005	0.003	0.064	22
23	FCS	0.000	0.005	0.002	0.044	30
24	FCS	0.000	0.005	0.003	0.064	22
25	FCS	0.000	0.005	0.002	0.045	30
26	FCS	0.000	0.005	0.003	0.064	22
27	FCS	0.000	0.005	0.002	0.045	30
C8	FCP	0	0.003	0	0.058	14
CA	FCP	.	.	.	.	.
CB	FCP	0	0.003	0	0.058	14
CD	FCP	0	0.003	0	0.064	22
E0	OSD	.	.	.	.	.
E1	OSD	.	.	.	.	.
E2	OSD	.	.	.	.	.
E3	OSD	.	.	.	.	.
E5	OSD	.	.	.	.	.
E7	OSD	.	.	.	.	.
E8	OSD	.	.	.	.	.
E9	OSD	.	.	.	.	.
Totals	FICON	0.002	0.042	0.020	.	.
Totals	FCP	0	0.036	0	.	.
Totals	OSA	0	0	0	.	.

Report displaying DPU utilization by CHPID and total DPU utilization

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DPU Metrics

Interpreting the associated report…

What will a problem look like?

- A single overutilized DPU
  - High number of FICON Express 32-4P/Network Express adapters linked to a given DPU
  - Smaller I/O block sizes
  - Heavy use of non-zHPF operations

Note: Full channel performance analysis requires additional metrics

Report: ESACHAN

Time/ CHPID	Chnl Type	<----DPU Util Pct-----> <-Channel-> LPAR	Total	<-Overall-> LPAR	Total	DPU Num
06:02:00						
20	FCS	0.000	0.005	0.003	0.064	22
21	FCS	0.000	0.005	0.002	0.045	30
22	FCS	0.000	0.005	0.003	0.064	22
23	FCS	0.000	0.005	0.002	0.044	30
24	FCS	0.000	0.005	0.003	0.064	22
25	FCS	0.000	0.005	0.002	0.045	30
26	FCS	0.000	0.005	0.003	0.064	22
27	FCS	0.000	0.005	0.002	0.045	30
C8	FCP	0	0.003	0	0.058	14
CA	FCP	.	.	.	.	.
CB	FCP	0	0.003	0	0.058	14
CD	FCP	0	0.003	0	0.064	22
E0	OSD	.	.	.	.	.
E1	OSD	.	.	.	.	.
E2	OSD	.	.	.	.	.
E3	OSD	.	.	.	.	.
E5	OSD	.	.	.	.	.
E7	OSD	.	.	.	.	.
E8	OSD	.	.	.	.	.
E9	OSD	.	.	.	.	.
Totals	FICON	0.002	0.042	0.020	.	.
Totals	FCP	0	0.036	0	.	.
Totals	OSA	0	0	0	.	.

Report displaying DPU utilization by CHPID and total DPU utilization

Pre-z17 Adapters

What about pre-z17 adapters?

- The I/O processing is done by ASICs on each I/O adapter
- Need to look at each individual microprocessor

Note: Full channel performance analysis requires additional metrics

Report: ESACHAN

Time/ CHPID	Chnl Type	<--Work Unit--> <Rates/Second-> LPAR	Total	Pct
15:45				
26	OSD	0	487	6.4
31	OSD	0	113	1.5
32	OSD	0	295	3.9
33	OSD	0	498	6.5
34	OSD	53	393	5.2
35	OSD	62	521	6.8
43	OSD	0	0	0
46	OSD	0	152	2.0
47	OSD	0	152	2.0
4A	OSD	2	3	0.0
4D	OSD	19	20	0.3
72	FCS	122	915	0.7
74	FCP	138	140	1.9
76	FCP	137	139	1.9
8A	FCS	122	505	0.4
9C	FCP	1838	1838	24
9D	FCP	137	139	1.9
Totals	FICON	244	1419	1.1
Totals	FCP	2250	2256	30
Totals	OSA	136	2940	39

Report displaying ASIC utilization by CHPID

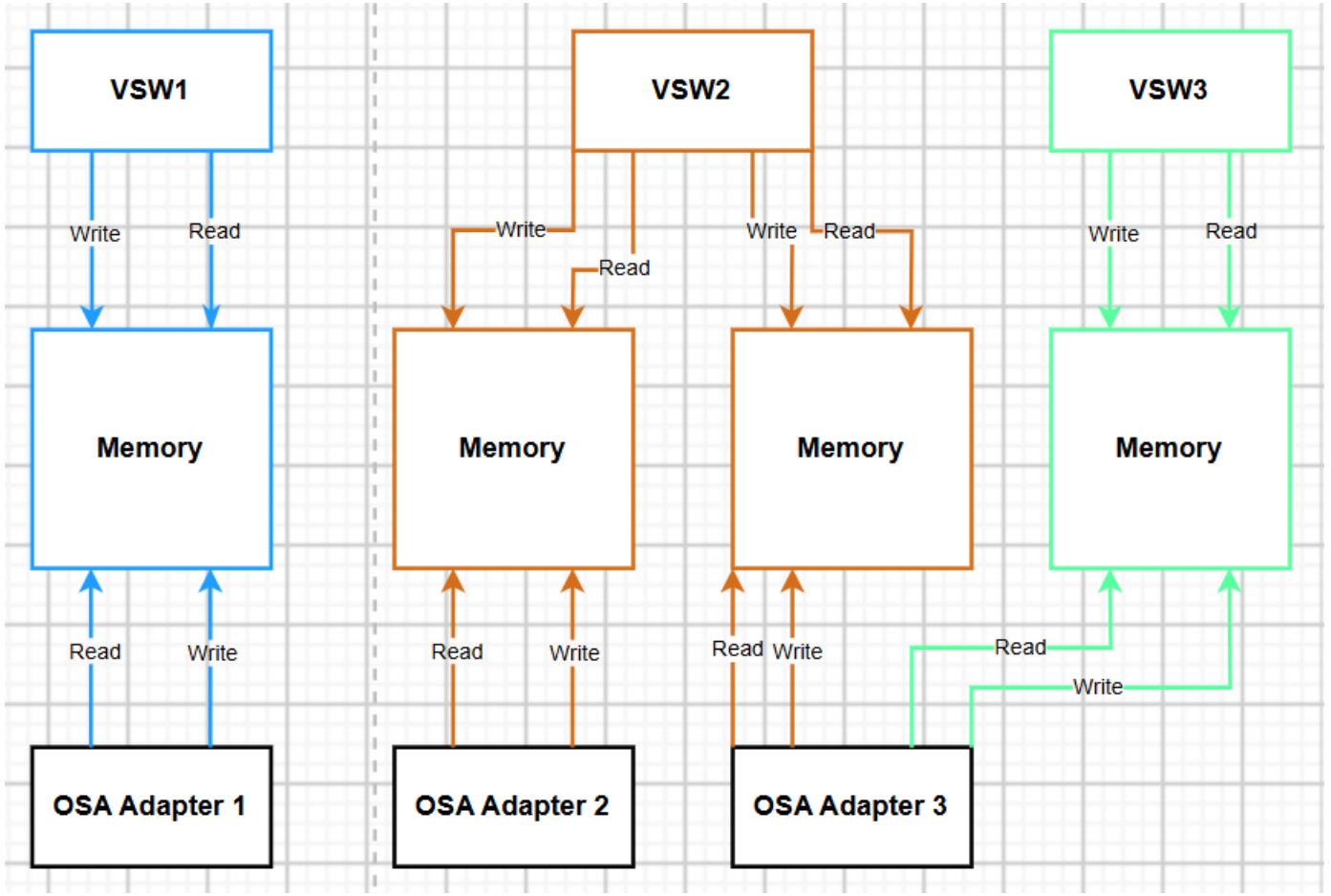
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EQDIO Metrics

QDIO Architecture

What is QDIO architecture?

- Predecessor of the EQDIO architecture
- Data transfer architecture defining how data flows between OS and adapter
- Utilizes memory as an intermediary between adapter and program
- Fixed limit to how much memory can be used
- Not the only architecture used…



Example QDIO VSwitch Configurations

When has QDIO been used historically?

- Utilized by real adapters
  - OSA Express through…
    - VSwitches
    - Dedicated devices
  - FICON Express adapter in FCP mode
    - Dedicated devices
- Utilized by virtual adapters
  - HiperSockets
  - Virtual QDIO NICs

When is QDIO vs EQDIO used today?

- On modern machines QDIO is still used for…
  - HiperSockets
  - Virtual QDIO NICs
  - FICON Express adapters in FCP mode
  - OSA adapters
- EQDIO utilized by a single virtual adapter
  - **Virtual EQDIO NICs**
- EQDIO utilized by a single physical adapter
  - Network Express (in OSH mode)
    - **VSwitches**
    - **Dedicated devices**

EQDIO VSwitches

Effects of EQDIO on VSwitch observability?

- Existing metrics must be looked at differently
- Additional metrics to observe new areas
- Further granularity

QDIO -> EQDIO: Metrics Changes

- Controlled by SYSTEM rather than a VM
- EQDIO Queue Storage is dynamic (1 – 256MB)(Input queue)

```
Report: ESAVSWC      Virtual Switch Configuration Report
-------------------------------------------------------------------------------------------------------------------------------
Date/Time                          Link      <Load Balance>            Control                 <activation>Queue   <--------Uplink Device--------->
 VSwitch  Virtual Switch    Sesn Agrgation           Int.  Control     Userid   Ownerid  Date  Time  Storage Dev  CSS                      Micr
 Name     Mac Address       Layr Group     Type      Secs  Userid      Name     Name     MM/dd hh:mm (MB)    No.  ID   MAC Address         Lvl
 -------- ----------------- ---- --------- --------- ----  --------    -------- -------- ----- ----- ------- ---- ---- ----------------- ----
06:02:00
 VSMLX01  03:00:61:00:00:09 ETH  LAGETH01  Forc Indp  300  SYSTEM      SYSTEM   SYSTEM   09/15 18:30       8 52A0 0806 56:B4:A2:32:92:24 0000
 VSMLX01  03:00:61:00:00:09 ETH  LAGETH01  Forc Indp  300  SYSTEM      SYSTEM   SYSTEM   09/15 18:30       8 52C0 0825 56:B4:A2:AB:74:83 0000
 VSWINT   03:00:02:00:00:0A ETH  .         Indepndnt    .  SYSTEM      SYSTEM   SYSTEM   07/22 08:51       8 0280 0230 56:B4:A2:B9:A2:42 0000
 VSWEXT   03:00:02:00:00:12 ETH  .         Indepndnt    .  SYSTEM      SYSTEM   SYSTEM   07/22 08:51       8 0480 0252 56:B4:A2:B9:B4:48 0000
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW3     SYSTEM   SYSTEM   09/15 18:31       8 8A00 0B78 D8:FF:26:92:25:52 0007
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW4     SYSTEM   SYSTEM   09/15 18:31       8 8B00 0B25 D8:FF:26:92:23:20 0007
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW2     SYSTEM   SYSTEM   09/15 18:30       8 9200 8A10 D8:FF:26:92:23:16 0007
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW1     SYSTEM   SYSTEM   09/15 18:31       8 9300 8A81 D8:FF:26:92:22:4A 0007
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW3     SYSTEM   SYSTEM   09/15 18:31       8 9400 8AF2 D8:FF:26:92:21:54 0007
 LGMLX01  03:00:61:00:00:05 ETH  LAGETH02  Forc Indp  300  DTCVSW4     SYSTEM   SYSTEM   09/15 18:31       8 9500 9273 D8:FF:26:92:26:72 0007
```

QDIO -> EQDIO: Metrics Changes

- Buffer count no longer generated

```
Report: ESAVSW       Virtual Switch Report
-------------------------------------------------------------------------------------------------------------------------
Date/Time Upl  <--Bytes--> <Packets > <Packet Errors / Sec> <---Buffers / Second--> <--Load Balance--->
 VSwitch  Dev  </ Second-> </ Second> <-Input--> <-Output-> <Processed> <Overflows> <--Frames/Second-->
 Name     No.  Recvd Sent  Recvd Sent Disc InErr Disc InErr Input Outpt Input Outpt Cur int.  Prev int.
 -------- ---- ----- ----- ----- ---- ---- ----- ---- ----- ----- ----- ----- ----- --------- ---------
06:02:00
 VSMLX01  52A0     8     0     0    0    0     0    0     0     .     .     .     .         0         0
 VSMLX01  52C0     8     0     0    0    0     0    0     0     .     .     .     .         0         0
 VSWINT   0280  1115  1002    16    1    0     0    0     0     .     .     .     .         .         .
 VSWEXT   0480     0     0     0    0    0     0    0     0     .     .     .     .         .         .
 LGMLX01  8A00  469K  167K   769  223    0     0    0     0   485   199     0     0       993       785
 LGMLX01  8B00  202K  241K   759  365    0     0    0     0   628   325     0     0      1124      1175
 LGMLX01  9200  190K 1872K   612 2132    0     0    0     0   540  2016     0     0      2743      2950
 LGMLX01  9300  465K     0   867    0    0     0    0     0   595     0     0     0       867       695
 LGMLX01  9400  145K  979K   627 1228    0     0    0     0   538  1017     0     0      1855      1973
 LGMLX01  9500  772K  532K  1137  781    0     0    0     0   642   726     0     0      1918      1831
```

QDIO -> EQDIO: Metrics Changes

- Extra buffer count no longer generated

Report: ESAVSW2 Virtual Switch Report Part Two

Date/Time VSwitch Name	Upl Dev No.	<--Signals---> <-per Second-> Read	Writ	Sync	<PCI Intrupts> <-per Second-> Total	Prcessed	<---network lock requests----> <--Per Second-> Ntwrk	Send	Recv	waits/sec Send	wait Recv	time	<-stack-> </second> rqst	dfrd	<---Marker PDUs----> Sent	Rcvd	Rspns	Time Out	TRC	SNF	Time Out Secs	Extra Buffrs
06:02:00																						
VSMLX01	52A0	17	17	1	8	0	0	1	8	0	0	0	0	0	0	0	0	0	0	0	300	.
VSMLX01	52C0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	.
VSWINT	0280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	.
VSWEXT	0480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	.
LGMLX01	8A00	0	145	0	484	484	484	191	484	0	0	0	0	0	0	0	0	0	0	0	300	126
LGMLX01	8B00	0	253	0	628	628	628	314	628	0	0	0	0	0	0	0	0	0	0	0	300	126
LGMLX01	9200	0	1719	0	540	540	540	1983	540	0	0	0	0	0	0	0	0	0	0	0	300	126
LGMLX01	9300	0	0	0	594	594	594	0	594	0	0	0	0	0	0	0	0	0	0	0	300	126
LGMLX01	9400	0	751	0	538	538	538	974	538	0	0	0	0	0	0	0	0	0	0	0	300	126
LGMLX01	9500	0	591	0	641	640	641	708	640	1	0	0	0	0	0	0	0	0	0	0	300	126

QDIO -> EQDIO: Metrics Changes

- Entirely new metrics with significant granularity
- Shows every individual queue used by each VSwitch

```
Report: ESAVSW3      Virtual Switch EQDIO Queues Activity Report Tyler Local
-------------------------------------------------------------------------------------------------------------------------------
Date/Time Upl            Total <------------------TX/RX Packets------------------> <------Pages-------> Force
 VSwitch  Dev            TX/RX                 <------Size-------> <---Type-----> <Current-> <To Prp-> Init
 Name     No.  QID QType Bytes Total Disc InErr Shrt Med  Lrg  Jumb Unic Mult Brdc Ready Pref Min  Max  Stalls State
 -------- ---- --- ----- ----- ----- ---- ----- ---- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ------ -----
14:04:00
 VSIINTL2 0280
                0 input     0     0    0     0    0    0    0    0    0    0    0    32   32   32  128      0     0
                1 outpt     0     0    0     0    0    0    0    0    0    0    0     1    0    8  255      0     0
                2 input  1111    16    0     0   15    1    0    0    1    0   15  2039 2048 2048  66K      0     0
                3 outpt  1002     1    0     0    0    1    0    0    1    0    0     1    0    8  16K      0     0
                4 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                5 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                6 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
```

Note: Data exclusively generated for EQDIO devices

QDIO -> EQDIO: Metrics Changes

- Traffic:
  - Bytes/packets
  - Packet size
  - Type

```
Report: ESAVSW3      Virtual Switch EQDIO Queues Activity Report Tyler Local
-------------------------------------------------------------------------------------------------------------------------------
Date/Time Upl                 Total <-------------------TX/RX Packets------------------> <------Pages-------> Force
 VSwitch  Dev                 TX/RX                <------Size-------> <---Type-----> <Current-> <To Prp-> Init
 Name     No.  QID QType      Bytes Total Disc InErr Shrt Med  Lrg  Jumb Unic Mult Brdc Ready Pref Min  Max  Stalls State
 -------- ---- --- -----      ----- ----- ---- ----- ---- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ------ -----
14:04:00
 VSIINTL2 0280
                  0 input        0     0    0     0    0    0    0    0    0    0    0    32   32   32  128      0     0
                  1 outpt        0     0    0     0    0    0    0    0    0    0    0     1    0    8  255      0     0
                  2 input     1111    16    0     0   15    1    0    0    1    0   15  2039 2048 2048  66K      0     0
                  3 outpt     1002     1    0     0    0    1    0    0    1    0    0     1    0    8  16K      0     0
                  4 outpt        0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                  5 outpt        0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                  6 outpt        0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
```

Note: Data exclusively generated for EQDIO devices

QDIO -> EQDIO: Metrics Changes

- Low-level memory usage:
  - Pages ready/preferred
  - Min/max pages

```
Report: ESAVSW3      Virtual Switch EQDIO Queues Activity Report Tyler Local
-------------------------------------------------------------------------------------------------------------------------------------------
Date/Time Upl            Total <------------------TX/RX Packets------------------> <------Pages-------> <-------------------------->  Force
 VSwitch  Dev            TX/RX                  <------Size-------> <---Type-----> <Current-> <To Prp-> <-------------------------->  Init
 Name     No.  QID QType Bytes Total Disc InErr Shrt Med  Lrg  Jumb Unic Mult Brdc Ready Pref Min  Max  Stalls                    State
 -------- ---- --- ----- ----- ----- ---- ----- ---- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ------                    -----
14:04:00
 VSIINTL2 0280
                0 input     0     0    0     0    0    0    0    0    0    0    0    32   32   32  128       0                    0
                1 outpt     0     0    0     0    0    0    0    0    0    0    0     1    0    8  255       0                    0
                2 input  1111    16    0     0   15    1    0    0    1    0   15  2039 2048 2048  66K       0                    0
                3 outpt  1002     1    0     0    0    1    0    0    1    0    0     1    0    8  16K       0                    0
                4 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K       0                    0
                5 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K       0                    0
                6 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K       0                    0
```

Note: Data exclusively generated for EQDIO VSwitches

QDIO -> EQDIO: Metrics Changes

- Basic Diagonistics:
  - Packets discarded/ In error
  - Stalls
  - Force Init State

```
Report: ESAVSW3      Virtual Switch EQDIO Queues Activity Report Tyler Local
-------------------------------------------------------------------------------------------------------------------------------
Date/Time Upl            Total <----------------TX/RX Packets------------------> <------Pages-------> Force
 VSwitch  Dev            TX/RX                 <------Size-------> <---Type-----> <Current-> <To Prp-> Init
 Name     No.  QID QType Bytes Total Disc InErr Shrt Med  Lrg  Jumb Unic Mult Brdc Ready Pref Min  Max  Stalls State
 -------- ---- --- ----- ----- ----- ---- ----- ---- ---- ---- ---- ---- ---- ---- ----- ---- ---- ---- ------ -----
14:04:00
 VSIINTL2 0280
                0 input     0     0    0     0    0    0    0    0    0    0    0    32   32   32  128      0     0
                1 outpt     0     0    0     0    0    0    0    0    0    0    0     1    0    8  255      0     0
                2 input  1111    16    0     0   15    1    0    0    1    0   15  2039 2048 2048  66K      0     0
                3 outpt  1002     1    0     0    0    1    0    0    1    0    0     1    0    8  16K      0     0
                4 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                5 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
                6 outpt     0     0    0     0    0    0    0    0    0    0    0     0    0    8  16K      0     0
```

Note: Data exclusively generated for EQDIO devices

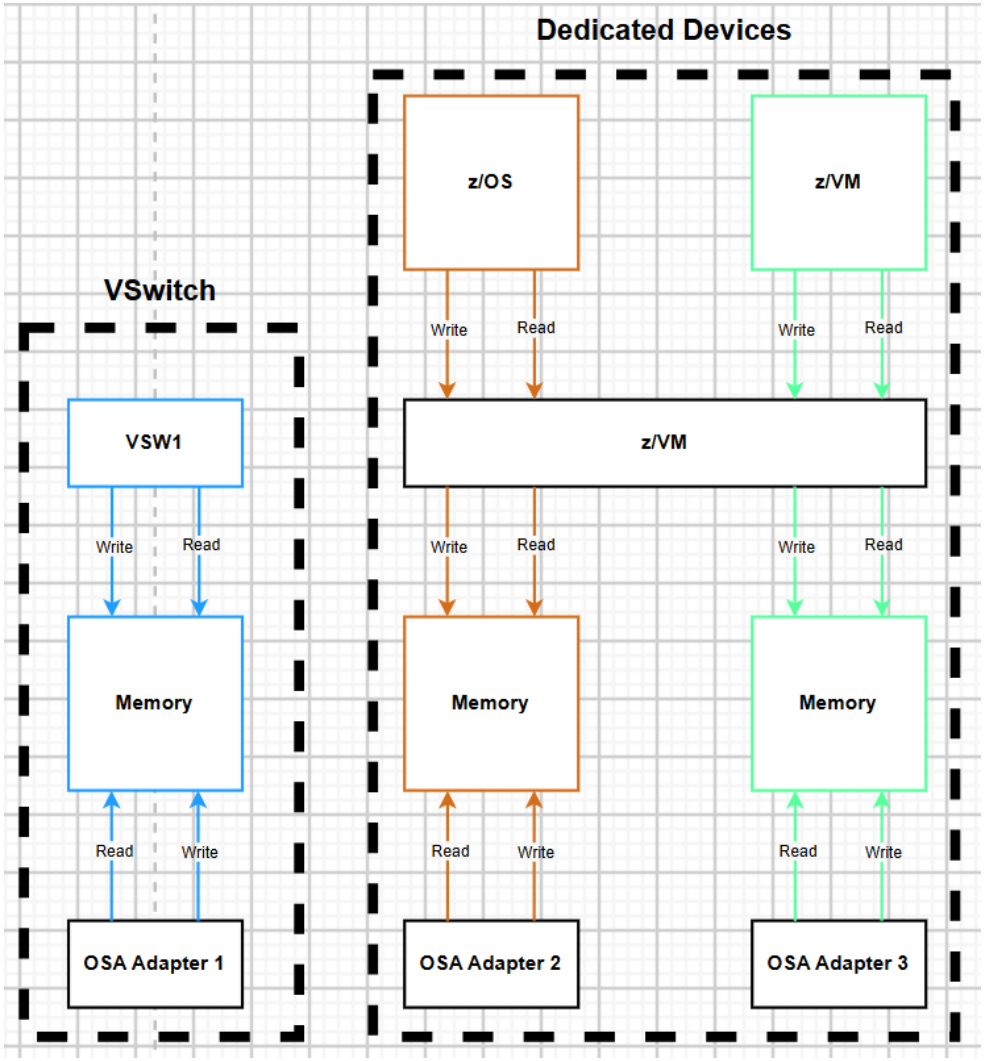
Dedicated EQDIO Devices

Dedicated EQDIO devices

- Similar to FCP/QDIO, EQDIO devices may be dedicated to a specific VM
- Linux guests do NOT support dedicated EQDIO devices
- Supported by:
  - z/OS
  - z/TPF
  - 2nd level z/VMs

Dedicated EQDIO devices vs EQDIO VSwitches

- Are the metrics the same?... No, but similar because…
  - Dedicated devices indirectly read/write to memory using z/VM as an intermediary
  - Differences in exposed metrics
- QIOASSIST is not supported for dedicated EQDIO devices



Sample VSwitch Config vs Sample dedicated device

EQDIO Devices

QDIO -> EQDIO: Metrics Changes

- High-level activity details based on throughput
  - Similar to QDIO devices and VSwitches
- CP Monitor does not produce buffer throughput on EQDIO data

```
Report: ESAQDIO      Queued I/O Overview
-------------------------------------------------------------------------------------------------------------------------
Time/                      Number Hiper QEBSM Multi <------Throughtput / second-------> <--QDIO--> <-EQDIO--> QEBSM      Inter
Dev. Device   Virt QDIO Queues Compl Mngd  Buff  <Buffers> <Bytes Sent> <Bytes Recv> <inst/sec> <inst/sec> instr CC2  upts
Nmbr Owner    DevN Fmt  In Out Queue Facil Facil Sent Recv Total  /buff Total  /buff Guest   CP Guest   CP /sec  /sec /sec
---- -------- ---- ---- -- --- ----- ----- ----- ---- ---- -----  ----- -----  ----- ----- ---- ----- ---- ----- ---- -----
07:03:00
0280 SYSTEM   0280 EQDI  2   5   No    No    No     0    0     0      0     0      0     0    0     0   31     0    0     6
```

Note: Reports subject to change

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EQDIO Devices

QDIO -> EQDIO: Metrics Changes

- Completely different set of low-level / diagnostic metrics compared to QDIO devices
- Observability per queue and overall

```
Report: ESAQDI4      Queued I/O: EQDIO Analysis
-------------------------------------------------------------------------------------------------------------------------------
Time/                          <------------Instr Issued / sec------------> Force Init                                  <Instr Iss>
Dev. Device   Virt QDIO <---By Guest--->  <----By CP-----> STAI STAI Init  Given          Plane Bytes <-Pages--> <-By Host->
Nmbr Owner    DevN Fmt  ECPQC SCPQC STAI  ECPQC SCPQC STAI  inp  out State State  QID QType Type  Trans Proc   Max ECPQC SCPQC
---- -------- ---- ---- ----- ----- ----  ----- ----- ---- ---- ---- ----- -----  --- ----- ----- ----- ---- ----- ----- -----
07:03:00
0280 SYSTEM   0280 EQDI    0     0    0     15    15    1    0    1     0     1
                                                                    0 input cntrl     0    0 256.0     0     0
                                                                    1 outpt cntrl     0    0 256.0     0     0
                                                                    2 input data      0    0 65536  13.5  13.5
                                                                    3 outpt data      0    0 65536   1.2   1.2
                                                                    4 outpt data      0    0 65536     0     0
                                                                    5 outpt data      0    0 65536     0     0
                                                                    6 outpt data      0    0 65536     0     0
```

Note: Reports subject to change, Data exclusively generated for EQDIO devices

VELOCITY SOFTWARE
PROVEN PERFORMANCE

QDIO -> EQDIO: Metrics Changes

- Traffic:
  - Bytes sent/received
  - Pages processed/max

```
Report: ESAQDI4      Queued I/O: EQDIO Analysis
-------------------------------------------------------------------------------------------------------------------------------
Time/                      <------------Instr Issued / sec------------> Force Init                                  <Instr Iss>
Dev. Device   Virt QDIO <---By Guest--->  <----By CP-----> STAI STAI Init  Given           Plane Bytes <-Pages--> <-By Host->
Nmbr Owner    DevN Fmt  ECPQC SCPQC STAI  ECPQC SCPQC STAI  inp  out State State  QID QType Type  Trans Proc   Max ECPQC SCPQC
---- -------- ---- ---- ----- ----- ----  ----- ----- ---- ---- ---- ----- -----  --- ----- ----- ----- ---- ----- ----- -----
07:03:00
0280 SYSTEM   0280 EQDI     0     0    0     15    15    1    0    1     0     1
                                                                      0 input cntrl     0    0 256.0     0     0
                                                                      1 outpt cntrl     0    0 256.0     0     0
                                                                      2 input data      0    0 65536  13.5  13.5
                                                                      3 outpt data      0    0 65536   1.2   1.2
                                                                      4 outpt data      0    0 65536     0     0
                                                                      5 outpt data      0    0 65536     0     0
                                                                      6 outpt data      0    0 65536     0     0
```

Note: Reports subject to change, Data exclusively generated for EQDIO devices

QDIO -> EQDIO: Metrics Changes

- Diagnostics:
  - Machine instructions
  - Init states

```
Report: ESAQDI4      Queued I/O: EQDIO Analysis
------------------------------------------------------------------------------------------------------------
Time/                          <------------Instr Issued / sec------------> Force Init                      <Instr Iss>
Dev. Device   Virt QDIO       <---By Guest--->  <----By CP-----> STAI STAI Init  Given          Plane Bytes <-Pages--> <-By Host->
Nmbr Owner    DevN Fmt        ECPQC SCPQC STAI  ECPQC SCPQC STAI  inp  out State State  QID QType Type  Trans Proc  Max ECPQC SCPQC
---- -------- ---- ----       ----- ----- ----  ----- ----- ---- ---- ---- ----- -----  --- ----- ----- ----- ---- ----- ----- -----
07:03:00
0280 SYSTEM   0280 EQDI           0     0    0     15    15    1    0    1     0     1
                                                                                        0 input cntrl     0     0 256.0     0     0
                                                                                        1 outpt cntrl     0     0 256.0     0     0
                                                                                        2 input data      0     0 65536  13.5  13.5
                                                                                        3 outpt data      0     0 65536   1.2   1.2
                                                                                        4 outpt data      0     0 65536     0     0
                                                                                        5 outpt data      0     0 65536     0     0
                                                                                        6 outpt data      0     0 65536     0     0
```

Note: Reports subject to change, Data exclusively generated for EQDIO devices

VELOCITY SOFTWARE
PROVEN PERFORMANCE

Power Consumption Metrics

Power Consumption Metrics

Where do the metrics come from?

- CP Monitor
  - Higher granularity power consumption on specific LPAR and CEC
  - Available with z/VM7.4 or higher
- HMC
  - View of the entire mainframe
  - Broad but complete overview of power usage
  - Visibility into environmental metrics
  - Full metrics available on the z17, earlier models may have a subset of metrics

Notes:
HMC data monitoring must be turned on in order to see HMC related metrics
Research in progress. As such metric descriptions and performance reports are subject to change

Power Consumption Metrics

Available Metrics

- **CEC power consumption**
  - LPARS
  - Standby
  - Infrastructure
- **Accuracy?**

```
Report: ESAPOWR      Hardware Power Consumption
-------------------------------------------------------------------------------------------------------------------------
                           <--------------Power Consumption(Watts)---------------> <--------Environmental metrics------->
                           <-----Workload------> <--------------CEC--------------> <--BTUs/Hour---> <Temp(Celsius)>
Time     CEC Ser. LPAR     Total  CPU  I/O  Stor Total LPARS Standby Infras CRatio Total  Air Water Room DewPt Exth Humid
-------- -------- -------- ----- ---- ---- ----- ----- ----- ------- ------ ------ ----- ---- ----- ---- ----- ---- -----
HMC Data:
06:02:00 P0030F78                               1254     .       .      .  0.999  4275 4275     0 18.6   8.3  29 0 24.7
                  PLACEH1      .
                  PLACEH2      .
                  PLACEH3      .
                  PLACEH4      .
                  PLACEH5      .
                  PLACEH6      .
                  PLACEH7      .
                  PLACEH8      .

Monitor Data:
                  VLXPMW09  54.3 35.2 12.1   7.0  1254     .     341.8  610.4
```

In-progress power performance report. Metrics labeled "." or starting with "PL" are expected but untested

Note: ***Research in progress. As such metric descriptions and performance reports are subject to change***

Power Consumption Metrics

Available Metrics

- **Power consumption by workload**
  - CPU
  - I/O
  - Storage

```
Report: ESAPOWR      Hardware Power Consumption
-------------------------------------------------------------------------------------------------------------------
                              <--------------Power Consumption(Watts)---------------> <--------Environmental metrics------->
                              <-----Workload------> <--------------CEC--------------> <--BTUs/Hour---> <Temp(Celsius)>
Time     CEC Ser. LPAR        Total  CPU  I/O  Stor Total LPARS Standby Infras CRatio Total  Air Water Room DewPt Exth Humid
-------- -------- --------    ----- ---- ---- ----- ----- ----- ------- ------ ------ ----- ---- ----- ---- ----- ---- -----
HMC Data:
06:02:00 P0030F78                                   1254     .       .      .  0.999  4275 4275     0 18.6   8.3  29 0 24.7
                  PLACEH1      .
                  PLACEH2      .
                  PLACEH3      .
                  PLACEH4      .
                  PLACEH5      .
                  PLACEH6      .
                  PLACEH7      .
                  PLACEH8      .

Monitor Data:
                  VLXPMW09   54.3 35.2 12.1   7.0  1254     .     341.8  610.4
```

In-progress power performance report. Metrics labeled "." or starting with "PL" are expected but untested

Note: ***Research in progress. As such metric descriptions and performance reports are subject to change***

Power Consumption Metrics

Available Metrics

- **Power consumption by LPAR**
  - Total

```
Report: ESAPOWR      Hardware Power Consumption
-------------------------------------------------------------------------------------------------------------------
                              <-----------Power Consumption(Watts)---------------> <--------Environmental metrics------->
                              <-----Workload------> <--------------CEC--------------> <--BTUs/Hour---> <Temp(Celsius)>
Time     CEC Ser. LPAR     Total  CPU  I/O  Stor Total LPARS Standby Infras CRatio Total  Air Water Room DewPt Exth Humid
-------- -------- -------- ----- ---- ---- ----- ----- ----- ------- ------ ------ ----- ---- ----- ---- ----- ---- -----
HMC Data:
06:02:00 P0030F78                                1254     .       .      .  0.999  4275 4275     0 18.6   8.3  29 0 24.7
                  PLACEH1      .
                  PLACEH2      .
                  PLACEH3      .
                  PLACEH4      .
                  PLACEH5      .
                  PLACEH6      .
                  PLACEH7      .
                  PLACEH8      .

Monitor Data:
                  VLXPMW09  54.3 35.2 12.1   7.0  1254     .     341.8  610.4
```

In-progress power performance report. Metrics labeled "." or starting with "PL" are expected but untested

Note: ***Research in progress. As such metric descriptions and performance reports are subject to change***

Power Consumption Metrics

Available Metrics

- **Environmental Metrics**
  - Air
  - Water
  - Total
  - Room
  - Dewpoint
  - Exhaust
  - Humidity

```
Report: ESAPOWR      Hardware Power Consumption
------------------------------------------------------------------------------------------------------------------------
                           <--------------Power Consumption(Watts)---------------> <--------Environmental metrics------->
                           <-----Workload------> <--------------CEC--------------> <--BTUs/Hour---> <Temp(Celsius)>
Time     CEC Ser. LPAR     Total  CPU  I/O  Stor Total LPARS Standby Infras CRatio Total  Air Water Room DewPt Exth Humid
-------- -------- -------- ----- ---- ---- ----- ----- ----- ------- ------ ------ ----- ---- ----- ---- ----- ---- -----

HMC Data:
06:02:00 P0030F78                              1254     .       .      .  0.999  4275 4275     0 18.6   8.3  29 0 24.7
                  PLACEH1      .
                  PLACEH2      .
                  PLACEH3      .
                  PLACEH4      .
                  PLACEH5      .
                  PLACEH6      .
                  PLACEH7      .
                  PLACEH8      .

Monitor Data:
                  VLXPMW09  54.3 35.2 12.1   7.0  1254     .     341.8  610.4
```

In-progress power performance report. Metrics labeled "." or starting with "PL" are expected but untested

Note: ***Research in progress. As such metric descriptions and performance reports are subject to change***

Takeaways

- The DPU instead of the ASICs must now be considered/understood in relation to z17 channel performance
- High-level EQDIO activity metrics must be looked at slightly differently
- Lower-level EQDIO metrics are entirely new and provide significantly higher granularity compared to QDIO metrics
- Significant and complete observability into power consumption via combining HMC and CP Monitor data

Thank you for listening!

Questions?

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Want to learn more? See our Tuning Guide:

https://velocitysoftware.com/tuneguide/tuning1.html

