

VELOCITY  
S O F T W A R E

# *Docker Performance Management*

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Containers...

Docker Options

Data Collection

What data is there

z/VM on z – efficient, scalable, FAST

Linux – very large penetration world wide

Linux Containers

- In productive use by few customers
- Requirements for management

IBM Secure Software Container

- Linux under cover
- signed container solution
- All access via controlled user interface

z/OS Container Extensions zCX

- Linux containers on zip under z/OS

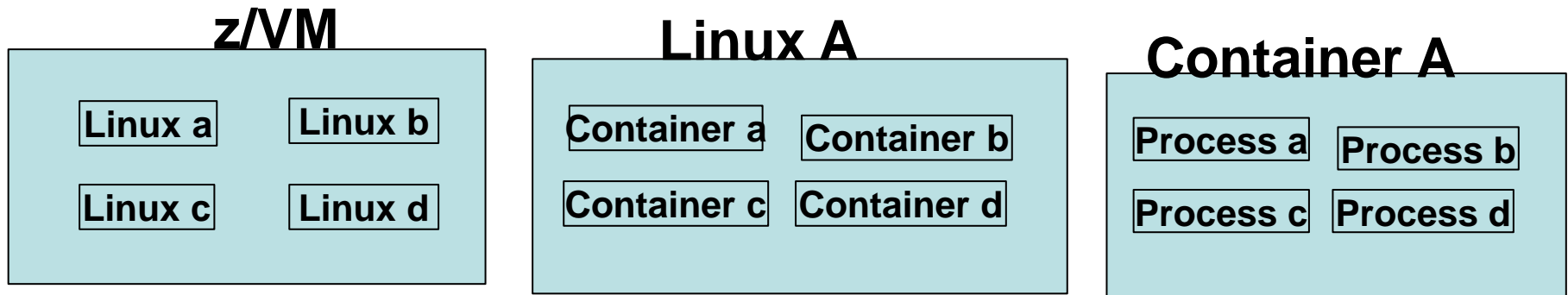
z/VM – The original virtualization

Linux on z – virtualized platform

Containers

- Docker most common
- Redhat (Rhel 8) only supports Open Container (OCI)
- IBM Software Secure container (SSC)
- z/OS Container Extensions

# *z/Linux Container Implementation – Host view*



## z/VM Hosting Linux servers

- All data “virtual machine” based
- CPU per Linux, disks / minidisks

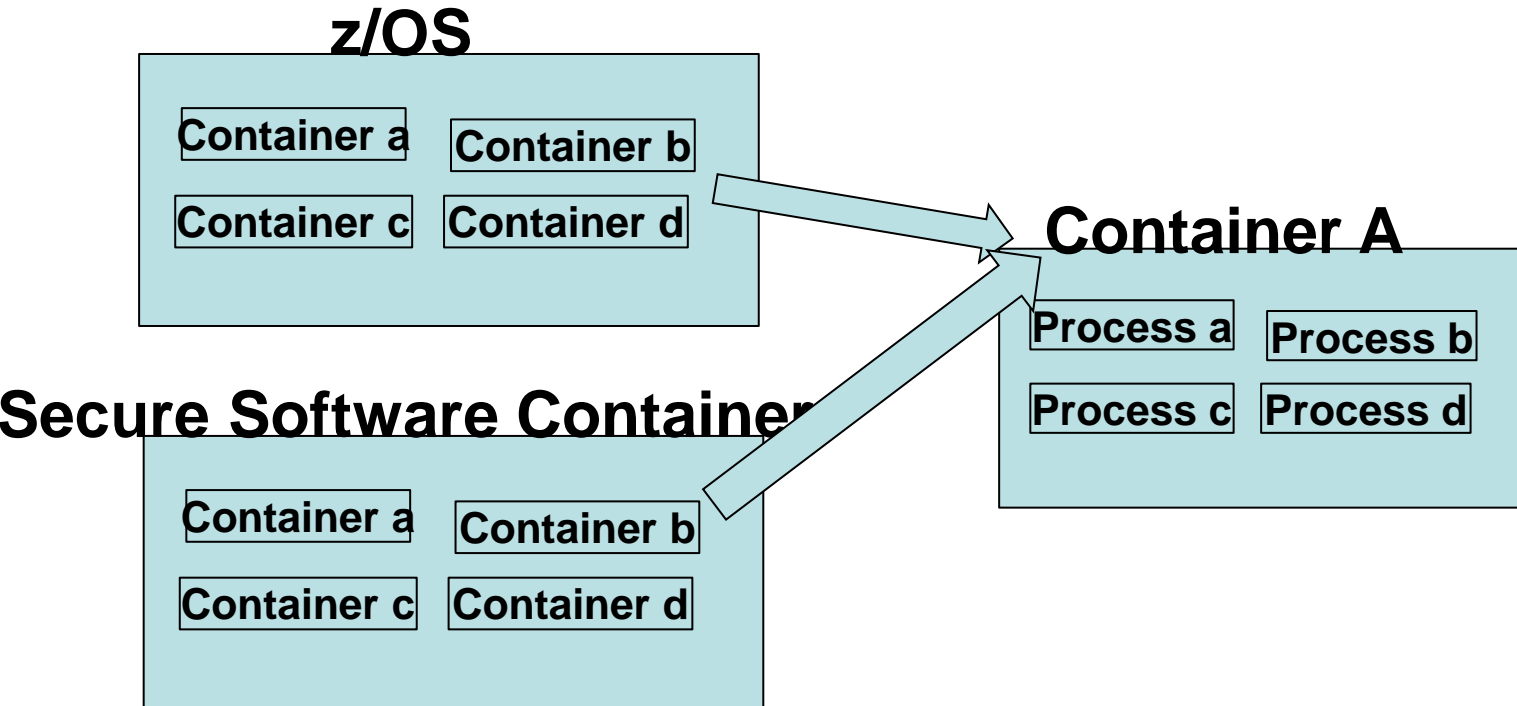
## Linux Host perspective

- Processes are processes
- File systems are file systems

## Container perspective

- Local Processes
- Local file systems

# Container Implementation – Other,...



z/OS has SMF for Address spaces

- SMF ONLY sees container and container resources -

Secure Container – very nice black box, got problems? bummer

## z/VM – CP Monitor

- Sees virtual machines (CPU, real memory, disks, other I/O)

## Linux - snmpd

- CPU, processes, file systems, network, real memory, etc
- Implemented, supported by zVPS

## Docker containers – Open Container Interface

- CPU, processes, file systems
- OCI Supported by snmp mib – supported by zVPS
- Collectd implemented in IBM Software Secure container (SSC)
- Collectd support Implemented, supported by zVPS

# Container Performance Management Options

## Open Container Interface

- Open software, Standard interface available

## Snmp mib inside container – it works....

## Snmp mib for docker

- Interface to Open Container Interface
- Mib provided by Velocity Software as part of zVPS
- Very efficient, designed for performance management
- Implemented, supported by zVPS

## collectd

- Open source facility
- <https://collectd.org/>
- - Not to be confused with <http://ssc-serv.com/>
- Collectd implemented in IBM Software Secure container (SSC)
- Implemented, supported by zVPS



## Docker (container technology) virtualizes:

- Interfaces (at least one per container)
- File systems
- Processes
- Disks

## What does Linux see?

- Processes are processes, same names, check parent process
- Docker manager is one process
- File systems – file systems have one name, containers see different
- Interfaces?

# Docker processes – host view

## What does Linux see?

- Sles12 is the host of the container
- Can see same process from two different perspectives

```
Screen: ESALNXC Velocity Software - VSIVM4          ESAMON 5.103 01/14 1
<----- Process -----> Appl
Node      Process Name          ID   PPID Group  Appl  Name
-----
sles12    gdm                   1515   1   1083  1515  gdm
          systemd              1521   1   1521  1521  systemd
          (sd-pam)              1522  1521  1521  1522  (sd-pam)
          dockerd              5319   1   5319  5319  dockerd
          docker-containe     5327  5319  5327  21935 docker-c
          docker-containe    6074  5327  6074  21935 docker-c
          httpd                6097  6074  6097  22015 httpd
          httpd                6151  6097  6097  22015 httpd
          httpd                6152  6097  6097  22015 httpd
          httpd                6153  6097  6097  22015 httpd
          docker-containe    6723  5327  6723  21935 docker-c
          stresser.sh       6746  6723  6746   6746  stresser
          sleep              22328 6746  6746  22328  sleep
          docker-containe    21118 5327  21118 21935 docker-c
          httpd                21141 21118 21141 22015 httpd
          httpd                21196 21141 21141 22015 httpd
          httpd                21197 21141 21141 22015 httpd
          httpd                21198 21141 21141 22015 httpd
          docker-containe    21331 5327  21331 21935 docker-c
          httpd                21354 21331 21354 22015 httpd
          httpd                21410 21354 21354 22015 httpd
          httpd                21411 21354 21354 22015 httpd
          httpd                21412 21354 21354 22015 httpd
```

# Docker processes – snmpd running inside

What does Linux see? What does docker container see?

- Snmpd running inside container (a bit expensive/big)
- Sles12 is the host of the container
- Rksctnr1 is a container with an snmp inside
- Can see same process from two different perspectives

Report: ESALNXP		LINUX HOST Process Statistics Report										Velocity		
node/ Name	<--Process ID	Ident--> PPID	GRP	Nice Valu	PRTY Valu	<-----CPU Percents----->					<----->			
						Tot	sys	user	syst	usrt	Size	RSS	Peak	S
11:15:00														
rksctnr1	0	0	0	0	0	19.0	0.03	0.02	0.03	18.9	31	11	396	
stresser	22	1	1	0	20	18.9	0.00	0	0.03	18.9	4	2		
sles12	0	0	0	0	0	20.4	0.72	0.99	0.04	18.6	3486	209	0	
snmpd	1485	1	1482	-10	10	0.94	0.55	0.38	0	0	21	10	0	
stresser	37173	37096	0	0	20	18.6	0.00	0	0.03	18.6	4	2		

## Collectd

- Open source package <https://collectd.org/>
- UDP – one direction only (different port, data format)
- Set ip address of collector and options
- Not as sophisticated or complete as VSI linux mib

## Plugin options supported (some supported by VSI)

- CPU (by CPU number) – system level
- LOAD – load averages
- DF – file systems
- DISK – disk activity
- Interface – network activity by interface
- Memory – system level
- Process – by process name?
- StatsD – different statistics
- Swap
- Virt – virtual machine

## IBM Secure Software Container

- Black box, as provided by IBM
- (Solution to performance – take a dump of partition)
- See <https://VelocitySoftware.com/collectd.html>
- Collectd open source docker solution
- Tested with IBM SSC
- IBM adds additional plugins

## z/OS Container Extensions zCX

- “container” is address space
- Virtualized, under covers, a black box for z/OS
- Likely collectd is solution

# IBM Secure Software Container / collectd

```
Report: ESASSCC          Collectd Report          V
Monitor initialized: 09/22/19 at 06:20:57 on 2828 serial 0314C7  F
-----
<-----Container-----> <-----CPU Percents----->
Name      <----IPADDR---->
          Totl  User  SYST  Nice  Intr  SIRQ  STL  Wait  Idle
-----
06:22:00
sles12    192.168.5.178    3.9  2.4  1.3    0  0.1  0.1  1.0  1.1  94.0
sles12    67.218.99.142   3.9  2.4  1.3    0  0.1  0.1  1.0  1.1  94.0
sles15    192.168.5.112   0.5  0.3  0.2    0    0  0.0  0.3  0.0  199
sles15    67.218.99.142   0.5  0.3  0.2    0    0  0.0  0.3  0.0  199
-----
06:23:00
sles12    192.168.5.178    2.5  1.3  1.1    0  0.1  0.1  0.4  0.7  96.4
sles12    67.218.99.142   2.5  1.3  1.1    0  0.1  0.1  0.4  0.7  96.4
sles15    192.168.5.112   0.5  0.3  0.2    0    0  0.0  0.3  0.0  199
sles15    67.218.99.142   0.5  0.3  0.2    0    0  0.0  0.3  0.0  199
```

## Collectd

- system cpu (user/system/nice)
- System performance indicators

# IBM Secure Software Container / collectd

Report: ESASSCC Velocity Software Corporate ZMAP 5.1.0 11/03/19 Page 490  
 Monitor initialized: First record analyzed: 09/22/19 06:21:00

```
-----
```

<----Container----->	<-----Memory Used (MB)----->							<-----Process States----->						
Name	<----IPADDR----->	<SlabUsed>							Blk	Page	run	Sleep	stop	zomb
		Used	Buff	Cach	Free	URcl	Recl							
-----														
06:22:00														
sles12	192.168.5.178	23.2	10.9	26.6	16.7	17.5	16.0	0	0	0	1.8	0	0	
sles12	67.218.99.142	23.2	10.9	26.6	16.7	17.5	16.0	0	0	0	1.8	0	0	
sles15	192.168.5.112	18.6	18.1	22.0	21.5	14.8	20.7	0	0	0	1.7	0	0	
sles15	67.218.99.142	18.6	18.1	22.0	21.5	14.8	20.7	0	0	0	1.7	0	0	
-----														
06:23:00														
sles12	192.168.5.178	23.2	11.0	26.6	16.0	17.5	16.0	0	0	0	3.6	0	0	
sles12	67.218.99.142	23.2	11.0	26.6	16.0	17.5	16.0	0	0	0	3.6	0	0	
sles15	192.168.5.112	18.6	18.1	22.0	21.5	14.8	20.7	0	0	0	3.3	0	0	
sles15	67.218.99.142	18.6	18.1	22.0	21.5	14.8	20.7	0	0	0	3.3	0	0	

## Collectd

- system memory
- Process overview
- Process states



# IBM Secure Software Container / collectd

Report: ESASSCP Collectd Process Report Velocity Software Corporate  
Monitor initialized: 09/22/19 at 06:20:57 on 2828 serial 0314C7 First record analyzed: 09/2

Container							<--Process-->	<---I/O-->	Disk			
Procname	Proc	<-----Process Storage (MBytes)----->					CPU	PageFlt	<Rate/Sec>	Bytes		
Time/Date	Count	ps_vm	ps_rss	ps_data	ps_code	stacksz	Percent	/Second	I/O	bytes	/Sec	
-----												
06:22:00												
sles15												
collectd	1	810	8.4	92.8	15.6	4194K	8.0	24.8	47.7	8681	0	
snmpd	1	20	8.3	5.3	13.3	0	1.0	0	0	0	0	
sles15												
collectd	1	810	8.4	92.8	15.6	4194K	8.0	24.8	47.7	8681	0	
snmpd	1	20	8.3	5.3	13.3	0	1.0	0	0	0	0	
-----												
06:23:00												
sles15												
collectd	1	810	8.4	92.8	15.6	4194K	8.0	21.0	47.2	8597	0	
snmpd	1	20	8.3	5.3	13.3	0	2.0	0	0	0	0	
sles15												
collectd	1	810	8.4	92.8	15.6	4194K	8.0	21.0	47.2	8597	0	
snmpd	1	20	8.3	5.3	13.3	0	2.0	0	0	0	0	

## Collectd

- process data
- Processes must be selected for measurement

# IBM SSC / collectd network data

Report: ESASSCN      Collectd Network Devices  
Monitor initialized: 09/22/19 at 06:20:57 on 2828 serial 0314C7

```
-----  
Container      <--Network Rates / Second-->  
DeviceName    Packets octets errors dropped  
-----  
06:22:00  
sles12        192.168.5.178  
  lo            0        3        0        0  
  docker0       0        0        0        0  
  eth0          6      1701     0        0  
sles12        67.218.99.142  
  lo            0        3        0        0  
  docker0       0        0        0        0  
  eth0          6      1701     0        0  
sles15        192.168.5.112  
  lo            0        0        0        0  
  eth0          2      1036     0        0  
sles15        67.218.99.142  
  lo            0        0        0        0  
  eth0          2      1036     0        0
```

## Collectd

- network data

# IBM Secure Software Container / collectd

Report: ESASSCF Collectd File Systems  
Monitor initialized: 09/22/19 at 06:20:57 on 2828 s

-----  
Container <-----Storage (MBytes)----->  
File System Size Free Reserved Used PCT  
-----

```
06:22:00
sles12 192.168.5.178
root 2955 2948 0 6 0.00
dev 512.4 512 0 0 0
usr-loca 531K 2864 2057 526K 0.99
tmp 531K 2864 2057 526K 0.99
var-opt 531K 2864 2057 526K 0.99
.snapsho 531K 2864 2057 526K 0.99
var-lib- 531K 2864 2057 526K 0.99
boot-zip 2063 5 5 2053 1.00
opt 531K 2864 2057 526K 0.99
opt-orac 531K 3529 770 527K 0.99
srv 531K 2864 2057 526K 0.99
var-cras 531K 2864 2057 526K 0.99
boot-gru 531K 2864 2057 526K 0.99
var-log 531K 2864 2057 526K 0.99
var-spo 531K 2864 2057 526K 0.99
var-tmp 531K 2864 2057 526K 0.99
home 2955 2948 0 6 0.00
run-user 2955 2948 0 6 0.00
boot 531K 2864 2057 526K 0.99
etc 531K 2864 2057 526K 0.99
usr 531K 2864 2057 526K 0.99
```

## Collectd

- File systems

## Snmpd supported added for open container

- Support included in zVPS

# Docker mib, configuration (zmon)

Screen: ESADOCK1 Velocity Software - VSIVM4  
1 of 3 Docker Configuration

ESAMON 5.103 01/14 11:03-  
NODE SLES12 2828

Time	Node	Container Index	Container Image	Container Name	Status
11:04:00	sles12	4c47e221510a	httpd2	bouncer6	runn
		587e637ade5e	httpd2	bouncer7	runn
		44ef8eb405e0	httpd2	bouncer8	runn
		5d3907c4b121	httpd2	bouncer2	runn
		41592c512082	httpd2	bouncer4	runn
		26650bfdd154	httpd2	bouncer6	runn
		50495cd506a4	httpd2	sharp_keller	runn

## Container configuration report, ESADOCK1

- Container ID is the funny number
- Image name, container name, and “running”

# Docker mib, configuration (zmap)

Report: ESADOCK1 DOCKER Configuration Report Velocity Software  
Monitor initialized: 12/17/19 at 13:31:28 on 2828 serial 0414C7 First record anal

Time / Node	<-----Container Configuration-----> Index	ImageName	ContName	Status	<-----Create-----> Date	Time
13:33:00						
sles12	b1da5097a5de	stressmem	flamboyant_kelle	runn	2019-11-23	00:44:13
	1c2edb787fdf	stresscpu	eager_curran	runn	2019-11-23	00:36:14
	50495cd506a4	httpd2	sharp_keller	runn	2019-11-23	00:19:27
13:34:00						
sles12	b1da5097a5de	stressmem	flamboyant_kelle	runn	2019-11-23	00:44:13
	1c2edb787fdf	stresscpu	eager_curran	runn	2019-11-23	00:36:14
	50495cd506a4	httpd2	sharp_keller	runn	2019-11-23	00:19:27
13:35:00						
sles12	b1da5097a5de	stressmem	flamboyant_kelle	runn	2019-11-23	00:44:13
	1c2edb787fdf	stresscpu	eager_curran	runn	2019-11-23	00:44:13
	50495cd506a4	httpd2	sharp_keller	runn	2019-11-23	00:36:14

## Container configuration report, ESADOCK1

- Container ID is the funny number
- Image name, container name, and “running”, start/stop

# Docker mib,resource by container (zmon)

Screen: ESADOCK2 Velocity Software - VSIVM4  
2 of 3 Docker Transactions

ESAMON 5.103 01/14 11:09-11:10  
NODE SLES12 2828 0414C

Time	Node	Container Index	<-----Storage in "MB"----->							
			Current		<Anonymous>		<---File-->			
			Use	Max	Cache	RSS	Inact	Activ	Inact	Activ
11:10:00	sles12	4c47e221510a	0	0	0	0	0	0	0	0
		587e637ade5e	13	13.08	7.99	2.38	0.33	2.38	6.26	1.40
		44ef8eb405e0	13	13.05	7.99	2.39	0.33	2.39	6.26	1.40
		5d3907c4b121	13	13.08	7.99	2.38	0.33	2.38	6.26	1.40
		41592c512082	13	12.91	7.99	2.38	0.33	2.38	6.26	1.40
		26650bfdd154	13	13.02	7.99	2.38	0.33	2.38	6.26	1.40
		50495cd506a4	8.76	14.78	3.07	3.27	1.91	1.69	1.41	1.34
		b1da5097a5de	3.66	13.08	3.25	0.21	0.05	0.16	0.80	2.45

## Container CPU, Storage report, ESADOCK2

- Container ID is the funny number
- Total cpu, storage

# Docker mib,resource by container (zmon)

Report: ESADOCK2 DOCKER Transaction Report Velocity Software  
Monitor initialized: 12/17/19 at 13:31:28 on 2828 serial 0414C7 First record analy

```
-----<-----Storage in "MB"----->
Node      Container  <CPU Percent> Current  <Anonymous> <---File--->
          Index   User  System  use  max  cache  rss  inact  activ  Inact  Activ
-----
13:33:00
sles12    b1da5097a5de  7.0    0.0   3.78 12.42  3.35 0.22  0.07  0.15  0.64  2.71
          1c2edb787fdf 17.9    0.0   4.22 12.20  3.77 0.22  0.09  0.13  0.67  3.10
          50495cd506a4  0      0     11.1 14.78  5.27 3.37  2.08  1.61  2.07  2.87
-----
13:34:00
sles12    b1da5097a5de  5.7    0.0   3.78 12.42  3.35 0.22  0.07  0.15  0.64  2.71
          1c2edb787fdf 15.9    0.0   4.22 12.20  3.77 0.22  0.09  0.13  0.67  3.10
          50495cd506a4  0      0     11.1 14.78  5.27 3.37  2.08  1.61  2.07  2.87
```

## Container CPU, Storage report, ESADOCK2

- Container ID is the funny number
- Total cpu, storage



# File systems – Host perspective

Report: ESAHST2

LINUX HOST Storage Analysis Report

Velocity Sof

NODE/ Time/ Date	Index	<-Utilization->			Errors	R/W R/W	<-----Storage----->			
		<MegaByte> Size	Used	Pct Full			Boot Flag	Alloc Units	Description	
sles12										
	52	20K	13K	66.5	0	Yes	Yes	4096	/	
	57	20K	13K	66.5	0	Yes	No	4096	/home	
	58	20K	13K	66.5	0	Yes	No	4096	/var/spool	
	76	20K	13K	66.5	0	Yes	No	4096	/var/lib/docker/btrfs	
	78	64.0	0	0	0	Yes	No	4096	/var/lib/docker/conta	
	79	938	0.0	0.0	0	No	No	4096	/var/lib/docker/conta	
	81	64.0	0	0	0	Yes	No	4096	/var/lib/docker/conta	
	82	938	0.0	0.0	0	No	No	4096	/var/lib/docker/conta	
	84	64.0	0	0	0	Yes	No	4096	/var/lib/docker/conta	
	85	938	0.0	0.0	0	No	No	4096	/var/lib/docker/conta	

/var/lib/docker/btrfs

/var/lib/docker/containers/50495cd506a4fe674013ed56

/var/lib/docker/containers/50495cd506a4fe674013ed56

/var/lib/docker/containers/1c2edb787fdf061055df85cb

/var/lib/docker/containers/1c2edb787fdf061055df85cb

/var/lib/docker/containers/b1da5097a5de45966a05930a

/var/lib/docker/containers/b1da5097a5de45966a05930a

- Filesystems have '/var/lib/docker/containers/' in name
- Container ID is the funny number

# File systems

Report: ESADOCK3      DOCKER File System Report      Velocity Software Corporate      ZM  
Monitor initialized: 12/17/19 at 13:31:28 on 2828 serial 0414C7      First record analyzed: 12/17/19

```
-----  
NODE/Container <--Utilization--> <-----Storage----->  
Time/ <MegaByte> Pct R/W Boot Alloc  
Date Index Size Used Full Errors R/W Flag Units Description  
-----  
13:33:00  
sles12  
b1da5097a5de  
84 64.0 0 0 0 Yes No 4096 /var/lib/docker/containers/b1da5097a5de45  
85 938 0.0 0.0 0 No No 4096 /var/lib/docker/containers/b1da5097a5de45  
1c2edb787fdf  
81 64.0 0 0 0 Yes No 4096 /var/lib/docker/containers/1c2edb787fdf06  
82 938 0.0 0.0 0 No No 4096 /var/lib/docker/containers/1c2edb787fdf06  
50495cd506a4  
78 64.0 0 0 0 Yes No 4096 /var/lib/docker/containers/50495cd506a4fe  
79 938 0.0 0.0 0 No No 4096 /var/lib/docker/containers/50495cd506a4fe  
-----
```

- Filesystems have '/var/lib/docker/containers/' in name

## Many virtualization options

- Linux
- Docker
- IBM ssc
- z/OS Container Extensions (linux on z/os)

## Performance management provided by VSI

- Snmp solutions
- Collectd solutions

## Single pane of glass