

# **z/VM PAV and HyperPAV Support**

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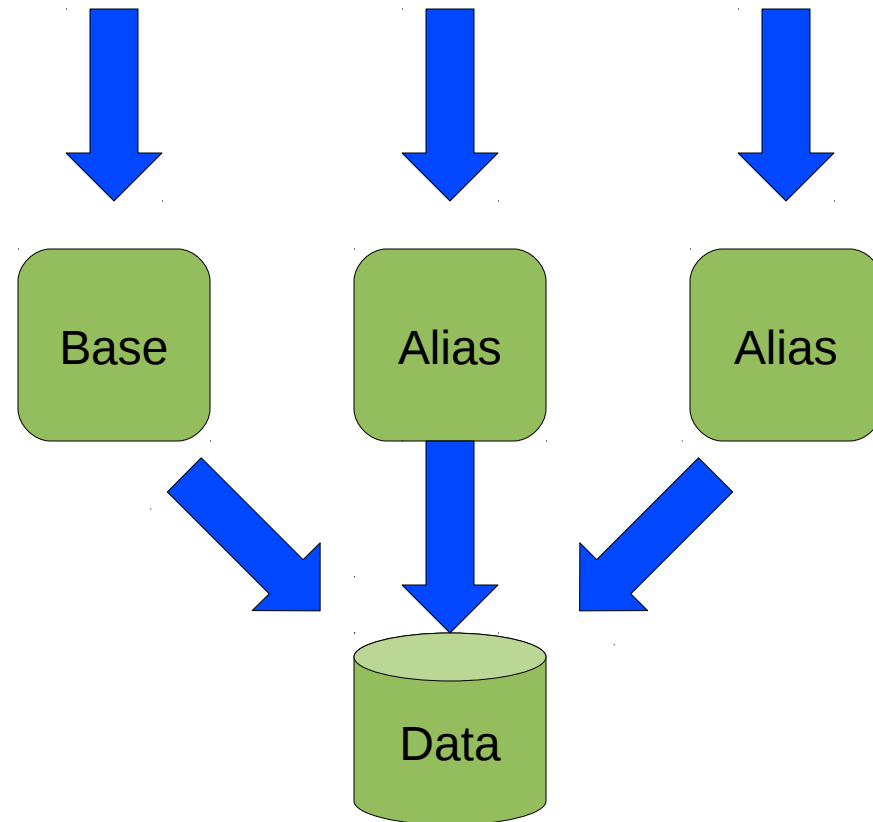
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- Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.  
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# Agenda

- PAV
  - Overview
  - Configuration
  - Commands
  - User Directory
  - Setup Example
  - Dynamic PAV
  - Performance
- HyperPAV
  - Overview
  - Configuration
  - Commands
  - User Directory
  - Configuration File
  - Documentation
- Reference



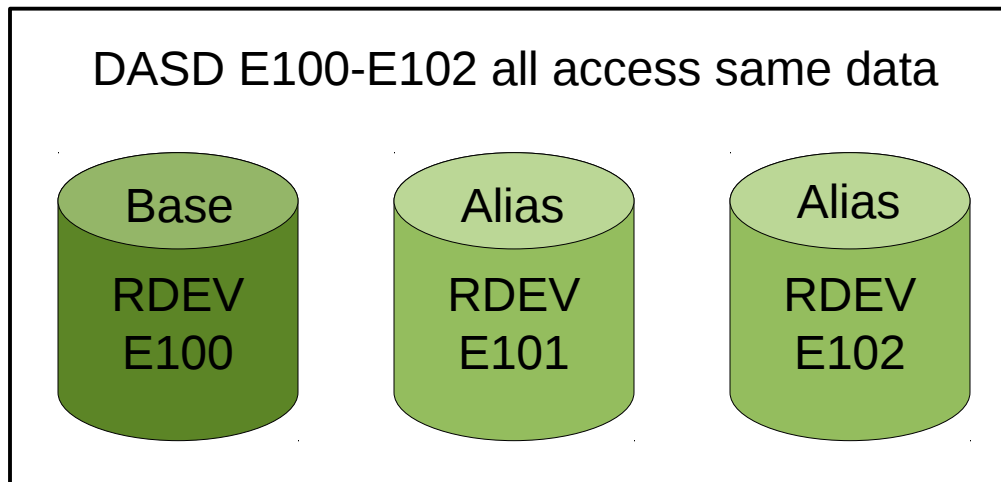
Thanks to Steve Wilkins for originally crafting this presentation

# PAV



# Overview

- z/VM provides support for the Parallel Access Volumes (PAV) feature of IBM System Storage subsystems.
- With PAV, a real DASD volume is accessed through a Base subchannel (device) and one or more Alias subchannels
  - Base volume shadowed by 1 or more Aliases
  - Each looks like separate real DASD to host operating system



# Overview

- z/Architecture allows only 1 active I/O to a single ECKD DASD
- Aliases overcome this restriction providing the ability to have multiple concurrent I/O operations on a DASD
- Allows higher I/O throughput by reducing I/O queuing
- Control unit provides data serialization
- Each I/O request specifies cylinder range:
  - Controller provides shared access for read cylinder ranges
  - Controller provides exclusive access for write cylinder ranges

# IOCP Configuration

- PAV volumes can be defined as 3390 Model 2, 3, 9 (inc. mod 27 and 54) DASD on 3990 Model 3 or 6, 2105, 2107, or 1750 Storage Controllers.
- 3380 track-compatibility mode for 3390 Model 2 or 3 DASD are also supported.
- IOCP Statements
  - CNTLUNIT
    - Control units for Bases and Aliases are **UNIT=3990**, 2105, 2107, or 1750
  - IODEVICE
    - Base **UNIT=3390** or 3390B or 3380 or 3380B
    - Alias **UNIT=3390** or 3390A or 3380 or 3380A

# Hardware Console Configuration

- The assignment of PAV Bases and Aliases is achieved with the control unit's Hardware Management Console (HMC)
- HMC configuration should match IOCP
- Use HMC to initially define which subchannels are Base subchannels, which subchannels are Alias subchannels, and which Alias subchannels are associated with each Base

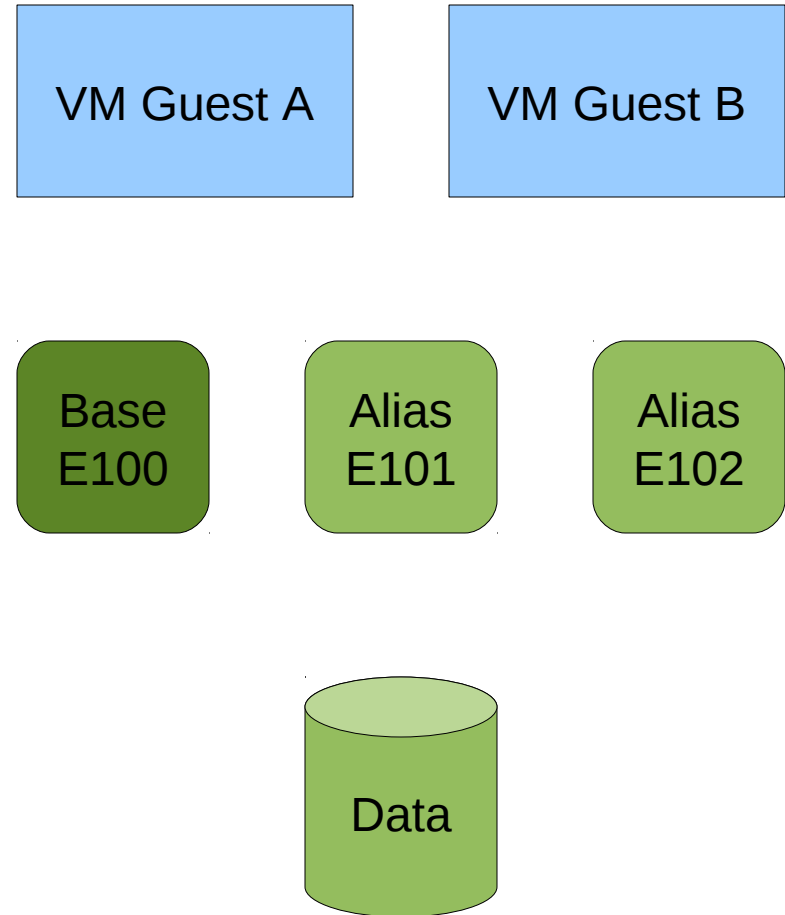


# VM Configuration

- A real Alias subchannel will not come online to VM without an associated real Base subchannel
- A real Base subchannel must have at least 1 associated real Alias subchannel for z/VM to recognize the device as a PAV Base subchannel
- Use the Class B, CP QUERY PAV command to view the current allocation of Base and Alias subchannels

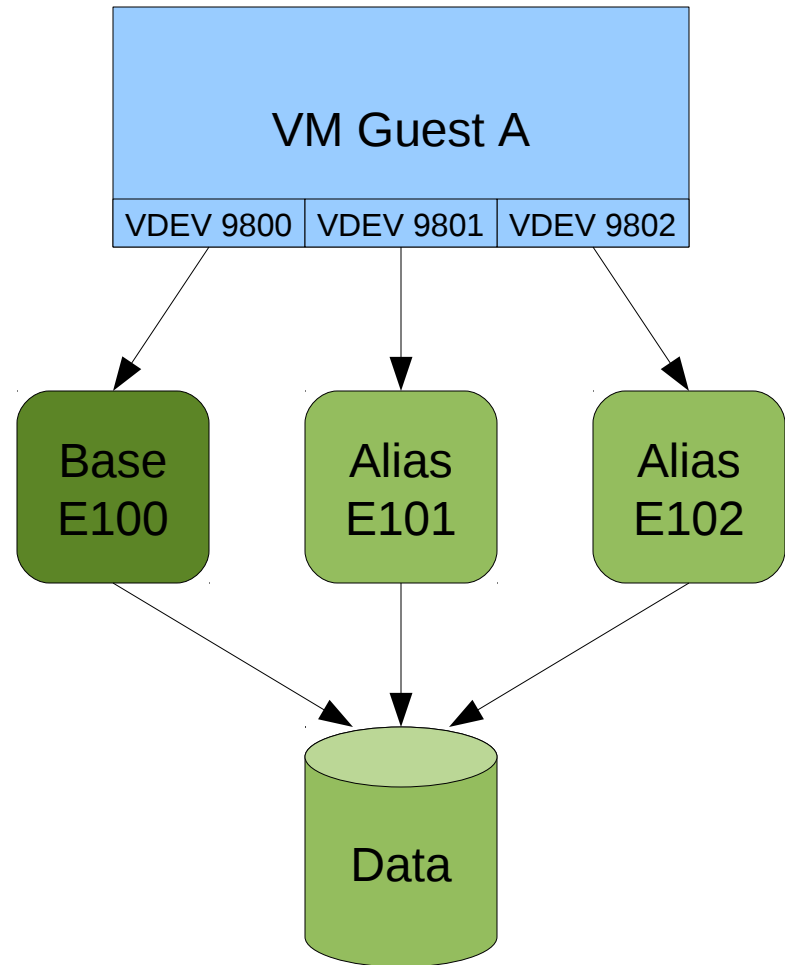
# VM Configuration (traditional)

- PAVs were traditionally supported by VM (z/VM 5.2.0 and earlier) for guests as dedicated DASD
- Base and Alias devices could be dedicated to a single guest or distributed across multiple guests
  - The latter is somewhat dangerous!
- Configured to guest(s) with the CP ATTACH command or DEDICATE user directory statement
- Only for guests that exploited the PAV architecture, like z/OS and Linux



# VM Configuration Today (Dedicated DASD)

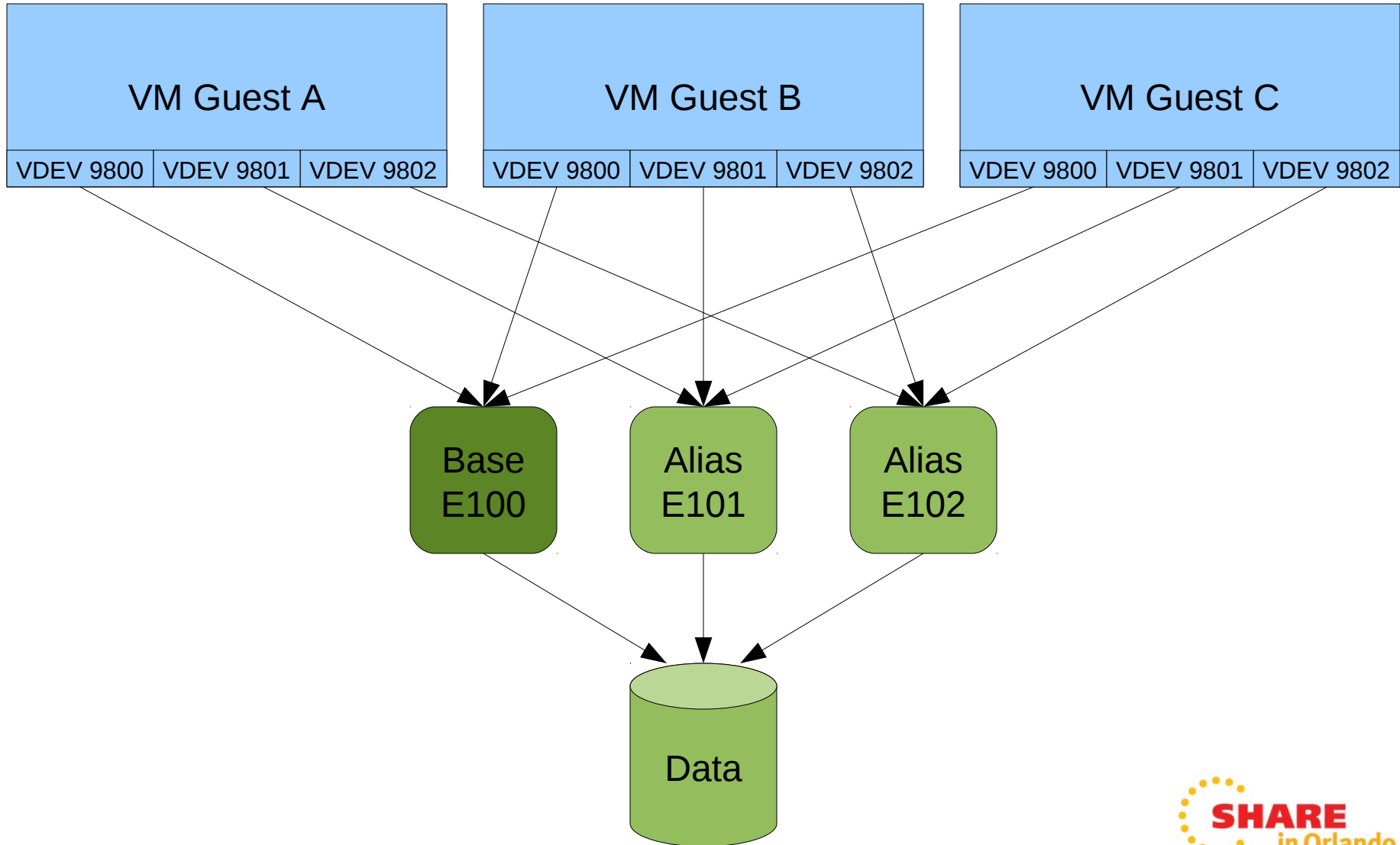
- Today, a Base and its Aliases may only be dedicated to one guest
  - Base must be dedicated first, all alias devices can follow
- Still configured with CP ATTACH command or DEDICATE user directory statement
- For guests that exploit the PAV architecture



# VM Configuration Today (Minidisks)

- z/VM provides linkable minidisks for guests that exploit PAV (e.g., z/OS and Linux); see illustration next slide
  - Base minidisks are defined with the existing MDISK or LINK user directory statements (LINK command also supported)
  - Aliases are defined with new PAVALIAS parameter of the DASDOPT and MINIOPT user directory statements or with the new CP DEFINE PAVALIAS command
- z/VM also provides workload balancing for guests that don't exploit PAV (e.g., CMS)
  - Real I/O dispatcher queues minidisk I/O across system attached Aliases
  - Minidisks are defined as in the past; nothing has changed.

# VM Configuration Today (Minidisks)



# ATTACH Command

- When attaching PAV DASD to a guest, the Base must be attached first before any associated Alias. An associated Alias can only be attached to the same guest as the Base.
- When attaching PAV DASD to the system, the Base must be attached first before any associated Alias.
  - Aliases can be attached to the system and are exploited for VM I/O if they contain temporary disk (TDSK) or minidisk (PERM) allocations.
  - Other CP volume allocations (e.g., PAGE) receive no benefit from system attached Aliases.

# DETACH Command

- When detaching PAV DASD from a guest, all dedicated Aliases associated with a particular Base must be detached from the guest before the Base can be detached.
- When detaching PAV DASD from the system, all system attached Aliases associated with a particular Base must be detached from the system before the Base can be detached.

# Minidisk Cache (MDC)

- Minidisk cache settings apply to the Base and are inherited by its Aliases
- SET MDCACHE command may not be used with Aliases; results in error



# DEFINE PAVALIAS Command

- The DEFINE PAVALIAS command is used to create new virtual PAV Alias minidisks. Function can also be accomplished by using the DASDOPT and MINIOPT user directory statements.
- Newly defined virtual Alias is automatically assigned to a unique underlying real PAV Alias.
- The command will fail if no more unique real Aliases are available to be associated with the virtual Alias (per guest virtual machine).

Privilege Class G

```
>>--DEFine--PAValias--vdev-- .----- .--BASE--basevdev-----><  
                                '-FOR-'
```

# Query Virtual PAV

Privilege Class G

```

>>--Query--'-.Virtual-----'-.ALL-----'-.PAV-----'-.vdev-----'
                                     | <-----< |
                                     '-vdev1-vdev2-'

```

Dedicated Responses

```

QUERY VIRTUAL PAV ALL
PAV BASE 0290 ON E100 WIL3
PAV ALIAS 0291 ON E101 WIL3 FOR BASE 0290

```

Minidisk Responses

```

QUERY VIRTUAL PAV ALL
PAV BASE 0290 ON E100 WIL3 ASSIGNED E100
PAV ALIAS 0291 ON E101 WIL3 ASSIGNED E101 FOR BASE 0290

```

# User Directory

- DASDOPT
  - Used for Full-Pack Minidisks
    - MDISK vdev devtype DEVNO rdev mode  
DASDOPT PAVALIAS vdev
    - MDISK vdev devtype 0 END volser mode  
DASDOPT PAVALIAS vdev-vdev
    - LINK userid vdev1 vdev2 mode  
DASDOPT PAVALIAS vdev.numDevs
- MINIOPT
  - Used for Non-Full-Pack Minidisks
    - MDISK vdev devtype 100 50 volser mode  
MINIOPT PAVALIAS vdev
    - LINK userid vdev1 vdev2 mode  
MINIOPT PAVALIAS vdev-vdev
- PAVALIAS option of DASDOPT and MINIOPT statements are used to create virtual PAV Alias minidisks for a guest.
- DASDOPT and MINIOPT should follow the MDISK or LINK statement associated with the virtual Base.
- DASDOPT and MINIOPT may be continued on multiple lines with trailing commas.
- Can have more Aliases in user directory than exist in hardware. Virtual Aliases will be assigned in ascending order until the real associated Aliases are exhausted. This will not prevent logon!
- Use DEDICATE vdev rdev for all dedicated PAV Base and Alias devices.

# PAV with Non-Fullpack Minidisks

- Neither z/VM, nor its guest operating systems, could uniquely identify distinct non-fullpack minidisks
  - Thus, I/O may inadvertently be driven down an incorrect alias
- z/VM 5.4 and later correctly address this problem
  - PTFs available for earlier releases via APAR VM64273
- Co-requisite fixes are required for guest operating systems
  - z/OS APARs OA22161 and OA25151 are available for z/OS v1.7 through v1.9
  - Linux on System z: see problem ID 34345 in patch 21 of the October 2005 stream on DeveloperWorks
    - <http://www.ibm.com/developerworks/linux/linux390/linux-2.6.16-s390-21-october2005.html>
    - Included in modern distro's from SUSE and Red Hat
- Patches can be applied in stages, but all need to be present in order to correct this problem.

# Setup example for Linux exploiting PAV minidisks

Base device predefined in user directory:

```
MDISK 200 3390 DEVNO E100 WR
```

q pav

```
Device E100 is a base Parallel Access Volume with the following aliases: E101  
Device E101 is an alias Parallel Access Volume device whose base device is E100
```

attach E100 to system

```
DASD E100 ATTACHED TO SYSTEM WIL6 PAV BASE
```

attach E101 to system

```
DASD E101 ATTACHED TO SYSTEM WIL6 PAV ALIAS
```

define pavalias 201 for base 200

```
DASD 201 DEFINED
```

query virtual pav all

```
PAV BASE 0200 ON E100 WIL6 ASSIGNED E100  
PAV ALIAS 0201 ON E101 WIL6 ASSIGNED E101 FOR BASE 0200
```

Configure Linux LVM to use virtual PAV Base 200 and Alias 201 as a single logical volume. For details, see Linux “How to Improve Performance with PAV” whitepaper at: [http://www-128.ibm.com/developerworks/linux/linux390/june2003\\_documentation.html](http://www-128.ibm.com/developerworks/linux/linux390/june2003_documentation.html)

# Dynamic PAV

- Dynamic PAV is the ability to re-associate an Alias device from one Base to another
- Guest issued dynamic PAV operation to a dedicated Alias:
  - Real (and virtual) Alias to Base association will change as long as the new Base is dedicated to the same guest. Otherwise, the dynamic PAV operation will fail.
- Guest issued dynamic PAV operation to an Alias minidisk:
  - Only the virtual configuration is altered if new virtual Base is the only minidisk on the underlying real Base and there is a unique real Alias available in which to associate the virtual Alias (per guest machine). Otherwise, the Dynamic PAV operation fails.
  - The real Alias to Base association never changes for minidisks.
- Out-board (control unit) initiated dynamic PAV operations:
  - All Alias minidisks associated with a real system attached Alias will be detached from their guests.
  - A dedicated Alias will behave as if guest issued the dynamic PAV operation.
- In the future, VM may permit dynamic PAV operations on **full-pack minidisks** to behave in the same manner as dedicated PAVs.

# Performance

- Dedicated DASD
  - Performance metrics for dedicated DASD are solely up to guest virtual machine; VM issues real I/O as indicated by guest.
- Minidisks
  - Useful for environments where I/O queuing occurs (see Performance Toolkit FCX168 report, or equivalent)
  - Performance gains may be realized only when full-pack minidisks are shared among guests with multiple LINK statements or when multiple non-full-pack minidisks reside on a real volume
  - Performance gains are achieved by multiplexing the I/O operations requested on each guest minidisk over the appropriate real PAV Base and Alias subchannels
  - Performance varies depending on controller model and read-write mix
  - “Law of Diminishing Returns”; defining more Aliases than needed can lower performance
  - Success Criterion: Response time equals service time (no wait queue)
  - For details see,
    - <http://www.vm.ibm.com/perf/pavmdc.html>
    - <http://www.vm.ibm.com/perf/reports/zvm/html/520pav.html>

# HyperPAV

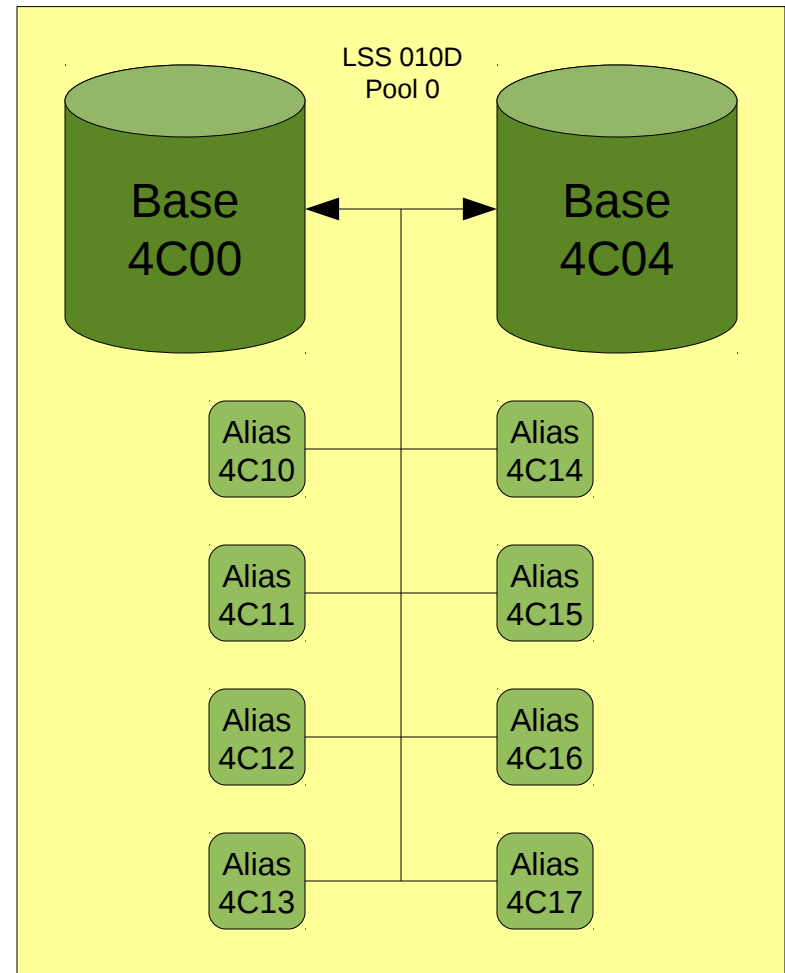


# Overview

- New feature of the DS8000 (only) that removes the static Alias to Base binding associated with traditional PAVs
- Alias and Base volumes are pooled per each LSS. An Alias can be associated with any Base in the Pool; done by host on each I/O request.
- Makes traditional Dynamic PAV obsolete
- VM support for dedicated DASD and Fullpack Minidisks available in z/VM 5.3.0 and later

# Overview

- VM dedicated DASD support via CP ATTACH command or DEDICATE user directory statement
- VM Minidisk Support:
  - workload balancing for guests that don't exploit HyperPAV
  - linkable full-pack minidisks for guests that do exploit HyperPAV
  - New CP DEFINE HYPERPAVALIAS command creates HyperPAV Alias minidisks for exploiting guests
  - Current exploiters of HyperPAV are z/VM, z/OS and Linux (SLES11)
  - Restricted to fullpack minidisks for exploiting guests; architecture change in the works.



# Configuration

- HyperPAV Base and Alias subchannels are defined on control unit's Hardware Management Console and in IOCP no differently than traditional PAVs
- HyperPAV hardware, priced feature enables floating Alias function associated with the HyperPAV architecture for each LSS (logical control unit)
- Operating system host determines which LSS (logical control unit) is in HyperPAV vs. traditional PAV mode

# Configuration

- A real HyperPAV Alias subchannel will not come online unless a HyperPAV Base exists in the same hardware Pool.
- A real HyperPAV Base subchannel needs at least 1 HyperPAV Alias in the same hardware Pool for z/VM to recognize the device as a HyperPAV Base subchannel.
- Use the Class B, CP QUERY PAV command to view the current HyperPAV Base and Alias subchannels along with their associated Pools.

# ATTACH / DETACH Commands

- Unlike traditional PAV DASD, HyperPAV Base and Alias devices can be attached and detached to/from a guest or the system in any order. There is no Base before Alias (or vice-versa) restrictions.
- HyperPAV Aliases can be attached to the system and are exploited for VM I/O if they contain temporary disk (TDSK) or minidisk (PERM) allocations.
- Other CP volume allocations receive no benefit from system attached HyperPAV Aliases.

# Minidisk Cache (MDC)

- Minidisk cache settings do not apply to HyperPAV Aliases. Cache settings are only applicable to HyperPAV Base devices.
- SET MDCACHE command may not be used with HyperPAV Aliases; results in error

# DEFINE HYPERPAVALIAS Command

- The DEFINE HYPERPAVALIAS command is used to create new virtual HyperPAV Alias minidisks.
- A newly defined virtual Alias is automatically assigned to a unique underlying real HyperPAV Alias (in the same real hardware Pool as the Base).
- The command will fail if no more unique, real Aliases are available in the real hardware Pool to be associated with the virtual Alias (per guest virtual machine).
- There can only be 254 Aliases per Pool; and a limit of 16,000 Pools per image.
- Command currently restricted to Full-Pack minidisks.

# Query Virtual PAV Command

## Dedicated

```
QUERY VIRTUAL PAV ALL  
HYPERPAV BASE 0200 ON E100 YAC001 POOL 1  
HYPERPAV ALIAS 0201 ON E101 POOL 1
```

## Minidisks

```
QUERY VIRTUAL PAV ALL  
HYPERPAV BASE 0200 ON E100 YAC001 ASSIGNED E100 POOL 1  
HYPERPAV ALIAS 0201 ASSIGNED E101 POOL 1
```



# SET CU Command

- The SET CU command is used to set the Parallel Access Volume function level of each applicable control unit (specified via controller's ssid).
- Default is either HYPERPAV\_allowed or PAV\_allowed depending on the installed capabilities of each control unit.
- HYPERPAV\_allowed can't be set if capability is not available on the control unit.
- All Alias devices in the specified control unit (ssid) must be off-line when changing from or to the HYPERPAV\_allowed setting.
- Command applies to only first-level VM images; error occurs otherwise.
- New QUERY CU command displays the PAV and HYPERPAV capabilities of applicable DASD control units.

```

      . -DASD- .
>>--SET--CU--'-----'--.-HYPERPAV_allowed-.-.-.-.-ssid-----><
      | -PAV_allowed-----|      '-ssid-ssid-'
      '-NOPAV_allowed-----'
  
```

# User Directory

- Use the COMMAND user directory statement with the DEFINE HYPERPAVALIAS command to create virtual HyperPAV Alias minidisks
- COMMAND statements must appear before all device definition statements, like MDISK and LINK statements for the Base minidisks
- Use DEDICATE vdev rdev for all dedicated HyperPAV Base and Alias devices

```
COMMAND DEFINE HYPERPAVALIAS vdev FOR BASE basevdev
MDISK basevdev devtype DEVNO rdev mode
MDISK basevdev devtype 0 END volser mode
LINK userid sourcevdev basevdev mode
```

# Configuration File

The following new system configuration file statements are useful for managing HyperPAV devices:

- **SYSTEM\_Alias** - Specifies HyperPAV Alias devices to be attached to the system at VM initialization.
- **CU** - Defines how VM initializes specific control units. Similar to the CP SET CU command (i.e., sets controller PAV mode).

# Documentation

- CP Command Reference
  - Command details
- CP Planning and Administration Guide
  - User Directory Statements
  - Configuration File Statements
  - “DASD Sharing Chapter” with “Using IBM Parallel Access Volumes” section
- CP Messages and Codes
  - New and changed messages
- Web
  - <http://www.vm.ibm.com/storman/pav/>
  - <http://www.vm.ibm.com/perf/pavmdc.html>
  - <http://www.vm.ibm.com/perf/reports/zvm/html/520pav.html>
  - [http://www-128.ibm.com/developerworks/linux/linux390/june2003\\_documentation.html](http://www-128.ibm.com/developerworks/linux/linux390/june2003_documentation.html)

# Fin

# Reference

# ATTACH / DETACH Responses

att 481a \*

DASD 481A ATTACHED TO WILKINS1 481A WITH DEVCTL PAV BASE

att 485c \*

DASD 485C ATTACHED TO WILKINS1 485C WITH DEVCTL PAV ALIAS

att 4c40-4c41 \*

DASD 4C40 ATTACHED TO WILKINS1 4C40 WITH DEVCTL HYPERPAV BASE

DASD 4C41 ATTACHED TO WILKINS1 4C41 WITH DEVCTL HYPERPAV ALIAS

det 485c from \*

DASD 485C DETACHED BY WILKINS1 PAV ALIAS

det 481a from \*

DASD 481A DETACHED BY WILKINS1 PAV BASE

det 4c40 from \*

DASD 4C40 DETACHED BY WILKINS1 HYPERPAV BASE

det 4c41 from \*

DASD 4C41 DETACHED BY WILKINS1 HYPERPAV ALIAS

# Query Virtual DASD DETAILS Responses

```
query virtual dasd details
```

```
DASD 0120 3390 SYE711 R/W          250 CYL ON DASD  E140 SUBCHANNEL = 000B  
  CACHE PAVBASE(02)
```

```
  ALIASES: 0121/E148 0122/E149
```

```
DASD 0121 3390 SYE711 R/W          250 CYL ON DASD  E140 SUBCHANNEL = 000D  
  CACHE PAVALIAS(0120/E148)
```

```
DASD 0122 3390 SYE711 R/W          250 CYL ON DASD  E140 SUBCHANNEL = 000E  
  CACHE PAVALIAS(0120/E149)
```

```
query virtual dasd details
```

```
DASD 0130 ON DASD  4C40 R/W YAC001 SUBCHANNEL = 0014  
  DEVCTL HYPERPAVBASE(8)
```

```
DASD 0131 ON DASD  4C44 R/W          SUBCHANNEL = 0018  
  DEVCTL HYPERPAVALIAS(4C44/8)
```



# Query Virtual Device Responses

q virtual 481a details

DASD 481A ON DASD 481A R/W BWPVT3 SUBCHANNEL = 0012  
DEVCTL PAVBASE(1)  
ALIASES: 485C/485C

q virtual 485c details

DASD 485C ON DASD 485C R/W BWPVT3 SUBCHANNEL = 0013  
DEVCTL PAVALIAS(481A/485C)

q virtual 4c40 details

DASD 4C40 ON DASD 4C40 R/W YAC001 SUBCHANNEL = 0014  
DEVCTL HYPERPAVBASE(8)

q virtual 4c44 details

DASD 4C44 ON DASD 4C44 R/W SUBCHANNEL = 0018  
DEVCTL HYPERPAVALIAS(4C44/8)

# Query DASD Details Responses (PAV)

```
q dasd details 481a
```

```
481A CUTYPE = 1750-E8, DEVTYPE = 3390-0A, VOLSER = BWPVT3, CYLS = 3339
```

```
CACHE DETAILS: CACHE NVS CFW DFW PINNED CONCOPY
```

```
-SUBSYSTEM Y Y Y - N N
```

```
-DEVICE Y - - Y N N
```

```
DEVICE DETAILS: CCA = 1A, DDC = --
```

```
DUPLEX DETAILS: --
```

```
PAV DETAILS: BASE VOLUME WITH 04 ALIAS VOLUMES
```

```
CU DETAILS: SSID = 0003, CUNUM = 4800
```

```
q dasd details 485c
```

```
485C CUTYPE = 1750-E8, DEVTYPE = 3390-0A, VOLSER = BWPVT3, CYLS = 3339
```

```
CACHE DETAILS: CACHE NVS CFW DFW PINNED CONCOPY
```

```
-SUBSYSTEM Y Y Y - N N
```

```
-DEVICE Y - - Y N N
```

```
DEVICE DETAILS: CCA = 5C, DDC = --
```

```
DUPLEX DETAILS: --
```

```
PAV DETAILS: ALIAS VOLUME ASSOCIATED WITH BASE 481A
```

```
CU DETAILS: SSID = 0003, CUNUM = 4800
```

# Query DASD Details Responses (HyperPAV)

```
q dasd details 4c40
```

```
4C40  CUTYPE = 2107-E8, DEVTYPE = 3390-0A, VOLSER = YAC001, CYLS = 3339  
      CACHE DETAILS:  CACHE NVS CFW DFW PINNED CONCOPY  
                -SUBSYSTEM  Y   Y   Y   -   N   N  
                -DEVICE     Y   -   -   Y   N   N  
      DEVICE DETAILS:  CCA = 00, DDC = --  
      DUPLEX DETAILS:  --  
      HYPERPAV DETAILS: BASE VOLUME IN POOL 8  
      CU DETAILS:  SSID = 010D, CUNUM = 4C40
```

```
q dasd details 4c44
```

```
4C44  CUTYPE = 2107-E8, DEVTYPE = 3390-0A, VOLSER =, CYLS =  
      CACHE DETAILS:  CACHE NVS CFW DFW PINNED CONCOPY  
                -SUBSYSTEM  Y   Y   Y   -   N   N  
                -DEVICE     N   -   -   N   N   N  
      DEVICE DETAILS:  CCA = 00, DDC = --  
      DUPLEX DETAILS:  --  
      HYPERPAV DETAILS: ALIAS VOLUME IN POOL 8  
      CU DETAILS:  SSID = 010D, CUNUM = 4C40
```

```
Ready; T=0.01/0.01 17:06:02
```

# Query PAV Responses

```
q pav
Device 3800 is a base Parallel Access Volume with the following aliases: 3843
3841 3842 3840
Device 3840 is an alias Parallel Access Volume device whose base device is 3800
Device 3841 is an alias Parallel Access Volume device whose base device is 3800
Device 3842 is an alias Parallel Access Volume device whose base device is 3800
Device 3843 is an alias Parallel Access Volume device whose base device is 3800
Device 4C40 is a base HyperParallel Access Volume device in Pool 8
Device 4C41 is a base HyperParallel Access Volume device in Pool 8
Device 4C42 is a base HyperParallel Access Volume device in Pool 8
Device 4C43 is a base HyperParallel Access Volume device in Pool 8
Device 4C44 is an alias HyperParallel Access Volume device in Pool 8
Device 4C45 is an alias HyperParallel Access Volume device in Pool 8
Device 4C46 is an alias HyperParallel Access Volume device in Pool 8
Device 4C47 is an alias HyperParallel Access Volume device in Pool 8
```

# Query CU Responses

```
q cu 0000-ffff devices
```

```
DASD CU 0001 DEVICES:
```

```
1006 1007
```

```
DASD CU 0003 DEVICES:
```

```
4840 4841 4842 4843 4844 4845 4846 4847
```

```
4848 4849 484A 484B 484C 484D 484E 484F
```

```
4850 4851 4852 4853 4854 4855 4856 4857
```

```
4858 4859 485A 485B 485C 485D 485E 485F
```

```
q cu 0000-ffff aliases
```

```
DASD CU 0001 HAS NO ASSOCIATED ALIASES
```

```
DASD CU 0003 ALIASES:
```

```
4848 4849 484A 484B 484C 484D 484E 484F
```

```
4850 4851 4852 4853 4854 4855 4856 4857
```

```
4858 4859 485A 485B 485C 485D 485E 485F
```

```
q cu 0000-ffff pavmode
```

```
DASD CU 0001 PAV FUNCTIONS DO NOT APPLY
```

```
DASD CU 0003 CURRENTLY PAV, PAV ALLOWED
```

```
DASD CU 0004 CURRENTLY NOPAV, PAV ALLOWED
```

```
DASD CU 0100 CURRENTLY HYPERPAV, HYPERPAV ALLOWED
```

# Restrictions

- A traditional PAV, real Alias may be attached to a guest or SYSTEM only after its associated real Base has been attached to the same guest or SYSTEM.
- A tradition PAV, real Base may be detached from a guest or SYSTEM only if all of its associated Aliases are already free.
- A traditional PAV, real Alias will not come online to VM without an associated real Base. Also, a real Base must have at least one associated real Alias for VM (for example, the QUERY PAV command) to recognize the device as a PAV.
- A real Base cannot be changed or deleted with the SET RDEVICE, DELETE RDEVICE, DELETE DEVICE, or MODIFY DEVICE commands unless all associated real Aliases have been deleted with the DELETE RDEVICE command.

# Restrictions

- CMS does not support virtual Aliases (whether traditional PAV or HyperPAV). Defining these virtual devices under CMS can cause similar damage that can be caused by issuing multi-write (MW) links.
- A virtual Alias (whether traditional PAV or HyperPAV) cannot be IPLed.
- PAV Aliases (whether traditional PAV or HyperPAV) can not be used as VM installation volumes (for example, do not use for the SYSRES volume).
- VM Paging and Spooling operations do not take advantage of PAVs (traditional or HyperPAV). It is recommended that PAGE and SPOOL areas be placed on DASD devices dedicated to this purpose.
- Virtual HyperPAV devices can only be defined as Full-Pack minidisks.
- Diagnoses x18, x20, xA4, x250, and the \*BLOCKIO system service do not support HyperPAV Alias devices since there is no means for specification of the associated Base. An attempt to do so will result in an error.