Learn What's New with INNOVATION Solutions and Hear about a Unique Solution for

Non-Disruptive Migration of z/VM and LINUX on System z Disk Volumes

SHARE 2014
in Pittsburgh
5 August 2014
Session 16261

INNOVATION® DATA PROCESSING

Agenda

Greetings and Lunch

What's new from INNOVATION
Tom Meehan

Non-disruptively Migrating Linux Guests in Their Entirety
Michael MacIsaac

INNOVATION® DATA PROCESSING

FDRPASVM Overview

z/VM Single System Image (SSI) and
Live Guest Relocation (LGR) allow you to “relocate”
Linux systems, by moving a running systems’ memory
and CPU to different LPARs. *What about the disk?*

Starting at a high level, then drilling down into specific examples, including real-world customer scenarios, Mike will describe **FDRPASVM**…
a solution that now allows you to also non-disruptively:

- Relocate Linux systems’ DASD volumes to a different device.
- Relocate z/VM systems’ DASD volumes to a different device.
- Migrate all your z/VM & Linux volumes to new DASD hardware.

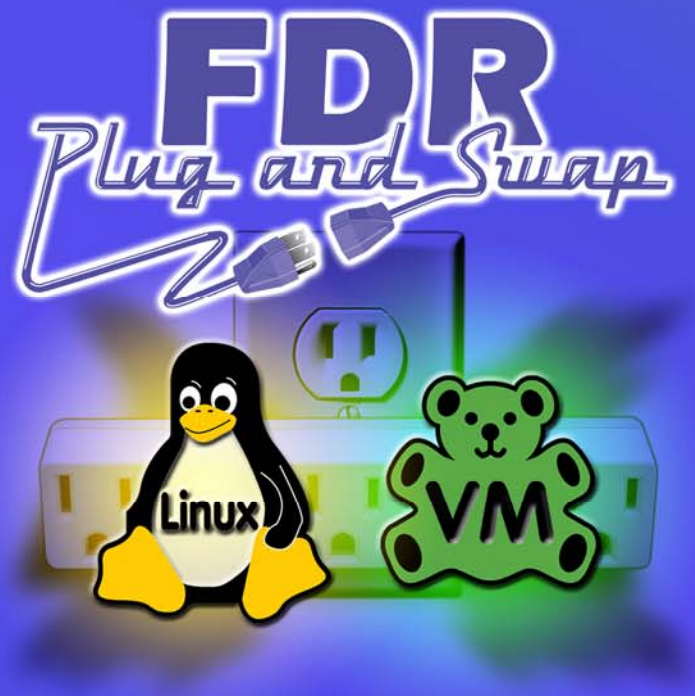
INNOVATION® DATA PROCESSING

Introductions

Hierarchy of Availability

Business Continuance Tools

Summary



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Introductions

- Who am I?
  - Michael MacIsaac
  - Product Manager for z/VM and Linux
  - mmacisaac@fdrinnovation.com
- Who are you?
  - An Innovation Data Processing customer?
  - An FDRPAS on z/OS customer?
  - Have z/VM & Linux in production/test/PoC?
  - A z/VM & Linux only shop?

INNOVATION® DATA PROCESSING

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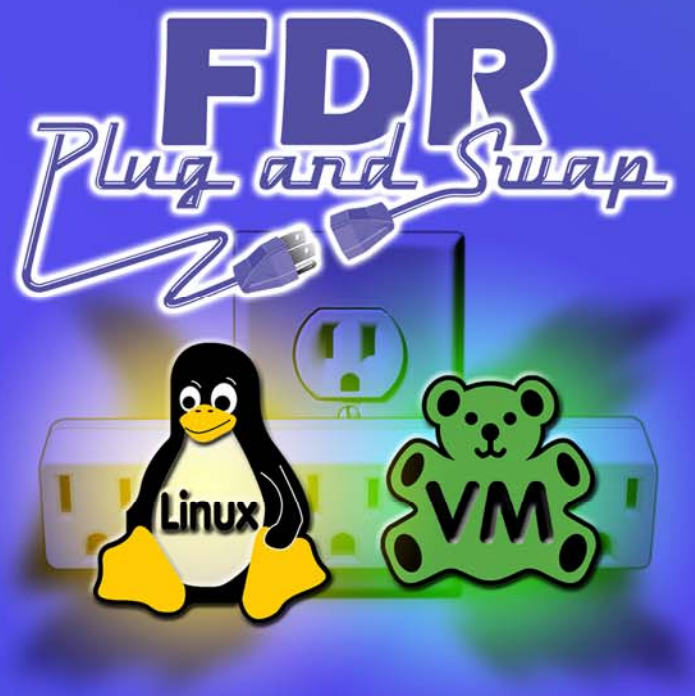

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Hierarchy of Availability

- Hierarchy of availability (lower to higher)
  - High Availability
  - Continuous Operations
  - Continuous Availability

Source: "*High Availability Architectures For Linux on IBM System z*" Version 2, June 15, 2010 by Steve Wehr, Scott Loveland and Harriet Morril of IBM

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High Availability

- High Availability (HA)
  - Provides service during defined periods, at agreed upon levels (SLAs)
    - Recovery Time Objective (RTO)
    - Recovery Point Objective (RPO)
  - Avoids **unplanned outages**
  - Employs failure detection, automatic recovery/failover, problem/change management, etc.

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Continuous Operations

- Continuous Operations (CO)
  - Avoids **planned outages**
  - Employs non-disruptive hardware and software upgrades and configuration changes
    - i.e. Use FDRPAS and FDRPASVM, or similar tools, for non-disruptive DASD migration in support of DASD technology upgrades

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Continuous Availability

- Continuous Availability (CA)
  - Delivers non-disruptive service to the end user, 24 hrs/day x 365 days/yr
  - No ***planned*** nor ***unplanned*** outages
  - Continuous operations + redundancy of any single point of failure and failover to the redundant components
    - i.e. GDPS/Hyperswap (IBM/Hitachi) and GDDR/Autoswap (EMC)

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Tools in Your HA Toolbox

- Resilient hardware with dynamic features
  - Mainframe, PR/SM, standby memory/CPUs, etc.
- Disk local mirroring and remote replication tools
- Resiliency z/VM and Linux features
  - Hot plugging memory, CPUs, file systems
- HA software
  - Oracle RAC, IBM WAS XD, IBM DB2 HADR, etc.
- Business continuance tools
  - z/VM 6.2+ SSI and LGR
  - Innovation FDRPAS for z/OS & FDRPASVM for z/VM

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Introductions

Hierarchy of Availability

Business Continuance Tools (on z/VM and Linux)

z/VM SSI and LGR

FDRPASVM non-disruptive migration

Summary

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z/VM SSI and LGR

- Single System Image (SSI)
  - 2-4 z/VM “member” systems share and coordinate resources
  - This becomes an “SSI cluster”
- Live Guest Relocation (LGR)
  - Running Linux systems can move cross-LPAR or CEC
  - Memory and CPU are moved, but not disk
- Can prevent planned outages

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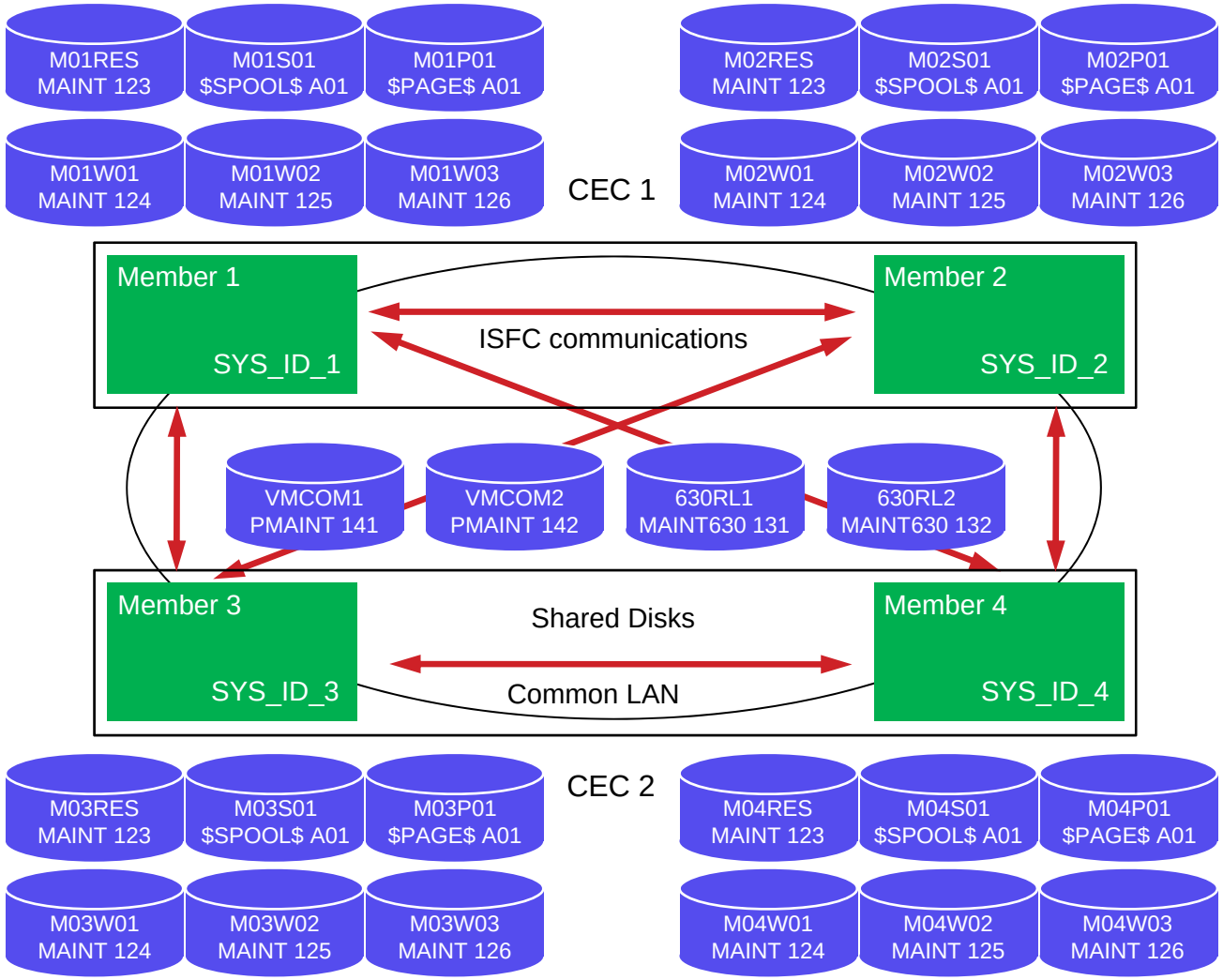
z/VM SSI Block Diagram



FDRPASVM

- Non-disruptively migrate DASD of running systems
  - Copies entire source volume(s) to target(s)
  - Monitors changed tracks on source volume
  - Copies changed tracks
  - Swaps all I/O operations to use target volume(s)
- Beta tested at customer sites in 2013
- GA in January 2014
- Supports z/VM 5.4, 6.2 and 6.3
- Non-disruptively move to a new DASD storage unit

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FDRPASVM Functions

- FDRPASVM supports migration of
  - Minidisk volumes (PERM)
  - Full-pack and DEDICATEd volumes
  - Smaller to larger volumes (ex: 3390-9 to 3390-27)
- FDRPAS functions
  - SIMSWAP – Simulate and validate main swap task
  - SIMSWAPMON – Simulate and validate monitoring updates
  - SWAPDUMP – Create point-in-time copy of volume(s)
  - SWAP – Copy and swap volume(s)

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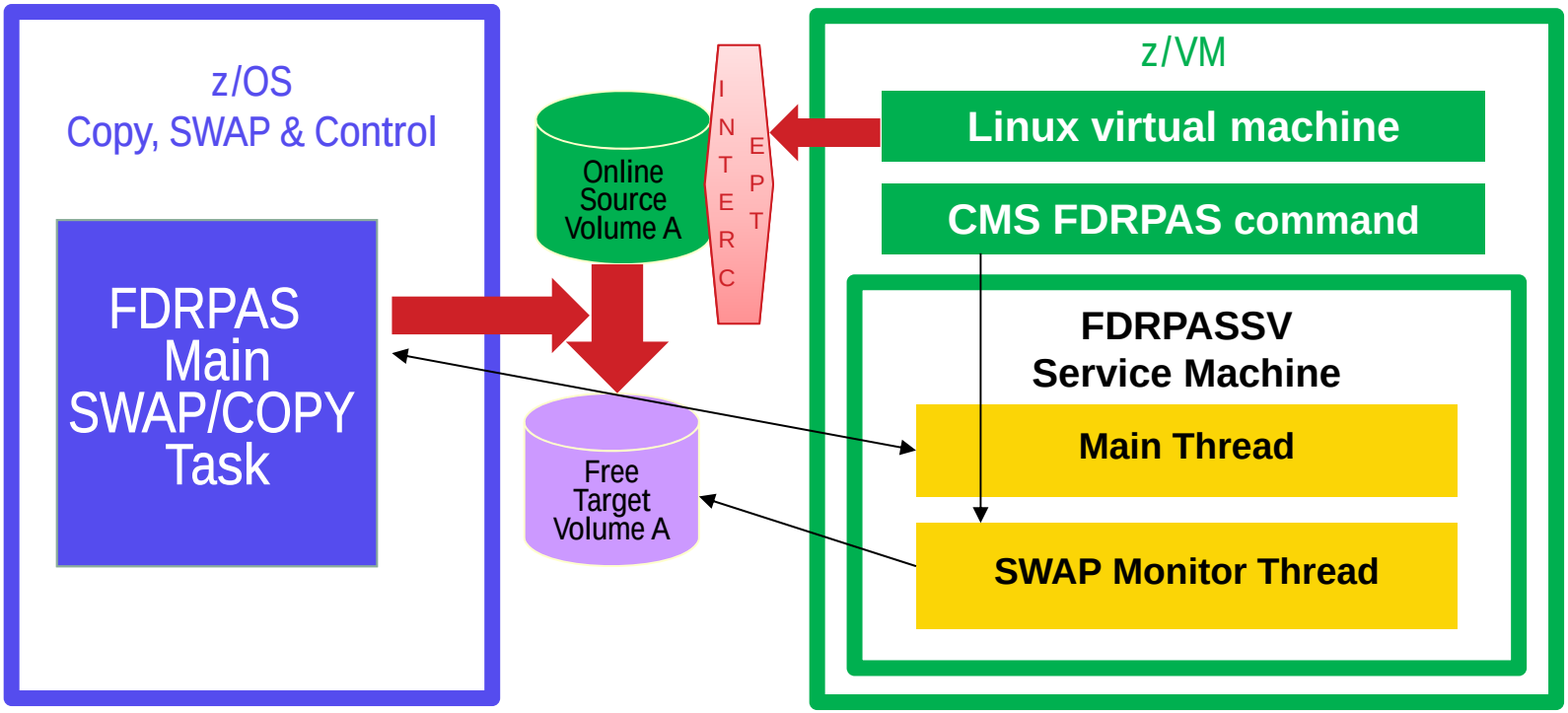
FDRPASVM Components



FDRPASVM Component Detail

- z/VM detail
  - Tracks changes to source device and swaps volser
  - System requirements
    - Service machine (FDRPASSV) is running
    - Source volume is **online**
    - Target volume is **online** and **FREE**
    - Monitor program started with FDRPAS command
- Start monitor on all LPARs w/access to target volumes
- z/OS detail
  - Copies to target and recopies changed tracks
  - System requirements
    - Same source volume is **online**
    - Same target volume is **offline**
    - Invoke **FDRPAS** job using JCL or ISPF

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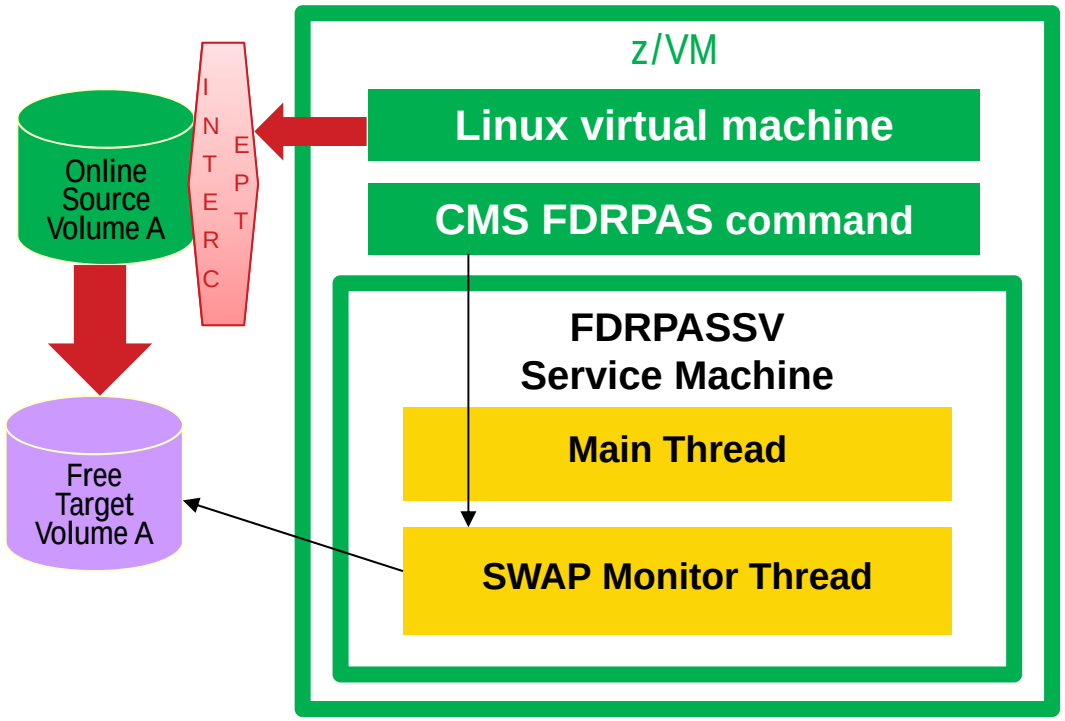
FDRPASVM Block Diagram



FDRPASVM Setup

- Service machine (FDRPASSV) is running
  - Logon to FDRPASSV interactively

```
...
DIAGNOSE 104 ALREADY DEFINED
...
PASIUCSM020I WAITING FOR AN EVENT TO PROCESS
```

  - Start FDRPASSV on AUTOLOG1 191 disk (mode F)

```
==> x profile exec f
...
/*****************************************************************/
/* Customer processing can be added here                         */
/*****************************************************************/
"CP XAUTOLOG TCPIP"           /* Autolog TCPIP                   */
"CP SET SIGNAL SHUTDOWN 300"  /* Allow guests  5 min to shut down*/
"CP XAUTOLOG FDRPASSV"        /* Start the FDRPASSV service machine */
...
```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FDRPASVM on z/VM Volumes

- Example of swapping Linux on rdev **1887** to **B887**
- Source volume is **online**
- Target volume is online and **FREE**
  - Use CP QUERY <rdev> and DETACH commands:

```
==> q 1887 b887
DASD 1887 CP SYSTEM VM1887   2
DASD B887 CP SYSTEM VMB887   0
==> detach b887 system
DASD B887  DETACHED SYSTEM
==> q 1887 b887
DASD 1887 CP SYSTEM VM1887   2
DASD B887 VMB887
```

FDRPASVM on z/VM Monitoring

- Monitor target volume (e.g. from MAINT)
  - Access FDRPAS CMS command:

```
...
'EXEC VMLINK PASMAINT 691'
'SET LANG (ADD PAS USER'
...
```

  - Issue FDRPAS command for target volume:

```
==> fdrpas monitor type swap b887
...
REQUEST ACCEPTED
SEVERING IUCV CONNECTION
...
  * MSG FROM FDRPASSV: PASIUCSM009I 1 ELIGIBLE DEVICE(S) FOUND
```

  - Watch console on FDRPASSV:

```
...
PASMONVW080I DEVICE B887(B887) WAITING FOR SWAP INITIATION
```


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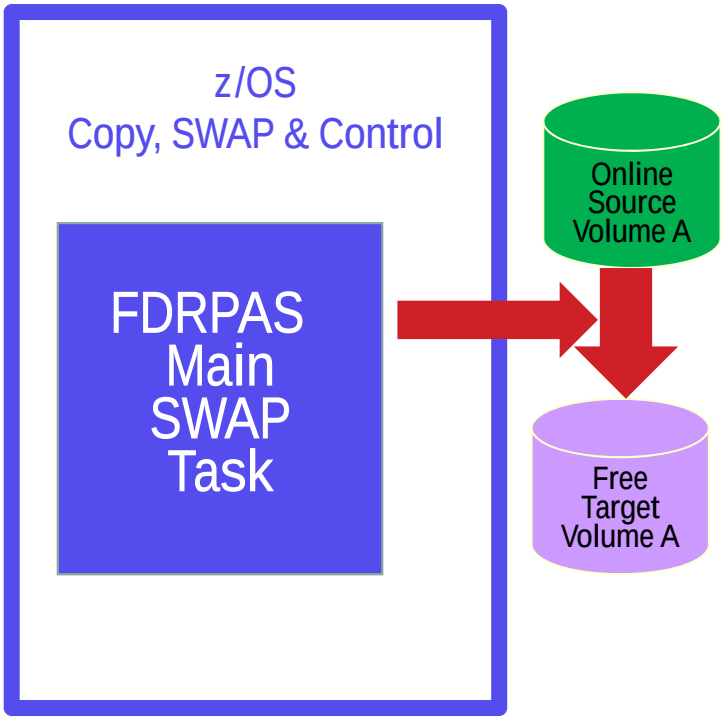
FDRPASVM z/OS Components



FDRPAS z/OS View of z/VM Volumes

- Source volume should be **online**
- Target volume is **offline**
  - Use DISPLAY and VARY commands

```
==> d u,,,1887
  UNIT TYPE STATUS        VOLSER     VOLSTATE
  1887 3390 OFFLINE                      /RSDNT
==> d u,,,B887
UNIT TYPE STATUS        VOLSER     VOLSTATE
  B887 3390 OFFLINE                      /RSDNT
==> v 1887,online
IEE302I 1887     ONLINE
==> d u,,,1887
  UNIT TYPE STATUS        VOLSER     VOLSTATE
  1887 3390 O             VM1887     PRIV/RSDNT
```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FDRPAS on z/OS Startup

- Invoke FDRPAS job in one of two ways
  - From a JCL job

```
==> submit
//PASTEST1 JOB ('PR=YES'),'ME',CLASS=M,
//   NOTIFY=ME
//*
//*******************************************************************
//*  FDRPAS                                                         *
//*******************************************************************
//*
//PASB    EXEC PASPROC
//PAS.SYSIN DD  *
*SIMSWAP TYPE=FULL,LARGERSIZE=OK,MAXTASKS=4,NONRESPONDING=FAIL
*SIMSWAPMON TYPE=FULL,LARGERSIZE=OK,MAXTASKS=4,NONRESPONDING=FAIL
*SWAPDUMP TYPE=FULL,LARGERSIZE=OK,MAXTASKS=32,NONRESPONDING=FAIL
 SWAP TYPE=FULL,LARGERSIZE=OK,MAXTASKS=32,NONRESPONDING=FAIL
 MOUNT VOL=VM1887,SWAPUNIT=B887
```

  - Using ISPF panels

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FDRPASVM Process Review

- FDRPAS and FDRPASVM “plumbing”
  - Install z/VM “intercepts” to monitor source volume changes
  - z/OS main SWAP task copies source to target volume
  - FDRPASSV swap thread passes changes to z/OS main SWAP
  - z/OS main SWAP task recopies changed tracks
  - Issue z/VM HYPERSWAP when source and target are in sync
  - Target volume becomes the source volume transparently
  - Remove FDRPASSV intercepts

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FDRPASVM z/VM Output

- On z/VM virtual machine invoking FDRPAS command
  - Messages from FDRPASSV:

```
...
* MSG FROM FDRPASSV: PASMONVT233I VMLAB63B (SERIAL# 04E2062818)
ACKNOWLEDGES THE SWAP OF VOL=VM1887 AND HAS JOINED IN SWAP OF UNIT=1887
TO B887
* MSG FROM FDRPASSV: PASMONVT241I FDRPAS SUCCESSFULLY COMPLETED SWAP OF
VOL=VM1887 TO UNIT=B887
```

  - Query source and target devices again:

```
==> q 1887 B887
DASD 1887 FDR3VM
DASD B887 CP SYSTEM VM1887   2
```


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FDRPAS z/OS Syslog Output

- JCL output (syslog)

```
FDR233  CPUB     (SERIAL# 02E2062818) ACKNOWLEDGES THE SWAP OF VOL=VM1887  - HTC
 2107900 TO HTC 2107900
FDR233  VMLAB63B (SERIAL# 04E2062818) ACKNOWLEDGES THE SWAP OF VOL=VM1887 AND HA
S JOINED IN SWAP OF UNIT=1887 TO B887
...
OPERATION STATISTICS FOR 3390 VOLUME.................VM1887
                      CYLINDERS ON VOLUME.............10,017
                      DATASETS PROCESSED...................0
                      BYTES READ FROM DASD.....7,593,410,036
                      DASD TRACKS SWAPPED............154,127
                      UPDATED TRACKS RECOPIED..........3,873
                      DASD EXCPS.....................10,418
                      TARGET DASD EXCPS..............10,371
                      CPU TIME (SECONDS)...............2.257
                      ELAPSED TIME (MINUTES).............2.6
                      SWAP TIME.........................2.4
FDR SUCCESSFULLY COMPLETED
```


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FDRPAS z/OS Customer Output

- From customer system in July, 2014

```
...
OPERATION STATISTICS FOR 3390 VOLUME.............volser
                 CYLINDERS ON VOLUME.............10,017
                 DATASETS PROCESSED...................0
                 BYTES READ FROM DASD.....7,465,766,880
                 DASD TRACKS SWAPPED.............151,535
                 UPDATED TRACKS RECOPIED..........1,281
                 DASD EXCPS......................10,217
                 TARGET DASD EXCPS...............10,103
                 CPU TIME (SECONDS)...............0.661
                 ELAPSED TIME (MINUTES).............2.8
                 SWAP TIME..........................2.5
FDR SUCCESSFULLY COMPLETED
```


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Living up to “in their entirety”

- A Linux running on LINUX154/SSI63B on DASD 189D with volser VM189D

```
# vmcp q userid
LINUX154 AT SSI63B
# vmcp q v 100
DASD 0100 3390 VM189D R/W      10016 CYL ON DASD  189D SUBCHANNEL = 0000

# ping vmlab2
PING vmlab2.idp.com (192.168.250.17) 56(84) bytes of data.
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=1 ttl=60 time=0.545 ms
...
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=9 ttl=60 time=0.415 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=10 ttl=60 time=0.668 ms
...
--- at ping 10, started a SWAP JCL job of VM189D to 189E ---
...
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=11 ttl=60 time=0.521 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=12 ttl=60 time=0.579 ms
...
--- at ping 50 from MAINT on SSI63B did a "VMRELO MOVE LINUX154 SSI63A" ---
...
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=49 ttl=60 time=0.644 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=50 ttl=60 time=0.610 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=56 ttl=60 time=0.856 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=57 ttl=60 time=0.804 ms
```


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Living up to “in their entirety” (cont’d)


```
--- at approximately ping 144, SWAP job completed
...
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=145 ttl=60 time=0.588 ms
64 bytes from vmlab2.idpnj.com (192.168.250.17): icmp_seq=146 ttl=60 time=0.572 ms
...
--- killed the job at ping 146 ---
```

- Linux was running on LINUX154/SSI63B on DASD 189D with volser VM189D

```
# vmcp q userid
LINUX154 AT SSI63A
# vmcp q v 100
DASD 0100 3390 VM189D R/W      10016 CYL ON DASD  189E SUBCHANNEL = 0000
```

- Now Linux is running on LINUX154/**SSI63A** on DASD **189E** with volser VM189D

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Give FDRPASVM a Try

- Request a trial:
  - http://www.fdr.com/riskfreetrial/index.cfm
- Request a copy of CALCDASD EXEC, email:
  - support@fdrinnovation.com

INNOVATION® DATA PROCESSING

Introductions

Hierarchy of Availability

Business Continuance Tools

Summary

User testimonial

Benefits

Resources

Q & A

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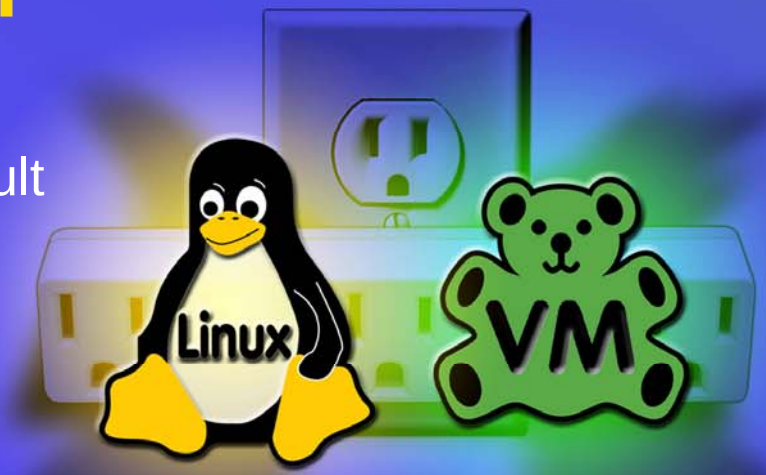
User Testimonial

Non-Disruptive Migration

"The business units requirements that rely on Linux volumes have made it very difficult for us to schedule outages to move their systems. FDRPASVM now allows us to move them non-disruptively like FDRPAS does for our z/OS volumes."

A Large Financial Company



Benefits of FDRPASVM

- FDRPAS technology has a proven reliability record
- Over 1700+ customer migrations since 2001
- Supports concurrent processing:
  - Of many volumes
  - By many users
- You don’t have to bring z/VM* or Linux systems down

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FDRPASVM Futures

- Swapping of CP-Owned volumes:
  - Support coming (2H ‘14) for
    - SYS RES
    - PAGE*
    - SPOOL*
    - DIRECTORY
    - Checkpoint/Warm start cylinders

      ** Must have at least two volumes – will be drained*
- Swapping smaller to larger volumes:
  - GA version: Copies source volume allocation table to target
  - Next release: Volume allocation table will reflect all PERM space

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Resources

- This presentation:
  - Will be uploaded to SHARE Web site
- Manuals
  - FDRPASVM V5.4L80 User Manual http://www.fdr.com/FDRPASVMdoc.pdf
  - FDRPAS, FDRMOVE, and FDRERASE Manual http://www.fdr.com/Manuals_CurrentVersion/FDRPAS_V54L80.pdf
- FDRPAS demo http://fdr.com/index.cfm?hptab=4&d=pasdemo
- Risk-free Trial http://www.fdr.com/riskfreetrial/form_rft.cfm
  - Choose “FDRPASVM product”
- My e-mail address mmacisaac@fdrinnovation.com

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Thank You…

- To learn more come to session 15483:
  Non-disruptively Migrating Linux Guests in Their Entirety

  Thursday, August 7, 2014
  1:30 PM - 2:30 PM
  Room 404

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