Food Lion
Non-Disruptive Data Migration

SHARE in New York, New York
Session 3084
Speaker: John Hooper (Food Lion, LLC)

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Purpose
The following discussion relates the experience of the Storage Management Team at Food Lion as a means of providing an understanding of why and how a mainframe site can employ FDRPAS™ a recent addition to the INNOVATION Data Processing Suite of Non-Disruptive Storage Management Solutions.

Overview
Food Lion successfully used FDRPAS™… during the installation of a new mainframe disk storage system, that was replacing an existing disk storage system, to relocate z/OS™ DASD Volumes in real time, with minimal impact on system performance and no disruption to the ongoing business processing.

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Who is Food Lion?

- One of the 10 largest grocery retailer in the nation with 1200 stores primarily in the southeastern United States

Food Lion is a grocery retailer located primarily in the southeastern United States.

We have over 1200 stores
We have approximately 73,000 employees
We are one of the 10 largest grocery retailers in the nation
Even though grocery is our business, it is computer data that enables us to compete in a VERY competitive market.
I am John Hooper.

I have been in mainframe technical services for almost 30 years.

I am one of us here today that remembers having to take down MVS and bring up SVS to define new GDGs. The good old days weren’t always good.

I work primarily within the operating system and associated ISV products. I seldom work with online applications or the network.

None of us in our technical support area are full-fledged performance experts.

We know what performance numbers are good for us…a lot of people tell us when they are not.

We know that hardware upgrades have to be transparent to all of our users.
Food Lion Data Center (then)

- IBM 2064 2C4 z/900 with three LPARS
  - running z/OS Release 1.4
  - mostly a CICS DB2 environment

- Over 6TB of data spread in two EMC boxes
  - EMC 8830 w/5 TB and ten FICON channels (1Gb)
  - EMC 8430 controller w/1.1 TB and eight ESCON channels

We currently have a single IBM 2064 2C4 z/900 processor with 3 LPARS.
We are running z/OS Release 1.4 on all images.
We have mostly a CICS DB2 environment.

Prior to the data migration in question we had:
1 EMC 8830 controller with 5 TB of usable mirrored disk with ten 1 GB FICON channels. This controller contained only production data.
1 EMC 8430 controller with 1.1 TB of usable mirrored disk with eight ESCON channels. This controller contained only test data.

The result was over 6TB of data spread across two EMC boxes.
It was time to replace the EMC 8430 controller. The 8430 was coming off lease.

Looking around, after a long process we purchased an IBM ESS 800 Shark with 3.3 TB of usable disk space.
The Challenge

- Replacing the 8430 meant moving data from
  - EMC 8430 to the IBM Shark
  - EMC 8430 to the EMC 8830
  - EMC 8830 to the IBM Shark.

The Shark was perceived to be the fastest of all of the controllers especially when considering that it had 2 GB FICON channels.

The best way for Food Lion to take advantage of this new speed was:

- Some data on the EMC 8830 needed to be moved to the IBM Shark.
- Some data from the EMC 8430 needed to be moved to the EMC 8830.
- Some data from the EMC 8430 needed to be moved to the IBM Shark.

Another consideration was that we were currently using EMC TimeFinder on the EMC 8830 and we would have to use IBM FlashCopy on the Shark.
Why not use Hardware Data Migration professional services?

The last migration we were involved with used professional services. The combination of two different storage vendors, the three controllers and a mix of FICON with ESCON this time, greatly complicated the prospects of professional services utilizing a hardware data migration solution.

The last migration only involved moving approximately 3 TB of data from one controller to another, but it took much longer than expected and there was a significant negative impact on performance all during the migration process.

The hardware migration solution was an all or nothing proposition. There was no granularity, just one controller into the other, no flexibility. There was no way to change the pacing of the transfer and once it started there was no way to back out of the transfer.

Production work ran much longer than normal. It was about noon on Monday when the migration completed and by that time there was a huge backlog of uncompleted work.

Poor performance, a lack of granularity along with an abundance of “no’s” tainted our experience. We decided that we would not migrate that way again. (Or else make sure our resumes were up-to-date first).
FDRPAS™ When and Where...

- ESCON / FICON Mix
- Distribute Volumes Across Multiple Storage Systems
- LSS Configuration PAV Constraints
- Incompatible FICON / FICON mix
- No Toleration for Any Interruption
- Time Constraint to Start
- Quick In and Out

FDRPAS is a recent addition to the INNOVATION Data Processing Suite of Non-Disruptive Storage Management Solutions.

Choose FDRPAS whenever there is:

ESCON and FICON Mix
- Replacing ESCON attach with FICON (or visa versa)

Distribution of Volumes Across Multiple Storage Systems
- Distribute volume across multiple storage systems

LSS Configuration and PAV Constraints
- Redistributing volumes across multiple SHARK LSS to make room for PAV

Incompatible FICON / FICON mix
- Check status of FICON connectivity

No Toleration for Any Interruption
- Installation and use of FDRPAS is totally non-disruptive

Time Constraint to Start
- Limits on availability of data migration specialists

Quick in and out
- Ideal for solution for customer satisfaction
Why FDRPAS?

We knew that FDRPAS was not the only player in the non-disruptive data migration market. In fact, it is the newest player.

We were already doing business with INNOVATION. We have a good relationship with INNOVATION.

- Have experience with FDR.
- Know FDR solutions are kept up-to-date with hardware enhancements.

INNOVATION offers a no-obligation trial of the software.

Found FDRPAS quick to install, easy-to-use and fast.

INNOVATION has a number of different payment options. We trust them.
The Project Plan

1. Install IBM ESS.
2. Insure FlashCopy and PAV work.
3. Define work volumes on the Shark, drain same number from EMC 8830.
4. Install FDRPAS, if testing going well.
5. Validate necessary IBM maintenance.
7. Build up experience, FDRPAS copy several volumes concurrently.
8. Let\'r rip, kick off full series of migrations to Shark.

The Project Plan

1. Install IBM ESS w/ 3.3 TB of usable disk space, 16 GB of cache and eight 2 GB FICON channels.
2. Insure FlashCopy and PAV work by copying a few fairly large files.
3. Define 30 work volumes on the Shark, draining that same number on the EMC 8830.
4. Install FDRPAS, if testing is going well.
5. Validate all necessary IBM maintenance is on all LPARS.
   - *This was not an issue as Food Lion z/OS maintenance was fairly current.*
6. Start out "low and slow" use FDRPAS to copy a single volume.
   - *That was successful.*
7. Build up experience, ensure its working as desired, use FDRPAS to concurrently copy multiple volumes.
   - *It was here that we uncovered our only implementation problem. Quickly resolved, it did however introduce some delay into our migration process. I will describe this later in detail.*
8. Let\'r rip, kick off the complete series of Symmetrix to Symmetrix and Symmetrix to Shark migrations.
Start ‘low and slow’

**Migration 1**
We copied all of our legacy TEST volumes to the Shark with FDRPAS. These volumes have comparatively light use. Recovery, if necessary, would not directly affect production processing.

**Migration 2**
We copied a TEST DB2 pool to the SHARK, again with FDRPAS. We now trusted FDRPAS and the Shark. We were looking for operational differences. DB2 processing is always critical.

**Migration 3**
We copied our TEST Natural and Adabas volumes to the Shark. Again, we were looking for operational differences. We are not doing a lot of development in Natural but we still have critical production applications written in that language.
Migration 4 – ‘build up experience’

This was the first critical migration. We copied a pool of 40 production volumes to the Shark. This data migration took 22 minutes with FDRPAS. The application using this pool fully utilizes TimeFinder at both the volume and data set level. Application changes were required after the migration to use FlashCopy.
Migration 5 – ‘build up experience’

We copied a pool of 48 test volumes to the Shark from the EMC 8430. This was the test equivalent to the volumes moved in Migration 4. This data migration took 33 minutes with FDRPAS. It was not as fast as most of the prior migrations. This was apparently due to the fact that the source volumes were on a disk controller that had ESCON connections rather than FICON.
Migration 6 – ‘let’r rip’
We copied 2 pools totaling 198 volumes to the Shark. This is the largest part of our non-DB2 data that is used by our legacy applications. These pools had also been processed by TimeFinder and required application changes. This data migration took 76 minutes with FDRPAS.

Migration 7 – ‘finish’m off’
We copied a relatively small 30-volume DB2 pool to the Shark.
The brief answer,
FDRPAS starts with original volume online and target offline:
Monitor tasks are started for offline target disk devices
A Swap task is started and monitor tasks joins in collaboration
FDRPAS (swap & monitor task) tracks updates to the old disk
Swap copies all inactive datasets’ tracks
Swap collects update lists from monitor tasks
Swap copies:
  Tracks of in use datasets from the old to the new disk
  Updated tracks are re-copied
FDRPAS quiesces I/O:
  Remaining tracks are copied to synchronize the disks
FDRPAS calls a system service to swap I/O to the new device,
  Volume is swapped.
  Target volume comes online and original goes offline
Voila! Volume is moved **while in use!**
How did we use FDRPAS to move our data?

The target volume of each swap operation must be varied offline prior to starting any of the monitor tasks or the swap job.

A monitor task has to run on all system images that share the affected disk volumes. We have three LPARS and in our environment all disk data is shared so we had to have a monitor task to run on 2 LPARS while the copy job [swap task] ran on the third.

We set up the monitor task as a true started task. It was just easier for us to do it this way. To insure performance of this task on what are sometimes over utilized LPARS we set them to SYSSTC service class.
Copy PASPROC from install library to proclib and customize.
Can be used to start monitor or swap tasks
–Used to start monitor external tasks
–Used to initiate for swaps started from ISPF -

A listing of our monitor task PROC is shown below:

```plaintext
//PASPROC  PROC PROG=FDRPAS,
//             LIB='SYSP.LL.FDRPAS.LOADLIB',
//             EMAIL=NULLFILE,            EMAIL STMT INPUT DATA SET
//             IN='SYS1.TECHSUP.PARMLIB', STATEMENT INPUT DATA SET
//             MBR=SHARK,                 STATEMENT MEMBER
//             OUT='SYSOUT=*',            FDRPAS SYSOUT
//             D=SHR                      INPUT DATASET DISPOSITION
//PAS      EXEC PGM=&PROG,REGION=ON
//*******************************************************************
//*  FDR PLUG AND SWAP
//*******************************************************************
//STEPLIB  DD  DISP=SHR,DSN=&LIB                                //SYSPRINT DD  &OUT
//SYSPRINT DD  &OUT                                                   //FDRSUMM  DD  &OUT
//SYSUDUMP DD  &OUT
//PASDEBUG DD  DUMMY
//FDREMAIL DD  DSN=&EMAIL,DISP=SHR
//SYSIN    DD  DSN=&IN(&MBR),DISP=&D
```

Default parmlib member SHARK.

```plaintext
MONITOR TYPE=SWAP,DURATION=120
MOUNT, SWAPUNIT=(8000, 8100, 8200, 8300)
```

Each controller was assigned a name in the parmlib for the STC.
The default member name was SHARK. A listing of this member is shown below:

```plaintext
MONITOR TYPE=SWAP,DURATION=120
MOUNT, SWAPUNIT=(8000, 8100, 8200, 8300)
```
The FDRPAS Swap copies the data.
Listing of the FDRPAS SWAP Job JCL

```
//COPYJOB  JOB ,'FDR PAS',CLASS=F,MSGCLASS=H
//COPY0001 EXEC  PGM=FDRPAS
//STEPLIB DD  DSN=SYSP.LL.FDRPAS.LOADLIB,DISP=SHR
//SYSUDUMP DD  SYSOUT=*  
//SYSPRINT DD  SYSOUT=*  
//PASDEBUG DD  DUMMY
//SYSIN DD *
SWAP   TYPE=FULL,MAXTASKS=5
MOUNT VOL=PRD001,SWAPUNIT=801A
MOUNT VOL=PRD002,SWAPUNIT=811A
MOUNT VOL=PRD003,SWAPUNIT=821A
MOUNT VOL=PRD004,SWAPUNIT=831A
MOUNT VOL=PRD005,SWAPUNIT=841A
MOUNT VOL=PRD006,SWAPUNIT=851A
MOUNT VOL=PRD007,SWAPUNIT=861A
MOUNT VOL=PRD008,SWAPUNIT=871A
MOUNT VOL=PRD009,SWAPUNIT=801B
```

Note that with the options taken that FDRPAS will run a maximum of 5 swap operations at a time from the list of requests.
Problems! – One Quickly Fixed

- FDR234 ERROR ON VOL=vvvvv – UNIT=uuuu REASON=E

Problems!
Yes, we had one “Quickly Fixed” problem.

As mentioned earlier we had a problem running multivolume SWAP processes. All processes after the first one would fail.

FDR234 ERROR ON VOL=vvvvv – UNIT=uuuu REASON=E

After a couple of dumps and traces it was determined that the problem was the result of a process performed by another product. This product issued an unusual set of channel commands to each online disk volume to query their status whenever any volume was varied online. FDRPAS itself issues a VARY ONLINE command to complete each SWAP operation. This resulted in the previously mentioned channel commands being issued for other volumes still being swapped. Since FDRPAS could not insure that this unusual channel command did not modify data, the integrity of that volume was considered to be compromised. This resulted in all SWAP operations still in process to be terminated.

FDRPAS support created a fix for that specific channel command sequence to fix the problem. That fix is P-54.4028.

This did take approximately 1 day to resolve. We felt that the time to fix this problem was extraordinary good and had no real impact on the project.
Realizations 1 / 2 / 3 / 4

1. FDRPAS did exactly what it was supposed to do, and no one noticed.

2. All volumes moved with the online systems active, during first shift, again no one noticed.

3. Moving data takes additional I/O, it wasn’t free, but again no one noticed.

4. There are more reasons beyond install to move volumes, so we are continuing to use FDRPAS.

Realization 1
FDRPAS did exactly what it was supposed to do. We were able to move about 500 volumes without noticeable impact on other workloads. The only reason that anyone knew this was happening was that they received notices that this was going to happen.

Realization 2
I hadn’t commented earlier but we moved all of these volumes during first shift. With care, this is actually the best time for this to occur in OUR environment. Online systems do require response time but our batch load outside of first shift is actually more intense. Certainly more data is updated outside of prime shift that will increase the synchronization time. No one noticed. We did limit FDRPAS to only swapping 5 volumes concurrently. All of our controllers had more paths than 5 paths. Our main concern was cache utilization and back-end load on the controllers. Again, no one noticed.

Realization 3
Our total I/O response time during one of the major volume swap operations did go up some. It had to. This highest 15 minute interval showed an average disk response time of 3.4 ms at about 3000 I/O’s per second. Before and after the swap operation it was about 1.7 ms. The volumes being swapped were obviously slower than the average but it typically stayed in single digits. Moving this much data can’t be free. We also had the luxury of having all FICON channels for all of the production migrations. Again, no one noticed.

Realization 4
We still use FDRPAS after the migration. We occasionally move volumes between the remaining two controllers to meet changing needs without requiring outages. We had never had two production disk controllers. Now that we do, there will be more reasons to move volumes between the two. This in fact has happened since the migration. For this reason we continue to use FDRPAS today.
FDRPAS Performance

• Many factors influence elapse time
  • Number of volumes - Amount of data to be copied
  • Speed of devices - Type and number of disk channels
  • Other system I/O - setup and checking

• FDRPAS™ Performance at Food Lion

• ESCON input & FICON output–
  48 volumes moved to the Shark - 33 min

• FICON in & out
  40 volumes moved to the Shark - 22 min
  198 volumes moved to the Shark - 76 min

The FDRPAS SWAP Task uses very little CPU time and the MONITOR Tasks uses less.

FDRPAS SWAP elapse times depend on many factors:
  ** Number of volumes concurrently swapping
  Amount of data to be copied (Number of volumes at what % full)
  Speed of source and target devices –
  Type and number of disk channels
  Other system and application I/O
  Accounting for setup and checking

Examples of start to finish elapse time for FDRPAS migration:
  48 volumes moved to the Shark in 33 minutes
  (ESCON input)
  40 volumes moved to the Shark in 22 minutes
  (FICON in & output)
  198 volumes moved to the Shark in 76 minutes
  (FICON in & output)
Ultimate Benefit

- FDRPAS moved all the volumes, no one in mainframe technical support lost any “sleep”, and no one at FoodLion noticed.

Ultimate Benefit

The most important thing is this and I am sure most of you in this room understand this completely: None of us in the mainframe technical staff had to lose any “beauty sleep”. Some of us have already lost too much.
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Any Questions