Introducing Native VSE/ESA Support for the RAMAC Virtual Array Storage

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Agenda

- **Abstract:** The RAMAC Virtual Array Storage uses a unique architecture to bring new dimensions to DASD storage. Learn about this subsystem and the software that exploit this architecture. Euro testing, almost instantaneous back-up/restore, storage management, etc., will be discussed. This session focuses on using the RAMAC Virtual Array Storage in VSE/ESA environments.

  - **RAMAC Virtual Array Storage:** Providing a functional overview of the IBM 9393 RAMAC Virtual Array Storage -- not an in-depth architectural overview -- with the purpose of developing an appreciation for the capabilities of the RVA.

  - **IXFP/SnapShot for VSE/ESA:** Providing function for monitoring the capacity of the RVA, a facility to rapidly duplicate data and the ability to manage the freespace of the RVA.

RAMAC Virtual Array Storage

An Introduction

IBM RAMAC Virtual Array Storage, Model X83

- **Emulates 3380s and 3390s**
- **Up to 1024 logical volumes**
- **290 - 1680 GB *effective*, orderable capacity**
- **3.5 - 6 GB *effective* cache storage**
- **16 MB *effective* nonvolatile storage**
- **Automatic data compression**
- **Up to 128 ESCON logical paths**
- **Log structured array**

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IBM RAMAC Virtual Array Storage, Model X83

- **Virtual disk architecture**
  - Allocated, but unoccupied space, uses no disk
  - Gaps and end of track use no space
- **RAID 6 architecture**
- **Up to 8 concurrent host data transfers**
- **Peer-to-Peer Remote Copy (PPRC)**
- **Automatic load balancing across volumes**
- **Concurrent LIC activation**

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RAID Technologies

- **RAID 0 -- no redundancy**
- **RAID 1 -- dual copy or mirroring**
- **RAID 2 -- synchronized access, error correcting code**
- **RAID 3 -- parallel access, fixed parity disk**
- **RAID 4 -- data striped, fixed parity disk**
- **RAID 5 -- data striped, distributed parity disk**
- **RAID 6 -- dual level redundancy**

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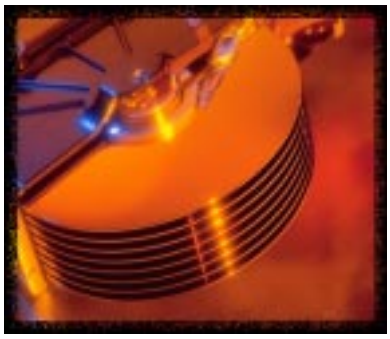
Traditional DASD Architecture

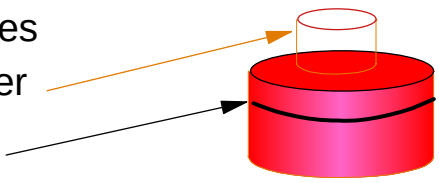
- **SLED** -- Single, Large, Expensive Disk



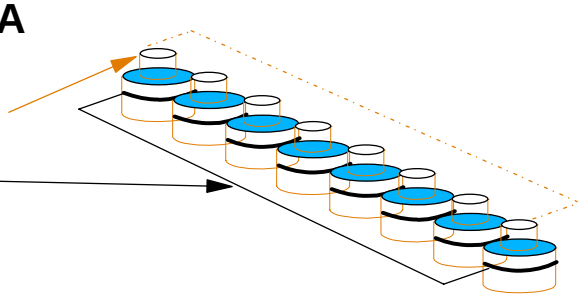
  - Fixed Environment
  - 1:1 Logical to Physical mapping

RVA Terminology

- **Host View**
  - Functional volumes
  - Functional cylinder
  - Functional track



- **Within the RVA**
  - Array disks
  - Array cylinder
  - Array track



Virtual DASD Architecture

- **Log structured file system**
  - Operates as a typical log file
  - Self-tuning design eliminates disk hot spots
  - Avoids RAID "write penalty"
- **Reduced volume contention (IOSQ)**
  - 32 full volumes => 64 half-full volumes
- **Compression, Compaction**
- **Elastic capacity**

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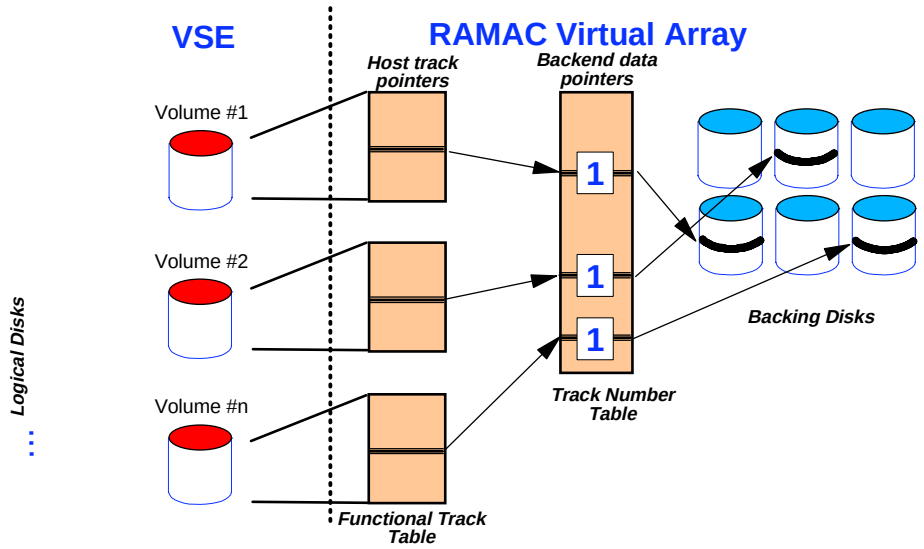
Log Structured Array



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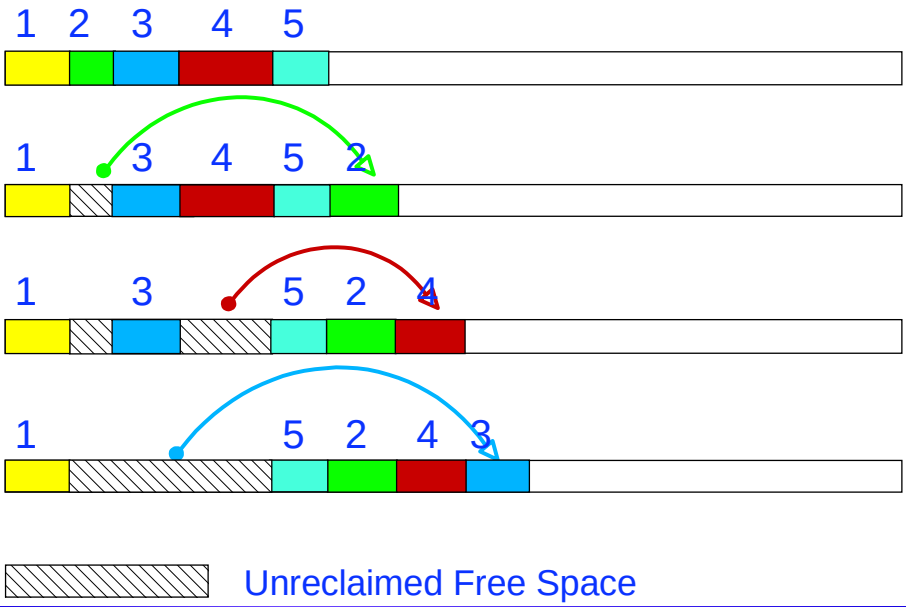
Record Update



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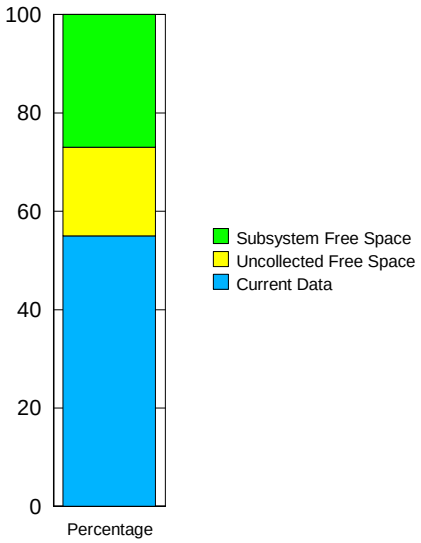
RVA Space Management

- **Net Capacity Load (NCL) percentage**
- **RVA capacity load**
  - Current or active data
  - Uncollected free space
  - Subsystem free space
- **Deleted Data Space**
- **Subsystem Free Space Collection**



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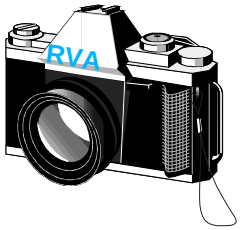
RAMAC Virtual Array Storage



IXFP/SnapShot for VSE/ESA

Three Basic Things Done with Data

- **Store it**
- **Use it**
- **Duplicate it**
- ***Of course, you need to do these things for your business processing, but ...***

duplication requires data movement and ...

moving data is usually not productive !

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IXFP/SnapShot for VSE/ESA

- **A priced, optional feature of VSE Central Functions**
- **It provides:**
  - SnapShot for rapid duplication of data
  - Deleted Data Space Release for more effective use of RVA capacity
  - Status and space utilization reports
- **Available: Now!!!**

Coming soon...

VSAM support with VSE/ESA 2.5

Attention Routine Command

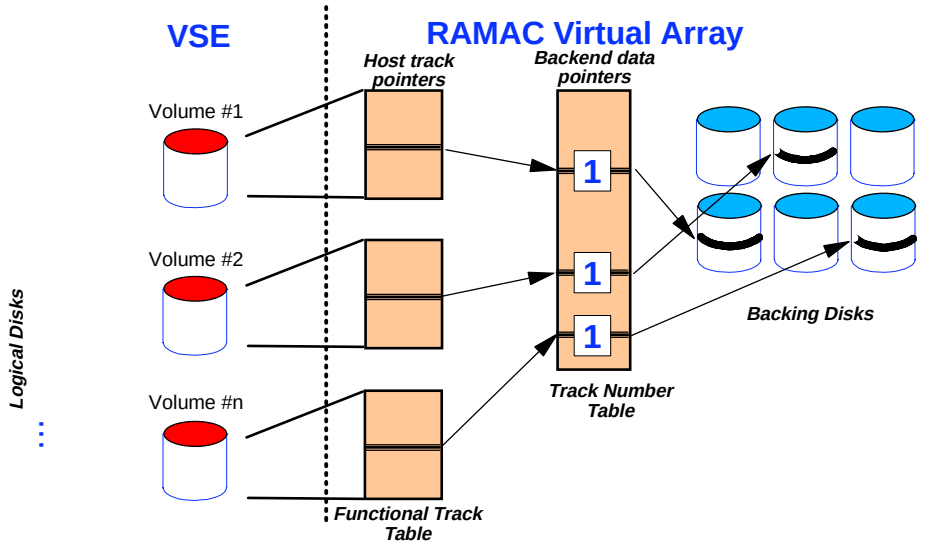
- **IXFP command**
  - **SNAP**,source:target,VOL1=volid
  - **DDSR**,unit
  - **REPORT**,unit

IXFP SNAP Command...

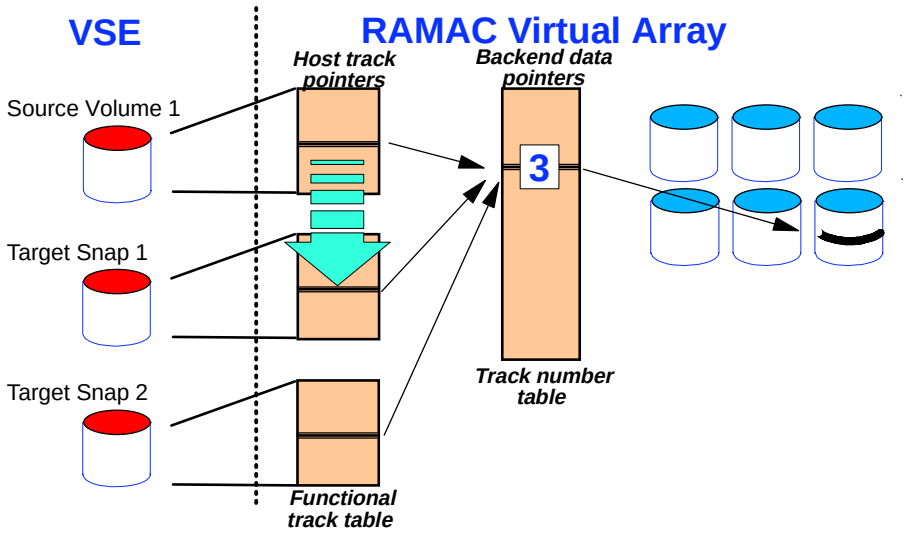
- **IXFP SNAP,source:target,VOL1=volid**
- **Duplicates entire volumes**
  - Target volume must be DVCDNed
  - Copy VOLID
- **Duplicates data within a cylinder range**
- **Duplicates a file from one volume to another**
  - Relocation is optional

Note: No VTOC checking of target volume is done before the copy is made for overlap on unexpired files.

Log Structured Array



SnapShot Pointer Manipulation



Physical Storage Considerations

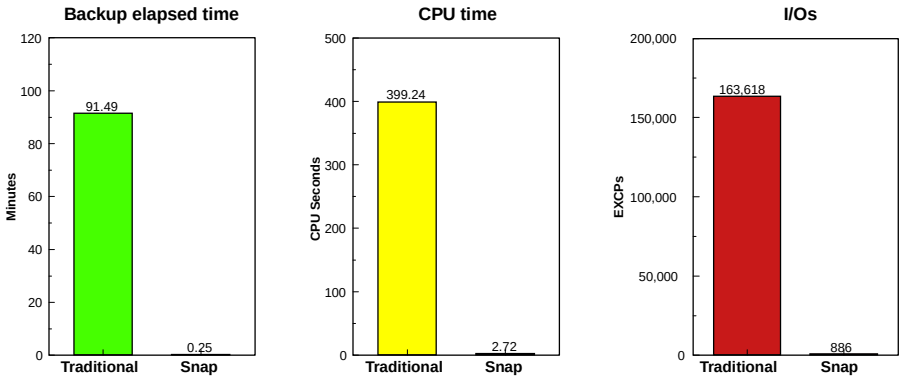
- **No backend storage is used at time of copy**
  - No matter how many copies are made!
- **Only *changed* data requires additional space**
- **Access patterns will change**
  - Snap copies may have lower access density
  - Virtual copies may reduce usage

IXFP SNAP Command -- Examples

```
ixfp snap,80e(dsn='test.data.1'):80f
AR+0015 IXFP23D SNAP FROM CUU=80E DSN='TEST.DATA.1' TO CUU=80F - REPLY
'YES'
TO PROCEED
15 yes
AR 0015 IXFP22I SNAP TO  CUU= 80F STARTED AT 11:44:44  11/20/1998
AR 0015 IXFP20I SNAP FUNCTION COMPLETED   AT 11:44:44  11/20/1998
AR 0015 1I40I  READY


ixfp snap,80e(dsn='test.data.1'):80f,noprompt
AR 0015 IXFP22I SNAP TO  CUU= 80F STARTED AT 18:16:59  11/17/1998
AR 0015 IXFP20I SNAP FUNCTION COMPLETED   AT 18:16:59  11/17/1998
AR 0015 1I40I  READY
```

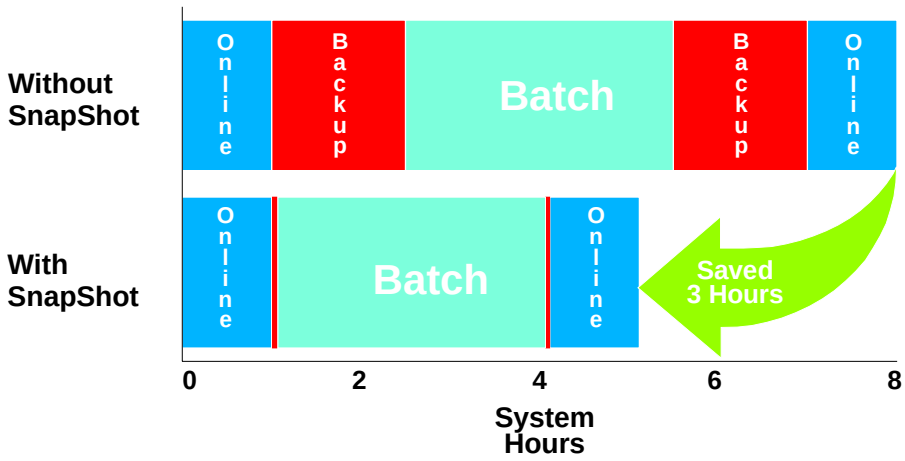

Dramatic Reductions in Data Replication Times



Traditional Data Replication vs. SnapShot
Large Healthcare Customer in USA

Impact on Batch Window

Batch window reduced !!!



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IXFP DDSR Command ...

- **IXFP DDSR,unit/file**
- **With no operands, deletes all expired VSE files on RVA subsystem(s)**
- **With specified unit (cuu), deletes all VSE files on the unit(s) specified**
- **With file, deletes specified file**
- **Space is returned to uncollected free space in the RVA**

Note: Any data secured file (DSF=Y) is not deleted by DDSR

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IXFP DDSR Command -- Example

```
ixfp ddsr,patev3(dsn='test.data.3')
AR+0015 IXFP29D DDSR FOR  CUU=80F DSN='TEST.DATA.3 - REPLY 'YES' FOR
DELETION
15 yes
AR 0015 1I40I  READY


ixfp ddsr,patev3
AR+0015 IXFP29D DDSR FOR  CUU=80F (WHOLE VOLUME) - REPLY 'YES' FOR
DELETION
15 yes
AR 0015 1I40I  READY


ixfp ddsr
AR+0015 IXFP26D 'TEST.DATA.1' HAS EXPIRED ON CUU=80E - REPLY 'YES' FOR
DELETION
15 yes
AR+0015 IXFP26D 'TEST.DATA.1' HAS EXPIRED ON CUU=80F - REPLY 'YES' FOR
DELETION
15 yes
AR 0015 1I40I  READY
```


IXFP REPORT Command ...

- **IXFP REPORT,unit**
- **With no unit specified, reports on the status of the entire RVA subsystem**
  - Shows virtual capacity (used and unused) and capacity load
- **With a unit specified, reports on the device status**
  - Shows capacity used -- allocated and actual space (MB and %), compression ratio

IXFP DDSR Command -- Example

```
ixfp report
AR 0015 SUBSYSTEM 1321117
AR 0015 *** DEVICE    DETAIL  REPORT ***
AR 0015     <---FUNC. CAPACITY (MB)--->  <---CAPACITY (%)--->   PHYS.   COMP.
AR 0015 CUU   DEF   ALLOC STORED UNUSED  ALLOC  STORED UNUSED USED(MB)  RATIO
AR 0015 80E 2838.0  N/A    392.9 2445.1   N/A    13.84  86.16   214.4    1.83
AR 0015 80F 2838.0  N/A    392.9 2445.1   N/A    13.84  86.16   214.4    1.83
AR 0015
AR 0015 *** DEVICE    SUMMARY REPORT
AR 0015 CAPACITY         <-----TOTAL----->  <------TOTALS %------>      COMP.
AR 0015    DEFINED             5676.032 MB  100.00                     RATIO
AR 0015    STORED               785.816 MB           13.84
AR 0015      PHYS.USED          428.908 MB                    7.56       1.83
AR 0015    UNUSED              4890.216 MB           86.16
AR 0015
AR 0015 *** SUBSYSTEM SUMMARY REPORT ***
AR 0015 SYSTEM    DEFINED-CAPACITY     DISK-ARRAY-CAP  FREE-DISK-ARRAY-CAP
AR 0015   PROD       726532.208 MB      117880.209 MB         57750.030 MB
AR 0015
AR 0015  NET-CAPACITY-LOAD(%)   COLL.-FREE-SPACE(%)   UNCOLL-FREE-SPACE(%)
AR 0015  TEST   PROD  OVERALL   TEST   PROD  OVERALL  TEST   PROD  OVERALL
AR 0015   0.00  51.01   51.01    0.00  47.55   47.55   0.00   1.44    1.44
AR 0015 1I40I  READY
```


VSE/VSAM Challenge

- **Potential for duplicate catalog names**
- **Potential for duplicate data set names in one catalog**
- **Potential for duplicate VOLIDs**
  - SHROPTN(1) causes lock on file
    - File-id and VOLID are used for lock and source and target are same

VSE/VSAM Solution

- **Synonym Backup**
  - A *synonym list* to cause OPEN and IDCAMS BACKUP to use the SnapShot copy
  - No change to current backup process -- except for synonym
  - VSAM makes the synonym connection to the catalog and data sets

Using Synonym Snapped Data Sets

- **Copy volumes containing Catalog and data sets using IDCAMS SNAP comand**
  - Change the VOLID during SNAP
- **Use IDCAMS IMPORT CONNECT to access the target catalog and data sets**
  - Catalog and data are not accessible to applications
- **Use IDCAMS BACKUP synonym backup**

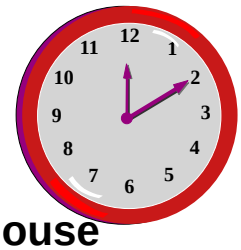
Example of Synonym Backup

```
// JOB SNAP AND BACKUP FROM SNAPPED VOLUME(S)
// ASSGN SYS005,180
// DLBL IJSYSUC,'VSESP.SNAP.CATALOG',,VSAM
// EXEC IDCAMS,SIZE=AUTO

  /* First, make SnapShot copy */                          -
  SNAP                                                     -
      SOURCEVOLUMES (SYSWK1,SYSWK2)                        -
      TARGETVOLUMES (VOLSN1,VOLSN2)


  /* Second, Synonym name for the snapped catalog  */      -
  IMPORT CONNECT OBJECTS((VSESP.SNAP.CATALOG               -
      VOLUMES(VOLSN1) DEVT(3390)))                         -
      CATALOG(VSAM.MASTER.CATALOG)


 /* Third, Backup from snapped copy */                     -
 BACKUP (*)                                                -
      SYNONYMLIST(                                         -
      SOURCEVOLUMES(SYSWK1,SYSWK2)                         -
      TARGETVOLUMES(VOLSN1,VOLSN2)                         -
      CATALOG(VSESP.USER.CATALOG)                          -
      SYNCATALOG(VSESP.SNAP.CATALOG)
/*
/&
```


SnapShot Requirements

- **Hardware**
  - IBM 9393 RAMAC Virtual Array Storage
    - Feature code 6001
    - LIC level 04.04.24 (min. 03.02.00)
- **Software**
  - VSE/ESA (5690-VSE) Version 2
    - APAR DY44820 for VSE/ESA 2.3
    - APAR DY44841 for VSE/ESA 2.1/2.2
  - VSE Central Functions (5686-066) with Feature Code 2030
  - VSE/ESA Version 2, Release 5 for VSE/VSAM Synonym support

SnapShot Business Benefit/Value



- **Duplication in seconds**
- **"Instant" data recovery**
- **Create and maintain data warehouse**
- **Reduce batch window, expand on-line availability**
- **Year 2000 or EMU testing and application development**

Saves Time

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SnapShot Business Benefit/Value

- **No "physical" media required for duplication**
- **No "physical" overhead resources for duplication**
  - Lower channel busy, CPU busy, fewer tape mounts, memory savings, fewer tape drives
- **Improved productivity**

Saves Money

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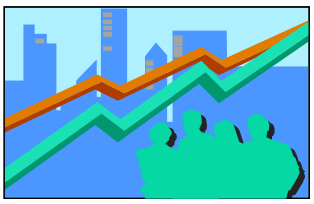
SnapShot Business Benefit/Value

- **Increases application availability**
- **Improves decision making**
  - Affordable data mining
  - Quick, inexpensive data duplication
- **Increases productivity**
- **Service level "insurance"**
  - Application recovery time buffer



Improves Business Productivity

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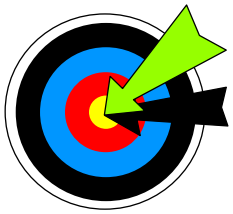
SnapShot Business Benefit/Value

- **Fewer production outages**
  - Test applications with full, current copies of production data
- **Improved application quality**
  - Test using current data
  - More productive testing
  - More effective testing in less time
  - Applications into production faster



Improves Quality

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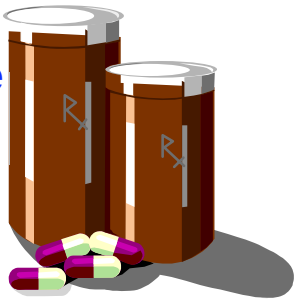
Maintenance Levels

- **Check with IBM Service**
- **RAMAC Virtual Array Storage**
  - **LIC Release ECA016 (04.06.11) or later level**
- **IXFP/SnapShot for VSE/ESA**
  - **(None)**
- **VSE/ESA**
  - **APAR DY44820 for VSE/ESA 2.3**
  - **APAR DY44841 for VSE/ESA 2.1/2.2**
- **VM/ESA with VSE/ESA guest**
  - **APAR VM61486 for minidisk cache**
- **ICKDSF**
  - **APAR PQ02288 -- Supports RVA device type**



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Education and Documentation

- **Education**
  - Course ES560: **Implementing IXFP for the RVA**
  - Course ES580: **SnapShot for the IBM RVA**
- **Redbooks**
  - ***IBM RAMAC Virtual Array*** (SG24-4951)
  - ***IBM RAMAC Virtual Array Storage, Peer-to-Peer Remote Copy, and IXFP/SnapShot for VSE/ESA*** (SG24-5360)
  - ***Implementing SnapShot*** (SG24-2241)

Note: "Memo to Users" is only other documentation provided for VSE/ESA V2.3, or earlier.

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