Intercom Computer Systems

JANUS

Migration of OAM Objects from Opticals, DASD and Tape to New Hardware

Product Overview V02R03

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Table of Contents

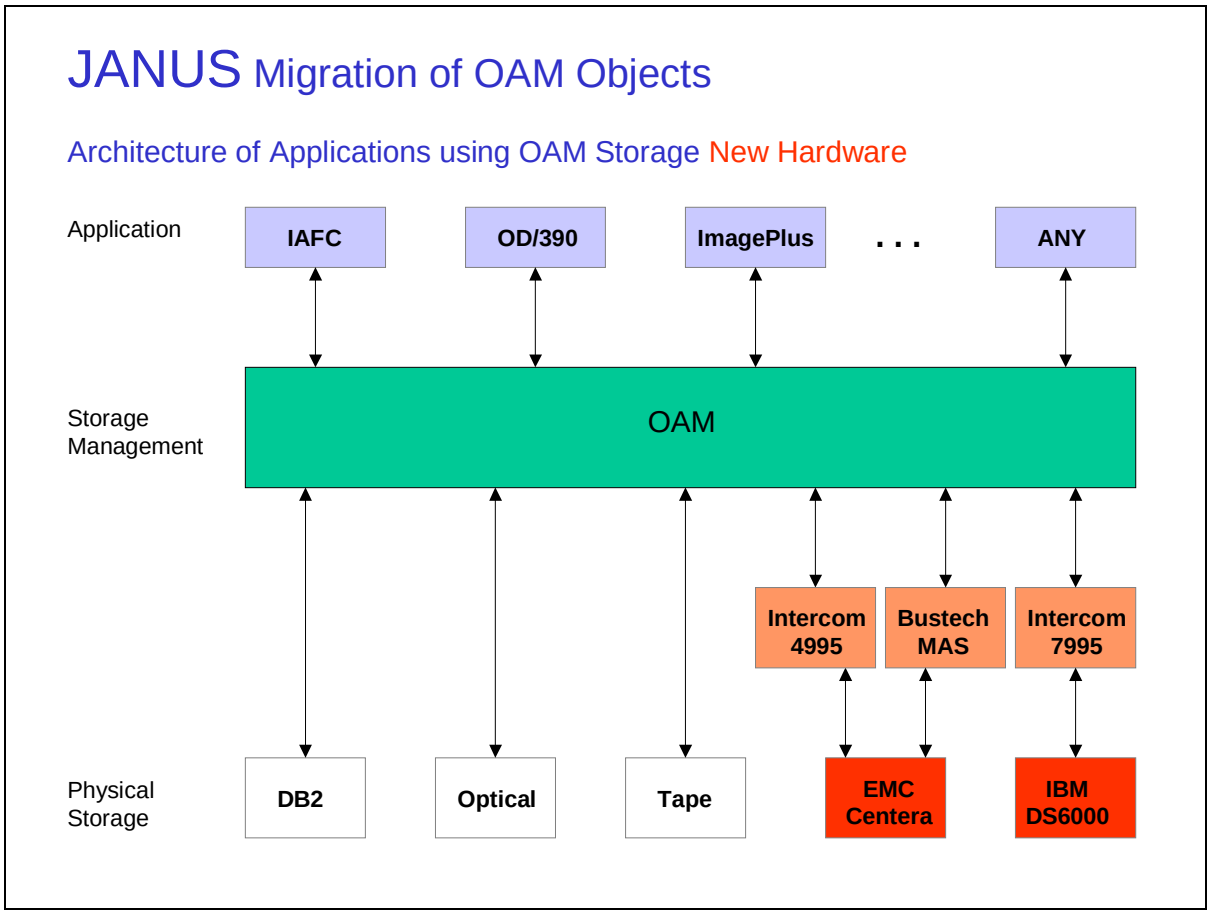
1 The Problem

Archiving on optical platters is no longer state of the art on IBM mainframes. IBM does not develop optical jukeboxes of the 3995 type anymore. Companies using archives on the basis of OAM are confronted with the need to install new hardware solutions and to migrate data to the new media. On the other hand new hardware storage systems have been developed, such as EMC's Centera or IBM's DS4000 or DS6000 series, which allow to archive large amounts of data on magnetic disk at very competitive costs. Classical archive systems, such as Image Plus, IAFC or OnDemand/390 are enabled to work with these new devices via *gateway interfaces* emulating 3995 jukeboxes to OAM.

Typical installations today have accumulated between 10 and 30 TB of data on opticals, corresponding to up to 500 million OAM objects. The best part of these data have to be stored for 10 years due to legal requirements. Archives that have been developed over many years normally aren't in an optimal structure anymore, because original requirements on storage, management and retrieval of the data have changed over the years. These archives might need a restructuring of the assignment of different report types to OAM storage groups.

The new storage systems cannot be restricted to the archiving of new data, old data must be migrated to the new storage systems, in order to benefit from the technical innovation and the superior access performance. IBM's OAM does not provide a utility able to migrate such an amount of objects in an easly controllable and auditable way.

JANUS has been developed to provide a reliable and easy to handle migration tool.



2 JANUS Migration: Standard and Extended

The ***JANUS Standard*** (or ***JANUS S***) migration is independent of the archive application, because it works on the OAM level. JANUS Standard is also independent of the specifics of the new storage system: the only requirement is that the new hardware (more specifically: the *gateway*) supports the standard OAM interface.

The migration process will be most efficient, if the regular archiving into one or several OAM storage groups is already switched to the new media, because the old data will then be READ ONLY. If archiving to opticals continues during the migration, planning and control processes will cause more effort.

The version ***JANUS Extended*** (or ***JANUS E***), provides additional functionality and increased flexibility for specific archive systems. Presently ***JANUS E*** supports Image Plus, IAFC and OnDemand/390, but can easily be adapted to other systems. The extended functionality, which can be implemented, depends on the archive system, because each archive system handles the information of the physical location of objects differently.

JANUS E uses ***three sets*** of OAM storage groups / collections:

Set 1: the original data on opticals (or DASD or tape)

Set 2: the new data archived regularly to the new media

Set 3: data migrated from opticals to the new media.

JANUS E provides an unrestricted **fallback/undo** functionality and the ability for **verification** on both the completeness and identity of the migrated objects, but requires some effort in **definining** additional OAM storage groups and collections. In addition, ***JANUS E*** provides the ability to **restructure** the assignment of collections to OAM groups on the basis of the experience accumulated over the years within a company.

A long time will be needed to migrate the data from the optical libraries IBM-3995 to the new media because of the large amount of data (typically many TeraBytes). Therefore the migration process

- needs careful planning for optimal use of resources
- must provide control and verification on the level of the individual object
- must not interfere with regular archiving of *new data* on new media and the access of *old data* on optical libraries.

3 JANUS Migration: Processes

3.1 Mapping Old Collections to New Collections

Both JANUS versions start with a definition task, where the set of *existing storage groups* and *collections* is mapped (in a DB2 table) to the set of *migrated storage groups* and *collections*. In *JANUS E* the migration set requires new storage group and collection definitions, in *JANUS S* both sets must be identical.

3.2 Collecting the Objects to be Migrated

In a second task JANUS collects references to all objects to be migrated in a DB2 table, together with the physical addresses of the original primary and backup copies. This table will be used in the next tasks to *plan, control* and *monitor* the migration process. The population of this table can be controlled by the user on the level of OAM storage groups and additional selection criteria (e.g. date ranges). This will allow to migrate some storage groups to new media while still archiving other storage groups to opticals, providing a minimal risk by a stepwise transition from old to new media.

3.3 Migration of Objects to New Media

In the third task the objects are physically migrated to the new media. The user has full flexibility to control which storage groups (or even which collections within a storage group) from which optical jukebox are to be migrated *sequentially* or *in parallel*. A high parallelity reduces the overall elapsed time for the migration considerably. The degree of parallelity is limited only by the number of optical drives that can be dedicated to the migration concurrently to the normal access to the data by online or batch users, the CPU usage is very small. In fact, a high degree of parallelity is unavoidable if the migration is expected to finish in a reasonable time frame.

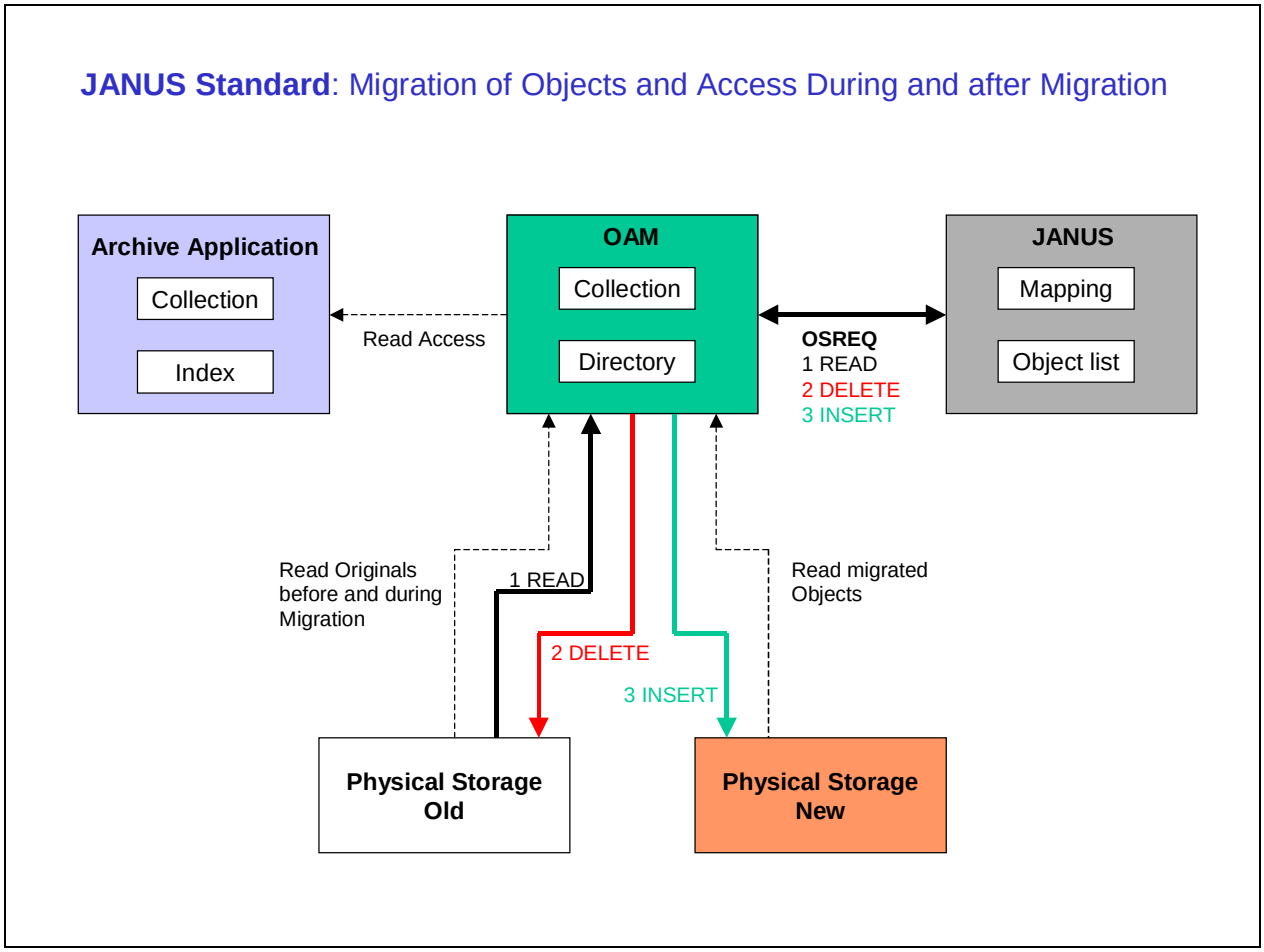
The migration of the objects is performed by the standard OAM interface, the OSREQ macro. The migration processes therefore appear to OAM just as additional concurrent users (like conventional online or batch users), in contrast to OAM utilities such as MOVEVOL or OSMC which may generate locking problems or poorly defined intermediate states.

The migration process is handled differently ***JANUS S*** and ***JANUS E***.

3.3.1 Migration JANUS Standard

In ***JANUS S*** the objects are ***moved*** from the original to the migration media. The original object is *read* into a buffer, *deleted* (logically) from the original location (i.e. the OAM directory rows are deleted) and then *written* to new media. After *moving* an object, the status value in the JANUS working table is updated and a DB2 COMMIT is performed. This guaranties the consistency of the data and the restartability of the JANUS processes: an object is either on the original or on the new media. In fact, JANUS programs may be interrupted and restarted at any time without the need for manual intervention.

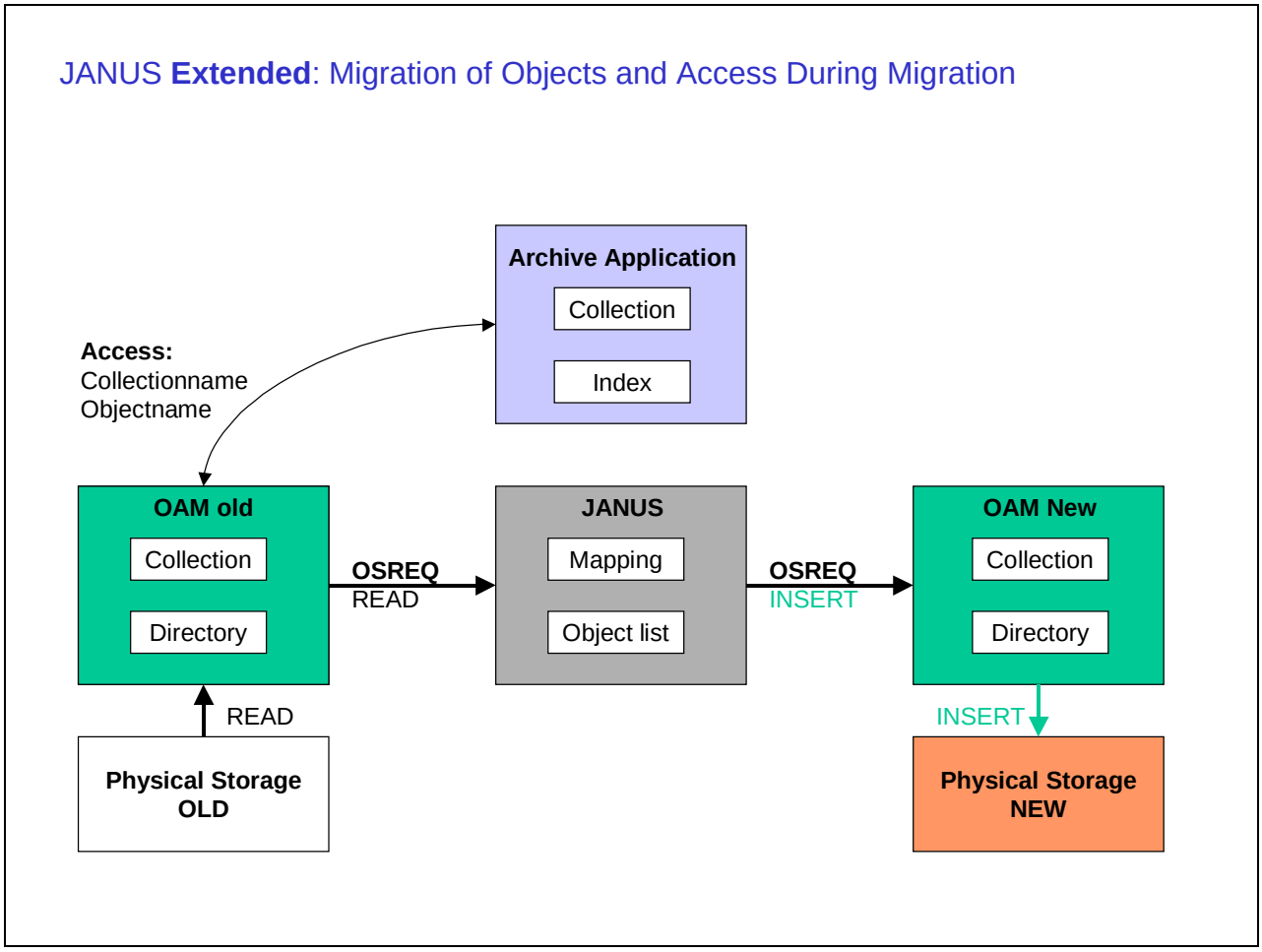
The migrated objects will be available for access by the users immediately after the DB2 COMMIT. The original objects will no longer be accessible (they are not lost, however, see below).



3.3.2 Migration JANUS Extended

In ***JANUS E*** a ***copy*** of the original objects is written to the new media, the original objects are accessed in READ ONLY mode, with no interference with other access processes. After copying an object the status value in the JANUS working table is updated and a DB2 COMMIT is performed. Consistency of the data and restartability are guaranteed in a similar way as in ***JANUS S***. Both, original and migrated objects coexist, and are accessible, through the whole migration process.

The original objects will still be accessed by the users, the migrated objects will not be available to the users until explicitly activated.



3.4 Activation of Objects on New Media in JANUS Extended

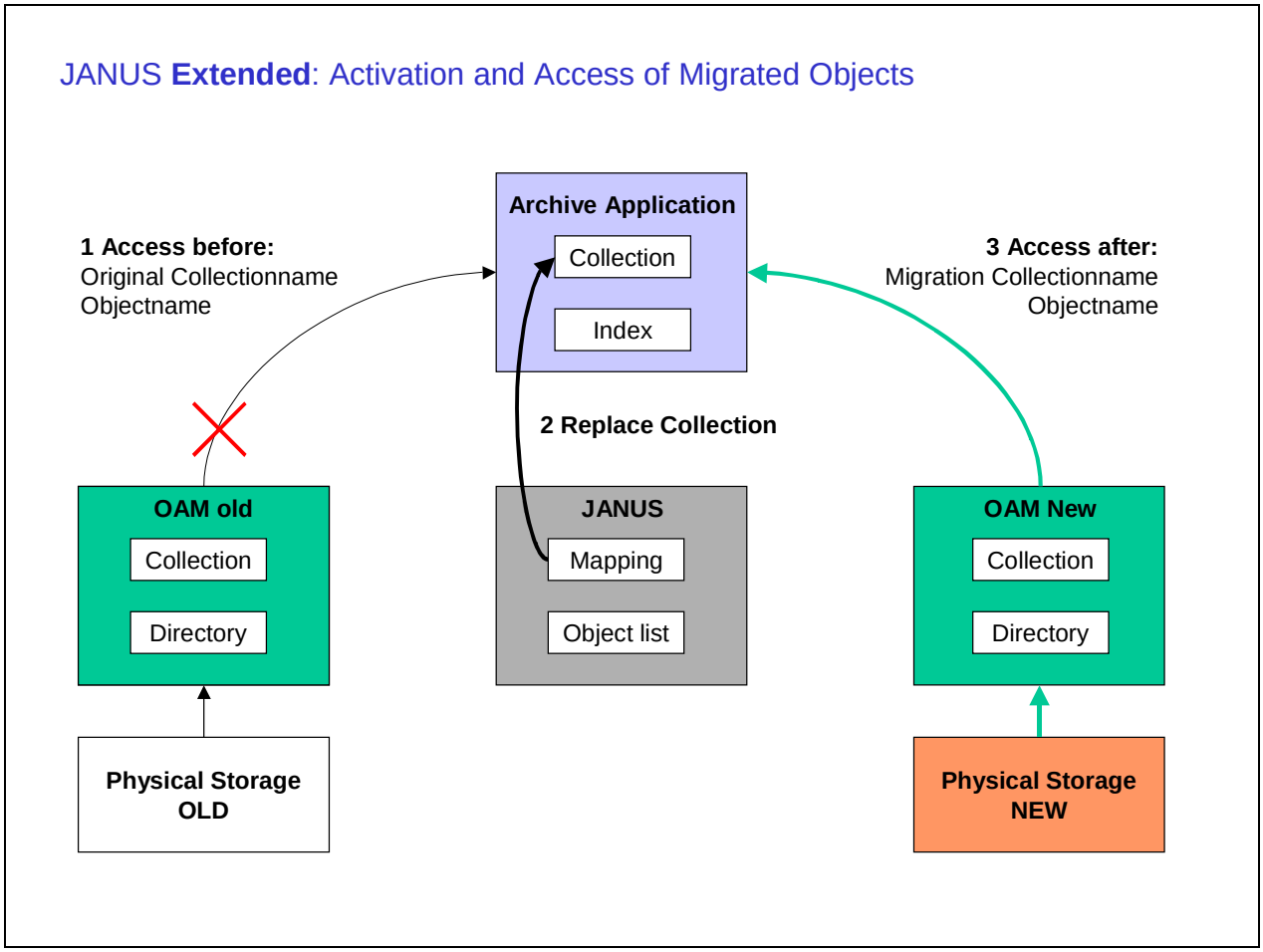
In ***JANUS E*** a fourth task is required: the migrated objects have to be made available to the archive application or *activated*. This is performed by a separate program where the collection definitions of the archive system (Image Plus …) are redirected to the migration collections. This process is very fast (updates of DB2 tables of the archive system and of status values of the JANUS tables only) and it is reversable (in case a problem would be encountered with the migrated data or if access to the original data would be required for verification purposes).

3.5 Verification

It is recommended that the user implements a program which *verifies* at least that

- all original objects were migrated
- the size of the migrated objects is identical to the size of the original ones.

This is easy to implement in ***JANUS E*** because original and migrated data coexist in different OAM storage groups. (***JANUS E*** provides such a verification program, which is limited to the case where original and migrated OAM storage groups and collections have the same structure.)



In addition, it is recommended to compare a randomly selected sample of original objects byte by byte with the corresponding migrated objects, in order to prove that the migration process is correct and that the objects were not modified in the migration process. (The comparison of all objects is too time consuming.)

JANUS S does not offer the opportunity that both, original and migrated, data are accessible by a program. If a similar verification as in ***JANUS E*** is required, it is necessary to unload the relevant attributes of the OAM directory tables before and after the migration and run a simple MVS file compare against these two files.

A user of ***JANUS S*** may have the need to verify or to prove that the migrated objects were not modified in the migration process. Fortunately, the original objects still exist on the optical platters. ***JANUS S*** can make the originals available by reconstructing the physical addresses of the original *primary* and/or *backup* copy from the ***JANUS*** working table to the new OAM directory table entries as *backup-2* and/or *backup* addresses. Access to the originals is then performed by telling OAM to access the backups. (This ***JANUS*** function is also available for ***JANUS E***).

4 Benefits of JANUS

In the following the general capabilities and benefits of the JANUS migration are summarized:

- JANUS handles the administration of millions of objects automatically and consistently
- The labor costs of a migration will be significantly reduced as compared to a manual migration on the basis of MOVEVOL or similar utilities
- JANUS programs are restartable any time without modifications of runtime parameters
- JANUS migration programs run with a high degree of parallelity due to OAM storage group independence, a prerequisite for a fast migration. A fast migration will reduce hardware and maintenance costs of optical libraries
- JANUS migration programs run concurrently to regular processes accessing OAM objects (online or batch), no locking with other access processes can occur
- JANUS provides a high flexibility in selecting the objects to be migrated by OAM storage group and collection, optical library and date range
- JANUS provides access to original objects (primary and/or backup copies) after migration.

Specific Benefits of ***JANUS S***:

- Minimal administrative overhead
- Migrated objects will be available for regular access immediately after the migration on the level of single objects
- Increased access performance during the migration process due to objects on fast new media
- Optical mount rates will drop dramatically during the migration process.

Specific Benefits of ***JANUS E***:

- Restructuring the physical layout of OAM storage groups in the migration process: poorly implemented layouts as a legacy of past years may be replaced by an optimal layout
- Easy verification for completeness and correctness of migrated data
- Simple and fast fallback mechanism to original data
- Maximum safety of the migration process as required by banks or assurance companies
- Reduction of optical mount rates for every activated storage group.

5 Service Offering

A five day workshop *Introduction into the JANUS Product* at the customer's site is offered by DR RAINER HARTMANN & PARTNER AG. The workshop covers the following topics:

Introduction into the concepts of JANUS

Installation of the software in the test- and production environments

Intensive training of the customer's personnel on all JANUS programs

Support on planning the productive migration

Objective of the workshop: the customer's personnel is familiar with the JANUS product an is able to perform the productive migration.

JANUS development and support: DR RAINER HARTMANN & PARTNER AG

JANUS distribution: Intercom Computer Systems