WHITE PAPER ON
ADABAS to ORACLE Migration

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Executive Summary
Relational Databases are potential data solutions for all the existing and new
developments in the Business Information Systems space, e.g. ERP, CRM, SCM
Systems and e-business Applications. This has motivated companies to modernize
their existing databases to the RDBMS architecture. This paper talks about a
migration process for one of the most popular databases (ADABAS, a Software AG
product) to ORACLE and other RDBMS on open platforms. The technology illustrated
in the paper has been perfected by Metalogic Systems. The process is tool-based
and time-tested through successful completion of several Migration projects from
ADABAS to ORACLE.
Introduction
ADABAS Database Management System
ADABAS (Adaptable Database) is a popular Database Management System. ADABAS is available on various versions of Mainframe, UNIX and Windows Operating Systems. ADABAS also provides a number of system utilities, administration tools, transaction manager, TP monitors etc. ADABAS database system can be accessed from a number of host languages, the most important of which is NATURAL, which is a 4 GL. Other than NATURAL, ADABAS can also be accessed from many procedural languages such as COBOL, PL/1, FORTRAN, ADA etc.

ADABAS Data Model
ADABAS is a relational-like database and has both similarities with and differences from true relational database management systems. In ADABAS, data is stored in tables in which rows represent individual data records and columns represent fields. On the other hand, in ADABAS, data relationships are stored physically in contrast with Relational databases where data relationships are logically created at run-time. Also unlike true relational databases, ADABAS supports repeating groups of fields (Multi-Value fields and Periodic groups.

ADABAS Migration
Metalogic provides a tool based solution for ADABAS to other RDBMS on open platform. Metalogic has successfully completed several migration projects from ADABAS to Oracle employing the tool based approach. A gross overview of the migration solution is depicted in figure 1 below.

Fig.1:
ADAWAN and PREDICT are the data definitions for ADABAS which are required as input to the conversion tool. The application program sources that access database are also affected by ADABAS to Oracle migration since data access methods are different in ADABAS and in Oracle. Thus any ADABAS to Oracle migration will involve the following activities –
1. **Data model migration**
2. **Data migration**
3. **Application program migration**

**Data model migration**

**Single and Multi-layout ADABAS tables**

Two types of ADABAS table definitions are available – ADAWAN and PREDICT. Both of these definitions are used as the input for conversion of ADABAS to ORACLE database. Both of these definitions are required for conversion because some information is exclusive to each of these definitions.

There are two types ADABAS PREDICT files – one containing single layout and the other containing multiple layouts. The migration strategy for this case is -

- One ADABAS table having a single layout is migrated to one ORACLE table.
- ADABAS table having multiple layouts are migrated to separate tables in ORACLE.

**Conversion of Key Column Definition**

The key column definition, described in the ADAWAN definition of ADABAS table, is broken down into its lowest level of granularity. This has been done to avoid overlapping of key definition. Figure 2 shows the portion of ADAWAN definition describing the key columns (SUPDE).

The ADABAS definition in figure 2 is converted into ORACLE table and is broken down into 4 columns. To simulate the behavior of the key columns, these 3 columns are specified as “NOT NULL” in the ORACLE table definition. Figure 3 shows the relevant portion of the ORACLE table definition.

**Fig.2:**

```
ADACMP FNDEF='02,AB,6,A,FI'  MODEL-CG
ADACMP FNDEF='02,AC,10,A,FI' MODEL-VARIANT
ADACMP SUPDE='SA=BK(1,9),BL(1,3),AB(5,6)'  SP-KEY-1
ADACMP SUPDE='SB=BK(1,9),BL(1,3),AC(14,18)' SP-KEY-2
```

**Fig.3:**

```
MODEL_CG_1_4                  CHAR(4)
MODEL_CG_5_6                  CHAR(2)  NOT NULL
MODEL_VARIANT_1_13            CHAR(13) NOT NULL
MODEL_VARIANT_14_18           CHAR(5)  NOT NULL
```
Conversion of UQ option

In the ADAWAN definition of some ADABAS tables, some fields are identified by “UQ” qualifier. This ADABAS option has been simulated by creating UNIQUE INDEX on this column. In figure 4, an example of such ADABAS definition having “UQ” qualifier is provided. Here, the field BUYER-CODE has been identified with UQ option. The UQ option should be replaced with Primary Key definition on that column in ORACLE. But instead of creating Primary Key on these columns, Unique Index will be created, which functionally will behave similar to Primary Key (will reject any duplicate data). It is also mentioned in the portion of ADAWAN definition describing the key columns (SUPDE).

Figure 5 is the converted INDEX definition in ORACLE corresponding to the UQ column in figure 4.

Conversion of Multiple Occurrences of Fields

Multiple occurrences of fields in ADABAS definition (with “MU” or “PE”) will be migrated to multiple columns of the table. Figure 6 is an example of ADABAS definition of a field with multiple occurrences. One field of ADABAS table (without having “MU” or “PE”) is migrated to one ORACLE column. In this case, the group name of the field definition is not migrated to ORACLE table definition. Only the elementary fields are migrated as columns of the ORACLE tables. In figure 6, all the child fields of OCF-DAISU will occur 35 times.

In the figure 7, the field VO-OCF-KEY itself will occur 30 times. This field will have no child. For both the cases, in the ORACLE table, converted from ADABAS, the field with multiple occurrences will be converted to separate multiple fields. In figure 6, all of JOGEN-DAISU and KIJUN-DAISU will be converted to 35 separate fields.
Fig. 6:

| ADACMP FNDEF='01,B1,PE(35)' | OCF-DAISU |
| ADACMP FNDEF='02,BA,3,P,FI' | JOGEN-DAISU |
| ADACMP FNDEF='02,EB,3,P,FI' | KIJUN-DAISU |

Fig. 7:

| ADACMP FNDEF='02,AX,25,A,NU,MU(30)' | VO-OCF-KEY |

Data Type Conversion

Figure 8 is the table-containing list of data type conversion from ADABAS to ORACLE 10g.

<table>
<thead>
<tr>
<th>ADABAS Data Type</th>
<th>Oracle Data Type</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CHAR</td>
<td>Space</td>
</tr>
<tr>
<td>P</td>
<td>NUMBER</td>
<td>Zero</td>
</tr>
<tr>
<td>N</td>
<td>NUMBER</td>
<td>Zero</td>
</tr>
</tbody>
</table>

Data Migration

Following are the components generated by the conversion tool for data migration.

a) **Data Download Program**: One COBOL program for each of the ADABAS files are generated and these are to be executed in the source environment. These programs use ADABAS files as input and create output in ASCII text format. To distinguish these files from other files, ldat extensions are added in the file name. SQL Loader uses these output files, for data loading.

b) **SQL Loader Control File**: One control file is generated for each table to load data in ORACLE database. The control files are generated based on the output file layouts of the download programs. Downloaded data is loaded in the ORACLE database using SQL Loader utility.

**Application program migration**

**Changes in COBOL Programs**

Whenever a cursor is declared in the pre-migrated COBOL program to fetch data, ADABAS used to create an implicit record buffer for the records to be fetched by the cursor. The record residing in the record buffer was used by the program. In case of Oracle there is no implicit record buffer. So a record buffer has to be declared in the program explicitly so that the program can use it in a similar manner as in the pre-migrated application.

The changes in the COBOL programs to control accessing ORACLE tables are given below in detail. Following is the list of areas where the changes are made:

- Working Storage Section
- Cursor Declaration
- Cursor Open
- Cursor Close
- Fetch from Cursor
- Insert Statement
- Update Statement
- Delete Statement
Find Statement

**Changes in NATURAL programs**

The NATURAL programs are migrated to MF-COBOL programs. This section describes
the strategy being applied for migration of different statements of NATURAL
programs into MF-COBOL programs.

*Figure 9* describes the conversion specification of different statements of NATURAL
programs to MF-COBOL.

**Fig.9:**

<table>
<thead>
<tr>
<th>NATURAL KEYWORD</th>
<th>NATURAL STATEMENT</th>
<th>COBOL STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINE</td>
<td>DEFINE DATA</td>
<td>There is no COBOL statement generated for these NATURAL statements. The data elements declared within this area (within DEFINE DATA ... END-DEFINE) are declared in converted COBOL programs within WORKING-STORAGE SECTION.</td>
</tr>
<tr>
<td></td>
<td>END-DEFINE</td>
<td></td>
</tr>
<tr>
<td>DELETE</td>
<td>READ BUYER-G-SUMMARY WITH BMS-UNIQUE-KEY ** DELETE</td>
<td>EXEC SQL DELETE PLANS_BUYER_GROUP_SUMMARY WHERE ROWID = :H-- PLN-BVR-GRP-SUBN-RID END-EXEC</td>
</tr>
<tr>
<td>FIND</td>
<td>FIND CONTROL-FILE WITH CONTROL-KEY = '1' IF NO RECORDS FOUND MOVE '(1370)' TO #ERROR-LINE-ALPHA MOVE 'CONTROL RECORD MISSING' TO #ERROR-TEXT PERFORM ABEND END-NOREC END-FIND</td>
<td>This has been replaced in the converted COBOL programs by cursors. A database cursor has been opened with the given FIND condition (CONTROL-KEY = '1') and records are fetched from that cursor to check whether any record satisfying this criteria exists or not.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GET</td>
<td>1100 GET MONTHLY-ORDER *ISN(0810) 1110 MOVE #R52SUB44-INTERFACE-AREA.#EX-NO 1120 TO MO-EX-NO 1130 * 1140 UPDATE(1100)</td>
<td>These NATURAL statements have been simulated in migrated COBOL program using SQL FETCH and UPDATE.</td>
</tr>
<tr>
<td>READ</td>
<td>READ BUYER-GROUP-SUMMARY WITH BMS-UNIQUE-KEY ** READ ** END-READ</td>
<td>This has been replaced in the converted COBOL programs by cursors. A database cursor has been opened in the order of key values and records are fetched from that cursor to simulate the READ.</td>
</tr>
<tr>
<td>UPDATE</td>
<td>UPDATE(0470)</td>
<td>PERFORM UPDATE-CUR00470</td>
</tr>
</tbody>
</table>
### ADABAS to Oracle – Migration Caselets.

Transformation projects executed for a reputed Auto-Maker, Japan

Metalogic along with Mahindra Satyam (erstwhile Satyam) has implemented three migration projects in Nissan Motors Ltd, Japan (Figures 10, 11 & 12) –

1. ASEAN PCC Migration (COBOL-NATURAL-ADABAS-Assembler to MF-COBOL and Oracle).
2. ASEAN OTD Migration (same as ASEAN PCC and enhancements)
3. CATS Migration (same as ASEAN OTD)

**Fig.10:**

<table>
<thead>
<tr>
<th>Customer</th>
<th>Challenges</th>
<th>Solution Approach</th>
</tr>
</thead>
</table>
| A reputed Japanese Auto-maker. | • Transformation of Application running on proprietary Mainframe environment to open systems  
• Handling of Japanese characters  
• Different types of enhancements/modifications after migration  
• Implementation of digit number change  
• Implementation of external error database  
• Implementation of off-site local conditions | • Automated transformation of application  
• Tool based implementation of Digit Expansion. Multi-lingual requirement and part of off-site local condition.  
• Automated Unit test at offshore. |
| Source         |                                                                              |                                                                                  |
| Hitachi mainframe, VOS 3 OS, COBOL, NATURAL, ASSEMBLER, ADABAS. |                                                                              |                                                                                  |
| Volume         | 841738 LOC                                                                 |                                                                                  |
| Target         |                                                                              |                                                                                  |
| AIX 5L, Oracle 13g, MF COBOL, SHELL scripts, SAM, HITACHI SORT |                                                                              |                                                                                  |

**Responsibility**

- As-is migration of all components  
- Implementation of enhancements/modifications  
- Unit testing of the migrated and modified components  
- Test data instrumentation for digit expansion effect  
- Integration test and UAT support

**Customer Benefits**

- Quick turnaround  
- Open system  
- Lower maintenance cost  
- Skill availability  
- Lower integration cost  
- Better aligned to the business

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Fig.11: ASEAN OTD Migration

**Customer**
A reputed Japanese Automobile maker.

**Requirement**
Legacy Mainframe Migration and enhancement

**Source**
Hitachi & IBM mainframes, VOS 3 & OS 390, OS, COBOL, NATURAL, ASSEMBLER, JCL, ADABAS, S.A.M.

**Challenges**
- Transformation of Application running on proprietary Mainframe environment to open systems
- Migration of ADABAS to ORACLE 10g
- Handling of Japanese characters
- Sixteen different types of enhancements/modifications after migration
- Implementing MQ and IES for ESB in target environment
- Implementation of factory code field expansion based on impact analysis of affected variables
- Implementation of external error database.

**Solution Approach**
- Automated transformation of database and application
- Tool based impact analysis for factory code expansion
- Tool based extraction of application error messages for error database implementation
- Tool based analysis for handling the effect of single byte KANA characters in SORT key.

**Responsibility**
- As-is migration of all components
- Implementation of enhancements/modifications
- Unit testing of the migrated and modified components
- Integration test and UAT support
- Go-Live support

**Customer Benefits**
- Quick turnaround
- Open system
- Lower maintenance cost
- Skill availability
- Lower integration cost
- Better aligned to the business

---

Fig.12: ASEAN PCC Migration

**Customer Profile**
An automobile manufacturer in Japan.
This was a migration project executed on behalf of one of our partners in Japan, for one of their customers.

**Source & Target Platforms**

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITACHI mainframe</td>
<td>Windows 2003/2008/2011</td>
</tr>
<tr>
<td>OS: VOS3, OS:91, COBOL</td>
<td>ORACLE 9i/MF</td>
</tr>
<tr>
<td>Language: COBOL, NATURAL</td>
<td>COBOL/UNIX</td>
</tr>
<tr>
<td>Language: COBOL, NATURAL</td>
<td>Shell Scripts.</td>
</tr>
<tr>
<td>Data: Flat files and DASBAS JCL</td>
<td></td>
</tr>
</tbody>
</table>

**Challenges**
- Transformation of Application running on proprietary Mainframe environment to open systems
- Migration of ADABAS to ORACLE 9i
- Bit data handling
- Handling of Japanese characters
- Conversion of EBCDIC data to ASCII

**Solution Approach**
Automated tool assisted in migration of:
- Cobol Programs to MF-Cobol.
- Remodelling ADABAS data model and Flat Files to Oracle 9i.
- JCL was converted to Unix Shell Scripts

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**Metalogic Migration Benefits**

The tool based ADABAS migration solution provided by Metalogic is a fast, low cost and reliable way to come out of the proprietary legacy application hosted on mainframes. The major business and technical benefits derived by the customer are listed below –

**Business Benefits**

a. Reduce cost of ownership to a great extent within a very short period of time  
b. Frees up maintenance budget to spend on enhancements and new initiatives  
c. Makes application enhancements and integration easier  
d. Eliminates resource (manpower) availability problems

**Technical Benefits**

a. Almost 100% automation- minimal manual work  
b. Complete solution for language, database and platform modernization  
c. Preserves valuable business logic of the existing application  
d. Web application architecture – thin client (browser)  
e. High automation ensures consistent quality and reduced risk.

**Conclusion**

The mission-critical nature of the Information System (IS) and its components are well documented. IS has transitioned into a source of competitive advantage from a mere hygiene resource destined to function as a data repository. The advent of ERP, CRM, e-business and the Supply Chain paradigm has brought about this transformation. But, to go one step ahead and convert it to a sustainable competitive advantage, firms need to equip their IS with the latest technology and more. The IS and its components must be robust to efficiently perform the installed functionalities and yet be ready to accommodate future upgrades and capacity expansions. The RDBMS system of data storage is one such key component. Metalogic Systems’ capabilities cut across a wide range of source (network, hierarchical, file, RDBMS) and target databases (RDBMS). To know more about our services and capabilities you can mail us, or, visit our website.