Blu Age’s automated modernization of legacy Natural / Adabas\(^1\) to JAVA architectures allows businesses to retain their years of investment in this applications. It requires no runtimes, and helps firms to quickly migrate to a relational database while incrementally modernizing the related business applications, enabling digital transformation, cloud migration & lowered operating cost.

\(^1\) by Software AG
Methodology

According to research from Fierce CIO, only 24% to 39% of modernization projects succeed. That is unacceptable to Blu Age.

During the last decade, we have experienced and proven an iterative, automated, incremental approach with modern DevOps practices for application modernization from Natural / Adabas architectures to Java that ensures projects are successful.

Each project starts with an 8 weeks POC, during which the transformation engine is fine-tuned to ensure compliance with our customer’s code quality requirements. The migration process is automated to increase speed and accuracy—providing at least a 400% productivity gain over a hand coding conversion. The process is incremental, breaking the project into logical subsets that can be modernized, tested, and delivered to the customer separately. As a result, it reduces the risk of failure associated with a so-called “big bang” implementation. At project start, leveraging SmartDCI by PKS, Adabas is converted to either Db2 or Oracle against which the transformed Java programs are run. The remaining Natural, COBOL, PL/1 or Assembler programs are still running against the Adabas with no impact to performance.

The cornerstone of our approach and methodology is “like-for-like” to ensure that the transformation process did not jeopardize the business functionality of the legacy even if the UX may change. “Like-for-Like” means that the functionalities of the modernized application will preserve the fundamental business logic built into the system through years of Natural / Adabas development. Our experience with modernization projects shows that it is critical to follow this principle of functional equivalence during the initial transformation from Natural / Adabas. This provides a modernized application 100% freed of its technological debt that has been functionally validated by complete testing while any additional enhancements like changes in the screens flows are implemented. This approach does not require the resource intensive process of creation or recreation of detailed requirements specifications, functional design and relevant test cases for acceptance as it would be the required in a classical waterfall approach.

Service & product offering

Blu Age Legacy Application Modernization Solutions are powered by:

› Blu Age Software Suite (which includes Database and Data modernization toolset, Reverse and Forward Engineering capabilities, and a continuous integration chain)
› DevOps-based methodology

› Blu Age Professional Services and Expertise in Legacy Modernization
› The migration of Adabas to Db2 or Oracle with native, optimized SQL schema, without changing the source code of your Natural existing programs is powered with SmartDCI by PKS.

Code transformation principles

Data Files & Dataset Artifacts
Old Architecture & Legacy Source Codes
Recording of Scenarios With Representative Users

1. Proof Cases Recording
2. Database Conversion and Data Migration
3. Source Code Conversion
4. Proof Cases Automation
5. Code Coverage & Code quality
   Relational Database & Schema
   New Architecture & Forward-Generated Source Codes
   Automated Scripts Executed Against the Modernized Solution

Transformation Iteration

2 2014, Why Legacy Modernization Projects Fail
3 https://www.pks.com contact: Heidi Schmidt (schmidt@pks.de).
The Blu Age tooling is built on the Model Driven Architecture principles as defined by Object Management Group. The transformation process extracts the business logic from the legacy programs and creates UML diagrams, which are then used as the functional specification to generate the modern, object-oriented application. The final application consists of 100% generated code, which is free of proprietary runtimes and complies with the most recent reliability, security and maintainability standards for object oriented programming. Any skilled Java resource can maintain the modernized application with a standard IDE (such as Eclipse) and take advantage of continuous integration (CI) chain built during the project to increase the efficiency and quality level of maintenance in leveraging automated testing, code coverage and continuous quality measurements tools. As a result, the output of the transformation will meet the customer’s expected code quality metrics defined and refined during the POC phase.

Technical debt and technical complexity is removed from the application. Changeability and maintainability of the new application is best in class with regards to industry standard benchmarks.

Blu Age’s modernization framework consists of combination of our proven modernization methodology and our purpose built modernization products. Both have successfully been used on major legacy application modernization projects in the Americas and in Europe. Blu Age can assist customers with their modernization directly or our modernization framework can be used directly by our customers or by our System Integrator Partners with assistance of our experts.

Recommended mapping between legacy artifact and modern code for natural

<table>
<thead>
<tr>
<th>Layer</th>
<th>Natural and Legacy Artifacts</th>
<th>Modern Java Artifacts</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs</td>
<td>- JCL</td>
<td>Spring Batch</td>
<td>Job and Step classes</td>
</tr>
<tr>
<td></td>
<td>- Unix Scripts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>Maps</td>
<td>Dojo</td>
<td>Maps transformed to Views</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spring Web Flow</td>
<td>Horizontal Scroll Maps Merged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spring MVC Components:</td>
<td>Usage of HTML grid with pagination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- XHTML</td>
<td>Maps transform to Screen Beans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Controllers</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>- Maps</td>
<td>Spring Services:</td>
<td>Application Screens Population Validation and Processing from Beans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Application</td>
<td>Business logic on Business Entities (Beans)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Business</td>
<td>Persistence calls to the DAO layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Persistence</td>
<td></td>
</tr>
<tr>
<td>Entities</td>
<td>- Maps</td>
<td>Hibernate - Spring JDBC:</td>
<td>Beans : Persisted Entities generated from modern database structure</td>
</tr>
<tr>
<td></td>
<td>- Local Data Areas</td>
<td>- Beans</td>
<td>DAO : Data access objects (Include JPQL queries)</td>
</tr>
<tr>
<td></td>
<td>- Global Data Areas</td>
<td>- DAO</td>
<td>Searches Transformed to Multi-criteria</td>
</tr>
<tr>
<td></td>
<td>- Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ADAREP</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>- DDM</td>
<td></td>
<td></td>
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4 https://sonarqube.com/about
Database modernization

The advantages associated with a modern, fully relational database are a main driver in Natural / Adabas modernizations. Blu Age makes this our first priority in the Adabas modernization process using SmartDCI from PKS.

At the start of the modernization cycle for each legacy instance, the data will be migrated to a modern Db2 or Oracle database on a native, optimized SQL database schema. Concurrently, Blu Age together with PKS will ensure the Natural application can still be used by implementing SmartDCI. This software allows the existing Natural applications to interact with the modernized database for the course of the migration. As the system is incrementally modernized, the modernized elements will interact directly with the Db2/Oracle database while the legacy pieces will continue to interact with the new database using the middleware.

Thanks to SmartDCI, the translation to SQL queries embedded in the Natural program is performed automatically at runtime and the applications remain unaffected. The translation of the data, its structure and its format is controlled by an internal database repository. When you create the repository, you can decide how each individual multiple field (MU) and each periodic group (PE) is to be depicted in the SQL relational target schema. This allows case-specific normalization, for example using index columns, as well as the moving of fields to separate tables with primary/foreign key relationships (column compression). The selection criteria for each depiction are based on the performance requirements and the technical use of the data.

Continuous integration for efficiency tracking

This approach is based on tracking key metrics to monitor the efficiency of the transformation process and to ensure good quality and maintainability of the modernized application. Blu Age considers that continuous controls of code quality, of tests automation and the percentage of code covered by tests, are critical to achieving a successful application modernization. These three metrics combined with the power of Blu Age transformation engine and the incremental implementation enabled with SmarDCI, are the five vital elements toward success:

1. MODERNIZATION COMPLETENESS: make sure no legacy code is left behind, that all the code in the scope of your project is modernized.
2. MODERN CODE QUALITY: make sure that the modern code is high quality, maintainable code, meeting object-oriented code quality standards (i.e. A, A, A with SonarQube).
3. LIKE-FOR-LIKE VALIDITY: for acceptance of the migration work, verify through functional equivalence testing that the modern code (TP and Batch) has exactly the same behavior and at least the same performance as the legacy.
4. TEST COVERAGE: Measure the accuracy of the transformation by controlling of the level of completeness of the testing of the modernized application–how much of the modern code has been successfully tested.
5. PHASED IMPLEMENTATION: Smart DCI allows the legacy and the java programs to share the same modernized database seamlessly. This enables to build a secured incremental migration plan.

The 5 key elements toward success

- Modernization Completeness
- Code Quality
- Functional Equivalence
- Test Coverage
- Phased Implementation

SmartDCI® for Adabas

- Natural
- PL/1
- COBOL
- Assembler

- Modern Application

SmartDCI® is available for Zos, Linux, UNIX, and Microsoft. It supports All Adabas functionality such as multiple fields, period groups, descriptors and Adabas speaks SQL!
Unique aspects of the Blu Age testing approach

The Blu Age testing approach differs from the traditional development testing cycle in that it incorporates continuous testing throughout the development process. A project is continuously tracked along the 4 dimensions of success: modernization completeness, code quality, functional equivalence, and code coverage. This required a Database conversion at the early stage of the project. In a modernization process, we aim for 100% active code modernization and test case code coverage in excess of 70%. Such project investment and good practice is leveraged during the maintenance in production.

> CODE QUALITY - Blu Age evaluated the industry standard code quality solutions, and recommends the open-source SonarQube tool. This tool provides a range of real-time information about the quality of the code being generated to ensure quality, minimize technical debt, and reveal any defects.

> FUNCTIONAL EQUIVALENCE TESTING - The purpose of functional equivalence testing in modernization projects is to validate that the functionality of the migrated applications behaves identically to that of the legacy applications and provides the same output for the same input to check the correctness of the business logic extracted from the legacy. The steps outlined next will be used as part of our functional testing approach. Combining them in the right way is key to the success of migration projects. It ensures that this modernization project will provide a solid foundation for future enhancements and other modernizations as well as introducing DevOps methods.

The “Like-for-like” step: keystone of your success

Our functional equivalence testing approach for transactions with UI includes the following steps:

> Video captures from an end-user, with the application test cases recorded (including a dump of the database before and after test case execution). All important variations need to be recorded to get a full picture of the functionality of a specific use case (this is critical for the quality of the tests).

> Blu Age will provide detailed guidelines for test cases during the intake phase to ensure highest possible code coverage.

> A detailed questionnaire will be also provided by Blu Age to ensure efficient preparation for the intake phase.

> During transformation tasks, Blu Age consultants will execute unitary test cases on the modernized application based on the videos. They will record and use Selenium or Protractor scripts to automate the test cases.

If execution is successful, the test script and the transformed programs will be accepted. Otherwise, they will iterate the migration until the test case from the legacy is successfully executed on the modernized application.

For Batch Jobs we use:

> A capture of database tables and files at the start of the job.

> A capture of database tables and files after the execution of the job.

During transformation tasks, Blu Age consultants will compare outputs generated by the modern job with the outputs generated by the legacy job in leveraging Blu Age’s Batch Compare Feature. Once all outputs match, the jobs are automated with automatic comparison of outputs. Furthermore each modernized batch is tuned to ensure a processing time at least equal to the legacy.

To ensure consistent code quality compliant with all requirements, we will leverage “continuous integration” (CI) Chain. In this approach, every developer integrates/commits his or her work on a daily basis at a minimum into the common code repository. Based on Jenkins automation scripts, this allows multiple integrations per day, each involving an automated build followed by the fully automated execution of a defined set of test cases. This approach ensures efficiency of the transformation process. Any changes that do not pass quality or functional equivalence are detected instantly at the time the corresponding change is added to the code repository, making it much easier to solve every kind of defects.

Test coverage

The focus on functional equivalence testing in the Blu Age modernization model clearly links the success of the project to the quality of the testing itself. It is, therefore, imperative that the test cases we use cover the all of the critical functionality and the majority of the total modernized code. To ensure this is the case, and to ensure the quality and maintainability of the modernized applications, Blu Age uses tools like JaCoCo to ensure that upwards of 70% of the code is covered (used) by valid test cases.
About Blu Age

Blu Age’s modernization solution is the most efficient, secure path for any organization to bring its strategic business applications into the digital era.

Blu Age offers this tooling both through licensing of the product as a service to systems integrators around the world and as a direct service provider, offering end-to-end modernization solutions directly to system integrators and industry clients.

Blu Age’s Application Modernization Capability: Application modernization is a range of IT activities that transform core applications into modern, flexible business applications and processes that increase alignment between a business’s applications and its goals.

How we work

With more than 15 years of experience providing modernization services across all industries, Blu Age is dedicated to and experienced in legacy modernization. We have three legacy modernization delivery centers on three continents as well as a product development center dedicated to developing processes, tools and accelerators for application modernization. Blu Age employs more than 140 application modernization consultants, whose specialties include source code analysis, source code modernization, and database/data migration.

About PKS

PKS acts as innovative software house with more than 30 years of expertise in the area of Adabas/Natural modernization and transformation. The team is made up of over 40 experienced software analysts, programming experts and web developers. From the German headquarters on Lake Constance PKS has been planning innovative, low-risk and future-proof software transformations around the world since 1988, and successfully implementing them together with customers.

At PKS, we are convinced that applications developed specifically for companies can lead to outstanding competitive advantages. However, this is only the case when software systems and developer teams work with modern tools and innovative methods. That’s why we’ve made it our job to support enterprises in making their business-critical applications more modular, their development processes more agile and the user experience better and easier.

How we work

The basic starting point at PKS is our comprehensive analysis of mature existing systems. This provides our customers with a basis for making the best possible decision about whether to renovate, modernize or replace core systems. That’s why we’ve made it our task to implement challenging transformation projects on time and on budget, using innovative tools, clever methods and sophisticated technology. Based on this principle we create software systems that are simple and efficient to use, and are fun for both developer and user.