metaware.

the complete IT modernization solution

Accurately Estimating and Comparing TCO for Mainframe Modernization Projects

Refine® expert planner

A Metaware White Paper

EXECUTIVE SUMMARY

Until recently, accurately predicting both the cost and the duration of IT projects has posed a significant challenge. Thanks to great strides in technology, it is now possible to determine more realistic and accurate estimates by using a combination of regression formulae and parameters derived from historical project information.

Although the benefits of Total Cost of Ownership (TCO), productivity and agility of mainframe modernization projects are clear, this is a much more challenging area to quantify because there is neither the reference model nor enough previous project experience to support this effort. As a result, accurately estimating the effort, cost and timeline of the project has almost been impossible.

To overcome this problem, Metaware has developed **Refine® expert planner**. This Expert System provides a comprehensive estimate for the modernization project; provides provides the IT department with a project charter, eliminating uncertainty and risk; and gives IT Executives and Upper Management a realistic and compelling business case for investment.

Refine® expert planner is specifically designed to provide the most accurate and realistic 360° assessment of a mainframe modernization project possible. By combining a unique yet comprehensive knowledgebase of consistent and proven parametric models, **Refine® expert planner** produces the highest quality estimates in the shortest amount of time.

By considering all aspects of modernization, from analysis of existing mainframe programs to performance requirements, configuration and financial analysis, **Refine® expert planner** delivers consistent and accurate estimates of the investments necessary for the initial project and to maintain the projected environment. The end result is a year-on-year TCO comparison comprised from accurate facts which support and simplify decision-making and project planning.

COMMON PROJECT PITFALLS

Accurately estimating the time, schedule and costs a project will engender has always been difficult and subsequently causes serious issues for IT. The latest release of the well-known CHAOS Summary reports[1] a mean overrun of about 44% in IT projects. This is an indicator that both expert and formal models are not efficient enough to accurately estimate IT projects.

Expert estimation has always been the primary means of calculating the likely project effort, while the increasing use of repeatable and standard development processes has allowed more accurate estimation and more rapid development cycles.

Formal models such as parametric estimating use statistics based on historical project data, as well as standard processes and proven methods. Formal models also rely on the analysis of business-specific aspects of project development, as well as the collection of data on projects undertaken in similar circumstances.

Unlike less complicated development projects, modernization projects do not create any business rules, functions, transactions, data or behaviors. Instead they change the infrastructure where components are executed. Therefore, both traditional expert and formal estimation models lack the capabilities required to bring accuracy and confidence because of the following shortcomings:

- Absence of standard processes and shared datasets, or proven specific methods
- Lack of industry or context-oriented experts with relevant and successful experience
- Inability to apply human estimation to determine the outcome of a project due to the voluminous number of factors (a range of 10^2)
- Scarcity of internal developers with knowledge of existing complex and intricate business and platform-specific customizations

A combination of models such as SLOC (Source lines of code), Analysis Effort Method and Function Point Analysis, and COCOMO could serve as a good foundation for reducing the magnitude of inaccuracy; nevertheless, more sophisticated estimation techniques backed by proven datasets and experiences are required.

THE IMPACT OF INACCURATE ESTIMATES

The TCO for information technology was originally developed by Gartner Group analyst Bill Kirwin in 1987.

TCO identifies costs resulting from two major components - direct and indirect - throughout the lifecycle of an asset, including acquisition, deployment, operation, support, and retirement. Direct costs are traditionally those that organizations find easiest to measure; as a result direct costs can often receive undue or excessive focus. Traditionally, direct costs are made up of

[1] Source: CHAOS Summary 2009, The Standish Group, April 2009

labor and capital costs while indirect costs are more difficult to quantify; however, Gartner surveys have demonstrated that they can typically represent a substantial component – as much as 60% – of the total cost of managing and owning an IT infrastructure.

The TCO is calculated by adding the annual costs associated with the current environment (OPEX). The cost structure used in the calculation includes costs for hardware, software, personnel, and facilities as follows:

- **Hardware**
  - Acquisition and upgrades: the costs of acquisition or leases of new equipment, and of upgrading hardware equipment (e.g., servers, storage, printers, networks, peripheral hardware)
  - Estimate of the portion of your overall infrastructure costs that will be consumed by the project (routers, ports, switch ports, cabling)
  - Maintenance: the costs associated by providing maintenance and support
  - Cost of backups and offsite storage
- **Software**
  - Acquisition: the costs of purchasing 3rd party software licenses (e.g., database, TP monitor, development environment, job scheduler, misc. utilities)
  - Maintenance: the annual maintenance fees associated with the usage of third party software
  - Additional annual application costs
- **Personnel**
  - Cost of salaries paid to permanent system administrators, including staff retraining or hiring new personnel.
- **Facilities**
  - Costs of physical data center space and associated electricity consumption

The costs listed above represent direct, tangible, and measurable operating costs (the hard costs).

The TCO of the existing mainframe environment takes into account:

- Initial/existing recurring costs: the actual costs of running the mainframe TCO (i.e., the “As-is” situation)
- Future Costs: the upcoming costs, including the consideration of the growth of the Mainframe over a period of 3 years. Mainframe growth, based on future business and technical requirements, may have an impact on the capacity required (MIPS capacity, memory size, disk space, IT resources, and facilities).

As a result, the financial analysis often demonstrates that acquisition costs, annual hardware and/or software maintenance, or a capacity-on-demand model have little to do with the real cumulative TCO of the mainframe. The true long-term cost may actually exceed the initial purchase price many times over, and an asset with a comparatively higher acquisition price may deliver the best value over time.

If TCO defines and measures the full scope of relevant direct and indirect costs for specific technologies and technology disciplines, the ROI is a ratio between the benefits of an investment relative to the amount invested. It is usually expressed as a percentage to demonstrate the cash flow resulting from an investment over a period of time, usually calculated year–on-year. The ROI is familiar to most IT and finance executives and is used as the basis of comparisons to select value-generating or cost-avoiding projects. The financial analysis of ROI includes at least the following elements:

- ROI (Return on Investment)
- IRR (Internal Rate of Return)
- NPV (Net Present Value)
- Annual Rate of Return/Annualized Rate of Return
- Cumulative TCO savings over the next 4 to 5 years

In the case of project estimates, accurately measuring the TCO of the mainframe is not that easy. Moreover, the comparison of the TCO of the two environments and the ROI of a mainframe modernization project requires the ability to accurately predict the overall cost and the configuration of the target architecture. The lack of a reference model and experience with mainframe modernization may introduce a large element of uncertainty and overconfidence in the projections.

REFINE® EXPERT PLANNER

In response, Metaware created **Refine® expert planner** to overcome the uncertainty and inaccuracy while calculating the mainframe TCO; estimating the costs and benefits of the modernization project; and defining the ROI. **Refine® expert planner** is a unique knowledge-based estimation expert system for assessing and planning modernization initiatives.

Using **Refine® expert planner**, Metaware can provide its customers with highly accurate and consistent predictions for:

- Configuration and performance of the target system environment
- Asset quantification (volume, quality, complexity) for modernization projects
- Project delivery, duration, quality, and staffing
- ROI of the modernization initiative

For more than 14 years, Metaware has been successfully building, using and refining its parametric models (mathematic formulae), calibrating them with historical data to calculate formal estimates of modernization projects.

1.1 Solution Objectives

The following situations are those that most frequently require **Refine® expert planner**:

- *Making an investment decision involving an IBM System Z modernization initiative.* A business case including a ROI analysis requires a reliable estimate of the initial investment

costs of the project, hardware and software acquisitions as well as the recurring costs (TCO).

- *Deciding the best strategy for a legacy system: modernize, rewrite, replace or do nothing.* A **Refine® expert planner** estimation model will help you to define and optimize a fact-based modernization strategy for your legacy assets.
- *Setting modernization budgets and schedules as the basis for planning and control.*
- *Deciding on or negotiating trade-offs among project costs, ROI, schedules, and the agility of the architecture of the target environment.*
- *Making cost and schedule risk management decisions.* You will have unavoidable uncertainties about many of the factors influencing the project cost and schedule. Expert System cost models will help you perform sensitivity and risk analyses to eliminate your sources of uncertainty.

1.2 Model Benefits

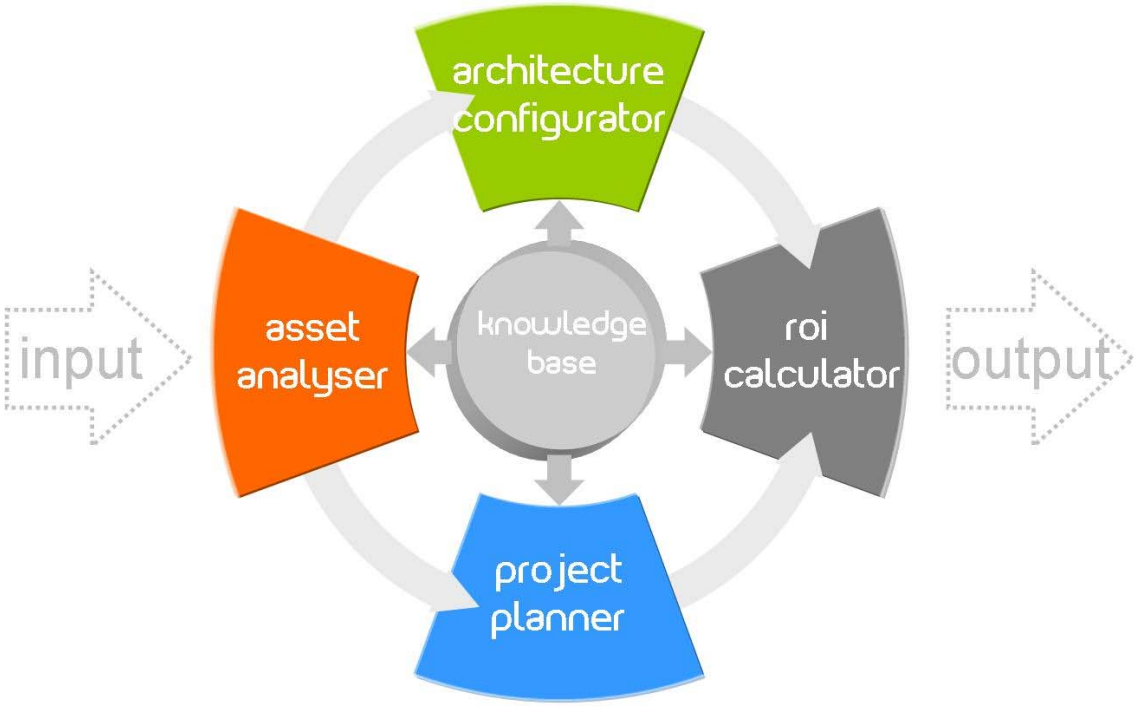
- **Accuracy**: Accurately planning and estimating software projects is an extremely difficult software management function. The reason that manual estimating methods fail for modernization projects can be expressed in a single word: *complexity*. There are hundreds of factors which determine the outcome of a modernization project, and it is not possible to deal with the combinations of these factors using manual methods.
- **Consistency**: There are many psychological factors potentially explaining the strong tendency towards over-optimism when estimating the effort required for a project. These factors need to be dealt with to ensure more accurate estimates. Such factors are minimized when using automated formal estimation models such as **Refine® expert planner**, resulting in consistent and more realistic estimates.
- **Automation**: The **Refine® expert planner** estimation model has been automated using Metaware technology and the engineered statistical data collected by Metaware experts from real-life experiences over a number of years.
- **Progressive accuracy**: **Refine® expert planner** supports an incremental process where the accuracy increases in line with the level of detail and the accuracy of the input data to the Estimation models. This feature enables the system to produce rough estimates even when the input data is minimal.
- **Leveraging Expertise**: The **Refine® expert planner** user leverages the cumulative experiences of hundreds of modernization projects. The quality of the estimates provided is less dependent on the expertise of the estimator, enabling estimates to be produced by users as disparate as Project Managers and Presales Managers.
- **Optimization**: **Refine® expert planner** provides a complete and rational view of all tradeoffs between features, schedules, quality and costs. You can explore the cost/value implications of additional project resources, software and hardware architectural options, multi-phase deployment strategy, improved methods and other technical changes.

1.3 Solution Architecture

As the premier Expert System for creating accurate budgets and plans for modernization projects, **Refine® expert planner** automates and reproduces the combination of expert and formal estimation. To simulate the performance of this specific estimation exercise, **Refine® expert planner** combines four parametric estimation models:

- **Asset Analyzer**: Measures software asset volume, complexity and quality
- **Architecture Configurator**: Estimates the size of the hardware and software infrastructure planned to host the replatformed asset
- **Project Planner**: Estimates work, resources, schedule, and defects
- **ROI Calculator**: Calculates the financial performance of the modernization initiative (ROI, IRR, NPV, etc.)

The following diagram depicts the main components of **Refine® expert planner**.



The models and the associated datasets are captured and stored in a codified format in the knowledgebase, which is the heart of the **Refine® expert planner**. It is the largest and most comprehensive repository of international modernization projects, containing a dataset that is continuously updated and maintained by Metaware staff using formal methods comprised from more than 180 worldwide modernization projects.

1.3.1 Asset Analyzer

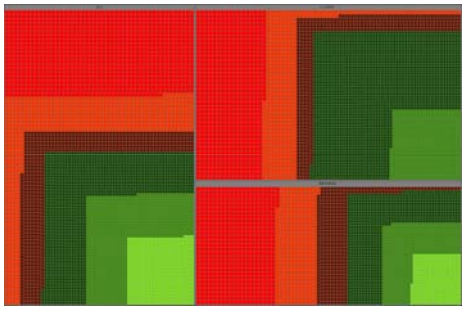
The Asset Analyzer module is used to model and quantify a software asset for input into project estimates. The objective of the Asset Analyzer is to measure the complexity of the components contained in the software asset and map out their characteristics with units of work (WU) utilized in the steps of the delivery stages.

Main characteristics include:

- Portability
- Robustness
- Maintainability
- Testability

WU type	Category	Definition
PROGRAM	Code	COBOL, NATURAL, PL/1, APS, VAGEN
JOB	Code	JCL, REXX, CLIST, Panels
FILES	Interface	PERMANENT PHYSICAL FILES, FILE CLASS
DBMS	Code and Architecture	DB2, IDMS, IMS-DB, ADABAS
SCREENS	Code and Architecture	MAP FILES, BMS, ISPF
OLTP	Architecture	CICS, IMS primitives and parameters
BATCH	Architecture	Utility, scheduler, etc.
MOM	Architecture	MQSeries, etc.

The Asset Analyzer model translates these characteristics into Complexity Factors. These are then used to assess the effort and risk associated with carrying out that work unit in the modernization project. The Complexity Factors are modeled to drive the cost estimation of the Project Planner Model and adjust the nominal effort of the project costs.



Complexity Factors are sorted into categories from “Very Low” to “Extra High” and are provided in a dashboard view for each component type.

Rating	Very Low	Low	Nominal	High	Very High	Extra High
Color						

1.3.2 Project Planner

The Project Planner module is an estimation model for providing accurate effort, cost and schedule estimates. The model in built on the modernization structured process invented by Metaware; it contains a mix of concurrent, iterative and cyclic processes which take into account the specifics of the **Refine**® workbench, the recommended **Refine**® work organization, and **Refine**® skill requirements.

The starting point of the Project Planner is to analyze the size of the project in terms of volume (number of software artifacts), complexity (relative to the replatforming transformation) and quality (consistency, robustness, etc.) of the asset.

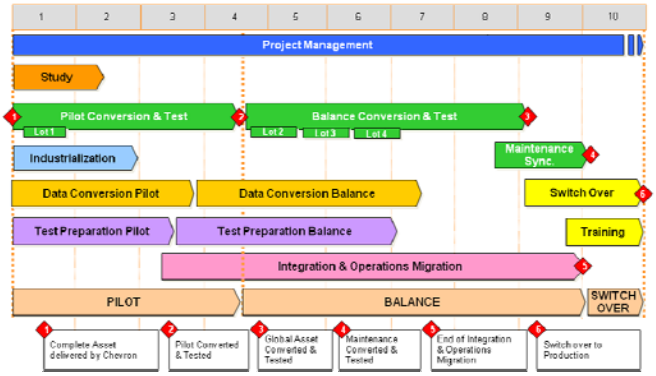
The Project Planner then produces estimates based on the specific attributes of the project in question (personnel, technologies, tools and project environment). Examples of the attributes which can affect the outcome of the estimate include (but are not limited to):

- The availability of customer expertise and knowledge with the applications and platforms to be modernized
- The experience of the customer in the areas of the test and project management process
- The experience of the delivery team with this kind of project

The outcome of the Project Planner is the estimation of the effort and associated costs for:

- Technical Study
- Industrialization
- Source code conversion
- Data conversion
- Regression Testing
- Switch-over
- Integration of the migrated system into the production environment

The planning process is completed with a high-level analysis of the project, including the estimated timeframe in months from the start of the project to the final switch-over, and finally, to production.



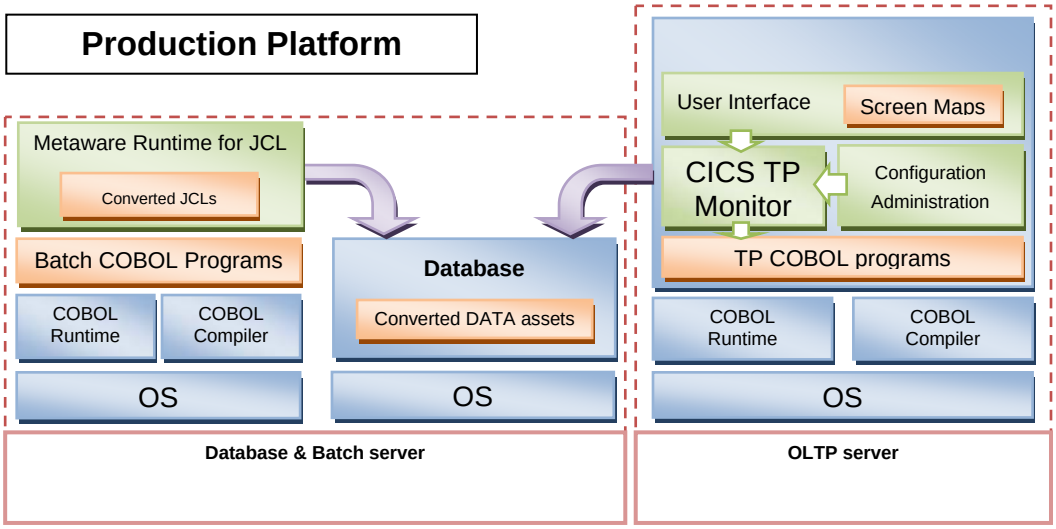
1.3.3 Architecture Configurator

The Architecture Configurator provides an accurate estimate of both the investments and recurring costs related to the hardware and software architecture in the target environment. To this end, the Configurator produces a detailed list of the hardware and software components required to meet a documented set of architecture performance criteria (i.e. availability, scalability, response time, etc.).

The starting point of the Architecture Configurator is to define the present and future Workloads of the applications which run on the IBM Mainframe. These are represented by a mix of reference activities (batch, OLTP, database, others), global trend, expected scalability and security margins.

Based on options selected from a list (including preferred hardware vendor, software solution, monolithic or distributed architecture, and/or software components distribution), the system designs and estimates the hardware and software configuration required by providing a detailed list of the components necessary to support the same workload in the open system environment.

The Architecture Configurator delivers core-based pricing estimations. Options include High-availability and multiple-environments configurations (development, integration, test, production, and more).



1.3.4 ROI Calculator

Consolidating the accurate estimates of both the Architecture Configurator and Project Planner, this ROI model provides a comprehensive estimation of the investments required to:

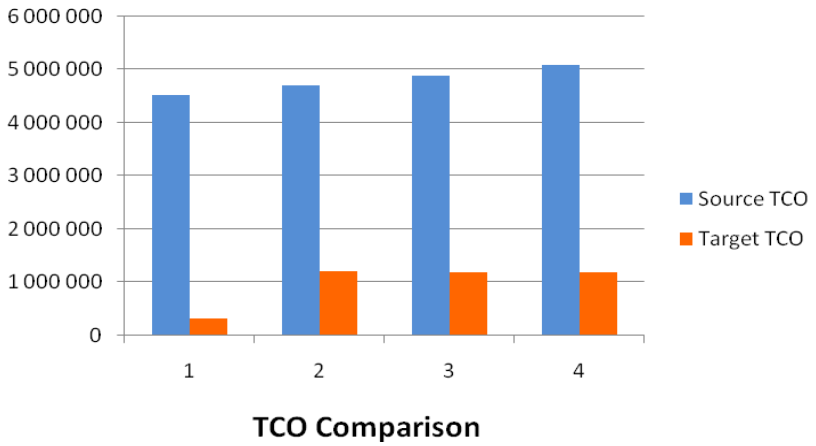
- Achieve the migration project
- Acquire, set up and configure the projected architecture
- Run the migrated applications and platform year-on-year

Additionally, the ROI Calculator model provides a financial assessment of the Source TCO based upon:

- The existing TCO (i.e., the "as-is" situation) representing the actual Mainframe operating costs
- The future costs (i.e., the "to-be" situation), including the expected growth in capacity over the next 3 years and its impact on the hardware platform, memory size, disk space, and IT resources allocation

This financial assessment is compared to the modernization investments estimates, enabling the ROI Calculator to automatically generate the following financial indicators as outputs:

- ROI (Return on Investment)
- Payback Period
- IRR (Internal Rate of Return)
- NPV (Net Present Value)
- Cumulative TCO over a period of time



The financial results are summarized in a detailed Project business case, which includes the following:

- The source and target TCO
- The modernization investments
- A calculation of the financial indicators

CONCLUSION

While the benefits in TCO, productivity and agility are widely recognized, building a realistic business case analysis for Mainframe Modernization can be a challenge for most organizations.

Metaware's **Refine® expert planner** combines accuracy and consistency with Mainframe Asset Analysis, Modernization Project Estimates, Target Architecture Sizing and TCO Comparisons.

The company's unique parametric models rely on the most credible knowledgebase and historical project data in existence (collating the expertise and parameters of more than 180 modernization projects), as well as best practices adapted from the most suitable standard estimation models.

Removing the uncertainty and risks from mainframe modernization, **Refine® expert planner** requires only a fraction of the time usually spent on assessing the mainframe environment and defining and sizing the architecture. By providing comprehensive insights on planning, budgeting and risks for the project, **Refine® expert planner** accelerates the investment decision and significantly improves ROI.

GLOSSARY

Annual Rate of Return	The annual rate of return is the return on an investment over a twelve-month period.
Annualized Rate of Return	The annualized rate of return is the return on an investment over a period other than one year (such as a month, or two years) multiplied or divided to give a comparable one-year return. For instance, a one-month ROI of 1% could be stated as an annualized rate of return of 12%; or a two-year ROI of 10% could be stated as an annualized rate of return of 5%.
Asset	In this document, *asset* refers to the whole component, source code and data used to form the programs on the mainframe systems.
Expert System	An Expert System is technology which attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to simulate the performance of the expert. However, methods that are common to most or all are: • The creation of a "knowledgebase," which uses some knowledge representative of the formulae to capture the Subject Matter Experts' (SME) knowledge • The process of gathering this knowledge from the SME and codifying it according to the formulae
Internal Rate of Return	The IRR is a capital budgeting metric used for investment decision. It is also called Discounted Cash Flow Rate of Return (DCFROR) or Rate of Return (ROR). It represents the indicator of the efficiency or quality of an investment, as opposed to Net Present Value (NPV), which indicates value or magnitude.
Modernization	In this document, modernization refers to the automated migration and replacement of costly components of the mainframe or the mainframe platform itself by cost-effective and agile technologies, while leveraging the existing developments and customizations of the mainframe.
Net Present Value **Net Present Worth**	NPV or NPW is defined as the total present value of a time series of cash flows. It is a standard method using the time value of money to measure the excess or shortfall of cash flows, in present value terms, once financing charges are met.

Parametric Estimating	Estimation models such as COCOMO, ANGEL and SLIM using statistics- and basic-regression formulae combined together with parameters derived from historical project data and current project characteristics.
ROI	The ROI is expressed as a percentage representing the ratio of money gained or lost on an investment relative to the amount of money invested. The amount of money gained or lost may be referred to as interest, profit/loss, gain/loss, or net income/loss. The money invested may be referred to as the asset, capital, principal, or the cost basis of the investment.
RSA	Reliability, Security and Availability
Unit of Work (WU)	A unit of work is the effort and subsequent cost associated with the completion of the entire migration lifecycle of a Line of Code (LOC), a program, a table or segment of a database, or a file. It incorporates a set of tasks resulting in work products following Metaware's specific mainframe migration methodology, from analysis to conversion and testing.

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