



# Decision Management Systems Platform Technologies Report

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# Optimizing and Simulating Decisions

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*Optimization is one of the five key capabilities needed when building Decision Management Systems. Each can be adopted incrementally, and can scale based on resources and business drivers.*

An optimization suite is an environment for defining and solving mathematical models and for simulating the differences between multiple similar mathematical models. An optimization suite allows a modeler or business analyst to define a business objective and a set of constraints and then “solve” this problem to see how best to run the business. Optimization suites support what is sometimes called Operations Research or Management Science.

There are three key uses of optimization in the context of Decision Management Systems:

- ▶ When a decision has a potentially complex answer that involves multiple elements, it may be effective to optimize the selection of these elements.
- ▶ When a decision answer is a single element then it may be useful to optimize across many decisions to allocate the available answers to each specific decision most effectively.
- ▶ When reviewing possible decision-making strategies as part of decision analysis it may be possible to use optimization to tune or select between these strategies.

## Navigating the Report

The [\*Decision Management Systems Platform Technologies Report\*](#) is a set of documents describing the best practices and technologies for building Decision Management Systems.

1. *Introducing Decision Management Systems*
2. *Use Cases for Decision Management Systems*
3. *Best Practices in Decision Management Systems.*
4. Five Key Capabilities
  - 4.1. *Managing Decision Logic with Business Rules*
  - 4.2. *Embedding Predictive Analytics*
  - 4.3. *Optimizing and Simulating Decisions*
  - 4.4. *Monitoring Decisions*
  - 4.5. *Modeling Decisions*
5. *Selecting Products for Building Decision Management Systems*

All readers should begin with *Introducing Decision Management Systems* as it gives an overview of the category, technologies and rationale.

Business and technical readers can continue with *Use Cases for Decision Management Systems* and *Best Practices in Decision Management Systems*.

Business and Technical Track	Technical Track
Introducing Decision Management Systems	Managing Decision Logic with Business Rules
Use Cases for Decision Management Systems	Embedding Predictive Analytics
Best Practices in Decision Management Systems	Optimizing and Simulating Decisions
	Monitoring Decisions
	Modeling Decisions
	Selecting Products for Building Decision Management Systems

Technical readers are recommended to read the five Key Capabilities documents (*Managing Decision Logic with Business Rules, Embedding Predictive Analytics, Optimizing and Simulating Decisions, Monitoring Decisions and Modeling Decisions*) to better understand the component technologies of Decision Management Systems. *Selecting Products for Building Decision Management Systems* will be useful as part of assessing technology needs.

More information on the report, its scope, reproduction and more is in the final section **About The Decision Management Systems Platform Technologies Report.**

## Overview

An optimization suite is an environment for defining and solving mathematical models and for simulating the differences between multiple similar mathematical models. An optimization suite allows a modeler or business analyst to define a business objective and a set of constraints and then "solve" this problem to see how best to run the business. Optimization suites support what is sometimes called Operations Research or Management Science.

There are really three uses of optimization in the context of Decision Management Systems:

- ▶ When a decision has a potentially complex answer that involves multiple elements it may be effective to optimize the selection of these elements.
- ▶ When a decision answer is a single element then it may be useful to optimize across many decisions to allocate the available answers to each specific decision most effectively.
- ▶ When reviewing possible decision-making strategies as part of decision analysis it may be possible to use optimization to tune or select between these strategies.

Optimization allows organizations to either find a feasible solution to a heavily constrained problem or to maximize the value gained from a constrained set of resources by finding the most profitable, quickest or cheapest combination of resources that are allowed. Optimization differs from both business rules and predictive analytics in several ways:

- ▶ Business rules are absolute where optimization need not be. For instance, business rules allow an offer to be made to someone only if certain conditions are true where an optimization model might allocate offers based on where they will be most effective.
- ▶ Optimization can be effective when business rules are numerous and potentially contradictory as it allows for trade-offs between values where business rules require defined sets of conditions.
- ▶ An analytic model is created through analysis of historical data while an optimization model is built explicitly from business know-how and historical data may be used to see how the model would have worked in the past (though this is not necessary).
- ▶ Because predictive analytic models are built and executed separately they are often very quick to execute. Optimization models in contrast must be solved each time they are used and this can require significant time and resources.

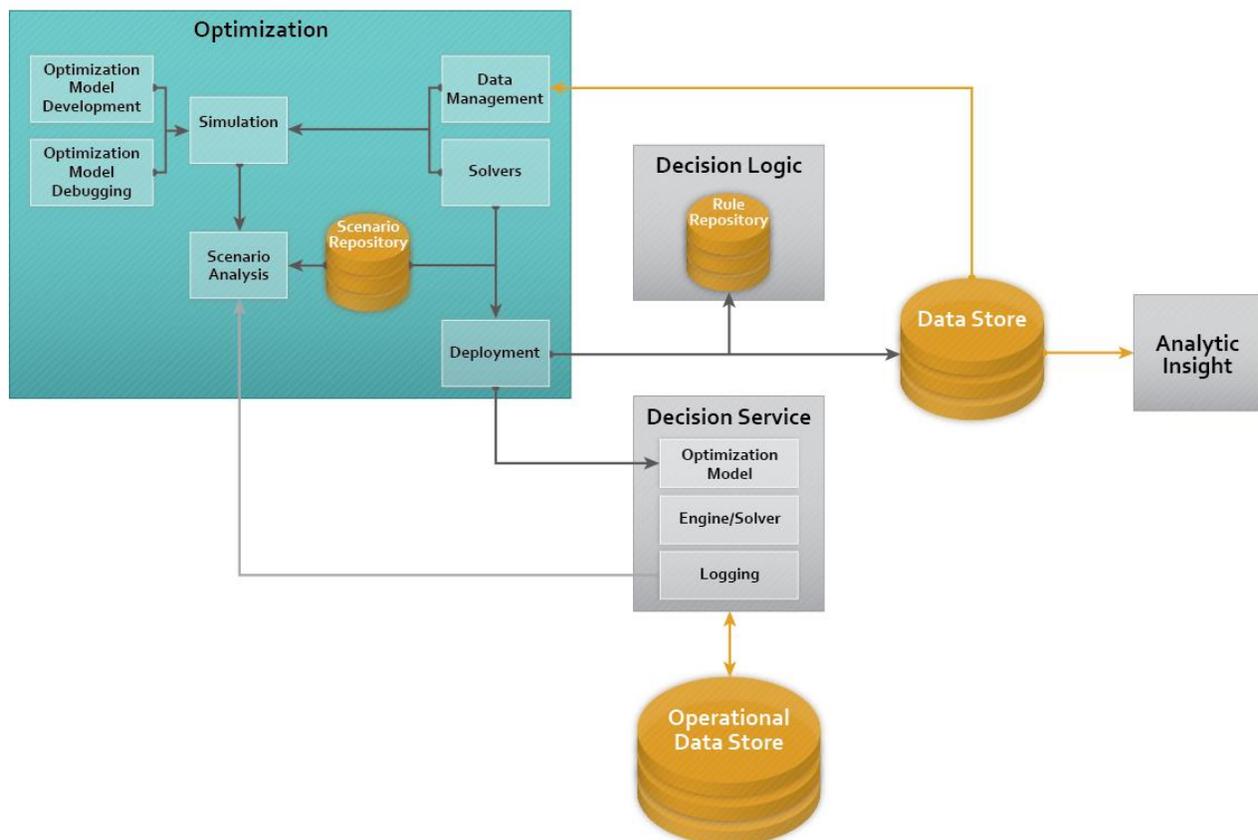
## Architecture

An optimization suite needs to support a range of activities:

- ▶ Defining a constrained optimization problem as a mathematical model using variables, an objective function and constraints both hard and soft.
- ▶ Solving this problem, often multiple times as elements of the problem are changed and re-assessed.
- ▶ Integration with a wide range of data sources so that data can be brought in and run through a defined optimization model. These data sources might be systems that are internal to the organization or external data.
- ▶ Simulation and comparison of different scenarios by a non-technical user to see what the best choice is likely to be going forward.

An optimization suite gives modelers and possibly business analysts the ability to manage tradeoffs and constraints to find the optimal action to take. An optimization suite requires the following elements.

Figure 1. Capabilities for Optimizing and Simulating Decisions



## Capabilities

### Optimization Model Development

At the core of defining an optimization model is a modeling language of languages. Some optimization suites have their own such language but several popular ones exist and some solvers (see below) can support several languages. Most optimization suites will provide an optimization model development environment suitable for modelers to specify models in one of more of these languages. This environment may be based on a commercial available IDE such as Eclipse or Visual Studio.

### Optimization Model Debugging

Debugging and profiling tools allow modelers to review and change the model to correct for identified problems - find conflicts, relax constraints or profile performance. Models can be complex and even unsolvable so profiling and debugging tools are essential to allow a viable model to be defined.

### Solvers

Most optimization suites include multiple engines or solvers that apply mathematical techniques to the developed models to "solve" the problems defined in those models. These solvers can be specific to different kinds of problems such as linear programming problems, mixed integer problems, quadratic-problems and combinations such as mixed integer quadratic problems. These solvers may be used to run scenarios, to find optimal actions that can be loaded into a production system as a batch or can execute in a Decision Service to solve an optimization problem as part of a single decision. In addition, many standalone solvers are available.

### Data Management

Optimization models are coded or constructed by hand but scenarios typically involve a large amount of data, often pulled from multiple data sources. An optimization suite must be able to connect to and retrieve information from a variety of structured and unstructured data sources as well as flat files of various kinds and present this data for scenario analysis.

### Scenario Analysis

Many optimization problems require an interface that allows a business analyst or business user to run and compare scenarios based on these models and associated data. Such scenario analysis involves rich visualization and the ability to bring real world historical data into the system to run through the model. Optimization suites include either scenario analysis interfaces or the ability to rapidly generate such interfaces for a given model.

## Deployment

The results of optimization can be deployed in several different ways. Deployment tools in an optimization suite may support the deployment of a model as results or recommendations, the packaging of a model to run against a solver running in another environment at run time or the conversion of optimal actions into rules that mimic the assignment of an optimal action.

## Repository

An optimization suite should offer an enterprise-class repository for storing and managing optimization models and associated scenarios. This repository may be a complete decision management repository that also stores business rules and predictive analytic models. It should provide access control and security, audit trails for changes made to models and versioning.

## Next Steps

Capabilities for monitoring and improving decisions over time are essential for Decision Management Systems both because decisions are high change components and because the time it takes a decision to come to fruition can be extensive, making it hard to tell good ones from bad ones.

Continuing reading [The Decision Management Systems Platform Technologies Report](#)

## Learn More:

We have extensive experience helping organizations like yours define, configure and implement Decision Management Systems that deliver on the value propositions described in this Report. Our clients are leading companies in insurance, banking, manufacturing, telecommunications, travel and leisure, health management, and retail.

- ▶ [Client Case Studies](#)
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## About The Decision Management Systems Platform Technologies Report

This report is focused on platform technologies used to build custom Decision Management Systems and our goal is to be comprehensive within this scope. Many vendors have developed powerful pre-configured Decision Management Systems focused on solving specific decision problems such as loan underwriting, claims handling or cross-channel marketing. For many organizations these solutions are ideal but they are not the focus of this report. Similarly, there are vendors that build custom Decision Management Systems for their customers and that have developed powerful platforms for doing so. If such a platform is not for sale to those building their own solutions, then it is out of scope for this report.

In both these scenarios the report's discussions of what kinds of functionality is useful, best practices and characteristics for suitable products may well be useful in the selection of vendors but some interpretation will be necessary.

Vendors and products in scope for the report are added continually. First Looks are also posted to [www.JTonEDM.com](http://www.JTonEDM.com) as they are completed. Each new version of the report will be made available at [decisionmanagementsolutions.com/decision-management-platform-technology/](http://decisionmanagementsolutions.com/decision-management-platform-technology/).

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Decision Management Solutions specializes in helping organizations build decision-centric, action-oriented systems and processes using decision management, business rules and advanced analytic technologies.

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