DECISION MANAGEMENT SOLUTIONS

By James Taylor

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Introducing Decision Management Systems

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Organizations are adopting a new class of operational systems called Decision Management Systems to meet the demands of consumers, regulators and markets because traditional systems are too inflexible, fail to learn and adapt, and crucially cannot apply analytics to take advantage of big data.

Decision Management Systems are agile, analytic, and adaptive. They can be changed rapidly to cope with new regulations or business conditions, leverage data to work to improve the quality and effectiveness of decisions, and learn from what works and what does not to improve continuously over time.

Decision Management Systems are built by focusing on the repeatable, operational decisions that affect individual transactions or customers. They offer high ROI because they improve the management of risk and the matching of price to risk, reduce or eliminate fraud and waste, increase revenue by maximizing opportunity, and improve resource utilization.

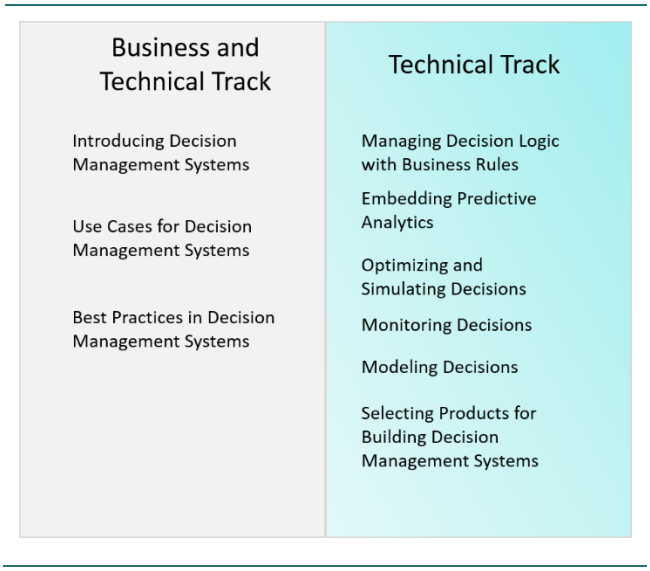
This Report, in five parts, describes Decision Management Systems capabilities and identifies the overall architecture, Decision Services, Decision Services in context, and how to make the case for Decision Management Systems. It also highlights the role of decision modeling in orchestrating and specifying all of these elements.

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 Advanced Analytics*
   - *4.3. Optimizing and Simulating Decisions*
   - *4.4. Monitoring and Improving 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*.

Technical readers are recommended to read the five Key Capabilities documents (*Managing Decision Logic with Business Rules, Embedding Advanced 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**

The Current Situation

In most organizations, there is a clear need for a Decision Management System, a new class of system. Decision Management Systems bring together two kinds of systems—operational systems that manage the transactions of the business and analytic systems that help you understand how to run the business better — to deliver systems that actively work to help you run your business or organization. Decision Management Systems are agile, analytic, and adaptive and are built using a three step process of decision discovery, decision service definition and implementation, and decision measurement and improvement. Decision Management Systems deliver high ROI by reducing fraud, managing risk, boosting revenue, and maximizing the value of scarce resources. To fulfill the promise of agile and adaptive systems that fully leverage big data, organizations will need to expand their enterprise architecture to include capabilities from the proven technologies described in this report.

Decision Management Systems have three critical characteristics that strongly differentiate them from current, mainstream business applications.

- Most such business applications are difficult, expensive, and time consuming to change. Established approaches and technologies play a role in the development of Decision Management Systems. Used alone, however, these technologies and approaches tend to deliver systems that are inflexible, static, and opaque. Decision Management Systems are agile and transparent.
- The business applications that support most organizations are entirely separate from the analytic environment of those organizations. Data mining, predictive analytic, machine learning and artificial intelligence/cognitive technologies are applied to problems outside the realm of an organization's transactional, business applications. Decision Management Systems are both operational *and* analytic.
- Finally, most business applications are designed and built to meet a specific set of requirements that is known and not expected to change. Decision Management Systems are adaptive, using analytic technology to learn and improve and supporting experimentation and evaluation by their users.

Tested and established in many industries, technologies suitable for developing Decision Management Systems include Business Rules Management Systems, data mining or analytic workbenches, and optimization suites, as well as new machine learning, in-database analytic infrastructure and more. Organizations will need to select those that have the capabilities they need, that demonstrate Decision Management best practices and that fit the organization's architecture and use cases.

Decision Management Systems Are Agile

Business Agility is an overused expression in corporate IT with all manner of approaches and technologies being promoted as delivering business agility in some way. Decision Management Systems are agile because the logic in them is easy to change and easy to adapt to changing circumstances. When new policies or regulations are issued, the logic that implemented them can easily be found and safely be changed. These changes don't undermine compliance because Decision Management Systems are transparent—it is clear how they will work in the future and also clear how they acted in each specific historical situation. This agility allows more stable business processes, as changes are easy to make to the Decision Management Systems that support those processes, and ensures that rapidly changing know-how and experience can also be effectively embedded in systems without the danger that it will become stale and out of date.

Decision Management Systems Are Analytic

Analytics is a hot topic in many organizations today with many increasingly focused on advanced analytics - data mining, predictive analytics, text analytics, machine learning, artificial intelligence and cognitive. Yet most analytic systems are completely separate from the operational systems that run the business. These analytic systems rely on data extracted from the operational systems but are otherwise quite standalone. In contrast, Decision Management Systems deeply embed analytic insight to improve their operational behavior. Analytics are used to divide customers or transactions into like groups to allow actions to be effectively targeted. Analytics are also used to make predictions of the degree of risk involved in a transaction, the likelihood of fraud or the extent and type of opportunity available. These predictions are used to select from the available alternatives in a way that will manage risk according to the organization's guidelines, reduce fraud, maximize revenue, and effectively allocate resources across competing initiatives.

Decision Management Systems Are Adaptive

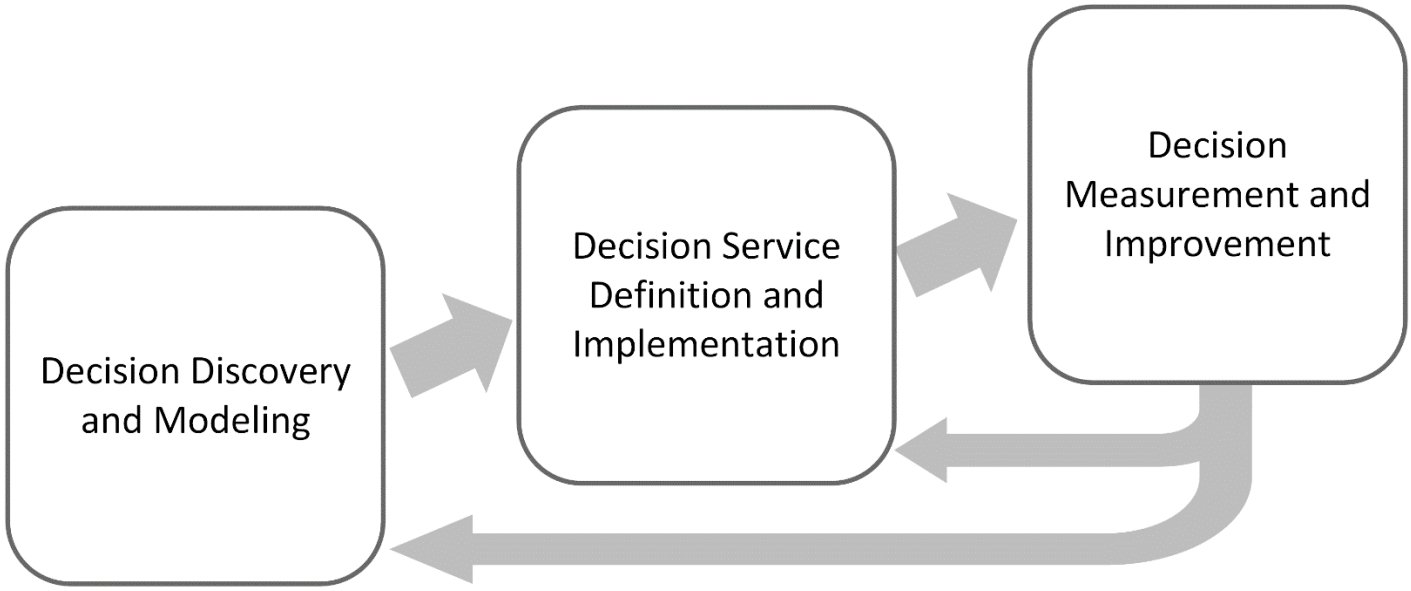
Business systems, like business people, need to constantly adapt and learn. They need to experiment and see if a new approach might work better than a long established one, challenging conventional wisdom. They must manage trade-offs in an ever changing business climate. They must allow their performance to be monitored in terms of how effective the decisions they make turn out to be. In this way, Decision Management Systems are adaptive, built to respond to changing conditions and to support a process of continuous improvement through machine learning, testing and experimentation.

However, there are steps to take before this vision can be achieved. Let's explore Decision Management Systems more thoroughly.

Building a Decision Management System

Building Decision Management Systems involves many of the same techniques, tools and best practices that building any reliable, high-performance operational system involves. All the skills and experience an organization has in developing information systems apply. The new and changed activities required fall into three phases—decision discovery and modeling, decision service definition and implementation, and decision measurement and improvement.

Figure 1. Three phases of Decision Management



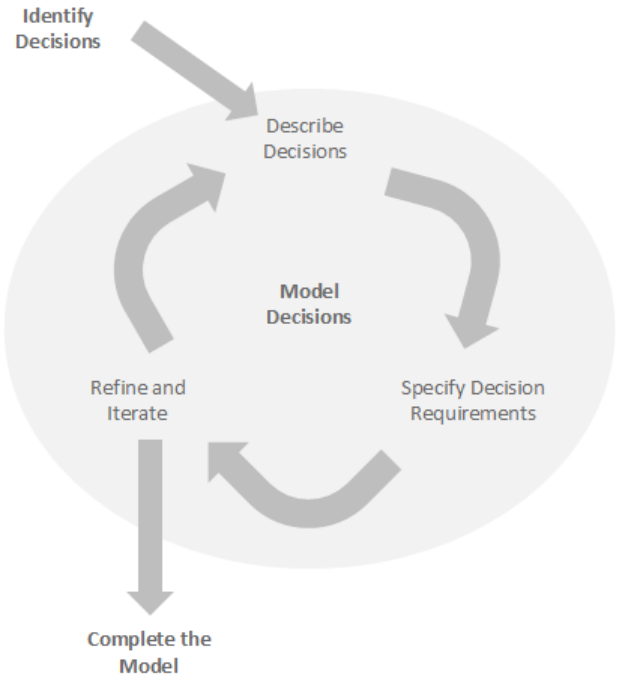
Decision Discovery and Modeling

Decision Management Systems are focused on automating and improving decisions. Most organizations do not have a well-defined approach for finding, modeling and managing the decisions they make. To effectively build Decision Management Systems, then, the first step is to find the repeatable, non-trivial decisions in the organization that have a measurable business impact and are therefore candidates for automation and improvement. Examples of suitable decisions can be found in *Use Cases for Decision Management Systems*.

There are a number of ways to find these decisions. They can often be found explicitly simply by interviewing and working with business experts. The tasks in business processes where choices are being made or where there is a pause for review are typically decision-making tasks. Many branches in processes are preceded by decision-making. Decisions can also be found by analyzing Key

Performance Indicators and other metrics to see what choices make a difference to those metrics. It is unusual for something to be tracked as a metric if there are no choices made that cause it to go up or down. The top level decisions that these approaches find should be described, primarily by defining a question that must be answered to make the decision along with the allowed or possible answers. For instance, a claims review decision might answer the question "Is this claim fraudulent and what should we do about it?" with allowed answers including routing it to the fraud investigators, putting it through a regular claims review or fast tracking it for immediate payment.

Figure 2. Steps in Decision Modeling



Top level decisions can and should be decomposed into the subordinate decisions they are dependent on—the smaller decisions that must be made before the top level one can be made. This decomposition is recursive and provides necessary detail on how these decisions are actually made day to day.

Decision modeling is a powerful technique used in Decision Discovery to capture decision requirements. Decision modeling has four steps that are performed iteratively

1. Identify Decisions.
2. Describe Decisions.
3. Specify Decision Requirements.
4. Refine and Iterate.

This process repeats until the decisions are completely specified and everyone has a clear sense of how the decisions will be made.

The decision models developed using this process are best expressed in the Decision Model and Notation (DMN) format, an industry standard notation.

Decision Services Definition and Implementation

The Decision Discovery and Modeling step enhances traditional analysis and requirement gathering tasks. Once the decisions are identified and modeled, an iterative process of development can begin. The objective is to develop Decision Services—coherent, well defined components that make a decision for the other processes and system components in the solution. Beginning by defining simple interfaces that allow these services to be asked a question and give back one of the allowed answers, an iterative approach is used to flesh out the decision making. The decomposition of the decision shows the sequencing and structure of the decisions and the business rules, predictive analytic models and optimization models required can be developed and added to this structure.

A complete Decision Service will generally require some combination of business rules, advanced analytics and optimization. Some decision services will not require analytic models, especially those primarily concerned with eligibility and compliance where business rules dominate. Even when analytic insight is important to a decision, sometimes that insight can be best represented with a set of business rules mined from historical data. When probabilities are needed, however, predictive analytic models will either need to be executed by the decision service, executed in the database the decision service is using or stored in the database that the decision service used if a batch update of the prediction is acceptable. Relatively fewer will require the deployment of optimization models as optimization is more likely to be applied to a large number of similar decisions with the optimal actions identified for each decision used to derive new business rules that are more likely to result in optimal decisions in the future.

Decision Measurement and Improvement

Decision services are developed and deployed as part of an overall systems development effort. Once deployed they must be monitored and analyzed to see if changes are required going forward. Decision services should be monitored for both proactive and reactive changes—changes that might help improve performance as well as necessary changes for compliance for instance. Performance management and other analytic tools can be used to assess the effectiveness of the decision making embedded in the system. As changes are identified and proposed it must be possible to effectively assess the impact of these changes before they are deployed. It may also be necessary or desirable to design new approaches and conduct new experiments to gather new data about what works and does not. Any changes made should be monitored to make sure they work as expected. Machine learning and other forms of adaptive analytic technology can also be applied to build learning directly into the decision services themselves.

Capabilities Needed for Building Decision Management Systems

Overview

Five key capabilities lay the foundation for building Decision Management Systems. Each can be adopted incrementally, and can scale based on resources and business drivers.

- Modeling Decisions
  Modeling decisions to specify their requirements and orchestrate technologies
- Managing Decision Logic with Business Rules
  Managing decision logic with a Business Rules Management System (BRMS) for transparency and agility
- Embedding Advanced Analytics
  Embedding advanced analytics (data mining, machine learning) for analytic decision-making
- Optimizing and Simulating Decisions
  Optimizing results given real-world trade-offs and simulating results
- Monitoring and Improving Decisions
  Applying automated and manual techniques to monitor and improve decision-making over time

We will introduce these five capabilities and put them in a broader context. For detailed descriptions, read *The Five Key Capabilities* Section of the Report.

Modeling Decisions

Today business analysts use a variety of techniques to accurately describe the requirements for an information system. However, current requirements approaches don't tackle decision-making. There is an emerging consensus that a Decision Requirements Model is the best way to specify decision-making. Decision Requirements Models can and should be developed in an industry standard way using the Object Management Group's Decision Model and Notation (DMN) standard.

A Decision Requirements Model provides the needed structure for the implementation of decision logic with business rules, supporting iteration and agile development. Decision Requirements Model frame predictive analytic and optimization efforts, linking analytics to business results and ensuring successful deployment. Decision Requirements Models are a common language across business, IT, and analytic organizations improving collaboration, increasing reuse, and easing implementation. Decision modeling is not a runtime or execution capability, unlike the others, but a way to specify the requirements for the others and orchestrate the technologies involved.

Managing Decision Logic with Business Rules

Like all information systems, Decision Management Systems require the definition of the logic to be applied during operations. In Decision Management Systems, this logic is primarily that of decision-making — how a particular decision should be made given the system's understanding of the current situation. Decision Management Systems must be more agile than traditional information systems, however, so this logic cannot be managed as code. The use of code to define decision-making logic makes that logic opaque to those on the business side that understand how the decision should be made. It also makes it hard to record exactly how a decision was made, as recording exactly what code was executed is often problematic. To manage logic in this way, most organizations will adopt a Business Rules Management System or a product that contains equivalent functionality.

Decision Management Systems require that decision logic is managed in a way that delivers design transparency, so it is clear how the decision will be made, and execution transparency, so it is clear how each specific decision was made. To manage logic in this way, most organizations will adopt a Business Rules Management System or a product that contains equivalent functionality.

Embedding Advanced Analytics

The management of decision logic is a foundational capability for Decision Management Systems. Most Decision Management Systems should also take advantage of the information available to an organization to improve the accuracy and effectiveness of each decision. Unlike human decision-makers, Decision Management Systems cannot use visualization and reporting technologies to understand the available information. In addition, while people have a great ability to extrapolate from information about the past to see what might happen in the future, systems treat data very literally.

To maximize the value of available information in terms of improved decision-making, Decision Management Systems must therefore embed predictive analytic models derived from historical data using mathematical techniques. These may be described as data mining, machine learning or even artificial intelligence/cognitive techniques. Analytic models assess the likelihood that something will be true in the future and make these assessments available to the decision logic in a Decision Management System, allowing decisions to be made in this context.

This shift from presenting data to humans, so that they can derive insight from it, to explicitly embedding analytic insight in systems using predictive analytic techniques means that organizations will need to adopt additional technologies to analyze their data.

Specifically, they will need to adopt a Predictive Analytic Workbench or equivalent functionality. They may also choose to adopt additional analytic infrastructure.

Optimizing and Simulating Decisions

Many decisions rely on limited resources. Whether these resources are staff, product inventory or service capacity, decisions often must be made in the context of a constrained set of resources. Organizations will generally want to optimize their results given these constraints and this means that trade-offs must be made. Organizations will need to adopt optimization and simulation technologies to manage trade-offs and to ensure that decisions are made in a way that produces the best possible results given the constraints on decision-making. These technologies allow modeling of the constraints and trade-offs and then use mathematical techniques to pick the set of outcomes that will maximize the benefit to an organization. These models can also be used to drive simulations of various scenarios to see which will produce the best outcome for the organization.

Monitoring and Improving Decisions

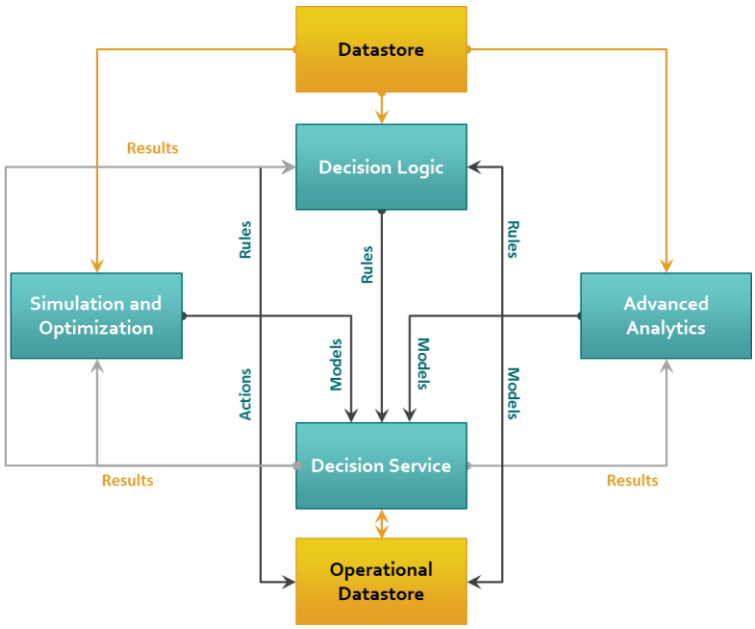
The nature of decision-making is that it is often not possible to tell how good a decision will turn out to be for some time. As a result, the ongoing monitoring of decisions made and their outcomes is important. Such monitoring allows decision-making to be improved systematically over time both by tracking decision performance and making changes when this performance is inadequate, and by conducting experiments and analyzing the results of these experiments. Most organizations will find that they will use their existing Performance Management and data infrastructure to conduct much of this analysis. However, the use of the decision logic and advanced analytic capabilities discussed above will also be necessary. This will allow for the explicit logging of decision-making approaches and outcomes as well as allowing for easy management of experiments in decision-making. Adaptive analytic techniques, such as machine learning, allow for some decision-making to be self-monitoring and for learning services to complement the decision services being deployed.

An organization that is established in developing Decision Management Systems will ultimately adopt technologies for all these capabilities. Some will find it useful to have more than one product with the same kind of capability, some will standardize on a single product. The products do not need to be adopted all at once, and some Decision Management Systems require only some of the capabilities.

Architecture

These execution capabilities come together in an overall platform for building Decision Management Systems. Figure 3 shows how the run time capabilities are combined to develop Decision Services.

Figure 3. Run Time Integration



Decision Logic capabilities allow for the editing of the business rules that represent the decision logic. These business rules are deployed to a Decision Service for execution.

Advanced Analytic capabilities allow for data to be analyzed and turned into either additional business rules (representing what has worked in the past and is likely to work in the future) or predictive analytic models that can be deployed either to a Decision Service or to the operational data store being used by the Decision Service.

Simulation and optimization capabilities are used to manage tradeoffs and constraints and can result in business rules that have been optimized, optimization models that can be solved in a Decision Service, or an explicit set of actions to be taken that can be pushed into an operational data store to drive behavior.

All three sets of capabilities rely on data infrastructure to deliver test and historical data while the predictive analytic capabilities can take advantage also of in-database modeling and scoring. The Decision Service itself can execute business rules, score records using predictive analytic models, solve constraint optimization problems, and potentially tune predictive analytic models to improve their predictive power while in use. All the capabilities can consume actuals information generated by a Decision Service's ability to log its decision-making. This enables the monitoring of decisions over time.

Decision Services

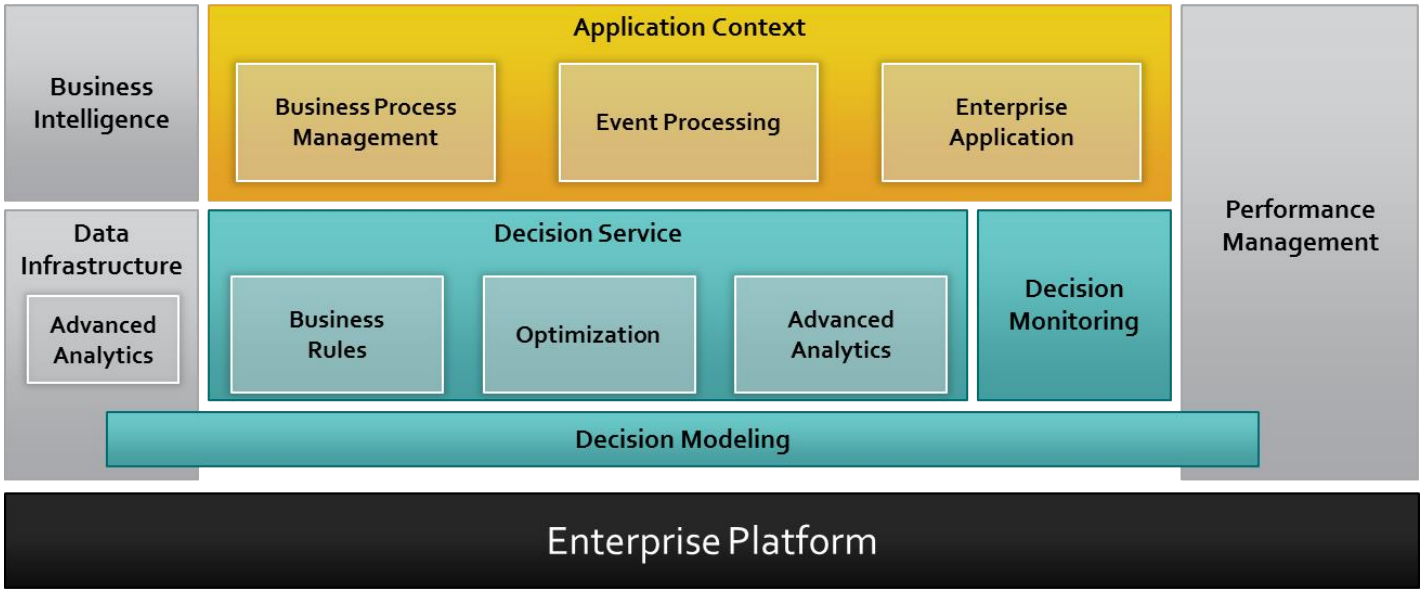
All the various deployment capabilities described above result in code or packages of definition being deployed to a Decision Service execution environment. This is typically a conceptual environment being in practice made up of elements of multiple products. This environment needs to be able to execute various elements, typically when invoked using a standard API. The decision itself is made by executing generated code on the underlying platform, business rules on a deployed

business rule engine, optimization models on a solver and predictive analytic models on a model execution engine.

Decision Services also need to be able to log what happened each time a decision was made — which rules fired, what model scores were calculated, and which outcomes were selected by the optimization model. Again, this logging often involves elements of multiple products but conceptually a single log can be generated.

Finally, model tuning may be available in the decision service, with a piece of analytic modeling code deployed to monitor the performance of deployed models and conduct experiments to see how the predictive performance of those models may be improved.

Figure 4. Decision Services and Decision Modeling in a Broader Architectural Context



Decision Services in Context

These technologies are used to develop and manage the decision logic, predictive analytic insight and optimization models required by a Decision Management System and to deploy this to a Decision Service. Decision Services operate in a broader enterprise IT context, however, as shown in Figure 4.

Decision Services are invoked for decision-making in an application context. This application context is increasingly a process being managed by a Business Process Management System. Decision Services can also be invoked by enterprise applications both packaged and legacy. While this is less common than invocation from a business process, it is by no means an uncommon pattern. A further growing

pattern is the use of a Decision Service to support an event-processing context, making a decision in response to a pattern of business events and then kicking off a business process or other service as a result. In each scenario, the application context fulfils an overall business need and the invoked Decision Service improves effectiveness and efficiency.

Decision Services are not stand-alone systems that run on specialist hardware or unique platforms. Instead, they run on the standard enterprise platforms in use today. Different technologies support the various application servers, service-oriented platforms and programming metaphors that are common and Decision Services can be developed that run on any such platform.

Decision Services rely also on a modern data infrastructure. This data infrastructure supplies operational data to the Decision Services and can also provide in-database analytic scoring. Business intelligence capabilities typically use this same data infrastructure provide insight to human decision makers. While this is not needed to develop Decision Services, business intelligence often complements these systems by supporting the handling of exceptions.

Decision Services may also use business intelligence infrastructure to provide additional context when returning a number of options.

Finally, the performance of Decision Services must be monitored to support continuous improvement. This ongoing decision analysis requires both capabilities within the Decision Service, such as support for both a champion and a challenger approach to a single decision, and integration with more typical business or corporate performance management capabilities such as dashboards and alerting systems.

Next Section: Use Cases for Decision Management Systems

The adoption of Decision Management Systems helps organizations meet the demands of consumers, regulators, and markets. In this section of the Report, we'll explore the many uses for Decision Management Systems across a wide swath of industries and situations.

There are many compelling use cases for Decision Management Systems. Any time an organization must make a decision over and over again and where the accuracy or consistency of that decision, its compliance with regulation, or its timeliness are important, Decision Management Systems play an important role. Organizations can often spot such decisions by looking for decision words such as determine, validate, calculate, assess, choose, select, and, of course, decide. For instance:

- Determine if a customer is eligible for a benefit
- Validate the completeness of an invoice
- Calculate the discount for an order
- Assess which supplier is lowest risk
- Select the terms for a loan
- Choose which claims to Fast Track

This section of the Report discusses use cases by decision type and by industry and outlines some general guidance to identify decisions suitable for Decision Management Systems.

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
- Our Services

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 as they are completed. Each new version of the report will be made available at decisionmanagementsolutions.com/decision-management-platform-technology/.

If you know of products you believe should be included or have other feedback, please let us know by sending us an email info@decisionmanagementsolutions.com.

CONTACT US

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

www.decisionmanagementsolutions.com

Email: info@decisionmanagementsolutions.com