Oracle Real Time Decisions (RTD) combines predictive analytics, business rules and optimization to automate high-volume operational decisions, allowing organizations of all sizes to deeply embed analytics and push better decisions to the front line.

Organizations make decisions that range from one-off strategic decisions through monthly and weekly tactical decisions to high-volume, high-speed front-line operational decisions. All companies must manage decisions about marketing and customer experience. From the website to emails, from the call center to self-service applications, decisions must be made about interacting with customers.

Today’s customer experiences span multiple channels and lines of business, challenging both IT and business stakeholders to deliver a cohesive cross-channel experience. Decisions need to be intelligently personalized in real time, at the moment of contact with the customer or in automated responses. Point solutions may address only a single channel or deliver targeted content based on off-line, static analytics. Companies need analytically optimized decisions at the point of interaction. This takes more than helping knowledge workers make better decisions; it means enabling systems, devices and front-line staff to make better decisions.

Decision Management focuses on optimizing decisions—not necessarily to find the theoretical optimum, but to prescribe the best possible in the time and circumstances. By learning from every interaction, Decision Management ensures results continue to improve over time, optimizing processes throughout the enterprise and across all channels.

Oracle has several Decision Management products—Oracle Rules, Oracle Data Mining and Oracle Real-Time Decisions. This paper discusses Oracle Real-Time Decisions.
Introducing Decision Management Systems

Decision Management Systems are agile, analytic and adaptive. They are agile so they can be rapidly changed to cope with new regulations or business conditions. They are analytic, putting an organization’s data to work and improving the quality and effectiveness of decisions. They are adaptive, learning from what works and what does not work to continuously improve over time.

Decision Management Systems improve profitability (lower costs, less fraud, better results), increase compliance (with policies and regulations) and deliver more precise and effective risk management. They offer organizations the ability to deliver 1:1 marketing and personalized next best actions for customers. These systems maximize the value of assets while focusing staff on higher-value decisions. They allow organizations to fundamentally change the staffing ratios at the heart of their businesses, all while delivering unprecedented business agility.

To build agile and adaptive systems that fully leverage “Big Data,” organizations need to adopt proven technologies tested and established in many industries, primarily business rules, predictive analytics and optimization. A Decision Management System pulls together these technologies and deploys them as a Decision Service that can be consumed by business processes, business events and applications. Business rules handle policies, regulations, best practices and know-how. Predictive analytics predict risk, segmentation, propensity and associations. Optimization handles trade-offs and constraints. These Decision Services fit at the heart of an Enterprise Architecture as shown in Figure 1.

Figure 1: Decision Services

Building a Decision Management System involves:
- Managing decision logic for transparency and agility
- Embedding predictive analytics for analytical decision making
- Optimizing results given real-world trade-offs and simulating results
- Monitoring and improving decision making over time

Oracle Real Time Decisions

Oracle Real Time Decisions (RTD) supports all four elements of building a Decision Management System—managing decision logic, embedding predictive analytics, optimizing results and monitoring and improving decision making. Key features of RTD include:

Table 1: Key Features

<table>
<thead>
<tr>
<th>Key Capability</th>
<th>Value Proposition</th>
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</thead>
<tbody>
<tr>
<td>Business rules and predictive analytic models as peers</td>
<td>Some decision management platforms focus more on business rules or predictive analytics but RTD provides an environment that balances the two as peers, maximizing the flexibility and power of the decision services that can be built with it.</td>
</tr>
<tr>
<td>Performance measures drive arbitration</td>
<td>RTD’s use of explicit performance measures—and its support for these being predictive analytic models, explicit properties or complex formulas—allows for effective arbitration between competing offers and decision outcomes.</td>
</tr>
<tr>
<td>Adaptive Analytic Models</td>
<td>RTD’s support for analytic models that learn, that identify and use predictors based on customer behavior, helps organizations scale their use of analytics across their channels and products while reducing the cycle time to learn about market changes and new opportunities. Automation of the full analytic lifecycle allows customers to use hundreds of models in production.</td>
</tr>
<tr>
<td>Pre-configured marketing optimization application</td>
<td>One of the most common and powerful use cases for decision management systems is in the support of marketing optimization, especially in a customer next best action scenario. RTD’s pre-configured application for marketing optimization reduces the time and effort to deploy this kind of decision management system.</td>
</tr>
<tr>
<td>Learning graphs</td>
<td>Adaptive analytics and learning engines are powerful tools in decision management but RTD’s learning graphs allow organizations to learn at a more granular level about their marketing and other offers. Combined with a tagging approach, these graphs allow organizations to evaluate the effectiveness of very specific elements of their marketing campaigns.</td>
</tr>
<tr>
<td>Independently deployable learning engine</td>
<td>The ability to deploy RTD’s learning engine separately from the decision engine allows organizations to apply sophisticated learning approaches to decisions that they are not yet ready to automate. This allows them to learn and improve across a wide range of possible scenarios.</td>
</tr>
<tr>
<td>Broad support for heterogeneous environments</td>
<td>RTD’s support for externally managed data, content, business rules and predictive analytic models makes it an ideal product for organizations working in a heterogeneous environment. The use of Oracle’s information management technology also serves to reduce integration complexity and effort.</td>
</tr>
</tbody>
</table>
Product Architecture

Oracle RTD presents a standard framework for managing decisions across all use cases as shown in Figure 2. This framework involves:

- Defining performance goals to measure a decision against.
- Making available a set of choices or assets from which the best should be selected.
- Using data to create predictive models and combining these models with explicit business policies and regulations—rules.
- Feeding the rules and predictive models into a decision engine that applies the performance goals.
- This engine producing optimized recommendations as well as powering Oracle RTD's own (adaptive) predictive models.
- Closing the loop back to the rules and predictive models that are fed into the engine.

Overall Architecture

The Oracle RTD Decision Management perspective is shown in Figure 3. Within this perspective, Oracle RTD consists of three core components—a decision engine, a learning engine and a decision management interface.

Decision Engine

The decision engine combines business rules and predictive analytics to make decisions and deliver these decisions as scalable decision services. It supports an automated test and learn framework and can adjust decision-making based on performance objectives as well as results from the learning engine.
The learning engine discovers meaningful and relevant correlations in an organization's data. Designed to handle large data volumes and to automatically learn from each transaction fed to it, the learning engine can be deployed independently or integrated with the decision engine to create adaptive analytic models.

**Decision Management Interface**

The final component is a collaborative interface for managing the decision management lifecycle. The interface empowers business, IT and analytic teams to work together to plan, define, execute and optimize decision management programs across channels.
**Standard Approach**

All RTD implementations use a standard approach to deliver decisions as shown in Figure 4. When a system, business process or service asks for advice (a decision) it invokes the decision engine which:

- Determines the choices that are eligible at that decision point.
- Scores these choices based on defined performance goals.
- Allocates the customer or transaction to one of the user-defined segments.
- Weights the scores based on the segment identified.
- Identifies the best choice and returns it to the calling system or process.
- Closes the loop by recording decision performance information.

*Figure 4: Standard Oracle RTD approach to decision-making*

Oracle RTD approach divides transactions into test and control groups. The designer of the decision decides how the transactions will be split between the test and the control group and this logic can be adjusted over time as necessary. For example, a business can start with 5% of the decisions being tested using a new approach with the remaining 90% staying business as usual. Based on the success of the test, the business can gradually increase the number using the new approach.
Key Features

Oracle Real Time Decisions is a highly developed platform for developing Decision Management Systems, especially those relating to the delivery of highly targeted content such as those used to drive dynamic inbound marketing interactions across a broad range of channels. 10 key features underlie this capability: A high performance decision service engine that executes business rules and predictive analytic models as peers to make performance measure-driven decisions is at the core. To support this, a decision management interface allows the definition of learning graphs and other elements of decision making. These learning graphs can be used by an automated learning engine to find meaningful correlations and can drive adaptive analytic models. Finally, users can develop and deploy composite decision services that leverage a common application development framework across Oracle applications and multiple deployment options.

High Performance Decision Service Engine

A decision service in RTD is defined as a configurable analytic flow—a sequence of steps—that is triggered by external systems or processes. Decision services can execute in batch or real-time and follow a configurable sequence combining “informants” that provide context or data about the decision required and “advisors” that return answers.

Decision services can be loosely coupled for a lightweight interaction involving only a few calls—for instance, a call center process can inform the decision service that a call has opened, request an offer to be made and finally inform the service that the offer was accepted to close the loop. Alternatively a tighter coupling allows decision services to be engaged interactively so that a step by step dialog can call the decision service multiple times, for example to gather additional context information before making a final decision.

The decision service engine automatically applies test and control groups to requests so that the calling system or process does not need to manage how many tests are being run or how to allocate transactions to the relevant groups, enabling cross-channel tests and control experiments to be defined. The engine supports very high performance environments, with RTD deployments delivering 500M offers per month on-premise for a financial services website, 160M decisions a month as part of a travel search cloud deployment and supporting 35,000 sales and service agents in a high tech call center for instance.

Business Rules and Predictive Analytic Models as peers

While there are decisions that can be made only with business rules and others that can be made only with predictive analytic models, many benefit from the use of both
Business rules and predictive analytic models in combination. Oracle RTD treats business rules and predictive analytic models as true peers, combining them to make decisions.

Business rules are used to define eligibility and to define segments used to filter customers. These business rules can depend on predictive scores from standard predictive analytic models imported into RTD or adaptive analytic models managed by RTD. A simple point and click, template-drive approach is used to define business rules and predictive analytic models can be imported from R as scripts (that can be executed by Oracle R Enterprise in the Oracle Database) or executed through Stored Procedures or Web Service calls. New business rules and predictive analytic models can be defined and deployed to a running system and any adaptive analytic models being used will be automatically updated during use based on the learning engine’s results.

**Performance measure-driven decisions**

Oracle RTD uses performance measures to drive decisions and to arbitrate between the eligible actions or offers available each time. The user can define a set of performance goals for each decision. These can be simple properties of an action such as a priority or value, a predictive analytic model such as retention risk or acceptance likelihood or any combination of these. Deterministic scoring rules (an additive scorecard) or arbitrarily complex formulae can be defined if necessary, allowing a wide range of performance goals to be specified for the decision. The weight of each performance goal can then be set for a decision, defining how the engine should trade-off the impact of a decision against each performance goal. A single set of weights can be defined or, as shown in Figure 6, separate weights can be defined for each of a series of segments defined using rules-based filters.

It should be noted that business users can add segments and change these weights in live RTD decision services without any IT involvement.
Decision Management Interface

The decision management interface provides an enterprise view of decisions and a collaborative environment for business users to manage their decisions. A thin client, role-based user interface supports a broad-based search, version control, audit trails of changes and multi-user collaboration. Visualization and reporting are provided and can be extended using Oracle Business Intelligence Enterprise Edition.

Figure 7: Editing In the Decision Management Interface

Within the interface, the decision repository is displayed using a folder-based structure specific to the installation. Each user sees a different view of this, based on their role, and can get basic information about everything in the repository. The offers or actions defined for decisions are at the core of this and each is managed with its supporting creative and eligibility rules. Multiple perspectives allow a focus on offers by campaign or by channel for instance and each change is recorded for a complete audit trail. Reporting and visualization support a wide range of decision performance measures and allow detailed analysis of the effectiveness of specific offers or creative to see which does best.

Learning Engine

The Oracle RTD learning engine is usable as a standalone learning application or can be integrated with the high performance decision service engine to drive adaptive analytic models. The learning engine’s core capability is its ability to derive correlations from the data fed into it.

The learning engine is configured to process business events defined by the user and fed into the engine using a standard API. The machine learning algorithms at the heart of the engine then derive correlations between these business events and other data elements—that a call that was transferred, a successful sale made and so on. When deployed stand-alone, the learning engine becomes a self-service tool for
business users to understand the correlations between customer attributes or other behavior in their systems and the business results they want. Even if they are not, for instance, ready to automate a decision they can deploy the learning engine to learn what works and what does not. If they are using the high performance decision service engine and feeding results from it into the learning engine then Oracle RTD provides a pre-defined link to use the correlations identified to drive adaptive analytic models in the engine.

For instance, Figure 8 shows that the most relevant attributes for predicting who will click on a particular banner—pages visited, products owned etc. These are built automatically by the engine and can consider demographic data, transactional information and information about the current interaction.

Figure 8: Predictive Drivers In The Learning Engine

These insights can be combined with traditional Business Intelligence tools to, for instance, find sets of customers that match the predictive drivers. In this way the learning engine is essentially doing automated data discovery and supporting very targeted data analysis.

The learning engine is multi-threaded, parallelized and designed to reduce database contention when updating conclusions or deleting processed records. It also supports multiple CPUs/Cores enabling it to process millions of learning records a day—Oracle has tested up to 58M learning records in a day.

Adaptive Analytic Models

While the high performance decision service engine can use predictive analytic models defined outside of Oracle RTD, it can also use RTD’s own adaptive analytic
models. In this mode, RTD builds a model based on what seems to predict the desired behavior no matter what it is. RTD uses automated versions of the usual data mining techniques to build these models as integrates with the learning engine to adapt these models as events happen and new correlations are identified. The models will prioritize those choices most likely to meet the performance goals defined offering both performance improvement and personalization without manual intervention. Overlapping time windows can be defined so that models recycle and the engine supports seasonality. Partitioning allows multiple models to be managed for different customer segments.

As is usual with automated model development and tuning there is not much incentive to limit the number of predictors so RTD brings in whatever predictors it finds. RTD manages the performance of adaptive models by having a separate deployed model and updating it when there is a statistically significant threshold is passed or in a time based way (say every minute). By reducing the time and cost to develop a model to nearly zero, RTD can use many hundreds or thousands of models and continually evaluate and improve their predictive power.

**Learning Graphs**

Graphs are increasingly used to show knowledge as a set of related concepts and then analyze the direct and indirect connections between these concepts. When using RTD for Marketing, for instance, the user can define a graph that connects campaigns and the offers within them, channels and the slot types and placements available; creative for an offer that is suitable for a slot type; tags that categorize these pieces of content ; and the specific slots available. The Learning Graph is configured to match the relevant nomenclature and data models. When an event occurs—a user clicks on an ad on a website say—RTD applies the learning from this event across the whole graph. It might therefore learn that the particular creative is effective for a certain kind of customer, that it is effective in that slot, that creative tagged a certain way is effective or that the offer it represents was particularly appealing. The learning potential of the event is thus multiplied as the engine uses the graph to propagate what it learns across, up and down the graph.

Oracle has found that the use of tags to categorize creative is particularly effective in the context of learning graphs. The fact that a piece of creative has been tagged as “humorous” or “green” for instance can be extremely predictive of the kind of customer to whom it will appeal. These tags can be defined by non-technical users and deployed into running systems where they are immediately used for learning.

The use of learning graphs means that the learning engine turns one click or interaction into multiple learning opportunities, improving the precision of what it learns and improving the rate at which it can adapt models to make them more predictive.
Composite Decision Services

Oracle RTD is built on the assumption that it will be part of a heterogeneous environment. As such it has the ability to integrate with a wide range of other systems to deliver composite decision services at a significantly reduced cost and with more rapid implementation. For instance, the content required for offers and actions could be stored in an external content management system and referenced in RTD. The use of Oracle’s data management layer means that information used in RTD can be stored in any data infrastructure and need not be managed in RTD’s own database. When new item are added to these systems of records, RTD will automatically apply the rules and models defined to this new information without requiring ETL work or re-deployment. In addition, when eligibility is extremely complex, RTD can be configured to reach out to an external web service for eligibility instead of using its own eligibility rules. Predictive analytic models can be brought in from outside, as discussed above and then either used as fixed predictions or fed into adaptive analytic models.

Combined with the usual ability of a decision service to be called anywhere it is needed and the ability to separate the learning engine from other RTD components, this focus allows RTD to be integrated with complex enterprise environments.

Oracle Application Development Framework

The Oracle RTD decision management interface and the various applications developed using Oracle RTD (and described in Availability below) are developed using the Oracle Application Development Framework. This provides visualization, reporting, collaboration, search and internationalization as well as integration with Oracle’s workflow products. Every new application at Oracle is using this framework and it allows the RTD team and application designers to develop and/or configure new applications quickly while ensuring that these applications are consistent with other business applications. The combination of this framework, the ability of RTD to be deployed as separate components and its support for process integration make it easy for Oracle, its partners and its customers to create domain specific applications for decision management use cases.

Multiple Deployment Options

RTD offers several alternatives for deployment mechanisms and implementation approaches. Cloud-based deployment of RTD allows mid-market customers access to the technology while also offering larger customers flexibility and rapid deployment when bring up new capabilities. Because the elements of RTD can be installed separately and both on-premise or in the cloud, incremental deployment is possible while still building to a comprehensive, enterprise deployment.
Availability

Customers can purchase the base product or pre-configured RTD applications.

Oracle RTD Applications

RTD for Customer Interaction Optimization

Customer Interaction Optimization is by far the most common use case for RTD with perhaps 80% of customers using RTD for this purpose. Oracle has developed an end-to-end application for the collaborative lifecycle management of customer interactions that supports planning, definition, execution, and optimization while using the learning engine to discover new marketing opportunities. The product has pre-configured flows for managing creative that can be triggered by CRM processes as well as out of the box task flows for managing content. Pre-defined learning graphs are available to ensure that the product prescribes the best creative and offer in the best channel.

RTD for Learn as You Go Applications

The learning engine forms the basis for this pre-packaged application for predictive data discovery. This application allows business users to tag content and then use the learning engine to see how people are learning from the content. This learning can be fed back into improving the content and the navigation of that content as well as identifying the characteristics that predict who will access which piece of content.

Other Oracle Applications

In addition a number of other applications have been developed or extended using the Oracle RTD platform including:

- Oracle WebCenter Sites
  Oracle RTD is used to deliver targeting and personalization.

- Siebel Call Center
  Oracle RTD is used to deliver Next Best Action selections for call center representatives in the context of their interactions with customers.

- Fusion Sales Predictor
  Lead scoring, part of the Fusion Sales Predictor, uses both Oracle RTD and Oracle Data Mining to automatically and analytically score leads.

- Fusion Workforce Predictions
  Uses workforce and talent indicators, current and historical, to predict performance and attrition, determine corrective action through “what if” scenario modeling, and provide the ability to implement that corrective action.
Conclusion

Oracle RTD is a powerful platform for building Decision Management Systems. By treating business rules and predictive analytic models as true peers and using performance measures to arbitrate between possible actions, RTD can deliver very effective decision services. The learning engine and its integration with the analytic engine to produce adaptive analytic models gives organizations a platform for learning what works and what does not quickly and effectively. With automated test and learn, support for decision graphs to refine this learning and the flexible tagging approach, organizations can continuously refine and improve their approach at an ever more granular level. Oracle’s focus on supporting a heterogeneous environment means that organizations can deploy decision services without having to recode existing rules or models or move existing content.

Particularly for those focused on marketing optimization or customer next best action, Oracle RTD offers a packaged solution that can offer immediate value and still be extended and adapted to support a wide range of future decisioning opportunities and deliver cross-channel decision logic.

Works Cited


Contact Us

If you have any questions about Decision Management Solutions or would like to discuss engaging us we would love to hear from you. Emails works best but feel free to use any of the methods below.

Email : info@decisionmanagementsolutions.com
Phone : +1 650 400-3029
Fax : +1 650 352-9247