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TECHNOLOGY

WHITE PAPER

Business Rules with Microsoft Dynamics® CRM Online and Windows® Azure

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Inside:
This guide describes business benefits and technical considerations for integrating the InRule® Business Rule Management System (BRMS) with Microsoft Dynamics® CRM Online, and how Windows Azure is used to enable that integration.

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EXECUTIVE SUMMARY

The combined architecture of Dynamics CRM Online, Windows Azure, and InRule is a compelling offering for firms that are looking to deliver state-of-the-art solutions that reinforce key solution development principles such as reusability, configuration instead of customization, service-oriented-architecture, and cloud computing.

This white paper will describe how these technologies can be leveraged to deliver a reusable framework that reduces development costs and risks, promotes configuration over code customization, lowers maintenance costs and improves time-to-market for functional changes.

It will provide details on how to integrate these technologies and how the InRule® BRMS supports the management of complex decision logic, business rules, and calculations without JavaScript or code, making applications configurable by subject matter experts. This paper will show how, by enabling subject matter experts to configure decision logic, rather than requiring programmers to customize CRM through JavaScript or code, InRule empowers subject matter experts to make more of an impact on your business.

PROLOGUE

Over the past several years, Microsoft Dynamics® CRM has gained a significant presence in enterprise computing. Dynamics CRM offers powerful, out-of-the-box features to support Customer Relationship Management. Additionally, the inherent nature of its configurability makes it a powerful platform for supporting many other types of business problems in addition to customer management business problems.

Although Dynamics CRM has strong support for managing data and user interfaces, many real-world business problems require that complex business logic be applied to application data to make decisions. Some examples include insurance rating and claims, loan origination, call center cross-selling, financial services monitoring, and government compliance for health care benefits or taxes.

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InRule®, the premier Business Rule Management System (BRMS) for the Microsoft platform, complements Dynamics CRM to help manage and execute complex logic against Dynamics CRM data. InRule *for Microsoft Dynamics* CRM offers out-of-the-box features including intuitive rule authoring and testing against CRM and a flexible and powerful .NET programming SDK for simple runtime integration. InRule helps customers gain additional business value from existing investments in Dynamics CRM.

Although every organization may have a differing combination of enterprise systems and underlying technology stacks, the general trends in enterprise computing have led many firms to incorporate the following principles when attempting to limit risk, reduce costs, and deliver modern application features.

Solution Development Principles:
- Develop software with reusable tools and frameworks to reduce development costs and risks.
- Favor software architectures that promote configuration over code customization, lowering maintenance cost and time-to-market for functional changes.
- Move toward service-oriented software architectures for logical scalability, reliability, and reuse.
- Move toward virtual and cloud computing as a hardware complement to the scalability, reliability, and reuse offered by service-oriented architectures.

The combined architecture of Dynamics CRM Online, Windows Azure, and InRule is a compelling offering for firms that are looking to deliver state-of-the-art solutions that strongly reinforce all four of the solution development principles listed above. Entire enterprise solutions can be completely deployed to the cloud, where the initial cost of ownership and time-to-market is lower when compared with on premise solutions.

## DYNAMICS CRM AS AN APPLICATION PLATFORM

Configuration

Dynamics CRM ships with a series of business objects called "entities." Each entity type contains related data fields about a business concept, such as an "account," a "contact," or a "lead." Entities can also be related to each other to form hierarchies using one-to-one or one-to-many relationships. (Example: an account may be related to a contact and many opportunities.)
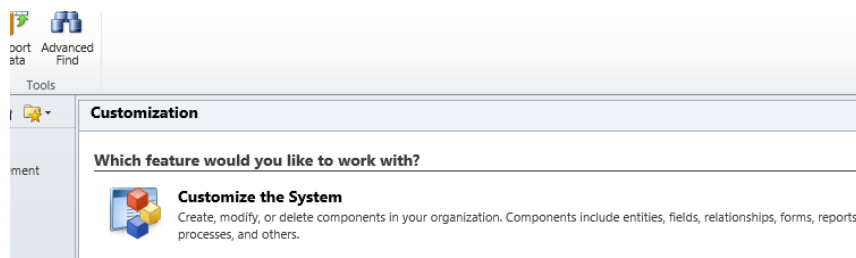
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Sample Entity Graph
(with 1:1 and 1:N relationships)

Account

Addresses

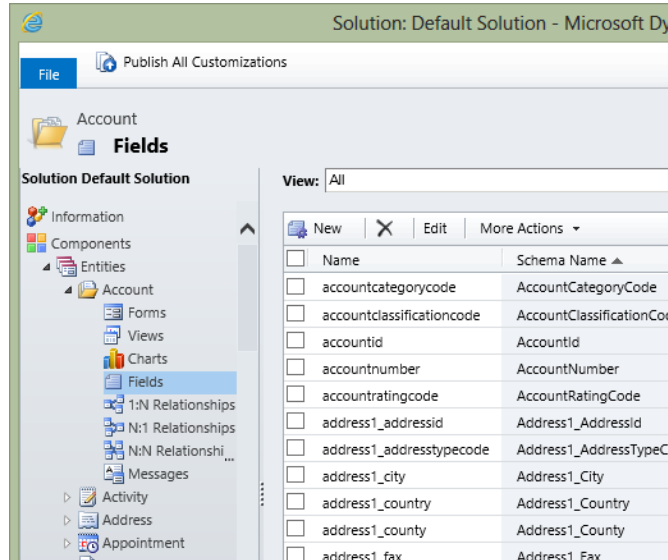Primary Contact

Appointments

Opportunities

Originating
Lead
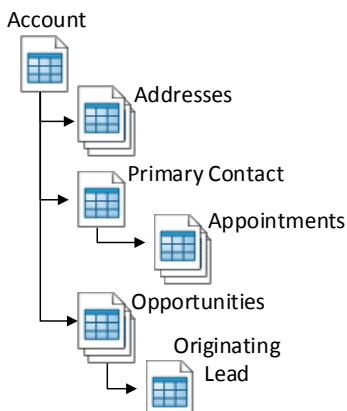
In addition to out-of-the-box entity definitions, Dynamics CRM allows new entities and relationships to be configured without changing code. A system administrator, software developer, or technically inclined business user, has the ability to define new data structures that can drive almost any conceivable business problem. The custom entity feature and additional configurability built upon the relational entity framework concept allows Dynamics CRM to be a candidate as an application platform for many enterprise applications. The business problems that these applications address may extend beyond traditional Customer Relationship Management business problems.

The screen shots below are from administration screens in Dynamics CRM that allow users to customize entity data structures:

Customization

Which feature would you like to work with?

Customize the System
Create, modify, or delete components in your organization. Components include entities, fields, relationships, forms, reports, processes, and others.

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NOTE: The configurable, relational entity model is the core feature that serves as a foundation for a series of enterprise features offered by the CRM platform. At their most basic level, all the features below are driven by configuration rather than by changing code:

- **Data model –** An optimized, relational database that has corresponding in-memory objects.
- **UI –** A series of user interface forms that manipulate business entities. The forms can be reconfigured without changing code. Entity sets can be queried with reusable "views."
- **Role based security –** User security that is manageable on an entity-by-entity basis. Direct integration with Active Directory, ADFS, and Windows Azure.
- **Reporting –** An efficient aggregate reporting engine where reports can be configured and republished without changing code.
- **Search –** Each entity set can be searched by combinations of fields with configurable search controls that support complex query clauses and wildcards.

Integration

In addition to configurable features, Dynamics CRM also offers an application framework with strong support for extension and integration by software developers and system administrators.

- **Events, workflows, and web resources –** When requirements for business problems exceed what is possible with out-of-the-box configuration, additional complexity can be supported with a rich event framework, a robust workflow engine, and an extensible web UI.
- **Service Oriented Architecture –** A set of SOAP and REST services exposes CRUD operations, entity metadata, and the event and workflow framework for reuse by other enterprise systems, back-end processes, and multiple user interfaces.

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- **Software Development Kit –** a simple and complete set of .NET and JavaScript programming interfaces exposes the functionality of the platform for cost-effective integration.

ENABLING DYNAMICS CRM FOR COMPLEX BUSINESS PROBLEMS USING BUSINESS RULES

Although Dynamics CRM offers a robust platform for managing enterprise data, it does not have out-of-the-box features for managing or applying complex business logic to that data. Many real-world problems must derive decisions based on hundreds of data points or distinct rules. Often rules must be chained together conditionally as logic is iteratively applied to a set of data.

Some business verticals that typically require complex decisioning:

- Insurance quoting, underwriting, and claims
- Health care diagnosis, eligibility, and pricing
- Government compliance with large sets of codes or laws
- Loan origination
- Engineering and mechanical maintenance
- Product configuration and pricing
- Business intelligence

NOTE: Across any of these business verticals, similar high-level rule requirements often emerge regardless of the business problem. The InRule BRMS has out-of-the-box features that help to address these common requirements:

- **Efficiently execute complex logic that drives real business decisions –** Complex decisions often require consideration of hundreds of data points and rules. Data points may be aggregated across complex entity hierarchies comprised of many different data types and collections.
- **Have business visibility into the logic that drives complex decisions –** Business logic should be easily readable and reportable for business users, not just software developers. This business should be comfortable with their understanding of how an application works.
- **Have the ability to easily version and change rules over time –** Rules often change over time. An application may need to be quickly updated to accommodate changes, but include the ability to execute older versions of rules when necessary.
- **Change the behavior of Dynamics CRM without having to change code –** Business users and subject matter experts should be empowered to make changes to the rules, just as easily as they can control other declarative features of CRM such as the entity model or user interface. Complex business logic should not be hard-coded and maintained only by software developers.

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- **Have the option to deploy as a completely cloud-based solution –** No on-premise hardware or software should be required, including management and execution of business rules.

IMPORTANT: InRule provides out-of-the-box rule authoring and testing support for Dynamics Online. InRule also provides code samples and reference software architectures for integration with the CRM SDK and CRM Online. Together, these offerings allow InRule customers to easily add value to their existing investments in Dynamics CRM.

NOTE: The out-of-the-box InRule catalog, irCatalog®, and custom WCF services built using the InRule rule engine are compatible with Windows Azure. This allows rule integration components to be installed in the cloud along with CRM Online.

AUTHORING RULES WITH DYNAMICS CRM ONLINE AND INRULE

The key to empowering Dynamics with complex business logic is giving users access to the powerful entity model that serves as the core for the Dynamics application platform. To enable rule authoring integration with Dynamics, InRule offers irX® *for CRM*, which is an extension to the InRule rule authoring tool, irAuthor®.

irX *for CRM* provides rule authors with access to the Dynamics CRM entity store while building rule applications. Users can connect to a CRM farm and generate rule application schemas directly from entities and relationships defined within CRM. Once the entity schemas are imported into rule applications, rules can be authored and tested against real-time CRM data.

IMPORTANT: Before rules can be executed at runtime in Dynamics Online, they need to be authored within rule applications using irAuthor and irX *for CRM*.

irX *for CRM* shows up in the control ribbon within irAuthor. To begin creating rules that will integrate with CRM Online data, the rule author can direct irAuthor to connect to a CRM Online organization service to download entity metadata. The screen shot below shows the irX *for CRM* ribbon in irAuthor.
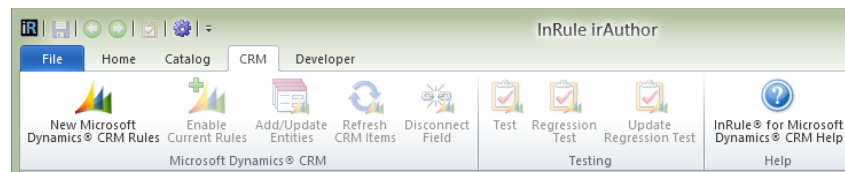
Once entity metadata has been downloaded, the rule author can then select entities, fields, and relationships to import into a rule application. Only fields and relationships needed by a particular business problem need to be included. Picklist field values are also imported into the rule application as lists to make rule authoring intuitive. Below are screen shots that show the irX *for CRM* entity selector and a sample rule application entity tree after the schema import has completed.
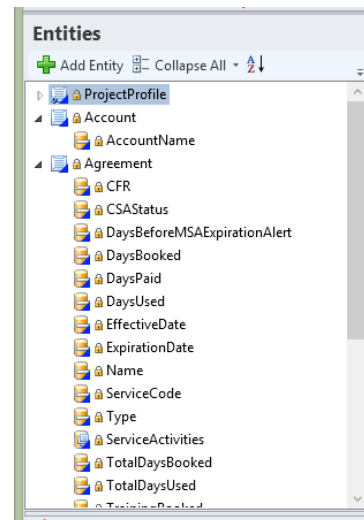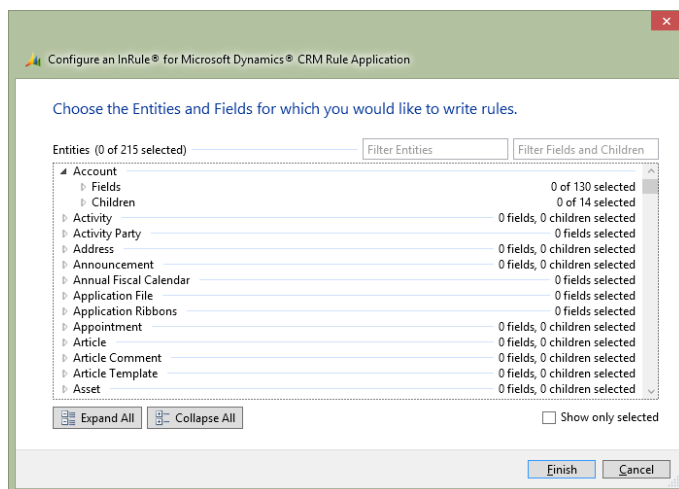
After CRM entities and fields have been imported, rule sets can be created to run against CRM entity instances. Each rule set can contain one or more rules. As rules are executing, they can walk through entity hierarchies to compare and calculate data. This allows for complex data manipulation, including aggregation across collection members, or even creating new entities and relationships within CRM.

i **NOTE:** A few sample rules are listed below that include data points from both out-of-the-box and custom CRM entity types:

- This rule aggregates a sum of a field in a child collection while considering a filter against three different fields. After the sum is calculated, it is reused in two additional calculations:
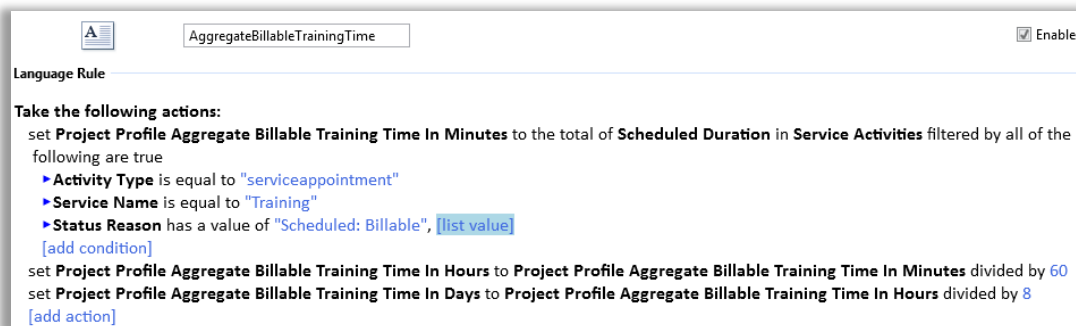
- The following two rules are used to validate CRM data. Based on the outcome of multiple conditions, warning messages can be dynamically formed to return messages to users.

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Once rules have been authored, they can be immediately tested against CRM Online data using irVerify®, the out-of-the-box InRule testing tool. Rule authors can select CRM entities that have been exposed from CRM views. They can then load the data directly from CRM Online, execute rules, and check results without having to commit saved changes back to the CRM data store.
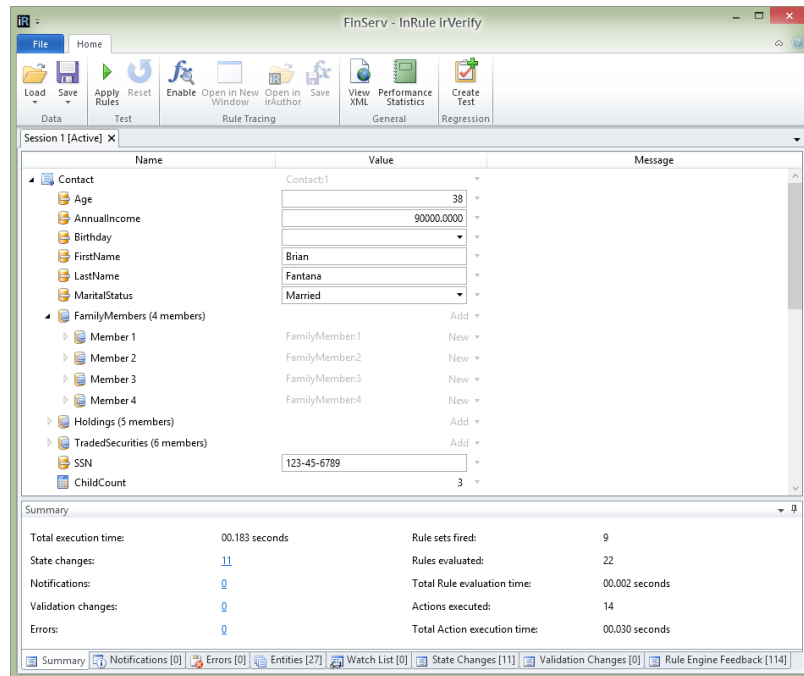
After rules are authored and tested, they can be published to the irCatalog web service. This catalog service can then be queried by components hosted in Dynamics CRM Online to execute rules at runtime.

NOTE: By default, the InRule installer will deploy irCatalog to on premise servers. However, the irCatalog web service and database can be manually deployed to the cloud using an Azure Web Role and SQL Azure.
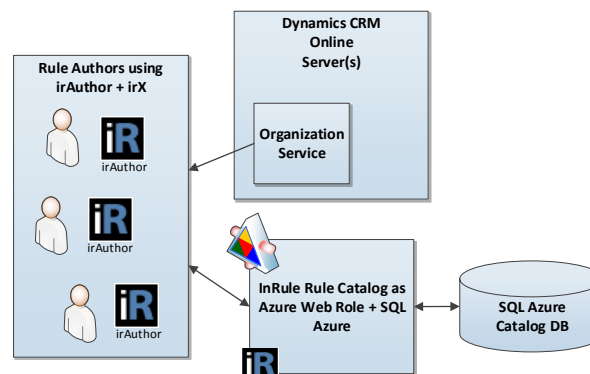
EXECUTING RULES WITH DYNAMICS CRM ONLINE AND INRULE

Once rules have been authored with irX *for CRM* and published to the catalog, they are now ready for integration and runtime execution. InRule provides code samples and reference software architectures for integration when running with CRM Online.

IMPORTANT: Dynamics CRM Online has the ability to host custom components such as plugins and workflows, but those components must run in the highly restricted

"sandbox" environment. The sandbox helps ensure stability and security of the Dynamics CRM Online environment. The InRule rule engine requires access to components that are not available in the sandbox. Therefore, out-of-process approaches must be used when integrating with Dynamics Online or on premise CRM farms that have sandbox restrictions.

Since rule execution components must be hosted on separate cloud servers from Dynamics Online, Windows Azure becomes a natural fit for rule execution servers. In addition, Dynamics Online has a built-in feature called "Service Endpoints" that allows for secure communication with the Azure Service Bus when making calls to out-of-process services.

This screen shot shows an example of a Service Endpoint that has been configured in a CRM Online environment. The endpoint can be called from CRM Plugins to initiate a call to a service that is registered with the Azure Service Bus.
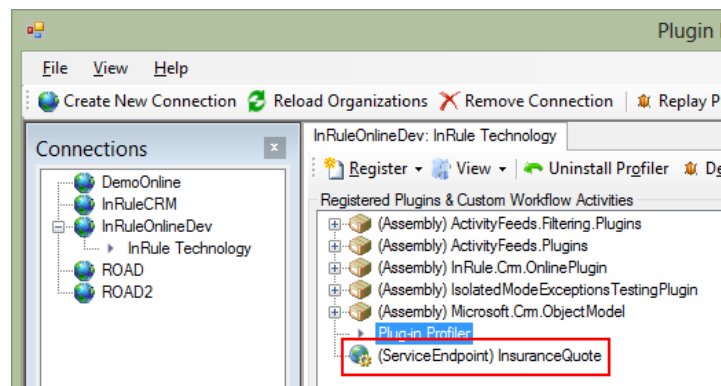
NOTE: Given the flexibility of Azure, .NET, WCF, and InRule, several possible approaches could be used to integrate a rule call with CRM Online. However, the following two approaches are suggested. Wherever possible, the approach using the REST Listener and Service Endpoint is suggested since it offers additional security options over calls against custom web services:

- o **Custom CRM-Online Plugin with Azure REST Listener –** includes rule execution running as an Azure Worker Role. Calls are marshaled through the Azure Service Bus using a CRM Service Endpoint.
- o **Azure Web Role with REST Service –** includes an approach that is similar to the WCF Web Services described in an earlier section of this document. The main difference for this approach is that the components are hosted in the cloud.

SOFTWARE ARCHITECTURE FOR ONLINE PLUGINS AND RULES

The following diagram describes the logical layout of components used in the CRM Online Plugin sample. This approach uses a CRM Online Plugin to call a Service Endpoint registered with Dynamics CRM. The Service Endpoint is used to marshal a call to a

custom Azure listener using the Azure Service Bus. Rule execution is invoked by registering events or "Steps" that will trigger after data changes occur in CRM.

IMPORTANT: For this reference architecture, all of the components are deployed to the cloud except for irAuthor. irAuthor is installed on the rule author's desktop, and can communicate directly with cloud-hosted services.
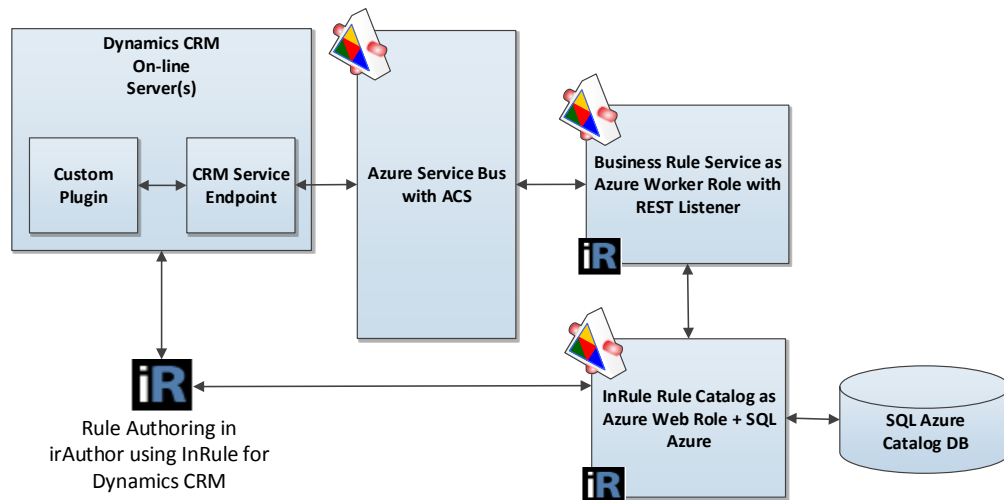
NOTE: If necessary, the rule catalog and rule execution services could be hosted on premise, with only Dynamics CRM Online and the Azure Service Bus hosted in the cloud.
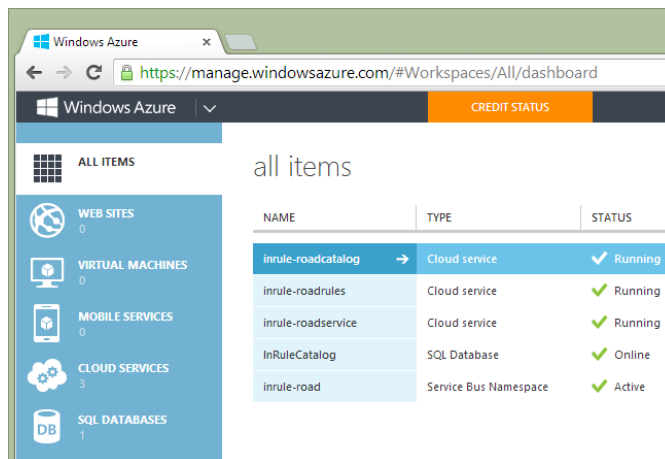
To initiate a rule execution call, a plugin DLL has been deployed to CRM Online. This plugin is registered to execute when entity data is changed in CRM. The plugin is configured to call a registered "Service Endpoint" and then persist data changes made by rules.
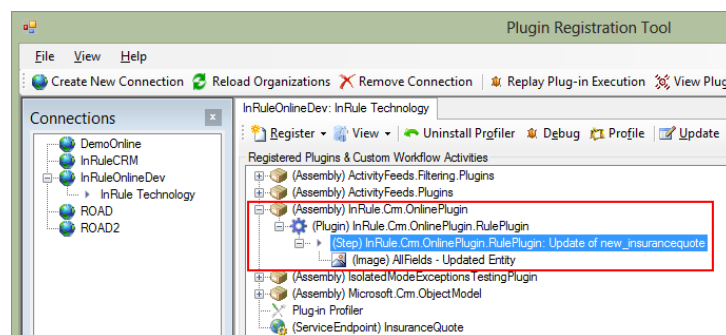
For an all-cloud deployment, there will be multiple web and worker roles deployed to Windows Azure. The screen shot below includes a worker role for rule execution and a web role for the catalog. An SQL Azure database is used to store rules. The Azure Service Bus is configured to allow for secure communication between CRM Online and rule services running in the Azure Worker Role.

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SOFTWARE ARCHITECTURE FOR CUSTOM WCF WEB SERVICES AND RULES

The Online Plugin approach is ideal to create secure and seamless integration with Dynamics CRM Online and business rules. However, the event framework built in to CRM may not be ideal for all business process scenarios. For some business processes, rule execution entry points may not align with data change events.

A more loosely-coupled approach between CRM Online and business rules can be achieved using a stand-alone Azure Web Role that contains a WCF REST web service. InRule provides a code sample for a WCF REST Web Service—this sample can be configured as a Web Role if necessary.

IMPORTANT: Per Microsoft documentation, initiating persistence from out-of-process web services should be avoided when working with CRM Online. The REST Web Role approach is best suited for "read only" calls that return results directly back to a browser, or for back-end or batch processing scenarios that do not interfere with user interaction.

The following diagram depicts another cloud-based approach, where a call is made to an out-of-process web service hosted in Azure.
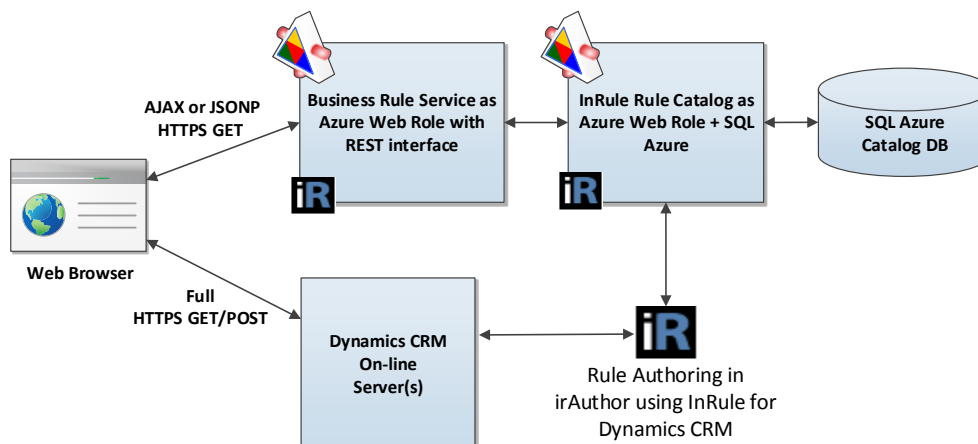
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NOTE: If the web service will be invoked using JavaScript within a web browser, then consideration should be given to the potential effects of cross-domain web service calls.

ADDITIONAL NOTES FOR CRM ONLINE AND INRULE INTEGRATION

Below is a list of additional technical details to be aware of when building a solution that includes InRule and Dynamics CRM Online:

- Based on Microsoft documentation, if calling out to services during an open CRM transaction, then data changes should be passed back to CRM Online for persistence. During rule processing a rule service may query back to CRM to load some additional data, but all final data values should be passed back to CRM Online for saving.

- In some cases rules will need to load data from Dynamics when running. If a plugin is used in those cases, then the plugin steps should be registered to run as a "pre-operation" instead of a "post-operation." If a post-operation is used then some queries may be blocked due to locking in Dynamics CRM.

- Since REST services are used for the Azure Worker Role, a Simple Web Token (SWT) is used with ACS as opposed to SAML. The Service Endpoint in Dynamics CRM should be configured to use REST. Setting up identity providers and rules groups in ACS for the first time can be confusing. Thankfully the Plugin Registration Tool in the CRM SDK includes a button that will attempt to automatically configure ACS for a given Azure Service Bus namespace.

- When using the CRM Service Endpoints, the information passed across the service bus is very rich. This allows for a programming model that is similar to writing an in-process plugin for CRM. Contextual information such as the user ID for the source event is available.

- The InRule engine is capable of handling complex trees of hierarchical CRM data when making a decision. Child entity collections and lookup fields can be populated and considered during execution of rules against a single root entity.

SUMMARY

Dynamics CRM offers a rich set of enterprise-level features for quickly creating and maintaining line-of-business applications. Dynamics CRM Online further strengthens these software offerings by providing robust and scalable deployments without the need to set up hardware or configure servers.

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The InRule BRMS can extend Dynamics CRM Online to allow for execution of complex business logic against CRM entity data. Complex rule execution allows customers to get more business value from investments in Dynamics CRM.

InRule enables business rule integration with Dynamic CRM Online with three key features:

- Out-of-the-box rule authoring and testing using irAuthor and irX *for CRM*.
- Code samples and reference software architectures that demonstrate best practices for rule engine integration.
- Support for rule management and execution in Windows Azure, which makes best use of software architectures offered by Dynamics CRM Online and the InRule rule engine.

Using Dynamics CRM, Azure, and InRule delivers a reusable framework that reduces development costs and risks. InRule provides organizations with real, proven, and measurable IT and business results; InRule users report an average savings of $488,059 versus hard coding.[i]

Dynamics CRM, Azure, and InRule provide an architecture that promotes configuration over code customization, lowering maintenance cost and improving time-to-market for functional changes. Azure delivers the cloud computing benefits of cost-effective scalability and reliability. Dynamics CRM Online and InRule deliver the benefits of a service-oriented architecture as well as configurability: while Dynamics CRM provides configurability of entity structures and UI, InRule provides configurability of decision logic, business rules, and calculations.

InRule is designed for real-world IT and business use, supporting the management of complex decision logic, business rules, and calculations without JavaScript or code. By enabling subject matter experts to configure decision logic, rather than requiring programmers to customize CRM through JavaScript or code, the InRule BRMS empowers subject matter experts to make more of an impact on your business.

[i] Total savings calculated based on average savings of implementation and maintenance as reported by survey respondents, calculated over a 7 year lifspan, using an 8% discount rate to compensate for the time value of money (TVM). Source: 2013 InRule User Community Annual Survey.

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