Resilient SYSTEMS

Resilient Incident Response Platform

ACTION MODULE PROGRAMMER'S GUIDE v24

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1. Objective

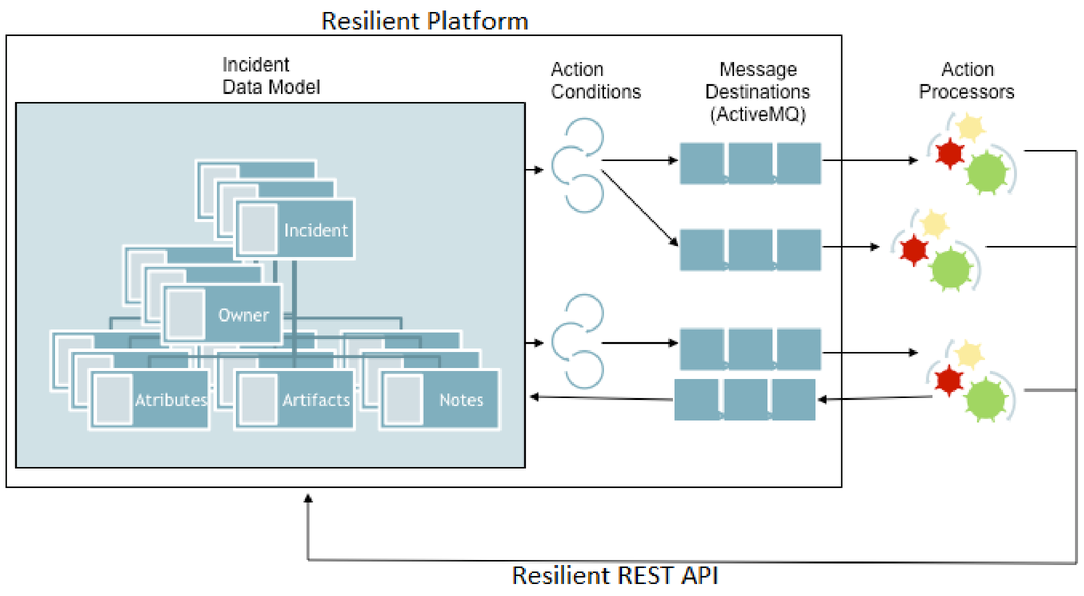
This document is intended for programmers, testers, architects and technical managers interested in developing and testing integrations with the Resilient Incident Response Platform using the Resilient Action Module. It assumes a general understanding of the Resilient platform and message-oriented middleware (MOM) systems.

2. Introduction

The Action Module is an available extension point to the Resilient platform that enables organizations to define and implement custom behaviors in response to user-defined conditions arising within the Resilient platform.

Actions can be configured within the Resilient platform as either automatic or manual. Automatic actions are executed automatically without user interaction when an event occurs meeting the pre-set conditions defined for that action. Manual actions require user invocation by clicking a button that appears in the Resilient user interface.

The Action Module is built on an embedded version of Apache ActiveMQ. When the incident data model changes match an action's pre-set conditions or the user manually invokes the action, a message describing the event is added to a message destination. An action processor then reads this message, performs an operation (possibly using the Resilient REST API) then optionally sends a reply back to the server. The following figure shows the Action Module within the Resilient platform architecture.



Action processors can implement custom business logic and interact with external systems. The following are some example use cases:

- User wants to be able to create a note (e.g., "We need to collect the logs from server xyz") and then be able to invoke an action on that note to generate a ticket in the IT helpdesk. It may be that the action requires additional parameters that need to be collected (e.g., BU, charge code, contact email) through a dialog prompt, which is supported through action layouts and fields.

- Customer has an internal asset DB. Every time an IP artifact is added, they want a custom action to be automatically invoked to check that IP against their asset DB and add information to the artifact.
- The customer has specific logic they want to use to set a field value, such as severity based on built-in and custom fields. Every time an incident is created or modified, they want to execute their custom logic and then set the value accordingly.
- There is a task in the IR plan that says, "You should disable any compromised user accounts," and we would like to include a "Disable AD Account" button to perform that action. When the user clicks the button, it prompts the user to enter the user ID and then it dispatches the custom action that connects to the local AD and disables the account.
- Customer uses Splunk or other SIEM. Every time a DNS name or IP address artifact is added, it automatically performs a SIEM search to find any relevant log entries. Add search results as incident/task note or amend the artifact description.
- When a malware sample is added as an artifact, send the malware sample to a sandbox virtual machine to analyze. Include the resulting report in the artifact description or as a note.

This document contains the information needed to design, implement and deploy Action Module processors.

3. Design Considerations

This section contains information about design considerations for Action Module processors.

3.1. Choosing a Programming Language and Messaging Protocol

The Action Module processors can be written in any language that allows TLS connections to a message broker using the STOMP or ActiveMQ (OpenWire) protocol.

The language you choose depends on many factors, including language familiarity. One additional factor to consider is the maturity of the client library support. Although most modern languages have messaging support (generally through libraries implementing the STOMP protocol), Java-based languages (e.g., Java, Groovy, Scala) are generally considered to have the most mature messaging support.

If you use a Java-based language, typically you would use the ActiveMQ client library, which uses the OpenWire protocol. There are libraries that support STOMP available for most modern programming languages. The following web page includes many different STOMP client library options: http://stomp.github.io/implementations.html#STOMP_Clients

The examples in this guide are written either in Groovy (which is Java-based) or Python.

3.2. User Authentication/Authorization

The Action Module processors authenticate to the message broker using Resilient credentials. It is recommended that you create dedicated service accounts for this purpose. These accounts can be created with very strong passwords.

Accounts can be created from the Resilient command line using the following commands:

```
$ openssl rand -hex 32
<SOME RANDOME HEX STRING>
$ sudo resutil newuser -email security@mycompany.com -org "My Company" -
first Security -last User
[sudo] password for resilient_admin: <enter Resilient_admin password>
Enter the password for the user: <random hex from above>
Confirm the password for the user: <random hex from above>
```

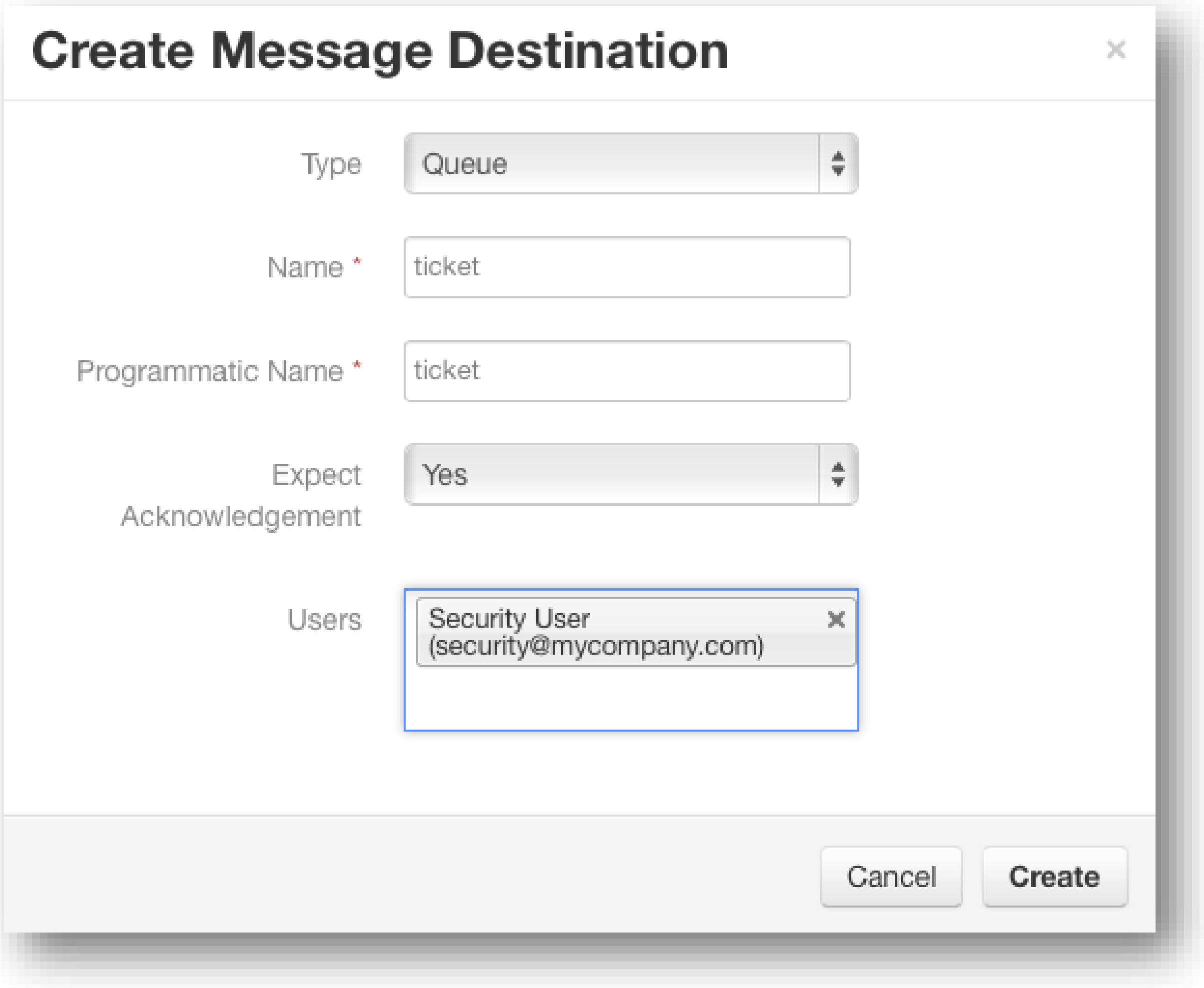
When prompted for the new user password, enter the random value from the "openssl rand" command. Because you use sudo to invoke the resutil tool, you may be prompted to enter your current login user password first.

The openssl command generates a random password of 32 bytes of data encoded as a hex string (which results in 64 characters). The second command adds a user using the random password from the previous command.

The users created by the resutil command are administrative users. This may or may not be required by your application. If it is not required, you can use the Resilient web application to remove the administrative rights before you use it to connect for the first time.

Some Action Module processors need to use the Resilient REST API to access or modify additional Resilient data. This same user account can be used to authenticate with the REST API.

Once created, you can grant the user access to the message destinations to which it needs access. This is done through the Resilient web application (Administrator Settings > Actions > Message Destinations), as shown in the following figure. You grant access to message destinations by adding the allowed users in the Users section.



Create Message Destination

Type	Queue
Name *	ticket
Programmatic Name *	ticket
Expect Acknowledgement	Yes
Users	Security User (security@mycompany.com)

3.3. Queue vs. Topic

Resilient Message Destinations can be configured to be either topics or queues. The following table describes the differences between topics and queues in the message broker context.

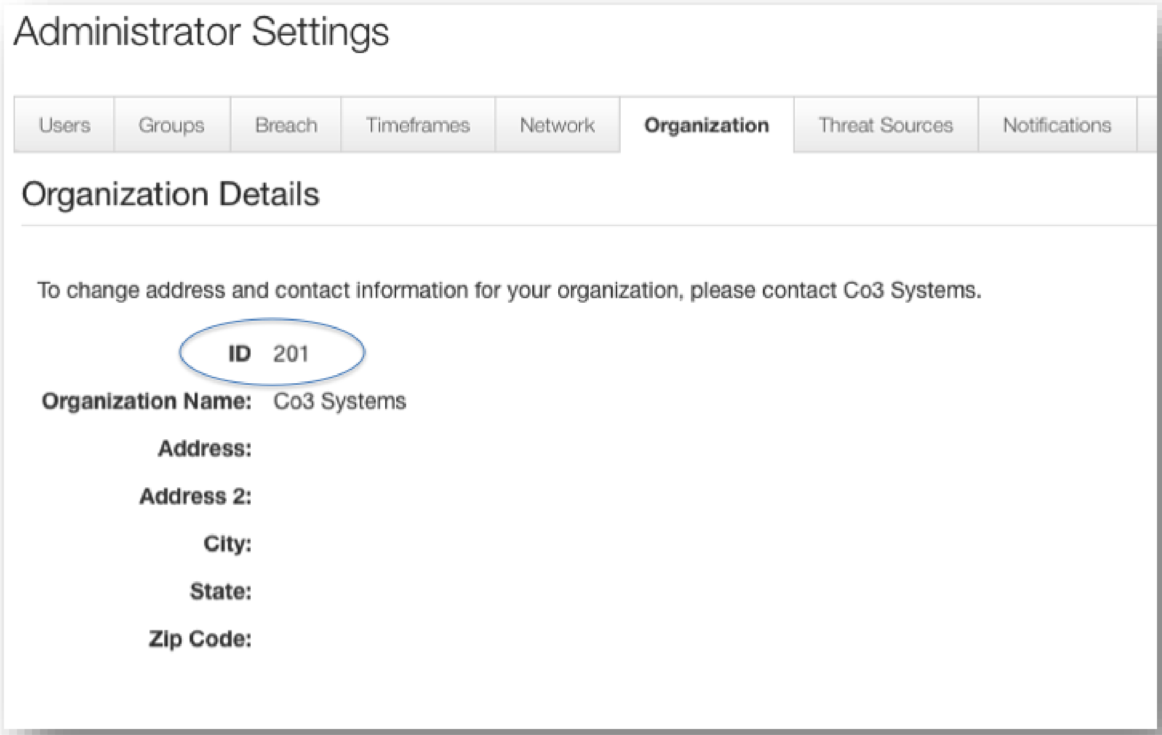
Type	Who receives messages?	No active subscribers?
Queue	One subscriber	Message is stored for later consumption
Topic	All *active* subscribers	Message is dropped

Based on the nature of Resilient integrations, we expect most message destinations to be created as queues. This ensures that messages do not get dropped because services are down.

3.4. Message Destination Naming

When you create a Message Destination, you give it a display name. The system automatically generates a programmatic name that is used when your action processors connect to it. The display name can contain any character. The programmatic name can contain only alphanumeric characters and underscores.

Please note that when you connect to the destination from your code, you have to specify a prefix that includes the organization's numeric ID. This ID is specified in Administrator Settings > Organization. The following figure illustrates how to locate your organization's ID.



Organization Details

To change address and contact information for your organization, please contact Co3 Systems.

ID	201
Organization Name:	Co3 Systems
Address:	
Address 2:	
City:	
State:	
Zip Code:	

If you created a message destination in the Resilient web UI with a programmatic name of "ticket" and your organization ID is 201 as it is in the previous figure, the name you would use in your Action Module processor code to read messages would be "actions.201.ticket".

NOTE: Some client libraries have you connect to the destination using a "/queue/" or "/topic" prefix. For example, if you are connecting to the ticket queue, you would use a name of "/queue/actions.201.ticket". Consult the documentation for your client library for more information.

3.5. Manual vs. Automatic Actions

As mentioned earlier, the Resilient platform supports two different types of actions: automatic and manual.

Automatic actions are automatically triggered by a pre-configured condition being met. When you define an automatic action, you are really describing the conditions under which a message is placed on a message destination, which is then consumed by an action processor to perform the desired processing. Automatic actions are managed through the Resilient web application (Administrator Settings > Actions > Automatic Actions).

Manual actions are those that are executed as a result of a user explicitly invoking them. Configuring a manual action results in an action option being displayed in an action menu in the appropriate place in the Resilient user interface. For example, if you configure a manual action on notes for escalating the note to an external ticketing system, then when users are viewing notes they see an option on the note's action menu to invoke that action. Like automatic actions, invoking a manual action results in a message being placed on a message destination, which is then consumed by an action processor to perform the desired processing. Manual actions are managed through the Resilient web application (Administrator Settings > Actions > Manual Actions).

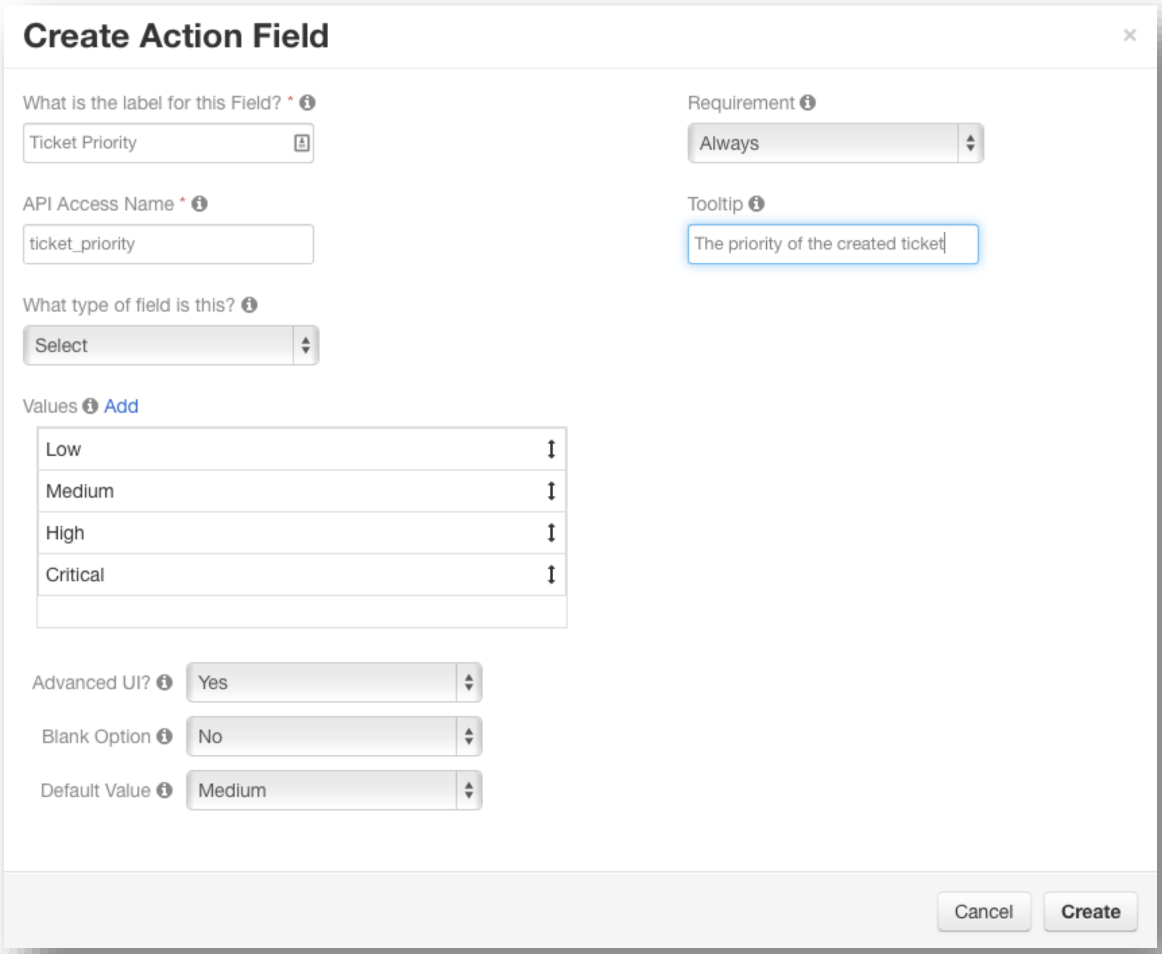
Both manual and automatic actions can be configured with conditions; however, the context of the condition evaluation is different between the two. For automatic actions, the conditions dictate when the action results in messages being added to the associated message destinations. For manual actions, the conditions dictate when the action is enabled in the user interface for a user.

If you do not add any conditions when configuring the action, the action always applies. For automatic actions, this means that a message is added to the message destinations whenever the object type is modified or created. For manual actions, this means that the action menu is always enabled in the UI.

3.6. Action Fields and Views

In some cases it is necessary for the user to enter additional information when a manual action is invoked. For example, if you are developing a "Create ticket" action, you may need to allow the user to select a Priority for the ticket that is to be created. You do this by creating an action field. Action fields are managed through the Resilient web application (Administrator Settings > Actions > Action Fields).

The following figure illustrates the creation of a Ticket Priority field that is later added to a manual action layout. It is a select field that has four values, Low, Medium, High and Critical. The field value is required.

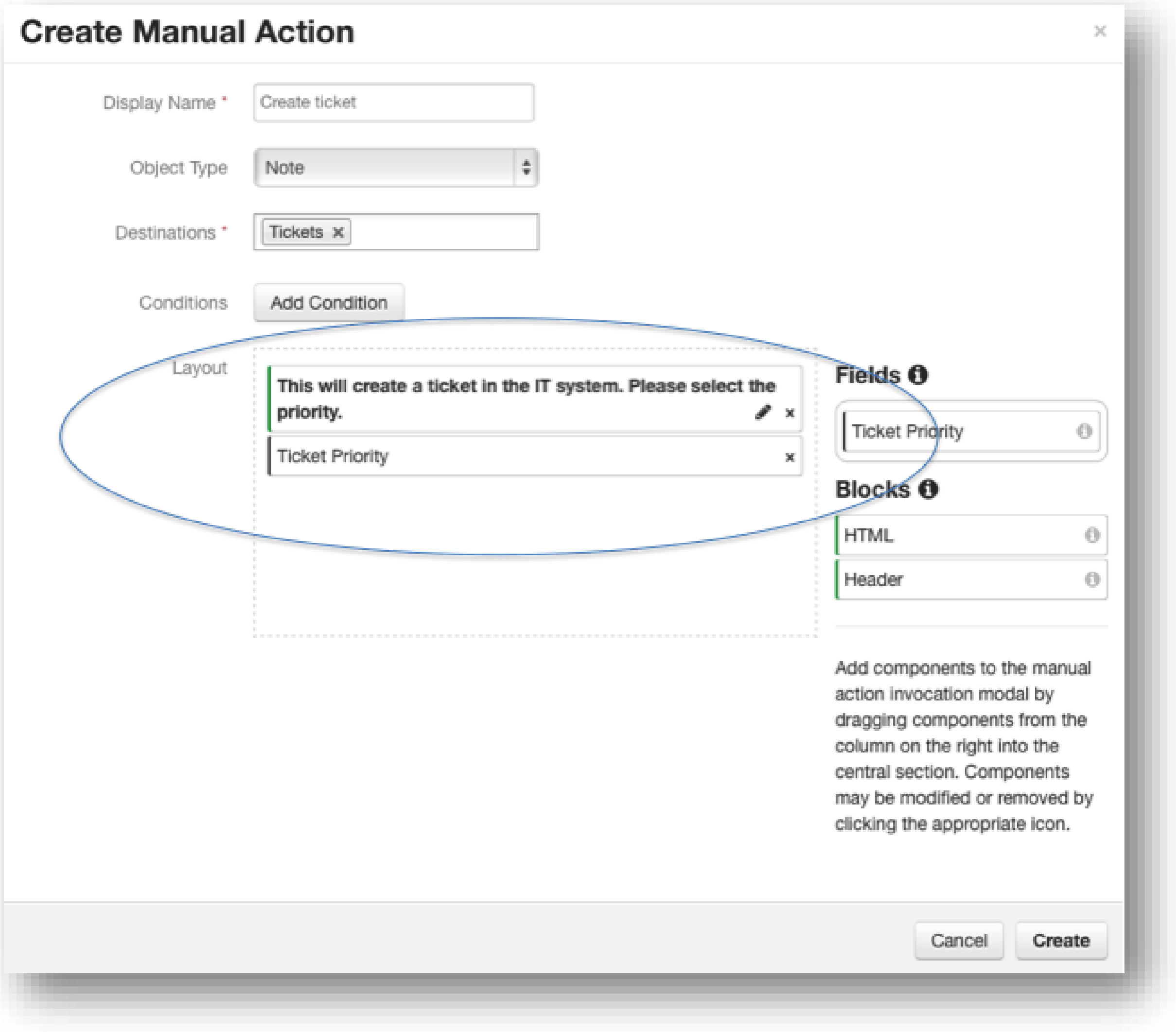


What is the label for this Field? * Ticket Priority
API Access Name * ticket_priority
What type of field is this? Select
Requirement: Always
Tooltip: The priority of the created ticket

Values
Low
Medium
High
Critical

Advanced UI? Yes
Blank Option: No
Default Value: Medium

After the field has been created, it can be added to one or more manual actions. The next figure shows how you add the field to the manual action's layout. The layout can also contain a "header" that gives the user some additional information, also shown in the figure.


Create Manual Action

Display Name *	Create ticket
Object Type	Note
Destinations *	Tickets
Conditions	Add Condition
Layout	This will create a ticket in the IT system. Please select the priority.
	Ticket Priority

Fields
Ticket Priority

Blocks
HTML
Header

Add components to the manual action invocation modal by dragging components from the column on the right into the central section. Components may be modified or removed by clicking the appropriate icon.

3.7. Action Data

Messages contain JSON data. The structure of the JSON data is described in the Resilient REST API documentation in the ActionDataDTO type. This structure contains much of the data that you need to implement with your action processors. However, if there is additional Resilient data that you require, you can access it using the Resilient REST API. See the Using the Resilient REST API section for considerations when doing this.

The following table describes the top-level properties in the ActionDataDTO type. For specific information about this type, consult the Resilient REST API documentation.

Field Name	Description
action_id	ID of the action that caused the message.
type_id	Type of object that caused the message. The types and their associated IDs are available through the REST API with the "/rest/orgs/{orgId}/types" endpoint.
incident	Incident object to which the invocation applies. Note that this value will be set for items that are subordinate to incidents. It is currently the case that all messages will contain an incident.
task	Task to which the invocation applies (if any). Note that this value will be set for items that are subordinate to tasks, such as task notes and task attachments.
artifact	Artifact to which the invocation applies (if any).
note	Note to which the invocation applies (if any).
milestone	Milestone to which the invocation applies (if any).
attachment	Attachment to which the invocation applies (if any).
type_info	Contains information about types/fields that are referenced by the other data. See the Action Data and Type Information section for more information.
properties	Contains the field values the user selected when invoking a manual action (if any).
user	Contains information about the user that invoked the action.

3.8. Action Data and Type Information

The data specified in the incident, task, artifact, note, milestone and attachment fields generally contains only ID values of objects they reference. For example, the incident "severity_code" field is a select list. The "incident.severity_code" value specified in the message data contains an integer (the severity ID). If your processor needs the severity text that was actually selected, you can get it from the type_info field.

```
# Python example of retrieving severity text from type_info

# Convert message text into a dictionary object
json_obj = json.loads(message)

# Get severity_code from the incident
```

```
sev_id = json_obj['incident']['severity_code']

# Use type_info to get the severity's text value
sev_field = json_obj['type_info'] \
  ['incident'] \
  ['fields'] \
  ['severity_code']

text = sev_field['values'][str(sev_id)]['label']

print "Severity text is %s" % text
```

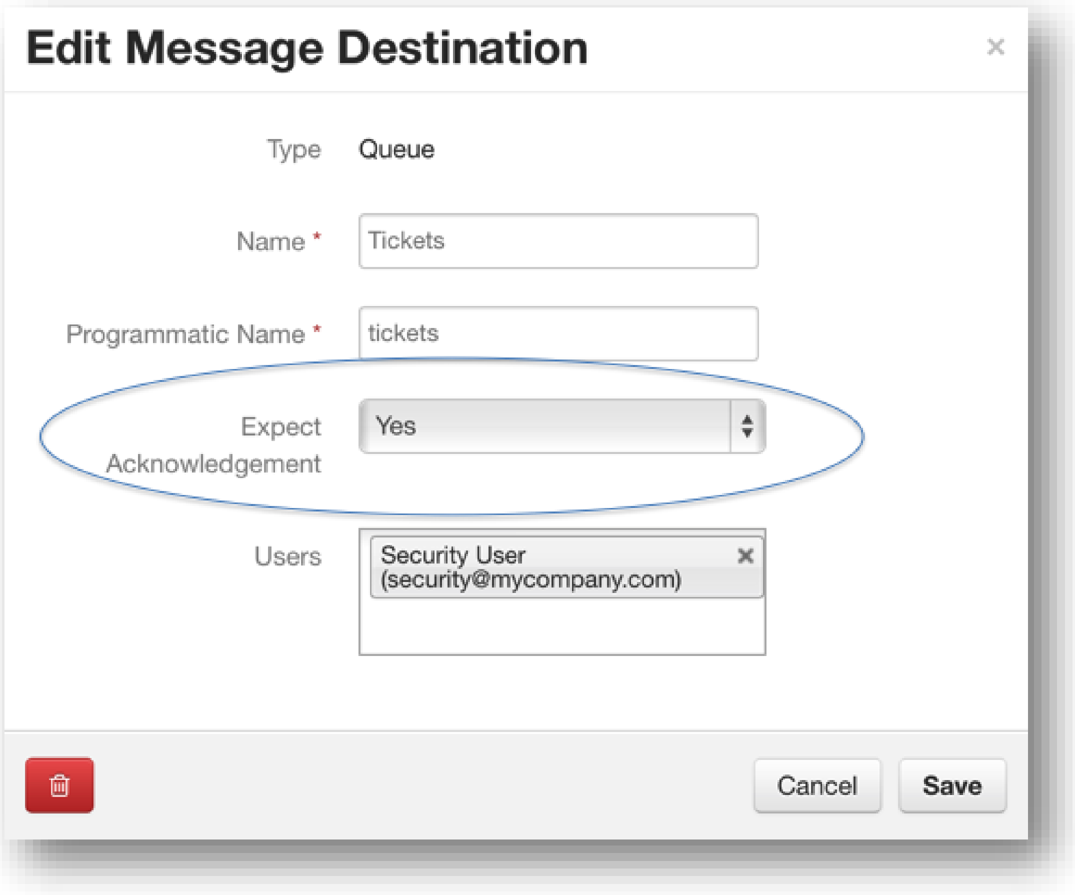
3.9. Message Headers

The Resilient platform includes various message headers that are needed (or in some cases just helpful) in processing messages.

Header Name	Request/Reply	Description
Co3ContextToken	Request	A token value that must be specified if the action processor calls back into the Resilient REST API. The primary purpose of this token is to ensure that actions processing does not result in an infinite loop. See the Using the Resilient REST API with Action Processors section for additional information.
correlation-id	Request and Reply	Identifies the action invocation to which this message applies. It must be included in acknowledgement messages sent back to the Resilient platform. See the Acknowledgements section for additional information. If you are using a JMS client, this value can be retrieved with the getJMSCorrelationID method.
reply-to	Request	Identifies a server-controlled message queue that must be used when acknowledging (replying to) this message. See the Acknowledgements section for additional information. If using a JMS client, this value can be retrieved with the getJMSReplyTo method.
Co3InvocationComplete	Reply	A boolean header that tells the Resilient platform whether processing is complete. The default is true, so you only need to include it if you are sending an informational message and it is not complete. This header is ignored if the reply message is JSON.

3.10. Acknowledgements

Some action processors consume messages and silently process them without returning any indication of progress or status to the Resilient platform ("fire and forget"). Other action processors return an acknowledgement when they have completed the processing of a message ("request/response"). The Resilient platform supports either mode of operation through the Expect Acknowledgement setting of the message destination, as shown in the following figure.


Edit Message Destination

Type Queue

Name * Tickets

Programmatic Name * tickets

Expect Acknowledgement Yes

Users Security User (security@mycompany.com)

When a message destination is configured with an Expect Acknowledgement value of Yes, the list of executed actions in the Resilient UI shows messages/invocations as Pending until the expected acknowledgement is received. If an acknowledgement is not received within 24 hours, the Resilient platform displays it as an error. You can see the list of actions invoked on an incident by selecting the Actions > Action Status option from the incident view.

If the message destination is configured with an Expect Acknowledgement value of No, the action immediately displays with a status of Completed.

The following is a partial example of how to send a reply using the stomp.py Python library:

```
# Simple reply using Python
class MyListener(object):
  def __init__(self, conn):
    self.conn = conn

  def on_message(self, headers, message):
    reply_headers = {'correlation-id': headers['correlation_id']}
    reply_to = headers['reply-to']
    reply_msg = "Processing complete"

    conn.send(reply_to, reply_msg, reply_headers)
```

The Resilient platform accepts either JSON or just a simple text string for reply messages. Simple plain text reply messages are a way to provide a success acknowledgement with minimal effort. You can also use a more descriptive JSON string value, which is parsed by the server.

The format for the JSON messages is included in the Resilient REST API documentation (see the ActionAcknowledgementDTO type). For convenience, the following table illustrates sample values for error and informational reply messages.

Reply Type	Example JSON
Error	{"message_type": 1, "message": "Some error occurred ...", "complete": true}
Information	{"message_type": 0, "message": "Started processing", "complete": false}
Completed	{"message_type": 0, "message": "Completed processing", "complete": true}

Processors can send reply messages, even if they are not expected. This allows informational or error messages to be returned even if no reply is expected. You may choose to utilize this behavior if you expect that the processors will rarely fail. Unexpected replies are displayed in the Action Status screen just as they are for expected ones.

3.11. TLS

Action processors must connect to the Resilient message broker using TLS v1.0 or higher. To ensure the security of the connection, action processors must properly validate the server certificate. The exact mechanisms for doing this varies by programming environment and is beyond the scope of this document. However, the following must be considered:

1. Is the certificate chain presented by the server *trusted*?
2. Is the certificate signature correct?
3. Has the certificate *expired*?
4. Was the certificate issued to the site to which the connection was made? That is, does the certificate's common name or subjectAltName match the connected server's name?

Some of the common JMS libraries for Java do not perform checking on the certificate name (#4 above). We have developed a workaround for this, which is used in the Java examples.

3.12. Using the Resilient REST API with Action Processors

Resilient action processors can make use of the Resilient REST API to update incidents, retrieve additional information not included in the action message data, etc.

The only restriction is that when making REST API requests you must specify the X-Co3ContextToken HTTP header. The value to specify in this header is passed as the Co3ContextToken message header.

This ensures that any modifications done through the API do not cause an infinite loop of message invocations. For example, if an incident action has no conditions specified then it triggers every time the incident is saved. If the downstream action processor itself saves the incident, then you might end up in a never-ending loop. The X-Co3ContextToken HTTP header tells the server to skip the action that generated the original message.

```
# Use Resilient REST API from Python processor
class MyListener(object):
  def __init__(self, conn):
    self.conn = conn
    self.client = co3.SimpleClient(...)

  def on_message(self, headers, message):
    # Get the token from the message header, set into client object
    self.client.context_header = headers['Co3ContextToken']
    message_obj = json.loads(message)

    inc_id = message_obj['incident']['id']
    url = "/incidents/{}/comments".format(inc_id)
    comment_data = {'text': 'Some comment for the incident'}

    # Create the comment
    self.client.post(url, comment_data)
```

Note that the above code is using the SimpleClient class that is included with the examples. SimpleClient provides post, put and delete methods that take the token as an argument. See the example processor code for additional details.

3.13. HTTP Conflict (409) Errors

It is possible for the Resilient platform to return an HTTP Conflict (409) status when updating (performing an HTTP PUT on) incidents using the REST API. This status code indicates that the incident you are modifying has changed since you last read it. Your processor must be written to handle this situation, generally by re-reading the incident object (using an HTTP GET), re-applying your changes and re-issuing the PUT.

The Resilient examples have accounted for this issue where necessary.

3.14. Using a Framework

There are frameworks that may simplify the development of Resilient action processors. You may want to investigate tools that may simplify the creation of action processors, which generally follows typical "Enterprise Integration Patterns". See the following table for ESB and ESB-like frameworks worthy of investigation.

NOTE: See http://www.enterpriseintegrationpatterns.com for more information about Enterprise Integration patterns.

Product	Language	Description
Apache Camel **http://camel.apache.org/**	Java	An open source framework for creating processing routes. For example, a route might: • Read a message from a queue (Resilient message destination) • Convert the message payload from a JSON string to an object • Invoke an HTTP POST on some external service • Send a reply back to the Resilient platform Most of this can be done through XML- or DSL-based configurations. There is an example of how you can use Apache Camel in the Resilient API examples distribution.
Apache ServiceMix ESB **http://servicemix.apache.org/**	Java	ServiceMix is an OSGi-based Enterprise Service Bus (ESB). ServiceMix can work seamlessly with Apache Camel to simplify route creation.
Mulesoft ESB **http://www.mulesoft.com**	Java	A commercial Enterprise Service Bus (ESB) that allows you to graphically create action processors using a number of built-in connectors. There is an example of how you can use Mulesoft in the Resilient API examples distribution.
Spring Integration **http://projects.spring.io/spring-integration/**	Java	Extends the Spring programming model to support Enterprise Integration Patterns.
Zato ESB **https://zato.io**	Python	An open source Python-based Enterprise Service Bus (ESB).

3.15. Always Running

It is easy to write an Action Module processor script that uses the Action Module to read action messages and perform some operation. When you are developing the script, it is fine to simply run it from the command line. However, when you exit the shell or log out of your desktop session, the program exits.

We advise that you consider in advance how you are going to ensure that the program remains running when the Action Module processor is deployed in the production environment.

If using Python, you might consider using the python-daemon library (Python 2) or python-daemon-3K (Python 3).

If using Java, you might consider using the Apache Commons Daemon project (http://commons.apache.org/proper/commons-daemon/).

3.16. Retry

You should consider how your Action Module processor handles situations where external systems (including the Resilient platform itself) are inaccessible.

It is generally desirable for Action Module processors to indefinitely retry their connection to the message destination. Indefinitely retrying to reconnect every 30-60 seconds is reasonable.

If other downstream operations fail, you need to decide how to proceed. It may be sufficient to simply fail the operation and send a response message to the Resilient platform indicating the failure, where these messages appear in the Action Status page.

This is one area where an integration framework can help. They generally have built-in support for error handling. For an example, see the Resilient Action Module Apache Camel example in the Resilient API distribution.

3.17. Processor Installation

Action processors are frequently written to assume the existence of certain message destinations and actions. You can create these dependencies using one of the following methods:

1. Create them manually using the web application.
2. Write a program that uses the Resilient REST API to create them.
3. Use the action-install.py Python script that is included in the Resilient examples.

#3 is recommended because it reduces the chance of errors during deployment of your Action Module processor.

4. Testing Considerations

Many of the design considerations discussed in the previous section lead to useful test cases. For example, the discussion on Retry leads a tester to a number of test cases dealing with how the Action Module processor handles situations where other systems are not running or return errors.

This section contains test cases that serve as a starting point for testing of an Action Module processor.

4.1. TLS

The Action Module processors connect to the Resilient platform using TLS. This applies to both the connection to the message destination (STOMP over TLS and Active MQ/OpenWire over TLS) and the Resilient REST API (HTTPS).

The TLS subsection in the

Design Considerations section discusses this in detail. This section includes some guidance on how you can test that TLS connections are properly established.

4.1.1. Certificate Trust

When you invoke the Action Module processor, you must confirm that a "man-in-the-middle certificate attack" causes an error and that no data is sent over the connection. The second part of that statement is important because it would be possible for bad code to establish a connection, send passwords *then* check for certificate trust. Sending the password over an untrusted channel would be a security vulnerability.

The simplest way to test this is to configure the client (Action Module processor in this case) to NOT trust the Resilient platform certificate and confirm that the operation fails due to a TLS error.

4.1.2. Certificate Common Name

If an Action Module processor thinks it is connecting to a host named "Resilient.mycompany.com" then it is important that the TLS certificate is issued to "Resilient.mycompany.com". If not and you proceed sending data, it is possible for a man-in-the-middle to present a certificate that was issued by a trusted source, but issued to a different entity (e.g., maybe it was issued to www.someothercompany.com). The accepted best practice for a TLS client to guard against this attack is to check that the certificate's common name (or subjectAltName) matches the host to which the connection is being made.

The simplest way to test this is to change your local hosts file to make "testhost" point to the Resilient platform's IP address, then try to connect using testhost. The connection should fail. Note that this should be performed against both the Resilient REST API (port 443) and the Action Module server (port 65000 and/or 65001).

4.2. Retry/Error Reporting

It is important for the Action Module processor to continue operating in the face of exceptions. The following should be tested:

- Does the Action Module processor have a log file?
- Does the Action Module processor report errors from external systems?
- Does the Action Module processor continue running when the Resilient platform is down?

4.3. Always Running

The Action Module processor should generally be running.

- Does the Action Module processor start automatically when the host on which it runs is restart?
- Does the Action Module processor process survive a user log out?

4.4. Conflicting Edits

If the Action Module processor updates the Resilient platform using the REST API, it must be written to handle situations where another user edits the same object.

- Has this situation been accounted for by the developer?
- If you invoke an action when the Action Module processor is stopped, then make another change to the object (say an incident), then start the Action Module processor. Does the Action Module processor properly update the incident? Note: If it is not handled by the developer, then you would likely get an error when the processor attempts to do the PUT operation.

4.5. Action Status Sent

Does the Action Module processor send a status or error message to the Resilient platform as appropriate? These status messages appear in the Actions > Action Status dialog.

4.6. Infinite Loops

Is it possible for the Action Module processor to get into an infinite loop? See the Co3ContextToken discussion in the Message Headers section.

4.7. Others?

If there are other elements of the Action Module processor that you think could be mentioned here, we'd love your feedback! Please contact us at success@resilientsystems.com.

5. Customer Success

If you need support in creating Action Module processors, please contact someone in our Customer Success group at success@resilientsystems.com.