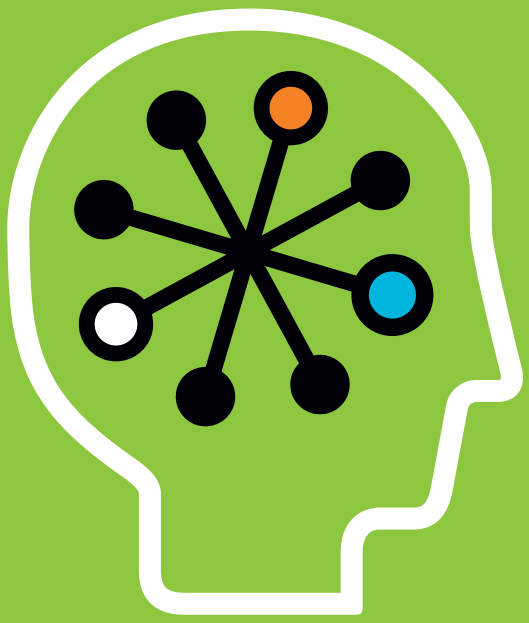

HP NNMi: the "i" is for integration.

White paper

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Executive summary

In many cases, the economic benefit of network management software is increased through integrations with other management software platforms. For example, integrations between application performance tools and network management tools can reduce the mean-time-to-repair network causing application performance issues by providing end-to-end views. Furthermore, integrations can support best-practice process frameworks, such as IT Infrastructure Library (ITIL) v3, which enables IT to optimize the utilization of people, process, and technology. Finally, companies may have standardized on specific management software platforms (e.g., service desk, CMDB), and integrations allow them to leverage those existing investments in support of their existing processes.

HP Software has developed HP Network Node Manager (NNMi) software with increased integration capabilities. In addition to providing a rich set of out-of-the-box integrations for HP Software and third-party platforms, HP NNMi includes several supported mechanisms for developing rich integrations. These additional mechanisms are classified as Level 1, Level 2, or Level 3 based on the degree of development effort and skill. The definitions for these levels are as follows:

- **Level 1**—integrations utilize uniform resource locator (URL) mechanisms. They require low investment and technical skill to implement. However, Level 1 integrations enable a broad range of use cases including the following: context sensitive launch into another HP product, third-party product, in-house URL addressable tool, specific HP NNMi views (tables and maps), and device details from another product.
- **Level 2**—integrations utilize HP NNMi automated actions. These integrations require a medium level of investment and technical skill. Examples of Level 2 integrations include: sending an e-mail based on key HP NNMi events, enrichment of events triggered by lifecycle changes to HP NNMi events, and/or HP Network Automation tasks triggered by HP NNMi events.
- **Level 3**—integrations are the most advanced and utilize the Web services-based API. These integrations typically require some level of programming via Java™, C#, and/or Perl. Examples of Level 3 integrations include bidirectional integrations with event consolidation platforms, trouble ticketing systems, and/or configuration management databases (CMDBs).

The purpose of this paper is to provide the following:

- An overview of the value, use cases, and features for the HP supported out-of-the-box integrations (see Figure 1)
- Detailed information about the Level 1, Level 2, and Level 3 integration capabilities such that customers can reasonably estimate the level of effort required for various custom integrations
- Specific examples of common integrations to HP NNMi (i.e., event consolidator and service desk/trouble ticketing system), which can be used as the basis for developing those integrations with third-party products.

HP NNMi software integrations (supported out of the box)

Figure 1. Business Service Management showing HP NNMi integrations

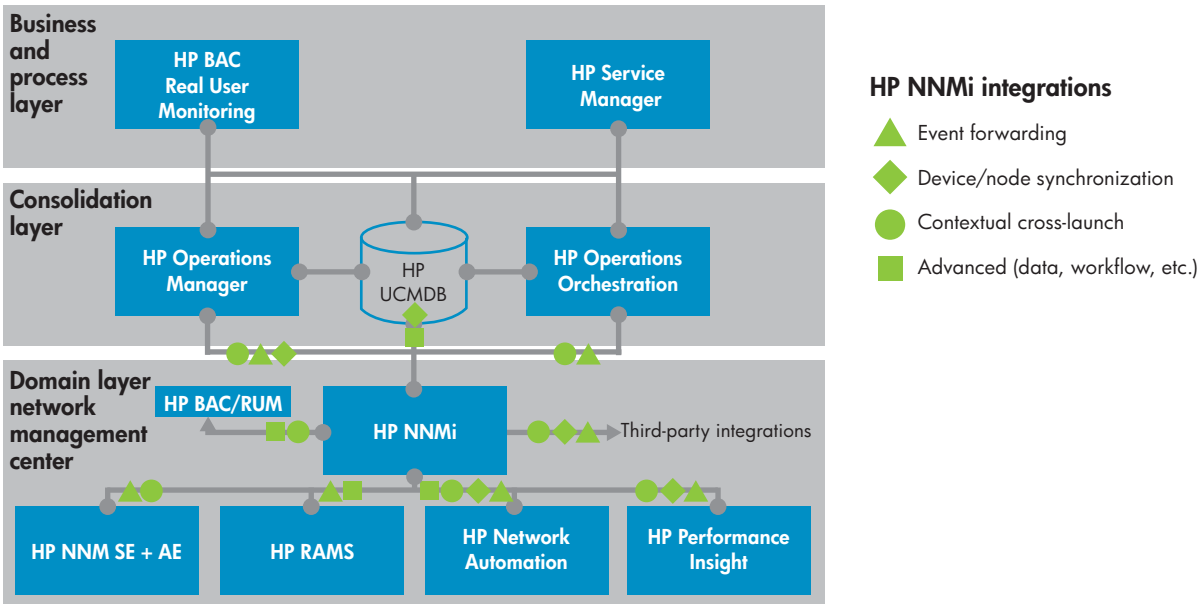


Figure 1 depicts a sample architecture of the HP Business Service Management (BSM) solution. The HP BSM solution is comprised of a business and process layer, a consolidation layer, and a domain layer. The domain layer encompasses the HP Network Lifecycle Management solution, which provides unified automation across network fault, availability, performance, and configuration management.

As a supplement to Figure 1, the following sections describe the use cases, features and value of the HP NNMi integrations in support of the HP BSM and Network Lifecycle Management (NLM) solutions.

HP NNMi integrations for Business Service Management

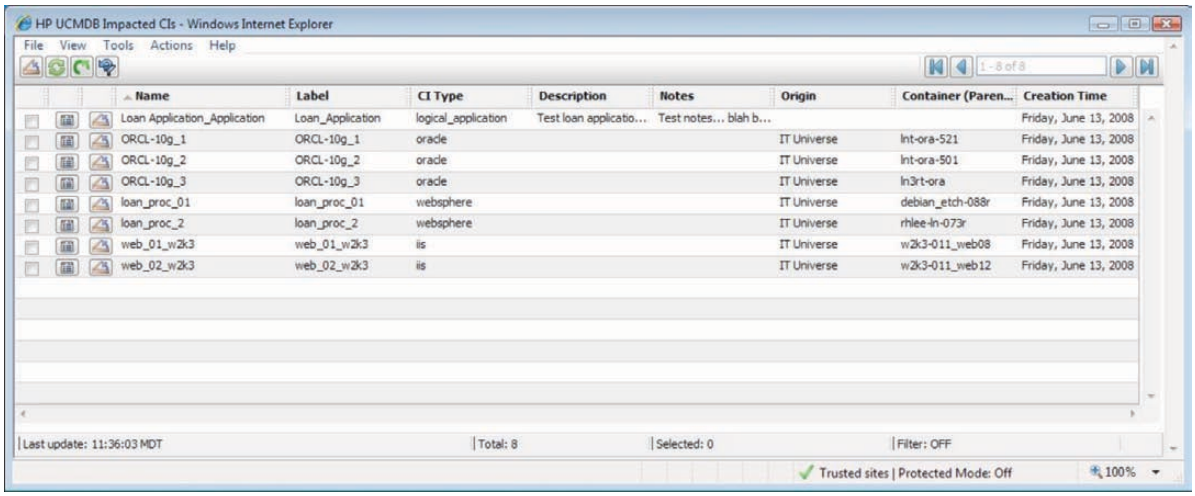
HP NNMi + HP UCMDB

There are essentially two components to the HP NNMi + HP UCMDB integration. The first component features HP NNMi as the authoritative discovery source for network configuration items and their relationships for the universal configuration management database (UCMDB). In other words, the UCMDB utilizes HP NNMi as a federated discovery source for network configuration items (CIs) and their relationships. This integration then supports the following use cases:

- Having network CIs within the HP UCMDB allows ITIL processes (incident, change, release) to include network configuration items. For example, HP Release Control Manager can perform automated collision and risk analysis inclusive of network CIs for change requests.
- This integration also facilitates the automatic creation of service dependency maps within HP Operations Manager to include network CIs. Therefore, operators managing through HP Operations Manager can visualize application and service impacts for network faults, which ultimately improves the accuracy of trouble ticket assignment and thus, the efficiency of IT.

The second component of the HP NNMi + HP UCMDB integration provides for application-aware network management. It allows network operators using HP NNMi to query the HP UCMDB for impacted services and applications that are associated with network faults. This enables network operations to prioritize its reaction to specific network faults based on business impact and can reduce mean time to repair (MTTR) for business-critical applications. Figure 2 provides a screen shot illustrating this use case.

Figure 2. HP NNMi screenshot showing impacted dependent services of network fault



HP NNMi + HP Operations Manager

The HP NNMi + HP Operations Manager integration supports a manager of manager (MOM) architecture for consolidation of incidents from multiple HP NNMi systems to HP Operations Manager. Consolidating incidents from HP NNMi and other monitoring platforms to HP Operations Manager, enables cross-domain operations management, which can reduce costs and improve efficiencies.

This integration includes features to synchronize the lifecycle state of incidents (e.g., open, closed, etc.) and to enable cross-launching from HP Operations Manager to HP NNMi in the context of the incident or affected device. Furthermore, the integration includes features to monitor the connection between HP NNMi and HP Operations Manager and will resynchronize incidents if the connection is interrupted.

HP Operations Manager will also map HP NNMi incidents to Service Navigator service dependency maps, which enables operators to determine the root cause of service impacts across a diverse set of infrastructure.

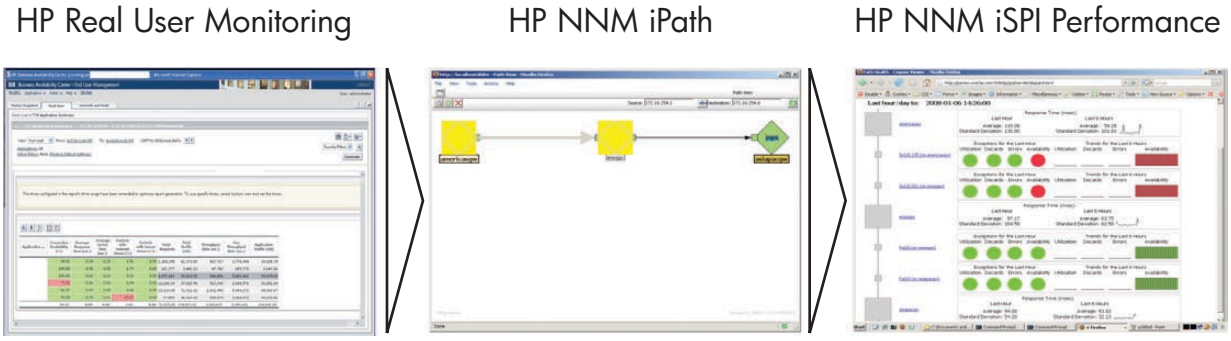
HP NNMi + HP Real User Monitor

The HP NNMi + HP Real User Monitor integration supports another use case for application-aware network management. This integration supports a top-down workflow where operators are able to contextually launch from HP Real User Monitor views to HP NNM iPath views. This integration reduces the time that IT staff, specifically application support and network operations, spend in "war rooms" working to solve complex cross-domain application performance issues. This integration is illustrated in Figure 3, which shows the supported workflow sequence.

HP NNMi + HP Operations Orchestration

The HP NNMi + HP Operations Orchestration integration helps reduce the time that an operator takes to obtain common diagnostic reports. This can be achieved either manually or automatically based on an incident configuration. With some simple "HP Operations Orchestration" flows provided with the embedded HP Operations Orchestration engine, operators can easily enrich common network issues with critical diagnostic information. For example, based on an "Interface Down" incident, this integration can automatically log into the device and do a "show interface" command. While the primary use case is to automatically launch a flow from an incoming incident, the same flows may be triggered by manual operator action. Because previously run flows can be referenced from an incident or device, baselining can be performed to provide for later comparison against anomalous conditions.

Figure 3.



HP NNMi integrations for network lifecycle management

HP NNMi + HP Network Automation

The HP NNMi + HP Network Automation integration includes a broad set of features that increase operator efficiency, reduce the cost of ownership, and increase service levels. For example, the integration allows HP Network Automation to automatically set an "out of service" state on network devices when those devices are scheduled for maintenance via HP Network Automation. Then, HP Network Automation is able to restore the active state on those devices within HP NNMi once the maintenance window is complete. This results in the avoidance of any false alarms during planned maintenance activities.

Also, the integration supports a broad set of contextual-based, cross-launching capabilities that improves operator productivity and reduces mean time to repair. HP NNMi operators are provided with a seamless workflow to analyze change and configuration data while troubleshooting network fault and performance problems. Following are some examples of supported use cases:

- From HP NNMi, HP Network Automation may be launched in the context of a node or an incident to:
  - View HP Network Automation device Information.
  - View HP Network Automation device Configuration.
  - View HP Network Automation device Configuration Diffs.
  - View HP Network Automation device Configuration History.
  - View HP Network Automation device compliance reports.
  - Run/view HP Network Automation defined diagnostics.
- HP NNMi operators can access devices via HP Network Automation telnet and SSH functions.

The HP NNMi + HP Network Automation integration also combines the power of HP NNMi's topology with HP Network Automation's device configuration information for proactive network management. For example, based on "new" or "changed-node" notifications from HP Network Automation, HP NNMi will automatically interrogate all connected network links on that device for duplex mismatch conditions. HP NNMi maintains the layer 2 connectivity for the interfaces on each end of these links and HP Network Automation maintains the duplex configuration settings for each interface—so together HP NNMi and HP Network Automation are able to automatically audit the network for this condition.

Additional features of the HP NNMi + HP Network Automation integration include the following:

- HP NNMi/HP Network Automation co-existence on a single server
- HP Network Automation passing new devices to HP NNMi as seeds
- HP Network Automation changing a device creates a change trap sent to HP NNM, as well as calls HP NNMi's Web service to rediscover the device
- When HP Network Automation configures SNMP community strings on devices, configure HP NNMi to utilize the community strings.
- When HP Network Automation configures a new device, apply settings for better manageability from HP NNMi (ACLs, etc.).

HP NNM iSPI for Performance + HP Performance Insight

The HP NNM iSPI for Performance provides operational network performance monitoring for up to 70 days' worth of data. After that time, the data can be forwarded to HP Performance Insight for long-term data retention, reporting, and trending. Together these use cases drive increased service levels as both fine-grained short-term and long-term negative performance trends can be identified before they impact services. Furthermore, because the HP NNM iSPI for Performance utilizes HP NNMi's polling process, double polling of the network for performance data is reduced—preserving precious network bandwidth.

HP NNMi + HP Route Analytics Management System (RAMS)

The HP NNMi + HP RAMS integration provides that the unique value of HP RAMS real-time management capabilities are leveraged by HP NNMi. First of all, HP RAMS forwards its traps to HP NNMi. HP RAMS is able to detect unique routing conditions, in real-time—such as the following: routing adjacency losses or routing prefix changes. These traps are forwarded to HP NNMi and presented to HP NNMi operators. Also the integration enables that the HP NNM iPath views contain an accurate layer 3 routing topology, which is provided to HP NNMi by HP RAMS. This means that iPath is aware of multi-path configurations (e.g., ECMP) and thus, provides the true path between points across the network for accurate troubleshooting.

HP NNMi integration capabilities

As described above, HP NNMi supports three levels of integration mechanisms, which vary by development effort and skill. This section provides a detailed review of each level so that customers can estimate the level of effort required for various custom integrations.

Level 1 integration capabilities

Contextual cross launching is one of the more powerful yet simple features of the HP NNMi's integration capabilities. URL-based launching can be accomplished in either direction. In other words, it is possible to launch another application, passing various attributes of the current selection from the HP NNMi console and to launch to specific HP NNMi views (tables, maps, object details, etc.) from an application by launching a browser page with the contextual details passed as URL parameters.

Integration mechanism	URL contextual cross launch, no additional license required
Deployment skills required	Administrator level with basic knowledge in formatting URL requests
Common examples/use cases	1. Launch a diagnostic report from a selected incident or node. 2. View network device details from a configuration management database.
Advanced use cases	1. Conditionally launch an application based on custom device attributes. 2. Launch a path view given two end points in the network.

Level 2 integration capabilities

With minimal scripting abilities, significant automation can be achieved by triggering actions based on incoming incidents or lifecycle updates to incidents. Automatic action configuration is included with HP NNMi. Simply write a script that performs some automated task that you'd like to run when a specific event is triggered in HP NNMi, configure that event type to launch your script, deploy the script, and you're done!

Integration mechanism	Automatic Actions, no additional license required
Deployment skills required	Primarily form-based configuration Scripting for automated actions requires knowledge of Jython or Perl.
Common examples/use cases	• Send an e-mail when a node goes down.
Advanced use cases	• Automatically gather diagnostics for a device based on an event type.

Level 3 integration capabilities

The most powerful features of the HP NNMi developer's toolkit are available as Web services. An array of capabilities allow programmatic access to HP NNMi's network topology inventory objects, incidents, notifications, Simple Network Management Protocol (SNMP) stack, and more.

Integration mechanism	Web service API, requires HP NNMi software developers kit license
Deployment skills required	Programming using Java, C#, Perl, or other platform that supports Web services.
Common examples/use cases	• Read HP NNMi's discovered network topology.
	• Hint a network device to HP NNMi's discovery process as device is provisioned.
Advanced use cases	• Temporarily pause HP NNMi polling a device during a scheduled maintenance window. • Query for and subscribe to the HP NNMi incident stream. • Query for objects in the HP NNMi topology inventory (nodes, interfaces, addresses, subnets, connections, VLANS, node groups) and subscribe to node notifications. • Inject incidents and conclusions. • Obtain and update HP NNMi SNMP communication settings and perform SNMP queries.

Third-party integrations (supported out of the box)

HP NNMi also supports integration with third-party products in alignment with HP NNM's tradition of participating in and supporting a broad management software ecosystem. Following are descriptions of third-party integrations with HP NNMi.

HP NNMi + NetScout nGenius
The HP NNMi + NetScout integration is another integration supporting application-aware network management. With this integration network operators can detect, locate, and diagnose network causing application performance issues down to the level of which application or hosts may be causing network congestion. The supported features of this integration include the following:

- Trap forwarding from NetScout nGenius to HP NNMi
- HP NNMi node status is affected by nGenius alerts.
- HP NNMi contextual based cross-launching to nGenius performance reports

HP NNMi + Alarmpoint Express
The HP NNMi + Alarmpoint integration extends the value of HP NNMi by providing integrated proactive remote notification services (e.g., e-mail, paging, SMS, etc.) for network operators. Supported features of this integration include bidirectional incident synchronization (i.e., lifecycle state, acknowledgement, and incident annotations).

Summary

Integrations can extend the value of HP NNMi software by enabling advanced diagnostic workflows and through the support of best-practice frameworks such ITIL v3. HP NNMi was developed with increased integration capabilities designed to improve service levels while increasing the efficiency and productivity of IT staff. HP NNMi supports a broad and rich set of out-of-the-box integrations for The HP Business Service Management solution and HP Network Lifecycle Management solution. Also, HP NNMi includes flexible integration mechanisms for developing custom integrations so that HP NNMi can be incorporated into a company's existing management framework.

Suggestions for additional reading

For more details, refer to the HP NNMi Developer's Toolkit documentation. The HP NNMi Developer Toolkit contains information about both the runtime capabilities as well as detailed descriptions of the Web services APIs complete with sample projects with Java source and deployable binaries.

See the HP NNMi Help **(Help for Administrators > Extending HP NNM AE Capabilities)** for more details on URL Actions and integration menu options in the HP NNMi console.

See the HP NNMi Help **(Help for Administrators > Integrating HP NNMi Elsewhere)** for more details on launching HP NNMi views from other applications.

For examples on launching various HP NNMi views, forms, tools, etc., see http://localhost/HP NNM/launchsamples.jsp from a system installed with HP NNMi.

See the HP NNMi Help **(Help for Administrators > Configuring Incidents > Configure and Action for an Incident)** for more details on Automatic Actions.

Appendix A

Level 1 integration examples

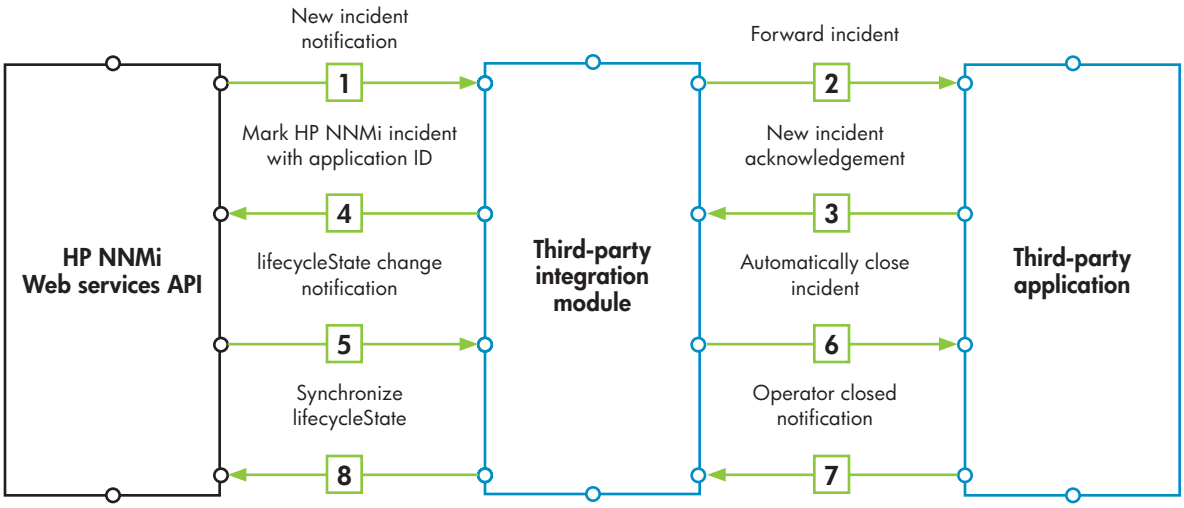
Feature/use case	Example programming
Launch a diagnostic report from a selected incident or node.	An action such as this can be configured using the 'URL Actions' configuration workspace available in the HP NNMi console. **http://myHost.com/myApp/devicereport?name=${name}**
View network device details from a configuration management database.	**http://<host>:<port>/HP NNM/launch?cmd=showForm&objtype=Node&nodename=router5500&menus=false**
Conditionally launch an application based on custom device attributes.	In addition to the standard attributes that HP NNMi provides for given devices, administrators can add "custom attributes" which may be referenced in URL Actions as shown below. ${customAttributes[name=com.my.protocol].value}:// ${customAttributes[name=com.my.host].value}: ${customAttributes[name=port].value}/myApplication This example uses custom attributes to define a URL application reference, which may be hosted on a number of alternative systems. The actual host for the application is determined at runtime from the custom attribute values of the currently selected device. Further, the value of the custom attribute may be used to configure a filter that is evaluated at runtime to determine if the menu option should be enabled or greyed out.
Launch a path view given two endpoints in the network.	This example shows how to construct a URL to launch a path view in a browser window. **http://<host>:<port>/HP NNM/launch?cmd=showPath&src=router2&dest=router4**

Level 3 integration examples

Feature/use case	Example programming
Read HP NNMi's discovered network topology.	Without showing the common details of accessing a web service, the code snippet below demonstrates how easy it is to read the nodes contained in HP NNMi's inventory: Node[] nodes=nodeService.getNodes();
Hint a network device to HP NNMi's discovery process as a device is provisioned	nodeService.addHints(newString[]{"router1","router2","15.2.1.1"});

Temporarily pause HP NNMi polling on a device during a maintenance window.	nodeService.updateManagementMode("OUTOFSERVICE");
	//perform re-configuration
	nodeService.updateManagementMode("MANAGED")

Figure 4. Incident lifecycle



Additional level 3 integration examples

The following are examples of how to program a couple of common integrations with programming tips that can be used to implement the type of integration being discussed.

Example 1: event consolidation

Event consolidation can be a very powerful integration allowing one or more HP NNMi management stations to feed critical network issues to a single management console avoiding the need to log into and continually monitor multiple alarm browsers.

Keep alarm source in-sync with state of alarm at event consolidation level.

Theory of operation

By subscribing to the HP NNMi Developer's Toolkit Incident Notification service, an integration module can receive real-time notifications of HP NNMi incidents as they appear in the Incident Browser. The integration may then call upon the services available in an event consolidation application to create a corresponding incident there and then map the ID of the created incident to the HP NNMi incident. The complete lifecycle of an incident is illustrated in Figure 4.

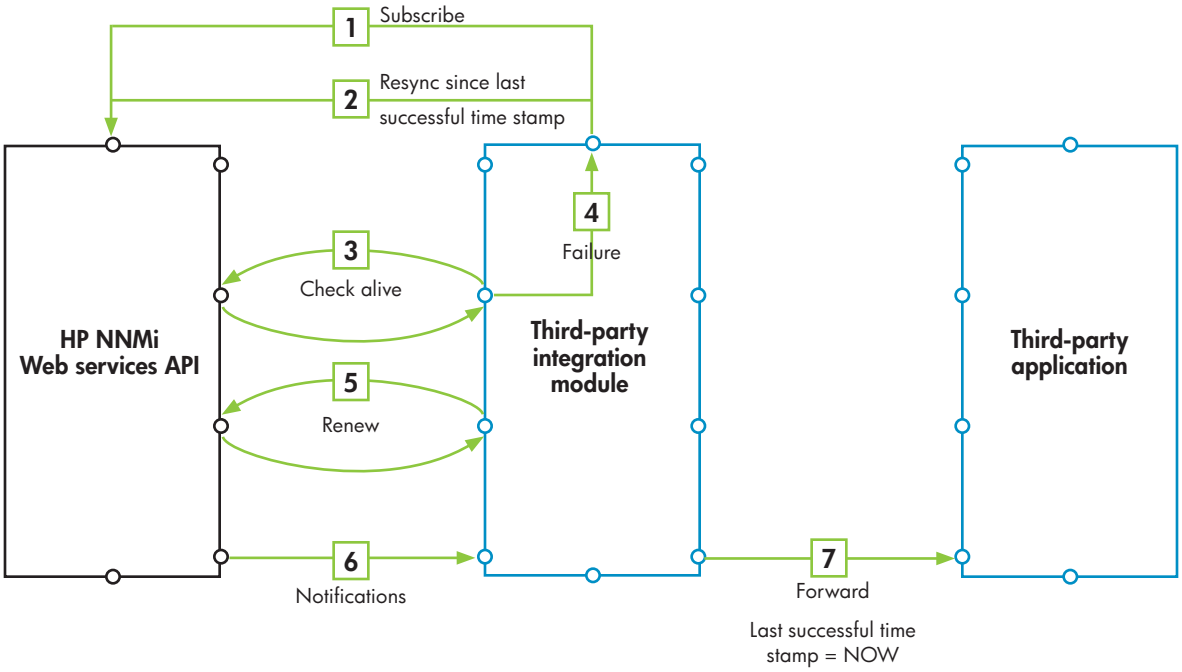
In Figure 4 above, we can see (1) the integration module receives a notification that an incident has been received in HP NNMi and that incident is then forwarded to the event consolidator (2). Upon creation of the new incident in the event consolidator, a response is received with the ID from the event consolidator (3) and this ID is then associated with the HP NNMi incident (4). This is accomplished by adding a custom incident attribute (CIA) to the original HP NNMi incident to contain the event consolidator incident ID.

After some time, the HP NNMi incident may become closed (either automatically by the software or by user action) and this notification is then sent to the integration module (5) who may then close the incident in the event consolidator (6). The reverse is also possible. If the event is closed in the event consolidator and the integration module is either polling for or subscribing to such updates from the event consolidator (7), it may then update the lifecycleState of the corresponding incident in HP NNMi (8). Note, for this bi-directional update capability, it is necessary that the event consolidator provide a means to persist the HP NNMi incident ID so that when the closed event is detected by the integration module, it can retrieve this ID and use it to update the HP NNMi incident.

Next let's examine some of the process flow details in using the HP NNMi Web services. Figure 5 on the following page illustrates the process for subscribing and re-synchronizing with HP NNMi.

Figure 5 shows the steps required for maintaining a subscription to the HP NNMi eventing service and to keep each system (HP NNMi and the event consolidator) in sync. First, the integration module needs to subscribe to the HP NNMi Incident Notification service (1). After establishing a valid subscription, the module may need to perform a re-synchronization query (2). This may be necessary if the subscription had been lost for some reason (for example, if either application had been brought down for some time). One way to accomplish this is to use a filtered query on the HP NNMi Incident Service to retrieve all incidents since a last known time when the integration module had achieved a valid subscription. Any incidents returned from this query are those that had most likely been missed since they are between the time of a previously successful subscription and the current time where we've just started a new subscription.

Figure 5. Process flow for forwarding HP NNMi incidents to event consolidator



Next the integration module will need to establish a timer to periodically validate that the subscription is still active and well (3). If for any reason, it is detected that the subscription has failed (4), the module should re-subscribe and re-do the re-sync query to avoid missing incidents during the time that our subscription may have been down.

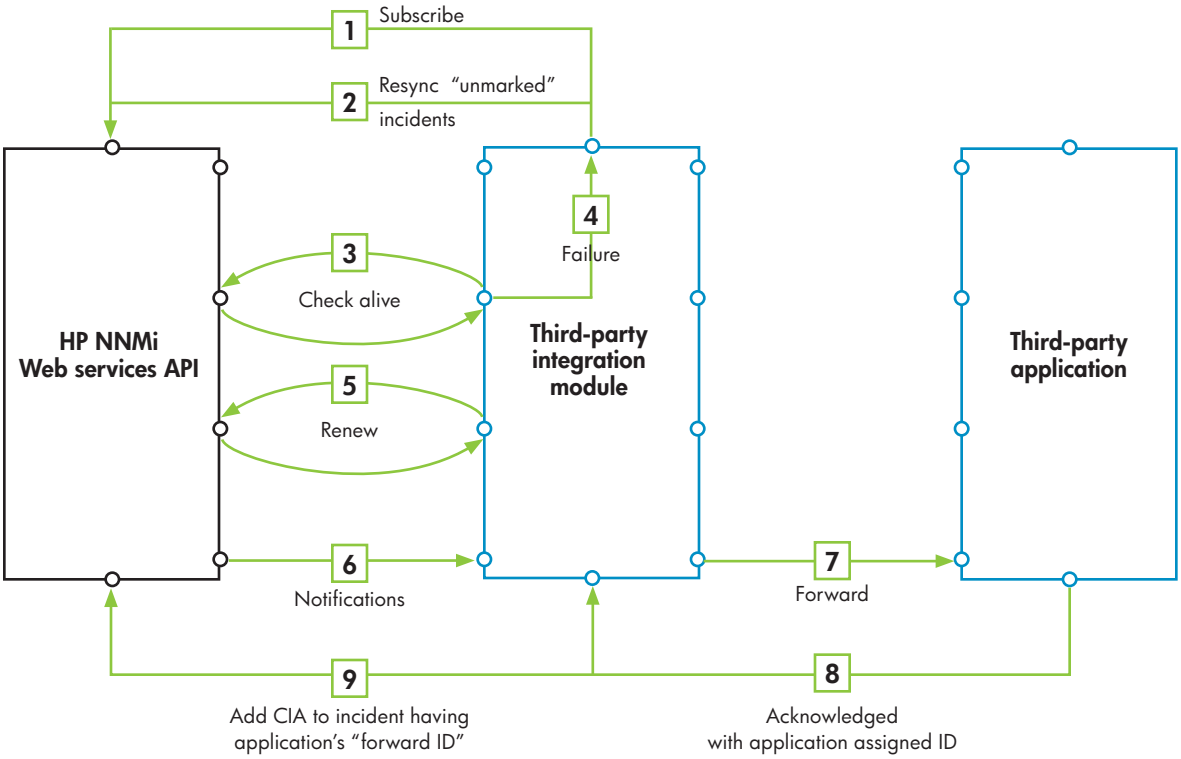
Since a subscription is not indefinite, the integration module will need to periodically renew the subscription to keep it alive (5). As notifications are received (5), the module may then forward them to the event consolidator (7) and update the last known valid subscription time (for the re-sync query) to the current time.

Figure 6 on the next page shows an alternative to using the time based re-sync query. In this case, the module is mapping the returned incident ID from the event consolidator to the HP NNMi incident using a CIA (as described earlier). With this attribute in place, we can now simply query for incidents that do not have the custom attribute for our re-synchronization (2). Any incidents that do not have the CIA mapping the incident as having been forwarded, are missed incidents that should now be forwarded.

Another option for this type of integration would be to provide an operator working in the event consolidator a means to quickly launch to the details of the HP NNMi incident, source node, or source object for the incident or to launch to the event consolidator incident details from the HP NNMi incident browser. For the former, we can provide URL Launch capability to the event consolidator incident by creating a URL Action that references the event consolidator application and passes it the event consolidator incident ID from the CIA that we created (4). For the reverse we can create a URL launch that opens an HP NNMi view (either to the incident, the source node, or source object provided we saved these values when we created the incident in the event consolidator). Please refer to the "Contextual Cross Launch" capabilities mentioned earlier.

We have described how we would use both the HP NNMi Incident Notification service (to subscribe and renew) as well as the Incident Service (to create a CIA, update lifecycleState, and perform re-sync queries). The HP NNMi Developer's Toolkit comes with two sample client projects (wse-notification-client and wse-notification-ejb-client) that demonstrate how to subscribe and renew a subscription with the HP NNMi Incident Notification service. The wsi-inventory-client project (also included in the developer's toolkit) demonstrates how the Incident Service can be used to perform filtered queries as well as update key attributes and add custom attributes. Please examine these projects and source files for more details.

Figure 6. Alternative process flow using ID mapping



Example 2: automated trouble ticket
Similar to event consolidation, by propagating root cause incidents as trouble tickets you can streamline and improve IT operations by enabling best-practice processes to incorporate network management (e.g., ITIL).

Automatically propagate network incidents to create trouble tickets.
In this example, we'll consider using Automatic Actions to create a trouble ticket in our IT management system. Given that the details of creating a trouble ticket vary from application to application, we'll assume that we can accomplish the actual ticket creation from an executable script that accepts several key attributes of an incident (e.g., name, source object name, source node name, etc.).

Next, we'll configure key incidents that we'd like to generate a ticket from via HP NNMi's Event Configuration. Using the Action Configuration tab, we can specify the script, which actually creates the trouble ticket passing the appropriate parameters (based on the type of script we're invoking—i.e., method parameters, space separated, etc.). For example, assuming we have a Perl script called "createTicket.pl" we might configure the invocation as such: *createTicket.pl $name $sourceObjectName $sourceNodeName.*

Automatically propagate network incidents to create trouble tickets.
Using the Web services and ws eventing capabilities of the HP NNMi Developer's Toolkit, we can accomplish the same use case in an alternative implementation based on the same application programming interfaces (APIs) and principals outlined in the Event Consolidation example mentioned earlier. Using the Web services requires more programming effort than using Automatic Actions, but the end result may be a desirable alternative to reduce maintenance costs when the number of event configurations exceeds the cost of maintaining a single process that can be configured independently. For example, with a simple filter description, a powerful integration using Web services can be used to handle all or a subset of HP NNMi incidents without having to configure each one individually.

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