IBM Network Performance Insight 1.3.1
Document Revision R2E1

Administering Network Performance Insight

IBM
Note
Before using this information and the product it supports, read the information in “Notices” on page 37.
## Contents

Administering Network Performance Insight.......................................................... v
  Intended audience........................................................................................................... v
  Organization.................................................................................................................. v
  Network Performance Insight architecture.................................................................. v
  IBM Community............................................................................................................ viii
  Network Performance Insight technical training........................................................ ix
  Support information....................................................................................................... ix
  Conventions used in this publication........................................................................... ix
  Typeface conventions ................................................................................................... ix

Chapter 1. Network Performance Insight user and group management.................... 1
  Default users.................................................................................................................. 2
  Logging in to the Dashboard Application Services Hub portal.................................. 3
  Creating users for Web applications........................................................................... 4
  Granting roles to the new user..................................................................................... 5
  Creating users to access the Network Performance Insight Dashboards from command line............................................................... 6
  Setting up LDAP authentication.................................................................................. 7
  Assigning default groups and roles to LDAP users on Ambari................................. 7

Chapter 2. Administering Network Performance Insight services through Ambari........ 9
  Adding nodes and components to existing hosts in a cluster...................................... 9
  Adding new hosts to the cluster.................................................................................. 9
  Adding ZooKeeper service to new hosts in a cluster.................................................. 10
  Adding components to new hosts in a cluster............................................................ 10
  Enabling service auto-start from Ambari..................................................................... 11
  Deleting masters and slaves hosts in a cluster............................................................ 12
  Decommissioning NodeManager and DataNode components................................. 12
  Decommissioning the Kafka Broker component...................................................... 13
  Deleting hosts from a cluster..................................................................................... 14
  Starting and stopping services................................................................................... 15
  Controlling the services from Ambari administration interface............................... 15
  Controlling the Ambari server and Network Performance Insight node services........ 16
  Restarting Tivoli Network Manager Storm Spout....................................................... 16
  Controlling Remote Flow Collector Service............................................................. 17
  Ambari Metrics System............................................................................................... 17
  Ambari metrics for monitoring Network Performance Insight services................... 18

Chapter 3. Database administration........................................................................... 21
  Backup and restore Storage Service data.................................................................... 21
  Backup......................................................................................................................... 22
  Backup and Archive.................................................................................................... 24
  Restoring backup data............................................................................................... 26
  Restoring Backup and Archive data........................................................................... 27
  Backup and restore Timeseries Service data............................................................. 28
  Before you begin......................................................................................................... 28
  Timeseries database - backup..................................................................................... 30
  Timeseries database - restore..................................................................................... 30
  Derby database and dashboard data backup and restore............................................ 31
  Backup procedure....................................................................................................... 32
Administering Network Performance Insight

Use this information to administer IBM Network Performance Insight, Version 1.3.1 and its integration services.

Intended audience

The audience who are network administrator or operations specialist responsible for configuring the Network Performance Insight product suite on an enterprise network.

To install Network Performance Insight successfully, you must have a thorough understanding of the following subjects:

• Network Performance Insight 1.3.1 system
• Basic principles of network protocols and network management
• Flow concepts
• RHEL Administration
• Jazz for Service Management

Organization

Read this summary to help you find the information that you need.

• Chapter 2, “Administering Network Performance Insight services through Ambari,” on page 9
• “Starting and stopping services” on page 15
• Chapter 3, “Database administration,” on page 21

Network Performance Insight architecture

IBM Network Performance Insight is a network performance monitoring system. It offers both real-time and historical trends in network performance and interactive view on the network data that helps in reduced network downtime and optimized network performance.

Network Performance Insight provides IBM Netcool® Operations Insight with comprehensive IP network device performance monitoring and session traffic analysis.

The following diagram shows how data is flowing through the various components in Network Performance Insight:
Network Performance Insight services

Network Performance Insight services are running on microservice architecture that has the software application as a suite of independently deployable, small, modular services in which each service runs a unique process and communicates through a well-defined, lightweight mechanism. Currently, Network Performance Insight 1.3.1 consists of the following microservices:

**Foundation services**
- Dashboard
- DNS
- Event
- Manager
- Storage
- UI

**Entity Metric services**
- Cacti Collector
- Exporter
- Formula Service
- Entity Analytics
- SNMP Collector
- Threshold
• Tivoli® Network Manager Collector

**Flow Metric services**

• Flow Analytics
• Flow Collector

For more information about these services, see their respective sections in *IBM Network Performance Insight: Product Overview*.

**Network Performance Insight additional components**

Some of the additional components that are introduced in Network Performance Insight, V1.3.1 for enhanced functions are described here:

**Technology Packs**

A set of ready-to-use Technology Packs is provided to perform second-level discovery and polling of resources to collect entity metric data. These Technology Packs can help to collect standard SNMP metrics, IP SLA metrics, and Performance Metric OOTB Device Support metrics.

For more information, see *Installing the Technology Packs* section in *Installing and Configuring IBM Network Performance Insight*.

**Network Performance Insight Dashboards**

These interactive dashboards are the built-in, JSON-based dashboards suite that can display aggregated network data from Network Performance Insight database with the help of REST API calls. It supports a combination of data from multiple data sources.

This feature provides a wide variety of dashboards for Network Operators, Network Engineers, and Network Capacity Planners. These dashboards help in pinpointing the troubled resources and general resource performance. A number of web-based configuration options are available to control the data that is displayed on the dashboards.

For more information, see *Network Performance Insight Dashboards* section in *IBM Network Performance Insight: Product Overview*.

**Note:** Networks for Operations Insight is a solution extension of Netcool Operations Insight that includes the following components and products:

• Tivoli Network Manager
• Tivoli Netcool Configuration Manager
• Network Performance Insight
• Network Health Dashboard
• Device Dashboard
• Topology Search

**Hortonworks Data Platform components**

Hortonworks Data Platform (HDP®) can be used to help process and analyze the volume, variety, and velocity of data that continually enters your organization every day. Network Performance Insight is installed as a service extension to the installed HDP® stack.

The features of HDP® that are used in Network Performance Insight:

• HDP®
• Default support for rolling upgrades for Hadoop services
• Support for long-running applications within YARN for enhanced reliability
• Spark in-memory distributed compute engine for dramatic performance increase
• Apache Ambari operational framework. Apache Ambari is an open framework for provisioning, managing, and monitoring Apache Hadoop clusters. Ambari provides an intuitive and easy-to-use Hadoop management web UI backed by its collection of tools and APIs that simplify the operation of Hadoop clusters.
• Essentially includes the following open source technologies for working with Network Performance Insight:
  – Apache Hadoop
  – Apache Kafka
  – Apache Ambari
  – Apache Spark
  – Apache ZooKeeper

  **Note:** Because Zookeeper requires a majority, it is best to use an odd number of machines. For example, with four machines ZooKeeper can handle the failure of a single machine; if two machines fail, the remaining two machines do not constitute a majority. However, with five machines ZooKeeper can handle the failure of two machines.

### Integrated products

Products that are integrated with Network Performance Insight 1.3.1:

**Cassandra**
It is available as a microservice that can be installed along with other microservices in Network Performance Insight. All the inventory metadata is stored in Cassandra.

**Jazz® for Service Management**
Dashboard Application Services Hub provides visualization and dashboard services in Jazz for Service Management. It has a single console for administering IBM products and related applications. Visualization for Network Performance Insight is federated into Dashboard Application Services Hub.

**IBM Tivoli Network Manager IP Edition**
Tivoli Network Manager provides first-level device discovery and polling of some standard SNMP metrics.

**Tivoli Netcool/OMNibus component of IBM Netcool Operations Insight**
Netcool Operations Insight is powered by the fault management capabilities of IBM Tivoli Netcool/OMNibus. In Network Performance Insight, V1.3.1, Tivoli Netcool/OMNibus is an important part of the solution for monitoring the network threshold violations.

### Related information

- IBM Network Performance Insight on IBM Knowledge Center
- Hortonworks Data Platform
- HDFS Architecture
- Apache Hadoop YARN
- Apache Kafka
- Apache Zookeeper
- IBM Networks for Operations Insight

### IBM Community

Connect, learn, and share with professionals and product support technical experts who provide their perspectives and expertise.

Access the IBM Network Performance Insight community. Use IBM Community in the following ways:
• Become involved with transparent development, an ongoing, open engagement between other users and IBM developers of Tivoli products. You can access early designs, sprint demonstrations, product roadmaps, and prerelease code.
• Connect one-on-one with the experts to collaborate and network about Tivoli and the Network and Service Assurance community.
• Read blogs to benefit from the expertise and experience of others.
• Use wikis and forums to collaborate with the broader user community.

**Network Performance Insight technical training**

For Tivoli technical training information, see the following Network Performance Insight Training website at [https://tnpmsupport.persistentsys.com/updated_trainings](https://tnpmsupport.persistentsys.com/updated_trainings).

**Support information**

If you have a problem with your IBM Software, you want to resolve it quickly. IBM provides the following ways for you to obtain the support you need:

**Online**

**IBM Support Assistant**
The IBM Support Assistant is a free local software serviceability workbench that helps you resolve questions and problems with IBM Software products. The Support Assistant provides quick access to support-related information and serviceability tools for problem determination. To install the Support Assistant software, go to [https://www.ibm.com/software/support/isa](https://www.ibm.com/software/support/isa).

**Troubleshooting Guide**
For more information about resolving problems, see the problem determination information for this product.

**Conventions used in this publication**

Several conventions are used in this publication for special terms, actions, commands, and paths that are dependent on your operating system.

**Typeface conventions**

This publication uses the following typeface conventions:

**Bold**
• Lowercase commands and mixed case commands that are otherwise difficult to distinguish from surrounding text
• Interface controls (check boxes, push buttons, radio buttons, spin buttons, fields, folders, icons, list boxes, items inside list boxes, multicolumn lists, containers, menu choices, menu names, tabs, property sheets), labels (such as **Tip:**; and **Operating system considerations:**)
• Keywords and parameters in text

**Italic**
• Citations (examples: titles of publications, diskettes, and CDs)
• Words defined in text (example: a nonswitched line is called a **point-to-point line**)
• Emphasis of words and letters (words as words example: "Use the word that to introduce a restrictive clause."; letters as letters example: "The LUN address must start with the letter L.")
• New terms in text (except in a definition list): a **view** is a frame in a workspace that contains data.
• Variables and values you must provide: ... where *mynam*e represents....

**Monospace**

• Examples and code examples
• File names, programming keywords, and other elements that are difficult to distinguish from surrounding text
• Message text and prompts addressed to the user
• Text that the user must type
• Values for arguments or command options

**Bold monospace**

• Command names, and names of macros and utilities that you can type as commands
• Environment variable names in text
• Keywords
• Parameter names in text: API structure parameters, command parameters and arguments, and configuration parameters
• Process names
• Registry variable names in text
• Script names
Chapter 1. Network Performance Insight user and group management

Use this information to provide user access to Network Performance Insight Dashboards based on the default user roles and user groups.

Network Performance Insight users have the following access to its web interfaces:

<table>
<thead>
<tr>
<th>Web interfaces</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Configuration</td>
<td>The Network Performance Insight Dashboards is pre-configured with working sets of default configurations. A broad range of functions in Network Performance Insight can be administratively configured. The System Configuration Console is to configure your Network Performance Insight system that is integrated with Dashboard Application Services Hub.</td>
</tr>
<tr>
<td>Performance Dashboards</td>
<td>Network Performance Insight provides built-in and interactive network traffic performance dashboards. You can administer the users specific to Network Performance Insight Dashboards here.</td>
</tr>
</tbody>
</table>
| Traffic Details Dashboard | You can launch the Traffic Details dashboard:  
  - From Device Dashboard  
  - From Event Viewer or AEL  
  - From Network Health Dashboard  
  The Traffic Details dashboard provides a simplified view of traffic performance data. The Flow data that is collected by Network Performance Insight is shown from Traffic Details dashboard. |

Administering users

User administration involves setting user access through the following tasks:

1. Creating and assigning groups to the user in WebSphere® administrative console.
2. Assigning roles to the created user to allow user to work with Network Performance Insight web interfaces from Dashboard Application Services Hub console settings.
3. Adding the user to gain access to Network Performance Insight Dashboards from Network Performance Insight Dashboards System Administration.

These tasks are applicable for both installation and upgrade Network Performance Insight scenarios.
After the installation of Network Performance Insight, some users, groups, and roles are created by default.

### Users and their groups

The following table describes users that are present after installation, along with their groups.

<table>
<thead>
<tr>
<th>User name</th>
<th>Group</th>
<th>Default password</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>npiadmin</td>
<td>• ConsoleAdmin</td>
<td>netcool</td>
<td>This user is authorized for all operations. By default, this user has permissions to administer all of the web interfaces.</td>
</tr>
<tr>
<td></td>
<td>• ConsoleUser</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ReadAdmin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• WriteAdmin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• dashboarduser</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• manager-gui</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• manager-jmx</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• manager-script</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• manager-status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• npiadministrator</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• npiuser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>npiuser</td>
<td>• ConsoleUser</td>
<td>netcool</td>
<td>By default, this user has permissions to access Network Performance Insight dashboards.</td>
</tr>
<tr>
<td></td>
<td>• dashboarduser</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• npiuser</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Default roles for the Device Dashboard

<table>
<thead>
<tr>
<th>Roles</th>
<th>Privileges</th>
</tr>
</thead>
<tbody>
<tr>
<td>noi_npi</td>
<td>View the Device Dashboard.</td>
</tr>
<tr>
<td>noi_npi_admin</td>
<td>Edit access to the Device Dashboard.</td>
</tr>
</tbody>
</table>

**Note:**

- The Device Dashboard installation process automatically creates the noi_npi and noi_npi_admin roles.

**Important:** Make sure to assign all the other user roles that are related to Tivoli Network Manager to the new users.

#### Default roles for Network Performance Insight Dashboards

The following role provides access control to the different pages on Network Performance Insight Dashboards and System Administration pages. When you create a new user by using the oed_user script, you must assign this role to the user.
### Table 3. User roles present after the installation

<table>
<thead>
<tr>
<th>Role</th>
<th>Privileges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewer</td>
<td>User has the full administration access to Network Performance Insight Dashboards:</td>
</tr>
<tr>
<td></td>
<td>• System Administration pages</td>
</tr>
<tr>
<td></td>
<td>• Network Performance Overview dashboards</td>
</tr>
<tr>
<td></td>
<td>• All NetFlow dashboards</td>
</tr>
<tr>
<td></td>
<td>• On Demand Filtering dashboards</td>
</tr>
</tbody>
</table>

### Related tasks

“Creating users to access the Network Performance Insight Dashboards from command line” on page 6

You can create users and grant roles who can access the Network Performance Insight Dashboards directly from command line. You do not need to access the Dashboard Application Services Hub UI to create users and grant roles. System administrators can automate the process to add users and assign roles to them with the help of the oed_user script.

### Related information

Network Manager user roles
Default users in Network Manager
Configuring the Device Dashboard

### Logging in to the Dashboard Application Services Hub portal

Information about how to access the Network Performance Insight Dashboards from Dashboard Application Services Hub.

#### Procedure

1. Open a web browser and enter the following URL for the Jazz™ for Service Management UI and reporting server:
   ```plaintext
   https://host.domain:port/DASH_context_root
   ```
   For example: https://<myserver.ibm.com>:16311/ibm/console
   Where:
   - host.domain is the fully qualified host name or IP address of the Jazz for Service Management UI and reporting server.
     - When single sign-on (SSO) is enabled, ensure that you use the fully qualified host name in the URL of the Jazz for Service Management reporting and UI server. SSO requires that the browser pass LTPA cookies to the Jazz for Service Management application server, and these cookies contain the fully qualified host name.
   - port is the secure HTTP port number that was specified during installation. The default value is 16311.
   - /DASH_context_root is the context root for the console that was specified during installation. The default value is /ibm/console.

2. Enter the user ID and password in the login page. Log in with smadmin credentials and click Go.

   The **Dashboard Application Services Hub Welcome** page opens.
Creating users for Web applications

Use these steps to create new users and assign the groups to the user, which provides with the appropriate access for accessing Jazz™ for Service Management server.

About this task

You can create one or more users. The users are added to the registry and a login account for each new user is automatically created. When creating the new user, you can also add the user as a member of one or more groups.

You must add the user and groups sequentially. Use the following order.

1. Create the users.
2. Assign the users to the relevant groups.

Procedure

1. Log in to Dashboard Application Services Hub portal as smadmin user.

2. Expand Console Settings (⚙️) > WebSphere Administrative Console.

3. Click Launch WebSphere Administrative Console.

4. From the navigation pane, click Users and Groups > Manage Users.

5. Click Create to create a new user.

6. In the User ID field, type a unique name to identify the user.

   This user ID will be added to the user registry and also will be used as the login account name.

7. In the First name field, type the given or first name of the user.

8. In the Last name field, type the family or last name of the user.

9. Optional: In the E-mail field, type an e-mail address for the user.

10. In the Password and Confirm password field, type a unique password.

11. Click Group Membership to add the user as a member of one or more existing groups.

12. In the Search by field, select the attribute from the list that you want to use to search for one or more users. For example, select Group name.

13. In the Search for field, either type the string that you want to search for to limit the set of groups, or use the wildcard character (*) to search for all groups. Whether the search is case sensitive or case insensitive depends on the user registry that you are using.

14. In the Maximum results field, specify the maximum number of search results that you want to display.

15. Click Search.

   After the search completes, the results are displayed in two lists:

   • Available - the list is for groups that matched the search criteria
   • Mapped To - the list is for groups that the user is already a member.

16. In the Available column, select the following groups and click < Add:

   • ConsoleAdmin
   • ConsoleUser
   • ReadAdmin
   • WriteAdmin
   • dashboarduser
   • manager-gui
• manager-jmx
• manager-script
• manager-status
• npiadministrator
• npiuser

17. Optional: To undo or remove the user as a member, highlight the groups from the **Mapped To** list and then click **Remove >**.

18. Click **Close** to return to **Create a User** page.

19. Click **Create**.

   If successful, a message will display that indicates that the user has been created. Also, the user ID and other user information will be added to the user registry, and a new login account will be created for the user.

20. To create another user, click **Create Like**.

21. Repeat the process until all the new users have been created.

---

**Granting roles to the new user**

New console users must be granted access to resources based on the role to which they have been assigned.

**Procedure**

1. Log in to Dashboard Application Services Hub portal as smadmin user.

2. In the navigation pane, select **Console Settings** > **User Roles**.

3. To assign a role to a user, click **Search**. A list of available users is displayed.

4. Select the new user from the **User ID** column.

   A list of available roles for the selected user is displayed on a new page.

5. Select the following roles to work with Network Performance Insight Dashboards from the available roles check box:
   • noi_npi
   • noi_npi_admin

   **Important:** Make sure to assign all the other user roles that are related to Tivoli Network Manager to the new users.

   **Note:** noi_npi and noi_npi_admin roles are created when the Device Dashboard is installed.

   For more information, see
   • **Installing the Device Dashboard** section in *Installing and Configuring IBM Network Performance Insight* guide.
   • **Network Manager user roles** section in *IBM Tivoli Network Manager IP Edition 4.2.0* guide.

6. Click **Save**.

---

**What to do next**

Log off from Dashboard Application Services Hub and log in again to ensure all the privileges that include admin privileges are available to the new user.

**Related information**

Network Manager user roles
Default users in Network Manager
Creating users to access the Network Performance Insight Dashboards from command line

You can create users and grant roles who can access the Network Performance Insight Dashboards directly from command line. You do not need to access the Dashboard Application Services Hub UI to create users and grant roles. System administrators can automate the process to add users and assign roles to them with the help of the oed_user script.

**Before you begin**

You must create the user and grant roles on WebSphere Application Server.

**Note:** Make sure to assign dashboarduser role to the user.

**Procedure**

1. Stop the Dashboard Service from all Network Performance Insight nodes by using the following tasks:
   a) Log in to Ambari server dashboard.
      Use the following default URL:
      http://<myserver.ibm.com>:8080
      The default user name is admin, and the default password is admin.
   b) Click **Hosts** and click the host where you installed the Dashboard Service one by one.
      All the services are displayed in the **Summary** page.
   c) Select **Stop** from the **Started** list.
      The service is stopped.

2. Run the command to grant users access to the Network Performance Insight Dashboards, reports, and administration tasks as follows:
   
   **Jazz for Service Management**
   
   **Note:** Run the script from the Network Performance Insight node that is configured for integration as NPI_UI_HOST parameter.
   
   For more information about the parameter, see **Editing the configuration files** section in *Installing and Configuring IBM Network Performance Insight*.

   ```shell
   ./opt/IBM/basecamp/basecamp-dashboard/bin/oed_user <user_id> <role>
   ```

   Where:
   
   - `<user_id>` - the user you want to create.
   - `<role>` - the default role for Network Performance Insight Dashboards, which is Viewer.

   **Note:** Use the absolute path to run the command.

   For example:

   ```shell
   ./opt/IBM/basecamp/basecamp-dashboard/bin/oed_user john Viewer
   ```

   The script checks the status of the Dashboard Service and alerts you to stop the service if it is running.

3. Restart the Dashboard Service on all the hosts in your cluster.
Setting up LDAP authentication

Configure your LDAP server to enable users who are defined in LDAP to log on to Network Performance Insight by specifying the LDAP credentials (user name and password) if configured correctly. It provides an additional security to user management. LDAP server implementations are typically tailored to the needs of your organization.

About this task

You must collect the information about your LDAP environment from your LDAP administrator.

Assigning default groups and roles to LDAP users on Ambari

Configuration setting that is required to assign default groups and roles to LDAP users on Ambari. The LDAP users can then access the dashboards.

Before you begin

Make sure that the users and groups are set up correctly in your LDAP server and the registry is configured on the WebSphere Application Server.

Procedure

1. Log in to Ambari server dashboard.
   Use the following default URL:
   http://<myserver.ibm.com>:8080
   The default user name is admin, and the default password is admin.

2. Click Services > NPI > Configs > Advanced.

3. Expand the Advanced npi-env pane and add the following lines in content text area to add the users and their groups to access the dashboards:

   Note: You can provide a comma-separated list of user groups that you created on your LDAP server to assign roles to them.

   ```
   security.dash.group-mapping="<ldapGroupName>->npiuser,dashboarduser,ConsoleUser",
   "<ldapAdminGroupName>->npiadministrator,dashboarduser,ConsoleAdmin"
   ```

   Where, `<ldapGroupName>` and `<ldapAdminGroupName>` are configured on your LDAP server.
   For example:

   ```
   security.dash.group-mapping="<ldapGroupName>->npiuser,dashboarduser,ConsoleUser",
   "<ldapAdminGroupName>->npiadministrator,dashboarduser,ConsoleAdmin"
   ```

4. Restart the UI Service by using the following steps:

   a) Click Services > NPI.

   b) Click Service Actions > Restart UIs.

Related concepts

“Default users” on page 2
After the installation of Network Performance Insight, some users, groups, and roles are created by default.

Related information

Configuring Lightweight Directory Access Protocol user registries
Chapter 2. Administering Network Performance Insight services through Ambari

The installation of Ambari server host and agents is now complete. Use this basic information to help you administer your Ambari environment.

Apache Ambari can provision, manage, and monitor Hadoop clusters. After Ambari server is installed, the default user admin/admin is created. This Ambari-level Administrator user has full control over all aspects of Ambari, and all the clusters that are managed by the Ambari instance, and the ability to manage users, groups, and clusters.

Related information
Ambari Administration Overview

Adding nodes and components to existing hosts in a cluster

Apache Hadoop clusters grow and change with use. You can add more services after you build your initial cluster with a base set of Hadoop services.

Related information
Using Apache Ambari to add new nodes to your existing cluster

Adding new hosts to the cluster

You can add more hosts to an existing cluster and assign these hosts to run as DataNodes and NodeManagers to expand both HDFS storage capacity and YARN processing power.

Before you begin
Set up SSH passwordless login on the new host.

For more information, see Setting SSH passwordless login in Installing and Configuring IBM Network Performance Insight

Procedure
1. Open a browser and access the Ambari server dashboard.
   Use the following default URL: http://<myserver.ibm.com>:8080
   The default user name is admin, and the default password is admin.
2. In the Ambari web interface, browse to the Hosts page and click the Actions button.
3. Select Add New Hosts.

   The ADD HOST WIZARD provides a sequence of prompts similar to the ones in the Ambari installation wizard. Follow the prompts, and provide information similar to that provided to define the first set of hosts in your cluster.

   For more information, see Setting up Network Performance Insight cluster in Installing and Configuring IBM Network Performance Insight
4. Select the slave components to include on the host.
   For example, DataNode and NodeManager.
   Ambari deploys the software packages on the hosts, push the configuration to the hosts, and start the components so they join their respective Services.
5. Perform the postinstallation tasks on the new host.
   For more information, see Postinstallation tasks in Installing and Configuring IBM Network Performance Insight
Adding ZooKeeper service to new hosts in a cluster

Expand your cluster further by adding the ZooKeeper service to the hosts in your cluster.

About this task

Because Zookeeper requires a majority, it is best to use an odd number of machines. For example, with four machines ZooKeeper can only handle the failure of a single machine; if two machines fail, the remaining two machines do not constitute a majority. However, with five machines ZooKeeper can handle the failure of two machines.

Procedure

1. Open a browser and access the Ambari server dashboard.
   Use the following default URL: http://<myserver.ibm.com>:8080
   The default user name is admin, and the default password is admin.
2. Click Services > ZooKeeper > Service Actions.
3. Select Add ZooKeeper Server and add it to the specific Network Performance Insight node host.
4. Restart the service.

Adding components to new hosts in a cluster

After a new node is added to the cluster, expand your cluster by adding all the master host components to the slave hosts in your cluster.

About this task

Add the following components:
- Mnager Service
- Kafka Broker

Procedure

1. Open a browser and access the Ambari server dashboard.
   Use the following default URL: http://<myserver.ibm.com>:8080
   The default user name is admin, and the default password is admin.
2. Click Hosts and browse to the specific host page and click the Add button.
3. Start all the added services.

What to do next

If you add a Kafka Broker to your new host, make sure to reassign the topic partition Leaders. Follow these steps:

1. Run the following commands to list all the available topics on your new host as follows:

```bash
cd /usr/iop/current/kafka-broker/bin
./kafka-topics.sh --zookeeper <myserver.ibm.com>:<port> --list
```

Typically, the port number is 2182. You might see an output as follows:
Note: Select an existing Zookeeper.

2. Use the output to create your topics-to-move.json file.

3. Follow the steps as in Reassigning Kafka topic partitions.

Enabling service auto-start from Ambari

When the Network Performance Insight system is restarted, you can automatically restart all the stopped services from the Ambari web interface.

About this task
Ambari auto start enables certain services to be marked for auto start so that whenever an agent node restarts, Ambari automatically restarts the stopped components. It’s a one time configuration.

Procedure
1. Log in to Ambari server dashboard.
Use the following default URL:
http://<myserver.ibm.com>:8080

The default user name is admin, and the default password is admin.
2. Click **Admin > Service Auto Start**.
3. Click **Enable All**.
4. Save the configuration.

## Deleting masters and slaves hosts in a cluster

Decommissioning is a process that supports removing a component from the cluster. You must decommission a master or slave before you remove the component or host from service. Decommissioning helps prevent potential loss of data or service disruption.

### Related information
- Managing Hosts

### Decommissioning NodeManager and DataNode components

Use this information to decommission NodeManager and or DataNode components on Ambari.

#### About this task

HDFS replication rule states that the number of live DataNodes must be equal or less than the replication factor. The `dfs.replication` is an HDFS global setting to set the replication factor that is available in `hdfs-site.xml` file. You can set this value on Ambari as follows:

1. Open a browser and access the Ambari server dashboard.

   Use the following default URL: http://<myserver.ibm.com>:8080

   The default user name is admin, and the default password is admin.

2. Click **Services > HDFS > Advanced**.
3. Expand the **General** pane and enter a value for the **Block replication**.

   **Note:** This value must be equal or less than the number of live DataNodes in your cluster.

#### Procedure

1. In the Ambari web interface, click **Hosts** to find the host FQDN on which the component is available.
2. Select the specific host to decommission the components.
3. Click **Actions > Selected Hosts > <component_type>**.

   You can decommission NodeManagers and DataNodes.

   **Note:** Make sure that decommissioning of NodeManagers and DataNodes is completed successfully with status that is changed to "Decommissioned". The decommissioning of DataNodes can take a long time based on the size of your DataNode.

4. Click **Decommission**.
5. Delete the decommissioned component as follows:

   a) Select the host name that is decommissioned in **Components**.
   b) Optional: Stop the component.

   A decommissioned slave component might restart in the decommissioned state.
   c) Select **Delete** from the component list.

6. Restart all services from Ambari.

#### Related tasks
- “Decommissioning the Kafka Broker component” on page 13
To remove a Kafka Broker component, first reassign the Kafka topic partition Leaders from the Kafka Broker by using the `kafka-reassign-partitions.sh` script, and then shutdown and delete the Kafka Broker component in Ambari.

**Related information**
- How to Delete a Component
- Decommissioning Masters and Slaves

### Decommissioning the Kafka Broker component
To remove a Kafka Broker component, first reassign the Kafka topic partition Leaders from the Kafka Broker by using the `kafka-reassign-partitions.sh` script, and then shutdown and delete the Kafka Broker component in Ambari.

**Before you begin**
Ensure that Kafka and ZooKeeper services are up and running.

**Procedure**

1. Connect to ZooKeeper Service by using the following commands:

   ```bash
   cd /usr/iop/current/kafka-broker/bin
   ./zookeeper-shell.sh <zookeeper_server>:<port>
   ```

   Where
   - `<zookeeper_server>` is the host name where ZooKeeper is running.
   - `<port>` is the port number where the ZooKeeper Service is running. By default, 2182.

2. In the ZooKeeper shell, list the brokers and their IDs by using the following command:

   ```bash
   ls /brokers/ids
   ```

3. In the ZooKeeper shell, get the specific Kafka Broker information with the help of the broker IDs by using the following commands:

   ```bash
   get /brokers/ids/<brokerId>
   ```

   The output looks as follows:

   ```
   "jmx_port":-1,"timestamp":"1473387779988", "endpoints": ["PLAINTEXT://<myserver.ibm.com>:6667"], "host": "<myserver.ibm.com>", "version":2,"port":6667}
   cZxid = 0xdef
   ctime = Thu Sep 08 22:22:59 EDT 2016
   mZxid = 0xdef
   pZxid = 0xdef
   cversion = 0
   dataVersion = 0
   aclVersion = 0
   ephemeralOwner = 0x1570cc10b1d0000
   dataLength = 127
   numChildren = 0
   ```

4. Exit the zookeeper shell, with the following command:

   ```bash
   quit
   ```

5. Identify the list of topics and partitions that require leadership and replicas reassignment by using the following commands:

   ```bash
   ./kafka-topics.sh --zookeeper <zookeeper_server>:2182 --describe
   ```

   The output looks as follows:
Note: Topic partitions that require reassignment are identified with Leader and Replicas values that are equal to the broker ID of the node that is to be decommissioned.

6. Isolate the topics for a specific broker ID that you want to delete by running the following commands:

For example, to decommission, broker ID 1004:

```
./kafka-topics.sh --zookeeper `hostname`:2182 --describe | egrep "Leader: 1004|Replicas: 1004"
```

You can see the following output:

```
Topic: topic1    Partition: 0    Leader: 1004    Replicas: 1004    Isr: 1004
Topic: topic3    Partition: 0    Leader: 1004    Replicas: 1004    Isr: 1004
Topic: topic4    Partition: 3    Leader: 1004    Replicas: 1004    Isr: 1004
Topic: topic5    Partition: 1    Leader: 1004    Replicas: 1004    Isr: 1004
```

7. Reassign partitions to a different Kafka Broker.

8. Stop the Kafka Broker Service and delete the component in Ambari.

9. Restart all the Network Performance Insight services and HDFS and YARN that might be consuming from the decommissioned Kafka node in the cluster.

Related tasks
“Decommissioning NodeManager and DataNode components” on page 12
Use this information to decommission NodeManager and or DataNode components on Ambari.

Related information
How to Delete a Component

Deleting hosts from a cluster
Deleting a host removes the host from the cluster.

Before you begin
Before you delete a host, complete the following tasks:

- Decommission any DataNodes, NodeManager, and Kafka Broker that are running on the host.
- Stop all components that are running on the host.
- Stop Ambari Metrics on each DataNode.
- Stop the Network Performance Insight node on the host.
- Move from the host any master components, such as NameNode or ResourceManager, running on the host.
- Turn Off Maintenance Mode, if necessary, for the host.

Procedure

1. Open a browser and access the Ambari server dashboard.
   Use the following default URL: `http://<myserver.ibm.com>:8080`
   The default user name is admin, and the default password is admin.
2. In the Ambari web interface, browse to the **Hosts** page and select the specific host that you want to remove.
3. Click **Host Actions > Delete Host**.
4. Restart all services from Ambari.

**Related information**
Deleting a Host from a Cluster

---

**Starting and stopping services**

Use this information to start and stop Network Performance Insight and its related components.

**About this task**

**Note:** If you must restart your server, stop all the services on that server. After the restart, start all the Network Performance Insight services manually.

**Controlling the services from Ambari administration interface**

Stop all IBM Open Platform with Apache Spark and Apache Hadoop services, by either using the Ambari administration interface or command line to start Ambari REST APIs.

**Procedure**

**Stopping the services**

- Click **Actions > Stop All** from the Ambari web interface.
  
  Then, wait for all of the services to stop.

- Optional: Follow this sequence to stop the services on Ambari web interface:
  
  The order in which to stop the services:
  1. Network Performance Insight
  2. MapReduce2
  3. YARN
  4. HDFS
  5. KAFKA
  6. Ambari Metrics
  7. ZooKeeper

**Starting the services**

- Click **Actions > Start All** from the Ambari web interface.
- Optional: Follow this sequence to start the services on Ambari web interface:

  The order in which to start the services:
  1. ZooKeeper
  2. Ambari Metrics
  3. KAFKA
  4. HDFS
  5. YARN
  6. MapReduce2
  7. Network Performance Insight
Controlling the Ambari server and Network Performance Insight node services
Commands to control the Ambari server and Network Performance Insight node services.

**Procedure**

- To start the Ambari server:
  ```
  service ambari-server start
  ```

- To stop the Ambari server:
  ```
  service ambari-server stop
  ```

- To restart the Ambari server:
  ```
  service ambari-server restart
  ```

- To check the Ambari server processes:
  ```
  ps -ef | grep Ambari
  ```

- To stop the Network Performance Insight node by using the following command:
  Run this step on the specific Network Performance Insight node server.
  ```
  service ambari-agent stop
  ```

- To start the Network Performance Insight node by using the following command:
  Run this step on the specific Network Performance Insight node server.
  ```
  service ambari-agent start
  ```

**Restarting Tivoli Network Manager Storm Spout**
The Storm Spout that is available with Tivoli Network Manager provides polling data and related metadata through Kafka.

**Procedure**

1. Go to the following directory:

   ```
   cd $NCHOME/precision/bin
   ```
   By default, $NCHOME is /opt/IBM/netcool/core.

2. Source the environment.

   ```
   source $NCHOME/env.sh
   ```

3. Restart the Storm by using the following commands

   ```
   itnm_stop storm
   itnm_start storm
   ```

**Related information**

- Starting and stopping Apache Storm
Controlling Remote Flow Collector Service
Start and stop the Remote Flow Collector Service and its associated services by command line.

**Starting the Remote Flow Collector associated services**
Use these steps to start the Remote Flow Collector and its associated services.

**Procedure**
1. Start Zookeeper Service by using the following command:
   
   ```
   sudo /usr/iop/current/zookeeper-server/bin/zkServer.sh start
   ```
2. Start Kafka Service by using the following command:
   
   ```
   sudo /usr/iop/current/kafka-broker/bin/kafka start
   ```
3. Start the Remote Flow Collector Service by using the following command:
   
   ```
   sudo systemctl start npi-remote-flow-collector
   ```

**Stopping the Remote Flow Collector associated services**
Use these steps to stop the Remote Flow Collector and its associated services.

**Procedure**
1. Stop the Remote Flow Collector Service by using the following command:
   
   ```
   sudo systemctl stop npi-remote-flow-collector
   ```
2. Stop Kafka Service by using the following command:
   
   ```
   sudo /usr/hdp/current/kafka-broker/bin/kafka stop
   ```
3. Stop Zookeeper Service by using the following command:
   
   ```
   sudo /usr/hdp/current/zookeeper-server/bin/zkServer.sh stop
   ```

**Checking the status of the Remote Flow Collector associated services**
Use these steps to check the status of the Remote Flow Collector and its associated services.

**Procedure**
1. Check the status of Remote Flow Collector Service by using the following command:
   
   ```
   sudo systemctl status npi-remote-flow-collector
   ```
2. Check the status of Kafka Service by using the following command:
   
   ```
   sudo /usr/iop/current/kafka-broker/bin/kafka status
   ```
3. Stop Zookeeper Service by using the following command:
   
   ```
   sudo /usr/iop/current/zookeeper-server/bin/zkServer.sh status
   ```

**Ambari Metrics System**
Ambari Metrics System (AMS) is a built-in system for collecting, aggregating, and serving metrics for various services in Ambari managed clusters.

It contains two components:
**Metrics Collector**
It is the stand-alone server that collects metrics, aggregates metrics, serves metrics from the Hadoop service sinks and the **Metrics Monitor**.

**Metrics Monitor**
It is installed on each host in the cluster to collect system-level metrics and forward to the **Metrics Collector**.

**Metrics Hadoop Sinks**
Plug into the various Hadoop components sinks to send Hadoop metrics to the Metrics Collector.

**Ambari metrics for monitoring Network Performance Insight services**
The Ambari web interface home page is a dashboard of the operating status of your cluster. The dashboard contains metrics widgets that provide status information for each service in your cluster, and the status of your cluster. You can use some of these Ambari metrics to monitor Network Performance Insight services.

By default, you can see metrics for HDFS, YARN, MapReduce, and ZooKeeper in addition to cluster-wide metrics in the Ambari dashboard. You can add and remove individual widgets, and rearrange the dashboard by dragging and dropping each widget to a new location in the dashboard.

Status information appears as pie and bar charts. You can see the following metrics for Network Performance Insight services:

<table>
<thead>
<tr>
<th>Widget</th>
<th>Description</th>
<th>Metrics</th>
<th>Network Performance Insight service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster membership</td>
<td>Number of microservices that are in the cluster. This metric is a division of MemberCount by StartedInstance.</td>
<td>MemberCount Number of instances that are able to join as a cluster member. StartedInstance Number of instances that are deployed.</td>
<td>Manager</td>
</tr>
<tr>
<td>Total deployed instances</td>
<td>Number of Network Performance Insight microservices that are deployed in the cluster.</td>
<td>TotalInstance</td>
<td>Manager</td>
</tr>
<tr>
<td>Flow Agg-IF records read</td>
<td>Total records that are read for Flow Aggregation Interface grouper.</td>
<td>FlowAggIFRecordsRead.sum</td>
<td>Flow Analytics</td>
</tr>
<tr>
<td>Flow Analytics IP Address Count</td>
<td>Number of IP addresses that are resolved by Flow Analytics Inventory.</td>
<td>FlowInventoryIPAdressCount.sum</td>
<td>Flow Analytics</td>
</tr>
<tr>
<td>Flow Collector disabled interface</td>
<td>Number of Interfaces that are disabled.</td>
<td>FlowCollectorDisabledInterfaceCount.max</td>
<td>Flow Collector</td>
</tr>
<tr>
<td>Flow Collector available interface</td>
<td>Number of Interfaces that are available to be added.</td>
<td>FlowCollectorAvailableInterfaceCount.min</td>
<td>Flow Collector</td>
</tr>
<tr>
<td>Flow Collector discarded raw records count</td>
<td>Total Number of RAW records that are discarded for all Flow collectors.</td>
<td>FlowCollectorFilteredRecords.sum</td>
<td>Flow Collector</td>
</tr>
<tr>
<td>Widget</td>
<td>Description</td>
<td>Metrics</td>
<td>Network Performance Insight service</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Flow Collector total records written</td>
<td>Total number of RAW records that are written to Storage.</td>
<td>FlowCollectorWrittenRecords.sum</td>
<td>Flow Collector</td>
</tr>
<tr>
<td>Flow Collector total records receive</td>
<td>Sum of RAW records that are received from all Flow Collectors.</td>
<td>FlowCollectorRecordReceived.sum</td>
<td>Flow Collector</td>
</tr>
<tr>
<td>ITNM Collector NCIM Interface records received</td>
<td>Number of NCIM Network Interface records that are received from Kafka connect through Tivoli Network Manager database.</td>
<td>ITNMCollectorNCIMRecordReceived</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>ITNM monitored instance</td>
<td>Number of monitored instances that are received from Kafka topic and processed by Tivoli Network Manager Collector.</td>
<td>ITNMCollectorMonitoredInstances</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>ITNM monitored objects</td>
<td>Number of monitored objects that are received from Kafka topic and processed by Tivoli Network Manager Collector.</td>
<td>ITNMCollectorMonitoredObjects</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>ITNM entity metrics records</td>
<td>Tivoli Network Manager Entity Metrics RAW records that are processed by Tivoli Network Manager Collector.</td>
<td>ITNMCollectorPollData</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>ITNM PollData Kafka Topic Lag</td>
<td>Tivoli Network Manager poll data Kafka topic lag offset by Collector.</td>
<td>CollectorKafkaPollDataLag</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>ITNM NCIM Interfaces</td>
<td>Tivoli Network Manager NCIM Interfaces that are processed by Tivoli Network Manager Collector.</td>
<td>ITNMCollectorNCIMInterfaces</td>
<td>Tivoli Network Manager Collector</td>
</tr>
<tr>
<td>Events Processed/ Stored</td>
<td>Threshold events that are processed and stored by Event service.</td>
<td>• EventsProcessed</td>
<td>Event</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EventsStored</td>
<td></td>
</tr>
<tr>
<td>DNS Name Resolution</td>
<td>Forward resolution (domain name to IP address) requests and responses.</td>
<td>• DNSResolveNameRequest</td>
<td>DNS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DNSResolveNameResponse</td>
<td></td>
</tr>
<tr>
<td>Widget</td>
<td>Description</td>
<td>Metrics</td>
<td>Network Performance Insight service</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>DNS Address Resolution</td>
<td>Reverse resolution (IP address to domain name) requests and responses.</td>
<td>• DNSResolveAddressRequest</td>
<td>DNS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DNSResolveAddressResponse</td>
<td></td>
</tr>
<tr>
<td>DNS Service Available Message Buffer</td>
<td>DNS Service free buffer queue to DNS server. Difference between DNSBufferMessageCapacity and DNSMessageBufferSize.</td>
<td>• DNSMessageBufferCapacity Buffer capacity for caching before sending to DNS.</td>
<td>DNS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• DNSMessageBufferSize Buffer used. This metric shows the capacity-size.</td>
<td></td>
</tr>
</tbody>
</table>

**Related information**

Ambari metrics
Chapter 3. Database administration

Provides information about essential administration tasks such as backing up and restoring your performance data that is stored in a specialized, indigenously developed database in IBM Network Performance Insight.

A backup is a safeguard against unexpected data loss and application errors. If you lose the original data, then you can reconstruct it by using a backup.

**Important:** As a part of database best practices, it is recommended that you run backup operation regularly. Backup and recovery procedures protect your database against data loss and reconstruct the data, if there is a data loss.

Network Performance Insight has two databases in V1.3.1:

- **Data that is stored in HDFS by the Storage Service.**
  
  You can use Network Performance Insight backup and restore scripts that are available in `/opt/IBM/basecamp/basecamp-storage/bin`. NetFlow traffic data is stored in this database.

- **Data that is stored in the Cassandra database by the Timeseries Service.**
  
  You can use Network Performance Insight backup and backupRestoreClient.sh scripts that are available in `/opt/IBM/basecamp/basecamp-timeseries/bin`. Performance metric data is stored in this database.

It is a good practice to schedule a backup operation regularly. You can set up a cron job to run the backup commands.

**Backup and restore Storage Service data**

Explains backup and restore operations on the data that is stored in HDFS by the Storage Service. Two modes of backup are available in Network Performance Insight 1.3.1.

The following are some typical scenarios of the backup activity:

- **Ad hoc backup before an application or services upgrade.**
- **Periodic backup to recover from a disaster or failure scenarios.**
- **Single node cluster backup in local directory.**

**Network Performance Insight data backup contents:**

- **Network Performance Insight storage data**
- **Domain objects**

Two types of backup modes:

- **Backup** - Store the Network Performance Insight backup contents in HDFS.
- **Backup and Archive** - Store the Network Performance Insight backup contents in HDFS and creates a `.tar` file to a specified local directory.

**Network Performance Insight storage data**

Network Performance Insight storage data is located in HDFS and can be viewed by browsing HDFS NameNode UI at the following HDFS directory: `/npi/work/storage`

**Domain objects**

Domain object snapshots, which are maintained in Kafka are critical for managing Network Performance Insight Domain processes. Hence important to have a backup setup regularly.
List of Network Performance Insight Kafka topics that are backed up during the procedure:

- snapshot.npi.cfg.domain_names-mgr
- snapshot.npi.cfg.retention_profile-mgr
- snapshot.npi.cfg.thresholds-mgr
- snapshot.npi.flow_metric.interface-mgr
- snapshot.npi.threshold.static_definition-mgr
- snapshot.npi.cfg.aggregation_disable-mgr
- snapshot.npi.cfg.autonomous_sys-mgr
- snapshot.npi.cfg.ip_address_group-mgr
- snapshot.npi.cfg.nbar2-mgr
- snapshot.npi.cfg.nbar-mgr
- snapshot.npi.cfg.tos-mgr
- snapshot.npi.flow_metric.art_target-mgr
- snapshot.npi.flow_metric.device-mgr
- snapshot.npi.flow_metric.qos_class-mgr
- snapshot.npi.flow_metric.qos_policy-mgr
- snapshot.npi.flow_metric.qos_queue-mgr
- snapshot.npi.cfg.resource_type-mgr
- snapshot.npi.cfg.site-mgr
- snapshot.npi.cfg.pack_info-mgr

**Backup**

Create a backup of your Network Performance Insight backup contents to prevent data loss if there is a service outage.

**Before you begin**

1. Ensure that the following services are up and running:
   - ZOOKEEPER
   - KAFKA
   - HDFS
   - Network Performance Insight

   You can start Network Performance Insight services through Ambari Server UI.

**About this task**

Explains how to backup Network Performance Insight backup contents.

For more information about **backup command reference in Fix Pack 1**, see [IBM Network Performance Insight: References](#).

**Note:** Resiliency might be better achieved with a combination of a periodic backup and a multi-node setup, for example, backup on a multi-node cluster environment.

**Procedure**

1. Log in as root or netcool user.
2. Change to the `/<basecamp_Home>/basecamp-storage` directory:
For example,

```bash
# cd /opt/IBM/basecamp/basecamp-storage
```

`<basecamp_Home>` is the location where the basecamp packages are installed.

3. Run the following command to display the usage for backup command.

```bash
# ./bin/backup -help
```

4. Run the following command to start the Network Performance Insight backup procedure.

```bash
# ./bin/backup
```

The backup script runs the following tasks in the background:

- Creates and stores Network Performance Insight backup contents in the following HDFS file system directories:
  - Network Performance Insight storage data at `/npi/work/storage/.snapshot/<BACKUP_VERSION>/`
    
    For example:
    ```bash
    /npi/work/storage/.snapshot/npi-1.3.1.0-<timestamp>/
    ```
  - Domain objects at `/npi/work/dmbackup/<BACKUP_VERSION>/.*.json`
    
    For example:
    ```bash
    /npi/work/dmbackup/npi-1.3.1.0-<timestamp>/snapshot.npi.cfg.domain_names-mgr.json
    ```

  **Note:** `<BACKUP_VERSION>` is the backup directory with the following naming format: `npi-1.3.1.0-yyyyMMddHHmmss`

  **Note:** Only the latest backup version is retained in the HDFS file system. All the older backup versions are deleted.

5. Verify the `/<basecamp_Home>/basecamp-storage/logs/basecamp-storage.log` file for any issues during the backup procedure.

   All messages during backup procedure are logged in `basecamp-storage.log` file.

**Browsing HDFS file system directories**

You can access HDFS NameNode UI to view the HDFS directories by using Quick Links in the Ambari Server user interface.

**Procedure**

1. Open a browser and access the Ambari server dashboard.

   Use the following default URL: `http://<myserver.ibm.com>:8080`

   The default user name is admin, and the default password is admin.

2. To access HDFS NameNode UI from Ambari Server UI, select Services > HDFS.

3. Click Quick Links > NameNode UI.

   The Overview page of the selected host is displayed.

4. To browse the HDFS file system in the HDFS NameNode UI, select Utilities > Browse the file system.

   The Browse Directory page is displayed.

5. Enter the directory path and click Go!
Backup and Archive

Create a backup of your Network Performance Insight backup contents to your local directory in your system to prevent data loss if there is a service outage.

Before you begin

1. Ensure that the following services are up and running:
   - ZOOKEEPER
   - KAFKA
   - HDFS
   - Network Performance Insight

   You can start Network Performance Insight services through Ambari Server UI.

About this task

Explains how to backup Network Performance Insight backup contents to your local directory.

Note: Depending on the size of your backup contents, Backup and Archive mode might be more reasonable for a single node set up, for example a stand-alone mode of deployment.

Important: Backing up content to LOCAL_BACKUP_DIRECTORY might take a long time to complete and take up large amount of disk space depends on the size of the backup contents.

Procedure

1. Log in as root or netcool user.
2. Change to the /<basecamp_Home>/basecamp-storage directory:

   For example,
   
   ```sh
   # cd /opt/IBM/basecamp/basecamp-storage
   ```

   <basecamp_Home> is the location where the basecamp packages are installed.
3. Run the following command to display the usage for backup command.

   ```sh
   # ./bin/backup -help
   ```
4. Run the backup script with –path option to create tar file of the backup contents to local directory by using the following command:

   ```sh
   # ./bin/backup -path <LOCAL_BACKUP_DIRECTORY>
   ```

   Note: Make sure that the netcool user has sufficient privilege to read and write the <LOCAL_BACKUP_DIRECTORY>. The directory must have sufficient disk space to contain the backup contents as well.

   For example:
   
   ```sh
   # ./bin/backup -path /opt/IBM/basecamp/basecamp-storage/work/backup
   ```

   You can specify any file path (-path) to store the backup tar file. In this example, tar file is created at /opt/IBM/basecamp/basecamp-storage/work/backup.

   By default, the backup script takes the following parameter.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-tool</td>
<td>/&lt;basecamp_Home&gt;/basecamp-storage/bin/backup-tool</td>
</tr>
</tbody>
</table>

**Note:** The backup script uses the default backup-tool script that is available in the Network Performance Insight package.

The backup script runs the following tasks in the background:

- Creates and stores Network Performance Insight backup contents in the following HDFS file system directories:
  - Network Performance Insight storage data at /npi/work/storage/.snapshot/<BACKUP_VERSION>/*
    
    For example:
    
    `/npi/work/storage/.snapshot/npi-1.3.1.0-<timestamp>`/*
  
  - Domain objects at /npi/work/dmbackup/<BACKUP_VERSION>/*.json
    
    For example:
    
    `/npi/work/dmbackup/npi-1.3.1.0-<timestamp>/snapshot.npi.cfg.thresholds-mgr.json`

  **Note:** `<BACKUP_VERSION>` is the backup directory with the following naming format:
  
  `npi-1.3.1.0-yyyyMMddHHmmss`

  Creates a copy of Network Performance Insight backup contents in a tar file within the specified backup path directory (<LOCAL_BACKUP_DIRECTORY>).

  For example, the backup contents that are created in /opt/IBM/basecamp/basecamp-storage/work/backup:

  ```
  # cd /opt/IBM/basecamp/basecamp-storage/work/backup
  # ls -lrt
  total 228236
  -rw-r--r-- 1 netcool hadoop 75581440 Jul 28 17:21 npi-1.3.1.0-<timestamp>.tar
  ```

  5. Optional: Run the backup script with `-tool` option to override the default backup-tool script, by using the following command:

  ```
  # cd /<basecamp_Home>/basecamp-storage
  # ./bin/backup -path <LOCAL_BACKUP_DIRECTORY> -tool <Customised_script>
  ```

  Where, the Customised_script is the full path of the script.

  The Customized_script takes the following parameter from the backup script:

  a. `<LOCAL_BACKUP_DIRECTORY>` specified with `-path`.
  b. The backup version name (`<BACKUP_VERSION>`), for example `npi-1.3.1.0-20170823145013`.

  **Note:** It depends entirely on the user on how they want to customize their backup-tool script.

  6. Verify the `/<basecamp_Home>/basecamp-storage/logs/basecamp-storage.log` file for any issues during the backup procedure.

  All messages during backup procedure are logged in basecamp-storage.log file.
Restoring backup data

You can restore the Network Performance Insight backup contents to a previous state by using the restore option. A backup image of the backup contents, which is generated with the backup procedure, must exist before you can use this script. The Network Performance Insight service state is restored to the same state as the backup copy.

Before you begin

1. Ensure that the Network Performance Insight service is down.
2. Ensure that the HDFS, Kafka, and ZooKeeper services are running.

You can stop Network Performance Insight services through Ambari Server UI.

About this task

Explains how to restore Network Performance Insight service to a previous state.

For more information about `restore command reference`, see IBM Network Performance Insight: References.

Procedure

1. Log in as root or netcool user.
2. Change to the `/<basecamp_Home>/basecamp-storage` directory:
   
   ```
   # cd /opt/IBM/basecamp/basecamp-storage
   ```
   
   `<basecamp_Home>` is the location where the basecamp packages are installed.
3. Run the following command to display the usage for restore command.

   ```
   # ./bin/restore -help
   ```

4. Run the following command to restore:

   ```
   # ./bin/restore
   ```

   After the restore procedure successfully completes, the Network Performance Insight backup contents is copied into the respective HDFS directories.
5. Start the Network Performance Insight process by using the Ambari Server UI.

   Ensure that process starts without any errors and your Network Performance Insight system works as expected.
6. Verify the `/<basecamp_Home>/basecamp-storage/logs/restore.log` file for any issues during the restore procedure.

   All messages during restore procedure are logged in `restore.log` file.
   
   a) If the restore procedure fails, the script tries to revert the restore process. The following message is seen in the log when restore procedure fails and the revert restore is triggered.

   ```
   GYMSB10210E: Begin revert Restore
   ```

   b) Contact technical support in the following cases:

   - You are unable to resolve issues that are highlighted in the log where you cannot proceed with a restore rerun.
   - If there are issues with starting the Network Performance Insight processes.
You see the following message, which indicates the revert restore failed:

GYMSB1021E: Failed to revert restore. error: <error stack trace>

You see the following message that indicates that the cleanup of Domain Object Kafka topics failed:

GYMSB1026E: Failed to clean Domain Object Kafka Topics, cause: Topics: <Failure Details>
The <Failure Details> message differs according to the issue.

For example:

GYMSB1026E: Failed to clean Domain Object Kafka Topics, cause: Topics: ${topic} exists after delete

Restoring Backup and Archive data

Explains how to restore the Network Performance Insight service to a previous state by using the backup contents tar file, which is created with the Backup and Archive procedure.

Before you begin

1. Ensure that the Network Performance Insight service is down.
2. Ensure that the HDFS, Kafka, and ZooKeeper services are running.

You can stop Network Performance Insight services through Ambari Server UI.

About this task

Explains how to restore Network Performance Insight service to a previous state by using the backup contents tar file.

Restriction:

You cannot perform a Restoring Backup procedure immediately after performing a Restoring Backup and Archive procedure.

It can only be done after a Backup procedure is run after the restore Backup and Archive procedure.

To summarize, you need to follow the following sequence:

1. Run the “Restoring Backup and Archive data” on page 27 data procedure.
2. Run the “Backup” on page 22 procedure.
3. Run the “Restoring backup data” on page 26 data procedure.

Procedure

1. Log in as root or netcool user.
2. Change to the /<basecamp_Home>/basecamp-storage directory:
   
   For example,

   ```
   # cd /opt/IBM/basecamp/basecamp-storage
   ```

   <basecamp_Home> is the location where the basecamp packages are installed.
3. Run the following command to display the usage for restore command.

   ```
   # ./bin/restore -help
   ```
4. To restore from a local backup file, run the following command:

   ```
   # ./bin/restore -localBackup <LOCAL_BACKUP_TAR_FILE>
   ```

   Note: You need to specify the full path of the backup tar file (<LOCAL_BACKUP_TAR_FILE>).
For example:

```
# ./bin/restore -localBackup /opt/IBM/basecamp/basecamp-storage/work/backup/npi-1.3.1.0-
<timestamp>.tar
```

After the restore procedure successfully completes, the Network Performance Insight storage backup tar file is extracted and copied into the respective HDFS directories.

5. Start the Network Performance Insight process by using the Ambari Server UI.
   Ensure that process starts without any errors and your Network Performance Insight system works as expected.

6. Verify the `/<basecamp_Home>/basecamp-storage/logs/restore.log` file for any issues during the restore procedure.
   All messages during restore procedure are logged in `restore.log` file.
   a) If the restore procedure fails, the script tries to revert the restore procedure. The following message is seen in the log when restore procedure fails and the revert restore is triggered.

```
GYMSB1020E: Begin revert Restore
```

b) You should seek technical support help for the following cases:
   1) You are unable to resolve issues that are highlighted in the log where you cannot proceed with a restore rerun.
   2) If there are issues with starting the Network Performance Insight processes.
   3) You see the following message, which indicates the revert restore failed:

```
GYMSB1021E: Failed to revert restore. error: <error stack trace>
```

4) You see the following message, which indicates that the cleanup of Domain Object Kafka topics failed:

```
GYMSB1026E: Failed to clean Domain Object Kafka Topics, cause: Topics: <Failure Details>
```
   The `<Failure Details>` message differs according to the issue.

   For example:
   ```
   GYMSB1026E: Failed to clean Domain Object Kafka Topics, cause: Topics: ${topic} exists after delete
   ```

### Backup and restore Timeseries Service data

Timeseries Service is introduced to collect and store SNMP performance data in timeseries database for massive scalability and performance. The data rendering time on dashboards is decreased to less than a second with the help of timeseries database.

Timeseries Service uses Kairos DB that is built on top of Cassandra, which is a NoSQL database. All the performance metrics are stored here.

For more information, see Timeseries in [IBM Network Performance Insight: Product Overview](#).

### Before you begin

Before you start the timeseries database backup, make sure to perform these tasks.

### Procedure

1. Ensure that Apache Cassandra is up and running. Check the status by running the following command on Ambari server node:

   ```
   /usr/bin/nodetool status
   ```
The status command provides the following information:

- **Status** - U (up) or D (down)
  Indicates whether the node is functioning or not.
- **State** - N (normal), L (leaving), J (joining), M (moving)
  The state of the node in relation to the cluster.
- **Address**
  The node’s URL.
- **Load** - updates every 90 seconds
  The amount of file system data under the Cassandra data directory after excluding all content in the snapshots subdirectories.
- **Tokens**
  The number of tokens set for the node.
- **Owns**
  The percentage of the data owned by the node per datacenter times the replication factor.
- **Host ID**
  The network ID of the node.
- **Rack**
  The rack is the availability zone of the node.

2. Ensure that the Timeseries Service is up and running. To check the status follow these steps:
   a) Run the `basecamp-manager-cmd` command on Ambari server
      ```bash
      cd /opt/IBM/basecamp/basecamp-manager/bin
      ./basecamp-manager-cmd -service basecamp-timeseries -host <hostname>
      ```
      Where:
      `<hostname>` is the Fully qualified host name (FQDN) where the service is located.
   b) 

3. Make sure that SSH Passwordless communication is set up correctly between Network Performance Insight hosts that have the Timeseries Service is installed and Cassandra cluster hosts.

   For more information, see Setting SSH passwordless login in Installing and Configuring IBM Network Performance Insight.

**Related information**

`nodetool -status`
Timeseries database - backup

Run the backupRestoreClient.sh script that is available in /opt/IBM/basecamp/basecamp-timeseries/bin directory. It can be used for both backup and restore operations on timeseries database in Network Performance Insight.

About this task

When the action for the script is backup, the backupRestoreClient.sh script calls the /opt/IBM/basecamp/basecamp-timeseries/bin/backup.sh script to perform the backup operations.

Note: Make sure that the directory that is specified in the backupPath option exists before you perform the operation.

Procedure

Run the backupRestoreClient.sh script for backup as follows:

```
cd /opt/IBM/basecamp/basecamp-timeseries/bin
./backupRestoreClient.sh -action=backup -backupPath=<LOCAL_BACKUP_DIRECTORY>
   - backupHost=<myserver.ibm.com>
```

Where:

• action can be backup or restore options.
• backupPath is the path where backup data can be placed.
• backupHost is the Fully qualified domain name of the server where the backup data is available.

```
./backupRestoreClient.sh -action=backup -backupPath=/tmp/backup
   - backupHost=<myserver.ibm.com>
```

If your Network Performance Insight cluster has three agent nodes, the backup script archives the data from each node and save the TAR files on the host that is specified in the script. For example, the following archived files are available in <myserver.ibm.com>:

• Cassandra_backup_<hostname1>.tar
• Cassandra_backup_<hostname2>.tar
• Cassandra_backup_<hostname3>.tar

Timeseries database - restore

Run the backupRestoreClient.sh script that is available in /opt/IBM/basecamp/basecamp-timeseries/bin directory. It can be used for both backup and restore operations on timeseries database in Network Performance Insight.

About this task

When the action for the script is restore, the backupRestoreClient.sh script calls the /opt/IBM/basecamp/basecamp-timeseries/bin/restore.sh script to perform the data restore operations. You can restore the data to a new cluster or to an existing cluster.

Procedure

Run the backupRestoreClient.sh script for backup as follows:

```
cd /opt/IBM/basecamp/basecamp-timeseries/bin
./backupRestoreClient.sh -action=restore -backupPath=<LOCAL_BACKUP_DIRECTORY>
   - backupHost=<myserver.ibm.com>
   - isNewCluster=true/false
```

Where:

• action can be backup or restore.
• backupPath is the path where backup data can be placed.
• backupHost is the Fully qualified domain name of the server where the backup data is available. It is the server where you have backed up the data previously.
• isNewCluster is the flag to indicate whether to restore the Cassandra database on a new cluster or on an existing cluster.

For example:

```bash
./backupRestoreClient.sh -action=restore -backupPath=/tmp/backup -backupHost=<myserver.ibm.com>
./backupRestoreClient.sh -action=restore -backupPath=/tmp/backup -backupHost=<myserver.ibm.com>
-isNewCluster=false
```

• isNewCluster = false

If your Network Performance Insight cluster has three agent nodes, the restore script restores each TAR file on separate nodes:
- Cassandra_backup_<hostname1>.tar is restored on <hostname1>.
- Cassandra_backup_<hostname2>.tar is restored on <hostname2>.
- Cassandra_backup_<hostname3>.tar is restored on <hostname3>.

• isNewCluster = true

If your new Network Performance Insight cluster has three agent nodes (X, Y, Z), the restore script restores each TAR file on all three agent nodes in the cluster.
- <hostnameX>
  - Cassandra_backup_<hostname1>.tar
  - Cassandra_backup_<hostname2>.tar
  - Cassandra_backup_<hostname3>.tar
- <hostnameY>
  - Cassandra_backup_<hostname1>.tar
  - Cassandra_backup_<hostname2>.tar
  - Cassandra_backup_<hostname3>.tar
- <hostnameZ>
  - Cassandra_backup_<hostname1>.tar
  - Cassandra_backup_<hostname2>.tar
  - Cassandra_backup_<hostname3>.tar

**Derby database and dashboard data backup and restore**

The H2 database stores the Network Performance Insight Dashboards data. Some of the information that is stored in Derby database; the list of dashboards, users, roles, page-role mapping information, dashboard state, and database queries that are used for dashboard pages, and so on. The backup operation includes both H2 database and other Network Performance Insight Dashboards related data.

**Before you begin**

Identify the Network Performance Insight host in your cluster that is integrated with Jazz for Service Management and perform the following steps:

1. Log in to the Dashboard Application Services Hub server as npiadmin user.

2. In the navigation pane, select **Console Settings > (settings icon) > Console Integrations.**
3. Click the **NPI** link and note down the Console Integration URL. For example, https://<myserver.ibm.com>:9443/Blaze/rest

   **Note:** You need the <myserver.ibm.com> hostname to understand from where to back up the data.

**About this task**

You must backup the Derby database and dashboards data from the Network Performance Insight host that is integrated with Dashboard Application Services Hub, and then restore the data back to another host in a multi-node environment. These steps are applicable if you have a single node environment.

All the required data is available in the /opt/IBM/basecamp/basecamp-dashboard folders.

For more information, see the following topics:

- *Logging in to the Dashboard Application Services Hub portal* section in Using IBM Network Performance Insight
- *Installation directory structure* in Installing and Configuring IBM Network Performance Insight

**Backup procedure**

Use these steps to back up the Derby database and other related data.

**Procedure**

1. Stop the Dashboard Service from Ambari as follows:
   a) Log in to Ambari server dashboard.
      Use the following default URL:
      http://<myserver.ibm.com>:8080
      The default user name is admin, and the default password is admin.
   b) Click **Hosts** and select your host that is integrated with Dashboard Application Services Hub.
   c) Select **Dashboard / NPI** from **Components** and click **Stop** from the list.
2. Log in to the Host that is integrated with Dashboard Application Services Hub as root user.
3. Create a target directory to hold all the backup data.
   For example, /opt/IBM/dashboard-backup that is referred to as <TARGET_DIR>.
4. Change the directory to /opt/IBM/basecamp/basecamp-ui/bin/ and run the backup script as follows:
   ```
   ./oed_backup.sh -target_dir=<TARGET_DIR>
   ```
   If backup is successful, you can see the following file in the <TARGET_DIR>:
   - OED_DB.tgz
   - OED_DASHBOARDS.tgz
5. Start the basecamp-ui service as follows:
   a) Log in to Ambari server dashboard.
      Use the following default URL:
      http://<myserver.ibm.com>:8080
      The default user name is admin, and the default password is admin.
   b) Click **Hosts** and select your host that is integrated with Dashboard Application Services Hub.
   c) Select **UI / NPI** from **Components** and click **Start** from the list.
Restore procedure

Use these steps to restore the H2 database and other related data.

Procedure

1. Stop the basecamp-ui Service from Ambari as follows:
   a) Log in to Ambari server dashboard.
      Use the following default URL:
      `http://<myserver.ibm.com>:8080`
      The default user name is admin, and the default password is admin.
   b) Click Hosts and select your host that is integrated with Dashboard Application Services Hub.
   c) Select UI / NPI from Components and click Stop from the list.

2. Log in to the host where you want to restore the backup data as root user.

3. Create a source directory and copy all backup data.
   For example, `/opt/IBM/dashboard-backup` that is referred to as `<SOURCE_DIR>`.

4. Change the directory to `/opt/IBM/basecamp/basecamp-ui/bin/` and run the restore script as follows:
   ```
   ./oed_restore.sh -source_dir=<SOURCE_DIR>
   ```
   If restore is successful, you can see the following changes in the `<SOURCE_DIR>`:
   • `OED_DB.tgz` file is extracted to `/basecamp/work/basecamp-ui/oed/`.
   • The `OED_DASHBOARDS.tgz` file is extracted to `/opt/IBM/basecamp/basecamp-ui/resources/dashboards`.

5. Start the basecamp-ui service as follows:
   a) Log in to Ambari server dashboard.
      Use the following default URL:
      `http://<myserver.ibm.com>:8080`
      The default user name is admin, and the default password is admin.
   b) Click Hosts and select your host that is integrated with Dashboard Application Services Hub.
   c) Select UI / NPI from Components and click Start from the list.
Chapter 4. Encrypting passwords

For security reasons, encrypt all the passwords that are used in system configurations and for user management.

About this task
An administrator can encrypt the passwords by using the npm-encrypt.sh script that is available in /opt/IBM/basecamp/basecamp-tools/bin directory.

Procedure
Run the npm-encrypt.sh script as follows:

```
cd /opt/IBM/basecamp/basecamp-tools/bin
./npm-encrypt.sh <password>
```

You can get the encrypted password that can be copied and used in configuration settings as required.
This information was developed for products and services offered in the US. This material might be available from IBM in other languages. However, you may be required to own a copy of the product or product version in that language in order to access it.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user’s responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
US

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan Ltd.
19-21, Nihonbashi-Hakozakicho, Chuo-ku
Tokyo 103-8510, Japan

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS"
WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO,
THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A
PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in
certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically
made to the information herein; these changes will be incorporated in new editions of the publication.
IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this
publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in
any manner serve as an endorsement of those websites. The materials at those websites are not part of
the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you provide in any way it believes appropriate without
incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the
exchange of information between independently created programs and other programs (including this
one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
US
Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

The performance data discussed herein is presented as derived under specific operating conditions. Actual results may vary.

The client examples cited are presented for illustrative purposes only. Actual performance results may vary depending on specific configurations and operating conditions.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM’s future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

All IBM prices shown are IBM’s suggested retail prices, are current and are subject to change without notice. Dealer prices may vary.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to actual people or business enterprises is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided “AS IS”, without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Each copy or any portion of these sample programs or any derivative work must include a copyright notice as follows:

© (your company name) (year).
Portions of this code are derived from IBM Corp. Sample Programs.
© Copyright IBM Corp. _enter the year or years_.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at “Copyright and trademark information” at www.ibm.com/legal/copytrade.shtml.

Adobe, Acrobat, PostScript and all Adobe-based trademarks are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, other countries, or both.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency which is now part of the Office of Government Commerce.
Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both

Microsoft and Windows are trademarks of Microsoft Corporation in the United States, other countries, or both.

ITIL is a registered trademark, and a registered community trademark of The Minister for the Cabinet Office, and is registered in the U.S. Patent and Trademark Office.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

Linear Tape-Open, LTO, the LTO Logo, Ultrium, and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and other countries.

Terms and conditions for product documentation

Permissions for the use of these publications are granted subject to the following terms and conditions.

Applicability

These terms and conditions are in addition to any terms of use for the IBM website.

Personal use

You may reproduce these publications for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative work of these publications, or any portion thereof, without the express consent of IBM.

Commercial use

You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

Rights

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM makes no guarantee about the content of these publications. The publications are provided "as-is" and without warranty of any kind, either expressed or implied,
INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.