Configuring Proxy with Apache Knox

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Set Up Knox Proxy

As of HDP 3.0, Knox Proxy is configured via the Knox Admin UI. To set up proxy, you will first define the provider configurations and descriptors, and the topologies will be automatically generated based on those settings.

About this task

The same topologies that were manageable in Ambari previously, still are. Within the Knox Admin UI, the topologies that are managed by Ambari should be read-only. Within an Ambari managed cluster, the Knox Admin UI is to be used for creating additional topologies. When a Knox instance is not managed by Ambari, all topology management will be done via the Knox Admin UI.

The following steps show the basic workflow for how to set up Knox Proxy. It involves defining provider configurations and descriptors, which are used to generate your topologies, which can define proxy (among other things). For examples of how to set up proxy for a specific service, see “Configuring Proxy with Apache Knox”. It is recommended that you use the dynamic topology file generation in the Knox Admin UI; these steps utilize that workflow. You can also manually set up Knox Proxy by manually configuring individual topology files.

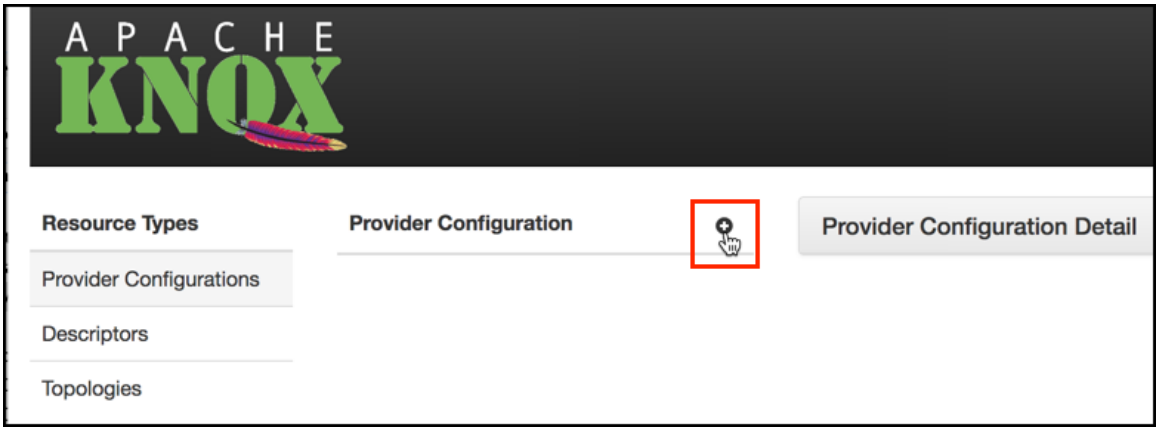
Before you begin

- Ambari is installed.
- The Demo LDAP server is running: **Ambari** > **Knox** > **Actions** > **Start Demo LDAP**.
- If you are proxying to services outside of the Knox host domain or redirecting to services for SSO that are in another domain, your whitelist is explicitly configured to accommodate that: **Ambari** > **Knox** > **Configs** > **Advanced knoxsso-topology**, e.g.

```
<param>
    <name>knoxsso.redirect.whitelist.regex</name>
    <value>^https?:\/\/(.*\.field\.hortonworks\.com|localhost|
127\.0\.0\.1|0:0:0:0:0:0:0:1|::1):[0-9].*$</value
</param>
```

Procedure

1. Navigate from Ambari to the Knox Admin UI: **Ambari** > **Knox** > **Quick Links** > **Knox Admin UI**.
   The Knox Admin UI opens, e.g. https://dw-weekly.field.hortonworks.com:8443/gateway/manager/admin-ui.
2. Login to the Admin UI.
   If you have not yet changed the credentials, the default credentials are admin/admin-password.
3. Create a Provider Configuration:
   a) From the Admin UI homepage, click **Provider Configurations** > +.



The **Create a New Provider Configuration** wizard opens.

b) Name the provider configuration: for example, hdp_ui_provider.

c) Add an Authentication provider:

1. Click **Add Provider**.
2. Select **Authentication** and click **Next**.
3. Choose your Authentication Provider Type: **LDAP, PAM, Kerberos, SSO (HeaderPreAuth), SSO Cookie (SSOCookieProvider), JSON Web Tokens (JWT), CAS, OAuth, SAML, OpenID Connect, Anonymous**.

   Note: OAuth, OpenID Connect, and CAS are community supported, they are not officially supported by Hortonworks.
4. Complete the required fields and click **OK**.

d) Add an Authorization provider:

1. Click **Add Provider**.
2. Select **Authorization** and click **Next**.
3. Click **Access Control Lists**.
4. Fill out the required fields and click **OK**.

e) Add an Identity Assertion provider:

1. Click **Add Provider**.
2. Select **Identity Assertion** and click **Next**.
3. Choose a Identity Assertion Provider Type: **Default, Concatenation, SwitchCase, Regular Expression, Hadoop Group Lookup (LDAP)**.

   Recommended: Default.
4. Fill out the required fields and click **OK**.

f) Add an HA provider:

1. Click **Add Provider**.
2. Select **HA** and click **Next**.
3. Select **Add Service** and click **Next**.
4. Fill out the required fields and click **OK**.

4. Define Descriptors for the topology to auto-discover services from Ambari.

a) Create a new descriptor. From the Admin UI homepage, click **Descriptors** > **+**.

b) Name the descriptor.

c) Beside the Provider Configuration field, click the **edit** button and select the Provider Configuration you created before.

d) Add Services (e.g., JOBTRACKER, HIVE, HDFSUI, STORM) by clicking the checkbox beside the service.

If the service you are looking for is not listed, you can add it later by editing the configuration (the plus icon next to services will present a text box.)

e) Add Discovery details:

Field	Example value
Address	http://dw-weekly.field.hortonworks.com:8080
Cluster	dwweekly
Username	admin
Password alias	ambari-discovery-password

f) Click **OK**.

What to do next

Verify the topology was generated correctly. You can review the XML topology file for accuracy from **Admin UI homepage** > **Topologies** > **<topology name, e.g. devcluster>**.

Example: Configure Knox Gateway for YARN UI

This example shows you how to set up a new custom Knox topology for YARN UI and installing services for YARN.

Setting up Topology File

1. Login to Ambari and access Knox service page.

   Knox Admin UI link could be found on the right pane of the Ambari's Knox page.

   Once this link is clicked, user will be asked to provide a username and password. This will be based on the ldap configured for the manager.
2. Accessing Knox admin UI page for topology creation

   Once admin lands in to the Knox admin UI, there are fundamentally three steps more to create a topology of desired use case.

   a. Create a custom provider configuration
   b. Define Descriptors for the topology to auto-discover services from Ambari
   c. Save and verify the topology which is created

   Next steps will cover topology creation in detail.
3. Creating a custom Provider Configuration

   Admin can click on the "Provider Configurations" in left panel to list all available providers. Click on the "+" button on the right side to create a new provider.

   Admin can select all the providers which are needed for defining "hdp_ui_provider"

   - Authentication (Anonymous)
   - Authorization (AclsAuthz/Access Control Lists)
   - HAProvider (Default)
   - Identity-assertion (Default)

   These 4 providers could be added by selecting each and giving values from the auto populated options. Detailed steps are given below.

   a. Add Authentication>Anonymous.
   b. Add Authorization>Access Control Lists.
   c. Add HAProvider>Default.
   d. Add Identity-Assertion>Default.
   e. Save the provider by clicking on save button at right bottom.
4. Defining Descriptors for topology: Click on "+" button near to Descriptor to define a new custom descriptor.

   a. Add all details for a descriptor:

      - Define a name for the descriptor
      - Select YARNUI from the below list
      - Configure Ambari address in "Discovery - Address"
      - Configure Ambari cluster name in "Discovery - Cluster"
      - Provide Ambari user name in "Discovery - Username"
      - "Discovery Password Alias" could be left as it is as below manual step to be ran on knox machine to avoid configuring password.

   b. Creating password alias, e.g.,

```
[root@ctr-e138-1518143905142-240189-01-046340 services]# /usr/$REPO/
$VERSION/knox/bin/knoxcli.sh create-alias ambari.discovery.password
Enter password:
Enter password again:
```

```
ambari.discovery.password has been successfully created.
```

c. Select provider configuration as “hdp_ui_provider”.

d. Press “Ok” to save the details.

e. Select “hdp_ui” descriptor to add “YARNUIV2” service.

Admin can add custom services which are see on the right pane under “Descriptor Detail”.

Not all services listed are officially supported. See “Knox- Supported Services” for details on which services are supported.

5. Verify topology:

Topologies>Select one topology: This is read-only pane where all configuration which are done for “hdp_ui” could be verified.

Changing QuickLinks for YARN UIs

Admin need to paste below quicklink.json file in Ambari server machine to ensure that YARN UIs quick links are accessible only via proxy.

1. Quick Link template

```
{
  "name": "default",
  "description": "default quick links configuration",
  "configuration": {
    "protocol":
    {
      "type": "HTTPS_ONLY"
    },
    "links": [
      {
        "name": "resourcemanager_ui",
        "label": "ResourceManager UI",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url": "%@://%@:%@/gateway/hdp_ui/yarnuiv2/",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "resourcemanager_logs",
        "label": "ResourceManager logs",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url": "%@://%@:%@/gateway/hdp_ui/yarn/logs",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "resourcemanager_jmx",
        "label":"ResourceManager JMX",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url":"%@://%@:%@/gateway/hdp_ui/yarn/jmx",
```

```
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "thread_stacks",
        "label":"Thread Stacks",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url":"%@://%@:%@/gateway/hdp_ui/yarn/stacks",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      }
    ]
  }
}
```

2. Place quicklinks.json in Ambari: In ambari-server host, at following path, place the quicklink file:

```
/var/lib/ambari-server/resources/stacks/$REPO/$VERSION/services/YARN/
quicklinks/quicklinks.json
```

   Please ensure that existing quicklinks.json in replaced with the attached json file from this document.
3. Restart Ambari: ambari-server restart
4. Verify QuickLinks.

   Post these steps, YARN Quick links will be accessible only via knox proxy.

Example: Configure Knox Gateway for LDAP

This example shows you how to set up the Knox Gateway with ShiroProvider, which involves configuring a provider for LDAP.

Context

LDAP authentication is configured by adding a "ShiroProvider" authentication provider to the cluster's topology file. When enabled, the Knox Gateway uses Apache Shiro (org.apache.shiro.realm.ldap.JndiLdapRealm) to authenticate users against the configured LDAP store.

Setting up Topology File

1. Login to Ambari and access Knox service page.

   Knox Admin UI link could be found on the right pane of the Ambari’s Knox page.

   Once this link is clicked, user will be asked to provide a username and password. This will be based on the ldap configured for the manager.
2. Accessing Knox admin UI page for topology creation

   Once admin lands in to the Knox admin UI, there are fundamentally three steps more to create a topology of desired use case.

   a. Create a custom provider configuration
   b. Define Descriptors for the topology to auto-discover services from Ambari

c. Save and verify the topology which is created

Next steps will cover topology creation in detail.

3. Creating a custom Provider Configuration

   Admin can click on the “Provider Configurations” in left panel to list all available providers. Click on the “+” button on the right side to create a new provider.

   Admin can select all the providers which are needed for defining “hdp_ui_provider”

   - Authentication (LDAP)
   - Authorization (AclsAuthz/Access Control Lists)
   - HAProvider (Default)
   - Identity-assertion (Default)

   These 4 providers could be added by selecting each and giving values from the auto populated options. Detailed steps are given below.

   a. Add Authentication>LDAP.
   b. Add Authorization>Access Control Lists.
   c. Add HAProvider>Default.
   d. Add Identity-Assertion>Default.
   e. Save the provider by clicking on save button at right bottom.

4. Defining Descriptors for topology: Click on “+” button near to Descriptor to define a new custom descriptor.

   a. Add all details for a descriptor:

   - Define a name for the descriptor
   - Select $Services from the below list
   - Configure Ambari address in “Discovery - Address”
   - Configure Ambari cluster name in “Discovery - Cluster”
   - Provide Ambari user name in “Discovery - Username”
   - “Discovery Password Alias” could be left as it is as below manual step to be ran on knox machine to avoid configuring password.

   b. Creating password alias, e.g.,

```
[root@ctr-e138-1518143905142-240189-01-046340 services]# /usr/$REPO/
$VERSION/knox/bin/knoxcli.sh create-alias ambari.discovery.password
Enter password:
Enter password again:
ambari.discovery.password has been successfully created.
```

   c. Select provider configuration as “hdp_ui_provider”.
   d. Press “Ok” to save the details.
   e. Select “hdp_ui” descriptor to add “$SERVICES”.

   Admin can add custom services which are see on the right pane under “Descriptor Detail”.

   Not all services listed are officially supported. See “Knox- Supported Services” for details on which services are supported.

5. Verify topology:

   Topologies>Select one topology: This is read-only pane where all configuration which are done for “hdp_ui” could be verified.

Changing QuickLinks for $SERVICE UIs

Admin need to paste below quicklink.json file in Ambari server machine to ensure that $SERVICE UIs quick links are accessible only via proxy.

1. Quick Link template

```
{
  "name": "default",
  "description": "default quick links configuration",
  "configuration": {
    "protocol":
    {
      "type": "HTTPS_ONLY"
    },
    "links": [
      {
        "name": "resourcemanager_ui",
        "label": "ResourceManager UI",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url": "%@://%@:%@/gateway/hdp_ui/$SERVICE/",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "resourcemanager_logs",
        "label": "ResourceManager logs",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url": "%@://%@:%@/gateway/hdp_ui/$service/logs",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "resourcemanager_jmx",
        "label":"ResourceManager JMX",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url":"%@://%@:%@/gateway/hdp_ui/$service/jmx",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      },
      {
        "name": "thread_stacks",
        "label":"Thread Stacks",
        "requires_user_name": "false",
        "component_name": "KNOX_GATEWAY",
        "url":"%@://%@:%@/gateway/hdp_ui/$service/stacks",
        "port": {
          "https_property": "gateway.port",
          "https_default_port": "8443",
          "regex": "^(\\d+)$",
          "site": "gateway-site"
        }
      }
```

```
      ]
    }
}
```

2. Place quicklinks.json in Ambari: In ambari-server host, at following path, place the quicklink file:

```
/var/lib/ambari-server/resources/stacks/$REPO/$VERSION/services/$SERVICE/
quicklinks/quicklinks.json
```

   Please ensure that existing quicklinks.json in replaced with the attached json file from this document.
3. Restart Ambari: ambari-server restart
4. Verify QuickLinks.

   Post these steps, $SERVICE Quick links will be accessible only via knox proxy.

Configuring the Knox Gateway

This section describes how to configure the Knox Gateway (proxy).

Knox Master Secret Overview

The master secret is required to start the gateway. The secret protects artifacts used by the gateway instance, such as the keystore, trust stores and credential stores.

You configure the gateway to persist the master secret, which is saved in the $gatewaydir/data/security/master file. Ensure that this directory has the appropriate permissions set for your environment.

Attention: Ensure that the security directory, $gatewaydir/data/security, and its contents are readable and writable only by the knox user. This is the most important layer of defense for master secret. Do not assume that the encryption is sufficient protection.

You may persist the master secret by supplying the -persist-master switch at startup. This will result in a warning indicating that persisting the secret is less secure than providing it at startup. We do make some provisions in order to protect the persisted password.

It is encrypted with AES 128 bit encryption and where possible the file permissions are set to only be accessible by the user that the gateway is running as.

After persisting the secret, ensure that the file at config/security/master has the appropriate permissions set for your environment. This is probably the most important layer of defense for master secret. Do not assume that the encryption if sufficient protection.

A specific user should be created to run the gateway this user will be the only user with permissions for the persisted master file.

You set the master secret during Knox installation.

For information on what services are supported for Knox Proxy, see the “Knox Supported Services Matrix”.

Related Information

Knox Supported Services Matrix

Change the Master Secret

How to change the Master Secret, when configuring the Knox Gateway.

About this task

The Master Secret can be changed under dire situations where the Administrator has to redo all the configurations for every gateway instance in a deployment, and no longer knows the Master Secret. Recreating the Master Secret requires not only recreating the master, but also removing all existing keystores and reprovisioning the certificates and credentials.

Attention:

Ensure that the security directory, $gateway/data/security, and its contents are readable and writable only by the knox user. This is the most important layer of defense for master secret. Do not assume that the encryption is sufficient protection.

Procedure

1. Enter:

```
cd {GATEWAY_HOME}
bin/knoxcli.sh create-master --force
```

2. If there is an existing keystore, update the keystore.

Manually Redeploy Cluster Topologies

How to manually redeploy cluster topologies, when configuring the Knox Gateway.

About this task

You are not required to manually redeploy clusters after updating cluster properties. The gateway monitors the topology descriptor files in the $gatewaydir/conf/topologies directory and automatically redeploys the cluster if any descriptor changes or a new one is added. (The corresponding deployment is in $gatewaydir/data/deployments.)

However, you must redeploy the clusters after changing any of the following gateway properties or gateway-wide settings:

- Time settings on the gateway host
- Implementing or updating Kerberos
- Implementing or updating SSL certificates
- Changing a cluster alias

When making gateway-wide changes (such as implementing Kerberos or SSL), or if you change the system clock, you must redeploy all the Cluster Topologies.

When making changes that impact a single cluster, such as changing an alias or restoring from an earlier cluster topology descriptor file, you only redeploy the affected cluster.

Procedure

1. To verify the timestamp on the currently deployed cluster(s), visit: cd $gatewaydir/data/deployments.
2. To redeploy, enter:

Choice	Enter
All clusters	$gatewaydir/bin/knoxcli.cmd redeploy
A specific cluster	cd $gatewaydir/bin/knoxcli.cmd redeploy --cluster $cluster_name Where $cluster_name is the name of the cluster topology descriptor (without the .xml extension). For example, myCluster.

3. To verify that a new cluster WAR was created, enter:

Choice	Enter
All clusters	cd $gatewaydir/data/deployments
A specific cluster	cd $gatewaydir/data/deployments

The system displays something similar to:

Choice	Output

All clusters	`cd $gatewaydir/data/deployments`
	
	`# .`
	`# ..`
	`# cluster.war.145514f4dc8`
	`# cluster.war.1457241b5dc`
	`# myCluster.war.145514f4dc8`
	`# myCluster.war.1457241b5dc`
	`# sandbox.war.145514f4dc8`
	`# sandbox.war.1457241b5dc`
	` 0 File(s) 0 bytes`
	` 8 Dir(s) 9,730,850,816 bytes free`
	
	A new file is created for each cluster, with the current timestamp.

A specific cluster	`cd $gatewaydir/data/deployments`
	
	`# .`
	`# ..`
	`# cluster.war.145514f4dc8`
	`# myCluster.war.145514f4dc8`
	`# myCluster.war.1457241b5dc`
	`# sandbox.war.145514f4dc8`
	` 0 File(s) 0 bytes`
	` 5 Dir(s) 9,730,977,792 bytes free`
	
	You should see that existing cluster war files are unchanged, but the war file for myCluster was updated (has a current timestamp).

Enable WebSockets

How to enable WebSockets, when configuring the Knox Gateway. Enabling WebSockets for Knox allows you to proxy applications that use WebSocket connections (e.g., Zeppelin.)

About this task

WebSocket is a communication protocol that allows full duplex communication over single TCP connection. Knox provides out-of-the-box support for WebSocket protocol, but currently, only text-based messages are supported.

By default, WebSocket functionality is disabled. WebSocket functionality must be enabled for Zeppelin UI (<role>ZEPPELINUI</role>) service definition to work.

Procedure

1. In /conf/gateway-site.xml, change gateway.websocket.feature.enabled to true:

```
<property>
      <name>gateway.websocket.feature.enabled</name>
```

```
        <value>true</value>
        <description>Enable/Disable websocket feature.</description>
    </property>
```

2. In /conf/{topology}.xml, change the topology rule:

```
<service>
        <role>WEBSOCKET</role>
        <url>ws://myhost:9999/ws</url>
    </service>
```

3. Restart the gateway:

```
cd $gateway bin/gateway.sh stop bin/gateway.sh start
```

Audit Gateway Activity

The Knox Gateway Audit Facility tracks actions that are executed by Knox Gateway per user request or that are produced by Knox Gateway internal events, such as topology deployments.

Tip:

The Knox Audit module is based on the Apache log4j. You can customize the logger by changing the log4j.appender.auditfile.Layout property in $gatewaydir/conf/gateway-log4j.properties to another class that extends Log4j. For detailed information see “Apache's log4j”.

Related Information

Apache's log4j

Audit Log Fields

Auditing events on the gateway are informational, the default auditing level is informational (INFO) and it cannot be changed.

The Audit logs located at $gatewaydir/knox/logs/gateway-audit.log.$date have the following structure:

EVENT_PUBLISHING_TIMEROOT_REQUEST_ID | PARENT_REQUEST_ID | REQUEST_ID | LOGGER_NAME | TARGET_SERVICE_NAME | USER_NAME | PROXY_USER_NAME | SYSTEM_USER_NAME | ACTION | RESOURCE_TYPE | RESOURCE_NAME | OUTCOME | LOGGING_MESSAGE

where:

- EVENT_PUBLISHING_TIME : contains the timestamp when record was written.
- ROOT_REQUEST_ID : Reserved, the field is empty.
- PARENT_REQUEST_ID : Reserved, the field is empty.
- REQUEST_ID : contains a unique value representing the request.
- LOGGER_NAME : contains the logger name. For example audit.
- TARGET_SERVICE_NAME : contains the name of the service. Empty indicates that the audit record is not linked to a service. For example, an audit record for topology deployment.
- USER_NAME : contains the ID of the user who initiated session with Knox Gateway.
- PROXY_USER_NAME : contains the authenticated user name.
- SYSTEM_USER_NAME : Reserved, field is empty.
- ACTION : contains the executed action type. The value is either authentication, authorization, redeploy, deploy, undeploy, identity-mapping, dispatch, or access.
- RESOURCE_TYPE contains the resource type of the action. The value is either uri, topology, or principal.

- RESOURCE_NAME : contains the process name of the resource. For example, topology shows the inbound or dispatch request path and principal shows the name of mapped user.
- OUTCOME contains the action results, success, failure, or unavailable.
- LOGGING_MESSAGE contains additional tracking information, such as the HTTP status code.

Change Roll Frequency of the Audit Log

Audit records are written to the log file /var/log/knox/gateway-audit.log and by default roll monthly. When the log rolls, the date that it rolled is appended to the end of the current log file and a new one is created.

Procedure

1. Open the $gatewaydir/conf/gateway-log4j.properties file in a text editor.
2. Change the log4j.appender.auditfile.DatePattern as follows: log4j.appender.auditfile.DatePattern = $interval.

   Where $interval is one of the following:

Setting	Description
yyyy-MM	Rollover at the beginning of each month
yyyy-ww	Rollover at the first day of each week. The first day of the week depends on the locale.
yyyy-MM-dd	Rollover at midnight each day.
yyyy-MM-dd-a	Rollover at midnight and midday of each day.
yyyy-MM-dd-HH	Rollover at the top of every hour.
yyyy-MM-dd-HH-mm	Rollover at the beginning of every minute.

Tip:

For more examples, see “Apache log4j: Class DailyRollingFileAppender”.

3. Save the file.
4. Restart the gateway: cd $gateway bin/gateway.sh stop bin/gateway.sh start.

Related Information

Apache log4j: Class DailyRollingFileAppender

Configuring Storm Plugin Audit Log to File

When the Storm Ranger plugin sends audit logs to a file via Log4jAuditProvider, a specific configuration must be used.

When the Storm Ranger plugin sends audit logs to a file via Log4jAuditProvider, a specific configuration must be used.

```
<appenders>
....
  <RollingFile name="STORMAUDIT"
                fileName="${sys:storm.log.dir}/ranger_audit.log"
                filePattern="${sys:storm.log.dir}/ranger_audit.log.%i">
        <PatternLayout>
            <pattern>${pattern}</pattern>
        </PatternLayout>
        <Policies>
```

```
            <SizeBasedTriggeringPolicy size="100 MB"/> <!-- Or every 100 MB
 -->
        </Policies>
        <DefaultRolloverStrategy max="9"/>
    </RollingFile>
    <Loggers>
     ......

      <Logger name="xaaudit" level="info">
        <AppenderRef ref="STORMAUDIT"/>
     </Logger>
    </Loggers>
</appenders>
```

Storm uses log4j2 format for log4j configurations. In log4j.xml, the name of the logger (in this case, “xaaudit”) is needed and not the whole class name with logger name; this is handled by the <Logger> tag.

Manually Configuring Knox Topology Files

If you choose not to use dynamic topology file generation via the Admin UI, you can manually configure your Knox Topologies.

See "Set up Knox Proxy" for how to use dynamic topology file generation.

Defining Cluster Topologies

The Knox Gateway supports one or more clusters. Each cluster configuration is defined in a topology deployment descriptor file in the $gateway/conf/topologies directory and is deployed to a corresponding WAR file in the $gateway/data/deployments directory. These files define how the gateway communicates with each cluster.

Topology Deployment Descriptor File Sections

The descriptor is an XML file contains the following sections:

- gateway/provider -- configuration settings enforced by the Knox Gateway while providing access to the cluster.
- service -- defines the service URLs used by the gateway to proxy communications from external clients.

Cluster Topology Provider and Service Roles

The gateway automatically redeploys the cluster whenever it detects a new topology descriptor file, or detects a change in an existing topology descriptor file.

The following table provides an overview of the providers and services:

Type	Role	Description
gateway/provider	hostmap	Maps external to internal node hostnames, replacing the internal hostname with the mapped external name when the hostname is embedded in a response from the cluster.
	authentication	Integrates an LDAP store to authenticate external requests accessing the cluster via the Knox Gateway. Refer to Set Up LDAP Authentication for more information.
	federation	Defines HTTP header authentication fields for an SSO or federation solution provider. Refer to Set up HTTP Header Authentication for Federation/SSO

Type	Role	Description
	identity-assertion	Responsible for the way that the authenticated user's identity is asserted to the service that the request is intended for. Also maps external authenticated users to an internal cluster that the gateway asserts as the current session user or group. Refer to Configure Identity Assertion for more information.
	authorization	Service level authorization that restricts cluster access to specified users, groups, and/or IP addresses. Refer to Configure Service Level Authorization for more information.
	webappsec	Configures a web application security plugin that provides protection filtering against Cross Site Request Forgery Attacks. Refer to Configure Web Application Security for more information.
HA provider	high availability	Syncs all Knox instances to use the same topologies credentials keystores.
service	$service_name	Binds a service with an internal URL that the gateway uses to proxy requests from external clients to the internal cluster services. Refer to “Configure Service URLs” for more information. E.G., NAMENODE, HDFS, JOBTRACKER, HIVE, KAFKA, STORM, etc.

Format

Cluster topology descriptors have the following XML format:

```
<topology>
    <gateway>
        <provider>
            <role></role>
            <name></name>
            <enabled></enabled>
            <param>
                <name></name>
                <value></value>
            </param>
        </provider>
    </gateway>
    <service></service>
</topology>
```

Configuring a Server for Knox

The Apache Knox Gateway redirects external requests to an internal service using service name and URL of the service definition.

Set up Service URLs (Proxy a Service)

How to configure access to an internal service through the Knox Gateway- AKA, how to proxy a service, such as Atlas, Ranger. or Oozie.

Procedure

1. Edit $gateway/conf/topologies$cluster-name.xml to add an entry similar to the following, for each service:

```
<topology>
    <gateway>
     ...
     </gateway>
     <service>
         <role> $service_name </role>
         <url> $schema://$hostname:$port</url>
     </service>
</topology>
```

   where:

   - $service_name is: AMBARI, AMBARIUI, ATLAS, HIVE, JOBTRACKER, NAMENODE, OOZIE, RANGER, RANGERUI, RESOURCEMANAGER, WEBHBASE, WEBHCAT, WEBHDFS, ZEPPELINUI, or ZEPPELINWS.
   - <url> is the complete internal cluster URL required to access the service, including:
     - $schema -- the service protocol
     - $hostname -- the resolvable internal host name
     - $port -- the service listening port

2. Save the file.

   Note:

   It is not necessary to restart the Knox server after making changes to the topology/ Cluster services.

   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

Service Definitions (Proxy a Service)

Reference examples of service definitions (examples of setting up proxy for services, such as Atlas, Ranger. or Oozie.)

Configure each service that you want to expose externally, being careful to define the internal hostname and service ports of your cluster.

The following example uses the defaults ports and supported service names.

```
<service>
    <role>AMBARI</role>
    <url>http://ambari-host:8080</url>
</service>

<service>
    <role>AMBARIUI</role>
    <url>http://ambari-host:8080</url>
</service>

<service>
    <role>ATLAS</role>
    <url>http://atlas-host:8443</url>
</service>

<service>
    <role>HIVE</role>
    <url>http://hive-host:10001/cliservice</url>
</service>

<service>
    <role>JOBTRACKER</role>
```

```
     <url>rpc://jobtracker-host:8050</url>
</service>

<service
    <role>NAMENODE</role>
     <url>hdfs://namenode-host:8020</url>
</service>

<service>
    <role>OOZIE</role>
    <url>http://oozie-host:11000/oozie</url>
</service>

<service>
    <role>RANGER</role>
    <url>http://ranger-host:6080</url>
</service>

<service>
    <role>RANGERUI</role>
    <url>http://ranger-host:6080</url>
</service>

<service>
    <role>RESOURCEMANAGER</role>
    <url>http://hive-host:8088/ws</url>
</service>

<service>
    <role>WEBHBASE</role>
    <url>http://webhbase-host:60080</url>
</service>

<service>
    <role>WEBHCAT</role>
    <url>http://webcat-host:50111/templeton</url>
</service>

<service>
    <role>WEBHDFS</role>
    <url>http://webhdfs-host:50070/webhdfs</url>
</service>

<service>
    <role>ZEPPELINUI</role>
    <url>http://zeppelin-host:9995</url>
</service>

<service>
    <role>ZEPPELINWS</role>
    <url>http://zeppelin-host:9995/ws</url>
</service>
```

Validate Service Connectivity

Use the commands in this section to test connectivity between the gateway host and the service, and then test connectivity between an external client to the service through the gateway.

About this task

Tip:

If the communication between the gateway host and an internal service fails, telnet to the service port to verify that the gateway is able to access the cluster node. Use the hostname and ports you specified in the service definition.

Procedure

1. At the gateway host, enter:

Service	Enter
WebHDFS	`curl http://$webhdfs-host:50070/webhdfs/v1?op=GETHOMEDIRECTORY`
WebHCat/Templeton	`curl http://$webhdfs-host:50111/templeton/v1/version`
Oozie	`curl http://$oozie-host:11000/oozie/v1/admin/build-version`
HBase/HBase REST Server	`curl http://$hbase-host:17000/version`
HiveServer2	`curl http://$hive-host:10001/cliservice`

Service	Displays
WebHDFS	`{"Path":"/user/gopher"}`
WebHCat/Templeton	`{"supportedVersions":["v1"],"version":"v1"}`
Oozie	`{"buildVersion":"4.0.0.2.1.1.0-302"}`
HBase/HBase REST Server	`rest 0.0.2 JVM: Oracle Corporation 1.7.0_51-24.45-b08 OS: Linux 3.8.0-29-generic amd64 Server:jetty/6.1.26 Jersey:1.8:`
HiveServer2	

2. At the external client, enter:

Service	Enter
WebHDFS	`curl https://$gateway-host:$gateway_port/$gateway/$cluster_name/`

Service	Enter
	`$webhdfs_service_name/v1?op=GETHOMEDIRECTORY`
WebHCat/Templeton	`curl https://$gateway-host:$gateway_port/$gateway/$cluster_name/$webhcat_service_name/v1/version`
Oozie	`curl https://$gateway-host:$gateway_port/$gateway/$cluster_name/$oozie_service_name/v1/admin/build-version`
HBase/HBase REST Server	`curl http://$hbase-host:17000/version`
HiveServer2	`curl https://$gateway-host:$gateway_port/$gateway/$cluster_name/$hive_service_name/cliservice`

Service	Displays
WebHDFS	`{"Path":"/user/gopher"}`
WebHCat/Templeton	`{"supportedVersions":["v1"],"version":"v1"}`
Oozie	`{"buildVersion":"4.0.0.2.1.1.0-302"}`
HBase/HBase REST Server	`rest 0.0.2 JVM: Oracle Corporation 1.7.0_51-24.45-b08 OS: Linux 3.8.0-29-generic amd64 Server:jetty/6.1.26 Jersey:1.8`
HiveServer2	

Add a New Service to the Knox Gateway

The Knox Gateway supports a declarative way for you to “plug in” a new service into the gateway simply and easily by using a few files.

About this task

Overview

Services and service additions in the Knox Gateway are defined as extensions to existing Knox Gateway functionality that enable you to extend the gateway’s capabilities. You use these services to convert information contained in the topology file to runtime descriptors.

The Knox Gateway supports a declarative way for you to “plug in” a new service into the gateway simply and easily by using the following two files:

- service.xml- file that contains the routes (paths) that the service will provide and the rewrite rules to bind these paths.
- rewrite.xml – file that contains the rewrite rules for the service.

Directory Structure

The Knox Gateway consists of a directory structure that you should become familiar with before attempting to add a new service to the gateway.

If you navigate to the data directory in your Knox home directory ({GATEWAY_HOME}/data}, you will see the following directory structure:

```
Services
    Service name
        Version
            service.xml
            rewrite.xml
```

For example, if you were to navigate to the WebHDFS Service directory, you would see the following directory structure:

```
Services
    WebHDFS
        2.4.0
            service.xml
            rewrite.xml
```

Procedure

1. Navigate to the services directory in your Knox gateway HOME directory ({GATEWAY_HOME}/data/services).
2. Add the service.xml and rewrite.xml files to the directory.

   Note:

   If you want to add the service to the Knox build, then add the service.xml and rewrite files to the gateway-services-definitions module.
3. Restart the Knox Gateway server:

```
cd $gateway/bin/gateway.sh stop
cd $gateway /bin/gateway.sh start
```

Example

```
<GATEWAY_HOME>/data/services/webhdfs/0.0.1/service.xml

<service role="WEBHDFS" name="webhdfs" version="0.0.1">
  <routes>
    <route path="/webhdfs/**"/>
  </routes>
</service>
```

```
<GATEWAY_HOME>/data/services/webhdfs/0.0.1/rewrite.xml

<rules>
  <rule dir="IN" name="WEBHDFS/webhdfs/inbound" pattern="*://*:*/**/webhdfs/
{path=**}?{**}">
    <rewrite template="{$serviceUrl[WEBHDFS]}/{path=**}?{**}"/>
  </rule>
```

```
</rules>
```

Mapping the Internal Nodes to External URLs

Hostmapping is an advanced configuration topic. Generally, it is only required in deployments in virtualized environments, such as Cloud deployments and some development and testing environments.

The isolation of the cluster is accomplished through virtualization that will hide the internal networking details (such as IP addresses and/or hostnames) from the outside world, while exposing other IP addresses and/or hostnames for use by clients accessing the cluster from outside of the virtualized environment. The exposed IP addresses and hostnames are available for use in the topology descriptor service definitions. This configuration works great for requests that are initiated from the external clients themselves which only ever use the Knox Gateway exposed endpoints.

Difficulties from these virtualized environments arise when the cluster redirects client requests to other nodes within the cluster and indicates the internal hostname locations, rather than those designated to be exposed externally. Since the services don't know or care whether a request is coming from an external or internal client, it uses its only view of the cluster, which is the internal details of the virtualized environment.

The Knox Gateway needs to know how to route a request that has been redirected by the service to an address that is not actually accessible by the gateway. Hostmapping acts as an adapter that intercepts the redirects from the service and converts the indicated internal address to a known external address that Knox will be able to route to once the client resends the request through the client facing gateway endpoint. The gateway uses the hostmap to replace the internal hostname within the routing policy for the particular request with the externally exposed hostname. This enables the dispatching from the Knox Gateway to successfully connect to the service within the virtualized environment. Otherwise, attempting to route to an internal-only address will result in connection failures.

A number of the REST API operations require multi-step interactions that facilitate the client's interaction with multiple nodes within a distributed system. External clients performing multi-step operations use the URL provided by the gateway in the responses to form the next request. Since the routing policy is hidden by the gateway from the external clients, the fact that the subsequent requests in the multi-stepped interaction are mapped to the appropriate externally exposed endpoints is not exposed to the client.

For example, when uploading a file with WebHDFS service:

1. The external client sends a request to the gateway WebHDFS service.
2. The gateway proxies the request to WebHDFS using the service URL.
3. WebHDFS determines which DataNodes to create the file on and returns the path for the upload as a Location header in a HTTP redirect, which contains the datanode host information.
4. The gateway augments the routing policy based on the datanode hostname in the redirect by mapping it to the externally resolvable hostname.
5. The external client continues to upload the file through the gateway.
6. The gateway proxies the request to the datanode by using the augmented routing policy.
7. The datanode returns the status of the upload and the gateway again translates the information without exposing any internal cluster details.

Set Up a Hostmap Provider

How to add the hostmap provider to the cluster topology descriptor and a parameter for each DataNode in the cluster.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add the Hostmap provider totopology/gateway using the following format:

```
<provider>
    <role>hostmap</role>
    <name>static</name>
```

```
    <enabled>true</enabled>
    <param>
        <name>$external-name</name>
        <value>$internal-dn-host</value>
    </param>
</provider>
```

where:

- $cluster-name.xml is the name of the topology descriptor file, located in $gateway /conf/topologies.
- $external-name is the value that the gateway uses to replace $internal_host host names in responses.
- $internal-dn-host is a comma-separated list of host names that the gateway will replace when rewriting responses.

3. To the hostmap provider, add a param for each additional DataNode in your cluster:

```
<param>
   <name>$external-name2</name>
   <value>$internal-dn2-host</value>
</param>
```

4. Save the file.
   Saving the results automatically deploys the topology with the change. The result is the creation of a new WAR file with modified timestamp in $gatewaydir/data/deployments.

Example of an EC2 Hostmap Provider

In this EC2 example two VMs have been allocated. Each VM has an external hostname by which it can be accessed via the internet. However the EC2 VM is unaware of this external host name, and instead is configured with the internal hostname.

- External hostnames - ec2-23-22-31-165.compute-1.amazonaws.com, ec2-23-23-25-10.compute-1.amazonaws.com
- Internal hostnames - ip-10-118-99-172.ec2.internal, ip-10-39-107-209.ec2.internal

The following shows the Hostmap definition required to allow access external to the cluster via the Apache Knox Gateway.

```
<topology>
    <gateway>
    ...
    <provider>
        <role>hostmap</role>
        <name>static</name>
        <enabled>true</enabled>
        <!-- For each host enter a set of parameters -->
        <param>
            <name>ec2-23-22-31-165.compute-1.amazonaws.com</name>
            <value>ip-10-118-99-172.ec2.internal</value>
        </param>
        <param>
            <name>ec2-23-23-25-10.compute-1.amazonaws.com</name>
            <value>ip-10-39-107-209.ec2.internal</value>
        </param>
       </provider>
      ...
     </gateway>
    <service>
   ...
   </service>
   ...
</topology>
```

Example of Sandbox Hostmap Provider

Hortonwork's Sandbox 2.x poses a different challenge for hostname mapping. This Sandbox version uses port mapping to make Sandbox appear as though it is accessible via localhost. However, Sandbox is internally configured to consider sandbox.hortonworks.com as the hostname. So from the perspective of a client accessing Sandbox the external host name is localhost.

The following shows the hostmap definition required to allow access to Sandbox from the local machine:

```
<topology>
    <gateway>
     ...
     <provider>
        <role>hostmap</role>
        <name>static</name>
        <enabled>true</enabled>
        <param>
            <name>localhost</name>
            <value>sandbox,sandbox.hortonworks.com</value>
        </param>
    </provider>
    ...
  <gateway>
 ...
</topology>
```

Enable Hostmap Debugging

Enable additional logging by editing the gateway-log4j.properties file in the directory.

About this task

Attention:

Changing the rootLogger value from ERROR to DEBUG generates a large amount of debug logging.

Procedure

1. Edit the $gateway /conf/gateway-log4j.propertiesgateway-log4j.properties file to enable additional logging.
2. Change ERROR to DEBUG on the following line: log4j.rootLogger=ERROR, drfa.

   Attention:

   Changing the rootLogger value from ERROR to DEBUG generates a large amount of debug logging.
3. Stop and then restart the gateway: cd $gateway bin/gateway.sh stop bin/gateway.sh start.

Configuring an Authentication Provider

An overview of authentication providers, to help you choose the right one for your environment.

There are two types of providers supported in Knox for establishing a user's identity:

- Authentication Providers
- Federation Providers

Authentication providers directly accept a user's credentials and validates them against some particular user store. Federation providers, on the other hand, validate a token that has been issued for the user by a trusted Identity Provider (IdP).

Authentication Providers

Providers have a name-value based configuration. There are different authentication providers:

- Anonymous

  Used by Knox to let the proxied service or UI do its own authentication.
- LDAP

  For LDAP/AD authentication with username and password. No SPNEGO/Kerberos support.
- SPNEGO

  For SPNEGO/Kerberos authentication with delegation tokens. No LDAP/AD support.
- PAM

  For PAM authentication with username and password, via ShiroProvider.

Federation Providers

There are different federation providers:

- HeaderPreAuth
- SSOCookieProvider
- JWT
- Pac4j

Related Information

Setting up JWT Federation Provider
Setting up Pac4j Federation Provider
Set Up LDAP Authentication
Setting Up SPNEGO Authentication
Setting up PAM Authentication
Set Up HeaderPreAuth Federation Provider
Set up SSOCookieProvider Federation Provider

Set Up LDAP Authentication

LDAP authentication is configured by adding a "ShiroProvider" authentication provider to the cluster's topology file. When enabled, the Knox Gateway uses Apache Shiro (org.apache.shiro.realm.ldap.JndiLdapRealm) to authenticate users against the configured LDAP store.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add the ShiroProvider authentication provider to /topology/gateway as follows:

```
<provider>
    <role>authentication</role>
    <name>ShiroProvider</name>
    <enabled>true</enabled>
    <param>
        <name>main.ldapRealm</name>
        <value>org.apache.shiro.realm.ldap.JndiLdapRealm</value>
    <param>
    <param>
        <name>main.ldapRealm.userDnTemplate</name>
        <value>$USER_DN</value>
    </param>
    <param>
        <name>main.ldapRealm.contextFactory.url</name>
        <value>$protocol://$ldaphost:$port</value>
    </param>
    <param>
        <name>main.ldapRealm.contextFactory.authenticationMechanism</name>
        <value>simple</value>
```

```
    </param>
    <param>
        <name>urls./**</name>
        <value>$auth_type</value>
    </param>
    <param>
        <name>sessionTimeout</name>
        <value>$minutes</value>
    </param>
</provider>
```

Where:

- $USER_DN

  is a comma-separated list of attribute and value pairs that define the User Distinguished Name (DN). The first pair must be set to " $attribute_name ={0}" indicating that the $attribute_name is equal to the user token parsed from the request. For example, the first attribute in an OpenLdap definition is UID={0}. The main.ldapRealm.userDnTemplate parameter is only required when authenticating against an LDAP store that requires a full User DN.
- $protocol :// $ldaphost : $port

  is the URL of the LDAP service, Knox Gateway supports LDAP or LDAPS protocols.
- $auth_type

  is either authcBasic, which provides basic authentication for both secured and non-secured requests, or SSL authcBasic, which rejects non-secured requests and provides basic authentication of secured requests.
- $minutes

  is the session idle time in minutes, the default timeout is 30 minutes.

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.
4. You can also configure LDAP authentication over SSL by following the steps below.
   a) Change the LDAP protocol from ladp :// to ldaps://.
   b) If LDAP is using a self-signed certificate, then import the LDAP's certificate into the CACerts file of the Java Virtual Machine (JVM) being used to run the Apache Knox Gateway. To import the LDAP certificate, enter the following commands:

```
%JAVA_HOME%\bin\keytool
-import -trustcerts -alias ldap_ssl -file C:\temp\FileFromLDAP.cert -
keystore %JAVA_HOME%/jre/lib/security/cacerts -storepass "changeit"
```

Related Information

Test an LDAP Provider

Configuring Advanced LDAP Authentication

The default configuration computes the bind Distinguished Name (DN) for incoming user based on userDnTemplate. This does not work in enterprises where users could belong to multiple branches of LDAP tree. You could instead enable advanced configuration that would compute bind DN of incoming user with an LDAP search.

Using Advanced LDAP Authentication

With advanced LDAP authentication, we find the bind DN of the user by searching LDAP directory instead of interpolating bind DN from userDNTemplate.

Example Search Filter to Find the Client Bind DN

Assuming:

- ldapRealm.userSearchAttributeName=uid
- ldapRealm.userObjectClass=person

- client specified login id = “guest”

LDAP Filter for doing a search to find the bind DN would be:

```
(&(uid=guest)(objectclass=person))
```

This could find the bind DN to be:

```
uid=guest,ou=people,dc=hadoop,dc=apache,dc=org
```

Please note that the userSearchAttributeName need not be part of bindDN.

For example, you could use

- ldapRealm.userSearchAttributeName=email
- ldapRealm.userObjectClass=person
- client specified login id = "john_doe@gmail.com
  ”

LDAP Filter for doing a search to find the bind DN would be:

```
(&(email=john_doe@gmail.com)(objectclass=person))
```

This could find bind DN to be

```
uid=johnd,ou=contractors,dc=hadoop,dc=apache,dc=org
```

Advanced LDAP Configuration Parameters

Description and sample of the available advanced bind and search configuration parameters.

Parameter	Description	Default	Sample
principalRegex	Parses the principal for insertion into templates via regex.	(.*)	(.*?)\\(.*) (e.g. match US\tom: {0}=US\tom, {1}=US, {2}=tom)
userDnTemplate	Direct user bind DN template.	{0}	cn={2},dc={1},dc=qa,dc=company,dc=com
userSearchBase	Search based template. Used with config below.	none	dc={1},dc=qa,dc=company,dc=com
userSearchAttributeName	Attribute name for simplified search filter.	none	sAMAccountName
userSearchAttributeTemplate	Attribute template for simplified search filter.	{0}	{2}
userSearchFilter	Advanced search filter template. Note & is & in XML.	none	(&(objectclass=person)(sAMAccountName={2}))
userSearchScope	Search scope: subtree, onelevel, object.	subtree	onelevel

Advanced LDAP Configuration Combinations

List of valid combinations of advanced LDAP configuration parameters.

Valid Combinations

There are a limited number of valid combinations of advanced LDAP configuration parameters:

- User DN Template
  - userDnTemplate (Required)
  - principalRegex (Optional)
- User Search by Attribute

  - userSearchBase (Required)
  - userAttributeName (Required)
  - userAttributeTemplate (Optional)
  - userSearchScope (Optional)
  - principalRegex (Optional)
- User Search by Filter
  - userSearchBase (Required)
  - userSearchFilter (Required)
  - userSearchScope (Optional)
  - principalRegex (Optional)

Advanced LDAP Configuration Precedence

The presence of multiple configuration combinations should be avoided. The rules below clarify which combinations take precedence when present.

- userSearchBase takes precedence over userDnTemplate
- userSearchFilter takes precedence over userSearchAttributeName

Advanced LDAP Authentication Addendum

This topic collects supplemental documentation on LDAP authentication.

Problem with userDnTemplate Based Authentication

UserDnTemplate based authentication uses configuration parameter ldapRealm.userDnTemplate. Typical value of userDNTemplate would look like uid={0},ou=people,dc=hadoop,dc=apache,dc=org.

To compute bind DN of the client, we swap the place holder {0} with login id provided by the client. For example, if the login id provided by the client is "guest', the computed bind DN would be uid=guest,ou=people,dc=hadoop,dc=apache,dc=org.

This keeps configuration simple.

However, this does not work if users belong to different branches of LDAP DIT. For example, if there are some users under ou=people,dc=hadoop,dc=apache,dc=org and some users under ou=contractors,dc=hadoop,dc=apache,dc=org,

We can not come up with userDnTemplate that would work for all the users.

Special Note on Parameter main ldapRealm contextFactory systemPassword

The value for this could have one of the following two formats:

- plaintextpassword
- ${ALIAS=ldcSystemPassword}

The first format specifies the password in plain text in the provider configuration. Use of this format should be limited for testing and troubleshooting.

We strongly recommend using the second format ${ALIAS=ldcSystemPassword} in production. This format uses an alias for the password stored in credential store. In the example ${ALIAS=ldcSystemPassword}, ldcSystemPassword is the alias for the password stored in credential store.

Assuming the plain text password is “pa$$word”, and your topology file name is “test.xml”, you would use following command to create the right password alias in credential store.

```
{GATEWAY_HOME}/bin/knoxcli.sh  create-alias ldcSystemPassword --cluster test
 --value pa$$word
```

Configure LDAP Authentication Caching

How to enable LDAP authentication caching using the Shiro Provider.

About this task

You can also configure the Apache Knox Gateway to cache LDAP authentication information by leveraging built-in caching mechanisms that the Shiro EhCache Manager provides. The ability to cache LDAP authentication information is useful in eliminating the need to authenticate against the LDAP server each time you use.

Note:

When the authentication information is cached, the Knox gateway will not authenticate the user again until the cache expires.

Procedure

1. Use the org.apache.hadoop.gateway.ShiroRealm.knoxLdapRealm in the Shiro configuration.
2. Set the main.ldaprealm.authenticationcachingEnabled property similar to the example shown below:

```
<provider>
    <role>authentication</role>
    <enabled>true</enabled>
    <param>
        <name>main.ldapRealm</name>
        <value>org.apache.hadoop.gateway.shirorealm.KnoxLdapRealm</value>
    </param>
    <param>
        <name>main.ldapGroupContextFactory</name>

 <value>org.apache.hadoop.gateway.shirorealm.KnoxLdapContextFactory</
value>
    </param>
    <param>
        <name>main.ldapRealm.ContextFactory</name>
        <value>$ldapGroupContextFactory</value>
    </param>
    <param>
        <name>main.ldapRealm.ContextFactory.url</name>
        <value>$ldap://localhost:33389</value>
    </param>
    <param>
        <name>main.ldapRealm.authorizationEnabled</name>
        <value>true</value>
    </param>
    <param>
        <name>main.ldapRealm.searchBase</name>
        <value>ou-groups,dc=hadoop,dc=apache,dc=org</value>
    </param>
    <param>
        <name>main.cacheManager</name>
        <value>org.apache.knox.gateway.shirorealm.KnoxCacheManager</value>
    </param>
    <param>
        <name>main.securityManager.cacheManager</name>
        <value>$cacheManager</value>
    </param>
    <param>
        <name>main.ldapRealm.authenticationCachingEnabled</name>
        <value>true</value>
    </param>
    <param>
        <name>main.ldapRealm.memberAttributeValueTemplate</name>
        <value>uid={0}ou=people,dc=hadoop,dc=apache,dc=org</value>
```

```
    </param>
    <param>
        <name>main.ldapRealm.contextFactory.systemUsername</name>
        <value>uid=guest,ou=people,dc=hadoop,dc=apache,dc=org</value>
    </param>
    <param>
        <name>main.ldapRealm.contextFactory.systemPassword</name>
        <value>guest=password</value>
    </param>
    <param>
        <name>urls./**</name>
        <value>authBasic</value>
    </param>
</provider>
```

In this example, you need to configure these properties to set the Knox Gateway for LDAP authentication caching. The Knox Gateway also includes several template topology files that you can use to test the caching function. You can locate these template files in the templates directory.

3. Test the caching function:
   a) Navigate to the Knox gateway HOME directory: cd {$GATEWAY_HOME}.
   b) Copy the templates files to your sandbox.

```
cp templates/sandbox.knoxrealm.ehcache.xml
conf.topologies/sandbox.xml
```

   c) Start the LDAP authentication provider: bin/ldap.sh start .
   d) Start the Knox gateway: bin/gateway.sh start .
   e) Once the gateway is started, make the following WebHDFS API call:

```
curl -ivk -u tom:tom-password -X GET
https://localhost:8443/gateway/sandbox/webhdfs/v1?op=GETHOMEDIRECTORY
```

   f) To see LDAP authentication caching working, shut down the LDAP authentication provider: bin/ldap.sh stop .
   g) Run the WebHDFS API call again.

```
curl -ivk -u tom:tom=password -X GET
https://localhost:8443/gateway/sandbox/webhdfs/v1?op=GETHOMEDIRECTORY
```

Example Active Directory Configuration

Example of an AD configuration with LDAP authentication.

Typically the AD main.ldapRealm.userDnTemplate value looks slightly different than OpenLDAP. The value for main.ldapRealm.userDnTemplate is only required if AD authentication requires the full User DN.

```
<topology>

            <gateway>

                <provider>
                    <role>authentication</role>
                    <name>ShiroProvider</name>
                    <enabled>true</enabled>
                    <param>
                        <name>sessionTimeout</name>
                        <value>30</value>
                    </param>
                    <param>
                        <name>main.ldapRealm</name>

 <value>org.apache.hadoop.gateway.shirorealm.KnoxLdapRealm</value>
```

```
                    </param>

<!-- changes for AD/user sync -->

<param>
    <name>main.ldapContextFactory</name>
    <value>org.apache.hadoop.gateway.shirorealm.KnoxLdapContextFactory</
value>
</param>

<!-- main.ldapRealm.contextFactory needs to be placed before other
 main.ldapRealm.contextFactory* entries  -->
<param>
    <name>main.ldapRealm.contextFactory</name>
    <value>$ldapContextFactory</value>
</param>

<!-- AD url -->
<param>
    <name>main.ldapRealm.contextFactory.url</name>
    <value>ldap://ad01.lab.hortonworks.net:389</value>
</param>

<!-- system user -->
<param>
    <name>main.ldapRealm.contextFactory.systemUsername</name>
    <value>cn=ldap-reader,ou=ServiceUsers,dc=lab,dc=hortonworks,dc=net</
value>
</param>

<!-- pass in the password using the alias created earlier -->
<param>
    <name>main.ldapRealm.contextFactory.systemPassword</name>
    <value>${ALIAS=knoxLdapSystemPassword}</value>
</param>

                    <param>

 <name>main.ldapRealm.contextFactory.authenticationMechanism</name>
                        <value>simple</value>
                    </param>
                    <param>
                        <name>urls./**</name>
                        <value>authcBasic</value>
                    </param>

<!--  AD groups of users to allow -->
<param>
    <name>main.ldapRealm.searchBase</name>
    <value>ou=CorpUsers,dc=lab,dc=hortonworks,dc=net</value>
</param>
<param>
    <name>main.ldapRealm.userObjectClass</name>
    <value>person</value>
</param>
<param>
    <name>main.ldapRealm.userSearchAttributeName</name>
    <value>sAMAccountName</value>
</param>

<!-- changes needed for group sync-->
<param>
    <name>main.ldapRealm.authorizationEnabled</name>
    <value>true</value>
```

```
</param>
<param>
    <name>main.ldapRealm.groupSearchBase</name>
    <value>ou=CorpUsers,dc=lab,dc=hortonworks,dc=net</value>
</param>
<param>
    <name>main.ldapRealm.groupObjectClass</name>
    <value>group</value>
</param>
<param>
    <name>main.ldapRealm.groupIdAttribute</name>
    <value>cn</value>
</param>


                </provider>

                <provider>
                    <role>identity-assertion</role>
                    <name>Default</name>
                    <enabled>true</enabled>
                </provider>

                <provider>
                    <role>authorization</role>
                    <name>XASecurePDPKnox</name>
                    <enabled>true</enabled>
                </provider>

            </gateway>

            <service>
                <role>NAMENODE</role>
                <url>hdfs://{{namenode_host}}:{{namenode_rpc_port}}</url>
            </service>

            <service>
                <role>JOBTRACKER</role>
                <url>rpc://{{rm_host}}:{{jt_rpc_port}}</url>
            </service>

            <service>
                <role>WEBHDFS</role>
                <url>http://{{namenode_host}}:{{namenode_http_port}}/
webhdfs</url>
            </service>

            <service>
                <role>WEBHCAT</role>
                <url>http://{{webhcat_server_host}}:{{templeton_port}}/
templeton</url>
            </service>

            <service>
                <role>OOZIE</role>
                <url>http://{{oozie_server_host}}:{{oozie_server_port}}/
oozie</url>
            </service>

            <service>
                <role>WEBHBASE</role>
                <url>http://{{hbase_master_host}}:{{hbase_master_port}}</
url>
            </service>
```

```
            <service>
                <role>HIVE</role>
                <url>http://{{hive_server_host}}:{{hive_http_port}}/
{{hive_http_path}}</url>
            </service>

            <service>
                <role>RESOURCEMANAGER</role>
                <url>http://{{rm_host}}:{{rm_port}}/ws</url>
            </service>
        </topology>
```

Example OpenLDAP Configuration

Example of an OpenLDAP configuration with LDAP authentication.

```
<provider>
    <role>authentication</role>
    <name>ShiroProvider</name>
    <enabled>true</enabled>
    <param>
        <name>main.ldapRealm</name>
        <value>org.apache.hadoop.gateway.shiorealm.KnoxLdapRealm</value>
    </param>
    <param>
        <name>main.ldapContextFactory</name>
        <value>org.apache.hadoop.gateway.shirorealm.KnoxLdapContectFactory</
value>
    </param>
    <param>
        <name>mainLdapRealm.contextFactory</name>
        <value>$ldapContextFactory</value>
    </param>
</provider>
```

Setting Up SPNEGO Authentication

SPNEGO/Kerberos authentication is configured by adding a "HadoopAuth" authentication provider to the cluster's topology file. When enabled, the Knox Gateway uses Kerberos/SPNEGO to authenticate users to Knox.

About this task

The HadoopAuth authentication provider for Knox integrates the use of the Apache Hadoop module for SPNEGO and delegation token-based authentication. This introduces the same authentication pattern used across much of the Hadoop ecosystem to Apache Knox and allows clients to using the strong authentication and SSO capabilities of Kerberos.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add the HadoopAuth authentication provider to /topology/gateway as follows:

```
<provider>
  <role>authentication</role>
  <name>HadoopAuth</name>
  <enabled>true</enabled>
  <param>
    <name>config.prefix</name>
    <value>hadoop.auth.config</value>
  </param>
  <param>
```

```
    <name>hadoop.auth.config.signature.secret</name>
    <value>knox-signature-secret</value>
  </param>
  <param>
    <name>hadoop.auth.config.type</name>
    <value>kerberos</value>
  </param>
  <param>
    <name>hadoop.auth.config.simple.anonymous.allowed</name>
    <value>false</value>
  </param>
  <param>
    <name>hadoop.auth.config.token.validity</name>
    <value>1800</value>
  </param>
  <param>
    <name>hadoop.auth.config.cookie.domain</name>
    <value>novalocal</value>
  </param>
  <param>
    <name>hadoop.auth.config.cookie.path</name>
    <value>gateway/default</value>
  </param>
  <param>
    <name>hadoop.auth.config.kerberos.principal</name>
    <value>HTTP/localhost@LOCALHOST</value>
  </param>
  <param>
    <name>hadoop.auth.config.kerberos.keytab</name>
    <value>/etc/security/keytabs/spnego.service.keytab</value>
  </param>
  <param>
    <name>hadoop.auth.config.kerberos.name.rules</name>
    <value>DEFAULT</value>
  </param>
</provider>
```

Configuration parameter descrptions:

Name	Description	Default
config.prefix	If specified, all other configuration parameter names must start with the prefix.	none
signature.secret	This is the secret used to sign the delegation token in the hadoop.auth cookie. This same secret needs to be used across all instances of the Knox gateway in a given cluster. Otherwise, the delegation token will fail validation and authentication will be repeated each request.	a simple random number
type	This parameter needs to be set to kerberos.	none, would throw exception
simple.anonymous.allowed	This should always be false for a secure deployment.	true
token.validity	The validity -in seconds- of the generated authentication token. This is also used for the rollover interval when signer.secret.provider is set to random or zookeeper.	36000 seconds
cookie.domain	domain to use for the HTTP cookie that stores the authentication token	null
cookie.path	path to use for the HTTP cookie that stores the authentication token	null

Name	Description	Default
kerberos.principal	The web-application Kerberos principal name. The Kerberos principal name must start with HTTP/…. For example: HTTP/localhost@LOCALHOST	null
kerberos.keytab	The path to the keytab file containing the credentials for the kerberos principal. For example: /Users/lmccay/lmccay.keytab	null
kerberos.name.rules	The name of the ruleset for extracting the username from the kerberos principal.	DEFAULT

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

What to do next

REST Invocation

Once a user logs in with kinit, their Kerberos session may be used across client requests with things such as curl. The following curl command can be used to request a directory listing from HDFS while authenticating with SPNEGO via the –negotiate flag:

```
curl -k -i --negotiate -u : https://localhost:8443/gateway/sandbox/webhdfs/
v1/tmp?op=LISTSTATUS
```

Setting up PAM Authentication

PAM authentication is configured by adding a "ShiroProvider" authentication provider to the cluster's topology file with PAM parameters. When enabled, the Knox Gateway uses Apache Shiro and the parameter org.apache.hadoop.gateway.shirorealm.KnoxPamRealm to authenticate users against the configured PAM store.

About this task

There are a large number of pluggable authentication modules available for authenticating access to services through the Knox Gateway. ShiroProvider, in addition to LDAP support, also includes support for PAM-based authentication for unix-based systems.

This opens up the integration possibilities to many other readily-available authentication mechanisms, as well as other implementations for LDAP-based authentication. More flexibility may be available through various PAM modules for group lookup, more complicated LDAP schemas, or other areas where the KnoxLdapRealm is not sufficient.

The primary motivation for leveraging PAM-based authentication is to provide the ability to use the configuration provided by existing PAM modules that are available in a system’s /etc/pam.d/ directory.

The parameter main.pamRealm.service refers to the service located in /etc/pam.d/login.

Procedure

1. In Ambari, add the ShiroProvider authentication provider to Knox>Configs>Advanced topology as follows:

```
<provider>
   <role>authentication</role>
   <name>ShiroProvider</name>
   <enabled>true</enabled>
   <param>
        <name>sessionTimeout</name>
        <value>30</value>
    </param>
    <param>
        <name>main.pamRealm</name>
        <value>org.apache.hadoop.gateway.shirorealm.KnoxPamRealm</value>
```

```
    </param>
    <param>
       <name>main.pamRealm.service</name>
       <value>login</value> </param>
    <param>
       <name>urls./**</name>
       <value>authcBasic</value>
   </param>
</provider>
```

2. Save the file.

Example of a PAM Configuration File

The Shiro configuration above refers to the login file contained in /etc/pam.d. The configuration of the login file can be modified for your deployment:

```
                          # login: auth account password session
auth       optional       pam_krb5.so use_kcminit
auth       optional       pam_ntlm.so try_first_pass
auth       optional       pam_mount.so try_first_pass
auth       required       pam_opendirectory.so try_first_pass
account    required       pam_nologin.so
account    required       pam_opendirectory.so
password   required       pam_opendirectory.so
session    required       pam_launchd.so
session    required       pam_uwtmp.so
session    optional       pam_mount.so
```

The first four fields are: service-name, module-type, control-flag and module-filename. The fifth and greater fields are for optional arguments that are specific to the individual authentication modules.

The second field in the configuration file is the module-type, it indicates which of the four PAM management services the corresponding module will provide to the application. Our sample configuration file refers to all four groups:

- auth: identifies the PAMs that are invoked when the application calls pam_authenticate() and pam_setcred().
- account: maps to the pam_acct_mgmt() function.
- session: indicates the mapping for the pam_open_session() and pam_close_session() calls.
- password: group refers to the pam_chauthtok() function.

Generally, you only need to supply mappings for the functions that are needed by a specific application. For example, the standard password changing application, passwd, only requires a password group entry; any other entries are ignored.

The third field indicates what action is to be taken based on the success or failure of the corresponding module. Choices for tokens to fill this field are:

- requisite: Failure instantly returns control to the application indicating the nature of the first module failure.
- required: All these modules are required to succeed for libpam to return success to the application.
- sufficient: Given that all preceding modules have succeeded, the success of this module leads to an immediate and successful return to the application (failure of this module is ignored).
- optional: The success or failure of this module is generally not recorded.

The fourth field contains the name of the loadable module, pam_*.so. For the sake of readability, the full pathname of each module is not given. Before Linux-PAM-0.56 was released, there was no support for a default authentication-module directory. If you have an earlier version of Linux-PAM installed, you will have to specify the full path for each of the modules. Your distribution most likely placed these modules exclusively in one of the following directories: /lib/security/ or /usr/lib/security/.

Test an LDAP Provider

Using cURL, you can test your LDAP configuration.

Procedure

1. Open the command line on an external client.

   Note:

   cURL is not a built-in command line utility in Windows.

2. Enter the following command to list the contents of the directory tmp/test:

   ```
   curl -i -k -u ldap_user : password -X GET / 'https://$gateway_host:8443/
   $gateway_path/$cluster_name/webhdfs/api/v1/tmp/test?op=LISTSTATUS
   ```

   If the directory exists, a content list displays; if the user cannot be authenticated, the request is rejected with an HTTP status of 401 unauthorized.

Related Information

Set Up LDAP Authentication

Test HTTP Header Tokens

Using cURL, you can test your HTTP Header Tokens configuration.

Procedure

Use following cURL command to request a directory listing from HDFS while passing in the expected header SM_USER, note that the example is specific to sandbox:

```
curl -k -i --header "SM_USER: guest" -v 'https://localhost:8443/gateway/
sandbox/webhdfs/v1/tmp?op=LISTSTATUS
```

Omitting the SM_USER: guest–header: guest" above results in a HTTP status 401 unauthorized

Setting Up 2-Way SSL Authentication

Mutual authentication with SSL provides the Knox gateway with the means to establish a strong trust relationship with another party. This is especially useful when applications that act on behalf of end-users send requests to Knox.

While this feature does establish an authenticated trust relationship with the client application, it does not determine the end-user identity through this authentication. It will continue to look for credentials or tokens that represent the end-user within the request and authenticate or federate the identity accordingly.

To configure your Knox Gateway for 2-way SSL authentication, you must first configure the trust related elements within gateway-site.xml file. The table below lists the different elements that you can configure related to 2-way mutual authentication. Use following cURL command to request a directory listing from HDFS while passing in the expected header SM_USER, note that the example is specific to sandbox:

Table 1: gateway-site.xml Configuration Elements

Name	Description	Possible Values	Default Value
gateway.client.auth.needed	Flag used to specify whether authentication is required for client communications to the server.	TRUE/FALSE	FALSE
gateway.truststore.path	The fully-qualified path to the truststore that will be used.		gateway.jks
gateway.truststore.type	The type of keystore used for the truststore.		JKS
gateway.trust.allcerts	Flag used to specify whether certificates passed by the client should be automatically trusted.	TRUE/FALSE	FALSE

Name	Description	Possible Values	Default Value
ssl.include.ciphers	A comma separated list of ciphers to accept for SSL.	See the “JSSE Provider docs>The SunJSSE Provider >Cipher Suites” for possible ciphers. These can also contain regular expressions as shown in the “Jetty documentation”.	
ssl.exclude.ciphers	A comma separated list of ciphers to reject for SSL.	See the “JSSE Provider docs>The SunJSSE Provider >Cipher Suites” for possible ciphers. These can also contain regular expressions as shown in the “Jetty documentation”.	

Once you have configured the gateway-site.xml file, all topologies deployed within the Knox gateway with mutual authentication enabled will require all incoming connections to present trusted client certificates during the SSL handshake process; otherwise, the server will be refuse the connection request.

Related Information

JSSE Provider docs>The SunJSSE Provider >Cipher Suites

Jetty Documentation

Configuring a Federation Provider

An overview of federation providers, to help you choose the right one for your environment.

There are two types of providers supported in Knox for establishing a user’s identity:

- Authentication Providers
- Federation Providers

Authentication providers directly accept a user’s credentials and validates them against some particular user store. Federation providers, on the other hand, validate a token that has been issued for the user by a trusted Identity Provider (IdP).

There are different federation providers:

- HeaderPreAuth

  HeaderPreAuth is a preauthenticated SSO provider.

  A number of SSO solutions provide mechanisms for federating an authenticated identity across applications. These mechanisms are at times simple HTTP Header type tokens that can be used to propagate the identity across process boundaries.

  Knox Gateway needs a pluggable mechanism for consuming these tokens and federating the asserted identity through an interaction with the cluster.

  The HeaderPreAuth provider is configured within the topology file and has a minimal configuration that assumes SM_USER for CA SiteMinder. The following example is the bare minimum configuration for SiteMinder (with no IP address validation).
- SSOCookieProvider

  The SSOCookieProvider enables the federation of the authentication event that occurred through KnoxSSO. KnoxSSO is a typical SP-initiated websso mechanism that sets a cookie to be presented by browsers to participating applications and cryptographically verified.
- JWT

  The JWT federation provider accepts JWT tokens as Bearer tokens within the Authorization header of the incoming request. Upon successfully extracting and verifying the token, the request is then processed on behalf of the user represented by the JWT token.

This provider is closely related to the Knox Token Service and is essentially the provider that is used to consume the tokens issued by the Knox Token Service.

- Pac4j

  Pac4j is a Java security engine to authenticate users, get their profiles and manage their authorizations in order to secure Java web applications. It supports many authentication mechanisms for UI and web services and is implemented by many frameworks and tools.

  For Knox, it is used as a federation provider to support the OAuth, CAS, SAML and OpenID Connect protocols. It must be used for SSO, in association with the KnoxSSO service and optionally with the SSOCookieProvider for access to REST APIs.

Set Up HeaderPreAuth Federation Provider

How to configure the HeaderPreAuth federation provider.

About this task

The Knox Gateway supports federation solution providers by accepting HTTP header tokens. This section explains how to configure HTTP header fields for SSO or Federation solutions that have simple HTTP header-type tokens.

The gateway extracts the user identifier from the HTTP header field. The gateway can also extract the group information and propagate it to the Identity-Assertion provider.

Note:

The Knox Gateway federation plug-in, HeaderPreAuth, trusts that the content provided in the authenticated header is valid. Using this provider requires proper network security.

Only use the HeaderPreAuth federation provider in environments where the identity system does not allow direct access to the Knox Gateway. Allowing direct access exposes the gateway to identity spoofing. Hortonworks recommends defining the preauth.ip.addresses parameter to ensure requests come from a specific IP addresses only.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add a HeaderPreAuth federation provider to topology/gateway as follows:

```
<provider>
    <role>federation</role>
    <name>HeaderPreAuth</name>
    <enabled>true</enabled>
    <param>
        <name>preauth.validation.method</name>
        <value>$validation_type</value>
    </param>
    <param>
        <name>preauth.ip.addresses</name>
        <value>$trusted_ip</value>
    </param>
    <param>
        <name>preauth.custom.header</name>
        <value>$user_field</value>
    </param>
    <param>
        <name>preauth.custom.group.header</name>
        <value>$group_field</value>
    </param>
</provider>
```

Where the values of the parameters are specific to your environment:

- $validation_type (Optional, recommended)

  Indicates the type of trust, use either preauth.ip.validation indicating to trust only connections from the address defined in preauth.ip.addresses OR null (omitted) indicating to trust all IP addresses.
- $trusted_ip (Required when the pre-authentication method is set to preauth.ip.validation)

  A comma-separated list of IP addresses, addresses may contain a wild card to indicate a subnet, such as 10.0.0.*.
- $user_field

  The name of the field in the header that contains the user name that the gateway extracts. Any incoming request that is missing the field is refused with HTTP status 401, unauthorized. If not otherwise specified, the default value is SM_USER.
- $group_field (Optional)

  The name of the field in the header that contains the group name that the gateway extracts. Any incoming request that is missing the field results in no group name being extracted and the connection is allowed.

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

Example SiteMinder Configuration

The following example is the bare minimum configuration for SiteMinder (with no IP address validation):

```
<provider>
    <role>federation</role>
    <name>HeaderPreAuth</name>
    <enabled>true</enabled>
    <param>
        <name>preauth.custom.header</name>
        <value>SM_USER</value>
    </param>
    <param>
        <name>preauth.ip.addresses</name>
        <value>10.10.0.*</value>
    </param>
</provider>
```

Related Information

Apache Knox 0.13.0 User's Guide > Authentication

Setting up JWT Federation Provider

For information on the JWT federation provider, see the “Apache Knox documentation”.

Related Information

Apache Knox 0.13.0 User's Guide > Authentication

Apache Knox 0.13.0 User's Guide > Pac4j Provider

Setting up Pac4j Federation Provider

For information on the JWT federation provider, see the “Apache Knox documentation”.

Set up SSOCookieProvider Federation Provider

How to configure the SSOCookieProvider.

About this task

The SSOCookieProvider enables the federation of the authentication event that occurred through KnoxSSO. KnoxSSO is a typical service provider-initiated webSSO mechanism that sets a cookie to be presented by browsers to participating applications and cryptographically verified.

Knox Gateway needs a pluggable mechanism for consuming these cookies and federating the KnoxSSO authentication event as an asserted identity in its interaction with the cluster for REST API invocations. This provider is useful when an application that is integrated with KnoxSSO for authentication also consumes REST APIs through the Knox Gateway.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add a SSOCookieProvider federation provider to topology/gateway as follows:

```
<provider>
        <role>federation</role>
        <name>SSOCookieProvider</name>
        <enabled>true</enabled>
        <param>
            <name>sso.authentication.provider.url</name>
            <value>https://host:port/gateway/idp/api/v1/websso</value>
        </param>
    </provider>
```

   where the values of the parameters are specific to your environment:

   - <name>sso.authentication.provider.url</name><</value>https://host:port/gateway/idp/api/v1/websso</value>
   - (Required) Indicates the location of the KnoxSSO endpoint and where to redirect the useragent when no SSO cookie is found in the incoming request.

3. Save the file.

Example

```
<topology>
  <gateway>
    <provider>
        <role>federation</role>
        <name>SSOCookieProvider</name>
        <enabled>true</enabled>
        <param>
            <name>sso.authentication.provider.url</name>
            <value>https://localhost:9443/gateway/idp/api/v1/websso</value>
        </param>
    </provider>
    <provider>
        <role>identity-assertion</role>
        <name>Default</name>
        <enabled>true</enabled>
    </provider>
  </gateway>
  <service>
      <role>WEBHDFS</role>
      <url>http://localhost:50070/webhdfs</url>
  </service>
  <service>
      <role>WEBHCAT</role>
      <url>http://localhost:50111/templeton</url>
  </service>
</topology>
```

Configuring Identity Assertion

The Knox Gateway identity-assertion provider determines which principal to propagate to the backend cluster service and represent the authenticated user. This allows the Knox Gateway to accept requests from external users and for the internal user to potentially be a product of a mapping, some transformation or other change to disambiguate the user identity within the cluster.

There are multiple options for Identity Assertion Provider, configured in Ambari under Knox>Configs>Advanced topology.

Table 2: Identity Assertion Providers

Provider	<name>	Use	Example
Default IAP Pseudo (deprecated)	<name>Default</name> <name>Pseudo</name> (deprecated)	The default identity assertion provider enables simple mapping of principal usernames and groups and is responsible for the establishing the identity that gets propagated to the cluster service as the effective user.	<provider> <role>identity-assertion</role> <name>Default</name> <enabled>true</enabled> <param> <name>principal.mapping</name> <value>guest=hdfs;</value> </param> <param> <name>group.principal.mappi name> <value>*=users;hdfs=admin</ value> </param> </provider>
Concat IAP	<name>Concat</name>	The Concat identity assertion provider allows for composition of a new user principal through the concatenation of optionally configured prefix and/or suffix provider parameters. This is a useful assertion provider for converting an incoming identity into a disambiguated identity within the cluster based on what topology is used to access.	<provider> <role>identity-assertion</role> <name>Concat</name> <enabled>true</enabled> <param> <name>concat.suffix</name> <value>_domain1</value> </param> </provider>
Switchcase IAP	<name>SwitchCase</name>	The SwitchCase identity assertion provider solves issues where down stream ecosystem components require user and group principal names to be a specific case. An example of how this provider is enabled and configured within the <gateway> section of a topology file is shown below.	<provider> <role>identity-assertion</role> <name>SwitchCase</name> <param> <name>principal.case</name> <value>lower</value>

Related Information

Hadoop Group Lookup Identity Assertion Provider
Define a Default Identity Assertion Provider
SwitchCase Identity Assertion Provider
Regular Expression Identity Assertion Provider
Concat Identity Assertion Provider

Define a Default Identity Assertion Provider

The default identity assertion provider enables simple mapping of principal usernames and groups and is responsible for the establishing the identity that gets propagated to the cluster service as the effective user.

About this task

When you define the Default identity-assertion provider without parameters, the authenticated user is asserted as the authenticated user. For example, using simple assertion if a user authenticates as "guest", the user's identity for grouping, authorization, and running the request is "guest". <name>Pseudo</name> identity assertion was renamed <name>Default</name>, but both are supported in config.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add a Default identity-assertion provider totopology/gateway as follows:

```
<provider>
    <role>identity-assertion</role>
    <name>Default</name>
    <enabled>true</enabled>
</provider>
```

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

Map Authenticated Users to Other Users

How to add user mapping rule to an identity-assertion provider:

About this task

The principal.mapping parameter of an identity-assertion provider determines the user name that the gateway asserts (uses as the authenticated user) for grouping, authorization, and to run the request on the cluster.

Procedure

1. Open the cluster topology descriptor file, $cluster-name.xml, in a text editor.
2. Add a Default identity-assertion provider to topology/gateway with the principal.mapping parameter as follows:

```
<provider>
    <role>identity-assertion</role>
    <name>Default</name>
    <enabled>true</enabled>
    <param>
        <name>principal.mapping</name>
        <value>$user_ids=$cluster_user;$user_ids=$cluster_user1;...</
value>
    </param>
</provider>
```

   where the value contains a semi-colon-separated list of external to internal user mappings, and the following variables match the names in your environment:

- $user_ids

  is a comma-separated list of external users or the wildcard (*) indicates all users.
- $cluster_user

  is the cluster user name the gateway asserts, that is the authenticated user name.

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

Mapping Authenticated Users to Groups

The Knox Gateway uses group membership for Service Level Authorization only. The gateway does not propagate the user's group when communicating with the cluster.

The group.principal.mapping parameter of the identity-assertion provider determines the user's group membership. The gateway evaluates this parameter after the principal.mapping parameter using the authenticated user. Unlike principal.mapping, the group mapping applies all the matching values. A user is a member of all matching groups.

Concat Identity Assertion Provider

The Concat identity assertion provider allows for composition of a new user principal through the concatenation of optionally configured prefix and/or suffix provider parameters. This is a useful assertion provider for converting an incoming identity into a disambiguated identity within the cluster based on what topology is used to access.

Concat Identity Assertion is a new provider for the Knox Gateway that enables you to map principals by concatenating strings to either the front or the back of a specified username. The Identity Assertion Provider provides the critical function of determining the Identity Principal that you will want to use in your cluster to represent the identity that has been authenticated at the gateway. For more information on the Identity Assertion Provider and how it is used in the Knox Gateway, refer to the Identity Assertion chapter in the Apache Knox 0.11.x User Guide. If you would like to convert the user principal into a value that represents an identity from a particular user domain, use a configuration similar to the below example.

```
<provider>
    <role>identity-assertion</role>
    <name>Concat</name>
    <enabled>true</enabled>
    <param>
        <name>concat.suffix</name>
        <value>domain1</value>
    </param>
<provider>
```

Notice in this example that the identity-assertion role has been named Concat and has been enabled (true) for the Identity Assertion Provider, with the conact.suffix parameter given a value of domain1 and concatenation will occur at the end of the username (concat.suffix). You may also use a parameter called concat.prefix to indicate a value to concatenate to the front of the username.

Hadoop Group Lookup Identity Assertion Provider

The Hadoop Group Lookup identity assertion provider looks up user's 'group membership' for authenticated users using Hadoop's group mapping service (GroupMappingServiceProvider).

This allows existing investments to be leveraged within Knox and used within the access control policy enforcement at the perimeter.

Using GroupMappingServiceProvider to Configure Group Mapping

An example of how to use HadoopGroupProvider to configure group mapping.

The 'role' for this provider is 'identity-assertion' and name is 'HadoopGroupProvider':

```
<provider>
        <role>identity-assertion</role>
```

```
        <name>HadoopGroupProvider</name>
        <enabled>true</enabled>
        <<param> ... </param>
    </provider>
```

Configuration

All the configuration for 'HadoopGroupProvider' resides in the provider section in a gateway topology file. The 'hadoop.security.group.mapping' property determines the implementation. Some of the valid implementations are as follows:

- org.apache.hadoop.security.JniBasedUnixGroupsMappingWithFallback

  This is the default implementation and will be picked up if 'hadoop.security.group.mapping' is not specified. This implementation will determine if the Java Native Interface (JNI) is available. If JNI is available, the implementation will use the API to resolve a list of groups for a user. If JNI is not available then the shell implementation, org.apache.hadoop.security.ShellBasedUnixGroupsMapping, is used, which shells out with the 'bash -c groups' command (for a Linux/Unix environment) or the 'net group' command (for a Windows environment) to resolve a list of groups for a user.
- org.apache.hadoop.security.LdapGroupsMapping

  This implementation connects directly to an LDAP server to resolve the list of groups. However, this should only be used if the required groups reside exclusively in LDAP, and are not materialized on the Unix servers.

GroupMappingServiceProvider Example

The following example snippet works with the demo LDAP server that ships with Apache Knox. Replace the existing 'Default' identity-assertion provider with the one below (HadoopGroupProvider):

```
<provider>
        <role>identity-assertion</role>
        <name>HadoopGroupProvider</name>
        <enabled>true</enabled>
        <param>
            <name>hadoop.security.group.mapping</name>
            <value>org.apache.hadoop.security.LdapGroupsMapping</value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.bind.user</name>
            <value>uid=tom,ou=people,dc=hadoop,dc=apache,dc=org</value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.bind.password</name>
            <value>tom-password</value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.url</name>
            <value>ldap://localhost:33389</value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.base</name>
            <value></value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.search.filter.user</
name>
            <value>(&amp;(|(objectclass=person)
(objectclass=applicationProcess))(cn={0}))</value>
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.search.filter.group</
name>
            <value>(objectclass=groupOfNames)</value>
```

```
        </param>
        <param>
            <name>hadoop.security.group.mapping.ldap.search.attr.member</
name>
            <value>member</value>
        </param>
        <param>

 <name>hadoop.security.group.mapping.ldap.search.attr.group.name</name>
            <value>cn</value>
        </param>
    </provider>
```

Here, we are working with the demo LDAP server running at 'ldap://localhost:33389' which populates some dummy users for testing that we will use in this example. This example uses the user 'tom' for LDAP binding. If you have different LDAP/AD settings you will have to update the properties accordingly.

Test the setup using the following command (assuming the gateway is started and listening on localhost:8443). Note that we are using credentials for the user 'sam' along with the command: curl -i -k -u sam:sam-password -X GET 'https://localhost:8443/gateway/sandbox/webhdfs/v1/?op=LISTSTATUS'.

The command should be executed successfully and you should see the groups 'scientist' and 'analyst' to which user 'sam' belongs to in gateway-audit.log: ||a99aa0ab-fc06-48f2-8df3-36e6fe37c230|audit|WEBHDFS|sam|||identity-mapping|principal|sam|success|Groups: [scientist, analyst]

Regular Expression Identity Assertion Provider

The regular expression identity assertion provider allows incoming identities to be translated using a regular expression, template and lookup table. This will probably be most useful in conjunction with the HeaderPreAuth federation provider.

There are three configuration parameters used to control the behavior of the provider:

Parameter	Description
input	This is a regular expression that will be applied to the incoming identity. The most critical part of the regular expression is the group notation within the expression. In regular expressions, groups are expressed within parenthesis. For example in the regular expression "(.*)@(.*?)..*" there are two groups. When this regular expression is applied to "nobody@us.imaginary.tld" group 1 matches "nobody" and group 2 matches "us".
output	This is a template that assembles the result identity. The result is assembled from the static text and the matched groups from the input regular expression. In addition, the matched group values can be looked up in the lookup table. An output value of "{1}_{2}" of will result in "nobody_us".
lookup	This lookup table provides a simple (albeit limited) way to translate text in the incoming identities. This configuration takes the form of "=" separated name values pairs separated by ";". For example a lookup setting is "us=USA;ca=CANADA". The lookup is invoked in the output setting by surrounding the desired group number in square brackets (i.e. []). Putting it all together, output setting of "{1}_[{2}]" combined with input of "(.*)@(.*?)..*" and lookup of "us=USA;ca=CANADA" will turn "nobody@us.imaginary.tld" into "nobody@USA".

Within the topology file the provider configuration might look like this:

```
<provider>
    <role>identity-assertion</role>
    <name>Regex</name>
    <enabled>true</enabled>
    <param>
```

```
        <name>input</name>
        <value>(.*)@(.*?)\..*</value>
    </param>
    <param>
        <name>output</name>
        <value>{1}_{[2]}</value>
    </param>
    <param>
        <name>lookup</name>
        <value>us=USA;ca=CANADA</value>
    </param>
</provider>
```

Using curl with this type of configuration might produce the following results:

```
curl -k --header "SM_USER: nobody@us.imaginary.tld" 'https://localhost:8443/
gateway/sandbox/webhdfs/v1?op=GETHOMEDIRECTORY'

{"Path":"/user/member_USA"}

url -k --header "SM_USER: nobody@ca.imaginary.tld" 'https://localhost:8443/
gateway/sandbox/webhdfs/v1?op=GETHOMEDIRECTORY'

{"Path":"/user/member_CANADA"}
```

SwitchCase Identity Assertion Provider

The SwitchCase identity assertion provider solves issues where down stream ecosystem components require user and group principal names to be a specific case.

These are the configuration parameters used to control the behavior of the provider.

Parameter	Description
principal.case	The case mapping of user principal names. Choices are: lower, upper, none. Defaults to lower.
group.principal.case	The case mapping of group principal names. Choices are: lower, upper, none. Defaults to setting of principal.case.

If no parameters are provided the full defaults will results in both user and group principal names being switched to lower case. A setting of “none” or anything other than “upper” or “lower” leaves the case of the principal name unchanged.

An example of how this provider is enabled and configured within the <gateway> section of a topology file is shown below. This particular example will switch user principals names to lower case and group principal names to upper case:

```
<provider>
    <role>identity-assertion</role>
    <name>SwitchCase</name>
    <param>
        <name>principal.case</name>
        <value>lower</value>
    </param>
    <param>
        <name>group.principal.case</name>
        <value>upper</value>
    </param>
    <enabled>true</enabled>
</provider>
```

Configuring Group Mapping

There are two ways to configure group mapping: “Mapping Authenticated Users to Groups” or “Hadoop Group Lookup Identity Assertion Provider”.

Related Information

Mapping Authenticated Users to Groups

Hadoop Group Lookup Identity Assertion Provider

Set Up an Authorization Provider

The ACLAuthz provider determines who is able to access a service through the Knox Gateway by comparing the authenticated user, group, and originating IP address of the request to the rules defined in the authorization provider.

About this task

The Knox Gateway has an out-of-the-box authorization provider that allows administrators to restrict access to the individual services within a cluster. This provider utilizes a simple and familiar pattern of using ACLs to protect resources by specifying users, groups and ip addresses that are permitted access.

Group membership is determined by the identity-assertion parameter group.principal.mapping.

Procedure

1. Open the cluster topology descriptor file, $cluster-name .xml, in a text editor.
2. Add a AclsAuthz authorization provider to topology/gateway with a parameter for each service as follows:

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>$service_name.acl.mode</name>
        <value>$mode</value>
    </param>
    <param>
        <name>$service_Name.acl</name>
        <value>$cluster_users;$groups_field;IP_field</value>
    </param>
    ...
</provider>
```

where:

- $service_name matches the name of a service element. For example,webhdfs.
- $mode determines how the identity context (the effective user, their associated groups, and the original IP address) is evaluated against the fields as follows:
  - AND specifies that the request must match an entry in all three fields of the corresponding $service_name .acl parameter.
  - OR specifies that the request only needs to match an entry in any field, $users_field OR $groups_field, OR $IP_field.
- $cluster_users is a comma-separated list of authenticated users. Use a wildcard (*) to match all users.
- $groups_field is a comma-separated list of groups. Use a wildcard (*) to match all groups.
- $IP_field is a comma-separated list of IPv4 or IPv6 addresses. An IP address in the list can contain wildcard at the end to indicate a subnet (for example: 192.168.*). Use a wildcard (*) to match all addresses.

Note:

The $service_name .acl.mode parameter is optional. When it is not defined, the default mode is AND ; therefore requests to that service must match all three fields.

3. Save the file.
   The gateway creates a new WAR file with modified timestamp in $gateway/data/deployments.

Only users in a specific group and from specific IP addresses

The following rule is restrictive. It only allows the guest user in the admin group to access WebHDFS from a system with the IP address of either 127.0.0.2 or 127.0.0.3:

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>webhdfs.acl</name>
        <value>guest;admin;127.0.0.2,127.0.0.3</value>
    </param>
</provider>
```

When the parameter acl.mode is not defined the default behavior is ALL, therefore following rule is the same as the one above:

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>webhdfs.acl.mode</name>
        <value>AND</value>
    </param>
    <param>
        <name>webhdfs.acl</name>
        <value>guest;admin;127.0.0.2,127.0.0.3</value>
    </param>
</provider>
```

Note:

If Guest is not in the admin group, the request is denied.

Two of the three conditions

The following rule demonstrates how to require two conditions, user and group but not IP address, using the Wildcard. The rule allows the guest user that belongs to the admin group to send requests from anywhere because the IP field contains an asterisk which matches all IP addresses:

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>webhdfs.acl</name>
        <value>guest;admin;*</value>
    </param>
</provider>
```

One of the three conditions

When the $service .acl.mode parameter is set to OR, the request only needs to match one entry in any of the fields. The request fails with HTTP Status 403 unauthorized, if no conditions are met.

The following example allows:

- guest to send requests to WebHDFS from anywhere.
- Any user in the admin group to send requests to WebHDFS from anywhere.

- Any user, in any group, to send a request to WebHDFS from 127.0.0.2 or 127.0.0.3.

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>webhdfs.acl.mode</name>
        <value>OR</value>
    </param>
    <param>
        <name>webhdfs.acl</name>
        <value>guest;admin;127.0.0.2,127.0.03</value>
    </param>
</provider>
```

Allow all requests

The following rule grants all users, in any group, and from any IP addresses to access WebHDFS:

Note:

When a wildcard is used in a field it matches any value. Therefore the Allow all requests example is the same as not defining an ACL.

```
<provider>
    <role>authorization</role>
    <name>AclsAuthz</name>
    <enabled>true</enabled>
    <param>
        <name>webhdfs.acl</name>
        <value>*,*,*</value>
    </param>
</provider>
```

Setting Up Knox Services for HA

This chapter describes how to set up the Knox Gateway for HA (high availability). Knox provides connectivity based failover functionality for service calls that can be made to more than one server instance in a cluster. Knox supports HA for HBase, Hive, Oozie, WebHCat, and WebHDFS.

```
<provider>
     <role>ha</role>
     <name>HaProvider</name>
     <enabled>true</enabled>
     <param>
         <name>OOZIE</name>
         <value>maxFailoverAttempts=3;failoverSleep=1000;enabled=true</
value>
     </param>
     <param>
         <name>HBASE</name>
         <value>maxFailoverAttempts=3;failoverSleep=1000;enabled=true</
value>
     </param>
     <param>
         <name>WEBHCAT</name>
         <value>maxFailoverAttempts=3;failoverSleep=1000;enabled=true</
value>
     </param>
     <param>
```

```
          <name>WEBHDFS</name>

 <value>maxFailoverAttempts=3;failoverSleep=1000;maxRetryAttempts=300;retrySleep=1000;en
value>
     </param>
     <param>
        <name>HIVE</name>

 <value>maxFailoverAttempts=3;failoverSleep=1000;enabled=true;zookeeperEnsemble=machine1
       zookeeperNamespace=hiveserver2</value>
     </param>
</provider>


<service>
    <role>OOZIE</role>
    <url>http://sandbox1:11000/oozie</url>
    <url>http://sandbox2:11000/oozie</url>
</service>
<service>
    <role>HBASE</role>
    <url>http://sandbox3:22000/hbase</url>
    <url>http://sandbox4:22000/hbase</url>
</service>
<service>
    <role>WEBHCAT</role>
    <url>http://sandbox5:33000/webhcat</url>
    <url>http://sandbox6:33000/webhcat</url>
</service>
<service>
    <role>WEBHDFS</role>
    <url>http://sandbox7:44000/webhdfs</url>
    <url>http://sandbox8:44000/webhdfs</url>
</service>
<service>
    <role>HIVE</role>
</service>
```

HA Prerequisites

Prerequisites before setting up the Knox Gateway for HA (high availability).

Add the following configuration to the Knox>Configs>Advanced>Topology file:

```
<provider>
     <role>ha</role>
     <name>HaProvider</name>
     <enabled>true</enabled>
```

Configure WebHDFS for Knox (HA)

REST API access to HDFS in a cluster is provided by WebHDFS. The following properties for Knox WebHDFS must be enabled in the /etc/hadoop/conf/hdfs-site.xml configuration file. The example values shown in these properties are from an installed instance of the Hortonworks Sandbox.

```
<property>
    <name>dfs.webhdfs.enabled</name>
    <value>true</value>
</property>
<property>
    <name>dfs.namenode.rpc-address</name>
    <value>sandbox.hortonworks.com:8020</value>
</property>
```

```
<property>
    <name>dfs.namenode.http-address</name>
    <value>sandbox.hortonworks.com:50070</value>
</property>
<property>
    <name>dfs.https.namenode.https-address</name>
    <value>sandbox.hortonworks.com:50470</value>
</property>
```

The values above must be reflected in each topology descriptor file deployed to the gateway. The gateway by default includes a sample topology descriptor file located at {GATEWAY_HOME}/deployments/sandbox.xml. The values in the following sample are also configured to work with an installed Hortonworks Sandbox VM.

```
<service>
    <role>NAMENODE</role>
    <url>hdfs://localhost:8020</url>
</service>
<service>
    <role>WEBHDFS</role>
    <url>http://localhost:50070/webhdfs</url>
</service>
```

The URL provided for the NAMENODE role does not result in an endpoint being exposed by the gateway. This information is only required so that other URLs can be rewritten that reference the Name Node's RPC address. This prevents clients from needing to be aware of the internal cluster details.

Related Information

WebHDFS REST API

Configure Knox for HA

Knox provides basic failover and retry functionality for REST API calls made to a service when service HA has been configured and enabled. To enable HA functionality in Knox, the following configurations must be added to the topology file.

Service	Parameter

WebHDFS	`<param>`
	`<name>WEBHDFS</name>`
	`<value>maxFailoverAttempts=3;failoverSleep=1000`
	`value>`
	`</param>`

HBase	`<param>`
	`<name>HBASE</name>`
	`<value>maxFailoverAttempts=3;failoverSleep=1000`
	`value>`
	`</param>`

Hive	`<param>`
	`<name>HIVE</name>`
	`<value>maxFailoverAttempts=3;failoverSleep=1000`
	`zookeeperNamespace=hiveserver2</`
	`value>`
	`</param>`

Oozie	`<param>`
	`<name>OOZIE</name>`
	`<value>maxFailoverAttempts=3;failoverSleep=1000`
	`value>`
	`</param>`

WebHCat	`<param>`
	`<name>WEBHCAT</name>`
	`<value>maxFailoverAttempts=3;failoverSleep=1000`
	`value>`
	`</param>`

The various configuration parameters are described below:

- maxFailoverAttempts -- The maximum number of times a failover will be attempted. The current failover strategy is very simplistic in that the next URL in the list of URLs provided for the service is used, and the one that failed is put at the bottom of the list. If the list is exhausted and the maximum number of attempts has not been reached, the first URL that failed will be tried again (the list will start again from the original top entry).
- failoverSleep -- The amount of time in milliseconds that the process will wait or sleep before attempting to failover.
- maxRetryAttempts -- The maximum number of times that a retry request will be attempted. Unlike failover, the retry is done on the same URL that failed. This is a special case in HDFS when the node is in safe mode. The expectation is that the node will come out of safe mode, so a retry is desirable here as opposed to a failover.

- retrySleep -- The amount of time in milliseconds that the process will wait or sleep before a retry is issued.
- enabled - Flag to turn the particular service on or off for HA.

The additional configuration parameters for Hive are described below:

- zookeeperEnsemble -- A comma separated list of host names (or IP addresses) of the zookeeper hosts that consist of the ensemble that the Hive servers register their information with. This value can be obtained from Hive's config file hive-site.xml as the value for the parameter 'hive.zookeeper.quorum'.
- zookeeperNamespace -- This is the namespace under which HiveServer2 information is registered in the ZooKeeper ensemble. This value can be obtained from Hive's config file hive-site.xml as the value for the parameter 'hive.server2.zookeeper.namespace'.

For the service configuration itself, the additional URLs for standby nodes should be added to the list. The active URL (at the time of configuration) should ideally be added at the top of the list. Example for HBase, Oozie, WebHCat, and WebHDFS:

```
<service>
    <role>{COMPONENT}</role>
    <url>http://{host1}:50070/{component}</url>
    <url>http://{host2}:50070/{component}</url>
</service>
```

Example for Hive:

```
<service>
    <role>HIVE</role>
</service>
```

Please note that there is no <url> tag specified here as the URLs for the Hive servers are obtained from ZooKeeper.

Configuring Knox With Kerberos

Once you have a cluster that uses Kerberos for authentication, you must configure Knox to work with that cluster.

About this task

To enable the Knox Gateway to interact with a Kerberos-protected cluster, add a knox user and Knox Gateway properties to the cluster.

Procedure

1. Find the fully-qualified domain name of the host running the gateway: hostname -f.

   If the Knox host does not have a static IP address, you can define the knox host as * for local developer testing.
2. At every Hadoop Master:
   - Create a UNIX account for Knox:

     ```
     useradd -g hadoop knox
     ```
   - Edit core-site.xml to include the following lines (near the end of the file):

     ```
     <property>
           <name>hadoop.proxyuser.knox.groups</name>
           <value>users</value>
     </property>

     <property>
           <name>hadoop.proxyuser.knox.hosts</name>
           <value>$knox-host</value>
     ```

```
</property>
```

where $knox-host is the fully-qualified domain name of the host running the gateway.

- Edit webhcat-site.xml to include the following lines (near the end of the file):

```
<property>
      <name>hadoop.proxyuser.knox.groups</name>
      <value>users</value>
</property>

<property>
      <name>hadoop.proxyuser.knox.hosts</name>
      <value>$knox-host</value>
</property>
```

where $knox_host is the fully-qualified domain name of the host running the gateway.

3. At the Oozie host, edit oozie-site.xml to include the following lines (near the end of the file):

```
<property>
      <name>oozie.service.ProxyUserService.proxyuser.knox.groups</name>
      <value>users</value>
</property>

<property>
      <name>oozie.service.ProxyUserService.proxyuser.knox.hosts</name>
      <value>$knox-host</value>
</property>
```

where $knox-host is the fully-qualified domain name of the host running the gateway.

4. At each node running HiveServer2, edit hive-site.xml to include the following properties and values:

```
<property>
      <name>hive.server2.enable.doAs</name>
      <value>true</value>
</property>

<property>
      <name>hive.server2.allow.user.substitution</name>
      <value>true</value>
</property>

<property>
      <name>hive.server2.transport.mode</name>
      <value>http</value>
      <description>Server transport mode. "binary" or "http".</
description>
</property>

<property>
      <name>hive.server2.thrift.http.port</name>
      <value>10001</value>
      <description>Port number when in HTTP mode.</description>
</property>

<property>
      <name>hive.server2.thrift.http.path</name>
      <value>cliservice</value>
      <description>Path component of URL endpoint when in HTTP mode.</
description>
</property>
```