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Preface

This content describes how to install and configure an Apache SolrCloud™ deployment mode.

How This Manual Is Organized

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Conventions

The following table describes the conventions that are used in this manual.

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<tr>
<td><strong>THIS TYPEFACE</strong> or this typeface</td>
<td>Denotes syntax that you must enter exactly as shown.</td>
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<tr>
<td>this typeface</td>
<td>Represents a placeholder (or variable), a cross-reference, or an important term.</td>
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<tr>
<td>underscore</td>
<td>Indicates a default setting.</td>
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<tr>
<td>Key + Key</td>
<td>Indicates keys that you must press simultaneously.</td>
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### Convention | Description
--- | ---
{} | Indicates two or three choices. Type one of them, not the braces.
[ ] | Indicates a group of optional parameters. None is required, but you may select one of them. Type only the parameter in the brackets, not the brackets.
| | Separates mutually exclusive choices in syntax. Type one of them, not the symbol.
... | Indicates that you can enter a parameter multiple times. Type only the parameter, not the ellipsis (...).
. . . | Indicates that there are (or could be) intervening or additional commands.

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Information You Should Have

To help our consultants answer your questions effectively, be prepared to provide the following information when you call:

- Your six-digit site code (xxxx.xx).
- Your WebFOCUS configuration:
  - The front-end software you are using, including vendor and release.
  - The communications protocol (for example, TCP/IP or HLLAPI), including vendor and release.
  - The software release.
  - Your server version and release. You can find this information using the Version option in the Web Console.
- The stored procedure (preferably with line numbers) or SQL statements being used in server access.
- The Master File and Access File.
- The exact nature of the problem:
  - Are the results or the format incorrect? Are the text or calculations missing or misplaced?
  - Provide the error message and return code, if applicable.
  - Is this related to any other problem?
- Has the procedure or query ever worked in its present form? Has it been changed recently? How often does the problem occur?
- What release of the operating system are you using? Has it, your security system, communications protocol, or front-end software changed?
Is this problem reproducible? If so, how?

Have you tried to reproduce your problem in the simplest form possible? For example, if you are having problems joining two data sources, have you tried executing a query containing just the code to access the data source?

Do you have a trace file?

How is the problem affecting your business? Is it halting development or production? Do you just have questions about functionality or documentation?

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Introducing Apache SolrCloud

Solr includes an Apache SolrCloud™ deployment mode, which is designed to provide a highly available, fault tolerant environment for distributing indexed content and query requests across multiple servers.

In this chapter:

- SolrCloud Capabilities
- SolrCloud Environment Example

SolrCloud Capabilities

SolrCloud capabilities provide distributed indexing and search capabilities, supporting the following features:

- Central configuration for the entire cluster.
- Automatic load balancing and failover for queries.
- Optionally, if no load balancer is being used, you can integrate Apache ZooKeeper™ for cluster coordination and configuration. With ZooKeeper, queries and updates can be sent to any server. Information in the ZooKeeper database is used to figure out which server or servers need to handle the request.

SolrCloud Environment Example

The following image shows one example of a SolrCloud environment. In this environment, ZooKeeper and Solr are located on the same machine.
**Note:** ZooKeeper and Solr can be located on separate machines.
Chapter 2

Installing and Configuring Apache SolrCloud

This topic provides system requirements and instructions that you need to install and configure SolrCloud. It also describes how to create the ibi-protected collection and how to install and configure a load balancer.

In this chapter:

- Configuring SolrCloud in a Windows Environment

Configuring SolrCloud in a Windows Environment

The following section describes how to configure SolrCloud in a Windows environment.

SolrCloud System Requirements for Windows

To install and configure SolrCloud, your machine must meet the following system requirements defined in Hardware Requirements on page 11 and Software Requirements on page 11.

**Hardware Requirements**

- 2-core processor, 1 processor per core
- 8 GB of RAM or higher is recommended for optimal performance
- 80 GB of disk space

**Software Requirements**

- Windows Server 2016
- Java Runtime Environment (JRE) version 1.8 or higher
- ZooKeeper 3.4.14

Configuring SolrCloud

The following topic provides an example procedure of how to install and configure SolrCloud on Windows. This procedure uses three different ZooKeeper servers.
Procedure:  How to Configure SolrCloud

Note: You must perform the steps in this procedure for each server, changing the ZooKeeper dataDir folder name and the value in the myid file, accordingly.

1. Extract the contents of the zookeeper-3.4.14 directory.
2. Under the zookeeper-3.4.14/conf folder, copy the zoo_sample.cfg file to zoo.cfg.
3. Edit the zoo.cfg file to reflect the following:
   a. Forward slashes (/) for the dataDir directory path. This is where ZooKeeper stores in-memory snapshots and transaction logs of updates to the database.
      Note: You must create a directory that the dataDir setting will point to for each of the ZooKeeper servers. For example:

      dataDir=C:/tmp/zookeeper/1

   b. Add the following line at the bottom of the file for each ZooKeeper instance in the group of ZooKeeper servers (ensemble):

      server.n=host:port1:port2

      where:

      n

      Indicates the ZooKeeper instance in the ensemble.

      host

      Is the host name of the server.

      port1

      Is the port number to use for the peer ZooKeeper servers to communicate with each other.

      Note: Although you may choose any port you want, port 2888 is the recommended port number to use.

      port2

      Is the port number to use for leader election, which is the process of designating a single process as the organizer of a task among several computers (nodes).

      Note: Although you may choose any port you want, port 3888 is the recommended port number to use.

      Note: It is recommended that you use the same port numbers on all of the ZooKeeper servers.
For example:

```
server.1=solrcloud1.ibi.com:2888:3888
server.2=solrcloud2.ibi.com:2888:3888
server.3=solrcloud3.ibi.com:2888:3888
```

c. Add the following command to allow access to all ZooKeeper status commands:

```
4lw.commands.whitelist=* 
```

4. Save the `zoo.cfg` file.

5. Create a folder named `1` in the `dataDir` directory.

6. Create a file named `myid` and include just the value `1` in it.

**Note:**

- Repeat steps 5 and 6 for each server instance, changing the `dataDir` folder name and the `myid` value, accordingly.

- Do not include an extension in the file name.

7. Navigate to the `zookeeper-3.4.14` directory.

8. To start ZooKeeper, from a command prompt, run the following command:

```
bin\zkserver
```

9. Open the appropriate ports in the Firewall to avoid port issues.

10. Install and configure Solr 8.2.0, by extracting the contents of the `solr-8.2.0` zip file.

11. In the `solr-8.2.0\bin\solr.in.cmd` file:

   a. Locate the line with the `set ZK_HOST` command.

   b. Remove the `REM` tag from the command.

   c. Set `ZK_HOST` to the ZooKeeper servers, using port 2181. For example:

```
solrcloud1:2181,solrcloud2:2181,solrcloud3:2181
```

12. Extract the contents of the `ibi_configs.zip` file into the `solr-8.2.0\server\solr\configsets` directory.

13. Navigate to the `solr-8.2.0` directory.

14. From a second command prompt, start the Solr server with the following command:

```
bin\solr start -c -p 8983
```
After all nodes are ready, and Zookeeper and Solr are running on all servers, the Solr Administration Console opens in a browser, as shown in the following image.

**Procedure: How to Create the ibi-protected Collection**

Create the ibi-protected collection, which contains the configuration for WebFOCUS indexes, as follows.

On any of the ZooKeeper servers, navigate to the solr-8.2.0 directory, open a command prompt, and run the following command:

```
bin/solr create -c ibi-protected -n ibi_configs -s 3 -rf 2
```

To confirm that the ibi-protected collection was created for each of the Solr servers, from the Solr Administration Console, select *Cloud*, and then select *Nodes*, as shown in the following image.
To see the status of the ZooKeeper servers, from the Solr Administration Console, select **Cloud**, and then select **ZK Status**, as shown in the following image.

**Procedure:** How to Install and Configure a Load Balancer

The following is an example of installing and configuring a load balancer using NGINX, a free, open-source product.

**Note:** Instead of using an external load balancer like NGINX, you can specify a string of Solr node URLs or ZooKeeper nodes in the Solr URL Search setting (IBI_INFOSEARCH_SOLR_URL) in the Administration Console.

The Search URL:

- Supports SolrCloud directly, meaning that the value can be a comma-separated string of Solr node URLs, for example:
  

- Supports a comma-separated string of ZooKeeper nodes, for example:
  
  `host1:port,host2:port,host3:port`
To install and configure a load balancer using NGINX:

1. Select a system on which to install NGINX.
2. Download the NGINX product and extract the contents of the zip file.
3. In the nginx/conf directory, edit the nginx.conf file.
   a. Create an upstream block to define the cluster for routing and load balancing.
   b. Add a line for each Solr server in the SolrCloud, including its port number.
   For example:

   ```
   upstream solr {
   server solrcloud1.ibi.com:8983;
   server solrcloud2.ibi.com:8983;
   server solrcloud3.ibi.com:8983;
   }
   ```

4. In the nginx.conf file, create a server block in the following format, with a port for the load balancer to listen on and a location:

   ```
   http://<upstream_block_name>
   ```
   For example:

   ```
   server {
   listen 80;
   server_name localhost;
   location / {
   proxy_pass http://solr;
   }
   }
   ```

5. To start NGINX from the top-level nginx folder, type the following command:

   ```
   start nginx
   ```

6. To stop NGINX, from the top-level nginx folder, type the following command:

   ```
   nginx -s quit
   ```

7. To access SolrCloud through the load balancer, use the following URL:

   ```
   http://solrcloud1.ibi.com:80
   ```
Chapter 3

Installing and Configuring Apache SolrCloud Under Docker

This topic provides instructions for installing and configuring SolrCloud under Docker®. Docker is a software platform, which enables you to build, test, and deploy applications quickly.

In this chapter:

- Configuring SolrCloud Under Docker in a Windows Environment

Configuring SolrCloud Under Docker in a Windows Environment

The following topic provides an example procedure of how to configure SolrCloud under Docker in a Windows environment.

Procedure: How to Configure SolrCloud Under Docker

1. Install Docker.
2. Copy the sample Docker Compose file from:
   

3. Create a mycluster folder on the host system C:\ drive and save the Docker Compose file in the folder.
4. Edit the docker-compose.yml file, and reflect the following changes:
   a. For all three solr service blocks, change image: solr:7 to image: solr:8.2.
   b. Add the following at the end of the solr1 service block to persist the data:

      ```yaml
      volumes:
      - /c/var_solr/solr1data:/var/solr
      - /c/zookeeper_data/zoo1data:/data
      - /c/zookeeper_data/zoo1log:/datalog
      ```
   c. Add the following at the end of the solr2 service block to persist the data:

      ```yaml
      volumes:
      - /c/var_solr/solr2data:/var/solr
      - /c/zookeeper_data/zoo2data:/data
      - /c/zookeeper_data/zoo2log:/datalog
      ```
d. Add the following at the end of the solr3 service block to persist the data:

```yaml
volumes:
  - /c/var_solr/solr3data:/var/solr
  - /c/zookeeper_data/zoo3data:/data
  - /c/zookeeper_data/zoo3log:/datalog
```

5. On the host system C:\ drive, create the following directories to match the paths in the volumes blocks:

- var_solr
- zookeeper_data

6. Under the /var_solr directory, create the following folders:

- solr1data
- solr2data
- solr3data

7. Under the /zookeeper_data directory, create the following folders:

- zoo1data
- zoo1log
- zoo2data
- zoo2log
- zoo3data
- zoo3log

8. Extract the ibi_configs configuration ZIP file into the var_solr/solr1data folder.

These volume entries in the docker-compose.yml file, and the physical folders created on the host system, create a volume mount for the docker container to access files on the host system through the mapped folder created in the container. These volume mounts create the persistence needed for the data when the container is destroyed and re-invoked.

9. Invoke Powershell, and when it starts, navigate to the mycluster folder where you saved your docker-compose.yml file.

10. Start the containers, by issuing the following command:

```
docker-compose up -d
```
11. Wait for the six containers to start.
   To confirm that the containers started, issue the following command:
   
   ```bash
   docker container ls
   ```

12. Upload the ibi_configs configuration to the ZooKeeper ensemble, by issuing the following command:
   
   ```bash
   docker exec solr1 bin/solr zk upconfig -n ibi_configs
   -d /var/solr/ibi_configs
   ```
   
   This will upload the configuration to all three ZooKeeper instances.

13. When completed, create the ibi-protected collection, by issuing the following command:
   
   ```bash
   docker exec solr1 bin/solr create -c ibi-protected -n ibi_configs
   -s 3 -rf 2
   ```
   
   This will create three shards and replicas for each Solr node, which completes the Solr and ZooKeeper setup and configuration.

**Procedure: How to Set Up and Configure a Load Balancer**

The following is an example of installing and configuring a load balancer, using NGINX.

1. Create a docker-compose.yml file, in a folder other than the mycluster folder. For example:
   
   ```yaml
   version: '3'
   services:
     docker_nginx:
       image: nginx:latest
       container_name: production_nginx
       volumes:
         - ./nginx.conf:/etc/nginx/nginx.conf
         - ./nginx/error.log:/etc/nginx/error_log.log
         - ./nginx/cache/:/etc/nginx/cache
       ports:
         - 80:80
       networks:
         - mycluster_solr

   networks:
     mycluster_solr:
       external: true
   ```

2. In the same folder where you save this docker-compose.yml file, you need an nginx.conf file, which describes the configuration. For example:
worker_processes  1;

events {
  worker_connections  1024;
}

http {
  include       mime.types;
  default_type  application/octet-stream;

  log_format main      "$remote_addr - $remote_user [$time_local] "$request" $status $bytes_sent "$http_referer" "$http_user_agent" "$gzip_ratio";
  log_format download "$remote_addr - $remote_user [$time_local] "$request" $status $bytes_sent "$http_referer" "$http_user_agent" "$http_range" "$sent_http_content_range";

  client_header_timeout  3m;
  client_body_timeout    3m;
  send_timeout           3m;
  client_header_buffer_size    1k;
  large_client_header_buffers 4 4k;

  gzip on;
  gzip_min_length  1100;
  gzip_buffers    4 8k;
  gzip_types     text/plain;

  output_buffers  1 32k;
  postpone_output 1460;

  sendfile    on;
  tcp_nopush  on;
  tcp_nodelay on;

  keepalive_timeout  75 20;

  upstream docker_nginx {
    server solr1:8983;
    server solr2:8983;
    server solr3:8983;
  }
}
server {
    listen       80;
    server_name  localhost;
    proxy_set_header Host             $host;
    proxy_set_header X-Real-IP        $remote_addr;
    client_max_body_size       10m;
    client_body_buffer_size    128k;
    proxy_connect_timeout      90;
    proxy_send_timeout         90;
    proxy_read_timeout         90;
    proxy_buffer_size          4k;
    proxy_buffers              4 32k;
    proxy_busy_buffers_size    64k;
    proxy_temp_file_write_size 64k;

    location / {            
        proxy_pass   http://docker_nginx;
    }

    location = /wpad.dat {  
        access_log  off;
        return  404;
    }
}

**Important:** The *upstream* block name *proxy_pass* value in the nginx.conf file, and the docker-compose.yml *service* name must all be the same, or it will not work properly. In these examples, *docker-nginx* is used.

3. Start the nginx container, by issuing the following command:
   
   `docker-compose up -d`

4. Wait for the container to start.

   To confirm that the container started, issue the following command:

   `docker container ls`

**Procedure:** How to Configure WebFOCUS to Use Our SolrCloud

1. On the Search page of the Administration Console configuration tab, add the following URL to the Solr Url text box:

   `http://nginxHostSystem:80`

2. Restart the Application Server.
3. Sign in to WebFOCUS and perform your data loads, indexRepository, and describeRepository web service commands to load the index.

For more information on indexRepository and describeRepository, see the WebFOCUS InfoSearch manual.
This topic provides instructions for installing and configuring SolrCloud under Kubernetes®. Kubernetes is an open source system for managing applications in a container technology environment.

In this chapter:

- Configuring SolrCloud Under Kubernetes in a Windows Environment

Configuring SolrCloud Under Kubernetes in a Windows Environment

The following topic provides an example procedure of how to configure SolrCloud under Kubernetes in a Windows environment.

Procedure: How to Configure SolrCloud Under Kubernetes

1. Install or obtain access to a Kubernetes environment.
2. Create a cluster that has a minimum of 8GB RAM, 2 CPUs, and a port range of 80-30000.
3. Download the Solr Helm Chart from the following link:
   
   https://github.com/helm/charts/tree/master/incubator/solr

4. Navigate to the solr folder and edit the values.yaml file, as follows:
   
   a. Locate the image: block.
   b. Change the tag: value from 7.7.2 to 8.2.0.

5. Save the values.yaml file.
6. Install Helm.
7. Add the Incubator repository to your environment, by executing the following command:
   
   helm repo add incubator http://storage.googleapis.com/kubernetes-charts-incubator

8. Install tiller in the cluster, by issuing the following command:
   
   helm init

9. Run the chart, by issuing the following command:
   
   helm install --name solr ./solr

   Note: Once all the pods are in Running status, you can add a load balancer.
Procedure: How to Set Up and Configure a Load Balancer

The following is an example of installing and configuring a load balancer, using Voyager Ingress.

1. Download the Voyager Ingress installation from AppsCode.com and follow the installation steps. The Voyager Ingress is used because it allows the StatefulSet pod names as hostNames for the load balancer.

2. Once the installation of the Voyager Ingress is complete and tests are working, create a YAML file, in any folder, for use with SolrCloud. For example, create a voyager_ingress.yaml file, as shown below:

```yaml
apiVersion: voyager.appscode.com/v1beta1
type: Ingress
metadata:
  name: example-ingress
  namespace: default
  annotations:
    ingress.appscode.com/stats: true
spec:
  rules:
    - http:
      paths:
        - path: /
          backend:
            hostNames:
              - solr-0
              - solr-1
              - solr-2
            serviceName: solr-headless
            servicePort: 8983

3. Issue the following command to start the Ingress:

   kubectl apply -f voyager_ingress.yaml

4. To access Solr, issue the following command to obtain the Load Balancer IP address and port:

   kubectl get svc

5. Use the IP address and port in the browser to see the Solr Administration Console.

6. If you want to see the stats page, issue the following commands to forward the Ingress pod with port 56789:

   - To get the pod name:

     kubectl get pods
To forward the pod name and port 56789:

```
kubectl port-forward
```

You can then issue the following command in a browser to see the stats:

```
http://127.0.0.1:56789
```

**Note:** With Kubernetes, the index data is persisted in the cluster.

**Procedure:** How to Configure WebFOCUS to Use Our SolrCloud

1. On the Search page of the Administration Console configuration tab, add the following URL to the Solr Url text box:

```
http://externalLoadBalancerIPaddress:port
```

2. Restart the Application Server.

3. Sign in to WebFOCUS and perform your data loads, indexRepository, and describeRepository web service commands to load the index.

   For more information on indexRepository and describeRepository, see the WebFOCUS InfoSearch manual.
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Apache SolrCloud™ Installation and Configuration
Release 8207