Exam Objective 2

Deploy a Single Datacenter

Deploy a Single Datacenter

Objective 2a: Start and manage the Consul process

Objective 2b: Interpret a Consul agent configuration

Objective 2c: Configure Consul network addresses and ports

Objective 2d: Describe and configure agent join and leave behaviors

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Difficulty Level

Starting the Consul Process

General Workflow to Start Consul

1. Download Consul Binaries

2. Develop Configuration File

3. Start the Consul Process

https://releases.hashicorp.com

Starting the Consul Process

- Consul is started by running the consul agent command
  - consul agent <flag>
- The provided flags will dictate how Consul is configured

Terminal

```
$ consul agent -config-file=/opt/consul/config.hcl
```

Starting the Consul Process

- Consul agent is commonly started using a service manager
  - systemctl
  - Windows Service Manager

- Service manager will start the Consul agent using a command line
  - Command line can include flags or...
  - Configurations can be part of the configuration file (most common)

Starting the Consul Process

- Command-line using Consul command-line options:
  - consul agent -<option> -<option> -<option>

Terminal

```
$ consul agent -datacenter="aws" -bind="10.0.10.42" -data-dir=/opt/consul
    -encrypt=<key> -retry_join="10.0.10.64,10.4.23.98"
```

Starting the Consul Process

- Command-line using Consul configuration file
  - -config-file
  - -config-dir

Terminal

```
$ consul agent -config-file=/etc/consul/config.hcl
```

Starting the Consul Process

- Command line using configuration file
  - -config-file
    - single file → /etc/consul.d/config.hcl

Terminal

```
$ cd /etc/consul.d
$ ls
config.hcl
```

Service Manager

```
/usr/local/bin/consul agent -config-file=/etc/consul.d/config.hcl
```

Starting the Consul Process

- Command line using configuration directory
  - -config-dir
    - points to a directory → /etc/consul.d

Terminal

```
$ cd /etc/consul.d
$ ls
config.hcl
metadata.hcl
service.hcl
```

Helpful when you have multiple files to be loaded

Service Manager

```
/usr/local/bin/consul agent -config-dir=/etc/consul.d/
```

Consul Server - Dev Mode

- Using consul server –dev will start Consul in dev server mode

Terminal

```
$ consul agent -dev
```

- Useful for starting a Consul agent
  - All persistence options are turned off
  - Enables in-memory server
  - Connect is enabled (will create a new root CA cert by default)
  - gRPC port defaults to 8502

Never run Consul in –dev mode in production

Manage the Consul Process

- Restarting the Consul process
  - Use the service manager

Terminal

```
$ systemctl restart consul
```

- Permanently removing the node
  - Gracefully remove node from Consul
  - Stop service

Terminal

```
$ consul leave
$ systemctl stop consul
```

Manage the Consul Process

- Reloading the Consul configuration
  - Can modify certain configuration options

Terminal

```
$ consul reload
```

- Not all configuration options are reloadable (not an exhaustive list)
  - ACL Tokens
  - Checks
  - Log level
  - Node Metadata
  - Services
  - TLS Configuration
  - Watches

https://www.consul.io/docs/agent/options#reloadable-configuration

Interpret a Consul Agent Configuration

- Configuration file can be written in JSON or HCL
  - Defines the configuration for the Consul Agent (server & client)

Terminal

```
...
"datacenter": "us-east-1",
  "client_addr": "0.0.0.0",
  "bind_addr": "10.11.11.11",
  "advertise_addr": "10.11.11.11",
  "bootstrap_expect": 5,
  "retry_join": ["provider=aws tag_key=Environment-Name tag_value=consul-cluster region=us-east-1"],
  "enable_syslog": true,
  "acl": {
   "enabled": true,
   "default_policy": "deny",
...
```

https://github.com/btkrausen/hashicorp/blob/master/consul/config.hcl

Interpret a Consul Agent Configuration

- Environment variables cannot be used to configure the Consul client.
- Key Options in a SERVER configuration file:
  - server (boolean) – is this a server agent or not
  - datacenter (string)– what datacenter to join
  - node (string) – unique name of agent (usually server name)
  - join/retry_join/auto-join (string) – what other servers/cluster to join
  - client_addr/bind_addr/advertise_addr (string) – what IP/interface to use for Consul communications
  - log_level (string) – level of logging (trace, debug, info, etc)
  - encrypt (string) – secret to use for encryption of Consul traffic (gossip)
  - data-dir (string) – provide a persistent directory for the agent to store state

https://www.consul.io/docs/agent/options

Interpret a Consul Agent Configuration

- Environment variables cannot be used to configure the Consul client
- Key Options in a SERVICE configuration file:
  - name (string) <req> – logical name of the service (web, app1, etc.)
  - id (string) – unique ID for this service – unique per agent (web-server-01, hcwebapp418, etc.)
  - port (integer) – what local port is the service running on? (80, 8080, 443)
  - check (arguments) – define arguments for health check

https://www.consul.io/api/agent/service.html#parameters-2

Configure Consul Network Addresses and Ports

eth0: 10.0.5.34
eth1: 10.0.3.88

Applications/Clients

Configure Consul Network Addresses and Ports

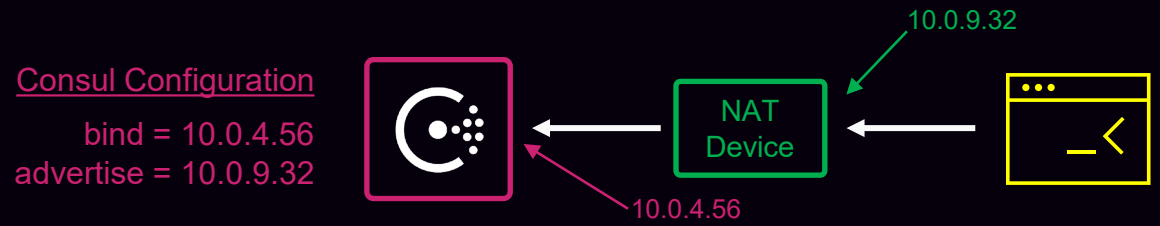
- DNS
  - Port 8600 might work fine in your environment
  - But others might lack the ability to send DNS traffic to a non-standard port (UDP 53)
  - Ports below 1024 require to be run with root privileges
    - We do NOT want to run Consul as a root user
  - We may need to set up forwarding using BIND or dnsmasq to forward requests received on 53 and forward to 8600

https://learn.hashicorp.com/tutorials/consul/dns-forwarding

Configure Consul Network Addresses and Ports

- Consul API
  - -bind – interface that the Consul agent itself uses
  - -advertise – the interface that Consul tells other agents and clients to use when connecting to the local agent

- Useful for when Consul server agent nodes have multiple interfaces or if Consul is behind a NAT device



Adding Servers

- Consul servers can "join" the cluster using multiple methods
- A Consul agent can join *any* node in the cluster
  - gossip will propagate the updated membership state across the cluster
- An agent that is already a member can join a different cluster
  - The two clusters will be merged into a single cluster

Adding Servers

- Multiple ways for an agent to join a cluster
  - Command line: consul join <host>

Terminal

```
$ consul join consul-node-a.example.com
Successfully joined cluster by contacting 1 nodes.
```

IP Address works, too

- <host> can be any member of the cluster, client or server
- Generally used for testing or lab environment
- Manual join not recommended for production deployments (use agent config)

Adding Servers

- Multiple ways for an agent to join a cluster
  - Configuration file
    - -join
      - specify one or more agents to join (IPv4, IPv6, or hostnames)
      - If Consul is unable to join specified agents, agent startup will fail
    - -retry_join
      - specify one or more agents to join (IPv4, IPv6, or hostnames)
      - Will continue retrying until successful
      - Ideal for automated deployments or when agents may start random order

Adding Servers

- Multiple ways for an agent to join a cluster
  - Configuration file

Terminal

```
{
  "bootstrap": false,
  "bootstrap_expect": 3,
  "server": true,
  "retry_join": ["10.0.10.34", "10.0.11.72“]
}
```

(agent join snippet)

Adding Servers

- Multiple ways for an agent to join a cluster
- Configuration file
  - Cloud Auto-join
    - Uses cloud meta-data to discover Consul nodes (tags)
      - AWS
      - Azure
      - GCP
      - Softlayer
      - Alibaba Cloud
      - Digital Ocean
      - Openstack
      - Scaleway
      - TencentCloud
      - Joyent Triton
      - vSphere
      - Packet
      - Linode
      - Kubernetes
  - Requires credentials for authentication

Adding Servers

- Multiple ways for an agent to join a cluster
- Configuration file
  - Cloud Auto-join

Terminal

```
{
  "bootstrap": false,
  "bootstrap_expect": 3,
  "server": true,
   "retry_join": ["provider=aws tag_key=consul tag_value=true"],
}
```

Removing Servers

- Command Line
  - Consul leave triggers a graceful leave and shutdown
  - It ensures that other nodes see the agent as “left” rather than “failed”

Terminal

```
$ consul leave
Graceful leave complete
```

  - For servers, a consul leave affects the raft peer-set, as Consul will reconfigure the cluster to have fewer servers

Listing Membership

- Determining the members of the cluster
  - Displays both servers and clients

Terminal

```
$ consul members
Node        Address          Status  Type    Build  Protocol  DC   Segment
consul-a    10.0.2.10:8301   alive   server  1.9.0  2         dc1
consul-b    10.0.2.11:8301   alive   server  1.9.0  2         dc1
web-app-01  10.0.8.9:8301    alive   client  1.8.6  2         dc1
```

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Difficulty Level

END OF SECTION