Tableau Server Enterprise Deployment Guide

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Contents

Tableau Server Enterprise Deployment Guide

The Tableau Server Enterprise Deployment Guide (EDG) has been developed to provide prescriptive guidance for deploying Tableau Server (on-premises or in the cloud). The Guide provides deployment guidance for enterprise scenarios in context of a reference architecture. We have tested the reference architecture to verify compliance with security, scale, and performance benchmarks, which conform to industry-standard best practices.

At a high-level, the core features of an industry standard enterprise deployment consist of a tiered topology where each layer of server application functionality (web gateway tier, application tier, and data tier) is bound and protected by access-controlled subnets. Users accessing the server application from the internet are authenticated at the web tier. Once authenticated, the request is proxied to a protected subnet where the application tier handles the business logic. High-value data is protected by the third subnet: the data tier. Services in the application tier communicate over the protected network to the data tier to service data requests to the backend data sources.

In this deployment, security is at the forefront of all design decisions and implementation. However, reliability, performance, and scalability are also priority requirements. Given the distributed and modular design of the reference architecture, reliability and performance scale in a linearly predictable way by strategically co-locating compatible services at each node and adding services at chokepoints.

Who should read this

The EDG has been developed for enterprise IT administrators who may require:

- An IT-managed Tableau deployment
- Industry compliance enforcement

- Industry deployment best practices
- Secure deployment by default

The EDG is an implementation guide for deploying the enterprise reference architecture. While this version of the EDG includes an example AWS/Linux implementation, the Guide can be used as a resource by experienced enterprise IT administrators to deploy the prescribed reference architecture into any industry standard data center environment.

Version

This version of EDG was developed for the 2021.2.3 version (or later) of Tableau Server. While you may use the EDG as a general reference for deploying older versions of Tableau Server, we recommend that you deploy the reference architecture with Tableau Server 2021.2.3 or later. Some features and options are not available on older versions of Tableau Server.

For the most up-to-date features and improvements, we recommend deploying EDG with Tableau Server 2022.1.7 and later.

The reference architecture described in this Guide supports the following Tableau clients: Web authoring with compatible browsers, Tableau Mobile, and Tableau Desktop version 2021.2.1 or later. Other Tableau clients (Tableau Prep, Bridge, etc) have not yet been validated with the reference architecture.

Highlight features

The first version of the Tableau Server reference architecture introduces the following scenarios and features:

- Client pre-authentication: Tableau clients (Desktop, Mobile, Web Authoring) authenticate with the corporate authentication provider in the web tier before accessing internal Tableau Server. This process is managed by configuring an authN plug-in on the Tableau Server Independent Gateway acting as reverse proxy server. See Part 5 - Configuring Web Tier.

- Zero trust deployment: Because all traffic to Tableau Servers is pre-authenticated, the entire Tableau deployment operates in a private subnet that does not require a trusted connection.
- External repository: The reference architecture specifies installing the Tableau repository onto an external PostgreSQL database, allowing DBAs to manage, optimize, scale, and back up the repository as a generic database.
- Initial node recovery: The EDG introduces a script that automates initial node restoration in the event of a failure.
- Tar-based backup and restore: Use familiar tar backups at strategic milestones of the Tableau deployment. In the event of a failure or deployment misconfiguration, you can quickly recover to the previous deployment stage by recovering the associated tar backup.
- Performance improvement: Customer and lab validation show a 15-20% performance improvement when running EDG compared to standard deployment.

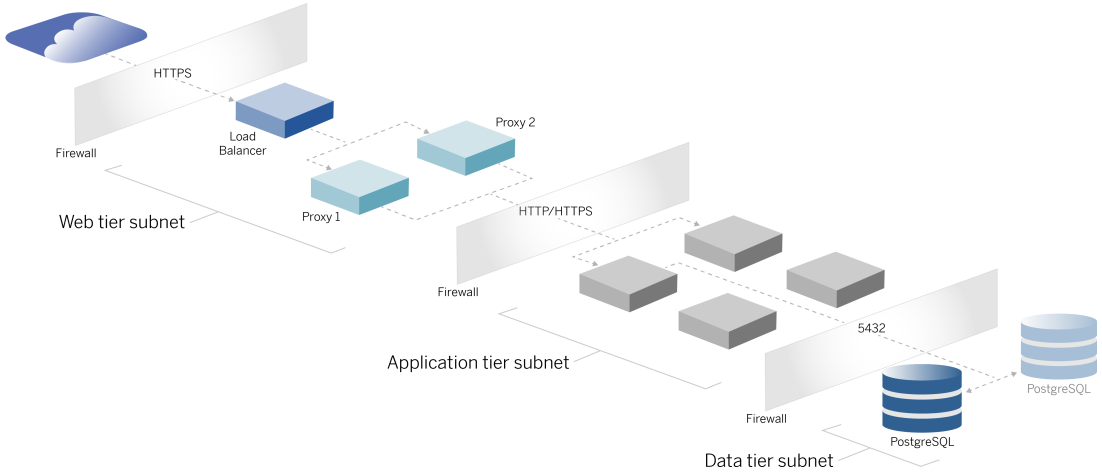
Licensing

The Tableau Sever reference architecture prescribed in this Guide requires a Tableau Advanced Management license to enable Tableau Server External Repository. You may also optionally deploy Tableau Server External File Store, which also requires the Tableau Advanced Management license. See *About Tableau Advanced Management on Tableau Server* (Linux).

Part 1 - Understanding Enterprise Deployment

Part 1 describes, in more detail, the features and requirements of industry-standard enterprise deployment for which the Tableau Server Enterprise Deployment Guide has been designed.

The following network diagram shows a generic datacenter tiered deployment with Tableau Server reference architecture.



Industry standards and deployment requirements

The following are features of industry standard deployments. These are the requirements that the reference architecture has been designed for:

- A multi-tiered network design: The network is bound by protected subnets to limit access at each layer: web layer, application layer, and data layer. No single communication is able to pass across subnets, as all communication is terminated at the next subnet.

- Ports and protocols blocked by default: Each subnet or security group will block all inbound and outbound ports and protocols by default. Communication is enabled, in part, by opening exceptions in the port or protocol configuration.
- Off-box web authentication: User requests from the internet are authenticated by an authentication module on the reverse proxy in the web tier. Therefore, all requests to the application layer are authenticated at the web tier before passing into the protected application layer.
- Platform-independent: Solution can be deployed with on-premises server applications or in the cloud.
- Technology-agnostic: Solution can be deployed in a virtual machine environment or in containers. May also be deployed on Windows or Linux. However, this initial version of the reference architecture and supporting documentation has been developed for Linux running in AWS.
- Highly available: All components in the system are deployed as a cluster and designed to operate in an active/active or active/passive deployment.
- Siloed roles: Each server performs a discrete role. This design partitions all servers such that access may be minimized to service-specific administrators. For example, DBAs manage PostgreSQL for Tableau, identity administrators manage authentication module in web tier, network and cloud administrators enable traffic and connectivity.
- Linearly scalable: as discrete roles, you can scale each tier service independently according to load profile.
- Client support: The reference architecture supports all Tableau clients: Tableau Desktop (versions 2021.2 or later), Tableau Mobile, and Tableau Web Authoring.

Security measures

As stated, a primary feature of industry standard datacenter design is security.

- Access: Each tier is bound by a subnet that enforces access control at the network layer using port filtering. Communication access between subnets may also be enforced by the application layer with authenticated services between processes.
- Integration: Architecture is designed to plug-in with Identity Provider (IdP) on reverse proxy in the web tier .
- Privacy: Traffic into the web tier is encrypted from the client with SSL. Traffic into the internal subnets may optionally be encrypted as well.

Web proxy tier

The web tier is a subnet in the DMZ (also referred to as the perimeter zone) that acts as a security buffer between the internet and the internal subnets where applications are deployed. The web tier hosts reverse proxy servers that do not store any sensitive information. The reverse proxy servers are configured with an AuthN plugin to pre-authenticate client sessions with a trusted IdP, before redirecting the client request to Tableau Server. For more information, see Pre-authentication with an AuthN module.

Load-balancers

The deployment design includes an enterprise load-balancing solution in front of the reverse proxy servers.

Load balancers provide important security and performance enhancements, by

- Virtualizing the front-end URL for the application tier services
- Enforcing SSL encryption
- Offloading SSL
- Enforcing compression between the client and the web tier services
- Protecting against DOS attacks
- Providing high-availability

Note: Tableau Server version 2022.1 includes the Tableau Server Independent Gateway. The Independent Gateway is a standalone instance of the Tableau Gateway process that serves as a Tableau-aware reverse proxy. At the time of release, the Independent Gateway has been validated, but not fully tested in the EDG reference architecture. After full testing is complete the EDG will be updated with Tableau Server Independent Gateway prescriptive guidance.

Application tier

The application tier is in a subnet that runs the core business logic of the server application. The application tier consists of services and processes that are configured across distributed nodes in a cluster. The application tier is only accessible from the web tier and is not directly accessible by users.

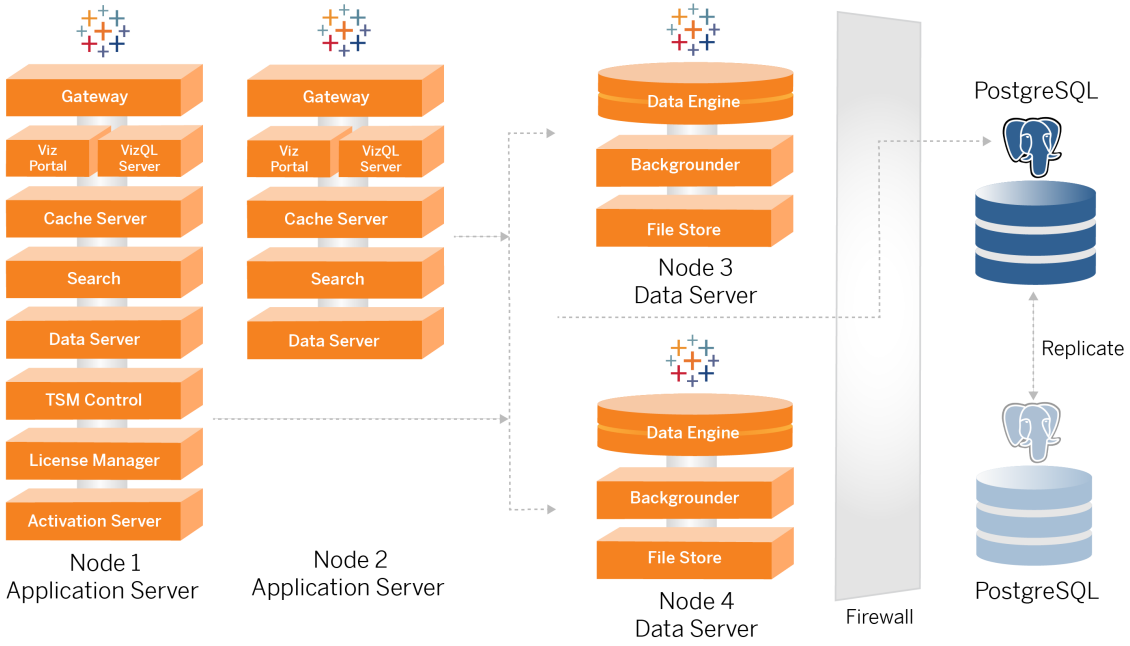
Performance and reliability are improved by configuring the application processes such that processes with different resource-use profiles (i.e., CPU intensive vs memory intensive) are co-located.

Data tier

The data tier is a subnet that holds valuable data. All traffic to this tier originates from the application tier and is therefore already authenticated. In addition to access requirements at the network layer with port configuration, this layer should include authenticated access and optionally encrypted traffic with the application tier.

Part 2 - Understanding the Tableau Server Deployment Reference Architecture

The following image shows the relevant Tableau Server processes and how they are deployed in the reference architecture. This deployment is considered the minimal enterprise-appropriate Tableau Server deployment.



The process diagrams in this topic are intended to show the major, defining processes of each node. There are many supporting processes that also run on the nodes that are not shown in the diagrams. For a list of all processes, see the configuration section of this guide, Part 4 - Installing and Configuring Tableau Server.

Tableau Server Processes

The Tableau Server reference architecture is a four node Tableau Server cluster deployment with external repository on PostgreSQL:

- Tableau Server initial node (Node 1): Runs required TSM administrative and licensing services that can only be run on a single node in the cluster. In the enterprise context, the Tableau Server initial node is the primary node in the cluster. This node also runs redundant application services with Node 2.
- Tableau Server application nodes (Node 1 and Node 2): The two nodes serve client requests, connect to and query data sources and to the data nodes.
- Tableau Server data nodes (Node 3 and Node 4): Two nodes that are dedicated to managing data.
- External PostgreSQL: this host runs the Tableau Server Repository process. For HA deployment you must run an additional PostgreSQL host for active/passive redundancy.

  You can also run PostgreSQL on Amazon RDS. For more information about the differences between running the repository on RDS vs an EC2 instance, see *Tableau Server External Repository* (Linux).

  Deploying Tableau Server with an external repository requires a Tableau Advanced Management license.

  If your organization does not have in-house DBA expertise, you may optionally run the Tableau Server Repository process in the default, internal PostgreSQL configuration. In the default scenario, the Repository is run on a Tableau node with embedded PostgreSQL. In this case, we recommend running the Repository on a dedicated Tableau node, and a passive Repository on an additional dedicated node to support Repository failover. See *Repository Failover* (Linux).

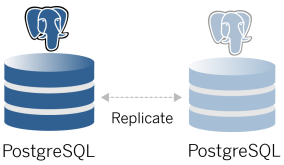
  By way of example, the AWS implementation described in this Guide explains how to deploy the external repository on PostgreSQL running on an EC2 instance.

- Optional: If your organization uses external storage, you may deploy the Tableau File Store as an external service. This Guide does not include the External File Store in the core deployment scenario. See *Install Tableau Server with External File Store* (Linux).

  Deploying Tableau Server with an external File Store requires a Tableau Advanced Management license.

PostgresSQL Repository

Tableau Server Repository is a PostgresSQL database that stores server data. This data includes information about Tableau Server users, groups and group assignments, permissions, projects, data sources, and extract metadata and refresh information.



The default PostgresSQL deployment consumes almost 50% of system memory resources. Based on its usage (for production and large production deployments) resource usage can go up. For this reason, we recommend running the Repository process on a computer that is not running any other resource-intensive server components like VizQL, Backgrounder, or Data Engine. Running the Repository process along with any of these components will create IO contentions, resource constraint, and will degrade overall performance of the deployment.

Node 1: Initial node

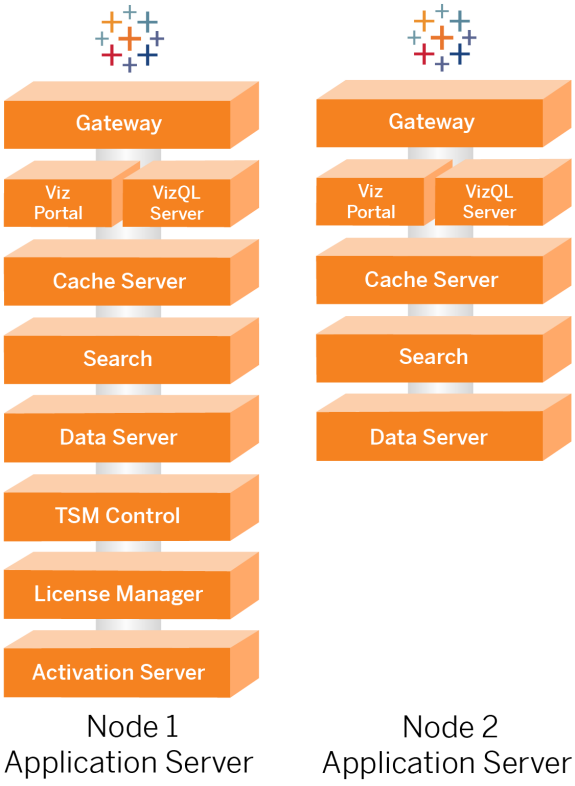
The initial node runs a small number of important processes and shares the application load with Node 2.

The first computer you install Tableau on, the "initial node," has some unique characteristics. Three processes run only on the initial node and cannot be moved to any other node except in a failure situation, the License Service (License Manager), Activation Service, and TSM Controller (Administration Controller).

Node 1 failover and automated restoration

The License, Activation, and TSM Controller services are critical to the health of a Tableau Server deployment. In the event of a Node 1 failure, users will still be able to connect to the Tableau Server deployment, as a properly configured reference architecture will route requests to Node 2. However without these core services, the deployment will be in a critical state of pending failure. See Initial node automated recovery.

Nodes 1 and 2: Application servers



Nodes 1 and 2 run the Tableau Server processes that serve client requests, query data sources, generate visualizations, handle content and administration, and other core Tableau business logic. The application servers do not store user data.

Note: "Application Server" is a term that also refers to a Tableau Sever process that is listed in TSM. The underlying process for "Application Server" is VizPortal.

Run in parallel, Node 1 and Node 2 scale to service requests from the load-balancing logic run on the reverse proxy servers. As redundant nodes, should one of these nodes fail, then client requests and servicing are handled by the remaining node.

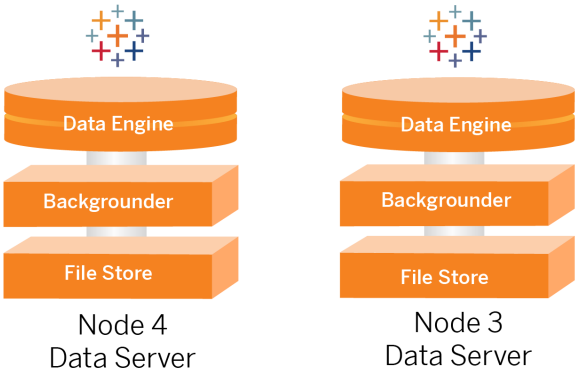
The reference architecture has been designed so that complimentary application processes run on the same computer. This means the processes are not competing for computing resources and creating contention.

For example, VizQL, a core processing service on application servers, is highly CPU and memory-bound, VizQL uses almost 60-70% of the CPU and memory on the computer. For this reason, the reference architecture is designed so that no other memory or CPU-bound processes are on the same node as VizQL. Testing shows that the amount of the load or number users doesn't affect the memory or CPU usage on VizQL nodes. For example, reducing the number of concurrent users in our load test only effects the performance of the dashboard or the visualization loading process, but does not reduce resource utilization. Therefore, based on the available memory and CPU during peak usage, you may consider adding more VizQL processes. As a starting place for typical workbooks, allocate 4 cores per VizQL process.

Scaling application servers

The reference architecture is designed for scale based on a use-based model. As a general starting point, we recommend a minimum of two application servers, each supporting up to 1000 users. As user base increases, plan to add an application server for each additional 1000 users. Monitor usage and performance to tune the user base per host for your organization.

Nodes 3 and 4: Data servers



The File Store, Data Engine (Hyper), and Backgrounder processes are co-located on Nodes 3 and 4 for the following reasons:

- Extract optimization: Running Backgrounder, Hyper, and File Store on the same node optimizes performance and reliability. During the extraction process, Backgrounder queries the target database, creates the Hyper file on the same node, and then uploads to File Store. By co-locating these processes on the same node the extraction creation workflow does not require copying amounts of data across the network or the nodes.
- Complimentary resource balancing: Backgrounder is mainly CPU intensive. Data Engine is a memory-intensive process. Coupling these processes allows maximum resource utilization on each node.
- Consolidation of data processes: Since each of these processes are back-end data processes, it makes sense to run them in the most secure data tier. In future versions of the reference architecture, the application and data servers will run in separate tiers. However, due to application dependencies in the Tableau architecture, application and data servers must run in the same tier at this time.

Scaling data servers

As with application servers, planning the resources that are required for Tableau data servers requires use-based modeling. In general, assume each data server can support up to 2000 extract refresh jobs per day. As your extract jobs increase, add additional data servers without the File Store service. Generally, the two-node data server deployment is suitable for deployments that use the local filesystem for the File Store service. Note that adding more application

servers does not impact performance or scale on data servers in a linear fashion. In fact, with the exception of some overhead from additional user queries, the impact of adding more application hosts and users is minimal.

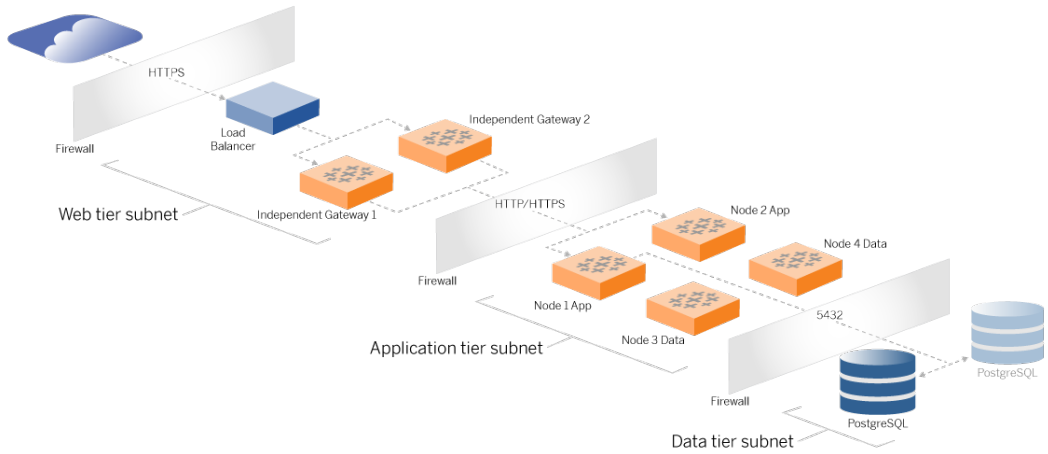
Part 3 - Preparing for Tableau Server Enterprise Deployment

Part 3 describes the requirements for preparing your infrastructure to deploy the Tableau Server reference architecture. Before you begin, we recommend reviewing, Part 2 - Understanding the Tableau Server Deployment Reference Architecture.

In addition to requirement descriptions, this topic provides an implementation example of the reference architecture in an AWS environment. The remainder of this Guide builds on the AWS reference architecture example started in this topic.

A core principle of the reference architecture is standardization with data center security best practices. Specifically, the architecture is designed to segregate services into protected network subnets. Inter-subnet communication is restricted to specific protocol and port traffic.

The following diagram illustrates the reference architecture subnet design for an on-premises deployment or a customer-managed cloud deployment. For an example cloud deployment, see the section below, Example: Configure subnets and security groups in AWS.



Subnets

Create three subnets:

- A web tier
- An application tier
- A data subnet.

Firewall/Security group rules

The tabs below describe the firewall rules for each tier of the datacenter. For AWS-specific security group rules, see the section later in this topic.

Web tier

The web tier is a public DMZ subnet that will handle inbound HTTPS requests and proxy the requests to the application tier. This design provides a layer of defense from malware that may be targeted at your organization. The web tier blocks access to the application/data tier.

Traffic	Type	Protocol	Port range	Source
Inbound	SSH	TCP	22	Bastion subnet (for cloud deployments)
Inbound	HTTP	TCP	80	Internet (0.0.0.0/0)
Inbound	HTTPS	TCP	443	Internet (0.0.0.0/0)
Outbound	All traffic	All	All	

Application tier

The application subnet is where the Tableau Server deployment resides. The application subnet includes the Tableau application servers (Node 1 and Node 2). The Tableau application

servers process user requests to the data servers and run core business logic.

The application subnet also includes the Tableau data servers (Node 3 and Node 4).

All client traffic to the application tier is authenticated at the web tier. Administrative access to the application subnet is authenticated and routed through the bastion host.

Traffic	Type	Protocol	Port range	Source
Inbound	SSH	TCP	22	Bastion subnet (for cloud deployments)
Inbound	HTTPS	TCP	443	Web tier subnet
Outbound	All traffic	All	All	

Data tier

The data subnet is where the external PostgreSQL database server resides.

Traffic	Type	Protocol	Port range	Source
Inbound	SSH	TCP	22	Bastion subnet (for cloud deployments)
Inbound	PostgreSQL	TCP	5432	Application tier subnet
Outbound	All traffic	All	All	

Bastion

Most enterprise security teams do not allow direct communication from the on-premises administrative system to the nodes deployed in the cloud. Instead, all administrative SSH traffic to the cloud nodes is proxied through a bastion host (also referred to as a "jump server"). For cloud deployments, we recommend bastion host proxy connection to all resources in the

reference architecture. This is an optional configuration for on-premises environments.

The bastion host authenticates administrative access and only allows traffic over SSH protocol.

Traffic	Type	Protocol	Port range	Source	Destination
Inbound	SSH	TCP	22	Admin computer IP address	
Outbound	SSH	TCP	22		Web tier subnet
Outbound	SSH	TCP	22		Application tier subnet

Example: Configure subnets and security groups in AWS

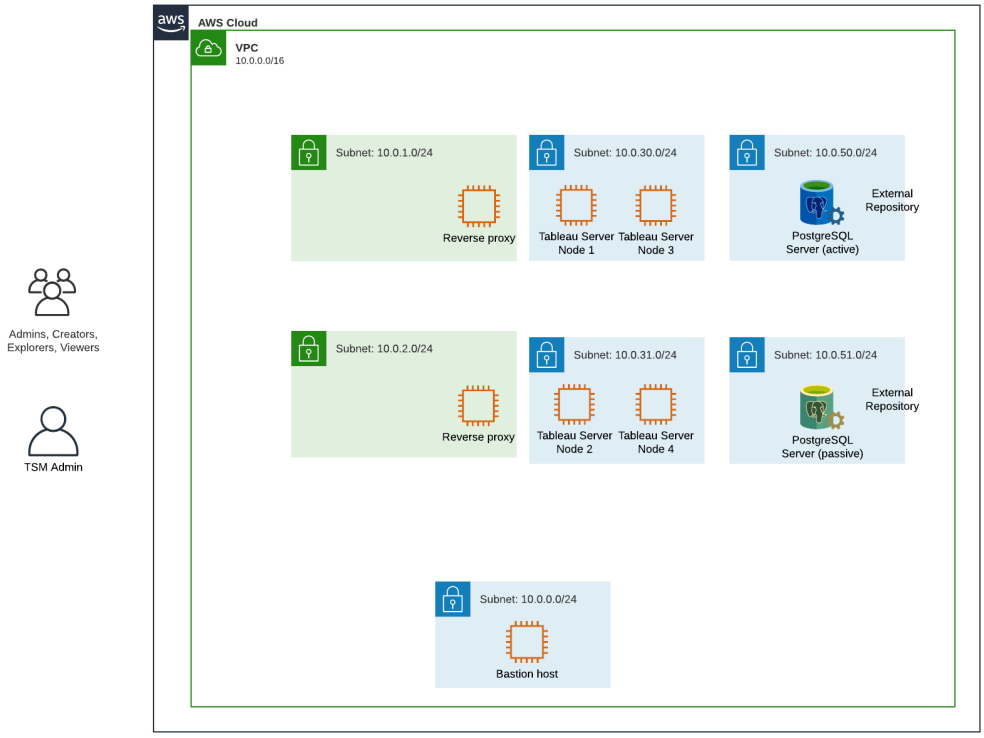
This section provides step-by-step procedures to create and configure the VPC and network environment for the Tableau Server reference architecture deployment in AWS.

The slides below show the reference architecture in four layers. As you progress through the slides, component elements are layered onto the topology map:

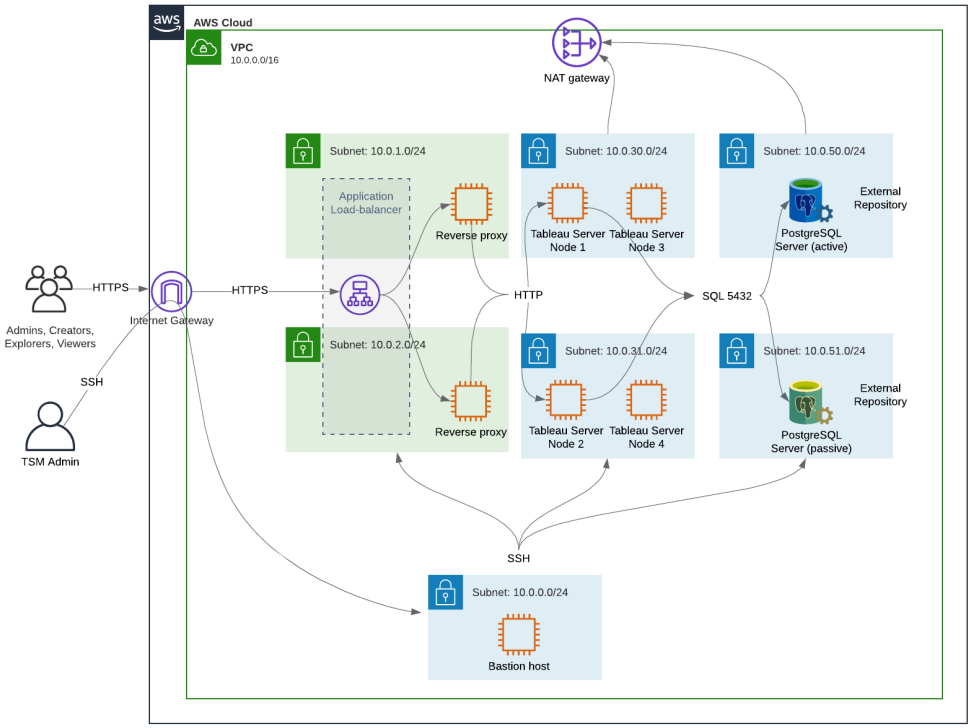
1. VPC subnet topology and EC2 instances: one bastion host, two reverse proxy servers, four Tableau servers, and at least one PostgreSQL server.
2. Protocol flow and internet connectivity. All inbound traffic is managed through the AWS internet gateway. Traffic to the internet is routed through the NAT.
3. Availability zones. The proxy, Tableau Server, and PostgreSQL hosts are evenly deployed across two Availability Zones.
4. Security groups. Four security groups (Public, Private, Data, and Bastion) protect each tier at the protocol level.

AWS reference architecture

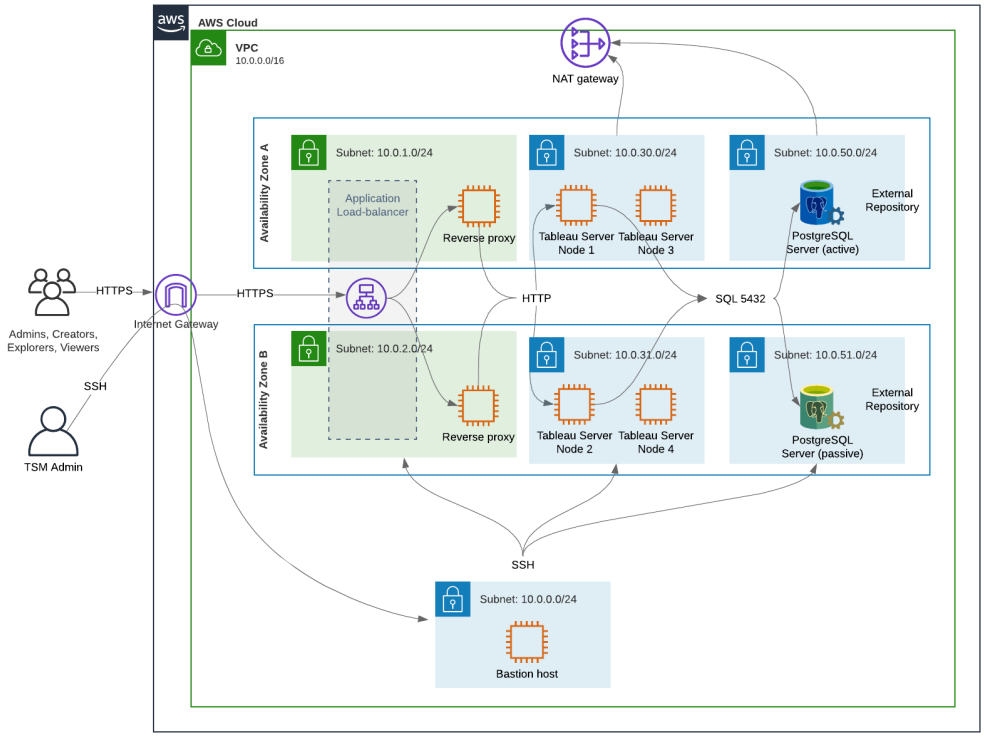
Slide 1: VPC subnet topology and EC2 instances



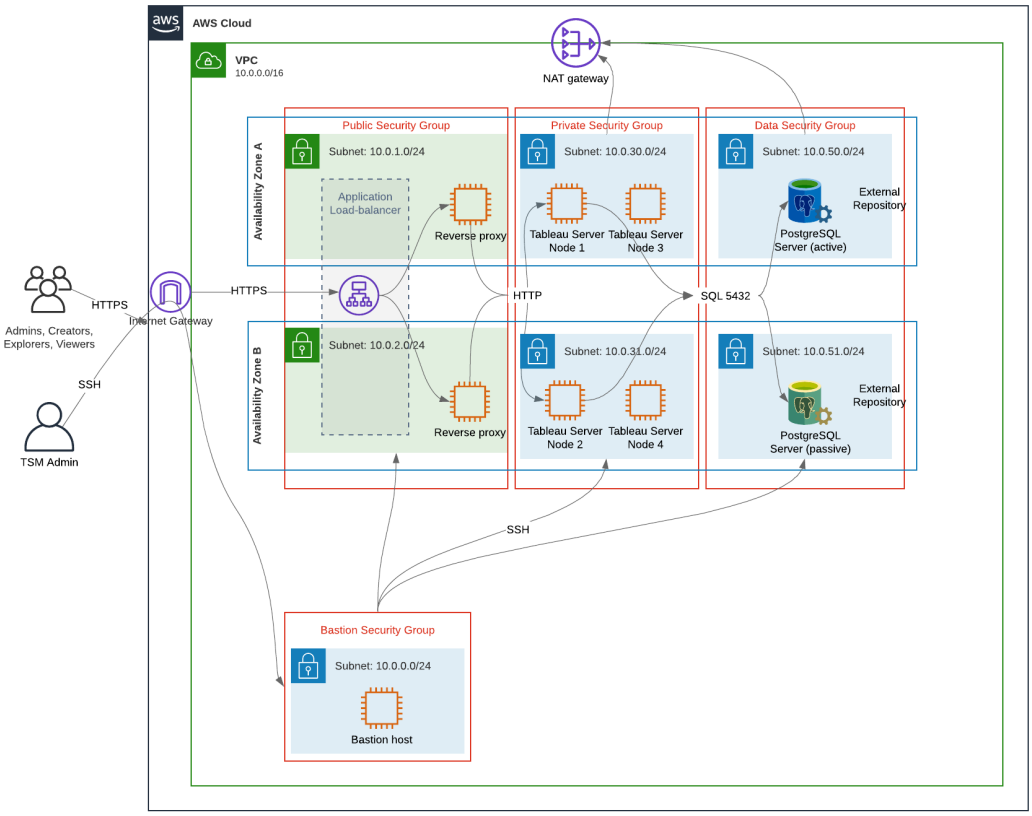
Slide 2: Protocol flow and connectivity



Slide 3: Availability zones



Slide 4: Security groups



AWS Availability Zones and high availability

The reference architecture as presented in this Guide specifies a deployment that provides availability through redundancy when any single host fails. However, in the AWS case where the reference architecture is deployed across two Availability Zones, availability is compromised in the very rare case where an Availability Zone fails.

VPC configuration

This section describes how to:

- Install and configure the VPC
- Configure internet connectivity

- Configure subnets
- Create and configure security groups

Configure VPC

The procedure in this section maps to the UI in the "classic" VPC Experience. You can toggle the UI to display the classic view by turning off the New VPC Experience in the upper-left corner of the AWS VPC Dashboard.

Run VPC wizard to create default Private and Public subnets and default routing and network ACL.

1. Before you configure a VPC, you must create an Elastic IP. Create an allocation using all defaults.
2. Run VPC wizard > "VPC with Public and Private Subnets"
3. Accept most defaults. Except for the following:
    - Enter a VPC name.
    - Specify the Elastic IP Allocation ID.
    - Specify the following CIDR masks:
        - Public subnet's IPv4 CIDR: 10.0.1.0/24, rename this subnet to `Public-a`.
        - Private subnet's IPv4 CIDR: 10.0.30.0/24, rename this subnet to `Private-a`.
    - Availability Zone: for both subnets, select the **a** option for the region that you are in.

    > **Note**: For the purposes of this example, we use **a** and **b** to distinguish between Availability Zones in a given AWS datacenter. In AWS, Availability Zone names may not match the examples shown here. For example, some Availability Zones include **c** and **d** zones within a datacenter.

4. Click **Create VPC**.
5. After VPC is created, create `Public-b`, `Private-b`, `Data`, and `Bastion` subnets. To create a subnet, click **Subnets** > **Create subnet**.

- `Public-b`: For Availability Zone, select the **b** option for the region that you are in. CIDR block: 10.0.2.0/24
- `Private-b`: For Availability Zone, select the **b** option for the region that you are in. CIDR block: 10.0.31.0/24
- `Data`: For Availability Zone, select the **a** zone for the region that you are in. CIDR block: 10.0.50.0/24. Optional: If you plan to replicate the external database across a PostgreSQL cluster, then create a Data-b subnet in Availability Zone b with a CIDR block of 10.0.51.0/24.
- `Bastion`: For Availability Zone, select either zone. CIDR block: 10.0.0.0/24

6. After the subnets are created, edit the route tables on the Public and the Bastion subnets to use the route table that is configured for the associated internet gateway (IGW). And edit the Private and Data subnets to use the route table that is configured for the network address translator (NAT).
    - To determine which route table is configured with the IGW or the NAT, click **Route Tables** in AWS dashboard. Select one of the two route table links to open the property page. Look at the Target value at **Routes** > **Destination**> **0.0.0.0/0**. The Target value differentiates the type of route and will either start with the `igw-` or `nat-` string.
    - To update route tables, **VPC** > **Subnets** > [subnet_name] > **Route table** > **Edit route table association**.

Configure security groups

The VPC wizard creates a single security group that you will not use. Create the following security groups (**Security Groups** > **Create security group**). The EC2 hosts will be installed into these groups across two Availability Zones as shown in the slide-diagram above.

- Create a new security group: **Private**. This is where all 4 nodes of Tableau Server will be installed. Later in the installation process, the Private security group will be associated with the 10.0.30.0/24 and 10.0.31.0/24 subnets.
- Create a new security group: **Public**. This is where proxy servers will be installed. Later in the installation process, the Public security group will be associated with the 10.0.1.0/24 and 10.0.2.0/24 subnets.
- Create a new security group: **Data**. This is where the PostgreSQL external Tableau repository will be installed. Later in the installation process, the Data security group will be associated with the 10.0.50.0/24 (and optionally, 10.0.51.0/24) subnet.

- Create a new security group: **Bastion**. This is where you'll install the bastion host. Later in the installation process, the Bastion security group will be associated with the 10.0.0.0/24 subnet.

Specify inbound and outbound rules

In AWS, security groups are analogous to firewalls in an on-prem environment. You must specify the traffic type, (eg, https, https, etc), protocol (TCP or UDP), and ports or port range (eg 80, 443, etc) that are allowed to pass in and/or out of the security group. For each protocol you must also specify the destination or source traffic.

Public security group rules

Inbound rules			
Type	**Protocol**	**Port range**	**Source**
HTTP	TCP	80	0.0.0.0/0
HTTPS	TCP	443	0.0.0.0/0
SSH	TCP	22	Bastion security group

Outbound rules			
Type	**Protocol**	**Port range**	**Destination**
All traffic	All	All	0.0.0.0/0

Private security group rules

The Private security group includes an inbound rule to allow HTTP traffic from the Public security group. Allow HTTP traffic only during the deployment process to verify connectivity. We recommend removing the HTTP inbound rule after you have finished deploying the reverse proxy and configuring SSL to Tableau.

Inbound rules			
Type	**Protocol**	**Port range**	**Source**
HTTP	TCP	80	Public security group
HTTPS	TCP	443	Public security group
PostgreSQL	TCP	5432	Data security group
SSH	TCP	22	Bastion security group
All traffic	All	All	Private security group

Outbound rule			
Type	**Protocol**	**Port range**	**Destination**
All traffic	All	All	0.0.0.0/0
PostgreSQL	TCP	5432	Data security group
SSH	TCP	22	Bastion security group

Data security group rules

Inbound rules			
Type	**Protocol**	**Port range**	**Source**
PostgreSQL	TCP	5432	Private security group
SSH	TCP	22	Bastion security group

Outbound rules			
Type	**Protocol**	**Port range**	**Destination**

All traffic	All	All	0.0.0.0/0
PostgreSQL	TCP	5432	Private security group
SSH	TCP	22	Bastion security group

Bastion host security group rules

Inbound rules			
Type	**Protocol**	**Port range**	**Source**
SSH	TCP	22	The IP address and net mask of the computer that you will use to log into AWS (admin computer).
SSH	TCP	22	Private security group
SSH	TCP	22	Public security group

Outbound rules			
Type	**Protocol**	**Port range**	**Destination**
SSH	TCP	22	The IP address and net mask of the computer that you will use to log into AWS (admin computer).
SSH	TCP	22	Private security group
SSH	TCP	22	Public security group
SSH	TCP	22	Data security group
HTTPS	TCP	443	0.0.0.0/0 (Optional: create this rule if you need to access the internet to download supporting software on the bastion host)

Enable auto-assign public IP

This provides you with an IP address for connecting to the proxy servers and bastion host.

For Public and Bastion subnets:

1. Select the subnet
2. Under **Actions** menu, select "Modify auto-assign IP settings."
3. Click "Enable auto-assign public IPv4 addresses."
4. Click **Save**.

Load balancer

> **Note**: If you are installing into AWS and following the example deployment in this guide, then you should install and configure the AWS load balancer later in the deployment process, as described in Part 5 - Configuring Web Tier.

For on-premises deployments, work with your network administrators to deploy load balancers to support the web tier of the reference architecture:

- A web-facing application load balancer that accepts HTTPS requests from Tableau clients and communicates with the reverse proxy servers.
- Reverse proxy:
  - We recommend a minimum of two proxy servers for redundancy and to handle client load.
  - Receives HTTPS traffic from load balancer.
  - Supports sticky session to Tableau host.
  - Configure proxy for round robin load balancing to each Tableau Server running the Gateway process.
  - Handles authentication requests from external IdP.
- Forward proxy: Tableau Server requires access to the internet for licensing and map functionality. Depending on your forward proxy environment, you may need to configure forward proxy safelists for Tableau service URLs. See *Communicating with the Internet* (Linux).

Configure host computers

Minimum recommended hardware

The following recommendations are based on our testing of real-world data in the reference architecture.

Application servers:

- CPU: 8 physical cores (16vCPUs),
- RAM: 128 GB (16 GB/physical Core)
- Disk space: 100 GB

Data servers

- CPU: 8 physical cores (16vCPUs),
- RAM: 128 GB (16 GB/physical Core)
- Disk space: 1 TB. If your deployment will make use of external storage for the Tableau File Store, you will need calculate the appropriate disk space. See *Install Tableau Server with External File Store* (Linux).

Proxy servers

- CPU: 2 physical cores (4vCPUs),
- RAM: 8 GB (4 GB/physical Core)
- Disk space: 100 GB

External repository database

- CPU: 8 physical cores (16vCPUs),
- RAM: 128 GB (16 GB/physical Core)
- Disk space requirement is dependent on your data load and how that will impact backup. See the section, *Backup and restore processes*, in the topic, *Disk Space Requirements* (Linux).

Directory structure

The reference architecture recommends installing the Tableau Server package and the data into non-default locations:

- Install package to: `/app/tableau_server`: Create this directory path before you install the Tableau Server package, and then specify this path during installation.
- Install Tableau data to: `/data/tableau_data`. Do not create this directory before you install Tableau Server. Instead, you must specify the path during installation, and then Tableau Setup will create and permission the path appropriately.

See Run installation package and initialize TSM for implementation details.

Example: Install and prep host computers in AWS

This section explains how to install EC2 hosts for each server type in the Tableau Server reference architecture.

The reference architecture requires eight hosts:

- Four instances for Tableau Server.
- Two instances for proxy servers (Apache).
- One instance for bastion host.
- One or two EC2 PostgreSQL database instances

Host instance details

Install host computers according to the details below.

Tableau Server

- Amazon Linux 2
- Instance Type: m5a.8xlarge
- Security group ID: Private

- Storage: EBS, 150 GiB, gp2 volume type. If your deployment will make use of external storage for the Tableau File Store, you will need calculate the appropriate disk space. See *Install Tableau Server with External File Store* (Linux).
- Network: install two EC2 hosts in each private subnet (10.0.30.0/24 and 10.0.31.0/24).
- Copy the latest maintenance release of Tableau Server 2021.2 (or later) rpm package from Tableau Downloads page to each Tableau host.

Bastion host

- Amazon Linux 2
- Instance Type: t3.micro
- Security group ID: Bastion
- Storage: EBS, 50 GiB, gp2 volume type
- Network: Bastion subnet 10.0.0.0/24

Tableau Server Independent Gateway

- Amazon Linux 2
- Instance Type: t3.xlarge
- Security group ID: Public
- Storage: EBS, 100 GiB, gp2 volume type
- Network: Install one EC2 instance in each public subnet (10.0.1.0/24 and 10.0.2.0/24)

PostgreSQL EC2 host

- Amazon Linux 2
- Instance Type: r5.4xlarge
- Security group ID: Data
- Storage: Disk space requirement is dependent on your data load and how that will impact backup. See the section, *Backup and restore processes*, in the topic, *Disk Space Requirements* (Linux).
- Network: Data subnet 10.0.50.0/24. (If you are replicating PostgreSQL in a HA cluster, then install the second host in the 10.0.51.0/24 subnet)

Verification: VPC connectivity

After you have installed the host computers, verify network configuration. Verify connectivity between the hosts by connecting with SSH from the host in the Bastion security group to the

hosts in each subnet.

Example: Connect to bastion host in AWS

1. Set up your admin computer for ssh-agent. This allows you to connect to hosts in AWS without placing your private key file on any EC2 instances.

   To configure ssh-agent on a Mac, run the following command:

   `ssh-add -K myPrivateKey.pem` or for latest Mac OS, `ssh-add --apple-use-keychain myPrivateKey.pem`

   For Windows, see the topic, Securely Connect to Linux Instances Running in a Private Amazon VPC.

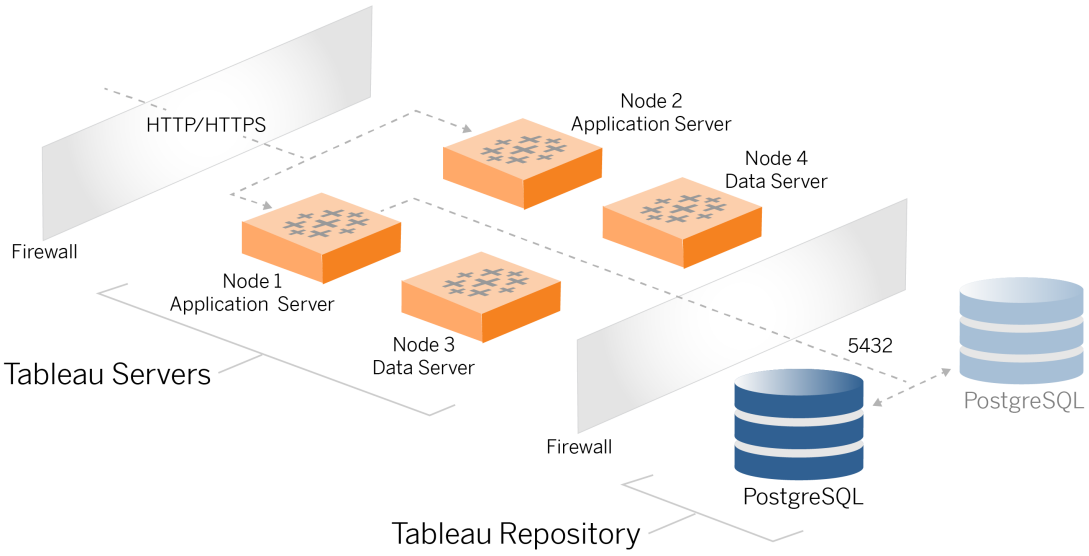
2. Connect to the bastion host by running the following command:

   ```
   ssh -A ec2-user@<public-IP>
   ```

3. You can then connect to other hosts in the VPC from the bastion host, using the private IP address, for example:

   ```
   ssh -A ec2-user@10.0.1.93
   ```

Part 4 - Installing and Configuring Tableau Server



This topic describes how to finish installing and configuring the baseline Tableau Server deployment. The procedure here continues with the AWS and Linux reference architecture example.

The Linux examples throughout the installation procedures show commands for RHEL-like distributions. Specifically the commands here have been developed with the Amazon Linux 2 distribution. If you are running the Ubuntu distribution, edit the commands accordingly.

Before you begin

You must prep and validate your environment as described in Part 3 - Preparing for Tableau Server Enterprise Deployment.

Install, configure, and tar PostgreSQL

This PostgreSQL instance hosts the external repository for the Tableau Server deployment. You must install and configure PostgreSQL before you install Tableau.

You can run PostgreSQL on Amazon RDS or on an EC2 instance. For more information about the differences between running the repository on RDS vs an EC2 instance, see *Tableau Server External Repository* (Linux).

By way of example, the procedure below shows how to install and configure Postgres on an Amazon EC2 instance. The example shown here is a generic installation and configuration for PostgreSQL in the reference architecture. Your DBA should optimize your PostgreSQL deployment based on the size of your data and performance needs.

Requirements: Note that you must be running PostgreSQL 1.6 and you must install the uuid-ossp module.

PostgreSQL versioning

You must install compatible major versions of PostgreSQL for the Tableau Server external repository. Additionally, minor versions must also meet minimum requirements.

Tableau Server versions	PostgreSQL minimum compatible versions
2021.2.3 - 2021.2.8 2021.3.0 - 2021.3.7 2021.4.0 - 2021.4.3	12.6
2021.2.10 - 2021.2.14 2021.3.8 - 2021.3.13 2021.4.4 - 2021.4.8	12.8
2021.2.15 - 2021.2.16	12.10

2021.3.14 - 2021.3.15 2021.4.9 - 2021.4.10	
2021.2.17 - 2021.2.18 2021.3.16 - 2021.3.17 2021.4.11 - 2021.4.12	12.11
2021.3.26 2021.4.23	12.15
2022.1.0	13.3
2022.1.1 - 2022.1.3	13.4
2022.1.4 - 2022.1.6	13.6
2022.1.7 - 2022.1.16 2022.3.0 - 2022.3.7 2023.1.0 - 2023.1.4	13.7
2022.1.17 - 2022.1.19 2022.3.8 - 2022.3.19 2023.1.5 - 2023.1.15 2023.3.0 - 2023.3.8	13.11
2022.3.20 - 2022.3.x 2023.1.16 - 2023.1.x 2023.3.9 - 2023.3.x	13.14
2024.0 - 2024.x	15.6

Install PostgreSQL

This example installation procedure describes how to install PostgreSQL version 13.6.

Sign-in to the EC2 host that you created in the previous Part.

1. Run update to apply latest fixes to the Linux OS:

   ```
   sudo yum update
   ```

2. Create and edit the file, pgdg.repo. in the `/etc/yum.repos.d/` path. Populate the file with the following configuration information:

   ```
   [pgdg13]
   name=PostgreSQL 13 for RHEL/CentOS 7 - x86_64
   baseurl-
   l=https://download.postgresql.org/pub/repos/yum/13/redhat/rhel-
   7-x86_64
   enabled=1
   gpgcheck=0
   ```

3. Install Posgres 13.6:

   ```
   sudo yum install postgresql13-server-13.6-1PGDG.rhel7.x86_64
   ```

4. Install the uuid-ossp module:

   ```
   sudo yum install postgresql13-contrib-13.6-1PGDG.rhel7.x86_64
   ```

5. Initialize Postgres:

   ```
   sudo /usr/pgsql-13/bin/postgresql-13-setup initdb
   ```

Configure Postgres

Finish the base installation by configuring Postgres:

1. Update the pg_hba configuration file, `/var/lib/pgsql/13/data/pg_hba.conf`, with the following two entries. Each entry must include the mask of the subnets where your Tableau Servers will be running:

   ```
   host all all 10.0.30.0/24 password

   host all all 10.0.31.0/24 password
   ```

2. Update the PostgreSQL file, `/var/lib/pgsql/13/data/postgresql.conf`, by adding this line:

   ```
   listen_addresses = '*'
   ```

3. Configure to start Postgres on reboot:

   ```
   sudo systemctl enable --now postgresql-13
   ```

4. Set superuser password:

   ```
   sudo su - postgres

   psql -c "alter user postgres with password 'StrongPassword'"
   ```

   > **Note**: Set a strong password. Do not use `'StrongPassword'` as shown in the example here.

   ```
   exit
   ```

5. Restart Postgres:

   ```
   sudo systemctl restart postgresql-13
   ```

Take PostgreSQL Step 1 tar backup

Create a tar back up of the PostgreSQL configuration. Creating a tar snapshot of the current configuration will save you time if you encounter failures as you continue the deployment.

We'll refer to this as the "Step 1" back up.

On PostgreSQL host:

1. Stop the Postgres database instance:

   ```
   sudo systemctl stop postgresql-13
   ```

2. Run the following commands to create the tar backup:

   ```
   sudo su
   cd /var/lib/pgsql
   tar -cvf step1.13.bkp.tar 13
   exit
   ```

3. Start Postgres database:

   ```
   sudo systemctl start postgresql-13
   ```

Restore Step 1

Restore to Step 1 if the Tableau Server initial node fails during installation.

1. On the computer running Tableau, run the obliterate script to completely remove Tableau Server from the host:

   ```
   sudo /app/tableau_server/packages/scripts.<version_code>/./tableau-server-obliterate -a -y -y -y -l
   ```

2. Restore the PostgreSQL Stage 1 tar. On the computer running Postgres, run the following commands:

   ```
   sudo su
   systemctl stop postgresql-13
   cd /var/lib/pgsql
   ```

```
tar  -xvf step1.13.bkp.tar

systemctl start postgresql-13

exit
```

Resume the installation process of installing the initial node of Tableau Server.

Before you install

If you are deploying Tableau according to the example AWS/Linux implementation described in this Guide, then you may be able to run the automated installation script, TabDeploy4EDG. The TabDeploy4EDG script automates the example installation of the four-node Tableau deployment that is described in procedures that follow. See Appendix - AWS Deployment Toolbox.

Install initial node of Tableau Server

This procedure describes how install the initial node of Tableau Server as defined by the reference architecture. With the exception of the package installation and the initialization of TSM, the procedure here uses the TSM command line whenever possible. In addition to being platform-agnostic, using TSM CLI allows a more seamless installation into virtualized and headless environments.

Run installation package and initialize TSM

Sign in to the Node 1 host server.

1. Run update to apply latest fixes to the Linux OS:

   ```
   sudo yum update
   ```

2. Copy the installation package from Tableau Downloads page to the host computer that will be running Tableau Server.

   For example, on a computer running Linux RHEL-like operating system, run

```
wget https://-
downloads.tableau.com/esdalt/2022<version>/tableau-server-<ver-
sion>.rpm
```

where `<version>` is the release number.

3. Download and install dependencies:

```
sudo yum deplist tableau-server-<version>.rpm | awk '/pro-
vider:/ {print $2}' | sort -u | xargs sudo yum -y install
```

4. Create the `/app/tableau_server` path in the root directory:

```
sudo mkdir -p /app/tableau_server
```

5. Run the installation program and specify the `/app/tableau_server` install path. For example, on a Linux RHEL-like operating system, run:

```
sudo rpm -i --prefix /app/tableau_server tableau-server-<ver-
sion>.x86_64.rpm
```

6. Change to the `/app/tableau_server/packages/scripts.<version_code>/` directory and run the `initialize-tsm` script located there:

```
sudo ./initialize-tsm -d /data/tableau_data --accepteula
```

7. After initialization is complete, exit the shell:

```
exit
```

Activate and register Tableau Server

1. Sign in to the Node 1 host server.
2. Provide the Tableau Server product key(s) in this step. Run the following command for each license key that you have purchased:

```
tsm licenses activate -k <product key>
```

3. Create a json registration file with the format as shown here:

```
{
"zip" : "97403",
"country" : "USA",
"city" : "Springfield",
"last_name" : "Simpson",
"industry" : "Energy",
"eula" : "yes",
"title" : "Safety Inspection Engineer",
"company_employees" : "100",
"phone" : "5558675309",
"company" : "Example",
"state" : "OR",
"opt_in" : "true",
"department" : "Engineering",
"first_name" : "Homer",
"email" : "homer@example.com"
}
```

4. After saving changes to the file, pass it with the `--file` option to register Tableau Server:

```
tsm register --file path_to_registration_file.json
```

Configure identity store

Note: If your deployment will make use of external storage for the Tableau File Store, you will need to enable External File Store before you configure the identity store. See *Install Tableau Server with External File Store* (Linux).

The default reference architecture uses a local identity store. Configure the initial host with local identity store by passing the `config.json` file with the `tsm settings import` command.

Import the `config.json` file according to your operating system:

The `config.json` file is included in the scripts.<version> directory path (for example, `scripts.20204.21.0217.1203`), and is formatted to configure the identity store.

Run the following command to import the `config.json` file:

```
tsm settings import -f /app/tableau_server-
/packages/scripts.<version_code>/config.json
```

Configure external Postgres

1. Create an external database json file with the following configuration settings:

   ```
   {
   "flavor":"generic",
   "masterUsername":"postgres",
   "host":"<instance ip address>",
   "port":5432
   }
   ```

2. After saving changes to the file, pass the file with the following command:

   ```
   tsm topology external-services repository enable -f <file-
   name>.json --no-ssl
   ```

   You will be prompted for the Postgres master username password.

   The option, `--no-ssl`, configures Tableau to use SSL/TLS only when the Postgres server is configured for SSL/TLS. If Postgres is not configured for SSL/TLS, then the connection is not encrypted. Part 6 - Post-Installation Configuration describes how to

enable SSL/TLS for the Postgres connection after you have completed the first phase of deployment.

3. Apply the changes.

   Run this command to apply the changes and restart Tableau Server:

   ```
   tsm pending-changes apply
   ```

4. Delete the configuration file that you used in Step 1.

Finish Node 1 installation

1. After Tableau Server has installed you must initialize the server.

   Run the following command:

   ```
   tsm initialize --start-server --request-timeout 1800
   ```

2. When initialization is finished, you must create a Tableau Server administrator account.

   Unlike the computer account that you are using to install and manage TSM operating-system components, the Tableau Server administrator account is an application account that used for creating Tableau Server users, projects, and sites. The Tableau Server administrator also applies permissions to Tableau resources. Run the following command to create the initial administrator account. In the following example, the user is called `tableau-admin`:

   ```
   tabcmd initialuser --server http://localhost --
   username "tableau-admin"
   ```

   Tabcmd will prompt you to set a password for this user.

Verification: Node 1 configuration

1. Run the following command to verify that TSM services are running:

   ```
   tsm status -v
   ```

Tableau should return the following:

```
external:
Status: RUNNING
'Tableau Server Repository 0' is running (Active Repository).
node1: localhost
Status: RUNNING
'Tableau Server Gateway 0' is running.
'Tableau Server Application Server 0' is running.
'Tableau Server Interactive Microservice Container 0' is run-
ning.
'MessageBus Microservice 0' is running.
'Relationship Query Microservice 0' is running.
'Tableau Server VizQL Server 0' is running.
...
```

All of the services will be listed.

2. Run the following command to verify that Tableau administrative site is running:

```
curl localhost
```

The first few lines should show Vizportal html, similar to this:

```
<!DOCTYPE html>
<html xmlns:ng="" xmlns:tb="">
<head ng-csp>
<meta charset="UTF-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
<meta name="viewport" content="initial-scale=1, maximum-
scale=2, width=device-width, height=device-height, viewport-fit-
t=cover">
<meta name="format-detection" content="telephone=no">
<meta name="vizportal-config ...
```

Take Step 2 tar backups

After you have verified the initial installation, take two tar backups:

- PostgreSQL
- Tableau initial node (Node 1)

In most cases, you can recover your installation of the initial node by restoring these tar files. Restoring the tar files is much quicker than reinstalling and reinitializing the initial node.

Create Step 2 tar files

1. On the initial node of Tableau, stop Tableau:

   ```
   tsm stop
   ```

   Wait for Tableau to stop before continuing to the next step.

2. On PostgreSQL host, stop the Postgres database instance:

   ```
   sudo systemctl stop postgresql-13
   ```

3. Run the following commands to create the tar backup:

   ```
   sudo su

   cd /var/lib/pgsql

   tar -cvf step2.13.bkp.tar 13

   exit
   ```

4. Verify that the Postgres tar file is created with root permissions:

   ```
   sudo ls -al /var/lib/pgsql
   ```

5. On the Tableau host, stop Tableau administrative services:

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./stop-administrative-services
   ```

6. Run the following commands to create the tar backup:

```
cd /data

sudo tar -cvf step2.tableau_data.bkp.tar tableau_data
```

7. On the Postgres host, start the Postgres database:

   ```
   sudo systemctl start postgresql-13
   ```

8. Start Tableau administrative services:

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./start-administrative-services
   ```

9. Run the `tsm status` command to monitor TSM state before restarting.

   In most cases, the command will first return a status of DEGRADED or ERROR. Wait a few minutes and run the command again. If the status of ERROR or DEGRADED is returned, continue waiting. Do not attempt to start TSM until the status, STOPPED is returned. And then run the following command:

   ```
   tsm start
   ```

Restore Step 2

This process restores the Tableau Node 1 and the Postgres instance to Step 2. After you have restored to this step, you can then redeploy the remaining Tableau Nodes.

1. Stop the tsm services on the initial Tableau host (Node 1):

   ```
   tsm stop
   ```

2. Stop Tableau administrative services on all nodes of the Tableau Server deployment. Run the following command on each node, in order (Node 1, Node 2, and then Node 3):

```
sudo /app/tableau_server/packages/scripts.<version_
code>/./stop-administrative-services
```

3. After Tableau services have stopped, restore the PostgreSQL Step 2 tar. On the computer running Postgres, run the following commands:

   - ```
     sudo su

     systemctl stop postgresql-13

     cd /var/lib/pgsql

     tar  -xvf step2.13.bkp.tar

     systemctl start postgresql-13

     exit
     ```

4. Restore the Tableau Step 2 tar. On the initial Tableau host, run the following commands:

   ```
   cd /data

   sudo rm -rf tableau_data

   sudo tar  -xvf step2.tableau_data.bkp.tar
   ```

5. On the Tableau Node 1 computer, remove the following files:

   - `sudo rm /data/tableau_data/data/t-absvc/appzookeeper/0/version-2/currentEpoch`
   - `sudo rm /data/tableau_data/data/t-absvc/appzookeeper/0/version-2/acceptedEpoch`
   - `sudo rm /data/tableau_data/data/t-absvc/tabadminagent/0/servicestate.json`

6. Start the Tableau administrative services:
   ```

```
sudo /app/tableau_server/packages/scripts.<version_
code>/./start-administrative-services
```

7. Reload the Tableau systmctl files and then run `start-administrative-services` again:

   ```
   sudo su -l tableau -c "systemctl --user daemon-reload"
   ```

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./start-administrative-services
   ```

8. On Node 1, run the `tsm status` command to monitor TSM state before restarting.

   In some cases, you will get an error, `Cannot connect to server...`. This error occurs because the tabadmincontroller service has not restarted. Continue to run `tsm status` periodically. If this error does not go away after 10 minutes, run the `start-administrative-services` command again.

   After a few moments, the `tsm status` command will return a status of DEGRADED, and then ERROR. Do not start TSM until the status, STOPPED is returned. And then run the following command:

   ```
   tsm start
   ```

Resume the installation process to install Tableau Server on remaining nodes.

Install Tableau Server on remaining nodes

To continue the deployment, copy the Tableau installer to each node.

Node configuration overview

This section describes the process to configure Nodes 2-4. The sections that follow provide detailed configuration and validation procedures for each step.

Installation of Tableau Server Nodes 2-4 requires that you generate, copy, and reference a bootstrap file during node installation.

To generate the bootstrap file, you run a TSM command on the initial node. You will then copy the bootstrap file to the target node, where you run it as part of the node initialization.

The following json content shows an example of a bootstrap file. (The certificate and crypto-related values have been truncated to make the example file easier to read.)

```
{
"initialBootstrapSettings" : {
       "certificate" : "-----BEGIN CERTIFICATE-----\r\...=\r\n-----END
CERTIFICATE-----",
       "port" : 8850,
       "configurationName" : "tabsvc",
       "clusterId" : "tabsvc-clusterid",
       "cryptoKeyStore" : "zs7OzgAAAAIAAAABAAAAA...w==",
       "toksCryptoKeystore" : "LS0tLS1CRUdJTiBUT00tLS0tCjM5MDBh...L",
       "sessionCookieMaxAge" : 7200,
       "nodeId" : "node1",
       "machineAddress" : "ip-10-0-1-93.us-west-1.compute.internal",
       "cryptoEnabled" : true,
       "sessionCookieUser" : "tsm-bootstrap-user",
       "sessionCookieValue" : "eyJjdHkiOiJKV1QiLCJl-
bmMiOiJBMTI4Q0JDLUhQ...",
       "sessionCookieName" : "AUTH_COOKIE"
       }
}
```

The bootstrap file includes connection-based validation to authenticate Node 1 and creates an encrypted channel for the bootstrap process. The bootstrap session is time-limited, and configuring and validating nodes is time consuming. Plan on creating and copying new bootstraps as you configure the nodes.

After you run the bootstrap file, you then sign in to the initial Tableau Server node and configure the processes for the new node. When you finish configuring the nodes, you must apply

changes and restart the initial node. The new node is configured and started. As you add nodes, the configuration and restart of the deployment will take consecutively longer to complete.

The Linux examples throughout the installation procedures show commands for RHEL-like distributions. If you are running the Ubuntu distribution, edit the commands accordingly.

1. Run update to apply latest fixes to the Linux OS:

   ```
   sudo yum update
   ```

2. Download and install dependencies:

   ```
   sudo yum deplist tableau-server-<version>.rpm | awk '/pro-
   vider:/ {print $2}' | sort -u | xargs sudo yum -y install
   ```

3. Create the `/app/tableau_server` path in the root directory:

   ```
   sudo mkdir -p /app/tableau_server
   ```

4. Run the installation program and specify the `/app/tableau_server` install path. For example, on a Linux RHEL-like operating system, run:

   ```
   sudo rpm -i --prefix /app/tableau_server tableau-server-<ver-
   sion>.x86_64.rpm
   ```

Generate, copy, and use the bootstrap file to initialize TSM

The following procedure shows how to generate, copy, and use a bootstrap file when initializing TSM on another node. In this example, the bootstrap file is named `boot.json`.

In this example, the host computers are running in AWS, where EC2 hosts are running Amazon Linux 2.

1. Connect to the initial node (Node 1) and run the following command:

   ```
   tsm topology nodes get-bootstrap-file --file boot.json
   ```

2. Copy the bootstrap file to Node 2.

   ```
   scp boot.json ec2-user@10.0.31.83:/home/ec2-user/
   ```

3. Connect to Node 2 and switch to the Tableau Server scripts directory:

   ```
   cd /app/tableau_server/packages/scripts.<version_number>
   ```

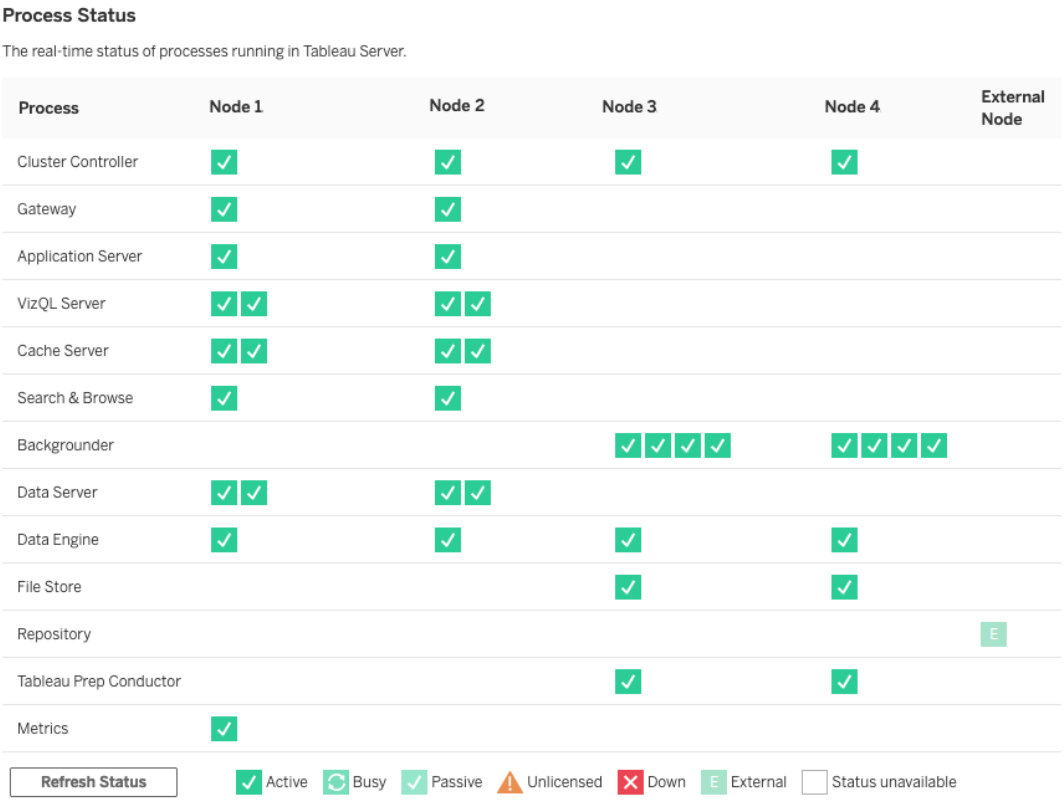
4. Run the `initialize-tsm` command and reference the bootstrap file:

   ```
   sudo ./initialize-tsm -d /data/tableau_data -b /home/ec2-user-
   /boot.json --accepteula
   ```

5. After `initialize-tsm` has completed, delete `boot.json`, and then exit or log out of the session.

Configure processes

You must configure the Tableau Server cluster on the node where the Tableau Server Administration Controller (TSM controller) is running. The TSM controller runs on the initial node.



Configure Node 2

1. After you have initialized TSM using the bootstrap file on Node 2, sign in to the initial node.

2. On the initial node (`node1`) run the following commands to configure processes on Node 2.:

```
tsm topology set-process -n node2 -pr clustercontroller -c 1
tsm topology set-process -n node2 -pr gateway -c 1
tsm topology set-process -n node2 -pr vizportal -c 1
tsm topology set-process -n node2 -pr vizqlserver -c 2
tsm topology set-process -n node2 -pr cacheserver -c 2
tsm topology set-process -n node2 -pr searchserver -c 1
tsm topology set-process -n node2 -pr dataserver -c 2
```

```
tsm topology set-process -n node2 -pr clientfileservice -c 1
tsm topology set-process -n node2 -pr tdsservice -c 1
tsm topology set-process -n node2 -pr collections -c 1
tsm topology set-process -n node2 -pr contentexploration -c 1
```

If you are installing version 2022.1 or later, add the Index and Search service as well:

```
tsm topology set-process -n node2 -pr indexandsearchserver -c 1
```

If you are installing version 2023.3 or later, only include the Index and Search service. Do not add the Search and Browse (searchserver) service

3. Review the configuration before you apply it. Run the following command:

   ```
   tsm pending-changes list
   ```

4. After you have verified that your changes are in the pending list (there will be other services in the pending list as well), apply the changes:

   ```
   tsm pending-changes apply
   ```

   The changes will require a restart. Configuration and restart will take some time.

5. Verify Node 2 configuration. Run the following command:

   ```
   tsm status -v
   ```

Configure Node 3

Initialize TSM using the bootstrap process on Node 3, and then run the `tsm topology set-process` commands below.

There is a Coordination Service warning that will display each time you set a process. You can ignore this warning as you set the processes.

1. After you initialize TSM using the bootstrap file on Node 3, sign in to the initial node (`node1`) and run the following commands to configure processes:

```
tsm topology set-process -n node3 -pr clustercontroller -c 1
tsm topology set-process -n node3 -pr clientfileservice -c 1
tsm topology set-process -n node3 -pr backgrounder -c 4
tsm topology set-process -n node3 -pr filestore -c 1
```

If you are installing version 2022.1 or later, add the Index and Search service as well:

```
tsm topology set-process -n node3 -pr indexandsearchserver -c 1
```

2. Review the configuration before you apply it. Run the following command:

   ```
   tsm pending-changes list
   ```

3. After you have verified that your changes are in the pending list (the list will include other services that are automatically configured), apply the changes:

   ```
   tsm pending-changes apply --ignore-warnings
   ```

   The changes will require a restart. Configuration and restart will take some time.

4. Verify the configuration by running the following command:

   ```
   tsm status -v
   ```

Deploy coordination service ensemble to Nodes 1-3

For standard reference architecture four-node deployment, run the following procedure:

1. Run the following commands on Node 1:

   ```
   tsm stop
   tsm topology deploy-coordination-service -n node1,node2,node3
   ```

   The process includes a restart of TSM, which will take some time.

2. After the coordination service is deployed, start TSM:

   ```
   tsm start
   ```

Take Step 3 tar backups

After you have verified the installation, take four tar backups:

- PostgreSQL
- Tableau initial node (Node 1)
- Tableau Node 2
- Tableau Node 3

Create Step 3 tar files

1. On the initial node of Tableau, stop Tableau:

   ```
   tsm stop
   ```

2. After TSM has stopped, stop Tableau administrative services on each node. Run the following command on each node, in order (Node 1, Node 2, and then Node 3):

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./stop-administrative-services
   ```

3. On PostgreSQL host, stop the Postgres database instance:

   ```
   sudo systemctl stop postgresql-12
   ```

4. Run the following commands to create the tar backup:

   ```
   sudo su

   cd /var/lib/pgsql

   tar -cvf step3.12.bkp.tar 12
   ```

```
exit
```

5. Verify that Postgres tar file is created with root permissions:

   ```
   sudo ls -al /var/lib/pgsql
   ```

6. On the Postgres host, start the Postgres database:

   ```
   sudo systemctl start postgresql-12
   ```

7. Create the tar backup on Node 1, Node 2, and Node 3. Run the following commands on each node:

   - `cd /data`

     ```
     sudo tar -cvf step3.tableau_data.bkp.tar tableau_data
     ```

   - Verify that the Tableau tar file is created with root permissions:

     ```
     ls -al
     ```

8. Start Tableau administrative services on each node in order (Node 1, Node 2, and then Node 3):

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./start-administrative-services
   ```

9. Run the `tsm status` command to monitor TSM state before restarting.

   In most cases, the command will return a status of DEGRADED, and then ERROR. Wait a few moments and run the command again. If the status of ERROR or DEGRADED is returned, continue waiting. Do not attempt to start TSM until the status, STOPPED is returned. And then run the following command:

   ```
   tsm start
   ```

Restore Step 3

This process restores the Tableau Node 1, Node 2, and Node 3. It also restores the Postgres instance to Step 3. After you have restored to this step, you can then deploy coordination service, Node 4, and then final node configurations.

1. Stop the tsm service on the initial Tableau host (Node 1):

   ```
   tsm stop
   ```

2. After TSM has stopped, stop Tableau administrative services on Node 1, Node 2, and Node 3. Run the following command on each node:

   ```
   sudo /app/tableau_server/packages/scripts.<version_
   code>/./stop-administrative-services
   ```

3. Restore the PostgreSQL Step 3 tar. On the computer running Postgres, run the following commands:

   ```
   sudo su
   systemctl stop postgresql-12
   cd /var/lib/pgsql
   tar -xvf step3.12.bkp.tar
   systemctl start postgresql-12
   exit
   ```

4. Restore the Tableau Step 3 tar on Node 1, Node 2, and Node 3. Run the following commands on each Tableau node:

   ```
   cd /data
   sudo rm -rf tableau_data
   sudo tar  -xvf step3.tableau_data.bkp.tar
   ```

5. On the Tableau Node 1 computer, remove the following files:

- `sudo rm /data/tableau_data/data/t-absvc/appzookeeper/1/version-2/currentEpoch`
- `sudo rm /data/tableau_data/data/t-absvc/appzookeeper/1/version-2/acceptedEpoch`
- `sudo rm /data/tableau_data/data/t-absvc/tabadminagent/0/servicestate.json`

If the shell returns a "file not found" error, you may need to change the path name to increment the number `<n>` in this section of the path: `.../ap-pzookeeper/<n>/version-2/....`

6. Restart the administrative services on Node 1, Node 2, and Node 3. Run the following commands on each node:

```
sudo /app/tableau_server/packages/scripts.<version_
code>/./start-administrative-services

sudo su -l tableau -c "systemctl --user daemon-reload"

sudo /app/tableau_server/packages/scripts.<version_
code>/./start-administrative-services
```

7. On Node 1, run the `tsm status` command to monitor TSM state before restarting.

   In some cases, you will get an error, `Cannot connect to server...`. This error occurs because the tabadmincontroller service has not restarted. Continue to run `tsm status` periodically. If this error does not go away after 10 minutes, run the `start-administrative-services` command again.

   After a few moments, the `tsm status` command will return a status of DEGRADED, and then ERROR. Do not start TSM until the STOPPED status is returned. And then run the following command:

```
tsm start
```

Resume the installation process to deploy coordination service on Nodes 1-3.

Configure Node 4

The process for configuring Node 4 is the same as Node 3.

Set the same processes as you set for Node 3, running the same set of commands as shown above, but specifying `node4` in the commands rather than `node3`.

As with Node 3 verification, verify the Node 4 configuration by running `tsm status -v`.

Before you proceed, wait for the File Store process on Node 4 to finish synchronizing. The File Store service status will return `is synchronizing` until it finishes. When the File Store service status returns `is running` you can proceed.

Final process configuration and verification

The final step to process configuration is to remove redundant processes from Node 1.

1. Connect to the initial node (`node1`).
2. Decommission the file store on Node 1. This will cause a warning about removing the file store from a co-located controller. You can ignore the warning. Run the following command:

   ```
   tsm topology filestore decommission -n node1
   ```

3. When file store is decommissioned, run the following command to remove the backgrounder process from Node 1:

   ```
   tsm topology set-process -n node1 -pr backgrounder -c 0
   ```

4. Review the configuration before you apply it. Run the following command:

   ```
   tsm pending-changes list
   ```

5. After you have verified that your changes are in the pending list, apply the changes:

```
tsm pending-changes apply
```

The changes will require a restart. Configuration and restart will take some time.

6. Verify the configuration:

   ```
   tsm status -v.
   ```

   Before you proceed, wait for the File Store process on Node 4 to finish synchronizing. The File Store service status will return `is synchronizing` until it finishes. When the File Store service status returns `is running` you can proceed.

Perform backup

A full recovery of Tableau Server requires a backup portfolio that includes three components:

- A backup file of the repository and file store data. This file is generated by the `tsm maintenance backup` command.
- A topology and configuration export file. This file is generated by the `tsm settings export` command.
- Authentication certificate, key, and keytab files.

For a full description of the backup and restore process, see the Tableau Server topic, *Perform a Full Backup and Restore of Tableau Server* (Linux).

At this stage of your deployment, all relevant files and assets that are required for a full restoration are included by running the `tsm maintenance backup` and `tsm settings export` commands.

1. Run the following command to export the configuration and topology settings to a file called `ts_settings_backup.json`

   ```
   tsm settings export -f ts_settings_backup.json
   ```

2. Run the following command to create a backup of the repository and file store data in a file named `ts_backup-<yyyy-mm-dd>.tsbak`. Ignore the warning about the file

store not being on the controller node.

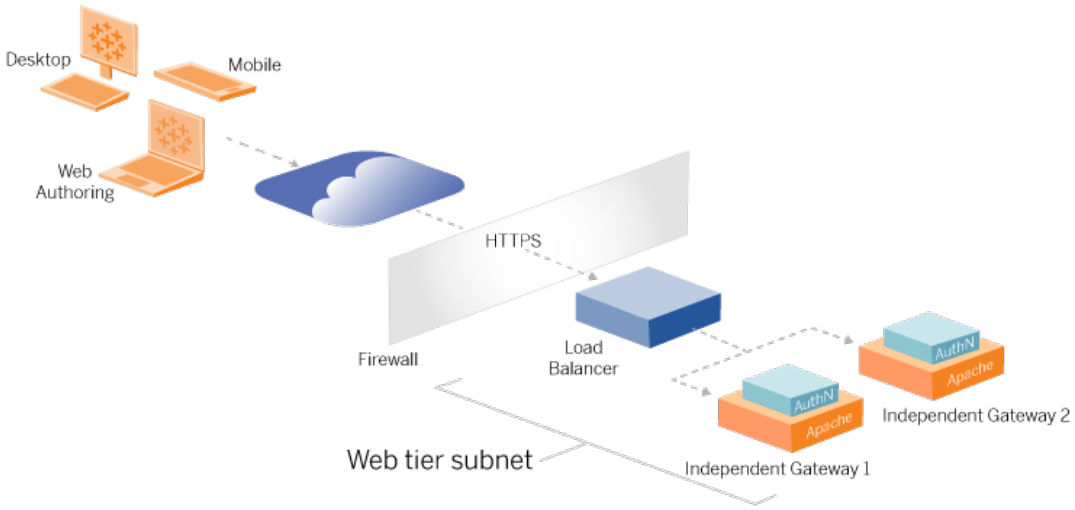
```
tsm maintenance backup -f ts_backup -d --skip-compression
```

Location of backup file:

```
/data/tableau_data/data/tabsvc/files/backups/
```

3. Copy both files and save them on a different storage asset that is not shared by your Tableau Server deployment.

Part 5 - Configuring Web Tier



The web tier of the reference architecture should include the following components:

- A web-facing application load balancer that accepts HTTPS requests from Tableau clients and communicates with the reverse proxy servers.
- Reverse proxy:
  - We recommend deploying the Tableau Server Independent Gateway.
  - We recommend a minimum of two proxy servers for redundancy and to handle client load.
  - Receives HTTPS traffic from load balancer.
  - Supports sticky session to Tableau host.
  - Configure proxy for round robin load balancing to each Tableau Server running the Gateway process.
  - Handles authentication requests from external IdP.
- Forward proxy: Tableau Server requires access to the internet for licensing and map functionality. You must configure forward proxy safelists for Tableau service URLs. See *Communicating with the Internet* (Linux).
- All client-related traffic may be encrypted over HTTPS:
  - Client to application load balancer
  - Application load balancer to reverse proxy servers

- Proxy server to Tableau Server
- Authentication handler running on reverse proxy to IdP
- Tableau Server to IdP

Tableau Server Independent Gateway

Tableau Server version 2022.1 introduced the Tableau Server Independent Gateway. The Independent Gateway is a standalone instance of the Tableau Gateway process that serves as a Tableau-aware reverse proxy.

Independent Gateway supports simple round robin load balancing to the backend Tableau Servers. However, Independent Gateway is not intended to serve as the enterprise application load balancer. We recommend running Independent Gateway behind an enterprise-class application load balancer.

The Independent Gateway requires an Advanced Management license.

Authentication and authorization

The default reference architecture specifies installing Tableau Server with local authentication configured. In this model, clients must connect to Tableau Server to be authenticated by the native Tableau Server local authentication process. We do not recommend using this authentication method in the reference architecture because the scenario requires that unauthenticated clients communicate into the application tier, which is a security risk.

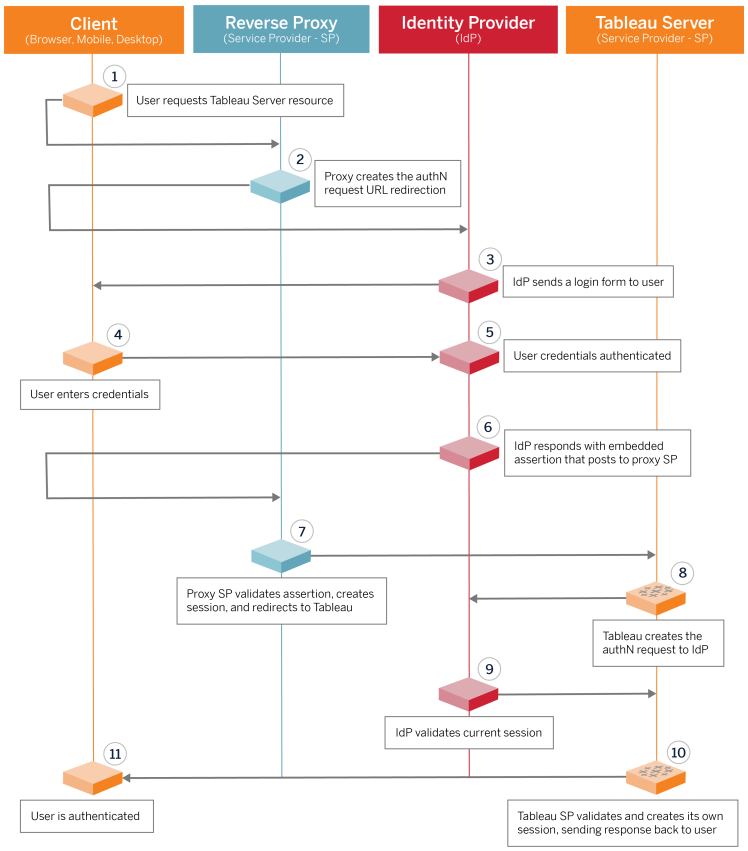
Instead, we recommend configuring an enterprise grade external identity provider coupled with an AuthN module to pre-authenticate all traffic to the application tier. When configured with an external IdP, the native Tableau Server local authentication process is not used. Tableau Server authorizes access to resources in the deployment after the IdP has authenticated the users.

Pre-authentication with an AuthN module

In the example documented in this Guide, SAML SSO is configured, but the pre-authentication process can be configured with most external identity providers and an AuthN module.

In the reference architecture the reverse proxy is configured to create a client authentication session with the IdP before proxying those request to Tableau Server. We refer to this process as the *pre-auth* phase. The reverse proxy will only redirect authenticated client sessions to Tableau Server. Tableau Server will then create a session, verify authentication of the session with the IdP, and then return the client request.

The following diagram shows the step-by-step detail of the pre-auth and authentication process with an AuthN module configured. The reverse proxy may be a generic 3rd party solution or the Tableau Server Independent Gateway:



Configuration overview

This is an overview of the process to configure the web tier. Verify connectivity after each step:

1. Configure two reverse proxies to provide HTTP access to Tableau Server.
2. Configure load balancing logic with sticky sessions on proxy servers to connect to each Tableau Server instance running the Gateway process.
3. Configure application load balancing with sticky sessions at the internet gateway to forward requests to the reverse proxy servers.
4. Configure authentication with an external IdP. You can configure SSO or SAML by installing an authentication handler on the reverse proxy servers. The AuthN module manages the authentication handshake between the external IdP and your Tableau deployment. Tableau will also act as an IdP service provider and authenticate users with the IdP.
5. To authenticate with Tableau Desktop in this deployment, your clients must be running Tableau Desktop 2021.2.1 or later.

Example web tier configuration with Tableau Server Independent Gateway

The remainder of this topic provides an end-to-end procedure that describes how to implement web tier in the example AWS reference architecture using Tableau Server Independent Gateway. For an example configuration using Apache as reverse proxy, see Appendix - Web Tier with Apache Example Deployment.

The example configuration is composed of the following components:

- AWS application load balancer
- Tableau Server Independent Gateway
- Mellon authentication module
- Okta IdP
- SAML authentication

Note: The example web tier configuration presented in this section includes detailed procedures for deploying third party software and services. We've made a best effort to verify and document the procedures to enable the web tier scenario. However, the third-party software may change or your scenario may differ from the reference architecture described here. Please refer to third-party documentation for authoritative configuration details and support.

The Linux examples throughout this section show commands for RHEL-like distributions. Specifically the commands here have been developed with the Amazon Linux 2 distribution. If you are running the Ubuntu distribution, edit the commands accordingly.

Deploying the web tier in this example follows a stepwise configuration and verification procedure. The core web tier configuration consists of the following steps to enable HTTP between Tableau and the internet. Independent Gateway is run and configured for reverse proxy/load balancing behind the AWS application load balancer:

1. Prepare environment
2. Install Independent Gateway
3. Configure Independent Gateway Server
4. Configure AWS application load balancer

After the web tier is set up and connectivity with Tableau is verified, configure authentication with an external provider.

Prepare Environment

Complete the following tasks before you deploy Independent Gateway.

1. AWS Security group changes. Configure the Public security group to allow inbound Independent Gateway housekeeping traffic (TCP 21319) from the Private security group.

2. Install version 22.1.1 (or later) on four node Tableau Server cluster as documented at Part 4 - Installing and Configuring Tableau Server.

3. Configure the two proxy EC2 instances in the Public security group as documented at Configure host computers.

Install Independent Gateway

Tableau Server Independent Gateway requires an Advanced Management license.

Deploying Tableau Server Independent Gateway consists of installing and running the .rpm package and then configuring initial state. The procedure included with this Guide provides prescriptive guidance for deploying into the reference architecture.

If your deployment differs from the reference architecture, consult the core Tableau Server documentation, *Install Tableau Server with Independent Gateway* (Linux).

> **Important**: Configuring Independent Gateway can be an error prone process. It is very difficult to troubleshoot configuration issues across two instances of Independent Gateway servers. For this reason, we recommend configuring one Independent Gateway server at a time. After you configure the first server and verify functionality, you should then configure the second Independent Gateway server.

Although you will configure each Independent Gateway server separately, run this installation procedure on both EC2 instances that you installed into the Public security group:

1. Run update to apply latest fixes to the Linux OS:

   ```
   sudo yum update
   ```

2. If Apache is installed, remove it:

   ```
   sudo yum remove httpd
   ```

3. Copy the version 2022.1.1 (or later) Independent Gateway installation package from Tableau Downloads page to the host computer that will be running Tableau Server.

   For example, on a computer running Linux RHEL-like operating system, run

   ```
   wget https://-
   downloads.tableau.com/esdalt/2022<version>/tableau-server-tsig-
   <version>.x86_64.rpm
   ```

4. Run the installation program. For example, on a Linux RHEL-like operating system, run:

   ```
   sudo yum install <tableau-tsig-version>.x86_64.rpm
   ```

5. Change to the `/opt/tableau/tableau_tsig/packages/scripts.<version_code>/` directory and run the `initialize-tsig` script located there. In addition to the `--accepteula` flag, you must include the IP range of the subnets where the Tableau Server deployment is running. Use the `-c` option to specify the IP range. The example below shows the command with the example AWS subnets specified:

   ```
   sudo ./initialize-tsig --accepteula -c "ip 10.0.30.0/24
   10.0.31.0/24"
   ```

6. After initialization is complete, open the `tsighk-auth.conf` file and copy the authentication secret in the file. You will need to submit this code for each Independent Gateway instance as part of the back-end Tableau Server configuration:

   ```
   sudo less /var/opt/tableau/tableau_tsig/config/tsighk-auth.conf
   ```

7. After you have run the previous steps on the both instances of the Independent Gateway, prepare the `tsig.json` configuration file. The configuration file consists of an "independentGateways" array. The array holds configuration objects that each define connection details for an Independent Gateway instance.

Copy the following the JSON and customize it according to your deployment environment. The example here shows a file for a sample AWS reference architecture.

The example JSON file below only includes connection information for one Independent Gateway. Later in the process, you will include the connection information for the second Independent Gateway server.

Save the file as `tsig.json` for the procedures that follow.

```
{
"independentGateways": [
 {
       "id": "ip-10-0-1-169.ec2.internal",
       "host": "ip-10-0-1-169.ec2.internal",
       "port": "21319",
       "protocol" : "http",
       "authsecret": "13660-27118-29070-25482-9518-22453"
       }]
 }
```

- `"id"` - The private DNS name of the AWS EC2 instance running Independent Gateway.
- `"host"` - same as `"id"`.
- `"port"` - The housekeeping port, by default, `"21319"`.
- `"protocol"` - The protocol for client traffic. Leave this as `http` for the initial configuration.
- `"authsecret"` - The secret that you copied in the previous step.

Independent Gateway: direct vs relay connection

Before proceeding you must decide which connection scheme to configure in your deployment: direct or relay connection. Each option is briefly described here, along with relevant decision data points.

Relay connection: You can configure Independent Gateway to relay client communication over a single port to the gateway process on Tableau Server. We refer to this as a *relay* connection:

- The relay process results in an extra hop from Independent Gateway to the backend Tableau Server Gateway process. The extra hop degrades performance as compared to the direct connection configuration.
- TLS is supported for relay mode. All communication in relay mode is restricted to a single protocol (HTTP or HTTPS) and can therefore be encrypted and authenticated with TLS.

Direct connection: The Independent Gateway can communicate directly with the back-end Tableau Server processes over multiple ports. We refer to this communication as *direct* connection:

- Because connection is direct to backend Tableau Server, client performance is markedly improved as compared to relay connection option.
- Requires opening 16+ ports from Public to Private subnets for direct process communication from Independent Gateway to Tableau Server computers.
- TLS is not yet supported on the processes from Independent Gateway to Tableau Server.

Configure relay connection

To run TLS between Tableau Server and Independent Gateway you must configure with a relay connection. The example scenarios in the EDG are configured with relay connection.

1. Copy `tsig.json` to Node 1 of your Tableau Server deployment.
2. On Node 1 run the following commands to enable Independent Gateway.

```
tsm stop
tsm configuration set -k gateway.tsig.proxy_tls_optional -v
none
tsm pending-changes apply
tsm topology external-services gateway enable -c tsig.json
tsm start
```

Configure direct connection

Since direct connection does not support TLS, we recommend configuring direct connection only if you are able to secure all network traffic by other means. To run TLS between Tableau Server and Independent Gateway you must configure with a relay connection. The example scenarios in the EDG are configured with relay connection.

If you are configuring Independent Gateway for direct connection to Tableau Server, you must enable the configuration to trigger communication. After Tableau Server communicates to the Independent Gateway, the protocol targets will be established. You must then retrieve the `proxy_targets.csv` from the Independent Gateway computer and open the corresponding ports from the Public to the Private security groups in AWS.

1. Copy `tsig.json` to Node 1 of your Tableau Server deployment.
2. On Node 1 run the following commands to enable Independent Gateway.

   ```
   tsm stop
   tsm topology external-services gateway enable -c tsig.json
   tsm start
   ```

3. On Independent Gateway computer run the following command to view the ports that the Tableau Server cluster is using:

   ```
   less /var/opt/tableau/tableau_tsig/config/httpd/proxy_targets.csv
   ```

4. Configure AWS security groups. Add the TCP ports listed in `proxy_targets.csv` to allow communication from the Public security group to the Private security group.

   We recommend automating port ingress configuration since the ports may change if the Tableau Server deployment changes. Adding nodes or reconfiguring processes on the Tableau Server deployment will trigger changes to the port access required by Independent Gateway.

Verification: Base topology configuration

You should be able to access the Tableau Server admin page by browsing to `http://<gateway-public-IP-address>`.

If the Tableau Server sign-in page does not load, or if Tableau Server doesn't start then follow these troubleshooting steps:

Network:

- Verify connectivity between Tableau deployment and Independent Gateway instance by running the following `wget` command from Tableau Server Node1: wget http://<internal IP address of Independent Gateway>:21319, for example:

  ```
  wget http://ip-10-0-1-38:21319
  ```

  If connection is refused or fails, then verify that the Public security group is configured to allow Independent Gateway housekeeping traffic (TCP 21319) from the Private security group.

  If security group is configured correctly, then verify you specified the correct IP addresses or IP ranges during the initialization of Independent Gateway. You can view and change this configuration in the `environment.bash` file located at `/etc/-opt/tableau/tableau_tsig/environment.bash`. If you make a change to this file then restart the tsig-http service as described below.

On the Proxy 1 host:

1. Overwrite the httpd.conf file with the Independent Gateway stub file:

   ```
   cp /var/opt/tableau/tableau_tsig/config/httpd.conf.stub /var/-opt/tableau/tableau_tsig/config/httpd.conf
   ```

2. Restart tsig-httpd as a first troubleshooting step:

   ```
   sudo su - tableau-tsig
   systemctl --user restart tsig-httpd
   exit
   ```

On Tableau Node 1

- Double-check the `tsig.json` file. If you find errors, fix them, and then run `tsm topology external-services gateway update -c tsig.json`.
- If running direct connection, verify the TCP ports listed in `proxy_targets.csv` are configured as ingress ports from Public to Private security groups.

Configure AWS application load balancer

Configure the load balancer as an HTTP listener. The procedure here describes how to add a load balancer in AWS.

Step 1: Create target group

A target group is an AWS configuration that defines the EC2 instances running your proxy servers. These are the targets for traffic from the LBS.

1. EC2>**Target groups** > **Create target group**
2. On Create page:
    - Enter a target group name, for example `TG-internal-HTTP`
    - Target type: Instances
    - Protocol: HTTP
    - Port: 80
    - VPC: Select your VPC
    - Under **Health checks** > **Advanced health checks settings** > **Success codes**, append the code list to read: `200,303`.
    - Click **Create**
3. Select the target group that you just created, and then click the **Targets** tab:
    - Click **Edit**.
    - Select the EC2 instances (or single instance if you are configuring one at a time) that are running proxy application, and then click **Add to registered**.
    - Click **Save**.

Step 2: Launch load balancer wizard

1. EC2> **Load Balancers** > **Create Load Balancer**
2. On "Select load balancer type" page, create an Application Load Balancer.

Note: The UI that is displayed to configure load balancer is not consistent across AWS datacenters. The procedure below, "Wizard configuration," maps to the AWS configuration wizard that begins with **Step 1 Configure Load Balancer**.

If your datacenter displays all configurations in a single page that includes a **Create load balancer** button at the bottom of the page, then follow the "Single page configuration" procedure below.

Wizard configuration

1. **Configure load balancer** page:
   - Specify name
   - Scheme: internet-facing (default)
   - IP address type: ipv4 (default)
   - Listeners (Listeners and routing):
     a. Leave the default HTTP listener
     b. Click **Add listener** and add `HTTPS:443`
   - VPC: select the VPC where you've installed everything
   - Availability Zones:
     - Select the **a** and **b** for your datacenter regions
     - In each corresponding drop-down selector, select the Public subnet (where your proxy servers reside).
   - Click: **Configure Security Settings**
2. **Configure Security Settings** page
   - Upload your public SSL certificate.
   - Click **Next: Configure Security Groups**.

3. **Configure Security Groups** page:

    - Select the Public security group. If the Default security group is selected, then clear that selection.
    - Click **Next: Configure Routing**.

4. **Configure Routing** page

    - Target group: Existing target group.
    - Name: Select target group that you created earlier
    - Click **Next: Register Targets**.

5. **Register Targets** page

    - The two proxy server instances that you configured previously should be displayed.
    - Click **Next: Review**.

6. **Review** page

    Click **Create**.

Single page configuration

Basic configuration

- Specify name
- Scheme: internet-facing (default)
- IP address type: ipv4 (default)

Network mapping

- VPC: select the VPC where you've installed everything
- Mappings:
    - Select the **a** and **b** (or comparable) Availability Zones for your datacenter regions
    - In each corresponding drop-down selector, select the Public subnet (where your proxy servers reside).

Security groups

Select the Public security group. If the Default security group is selected, then clear that selection.

Listeners and routing

- Leave the default HTTP listener. For **Default action**, specify the Target Group that you previously set up.
- Click **Add listener** and add `HTTPS:443`. For **Default action**, specify the Target Group that you previously set up.

Secure listener settings

- Upload your public SSL certificate.

Click **Create load balancer**.

Step 3: Enable stickiness

1. After the load balancer is created, you must enable stickiness on the Target Group.
    - Open AWS Target Group page (**EC2**> **Load Balancing**> **Target groups**), select the target group instance that you just set up. On the **Action** menu, select **Edit attributes**.
    - On the **Edit attributes** page, select **Stickiness**, specify a duration of `1 day`, and then **Save changes**.
2. On load balancer, enable stickiness on the HTTP listener. Select the load balancer you just configured, and then click the **Listeners** tab:
    - For **HTTP:80**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. Delete the existing THEN rule and replace it by clicking **Add action** > **Forward to...**. In the resulting THEN configuration, specify the same target group you have created. Under Group-level stickiness, enable stickiness and set duration to 1 day. Save the setting and then click **Update**.

Step 4: Set idle timeout on load balancer

On load balancer, update idle timeout to 400 seconds.

Select the load balancer you have configured for this deployment, and then click **Actions** > **Edit attributes**. Set **Idle timeout** to `400` seconds, and then click **Save**.

Step 5: Verify LBS connectivity

Open AWS Load Balancer page (**EC2**> **Load Balancers**), select the load balancer instance that you just set up.

Under **Description**, copy the DNS name and paste it into a browser to access the Tableau Server sign in page.

If you get a 500-level error, then you may need to restart your proxy servers.

Update DNS with public Tableau URL

Use your domain DNS zone name from the AWS Load Balancer description to create a CNAME value in your DNS. Traffic to your URL (tableau.example.com) should be sent to the AWS public DNS name.

Verify connectivity

After your DNS updates are finished, you should be able to navigate to the Tableau Server sign-in page by entering your public URL, for example, `https://tableau.example.com`.

Example authentication configuration: SAML with external IdP

The following example describes how to setup and configure SAML with Okta IdP and Mellon authentication module for a Tableau deployment running in the AWS reference architecture.

This example picks up from the previous section and assumes that you are configuring one Independent Gateway at a time.

The example describes how to configure Tableau Server and Independent Gateway over HTTP. Okta will send request to the AWS load balancer over HTTPS, but all internal traffic will travel over HTTP. As you configure for this scenario, be aware of the HTTP vs HTTPS protocols when setting URL strings.

This example uses Mellon as a pre-authentication service provider module on the Independent Gateway servers. This configuration ensures that only authenticated traffic connects to Tableau Server, which also acts as a service provider with the Okta IdP. Therefore, you must configure two IdP applications: one for the Mellon service provider and one for the Tableau service provider.

Create Tableau administrator account

A common mistake when configuring SAML is to forget to create an administrator account on Tableau Server before enabling SSO.

The first step is to create an account on Tableau Server with a Server Administrator role. For the example Okta scenario, the username must be in a valid email address format, for example, user@example.com. You must set a password for this user, but the password will not be used after SAML is configured.

Configure Okta pre-auth application

The end-to-end scenario described in this section requires two Okta applications:

- Okta pre-auth application
- Okta Tableau Server application

Each of these applications are associated with different metadata that you will need to configure on the reverse proxy and Tableau Server, respectively.

This procedure describes how to create and configure the Okta pre-auth application. Later in this topic you will create the Okta Tableau Server application. For a free test Okta account with limited users, see the Okta Developer web page.

Create a SAML app integration for the Mellon pre-authentication service provider.

1. Open the Okta administration dashboard > **Applications** > **Create App Integration**.

2. On **Create a new app integration** page, select **SAML 2.0** and then click **Next**.

3. On the **General Settings** tab, enter an App name, for example `Tableau Pre-Auth`, and then click **Next**.

4. On the **Configure SAML** tab:

   - Single sign on (SSO) URL. The final element of the path in the single sign on URL is referred to as the `MellonEndpointPath` in the `mellon.conf` configuration file that follows later in this procedure. You can specify whatever endpoint you would like. In this example, `sso` is the endpoint. The last element, `postResponse`, is required: `https://tableau.example.com/sso/postResponse`.
   - Clear the checkbox: **Use this for Recipient URL and Destination URL**.
   - Recipient URL: Same as SSO URL, but with HTTP. For example, `http://tableau.example.com/sso/postResponse`.
   - Destination URL: same as SSO URL, but with HTTP. For example, `http://tableau.example.com/sso/postResponse`.
   - Audience URI (SP Entity ID). For example, `https://tableau.example.com`.
   - Name ID format: `EmailAddress`
   - Application username: `Email`
   - Attributes Statements: Name = `mail`; Name format = `Unspecified`; Value = `user.email`.

   Click **Next**.

5. On the **Feedback** tab, select:

   - **I'm an Okta customer adding an internal app**
   - **This is an internal app that we have created**
   - Click **Finish**.

6. Create the pre-auth IdP metadata file:

   - In Okta: **Applications** > **Applications** > Your new application (e.g., `Tableau Pre-Auth`) > **Sign On**
   - Adjacent to **SAML Signing Certificates**, click **View SAML setup instructions**.

- On the **How to Configure SAML 2.0 for <pre-auth> Application**, page, scroll down to **Optional** section, **Provide the following IDP metadata to your SP provider**.
- Copy the contents of the XML field and save them in a file called `pre-auth_idp_metadata.xml`.

7. (Optional) Configure multifactor authentication:

    - In Okta: **Applications** > **Applications** > Your new application (e.g., `Tableau Pre-Auth`) > **Sign On**
    - Under **Sign On Policy**, click **Add Rule**.
    - On the **App Sign On Rule**, specify a name and the different MFA options. To test functionality, you can leave all options as default. However, under **Actions**, you must select, **Prompt for factor**, and then specify how often users must sign in. Click **Save**.

Create and assign Okta user

1. In Okta, create a user with the same username that you created in Tableau (user@example.com): **Directory** > **People** > **Add person**.
2. After the user is created, assign the new Okta app to that person: Click the user name then assign the application in **Assign Application**.

Install Mellon for pre-auth

This example uses mod_auth_mellon, a popular open source module. Some Linux distributions package obsolete mod_auth_mellon versions from an older repository. Those obsolete versions may contain unknown security vulnerabilities or functional problems. If you choose to use mod_auth_mellon, check that you are using a current version.

The mod_auth_mellon module is third-party software. We've made a best effort to verify and document the procedures to enable this scenario. However, third-party software may change or your scenario may differ from the reference architecture described here. Please refer to third-party documentation for authoritative configuration details and support.

1. On the active EC2 instance that is running Independent Gateway, install a current version of the Mellon authentication module.

2. Create the `/etc/mellon` directory:

   ```
   sudo mkdir /etc/mellon
   ```

Configure Mellon as pre-auth module

Run this procedure on the first instacee of Independent Gateway.

You must have a copy of `pre-auth_idp_metadata.xml` file that you created from the Okta configuration.

1. Change directory:

   ```
   cd /etc/mellon
   ```

2. Create the service provider metadata. Run the `mellon_create_metadata.sh` script. You must include the entity ID and the return URL for your organization in the command.

   The return URL is referred to as the *single sign on URL* in Okta. The final element of the path in the return URL is referred to as the `MellonEndpointPath` in the `mellon.conf` configuration file that follows later in this procedure. In this example, we specify `sso` as the endpoint path.

   For example:

   ```
   sudo /usr/libexec/mod_auth_mellon/mellon_create_metadata.sh
   https://tableau.example.com "https://tableau.example.com/sso"
   ```

   The script returns the service provider certificate, key, and metadata files.

3. Rename the service provider files in the `mellon` directory for easier readability. We will refer to these files by the following names in the documentation:

```
sudo mv *.key mellon.key
sudo mv *.cert mellon.cert
sudo mv *.xml sp_metadata.xml
```

4. Copy the `pre-auth_idp_metadata.xml` file to the same directory.

5. Change ownership and permissions on all files in `/etc/mellon` directory:

```
sudo chown tableau-tsig mellon.key
sudo chown tableau-tsig mellon.cert
sudo chown tableau-tsig sp_metadata.xml
sudo chown tableau-tsig pre-auth_idp_metadata.xml
sudo chmod +r * mellon.key
sudo chmod +r * mellon.cert
sudo chmod +r * sp_metadata.xml
sudo chmod +r * pre-auth_idp_metadata.xml
```

6. Create the `/etc/mellon/conf.d` directory:

```
sudo mkdir /etc/mellon/conf.d
```

7. Create the `global.conf` file in the `/etc/mellon/conf.d` directory.

   Copy the file contents as shown below, but update `MellonCookieDomain` with your root domain name. For example, if domain name for Tableau is `tableau-.example.com`, enter `example.com` for the root domain.

```
<Location "/">
AuthType Mellon
MellonEnable auth
Require valid-user
MellonCookieDomain <root domain>
MellonSPPrivateKeyFile /etc/mellon/mellon.key
MellonSPCertFile /etc/mellon/mellon.cert
MellonSPMetadataFile /etc/mellon/sp_metadata.xml
```

```
MellonIdPMetadataFile /etc/mellon/pre-auth_idp_metadata.xml
MellonEndpointPath /sso
</Location>

<Location "/tsighk">
MellonEnable Off
</Location>
```

8. Create the `mellonmod.conf` file in the `/etc/mellon/conf.d` directory.

   This file holds a single directive that specifies the location of the `mod_auth_mellon.so` file. The location in the example here is the default location of the file. Verify that the file is in this location, or change the path in this directive to match the actual location of `mod_auth_mellon.so`:

   ```
   LoadModule auth_mellon_module /usr/lib64/httpd/modules/mod_
   auth_mellon.so
   ```

Create Tableau Server application in Okta

1. In Okta dashboard: **Applications** > **Applications** > **Browse App Catalog**
2. In **Browse App Integration Catalog**, search `Tableau`, select the Tableau Server tile, and then click **Add**.
3. On **Add Tableau Server** > **General Settings**, enter a Label, and then click **Next**.
4. In Sign-On Options, select **SAML 2.0**, and then scroll down to Advanced Sign-on Settings:
   - **SAML Entity ID**: enter the public URL, for example, https://tableau.example.com.
   - **Application user name format**: Email
5. Click the **Identity Provider metadata** link, to launch a browser. Copy the browser link. This is the link you will use when you configure Tableau in the procedure that follows.
6. Click **Done**.
7. Assign the new Tableau Server Okta app to your user (user@example.com): Click the user name then assign the application in **Assign Application**.

Set authentication module configuration on Tableau Server

Run the following commands on Tableau Server Node 1. These commands specify the file locations for the Mellon configuration files on the remote Independent Gateway computer. Double-check that the file paths specified in these commands map to the paths and file location on the remote Independent Gateway computer.

```
tsm configuration set -k gateway.tsig.authn_module_block -v
"/etc/mellon/conf.d/mellonmod.conf" --force-keys
tsm configuration set -k gateway.tsig.authn_global_block -v
"/etc/mellon/conf.d/global.conf" --force-keys
```

To reduce downtime, do not apply changes until you have enabled SAML as described in the next section.

Enable SAML on Tableau Server for IdP

Run this procedure on Tableau Server Node 1.

1. Download the Tableau Server application metadata from Okta. Use the link that you saved from the previous procedure:

   ```
   wget https://dev-66144217.okta.-
   com/app/exk1egxgt1fhjkSeS5d7/sso/saml/metadata -O idp_
   metadata.xml
   ```

2. Copy a TLS certificate and related key file to the Tableau Server. The key file must be an RSA key. For more information about SAML certificate and IdP requirements, see *SAML Requirements* (Linux).

   To simplify certificate management and deployment, and as a security best practice, we recommend using certificates generated by a major trusted-third party certificate authority (CA). Alternatively, you may generate self-signed certificates or use certificates from a PKI for TLS.

If you do not have a TLS certificate, you can generate a self-signed certificate using the embedded procedure below.

Generate a self-signed certificate

Run this procedure onTableau Server Node 1.

a. Generate signing root certificate authority (CA) key:

```
openssl genrsa -out rootCAKey-saml.pem 2048
```

b. Create the root CA certificate:

```
openssl req -x509 -sha256 -new -nodes -key rootCAKey-sam-
l.pem -days 3650 -out rootCACert-saml.pem
```

You will be prompted to enter values for the certificate fields. For example:

```
Country Name (2 letter code) [XX]:US
State or Province Name (full name) []:Washington
Locality Name (eg, city) [Default City]:Seattle
Organization Name (eg, company) [Default Company Ltd]:T-
ableau
Organizational Unit Name (eg, section) []:Operations
Common Name (eg, your name or your server's hostname) []:t-
ableau.example.com
Email Address []:example@tableau.com
```

c. Create the certificate and related key (`server-saml.csr`and `server-sam-l.key` in the example below). The subject name for the certificate must match the public host name of the Tableau host. The subject name is set with the `-subj` option with the format `"/CN=<host-name>"`, for example:

```
openssl req -new -nodes -text -out server-saml.csr -keyout
server-saml.key -subj "/CN=tableau.example.com"
```

d. Sign the new certificate with the CA certificate that you created above. The following command also outputs the certificate in the `crt` format:

```
openssl x509 -req -in server-saml.csr -days 3650 -CA
rootCACert-saml.pem -CAkey rootCAKey-saml.pem -CAcre-
ateserial -out server-saml.crt
```

e. Convert the key file to RSA. Tableau requires an RSA key file for SAML. To convert the key, run the following command:

```
openssl rsa -in server-saml.key -out server-saml-rsa.key
```

3. Configure SAML. Run the following command, specifying your entity ID and return URL, and the paths to the metadata file, certificate file, and key file:

```
tsm authentication saml configure --idp-entity-id "https://t-
ableau.example.com" --idp-return-url "https://t-
ableau.example.com" --idp-metadata idp_metadata.xml --cert-file
"server-saml.crt" --key-file "server-saml-rsa.key"

tsm authentication saml enable
```

4. If your organization is running Tableau Desktop 2021.4 or later, then you must run the following command to enable authentication through the reverse proxy servers.

   Versions of Tableau Desktop 2021.2.1 - 2021.3 will work without running this command, provided that your pre-authentication module (e.g., Mellon) is configured to allow top-level domain cookie preservation.

```
tsm configuration set -k features.ExternalBrowserOAuth -v false
```

5. Apply configuration changes:

```
tsm pending-changes apply
```

Restart tsig-httpd service

As your Tableau Server deployment applies changes, sign back into the Tableau Server Independent Gateway computer and run the following commands to restart the tsig-httpd service:

```
sudo su - tableau-tsig
systemctl --user restart tsig-httpd
exit
```

Validate SAML functionality

To validate end-to-end SAML functionality, sign-in to Tableau Server with the public URL (e.g., https://tableau.example.com) with the Tableau admin account that you created at the beginning of this procedure.

If TSM doesn't start ("gateway error") or if you get browser errors when you attempt to connect, see Troubleshooting Tableau Server Independent Gateway.

Configure authentication module on second instance of Independent Gateway

After you have successfully configured the first instance of Independent Gateway, deploy the second instance. The example here is the final process for installing the AWS/Mellon/Okta scenario described in this topic. The procedure assumes that you have already installed Independent Gateway on the second instance as described in this topic previously (Install Independent Gateway).

The process for deploying the second Independent Gateway requires the following steps:

1. On the second instance of Independent Gateway: Install the Mellon auth module.

   Do not configure the Mellon auth module as described earlier in this topic. Instead, you must clone the configuration as described in the subsequent steps.

2. On the configured (first) instance of Independent Gateway:

   Take a tar copy of the existing Mellon configuration. The tar backup will preserve all directory hierarchy and permissions. Run the following commands:

   ```
   cd /etc
   ```

   ```
   sudo tar -cvf mellon.tar mellon
   ```

   Copy `mellon.tar` to the second instance of Independent Gateway.

3. On the second instance of Independent Gateway:

   Extract ("unzip") the tar file to the second instance in the `/etc` directory. Run the following commands:

   ```
   cd /etc
   ```

   ```
   sudo tar -xvf mellon.tar
   ```

4. On Node 1 of the Tableau Server deployment: Update the connection file (`tsig.json`) with the connection information from the second Independent Gateway. You will need to retrieve the authentication key as described in this topic previously (Install Independent Gateway).

   An example connection file (`tsig.json`) is shown here:

   ```
   {
   "independentGateways": [
    {
      "id": "ip-10-0-1-169.ec2.internal",
      "host": "ip-10-0-1-169.ec2.internal",
      "port": "21319",
   ```

```
    "protocol" : "http",
    "authsecret": "13660-27118-29070-25482-9518-22453"
  },
  {
    "id": "ip-10-0-2-230.ec2.internal",
    "host": "ip-10-0-2-230.ec2.internal",
    "port": "21319",
    "protocol" : "http",
    "authsecret": "9055-27834-16487-27455-30409-7292"
  }]
  }
```

5. On Node 1 of the Tableau Server deployment: Run the following commands to update the configuration:

   ```
   tsm stop

   tsm topology external-services gateway update -c tsig.json

   tsm start
   ```

6. On both instances of Independent Gateway: As Tableau Server is starting, restart the `tsig-httpd` process:

   ```
   sudo su - tableau-tsig

   systemctl --user restart tsig-httpd

   exit
   ```

7. In AWS **EC2>Target groups**: Update target group to include the EC2 instance running the second Independent Gateway instance.

   Select the target group that you just created, and then click the Targets tab:

   - Click **Edit**.
   - Select the EC2 instance of the second Independent Gateway computer, and then click **Add to registered**.Click **Save**.

Part 6 - Post-Installation Configuration

Configure SSL/TLS from load balancer to Tableau Server

Some organizations require end-to-end encryption channel from the client to the back end service. The default reference architecture as described to this point specifies SSL from the client to the load balancer running in the web tier of your organization.

This section describes how to configure SSL/TLS for Tableau Server and the Independent Gateway in the example AWS reference architecture. For a configuration example describing how to configure SSL/TLS on Apache in AWS reference architecture, see Example: Configure SSL/TLS in AWS reference architecture.

At this time, TLS is not supported on the backend Tableau Server processes that run in the 8000-9000 range. To enable TLS, you must configure Independent Gateway with a relay connection to the Tableau Server.

This procedure describes how to enable and configure TLS on Independent Gateway to Tableau Server, and Tableau Server to Independent Gateway. The procedure encrypts the relay traffic over HTTPS/443 and housekeeping traffic over HTTPS/21319.

The Linux procedures throughout this example show commands for RHEL-like distributions. Specifically the commands here have been developed with the Amazon Linux 2 distribution. If you are running the Ubuntu distribution, edit the commands accordingly.

The guidance here is prescriptive to the specific AWS example reference architecture as presented in this Guide. Therefore, optional configurations are not included. For full reference documentation, see *Configure TLS on Independent Gateway* (Linux).

Before you configure TLS

Perform the TLS configurations outside of business hours. Configuration requires at least one restart of Tableau Server. If you are running a full four-node reference architecture deployment, then restarting can take a while.

- Verify that clients can connect to Tableau Server over HTTP. Configuring TLS with Independent Gateway is a multi-step process and may require troubleshooting. Therefore, we recommend starting with a fully operational Tableau Server deployment before configuring TLS.

- Collect TLS/SSL certificates, keys, and related assets. You will need SSL certificates for the Independent Gateways and for Tableau Server. To simplify certificate management and deployment, and as a security best practice, we recommend using certificates generated by a major trusted-third party certificate authority (CA). Alternatively, you may generate self-signed certificates or use certificates from a PKI for TLS.

  The example configuration in this topic uses the following asset names by way of illustration:
  - `tsig-ssl.crt`: The TLS/SSL certificate for Independent Gateway.
  - `tsig-ssl.key`: The private key for `tsig-ssl.crt` on Independent Gateway.
  - `ts-ssl.crt`: The TLS/SSL certificate for Tableau Server.
  - `ts-ssl.key`: The private key for `tsig-ssl.crt` on Tableau Server.
  - `tableau-server-CA.pem`: The root certificate for the CA that generates the certificates for the Tableau Server computers. This certificate is generally not required if you are using certificates from major trusted-third parties.
  - `rootTSIG-CACert.pem`: The root certificate for the CA that generates the certificates for the Independent Gateway computers. This certificate is generally not required if you are using certificates from major trusted-third parties.
  - There are other certificates and key file assets required for SAML that are detailed in Part 5 of this Guide.

  - If your implementation requires the use of a certificate chain file, see the Knowledge Base article, Configure TLS on Independent Gateway when using a certificate that has a certificate chain.

- Verify that you have access to IdP. If you are using an IdP for authentication, you will likely need to make changes to the recipient and destination URLs at the IdP after you have configured SSL/TLS.

Configure Independent Gateway computers for TLS

Configuring TLS can be an error prone process. Since troubleshooting across two instances of Independent Gateway can be time consuming, we recommend enabling and configuring TLS on the EDG deployment with just one Independent Gateway. After you have validated that TLS works across the deployment, then configure the second Independent Gateway computer.

Step 1: Distribute certificates and keys to Independent Gateway computer

You can distribute the assets to any arbitrary directory as long as the tsig-httpd user has read access to the files. The paths to these files are referenced in other procedures. We will use the example paths under `/etc/ssl`, as shown below, throughout the topic.

1. Create directory for private key:

   ```
   sudo mkdir -p /etc/ssl/private
   ```

2. Copy the certificate and key files to the `/etc/ssl` paths. For example,

   ```
   sudo cp tsig-ssl.crt /etc/ssl/certs/
   ```

   ```
   sudo cp tsig-ssl.key /etc/ssl/private/
   ```

3. (Optional) If you are using a self-signed or PKI certificate for SSL/TLS on Tableau Server, then you must copy the CA root certificate file to the Independent Gateway com-

puter as well. For example,

```
sudo cp tableau-server-CA.pem /etc/ssl/certs/
```

Step 2: Update the environmental variables for TLS

You must update port and protocol environmental variables for Independent Gateway configuration.

Change these values by updating the file, `/etc/opt/tableau/tableau_tsig/environment.bash`, as follows :

```
TSIG_HK_PROTOCOL="https"
TSIG_PORT="443"
TSIG_PROTOCOL="https"
```

Step 3: Update the stub configuration file for HK protocol

Manually edit the stub configuration file (`/var/opt/tableau/tableau_tsig/-config/httpd.conf.stub`) to set TLS-related Apache httpd directives for the housekeeping (HK) protocol.

The stub configuration file includes a block of TLS-related directives that are commented out with a `#TLS#` marker. Remove the markers from the directives as shown in the example below. Note that the example shows use of root CA certificate for the SSL certificate used on Tableau Server with the `SSLCACertificateFile` option.

```
#TLS# SSLPassPhraseDialog exec:/path/to/file
<VirtualHost *:${TSIG_HK_PORT}>
SSLEngine on
#TLS# SSLHonorCipherOrder on
#TLS# SSLCompression off
SSLCertificateFile /etc/ssl/certs/tsig-ssl.crt
SSLCertificateKeyFile /etc/ssl/private/tsig-ssl.key
SSLCACertificateFile /etc/ssl/certs/tableau-server-CA.pem
#TLS# SSLCARevocationFile /path/to/file
</VirtualHost>
```

These changes will be lost if you re-install Independent Gateway. We recommend making a back-up copy.

Step 4: Copy stub file and restart the service

1. Copy the file that you updated in the last step, to update httpd.conf with the changes:

   ```
   cp /var/opt/tableau/tableau_tsig/config/httpd.conf.stub /var/-
   opt/tableau/tableau_tsig/config/httpd.conf
   ```

2. Restart the Independent Gateway service:

   ```
   sudo su - tableau-tsig
   systemctl --user restart tsig-httpd
   exit
   ```

After you restart, the Independent Gateway will be nonoperational until you run the next set of steps on Tableau Server. After you have completed the steps on Tableau Server, Independent Gateway will pick up changes and come online.

Configure Tableau Server Node 1 for TLS

Run these steps on Node 1 of the Tableau Server deployment.

Step 1: Copy certificates and keys and stop TSM

1. Verify that you have the Tableau Server "external SSL" certificates and keys copied to Node 1.

2. To minimize downtime, we recommend stopping TSM, running the following steps, and then starting TSM after changes have been applied:

   ```
   tsm stop
   ```

Step 2: Set certificate assets and enable Independent Gateway configuration

1. Specify the location of certificate and key files for Independent Gateway. These paths reference the location on the Independent Gateway computers. Note that this example assumes the same certificate and key pair are used to protect HTTPS and housekeeping traffic:

   ```
   tsm configuration set -k gateway.tsig.ssl.cert.file_name -v
   /etc/ssl/certs/tsig-ssl.crt --force-keys
   tsm configuration set -k gateway.tsig.ssl.key.file_name -v
   /etc/ssl/private/tsig-ssl.key --force-keys
   ```

2. Enable TLS for HTTPS and HK protocols for Independent Gateway:

   ```
   tsm configuration set -k gateway.tsig.ssl.enabled -v true --
   force-keys
   tsm configuration set -k gateway.tsig.hk.ssl.enabled -v true --
   force-keys
   ```

3. (Optional) If you are using a self-signed or PKI certificate for SSL/TLS on the Independent Gateway, then you must upload the CA root certificate file. The CA root certificate file is the root certificate that was used to generate the certificates for the Independent Gateway computers. For example,

   ```
   tsm security custom-cert add -c rootTSIG-CACert.pem
   ```

4. (Optional) If you are using a self-signed or PKI certificate for SSL/TLS on Tableau Server, then you must copy the CA root certificate file to the Independent Gateway `/etc/ssl/certs` directory. The CA root certificate file is the root certificate that was used to generate the certificates for the Tableau Server computers. After you have copied the certificate to the Independent Gateway, you must specify the location of the certificate on Node 1 with the following tsm command. For example,

```
tsm configuration set -k gateway.tsig.ssl.proxy.gateway_relay_
cluster.cacertificatefile -v /etc/ssl/certs/tableau-server-
CA.pem --force-keys
```

5. (Optional: for testing purposes only) If you are using sharing self-signed or PKI certificates across computers and therefore the subject names on the certificates do not match the computer names, then you must disable certificate verification.

   ```
   tsm configuration set -k gateway.tsig.ssl.proxy.verify -v
   optional_no_ca --force-keys
   ```

Step 3: Enable "external SSL" for Tableau Server and apply changes

1. Enable and configure "external SSL" on Tableau Server:

   ```
   tsm security external-ssl enable --cert-file ts-ssl.crt --key-
   file ts-ssl.key
   ```

2. Apply changes.

   ```
   tsm pending-changes apply
   ```

Step 4: Update the gateway configuration JSON file and start tsm

1. Update the Independent Gateway configuration file (for example, `tsig.json`) on the Tableau Server side to specify the `https` protocol for the Independent Gateway objects:

   ```
   "protocol" : "https",
   ```

2. Remove (or comment-out) the connection information for the second instance of Independent Gateway. Be sure to verify the JSON in an external editor before you save it.

   After you have configured and validated TLS for the single instance of Independent Gateway, you will update this JSON file with the connection information for the second instance of Independent Gateway.

3. Run the following command to update the Independent Gateway configuration:

```
tsm topology external-services gateway update -c tsig.json
```

4. Start TSM.

   ```
   tsm start
   ```

5. While TSM is starting, sign in to the Independent Gateway instance and restart the `tsig-httpd` service:

   ```
   sudo su - tableau-tsig

   systemctl --user restart tsig-httpd

   exit
   ```

Update IdP authentication module URLs to HTTPS

If you have configured an external identity provider for Tableau, then you will likely need to update return URLs in the IdP administrative dashboard.

For example, if you are using a Okta pre-auth application, you will need to update the application to use HTTPS protocol for the Recipient URL and the Destination URL.

Configure AWS load balancer for HTTPS

If you are deploying with AWS load balancer as documented in this guide, then you reconfigure the AWS load balancer to send HTTPS traffic to the computers running Independent Gateway:

1. Delete existing HTTP target group:

   In **Target Groups**, select the HTTP target group that has been configured for the load balancer, click **Actions**, and then click **Delete**.

2. Create HTTPS target group:

   Target groups > **Create target group**

- Select "Instances"
- Enter a target group name, for example `TG-internal-HTTPS`
- Select your VPC
- Protocol: HTTPS 443
- Under **Health checks** > **Advanced health checks settings** > **Success codes**, append the code list to read: `200,303`.
- Click **Create**.

3. Select the target group that you just created, and then click the **Targets** tab:

   - Click **Edit**
   - Select the EC2 instance that is running Tableau Server Independent Gateway that you have configured, and then click **Add to registered**.
   - Click **Save**.

4. After the target group is created, you must enable stickiness:

   - Open AWS Target Group page (**EC2**> **Load Balancing**> **Target groups**), select the target group instance that you just set up. On the **Action** menu, select **Edit attributes**.
   - On the **Edit attributes** page, select **Stickiness**, specify a duration of `1 day`, and then **Save changes**.

5. On load balancer, update listener rules. Select the load balancer you have configured for this deployment, and then click the **Listeners** tab.

   - For **HTTP:80**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. Delete the existing THEN rule and replace it by clicking **Add action** > **Redirect to...**. In the resulting THEN configuration, specify `HTTPS` and port `443` and leave the other options to default settings. Save the setting and then click **Update**.
   - For **HTTPS:443**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. Delete the existing THEN rule and replace it by clicking **Add action** > **Forward to...**. Specify the Target group to the HTTPS group that you just created. Under **Group-level stickiness**, enable stickiness and set duration to 1 day. Save the setting and then click **Update**.

6. On load balancer, update idle timeout to 400 seconds. Select the load balancer you have configured for this deployment, and then click the **Actions** > **Edit attributes**. Set **Idle timeout** to `400` seconds, and then click **Save**.

Validate TLS

To validate TLS functionality, sign-in to Tableau Server with the public URL (e.g., https://tableau.example.com) with the Tableau admin account that you created at the beginning of this procedure.

If TSM is not starting or you get other errors, see Troubleshooting Tableau Server Independent Gateway.

Configure second instance of Independent Gateway for SSL

After you have successfully configured the first instance of Independent Gateway, deploy the second instance.

The process for deploying the second Independent Gateway requires the following steps:

1. On the configured (first) instance of Independent Gateway: Copy the following files to corresponding locations on the second instance of Independent Gateway:
   - `/etc/ssl/certs/tsig-ssl.crt`
   - `/etc/ssl/private/tsig-ssl.key` (You will need to create the `private` directory on the second instance).
   - `/var/opt/tableau/tableau_tsig/config/httpd.conf.stub`
   - `/etc/opt/tableau/tableau_tsig/environment.bash`
2. On Node 1 of the Tableau Server deployment: Update the connection file (`tsig.json`) with the connection information from the second Independent Gateway.

   An example connection file (`tsig.json`) is shown here:

```
{
"independentGateways": [
 {
   "id": "ip-10-0-1-169.ec2.internal",
   "host": "ip-10-0-1-169.ec2.internal",
   "port": "21319",
   "protocol" : "https",
   "authsecret": "13660-27118-29070-25482-9518-22453"
 },
 {
   "id": "ip-10-0-2-230.ec2.internal",
   "host": "ip-10-0-2-230.ec2.internal",
   "port": "21319",
   "protocol" : "https",
   "authsecret": "9055-27834-16487-27455-30409-7292"
 }]
 }
```

3. On Node 1 of the Tableau Server deployment: Run the following commands to update the configuration:

   ```
   tsm stop

   tsm topology external-services gateway update -c tsig.json

   tsm start
   ```

4. On both instances of Independent Gateway: As Tableau Server is starting, restart the `tsig-httpd` process on both instances of Independent Gateway:

   ```
   sudo su - tableau-tsig

   systemctl --user restart tsig-httpd

   exit
   ```

5. In AWS **EC2>Target groups**: Update target group to include the EC2 instance running the second Independent Gateway instance.

Select the target group that you just created, and then click the Targets tab:

- Click **Edit**.
- Select the EC2 instance of the second Independent Gateway computer, and then click **Add to registered**.Click **Save**.

Configure SSL for Postgres

You may optionally configure SSL (TLS) for the Postgres connection for the external repository connection on Tableau Server.

To simplify certificate management and deployment, and as a security best practice, we recommend using certificates generated by a major trusted-third party certificate authority (CA). Alternatively, you may generate self-signed certificates or use certificates from a PKI for TLS.

This procedure describes how to use OpenSSL to generate self-signed certificate on the Postgres host on a RHEL-like Linux distribution in the example AWS reference architecture.

After you generate and sign the SSL certificate, you must copy the CA certificate to the Tableau host.

On the host running Postgress:

1. Generate signing root certificate authority (CA) key:

   ```
   openssl genrsa -out pgsql-rootCAKey.pem 2048
   ```

2. Create the root CA certificate:

   ```
   openssl req -x509 -sha256 -new -nodes -key pgsql-rootCAKey.pem
   -days 3650 -out pgsql-rootCACert.pem
   ```

   You will be prompted to enter values for the certificate fields. For example:

   ```
   Country Name (2 letter code) [XX]:US
   State or Province Name (full name) []:Washington
   Locality Name (eg, city) [Default City]:Seattle
   ```

```
Organization Name (eg, company) [Default Company Ltd]:Tableau
Organizational Unit Name (eg, section) []:Operations
Common Name (eg, Postgres server's hostname) []:ip-10-0-1-
189.us-west-1.compute.internal
Email Address []:example@tableau.com
```

3. Create the certificate and related key (`server.csr`and `server.key` in the example below) for the Postgres computer. The subject name for the certificate must match the EC2 private DNS name of the Postgres host. The subject name is set with the `-subj` option with the format "`/CN=<private DNS name>`", for example:

   ```
   openssl req -new -nodes -text -out server.csr -keyout serv-
   er.key -subj "/CN=ip-10-0-1-189.us-west-1.compute.internal"
   ```

4. Sign the new certificate with the CA certificate that you created in step 2. The following command also outputs the certificate in the `crt` format:

   ```
   openssl x509 -req -in server.csr -days 3650 -CA pgsql-rootCACer-
   t.pem -CAkey pgsql-rootCAKey.pem -CAcreateserial -out serv-
   er.crt
   ```

5. Copy the crt and key files to the Postgres `/var/lib/pgsql/13/data/` path:

   ```
   sudo cp server.crt /var/lib/pgsql/13/data/
   ```

   ```
   sudo cp server.key /var/lib/pgsql/13/data/
   ```

6. Switch to root user:

   ```
   sudo su
   ```

7. Set permissions on the cer and key files. Run the following commands:

   ```
   cd /var/lib/pgsql/13/data
   chown postgres.postgres server.crt
   chown postgres.postgres server.key
   chmod 0600 server.crt
   chmod 0600 server.key
   ```

8. Update the pg_haba configuration file, `/var/lib/pgsql/13/data/pg_hba.conf` to specify md5 trust:

   Change the existing connection statements from

   `host all all 10.0.30.0/24 password`, and

   `host all all 10.0.31.0/24 password`

   to

   `host all all 10.0.30.0/24 md5`, and

   `host all all 10.0.31.0/24 md5`.

9. Update the postgresql file, `/var/lib/pgsql/13/data/postgresql.conf`, by adding this line:

   ```
   ssl = on
   ```

10. Exit root user mode:

    ```
    exit
    ```

11. Restart Postgres:

    ```
    sudo systemctl restart postgresql-13
    ```

Optional: Enable certificate trust validation on Tableau Server for Postgres SSL

If you followed the installation procedure in Part 4 - Installing and Configuring Tableau Server, then Tableau Server is configured with optional SSL for the Postgres connection. This means that configuring SSL on Postgres (as described above) will result in an encrypted connection.

If you want to require certificate trust validation for the connection, then you must run the following command on Tableau Server to reconfigure the Postgres host connection:

```
tsm topology external-services repository replace-host -f <file-
name>.json -c CACert.pem
```

Where `<filename>.json` is the connection file described in Configure external Postgres. And `CACert.pem` is the CA certificate file for the SSL/TLS certificate used by Postgres.

Optional: Verify SSL connectivity

To verify SSL connectivity, you must:

- Install the Postgres client on Tableau Server Node1.
- Copy the root certificate that you created in the previous procedure to the Tableau host.
- Connect to Postgres server from Node1

Install Postgres client on Node1

This example shows how to install version Postgres 13.4. Install the same version that you are running for the external repository.

1. On Node 1, create and edit the file, pgdg.repo, in the `/etc/yum.repos.d` path. Populate the file with the following configuration information.

   ```
   [pgdg13]
   name=PostgreSQL 13 for RHEL/CentOS 7 - x86_64
   baseurl-
   l=https://download.postgresql.org/pub/repos/yum/13/redhat/rhel-
   7-x86_64
   enabled=1
   gpgcheck=0
   ```

2. Install the Postgres client:

   ```
   sudo yum install postgresql13-13.4-1PGDG.rhel7.x86_64
   ```

Copy root certificate to Node 1

Copy the CA certificate (`pgsql-rootCACert.pem`) to the Tableau host:

```
scp ec2-user@<private-DNS-name-of-Postgress-host>:/home/ec2-user-
/pgsql-rootCACert.pem /home/ec2-user
```

Connect to Postgres host over SSL from Node 1

Run the following command from Node1, specifying the Postgres server host IP address and the root CA certificate:

```
psql "postgresql://postgres@<IP-address>:5432/-
postgres?sslmode=verify-ca&sslrootcert=pgsql-rootCACert.pem"
```

For example:

```
 psql "post-
gresql://postgres@10.0.1.189:5432/postgres?sslmode=verify-ca&ssl-
rootcert=pgsql-rootCACert.pem"
```

Postgres will prompt you for the password. After successful sign in, the shell will return:

```
psql (13.4)
SSL connection (protocol: TLSv1.2, cipher: ECDHE-RSA-AES256-GCM-
SHA384, bits: 256, compression: off)
Type "help" for help.
postgres=#
```

Configure SMTP and event notifications

Tableau Server sends email notifications to admins and users. To enable this, you must configure Tableau Server to send mail to your email server. You must also specify the event types, thresholds, and subscription information you want sent.

For the initial configuration of SMTP,and notifications we recommend that you use the configuration file template below to create a json file. You can also set any single configuration key listed below with the syntax described *tsm configuration set* (Linux).

Run this procedure on Node 1 in your Tableau Server deployment:

1. Copy the following json template to a file. Customize the file with your SMTP configuration options and the subscription and alert notifications for your organization.

    - To see a list and description of all SMTP options see *SMTP CLI configuration reference* (Linux).
    - To see a list and description of all notification event options, see the CLI section of *Configure Server Event Notification* (Linux).

```
{
"configKeys": {
       "svcmonitor.notification.smtp.server": "SMTP server host
name",
       "svcmonitor.notification.smtp.send_account": "SMTP user name",
       "svcmonitor.notification.smtp.port": 443,
       "svcmonitor.notification.smtp.password": "SMTP user account
password",
       "svcmonitor.notification.smtp.ssl_enabled": true,
       "svcmonitor.notification.smtp.from_address": "From email
address",
       "svcmonitor.notification.smtp.target_addresses": "To email
address1,address2",
       "svcmonitor.notification.smtp.canonical_url": "Tableau Server
URL",
       "backgrounder.notifications_enabled": true,
       "subscriptions.enabled": true,
       "subscriptions.attachments_enabled": true,
       "subscriptions.max_attachment_size_megabytes": 150,
       "svcmonitor.notification.smtp.enabled": true,
       "features.DesktopReporting": true,
       "storage.monitoring.email_enabled": true,
```

```
            "storage.monitoring.warning_percent": 20,
            "storage.monitoring.critical_percent": 15,
            "storage.monitoring.email_interval_min": 25,
            "storage.monitoring.record_history_enabled": true
            }
}
```

2. Run the `tsm settings import -f file.json` to pass the json file to Tableau Services Manager.
3. Run the `tsm pending-changes apply` command to apply the changes.
4. Run the `tsm email test-smtp-connection` to view and verify the connection configuration.

Install PostgreSQL driver

To view admin views on Tableau Server, the PostgreSQL driver must be installed on Node1 of the Tableau Server deployment.

1. Go to the Tableau Driver Download page and copy the URL for the PostgreSQL jar file.
2. Run the following procedure on each node of the Tableau deployment:
    - Create the following file path:

      ```
      sudo mkdir -p /opt/tableau/tableau_driver/jdbc
      ```

    - From the new path, download the latest version of the PostgreSQL jar file. For example:

      ```
      sudo wget https://-
      downloads.tableau.com/drivers/linux/postgresql/postgresql-
      42.2.22.jar
      ```

3. On the initial node, restart Tableau Server:

```
tsm restart
```

Configure strong password policy

If you are not deploying Tableau Server with an IdP authentication solution, we recommend security hardening the default Tableau password policy.

If you are deploying Tableau Server with an IdP, then you must manage password policies with the IdP.

The following procedure includes json configuration for setting password policy on Tableau Server. For more information about the options below, see *Local Authentication* (Linux).

1. Copy the following json template to a file. Fill in the key values with your password policy configuration.

```
{
 "configKeys": {
       "wgserver.localauth.policies.mustcontainletters.enabled":
true,
       "wgserver.localauth.policies.mustcontainuppercase.enabled":
true,
       "wgserver.localauth.policies.mustcontainnumbers.enabled":
true,
       "wgserver.localauth.policies.mustcontainsymbols.enabled":
true,
       "wgserver.localauth.policies.minimumpasswordlength.enabled":
true,
       "wgserver.localauth.policies.minimumpasswordlength.value": 12,
       "wgserver.localauth.policies.maximumpasswordlength.enabled":
false,
       "wgserver.localauth.policies.maximumpasswordlength.value":
255,
       "wgserver.localauth.passwordexpiration.enabled": true,
```

```
        "wgserver.localauth.passwordexpiration.days": 90,
        "wgserver.localauth.ratelimiting.maxbackoff.minutes": 60,
        "wgserver.localauth.ratelimiting.maxattempts.enabled": false,
        "wgserver.localauth.ratelimiting.maxattempts.value": 5,
        "vizportal.password_reset": true
    }
}
```

2. Run the `tsm settings import -f file.json` to pass the json file to Tableau Services Manager to configure Tableau Server.

3. Run the `tsm pending-changes apply` command to apply the changes.

Part 7 - Validation, Tools, and Troubleshooting

This part includes post-installation validation steps and troubleshooting guidance.

Failover system validation

After you have configured your deployment, we recommend running simple failover tests to validate system redundancy.

We recommend running the following steps to validate failover functionality:

1. Shut down the first instance of Independent Gateway (TSIG1). All inbound traffic should route through the second instance of Independent Gateway (TSIG2).
2. Resart TSIG1 and then shut down TSIG2. All inbound traffic should route through TSIG1.
3. Restart TSIG2.
4. Shut down Tableau Server Node 1. All Vizportal/Application service traffic will fail over to Node 2.

   Note As of September 2022, Node 1 high availability was compromised on certain versions of Tableau Server 2021.4 and later. Client connections will fail if Node 1 is down. This issue has been fixed in these maintenance releases:

   - 2021.4.15 and later
   - 2022.1.11 and later
   - 2023.1.3 and later

   To ensure your Tableau Server installation using ATR activations will have a 72

> hour grace period after initial node failure, install or upgrade to one of these versions. For more details, see Tableau Server HA using ATR Does Not Have a Grace Period After the Initial Node Failure in the Tableau Knowledge Base.

5. Restart Node1 and shut down Node 2. All Vizportal/Application service traffic will fail over to Node 1.
6. Restart Node 2.

In this context "shutting down" or "restarting" is done by turning off the operating system or virtual machine without attempting a graceful shut down of the application before hand. The goal is to simulate a hardware or virtual machine failure.

The minimum validation step for each failover test is to authenticate with a user and perform basic view operations.

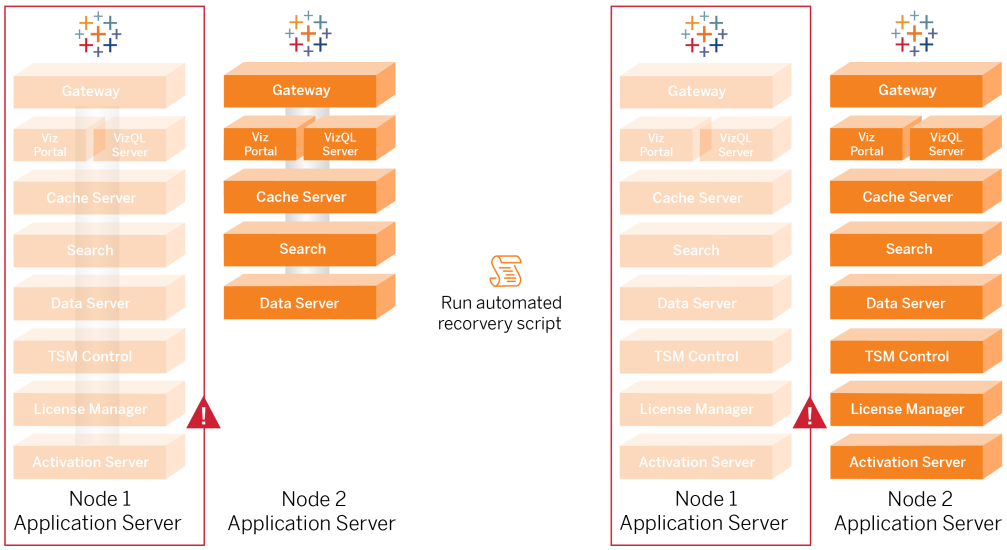
You may get a "Bad Request" browser error when you attempt to sign-in after a simulated failure. You may see this error even if you clear the cache in the browser. Often this issue occurs when the browser is caching data from previous IdP session. If this error persists even after you clear the local browser cache, validate the Tableau scenario by connecting with a different browser.

Initial node automated recovery

Tableau Server version 2021.2.4 and later include an automated initial node recovery script, `auto-node-recovery`, in the scripts directory (`/app/tableau_server-/packages/scripts.<version>`).

If there is a problem with the initial node and you have redundant processes on Node 2, there is no guarantee that Tableau Server will continue to run. Tableau Server may continue to run for up to 72 hours after an initial node failure, before the lack of the licensing service impacts other processes. If so, your users may be able to continue to sign in and see and use their content after the initial node fails, but you will not be able to reconfigure Tableau Server because you won't have access to the Administration Controller.

Even when configured with redundant processes, it is possible that Tableau Server may not continue to function after the initial node fails.



To recover initial node (Node 1) failure:

1. Sign in to Tableau Server Node 2.
2. Change to the scripts directory:

   ```
   cd /app/tableau_server/packages/scripts.<version>
   ```

3. Run the following command to launch the script:

   ```
   sudo ./auto-node-recovery -p node1 -n node2 -k <license keys>
   ```

   Where `<license keys>` is a comma-separated (no spaces) list of the license keys for your deployment. If you do not have access to your license keys, visit the Tableau Customer Portal to retrieve them. For example:

   ```
   sudo ./auto-node-recovery -p node1 -n node2 -k TSB4-8675-309F-TW50-9RUS,TSNM-559N-ULL6-22VE-SIEN
   ```

The auto-node-recovery script will execute about 20 steps to recover services to Node 2. Each step is displayed in the terminal as the script progresses. More detailed status is logged to `/data/tableau_data/logs/app-controller-move.log`. In most environments, the script takes between 35 and 45 minutes to complete.

Troubleshooting initial node recovery

If node recovery fails, you may find running the script interactively to allow or disallow discrete steps in the process useful. For example, if the script fails part way through the process, you can review log file, make changes to the configuration, and then run the script again. By running in interactive mode, you can then skip all the steps until you get to the step that failed.

To run in interactive mode, add the `-i` switch to the script argument.

Rebuilding the failed node

After you have run the script, Node 2 will be running all of the services that were formerly on the failed Node 1 host. To add in the 4 node, you need to deploy a fresh Tableau Server host with the bootstrap file and configure it as you did for the original Node 2, as specified in Part 4. See Configure Node 2.

switchto

Switchto is a script from Tim that makes switching between windows easy.

1. Copy the following code into a file called `switchto` in the home directory on your bastion host.

```
#!/bin/bash
#-----------------------------------------------------------------
-----
# switchto
#
# Helper function to simplify SSH into the various AWS hosts
```

```
when
# following the Tableau Server Enterprise Deployment Guide
(EDG).
#
# Place this file on your bastion host and provide your AWS
hosts'
# internal ip addresses or machine names here.
# Example: readonly NODE1="10.0.3.187"
#
readonly NODE1=""
readonly NODE2=""
readonly NODE3=""
readonly NODE4=""
readonly PGSQL=""
readonly PROXY1=""
readonly PROXY2=""

usage() {
echo "Usage: switchto.sh [ node1 | node2 | node3 | node4 |
pgsql | proxy1 | proxy2 ]"
}


ip=""

case $1 in
       node1)
               ip="$NODE1"
               ;;
       node2)
               ip="$NODE2"
               ;;
       node3)
               ip="$NODE3"
               ;;
```

```
        node4)
                ip="$NODE4"
                ;;
        pgsql)
                ip="$PGSQL"
                ;;
        proxy1)
                ip="$PROXY1"
                ;;
        proxy2)
                ip="$PROXY2"
                ;;
        ?)
                usage
                exit 0
                ;;
        *)
                echo "Unkown option $1."
                usage
                exit 1
                ;;
esac

if [[ -z $ip ]]; then
echo "You must first edit this file to provide the ip addresses
of your AWS hosts."
exit 1
fi

ssh -A ec2-user@$ip
```

2. Update the IP addresses in the script to map to your EC2 instances and then save the file.
3. Apply permissions to the script file:

```
sudo chmod +x switchto
```

Usage:

To switch to a host, run the following command:

```
./switchto <target>
```

For example, to switch to Node 1, run the following command:

```
./switchto node1
```

Troubleshooting Tableau Server Independent Gateway

Configuring Independent Gateway, Okta, Mellon, and SAML on Tableau Server can be an error prone process. The most common root cause of failures is a string error. For example, a trailing slash (`/`) on the Okta URLs specified during configuration may cause a SAML assertion-related mismatch error. This is just one example. There are many opportunities during configuration to input an incorrect string across any of the applications.

Restart tableau-tsig service

Always start (and finish) troubleshooting by restarting the tableau-tsig service on the Independent Gateway computers. Restarting this service is quick and often triggers the updated config to load from the Tableau Server.

Run the following commands on the Independent Gateway computer:

```
sudo su - tableau-tsig

systemctl --user restart tsig-httpd

exit
```

Find incorrect strings

If you have made a string error (copy/paste mistake, string truncated, etc), take time to walk through each of the settings that you configured:

- Okta pre-authentication configuration. Carefully review the URLs that you have set. Look for trailing slashes. Verify HTTP vs HTTPS.
- Shell history for SAML configuration on Node 1. Review the `tsm authentication saml configure` command that you ran. Verify that all of the URLs match those that you have configured in Okta. While you are reviewing shell history from Node 1, verify that the `tsm configuration set` commands that specify the Mellon configuration file paths map exactly to the file paths where you copied the files on Independent Gateway.
- Mellon configuration on Independent Gateway. Review the shell history to verify that you created the metadata with the same URL string that you have configured in Okta and Tableau SAML. Verify that all the paths that are specified in `/etc/mellon/conf.d/global.conf` are correct and that the `MellonCookieDomain` is set to your root domain, not your Tableau subdomain.

Search relevant logs

If all strings appear to be set correctly, then you should inspect logs for errors.

Tableau Server logs errors and events to dozens of different log files. Independent Gateway logs to a set of local files as well. We recommend inspecting these logs in the following order.

Independent Gateway log files

The default location of the Independent Gateway log files are at `/var/opt/tableau/tableau_tsig/logs`.

- `access.log`: This log is useful to the extent that it has entries that show connections from the Tableau Server nodes. If you are getting gateway errors (won't start) when you attempt to start TSM, and there are no entries in the `access.log` file, then there is a core connectivity issue. Always verify AWS security group configuration as a first step. Another common issue is a typo in `tsig.json`. If you make an update to tsig.json, run

`tsm stop` before running `tsm topology external-services gateway update -c tsig.json`. After tsig.json is updated, run `tsm start`.

- `error.log`: Among other entries, this log includes SAML and Mellon errors.

Tableau Server tabadminagent log file

The `tabadminagent` (not `tabadmincontroller`) set of files are the only relevant log files for troubleshooting Independent Gateway-related errors.

You must find where Independent Gateway errors have been logged to `tabdminagent`. These errors can be on any node, but they are only on one node. Perform the following steps on each node in the Tableau Server cluster until you find the “independent” string:

1. Locate the tabadminagent log file location on Tableau Server nodes 1-4 in EDG setup:

   ```
   cd /data/tableau_data/data/tabsvc/logs/tabadminagent
   ```

2. Open latest log to read:

   ```
   less tabadminagent_nodeN.log
   ```

   (replace N with node number)

3. Search for all instances of “Independent” and “independent” - by using the following search string:

   ```
   /ndependent
   ```

   If there are no matches, then go to next node and repeat steps 1-3.

4. When you get a match: `Shift + G` to move to bottom to get last error messages.

Reload httpd stub file

Independent Gateway manages configuration of httpd for Apache. A generic operation that will often fix transient issues is to reload the httpd stub file that seeds the underlying Apache configuration. Run the following commands on both instances of Independent Gateway.

1. Copy the stub file over to httpd.conf:

   ```
   cp /var/opt/tableau/tableau_tsig/config/httpd.conf.stub /var/-
   opt/tableau/tableau_tsig/config/httpd.conf
   ```

2. Restart the Independent Gateway service:

   ```
   sudo su - tableau-tsig
   systemctl --user restart tsig-httpd
   exit
   ```

Delete or move log files

Independent Gateway logs all access events. You will need to manage log file storage to avoid filling up disk space. If your disk fills up Independent Gateway will be unable to write access events and the service will fail. The following message will be logged to error.log on Independent Gateway:

```
(28)No space left on device: [client 10.0.2.209:54332] AH00646:
Error writing to /var/opt/tableau/tableau_tsig/-
logs/access.%Y_%m_%d_%H_%M_%S.log
```

This failure will result in a status of `DEGRADED` for the `external` node when you run `tsm status -v` on Tableau Node 1. The `external` node in the status output refers to Independent Gateway.

To resolve this issue, delete or move the access.log files off the disk. Access.log files are stored at `/var/opt/tableau/tableau_tsig/logs`. After you have cleared the disk, restart tableau-tsig service.

Browser errors

Bad Request: A common error for this scenario is a "Bad Request" error from Okta. Often this issue occurs when the browser is caching data from previous Okta session. For example, if you manage the Okta applications as an Okta administrator and then attempt to access Tableau using a different Okta-enabled account, session data from the administrator data may

cause the "Bad Request" error. If this error persists even after you clear the local browser cache, try validating the Tableau scenario by connecting with a different browser.

Another cause of the "Bad Request" error is a typo in one of the many URLs that you enter during the Okta, Mellon, and SAML configuration processes. Check that you entered all of these without error.

Often the `error.log` file on the Independent Gateway server will specify which URL is causing the error.

Not Found - The requested URL was not found on this server: This error indicates one of many configuration errors.

If the user is authenticated with Okta, and then receives this error, then it's likely that you have uploaded the Okta pre-auth application to Tableau Server when you configured SAML. Verify that you have the Okta Tableau Server application metadata configured on Tableau Server, and not the Okta pre-auth application metadata

Other troubleshooting steps:

- Review the Okta pre-auth application settings. Be sure HTTP vs HTTPS protocols are set as specified in this topic.
- Restart tsig-httpd on both Independent Gateway servers.
- Verify that `sudo apachectl configtest` returns “Syntax OK” on both Independent Gateways.
- Verify that the test user is assigned to both applications in Okta.
- Verify that stickiess is set on the load balancer and associated target groups.

Verify TLS connection from Tableau Server to Independent Gateway

Use the `wget` command to verify connectivity and access from Tableau Server to Independent Gateway. Variations of this command can help you understand if certificate issues are causing connection problems.

For example run this `wget` command to verify the housekeeping (HK) protocol from Tableau Server:

```
wget https://ip-10-0-1-38.us-west-1.compute.internal:21319
```

Construct the URL with the same host address that you included for the host option of the tsig.json file. Specify the `https` protocol, and append the URL with the HK port `21319`.

To check connectivity and ignore certificate verification:

```
wget https://ip-10-0-1-38.us-west-1.compute.internal:21319 --no-check-certificate
```

To verify root CA cert for TSIG is valid:

```
wget https://ip-10-0-1-38.us-west-1.compute.internal:21319 --ca-certificate=tsigRootCA.pem
```

If Tableau is able to communicate, then you may still get content-related errors, but you will not get connection-related errors. If Tableau is unable to connect at all, then start by verifying protocol configuration in the firewall/security groups. For example, the inbound rules for the security group where Independent Gateway resides must allow TCP 21319.

Appendix - AWS Deployment Tool-box

This topic includes tools and alternate deployment options for the reference architecture when deployed in AWS. Specifically, this topic describes how to automate the example AWS deployment that is described throughout the EDG.

TabDeploy4EDG automated installation script

The TabDeploy4EDG script automates the implementation of the four-node Tableau deployment that is described in Part 4 - Installing and Configuring Tableau Server. If you are following the example AWS implementation as described in this Guide, then you may be able to run TabDeploy4EDG.

Requirements. To run the script, you must prepare and configure the AWS environment according to the example implementation in Part 3 - Preparing for Tableau Server Enterprise Deployment:

- VPC, subnet, and security groups have been configured as described. IP addresses do not have to match those that are shown in the example implementation.
- Four EC2 instances running the latest, updated builds of AWS Linux 2
- PostgreSQL is installed and has been configured as described in Install, configure, and tar PostgreSQL .
- A Step 1 tar backup file is on the EC2 instance where PostgreSQL is installed, as described in Take PostgreSQL Step 1 tar backup.
- The EC2 instance that will be running Node 1 of the Tableau Server deployment has been configured to communicate with PostgreSQL as described in Part 4 - Installing and Configuring Tableau Server.
- You have logged into each EC2 instance with an SSH session from the bastion host.

The script takes about 1.5-2 hours to install and configure the four Tableau servers. The script configures Tableau according to the prescribed settings of the reference architecture. The script performs the following actions:

- Restores Stage 1 backup of PostgreSQL host if you specify a path to the PostgreSQL host's tar file.
- Obliterates existing Tableau installations on all nodes.
- Runs `sudo yum update` on all nodes.
- Downloads and copies Tableau rpm package to each node.
- Downloads and installs dependencies to each node.
- Creates `/app/tableau_server` and installs package on all nodes.
- Installs Node 1 with a local identity store and configures external repository with PostgreSQL.
- Performs bootstrap installation and initial configuration of Node 2- Node 4.
- Deletes the bootstrap file and the configuration file for TabDeploy4EDG.
- Configures services across the Tableau cluster according to reference architecture specifications.
- Validates installation and returns status for each node.

Download and copy the script to the bastion host

1. Copy the script from the TabDeploy4EDG samples page and paste the code into a file called, `TabDeploy4EDG`.
2. Save the file to the home directory on the EC2 host that is serving as the bastion host.
3. Run the following command to change the mode on the file to make it executable:

```
sudo chmod +x TabDeploy4EDG
```

Run TabDeploy4EDG

TabDeploy4EDG must be run from the bastion host. The script has been written with the assumption that you are running under the context of ssh forward agent as described at Example: Connect to bastion host in AWS. If you are not running with ssh forward agent context, then you will be prompted for passwords throughout the installation process.

1. Create, edit, and save a registration file (`registration.json`). The file must be a properly-formatted json file. Copy and customize the following template:

```
{
        "zip" : "97403",
        "country" : "USA",
```

```
        "city" : "Springfield",
        "last_name" : "Simpson",
        "industry" : "Energy",
        "eula" : "yes",
        "title" : "Safety Inspection Engineer",
        "phone" : "5558675309",
        "company" : "Example",
        "state" : "OR",
        "department" : "Engineering",
        "first_name" : "Homer",
        "email" : "homer@example.com"
}
```

2. Run the following command to generate a template configuration file:

   ```
   ./TabDeploy4EDG -g edg.config
   ```

3. Open the configuration file to edit:

   ```
   sudo nano edg.config
   ```

   At a minimum, you must add the IP addresses of each EC2 host, a file path to the registration file, and a valid license key.

4. When you are done editing the configuration file, save it, and then close it.

5. To run TabDeploy4EDG, run the following command:

   ```
   ./TabDeploy4EDG -f edg.config
   ```

Example: Automate AWS infrastructure deployment with Terraform

This section describes how to configure and run Terraform to deploy the EDG reference architecture in AWS. The example Terraform configuration presented here deploys an AWS VPC

with the subnets, security groups, and EC2 instances that are described in Part 3 - Preparing for Tableau Server Enterprise Deployment.

Sample Terraform templates are available on the Tableau Samples website at https://help.tableau.com/samples/en-us/edg/edg-terraform.zip. These templates must be configured and customized for your organization. The configuration content provided in this section describes the minimum required template changes you must customize to deploy.

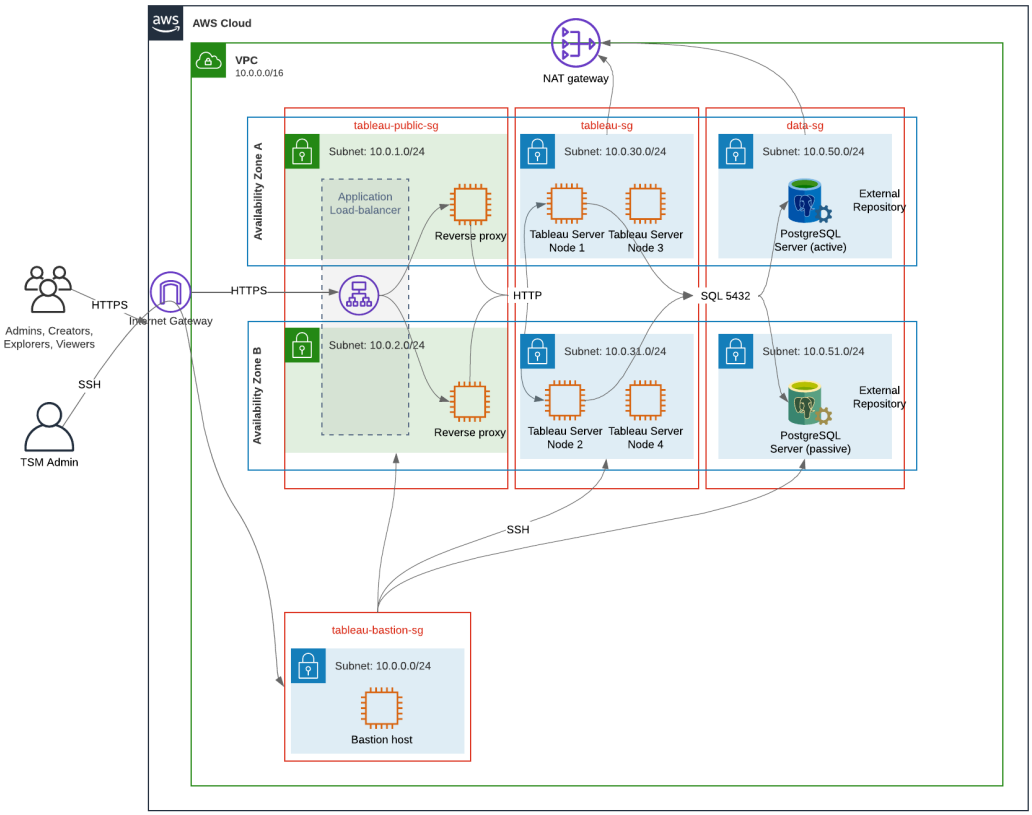
Goal

The Terraform templates and content provided here are intended to provide a working sample that will allow you to deploy EDG quickly in a development test environment.

We've made a best effort to test and document the example Terraform deployment. However, using Terraform to deploy and maintain EDG in a production environment will require Terraform expertise that is beyond the scope of this example. Tableau does not provide support for the example Terraform solution documented here.

End state

Follow the procedure in this section to set up a VPC in AWS that is functionally equivalent to the VPC that is specified in Part 3 - Preparing for Tableau Server Enterprise Deployment.



The sample Terraform templates and supporting content in this section:

- Creates a VPC with an elastic IP address, two availability zones, and subnets organization as shown above (IP addresses are different)
- Creates the Bastion, Public, Private, and Data security groups.
- Sets most ingress and egress rules on the security groups. You will need to edit security groups after Terraform runs.
- Creates the following EC2 hosts (each running AWS Linux2): bastion, proxy 1 proxy 2, Tableau node 1, Tableau node 2, Tableau node 3, Tableau node 4.
- EC2 hosts for PostgreSQL are not created. You must create the EC2 manually in the Data security group, and then install and configure PostgreSQL as described in Install, configure, and tar PostgreSQL .

Requirements

- AWS account - you must have access to an AWS account that allows you to create VPCs.
- If you are running Terraform from a Windows computer, you will need to install AWS CLI.
- An available elastic IP address in your AWS account.
- A domain that is registered in AWS Route 53. Terraform will create a DNS zone and related SSL certificates in Route 53. Therefore, the profile under which Terraform runs, must also have appropriate permissions in Route 53.

Before you begin

- The command line examples in this procedure are for Terminal with Apple OS. If you are running Terraform on Windows you may need to adapt commands with file paths as appropriate.
- A Terraform project is made up of many text configuration files (.tf file extension). You configure Terraform by customizing these files. If you do not have a robust text editor, install Atom or Text++.
- If you are sharing the Terraform project with others, we recommend storing the project in Git for change management.

Step 1 - Prepare environment

A. Download and install Terraform

https://www.terraform.io/downloads

B. Generate private-public key pair

This is the key that you will use to access AWS and the resulting VPC environment. When you run Terraform, you'll include the public key.

Open Terminal and run the following commands:

1. Create a private key. For example, `my-key.pem`:

   ```
   openssl genrsa -out my-key.pem 1024
   ```

2. Create a public key. This key format is not used for Terraform. You will convert it to a ssh key later in this procedure:

   ```
   openssl rsa -in my-key.pem -pubout > my-key.pub
   ```

3. Set permissions on the private key:

   ```
   sudo chmod 0600 my-key.pem
   ```

   To set permissions on Windows:

   - Locate the file in Windows Explorer, right-click on it then select **Properties**. Navigate to the **Security** tab and then click **Advanced**.
   - Change the owner to you, disable inheritance and delete all permissions. Grant yourself **Full control** and then click **Save**. Mark the file as read-only.

4. Create ssh public key. This is the key you'll copy into Terraform later in the process.

   ```
   ssh-keygen -y -f my-key.pem >my-key-ssh.pub
   ```

C. Download project and add state directory

1. Download and unzip the EDG Terraform project and save them to your local computer. After you unzip the download you'll have a top-level directory, edg-terraform, and a series of subdirectories.

2. Create a directory called `state`, as a peer to the top-level `edg-terraform` directory.

Step 2: Customize the Terraform templates

You must customized the Terraform templates to suit your AWS and EDG environment. The example here provides the minimum template customizations that most organization will need to make. It's likely that your particular environment will require other customizations.

This section is organized by template name.

Be sure to save all changes before proceeding to *Step 3 - Run Terraform*.

versions.tf

There are three instances of `versions.tf` files where the `required_version` field must match the version of terraform.exe you're using. Check the version of terraform (`terraform.exe -version`) and update each of the following instances:

- `edg-terraform\versions.tf`
- `edg-terraform\modules\proxy\versions.tf`
- `edg-terraform\modules\tableau_instance\versions.tf`

key-pair.tf

1. Open the public key that you generated in Step 1B and copy the key:

   ```
   less my-key-ssh.pub
   ```

   Windows: Copy the contents of your public key.

2. Copy the public key string into the public_key argument, for example:

   ```
   resource "aws_key_pair" "tableau" {
   key_name = "my-key"
   public_key = "ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAAAgQ (truncated
   example) dZVHambOCw=="
   ```

Ensure that the `key_name` value is unique in the datacenter or `terraform apply` will fail.

locals.tf

Update `user.owner` to your name or alias. The value you enter here will be used for the "Name" tag in AWS on the resources that Terraform creates.

providers.tf

1. Add tags per your organization's requirements. For example:

```
default_tags {
  tags = {

   "Application" = "tableau",
   "Creator" = "alias@example.com",
   "DeptCode" = "8675309",
   "Description" = "EDG",
   "Environment" = "test",
   "Group" = "itcloud@example.com"
  }
}
```

2. If using `provider`, comment out the `assume_role` lines:

```
/* assume_role {
role_arn     = "arn:aws:iam::310946706895:role/terraform-
backend"
session_name = "terraform"
}*/
```

elb.tf

Under `'resource "aws_lb" "tableau" {'` choose a unique value to use for `name` and `tags.Name`.

If another AWS load balancer has the same name in the datacenter, then `terraform apply` will fail.

Add `idle_timeout`:

```
resource "aws_lb" "tableau" {
name                       = "edg-again-alb"
load_balancer_type         = "application"
subnets                    = [for subnet in aws_subnet.public :
```

```
subnet.id]
security_groups            = [aws_security_group.public.id]
drop_invalid_header_fields = true
idle_timeout               = 400
tags = {
Name = "edg-again-alb"
}
                       }
```

variables.tf

Update root domain name. This name must match the domain that you have registered in Route 53.

```
variable "root_domain_name" {
 default = "example.com"
 }
```

By default, the subdomain, `tableau`, is specified for the VPC DNS domain name. To change this, update `subdomain`:

```
variable "subdomain" {
 default = "tableau"
}
```

modules/tableau_instance/ec2.tf

There are two ec2.tf files in the project. This customization is for the Tableau instance of the ec2.tf in the directory: `modules/tableau_instance/ec2.tf`.

- If required, add tags blob:

```
tags = {
 "Name" : var.ec2_name,
 "user.owner" = "ALIAS",
 "Application" = "tableau",
 "Creator" = "ALIAS@example.com",
 "DeptCode" = "8675309",
```

```
 "Description" = "EDG",
 "Environment" = "test",
 "Group" = "itcloud@example.com"
 }
}
```

- As needed, optionally update your storage to handle your data requirements:

  Root volume:

  ```
  root_block_device {
   volume_size = 100
   volume_type = "gp3"
  }
  ```

  Application volume:

  ```
  resource "aws_ebs_volume" "tableau" {
   availability_zone = data.aws_subnet.tableau.availability_zone
   size              = 500
   type              = "gp3"
  }
  ```

Step 3 - Run Terraform

A. Initialize Terraform

In Terminal, change to the `edg-terraform` directory and run the following command:

```
terraform init
```

If initialization is successful continue to the next step. If initialize failed, follow the instructions in the Terraform output.

B. Plan Terraform

From the same directory, run the plan command:

```
terraform plan
```

This command can be run multiple times. Run as many times as needed to fix errors. When this command runs error free continue to the next step.

C. Apply Terraform

From the same directory run the apply command:

```
terraform apply
```

Terraform will prompt you to verify deployment, type `Yes`.

Optional: Destroy Terraform

You can destroy the entire VPC by running the destroy command:

```
terraform destroy
```

The destroy command will only destroy what it has created. If you have made manual changes to some objects in AWS (i.e., security groups, subnets, etc), then the `destroy` will fail. To exit out of a failing/hanging destroy operation, type `Control + C`. You must then clean up the VPC manually to the state where it was when Terraform originally created it. You can then run the `destroy` command.

Step 4 - Connect to bastion

All command line connection is through the bastion host on TCP 22 (SSH protocol).

1. In AWS create an inbound rule in the bastion security group (**AWS** > **Security Groups** > **Bastion SG** > **Edit inbound rules**) and create a rule to allow SSH (TCP 22) connections from the IP address or subnet mask where you will be running Terminal commands.

   Optional: You may find it helpful to allow file copying between the EC2 instances in the Private and Public groups during deployment. Create inbound SSH rules:

   - Private: create inbound rule to allow SSH from Public
   - Public: create inbound rule to allow SSH from Private and from Public

2. Use the pem key that you created in Step 1.B to connect to the bastion host:

   On Mac terminal:

   Run the following commands from the directory where the pem key is stored:

   ```
   ssh-add —apple-use-keychain <keyName>.pem
   ```

   If you get a warning about private key being accessible by others, then run this command: `chmod 600 <keyName.pem>` and then run the `ssh-add` command again.

   Connect to the bastion host with this command: `ssh -A ec2-user@IPaddress`

   For example: `ssh -A ec2-user@3.15.12.112.`

   On Windows using PuTTY and Pageant:

   a. Create ppk from pem key: Use PuTTY Key Generator. Load the pem key that you created in Step 1.B. After the key imports, click **Save private key**. This creates a ppk file.

   b. In PuTTY - open configuration and make the following changes:

      - Sessions>Host Name: add IP address of bastion host.
      - Sessions>Port: 22
      - Connection>Data>Auto-login username: ec2-user
      - Connection>SSH>Auth>Allow agent forwarding
      - Connection>SSH>Auth> For private key, click Browse and select the .ppk file that you just created.

   c. Install Pageant and load the ppk into the application.

Step 5 -Install PostgreSQL

The Terraform template does not install PostgreSQL for use as the external repository. However, the associated security group and subnet is created. If you will be installing the external repository on an EC2 instance running PostgreSQL, then you must deploy

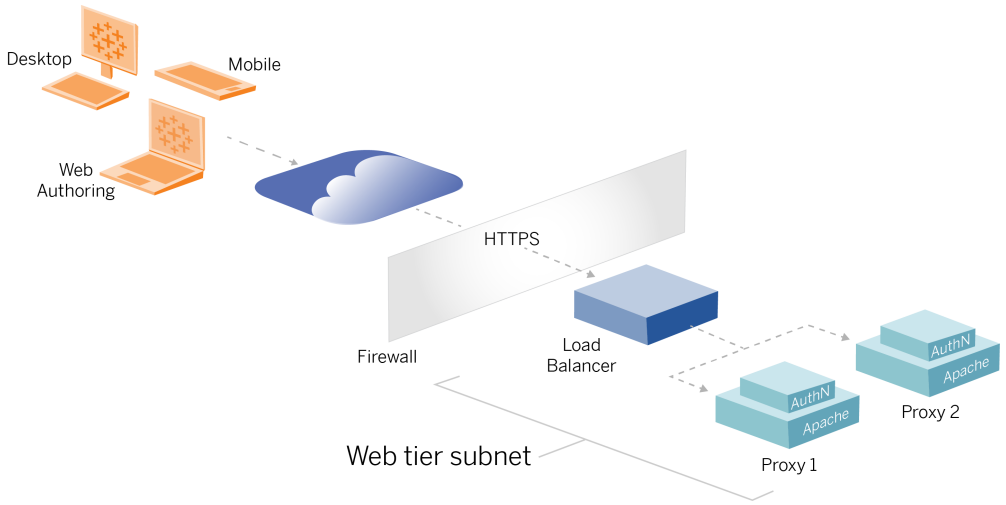
the EC2 instance as described in Part 3 - Preparing for Tableau Server Enterprise Deployment.

Then install, configure, and tar-backup PostgreSQL as described in Part 4 - Installing and Configuring Tableau Server.

Step 6 - (Optional) Run DeployTab4EDG

The TabDeploy4EDG script automates the implementation of the four-node Tableau deployment that is described in Part 4. See TabDeploy4EDG automated installation script.

Appendix - Web Tier with Apache Example Deployment



This topic provides an end-to-end procedure that describes how to implement web tier in the example AWS reference architecture. The example configuration is composed of the following components:

- AWS application load balancer
- Apache proxy servers
- Mellon authentication module
- Okta IdP
- SAML authentication

Note: The example web tier configuration presented in this section includes detailed procedures for deploying third party software and services. We've made a best effort to verify and document the procedures to enable the web tier scenario. However, the third-party software may change or your scenario may differ from the reference architecture described here. Please refer to third-party documentation for authoritative configuration details and support.

The Linux examples throughout this section show commands for RHEL-like distributions. Specifically the commands here have been developed with the Amazon Linux 2 distribution. If you are running the Ubuntu distribution, edit the commands accordingly.

Deploying the web tier in this example follows a stepwise configuration and verification procedure. The core web tier configuration consists of the following steps to enable HTTP between Tableau and the internet. Apache is run and configured for reverse proxy/load balancing behind the AWS application load balancer:

1. Install Apache
2. Configure reverse proxy to test connectivity to Tableau Server
3. Configure load balancing on proxy
4. Configure AWS application load balancer

After the web tier is set up and connectivity with Tableau is verified, configure authentication with an external provider.

Install Apache

Run the following procedure on both EC2 hosts (Proxy 1 and Proxy 2). If you are deploying in AWS according to the reference architecture example then you should have two availability zones and be running a single proxy server in each zone.

1. Install Apache:

   ```
   sudo yum update -y
   sudo yum install -y httpd
   ```

2. Configure to start Apache on reboot:

   ```
   sudo systemctl enable --now httpd
   ```

3. Verify that the version of httpd you have installed includes `proxy_hcheck_module`:

   ```
   sudo httpd -M
   ```

The `proxy_hcheck_module` is required. If your version of httpd does not include this module, then update to a version of httpd that does include it.

Configure proxy to test connectivity to Tableau Server

Run this procedure on one of the proxy hosts (Proxy 1). The purpose of this step is to verify connectivity between the internet to your proxy server to the Tableau Server in the private security group.

1. Create a file called `tableau.conf` and add it to the `/etc/httpd/conf.d` directory.

   Copy the following code and specify the `ProxyPass` and `ProxyPassReverse` keys with the private IP address of Tableau Server Node 1.

   > **Important**: The configuration shown below is not a secure and should not be used in production. This configuration should only be used during the installation process to verify end-to-end connectivity.

   For example, if the private IP address of Node 1 is `10.0.30.32`, then the contents of the `tableau.conf` file would be:

   ```
   <VirtualHost *:80>
   ProxyPreserveHost On
   ProxyPass "/" "http://10.0.30.32:80/"
   ProxyPassReverse "/" "http://10.0.30.32:80/"
   </VirtualHost>
   ```

2. Restart httpd:

   ```
   sudo systemctl restart httpd
   ```

Verification: Base topology configuration

You should be able to access the Tableau Server admin page by browsing to `http://<-proxy-public-IP-address>`.

If the Tableau Server sign-in page does not load in your browser then follow these troubleshooting steps on the Proxy 1 host:

- Stop and then start httpd as a first troubleshooting step.
- Double-check the `tableau.conf` file. Verify that the Node 1 private IP is correct. Verify double-quotes and carefully review syntax.
- Run the `curl` command on the reverse proxy server with Node 1 private IP address, for example, `curl 10.0.1.90`. If the shell does not return html, or if it returns html for the Apache test web page, then verify protocol/port configuration between the Public and Private security groups.
- Run the `curl` command with Proxy 1 private IP address, for example, `curl 10.0.0.163`. If the shell returns the html code for the Apache test web page, then the proxy file is not configured correctly.
- Always restart httpd (`sudo systemctl restart httpd`) after any configuration change to the proxy file or to the security groups.
- Make sure TSM is running on Node 1.

Configure load balancing on proxy

1. On the same proxy host (Proxy 1) where you created the `tableau.conf` file, remove the existing Virtual Host configuration and edit the file to include load-balancing logic.

   For example:

   ```
   <VirtualHost *:80>
   ServerAdmin admin@example.com
   #Load balancing logic.
   ProxyHCExpr ok234 {%{REQUEST_STATUS} =~ /^[234]/}
   Header add Set-Cookie "ROUTEID=.%{BALANCER_WORKER_ROUTE}e;
   path=/" env=BALANCER_ROUTE_CHANGED
   <Proxy balancer://tableau>
   ```

```
#Replace IP addresses below with the IP addresses to the
Tableau Servers running the Gateway service.
BalancerMember http://10.0.3.40/ route=1 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
BalancerMember http://10.0.4.151/ route=2 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
ProxySet stickysession=ROUTEID
</Proxy>
ProxyPreserveHost On
ProxyPass / balancer://tableau/
ProxyPassReverse / balancer://tableau/
</VirtualHost>
```

2. Stop and then start httpd:

   ```
   sudo systemctl stop httpd
   sudo systemctl start httpd
   ```

3. Verify the configuration by browsing to the public IP address of Proxy 1.

Copy configuration to second proxy server

1. Copy the `tableau.conf` file from Proxy 1 and save it to the `/etc/httpd/conf.d` directory on Proxy 2 host.

2. Stop and then start httpd:

   ```
   sudo systemctl stop httpd
   sudo systemctl start httpd
   ```

3. Verify the configuration by browsing to the public IP address of Proxy 2.

Configure AWS application load balancer

Configure the load balancer as an HTTP listener. The procedure here describes how to add a load balancer in AWS.

Step 1: Create target group

A target group is an AWS configuration that defines the EC2 instances running your proxy servers. These are the targets for traffic from the LBS.

1. EC2>**Target groups** > **Create target group**

2. On Create page:

   - Enter a target group name, for example `TG-internal-HTTP`
   - Target type: Instances
   - Protocol: HTTP
   - Port: 80
   - VPC: Select your VPC
   - Under **Health checks** > **Advanced health checks settings** > **Success codes**, append the code list to read: `200,303`.
   - Click **Create**

3. Select the target group that you just created, and then click the **Targets** tab:

   - Click **Edit**.
   - Select the EC2 instances (or single instance if you are configuring one at a time) that are running proxy application, and then click **Add to registered**.
   - Click **Save**.

Step 2: Launch load balancer wizard

1. EC2> **Load Balancers** > **Create Load Balancer**

2. On "Select load balancer type" page, create an Application Load Balancer.

Note: The UI that is displayed to configure load balancer is not consistent across AWS datacenters. The procedure below, "Wizard configuration," maps to the AWS configuration wizard that begins with **Step 1 Configure Load Balancer**.

If your datacenter displays all configurations in a single page that includes a **Create load**

balancer button at the bottom of the page, then follow the "Single page configuration" procedure below.

Wizard configuration

1. **Configure load balancer** page:
    - Specify name
    - Scheme: internet-facing (default)
    - IP address type: ipv4 (default)
    - Listeners (Listeners and routing):
        a. Leave the default HTTP listener
        b. Click **Add listener** and add `HTTPS:443`
    - VPC: select the VPC where you've installed everything
    - Availability Zones:
        - Select the **a** and **b** for your datacenter regions
        - In each corresponding drop-down selector, select the Public subnet (where your proxy servers reside).
    - Click: **Configure Security Settings**
2. **Configure Security Settings** page
    - Upload your public SSL certificate.
    - Click **Next: Configure Security Groups**.
3. **Configure Security Groups** page:
    - Select the Public security group. If the Default security group is selected, then clear that selection.
    - Click **Next: Configure Routing**.
4. **Configure Routing** page
    - Target group: Existing target group.
    - Name: Select target group that you created earlier
    - Click **Next: Register Targets**.
5. **Register Targets** page

- The two proxy server instances that you configured previously should be displayed.
- Click **Next: Review**.

6. **Review** page

   Click **Create**.

Single page configuration

Basic configuration

- Specify name
- Scheme: internet-facing (default)
- IP address type: ipv4 (default)

Network mapping

- VPC: select the VPC where you've installed everything
- Mappings:
  - Select the **a** and **b** (or comparable) Availability Zones for your datacenter regions
  - In each corresponding drop-down selector, select the Public subnet (where your proxy servers reside).

Security groups

Select the Public security group. If the Default security group is selected, then clear that selection.

Listeners and routing

- Leave the default HTTP listener. For **Default action**, specify the Target Group that you previously set up.
- Click **Add listener** and add `HTTPS:443`. For **Default action**, specify the Target Group that you previously set up.

Secure listener settings

- Upload your public SSL certificate.

Click **Create load balancer**.

Step 3: Enable stickiness

1. After the load balancer is created, you must enable stickiness on the Target Group.
    - Open AWS Target Group page (**EC2**> **Load Balancing**> **Target groups**), select the target group instance that you just set up. On the **Action** menu, select **Edit attributes**.
    - On the **Edit attributes** page, select **Stickiness**, specify a duration of `1 day`, and then **Save changes**.
2. On load balancer, enable stickiness on the HTTP listener. Select the load balancer you just configured, and then click the **Listeners** tab:
    - For **HTTP:80**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. Delete the existing THEN rule and replace it by clicking **Add action** > **Forward to...**. In the resulting THEN configuration, specify the same target group you have created. Under Group-level stickiness, enable stickiness and set duration to 1 day. Save the setting and then click **Update**.

Step 4: Set idle timeout on load balancer

On load balancer, update idle timeout to 400 seconds.

Select the load balancer you have configured for this deployment, and then click **Actions** > **Edit attributes**. Set **Idle timeout** to `400` seconds, and then click **Save**.

Step 5: Verify LBS connectivity

Open AWS Load Balancer page (**EC2**> **Load Balancers**), select the load balancer instance that you just set up.

Under **Description**, copy the DNS name and paste it into a browser to access the Tableau Server sign in page.

If you get a 500-level error, then you may need to restart your proxy servers.

Update DNS with public Tableau URL

Use your domain DNS zone name from the AWS Load Balancer description to create a CNAME value in your DNS. Traffic to your URL (tableau.example.com) should be sent to the AWS public DNS name.

Verify connectivity

After your DNS updates are finished, you should be able to navigate to the Tableau Server sign-in page by entering your public URL, for example, `https://tableau.example.com`.

Example authentication configuration: SAML with external IdP

The following example describes how to setup and configure SAML with Okta IdP and Mellon authentication module for a Tableau deployment running in the AWS reference architecture. The example describes how to configure Tableau Server and the Apache proxy servers to use HTTP. Okta will send request to the AWS load balancer over HTTPS, but all internal traffic will travel over HTTP. As you configure for this scenario, be aware of the HTTP vs HTTPS protocols when setting URL strings.

This example uses Mellon as a pre-authentication service provider module on the reverse proxy servers. This configuration ensures that only authenticated traffic connects to Tableau Server, which also acts as a service provider with the Okta IdP. Therefore, you must configure two IdP applications: one for the Mellon service provider and one for the Tableau service provider.

Create Tableau administrator account

A common mistake when configuring SAML is to forget to create an administrator account on Tableau Server before enabling SSO.

The first step is to create an account on Tableau Server with a Server Administrator role. For the example Okta scenario, the username must be in a valid email address format, for example, user@example.com. You must set a password for this user, but the password will not be used after SAML is configured.

Configure Okta pre-auth application

The end-to-end scenario described in this section requires two Okta applications:

- Okta pre-auth application
- Okta Tableau Server application

Each of these applications are associated with different metadata that you will need to configure on the reverse proxy and Tableau Server, respectively.

This procedure describes how to create and configure the Okta pre-auth application. Later in this topic you will create the Okta Tableau Server application. For a free test Okta account with limited users, see the Okta Developer web page.

Create a SAML app integration for the Mellon pre-authentication service provider.

1. Open the Okta administration dashboard > **Applications** > **Create App Integration**.
2. On **Create a new app integration** page, select **SAML 2.0** and then click **Next**.
3. On the **General Settings** tab, enter an App name, for example `Tableau Pre-Auth`, and then click **Next**.
4. On the **Configure SAML** tab:
    - Single sign on (SSO) URL. The final element of the path in the single sign on URL is referred to as the `MellonEndpointPath` in the `mellon.conf` configuration file that follows later in this procedure. You can specify whatever endpoint you would like. In this example, `sso` is the endpoint. The last element, `postResponse`, is required: `https://tableau.example.com/sso/postResponse`.
    - Clear the checkbox: **Use this for Recipient URL and Destination URL**.

- Recipient URL: Same as SSO URL, but with HTTP. For example, `http://tableau.example.com/sso/postResponse`.
- Destination URL: same as SSO URL, but with HTTP. For example, `http://tableau.example.com/sso/postResponse`.
- Audience URI (SP Entity ID). For example, `https://tableau.example.com`.
- Name ID format: `EmailAddress`
- Application username: `Email`
- Attributes Statements: Name = `mail`; Name format = `Unspecified`; Value = `user.email`.

Click **Next**.

5. On the **Feedback** tab, select:
   - **I'm an Okta customer adding an internal app**
   - **This is an internal app that we have created**
   - Click **Finish**.
6. Create the pre-auth IdP metadata file:
   - In Okta: **Applications** > **Applications** > Your new application (e.g., `Tableau Pre-Auth`) > **Sign On**
   - Adjacent to **SAML Signing Certificates**, click **View SAML setup instructions**.
   - On the **How to Configure SAML 2.0 for <pre-auth> Application**, page, scroll down to **Optional** section, **Provide the following IDP metadata to your SP provider**.
   - Copy the contents of the XML field and save them in a file called `pre-auth_idp_metadata.xml`.
7. (Optional) Configure multifactor authentication:
   - In Okta: **Applications** > **Applications** > Your new application (e.g., `Tableau Pre-Auth`) > **Sign On**
   - Under **Sign On Policy**, click **Add Rule**.
   - On the **App Sign On Rule**, specify a name and the different MFA options. To test functionality, you can leave all options as default. However, under **Actions**, you must select, **Prompt for factor**, and then specify how often users must sign in. Click **Save**.

Create and assign Okta user

1. In Okta, create a user with the same username that you created in Tableau (user@example.com): **Directory** > **People** > **Add person**.
2. After the user is created, assign the new Okta app to that person: Click the user name then assign the application in **Assign Application**.

Install Mellon for pre-auth

1. On the EC2 instances that are running the Apache proxy server, run the following commands to install PHP and Mellon modules:

   ```
   sudo yum install httpd php mod_auth_mellon
   ```

2. Create the `/etc/httpd/mellon` directory

Configure Mellon as pre-auth module

Run this procedure on both proxy servers.

You must have a copy of `pre-auth_idp_metadata.xml` file that you created from the Okta configuration.

1. Change directory:

   ```
   cd /etc/httpd/mellon
   ```

2. Create the service provider metadata. Run the `mellon_create_metadata.sh` script. You must include the entity ID and the return URL for your organization in the command.

   The return URL is referred to as the *single sign on URL* in Okta. The final element of the path in the return URL is referred to as the `MellonEndpointPath` in the `mellon.conf` configuration file that follows later in this procedure. In this example, we specify `sso` as the endpoint path.

For example:

```
sudo /usr/libexec/mod_auth_mellon/mellon_create_metadata.sh
https://tableau.example.com "https://tableau.example.com/sso"
```

The script returns the service provider certificate, key, and metadata files.

3. Rename the service provider files in the `mellon` directory for easier readability. We will refer to these files by the following names in the documentation:

```
sudo mv *.key mellon.key
sudo mv *.cert mellon.cert
sudo mv *.xml sp_metadata.xml
```

4. Copy the `pre-auth_idp_metadata.xml` file to the same directory.

5. Create the `mellon.conf` file in the `/etc/httpd/conf.d` directory:

```
sudo nano /etc/httpd/conf.d/mellon.conf
```

6. Copy the following contents into `mellon.conf`.

```
<Location />
MellonSPPrivateKeyFile /etc/httpd/mellon/mellon.key
MellonSPCertFile /etc/httpd/mellon/mellon.cert
MellonSPMetadataFile /etc/httpd/mellon/sp_metadata.xml
MellonIdPMetadataFile /etc/httpd/mellon/pre-auth_idp_
metadata.xml
MellonEndpointPath /sso
MellonEnable "info"
</Location>
```

7. Add the following contents into the existing `tableau.conf` file:

   Inside the `<VirtualHost *:80>` block, add the following content. Update `Server-Name` with the public host name in your Entity ID:

```
DocumentRoot /var/www/html
ServerName tableau.example.com
ServerSignature Off
ErrorLog logs/error_sp.log
CustomLog logs/access_sp.log combined
LogLevel info
```

Add the Location block outside of the `<VirtualHost *:80>` block. Update `MellonCookieDomain` with the top-level domain to preserve cookie information as shown:

```
<Location />
AuthType Mellon
MellonEnable auth
Require valid-user
MellonCookieDomain example.com
</Location>
```

The complete `tableau.conf` file should look like the following example:

```
<VirtualHost *:80>
ServerAdmin admin@example.com
ProxyHCExpr ok234 {%{REQUEST_STATUS} =~ /^[234]/}
Header add Set-Cookie "ROUTEID=.%{BALANCER_WORKER_ROUTE}e;
path=/" env=BALANCER_ROUTE_CHANGED
<Proxy balancer://tableau>
BalancerMember http://10.0.3.36/ route=1 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
BalancerMember http://10.0.4.15/ route=2 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
ProxySet stickysession=ROUTEID
</Proxy>
ProxyPreserveHost On
ProxyPass / balancer://tableau/
ProxyPassReverse / balancer://tableau/
DocumentRoot /var/www/html
```

```
ServerName tableau.example.com
ServerSignature Off
ErrorLog logs/error_sp.log
CustomLog logs/access_sp.log combined
LogLevel info
</VirtualHost>
<Location />
AuthType Mellon
MellonEnable auth
Require valid-user
MellonCookieDomain example.com
</Location>
```

8. Verify the configuration. Run the following command:

   ```
   sudo apachectl configtest
   ```

   If the configuration test returns an error, fix any errors and run configtest again. A successful configuration will return, `Syntax OK`.

9. Restart httpd:

   ```
   sudo systemctl restart httpd
   ```

Create Tableau Server application in Okta

1. In Okta dashboard: **Applications** > **Applications** > **Browse App Catalog**
2. In **Browse App Integration Catalog**, search `Tableau`, select the Tableau Server tile, and then click **Add**.
3. On **Add Tableau Server** > **General Settings**, enter a Label, and then click **Next**.
4. In Sign-On Options, select **SAML 2.0**, and then scroll down to Advanced Sign-on Settings:
   - **SAML Entity ID**: enter the public URL, for example, https://tableau.example.com.
   - **Application user name format**: Email

5. Click the **Identity Provider metadata** link, to launch a browser. Copy the browser link. This is the link you will use when you configure Tableau in the procedure that follows.
6. Click **Done**.
7. Assign the new Tableau Server Okta app to your user (user@example.com): Click the user name then assign the application in **Assign Application**.

Enable SAML on Tableau Server for IdP

Run this procedure on Tableau Server Node 1.

1. Download the Tableau Server application metadata from Okta. Use the link that you saved from the previous procedure:

   ```
   wget https://dev-66144217.okta.-
   com/app/exk1egxgt1fhjkSeS5d7/sso/saml/metadata -O idp_
   metadata.xml
   ```

2. Copy a TLS certificate and related key file to the Tableau Server. The key file must be an RSA key. For more information about SAML certificate and IdP requirements, see *SAML Requirements* (Linux).

   To simplify certificate management and deployment, and as a security best practice, we recommend using certificates generated by a major trusted-third party certificate authority (CA). Alternatively, you may generate self-signed certificates or use certificates from a PKI for TLS.

   If you do not have a TLS certificate, you can generate a self-signed certificate using the embedded procedure below.

Generate a self-signed certificate

Run this procedure onTableau Server Node 1.

a. Generate signing root certificate authority (CA) key:

```
openssl genrsa -out rootCAKey-saml.pem 2048
```

b. Create the root CA certificate:

```
openssl req -x509 -sha256 -new -nodes -key rootCAKey-sam-
l.pem -days 3650 -out rootCACert-saml.pem
```

You will be prompted to enter values for the certificate fields. For example:

```
Country Name (2 letter code) [XX]:US
State or Province Name (full name) []:Washington
Locality Name (eg, city) [Default City]:Seattle
Organization Name (eg, company) [Default Company Ltd]:T-
ableau
Organizational Unit Name (eg, section) []:Operations
Common Name (eg, your name or your server's hostname) []:t-
ableau.example.com
Email Address []:example@tableau.com
```

c. Create the certificate and related key (`server-saml.csr`and `server-sam-l.key` in the example below). The subject name for the certificate must match the public host name of the Tableau host. The subject name is set with the `-subj` option with the format `"/CN=<host-name>"`, for example:

```
openssl req -new -nodes -text -out server-saml.csr -keyout
server-saml.key -subj "/CN=tableau.example.com"
```

d. Sign the new certificate with the CA certificate that you created above. The following command also outputs the certificate in the `crt` format:

```
openssl x509 -req -in server-saml.csr -days 3650 -CA
rootCACert-saml.pem -CAkey rootCAKey-saml.pem -CAcre-
ateserial -out server-saml.crt
```

e. Convert the key file to RSA. Tableau requires an RSA key file for SAML. To convert the key, run the following command:

```
openssl rsa -in server-saml.key -out server-saml-rsa.key
```

3. Configure SAML. Run the following command, specifying your entity ID and return URL, and the paths to the metadata file, certificate file, and key file:

```
tsm authentication saml configure --idp-entity-id "https://t-
ableau.example.com" --idp-return-url "https://t-
ableau.example.com" --idp-metadata idp_metadata.xml --cert-file
"server-saml.crt" --key-file "server-saml-rsa.key"

tsm authentication saml enable
```

4. If your organization is running Tableau Desktop 2021.4 or later, then you must run the following command to enable authentication through the reverse proxy servers.

   Versions of Tableau Desktop 2021.2.1 - 2021.3 will work without running this command, provided that your pre-authentication module (e.g., Mellon) is configured to allow top-level domain cookie preservation.

```
tsm configuration set -k features.ExternalBrowserOAuth -v false
```

5. Apply configuration changes:

```
tsm pending-changes apply
```

Validate SAML functionality

To validate end-to-end SAML functionality, sign-in to Tableau Server with the public URL (e.g., https://tableau.example.com) with the Tableau admin account that you created at the beginning of this procedure.

Validation troubleshooting

Bad Request: A common error for this scenario is a "Bad Request" error from Okta. Often this issue occurs when the browser is caching data from previous Okta session. For example, if you manage the Okta applications as an Okta administrator and then attempt to access Tableau using a different Okta-enabled account, session data from the administrator data may cause the "Bad Request" error. If this error persists even after you clear the local browser cache, try validating the Tableau scenario by connecting with a different browser.

Another cause of the "Bad Request" error is a typo in one of the many URLs that you enter during the Okta, Mellon, and SAML configuration processes. Check all of these carefully.

Often the httpd `error.log` file on the Apache server will specify which URL is causing the error.

Not Found - The requested URL was not found on this server: This error indicates one of many configuration errors.

If the user is authenticated with Okta, and then receives this error, then it's likely that you have uploaded the Okta pre-auth application to Tableau Server when you configured SAML. Verify that you have the Okta Tableau Server application metadata configured on Tableau Server, and not the Okta pre-auth application metadata

Other troubleshooting steps:

- Review `tableau.conf` carefully for typos or configuration errors
- Review the Okta pre-auth application settings. Be sure HTTP vs HTTPS protocols are set as specified in this topic.
- Restart httpd on both proxy servers.
- Verify that `sudo apachectl configtest` returns “Syntax OK” on both proxy servers.
- Verify that the test user is assigned to both applications in Okta.
- Verify that stickiess is set on the load balancer and associated target groups

Configure SSL/TLS from load balancer to Tableau Server

Some organizations require end-to-end encryption channel from the client to the back end service. The default reference architecture as described to this point specifies SSL from the client to the load balancer running in the web tier of your organization.

To configure SSL from the load balancer to Tableau Server, you must:

- Install a valid SSL certificate on both the Tableau and proxy servers.
- Configure SSL from the load balancer to the reverse proxy servers.
- Configure SSL from the proxy servers to Tableau Server.
- You may also configure SSL from Tableau Server to the PostgreSQL instance.

The remainder of this topic describes this implementation in the context of the example AWS example reference architecture.

Example: Configure SSL/TLS in AWS reference architecture

This section describes how to configure SSL on Tableau and configure SSL on an Apache proxy server, all running in the example AWS reference architecture.

The Linux procedures throughout this example show commands for RHEL-like distributions. Specifically the commands here have been developed with the Amazon Linux 2 distribution. If you are running the Ubuntu distribution, edit the commands accordingly.

Step 1: Gather certificates and related keys

To simplify certificate management and deployment, and as a security best practice, we recommend using certificates generated by a major trusted-third party certificate authority (CA).

Alternatively, you may generate self-signed certificates or use certificates from a PKI for TLS.

The following procedure how to generate self-signed certificates. If you are using 3rd party certificates as we recommend, then you can skip this procedure.

Run this procedure on one of the proxy hosts. After you generate the certificate and associated key, you will share it to the other proxy host and to Tableau Server Node 1.

1. Generate signing root certificate authority (CA) key:

   ```
   openssl genrsa -out rootCAKey.pem 2048
   ```

2. Create the root CA certificate:

   ```
   openssl req -x509 -sha256 -new -nodes -key rootCAKey.pem -days
   3650 -out rootCACert.pem
   ```

   You will be prompted to enter values for the certificate fields. For example:

   ```
   Country Name (2 letter code) [XX]:US
   State or Province Name (full name) []:Washington
   Locality Name (eg, city) [Default City]:Seattle
   Organization Name (eg, company) [Default Company Ltd]:Tableau
   Organizational Unit Name (eg, section) []:Operations
   Common Name (eg, your name or your server's hostname) []:t-
   ableau.example.com
   Email Address []:example@tableau.com
   ```

3. Create the certificate and related key (`serverssl.csr`and `serverssl.key` in the example below). The subject name for the certificate must match the public host name of the Tableau host. The subject name is set with the `-subj` option with the format `"/CN=<host-name>"`, for example:

   ```
   openssl req -new -nodes -text -out serverssl.csr -keyout
   serverssl.key -subj "/CN=tableau.example.com"
   ```

4. Sign the new certificate with the CA certificate that you created in step 2. The following command also outputs the certificate in the `crt` format:

```
openssl x509 -req -in serverssl.csr -days 3650 -CA rootCACer-
t.pem -CAkey rootCAKey.pem -CAcreateserial -out serverssl.crt
```

Step 2: Configure proxy server for SSL

Run this procedure on both proxy servers.

1. Install the Apache ssl module:

```
sudo yum install mod_ssl
```

2. Create the `/etc/ssl/private` directory:

```
sudo mkdir -p /etc/ssl/private
```

3. Copy the crt and key files to the following `/etc/ssl/` paths:

```
sudo cp serverssl.crt /etc/ssl/certs/

sudo cp serverssl.key /etc/ssl/private/
```

4. Update the existing `tableau.conf` with the following updates:

   - Add the SSL rewrite block:

     ```
     RewriteEngine on
     RewriteCond %{SERVER_NAME} =tableau.example.com
     RewriteRule ^ https://%{SERVER_NAME}%{REQUEST_URI}
     [END,NE,R=permanent]
     ```

   - In the SSL rewrite block, update the `RewriteCond` server name: add your public host name, for example, `tableau.example.com`
   - Change `<VirtualHost *:80>` to `<VirtualHost *:443>`.
   - Wrap the `<VirtualHost *:443>` and the `<Location />` blocks with `<IfModule mod_ssl.c>` ... `</IfModule>`.

- `BalancerMember`: change the protocol from `http` to `https`.
- Add `SSL*` elements inside the `<VirtualHost *:443>` block:

```
SSLEngine on
SSLCertificateFile /etc/ssl/certs/serverssl.crt
SSLCertificateKeyFile /etc/ssl/private/serverssl.key
SSLProxyEngine on
SSLProxyVerify none
SSLProxyCheckPeerName off
SSLProxyCheckPeerExpire off
```

- In the `LogLevel` element: add `ssl:warn`.
- Optional: If you have installed and configured an authentication module, then you may have additional elements in the tableau.conf file. For example, the `<Location /> </Location>` block will include elements.

An example tableau.conf file configured for SSL is shown here:

```
RewriteEngine on
RewriteCond %{SERVER_NAME} =tableau.example.com
RewriteRule ^ https://%{SERVER_NAME}%{REQUEST_URI} [END,NE,R-
R=permanent]

<IfModule mod_ssl.c>
<VirtualHost *:443>
ServerAdmin admin@example.com
ProxyHCExpr ok234 {%{REQUEST_STATUS} =~ /^[234]/}
Header add Set-Cookie "ROUTEID=.%{BALANCER_WORKER_ROUTE}e;
path=/" env=BALANCER_ROUTE_CHANGED
<Proxy balancer://tableau>
BalancerMember https://10.0.3.36/ route=1 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
BalancerMember https://10.0.4.15/ route=2 hcmethod=GET hcex-
pr=ok234 hcuri=/favicon.ico
ProxySet stickysession=ROUTEID
</Proxy>
ProxyPreserveHost On
```

```
ProxyPass / balancer://tableau/
ProxyPassReverse / balancer://tableau/
DocumentRoot /var/www/html
ServerName tableau.example.com
ServerSignature Off
ErrorLog logs/error_sp.log
CustomLog logs/access_sp.log combined
LogLevel info ssl:warn
SSLEngine on
SSLCertificateFile /etc/ssl/certs/serverssl.crt
SSLCertificateKeyFile /etc/ssl/private/serverssl.key
SSLProxyEngine on
SSLProxyVerify none
SSLProxyCheckPeerName off
SSLProxyCheckPeerExpire off
</VirtualHost>
<Location />
#If you have configured a pre-auth module (e.g. Mellon) include
those elements here.
</Location>
</IfModule>
```

5. Add index.html file to supress 403 errors:

   ```
   sudo touch /var/www/html/index.html
   ```

6. Restart httpd:

   ```
   sudo systemctl restart httpd
   ```

Step 3: Configure Tableau Server for external SSL

Copy the serverssl.crt and serverssl.key files from the Proxy 1 host to the initial Tableau Server (Node 1).

Run the following commands on Node 1:

```
tsm security external-ssl enable --cert-file serverssl.crt --key-
file serverssl.key
tsm pending-changes apply
```

Step 4: Optional authentication configuration

If you have configured an external identity provider for Tableau, then you will likely need to update return URLs in the IdP administrative dashboard.

For example, if you are using a Okta pre-auth application, you will need to update the application to use HTTPS protocol for the Recipient URL and the Destination URL.

Step 5: Configure AWS load balancer for HTTPS

If you are deploying with AWS load balancer as documented in this guide, then you reconfigure the AWS load balancer to send HTTPS traffic to the proxy servers:

1. Deregister existing HTTP target group:

   In **Target Groups**, select the HTTP target group that has been configured for the load balancer, click **Actions**, and then click **Register and deregister instance**.

   On the **Register and deregister targets** page, select the instances that are currently configured, click **Deregister**, and then click **Save**.

2. Create HTTPS target group:

   Target groups > **Create target group**

   - Select "Instances"
   - Enter a target group name, for example `TG-internal-HTTPS`
   - Select your VPC
   - Protocol: HTTPS 443
   - Under **Health checks** > **Advanced health checks settings** > **Success codes**, append the code list to read: `200,303`.
   - Click **Create**.

3. Select the target group that you just created, and then click the **Targets** tab:

- Click **Edit**
- Select the EC2 instances that are running proxy application, and then click **Add to registered**.
- Click **Save**.

4. After the target group is created, you must enable stickiness:

   - Open AWS Target Group page (**EC2**> **Load Balancing**> **Target groups**), select the target group instance that you just set up. On the **Action** menu, select **Edit attributes**.
   - On the **Edit attributes** page, select **Stickiness**, specify a duration of `1 day`, and then **Save changes**.

5. On load balancer, update listener rules. Select the load balancer you have configured for this deployment, and then click the **Listeners** tab.

   - For **HTTP:80**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. Delete the existing THEN rule and replace it by clicking **Add action** > **Redirect to...**. In the resulting THEN configuration, specify `HTTPS` and port `443` and leave the other options to default settings. Save the setting and then click **Update**.
   - For **HTTP:443**, click **View/edit rules**. On the resulting **Rules** page, click the edit icon (once at the top of the page, and then again by the rule) to edit the rule. In the **THEN** configuration, under **Forward to...** change theTarget group to the HTTPS group that you just created. Under **Group-level stickiness**, enable stickiness and set duration to 1 day. Save the setting and then click **Update**.

Step 6: Verify SSL

Verify the configuration by browsing to https://tableau.example.com.