



IE3020

Directory Services and Network Management

3nd Year, 2nd Semester

Individual Assignment

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Declaration

I certify that this report does not incorporate without acknowledgement, any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief, it does not contain any material previously published or written by another person, except where due reference is made in text.

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1. Introduction

Establishing a Linux-based Domain Controller with Samba to supply Active Directory (AD) services is the primary goal of this assignment, which aims to provide hands-on experience in network administration. Additionally, it entails setting up a client computer to join the domain and authenticate with AD credentials, mimicking an actual business setting. In order to keep an eye on the functionality and condition of the domain controller and client computers, the assignment also calls for the deployment of Zabbix, a potent open-source network monitoring tool. With the help of this configuration, students may comprehend important network administration ideas such as DNS resolution, user authentication, service monitoring, and system health reporting in a controlled network environment.

1.1.Importance of Active Directory and Network Monitoring

By giving administrators the ability to oversee user accounts, implement security regulations, and regulate resource access throughout an organization, Active Directory (AD) is essential to centralized network management. It makes authorization and authentication easier by keeping a safe and organized database of machines, users, and other resources. Directory-based services, group policies, and single sign-on (SSO) are further elements that AD enables that are necessary for effective and safe enterprise IT settings.

In contrast, network monitoring is essential for preserving a network's security, functionality, and health. Server load, network traffic, service availability, and possible problems may all be seen in real time with tools like Zabbix. Administrators may identify problems early, minimize downtime, enhance performance, and guarantee that vital services like Active Directory are operating correctly by regularly tracking these metrics. AD and network monitoring work together to support cybersecurity and operational efficiency as the foundation of contemporary IT infrastructure.

1.2.Tools Used

- ❖ Samba: Allows the Linux server to function as a domain controller compatible with Active Directory.
- ❖ Kerberos: Offers domain users and services safe authentication.
- ❖ DNS: Helps find domain controllers and resolves domain names.
- ❖ DHCP (Optional): Gives client computers IP addresses and DNS configurations.
- ❖ Zabbix: Keeps an eye on client and server performance and health.
- ❖ sssd: Manages user identity and authentication for Linux clients.
- ❖ realmd: Makes it easier to add Linux clients to the domain.

2. System Overview

- **Linux Distribution:** Ubuntu Server 22.04 LTS
- **Virtualization Tool:** Oracle VirtualBox
- **Virtual Machines:**
 - 1 Server (Domain Controller + Zabbix)
 - 1 Client (Linux(Fedora))
- **Network Topology:** Host-only Adapter (for internal VM communication)
- **IP Addressing Scheme:**
 - Server: 192.168.1.1
 - Client: 192.168.56.20
- **Domain Name:** smith.jo

3. Part 1 – Domain Controller Setup

3.1 Install Required Packages

```
sudo apt update  
sudo apt install samba krb5-config krb5-user winbind dnsutils
```

```
Setting up apport (2.28.1-0ubuntu0.5) ...  
apport-autoreport.service is a disabled or a static unit not running, not starting it.  
Setting up liblvm2cmd2.03-amd64 (2.03.16-3ubuntu0.2) ...  
Setting up dmeventnd (2:1.02.185-3ubuntu0.2) ...  
dm-event.service is a disabled or a static unit not running, not starting it.  
Setting up lvm2 (2.03.16-3ubuntu0.2) ...  
Processing triggers for dbus (1.14.10-4ubuntu0.1) ...  
Processing triggers for libblkid0 (2.32.0-0ubuntu0.4) ...  
Processing triggers for man-db (2.12.0-1ubuntu0.2) ...  
Processing triggers for initramfs-tools (0.142ubuntu25.5) ...  
update-initramfs: Generating /boot/initrd.img-6.8.0-59-generic  
Scanning processes...  
Scanning candidates...  
Scanning linux images...  
Running kernel seems to be up-to-date.  
Restarting services...  
systemctl restart multipathd.service polkit.service udisks2.service  
Service restarts being deferred:  
systemctl restart ModemManager.service  
/etc/systemd/system/getty@.service  
systemctl restart systemd-logind.service  
systemctl restart unattended-upgrades.service  
No containers need to be restarted.  
User sessions running outdated binaries:  
user @ session #1: apt[1469], login[1074]  
user @ user manager service: systemd[1169]  
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
user@dmmsuser:~$ sudo apt update && sudo apt upgrade -y  
Hit:1 http://security.ubuntu.com/ubuntu noble-security InRelease  
Hit:2 http://ppa.launchpad.net/ubuntu/noble InRelease  
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease  
Hit:4 http://lk.archive.ubuntu.com/ubuntu noble-backports InRelease  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
1 package can be upgraded. Run 'apt list --upgradable' to see it.  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Calculating upgrade... Done  
The following upgrades have been deferred due to phasing:  
| ubuntu-drivers-common  
0 upgraded, 0 newly installed, 0 to remove and 1 not upgraded.  
user@dmmsuser:~$ _
```

Figure 1: update samba tools

```

GNU nano 7.2
nameserver 127.0.0.1
search smith.jo
etc/resolv.conf *

```

Figure 2: create resolv.conf file

3.2 Provision Domain Controller

```
sudo samba-tool domain provision --use-rfc2307 --interactive
```

```

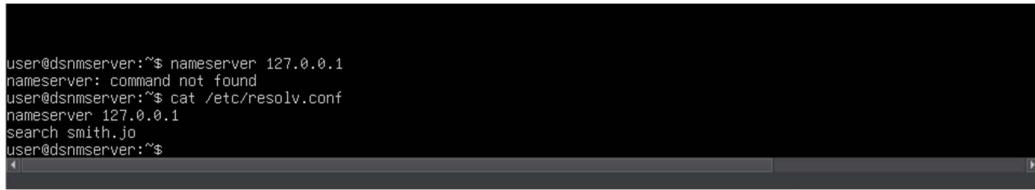
user@Ubuntu:~$ sudo samba-tool domain provision --use-rfc2307 --interactive
Realm: SMITH.JO
Domain [SMITH]: SMITH
Server Role (dc, member, standalone) [dc]: dc
DNS backend (SAMBA_INTERNAL, BIND9_FLATFILE, BIND9_DLZ, NONE) [SAMBA_INTERNAL]: SAMBA_INTERNAL
DNS forwarder IP address (write 'none' to disable forwarding) [127.0.0.53]: 8.8.8.8
Administrator password:
Retype password:
INFO 2025-05-06 06:53:42.362 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2128: Looking up IPv4
INFO 2025-05-06 06:53:42.362 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2145: Looking up IPv6
INFO 2025-05-06 06:53:42.531 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2318: Setting up share
INFO 2025-05-06 06:53:42.549 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2322: Setting up security
INFO 2025-05-06 06:53:42.568 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2327: Setting up the
INFO 2025-05-06 06:53:42.624 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2330: Setting up the
INFO 2025-05-06 06:53:42.652 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2333: Setting up idmap
INFO 2025-05-06 06:53:42.669 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #2340: Setting up SAM
INFO 2025-05-06 06:53:42.676 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #886: Setting up sam.l
INFO 2025-05-06 06:53:42.676 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #898: Setting up sam.l
INFO 2025-05-06 06:53:42.682 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1320: Pre-loading the
Unable to determine the DomainSID, can not enforce uniqueness constraint on local domainSIDs

INFO 2025-05-06 06:53:42.707 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1399: Adding DomainDN
INFO 2025-05-06 06:53:42.721 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1431: Adding configuration
INFO 2025-05-06 06:53:42.731 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1446: Setting up sam
INFO 2025-05-06 06:53:44.450 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1466: Setting up sam
INFO 2025-05-06 06:53:44.544 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1508: Setting up distribution
INFO 2025-05-06 06:53:45.693 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1516: Modifying distribution
INFO 2025-05-06 06:53:45.719 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1523: Adding users
INFO 2025-05-06 06:53:45.725 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1529: Modifying users
INFO 2025-05-06 06:53:45.744 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1532: Adding computer
INFO 2025-05-06 06:53:45.750 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1538: Modifying computer
INFO 2025-05-06 06:53:45.752 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1542: Setting up sam
INFO 2025-05-06 06:53:45.841 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1573: Setting up well-known
INFO 2025-05-06 06:53:45.889 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1587: Setting up sam
INFO 2025-05-06 06:53:45.999 pid:18230 /usr/lib/python3/dist-packages/samba/provision/_init_.py #1595: Setting up self
Repacking database from v1 to v2 format (first record CN=ms-DS-Required-Forest-Behavior-Version,CN=Schema,CN=Configuration)
Repack: re-packed 10000 records so far
Repacking database from v1 to v2 format (first record CN=rpcContainer-Display,CN=41D,CN=DisplaySpecifiers,CN=Configuration)
Repacking database from v1 to v2 format (first record CN=d262aae8-41f7-48ed-9f35-56bbb677573d,CN=Operations,CN=DomainUpd
^C

```

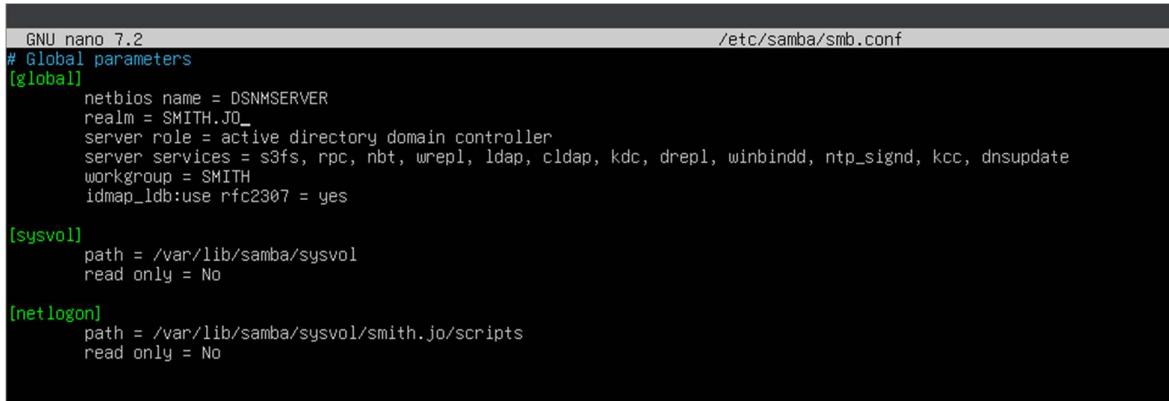
Figure 3: provision domain controller

3.3 Configuration Files



```
user@dsnmserver:~$ nameserver 127.0.0.1
nameserver: command not found
user@dsnmserver:~$ cat /etc/resolv.conf
nameserver 127.0.0.1
search smith.jo
user@dsnmserver:~$
```

Figure 4: /etc/resolv.conf



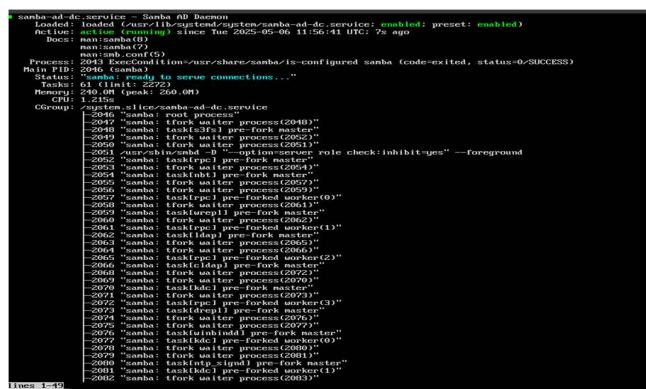
```
GNU nano 7.2
# Global parameters
[global]
    netbios name = DSNMSERVER
    realm = SMITH.JO_
    server role = active directory domain controller
    server services = s3fs, rpc, nbt, wrepl, ldap, cldap, kdc, drepl, winbindd, ntp_signnd, kcc, dnsupdate
    workgroup = SMITH
    idmap_ldb:use rfc2307 = yes

[sysvol]
    path = /var/lib/samba/sysvol
    read only = No

[netlogon]
    path = /var/lib/samba/sysvol/smith.jo/scripts
    read only = No
```

Figure 5: /etc/samba/smb.conf

3.4 Start and Enable Samba

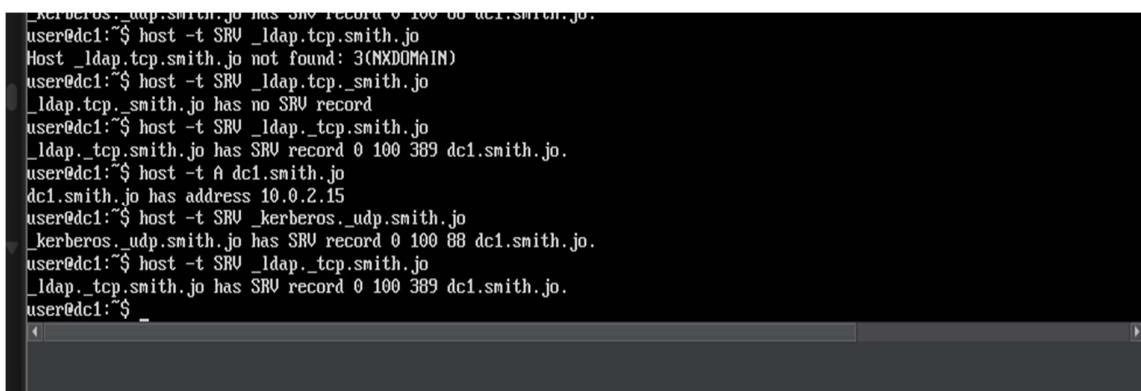


```
* samba-ad-dc.service - Samba AD Backend
   Loaded: loaded (/usr/lib/systemd/system/samba-ad-dc.service; enabled; preset: enabled)
   Active: active (running) since Tue 2025-05-06 11:56:41 UTC; 7s ago
     Docs: man:samba(8)
           man:samba(5)
           man:smb.conf(5)
   Process: 2046 ExecStart=/usr/share/samba/is-configured samba (code=exited, status=0/SUCCESS)
   Main PID: 2046 (samba)
      Tasks: 61 (limit: 4094)
        Memory: 240.0M (Peak: 260.0M)
         CPU: 0.000 CPU(s) used
        CGroup: /system.slice/samba-ad-dc.service
                  ├─2047 "samba" tfork writer process(2046)
                  ├─2048 "samba" tfork writer process(2047)
                  ├─2049 "samba" tfork writer process(2052)
                  ├─2050 "samba" taskidle1 pre-fork master
                  ├─2051 "samba" taskidle1 pre-fork master
                  ├─2052 "samba" taskidle1 pre-fork master
                  ├─2053 "samba" tfork writer process(2053)
                  ├─2054 "samba" taskidle1 pre-fork master
                  ├─2055 "samba" tfork writer process(2055)
                  ├─2056 "samba" taskidle1 pre-fork master
                  ├─2057 "samba" tfork writer process(2057)
                  ├─2058 "samba" tfork writer process(2061)
                  ├─2059 "samba" taskidle1 pre-fork master
                  ├─2060 "samba" tfork writer process(2062)
                  ├─2061 "samba" taskidle1 pre-fork master
                  ├─2062 "samba" taskidle1 pre-fork master
                  ├─2063 "samba" taskidle1 pre-fork master
                  ├─2064 "samba" tfork writer process(2066)
                  ├─2065 "samba" taskidle1 pre-fork master
                  ├─2066 "samba" taskidle1 pre-fork master
                  ├─2067 "samba" taskidle1 pre-fork master
                  ├─2068 "samba" taskidle1 pre-fork master
                  ├─2069 "samba" taskidle1 pre-fork master
                  ├─2070 "samba" taskidle1 pre-fork master
                  ├─2071 "samba" taskidle1 pre-fork master
                  ├─2072 "samba" taskidle1 pre-fork master
                  ├─2073 "samba" taskidle1 pre-fork master
                  ├─2074 "samba" tfork writer process(2076)
                  ├─2075 "samba" taskidle1 pre-fork master
                  ├─2076 "samba" taskidle1 pre-fork master
                  ├─2077 "samba" taskidle1 pre-fork master
                  ├─2078 "samba" taskidle1 pre-fork master
                  ├─2079 "samba" taskidle1 pre-fork master
                  ├─2080 "samba" taskidle1 pre-fork master
                  └─2082 "samba" tfork writer process(2082)
```

Figure 6: samba status

3.5 DNS and Kerberos Testing

```
host -t SRV _ldap._tcp.domain  
kinit administrator
```



```
_kerberos._udp.smith.jo has SRV record 0 100 88 dc1.smith.jo.  
user@dc1:~$ host -t SRV _ldap.tcp.smith.jo  
Host _ldap.tcp.smith.jo not found: 3(NXDOMAIN)  
user@dc1:~$ host -t SRV _ldap.tcp._smith.jo  
_ldap.tcp._smith.jo has no SRV record  
user@dc1:~$ host -t SRV _ldap._tcp.smith.jo  
_ldap._tcp.smith.jo has SRV record 0 100 389 dc1.smith.jo.  
user@dc1:~$ host -t A dc1.smith.jo  
dc1.smith.jo has address 10.0.2.15  
user@dc1:~$ host -t SRV _kerberos._udp.smith.jo  
_kerberos._udp.smith.jo has SRV record 0 100 88 dc1.smith.jo.  
user@dc1:~$ host -t SRV _ldap._tcp.smith.jo  
_ldap._tcp.smith.jo has SRV record 0 100 389 dc1.smith.jo.  
user@dc1:~$ _
```

Figure 7 : DNS checking

```
KINIT: Password read interrupted while getting initial credentials  
user@dc1:~$ kinit administrator@SMITH.JO  
Password for administrator@SMITH.JO:  
Warning: Your password will expire in 41 days on Tue 17 Jun 2025 11:19:55 PM UTC  
user@dc1:~$ _
```

Figure 8 : Kerberos server

```
user@dc1:~$ klist  
Ticket cache: FILE:/tmp/krb5cc_1000  
Default principal: administrator@SMITH.JO  
  
Valid starting     Expires            Service principal  
05/06/2025 23:31:12  05/07/2025 09:31:12  krbtgt/SMITH.JO@SMITH.JO  
      renew until 05/07/2025 23:31:06  
user@dc1:~$ _
```

Figure 9 : kinit

```
GNU nano 7.2                                     /etc/hosts
127.0.0.1 localhost
127.0.1.1 Ubuntu
192.168.1.1 dc1.smith.jo dc1

# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0  ip6-localnet
ff00::0  ip6-mcastprefix
ff02::1  ip6-allnodes
ff02::2  ip6-allrouters
```

```
user@dc1:~$ sudo cp /var/lib/samba/private/krbs.conf /etc/krbs.conf
cp: cannot stat '/var/lib/samba/private/krbs.conf': No such file or directory
user@dc1:~$ sudo cp /var/lib/samba/private/krb5.conf /etc/krb5.conf
cp: cannot create regular file '/etc/krb5.conf': No such file or directory
user@dc1:~$ sudo cp /var/lib/samba/private/krb5.conf /etc/krb5.conf
user@dc1:~$ cat /etc/krb5.conf
[libdefaults]
    default_realm = SMITH.JO
    dns_lookup_realm = false
    dns_lookup_kdc = true

[realms]
SMITH.JO = {
    default_domain = smith.jo
}

[domain_realm]
    dc1 = SMITH.JO
user@dc1:~$ _
```

```
user@dc1:~$ sudo cp /var/lib/samba/private/krbs.conf /etc/krbs.conf
cp: cannot stat '/var/lib/samba/private/krbs.conf': No such file or directory
user@dc1:~$ sudo cp /var/lib/samba/private/krb5.conf /etc/krb5.conf
cp: cannot create regular file '/etc/krb5.conf': No such file or directory
user@dc1:~$ sudo cp /var/lib/samba/private/krb5.conf /etc/krb5.conf
user@dc1:~$ cat /etc/krb5.conf
[libdefaults]
    default_realm = SMITH.JO
    dns_lookup_realm = false
    dns_lookup_kdc = true

[realms]
SMITH.JO = {
    default_domain = smith.jo
}

[domain_realm]
    dc1 = SMITH.JO
user@dc1:~$ host -t A dc1.smith.jo 127.0.0.1
Using domain server:
Name: 127.0.0.1
Address: 127.0.0.1#53
Aliases:

dc1.smith.jo has address 10.0.2.15
user@dc1:~$ host -t SRV _ldap._tcp.smith.jo 127.0.0.1
Using domain server:
Name: 127.0.0.1
Address: 127.0.0.1#53
Aliases:

_ldap._tcp.smith.jo has SRV record 0 100 389 dc1.smith.jo.
user@dc1:~$ samba-tool domain info 127.0.0.1
Forest          : smith.jo
Domain         : smith.jo
Netbios domain : SMITH
DC name        : dc1.smith.jo
DC netbios name : DC1
Server site    : Default-First-Site-Name
Client site    : Default-First-Site-Name
```

4. Part 2 – Client Configuration

```

user@dc1:~$ dig -t SRV _ldp._tcp.smith.jo @192.168.1.1
;; communication error to 192.168.1.1#53: timed out
;; communications error to 192.168.1.1#53: timed out
;; communications error to 192.168.1.1#53: timed out

; <>> DIG 9.10.30-Ubuntu0.24.04.2-Ubuntu <>> -t SRV _ldp._tcp.smith.jo @192.168.1.1
;; global options: +cmd
;; no servers could be reached
user@dc1:~$ dig -t SRV _ldap._tcp.smith.jo @192.168.1.1
;; communications error to 192.168.1.1#53: timed out
;; communications error to 192.168.1.1#53: timed out
;; communications error to 192.168.1.1#53: timed out

; <>> DIG 9.10.30-Ubuntu0.24.04.2-Ubuntu <>> -t SRV _ldap._tcp.smith.jo @192.168.1.1
;; global options: +cmd
;; no servers could be reached
user@dc1:~$ dig -t SRV _ldap._tcp.smith.jo @10.0.2.15
;; global options: +cmd
;; Got answer:
;; ->>HEADER<- opcode: QUERY, status: NOERROR, id: 41893
;; flags: qr aa rd ra ad: QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
;; QUESTION SECTION:
;_ldap._tcp.smith.jo. IN SRV
;; ANSWER SECTION:
_ldap._tcp.smith.jo. 900 IN SRV 0 100 389 dc1.smith.jo.

;; AUTHORITY SECTION:
smith.jo. 3600 IN SOA dc1.smith.jo. hostmaster.smith.jo. 23 900 600 86400 3600

;; Query time: 0 msec
;; SERVER: 10.0.2.15#53(10.0.2.15) (UDP)
;; WHEN: Wed May 07 14:41:42 UTC 2025
;; MSG SIZE rcvd: 108

user@dc1:~$
```

Figure 10 : Connection checking

```

libsss-ldmap0 libsss-nss-ldmap0 oddjob oddjob-mkhomedir python3-sss realm sssd sssd-ad sssd-ad-common sssd-common sss
sssd-ldap sssd-proxy wanamerican
0 upgraded, 36 newly installed, 0 to remove and 1 not upgraded.
Need to get 3,171 kB of archives.
After this operation, 12.8 MB of additional disk space will be used.
Get:1 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libbsas12-modules-gssapi-mit amd64 2.1.28+dfsg1-5ubuntu
Get:2 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 acl1 amd64 0.9.2-1ubuntu2 [100 kB]
Get:3 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libcrack2 amd64 2.9.6-5.1build2 [29.0 kB]
Get:4 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 cracklib-runtime amd64 2.9.6-5.1build2 [147 kB]
Get:5 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 ldap-utils amd64 2.6.7+dfsg1-1expubuntu8.2 [153 kB]
Get:6 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libbasiccubjects0 amd64 0.6.2-2.1build1 [5,954 kB]
Get:7 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libcares2 amd64 1.27.0-0.1ubuntu1 [73.7 kB]
Get:8 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libcollection4 amd64 0.6.2-2.1build1 [22.8 kB]
Get:9 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libdhash16 amd64 0.6.2-2.1build1 [8,614 kB]
Get:10 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libpath-util16 amd64 0.6.2-2.1build1 [8,744 kB]
Get:11 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libref-array16 amd64 0.6.2-2.1build1 [7,420 kB]
Get:12 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libini-config5 amd64 0.6.2-2.1build1 [43.5 kB]
Get:13 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libipa-hbac0t64 amd64 2.9.4-1.1ubuntu6.2 [17.7 kB]
Get:14 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libfsidmap1 amd64 1:2.6.4-3ubuntu5.1 [48.3 kB]
Get:15 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libipquality-common all 1.4.5-3build1 [7,748 kB]
Get:16 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libipquality1 amd64 1.4.5-3build1 [13.5 kB]
Get:17 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 libpar-pquality amd64 1.4.5-3build1 [11.7 kB]
Get:18 http://lk.archive.ubuntu.com/ubuntu noble/universe amd64 oddjob amd64 0.34.7-2 [42.7 kB]
Get:19 http://lk.archive.ubuntu.com/ubuntu noble/universe amd64 oddjob-mkhomedir amd64 0.34.7-2 [15.2 kB]
Get:20 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 realm amd64 0.17.1-3build2 [162 kB]
Get:21 http://lk.archive.ubuntu.com/ubuntu noble/main amd64 wanamerican all 2020.12.07-2 [236 kB]
Get:22 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libnss-sss amd64 2.9.4-1.1ubuntu6.2 [31.9 kB]
Get:23 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libpanss amd64 2.9.4-1.1ubuntu6.2 [50.7 kB]
Get:24 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libnss-certmap0 amd64 2.9.4-1.1ubuntu6.2 [47.4 kB]
Get:25 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libnss-ldmap0 amd64 2.9.4-1.1ubuntu6.2 [22.0 kB]
Get:26 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 libnss-nss-ldmap0 amd64 2.9.4-1.1ubuntu6.2 [30.6 kB]
Get:27 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 python3-sss amd64 2.9.4-1.1ubuntu6.2 [47.3 kB]
Get:28 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-common amd64 2.9.4-1.1ubuntu6.2 [1,139 kB]
Get:29 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-ad-common amd64 2.9.4-1.1ubuntu6.2 [77.1 kB]
Get:30 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-krb5-common amd64 2.9.4-1.1ubuntu6.2 [68.8 kB]
Get:31 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-ad amd64 2.9.4-1.1ubuntu6.2 [136 kB]
Get:32 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-ipa amd64 2.9.4-1.1ubuntu6.2 [221 kB]
Get:33 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-ldap amd64 2.9.4-1.1ubuntu6.2 [145.5 kB]
Get:34 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-proxy amd64 2.9.4-1.1ubuntu6.2 [131.3 kB]
Get:35 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd-common amd64 2.9.4-1.1ubuntu6.2 [44.6 kB]
Get:36 http://lk.archive.ubuntu.com/ubuntu noble-updates/main amd64 sssd amd64 2.9.4-1.1ubuntu6.2 [4,124 kB]
Fetched 3,171 kB in 14s (224 kB/s)
Extracting templates from packages: 100%
Preconfiguring packages ...
Selecting previously unselected package libbsas12-modules-gssapi-mit:amd64.
(Reading database ... 86256 files and directories currently installed.)
Preparing to unpack .../00-libbsas12-modules-gssapi-mit_2.1.28+dfsg1-Subuntu3.1_amd64.deb ...
Unpacking libbsas12-modules-gssapi-mit:amd64 (2.1.28+dfsg1-Subuntu3.1) ...

Progress: [ 0%] [.....]
```

Figure 11 : installing domain join tool

```
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
user@dc1:~$ realm discover smith.jo  
smith.jo  
  type: kerberos  
  realm-name: SMITH.JO  
  domain-name: smith.jo  
  configured: no  
user@dc1:~$
```

Figure 12 : realm discover

```
GNU nano 7.2                                     etc/sssd/sssd.conf *
```

```
[sssd]  
domains = smith.jo  
config_file_version = 2  
services = nss.pam  
  
[domain smith.jo]  
default_shell = /bin/bash  
krb5_store_password_if_offline = True  
cache_credentials = True  
krb5_realm = SMITH.JO  
realmd_tags = manages-system joined-with.adcli  
id_provider = ad  
ldap_sasl_authid = dc1  
fallback_homedir = /home/%u@%d  
ad_domain = smith.jo  
use_fullyQualifiedNames = True  
ldap_id_mapping = True  
access_provider = ad
```

Figure 13 : for joining domain

```
kinit: KDC reply did not match expectations while getting initial credentials  
user@dc1:~$ kinit Administrator@SMITH.JO:  
Password for Administrator@SMITH.JO:  
Warning: Your password will expire in 41 days on Tue 17 Jun 2025 11:19:55 PM UTC  
user@dc1:~$ klist  
Ticket cache: FILE:/tmp/krb5cc_1000  
Default principal: Administrator@SMITH.JO  
  
Valid starting     Expires            Service principal  
05/07/2025 15:05:21  05/08/2025 01:05:21  krbtgt/SMITH.JO@SMITH.JO  
      renew until 05/08/2025 15:05:15  
user@dc1:~$ su - Administrator@smith.jo
```

Figure 14 : test domain

```
su: user Administrator@SMITH.JO does not exist or the user entry does not contain all the required fields  
user@dc1:~$ sudo samba-tool user add smith  
New Password:  
Retype Password:  
User 'smith' added successfully  
user@dc1:~$ _
```

Figure 15 : test login

```
user@dc1:~$ sudo samba-tool user list
Guest
Administrator
krbtgt
mkoster
smith
user@dc1:~$ _
```

Figure 16 : verify logins users

```
user@dc1:~$ kinit smith@SMITH.JO
Password for smith@SMITH.JO:
Warning: Your password will expire in 41 days on Wed 18 Jun 2025 03:08:00 PM UTC
user@dc1:~$
```

Figure 17 : test authentication

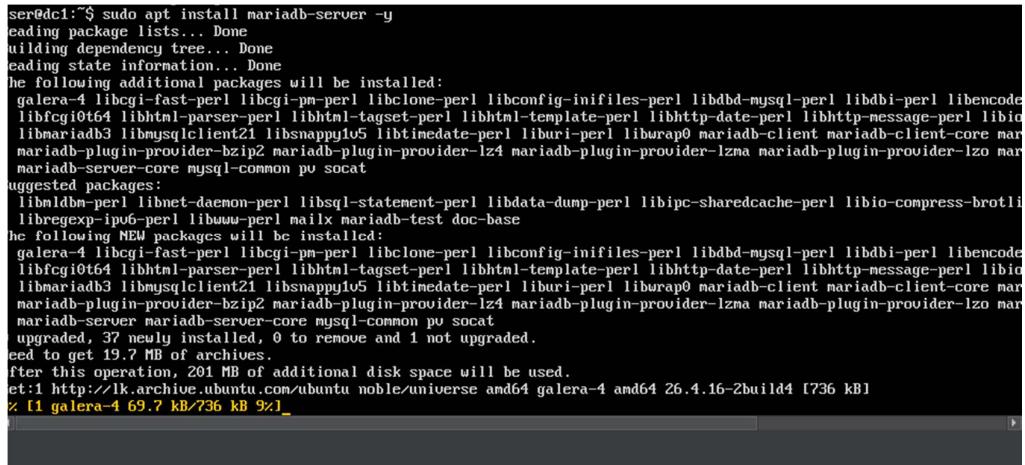
```
user@dc1:~$ klist
Ticket cache: FILE:/tmp/krb5cc_1000
Default principal: smith@SMITH.JO

Valid starting     Expires            Service principal
05/07/2025 15:12:30 05/08/2025 01:12:30  krbtgt/SMITH.JO@SMITH.JO
      renew until 05/08/2025 15:12:23
user@dc1:~$
```

Figure 18 : test authentication

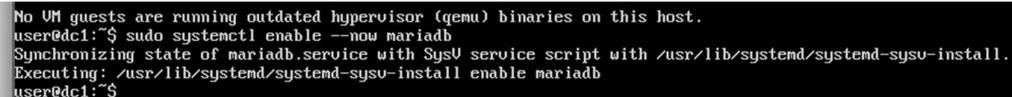
5. Part 3 – Zabbix Monitoring

5.1 Zabbix Installation on Domain Controller



```
ser@dc1:~$ sudo apt install mariadb-server -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
galera-4 libcgifast-perl libcgipm-perl libclone-perl libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libencode
libfcgi0t64 libhtml-parser-perl libhtml-tagset-perl libhtml-template-perl libhttp-date-perl libhttp-message-perl libio
libmariadb3 libmysqlclient21 libsnappy1v5 libtimedate-perl liburi-perl libwrap0 mariadb-client mariadb-client-core mar
mariadb-plugin-provider-bzip2 mariadb-plugin-provider-lz4 mariadb-plugin-provider-lzma mariadb-plugin-provider-lzo mar
mariadb-server mariadb-server-core mysql-common pu socat
Suggested packages:
libltdbm-perl libnet-daemon-perl libsql-statement-perl libdata-dump-perl libipc-sharedcache-perl libio-compress-brotli
libreexp-ip6-perl libwww-perl mailx mariadb-test doc-base
The following NEW packages will be installed:
galera-4 libcgifast-perl libcgipm-perl libclone-perl libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libencode
libfcgi0t64 libhtml-parser-perl libhtml-tagset-perl libhtml-template-perl libhttp-date-perl libhttp-message-perl libio
libmariadb3 libmysqlclient21 libsnappy1v5 libtimedate-perl liburi-perl libwrap0 mariadb-client mariadb-client-core mar
mariadb-plugin-provider-bzip2 mariadb-plugin-provider-lz4 mariadb-plugin-provider-lzma mariadb-plugin-provider-lzo mar
mariadb-server mariadb-server-core mysql-common pu socat
Upgraded, 37 newly installed, 0 to remove and 1 not upgraded.
Need to get 19.7 MB of archives.
After this operation, 201 MB of additional disk space will be used.
Get:1 http://lk.archive.ubuntu.com/ubuntu noble/universe amd64 galera-4 amd64 26.4.16-2build4 [736 kB]
xz 1 galera-4 69.7 kB/736 kB 9%
```

Figure 19 : installing mariadb



```
No UM guests are running outdated hypervisor (qemu) binaries on this host.
user@dc1:~$ sudo systemctl enable --now mariadb
Synchronizing state of mariadb.service with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable mariadb
user@dc1:~$
```

Figure 20 : installing mariadb

```

user@dc1:~$ sudo mysql -u root
ERROR 1698 (28000): access denied for user 'user'@'localhost'
user@dc1:~$ sudo mysql -u root
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MariaDB connection id is 32
Server version: 10.11.11-MariaDB-0ubuntu0.24.04.2 Ubuntu 24.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> CREATE DATABASE zabbix CHARACTER SET utf8mb4 COLLATE utf8mb4_bin;
Query OK, 1 row affected (0.003 sec)

MariaDB [(none)]> CREATE USER 'zabbix'@'localhost' IDENTIFIED BY 'zabbixDBpass';
Query OK, 0 rows affected (0.004 sec)

MariaDB [(none)]> GRANT ALL PRIVILEGES ON zabbix.* TO 'zabbix'@'localhost';
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near 'PRIVILEGES ON zabbix.* TO 'zabbix'@'localhost'' at line 1
MariaDB [(none)]> GRANT ALL PRIVILEGES ON zabbix.* TO 'zabbix'@'localhost';
Query OK, 0 rows affected (0.003 sec)

MariaDB [(none)]> SET GLOBAL log_bin_trust_function_creators = 1;
Query OK, 0 rows affected (0.003 sec)

MariaDB [(none)]> FLUSH PRIVILEGES;
-> FLUSH PRIVILEGES;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the right syntax to use near 'FLUSH PRIVILEGES' at line 2
MariaDB [(none)]> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.003 sec)

MariaDB [(none)]> EXIT
Bye
user@dc1:~ -

```

Figure 21 : create Zabbix database and user

```

user@dc1:~$ wget https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix-release/zabbix-release_6.0.4+ubuntu22.04_all.deb
--2025-05-07 15:55:25-- https://repo.zabbix.com/zabbix/6.0/ubuntu/pool/main/z/zabbix-release/zabbix-release_6.0.4+ubuntu22.04_all.deb
Resolving repo.zabbix.com (repo.zabbix.com)... 178.128.6.101, 2604:a880:2:d0::2062:d001
Connecting to repo.zabbix.com (repo.zabbix.com)|178.128.6.101|:443... connected.

```

```

Selecting previously unselected package zabbix-release.
(Reading database ... files and directories currently installed.)
Preparing to unpack zabbix-release_6.0.4+ubuntu22.04_all.deb ...
Unpacking zabbix-release (1:6.0.4-1+ubuntu22.04) ...
Setting up zabbix-release (1:6.0.4-1+ubuntu22.04) ...

```

```

Enter password:
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MariaDB connection id is 33
Server version: 10.6.21-MariaDB-0ubuntu0.22.04.2 Ubuntu 22.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> SET GLOBAL log_bin_trust_function_creators = 0;
Query OK, 0 rows affected (0.000 sec)

MariaDB [(none)]>

```

```
# sudo nano /etc/zabbix/zabbix_server.conf
```

Figure 22 :zabbix creation

5.2 Zabbix Agent Installation

```
# Define /zabbix alias, this is the default
:IfModule mod_alias.c>
    Alias /zabbix /usr/share/zabbix
:/IfModule>

:Directory "/usr/share/zabbix">
    Options FollowSymLinks
    AllowOverride None
    Order allow,deny
    Allow from all

    <IfModule mod_php.c>
        php_value max_execution_time 300
        php_value memory_limit 128M
        php_value post_max_size 16M
        php_value upload_max_filesize 2M
        php_value max_input_time 300
        php_value max_input_vars 10000
        php_value always_populate_raw_post_data -1
    </IfModule>

    <IfModule mod_php7.c>
        php_value max_execution_time 300
        php_value memory_limit 128M
        php_value post_max_size 16M
        php_value upload_max_filesize 2M
        php_value max_input_time 300
        php_value max_input_vars 10000
        php_value always_populate_raw_post_data -1
        php_value date.timezone Asia/Colombo
    </IfModule>
:/Directory>

:Directory "/usr/share/zabbix/conf">
    Order deny,allow
    Deny from all
    <files *.php>
        Order deny,allow
        Deny from all
    </files>
:/Directory>
```

Figure 23 : set apache PHP

```
@zabbix-server.service - Zabbix Server
 Loaded: loaded (/lib/systemd/system/zabbix-server.service; enabled; vendor preset: enabled)
 Active: active (running) since Sat 2025-05-03 15:57:53 +0530; 55s ago
 Main PID: 16803 (zabbix_server)
   Tasks: 48 (limit: 2211)
  Memory: 63.2M
     CPU: 468ms
      CGroup: /system.slice/zabbix-server.service
              └─16803 /usr/sbin/zabbix_server -c /etc/zabbix/zabbix_server.conf
                  ├─16805 "/usr/sbin/zabbix_server: ha manager"
                  ├─16806 "/usr/sbin/zabbix_server: http"
                  ├─16807 "/usr/sbin/zabbix_server: service manager #1 [processed 0 events, updated 0 event tags, deleted 0 problems, synced 0 service updates, idle 5.009673 sec]
```

Figure 24 : enable Zabbix and apache

5.3 Configure Zabbix Dashboard

The figure consists of three screenshots of the Zabbix web interface:

- Pre-installation summary:** A configuration wizard step showing database details (MySQL, localhost, port default, name zabbix, user zabbix, password masked). It also shows the Zabbix server name as "mb-dc1-ubuntu22". Buttons for "Back" and "Next step" are at the bottom.
- Login screen:** A standard login form with fields for "Username" (Admin), "Password" (masked), and a "Remember me for 30 days" checkbox. A "Sign in" button is at the bottom.
- Global view dashboard:** A monitoring dashboard titled "Global view". It includes a "System information" table and a status summary bar. The status bar shows counts for Available (1), Not available (0), Unknown (0), Total (1), Disaster (0), High (0), Average (0), Warning (0), Information (0), and Not classified (0). To the right is a clock icon and a "Favorite maps" section.

Figure 25 : web UI

```

zabbix-agent.service - Zabbix Monitor Agent
  Loaded: loaded (/usr/lib/systemd/system/zabbix-agent.service; enabled; preset: disabled)
  Drop-In: /usr/lib/systemd/system/service.d
    └─10-timeout-abort.conf
    Active: active (running) since Sat 2025-05-03 17:04:50 +0530; 34s ago
      Main PID: 4471 (zabbix_agentd)
        Tasks: 6 (limit: 2242)
          Memory: 5.2M
            CPU: 45ms
          CGroup: /system.slice/zabbix-agent.service
            ├─4471 /usr/sbin/zabbix_agentd -f
            ├─4472 "/usr/sbin/zabbix_agentd: collector [idle 1 sec]"
            ├─4473 "/usr/sbin/zabbix_agentd: listener #1 [waiting for connection]"
            ├─4474 "/usr/sbin/zabbix_agentd: listener #2 [waiting for connection]"
            ├─4475 "/usr/sbin/zabbix_agentd: listener #3 [waiting for connection]"
            ├─4476 "/usr/sbin/zabbix_agentd: active checks #1 [idle 1 sec]"

May 03 17:04:50 fedora39 systemd[1]: Started zabbix-agent.service - Zabbix Monitor Agent.
May 03 17:04:50 fedora39 zabbix_agentd[4471]: Starting Zabbix Agent [Zabbix server]. Zabbix 6.0.33 (revision e05e6ba9dca).
May 03 17:04:50 fedora39 zabbix_agentd[4471]: Press Ctrl+C to exit.
root@fedora39:~# 
```

Figure 26 : active Zabbix monitor agent

Hosts

Host added

Groups: Cloud servers

Interfaces: Type or address: Agent [10.0.1.20] Connected to: DNS Port: 1050 Default

Description:

Monitored by proxy: (no proxy)

Enabled:

Create host Import Filter ▾

Name	Items	Triggers	Graphs	Discovery	Web	Interface	Proxy	Templates	Status	Availability	Agent encryption	Info	Tags
Fedora Client	Items 42	Triggers 14	Graphs 8	Discovery 3	Web	10.0.1.20:1050	Linux by Zabbix agent		Enabled	OK	None		
Zabbix server	Items 134	Triggers 73	Graphs 31	Discovery 4	Web	127.0.0.1:1050	Linux by Zabbix agent, Zabbix server health		Enabled	OK	None		

Displaying 2 of 2 found

Figure 27 : Add the new host

ZABBIX

Hosts

Host groups: type here to search

Templates: type here to search

Name:

DNS:

IP:

Port:

Monitored by: Any

Proxy:

Tags: AndOr Or Contains Remove

Apply Reset

Name	Items	Triggers	Graphs	Discovery	Web	Interface	Proxy	Templates	Status	Availability	Agent encryption	Info	Tags
Fedora Client	Items 79	Triggers 31	Graphs 16	Discovery 3	Web	10.0.1.20:1050	Linux by Zabbix agent		Enabled	OK	None		
Zabbix server	Items 134	Triggers 73	Graphs 31	Discovery 4	Web	127.0.0.1:1050	Linux by Zabbix agent, Zabbix server health		Enabled	OK	None		

Displaying 2 of 2 found

0 selected

Zabbix 6.0.40, © 2001–2025, Zabbix SIA

Figure 28 : verify host

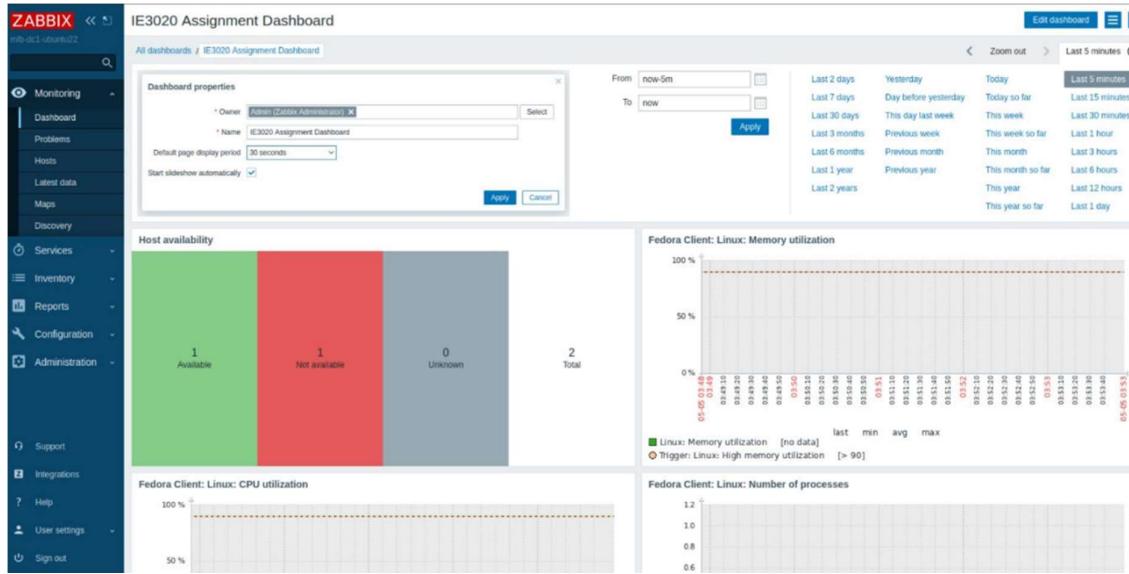


Figure 29 : Monitoring

6. References

- **Samba Wiki** – <https://wiki.samba.org>
- **Zabbix Documentation** – <https://www.zabbix.com/documentation>
- **Ubuntu Server Guide** – <https://ubuntu.com/server/docs>
- **Realmd and SSSD Setup Guide** – https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/html/system_level_authentication_guide
- **Kerberos Documentation** – <https://web.mit.edu/kerberos/krb5-latest/doc>
- **VirtualBox User Manual** – <https://www.virtualbox.org/manual>