Introduction to Ansible Deployment at Omnitouch

Overview

Omnitouch Network Services uses Ansible as its infrastructure automation platform to deploy complete cellular network solutions (4G/5G) in a consistent, repeatable, and automated manner. This document provides an overview of how we leverage Ansible to orchestrate complex telecom deployments.

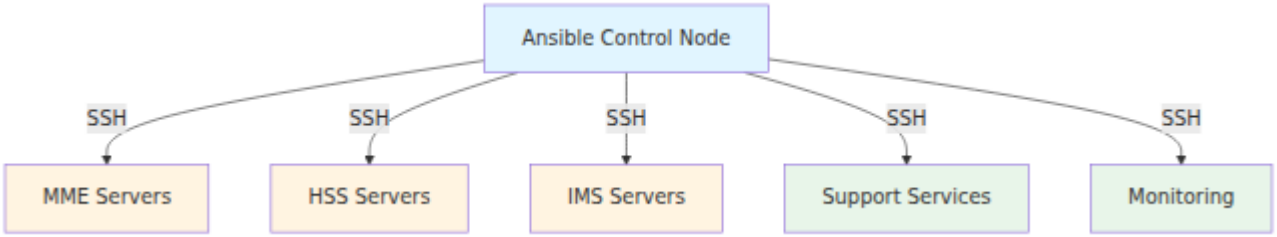
What is Ansible?

Ansible is an open-source automation tool that allows you to:

- Configure systems
- Deploy software
- Orchestrate complex workflows
- Manage infrastructure as code

Ansible uses a declarative approach - you describe the **desired state** of your systems, and Ansible ensures they reach that state.

How Omnitouch Uses Ansible



Key Concepts

1. Inventory (Hosts Files)

Defines **what** systems to manage. Each customer deployment has a hosts file that describes:

- All virtual machines in the network
- Their IP addresses
- Network configuration
- Service-specific parameters

Host files are what you will be working with to define your network.

See: Hosts File Configuration

2. Roles

Defines **how** to configure each component. Roles are reusable units that contain:

- Tasks (steps to execute)
- Templates (configuration file templates)
- Handlers (actions triggered by changes)
- Variables (default configuration values)

Example roles for OmniCore components: `omnihss`, `omnisgwc`, `omnipgwc`, `omnidra`, etc

These are defined by the ONS team, while you can edit them, there's generally cleaner ways to make any tweaks you might need from within your hosts file.

3. Playbooks

Orchestrates **when** and **where** roles are applied:

```
- name: Deploy EPC Core
  hosts: mme
  roles:
    - common
    - omnimme
```

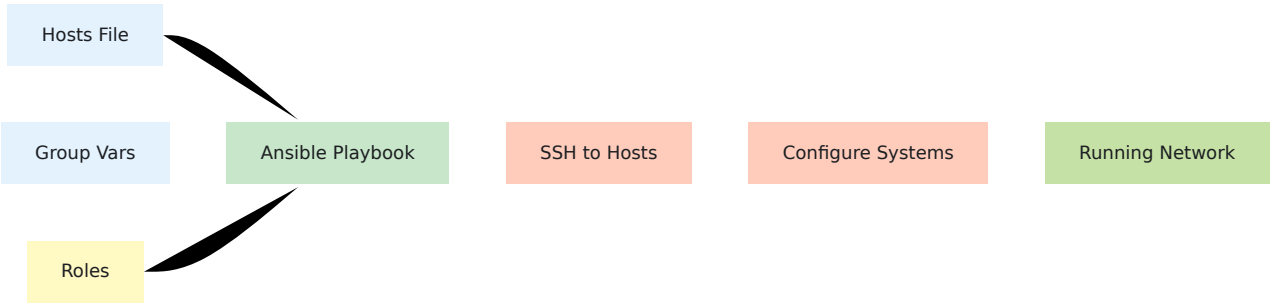
We use these essentially as groups for the roles.

4. Group Variables

Provides **customer-specific configuration** that overrides role defaults. This is where customer customization happens without modifying the base roles.

See: Group Variables and Configuration

Deployment Architecture



The Deployment Process

1. Define Infrastructure

Create a hosts file describing your network topology:

Planning Note: Before defining infrastructure, review the IP Planning Standard for guidance on network segmentation, IP address allocation, and subnet organization.

Proxmox Users: If deploying on Proxmox, see Proxmox VM/LXC Deployment for automated VM/container provisioning.

See: Hosts File Configuration and Configuration Reference

```
mme:
  hosts:
    customer-mme01:
      ansible_host: 10.10.1.15
      mme_code: 1
```

2. Customize Configuration

Set customer-specific variables in `group_vars`:

```
plmn_id:
  mcc: '001'
  mnc: '01'
customer_name_short: customer
```

#ToDo - Add link here to conifg reference for complete list

3. Run Playbooks

Deploy the network:

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/epc.yml
```

4. Automated Deployment

Ansible will:

- Create/provision VMs (if using Proxmox/VMware integration)
- Configure networking
- Install software packages from APT cache
- Deploy application code
- Configure services with customer settings

- Start services
- Validate deployment

Key Components We Deploy

OmniCore (4G/5G Packet Core Platform)

- **OmniHSS** - Home Subscriber Server
- **OmniSGW** - Serving Gateway (Control plane)
- **OmniPGW** - Packet Gateway (Control plane)
- **OmniUPF** - User Plane Function
- **OmniDRA** - Diameter Routing Agent
- **OmniTWAG** - Trusted WLAN Access Gateway

See: https://docs.omnitouch.com.au/docs/repos/OmniCore

OmniCall (Voice & Messaging Platform)

- **OmniCall CSCF** - Call Session Control Function (P-CSCF, I-CSCF, S-CSCF)
- **OmniTAS** - IMS Application Server (VoLTE/VoNR services)
- **OmniMessage** - SMS Center (SMS-C)
- **OmniMessage SMPP** - SMPP protocol support
- **OmniSS7** - SS7 signaling components (STP, HLR, CAMEL)
- **VisualVoicemail** - Voicemail functionality

See: https://docs.omnitouch.com.au/docs/repos/OmniCall

OmniCharge/OmniCRM

- **CRM Platform** - Customer relationship management, self-signup, billing

See: https://docs.omnitouch.com.au/docs/repos/OmniCharge

Support Services

- **DNS** - Network DNS resolution
- **License Server** - License management
- **Monitoring** - Prometheus, Grafana

See: Deployment Architecture Overview

Package Management

We use a hybrid package distribution model:

Pre-compiled APT Packages

All Omnitouch software is distributed as Debian packages (`.deb` files):

- Built from source in our CI/CD pipeline
- Versioned and tested
- Hosted on package repositories

APT Cache System

Customers can choose between:

1. **Local APT Cache** - Mirror of required packages on-site for offline deployment
2. **Public Repository** - Direct access to Omnitouch's hosted package repository

See: APT Cache System

License Management

All Omnitouch software components require valid licenses managed through a central license server:

- Components check license validity on startup
- Features are enabled/disabled based on license
- License server can be local or cloud-hosted

See: License Server

Benefits of This Approach

Repeatability

The same Ansible playbooks can deploy:

- Development labs
- Testing environments
- Production networks
- Customer sites

Consistency

Every deployment uses the same tested configurations, reducing human error.

Version Control

Infrastructure is defined as code in Git:

- Track all changes
- Review before deployment
- Roll back if needed

Customization Without Complexity

Customers can customize their deployment through `group_vars` without modifying core roles.

Rapid Deployment

Deploy a complete cellular network in hours instead of days or weeks.

Getting Started

Prerequisites

Before running Ansible playbooks, you need to set up a Python virtual environment and install the required dependencies.

1. Create a Python Virtual Environment

Create an isolated Python environment for the Ansible deployment:

```
python3 -m venv .venv
```

2. Activate the Virtual Environment

Activate the virtual environment:

```
source .venv/bin/activate
```

On Windows, use:

```
.venv\Scripts\activate
```

3. Install Required Packages

Install all dependencies from the requirements.txt file:

```
pip install -r requirements.txt
```

This will install Ansible and all necessary Python packages for Omnitouch deployment automation.

Note: Keep the virtual environment activated whenever running Ansible commands. You can deactivate it when finished by running `deactivate`.

Deployment Steps

1. Review the Hosts File Configuration to understand how to define your network
2. Learn about Group Variables for customization
3. Understand the APT Cache System for package management
4. Review the Deployment Architecture to see how everything fits together
5. Deploy!

Next Steps

- IP Planning Standard - **Plan your network architecture and IP allocation**
- Hosts File Configuration - Learn how to define your network topology
- APT Cache System - Understand package distribution
- License Server - Learn about license management
- Deployment Architecture Overview - See the complete picture
- Group Variables Configuration - Customize your deployment
- Utility Playbooks - Operational tools for health checks, backups, and maintenance

APT Repository & Package Distribution

Overview

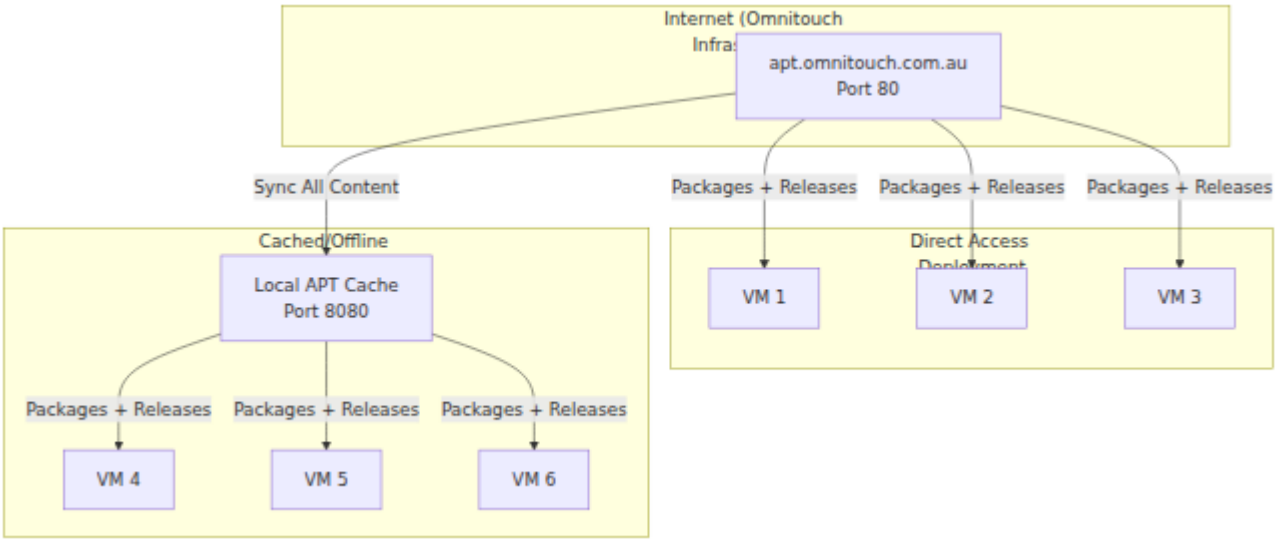
The Omnitouch APT system provides package distribution for all deployments. Two types of content are served:

1. **APT Packages** — Debian packages installed via `apt install`
2. **Binary Releases** — Pre-built binaries downloaded directly (Prometheus exporters, agents, etc.)

Two deployment models are supported:

1. **Direct Access** — VMs pull packages directly from `apt.omnitouch.com.au`
2. **Local Cache Mirror** — A local server syncs from Omnitouch and serves packages to VMs (for offline/airgapped deployments)

Architecture



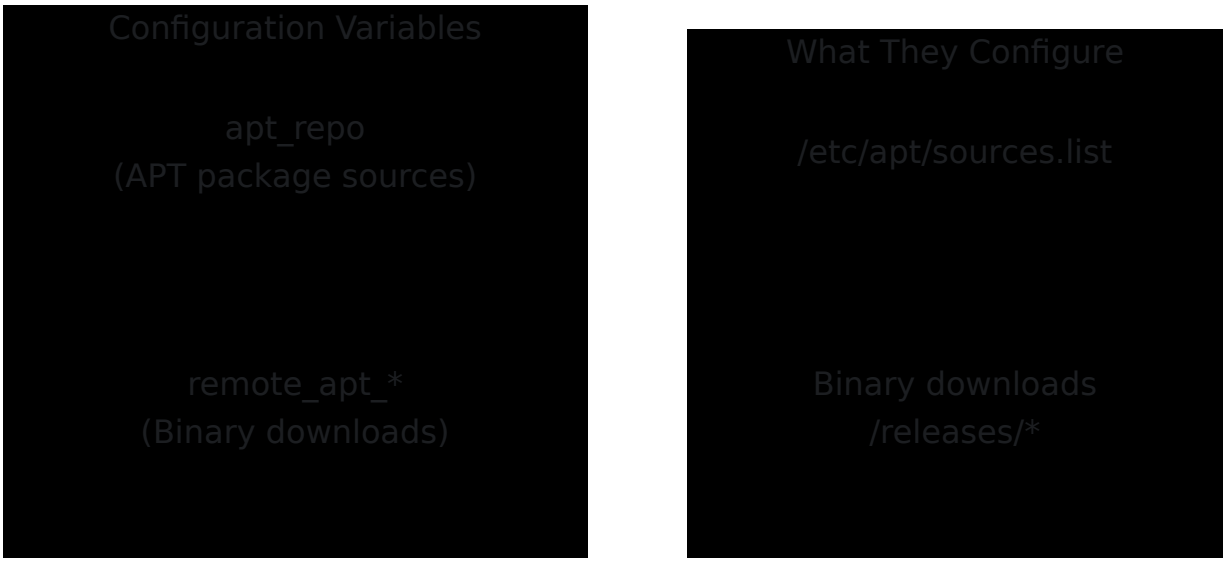
Content Served

The APT server hosts all content required for deployments:

Content Type	Description	Path
Omnitouch Packages	Custom-built `.deb` packages (omnihss, omnimme, etc.)	`/dists/<distro>/`
Ubuntu Packages	Cached Ubuntu packages with all dependencies	`/<distro>/pool/main/`
GitHub Releases	Pre-built binaries (Prometheus, Grafana, Homer, etc.)	`/releases/<org>/<repo>/`
Source Tarballs	Source archives for web apps (CGrateS_UI, speedtest)	`/repos/`
Third-Party Packages	Galera, FRR, InfluxDB, KeyDB, etc.	`/releases/<vendor>/`

Configuration Variables

Two separate variable sets control package distribution. Understanding their purposes is essential for correct configuration.



Variable Purposes

Variable Set	Purpose	Used For
`apt_repo`	Configures APT package sources	`/etc/apt/sources.list` and `/etc/apt/sources.list.d/*.list`
`remote_apt_*`	Configures binary download URLs	Downloading files from `/releases/` path (Node Exporter, Zabbix, Nagios, etc.)

When Each Variable Set Is Used

Scenario	APT Sources (`apt_repo`)	Binary Downloads (`remote_apt_*`)
`use_apt_cache: true`	Uses `apt_repo.apt_server`	Uses `apt_repo.apt_server`
`use_apt_cache: false`	Uses `apt_repo.*` with credentials	Uses `remote_apt_*` with credentials

When `use_apt_cache: false`, both variable sets are required.

Option 1: Direct Access

For deployments with internet connectivity, VMs pull packages directly from the Omnitouch APT server.

Network Requirements

Source IP Whitelisting: Your public IP address must be whitelisted on the Omnitouch APT server. During setup, provide your source subnets to Omnitouch. In return, you will receive:

- **Username** and **password** for HTTP Basic Auth
- **FQDN** for the APT server

Firewall Requirements: Outbound access to the following Omnitouch IP ranges must be allowed:

Network	Range
IPv4	`144.79.167.0/24`
IPv4	`160.22.43.0/24`
IPv6	`2001:df3:dec0::/48`
ASN	`AS152894`

Services requiring access to Omnitouch infrastructure:

Service	Port	Protocol	Purpose
APT Server	80	TCP	Package downloads
APT Server	53	TCP/UDP	DNS resolution for `apt.omnitouch.com.au`
License Server	123	UDP	NTP time synchronization for license validation
License Server	53	TCP/UDP	DNS resolution for license validation

Ensure HTTP (TCP/80), NTP (UDP/123), and DNS (TCP+UDP/53) traffic is allowed to the Omnitouch IP ranges.

Configuration

```yaml
all:
  vars:
    use_apt_cache: false

    # APT package sources configuration
    # Configures /etc/apt/sources.list for apt install commands
    apt_repo:
      apt_server: "apt.omnitouch.com.au"
      apt_repo_username: "your-username"
      apt_repo_password: "your-password"

    # Binary downloads configuration
    # Used for downloading files from /releases/ path
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_port: 80
    remote_apt_protocol: "http"
    remote_apt_user: "your-username"
    remote_apt_password: "your-password"
```

Parameters

APT Package Sources (`apt_repo`)

Parameter	Type	Required	Default	Descriptio
`apt_repo.apt_server`	String	Yes	-	APT server hostname o IP address
`apt_repo.apt_repo_username`	String	Yes	-	HTTP Basic Auth username for APT sources
`apt_repo.apt_repo_password`	String	Yes	-	HTTP Basic Auth password fo APT source

Binary Downloads (`remote_apt_*`)

Parameter	Type	Required	Default	Description
`remote_apt_server`	String	Yes	-	Server hostname or IP for binary downloads
`remote_apt_port`	Integer	No	`80`	Server port for binary downloads
`remote_apt_protocol`	String	No	`http`	Protocol (`http` or `https`)
`remote_apt_user`	String	Yes	-	HTTP Basic Auth username for downloads
`remote_apt_password`	String	Yes	-	HTTP Basic Auth password for downloads

General

Parameter	Type	Required	Default	Description
`use_apt_cache`	Boolean	Yes	-	Must be `false` for direct access

URL Patterns (Direct Access)

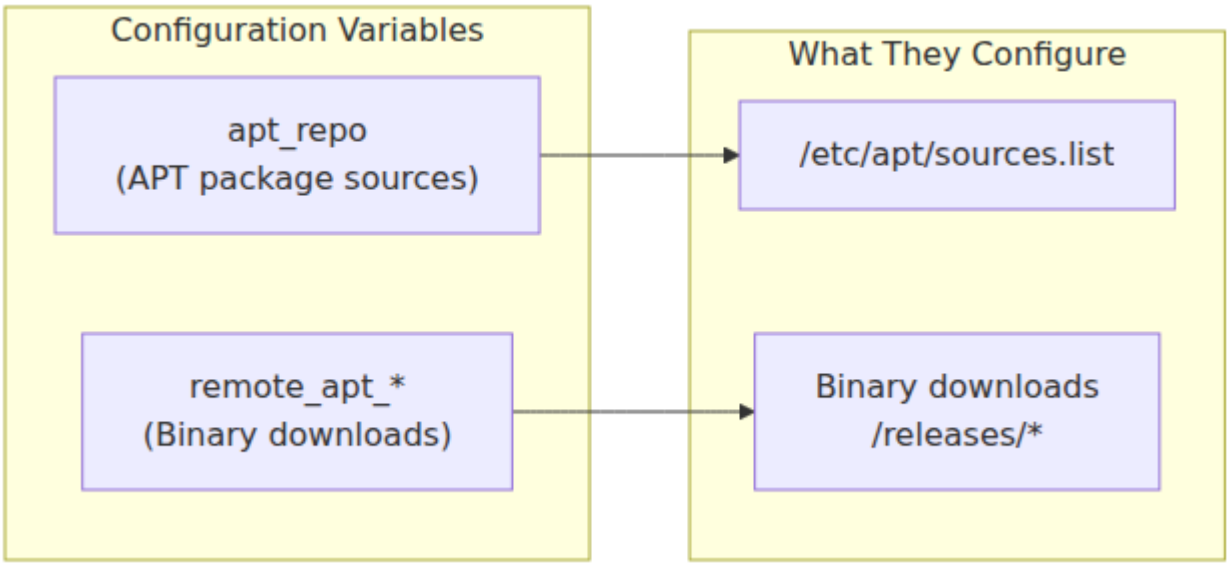
APT Package Sources (configured in `/etc/apt/sources.list`):

```
deb [trusted=yes] http://{apt_repo_username}:
{apt_repo_password}@{apt_server}/ noble main
```

Binary Downloads (used by Ansible `get_url` tasks):

```
http://{remote_apt_user}:
{remote_apt_password}@{remote_apt_server}:
{remote_apt_port}/releases/prometheus/node_exporter/node_exporter-
1.8.1.linux-amd64.tar.gz
```

How It Works

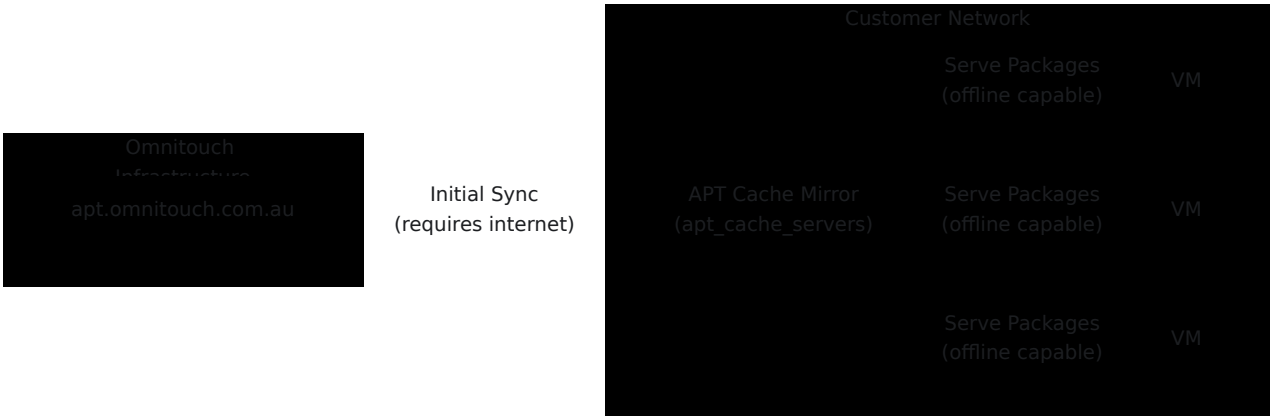


VMs authenticate with HTTP Basic Auth for both APT packages and binary downloads. Ubuntu system packages are also served from the Omnitouch server (pre-cached), so VMs do not need access to Ubuntu mirrors.

Option 2: Local Cache Mirror

For offline, airgapped, or bandwidth-constrained deployments, deploy a local APT cache that syncs all content from Omnitouch.

Architecture



Configuration

Define the cache server in your hosts file with its repository configuration:

```
apt_cache_servers:
  hosts:
    customer-apt-cache:
      ansible_host: 192.168.1.100
      gateway: 192.168.1.1
  vars:
    # Cache server syncs packages from authenticated repository
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_port: 80
    remote_apt_protocol: "http"
    remote_apt_user: "your-username"
    remote_apt_password: "your-password"

all:
  vars:
    # use_apt_cache: true  # Auto-set when apt_cache_servers group
exists
    # apt_repo.apt_server: auto-derived to 192.168.1.100 (first
cache server)
```

How it works:

- **Cache server** (`192.168.1.100`): Uses `remote_apt_*` credentials to sync packages from `apt.omnitouch.com.au:80`

- **All other hosts**: Automatically derive `apt_repo.apt_server: "192.168.1.100"` and pull from cache at port `8080` without credentials

Parameters

APT Package Sources (`apt_repo`)

Parameter	Type	Required	Default	Descrip
`apt_repo.apt_server`	String	Yes	Auto-derived	Local cache IP. Automat derived fro `apt_cache_` host if not specified.
`apt_repo.apt_repo_username`	String	No	-	Not require using cache auth neede
`apt_repo.apt_repo_password`	String	No	-	Not require using cache auth neede

Cache Server Sync (`remote_apt_*`)

These variables configure how the cache server syncs content from Omnitouch:

Parameter	Type	Required	Default	Description
`remote_apt_server`	String	Yes	-	Omnitouch APT server to sync from
`remote_apt_port`	Integer	No	`80`	Omnitouch APT server port
`remote_apt_protocol`	String	No	`http`	Protocol for sync connection
`remote_apt_user`	String	Yes	-	Credentials for syncing from Omnitouch
`remote_apt_password`	String	Yes	-	Credentials for syncing from Omnitouch

General

Parameter	Type	Required	Default	Description
`use_apt_cache`	Boolean	No	`true`	Automatically set to `true` when `apt_cache_servers` group exists
`apt_cache_port`	Integer	No	`8080`	Port the local cache server listens on

URL Patterns (Cache Mode)

APT Package Sources (configured in `/etc/apt/sources.list`):

```
deb [trusted=yes] http://192.168.1.100:8080/noble noble main
```

Binary Downloads (used by Ansible `get_url` tasks):

```
http://192.168.1.100:8080/releases/prometheus/node_exporter/node_expo
1.8.1.linux-amd64.tar.gz
```

No credentials required for cache access—it uses `[trusted=yes]` APT configuration.

Deploying the Cache

1. **Provision the cache server** (VM or LXC container with 50+ GB disk)
2. **Run the cache setup playbook:**

   ```
   ansible-playbook -i hosts/customer/production.yml
   services/apt_cache.yml
   ```

3. **Verify the cache** by browsing to `http://192.168.1.100:8080/`

What Gets Synced

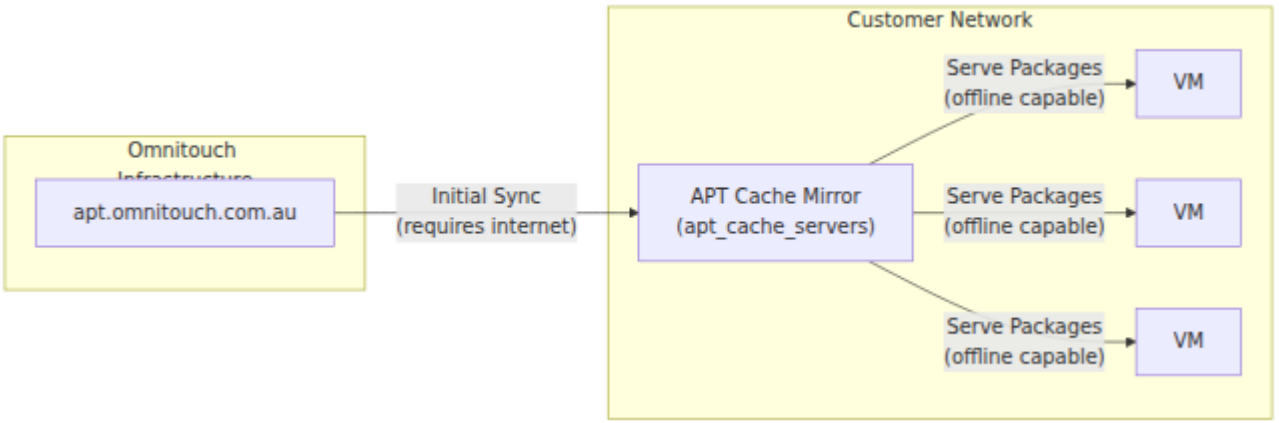
The cache mirror syncs **all content** from the Omnitouch APT server using recursive wget download:

Content directories synced:

Path	Content
`/dists/<distro>/`	APT repository metadata (Packages, Release files)
`/pool/main/`	Omnitouch custom .deb packages
`/<distro>/pool/main/`	Ubuntu packages and all dependencies
`/releases/`	GitHub releases (Prometheus, Grafana, Zabbix, etc.)
`/repos/`	Source tarballs (Erlang, Elixir, CGrateS_UI, etc.)

After initial sync, the cache can serve all packages without internet connectivity.

How It Works



The cache mirror uses `wget --recursive` with HTTP Basic Auth to download all content from the Omnitouch APT server. Subsequent syncs only download new/changed files (timestamping).

Automatic Configuration

When an `apt_cache_servers` group exists in your inventory, the system automatically:

1. Sets `use_apt_cache: true` for all hosts (unless explicitly overridden)
2. Derives `apt_repo.apt_server` from the first cache server's `ansible_host` IP

Minimal Configuration Example

```yaml
apt_cache_servers:
  hosts:
    apt-cache-01:
      ansible_host: 192.168.1.100
      gateway: 192.168.1.1
  vars:
    # Cache server syncs content from Omnitouch repository
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_user: "your-username"
    remote_apt_password: "your-password"
```

What happens automatically:

- All hosts (except cache server) get `use_apt_cache: true`
- All hosts (except cache server) get `apt_repo.apt_server: "192.168.1.100"`
- All hosts pull from `http://192.168.1.100:8080/` without credentials
- Cache server syncs packages from `http://your-username:your-password@apt.omnitouch.com.au/`

Override Automatic Behavior

To force direct access even with cache servers defined:

```yaml
all:
  vars:
    use_apt_cache: false  # Force direct access even with cache
servers defined

    apt_repo:
      apt_server: "apt.omnitouch.com.au"
      apt_repo_username: "user"
      apt_repo_password: "pass"

    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_user: "user"
    remote_apt_password: "pass"
```

Configuration Summary

Scenario 1: Direct Access to APT Server (No Cache)

All hosts pull packages directly from the APT repository server.

```yaml
all:
  vars:
    use_apt_cache: false

    # APT package sources - used by all hosts
    apt_repo:
      apt_server: "apt.omnitouch.com.au"
      apt_repo_username: "user"
      apt_repo_password: "pass"

    # Binary downloads - used by all hosts
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_port: 80
    remote_apt_protocol: "http"
    remote_apt_user: "user"
    remote_apt_password: "pass"
```

Result: All hosts generate `deb [trusted=yes] http://user:pass@apt.omnitouch.com.au/ noble main`

Scenario 2: APT Cache Server Defined in Hosts File (Automatic)

Cache server is in your inventory and will be deployed/synced by Ansible.

```
apt_cache_servers:
  hosts:
    cache-server:
      ansible_host: 192.168.1.100
      gateway: 192.168.1.1
  vars:
    # Cache server syncs packages from authenticated repository
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_port: 80
    remote_apt_protocol: "http"
    remote_apt_user: "user"
    remote_apt_password: "pass"

# No configuration needed in all: vars:
# Everything auto-derived from apt_cache_servers group
```

Result:

- **Cache server**: Syncs from `http://user:pass@apt.omnitouch.com.au:80/`
- **All other hosts**: Generate `deb [trusted=yes] http://192.168.1.100:8080/noble noble main` (no credentials)

Scenario 3: Remote APT Cache NOT in Hosts File (Manual)

Cache server exists elsewhere and is already set up (not managed by your Ansible).

```yaml
all:
  vars:
    use_apt_cache: true

    # Point all hosts to the external cache server
    apt_repo:
      apt_server: "192.168.1.100"  # IP of external cache server
      apt_repo_port: 8080           # Cache typically runs on port
8080

# No apt_cache_servers group needed
# No remote_apt_* needed (cache is already set up externally)
```

Result: All hosts generate `deb [trusted=yes] http://192.168.1.100:8080/noble noble main` (no credentials)

Complete Example

Here's a complete working example showing cache server configuration with multiple application hosts:

```yaml
# APT Cache Server Group
apt_cache_servers:
  hosts:
    customer-apt-cache:
      ansible_host: 10.179.1.114
      gateway: 10.179.1.1
      host_vm_network: "vmbr0"
      num_cpus: 4
      memory_mb: 16384
      proxmoxLxcDiskSizeGb: 120
  vars:
    # Cache server syncs packages from authenticated repository
    remote_apt_server: "apt.omnitouch.com.au"
    remote_apt_port: 80
    remote_apt_protocol: "http"
    remote_apt_user: "customer-username"
    remote_apt_password: "customer-secure-token"

# Application Servers
hss:
  hosts:
    customer-hss01:
      ansible_host: 10.179.2.140
      gateway: 10.179.2.1

mme:
  hosts:
    customer-mme01:
      ansible_host: 10.179.1.15
      gateway: 10.179.1.1

dns:
  hosts:
    customer-dns01:
      ansible_host: 10.179.2.177
      gateway: 10.179.2.1

# Global Configuration
all:
  vars:
    # Auto-configuration (no manual config needed):
    # - use_apt_cache: true (auto-enabled when apt_cache_servers
exists)
```

```
    # - apt_repo.apt_server: "10.179.1.114" (auto-derived from
cache server)
```

What happens during deployment:

1. **Cache server (`10.179.1.114`):**
   - Uses `remote_apt_*` from its `vars:` section
   - Downloads all packages from `http://customer-username:customer-secure-token@apt.omnitouch.com.au:80/`
   - Serves packages on port 8080 via nginx
2. **Application hosts (`customer-hss01`, `customer-mme01`, `customer-dns01`):**
   - Auto-detect `apt_cache_servers` group exists
   - Auto-set `use_apt_cache: true`
   - Auto-derive `apt_repo.apt_server: "10.179.1.114"`
   - Generate: `deb [trusted=yes] http://10.179.1.114:8080/noble noble main`
   - Pull all packages from cache server (no credentials required)

Updating the Cache

To sync new packages or updates:

```
ansible-playbook -i hosts/customer/production.yml
services/apt_cache.yml
```

This incrementally syncs all content from the Omnitouch APT server:

- New Omnitouch package versions
- New Ubuntu packages and dependencies
- New GitHub releases
- Updated source tarballs

The sync uses `wget --timestamping`, so existing unchanged files are skipped, making re-sync fast.

Note: The Omnitouch APT server (`apt.omnitouch.com.au`) is the single source of truth for all packages. Run `services/apt.yml` on the apt server first to build/update packages, then run `services/apt_cache.yml` on cache mirrors to sync.

Troubleshooting

APT Update Fails with 401 Unauthorized

Symptoms:

```
Failed to fetch
http://10.179.1.115:80/noble/dists/noble/main/binary-
amd64/Packages  401  Unauthorized
```

Possible causes:

- `apt_repo` configuration defined in `all: vars:` instead of `apt_cache_servers: vars:`
- Hosts trying to access authenticated repository directly instead of cache
- Incorrect `apt_repo_username` or `apt_repo_password`
- Source IP not whitelisted on Omnitouch APT server
- Using cache credentials for direct access or vice versa

Resolution:

1. **Check configuration scope**: Ensure `apt_repo` with credentials is defined in `apt_cache_servers: vars:`, NOT in `all: vars:`
2. **Verify cache mode**: When using cache, hosts should connect to cache server (port 8080), not repository (port 80)
3. **Check generated sources**: On failing host, check `/etc/apt/sources.list.d/omnitouch.list`

    - **Correct (cache mode)**: `deb [trusted=yes] http://10.179.1.114:8080/noble noble main`
    - **Incorrect (has credentials in wrong place)**: `deb [trusted=yes] http://user:pass@10.179.1.115:80/noble noble main`
4. Verify credentials are correct for your deployment mode
5. Confirm your public IP is whitelisted with Omnitouch (if using direct access)

Binary Downloads Fail (Node Exporter, Zabbix, etc.)

Symptoms: Ansible playbook fails downloading files from `/releases/` path

Possible causes:

- `remote_apt_*` variables not configured
- Incorrect `remote_apt_user` or `remote_apt_password`
- Missing `remote_apt_server` when `use_apt_cache: false`

Resolution:

1. Ensure all `remote_apt_*` variables are defined
2. Verify credentials match those provided by Omnitouch
3. Check that `remote_apt_server` points to correct host

Cache Server Cannot Sync

Symptoms: Cache server playbook fails to download packages

Possible causes:

- Cache server has no internet access
- `remote_apt_*` credentials incorrect
- Firewall blocking outbound connections to Omnitouch

Resolution:

1. Verify cache server can reach `apt.omnitouch.com.au` on port 80

2. Check `remote_apt_*` credentials
3. Review firewall rules for outbound access

Related Documentation

- Hosts File Configuration — Inventory and variable configuration
- Configuration Reference — Complete parameter reference
- Deployment Architecture — Overall system architecture
- Proxmox Deployment — Deploying cache server as LXC container

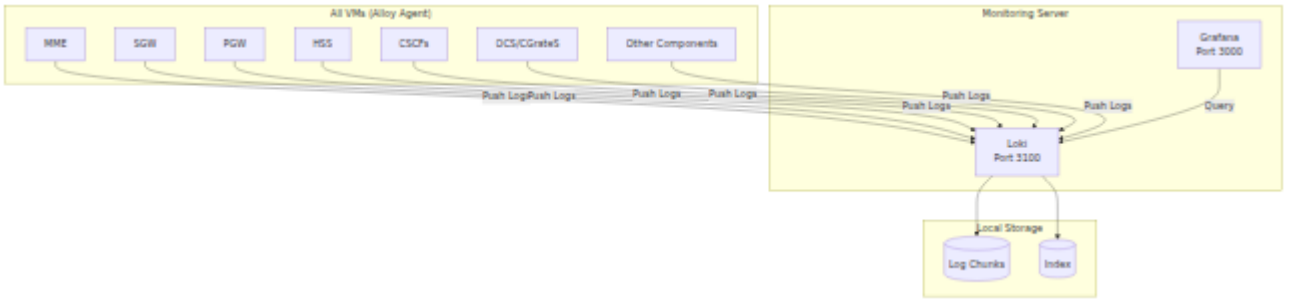
Centralized Logging

Overview

OmniCore includes a centralized logging system that collects logs from all components and makes them searchable through Grafana. The system uses:

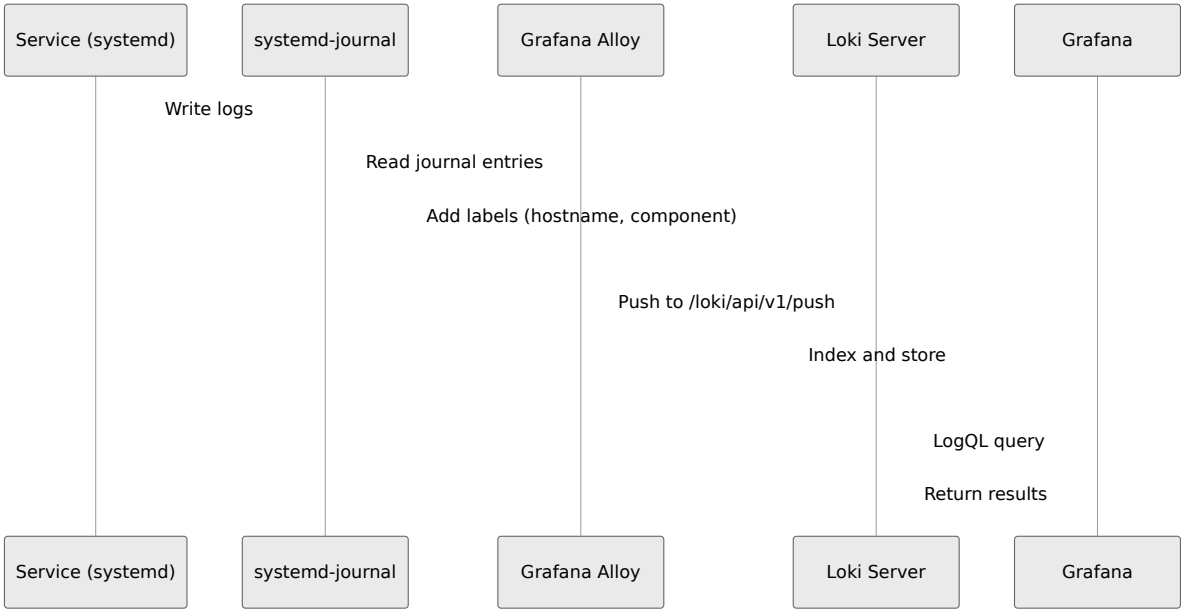
- **Grafana Alloy** — Log collection agent deployed on all VMs
- **Grafana Loki** — Log aggregation and storage server on monitoring hosts
- **Grafana Dashboards** — Pre-built dashboards for each component type

Architecture



How It Works

Log Collection Flow



Component Labels

Each log entry is automatically labeled based on the host's inventory group membership:

Inventory Group	Component Label	Services Collected
`mme`	`mme`	omnimme, open5gs
`sgw`	`sgw`	omnisgwc, open5gs
`pgw`	`pgw`	omnipgwc, open5gs
`upf`	`upf`	omniupf, frr
`hss`	`hss`	omnihss, pyhss, mysql
`dra`	`dra`	omnidra, freediam
`pcscf`, `scscf`, `icscf`	`cscf`	kamailio, rtpengine
`applicationserver`	`applicationserver`	freeswitch, omnitas
`ocs`	`ocs`	cgrates, ocs, pcef, keydb
`cgrates`	`cgrates`	cgrates, mysql
`omnimessage`	`omnimessage`	omnimessage, kamailio
`dns`	`dns`	named, bind
`omnicrm`	`omnicrm`	omnicrm, nginx, mysql
`monitoring`	`monitoring`	prometheus, grafana, loki, nginx

Log Labels

Every log entry includes these labels for filtering and querying:

Label	Description	Example
`job`	Hostname of the source VM	`customer-mme01`
`hostname`	Same as job (for compatibility)	`customer-mme01`
`component`	Component type from inventory group	`mme`, `cscf`, `ocs`
`unit`	systemd unit name	`omnimme.service`
`level`	Log severity	`info`, `warning`, `error`
`service`	Syslog identifier	`omnimme`

Configuration

Automatic Deployment

Logging is automatically configured when:

1. A `monitoring` group exists in your inventory
2. The common role runs on target hosts

No additional configuration is required for basic functionality.

Inventory Requirements

```
monitoring:
  hosts:
    customer-monitoring01:
      ansible_host: 10.10.2.200
      gateway: 10.10.2.1
```

When the `monitoring` group is defined:

- **Monitoring hosts**: Run Loki server (receives and stores logs)
- **All other hosts**: Run Alloy agent (collects and sends logs)

Retention Configuration

Loki is configured with dual retention limits:

Setting	Default	Description
Time-based retention	7 days	Logs older than 7 days are deleted
Size-based retention	50 GB	Oldest logs deleted when storage exceeds 50 GB

Whichever limit is reached first triggers log deletion.

To customize retention, override these variables in your inventory:

```yaml
all:
  vars:
    loki_retention_period: "168h"  # 7 days in hours
```

Alloy Buffer Configuration

Alloy buffers logs locally when Loki is unreachable. The buffer is limited to prevent disk exhaustion:

Setting	Default	Description
WAL max size	500 MB	Maximum disk space for buffered logs
WAL max segment age	1 hour	Oldest buffered logs dropped after 1 hour

When the buffer fills, oldest logs are dropped to make room for new entries.

Grafana Dashboards

Pre-built dashboards are automatically provisioned for each component type.

Available Dashboards

Dashboard	Location	Description
CSCF Logs	Logs → CSCF Logs	P-CSCF, S-CSCF, I-CSCF (Kamailio) logs
MME Logs	Logs → MME Logs	MME attach/detach events and errors
SGW Logs	Logs → SGW Logs	SGW session and bearer events
PGW Logs	Logs → PGW Logs	PGW PDN and session events
HSS Logs	Logs → HSS Logs	HSS Diameter messages and auth events
OmniMessage Logs	Logs → OmniMessage Logs	SMS delivery and SMPP events
OCS/CGrateS Logs	Logs → OCS/CGrateS Logs	Charging events and JSONRPC traffic
CGrateS RPC Calls	Logs → CGrateS RPC Calls	Search and correlate RPC requests/responses with latency

Dashboard Features

Each dashboard includes:

- **Search box** — Free-text search across all logs
- **Log rate graphs** — Volume over time by host and severity
- **Component sections** — Grouped views (e.g., P-CSCF, S-CSCF, I-CSCF)
- **Error filtering** — Pre-filtered views for errors and failures
- **Live tail** — Real-time log streaming (10-second refresh)

Using the Dashboards

1. Navigate to Grafana (typically `http://<monitoring-host>:3000`)
2. Go to **Dashboards** → **Logs** → select component
3. Use the **Search** variable to filter logs
4. Adjust time range as needed

Querying Logs

LogQL Basics

Loki uses LogQL for querying. Basic syntax:

```
{label="value"} |= "search string"
```

Common Queries

All logs from a specific host:

```
{hostname="customer-mme01"}
```

All MME component logs:

```
{component="mme"}
```

Search for errors across all CSCFs:

```
{component="cscf"} |~ "(?i)error"
```

Filter by systemd unit:

```
{unit="kamailio.service"}
```

Combine filters:

```
{component="hss", hostname="customer-hss01"} |= "ULR" |=
"DIAMETER_SUCCESS"
```

Log Rate Queries

Log volume per component:

```
sum by (component) (rate({job=~".+"} [5m]))
```

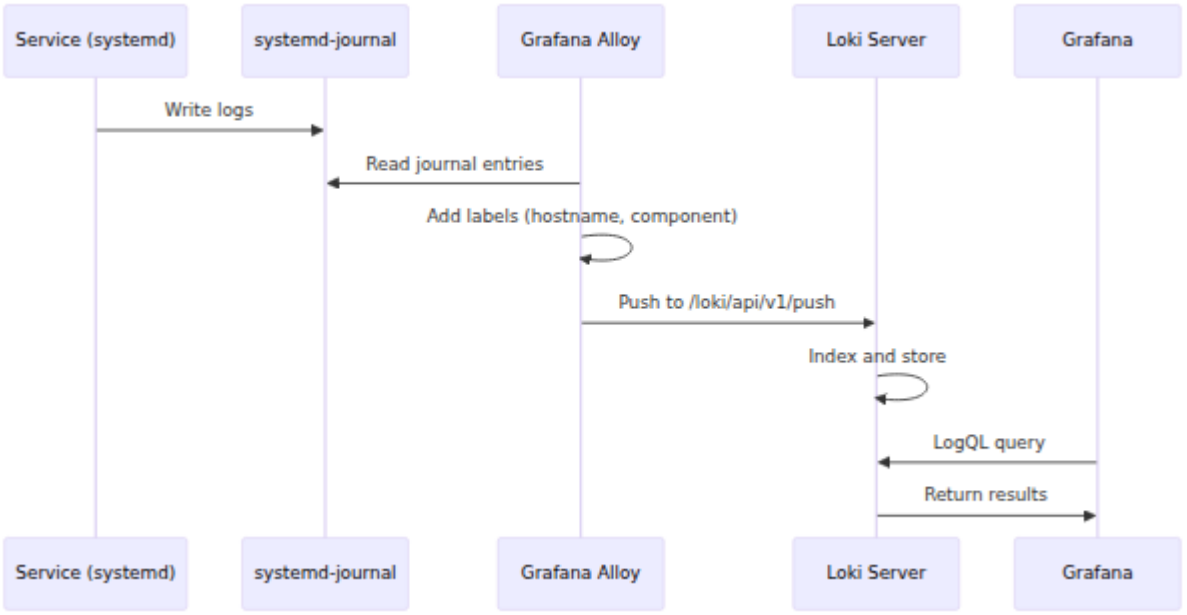
Error rate for CSCF:

```
sum(rate({component="cscf"} |~ "(?i)error" [5m]))
```

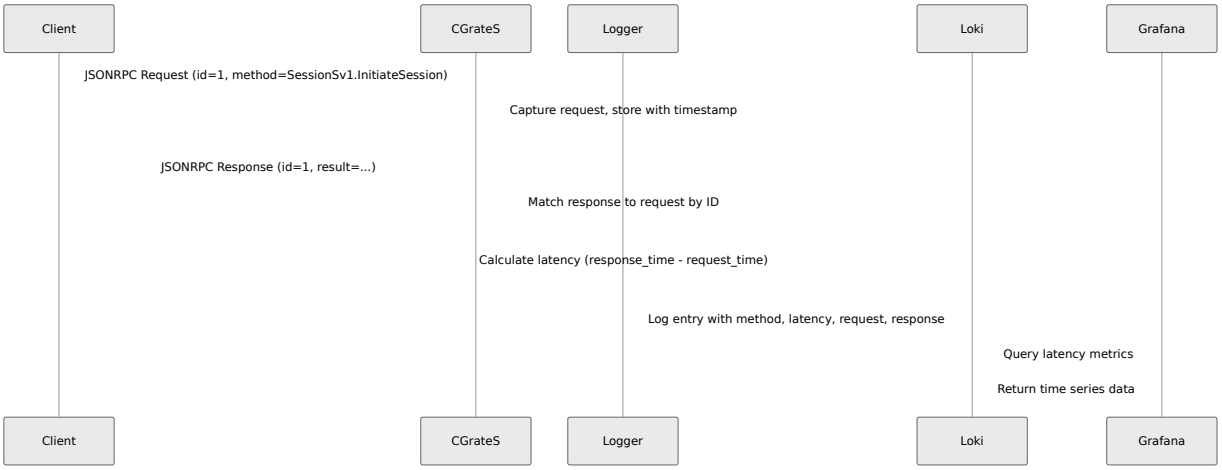
CGrateS JSONRPC Logging

For OCS/CGrateS deployments, JSONRPC traffic is captured and logged with request/response correlation and latency tracking for performance analysis and debugging.

Architecture



Request/Response Flow



What Gets Captured

Traffic on these CGrateS ports is captured:

Port	Service Name	Protocol	Description
2012	`rpc_json`	TCP	Raw JSONRPC over TCP
2080	`http`	HTTP	HTTP API (filters out `/metrics` and `/health`)

The logger automatically filters out:

- Prometheus metrics scrapes (`GET /metrics`)
- Health check requests (`GET /health`)
- Gzip-compressed responses (binary data)

Log Format

JSONRPC logs are written to `/var/log/cgrates/jsonrpc.log`. Each log entry represents a **completed request/response pair** with latency measurement:

```
2026-03-01T10:30:45.123456 port=2012 service=rpc_json request_id=1
method=SessionSv1.InitiateSession latency_ms=2.45 status=ok error=
src=10.10.1.50:45678 dst=10.10.2.100:2012 request=
{"id":1,"method":"SessionSv1.InitiateSession",...} response=
{"id":1,"result":{...}}
```

Log Fields

Field	Description	Example
`timestamp`	ISO 8601 timestamp when response was received	`2026-03-01T10:30:45.123456`
`port`	CGrateS port the request was made to	`2012`, `2080`
`service`	Service name for the port	`rpc_json`, `http`
`request_id`	JSONRPC request ID for correlation	`1`, `42`, (empty for null)
`method`	JSONRPC method name	`SessionSv1.InitiateSession`
`latency_ms`	Round-trip latency in milliseconds	`2.45`
`status`	Result status	`ok`, `error`
`error`	Error message if status is error	`INSUFFICIENT_CREDIT`
`src`	Source IP:port (client)	`10.10.1.50:45678`
`dst`	Destination IP:port (CGrateS)	`10.10.2.100:2012`
`request`	Full JSONRPC request payload (compacted JSON)	`{"id":1,"method":"..."}`
`response`	Full JSONRPC response payload (compacted JSON)	`{"id":1,"result":{...}}`

Grafana Dashboard

The **OCS / CGrateS Logs** dashboard includes dedicated panels for JSONRPC analysis.

JSONRPC Latency by Method

A time series graph showing latency for each JSONRPC method over time. Useful for identifying:

- Slow methods that may need optimization
- Latency spikes indicating system issues
- Performance trends over time

The legend displays mean and max latency per method.

JSONRPC Traffic

A logs panel showing all JSONRPC request/response pairs with:

- Timestamp
- Method name
- Latency
- Full request and response payloads (prettified)

Method Drill-down

Filter JSONRPC traffic by a specific method using the **Method** variable at the top of the dashboard. Enter the method name (e.g., `SessionSv1.InitiateSession`) to see only traffic for that method.

CGrateS RPC Calls Dashboard

The dedicated **CGrateS RPC Calls** dashboard provides focused tools for troubleshooting API calls and correlating requests with responses.

Use Case: Finding a Failed Call

When a user reports "I tried to call 1234 and it failed":

1. Open **Dashboards → Logs → CGrateS RPC Calls**
2. In the **Search** field, enter the phone number or account ID: `1234`
3. Set **Status** to **Error** to see only failed calls
4. The **RPC Call Search** panel shows all matching calls with full request/response

Each log entry shows the complete request payload (what was sent) and response payload (what CGrateS returned), making it easy to identify the exact error.

Dashboard Variables

Variable	Purpose	Example
Search	Free-text search in request/response payloads	`1234`, `Account123`, `INSUFFICIENT_CREDIT`
Method	Filter by RPC method name	`SessionSv1.InitiateSession`, `CDRsV1.ProcessEvent`
Status	Filter by result status	All, Success, Error

Dashboard Panels

Summary Stats (top row):

- **Total RPC Calls** — Count of all calls in the time range
- **Errors** — Count of failed calls (color-coded: green=0, yellow=1-9, red=10+)
- **Avg Latency** — Average round-trip time (color-coded thresholds)
- **Max Latency** — Highest latency call

RPC Latency by Method: Time series showing latency for each method. Hover to see specific values.

RPC Call Search: Main log panel showing matched calls. Click any entry to expand and see full request/response JSON.

Failed RPC Calls: Pre-filtered view showing only `status=error` calls.

Method Breakdown: Pie charts showing call distribution and error distribution by method.

Querying JSONRPC Logs

Basic Queries

All JSONRPC traffic:

```
{job="cgrates-jsonrpc"}
```

Filter by method:

```
{job="cgrates-jsonrpc"} |= "method=SessionSv1.InitiateSession"
```

Search request/response payloads:

```
{job="cgrates-jsonrpc"} |= "Account\":\"12345"
```

Errors only:

```
{job="cgrates-jsonrpc"} |= "status=error"
```

Latency Analysis

Extract latency as metric (for graphs):

```
max_over_time(
  {job="cgrates-jsonrpc"}
  |= "method="
  | regexp "method=(?P<method>[^ ]+) latency_ms=(?P<latency>[0-
9.]+)"
  | __error__=""
  | unwrap latency [$__auto]
) by (method)
```

Find slow requests (latency > 100ms):

```
{job="cgrates-jsonrpc"}
| regexp "latency_ms=(?P<latency>[0-9.]+)"
| latency > 100
```

Method-Specific Queries

CDR processing:

```
{job="cgrates-jsonrpc"} |= "method=CDRsV1"
```

Session management:

```
{job="cgrates-jsonrpc"} |~ "method=SessionSv1"
```

Account operations:

```
{job="cgrates-jsonrpc"} |~ "method=ApierV"
```

Service Management

The JSONRPC logger runs as a systemd service on OCS/CGrateS hosts.

Check service status:

```
systemctl status cgrates-jsonrpc-logger
```

View service logs:

```
journalctl -u cgrates-jsonrpc-logger -f
```

Restart the service:

```
systemctl restart cgrates-jsonrpc-logger
```

Troubleshooting

No JSONRPC Logs Appearing

Symptoms: JSONRPC Traffic panel shows no data

Possible causes:

- Logger service not running
- ngrep not installed
- Network interface mismatch
- Alloy not collecting the log file

Resolution:

1. Check logger service status:
   ```
   systemctl status cgrates-jsonrpc-logger
   journalctl -u cgrates-jsonrpc-logger -n 50
   ```
2. Verify ngrep is installed:
   ```
   which ngrep
   ```
3. Check log file is being written:

```
tail -f /var/log/cgrates/jsonrpc.log
```

4. Verify Alloy is collecting the file:

```
journalctl -u alloy | grep jsonrpc
```

Latency Graph Shows No Data

Symptoms: JSONRPC Latency by Method panel shows "No data"

Possible causes:

- No JSONRPC traffic in the selected time range
- Log format mismatch (regex not matching)

Resolution:

1. Verify logs exist for the time range:

```
{job="cgrates-jsonrpc"} |= "method="
```

2. Check that `latency_ms` field is present in logs
3. Expand the time range

High Pending Request Count

Symptoms: Debug logs show many stored requests but few logged completions

Possible causes:

- Requests without responses (client disconnected)
- Response captured before request (packet ordering)
- Request ID mismatch between request and response

Resolution:

1. The logger automatically cleans up pending requests older than 60 seconds
2. Check for network issues between client and CGrateS

3. Verify CGrateS is responding to requests

File Logs

In addition to systemd journal logs, Alloy collects specific log files:

FreeSWITCH Logs (Application Servers)

Path	Job Label
`/var/log/freeswitch/*.log`	`freeswitch`

Nginx Logs (OmniCRM)

Path	Job Label	Type Label
`/var/log/nginx/access.log`	`nginx`	`access`
`/var/log/nginx/error.log`	`nginx`	`error`

CGrateS JSONRPC (OCS)

Path	Job Label
`/var/log/cgrates/jsonrpc.log`	`cgrates-jsonrpc`

Troubleshooting

Logs Not Appearing in Grafana

Symptoms: No logs visible in Loki dashboards

Possible causes:

- Alloy service not running on source host
- Loki service not running on monitoring host
- Network connectivity between hosts blocked
- Alloy cannot reach Loki on port 3100

Resolution:

1. Check Alloy status on source host:

   ```
   systemctl status alloy
   journalctl -u alloy -f
   ```

2. Check Loki status on monitoring host:

   ```
   systemctl status loki
   journalctl -u loki -f
   ```

3. Test connectivity from source to monitoring:

   ```
   curl http://<monitoring-ip>:3100/ready
   ```

4. Verify firewall allows TCP 3100 from all hosts to monitoring

Alloy High Disk Usage

Symptoms: `/var/lib/alloy` consuming significant disk space

Possible causes:

- Loki unreachable for extended period

- WAL buffer filling up

Resolution:

1. Check Loki connectivity (see above)
2. If Loki is down, logs buffer locally up to 500 MB
3. Once Loki is reachable, buffered logs are sent automatically
4. If buffer is full, oldest logs are dropped (by design)

Loki Storage Full

Symptoms: Loki stops accepting logs, disk full on monitoring server

Possible causes:

- Log volume exceeds 50 GB retention limit
- Retention compaction not running

Resolution:

1. Check Loki storage usage:
   ```
   du -sh /var/lib/loki/
   ```
2. Verify compactor is running (check Loki logs)
3. Manually trigger compaction if needed by restarting Loki
4. Consider increasing disk allocation or reducing retention period

Missing Component Labels

Symptoms: Logs appear but `component` label is `infrastructure` instead of expected value

Possible causes:

- Host not in expected inventory group
- Alloy config not regenerated after inventory change

Resolution:

1. Verify host is in correct inventory group
2. Re-run Ansible to regenerate Alloy config:

```
ansible-playbook -i hosts/customer/hosts.yml services/all.yml -
-limit <hostname>
```

3. Restart Alloy:

```
systemctl restart alloy
```

Service Ports

Service	Port	Protocol	Description
Loki	3100	HTTP	Log ingestion and query API
Loki	9096	gRPC	Internal gRPC (not used externally)
Alloy	12345	HTTP	Alloy metrics and UI
Grafana	3000	HTTP	Dashboard access

Related Documentation

- Monitoring & Observability — Grafana, Prometheus, dashboards, and alerting
- Deployment Architecture — Overall system architecture
- Hosts File Configuration — Inventory configuration
- Configuration Reference — Complete parameter reference

Configuration Reference

Overview

This document provides a comprehensive reference for configuring OmniCore deployments through hosts files. Configuration is primarily defined in host inventory files with minimal group_vars overrides needed for modern deployments.

For product-specific documentation, see:

- **OmniCore**: https://docs.omnitouch.com.au/docs/repos/OmniCore
- **OmniCall**: https://docs.omnitouch.com.au/docs/repos/OmniCall
- **OmniCharge**: https://docs.omnitouch.com.au/docs/repos/OmniCharge

Configuration Approach

Modern OmniCore deployments use a simplified configuration model:

Key Principle: Most configuration is defined directly in the hosts file. Role defaults handle the majority of settings, with group_vars used only for specific customizations.

Network Planning

Before configuring hosts, review the IP Planning Standard for guidance on:

- Network segmentation strategies
- IP address allocation

- Subnet organization
- Public IP handling

Common Host Parameters

#ToDo - Just say to check hosts-file-configuration.md for this

Service-Specific Flags

```
cdrs_enabled: True                # Enable CDR generation
in_pool: False                    # Exclude from load balancing
pool
online_charging_enabled: False    # Enable OCS integration
recording: True                   # Enable call recording (AS)
populate_crm: False               # Populate CRM with initial data
```

Global Variables (all:vars)

The `all:vars` section contains deployment-wide settings. Modern deployments use minimal global variables with most configuration in role defaults.

Essential Global Variables

Authentication & Access

```
ansible_connection: ssh
ansible_user: root
ansible_password: password
ansible_become_password: password
```

Alternative: Use SSH keys instead of passwords:

```
ansible_ssh_private_key_file: '/path/to/key.pem'
```

Customer Identity

```
customer_name_short: omnitouch
customer_legal_name: "YKTN Lab"
site_name: YKTN
region: AU
TZ: Australia/Melbourne
```

PLMN Configuration

```
plmn_id:
  mcc: '001'               # Mobile Country Code (3 digits)
  mnc: '01'               # Mobile Network Code (2-3 digits)
  mnc_longform: '001'     # Zero-padded MNC (always 3 digits)

diameter_realm: epc.mnc{{ plmn_id.mnc_longform }}.mcc{{
plmn_id.mcc }}.3gppnetwork.org
```

Purpose: Uniquely identifies your mobile network. Used for Diameter realm construction.

Network Names

```
network_name_short: Omni
network_name_long: Omnitouch
tac_list: [10100,100]           # Default TAC list (can override
per-MME)
```

Displayed: Network names shown on UE devices in Settings > Mobile Network.

DNS Configuration

```
netplan_DNS: False              # Use systemd-resolved instead of
netplan DNS
manage_resolv_conf: True        # Set to False to prevent Ansible
from managing /etc/resolv.conf
```

Note: When `manage_resolv_conf` is set to `False`, Ansible will not overwrite `/etc/resolv.conf` on that host. This is useful for hosts that require custom DNS configuration or are managed by external systems. Can be set per-host in the inventory or globally in `all:vars`.

APT Repository Configuration

Automatic Defaults: When an `apt_cache_servers` group is defined with hosts:

- `use_apt_cache` automatically defaults to `True` (unless explicitly set to `False`)
- `apt_repo.apt_server` automatically defaults to the first cache server's IP

```
# Manual configuration (optional if apt_cache_servers group
exists)
use_apt_cache: True              # Use local APT cache vs direct
repo access

apt_repo:
  apt_server: "10.10.1.114"      # APT cache server or repo server
  # Credentials only needed when use_apt_cache: False
  # apt_repo_username: "omni"
  # apt_repo_password: "omni"

# Binary downloads and cache sync configuration
# Used for: (1) downloading binaries from /releases/ when
use_apt_cache: false
#           (2) cache server syncing from Omnitouch when
use_apt_cache: true
remote_apt_server: "apt.omnitouch.com.au"
remote_apt_user: "omni"
remote_apt_password: "omni"
```

See: APT Cache System

License Server

```
license_server_api_urls: ["https://10.10.2.150:8443/api"]
license_enforced: true
```

See: License Server

MME Settings

```
mme_dns: False                    # Enable MME DNS resolution
```

SAEGW Settings

```
mtu: 1400                         # Maximum Transmission Unit
```

IMS Settings

```
ims_dra_support: False            # Route IMS through DRA
enable_homer: False               # Enable Homer SIP capture
```

RAN Monitor Configuration

```
use_nokia_monitor: True
use_casa_monitor: True
install_influxdb: True

influxdb_user: monitor
influxdb_password: "secure-password"
influxdb_organisation_name: omnitouch
influxdb_nokia_bucket_name: nokia-monitor
influxdb_casa_bucket_name: casa-monitor
influxdb_operator_token: "generated-token"
influxdb_url: http://127.0.0.1:8086

enable_pm_collection: False
enable_alarm_collection: False
enable_location_collection: False
enable_ran_status_collection: True
enable_nokia_rectifier_collection: False
collection_interval_in_seconds: 120

ran_monitor:
  sql:
    user: ran_monitor
    password: "secure-password"
    database_host: 127.0.0.1
    database_name: ran_monitor
  influxdb:
    address: 10.10.2.135
    port: 8086
  nokia:
    airscales:
    - address: 10.7.15.66
      name: site-Lab-Airscale
      port: 8080
      web_password: nemuuser
      web_username: Nemuadmin
```

Firewall Configuration

```yaml
firewall:
  allowed_ssh_subnets:
    - '10.0.1.0/24'
    - '10.0.0.0/24'
  allowed_ue_voice_subnets:
    - '10.0.1.0/24'
  allowed_carrier_voice_subnets:
    - '10.0.1.0/24'
  allowed_signaling_subnets:
    - '10.0.1.0/24'
```

Roaming DNS Servers

```yaml
roaming_dns_servers:
  wildcard: ['10.0.99.1']
  # Carrier-specific DNS (PLMN-based)
  123456:                          # Example Carrier 1
    - '10.10.2.197'
  654321:                          # Example Carrier 2
    - '10.10.0.4'
```

Local Users (SSH Keys)

```yaml
local_users:
  usera:
    name: Example User A
    public_key: "ssh-rsa AAAAB3Nza..."
  userb:
    name: Example User B
    public_key: "ssh-ed25519 AAAAC3..."
```

Hypervisor Configuration

Proxmox

```yaml
proxmoxServers:
  customer-prxmx01:
    proxmoxServerAddress: 10.10.0.100
    proxmoxServerPort: 8006
    proxmoxRootPassword: password
    proxmoxApiTokenName: AnsibleToken
    proxmoxApiTokenSecret: "token-secret"
    proxmoxTemplateName: ubuntu-24.04-cloud-init-template
    proxmoxTemplateId: 9000
    proxmoxNodeName: pve01

# Default Proxmox settings
proxmoxServerAddress: 10.10.0.100
proxmoxServerPort: 8006
proxmoxNodeName: 'pve01'
proxmoxLxcOsTemplate: 'local:vztmpl/ubuntu-24.04-standard_24.04-2_amd64.tar.zst'
proxmoxApiTokenName: DocsTest
proxmoxLxcCores: 8
proxmoxLxcDiskSizeGb: 20
proxmoxLxcMemoryMb: 64000
proxmoxLxcRootFsStorageName: SSD_RAID0
proxmoxLxcBridgeName: vmbr0
proxmoxTemplateName: "ubuntu-24.04-cloud-init-template"
proxmoxStorage: SSD_RAID0
vLabNetmask: 24
PROXMOX_API_TOKEN: "token-secret"
vlabRootPassword: password
vLabPublicKey: "ssh-rsa AAAAB3..."
mask_cidr: 24
```

VMware vCenter

```yaml
vcenter_ip: "vcenter.example.com"
vcenter_username: "administrator@vsphere.local"
vcenter_password: "password"
vcenter_datacenter: "DC1"
vcenter_vm_template: ubuntu-24.04-model
vcenter_vm_disk_size: 50
vcenter_folder: "Omnicore"
host_vm_network: "Management"

vhosts:
  "10.0.0.23":
    vcenter_cluster_ip: 10.0.0.23
    vcenter_datastore: "datastore1 (3)"

netmask: 255.255.255.0
```

Related Documentation

- IP Planning Standard - Network architecture and IP allocation guidelines
- Hosts File Configuration - How to structure hosts files
- Group Variables Configuration - When and how to use group_vars
- Netplan Configuration - Secondary IPs and multi-NIC setup
- Deployment Architecture - How components interact
- APT Cache System - Package management
- License Server - License configuration

Product Documentation

For detailed operational guides and advanced configuration:

- **OmniCore Components**: https://docs.omnitouch.com.au/docs/repos/OmniCore

- **OmniCall Components**: https://docs.omnitouch.com.au/docs/repos/OmniCall
- **OmniCharge/OmniCRM**: https://docs.omnitouch.com.au/docs/repos/OmniCharge

Deployment Architecture Overview

Overview

This document provides a complete view of how Omnitouch Network Services' cellular network software is deployed using Ansible, showing how all components fit together to create a working 4G/5G network.

See the IP Planning Standard for detailed component placement, IP address assignment guidelines, and public IP handling.

Complete Deployment Example

0. Infrastructure Provisioning (Optional)

For Proxmox deployments, provision VMs/LXCs before configuration:

```
# Deploy VMs on Proxmox
ansible-playbook -i hosts/Customer/hosts.yml
util_playbooks/proxmox.yml

# Or deploy LXC containers (lab/test only)
ansible-playbook -i hosts/Customer/hosts.yml
util_playbooks/proxmox_lxc.yml
```

See: Proxmox VM/LXC Deployment

1. Infrastructure Definition (Hosts File)

```yaml
# Define what to deploy and where
mme:
  hosts:
    customer-mme01:
      ansible_host: 10.10.1.15

hss:
  hosts:
    customer-hss01:
      ansible_host: 10.10.2.140

# ... all other components
```

See: Hosts File Configuration

2. Customization (group_vars)

The `group_vars` folder is where we can store any config overrides needed at a host, site or network level.

For example you'd have a folder with your OmniMessage SMSc config, the SIP trunks your TAS connects to would live here, all your Diameter Routing logic, etc, etc.

See: Group Variables Configuration

3. Package Distribution (APT Cache)

```yaml
# Configure where to get packages
apt_repo:
  apt_server: "10.254.10.223"  # Cache server IP or direct repo
server
use_apt_cache: false  # true = use local cache, false = direct
repo access
```

See: APT Cache System

4. License Configuration

```
# Point components to license server
license_server_api_urls: ["https://10.10.2.150:8443/api"]
license_enforced: true
```

See: License Server

5. Execute Deployment

Individual components can be deployed by running `services/twag.yml` for example, but the `services/all.yml` will handle everything, and you can use `--limit=myhost` or `--limit=mmee,sgw`, etc, to limit the hosts we're working on.

```
# Deploy complete network
ansible-playbook -i hosts/customer/host_files/production.yml
services/all.yml

# Or deploy specific components
ansible-playbook -i hosts/customer/host_files/production.yml
services/epc.yml
ansible-playbook -i hosts/customer/host_files/production.yml
services/ims.yml
```

Related Documentation

- Introduction to Ansible Deployment - Getting started
- Service Playbooks - **Playbook reference and hierarchy**
- Hosts File Configuration - Defining infrastructure
- IP Planning Standard - **Network architecture and IP allocation**
- Group Variables Configuration - Customization
- APT Cache System - Package management
- License Server - License management
- Monitoring & Observability - Grafana, Prometheus, alerting, and dashboards
- Centralized Logging - Loki and Alloy log collection

Product Documentation

For detailed information on configuring each component:

- **OmniCore** (4G/5G Packet Core): https://docs.omnitouch.com.au/docs/repos/OmniCore
  - OmniHSS, OmniSGW, OmniPGW, OmniUPF, OmniDRA, OmniTWAG
- **OmniCall** (Voice & Messaging): https://docs.omnitouch.com.au/docs/repos/OmniCall
  - OmniTAS, OmniCall CSCF, OmniMessage, OmniSS7, VisualVoicemail
- **OmniCharge/OmniCRM** (Billing): https://docs.omnitouch.com.au/docs/repos/OmniCharge
- **Main Documentation**: https://docs.omnitouch.com.au/

Group Variables Configuration

Overview

The `group_vars` directory is where you store custom configuration files that override default templates.

This is where your customer-specific configurations live - SIP trunks, Diameter routing rules, SMS routing logic, dialplans, and any other customizations where you don't want the default config - It lives in `group_vars`.

Location: `hosts/{Customer}/group_vars/`

How It Works

Ansible roles have default configuration templates. To customize for a specific deployment, place your custom files in `group_vars` and reference them in your hosts file.

```
Role Default Template → group_vars Override (if specified) →
Deployed Config
```

Example 1: Custom Configuration Template (OmniMessage)

Some components accept custom Jinja2 configuration templates.

File Structure

```
hosts/Customer/
└── group_vars/
    └── smsc_controller.exs        # Your custom config template
```

Reference in Hosts File

```yaml
omnimessage:
  hosts:
    customer-smsc-controller01:
      ansible_host: 10.10.3.219
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"
      smsc_template_config: smsc_controller.exs   # Reference your
template filename in group_vars
```

What happens:

1. Ansible finds `smsc_template_config: smsc_controller.exs`
2. Looks in `hosts/Customer/group_vars/smsc_controller.exs`
3. Templates it with Jinja2 (can use `{{ inventory_hostname }}`, `{{ plmn_id.mcc }}`, etc.)
4. Deploys to `/etc/omnimessage/runtime.exs`
5. Restarts the service

Without `smsc_template_config`, the default template from the role is used.

Configuration details: See https://docs.omnitouch.com.au/docs/repos/OmniCall

---

Example 2: Configuration File Collections (OmniTAS Gateways & Dialplans)

Some components use directories of configuration files.

File Structure

```
hosts/Customer/
└── group_vars/
    ├── gateways_prod/              # SIP gateway configs
    │   ├── gateway_carrier1.xml
    │   ├── gateway_carrier2.xml
    │   └── gateway_emergency.xml
    ├── gateways_lab/               # Lab gateways
    │   └── gateway_test.xml
    ├── dialplan/                   # Call routing rules (default)
    │   ├── mo_dialplan.xml         # Mobile Originated (outgoing)
    │   ├── mt_dialplan.xml         # Mobile Terminated (incoming)
    │   └── emergency.xml
    └── dialplan_lab/               # Lab dialplans
        └── mo_dialplan.xml
```

Reference in Hosts File

```yaml
applicationserver:
  hosts:
    customer-tas01:
      ansible_host: 10.10.3.60
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"
      gateways_folder: "gateways_prod"   # Reference your gateway
folder to use on this host
      dialplan_folder: "dialplan"         # Optional - defaults to
"dialplan" if not set
```

What happens:

1. Ansible finds `gateways_folder: "gateways_prod"`
2. Copies all files from `hosts/Customer/group_vars/gateways_prod/` to `/etc/freeswitch/sip_profiles/`
3. Copies all files from `hosts/Customer/group_vars/dialplan/` (or the folder specified by `dialplan_folder`) to OmniTAS templates directory
4. Services load the configurations

Different environments: Use different folders per environment:

- `gateways_folder: "gateways_lab"`
- `gateways_folder: "gateways_prod"`
- `gateways_folder: "gateways_customer_specific"`
- `dialplan_folder: "dialplan_lab"`
- `dialplan_folder: "dialplan_prod"`

Configuration details: See https://docs.omnitouch.com.au/docs/repos/OmniCall

---

Example 3: Custom Configuration Template (OmniHSS)

The Home Subscriber Server accepts custom runtime configuration templates.

File Structure

```
hosts/Customer/
└── group_vars/
    └── hss_runtime.exs.j2        # Your custom HSS config
template
```

Reference in Hosts File

```
omnihss:
  hosts:
    customer-hss01:
      ansible_host: 10.10.3.50
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"
      hss_template_config: hss_runtime.exs.j2   # Reference your
template filename in group_vars
```

What happens:

1. Ansible finds `hss_template_config: hss_runtime.exs.j2`
2. Looks in `hosts/Customer/group_vars/hss_runtime.exs.j2`
3. Templates it with Jinja2 (can use `{{ inventory_hostname }}`, `{{ plmn_id.mcc }}`, etc.)
4. Deploys to `/etc/omnihss/runtime.exs`
5. Restarts the service

Without `hss_template_config`, the default template from the role is used.

Configuration details: See https://docs.omnitouch.com.au/docs/repos/OmniCore

---

Example 4: Custom Configuration Template (OmniMME)

The Mobility Management Entity accepts custom runtime configuration templates.

File Structure

```
hosts/Customer/
└── group_vars/
    └── mme_runtime.exs.j2        # Your custom MME config
template
```

Reference in Hosts File

```yaml
omnimme:
  hosts:
    customer-mme01:
      ansible_host: 10.10.3.51
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"
      mme_template_config: mme_runtime.exs.j2   # Reference your
template filename in group_vars
```

What happens:

1. Ansible finds `mme_template_config: mme_runtime.exs.j2`
2. Looks in `hosts/Customer/group_vars/mme_runtime.exs.j2`
3. Templates it with Jinja2 (can use `{{ inventory_hostname }}`, `{{ plmn_id.mcc }}`, etc.)
4. Deploys to `/etc/omnimme/runtime.exs`
5. Restarts the service

Without `mme_template_config`, the default template from the role is used.

Configuration details: See https://docs.omnitouch.com.au/docs/repos/OmniCore

---

Real-World Directory Structure Example

```
hosts/Customer/
├── host_files/
│   └── production.yml          # Hosts file references group_vars
files
└── group_vars/
    ├── smsc_controller.exs     # OmniMessage custom template
    ├── smsc_smpp.exs           # OmniMessage SMPP custom template
    ├── tas_runtime.exs.j2      # TAS custom template
    ├── hss_runtime.exs.j2      # HSS custom template
    ├── mme_runtime.exs.j2      # MME custom template
    ├── dra_runtime.exs.j2      # DRA custom template
    ├── pgwc_runtime.exs.j2     # PGW custom template
    ├── dea_runtime.exs.j2      # DEA custom template
    ├── upf_config.yaml         # UPF configuration
    ├── crm_config.yaml         # CRM configuration
    ├── stp.j2                  # SS7 STP template
    ├── hlr.j2                  # SS7 HLR template
    ├── camel.j2                # SS7 CAMEL template
    ├── ipsmgw.j2               # IP-SM-GW template
    ├── omnicore_smsc_ims.yaml.j2  # SMSC IMS config
    ├── pytap.yaml              # TAP3 configuration
    ├── sip_profiles/           # SIP gateways (folder)
    │   └── gateway_otw.xml
    └── dialplan/               # Call routing rules (folder)
        ├── mo_dialplan.xml     # Mobile Originated
        ├── mt_dialplan.xml     # Mobile Terminated
        └── mo_emergency.xml    # Emergency routing
```

Common Parameters That

Reference group_vars

Parameter	Component	References
`smsc_template_config`	omnimessage	Jinja2 template file (e.g., `smsc_controller.exs`)
`smsc_smpp_template_config`	omnimessage_smpp	Jinja2 template file (e.g., `smsc_smpp.exs`)
`gateways_folder`	applicationserver	Folder name (e.g., `sip_profiles`)
`dialplan_folder`	applicationserver	Folder name (e.g., `dialplan`) - defaults to `dialplan` if not set
`tas_template_config`	applicationserver	Jinja2 template file (e.g., `tas_runtime.exs.j2`)
`hss_template_config`	omnihss	Jinja2 template file (e.g., `hss_runtime.exs.j2`)
`mme_template_config`	omnimme	Jinja2 template file (e.g., `mme_runtime.exs.j2`)
`dra_template_config`	dra	Jinja2 template file (e.g., `dra_runtime.exs.j2`)

Parameter	Component	References
`pgwc_template_config`	pgwc	Jinja2 template file (e.g., `pgwc_runtime.exs.j2`)
`frr_template_config`	omniupf	Jinja2 template file (e.g., `frr.conf.j2`)
SS7 templates	ss7 (various roles)	Jinja2 template files (e.g., `stp.j2`, `hlr.j2`, `camel.j2`)
Config YAMLs	Various components	Direct config files (e.g., `upf_config.yaml`, `crm_config.yaml`)

Key Points

1. **group_vars holds customizations** - Overrides for default configurations
2. **Reference by name** - Use parameters like `smsc_template_config` or `gateways_folder`
3. **Templates support Jinja2** - Access any Ansible variable with `{{ variable_name }}`
4. **Folders deploy everything** - All files in referenced folders are copied
5. **Version control everything** - Commit all group_vars to Git

When to Use group_vars

✅ Use group_vars for:

- Custom component configuration templates

- SIP gateway definitions
- Call routing dialplans
- Diameter routing rules
- Customer-specific settings that override defaults

❌ Don't use group_vars for:

- Basic host configuration (IPs, hostnames) - Use hosts file
- One-off testing - Use host-specific vars in hosts file
- Temporary changes - Edit on target, commit to group_vars if permanent

---

Related Documentation

- Configuration Reference - All host parameters and what they do
- Hosts File Configuration - How to structure hosts files
- **OmniCall Configuration**: https://docs.omnitouch.com.au/docs/repos/OmniCall - What goes in the config files
- **OmniCore Configuration**: https://docs.omnitouch.com.au/docs/repos/OmniCore - Component configuration details

Utility Playbooks

Overview

This repository includes several utility playbooks for maintenance, monitoring, and operational tasks. These complement the main deployment playbooks with day-to-day management capabilities.

Health Check Utility

The Health Check utility generates an HTML report showing system health, service status, uptime, and version information across all OmniCore components.

Runs automatically as part of `services/all.yml` playbook.

Usage

Manual Run

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/health_check.yml
```

Output

Report is generated at `/tmp/health_check_YYYY-MM-DD HH:MM:SS.html`

Open in any web browser to view.

Report Contents

The HTML report displays:

Host Information

- **Host name and IP address**
- **Network/Subnet** (from `host_vm_network` variable, or N/A if not set)
- **CPU** (vCPU count)
- **RAM** (total and free memory)
- **Disk** (root partition total and free space with percentage)
- **OS** (distribution and version)

Service Status

- **Service status** (active/inactive with color indicators)
- **Uptime**
- **Version/release information**

HSS Diameter Peers

- **Database connection status** (connected/disconnected)
- **Diameter peer connections** (IP, origin host, status)
- Fetched from HSS metrics endpoint (port 9568)

Other Common Utilities

Base System Configuration

Common Role (`services/common.yml`)

- Applies base system configuration to all hosts
- Sets up repositories, SSH keys, timezone, NTP
- Configures networking and system hardening
- Run this before deploying services

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/common.yml
```

Setup Users (`services/setup_users.yml`)

- Creates and configures user accounts across all hosts
- Manages SSH keys and sudo privileges
- Ensures consistent user setup

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/setup_users.yml
```

Reboot (`services/reboot.yml`)

- Gracefully reboots all targeted hosts
- Waits for systems to come back online (5 minute timeout)
- Useful after kernel updates or configuration changes

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/reboot.yml
```

Operational Utilities

IP Plan Generator (`util_playbooks/ip_plan_generator.yml`)

- Generates HTML report of IP address assignments
- Shows complete network topology from hosts file
- Useful for documentation and troubleshooting

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/ip_plan_generator.yml
```

HSS Backup (`util_playbooks/hss_backup.yml`)

- Backs up HSS database tables
- Copies MySQL dump to local Ansible machine
- Interactive prompts for backup path

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/hss_backup.yml
```

Get Local Capture (`util_playbooks/getLocalCapture.yml`)

- Fetches the two most recent packet capture files from all hosts
- Retrieves pcap files from `/etc/localcapture/`
- Useful for debugging connectivity issues

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/getLocalCapture.yml
```

Update MTU (`util_playbooks/updateMtu.yml`)

- Updates network interface MTU settings
- Applies changes via netplan
- Useful for jumbo frame configuration

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/updateMtu.yml
```

Related Documentation

- Main README - Overview and getting started
- Introduction to Ansible Deployment - Running playbooks
- Hosts File Configuration - Configure your inventory
- Deployment Architecture - Complete system overview
- APT Cache System - Package management

Hosts File Configuration

Overview

The hosts file (also called inventory file) is the central configuration document that defines your entire cellular network deployment. It specifies:

- What network functions to deploy
- Where they run (IP addresses, network segments)
- How they're configured (service-specific parameters)
- Customer-specific settings (PLMN, credentials, features)

File Location

Hosts files are organized by customer and environment:

```
services/hosts/
└── Customer_Name/
    └── host_files/
        ├── production.yml
        ├── staging.yml
        └── lab.yml
```

Example Hosts File Structure

Here's a simplified example showing the key sections:

```yaml
# EPC Components
mme:
  hosts:
    customer-mme01:
      ansible_host: 10.10.1.15
      gateway: 10.10.1.1
      host_vm_network: "vmbr1"
      mme_code: 1
      network_name_short: Customer
      tac_list: [600, 601, 602]

sgw:
  hosts:
    customer-sgw01:
      ansible_host: 10.10.1.25
      gateway: 10.10.1.1
      cdrs_enabled: true

pgwc:
  hosts:
    customer-pgw01:
      ansible_host: 10.10.1.21
      gateway: 10.10.1.1
      ip_pools:
        - '100.64.16.0/24'

# IMS Components
pcscf:
  hosts:
    customer-pcscf01:
      ansible_host: 10.10.4.165

# Support Services
license_server:
  hosts:
    customer-licenseserver:
      ansible_host: 10.10.2.150

# Global Variables
all:
  vars:
    ansible_connection: ssh
    ansible_password: password
```

```
    customer_name_short: customer
    plmn_id:
      mcc: '001'
      mnc: '01'
```

Common Host Parameters

Network Configuration

Every host typically includes:

```
pcscf:
  hosts:
    customer-pcscf01:
      ansible_host: 10.10.1.15      # IP address for SSH access
      gateway: 10.10.1.1             # Default gateway
      host_vm_network: "vmbr1"       # name of NIC to use on
Hypervisor
```

Note: For guidance on IP address planning and network segmentation strategies, see the IP Planning Standard which outlines the recommended four-subnet architecture for OmniCore deployments.

Proxmox Users: The `host_vm_network` parameter specifies which bridge to use. See Proxmox VM/LXC Deployment for automated provisioning.

VM Resource Allocation

For services needing specific resources:

```
num_cpus: 4                     # CPU cores
memory_mb: 8192                 # RAM in megabytes
proxmoxLxcDiskSizeGb: 50      # Disk size in GB
```

Service-Specific Parameters

Each network function has its own parameters. Examples:

MME:

```yaml
mme_code: 1                      # MME identifier (1-255)
mme_gid: 1                       # MME Group ID
network_name_short: Customer     # Network name (shown on phones)
network_name_long: Customer Network
tac_list: [600, 601, 602]      # Tracking Area Codes
```

PGW:

```yaml
ip_pools:                        # IP pools for subscribers
  - '100.64.16.0/24'
  - '100.64.17.0/24'
combined_CP_UP: false            # Separate control/user plane
```

For detailed explanation of what each variable controls, see: Configuration Reference

Application Server:

```yaml
online_charging_enabled: true  # Enable OCS integration
tas_branch: "main"             # Software branch to deploy
gateways_folder: "gateways_prod"  # SIP gateway configuration
```

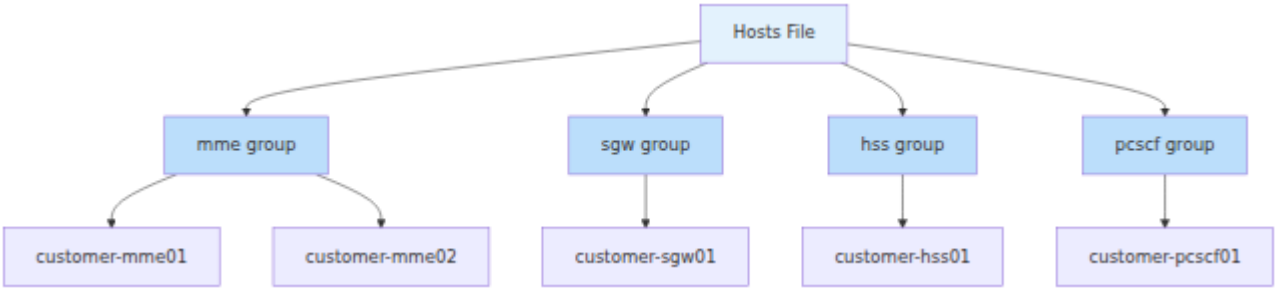
Global Variables Section

The `all:vars` section contains settings that apply to the entire deployment:

```yaml
all:
  vars:
    # Authentication
    ansible_connection: ssh
    ansible_password: password
    ansible_become_password: password

    # Customer Identity
    customer_name_short: customer
    customer_legal_name: "Customer Inc."
    site_name: "Chicago DC1"
    region: US

    # PLMN (Mobile Network) Identifier
    plmn_id:
      mcc: '001'              # Mobile Country Code
      mnc: '01'               # Mobile Network Code
      mnc_longform: '001'     # Zero-padded MNC

    # Network Names
    network_name_short: Customer
    network_name_long: Customer Network

    # APT Repository
    # Note: If apt_cache_servers group is defined with hosts,
    # use_apt_cache defaults to true and apt_repo.apt_server
    # defaults to the first cache server's IP automatically
    apt_repo:
      apt_server: "10.254.10.223"
      apt_repo_username: "customer"
      apt_repo_password: "secure-password"
    use_apt_cache: false

    # Timezone
    TZ: America/Chicago
```

Understanding Host Groups

Ansible organizes hosts into groups that correspond to roles:

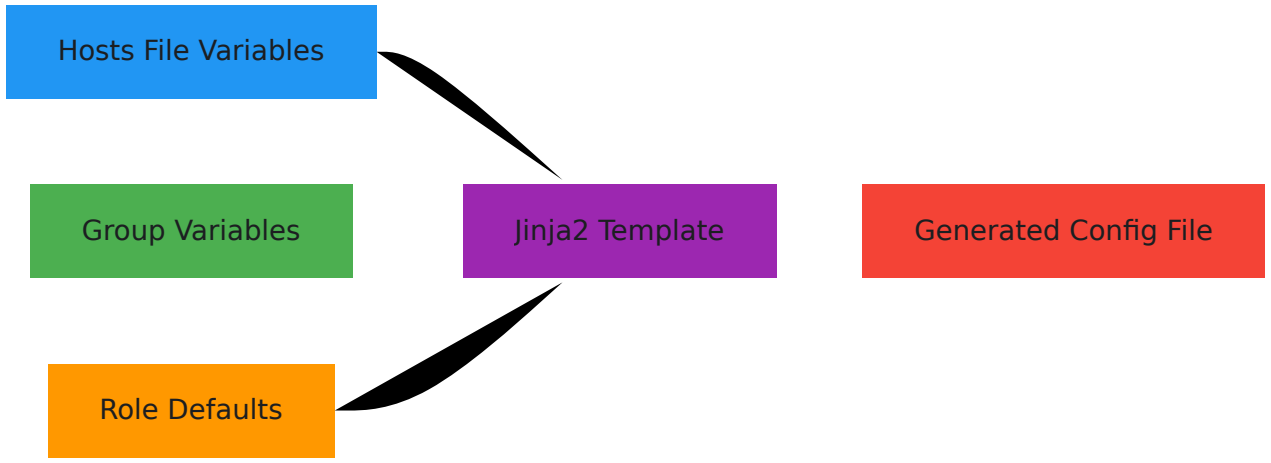


When you run a playbook targeting `mme`, it applies to all hosts in the `mme:hosts:` section.

Configuration with Jinja2 Templates

Ansible uses **Jinja2 templating** to generate configuration files from the variables defined in your hosts file and group_vars.

How Jinja2 Works



Example Template Usage

Hosts file defines:

```
plmn_id:
  mcc: '001'
  mnc: '01'
customer_name_short: acme
```

Jinja2 template (in role):

```
# mme_config.yml.j2
network:
  plmn:
    mcc: {{ plmn_id.mcc }}
    mnc: {{ plmn_id.mnc }}
  operator: {{ customer_name_short }}
  realm: epc.mnc{{ plmn_id.mnc_longform }}.mcc{{ plmn_id.mcc
}}.3gppnetwork.org
```

Generated configuration file:

```
network:
  plmn:
    mcc: 001
    mnc: 01
  operator: acme
  realm: epc.mnc001.mcc001.3gppnetwork.org
```

Common Jinja2 Patterns

Accessing nested variables:

```
{{ plmn_id.mcc }}
{{ apt_repo.apt_server }}
```

Conditional logic:

```
{% if online_charging_enabled %}
  charging:
    enabled: true
    ocs_ip: {{ ocs_ip }}
{% endif %}
```

Loops:

```
tracking_areas:
{% for tac in tac_list %}
  - {{ tac }}
{% endfor %}
```

Formatting:

```
# Zero-pad to 3 digits
mnc{{ '%03d' | format(plmn_id.mnc|int) }}
```

Overriding Variables with group_vars

While the hosts file defines infrastructure and host-specific settings, `group_vars` can override defaults for groups of hosts.

See: Group Variables Configuration

Complete Example Hosts File

Here's a more complete example (with sensitive data obscured):

```yaml
# EPC Core
mme:
  hosts:
    customer-mme01:
      ansible_host: 10.10.1.15
      gateway: 10.10.1.1
      host_vm_network: "vmbr1"
      mme_code: 1
      mme_gid: 1
      network_name_short: Customer
      network_name_long: Customer Network
      tac_list: [600, 601, 602, 603]
      omnimme:
        sgw_selection_method: "random_peer"
        pgw_selection_method: "random_peer"

sgw:
  hosts:
    customer-sgw01:
      ansible_host: 10.10.1.25
      gateway: 10.10.1.1
      host_vm_network: "vmbr1"
      cdrs_enabled: true

pgwc:
  hosts:
    customer-pgw01:
      ansible_host: 10.10.1.21
      gateway: 10.10.1.1
      host_vm_network: "vmbr1"
      ip_pools:
        - '100.64.16.0/24'
      combined_CP_UP: false

hss:
  hosts:
    customer-hss01:
      ansible_host: 10.10.2.140
      gateway: 10.10.2.1
      host_vm_network: "vmbr2"

# IMS Core
pcscf:
```

```
  hosts:
    customer-pcscf01:
      ansible_host: 10.10.4.165
      gateway: 10.10.4.1
      host_vm_network: "vmbr4"

icscf:
  hosts:
    customer-icscf01:
      ansible_host: 10.10.3.55
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"

scscf:
  hosts:
    customer-scscf01:
      ansible_host: 10.10.3.45
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"

applicationserver:
  hosts:
    customer-as01:
      ansible_host: 10.10.3.60
      gateway: 10.10.3.1
      host_vm_network: "vmbr3"
      online_charging_enabled: false
      gateways_folder: "gateways_prod"

# Support Services
license_server:
  hosts:
    customer-licenseserver:
      ansible_host: 10.10.2.150
      gateway: 10.10.2.1
      host_vm_network: "vmbr2"

monitoring:
  hosts:
    customer-oam01:
      ansible_host: 10.10.2.135
      gateway: 10.10.2.1
      host_vm_network: "vmbr2"
      num_cpus: 4
```

```
      memory_mb: 8192

dns:
  hosts:
    customer-dns01:
      ansible_host: 10.10.2.177
      gateway: 10.10.2.1
      host_vm_network: "vmbr2"

# Global Variables
all:
  vars:
    ansible_connection: ssh
    ansible_password: password
    ansible_become_password: password

    customer_name_short: customer
    customer_legal_name: "Customer Network Inc."
    site_name: "Primary DC"
    region: US
    TZ: America/Chicago

    # PLMN Configuration
    plmn_id:
      mcc: '001'
      mnc: '01'
      mnc_longform: '001'
    diameter_realm: epc.mnc{{ plmn_id.mnc_longform }}.mcc{{
plmn_id.mcc }}.3gppnetwork.org

    # Network Names
    network_name_short: Customer
    network_name_long: Customer Network
    tac_list: [600, 601]

    # APT Configuration
    apt_repo:
      apt_server: "10.254.10.223"
      apt_repo_username: "customer"
      apt_repo_password: "secure-password"
    use_apt_cache: false

    # Charging Configuration
    charging:
```

```
      data:
        online_charging:
          enabled: false
      voice:
        online_charging:
          enabled: true
          domain: "mnc{{ plmn_id.mnc_longform }}.mcc{{ plmn_id.mcc
}}.3gppnetwork.org"

    # Firewall Rules
    firewall:
      allowed_ssh_subnets:
        - '10.0.0.0/8'
        - '192.168.0.0/16'
      allowed_ue_voice_subnets:
        - '10.0.0.0/8'
      allowed_signaling_subnets:
        - '10.0.0.0/8'

    # Hypervisor Configuration (Proxmox example)
    proxmoxServers:
      customer-prxmx01:
        proxmoxServerAddress: 10.10.0.100
        proxmoxServerPort: 8006
        proxmoxApiTokenName: Customer
        proxmoxApiTokenSecret: "token-secret"
        proxmoxTemplateName: ubuntu-24.04-cloud-init-template
        proxmoxNodeName: pve01
```

See Proxmox VM/LXC Deployment for complete Proxmox setup and configuration details.

Product Documentation References

For detailed configuration of each component, refer to the official product documentation:

OmniCore Components:

- **OmniCore Documentation**: https://docs.omnitouch.com.au/docs/repos/OmniCore

- **OmniHSS** - Home Subscriber Server
- **OmniSGW** - Serving Gateway (Control plane)
- **OmniPGW** - Packet Gateway (Control plane)
- **OmniUPF** - User Plane Function
- **OmniDRA** - Diameter Routing Agent
- **OmniTWAG** - Trusted WLAN Access Gateway

OmniCall Components:

- **OmniCall Documentation**: https://docs.omnitouch.com.au/docs/repos/OmniCall
- **OmniTAS** - IMS Application Server (VoLTE/VoNR)
- **OmniCall CSCF** - Call Session Control Functions
- **OmniMessage** - SMS Center
- **OmniMessage SMPP** - SMPP Protocol Support
- **OmniSS7** - SS7 Signaling Stack
- **VisualVoicemail** - Voicemail

OmniCharge/OmniCRM:

- **OmniCharge Documentation**: https://docs.omnitouch.com.au/docs/repos/OmniCharge

Related Documentation

- Introduction to Ansible Deployment - Overall deployment process
- Configuration Reference - **Complete guide to all configuration variables**
- Group Variables Configuration - Overriding default configurations
- IP Planning Standard - **Network architecture and IP allocation guidelines**
- Netplan Configuration - **Secondary IPs and advanced network configuration**
- APT Cache System - Package distribution
- License Server - License management

- Deployment Architecture Overview - Complete system view

Next Steps

1. Create your hosts file based on this template
2. Define your PLMN and network identity
3. Configure APT repository access
4. Set up license server
5. Customize with group_vars as needed
6. Deploy with Ansible playbooks

OmniCore IP Planning Standard

Overview

This document outlines the standard IP planning approach for OmniCore deployments. The architecture requires **four internal subnets** to properly segment network functions for security, performance, and operational clarity.

IP Allocation Requirements

Standard Allocation: Four /24 Subnets

Each OmniCore deployment requires four distinct subnets for internal networking:

1. **Packet Core Network** - First /24
2. **Signaling Network** - Second /24
3. **IMS Internal Network** - Third /24
4. **UE Public Network** - Fourth /24

Important: These are Recommendations, Not Requirements

The subnet allocation described in this document is a **recommended best practice** for organizing OmniCore deployments. However, the architecture is **completely flexible**:

- **All hosts in one subnet**: You can place all components in a single subnet if that suits your deployment needs
- **Each host type in its own subnet**: You can create separate subnets for each component type (one for MMEs, one for HSS, etc.)

- **Custom groupings**: You can organize hosts into any subnet structure that makes sense for your specific requirements
- **Mix internal and public IPs**: Some hosts can use internal (RFC 1918) addresses while others use public IPs, all within the same deployment

The recommended four-subnet approach provides optimal **security isolation, traffic management, and operational clarity**, which is why we suggest it for production deployments. However, you should adapt the IP plan to fit your specific network topology, available address space, and operational requirements.

Network Segment Breakdown

1. Packet Core Network (First /24)

Purpose: User plane and core control plane elements

Components:

- OmniMME (Mobility Management Entity)
- OmniSGW (Serving Gateway)
- OmniPGW-C (PDN Gateway Control Plane)
- OmniUPF/PGW-U (User Plane Function / PDN Gateway User Plane)

Example: `10.179.1.0/24`

```
mme:
  hosts:
    omni-site-mme01:
      ansible_host: 10.179.1.15
      gateway: 10.179.1.1
      host_vm_network: "vmbr1"
```

---

2. Signaling Network (Second /24)

Purpose: Diameter signaling, policy, charging, and management functions

Components:

- OmniHSS (Home Subscriber Server)
- OmniCharge OCS (Online Charging System)
- OminiHSS PCRF (Policy and Charging Rules Function)
- OmniDRA DRA (Diameter Routing Agent)
- DNS Servers
- TAP3/CDR Servers
- Monitoring/OAM
- SIP capture
- License Server
- RAN Monitor
- Omnitouch Warning Link CBC (Cell Broadcast Center) - if deployed
- APT Cache Servers - if deployed

Example: `10.179.2.0/24`

```
hss:
  hosts:
    omni-site-hss01:
      ansible_host: 10.179.2.140
      gateway: 10.179.2.1
      host_vm_network: "vmbr2"
```

---

3. IMS Internal Network (Third /24)

Purpose: IMS core signaling and services (internal SIP signaling)

Components:

- OmniCSCF S-CSCF (Serving Call Session Control Function)

- OmniCSCF I-CSCF (Interrogating Call Session Control Function)
- OmniTAS (Telephony Application Server / Application Server)
- OmniMessage (SMS Controller, SMPP, IMS)
- OmniSS7 STP (SS7 Signaling Transfer Point)
- OmniSS7 HLR (Home Location Register) - for 2G/3G
- OmniSS7 IP-SM-GW (MAP SMSc)
- OmniSS7 CAMEL Gateway

Example: `10.179.3.0/24`

```
scscf:
  hosts:
    omni-site-scscf01:
      ansible_host: 10.179.3.45
      gateway: 10.179.3.1
      host_vm_network: "vmbr3"
```

---

4. UE Public Network (Fourth /24)

Purpose: User-facing services such as IMS and DNS

Components:

- OmniCSCF P-CSCF (Proxy Call Session Control Function)
- XCAP Servers
- Visual Voicemail Servers
- Customer DNS

Example: `10.179.4.0/24`

```
pcscf:
  hosts:
    omni-site-pcscf01:
      ansible_host: 10.179.4.165
      gateway: 10.179.4.1
      host_vm_network: "vmbr4"
```

Implementation Methods

OmniCore supports two primary methods for implementing this network segmentation:

Method 1: Physical/Virtual Network Interfaces (Recommended for Production)

Use separate NICs or virtual bridges for each network segment. This provides the strongest isolation and is the recommended approach for production deployments.

Example:

```yaml
# Packet Core - vmbr1
mme:
  hosts:
    omni-lab07-mme01:
      ansible_host: 10.179.1.15
      gateway: 10.179.1.1
      host_vm_network: "vmbr1"

# Signaling - vmbr2
hss:
  hosts:
    omni-lab07-hss01:
      ansible_host: 10.179.2.140
      gateway: 10.179.2.1
      host_vm_network: "vmbr2"

# IMS Internal - vmbr3
icscf:
  hosts:
    omni-lab07-icscf01:
      ansible_host: 10.179.3.55
      gateway: 10.179.3.1
      host_vm_network: "vmbr3"

# UE Public - vmbr4
pcscf:
  hosts:
    omni-lab07-pcscf01:
      ansible_host: 10.179.4.165
      gateway: 10.179.4.1
      host_vm_network: "vmbr4"
```

Method 2: VLAN-Based Segmentation

Use a single physical interface with VLAN tagging to separate networks. This is suitable for smaller deployments or when physical NICs are limited.

Example:

```yaml
# All components use vmbr12 with different VLANs
applicationserver:
  hosts:
    ons-lab08sbc01:
      ansible_host: 10.178.2.213
      gateway: 10.178.2.1
      host_vm_network: "ovsbr1"
      vlanid: "402"

dra:
  hosts:
    ons-lab08dra01:
      ansible_host: 10.178.2.211
      gateway: 10.178.2.1
      host_vm_network: "ovsbr1"
      vlanid: "402"

dns:
  hosts:
    ons-lab08dns01:
      ansible_host: 10.178.2.178
      gateway: 10.178.2.1
      host_vm_network: "ovsbr1"
      vlanid: "402"
```

Network Configuration:

- Configure VLANs on the physical switch
- Tag traffic appropriately at the hypervisor level
- Route between VLANs at the gateway/firewall

Example VLAN Mapping:

```
VLAN 10: 10.x.1.0/24 (Packet Core)
VLAN 20: 10.x.2.0/24 (Signaling)
VLAN 30: 10.x.3.0/24 (IMS Internal)
VLAN 40: 10.x.4.0/24 (UE Public)
```

Working with Public IP Addresses

Overview

Many OmniCore deployments require some components to have public IP addresses for external connectivity, such as:

- **DRA** - For roaming diameter signaling with external carriers
- **Roaming SGW/PGW** - For GTP traffic from roaming partners
- **ePDG** - For WiFi calling (IPsec tunnels from UEs)
- **SMSC Gateway** - For SMPP connections to external SMS aggregators
- **P-CSCF** (in some deployments) - For direct UE SIP registration

How to Assign Public IPs

Public IPs are handled **exactly the same way as internal IPs** in your host inventory files. Simply specify the public IP address in the `ansible_host` field along with the appropriate gateway and netmask.

Example: Roaming SGW/PGW with Public IPs

```yaml
sgw:
  hosts:
    # Internal SGWs on private network
    opt-site-sgw01:
      ansible_host: 10.4.1.25
      gateway: 10.4.1.1
      host_vm_network: "v400-omni-packet-core"

    # Roaming SGWs with public IPs
    opt-site-roaming-sgw01:
      ansible_host: 203.0.113.10
      gateway: 203.0.113.9
      netmask: 255.255.255.248       # /29 subnet
      host_vm_network: "498-public-servers"
      in_pool: False
      cdrs_enabled: True

smf:  # PGWs
  hosts:
    # Roaming PGW with public IP
    opt-site-roaming-pgw01:
      ansible_host: 203.0.113.20
      gateway: 203.0.113.17
      netmask: 255.255.255.240       # /28 subnet
      host_vm_network: "497-public-services-LTE"
      in_pool: False
      ip_pools:
        - '100.64.24.0/22'
```

Example: DRA with Public IP

```yaml
dra:
  hosts:
    opt-site-dra01:
      ansible_host: 198.51.100.50
      gateway: 198.51.100.49
      netmask: 255.255.255.240       # /28 subnet
      host_vm_network: "497-public-services-LTE"
```

Example: ePDG with Public IP

```yaml
epdg:
  hosts:
    opt-site-epdg01:
      ansible_host: 198.51.100.51
      gateway: 198.51.100.49
      netmask: 255.255.255.240       # /28 subnet
      host_vm_network: "497-public-services-LTE"
```

Mixing Internal and Public IPs

It's common to have a mix of internal and public IPs within the same component group. For example:

- Internal SGWs for local sites using GTP
- Public SGWs specifically for roaming traffic from external carriers
- The same PGW-C can manage both internal and external SGWs

OmniCore's architecture handles this seamlessly - just configure each host with its appropriate IP addressing.

License Server

Overview

The License Server manages feature activation for all Omnitouch components. Each component validates its license on startup and periodically during operation.

Setup

1. Define in Hosts File

```
license_server:
  hosts:
    customer-licenseserver:
      ansible_host: 10.10.2.150
      gateway: 10.10.2.1
      host_vm_network: "vmbr2"

all:
  vars:
    customer_legal_name: "Customer Name"
    license_server_api_urls: ["https://10.10.2.150:8443/api"]
    license_enforced: true
```

2. Provide License File

Place `license.json` (provided by Omnitouch) in `hosts/Customer/group_vars/`

3. Deploy

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/license_server.yml
```

You can check the status of all license by browsing to https://license_server .

Network Requirements

Firewall Configuration

Client site firewalls must be configured to allow HTTPS (port 443) traffic to the following Omnitouch license validation servers:

Hostname	IP Address	Purpose
time.omnitouch.com.au	160.22.43.18	License validation server 1
time.omnitouch.com.au	160.22.43.66	License validation server 2
time.omnitouch.com.au	160.22.43.114	License validation server 3

Required outbound rules:

- Protocol: HTTPS (TCP/443)
- Destination: 160.22.43.18, 160.22.43.66, 160.22.43.114
- Direction: Outbound

DNS Requirements

The license server requires functional DNS resolution to communicate with the Omnitouch license validation infrastructure.

Required DNS configuration:

- The license server must have access to public DNS servers
- Configure DNS to use one of the following:
  - 1.1.1.1 (Cloudflare - supports secure DNS)
  - 8.8.8.8 (Google Public DNS)
- Do not use internal/corporate DNS servers for the license server

Note: The Omnitouch license servers use secure DNS (DoH/DoT). Using public DNS servers ensures proper DNSSEC validation and prevents issues with DNS interception by security appliances.

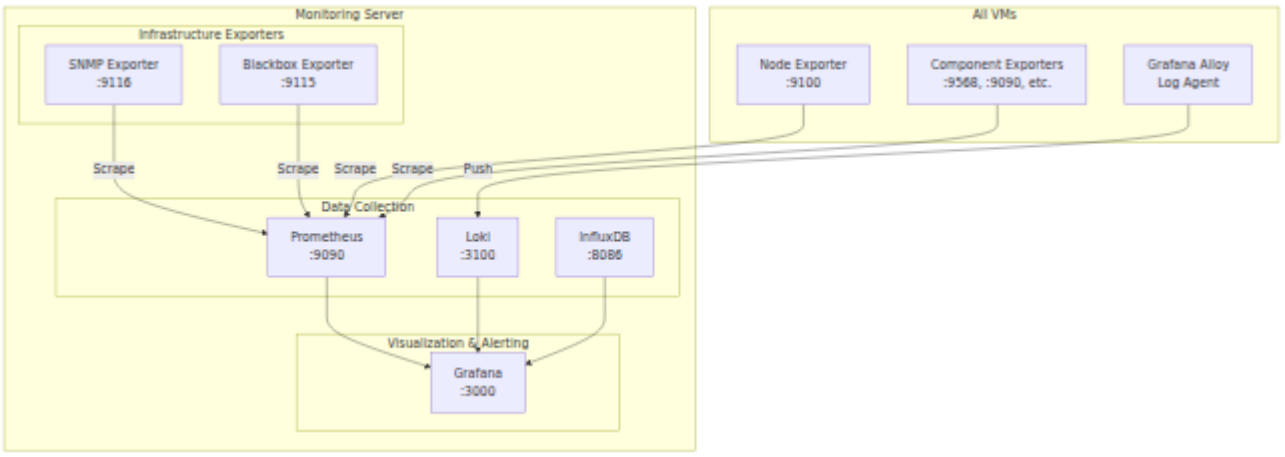
Related Documentation

- Configuration Reference
- Hosts File Configuration

Monitoring & Observability

Overview

OmniCore includes a comprehensive monitoring and observability stack that provides metrics collection, log aggregation, visualization, and alerting. The system is deployed automatically by the monitoring role.



Components

Component	Purpose	Port	Data Retention
Prometheus	Time-series metrics storage	9090	15 days (default)
Loki	Log aggregation	3100	7 days or 50GB
InfluxDB	RAN metrics (Nokia)	8086	30 days
Grafana	Visualization and alerting	3000	N/A
Node Exporter	Host metrics	9100	N/A
SNMP Exporter	Network device metrics	9116	N/A
Blackbox Exporter	ICMP/HTTP probes	9115	N/A

Data Sources

Prometheus

Prometheus scrapes metrics from all OmniCore components every 1 minute.

Datasource UID: `omnicore_prometheus`

Scraped Targets

Job Name	Inventory Group	Port	Metrics
`Node Exporter`	`all`	9100	Host CPU, memory, disk, network
`MMEs`	`mme`	9568	Session counts, attach/detach rates
`HSS`	`hss`	9568	Auth requests, subscriber lookups
`SGW-C`	`sgw`	9568	Bearer counts, GTP-C messages
`PGW-C`	`pgwc`	9090	PDN connections, IP allocations
`UPF Standalone`	`upf`	9090	Packet counts, throughput
`Kamailio CSCF`	`pcscf`, `scscf`, `icscf`	9090	Registrations, transactions
`ApplicationServer FreeSWITCH`	`applicationserver`	9090	Call counts, channel usage
`DRA`	`dra`	9568	Routing decisions, peer status
`OmniMessage`	`omnimessage`	9568	SMS delivery, SMPP sessions
`OmniSS7`	`omniss7`	8080	SS7/SIGTRAN gateway metrics

Job Name	Inventory Group	Port	Metrics
`KeyDB`	`ocs`	9121	Memory usage, operations/sec
`CGrateS`	`ocs`	2080	Rating, charging, CDR stats

Infrastructure Exporters

Exporter	Targets	Configuration Variable
SNMP (MikroTik)	Routers/switches	`mikrotik.hosts`
SNMP (iDRAC)	Dell servers	`idrac.hosts`
SNMP (Synology)	NAS devices	`synology.hosts`
SNMP (SAF)	Microwave links	`saf.hosts`
SNMP (Cisco)	Switches	`cisco.hosts`
Blackbox ICMP	All hosts + 8.8.8.8	Automatic
VMware	vCenter clusters	`vcenter_ip`, `vcenter_password`
Proxmox	PVE clusters	`proxmoxServers`

Loki

Loki receives logs from Grafana Alloy agents running on all VMs.

Datasource UID: `omnicore_loki`

See Centralized Logging for detailed Loki/Alloy configuration.

Log Labels

Label	Description	Example
`hostname`	Source VM hostname	`customer-mme01`
`component`	Component type	`mme`, `cscf`, `ocs`
`unit`	systemd unit name	`omnimme.service`
`level`	Log severity	`info`, `error`

InfluxDB

InfluxDB stores time-series data for specific use cases requiring longer retention or different query patterns.

Datasource UID: `omnicore_influxdb`

Databases

Database	Purpose	Retention
`nokia-monitor`	Nokia RAN performance metrics	30 days
`dra`	DRA routing statistics	365 days
`Omnicharge_TAP3`	Roaming TAP file metrics	90 days

Grafana Dashboards

Dashboard Organization

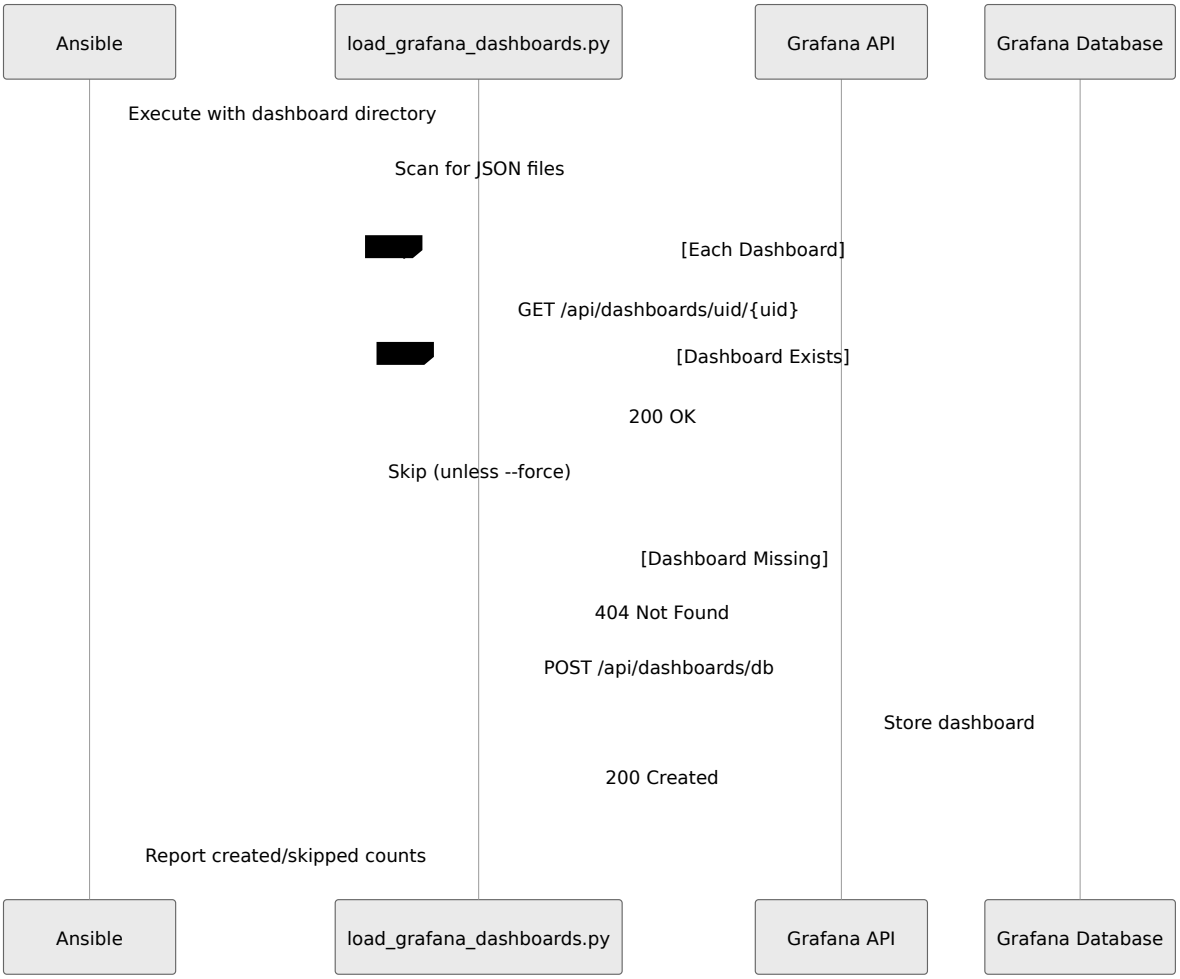
Dashboards are organized into folders by functional area:

Folder	Contents
BSS	CGrateS, KeyDB, charging dashboards
EPC	MME, SGW, PGW, UPF, HSS, DRA dashboards
IMS	CSCF, Application Server, OmniMessage dashboards
Infrastructure	Node Exporter, SNMP, network monitoring
RAN	Nokia/OmniRAN performance dashboards
Logs	Component-specific log viewers

Dashboard Loading (API-Based)

Dashboards are loaded via the Grafana API rather than file-based provisioning. This allows dashboards to be:

- Edited through the Grafana UI
- Modified via API
- Version controlled in the Ansible repository



Loading Dashboards

Dashboards are loaded automatically during Ansible deployment. To manually reload:

```
# From the Ansible controller
python3 roles/monitoring/files/load_grafana_dashboards.py \
    --url http://<monitoring-ip>:3000 \
    --user admin \
    --password <grafana_admin_password> \
    --dashboards-dir roles/monitoring/templates/grafana/dashboards

# Force update existing dashboards
python3 roles/monitoring/files/load_grafana_dashboards.py \
    --url http://<monitoring-ip>:3000 \
    --user admin \
    --password <grafana_admin_password> \
    --dashboards-dir roles/monitoring/templates/grafana/dashboards
\
    --force
```

Dashboard Source Files

Dashboard JSON files are stored in the Ansible repository:

```
roles/monitoring/templates/grafana/dashboards/
├── BSS/
│   ├── KeyDB_Cluster.json
│   ├── cgrates_mysql.json
│   └── cgrates_stats.json
├── EPC/
│   ├── MME_Dashboard.json
│   ├── OmniHSS.json
│   ├── OmniDRA.json
│   ├── SGW.json
│   ├── PGWs.json
│   └── ...
├── IMS/
│   ├── SMSc.json
│   ├── MMSc.json
│   └── ...
├── Infrastructure/
│   ├── Node_Exporter_Full.json
│   ├── MikroTik_Dashboard.json
│   └── ...
├── RAN/
│   ├── Nokia_Overview.json
│   ├── Nokia_Detailed.json
│   └── ...
└── Logs/
    ├── CSCF_Logs.json
    ├── MME_Logs.json
    └── ...
```

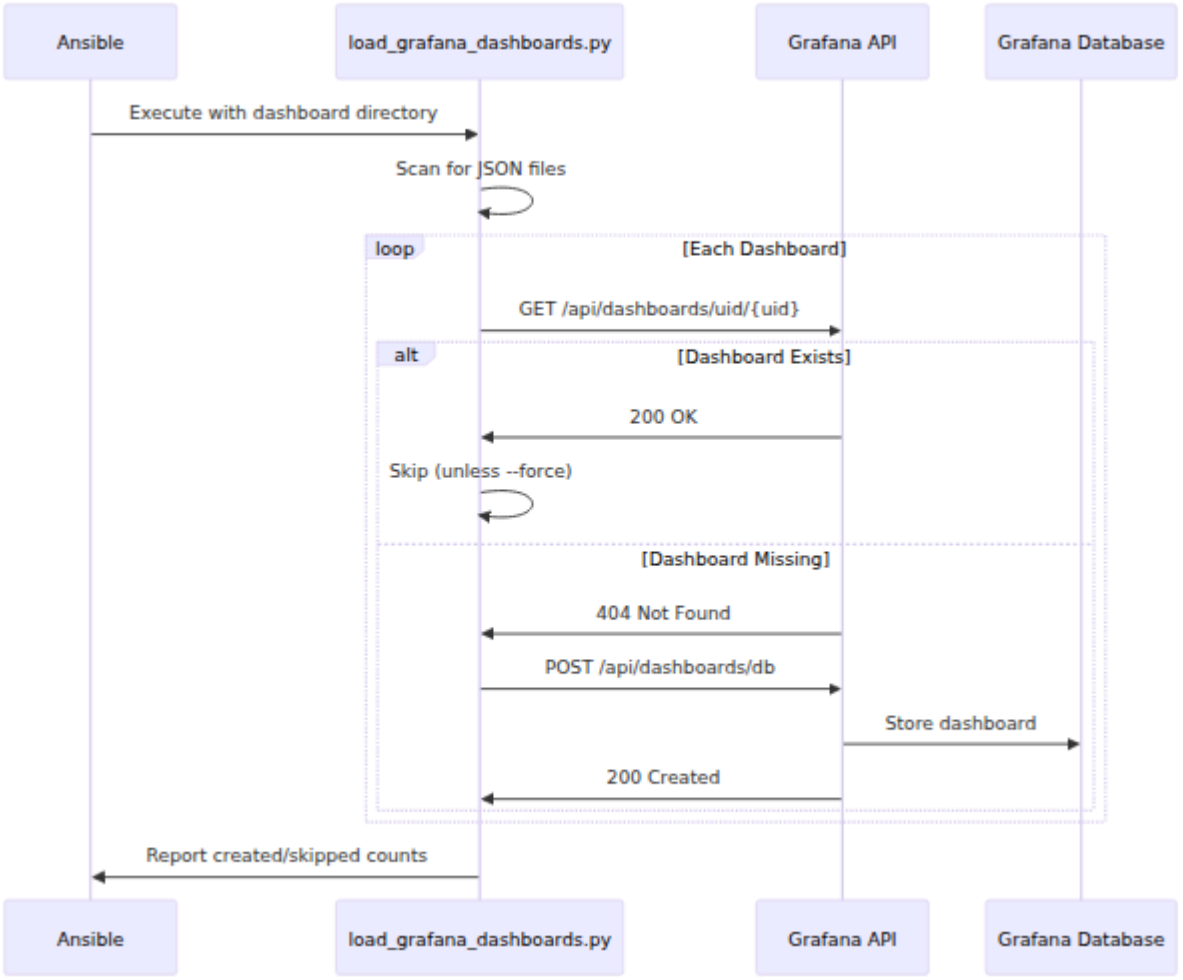
Dashboard Backup

Export dashboards and alerts from a running Grafana instance to the repository for version control:

```
# From roles/monitoring directory
python3 export_grafana.py --customer <CUSTOMER>
```

This exports:

- All dashboards to `roles/monitoring/templates/grafana/dashboards/{folder}/*.json` (shared across customers)
- Alert rules to `hosts/Omnicore_{CUSTOMER}/group_vars/grafana/alerts/all_alert_rules.json`
- Contact points to `hosts/Omnicore_{CUSTOMER}/group_vars/grafana/alerts/contact_points.json`
- Notification policies to `hosts/Omnicore_{CUSTOMER}/group_vars/grafana/alerts/notification_policies.json`



Export Behavior

- Only writes files that have changed (ignoring volatile fields like `version` and `id`)

- Preserves folder structure matching Grafana organization
- Maps dashboard titles to consistent filenames

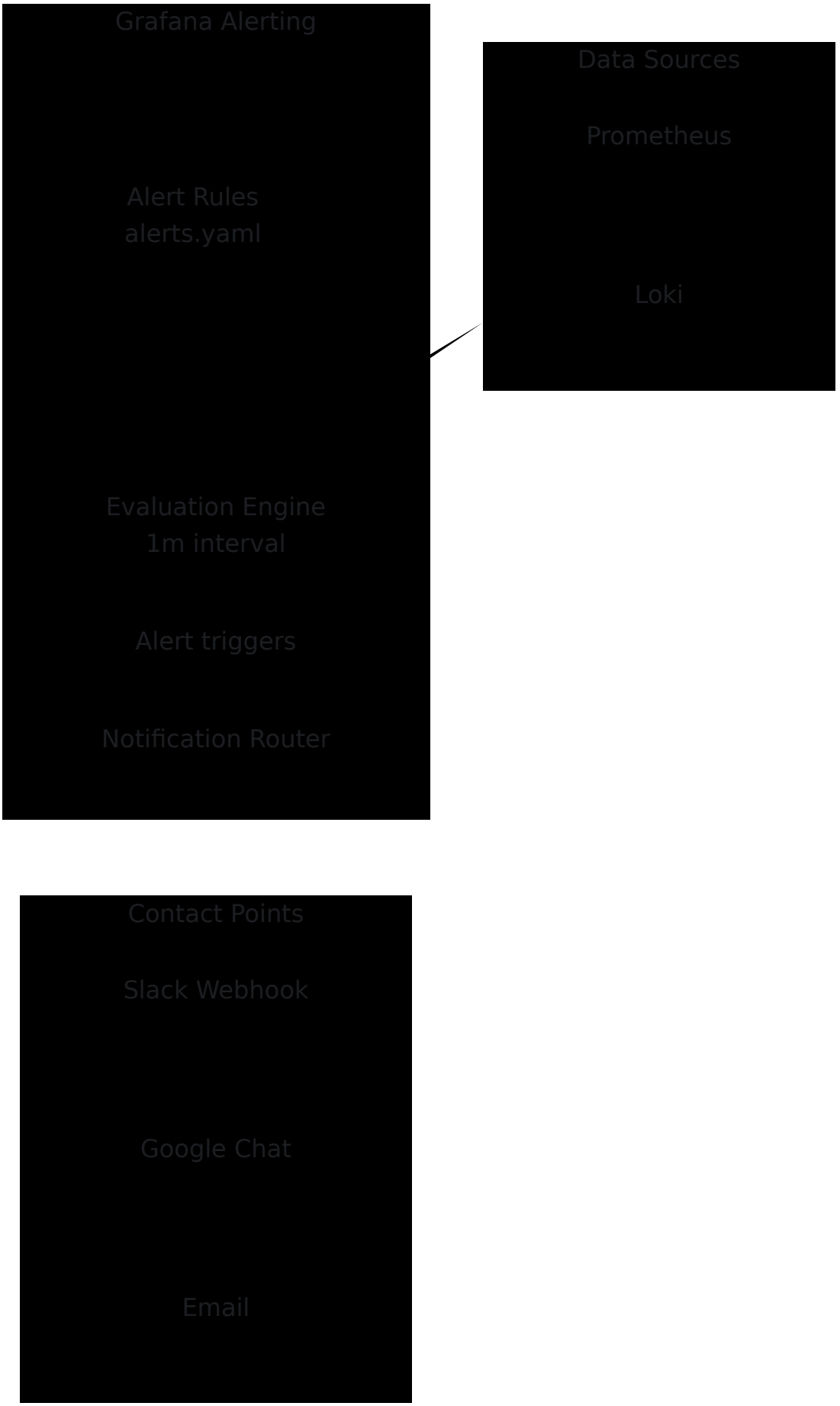
Custom Dashboards

Customer-specific dashboards can be placed in `group_vars/grafana/dashboards/` and will be loaded alongside the standard dashboards:

```
hosts/customer/group_vars/
└── grafana/
    └── dashboards/
        ├── Custom_Dashboard_1.json
        └── Custom_Dashboard_2.json
```

Alerting

Architecture


Grafana Alerting
Alert Rules
alerts.yaml
Evaluation Engine
1m interval
Alert triggers
Notification Router
Data Sources
Prometheus
Loki
Contact Points
Slack Webhook
Google Chat
Email

Alert Loading

Alerts are defined in YAML and loaded via API, similar to dashboards:

```
python3 roles/monitoring/files/load_grafana_alerts.py \
    --url http://<monitoring-ip>:3000 \
    --user admin \
    --password <grafana_admin_password> \
    --alerts-file
roles/monitoring/templates/grafana/provisioning/alerting/alerts.yaml
```

Default Alert Rules

Alert	Folder	Condition	For Duration
Disk Space 90% Used	Infrastructure	Root filesystem > 90%	5 minutes
CPU Above 90%	Infrastructure	CPU usage > 90%	5 minutes
System Load over 90%	Infrastructure	Load average > 90%	5 minutes
Host Down	Infrastructure	Prometheus target unreachable	5 minutes
MME Subs Dropped 40%	EPC	Session count drops 40%	30 seconds
0 Subs on MME	EPC	No attached subscribers	5 minutes
IMS Subs down 40%	IMS	P-CSCF registrations drop 40%	30 seconds
Average MOS below 4	IMS	Voice quality degraded	5 minutes
eNodeB Count Dropped	RAN	Connected eNBs decreased	1 minute
Diameter Response Delay High	EPC	P95 latency spike	5 minutes

Alert Rule Structure

Alert rules in `alerts.yaml`:

```yaml
apiVersion: 1
groups:
  - orgId: 1
    name: Alerts Group
    folder: Infrastructure
    interval: 1m
    rules:
      - uid: alert-lowDiskSpace
        title: Disk Space 90% Used on host
        condition: C
        data:
          - refId: A
            datasourceUid: omnicore_prometheus
            model:
              expr: |
                100 - ((node_filesystem_avail_bytes{job="Node
Exporter",mountpoint="/"} * 100)
                / node_filesystem_size_bytes{job="Node
Exporter",mountpoint="/"})
          # ... threshold expressions
        noDataState: OK
        execErrState: Error
        for: 5m
        annotations:
          summary: Disk space hit above 90% on host
        labels:
          type: resource
```

Contact Points Configuration

Contact points are configured via inventory variables:

```yaml
# In group_vars/all.yml or customer-specific vars
monitoring_data:
  contactPoints:
    - orgId: 1
      name: default
      receivers:
        # Slack integration
        - uid: slack-alerts
          type: slack
          disableResolveMessage: false
          settings:
            url: "https://hooks.slack.com/services/xxx/yyy/zzz"

        # Google Chat integration
        - uid: gchat-alerts
          type: googlechat
          disableResolveMessage: false
          settings:
            url:
"https://chat.googleapis.com/v1/spaces/xxx/messages?key=yyy"
```

Notification Policies

Notification policies route alerts to appropriate contact points:

```yaml
# templates/grafana/notification-policies.yaml.j2
apiVersion: 1

policies:
  - orgId: 1
    receiver: default
    group_by: ['alertname', 'instance']
    group_wait: 30s
    group_interval: 5m
    repeat_interval: 4h
```

Configuration Reference

Prometheus Configuration

Located at `/etc/prometheus/prometheus.yml` on monitoring server.

Parameter	Default	Description
`scrape_interval`	1m	How often to scrape targets
`evaluation_interval`	1m	How often to evaluate recording rules
`scrape_timeout`	50s	Timeout for scrape requests

Grafana Configuration

Located at `/etc/grafana/grafana.ini` on monitoring server.

Key settings configured by the monitoring role:

Setting	Value	Description
`admin_password`	`grafana_admin_password` var	Admin user password
`allow_embedding`	true	Enable embedding in iframes
`provisioning`	`/etc/grafana/provisioning`	Provisioning directory

Loki Configuration

See Centralized Logging for Loki retention and storage settings.

InfluxDB Configuration

Located at `/etc/influxdb/influxdb.conf` on monitoring server.

Database	Retention Policy	Duration
`nokia-monitor`	`autogen`	30 days
`dra`	`autogen`	365 days
`Omnicharge_TAP3`	`autogen`	90 days

Service Ports

Service	Port	Protocol	Description
Grafana	3000	HTTP	Dashboard UI and API
Prometheus	9090	HTTP	Metrics storage and query
Loki	3100	HTTP	Log ingestion and query
InfluxDB	8086	HTTP	InfluxDB API
Node Exporter	9100	HTTP	Host metrics
SNMP Exporter	9116	HTTP	SNMP metrics proxy
Blackbox Exporter	9115	HTTP	Probe metrics
Alloy	12345	HTTP	Alloy UI and metrics

Common Operations

Viewing Metrics

1. Open Grafana at `http://<monitoring-ip>:3000`
2. Navigate to **Dashboards** and select the appropriate folder
3. Use time range selector to adjust the view window

Searching Logs

1. Open Grafana at `http://<monitoring-ip>:3000`
2. Go to **Explore** and select **Loki** datasource
3. Use LogQL queries:

```
# All logs from a specific host
{hostname="customer-mme01"}

# Errors from all MME components
{component="mme"} |~ "(?i)error"

# Search for specific IMSI
{component="hss"} |= "123456789012345"
```

Creating Custom Alerts

1. Create alert rule in `roles/monitoring/templates/grafana/provisioning/alerting/alerts.yaml`
2. Run the monitoring playbook or manually load:

```
python3 roles/monitoring/files/load_grafana_alerts.py \
    --url http://<monitoring-ip>:3000 \
    --user admin --password <password> \
    --alerts-file
roles/monitoring/templates/grafana/provisioning/alerting/alerts.y
\
    --force
```

Backing Up Dashboards

After making changes in Grafana UI, export to repository:

```
cd roles/monitoring
python3 export_grafana.py --url http://<monitoring-ip>:3000
git add templates/grafana/
git commit -m "Update dashboards from production"
```

Troubleshooting

Prometheus Target Down

Symptoms: Dashboard shows "No Data" or target status shows DOWN

Possible causes:

- Service not running on target host
- Firewall blocking exporter port
- Incorrect hostname resolution

Resolution:

1. Check if service is running on target:

   ```
   systemctl status <service>
   curl http://localhost:<port>/metrics
   ```

2. Verify connectivity from monitoring server:

   ```
   curl http://<target>:<port>/metrics
   ```

3. Check Prometheus targets page: `http://<monitoring-ip>:9090/targets`

Dashboard Not Loading

Symptoms: Dashboard shows loading spinner or error

Possible causes:

- Datasource connection failed
- Query timeout
- Dashboard JSON corruption

Resolution:

1. Test datasource in Grafana: **Configuration** → **Data Sources** → **Test**
2. Check Grafana logs: `journalctl -u grafana-server -f`
3. Try re-loading dashboard from repository

Alerts Not Firing

Symptoms: Condition is met but no notification received

Possible causes:

- Alert is paused
- Contact point misconfigured
- Notification policy not matching

Resolution:

1. Check alert state in Grafana: **Alerting** → **Alert rules**
2. Verify contact point test works: **Alerting** → **Contact points** → **Test**
3. Review notification policy routing

Grafana Cannot Connect to Datasource

Symptoms: "Bad Gateway" or connection timeout in Grafana

Possible causes:

- Prometheus/Loki/InfluxDB service down
- Firewall blocking localhost connections
- Service bound to wrong interface

Resolution:

1. Check service status:

```
systemctl status prometheus loki influxdb
```

2. Verify service is listening:

```
ss -tlnp | grep -E '9090|3100|8086'
```

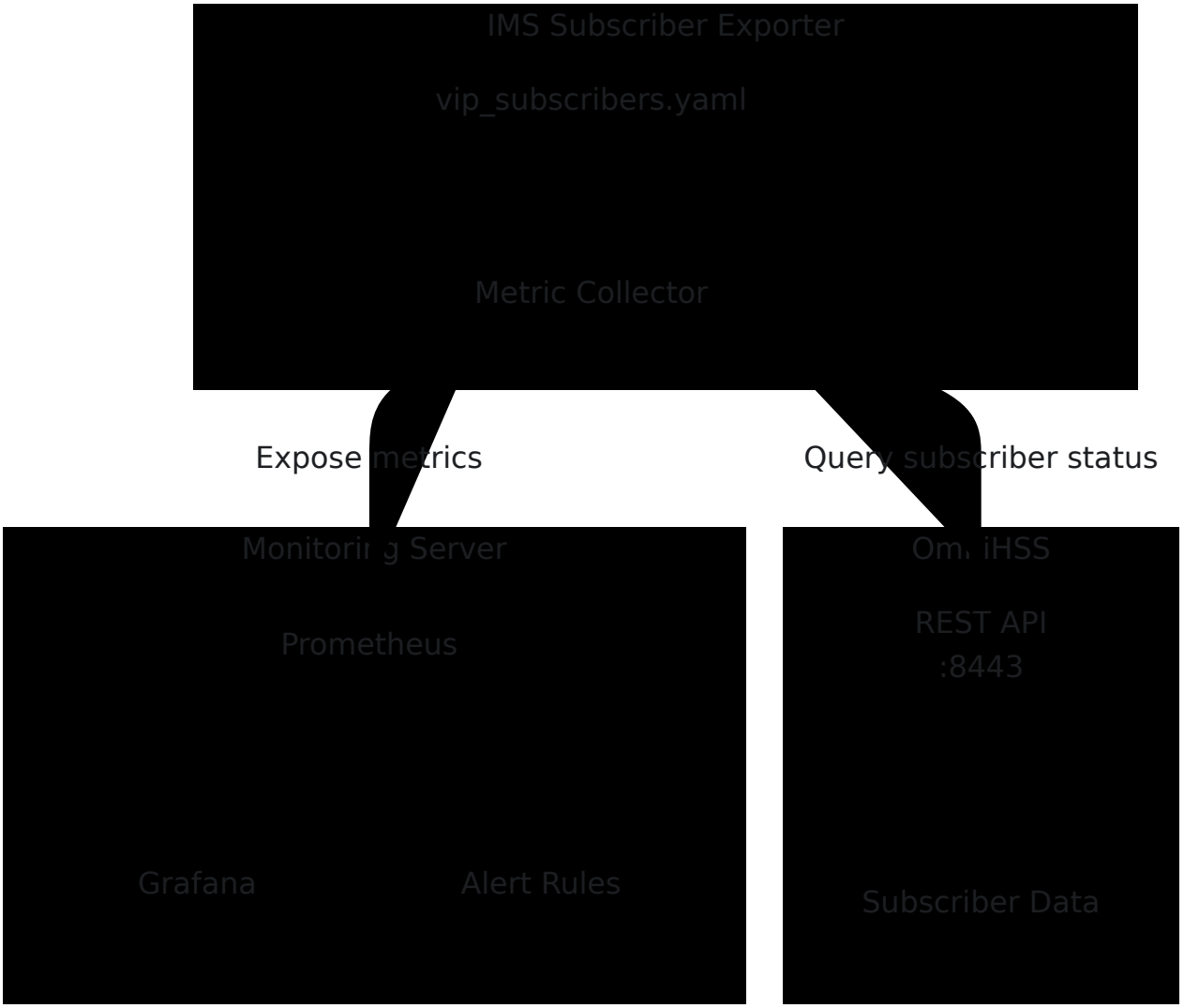
3. Test local connectivity:

```
curl http://localhost:9090/api/v1/status/config
curl http://localhost:3100/ready
```

VIP Subscriber Monitoring

VIP Subscriber Monitoring provides real-time status tracking for critical subscribers. The system monitors IMS registration, EPC attachment, and UE reachability for designated high-priority subscribers such as emergency services, hospitals, and key infrastructure.

Architecture



Service Types

Subscribers are categorized by expected service type, which determines health evaluation:

Type	IMS Required	EPC Required	Use Case
`full`	Yes	Yes	Standard mobile subscribers with voice and data
`voip_only`	Yes	No	VoIP-only devices (IP phones, softphones)
`data_only`	No	Yes	Data-only devices (routers, IoT, M2M)

Health evaluation:

- **full**: Healthy when both IMS registered (`assigned_scscf` not null) AND EPC attached (`last_seen_mme` not null)
- **voip_only**: Healthy when IMS registered (`assigned_scscf` not null)
- **data_only**: Healthy when EPC attached (`last_seen_mme` not null)

Configuration

VIP subscribers are configured in the host group variables:

File: `hosts/<customer>/group_vars/vip_subscribers.yaml`

```yaml
vip_subscriber_monitoring:
  hss_url: "https://10.80.12.140:8443"

  # Monitoring settings
  scrape_interval_seconds: 30
  ping_timeout_seconds: 2
  ping_count: 2

  # Subscribers to monitor
  subscribers:
    # Full service subscribers (IMS + EPC)
    - imsi: "313380930011949"
      label: "Sea Rescue"
      type: "full"

    - imsi: "313380930011948"
      label: "Police"
      type: "full"

    # Data-only services (routers, IoT - no IMS expected)
    - imsi: "313380930010064"
      label: "Hospital Router"
      type: "data_only"

    # VoIP-only services (IMS expected, no data bearer)
    - imsi: "896468419011262"
      label: "Hospital Phones"
      type: "voip_only"
```

Configuration Parameters

Parameter	Type	Required	Default	Descrip
`hss_url`	String	Yes	-	OmniHSS RES (HTTPS)
`scrape_interval_seconds`	Integer	No	30	How often to subscriber sta
`ping_timeout_seconds`	Integer	No	2	Timeout for U tests
`ping_count`	Integer	No	2	Number of pi packets to se
`blackbox_exporter_url`	String	No	-	Remote black exporter URL tests (e.g., `http://pcscf` Uses remote l probe instead ping.
`subscribers`	List	Yes	-	List of subscri monitor

Subscriber Parameters

Parameter	Type	Required	Default	Description
`imsi`	String	Yes	-	Subscriber IMSI (15 digits)
`label`	String	No	IMSI	Human-readable name for display
`type`	String	No	`full`	Service type: `full`, `voip_only`, or `data_only`

Note: MSISDN is automatically retrieved from the HSS API response and does not need to be configured.

Metrics

The exporter exposes metrics on port 9550 at `/metrics`.

Status Metrics

Metric	Type	Description
`vip_subscriber_service_healthy`	Gauge	1 if subscriber meets health criteria for their service type, 0 otherwise
`vip_subscriber_ims_registered`	Gauge	1 if subscriber has assigned S-CSCF, 0 otherwise
`vip_subscriber_epc_registered`	Gauge	1 if subscriber has active MME attachment, 0 otherwise
`vip_subscriber_ue_ip_reachable`	Gauge	1 if UE IP responds to ping, 0 otherwise
`vip_subscriber_hss_reachable`	Gauge	1 if HSS API returned valid data, 0 otherwise
`vip_subscriber_enabled`	Gauge	1 if subscriber account is enabled in HSS, 0 otherwise

Age Metrics

Metric	Type	Description
`vip_subscriber_ims_registration_age_seconds`	Gauge	Seconds since last IMS registration (-1 if not registered)
`vip_subscriber_epc_registration_age_seconds`	Gauge	Seconds since last EPC update location (-1 if not attached)

Info Metric

Metric	Type	Description
`vip_subscriber_info`	Gauge	Always 1, carries all status and info as labels

Labels on all metrics:

Label	Description	Example
`imsi`	Subscriber IMSI	`313380930011948`
`label`	Human-readable name	`Police`
`msisdn`	Phone number (from HSS)	`24724748250`
`type`	Service type	`full`, `voip_only`, `data_only`

Additional labels on `vip_subscriber_info`:

Label	Description	Example
`healthy`	Service health status	`1` or `0`
`ims`	IMS registration status	`1` or `0`
`epc`	EPC attachment status	`1` or `0`
`ping`	UE IP reachability	`1` or `0`
`assigned_scscf`	S-CSCF hostname	`scscf01.ims.example.com`
`last_seen_mme`	MME hostname	`mme02.epc.example.com`
`ue_ip`	UE assigned IP address	`100.72.83.20`

Example Queries

```
# Count of healthy VIP subscribers
count(vip_subscriber_service_healthy == 1)

# Count of unhealthy VIP subscribers
count(vip_subscriber_service_healthy == 0)

# IMS registration status for VoIP services
vip_subscriber_ims_registered{type=~"voip_only|full"}

# EPC attachment status for data services
vip_subscriber_epc_registered{type=~"data_only|full"}

# Subscribers with stale IMS registration (>1 hour)
vip_subscriber_ims_registration_age_seconds > 3600
```

Dashboard

The **IMS VIP Subscribers** dashboard provides real-time visibility into VIP subscriber status.

Location: Grafana → IMS → IMS VIP Subscribers

Dashboard URL: `/d/ims-vip-subscribers/`

Panels

Panel	Description
Services Healthy	Count of subscribers meeting health criteria
Services Unhealthy	Count of subscribers failing health criteria
IMS Registered	Count of subscribers with active IMS registration
EPC Registered	Count of subscribers with active EPC attachment
UE Reachable	Count of subscribers with pingable UE IP
Total Monitored	Total number of configured VIP subscribers
VIP Subscriber Status	Table showing all subscribers with status columns
Service Health Over Time	State timeline showing health history

Alerting

Alert rules fire when VIP subscriber services become unhealthy.

VIP Subscriber Service Unhealthy

Alert: `VIP Subscriber Service Unhealthy` **Severity**: Critical **For**: 1 minute
Condition: `vip_subscriber_service_healthy == 0`

Annotations:

- **Summary**: `VIP Subscriber {{ $labels.label }} is unhealthy`
- **Description**: Includes service type and appropriate identifier:
  - VoIP services: Name and MSISDN
  - Data services: Name and IMSI
  - Full services: Name, MSISDN, and IMSI

Example alert descriptions:

- `Hospital Phones (voip_only) service is DOWN. MSISDN: 24724766000`
- `Hospital Router (data_only) service is DOWN. IMSI: 313380930010064`
- `Police (full) service is DOWN. MSISDN: 24724748250 IMSI: 313380930011948`

Adding New VIP Subscribers

1. Edit the configuration file:

```
# hosts/<customer>/group_vars/vip_subscribers.yaml
subscribers:
  - imsi: "123456789012345"
    label: "New VIP Subscriber"
    type: "full"  # or voip_only, data_only
```

2. Deploy the updated configuration:

```
scp vip_subscribers.yaml <monitoring-server>:/tmp/
ssh <monitoring-server> "sudo cp /tmp/vip_subscribers.yaml
/etc/prometheus/vip_subscribers.yaml && sudo systemctl restart
ims-subscriber-exporter"
```

3. Verify the new subscriber appears in metrics:

```
curl -s http://<monitoring-server>:9550/metrics | grep "New VIP
Subscriber"
```

Related Documentation

- Centralized Logging — Detailed Loki and Alloy configuration
- Deployment Architecture — Overall system architecture
- Hosts File Configuration — Inventory configuration

Netplan Configuration

Overview

OmniCore can automatically configure network interfaces on deployed VMs using netplan. This is useful for:

- Setting up the primary management interface (eth0)
- Adding secondary interfaces for public IPs, peering connections, or dedicated traffic
- Configuring static routes for specific destinations

Enabling Netplan Configuration

To enable automatic netplan configuration for a host, add the `netplan_config` variable pointing to a Jinja2 template in your `group_vars` folder:

```
dra:
  hosts:
    <hostname>:
      ansible_host: 10.0.1.100
      gateway: 10.0.1.1
      netplan_config: netplan.yaml.j2
```

The template will be sourced from `hosts/<customer>/group_vars/netplan.yaml.j2`.

Template Reference

Here is the complete `netplan.yaml.j2` template with comments explaining each section:

```
network:
  version: 2
  ethernets:
    # Primary interface - uses ansible_host and gateway from
inventory
    eth0:
      addresses:
      - "{{ ansible_host }}/{{ mask_cidr | default(24) }}"
      nameservers:
        addresses:
{% if 'dns' in group_names %}
        # If this host IS a DNS server, use external DNS to avoid
circular dependency
        - 8.8.8.8
{% else %}
        # Otherwise, use DNS servers from the 'dns' group in
inventory
{% for dns_host in groups['dns'] | default([]) %}
        - {{ hostvars[dns_host]['ansible_host'] }}
{% endfor %}
{% endif %}
        search:
        - slice
      routes:
      - to: "default"
        via: "{{ gateway }}"

{% if secondary_ips is defined %}
    # Secondary interfaces - loop through secondary_ips dict from
inventory
    # Interface naming: ens19, ens20, ens21... (18 + loop.index)
{% for nic_name, nic_config in secondary_ips.items() %}
    ens{{ 18 + loop.index }}:
      addresses:
      - "{{ nic_config.ip_address }}/{{ mask_cidr | default(24)
}}"
{% if nic_config.routes is defined %}
      # Static routes for this interface - each route uses this
interface's gateway
      routes:
{% for route in nic_config.routes %}
      - to: "{{ route }}"
        via: "{{ nic_config.gateway }}"
```

```
{% endfor %}
{% endif %}
{% endfor %}
{% endif %}
```

Key points:

- `ansible_host` and `gateway` come from the host's inventory entry
- DNS servers are dynamically pulled from hosts in the `dns` group
- Secondary interfaces are named `ens19`, `ens20`, etc. to match Proxmox NIC naming
- Each secondary IP can have its own gateway and static routes

Primary Interface Configuration

The primary interface (eth0) is configured automatically using:

- `ansible_host` - The IP address
- `gateway` - The default gateway
- `mask_cidr` - Network mask (defaults to 24)

DNS servers are automatically set to:

- Hosts in the `dns` group (uses their `ansible_host` IPs)
- Falls back to `8.8.8.8` if the host is itself a DNS server

Secondary Interfaces

For hosts requiring additional network interfaces (public IPs, peering, etc.), use the `secondary_ips` configuration.

Schema

```
secondary_ips:
  <logical_name>:
    ip_address: <ip_address>
    gateway: <gateway_ip>
    host_vm_network: <proxmox_bridge>
    vlanid: <vlan_id>
    routes:                    # Optional - static routes via this
interface
      - '<destination_cidr>'
      - '<destination_cidr>'
```

Interface Naming

Secondary interfaces are automatically named using Ubuntu's predictable naming scheme:

- First secondary interface: `ens19`
- Second secondary interface: `ens20`
- Third secondary interface: `ens21`
- And so on...

This matches the interface names assigned by Proxmox when adding additional NICs to a VM.

Example Configuration

```yaml
dra:
  hosts:
    <hostname>:
      ansible_host: 10.0.1.100
      gateway: 10.0.1.1
      host_vm_network: "ovsbr1"
      vlanid: "100"
      netplan_config: netplan.yaml.j2
      secondary_ips:
        public_ip:
          ip_address: 192.0.2.50
          gateway: 192.0.2.1
          host_vm_network: "vmbr0"
          vlanid: "200"
          routes:
            - '198.51.100.0/24'
            - '203.0.113.0/24'
        peering_ip:
          ip_address: 172.16.50.10
          gateway: 172.16.50.1
          host_vm_network: "ovsbr2"
          vlanid: "300"
          routes:
            - '172.17.0.0/16'
```

Generated Netplan Output

The above configuration generates:

```yaml
network:
  version: 2
  ethernets:
    eth0:
      addresses:
      - "10.0.1.100/24"
      nameservers:
        addresses:
        - 10.0.1.53
        search:
        - slice
      routes:
      - to: "default"
        via: "10.0.1.1"
    ens19:
      addresses:
      - "192.0.2.50/24"
      routes:
      - to: "198.51.100.0/24"
        via: "192.0.2.1"
      - to: "203.0.113.0/24"
        via: "192.0.2.1"
    ens20:
      addresses:
      - "172.16.50.10/24"
      routes:
      - to: "172.17.0.0/16"
        via: "172.16.50.1"
```

Proxmox Integration

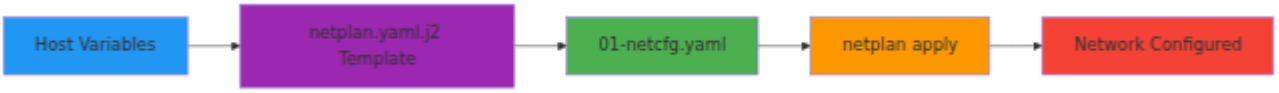
When using the `proxmox.yml` playbook, secondary NICs are automatically created on the VM:

1. **New VMs**: Secondary NICs are added during initial provisioning
2. **Existing VMs**: Secondary NICs are added and the VM is rebooted to apply changes

The Proxmox configuration uses:

- `host_vm_network` - The bridge to attach the NIC to
- `vlanid` - VLAN tag for the interface

How It Works



1. Variables from hosts file are passed to the Jinja2 template
2. Template renders to `/etc/netplan/01-netcfg.yaml`
3. Any existing netplan configs are removed to prevent conflicts
4. `netplan apply` activates the configuration
5. IP addresses are verified with `ip addr show`

Common Use Cases

Diameter Edge Agent (DEA) with Public IP

```
<hostname>:
  ansible_host: 10.0.1.100           # Internal management IP
  gateway: 10.0.1.1
  netplan_config: netplan.yaml.j2
  secondary_ips:
    diameter_roaming:
      ip_address: 192.0.2.50         # Public IP for roaming
partners
      gateway: 192.0.2.1
      host_vm_network: "vmbr0"
      vlanid: "200"
      routes:
        - '198.51.100.0/24'          # Roaming partner network
```

PGW with S5/S8 Interface

```
<hostname>:
  ansible_host: 10.0.2.20            # Internal IP
  gateway: 10.0.2.1
  netplan_config: netplan.yaml.j2
  secondary_ips:
    s5s8_interface:
      ip_address: 203.0.113.17       # Public S5/S8 IP
      gateway: 203.0.113.1
      host_vm_network: "vmbr0"
      vlanid: "50"
```

Multi-homed Server with Separate Management and Data Networks

```
<hostname>:
  ansible_host: 10.0.1.100           # Management network
  gateway: 10.0.1.1
  netplan_config: netplan.yaml.j2
  secondary_ips:
    data_network:
      ip_address: 10.0.2.100         # Data network
      gateway: 10.0.2.1
      host_vm_network: "ovsbr2"
      vlanid: "200"
    backup_network:
      ip_address: 10.0.3.100         # Backup network
      gateway: 10.0.3.1
      host_vm_network: "ovsbr3"
      vlanid: "300"
```

Referencing Secondary IPs in Templates

You can reference secondary IP addresses in other Jinja2 templates and configuration files.

On the Same Host

When configuring a service on the same host that has secondary IPs, you can reference directly or use `inventory_hostname`:

```
# Reference directly (simplest)
{{ secondary_ips.diameter_public_ip.ip_address }}

# Or explicitly via inventory_hostname (same result)
{{ hostvars[inventory_hostname]['secondary_ips']
['diameter_public_ip']['ip_address'] }}

# Access other properties
{{ secondary_ips.diameter_public_ip.gateway }}
{{ secondary_ips.diameter_public_ip.vlanid }}
```

From Another Host

When you need to reference a *different* host's secondary IP (e.g., configuring a peer connection), use `hostvars` with the target hostname:

```
# Reference first host in dra group
{{ hostvars[groups['dra'][0]]['secondary_ips']
['diameter_public_ip']['ip_address'] }}

# Loop through all DRA hosts and get their public IPs
{% for host in groups['dra'] %}
{% if hostvars[host]['secondary_ips'] is defined %}
  - {{ hostvars[host]['secondary_ips']['diameter_public_ip']
['ip_address'] }}
{% endif %}
{% endfor %}
```

Example: DRA Peer Configuration

Configure a diameter peer to bind to its own public IP:

```
# In dra_config.yaml.j2 - use inventory_hostname for the current
host
peers:
  - name: external_peer
    # Bind to this host's public diameter IP
    local_ip: {{ hostvars[inventory_hostname]['secondary_ips']
['diameter_public_ip']['ip_address'] }}
    remote_ip: 198.51.100.50
    port: 3868
```

Checking if Secondary IPs Exist

Always check if the variable exists before using it:

```
{% if secondary_ips is defined and
secondary_ips.diameter_public_ip is defined %}
public_ip: {{ secondary_ips.diameter_public_ip.ip_address }}
{% else %}
public_ip: {{ ansible_host }}
{% endif %}
```

Troubleshooting

Verify Interface Names

SSH to the VM and check interface names:

```
ip link show
```

Expected output for a VM with two secondary interfaces:

```
1: lo: <LOOPBACK,UP,LOWER_UP> ...
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> ...
3: ens19: <BROADCAST,MULTICAST,UP,LOWER_UP> ...
4: ens20: <BROADCAST,MULTICAST,UP,LOWER_UP> ...
```

Check Netplan Configuration

```
cat /etc/netplan/01-netcfg.yaml
```

Apply Netplan Manually

```
netplan apply
```

Debug Netplan

```
netplan --debug apply
```

Verify Routes

```
ip route show
```

Related Documentation

- Hosts File Configuration - Host inventory setup
- Proxmox VM/LXC Deployment - VM provisioning
- Configuration Reference - All configuration variables

Proxmox VM/LXC Deployment

The majority of our customers run the OmniCore stack on Proxmox, this guide explains in detail how to use the `proxmox` plays to setup their environment using Proxmox.

We still continue to support VMware, HyperV and cloud (Currently Vultr / AWS / GCP) for deployments.

See Also:

- Hosts File Configuration - Define VMs to deploy
- IP Planning Standard - IP address assignment guidelines
- Netplan Configuration - Secondary IPs and multi-NIC setup
- Deployment Architecture - Complete deployment workflow

LXC vs VM

LXC Containers:

- Lightweight, shares host kernel
- Fast startup, low overhead
- Limited isolation
- Cannot run custom kernels or kernel modules
- **Not suitable for production deployments**
- **Cannot run UPF** (requires kernel modules/TUN devices)

VMs (KVM):

- Full virtualization with dedicated kernel
- Complete isolation
- Can run kernel modules and custom networking
- Higher resource overhead

- **Recommended for production**
- **Required for UPF deployments**

Use Cases:

- **VMs**: Production sites, UPF, all network functions
- **LXC**: Lab/test environments, lightweight services (apt-cache, monitoring)

Proxmox Setup

1. Create API Token

```
# In Proxmox UI: Datacenter → Permissions → API Tokens
# Create token: root@pam!<TokenName>
# Copy the token secret (shown once)
```

2. Create Cloud-Init VM Template (for VMs only)

Run this script on the Proxmox host. It downloads Ubuntu's cloud image and creates a template with cloud-init user credentials.

```
#!/bin/bash
set -e

TEMPLATE_ID=9000
IMAGE_URL="https://cloud-images.ubuntu.com/noble/current/noble-
server-cloudimg-amd64.img"
IMAGE="noble-server-cloudimg-amd64.img"

echo "=== Downloading Ubuntu cloud image ==="
cd /var/lib/vz/template/iso
wget -N "$IMAGE_URL"

echo "=== Cleaning up old template ==="
qm destroy $TEMPLATE_ID --purge 2>/dev/null || true

echo "=== Enabling snippets storage ==="
pvesm set local --content images,vztmpl,iso,backup,snippets

echo "=== Creating cloud-init user-data ==="
mkdir -p /var/lib/vz/snippets
cat > /var/lib/vz/snippets/user-data.yml << 'USERDATA'
#cloud-config
ssh_pwauth: true
users:
  - name: omnitouch
    plain_text_passwd: password
    lock_passwd: false
    shell: /bin/bash
    sudo: ALL=(ALL) NOPASSWD:ALL
    groups: sudo
USERDATA

echo "=== Creating template VM ==="
qm create $TEMPLATE_ID --name ubuntu-2404-template --memory 2048 -
-cores 2 --net0 virtio,bridge=vmbr0
qm importdisk $TEMPLATE_ID $IMAGE local-lvm
qm set $TEMPLATE_ID --scsihw virtio-scsi-pci --scsi0 local-
lvm:vm-${TEMPLATE_ID}-disk-0
qm set $TEMPLATE_ID --ide2 local-lvm:cloudinit
qm set $TEMPLATE_ID --boot c --bootdisk scsi0
qm set $TEMPLATE_ID --vga std
qm set $TEMPLATE_ID --agent enabled=1
qm set $TEMPLATE_ID --cicustom user=local:snippets/user-data.yml
```

```
qm template $TEMPLATE_ID

echo "=== Template $TEMPLATE_ID created successfully ==="
```

Notes:

- Template provides a fallback login: `omnitouch` / `password` (for console access if cloud-init fails)
- When cloning via Ansible, credentials are overridden from `local_users` in your hosts file:
  - Username: First user's key from `local_users`
  - Password: First user's `password` field (defaults to 'password' if not set)
  - SSH key: First user's `public_key` field
- `--vga std` ensures the Proxmox web console works
- `-N` flag on wget only downloads if newer than local copy

Alternative: Manual Template from ISO

If cloud images aren't available or you need a custom install:

Step 1: Create VM via Web UI

- Create New VM → VM ID 9000, Name: ubuntu-2404-template
- OS: Upload Ubuntu Server ISO or use existing ISO
- System: Default (SCSI Controller: VirtIO SCSI)
- Disks: 32GB, Bus: SCSI
- CPU: 2 cores
- Memory: 2048 MB
- Network: VirtIO, bridge vmbr0
- Start VM and install Ubuntu Server

Step 2: Inside VM - Clean and prepare

```
# Install cloud-init
sudo apt update
sudo apt install cloud-init qemu-guest-agent -y

# Clean machine-specific data
sudo cloud-init clean
sudo rm -f /etc/machine-id /var/lib/dbus/machine-id
sudo rm -f /etc/ssh/ssh_host_*
sudo truncate -s 0 /etc/hostname
sudo truncate -s 0 /etc/hosts

# Clear bash history and shutdown
history -c
sudo poweroff
```

Step 3: Add Cloud-Init and Convert to Template

- Select VM → Hardware → Add → CloudInit Drive (select storage e.g., local-lvm)
- Cloud-Init → User: `omnitouch`, Password: `password`
- Hardware → Options → QEMU Guest Agent → Enable
- Right-click VM → Convert to Template

3. Download LXC Template (for LXC only)

```
# In Proxmox node shell:
pveam update
pveam download local ubuntu-24.04-standard_24.04-2_amd64.tar.zst
```

Hosts File Configuration

For VM Deployment (proxmox.yml)

```yaml
all:
  vars:
    proxmoxServers:
      pve-node-01:
        proxmoxServerAddress: 192.168.1.100
        proxmoxServerPort: 8006
        proxmoxRootPassword: YourPassword
        proxmoxApiTokenName: ansible
        proxmoxApiTokenSecret: "your-token-secret-uuid"
        proxmoxTemplateName: ubuntu-2404-template
        proxmoxTemplateId: 9000
        proxmoxNodeName: pve-node-01
        storage: local-lvm  # optional
      pve-node-02:
        # ... second node config

    # User credentials - first user is used for VM cloud-init
    local_users:
      admin_user:
        name: Admin User
        public_key: "ssh-rsa AAAA..."
        password: "optional-password"  # defaults to 'password' if
not set

mme:
  hosts:
    site-mme01:
      ansible_host: 192.168.1.10
      gateway: 192.168.1.1
      vlanid: "100"  # optional
```

For LXC Deployment (proxmox_lxc.yml)

```yaml
all:
  vars:
    proxmoxServerAddress: 192.168.1.100
    proxmoxServerPort: 8006
    proxmoxNodeName: ['pve-node-01', 'pve-node-02']  # single or
list
    proxmoxApiTokenName: ansible
    PROXMOX_API_TOKEN: "your-token-secret-uuid"
    proxmoxLxcOsTemplate: 'local:vztmpl/ubuntu-24.04-
standard_24.04-2_amd64.tar.zst'
    proxmoxLxcCores: 2
    proxmoxLxcMemoryMb: 4096
    proxmoxLxcDiskSizeGb: 30
    proxmoxLxcRootFsStorageName: local-lvm
    mask_cidr: 24
    host_vm_network: vmbr0

    # User credentials - first user is used for initial VM/LXC
access
    local_users:
      admin_user:
        name: Admin User
        public_key: "ssh-rsa AAAA..."
        password: "optional-password"  # defaults to 'password' if
not set

apt_cache_servers:
  hosts:
    site-cache:
      ansible_host: 192.168.1.20
      gateway: 192.168.1.1
      vlanid: "100"  # optional
      proxmoxLxcDiskSizeGb: 120  # per-host override
```

Usage

Deploy VMs

```
ansible-playbook -i hosts/Customer/hosts.yml
util_playbooks/proxmox.yml
```

Deploy LXC Containers

```
ansible-playbook -i hosts/Customer/hosts.yml
util_playbooks/proxmox_lxc.yml
```

Delete VMs/LXCs

```
ansible-playbook -i hosts/Customer/hosts.yml
util_playbooks/proxmox_delete.yml
```

Behavior

proxmox.yml

- Checks if VM with same name already exists in Proxmox
- Distributes VMs across nodes using round-robin
- Clones from template
- Configures static IP, tags, and cloud-init
- **Sets cloud-init user credentials from first `local_users` entry**
- Supports VLAN tagging

proxmox_lxc.yml

- Checks container doesn't exist by name or IP

- Distributes LXCs across nodes using round-robin
- Creates container with static IP
- **Automatically creates first `local_users` account with sudo access and SSH key**
- Configures netplan for networking
- Auto-starts containers
- Excludes UPF hosts

proxmox_delete.yml

- Stops and deletes VM/LXC matching inventory hostname
- Searches across all configured nodes
- Force stops after 20 seconds

VM/LXC Distribution & Tagging

Round-Robin Distribution

VMs and LXCs are automatically distributed across Proxmox nodes using round-robin (modulo) logic:

Example with 3 hypervisors and 5 MMEs:

```
mme01 → pve-node-01 (index 0 % 3 = 0)
mme02 → pve-node-02 (index 1 % 3 = 1)
mme03 → pve-node-03 (index 2 % 3 = 2)
mme04 → pve-node-01 (index 3 % 3 = 0)
mme05 → pve-node-02 (index 4 % 3 = 1)
```

How it works:

1. Playbook identifies the host's role group (e.g., `mme`, `sgw`, `hss`)
2. Calculates host index within that group (0-based)
3. Uses modulo operation: `host_index % number_of_nodes`
4. Selects hypervisor based on result

Configuration:

```
# For VMs (proxmox.yml) - define multiple servers
proxmoxServers:
  pve-node-01: { ... }
  pve-node-02: { ... }
  pve-node-03: { ... }

# For LXCs (proxmox_lxc.yml) - list multiple nodes
proxmoxNodeName: ['pve-node-01', 'pve-node-02', 'pve-node-03']
```

Automatic Tagging

VMs and LXCs are automatically tagged with:

- **Role/Group names**: All Ansible groups the host belongs to
- **Site name**: The `site_name` variable

Example:

```
site_name: "melbourne-prod"

mme:
  hosts:
    melbourne-mme01: { ... }
```

Result: VM/LXC tagged with: `mme`, `melbourne-prod`

Tags are visible in Proxmox UI and useful for filtering/organization.

Per-Host Overrides

Override defaults on specific hosts:

```yaml
hosts:
  high-spec-host:
    ansible_host: 192.168.1.50
    gateway: 192.168.1.1
    proxmoxLxcCores: 8        # override cores
    proxmoxLxcMemoryMb: 16384  # override memory
    proxmoxLxcDiskSizeGb: 100  # override disk
```

Service Playbooks

Service playbooks deploy and configure OmniCore infrastructure. Located in the `services/` directory.

Playbook Hierarchy

Playbooks are structured hierarchically to enable fast, targeted deployments:

```
all.yml
├── setup_users.yml
├── apt_cache.yml
├── dns.yml
├── common.yml
├── license_server.yml
├── monitoring.yml
│   └── grafana.yml
├── epc.yml
│   ├── common.yml
│   ├── omnimme.yml
│   ├── omnisgwc.yml
│   ├── omnipgwc.yml
│   ├── upf.yml
│   ├── omnihss.yml
│   └── omnidra.yml
├── ims.yml
│   ├── pcscf.yml
│   ├── icscf.yml
│   ├── scscf.yml
│   ├── as.yml
│   ├── omnimessage.yml
│   ├── smsc.yml
│   └── omnisep.yml
├── omniepdg.yml
├── omniss7.yml
├── ocs.yml
├── crm.yml
├── ran_monitor.yml
└── health_check.yml
```

Run only what you need. Deploying a single component (e.g., `omnimme.yml`) takes seconds. Running `all.yml` across 50 hosts takes longer but handles everything. Use `--limit` to narrow scope further.

Quick Reference

Top-Level Playbooks

Playbook	Scope	Description
`all.yml`	Full network	Complete deployment: users, DNS, monitoring, EPC, IMS, OCS, CRM
`epc.yml`	Packet Core	MME, SGW-C, PGW-C, UPF, HSS, DRA
`ims.yml`	Voice/IMS	P/I/S-CSCF, Application Server, XCAP, Messaging
`ocs.yml`	Charging	CGrateS, KeyDB cluster, OCS sync
`monitoring.yml`	Observability	Prometheus, Grafana, exporters, HOMER

Infrastructure Playbooks

Playbook	Description
`common.yml`	Base OS config, packages, NTP, logging agents
`setup_users.yml`	Local user accounts and SSH keys
`dns.yml`	DNS server deployment
`license_server.yml`	OmniCore license server
`netplan.yml`	Network interface configuration
`firewall.yml`	iptables/nftables rules
`apt_cache.yml`	Local APT mirror (if enabled)

EPC Components

Playbook	Component	Description
`omnimme.yml`	OmniMME	Mobility Management Entity (4G)
`omnisgwc.yml`	OmniSGW-C	Serving Gateway Control Plane
`omnipgwc.yml`	OmniPGW-C	PDN Gateway Control Plane
`upf.yml` / `omniupf.yml`	OmniUPF	User Plane Function (combined SGW-U/PGW-U)
`omnihss.yml` / `hss.yml`	OmniHSS	Home Subscriber Server
`omnidra.yml`	OmniDRA	Diameter Routing Agent
`omnitwag.yml`	OmniTWAG	Trusted Wireless Access Gateway
`omniepdg.yml`	OmniEPDG	Evolved Packet Data Gateway (WiFi Calling)
`gtp_proxy.yml`	GTP Proxy	GTP traffic proxy

IMS Components

Playbook	Component	Description
`pcscf.yml`	P-CSCF	Proxy Call Session Control Function
`icscf.yml`	I-CSCF	Interrogating CSCF
`scscf.yml`	S-CSCF	Serving CSCF
`as.yml`	OmniTAS	Telephony Application Server
`omnisep.yml`	OmniSEP	XCAP, Entitlement Server, BSF, Visual Voicemail
`omnimessage.yml`	OmniMessage	SMS-over-IP controller
`smsc.yml`	SMSC	Short Message Service Centre

Supporting Services

Playbook	Description
`ocs.yml`	Online Charging System (CGrateS + KeyDB)
`crm.yml`	Customer management portal
`omniss7.yml`	SS7/SIGTRAN gateway
`homer.yml`	SIP/Diameter packet capture
`grafana.yml`	Grafana dashboards and alerting
`promtail.yml`	Log shipping to Loki
`ran_monitor.yml`	RAN monitoring integration

VM Provisioning

Playbook	Description
`proxmox.yml`	Create VMs on Proxmox VE
`proxmox_lxc.yml`	Create LXC containers (lab/test)
`proxmox_delete.yml`	Delete Proxmox VMs/LXCs

Operations

Playbook	Description
`backup.yml`	Backup databases and configs
`reboot.yml`	Controlled reboot of hosts
`shutdown.yml`	Graceful shutdown
`apt_update.yml`	Update packages
`apt_refresh_metadata.yml`	Refresh APT cache metadata
`speedtest.yml`	Network throughput testing

Restore Playbooks

Playbook	Description
`restore_applicationserver.yml`	Restore OmniTAS from backup
`restore_omnimessage_controller.yml`	Restore OmniMessage from backup
`restore_smsc.yml`	Restore SMSC from backup

Usage

Deploy Everything

```
ansible-playbook -i hosts/customer/host_files/production.yml
services/all.yml
```

Deploy Specific Subsystem

```
# Just the packet core
ansible-playbook -i hosts/customer/host_files/production.yml
services/epc.yml

# Just IMS/voice
ansible-playbook -i hosts/customer/host_files/production.yml
services/ims.yml
```

Deploy Single Component

```
# Update only the MME
ansible-playbook -i hosts/customer/host_files/production.yml
services/omnimme.yml

# Update only monitoring
ansible-playbook -i hosts/customer/host_files/production.yml
services/monitoring.yml
```

Limit to Specific Hosts

```
# Run all.yml but only on one host
ansible-playbook -i hosts/customer/host_files/production.yml
services/all.yml --limit mme01

# Run on multiple specific hosts
ansible-playbook -i hosts/customer/host_files/production.yml
services/all.yml --limit "mme01,hss01"

# Run on a group
ansible-playbook -i hosts/customer/host_files/production.yml
services/all.yml --limit mme
```

Related Documentation

- Deployment Architecture - Overall deployment workflow
- Hosts File Configuration - Defining infrastructure
- Group Variables Configuration - Customization
- Utility Playbooks - Operational tools (health check, restore, etc.)
- Monitoring & Observability - Grafana, Prometheus, alerting

Utility Playbooks

Utility playbooks provide operational tools for managing deployed OmniCore infrastructure. These playbooks are located in the `util_playbooks/` directory and can be run independently to perform common maintenance and troubleshooting tasks.

Quick Reference

Playbook	Purpose
`proxmox.yml`	Provision VMs on Proxmox
`proxmox_delete.yml`	Delete VMs/LXCs on Proxmox
`proxmox_lxc.yml`	Provision LXC containers on Proxmox
`vmware.yml`	Provision VMs on VMware vSphere
`vmware_delete.yml`	Delete VMs on VMware vSphere
`health_check.yml`	Generate comprehensive health report for all services
`restore_hss.yml`	Restore HSS database and/or configuration from backup
`restore_ocs.yml`	Restore OCS KeyDB, MySQL, and configuration from backup
`ip_plan_generator.yml`	Generate network documentation with Mermaid diagrams
`get_ports.yml`	Audit open ports and listening services across all hosts
`getLocalCapture.yml`	Retrieve packet capture files from hosts
`delete_local_user.yml`	Remove a local user account from all hosts

VM Provisioning

VM provisioning playbooks create and manage virtual machines on hypervisor platforms. All playbooks support `--limit` to target specific hosts or groups.

See Proxmox Deployment for detailed configuration.

Proxmox

Files: `util_playbooks/proxmox.yml`, `util_playbooks/proxmox_lxc.yml`, `util_playbooks/proxmox_delete.yml`

```
# Provision VMs
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/proxmox.yml

# Provision specific group only
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/proxmox.yml --limit mme

# Provision LXC containers
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/proxmox_lxc.yml

# Delete VMs/LXCs
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/proxmox_delete.yml --limit old-host
```

VMware vSphere

Files: `util_playbooks/vmware.yml`, `util_playbooks/vmware_delete.yml`

Prerequisites: Requires dependencies from `requirements.txt` to be installed.

Usage:

```
# Provision VMs
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/vmware.yml

# Provision specific group only
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/vmware.yml --limit mme

# Delete VMs
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/vmware_delete.yml --limit old-host
```

Required Variables:

```yaml
all:
  vars:
    vcenter_ip: "vcenter.example.com"
    vcenter_username: "administrator@vsphere.local"
    vcenter_password: "password"
    vcenter_datacenter: "Datacenter"
    vcenter_folder: "OmniCore"
    vcenter_vm_template: "ubuntu-2404-template"
    vhosts:
      esxi-01:
        vcenter_cluster_ip: "192.168.1.10"
        vcenter_datastore: "datastore1"
```

Health Check

File: `util_playbooks/health_check.yml`

Generates a comprehensive HTML health report covering all deployed OmniCore and OmniCall services.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/health_check.yml
```

Output: `/tmp/health_check_YYYY-MM-DD HH:MM:SS.html`

Information Collected

Component	Data Collected
All services	Service status, version, uptime
OmniHSS	Database status, Diameter peer connections
OmniDRA	Diameter peer connections and status
OmniTAS	Active calls, sessions, registrations, CPU usage
OCS	KeyDB replication status

HSS Restore

File: `util_playbooks/restore_hss.yml`

Restores OmniHSS from backup files. Supports restoring database only, configuration only, or both.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/restore_hss.yml
```

Backup File Formats

Type	Filename Pattern	Contents
Database	`hss_dump_<hostname>_<timestamp>.sql`	MySQL dump of `omnihss` database
Config	`hss_<hostname>_<timestamp>.tar.gz`	Archive of `/etc/omnihss` directory

OCS Restore

File: `util_playbooks/restore_ocs.yml`

Restores OCS (CGrateS) from backup files. Handles multi-master KeyDB replication by restoring to one node and allowing replication to sync to others.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/restore_ocs.yml
```

Restore Process

1. Stops CGrateS and KeyDB on all OCS nodes
2. Clears AOF files to prevent conflicts with restored data
3. Restores KeyDB RDB to first node, starts KeyDB, lets replication sync
4. Restores MySQL StoreDB (optional)
5. Restores `/etc/cgrates` configuration (optional)
6. Starts CGrateS on all nodes

Backup File Formats

Type	Filename Pattern	Contents
KeyDB DataDB	`keydb_dump_<hostname>_<timestamp>.rdb`	KeyDB RDB snapshot
MySQL StoreDB	`cgrates_dump_<hostname>_<timestamp>.sql`	MySQL dump of `cgrates` database
Config	`cgrates_<hostname>_<timestamp>.tar.gz`	Archive of `/etc/cgrates` directory

Prompts

Prompt	Required	Description
KeyDB RDB dump path	Yes	Full path to the KeyDB RDB backup file
MySQL SQL dump path	No	Full path to the CGrateS SQL dump (skip to preserve current StoreDB)
Config tar.gz path	No	Full path to the config backup (skip to preserve current config)

IP Plan Generator

File: `util_playbooks/ip_plan_generator.yml`

Generates network documentation from inventory, including:

- Host IP assignments (primary and secondary NICs)

- Network segment overview
- Interface connectivity diagrams (Diameter, GTP, PFCP, SIP, SS7)

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/ip_plan_generator.yml
```

Output Files

File	Format	Description
`/tmp/ip_plan_<customer>_<site>.md`	Markdown	Text-based documentation
`/tmp/ip_plan_<customer>_<site>.html`	HTML	Interactive diagram with filterable layers

Port Audit

File: `util_playbooks/get_ports.yml`

Audits all listening ports across the deployment and generates documentation.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/get_ports.yml
```

Output Files

File	Description
`/tmp/all_ports.csv`	CSV with hostname, IP, protocol, port, service
`./open_ports.rst`	reStructuredText table for Sphinx documentation

Data Collected

Field	Description
Hostname	Inventory hostname
IP	Host's `ansible_host` IP address
IP Version	IPv4 or IPv6
Transport	TCP or UDP
Port	Listening port number
Service	Process name

Local Capture Retrieval

File: `util_playbooks/getLocalCapture.yml`

Retrieves the two most recent packet capture files from each host's `/etc/localcapture` directory.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/getLocalCapture.yml
```

Output: `./localCapturePcaps/<hostname>/*.pcap`

User Management

File: `util_playbooks/delete_local_user.yml`

Removes a local user account from all hosts in the inventory.

```
ansible-playbook -i hosts/customer/host_files/production.yml
util_playbooks/delete_local_user.yml
```

Prompt: Enter the username to delete when prompted.

Running Utility Playbooks

Basic Syntax

```
ansible-playbook -i <inventory_file> util_playbooks/<playbook>.yml
```

Common Options

Option	Description
`-i <inventory>`	Specify inventory file
`--limit <hosts>`	Limit to specific hosts or groups
`-v` / `-vv` / `-vvv`	Increase verbosity
`--check`	Dry run (show what would change)
`--diff`	Show file differences

Examples

```
# Run health check on production
ansible-playbook -i hosts/acme/host_files/production.yml
util_playbooks/health_check.yml

# Restore HSS on a specific host
ansible-playbook -i hosts/acme/host_files/production.yml
util_playbooks/restore_hss.yml --limit hss01

# Generate IP plan with verbose output
ansible-playbook -i hosts/acme/host_files/production.yml
util_playbooks/ip_plan_generator.yml -v
```