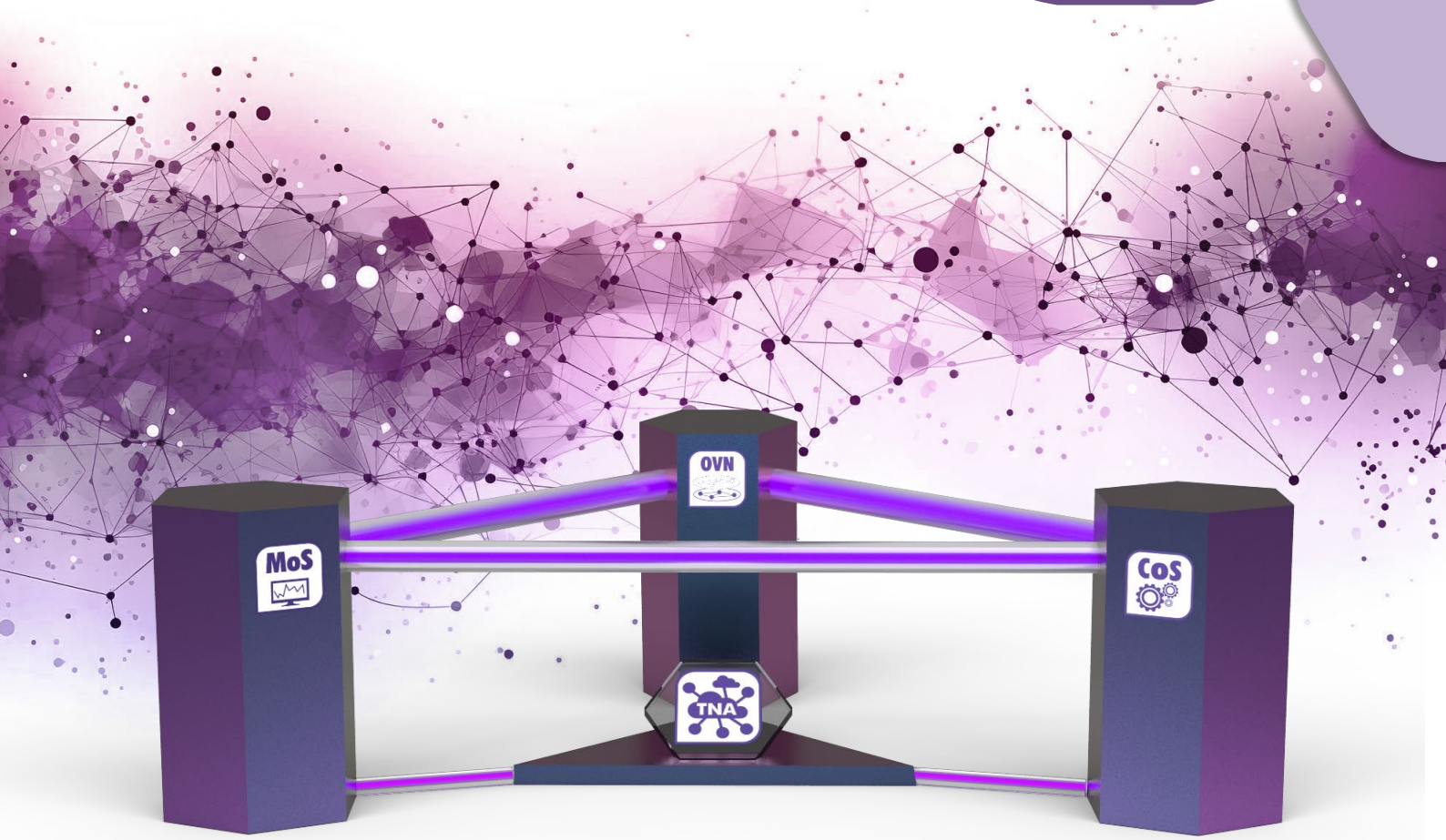
Tiesse
Innovation made in Italy®

Management and automation software



TNA
Tiesse Network Architecture

Zero Touch Provisioning

MoS CoS OVN

Modular suite

Datasheet

WWW.TIESSE.COM

TNA

Tiesse Network Architecture

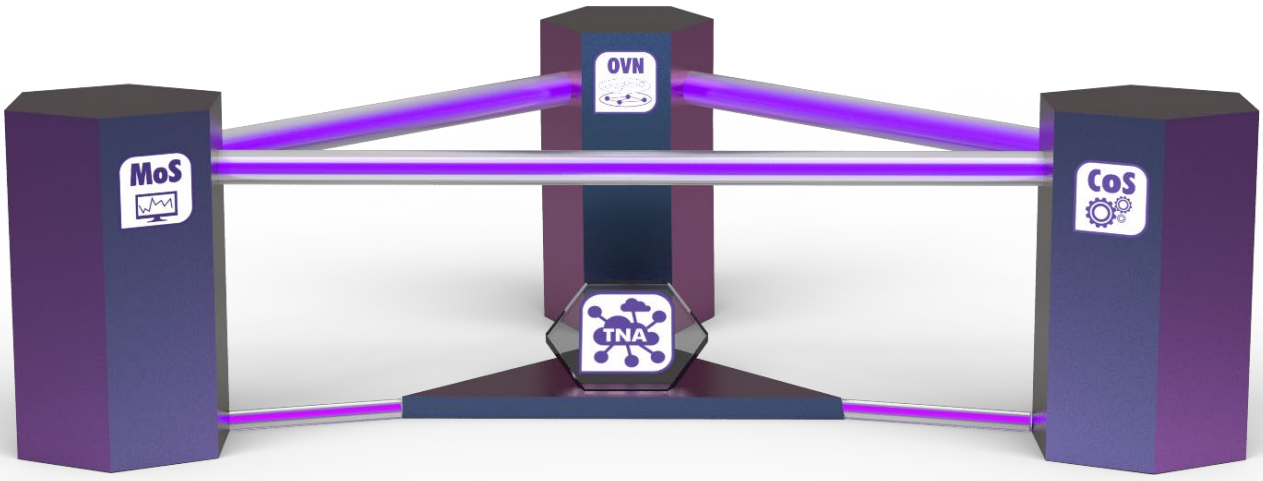
TNA is a distributed SD-WAN solution that gives you complete control over what happens on your network.

TNA (Tiesse Network Architecture) is the platform that gives you complete control over your network. Its main purpose is to enable the creation of a Zero Touch Provisioning network architecture and the monitoring of that network.
It allows you to:

- monitor devices and network status
- view aggregated data
- automatically manage configuration updates according to user-defined policies, triggers or information based on data from all devices.

Another feature of the TNA suite is the ability to perform traffic engineering functions in order to transparently select the link that best suits the performance requirements of the applications.
In addition, the TNA suite allows remote sites to be connected by dynamically creating an overlay network on the public Internet.
The TNA suite is a modular and flexible solution consisting of the following modules **MoS**, **CoS** and **OVN**.

OVN is the module that allows you to create and manage an overlay network on both public and private IP networks subject to NAT, used in the context of an SD-WAN solution.



MoS is the monitoring and analysis module that collects data relating to the behaviour and status of both the network and individual devices. It is capable of monitoring the data traffic of **over 400 applications**, measuring the quality of the links used, detecting any network congestion, and measuring router performance.
MoS also has a specific **Network Anomaly Detection** module.

CoS is the module that allows you to centrally inventory, configure, maintain and update networks of remote routers and IoT devices, both on public and private IP networks.

MoS

Network monitoring and analysis module

The router has an additional agent that periodically sends router operating data to the MOS I module via a TLS session.
The frequency of transmission is a configurable parameter expressed in seconds.
The data that can be exported and viewed may vary depending on the type of device and service. For example, the following information is sent:

- *Uptime* of peripheral network devices and any reboots per time interval
- *Throughput* expressed in bits per second and number of packets per second for all physical, virtual and tunnel network interfaces.
- In the case of a multi-home system, which link is used for the connection (primary or secondary)
- Signal strength on 2G, 3G and 4G networks, if present
- xDSL line alignment data, if present
- Number of active connections (TCP/UDP)
- Number of devices connected to the Wi-Fi network, if present
- Nexthop Round trip time for all interfaces
- Round trip time to an arbitrary destination and with a choice of sending protocol between HTTP, ICMP, UDP, TCP, BFD and TWAMP
- Device CPU and memory usage
- Application-based traffic data
- Data consumption per network interface
- Etc.

COME FUNZIONA

MoS is specifically integrated with Grafana® software, which provides the analysis environment and allows you to run queries and view information using flexible, customisable dashboards.

All metrics and data can be viewed individually or in aggregate form, such as the number of devices transmitting or receiving on a specific network interface, the router with the highest number of active connections as a percentage, or devices with metrics below a certain threshold: the combinations and analyses are virtually unlimited.

Plugins are available that allow interfacing with the most popular data analysis systems.

Furthermore, integration with Open Source monitoring tools is possible.

A **NAD (Network Anomaly Detection)** module is also available, integrated with MOS, which allows you to train an LSTM model, such as Keras/Tensor Flow, to predict unusual network conditions, such as congestion or connection degradation, and prevent impacts on service quality.

ALL-IN-ONE

- ✓ **Visualization** - Wide range of display options to simplify data comprehension.
- ✓ **Multi-channel notification system** - Independent of the graphical interface and extensible. Limits the phenomenon of 'alarm fatigue'.
- ✓ **Aggregation** - Data can be gathered and aggregated within a single dashboard.
- ✓ **Open** - Allows rapid integration and customisation thanks to the use of various plugins available for Grafana® software, an open-source platform.
- ✓ **Extensions** - Creation of hundreds of dashboards and plugins to enhance the data management experience.
- ✓ **Navigation** - Data exploration thanks to ad-hoc queries and dynamic drill-downs. Comparison of different data collection periods and queries.
- ✓ **Collaboration** - Through the agile sharing of data and dashboards from Grafana® software, a data-driven culture is created and expanded across the network.
- ✓ **Autenticazione** - Supportati vari meccanismi di autenticazione quali LDAP, Google Auth, Grafana.com, Github.
- ✓ **Organizzazione** - Possono essere gestite molteplici organizzazioni ognuna con i propri amministratori ed utenti, regole e dashboards. E' supportata la funzione multi-tenancy.
- ✓ **Preferenze** - Per gli amministratori, è possibile selezionare sfondi (tema scuro o chiaro) delle dashboard, modificare i fusi orari e altre impostazioni secondo le specifiche esigenze e preferenze.
- ✓ **Filtri ad hoc** - Creazione di centinaia di dashboard e plugins per ampliare l'esperienza di gestione dati.

MULTI-CHANNEL NOTIFICATION SYSTEM

The multi-channel notification system is **a real-time notification** system that is independent but still integrated into the graphical interface. It is efficient and capable of supporting complex settings and configurations thanks to its own independent database.

Notifications can be sent via various channels: the most commonly used are email, Slack, Pushover and HTTP calls; it is possible to add others, as well as set events to be notified based on even complex parameters.

The MoS multi-channel notification system also has an **"alarm fatigue" protection** function. It is not uncommon for notification systems to experience moments of tilt due to the complexity of trigger event settings, resulting in hundreds of alerts being generated, with the risk of missing important notifications among the large number received: the multi-channel notification system is able to limit this problem thanks to the '**throttling**' function.

The system monitors both the number of alerts sent per hour and whether those generated by the same trigger event exceed a certain amount: in this case, the frequency of sending is revised in order to improve reception, and the notifications themselves are automatically grouped into a single message.

Thanks to the multi-channel notification system, the operator will no longer be dependent on the monitor and graphs for information on events and conditions of interest, but will receive notifications on the channels set up.

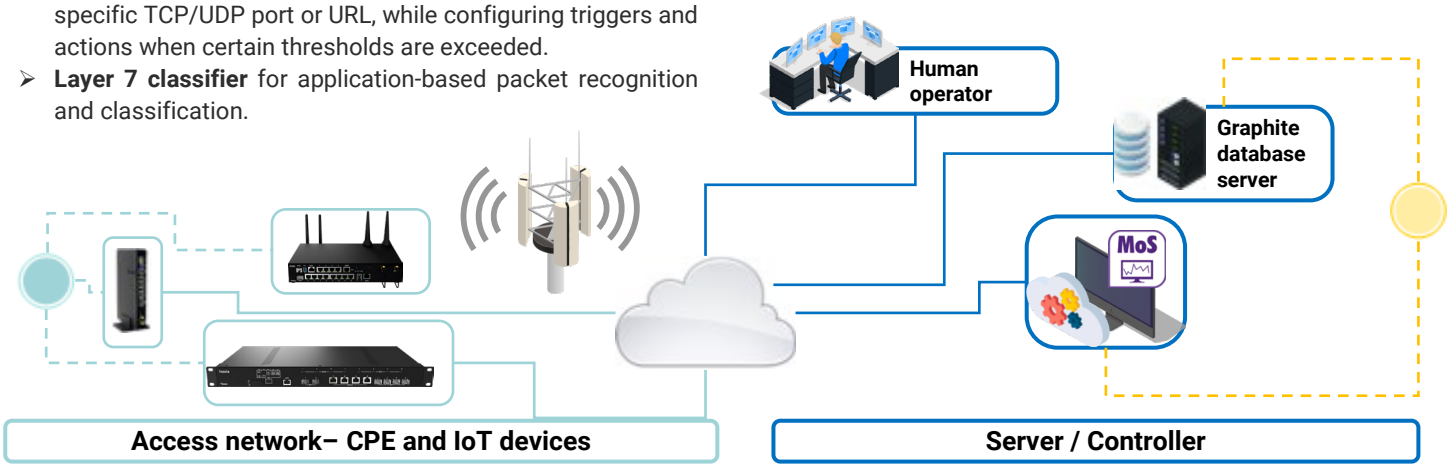
ARCHITECTURE

CPE and Tiesse equipment side (access network)

- ➢ **MoS agent (collectd)** installed on Tiesse routers and devices, consisting of a set of plugins, each of which collects data and information.
- ➢ **RTR service** (Responder Time Reporter) present to measure performance and round trip delay to an IP address, a specific TCP/UDP port or URL, while configuring triggers and actions when certain thresholds are exceeded.
- ➢ **Layer 7 classifier** for application-based packet recognition and classification.

Server / Controller

- ➢ **Load Balancer** and relay nodes to handle up to 10 million metrics per minute.
- ➢ The **database** time-series and the backend server.
- ➢ **Front end** which displays data and allows it to be used (system based on the Grafana® software GUI).



DASHBOARD

The dashboard is flexible and can be customised and personalised according to specific requirements directly by the administrators themselves or can be set up in advance by Tiesse. The product is supplied with a predefined dashboard that includes the following areas.

Router panel

Monitoring and visualisation of key resources **for each individual device** (router, CPE, IoT)

- Router reachability
- Connectivity to a target network/internet (primary/backup or other)
- Reboot count
- Uptime
- RTT - Round Trip Time
  - last mile
  - towards internet targets
- Router load based on current and queued activities on the system
- CPU and memory usage
- Number of active connections
- Inbound/outbound throughput, per interface
- Traffic generated/received per interface
- Traffic classification by application type for specific router
- Number of devices connected to active Wi-Fi network(s)
- GPON optical connections
  - Uptime
  - Input and output optical power
  - Transceiver temperature
- Radio cellular connection
  - Signal strength for each type of connection (4G/3G/2G e SINR, RSRP, RSSI, RSCP, EC/IO)
  - SIM card in use
- xDSL connection
  - Uptime
  - Connection status
  - Signal attenuation
  - Signal-to-noise ratio (SNR)
  - Redundancy errors (CRC)

All router panel

Monitoring and **aggregate** visualisations

- Total number of connected routers, reachable and unreachable, based on uptime
- Number of routers transmitting on a specific interface
- Total number of routers with active mobile connection
- Number of active routers grouped by connection type (primary, backup, other)
- Top 5 active routers by number of connections
- Number of routers connected to 4G, 3G and 2G networks
- Ranking by time of the last routers connected and those no longer reachable
- Ranking of devices by response time (highest and lowest RTT) to a given destination
- Reachable and unreachable devices, based on uptime, within a specified time range

OVN

Monitoring and visualisation of **data relating to the Overlay Network**

- Number of nodes (edges) with which the router has an open peer-to-peer channel
- Bytes and number of packets of the overlay network control protocol
- Total bytes and packets transmitted/received by the router in the overlay network
- Total data transmitted/received via supernode (unicast, multicast and broadcast)
- Bytes and packets transmitted/received via peer-to-peer
- For each router with which peer-to-peer data exchange has taken place, the following are reported:
  - number of bytes/packets passed both in reception and transmission
  - amount of data exchanged with the router via supernode
  - data exchanged via supernode divided by type (unicast, multicast and broadcast)

VoIP

Monitoring and visualisation of relevant **data in Voice over IP (VoIP) scenarios**

- Date and time of the last answered, unanswered, busy, failed, or congested call
- Total duration of answered calls
- Grand total of calls and total divided by answered, unanswered, busy, failed, congested, and total
- Line usage based on active and simultaneous calls
- Connection status for each VoIP server (not registered, registered, rejected)
- For each registered VoIP server, the total number of calls originating from it is shown, divided by type (answered, unanswered, busy, failed, and congested), date, and time
- For each individual FSX port (POTS) on the router, the following information is provided:
  - operating status
  - number of bytes and packets for calls in progress
  - last incoming call answered, unanswered, failed, busy and congested, total number of calls
  - last outgoing call answered, unanswered, failed, busy and congested, total number of calls
- Voltage and electric current values

Intelligent routing - Advanced Traffic Engineering

Thanks to its modules (**CoS**, **MoS**, **OVN**) and their functionalities, the **TNA** suite allows for 'Intelligent routing', i.e. the intelligent routing of data based on the status of the network and the devices that comprise it. The most relevant functionalities are:Policy Based Routing

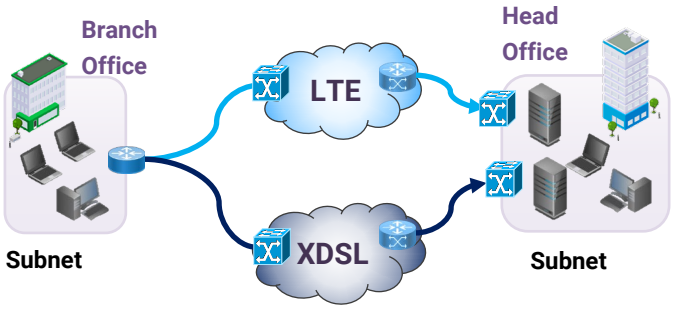
- L7 classifier
- Responder Time Reporter (RTR)
- Overlay Network management (**OVN** module)

By using these and other features together, devices can dynamically modify the configurations and routings used. This provides a complete distributed SDN solution that is ready to respond to changes in network and connection statuses, managing them in an advanced and intelligent manner.

Example - Intelligent routing of HTTP traffic

In this scenario, an xDSL connection is used to connect the head office with the branch offices.

By setting up an event related to HTTP traffic, it is possible to automatically divert web traffic to a mobile radio connection when the values detected do not fall within the threshold values set by the user.



L7

MoS features the **L7 classifier module**, which classifies the most commonly used applications and protocols through accurate and detailed inspection of generated traffic (DPI).

The total amount of data and packets recognised is reported for each individual application. All data can be used to implement any user-defined policies.

The L7 classifier also allows you to set advanced quality of service (QoS) policies within the TNA suite.

SCALABILTY

The Server/Controller component of the MoS module is based on **GOLANG**, the language created by Google for cloud computing infrastructures.

The use of resources by MoS is optimised to make it highly scalable; however, the sizing of these resources depends on the routers to be monitored, as well as the number of metrics per router, the data storage time and the granularity with which the data is monitored over time: the system hosting the Server/Controller must therefore be appropriately configured with these values in mind. A single instance of a dual-processor server equipped with 8GB of RAM can support up to 500,000 metrics/minute.

MoS therefore offers high **scalability**, **availability** and **efficiency**. The architecture is also based on micro-services and can be run on **Kubernetes** for maximum reliability and scalability.

RTR - Responder Time Reporter

MoS is complemented by the **RTR (Responder Time Reporter)** module, which offers the ability to measure network performance and transit times.

RTR periodically sends probe packets (HTTP request, ICMP Echo, UDP Echo, TCP syn, TWAMP - RFC 5357 probe packets) to a specific recipient, collecting the following data for each measurement:

- Round Trip Time
- packet loss
- number of errors

It is also possible to set threshold values for packet loss and Round Trip Time, which allow specific events to be triggered when the values detected do not fall within the set threshold, thereby enabling the implementation of advanced traffic engineering. For example, the user can perform an automatic connection change by setting an event: when the detected values are not within the defined threshold, the connection is moved transparently and automatically.

ANOMALY DETECTION

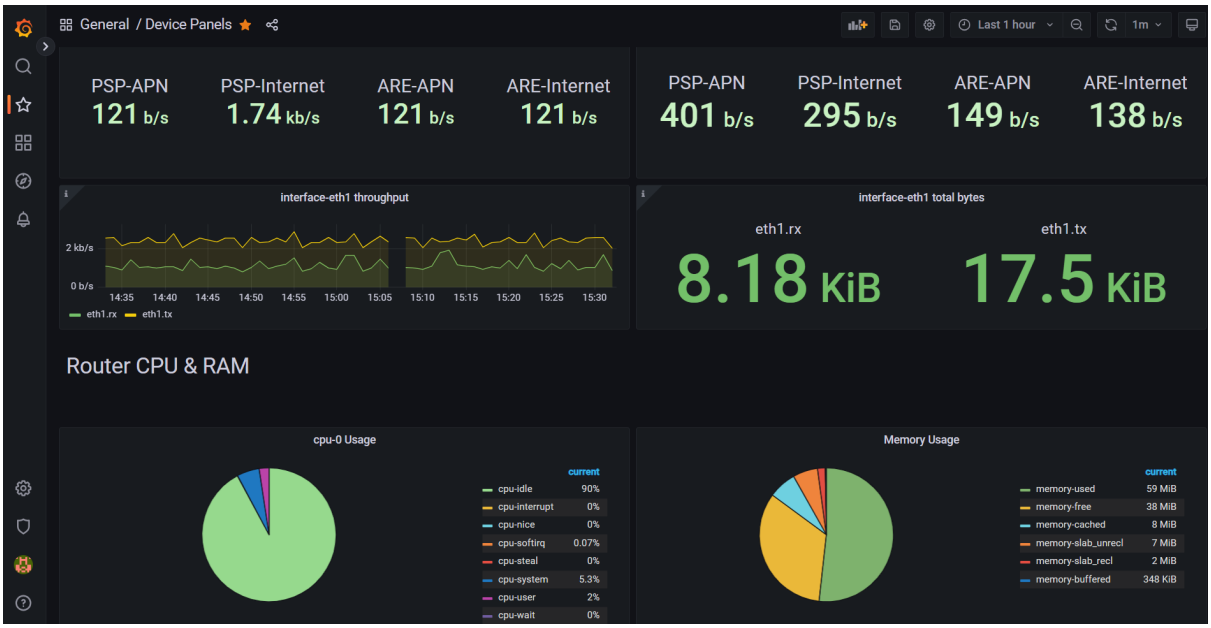
MoS is able to detect anomalies thanks to a specific data analysis component; it recognises network and traffic anomalies both towards routers and central systems.

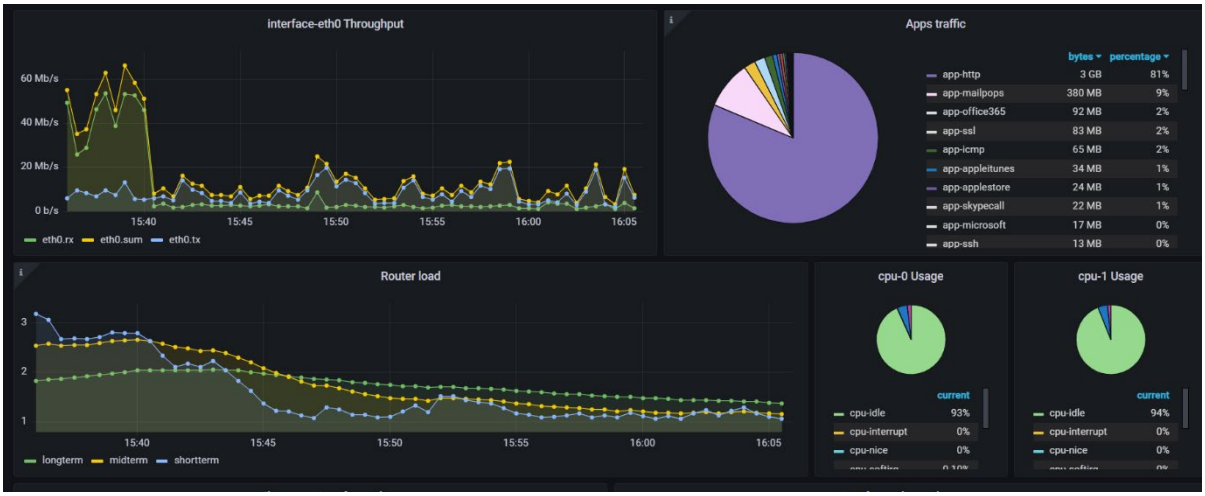
The system uses Keras/Tensorflow **Machine Learning APIs** to autonomously build anomaly thresholds (without human intervention, there is no need to configure or set anything). These thresholds are then updated according to an incremental learning model.

When one of these values is exceeded, the network administrator is immediately notified via appropriate alarms.

DASHBOARD EXAMPLES

Router panel





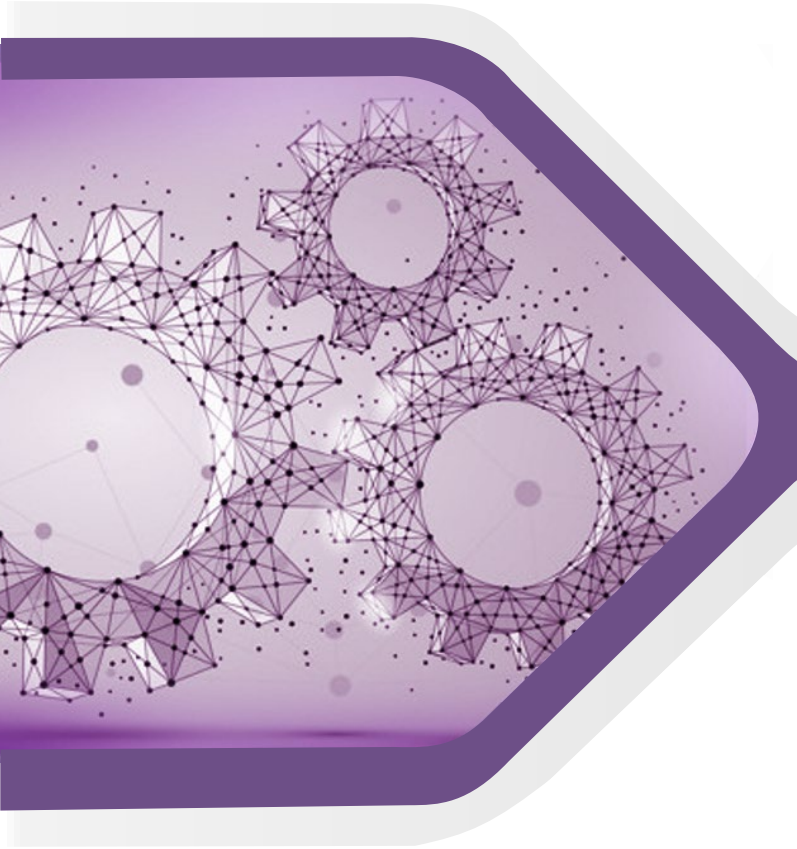
DASHBORD EXAMPLES

All routers

OVN

VoIP

xDSL



CoS

Centralised management module

CoS is a component of the TNA (Tiesse Network Architecture) suite that allows you to perform router inventory and manage configuration and firmware updates.
It allows you to perform the initial installation of the router in **Zero Touch Provisioning** mode.

KEYS FACTORS

Configuring devices one by one requires a lot of manual work and involves the possibility of human error, which further increases release times.

Tiesse's **CoS**:

- **Reduces effort**
- **Limits errors**
- **Cuts costs**

allowing the user to modify the configurations of multiple devices at once, as well as upload firmware to different routers and devices, copy configurations, and schedule updates with a single click.

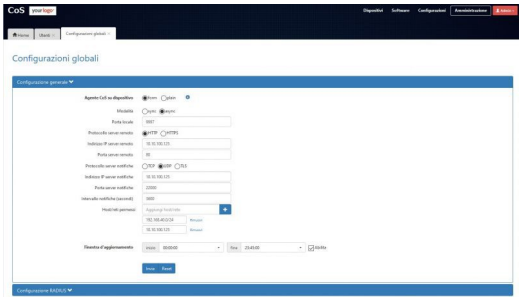
Furthermore, CoS enables:

- Rapid configuration implementation and reduced installation times
- Greater efficiency in deployment
- Reduced risks associated with general network administration
- Easy integration of new remote sites
- Long-lasting installations that support easy configuration migration

FEATURES

- Automatic network discovery and inventory
- Display of configuration and firmware version information
- Firmware and configuration updates performed by an operator or scheduled by setting time slots
- Creation and distribution of network device configuration templates
- Classification of devices and creation of multiple groups
- Bulk network parameter setting in a few simple steps
- Setting commands to enable or disable specific services for specific operators or connection types
- Viewing and downloading reports for each scheduled update
- Defining user accounts with different privilege levels, from read-only to administrator. Each user level has specific restrictions, such as setting updates, creating and modifying templates, managing additional services and exceptions, modifying and creating user accounts, and managing global settings.

HOW IT WORKS



Each router has an agent that periodically sends a notification to the Cos Server module.

This notification contains information about the current firmware and configurations.

After receiving the notification, the server process compares the version installed on the device with the desired version and thus determines whether an update (of the configuration, firmware, or both) is necessary.

The update can be performed immediately, as soon as the server receives the notification, or it can be scheduled on an hourly basis, at a specific interval.

Furthermore, to avoid congestion, the maximum number of updates to be performed in each time interval is programmed.

The COS Server can obtain the router configuration by interfacing with the customer's database. Specific APIs are available for this purpose, which the customer can use.

The specific configuration for each router is generated from the customer's database.

The initial configuration of the router can be done in two ways:

1. **Manual setup** of minimum reachability configuration, i.e. configuration of the router's IP address and routing route to connect to the COS server
2. **Auto-provisioning**: the router is delivered with auto-provisioning functionality directly from the factory. This configuration involves enabling a protocol that allows the router to automatically obtain its own IP address and, once discovered, it presents itself to the Cos server and receives the final configuration for that location.

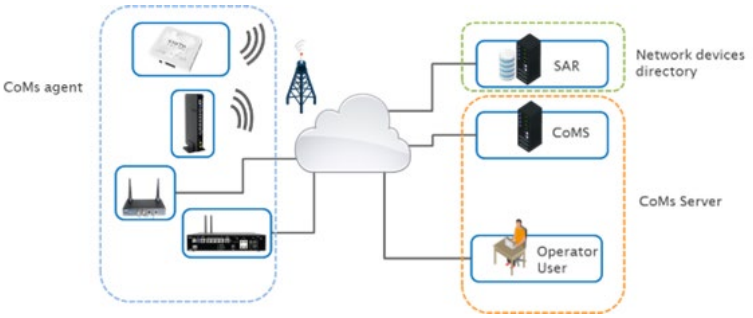
The configuration is expressed according to the YANG model; the protocol used between the CoS server and routers is NETCONF.

The advantage of this approach is that the CoS server can be easily adapted to configure other routers that support this standard.

SCENARIOS

CoS is composed by:

- Routers and M2M/IoT network devices equipped with the CoS agent
- CoS server, which manages both verification and update processes. The application is the heart of the CoS system and is responsible for listening for messages/notifications sent by various network devices. The web interface allows interaction between the operator and users.
- The database containing all information relating to each router (configuration, personal details, firmware release, etc.)



WEB GUI

The web interface is accessible with the corresponding authentication level (via Radius server). The interface is organised into tabs grouped by functionality, which are further divided into specific sections.

Main features	Sections
iOS	Firmware
Devices	Groups Routers Router exceptions
Admin	General settings Users Process logs

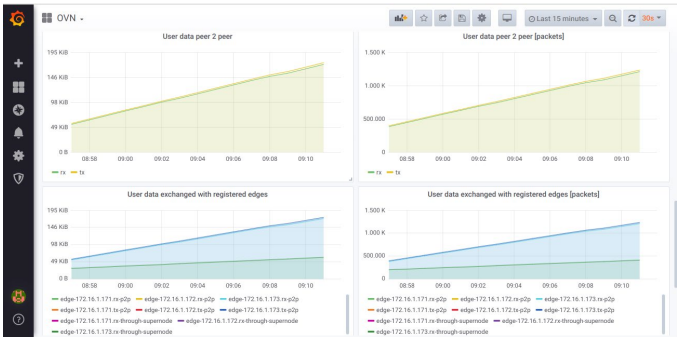
Main features	Sections
Configuration	Services Carriers Line types Router models Router functions Templates Add-on services

OVN

Module for managing Overlay Networks

OVN (Overlay Virtual Network) is the ideal solution for creating secure, encrypted virtual networks, allowing routers to communicate across existing networks (public, private or NAT-enabled).
This technology offers a higher level of security, agility and scalability, significantly reducing costs compared to traditional solutions such as MLPS.

OVN can manage both Hub & Spoke and Full Mesh topologies.
It is based on standard protocols and can also create tunnels to concentrators from other manufacturers.
It manages Hub-and-Spoke Topology and Full-Mesh Topology.



The OVN module has been designed to achieve:

- **Security**
- **Agility**
- **Scalability**
- **Competitiveness**

And

High cost reduction

Unlike more widespread solutions, such as MPLS and IPSec, which also require very expensive hardware, the Tiesse solution is much more economical and reduces usage/management/maintenance costs because it uses user-space tunnelling technologies and is based on general-purpose hardware (such as virtual machines or physical servers on the x86 platform), exploiting parallelism for OVN tunnel management.

Advanced monitoring

Integrated with TNA and Grafana®, the OVN module allows you to monitor nodes, data traffic and tunnel status, providing a comprehensive and detailed view of the network.

Tiesse

Innovation made in Italy®

Tiesse is a totally Italian company with more than 25 years of experience in the design, development and production of network equipment and IoT devices, suitable for use in mission-critical and industrial scenarios. Tiesse's most successful series, Imola, Lipari and Levanto, are innovative, competitive and certified, and are present in the networks of the major telecommunications operators, in the energy sector, large-scale distribution and vertical sectors, both in the Italian and foreign markets.

Further information on Tiesse solutions can be found on the company website www.tiesse.com.

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