DEPLOYING OSM IN PRODUCTION

OSM Ecosystem Day
March 12th 2020
Topics to cover

1. Indra / Minsait
2. Indra and Open Source MANO
3. OSM Distros
4. OSM Infrastructure
5. OSM Operations
6. Integration into the Telco Systems
Indra is one of the leading global consulting and technology companies and the technology partner for its clients’ key businesses around the world.

Minsait is the Indra brand commercialising services and solutions in the information technology industry. It has developed an offer of proprietary solutions and advanced services with high technological added value, making it possible for its clients to solve their more critical matters and improve their processes, efficiency, profitability and differentiation.

**About Indra and Minsait ...**

We work in the entire value chain

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Think</strong></td>
<td><strong>Builds</strong></td>
</tr>
<tr>
<td>Strategic consultancy</td>
<td>Proprietary &amp; Third party solutions</td>
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<tr>
<td>Processes consultancy</td>
<td>Architecture &amp; Integration</td>
</tr>
<tr>
<td>Digital transformation</td>
<td>Own technology</td>
</tr>
</tbody>
</table>

### Financials

€3,104m turnover in 2018

+43,000 professionals

+140 Countries

+4,000 T&M professionals

**Energy & Industry** 19%

**Financial Services** 22%

**Transport & Traffic** 17%

**Defence & Security** 19%

**Telco & Media** 8%

**Public sector. and Health** 15%

*An Indra company*
We work in 15 countries in 4 continents and for more than 30 operators (including 4 of the top 10)

Our figures in Telco & Media

- **Applications management and maintenance**
  - In the BSS and OSS domains through multidisciplinary and global teams
  - +800 BSS / OSS applications: Business Intelligence, Corporate Systems, Network Creation and Provisioning Systems, Supervision, Network Services, ...

- **Data management**
  - With our Telco BigData solution (BigBox)
  - 45M customers
  - 7 countries
  - 1.3 PB data managed

- **Infrastructure management**
  - Through our Sites-asset management solution
  - 15,000 antennas
  - 6,000 municipalities

- **Advertising management**
  - Through our content management solution
  - +14% ads watched
  - +44% purchasing willingness

Business Management
- With the B2B/B2C Connecta solution (eInvoice)
  - 17 m customers with 6,000 m+ bills stored
  - 920K documents / hour

Portability management
- With our Portability Management solution
  - 95 m portabilities processed
  - 6 countries and 10 operators

Network Management
- With DRACO, our fibre monitoring solution
  - 45,000 KM of monitored fibre
  - 125 RTUs (Remote Tester Units)

Support systems
- With our comprehensive ERP solutions service
  - 80% DBs reduction and 40% customized development
  - 50% simplification of the financial model

Back office automation
- With our RPA solutions
  - +26,000 tickets reduction/day
  - +190,000 FTEs reduction/month
Presence in 20+ countries, with operations and services in many of the world's leading telecommunications operators

1. UK  O2 (Mobile)
2. Ireland  TEPS
3. Germany  O2 (Mobile and Fixed)
4. Portugal  Portugal Telecom (Mobile and Fixed)
            NOS
            Anacom (Regulator)
5. Morocco  Orange Maroc
            INWI
6. Italy  Telecom Italia (Mobile and Fixed)
          Wind3 (Mobile and Fixed)
          Vodafone (Mobile and Fixed)
          Open Fiber
7. Spain  Telefónica (Mobile and Fixed)
          Orange – Jazztel
          Vodafone-Ono
          Telecable
          Iberbanda
          R – Euskaltel
          Yoigo
          Cellnex
          Telxius Torres España
          Másmóvil
8. Bulgaria  PPF Group
10. Slovakia  T-Mobile
11. Croatia  T-Mobile
12. Moldova  Orange
13. Serbia  PPF Group
Deploying OSM in production

Presence in 20+ countries, with operations and services in many of the world’s leading telecommunications operators

- **Mexico**: Movistar (Mobile) AT&T Telcel Altán Cablevisión
- **CA**: Movistar ICE Cable & Wireless
- **Colombia**: Movistar (Mobile and Fixed) UNE – TIGO Azteca Com. Claro
- **Peru**: Movistar (Mobile and Fixed) Claro Azteca Com. Entel
- **Brazil**: Movistar (Telesp, Vivo & GVT) TIM (Mobile and Fixed) Claro (Mobile) Oi
- **Chile**: Movistar (Mobile and Fixed) WeM VTR Entel
- **Argentina**: Movistar (Mobile and Fixed) Telecom (Mobile) Personal (Mobile) Telxius Cable Argentina
- **Philippines**: Globe Smart

Latam & Philippines

An Indra company
We have a broad ecosystem of alliances and relevant partners for the industry

Deploying OSM in production

Full-Stack
Main Partners:

Other relevant partners:
Indra and Open Source MANO
Participant in OSM since inception in 2016

Deploying OSM in production
Deploying OSM in production

**TMForum 2017 integration effort: Performance management with Telefónica, Verizon, Riverbed, Sigscale**

<table>
<thead>
<tr>
<th>FIXED BROADBAND ACCESS SCENARIO</th>
<th></th>
</tr>
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<tbody>
<tr>
<td><strong>Performance Management</strong></td>
<td></td>
</tr>
<tr>
<td>OSS</td>
<td></td>
</tr>
<tr>
<td>1. Fine grained performance counters are retrieved directly from the VNF, whose management address is discovered by interrogating the SO</td>
<td></td>
</tr>
<tr>
<td>2. Coarse grained performance counters for SO: internal use and summarized health checks are retrieved from the OSM NB interface and available in the descriptors (pre release 3 feature)</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Configuration Server VNF</strong></td>
<td></td>
</tr>
<tr>
<td>2. <strong>AAA VNF</strong></td>
<td></td>
</tr>
<tr>
<td>3. <strong>AAA VNF</strong></td>
<td></td>
</tr>
<tr>
<td>4. <strong>Load Balancer VNF</strong></td>
<td></td>
</tr>
<tr>
<td>Network Service</td>
<td></td>
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</tbody>
</table>

[Day 2] NFV Management with Open APIs in Open Source MANO
Deploying OSM in production

Contributions to the community: Monitoring stack for the Kubernetes deployment

`./install_osm.sh -c k8s --k8s_monitor`

Access dashboard: [http://<osm-host>:3000](http://<osm-host>:3000)
Deploying OSM in production

**iAAA as a reference VNF**

Auto-scaling of Radius/PCRF server. To be used for UNICA-Next proofs of Concept
The distros
The commercial distros

We work with the three commercial Open Source MANO distros (in alphabetical order)

- Canonical Charmed OSM
  - [Link](https://charmed-osm.com/)

- TATA TE - OSM
  - [Link](https://www.tataelxsi.com/TE-OSM/index.html)

- Whitestack WhiteNFV
  - [Link](https://www.whitestack.com/products/whitenfv/)
OSM infrastructure
Although OSM may be deployed on bare metal servers, in the most typical scenario it is installed on top of a pre-existing IaaS (e.g. Openstack, VMWare VIO)

The full stack is as follows
Deploying OSM in production

The required infrastructure

- **Support VM**
  - Deployment support

- **Kubernetes Cluster**
  - Kubernetes Masters
  - Load Balancers
  - Kubernetes Workers

- **OSM VCA**

E.g. Canonical Juju, Whitestack/Tata deployer workstations

Nodes with significant resources required
Sizing

Details *may vary* as a function of the VIM size, distro, operator requirements, etc.

Numbers below intended as a reference for orders of magnitude

<table>
<thead>
<tr>
<th>Host / Virtual Machine</th>
<th>Number of nodes</th>
<th>Starting resources required</th>
<th>How does it scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment support</td>
<td>1 to 3</td>
<td>1 Core, 4GB RAM, &lt;100GB disk</td>
<td>-</td>
</tr>
<tr>
<td>Kubernetes masters</td>
<td>3 to 6</td>
<td>2 Core, 8GB RAM, &lt;100GB disk</td>
<td>-</td>
</tr>
<tr>
<td>Kubernetes workers</td>
<td>3</td>
<td>8 Core, 32GB RAM 9 Volumes 100GB 14 Volumes 16GB</td>
<td>With the number of Day-2 operations and monitoring params expected</td>
</tr>
<tr>
<td>VCA</td>
<td>3</td>
<td>16 Core, 64GB RAM 100GB Disc</td>
<td>With number of proxy charms (100/Node)</td>
</tr>
</tbody>
</table>
Networking

Outgoing traffic OSM → Operator systems will have origin IP address one of the Worker Nodes

Incoming traffic Operator Systems → OSM will be directed through load balancer
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Communication flows / Security policies

| To Deployer | Deployer and administration machine to Juju controller / ssh |
| To Load Balancer | Users to OSM Graphical User Interface & Dashboards / https ports 88, 3000 |
| To Load Balancer | Users and OSS to NBI / https port 9999 |
| IaaS | Deployer, K8s master & integrator to IaaS API to request resources (storage, LB…)
| From K8S workers | OSM workers to LDAP server / TLS port 636 |
| From K8S workers | OSM workers to SIEM and log collector / TBD |
| From K8S workers | OSM workers to Alarming system / TBD |
| From K8S workers | OSM workers to VIM and SDN-C / https ports TBD |
OSM Operations
Deploying OSM in production

Level 1 / 2 / 3 Support

Onsite L1 support (Indra)
Or Client Operations

Production & pre-production systems

Engineer on-site per OB for production & pre-production

Remote L2 support
Reactive

Current version Lab
Scratch Lab

Remote L3 support
Development

Common team for all clients.
Triage of issues.
Two lab systems (at least): One for current version and another one to be dressed with a version on demand, fit to the Client issue

Distro & Integrator CI/CD

Support phone and ticketing tool
Bug fixing. Sync with upstream

Client Operations or Local Support
Reports issue

L2 support
Verifies issue, reproduces and reports if appropriate

L3 support
Generates patch

Impact analysis
Method Of Procedure
Request maintenance window

Fills bug

Feature & design

Fills bug

Upstreams code update

Upstream project

MDL

FAST TRACK
Operation and maintenance processes

**Backup**
Both Kubernetes cluster and OSM. Adapt to whatever is available in the Telco infrastructure.

**Software updates**
Bugs and security patches with backwards compatibility as part of L2 support. Major version changes require dedicated activities.

**Adding additional resources**
As the size of the managed resource pool grows, the OSM infrastructure may need to grow by adding more nodes or scaling vertically the existing ones.

**Housekeeping**
Configuration changes (e.g. LDAP, logs..), checking of database performance, host health, etc.
Deploying OSM in production

VNF integration into OSM with Telco mindset

VNF onboarding. Definition of descriptors.
May be done in Indra lab, previous to any activities in the end client lab.

VNF management. Definition of charms

Testing
Functional, performance and management.

Experience with vEPC (e.g. Mavenir), SD-WAN (Versa), Fixed Access (virtual Cisco ASR 9K, Nokia), etc.
Integration into Operator Systems
Deploying OSM in production

LDAP integration

User-Password stored in operator LDAP
- Operators usually employ an LDAP server for storage of credentials
- This is only for user identity. Roles (authorization) are normally managed in the specific platform. The user has to reside also in OSM.
- The approach consists on leveraging the existing OSM keystone backend, configured to use an external LDAP for identity storage
Only needed if the user must be able to avoid logging-in again if already used another portal

- The proposed architecture consists on leveraging the SAML2 federation capabilities in Keystone/Shibboleth. Openstack Horizon uses this approach.
- The client will authenticate in UNICA portal, which generates a SAML2 assertion that is trusted by Keystone/Shibboleth (federated in UNICA OpenAM)
- Keystone redirects back the client with a token that can be used in OSM NBI
Fault and Performance management of OSM modules

Monitoring of OSM infrastructure

- **Metrics**: OSM dashboards & export to client systems via Prometheus federation
- **Alarms**: Exported to client systems via Prometheus Alert manager (e.g. SNMP) after grouping, inhibition, throttling & silencing configuration
- **Log collection**: Agents in OSM and storage internal or external in client provided database

![Diagram of monitoring and alerting](image)