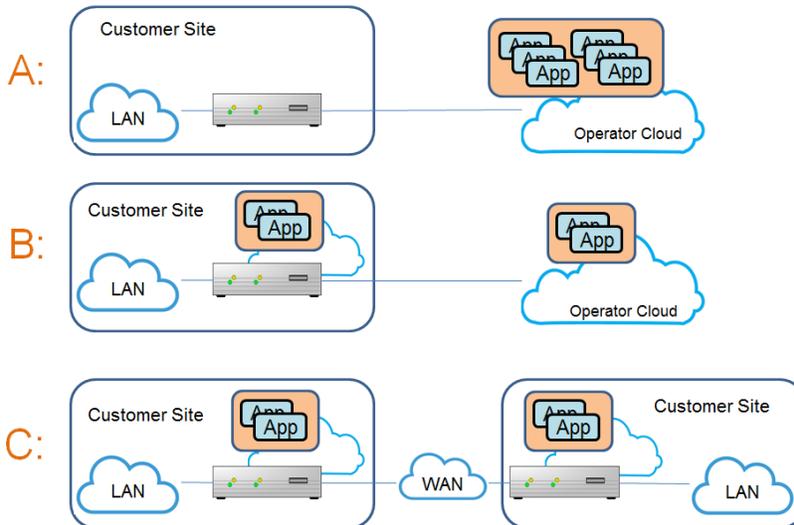# Virtual CPE monitoring

A virtual CPE is virtual in the sense that services are implemented in virtual machines or containers separated from the physical hardware device. This means that the execution environment is virtualized by a hypervisor or other technologies.

There are three ways to distribute functionality for the CPE (Customer Premises Equipment).

Architecture Type A
Just a physical CPE at customer sites with control plane and all services functionality located in the network/cloud.
Low cost CPE for the consumer market.

Architecture Type B
Functionality is distributed between the network/cloud and the on-premises virtual CPE.
As functions are moved to the operator cloud environment, the operator will own the environmental impacts (CO2 budgets, electricity, cooling).

Architecture Type C
The CPE functionality resides on the on-premises virtualized CPE at customer sites.
Flexible CPE targeting the Enterprise market.

An on premise virtual CPE can be seen as a small cloud instance where capacity is limited to what can be delivered by the compute, storage and network resources contained in the physical unit.
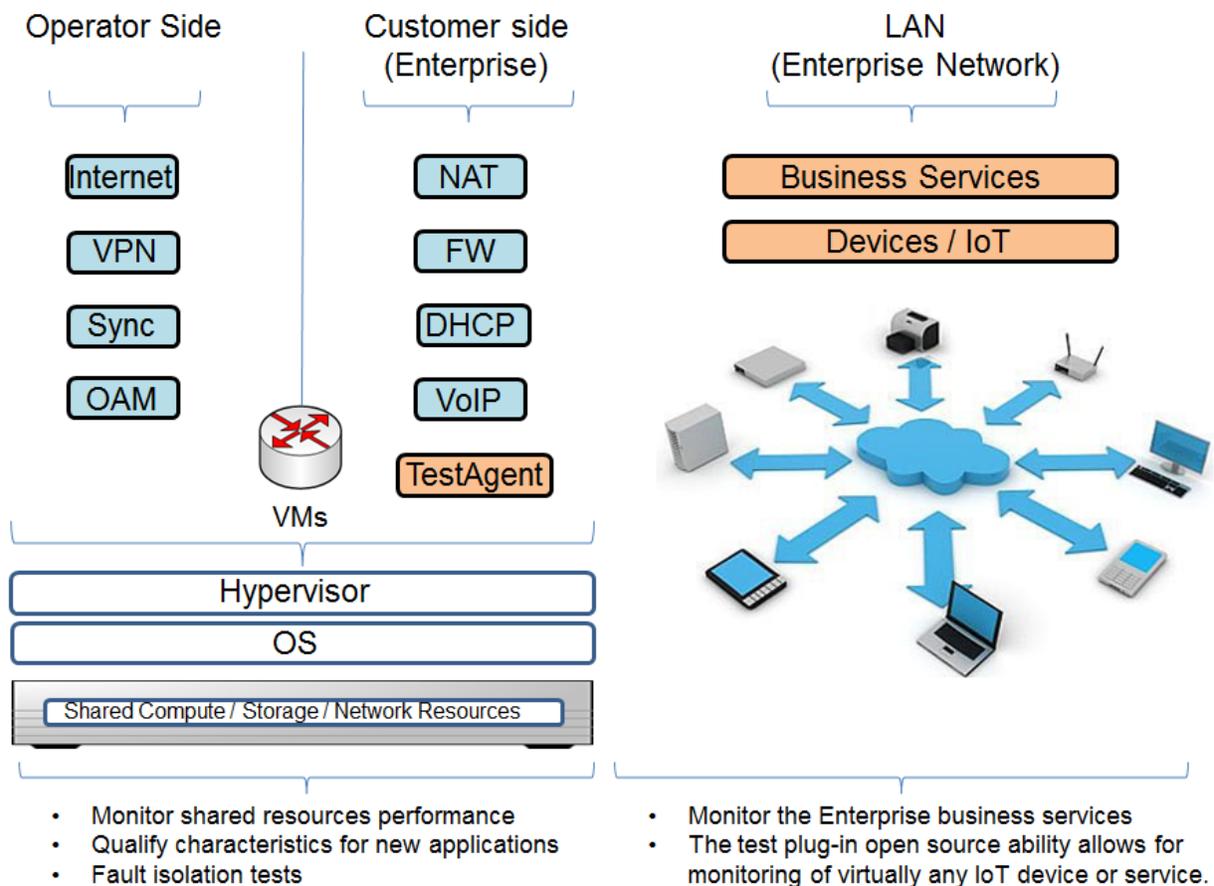As VMs providing the CPE functionality are sharing the resources of the CPE platform, the application behavior becomes less deterministic than for a solution with reserved resources.

This means that monitoring is even more important in a virtualized CPE environment to ensure the performance of services.
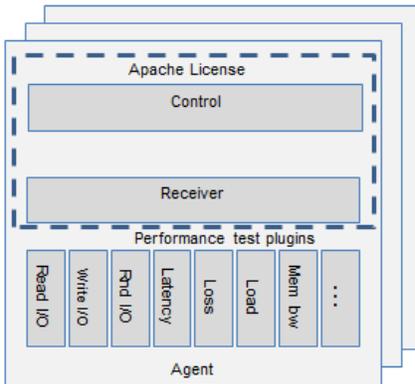
Procurement → **Operations** → **Avoid lock-ins**

The cloudmon 360 system for virtualized CPEs.

- **Vendor Selection / Procurement**: Perform comparative benchmarking with different workloads and traffic models to assess CPE Solutions.
- **Operations / Pre-qualification**: Pre-qualify the capacity before a new application is started by simulating the behavior of the new application.
- **Operations / Monitoring**: Application & Network Performance Monitoring from the Telco and Enterprise sides of the CPE.
- **Avoid vendor lock-in**: Monitoring of business services and the potentially large number of devices and services provided by IoT devices.

Operator Side

Customer side (Enterprise)

LAN (Enterprise Network)

Internet | NAT | Business Services
VPN | FW | Devices / IoT
Sync | DHCP
OAM | VoIP
| TestAgent |

VMs

Hypervisor

OS

Shared Compute / Storage / Network Resources

- Monitor shared resources performance
- Qualify characteristics for new applications
- Fault isolation tests

- Monitor the Enterprise business services
- The test plug-in open source ability allows for monitoring of virtually any IoT device or service.

The CloudMon360 system is composed of two main parts, the agent and the controller.


Agents are installed in virtual CPEs, with the potential of separating
monitoring of the operator and customer sides.

Each agent holds a number of test plug-ins. Each test plug in performs a specific test (IO read / write, Storage, Web look up, TWAMP etc).

The solution provides a number of ready to go test plug-ins with comprehensive coverage of the virtual CPE compute, storage and network functionality.
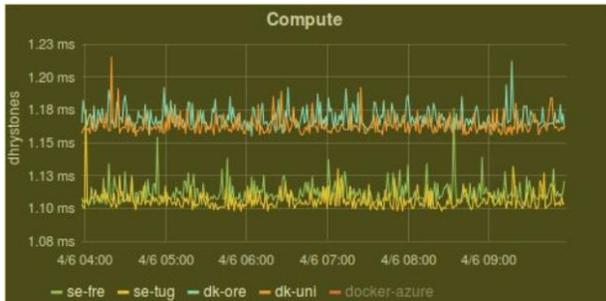
The Compute test plug-in bogomips metrics example.
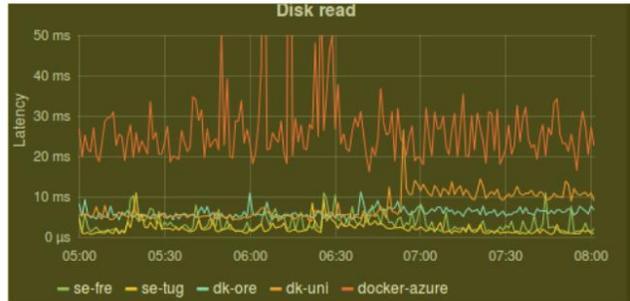
The Storage Read test plug-in generating time latency performance metrics.

There is also an opportunity for the customer to build own plug-ins as the agent is open source. This means that a specific test, be it from the Nagios library or elsewhere, can be wrapped into the framework. This open source strategy has several advantages.

- As the number of different devices and related functionality will grow exponentially, a proprietary set of tests from any given vendor will not be sufficient.
- New tests can be developed for specific needs in a simple and straight forward manner by example of the existing test plug-ins.
- The CloudMon360 customer is not tied to a specific vendor (with related resource and price level constraints) for expanding the system or future proofing existing installations.

The back end or controller component of the CloudMon360 system handles the tasks of configuring, storing and exporting performance metrics. Integration with external orchestration systems is supported by an interactive CLI, Netconf / Yang over SSH and Rest API.

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