

Telefónica's TCloud API Specification

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1 INTRODUCTION TO THE TLOUD API

The TCloud API is a RESTfull, resource-oriented API accessed via HTTP which uses XML-based representations for information interchange. It constitutes an extension of some of the main standardization initiatives in Cloud management, such as the Open Virtualization Format (OVF), defined by the DMTF, and the vCloud specification, published by VMware and submitted to the DMTF for consideration.

TCloud API defines a set of operations to perform actions over the following basic elements:

- Virtual Appliances (VApp). This resource represents elements designed to run on a virtualization platform. Typically a VApp is considered a Virtual Machine running on top of a hypervisor, but TCloud leaves the vendor to determine the bounds of VApp concept. In some implementations, firewall, load balancers or NAS storage may be interpreted as VApps.
- Virtual Data Centres (VDC). VApps resides in a VDC context. A VDC is a set of virtual resources (e.g. networks, computing capacities...) which incarnate VApps. VDCs may be understood as a pool of infrastructure resources which supports a set of VApps.
- Organizations (Org). VDCs are owned by Organizations. An organization represents any kind of independent unit which manages its own cloud resources (e.g. enterprises, divisions, groups...).

TCloud API defines operations to perform actions over above resources categorized as follows:

- Self-Provisioning operations. This includes capabilities for instantiating VApps and VDC resources.

- Self-Management extensions. This includes capabilities for manage instantiated VApps. Some examples are adding more hardware to an existing VApp or shutting down a Virtual Machine.

TCloud API defines this set of core operations. More extensions may be applied by implementers to provide actions not considered in this specification. Along this core, TCloud defines the following extensions:

- Self-Monitoring operations. This includes capabilities for obtaining information of virtual resources used by VApps, VDCs or Organizations. Some examples are obtaining the amount of memory used by a Virtual Machine or obtaining the used bandwidth for a VDC.
- Self-Administration extensions. This includes capabilities for managing Organizations. Some examples are creating a new Organization or adding more users to it.

TCloud data types are declared in a way that they can be extended.

2 OPERATIONS

In this section, the TCloud API operations are described. These operations are classified in the following areas:

- Self-Provisioning API. These operations are used to provision new resources in the cloud.
- Self-Management API. These operations are used to manage the resources previously deployed in the cloud.
- Miscellanea operations. Operations not included in the previous areas.

Each operation is described including the following information:

- Operator and resource URL. Includes the HTTP operator (GET, POST, PUT or DELETE) and the location of the REST-oriented resource.
- Description. A description of the operation.
- Input. A description of the input expected by operation.
- Output. A description of the output produced by operation.
- Errors. A description of the errors that this operation may raise.

URIs are abbreviated using *<item-uri>* form, where item may be an organization, a VDC, a service, a BB instance, and so on. The following BNF rules describe all the possible URIs.

URI	Description
-----	-------------

<code><api-uri> ::= "https://tcloud.telefonica.com/api"</code>	<i>The base-URI of TCloud API</i>
<code><org-uri> ::= <api-uri>/<org-id></code>	<i>Organization resource</i>
<code><vdc-uri> ::= <org-uri>/vdc/<vdc-id></code>	<i>Virtual Data Centre resource</i>
<code><vapp-uri> ::= <vdc-uri>/vapp/<vapp-id> <vapp-uri>/<vapp-id></code>	<i>Virtual Application resource</i>
<code><hwitem-uri> ::= <vapp-uri>/hw/<hwitem-id></code>	<i>Hardware item resource (cpu, memory, vnic, vdisk, etc)</i>
<code><net-uri> ::= <vdc-uri>/net/<net-id></code>	<i>Network resource</i>

Each input, output and error is represented by a data type expressed in XML. To obtain a description of them, see sections 0 and 3.13.

Some actions like monitoring and logging may be invoked on any kind of deployable resource. It includes VDCs, VApps and BB instances. In case of VDCs and VApps, since they are compositions of VApps and Hardware Items, the data obtained is an aggregation of the data produced by aggregated elements. For instance, the operation for obtaining CPU usage for a VApps returns an aggregation of CPU usage for every Hardware Item included in this VApps .

2.1 Self-Provisioning API

Operator & URI	POST <vdc-uri>/action/instantiateOvf
Description	Instantiates a new Service in target VDC based on a OVF description
Input	Instantiate OVF parameters
Output	Task representing the instantiation process (after completion, its Result element references the VApp resource)
Errors	Unknown Elements, Already Exists

Operator & URI	GET <vapp-uri>
Description	Obtains the description for a previously provisioned VApp
Input	None
Output	VApp
Errors	Unknown Elements

Operator & URI	DELETE <vapp-uri>
Description	Removes an existing VApp (there are some restrictions; see VApp description on section 3.5)
Input	None
Output	Task (after completion, its Result element references the parent VApp for leaf VApps or the VDC for root VApps).
Errors	Unknown Elements, Not Applicable

Operator & URI	POST <vapp-uri>/action/instantiateOvf
Description	Add a new child VApp (there are some restrictions; see VApp description on section 3.5)
Input	Instantiate OVF Params
Output	Task (after completion, its Result element references the new VApp resource).

Errors	Unknown Elements, Invalid Input
---------------	---------------------------------

Operator & URI	POST <vdc-uri>/action/cloneVApp
Description	Clone a existing VApp (there are some restrictions; see VApp description on section 3.5)
Input	Clone VApp Params
Output	Task (after completion, its Result element references the new VApp resource).
Errors	Unknown Elements, Invalid Input

Operator & URI	POST <vapp-uri>/hw
Description	Add new hardware item for a VApp (there are some restrictions; see VApp description on section 3.5)
Input	ovf:RASD_Type

Output	Task (after completion, its Result element references the modified VApp resource).
Errors	Unknown Elements, Invalid Input

Operator & URI	PUT <hwitem-uri>
Description	Edit hardware item for a VApp (there are some restrictions; see VApp description on section 3.5)
Input	ovf:RASD_Type
Output	Task (after completion, its Result element references the modified VApp resource).
Errors	Unknown Elements, Invalid Input

Operator & URI	DELETE <hwitem-uri>
Description	Remove a hardware item from a VApp (there are some restrictions; see VApp description on section 3.5)

Input	None
Output	Task (after completion, its Result element references the modified VApp resource).
Errors	Unknown Elements, Not Applicable

Operator & URI	POST <vdc-uri>/net/action/add
Description	Instantiates a new VLAN in target VDC based on a network description
Input	Network Type
Output	Task representing the instantiation process (after completion, its Result element references the new Network resource)
Errors	Unknown Elements, Invalid Input

Operator & URI	GET <net-uri>
---------------------------	---------------

Description	Obtains the description for a previously provisioned network
Input	None
Output	Network Type
Errors	Unknown Elements

Operator & URI	PUT <net-uri>
Description	Edit an existing network (there are some restrictions; see Network description)
Input	Network Type
Output	Task representing the modification process (after completion, its Result element references the new Network resource)
Errors	Unknown Elements, Invalid Input

Operator & URI	DELETE <hwitem-uri>
Description	Removes an existing network (there are some restrictions; see Network description on section 3.6)
Input	None
Output	Task representing the removal process (after completion, its Result element references the target VDC resource)
Errors	Unknown Elements, Not Applicable

2.2 Self-Management API

Operator & URI	POST <vapp-uri>/power/action/<power-action>
Description	<p>Perform a power action on a VApp. If it has child VApps, this action will affect to all of them. <power-action> is one of the following</p> <ul style="list-style-type: none"> ▪ <i>powerOn</i>. The VApp is powered on. This is an operation requested to hypervisor, transparent for

	<p>host OS.</p> <ul style="list-style-type: none"> ▪ <i>powerOff</i> The VApp is powered off. This is an operation requested to hypervisor, transparent for host OS. ▪ <i>reset</i>. The VApp is reset. This is an operation requested to hypervisor, transparent for host OS. ▪ <i>suspend</i>. The VApp is suspended. This is an operation requested to hypervisor, transparent for host OS. ▪ <i>shutdown</i>. The VApp is shut down. This is a gracefull operation requested to host OS. ▪ <i>reboot</i>. The VApp is rebooted. This is a gracefull operation requested to host OS.
Input	None
Output	Task
Errors	Unknown Elements

Operator & URI	POST <vapp-uri>/snapshot/action/take
Description	Take a snapshot of the VApp

Input	None
Output	Task (after completion, its Result element references the Snapshot resource)
Errors	Unknown Elements

Operator & URI	GET <vapp-uri>/snapshot
Description	Obtain the list of snapshots available for target VApp
Input	None
Output	Snapshot List
Errors	Unknown Elements

Operator & URI	GET <vapp-uri>/snapshot/<snapshot-id>
Description	Obtain the description of a snapshot for target VApp

Input	None
Output	Snapshot
Errors	Unknown Elements

Operator & URI	POST <vm-uri>/snapshot/<snapshot-id>/action/restore
Description	Restore a previously taken snapshot
Input	None
Output	Task (after completion, its Result element references the VApp resource)
Errors	Unknown Elements

2.3 Miscellanea

Operator & URI	POST <api-uri>/login
Description	Log-in in platform. Using HTTP basic authentication, it returns a cookie which contains an authentication token to be validated in future requests.
Input	None (requieres a basic authentication HTTP header)
Output	Costumer Information (includes a Set-Cookie header with the authentication token to be presented in Cookie header in future requests).
Errors	HTTP 401 Not Authorized is returned if authentication fails

Operator & URI	GET <vdc-uri>/task
Description	Returns a tasks list for target VDC.
Input	None
Output	Tasks List

Errors	Unknown Elements
---------------	------------------

Operator & URI	GET <vdc-uri>/task/<task-id>
Description	Returns a task owned by target VDC.
Input	None
Output	Task
Errors	Unknown Elements

Operator & URI	POST <vdc-uri>/task/<task-id>/action/cancel
Description	Cancel a task in execution
Input	None
Output	Task element, now in cancelled status.

Errors	Unknown Elements
---------------	------------------

3 DATA TYPES

This section provides a detailed description of the data types used in the TCloud API. Each data entity is described in terms of XML attributes and child elements that it admits.

TCloud resource entities follow a hierarchy in two different aspects:

- Some resources are classified as containers, i.e. they contain other resources aggregated. Examples of this kind of resources are VDCs, Services or Organizations. They form a hierarchy based on container-contained relations. The following picture depicts a UML model which represents these containment relationships.
- Some resource types extend others forming a classic object-oriented class hierarchy.

3.1 Common Child Elements

The following child elements may be contained in several kinds of entities.

3.1.1 Reference

A Reference is a link present in one resource which points to another resource. It's a leaf-element with the following attributes:

Name	Min.	Max.	Type	Description
href	1	1	xs:anyURI	An hyperlink to referenced resource

type	0	1	xs:string	The media type of referenced resource
name	0	1	xs:string	The name of the referenced entity

3.1.2 Link

A Link is a resource very similar to References with only one difference: Links are categorized, i.e. the kind of relation between referenced and referrer resources are named. This resource is a leaf-element as well, defining the following attributes:

Name	Min.	Max.	Type	Description
rel	1	1	Relation Type	The relation of resource respect referenced resource.
href	1	1	xs:anyURI	An hyperlink to referenced resource
type	0	1	xs:string	The media type of referenced resource
name	0	1	xs:string	The name of the referenced entity

Relation Type admits one of the following values:

Value	Description	Admitted HTTP Operator
<i>add</i>	Used in container resources to reference an operator for add more items	POST
<i>alternate</i>	Used in resources to reference an alternative location for it	GET
<i>copy</i>	Used in resources to reference a copy operator	POST
<i>up</i>	Used in contained resources to reference the parent container	GET
<i>down</i>	Used in container resources to reference a child contained resource	GET
<i>edit</i>	Used in resources to reference a edit operator	PUT
<i>move</i>	Used in resources to reference a move operator	POST
<i>remove</i>	Used in resources to reference a remove operator	DELETE

<i>power:powerOn</i>	Used in VApp to reference power on action	POST
<i>power:powerOff</i>	Used in VApp to reference power off action	POST
<i>power:reset</i>	Used in VApp to reference reset action	POST
<i>power:suspend</i>	Used in VApp to reference suspend action	POST
<i>power:shutdown</i>	Used in VApp to reference shutdown action	POST
<i>task:cancel</i>	Used in tasks to reference the cancel facet resource	POST
<i>snapshots</i>	Used in VApp to reference its snapshot list	GET
<i>snapshot:take</i>	Used in VApp to reference snapshot taking action	POST
<i>snapshot:restore</i>	Used in Snapshots to reference the restore action	POST

More values are admitted to indicate resources provided by TCloud Extensions. These values are documented in these extensions.

Links may appear in almost any resource available in TCloud API to reference other related resources. In this section, each data type description includes the available links to resources described in API core. Some other resources provided by TCloud API Extensions may be referenced as well, but they are not documented in this section.

3.2 OVF Descriptor

Open Virtualization Format is a standard format for representing virtual appliances to be run in virtual machines. TCloud API uses it for representing services, using mechanisms defined by OVF to extend it with TCloud-specific semantic not covered by original specification.

For more details on TCloud-specific extensions to OVF, see OVF 1.0 specification and TCloud OVF Extensions.

3.2.1 Resource Identifiers

TCloud uses OVF descriptors to instantiate new VApps. These VApps and their elements, once provisioned, will be represented by REST resources which accept HTTP operations over them. The platform must decide how resource URI is assigned to each resource. Typically, each VApp element has an identifier or name which fills a URI template to compose a full unique identifier. For instance, a VM named *Front End 1* deployed in a VApp *Sales Service* provisioned in a VDC *Production* owned by organization *Example Ltd.* may have a URI similar to:

<http://cloud.telefonica.com/api/org/56/vdc/3/vapp/sales/fe1>

This URI is composed by a path of identifiers. API clients may indicate which one must be assigned to each VApp element in OVF descriptor at instantiation phase using the following elements:

- For root VApp, the name attribute present in `<InstantiateOVFParams>` element will be used as resource identifier.

- For non-root VApps, the `ovf:id` attribute present in `<VirtualSystem>` or `<VirtualSystemCollection>` element will be used as resource identifier.
- For VM hardware (e.g. disks, VNICs...), the `rasd:InstanceID` element under `<Item>` will be used as resource identifier.

The following example depicts a Instantiate OVF Params element indicating which URIs will be assigned to each VApp element.

```
<!-- New VApp resource at http://.../vdc/12/vapp/sales -->
<InstantiateOVFParams name="sales">
  <Envelope>
    ...
    <NetworkSection>...</NetworkSection>
    ...
    <VirtualSystemCollection ovf:id="root-vsc">
      <Info>Service definition</Info>
      <Name>My Example Website service</Name>
      <!-- New VM resource at http://.../vdc/12/vapp/sales/fel -->
      <VirtualSystem ovf:id="fel">
        <Info>Front-End 1 Definition</Info>
        <VirtualHardwareSection>
          <Info>Front-End 1 Hardware Definition</Info>
          <!-- New disk resource at
            http://.../vdc/12/vapp/sales/fel/hw/disk0 -->
          <Item><InstanceID>disk0</InstanceID>...</Item>
          <!-- New disk resource at
            http://.../vdc/12/vapp/sales/fel/hw/disk1 -->
          <Item><InstanceID>disk1</InstanceID>...</Item>
          <!-- New VNIC resource at
            http://.../vdc/12/vapp/sales/fel/hw/vnic0 -->
          <Item><InstanceID>vnic0</InstanceID>...</Item>
        </VirtualHardwareSection>
      </VirtualSystem>
    </VirtualSystemCollection>
  </Envelope>
</InstantiateOVFParams>
```

```

    ...
  </VirtualSystem>
  ...
</VirtualSystemCollection>
  ...
  <InstantiationParams>...</InstantiationParams>
</Envelope>

```

3.3 Instantiate OVF Params

In order to instantiate an OVF package, the user must provide configuration parameters which indicate how does a VApp must be deployed (i.e. what resources must be used to instantiate it and how). This parameters are indicated at VApp instantiation using Instantiate OVF Params type. This type is conceived as a container which holds a `<ovf:Envelope>` element representing the VApp elements and a `<InstantiationParams>` which provides the configuration for instantiation.

Instantiate OVF Params are defined by type `application/vnd.telefonica.tcloud.instantiateOVFParams+xml`. This type is formed by the following elements:

Name	Mult.	Type	Description
<i>Attributes</i>			
name	1	xs:string	A name which identifies the new VApp. This name will be used to compose the VApp resource URI.

<i>Child elements</i>			
Description	0..1	xs:string	A description of the VApp to be instantiated.
Envelope	1	ovf:EnvelopeType	OVF descriptor representing the VApp elements.
InstantiationParams	0..1	Instantiation Params Type	A container which holds instantiation parameters (see 3.3.1).

The following example depicts a Instantiate OVF Params element:

```
<InstantiateOVFParams name="websrv-3">
  <ovf:Envelope>
    <NetworkSection>
      <Info>...</Info>
      <Network name="fe-vlan" />
    </NetworkSection>
    <VirtualSystemCollection ovf:id="root-vsc">
      <Info>...</Info>
      <VirtualSystem ovf:id="fe1">...</VirtualSystem>
      <VirtualSystem ovf:id="be1">...</VirtualSystem>
    </VirtualSystemCollection>
    ...
  </ovf:Envelope>
  <InstantiationParams>
    <NetworkConfigSection>
```

```
<Info>...</Info>
<NetworkConfig name="fe-vlan">
  <NetworkAssociation
    href="http://.../api/org/56/vdc/12/net/public-vlan" />
  </NetworkAssociation>
</NetworkConfig>
</NetworkConfigSection>
...
<AspectsSection>
  <VAppAspects id="fe1">
    <Info>Section describing instantiation aspects for VApp 'fe1'</Info>
    <TargetClusters>
      <Cluster id="25" />
      <Cluster id="37" />
    </TargetClusters>
    <Stateless value="true" />
    <FaultProtection type="ha" />
    <Backup type="gold" />
  </VAppAspects>
  <VAppAspects id="be1">
    <Info>Section describing instantiation aspects for VApp 'be1'</Info>
    <TargetClusters>
      <Cluster id="25" />
    </TargetClusters>
    <Stateless value="false" />
    <FaultProtection type="ha" />
    <CustomBackup mode="complete" periodicity="monthly" expiretime="7" />
  </VAppAspects>
</AspectsSection>
</InstantiationParams>
</InstantiateOVFParams>
```

3.3.1 Instantiation Params

Instantiation Params type defines a set of parameters which indicate the configuration to be applied for the resources defined in an OVF descriptor.

There are two different configurations which may be parameterized using this type:

- Network resources. Each logic network described in OVF package is described, indicating which concrete VDC network resource is used to incarnate it.
- Aspect parameters. A generic and open parameter which is used to indicate VApp aspects which are part of the deployment (not the system itself). Some examples would be backup policies, disaster-recovery support, physical clusters candidates to host the VApp, and so on. See 3.8 for more details.

Name	Mult.	Type	Description
<i>Child elements</i>			
NetworkConfigSection	1	Network Config Section Type	Network configuration section. Formed by several Network Config elements, each one describing one network present in the OVF Envelope. The name attribute of Network Config must match the <code>ovf:name</code> of the <code><Network></code> element in OVF descriptor. ¹

¹ It's possible that some logical networks are not mapped using a Network Config element. In such case, the behavior is platform-dependent.

AspectsSection	0..1	Aspects Section Type	Formed by several aspects which describe deployment aspects for each virtual system.
----------------	------	----------------------	--

3.4 Clone VApp Params

This type is used as input for VApp clone operator. It contains all information needed in order to cloning an existing VApp.

Name	Mult.	Type	Description
<i>Attributes</i>			
name	1	xs:string	A name for the new cloned VApp.
<i>Child elements</i>			
Description	0..1	xs:string	A leaf-element which describes the new cloned VApp.
VApp	1	Reference Type	A reference to the VApp to be cloned.

3.5 VApp

A VApp represents a provisioned service, ready to be used.

In its simplest form, it's formed by some OVF sections which describe the service and a set of links which references the facet resources needed to perform operations (reboot a VM, add a new VNIC, resize a disk...).

This simplest form may become more complex when several VApps are grouped (in other words, when OVF package contains one or more `<VirtualSystemCollection>` elements). In that case, VApp resources are instantiated in a hierarchical approach, making up a tree of VApps. Each `<VirtualSystem>` element in OVF descriptor is used to instantiate a VApp describing the provisioned service item. `<VirtualSystemCollection>` is instantiated as a VApp as well, but in this case no appliance is described (this VApp is used only as a container of other VApps). To support this VApp hierarchy, this type includes members which describe parent and children VApps.

VApp type provides OVF Sections to describe the represented service item. These sections are derived from source Instantiate OVF Params element provided during provisioning with some additional Link elements embed. These links provide a reference to management and monitoring operations. The links admitted by each element are described in the following table.

Element	Link Relation	Description
VApp	power:*	A facet resource to manage power actions for a VM (the asterisk represents each power action described in 3.1.2)
VApp	remove	A facet resource to remove this VApp. Only applicable to VApps (turned off for VMs) which have no children.

VApp	up	A reference to the parent VDC which contains this VApp. Only applicable to root VApps (VApp with no parent VApp).
VApp	add	A facet resource to add a new service item as a new child of this VApp, using a Instantiate OVF Params element. Only applicable to non-leaf VApps (those which already have children).
VApp	copy	A facet resource to clone a VM. Only applicable to leaf VApps (those which have no children). For Disk Drive item the owner VApp must be stopped.
VApp	snapshots	Snapshot resources for this VApp. Only applicable to leaf VApps (those which have no children).
VApp	snapshot:take	A facet resource to take VApp snapshots. Only applicable to leaf VApps (those which have no children).
VirtualHardwareSection	add	A facet resource to add more hardware to a VM. This new hardware cannot be neither a Processor nor a Memory items

Item	edit	<p>A facet resource to edit a hardware item. Only the following RASD values may be altered:</p> <ul style="list-style-type: none"> • rasd:Connection to indicate a new address for network adapters • rasd:VirtualQuantity to indicate the current quantity for the item • rasd:Reservation to indicate the minimum quantity for the item • rasd:Limit to indicate the maximum quantity for the item
Item	remove	<p>A facet resource to remove existing hardware from VM. This hardware cannot be neither a Processor nor a Memory items. The owner VApp must be stopped.</p>
Item	copy	<p>A facet resource to clone a hardware item. This hardware cannot be neither a Processor nor a Memory items</p>

TCloud API allows extensions to include more links to VApp elements, so additional links may appear in VApp elements.

Each VApp contains only those OVF Sections which fully describes it. That includes the following:

- Any OVF section included in <VirtualSystem> or <VirtualSystemCollection> which describes the original VApp.
- For leaf VApps, <NetworkSection> and <NetworkConfigSection> corresponding to the networks that the VApp is connected to.
- For non-leaf VApps, <NetworkSection> and <NetworkConfigSection> corresponding to the networks that the children VApps are connected to.
- For leaf VApps, the <AspectsSection> which describes deployment aspects for this VApp.

Every VApp resource has its own URI, even if it is not a root VApp. Its representation may be obtained using HTTP GET operator. Non-root VApps provide a reference to its parent VApp. Non-leaf VApps include a full description (not a reference) of each child defined inside (in such case, embed VApps do not provide a reference to its parent).

VApp is defined by type `application/vnd.telefonica.tcloud.vapp+xml`. This type is formed by the following elements:

Name	Mult.	Type	Description
<i>Attributes</i>			
name	1	xs:string	VApp name
href	0..1	xs:anyURI	A reference to the VApp.
<i>Child elements</i>			

Link (up)	0..1	Link Type	A link of up rel which references the VDC which owns this VApp.
Description	0..1	xs:string	A leaf-element which describes the VApp.
VAppParent	0..1	Reference Type	A reference to the parent VApp
Children	0..1		A sequence of VApp elements
OVF Sections	0..n	ovf:Section_Type	OVF sections derived from the OVF Envelope and Instantiation Params during provisioning. These sections may include Link elements to operations and context applicable to each resource.

The following XML fragment provides an example of a VApp element.

```
<VApp name="sales"
  href="http://cloud.telefonica.com/api/org/56/vdc/9/vapp/3">
  <Link rel="up"
    href="http://cloud.telefonica.com/api/org/56/vdc/9" />
  <Link rel="add"
    type="application/vnd.telefonica.tcloud.instantiateOVFParams+xml"
    href="http://.../api/org/56/vdc/9/vapp/3/actions/instantiateOvf" />
  <NetworkSection>
    <Info>...</Info>
    <Network name="frontend-vlan" />
  </NetworkSection>
  <NetworkConfigSection name="frontend-vlan">
```

```

<NetworkAssociation
  href="http://cloud.telefonica.com/api/org/56/vdc/9/net/4" />
</NetworkConfigSection>
<Children>
  <VApp name="vm-1"
    href="http://cloud.telefonica.com/api/org/56/vdc/9/vapp/3/vm-1">
    <Link rel="power:powerOn"
      href="http://../api/org/56/vdc/9/vapp/3/vm-1/power/actions/powerOn" />
    <Link rel="power:powerOff"
      href="http://../api/org/56/vdc/9/vapp/3/vm-1/power/actions/powerOff" />
    ...
    <Link rel="power:reboot"
      href="http://../api/org/56/vdc/9/vapp/3/vm-1/power/actions/reboot" />
    <Link rel="snapshots"
      type="application/vnd.telefonica.tcloud.snapshotList+xml"
      href="http://../api/org/56/vdc/9/vapp/3/vm-1/snapshot" />
    <Link rel="snapshot:take"
      type="application/vnd.telefonica.tcloud.snapshotList+xml"
      href="http://../api/org/56/vdc/9/vapp/3/vm-1/snapshot/take" />
    <OperatingSystemSection>...</OperatingSystemSection>
    <VirtualHardwareSection>
      <Link rel="add" type="application/ovf.item+xml"
        href="http://../api/org/56/vdc/9/vapp/3/vm-1/hw />
      <Item>
        <Description>Memory Size</Description>
        <InstanceID>1</InstanceID>
        ...
        <Link rel="edit" type="application/ovf.item+xml"
          href="http://../api/org/56/vdc/9/vapp/3/vm-1/hw/1" />
      </Item>
      ...
      <Item>
        <Description>Hard Disk Drive 1</Description>

```

```

<InstanceID>8</InstanceID>
...
<Link rel="edit" type="application/ovf.item+xml+xml"
      href="http://.../api/org/56/vdc/9/vapp/3/vm-1/hw/8" />
<Link rel="remove"
      href="http://.../api/org/56/vdc/9/vapp/3/vm-1/hw/8" />
</Item>
...
</VirtualHardwareSection>
</VApp>
...
<!-- More children following... -->
</Children>
</VApp>

```

3.6 Network

Network type is used to represent a network element in the context of a VDC. Logical networks defined in an OVF package are incarnated using concrete network resources indicating this relation in Instantiation Params.

Networks are defined by type `application/vnd.telefonica.tcloud.network+xml`. This type is formed by the following elements.

Name	Mult.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the network resource

name	1	xs:string	A name for the network.
<i>Child elements</i>			
Description	0..1		A leaf-element which provides a description for this network. This data is extracted from the <ovf:Description> element under <ovf:Network> when the network resource is instantiated.
Configuration	1	Network Configuration Type	Configuration data for target network

Network configuration type describes the configuration for a network element. This type is formed by the following elements.

Name	Mult.	Type	Description
<i>Child elements</i>			
Dns	1..n	IP Address Type	One or more leaf-elements which contain a network address for a DNS server accesible from target network
Gateway	1	IP Address Type	A leaf-element which contains a network address for default gateway in target network

Netmask	1	IP Address Type	A leaf-element which contains a network mask for target network
Bandwidth	0..1	xs:decimal	Network bandwidth in GBs

The following code depicts an example of this type.

```
<Network href="http://cloud.telefonica.com/api/org/56/vdc/9/net/9"
  name="Firewall Back-Link" />
  <Description>The network behind the VDC firewall</Description>
  <Configuration>
    <Dns>192.168.43.3</Dns>
    <Gateway>192.168.55.1</Gateway>
    <Netmask>255.255.255.0</Netmask>
    <Bandwidth>1.5</Bandwidth>
  </Configuration>
</Network>
```

3.7 Network Config Section

Network Config Section type describes the configuration for a set of `<Network>` elements in an OVF descriptor or VApp (this `<Network>` is not the resource which represents an available network resource in a VDC context). This type is formed by the following elements:

Name	Mult.	Type	Description
<i>Attributes</i>			

ovf:required	1	xs:boolean	A boolean indicating whether this section is mandatory for processing the OVF descriptor that this section belongs to.
<i>Child elements</i>			
Info	1	ovf:Info_Type	This element describes the purpose of this section (required by OVF).
Link (edit)	0..1	Link Type	A link to the edit facet resource. Only available when present in a VApp resource.
Link (remove)	0..1	Link Type	A link to the remove facet resource. Only available when present in a VApp resource.
NetworkConfig	0..n	Network Config Type	One node for each network configuration

Network Config type describes the configuration for each logic network included in OVF descriptor or VApp state. This type is formed by the following elements:

Name	Mult.	Type	Description
<i>Attributes</i>			

name	1	xs:string	The name of the network which configuration is described. This name must match the <code>ovf:name</code> attribute given in the <code><Network></code> element which represents the configured network.
<i>Child elements</i>			
NetworkAssociation	0..1	Reference Type	A reference to the concrete network in a VDC which incarnates this logical network.

3.8 Aspects Section

VApp Aspects type defines several aspects which characterizes the deployment context of a VApp. This type is extensible, accepting customized elements defined by vendors.

This type is defined by type `application/vnd.telefonica.tcloud.aspectsSection+xml` and formed by the following elements.

Name	Mult.	Type	Description
<i>Attributes</i>			
Required	1	xs:boolean	A boolean value which indicates whether this aspect must be processed by platform. When used in Instantiation Params and its value is set to true, the

			platform must process this aspect and take it into account for provisioning. If the platform does not recognize the aspect, the provisioning operation must be rejected unless its value is set to false.
*	0..n	Xs:anyAttribute	Zero or more attributes with any name and of any type are allowed.
<i>Child elements</i>			
*	0..n	xs:any	Zero or more elements with any name and any type are allowed.

3.9 Snapshot

Snapshot represents a frozen copy of running VM data. It's commonly used to define recovery points which allow restoring the system after some action which ends in trouble.

This type is defined by type `application/vnd.telefonica.tcloud.snapshot+xml` and formed by the following elements:

Name	Mult.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the snapshot

date	1	xs:dateTime	Date and time when the snapshot was taken
<i>Child elements</i>			
Link (up)	1	Link Type	A link to VM which owns the snapshot
Link (snapshot:restore)	0..1	Link Type	A link for restoring the snapshot

3.10 Snapshot List

Snapshot list represents a set of VM snapshots.

Snapshot Lists are defined by type `application/vnd.telefonica.tcloud.snapshotList+xml`. This type is formed by the following elements.

Name	Mult.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the snapshot list
<i>Child elements</i>			

Snapshot	0..n	Snapshot Type	Snapshot resource representation
----------	------	---------------	----------------------------------

The following code depicts an example for this type.

```
<SnapshotList
  href="http://cloud.telefonica.com/api/org/56/srv/2/vm/6/snapshots">
  <Snapshot
    href="http://.../api/org/56/srv/2/vm/6/snapshots/20100115-1404"
    date="2010-01-15T14:04:00Z">
    <Link rel="up" href="http://.../api/org/56/srv/2/vm/6" />
    <Link rel="snapshot:restore"
href="http://.../api/org/56/srv/2/snapshots/20100115-1404/action/restore" />
  </Snapshot>
  <Snapshot
    href="http://.../api/org/56/srv/2/vm/6/snapshots/20100114-0945"
    date="2010-01-14T09:45:00Z">
    <Link rel="up"
      href="http://cloud.telefonica.com/api/org/56/srv/2/vm/6" />
    <Link rel="snapshot:restore"
      href="http://.../api/org/56/srv/2/snapshots/20100114-
0945/action/restore" />
  </Snapshot>
</SnapshotList>
```

3.11 Tasks List

A Tasks List represents a list of queued, running and recently completed tasks.

Tasks Lists are defined by content type `application/vnd.telefonica.tcloud.tasksList+xml`. This type is formed by the following elements:

Name	Min	Max	Type	Description
<i>Attributes</i>				
href	1	1	xs:anyURI	A reference to the task list
<i>Child elements</i>				
Task	0	N	Task Type	Tasks defined in this list

The following XML snippet provides an example for this type:

```
<TaskList href="http://cloud.example.com/api/org/15/vdc/56/task">
  <Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/634"
    startTime="2010-01-03T09:36:32Z"
    expiryTime="2010-01-03T10:36:32Z"
    status="running">
    <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/15/vdc/56/task/634/action/cancel" />
    <Owner href="http://cloud.example.com/my-vdc"
      type="application/vnd.telefonica.tcloud.vdc+xml"
      name="My Dear VDC" />
  </Task>
  <Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/635"
    startTime="2010-01-03T09:36:32Z"
```

```

    endTime="2010-01-03T09:37:10Z"
    expiryTime="2010-01-03T10:36:32Z"
    status="success">
  <Owner href="http://cloud.telefonica.com/api/org/15/vdc/56"
    type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result href="http://cloud.telefonica.com/api/org/15/vdc/56/vapp/websrv-5"
    type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>
<Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/636"
  startTime="2010-01-03T09:36:32Z"
  expiryTime="2010-01-03T10:36:32Z"
  status="error">
  <Owner href="http://cloud.telefonica.com/api/org/15/vdc/56"
    type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Error message="no available cluster found; try later"
    vendorSpecificErrorCode="A56H09" />
</Task>
</TaskList>

```

3.12 Task

A Task provides a description of an asynchronous operation result of a previously invoked request. Things like VApp instantiation, VApp modification, VM start, VM shutdown and so on, are not executed immediately. Instead, requests are used as input to orchestrate complex procedures which may take a while. Task resources describe these procedures.

Tasks are defined by type `application/vnd.telefonica.tcloud.task+xml`. This type is formed by the following elements:

Name	Mul.	Type	Description

<i>Attributes</i>			
href	1	xs:anyURI	Provides an opaque reference to task resource
startTime	1	xs:dateTime	Indicates when does the task started
endTime	0..1	xs:dateTime	Indicates when does the task ended. If task is still running, this attribute is omitted.
expireTime	0..1	xs:dateTime	Indicates when does the task is considered to be timed out. If task is already ended, this attribute is omitted.
status	1	TaskStatusType	<p>Task current status. The following values are admitted:</p> <ul style="list-style-type: none"> • queued (the task is queued for execution) • waiting (the task is waiting for approval)² • running (the task is currently running) • success (the task is completed)

² In enterprise clouds, some sensible operations must be approved before they are executed. This value is used to indicate so.

			<p>successfully),</p> <ul style="list-style-type: none"> error (the task is finished but it failed) cancelled (the task has been cancelled by user)
<i>Child elements</i>			
Link (cancel)	0..1	Link Type	A link to the facet resource for cancelling this task. Its only available when the task can be cancelled (its queued or waiting).
Owner	1	Reference Type	A reference to VDC in which the task is to be executed
Result	0..1	Reference Type	A reference to task result resource (e.g. for VApp instantiation, a reference to newly created VApp). If task status is not success, this child element is omitted.
Error	0..1	Error Type	A description of the error which caused the task to fail, only if status is error

Error Type is a leaf-element with the following attributes:

Name	Mul.	Type	Description
<i>Attributes</i>			
message	1	xs:string	A message describing the error
majorErrorCode	0..1	xs:string	Major error code
minorErrorCode	0..1	xs:string	Minor error code
vendorSpecificErrorCode	0..1	xs:string	Vendor-specific error code

The following XML snippets provide an example for this type:

```
<Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/634"
      startTime="2010-01-03T09:36:32Z"
      expiryTime="2010-01-03T10:36:32Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/15/vdc/56/task/634/action/cancel" />
  <Owner href="http://cloud.example.com/my-vdc"
        type="application/vnd.telefonica.tcloud.vdc+xml"
        name="My Dear VDC" />
</Task>
```

```
<Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/635"
```

```

    startTime="2010-01-03T09:36:32Z"
    endTime="2010-01-03T09:37:10Z"
    expiryTime="2010-01-03T10:36:32Z"
    status="success">
  <Owner href="http://cloud.telefonica.com/api/org/15/vdc/56"
    type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result href="http://cloud.telefonica.com/api/org/15/vdc/56/vapp/websrv-5"
    type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>

```

```

<Task href="http://cloud.telefonica.com/api/org/15/vdc/56/task/636"
  startTime="2010-01-03T09:36:32Z"
  expiryTime="2010-01-03T10:36:32Z"
  status="error">
  <Owner href="http://cloud.telefonica.com/api/org/15/vdc/56"
    type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Error message="no available cluster found; try later"
    vendorSpecificErrorCode="A56H09" />
</Task>

```

3.13 Organization

An Organization Description contains the set of information characterizing a independent working unit (e.g. customer, division, working group...).

Organization descriptions are defined by the application/vnd.telefonica.tcloud.org+xml type. This type is formed by the following elements:

Name	Mul.	Type	Description

<i>Attributes</i>			
href	1	xs:anyURI	A reference to organization resource
name	1	xs:string	A friendly name for the organization.
<i>Child elements</i>			
Description	0..1	xs:string	An optional description of the organization.
Link (down)	0..n	Link Type	Zero or more links of rel down which references VDCs owned by the organization.

The following XML snippets provide an example for this type:

```
<Org href="http://cloud.telefonica.com/api/org/56"
  name="Foobar Inc.">
  <Description>Foobar Inc.</Description>
  <Link rel="down"
    type="application/vnd.telefonica.tcloud.vdc+xml"
    href="http://cloud.telefonica.com/api/org/56/vdc/production" />
  <Link rel="down"
    type="application/vnd.telefonica.tcloud.vdc+xml"
    href="http://cloud.telefonica.com/api/org/56/vdc/development" />
  <!-- More VDC links following... -->
  ...
</Org>
```

3.14 VDC

A VDC contains information characterizing a Virtual Data Center.

VDC descriptions are defined by the `application/vnd.telefonica.tcloud.vdc+xml` type. This type is formed by the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			
href	0..1	xs:anyURI	A reference to the VDC Description
name	1	xs:string	A friendly name for the organization.
<i>Child elements</i>			
Link (up)	0..1	Link Type	A link with up relation referencing the parent Organization resource
Link (down)	0..n	Link Type	A link with down relation referencing the VApps provisioned in the VDC.
Link (add)	0..1	Link Type	A link with add relation referencing a facet resource for adding a new VApp
Description	0..1	xs:string	An optional leaf-element which

			describes the purpose of this VDC.
Type	0..1	xs:string	An optional provider-specific type description
StorageCapacity	0..1		Defines the storage capacity available in the VDC for VM images. When no defined, there is not limit.
ComputeCapacity	0..1		Defines the compute capacity available in the VDC. When no defined, there is not limit.
AvailableNetworks	0..1		A container for References to Networks existing in target VDC. These networks may be created using provisioning operations. Networks may be created internally as well, for instance to represent some platform-predefine networks (public Internet access) or a customer-private network (VPN) configured physically to be used by all VDCs owned by some Org).

The following code depicts an example for this type.

```
<VDC href="http://cloud.telefonica.com/api/org/56/vdc/3"
  name="Foobar - Development Sandbox">
  <Link rel="up"
    type="application/vnd.telefonica.tcloud.org+xml"
    href="http://cloud.telefonica.com/api/org/56" />
  <Link rel="add"
```

```
    type="application/vnd.telefonica.tcloud.instantiateOVFParams+xml"
    href="http://.../api/org/56/vdc/3/action/instantiateOvf" />
<Description>A sandbox environment for Foobar development</Description>
<AvailableNetworks>
  <Network href="http://cloud.telefonica.com/api/org/56/vdc/3/net/1"
    name="Internet Public Access" />
  <Network href="http://cloud.telefonica.com/api/org/56/vdc/3/net/2"
    name="Enterprise VPN" />
  <Network href="http://cloud.telefonica.com/api/org/56/vdc/3/net/13"
    name="Firewall Back-Link" />
  <!-- More network references following... -->
  ...
</AvailableNetworks>
<Link rel="down"
  type="application/vnd.telefonica.tcloud.vapp+xml"
  href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/websrv1" />
<Link rel="down"
  type="application/vnd.telefonica.tcloud.vapp+xml"
  href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/websrv2" />
<Link rel="down"
  type="application/vnd.telefonica.tcloud.vapp+xml"
  href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/mta" />
  <!-- More VApp links following... -->
</VDC>
```

4 ERROR TYPES

Errors are results for erroneous operations. Although a complete error list is yet to be defined in cooperation with technical partners, some basic error types identified so far are described in the following sections.

4.1 Unknown Elements

This error type is returned when unknown elements (Org, VDC, VApp...) was specified in a URI. HTTP 404 Not Found code is applied to response.

The following XML snippet provides an example for this error:

```
<ErrorSet>
  <UnknownElements>
    <Element type="vapp"
      ref="http://.../api/org/12/vdc/3/vapp/sales" />
  </UnknownElements>
  <!-- more errors... -->
</ErrorSet>
```

4.2 Not Applicable

This error type is returned when an operation is request on a resource which doesn't support it. HTTP 404 Not Found code is applied to response.

The following XML snippet provides an example for this error:

```
<ErrorSet>
  <NotApplicable op="shutdown"
    href=" http://.../api/org/12/vdc/3/vapp/sales/firewall">
```

```
    This VApp is incarnated with a hardware-based firewall and can't be
shutdowned
  </NotApplicable>
  <!-- more errors... -->
</ErrorSet>
```

4.3 Invalid Input

This error type is returned when an invalid input (invalid OVF document...) is provided. HTTP 400 Bad Request is applied to response.

The following XML snippet provides an example for this error:

```
<ErrorSet>
  <InvalidInput
    expected="application/vnd.telefonica.tcloud.instantiateOvfParams">
    Syntax error in line 13
  </InvalidInput>
  <!-- more errors... -->
</ErrorSet>
```

4.4 Unavailable Resources

This error type is returned when there aren't enough resources to satisfy a service provisioning or a Building Block instance addition. HTTP 503 Service Unavailable is applied to response.

The following XML snippet provides an example for this error:

```
<ErrorSet>
  <UnavailableResources>No cluster available.</UnavailableResources>
  <!-- more errors... -->
</ErrorSet>
```

5 DIFFERENCES WITH vCloud API

TCloud API is based on vCloud API specification 0.8, as published by VMware, Inc. In essence, the main operations and data types defined in vCloud are maintained in TCloud. In some cases, in order to fulfil TCloud architecture some little differences are applied. These differences may be categorized in classes described in the following table:

Codename	Class description	vCloud Comply
Additional Operations and Data Types	Addition of operations and data types not existing in vCloud	Level 1
Omission of Operations and Data Types	Omission of data members defined in vCloud. Some functionality defined in vCloud is not considered in TCloud. This difference consists in omitting a data member defined in vCloud when it's marked as optional.	Level 1
Data Type Extension	Extension of data types defined in vCloud. In order to include new data members not considered by vCloud, original data types are extended to include new elements.	Level 2
Particular Interpretation	Particular interpretation of some aspects not clearly defined in vCloud.	Level 1

Alternative Manner	Alternative manner considered by TCloud respect some vCloud mechanism	Level 2
--------------------	---	---------

Each difference class is classified respect its vCloud-compliance level.

- vCloud compliance level 1 indicates that this difference is completely compatible with vCloud specification, i.e. it doesn't contradict the specification in any of its parts. Some new functionality may be added, but a vCloud-compliant API consumer should work with this addition.
- vCloud compliance level 2 indicates that this difference requires minor changes in vCloud specification.

In this section, the differences with vCloud API are described.

Class	Data Type Extension
Compliance Level	Level 1
Description	New members added to RelationType enumeration: monitor:measures, monitor:subscribe, snapshots, snapshot:take and snapshot:restore
Reason	TCloud defines additional functionality respect vCloud. It means that more resource types are available in the former. These new relations must be included in rel attribute for Link Type for referencing monitoring and snapshot functionalities not included in vCloud.

Class	Particular Interpretation
Compliance Level	Level 1
Description	Use of different URI schemes. vCloud keeps some resource URI schemes open, allowing the platform to decide their location. That is the case of main resources like VApps or VDCs. vCloud specification establishes that this URIs are returned by platform as result of provisioning operations or Organization browsing, and no URI structure is imposed. TCloud establishes a non-mutable URI scheme (see API Operations)
Reason	Hierarchical structure provides a more intelligible conception of resources (something like org/vdc/vapp/...). Non-mutable URI scheme allows a client-code programmer to know the exact location of a resource without browsing other resources or parsing server responses.

Class	Additional Operations and Data Types
Compliance Level	Level 1
Description	Monitoring functionality included. Operations and data types for self-monitoring are added.

Reason	vCloud does not include any kind of mechanism for monitoring cloud resources
---------------	--

Class	Additional Operations and Data Types
Compliance Level	Level 1
Description	VM snapshot functionality included. Operations and data types for managing VM snapshots are added.
Reason	vCloud does not include any kind of mechanism for managing VM snapshots

Class	Alternative Manner
Compliance Level	Level 2
Description	Use of an alternative mechanism to perform addition, modifications and removal of VApp hardware. vCloud defines a mechanism consistent in POSTing a new ovf:VirtualHardwareSection_Type to a facet resource in order to perform hardware management. TCloud uses a specific facet resource for each single hardware element

	accepting PUT, POST and REMOVE operators for adding, modifying or removing hardware, using RASD_Type as input data when needed.
Reason	POSTing a ovf:VirtualHardwareSection_Type as a whole means that more than one addition, modification or removal may be applied at the same time. It's quite complex for cloud management software to manage more than one action in the same operation, so a step-by-step alternative is provided by TCloud.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	Catalogue management functionalities are not included in TCloud
Reason	This functionality is not considered important enough to be included in the first version of TCloud API.

Class	Omission of Operations and Data Types
Compliance	Level 1

Level	
Description	Instantiation of OVF package as VApp Template is not included in TCloud.
Reason	This functionality is not considered important enough to be included in the first version of TCloud API.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	TCloud does not include deploy and undeploy operations present in vCloud. Instead, a just instantiated VApp is completely deployed but turned off (in case of VMs, which should be booted by end-user one by one)
Reason	TCloud architecture integrates service provisioning and service deployment in the same action

Class	Alternative Manner
Compliance	Level 2

Level	
Description	Facet resource for creating a new Organization is located in a different URI.
Reason	vCloud uses <vCloud-uri>/action/add for this facet resource. <vCloud-uri> represents the root URI for the API, so action/add is completely unclear respect what is to be created. TCloud uses <api-uri>/org/action/add which is more clarifying. Since this facet resource is described as part of vCloud Administrative Extensions, it's not considered important to be completely aligned with vCloud.

Class	Particular Interpretation
Compliance Level	Level 1
Description	VDC creation uses VDC Type instead of VdcAllocation type.
Reason	VdcAllocation type is mentioned in vCloud Administrative Extensions but it is not included in vCloud XML Schemas or any other piece of documentation.

Class	Omission of Operations and Data Types
--------------	---------------------------------------

Compliance Level	Level 1
Description	Instantiate OVF Params type omits VAppParent element present in vCloud.
Reason	The use of this element is not documented and it has not an evident application.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	Instantiation Params type omits IpAssignmentSection, ProductSection, VirtualHardwareSection and NetworkSection elements present in vCloud.
Reason	vCloud does not specify how to map these configuration parameters to OVF artefacts. For instance, IpAssignmentSection provides IP configuration, but the target of it is not specified and no mechanism to indicate it is provided. The same happens with ProductSection and VirtualHardwareSection. NetworkSection is omitted since this network declaration is already found in ovf:Envelope element. Only NetworkConfigSection is included in TCloud to map a OVF network to a VDC network which incarnates the former.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	Attributes linkedClone and deploy for Clone VApp Params are omitted.
Reason	linkedClone attribute is omitted since its function is not clearly explained in vCloud (specification mentions the concept of linked clone with no additional description). deploy attribute is not necessary because there is no deployment action in TCloud (once provisioned, a VApp is always deployed).

Class	Particular Interpretation
Compliance Level	Level 1
Description	An OVF descriptor with multiple VirtualSystem elements generates a tree of VApps. Each VirtualSystemCollection is mapped to a VApp which represents a container for other VApps (e.g service, front-end groups, etc). Each VirtualSystem is mapped to a leaf VApp which represents a VM. Different operations are admitted for container VApps

	respect leaf VApps.
Reason	vCloud does not conclude what to do with an OVF with multiple VirtualSystem elements. TCloud defines this provisioning policy.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	AssociatedNetwork elements are omitted.
Reason	Although AssociatedNetwork appears in XML schema, it is not described in vCloud specification (it looks like a typo).

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	Optional Features element omitted in Network Config.
Reason	TCloud architecture does not admit a end-user to specify

	DHCP or fence mode configuration for her networks resources. In TCloud, NAT and firewall rules are not integrated as part of network resources but as separated VApps. TCloud architecture supports different network element flavours (firewall, load balancers...). These components are conceived as a VApp characterized and customized (shared storage is conceived as VApp as well).
--	--

Class	Data Type Extension
Compliance Level	Level 2
Description	New member Bandwidth is added to Network Configuration in order to optionally indicate a bandwidth limit for a VLAN.
Reason	Setting up bandwidth limits for a VLAN is a platform requirement in TCloud.

Class	Additional Operations and Data Types
Compliance Level	Level 1

Description	TCloud includes additional operations (create, modify, remove) for managing network resources for a VDC
Reason	TCloud architecture admits the management of VLANs in order to provide flexible network topology, avoiding the exclusive use of predefined networks.

Class	Omission of Operations and Data Types
Compliance Level	Level 1
Description	TCloud omits NetworkConnectionSection in VApps.
Reason	This element is insufficient to represent network connections, even in vCloud. NetworkConnectionSection appears in the context of a VApp. It contains several NetworkConnection elements which indicates an IP configuration for each network connected to target VApp. The problem is that these elements provide a (network, IP address) tuple. Since a VApp may be connected to a network with multiple VNICs (each one with a particular IP address), this tuple is insufficient.

Class	Data Type Extension
--------------	---------------------

Compliance Level	Level 2
Description	TCloud includes an additional member waiting to TaskStatusType.
Reason	TCloud provides this new member to indicate that the task is waiting for its approval. This feature is essential in cloud implementations which require human authorization for some sensible tasks.

Annex A. Self-Monitoring Extensions

TCloud Self-Monitoring extensions defines a set of entities and operations to perform monitoring actions on cloud resources. This supports two different models for accessing monitoring data:

- Polling model. The client fetches monitoring data from resources using HTTP requests.
- Push model. The client registers HTTP callbacks which are invoked each time a new monitoring event is available.

Monitoring extensions includes more `Link` elements in cloud resources to indicate the location of monitoring facet resources. This links requires the following additional values for `rel` attribute.

Value	Description	Admitted HTTP Operator
<i>monitor:measures</i>	Used in resources to reference the available monitoring measures	GET
<i>monitor:subscribe</i>	Used in Measure Values to reference the monitoring subscribing facet resource.	POST

The following cloud resources admit monitoring operations:

- VDCs. Provide aggregated monitoring values for the VApps which resides in it.

- VApps. Provide aggregated monitoring values for its hardware elements.
- VApp hardware elements. Provide monitoring values for a concrete hardware element (e.g. single disk drive, CPU, memory...).

There are different measure types which may be monitored, each one applicable to certain resource types.

The following tables summarize the measure types applicable to each resource type:

Name	Value Type	Range	Description
<i>For VApps</i>			
<i>cpuUsage</i>	<i>xs:decimal</i>	<i>0..100</i>	Percentage usage of the CPU (may be unavailable for hardware-based firewalls or load balancers)
<i>memoryUsage</i>	<i>xs:decimal</i>	<i>0..n</i>	Amount of used memory in MB (may be unavailable for hardware-based firewalls or load balancers).
<i>diskUsage</i>	<i>xs:decimal</i>	<i>0..n</i>	Aggregated amount of used disk in GB (may be unavailable for hardware-based firewalls or load balancers).

<i>netInput</i>	xs:decimal	0..n	Aggregated input Bandwith in Mbps.
<i>netOutput</i>	xs:decimal	0..n	Aggregated output Bandwith in Mbps.
<i>For Hardware Items which represents VNICs</i>			
<i>netInput</i>	xs:decimal	0..n	Input Bandwith in Mbps.
<i>netOutput</i>	xs:decimal	0..n	Output Bandwith in Mbps.
<i>For Hardware Items which represents Disk Drives</i>			
<i>diskUsage</i>	xs:decimal	0..n	Aggregated amount of used disk in GB.
<i>For Networks</i>			
<i>bandwithUsage</i>	xs:decimal	0..n	Network traffic in Mbps
<i>For Virtual Data Centre</i>			
<i>cpuUsage</i>	xs:decimal	0..100	Percentage usage of the CPU
<i>memoryUsage</i>	xs:decimal	0..n	Amount of used memory in MB.

<i>diskUsage</i>	xs:decimal	0..n	Aggregated amount of used disk for VM images in GBs.
<i>bandwithUsage</i>	xs:decimal	0..n	Network traffic in Mbps

1. Operations

In this section the operations admitted by cloud resources for monitoring actions are described.

Each operation is described using the same notation as TCloud API core operations. URIs are abbreviated using `<item-uri>` form, where item may be an organization, a VDC, a service, a BB instance, and so on. The following BNF rules describe all the possible URIs.

URI	Description
<code><measurable-uri> ::= <vdc-uri> <vapp-uri> <hwitem-uri> <net-uri></code>	<i>Measurable resource</i>
<code><measure-uri> ::= <measurable-uri>/monitor/<measure-id></code>	<i>A measure resource with monitoring abilities (<measure-id> is described in section ¡Error! No se encuentra el origen de la referencia.).</i>

The following operations are admitted:

Operator & URI	GET <measurable-uri>/monitor
Description	Obtains the list of available measures for measurable resource.
Input	None
Output	Measure Descriptor List
Errors	Unknown Elements, Not Deployed

Operator & URI	GET <measure-uri>[?samples=n]
Description	Obtains last n samples for measure.
Input	None
Output	Measure Values
Errors	Unknown Elements, Not Deployed

Operator & URI	GET <measure-uri>/subscription
Description	Obtains the set of callback subscriptions for given measure.
Input	None
Output	Monitoring Subscriptions List
Errors	Unknown Elements

Operator & URI	POST <measure-uri>/subscription
Description	Subscribes a new callback to monitor given measure.
Input	xs:anyURI
Output	Monitoring Subscriptions
Errors	Unknown Elements, Invalid Input

Operator & URI	GET <measure-uri>/subscription/<callback-id>
Description	Obtains detailed information for a previously subscribed callback
Input	None
Output	Monitoring Subscription
Errors	Unknown Elements

Operator & URI	DELETE <measure-uri>/subscription/<callback-id>
Description	Removes a previously registered subscription to monitor given measure
Input	None
Output	None
Errors	Unknown Elements

2. Data Types

2.1. Measure Descriptor

Measure Descriptor represents the description of an available measure associated to a given resource.

Measures are defined by type `application/vnd.telefonica.tcloud.measureDescriptor+xml`. This type is formed by the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the resource
name	1	xs:string	Name of the measure, matching the measure type described above.
<i>Child elements</i>			
Link	0..1	Link Type	Link for event subscription for this measure
ValueType	1	xs:string	Name of a xs:anySimpleType of the measure, matching the value type for measure type indicated by

			name.
MinValue	0..1	'xs:anySimpleType'	A leaf-element which indicates the expected minimal measure value. This element allows a unit attribute of type xs:string which indicates the value unit.
MaxValue	0..1	'xs:anySimpleType'	A leaf-element which indicates the expected maximum measure value. This element allows a unit attribute of type xs:string which indicates the value unit.
Description	1	xs:string	A leaf-element which indicates the expected minimal measure value. This element allows a unit attribute of type xs:string which indicates the value unit.

The following XML snippet provides an example for this type:

```
<MeasureDescriptor href="http://cloud.example.com/my-vdc/my-service/my-vm"
name="cpuUsage">
  <Link rel="monitor:subscribe"
type="application/vnd.telefonica.tcloud.monitoringCallback+plain"
href="http://cloud.example.com/my-org/my-vdc/my-service/my-
vm/monitor/cpuUsage/subscription" />
  <ValueType>xs:decimal</ValueType>
  <MinValue>0</MinValue>
  <MaxValue>100</MaxValue>
```

```
<Description>Percentage of used CPU in a Virtual Machine</Description>
</MeasureDescriptor>
```

2.2. Measure Descriptor List

Measure Descriptor List provides a container which holds measure descriptor. It's used to discover which measures are available for a given resource.

Measure Descriptors are defined by type `application/vnd.telefonica.tcloud.measureDescriptorList+xml`. This type is formed by the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the resource
<i>Child elements</i>			
Link (up)	0..1	Link Type	Link to the measurable resource which owns this measures.
MeasureDescriptor	0..n	Measure Descriptor Type	Zero or more measure descriptor which describe the available measures for a given resource.

The following XML snippet provides an example for this type:

```
<MeasureDescriptorList
href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/12/vm-1/monitor">
  <Link rel="up"
    type="application/vnd.telefonica.tcloud.vapp+xml"
    href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/12/vm-1" />
  <MeasureDescriptor
href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/12/vm-
1/monitor/cpuUsage" name="cpuUsage">
    <Link rel="monitor:subscribe"
      type="application/vnd.telefonica.tcloud.monitoringCallback+plain"
      href="http://cloud.telefonica.com/api/org/56/vdc/3/vapp/12/vm-
1/monitor/cpuUsage/subscription" />
    <ValueType>xs:decimal</ValueType>
    <minValue>0</minValue>
    <maxValue>100</minValue>
    <Description>Percentage of used CPU in a Virtual Machine</Description>
  </MeasureDescriptor>

  <!-- More measure descriptors ... -->
  ...
</MeasureDescriptorList>
```

2.3. Measure Values

Measure values represent a set of monitoring information for a given measure.

Measures are defined by type `application/vnd.telefonica.tcloud.measure+xml`. This type is formed by the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	A reference to the measure
<i>Child elements</i>			
Link	0..1	Link Type	Link for event subscription for this measure
Sample	1..n	Sample Type	A element which describes a measure sample.

Sample Type is defined as follows:

Name	Mul.	Type	Description
<i>Attributes</i>			
timestamp	1	xs:dateTime	A time stamp which indicates when does the measure was taken
unit	0..1	xs:string	Attribute which indicates the value unit using CIM RASD representation

<i>Child elements</i>			
Value	1		A leaf-element which indicates the sample value.
Capacity	0..1		A leaf-element which indicates the measure maximum value.

The following XML snippet provides an example for this type:

```
<Measure
href="http://.../api/org/3/vdc/2/vapp/websrv/vml/hw/disk0/monitor/diskUsage">
  <Link rel="monitor:subscribe"
        type="application/vnd.telefonica.tcloud.monitoringCallback+plain"
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0//mo
nitor/diskUsage/subscription" />
  <Sample unit="byte * 2^30" timestamp="2010-01-03T09:30:10Z" >
    <Value>37.4</Value>
    <Capacity>152</Capacity>
  </Sample>
  <Sample unit="byte * 2^30" timestamp="2010-01-03T10:30:10Z" >
    <Value>37.7</Value>
    <Capacity>152</Capacity>
  </Sample>
  <Sample unit="byte * 2^30" timestamp="2010-01-03T11:30:10Z" >
    <Value>33.2</Value>
    <Capacity>152</Capacity>
  </Sample>
</Measure>
```

2.4. Monitoring Subscription

A Monitoring Subscription represents a RESTfull resource which provides a mechanism to notify a monitoring event. It contains a callback URL which accepts HTTP POST operations with Measure Values content.

This data type is defined by application/vnd.telefonica.tcloud.monitoringSubscription+xml and comprises the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			
href	1	xs:anyURI	Reference to monitoring subscription
status	1	Subscription Status	<p>Subscription status. One of: + new: subscription is new, and no event was delivery yet to check whether the callback is processing successfully</p> <ul style="list-style-type: none"> • accepting: callback is accepting events successfully • rejecting: callback is rejecting events. Delivery is disabled for a while until it recovers
<i>Child elements</i>			
Callback	1	Reference Type	A reference to the callback URL, which accepts a content type application/vnd.telefonica.tcloud.measure+xml

Link	0..1	Link Type	A link to subscription list for given measure.
------	------	-----------	--

The following XML snippet provides an example for this type:

```
<MonitoringSubscription
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0/monitor/cpuUsage/subscription/12"
status="accepting">
  <Link rel="up"
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0/monitor/cpuUsage/subscription" />
  <Callback href="http://sysadmin.mysite.com/servlets/do.ReceiveMeasure"
type="application/vnd.telefonica.tcloud.measure+xml" />
</MonitoringSubscription>
```

2.5. Monitoring Subscription List

Monitoring Subscription List provides a list of subscriptions registered in a measure for its monitoring.

This data type is defined by application/vnd.telefonica.tcloud.monitoringCallbacksList+xml and comprises by the following elements:

Name	Mul.	Type	Description
<i>Attributes</i>			

href	1	xs:anyURI	The reference to subscription list
<i>Child elements</i>			
MonitoringSubscription	0..n	Monitoring Subscription	A monitoring subscription descriptor

The following XML snippet provides an example for this type:

```
<MonitoringSubscriptionsList
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0/monitor/cpuUsage/subscription">
  <MonitoringSubscription
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0/monitor/cpuUsage/subscription/12"
      status="accepting">
    <Callback href="http://sysadmin.example.com/my-monitoring-agent"
      type="application/vnd.telefonica.tcloud.measure+xml" />
  </MonitoringSubscription>
  <MonitoringSubscription
href="http://cloud.telefonica.com/api/org/3/vdc/2/srv/websrv/vml/hw/disk0/monitor/cpuUsage/subscription/13"
      status="accepting">
    <Callback href="http://sales.example.com/cpu-usage-control"
      type="application/vnd.telefonica.tcloud.measure+xml" />
  </MonitoringSubscription>
</MonitoringSubscriptionsList>
```

Annex B. Self-Administration Extensions

1. Operations

The following operations are admitted to manage organization resources.

Operator & URI	POST <api-uri>/org/action/add
Description	Create a new organization
Input	Organization Type
Output	Task (after completion, its Result element references the Organization resource)
Errors	Invalid Input

Operator & URI	PUT <org-uri>
Description	Modify an existing organization
Input	Organization Type

Output	Task (after completion, its Result element references the Organization resource)
Errors	Unknown Elements, Invalid Input

Operator & URI	DELETE <org-uri>
Description	Remove an existing organization (its VDCs must be removed before)
Input	None
Output	None
Errors	Unknown Elements

Operator & URI	POST <org-uri>/vdc/action/add
Description	Create a new VDC for target organization
Input	VDC Type (Link and AvailableNetworks elements are

	ignored)
Output	VDC Type (Link and AvailableNetworks elements are added)
Errors	Unknown Elements, Invalid Input

Operator & URI	PUT <vdc-uri>
Description	Modify an existing VDC
Input	VDC Type (Link and AvailableNetworks elements are ignored)
Output	VDC Type (Link and AvailableNetworks elements are added)
Errors	Unknown Elements, Invalid Input

Operator & URI	DELETE <vdc-uri>
Description	Remove an existing VDC (its VApps must be removed)

	before)
Input	None
Output	None
Errors	Unknown Elements

2. Data Types

This extension uses the same data types defined in TCloud API core.

Annex C. Workflow Example

3. TCloud API Workflow Example

This annex presents a workflow example which shows how to perform a set of typical actions using TCloud API. This workflow is formed by the following steps:

- Create a Organization resource
- Create a VDC resource
- Create a Virtual LAN for VDC resource
- Create a service (VApp) from an OVF description
- Modify a VApp hardware configuration
- Add a new VApp to an existing service
- Remove a VApp
- Obtain monitoring data from certain resources
- Take a VM snapshot
- Restore a VM snapshot

3.1. Create a Organization Resource

VApps are instantiated in a VDC context, and a VDC is owned by an Organization. The following request may be used to create a Organization.

Request:

```
POST https://cloud.telefonica.com/api/org/action/add
Content-Type: application/vnd.telefonica.tcloud.org+xml
```

```
<Organization name="mycompany">
  <Description>My Company Ltd.</Description>
</Organization>
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.org+xml

<Organization name="mycompany"
  href="http://cloud.telefonica.com/api/org/mycompany">
  <Description>My Company Ltd.</Description>
</Organization>
```

Instantiated resource at response provides an href attribute to itself.

3.2. Create a VDC resource

A VDC resource may be created using the following request:

```
Request:

POST https://cloud.telefonica.com/api/org/mycompany/vdc/action/add
Content-Type: application/vnd.telefonica.tcloud.vdc+xml

<VDC name="bss">
  <Description>Business Support Systems</Description>
</VDC>
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vdc+xml

```
<VDC name="bss"
  href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss">
  <Description>Business Support Systems</Description>
  <Link rel="up" href="http://cloud.telefonica.com/api/org/mycompany" />
  <StorageCapacity>
    <Units>bytes * 10^9</Units> <!-- GB -->
    <Allocated>10000</Allocated>
    <Used>0</Used>
  </StorageCapacity>
  <ComputeCapacity>
    <Cpu>
      <Units>hz * 10^6</Units> <!-- MHz -->
      <Allocated>20000</Allocated>
      <Used>0</Used>
    </Cpu>
    <Memory>
      <Units>bytes * 2^30</Units> <!-- GB -->
      <Allocated>256</Allocated>
      <Used>0</Used>
    </Memory>
    <InstantiatedVmsQuota>
      <Limit>100</Limit>
      <Used>0</Used>
    </InstantiatedVmsQuota>
    <DeployedVmsQuota>
      <Limit>50</Limit>
      <Used>0</Used>
    </DeployedVmsQuota>
```

```

</ComputeCapacity>
<AvailableNetworks>
  <Network
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public"
    name="public" />
  </AvailableNetworks>
</VDC>

```

In this response, VDC capacity is returned. This behaviour is platform-dependent. In this case, a predefined amount of resources are pre-assigned to this VDC, but the user may have included capacity expectations in her request if the platform supports it.

In the example, a predefined network is available by default (an Internet public access). This behaviour is platform-dependent as well. To obtain a full description of this predefined network, a GET operation may be requested.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public
```

Response:

```

200 OK
Content-Type: application/vnd.telefonica.tcloud.network+xml

<Network name="public"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public">
  <Description>Internet public access</Description>
  <Link rel="monitor:measures"
    type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public/monitor
" />
  <Configuration>
    <Dns>193.147.71.12</Dns>
    <Gateway>193.147.45.1</Gateway>
    <Netmask>255.255.255.0</Netmask>
    <Bandwidth>10.0</Bandwidth>
  </Configuration>
</Network>
```

3.3. Create a Virtual LAN for VDC resource

Once a VDC is available, it may be populated with Virtual LANs which interconnects VApps internally.

Request:

```
POST https://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/action/add
Content-Type: application/vnd.telefonica.tcloud.network+xml
```

```
<Network name="fel">
  <Description>A Virtual LAN to interconnect front-ends</Description>
  <Configuration>
    <Bandwidth>5.0</Bandwidth>
  </Configuration>
</Network>
```

Response:

```
200 OK
```

```
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/1"
      startTime="2010-01-03T09:36:32Z"
      expiryTime="2010-01-03T10:36:32Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/1/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```

After some time (the VLAN is completely instantiated), the Task resource will indicate a different status, pointing to the instantiated Network resource:

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/1
```

Response:

200 OK

```
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/1"
      startTime="2010-01-03T09:36:32Z"
      endTime="2010-01-03T09:37:10Z"
      status="success ">
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fe1"
```

```

    type="application/vnd.telefonica.tcloud.network+xml" />
</Task>

```

A GET request may be applied on the reference provided by the task resource to obtain a full description of the instantiated network.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel
```

Response:

```
200 OK
```

```
Content-Type: application/vnd.telefonica.tcloud.network+xml
```

```

<Network name="fel"
  href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel">
  <Description>A Virtual LAN to interconnect front-ends</Description>
  <Link rel="monitor:measures"
    type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"
    href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel/monitor"
  />
  <Configuration>
    <Dns>192.168.43.3</Dns>
    <Gateway>192.168.55.1</Gateway>
    <Netmask>255.255.255.0</Netmask>
    <Bandwidth>5.0</Bandwidth>
  </Configuration>
</Network>

```

This new network will be listed as available network resource in the VDC context.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vdc+xml

```
<VDC name="bss"
  href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss">
  <Description>Business Support Systems</Description>
  <Link rel="up" href="http://cloud.telefonica.com/api/org/mycompany" />
  <StorageCapacity>...</StorageCapacity>
  <ComputeCapacity>...</ComputeCapacity>
  <AvailableNetworks>
    <Network
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public"
      name="public" />
    <Network
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel"
      name="fel" />
  </AvailableNetworks>
</VDC>
```

3.4. Create a service (VApp) from an OVF description

To instantiate a new service, a OVF Envelope is wrapped with Instantiate OVF Params data type which adds specific configuration and instantiation parameters for the service.

Figure 1 depicts a typical service.

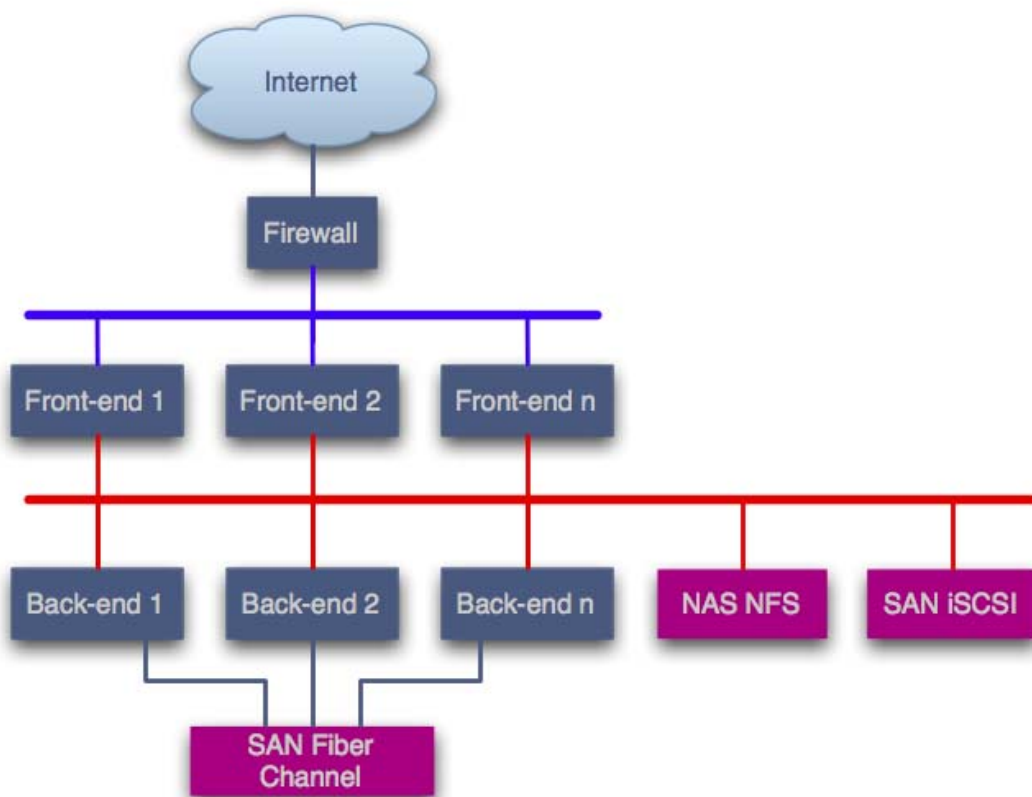


Figure 1. A typical service architecture

This service is instantiated with the following request.

Request:

POST

<https://cloud.telefonica.com/api/org/mycompany/vdc/bss/action/instantiateOvf>

Content-Type: application/vnd.telefonica.tcloud.instantiateOVFParams+xml

```
<InstantiateOvfParams name="sales">
  <Description>BSS for Sales Department</Description>
  <Envelope>
    <NetworkSection>
      <Info>Declaration of logical networks</Item>
      <Network name="public-net" />
      <Network name="front-net" />
      <Network name="back-net" />
    </NetworkSection>
    <DiskSection>
      <Info>Declaration of logical disks</Item>
      <Disk diskId="nas1-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="200" />
      <Disk diskId="san1-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="300" />
      <Disk diskId="san2-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="350" />
      <Disk diskId="fe1-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
      <Disk diskId="fe2-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
      ...
      <Disk diskId="be1-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
      <Disk diskId="be2-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
      ...
    </DiskSection>
  </Envelope>
</InstantiateOvfParams>
```

```
</DiskSection>
<VirtualSystemCollection id="root-vsc">

  <!-- A firewall -->
  <VirtualSystem id="10201-001">
    <VirtualHardwareSection>
      <System>
        <VirtualSystemType>firewall.hw</VirtualSystemType>
      </System>
      <Item>
        <rasd:InstanceID>1</rasd:InstanceID>
        <rasd:ElementName>Input Ethernet Adapter</rasd:ElementName>
        <rasd:ResourceType>10</rasd:ResourceType>
        <rasd:Connection>public-net</rasd:Connection>
      </Item>
      <Item>
        <rasd:InstanceID>2</rasd:InstanceID>
        <rasd:ElementName>Output Ethernet Adapter</rasd:ElementName>
        <rasd:ResourceType>10</rasd:ResourceType>
        <rasd:Connection>front-net</rasd:Connection>
      </Item>
    </VirtualHardwareSection>
  </VirtualSystem>

  <!-- A low-cost NAS storage -->
  <VirtualSystem id="10320-001">
    <VirtualHardwareSection>
      <System>
        <VirtualSystemType>nas.nfs.lowcost</VirtualSystemType>
      </System>
      <Item>
        <rasd:InstanceID>1</rasd:InstanceID>
        <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
```

```

        <rasd:ResourceType>10</rasd:ResourceType>
        <rasd:Connection>back-net</rasd:Connection>
    </Item>
    <Item>
        <rasd:InstanceID>2</rasd:InstanceID>
        <rasd:ElementName>NAS volume</rasd:ElementName>
        <rasd:ResourceType>17</rasd:ResourceType>
        <rasd:HostResource>ovf:/disk/nas1-disk</rasd:HostResource>
    </Item>
</VirtualHardwareSection>
</VirtualSystem>

<!-- A SAN storage of type iSCSI -->
<VirtualSystem id="10321-001">
    <VirtualHardwareSection>
        <System>
            <VirtualSystemType>san.iscsi</VirtualSystemType>
        </System>
        <Item>
            <rasd:InstanceID>1</rasd:InstanceID>
            <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
            <rasd:ResourceType>10</rasd:ResourceType>
            <rasd:Connection>back-net</rasd:Connection>
        </Item>
        <Item>
            <rasd:InstanceID>2</rasd:InstanceID>
            <rasd:ElementName>iSCSI LUN</rasd:ElementName>
            <rasd:ResourceType>17</rasd:ResourceType>
            <rasd:HostResource>ovf:/disk/san1-disk</rasd:HostResource>
        </Item>
    </VirtualHardwareSection>
</VirtualSystem>

```

```
<!-- A SAN storage of type fiber channel -->
<VirtualSystem id="10322-001"> <!-- This id attribute is assigned by
Business Tier. -->
  <VirtualHardwareSection>
    <System>
      <VirtualSystemType>san.fc.highspeed</VirtualSystemType>high-speed
disks -->
    </System>
    <Item>
      <rasd:InstanceID>1</rasd:InstanceID>
      <rasd:ElementName>Fiber Channel LUN</rasd:ElementName>
      <rasd:ResourceType>17</rasd:ResourceType>
      <rasd:HostResource>ovf:/disk/san2-disk</rasd:HostResource>
    </Item>
  </VirtualHardwareSection>
</VirtualSystem>

<!-- A front-end VM -->
<VirtualSystem id="10001-001">
  <VirtualHardwareSection>
    <System>
      <VirtualSystemType>vm.vmx-4</VirtualSystemType>
    </System>
    <Item>
      <rasd:InstanceID>1</rasd:InstanceID>
      <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
      <rasd:ResourceType>10</rasd:ResourceType>
      <rasd:Connection>front-net</rasd:Connection>
    </Item>
    <Item>
      <rasd:InstanceID>2</rasd:InstanceID>
      <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
      <rasd:ResourceType>10</rasd:ResourceType>
```

```

        <rasd:Connection>back-net</rasd:Connection>
    </Item>
    <Item>
        <rasd:InstanceID>3</rasd:InstanceID>
        <rasd:ElementName>System Disk</rasd:ElementName>
        <rasd:ResourceType>17</rasd:ResourceType>
        <rasd:HostResource>ovf:/disk/fel-sysdisk</rasd:HostResource>
    </Item>
    <!-- More Item sections following describes memory, CPU... -->
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>
    <DiskMap mountPoint="/" diskId="fel-sysdisk" />
    <DiskMap mountPoint="/var/nfs" diskId="nas1-disk" />
    <DiskMap mountPoint="/usr" diskId="san1-disk" />
</DiskMappingSection>
</VirtualSystem>
<!-- Some other front-ends following... -->
...

<!-- A back-end VM -->
<VirtualSystem id="10001-010">
    <VirtualHardwareSection>
        <System>
            <VirtualSystemType>vm.vmx-4</VirtualSystemType>
        </System>
        <Item>
            <rasd:InstanceID>1</rasd:InstanceID>
            <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
            <rasd:ResourceType>10</rasd:ResourceType>
            <rasd:Connection>back-net</rasd:Connection>
        </Item>
        <Item>

```

```

        <rasd:InstanceID>2</rasd:InstanceID>
        <rasd:ElementName>System Disk</rasd:ElementName>
        <rasd:ResourceType>17</rasd:ResourceType>
        <rasd:HostResource>ovf:/disk/bel-sysdisk</rasd:HostResource>
    </Item>
    <!-- More Item sections following describes memory, CPU... -->
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>
    <DiskMap mountPoint="/" diskId="bel-sysdisk" />
    <DiskMap mountPoint="/var" diskId="san1-disk" />
</DiskMappingSection>
</VirtualSystem>
<!-- Some other back-ends following... -->
...
</VirtualSystemCollection>
</Envelope>
<InstantiationParams>
    <NetworkConfigSection>
        <Info>Logical networks configuration</Item>
        <NetworkConfig name="public-end">
            <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public" />
            </NetworkConfig>
        <NetworkConfig name="front-end">
            <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fe1" />
            </NetworkConfig>
        <NetworkConfig name="back-end">
            <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/bel" />
            </NetworkConfig>
        </NetworkConfigSection>

```

```
</InstantiationParams>  
</InstantiateOvfParams>
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.task+xml

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/2"  
      startTime="2010-01-03T11:36:32Z"  
      expiryTime="2010-01-03T12:36:32Z"  
      status="running">  
  <Link rel="task:cancel"  
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/2/cancel" />  
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"  
        type="application/vnd.telefonica.tcloud.vdc+xml" />  
</Task>
```

After task completion, it presents an update status.

Request:

GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/2

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.task+xml

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/2"
```

```

    startTime="2010-01-03T11:36:32Z"
    endTime="2010-01-03T11:38:32Z"
    status="success">
    <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
    <Result
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales"
        type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>

```

Now it's possible to obtain the VApp resource state.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vapp+xml

```

<VApp name="sales">
  <Description>BSS for Sales Department</Description>

  <Link rel="up"
    href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss" />
  <Link rel="add"
    type="application/vnd.telefonica.tcloud.instantiateOVFParams+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/action/
instantiateOVF" />

```

```

<Link rel="monitor:measures"
type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/monitor
" />

<NetworkSection>
  <Info>Declaration of logical networks</Item>
  <Network name="public-net" />
  <Network name="front-net" />
  <Network name="back-net" />
</NetworkSection>

<NetworkConfigSection>
  <Info>Logical networks configuration</Item>
  <NetworkConfig name="public-end">
    <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/public" />
    </NetworkConfig>
  <NetworkConfig name="front-end">
    <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fe1" />
    </NetworkConfig>
  <NetworkConfig name="back-end">
    <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/be1" />
    </NetworkConfig>
  </NetworkConfigSection>

<DiskSection>
  <Info>Declaration of logical disks</Item>
  <Disk diskId="nas1-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="200" />

```

```

    <Disk diskId="san1-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="300" />
    <Disk diskId="san2-disk" capacityAllocationUnits="bytes * 2 ^30"
capacity="350" />
    <Disk diskId="fe1-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    <Disk diskId="fe2-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    ...
    <Disk diskId="be1-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    <Disk diskId="be2-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    ...
</DiskSection>

<Children>

    <!-- A firewall -->
    <VApp name="10201-001"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10201-
001">
        <Link rel="remove"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10201-
001" />
        <Link rel="monitor:measures" type="application/vnd.telefonica.tcloud.
measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10201-
001/monitor" />
        <VirtualHardwareSection>

```

```

<System>
  <VirtualSystemType>firewall.hw</VirtualSystemType>
</System>
<Item>
  <rasd:InstanceID>1</rasd:InstanceID>
  <rasd:ElementName>Input Ethernet Adapter</rasd:ElementName>
  <rasd:ResourceType>10</rasd:ResourceType>
  <rasd:Connection>public-net</rasd:Connection>
</Item>
<Item>
  <rasd:InstanceID>2</rasd:InstanceID>
  <rasd:ElementName>Output Ethernet Adapter</rasd:ElementName>
  <rasd:ResourceType>10</rasd:ResourceType>
  <rasd:Connection>front-net</rasd:Connection>
</Item>
</VirtualHardwareSection>
</VApp>

<!-- A low-cost NAS storage -->
<VApp name="10320-001"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10320-001">
  <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10320-001" />
  <Link rel="monitor:measures" type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10320-001/monitor" />
  <VirtualHardwareSection>

```

```

<System>
  <VirtualSystemType>nas.nfs.lowcost</VirtualSystemType>
</System>
<Item>
  <rasd:InstanceID>1</rasd:InstanceID>
  <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
  <rasd:ResourceType>10</rasd:ResourceType>
  <rasd:Connection>back-net</rasd:Connection>
</Item>
<Item>
  <rasd:InstanceID>2</rasd:InstanceID>
  <rasd:ElementName>NAS Volume</rasd:ElementName>
  <rasd:ResourceType>17</rasd:ResourceType>
  <rasd:HostResource>ovf:/disk/nas1-disk</rasd:HostResource>
</Item>
</VirtualHardwareSection>
</VApp>

<!-- A SAN storage of type iSCSI -->
<VApp name="10321-001"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10321-001">
  <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10321-001" />
  <Link rel="monitor:measures" type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10321-001/monitor" />
  <VirtualHardwareSection>

```

```

    <System>
      <VirtualSystemType>san.iscsi</VirtualSystemType>
    </System>
  <Item>
    <rasd:InstanceID>1</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
  </Item>
  <Item>
    <rasd:InstanceID>2</rasd:InstanceID>
    <rasd:ElementName>iSCSI LUN</rasd:ElementName>
    <rasd:ResourceType>17</rasd:ResourceType>
    <rasd:HostResource>ovf:/disk/san1-disk</rasd:HostResource>
  </Item>
</VirtualHardwareSection>
</VApp>

<!-- A SAN storage of type fiber channel -->
<VApp name="10322-001"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10322-001">
  <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10322-001" />
  <Link rel="monitor:measures" type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10201-001/monitor" />
  <VirtualHardwareSection>

```

```

        <System>
          <VirtualSystemType>san.fc.highspeed</VirtualSystemType>high-speed
disks -->
        </System>
        <Item>
          <rasd:InstanceID>1</rasd:InstanceID>
          <rasd:ElementName>Fiber Channel LUN</rasd:ElementName>
          <rasd:ResourceType>disk</rasd:ResourceType>
          <rasd:HostResource>ovf:/disk/san2-disk</rasd:HostResource>
        </Item>
      </VirtualHardwareSection>
    </VApp>

    <!-- A front-end VM -->
    <VApp name="10001-001"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001">
      <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001" />
      <Link rel="power:powerOn"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/power/actions/powerOn" />
      <Link rel="power:powerOff"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/power/actions/powerOff" />
      <!-- More links for managing power following... -->
      ...
      <Link rel="power:reboot"

```

```

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/power/actions/reboot" />
    <Link rel="monitor:measures" type="application/vnd.telefonica.tcloud.
measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/monitor" />
    <Link rel="snapshots"
        type="application/vnd.telefonica.tcloud.snapshotList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/snapshot" />
    <Link rel="snapshot:take"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/snapshot/take" />
    <VirtualHardwareSection>
        <Link rel="add" type="application/ovf.item+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/hw" />
    <System>
        <VirtualSystemType>vm.vmx-4</VirtualSystemType>
    </System>
    <Item>
        <Link rel="edit" type="application/ovf.item+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
001/hw/1" />
        <Link rel="monitor:measures"
type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-001/hw/1/monitor" />
    <rasd:InstanceID>1</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>front-net</rasd:Connection>
</Item>
<Item>
    <Link rel="edit" type="application/ovf.item+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-001/hw/2" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-001/hw/2/monitor" />
    <rasd:InstanceID>2</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
</Item>
<Item>
    <Link rel="remove"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-001/hw/2" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-001/hw/2/monitor" />
```

```

        <rasd:InstanceID>3</rasd:InstanceID>
        <rasd:ElementName>System Disk</rasd:ElementName>
        <rasd:ResourceType>17</rasd:ResourceType>
        <rasd:HostResource>ovf:/disk/fel-sysdisk</rasd:HostResource>
    </Item>
    <!-- More Item sections following describes memory, CPU... -->
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>
    <DiskMap mountPoint="/" diskId="fel-sysdisk" />
    <DiskMap mountPoint="/var/nfs" diskId="nas1-disk" />
    <DiskMap mountPoint="/usr" diskId="san1-disk" />
</DiskMappingSection>
</VApp>
<!-- Some other front-ends following... -->
...

<!-- A back-end VM -->
<VApp name="10001-010"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010">
    <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010" />
    <Link rel="power:powerOn"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/power/actions/powerOn" />
    <Link rel="power:powerOff"

```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/power/actions/powerOff" />
  <!-- More links for managing power following... -->
  ...
  <Link rel="power:reboot"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/power/actions/reboot" />
  <Link rel="monitor:measures" type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/monitor" />
  <Link rel="snapshots"
    type="application/vnd.telefonica.tcloud.snapshotList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/snapshot" />
  <Link rel="snapshot:take"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/snapshot/take" />
  <VirtualHardwareSection>
    <Link rel="add" type="application/ovf.item+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw" />
  <System>
    <VirtualSystemType>vm.vmx-4</VirtualSystemType>
  </System>
  <Item>
    <Link rel="edit" type="application/ovf.item+xml"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/1" />
    <Link rel="monitor:measures"
type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/1/monitor" />
    <rasd:InstanceID>1</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
</Item>
<Item>
    <Link rel="remove"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/2" />
    <Link rel="monitor:measures"
type="application/vnd.telefonica.tcloud.measureDescriptorList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/2/monitor" />
    <rasd:InstanceID>2</rasd:InstanceID>
    <rasd:ElementName>System Disk</rasd:ElementName>
    <rasd:ResourceType>17</rasd:ResourceType>
    <rasd:HostResource>ovf:/disk/bel-sysdisk</rasd:HostResource>
</Item>
<!-- More Item sections following describes memory, CPU... -->
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>
    <DiskMap mountPoint="/" diskId="bel-sysdisk" />
```

```
        <DiskMap mountPoint="/var" diskId="san1-disk" />
      </DiskMappingSection>
    </VApp>
    <!-- Some other back-ends following... -->
    ...
  </Children>
</InstantiateOvfParams>
```

Each child VApp may be browsed independently following the reference provided by parent VApp:

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010
```

Response:

```
200 OK
```

```
<VApp name="10001-010"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010">
```

```
  <VAppParent
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales" />
```

```
  <Link rel="remove"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010" />
```

```
  <Link rel="power:powerOn"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/power/actions/powerOn" />
```

```

<Link rel="power:powerOff"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/power/actions/powerOff" />
  <!-- More links for managing power following... -->
  ...
  <Link rel="power:reboot"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/power/actions/reboot" />
    <Link rel="monitor:measures" type="application/vnd.telefonica.tcloud.
measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/monitor" />
      <Link rel="snapshots"
        type="application/vnd.telefonica.tcloud.snapshotList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/snapshot" />
        <Link rel="snapshot:take"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/snapshot/take" />
          <VirtualHardwareSection>
            <Link rel="add" type="application/ovf.item+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw" />
              <System>
                <VirtualSystemType>vm.vmx-4</VirtualSystemType>
              </System>
            <Item>

```

```

    <Link rel="edit" type="application/ovf.item+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/1" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/1/monitor" />
    <rasd:InstanceID>1</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
</Item>
<Item>
    <Link rel="remove"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/2" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/2/monitor" />
    <rasd:InstanceID>2</rasd:InstanceID>
    <rasd:ElementName>System Disk</rasd:ElementName>
    <rasd:ResourceType>17</rasd:ResourceType>
    <rasd:HostResource>ovf:/disk/bel-sysdisk</rasd:HostResource>
</Item>
<!-- More Item sections following describes memory, CPU... -->
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>

```

```

<DiskMap mountPoint="/" diskId="bel-sysdisk" />
<DiskMap mountPoint="/var" diskId="san1-disk" />
</DiskMappingSection>
</VApp>

```

3.5. Manage VM Power

Once a VApp is completely instantiated and deployed, its power supply (in case of VMs) may be managed. To do so, the user may follow the links provided by VApp state representation. By default, a just instantiated VM is turned off. For powering on, the following request is made.

Request:

```

POST https://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/power/actions/powerOn

```

Response:

```

200 OK
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/3"
      startTime="2010-01-03T12:01:12Z"
      expiryTime="2010-01-03T12:31:12Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/3/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>

```

After a while, the task is completed.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/3
```

Response:

```
200 OK
```

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/3"
      startTime="2010-01-03T12:01:12Z"
      endTime="2010-01-03T12:01:36Z"
      status="success">
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result
href="https://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010"
        type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>
```

The same request may be applied to the rest of VMs which forms the whole service.

3.6. Modify a VApp hardware configuration

Once a VApp is instantiated, it may be updated by adding, removing or modifying its hardware. To do so, the links provided by VApp state representation may be followed. The set of allowed operations for certain hardware depends on its nature and the nature of the VApp. For instance, a VApp incarnating a firewall includes a Virtual NIC which cannot be removed; no more hardware may be added. A VApp incarnating a VM contains a memory hardware element which cannot be removed, but it can be modified (increase or decrease its amount).

The following example presents how to modify the number of virtual CPUs for a VM.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vapp+xml

```
<VApp name="10001-010"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010">
```

...

```
<VirtualHardwareSection>
```

```
<Link rel="add" type="application/ovf.item+xml"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw" />
```

...

```
<Item>
```

```
<Link rel="edit"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4" />
```

```
<Link rel="monitor:measures"
```

```
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4/monitor" />
  <rasd:ResourceType>4</rasd:ResourceType>
  <rasd:InstanceID>4</rasd:InstanceID>
  <rasd:ElementName>1024 MB of memory</rasd:ElementName>
  <rasd:AllocationUnits>byte * 2^20</rasd:AllocationUnits>
  <rasd:VirtualQuantity>1024</rasd:VirtualQuantity>
</Item>
...
</VirtualHardwareSection>
...
</VApp>
```

Following the link provided by VApp to edit the memory, we may increase it to 2GB.

Request:

```
PUT http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4
Content-Type: application/vnd.dmtf.cim.rasdType+xml
```

```
<rasd:Item>
  <rasd:ResourceType>4</rasd:ResourceType>
  <rasd:InstanceID>4</rasd:InstanceID>
  <rasd:ElementName>2048 MB of memory</rasd:ElementName>
  <rasd:AllocationUnits>byte * 2^20</rasd:AllocationUnits>
  <rasd:VirtualQuantity>2048</rasd:VirtualQuantity>
</rasd:Item>
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/4"
      startTime="2010-01-03T12:20:54Z"
      expiryTime="2010-01-03T12:30:54Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/4/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```

After a while, the task is completed.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/4
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/4"
      startTime="2010-01-03T12:20:54Z"
      endTime="2010-01-03T12:21:32Z"
      status="success">
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```

```

<Result
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010"
      type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>

```

3.7. Add a new VApp to an existing service

Following the link provided by the root VApp which represents the whole service, it's possible to add more VApps. A new VM is added to manage LDAP accounts with the following request.

```

Request:

POST
https://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/action/instantiateOVF
Content-Type: application/vnd.telefonica.tcloud.instantiateOvfParams+xml

<InstantiateOVFParams name="ldap">
  <Description>A LDAP sub-service for BSS of Sales Department</Description>
  <Envelope>
    <NetworkSection>
      <Info>Declaration of logical networks</Item>
      <Network name="front-net" />
    </NetworkSection>
    <DiskSection>
      <Info>Declaration of logical disks</Item>
      <Disk diskId="ldap-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    </DiskSection>
    <VirtualSystem id="10001-021">

```

```

<VirtualHardwareSection>
  <System>
    <VirtualSystemType>vm.vmx-4</VirtualSystemType>
  </System>
  <Item>
    <rasd:InstanceID>1</rasd:InstanceID>
    <rasd:ElementName>2 Virtual Processors</rasd:ElementName>
    <rasd:ResourceType>3</rasd:ResourceType>
    <rasd:VirtualQuantity>2</rasd:VirtualQuantity>
  </Item>
  <Item>
    <rasd:InstanceID>2</rasd:InstanceID>
    <rasd:ElementName>1024 MB of Memory</rasd:ElementName>
    <rasd:ResourceType>4</rasd:ResourceType>
    <rasd:AllocationUnits>byte * 2 ^20</rasd:AllocationUnits>
    <rasd:VirtualQuantity>1024</rasd:VirtualQuantity>
  </Item>
  <Item>
    <rasd:InstanceID>3</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
  </Item>
  <Item>
    <rasd:InstanceID>4</rasd:InstanceID>
    <rasd:ElementName>System Disk</rasd:ElementName>
    <rasd:ResourceType>17</rasd:ResourceType>
    <rasd:HostResource>ovf:/disk/bel-sysdisk</rasd:HostResource>
  </Item>
</VirtualHardwareSection>
<DiskMappingSection>
  <Info>Mapping between mountpoints and disks</Info>
  <DiskMap mountPoint="/" diskId="ldap-sysdisk" />

```

```

    </DiskMappingSection>
  </VirtualSystem>
</Envelope>
<InstantiationParams>
  <NetworkConfigSection>
    <NetworkConfig name="front-net">
      <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel" />
      </NetworkConfig>
    </NetworkConfigSection>
  </InstantiationParams>
</InstantiateOVFParams>

```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.task+xml

```

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/5"
  startTime="2010-01-03T14:19:46Z"
  expiryTime="2010-01-03T15:19:46Z"
  status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/5/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
    type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>

```

After task completion it's possible to gain access to the new VApp.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/5
```

Response:

200 OK

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/5"
      startTime="2010-01-03T14:19:46Z"
      endTime="2010-01-03T15:56:12Z"
      status="success">
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021"
        type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>
```

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vapp+xml

```
<VApp name="ldap"
```

```

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021">
  <Description>A LDAP sub-service for BSS of Sales Department</Description>
  <VAppParent
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales" />

  <NetworkSection>
    <Info>Declaration of logical networks</Item>
    <Network name="front-net" />
  </NetworkSection>
  <NetworkConfigSection>
    <NetworkConfig name="front-net">
      <NetworkAssociation
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/net/fel" />
      </NetworkConfig>
    </NetworkConfigSection>
    <DiskSection>
      <Info>Declaration of logical disks</Item>
      <Disk diskId="ldap-sysdisk" capacityAllocationUnits="bytes * 2 ^30"
capacity="50" />
    </DiskSection>

    <Link rel="remove"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/ldap"
/>
    <Link rel="power:powerOn"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/power/actions/powerOn" />
    <Link rel="power:powerOff"

```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021/power/actions/powerOff" />
  <!-- More links for managing power following... -->
  ...
  <Link rel="power:reboot"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021/power/actions/reboot" />
  <Link rel="snapshots"
    type="application/vnd.telefonica.tcloud.snapshotList+xml"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021/snapshot" />
  <Link rel="snapshot:take"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021/snapshot/take" />
  <Link rel="monitor:measures"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/ldap/monitor"
  type="application/vnd.telefonica.tcloud.measureDescriptorList+xml" />

  <VirtualHardwareSection>
    <Link rel="add"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021/hw"
  type="application/vnd.dmtf.cim.rasd+xml" />

  <System>
    <VirtualSystemType>vm.vmx-4</VirtualSystemType>
```

```

</System>
<Item>
  <Link rel="edit" type="application/application/vnd.dmtf.cim.rasd+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/1" />
  <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/1/monitor" />
  <rasd:InstanceID>1</rasd:InstanceID>
  <rasd:ElementName>2 Virtual Processors</rasd:ElementName>
  <rasd:ResourceType>3</rasd:ResourceType>
  <rasd:VirtualQuantity>2</rasd:VirtualQuantity>
</Item>
<Item>
  <Link rel="edit" type="application/application/vnd.dmtf.cim.rasd+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/2" />
  <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/2/monitor" />
  <rasd:InstanceID>2</rasd:InstanceID>
  <rasd:ElementName>1024 MB of Memory</rasd:ElementName>
  <rasd:ResourceType>4</rasd:ResourceType>
  <rasd:AllocationUnits>byte * 2 ^20</rasd:AllocationUnits>
  <rasd:VirtualQuantity>1024</rasd:VirtualQuantity>
</Item>
<Item>

```

```

    <Link rel="edit" type="application/application/vnd.dmtf.cim.rasd+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/3" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/3/monitor" />
    <rasd:InstanceID>3</rasd:InstanceID>
    <rasd:ElementName>Ethernet Adapter</rasd:ElementName>
    <rasd:ResourceType>10</rasd:ResourceType>
    <rasd:Connection>back-net</rasd:Connection>
</Item>
<Item>
    <Link rel="edit" type="application/application/vnd.dmtf.cim.rasd+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/4" />
    <Link rel="monitor:measures"
type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
021/hw/4/monitor" />
    <rasd:InstanceID>4</rasd:InstanceID>
    <rasd:ElementName>System Disk</rasd:ElementName>
    <rasd:ResourceType>17</rasd:ResourceType>
    <rasd:HostResource>ovf:/disk/bel-sysdisk</rasd:HostResource>
</Item>
</VirtualHardwareSection>
<DiskMappingSection>
    <Info>Mapping between mountpoints and disks</Info>
    <DiskMap mountPoint="/" diskId="ldap-sysdisk" />

```

```
</DiskMappingSection>
</InstantiationParams>
</VApp>
```

3.8. Remove a VApp

An existing VApp may be removed once turned off. To do so, the following operation may be requested:

Request:

```
DELETE http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-021
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/6"
      startTime="2010-01-03T14:25:31Z"
      expiryTime="2010-01-03T15:25:31Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/6/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```

After task completion, the VApp is removed.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/6
```

Response:

```
200 OK
```

```
Content-Type: application/vnd.telefonica.tcloud.task+xml
```

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/6"
      startTime="2010-01-03T14:25:31Z"
      endTime="2010-01-03T14:27:09Z"
      status="success">
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
  <Result
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales"
        type="application/vnd.telefonica.tcloud.vapp+xml" />
</Task>
```

3.9. Obtain monitoring data

There are different cloud resources which may be monitored. To do so, the links provided by VApps are followed.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.vapp+xml

```
<VApp name="10001-010"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010">
```

```
...
```

```
<Link rel="monitor:measures" type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/monitor" />
```

```
...
```

```
<VirtualHardwareSection>
```

```
...
```

```
<Item>
```

```
...
```

```
<Link rel="monitor:measures" type="application/vnc.telefonica.tcloud.measureDescriptorList+xml"
```

```
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4/monitor" />
```

```
<rasd:ResourceType>4</rasd:ResourceType>
```

```
<rasd:InstanceID>4</rasd:InstanceID>
```

```
<rasd:ElementName>1024 MB of memory</rasd:ElementName>
```

```
<rasd:AllocationUnits>byte * 2^20</rasd:AllocationUnits>
```

```
<rasd:VirtualQuantity>1024</rasd:VirtualQuantity>
```

```
</Item>
```

```
...
```

```
</VirtualHardwareSection>
```

```
...
</VApp>
```

The following request obtains the monitoring measures available for target VM memory.

Request:

```
GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4/monitor
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.measureDescriptorList+xml

<MeasureDescriptorList
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4/monitor">
  <Link rel="up"
    type="application/vnd.telefonica.tcloud.vapp+xml"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010" />
  <MeasureDescriptor
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/hw/4/monitor/memoryUsage"
    name="memoryUsage">
    <Link rel="monitor:subscribe"
      type="application/vnd.telefonica.tcloud.monitoringCallback+plain"
```

```

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage" />
  <Unit>byte * 2^20</Unit>
  <MinValue>0</MinValue>
  <MaxValue>2048</MaxValue>
  <Description>Amount of used memory</Description>
</MeasureDescriptor>
</MeasureDescriptorList>

```

To obtain a measure, the following request may be invoked.

Request:

```

GET http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage?samples=3

```

Response:

```

200 OK
Content-Type: application/vnd.telefonica.tcloud.measure+xml

<Measure
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage">
  <Link rel="monitor:subscribe"
    type="application/x-url"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage/subscription" />
  <Sample unit="byte * 2^20" timestamp="2010-01-03T09:30:10Z" value="712" />
  <Sample unit="byte * 2^20" timestamp="2010-01-03T09:30:15Z" value="714" />

```

```
<Sample unit="byte * 2^20" timestamp="2010-01-03T09:30:20Z" value="698" />
</Measure>
```

It's possible to register a callback URL to obtain monitoring measures in a push manner.

Request:

```
POST http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage/subscription
Content-Type: application/x-url

http://example.com/monitoring/do.ReceiveMeasure
```

Response:

```
200 OK
<MonitoringSubscription

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage/subscription/1"
  status="accepting">
  <Link rel="up"

href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-
010/hw/4/monitor/memoryUsage" />
  <Callback href="http://example.com/monitoring/do.ReceiveMeasure"
    type="application/vnd.telefonica.tcloud.measure+xml" />
</MonitoringSubscription>
```

3.10. Take a VM snapshot

The following messages exemplify the typical transactions that take place when taking a VM snapshot.

Request:

```
POST https://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/snapshot/action/take
```

Response:

```
200 OK
Content-Type: application/vnd.telefonica.tcloud.task+xml

<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/18"
      startTime="2010-01-03T14:19:46Z"
      expiryTime="2010-01-03T15:19:46Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/18/cancel" />
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```

3.11. Restore a VM snapshot

The following messages exemplify the typical transactions that take place when restoring a VM snapshot.

Request:

```
POST https://cloud.telefonica.com/api/org/mycompany/vdc/bss/vapp/sales/10001-010/snapshot/action/restore
```

Response:

200 OK

Content-Type: application/vnd.telefonica.tcloud.task+xml

```
<Task href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/221"
      startTime="2010-01-03T14:18:46Z"
      expiryTime="2010-01-03T15:18:46Z"
      status="running">
  <Link rel="task:cancel"
href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss/task/221/cancel"
/>
  <Owner href="http://cloud.telefonica.com/api/org/mycompany/vdc/bss"
        type="application/vnd.telefonica.tcloud.vdc+xml" />
</Task>
```