PKS - A service provider perspective – Learning from a real-world project

Jerome ASSERAY
Global Solution Consultant on Orange Group – VMware, Inc.
jasseray@vmware.com

Thierry CHAUMERON
Business Owner, Private and Hybrid Cloud Solutions - Orange Business Services
thierry.chaumeron@orange.com
Disclaimer

This presentation may contain product features or functionality that are currently under development.

This overview of new technology represents no commitment from VMware to deliver these features in any generally available product.

Features are subject to change, and must not be included in contracts, purchase orders, or sales agreements of any kind.

Technical feasibility and market demand will affect final delivery.

Pricing and packaging for any new features/functionality/technology discussed or presented, have not been determined.
Agenda

#1 The requirement & the challenge
#2 From vision to validation
#3 The technical architecture and POC findings
#4 From POC to service
#5 Conclusion

Definition

PKS : VMware Pivotal Container Service
The requirement & The challenge

#1
Background & Requirements

Starting point is...

An existing Private Cloud Solution built & managed by Orange Business Services
- based on VMware vSphere, vCD, NSX-V and vROPS
- located within customer premises
- integrated into OBS tooling who operates remotely
- a very stable production platform with growing adoption

The need for evolution

Customer wishes to expand its cloud with CI/CD and DBaaS offerings
Customer is interested in Kubernetes as CaaS
Customer has skilled persons on Kubernetes, Docker,…

The requirement

How to deliver an agile multi-tenant self-service Kubernetes Docker environment…
... yet managed by Orange Business Services at same production grade quality as the rest of the private cloud?

How to on-board the end users on this new environment and get adoption?
Customer vision

- DNS manages access to their deployments
- CNAME record
- K_S Service Discovery & DNS
- Web, API
- Management layer
- Private Cloud operates
- Kubernetes
Preferred technology

Container Landscape

Source: https://www.cncf.io/blog/2017/12/06/cloud-native-technologies-scaling-production-applications/
Preferred Technology

Why Kubernetes

A container orchestration tool is mandatory
- Kubernetes was conceived by Google and given to the opensource community
- Kubernetes is part of CNCF (Cloud Native Computive Foundation)
- Kubernetes provides more interest than his competitors Swarm and Mesos
- Most active Opensource community

Already broadly used at Orange

Why PKS

The user experience benefits
- Self-service creation of Kub. clusters
- Provides HA Kubernetes
- Provides secured Harbor Registry
- Multi-tenant
- Simplifies deployment and day 2 for K8S
- Integrates with existing private environment

The service provider benefits
- Supported by VMware
- Integration with vCenter
- Deep Integration with NSX-T
- Integration with vROPs and vRLI
- Allows for reuse of CSP operations tools

The customer CIO benefits
- K8S end-user experience / multi-tenant
- Management by CSP with E2E commitment
From vision to validation

#2
The POC Approach
From Vision to Validation

Workshop: agree objectives

OBS Proposal for PKS POC

6 months POC
- Elaborate Customer use cases
- Elaborate OBS Managed CaaS
- Elaborate OBS Managed vSphere

POC Outcomes

OBS Proposal for transfer to Operations

POC Workshop

PKS POC Proposal (end Jan18)

6months POC
- Managed vSphere
- Managed CaaS

Transition to Operations
- Dual Site
- Ops/Mon
- BKUP/DR

POC Findings
Objective is to begin testing the platform/service rather than prove the platform is production ready before use. Need for a Fast Track Design/Build approach?

- Adopt VMware Design/Build (if available)
- Minimal (if any) Validation & Verification process

Aim to elaborate the System Design during the POC instead of before.
POC Scope, Resourcing and Limitations

POC Scope

**OBS**
- to define PKS POC target features
- to design POC target infra and PKS solution
- to install/build POC infra and SW solution

**OBS and Customer**
- to define requirements and POC test/acceptance criteria

**Customer**
- to perform tests
- to on-board end-users & get their experience

**OBS and Customer**
- to deliver POC findings
- POC acceptance review

POC Resourcing

**PKS POC Design/Build (2m)**
- Project Manager
- Solution Architect, TDA
- Local Team
  - VMW PS (PKS)
  - VMW TIO
  - LAN TIO

POC Limitations

- 6-month duration following build
- POC following GA release of PKS
  - thus POC initiated shortly after GA date announcement
  - dependant on PKS release, GA release expected early 2018

- PoC blades unavailable for production
- No operations monitoring
- No backup/DR
- Does not include transfer to customer operations
- Support managed by project team
The technical architecture and POC findings

#3
Customer deployment – main highlights

Integration with customer’s Active Directory service (AD/ADFS)
High Availability
VROPS integration (reporting/dashboard)
Harbor RBAC Model
Dynamic DNS
Multitenancy
Kubernetes Administration
Access and Security
PKS Includes

- PKS Controller
- NSX-T, Harbor, GCP Broker
- Deploys & Configures
  - CFCR
  - vSphere
  - NSX-T Integration
  - Harbor
- Manages Cluster Day 2
  - Scaling
  - Patching
  - Upgrades
  - Failures

PKS - production grade k8s

Kubes CFCR

Harbor
Private Container Registry

Kubernetes As a Bosh Release
BOSH Deploys/Manages VMs

CPI

vSphere

CNI

NSX-T

#cluster update K8s-3 worker=5
High Availability
Multiple Layers HA

- **SW Development**
- **Platform Services (CaaS with PKS)**
- **IaaS**
- **Virtualized Infrastructure**
- **Physical Infrastructure**

### PKS Native HA
- **NSX-T HA (Control and Data Plane)**
- **Shared Datastore**
- **vSphere Clusters, vMotion, DRS and HA**

### k8s Native HA
- **BOSH Resurrection Plugin**
- **BOSH AZ**
- **K8s Deployments, K8s StatefulSet**
  - Multiple Master Nodes, Replication Controller
  - K8s PV/PVC (integration with Hatchway)
  - Harbor Replication Mode

**Physical Storage Redundancy**
**Network and Compute Redundancy**
High Availability
Features Analysis

Some elements already deployed

Some elements will be deployed after upgrade

Some elements do not provide any value in a non production environment, they are standard features with no impact on design

<table>
<thead>
<tr>
<th>HA Layer</th>
<th>HA features</th>
<th>Currently implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW Development</td>
<td>ReplicaSet</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>K8s Deployments,</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>K8s StatefulSet</td>
<td>✔</td>
</tr>
<tr>
<td>Platform Services</td>
<td>Multiple Master Nodes</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>Replication Controller</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>K8s PV/PVC</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>Harbor Replication Mode</td>
<td>✗ (not for PoC)</td>
</tr>
<tr>
<td>IaaS</td>
<td>BOSH Resurrecto Plugin</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>BOSH AZ</td>
<td></td>
</tr>
<tr>
<td>Virtualized Infrastructure</td>
<td>NSX-T HA – Control Plane</td>
<td>✗ (not for PoC)</td>
</tr>
<tr>
<td></td>
<td>NSX-T HA – Data Plane</td>
<td>✗ (not for PoC)</td>
</tr>
<tr>
<td></td>
<td>Shared Datastore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vSphere Clusters (DRS and HA)</td>
<td></td>
</tr>
<tr>
<td>Physical Infrastructure</td>
<td>Physical Storage Redundancy</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td>Network and Compute Redundancy</td>
<td>✔</td>
</tr>
</tbody>
</table>
vRealize Operations Manager Management Pack for Container Monitoring

- An Adapter based solution to monitor Kubernetes clusters
- Each adapter instance represents a single Kubernetes cluster
- Visualize the cluster topology of Nodes, Pods, Containers, Services and Namespaces
- Has multiple dashboards to provide the overview as well as capability to troubleshoot the Kubernetes infrastructure
- Provides co-relation between the virtual infrastructure and Kubernetes infrastructure
- Has multiple alerts at various object types to help monitoring the Kubernetes infrastructure
vROps Integration

Kubernetes Clusters Overview

Kubernetes Clusters Troubleshooting
Harbor RBAC Model
Access Control to Images

People with different roles should have different access:
- Developer – Read/Write
- Tester – Read Only

Different rules should be enforced in different environments:
- Dev/test env – many people can access
- Production – a limited number of people can access

Can be integrated with internal user management system (LDAP)

Note: Any user can create projects and will have admin role. This can be restricted only to Harbor admin.
# Harbor RBAC Model

Organizational structure and Service management

<table>
<thead>
<tr>
<th></th>
<th>Simplified service management</th>
<th>Organizational structure</th>
<th>No delay in creating projects</th>
<th>No delay in image push</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Everyone can create projects and push images</td>
<td>✗</td>
<td>✗</td>
<td>✔✔✔</td>
<td>✔✔✔</td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBS can create projects, Everyone can push images</td>
<td>✗</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>Option 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBS can create projects, Project Admin (OrgAdmin) can push images</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>Option 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBS can create projects and push images</td>
<td>✔✔</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

Harbor RBAC Model

Organizational structure and Service management
DNS Resolution
Current Solution – Static DNS

DNS Records
- registry.customer.int A 10.23.31.251
- k8s1.customer.int A 10.23.31.1
- app1.customer.int A 10.23.36.5
- app2.customer.int A 10.23.36.10
- k8s2.customer.int A 10.23.31.2
- app3.customer.int A 10.23.36.15

Deployment of new services requires registration with customer DNS.

Deployment of new K8S cluster requires registration with customer DNS.
DNS Resolution
Partially Automated – ExternalDNS

ExternalDNS – Kubernetes Incubator Project that updates external DNS server
https://github.com/kubernetes-incubator/external-dns

PKS DNS Server provisioned and subdomain delegated

ExternalDNS runs as a service within each K8S cluster and updates DNS records in PKS DNS.

K8S Clusters must still be manually registered when provisioned.

Using a delegated DNS servers allows OBS to action the changes
PKS Multi Tenancy

- OrgAdmin1
  - K8s Cluster 1
    - Namespace A
    - Namespace D
  - User01
  - User02

- OrgAdmin2
  - K8s Cluster 2
    - Namespace B
    - Namespace E
  - User01
  - User02

- OrgAdmin3
  - K8s Cluster 3
    - Namespace C
    - Namespace F
  - User01
  - User02
Kubernetes Permissions

Issues Arising from K8S admin permissions

PKS Admin Initiates Provisioning of new K8S Cluster.
- BOSH Provisions new K8S cluster comprised of a master node and 1 or more worker nodes.
- K8S Cluster Admin connects to cluster to provision and manage services and pods.
- K8S Cluster Admin removes a node from the cluster.
- Node VM becomes orphaned as BOSH is not aware that it has been removed from the cluster. Resources are consumed by the VM but not available through the K8S cluster. VM is never automatically de-provisioned.
PKS global architecture – Access & Security

1st Option: Exposing Kubernetes and Harbor to restricted users

- K8S Dashboard available only from restricted users
- Harbor UI available only from restricted users
- Service Networks available from all customer Networks
PKS global architecture – Access & Security

2nd Option: Exposing Kubernetes and Harbor to Entire customer Network

Make K8S Dashboard and Harbor UI available from all customer Networks.

Permits ease of use of PKS environment, reducing potential barriers to adoption.

Due to increased attack surface needs to be assessed by customer security team.

Recommendation is to review if a clear use case presents itself during POC.
From POC to service

#4
From POC to service

OBS and Customer
• Definition of RACI for the service

OBS
• Design and deployment on target production infrastructure: HLD, LLD
• Integration into OBS operational tools: monitoring, logs, backup
• Transfer to operations team: guidelines for build, provisioning, day-2 actions

Customer
• End-user training & ramp-up on Kubernetes / Docker & Registry usage
• Application management

VMware and OBS
• Developers enablement session
• Hackathon
# Service Model – RACI example – 1st option

**PKS, BOSH, NSX-T & vSphere, Kubernetes and Harbor**

<table>
<thead>
<tr>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NSX-T</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Amending ACL Rules</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Amending NAT Rules</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td><strong>vSphere</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Cluster Expansion (add nodes)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td><strong>PKS &amp; BOSH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Deployment of new K8S Clusters</td>
<td>RC</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kubernetes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>R</td>
<td>CI</td>
</tr>
<tr>
<td>Deployment of Pods/Services</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td><strong>Harbor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>CI</td>
</tr>
<tr>
<td>Creation of new Projects</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Push images into Project</td>
<td>RACI</td>
<td></td>
</tr>
<tr>
<td>Pull images from Project</td>
<td>RACI</td>
<td></td>
</tr>
</tbody>
</table>
## Service Model – RACI example – 2nd option

**PKS, BOSH, NSX-T & vSphere, Kubernetes and Harbor**

<table>
<thead>
<tr>
<th>NSX-T</th>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td></td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Amending ACL Rules</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Amending NAT Rules</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vSphere</th>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Cluster Expansion (add nodes)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PKS &amp; BOSH</th>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Deployment of new K8S Clusters</td>
<td></td>
<td>RA</td>
<td>RACI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kubernetes</th>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>R</td>
<td>CI</td>
<td>RACI</td>
</tr>
<tr>
<td>Deployment of Pods/Services</td>
<td>RA</td>
<td>CI</td>
<td>RACI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harbor</th>
<th>OBS</th>
<th>Customer IT</th>
<th>Customer Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage and Operate</td>
<td>RACI</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Capacity Management</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Incident Resolution</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Non disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Patching &amp; Upgrades (Disruptive)</td>
<td>RA</td>
<td>RA</td>
<td>Cl</td>
</tr>
<tr>
<td>Creation of new Projects</td>
<td></td>
<td>RA</td>
<td>RACI</td>
</tr>
<tr>
<td>Push images into Project</td>
<td></td>
<td>RA</td>
<td>RACI</td>
</tr>
<tr>
<td>Pull images from Project</td>
<td></td>
<td>RA</td>
<td>RACI</td>
</tr>
</tbody>
</table>
Monitoring

vROPS for PKS

Operator KPIs
Single Pane for SDDC & K8s clusters monitoring
vRLI Integrated
Alert on K8s KPIs
Entity Relationship
Capacity Planning
Integrated with PKS
Monitoring
Integration in Orange Business Services monitoring tool-chain

Monitored items
- appliance
- services

Real time event management
- Collect
  - Type 1
  - Type 2
  - Type 3
- Process
  - Filter
  - Enrich
  - Correlate

Manage
- Display
- Notify
- Technical Instructions
- Trouble Ticket
- Incident

OBS Cloud operations

Monitoring Consultation

Event

VCD
vSphere
vROPS
PKS
much reuse

VMworld 2018 Content: Not for publication or distribution
Log management

vRLI / Syslog for Bosh

> UDP, TCP and/or TLS can be used

vRLI / Syslog for PKS
PKS DevOps tools

Managed
Operations focus
Conclusion

#5
PKS fit into Orange Business Services
Private and Hybrid Cloud & Managed Services practices

Apps « Cloud Native »
- DevOps on IaaS, CaaS, PaaS
- Continuous integration
- Automation
- KPI measurement oriented Dev

Driven by DevOps tools
- Git
- XIRA
- SonarQube
- Jenkins
- Splunk

User experience
- The user at the center
- Use and behavior
- Design thinking
- Experimentation
- Feedback & continuous improvement

Containers orchestration
- Kubernetes API
- PKS

Transversal collaboration
- IT & business
- Single team with multiple skills
- Collaboration between IT & Business
- Sprints, leverages sharing

PaaS
- CloudFoundry

DevOps tools
- ANSIBLE
- Terraform
- OpenStack
- PKS
- Heat API

Software Defined cloud & orchestration
- SD Compute
- SD Network
- SD Storage
- vRO / vRA

Managed services
- All types of applications, data
- High availability of production services 24h x 7d
- Reduction of safety risks
- Data protection & backup
- Disaster recovery
- Compliance
- Scaling up and evolution
- Support & expertise

Private Cloud Infrastructure

Public Cloud Infrastructure

©2018 VMware, Inc.
Orange Business Services and VMware partnership

Technology

- Cloud Native & legacy applications
- Software Defined cloud and PaaS
- Scaled performance & stability
- Progressive scaling with HCI

Services

- we simplify, accelerate & run reliably
- we take care of all aspects of the end-to-end private and hybrid cloud including design, security, resilience, data protection, change management, incident management, self-service portal
- we migrate, automate and run applications with enterprise grade perf. & service continuity
Find more information...

More information on PKS and VMware solutions with Orange:

Contact jasseray@vmware.com
visit Vmware PKS website: https://cloud.vmware.com/pivotal-container-service

More information on PKS and Cloud Solutions from Orange Business Services:

Contact thierry.chaumeron@orange.com
visit Orange Business Services cloudstore: https://cloud.orange-business.com/fr/
visit Orange Business Services website: https://www.orange-business.com/fr/solutions/cloud-computing
DON’T FORGET TO FILL OUT YOUR SURVEY.
POSSIBLE BEGINS WITH YOU

THANK YOU!
Please make your way to Hall 8.1 on the upper walkway where a hot and cold lunch will be served until 14.00