

# WHY SERVICE PROVIDERS NEED A CARRIER PaaS SOLUTION

cPaaS FOR NETWORK FUNCTIONS VIRTUALIZATION

WHITE PAPER

Carrier PaaS provides the tools service providers need to transform their current network operational model to a more agile, flexible and cost effective one, while allowing them to introduce new services quickly and with much lower risk. While there are a number of PaaS solutions on the market today, most do not provide the carrier PaaS capabilities that service providers need. This paper describes service providers' unique PaaS requirements and explains how a carrier PaaS solution, such as the Alcatel-Lucent CloudBand™ carrier PaaS (cPaaS) solution, meets those requirements.

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# 1. EVOLUTION IS ESSENTIAL

Today, most service providers realize that traditional approaches to building, supporting and monetizing their networks are no longer sustainable. To compete in today's constantly shifting landscape, service providers must move beyond the constraints of legacy systems to become more dynamic, nimble and innovative in the way they operate and deliver new services. At the same time, they must keep capital and operating expenses down.

Forward-thinking service providers are using the cloud to evolve their infrastructure, modernize operations and more aggressively pursue new business opportunities. They're taking advantage of their distributed footprint and carrier-grade network characteristics to build a better cloud — the carrier cloud.

## **PaaS as the foundation for service providers' network evolution**

Platform as a Service (PaaS) is an essential building block for service providers looking to gain the greatest benefits from the carrier cloud as they evolve their network. PaaS provides cloud-based tools that accelerate and simplify development, delivery and management of complex applications while lowering development and operational costs and risks. PaaS tools are used to model, onboard and manage applications over various cloud environments.

Virtualizing the network and moving it onto an elastic and distributed cloud platform allows service providers to move toward a homogeneous, cloud-based infrastructure. Network elements and applications are implemented as sets of virtual machines, storage devices and associated network configurations, creating an infrastructure that can be shared across all applications. The infrastructure becomes a platform to increase service agility and reduce costs.

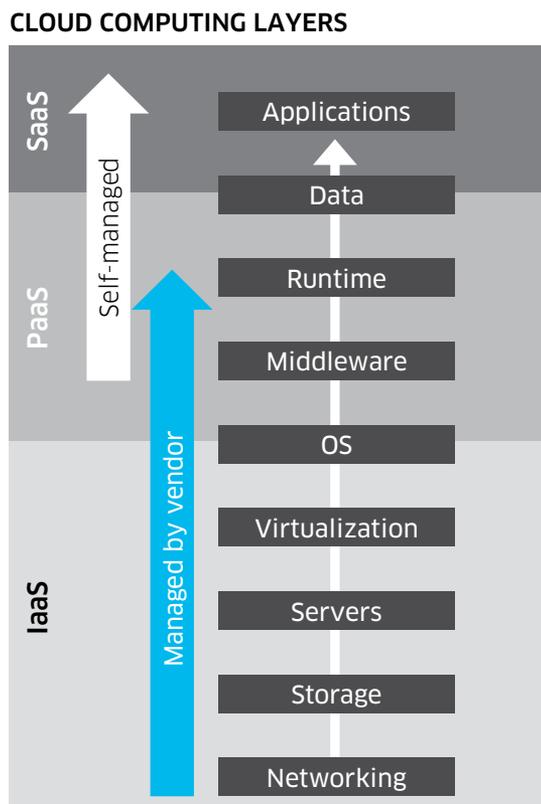
Service providers are increasingly recognizing the benefits that virtualization and the cloud bring. In October 2012, a group of 13 Tier 1 service providers formed the Network Functions Virtualization (NFV) initiative and a new NFV Industry Specifications Group (ISG) under the auspices of the European Telecommunications Standards Institute (ETSI). The initiative challenges the assumption that purpose-built hardware and special-purpose silicon can deliver a better price-performance ratio than general-purpose compute and storage servers. The founders of the initiative are expecting significant cost savings and greater agility from shared multi-tenant resources, automation of operational processes and cost-effective mass-produced hardware.

## 2. UNDERSTANDING PaaS AND ITS BENEFITS

PaaS is an abstraction layer above the cloud infrastructure that brings all of the advantages of the cloud to building, deploying and managing applications throughout their life cycle. With access to PaaS, developers and developer operations (DevOps) can build and deliver applications over the cloud while taking advantage of instant resource provisioning, fast scaling up and down, pay-per-consumption models and other cloud advantages, such as freedom from worrying about the underlying infrastructure.

Figure 1 illustrates where PaaS sits with respect to IaaS and SaaS in the cloud computing layers<sup>1</sup>.

Figure 1. PaaS sits in between IaaS and SaaS in the cloud computing layers



Source: 451 Research

The differences among the various PaaS offerings on the market can be characterized by the level of control versus the productivity they offer the user.

PaaS platforms that focus mainly on productivity take a developer and application-driven approach. Such PaaS platforms provide generic application containers for running the code. The PaaS platform deals with all of the operational aspects needed to run the application, including deployment, scaling and fail-over. The user is not aware of, or in control of, the infrastructure resources the application is consuming. Examples include Google App Engine, Salesforce.com, Microsoft Azure and AWS Beanstalk.

<sup>1</sup> Cloud Computing: Segment Focus PaaS, 451 Research, April 2012.

Control-focused PaaS platforms take more of a DevOps approach. They give the user tools to automate the operational environment through scripts and recipes, while maintaining visibility and control over the underlying infrastructure and the way in which it scales and heals. Examples include Cloud Foundry, AWS OpsWorks and GigaSpaces Cloudify.

## **Addressing operational challenges with PaaS**

PaaS tools can solve a number of operational challenges related to the way applications are developed, deployed and maintained. The main challenges that PaaS tools address include:

- **Reducing application complexity**

Today's typical applications can include a database platform, an application server, a message bus and other components, each requiring its own manual setup and configuration. Complexity increases when trying to install and configure all of these components so they will work together for high availability.

PaaS tools abstract the infrastructure from the application, enabling the application to use the infrastructure it requires without understanding the infrastructure or how it is provisioned. PaaS tools also automate the way applications are deployed, scaled and managed throughout their life cycle.

- **Accessing application knowledge**

Application deployment knowhow is divided among various experts who do not necessarily collaborate with each other. Some may be in different departments, such as the data center department or the network department, some may no longer work for the company, and others may work for a third party.

PaaS tools enable the creation of a recipe (blueprint) that captures application knowhow, including its structure, the different tiers it is made of, the relationships between the tiers, and how the application life cycle should be managed. Widely used tools for creating application blueprints are Chef and Puppet. A blueprint can be used multiple times for different application deployments by different groups within an organization or by different customers.

- **Auto-scaling and auto-healing to meet changing needs**

Rather than planning for additional capacity in peak times, where the system generally remains idle 80 percent of the time, users can enjoy the benefits of cloud elasticity, scaling dynamically to meet changing needs. Elastic environments, however, still require intelligent scaling. Auto-healing is also critical for an application. In the event that the application fails a new instance is created immediately without the need for manual intervention. A new instance of the application is created with the same specifications and without posing any degradation to the user-experience.

PaaS tools automate application scaling and auto-healing according to pre-set key performance indicators (KPIs) at the infrastructure or application level.

- **Simplifying deployment**

Application deployment may vary from one use case to another. For example, deployment for testing is different from deployment for production. Application deployment for a US operator is different from that of a European operator. Differences can be in scale, such as the number of resources needed, or they can involve constraints such as availability, geo-constraints and security levels.

PaaS tools capture an application blueprint that can be used for different types of deployments with varying constraints, policies and resources.

- **Streamlining application life-cycle management**

Managing the application life cycle from creation to tear-down requires the ability to control many operations, including delivering upgrades while minimizing downtime and monitoring according to usage KPIs as well as traditional CPU and memory KPIs. Mechanisms need to be in place to ensure their high availability and reliability.

PaaS tools enable application life-cycle management. They can also monitor applications according to different KPIs.

### **3. CARRIER PaaS: CUSTOM-MADE FOR SERVICE PROVIDERS**

Despite the appeal of cloud environments and the opportunities enabled by PaaS, many service providers are reluctant to take the first step because application migration and deployment in the cloud bring challenges that are unique to carrier environments. Most PaaS tools available today address the basic operational challenges associated with building, deploying and maintaining applications, but lack the carrier-grade attributes that service providers require.

A carrier PaaS solution is focused on both productivity and control. It combines cloud advantages with the service providers' own distributed network footprint and knowhow to address the unique challenges and requirements service providers face in building and deploying network applications and appliances in a distributed, multi-tenant and automated environment.

A carrier PaaS solution offers service providers five main advantages over enterprise-grade PaaS tools:

1. Application and infrastructure neutrality
2. Automation and scalability
3. Security and resiliency
4. SLA compliance
5. Regulatory and business rules compliance

#### **Application and infrastructure neutrality**

In many cases, service provider applications are written and developed in tools that are not supported by traditional PaaS platforms. Service providers need a PaaS solution that can capture the knowhow and structure of an application, regardless of the software stack used to write that application. They also need the freedom to deploy applications on any type of infrastructure using any type of hypervisor.

A carrier PaaS solution can support and manage a mix of infrastructure and hypervisors in a seamless way. Unlike traditional PaaS solutions, a carrier PaaS solution is application stack-agnostic so there is no need to rewrite existing applications. Service providers have the flexibility to use any development environment and deploy any application written on top of any stack on top of any cloud.

## **Automation and scalability**

Service providers typically run multiple applications over a large distributed and shared data center footprint to serve a large number of customers. As a result, they require a PaaS solution that offers maximum automation, provides tools that allow them to work at large scale, and supports shared multi-tenancy for applications so they can make optimum use of their infrastructure.

A carrier PaaS solution goes beyond traditional PaaS solutions by automatically scaling according to monitored infrastructure and application-level KPIs. Scaling occurs across the service provider's distributed footprint to optimize application placement and reduce capacity investment requirements.

## **Security and resiliency**

Security and resiliency are primary concerns for service providers, especially when moving to a cloud model. To support the SLAs that services require, service providers need a platform that ensures strict reliability and security standards. At the application level, separation between application tiers is required to provide access to the public-facing part of the application and maximum security to the back-end part of the application.

A carrier PaaS solution uses virtual private networks (VPNs) and firewalls to provide the separation service providers need. It supports multi-tenancy with user separation to make resource usage more efficient without compromising security.

At the user and organization levels, a carrier PaaS solution supports application multi-tenancy in a way that makes optimal use of the underlying infrastructure but maintains full separation between the applications of different users or organizations. This capability gives service providers a higher degree of control over different business groups and users for better security.

In addition, resource diversity rules are applied to application tiers for various redundancy and failover scenarios to ensure application resiliency. Automatic healing across the service provider's distributed footprint according to monitored infrastructure and application-level KPIs provides further resiliency. Together, these capabilities help service providers ensure end-to-end application resiliency and reliability.

## **SLA compliance**

Service providers are distinguished by their ability to guarantee SLAs. When they move to a PaaS model, they must be able to maintain the same SLA guarantees they delivered when applications were not virtualized.

A carrier PaaS solution uses policy rules, network information, auto-healing and auto-scaling to ensure SLA compliance and conformance. Policy rules ensure that customer applications are placed according to their unique security, business and regulation requirements. Combining these policy rules with network-related information ensures optimal placement of customer workloads for optimal quality of service (QoS).

In addition, auto-healing and auto-scaling of workloads ensure that application availability and quality are maintained at all times. With these capabilities, service providers can guarantee end-to-end SLAs because optimized application deployments meet security, resiliency, regulatory and end-user experience needs.

## Regulatory and business rules compliance

Service providers are often obligated to comply with regulations, and in some cases constraints that are related to the business requirements of a certain customer.

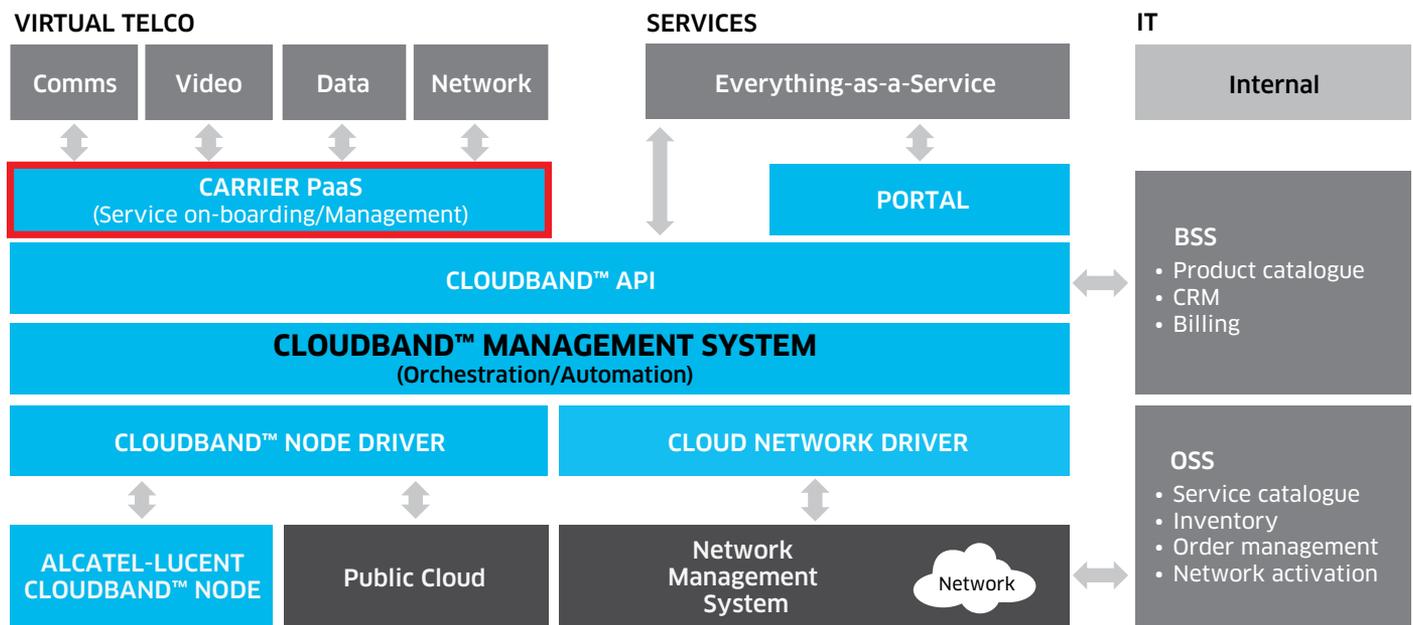
A carrier PaaS solution allows service providers to deploy applications according to pre-defined criteria to ensure compliance with government and industry regulations such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States and regulatory constraints related to geographical placement of information and workloads.

## 4. CARRIER PaaS WITH ALCATEL-LUCENT CLOUDBAND

The Alcatel-Lucent's CloudBand platform with integrated cPaaS for application management provides all of the traditional PaaS benefits outlined in section 2 while meeting the carrier-specific PaaS requirements outlined in section 3. It allows service providers to leverage their most valuable asset — the network — to jumpstart the move from a traditional architecture to a cloud-based service enablement platform so they can profit from the agility and efficiency offered by PaaS.

As illustrated in Figure 2, the CloudBand cPaaS solution is built on top of the CloudBand cloud orchestration and automation platform. It takes full advantage of CloudBand's network, distribution, placement and optimization features, but is a completely independent and autonomous environment with its own, high-availability scheme. It does not affect other CloudBand users in case of a failure or outage.

Figure 2. The Alcatel-Lucent's CloudBand platform with integrated cPaaS for application management



Key features in the CloudBand cPaaS solution include the following.

## **A hardware- and platform-agnostic environment**

CloudBand, with cPaaS built on top of it, is a heterogeneous cloud environment with multivendor support. It supports various types of cloud management stacks, hypervisors and hardware platforms while remaining fully transparent to end-user and client applications.

## **Recipes to automate operations**

CloudBand cPaaS recipes capture the knowhow associated with any application, no matter which software stack it was built on. Recipes are simple, yet comprehensive instructions that describe the business rules for the application, including:

- IaaS requirements
- Service requirements
- Application life-cycle logic
- Auto-healing rules
- Auto-scaling rules
- Monitoring rules

Recipes are written once during the design phase, either by the application vendor or by the DevOps person at the service provider. Once the recipe is created, the service can be deployed in an automated and repeatable fashion.

## **User-specific deployment policies**

The CloudBand cPaaS solution decouples application onboarding — the recipe — from application deployment. Decoupling allows different users to deploy the same application according to their specific needs in terms of scale, policy and business requirements. Deployment policies define factors such as geo-optimization and affinity rules, security, availability and compliance classes. With these capabilities, organizations such as government departments, for example, can ensure that personal information stays within specific geographical boundaries to comply with regulations. Deployment is a simple process where policies and rules can be defined using the CloudBand cPaaS portal with no need for specialized knowledge.

## **Smart placement to optimize application deployments**

CloudBand uses sophisticated algorithms to optimize application deployment. The recipe, in conjunction with the deployment policies and network information, is used to determine the optimum virtual machine placement within the various cloud sites. As illustrated in Figure 4, the Alcatel-Lucent CloudBand cPaaS solution processes the recipe and policy files and deploys the application according to customer-defined requirements and constraints using CloudBand's smart placement algorithms.

The smart placement algorithms consider network information as well as the status of traditional cloud resources such as CPU, memory and storage when placing applications. For example, a user that wants to deploy an application consisting of a front-end and a back-end might define the following requirements:

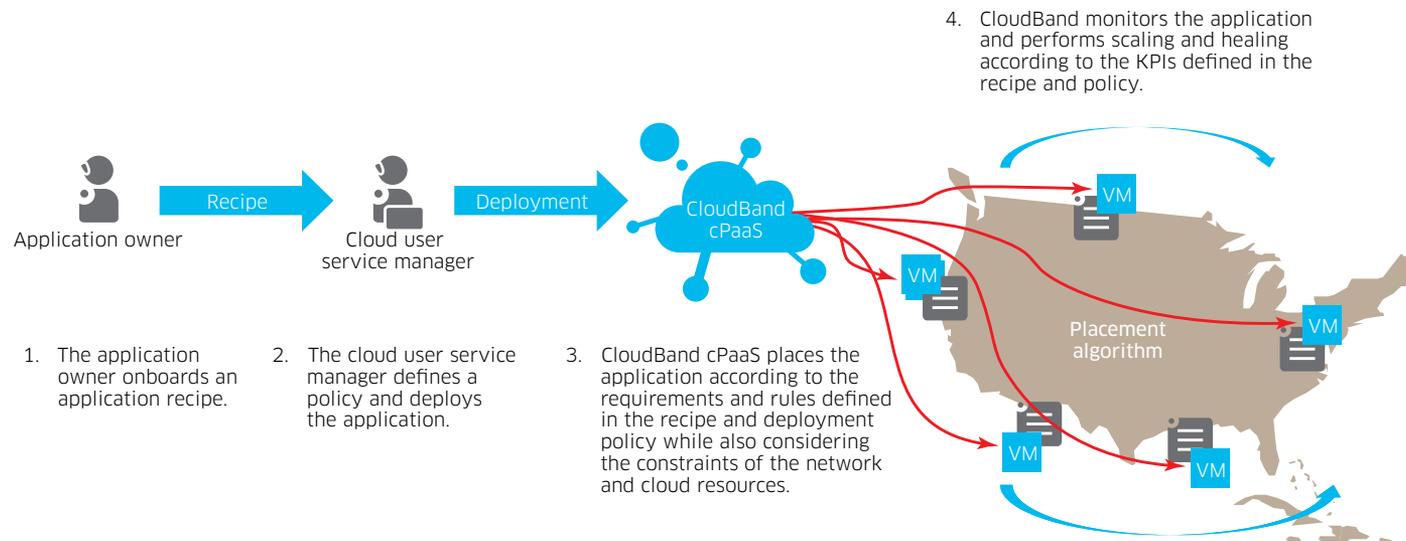
- Three virtual machines per tier to start.
- Virtual machines in the same tier — front-end and back-end — should not reside in the same zones.
- The application should be deployed only on nodes that are payment card industry (PCI)-compliant.

The CloudBand placement algorithms consider the constraints that are defined in the user deployment policy together with the cloud resources and network information to achieve a near optimal, yet practical, placement based on service provider optimization targets.

## End-to-end application monitoring, auto-healing and auto-scaling

Once the application is deployed, the CloudBand cPaaS solution continuously monitors it and applies auto-healing and auto-scaling rules according to the KPIs and rules defined in the application recipe and deployment policy. KPIs can be defined around any business or application logic.

Figure 3. CloudBand makes it easy to optimize application deployments



A DNS resolver server deployment is a good example. The CloudBand cPaaS solution can monitor a parameter such as the number of lookup requests per second. The KPI information within the recipe will include thresholds related to this specific metric. For example, the threshold for scaling up could be 50 requests per second and the threshold for scaling down could be 20 requests per second.

This metric on the DNS resolver server will be constantly monitored by the cPaaS solution. If the number of requests per second goes above or below these thresholds, the CloudBand cPaaS solution initiates the scaling and healing actions defined in the recipe.

## Flexible deployments for compliance and conformance

The CloudBand deployment policy engine is integrated into the CloudBand cPaaS solution to provide applications with the resources they need to maintain performance and comply with SLAs. For example, administrators can optimize application deployment for specific requirements, such as:

- Application component distribution across CloudBand Nodes
- Geographic proximity to end users
- Affinity rules for various redundancy and failover scenarios

## 5. CONCLUSION

Alcatel-Lucent's CloudBand platform with integrated cPaaS for application management is designed for service provider environments. It provides all of the capabilities needed to take full advantage of the NFV opportunity. With the CloudBand, service providers gain:

- A holistic solution for deploying carrier-grade applications over cloud infrastructure, including a heterogeneous, platform-independent environment that functions independent of application stacks.
- Fully automated life cycle management that eliminates the need for manual intervention.
- Increased flexibility in determining the way applications are deployed because developer-defined recipes are separated from administration-defined deployment rules.
- Optimized application placement based on developer-defined recipes, user-defined policies and sophisticated Alcatel-Lucent Bell Labs algorithms to meet SLA and other compliance requirements.
- An easy-to-use graphical user interface (GUI) for fast deployment of new applications.
- Carrier-grade availability, reliability, and security.

For more information about Alcatel-Lucent CloudBand and its carrier PaaS capabilities, visit [alcatel-lucent.com/cloud](http://alcatel-lucent.com/cloud).

## 6. ABBREVIATIONS

AWS	Amazon Web Services
CAPEX	capital expenditure
cPaaS	carrier Platform as a Service
CPU	central processing unit
ETSI	European Telecommunications Standards Institute
GUI	graphical user interface
IaaS	Infrastructure as a Service
ISG	Industry Specifications Group
KPI	key performance indicator
NFV	Network Functions Virtualization
OPEX	operating expenditure
PaaS	Platform as a Service
PCI	payment card industry
QoS	quality of service
SaaS	Software as a Service
SLA	service level agreement
VPN	virtual private network

## 7. RESOURCES

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