

Carrier Cloud



**Carrier-centric, Carrier-grade and
Founded on IT and Network Innovation**

Table of Contents

1. Acquiring New Value Chains with Cloud

2. Carrier Cloud

2.1 Cloud Services by Carrier

2.2 Carriers' Advantage

3. Building Clouds

3.1 Core Platforms

3.2 Cloud Service Platform

3.3 SaaS Applications

3.4 NGN Transport and Access

3.5 Cloud Connected Devices, Gateways and Terminals

4. Supporting Cloud Services

5. Winning in Cloud

5.1 Carrier-grade Cloud

5.2 Inherent Cloud Risks

5.3 IT + Network Innovation and Integration

6. Nearer to You

Appendix - Acronyms

1. Acquiring New Value Chains with Cloud

There comes a time in every successful business when it becomes hard to grow. In developed and developing countries alike, market saturation in telecoms is limiting customer acquisitions and value added services have not been able to generate the same revenue as voice services. To continue to grow, it is time to look for other revenue sources.

NEC believes that for sustainable and substantial growth, “Business IT from the cloud” should be one of the first places to look. Figure 1 shows four examples of value chains that are important and mature sources of revenue. Which value chains are most accessible will depend on your local situation. Carriers already dominate the communications (and to some extent the personal media distribution) value chains. Energy and government service provision are certainly important areas to study, but in most cases Business IT seems a good place to start due to the general trend of SMEs moving to opex oriented models for software, systems and services. As the diagram shows, the carrier can position itself to capture value from many value chains by providing an IT + communications capability to enable these business models or help deliver public services at lower cost. Through connecting customers or delivering content, this hub and spoke (core oriented model) has placed you at the center of many business models, maximizing your potential for revenue.

The previous Internet age saw users and content providers breaking away to form a direct relationship beyond the reach of the carrier’s billing system. The cloud era, underpinned by the concept of “if we share, we can save money and gain best practice”, is ironically marked by consolidation and a return to centralization, featuring the carriers’ preferred, core oriented business model. This time, the datacenter is the new core.

Cloud is not new and we can already see well known Web 2.0 cloud players controlling payment, identity and access within the cloud, justified through a much enhanced end-customer experience.

NEC is committed to helping its carrier customers expand their business horizons to include new value chains such as Business IT. This new revenue will come from a new, more intimate relationship with business or enterprise customers, penetrating further into the technology, service and management aspects of their business operations.



Figure 1. Carrier-Centric Cloud: Capture multiple value chains

2. Carrier Cloud

This paper describes something we at NEC call Carrier Cloud. The concept has three pillars:

- Carrier-centric cloud, which is the use of cloud computing services, technologies and business models to acquire new value chains;
- Carrier-grade cloud – being able to deliver cloud services that millions can rely on;
- Differentiation through IT and network innovation and integration.

Later we will discuss what makes Carrier Cloud special, but first let's take a look at the service landscape.

2.1 Cloud Services by Carrier

Cloud services are the fundamental purpose of cloud: “The ability to provide services on demand, on a per-use basis, which scale dynamically, with the illusion of unlimited resources and without exposing the actual assets providing the service.”

What is important to the business customer, whose core purpose is rarely IT, is that they can convert much of their IT capex to IT opex while cutting inhouse IT support opex. For consumers, it is the same model except that they are expected to generate advertising or market intelligence income for the provider.

The uptake of cloud services among the small to medium size enterprise community is complicated. We need to look at network bandwidth and stability, the prevalence of software piracy, regional trust levels and the attractiveness of the accumulated business applications (SaaS) portfolio.

NEC can see at least two phases of cloud service provision for carriers. The phases are differentiated by ecosystem complexity. In Figure 2, Stage 2 demands more cloud user devices, embedded devices, new business models and processes interacting within a more complex ecosystem.

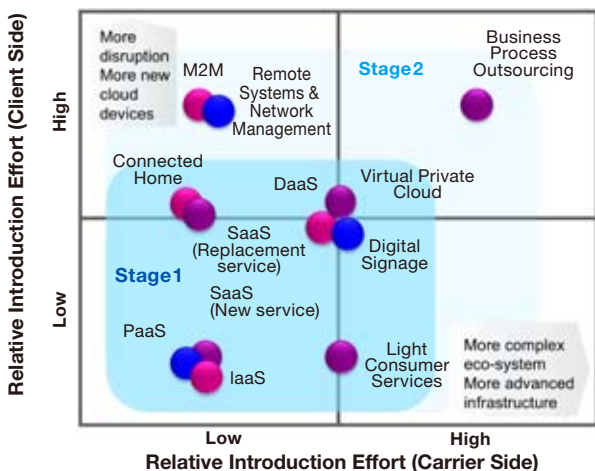


Figure 2. Cloud Service Phases

2.2 Carriers' Advantage

We have already talked about the need for new revenue sources and how the cloud owner can control the cloud business model. This is strong motivation for carriers to move into this space – but what competitive advantages do they have?

Our studies have shown that carriers have several advantages over Web 2.0 cloud service providers. These advantages includes their networks, which provide appropriate bandwidth, quality of service and end-to-end security; and commercial maturity which provides more commercial stability, customer support, customer trust and better operational processes. Better service availability can be derived from both. Carriers already have human resources and know-how to build/ operate datacenters and backup centers. Carriers also have many telephony switching central offices that have earth-quake resistant, high-power air conditioning, power supply and security facilities. Carrier can use these offices as datacenters. Based on their human and material resources, carriers are considered to have great advantages over other cloud providers.



Figure 3. The Carrier Advantage

These advantages give the carrier a secret weapon, an end-to-end SLA that can only come from a carrier with service availability at carrier levels.

Carriers have other strong points, too: they have preferential access to user's location information such as GPS or femtocell information for example. Carriers can even handle settlement and authentication functions, and use information about their customers and sales channels. All of which add value to cloud services. As carriers can bundle network access with cloud services, they can also offer a more competitive price.

3. Building Clouds

Cloud is not about platforms, it's about people, services and solutions. While SaaS services will run on a "Platform as a Service" (PaaS), digital signage, Desktop as a Service (DaaS) and Connected Home need much more than PaaS; they need servers, devices and a business model. On the telecoms infrastructure side, we have many industry standards and blueprints on which to build a network, but IT oriented services are driven more by the carrier and their customers. So when NEC works with customers on Carrier Cloud, we design the service together; including the business model, service roadmap, platform, support and operations. To achieve Carrier Cloud, you need to visualize and automate cloud services operations. It is also important to virtualize the network and to control the network's paths and flows dynamically. A Carrier Cloud solution has at least the following key elements:

Inside the datacenter

- IT Platform (IaaS)
- NGN core infrastructure
- OSS for cloud + network
- Cloud Service Platform (PaaS)
- SaaS applications
- Call center & helpdesk
- Datacenter operations

Outside the datacenter

- NGN access and transport
- Gateway equipment
- End-user terminals & devices
- IT consulting
- Third party management

3.1 Core Platforms

Below we can see the logical structure of the Carrier Cloud – the heart of several value chains beyond pure telecoms. In the center we have the core IT platform (servers, storage and IT networking) and the network core with its policy control, IMS and service switching functions. Thirdly we have our cloud + network OSS allowing the integration and fulfillment of carrier borne cloud services.

3.2 Cloud Service Platform

Utilizing this core is the Cloud Service Platform. Its role is to provide the facilities required by SaaS applications so they can operate and thrive within the cloud. The most important function is the marketplace. It allows customers to buy service licenses, give feedback on services, get expert help from the community and move data between applications. This is a different level of functionality than earlier ASP models which ran hosted software licenses in separate silos.

Other more basic functions of the Cloud Service Platform include single sign-on for all services, and a charging gateway that accepts charging events from SaaS applications. The PaaS hosts APIs which allow the SaaS service to access the secure database, message passing and multi-tenant IaaS capabilities of the core IT Platform.

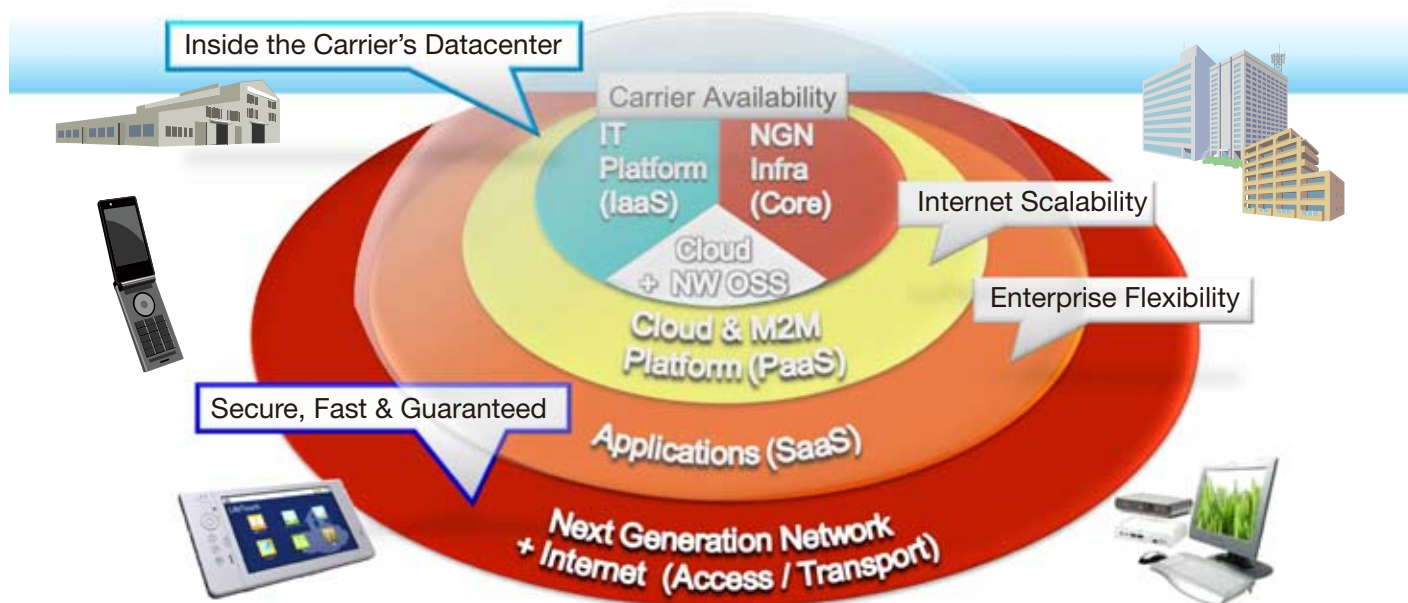


Figure 4. Carrier Datacenter Centric Cloud

- The datacenter is at the heart of the Carrier Cloud
- The Network is both in the datacenter and beyond

3. Building Clouds

3.3 SaaS Applications

Revenue generating applications are hosted on the Cloud Service Platform. These are typically provided by third party ISVs wishing to provide services to the carrier's SME subscribers. They could be hosted on another cloud but a carrier's attractive traffic and hosting prices, an SLA and the carrier's brand should win them over.

3.4 NGN Transport and Access

The quality of cloud services is only as good as the network delivering the service. QoS, stability and security are the carrier's primary weapons when competing with Web 2.0 clouds.

In some countries, carriers are looking at LTE hot zones as the key to providing cloud in central business districts, where customers are highly mobile. In some developing countries, this will be the primary broadband access service.

Lighter cloud based services such as SaaS can be used successfully over lower broadband speeds provided by DSL and HSDPA. Heavier services such as DaaS require more bandwidth. A single user can normally use DSL or HSDPA to support a DaaS session when out of the office, but it may not be feasible to have many users sharing the same connection.

As we move from an era of "best effort" to "as promised", more bandwidth will either have to be managed on a per flow basis or within fatter virtual pipes, dedicated to commercial cloud traffic. Transport networks that are service and user aware will have an advantage in delivering cloud. This awareness has to permeate every layer of the transport since higher level policy control systems can only really work when they receive the bandwidth they expect. In the future, NEC believes that OpenFlow™ technologies will unify the telecoms transport and datacenter's IT network. OpenFlow brings an unrivalled awareness and communication between the network and the application management layer.

3.5 Cloud Connected Devices, Gateways and Terminals

Home Gateways and femtocells are the critical link between the cloud, home and SME domains. Now users can stream media in their house from anywhere. They can access media libraries in the cloud or remotely control home electronics and appliances such as personal video recorders and digital picture frames.

Machine to Machine (M2M) can be commercial or consumer in nature but millions of cloud devices will need to be connected and controlled, each within their own unique cloud business process. From smart cars to e-book readers, set-top boxes to electricity meters, each one will have their own business model, charging model with embedded traffic charges and roaming policies. This list continues to grow.

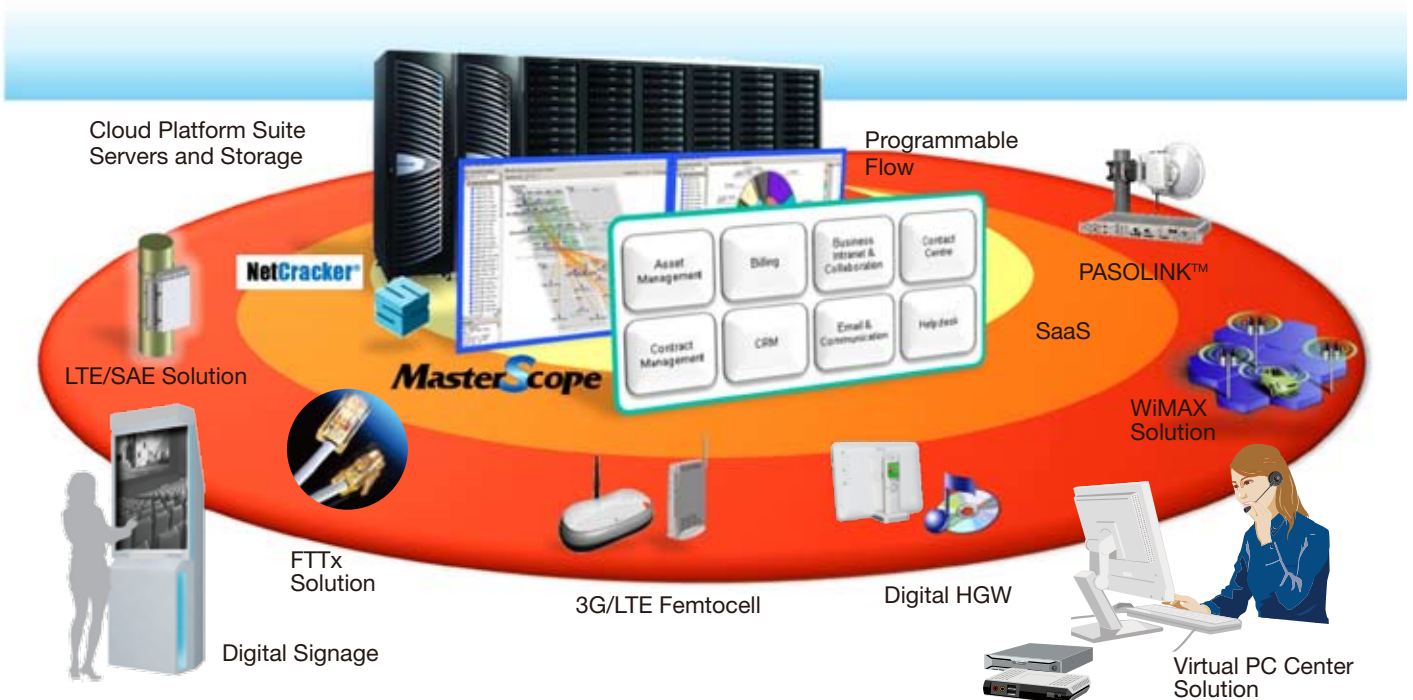


Figure 5. NEC's Solutions for Carrier Cloud Services

4. Supporting Cloud Services

For most SMEs, IT is not their core purpose and cloud unchains them from IT, allowing them to focus on customers. In the Carrier Cloud model, the carrier takes the responsibility for their IT support needs.

Ideally each user within a customer should be able to call one number and receive help on any of their SaaS subscriptions. Limiting calls to nominated representatives may have individuals questioning if economies made on in-house support are valid.

Remember that in cloud, applications will increasingly share data and interact, so most applications cannot take a silo approach to support. Problems will often happen at the border between services as data is shared between applications. Over time, a scalable way to manage cloud application support will need to be implemented as the cloud portfolio expands.

5. Winning in Cloud

NEC believes that there are two critical elements to the winning formula for Carrier Cloud:

1. Carrier-grade cloud, the ability to deliver cloud services that millions can rely on;
2. IT + network innovation and integration.

5.1 Carrier-grade Cloud

As a carrier you know how to keep millions of customers happy at once. You know the cost of managing and compensating for an outage and you can imagine that while telecoms provided critical infrastructure to the nation, cloud IT infrastructure is critical to the businesses that would be paralyzed without access to their systems.

These are just some of the issues that underline the difference between mass cloud IT and today's enterprise IT. For this reason, NEC has developed carrier service platforms that are 99.9999% available at the service platform level. We are not suggesting that every customer wants to invest in that level of availability, but it is an option. In fact, many of the same mission critical middleware and operational management systems are available to all as part of our standard cloud proposition.

5.2 Inherent Cloud Risks

Cloud computing was designed as a business model that allowed extreme dynamic scaling at a cost closely matching actual usage. To achieve this dream, multi-tenant scale and resource sharing are essential.

The consolidation and centralization of resources brings a concentration of risk – that of all the eggs being in the same datacenter. Secondly, to continually offer more value, cloud services are “encouraged” to interact for the common good, exchanging data and sharing functionality.

This closer cohesion links services such that they become highly dependent upon each other. This is another substantial inherent risk.

Many cloud risks can typically be resolved through various forms of redundancy and service mobility.

- Redundancy ensures that there are always more IT resources (and copies of data) available to continue processing during any failure;
- Service mobility ensures that the live service can be moved at the right time to alternate resources, while providing fast access to storage.

To implement these strategies we use many tools and processes including Invariant Analysis (which can detect silent errors), Virtual Machine mobility (which moves the service before failure) and Network Virtualization (which moves the service between datacenters) to name but a few. Happily, NEC uses these same management techniques to make clouds more environmentally friendly too.

5.3 IT + Network Innovation and Integration

Carrier Cloud is a fusion of IT and telecoms business models, technology and infrastructure – plus some people to help. For NEC and our customers, now is the time of IT and network integration: Openflow technology lets the application layer talk to and dynamically control the network. Thin clients are tuned for DSL and wireless networks. Home Gateways link home IT to the WAN. Virtualized servers smooth video streaming peaks on VOD management systems, while application statistics between network and application look for silent problems. We have released our Cloud Platform Suite: a Cloud IT virtual processing and storage platform with power, weight and cooling optimized for telecoms switching rooms.

6. Nearer to You

We want to help carriers build their own Carrier Cloud, a carrier-centric platform featuring services, solutions and people who allow you to acquire new value chains and revenue. Each cloud is different, so we are expanding our ability to work with you locally to help design the right business case, service portfolio and operational capability. This will enable you to operate an innovative, SLA-driven, carrier-centric, carrier-grade cloud.

For more information on NEC and NEC's Carrier Cloud solution, please visit us at: <http://www.nec.com/cloud>

Appendix Acronyms

API	Application Program Interface
ASP	Application Service Provider
CAPEX	Capital Expenditures
DaaS	Desktop as a Service
DSL	Digital Subscriber Line
GPS	Global Positioning System
HSDPA	High Speed Downlink Packet Access
IaaS	IT Platform
IMS	Information Management System
ISV	Independent Software Vendor
IT	Internet Technology
LTE	Long Term Evolution
M2M	Machine to Machine
NGN	Next Generation Network
OPEX	Operating Expenditures
OSS	Operations Support Systems
PaaS	Platform as a Service
QoS	Quality of Service
SaaS	Software as a Service
SLA	Service Level Agreement
SME	Small to Medium size Enterprise
VOD	Video on Demand