## Executive Summary

Communication Service Providers (CSPs), have two basic instruments to increase their competitiveness: first, lower their business and operational costs and seek bottom line growth and second, increase their revenue streams and achieve top line growth. The advent of network function virtualization (NFV) and software defined networking (SDN) has enabled CSPs to exercise both instruments. Migration to an SDN/NFV based network infrastructure and cloud style, automated operations will enable CSPs to become agile – a much needed attribute for success in today's market reality.

**Agility** needs business transformation and has four basic principles: customer agility, business agility, infrastructure agility and service agility. All four principles have been defined in the market. Combined, they enable the CSP to lower cost of operation and increase revenue.

Lowering costs has naturally a major positive impact on a CSP's competitiveness, but there are limits as to how much savings can be realized with any approach. It is the ability to increase revenue levels that sees no limit, and being agile in responding to changing market conditions and customer expectations is the key to enabling a CSP to offer a multitude of serivces, focus on specific target customers and do so quickly.

Infrastucture and service agility require the right tools , and one important tool is operations support system (OSS), which allows CSPs to reduce time-to-market and lower the cost of new service creation and deployment, operating in a hybrid infrastructure (traditional and virtualized) during CSP's business transformation. The focus on this paper is on quantifying the impact of being agile. The paper first provides the definition of agility and then quantifies the time-to-market, service creation and revenue generation advantages of being able to create new services quicker and taking them to market faster. ACG has determined that there is a 77% savings in labor cost, 13% differential in revenue generation per service launched based on a faster time-to-market advantage and a 47% increase in revenue level based on increased number of services that can be launched.

## Introduction

Many Communication Service Providers (CSPs) are taking advantage of the new capabilities that are inherent in a cloud-based infrastructure and operations to transform to Digital Service Providers (DSPs). To reach this objective, they are faced with the daunting, but necessary, task of migrating from their existing purpose-built network infrastructure to a virtualized, programmable, highly automated equivalent. The process is not simply limited to physical replacement of their existing network but a fundamental change in their company's overall operation, culture and processes. For example, closer cooperation of application development teams and service creation and deployment teams is necessary to maximize a CSP's internal efficiencies and enable a faster time-to-market (TTM) in service creation and delivery time frame. CSPs are convinced that network function virtualization (NFV) and software defined networking (SDN) are the essential technologies for their network infrastructure and operations tranformation as part of their journey to becoming DSPs (Digital Service Providers). The benefits of this journey include lowering their cost structure of business, increasing revenue streams from diversified digital service offerings and the ability to offer excellent service experience to their customers. Lowering the network infrastructure's TCO is naturally a major goal, but it is the revenue side of the ledger that could have a major impact in contributing to CSP's business KPI (key performance indicators). Lowering the TCO has limits, it never dips below zero! But the sky is the proverbial limit for increasing revenue. Agility is a key element that contributes to revenue growth.

So what does agility mean? How does one define, measure and quantify agility?

Agility is not confined to one concept and it is not abstract: agility is a full cycle practice in the CSP's business starting with business agility (establishing an agile operation to address company's and customers' needs), network programmability & infrastructure agility (elasticity of resources, automation of network provisioning), customer agility (the ability to respond, in real-time, to changing customer demands, including empowering them to fine-tune their own service preferences) and service agility (defining, implementing and deploying new services faster). Service agility also includes the ability to modify services per market feedback or removing an unsuccessful service quickly (the fast fail method). One of the main goals of agility is to ensure service responsiveness to satisfy customers' high expectations of immediate response when consuming their services. The process for gaining agility requires substantial reduction in and management of risks as well as the capability in empowering the customer to be in control of services. As CSPs transform to DSPs, deploying an order of magnitude more services, than they traditionally do, will be essential to remaining competitive and maintaining business KPIs.

This paper focuses on service agility (which inherently requires infrastructure agility) and aims to define and quantify their combined impact on CSP's KPIs. In virtualized network infrastructures, the role of the operations support system (OSS) becomes invaluable in achieving service agility. It enables management and orchestration of the virtualized infrastructure to quickly and efficiently build the necessary tools for service creation and deployment. It enables CSPs to rapidly deploy network services across a set of network functions and vendors. It will take the CSPs a few years to fully virtualize their network infrastructure, as legacy processes and standalone applications can hinder the transformation from a CSP to a DSP; therefore, an OSS product that supports both purpose-built and virtualized infrastructures is an essential tool to pave the way to this transition and is intuitively more cost effective.

The paper will include comparisons in service deployment time frames and revenue levels between an agile operator that is using a virtualized network infrastructure and an operator that is using a traditional network infrastructure. The comparison is focused on improvements in time to market for services and the ability to take more (and innovative) services to market using a fast fail approach.

## Defining Agility

For CSPs, agility is an important business goal to maintain its competitive edge, especially in light of increasing traffic demands, consumers' expectations for instant gratification and diminishing revenue per bit of data traffic. To address these stringent requirements, the definition of agility, and specifically service agility, has had to evolve. These challenges can be viewed as opportunities if the CSP has the right tools and processes in place. A holistic approach in running their business is necessary for CSPs to transform themselves into an agile entity that is capable of delivering new services in a much shorter time, operate business efficiently and maintain their own business KPIs. To do so, they need solutions that are much more flexible, programmable and open than what they use in today's network operations. In addition, they need to revamp their current mode of business operation to be able to achieve the aforementioned goals.

The approach to agility has been defined in four major elements (Figure 1):

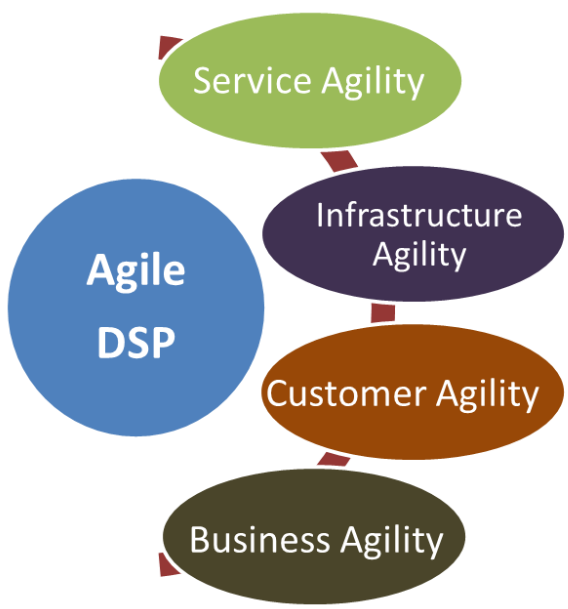


Figure 1. The Agile Digital Service Provider

1. Service agility: Ability to create, modify and remove a new or an existing service in a fraction of the time and cost that it took via traditional tools and methodologies. This is possible via a service orchestration layer that is capable of supporting a hybrid (traditional and virtualized) infrastructure using common data models and policy framework.

2. Infrastructure agility: Ability to allocate/reallocate/deallocate resources as necessary to make efficient and effective use of the network infrastructure. This is what an SDN/NFV based network offers with the capability for elasticity of CPUs, storage, virtual ports. Automating network operations, which historically have been conducted via sequential and lengthy procedures, is a major component of the infrastructure agility.

3. Customer agility: Ability to offer self-service capability to the customer to create/modify its own services with no or minimal intervention. Furthermore, use of real-time analytics is essential to gauge customers' interests (or lack thereof), behaviors and requirements and use service agility to fine-tune their services. Giving the subscribers the ability to control their own services using a network that delivers instant responses increases their loyalty and reduces churn.

4. Business agility: Ability to create a business environment in which teams can quickly organize and address the company's and the customers' needs. These include the ability to form new strategic alliances with partners and creation of new business models. These require a major shift in the CSP's organizational structure and its mode of operation. It is an exercise in leadership and overcoming psychological barriers to change.

There has been significant attention given to the latter three agility concepts[1]. As migration to an SDN/NFV based network infrastructure continues to gain substantial traction, a CSP's main objective, which was initially focused on cost savings (TCO), has shifted to revenue generation. Infrastructure Agility and the associated Service Agility play a key role in achieving this. ACG Research has conducted economic analyses on many network infrastructures, comparing a virtualized network to its equivalent purpose-built one. There are two distinct cases in this migration:

1. Virtualization of an existing infrastructure.

2. Deploying a new infrastructure based on SDN/NFV with VNFs, for example, opting not to build the network with purpose-built devices.

For Case 1, in almost all scenarios, the TCO based return on investment (ROI) over five to seven years was insignificant or even negative depending on the network dimensions. The differential in TCO included a period of absorbing two different operational expenditures (opex): one for the existing purpose-built network as it is being replaced and one for the NFV based network as it is being built up.

For Case 2, this ROI was substantial (>100% or more) over the same period. But this case is atypical unless the CSP is a green operator with no existing infrastructure or the established CSP opts to create islands of NFV based segments to operate independently from its existing infrastructure (again not a likely scenario as management of two different types of networks should not be a goal as virtualization is being adopted).

[1] http://www.sciencedirect.com/science/article/pii/S0148296311000427
http://www8.hp.com/us/en/software-solutions/devops-solutions/services.html
https://www.hpe.com/us/en/networking/nfv.html

For the same network dimensions, ACG Research found that the overwhelming factor in migration to virtualization is the economics of creation, modification and removal of services with an NFV-based network infrastructure by using a software-defined provisioning capability of an OSS system.

Regardless of TCO savings, there is always a hard limit: costs never go to zero (Figure 2). There are no giveaways, and opex will continue to be the major cost component in running a network. However, there is no limit to earnings, and increase in revenue levels are only limited to the CSP's creativity and diligence in ensuring that its target markets get what they need, and it can do so with rapid time-to-market relative to historical time frames.

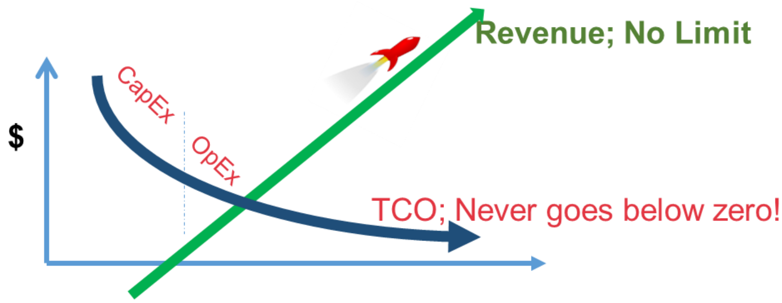


Figure 2. TCO and Revenue Limits

## Quantifying Service & Infrastructure Agility

As mentioned earlier, service agility inherently goes in-step with infrastructure agility. The two most important aspects of NFV-based infrastructures are the ability to benefit from elasticity of network resources and assets, and the opportunity to automate the different workflows that have historically been done via a series of manually driven tasks. Specifically, the latter is afforded by a modernized OSS software that can significantly reduce the time-to-market for just-in-time delivery of new (or modified, existing) services. This is in line with customers' heightened expectations of instant gratification and personalization of services, which leads to higher loyalty and less churn levels.

Given that the majority of existing OSS systems are in use for traditional networks, combined with the desire of CSPs to ensure maximization of asset utilization, it behooves the vendors to offer solutions that address both traditional and virtualized infrastructures (hybrid model) to enable their customers for a smooth transformation to a DSP. Therefore, an OSS system must be able to address orchestration of services, analytics, fulfillment and assurance in both types of infrastructures (for example, HPE Service Director for OSS[2]). An ideal OSS system breaks the traditional sequential workflow methodologies and offers analytic functions (to provide data for service personalization) and, importantly, offers closed-loop between fulfillment and assurance processes and uses common data models across different processes. This is essential to simplify the CSP's business processes, ensure the effective use of company resources, especially its technical labor force (that is network operation center engineers) and make the network ready to support services for Internet of Things or Industrial Internet of Things (city lighting, aviation, waste management) and lucrative enterprise services. Therefore, if a CSP decides to cross-

[2] http://h20195.www2.hpe.com/V2/GetDocument.aspx?docname=4AA6-3832ENW&cc=us&lc=en

reference OSS subscriber data with local restaurant deals to spur online transactions, it can do so with minimal effort in system or process tasks.

The management and orchestration capabilities provided by the OSS enable rapid provisioning of services that promotes fast TTM in service deployment. The right OSS system offers interoperability to support a business partner's product on-boarding, offering southbound and northbound APIs. This way, services can be created and easily integrated into the catalog of offered services to generate revenues. CSPs will have the ability to increase the number of services by an order of magnitude (10s of services in NFV based networks versus a few, for example, two to five within a specific time period). The back office processes, such as customer relationship management (CRM), billing and analytics offered by business software systems (BSS) ensure a continuous and predictable revenue stream. Generally, CSPs do not purchase new BSS platforms for functions such as catalog and order management, billing, CRM and business analytics. They opt to incrementally add modules to support the virtualized network segment(s) to support, mainly, service creation and management.

Both of these concepts have been amply covered in the industry in terms of their technical requirements and advantages in a virtualized network infrastructure. This paper focuses on the value and business KPIs of creating and launching new services. In this case, service agility of an agile operator using a modernized OSS software and SDN/NFV enabled infrastructure is compared to the traditional operator using legacy tools and business operations. The main assumption for the calculations is the presence of an OSS solution that supports both modes during the full transition to network virtualization.

## Quantifying Service Creation

The desire to maximize the utilization of an asset (even when it is fully depreciated) that is incapable of providing the necessary functions can translate into a "sunk cost fallacy" for CSPs. Therefore, they may have a tendency to postpone or avoid modernization of their OSS system. This could prove costly for the CSPs having a high opportunity cost level. Nevertheless, vendors must offer solutions that enable the CSP to transform itself to a DSP at its own pace and fully migrate once they are convinced that all risks in new investments are mitigated (see Figure 3).

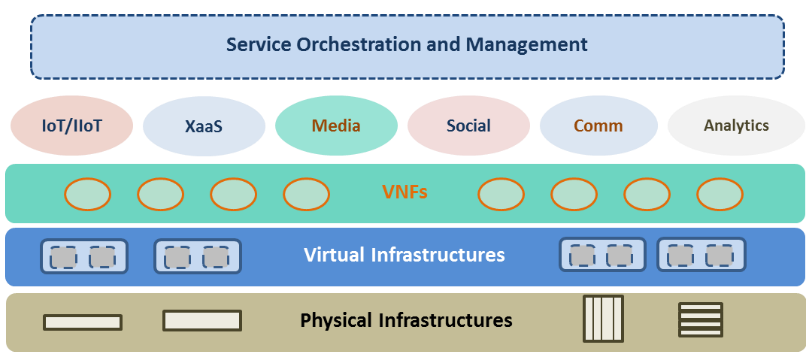


Figure 3. Hybrid Service Orchestration Model

The steps needed for service creation with OSS are shown in Figure 4. The steps are the same for either type of infrastructure but the time-to-completion for service creation is significantly different.

Quantifying the value of a faster service creation and faster service launches includes analysis of its time-to-market advantages relative to legacy solutions and, more importantly, its potential for revenue generation.

## Financial Impact Analysis

NFV advantages in service agility enable economies of scale in service delivery relative to the personnel who are involved in the inception, creation and delivery of services. An agile operator can expect to be able to offer an order of magnitude more services in the same period as a traditional operator[3].
A new service deployment decision may be customer driven or via CSP/DSP's internal research driven. The latter, obviously, carries a higher risk. Nevertheless, in either case, the CSP can tune or remove a service that does not match its KPIs with minimal cost since the cost of service launch is much lower in Virtualized Mode of Operation (VMO) than a Present Mode of Operation-based (PMO) infrastructure. This is shown in the Chevron diagram of Figure 4. (See the following for an explanation of each[4].)

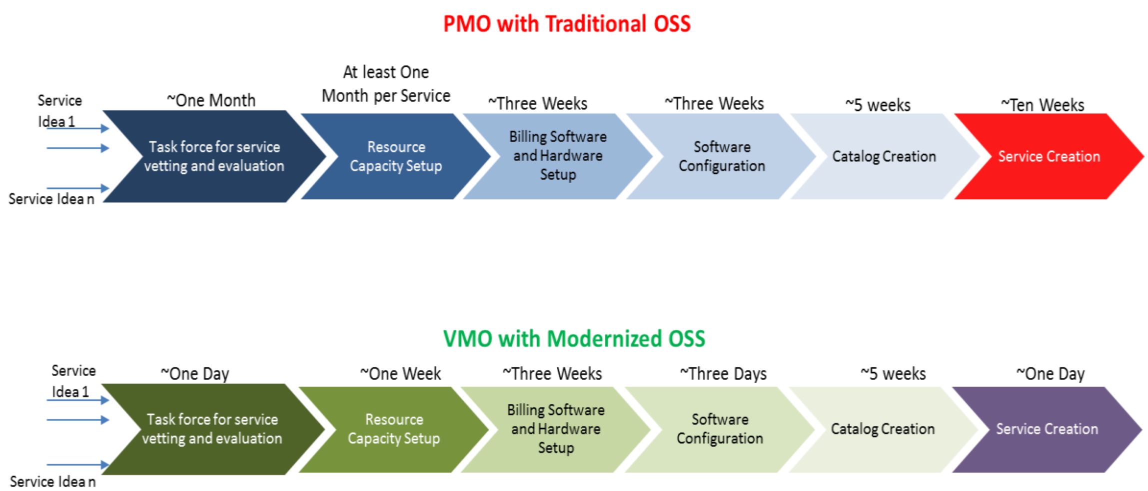


Figure 4. Comparison in VMO and PMO Service Creation Timeline

ACG's relative agility index, which measures the agility of a specific solution ($S_1$) that can create a new resource versus its competing solution ($S_2$) capable of creating the same resource, is 33% in Figure 5. That is, it takes the VMO one-third of the time to create a service as it would for the PMO. This is a significant advantage for time-to-market (about 100 days in this case), which translates into an opportunity cost for the CSP with the PMO infrastructure. This is used in revenue generation calculations in the subsequent sections.

Next, we examine two revenue-upside scenarios that quantify service agility, and one an opex saving scenario for VMO versus PMO based on different variables:

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[3] http://www.webscalenetworking.com/topics/webscalenetworking/articles/411041-telecoms-ready-500-new-service-launches-per-year.htm

[4] http://52.33.143.84/wp-content/uploads/2016/01/ACG-Gi-Lan-TCO.pdf

**Operational Savings in Service Creation / Service Launch for the Agile Operator**

A comparison of the advantages of OSS VMO versus PMO includes the number of full-time equivalents needed to support the network's operation for a specific service. Typically services are planned and then launched, then customer orders are activated for that service in some cases provisioning new resources), service assurance (management and mitigation of trouble reports) and analytics (service tuning based on customers' behavior) greatly enhances service agility in service offerings. These on-going operation support procedures include monitoring, managing and resolving problem reports. Automation of service assurance and fulfillment (service idea vetting and implementation, provisioning of resources and activation of the service are included in this analysis.

A typical scenario in delivery of managed services (CPE) and its equivalent vCPE was used to quantify the advantages of a modernized OSS for the agile CSP relative to the traditional CSP. ACG Research's findings show a marked improvement on the impact of service creation and delivery for an agile CSP using modernized OSS automation versus a CSP using the traditional methodology (PMO-based) where tasks are conducted in a serial and labor-intensive manner.

The time frame for each task is shown in Table 1. Of note is the time that it takes to deliver the service for VMO; this only take a few hours (shown in one day in the table). For PMO, it also takes about one day, in terms of truck roll, but it takes ***O*(**months) (order of months) to actually deliver the service when scheduling, administration and other manual tasks are considered. Note that schedule time is not included such as time to wait to deliver the service. However, this negatively impacts the time-to-market. Another major obstacle in service onboarding for the PMO is the time it takes to vet a new service. Since the PMO-based CSP cannot tolerate high risks in offering new services, it has to ensure a near 100% success level for the service. Therefore, the vetting team will include not only the engineering team but potentially high ranking officers (director of operation and vice president of finance), making the process both lengthy and much more expensive.

| **OSS Operations (Mixed Skill Sets)** | **Service Vetting & Acceptance** | **Deployment Preparation** | **Service Activation** | **Service Delivery** | **Fault Mitigation** | **Service Tuning** |
|---|---|---|---|---|---|---|
| **VMO** | | | | | | |
| Service On-Boarding | 7 | 14 | 4 | 0.5 | x | x |
| Service Assurance (Assume Self-healing) | | | | | 2 | |
| Analytics | | | | | | 1 |
| **PMO** | | | | | | |
| Service Onboarding | 28 | 38.5 | 15 | 75 | x | x |
| Service Assurance | | | | | 12 | |
| Analytics | | | | | | 12 |

Table 1. Tasks and Time Frames Taken for Managed Services (in Days)

Figure 5 depicts the savings levels for the agile CSP. Note: only cost of labor is included in this comparison.

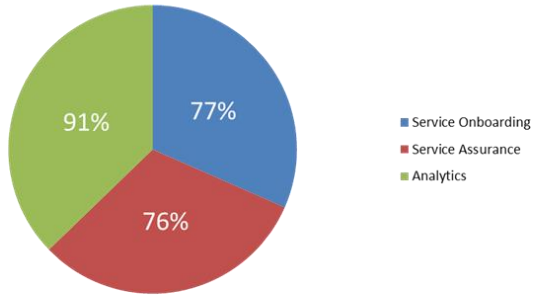


Figure 5. "Agile CSP" Labor Cost Savings Relative to Traditional CSP

**Revenue Growth Scenarios**

*Scenario 1: Faster time to market for a fixed number of services, launched per year.* This scenario compares two operators launching a fixed number (4 in this case) services/year. The Agile operator can launch these four services much faster (100 days faster in this case) than the traditional operator. This translates to revenue in three ways: first, 100 days of additional revenues; second, due to the ability to launch that service faster, capture or steal market share from the 2nd operator; and third, due to the ability to meet customer expectations faster/better, resulting in reduction of churn. Also, in this case, since we keep the number of services launched as a constant for two operators, the agile operator can do it with fewer resources, so there is a financial impact from lower operational expenses. The quantification is the net of these four cases.

A simple case is used to show the revenue differential between CSP and DSP for four different services to be deployed by both operators. In this example, the agile CSP with the VMO infrastructure and modernized OSS, as mentioned, is 100 days ahead of the traditional CSP in launching its services (four in this case). In addition, the cost of creating a new service is 77% less for the agile operator since the agile CSP can launch these same services with fewer labor resources. This translates directly into market share loss for the traditional CSP and higher costs of service creation, respectively. We use ACG's relative agility index to apply in this scenario (assumption, the services are uniformly distributed among the available pool of subscribers).

Table 2 shows the basic assumptions for this case.

| Scenario Assumptions: 4 New Services Launched in 1 year | |
|---|---|
| Total available subscribers for both operators | 8,000,000 |
| ARPU for Service 1, 2, 3 and 4 | \$15, \$8, \$20, \$10 USD, respectively |
| Cost of new service creation for the agile CSP per 100,000 subscribers | \$100,000 |
| ARPU discount for traditional CSP to capture market share for being late to market | 15% |
| Loss of market share for agile CSP when traditional CSP launches service | 20% |
| Churn rate for traditional CSP | 1.0% |
| Churn rate for agile CSP | 0.5% |
| Loss of market share for traditional CSP for delay to market for a service | 1% per month for 100 days |

Table 2. Scenario Assumptions for Four Services

Based on the assumptions in Table 2, the agile CSP will have a revenue advantage of 13%, per service launched, in the first 12 months once the services have been deployed.

*Scenario 2: More services offered to market using fixed amount of resources/manpower.*

In this scenario we keep the resources that two operators have as a constant. In this case, if with a given set of resources the traditional operator can launch four services, the agile operator can launch a higher number of services (less resources and less time required pre service creation and launch). Further, to conservatively, we assume that the agile operator has a fast fail approach so only 30% of its services actually are attractive and generate revenue. We then quantify it in three ways. First, additional revenue from the extra services; second, additional subscribers due to offering more services and better market reach (similar to the shelf-space concept) and third, reduced churn due to the ability in meeting the customer needs better.

This scenario depicts the revenue differential derived from the number of services that can be offered within a year. One assumption in this case is that with a given set of resources the traditional CSP can launch X services (X=4 in this case), and in the same time frame, the agile operator can launch 25[5]. A probability of success is assigned to services that are generated for agile CSP and the traditional CSP. The traditional CSP must go through a thorough process with diligence and spend time to ensure that the service is successful since the cost of an unsuccessful service is too high. This is not the case for the agile CSP since it can tune/remove the service with minimal cost, if it has to do so at a later date. Therefore, the $P_{success}$ for the traditional CSP is set at 100% and 30% for the agile CSP (a rather conservative level). However, the agile CSP can deploy an order of magnitude higher number of services than the traditional CSP, shown in Figure 6. Δt reflects the faster TTM for the agile CSP. Churn rate is also assigned per operator-type as the agile CSP is expected to have a higher customer satisfaction level, in general.

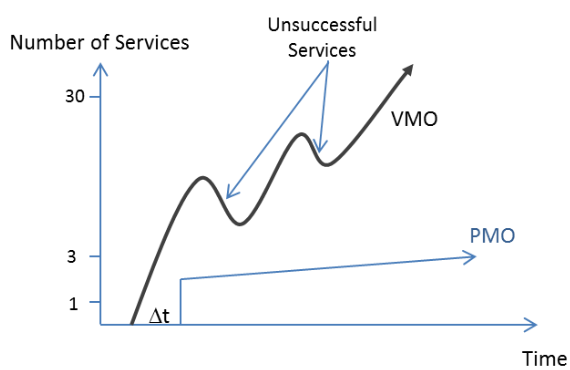


Figure 6. Service Profile for DSP with VMO and CSP with PMO Infrastructures

Table 3 shows the basic assumptions for this case.

| Scenario Assumptions: Seven Years | |
|---|---|
| Total available customers | 100,000 |
| Average number of new services launched per year for agile CSP | 25 |
| Probability of success for agile CSP's new services | 30% |
| Average number of new services launched per year | 4 |

[5] *Based on ACG Research calculations*

| | |
|---|---|
| for the traditional CSP | |
| Probability of success for the traditional CSP’s new services | 100% |
| Churn rate for traditional CSP | 1.0% |
| Churn rate for agile CSP | 0.5% |
| Average revenue per customer for all services | $50 |

Table 3. Scenario Assumptions

In a period of one year, the DSP benefited from a 47% advantage in revenue differential, which clearly shows the strengths of the DSP for its ability to create and deploy many new services even with the assumption of a small probability of success for the set of services.

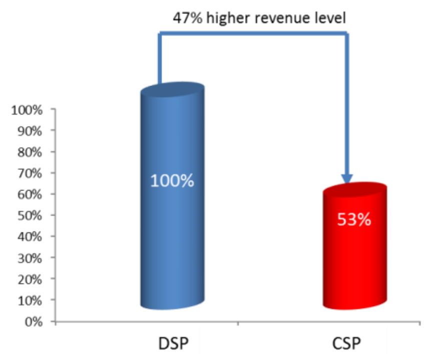


Figure 7. Cumulative Revenue Differential between DSP & CSP

## Conclusion

Agility has become a blanket goal that offers expectations of enhanced competitive positioning to CSPs. However, while there are several areas of consideration for a CSP to become agile, service and infrastructure agility will have a great impact on top line growth expectations. As CSPs transition to become DSPs, they need the right tools to achieve service agility. A first step for this transition is the transformation of the infrastructure to be a programmable entity using technologies like SDN/NFV and cloud. Because the CSP will be operating both types (traditional and virtualized) of infrastructures for the next few years, the optimal tool enables service agility for a hybrid network infrastructure. A modernized OSS is one such tool. An example of such a tool that offers agility for both types of networks is HPE’s Service Director that can reduce the time for service onboarding from months to weeks.

Agility in service creation and service launches has tangible impact on CSP financials. In the scenarios we explored, the agile CSP benefited from a 13% increase in revenue level, per service launched, due to faster time to market. The Agile CSP could also benefit from the ability to launch many more services in support of changing customer expectations for personalization and, in this case, our modeling shows a 47% differential in revenue level. These are substantial differences and can clearly give the agile CSP a definite competitive edge.