What Every VoIP Operator Should Know Before Buying a Full Featured Class 4 Switch with Integrated Billing, Routing, and Switch Capabilities

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1. Using a VoIP Operation in your Business

One method of reducing costs significantly for a telecoms operator or a large scale telephony network which is typically using old technology such as TDM, is to use Voice over Internet Protocol (VoIP) and Session Initiated Protocol (SOP) to interconnect with their carriers and clients. Considerable savings can be achieved by running your own telephone network over public Internet with or without IPsec tunneling and through implementing an allinone softswitch on your network that has billing, routing and switch all bundled together. This will allow you to bypass the traditional telephone connectivity and maximise your savings, also gaining more control of your network capacity by leveraging the public demand Internet for Voice calls.

An allinone Class 4 softswitch allows VoIP operators to reduce manual workload and financial loss due to errors, specifically in rate delivery and rate import, by automating and streamlining the entire operation such that minimum human intervention is needed.

Today, there are more than a dozen different Class 4 switch vendors to choose from, all of whom claim their products provide superior security and performance for VoIP Termination and Origination. How do you then select the best one for your needs? A VoIP operator must carefully weigh factors such as real world session performance (versus performance in a lab using carefully controlled scenarios), robustness of features, stability, scalability and customization before choosing the right Class 4 switch for their network.

This Buyer's Guide is designed to help VoIP operators evaluate a Class 4 switch appropriate for their business and distinguish an average Class 4 Switch from one that delivers superior performance and features. It will aid the buyer in sourcing and purchasing the product and will also help to identify results to be expected once a Class 4 Switch is installed on the network.

2. Key Functions to consider when shopping for a Class 4 switch

There are several factors to look at when selecting a Class 4 Switch to facilitate VoIP operations that reduce costs, maximize profit, avoid loss of and deliver new, revenuegenerating services.

So what do you need it to do?

- The first factor is the capacity of connections allowed at any one time, or over time, as demand grows. Can it cope with the volume of connections a VoIP operator is planning to grow to?

- Then consider how effectively it can manage these volumes, switching calls between partners and controlling traffic flows, while ensuring that there is no interruption or delay.

- A big issue is always security of the network and data. Particularly when VoIP access is run as a commercial service, can it offer the security you need? For all operators there are concerns. Does the switch include the full range of security features expected? Will

it protect against DDoS attacks and block unauthorised access and abuse, while still ensuring a smooth flow of connections for both the data and signalling path?

- Can it handle all the tracking for billing and control of clients credit facilities, all in real time? Will it ensure call blocking when limits are reached and flag this up to the operator to ensure the account is managed? Can it handle more complex contract terms for different clients?

- SIP Interoperability, or how well does it interconnect with other SIP devices, including the hardware and software of all other switches?

- Does the Class 4 switch support the SIP RFC standard legacy call center and PBX solutions and older technologies which are still in use in various parts of the globe?

- How easy is it to build up the VoIP network to meet new demands in volume of connections and capacity of users?

We will address each key factor in more detail below and also look at the leading market Class 4 softswitch products available and how they measure against each one.

2.1 Switch Connection Capacity and Session Performance

Session performance refers to the number of concurrent sessions that a Class 4 Switch can support at any one time, its capacity to multitask. A session is defined as an exchange of media in either voice or video format between two end points. A session has both a channel in and a channel out that work in tandem, or it can include more than one outward channel, where the switch links to alternative routing to prevent interruption of flows. So when selecting a Class 4 switch you need to look at the maximum number of sessions it can handle at any one time. For a call centre this would need to be exceptionally high, but for most VoIP operators it is unlikely that the total user population will be utilising the service at the same time. There is a balancing act between session handling volumes and call per second capability. Also, for a VoIP operator whose primary traffic is wholesale rather than retail, it is common that the call quality is lower and average seizure ratio (ASR) is low. Since the ratio of channels to sessions is usually higher than 1:1, a VoIP operator with 1000 active sessions might be well served by a Class 4 switch that supports 10,000 concurrent channels this would allow for the possibility that one in every 10 call users would be engaged in a voice or video call at the same time.

How do you assess the performance of a switch from different vendors ? Many vendors will use simple SIP sessions as the basis for their calculations when providing performance data on their product. They will use lab tested scenarios to indicate the performance level their switch can provide, but in live high callpersecond traffic there can be a significant failure rate or slow response due to packet drop and callpersecond will be higher in a reallife scenario due to DP packet retry, which is common when packet is transmitting over the public internet. In order to

select a Class 4 switch with adequate realworld live performance levels, VoIP operators should look for one that offers:

- High session performance even during high load
- Unimpacted performance during a DoS attack, high CPS conditions or overload conditions
- Rapid startup and initialization of the Class 4 switch following a hardware restart
- 99.999% reliability or higher
- Hardware redundancy for seamless disaster recovery
- Automatic Call session and media path migration during server failure.

2.2 Call Routing and Quality of Service

Class 4 switches are not only responsible for terminating SIP traffic at the VoIP operator network—they are responsible for selecting the most efficient and secure routing for delivery of media between end-points. This selection process, referred to as call routing, is intended to prevent any interruption or distortion of traffic over carrier networks involved. Selecting the most

efficient route also results in significant savings for VoIP operators, both by reducing toll costs through intranetwork routing and through a process known as least cost routing (LCR).

A Class 4 Switch uses LCR calculations to decide which routing path will be the cheapest, taking into account the time of day, the selected destination point and the reliability of the connection channels. Not all Class 4 switches can support the full range of cost and quality variables to ensure the maximisation of call service and minimisation of cost due to differences in infrastructure over time. There is a significant saving to be gained when looking at wholesale carrier routing. The more variables a Class 4 Switch can consider in its route hunting formula, the higher the potential savings the VoIP operator can achieve

2.3 Quality of Service Based Routing Selection

For VoIP operators who are providing services to direct retail clients, quality of service is more important than cost. In many carrier networks, there are hundreds or thousands of possible routes and each route can consist of a mix of carriers. A Class 4 switch should have the ability to rank the order of preferred carrier for each call based on the historical QoS statistics, including AnswerSeizure Ratio (ASR) and Automatic Call Distributions (ACD). For instance, if a carrier has traditionally not able to terminate traffic for certain code, there is no need to send calls for that code over this carrier again.

2.4 Customisation and Policy Manageme

A VoIP Operator will have a number of policy options that determine the nature of call routing and allow the Switch to best serve the preferences and customisation of each different VoIP operator. These policies cover many aspects of the communication protocols including cost,

past traffic statistics and load management.

Nowadays Class 4 switch vendors will recommend implementation of a centralized policy management system that covers all Class 4 switches in the VoIP operator's network. Previously each switch had to be individually set up with a policy guide and would apply these at the local network level, leading to variations in policies for the different switches in a network. This can create conflicts around looping, False Answer Supervision (FAS), least ASR or minimum % of short duration calls, requiring each client routing to be unique within their Class 4 switch setup.

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A centralized policy management model will save time, require less maintenance of switches and reduce conflicts occurring at network touch points. With a centralized policy management mode, the VoIP Operator would set up all routing in the centralized routing engine, and deploy different VoIP switch engines among different locations.

2.5 Granulation of Capacity Control

For a VoIP operator, call session capacity and CPS capability is a limited resource. A VoIP operator can only get a specific quantity of channels or callpersecond capacity from each carrier. To be able to maximize the profit, it is important to intelligently allocate these limited resources to clients. Many Class 4 switches give a VoIP operator the ability to limit the channel and CPS at the overall client level, but in fact, it is more desirable to be able to control it at the trunk or host level or code level. This would give the VoIP operator total control to allocate the limited capacity to the client, trunk, and traffic that drives the most profit, while at the same time, able to fully utilise the capacity allocated. Also, instead of sending calls above the capacity that a carrier is allowed, Class 4 should not waste valuable hold time and route calls to the next carrier without retries and other attempts.

The other important aspect is that, the ability to limit call channel and CPS at the callid and calling number level is an important aspect of capacity control. For Origination traffic, a VoIP operator would typically limit the call to each DID to one or two channels. For a retail VoIP operator who wants to avoid call center traffic from jamming their network, they can use Callerid level limits to block calls with repeating automatic number identification (ANI) to a maximum of 1 2 calls at any time for the same ANI. This would effectively block out all the low quality internal work order AS calls usually demonstrated in call center wholesale traffic.

2.6 Size of Routing

A Class 4 switch for a VoIP operator should have the capability to process route determination on a detailed code basis, to be able to select those with higher profit margins. For example, in the case of US domestic routing, it is not uncommon for a VoIP operator to route traffic between carriers of 6 digits NPA NXX prefix and carriers who provide full 10 digits routing. A 10 digit routing means 10 million records. The ability to handle large routing sets also allows the VoIP operator to take advantage of cost saving from long prefix routes.

The more routing variables a Class 4 switch can handle, the higher the profitability to the VoIP operator, as Class 4 will have more opportunity to cherry pick on LCR

2.7 Session Initiated Protocol Interoperability

Session Initiated Protocol (SIP) should be the same across the industry, but in reality there are variations in both hardware and software systems from different manufacturers and developers.

So there is an element of 'normalisation' or translation between SIPs which the Class 4 switch must manage, to ensure that all signaling instructions are properly communicated across the carriers and switches. This is particularly so when routes go through a mix of SIP devices or systems which all seem to have different SIP variations.

So one aspect for a potential buyer to consider is the degree of interoperability the Class 4 switch can achieve without any failures in signaling. It must include SIP message manipulation tools that ensure SIP headers are modified to match across networks. There are protocol standards set for the industry for trunking implementations and SIP Forum for IP multimedia subsystem implementations which should be as consistent as possible across all connections.

Again, with different hardware amongst carriers and with other switch vendors protocols, there must be extensive interoperability testing to provide seamless transitioning across networks for the VoIP operator. It is important to check that this has all been completed and documented by a vendor

2.8 Security

Given that the Class 4 switch is a routing system from the network (secured) to the rest of the world and the internet (unsecured), how well does it maximise network security without limiting its normal operations and purpose. What are the main features of its security protocols to protect against both toll fraud and interruption of services by ddos (distributed denial of service) attack? Loss of call service means loss of revenue. Unauthorised use can also impact profitability. Interception of communications can lead to disruption of business operations and allow loss of data and intellectual property.

VoIP operators should look for a switch that includes the following security protocols and best practices for prevention of malicious or fraudulent abuses of the system:

DoS/DDoS Prevention - Denial of service (DoS) and Distributed Denial of service (DDoS) attacks can shut down a network blocking access for all users. There have been recent high profile such events impacting major industries in the Ukraine, the UK Parliament and some global financial institutions. A Class 4 switch, therefore, must be able to identify both DoS and DDoS attacks through a mix of end point recognition (e.g., is the request coming from an authorized IP?) and pattern analysis (are thousands of devices sending an identical call number and / or caller id?). Sometimes, the attack may be targeted to bring down your switch and, thus your business, instead of trying to terminate unauthorized calls to make direct financial benefit.

Fraud Detection- a Class 4 switch should be able to track the amount of calls sent by a client on the basis of call attempt, total duration, and total cost per day and per hour. If a client suddenly sends a high amount of traffic that exceeds a certain threshold value, an efficient Class 4 switch should automatically block the client trunk and send an email to the operator for a full investigation. An automatic blocking and email notification is essential to protect against disruption and potential loss because it is much more common for a hacking activity to take place during weekends or national holidays when there is reduced staff levels, permitting a larger window of opportunity..

Topology Hiding- this is the practice of protecting the identity of authorised devices within the network from being acquired to permit intrusion. A Class 4 Switch should act as a barrier between carrier and client networks and IP addresses being made available outside these networks. This prevents attackers from targeting and/or exploiting a specific end point device that has an IP address in order to illegally access voicemail or other services. It also ensures that the privacy of the call is protected to avoid any personal abuse from unknown connections.

Automatic Credit Limit Block- a Class 4 switch must be able to keep a running total of the traffic sent by each client and be able to set a limit on this on a per client basis. If the client transmits traffic exceeding the limit, then the Class 4 switch should automatically block any additional traffic attempt. By doing this, even if a client's switch is hacked, the damage is limited by the amount of credit allowed.

IP Based Access Control- IP Access Control refers to the ability to limit access to each admin user's account by one or more authorised IP addresses only. By doing so, even when a user's

password is compromised, the hacker still can't login due to this additional level of security check. Much of today's toll fraud is caused by hackers gaining illegal access to the switch and illegally inserting their own IP to allow that IP to send traffic and terminate via the victim's switch. By employing IP Based Access Control, a Class 4 switch won't be compromised even when the user's password is exposed.

User Login Tracking- each user login attempt, or access from IP, should be recorded. This gives the VoIP operator the ability to flag up the issue if the user's password is compromised. Also, it is common for malicious users to attempt to gain illegal access outside normal working hours. Records of all successful and/ or failed attempts at access let the VoIP operator know to check if there are any suspicious attempts out of hours.

2.9 Integrated Billing

One of the key operations of a commercial VoIP operator is Billing. As each VoIP operator's clients can be sending hundreds or even thousands of concurrent call sessions, it is important that a Class 4 switch is equipped with realtime billing, handling of prepaying and post payment and automatic blocking of calls when a client's balance falls below a certain assigned value, set on a per client basis. If a Class 4 switch does not have built in billing, a VoIP operator will need to purchase another billing software solution and integrate it, with additional costs to the setup and operations, along with greater risk of conflicts in the overall structure.

For a Class 4 switching application, it is important that the billing can keep up with call traffic volumes. If the built in billing can't handle the same speed as call traffic, then it is possible that the switch is not able to stop a call right after the client's balance is below the required credit limit. For a serious VoIP operator this is an essential requirement of a switch's capability and performance.

Here are features that a Class 4 switch should provide if integrated billing is supported:
- Ability to configure a client as either a prepay or postpay client
- For postpay clients, the ability to set credit limit
- Auto invoice to be triggered on different payment terms such as 7 net 7, 15 net 15, or 30 net 30
- Auto payment gateway support for Paypal and Stripe
- Daily balance summary
- Real time balance update
- Payment Gateway integration

2.10 Scalability

Another factor to consider when deciding on the Class 4 Switch that best suits you is not just that it meets an operator's current call volume needs but that it will allow for the future plans and growth

in demand, given that there has been significant growth in tablet and smartphone connectivity and access to broadband, which allows for even greater VoIP calls and connections. So the volume of SIP traffic is growing constantly and the switch needs to be scaled up accordingly.

There is a vast array of Class 4 Switches that can permit more and more session handling, but also look at the pricing structure for different scales as these can vary a lot.

Other cost factors include encryption and media transcoding, licensing of call routing and policy management software support, also those associated with installation and maintenance of equipment

3. Comparison of market leading Soft Switch versions

In the table below we look at the carrier grade class (16,000 - 64,000 sessions) Class 4 Switch available from Denovo Lab, the Class 4 Fusion 6, comparing it to those on offer from other vendors:

	Denovo Class 4 Fusion V6	Carrier Grade Switch SO	Carrier Grade Switch SN	Carrier Grade Switch AP
Switching	YES	YES	YES	YES
Routing	YES	YES	YES	YES
Integrated Billing	YES	NO	YES	YES
PCAP extraction	YES	NO	NO	NO
Monitoring	YES	NO	NO	NO
Integrated Bad Number blocking	YES	YES	NO	NO
Client Portal	YES	YES	NO	YES
Agent Portal	YES	YES	NO	NO
DID Origination	YES	NO	NO	NO

As you can see, all of these vendors' Class 4 Switch have some of the features we looked at above but only one of them offers everything we have discussed.

4. The Denovo Class 4 Fusion V6

So let's take a more in depth look at this Class 4 Switch and see what makes it the best product on the market for your needs (in our opinion).

Here are some of the ways this product offers better functionality to you:

4.1 Customized kernel level media proxy handling facilities

DenovoLab are the industry's only Class 4 Switch company that builds their own kernel¬based media proxy facilities. This is important as it allows many different forms of media to be transmitted faster and more efficiently, so reducing load on the CPU's — critical again to the longer term life of a switch when you consider the ever growing size and volume of media being transmitted with the explosion of VoIP switches and internet connectivities. At DenovoLab, we aim to build for the longer term, not supplying a switch with a limited useful life.

4.2 Customization and Policy Management

DenovoLab recognizes the VoIP operator's need for a centralized policy system. As the system grows then the Operator wants to ensure all additional switching engine adhere to the same policies and do not require individual policy formulation, testing and ongoing maintenance. This would increase the risk of system configuration errors, causing call failures and loss of service. It also plays a key role in centralized session management, something that DenovoLab offers with its high performance algorithmic driven routing engine. With DenovoLab, a VoIP Operator can deploy a centralized Routing Engine and many Switching Nodes all over the internet. This not only brings greater level of redundancy but also saves time and reduces error by not having to duplicate a routing policy for each switching node.

4.3 Performance and Connectivity

Let us look at the capacity of the different switch options in terms of Carrier pre¬selection (CPS) and the number of channels offered. As can be seen from the table below the Denovo switch has greater capacity for handling extremely high CPS and Call Channel, allowing both higher volumes of call traffic and better quality of connection and transmission. So there is less risk of

loss of service due to overload. Denovo recognises that bigger capacities can be better in today's world and will be essential in tomorrow's.

Greater capacity gives added security to the whole system, reducing risks of dos and ddos impact.

Also worth bearing in mind is the difference between lab testing of connectivities and real live conditions. One is very controlled and the other much less so. You need to be sure that your SIP switch can cope under pressure in all circumstances, including all the media proxying.

	Denovo Lab	Opensips	Vendor SO
CPS	17000	12000	100000
Channel	200000	100000	100000

4.4 Rate Management

It is common for a VoIP Operator to have many carriers and each carrier may offer many destinations. In some extreme cases, as in US domestic routing, it is common for a carrier to offer a rate deck of 170K coes and each code has three different rates, namely inter_rate, intra_rate, and indeterminate_rate. When there are 100s of carriers, that means the routing complexity of over 510,000,000. To handle this the DenovoLab Class 4 switch has its own internal routing specific memory¬ based DB that is developed using and ¬dimensional tree ¬based model. This algorithmic approach to route searching gives the Denovo Lab switch the ability to handle a near infinite amount of route search possibilities at O(1) no matter how many different route options are involved.

5. Deployment Methods for a Class 4 Switch

Cloud network deployment or on¬premises Switch?

When looking at upgrading your network and adding in Class 4 switch options, the next thing to consider is how and where you want to store and manage this system. Take a look at your current network structure and whether you want your VoIP operation to be managed on local servers, together with running in¬house support functions, or do you want to outsource all of this? What about taking advantage of cloud storage facilities?

There are various different ways of purchasing and deploying your switch and it's attendant hardware, along with maintaining the network over time and planning for future upscaling of services and facilities.

Due to capital restrictions, you may want to look at purchasing equipment through a reseller. Many VoIP operators wish to focus on their core business, that of providing a communications facility to their clients.

They can opt to source the equipment through a reseller who then sells or leases to the VoIP operator and manages the IT infrastructure, agreeing an annual service contract. In a fully managed services model, the MSP (Managed Service Provider) offers a managed Class 4 switching service for which the VoIP operator pays a monthly fee. This model will include procurement,

staging and configuration, on-site installation, and ongoing monitoring and maintenance.

However, with the more recent introduction of cloud storage facilities where much of the software resides "in the cloud" (on servers owned and managed by the Service Provider on their own premises), the Service Provider offers hosted services to multiple operators via the internet. This can result in economies of scale which can be passed on to VoIP operator, as cloud servers are mostly run at 75-90% utilization, enabling cost¬efficiencies. Other advantages of the cloud storage option include better scalability and more timely software upgrades.

5.1 On Premises Vs Hosted Switch

On Premises Switching	Hosted Switching
Need to have your own system support person	No system support person needed
Better control of your own IP and network	Rely on service provider for the network
Less flexible in hardware upgrade	Service provider manages the hardware upgrade
Additional expenditure on hardware when increasing capacity of system	Service provider takes care of hardware upgrades when volume grows.

6. Types of Class 4 Switch Vendors

There are several types of Class 4 Switch manufacturer that a VoIP operator can choose from for sourcing their desired solution. As previously noted, these Class 4 switch vendors are increasingly offering managed and hosted services.

Hardware Switch Vendor — Hardware switch vendors sell their Class 4 Switch as a piece of integrated hardware to the VoIP operator. This type of hardware is specially developed to run Class 4 switch connectivity. A hardware switch is offered by the more established vendors and can suffer from lack of features and complexity in configuration. Most require the VoIP operator to learn a specific command line syntax and do not offer additional features outside the scope of routing and switching. Due to the use of specialized hardware, this kind of Class 4 switch is typically much more expensive, but it is also more stable due to smaller feature scope and lack of integration issues, which may arise due to any potential software and hardware and OS

incompatibility.

Softswitch Vendor -Software switch vendors offer their Class 4 switch in a software format that the VoIP operator can install in a commodity server running either Linux OS or Windows OS. The vendor will offer either an RPM or IOS installation method for the VoIP operator to install on their own server. A VoIP operator can save a lot of money by running the software Class 4 switch in clouds such as Google Cloud Service or AWS. A software based Class 4 switch has many more features and functionality than the hardware option, and in most cases

bundled with billing, monitoring, and operation automated features such as rate generation and delivery.

The cost of a software based Class 4 switch is also much lower. Due to the ease of upgrade enjoyed by software based Class 4 switch applications, it is also much easier to add new features and patch any fixes required. Most of the software based Class 4 switch vendors also offer a hosted option which supplies the switching platform as a hosted service.

This classification of Class 4 switch vendor writes their own switching and routing logic. Some utilize open source SIP stack such as Sofia¬SIP or Resiprocate, while some write completely from scratch. Due to the large amount of RFC that a Class 4 switch needs to support and the large amount of different interoperability possibilities to various other switches, a well¬tested and used SIP stack is much more reliable than rebuilding a new one. It is a very difficult and time consuming process to develop and test all interoperability possibilities in the coding.

Opensource Softswitch — It is common for a VoIP operator to use open source software such as Opensips, Asterisk, and Freeswitch to run their VoIP operation. An open source softswitch's advantage is that it is totally free of charge, but it can suffer from a lack of customization in it's features, making it unsuitable for the needs of many commercial VoIP operators. For instance, Freeswitch, Asterisk, and Opensips don't have out¬of¬box billing and routing. The VoIP operator will need to hire a specialist to develop those capabilities, although some open source code does exist in the internet to be freely used. The cost and long term maintenance of an open source platform will require the VoIP operator to have a service contract or similar support, which has to be available at all times. If there is a problem, it may cause down time which is undesirable, as telecom operations need to be run on a 24/7 service to customers.

Freeswitch and Asterisk are commonly used by VoIP operators. These are plentiful in terms of the amount of sophisticated PBX media based features supported, but for a Class 4 switching service, these features are not always required. These additional unnecessary features make the switch inferior in performance. While it is possible to run well in small traffic situations, for a wholesales scenario of high density traffic pattern, they can't handle the CPS and will require a cluster of servers, which in turns mean higher cost.

Opensips (aka Kamilio) is commonly used by VoIP operators for wholesale operations as it

is known for its capability for handling very high call per second volumes. Opensips, however, suffers from a lack of billing and integrated monitoring features. Also the user interface for configuration of routing is clunky and difficult to manage. These capabilities will need to be developed or purchased from a third party to meet the client's needs, adding to the cost of the operation. A VoIP operator who is intensively relying on Opensips to run their day to day switching platform must also have its own in house technicians familiar with Opensips, or have a service contract with a consulting company. This also poses a higher risk of downtime and loss of service to users. When adding in a separate billing solution to OpenSips, a lot of development effort will need to be spent to make the entire integrated billing, switching and routing package work efficiently in a high performance setting, while at the same time being easy to administer by the VoIP operator's staff. Also, compared to an integrated software based Class 4 switch, this option means more hardware power is needed to run the extra software required to complete the total switching solution for end to end operations.

Compared to a software based fully integrated Class 4 switch, which is now being offered at very economical prices, with some VoIP operators offering a community edition free of charge, it means that the Open Source switch model is not a good option for a VoIP operator due to the additional technical maintenance and hardware costs that are involved in this set up.

Many software based switch vendors are simply building their solution on top of an open source software option, by adding a layer of interface on top to bundle the billing and routing surrounding the open source software framework. Most of these vendors offer their solution as a hosted package, as they don't own any of the intellectual property, but simply serve as a system integrator for various open source software options bundled together. While this kind of open source switch integrator does not require capital investment in software development, they do also suffer from poor scalability issues and that means more costs in terms of additional hardware and systems maintenance. This will in terms translate to higher price offerings to users. Therefore, it is not uncommon to see an open source switch integrator offering their hosted switch option at a similar or even slightly higher price than a software Class 4 switch provider who has invested the time and money on optimizing their fully developed and integrated Class 4 switch, to drive down the cost of greater ongoing maintenance and minimize the amount of hardware power needed for the same scale of operation.
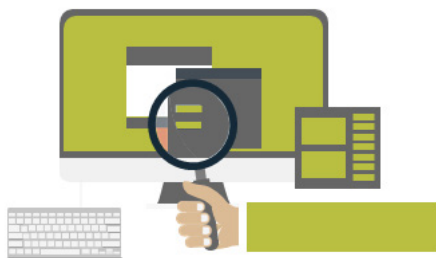
7. Other things to consider in the development of your VoIP solution and Switch solution.

- Will the Switch be compatible with the existing structure of my network and operations or will it require some tweaking of other areas to ensure a smooth flow of communications and control. Does it fit with the current operation workflow such as billing, invoicing, alert sending, rate import, generation and delivery.

- How easy will it be to administer on a day to day basis under normal circumstances. How much manual work is required to achieve all the necessary management of operations, or how much will I save on costs of administration through greater functionality of the Class 4 switch selected.

- Also how great is the risk of down time because of conflicts with other areas of the network and internet. Does the vendor have a good knowledge of configuring the Switch to work with all other connections currently used on the Internet. Is the interoperability fully tried and tested?. Will it be fit for purpose in all scenarios to ensure there is full market and use potential? Is there an evaluation programme for this?

- What sort of documentation comes with the Switch, is there a complete user guide. Is there any training provided to the staff. Does the vendor have its own engineers who understand the product fully and offer support staff available 24/7.

This buyer's guide has focused on carrier grade Class 4 switches but all the above points need to be considered when shopping for any size of switch and VoIP operation. It is important that buyer considers what it is they want from their investment and how the Switch is to be maintained and operated to achieve the best possible solution for the business.

Appendix A: Benefits of Integrated Class 4 Switch

In the past, VoIP Operators had one way to get their VoIP business up and running at a reasonable cost: by purchasing billing, switch, reporting, monitoring solutions from different vendors and integrating each of these themselves. With the advent of an all¬in¬one integrated Class 4 Switch, however, Class 4 Switch vendors began to offer telco¬in¬a¬box all¬in¬one software to their customers. An integrated Class 4 Switch has many advantages over traditional standalone Class 4 switch options:

- Elimination of risk and cost associated with integrating different software packages
- Elimination of point of contact failures and risk at the integration points between software packages
- Have one point of contact for all support and issue resolution
- Higher performance, more real¬time, less down time

Appendix B: ROI Case Studies

VoIP operations can allow a business to improve profitability, customer service, and can lead to a reduction in operational costs —and deliver a return on investment (ROI)—let's take a look at two case studies:

>> A US VoIP Operator

>> An Indian Call Centre

Case Study: A US VoIP Operator whose core business is call center traffic

For a VoIP Operator whose primary client base is call centers, the day to day challenge is to terminate extremely high call¬per¬second short duration traffic during peak hours. Terminating call center traffic means higher profit but the call center requires very high cps traffic to be handled or else the call center may lose money and efficiency. This is particularly noticeable if the VoIP operator's switch encounters failure, inability to respond to SIP requests or rejecting of calls during peak periods.

So the VoIP Operator decided to move to another Class 4 Switch that is especially designed to support high call¬per¬second traffic. By implementing this high performance Class 4 Switch, the VoIP operator was able to increase sales revenue, knowing that the call center is confident that their traffic can all be terminated without technical failure in the switching operations. The VoIP Operator can focus on business development instead of the troubleshooting of the Switch.

There is also no need to ask the call center clients to reduce the CPS limit.

The new Class 4 switch enabled higher CPS traffic to be terminated. In addition, the optimized software Class 4 switch infrastructure allowed the VoIP operator to add light weight proxy to handle increases in load, along with a centralized routing and billing engine. Moreover, the network support staff can use one single interface to see the traffic across all SIP proxies while managing a single set of centralized routing configurations. The VoIP Operator will save millions of dollars by reducing switching costs and the OPEX associated with multiple Class 4 switch solutions.

As an added benefit, the company is able to save substantial amounts of money each year on switching costs, by moving to their own hosted WAN¬based solution.

Case Study: An Call Center company based in India

 The company in this case study is a call center located in India. It is serving US based companies by providing English speaking telephone sales support. Each day, it aims to make

over 500K outbound phone calls to the United States. The company is using Vicidial software

services and all outbound calls are sent to a US VoIP operator at a flat rate per minute.

In order to avoid call rejection, the call center paid a high raid per minute. However, they were frequently facing problems during peak periods, as the VoIP operator they were using was getting switch failure when the call value was high. So, the call center finally decided to invest in its own Class 4 Switch. By using this the call centre is able to set up dozens of VoIP operators and the solution provides an LCR feature to send calls to the lowest call vendor based on each vendor's rate deck.

When one vendor is getting a switch failure, the call center's Class 4 switch will automatically route calls to the next VoIP operator. Not only can the call center enjoy non¬stop 24/7 termination of calls via the use of over dozen VoIP operator routes, it can save as much as 50% of charges, by sending calls to vendors over Least¬Cost¬Routing to each VoIP operator's variable rate deck, instead of paying for a high flat rate to just one VoIP operator.

The Class 4 solution has given the call center the control they need to manage their own VoIP network and increase their customer satisfaction and operational efficiency.

Appendix C: Key Factors and Offered Solutions

Key Factors	Offered Solutions	Consider
Capacity	Session Performance ¬published QoS information such as ASR and ACD	Live conditions measures,maximum load tested, ddos response, disaster recovery, hardware restart, server failure
Commercial suitability	Service run as wholesale or retail business. Case studies	Tracking of all call attempts, connections, costs, user feedback, down times, failure rates, billing, general activity reporting for management
Security	Protection levels from fraud, hacking, privacy issues	History of vendor, independent audits,
Interoperability	Ability to work with other switches and protocols across the internet with efficiency and low failure rates.	Full testing of Switch in real world setup, other customer's results and recommendations.
Scalability	Options for adding additional capacity to the system with minimum cost and restructuring	Looking at tomorrow's plans and needs and whether the Switch will fit with anticipated growth in traffic. Storage in the 'cloud'.

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