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1. Introduction

The telecom voice wholesales business is undoubtedly a difficult business to be in right now. The impact of free communication apps such as Skype, Whatsapp and Wechat have significantly reduced the volume in voice calls that everyone makes. Overall, there is much less volume and Tier One telecoms are reducing the retail rate to their retail clients so as to increase the volume of their own domestic traffic and also any overseas traffic. All this boils down to reduced margin per call which, along with lower call volume, has resulted in significantly less profit. At the same time, in order for carriers to cope up with greater competitiveness in the business, they need to look outwards to build more interconnections, finding new ways to maintain the same business profit. Everyone in this industry would agree that the voice wholesales industry is a highly dynamic one, with rate changes every minute. No matter whether volume is low or high, a wholesale VoIP carrier has to deal with constant rate changes, routes changes, contract changes, disputes and trouble tickets all the time.

At the same time as VoIP (Voice over Internet Protocol) wholesalers are experiencing eroding profit, the daily operation has become much more complex and these factors as well as the following industry developments are what is driving the next generation VoIP wholesales platform.

1.1 Increasing trunking to IP-based SIP trunking for voice communication

In the past, wholesales carriers have been mainly using TDM circuits to transmit voice calls. TDM circuits, despite the fact that they terminate voice calls with high quality and guarantee delivery of service, are expensive to deploy. Nowadays, carriers are rushing to IP-based SIP networks to exchange voice traffic and this IP-based voice network has virtually no cost to it. As IP-based networking technology is progressing, the quality of voice call over IP is already as good or nearly as good as TDM. This has made it much easier for new players to enter the industry, becoming a telecom carrier or wholesales carrier by utilizing VoIP technology.

1.2 Trading volumes are getting bigger and bigger

The use of VoIP and SiP (Session Initiated Protocol) trunking has significantly drive down the cost of wholesales trading. It costs next to nothing to establish interconnections. Many wholesales carriers have 500 or even over 1000 trading partners and trade in terms of millions of minutes per day.

1.3 Growing number of voice carriers and resellers

With the use of IP, there is very little capital cost for anyone to start up in the business and become an ITSP (Internet Telephony Service Provider). Anyone can get a VoIP switch running for as little as \$500 per month and start trading very rapidly. With a lot more players entering into the market, a voice wholesales carrier needs to be able to cope with many more partners and interconnections in order to take advantage of expansion in route choices and reduced rates from larger partner pools.

1.4 Tier One carriers are entering the wholesale space

As domestic voice volume is decreasing, many global tier one carriers are starting to turn to wholesales trading to maintain their revenue. Tier one operators such as Orange, AT&T and Verizon are consolidating their retail call volumes and leveraging this to trade at the wholesales level to 1) drive down cost and 2) increase revenue, by establishing more bilateral partnerships and swapping their own retail routes with other partners, selling international voice termination at a global level.

1.5 Technology players are getting into the telecom market

Players like Microsoft who are entering the telecom space selling voice services with Skype or what Google provides with their Google Voice application, is quickly changing the market space. These technology giants may sell voice services at loss but make money on cloud services.

1.6 Increased number of spam or unwanted traffic

With the usage of IP and SIP trunking, it is becoming much easier for people to set up an outbound call center to robo-dial calls out for marketing or fraud purposes. Anyone nowadays can download some open source software and start robo-dialing. The cost of robo-dialer software has been reduced to virtually nothing and as a result, the volume of call center traffic keeps increasing, while the volume of real person to person calling traffic has gradually been decreasing.

These industry wide changes are already being felt in the market and each voice carrier must face up to them and realistically ask themselves how they should cope going forward. A voice wholesales carrier can either take advantage of the trends, ride with them and make them work to their advantage, or risk being outperformed by other companies who see these developments as an opportunity, instead of hurdles to their operations.

Unlike in the old days, a voice wholesales carrier can't rely on a good team of people to compete successfully in today's telecom wholesales business. It is much more important to have a great platform that is equipped with artificial intelligence and automation, one that can fully and systematically align the entire organization's operation and workflow. This is the key to success in the industry in the years to come.

With this in mind, the purpose of this white paper is to give an introduction as to what a next generation wholesales platform should include.

2 What does it mean to be a Next Generation Wholesales Platform ?

The idea of fully integrated wholesales platform is not a new one. The idea has been floating around in the telecom industry for quite some time already. Many telecom carriers even have a large in house IT team to build up their own set of automation capability and workflow automation solutions. For the larger carriers, departmental function is so scattered in different places that

each party is worried about losing the control they currently do have.

Due to the eroding of profit and increasing interconnection, even traditional tier one carriers have no choice but to adopt an integrated wholesales platform approach, in order to save labor processing cost, reduce loss arising from human error and increase the speed of response to customers.

In this white paper, we will cover all the key factors for a wholesales carrier to decide whether to switch to a next generation voice wholesale platform.

3 Key Benefits of an Integrated Wholesales Platform

One of the key benefits of an integrated wholesale platform is that it's a central data source for all the variables important to a voice carrier's business. It includes call detail records (CDRs), rates, payments, invoices, etc.

An integrated wholesales platform consists of switching, routing, finance, reporting and customer interaction in one central data system.

The idea of an integrated wholesales platform is to build this intelligence in a closed loop manner to link up every process in a voice wholesales business, including sales, operation, finance, routing, and billing. As a user of an integrated wholesales platform, the carrier not only gains speed and access to real time data, but also accuracy and efficiency in day to day operations.

3.1 Increased profitability from gaining and sharing visibility into the business

The purpose of integrating processes together is so that the entire integrated workflow can bring in much more value to the business as a whole.

For example, a network operation center manager may need to know how much traffic was terminated in the previous month or which clients bring in more profit, in order to allocate limited capacity and resources in a more intelligent manner.

Likewise, a finance person whose job was primarily to manage accounts payable and accounts receivables, could now identify whether a route is selling at loss, or if any particular vendor may bring better margins compared to the others.

Giving this full visibility to everyone in the business not only helps them to carry out their own job more accurately and efficiently, more importantly, it gives the personnel involved a way to point out potential loopholes and undiscovered profit opportunities.

Here are some examples we can think about:

Opportunity Analysis

With total visibility into buy and sell rates, an integrated platform can uncover certain aggressive rates that exist for a specific country for a very short amount of time.

An integrated wholesales platform can discover specific codes that are selling at below market price and give a carrier the opportunity to cherry pick for even a short period of time.

Reporting

A real-time reporting system give you visibility to check the profit at a client level, vendor level or destination level. You can see for each destination what kind of margin you are earning for each client. If one client is offering a higher margin, then it means you can try to offer different terms to your other partners or allocate more capacity to the client that shows the better profile. A Network Operations Centre (NOC) can look at this and make routing changes immediately, to generate additional margin for the company.

Pricing Analysis

An integrated wholesales platform will let you see the quality of route and rate of route together on one screen. With this information, NOC personnel can intelligently route traffic based on both the profitability and quality of routing. Sometimes, a route that has higher margin may have lower Answer Seizure Ratio (ASR). A NOC can route traffic based on percentage, round robin or least cost routing. A top-notch routing manager should consider both vendor rate as well as route quality when deciding how to route each call.

Rate Generation

Usually the people who generate rates don't care about quality of route or the amount of trouble tickets due to a lack of visibility on these statistics. An integrated wholesales platform not only automates the rate generation process but also take into consideration the quality of vendors when generating proper rates offers.

3.2 Greater Automation

Automation gives significant advantages to a voice wholesales carrier because it leads to greater accuracy in every aspect of the business. In the telecoms world, a few mistakes or a dot in the wrong place can be catastrophic, as these can cause a lot of problems in the billing and generate more disputes. Whenever there is an invoice dispute, this causes the finance personnel a lot of work in checking and comparing CDRs. In a typical tier one carrier, each day may have billions

of call records. The amount of time spent in reconciling disputes and the cost associated with the manual labor involved in this can be as much as the disputed amount.

The beauty of an integrated wholesales platform is that it prevents such problems at the root level.

Automation can also reduce the amount of manual labor required overall. With an integrated wholesales platform, it is not abnormal to run the entire voice wholesales operation with one or two staff at any time.

An integrated wholesales platform can significant trim down the labor needed for normal operations such as:

Rate Sheet Generation - When the logic of how a rate deck is supposed to be generated as well as the delivery of rate deck to client, is fully automated, one can serve more clients with less time.

Invoice Delivery - With auto invoice delivery, the integrated platform automatically issues invoices based on the payment terms of each client. There is no need to compile a bunch of invoices but simply let the platform handle it automatically. Once set up, invoices get sent out without any error or mistake.

Automatic Rate Import - Manual rate import is always a key source of error in a dispute situation. With an integrated wholesales platform, rate sheets of different forms and style can be reformatted by the platform automatically without any error.

3.3 Speed of Operation

In the voice industry, it was standard that there is a week's notice in advance for all rate changes. This was to allow time for a carrier to upload revised rates and reduce the possibility of charging errors due to insufficient staff time to upload changes eg during holiday periods.

In many cases the market of voice is changing so fast that now a vendor may change rates immediately or if you request an advance notice, the vendor would have to block the route until that notice week has passed and the new rate is effective, to reopen the route. This means that within that entire week, the destination may be totally closed off. In voice wholesales this kind of situation often happens, especially when there is a national crackdown in SIM boxing or some other sudden political event.

Therefore, the ability to be able to react quickly to the changes in the market condition in a way that does not increase the possibility of human error is a key capability giving a carrier opportunities to outperform others in today's voice wholesales business.

3.4 Integrated System

Many VoIP wholesales carriers use more than one system, rather than have them integrated together. For example, in many carriers, there is separate routing engine, switch engine and billing engine. The next generation integrated wholesales platform is superior in that there is not only cost saving in hardware utilization, there is significantly less administration required than is necessary in maintaining multiple systems. The administrative integration between each system is in itself a lot of work. This is also a driving force behind why many Tier One operators are migrating to an integrated wholesales platform.

Within the scope of an integrated voice wholesales platform, billing is only one aspect of it. There is also routing, monitoring, credit control, finance, reporting, etc. With an integrated approach, a voice carrier can reduce both workload and risk of error on integration of many heterogeneous systems altogether. There is no need to wait for months to add single features and have them reflected in all systems.

Here are some ways a voice wholesales carrier can take advantage of an integrated wholesales platform:

- Ease of communication between departments

In the old days, it was necessary for one department to take a screenshot, export the report from one system and send it over to another department. An example is where a Network Operation Center has access to a routing report and can tell who is terminating traffic to whom. The finance department can only see CDRs and invoices from the billing platform. When finance needs to reconcile traffic for disputes purpose, there is a lot of downloading or screen capture that has to take place. On the other hand, a fully integrated wholesales platform lets a carrier's internal department be able to work synchronously on one platform and based on one set of data. Not only is the work more efficient, but also less error prone.

- Consolidating of origination and termination traffic

Many carriers have two systems, one for wholesales termination and one for DID/Origination traffic. It is not easy for finance to come up with a consolidated invoice without copying and pasting reports from various systems.

More importantly, the ability to easily set up routing to route more calls to numbers that are owned by the carrier can be a big cost saving, especially for Tier 1 carriers that have a lot of DID subscribers. By having both origination and termination traffic together on one platform, a carrier can effectively route calls to their own DID networks and reduce the cost to this on-net traffic to virtually zero.

- Consolidation of international and domestic traffic

The ability to route both international and domestic traffic within one coherent platform is another huge benefit to a carrier's routing operation. With the decreasing domestic traffic due to growing popularity of FREE P2P apps such as Whatsapp, Facebook Messenger, and Wechat, each country's tier one operators are seeing less local traffic. The trend of the next generation integrated wholesales platform is to enable carriers to increase revenue by being able to terminate international traffic and sell additional products in one platform.

3.5 Efficiency in Finance Reconciliation and Dispute Management

Accounts payable and receivable are one of the most important aspects within a voice carrier because any delay in processing means losing the trust from vendors and not getting payment on time. With margins decreasing, it is not uncommon for a carrier to make 1 -2 % profit out of the overall revenue. Many carriers are using factoring to finance their traffic flow as well. That is why the ability to send out invoices on time and the ability to quickly reconcile incoming invoices are critical to the success of a voice wholesales carrier.

With the help of an integrated wholesales platform, the finance department can quickly pull up reports in real time from live traffic. There is no need to wait for call detail reports to be exported and then imported to some other reporting system. The data lost due to errors or mistakes in the integration is also fully eliminated as well.

Invoice dispute is very common in the voice wholesales industry. With an integrated voice wholesales platform, the data for each generated invoice is all drawn from the same database and therefore, the possibility of error is less and invoicing is much more accurate. When any client dispute arrives, a financial team member can easily pull up reports and compare by code or destination bases more easily, quickly figuring out the reason for any dispute.

In the old days, the finance personnel would need to do a lot of manual work including downloading CDRs, summing up numbers on Excel. Some carriers would even waive a dispute if it was only for a few hundred dollars because the cost of labor in reconciling the dispute was just too much to justify reviewing the charge. With the efficiency introduced by an integrated wholesale platform, the carrier can get accurate reports that they can count on in real time.

While terminating traffic, it is very common that one destination may be terminated by more than one vendor. With thousands of destinations and where each destination can have multiple vendors, it is very difficult to manually figure out the best vendor constitution for each destination. With real-time profitability reporting, finance and routing engineers can in real-time pinpoint cases where one vendor is terminating at a much lower rate and therefore, route more traffic to them for that particular destination. An integrated wholesales platform can not only route calls by least cost routing, but also send out a notification when a cost reduction opportunity exists.

4 Advanced Features in a Next Generation Voice Wholesales Platform

In addition to the benefits described above, a next generation voice wholesales platform can bring in much more capability, which we will look at in this section.:

4.1 Real Time Routing

The next generation defines real time routing not only by least cost routing, but the platform can also have intelligence to select routing based on hour of day, day of week, caller-id, as well as real time statistics such as capacity limit, real time ASR and ACD at the country, destination or code level.

In the older generation of wholesales platform, a carrier would set up batch loading to export CDR, aggregating data into a report, and regenerate new routing based on historic data and then import the routing selections back into the routing engine. With today's latest generation of voice wholesales platforms, all data is centralized in one place, the routing engine gets real time CDR and real time reporting on which to base its routing decisions. There is no need for any duct taping solution to glue systems together and suffer the unavoidable delays in a scattered systems approach.

4.2 Real Time Reporting

Before the arrival of next generation voice wholesales platform, it was very common for a voice wholesales carrier to purchase or rent reporting platforms. There are many reporting platforms out there that utilise different adapters to read the call detail reports of their many switching engines. One can imagine that with this kind of approach, any change in feature in the switching engine is not easily highlighted by the reporting engine because these are developed by two different parties. Also, there are always delays involved in exporting, importing, and aggregating CDRs. Many errors can occur even during the transmission of data.

In the world of telecommunication, business operates on a 24/7 schedule. There is never a single minute that there are no CDRs being generated. The more complicated the integration workflow is the higher the possibility of errors.

With the next generation wholesales platform, everything is all in one, all the time. CDRs is real time, and reporting is tightly and self-sufficiently integrated. Accuracy and real-time visibility work like a piece of cake in this system.

4.3 Real Time Rate Updates and Granularity of Rate Definition

In the old days, a carrier would have separate systems for billing and for routing, along with yet another system for switching. What that means is that when a rate sheet arrives, someone would have to import it to the billing system, then the routing engine would rank the vendor route by cost and come up with a routing table, which is then loaded to the switch or the switch would query in real time to the routing engine.

The problems in this are twofold. When rate data needs to be propagated from one system to next, that means there are many opportunities for error. Also, it means there is going to be some delay before a new imported rate can affect the routing. With international wholesale voice business, rates change constantly and clients expect any decrease to be effective immediately with live traffic charged on that new rate. Any delay in implementing a new rate may be a potential loss to the carrier or a risk of clients moving elsewhere.

With the introduction of a next generation voice wholesales platform, since data is all integrated in one place, this data centric approach makes it possible for routing to take immediate effect whenever a new rate is advised and imported. Data for rates can be constantly verified against neutral third party listing sites which also reduces the risk of delays in updating this information.

This instant effectiveness of any rate changes and have it directly imported into the routing logic, is what makes the next generation wholesales platform's data centric model most competitive.

4.4 Credit Management

There have many many stories about carriers getting defrauded by a client because the system they were using did not have the ability to block traffic in real time. This problem has been very severe for carriers with either prepay or postpay clients.

Without an integrated wholesales platform that keeps one single repository of client balance and client payment history, it is not possible to cut traffic in real time. When billing and switching are in different engines, there are always delays in disconnecting live traffic for clients that are below the limit.

While some traditionally designed systems do make use of real time querying from switch to billing engine to obtain the balance outstanding for each client, making it near real time, this suffers from the following disadvantages:

1. It is causing additional PDD (post dial delay) when each call generates a request from the switch to the billing engine before the connection is confirmed and created by the switch. In the wholesales world, each millisecond increase in PDD has a negative effect in the ASR of your live traffic.
2. When a client is sending a high volume of concurrent calls that have very long duration, checking the client's balance at the beginning of each call is not going to work because

when the client's balance is below the credit limit, there are some calls still in progress.

When using the next generation wholesales platform, the data centric approach means that the switch has real-time instant access to a client balance without any need for integration. Whenever a client's balance is below the credit limit, the switch is instantly aware of this without any delay or integration and so the switch can cut the in-progress calls accordingly.

4.5 Big Data CDR Processing

It is not uncommon for a typical voice wholesales carrier to process 100 millions of CDRs a day. Even a small wholesales carrier easily has over million CDRs each day. When it comes to troubleshooting a ticket, it is critical to be able to pull up any CDRs in real time, without delay. So, the ability to store and quickly search for CDRs is an important feature that affects the day to day operations for all staff within a carrier business.

In some countries, such as US, a law enforcement agency may require carriers to keep CDRs for as long as 9 months.

Additionally, a carrier always need to handle plenty of re-rate, which puts a lot of pressure on carriers to be able store CDRs for a significant period of time. As a result, there is a growing demand for the next generation integrated wholesales platform which includes cloud storage facilities such as Google Cloud Storage or AWS. The platform will not just push CDRs into cloud storage but must also retain the ability to query them when needed. That means the next generation integrated wholesales platform needs to keep open access locally such that when a user demands any historical data, it can be quickly and easily returned.

4.6 Multi-Tenant Cloud

The next generation integrated wholesales platform should support both stand alone deployment as well as cloud based deployment. By integrating all processes tightly and cutting off all the unnecessary re-integration, a wholesales platform can be run in a much more efficient manner such that multiple carriers can share the same set of equipment and create major reductions in CAPEX to benefit everyone in the exosystem.

Multi-tenant cloud-based wholesales platforms are especially attractive for medium to smaller wholesalers because everyone shares facilities, renting or leasing as needed at a much lower cost.

4.7 Partner portals

In today's voice wholesales business, speed is everything and wholesales business is also a customer service centric one. The faster you can get data to your clients, the more clients will stick around. In the next generation voice wholesales platform, a carrier can provide a vendor and client portal for their partners to check CDRs, view reports, file trouble tickets and download

rate decks. Customer service is significantly improved with no additional labour cost through the use of fully automated partner portals.

Automatic payment submission and auto credit update is also another key factor as well. Especially for prepay clients want to have the ability to pay whenever they want to, even outside a carriers' office hours or if closed for national holidays. The ability to instantly accept and update payment and credit via a portal is what makes it attractive for clients to continue cooperation with a carrier.

4.8 Rate Deck Generation and delivery

In a typical tier one carrier business, there will be a pricing team that is specifically responsible for determining the rate for each country. In order to generate a new rate deck, most carriers use excel spreadsheets and manually grab rates sheets from different vendors. The problem with this approach is that it is inefficient, very manually intensive and where in the voice wholesales industry rates change every instant, quickly out of date..

It is very difficult for a human being to compare manually the new vendor rates and sell rates for each and every destination. It is very easy for someone to miss out on rate changes or update a rate incorrectly. While it is possible for a carrier to reconsider the rate changes following scheduled rates changes, time has already been wasted.

With the next generation voice wholesales platform, all the vendor rates and the carrier's own sell deck is all centralized in one data repository. The platform can therefore, easily and automatically, generate new rate decks based on the most updated rates on each and every destination.

The other aspect of rate generation is the delivery of the new rate deck to the proper set of clients. Many clients are using mass mailing to achieve this task. With the use of a new generation voice wholesales platform, rate is delivered to each client accurately and automatically. The platform knows which clients are assigned which products and rate decks. Where a new rate deck is automatically generated, the platform can also send it out directly to the relevant clients as needed.

Even more important than that, a next generation voice wholesales platform can even track if the rate delivery email is actually opened and acknowledged. The platform can track if the specific rate deck file download URL is being clicked on and if not, it can automatically disable the client trunk temporarily to avoid any potential rate disputes.

4.9 QoS Routing

For voice wholesale carriers that also terminate their own organic retail traffic, buying the lowest cost route is less important than end user satisfaction. With much higher margin, voice carriers can afford to pay for more quality routing in order to maintain end user retention levels. This is

where QoS based routing becomes a factor in the service provided by a carrier . QoS routing means the platform should rank each termination vendor for each destination and send calls based on ASR and ACD from the highest quality to the least.

With the traditional wholesales platform or a platform that is re-integrating stand alone reporting and routing engines together, they would normally do a batch run for re-evaluating the quality of each terminating carrier based on live traffic. Then, there needs to be some program to convert the QoS ranking back into the routing database for updates to the routing system.

This process can be automated, but it is still run in batch mode and based on historic data. In the voice wholesales market, which is highly competitive and where everything changes instantly, this can create several different issues. For instance, a GSM gateway route may have worked perfectly one minute ago but now it is not working due to SIM cards getting blocked. Therefore, it is very important that the live traffic QoS can be directly integrated with the routing to achieve a real-time QoS based routing selection.

4.10 Test Call Automation

Test Call management is an important aspect for the wholesales carrier's NOC personnel. Nowadays, there are many third party test tools out there that let a VoIP carrier easily conduct test calls and report good results including ring tone, and live media recording. It also let NOC personnel trigger immediate trouble tickets whenever a test call result shows the route is unable to connect or for false answer supervision. Nowadays there are many kinds of testing sites out there providing this kind of service. The issue is that a carrier will need to setup trunks in both the test platform and in their own switch platform. When fault is identified, NOC personnel will need to go back to the switch platform to adjust routing.

In next generation VoIP wholesales platforms, the test call is integrated tightly with the platform. When a fault is found, NOC personnel can very easily trigger a route block or route changes. Similarly NOC personnel can simple click a button to trigger regular test calls, or even let the platform automatically issue test calls on a scheduled basis and automatically block or adjust routing for any route that is found to be faulty.

With the help of a next generation VoIP platform, the carrier not only improves their quality of routing, but also significantly increases customer satisfaction through automatic route checking. This capability is especially important for carriers with retail traffic.

4.11 PCAP Storage

For a carrier, the ability to be able to pull up packet capture (PCAP) at will is a variable capability used when it comes to troubleshooting a media problem or for dispute resolution. For example, when two carriers are in dispute due to duration difference, PCAP is the best way to show via the electronic signal, when is the exact time a call is answered with 200 OK or ended with

CANCEL or BYE.

The traditional problems with giving carriers the ability to obtain the PCAP file for each call are the following:

1. The times when a PCAP file is needed for a specific call is rare, but the storage needed to store PCAP files for all calls for a specific period of time is huge.
2. Capturing and storing PCAP for the network interface and segmenting them into one file per call is an operation that consumes a significant amount of CPU and Memory
3. A fast I/O is needed to save PCAP files in hard disks.

The next generation VoIP platform will need the ability to be tightly integrated with cloud storage to store PCAP files remotely. Also, upon user's request, the next generation VoIP wholesales platform should be able to easily correlate the relevant PCAP for each particular call and return it as a downloaded file or in a graphical display of call flow.

4.12 Trouble Ticket Integration

The next generation wholesales platform not only effectively aligns all departments within a carriers business, harvesting the benefits of time saving and less labor, but also lets carriers collaborate more effectively with partners via trouble ticket integration.

There are two ways that a next generation wholesales platform can achieve this. Firstly, the next generation wholesales platform can set the wholesale carrier's network operation center staff to be notified at specific QoS parameter thresholds, such as minimum ASR and minimum ACD. When such parameters are set, the next generation wholesales platform will automatically send out trouble tickets with CDR reports to the partner's email.

Secondly, the carrier's network operation center staff can easy select CDRs for specific calls and then request the platform to send out trouble tickets to partners automatically. The platform can even associate each CDR with a PCAP file and send it along within the trouble ticket email.

5. About DeNoVoLab Class 4 Fusion

DeNoVoLab is the market leader in voice wholesaler platform solutions, helping carriers to solve the many challenges of operating an efficient and profitable VoIP business with its advanced software, Class 4 Fusion. Class 4 Fusion enables carriers, resellers and emerging market providers to automate their wholesales operation from finance to engineering, reporting and to real time monitoring.

DeNoVoLab have developed a fully automated and highly efficient platform that links up all processes within a carrier business. DeNoVoLab's solution is different from other solutions in the market in the following ways:

5.1 Fully Integrated

DeNoVoLab's Class 4 Fusion integrates all the vital components of a carrier's network together, including Routing Engine, Switching Engine, Billing Engine, Reporting Engine, CDR Storage, and Monitoring.

5.2 High Performance

DeNoVoLab's Class 4 Fusion is built from the ground up to handle high call per second and concurrent call sessions. All modules from routing, switching, CDR generation, and reporting, are designed and developed with the real-time handling of tens of thousands of call per second in mind.

5.3 Big Data Approach

DeNoVoLab's Class 4 Fusion platform has a built-in 'Big Data' database that is specialized and optimized for very high volumes of CDR traffic. Supporting hybrid local and cloud storage such as AWS and Google Storage and automatic CDR migration from local to cloud storage, there is no need to worry about running out of disk space and yet, the carrier's personnel can still query historical CDR records at will.

5.4 Data Centric Design

DeNoVoLab Class4 Fusion keeps a single set of data and all modules are run on top of the same data set. With this approach, the finance, network, and routing operation can get a 360 degree view of each partner. This is especially handy when for example, a partner is not paying their bill, then the billing module can automatically detect and disable the client, within needing any manual intervention or integration between different systems.

5.5 Distributed Architecture

Class 4 Fusion architecture is fully distributed in such a way that a carrier can run multiple instances of switching engines and routing engines on the same colocation facility or on separate facilities. This flexibility enables maximum redundancy and zero fault tolerance.

5.6 Automation Support

DeNoVoLab's Class 4 Fusion is bundled with many automated features that are not found in any other traditional VoIP wholesales platform, such as:

- Automatic Rate Generation
- Automatic Rate Delivery
- Automatic Route Testing
- Automatic Rate Import

5.7 Fault Tolerance

DeNoVoLab Class 4 Fusion is able to sustain all possible system failures and still able to protect the carrier's operation. Some examples of Class 4 Fusion's fault tolerance ability are as follows:

Disk Failure or Out of Disk Space - Class 4 Fusion automatically rejects new call attempts with a 503 Service Unavailable flag. That way, clients can route advance to the next available carrier and at the same time protect carriers from billing disputes.

Database Failure - Class 4 Fusion uses Postgres Database to keep configuration data but does not rely on this database to route traffic. When the database failure occurs, a switch can continue to operate and a client's balance data is kept inside the switch. So, in case of Database failure, the switch can continue to terminate traffic and balance will continue to be tracked as well, internally within the switch itself until such time as the database is running again.

Automatic Recovery - Class 4 Fusion comes with a state of the art automatic self-recovery mechanism. In case of hardware, operation system, or software failure, the platform's self-recovery mechanism is capable of self-restarting and automatically processing all call records to ensure no false billing is generated.

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