NGN MIGRATION STRATEGIES

A comparison of the options available to service providers for migrating from circuit switched to next-generation, multiservice broadband networks

A MetaSwitch™ White Paper

SUMMARY

Service providers are seeking to migrate their voice networks from traditional circuit switches towards a next generation architecture. This holds the promise of an integrated infrastructure and the ability to offer new converged services, but also presents a bewildering array of options. This white paper seeks to

- identify six key "litmus tests" for next-generation voice solutions
- apply those tests to a range of possible approaches to strategic network migration.

We conclude that service providers should look for solutions that can be readily integrated with the traditional network, while offering a clear packet-based migration path that does not fundamentally depend on legacy equipment.

NOTICE

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1. BACKGROUND

For many years, service providers have deployed separate voice and data networks, based on proven – if expensive – equipment from the major vendors. This approach has brought many advantages, for example in terms of reliability, but turns out to be restrictive when compared with Next-Generation Networks (NGNs), which promise

- improved network efficiency and reduced operating costs thanks to a converged, packet-based broadband infrastructure
- increased flexibility to rapidly deploy innovative converged voice/data services based on open, multi-vendor architectures.

The reality is that while many of the NGN pieces are in place, the architectural models and standard protocols are relatively immature and rapidly evolving, with the result that we are still some way from a comprehensive end-to-end NGN solution.

This creates a dilemma for service providers who

- need to minimize capital outlay and maximize short-term returns
- realize that some next-generation equipment can be deployed today, offering significant short-term benefits
- are worried about building a network that cannot evolve as the NGN standards emerge
- have concerns about the reliability and stability of potential vendors, large and small.

This white paper examines some of the options available to service providers seeking to navigate their way through this uncharted territory.

2. THE SIX TESTS

When evaluating a next-generation solution, there are many questions that need to be asked to determine whether it offers a deployable NGN migration strategy. These can be distilled into six key tests.

1. **Is the service intelligence located in the Converged (Packet-based) Network?** Any technology that relies on legacy circuit-switched network elements for call control and service intelligence is unlikely to evolve and be at the heart of the next-generation network.

2. **Are the architecture and standards employed open and mature?** If not, there is the very real risk of being locked into proprietary, unstable and/or dead-end technology.

3. **Does the technology enable convergence of the access network?** Delivering voice and data over a single broadband connection (whether DSL, T1, wireless or fiber) is a key step in achieving long-term end-to-end convergence.

4. **Does the technology enable convergence of the backbone network?** The advantages of maintaining a converged backbone are just as great as for converged access lines – and a fundamental part of the NGN approach.

5. **Does the technology integrate with existing legacy systems?** While the eventual goal is end-to-end NGN, it will be decades before legacy networks disappear. On the access side, this means that support for POTS telephone lines and DLCs may be a requirement; in the backbone network, interconnection with SS7 signaling and TDM trunks, 911 and operator services, databases for 1-800 and local number portability and CALEA[1], are all essential. Furthermore, provisioning and network management systems must be capable of seamless integration with existing processes.

6. **Is the solution ready to deploy?** In addition to the above considerations, carrier-class reliability, manageability and quality of service are vital. A carefully planned series of lab and market trials are essential to ensure that equipment meets the required levels of reliability and quality.

The rest of this paper examines the following migration options in the light of these key tests:

- Legacy Class 4 / 5 switches
- "Green Field" Softswitch/VoIP
- Internet Offload
- Class 4 Replacement
- First-generation Voice over Broadband
- The MetaSwitch Solution.

[1] Communications Assistance for Law Enforcement Act

3. MIGRATION STRATEGIES

3.1 LEGACY CLASS 4 AND 5

The "easiest" path – particularly as the cost of legacy Class 4 and 5 switches tumbles – is to continue with the existing, proven technology, waiting for the NGN products to mature and evolve.

While it makes sense to make maximum use of already-deployed equipment, those service providers who sensibly put an NGN transition strategy in place now will reap the rewards of that investment through

- cost and operational savings
- enhanced services that will attract and retain customers
- experience of the new technology that will enable them to stay ahead for years to come.

In short, this "wait and see" approach is reliable and well-understood, but does not position service providers for a converged network strategy and, with the service intelligence placed firmly in the legacy network, does not represent a future-proof investment.

3.2 GREEN FIELD SOFTSWITCH/VOIP

Service providers planning a "green field" deployment, with no pre-existing legacy equipment, may consider an installation using only next-generation equipment such as Softswitch call agents, signaling and media gateways, residential gateways, and IP phones.

While this is clearly the long-term architecture towards which the industry is working, in the short-term there are several issues.

- Legal requirements (e.g. for 911, CALEA) and customers' expectation that services will be at least equivalent to those currently delivered by Class 5 switches, mean that substantial legacy interfaces will be required.

- As already indicated, standards for Softswitch-based networks are still being defined (e.g. which protocols to use for signaling between call agents), with "interoperability islands" between small sets of partners. Any pure NGN solution will likely require the use of proprietary protocols, with the result that the selection of a particular vendor's Softswitch restricts the choice of interoperable network elements.

- Service providers are finding that it is not just the standards that are immature: much "pure NGN" equipment still has a long way to go before it can demonstrate carrier-class reliability and quality of service that is essential for a competitive offering.

- Immediate deployment is also complicated by lack of integrated management tools, and limited scalability of many Softswitch platforms.

The bottom line is that, in most scenarios, service providers need to examine hybrid approaches that will fit into the existing network, and act as a strategic bridge allowing migration to greater NGN capabilities over time.

3.3 INTERNET OFFLOAD

With the rapid increase in dial-up internet calls, the Class 4/5 switch network has had to cope with an increase in average call duration – from 2-3 minutes up to over 20 minutes. A variety of "Internet/PRI Offload" or "Tandem Offload" applications enable calls to service providers to bypass Class 5 switches, thereby freeing up those resources. Two such applications are shown in Figure 1:

- A PRI offload switch takes traffic intended for an ISP's RAS server from the Class 4 switch, bypassing the Class 5 Switch (B) closest to the ISP.
- A tandem offload switch bypasses both the Class 4 and Class 5 (B) switches, maximizing resources available for voice traffic.

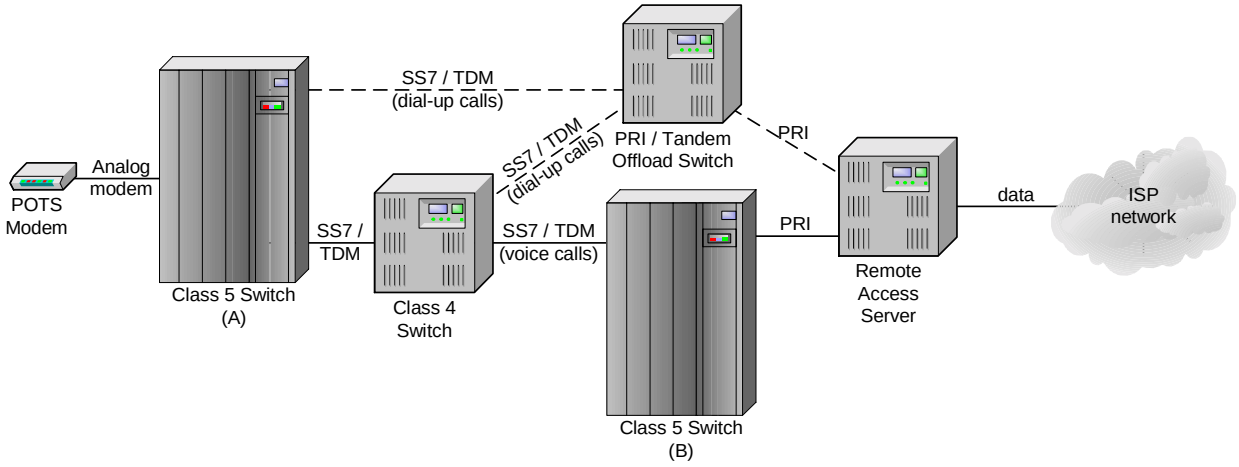

Figure 1: PRI/Tandem Offload

Such applications allow service providers to achieve cost savings through more efficient use of their legacy Class 4 and 5 resources. They may also be combined with Class 4 Replacement functionality (see section 3.4) for greater effectiveness. However, they are a tactical "workaround" for the specific problem of lengthy dial-up calls, and do not fundamentally change the existing PSTN architecture: voice is still carried over TDM trunks, quite separate from the data backbone.

Internet Offload therefore delivers short-term cost savings, but does not represent either a short or long-term next-generation solution.

3.4 CLASS 4 REPLACEMENT

The primary application of packet voice over recent years is the trunking of long-distance voice traffic over a packet backbone instead of the SS7/TDM network. As Figure 2 illustrates, legacy access networks and Class 5 switches remain in place, with TDM-to-packet gateways replacing Class 4 switches.

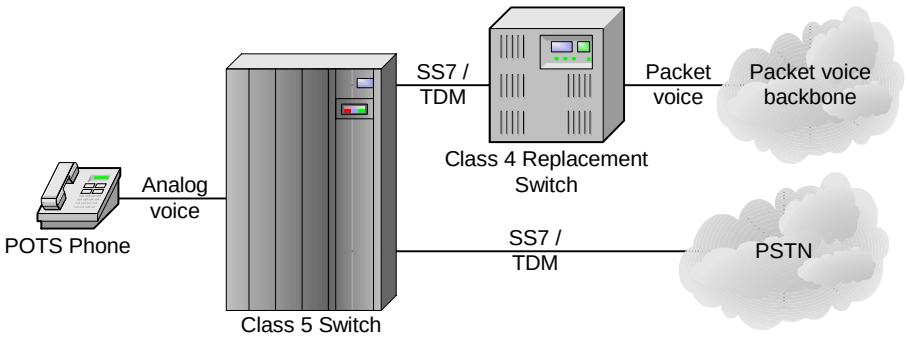

Figure 2: Use of packet gateway for Class 4 Replacement

The advantages of this approach are that

- it is now a proven technology that can be deployed seamlessly in the existing network, prolonging the lifespan of deployed legacy switches
- it exploits the packet backbone, thereby removing the requirement for additional investment in the TDM infrastructure
- in the longer-term, Class 4 replacement switches may become media gateways within a Softswitch-controlled network.

Service providers must bear in mind, however, that this is only a partial solution, for several reasons.

- With the Softswitch standards still evolving, voice routing on the packet backbone is typically based on proprietary protocols.
- Class 4 switches, and their replacements, are dependent on Class 5 switches for the service intelligence (subscriber services and applications) required by customers. While it may be possible to re-use some of their media gateway capabilities in a next-generation network, the core problem of how to provide that service intelligence remains – and must be resolved.

- The Class 4 replacement approach only address the packet backbone, not the access network, so do not offer a migration path towards a comprehensive NGN architecture.

While this approach is attractive from many respects, we must also address open, next-generation service intelligence and convergence in the access network for a truly comprehensive future-proof strategy.

3.5 FIRST-GENERATION VOICE OVER BROADBAND

Approaching next-generation evolution from the access side of the network, the first generation of Voice over Broadband (VoB) solutions enables both packet voice and data to be carried over broadband access lines (DSL, T1/E1, wireless, fiber, etc.).

Figure 3 illustrates how this works: At the customer premises, an Integrated Access Device (IAD) converts analog POTS telephone signals to packet-based protocols such as the ATM Forum's Broadband Loop Emulation Service (BLES) for signaling and AAL2 or RTP for media. In the network, these protocols are typically converted by a Voice Gateway into GR-303 (in North America) or V5.2 (internationally) and TDM media, which feed directly into a legacy Class 5 switch.

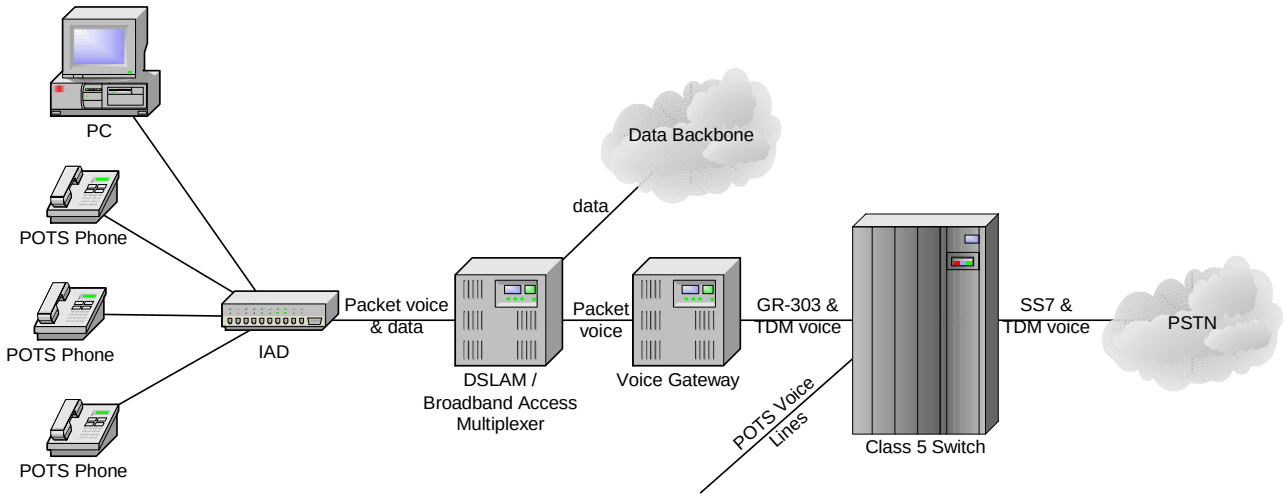

Figure 3: Broadband Voice Gateway with Legacy Class 5

Although this technology is relatively young, it is not especially complex, and can be quickly integrated into an existing circuit-switched network. In addition, focused work by industry groups such as OpenVoB™ has resulted in true multi-vendor interoperability, enabling service providers to choose from a wide range of interoperable voice gateways and IADs.

The main drawback with most VoB solutions is that, like Class 4 replacements, they still fundamentally relies on the legacy Class 5 switch to provide all the "difficult" PSTN features such as dial-tone, subscriber services, SS7 connectivity, etc. The service intelligence is still implemented over a legacy narrowband GR-303 interface.

Many Voice Gateway vendors claim that they offer a migration path by being convertible to Media Gateways, converting packet and TDM media under the control of a Softswitch. Unfortunately, this does not represent a future-proof next-generation strategy for two reasons.

- First, since Media Gateways contain little "intelligence", their key-differentiating feature will be hardware density. Given the rapid rate of hardware improvements, today's leading Voice Gateway products will likely be at least an order of magnitude less dense than the leading Media Gateways in 12-18 months' time.[2]

- Second, media conversion is the easy part of the next-generation network. The strategic core of a converged network is the service intelligence that resides in the call agent and application servers that deliver subscriber services and replace legacy Class 5 switches. Only once that intelligence is moved to a next-generation platform can a converged network truly start taking shape – and that is the area where service providers should be focusing their attention.

Furthermore, this approach does not provide a means to bring legacy POTS access lines into the overall converged access solution – they are still handled quite separately by the Class 5 switch.

In short, VoB in this form may be a great tactical solution in some situations, but as the key Voice Gateway component provides little more than simple protocol conversion, it will not evolve into a strategic next-generation platform.

3.6 THE METASWITCH SOLUTION

The **MetaSwitch VP3500 Next Generation Class 5 Switch**, illustrated in Figure 4, combines the best elements of the Voice over Broadband solution with a Class 5 Softswitch in a compact, single-chassis system that

- enables converged access via proven VoB protocols (ATM or IP over DSL, cable, fixed wireless, T1, …)

- supports traditional POTS lines via traditional and next-generation broadband DLCs

- switches voice onto both SS7/TDM and packet backbones

- genuinely provides a full range of Class 5 services without a legacy Class 5 switch

- has the carrier-class reliability and features required for immediate deployment, while providing an upgrade path for future evolution to the distributed Softswitch networks of tomorrow.

[2] MetaSwitch estimate based on research of hardware development already in progress in the industry.

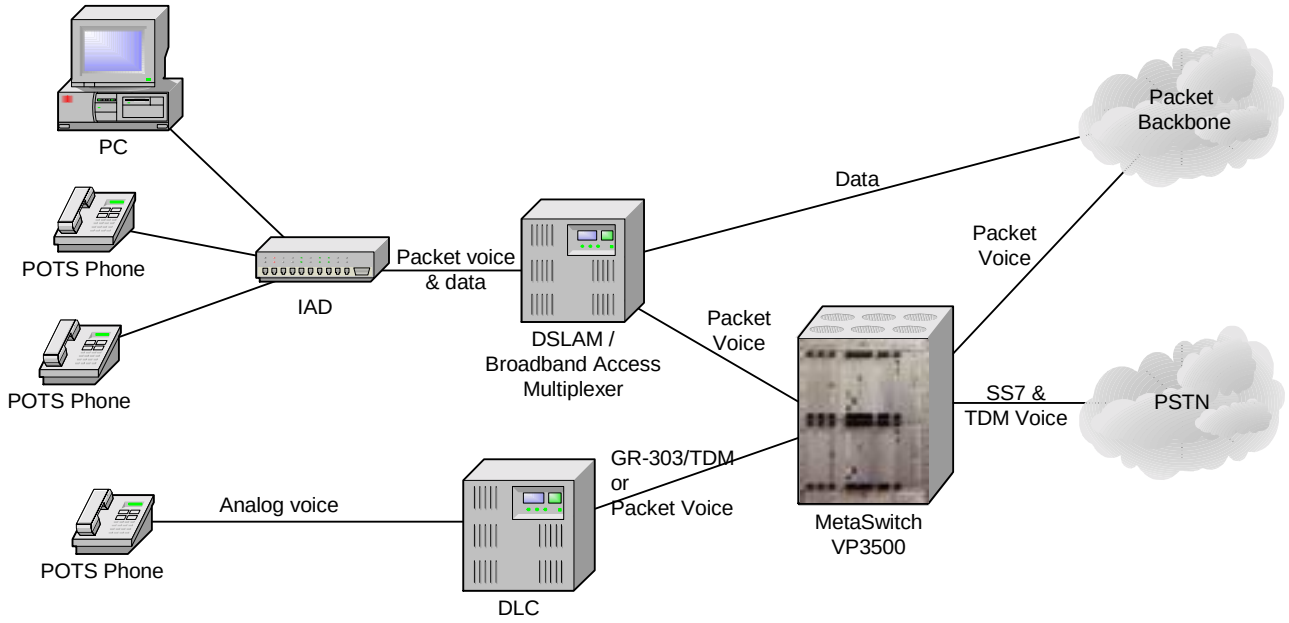

Figure 4: The MetaSwitch VP3500 Next Generation Class 5 Switch

This feature set makes the VP3500 ideal for service providers seeking to

- generate additional revenue from data lines (such as DSL) by adding high-revenue voice services
- expand into new geographical regions, where backhauling long distances to their existing facilities may be overly complex and expensive
- add next-generation Class 5 services to their network, either replacing existing Class 5 switches or as existing capacity is exhausted
- build an entirely green-field network providing broadband voice and data and/or POTS voice using a single switching platform.

3.7 SUMMARY

Table 1 summarizes the above analysis.

	1. Next-gen service intelligence	2. Open, mature architecture	3. Converged Access	4. Converged Backbone	5. Legacy Integration	6. Ready for deployment
Legacy Class 4/5	✗	✓	✗	✗	✓	✓
Greenfield Softswitch/VoIP	✓	✗	✓	✓	✗	✗
Internet Offload	✗	✓	✗	✗	✓	✓
Class 4 replacement	✗	✓	✗	✓	✓	✓
First-generation Voice over Broadband	✗	✓	✓	✗	✓	✓
MetaSwitch VP3500	✓	✓	✓	✓	✓	✓

Table 1: Analysis of NGN Migration Strategies

4. VENDOR SELECTION

With start-ups going out of business and established vendors withdrawing previously-committed product lines, service providers need to select their strategic partners based not just on product features, but also the organization's engineering excellence, quality of support, track record and long-term financial viability.

In this regard, MetaSwitch stands out from the crowd.

As a division of Data Connection, MetaSwitch leverages over 20 years' experience supplying communications technology and support to the leading service providers including Verizon, SBC and BT and major equipment vendors.

The company has world-leading products and expertise in networking protocols (MPLS, MGCP, Megaco/H.248, SIP, …) and applications (unified messaging, conferencing, …), with the result that we provide technology to most of the major players including Lucent, Nortel and Cisco, as well as emerging vendors such as Sonus and Convergent.

Data Connection is a relentlessly profitable and stable private company, creating a basis for long-term investment and growth that ensures our ability to fund ongoing product investment and deliver first-class customer support.

MetaSwitch has offices in Alameda (California), Reston (Virginia), and Enfield (North London), Chester and Edinburgh in the UK.

5. CONCLUSION

There can be little doubt that next-generation networks will happen, and that much of the enabling technology is already emerging. The key issue facing service providers is how to select the right migration path to keep their business on track in the short term while steadily moving towards the NGN objective.

As this paper has shown, there is a range of options, from doing nothing to building a "total NGN solution" right away. For service providers looking for a reliable, cost-effective platform that can be deployed today, generate short-term revenue and evolve as the NGN standards mature, the MetaSwitch VP3500 represents a compelling all-round solution.

GLOSSARY

AAL2	*ATM Adaptation Layer 2*, a media-bearing protocol for Voice over ATM
BLES	*Broadband Loop Emulation Service*, the standard for Voice over ATM/DSL signaling, defined in ATM Forum document af-vmoa-0145
CALEA	*Communications Assistance for Law Enforcement Act*
DLC	*Digital Loop Carrier*
DSL	*Digital Subscriber Line*
GR-303	A digital signaling protocol used between DLC and Class 5 switches in North America
H.248	An ITU protocol for media gateway control, closely related to Megaco
IAD	*Integrated Access Device*, customer premises equipment providing DSL data and voice connectivity
ISP	*Internet Service Provider*
Megaco	An IETF protocol for media gateway control, closely related to H.248
MGCP	*Media Gateway Control Protocol*
NEBS	*Network Equipment Building Standards*
NGN	*Next Generation Network*
POTS	*Plain Old Telephone System*
PRI	*Primary Rate Interface*
PSTN	*Public Switched Telephone Network*
RAS	*Remote Access Server*
RTP	*Real Time Protocol*, a media-bearing protocol for Voice over IP
SIP	*Session Initiation Protocol*
SS7	*Signaling System 7*
TDM	*Time Division Multiplexing*
V5.2	A digital signaling protocol used between DLC and Class 5 switches outside of North America
VoB	*Voice over Broadband*

