This article will focus on the several threads or evolution paths that can drive the migration of an existing TELCO operator network towards an integrated Voice, Broadband and Multimedia Services network. In particular, we will address the current challenges of the emerging countries TELCO’s: the existing network optimization, the introduction of broadband infrastructure, the handling of the long distance Voice over IP traffic and the VoIP Corporate Services. To undergo all this and successfully address the subsequent migration steps to reach a fully consolidated NGN network a careful planning, a change of mind and a global understanding of the whole picture is needed at the operator key persons.
Alcatel can help operators in developing countries to plan and realize a consistent, business-driven approach for migrating their networks to broadband and next generation services.

**Introduction**

Telecommunication operators in the developing countries are facing many challenges. One of the biggest and most important is how to cope with network evolution given today’s scenario of low available investment, uncertainty, stagnating demand, political crises, etc. In the current state of the market, it is difficult for an operator to justify investing in a network migration plan. Today, many operators face severe debts, telephone tariffs fixed by the government, and an uncertain political and economic future. Obtaining investment in these conditions is almost a “mission impossible”.

However, it is possible to help an operator create an evolutionary plan which, based on today’s needs, defines the steps that are needed to achieve future network evolution. To do so, we need a comprehensive understanding of the operator’s context. In particular, we have to identify the key driver “trends” on which the evolutionary plan should be based. These trends are usually treated by the operators as simple standalone projects or needs, and are not identified as key factors in a chain of events that can trigger fundamental longer term changes in their networks.

**Trend 1: PSTN Network Optimization**

*Optimize the installed base using NGN-ready technology*

The telecommunication operators in most developing countries have a Public Switched Telephone Network (PSTN) infrastructure consisting of equipment from different vendors and a variety of switching technologies. Whereas the more populous and richer areas have been the targets for larger capacity, more modern switches, smaller and poorer areas are usually left with old outdated technology, with the result that they face problems with service, support and excessive maintenance costs. Certainly, the main causes are the great differences that exist between different regions in many emerging countries. For example, it is common to speak about the “two Brazils”: one composed of consumers with a high purchasing power and a profile similar to that found in more developed countries, and another one in which many people struggle to survive without enough income to meet even their basic needs.

**Drivers**

Today almost every telecommunication operator is looking for ways to decrease its network operating costs. At the same time, a support program must be implemented to cope with older legacy equipment, high costs for software changes/updates and even problems with replacing faulty parts or boards. Finally, regulatory constraints sometimes come into the picture (e.g. services such as number portability, per-minute billing), forcing evolution in outdated parts of the network.

**Proposed solution**

In medium and low penetration areas, the deployment of multi-service access nodes - Next Generation Network (NGN) ready technology that provides basic voice telephone and other services - like the Alcatel 1540 Litespan, can be a good initial step in this programmed evolution. In this way, the operator can replace small
switches and old remote units that are causing operational headaches. Additionally, the operator can provide users with a broader range of services, such as Digital Subscriber Line (DSL) and leased lines. However, as the initial broadband penetration in such areas will not be high, the Alcatel 1540 Litespan is a suitable choice for this step.

**Technical details**

The Alcatel 1540 Litespan will initially be connected via a V5.2 interface to bigger (and newer) switches in more populous areas, ensuring their smooth introduction into the network and resolving any technical, service related or regulatory issues. Figure 1 shows the suggested network architecture. Usually (particularly in developing countries), any old switches or remote units that are removed can be used as spare parts in other locations, helping to ease the problem of replacing faulty components.

**Trend 2: IP Network Evolution**

**Add broadband services**

Much has been written about this, and almost every incumbent operator is currently either deploying or actively considering deploying broadband services using DSL technology. In most developing countries there are some areas with strong demand that justify almost any broadband investment case. However, most operators only see this as one “additional” service; few of them realize that it is a crucial step in their network evolution, and should therefore be carefully planned and implemented as part of their evolutionary strategy, not as an isolated project. It is important to highlight that, together with this initial deployment in high demand areas, operators must put in place an introduction strategy for areas where the demand is lower.

**Proposed solution**

Figure 2 illustrates the proposed architecture in which Digital Subscriber Line Access Multiplexers (DSLAM) are typically collocated with the switches in the biggest and most important areas. In this case, broadband penetration will be substantially higher than that in remote or smaller areas, making the Alcatel 73xx ASAM/ESAM family of DSLAMs the right choice for this step.

In the case of remote or smaller zones, if (as outlined earlier) the operator is following the PSTN optimization trend, the deployed access nodes can easily provide a DSL solution where broadband penetration is low. In this case, the Alcatel 1540 nodes need to be connected to the data network, typically via n x E1s or an STM-1 (Synchronous Transport Module) link.

**Trend 3: Long Distance**

**International VoIP Traffic**

**Long distance bypass networks**

Developing countries have a singular pattern of incoming/outgoing international calls as the number of incoming calls greatly exceeds the number of outgoing ones. While this is caused by a combination of factors, including calls from numerous expatriates working abroad in more developed countries, statistics have shown that a large part of this incoming traffic is using Voice over IP (VoIP), and is usually not passing through the incumbent operator. Even in countries, such as Colombia and Brazil, where VoIP termination to the PSTN is only allowed to licensed operators and forbidden by the law to any others, the level of VoIP traffic is significant and growing.

It is therefore a logical move for the operator to become involved in this market in order to regain control of the activity in the hands of the “bypassers” and increase its revenue from traffic that is currently not using its network. Clearly, one way to eliminate the “bypassers” is to cut prices. Of course, the operator is best placed to do this, as it owns the local interconnect and can handle a large-scale scenario.
Proposed solution

The operator can deploy an international VoIP infrastructure, including a central Alcatel 5020 Softswitch to handle call control, routing and different protocol interworking scenarios, and media gateways in every Point of Presence (PoP) in each of the target countries where an interconnection with a Time Division Multiplex (TDM) operator is needed. In the case of IP interconnection, the Alcatel 5450 Access Border gate, a VoIP session controller node, can be used to meet the needs for security and/or Quality of Service (QoS).

Care has to be taken when drawing up interconnect agreements with major VoIP Clearing Houses or Brokers, such as AT&T or ITXC, and bilateral agreements with other VoIP operators, as the nature of the long distance VoIP business is far more volatile and price sensitive than the regular PSTN business.

**Trends**

**Unification: Reusing Long Distance Bypass Investment to Provide IP Telephony**

IP telephony for corporate, Small Office / Home Office (SOHO) and high end users is the natural next step that an operator should consider taking. After successfully deploying both a DSL and long distance bypass VoIP infrastructure, the additional investment needed is minimal as almost all the previous investments are reusable for the IP telephony application.

Value-added services, like voice Virtual Private Networks (VPN), IP-Centrex and multimedia conferencing, can also be offered, enhancing the operator’s service portfolio and generating additional revenue.

**Drivers**

Several needs can lead to the implementation of IP-based telephony:

- **Differentiation:** To provide a service that is different from the competition.
- **Packaging:** To offer data and voice (and multimedia) services together as a way to lock-in customers.
- **New services:** Voice VPN, IP-Centrex and videotelephony are examples of services that address particular market needs (especially in the SOHO and small corporate markets) and require IP-based telephony.

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**Fig. 3: Reuse long distance bypass investments to provide IP telephony**

- **BRAS:** Broadband Remote Access Server
- **IAD:** Integrated Access Device
- **IMT:** Inter-Machine Trunk
- **PBX:** Private Branch Exchange
- **POTS:** Plain Old Telephone Service
Optimization: A VoIP solution for several terminals using only one broadband data link can reduce deployment and maintenance costs both in areas where copper is scarce and on greenfield sites.

Proposed solution

The advantage of having a multi-application Softswitch platform, such as the Alcatel 5020, then becomes clear. The existing 5020 used for long-distance VoIP international traffic can easily be expanded to retain the native IP-based subscribers, typically via the Session Initiation Protocol (SIP). Depending on the network size, all that is needed to offer IP telephony is a small increase in the number of Alcatel 5020 licenses and a few extra media gateway ports. Figure 3 shows the proposed network architecture.

Advanced services, like IP-Centrex, multimedia conferencing and unified messaging, can be provided by application servers working on top of the IP telephony infrastructure.

NGN Evolution Plan

Today most people agree that the established PSTNs will only evolve slowly and gradually, starting in areas where there is an urgent need or a real business rationale. It is worth emphasizing that the more successful the operator has been in following the three driver trends mentioned previously, the easier will be its NGN evolution plan.

Figure 4 depicts a step-by-step plan for a typical NGN migration, considering the driver trends and the evolutionary steps.

NGN Evolution Step 4: Migrate Litespans into VoIP Access Gateways

Once the operator has a VoIP infrastructure, the new deployment of access nodes can certainly be VoIP-based. A plan for migrating the existing nodes (those already connected to the data network) should also be launched.

Drivers

While this step should be part of every operator’s network evolution planning, several drivers can add momentum:

- Switch obsolescence: At some point in time, the switches to which the access nodes are connected will start to experience the typical problems associated with obsolescence, such as the phasing out of a version or more expensive maintenance.

- Network growth: In certain developing countries there is still room for new subscribers. In some cases, there are also new areas where the operator can start to offer services following deregulation. In this case it makes sense to reduce the load on large switches by removing the remaining V5.2 access nodes that consume parts of their capacity.

- Service interaction: As IP telephony and multimedia services (and mobile integration, in certain cases) become more common, migrating existing access nodes to VoIP will have clear advantages in terms of service integration (for voice VPN, IP-Centrex, etc).

Proposed solution

The NGN-ready Alcatel 1540 access nodes can be migrated to VoIP access gateways by adding a VISC-A gateway card. The migrated subscribers can be controlled from the existing 5020 (or a 5020 MGC, if that is the case). Migration can be achieved smoothly on a per-subscriber basis.

The network architecture is depicted in Figure 5.

NGN Evolution Step 5: Migrate Switches to DSLAM-V and 5020 MGCs

The final evolutionary step is to convert the remaining subscriber base to NGN. This will take several years; the typical scenario will be an expanding NGN overlaid with the diminishing PSTN over a long transition period.
Like the former step, this one should be part of the operator’s network evolution planning. Several drivers can push for this phase:

- **Switch obsolescence**: This could potentially force migration of parts of the network as the existing equipment becomes unsupported or too old.
- **Network growth**: Particularly in greenfield cases (still present in some developing countries), a DSLAM-V based solution will be the preferred approach for offering the voice + broadband service combination. (Note that certain cases can be tackled today with the Alcatel 1540 Litespan AGW solution.)
- **Service interaction**: It is very likely that, as the availability of broadband services increases (VoIP, Video over IP, multimedia services, content services, etc.), the demand for greater integration with the PSTN will increase. It is important to notice that migrating a class 5 user to NGN will allow him or her to utilize most of the application servers and services in the NGN without the need for classical (and sometimes expensive) “workarounds” (e.g. the need for an 0800 number routed to a media gateway).

**Proposed solution**

Existing DSLAMs can migrate to DSLAM-V avoiding the classical “loop” to the PSTN switch and directly offering basic telephone line services to DSL subscribers, who will now be controlled from the Alcatel 1000 S12/E10 exchanges, the existing hardware can evolve to the 5020 MGC, fully integrated with the established Alcatel 5020 solution, to ensure that its capacity and processing power are fully reused.

The proposed solution and network architecture are depicted in Figure 6.

**Conclusion**

Today, network evolution is a common concern of network operators worldwide. However, not all of them have a clear vision as to how to do it, and (especially in the developing countries) no clear budget for it. In spite of this,
it is possible to create a long-term evolutionary plan based on current and future needs.

PSTN optimization is, in many cases, one of the threads to be included in any such plan, as many operators (especially in Latin America) utilize many different switching technologies in their networks and are, in most cases, experiencing support and maintenance problems in some of them.

The broadband revolution is happening in Latin America, naturally at different speeds and with different degrees of coverage in each country (with some exceptions, such as the Paraguay case). Nevertheless, few operators realize that in the future NGN services will be offered over the broadband infrastructure they are currently deploying. This is a crucial point that should be considered when planning broadband deployment (DSLAM collocation, DSLAM-V migration, etc).

Operators also need to closely follow the VoIP long distance business. Because of the large numbers of expatriates and migrants from Latin America to the US and within neighboring countries (e.g. from Bolivia to Argentina, from Peru to Chile), this type of traffic is growing significantly. The interest of the operators should not be restricted to generating extra revenue, but should extend to justifying an initial VoIP infrastructure that can easily be reused for other applications, like VoIP corporate services and IP-Centrex.

Once they have gained sufficient momentum, the planned evolutionary steps (e.g. migrating to access gateways, adding an Alcatel 5020 MGC to the existing S12/E10 base or evolving DSLAMs to DSLAM-V) can be executed. Our task is just starting: to help our customers realize how they can tackle their network migration and to work with them to achieve it.
Abbreviations

NGN  Next Generation Networks
PSTN  Public Switched Telephonic Network
PoP   Point of Presence
LDB   Long Distance Bypass
AGW   Access Gateway
VPN   Virtual Private Network
MGC   Media Gateway Controller
DSLAM Digital Subscriber Line Access Multiplexer