Egypt Telecommunications Master Plan II

Volume 3

Recommendations & Voice over IP Update

Prepared by

Infocom Technology Inc.

Prepared for USAID Mission to Egypt, Egypt Ministry of Communications and Information technology and Telecom Egypt (MCIT/TE)

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PREFACE

Since the publication of the Master Plan Phase I for Egypt's Ministry of Communications and Information Technology and Telecom Egypt (MCIT/TE) in 2000, several major changes have taken place in Egypt and elsewhere, including:

- New far-reaching deregulations in the Egyptian Telecom sector, including loop unbundling, reduction in international transmission tariffs, and the licensing of DSL service providers.
- New advances in Voice over IP technology and products.
- The emergence and maturation of new international standards, such as MPLS (Multi-Protocol Label Switching) and SIP (Session Initiation Protocol).
- The entry of many new service providers into the Egyptian market, especially in the DSL area.
- New emphasis on evolving the telecommunication infrastructure to Broadband Access.

Master Plan phase 2 volumes 1 and 2 addressed an overall strategy for Broadband Access with focus on DSL, FTTP, Cable TV, last mile access and Wi-Fi. The purpose of this volume, volume 3, is to provide a summary of recommendations and address new recommendations in the area of Voice over IP. These recommendations apply directly to Telecom Egypt, but have also important impact on other service providers, especially DSL access providers.

VoIP technology is by no means a mature one. The standards are still evolving, and service providers are still assessing the best and most economical ways for introducing it in their network infrastructure. In this report we attempt to provide a balanced view that takes into account the Egyptian market place, the state of the industry and the regulatory environment. We strongly recommend that this report be updated in a year or two since we expect the technology and its applications to continue to evolve in the near term.

Feedback Procedure

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EXECUTIVE SUMMARY

The objective of this volume, volume 3 of the Master Plan II documents, is to summarize all recommendations to MCIT/TE, address recent developments in Voice over IP (VoIP) and to provide guidance to Egypt's Ministry of Telecommunication & Information Technology and Telecom Egypt (MCIT/TE) in terms of strategy and short term recommendations.

The following is summary of the Master Plan II recommendations:

1. CDMA is a strategic direction for fixed wireless with the potential of providing limited mobility and a base for 3G mobile communications.
2. Continue the deployment of modem pooling for the "Free Internet" model.
3. Pursue aggressively with unbundling and DSLAM co-location as the base for ADSL initiative.
4. Continue to deploy packetized IP-based core infrastructure for aggregated voice and data services.
5. Expand on Optical-Ethernet capabilities for aggregated services.
6. Deploy IP-soft switch and implement IP-centrex for business applications
7. Continue to deploy ATM edge network for multiservice environment in rural areas.
8. Initiate study on DWDM fiber transmission network.
9. Establish state of the art network management capabilities on sub-regional and national levels.
10. Proceed aggressively on Wi-Fi implementation based on minimum regulations and commission a study for WiMax technology and applications.
11. Deploy CATV and FTTP/VDSL networks in new urban areas and cities.
12. Investigate deployment of fiber in underground utilities, such as gas pipes and sewage pipes.
13. Plan for the triple play (data, voice, video) environment for service providers within the de-regulation process.
14. Investigate the implementation of VoIP in the outgoing international network.

The debate on the role of VoIP in a carrier's infrastructure continues. Some of the issues that were raised in the past have been partially addressed, especially in the area of standards, quality of service (QoS) and security. The main issue that is still open is the economic viability of this technology vis-à-vis the existing TDM infrastructure. Given our experience in this industry and what we see happening in other countries, we conclude the following:

1. The use of VoIP ***strictly*** as a core technology replacement for TDM is not economically viable yet due to the need for additional equipment, Operations Support Systems, network bandwidth and highly qualified technicians. The situation might change in 2-3 years. However, trials and gradual deployment should continue.

2. The use of VoIP in the ***core infrastructure*** of Telecom Egypt should be considered along with the planning for new revenue generating IP-based services. These new services include multi-media services, Presence services, etc. However, we should note that for some of these applications the stage is not set yet for their introduction due to the immaturity of the application platforms, business models, customer premise equipment and support systems.
3. We recommend the use of VoIP at the edge of the network with the introduction of established services such as ***IP Centrex and VoIP over Broadband***. These services can generate new revenues for TE and at the same time stimulate DSL access and business applications.
4. We recommend the use of ***VoIP in International Long Distance on a selective basis*** as detailed in this volume. It is important to emphasize that given the monopoly role that TE still plays in the International Long Distance segment, that any decision should be made after careful consideration of the issues we listed in this report.

Given the dynamic nature of this technology and the quick pace of product enhancements, we recommend that this report be updated in a year or so. We also suggest to conduct soon a more detailed analysis of the new IP based services and their potential implementation in the Egyptian market.

SCOPE

This volume (Volume 3) provides a summary of the Master Plan II recommendations, and addresses voice over IP Technology for Telecom Egypt. Volume 1 provides a summary of Egypt Broadband Access Strategy and addresses various recommendations to increase broadband users penetration in Egypt. Volume 2 covers in detail the broadband technologies with a focus on VDSL and FTTP, Wi-Fi, CATV, last mile access, and mobile communications (3G). Below, we provide an outline of the proposed Egypt Telecommunications Master Plan Phase II Documents and its contents.

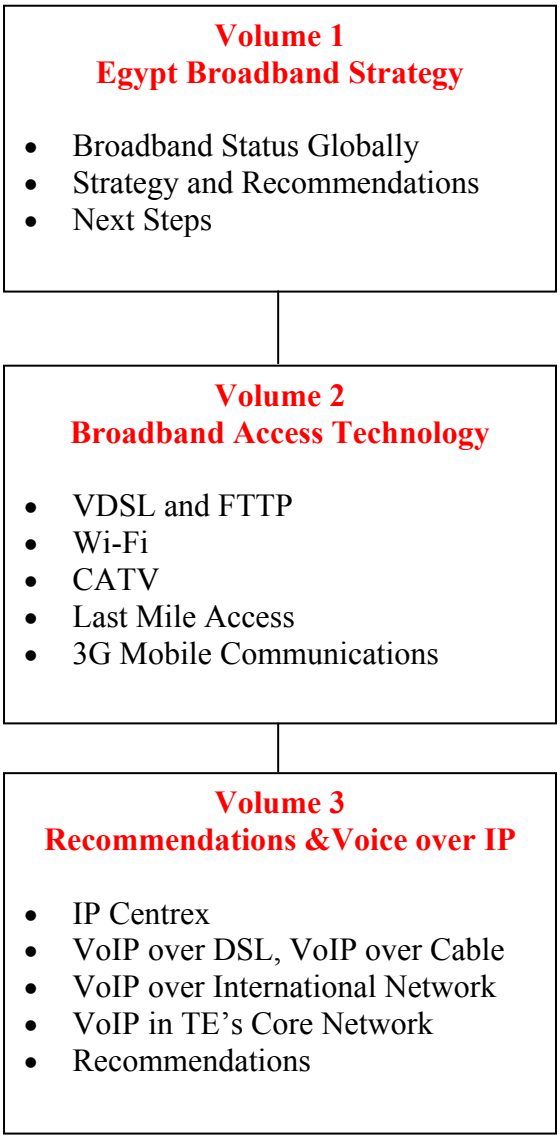

Figure 1: Telecommunications Master Plan Phase II Documents Outline

1 INTRODUCTION

As a technology, VoIP can play different roles within a service provider's infrastructure. However, one of the key issues surrounding VoIP revolves around its economics vs. the current TDM infrastructure. It is difficult to justify VoIP strictly on the basis of replacing TDM technology, due to the additional bandwidth required to handle the VoIP packets and the cost of the additional equipment. However, when coupled with the creation of new revenue generating services, VoIP can produce a positive business case.

In the rest of this section, we focus on new VoIP applications that we feel can benefit Telecom Egypt, its customers and at the same time stimulate the introduction of VoIP technology in TE's infrastructure. At the end of the section we address the migration of the TE core network to VoIP.

2 VoIP APPLICATIONS & SERVICES

2.1 IP CENTREX

2.1.1 Architecture

Many business customers today have large enough enterprise locations to justify the need for a PBX to provide intra-location voice connectivity and to reduce the number of external lines that are required. It also provides the business customer with the ability to use a private numbering plan (or extensions). However, in many cases, the business customer may prefer not to own the equipment or its management. In this case, they would be willing to buy a service from a service provider to perform the same functions. Such a service is referred to as **Centrex** and is provided to the end customers by the local voice switch in the CO.

In the past few years, many business customers installed VoIP phones in their enterprise networks instead of regular TDM phones. There are several manufacturers of these phones including Mitel, Cisco, Polycom, Siemens, etc. The second generation of these phones uses SIP signaling instead of MGCP (Media Gateway Control Protocol) to communicate with the network. There are also soft phones, e.g. a PC that provides a phone function in software. With the advent of these IP phones, it is now possible for an enterprise to combine both voice and data on the same Ethernet network. There is a need though for a Centrex service that works with the IP phones, hence **IP Centrex.**

Figure 2 illustrates the basic architecture. The enterprise customer may have PCs, servers, IP phones in addition to regular TDM phones. In order to carry the traffic over the LAN, the TDM phones are connected to an adapter (aka as an Integrated Access Device or IAD) whose function is to act as a small media gateway for those phones. All the traffic from the customer's location is carried from the router over a private line to the carrier's CO (i.e. TE). In the CO all the customer lines terminate on an IP Service Switch, which provides the following functions:

- Aggregate all the customer lines into a higher speed line towards the IP Centrex Gateway.
- Provide virtual routing function for each customer. Such function allows the customer to maintain their own private IP addressing plan on their LAN.
- Network address translation (NAT) to translate the customer private IP addresses to public ones and hence allow the IP packets to be routed over a public IP network.

In order to protect the IP Centrex Gateway from intruders and DoS (Denial of Service) attacks, a Firewall is used between the IP Service Switch and the IP Centrex Gateway. The Gateway performs the typical Media Gateway function (IP >> TDM) and routes the PCM voice traffic to the TE local switch using the V5.2 standard. Call setups take place between the IP Centrex Gateway and the PSTN switches with the help of a Softswitch, which interfaces to the SS7 network. Usually, there is a need for only one Softswitch in the network to handle the entire signaling load. Another one is needed as a back up in case of failures.

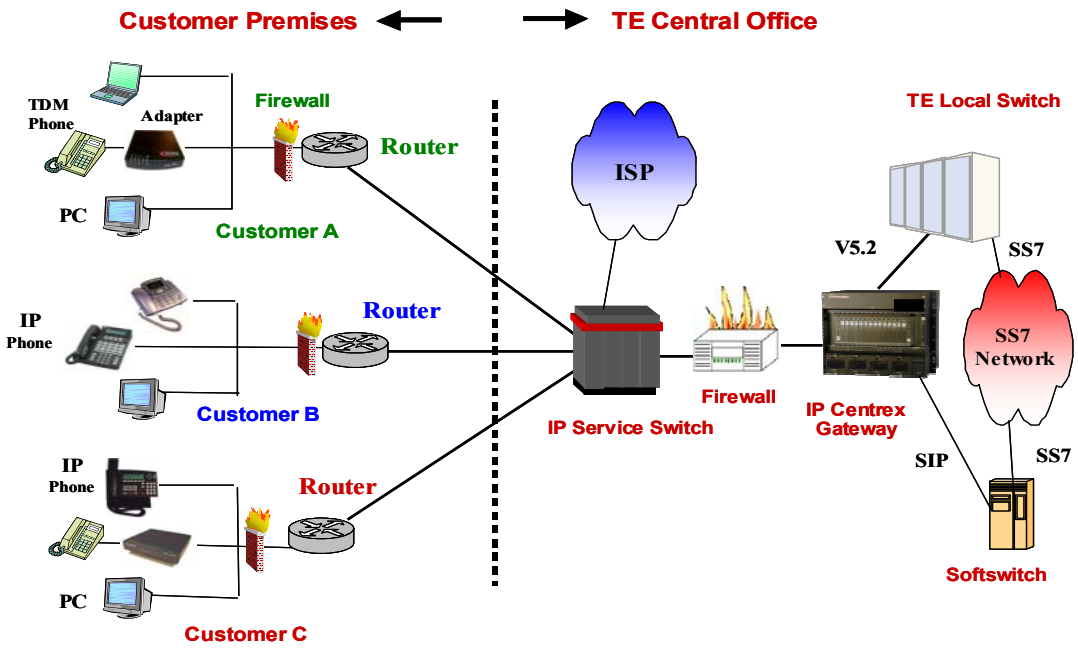

Figure 2: IP- Centrex Architecture

There are three types of traffic flows for a particular customer:

- Intra-Location voice calls are routed through the IP Service Switch and back to the customer location. No media conversion is needed.
- PSTN-bound voice calls go through the IP Service Switch to the IP Centrex Gateway to the PSTN network.
- Off-net data traffic (to the Internet or another enterprise location) goes to the IP Service Switch and from there onto the ISP.

2.1.2 Business Model

Here we provide a suggested business model. Clearly, there other possible scenarios, however the final business model is expected to come out as a result from various meetings and discussions between the concerned parties. In this application, the customer–provider relationship can work as follows:

- Telecom Egypt provides the IP Centrex service and bills the enterprise customer for managing the On-Net calls, for terminating the Off-Net calls as well as the ISP connectivity (for the data traffic). The charge for the Centrex function will depend on the number of supported phones and other features such as the Virtual Router and NAT.
- Telecom Egypt could also provide the IP phones to the enterprise customer in cooperation with a couple of suppliers. Alternatively, TE can provide the customer with a list of approved phones and suppliers.

- TE could contract a private company to provide on-site installation and on-going maintenance. Alternatively, it could provide the customer with a list of approved companies for that purpose.

2.2 VOIP OVER DSL

2.2.1 Architecture

DSL is the most popular broadband access technologies worldwide. In addition to its use to provide high-speed access to the Internet, a DSL line can carry voice and video services (in the case of VDSL). Voice traffic over DSL comes in two flavors:

a. TDM voice. The regular telephone at the customer location is connected to a splitter that combines the voice with the modulated DSL traffic. The combined signal is what gets transmitted over the loop. At the Central Office, another splitter removes the TDM voice traffic and forwards it to the voice switch.

b. VoIP also known as derived voice. In this situation, the source of the traffic could be a PC or an IP phone. The VoIP traffic is modulated over the DSL line and is carried as data traffic all the way to the CO and beyond. If one user with an IP phone calls another one with an IP phone connected to a DSL line, then the traffic stays entirely in the data domain. However, if the called party is a regular phone, the voice needs to be converted back to TDM (or PCM to be more accurate) with the help of a VoIP Gateway.

Figure 3 illustrates the architecture for handling VoIP over DSL. For off-net voice calls, i.e., calls in which one of the end points is a regular phone, the VoIP traffic needs to be converted to TDM (using a VoIP Gateway), then carried over the PSTN and finally terminated on the other phone. A Softswitch handles all the VoIP signaling and interfaces to the SS7 network.

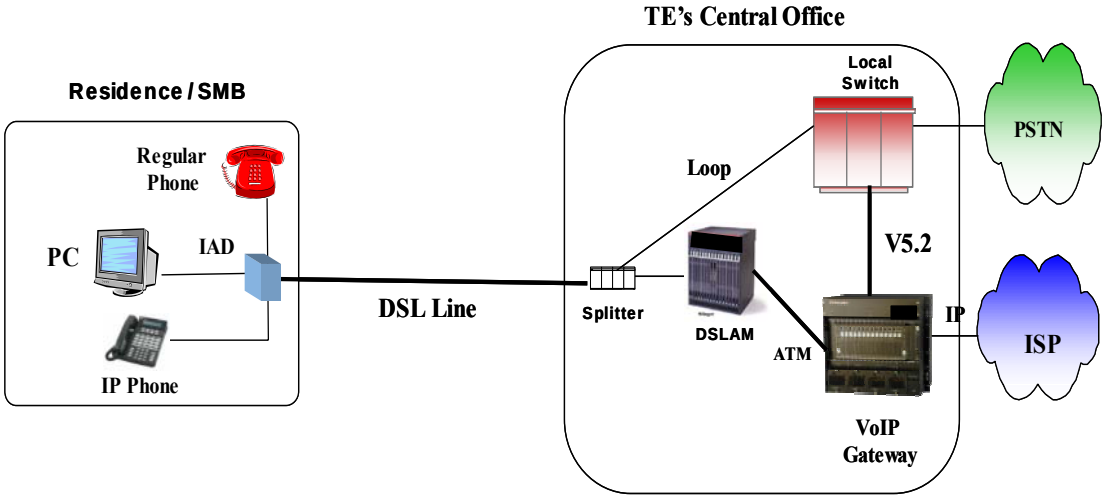

Figure 3: VoIP over DSL Architecture

The VoIP Gateway could be provided by Telecom Egypt and located in each CO where a DSLAM is housed. The Softswitch could be located in one of the TE COs. One Softswitch is sufficient to handle all the VoIP traffic in the network, though another one will be needed for reliability purposes.

There are three possible call patterns:

a. *VoIP – VoIP call*: The call stays in the data network owned by the DSL provider. TE does not get involved in the setup and handling of voice traffic.
b. *VoIP – TDM call*: The VoIP user initiates the signaling from the IP phone. With the help of the Softswitch, a path is established between the TDM phone over TE's network and the IP phone going through the Gateway and the DSL line.
c. *TDM – VoIP call*: The TDM phone user initiates the call through TE's network. Using SS7 signaling to the Softswitch. a path is established to the Gateway and over the DSL line to the VoIP phone.

2.2.2 Business Model

We should emphasize also that the final business model should emerge from the various meetings and discussions between the concerned parties, and the recommendations here represent one possible scenario.

The recommendation is for TE to own the Gateways and the Softswitch and charge the DSL providers for each call that initiates or terminates off-net. The customer-provider relationship works as follows:

- The DSL access provider provides the VoIP service to the DSL customer and bills the customer for all calls.
- Customer support is handled by the DSL provider with support from TE.
- For every call that originates from an IP phone and terminates off-net, TE charges the DSL provider for the call. Billing elements could include a minimum call setup charge and per minute charge.
- For calls that originate off-net, TE charges the caller the standard rate and compensates the DSL provider for terminating the call. That compensation could be on a per minute basis.

Such business arrangement provides a new revenue stream for each provider. It allows the DSL provider to offer VoIP over the DSL line hence create more appeal for the DSL service (bundling). TE will collect a new revenue stream in return for providing the Gateway and Softswitch functions.

2.3 VOIP OVER CABLE NETWORKS

2.3.1 Architecture

The high level architecture of VoIP in Cable networks is somewhat similar to that of DSL networks, though obviously the details are quite different. See Figure 4. In addition to the standard video service, a customer can buy high-speed Internet Access and VoIP services. A VoIP phone connects to the "Cable Terminal Interface" which handles all the coding, modulation, and multiplexing. It interfaces to the Cable plant and supports the DOCSIS standard for the high-speed data and the PacketCable standard for the VoIP calls. At the Cable Headend, and once the signal is demodulated, the VoIP traffic is routed to a Media Gateway (MGW) where the conversion to PCM takes place. The MGW interfaces to the local TE switch using the V5.2 standard. As an alternative to the V5.2 standard, a Softswitch could be used as described in Section 2.1.

If the Cable Headend is co-located in a TE CO, then the connection between the MGW and the local switch is an intra-office one. Otherwise, private lines need to be provisioned between the two network elements.

This architecture is similar to that of IP Centrex and VoIP over DSL in that once the VoIP traffic reaches the CO (or Cable Headend) it is treated the same way using a MGW. The IP Centrex Gateway is a MGW that performs additional functions.

2.3.2 Business Model

Conceptually, the role of TE in Cable networks is similar to the one described above in Sections 2.1 and 2.2:

- TE can provide and manage the MGW and transport the voice calls over the PSTN.
- The Cable provider "owns" and bills the customer.
- TE bills the Cable provider for all the voice calls.
- TE provides and maintains the MGW.
- The Cable provider is responsible for providing technical support to the customer, and interfaces with TE to resolve issues with the MGW and beyond.

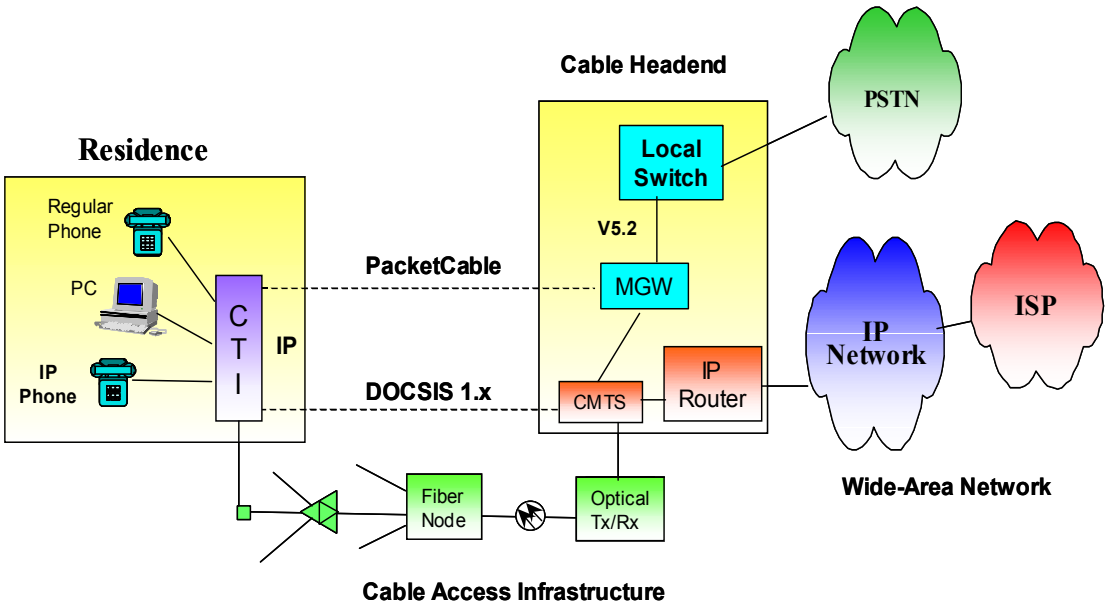

Figure 4: VoIP over Cable Architecture

2.4 VOIP IN INTERNATIONAL NETWORK

Once should divide international long distance traffic into two parts, incoming and outgoing calls.

a. Incoming Calls:

Since International long distance is still regulated in Egypt, the major International carriers have no choice but to terminate all of the TDM traffic destined to Egypt directly on TE's international gateway switches. For that, TE charges those carriers a settlement fee to terminate the traffic locally in Egypt.

However, there may be international VoIP providers, which may be interested in developing the markets for VoIP calls destined to Egypt. For example, ITXC in the US may be willing to promote a low cost VoIP service from the US to Egypt if TE is willing to terminate that traffic. TE has a couple of options for doing that:

1. Contract an international "VoIP Wholesaler" to install VoIP gateways in Egypt. In return, the Wholesaler pays TE a certain amount per minute for every call that TE terminates within Egypt. Minimal investment will be required in this case. All marketing and customer support costs will be handled by the VoIP Wholesaler.
2. TE installs its own gateways to terminate the calls originated by its international VoIP partners. As before TE collects a fee for terminating the calls. The fee in this case will be higher than in the previous case since TE owns the VoIP Gateways and is responsible for its maintenance.

In any case, regardless of the implementation option, TE should pursue this path only if it is convinced that the international VoIP partner can bring new traffic that otherwise would not have materialized. Otherwise, that traffic may be simply at the expense of the regular TDM traffic for which TE normally collects a much higher settlement rate from the international TDM carrier (e.g. AT&T).

Figures 5 and 6 illustrate the International VoIP architecture, which applies to all the scenarios discussed in section 2.5.

Figure 5: International VoIP using a Wholesaler

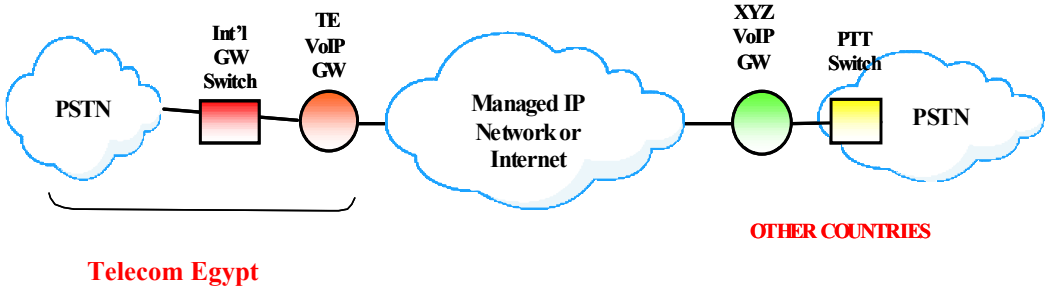

Figure 6: International VoIP using TE-Owned Gateway

b. Outgoing Calls:

Since TE is the only carrier licensed in Egypt to initiate international calls, we don't see any reason to offer an outgoing VoIP service to international destinations. However, if TE believes that offering such a service at a significantly lower rate and lower quality than the regular TDM service would stimulate demand for international originating traffic then we recommend offering a **"Budget VoIP"** service. Such a service should be of lower quality than the current service. Otherwise, customers will stop using the current service and use the new VoIP instead. The net result would be significant reduction in TE's

revenues. The lower quality is the result of using a low bit rate codec such as G.729a or G.723. This service should be offered with pre-paid cards under a new label (service name). See Figures 5 and 6.

Another motivation for using VoIP in outgoing calls is to reduce the amount of settlement that TE has to pay the foreign carriers. By terminating the VoIP traffic on VoIP carriers in the foreign countries, TE can reduce its settlement cost by a large percentage. The service to the caller in Egypt would still be the same. The caller dial the same numbers, gets the same quality at the same standard rates as before. The only difference is that the calls are routed from the International Gateways to VoIP Gateways. The resulting IP traffic is then transmitted over the Internet to the VoIP carrier in the foreign country where it is terminated on the PSTN network in that country. **This technique is used today by many major carriers to reduce their costs, especially to countries that require a high settlement rate. See Figures 5 and 6.**

2.5 VOIP IN TE'S CORE NETWORK

As a pure technology replacement, it is hard to justify the economics of using VoIP in the tandem network vs. the existing TDM infrastructure. VoIP as a technology does not save any bandwidth. Additional equipment and network management systems will have to be purchased and installed. Furthermore, there are many potential issues with VoIP QoS, and security that have to be assessed carefully. In addition, because of the IP nature of VoIP, TE would need to hire a new set of network technicians who are knowledgeable with IP. Such a skill set is hard to find and hence expensive.

On the other hand, VoIP offers the promise of new multi-media and other innovative services such as "Presence services". Some of these services are still in the concept phase. The applications platform and the Operations Support Systems that are required to offer them successfully are not widely available.

3 VoIP RECOMMENDATIONS

1. Given the emphasis on making DSL successful in Egypt, we recommend that NTRA and MCIT allow ADSL/SDSL providers to offer VoIP service over the DSL lines as described earlier in this document. Coupled with that, TE can offer the Gateway and Softswitch functionality. This is a win-win arrangement for all parties involved.

2. We recommend that TE offer an IP Centrex service for its SME customers. It is an established service that can bring a new revenue stream.

3. Even though there is no cable infrastructure in Egypt today, however if and when such an infrastructure is deployed we recommend that VoIP be offered using the same architecture and equipment used in offering VoIP service over DSL.

4. International VoIP:
   a. TE should replace TDM circuits to some of the foreign countries with VoIP for outgoing traffic to reduce its settlement costs. Focus should be on those countries that demand a high settlement rate.
   b. TE should consider offering a Budget VoIP service for outgoing calls only if it helps to stimulate outgoing traffic from Egypt.
   c. TE should consider terminating VoIP calls only if it feels that this traffic will not be at the expense of the existing incoming TDM traffic from its traditional international partners.

5. VoIP in TE's Core Network:

We recommend that TE to start intial deployment of VoIP based services and at the same time, initiate a study to detail a set of new VoIP based services, the corresponding network architecture and the equipment requirements.

4 SUMMARY of MASTER PLAN II RECOMMENDATIONS

The following is summary of the Master Plan II recommendations;

1. CDMA is a strategic direction for fixed wireless with the potential of providing limited mobility and a base for 3G mobile communications.
2. Continue the deployment of modem pooling for the "Free Internet" model.
3. Pursue aggressively with unbundling and DSLAM co-location as the base for ADSL initiative.
4. Continue to deploy packetized IP-based core infrastructure for aggregated voice and data services.
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