Voice over the IP network

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Voice over the IP network

Outline of presentation:

Introduction

I - Operation

II - Quality

III - Threats and opportunities
Voice over the IP network

Outline of presentation:

IV – Tariffs

V – Regulation

Conclusion
Voice over the IP network

Introduction

Internet telephony refers to voice transmission over the public Internet network.

Voice over the IP network (VoIP) refers to voice transmission using the Internet protocol. The network used may be the public Internet network or a private network.
Voice over the IP network

Introduction

In the telecommunication world, the arrival of VoIP represents a major change of the same magnitude as when the telephone replaced the telegraph.
Introduction

VoIP will be considered in relation to conventional telephony.

VoIP is based on packet switching over the IP network.

Conventional telephony uses circuit switching over the PSTN.
# Voice over the IP network

## Characteristics of the two networks

<table>
<thead>
<tr>
<th>PSTN</th>
<th>IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High reliability</td>
<td>Relative reliability</td>
</tr>
<tr>
<td>• High voice transmission quality</td>
<td>Acceptable transmission quality</td>
</tr>
<tr>
<td>• Real time</td>
<td>Deferred time</td>
</tr>
</tbody>
</table>
I – Operation

Operation will be viewed from the point of view of the VoIP user and service provider.
I – Operation

For the user, there are three access modes:

- PC to PC
- PC to telephone
- Telephone to telephone
Voice over the IP network

PC to PC
Voice over the IP network

PC to telephone

PC  Internet  Gateway  Public Exchange  Telephone  Fax
Voice over the IP network

Telephone to telephone

![Diagram of voice over the IP network](image_url)
I - Operation

For the provider, two aspects have to be analysed, namely national and international service provision.

Required equipment:

- Router
- Gateway
- Gatekeeper
- Administration server
Voice over the IP network

- Router: Essential component which handles the routing of packets.

- Gateway: Handles interconnection between the IP network and the PSN. Handles voice coding, decoding and packetization functions. Includes analogue/digital interconnection interface.

- Gatekeeper: Handles call authentication, authorization and supervision. Converts telephone number to IP address and vice versa.

Administration server: Handles customer billing, post or prepaid, through the collection of CDRs.
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Architecture for national application
Voice over the IP network

Architecture for international application
II – Quality of service

II.1 – Quality factors on the PSTN

Quality of service in voice transmission depends on several factors:

- transmission delay
- jitter
- echo
II – Quality of service

II.1 – Quality factors on the PSTN

• transmission delay

This is the time which elapses between the emission and restitution of speech. The shorter the transmission delay, the higher the call quality.

<table>
<thead>
<tr>
<th>Delay in each direction</th>
<th>Communication difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 ms</td>
<td>28%</td>
</tr>
<tr>
<td>450 ms</td>
<td>35%</td>
</tr>
<tr>
<td>700 ms</td>
<td>46%</td>
</tr>
</tbody>
</table>
II – Quality of service

II.1 – Quality factors on the PSTN

• jitter

Jitter is the variation in transmission delay. For good communication quality, jitter must be constant and remain below 100 ms.
II - Quality of service

II.1 - Quality factors on the PSTN

- echo

Echo is the delay between the emission of a signal and reception of this signal reflected. The phenomenon is not perceptible if this delay is less than 50 ms.
II – Quality of service

II.1 – Quality factors on the PSTN

On the STN, these parameters can be controlled, thus achieving an acceptable call quality.

On the IP network and especially the Internet, however, these parameters cannot be controlled for reasons we shall look at under the next item.
Voice over the IP network

II – Quality of service

II.2 – Factors impairing quality over IP

• transmission delay

Encoding and decoding, voice packetization and routing (time spent in routers during peak traffic periods) are serious handicaps for quality of service.
II – Quality of service

II.2 – Factors impairing quality over IP

• jitter

Poor quality, mainly because packets do not always take the same route and thus arrive in a “disorderly” manner.
II – Quality of service

II.2 – Factors impairing quality over IP

• packet loss

In times of congestion, routers destroy some packets. It is estimated that a packet loss of greater than 20% results in a negligible speech restitution quality.

Solutions are envisaged to improve VoIP transmission quality.
II - Quality of service

II.3 - Possible solutions

- Define classes of service
- Increase bandwidth
- Increase router capacity
- Harmonize equipment
II – Quality of service

II.3 – Possible solutions

- Define classes of service

The idea of classes of service is to distinguish between different types of packet (voice, video, mail, Web) and prioritize processing for packets requiring a high level of quality, reserving the appropriate amount of bandwidth.
II – Quality of service

II.3 – Possible solutions

• Increase bandwidth

Increasing bandwidth would improve packet transit time in the network.
Voice over the IP network

II – Quality of service

II.3 – Possible solutions

• Increase router capacity

In general, a router can process up to 100,000 packets per second. Increasing router capacity is under consideration, with talk of Giga routers and Tetra routers capable of processing 1 million or 1 billion packets per second.
II – Quality of service

II.3 – Possible solutions

- Harmonize equipment

By harmonizing equipment (especially compression/decompression and voice packetization), the delay between emission and reception of voice on the IP network can be reduced.
Voice over the IP network

III - Threats and opportunities

III.1 - Threats

III.2 - Opportunities
III - Threats and opportunities

III.1 - Threats

• Circumventing accounting rates

Probable loss of turnover when accounting rates are circumvented by fraudulent interconnection.

With fraudulent interconnection, the incumbent operator collects the much lower price of a national call instead of a more profitable accounting rate.
III – Threats and opportunities

III.1 – Threats

• Circumvention of accounting rates

Given that international settlements may account for up to 30% of an incumbent operator’s turnover in Africa, the resulting losses may come to several billion francs.
III – Threats and opportunities

III.1 – Threats

- Fall in turnover for international calls

Competition for international calls with highly competitive tariffs using prepaid IP cards.

In most countries of the region, purchasing power is low; VoIP is thus a godsend for telephoning abroad and spending less.
III - Threats and opportunities

III.1 - Threats

• Lower turnover on international calls

Given that revenues from international calls may account for up to 75% of some operators’ turnover, this is a significant threat for them.
III - Threats and opportunities

Case study

An operator ADOLEV IC COM sends 4 million minutes and receives 13 million minutes.

Its tariffs and the breakdown of its international calls are shown in the tables below.

An ISP sets up business and offers call termination services and outgoing international communications with prepaid cards unbeknown to the incumbent operator.
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III – Threats and opportunities

Case study

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting rate</td>
<td>0.40 SDR per mn</td>
</tr>
<tr>
<td>Tariff for international calls</td>
<td>1.50 SDR per mn</td>
</tr>
<tr>
<td>Tariff for local calls</td>
<td>0.01 SDR per mn</td>
</tr>
<tr>
<td>Tariff for long-distance calls</td>
<td>0.02 SDR per mn</td>
</tr>
</tbody>
</table>
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III - Threats and opportunities

Case study

<table>
<thead>
<tr>
<th>Incoming international traffic</th>
<th>Outgoing international traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of call</td>
<td>Percentage</td>
</tr>
<tr>
<td>To mobiles</td>
<td>50%</td>
</tr>
<tr>
<td>Local</td>
<td>35%</td>
</tr>
<tr>
<td>Long distance</td>
<td>15%</td>
</tr>
</tbody>
</table>
### III – Threats and opportunities

#### III.1 – Threats

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
<th>Revenues I</th>
<th>Revenues II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting rate</td>
<td>0.40 SDR per mn</td>
<td>2 600 000 SDR</td>
<td>1 430 000 SDR</td>
</tr>
<tr>
<td>Tariff for international calls</td>
<td>1.50 SDR per mn</td>
<td>6 000 000 SDR</td>
<td>3 900 000 SDR</td>
</tr>
<tr>
<td>Tariff for local calls</td>
<td>0.01 SDR per mn</td>
<td>20 475 SDR</td>
<td>9 100 SDR</td>
</tr>
<tr>
<td>Tariff for trunk calls</td>
<td>0.02 SDR per mn</td>
<td>17 550 SDR</td>
<td>2 800 SDR</td>
</tr>
<tr>
<td>Tariff for calls to mobiles</td>
<td>0.03 SDR per mn</td>
<td>87 750 SDR</td>
<td>10 500 SDR</td>
</tr>
</tbody>
</table>

**Total:**
- Revenues I: 8 600 000 SDR
- Revenues II: 5 478 175 SDR
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III – Threats and opportunities

Case study

The fraudulent appearance of this ISP has resulted in a loss of SDR 3 121 825, i.e. over 30% of revenues from international operations.
III – Threats and opportunities

III.2 – Opportunities

VoIP has to be considered as an opportunity and, as such, we have to look at how to derive maximum benefit from it.
III - Threats and opportunities

III.2 - Opportunities

A sharp increase in incoming international traffic may be anticipated due to a lower accounting rate and especially the growing use of prepaid IP cards in the main countries with which African operators have relations.
III – Threats and opportunities

III.2 – Opportunities

There is, moreover, a large demand for communications which is not satisfied on account of low purchasing power or very high tariffs for international calls.

VoIP would offer a possible solution to satisfy this demand and generate additional revenues.
III - Threats and opportunities

III.2 - Opportunities

To derive maximum benefit from VoIP, a commercial strategy is required, together with effective monitoring of commercial operations. Without being exhaustive, this strategy may include the following:
III - Threats and opportunities

III.2 - Opportunities

Implement tariff rebalancing
Keep accounting rates down
Create a legal framework for call termination over the IP network
Implement network surveillance
Provide a VoIP service
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IV - Tariffs: **Main cost centres**

- Local interconnection
- Voice transfer
- Call termination
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IV – Tariffs: Main cost centres

Local interconnection

- Cost of infrastructures for connection to PSTN (analogue line, ISDN, E1)
- Cost of using PSTN infrastructures
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IV - Tariffs: **Main cost centres**

- Costs of transfer equipment (router, gateway, gatekeeper, administration, link)
- Commercial costs, administrative costs, other costs
- Cost of producing cards

Voice transfer
Voice over the IP network

IV - Tariffs: Main cost centres

- Call termination
- Cost of transit
- Cost of termination
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IV - Tariffs in practice

The price of a VoIP call is two to three times lower than the price of a call over the PSTN for a service offered by an ISP. This factor is even greater for a call from PC to telephone.
**Voice over the IP network**

IV - Tariffs in practice

**Example:** Cost of a one-minute call from Togo to France with different technologies.

<table>
<thead>
<tr>
<th></th>
<th>Togo Telecom</th>
<th>VoIP by ISP</th>
<th>PC to phone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed line</td>
<td>500</td>
<td>200</td>
<td>29</td>
</tr>
<tr>
<td>Mobile</td>
<td>500</td>
<td>200</td>
<td>170</td>
</tr>
</tbody>
</table>


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IV – Tariffs in practice

There are several reasons for these huge differences:

Design of the networks
Light and inexpensive infrastructures for VoIP
No high accounting rates
Voice over the IP network

IV - Tariffs in practice

• Network design

The IP network obeys an objective of minimum quality and “best effort” in a competitive environment.

The switched network is constructed with the aim of maximum quality in a monopoly environment.
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IV – Tariffs in practice

- Network design

The IP network is a shared-resource network

Everyone uses the same circuit

The PSTN is a dedicated-resources network

A circuit is opened for each call
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IV – Tariffs in practice

• Light and inexpensive infrastructures for VoIP

The infrastructures for voice transfer are much lighter than the PSTN equipment fulfilling the same functions, thus yielding considerable savings in terms of fixed operating costs.
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IV – Tariffs in practice

• Light and inexpensive infrastructures for VoIP

Much more software than hardware, hence lower maintenance costs.
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IV – Tariffs in practice

- No high accounting rates

For the provision of VoIP, there are no accounting rates as in conventional telephony.

The system entails call termination offered by an international VoIP provider who has equipment in several countries and therefore pays a national interconnection charge which is the termination charge.
IV – Tariffs in practice

- No high accounting rates

In practice, the VoIP provider has to deal with a single partner that handles transit and call termination services.

Since VoIP suppliers are companies located in the developed countries operating with high volumes, they offer more attractive call termination tariffs than the accounting rate system.
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V – Regulation

Regulation of VoIP is still an issue, even in countries ahead of the game.

In the United States, for example, there has been considerable activity on the legal front in the first half of 2004 with regard to whether or not VoIP should be regulated.
**Voice over the IP network**

**V – Regulation**

While for the moment FCC has decided not to regulate the service, some States like California have already started to regulate it, and others like Minnesota are contemplating regulating it and are likely to do so.
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V – Regulation

We believe that VoIP should be regulated in our countries, by means of a licensing or authorization regime, subject to approval of a set of terms, conditions and specifications.
V – Regulation

Regulation would serve to:

- Protect all players in the market
- Ensure healthy market competition.
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V – Regulation

V.1 – Protecting all players in the market

- VoIP suppliers

Protection against the dominant position of incumbent operators, enabling VoIP suppliers access to incumbent operators’ resources that are essential to their operations.
Voice over the IP network

V – Regulation

V.1 – Protecting all players in the market

• VoIP suppliers

Guarantee such access to essential resources at a fair and equitable price.
Voice over the IP network

V – Regulation

V.1 – Protecting all players in the market

- Wireline and mobile operators

Guaranteeing fair and equitable renumeration for their resources.
Voice over the IP network

V – Regulation

V.1 – Protecting all players in the market

• Consumers
  Guaranteeing quality of service
  Guaranteeing availability of the service
  Providing information on tariffs
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V – Regulation

V.2 – Ensuring healthy competition in the market

Should the constraints imposed on wireline and mobile operators also apply to VoIP operators?
V – Regulation

Constraints may or may not be applied to VoIP service providers according to their status.

It must be acknowledged that any constraint has a cost that would have an impact on the tariffs offered by an operator.

Healthy competition requires that all operators bear the same costs deriving from their obligations, so that any given operator does not enjoy a favourable position in relation to another.
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V – Regulation

In our view, certain obligations should be imposed on VoIP operators:

• Interconnection obligation
  To interconnect with public networks within the rules set by the regulatory body

• Obligation to contribute to universal service
  Contribute to funding universal service, contribute to the telecommunication development fund
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V – Regulation

In our view, certain obligations should be imposed on VoIP operators:

• **Obligation in terms of quality of service**
  Service accessibility, service information

• **Obligation in terms of service availability**
  Availability of the service in terms of time and place
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Conclusion

VoIP is a growth service worldwide. It is of low quality, especially when set up over the public Internet.

An improvement in quality may be anticipated in the coming years, but this will take time and above all will cost a lot of money.
Conclusion

The future of the VoIP service will depend on the efforts to rebalance tariffs made by the incumbent operators, and on how accounting rates evolve with time.

Provision of the service should be encouraged in our countries, since it could meet a social need for populations with a low purchasing power.
Conclusion

We believe that incumbent operators should provide ranges of service at different prices according to quality.

Finally, regulatory bodies must implement the right regulatory policy to enable VoIP to develop smoothly alongside conventional telephony.