

Internet Telephony (or VoIP): a Reality?





Mourad Cherfaoui

Agenda

- ❑ Traditional Telephony (Residential, Enterprise, Wireless) Overview.
- ❑ Internet Overview.
- ❑ Voice and Data Convergence.
- ❑ Internet Telephony Scenarios.
- ❑ Internet Telephony in Algeria (Where it stands and Investment Opportunities).

Traditional Telephony Overview

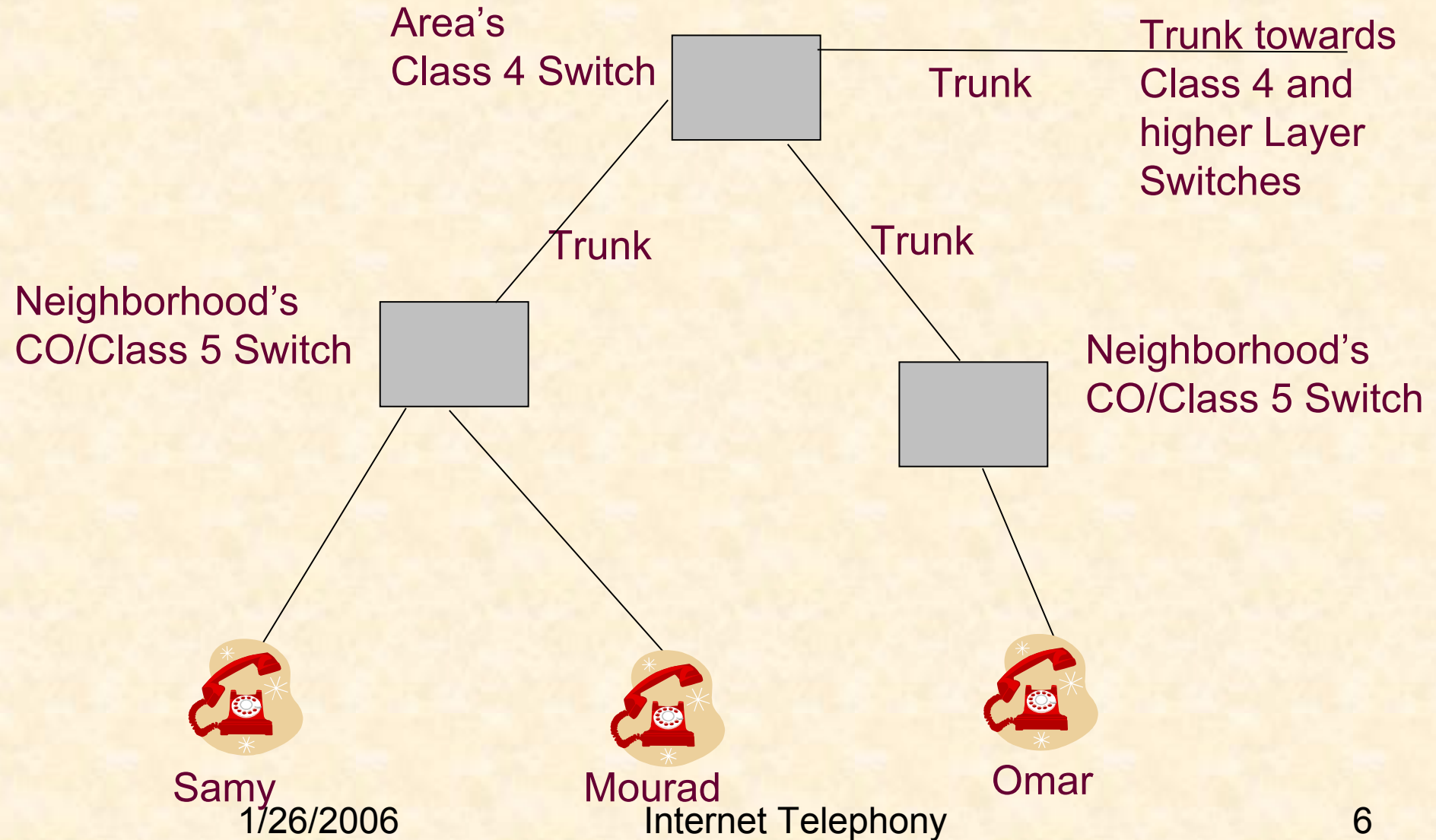
A Little History

-  Graham Bell connected 2 rudimentary phones (Carbon Membrane and a Magnet) with an electrical cord. 1876.
-  Direct connection between every 2 phones. No dialing.
-  First improvement: connect every phone to an operator to switch calls.
-  Second improvement: Dialing and Mechanical Switches (later on: Electronic Switches)

How does it work?

- ❑ A pair of copper wires runs between a subscriber home and a local Central Office (or Class 5 switch).
- ❑ COs connect to their local Tandem Switch (or Class 4 Switch).
- ❑ Local Tandem Switches connect to higher Layer Tandem Switches.
- ❑ Switches connect through Trunks.
- ❑ Telephone Network is also called PSTN (Public Switched Transport Network).

Here is how it looks like



Some PSTN Concepts

- ❑ Signaling: on hook, off hook, digits collection
 - ❑ In-band Signaling
 - ❑ Out of Band Signaling
- ❑ Bandwidth: line capacity (in KHz or Kbits/s)
- ❑ Voice Circuit: the bandwidth used by a voice communication.
- ❑ IN Services (or Class Services). 800 Number, LNP (Local Number Portability), Call Forward, etc.
- ❑ Analog vs. Digital Voice

Subscriber Line

- ❑ The line between a subscriber and the CO.
- ❑ Voice stream is usually analog.
- ❑ The capacity (or bandwidth) of the line is limited to 4KHz (64KBits/s)
- ❑ Signaling is in-band.
- ❑ *ISDN* (digital voice, out of band signaling) did not really catch up.

Trunks

- ❑ That's the link between Switches.
- ❑ Copper Cables between local switches
- ❑ Optical Fiber/Satellite between higher level Switches.
- ❑ Link capacities are hierarchical:
 - ❑ T1 (31 voice circuits)
 - ❑ T3 (28 T1), T4 (168 T1)
 - ❑ Sonet (OC3, OC4)
- ❑ Trunks carry digital voice.

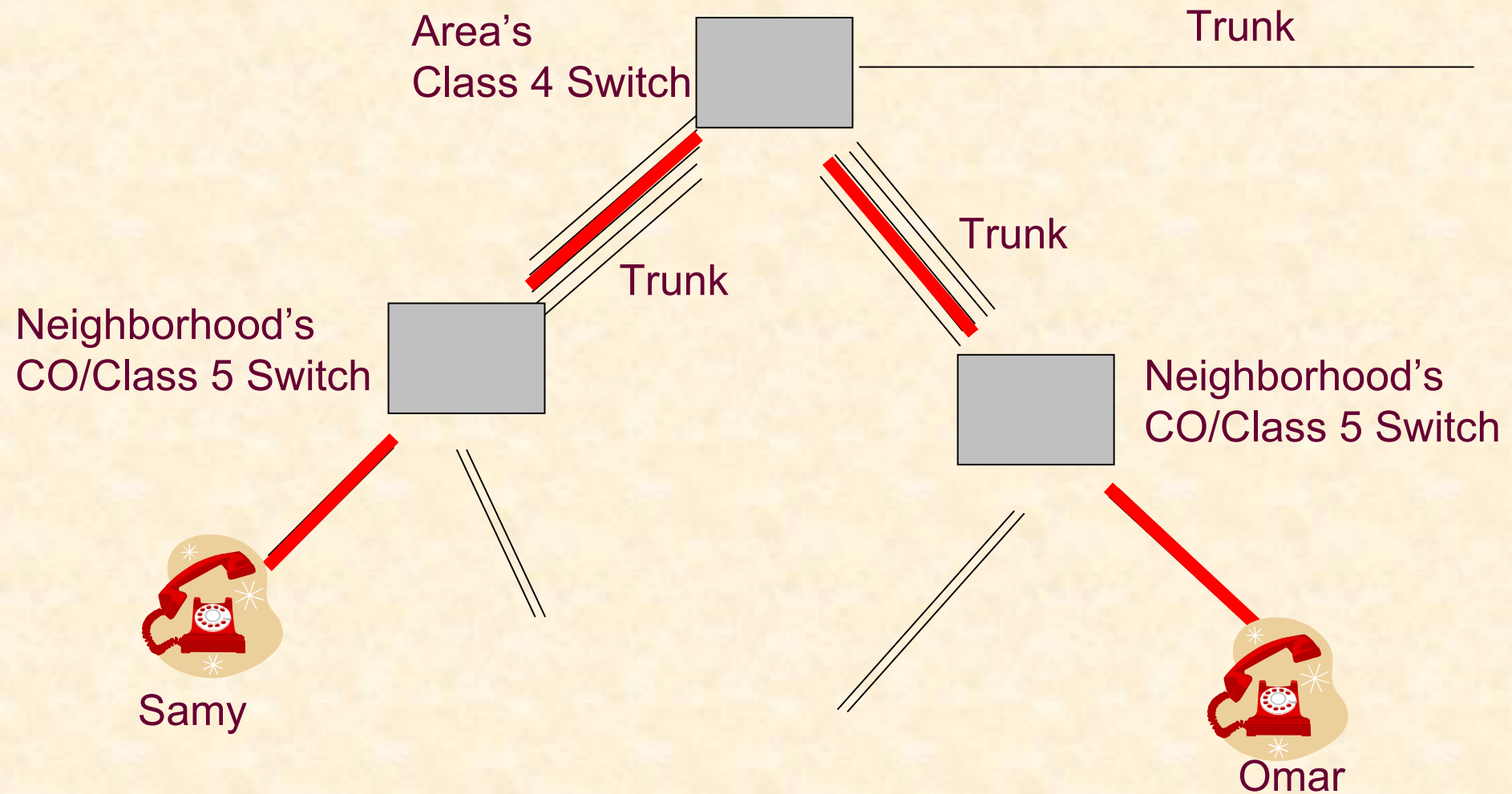
Signaling between Trunks

- ❑ Old Switches: in-band => not flexible, hard to deploy IN services.
- ❑ Modern Switch use out of band Signaling. SS7 is the most popular.
- ❑ SS7:
 - ❑ Very flexible.
 - ❑ Saves bandwidth for voice.
 - ❑ Delegates IN Services to special nodes in the network (SCPs).

Close up view of a Trunk



Putting the Pieces Together



Samy

Omar

1/26/2006

Internet Telephony

12

PSTN Players

- Service Providers:
 - Local Services: LECs (Local Exchange Carriers). Baby Bells. IN services: CallId, Call Blocking, CallBack, Last calls.
 - Long Distance: IXC (Inter-Exchange Carriers). Sprint, ATT, MCI, etc. IN Services: 800 Numbers, Calling Card.

- Equipment Vendors: Ericsson, Nortel, Alcatel, Lucent

Misc. PSTN Information

- ❑ North America uses a dialing plan called NANP (North American Numbering Plan):
 - ❑ NPA-NXX-XXXX ex: 408 673 2983
- ❑ International dialing plan is called E.164
 - ❑ (CC) (NDC) (Subscriber Number)
- ❑ Long Distance Preferred Carrier:
 - ❑ NANP + 10-XX-XXX CO selects LD Carrier

PSTN Drawbacks

- ❑ Very poor usage of bandwidth
- ❑ New services can't be deployed quickly enough
- ❑ PSTN network not suitable for carrying non-voice information (data).

BUT

PSTN Network is very reliable. Almost always up. Subscribers phones powered independently.

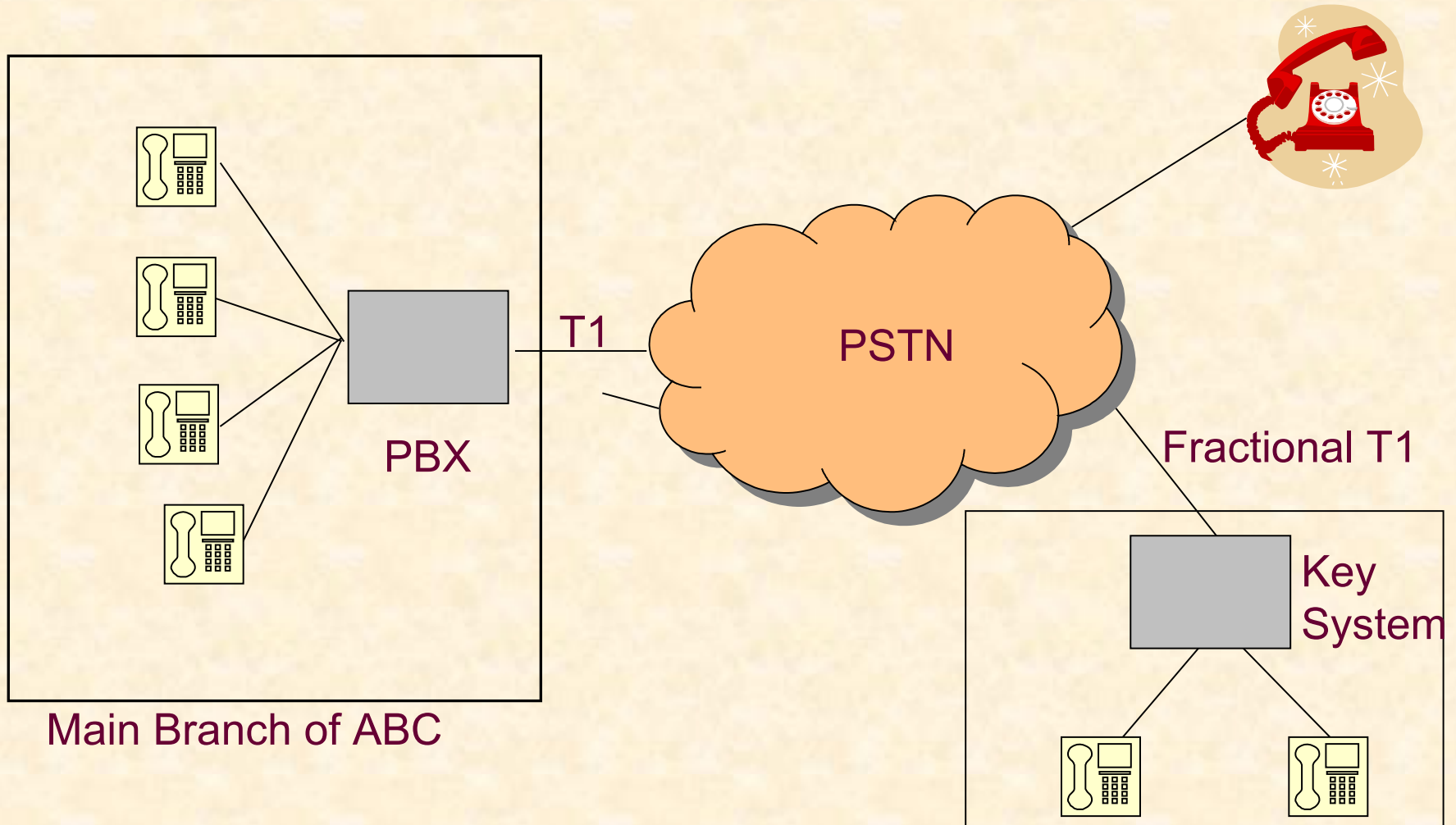
Enterprise Telephony

- ❑ Private companies have different needs than residential users: more services, short dialing.
- ❑ Options:
 - ❑ Business Lines: costly, limited capabilities.
 - ❑ Centrex Lines: Local PSTN Provider (e.g. SBC) manages ET. Costly and not flexible.
 - ❑ Acquire own Switch or PBX (Private Branch eXchange). Flexibility to add, move, numbers. Cost effective. Key Systems are small PBXs.

PBX

- ❑ PBXs typically provide more services : 3 way calling, voice mail, callback, transfer, park, etc.
- ❑ PBX need to provide a programming interface: CTI (Computer Telephony Integration) to support additional applications: Call Centers, Conferencing, etc.

Example: ABC Company

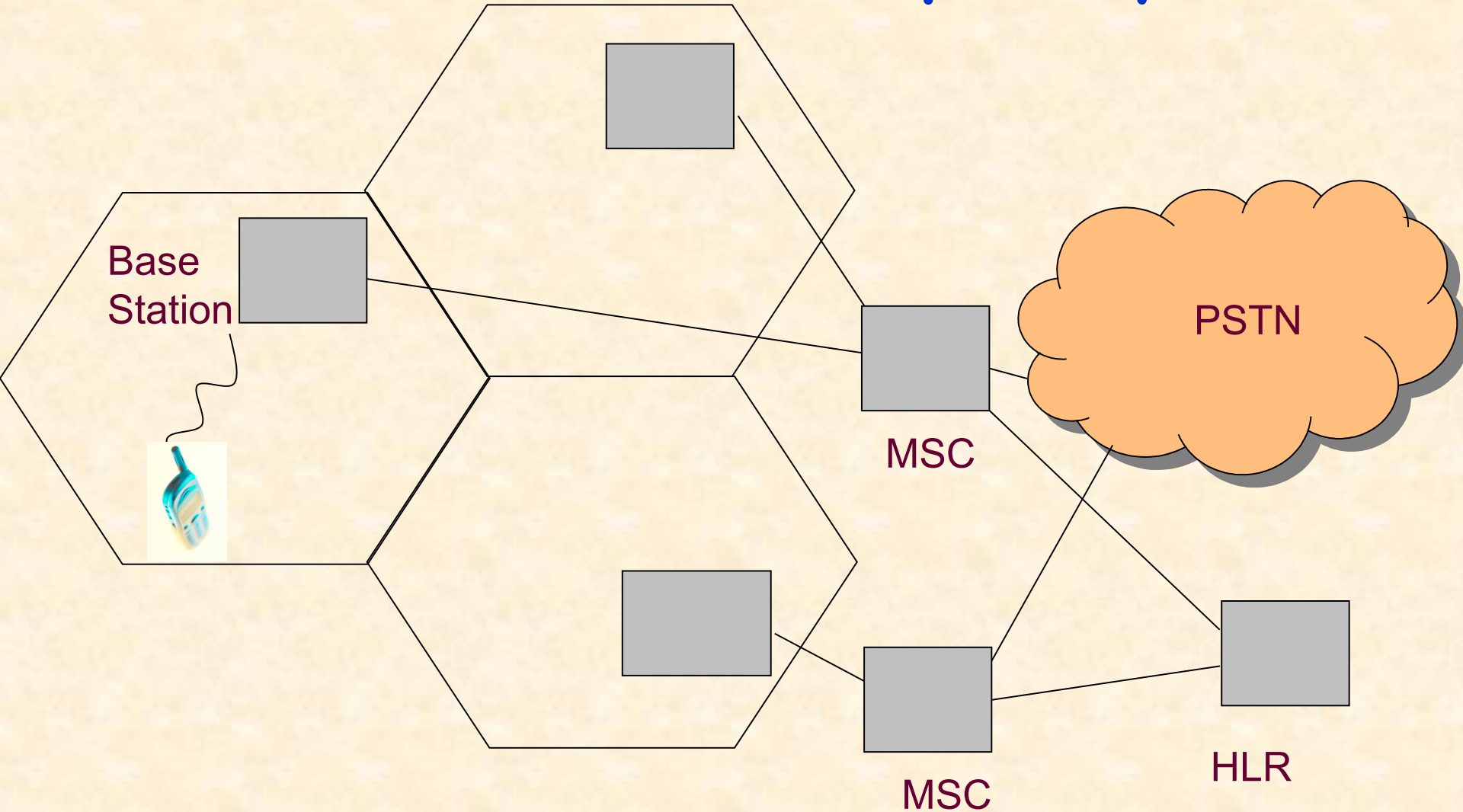


Main Branch of ABC

1/26/2006

Internet Telephony Remote Branch of ABC

Wireless Telephony



Internet

Why do we need another network (than PSTN)?

- ❑ Data has different requirements than voice:
 - ❑ Usually no time constraint
 - ❑ Data Integrity is important unlike voice.
 - ❑ Data comes in bursts.
- ❑ PSTN not suitable for data:
 - ❑ voice circuit needs to be reserved but not used.
 - ❑ No mechanism for data integrity.

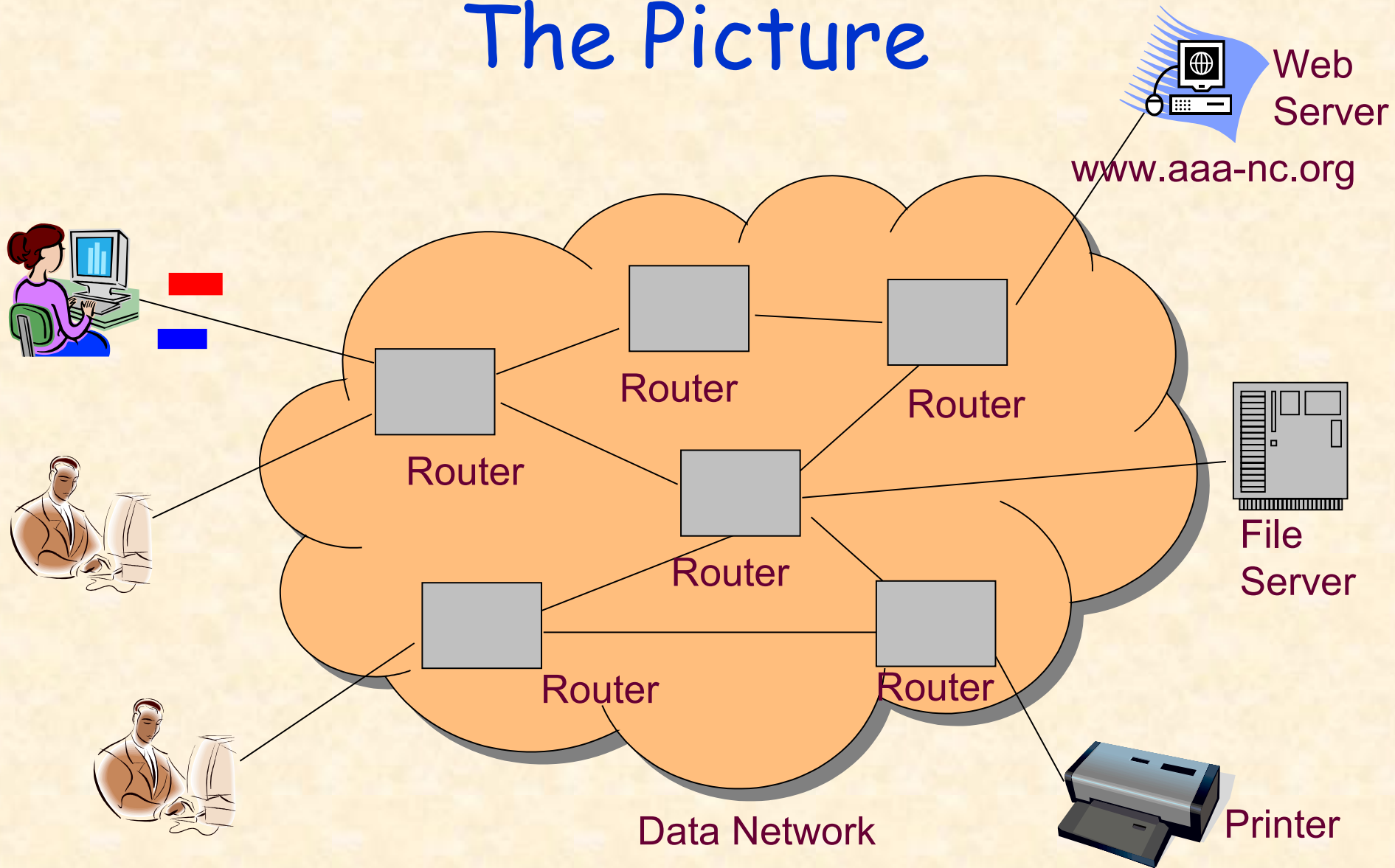
Solution: Data Network

- ❑ Fragment data (e.g Word file) into chunks called Packets.
- ❑ Each packet contains a portion of the data plus control information (source and destination addresses, order, error control, etc).
- ❑ Each packet is sent individually through the network.

Benefits of Data Packets

- Only lost packets need to be re-transmitted.
- No need to reserve a circuit.
- Sharing of resources
- Packets can take different Routes

The Picture



The Internet

- ❑ Many Data Networks exist, some suited for Local Areas (LANs) and others for Wide Areas (WANs).
- ❑ Internet is the "language" that makes networks talk to each other: Inter-Net(works)
- ❑ Internet began in the early 1970s (DOD).

Examples of LANs: Ethernet, Token Ring

Examples of WANs: ATM, Sonet.

What Internet defines

- ❑ How to build Packets. Internet Packets are called IP Packets.
- ❑ Format of Addresses: A.B.C.D, e.g. 172.19.143.236 or hoggar@cerist.dz
- ❑ How to direct or **route** Packets to destination (through routers). Routers use Routing Tables.
- ❑ Node to Node conversation protocol. 2 Protocols: TCP and UDP.

Internet Addresses

- ❑ A.B.C.D
- ❑ A, B, C, D: numbers between 0 and 255.
- ❑ A prefix in the address (e.g. A) identifies the network and the remaining the node in the network.
- ❑ Internet addresses are *geographically opaque*: we can't tell where the node is by looking at the address unlike PSTN directory numbers.

Misc. Internet

- ❑ Packets in internet are routed using tables in routers. Tables can be static or dynamic.
- ❑ Internet has 2 modes of transmission:
 - ❑ TCP: packets are re-transmitted in case of errors, packets are re-ordered at arrival.
 - ❑ UDP: no retransmission, no ordering. Best effort.

Internet and Quality

- ❑ Users expect a QoS (Quality of Service) from the Internet.
- ❑ Private Internet(s) can be very reliable and provide a high QoS.
- ❑ The Public Internet does not provide any QoS guarantee BUT it's free!
- ❑ Overall, the PSTN offers a better reliability because it has been improving over a very long period.

Voice and Data Convergence.

Converge to PSTN?

- ❑ PSTN not suitable for data because:
 - ❑ data may require high bandwidth or very low bandwidth.
 - ❑ data transmission don't need to reserve a circuit.

Converge to Internet

Packets can carry voice (Voice over IP or VoIP)
BUT:

- Packets need to get to destination within a limited time.
- Packets need to get in the right order to destination.
- Loss of packets is acceptable.

Can internet meet these requirements?

So Can Internet Support Voice?

Yes BUT:

- Private Internets can offer the required guarantees.
- The Public Internet cannot offer these guarantees BUT it has improved a lot in recent years. It can support voice although with a lower quality than its private counterpart.

Benefits of VoIP

- ❑ Save bandwidth during silence.
- ❑ Voice can be compressed
- ❑ Better sharing of network resources
- ❑ Better handling of errors (packets can take different routes).
- ❑ Cost saving: 1 network to manage vs. 2 before (voice and data networks)
- ❑ Mobility: IP address not tied to a particular area.

Benefits of VoIP (Cont'd)

- ❑ Cost saving on equipments/software: PCs running Linux can often be used unlike PSTN.
- ❑ Interaction with other Internet tools: Web, Email, Calendaring, etc.
- ❑ Easier new Services introduction.
- ❑ Better security thanks to encryption.
- ❑ BUT:
- ❑ Quality is generally lower than PSTN but the gap is closing.
- ❑ PSTN better in handling 911, power outages.

VoIP Solutions

VoIP Configurations

- ❑ Using the Free Public Internet: Skype, Yahoo Messenger, MS Netmeeting.
- ❑ Using a Private Internet: Vonage, Lingo, Enterprise telephony.
- ❑ Mixed PSTN/Internet: Prepaid Calling Card, Grooming, Public internet to PSTN (Skype).

VoIP on the Public Internet

- ❑ QoS not guaranteed.
- ❑ Lower voice quality than PSTN.
BUT hey, it's free!
- ❑ Furthermore, drawbacks offset by features not in PSTN: mobility, voice encryption, integration with email, web, etc.
- ❑ Players: Skype, Yahoo Messenger, MS NetMeeting.

VoIP on the Public Internet (2)

NEW YORK (AP) -- Broadband gear maker NetGear Inc. is introducing a cordless phone to dial Skype Internet calls over any Wi-Fi connection without a personal computer, joining a parade of new products at the International Consumer Electronics Show bringing online telephony to the mainstream.

Other announcements at CES involving VoIP, or Voice over Internet Protocol, included new phones from two major names in consumer electronics, Panasonic Communications Co. and Philips Electronics NV.

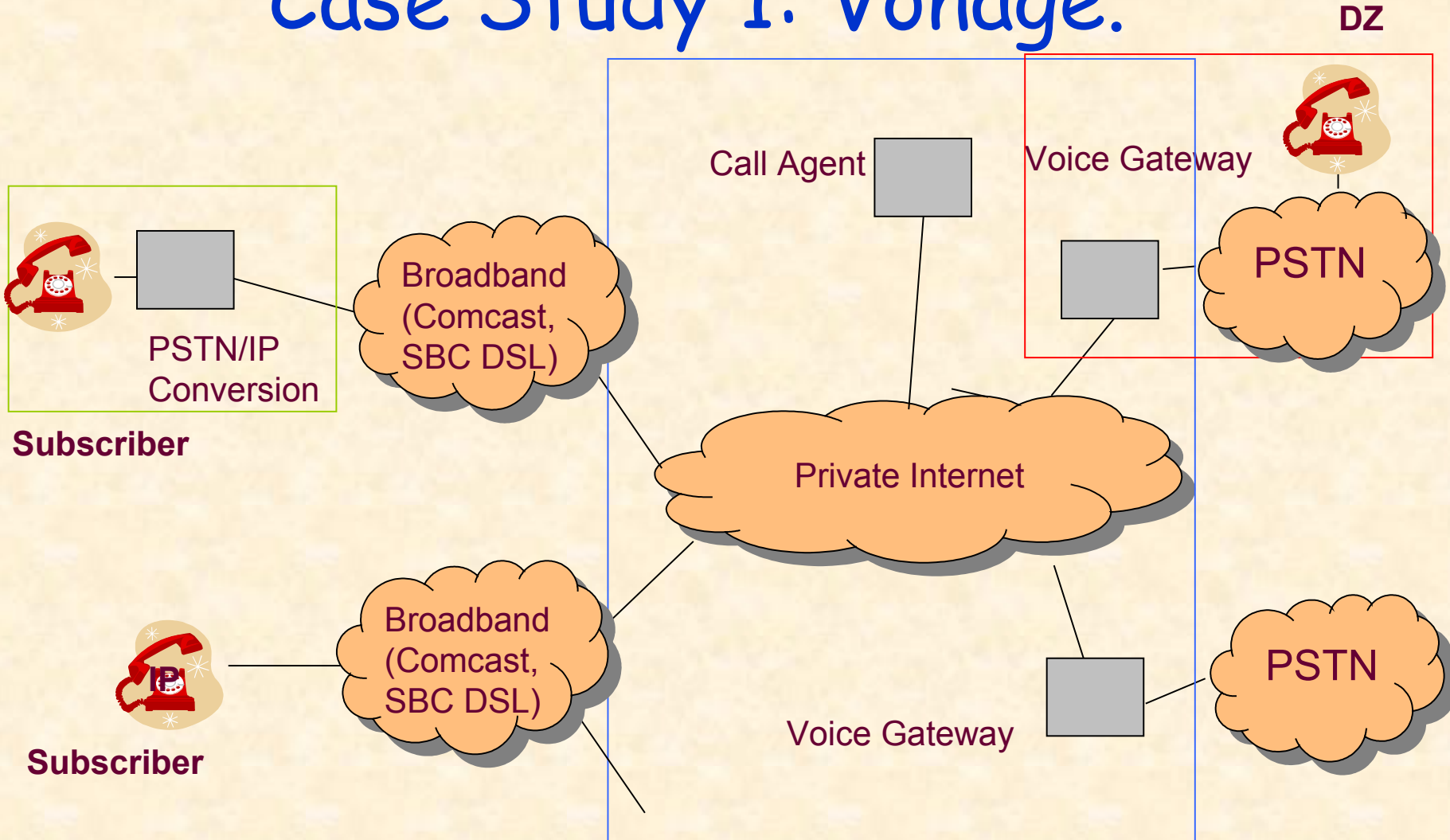
In: VoIP Calling Goes Mainstream at CES Event

http://biz.yahoo.com/ap/060104/gadget_show_voip.html?.v=2

Private Internet VoIP

- ❑ Usually guaranteed QoS.
- ❑ Good voice quality
- ❑ Users need to pay a fee but much lower than for PSTN.
- ❑ Same User Experience as PSTN
- ❑ ISPs (Internet Service Providers) benefit the most in this market because of expertise in IP.
- ❑ Players: Vonage, Lingo, Enterprise Telephony
- ❑ Equipment vendors:
 - ❑ Service Providers: Cisco, Sonus, Lucent, Nortel, etc.
 - ❑ Enterprise Telephony: Cisco, Avaya, Alcatel, Nortel, etc.

Private Internet VoIP, Case Study 1: Vonage.



1/26/2006

Internet Telephony **Smart Calling Card**

41

On Vonage

NEW YORK (AP) -

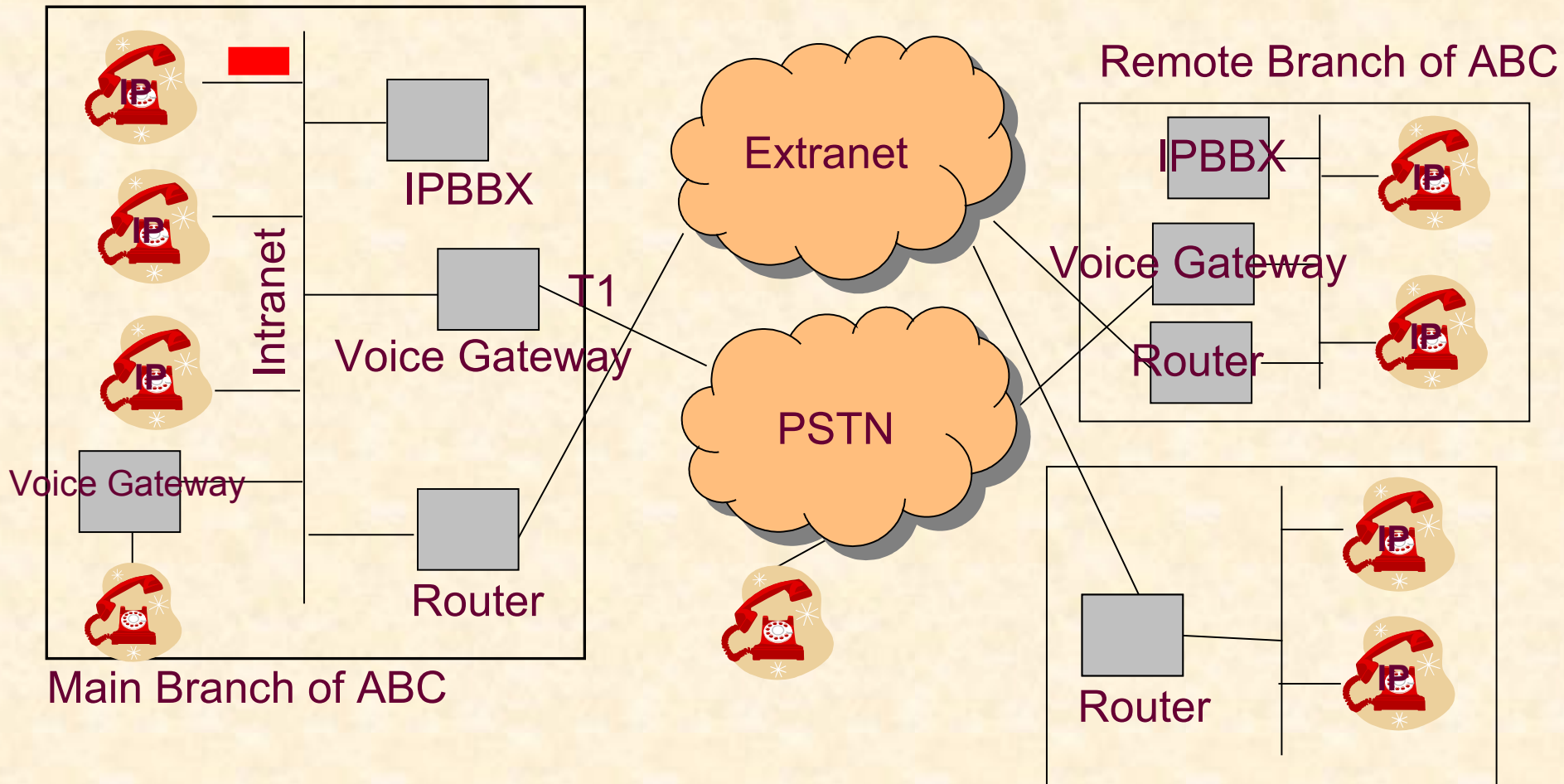
.....

In addition, Panasonic said it is introducing a cordless system for VoIP phone service from Vonage Holdings Corp., while Philips unveiled an alliance with Microsoft Corp. to introduce VoIP products

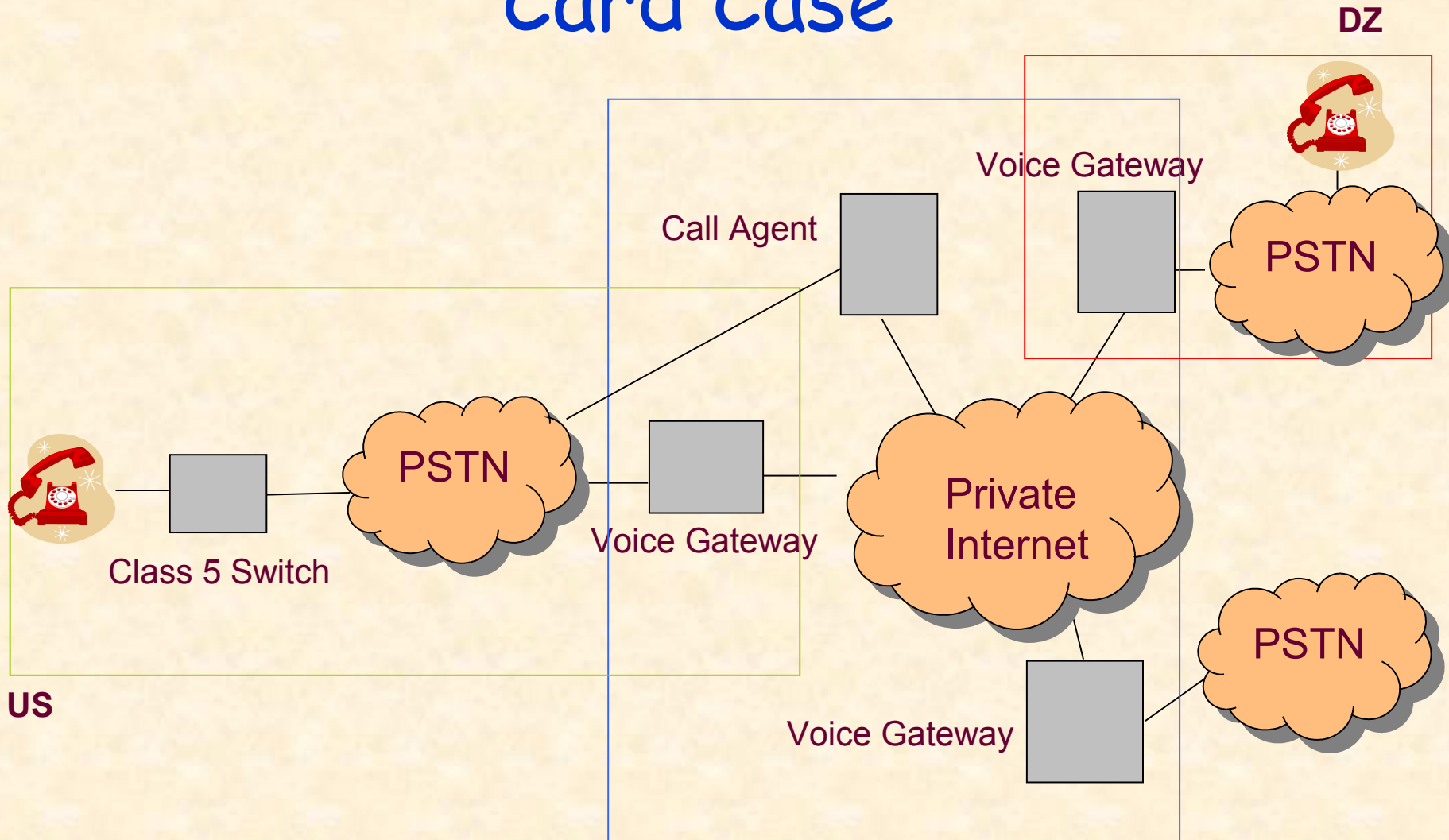
In: VoIP Calling Goes Mainstream at CES Event

http://biz.yahoo.com/ap/060104/gadget_show_voip.html?.v=2

Toll Bypass



Mixed PSTN/Internet: Prepaid Card Case



US

DZ

1/26/2006

Internet Telephony **Smart Calling Card**

44

VoIP in Algeria

Can I Call Algeria for free?

- Of course it's possible using the public internet and PC calling: Skype, yahoo messenger, MS NetMeeting.
- You will need you peer to have the same software and a speaker/headset and an internet access (usually broadband)
- Quality in not guaranteed. Voice quality is lower than PSTN
- You can also purchase a Vonage box with a local number and ship it to Algeria.

VoIP Regulation In Algeria

- Everything VoIP is regulated by ARPT (Autorité de Régulation de la Poste et des Télécommunications).
See <http://www.arpt.dz>
- Voice Market has been deregulated (open to competition). E.g Orascom in PSTN.
- ARPT granted 4 licenses for VoIP to 4 ISPs:
 - SmartLink Communication (SLC): wireless internet. El watan
- Edition du 14 juillet 2005
 - l'EEPAD:
 - Last Net:
 - Webcom:

VoIP In Algeria

- These ISPs are planning to provide Vonage-like type of service.
- As of today none has started service.
- Expect some "political" issues as these ISPs will be competing with Algerie-Telecom and Orascom.

Enterprise VoIP in Algeria

- IPPBX not in the realm of ARPT.
- Top Algerian Companies are starting to switch to VoIP. E.g Wataniya.
- Motivation is mostly Toll-Bypass.
- Most if not all vendors are non-Algerian (mostly French and middle-eastern) although many have sites in Algeria. Example: ARES (France)
- ALBM is an Algerian company recently bought by CFAO (France).

Investment Opportunities in VoIP in Algeria

- Residential VoIP seems a tough market to be in. ISPs are well positioned. Requires advanced expertise in IP and an important investment.
- More opportunities in Enterprise VoIP, especially small companies.