Voice Over Internet Protocol (VoIP) Issues and Challenges

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Content

- Network Evolution and drivers
- VoIP Realizations
- VoIP Deployments in Canada
- Impacts and Challenges
  - Technical
  - Policy and Regulation

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Drivers Affecting Network Changes

- Network Simplification
- Lower start-up and operating costs
- Regulations
- Leap frog competition
- Fast service introduction and customization

End User

IP-based Network

Technology

- Lower LD voice service rate
- Improved codec compression techniques
- Faster processing power
- Traffic control mechanism

Service Provider

The telecom network is undergoing extensive changes to meet new market and service demands.

Network Architecture Evolution

Today – Single Service Networks

Future – Multi-Service Networks

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Enters VoIP...What is it?

- Many names, different meaning to different people:
  - Soft-switching
  - Next Generation Voice Network
  - IP Telephony
  - Voice over Internet
  - Voice over Internet Protocol
  - Voice over Packet
  - IP Communications

Various implementations of VoIP systems and user expectations.

VoIP Network Architecture – 3 Key Functional Elements

- **Media Gateway Controller / Softswitch / Gatekeeper**
  - Instructs Media Gateways on how to set-up, handle, and terminate individual media flows

- **Media Gateway (MG)**
  - Translates between TDM voice and packet data
  - Establish media path

- **Signalling Gateway**
  - Inter-works with the SS7 network for call control

**Different signalling and control standards between network elements:**
- H.323, MGCP, IETF Megaco/ITU-T
- H.248, SIP, SIP-T ...
- Different VoIP realizations and physical architectures
VoIP Realizations

- PC Applications
- PSTN Bypass
  - Toll
  - Enterprise
  - Broadband VoIP
  - Cable VoIP
- Next Generation Network
  - Circuit-Switch Replacement
  - Service creation and customization

- Combining network and CPE (edge) intelligence allows service customization and new service revenue
- Varieties of VoIP deployments

PC Applications – PC to PC (Internet to Internet)

- User
  - Free calls between PCs
  - Low voice quality and reliability
- Technology
  - PC client software (e.g. Microsoft NetMeeting) for voice and multimedia communications between PCs with the same client software
  - VoIP processing performed in PCs
- Network
  - Network traffic carried in public Internet
  - No legacy PSTN
**PSTN Bypass – PC to Phone**

- **User**
  - Voice calls between PC and PSTN phone
  - A fee normally charged
  - Voice quality varies, depending on service provider networks
- **Technology**
  - PC client software
  - VoIP processing performed in PCs
- **Network**
  - Network traffic carried in public Internet or in managed IP network
  - Requires VoIP Gateway to interwork with PSTN

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**PSTN Toll Bypass – Phone to Phone**

- **User**
  - Cheaper long distance voice calls via pre-paid calling cards
  - Service offered since 1995 due to high international LD tariff
  - May require to dial up to 24-digits for call establishment
  - Voice quality varies
  - VoIP technology invisible to users
- **Network**
  - Global coverage and interconnection among allied VoIP service providers
PSTN Bypass – Enterprise IP PBX

- VoIP PBX provides Media Gateway and router functions
- Supports voice and data services
- Voice and data traffic between enterprise sites is carried by the IP network.
- PSTN carries overflow voice traffic and off-net calls
- Well suited for road warriors
  - Access corporate network resources
  - Make VoIP long distance calls on any Internet access to corporate phones or public PSTN phones.

PSTN Bypass – Broadband VoIP Service Provider

- New breed of VoIP service provider exploiting over providers’ broadband access
- User Features:
  - Low local and LD residential rates
  - Free calls to Canada
  - Extensive call feature set
  - Choice of area codes independent of customer location
- Cons to users:
  - Reliability - best effort service
    - Dependent on access provider network reliability
    - Affected by power outage
  - Number Portability
  - 911

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Cable IP Telephony – Converged IP Architecture

Cable Operator implements a single IP infrastructure and offers innovative new services (voice, data, video) to compete with telcos.

Carrier PSTN Circuit Switch Replacement

- **Business Motivation**
  - New competitive carriers: leap frog incumbent carrier by deploying new packet technology
  - Incumbent carriers: evolve legacy circuit-switched networks to packet-based to reduce cost and compete with new carriers
  - Provides IP Centrex features and service customizations as competitive solution to IP PBX
- **Provides Phone - Phone communication**
  - Users can continue to use traditional voice phone set
  - IP phones are supported in IP Centrex
- **Stringent service and reliability requirements:**
  - Voice quality at least equal to wireless phones
  - Five 9’s reliability
### Canadian Carriers and Cable VoIP Service Offering

**Some examples…**

- **Telus (2003-04)**
  - PSTN toll switch replacement as first step to VoIP migration,
  - IP Centrex (hosted IP services) offering targeting corporate customers
    - A voice-over IP (VoIP) service combining local and long-distance voice with new IP-enabled features.
- **Bell (2003-04)**
  - Provides IP Centrex features
  - Focus on service creation, customization, and integration
  - PSTN switch replacement in future
- **Rogers Cable (planned 2005)**
  - Full VoIP phone services offering, including 911
  - In direct competition with the telcos
- **Shaw Cable**
  - Filed for CLEC status

### Broadband Service Provider Offering

- **Vonage (2003-4)**
  - Vonage offers virtual second lines with Toronto area codes to customers with US billing addresses
    - Allows people in Toronto to call a Vonage customer’s Toronto number without incurring long distance charges
  - Vonage started offering Canadians the same service it offers Americans in April 2004
    - Partnering with a Canadian CLEC who provides Canadian phone numbers and interconnection with the PSTN
- **Primus (2004)**
  - Partnering with a Canadian CLEC to offer VoIP Talk-Broadband™ service (PC-to-Phone)
  - Similar service offerings as Vonage
Technical Challenges

- Interoperability is the primary hurdle
  - Interworking of VoIP islands
  - The default (and less efficient) inter-connection is legacy PSTN/TDM
- Voice quality depends on engineering of managed IP network
- VoIP network security mechanism and implementation
- Lawful interception
- Local powering or network powering in case of power outages
- 911
- Exhaustion of phone numbers

Technical challenges and their solutions closely linked to policies and regulations.

Policy and Regulation – Technical Issues

- Interconnection architecture and tariff between IXC and IP CLEC
  - Current definitions under the CRTC Telecom Decision are based on TDM switch technology. These definitions affect VoIP interconnection arrangements and the associated tariff.
  - On April 7, 2004, the CRTC initiated proceeding on VoIP Services and issued a preliminary view (CRTC 2004-2)
Policy and Regulation – Technical Issues

• Interconnection architecture and tariff between IXC and IP CLEC (cont’d)

  – No agreement reached in CRTC on interconnection due to different views on the definition of “end-office” and “access tandem” under the IP network architecture:
    • Is Media Gateway an end-office?
    • Is the Media Gateway Controller an Access Tandem?
    • Is the Media Gateway Controller an end-office while the Media Gateways it controls are “remotes”?

Need to develop new technology independent definitions for End-Office and Access Tandem to accommodate VoIP networks.

Policy and Regulation – Competitive Issues

• Overall impact on competition is still impossible to predict
  – Would greater competition through VoIP lead to deregulation, or require greater regulation?
  – Will a major overhaul of competitive framework be required?

• Should telephony services be regulated differently due to different technologies used?
  – TDM
  – VoIP as PSTN replacement
  – VoIP offered by ISPs
  – Cable Telephony

• Access charges for VoIP service providers
• Unbundling of access and network services:
  – Should competitive access be provided to choose VoIP service providers via Packer Cable or DSL access?
Policy and Regulations – Consumers/Social Issues

• Should VoIP have QoS or Grade of Service guarantee?
• E911 obligations
• Powering of CPE
• Universality of voice services expectations for VoIP?
  – Carriers
  – ISPs
• Lawful Intercept requirement: does it apply to all forms of VoIP architectures?
• Number Portability obligations
• Consumer education on limitations of VoIP
  – VoIP service providers should specify VoIP technology limitations, e.g. No 911, no power outage protection, reliability not guaranteed, no number portability, etc.

Thank You