Voice Over DSL
An Overview

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Scope

- What is VoDSL?
- Implementation Schemes
- Reference Model
- System/Signaling/Service Requirements
- What does the Future hold for VoDSL?
What is VoDSL?

- Uses DSL lines over existing copper wire infrastructure to transport voice
- Supports multiple phone lines over single subscriber line
- Voice calls are converted into digital data packets
- Uses the extra DSL bandwidth dynamically
- Main goal: simulate the traditional phone system
- Why VoDSL? More cost effective!
Device Requirements For VoDSL

1. Customer Equipment – telephones, private branch exchange, fax, etc.

2. Integrated Access Device (IAD) – serves many different functions including DSL modem. The IAD serves as an interface between the DSL network service and the customer’s voice and data equipment. The packetization of voice traffic takes place and is prioritized over data traffic to ensure toll-quality voice delivery.

3. DSL Line – transports data and packetized voice to nearest carrier facility over twisted-pair copper loops.

4. DSLAM – terminates multiple DSL lines
Device Requirements For VoDSL (cont’d)

5. Data Switch – receives traffic from the DSLAM and separates the data from the voice packets; data traffic is sent to data network, voice packets are sent to the voice gateway.

6. Voice Gateway – voice packets are depacketized and converted to a standards-based format for delivery to a Class-5 voice switch.

7. Class-5 Switch – telephony switch providing dial tone, call routing, and services; also generates records for billing.

8. PSTN – the public telephone network.
Device Requirements For VoDSL (cont’d)
Implementation Schemes

- Channelized VoDSL (CVoDSL)
- ATM Broadband Loop Emulation Service (BLES)
- Voice over IP / Multi-service Broadband Network (MBN)
CVoDSL vs. VoATM and VoIP

Customer Premise

VoIP

IP

PPP

AAL2

AAL5

ATM

VoATM

Channelized VoDSL

POTS

xDSL Physical Layer

Network

IP

PPP

AAL5

AAL2

ATM

Baseband POTS
CVoDSL

- Physical Layer of OSI Model
- 64 kbps channels upstream and downstream for each voice line, supports up to 4 lines
- Reduces available bandwidth
- Dynamically allocated
- Cost savings
CVoDSL (cont’d)
BLES

- Goal: fully functional transport of Class-5 switch subscriber line services through the broadband access network to the end user
- CP-IWF provisioned with at least 2 PVCs, one for data and one for voice, voice having a higher priority to ensure toll-quality service
- Voice gateway in the network sends voice traffic to Class-5 switch
- Most cost effective where there is existing voice services over switching network
- Guaranteed QoS
BLES (cont’d)
BLES Protocol Stack

- Voice Processing in DSP
  - Compression
  - Echo Cancellation
  - VAD/ Comfort Noise
  - Jitter Lost Packets etc.
- AAL2 Signaling
- ATM Transport
- ADSL Physical
VoIP/MBN

- Provides voice service over DSL from the regional broadband network, without the need for Class-5 switch
- Customer side like BLES, but on network side the Class-5 switch is replaced with various gateway devices
- Most cost effective where a service provider wants to add voice services over existing data network
- QoS is not guaranteed
MBN (cont’d)
MBN Protocol Stack

- Voice Processing in DSP
  - Compression
  - Echo Cancellation
  - VAD/ Comfort Noise
  - Jitter Lost Packets etc.
- Voice over UDP/IP
  - Encapsulation is either PPP or IP over ATM
- AAL 5 circuit emulation
- ATM Transport
- ADSL Physical
VoDSL Reference Model
VoDSL Reference Model Definitions with Interfaces

- Service Provider Equipment (SPE)
- Access Network InterWorking Function (AN-IWF)
- Regional Broadband Network (RBN)
- Access Node (AN)
- Network Termination (NT)
- Customer Premises InterWorking Function (CP-IWF)
- Customer Premises Distribution Network (CPDN)
VoDSL Reference Model Definitions w/ Interfaces cont’d

- Customer Premises Equipment (CPE)
- Signaling Protocol Between the Elements
  - Dependant on Implementation Schemes
  - Still Varies – A11, A10a, A10, V, U, Ta, T, R
System Requirements

- Multi-line Capabilities
- Over Subscription
  - Blocking
- Dynamic Bandwidth Allocation
  - AAL2/AAL5
    - Silence Suppression
- Voice Quality
  - Maximum Delay
- Echo Cancellation
System Requirements cont’d

- Service Feature Transparency
- Continuous Availability
  - Possible Service Interruptions
- Performance
  - Comparable to POTS
- Management
  - Will Talk About Later
System Requirements cont’d

- Network Security
  - Denial of Service
  - Theft of Service
- Network Compatibility
  - Compatibility with the existing base
  - Ability for Future Growth
- Reliability
  - Minimum Reliability
  - Cross Layer Communication
General Service Requirements

- 64 Kbps µ/A-law encoding
- Quality of Service (QOS)
- End to End DTMF signaling
- Bearer Capabilities Negotiation
- Fax & Modem Transmission
- Hook-Flash Support
- Distinctive Ringing Support
- TTY (TDD) Terminal Support
Signaling Requirements

- Class 5 Services
  - Regular Telephony Features
    - Outgoing Call Establishment
    - Incoming Call Request
    - Call Release
    - Basic Service Characteristics
  - Supplementary Features
    - Custom Calling Features
Signaling Requirements cont’d

- CLASS Features
  - CLASS (Custom Local Area Signaling Service)
- CENTREX Features
Management

- Configuration, Fault
- Performance, and Security
- Two Means of Initiation

Protocols:
- SNMP (Simple Network Management Protocol)
- CMIP (Common Management Information Protocol)
Future of VoDSL

- Some Protocols More Feasible Than Others
- Early Wide Deployment Problems
  - Small to Medium Enterprises (SME)
- Must be Compatible with Legacy Equipment
- Still Testing
- Pros
  - Integrated Services
  - Bandwidth Conservation
  - Speculations for a Growing Market
  - Cost Savings
    - CLEC (Competitive Local Exchange Carrier)
    - ILEC (Incumbent Local Exchange Carrier)
Cost Savings Example

<table>
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<tr>
<th>Provider/Service</th>
<th>Lines</th>
<th>Local Service</th>
<th>Long Distance</th>
<th>Internet Access</th>
<th>Monthly Price</th>
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<tr>
<td>CLEC VoDSL</td>
<td>4</td>
<td>Unlimited</td>
<td>625 minutes</td>
<td>Yes</td>
<td>$200</td>
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<tr>
<td>ILEC business POTS lines</td>
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<td>Unlimited</td>
<td>Not included</td>
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<td>$268</td>
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<tr>
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<td>Unlimited</td>
<td>Not included</td>
<td>Not included</td>
<td>$892</td>
</tr>
</tbody>
</table>

(1) Prices and included minutes are averages derived from an averaging of published CLEC and ILEC offerings of VoDSL and POTS services.
Future of VoDSL cont’d

- Voice Line Increase
- Long Distance Service Increase
- Open VoB
- Compete with Larger Carriers

Cons
- No Transport Consensus
- Lack of Power Backup
- Current Telecom Market Slowdown
- Lack of Support on Lifeline Services
Future of VoDSL cont’d

- Technical Issues
  - Flow Through Provisioning
  - Soft-Switch Based VoDSL
THE END!!!
References

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