Requirements for End-to-End VoIP Header Compression
(draft-ash-e2e-voip-hdr-comp-rqmts-00.txt)
End-to-End VoMPLS Header Compression
(draft-ash-e2e-vompls-hdr-compress-01.txt)
End-to-End VoIP Header Compression Using cRTP
(draft-ash-e2e-crtp-hdr-compress-01.txt)

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Outline

(draft-ash-e2e-voip-hdr-comp-rqmts-00.txt)
(draft-ash-e2e-vompls-hdr-compress-01.txt)
(draft-ash-e2e-crtp-hdr-compress-01.txt)

- motivation, problem statement, requirements & background for E2E VoIP header compression
- brief review of proposals
  - ‘you read the drafts’
- issues
  - AVT WG charter extension
  - protocol extensions for cRTP, RSVP-TE, RFC2547 VPNs
  - resynchronization & performance of cRTP/'simple' mechanisms
  - scalability of E2E VoMPLS applied CE-CE
  - LDP application as the underlying LSP signaling mechanism

Motivation & Problem Statement for E2E VoIP Header Compression (draft-ash-e2e-voip-hdr-comp-rqmts-00.txt)

- motivation
  - carriers evolving to converged MPLS/IP backbone with VoIP services
    - enterprise VPN services with VoIP
    - legacy voice migration to VoIP
- problem statement
  - VoIP typically uses voice/RTP/UDP/IP/ encapsulation
    - voice/RTP/UDP/IP/MPLS with MPLS labels added
  - VoIP typically uses voice compression (e.g., G.729) to conserve bandwidth
    - compressed voice payload typically no more than 30 bytes
    - packet header at least 48 bytes (60% overhead)
  - end-to-end (compressor/gateway to decompressor/gateway VoIP header compression required
    - significantly reduce overhead
    - important on access links where bandwidth is scarce
    - important on backbone facilities where costs are high (e.g., some global cross-sections)
    - E.g., for large domestic network with 300 million voice calls per day
      - consume 20-40 gigabits-per-second on backbone network for headers alone
      - save 90% bandwidth capacity with E2E VoIP header compression

Requirements for E2E VoIP Header Compression
(draft-ash-e2e-voip-hdr-comp-rqmts-00.txt)

- avoid link-by-link compression/decompression cycles
  - compression should be end-to-end (compressor-gateway to decompressor-gateway) through MPLS network
  - **CE1/GW --> PE1 --> P --> PE2 --> CE2/GW**
  - CE1/GW is compressor, typically a gateway, CE2/GW is decompressor, typically a gateway
- provide efficient voice transport
- support various voice encoding (G.729, G.723.1, etc.)
- use standard compress/decompress algorithms (e.g., [cRTP], [SIMPLE])
- operate in RFC2547 VPN context
- operate in MPLS networks using either [LDP] or [RSVP] signaling
- be scalable to a very large number of CE --> CE flows
  - use standard protocols to aggregate RSVP-TE signaling (e.g. [RSVP-AGG])
  - minimize setups of tunnels & call sessions

Requirements for E2E VoIP Header Compression

(draft-ash-e2e-voip-hdr-comp-rqmts-00.txt)

- use standard protocols to signal context identification & control information (e.g., [RSVP], [RSVP-TE])
- use standard protocols to prioritize packets (e.g., [DIFFSERV, DIFF-MPLS])
- use standard protocols to allocate LSP bandwidth (e.g., [DS-TE])
- use standard protocols to make [cRTP] more tolerant of packet loss (e.g., [cRTP-ENHANCE])
- add minimal delay to the VoIP media flows

Background for E2E VoIP Header Compression

- prior work in MPLS WG by Swallow/Berger on 'simple' mechanism
  - work accepted by MPLS WG for charter extension (IETF-47, 3/2000)
  - I-D's expired before charter extended
- 'simple' E2E header compression
  - transmit only first order differences
  - resynchronization not needed with lost packets
  - ~50% header compression with 'simple'
- cRTP-based (RFC 2508) link-by-link header compression
  - algorithms specified in RFC 2508
  - resynchronization required with lost packets
  - ~90% header compression

Brief Review of Proposals
End-to-End VoMPLS Header Compression
(draft-ash-e2e-vompls-hdr-compress-01.txt)

- steps
  - use RSVP to establish LSPs between CE1/GW-CE2/GW
  - use cRTP (or simple HC) to compress header at CE1/GW, decompress at CE2/GW
  - CE1/GW requests session context IDs (SCIDs) from CE2/GW
  - CE1/GW appends CE2/GW label to compressed header
  - header compression context routed from CE1/GW --> PE1 --> P --> PE2 --> CE2/GW
  - route compressed packets with MPLS labels CE1/GW --> CE2/GW
  - packet decompressed at CE2/GW using cRTP (or simple HC) algorithm
- advantages
  - minimizes PE requirements
- disadvantages
  - CE/GW's need to run RSVP, possible scalability issue

Brief Review of Proposals
End-to-End VoIP Header Compression Using cRTP
(draft-ash-e2e-crtp-hdr-compress-01.txt)

- steps
  - use RSVP to establish LSPs between PE1-PE2
  - use cRTP to compress header at CE1/GW, decompress at CE2/GW
  - PE1 requests SCIDs from PE2
  - header compression context routed from CE1/GW --> PE1 --> P --> PE2 --> CE2/GW
  - PE1 & PE2 create ‘SCID routing tables’ & perform ‘SCID switching’ for compressed packets (SCID --> MPLS labels)
  - route compressed packets with MPLS labels PE1 --> PE2
  - packet decompressed at CE2/GW using cRTP algorithm
- advantages
  - minimizes CE/GW requirements
- disadvantages
  - additional PE requirements (need to create ‘SCID routing tables’)

Several Work Items

- extend cRTP to work over links with high delay & packet loss
  - assume enhanced cRTP (ECRTP) sufficient for now
- how to directly route cRTP packets using SCID switching
  - rather than doing a decompression/routing/compression cycle
  - Section 3.1 of draft-ash-e2e-crtp-hdr-compress-01.txt
  - router can do in isolation, without being observable by upstream or downstream routers
  - cRTP will see a ‘link’ with higher latency
  - independent of MPLS
- how to do ECRTP over an MPLS LSP
  - new signaling needed
  - compression between ingress-egress routers of LSP
  - can be viewed as the MPLS equivalent of RFC 2509
- how SCID switching can be applied by the ingress router of a compressed MPLS LSP

Issue 1 - AVT WG Charter Extension

- end-to-end VoIP header compression not fully within current charter of the AVT WG (or any WG)
- Transport Area Directors & Sub-IP Area Directors suggest AVT is best overall fit
  - coordination needed with other WGs (e.g., MPLS)
- extensions needed
  - proposals for VoIP header compression mechanisms
    - in scope
  - proposals for extensions to RSVP-TE to create tunnels
    - in scope

Issue 2 - Protocol Extensions for cRTP, RSVP-TE, RFC2547 VPNs

- extensions to [cRTP] and [cRTP-ENHANCE]
  - new packet type field to identify FULL_HEADER, CONTEXT_STATE, etc. packets
  - create 'SCID routing tables' to allow routing based on the session context ID (SCID)
- new objects defined for [RSVP-TE]
- extensions to RFC2547 VPNs
  - SCID routing combined with label switching at PE’s
- extensions need coordination with other WGs (MPLS, PPVPN, etc.)

Issue 3 - Resynchronization & Performance of cRTP/'simple' Mechanisms

- E2E VoMPLS using cRTP header compression might not perform well with frequent resynchronizations
- performance needs to be addressed
  - 'simple' avoids need for resynchronization
  - cRTP achieves greater efficiency than 'simple' (90% vs. 50% header compression), but requires resynchronization
    - use standard protocols to make cRTP more tolerant of packet loss (e.g., [cRTP-ENHANCE])

Issue 4 - Scalability of E2E VoMPLS Applied CE-CE

- RSVP-TE advantages
  - allows VoIP bandwidth assignment on LSPs
  - QoS mechanisms
- if applied CE/GW-CE/GW would require a large number of LSPs to be created
- concern for CE/GW/PE/P ability to do necessary processing & architecture scalability
  - processing & label binding at every MPLS node on path between each GW-GW pair
  - processing every time resource reservation is modified (e.g., to adjust to varying number of calls on a GW-GW pair)
  - core router load from thousands of LSPs, setup commands, refresh messages

Issue 5 - LDP Application as Underlying LSP Signaling Mechanism

- desirable to signal VoMPLS tunnels with LDP
  - many RFC2547 VPN implementations use LDP as underlying LSP signaling mechanism
  - scalable
- may require substantial extensions to LDP
  - 2 I-D's propose ways for LDP to signal 'VC' (outer) labels for PWs
    - http://ietf.org/internet-drafts/draft-ietf-pwe3-control-protocol-01.txt
    - http://www.ietf.org/internet-drafts/draft-rosen-ppvpn-l2-signaling-02.txt
  - Rosen's I-D suggests ways to do auto-discovery
  - this together with LDP capability to distribute inner labels might support CE/GW-CE/GW VoIP header compression LSPs (within the context of RFC 2547)
- other LDP issues
  - no bandwidth associated with LSPs.
  - QoS mechanisms limited

Next Steps

- propose Charter extension to AVT to include end-to-end VoIP header compression
  - progress I-D’s within AVT