Bandwidth constrained bypass routing without reservation

draft-szarecki-teas-bw-aware-bypass-no-reservation

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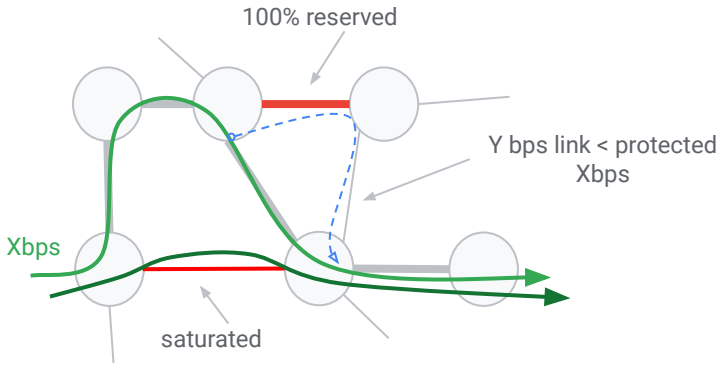
Disclaimer

I’m speaking in behalf of myself.

Any content and information must not be associated with my employer.

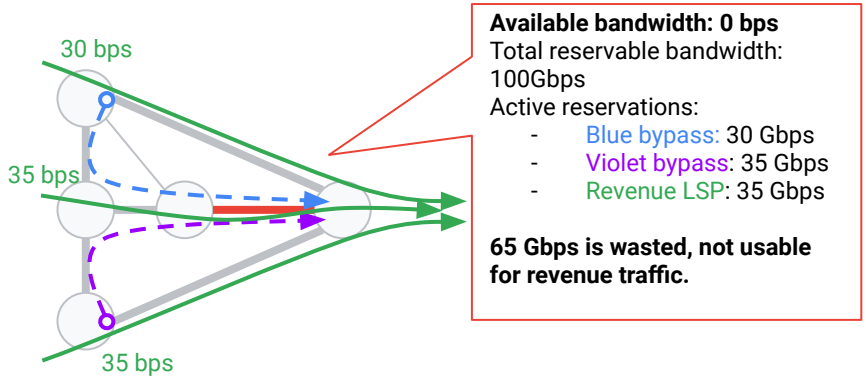
Bypass without bandwidth reservation.

- Bypass w/o reservation takes shortest-path even if
  - Links are already 100% used/reserved
  - And link capacity is too small to carry protected traffic
- **Congestion losses when bypass in use**



Bypass with bandwidth reservation - Cost Prohibitive

- Reserved bandwidth is NOT USED most of time
  - ~ 5 minutes after failure, and then nothing till next failure...
- Reservation for multiple bypasses are independent and additive.
- **Highly overprovisioned network.**



NOTE: Under SPOF, only either blue or violet bypass is in use.

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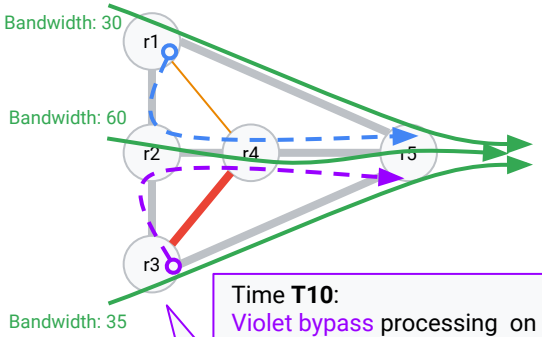
- Decouple CSPF path computation form bypass signalling
  - Calculate path ERO with X bps bandwidth constraints against TED
  - Use above ERO to signal path with Y bps bandwidth.
  - The Y = f(X) such Y < X; Y could be constant, including 0
- Derive value of X automatically - Protected Bandwidth (PBW)
- Optimize Bypasses infrequently

Derive bypass Protected Bandwidth (PBw) automatically

- The PLR (bypass head) knows LSP->Bypass-tunnel (N:1) mapping and LSPs bandwidths.
- PLR periodically scan all MPLS-TE LSP and sum-up its bandwidth per Bypass-tunnel - Protected Bandwidth sample.
  - Interval < Bypass-tunnel reoptimization timer (⅓ or lower).
  - (Optional) smoothing function over most recent samples.
  - When Bypass-tunnel path need to be calculated, PBw value is used as CSPF constrain (only).
- Statically configured minimum bandwidth for CSPF (min_PBw)
  - New Bypass-tunnel
  - Fall-back if CSPF returns no path for dynamin PBw
- Other procedures possible

Bypass path calculation and signalling

- Calculate path ERO with PBW bps bandwidth constraints against TED.
- Use above ERO to signal path with Y bps bandwidth.
  - Y = f(PBW)
  - Y may be 0 (all further slides and consideration).



Time **T0**:
Blue bypass processing on **r1**
TED:
r1>r2: available/total bw: 100/100
r1>r4: available/total bw: 10/10
r1>r5: available/total bw: 70/100
r2>r4: available/total bw: 40/100
r3>r2: available/total bw: 100/100
r3>r4: available/total bw: 10/100
r3>r5: available/total bw: 65/100
r4>r5: available/total bw: 40/100
CSFP calc:
Bw required "30"
r1>r4 and r1>r5 pruned
ERO: r1, r2, r4, r5
RSVP signal
Bw reservation **"0"**
ERO: r1, r2, r4, r5

No changes in TED

Time **T10**:
Violet bypass processing on **r3**
TED:
r1>r2: available/total bw: 100/100
r1>r4: available/total bw: 10/10
r1>r5: available/total bw: 70/100
r2>r4: available/total bw: 40/100
r3>r2: available/total bw: 100/100
r3>r4: available/total bw: 10/100
r3>r5: available/total bw: 65/100
r4>r5: available/total bw: 40/100
CSFP calc:
Bw required "35"
r3>r4 and r3>r5 pruned
ERO: r3, r2, r4, r5
RSVP signal
Bw reservation **"0"**
ERO: r3, r2, r4, r5

The r2>r4 and r4>r5 has available bandwidth (40) for:
- More bypasses
- New protected LSP

Optimize Bypasses infrequently

- Calculating Bypass-tunnels BW and then path (ERO) can be computationally expensive.
- Triggers for Bypass-path computation
  - Periodic optimization (recommended to implement separate optimization timers for MPLS-TE LSP and Bypass-tunnels)
  - Bypass-Tunnel failure (get PathErr/PathTear) due to e.g. failure/drain of link traversed by bypass-tunnel .
  - Initialization of new bypass-tunnel.
  - ~~Change in Bypass-tunnel bandwidth due to change of Sum of protected LSP Bandwidth~~
    - Too much churn
    - Not recommended
    - Area of future improvements

Applicability

- Not the perfect solution
  - Bypass-tunnel path is correct only at time of computation. Links available Bw may change right after it.
  - Multiple bypass-tunnels (e.g. from different PLR) protecting same SLRG may use same available bandwidth - risk of overloading.
    - Avoid “least-fill”, “most-fill”
- Local PLR behaviour - no changes to protocols
  - Gradual deployment, immediate benefits
  - No need for interoperability among implementations
- Dot capacity guarantee, but higher probability of no congestion.

Preview of -01

- Bandwidth-aware
  - -00 - PBW & Available-Bw aware, TE-metric optimized
  - -01 add alternative approach - Available-Bw only awate, unreserved BW optimized
  - More contributors
- Route bypass along max-available-capacity path
  - Simplified max-flow problem
  - Round max-available-capacity to “equalize” paths of similar max-available-capacity
  - Limits on: number of Hop, path TE-cost, etc