BANANA BOF
Scope & Problem Description
IETF 97: Seoul, Korea
Margaret Cullen <mrcullen42@gmail.com>
Brian Trammell <ietf@trammell.ch>
Bandwidth aggregation and failover solutions for multi-access networks where the end-nodes are not multi-access-aware

- Higher bandwidth (through bandwidth aggregation)
- Increased reliability (through failover)
BANANA BOF Scope

- Bandwidth aggregation and failover solutions for multi-access networks where the end-nodes are not multi-access-aware
  - Higher bandwidth (through bandwidth aggregation)
  - Increased reliability (through failover)
- Traffic is sent through default router or the path chosen by Source Address Selection
  - Flow is limited to bandwidth of chosen link
  - Other path is unused
  - Flow will not switch to other path if initial path becomes unavailable
Three Solution Scenarios

- **Single Operator**
  - Multiple access networks provided by a single provider (e.g. DSL & LTE)
  - De-aggregation can occur within the provider network

- **Aggregation Service**
  - Multiple access networks from multiple providers (e.g. DSL & Cable)
  - All traffic from the home is routed/proxied through a de-aggregation service somewhere in the Internet, and then sent to the original destination

- **Edge-to-Edge**
  - Multiple access networks from single or multiple providers
  - Traffic is de-aggregated by multi-access-aware hardware at the remote edge
Single-Operator Scenario

- Home
  - CPE
    - Link 1
    - Link 2
  - ISP
  - Internet
  - Content Source
Single-Operator Scenario
Aggregation Service Scenario

Home

Internet

Content Source

CPE

CPE

H
Aggregation Service Scenario
Edge-to-Edge Scenario
Edge-to-Edge Scenario
Solution Proposals

- GRE Tunnel Bonding
  - Current draft assumes Single Operator scenario, could be easily adapted to Aggregation Service scenario
  - Traffic is shared on a per-packet basis and tunneled to the de-aggregation point in GRE Tunnels.

- MPTCP Proxy Solution(s)
  - https://datatracker.ietf.org/doc/draft-peirens-mptcp-transparent/ & other work
  - Current work applies to Single Operator or Aggregation Service scenarios
  - Simple case is TCP-only, work is underway on support for UDP – multiple options being explored
Solution Proposals (2)

- **Multipath Bonding at Layer 3**
  - Edge-to-edge solution, but incomplete (discovery, security)
  - Output of the Applied NW Research group of the IRTF
  - UDP-only solution, would need work to pair with a TCP solution like MPTCP Proxy

- **MAG Multipath Binding Option**
  - Mobile IP-based solution, work being done in DMM WG
  - Scenario would depend on the topology of the MIP network
Solution Proposals (3)

- Bonding Solution for Hybrid Access
  - 3GPP-specific solution for Single-Operator scenario
High-Level Challenges

- Performance (only do aggregation if it increases app-level throughput, bottleneck discovery, flow control to avoid buffer bloat or congestion)
- Small number of flows (makes flow-based load sharing ineffective, do not want high-bandwidth flows constrained to a single link)
- Bypass requirement (some traffic is required by law, regulations or contracts to take a particular path)
- Tunnel issues: packet reordering, MTU issues, etc.
- Proxy issues: encrypted traffic, side-effects of session termination, etc.
High-Level Challenges (2)

- Provisioning/configuration/discovery (multi-access network details, de-aggregation point, credentials, etc.)
- Reverse routing (operator controlled? IP address translation? transport-layer session termination?)
- TCP-only vs. TCP/UDP – bulk of traffic is TCP now, but will that remain constant as QUIC is deployed more widely? what about UDP failover?
- Security! – Must not become a vehicle for MITM attacks!
- Transition Strategy – how does this mechanism interact with end-to-end MPTCP? with end-nodes that are multi-access aware? etc.
Clarifying Questions?