Outline

I. ICN-Ping
   I. draft-mastorakis-icnrg-icnping-00
II. ICN-Traceroute: additions/changes vs. ICN-Ping
   I. draft-mastorakis-icnrg-icntraceroute-00
III. Security Considerations

I. ICN Ping

draft-mastorakis-icnrg-icnping-00

Functionality (by analogy with ip ping)

- Target Flavors
  - Is an ICN forwarder reachable?
  - Is a producer application reachable?
  - Is a cached object reachable?
- RTT measurements
  - Run several pings and provide times for each response

Reachability

- Is an ICN forwarder reachable?
  - Forwarders need names
  - Forwarder names must be routable
  - Forwarder names must be well-known
- Is a producer application reachable? Where?
  - What does it mean for an application to be reachable?
  - What name(s) would be used to determine if an application is reachable
- Is a cached object reachable? Where?
  - What does it mean for a cached object to be reachable?
  - What name(s) would be used to determine if a cached object is reachable?

Multipath

- E.g. RTT measurements in presence of multipath?
  - Path Identification
    - PathId TLV in Data Message packet header
  - Path Steering
    - PathId TLV in Interest Message packet header causes Interest to follow the reverse path of the Data Message that returned the PathId
  - Path Discovery
    - For Interests sent without PathIds, forwarders will switch Interests, making a probabilistic choice among next hops.

Echo Request/Reply Contents/Purpose

- Echo request
  1. Target Name
  2. PathId
  3. CS bypass
- Echo reply
  - Responding forwarder name
  - Return code (type of reachability, 1-3)
  - Is reply signed or unsigned?

Packet Formats and Processing Procedures

- Re-use Interest/Data/IntReturn Message Types
  - Largely match Int/Data forwarding semantics
    - Avoid aggregation with other pings or with Interests: Include random nonce in name**(?)**
    - Avoid CS caching of response: ExpiryTime TLV=0
    - Header PathId for identification/steering (not restricted to echo)
- Echo Request/Reply Packet types
  - Quick identification of ping messages
  - Allows forwarding semantic differences
    - Application node response from forwarder, i.e. Interest not passed to locally attached target application
    - Transit node CS bypass, e.g. using Hash restriction
- Matching can optionally be FIB LPM-based (e.g. add entry for local router name to FIB, with internal next-hop)

II. ICN Traceroute

draft-mastorakis-icnrg-icntraceroute-00

Functionality (by analogy with ip traceroute)

- Target Flavors
  - What is the path to an ICN forwarder?
  - What is the path to a producer application?
  - What is the path to a cached object?
- Path hop-by-hop RTT measurements
  - Run several protocol exchanges for each hop and provide times for each response
- High overlap with ping functionality/ mechanisms/procedures

Differences with Ping Proposal

- Two packet types: TracerouteRequest, TracerouteReply
- Core mechanism based on HopLimit Expiry (as with ip traceroute)
  - Additional reply code from responding forwarder: HopLimitExpired

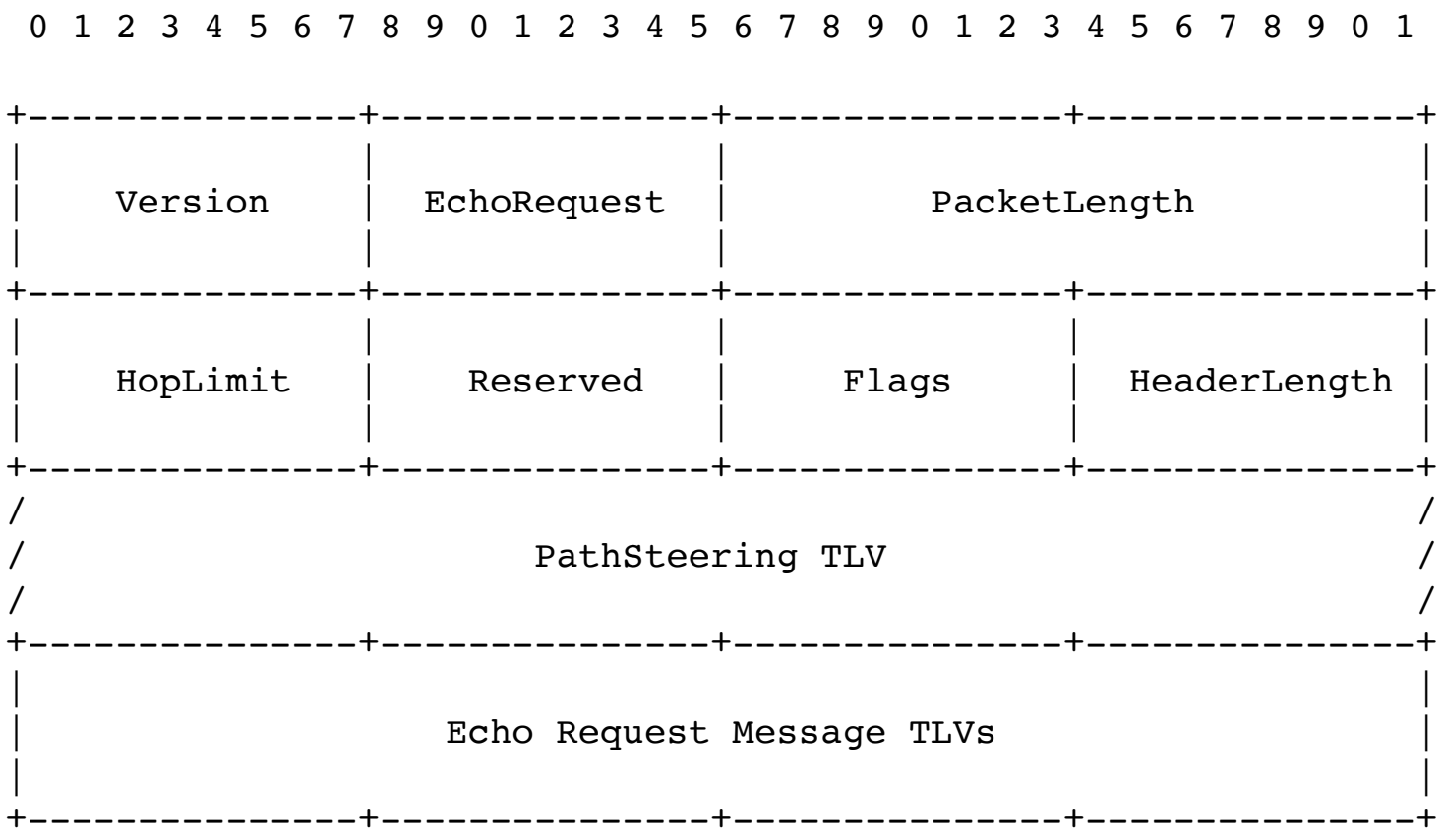
III. Security Considerations

Security Considerations

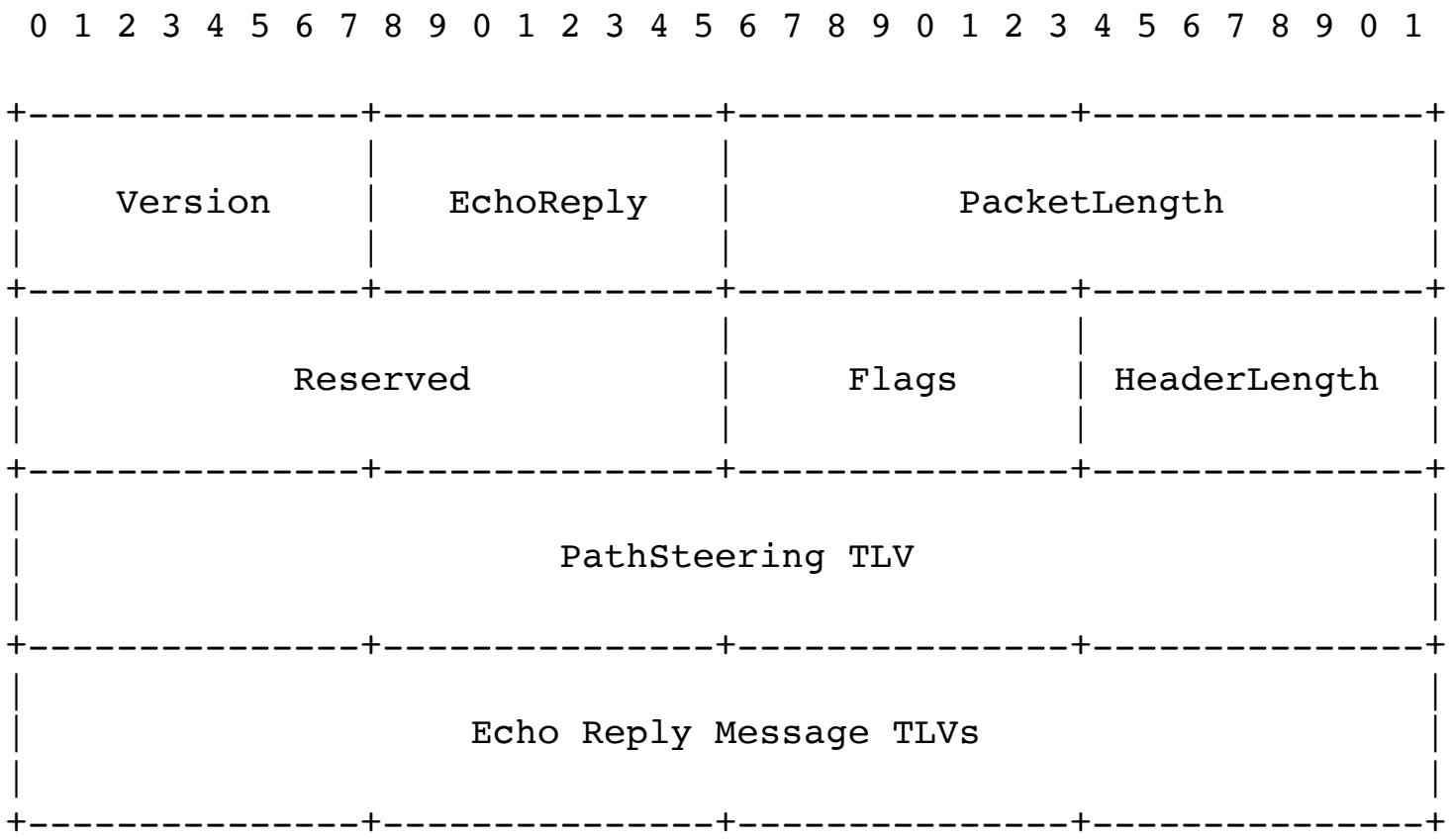
- Threat Model Choices:
  - On-path/Off-path
  - Reflection attacks
- Response messages: Signed or Unsigned?

A. Backup Slides

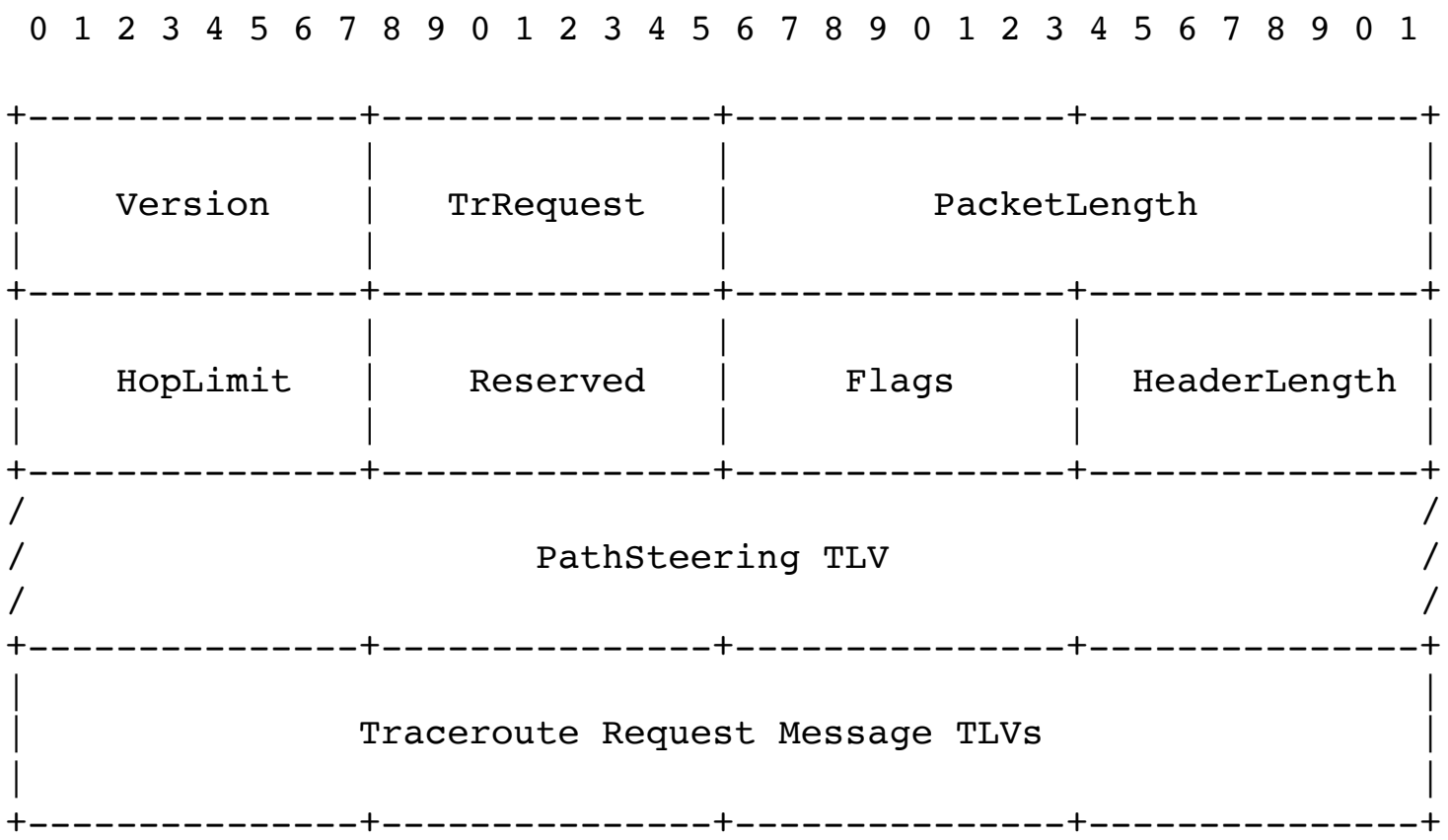
Packet Formats: Echo Request



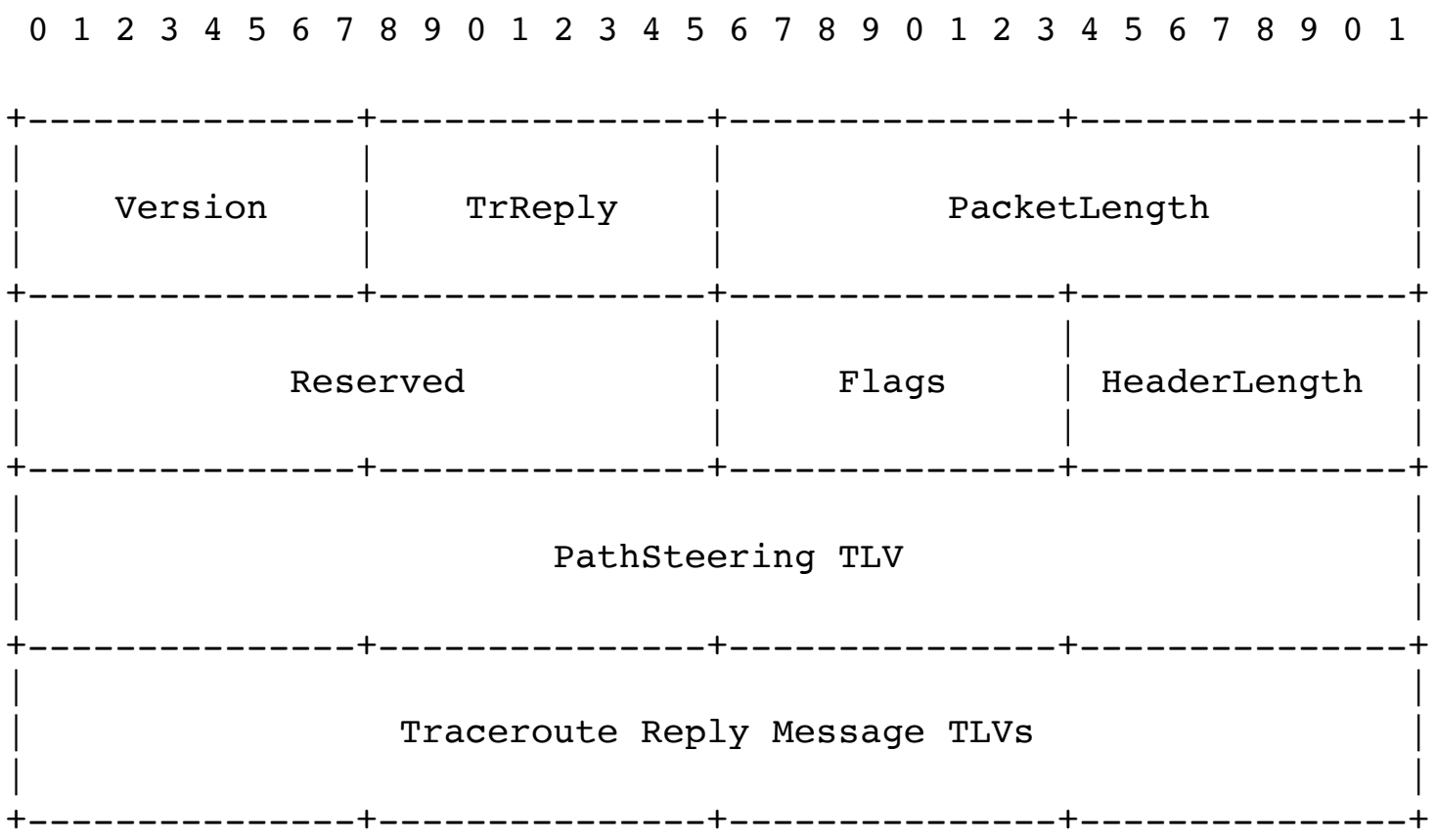
Packet Formats: Echo Reply



Packet Formats: Traceroute Request



Packet Formats: Traceroute Reply



Path Identification and Steering

A flow consists of multiple subflows. Each subflow's path reports its own $R_{sf}(t)$

- What entity tracks a flow's multiple subflows and their current $R_{sf}(t)$?
  - *Consumer endpoint* (application/application-library), the only entity given stated goals and assumptions
  - Significant extra responsibility for consumer vs. single-path situation
- How does consumer endpoint identify subflows and per-subflow $R_{sf}(t)$?
  - *Path identifier*, reported in Data message
- How are consumer endpoint's decisions about per-subflow rates honored for the consumer's Interests?
  - *Path identifier*, reflected back in Interest
- How are subflows discovered?
  - Interests without path identifiers must be sent initially/periodically
  - Forwarders with multiple next hops choose probabilistically
- Path Identification mechanisms have other possible uses, e.g. for ICN ping performance measurement.