Improving the Interactions Between Transport & Network Mechanisms

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Background

- disconnect between the INT and TSV areas on how transports and mobility mechanisms interact
- there’s been a number of BOFs and BOF proposals in this problem space
- sometimes with problematic scopes, sometimes got formed and ran out of steam
- anyway, these are indications that there is energy in the IETF/IRTF to do something in this area
- this talk attempts to encourage such work and provide a possible scope
Layering Is Good

• layers in the network stack provide communication abstractions

• they expose well-defined sets of operations & information

• hide layer-internal intricacies from their users (and details of layers further “down”)

• this is good! modular design at work
Example: Network Layer

- abstraction is something like
  - “will deliver your packets in some order”
  - “may deliver multiple copies of some packets”
  - “may not deliver some others”
- hides other network-layer functionality, such as
  - packet fragmentation/reassembly
  - route computation and forwarding
But in Practice...

• users of the network-layer abstraction, i.e., mostly the transport protocols, have made additional assumptions about it

• these assumptions are the basis of many key transport-layer mechanisms, such as
  • congestion control
  • flow control
  • reliability mechanisms
Example Assumptions

• hosts remain at the network port identified by an IP address for long times

• packets between the same src/dst addresses mostly follow the same path

• paths change on time scales that are orders of magnitude greater than the RTT

• path characteristics change on similarly large time scales

• connectivity along a path is very rarely disrupted
Reality Check

• many of these assumptions are no longer generally true throughout the whole network

• especially with recent/proposed network layer extensions, such as MIP, HIP, SHIM6, NEMO, etc.

• but also simply because recent link technologies are different
  • network-based mobility
  • link-layer retransmissions
  • non-congestion-related packet loss
Consequences

• traditional transport mechanisms are performing less well than in the past

• not news: resulted in a gazillion of “optimize transport protocol X for scenario Y” proposals
  • where X is mostly TCP
  • and Y = satellites, 802.11, GSM, 3G, ad hoc networks, high bit-error links, etc.

• but vast majority of these proposals are band aids
  • specific fixes for limited scenarios
  • not appropriate for a general-purpose Internet
What Could Be Appropriate?

• idea: extend the communication abstraction that the network layer provides to its users

• but keep it independent of specific...
  • network-layer extensions
  • link technologies
  • application or deployment scenarios

• result should be universally and incrementally deployable
Not a New Idea

- existing mechanisms already enhance the network-layer communication abstraction in this way
- ECN: “I’m about to start dropping these packets”
- Quickstart: “you may send me packets at rate n”
- XCP: evolved congestion control framework

- and don’t forget about ancient stuff like ICMP
- unreachable: “this host/network is not here”
- source quench: “stop sending so fast”
- all these define new pieces of network-layer information that new transport mechanisms act on
General Principle?

- examples on the previous slide follow same general principle
- provide additional information about network-layer events to transport protocols
- information should be advisory & optional: transports shouldn’t depend on them
- new transport mechanisms act on this to improve operation and performance
- seems like a useful general principle for approaches in this space
What Next?

• TSV and INT ADs started a discussion list for people interested in this problem space
  • ternli@ietf.org
  • https://www.ietf.org/mailman/listinfo/ternli
  • goal is to identify interested parties and discuss what work could be done where in the IETF/IRTF (and then start doing it...)