Requirement for A General Transport Protocol for In-Network Computing in Support of RPC-based Applications

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Background

• In-network computing (INC) is a new paradigm that involves the programmable network switches to improve the application performance (e.g., lower latency, higher throughput) or reduce the system cost (e.g., lower power consumption, fewer servers)
  • IETF COINRG is dedicated for the related research
• Specifically, here INC means the applications supported by on-path programmable switches
• The most promising INC applications (aggregation, caching, agreement) follows the same RPC pattern
• Each packet is an individual message that can be processed
  • The computing can be solely or partially done by network devices in the network, and the result can be replied by a network device or a server
Inc Network Protocol Layer Model

- Break the E2E assumption of the transport layer
- A new E2M2E model (M stands for middle point)
INC Service Model and Communication Pattern

Sync Collaboration (SC) | x | x | x |
Async Collaboration (AC) | x | | |
Individual Request (IR) | x | x | |

Device Only Mode (DO)

Device+Server Mode (DS)

Hybrid Mode (HM)
INC Transport Protocol Function and Requirements

• Main function:
  • Signaling
    • Request in-network processing and get acknowledged
    • Allow falling back to server processing
  • Reliability
    • Packet loss detection and retransmission
  • Congestion control
    • Window-based
    • ECN

• Requirement:
  • Keep complex logic out of switch, only done in end servers
  • General to all the INC applications with the RPC pattern
  • Extensible for future enhancements

• Advantage:
  • Transparent to algorithms for packet loss detection (in switch and in server) and congestion control (in server)
  • Transparent to application logic
Existing Transport Protocols

- TCP
- UDP
- QUIC
- MTP
- RDMA
- HOMA
- Ad hoc protocols
- ...
Requirements for INC Transport Protocol

• Simplicity
• Generality
• Openness
• Compatibility
Purpose of draft

• Raise the community awareness to the problem
• Understand the problem space
• Explore the opportunities
• Collaboration welcome!