MPTCP PROXY

• Implementation Update
  • Interoperability
  • Code Release

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Realization of MPTCP PROXY:
- Sequential packet processing (Packet Filter)
- No split connection.
- No stream assembly. No segment buffering.
MPTCP Proxy Objectives

• Mobility between untrusted domains
• Cellular traffic offload to untrusted domains

• Exploit MPTCP’s middlebox compliance

• Focus: Incremental deployment
  – Mobile: Easy upgrade & cross-platform portability
  – Network: Compliance with gateway processing
MPTCP Proxy: How it Works.

- Multiple simultaneous subflows per connection
  - Proxy MPTCP Sender: Uses one subflow at a time
  - Proxy MPTCP Receiver: Multipath-capable

- MBB handover → Multipath operation for ~RTT
  - New data on new subflow
  - In-flight data & retransmissions of old data on old subflow

- BBM handover → Single-path operation
  - Immediate cut of old subflow
  - Creates & switches to new subflow, recovers lost data

- Mobility needs only one flow & congestion control
MPTCP Proxy

Algorithmic Challenges
MPTCP Proxy: Packet Splitting

- During seamless handover
- When peer does multipath transmission
MPTCP Proxy: ACK Replication

MPTCP ➔ SFL1, DSN=1, SSN=50 ➔ TCP SN=11
Sender SFL2, DSN=2, SSN=60 ➔ TCP SN=12

SFL1, DAN=3, SAN = 51 ➔ TCP AN=13 ➔ TCP
SFL2, DAN=3, SAN = 61 ➔ TCP

MPTCP ➔ SFL1, DSN=3, SSN=51 ➔ TCP SN=13
Sender

SFL1, DAN=4, SAN = 52 ➔ TCP AN=14 ➔ TCP
SFL2, DAN=4, SAN = 62 ➔ TCP

• Keep track SSN↔DSN↔TSN mapping history
Non-Monotonous Mappings

- TCP → SFL: Monotonize mappings. Impossible after break!
- SFL → TCP: Data ACK Nmb (DSS) may not be provided!
- There is no Data SACK! How to translate SFL SACK to TCP?
Sequence Space Projection

- Project ACKed SEQ space from TCP → SFL or SFL → TCP
- Requires inference: SFL ACK → Data ACK
  Legitimate outside proxy multipath transmission!
Selective ACK after Break

- TCP ACK → SFL SACK Block
- TCP SACK Block → SFL ACK
MPTCP Proxy: Implementation

- Linux >= 2.6.14
- Packet filter: Netfilter + Netlink
- Prototype: Userspace, IPtables
- Command-line interface
MPTCP Proxy: Feature Support

• All features of MPTCP design doc…

Except:
  – IPv6
  – 8 octet DSN
  – ADD_ADDRESS
  – DSS Checksums
  – MP_FAIL

• Command line features:
  – Establish/tear down of subflows
  – MBB: Seamless handover between established subflows
  – BBM: Breaks subflow and establishes new subflow on new interface
Interoperability Tests

- Native MPTCP: Olivier Bonaventure’s group
- Support by Christoph Paasch
Interoperability: Basic Trials

• Establishment of connections ✓
• Adding (multiple) subflows ✓
• Closing subflow(s) ✓
• Closing connections ✓
• Fast closing of connections ✓

Done for:
MPTCP Proxy ↔ Native MPTCP
MPTCP Proxy ↔ MPTCP Proxy
Interoperability: Dynamics

- MPTCP Proxy switches:  MP_PRIO (3B, B=0) + MP_PRIO (3B, B=1)
- MPTCP Proxy breaks:  REMOVE_ADDR, SFL RST

- Native MPTCP:  multipath operation
Native MPTCP + server → MPTCP Proxy + client
MPTCP Proxy Switches

RTT = 30ms
Native MPTCP + server → MPTCP Proxy + client
Native MPTCP does multipath
Native MPTCP + server → MPTCP Proxy + client
Native MPTCP does multipath
Code Release

- MPTCP Proxy Vs 0.9: Released on Oct 26, 2012
- Installation & Operation Guide
Next Steps

• New signaling features for proxy support
  – Implicit proxy
  – Explicit proxy
  – Anchor features

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