Rethinking the MPTCP handshake

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Weaknesses of the current handshake
Deployment behind layer-4 loadbalancers

Clients

Layer-4 Loadbalancers

Frontend Servers/Proxies

Token: A

Token: A

Different servers may choose the same token/key
Deployment behind layer-4 loadbalancers

Different loadbalancers are not aware of the MPTCP-state
Deployment behind layer-4 loadbalancers

- Deployment behind a loadbalancer is very difficult
  - Not possible to do classic layer-4 loadbalancer
  - Thus, requires unicast IP on each server, implying DNS-based load balancing
  - Scalability becomes a major concern
Security: Different attacker models per subflow

- Initial subflow
  - Attacker **cannot** eavesdrop the SYNs
    - MPTCP sends keys in plaintext
- Additional subflows
  - Attacker **can** eavesdrop the SYNs
    - Must use HMAC to prove knowledge of keys without revealing them
Security

- Inconsistent attacker models on the MPTCP subflows

- Security-sensitive applications will anyways rely on TLS (or equivalent)
What can we change?

RFC6824-bis will bump the version number

→ Opportunity to address these challenges!
Rethinking the handshake

MPTCP behind loadbalancers:

- Token should be locally “meaningful”

Security aspects of MPTCP

- Consistent attacker models across all subflows
- Leverage higher-layer security for MPTCP

“Design MPTCP for tomorrow’s protocol stack: HTTP/2, TLS, MPTCP, IPv6” - O. Bonaventure
Making the token locally “meaningful”

- SYN + MP_CAPABLE (token_A)
- SYN/ACK + MP_CAPABLE (token_B)
- ACK + MP_CAPABLE (token_A, token_B)

Token announced explicitly, makes it locally “meaningful” on the server-side

✓ Loadbalancers are supported
Tomorrow’s protocol stack: HTTP/2, TLS, MPTCP, IPv6

- Do we need a separate key-negotiation mechanism for MPTCP, when TLS already does it?
- Security provided by TLS is superior to the one MPTCP can ever provide
- Use a derivate of the TLS-key for MPTCP’s HMAC (cfr., draft-paasch-mptcp-ssl & draft-bonaventure-mptcp-tls)
Tentative proposed handshake

SYN + MP_CAPABLE (token_A, key_selection)

SYN/ACK + MP_CAPABLE (token_B, key_selection)

ACK + MP_CAPABLE (token_A, token_B, key_selection)

key_selection to choose among a set of key-negotiation techniques (e.g., TLS, PSK, null-Key,...)
• As RFC6824-bis bumps the version number, we have an opportunity to address a lot of issues

• Loadbalancer-support is key for widespread deployment

• We can address the security issues as well by leveraging TLS (is a push for TLS as well)