INTERNET-DRAFT
Intended Status: Experimental
Expires: Apr 19, 2016

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Oct 17, 2015

MPTCP Enhancement Opportunities
draft-palanivelanchetansenthil-mptcp-enhancements-00

Abstract

MPTCP Intends to address a wide range of issues, with minimal implementation tweaks. Though this works in a range of use cases,there are some use cases, where some standard implementation recommendations could help. The Purpose of this draft is to document Opportunities, where Enhancements to MPTCP can translate to more wider deployments.

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1 Introduction

The Scope of the use cases discussed is limited to impact on end-user experience only and recommended updates at SP (PE Router). The initial versions of this draft would document findings from tests covering various end-user use cases in detail, that presents mptcp enhancement opportunities. The later versions of the document would strive to provide solutions for the documented usecase scenarios.

1.1 Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

2 MPTCP Enhancement Opportunities - End user Use cases

2.1 Short Flows vs Long Flows

Internet traffic MUST have Security, Throughput, Reliability,.. taken care across different network conditions, modes of access and flows. Data access can be categorized into short or long flows.

Too many Small Flows => Higher Number of Transactions. But, much less Bandwidth Consumption

Can we achieve Low latency for short flows?

Average completion of flow with mptcp can be higher than completion time without mptcp With Bunch of Short Flows, MPTCP may negatively impact throughput

Even a single lost packet can force an entire connection to wait for an RTO.

Far Lesser Long Flows => Lesser Number of Transactions. But, higher Bandwidth Consumption

Can we achieve higher Throughput for Long Flows Without compromising on performance?

How do we maintain Reliability? How do we manage tolerance to sudden and high bursts of traffic?

In Summary, Both long and short flows are important from the enduser perspective. We need to come up with appropriate definition and clear demarcation for short and long flows, from MPTCP Perspective. These need be dealt differently (Probably with multiple profiles).

2.2 Application based Path selection and Adaptive buffering

How much of benefit it would be when we consider different type of applications, for better mptcp profiling. Typical internet applications are categorized as Elastic and InElastic.

Elastic vs Inelastic Applications..How does it matter to MPTCP?

MPTCP performance is impacted :

When the size of the receive buffer is limited.

Path with high RTT may result in the receive buffer size growing beyond the allowed maximum

Diversified RTT

Different ways of handling packets => Better Performance.

In Summary, Application based Path Selection and Adaptive Buffering can help with the above scenarios. Tweaking the buffer sizes based on the type of application and/or network condition can positively impact the flows.

2.3 Path Selection Enhancements

Path Selection is one of the important part of MPTCP. Though there are existing tools that help diagnose issues in the path, there still is scope to fine tune it further flexible based on certain factors.

Usecases where MPTCP path selection can be enhanced:

For High packet loss and High latency networks?

Multiple profiles to dynamically switch (move across) the networks?

Roaming scenarios

In Summary, The best optimal path is ever changing in the Internet. Frequent switching may cause unnecessary overheads and can impact performance. Enhanced yet controlled Path Selection and Path Switching can help get better performance out of the network.

2.4 Optimal number of paths

The best and effective path selection is critical to the effect of MPTCP for the client application. How about the optimal number of sub-flows? Can we improve client experience by controlling number of sub flows based on certain factors?

Controlling the number of sub flows getting created:

How many is too many?

Can this be controlled? What Inputs to Consider?

- Based on Network Characteristics
- Historic data (region wise)

In Summary, MPTCP being not too strict as well as not too flexible, Certain profiling based on detailed analysis of data can positively impact MPTCP experience

3 UseCase Scenarios (Simulated in Lab) and Results

Data for enhancement opportunities are derived from our lab tests. These tests are done in a reasonably populated, yet contained test network. The initial set of tests are more focused on the throughput side and covers simulated Near, Mid and Far cell network conditions. The Intention is to get detailed data from set of tests to cover different types of data access (short/long or elastic/inelastic applications, mobile network conditions,..etc) as well as different mptcp profiles (for eg. number of sub flows). The detailed analysis and summary would be presented in the later sections of the document, followed by design/implementation recommendations for the SPs.

3.1 MPTCP Enabled Client Uploads data from Non-MPTCP Capable Server

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.2 MPTCP Enabled Client Uploads data from MPTCP Enabled Server

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.3 MPTCP Enabled Client Uploads data from Non-MPTCP Capable Server with Intermediate MPTCP Enabled devices (proxy?)

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.4 MPTCP Enabled Client Uploads data from MPTCP Enabled Server with Intermediate MPTCP Enabled devices (proxy?)

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.5 MPTCP Enabled Client Downloads data from Non-MPTCP Capable Server

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.6 MPTCP Enabled Client Downloads data from MPTCP Enabled Server

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.7 MPTCP Enabled Client Downloads data from Non-MPTCP Capable Server with Intermediate MPTCP Enabled devices (proxy?)

<Shared in IETF-94 WG Discussion.. Will be updated here>

3.8 MPTCP Enabled Client Downloads data from MPTCP Enabled Server with Intermediate MPTCP Enabled devices (proxy?)

<Shared in IETF-94 WG Discussion.. Will be updated here>

4 Security Considerations

None

5 IANA Considerations

None

6 References

6.1 Normative References

[RFC2119] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

6.2 Informative References

[RFC6182] Ford, A., Raiciu, C., Handley, M., Barre, S., and J.Iyengar, "Architectural Guidelines for Multipath TCP Development", RFC 6182, March 2011.

[RFC6356] Raiciu, C., Handley, M., and D. Wischik,"Coupled Congestion Control for Multipath Transport Protocols", RFC 6356,October 2011.

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