Business Models in a Multipath World

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SEVENTH FRAMEWORK PROGRAMME

Although Multipath TCP is a mere technical change to the TCP protocol providing improved resilience and throughput, it will have considerable impact on the value networks and business models of Internet access provisioning.

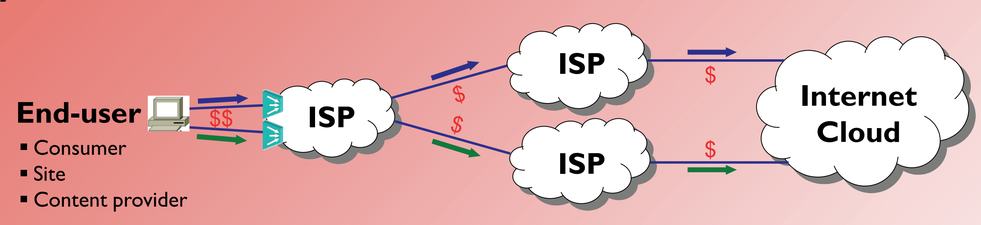
Next steps

- Use case analysis by using SWOT and Porter's five forces
- Adoption models of MPTCP
- User incentives of switching from classic TCP to MPTCP
- Benefits of coordinated congestion control

Business models and value networks

Organization of the value network depends on the way end-users choose to set up their access links. Some potential use cases, i.e. technical architectures and the corresponding value networks, are listed below.

Key stakeholders: End-users and ISPs



Potential MPTCP Use Cases

1. **End-user with single physical access to one ISP**
   A. ISP splits the traffic via a proxy
   B. ISP provides multiple sessions over one access link
2. **End-user with dual physical access to one ISP**
   A. Mobile terminal with two access technologies (3G and WLAN)
   B. Disjoint connectivity (such as two DSL lines) to single ISP
3. **End-user with dual physical access to different ISPs**
   A. Mobile terminal with two access technologies (3G and WLAN)
   B. Disjoint connectivity (such as two DSL lines) to multiple ISPs
4. **End-user with physical access to multiple ISPs but with one contract to a Virtual Multipath Operator**

What is Multipath TCP?

Multipath TCP (MPTCP) is one manifestation of ***resource pooling*** principle. MPTCP allows multiple paths between endpoints to be used simultaneously so that they appear to the application as a single transport connection. This is achieved through dynamic scheduling of traffic across available paths.

Benefits: improved resilience and higher bandwidth

Resource Pooling

The resource pooling principle improves use of the Internet's resources by allowing separate resources act as if they were a single large resource.

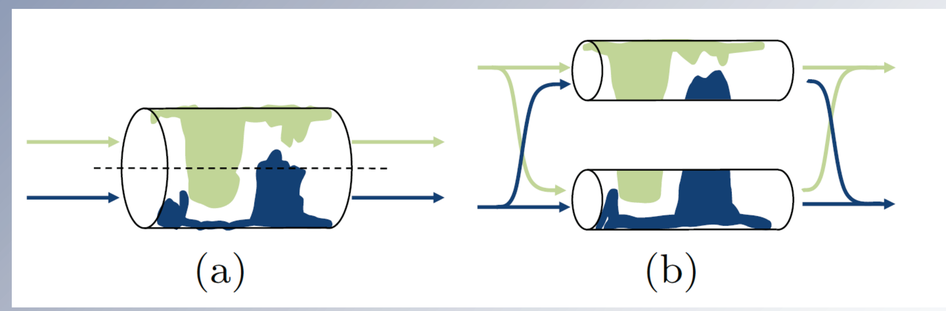


Figure 1. Pooling capacity (a) between "circuits" on a single link, and (b) across links. In both cases pooling improves the ability to cope with bursts or unexpected traffic patterns; the latter case achieves robustness to link failure.

From D. Wischik, M. Handley and M. Bagnulo Braun, The Resource Pooling Principle, ACM SIGCOMM CCR, volume 58, issue 5, (October 2008), 47–52.

Example use case: 3.A MPTCP capable mobile terminal with multihomed access to multiple ISPs

In this use case end-user multihomes, i.e., has two physical access connections to two different ISPs. More specifically, the ubiquitous 3G connectivity of a mobile terminal is supplemented by high WLAN bandwidth when available.

End-user perspective: MPTCP allows more efficient usage of the device capabilities. Additionally, MPTCP offers seamless handover of sessions between different access connections.

ISP perspective: As multihoming is controlled by the end-user, the chances for ISPs to affect the use case are small. Nevertheless, MPTCP increases competition between ISPs since network performance becomes more visible to end-users.

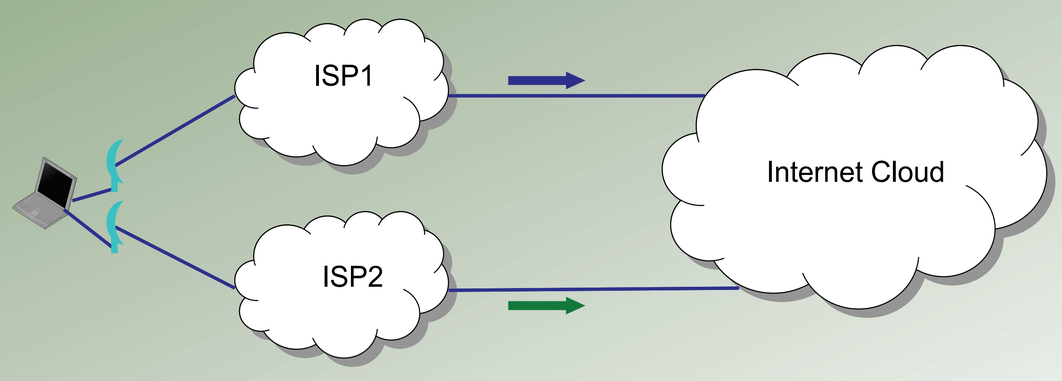


Figure 2. Technical architecture and value network of the use case 3.A

Table 1. SWOT analysis for end-user

Strengths	Weaknesses
▪ Power to race ISPs	▪ Overhead of two contracts and bills ▪ Disparity in access bandwidths (3G vs. WLAN)
Opportunities	**Threats**
▪ More seamless and robust connectivity ▪ Higher bandwidth spotwise	▪ Higher costs (flat and/or metered rates) ▪ Shorter stand-by time when using multiple radio interfaces at the same time

Table 2. SWOT analysis for ISPs

Strengths	Weaknesses
▪ Ownership of at least one customer access line ▪ Existing customer relationship will be maintained	▪ Inability to provide multipath without involvement of a second ISP
Opportunities	**Threats**
▪ Additional revenue through multihoming of prior sole ISP2 customers ▪ Good network performance visible to end-users and may become chargeable	▪ Bad network performance visible to end-users and may lead to churn ▪ Customers want to pay less for individual access when they need two for full multihoming