



LEDBAT APPLICATIONS PRACTICES AND RECOMMENDATIONS

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CHANGES FROM PREVIOUS VERSION (TANA-00)

- Significant changes based on mailing list feedback
- Reached out to people that made comments during last meeting in order to get specifics and tried to incorporate
- Clean-up and reorganization of sections
- Recommendation section starting to grow



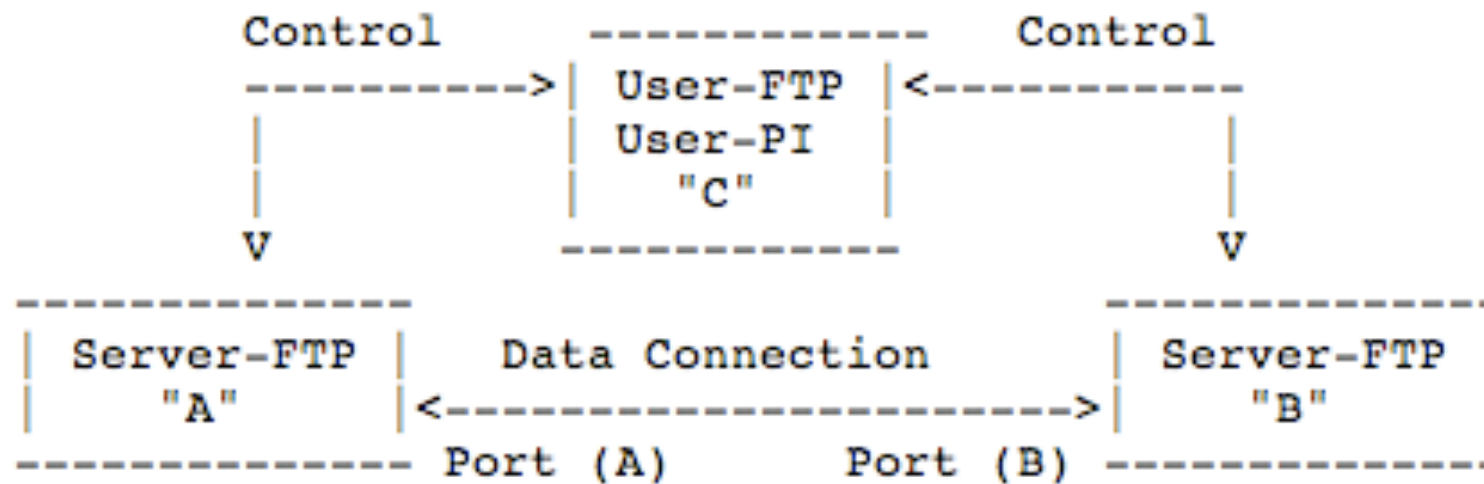
MULTIPLE TCP CONNECTIONS

ADVANTAGES

- 3.1. Avoiding head-of-line blocking 5
- 3.2. Logical partitioning at application level 5
- 3.3. Multiple streams with different properties 5
- 3.4. Signaling application layer request completion 5
- 3.5. High bandwidth-delay links 5
- 3.6. Error resiliency and reliability 5
- 3.7. Leveraging multiple processors in a system 5



LOGICAL PARTITIONING AT APPLICATION LEVEL



MULTIPLE STREAMS WITH DIFFERENT PROPERTIES

- NAGLE
- RFC1323
- Path MTU Discovery
- SACK and its options



SIGNALING APPLICATION LAYER REQUEST COMPLETION

- If the application assumes that connection close indicates the completion of a request, it becomes necessary to have new connections for multiple requests. This was a reason for multiple connections in HTTP 1.0.



HIGH BANDWIDTH-DELAY LINKS

- In the presence of a large bandwidth-delay product, the 16-bit window size parameter in TCP header does not allow the application to fully utilize the link.
- In such situations, the current practice is to negotiate the Window Scale Option [RFC1323]. In addition multiple TCP connections can allow the application to achieve an effectively larger window size so that it can better utilize a link with high bandwidth-delay product (e.g. iSCSI [SCSIREF]).



ERROR RESILIENCY AND RELIABILITY

- The more connections you use to download an object, the less chance of a single failure on one connection having a negative impact on the whole download.
- Especially with P2P applications, this makes the network robust to failures and churn in participants.
- How many connections are enough?



LEVERAGING MULTIPLE PROCESSORS IN A SYSTEM

- With multiple processor systems, there can be higher performance with parallelism and multiple connections spread over different processors.



MULTIPLE TCP CONNECTIONS DISADVANTAGES

- 4.1. Additional connection setup overhead 6
- 4.2. Memory Space 6
- 4.3. Link Bandwidth 6
- 4.4. Middleboxes
 - IPv4 Depletion and Sharing an IP address?



RECOMMENDATIONS

- 5.1. Diffserv 8
 - RFC3662
- 5.2. Window scale negotiation 8
 - RFC1323
- 5.3. Sweet spot of connections vs. speed ?
- 5.4. When multiple connections increases latency?

