Project

# Report

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**Content**

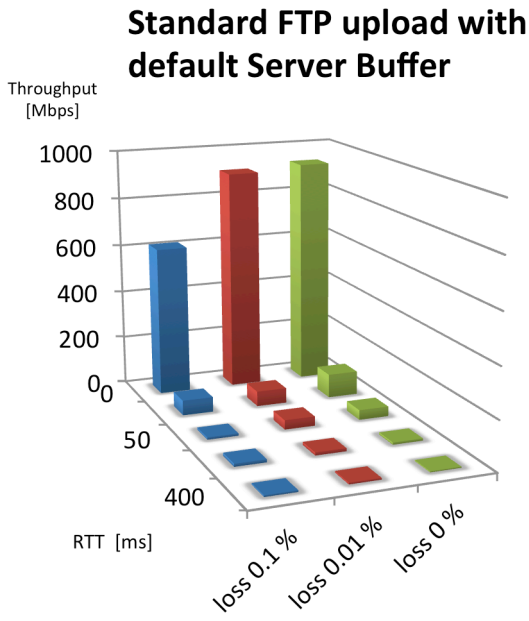


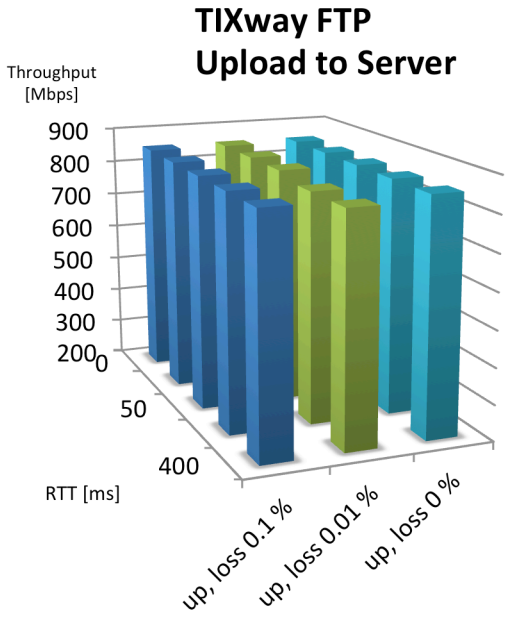
 

## 1 Management Summary

This evaluation focused on the performance gain when using TIXway, a semi transparent acceleration solution from Tixel, in Wide Area Networks (WAN). The tests confirmed that a much better throughput can be achieved when using TIXway on impaired long delay links than with standard FTP transmissions.

TIXway proofed as a powerful and reliable solution for accelerating FTP traffic especially on loss afflicted high latency IP networks like WAN connections. It was easy to set up and operate and worked transparently with different FTP software and operating systems.



## 2 Introduction

This report covers the performance testing conducted by IRT according to offer “IRT 193-12” on the TIXway WAN file transfer acceleration solution and the test procedures have been elaborated with Tixel.

TIXway accelerates FTP traffic on loss afflicted high latency IP network, usually WAN links. A typical field of application is transfer of media data e.g. for TV news contribution, digital cinema production and distribution. TIXway consists of two components, a client side gateway located in close proximity to the FTP client(s) and a server side gateway located in close proximity to the FTP server. Between those two gateways the accelerating TIXway gateways are deployed which are implemented as software running on Linux platforms.

## 3 Test Coverage

The following issues were in scope of the examination

- Operational capabilities
- Transfer speed of a single FTP transfer with and without TIXway
    - With increasing delay
    - With packet loss
- Recovery after network or power outage

The tests were conducted both ways with and without using TIXway in the signal path. Thereby it was possible to compare and evaluate the effect of TIXway on the transmission at changing network conditions. Transfer speeds were examined at different impairments including delay and packet loss representing various typical network conditions. The tests were largely focusing on typical use cases as well as on 'worst case scenarios' assuming that results for less demanding network conditions will be at least as good.

Recovery of the transmission after network connection or power outage was also part of the evaluation to examine if the FTP transfer be continued after a reasonable time.

## 4 Tested Applications

TIXway is designed to run with various standard FTP clients and servers. To indicate compatibility, besides detailed measurements with Filezilla some functional tests with typical FTP clients were conducted *(Table 1)*.

| FTP Software | Client/Server | Operating System |
|---|---|---|
| Filezilla | Server | Windows 7 |
| Filezilla | Client | Windows 7, Mac OS X, Ubuntu Linux 12.4 |
| Win SCP | Client | Windows 7 |
| lftp | Client | Ubuntu Linux 12.4 |
| gftp | Client | Ubuntu Linux 12.4 |
| Terminal | Client | Windows 7, Mac OS X, Ubuntu Linux 12.4 |

*Table 1: FTP Client and Server Software*

## 5 Test Setup

The test setup consists of a client side network and a server side network. The client side network comprises an FTP client and a TIXway gateway – both

running on separate hardware[1] and connected to a gigabit switch. The server side network comprises an FTP server, a second TIXway gateway and a gigabit switch as well. On the FTP client and server hardware a RAM disk is used to eliminate disk access related bottlenecks.

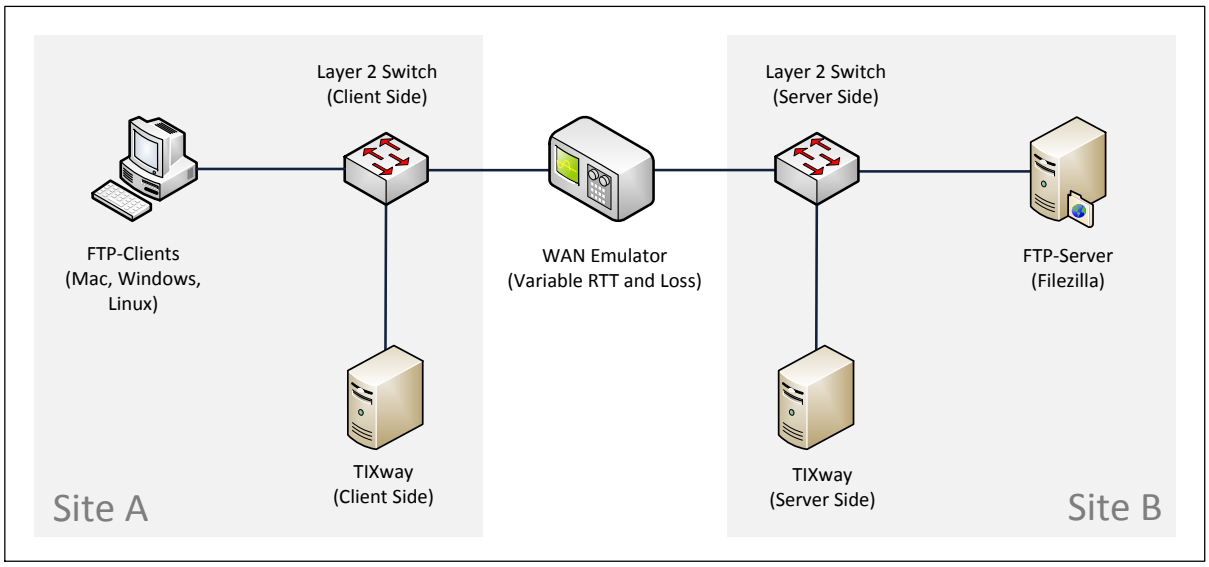



*Figure 1: TIXway Evaluation Testbed*

The client and the server side switches are connected via a 1 Gigabit Ethernet (GE) link. To emulate a WAN connection and bring in delay and loss, a network impairment device (ADTECH AX /4000 Gigabit Ethernet Impairment Emulator) is placed in between that link *(Figure 1)*.

## 5.1 Basic Functionality

The TIXway gateways operate inside the signal path and are semi-transparent to the user and the FTP application. When an FTP transfer is launched the FTP client connects to the (nearest) TIXway client side gateway via standard FTP.

[1] The TIXway gateway nodes were provided by TIXEL on appropriate hardware. TIXway can also run as a service on the same machine as the FTP client/server application.

Then a suitable server side gateway is selected according to the target FTP server. Next the client side gateway connects to the server side gateway via RWTP (TIXELs WAN-optimized transfer protocol). This connection typically runs over the (time critical and error-prone) wide area link. Then from the server side gateway a standard FTP connection is established to the target FTP server by using the credentials provided by the user. After setting up this connection chain the data transfer between FTP client and server is launched. Aside from connecting to a different FTP server address there is no change in the end user's configuration.

## 6 Detailed Test Procedure

The evaluation focused on the achievable performance gain when using TIXway gateways in the FTP path rather than relying on standard FTP for the WAN link. To keep the total number of separate tests at a reasonable size at first the Filezilla client/server application was chosen as the main test case. Filezilla is easy to use, very common among FTP-users and multi-OS capable.

### 6.1 Transfer Tests

In order to have a reference value and to rule out any serious bottlenecks at the standard FTP or the network components all tests were run initially without network impairments or TIXway gateways in the transfer path. Next the maximum throughput[2] (i.e. close to line rate of 1 Gbit/s) was measured in a "clean" environment (no WAN impairments, no gateways involved) as a reference. After successfully sizing the system a series of uploads and downloads with different WAN impairments was conducted (see 7 Test Results).

[2] Throughput is calculated by filesize and transfer time given by the FTP client.

The following parameters were chosen for the measurements:

| Round Trip Delay [ms] | IP Packet Loss [%] | File Sizes [MB] |
|---|---|---|
| 0; 20; 50; 200; 400; 1000 | 0; 0.01; 0.1 | 10; 20; 200; 500; 1000; 2000; 5000 |

*Table 2: Test Parameters*

To reduce complexity not all parameters/parameter combinations were used in each test but a representative subset of parameters/combinations was chosen for testing.

The same measurements with the same parameter combinations/ impairments were executed using the TIXway gateways in the transfer path. This measurement series was then compared with the performance of the legacy system without acceleration.

After successfully testing the Filezilla client on a Windows 7 platform the client was also tested on Mac OS X and on Ubuntu Linux. For those additional tests a subset of measurements was conducted that covered clean setups and setups with typical WAN parameters. Finally other typical FTP clients were tested on all three platforms for functionality and compatibility with TIXway only.

### 6.2 System Recovery (Network and Power Outage)

The evaluation also covered system recovery. It was tested if the TIXway transmission recovers from an outage of network connectivity or power (by unplugging and re-unplugging the corresponding cable). A potential automatic recovery depends not only on TIXway but also on the capabilities of the FTP client software. By design TIXway does not automatically recover from outages in the notion of re-setting up file transfers as data is not stored permanently. But it gives FTP applications the possibility to continue their transfers after the TIXway recovery.

In the case of a network outage TIXway should immediately continue operation. Depending on time-outs and recovery methods of the used FTP software interrupted file transfers can continue as well. After a power outage TIXway is supposed to continue regular operation whereupon time for recovery mainly depends on the used PC platform (BIOS, hardware, etc.) and operating system. Usually TIXway is set up as a service automatically starting upon boot sequence. Thus TIXway operation can continue immediately after finishing the OS boot process.

# 7 Test Results

The FTP transfer rate depends on various factors like FTP client and server systems (software, hardware, file system etc.), network conditions and the overall performance of the TIXway nodes. As the performance speed-up of the acceleration system was to be evaluated the setup has been dimensioned without any impairments or TIXway nodes in the transfer path first. The maximum throughput measured was about 900 mbps for an upload to the server. For the download to the server about 800 mbps were accomplished.

## 7.1 Standard FTP Performance

Delay and packet loss were added to the transmission. As expected this had a tremendous impact on the achievable throughput. Adding 20 ms of round trip time (RTT) decreases the throughput by almost 90 %. With an RTT of 400 ms an efficient transfer has become almost impossible as the data rate drops to about 4 Mbps.

Packet loss also has a significant influence on the throughput. While the transmission was robust to a loss rate up to 0.01 %, a noticeable performance drop could be observed above 0.1 % packet loss *(Figure 2).*

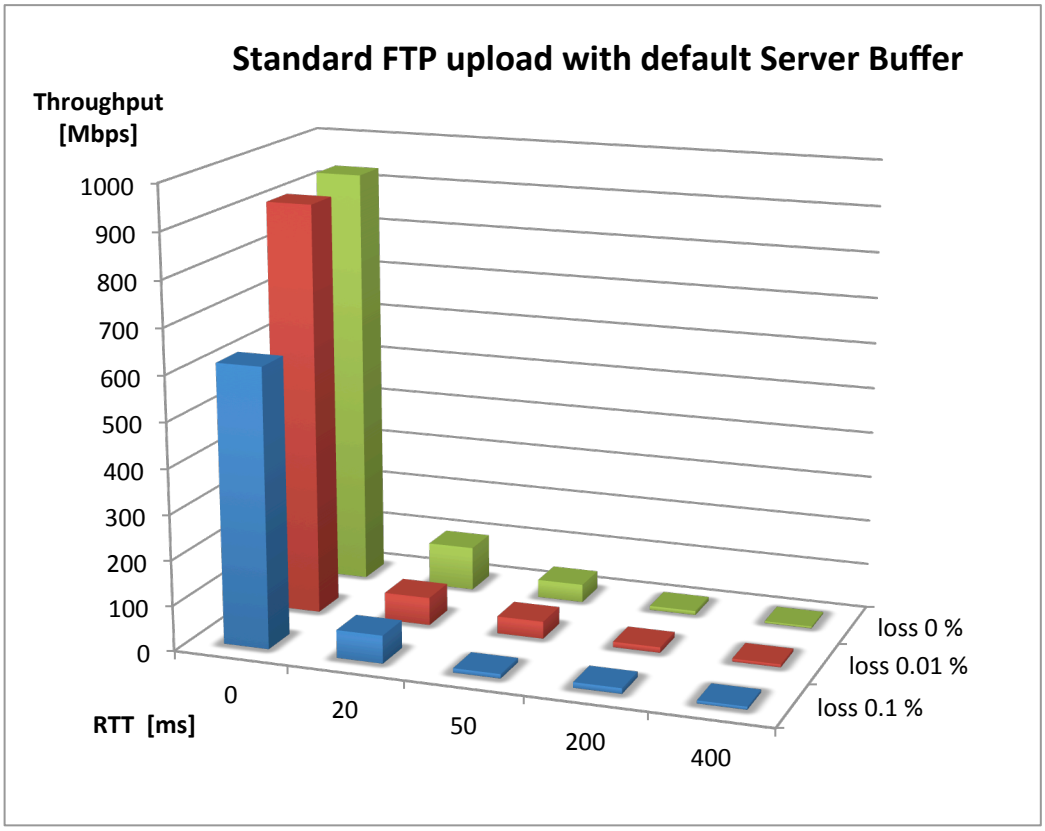



*Figure 2: Standard FTP Performance*

## 7.2 TIXway FTP Performance

Similar measurements as in 7.1 were executed by using the TIXway gateways in the transfer path. Without any impairment involved the maximum throughput reached 800 Mbps for a download to the client and 850 Mbps for an upload to the server. When introducing delay and loss to the transmission the throughput stays at the same level. No significant performance drop was observed as seen in the previous test *(Figures 3 and 4).* It is obvious that a massive performance gain can be achieved when using TIXway even on highly impaired connections.

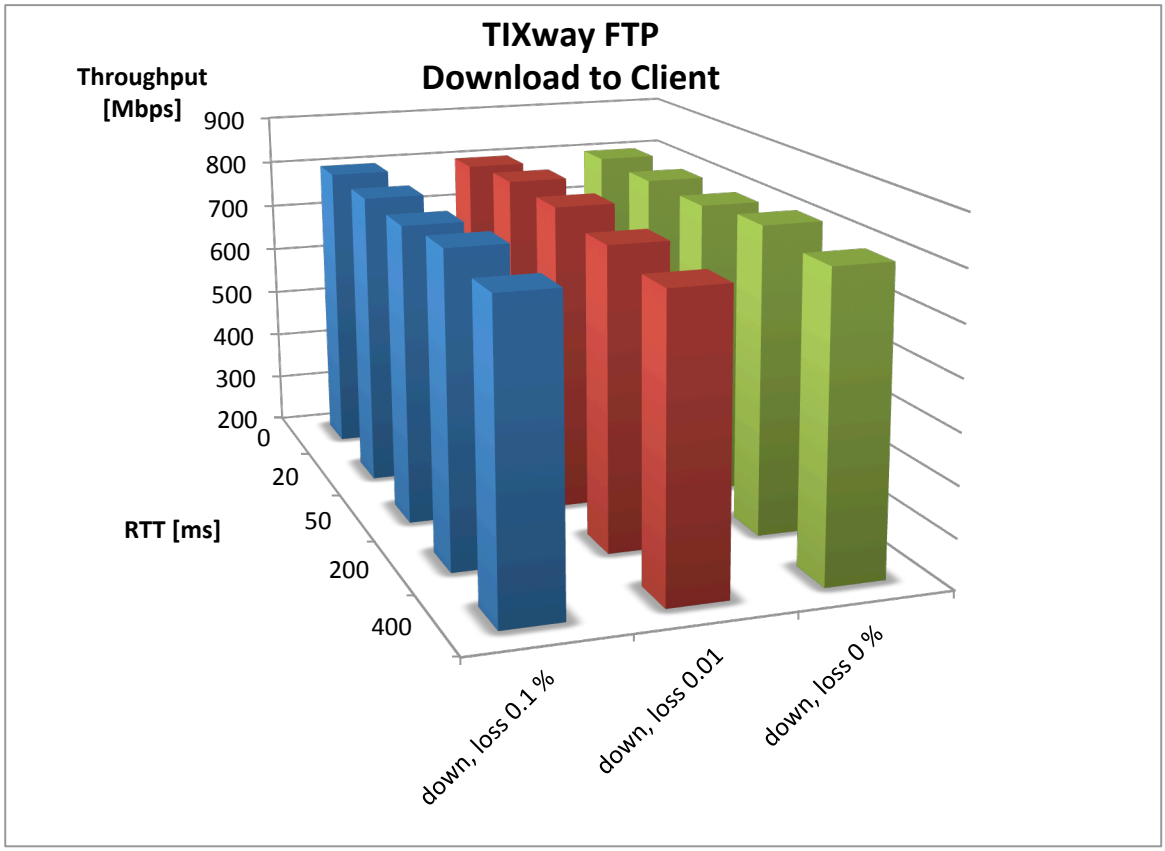



*Figure 3: TIXway FTP Transfer (Download to Client)*

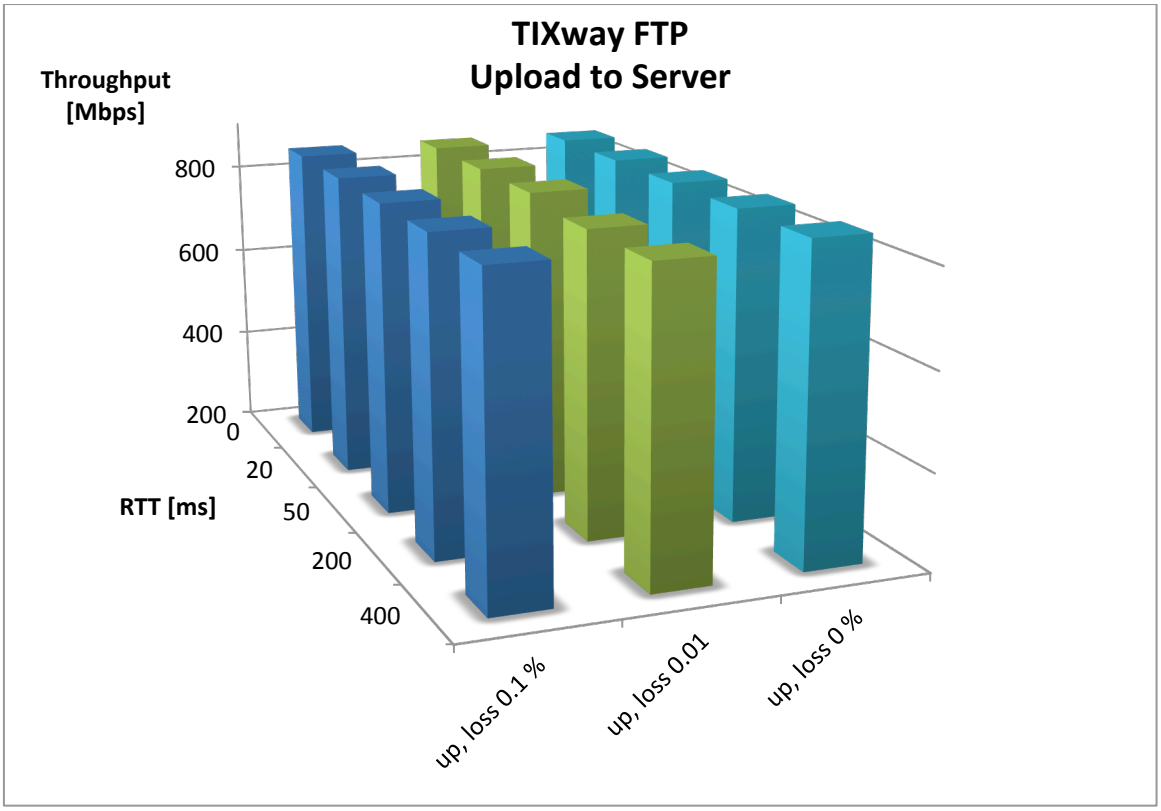



*Figure 4: TIXway FTP Transfer (Upload to Server)*

In previous tests the download reached a slightly less throughput than the upload. For optimization e.g. a Filezilla FTP-software allows buffer modifications on the server side. Hence the default internal transfer buffer size (32768 Byte) and the socket buffer size (65536 Byte) of the Filezilla server application were increased by four times. These changes led to a much better performance in both directions, especially the download *(Figure 5 and 6)*. Consequently all following tests were executed with these optimized buffer settings.

To indicate multi-operating system (OS) capability a subset of plain and TIXway FTP tests was executed on other operating systems, i.e. Mac OS X and Ubuntu Linux 12.4 as well. Both measurement series produced similar results as the Windows based tests before. When using standard FTP on impaired links this leads to a heavy drop of performance. When using TIXway on such links no performance drop was noticed. The Apple Macintosh (laptop) showed a little less performance than the slightly more powerful Linux machine.

While the client changed, the server stayed the same throughout the whole evaluation (running on a Windows 7 pro platform). Finally on all three OS platforms functionality and compatibility tests with other FTP clients (Win SCP, lftp, gftp, on board [terminal]) were successfully performed.

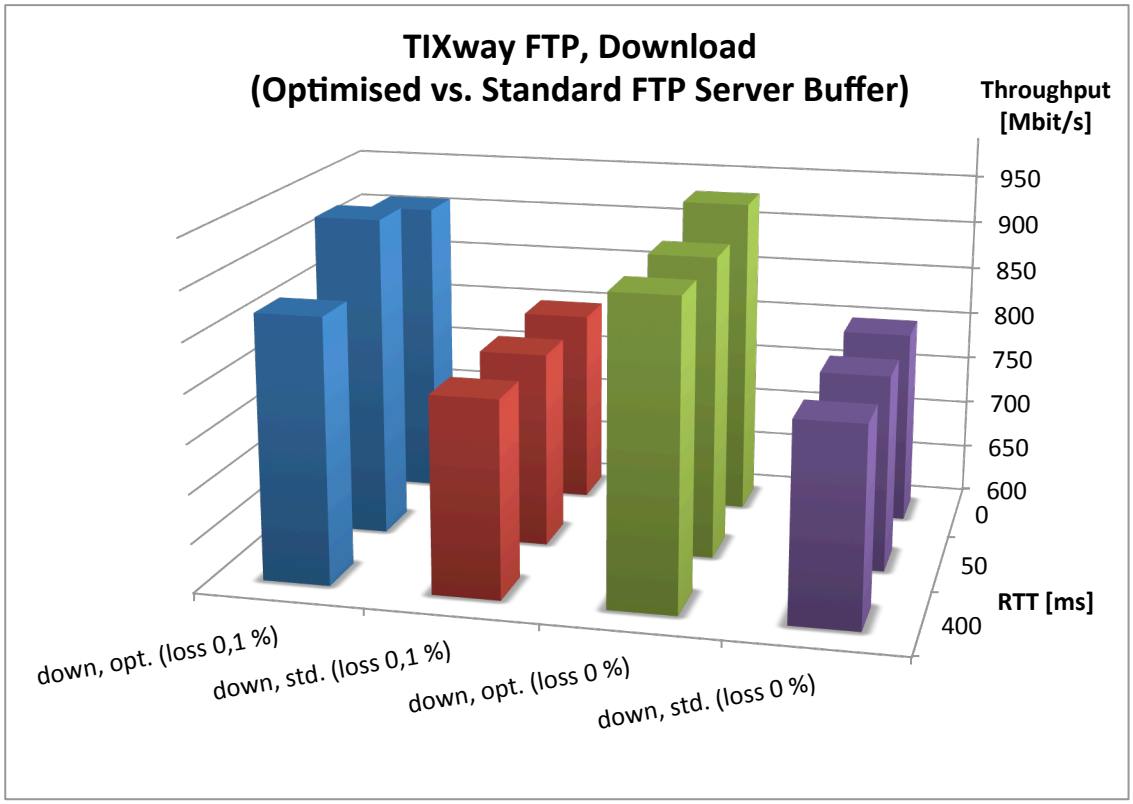



*Figure 5: TIXway FTP Download (Optimised vs. Standard FTP Server Buffer)*

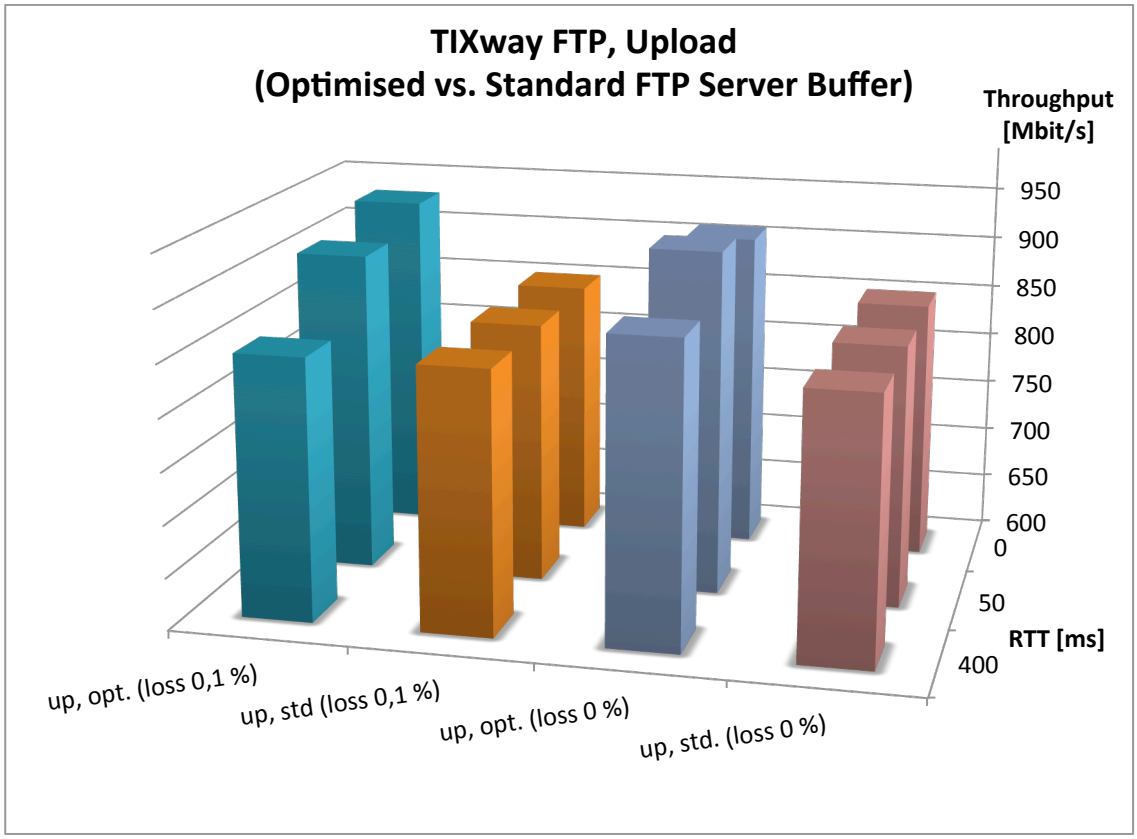



*Figure 6: TIXway FTP/Upload (Optimised vs. Standard FTP Server Buffer)*

TIXway was also tested successfully with asymmetric transmissions. A typical use case is a broadband satellite connection in combination with a return channel of reduced bandwidth. Both links typically bring a very different delay into the communication. The tests showed that such a setting does not negatively influence the performance optimisation by TIXway.

### 7.3 Recovery Capabilities

As mentioned before the basis of an automatic recovery and especially the restart of a transmission depends on the capabilities of the FTP client software.

Basically TIXway itself does not store data permanently. But TIXway enables the FTP application to resume or restart interrupted transfers. As Filezilla is capable to set up and continue interrupted transmissions all recovery tests with TIXway were successful. After a network or power outage the connection was re-established successfully and the FTP transfer was continued in a reasonable time.

## 8 Conclusion

This evaluation focused on the performance gain when using TIXway in WAN environments. The tests confirmed that a much better throughput can be achieved with TIXway on impaired long delay links than with standard FTP transmissions.

While the throughput drops dramatically with increasing delay and loss for standard FTP it stays at the same (high) level for a wide range of impairments when inserting TIXway into the WAN link.

The evaluation also covered system recovery after a network connectivity or power outage. The TIXway gateways automatically reconnect to each other and enable the FTP applications to continue their transmissions.

The tests showed that TIXway is a powerful and reliable solution for accelerating FTP traffic especially on loss afflicted high latency IP networks like WAN connections. It is easy to set up and operate and works transparent with different FTP software and operating systems.

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