BATS Europe
FAST PITCH Specification

Version 2.1
30 November 2010

Contents

1 Overview

The BATS Europe FAST PITCH market data protocol delivers BATS market data messages wrapped in a SOUP envelope over a TCP connection.

BATS has developed a compressed feed based on the FAST Protocol. BATS Europe FAST PITCH compression typically achieves 73% compressed on a PITCH data stream. How this translates to actual network bandwidth depends on the number of messages sent in a single TCP/IP packet. Many factors influence the number of messages in a single TCP/IP frame, including: event rate, network utilisation, and network latency. BATS Europe FAST PITCH compression will decrease network utilisation by 37% to 72% with results being directly proportional to network utilisation.

BATS can optionally enable Nagel's algorithm (i.e., turn of `TCP_NO_DELAY`) on a PITCH port if desired by the participant. At the cost of a small increase in latency, this can significantly increase the number of messages per TCP/IP frame, resulting in higher effective compression.

2 Compatibility with BATS Exchange

The underlying PITCH messages used are a superset of the messages used on the BATS US Exchange. Some additional "long format" messages have been added which allow for larger sizes and prices.

Participants which have been using FAST PITCH successfully on BATS Exchange will need to make minor changes to be compatible with BATS Europe FAST PITCH. Since the messages are a superset, participants which successfully use BATS Europe FAST PITCH can use the same code, unmodified, with BATS Exchange.

See the BATS Europe PITCH Specification for information about the underlying PITCH protocol.

3 API

BATS provides source code to a decoder written in C, along with a simple program that can read compressed PITCH from a file and produce an uncompressed output file.

The FAST reference API provided by FPL does not implement incremental stream decoding or the `FAST_OP_DEFAULT` field operator. We recommend using the supplied BATS decoder to decode BATS Europe FAST encoded PITCH.

The decoder has two public functions:

```
/* Initialise decoder. */
void BATS_FASTPITCH_InitCache(void);

/* Decode bytes.
 *
 * Returns BFS_NeedMoreData (-1)
 * BFS_Error (-2)
 * input bytes decoded (> 0)
 */
int BATS_FASTPITCH_DecodeMessage(
    unsigned char const *src, /* first non-decoded input byte */
    unsigned srcLen,          /* length of non-decoded data available */
    unsigned char *dst,       /* buffer to hold single decoded output message */
    unsigned dstLen,          /* length available at dst */
    unsigned *dstUsed         /* receives amount of dst used to hold decoded output */
);
```

The decoder will return `BFS_NeedMoreData` (-1) if sufficient input bytes for a full output message are not

provided. In this case, you should try again after receiving more data. When retrying, the original input bytes must be supplied again with the new data appended.

If there was an unrecoverable decoding error, the decoder will return `BFS_Error` (-2), in which case the only recourse is to disconnect and reconnect to the PITCH server. An unrecoverable decode error shoulud only occur if the decoder is not being used correctly.

If the return value is positive, it indicates the number of encoded input bytes that were consumed. The next call to the decoder should not include these already consumed bytes. A single SOUP wrapped output message is written to a destination buffer provided to the decode function. The number of bytes written to the output buffer is returned via an output parameter.

The full SOUP conversation is encoded, so all bytes received by the client socket must be passed through the decoder prior to processing the SOUP envelope. The output of the decoder may be processed by your existing SOUP/PITCH logic. All messages sent from the client to the server are *not* encoded and have the same meaning on a compressed FAST PITCH port as a normal PITCH port.

The decoder keeps its state in a static global array in `batsfastdecode.c`. This is fine if your client process is processing a single PITCH stream. If you need to decode more than one PITCH stream per process, you will need to modify the initialisation and decoder functions to take the state array as a parameter.

Provided source files are located at:

http://www.batstrading.com/resources/membership/batsfastpitch.zip

`batsfastcommon.h`	Included by the decoder implementation.
`batsfastdecode.h`	Included by your application.
`batsfastdecode.c`	Decoder implementation.
`batsfastdecodetest.c`	Sample program that uses the decoder.
`pitchsample.dat`	Uncompressed PITCH sample.
`pitchsample.enc`	FAST PITCH sample.

No makefiles or project files are supplied.

The sample may be built as follows:

```
gcc -o batsfastdecodetest batsfastdecodetest.c batsfastdecode.c
```

or

```
cl batsfastdecodetest.c batsfastdecode.c
```

for gcc or MSVC, respectively.

Run as:

```
batsfastdecodetest pitchsample.enc pitchsample.dec
```

Verify that the generated `pitchsample.dec` is identical to the supplied `pitchsample.dat`.

4 Intellectual Property

One of the key techniques used by FAST is protected by a patent held by the Chicago Mercantile Exchange ("CME").

Please see http://www.fixprotocol.org/fastagreement for details about how this may apply to you.

5 Latency and CPU Analysis

The following FAST performance statistics were gathered on servers running in the BATS Exchange production environment. BATS anticipates similar savings for the BATS Europe production environment.

	Slowest Hop Bandwidth (bps)	Avg PITCH Size (bytes)	Avg FAST Size (bytes)	TCP/IP Overhead (bytes)	PITCH Serialisation Time (μsec)	FAST Serialisation Time (μsec)	Serialisation Savings (μsec)	Encoder Time (μsec)	Decoder Time (μsec)	FAST Time Saved (μsec)
1G	1,000,000,000	38	11	40	0.624	0.408	0.216	0.526	0.303	-0.613
100M	100,000,000	38	11	40	6.240	4.080	2.160	0.526	0.303	1.331
50M	50,000,000	38	11	40	12.480	8.160	4.320	0.526	0.303	3.491
10M	10,000,000	38	11	40	62.400	40.800	21.600	0.526	0.303	20.771
5M	5,000,000	38	11	40	124.800	81.600	43.200	0.526	0.303	42.371

Messages/sec	Encoder Time (μsec)	Decoder Time (μsec)	Encoder %CPU	Decoder %CPU
10,000	0.526	0.303	0.5%	0.3%
20,000	0.526	0.303	1.1%	0.6%
30,000	0.526	0.303	1.6%	0.9%
40,000	0.526	0.303	2.1%	1.2%
50,000	0.526	0.303	2.6%	1.5%

6 Support

Please email questions or comments regarding this specification to `tradedeskeurope@batstrading.com`.

7 Revision History

9 September 2008

- Initial Europe version.

15 December 2009

- Version 2.0.
- Formatting updates for consistency with other BATS Europe specifications.

30 November 2010

- Version 2.1.
- Updated link to `batsfastpitch.zip`.