

TicTacToe Text Protocol

FTOP (Four-T-One-P) is a text based protocol for communication with TicTacToe programs, based on and inspired by [GNU Go Text Protocol 2 Specification](#).

Current Status

FTOP v1 has been implemented in Felix-3T.

Protocol Basics

Character Set

All messages exchanged in this protocol are to be considered as 8-bit character sequences. Only characters in the US-ASCII character set are used for standardized commands and responses.

Control Characters

Character values 0-31 and 127 are control characters in ASCII. The following control characters have a specific meaning in the protocol:

```
LF (dec 10) Line Feed
```

All other control characters must be discarded on input and should not be used on output.

Whitespace

Only `SPACE` ((dec 32) `Space`) indicates whitespace in the protocol.

In the rest of the specification we use 'space' to denote a whitespace character. On output only a `SPACE` should be used.

Command Structure

A command is exactly one line long, with the syntax

```
command_name [arguments]
```

Response Structure

if successful, the engine returns a response of the form

```
= result
```

Here, = indicates success and result is a piece of text ending with two consecutive newlines.

Error Messages

If unsuccessful, the engine returns a response of the form

```
? error_message
```

Here, ? indicates failure and `error_message` gives an explanation for the failure, also ending with two consecutive newlines.

Timing

There are no synchronization requirements between the controller and the engine. The controller may send commands at any time, regardless of whether it has obtained responses for previous commands. The engine may send responses whenever they are ready. It must, however, respond to the commands in the same order as they come in. The engine is allowed to make pauses while sending a response.

Empty Lines

Empty lines and lines with only whitespace sent by the controller must be ignored by the engine. No response must be generated. Empty lines and lines with only whitespace sent by the engine and occurring outside a response must be ignored by the controller.

Board Coordinates

Board cells, are encoded by a letter plus a number. On a 3x3 board the letters go from A to C, from the left to the right. The numbers go from 1 to 3, from the bottom to the top. Thus, the lower left corner is called A1, the lower right corner C1, the upper left corner A3 and the upper right corner C3.

Protocol Details

Preprocessing

When a command string arrives to an engine, it is expected to perform the following two operations before any further parsing takes place:

- Remove all occurrences of all control characters.
- Discard any empty or white-space only lines.

When a response arrives to a controller, it is expected to do same steps.

Naturally an implementation does not have to actually do this preprocessing as a separate step but may interleave it with other parts of the parsing. For purposes of the following specifications,

though, the preprocessing is supposed to have been carried out in full.

Syntactic Entities

Simple Entities

- **int:** An `int` is an unsigned integer in the interval $0 \leq x \leq 2^{31} - 1$
- **string:** A `string` is a sequence of printable, non-whitespace characters. Strings are case sensitive.
- **cell:** A `cell` is a board coordinate consisting of one letter and one number, as defined in section [Board Coordinates](#Board Coordinates). Vertices are not case sensitive. For example: `A1 = a1`.
- **player:** A `player` is one of the strings `x` to denote `Player X` or `o` to denote `Player O`. Players are not case sensitive.
- **move:** A `move` is the combination of one `player` and one `cell`, separated by space. Moves are not case sensitive. Example: `x a1`

Compound Entities

- **list:** An `x*` is a space separated list of entities of type `x`, where `x` may be any of the entities specified so far. The list can have an arbitrary number of elements and goes on until an `LF` is encountered.

Commands

A command has one of the syntaxes;

```
command_name arguments\ncommand_name\n
```

- `command_name` is a string.
- `arguments` is a space separated list of some collection of entities, the composition of which varies with the command, if `arguments` is missing it counts as empty.

Success Responses

A successful response has one of the syntaxes

```
=\n\n= response\n\n
```

- `response` is some collection of entities, separated by space or single `LF`, the composition of which varies with the command. The response may be empty.

Failure Response

An unsuccessful response has syntax of

```
? error_message\n\n
```

- `error_message` is a string.

Standard Error Messages

If the engine receives an unknown or unimplemented command, use the error message `unknown command`.

For other failures, the engine can freely choose error message.

Internal State

State Variables

An engine is expected to keep track of the following state information:

- board size
- board configuration
- move history

Default State

There is no default state for any state variable. When first started, the engine may set these as it likes. A controller which has some specific opinion about these values must set them explicitly with the appropriate commands, including clearing the board.

State Maintenance

The state is changed by certain commands, as specified in their description in section [Commands](#)

Commands

Required Commands

All implementations are required to support the following commands:

```
protocol_version
name
version
list_commands
quit
clear_board
play
genmove
```

List of All Commands

Administrative Commands

- **protocol_version**
 - arguments: none
 - effects: none
 - output: `version_number`
 - `int version_number` - Version of the FTOP Protocol
 - fails: never
- **name**
 - arguments: none
 - effects: none
 - output: `name`
 - `string name` - Name of the engine
 - fails: never
- **version**
 - arguments: none
 - effects: none
 - output: `version`
 - `string version` - Version of the engine
 - fails: never
- **list_commands**
 - arguments: none
 - effects: none
 - output: `commands`
 - `string commands` - list of commands, one per row
 - fails: never
- **quit**
 - arguments: none
 - effects: The session is terminated and the connection is closed.
 - output: none
 - fails: never

Setup Commands

- **clear_board**
 - arguments: none
 - effects: The board is cleared, move history is reset to empty.
 - output: none
 - fails: never

Core Play Commands

- **play**
 - arguments: `move`
 - `move move` - Player and cell of the move
 - effects: A stone of the requested player is played at the requested cell. The move is added to

the move history.

- output: none
- fails: syntax error, illegal move. Fails with the error message `illegal move`.

- **genmove**

- arguments: `player`
 - `player player` - Player for which to generate a move.
- effects: A stone of the requested player is played where the engine chooses. The move is added to the move history.
- output: `cell`
 - `cell cell` - Cell where the move was played.
- fails: never

Debug Commands

- **showboard**

- arguments: none
- effects: none
- output: `board`
 - `string board` - A diagram of the board position.
- fails: never

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