Blessed Documentation

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CHAPTER 1

Introduction

Blessed is a thin, practical wrapper around terminal capabilities in Python.

Coding with *Blessed* looks like this…

```
from blessed import Terminal

t = Terminal()

print(t.bold('Hi there!'))
print(t.bold_red_on_bright_green('It hurts my eyes!'))

with t.location(0, t.height - 1):
    print(t.center(t.blink('press any key to continue.')))

with t.cbreak():
    inp = t.inkey()
print('You pressed ' + repr(inp))
```

1.1 Brief Overview

Blessed is a more simplified wrapper around curses, providing :

- Styles, color, and maybe a little positioning without necessarily clearing the whole screen first.
- Works great with standard Python string formatting.
- Provides up-to-the-moment terminal height and width, so you can respond to terminal size changes.
- Avoids making a mess if the output gets piped to a non-terminal: outputs to any file-like object such as *StringIO*, files, or pipes.
- Uses the terminfo(5) database so it works with any terminal type and supports any terminal capability: No more C-like calls to tigetstr and tparm.

- Keeps a minimum of internal state, so you can feel free to mix and match with calls to curses or whatever other terminal libraries you like.
- Provides plenty of context managers to safely express terminal modes, automatically restoring the terminal to a safe state on exit.
- Act intelligently when somebody redirects your output to a file, omitting all of the terminal sequences such as styling, colors, or positioning.
- Dead-simple keyboard handling: safely decoding unicode input in your system's preferred locale and supports application/arrow keys.
- Allows the printable length of strings containing sequences to be determined.

1.2 Before And After

With the built-in curses module, this is how you would typically print some underlined text at the bottom of the screen:

```
from curses import tigetstr, setupterm, tparm
from fcntl import ioctl
from os import isatty
import struct
import sys
from termios import TIOCGWINSZ

# If we want to tolerate having our output piped to other commands or
# files without crashing, we need to do all this branching:
if hasattr(sys.stdout, 'fileno') and isatty(sys.stdout.fileno()):
    setupterm()
    sc = tigetstr('sc')
    cup = tigetstr('cup')
    rc = tigetstr('rc')
    underline = tigetstr('smul')
    normal = tigetstr('sgr0')
else:
    sc = cup = rc = underline = normal = ''

# Save cursor position.
print(sc)

if cup:
    # tigetnum('lines') doesn't always update promptly, hence this:
    height = struct.unpack('hhhh', ioctl(0, TIOCGWINSZ, '\000' * 8))[0]

    # Move cursor to bottom.
    print(tparm(cup, height - 1, 0))

print('This is {under}underlined{normal}!'
      .format(under=underline, normal=normal))

# Restore cursor position.
print(rc)
```

The same program with *Blessed* is simply:

```
from blessed import Terminal
```

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```
term = Terminal()
with term.location(0, term.height - 1):
    print('This is' + term.underline('underlined') + '!')
```

1.3 Requirements

Blessed is tested with Python 2.7, 3.4, 3.5, 3.6, and 3.7 on Linux, Mac, and FreeBSD. Windows support was just added in October 2019, thanks to kind contributions from avylove, give it a try, and please report any strange issues!

1.4 Further Documentation

More documentation can be found at http://blessed.readthedocs.org/en/latest/

1.5 Bugs, Contributing, Support

Bugs or suggestions? Visit the issue tracker and file an issue. We welcome your bug reports and feature suggestions!

Would you like to **contribute**? That's awesome! We've written a guide to help you.

Are you stuck and need **support**? Give stackoverflow a try. If you're still having trouble, we'd like to hear about it! Open an issue in the issue tracker with a well-formed question.

1.6 License

Blessed is under the MIT License. See the LICENSE file.

1.7 Forked

Blessed is a fork of blessings. Changes since 1.7 have all been proposed but unaccepted upstream.

Furthermore, a project in the node.js language of the same name is **not** related, or a fork of each other in any way.

CHAPTER 2

Overview

Blessed provides just **one** top-level object: *Terminal*. Instantiating a *Terminal* figures out whether you're on a terminal at all and, if so, does any necessary setup:

```
>>> term = Terminal()
```

After that, you can proceed to ask it all sorts of things about the terminal, such as its size:

```
>>> term.height, term.width
(34, 102)
```

Its color support:

```
>>> term.number_of_colors
256
```

And use construct strings containing color and styling:

```
>>> term.green_reverse('ALL SYSTEMS GO')
'\x1b[32m\x1b[7mALL SYSTEMS GO\x1b[m'
```

Furthermore, the special sequences inserted with application keys (arrow and function keys) are understood and decoded, as well as your locale-specific encoded multibyte input, such as utf-8 characters.

2.1 Styling and Formatting

Lots of handy formatting codes are available as attributes on a *Terminal* class instance. For example:

```
from blessed import Terminal

term = Terminal()

print('I am ' + term.bold + 'bold' + term.normal + '!')
```

These capabilities (*bold*, *normal*) are translated to their sequences, which when displayed simply change the video attributes. And, when used as a callable, automatically wraps the given string with this sequence, and terminates it with *normal*.

The same can be written as:

```
print('I am' + term.bold('bold') + '!')
```

You may also use the *Terminal* instance as an argument for the `str.format`() method, so that capabilities can be displayed in-line for more complex strings:

```
print('{t.red_on_yellow}Candy corn{t.normal} for everyone!'.format(t=term))
```

2.1.1 Capabilities

The basic capabilities supported by most terminals are:

bold Turn on 'extra bright' mode.

reverse Switch fore and background attributes.

blink Turn on blinking.

normal Reset attributes to default.

The less commonly supported capabilities:

dim Enable half-bright mode.

underline Enable underline mode.

no_underline Exit underline mode.

italic Enable italicized text.

no_italic Exit italics.

shadow Enable shadow text mode (rare).

no_shadow Exit shadow text mode.

standout Enable standout mode (often, an alias for `reverse`).

no_standout Exit standout mode.

subscript Enable subscript mode.

no_subscript Exit subscript mode.

superscript Enable superscript mode.

no_superscript Exit superscript mode.

flash Visual bell, flashes the screen.

Note that, while the inverse of *underline* is *no_underline*, the only way to turn off *bold* or *reverse* is *normal*, which also cancels any custom colors.

Many of these are aliases, their true capability names (such as 'smul' for 'begin underline mode') may still be used. Any capability in the terminfo(5) manual, under column **Cap-name**, may be used as an attribute of a *Terminal* instance. If it is not a supported capability, or a non-tty is used as an output stream, an empty string is returned.

2.1.2 Colors

Color terminals are capable of at least 8 basic colors.

- `black`
- `red`
- `green`
- `yellow`
- `blue`
- `magenta`
- `cyan`
- `white`

The same colors, prefixed with *bright_* (synonymous with *bold_*), such as *bright_blue*, provides 16 colors in total.

Prefixed with *on_*, the given color is used as the background color. Some terminals also provide an additional 8 high-intensity versions using *on_bright*, some example compound formats:

```
from blessed import Terminal

term = Terminal()

print(term.on_bright_blue('Blue skies!'))

print(term.bright_red_on_bright_yellow('Pepperoni Pizza!'))
```

You may also specify the `color()` index by number, which should be within the bounds of value returned by *number_of_colors*:

```
from blessed import Terminal

term = Terminal()

for idx in range(term.number_of_colors):
    print(term.color(idx)('Color {0}'.format(idx)))
```

You can check whether the terminal definition used supports colors, and how many, using the *number_of_colors* property, which returns any of *0*, *8* or *256* for terminal types such as *vt220*, *ansi*, and *xterm-256color*, respectively.

2.1.3 Colorless Terminals

If the terminal defined by the Environment variable **TERM** does not support colors, these simply return empty strings. When used as a callable, the string passed as an argument is returned as-is. Most sequences emitted to a terminal that does not support them are usually harmless and have no effect.

Colorless terminals (such as the amber or green monochrome *vt220*) do not support colors but do support reverse video. For this reason, it may be desirable in some applications to simply select a foreground color, followed by reverse video to achieve the desired background color effect:

```
from blessed import Terminal

term = Terminal()
```

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```
print(term.green_reverse('some terminals standout more than others'))
```

Which appears as *black on green* on color terminals, but *black text on amber or green* on monochrome terminals. Whereas the more declarative formatter *black_on_green* would remain colorless.

Note: On most color terminals, *bright_black* is not invisible – it is actually a very dark shade of gray!

2.1.4 Compound Formatting

If you want to do lots of crazy formatting all at once, you can just mash it all together:

```
from blessed import Terminal

term = Terminal()

print(term.bold_underline_green_on_yellow('Woo'))
```

I'd be remiss if I didn't credit couleur, where I probably got the idea for all this mashing.

This compound notation comes in handy if you want to allow users to customize formatting, just allow compound formatters, like *bold_green*, as a command line argument or configuration item such as in the *tprint.py* demonstration script.

2.2 Moving The Cursor

When you want to move the cursor, you have a few choices:

- `location(x=None, y=None)` context manager.
- `move(row, col)` capability.
- `move_y(row)` capability.
- `move_x(col)` capability.

Warning: The *`location()`* method receives arguments in positional order *(x, y)*, whereas the `move()` capability receives arguments in order *(y, x)*. Please use keyword arguments as a later release may correct the argument order of *`location()`*.

2.3 Finding The Cursor

We can determine the cursor's current position at anytime using *`get_location()`*, returning the current (y, x) location. This uses a kind of "answer back" sequence that your terminal emulator responds to. If the terminal may not respond, the *`timeout`* keyword argument can be specified to return coordinates (-1, -1) after a blocking timeout:

```
from blessed import Terminal

term = Terminal()

row, col = term.get_location(timeout=5)

if row < term.height:
    print(term.move_y(term.height) + 'Get down there!')
```

2.3.1 Moving Temporarily

A context manager, *location()* is provided to move the cursor to an *(x, y)* screen position and restore the previous position upon exit:

```
from blessed import Terminal

term = Terminal()

with term.location(0, term.height - 1):
    print('Here is the bottom.')

print('This is back where I came from.')
```

Parameters to *location()* are the **optional** *x* and/or *y* keyword arguments:

```
with term.location(y=10):
    print('We changed just the row.')
```

When omitted, it saves the cursor position and restore it upon exit:

```
with term.location():
    print(term.move(1, 1) + 'Hi')
    print(term.move(9, 9) + 'Mom')
```

Note: calls to *location()* may not be nested.

2.3.2 Moving Permanently

If you just want to move and aren't worried about returning, do something like this:

```
from blessed import Terminal

term = Terminal()
print(term.move(10, 1) + 'Hi, mom!')
```

move(y, x) Position cursor at given **y**, **x**.

move_x(x) Position cursor at column **x**.

move_y(y) Position cursor at row **y**.

2.3.3 One-Notch Movement

Finally, there are some parameterless movement capabilities that move the cursor one character in various directions:

- `move_left`
- `move_right`
- `move_up`
- `move_down`

Note: *move_down* is often valued as \n, which additionally returns the carriage to column 0, depending on your terminal emulator, and may also destructively destroy any characters at the given position to the end of margin.

2.4 Height And Width

Use the *height* and *width* properties to determine the size of the window:

```
from blessed import Terminal

term = Terminal()
height, width = term.height, term.width
with term.location(x=term.width / 3, y=term.height / 3):
    print('1/3 ways in!')
```

These values are always current. To detect when the size of the window changes, you may author a callback for SIGWINCH signals:

```
import signal
from blessed import Terminal

term = Terminal()

def on_resize(sig, action):
    print('height={t.height}, width={t.width}'.format(t=term))

signal.signal(signal.SIGWINCH, on_resize)

# wait for keypress
term.inkey()
```

2.5 Clearing The Screen

Blessed provides syntactic sugar over some screen-clearing capabilities:

`clear` Clear the whole screen.

`clear_eol` Clear to the end of the line.

`clear_bol` Clear backward to the beginning of the line.

`clear_eos` Clear to the end of screen.

2.6 Full-Screen Mode

If you've ever noticed a program, such as an editor, restores the previous screen (such as your shell prompt) after exiting, you're seeing the *enter_fullscreen* and *exit_fullscreen* attributes in effect.

enter_fullscreen Switch to alternate screen, previous screen is stored by terminal driver.

exit_fullscreen Switch back to standard screen, restoring the same terminal state.

There's also a context manager you can use as a shortcut:

```
from __future__ import division
from blessed import Terminal

term = Terminal()
with term.fullscreen():
    print(term.move_y(term.height // 2) +
          term.center('press any key').rstrip())
    term.inkey()
```

2.7 Pipe Savvy

If your program isn't attached to a terminal, such as piped to a program like *less(1)* or redirected to a file, all the capability attributes on *Terminal* will return empty strings. You'll get a nice-looking file without any formatting codes gumming up the works.

If you want to override this, such as when piping output to *less -r*, pass argument value *True* to the *force_styling* parameter.

In any case, there is a *does_styling* attribute that lets you see whether the terminal attached to the output stream is capable of formatting. If it is *False*, you may refrain from drawing progress bars and other frippery and just stick to content:

```
from blessed import Terminal

term = Terminal()
if term.does_styling:
    with term.location(x=0, y=term.height - 1):
        print('Progress: [=======>   ]')
print(term.bold("60%"))
```

2.8 Sequence Awareness

Blessed may measure the printable width of strings containing sequences, providing *center()*, *ljust()*, and *rjust()* methods, using the terminal screen's width as the default *width* value:

```
from __future__ import division
from blessed import Terminal

term = Terminal()
with term.location(y=term.height // 2):
    print(term.center(term.bold('bold and centered')))
```

Any string containing sequences may have its printable length measured using the *length()* method.

Additionally, a sequence-aware version of `textwrap.wrap()` is supplied as class as method *wrap()* that is also sequence-aware, so now you may word-wrap strings containing sequences. The following example displays a poem word-wrapped to 25 columns:

```
from blessed import Terminal

term = Terminal()

poem = (term.bold_cyan('Plan difficult tasks'),
        term.cyan('through the simplest tasks'),
        term.bold_cyan('Achieve large tasks'),
        term.cyan('through the smallest tasks'))

for line in poem:
    print('\n'.join(term.wrap(line, width=25, subsequent_indent=' ' * 4)))
```

Sometimes it is necessary to make sense of sequences, and to distinguish them from plain text. The *split_seqs()* method can allow us to iterate over a terminal string by its characters or sequences:

```
from blessed import Terminal

term = Terminal()

phrase = term.bold('bbq')
print(term.split_seqs(phrase))
```

Will display something like, `['\x1b[1m', 'b', 'b', 'q', '\x1b(B', '\x1b[m']`

Similarly, the method *strip_seqs()* may be used on a string to remove all occurrences of terminal sequences:

```
from blessed import Terminal

term = Terminal()
phrase = term.bold_black('coffee')
print(repr(term.strip_seqs(phrase)))
```

Will display only `'coffee'`

2.9 Keyboard Input

The built-in python function `raw_input()` does not return a value until the return key is pressed, and is not suitable for detecting each individual keypress, much less arrow or function keys.

Furthermore, when calling `os.read()` on input stream, only bytes are received, which must be decoded to unicode using the locale-preferred encoding. Finally, multiple bytes may be emitted which must be paired with some verb like `KEY_LEFT`: blessed handles all of these special cases for you!

2.9.1 cbreak

The context manager *cbreak()* can be used to enter *key-at-a-time* mode: Any keypress by the user is immediately consumed by read calls:

```
from blessed import Terminal
import sys

term = Terminal()

with term.cbreak():
    # block until any single key is pressed.
    sys.stdin.read(1)
```

The mode entered using *cbreak()* is called cbreak(3) in curses:

> The cbreak routine disables line buffering and erase/kill character-processing (interrupt and flow control characters are unaffected), making characters typed by the user immediately available to the program.

2.9.2 raw

raw() is similar to cbreak, except that control-C and other keystrokes are "ignored", and received as their keystroke value rather than interrupting the program with signals.

Output processing is also disabled, you must print phrases with carriage return after newline. Without raw mode:

```
print("hello, world.")
```

With raw mode:

```
print("hello, world.", end="\r\n")
```

2.9.3 inkey

The method *inkey()* combined with *cbreak* completes the circle of providing key-at-a-time keyboard input with multibyte encoding and awareness of application keys.

inkey() resolves many issues with terminal input by returning a unicode-derived *Keystroke* instance. Its return value may be printed, joined with, or compared like any other unicode strings, it also provides the special attributes *is_sequence*, *code*, and *name*:

```
from blessed import Terminal

term = Terminal()

print("press 'q' to quit.")
with term.cbreak():
    val = ''
    while val.lower() != 'q':
        val = term.inkey(timeout=5)
        if not val:
            # timeout
            print("It sure is quiet in here ...")
        elif val.is_sequence:
            print("got sequence: {0}.".format((str(val), val.name, val.code)))
        elif val:
            print("got {0}.".format(val))
    print('bye!')
```

Its output might appear as:

```
got sequence: ('\x1b[A', 'KEY_UP', 259).
got sequence: ('\x1b[1;2A', 'KEY_SUP', 337).
got sequence: ('\x1b[17~', 'KEY_F6', 270).
got sequence: ('\x1b', 'KEY_ESCAPE', 361).
got sequence: ('\n', 'KEY_ENTER', 343).
got /.
It sure is quiet in here ...
got sequence: ('\x1bOP', 'KEY_F1', 265).
It sure is quiet in here ...
got q.
bye!
```

A *timeout* value of *None* (default) will block forever until a keypress is received. Any other value specifies the length of time to poll for input: if no input is received after the given time has elapsed, an empty string is returned. A *timeout* value of *0* is non-blocking.

2.9.4 keyboard codes

When the *is_sequence* property tests *True*, the value is a special application key of the keyboard. The *code* attribute may then be compared with attributes of *Terminal*, which are duplicated from those found in curs_getch(3), or those constants in curses beginning with phrase *KEY_*.

Some of these mnemonics are shorthand or predate modern PC terms and are difficult to recall. The following helpful aliases are provided instead:

blessed	curses	note
KEY_DELETE	KEY_DC	chr(127).
KEY_TAB		chr(9)
KEY_INSERT	KEY_IC	
KEY_PGUP	KEY_PPAGE	
KEY_PGDOWN	KEY_NPAGE	
KEY_ESCAPE	KEY_EXIT	
KEY_SUP	KEY_SR	(shift + up)
KEY_SDOWN	KEY_SF	(shift + down)
KEY_DOWN_LEFT	KEY_C1	(keypad lower-left)
KEY_UP_RIGHT	KEY_A1	(keypad upper-left)
KEY_DOWN_RIGHT	KEY_C3	(keypad lower-left)
KEY_UP_RIGHT	KEY_A3	(keypad lower-right)
KEY_CENTER	KEY_B2	(keypad center)
KEY_BEGIN	KEY_BEG	

The *name* property will prefer these aliases over the built-in curses names.

The following are **not** available in the curses module, but are provided for keypad support, especially where the *keypad()* context manager is used with numlock on:

- KEY_KP_MULTIPLY
- KEY_KP_ADD
- KEY_KP_SEPARATOR
- KEY_KP_SUBTRACT
- KEY_KP_DECIMAL

- KEY_KP_DIVIDE
- KEY_KP_0 through KEY_KP_9

CHAPTER 3

Examples

A few programs are provided with blessed to help interactively test the various API features, but also serve as examples of using blessed to develop applications.

These examples are not distributed with the package – they are only available in the github repository. You can retrieve them by cloning the repository, or simply downloading the "raw" file link.

3.1 editor.py

https://github.com/jquast/blessed/blob/master/bin/editor.py

This program demonstrates using the directional keys and noecho input mode. It acts as a (very dumb) fullscreen editor, with support for saving a file, as well as including a rudimentary line-editor.

3.2 keymatrix.py

https://github.com/jquast/blessed/blob/master/bin/keymatrix.py

This program displays a "gameboard" of all known special KEY_NAME constants. When the key is depressed, it is highlighted, as well as displaying the unicode sequence, integer code, and friendly-name of any key pressed.

3.3 on_resize.py

https://github.com/jquast/blessed/blob/master/bin/on_resize.py

This program installs a SIGWINCH signal handler, which detects screen resizes while also polling for input, displaying keypresses.

This demonstrates how a program can react to screen resize events.

3.4 progress_bar.py

https://github.com/jquast/blessed/blob/master/bin/progress_bar.py

This program demonstrates a simple progress bar. All text is written to stderr, to avoid the need to "flush" or emit newlines, and makes use of the move_x (hpa) capability to "overstrike" the display a scrolling progress bar.

3.5 tprint.py

https://github.com/jquast/blessed/blob/master/bin/tprint.py

This program demonstrates how users may customize FormattingString styles. Accepting a string style, such as "bold" or "bright_red" as the first argument, all subsequent arguments are displayed by the given style. This shows how a program could provide user-customizable compound formatting names to configure a program's styling.

3.6 worms.py

https://github.com/jquast/blessed/blob/master/bin/worms.py

This program demonstrates how an interactive game could be made with blessed. It is similar to NIBBLES.BAS or "snake" of early mobile platforms.

3.7 resize.py

https://github.com/jquast/blessed/blob/master/bin/resize.py

This program demonstrates the `get_location()` method, behaving similar to resize(1) : set environment and terminal settings to current window size. The window size is determined by eliciting an answerback sequence from the connecting terminal emulator.

3.8 detect-multibyte.py

https://github.com/jquast/blessed/blob/master/bin/detect-multibyte.py

This program also demonstrates how the `get_location()` method can be used to reliably test whether the terminal emulator of the connecting client is capable of rendering multibyte characters as a single cell.

CHAPTER 4

Further Reading

As a developer's API, blessed is often bundled with frameworks and toolsets that dive deeper into Terminal I/O programming than `Terminal` offers. Here are some recommended readings to help you along:

- terminfo(5) manpage of your preferred posix-like operating system. The capabilities available as attributes of `Terminal` are directly mapped to those listed in the column **Cap-name**.
- termios(4) of your preferred posix-like operating system.
- The TTY demystified by Linus Åkesson.
- A Brief Introduction to Termios by Nelson Elhage.
- Richard Steven's Advance Unix Programming ("AUP") provides two very good chapters, "Terminal I/O" and "Pseudo Terminals".
- GNU's The Termcap Manual by Richard M. Stallman.
- Chapter 4 of CUNY's course material for *Introduction to System Programming*, by Stewart Weiss
- Chapter 11 of the IEEE Open Group Base Specifications Issue 7, "General Terminal Interface"
- The GNU C Library documentation, section Low-Level Terminal Interface
- The source code of many popular terminal emulators. If there is ever any question of "the meaning of a terminal capability", or whether or not your preferred terminal emulator actually handles them, read the source!

  These are often written in the C language, and directly map the "Control Sequence Inducers" (CSI, literally `\x1b[` for most modern terminal types) emitted by most terminal capabilities to an action in a series of `case` switch statements.

  - Many modern libraries are now based on libvte (or just 'vte'): Gnome Terminal, sakura, Terminator, Lilyterm, ROXTerm, evilvte, Termit, Termite, Tilda, tinyterm, lxterminal.
  - xterm, urxvt, SyncTerm, and EtherTerm.
  - There are far too many to name, Chose one you like!
- The source code of the tty(4), pty(4), and the given "console driver" for any posix-like operating system. If you search thoroughly enough, you will eventually discover a terminal sequence decoder, usually a `case` switch

that translates `\x1b[0m` into a "reset color" action towards the video driver. Though `tty.c` is linked here (the only kernel file common among them), it is probably not the most interesting, but it can get you started:

  - FreeBSD
  - OpenBSD
  - Illumos (Solaris)
  - Minix
  - Linux

The TTY driver is a great introduction to Kernel and Systems programming, because familiar components may be discovered and experimented with. It is available on all operating systems, and because of its critical nature, examples of efficient file I/O, character buffers (often implemented as "ring buffers") and even fine-grained kernel locking can be found.

- Thomas E. Dickey has been maintaining xterm, as well as a primary maintainer of many related packages such as ncurses for quite a long while.
- termcap & terminfo (O'Reilly Nutshell) by Linda Mui, Tim O'Reilly, and John Strang.
- Note that System-V systems, also known as Unix98 (SunOS, HP-UX, AIX and others) use a Streams interface. On these systems, the ioctl(2) interface provides the `PUSH` and `POP` parameters to communicate with a Streams device driver, which differs significantly from Linux and BSD.

  Many of these systems provide compatible interfaces for Linux, but they may not always be as complete as the counterpart they emulate, most especially in regards to managing pseudo-terminals.

CHAPTER 5

Growing Pains

When making terminal applications, there are a surprisingly number of portability issues and edge cases. Although Blessed provides an abstraction for the full curses capability database, it is not sufficient to secure you from several considerations shared here.

5.1 8 and 16 colors

Where 8 and 16 colors are used, they should be assumed to be the CGA Color Palette. Though there is no terminal standard that proclaims that the CGA colors are used, their values are the best approximations across all common hardware terminals and terminal emulators.

A recent phenomenon of users is to customize their base 16 colors to provide (often, more "washed out") color schemes. Furthermore, we are only recently getting LCD displays of colorspaces that achieve close approximation to the original video terminals. Some find these values uncomfortably intense: in their original CRT form, their contrast and brightness was lowered by hardware dials, whereas today's LCD's typically display colors well near full intensity.

Though we may not *detect* the colorspace of the remote terminal, **we can**:

- Trust that a close approximation of the CGA Color Palette for the base 16 colors will be displayed for **most** users.
- Trust that users who have made the choice to adjust their palette have made the choice to do so, and are able to re-adjust such palettes as necessary to accommodate different programs (such as through the use of "Themes").

Note: It has become popular to use dynamic system-wide color palette adjustments in software such as f.lux, "Dark Mode", "Night Mode", and others, which adjust the system-wide "Color Profile" of the entire graphics display depending on the time of day. One might assume that `term.blue("text")` may become **completely** invisible to such users during the night!

5.2 Where is brown, purple, or grey?

There are **only 8 color names** on a 16-color terminal: The second set of eight colors are "high intensity" versions of the first in direct series.

The colors *brown*, *purple*, and *grey* are not named in the first series, though they are available:

- **brown**: *yellow is brown*, only high-intensity yellow (`bright_yellow`) is yellow!
- **purple**: *magenta is purple*. In earlier, 4-bit color spaces, there were only black, cyan, magenta, and white of low and high intensity, such as found on common home computers like the ZX Spectrum.

  Additional "colors" were only possible through dithering. The color names cyan and magenta on later graphics adapters are carried over from its predecessors. Although the color cyan remained true in RGB value on 16-color to its predecessor, magenta shifted farther towards blue from red becoming purple (as true red was introduced as one of the new base 8 colors).
- **grey**: there are actually **three shades of grey** (or American spelling, 'gray'), though the color attribute named 'grey' does not exist!

  In ascending order of intensity, the shades of grey are:

  - `bold_black`: in lieu of the uselessness of an "intense black", this is color is instead mapped to "dark grey".
  - `white`: white is actually mild compared to the true color 'white': this is more officially mapped to "common grey", and is often the default foreground color.
  - `bright_white`: is pure white (`#ffffff`).

5.2.1 white-on-black

The default foreground and background should be assumed as *white-on-black*.

For quite some time, the families of terminals produced by DEC, IBM, and Tektronix dominated the computing world with the default color scheme of *green-on-black* and less commonly *amber-on-black* monochrome displays: The inverse was a non-default configuration. The IBM 3270 clients exclusively used *green-on-black* in both hardware and software emulators, and is likely a driving factor of the default *white-on-black* appearance of the first IBM Personal Computer.

The less common *black-on-white* "ink paper" style of emulators is a valid concern for those designing terminal interfaces. The color scheme of *black-on-white* directly conflicts with the intention of *bold is bright*, where `term.bright_red('ATTENTION!')` may become difficult to read, as it appears as *pink on white*!

History of ink-paper inspired black-on-white

Early home computers with color video adapters, such as the Commodore 64 provided *white-on-blue* as their basic video terminal configuration. One can only assume such appearances were provided to demonstrate their color capabilities over competitors (such as the Apple][).

More common, X11's xterm and the software HyperTerm bundle with MS Windows provided an "ink on paper" *black-on-white* appearance as their default configuration. Two popular emulators continue to supply *black-on-white* by default to this day: Xorg's xterm and Apple's Terminal.app.

Note: Windows no longer supplies a terminal emulator: the "command prompt" as we know it now uses the MSVCRT API routines to interact and does not make use of terminal sequences, even ignoring those sequences that MS-DOS

family of systems previously interpreted through the ANSI.SYS driver, though it continues to default to *white-on-black*.

5.3 Bold is bright

Where Bold is used, it should be assumed to be *Bright*.

Due to the influence of early graphics adapters providing a set of 8 "low-intensity" and 8 "high intensity" versions of the first, the term "bold" for terminals sequences is synonymous with "high intensity" in almost all circumstances.

5.3.1 History of bold as "wide stroke"

In typography, the true translation of "bold" is that a font should be displayed *with emphasis*. In classical terms, this would be achieved by pen be re-writing over the same letters. On a teletype or printer, this was similarly achieved by writing a character, backspacing, then repeating the same character in a form called **overstriking**.

To bold a character, `C`, one would emit the sequence `C^HC` where `^H` is backspace (0x08). To underline `C`, one would would emit `C^H_`.

Video terminals do not support overstriking. Though the mdoc format for manual pages continue to emit overstriking sequences for bold and underline, translators such as mandoc will instead emit an appropriate terminal sequence.

Many characters previously displayable by combining using overstriking of ASCII characters on teletypes, such as: ±, , or were delegated to a code page or lost entirely until the introduction of multibyte encodings.

Much like the "ink paper" introduction in windowing systems for terminal emulators, "wide stroke" bold was introduced only much later when combined with operating systems that provided font routines such as TrueType.

5.3.2 Enforcing white-on-black

In conclusion, *white-on-black* should be considered the default. If there is a need to **enforce** *white-on-black* for terminal clients suspected to be defaulted as *black-on-white*, one would want to trust that a combination of `term.home + term.white_on_black + term.clear` should repaint the entire emulator's window with the desired effect.

However, this cannot be trusted to **all** terminal emulators to perform correctly! Depending on your audience, you may instead ensure that the entire screen (including whitespace) is painted using the `on_black` mnemonic.

5.4 Beware of customized color schemes

A recent phenomenon is for users to customize these first 16 colors of their preferred emulator to colors of their own liking. Though this has always been possible with `~/.XResources`, the introduction of PuTTy and iTerm2 to interactively adjustment these colors have made this much more common.

This may cause your audience to see your intended interface in a wildly different form. Your intended presentation may appear mildly unreadable.

Users are certainly free to customize their colors however they like, but it should be known that displaying `term.black_on_red("DANGER!")` may appear as "grey on pastel red" to your audience, reducing the intended effect of intensity.

5.4.1 256 colors can avoid customization

The first instinct of a user who aliases ls(1) to `ls -G` or `colorls`, when faced with the particularly low intensity of the default `blue` attribute is **to adjust their terminal emulator's color scheme of the base 16 colors**.

This is not necessary: the environment variable `LSCOLORS` may be redefined to map an alternative color for blue, or to use `bright_blue` in its place.

Furthermore, all common terminal text editors such as emacs or vim may be configured with "colorschemes" to make use of the 256-color support found in most modern emulators. Many readable shades of blue are available, and many programs that emit such colors can be configured to emit a higher or lower intensity variant from the full 256 color space through program configuration.

5.5 Monochrome and reverse

Note that `reverse` takes the current foreground and background colors and reverses them. In contrast, the compound formatter `black_on_red` would fail to set the background *or* foreground color on a monochrome display, resulting in the same stylization as `normal` – it would not appear any different!

If your userbase consists of monochrome terminals, you may wish to provide "lightbars" and other such effects using the compound formatter `red_reverse`. In the literal sense of "set foreground color to red, then swap foreground and background", this produces a similar effect on **both** color and monochrome displays.

For text, very few `{color}_on_{color}` formatters are visible with the base 16 colors, so you should generally wish for `black_on_{color}` anyway. By using `{color}_reverse` you may be portable with monochrome displays as well.

5.6 Multibyte Encodings and Code pages

A terminal that supports both multibyte encodings (UTF-8) and legacy 8-bit code pages (ISO 2022) may instruct the terminal to switch between both modes using the following sequences:

- `\x1b%G` activates UTF-8 with an unspecified implementation level from ISO 2022 in a way that allows to go back to ISO 2022 again.
- `\x1b%@` goes back from UTF-8 to ISO 2022 in case UTF-8 had been entered via `\x1b%G`.
- `\x1b%/G` switches to UTF-8 Level 1 with no return.
- `\x1b%/H` switches to UTF-8 Level 2 with no return.
- `\x1b%/I` switches to UTF-8 Level 3 with no return.

When a terminal is in ISO 2022 mode, you may use a sequence to request a terminal to change its code page. It begins by `\x1b(`, followed by an ASCII character representing a code page selection. For example `\x1b(U` on the legacy VGA Linux console switches to the IBM CP437 code page, allowing North American MS-DOS artwork to be displayed in its natural 8-bit byte encoding. A list of standard codes and the expected code page may be found on Thomas E. Dickey's xterm control sequences section on sequences following the Control-Sequence-Inducer.

For more information, see What are the issues related to UTF-8 terminal emulators? by Markus Kuhn of the University of Cambridge.

One can be assured that the connecting client is capable of representing UTF-8 and other multibyte character encodings by the Environment variable `LANG`. If this is not possible or reliable, there is an intrusive detection method demonstrated in the example program *detect-multibyte.py*.

5.7 Alt or meta sends Escape

Programs using GNU readline such as bash continue to provide default mappings such as *ALT+u* to uppercase the word after cursor. This is achieved by the configuration option altSendsEscape or metaSendsEscape

The default for most terminals, however, is that the meta key is bound by the operating system (such as *META + F* for find), and that *ALT* is used for inserting international keys (where the combination *ALT+u, a* is used to insert the character `ä`).

It is therefore a recommendation to **avoid alt or meta keys entirely** in applications, and instead prefer the ctrl-key combinations, so as to avoid instructing your users to configure their terminal emulators to communicate such sequences.

If you wish to allow them optionally (such as through readline), the ability to detect alt or meta key combinations is achieved by prefacing the combining character with escape, so that *ALT+z* becomes *Escape + z* (or, in raw form `\x1bz`). Blessings currently provides no further assistance in detecting these key combinations.

5.8 Backspace sends delete

Typically, backspace is `^H` (8, or 0x08) and delete is ^? (127, or 0x7f).

On some systems however, the key for backspace is actually labeled and transmitted as "delete", though its function in the operating system behaves just as backspace.

It is highly recommend to accept **both** `KEY_DELETE` and `KEY_BACKSPACE` as having the same meaning except when implementing full screen editors, and provide a choice to enable the delete mode by configuration.

5.9 The misnomer of ANSI

When people say 'ANSI Sequence', they are discussing:

- Standard ECMA-48: Control Functions for Coded Character Sets
- ANSI X3.64 from 1981, when the American National Standards Institute adopted the ECMA-48 as standard, which was later withdrawn in 1997 (so in this sense it is *not* an ANSI standard).
- The ANSI.SYS driver provided in MS-DOS and clones. The popularity of the IBM Personal Computer and MS-DOS of the era, and its ability to display colored text further populated the idea that such text "is ANSI".
- The various code pages used in MS-DOS Personal Computers, providing "block art" characters in the 8th bit (int 127-255), paired with ECMA-48 sequences supported by the MS-DOS ANSI.SYS driver to create artwork, known as ANSI art.
- The ANSI terminal database entry and its many descendants in the terminfo database. This is mostly due to terminals compatible with SCO UNIX, which was the successor of Microsoft's Xenix, which brought some semblance of the Microsoft DOS ANSI.SYS driver capabilities.
- Select Graphics Rendition (SGR) on vt100 clones, which include many of the common sequences in ECMA-48.
- Any sequence started by the Control-Sequence-Inducer is often mistakenly termed as an "ANSI Escape Sequence" though not appearing in ECMA-48 or interpreted by the ANSI.SYS driver. The adjoining phrase "Escape Sequence" is so termed because it follows the ASCII character for the escape key (ESC, `\x1b`).

CHAPTER 6

API Documentation

6.1 terminal.py

Module containing *Terminal*, the primary API entry point.

class Terminal(*kind=None*, *stream=None*, *force_styling=False*)

An abstraction for color, style, positioning, and input in the terminal.

This keeps the endless calls to `tigetstr()` and `tparm()` out of your code, acts intelligently when somebody pipes your output to a non-terminal, and abstracts over the complexity of unbuffered keyboard input. It uses the terminfo database to remain portable across terminal types.

Initialize the terminal.

Parameters

- **kind** (*str*) – A terminal string as taken by `curses.setupterm()`. Defaults to the value of the `TERM` environment variable.

  Note: Terminals withing a single process must share a common `kind`. See *_CUR_TERM*.

- **stream** (*file*) – A file-like object representing the Terminal output. Defaults to the original value of `sys.__stdout__`, like `curses.initscr()` does.

  If `stream` is not a tty, empty Unicode strings are returned for all capability values, so things like piping your program output to a pipe or file does not emit terminal sequences.

- **force_styling** (*bool*) – Whether to force the emission of capabilities even if `sys.__stdout__` does not seem to be connected to a terminal. If you want to force styling to not happen, use `force_styling=None`.

  This comes in handy if users are trying to pipe your output through something like `less -r` or build systems which support decoding of terminal sequences.

__getattr__(*attr*)

Return a terminal capability as Unicode string.

For example, `term.bold` is a unicode string that may be prepended to text to set the video attribute for bold, which should also be terminated with the pairing *normal*. This capability returns a callable, so you can use `term.bold("hi")` which results in the joining of `(term.bold, "hi", term.normal)`.

Compound formatters may also be used. For example:

```
>>> term.bold_blink_red_on_green("merry x-mas!")
```

For a parametrized capability such as `move` (or `cup`), pass the parameters as positional arguments:

```
>>> term.move(line, column)
```

See the manual page terminfo(5) for a complete list of capabilities and their arguments.

kind
Read-only property: Terminal kind determined on class initialization.

Return type str

does_styling
Read-only property: Whether this class instance may emit sequences.

Return type bool

is_a_tty
Read-only property: Whether *stream* is a terminal.

Return type bool

height
Read-only property: Height of the terminal (in number of lines).

Return type int

width
Read-only property: Width of the terminal (in number of columns).

Return type int

location(*x=None*, *y=None*)
Context manager for temporarily moving the cursor.

Move the cursor to a certain position on entry, let you print stuff there, then return the cursor to its original position:

```
term = Terminal()
with term.location(2, 5):
    for x in xrange(10):
        print('I can do it %i times!' % x)
print('We're back to the original location.')
```

Specify `x` to move to a certain column, `y` to move to a certain row, both, or neither. If you specify neither, only the saving and restoration of cursor position will happen. This can be useful if you simply want to restore your place after doing some manual cursor movement.

Note: The store- and restore-cursor capabilities used internally provide no stack. This means that *location()* calls cannot be nested: only one should be entered at a time.

get_location(*timeout=None*)
Return tuple (row, column) of cursor position.

Parameters **timeout** (*float*) – Return after time elapsed in seconds with value `(-1, -1)` indicating that the remote end did not respond.

Return type tuple

Returns cursor position as tuple in form of (row, column).

The location of the cursor is determined by emitting the `u7` terminal capability, or VT100 Query Cursor Position when such capability is undefined, which elicits a response from a reply string described by capability `u6`, or again VT100's definition of `\x1b[%i%d;%dR` when undefined.

The `(row, col)` return value matches the parameter order of the `move` capability, so that the following sequence should cause the cursor to not move at all:

```
>>> term = Terminal()
>>> term.move(*term.get_location())
```

Warning: You might first test that a terminal is capable of informing you of its location, while using a timeout, before later calling. When a timeout is specified, always ensure the return value is conditionally checked for `(-1, -1)`.

fullscreen()

Context manager that switches to secondary screen, restoring on exit.

Under the hood, this switches between the primary screen buffer and the secondary one. The primary one is saved on entry and restored on exit. Likewise, the secondary contents are also stable and are faithfully restored on the next entry:

```
with term.fullscreen():
    main()
```

Note: There is only one primary and one secondary screen buffer. *fullscreen()* calls cannot be nested, only one should be entered at a time.

hidden_cursor()

Context manager that hides the cursor, setting visibility on exit.

with term.hidden_cursor(): main()

Note: *hidden_cursor()* calls cannot be nested: only one should be entered at a time.

color

A callable string that sets the foreground color.

Parameters **num** (*int*) – The foreground color index. This should be within the bounds of *number_of_colors*.

Return type *ParameterizingString*

The capability is unparameterized until called and passed a number, 0-15, at which point it returns another string which represents a specific color change. This second string can further be called to color a piece of text and set everything back to normal afterward.

on_color

A callable capability that sets the background color.

Parameters **num** (*int*) – The background color index.

Return type *ParameterizingString*

normal
A capability that resets all video attributes.

Return type str

`normal` is an alias for `sgr0` or `exit_attribute_mode`. Any styling attributes previously applied, such as foreground or background colors, reverse video, or bold are reset to defaults.

stream
Read-only property: stream the terminal outputs to.

This is a convenience attribute. It is used internally for implied writes performed by context managers *hidden_cursor()*, *fullscreen()*, *location()*, and *keypad()*.

number_of_colors
Read-only property: number of colors supported by terminal.

Common values are 0, 8, 16, 88, and 256.

Most commonly, this may be used to test whether the terminal supports colors. Though the underlying capability returns -1 when there is no color support, we return 0. This lets you test more Pythonically:

```
if term.number_of_colors:
    ...
```

ljust(*text*, *width=None*, *fillchar=' '*)
Left-align `text`, which may contain terminal sequences.

Parameters

- **text** (*str*) – String to be aligned
- **width** (*int*) – Total width to fill with aligned text. If unspecified, the whole width of the terminal is filled.
- **fillchar** (*str*) – String for padding the right of `text`

Return type str

rjust(*text*, *width=None*, *fillchar=' '*)
Right-align `text`, which may contain terminal sequences.

Parameters

- **text** (*str*) – String to be aligned
- **width** (*int*) – Total width to fill with aligned text. If unspecified, the whole width of the terminal is used.
- **fillchar** (*str*) – String for padding the left of `text`

Return type str

center(*text*, *width=None*, *fillchar=' '*)
Center `text`, which may contain terminal sequences.

Parameters

- **text** (*str*) – String to be centered
- **width** (*int*) – Total width in which to center text. If unspecified, the whole width of the terminal is used.

- **fillchar** (*str*) – String for padding the left and right of `text`

Return type str

length(*text*)

Return printable length of a string containing sequences.

Parameters **text** (*str*) – String to measure. May contain terminal sequences.

Return type int

Returns The number of terminal character cells the string will occupy when printed

Wide characters that consume 2 character cells are supported:

```
>>> term = Terminal()
>>> term.length(term.clear + term.red(u''))
10
```

Note: Sequences such as 'clear', which is considered as a "movement sequence" because it would move the cursor to (y, x)(0, 0), are evaluated as a printable length of *0*.

strip(*text*, *chars=None*)

Return `text` without sequences and leading or trailing whitespace.

Return type str

```
>>> term.strip(u' \x1b[0;3m xyz ')
u'xyz'
```

rstrip(*text*, *chars=None*)

Return `text` without terminal sequences or trailing whitespace.

Return type str

```
>>> term.rstrip(u' \x1b[0;3m xyz ')
u'  xyz'
```

lstrip(*text*, *chars=None*)

Return `text` without terminal sequences or leading whitespace.

Return type str

```
>>> term.lstrip(u' \x1b[0;3m xyz ')
u'xyz '
```

strip_seqs(*text*)

Return `text` stripped of only its terminal sequences.

Return type str

```
>>> term.strip_seqs(u'\x1b[0;3mxyz')
u'xyz'
>>> term.strip_seqs(term.cuf(5) + term.red(u'test'))
u'     test'
```

Note: Non-destructive sequences that adjust horizontal distance (such as `\b` or `term.cuf(5)`) are replaced by destructive space or erasing.

split_seqs(*text*, ***kwds*)
Return `text` split by individual character elements and sequences.

Parameters **kwds** – remaining keyword arguments for `re.split()`.

Return type list[str]

```
>>> term.split_seqs(term.underline(u'xyz'))
['\x1b[4m', 'x', 'y', 'z', '\x1b(B', '\x1b[m']
```

wrap(*text*, *width=None*, ***kwargs*)
Text-wrap a string, returning a list of wrapped lines.

Parameters

- **text** (*str*) – Unlike `textwrap.wrap()`, `text` may contain terminal sequences, such as colors, bold, or underline. By default, tabs in `text` are expanded by `string.expandtabs()`.
- **width** (*int*) – Unlike `textwrap.wrap()`, `width` will default to the width of the attached terminal.

Return type list

See `textwrap.TextWrapper` for keyword arguments that can customize wrapping behaviour.

getch()
Read, decode, and return the next byte from the keyboard stream.

Return type unicode

Returns a single unicode character, or `u''` if a multi-byte sequence has not yet been fully received.

This method name and behavior mimics curses `getch(void)`, and it supports *inkey()*, reading only one byte from the keyboard string at a time. This method should always return without blocking if called after *kbhit()* has returned True.

Implementors of alternate input stream methods should override this method.

ungetch(*text*)
Buffer input data to be discovered by next call to *inkey()*.

Parameters **ucs** (*str*) – String to be buffered as keyboard input.

kbhit(*timeout=None*, ***_kwargs*)
Return whether a keypress has been detected on the keyboard.

This method is used by *inkey()* to determine if a byte may be read using *getch()* without blocking. The standard implementation simply uses the `select.select()` call on stdin.

Parameters **timeout** (*float*) – When `timeout` is 0, this call is non-blocking, otherwise blocking indefinitely until keypress is detected when None (default). When `timeout` is a positive number, returns after `timeout` seconds have elapsed (float).

Return type bool

Returns True if a keypress is awaiting to be read on the keyboard attached to this terminal. When input is not a terminal, False is always returned.

cbreak()
Allow each keystroke to be read immediately after it is pressed.

This is a context manager for `tty.setcbreak()`.

This context manager activates 'rare' mode, the opposite of 'cooked' mode: On entry, `tty.setcbreak()` mode is activated disabling line-buffering of keyboard input and turning off automatic echo of input as output.

Note: You must explicitly print any user input you would like displayed. If you provide any kind of editing, you must handle backspace and other line-editing control functions in this mode as well!

Normally, characters received from the keyboard cannot be read by Python until the *Return* key is pressed. Also known as *cooked* or *canonical input* mode, it allows the tty driver to provide line-editing before shuttling the input to your program and is the (implicit) default terminal mode set by most unix shells before executing programs.

Technically, this context manager sets the `termios` attributes of the terminal attached to `sys.__stdin__`.

Note: `tty.setcbreak()` sets `VMIN = 1` and `VTIME = 0`, see http://www.unixwiz.net/techtips/termios-vmin-vtime.html

---

raw()

A context manager for `tty.setraw()`.

Although both `break()` and *raw()* modes allow each keystroke to be read immediately after it is pressed, Raw mode disables processing of input and output.

In cbreak mode, special input characters such as `^C` or `^S` are interpreted by the terminal driver and excluded from the stdin stream. In raw mode these values are receive by the *inkey()* method.

Because output processing is not done, the newline `'\n'` is not enough, you must also print carriage return to ensure that the cursor is returned to the first column:

```
with term.raw():
    print("printing in raw mode", end="\r\n")
```

keypad()

Context manager that enables directional keypad input.

On entrying, this puts the terminal into "keyboard_transmit" mode by emitting the keypad_xmit (smkx) capability. On exit, it emits keypad_local (rmkx).

On an IBM-PC keyboard with numeric keypad of terminal-type *xterm*, with numlock off, the lower-left diagonal key transmits sequence `\\x1b[F`, translated to *Terminal* attribute `KEY_END`.

However, upon entering *keypad()*, `\\x1b[OF` is transmitted, translating to `KEY_LL` (lower-left key), allowing you to determine diagonal direction keys.

inkey(*timeout=None*, *esc_delay=0.35*, ***_kwargs*)

Read and return the next keyboard event within given timeout.

Generally, this should be used inside the *raw()* context manager.

Parameters

- **timeout** (*float*) – Number of seconds to wait for a keystroke before returning. When `None` (default), this method may block indefinitely.
- **esc_delay** (*float*) – To distinguish between the keystroke of `KEY_ESCAPE`, and sequences beginning with escape, the parameter `esc_delay` specifies the amount of

time after receiving escape (`chr(27)`) to seek for the completion of an application key before returning a *Keystroke* instance for `KEY_ESCAPE`.

Return type *Keystroke*.

Returns *Keystroke*, which may be empty (`u''`) if `timeout` is specified and keystroke is not received.

Raises **RuntimeError** – When *stream* is not a terminal, having no keyboard attached, a `timeout` value of `None` would block indefinitely, prevented by by raising an exception.

Note: When used without the context manager *cbreak()*, or *raw()*, `sys.__stdin__` remains line-buffered, and this function will block until the return key is pressed!

---

class WINSZ

Structure represents return value of `termios.TIOCGWINSZ`.

ws_row
rows, in characters

ws_col
columns, in characters

ws_xpixel
horizontal size, pixels

ws_ypixel
vertical size, pixels

Create new instance of WINSZ(ws_row, ws_col, ws_xpixel, ws_ypixel)

_CUR_TERM = None

6.2 formatters.py

Sub-module providing sequence-formatting functions.

_make_colors()
Return set of valid colors and their derivatives.

Return type set

_make_compoundables(*colors*)
Return given set `colors` along with all "compoundable" attributes.

Parameters **colors** (*set*) – set of color names as string.

Return type set

COLORS = {'black', 'blue', 'bright_black', 'bright_blue', 'bright_cyan', 'bright_green', 'b
Valid colors and their background (on), bright, and bright-background derivatives.

COMPOUNDABLES = {'black', 'blink', 'blue', 'bold', 'bright_black', 'bright_blue', 'bright_c
Attributes and colors which may be compounded by underscore.

class ParameterizingString
A Unicode string which can be called as a parameterizing termcap.

For example:

```
>>> term = Terminal()
>>> color = ParameterizingString(term.color, term.normal, 'color')
>>> color(9)('color #9')
u'\x1b[91mcolor #9\x1b(B\x1b[m'
```

Class constructor accepting 3 positional arguments.

Parameters

- **cap** – parameterized string suitable for curses.tparm()
- **normal** – terminating sequence for this capability (optional).
- **name** – name of this terminal capability (optional).

__call__(**args*)

Returning *FormattingString* instance for given parameters.

Return evaluated terminal capability (self), receiving arguments `*args`, followed by the terminating sequence (self.normal) into a *FormattingString* capable of being called.

Return type *FormattingString* or *NullCallableString*

class ParameterizingProxyString

A Unicode string which can be called to proxy missing termcap entries.

This class supports the function *get_proxy_string()*, and mirrors the behavior of *ParameterizingString*, except that instead of a capability name, receives a format string, and callable to filter the given positional `*args` of *ParameterizingProxyString.__call__()* into a terminal sequence.

For example:

```
>>> from blessed import Terminal
>>> term = Terminal('screen')
>>> hpa = ParameterizingString(term.hpa, term.normal, 'hpa')
>>> hpa(9)
u''
>>> fmt = u'\x1b[{0}G'
>>> fmt_arg = lambda *arg: (arg[0] + 1,)
>>> hpa = ParameterizingProxyString((fmt, fmt_arg), term.normal, 'hpa')
>>> hpa(9)
u'\x1b[10G'
```

Class constructor accepting 4 positional arguments.

Parameters

- **fmt** – format string suitable for displaying terminal sequences.
- **callable** – receives __call__ arguments for formatting fmt.
- **normal** – terminating sequence for this capability (optional).
- **name** – name of this terminal capability (optional).

__call__(**args*)

Returning *FormattingString* instance for given parameters.

Arguments are determined by the capability. For example, `hpa` (move_x) receives only a single integer, whereas `cup` (move) receives two integers. See documentation in terminfo(5) for the given capability.

Return type *FormattingString*

get_proxy_string(*term*, *attr*)
Proxy and return callable string for proxied attributes.

Parameters

- **term** (*Terminal*) – *Terminal* instance.
- **attr** (*str*) – terminal capability name that may be proxied.

Return type None or *ParameterizingProxyString*.

Returns *ParameterizingProxyString* for some attributes of some terminal types that support it, where the terminfo(5) database would otherwise come up empty, such as `move_x` attribute for `term.kind` of `screen`. Otherwise, None.

class FormattingString
A Unicode string which doubles as a callable.

This is used for terminal attributes, so that it may be used both directly, or as a callable. When used directly, it simply emits the given terminal sequence. When used as a callable, it wraps the given (string) argument with the 2nd argument used by the class constructor:

```
>>> style = FormattingString(term.bright_blue, term.normal)
>>> print(repr(style))
u'\x1b[94m'
>>> style('Big Blue')
u'\x1b[94mBig Blue\x1b(B\x1b[m'
```

Class constructor accepting 2 positional arguments.

Parameters

- **sequence** – terminal attribute sequence.
- **normal** – terminating sequence for this attribute (optional).

__call__(**args*)
Return `text` joined by `sequence` and `normal`.

class NullCallableString
A dummy callable Unicode alternative to *FormattingString*.

This is used for colors on terminals that do not support colors, it is just a basic form of unicode that may also act as a callable.

Class constructor.

__call__(**args*)
Allow empty string to be callable, returning given string, if any.

When called with an int as the first arg, return an empty Unicode. An int is a good hint that I am a *ParameterizingString*, as there are only about half a dozen string-returning capabilities listed in terminfo(5) which accept non-int arguments, they are seldom used.

When called with a non-int as the first arg (no no args at all), return the first arg, acting in place of *FormattingString* without any attributes.

split_compound(*compound*)
Split compound formating string into segments.

```
>>> split_compound('bold_underline_bright_blue_on_red')
['bold', 'underline', 'bright_blue', 'on_red']
```

Parameters **compound** (*str*) – a string that may contain compounds, separated by underline (_).

Return type list

resolve_capability(*term*, *attr*)
Resolve a raw terminal capability using `tigetstr()`.

Parameters

- **term** (`Terminal`) – *Terminal* instance.
- **attr** (*str*) – terminal capability name.

Returns string of the given terminal capability named by `attr`, which may be empty (u'') if not found or not supported by the given *kind*.

Return type str

resolve_color(*term*, *color*)
Resolve a simple color name to a callable capability.

This function supports *resolve_attribute()*.

Parameters

- **term** (`Terminal`) – *Terminal* instance.
- **color** (*str*) – any string found in set *COLORS*.

Returns a string class instance which emits the terminal sequence for the given color, and may be used as a callable to wrap the given string with such sequence.

Returns *NullCallableString* when *number_of_colors* is 0, otherwise *FormattingString*.

Return type *NullCallableString* or *FormattingString*

resolve_attribute(*term*, *attr*)
Resolve a terminal attribute name into a capability class.

Parameters

- **term** (`Terminal`) – *Terminal* instance.
- **attr** (*str*) – Sugary, ordinary, or compound formatted terminal capability, such as "red_on_white", "normal", "red", or "bold_on_black", respectively.

Returns a string class instance which emits the terminal sequence for the given terminal capability, or may be used as a callable to wrap the given string with such sequence.

Returns *NullCallableString* when *number_of_colors* is 0, otherwise *FormattingString*.

Return type *NullCallableString* or *FormattingString*

COLORS = {'black', 'blue', 'bright_black', 'bright_blue', 'bright_cyan', 'bright_green', 'b
Valid colors and their background (on), bright, and bright-background derivatives.

COMPOUNDABLES = {'black', 'blink', 'blue', 'bold', 'bright_black', 'bright_blue', 'bright_c
Attributes and colors which may be compounded by underscore.

6.3 keyboard.py

Sub-module providing 'keyboard awareness'.

class Keystroke
A unicode-derived class for describing a single keystroke.

A class instance describes a single keystroke received on input, which may contain multiple characters as a multibyte sequence, which is indicated by properties *is_sequence* returning `True`.

When the string is a known sequence, *code* matches terminal class attributes for comparison, such as `term.KEY_LEFT`.

The string-name of the sequence, such as `u'KEY_LEFT'` is accessed by property *name*, and is used by the `__repr__()` method to display a human-readable form of the Keystroke this class instance represents. It may otherwise by joined, split, or evaluated just as as any other unicode string.

Class constructor.

static __new__(*cls*, *ucs=''*, *code=None*, *name=None*)
Class constructor.

is_sequence
Whether the value represents a multibyte sequence (bool).

name
String-name of key sequence, such as `u'KEY_LEFT'` (str).

code
Integer keycode value of multibyte sequence (int).

get_keyboard_codes()
Return mapping of keycode integer values paired by their curses key-name.

Return type dict

Returns dictionary of (code, name) pairs for curses keyboard constant values and their mnemonic name. Such as key `260`, with the value of its identity, `u'KEY_LEFT'`. These are derived from the attributes by the same of the curses module, with the following exceptions:

- `KEY_DELETE` in place of `KEY_DC`
- `KEY_INSERT` in place of `KEY_IC`
- `KEY_PGUP` in place of `KEY_PPAGE`
- `KEY_PGDOWN` in place of `KEY_NPAGE`
- `KEY_ESCAPE` in place of `KEY_EXIT`
- `KEY_SUP` in place of `KEY_SR`
- `KEY_SDOWN` in place of `KEY_SF`

This function is the inverse of `get_curses_keycodes()`. With the given override "mixins" listed above, the keycode for the delete key will map to our imaginary `KEY_DELETE` mnemonic, effectively erasing the phrase `KEY_DC` from our code vocabulary for anyone that wishes to use the return value to determine the key-name by keycode.

get_keyboard_sequences(*term*)
Return mapping of keyboard sequences paired by keycodes.

Parameters **term** (*blessed.Terminal*) – *Terminal* instance.

Returns mapping of keyboard unicode sequences paired by keycodes as integer. This is used as the argument `mapper` to the supporting function `resolve_sequence()`.

Return type OrderedDict

Initialize and return a keyboard map and sequence lookup table, (sequence, keycode) from *Terminal* instance `term`, where `sequence` is a multibyte input sequence of unicode characters, such as `u'\x1b[D'`, and `keycode` is an integer value, matching curses constant such as term.KEY_LEFT.

The return value is an OrderedDict instance, with their keys sorted longest-first.

_alternative_left_right(*term*)

Determine and return mapping of left and right arrow keys sequences.

Parameters **term** (*blessed.Terminal*) – *Terminal* instance.

Return type dict

This function supports `get_terminal_sequences()` to discover the preferred input sequence for the left and right application keys.

Return dict of sequences `term._cuf1`, and `term._cub1`, valued as `KEY_RIGHT`, `KEY_LEFT` (when appropriate). It is necessary to check the value of these sequences to ensure we do not use `u' '` and `u'\b'` for `KEY_RIGHT` and `KEY_LEFT`, preferring their true application key sequence, instead.

_inject_curses_keynames()

Inject KEY_NAMES that we think would be useful into the curses module.

This function compliments the global constant *DEFAULT_SEQUENCE_MIXIN*. It is important to note that this function has the side-effect of **injecting** new attributes to the curses module, and is called from the global namespace at time of import.

Though we may determine *keynames* and codes for keyboard input that generate multibyte sequences, it is also especially useful to aliases a few basic ASCII characters such as `KEY_TAB` instead of `u'\t'` for uniformity.

Furthermore, many key-names for application keys enabled only by context manager *keypad()* are surprisingly absent. We inject them here directly into the curses module.

It is not necessary to directly "monkeypatch" the curses module to contain these constants, as they will also be accessible as attributes of the Terminal class instance, they are provided only for convenience when mixed in with other curses code.

DEFAULT_SEQUENCE_MIXIN = (('\n', 343), ('\r', 343), ('\x08', 263), ('\t', 512), ('\x1b', 3

In a perfect world, terminal emulators would always send exactly what the terminfo(5) capability database plans for them, accordingly by the value of the `TERM` name they declare.

But this isn't a perfect world. Many vt220-derived terminals, such as those declaring 'xterm', will continue to send vt220 codes instead of their native-declared codes, for backwards-compatibility.

This goes for many: rxvt, putty, iTerm.

These "mixins" are used for *all* terminals, regardless of their type.

Furthermore, curses does not provide sequences sent by the keypad, at least, it does not provide a way to distinguish between keypad 0 and numeric 0.

CURSES_KEYCODE_OVERRIDE_MIXIN = (('KEY_DELETE', 330), ('KEY_INSERT', 331), ('KEY_PGUP', 33

Override mixins for a few curses constants with easier mnemonics: there may only be a 1:1 mapping when only a keycode (int) is given, where these phrases are preferred.

6.4 sequences.py

Module providing 'sequence awareness'.

class SequenceTextWrapper(*width*, *term*, ***kwargs*)

Object for wrapping/filling text. The public interface consists of the wrap() and fill() methods; the other methods

are just there for subclasses to override in order to tweak the default behaviour. If you want to completely replace the main wrapping algorithm, you'll probably have to override _wrap_chunks().

Several instance attributes control various aspects of wrapping:

width (default: 70) the maximum width of wrapped lines (unless break_long_words is false)

initial_indent (default: "") string that will be prepended to the first line of wrapped output. Counts towards the line's width.

subsequent_indent (default: "") string that will be prepended to all lines save the first of wrapped output; also counts towards each line's width.

expand_tabs (default: true) Expand tabs in input text to spaces before further processing. Each tab will become 0 .. 'tabsize' spaces, depending on its position in its line. If false, each tab is treated as a single character.

tabsize (default: 8) Expand tabs in input text to 0 .. 'tabsize' spaces, unless 'expand_tabs' is false.

replace_whitespace (default: true) Replace all whitespace characters in the input text by spaces after tab expansion. Note that if expand_tabs is false and replace_whitespace is true, every tab will be converted to a single space!

fix_sentence_endings (default: false) Ensure that sentence-ending punctuation is always followed by two spaces. Off by default because the algorithm is (unavoidably) imperfect.

break_long_words (default: true) Break words longer than 'width'. If false, those words will not be broken, and some lines might be longer than 'width'.

break_on_hyphens (default: true) Allow breaking hyphenated words. If true, wrapping will occur preferably on whitespaces and right after hyphens part of compound words.

drop_whitespace (default: true) Drop leading and trailing whitespace from lines.

max_lines (default: None) Truncate wrapped lines.

placeholder (default: ' [...]') Append to the last line of truncated text.

Class initializer.

This class supports the *wrap()* method.

_wrap_chunks(*chunks*)
Sequence-aware variant of `textwrap.TextWrapper._wrap_chunks()`.

This simply ensures that word boundaries are not broken mid-sequence, as standard python textwrap would incorrectly determine the length of a string containing sequences, and may also break consider sequences part of a "word" that may be broken by hyphen (-), where this implementation corrects both.

_handle_long_word(*reversed_chunks*, *cur_line*, *cur_len*, *width*)
Sequence-aware `textwrap.TextWrapper._handle_long_word()`.

This simply ensures that word boundaries are not broken mid-sequence, as standard python textwrap would incorrectly determine the length of a string containing sequences, and may also break consider sequences part of a "word" that may be broken by hyphen (-), where this implementation corrects both.

class Sequence
A "sequence-aware" version of the base `str` class.

This unicode-derived class understands the effect of escape sequences of printable length, allowing a properly implemented *rjust()*, *ljust()*, *center()*, and *length()*.

Class constructor.

Parameters

- **sequence_text** – A string that may contain sequences.
- **term** (*blessed.Terminal*) – *Terminal* instance.

ljust(*width*, *fillchar=' '*)
Return string containing sequences, left-adjusted.

Parameters

- **width** (*int*) – Total width given to right-adjust `text`. If unspecified, the width of the attached terminal is used (default).
- **fillchar** (*str*) – String for padding right-of `text`.

Returns String of `text`, right-aligned by `width`.

Return type str

rjust(*width*, *fillchar=' '*)
Return string containing sequences, right-adjusted.

Parameters

- **width** (*int*) – Total width given to right-adjust `text`. If unspecified, the width of the attached terminal is used (default).
- **fillchar** (*str*) – String for padding left-of `text`.

Returns String of `text`, right-aligned by `width`.

Return type str

center(*width*, *fillchar=' '*)
Return string containing sequences, centered.

Parameters

- **width** (*int*) – Total width given to center `text`. If unspecified, the width of the attached terminal is used (default).
- **fillchar** (*str*) – String for padding left and right-of `text`.

Returns String of `text`, centered by `width`.

Return type str

length()
Return the printable length of string containing sequences.

Strings containing `term.left` or `\b` will cause "overstrike", but a length less than 0 is not ever returned. So _\b+ is a length of 1 (displays as +), but `\b` alone is simply a length of 0.

Some characters may consume more than one cell, mainly those CJK Unified Ideographs (Chinese, Japanese, Korean) defined by Unicode as half or full-width characters.

For example:

```
>>> from blessed import Terminal
>>> from blessed.sequences import Sequence
>>> term = Terminal()
>>> msg = term.clear + term.red(u''), term
>>> Sequence(msg).length()
10
```

> **Note:** Although accounted for, strings containing sequences such as `term.clear` will not give accurate returns, it is not considered lengthy (a length of 0).

strip(*chars=None*)
Return string of sequences, leading, and trailing whitespace removed.

Parameters **chars** (*str*) – Remove characters in chars instead of whitespace.

Return type str

lstrip(*chars=None*)
Return string of all sequences and leading whitespace removed.

Parameters **chars** (*str*) – Remove characters in chars instead of whitespace.

Return type str

rstrip(*chars=None*)
Return string of all sequences and trailing whitespace removed.

Parameters **chars** (*str*) – Remove characters in chars instead of whitespace.

Return type str

strip_seqs()
Return `text` stripped of only its terminal sequences.

Return type str

padd()
Return non-destructive horizontal movement as destructive spacing.

Return type str

iter_parse(*term*, *text*)
Generator yields (text, capability) for characters of `text`.

value for `capability` may be `None`, where `text` is `str` of length 1. Otherwise, `text` is a full matching sequence of given capability.

measure_length(*text*, *term*)
Deprecated since version 1.12.0..

Return type int

CHAPTER 7

Contributing

We welcome contributions via GitHub pull requests:

- Fork a Repo
- Creating a pull request

7.1 Developing

Prepare a developer environment. Then, from the blessed code folder:

```
pip install --editable .
```

Any changes made in this project folder are then made available to the python interpreter as the 'blessed' package from any working directory.

7.1.1 Running Tests

Install and run tox

```
pip install --upgrade tox
tox
```

Py.test is used as the test runner, supporting positional arguments, you may for example use looponfailing with python 3.5, stopping at the first failing test case, and looping (retrying) after a filesystem save is detected:

```
tox -epy35 -- -fx
```

7.1.2 Test Coverage

When you contribute a new feature, make sure it is covered by tests. Likewise, a bug fix should include a test demonstrating the bug. Blessed has nearly 100% line coverage, with roughly 1/2 of the codebase in the form of tests,

which are further combined by a matrix of varying `TERM` types, providing plenty of existing test cases to augment or duplicate in your favor.

7.1.3 Style and Static Analysis

The test runner (`tox`) ensures all code and documentation complies with standard python style guides, pep8 and pep257, as well as various static analysis tools through the **sa** target, invoked using:

```
tox -esa
```

All standards enforced by the underlying style checker tools are adhered to, with the declarative exception of those found in landscape.yml, or inline using `pylint: disable=` directives.

CHAPTER 8

Version History

1.16

- Windows support?! #110 by avylove.

1.15

- disable timing integration tests for keyboard routines.

  They work perfectly fine for regression testing for contributing developers, but people run our tests on build farms and open issues when they fail. So we comment out these useful tests. #100.

- Support python 3.7. #102.
- Various fixes to test automation #108

1.14

- bugfix: *wrap()* misbehaved for text containing newlines, #74.
- bugfix: TypeError when using `PYTHONOPTIMIZE=2` environment variable, #84.
- bugfix: define `blessed.__version__` value, #92.
- bugfix: detect sequences `\x1b[0K` and `\x1b2K`, #95.

1.13

- enhancement: *split_seqs()* introduced, and 4x cost reduction in related sequence-aware functions, #29.
- deprecated: `blessed.sequences.measure_length` function superseded by *iter_parse()* if necessary.
- deprecated: warnings about "binary-packed capabilities" are no longer emitted on strange terminal types, making best effort.

1.12

- enhancement: *get_location()* returns the `(row, col)` position of the cursor at the time of call for attached terminal.

- enhancement: a keyboard now detected as *stdin* when `stream` is `sys.stderr`.

1.11

- enhancement: *`inkey()`* can return more quickly for combinations such as `Alt + Z` when `MetaSendsEscape` is enabled, #30.
- enhancement: *`FormattingString`* may now be nested, such as `t.red('red', t.underline('rum'))`, #61

1.10

- workaround: provide `sc` and `rc` for Terminals of `kind='ansi'`, repairing *`location()`* #44.
- bugfix: length of simple SGR reset sequence `\x1b[m` was not correctly determined on all terminal types, #45.
- deprecated: `_intr_continue` arguments introduced in 1.8 are now marked deprecated in 1.10: beginning with python 3.5, the default behavior is as though this argument is always True, PEP-475, blessed does the same.

1.9

- enhancement: *`break_long_words`* now supported by `Terminal.wrap()`
- Ignore `curses.error` message `'tparm() returned NULL'`: this occurs on win32 or other platforms using a limited curses implementation, such as PDCurses, where `curses.tparm()` is not implemented, or no terminal capability database is available.
- Context manager *`keypad()`* emits sequences that enable "application keys" such as the diagonal keys on the numpad. This is equivalent to `curses.window.keypad()`.
- bugfix: translate keypad application keys correctly.
- enhancement: no longer depend on the '2to3' tool for python 3 support.
- enhancement: allow `civis` and `cnorm` (*hide_cursor*, *normal_hide*) to work with terminal-type *ansi* by emulating support by proxy.
- enhancement: new public attribute: *`kind`*: the very same as given `Terminal.__init__.kind` keyword argument. Or, when not given, determined by and equivalent to the `TERM` Environment variable.

1.8

- enhancement: export keyboard-read function as public method `getch()`, so that it may be overridden by custom terminal implementers.
- enhancement: allow *`inkey()`* and *`kbhit()`* to return early when interrupted by signal by passing argument `_intr_continue=False`.
- enhancement: allow `hpa` and `vpa` (*move_x*, *move_y*) to work on tmux(1) or screen(1) by emulating support by proxy.
- enhancement: add *`rstrip()`* and *`lstrip()`*, strips both sequences and trailing or leading whitespace, respectively.
- enhancement: include wcwidth library support for *`length()`*: the printable width of many kinds of CJK (Chinese, Japanese, Korean) ideographs and various combining characters may now be determined.
- enhancement: better support for detecting the length or sequences of externally-generated *ecma-48* codes when using `xterm` or `aixterm`.
- bugfix: when `locale.getpreferredencoding()` returns empty string or an encoding that is not valid for `codecs.getincrementaldecoder`, fallback to ASCII and emit a warning.
- bugfix: ensure *`FormattingString`* and *`ParameterizingString`* may be pickled.

- bugfix: allow *~.inkey* and related to be called without a keyboard.
- **change**: `term.keyboard_fd` is set `None` if `stream` or `sys.stdout` is not a tty, making `term.inkey()`, `term.cbreak()`, `term.raw()`, no-op.
- bugfix: `\x1bOH` (KEY_HOME) was incorrectly mapped as KEY_LEFT.

1.7

- Forked github project erikrose/blessings to jquast/blessed, this project was previously known as **blessings** version 1.6 and prior.
- introduced: context manager *cbreak()*, which is equivalent to entering terminal state by `tty.setcbreak()` and returning on exit, as well as the lesser recommended *raw()*, pairing from `tty.setraw()`.
- introduced: *inkey()*, which will return one or more characters received by the keyboard as a unicode sequence, with additional attributes *code* and *name*. This allows application keys (such as the up arrow, or home key) to be detected. Optional value *timeout* allows for timed poll.
- introduced: *center()*, *rjust()*, *ljust()*, allowing text containing sequences to be aligned to detected horizontal screen width, or by *width* specified.
- introduced: *wrap()* method. Allows text containing sequences to be word-wrapped without breaking mid-sequence, honoring their printable width.
- introduced: *strip()*, strips all sequences *and* whitespace.
- introduced: *strip_seqs()* strip only sequences.
- introduced: *rstrip()* and *lstrip()* strips both sequences and trailing or leading whitespace, respectively.
- bugfix: cannot call `curses.setupterm()` more than once per process (from `Terminal.__init__()`): Previously, blessed pretended to support several instances of different Terminal *kind*, but was actually using the *kind* specified by the first instantiation of *Terminal*. A warning is now issued. Although this is misbehavior is still allowed, a `warnings.WarningMessage` is now emitted to notify about subsequent terminal misbehavior.
- bugfix: resolved issue where *number_of_colors* fails when *does_styling* is `False`. Resolves issue where piping tests output would fail.
- bugfix: warn and set *does_styling* to `False` when the given *kind* is not found in the terminal capability database.
- bugfix: allow unsupported terminal capabilities to be callable just as supported capabilities, so that the return value of *color*(n) may be called on terminals without color capabilities.
- bugfix: for terminals without underline, such as vt220, `term.underline('text')` would emit `'text' + term.normal`. Now it emits only `'text'`.
- enhancement: some attributes are now properties, raise exceptions when assigned.
- enhancement: pypy is now a supported python platform implementation.
- enhancement: removed pokemon `curses.error` exceptions.
- enhancement: do not ignore `curses.error` exceptions, unhandled curses errors are legitimate errors and should be reported as a bug.
- enhancement: converted nose tests to pytest, merged travis and tox.
- enhancement: pytest fixtures, paired with a new `@as_subprocess` decorator are used to test a multitude of terminal types.

- enhancement: test accessories `@as_subprocess` resolves various issues with different terminal types that previously went untested.
- deprecation: python2.5 is no longer supported (as tox does not supported).

1.6

- Add *does_styling*. This takes `force_styling` into account and should replace most uses of *is_a_tty*.
- Make *is_a_tty* a read-only property like *does_styling*. Writing to it never would have done anything constructive.
- Add `fullscreen`()` and `hidden_cursor()` to the auto-generated docs.

1.5.1

- Clean up fabfile, removing the redundant `test` command.
- Add Travis support.
- Make `python setup.py test` work without spurious errors on 2.6.
- Work around a tox parsing bug in its config file.
- Make context managers clean up after themselves even if there's an exception (Vitja Makarov PR #29).
- Parameterizing a capability no longer crashes when there is no tty (Vitja Makarov PR #31)

1.5

- Add syntactic sugar and documentation for `enter_fullscreen` and `exit_fullscreen`.
- Add context managers *fullscreen()* and *hidden_cursor()*.
- Now you can force a *Terminal* to never to emit styles by passing keyword argument `force_styling=None`.

1.4

- Add syntactic sugar for cursor visibility control and single-space-movement capabilities.
- Endorse the *location()* context manager for restoring cursor position after a series of manual movements.
- Fix a bug in which *location()* that wouldn't do anything when passed zeros.
- Allow tests to be run with `python setup.py test`.

1.3

- Added *number_of_colors*, which tells you how many colors the terminal supports.
- Made *color*(n) and *on_color*(n) callable to wrap a string, like the named colors can. Also, make them both fall back to the `setf` and `setb` capabilities (like the named colors do) if the termcap entries for `setaf` and `setab` are not available.
- Allowed *color* to act as an unparametrized string, not just a callable.
- Made *height* and *width* examine any passed-in stream before falling back to stdout (This rarely if ever affects actual behavior; it's mostly philosophical).
- Made caching simpler and slightly more efficient.
- Got rid of a reference cycle between *Terminal* and *FormattingString*.
- Updated docs to reflect that terminal addressing (as in `location()`) is 0-based.

1.2

- Added support for Python 3! We need 3.2.3 or greater, because the curses library couldn't decide whether to accept strs or bytes before that (http://bugs.python.org/issue10570).
- Everything that comes out of the library is now unicode. This lets us support Python 3 without making a mess of the code, and Python 2 should continue to work unless you were testing types (and badly). Please file a bug if this causes trouble for you.
- Changed to the MIT License for better world domination.
- Added Sphinx docs.

1.1

- Added nicely named attributes for colors.
- Introduced compound formatting.
- Added wrapper behavior for styling and colors.
- Let you force capabilities to be non-empty, even if the output stream is not a terminal.
- Added `is_a_tty` to determine whether the output stream is a terminal.
- Sugared the remaining interesting string capabilities.
- Allow `location()` to operate on just an x *or* y coordinate.

1.0

- Extracted Blessed from nose-progressive.

CHAPTER 9

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