Writing Babeltrace 2 plugins

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Contents

Questions?
Note slide number and ask at the end.

Babeltrace 2, reminder and status

Babeltrace 2, a reminder

- Process, analyze, convert traces of various formats.
- Shortcomings of Babeltrace 1:
  - Intermediary representation (IR) coupled to CTF
  - No external plugin system
- Cross-platform: Linux, macOS, Windows
- https://github.com/efficios/babeltrace

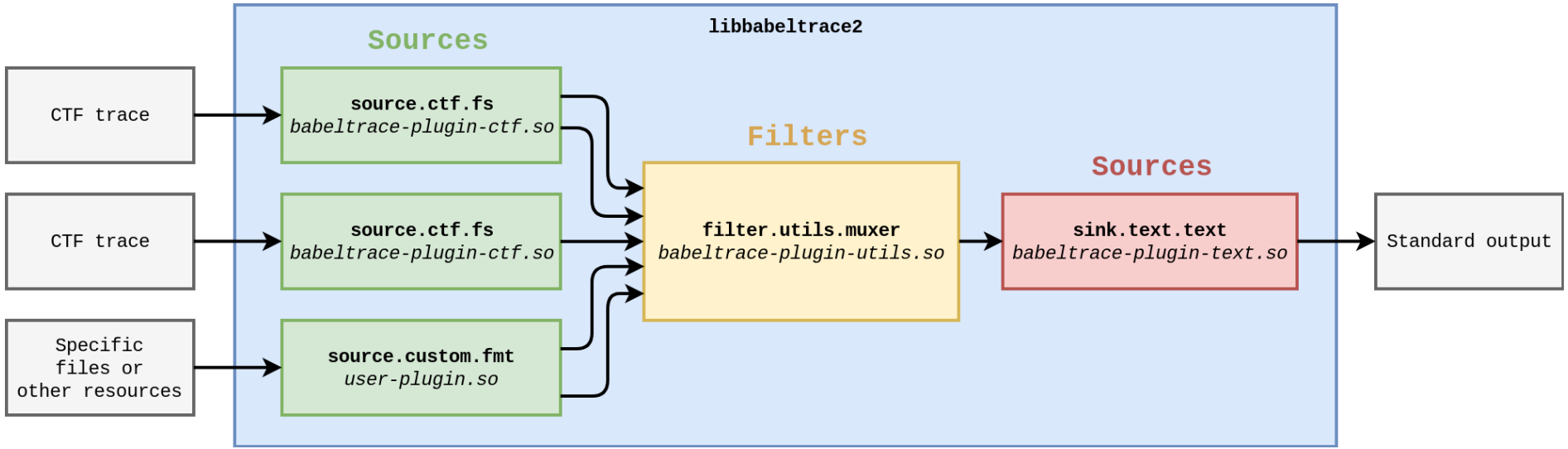
Babeltrace 2, a status update

- All expected API changes for 2.0 are **done**.
- **Documentation** is being written.
- **RC1** is expected in A Few Weeks™

Important concepts

It all starts with a graph

A **graph** is made of several **components** connected together



Communication between components

- **Messages** flow from upstream components to downstream components.
- Some message types:
  - Stream beginning message
  - Event message
  - Stream end message

Lifecycle of a graph (simplified)

- User adds components and connects them
- Sinks create iterators on their input ports
- The graph asks sinks to consume from their iterators
- When all iterators of all sinks have reached the end, the graph execution has completed successfully.

The library vs the command-line tool

- **libbabeltrace2** is a library to build and execute a graph
  - C and Python bindings
- **babeltrace2** is a CLI tool build around libbabeltrace2 to build and run a graph from the command line

Your component classes…

- … can be written in C or Python
- … can be written directly in your application that uses libbabeltrace2 (either in C or Python)
- … can be distributed as plugins, loaded by another application using libbabeltrace2 (including the babeltrace2 CLI)
  - C plugins are distributed as .so/.dll shared libraries
  - Python plugins are distributed as .py source files

Let's write some components

Boilerplate for a Python plugin

- Named **bt_plugin_*.py**
- Registration: **bt2.register_plugin(__name__, 'foo')**

My first sink

- In `__init__`, create input port.
- In `_user_graph_is_configured`, create iterator on the input port (on the upstream component).
- In `_user_consume`, consume messages from the iterator and do something useful with them.

Let's go try it ⌨.

My first source

- In `__init__`, create trace class, stream class, event class and output port.
- Define source's iterator class.
- In the iterator's `__next__`, return some messages.

Let's go try one ⌨.

Next steps

Next steps

- Use **parameters** for component configuration.
- Support `babeltrace.support-info` query to allow for automatic source discovery.
  - This makes `babeltrace2 <mytrace>` just work.
- Use error error system to provide user-friendly error messages.

Plugin examples

- Multiple in-tree component classes
- Some examples here [1]:
  - CAN Bus messages source
  - Plot-drawing sink

[1] https://github.com/simark/babeltrace-fun-plugins

Questions

Thanks for your attention. Any questions?

Bonus slides!

Queries

Queries are a way to poke a component class to get some information, before a component of that class is instantiated.

- Can be queried from the CLI or programmatically.
- Arbitrary query object (a string) and parameters.
- In Python, implement static/class method `_user_query`.

Automatic source discovery

- User-friendly alternative to having to specify components explicitly (with `-c source.foo.bar --params ...`).
- When a non-option string is passed to the CLI (e.g. `babeltrace2 mytrace`), it queries all known source component classes (CC) with the `babeltrace.support-info` object. CC respond with a weight in the [0, 1] range.
- Recurses into directories.
- Works with paths (files and directories) and other strings (e.g. `babeltrace2 net://somehost:1234`).

Error handling

When an error occurs, your plugin can append **error causes**, such that when a critical failure happens, the user can see precisely where things went wrong.

- In Python, simply raise an exception, the native side translates it to an error cause.
- In C, you have to do it manually, with e.g. `BT_CURRENT_THREAD_ERROR_APPEND_CAUSE_FROM_COMPONENT`

Error handling

Here's an example of an error stack printed by the CLI.

```
ERROR:    [Babeltrace CLI] (/home/smarchi/src/babeltrace/src/cli/babeltrace2.c:2364)
  Cannot create components.
CAUSED BY [Babeltrace CLI] (/home/smarchi/src/babeltrace/src/cli/babeltrace2.c:2187)
  Cannot create component: plugin-name="demo", comp-cls-name="MyFirstSource", comp-cls-type=0, comp-name="sou
CAUSED BY [Babeltrace library] (/home/smarchi/src/babeltrace/src/lib/graph/graph.c:1343)
  Component initialization method failed: status=ERROR, comp-addr=0x55febcac8890, comp-name="source.demo.MyFi
  comp-class-type=SOURCE, comp-class-name="MyFirstSource", comp-class-partial-descr="", comp-class-is-frozen=
CAUSED BY [source.demo.MyFirstSource: 'source.demo.MyFirstSource'] (/home/smarchi/src/babeltrace/src/bindings
  Traceback (most recent call last):
    File "/tmp/babeltrace/lib/python3.6/site-packages/bt2/component.py", line 522, in _bt_init_from_native
      self.__init__(params, obj)
    File "./bt_plugin_foo.py", line 34, in __init__
      this_is_an_error()
  NameError: name 'this_is_an_error' is not defined
```

Details sink

The `sink.text.details` component class (provided with BT2) prints details about all messages it receives (even what is not directly user-visible), in a deterministic way. Useful for:

- Debugging while developping a source of filter.
- Automated tests, compare the `sink.text.details` output to an expected output.
- Verifying that the Python component you are re-writting in C provides the same results.

Details sink

An example:

```
Trace class:
  Stream class (ID 0):
    Supports packets: No
    Supports discarded events: No
    Supports discarded packets: No
    Default clock class:
      Frequency (Hz): 1,000,000,000
      Precision (cycles): 0
      Offset (s): 0
      Offset (cycles): 0
      Origin is Unix epoch: Yes
    Event class `my-event` (ID 0):

[Unknown]
{Trace 0, Stream class ID 0, Stream ID 0}
Stream beginning:
  Trace:
    Stream (ID 0, Class ID 0)

[123 cycles, 123 ns from origin]
{Trace 0, Stream class ID 0, Stream ID 0}
Event `my-event` (Class ID 0):

[Unknown]
{Trace 0, Stream class ID 0, Stream ID 0}
Stream end
```