Stream Device Driver

A flexible driver for a wide range of devices with byte stream oriented interfaces

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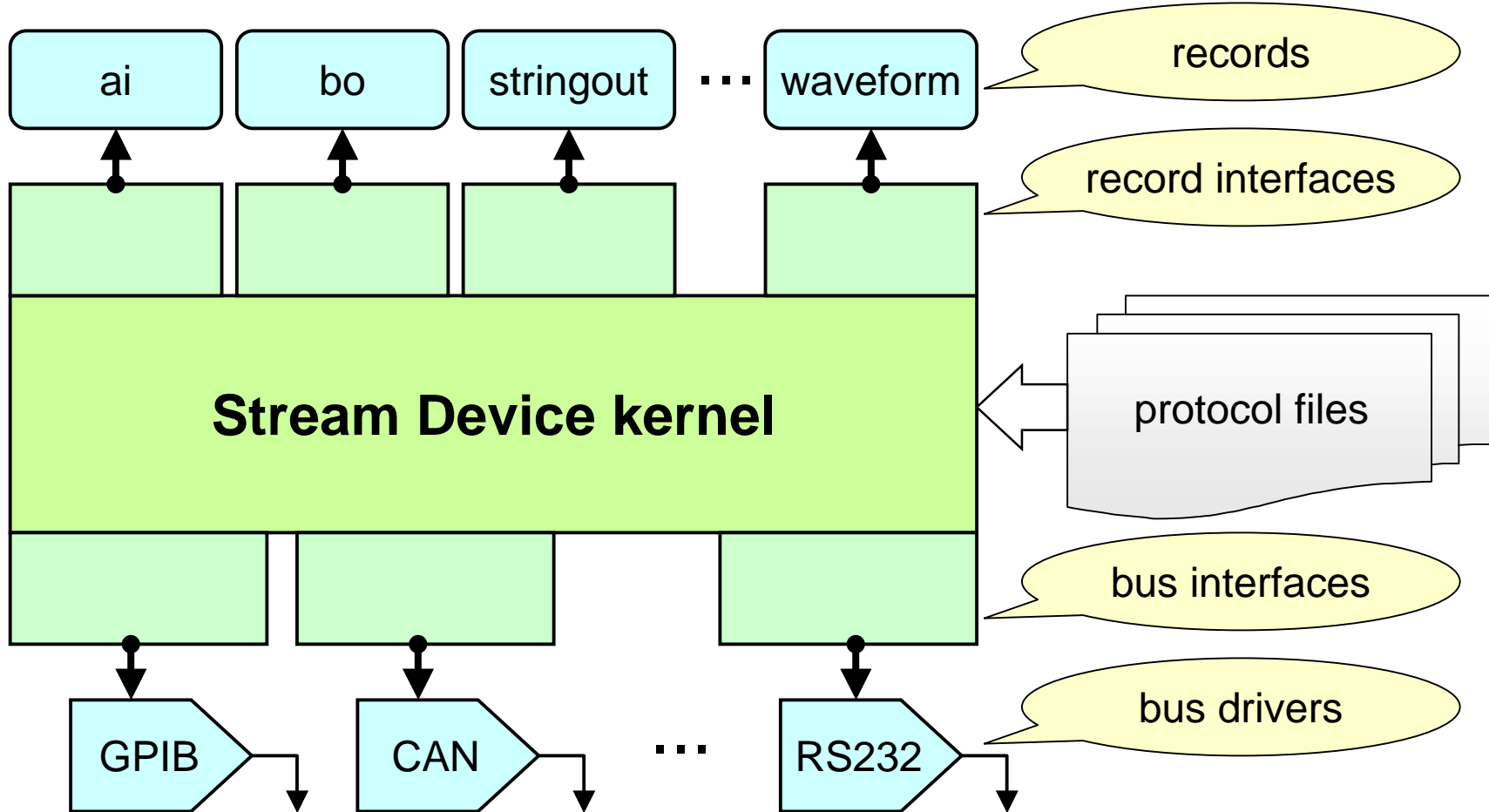
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Motivation

- ## Missing support for string i/o on CAN
  - – RS232 devices connected via CAN-nodes

- ## Problematic EPICS GPIB driver
  - – several GPIB devices, some non-standard
  - – writing new support for every device is inefficient
  - – configured commands better than hardcoded

→One driver for any string based device on any fieldbus wanted

Modular Structure

records

record interfaces

Stream Device kernel

protocol files

bus interfaces

bus drivers

| ai | bo | stringout | ⋯ | waveform |

| GPIB | CAN | ⋯ | RS232 |

I/O Protocol

- Device specific

- Independent of bus architecture and record type

- Plain text file, easy to configure

- Sequence of commands

- ASCII and binary data i/o

- printf/scanf-like formatting

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Commands

- `out` *`string`*`;`
  Writes *`string`* to output

- `in` *`string`*`;`
  Matches input against *`string`*

- `wait` *`time`*`;`
  Waits *`time`* milliseconds

- `event` *`timeout`*`;`
  Waits for *`timeout`* milliseconds for event

Links and Protocols

Protocol File "HP-54520"

```
#HP oscilloscope 54520

Terminator = LF;

info {
  out "%s";
  in "%39c";
}
range {
  out "CHAN\$1:RANG?";
  in "%f";
}
rangeSet {
  out "CHAN\$1:RANG %f";
}
```

Record Examples

```
record (stringout "scope-info")
{
 field (DTYP, "stream")
 field (OUT, "@HP-54520 info gpib 7")
}

record (ai, "scope-range1")
{
 field (DTYP, "stream")
 field (INP, "@HP-54520 range(1) gpib 7")
}

record (ao, "scope-range2:set")
{
 field (DTYP, "stream")
 field (OUT, "@HP-54520 rangeSet(2) gpib 7")
}
```

Formatted I/O

- ## Standard printf/scanf conversions
  - analog: %f, %e, %E, %g, %G
  - integer: %i, %d, %u, %o, %x, %X
  - string: %s, %c, %[*charset*]

- ## Additional conversions
  - binary: %b
  - raw bytes: %r (big and little endian)
  - BCD: %D (signed and unsigned)
  - enumeration: %{*string0*|*string1*|...}

Record Interfaces

- Interfaces for common record types exist:
  ao, ai, longout, longin, stringout, stringin,
  bo, bi, mbbo, mbbi, mbboDirect, mbbiDirect,
  waveform

- New record types can be added

- Supports scalar and array data types

- Easy to write ($\approx$ 1 kbyte C-code)

Bus Interfaces

- Existing interfaces:
  - GPIB   (Microsys IEC03)
  - CAN   (ESD CAN02)
  - RS232   (TEWS TIP866, by Juraj Krempasky, SLS)

- Can be extended to other bus types

- Not so easy to write

- Knowledge of bus driver and/or bus hardware (i/o board) required

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Experience

- In use since 1999

- Currently more than 600 records at DELTA

- About 20 device types
  - Stanford Research Systems DG535 pulse generator
  - item MSE CAN S2 stepper motor control
  - Prema 5001 digital multimeter
  - Danfysik System 8000 power supply
  - Balzers TPG 300 pressure sensor
  - HP oszilloscopes, signal generators, ...
  - ...

To Do

- ## Protocol extensions
  - initialization block
  - control flow

- ## Simplify bus interface

- ## Additional bus interfaces
  - file and socket interfaces
  - CA interfaces (e.g. to string records)
  - LAN-GPIB interface

download and documentation:
www.delta.uni-dortmund.de/controls