

Software 35.34

API

Time Synchronization: Ability to set the time synchronization state of a 1U unit using command line tools or API verbs. See `esl_tt_mode`

Waveform call-back (C++)

The waveform call-back function has been modified to accept the timestamp that the waveform has been generated on and the raw waveform data has been placed in an access `class`.

```
virtual bool waveform_data (int erridx, int unit, int port, int ew_port, int event, char *  
cause, esl::timestamp * ts, esl::utils::special_data * data_) {return true;}
```

Waveform on Connect and ErrorReset states

With suitable versions of the 1U and 3U firmware it is now possible to gather waveforms on transition to the ErrorReset and Connected states.

Python

Documentation

Updated **python.pdf** documentation

Raspberry PI

We now support python on the Raspberry PI

Waveform Call-back

It is now possible to record waveforms in python see python example **connect_waveform**

Java

Documentation

Updated **java.pdf** documentation

Java 17

We now provide support for Java 17 which has LTS to 2029 see

<https://www.oracle.com/java/technologies/java-se-support-roadmap.html>

Waveforms

We now provide a call-back for the receipt and saving of waveforms

platforms/Java

Various Linux platforms use different versions of Java based upon OpenJDK and the packages for those platforms are based on the version of java available to the release.

We provide support for versions of Java the libraries and executables being found in this directory. Note the two subdirectories are for 32-bit and 64-bit versions of Java

C++

We ship a C++ API to use with our units, unfortunately there is no standard for decorating names in C++ and use of slightly different compilers may result in linkage errors. If you suffer from a unresolved symbols which should be resolvable please contact support@4links.co.uk and we will rebuild for your particular compiler

Debug Library

We now ship the instrumented debug library in a separate debug directory enabling detailed debugging to be performed without over writing the live non debug library. This debug library can be selected by setting `LD_LIBRARY_PATH` and `PATH` variables. If you are having trouble with your application, please use **ESL_TX_DEBUG** and **ESL_RX_DEBUG** (discussed in the concept guide)

Command Line

esl_tt_mode

Utility for controlling time synchronization mode for 1U devices. Usage is

esl_tt_mode <ipaddr> to find current state

esl_tt_mode <ipaddr> isol to set isolated

esl_tt_mode <ipaddr> sync to set synchronized

esl_tt_mode <ipaddr> ref to set as a reference for other units

CCSDS Plugin

We now have a Spacewire CCSDS plugin available for the native read program

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API

Support for timecodes automatically generated on 1U (4.7+) and 3U (2.3+)

Allow automatic timecodes to be generated (see timecodes.pdf)

Debug Environment Variables

Ability to track what your application is doing on spacewire using `ESL_TX_DEBUG` and `ESL_RX_DEBUG` (discussed in the concept guide)

Support for timecodes clocked on 1U SMA (4.8+)

Allow timecodes to be generated under external hardware control (see timecodes.pdf)

Support for reading 1U Sensor values (4.8+)

Introduced verb for reading 1U temperatures, fan speed and battery voltage synchronously and asynchronously using `EtherSpaceLink_device_sensor`. The following sensors are supported (starting at sensor 0)

- Temperature Zone 1
- Temperature Zone 2
- Fan Speed (*32)
- VBatt

See `esl_version.c`

Support for setting SMA voltage thresholds on 1U (4.8+)

`EtherSpaceLink_set_SMA_name_voltage` / `EtherSpaceLink_set_SMA_voltage` verbs introduced.

Valid names are

- SMA_78_RXV
- SMA_56_RXV
- SMA_12_RXV
- SMA_34_RXV
- SMA_78_TXV
- SMA_56_TXV

API Enumerations

- `EtherSpaceLink_SMA_78_RXV`
- `EtherSpaceLink_SMA_56_RXV`
- `EtherSpaceLink_SMA_12_RXV`
- `EtherSpaceLink_SMA_34_RXV`
- `EtherSpaceLink_SMA_78_TXV`
- `EtherSpaceLink_SMA_56_TXV`

Python Examples

The examples had the key and the flags field the wrong way around.

Applications

`spw` and `spw_ioio` support automated generation of timecodes (see [timecodes.pdf](#))

`msr` now supports reset of timetags via `/resetTT` option on 1U (4.7+) and 3U (2.3+)

`spw,msr` and `spw_ioio` now support setting threshold voltages on the SMA

Documentation

[timecodes.pdf](#) describing automated timecodes

[concept_guide.pdf](#) introduction to spacewire and the 4Links products

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Platform

We now support **Debian 11 (Bullseye)**

API

Windows PIP/Wheel Package for Python 3.7

This package would not run standalone (it required 4 Links API to be installed as well)

Windows Python 3.9

We now support Windows 3.9 as part of the API and a PIP/Wheel package

Documentation

Updated **python.pdf** with information about Windows Python Support. If the version of python being used is not on our supported list, end users are requested to contact support@4links.co.uk in order for us to build support for the requested version of python

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Documentation

Device Update

updates.pdf how to update the firmware for units

Error Injection

ErrorInjection.pdf error injection documentation and examples
transport_credit example program controlling transport credit

API

C

`EtherSpaceLink_set_speed_delay`, the function **EtherSpaceLink_set_speed** can take a while to transition from the one speed to another (for example 10Mbps to 200Mbps) as the PLL is transitioned to the correct speed. It is possible for your application to run at incorrect speeds. In order to alleviate this issue, we now introduce a delay. You can use **EtherSpaceLink_set_speed_delay** to extend or remove the delay.

C++/Python

speed_delay binding to **EtherSpaceLink_set_speed_delay**

Applications

spw_msrr

`spw_msrr` is a native version of the **java read** program. It provides the same functionality as the java program without having to install a Java Runtime.

We have added two options to this program for managing the timestamp display of the unit (currently the time displayed is the time in nanoseconds since unit powered on)

-epochtime displays the time as a nanosecond / epoch combination

-humantime displays the time in a conventional date format

We now ship the dissectors for RMAP on Windows platforms.

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Documentation

End User License Agreement

We now provide a formal End User License Agreement

Programs

spw_echo

This program is used to echo data between ports. It has been updated to

- 1.Support proxying of data between more than two ports
- 2.Allow filtering of data using a LUA plugin (see plugins\lua\spwecho/frame_filter.lua)

spw_ioio spw_msrr

These replacements for the java READ and SPWIO java programs now correctly run on windows

spw_read spw_io

Windows wrappers for the java READ and SPWIO java and spw_ioio, spw_msrr programs. If installed the java programs are called. If java is not installed the compatible spw_msrr and spw_ioio programs are called.

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Installation

Debian Stretch

We support Debian Stretch. Packages are supplied in deb format.

Debian Buster

We support Debian Buster. Packages are supplied in deb format.

Ubuntu

Packages are now supplied in deb format, and the use of alien is no longer required.

Alma Linux 8

With the change of emphasis of future CentOS builds, various new distributions are coming to the market in order to fulfill the same role. The first of these is Alma Linux.

Packages are in the standard RPM format.

Utilities

spw_msrr

A new program which is identical in command syntax to the Java Read program. This provides read functionality without having to install a Java runtime. Custom dissectors can be written without recourse to java or C++ using the **Lua** programming language. See the document **dissectors.pdf**.

Note that this program is not available on CentOS 5 or CentOS 6.

spw_ioio

A new program which is identical in command syntax to the Java SpwIO program. This provides spwio functionality without having to install a Java runtime. Custom dissectors and encoders can be written without recourse to java or C++ using the **Lua** programming language.

See the document **dissectors.pdf** for information on writing a dissector and **encoders.pdf** for writing an encoder.

Note that this program is not available on CentOS 5 or CentOS 6.

READ.jar

This program used to give extreme (10^9 megabytes per second) estimated link speeds when decoding packets. This has been resolved.

The RMAP dissector has been updated to include better information to handle read modify writes better.

We now show auto increment as **AI** rather than "..."

3ucodes

This program displays diagnostic information for error codes on the 3U units. If you don't supply a code, it displays information about all codes, if given a specific code to displays information about that code.

3usetup

This program allows users to quickly configure their 3U devices.

spw_io

This is a wrapper to call the Java Program spwio.jar , if the java app is not installed it will call the **spw_ioio** program.

spw_msr

This is a wrapper to call the Java Program read.jar , if the java app is not installed it will call the **spw_msr** program.

API

C++/Python Virtual Callbacks

All virtual callbacks are now private virtual functions allowing callbacks to be **only** called when the event occurs. This primarily is meant to resolve issues associated with calling virtual functions from python resulting in application locking up due to **GIL** issues.

Fuzzing Support

pre_flush application callback added to aid fuzz testing, see the document **fuzz.pdf** in the documents section.

C++/C/Python Protocol Decoders

We provide API access to the decoder library for C/C++ and python programs. This allows users to embed 4links and custom dissectors in their applications. The C binding may be used to access the decoder library from LabView as well.

Python examples are **msr_decode_file** and **msr_decode_buffer**

C/C++ examples are **proto_decode_buffer.c** and **proto_decode_file.c**

C++/Python

set_close_on_exec (Linux/MacOS) if you wish to use fork in your application you may need to set this flag in order to ensure correct network operation.

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API

C/C++/Python

The address of the 4Links unit can have a bind device / address specified, such that the connection is bound to that device / ip address prior to the connection being made. This is achieved by appending @<devicename> or @ipaddress to the connection string, for example dsi@eth0 or [dsi@10.10.10.1](#). Port number overrides must be present before this string , for example dsi:4949@eth0.

Binding to a device is not present on windows, and may require privilege on certain platforms.

RMAP

When performing an RMAP write of zero bytes an additional 0x00 EOP sequence was sent this has been resolved

The RMAP API documentation has been updated to include references to the examples

C

It is now possible to initiate MSR captures from C, since these functions are exported in our DLL it is now very easy to capture from such tools as LabView. See [eslcapture.h](#)

Utilities

rmap_server

In order facilitate testing of RMAP initiators who wish to have a memory read/write interface we have shipped rmap_server. It's usage is **rmap_server <dsi> port** where dsi is the ip address of your DSI and port is the port number we attach to. There will then be an RMAP memory target running on the DSI.

Simply connect your initiator to a spacewire port on your DSI and you should be able to test it.

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API

RMAP

Server performance improvement, previously RMAP API only read from 8 byte chunks, now uses large network buffer.

0 byte transfers, rmap reads,writes, and readmodifywrites with 0 sized buffers would fail.

Improved memory usage, rmap does not allocate buffers for handling rmap responses instead uses the rmap transaction parameter as a context.

Transaction Identifier, introduced API verbs for controlling the scope of the transaction identifier (previously on a per dsi basis), now can be on a per port basis, per dsi basis, and global basis.

Allowed user callback class to assign transaction identifiers

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API

C

Introduced **EtherSpaceLink_hold_data** as a means of holding data until either J1/J2 transition to high.

C++ / Python/ Java

hold_data as a means of holding data until either J1/J2 transition

C++ / Python RMAP

clientside/serverside API available see **rmap_api.pdf**

A set of examples for C++ and python

C++ application programming simplified

C++ callback now passed target logical address rather than return address logical address

Sometimes RMAP Read calls returned with previous data due to locking issue

MSR API

Improved example for msr python binding

Now accepts JSON capture configuration

Java API

Java API now reports errors by exception rather than return code

Documentation

User Guides

Some of the user guides had an incorrect pinout with respect to the spacewire D type connector

Python

Updated documentation on the python capture interface classes **msr_capture** and **pcap_capture**

.

Utilites

Virtual DSI

On Windows platforms the return value from the accept call was not checked correctly.

Web Interface

We provide a **msrw** an application which provide a web based JSON service allowing JSON requests to control the acquisition of data from an msr. This is documented in **web_msr.pdf**.

Java Wrappers (Linux and MAC)

These wrapper classes did not handle quoted parameters correctly. This has been resolved.

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API

Non Blocking Calls

When non-blocking calls are made without erroring out it is not possible to differentiate between timeout calls and calls interrupted by meta data callbacks as both cases have PART_EOP_EEP set as the packet type. That is a return value of 0 and metadata type set to PART_EOP_EEP.

This has been changed such that in the event of a timeout the metadata is now set to TIMEOUT.

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API

C

We now provide **libetherspacelink_static.a** on Linux/Mac and **etherspacelink_static.lib** on Windows, for those developers who wish to have a runtime embedded into their applications without recourse to an external runtime.

Python

We now support python 3 on **CentOS 7** and **CentOS 8**

We now supply a PIP (whl) package which can be used to install the python module without recourse to install the complete package. We currently do not support source whl distributions.

Utilities

vdsi Introduced a virtual **DSI** utility allowing application developers to code against our API without having physical access to our hardware. This may be useful for software test and integration. Please see the documentation in **docs/V-DSI**

Wireshark

Wireshark.pdf has been updated with the complete list of packet codes

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API

C++

nolinks function now returns unsigned as can't have a device with negative links and errors are thrown.

active_port now accepts an unsigned port number as port numbers can't be negative.

Java

The supplied jar file etherlinks.jar was built using an unnamed package which may be problematic for developers. The jar file now packages in **com._4links.spacewire**.

In order to change your java accordingly you need to add **import com._4links.spacewire.*;** to your java.

Utilities

spw

The program breaks down packets into chunks for transmission. When only transmitting on a single link it no longer does this.

The spw program now prints out the chunk size it is using, and if no chunking is taking place indicates this too.

Documentation

graphical_msr.pdf

Updated documentation with a section on how to use our software in conjunction with gtkwave.

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API

C++

We have reduced the size of the `esl::connection` class such that it is easier to instantiate said objects on the stack. Previously objects of this type held on the stack (especially in Windows) would lead to program aborts.

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API

python

We have introduced the **msr_capture** and **pcap_capture** classes for application developers who wish to control an msr during their runs. The **msr_capture** captures in the 4links native format and **pcap_capture** captures in a pcap form.

The constructor takes 4 parameters

- The hostname / ip address of the msr
- The target file / directory
- The capture configuration file (as generated by the GUI program)
- File Size, if you want the capture to split the data into multiple files please specify the file size that you want the capture to be split into, this size is in MB. If you don't want file splitting then specify 0

We have supplied the python examples **msr** and **msr_cap**.

Python API Performance

We have updated the python API guide discussing implications of python's threading model.

The python interpreter has some known issues with respect to threading, whilst python uses system threads to implement threading, the actual interpreter can only run in one thread at a time, if other threads are not waiting on I/O they will be waiting for the python interpreter to be assigned to that thread.

Essentially python code in python threads is run co-operatively.

A more elegant way of putting this, is that currently you will never get more than a single core's worth of python code running at any instant.

If you need to have more than a single core's worth of code running, then your application must be process based as opposed to thread based.

Java Read Application

This program displayed false EOP's at the end of packet captures. This has now been resolved.

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API

C

EtherSpaceLink_open does not check the result code of the asynchronous connect call correctly and will try and negotiate on a connection which is not connected resulting in a somewhat incorrect error code being returned. You will still get an error, but with this correction or more applicable error.

C

Introduction of **EtherSpaceLink_request_link_status_port** which requests port status without switching active link on DSI/MSR and 3U devices. On ESL devices it will switch the active port.

C++/ python

request_link_status_port method added which performs the same as the function above for the connection class

The timetag callbacks on Windows would report incorrect wall times thus producing incorrect pcap packet timestamps.

msr

Corrected usage of the /f parameter so as not to error.

The msr program has the ability to break large captures into smaller configurable chunks. Currently they are incrementally numbered, the file name is now the start and end times of the capture. If you want the chunks to be incrementally file numbered set the environment variable **ESL_FILE_INDEX**

PCAP capture

The offset from UTC in the PCAP header is now populated ensuring consistent timing when reading pcap files in different timezones..

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New Linux Platform

We now support **Ubuntu 20.04** with this release comes for support for both python 2.7 and python 3.

The default is for python 2.7 (as this is the install default) but if you wish to use python 3 then set the environment variable **ESL_PYTHON_VER** to **3**

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Release Notes

msr capture program

The msr capture program allows users to capture traffic on specific ports, currently it captures traffic on all ports irrespective of this parameter. This has now been rectified.

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spwio Documentation

The PDF for spwio was incorrectly printed in landscape as opposed to portrait.

esl_srscfg

We have introduced the **esl_srscfg** utility in order to make configuring SRS routers simpler.

esl_spw

We have introduced **esl_rspw** a utility which allows one to send and receive RMAP/CCSDS and raw messages without resort to complex programming.

spwio RMAP plugin

This plugin displayed “...” when either more than 8 bytes of data were received or if the increment address flag was set, this caused a degree of confusion. Instead, if the increment address flag is set the plugin displays the token “AI”

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MSR Capture

When requested to capture NULLS (ESC-FCT) the msr capture program generates the appropriate records whilst recording to PCAP formatted files.

Java Read Program

The Java read program now displays NULLS (ESC FCT) when encountered.

Wireshark Plugin

The wireshark plugins now display ESC FCT (NULL) and FCT frame data.

Spw program

We now allow a spin up period in the average throughput calculations

SRS Configuration

We have improved error reporting when configuring SRS routers.

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CentOS-8

We now provide support for CentOS-8

Apple Mac 19.0.0

We now provide support for MacOS Catalina (19.0.0)

API Change

EtherSpaceLink_dump_status

This function provides a means of dumping given context to stderr for help in debugging applications.

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Wireshark / PCAP Integration

When using packet aggregation with the final EOP being preserved (ESL_PCAP_RECORD_EOP_TS) we didn't preserve the final EOP if short timestamps were sent by the msr. This is now rectified.

API Change

The EthersSpaceLink_close, EthersSpaceLink_shutdown, EthersSpaceLink_abort calls now shutdown the spacewire ports automatically, user applications no longer have to.

Documentation

The documentation for the 3U was missing, this is now included in the doc package.

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Release Notes

Graphical Capture program

When running capture recording to multiple files, the file size limit is now respected.

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Version Number change

We have now added patch release numbers to the version identification.

The version numbering is now of the format

`<ReleaseNumber>.<VersionNumber><PatchLevel>`

The first patch to this version will be known as 34.82.

C++ RMAP

The C++ API for RMAP has been corrected with respect to the endianness of the command byte, previously the bit positions of command flags were reversed causing corrupt RMAP messages.

READ program

The java read program did not load the RMAP plugin correctly.

RMAP plugin

Support for Read Modify Write verb has been added

MSR capture program

The msr capture program places waveforms in the current directory if the environment variable ESL_WF_DIR is not set. ESL_WF_DIR is an environment variable that controls where waveform files are saved.

Waveform files

When a waveform file is saved by the msr program, the name of the file is printed to stdout and the waveform file is prefixed with the epoch time. Allowing easy identification of the capture file in any logs.

SVG Waveform files

These are now scaled correctly, so there are no longer have large blocks of unreadable color.

Python 3.7 Support on Windows

Support for Python 3.7 on windows. If python 3.7 is required, set ESL_PYTHON_VER to 3.7 prior to running 4linksvars.

Python timecode example

examples/python/timecode is an example of how to send and listen for Spacewire timecodes.

Graphical Capture program on Windows

The graphical capture program uses GTK, however the GTK runtime ships with a DLL used by other packages and this can stop the program starting. The environment program 4linksvars.bat puts the GTK libraries in the path before other libraries.

Change of License for example programs

All examples are now shipped with the BSD license making copying and reuse of the examples easier.

Graphical Capture program / Wireshark Integration

It is now possible to capture directly into Wireshark from within the graphical capture program

Improved PCAP buffering

The PCAP file buffer has been made an optimal size.

API Changes

Return Values

Throughout a return value of `-1` was used to indicate an error, this has been changed. If a function returns a value `< 0` an error has occurred, the returned value being the error code as described in `EtherSpaceLink_Constants.h`. This change does not affect the C++ or Python bindings as error handling is now by exception.

`EtherSpaceLink_read_packet_full`

When called with `EtherSpaceLink_REPORT_SPECIAL_DATA` and `EtherSpaceLink_REPORT_EXTENSION_DATA` this function used to return `-2 - <number of bytes>`. This conflicts with the error handling as defined above. Instead the returned flags indicate whether a size is being returned. If the returned flags are `EtherSpaceLink_SPECIAL_SIZE` or `EtherSpaceLink_EXTENSION_SIZE` then the returned value is the number of special or extension bytes.

Example:

```
unsigned char rxbuf[4096];
int bytes_received, extension, ii;
int flags;
int active_port;

EtherSpaceLink esldev = EtherSpaceLink_open("1.1.1.1:1234");
if (!esldev)
{
    printf("Unable to connect\n");
    return 1;
}

bytes_received = EtherSpaceLink_read_packet_full ( esldev,
                                                rxbuf,
                                                sizeof(rxbuf),
                                                &flags,
                                                EtherSpaceLink_REPORT_EXTENSION_DATA
                                                | EtherSpaceLink_REPORT_SPECIAL_DATA
                                                );

if (bytes_received < 0)
{
    // Error condition
    fprintf(stderr, "Error %d \n", bytes_received);
    return 1;
}
switch (flags)
```

```
{
  case EtherSpaceLink_SPECIAL_SIZE:
  case EtherSpaceLink_EXTENSION_SIZE:
    fprintf (stdout, "%d bytes of special data\n", bytes_received);
}
```

receivePacket (java)

This function no longer reports the size of extension or special data as a negative number. Instead one must check the context of the return value by calling **get_terminator**. If this function returns **SPECIAL_SIZE** or **EXTENSION_SIZE** then the size returned is the extension size. Note that if **enable_callbacks** is called the application developer does not have to perform analysis of special and extension_data, and instead you get high level callbacks (e.g. link changed, error, or waveform data);

EtherspaceLink_fastclose

Introduced new API verb which shuts down the connection as soon as possible using SO_LINGER with a timeout of 0.

Language Implementations

C++ method fastclose

Java method fastclose

Python method fastclose

EtherspaceLink_sendtimecode

Explicit function to send a Spacewire timecode.

Language Implementations

C++ method send_timecode(timecode)

Java method send_timecode(timecode)

Python method send_timecode(timecode)

EtherspaceLink_get_error

This returns the last error to occur in the **current thread** in the EtherSpaceLink library, mostly it should not be required to call this as functions return the error code directly. This change ensures that error codes are thread safe between receiver and transmit threads.

EtherspaceLink_get_error_text

This returns a string description of the error last error to occur in the **current thread**.

This change ensures that error codes are thread safe between receiver and transmit threads.