

OPEN MATTERS !?!

- A critical perspective on proprietary systems -

HB9FXQ, Frank Werner-Krippendorf

AGENDA

Who is HB9FXQ?

Accessibility of **knowledge & technology**

Give us some **samples**

OK nice, and now some **more real world samples** please!

Get to the point, what do you want to say?

Start the **discussion!**

Ok, we are all engineers
in the audience... so tell
us something NEW!

WHO IS HB9FXQ

Licensed **2015**

; -)

Developing **software** since more than **10 years**, currently @ **kripp.ch GmbH**

Software & electronics **enthusiast**

Father of two, living in the **Bern** area. **JN36RX**

Twitter **@HB9FXQ**

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WHAT MADE HAM RADIO SO INTERESTING FOR A SOFTWARE GUY

((((**Omnipresent** communication technologies))))

...Many of them **wireless**

...Many of them **proprietary**

...Many of them **insecure !?** -> **Wait security?** ...Pls explain
the relation to HAM Radio !

WHAT MADE HAM RADIO SO INTERESTING FOR A SOFTWARE GUY

We all share a deep interest in **science** in general

...especially in **PHYSICS, ELECTRONICS & COMPUTER SCIENCE**

ACCESSIBILITY OF KNOWLEDGE

Information is available for
free - it's **our free choice**
to use it.

A basic aspect of our
hobby is **gaining and**
sharing knowledge

ACCESSIBILITY OF KNOWLEDGE & TECHNOLOGY

I'd say that...

... accessibility is a **major criteria for technology to be applied**

... **OPEN** interfaces and hardware **are catalyzer for new application**

Give some
examples!



ONCE UPON A TIME... IN

2005

A hardware platform was released, that changed the world of electronics in hobby completely.

This is the moment for a **quiz... ::::** Shout out, if you know what's on the next slide :)

2005

Right! Arduino

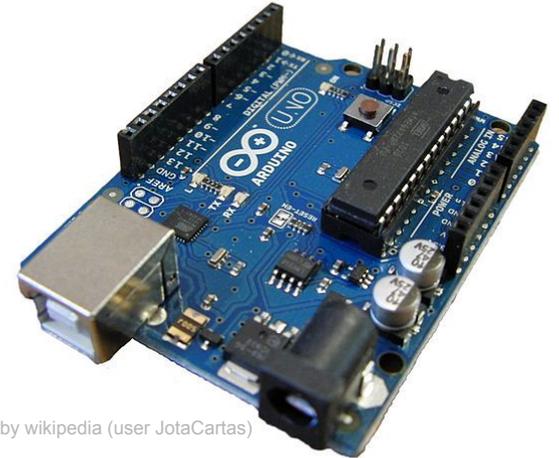


Image by wikipedia (user JotaCartas)

History [edit]

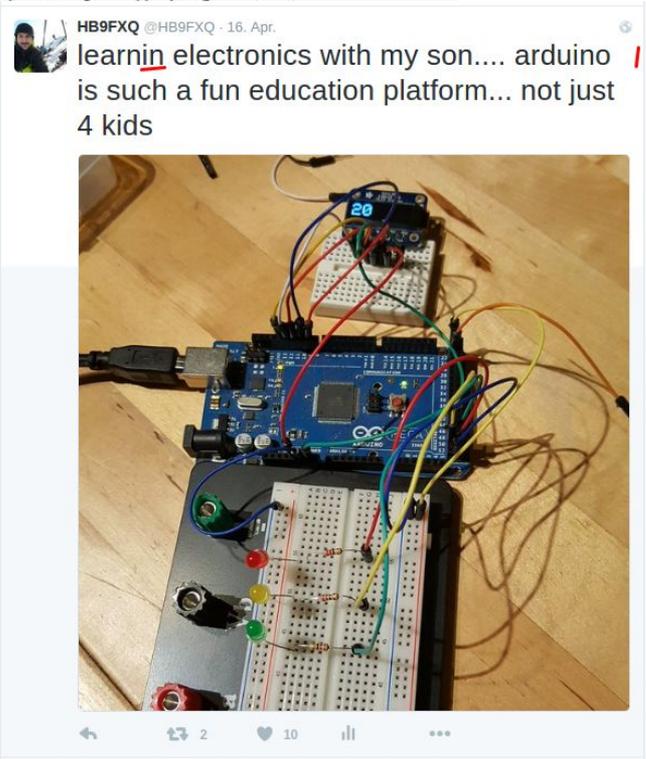
Colombian student Hernando Barragán created the development platform *Wiring* as his Master's thesis project in 2004 at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. Massimo Banzi and Casey Reas (known for his work on Processing) were supervisors for his thesis. The goal was to create low cost, simple tools for non-engineers to create digital projects. The Wiring platform consisted of a hardware PCB with an ATmega128 microcontroller, an integrated development environment (IDE) based on Processing and library functions to easily program the microcontroller.^[4]

In 2005, Massimo Banzi, with David Mellis (then an IDII student) and

```
#define LED_PIN 13

void setup() {
  pinMode(LED_PIN, OUTPUT); // Enable
}

void loop() {
  digitalWrite(LED_PIN, HIGH); // Turn o
  delay(1000); // Wait o
  digitalWrite(LED_PIN, LOW); // Turn o
  delay(1000); // Wait o
}
```



START SMALL, THINK BIG

Major impact on

Educational environments

Hobby AND **professional** projects

Arose interest of people that would never start to apply / use / think of microcontroller technology, like **applications in art installations**

TODAY

2012

Raspberry Pi

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Meet wikipedians from 24th to 26th June in Wikimania 2016 in Esino Lario! Any detail on the page of the event.



[Help with translations!](#)

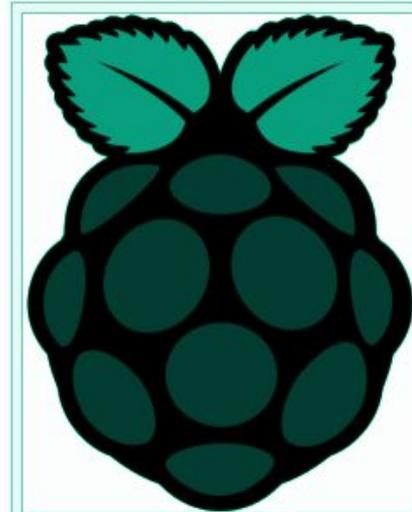
Raspberry Pi

From Wikipedia, the free encyclopedia

"RPI" redirects here. For other uses, see RPI.

The **Raspberry Pi** is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation with the intent to promote the teaching of basic computer science in schools and developing countries.^{[7][8][9]} The original

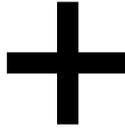
Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations through licensed



Raspberry Pi logo



Open, affordable hardware

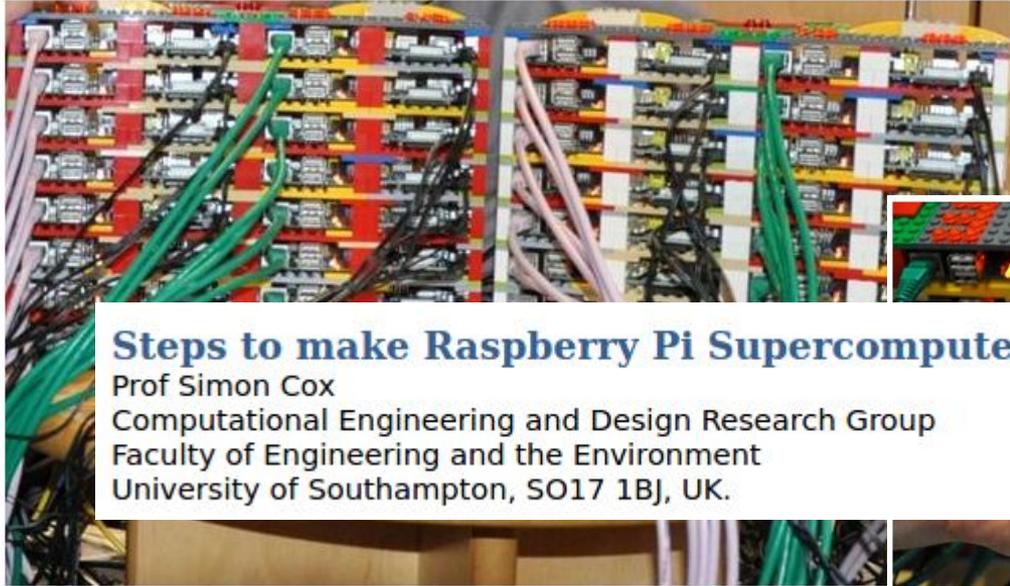


A free and open software platform



PERFECT CONDITIONS FOR OUR APPLICATIONS IN HAM
RADIO

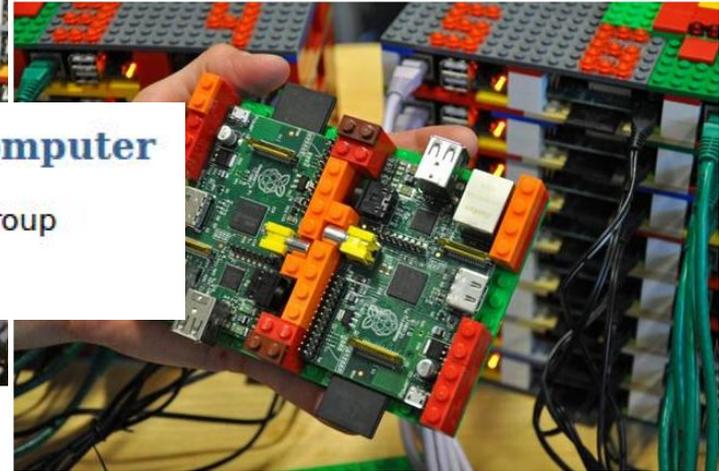
(Picture Credits below: Glenn Harris 2012)



Steps to make Raspberry Pi Supercomputer

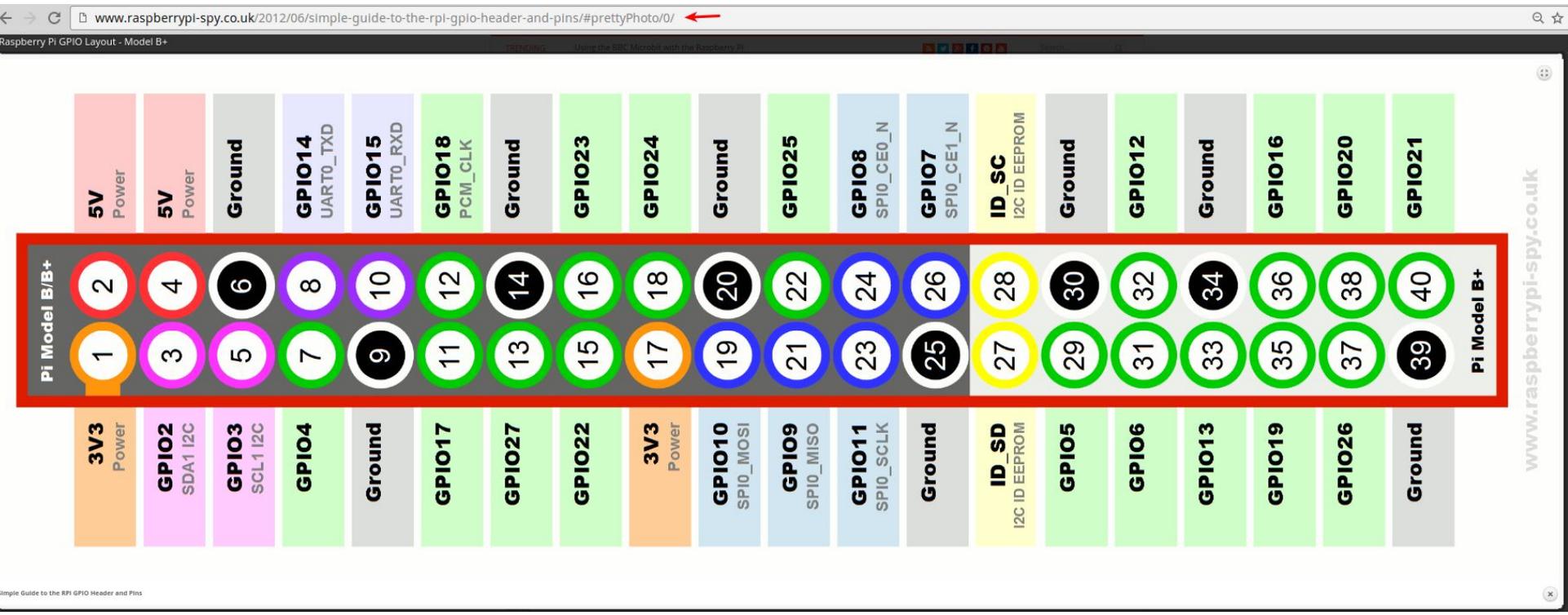
Prof Simon Cox

Computational Engineering and Design Research Group
Faculty of Engineering and the Environment
University of Southampton, SO17 1BJ, UK.



Source: http://www.southampton.ac.uk/~sjc/raspberrypi/pi_supercomputer_southampton.htm

CREATIVE APPLICATION, IN COMBINATION WITH A VERY EDUCATIONAL VALUE



WHAT DO HAMS WITH THE RASPBERRY PI?

OK nice, and now some
more real world
samples please!



OM(G) wait, you promised a
critical perspective..



WHERE ARE WE TODAY

Digital **S**ignal **P**rocessing became central.

Software **D**efined **R**adio in general - my passion!

Manufacturing processes **minimizing technology**..

More computing power generates new possibilities

BLACK BOXES EVERYWHERE !?

Success factors of 'Arduino' & 'Raspberry PI' -

projected on HAM Radio technology

NEW TECH CHANGED THE GAME.
THAT'S NOTHING NEW...

.... BUT INTERVALS OF NEW
TECH /TRENDS/ ARE GETTING
FASTER

HIGH-TECH FINDS IT'S WAY INTO OUR HAM EQUIPMENT

I'd say we're **at the edge** of a complete **new generation** of rigs.

We see component's **known from the SDR world** being **integrated into traditional TRX** systems.

HISTORY REPEATS!?

Compare the situation to
mobile phones

Currently we choose
between a Fruit or a Robot
platform... not much space
in between

We don't want this
situation in HAM Radio!

BE SURE TO KEEP THE
FOCUS ON ONE MAIN
ASPECT OF OUR HOBBY:

THE FREEDOM OF
ACCESSIBLE, OPEN
TECHNOLOGY

SAMPLES, NOW!

ONE MORE QUESTION

What is an API / SDK?

**Who has never
heard of an API?**

Application

Programming

Interface

THE SDRPLAY

- Very good specs compared to the RTL* family dongles
- Affordable
- System independent API
- Connected by USB



3 API Functions

The header `mir_sdr.h` defines the external function prototypes provided by this API. All functions are blocking.

3.1 Supported Functions

```

mir_sdr_ErrT mir_sdr_StreamInit(int *gRdB, double fsMHz, double rfMHz, mir_sdr_Bw_MHzT bwType, mir_sdr_If_kHzT ifType,
                               int LNAEnable, int *gRdBsystem, int useGrAltMode, int *samplesPerPacket,
                               mir_sdr_StreamCallback_t StreamCbFn, mir_sdr_GainChangeCallback_t GainChangeCbFn, void *cbContext);
mir_sdr_ErrT mir_sdr_StreamUninit(void);
mir_sdr_ErrT mir_sdr_SetRf(double drfHz, int abs, int syncUpdate);
mir_sdr_ErrT mir_sdr_SetFs(double dfsHz, int abs, int syncUpdate, int reCal);
mir_sdr_ErrT mir_sdr_SetGr(int gRdB, int abs, int syncUpdate);
mir_sdr_ErrT mir_sdr_SetGrParams(int minimumGr, int lnGrThreshold);
mir_sdr_ErrT mir_sdr_SetDcMode(int dcCal, int speedUp);
mir_sdr_ErrT mir_sdr_SetDcTrackTime(int trackTime);
mir_sdr_ErrT mir_sdr_SetSyncUpdateSampleNum(unsigned int sampleNum);
mir_sdr_ErrT mir_sdr_SetSyncUpdatePeriod(unsigned int period);
mir_sdr_ErrT mir_sdr_ApiVersion(float *version);
mir_sdr_ErrT mir_sdr_ResetUpdateFlags(int resetGainUpdate, int resetRfUpdate, int resetFsUpdate);
mir_sdr_ErrT mir_sdr_DownConvert(short *in, short *xi, short *xq, unsigned int samplesPerPacket, mir_sdr_If_kHzT ifType,
                                unsigned int M, unsigned int preReset);
mir_sdr_ErrT mir_sdr_SetPpm(double ppm);
mir_sdr_ErrT mir_sdr_SetLoMode(mir_sdr_LoModeT loMode);
mir_sdr_ErrT mir_sdr_SetGrAltMode(int *gRdB, int LNAenable, int *gRdBsystem, int abs, int syncUpdate);
mir_sdr_ErrT mir_sdr_DcOffsetIQImbalanceControl(unsigned int DCenable, unsigned int IQenable);
mir_sdr_ErrT mir_sdr_DecimateControl(unsigned int enable, unsigned int decimationFactor, unsigned int wideBandSignal);
mir_sdr_ErrT mir_sdr_AgcControl(unsigned int enable, int setPoint_dBfs, int knee_dBfs, unsigned int decay_ms,
                               unsigned int hang_ms, int syncUpdate, int LNAEnable);
mir_sdr_ErrT mir_sdr_GetGrByFreq(double rfMHz, mir_sdr_BandT *band, int *gRdB, int LNAenable, int *gRdBsystem,
                                int useGrAltMode);
mir_sdr_ErrT mir_sdr_Reinit(int *gRdB, double fsMHz, double rfMHz, mir_sdr_Bw_MHzT bwType, mir_sdr_If_kHzT ifType,
                            mir_sdr_LoModeT loMode, int LNAEnable, int *gRdBsystem, int useGrAltMode, int *samplesPerPacket,
                            mir_sdr_ReasonForReinitT reasonForReinit);
mir_sdr_ErrT mir_sdr_DebugEnable(unsigned int enable);

```

3.2 Deprecated Functions

These functions are no longer supported. They will still work but will be removed in a future version of the API.

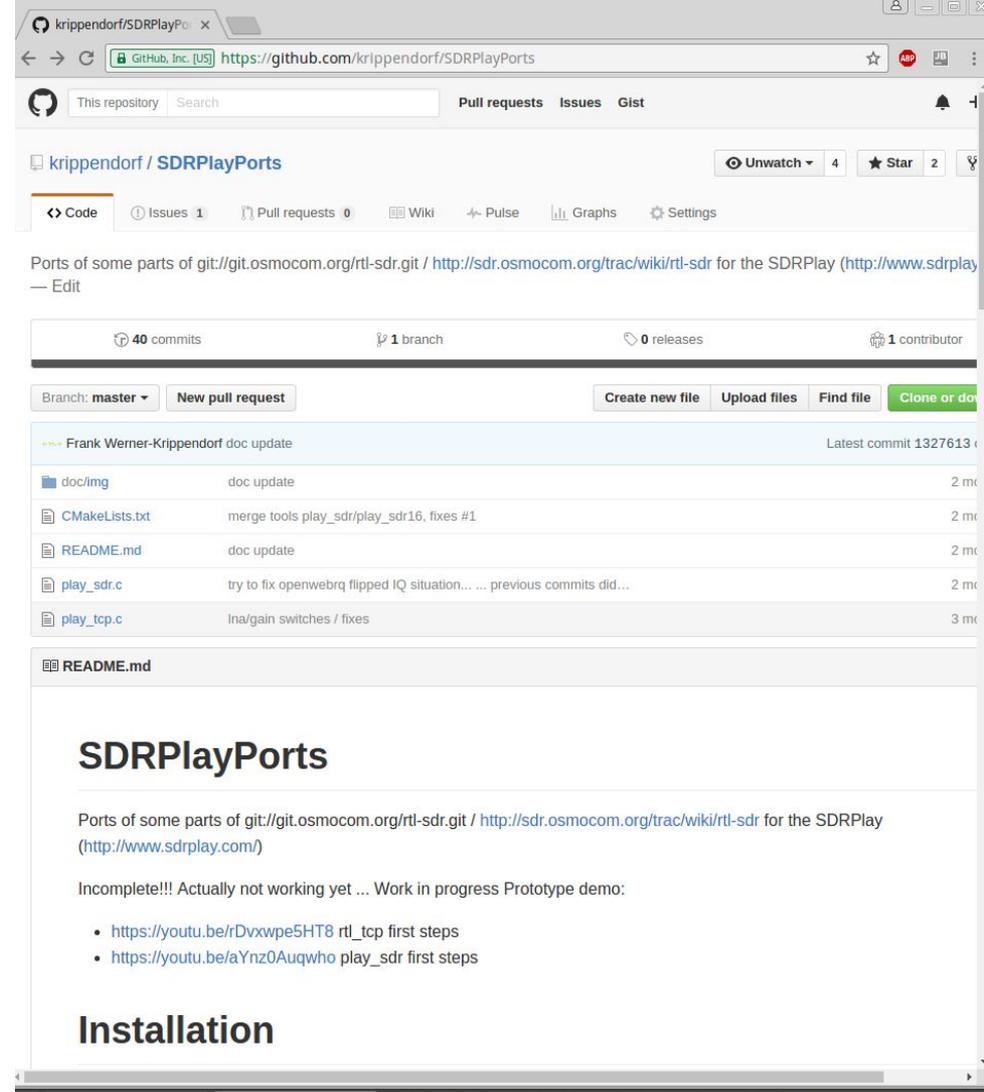
```

mir_sdr_ErrT mir_sdr_Init(int *gRdB, double fsMHz, double rfMHz, mir_sdr_Bw_MHzT bwType, mir_sdr_If_kHzT ifType,

```

Adapted the rtl_sdr / rtl_tcp utility to SDRplay

- Received a lot feedback by Email
- People started to use it in their projects
- Good support from the vendor
- Beside the learning effects, many new ideas were born
- Realized, that the device itself is not bound to the use cases the vendor suggests - creativity is the only Limit



The screenshot shows a GitHub repository page for 'krippendorf / SDRPlayPorts'. The repository has 40 commits, 1 branch, 0 releases, and 1 contributor. The current branch is 'master'. The file list includes:

File	Description	Commit
doc/img	doc update	2 m
CMakeLists.txt	merge tools play_sdr/play_sdr16, fixes #1	2 m
README.md	doc update	2 m
play_sdr.c	try to fix openwebrq flipped IQ situation... previous commits did...	2 m
play_tcp.c	Ina/gain switches / fixes	3 m

The README.md content is visible below the file list:

SDRPlayPorts

Ports of some parts of [git://git.osmocom.org/rtl-sdr.git](http://git.osmocom.org/rtl-sdr.git) / <http://sdr.osmocom.org/trac/wiki/rtl-sdr> for the SDRPlay (<http://www.sdrplay.com/>)

Incomplete!!! Actually not working yet ... Work in progress Prototype demo:

- <https://youtu.be/rDvxwpe5HT8> rtl_tcp first steps
- <https://youtu.be/aYnz0Auqwho> play_sdr first steps

Installation

Using OpenWebRX with SDRplay:

```
# >> RTL-SDR via rtl_sdr
```

```
start_rtl_command="play_sdr -b 600 -s {samp_rate} -f {center_freq} -x 16 -g {rf_gain} -y 0 -".format(rf_gain, format_conversion="csdr convert_s16_f"
```

The screenshot displays the OpenWebRX web interface. On the left, a terminal window shows the configuration for the SDRplay receiver. A green box highlights the `start_rtl_command` configuration line. The terminal output shows the following configuration:

```
47 receiver_gpio=(1, 0x0000, 0, 0x0000)
48 photo_height=256
49 photo_title="Passover of Budapest from Schönerz Daiton Directory"
50 photo_size=""
51 You can add your own background photo and receiver information via /s
52 Receiver is operated by: %s host=%s/rtl_fm ADPCM"/%P/PK ADPCM"/s=dr//
53 Device: N/A RTL-SDR v4
54 Antenna: N/A RTL-SDR v4
55 Website: %s host="http://localhost" target="_blank" http://localhost/
56 ***
57 # --- set the listing ---
58 # If you want your own receiver to be listed publicly on sdr.hu, then take the following steps:
59 # 1. Register at: http://sdr.hu/register
60 # 2. You will get an unique key by email - copy it and paste here:
61 sdhu_key = ""
62 # 3. Set this setting to true to enable listing:
63 sdhu_public_listing = false
64 # --- set the settings ---
65 dsp_plugin="cubiq"
66 fft_fft_size
67 fft_size=4096
68 samp_rate = 240000
69 center_freq = 710000
70 rf_gain = 18 use 0 for an RTL-SDR, rf_gain will set the bias to auto gain mode, else it will be in manual
71 gain = 0
72 # ---
73 audio_compression="adpcm" audio_codec="adpcm", "h264"
74 fft_compression="adpcm" audio_codec="adpcm", "h264"
75 # ---
76 start_rtl_thread=true
77 # ---
78 # --- set the receiver's appropriate ---
79 # ---
80 start_rtl_command="play_sdr -b {samp_rate} -f {center_freq} -x 16 -g {rf_gain} -y 0 -".format(rf_gain, format_conversion="csdr convert_s16_f"
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```

On the right, the OpenWebRX interface shows a spectrum display with a frequency range from 7.000 MHz to 7.010 MHz. The display shows a signal at approximately 7.003 MHz. The interface includes a search bar, a list of receivers, and a control panel for the selected receiver. The control panel shows the following settings:

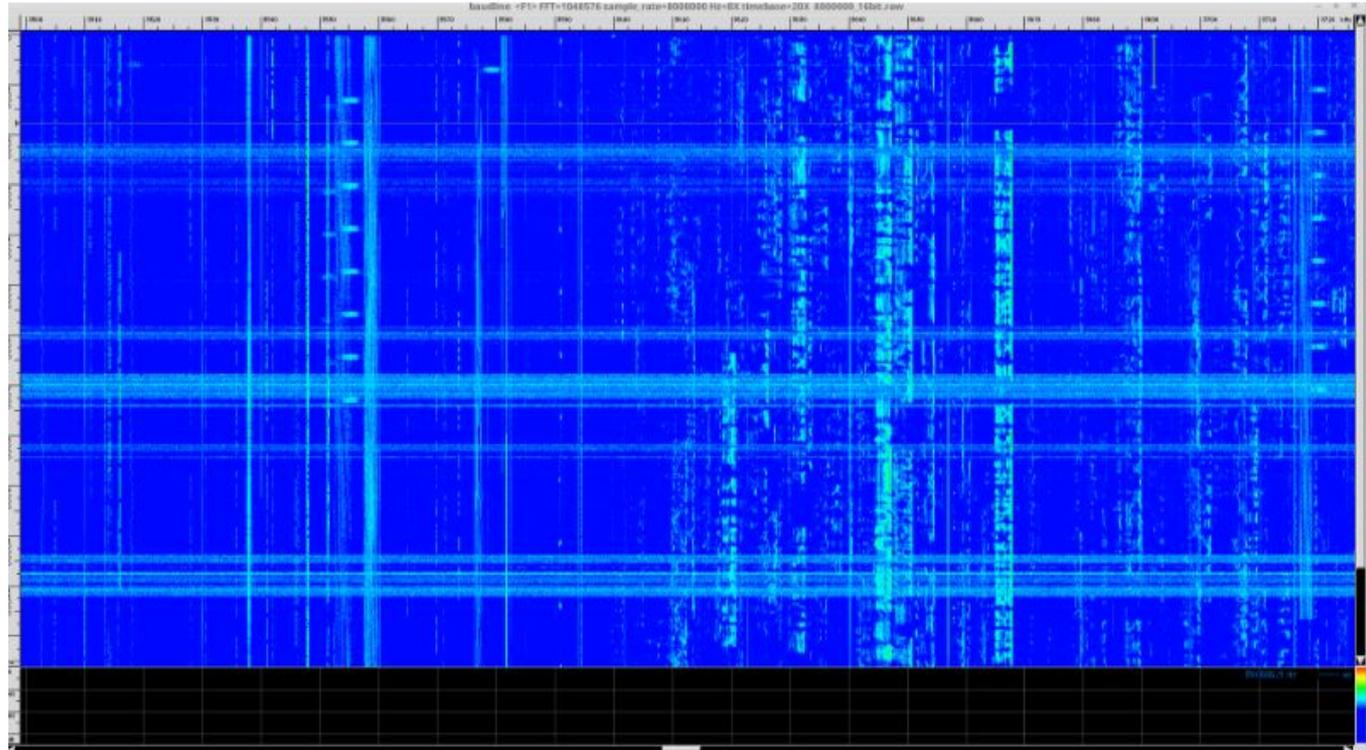
- Audio driver: (0.7 s)
- Audio output: (4.7 kbps)
- Audio streams: (24 kbps)
- Microphone usage: (73.2 kbps)
- Server CPU: (14%)
- Clients: (1)

The interface also displays the current frequency: 7.070.3 MHz and the mode: FM. The control panel includes sliders for volume and gain, and buttons for FM, AM, LSB, USB, and CW.

- Use with Baudline

```
timeout 15s play_sdr -s 8000000 -b 600 -f 3.6M -g 35 -l 0 -x 16 8000000_16bit.raw
```

Signal analysis with Baudline



FLEX RADIO 6XXX

- My (current) dream transceiver ;)
- Platform independent interface!
- Connected by Ethernet



Beside the supplied client application SmartSDR various APIs are available. External AND Internal!

Show 15 entries Search:

API	Platform	Capabilities	Example Applications
FlexLib™	Microsoft Windows .NET	Complete access to all command, control, status, metering, real time panadapter, waterfall and streaming sample data	Building a new client interface, integrating Flex series radios into existing communications applications on Windows platforms
SmartSDR Waveform API (External)	Any TCP/IP and UDP/IP capable system	Access to command, control and sample data running inside the FLEX-6000	Build new processing modes or capabilities available to radio clients, but running external to the radio. Solutions run on a computer adjacent to the radio, expanding radio capabilities
SmartSDR Waveform API (Internal)	FLEX-6000 Signature Series Radios	Access to command, control and sample data running inside the FLEX-6000	Build new processing modes or capabilities internal to the radio. Solutions may be deployed as packages to be loaded into the radio, expanding capabilities of the radio
SmartSDR Objective-C	Apple iOS / OSX	Partial access to many SmartSDR command, control and status information	iPad / iPhone / Mac applications operating on the FLEX-6000 Signature Series radios
SmartSDR API	Any TCP/IP and UDP/IP capable system	Complete access to all command, control, status, metering, real time panadapter, waterfall and streaming sample data	Building a new client interface, integrating Flex series radios into existing communications applications on non-Windows platforms
CAT	Serial	Control of up to	Integrating with existing

I've ported the vendor API to compile on Mono (Linux)

- Received a lot feedback by Email and in the forums
- People started to use it in their projects
- The radio is software independent, due to the open API it can be

The screenshot shows the GitHub interface for the repository 'krippendorf / FlexlibMono'. At the top, there are navigation links for 'Pull requests', 'Issues', and 'Gist'. The repository name is displayed with 'Unwatch', 'Star', and 'Fork' buttons. Below this, there are tabs for 'Code', 'Issues', 'Pull requests', 'Wiki', 'Pulse', 'Graphs', and 'Settings'. The main content area shows the repository's description: 'Mono compatible version of Smartsdr Flexlib <https://www.hb9fxq.ch> — Edit'. It also displays statistics: 13 commits, 1 branch, 0 releases, and 1 contributor. A table lists the repository's files and folders, including '3rdParty', 'doc/img', 'src', '.gitignore', '.travis.yml', 'buildtools.sh', 'contributors.txt', and 'readme.md'. The 'readme.md' file is selected, showing a 'build passing' status and the title 'Mono/Linux compatible version of Flexlib'. The README content includes a subtitle 'Mono/Linux compatible version of Flexlib', a paragraph 'A few experiments with Flexlib on mono. Currently only short experiments and snippets.', and a section 'How to install?' with instructions to get a recent version of mono from <http://www.mono-project.com/download/> and to run a command.

This repository Search Pull requests Issues Gist 🔔 + 🌙

krippendorf / FlexlibMono Unwatch 2 Star 0 Fork 0

Code Issues 0 Pull requests 0 Wiki Pulse Graphs Settings

Mono compatible version of Smartsdr Flexlib <https://www.hb9fxq.ch> — Edit

13 commits 1 branch 0 releases 1 contributor

Branch: master New pull request Create new file Upload files Find file Clone or download

File/Folder	Commit	Time
3rdParty	first commit	2 months ago
doc/img	first commit	2 months ago
src	invalid lock	2 months ago
.gitignore	first commit	2 months ago
.travis.yml	travis	2 months ago
buildtools.sh	mini build script	2 months ago
contributors.txt	first commit	2 months ago
readme.md	Update readme.md	2 months ago

readme.md

build passing

Mono/Linux compatible version of Flexlib

A few experiments with Flexlib on mono. Currently only short experiments and snippets.

How to install?

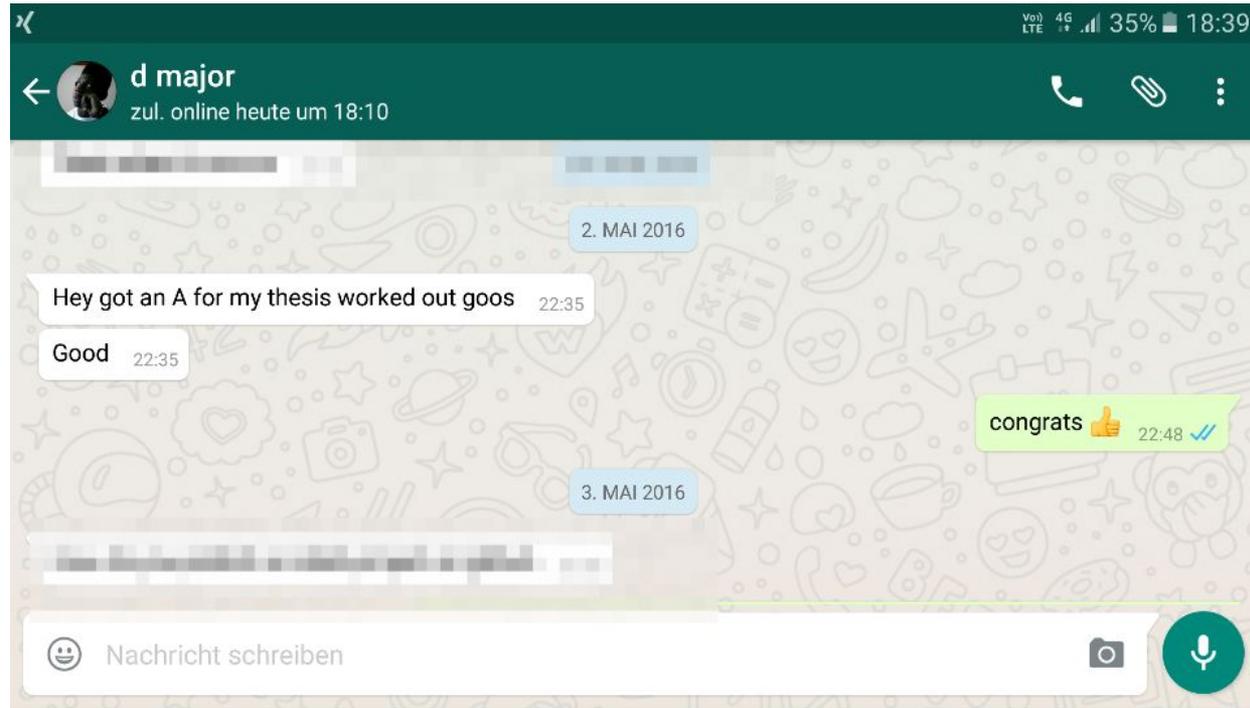
You'll need a recent version of mono, get it from <http://www.mono-project.com/download/>

Then run:

A student from the University of Victoria integrated it in parts of his HONOURS THESIS

“Implementing a Flex Radio Block in GNU Radio”

A perfect example, how open software encourages the community to join forces



WHY DO YOU MENTION SDRPLAY AND FLEX RADIO 6K AND NOT XY

It's no advertising, it's simply the hardware I've chosen for my activities.

They both have one thing in common: The hardware is non-open for various reasons.

I was asking the vendor a short question:

“Would you agree, when I say the hardware part of your product is “non-open””

AND I GOT IMMEDIATE RESPONSE :-)

Jon from SDRplay said:

“Hi Frank, that is fine. We encourage use of our published API and do all we can to link it to popular SDR software running on multiple host processing platforms.”

Stephen from Flexradio said:

“Yes, it is fair to say the the hardware is not open if by this you mean that we do not publish all of the details to build your own set of hardware. As a practical matter, there are almost no hams that would build a radio that includes several fine-pitch BGA parts unless they were doing it to go into business. This means the only people we would help by publishing the hardware would be competitors. That doesn't make much sense.”

THERE ARE VENDORS....

... found a good balance between open and free access, while keeping their value closed - the knowhow and engineering efforts.

They are not binding you to a proprietary software system - that they offer.

In my eyes that's a good perspective for future commercial devices.

Get to the point, what do you
want to say?

<<<<<>>>>>

OPEN INTERFACES

...will be a key aspect for upcoming RIG generations

OPEN != GRATIS

But accessibility of technology as a very very high value of HAM Radio

DON'T BUY A PIG IN A POKE

**Even if you don't "need" an open interface. You
might in future!**

TIME TO START THE DISCUSSION! SPREAD THE WORD

This slides will be published soon, also a related article
(German language)

Option A)

Discuss on hamspirit.de

Option B) Discuss this talk on:

HB9FXQ.CH

