
RONJA
User Controlled Technology Optical Datalink
Karel 'Clock' Kulhavy

- 1998: Experiments with IrDA 115.200 Baud
- 2005:
  - 10Mbps
  - 1.4km range
  - Full duplex
  - Red or infrared
- User Controlled Technology (UCT)
- A project of Twibright Labs

Range

- Transmission by ordinary (infra)red light
- Rain, snow OK
- 1.4km range @4km visibility
- Stable, given by white noise from Sun

Transmitter

- LED from car brake light (cost 1$)
- 13cm lens (3$)
- 17mW of red light
- Unconditionally eye safe
- 4m spot @ 1km

Material and time cost

- 100$ for one device total material cost
- Most expensive components:
  - Electronic 1.20$ (16MHz crystal oscillator)
  - Mechanic 4$ (smoke pipe 1 meter)
  - Optic 2-15$ (130mm loupe)
- 70 hours building time for average Joe
- Much less hours with careful planning
- Most time spend on searching for tools and parts

Advantages

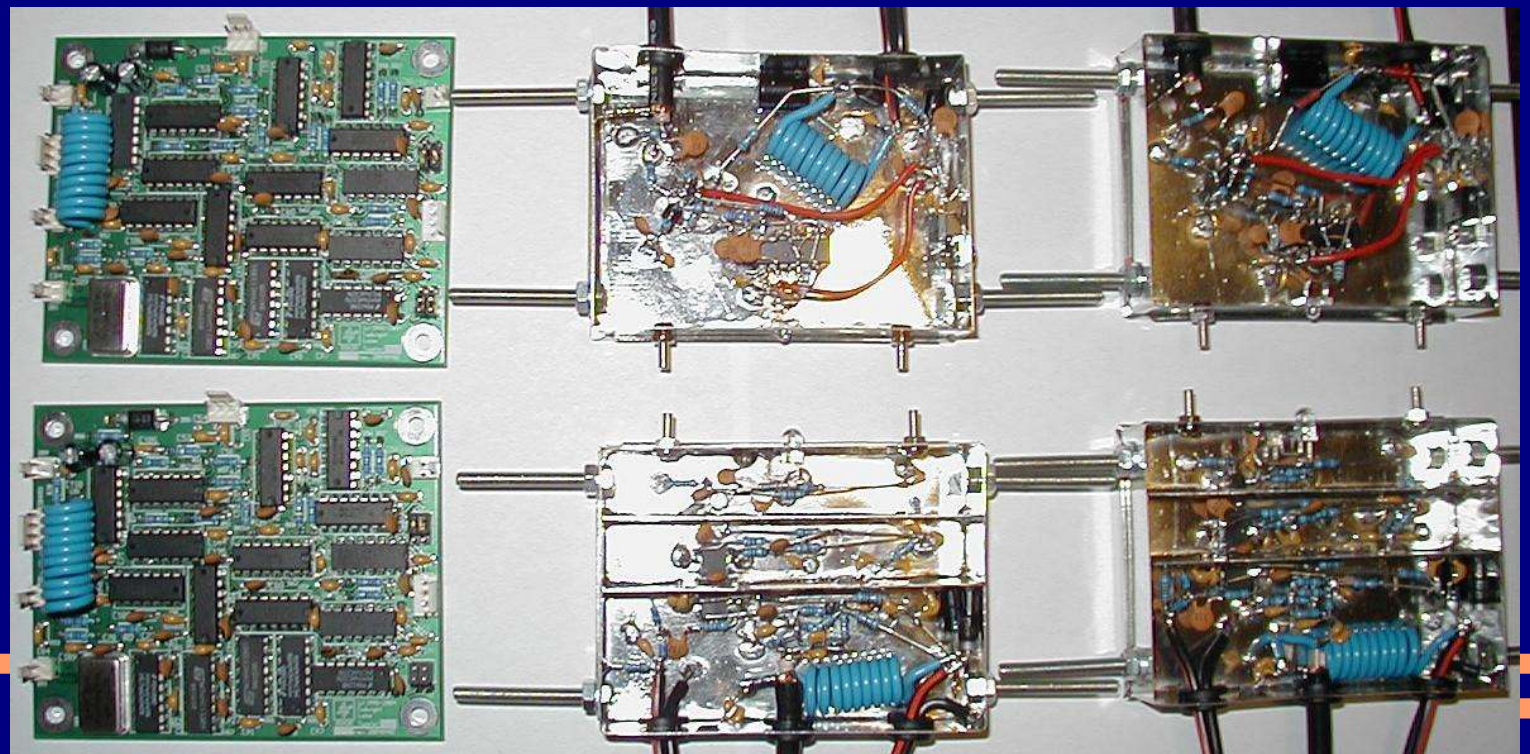
- No interference
- No spectrum regulation
- No electrosmog
- Difficult eavesdropping
- Smooth throughput
- Full duplex
- No packetloss

Disadvantages

- Dropouts on fog (no problem for ordinary usage)
- Mount requirements
- PtP topology only
- Mechanics: 10-20kg

Support

- "I have populated more than 20 Twisters and I have to say all worked on the first try." (Petr Seliger, Ronja mailing list)
- Adhere to the guide -> works on the 1st try
- Doesn't work -> bug -> report to Ronja ML
- Bugs have priority to features



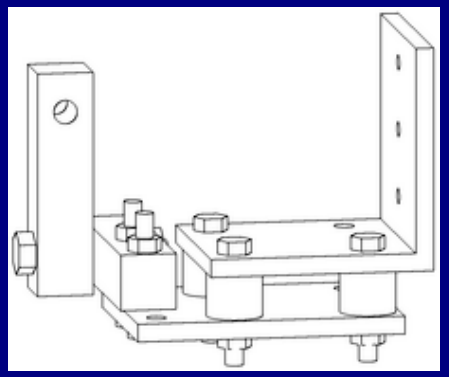
Ronja + WiFi backup

- “Ronja is a really robust device. It runs [on our 800m link] even if you cover 95% of the lens with a paper. That will be useful when a fog comes.”
  http://bakulak.czfree.net/news.html
- Can't wait even in thick fog?
- Special SW requirements
  - Immediate dropout detection

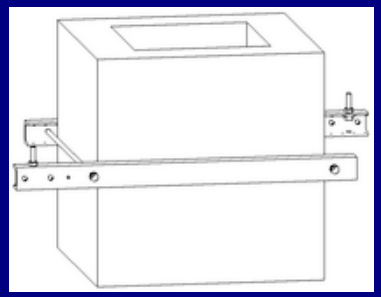
Modularity

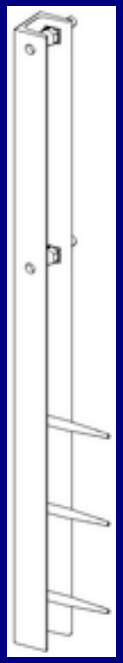
- 3 different models (AUI, RJ45, red, infrared)
- 6 electronic modules (2RX, 2TX, 2interf.)
- 7 mechanic modules (6 consoles + 1 holder)
- 2 optical modules (90mm and 130mm heads)
- 1 Ronja = RX+TX+interface+optical head+holder+console+cabling
- 1 link=2 Ronjas
- PC or switch (managed)

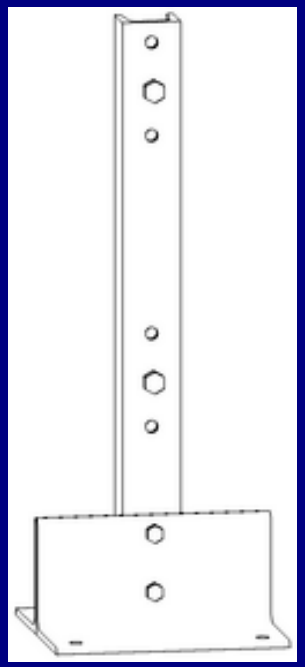
Mechanical mounting

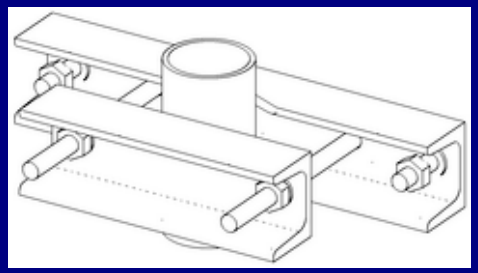


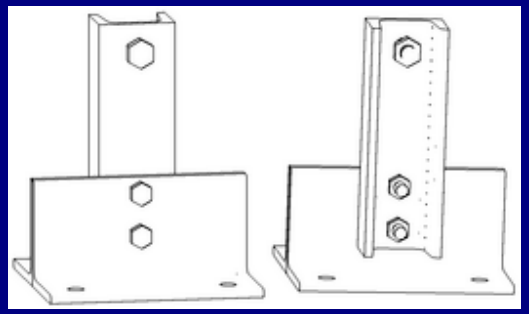
- Holder with fine and rough alignment
- 5 types of console
  - Chimney
  - Parallel
  - Perpendicular
  - Mast
  - Corner





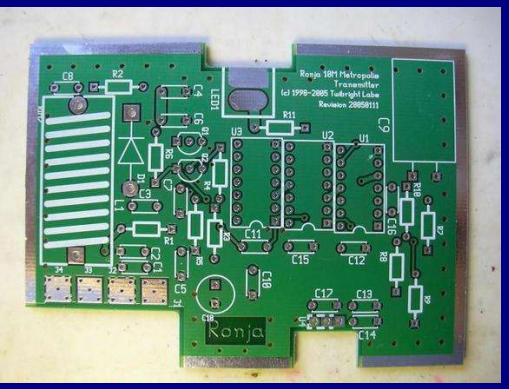
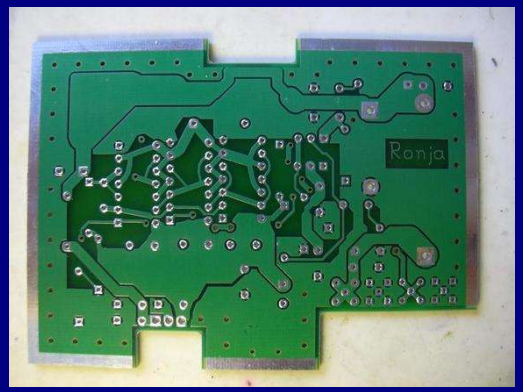
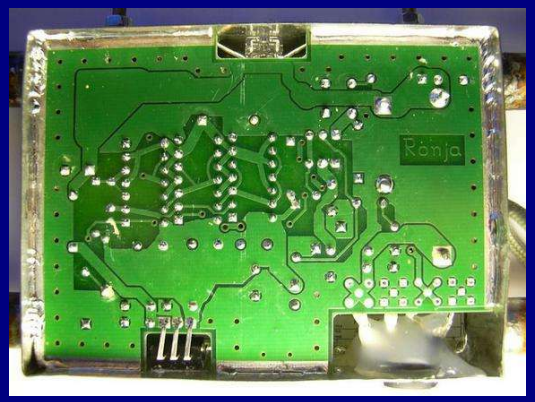


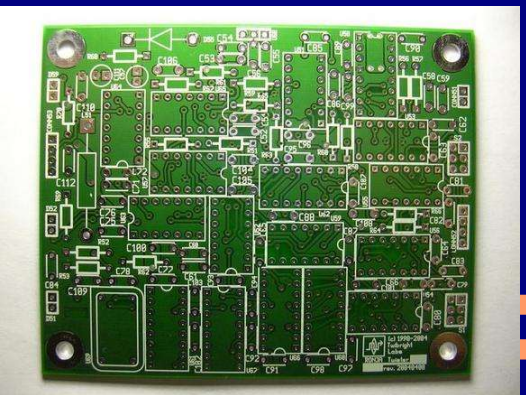
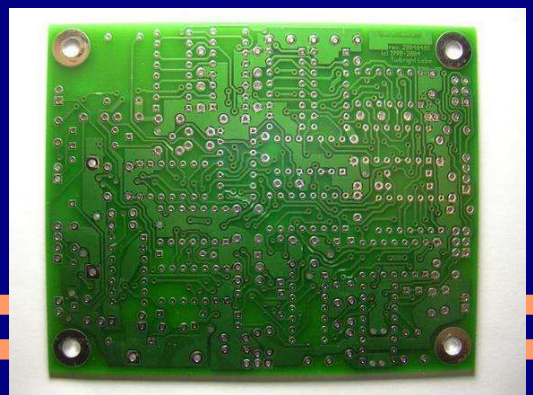




Boards

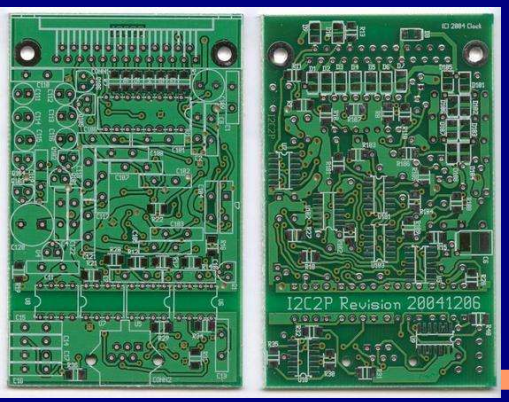
- Twister, TX
- Download *.zip, e-mail to fabhouse, get boards by post.
- Standardized format accepted by all fabhouses
- No thinking required to order

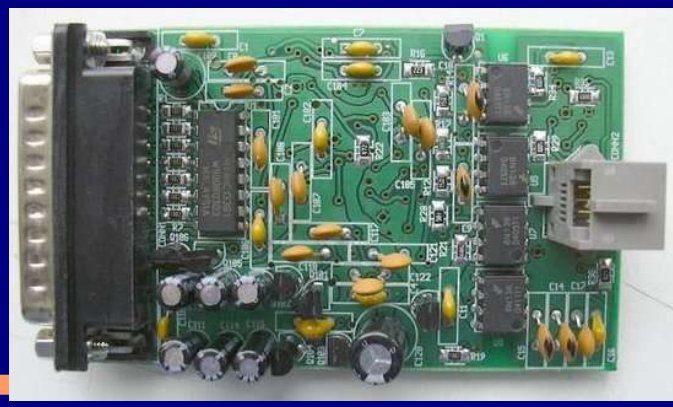




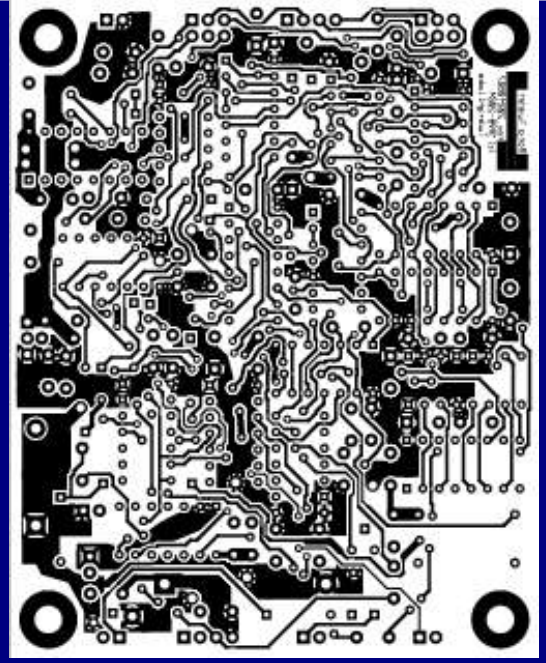
SMD miniaturization

- Already done on another Twibright Labs project – I2C2P
- The same toolchain as Ronja
- Easily solderable by layman with $20 soldering gun
- Cheaper, faster to build than TMD





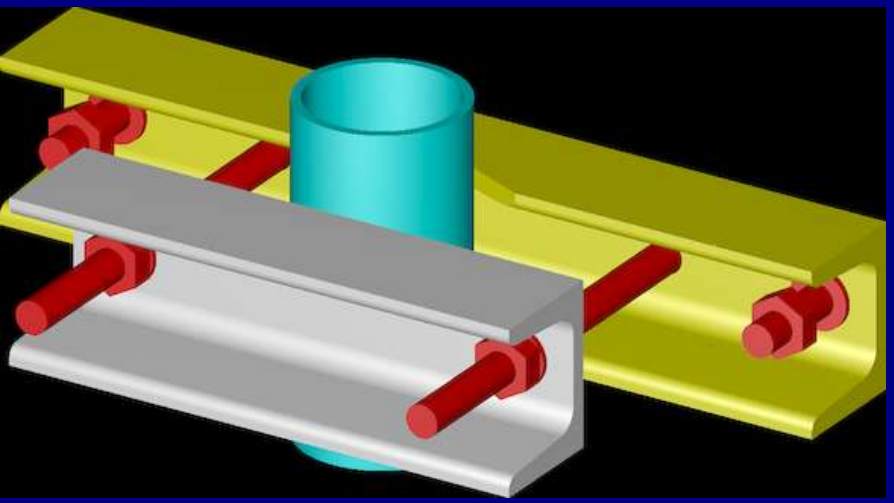
Freedom

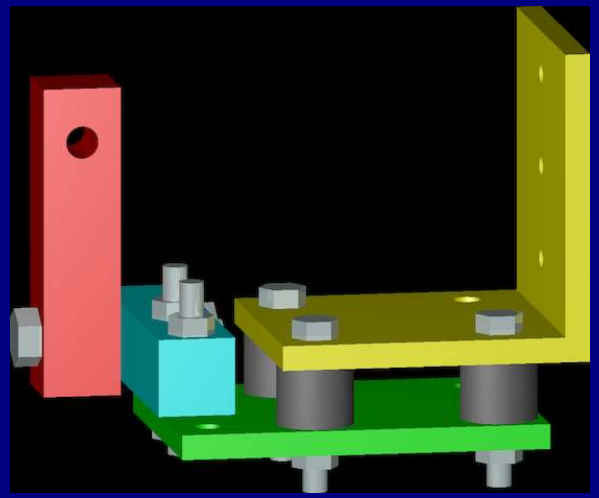


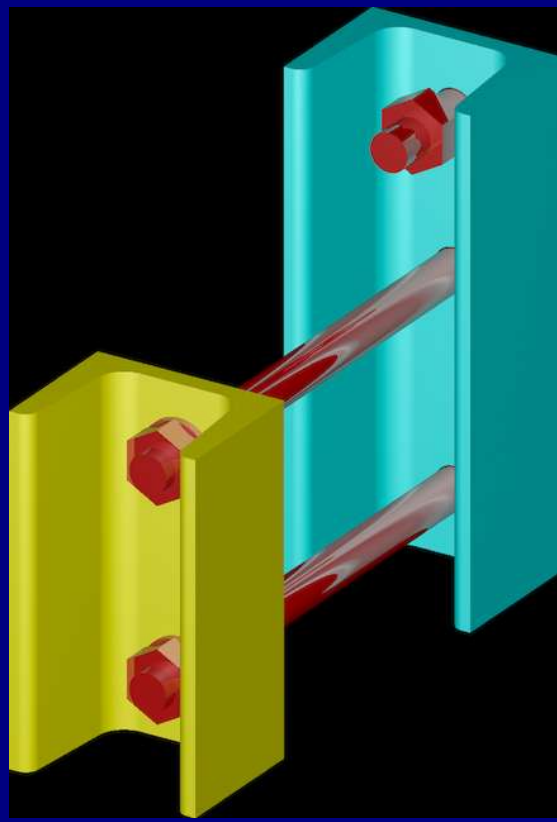
- DIY for laymen
- Step-by-step guide
- Minimum skills required
- Various operations can be ordered
- Complete source codes online under GPL
- Only free software tools used on development
- Anyone can do his own fork if he doesn't like it

Advanced free software tools

- 3D modelling BRL-CAD
- 2D modelling QCad
- Schematics, boards: gEDA
- 250MB of source tree
- 2 hours make time





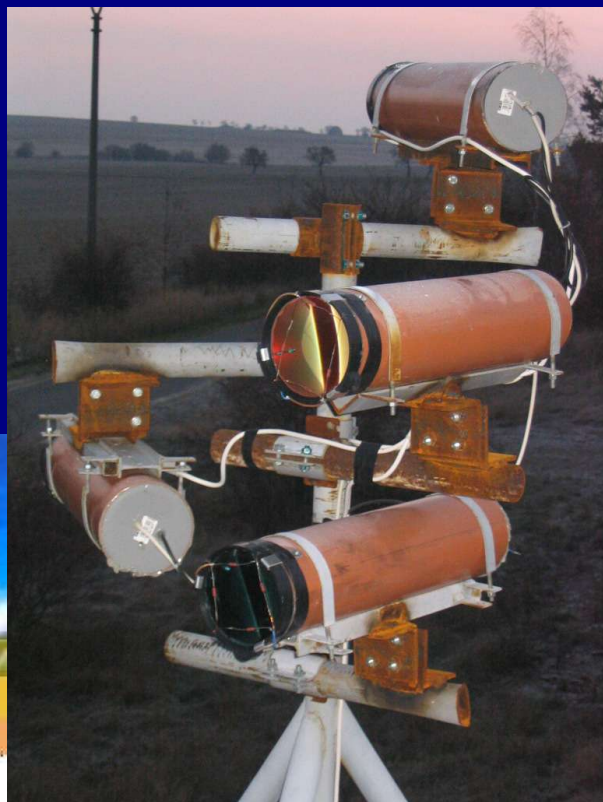


Installations

- 102 registered installations
- 57 km total length
- 9 different countries

Installation peculiarities

- 1.7km longest (Poruba, CZ)
- 1.3/0.4km analogue retranslation (Běhařovice, CZ)
- 990m student dormitory, 1000 students (SK)
- Prague: 21 links in one community network (CZFree.NET)

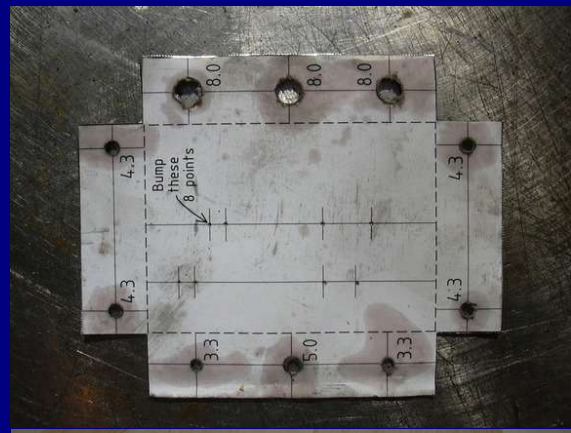


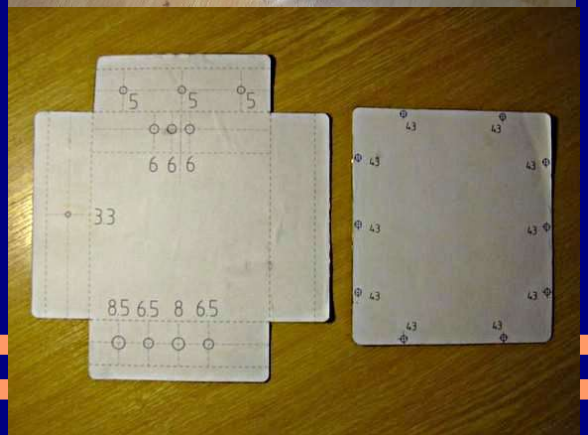
21 installations in Prague CZFree.NET

- Continuous community network
- Attempt for independent last-mile infrastructure
- Covers whole Prague
- Mostly WiFi
- Ronja solves interference

Postindustrial nature

- Widespread availability of raw material resources
- Byproduct of globalized consumerism
- Ronja can exploit IKEA EMU 0507/0518 box
- Drilling templates speed up manufacture





“It's not anymore about the product. Now it's about the attitude.” (Stacy Peralta, Dogtown and Z-Boys, 2001)

Lucasvo holding prototype of bugfixed parallel console

Social aspects of UCT

- Age or education show not to be important for users or developer (I got no EE school)
- Breaks barriers
- Lot of fun with friends in the garage
- Modern autistic computer-addict lifts his ass from the computer and becomes a human again
- Consumption and power replaced by creativity

Humanistic aspects of UCT

- No more automaton conformist consumerism
- Both user and developer:
  - in control of the product
  - treated as fellow human, not exploited
  - individuality is respected (mailing list)
- More effective learning of technical subject than in school

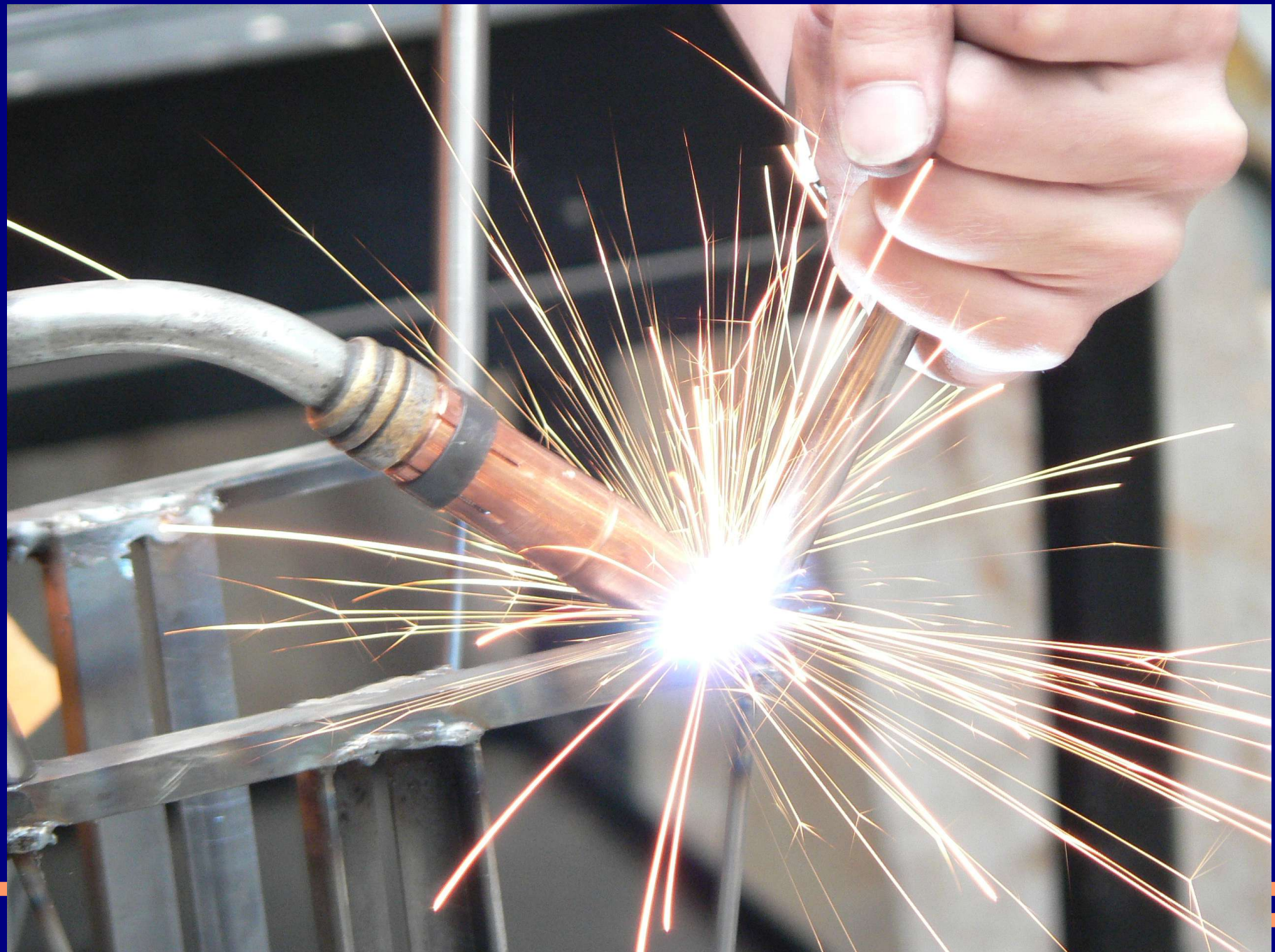
Project bottleneck

- 90% of delopment cost is time
- Est. 80% done by me, 20% by other developers
- Time dedication of main developer (=me)
- Currently ~1 hour/day
- 8 hours/day would be optimal
- New developers slow in beginning (low usability of free software tools, lack of experience)

Project future

- 3.0km range with Fogtown TX (right)
- 100Mbps
- 2$ cheap laser pointer measured BW of 1GHz
- Ideal for 1Gbps!

Welding the Fogtown prototype



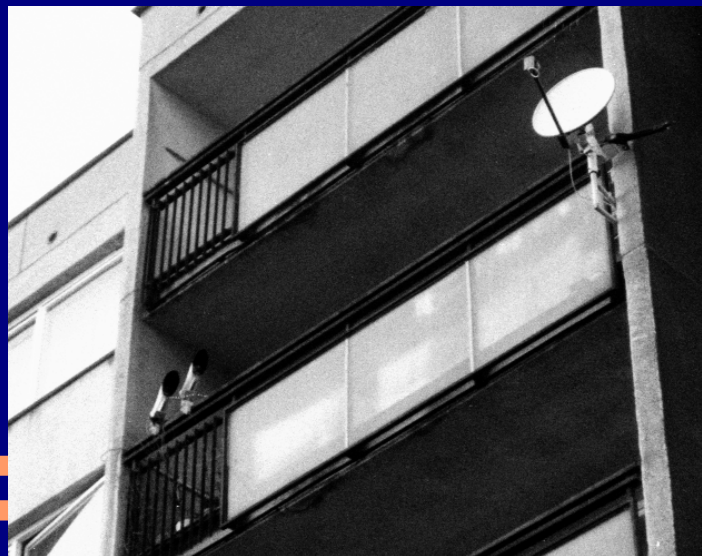

The
End

References

- http://ronja.twibright.com Ronja website
- K.Banke, C. Houghton: A Cheap and Simple Experimental Wide-Band Laser Link, http://www.earthsignals.com/add_CGC/hr/Wb_Las
- http://twibright.com Twibright Labs website

What about historic urban zones?

- Ronja can be concealed
  - Behind a window
  - Behind a chimney
- Ronja is smaller than a satellite dish



How to make multipoint with Ronja?

- More Ronjas have to be installed in one place
- No interference occurs

Definition of UCT

- UCT is Free Software concept generalized to technology
- 4 essential freedoms (taken from Stallman):
  - The freedom to use the device as you wish
  - The freedom to study the source documents and change it to implement what you wish
  - The freedom to manufacture and sell the device
  - The freedom to publish modified versions