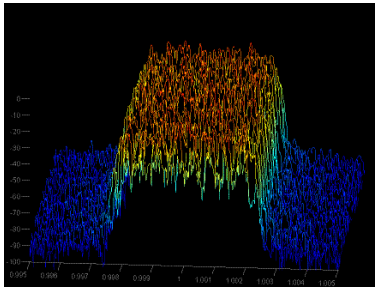
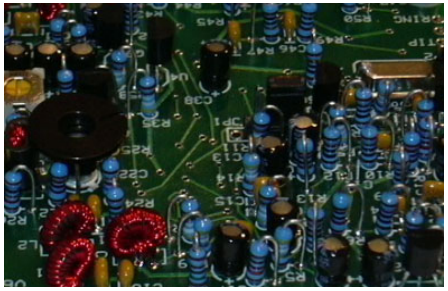
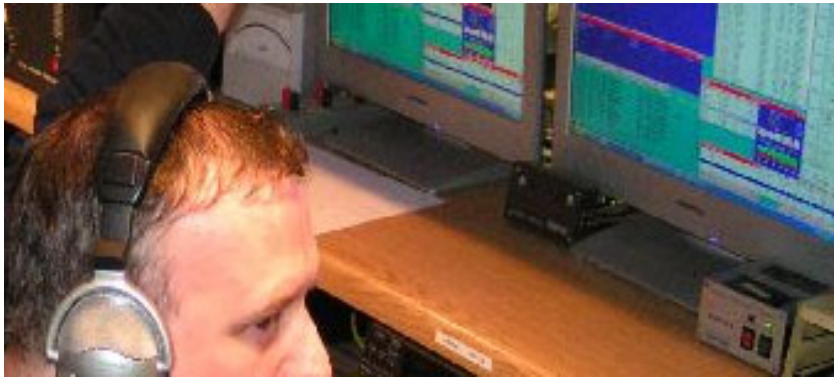






Software Defined Radio & Contesting

A new technology and its possibilites

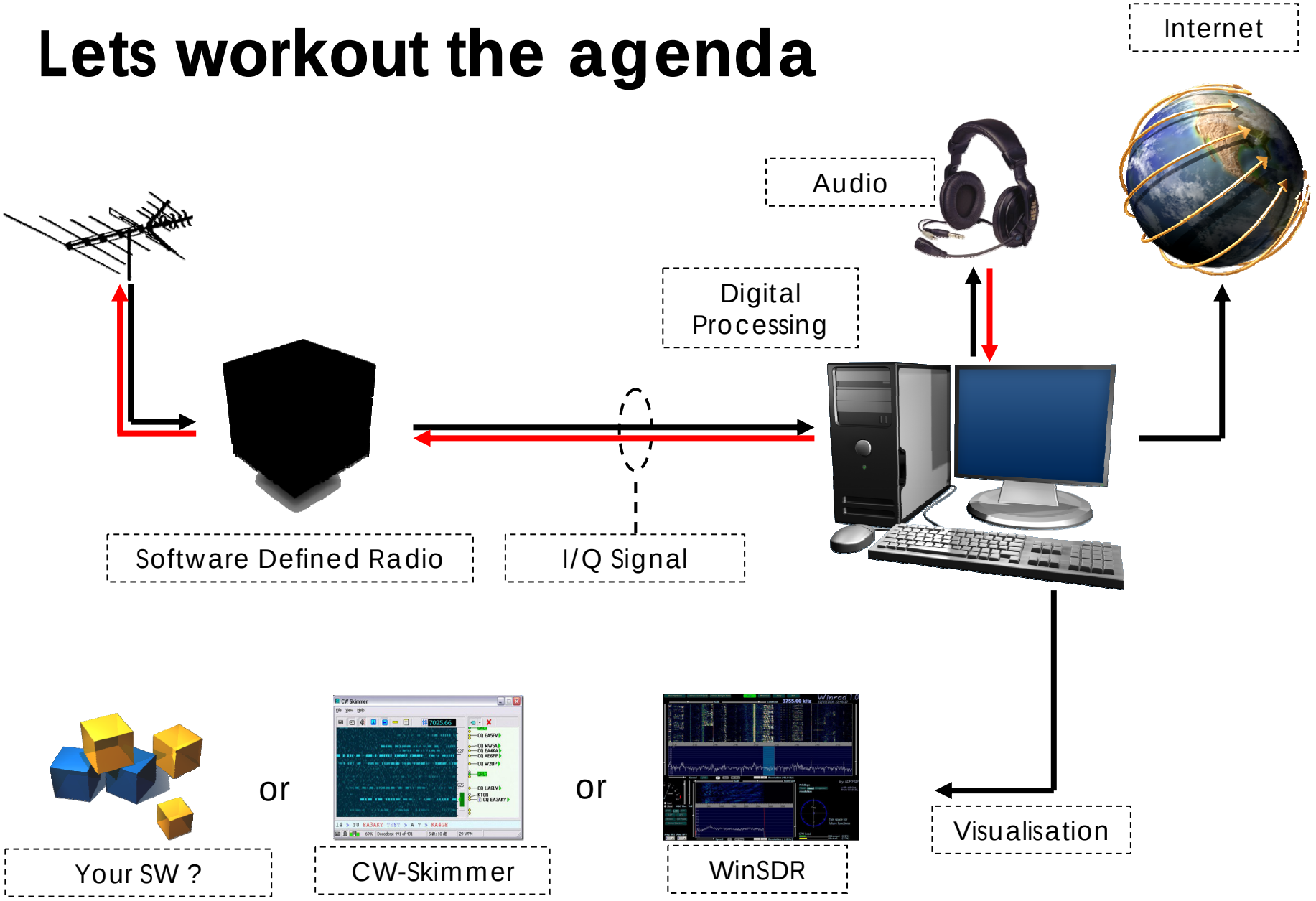
Tobias Wellnitz, DH1TW

Tobias@dh1tw.de

Friedrichshafen

June 2008

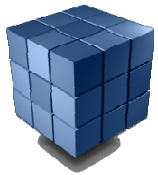
Lets workout the agenda



Agenda

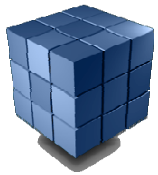
- Software Defined Radios
- Digital Processing (PC)
- Internet
- Contest Applications
- Conclusions

Agenda



- **Software Defined Radios**
  - **Top Level Drivers**
  - **Direct Down Down Converter (DDC)**
  - **Quadrature Sampling Detector (QSD)**
  - **Performance**
- Digital Processing (PC)
- Internet
- Contest Applications
- Conclusions

SDR – Top level drivers

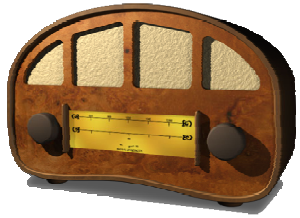


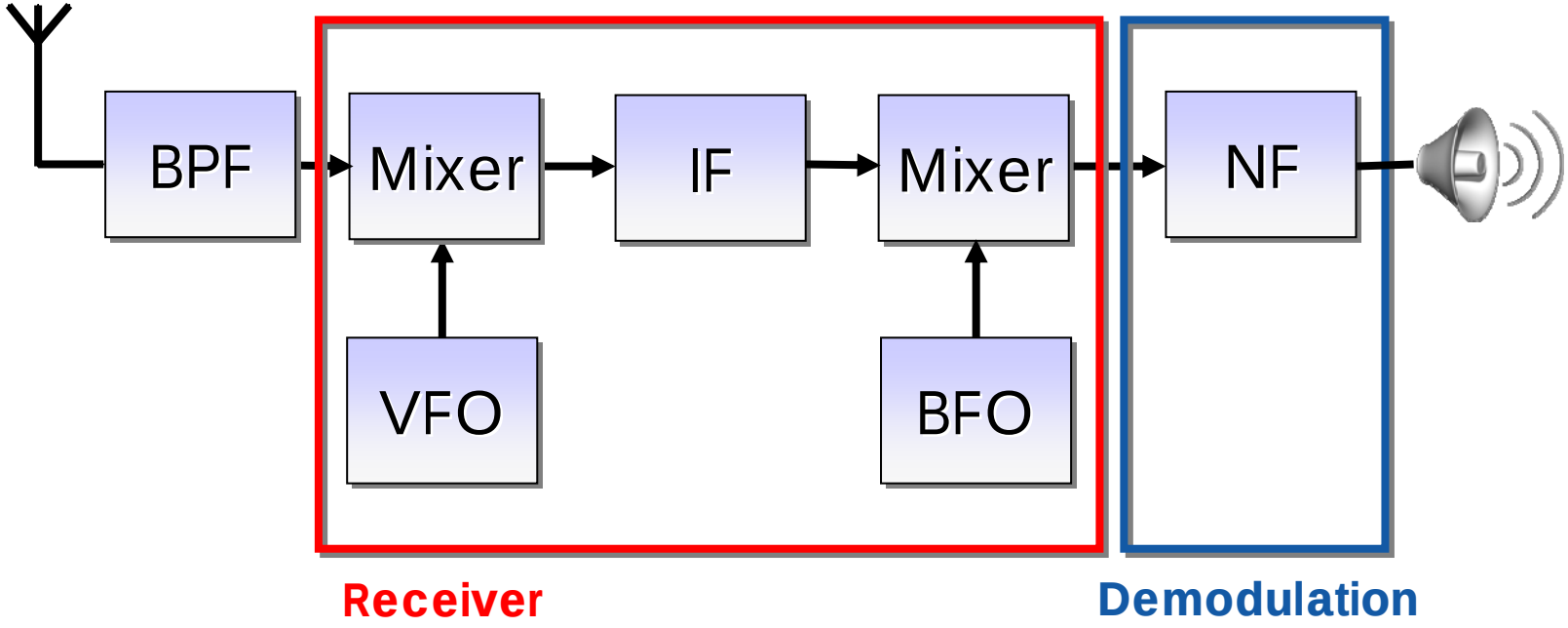
Why are SDRs so interesting ?

- High Performance BDR / IP3
- 99% of signal path is in the digital domain
- Very big baseband bandwidth (today already up to 800kHz)
- Software is defining the receiver
  - Digital filtering
  - Arbitary modes (SSB, PSK, CW, AM, DRM..)
- Attractive price

Variety of SDR

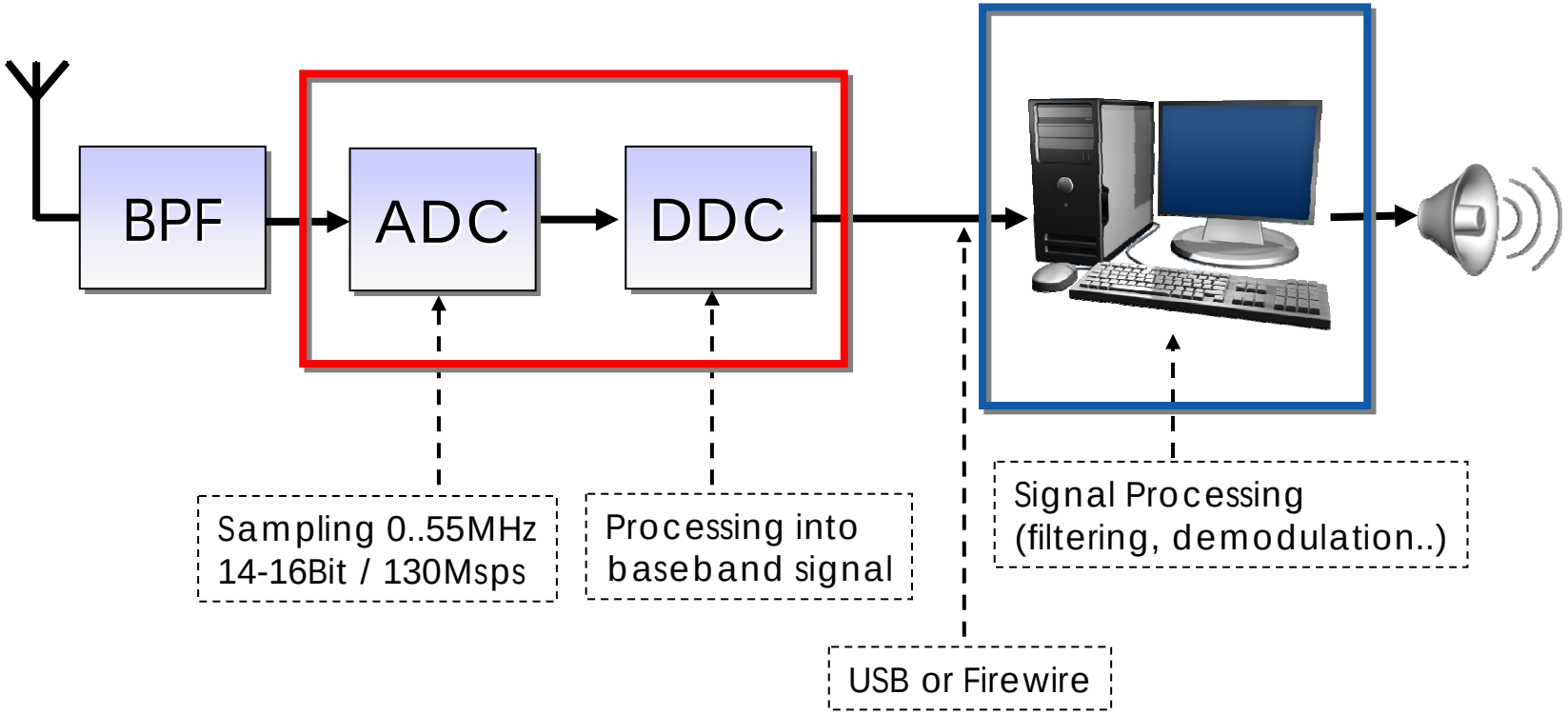
Classic Analog Receiver (Simplified)





Variety of SDR

Digital Down Converter (DDC)



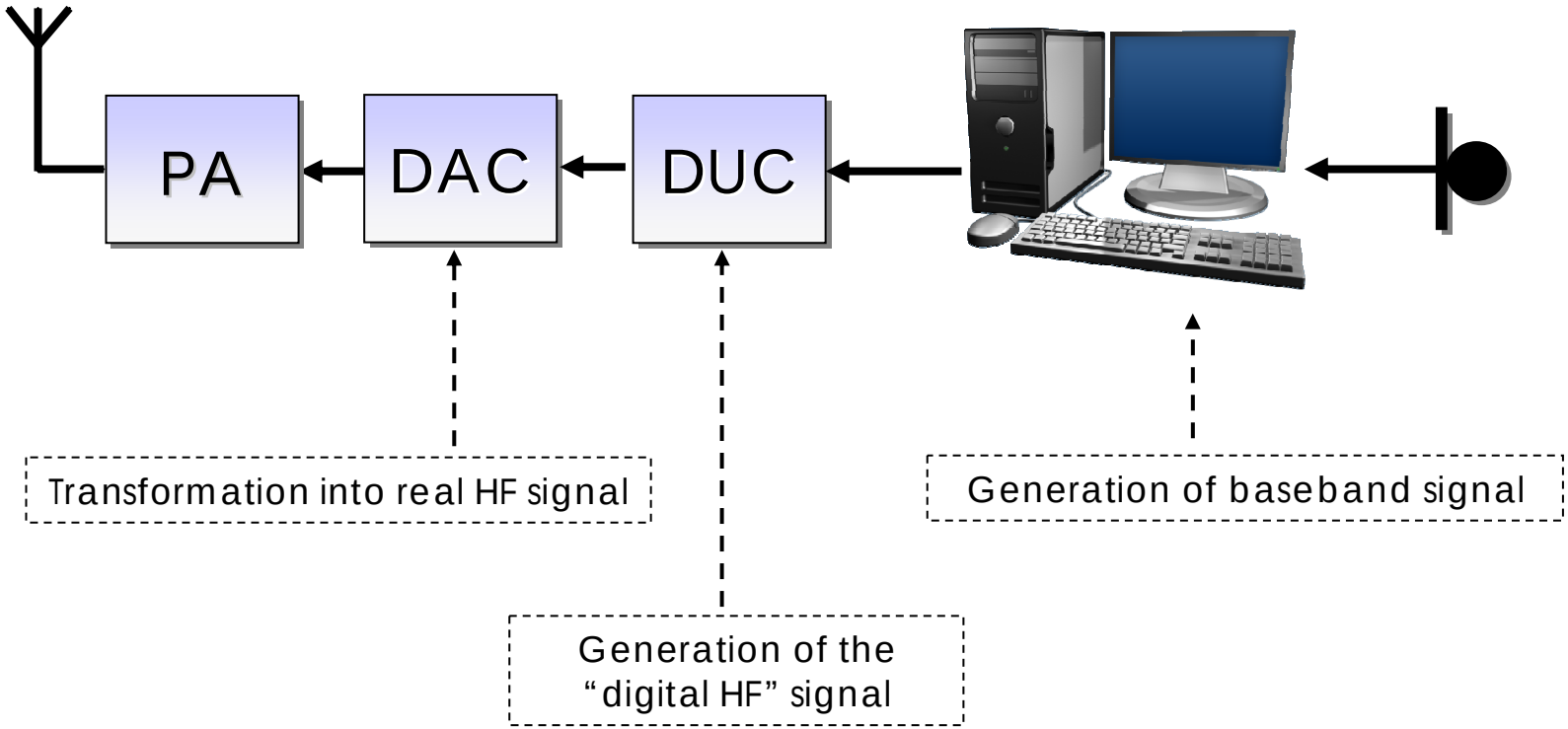
Characteristics:

- About 100dB Dynamic Range
- Up to 800kHz Bandwidth

10 Minutes recording
@400kHz = 1,76Gbyte

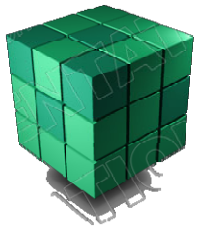
Variety of SDR

Digital Up Converter (DUC)



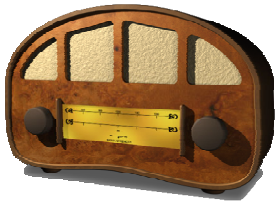
Variety of SDR

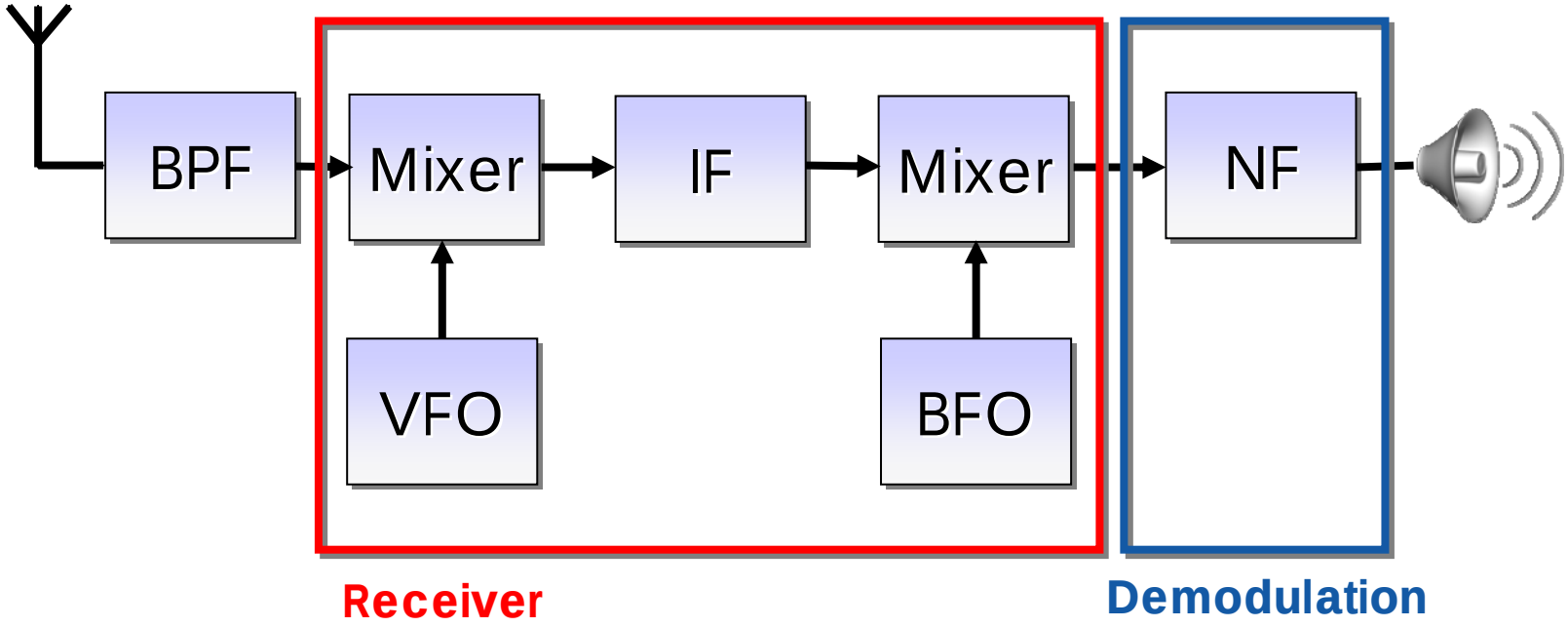
DDC Receivers / DUC Transceiver

Product	Type
	**Perseus** Receiver from 10kHz - 30MHz
	**SDRIQ / SDR14** Receiver from 500Hz - 30MHz
 ADT-200A	**ADT-200A** Full SDR transceiver RX: 10kHz - 30MHz TX: 1,8MHz – 29,7MHz

Variety of SDR

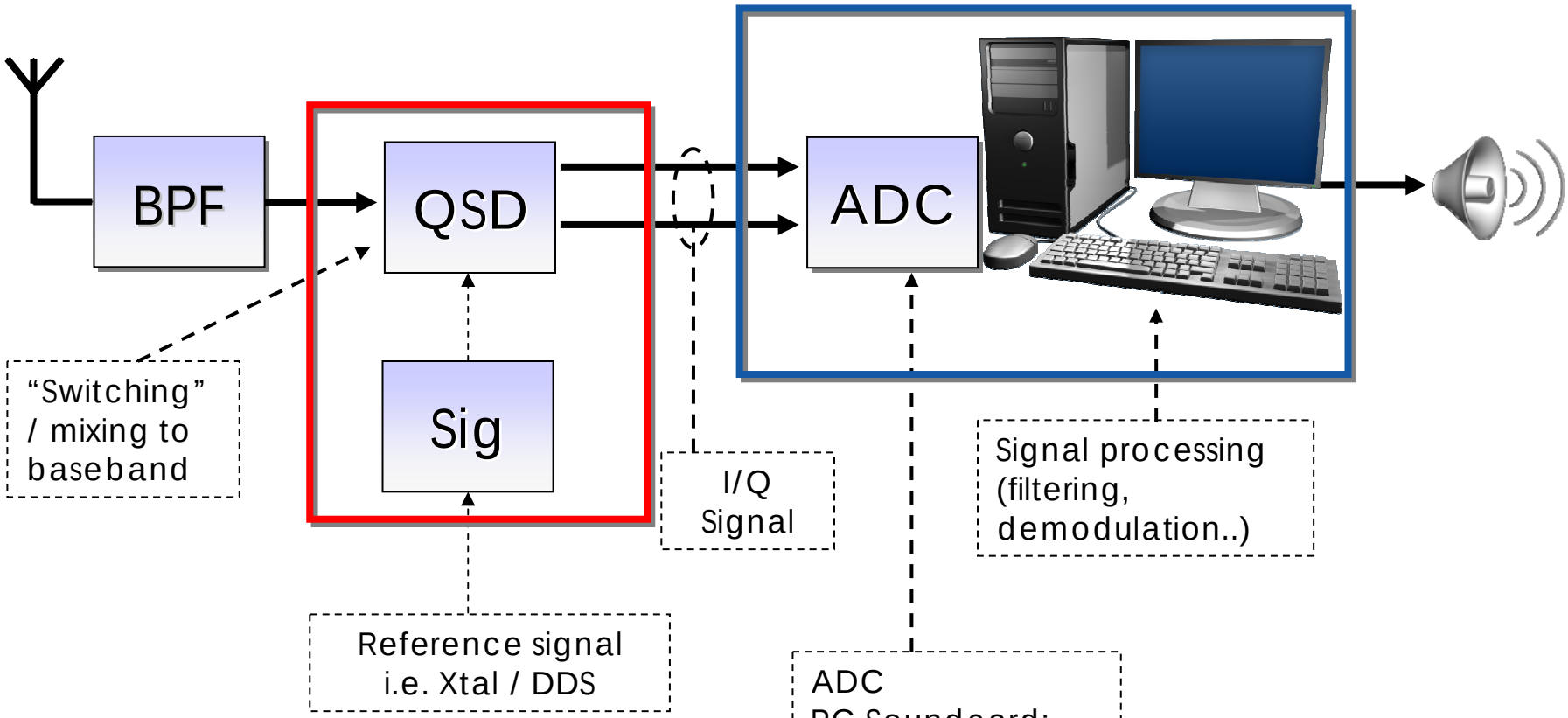
Classic Analog Receiver (Simplified)





Variety of SDR

Quadrature Sampling Detector (QSD)

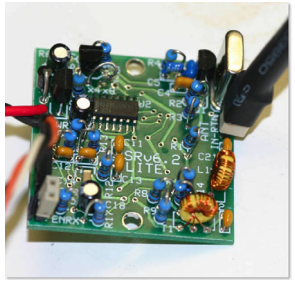
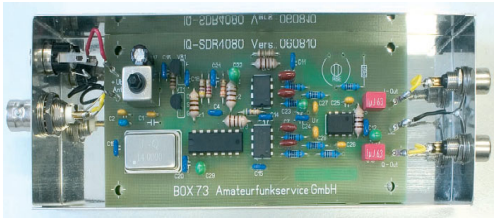


Characteristics:

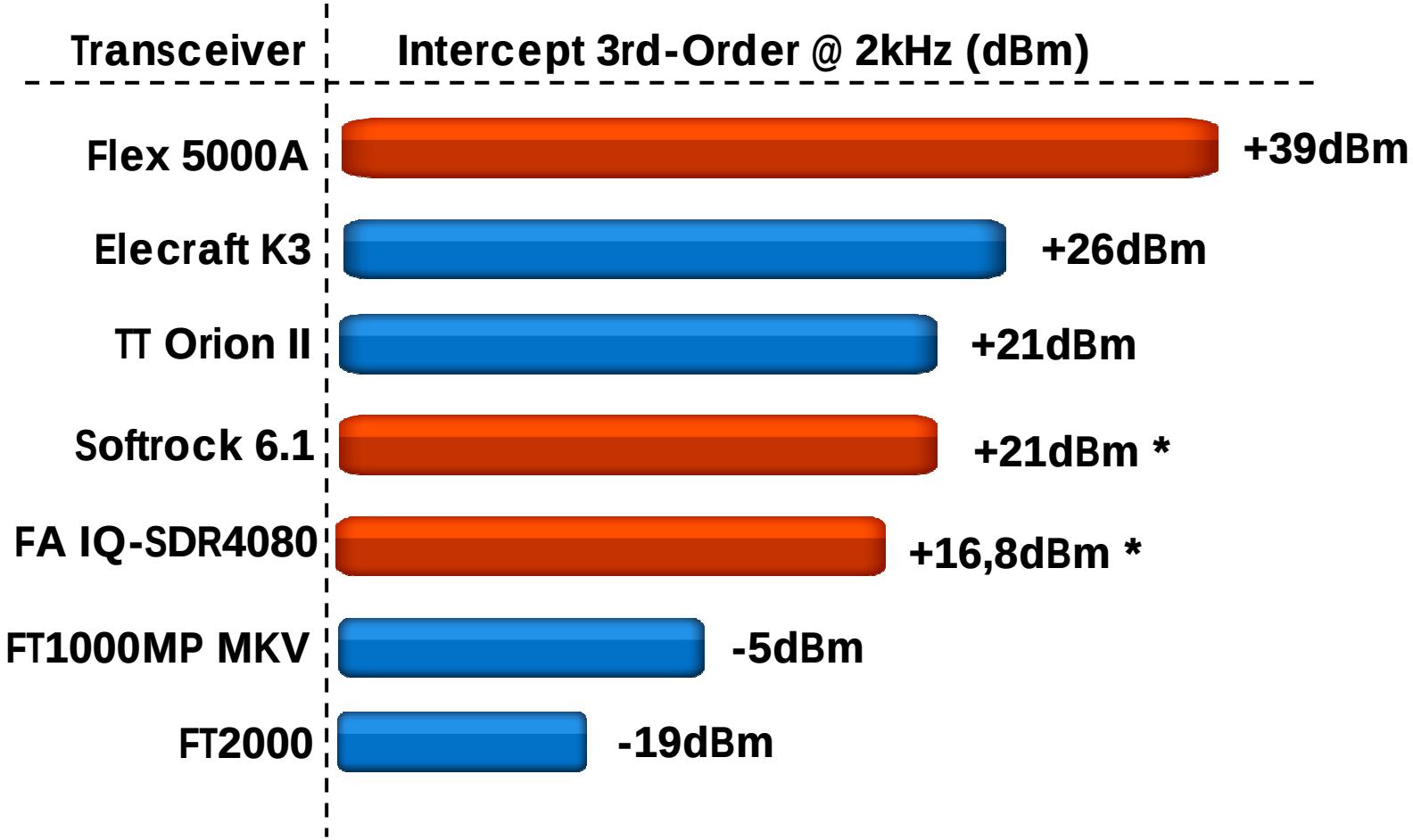
- About 100dB Dynamic Range
- Up to 192kHz Bandwidth

Variety of SDR

QSD Receivers / QSD Exciter

Product	Type
	**Softrock Kits** Receiver / transmitter mostly singleband 80m / 40m / 20m…
	**Funkamateur Kits** Receiver singleband 80m / 40m / 6m
	**Flex 5000A** Full SDR transceiver 160m – 6m

Performance of SDR



Measurements made by ARRL Test Lab

* Measurements made Dr. Bodo Scholz, DJ9CS

Agenda

- Software Defined Radios
- **Digital Processing (PC)**
  - **Hardware**
  - **Software**
  - **Human Machine Interface (HMI)**
- Internet
- Contest Applications
- Conclusions

Digital Processing - Hardware

Soundcard

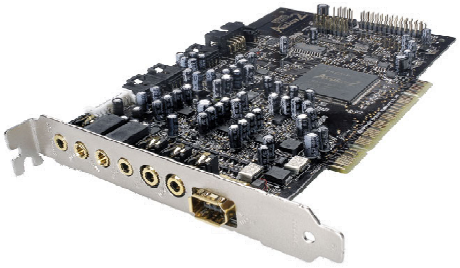
Soundcard defines the SDR's performance!

Recommended: 24Bit / 96kHz – 192kHz

Price Value: Soundblaster Live! 24 (external)

High End: M-Audio Delta 44 / Edirol FA-66

Stereo Linein for I/Q signal needed



Personal Computer

Digital processing is task of the PC

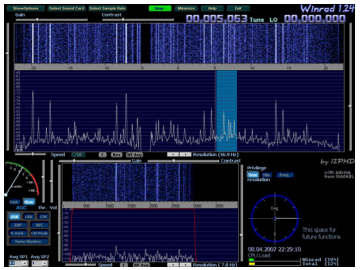
The more CPU and Ram the better

Recommended: Dual Core CPU / 2GByte RAM

Digital Processing - Software

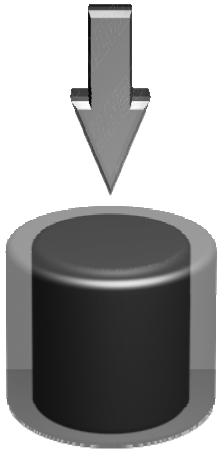
Audio

- Shape your own filters
- All modes are available
- Listen to various band segments in parallel



Visualisation of the Bands

- “See” if there is any activity on the bands
- Find a free frequency
- Identify jammers and key-clickers



Harddisk

Record whole Bandsections to disk

- Post Contest / DX analysis
- Evaluation of software / filters / algorithms
- Objective proof if someone is “clicking”

Digital Processing – Radio Control

Radio Control

Classic approach would be a 1:1 copy of the transceivers User Interface (UI)

..but, the mouse slows down everything so much…

Contester need efficient controls 

Digital Processing – HMI

SDRs give flexibility in the Design of the Human Machine Interface (HMI)

Griffin Powermate VFO

Shuttle Pro Rig Control

Herkules DJ Console
USB API available!

Design your own Interface

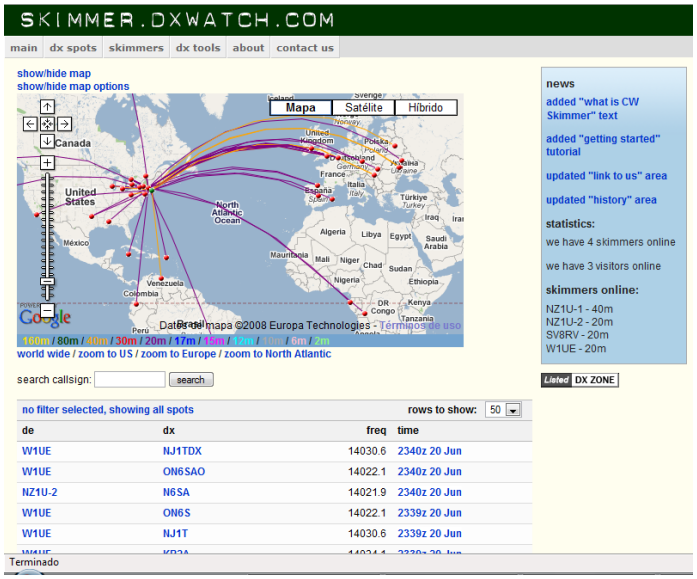
Agenda

- Software Defined Radios
- Digital Processing (PC)
- **Internet**
  - **WebSDR**
  - **Reverse Beacon Project**
- Contest Applications
- Conclusions

Internet – Reverse Beacon Project

DX Cluster based on heard Signals around the world

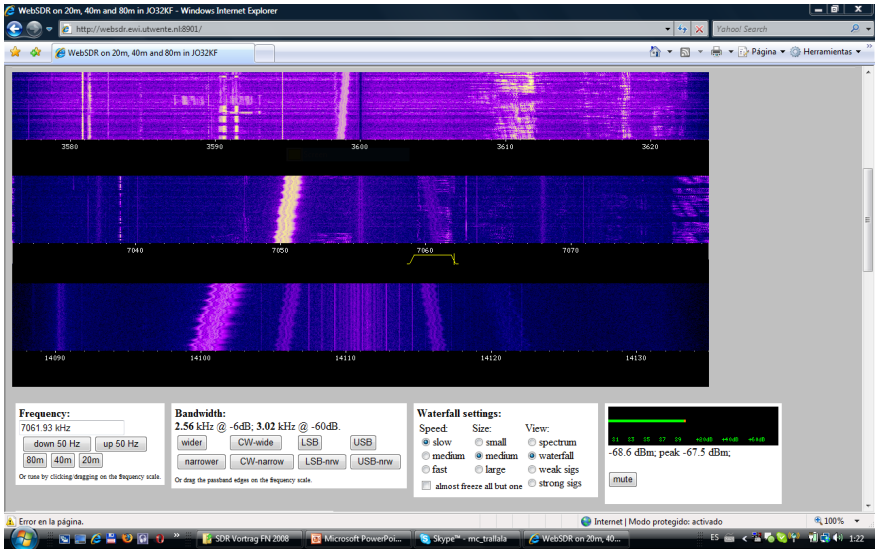
- Privately operated SDR receivers located around the world
- Signals automatically decoded by CW Skimmer
- Everybody is invited to participate!
- http://skimmer.dxwatch.com



Internet - WebSDR

Web based Receiver for 80m, 40m and 20m

- Audio and visual (Waterfall) display
- Selectable modulation
- Individual ajustable bandwidth
- Latency of less than 0,5 sec
- http://websdr.ewi.utwente.nl:8901/



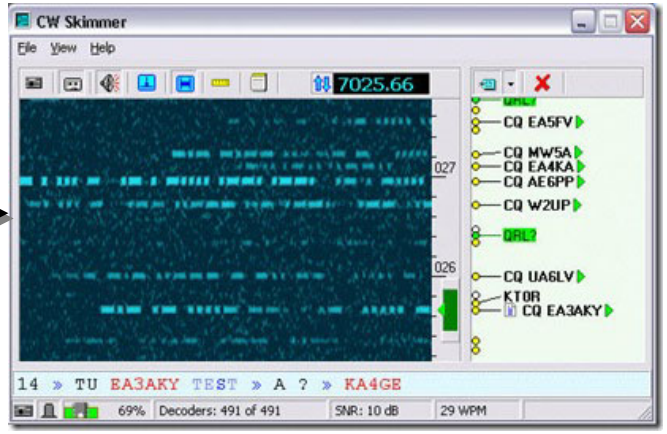
Agenda

- Software Defined Radios
- Digital Processing (PC)
- Internet
- **Contest Applications**
  - **SDR Hybrid / IF Modification**
  - **Electrical Antenna Beam Stearing**
  - **IP Based Signal Distribution**
- Conclusions

Contest Appl. – SDR Hybrid

Tap the IF Signal with an SDR

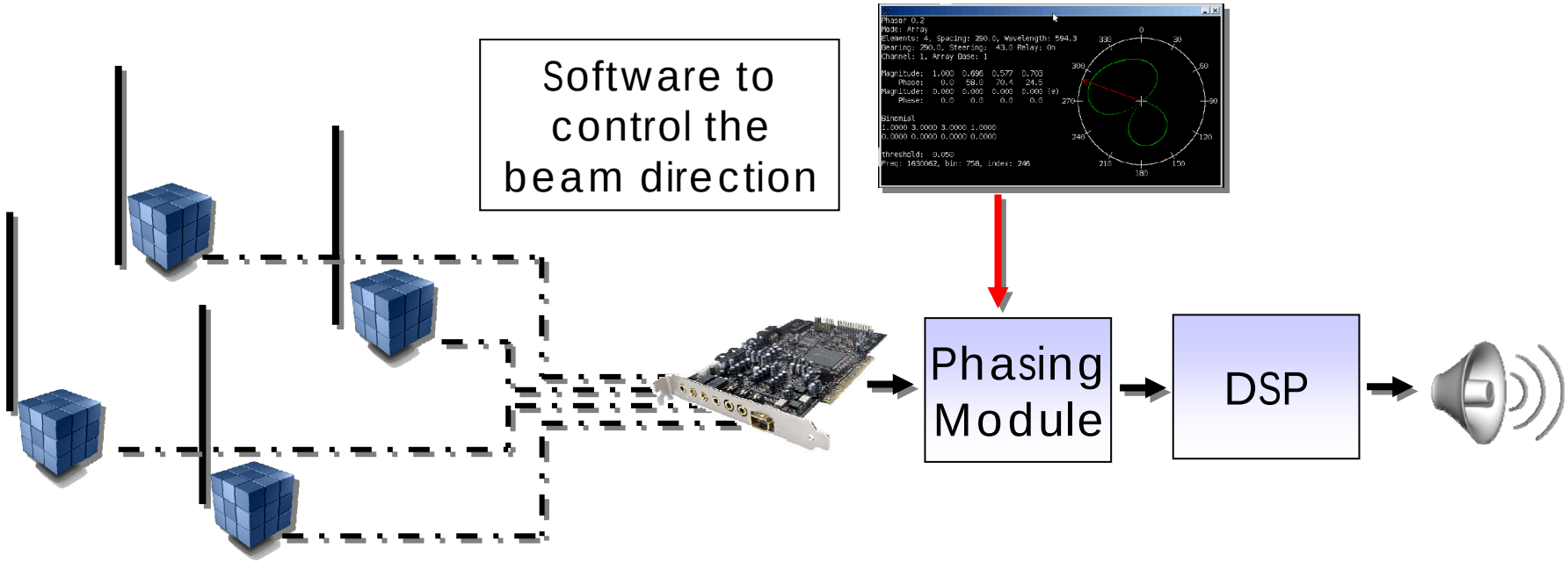
- Enjoy a 20 – 100kHz bandscope
- Softrock / “Funkamateur” IF-Kits available
- Various modifications available in the internet
- Modern transceivers already prepared
  (Orion, K3, FT2000, FT950..)



Contest Appl. – Beam Stearing

Stear your Antennas Electrically

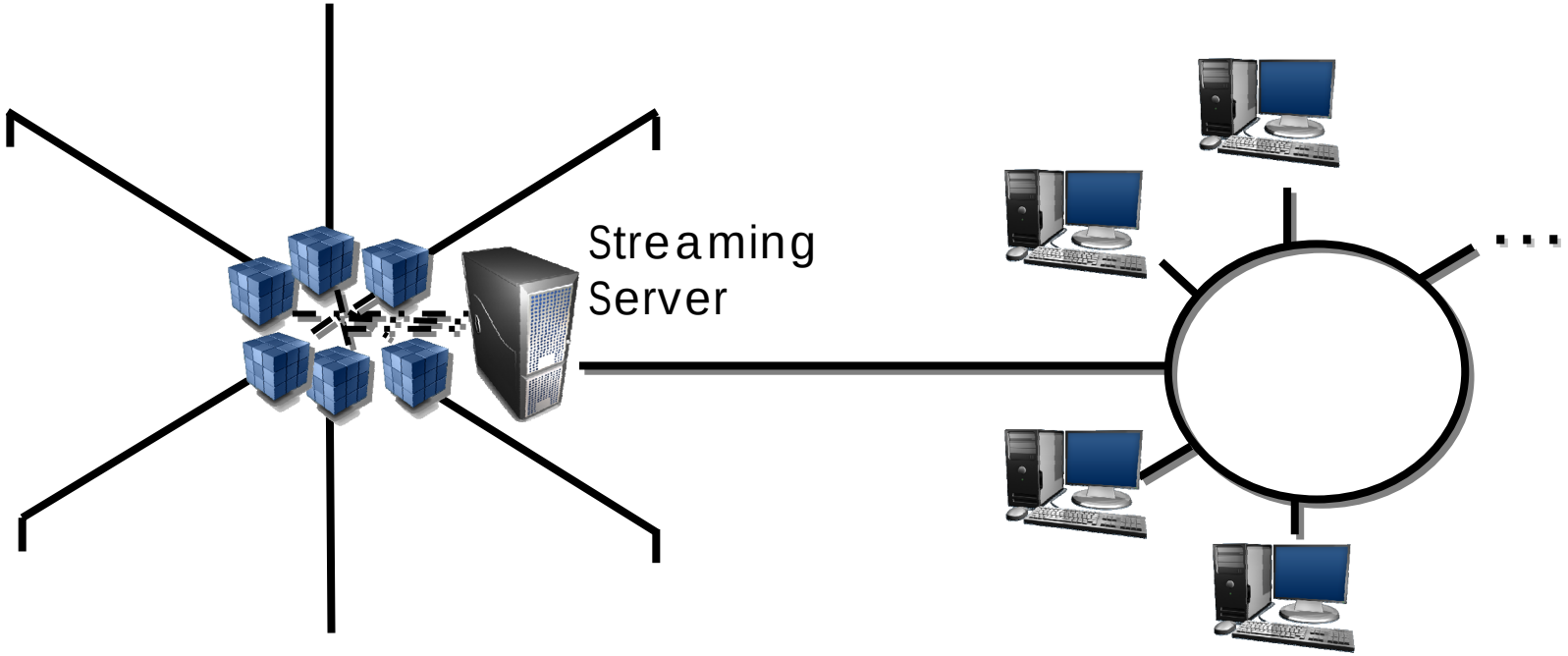
- Several receiving antennas (i.e short verticals) necessary
- Softrock receivers at the base of each antenna
- Shaping beam with digital baseband signals in phasing module
- K1LT – presentation at Dayton 2008



Contest Appl. – Signal Distribution

Distribute the Beverage signals via IP stream

- Dealing with NF instead of HF make things easier
- Independent number of clients / receivers
- “See” from which direction you are being called

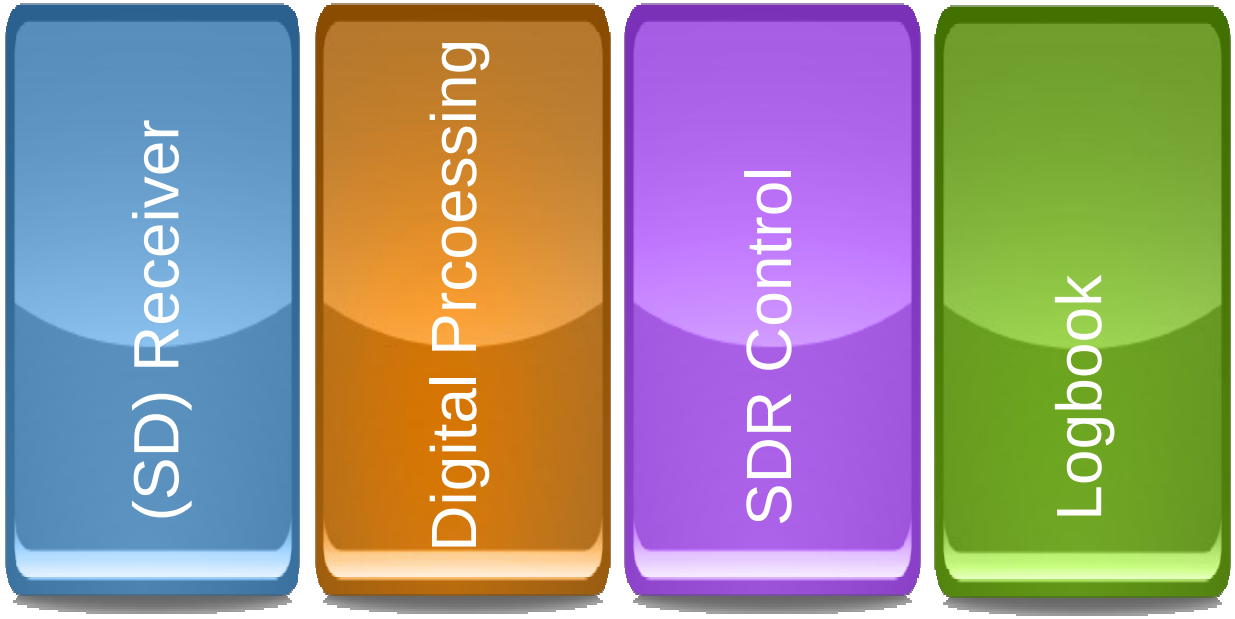


Agenda

- Software Defined Radios
- Digital Processing (PC)
- Internet
- Contest Applications
- **Conclusions**

Conclusions

Think in terms of **Service Oriented Architecture (SOA)**



- Modules work independent of each other
- Modules don’t have to be at the same location
- **Definition of Standard Interfaces needed!**

Conclusions

- SDR Receivers offer high performance
- SDR makes homebrewing RIGs again interesting
- SDR offer a whole new world of applications
- Everybody can start with SDRs for very little money

Future has already started!

Abbreviations

ADC	Analog to digital converter
AM	Amplitude modulation
BDR	Blocking dynamic range
BFO	Beat frequency oscillator
BPF	Band pass filter
CPU	Central processing unit
CW	Continuous wave
DAC	Digital to analog converter
DDC	Direct down converter
DDS	Direct digital synthesis
DRM	Digital radio mondiale
DSP	Digital signal processor
DUC	Direct up converter
HMI	Human machine interface
IF	Intermediate frequency
IP	Internet protocol
IP3	Intercept point 3rd order
I/Q	Inphase / Quadrature
NF	Low frequency
PA	Power amplifier
PC	Personal computer
PSK	Phase shift keying
QSD	Quadrature sampling detector
RX	Receiver
SDR	Software defined radio
Sig	Signal generator
SSB	Single side band
TX	Transmitter
UI	User interface
USB	Universal serial bus
VFO	Variable frequency oscillator
Xtal	Crystal oscillator