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An Universal Framework for Scalable Software Defined or Cognitive Radios Running on Desktop Computers

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Outline

1. Motivation
2. State of the Art
3. New Framework
4. Results
5. Conclusions

Motivation

1. Implementing an universal broadcasting receiver running on desktop computers

2. But only simple broadcasting services with narrow output bandwidths can be realized on current desktop computers

How can we realize more complex receivers which can ensure real-time execution on different kinds of desktop computers?

A new universal scalable software defined radio framework

State of the Art

1.Software Defined Radios on Desktop Computers (incl. Multi-Threading)

- GNU Radio
- Open-DVB or Soft-DVB
- e.g. WinRadio, PowerSDR, SDRadio, Dream and Diorama
- etc.

2.Extended Hardware Scalable Systems (using (GP)GPUs, FPGAs, etc.)

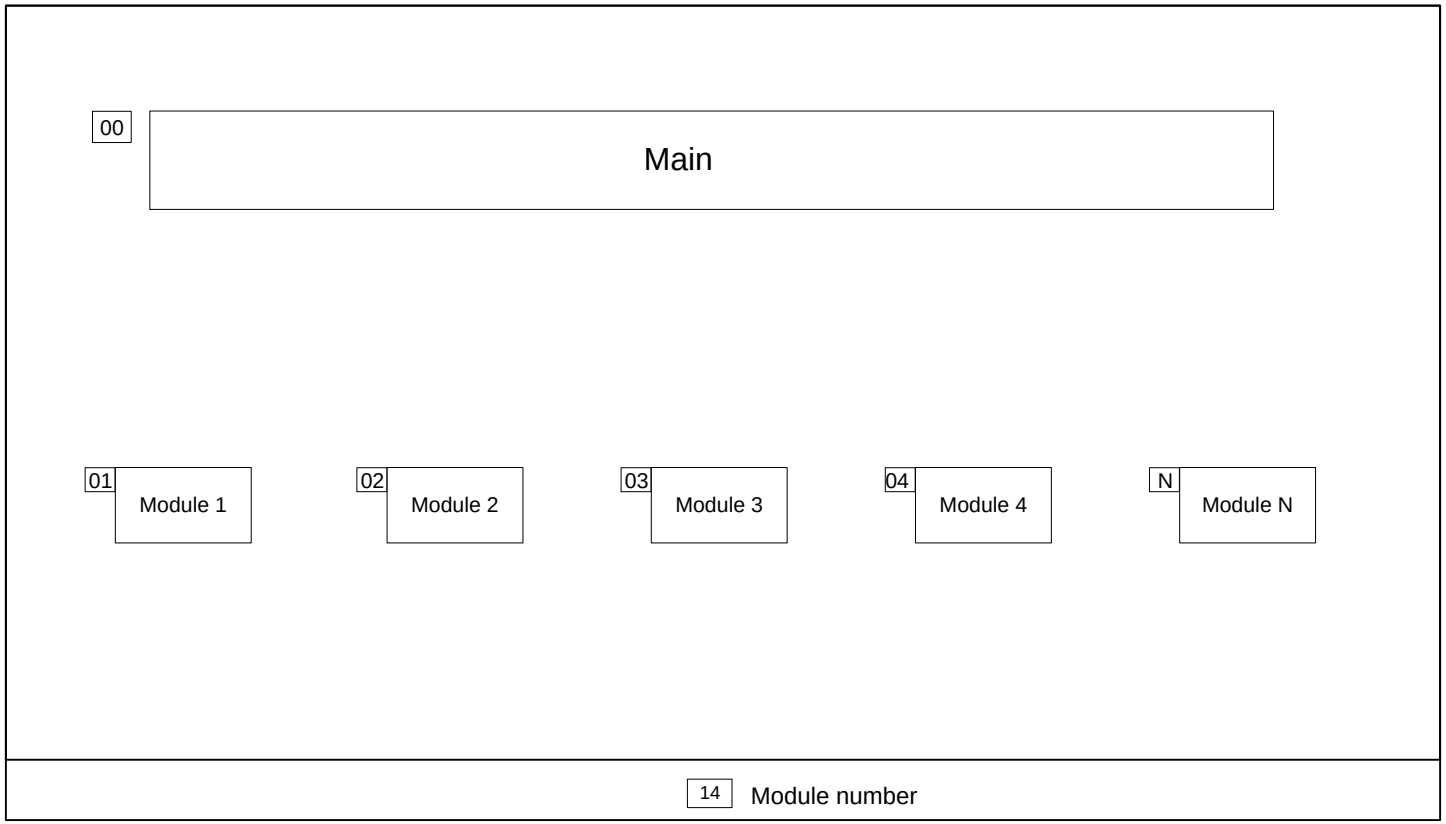
- Projects at Carnegie Mellon School of Computer Science
- SAIC - ”Science Applications International Corporation”

3.Software Resource-Quality Scalable Systems

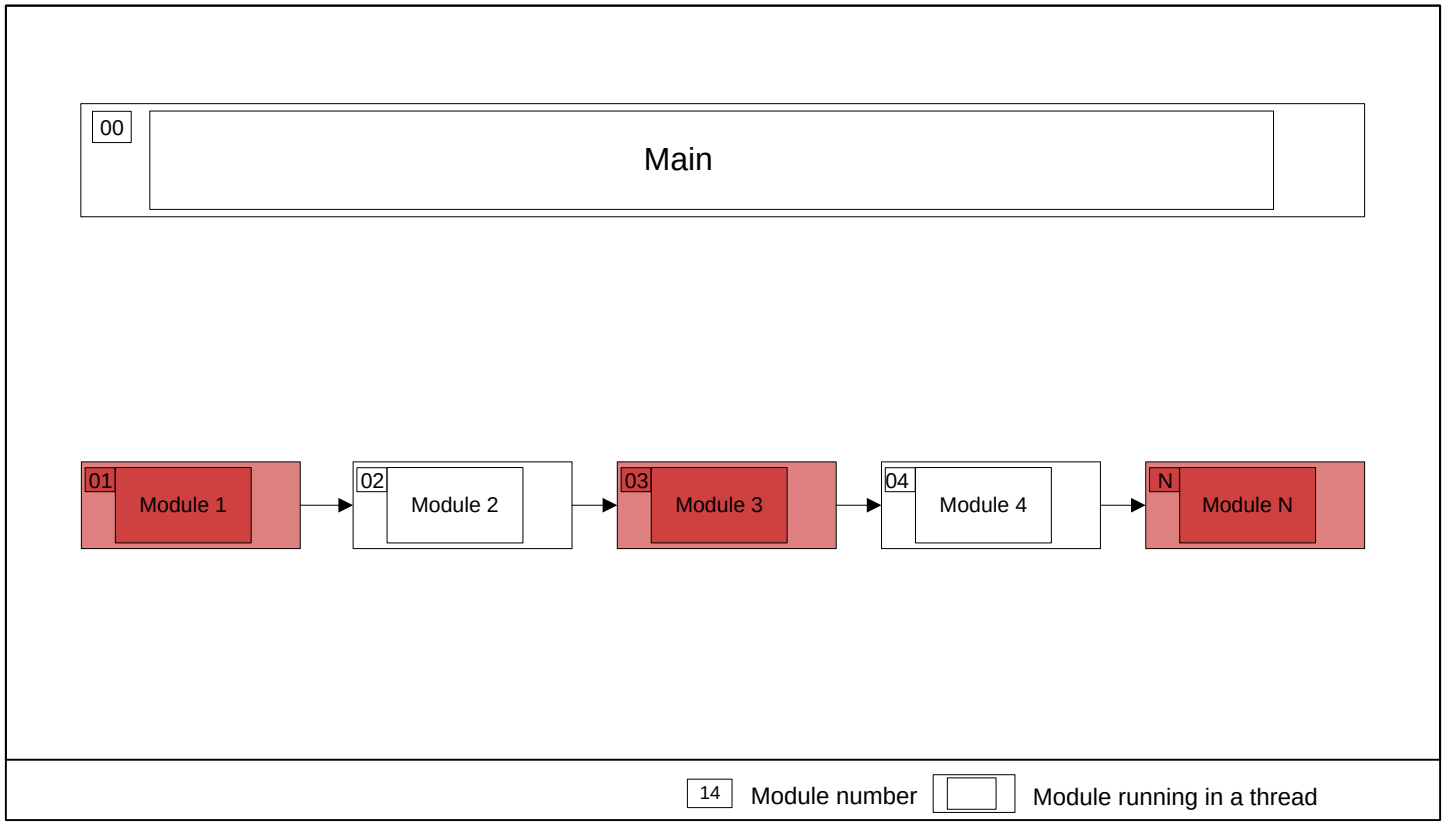
- No solution available

A combination of all three concepts is unknown!

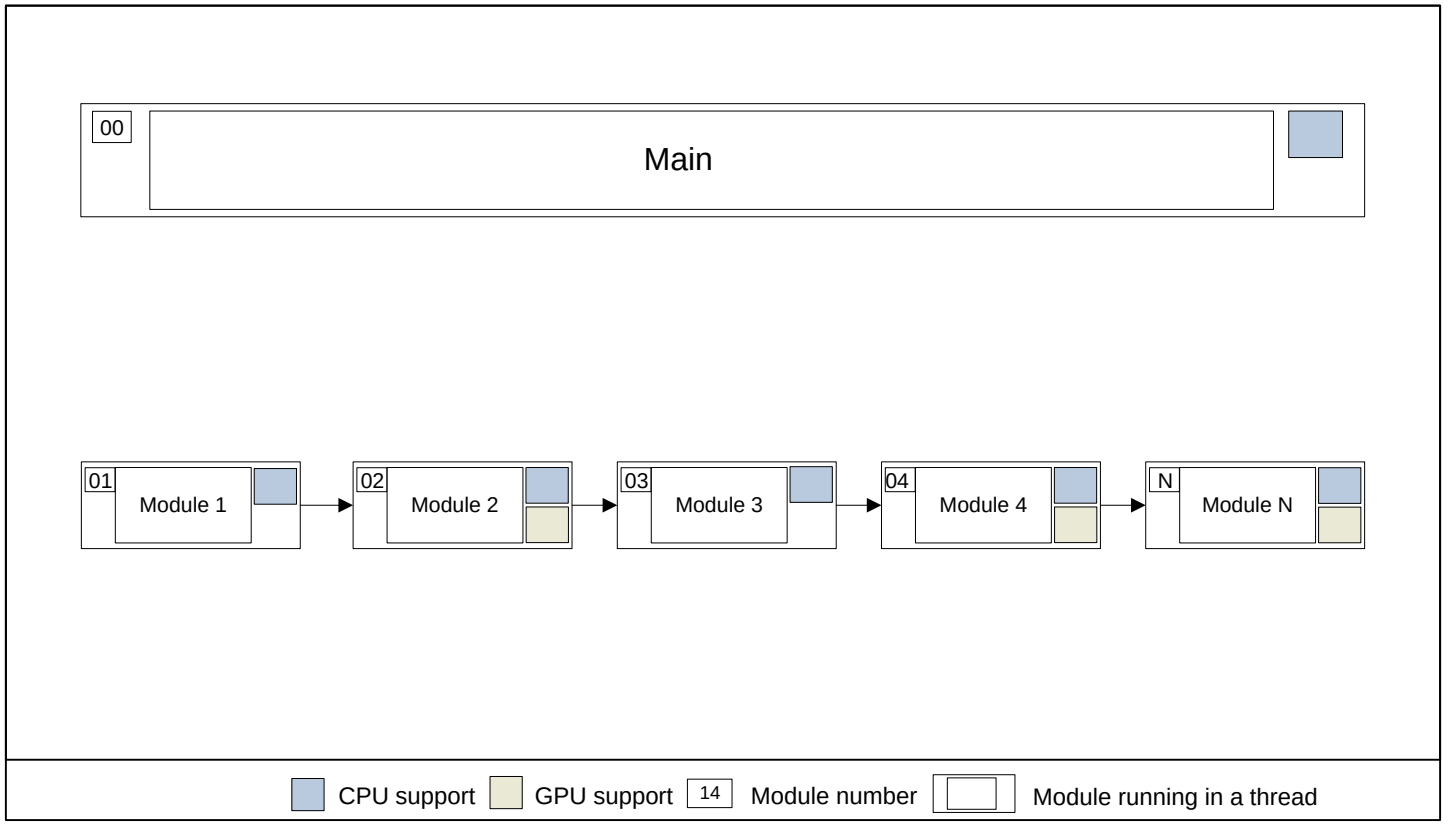
New Framework (1/2)



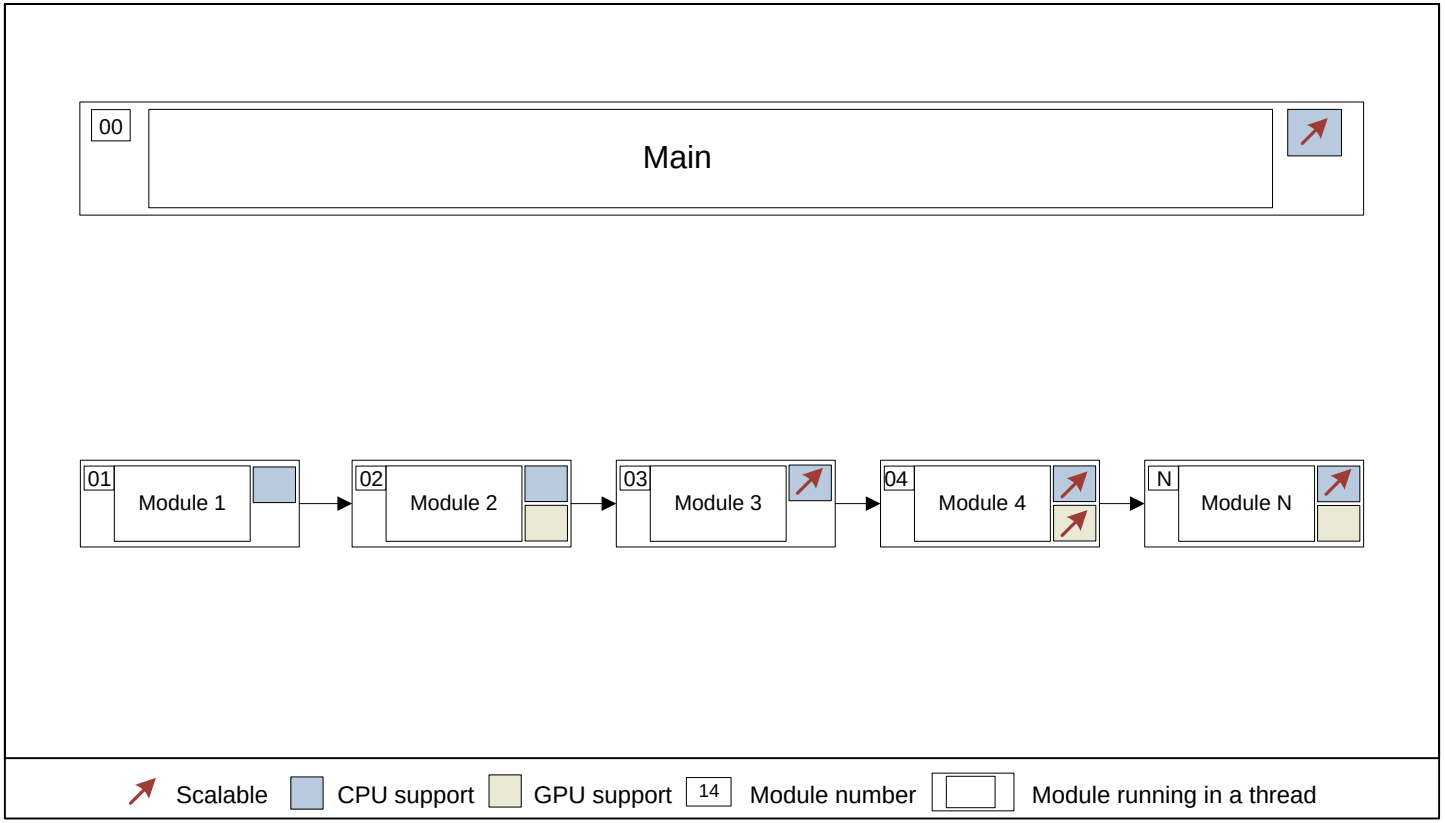
New Framework (1/2)



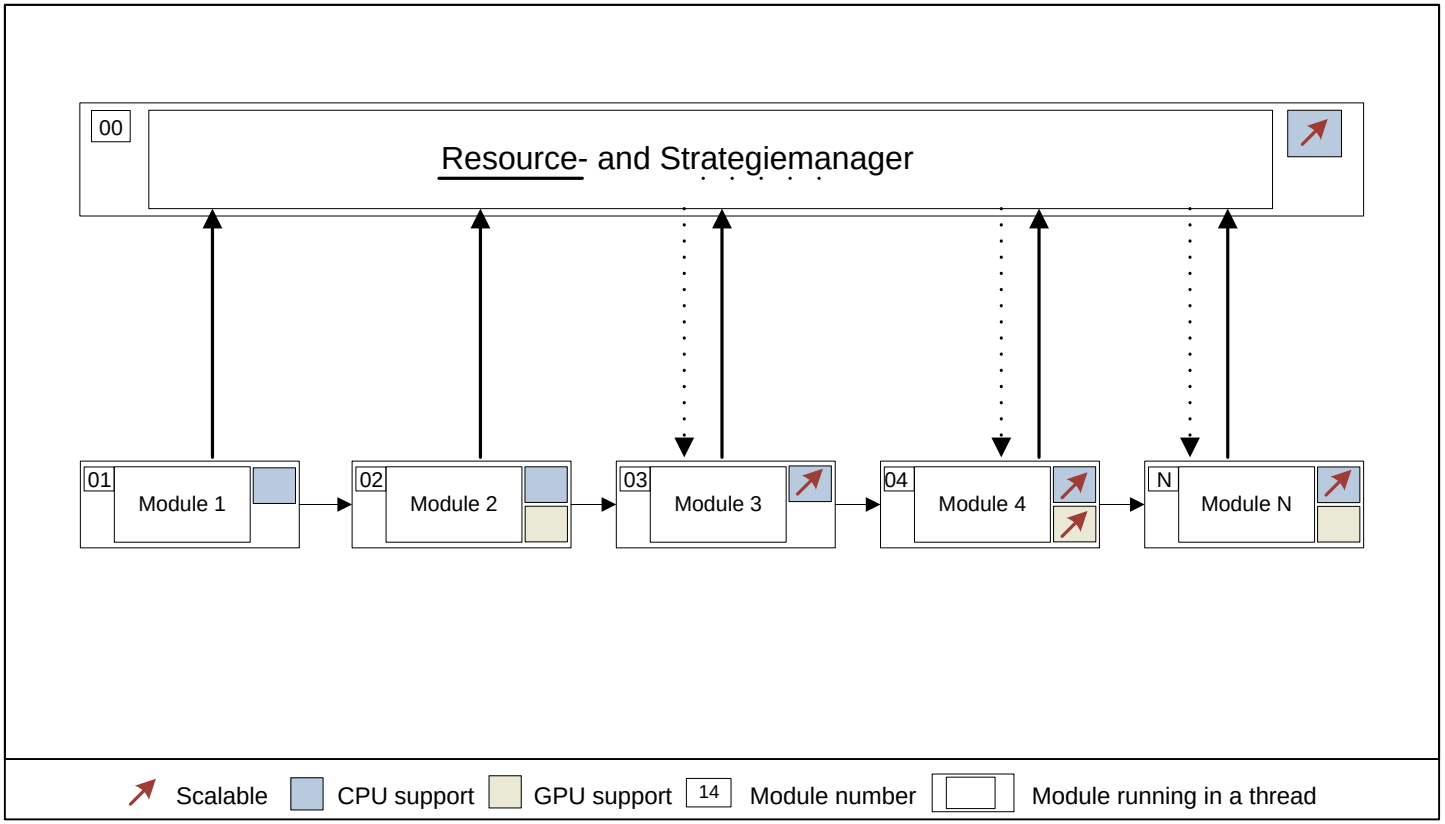
New Framework (1/2)



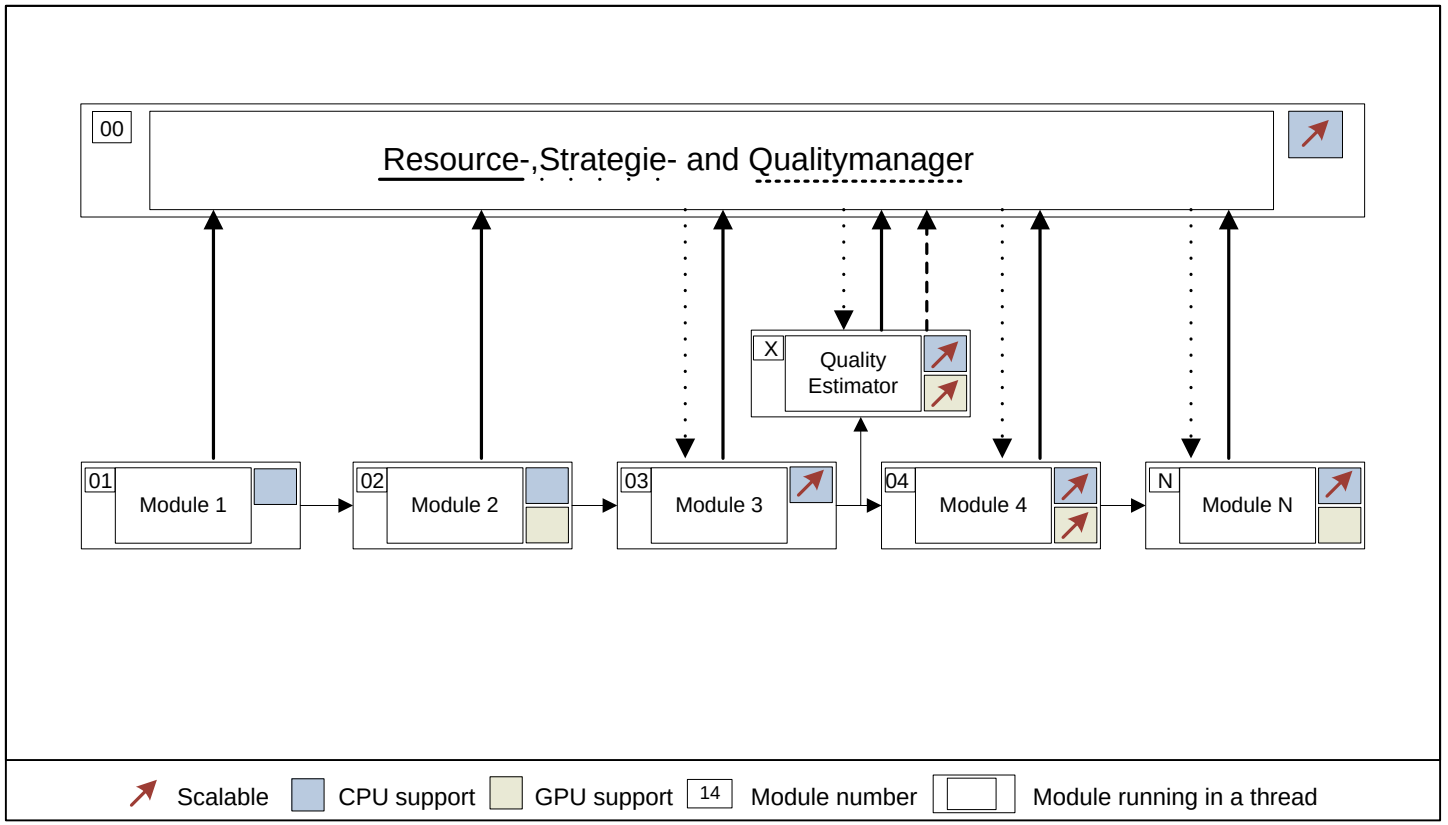
New Framework (1/2)



New Framework (1/2)



New Framework (1/2)



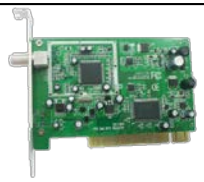
New Framework (2/2)

Antenna

Cable

ADC
+ I/Q-Tuner

USRP2



PCI-Board

ADC
+ Low IF-Tuner
+ I/Q-Tuner
+ ATV-Decoder

„PhiloRadio“ - SDR

Features:
- Multi-Threading-Support
- Ext. Hardware scalable
- Software scalable
- Script based

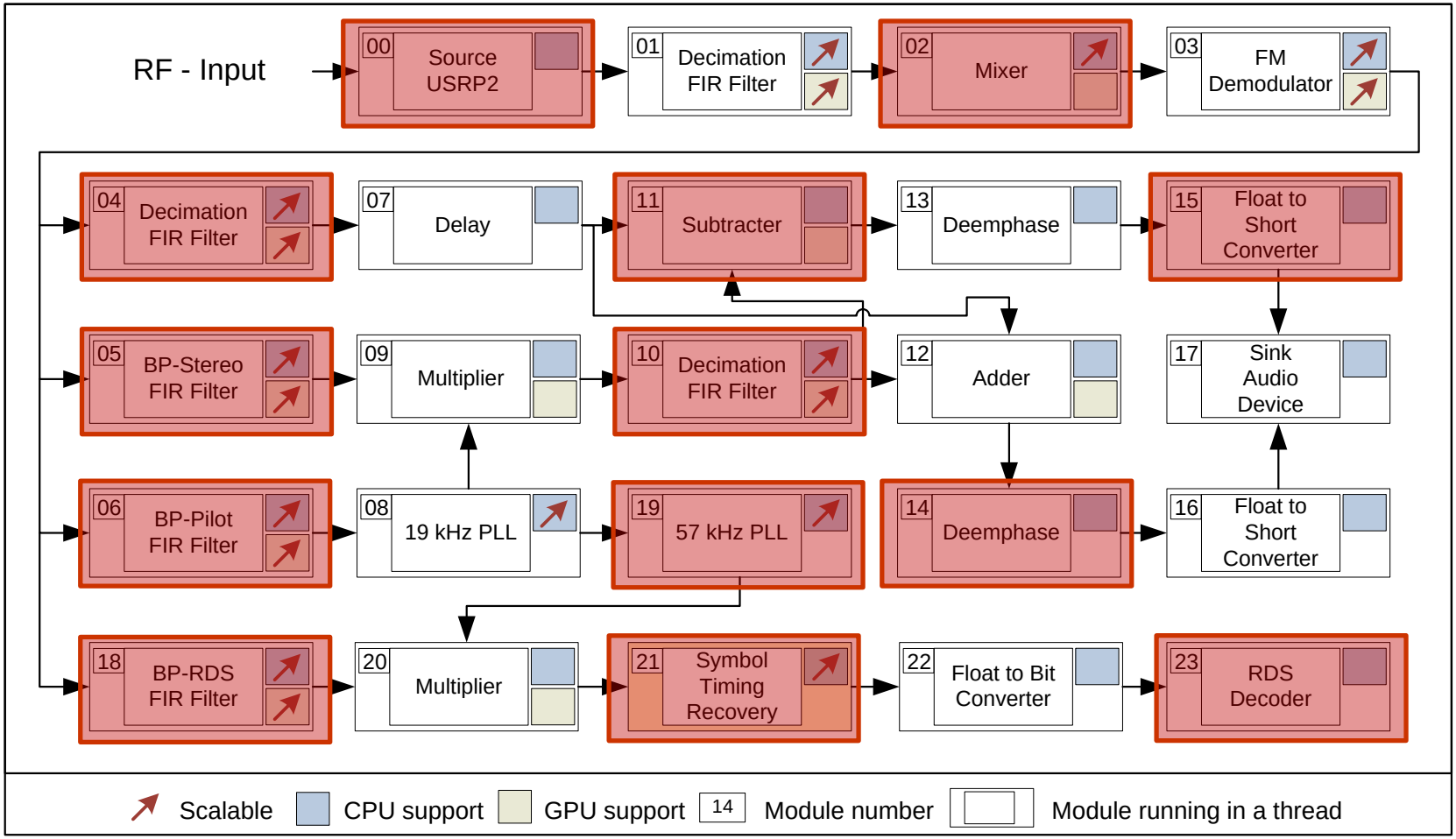
Libraries:
- Intel® MKL/IPP
- SFML
- wxWidgets
- NVIDIA CUDA™
- Boost
- Smartheap

Tools:
-Intel® C/C++ Compiler
-Intel® V-Tune
-Matlab® and Simulink®
-GNU Octave

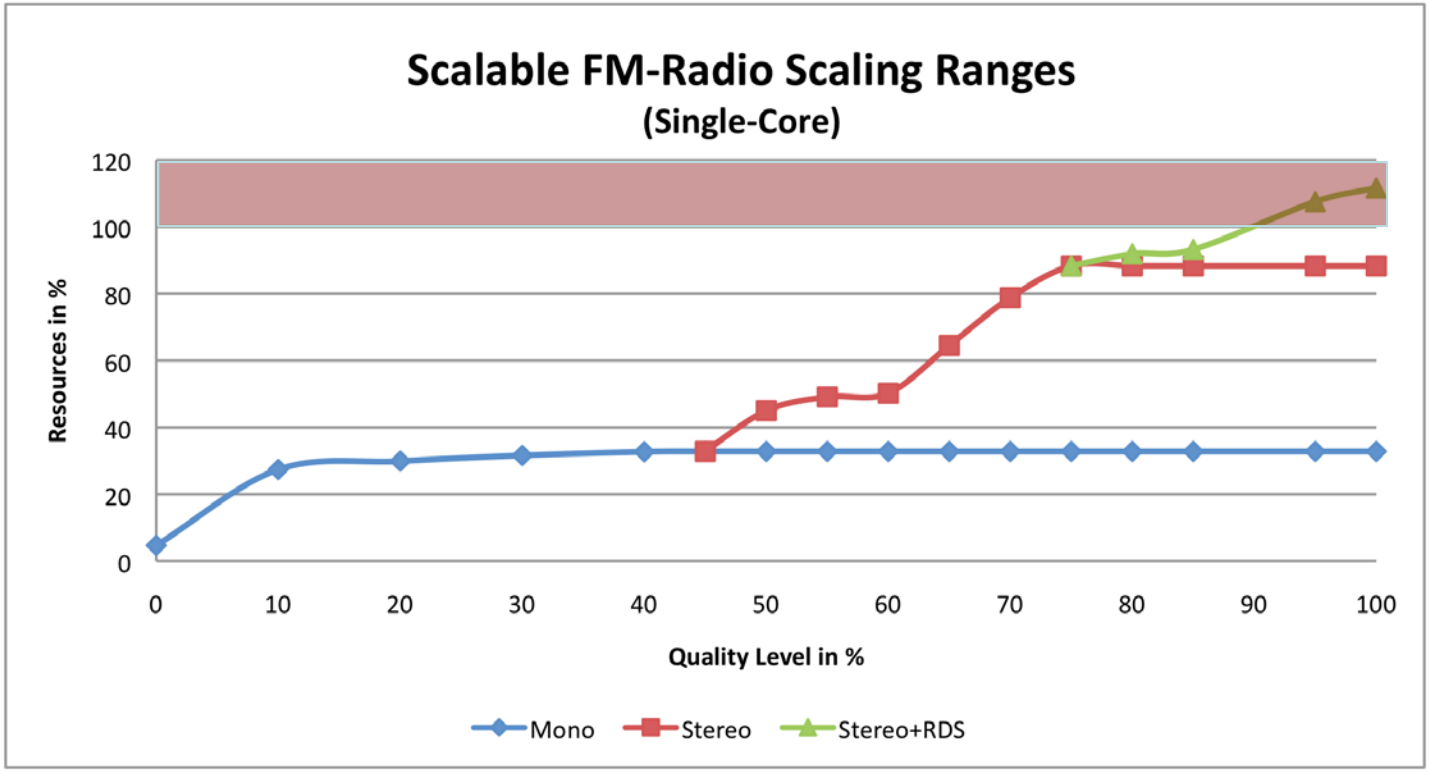
Peripheral
Equipment

Results (1/5)

Analog Radio (FM-Stereo) Receiver + RDS-Decoder

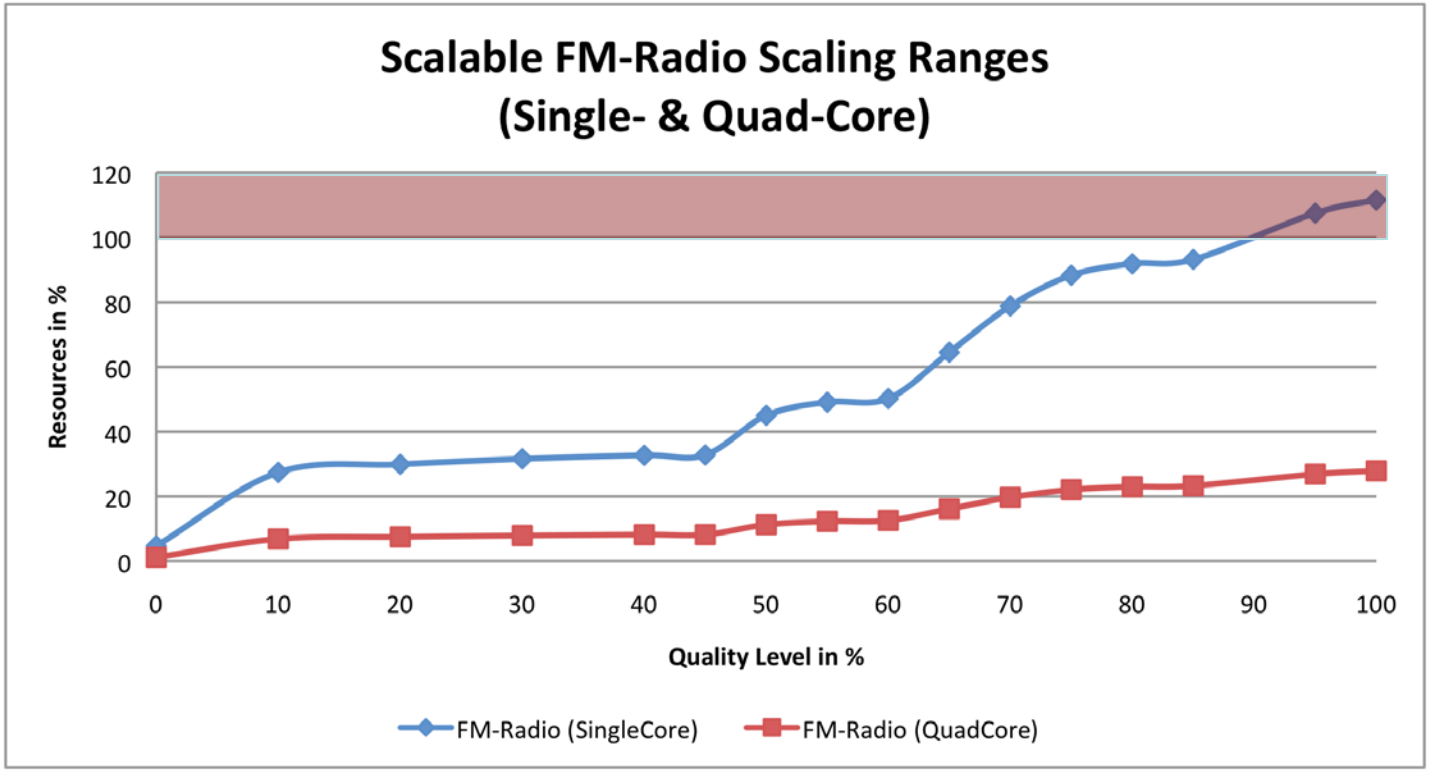


Results (2/5)



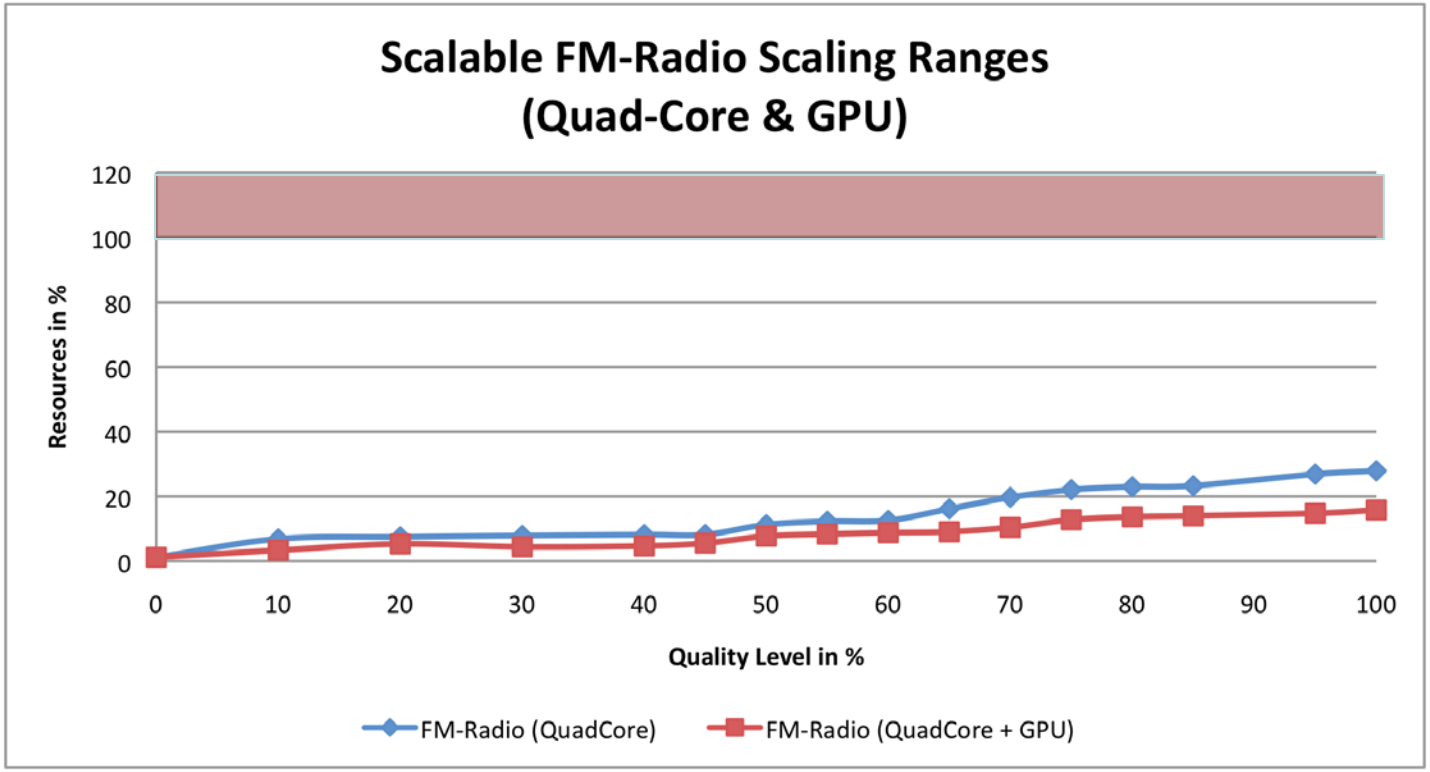
- 45% scalable modules - receiver scaling range 5% to 112%

Results (3/5)



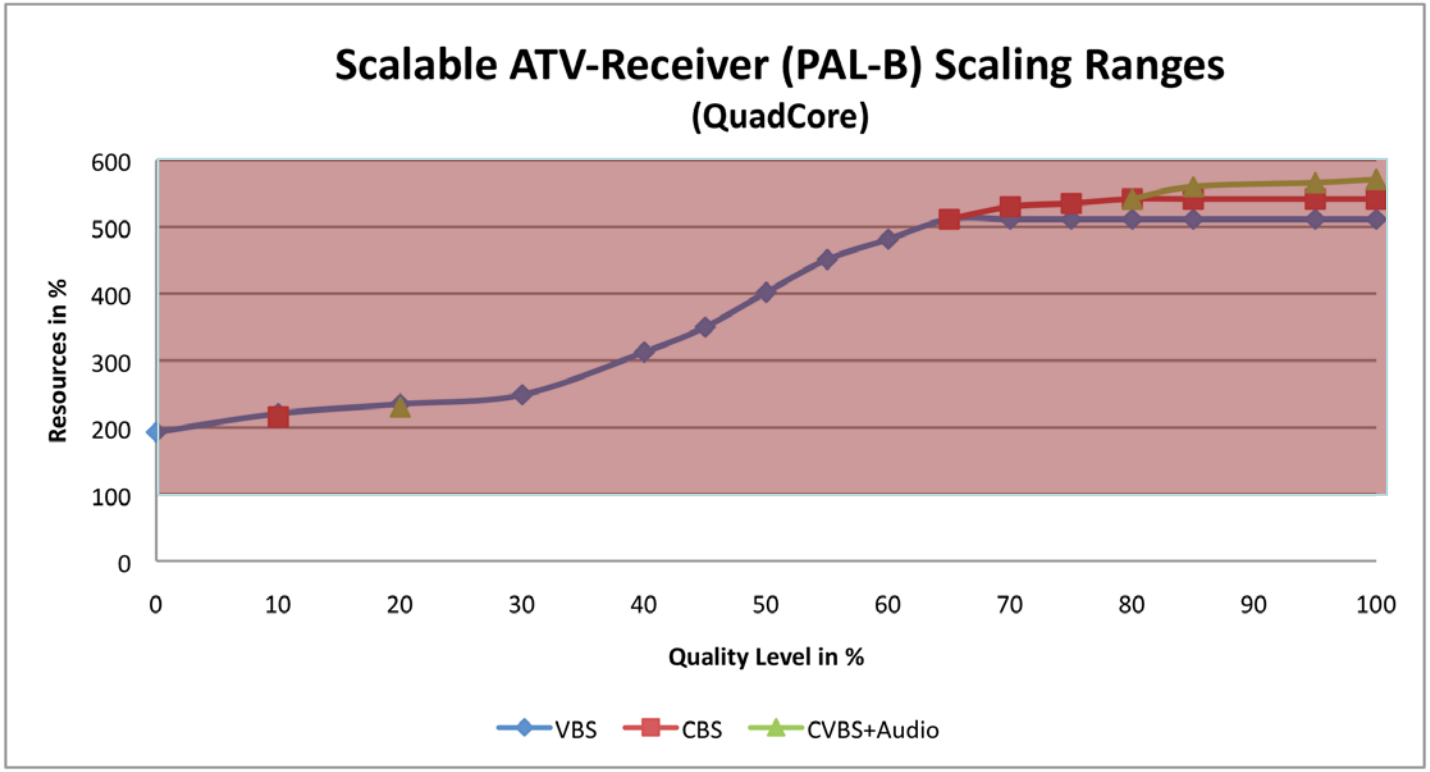
- Speedup of factor 3.8 can be achieved on a Quad Core

Results (4/5)



- more than 50% GPU support ⇨ speed enhancement of factor 2 possible

Results (5/5)



- 45% scalable modules - receiver scaling range 200% to 580%
- more than 60% GPU support possible ⇨ speed enhancement unknown

Conclusions

Advantages:

1. No comparable solution on the market or unknown till now
2. Every core on a GPU or on a GPP can be used
3. Different powerful desktop computers are supported
4. Reliable real-time system
5. Highly flexible, low cost, future-oriented and future-proof
6. Can help to save power

Drawbacks:

1. Complex broadcasting services are still a challenge
2. CUDA™ should be replaced by OpenCL or Intel® Ct Technology
3. Synchronization-Overhead increases to fast for high number of modules
4. Find right quality estimators is not easy

Thank you for your attention!
Questions?