Joern Henneberg, MSEE
Lynnwood, WA 98087 - USA
joern@henneberg-online.org

Portfolio

The following portfolio shows a selected excerpt of my product-related work throughout my career, which highlights individual contributions and essential achievements. It demonstrates my broad background in Hardware Engineering, Firmware and FPGA design, and Leadership qualifications.

Please note that for confidentiality reasons not all of my work, contributions or project details can be demonstrated. Therefore the list cannot claim to be exhaustive, nor can it unfortunately claim to include all significant and important projects I have worked on.

Synapse Product Development

Synapse is a product development and consultancy firm, working with the best companies in the world to drive innovation and introduce cutting-edge devices that positively impact our lives.

With cutting-edge technology, high-stakes product development and Fortune500 clients come strict NDAs, which often don't allow Synapse to list the company as a client.

Unfortunately, so far all products and projects I have worked on at Synapse fall into this category – I therefore can't share project-specific details or achievements, but must point to the general overview for Synapse found in my resume.

Native Instruments

Traktor Kontrol S8

Product description:
All-in-one 4-channel DJ system with standalone capabilities, touch-strip functionality and high-speed USB 2.0 interface for audio, display and controller data streaming

Individual contributions:
- Hardware architecture
- Definition of intra-board communication scheme and protocol
- Schematic entry for a number of the 13 different boards in total
- Firmware architecture and initial implementation for UI micro-controllers in C
- FPGA design
  - re-used existing dual-display driver technology
  - Implemented LVDS encoder core for display data transmission between left and right display, integrated into design
- Regulatory certification: EMI measurements and debug
- Cross-functional team lead
  - BOM cost management
  - driving towards milestones
  - managing 3rd-party contractors

Achievements:
- Single firmware source code design and binary build
  - targets 6 low-cost ARM Cortex-M0+ micro-controller on 3 different UI boards
  - hardware architecture and schematics designed to allow this simplification
- Differential display data transmission between left and right deck using LVDS
  - 24-bit parallel display data transmitted over 4 LVDS lines
  - eliminates source of EMI (long-distance parallel bus routing)
- Hardware Architecture enables direct, unmodified re-use of PCBs for Traktor Kontrol D2
- Shipped within aggressive schedule and budget

Traktor Kontrol D2

Product description:
Modular DJ Deck controller with touch-strip functionality and high-speed USB 2.0 interface for display and controller data streaming
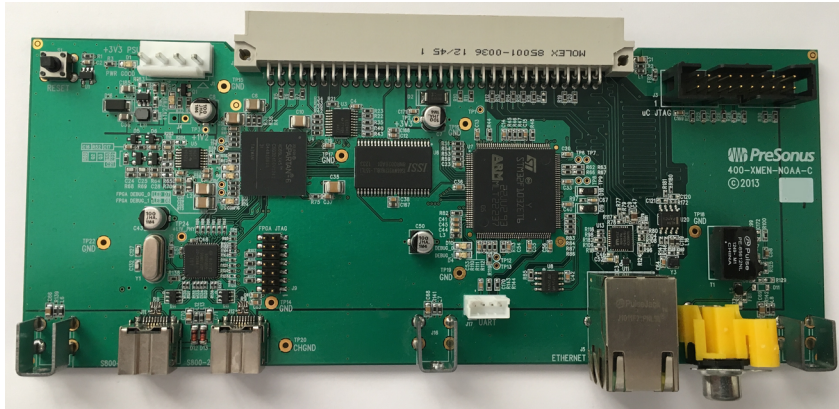
Individual contributions:
- Hardware architecture
- Regulatory certification: EMI measurements and debug
- Cross-functional team lead
  - BOM cost management
  - driving towards milestones
  - managing 3rd-party contractors

Achievements:
- Substantially reduced time-to-market to 5 month, achieved through
  - re-using 2 out of 3 PCBs without modifications from Traktor Kontrol S8
  - re-using 95% of UI Firmware design
- Shipped within schedule and budget

PreSonus Audio Electronics

StudioLiveAI family of Console Mixers

Product description:
Backplane digital audio communication and processing card for StudioLive AI Console Mixers family with 2x FireWire-800, 10/100 Mbps Ethernet and Spdif interfaces

Individual contributions:
- Hardware architecture and system integration definition
- Schematic design and entry
- Close co-operation with PCB Designer to address and optimize high-speed signal routing requirements
- Prototyping, bring-up and debug
- Graphic Equalizer (GEQ) audio processing FPGA core
  - functional specification and software interface definition
  - implementation and verification
  - integration with 3rd-party modules

Achievements:
- Off-loaded GEQ from over-burdened system DSP to FPGA on backplane card
  - freed up enough system resources to make the DSP design viable again
  - 16 channels x 31 bands = 496 biquads at 96 kHz sample rate
- Introduced PSL Assertion Language, improving FPGA verification quality
- Single card architecture to serve all 3 mixer family members

Avid (M-Audio)

MBox 3 Pro

Product description:
High-quality, professional-grade 8x8 FireWire audio interface

Individual contributions:
- FPGA design specification, implementation and verification
    - I2S receiver and transmitter cores
    - digital sample rate up-converter core by a factor of 2
    - digital sample rate down-converter core by a factor of 2
    - multi-channel UI LED PWM driver
    - parallel bus interface to main micro-controller

Achievements:
- FPGA core designed to fit into smallest available Xilinx Spartan-3A family member
- FPGA design used to bridge 2 different pre-existing technologies, allowing direct re-use (lowering cost and time-to-market)
- Off-loaded LED driving functionality from micro-controller to FPGA, reducing processing requirements on main micro-controller

Torq Nexus (not released to production)
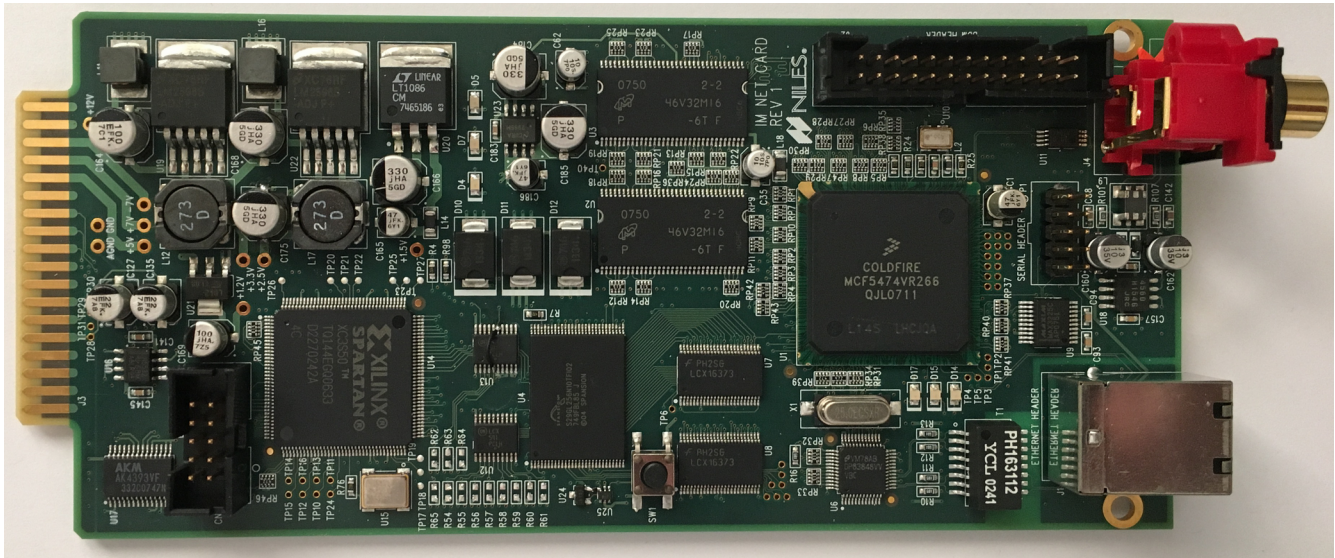

Product description:
Digital DJ Battle Mixer with USB audio interface and standalone functionality

Individual contributions:
- UI ARM micro-controller Firmware design in C
  - used M-Audio's home-brew one-shot Operating System
- DSP Firmware design in C++
  - ported audio filter algorithms to new DSP
- worked with EE resources to validate system and firmware requirements
- Board-level bring-up and functional verification
- Firmware debug

SaneWave

Internet radio backplane card

Product description:
Backplane internet radio card for multi-channel, multi-source home installation audio server with 10/100 Mbps Ethernet port, digital audio backplane connection and stereo analog audio output

Individual contributions:
- Hardware architecture
- Schematic design and entry
- FPGA design specification, implementation and verification
  - I2S transmitter core
  - parallel bus interface to Coldfire MCU
- Bring-up and debug

Achievements:
- Two revision hardware design, with only minor modifications going into revision 2
- Delivered hardware design within schedule and budget

Other Projects

Eng-DB-2

Product description:
Eng-DB-2 is a light-weight, open-source Engineering database, allowing to manage components and assemblies, their associated AVLs (Approved Vendor List), assemble BOMs for finished goods in an automated fashion, and annotate them with cost from the database as well as quotations received from suppliers. The tool closes the gap between features provided by commercially available PLM systems usually used by Operations, and needs from Engineering usually not served by those systems.

https://sourceforge.net/projects/eng-db-2/
http://www.henneberg-online.org/joern/project_engdb.html

One of the main notable workflows supported is the iterative process of creating a finished goods BOM and driving it towards target cost:
- create the finished goods BOM in an automated fashion
- request a quotation from suppliers or contract manufacturers
- import the quotation back into the database and re-generate the BOM, which is now annotated with the received quotation
- compare the quotation against existing known database prices as well as overall target cost
- use the information to drive both negotiations with suppliers and contract manufacturers as well as the product design itself
- update database prices with agreeable portions of the quotation
- re-start the process for the next product milestone

After going through a few products and iterations the database will contain fairly realistic component prices, which in turn will provide a good and consistent basis for initial product cost approximations of upcoming new product ideas.

Individual contributions:
- programming of component batch import feature
- bug fixes, active source code maintainer

Achievements:
- used in several companies to successfully ship commercial products
- improved new product cost estimations at Native Instruments
- improved uncovering of inconsistent component quotations at PreSonus Audio Electronics