

# Martin C. Alcock, M. Sc. (Dist), MIEEE

## Embedded System Specialist

A software engineer with an emphasis on real time systems, FPGA and ASIC design, and digital signal processing on processors and reconfigurable computing platforms. Specialized application domains in the telecommunications and digital cable space.

### Core Competencies: Software Engineering

Software Engineering • OO Design • UML • Embedded Systems  
Programming in C/C# /C++/Java • Agile Development • MySQL  
Real time system design • Network programming • TCP/IP • Stack design  
Prototyping • Board turn/up • Debugging • Performance tuning  
Windows Applications • Unix/Linux Applications • Web based Applications  
CVS/SVN Revision Control • Code reviews • Software Quality Assurance

### Core Competencies: Signal Processing

Cellular telephony • Modulation and Demodulation • Filtering • Integration  
Sonar processing • FFT • QAM/QPSK • OFDM • GPS/DGPS  
Sub-sampling • Interpolation and Decimation • DES encryption

### Core Competencies: Embedded Systems

Xilinx ISE • Altera Quartus II • VHDL • Verilog • DSP on FPGA  
ARM Cortex embedded processors • Altera NIOS/HPS • Ethernet on Silicon

### SKILLS

### Years of Experience

Real Time/Embedded Systems	30+
C/C++/C# Programming	30+
Digital Signal Processing	30+
FPGA Design/VHDL/Verilog	30+
Modems/Telecommunications	30+
Project Management	30+
Cellular Telephony	30
Wireless Communications	30
Unix/Linux Applications	20
Windows Applications	20
TCP/IP	10
Ethernet and stack design	10
C#/ASP.NET Applications	7
OO Design/UML	7
FPGA based processors	5+
Java Programming	5+

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## CAREER HIGHLIGHTS

- **Published a minimal logic FFT algorithm** based on negabinary complex numbers, patent being filed.
- **Designed a MPEG splicing technology** based on an embedded native Java processor in an FPGA. Demonstrated real time performance.
- **Created a networked insertion system** for cable television, in both analog and digital domains. Patent pending.
- **Invented and developed a system for tracking bus passengers** by combining wireless and RFID technologies together, patent pending.
- **Created a video on demand system** and rolled out a pilot program. Patent granted for a unique approach to delivering media to rooms which was based on a home grown delivery technology implemented in a processor and FPGA.
- **Led the development of an FPGA/ASIC based OFDM transceiver** delivered the first market-ready consumer product and platform for future products. Led the development as architect, line and project manager of a large engineering group.
- **Launched a program for a credit card size DGPS receiver** shrinking an existing product by a factor of 5 and cost by a factor of 10 by re-implementing a design in single DSP processor using zero IF demodulation.
- **Created a rapid prototyping tool** for DSP system designs called 'EZDSP', including a language compiler, coefficient generator and software oscilloscope. Cloned by Xilinx and is now known as 'chip scope'.
- **Invented** a novel scheme for communicating with through a pipe wall by modulating a magnet with coherent FSK. Invention included a novel and proprietary FM demodulator using PSK.
- **Designed** a state machine processing engine to control a radio repeater, including timeout and DTMF control. Built both a discrete component and CPLD implementation, and wrote a software simulator. Deployed 5 systems.
- **Discovered a novel method for pipe wall profiling** by using a DFT algorithm as a demodulator, implemented on a DSP and FPGA. Deployed to profile riser pipes in the North Sea.
- **Created a Midi interface** for a pipe organ multiplexing system using a proprietary Manchester decoder on FPGA and microcontroller.
- **Implemented a  $\pi/4$  QPSK modem for digital cellular** on a single Xilinx FPGA without multipliers.
- **Directed an ASIC program for a cellular phone and** delivered both the ASIC and the phone to market as technical project leader, and architect.
- **Earned an M. Sc. Degree** in Software Engineering with Distinction, thesis work received dissertation of the year award.

## WORK HISTORY

### ***Sept 2001 to Present***

dba Praebius Communications Inc July 2006 to present, and  
Integen Technologies Inc, September 2001 to May 2006  
Consultant, Oxford Global Resources, March 2013 to Present

### *Java Acceleration project (September '15 to present)*

- Designed a system to accelerate Java Enterprise servers using FPGA platforms and OpenCL
- Created a bridge from a Java application to an FPGA based kernel
- Produced a demonstration on an Arrow SOCKit board

### *High speed Ethernet system (March '13 to September '15)*

- Designed and implemented a high speed Ethernet front end for a supercomputer using several NIOS embedded processors on an Altera Stratix IV FPGA
- Coded low-level drivers for hardware components on a NIOS processor and wrote system diagnostics in C++
- Implemented hardware assisted UDP offloading logic to enable high speed traffic in a NIOS environment by intercepting MAC traffic
- Designed and implemented a Content addressable memory (CAM) and implemented a hardware assisted buffering scheme

### *Cable Head End contract work (March '12 to March '13)*

- Designed and wrote signal processing software in C++ including modulation and spectral analysis.
- Implemented new features for MPEG transport packet processing on an existing Xilinx Virtex 5 design in Verilog
- Designed and implemented Ethernet subsystems for offloading UDP packets on a Linux-based Power PC in an FPGA
- Simulated and verified design of a large cable head end ASIC in Verilog using ModelSim, captured data for further analysis

### *Advertising Insertion System contract (July '06 to February '12)*

- Designed digital ad insertion and playback software for small cable head ends using MPEG-2 playback on Windows that ran in real time
- Ported server code to an Ubuntu Linux platform
- Designed an internet based cue redistribution system using TCP/IP and UDP
- Implemented head end for insertion system on Windows Server platform in C/C++
- Created a traffic and billing system into a novel cloud computing model using ASP.NET, C# and MySQL on Windows Server
- Managed the deployment and turn up of 100+ field inserters
- Filed US patent application 12,287,793 as co-inventor

### *Video on demand contract (Sept '01 to July '06)*

- Created a custom cable-based 802.3 delivery technology for small hotels based using a microcontroller and home grown cable modem.
- Implemented microcontroller code in real time using embedded C
- Implemented modulation/demodulation code on FPGA using VHDL

- Developed Ethernet-to-cable algorithms for head end modem, including congestion and windowing algorithms
- Built a custom video on demand system as an overlay to 802.3 system
- Led a multi-disciplinary team in hardware, software and industrial design
- Created a web-based traffic and billing system using C# and ASP.NET

Other short term contract work (2006-2013)

- Launched a product for a security application based on Android, ASP.NET and MySQL technologies
- Gathered requirements and wrote all specifications, performed top level analysis and designed server architecture in UML
- Designed and implemented a mobile application on Android platform in Java
- Developed numerous websites using ASP.NET and C# and MySQL databases
- Designed coverage estimates for small buildings and Installed 802.11 wireless networks using commercial access points
- Installed PBX system in a small office
- Installed several Cat5 wired Ethernet systems

Derivative Work from M. Sc thesis

- Created an FPGA based MPEG transport stream splicing technology
- Designed MPEG splicing system using UML OO analysis
- Built FPGA based MPEG splicing engine in Verilog
- Implemented C++ code in NIOS processor on DE-2 platform
- Implemented embedded Java engine (JOP) and ported C++ to Java
- Designed Java code using Asta, Eclipse and NetBeans debug environments
- Implemented minimal TCP/IP stack on target processor in Java
- Expanded JOP to add an interface to ethernet MAC/PHY

Research and development projects (ongoing)

- Invented a novel power-saving FFT implementation using negabinary complex arithmetic, prototyped on an FPGA using VHDL
- Published paper on FFT work, also patent pending
- Developed a real time mixed-mode MPEG-2 decoder in C++
- Researching algorithm translation for acceleration

**November 1997 to August 2001, Senior Manager**

WiLAN Inc

- Conceived the architecture for an FPGA-based 802.16 (WiMAX) wireless transceiver
- Participated in working group for the WiMAX and G4 (LTE) cellular standards
- Led a multi-disciplinary development team to deliver this and other products in the roles of line and project manager, and lead architect.
- Implemented an embedded FFT algorithm on single Xilinx 4000 series FPGA.
- Absorbed other engineering groups, which included similar products on DSP based platforms.
- Promoted to a senior engineering management role and my successor continued my work to roll out an ASIC based version as well.
- Wrote applications for SR&ED credits, as well as ITC and IRAP funding

*Further experience for the years 1975 to 1997 are available on request. A synopsis of work in this time period includes assembler level programming for data communications, work in cellular telephony heading up a design group to deliver a chip set for a G1 cellular telephone, and algorithm design and implementation for G2.*

*Further work includes independent consulting to design and implement signal processing algorithms for pipeline profiling, which led to the invention of a DSP experimentation tool.*

## **EDUCATION AND CITIZENSHIP**

Master of Science in Software Engineering, University of Liverpool, United Kingdom, and Degree was awarded with distinction. Dissertation topic was an object oriented methodology to implement real time systems on an FPGA using a combination of embedded controllers and logic, which achieved the Dissertation of the year award.

Dual citizen of both Canada and United Kingdom, and holder of valid passports for both countries and entitled to work in the United States under a TN Visa. Also screened by US and Canadian customs as a member of the NEXUS trusted traveler program.

## **PATENTS AND PUBLICATIONS**

2,634,133	"An architecture for the distribution of data services over coaxial cable" Canadian, primary inventor.
2,724,765	"Vehicular Passenger Identification System and Method". Canadian, primary Inventor
5,309,482	"Receiver having an adjustable matched filter". US, co-Inventor
12,287,793	"Networked Ad Insertion System". US, co-Inventor
	"An object oriented methodology for the analysis and design of real-time mixed mode systems" M. Sc. Thesis and subsequent IEEE paper.
	"Design of a power-reduced FFT for OFDM transceivers using negabinary arithmetic" In progress as an IEEE publication.

## **REFERENCES**

Available on request.

## **OTHER INTERESTS**

Licensed Amateur radio operator, private pilot for small single and dual engine aircraft under 12,500 lbs, certified Scuba instructor and member of PADI and an Amateur Symphonic Conductor, interested in classical and baroque music.