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Timothy's primary strengths are hands on device design or architecture with UML or SysML, anticipating the future of science and technology, creating interconnected smart devices using Linux, Android, iOS Windows and WinCE. He prefers **Python** for **AI deep learning neural networks** and **C, C++14** for **real-time** work, but also uses JavaScript, Lua, Bash and Java/Scala. He has a scientific test approach to projects, so designs and code are proven though tests, continuous integration and continuous delivery using tools like Jenkins. His interests include **ML, AI, Deep Learning**, Artificial Super-intelligence, Raspberry Pi servers, OpenCV, Vulcan API 3D graphics and OpenGL/WebGL. Has an intuitive approach to satnav, GIS, drone flight navigation, AR/VR, 3D optics or any 3D visualisation project.

He has many years of ARM based Linux, embedded real-time even bare metal systems with Bluetooth low energy and USB. He used Enterprise Architect (UML2, OOD/OOA) design patterns to design a medical product and coded it.   
 *March 2019*

* **Moved thousands of video devices to the cloud: leading edge WebRTC, Gstreamer, Docker, Kubernetes.**
* **AI deep learning neural networks libraries in C++14 and Python 3 including simulated robotics.**
* Server/cloud enabled the worlds longest lasting smart card security system, SecurID with advanced encryption.
* Kernel protection and application change protection for all **Formula 1** race teams as **anti-cheating** **security**.
* Developed tests for billions of contactless smartcards for banks that combine with NFC on Apple Watches.
* Worlds Worlds first Python and C++ Raspberry Pi Sat-Nav with spoken instructions and driver anticipation.
* Creating drone aerospace RTK GNSS position and orientation sensors and with ARM STM32, Linux & C.
* 3D optical image recognition with OpenCL, OpenCV, OpenGL, on Windows, Ubuntu and Linux Tegra.
* Developed GPS devices with 3D environmental awareness and millimetre precision, extensive C and C++ use.
* Background checked: “*Scottish Disclosure*” certificate of financial applications and personal device security.
* Wrote the NDK part of Sony Video Player for Android and ported Linux to Android Kernel NDK C++
* Medical innovation using 3D rendering and optics. Also attended the UK's first Mini-Medical School 2 years running at the Centre for Life in association with Newcastle University Medical School.
* 6 ½ Years VxWorks Tornado at Bell Labs and Motorola developing major elements of VoIP for WCDMA 3G.
* The worlds largest Windows Embedded C++ project involving wireless and networking for GIS & LIDAR.
* 3G protocol stack for femtocells which extends 3G indoors for low cost Internet access.
* 4G Mobile Phone remote PHY/MAC upgrade of XMAX XG Phones cross compiled from Ubuntu to ARM.
* 7 Years Java and JavaScript, 2 years jQuery web scraping. Recently web generation using CSS3 & HTML5.
* C++ Boost data mining language analysis. XML/XSLT Semantic web, SPARQL JavaScript and Java.
* 18 months’ VoIP experience for voice compression at Bell Labs, Motorola and Selex Communications
* Strong design together with customer requirements support skills backed by agile, pair programming or scrum UML, documentation, Java, C, C++11, algorithms, firmware development and debugging skills.
* In 1990 he wrote his first real-time “bare metal” embedded operating system from scratch on a MC68302 communications processor using C and assembler.

## Professional Experience

*About Tim’s medical engineering and lead architect skills, please see his reference.*

**Safety Critical Design and Development of Medical Injectors for Phillips Medisize** *– 1 Oct 2018 to present*

Leading the design of a safety critical electromechanical medical software using Enterprise Architect with UML-SysML state machine diagrams to win $1M of preliminary funding. Coded the real-time robotic control and the graphics interface in only 3 months and shipped the prototypes to the USA for UX “*user experience*” trials.   
Provided some safety critical risk analysis, where progress was helped by learning embedded skills from senior engineering positions line Bell Labs and having interests in science, medicine, safety and EMC shielding.  
\_ **Autonomous Flight Firmware + AI Deep Learning for Optimum Scientific** *– 2 October ‘17 - 28 Sep ‘18*

Leading a team for cryptographic verification of embedded images in autonomous flying vehicles. AES hardware encryption in i.MX chips C/C++. Integrating AI into blockchain in a unique way such that private and public data is verified separately. Safety reviews depend on Google Test which it was discovered could be generated. AI genetic algorithms generate code and simulate outcomes of training with added “*ethical rules*” built into deep convolutional neural networks. Simulating robotic components using Sim-mechanics, roslib and rospy on Linux. Navigation QGIS and 3D Python GIS algorithms. Also applied deep learning algorithms to multilayer perception. Feeding AI carefully chosen positive and negative examples for recovering from dangerous situations by learning from history and learning how humans follow procedures. Python 3.6 NumPy/rospy, Nvidia Jetson, i.MX\*, Tegra.

**Consultant Innovative Products Developer – Infineon Technologies**  *– Feb 2017 to 29 Sep 2017*

* Helped turn 2017 PhD students’ projects into practical reality, using devices with 3D camera FPGAs. World leader in AI genetic algorithms for rapid optimization of FPGA designs with C, logic and deep learning algorithms. Updating C/C++11 apps that use libraries including: Tango (3D world), Qt, OpenCV (computer vision/AR/VR), PyOpenCL, OpenGL **+** OpenCL for GPUs and MATLAB. Android 3D phones, Windows and Linux with 3D ToF cameras attached. MATLAB/OpenCV code focused on 3D stereo calibration which involves lots of geometry that helps eliminate errors by integrating hundreds of readings. Activities include agile planning, team design, innovations coordination, LED and laser safety, physical design [high rigidity camera holders on phones], software design, AR camera products, testing with Python, Jenkins and Catch.h and English documentation. New direction: deep learning and neural networks with Python, 3D Meshed IoT, QM, quantum optics/computers, fiber optic driven optical sensors and new sources of energy.

**Linux DevOps Consultant (cloud video streaming and broadcasting) – Barco** *–* *Sept 2016 to Feb 2017*

* Ported an embedded video device to a Debian Linux ClickShare Cloud for broadcasting for medical, educational and corporate use. Contributed to **DevOps** integration by configuring Nginx inside both embedded devices and **Linux Docker containers**, thus porting the ARM embedded version to the cloud. Technologies include **H.264**, **Motion JPEG**, **gstreamer** with **D-Bus**, cloud based **WebRTC** browser plugins, cloud based **Redis Pub/Sub** and **MirrorOp** web servers connecting and forwarding video controlled by C based drivers, **Node.js,** **Qt C++14** applications with **OpenCV** facial recognition and head orientation. Combined accelerometers, audio and 3D face tracking with augmented reality merging video images, making a new product possible. Attended the Berlin gstreamer conference 2016, then completed the work by doing demonstrations and creating 100 **Python** Networking tests using **json** to target the **REST** **API** of the product, essential for the **Jenkins** &**JIRA** continuous integration and remote product monitoring and maintenance for these and **JavaScript Web Services**. Also introduced **WebRTC getStats** + **D3.js** statistical monitoring which reports important broadcasting quality of service information (QoS: lag and jitter). Designed APIs used to remotely control and maintain the services in the field.

**Embedded Architect for Satellite Tracking Devices – Honeywell Project** *–* *Oct 2015 to June 2016*

* Designed from scratch and wrote the messaging system for tracking millions of shipping containers by satellite. C/C++ for low power ARM FreeRTOS based targets that included **GNSS** (**GPS, GLONASS and BeiDou + accelerometer)**. This sends position messages both by **Iridium satellite** and by GSM/GPRS. Using **Jenkins** with loop-back message tests. Negotiated the addition of extra features.

**Senior Linux Embedded Consultant - Technicolor Thompson  *–*** *April to August 2015*

* Development for worlds largest producer of set-top-boxes, and Ethernet WiFi VDSL Internet routers with “*Internet with of Things*” (IoT); support of **billions** of customer units. He worked with a team 40% based in Mumbai India, 10% in China and 50% in Europe. He re-engineered the multimedia firmware related to DLNA and UpNP with video streaming interfaces between Windows and Linux XBMC. Kodi was built with C++, but “*minidlna*” is coded in C, Lua and Bash for an **OpenWRT** target with Broadcom ARM chip-sets. Scrum/sprint agile systems were used with Jira, Jenkins, gitolite and git. He wrote a Yocto C++14 development configuration application that automatically transfers files to one or more embedded targets immediately they are changed, “*reacto*” is probably the worlds fastest Linux CMS application with built in SSL/SSH. Timothy was also responsible for initiating a patent called *LiFiDoctor*.

**High Reliability Test Server**  *-*  **altran project** *–* *November 2014 to February 2015*

* **Creating a Debian test and mesh monitoring applications. C for kernel space and user space; C, C++ & Python for user applications. Py.test for testing and automation.** DOORS requirements.

**Consultant to Leica *(Worlds Biggest Windows Compact Embedded project)*** *–* *August 2013 to August 2014*

* WinCE Embedded C++ development for a flagship product that can be described as what you could imagine phones being able to do in 12 years time. Remote control code for robotically guided telescopic camera with motion tracking. Cross platform development from Windows x64 to ARM based devices and programming peripheral interfaces including 3D laser, accelerometers, compass, Bluetooth LE, BLE 4.0, WiFi and GNSS/RTK/GPS receivers. One responsibility was to debug and release 72 new libraries with about 2000 C++ header files to a 3rd party developer. Includes Qt 5.3 QML with Qt Creator and OpenGL.

**Banking Smart Card Systems NXP Semiconductors, Gratkorn, Austria** *–**March to July’13*

* Ported the MIFARE Plus C++ CppUnit test suite over to Windows C++ which is used for the verification of protocol compliance of contactless smartcards supplied to banks around the world. This is done especially to support banking clients developing applications for billions of credit cards and who have licences to use our RFID and NFC chips. Python automatic NFC tests for Google and Apple devices. Encouraged NXP to use their own internal integrity software to increase survivability. Training a colleague from Scotland to do similar embedded work and supporting his new payment ecosystem idea.

**Bioinformatics Consultant for 3D Graphics and Diagnostics**  *–* *November 2012 - February 2013.*

* 3D visualisation using NVIDIA CUDA 5, OpenCL, SIMD for intensive processing massively parallel algorithms and displaying the data to correlate patterns. 3D composites, rendering using Autodesk 3ds Max with MAXscript. C++ libraries combined with OpenGL and augmented reality (transparent, text, animation). Perspectives of 3D data tested with Unity3D. Physics and statistical analysis: filtering the data so that clear correlations between cause and effect can be seen. Additional applications run on Ubuntu Linux with Bluetooth link to an Android NDK service. Extensive use of Linux, Git, Ubuntu and Eclipse.

**Mobile Linux SatNav with Robotics – Exactrak –** *July - November 2012*

* Developed new SatNav software for gritter lorries on Raspberry Pi. This ARM Cortex audio only SatNav guidance system was specified, designed and coded by Timothy and he wrote over 30 mathematical tools to calculate and predict vehicle position. Ordinance Survey map routes were loaded into Quantum GIS (Geographical Information System) for automatic drive testing. In addition to reading GPS NMEA his software also controls several items of hardware to automatically trigger vehicle robotics at different locations. Road testing proved that the computerised speech instructions to the driver worked astonishingly well. Document subjects written include “ARM & Tablet Choices for Vehicle Applications”, “3D Augmented Reality and Video Sequence Satellite Navigation Design”, “EMC Design for Vehicles”. **Skills**: driver psychology, 2D/3D geometry, GIS, Ubuntu, Debian, Raspbian, Python, HTML5, CSS3, Bash, C++, git and automotive EMC.

**Embedded Linux Device Designer – Optimum Scientific in UK –** *March 2012 – July 2012*

* IPsec Linux Device Drivers running on Intel (Eclipse and C). Also client remote applications run on the iPad iOS 5.1 and on Android ICS. He developed Android NDK C++/Java using the Eclipse IDE and iPad apps using OS X Xcode and Objective-C. Continuous use of git for source code and J-Link, J-Trace and logic analysers to verify firmware interface to FPGA VHDL spec's. Up to 3 Linux device driver modules interact in order to service more than one network application at a time connected to dedicated IPsec accelerated FPGA. Automated IPsec/IPv6 protocol testing using Python (PyDev/PyUnit) combined with C++, Python and Bash. Network analysis involved the use of Wireshark, nmap and Cisco network simulators.

**Embedded Linux Consultant – McLaren F1 –** *March 2012 - Consultancy is Ongoing*

* McLaren Formula 1 Electronic Systems (Woking, Surrey UK) – Add CBM Debian Linux anti-cheating enhancements for the WiMAX telemetry unit to prevent F1 race cheating and satisfy the FIA that the unit has high integrity. Used Message Authentication Codes (hash values) for kernel, applications and configuration integrity and authentication. In the two weeks that were available he wrote a full set of Debian Linux requirements and designs together with a recursive hashing application which is of primary importance to the McLaren as a means of preventing race cheating for all the F1 teams. When you see a box removed from vechicles after an F1 race, that box has software used to verify all applications, as written by Timothy.

**Android/Linux Software Multimedia Engineer – Sony –** *May 2011 to March 2012*

* Mpeg4 invention of an algorithm for remote secure audio/video on Android SDK (Java) and Android NDK (embedded Linux C & C++). Eclipse and Netbeans on Ubuntu with ARM compilers and an agile (Scrum/Sprint) project life-cycle using Hudson/Jenkins XML/Bash scripts. Extensive RPC/IPC messaging used in most embedded Linux Kernel, ARM, DSP and NEON designs.

**UAV Embedded Linux Aerospace Firmware – V5 Contract –** *January 2011 – May 2011*

* Deploying blimps to earthquake disaster zones when mobile phones no longer work. ARM Cortex STM32 mostly with C working on several projects including UAV navigation sensors and radio links to ground control stations (GCS running C# graphics applications). Using MATLAB and Simulink he wrote the high level designs, telemetry protocols integrating the blimp devices: IMU, camera gimbal, radar, interfaces to lightning detectors and GPS. .NET C# Windows 7 applications, including GCS ported to Linux/C++. ZenitPCB pcb layout tools for board layout, specifically camera gimbal control board.

**Consultant Software Design Engineer – Landis+Gyr Switzerland –** *May to – 31st Dec 2010*

* IPV6 Stack Design and Integration. Developed the socket2me and abstraction layer for TCP/IP ARM Cortex-M3 embedded smart metering using C on Eclipse and NetBeans IDE.

**Embedded Linux Software Architect – Optimum Scientific –** *June 2008 to – May 2010*

* **Selous Monitoring.** Tim developed a scalable multi-threaded audio sensor array of devicesbased on [ARM Cortex-A8 with a cross platform portable C/C++ multi threading and TI DSP code on OMAP processors. Server PostgreSQL database C/C++ library. Client embedded devices (*Scouts*) are based on BeagleBoards (for TI audio DSP on OMAP3 similar to Gumstix) running Ångström.](http://www.arm.com/products/CPUs/ARM_Cortex-A8.html)
* **Low Latency Messaging Protocols –** Create FIX 5.0 libraries in C++ with low latency predictive encoder messaging techniques that increases communication speed by 60%.

**Senior Embedded Software Engineer – Cambridge Consultants –** *March 2008 to June 2008*

* **XMAX/WiFi XG Phone Project.**  Design and development of communications drivers and FLASH drivers for the MAC part of the XG TX60 phone using both C and C++ as instructed by XG. Initially used ARM Development Suite (ADS) then moved to KEIL RealView with uVision3 for an Atmel AT91 ARM7 target. Visual C++ was used for simulation and FLASH upgrade from PCs via RS232. Also GCC C++ was used with embedded Linux on Freescale IMX7 ARM9 WiFI targets. Ubantu Linux was used along side Windows. UML Sequence diagrams were documented in Word with the help of *Enterprise Architect*.

**Embedded Software Engineer – 3G state of the art femtocells “ip.accesses”** *July –Oct 07*

* Fault tolerance message services for picoChip ARM Linux device designed to provide multiple internet connections over a 3G mobile air interface, indoors. Enterprise Architect and UML2. Most of the target code is written in gnu C including his Linux kernel device drivers.

**Design Engineer - Selex Communications (Marconi)** *– November 2006 - July 2007*

* **HF Radio -** This project uses HF radio protocols which includes the use of TCP/IP, SMTP Email and VoIP.   
  C and **C++** Boost libraries, UML2, **Rational Rose RT** (using RUP), this is very similar to IBM Rhapsody. He was responsible for the embedded audio matrix.

**Consultant – WinCE PDA Smart Phones** *– June 06 to November 2006*

* **PDA Windows Mobile 5 Project** – Visual Studio 2005 team system and Windows Mobile SDK with Microsoft .NET Compact Framework (embedded windows). The code was mostly C# with some C++.

**Stock Market Internet Intelligence Gathering (Semantic Web Data Mining)** *– Jan 05 – June 06 + ongoing*

* **EagleEye** data mining of “*financial market emotion”* by language analysis of hundreds of web pages per second: Reuters, NASDAQ and NYSE. Measures *panic/greed*, *popularity/disapproval* and draws 3D graphs. **EagleEye3**: state of the art web scraping using Java, JavaScript, jQuery, SPARQL, RDF, RDFS and OWL performs multi-threaded filter analysis with C++ Boost and uses [ProstgreSQL, a fast SQL database. TDD.](http://www.postgresql.org/)

**Software Engineer & Embedded Systems Integration Engineer** *- July 04 – Dec 04*

* Embedded Safety Critical Project – Tornado and [VxWorks **C** project: new FLASH bootstrap system that is exceptionally secure that runs Runs on](http://www.windriver.com/) [PowerQUICC](http://www.3g.co.uk/PR/October2004/8450.htm) & [TrueFFS](http://cdn.windriver.com/products/device_technologies/middleware/true_ffs/).

**Orange Mobile whilst with AePONA Ltd. – Intelligent Networks**  *- 5 Dec' 2003 – June 2004*

* Responsible for the design and server integration of the Orange Customer Collections mobile voice announcement system with [Telcordia SPACE ISCP (a programming language for Intelligent Networks and the SS7 stack). The project was said to be worth £2.2 million to Orange per year!](http://www.telcordia.com/products/iscp_system/index.html)

**Motorola Center of Excellence - Lead Firmware Engineer UMTS & GSM** - *May 2000 - March 2003*

* **UMTS Embedded Message Services Architecture** and **PCI Local Bus device drivers.**   
  Tim added a fast multi processor shared memory driver to a base station with [VxWorks, so that it ran messaging 50 times faster than the Windriver supplied TCP/IP stack. Hardware:](http://www.windriver.com/) [PowerPC](http://en.wikipedia.org/wiki/PowerPC) cpu's with [AltiVec](http://www.freescale.com/webapp/sps/site/overview.jsp?nodeId=018rH3bTdGmKqW5Nf23130) (PowerPC G4). The ability to bypass the IP stack and use direct fire packet streaming technology is important to many low latency problems, specifically switching problems. All C code. Wrote an FPGA Simulator in C.
* Analysis Tools - [AMR (](http://www.vovida.org/applications/downloads/AMR/)[H.323](http://www.openh323.org/standards.html)/ [G.722.2](http://www.vocal.com/data_sheets/g722d2.html)) 3G speech compression encoding technology (VoIP) for GPRS and UMTS phones. Massive fast message monitoring database. C++, [Rational Rose UML](http://www.csc.calpoly.edu/~dbutler/tutorials/winter96/rose/cscpaper.html).

**Lucent Technologies - Bell Labs - Principal Software Engineer**  - *August 1996 to April 2000*

* **AIRLOOP** project. Led graduates developing wireless [WCDMA C & **C++** code on](http://www.umtsworld.com/technology/wcdma.htm) [Solaris](http://developer.sun.com/) (UNIX) for [VxWorks](http://www.windriver.com/) UltraSPARC embedded targets. This microwave technology provides [Voice over IP](http://www.iptelephony.org/) (VoIP, [H.323](http://www.openh323.org/standards.html), [G.729](http://www.gaoresearch.com/products/speechsoftware/other/g729.php) & [L2TP](http://www.networksorcery.com/enp/protocol/l2tp.htm)).  Telelogic Tau design tools (OOD) used extensively eg. sequence diagrams pre-date UML. Continuous Integration style of automated testing where Timothy also wrote the tools for test repeatability.

**Philips Research Labs**  -  *August 1994 to August 1996 -* Graphics simulation **OOD** tool [OMT with VC++ this predates the invention of UML and UML was based on OMT.](http://www.iconixsw.com/Iconix_Movies/Rumbaugh.MOV)

**REL Ltd. Senior Software Engineer –**  *April 1990 to August 1994*

* OPAL MC68302 Communications DSP Processor, he was the first to port [SecurID, (PKCS #11) the worlds leading smartcard authentication software to Solaris UNIX for BT Research Laboratories.](http://www.rsasecurity.com/node.asp?id=1156)

**Advantage Computer Systems - Technical Consultant** - *May 1989 to April 1990 -* data recovery services*.*

**Gymtek Systems Ltd (Inshape) - Software Engineer** - *September,1988 to May 1989 -*

* CO2 heart and lung monitoring equipment with Zortech **C/C++** and telemetry data analysis.

**Bristol City Council** - **Database programmer/clerical assistant** *- September 1986 to September 1987*

* Personnel management and created a relational database for the management of personnel with dBase III Plus. Conduct interviews. **Advanced C Programming** at Bristol University, a short course.

1. His interest in medical innovation for remote medical devices is proven by attending the UK's first Mini-Medical School 2 years running at the Centre for Life in association with Newcastle University Medical School.
2. AI, Deep Learning, Machine Learning, Artificial Intelligence, GDPR, C++14, C++17, Boost, C++11, Ubuntu, Red Hat, RHEL, Docker, Linux, Security, Perforce, Team City, TeamCity, Simulation, RFID, NFC, Smart Card, RSA, git, C++, STL, GIS, ARM, OpenGL, QT Creator, QML, Scala, Android NDK, Android Jelly Bean, Jellybean, Android ICS, Android Ice Cream Sandwich, Apps, MongoDB, Oracle, No SQL, MySQL, Big Data Qt.
3. Scrum master, Extreme Programming, teaches: [continuous integration and “](http://martinfowler.com/articles/continuousIntegration.html)[Stephen Covey team principals](http://www.the3rdalternative.com/)” as the most effective way to improve quality, reduce project risks and keep both the developer teams and customers happy.

## Vocational Training and Qualifications

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| --- | --- |
| ***Course*** | ***Date*** |
|  |  |
| **Mini-Medical School – 6 weeks courses. So far he attended 2 years in a row. In Newcastle** | **Oct' 08 & 09** |
| **Microsoft COM and DCOM – Full certificate** | **May 2002** |
| **C++ Advanced Programming with Design - Passed Exam** | **25/01/02** |
| **UMTS Telecommunications Course** | **Nov 2001** |
| [WCDMA for UMTS Radio Access 3G **by Harri Holma, Antti Toskala  These teachers are authors of many books on UMTS, 3G, 4G and LTE.**](http://www.conted.ox.ac.uk/cpd/electronics/courses/UMTS.asp)  **This course was organised by Motorola and run at Oxford University.** | **June'2000** |
| [Kepner Tregoe Project Management Workshop **- Certificate**](http://www.kepner-tregoe.com/expertise/training/expertise-training-pm.cfm) | **April 1999** |
| **Wideband Telecommunications Course - Certificate** | **May 1998** |
| **Object Oriented Design For Senior Developers – by Lucent Technologies Bell Labs** | **1997** |
| **VxWorks Real Time Programming Course – by Ian Willats who is famous for  real-time automation and is also a skilled teacher. (Course organised by Bell Labs)**  **This course even included compiling VxWorks (the OS source code) from scratch.** | **1997** |
| **Advanced C Programming (3 week course)** | **July 1987** |
| **Part-time Evening Courses: UNIX, C, Fortran, Pascal, on VAX11 750 and DEC10.**  **“UNIX and C” was run in the evenings by Dr Chris Gunner at “University of Westminster” which was then called “The Polytechnic of Central London”** | 1983-1986 |

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