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Overview

Ross has 30 years experience in telecommunications technology development, product design, system design, marketing and technical sales support. This experience has provided Ross with in-depth knowledge of video, voice & data protocols, equipment design, network design and management. Through this experience, he has accrued the ability to see the big picture and then drill down into the details – which is where the network design gotcha's are often found - in advance, rather than after installation.

In the early 80s, well before the availability of standard SONET/SDH and ATM networks, Ross's telecommunications experience was first cast through the design of multi-protocol optical fibre access, local area and metro area networks. This is where he cut his teeth on hybrid TDM and Ethernet packet networks. As standards evolved, so did Ross's knowledge and experience – including protocols such as FDDI and FDDI-II, Fast Ethernet, Iso-Ethernet, SONET/SDH and ATM. Products developed by AWA Ltd under Ross's architectural guidance were driven by Telco, Civil and Defence customer applications. As a result, Ross was always involved in the systems design for the application - which not only included the communications network design, but also the interfacing of customer equipment to the network via narrowband/broadband analog and digital protocols such as PDH, ISDN, ADSL, Ethernet, Token Ring and MIL-STD-1553. Example applications included radio, intercom, telephone and data switching systems for emergency services and air traffic control, shipborne and airborne communications systems and the first Video-on-Demand over ADSL trial for Telstra in Australia (1994).

In the late 1990s, Ross co-founded a Photonics start-up company called Redfern Broadband Networks Inc. (RBN) – which was targeted at the xWDM market opportunity. During its 9 years of operation, RBN designed, developed, manufactured and sold DWDM, CWDM and Next Generation SONET/SDH multiplexers using the latest GFP standards. As RBN evolved during this period, so did Ross's roles – including Chief Engineer, Network Architect, Product Manager and CTO. As Chief Engineer, he defined the architecture of RBN's first xWDM products and extended his knowledge with multi-protocol interfaces such as: 1G and 10G Ethernet; ESCON, FICON, 1G, 2G, 4G & 10G Fibre Channel for Storage Area Networks (SANs); DVB-ASI, SDI and HD-SDI for Video.

In 2003, as RBN's Network Architect, Ross worked onsite for 12 months with RBN's US partner AFC (now Tellabs) to assist in the design of FTTN, FTTP, inter-office and enterprise networks for US carriers such as Sprint - based on RBN's GigaEdge 8200 environmentally hardened CWDM ROADM. Once again, Ross was involved in the overall systems design for US Telco customers – interfacing for example to IGMP routers and switches at the Central Office end of the network and ADSL multiplexers, DLC multiplexers and premises TDM & Data equipment at the client end of the network.

From 2004 to 2007, as RBN's Product Manager and CTO, Ross worked closely with RBN's new global partner Marconi/Ericsson to develop a multi-protocol edge MSPP that inter-operated with their core MSPP/MSSP platforms such as the OMS-1664. Familiarity with OTN standards, 40G and future 100G networks was accrued during this period. Additionally, Ross worked with Ericsson's GPON product group (Entrisphere) in the US to design the architecture and filter specifications for a CWDM overlay network for their existing GPON networks. A trial CWDM overlay network using RBN's new edge MSPP and Ericsson's GPON was successfully demonstrated to one of Ericsson's customers. Ross's team also developed GigE broadcast upgrades to its edge MSPP platform to meet the requirements of Embarq (previously Sprint) for low cost IPTV backbone rings.

In 2008, as part of the acquisition of RBN by Sorrento Networks Inc., Ross supported the technology transfer of RBN's IP, products and assets to Sorrento in the US – once again providing xWDM and FTTN network design support to Sorrento and its customers.

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Standards & Industry Participation

Through his in-depth knowledge of multi-protocol networking technologies, Ross has participated in the development through standards committees and marketing through industry forums of several international standards, including FDDI-I & II, Iso-Ethernet, ADSL & CWDM. He led the reference model sub-committee of the Standards Australia Digital Video Services task Group; has contributed to broadband studies in Australia; and has undertaken a Photonics international benchmarking mission for the Australian Government to assist their decision process for investing in Photonics research. Recently, Ross has been involved in the Budde round-tables aimed at influencing the Australian Government rollout of FTTN and FTTP networks; in the Embedded Systems Australia (ESA) industry meetings; and in the Warren Centre for Advanced Engineering.

Experience

Network design experience for telecommunications, civil and defence applications has been accrued through: RBN; AWA Communications; AWA Defence & Aerospace; the RAAF and independent consulting undertaken for clients through Haltec Enterprises:

- CWDM/GPON overlay design for Ericsson and their customers (USA and Asia) with a successful demonstration using RBN's edge MSPP and CWDM filter products;
- Broadcast GigE backbone ring design for Embarq (previously Sprint) IPTV networks (USA);
- Inter-office, stacked OC-n rings and FTTN network designs for Embarq/Sprint (USA);
- Wireless backhaul fibre-optic network designs for Embarq/Sprint (USA);
- Fibre-optic GigE and STM-n network designs for RailCorp (NSW Australia);
- Fibre-optic network designs for PCCW, China Light & Power and Macau Telecom;
- Inter-office and enterprise fibre-optic network designs for other IOCs in the USA;
- Fibre-optic backbone designs for USAF bases – including video overlay networks;
- Fibre-optic network designs for utilities such as Tri-State Power (USA);
- FTTH network design based on GigE/xWDM and FE for Snowy Mountains ISP;
- Independent Review of ADI (now Thales Australia) Air Defence switching system;
- Architectural design of MILNET-2000 based fibre-optic video/voice/data backbone networks for Telephonics (New York) TCOMSS military airborne communications management system; General Dynamics mission critical military airborne data recorders; and Singapore Technologies (STE&E) Shipboard Integrated Communications System (SiCS);
- Architectural design of an AWANET-100 based voice/data switching & control system for The Australian Advanced Air Traffic System (TAAATS) – working closely with Thomson-CSF (now a member of the Thales Group);
- Turn-key system design of Telstra's first Video-on-Demand over ADSL Pay TV trial, based on: AWANET-100 as a 96-channel MPEG video switch, ABC's DCART as a MPEG video server, Amati DMT-ADSL modems (2.048 Mb/s); and NTL MPEG-1 encoder and decoders;
- Architectural design of multi-protocol fibre-optic data buses for the RAN New Construction Submarines and ANZAC Frigates with network prototyping under Australian Defence Industry support contracts (resulting in AWA's MILNET-2000 backbone networking product which was later deployed in overseas military systems);
- Architectural design of AWANET-30 based voice/data switching & control systems for the Sydney Police Centre radio control system and RAAF Base Tindal air traffic control system;
- Fibre-optic backbone ring for Allen-Bradley programmable logic controllers (PLCs) installed around Brisbane International Airport and Argyle Diamond Mines (Western Australia);
- Design of a prototype Medevac intercom system for RAAF C130 Hercules aircraft.

In all the above applications, Ross worked closely with colleagues, partner companies and the end-customers to define or understand the application requirements, including the client equipment interface specifications, throughput, latency and availability requirements, before specifying and developing a dedicated or integrated, multi-protocol network solution or a range of options. Where applicable, Ross also provided technical support during network/system installation and commissioning.

Employment

Ross's career has encompassed executive and product management roles ranging from a large systems integration and manufacturing company (AWA) to a start-up company (RBN) focused on new generation telecommunications products and networks. This accumulated experience is available to the industry at large through Ross's consulting company – Haltec Enterprises Pty Ltd. Career highlights include:

- **RBN Inc. - CTO, Product Manager, Network Architect & Chief Engineer**
Ross was the co-founder of Redfern Broadband Networks Inc., a start-up fibre-optic networking equipment company formed during the Photonics boom years. Ross held various executive roles commensurate to the needs of the company throughout its 9 years of operation. Generally, Ross was the product and network architect. These positions required Ross to work closely with partners, sales teams and customers to understand real application requirements and to convert these requirements to leading edge networking products and solutions. These roles extended Ross's previous knowledge and experience in multi-protocol, mission critical network design for Inter-office, Enterprise, FTTN and FTTP applications. Customers included telecommunications carriers, utilities and defense in the USA, Europe and Asia-Pacific. Partners included Corvis, AFC and Marconi/Ericsson.
- **AWA Ltd – Network Strategy, Product Manager & Research Lab Manager**
Ross worked his way up from junior R&D engineer to the Research Lab Manager of AWA Ltd – at the time being Australia's blue-chip electronics and systems company with 6,000 employees and \$600 Million annual revenue (which was reasonably large in the mid-80s). Ross then followed the fruits of his research across to product management positions in AWA Defence & Aerospace and AWA Communications and provided a senior technical advisory role to AWA Corporate. Throughout his 18 years at AWA Ltd, Ross was influential on the direction of AWA's research activities and subsequent multi-protocol, mission-critical, fibre-optic networking products and systems that stemmed from these earlier research activities. In 1994, Ross was the 2nd AWA employee to be awarded "AWA Fellow" (following the IBM career-path model) in recognition of his technical excellence and innovation.
- **Royal Australian Air Force – Radio Officer for 486 Maintenance Squadron**
As a graduate engineer, the RAAF provided Ross with team management skills – having a team of 50 radio, intercom and radar technicians to manage. The RAAF also provided Ross the opportunity to develop a prototype Medevac intercom system for the C130 Hercules transport aircraft and provided technical training experience and detailed knowledge of the internal operation of Defence organizations and their procurement procedures.

Technology

A common technology thread throughout Ross's career has been multi-protocol, mission-critical and fibre-optic communications network designs for telecommunications, civil and defence applications. More specifically, Ross has expert knowledge of the following:

- LAN - Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gig Ethernet, Token Ring, FDDI-I & II;
- SAN - ESCON, FICON, IBM ETR (Sysplex Timer), 1G, 2G, 4G & 10G Fibre Channel;
- Access – POTS, ISDN, xDSL, FTTP, PON (GPON / EPON), AON (GE/FE switch), CWDM;
- Metro - SONET/SDH, OTN, MSPP, DVB-ASI / SDI / HD-SDI (digital video), Metro DWDM;
- WAN – MSSP, Grooming, Long Haul DWDM, EDFAs, ROADMs, 40G and 100G Ethernet;
- IP & MPLS network interface requirements, including IGMP routers
- Network Management (Local Craft and NOC)
- Mission critical network design
- Network capacity planning

Awards

- IE Aust (Sydney), Engineering Excellence Awards, Best Product - AWANET30, 1987
- The AWA Award of Fellow, in recognition of technical excellence and innovation, 1994
- The Ernest Fisk Award to Ross Halgren (Chief Engineer - RBN) for significant individual contribution to the telecommunication industry, CommsWorld Telecoms Awards, 2001
- IE Aust (Sydney), Engineering Excellence Awards, Best Product and Winner of the AusIndustry National Innovation Award - RBN8200 CWDM ROADM, 2002
- SUPERQuest Award (USA) for Best Optical Networking Product - RBN2330 MSPP, 2004

Publications

Ross has authored many publicly available technical papers and white papers and has spoken at telecommunications conferences in Australia and overseas. The following is a sample of Ross's publications relating to multi-protocol local, access & metro networks:

- WARREN CENTRE Report, "Local Area Networks, with Particular Reference to Office Automation", University of Sydney, Case Studies Group Leader: R.HALGREN (AWA), 1983
- R.HALGREN (AWA), "Local Area Optical Fibre Networks", Proc. 8th Australian Workshop on Optical Communications, University of Adelaide, Dec 1983
- R.HALGREN, C.J. STEIN (AWA), "AWANET An Integrated Services Backbone Network", Proceedings FOC/LAN 85 Conference, San Francisco, U.S.A., PP. 14-18, Sep 1985
- R.HALGREN, I.R.VELTMAN (AWA), "MILNET Shipboard Data Bus Application", Proc. IREECON87, Sydney Australia, pp. 18-21, Sep 1987
- R.HALGREN (AWA), "MILNET Presentation to US Navy SAFENET Local Area Network Working Group Meeting", San Diego, U.S.A., 13-14 Jan 1988
- R.HALGREN (AWA), "Next Generation Airport/ATC Communication Networks", Australian Aeronautical Conference, Melbourne, pp. 439 444, 9-11 October 1989
- R.HALGREN (AWA), "Developments with FDDI and FDDI-II", IIR Conference on Current and Future Trends in Cabling, Sydney, Australia, 29-30 June 1992
- R.HALGREN (AWA), "Ship System Integration using FDDI-II Fibre Optic Data Buses", Maritime Technology 21st Century, 1992 Conf., University of Melbourne, 25-27 Nov. 1992
- R.HALGREN (AWA), "ADSL & New Technologies for Transmission over Cables", IIR Conference on Cabling, Sydney, Australia, 15-17 February 1995
- R.HALGREN (AWA), "Industry Development Opportunities for Australian Manufacturers", IIR Conference on Telecommunications Infrastructure, Sydney, Australia, 30 May 1996
- Miscellaneous Publication SAA/SNZ MP74-1996; "Strategies for the Development of Standards for Digital Video and Associated Services. Attachment 5 - A Reference Model for Digital Services written by R.HALGREN (AWA).
- R.HALGREN (AWA), "MC2 (100 Mbps) FDDI-II Multi-Chassis Product Overview", 6th Annual GO-MVIP Conference, New York, 18 October 1996
- R.HALGREN (Haltec Enterprises), PHIL CARMONT (Macquarie Bank), "International Benchmarking Mission Report", Seminar on Photonics Technology, The Photonics in Australia Project, Sydney, Australia, 3 September 1998
- R. HALGREN (RBN), "CWDM and GFP in the Metro Core"
http://www.lightreading.com/wp_redirect.asp?doc_id=27190 , 5 February 2003
- R.HALGREN, J.HASH (RBN), "Comparison of CWDM and PON Transport Architectures in Enabling Appropriate Network Planning", National Fibre-Optic Engineers Conference, September 7-12, 2003, Orlando, Florida, USA
- S.HUSSAIN (MARCONI) & R.HALGREN (RBN), "CWDM & OEO Transport Architectures", IEE in Conference Publication, "Future Challenges and Opportunities for DWDM and CWDM in Photonic Networks", IEE Midlands Communications Group, UK, 11th June 2004

Summary

As a senior consultant, Ross brings 30 years of experience in the detailed design of multi-protocol multiplexing, switching and fibre-optic transmission equipment and its application to mission critical telecommunications, civil and defence networks. For the purpose of integrating and selling the communications products that Ross and his engineering teams have developed, he has designed networking solutions for partners and customers in the USA, Europe and Asia-Pacific and provided technical support during the installation and commissioning of such networks. Ross is adaptable and experienced at working in multiple roles and levels in an organization. He has experience working for large organizations and the life cycle of start-up company - raising investment funding, developing products and channels, selling the start-up company and supporting technology transfer to its acquirer. His core expertise is in: product and network architecture specification and design; undertaking comparative tradeoffs in price, functionality and performance; providing commercial strategy, marketing support and technical sales support to business owners, partners and customers.