ANTHONY S. ACAMPORA

Personal Information:

Born:	December 20, 1946; Brooklyn, N.Y.
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Business Address:	University of California, San Diego Dept. of Electrical and Computer Engineering and Center for Wireless Communications Engineering Building Unit One MC 0409, Room 6606 9500 Gilman Drive La Jolla, CA 92093-0409
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Education:

Ph.D. (E.E.) Polytechnic Institute of Brooklyn, 1973 (Quantum electronics and nonlinear wave-matter interaction. Doctoral Thesis Title: "Semi-classical Theory of Gaseous Dipolar Media with Application to the Gas Laser")

M.S.E.E. Polytechnic Institute of Brooklyn, 1970
(Masters Thesis: "Slotted Plasma Waveguide")

B.S.E.E. Polytechnic Institute of Brooklyn, 1968
(summa cum laude)

Experience:

2008-Present: University of California, San Diego
Professor of Electrical and Computer Engineering, Emeritus;
Recalled to Research

Responsibilities as Professor of Electrical and Computer Engineering, Emeritus include teaching of a graduate level course in wireless networks, original research, and supervision of graduate students. Research interests include broadband telecommunication networks, the Internet, cellular/wireless access

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systems, optical networks, network performance management, and multimedia applications.

2000 – 2007: University of California, San Diego
Professor of Electrical and Computer Engineering

Responsibilities as Professor of Electrical and Computer Engineering include teaching of basic courses in telecommunications, original research, and supervision of graduate students. Research interests include broadband telecommunication networks, the Internet, cellular/wireless access systems, optical networks, network performance management, and multimedia applications.

1995-1999: University of California, San Diego
Professor of Electrical and Computer Engineering, and Director, Center for Wireless Communications

Responsibilities as Director of the Center for Wireless Communications included overall technical and administrative management, funding, budget allocation, publicity, and direction of a cross-disciplinary program of research and education targeted at the emerging needs of the cellular and wireless communications industry. The Center seeks to develop a strong university/industrial partnership as needed to produce a relevant program of systems and technology-oriented research, and places high priority on strategic planning, collaboration, technology transfer and the generation of highly trained graduates at all degree levels to meet industrial human resources needs. Topics of interest include low power circuitry (radio frequency, analog, and digital), antennas and propagation, communication theory (including modulation, coding, multiple access, and speech, video, and image compression), communications networks (including management and control policies, cell handoff, quality of service guarantees, and spectrum-sharing strategies) and multimedia applications. A unifying theme for the Center's program is that of Broadband Wireless, that is, approaches for extending capabilities and services from the emerging broadband wireline infrastructure to the wireless pedestrian and mobile domains. Activities at the center are supported entirely by the wireless communications industry, and representatives from

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participating companies are heavily involved in all aspects of the Center's operations.

1988-1995: Columbia University
Professor of Electrical Engineering and Director of the Center for Telecommunications Research, a National Science Foundation Engineering Research Center.

Responsibilities as Professor of Electrical Engineering included teaching of basic and advanced courses in communication theory and networks, original research, and supervision of graduate students. Research interests included new systems architectures and performance analysis for wireless personal communication networks and high-speed all-optical networks, self-routing broadband packet switching, performance management of broadband multimedia networks, and high- speed applications for telecommunications.

Responsibilities as CTR Director included overall technical and administrative management, funding stabilization, budget allocation, publicity and direction of a cross-disciplinary research center with participation from 25 faculty members, 55 graduate students, eight full-time research scientists and engineers, and six administrative staff members. Developed CTR vision and strategic plan, and organized five focused cross-disciplinary research projects involving (1) wireless access/personal communications; (2) lightwave networks; (3) network traffic control and fault management strategies for integrated telecommunications; (4) multimedia telecommunications; and (5) digital image/digital TV. These cross-disciplinary projects included fundamental and applied research on new systems and concepts, analytical methodologies, lightwave devices, VLSI, and telecommunications software. The Center was supported by the National Science Foundation as part of its Engineering Research Center Program and through an Industrial Participants Program involving 27 companies representative of telecommunication carrier, equipment vendor, and user communities. The annual budget of the CTR was approximately $5M. In addition to management of the research program, CTR-related responsibilities included maintaining and expanding the base of industrial participants, initiating

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university/industrial collaborative research projects, encouraging technology transfer for the purpose of timely commercial fruition, and implementation of a cross-disciplinary educational program in telecommunications to produce students meeting the needs of industry.

Organized and initiated a major jointly-defined university/industrial collaborative research project involving CTR and nine of its Industrial Participants. Known as ACORN, this project was targeted toward the lightwave network of the 21st century. In addition to ACORN project-specific funding, industrial support involved committed manpower and device technologies. The ACORN project produced two "firsts": the first laboratory implementation of an optically-based self-routing ATM (Asynchronous Transfer Mode) network, and the first working gigabit/sec. ATM network.

Helped to organize two major university-industrial consortia in response to announced Advanced Research Project Agency (ARPA) programs targeted at all-optical networks. The Optical Network Technology Consortium participants included Columbia University, Bellcore, Hughes Aircraft, and Northern Telecom (principal members), along with United Technologies, Lawrence Livermore National Laboratory and Rockwell. ONTC research was focused on systems architectures, control algorithms, and device technologies for a prototypical all-optical national telecommunications infrastructure. ONTC funding in the amount of $11.5M was secured for two project phases.

The on-going National Transparent Optical Network Consortium (NTONC) includes University of California (San Diego), Columbia University, Northern Telecom, Hughes Aircraft, Lawrence Livermore National Laboratories, United Technologies, Rockwell, Pac Bel, and Sprint. NTONC research involves deployment of a multi-wavelenth wide area all-optical network spanning the San Francisco Bay area and emulation of geographically wide area optical networks serving very large user populations. Consortium funding in the amount of $10.8M has been secured.

1968 - 1988: AT&T Bell Laboratories

1987 - 1988: Director, Transmission Technology Laboratory.

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Managed an organization of 80 people, consisting of three Department Heads, eight Technical Supervisors, 49 engineers and scientists (all with PhDs or MS degrees), and 20 support personnel. Responsible for a broad spectrum of forward-looking work involving broadband data networking, design and application of digital signal processors, broadband document storage and retrieval services, optical switching and networking, and high resolution real-time graphics.

The scope of work included establishment of fundamental theoretical performance limits, the formulation of innovative system concepts to approach these limits, and the prototype implementation of key elements for the purpose of technical feasibility demonstration.

1983 - 1987: Department Head, Network Systems Research Department. Managed an organization of nine research staff members (all PhDs) with a supporting staff of four. Responsibilities included basic and applied research on broadband multiuser networks using wire, radio, electronics, and lightwave technologies for local and metropolitan area application. Emphasis was placed on packet communications for integrating voice, data, image, and video services. Department performed much pioneering work in telecommunication networking and published extensively.

1981 - 1983: Supervisor, Data Theory Group. Responsible for basic theoretical studies in the field of data communications, including modulation and coding, adaptive filtering, and media access schemes for channel sharing among bursty computer traffic sources.

1974 - 1981: Member of Technical Staff, Satellite Systems Research Department. Performed basic and applied research in the field of high capacity digital satellite systems, including modulation and coding theory, time division multiple access methods, and efficient frequency re-use techniques. Work focused on advanced concepts for multiple scanning spot beam systems which combine the power advantage of highly directive spot beam antennas, the capacity advantage of frequency re-use among the spot beams, and the universal service capability of an area coverage system. Also worked on innovative approaches for sharing satellite resources to overcome rain fading

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at frequencies about 10 Ghz. Collectively, these techniques defined the direction for next generation satellite systems.

1968 - 1974: Member of Technical Staff, SAFEGUARD Radar laboratory. Responsible for radar system design and analysis, including high power microwave transmitters and radar signal processing algorithms. Also worked on waveguide breakdown phenomena at high power levels and techniques to overcome the same, and on the implementation of high power coherent burst waveforms.

Major Technical Contributions:

Networks for Wireless Access - Developed systems approaches for extending bandwidth-upon-demand broadband service into the wireless cellular environment, including packet-based media access strategies which insure high link-level availability in a harsh multipath fading environment, and a novel "virtual tree" approach to permit deployment of high capacity microcells/picocells while avoiding the need for call processor involvement to handle the commensurate surge in cell hand-off requests.

Broadband Communications Networks - Guided and contributed to pioneering work on local and metropolitan area packet networks. Proposed a short-bus local area network architecture which permits perfect capture media access with priority contention to integrate diverse traffic types by avoiding the long propagation delay associated with distributed networks. Contributed to the theory and understanding of high-performance space-division packet switching. Proposed and promoted an architecture for a nationwide all-optical telecommunications infrastructure suitable for bandwidth-intensive multimedia applications. This architecture, known as multihop, solves a major problem by tapping, for the first time, the vast bandwidth potential of lightwave technology (tens of terahertz) through network ports constrained in speed by electronic technology (several gigabits/sec.). Developed and promoted an understanding of the potential of passive, all-optical networks. Originated pioneering work on complexity managment which exploits the enormous bandwidth potential of VLSI-based packet switches and optical communication links to simplify management and control software. Formulated theory of re-arrangeable optical networks using wavelength agility for network optimization. Conceived novel packet compression/expansion technique to further exploit optical spectrum for telecommunications. Proposed Free Space Optical Mesh as a highly reliable, easily deployed, inexpensive last-mile technology to deliver ultra-broadband services to

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small, medium, and large businesses, residential subscribers. The FSO mesh technology may also be applied for cellular/wireless data backhaul. Co-founded AirFiber, Inc., to commercialize the FSO mesh.

High Capacity Digital Satellite Systems - Contributed a basic understanding of the factors and fundamental limits governing throughput in multibeam frequency re-use systems, and proposed several innovative system architectures to approach these limits. Proposed a multiple scanning spot beam system which dynamically matches satellite resources to terrestrial traffic patterns, producing both a ten-fold increase in system capacity and a ten-fold increase in link power margin. Proved a basic theorem governing the non-conflicting assignability of terrestrial traffic to multiple satellite transponders which has since found general applicability to switching systems. Proposed a scheme for dynamically allocating a limited pool of shared satellite resources among a large number of ground stations to relieve local rain fade events and showed that this provides yet an additional ten-fold increase in capacity. The above contributions appeared as major elements of NASA's advanced technology satellite program.

Major Managerial Accomplishments:

Identified several emerging topics deserving of focused research efforts, including Local Area Networks, Metropolitan Area Networks, Broadband Packet Switching, Multiuser Lightwave Communication Networks, and Universal Network Access. Organized, secured funding for, contributed to, and managed major research initiatives on the above topics involving basic theoretical understanding, innovative system concepts, feasibility demonstrations, and applications. Each of these initiatives has, in general, produced several major technological innovations (see also Publications and Patents).

Initiated general personnel practices encouraging research staff members to plan and organize their research goals and work programs. These plans have had substantial benefit with regard to work program directions, expected pace of accomplishment, identification of emerging topics to pursue, and termination of effort in mature fields no longer requiring major research coverage. Encouraged ample flexibility to change directions in response to new ideas and opportunities. Raised levels of expectations, regarding both management and subordinates, resulting in enhanced productivity. Many colleagues and former subordinates enjoy world-wide reputations in their fields. The quality of research

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accomplishment has improved steadily, as has the ability to attract and retain top-notch research talent.

Successfully coupled state-of-the-art device technology with major system architectural innovations to produce several major research breakthroughs. Served for ten years on AT&T Bell Laboratories' Cooperative Research Fellowship Program Committee. This program provides tuition, living stipend, and mentoring for Ph.D. students who are members of minority groups. Approximately 30 students participated in the program during any given year.

Funding:

A) NSF Engineering Research Center Program.

NSF Engineering Research Center funding was based upon comprehensive annual reports and site visits, and evidence of strong cross-disciplinary research accomplishments, active industrial participation, and student involvement at all degree levels must be apparent. In addition to these thorough annual reviews, an exhaustive evaluation was conducted every third year to assess suitability for grant renewal. Industrial funding (much more volatile) was based upon accomplishment and long-term strategic value of the Center's programs.

- 1988-1989. Prepared annual reports (each approximately 100 pages) and organized NSF site visits leading to the awarding of $6.8M from NSF (two-year total) for 1989 and 1990 calendar year.

- 1990. Prepared renewal proposal (100 pages) and organized successful NSF site visit which resulted in a $14.7M renewal grant over a five-year period (1991-1996).

- 1991-1994. Prepared annual reports (108, 55, 40, and 30 pages, respectively) and organized NSF site visits to secure NSF funding of $11M total for 1992, 1993, 1994 and 1995 calendar years (part of 5-year grant requiring annual re-commitment).

B) Industrial

- 1989-1995. Secured industrial funding of $10.7M (total) through CTR's Industrial Participants Program involving 27 companies. Program involved three-year commitment per company. Most industrial contracts extend beyond 1995.

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Many Industrial Participants have previously renewed for second or third three-year commitments.

- 1995- 1999. Participated in the organization of UCSD's Center for Wireless Communications and serving as Director from July, 1995, to Nov., 1999. The CWC is funded entirely by industrial grants in the amount of approximately $1M annually.

C) Other

- 1991-1995. Participated in the organization of the Optical Network Technology Consortium (ONTC) involving Columbia University and six companies. Secured ARPA funding of $11.5M total for 3 years ($750K to Columbia). Participating in preparation of follow-up proposal, in progress.

- 1994-1995. Participated in the organization of the National Transparent Optical Network Consortium (NTONC) involving the University of California (San Diego), Columbia University, and seven companies. Secured ARPA funding of $10.8M total for 3 years ($360K to UCSD and Columbia).

- 1999-2001. Co-investigator, In-home Ad-hoc Networks, State of California Communications Research Initiative ($194,476 total)

- 1999-2001. Co-investigator, Space-Time Processing for Mobile Communications, State of California Communications Research Initiative ($213,396 total)

- 1999-2001. Co-investigator, Enhanced Coverage for Wireless Systems, State of California Communications Research Initiative ($271,915 total)

- 1999-2001, Principal Investigator, Universal Wireless Communications, State of California Communications Research Initiative ($279,153 total)

- 1999-2001. Principal Investigator, Wireless Access to the Internet, State of California Communications Research Initiative ($245,962 total)

- 2001-2002. Principal Investigator, various projects, Center for Wireless Communications ($100,000 total)

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- 2003-2006. Principal Investigator, various projects, Center for Wireless Communications ($300,000 total)

- 2004-2006 Principle Investigator, Mesh-Based Last-Mile Networks, Center for Networked Systems

Honors:

1995 IEEE Frederick Elersick Award for Best Paper appearing in IEEE Communications Magazine. Paper title: "The Scalable Lightwave Network," Dec. 1994.

Fellow, Institute of Electrical and Electronic Engineers (IEEE) (1988), cited for contributions to high capacity digital satellite systems and broadband local communication networks.

Listed, Who's Who in America (1988-present).

Listed, Who's Who Register of Business Leaders.

Sigma Xi (1968).

Eta Kappa Nu (1968).

Professional Activities:

Delivered invited testimony to U.S. House of Representatives Subcommittee on Science, on the role of basic research in economic competitiveness (1991).

Member, IEEE Communications Society Board of Governors, 1990-92.

General Chairman, IEEE International Workshop on Mobile Multimedia Communications (1999).

General Chairman, International Conference on Universal Personal Communications (1997).

General Chairman, Third IEEE Workshop on Metropolitan Area Networks (1989).

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Tutorial Chairman, IEEE INFOCOM Conference (1988).

General Chairman, First IEEE Workshop on Space Communications (1981).

Editor for Local Lightwave Networks, IEEE Transactions on Communications (1987, 1988).

Editor for Satellite and Space Communications, IEEE Transactions on Communications (1983-1986).

Organized new IEEE-Sponsored workshops on VLSI in Communications (1981) and Metropolitan Area Networks (1986).

Member, Technical Program Committee, IEEE National Telecommunications Conference (1981), IEEE INFOCOM (1983, 1988, 1990, 1991, 1992), IEEE Workshops on Metropolitan Area Networks (1986, 1987, 1990, 1991, 1992, 1993).

Participated in two NSF workshops to chart future research directions in communications and networks (1990, 1992).

Advisory Board, Columbia Informatics and Telecommunications Institute (1989-1995).

Invention Advisory Committee, Liberty Science Center (1991-2000).

Organized and chaired numerous technical sessions at International Communications Conferences, Global Telecommunications Conferences, Communication Theory Workshops, INFOCOM Conferences, Eastern Communication Forum, International Workshop on Digital Communications, European Wireless Conference

Participated in NSF Networking Panel for Proposal Review (2002)

Committee Member, National Research Council Computer Science and Telecommunications Board Project on "The Intent in the Evolving Telecommunications Infrastructure" (1998 – 1999)

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Publications (Textbook)

An Introduction to Broadband Networks: LANs, MANs, ATM, B-ISDN, and Optical Networks for Integrated Multimedia Telecommunications, published by Plenum Publishing Corporation (N.Y.), 1994.

Publications (Book Chapters)

M. Naghshineh, M. Schwartz, and A.S. Acampora, "Issues in Wireless Access Broadband Networks," *Wireless Information Networks*, Kluwer Academic Publications, 1995.

A.S. Acampora, "Architectures for Hardware and Software Scalable Multiwavelength Networks," *Photonic Networks*, published by Springer-Verlag, 1997.

A.S. Acampora, S.V. Krishnamurthy, and M. Zorzi, "Media Access Protocols for Use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Communications", *Wireless Networks*, Springer-Verlag, 1998.

A.S. Acampora, J.S. Reddy, R. A. Gholmieh, and H. Jin, "Role of Software Defined Radio in Wireless Access to the Internet" 12th Tyrrhenian International Workshop on Digital Communications, September 2000; also reproduced in "Software Radio," Springer – Verlag, 2001.

Publications (Archive Journals):

Digital Multibeam Communication Satellite Systems

A.S. Acampora, "Reliability Considerations for Multiple Spot Beam Communication Satellites," Bell System Technical Journal, Vol. 56, No. 4, April 1977, pp 575-596. Proposed and studied several highly efficient transponder sparing techniques to greatly improve overall multi-transponder satellite reliability.

A.S. Acampora, "Spectral Sharing in Hybrid Spot and Area Coverage Satellite Systems via Channel Coding Techniques," Bell System Technical Journal, Vol. 57, No. 7, Part 2, Sept. 1978, pp 2613-2632. Proposed and studied channel coding to permit universal coverage of the Continental United States from a geosynchronous satellite employing overlapping spot and wide-area beams.

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A.S. Acampora and B.R. Davis, "Efficient Utilization of Satellite Transponders via Time-Division Multibeam Scanning," Bell System Technical Journal, Vol. 57, No. 8, Oct. 1978, pp 2901-2914. Describes a new communication satellite system architecture invented and patented by Acampora to provide universal coverage over a wide area by means of a plurality of high capacity scannable spot beams. Also contains proof of a theorem governing necessary and sufficient conditions for the assignment of terrestrial traffic to transponders. This fundamental theorem has since been widely applied to a variety of terrestrial switching systems.

A.S. Acampora, "Digital Error Rate Performance of Active Phased Array Satellite Systems," IEEE Trans. Antennas and Propagation, Vol. AP-26, No. 6, Nov. 1978, pp 833-842. Computes intermodulation distortion and bit error rate caused by nonlinear amplification of signals in a multi-beam phased array satellite system.

A.S. Acampora, C. Dragone, and D.O. Reudink, "A Satellite System with Limited Scan Spot Beams," IEEE Trans. Communications, Vol. COM-27, No. 10, Oct. 1979, pp 1406-1415. Applies a fundamental theorem, previously proven by Acampora, to yield a practical way to implement the multiple scanning spot beam concept.

A.S. Acampora and R.E. Langseth, "Baseband Processing in a High Speed Burst Modem for a Satellite Switched Time-Division-Multiple-Access System," IEEE Trans. Communications, Vol. COM-27, No. 10, Oct. 1979, pp 1496-1503. Presents block diagram designs and analysis of the modules needed to synchronize and process signals under the unique constraints imposed by high-speed operation.

A.S. Acampora, "A Shared Resource Time-Division-Multiple-Access Approach to Increase the Rain Margin of 12/14 Ghz Satellite Systems," Bell System Technical Journal, Vol. 58, No. 9, Nov. 1979, pp 2097-2111. Presents a new technique to overcome rain fading in satellite systems by sharing and dynamically deploying a small pool of reserved time slots to those ground stations suffering local fade events. The basic technique was shown to reduce the required space platform power by 90%, representing an order-of-magnitude saving of this extremely expensive and fundamentally limiting spacecraft component.

A.S. Acampora and J.T. Curry, "Frame Synchronization Concept for Time-Division-Multiple-Access Burst Modems," IEEE Trans. Aerospace and Electronic

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Systems, Vol. AES-16, No. 2, March 1980, pp 169-179. Presents analytical and experimental results for a high-speed frame synchronizer built and tested in the laboratory.

A.S. Acampora, "The Ultimate Capacity of Frequency Re-Use Communication Satellites," Bell System Technical Journal, Vol. 59, No. 7, Sept. 1980, pp 1089-1122. Derives a rigorous information-theoretic bound on the informational throughput, or capacity, achievable by a multi-beam satellite constrained by power, bandwidth, and satellite antenna aperture dimensions (beamwidth).

A.S. Acampora, "Rain Margin Improvement Using Resource Sharing in 12 Ghz Satellite Downlinks," Bell System Technical Journal, Vol. 60, No. 2, Feb. 1981, pp 167-192. Analytically derives the additional rain margin provided via sharing of a small pool of transponder time slots among geographically dispersed ground stations when accounting for real rain fade statistics and correlations.

D.O. Reudink, A.S. Acampora, and Y.S. Yeh, "The Transmission Capacity of Multi-Beam Communication Satellites," Proceedings IEEE, Vol. 69, No. 2, Feb. 1981, pp 209-225. Describes and analyzes the practical limitations on informational throughput delivered by a multi-beam geosynchronous satellite under power, antenna size, and bandwidth constraints, and subject to intersatellite interference, rain fading, and non-uniform terrestrial traffic patterns.

A.S. Acampora, "The Use of Resource Sharing and Coding to Increase the Capacity of Digital Satellites," IEEE J. Sel. Topics in Communications, Vol. SAC-1, No. 1, Jan. 1983, pp 132-142. Proposes and studies a generalized technique using adaptive forward error correcting coding for sharing a small pool of unused time slots to protect a large number of ground stations against rain fades. Contains a rigorous analysis involving coding gain and rain fade statistics to show a ten-fold improvement in informational throughput achievable by use of this technique.

Broadband Communication Networks

A.S. Acampora and M.G. Hluchyj, "A New Local Area Network Architecture Using a Centralized Bus," IEEE Communications Mag., Vol. 22, No. 8, Aug. 1984, pp 12-21. Describes a short bus Local Area Network which integrates voice and data, achieves perfect capture, and is shown, by analysis, to provide the best throughput-delay performance possible.

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A.S. Acampora, M.G. Hluchyj, C.D. Tsao, "A Centralized Bus Architecture for Local Area Networks," Journal of Telecomm. Networks, Vol. 3, No. 2, Summer 1984, pp 89-102. Elaborates upon the architecture and performance advantages of centrally located short bus Local Area Networks.

K.Y. Eng and A.S. Acampora, "Fundamental Conditions Governing Time-Division-Multiplex Switching Assignments in Terrestrial and Satellite Networks," IEEE Trans. Communications, Vol. COM-35, No. 7, July 1987. Establishes necessary and sufficient conditions governing traffic assignability to the ports of a multi-stage Time Division Switch.

Y.S. Yeh, M.G. Hluchyj, and A.S. Acampora, "The Knockout Switch: A Simple Modular Architecture for High Performance Packet Switching," J. Selected Areas in Communications, Vol. SAC-5, No. 8, Oct. 1987, pp 1274-1283. Proposes and analytically studies a new space division packet switch based on a fully connected architecture to achieve the irreducible delay-throughput performance arising from congestion at the output port only. The overall complexity is controlled by a novel tournament-like contention resolution 1 scheme. Reprinted in Performance Evaluation of High Speed Switching Fabrics and Networks, IEEE Press, ed. T. Robertazzi, 1992.

A.S. Acampora, M.G. Hluchyj, and M.J. Karol, "Terabit Lightwave Networks: The Multihop Approach," AT&T Technical Journal, Vol. 66, No. 6, Nov./Dec. 1987, pp 21-34. Describes a novel lightwave network architecture, originally conceived by Acampora, which for the first time, taps the vast bandwidth potential of lightwave technology through speed constrained electro-optic ports. This approach solves a long-standing problem in broadband lightwave networks and permits a one-thousand fold increase in deliverable informational throughput compared against alternative approaches.

A.S. Acampora and K.Y. Eng, "A Decoupled Approach for Fast Time Division Multiplex Assignment in Constrained Hierarchical Systems," IEEE Trans. Communications, Vol. COM-36, No. 5, May 1988, pp 636-640. Describes a new switching architecture using frame memories to decouple the inbound and outbound assignments, thereby reducing a very difficult two-dimensional matrix search into two trivially simple one-dimensional searches.

A.S. Acampora and M.J. Karol, "An Overview of Lightwave Packet Networks," IEEE Network Magazine, Vol. 3, No. 1, Jan. 1989. Describes opportunities,

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constraints, and novel architectures to realize the capacity potential of lightwave networks through speed-constrained electro-optic ports.

A.S. Acampora, "A High Capacity Metropolitan Area Network Using Lightwave Transmission and Time Multiplexed Switching," IEEE Trans. Communications, Vol. COM-38, No. 10, Oct. 1990. Presents a combined time and wavelength multiplexed architecture to achieve extremely high capacity in a centrally located switch. Proves a basic theorem governing traffic assignability and applies this to show that with no loss of performance, each wavelength can be separately switched, thereby greatly reducing the bandwidth required and the dimensionality of the switch.

J.F. Labourdette and A.S. Acampora, "Logically Rearrangeable Multihop Lightwave Networks," IEEE Trans. Communications, Vol. 39, No. 8, Aug. 1991. Identifies the independence between physical topology and logical wavelength connectivity in multihop lightwave networks and presents and studies heuristic techniques to match connectivity with traffic patterns.

A.S. Acampora and S.I.A. Shah, "Multihop Lightwave Networks: A Comparison of Store & Forward and Hot Potato Routing," IEEE Trans. Communications, Vol. 40, No. 6, June 1992. Derives the probability distribution for the number of hops and demonstrates a hot potato throughput degradation factor of 3 to 4 relative to store & forward.

A.S. Acampora and J.F. Labourdette, "A Traffic-Handling Comparison of Centralized and Distributed ATM Switching Systems," accepted, IEEE Trans. Comm. Shows how traffic nonuniformities can be exploited to improve the throughput of distributed, wide area optical multihop networks and to produce a call blocking performance essentially equal to that of a large centralized switch.

Z.-S. Zhang and A.S. Acampora, "Analysis of Multihop Lightwave Networks with Hot Potato Routing and Optical Packet Compression," submitted to IEEE Trans. Comm.

A.S. Acampora, "Intelligent Optical Networks: Research, Education, and Industrial Programs at the Center for Telecommunications Research," Proc. IEEE, Vol. 81, No. 1, Jan. 1993. Describes the various programs underway at CTR--their organization, cross-disciplinary dependencies, industrial involvement, and strategic planning evolution; technically highlights optical networks and broadband cellular access.

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C.A. Brackett and A.S. Acampora, et al., "A Scalable Multiwavelength Multihop Optical Network," IEEE J. Lightwave Tech., Vol. 11, No. 516, May/June 1993, special issue on Broadband Optical Networks. Describes and studies an approach employing wavelength re-use for modular optical networks, scalable to national scope.

R. Gidron and A.S. Acampora, "A User Tunable Access Lightwave Network," IEEE J. Lightwave Tech., Vol 11, No. 5/6, May/June 1993. Presents a novel technique for reconfiguring an optical network in response to changing traffic patterns by reassigning users to different access stations, thereby avoiding transient service disruptions during reconfiguration phase.

R. Chipalkatti, Z.-S. Zhang, and A.S. Acampora, "Protocols for Optical Star Coupler Network using WDM: Performance and Complexity Studies," IEEE J. Sel. Areas Comm., Vol. 11, No. 4, May 1993, special issue on Gigabit Protocols. Discusses systems issues associated with coordination among stations in a packet network using rapid wavelength agility, and contrasts performance of several protocols.

S.D. Elby and A.S. Acampora, "Wavelength-Based Cell Switching in ATM Mutlihop Lightwave Networks," accepted, Computer Networks and ISDN Systems, Vol. 26, 1994. Presents an algorithm which exploits limited tunability of semiconductor lasers and "don't care" states of multihop networks to vastly improve optical fanout, network throughput, and end-to-end delay.

Z.S. Zhang and A.S. Acampora, “Performance Analysis of Multihop Lightwave Networks with Hot Potato Routing and Distance-Age Priorities,” IEEE Trans, Communications, Vol. 42, No. 8, Aug. 1994. Presents an analysis of achievable delay and throughput for various priority schemes based on package age and distance from destination.

J.F. Labourdette, G. Hart, and A.S. Acampora, “Branch-Exchange Sequences for Reconfigurable Lightwave Networks,” IEEE Trans. Communications, Vol. 42, No. 10, Oct. 1994. Describes how a target multihop optical network topology can be achieved from an original configuration via a sequence of minimally-disruptive two link Branch Exchange Operations.

A.S. Acampora, “The Scalable Lightwave Network,” IEEE Communications Magazine, Vol. 32, No. 12, Dec. 1994. Presents a novel architectural approach

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for distributed multihop lightwave networks in which both the required amount of hardware and the complexity of the call routing and reconfiguration algorithms scale in direct proportion to the number of users, such that the necessary configurement and computational complexity per user are constants, even for very large networks.

A.S. Acampora and J.F. Labourdette, "A Traffic Handling Comparision of Centralized and Distributed ATM Switching Systems," IEEE Trans. Communications, Vol. 43, No. 6, June 1995. Shows how a multihop lightwave network can be operated as a geographically distributed ATM Switch, and demonstrates that performance compares favorably to the best achievable by an ideal centralized switch with output queueing.

Z. S. Zhang and A.S. Acampora, "A Heuristic Wavelength Assignment Algorithm for Multihop WDM Networks With Wavelength Routing and Wavelength Re-Use," IEEE/ACM Trans. Networking, Vol. 3, No. 3, June 1995. Presents a heuristic strategy for assigning a limited number of wavelengths among multihop access stations in accordance with point-to-point traffic nonuniformities, and shows that ATM call handling performance compares favorably to the best possible from an idealized centralized switch with output queueing.

Z.S. Zhang, D. Guo, and A.S. Acampora, "Logarithmically Scalable Routing Algorithms in Large Optical Networks," Journal of High Speed Networks, Vol. 4, No. 1, 1995. Presents a multihop lightwave network topology and virtual connection routing algorithms of complexity which scales logarithmically with number of users, and demonstrates performance which compares favorably to the best possible from an ideal centralized switch with output queueing.

M. Kovacevic and A.S. Acampora, "On the Benefits of Wavelength Translation in All-Optical Clear Channel Networks," IEEE Journal Selected Areas in Communications, issue on Optical Networks, Vol. 14, No. 5, June 1996. Compares the capacity of clear-channel optical networks for a system allowing direct optical wavelength translation against that of a system constrained by fixed wavelength assignment.

D. Guo and A.S. Acampora, "Scalable Multihop WDM Passive Ring with Optimal Wavelength Assignment and Adaptive Wavelength Routing," IEEE Journal Lightwave Technology, June 1996.

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M. Kovacevic and A.S. Acampora, “Electronic Wavelength Translation in Optical Networks,” IEEE Journal Lightwave Technology, special issue on Multiwavelength Optical Technology and Networks, Vol. 14, No. 6, June 1996. Compares the capacity of fixed wavelength optical networks against that of networks permitting wavelength translation via electro-optic conversion.

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A.S. Acampora, "Signal-to-Noise Analysis of an Optical Packet Compression/Expansion Technique," IEEE Communication Theory Workshop, July 1991, Rhodes, Greece.

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A.S. Acampora, "Management and Control of All-Optical Networks," Gigabit Network Symposium, July 1991, Washington.

A.S. Acampora, "Application of Wavelength Agility to Distributed ATM Switching on a 'Passive' Optical Medium," IEEE Computer Communications Workshop, Oct. 1991, Monterey.

A.S. Acampora, "Toward an All-Optical Telecommunications Infrastructure," GTE Technical Executive Management Meeting, Dec. 1991, Tampa.

A.S. Acampora, "Optical Networks: Facts, Myths and Reality," invited paper, 1992 Optical Fiber Conference, San Jose, Feb. 1992.

A.S. Acampora, "All-Optical Networks," invited paper, IEEE Workshop on Metropolitan Area Networks, Taormina, Italy, May 1992.

A.S. Acampora, "Toward an All-Optical Telecommunications Infrastructure," LEOS Summer Topical Meeting on Optical Networks, Santa Barbara, Aug. 1992.

S.D. Elby and A.S. Acampora, "Use of Limited Wavelength Agility in Multihop Lightwave Networks," LEOS Summer Topical Meeting on Optical Networks, Santa Barbara, Aug. 1992.

A.S. Acampora, "WDM-Based Optical Networks," 1993 Optical Fiber Conference, San Jose, Feb. 1993.

A.S. Acampora, "Who Needs All-Optical Networks?", panel session, IEEE INFOCOM '93, San Francisco.

A.S. Acampora, "A Model System for Third Generation Personal Wireless Communications," Telecomm. Research Seminar, Center for Advanced Technology in Telecommunications, Polytechnic University, Dec. 3, 1992.

A.S. Acampora and M. Naghshineh, "Wireless ATM Networks," 6th IEEE LAN/MAN Workshop, San Diego, Oct. 1993.

A.S. Acampora and M. Naghshineh, "An Architecture and Methodology for Mobile Executed Cell Hand-off in Wireless ATM Networks," 8th IEEE Workshop on Computer Comm., San Diego, Oct. 1993.

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A.S. Acampora, "Toward an All-Optical Telecommunications Infrastructure," ARPA Principal Investigators Conf., Santa Rosa, Aug. 1993.

A.S. Acampora, Packet Access in Third Generation Personal Wireless Networks," AT&T Bell Laboratories, Feb. 1994.

M. Naghshineh and A.S. Acampora, "Issues in Wireless Access Broadband Networks," Fifth WINLAB Workshop on Third Generation Wireless Networks, April 1995, New Brunswick.

A.S. Acampora, "Trends in Broadband Wireless Access," IEEE San Diego Sectional Meeting, Dec. 1995, San Diego.

A. Acampora, S.V. Krishnamurthy, and M. Zorzi, "Media Access Protocols for use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Applications", 9th Tyrhennian Conference on Digital Communications, Lerici, Italy, Sept. 1997.

A.Acampora, "Strategies for Universal Wireless Access", Workshop on Multi-Access, Mobility and Teletraffic for Wireless Communications, Venice,Oct.1999

A.Acampora and L. Du, "Free-Space Optical Networks: Some Capacity Considerations," IEEE LEOS Summer Topicals Meeting, San Diego, July 2005

A.Acampora, R. Tamari, and S. Bhardwaj, "A Best-Case Performance Comparison of Cellular Data Networks with Cooperating and Non-Cooperating Base Stations," Workshop on Cooperative Coomunications, Wireless Internet Center for Advanced Technology, Polytechnic University, Brooklyn, NY, Oct. 2005

A. Acampora, "At the Forefront of Modern Telecommunications", 2007 Distinguished Lecturer series, University of Padua, April 18, 2007

A.Acampora, "Quality-of-Service Considerations for Cellular and Ad-hoc Wireless Networks," 4th Int'l Telecom Networking Workshop IT-NEWS (QoS-IP) 2008, Venice, Italy Feb.13-15, 2008

Courses/Seminars Taught at Columbia University:

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EE.E9701: Communication Systems and Networks (Autumn 1988, Autumn, 1989, Autumn 1990, Autumn 1991, Autumn 1992, Autumn 1993).

EE.E4702: Communications Theory and Networks (Spring 1989, Spring 1990, Spring 1991, Spring 1992, Spring 1994).

Courses/Seminars Taught at UCSD:

ECE 151: Probability and Statistics for Engineers (Spring 1996)

ECE 257B: Wireless Networks (Spring 1996, Winter 1997, Winter 2000, Winter 2003, Winter 2004, Winter 2005, Winter 2006, Winter 2007, Winter 2008, Winter 2009, Winter 2010)

ECE 109: Probability and Statistics for Engineers (Spring 1997, Winter 1998, Winter 1999, Winter 2000, Winter 2001, Winter 2002, Winter 2003 Winter 2004, Winter 2005, Winter 2006, Winter 2007)

ECE 153 Probability and Random Processes (Spring 2003, Spring 2004, Fall 2004, Spring 2006)

External Courses:

Developed and regularly offer multi-day intensive short courses to practicing engineers on the topics of Modern Telecommunications, Cellular Systems, and Broadband Networks. All three have been offered nationally and internationally numerous times over the past ten years.

Doctoral Students:

J.F. Labourdette: Wavelength agile re-arrangeable lightwave networks

S.I.A. Shah: Very high speed lightwave networks

R. Khayata: Broadband radio Local Area Networks

R. Gidron: Traffic control in lightwave networks

D. Seidman: Optical network logical topologies and traffic flow).

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S. Elby: Multihop networks with rapidly tunable elements.

M. Naghshineh: Handoff, registration, and traffic management in ATM-based wireless personal networks.

N. Jaganath: Scalable management algorithms for multihop optical networks.

D.-Y. Guo: Logical hierarchies for scalable optical networks.

S. Krishnamurthy: Broadband wireless access networks.

P. Adhikari: Broadband wireless access networks.

Q. Gao: Broadband wireless access networks.

R. Gholmieh: Multicode CDMA for improved coverage

J. Reddy: Wireless access to the Internet

Y. Tokgoz: Wireless networks for the home and office

H. Jin : Adaptive Antennas for improved capacity

S.Bhardwaj: Wireless Networks with Cooperative Nodes

L. Du: Broadband Wireless Access Networks

V.Menon: Ad-hoc Wireless Networks

Michael Tan: Ad-hoc Wireless Networks

Louisa Ip: Ad-hoc Wireless Networks

Patents Issued:

U.S. Patent No.	Title	Issue Date
4,087,787	Decoder for Implementing An Approximation of the Viterbi Algorithm Using Analog	May 2, 1978

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	Processing Techniques	
4,145,658 (co-inventors: D.O Reudink, Y.S. Yeh)	Method and Apparatus for Cancelling Interference Between Area Coverage and Spot Coverage Antenna Beams	Mar. 20, 1979
4,163,942 (co-inventors: D.O. Reudink, Y.S. Yeh	Method and Apparatus for Effecting Communication with Receivers Disposed in Blackout Regions Formed by Concurrently Transmitted Overlapping Global and Spot Beams	Aug. 7, 1979
4,178,550 (co-inventors: D.O. Reudink, Y.S. Yeh)	Method and Apparatus to Permit Substantial Cancellation of Interference Between a Received First and Second Signal	Dec. 11, 1979
4,232,197 (co-inventor: R.E. Langseth)	Processor For a TDMA Burst Modem	Nov. 4, 1980
4,232,266	Technique for Sharing a Plurality of Transponders Among a Same or Larger Number of Channels	Nov. 4, 1980
4,252,999 1981 (co-inventors: R.E. Langseth, D.O. Reudink, Y.S. Yeh)	Signaling and Ranging Technique for a TDMA Satellite Communication System	Feb. 24,
4,301,533 1981 (co-inventor: D.O. Reudink)	Technique for Increasing the Rain Margin of a TDMA Satellite Communication System	Nov. 17,

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4,309,764	Technique for Increasing the Rain Margin of a Satellite Communication System	Jan. 5, 1982
4,315,262 (co-inventor: D.O. Reudink)	Satellite Communication System with a Plurality of Limited Scan Spot Beams	Feb. 9, 1982
4,381,562	Broadcast Type Satellite Communication Systems	Apr. 26, 1983
4,425,639 (co-inventors: D.O. Reudink, Y.S. Yeh)	Satellite Communications System with Frequency Channelized Beams	Jan. 10, 1984
4,495,619	Transmitter and Receiver Using Sharing and Coding for Increased Capacity	Jan. 22, 1985
4,593,282 (co-inventors: M.G. Hluchyj, C.D. Tsao)	Network Protocol For Integrating Synchronous and Asynchronous Traffic on a Common Serial Data Bus	June 3, 1986
4,638,476 (co-inventor: M.J. Gans)	Technique for Dynamic Resource Allocation in a Communication System	Jan. 20, 1987
4,726,040	A Burst Demodulator	Feb. 16, 1988
4,730,310 (co-inventors: T.S. Chu, C. Dragone, M.J. Gans)	Terrestrial Communications System	Mar. 8, 1988

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4,730,305 (co-inventor: K.Y. Eng)	Fast Assignment Technique for Use in a Switching Arrangement	Mar. 8, 1988
4,760,570 (co-inventors: M.G. Hluchyj, Y. S. Yeh)	The N x N "Knockout" Switch for High Performance Packet Switching Systems	July 26, 1988
4,789,983 (co-inventor: J.H. Winters)	Wireless Network for Wideband Indoor Communications	Dec. 6, 1988
4,914,648 (co- inventors: M.G. Hluchyj and M.J. Karol)	Multichannel Communication Multihop Lightwave Network	April 3, 1990
5,121,240	Optical Packet Time Compression and Expansion	June 9, 1992
5,487,065 (co-inventor: M. Nagshineh)	Method and Apparatus for Supporting Mobile Communications in Asynchronous Transfer Mode Based Networks	Jan.23,1996
5,497,504 (co-inventor: M. Nagshineh)	System and Method for Connection Control in Mobile Communications	Mar. 5, 1996
5,528,583 (co-inventor: M. Nagshineh)	Method and Apparatus for Supporting Mobile Communications in Mobile Communications Networks	Jun. 18,1996
5,530,575 (co-inventor:	Systems and Methods for Employing a Recursive Mesh Network with Extraplanar Links	Jun. 25,1996

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G.C. Brown)		
5,553,074	Transmission Format in Packet Based Communications	Sep. 3, 1996
5,590,125 (co-inventor: M. Nagshineh)	Method and Apparatus for Supporting Mobile Communications in Asynchronous Transfer Mode Based Networks	Dec.31,1996
5,697,066	Media Access Protocol for Packet Access Within a Radio Cell	Dec. 9, 1996
6,049,593	Hybrid Universal Broadband Telecommunications Using Small Radio Cells Interconnected by Free-Space Optical Links	April 11, 2000
6,314,163B1	Hybrid Universal Broadband Telecommunications Using Small Radio Cells Interconnected by Free-Space Optical Links	Nov. 6, 2001
6,594,043 (co-inventors: S.H. Bloom and J.E. Dunn)	System and Method for Providing an Eye Safe Laser Communication System	July 15, 2003
6,751,455 B1	Power and Bandwidth Adaptive In-Home Wireless Communications System With Power Grid Powered Agents and Battery Powered Clients	June15, 2004
6,816,682 (co-inventor: S.I. Ionov)	Global Gateway Architecture for Interconnecting Regional Satellites Into a Communication Network	Nov. 9, 2004
6,907,017 (co-inventor: J.S. Reddy)	Mobility Management in Wireless Internet Protocol Networks	June 14, 2005
7,103,280 B1 (co-inventors:	Architecture for an Optical Satellite Communication Network	Sept. 5, 2006

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S.I. Ionov and G.C. Valley)		
7,197,326 B2	Adaptive Local Wireless Communication System	Mar. 27, 2007
7,409,160 B2 (co-inventors: S.I. Ionov, G.C.) Valley, and H.H. Izadpanah)	Global Gateway Architecture for Interconnecting Regional Satellites Into a Communication Network	Aug. 5, 2008
7,486,641B2 (co-inventor: J.S. Reddy)	Mobility Management in Wireless Internet Protocol Networks	Feb. 3, 2009
7,551,939 B2	Power-Grid-Powered Agents for Wireless Communication Systems	June 23, 2009

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