

Energy automation and digital communications innovator, technology developer, entrepreneur and strategist.

Successful achievements throughout more than 40 years of innovation in automation, energy, multimedia and information technology. Proven ability to create, communicate and commercialize new ideas and technology.

Conceived, developed and manufactured technology that has enjoyed significant worldwide mass-market impact, including:

- Patented energy conservation and automation systems for digital control of lighting in 1972-75;
- Computerized interactive building lighting automation in the 1973-77;
- Conceived and launched first US video music network (StarStream) in 1977-80;
- Developed and produced a series of advanced building automation, energy and lighting management and communications systems throughout the 1970s, 80s and 90s;
- Since the mid-1990s, Mr. Silverman has focused on developing internet-based electricity and grid automation technology for utilities and consumers, to deliver consumer-centric “smart grid” conservation for energy and water.

Demand-side Utility Automation Technology and Interoperability

Led co-development effort with Raytheon Co. for Demand-side Energy Management technology during 1993-97 at LightMedia Corporation. The resulting ECS-2000 system was used by utilities including Central and SouthWest, Southern Co., Detroit Edison and others, as well as the Wisconsin Bell Div. of Ameritech.

This work was continued with the Electric Power Research Institute (EPRI) in 1997-2000, in the Energy Network Computer (“en|c”) project, a collaboration between EPRI and Oracle’s Network Computer group. Demonstration systems were fielded with several utilities including PECO and DTE Energy. Other non-utility projects during this period included the design and engineering of integrated systems for the estates of the co-founder and former Chairman of Apple Computer, and for the Seattle home of a co-founder of Microsoft.

Mr. Silverman founded Broadband Energy Networks Inc. in April 2002 to develop commercial technology leveraging the convergence of broadband networks and electricity distribution. GRIDPLEX NETWORKS LLC was founded in 2008 to apply Broadband Energy’s web-based, customer centric automation technology to “Smart Grid” and “Smart Micro-Grid” deployments.

Several patents and copyright applications are currently pending that cover recent development work in the Internet, communications, energy and information fields. A visual overview of his professional career is available on the web at www.lawrencesilverman.com.

Professional background

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| 1969-1977 | Digital Lighting Corporation , NY, NY – founder and President – interactive lighting control and automation systems. Acquired by Lightolier Inc. (Div. Genlyte-Thomas) in 1977; now Lightolier Controls. |
| 1977-1979 | Starstream Productions, Inc. , NY, NY – founder and Executive Producer – first US video music network – partnership with Billboard Magazine to develop worldwide video music network; precursor to MTV in 1982. |
| 1980-1993 | Transtek International Ltd. , NY, NY, London UK and Mexico City Mexico – founder and President – developer, systems integrator and installation for large-scale international projects in hotels, conference centers and cruise ships worldwide. Full-scale integrated building communications and automation systems in over 40 major projects, many of which used automation technology developed by Mr. Silverman. |
| 1992-2002 | LightMedia Corporation and LightMedia Interactive , Upper Darby PA – founder & CEO – systems and applications for automation in buildings and homes; energy management systems and software (www.lightmedia.com). Technology licensed to GRIDPLEX NETWORKS LLC. |
| 1999-2002 | Buylines.net, Inc. , Upper Darby PA – founder and CEO; Chief Strategist –B2B application services (ASP) delivered over the Internet. Venture acquired in 2000 by a Washington DC investment firm. |
| 2002-2007 | Broadband Energy Networks Inc. – founder and President – systems to manage electrical devices and systems – see www.broadbandenergynetworks.com |
| 2008-date | GRIDPLEX NETWORKS LLC – Chairman and Chief Scientist – automated web-based interoperable networks for Conservation of Energy and Water to empower Green Communities Worldwide www.gridplex-inc.com |

Education: Graduated Phillips Exeter Academy, Exeter New Hampshire in 1963; entered MIT at 16 in Physics and Computer Science (1963-67). MIT varsity wrestling team – New England Championship (3rd). Completed course requirements for BS but left MIT prior to receiving degree in 1967 to found computer and interactive automation company - Digital Lighting Corp. - in NYC. Pursued supplemental studies in electronic media and communications at the New School University in NYC 1968-69.

Personal: Age 62 (b. 1947). Married to the former Nancy Lea Buxton of Charlottesville VA since Nov. 1974. Two children: Katharine, age 34, and Alexander, age 28.

Special Expertise

- **Equipment Manufacturing** - automated monitoring and control system hardware and embedded software
- **System Interoperability** – particularly integration of new communications protocols with legacy systems
- **Customer Systems** – especially energy portal and consumer-centric applications
- **Advanced Meter Interface** - standards and communications
- **Integrated and/or Cross-cutting Systems** – including extension of “Smart Grid” and integration of “Smart Micro-Grid”, DG and DR, and extensions of “Smart Grid” technology from electricity to water, gas and carbon emission reductions by end-users

Contact:

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Chairman and Chief Scientist

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Digital Lighting Corporation, NY, NY (1969-77), Founder & President

Founded company, incorporated in 1969. Developed and patented a computerized multimedia lighting and energy control system, installed in high profile projects throughout the US. Systems used in architecture and design, film, theater, entertainment and building energy management. Operated 40-person manufacturing facility for company's products, including UL testing and certification. Established distribution and rep network, as well as OEM programs with major lighting manufacturers. Digital Lighting originated the concept for the LyteMode products and systems that are sold today by Lightolier (Div. Genlyte-Thomas) as their premium architectural lighting control system. Company sold in 1977-8 to Lightolier-Genlyte; operates today as Lightolier Controls.

Co-holder of US Patent 3,869,699 issued Mar. 4, 1975.

Digital Lighting automation and control products — Design and development of modular commercial, architectural and entertainment lighting control products and systems distributed internationally.

Products designed and manufactured by Digital Lighting under Mr. Silverman's direction included:

- **PDC 6x9 Programmable Lighting Controller** – Interactive Control System User Interface (UL and NYC listed)
- **PDC – D2.4kW Programmable Dimmer Control** - power module and rack (UL and NYC listed)
- **LM System II Programmable PreSet Controllers** – including preset mastering system, remote preset panels, special effects panels, assignor panels and automatic inputs from timeclocks, photocells and sensors
- **PDC-3 System** – integrated programmable control system and power unit (UL). Sold by Altman Stage Lighting as "Galaxy" and by Swivelier as "StarTron".
- **Autofade** (for Lightolier) – programmable control unit – first product in what became Lightolier Controls
- **Video Replay and Display System** - Digital Video-to-Analog computerized lighting control system array – installed to operate scoreboard in Cleveland Stadium, used two Digital Equipment PDP-11s in parallel, digital dimmers connected to a 22,000 lamp display. Co-development with General Electric Lamp Division.
- **LyteMode** – (for Lightolier, now Genlyte Thomas) original designs and specifications for the programmable architectural lighting control network, sold as the top-of-the-line architectural system by Lightolier Controls.

Digital Lighting Projects — Digital Lighting automation technology used in projects in 1971-1977 including:

- **Broadway musicals** — New York City. Custom electronic lighting systems and controls for **Chicago, Pippin, Dancin', Jesus Christ Superstar, Hair** (touring productions).
- **Independence Hall** — Philadelphia, PA. Automated Light & Sound spectacular for the 1976 US Bicentennial.
- **General Electric Lighting Institute** — Nela Park, Ohio. Computerized lighting energy management system at G.E. Lighting headquarters, Nela Park, Cleveland OH.
- **Cleveland Stadium Scoreboard** — Cleveland, Ohio. One of the world's first digital video computerized scoreboards capable of instant replays. Automated digital control system to control 22,400 lamps for digital video display 240x80. Collaboration with GE Lighting (1977-79).
- **Windows on the World** — Lighting systems and automated controls for the facilities at the top of the World Trade Center, New York, NY.
- **Tavern-on-the-Green** — Lighting controls and design for the facility in Central Park, New York, NY.
- **Studio 54** — NY, NY. Interactive electronic lighting control system for the most sensational discotheque in the world.
- **Saturday Night Fever** – Robert Stigwood Productions; lighting consultant for original NYC production. Film won Academy Award for Best Actor (1977).
- **Thank God It's Friday** – Columbia Pictures; lighting consultant for Los Angeles production. Film won Academy Award for Best Song (1978).
- **Playboy Club** — Multimedia entertainment systems throughout facility, New York, NY.
- **Hollywood Palace** — Founded and developed concept for multimedia music TV theater & club, LA
- **Lightolier, Inc.** — Design of the LyteMode™ and Autofade™ Architectural lighting control products and systems.

Awards:

- **Illuminating Engineering Society (IESNA) — Outstanding New Product** recognition from the IESNA in 1974 and 1975
- **Illuminating Engineering Society (IESNA) —** nomination for highest industry system award in 1977 for programmable building lighting automation project.
- **Industry committees:** **Illuminating Engineering Society of North America (I.E.S.)** - Member of the Progress Committee for Electronic Controls from 1975-80.

Starstream Productions, Inc., NY, NY (1977-79), Founder & Executive Producer

Starstream Video Music Network — Conceived and developed the first TV-based video music network in the U.S. — “Starstream” — which was established by Mr. Silverman in partnership with Billboard Magazine in 1977. Mr. Silverman was the founder and Executive Producer. Originated and developed the TV video music entertainment format and secured, negotiated and licensed content from record and film companies.

Also responsible for the design and development of StarStream[®] music video system, including satellite, stereo synthesis and video playback systems. Starstream led to the formation of the MTV Network by Warner-AMEX in 1981. The Hollywood Palace in Los Angeles was originally developed to become the anchor studio for production of StarStream music videos.

Transtek International Ltd., NY, NY (1980-1993), President

Large-scale integration of diverse systems and automation controls for international projects in hotels, corporate and convention centers and other public facilities. Projects included design, engineering, specification and supply of energy management, lighting and communications systems.

1980 Winter Olympic Games — Lake Placid, New York. Official Consultant Olympic Village.

Televisa Networks — Mexico City Studios — Computer Automation Systems

Hotel Fiesta Americana Hotels — Guadalajara, Cancun, Tijuana, Mexico.

Pemex Tower — Mexico City, Mexico.

Sheraton International Hotels — Mexico City, St. Maarten, Rio de Janeiro, Cancun, Ixtapa

Hyatt International Hotels — Gibraltar

Hilton International Hotel — Barcelona, Spain

Scott Paper Headquarters — Philadelphia, PA

Pennsylvania State House — House and Senate Majority Caucus Rooms, Harrisburg, PA

Franklin Institute Science Museum — Philadelphia, PA

Cunard Lines — Princess, Countess, Sagafjord and Vistafjord luxury cruiseliners.

Nikko Hotel — **Japan Air Lines** - Mexico City, Mexico.

The Hollywood Palace — Hollywood, CA

Kings Mountain Estate Theater — Woodside, CA

QOR Technology Inc. — Automated Architectural Lighting Controls - Mr. Silverman designed the advanced automation and control systems that were installed in many Transtek projects listed above. Transtek operated QOR as its manufacturing subsidiary in 1985-91. Products developed and manufactured under Mr. Silverman’s direction include:

- **LightMatrix™ - DMR 2400x4** — 2kW Digital Dimmer and integrated 10kW Power Control pack
- **LightMatrix™ - PGM 4x4 and REMx4** - User Interface programming and control panel

Awards:

- **International Lighting Design Award - Edwin F. Guth International Illumination Design Assn. (I.I.D.A.) 1986 Award of Excellence** - Illuminating Engineering Society and the American Assn. of Interior Designers
- **International Hotel Design Magazine Award** for lighting — 1988 from the AIA (Am. Institute of Architects)
- **Philadelphia Chamber of Commerce - Exporter of the Year** — 1990
- **Pennsylvania Governor's Award for Exporting** — 1991
- **Philadelphia 100** — recognition as one of the Philadelphia region’s fast growth companies — 1991
- **U.S. Small Business Administration PA/MD region - "Exporter of the Year"**— 1992

LightMedia Corporation, Upper Darby PA (1992-2000), President

- **LON-based Systems designed, manufactured and installed as the original test-bed of the LONWorks technology at the Residence of Founder Mike Markkula, Kings Mountain Project** — Woodside, CA — 1992-94. Design, engineering and development of systems and controls for Mike Markkula, founder of Echelon Corporation and co-founder and former Chairman of Apple Computer. This project provided the original test-bed for the Echelon control and communications technology, and included development of a LONWorks dimming system:
 - **LightMatrix-LON™** — Echelon-based LONworks Integrated Lighting and Equipment preset controls
 - **LON Controls** for curtains, windows and other motorized devices.

Neuron-based LONworks Automation Control Systems and Software — 1992-94. Developed integrated hardware and software platform for interactive home and building automation. Prototyped TV-based user-interface in collaboration with RCA for use in hotels and hospitals as universal user-interface.

Ameritech — Wisconsin Bell – 1993-94. Design and engineering of energy management and control systems using LONWorks™ technology in a Building Automation project to demonstrate remote network control of building systems.

Lakeside Residence — Medina, WA – 1993-94. Development work for the "people-tracking" system, an RF smart card system for the residence of one of the founders of Microsoft, as the primary input to the home automation and control system (not for public disclosure).

OpenHouse™ — 1995-96. OpenHouse™ - PC-and-TV-based Integrated broadband Home Information and Control system software for residential gateways - developed as a prototype with Central and SouthWest electric utility.

Utility Demand-side Energy Management Networks – 1994-97. Led co-development with Raytheon of Energy Management and Communications Systems for electric utilities, the ECS-2000. User-interface and software design team developed a small-scale Energy Management and Intelligent Information System installed in thousands of residences and businesses by energy utilities around the US, including Central & SouthWest (TX) – 800 home DSEM deployment; Detroit Edison Intelligent Link (Detroit MI), Southern Co. (Atlanta GA), and others.

The ECS-2000 Energy Management System delivered control signals, information and messaging over existing electric wiring and documented peak reduction of up to 30% and overall consumer usage by 12-15%. Personally developed many of the user-screens for the Raytheon ECS-2000 User Interface Module, and managed the overall technology and software development effort. First implementation of consumer choice and control.

Collaboration with Electric Power Research Institute (EPRI) and Oracle Network Computer Inc. (NCI) Div. — 1997-99. Conceived, prototyped and demonstrated Universal Gateway™ interface software - BusinessLinc™ and NexTV™ - Internet-based platforms delivering value-added applications and services for information appliances, aimed at small-to-medium business and homes. Developed business and revenue model to support deployment of services to Internet-based user community. Conceived unique graphical user-interface and navigation system, using the NCI-OS protocol for interactive “thin-clients”, including information appliances and set-top boxes. Patent applications pending on several Internet-based communications, messaging and energy applications included.

Concept for Internet-based Information and Commerce Networks explored in demonstration projects with energy utilities around the US, including Detroit Edison, PECO, and Central SouthWest, for residential and commercial use.

Industry committees:

Standards Committee participation including the **Electronic Industry Assn. (EIA) Consumer Electronics Bus (“CEBus”) Committee** (1988-90) and **Echelon LonMark® Committee** (1993-94), establishing standards for network interoperability and product operating protocols.

Buyline.net, Inc., Upper Darby PA (Dec 1999 – Jan 2002), founder

Developed online electronic commerce for business-to-business by embedding RFP/RFQ capability in online Yellow Pages and business directories (one of a suite of online services for small-to-medium businesses). Co-founded company; led development and strategic partnership programs. In 2000 sold majority interest to Washington DC investment group that installed CEO and management team. Company relocated to Arlington, VA; subsequently merged into parent, U.S. Technologies Inc.

Broadband Energy Networks Inc., Upper Darby PA (Apr 2002–Dec. 2007), Founder & President

Networked energy, information and automation services.

In Dec., 2002, acquired assets that had cost Coactive Networks Inc., a venture-backed leader in residential gateways, over \$42M. Also acquired selected assets of Motorola’s PowerCom Prepaid Metering Division (LON-based meter with remote read-out) in 2004.

Developed multi-protocol universal gateway including LON, ModBus, ZWave, Zigbee &c gateway for IP integration across PLC, RF and wired media (RS-232, RS-485, pulse).

Broadband Energy licensed LightMedia’s algorithms for customer-centric user-interface and applications.

Developed and installed User systems for IBM installed at original CenterPoint Energy Smart Grid BPL Demonstration Laboratory in Houston TX in 2005-6, including AMR, AMI and Customer Service systems and applications.

Automated Demand Response demonstration systems were installed in an EPRI-funded project at Rochester Public Services, Rochester MN in 2006.

Awards

Best Management Team 2006 – Ben Franklin Partnership, Philadelphia PA

Industry Presentations

Invited Presenter at the following Smart Grid Conferences:

- Cleantech Conferences in 2006-8 in Washington DC and Shanghai China
- Broadband Utility BPL Conference – Hong Kong 2007 and 2008
- Grid InterOp – Policy and Technology Presentation - 2008

GRIDPLEX INC. AND GRIDPLEX NETWORKS LLC, Upper Darby PA (2008 – present), Chairman and Chief Scientist

GRIDPLEX was formed to expand the use of the technology of Broadband Energy as a foundation to develop and deploy networks providing Conservation Applications and Systems for Energy and Water to “Empower Green Communities” around the globe. Assets and intellectual property of Broadband Energy acquired by GRIDPLEX NETWORKS LLC.

Adjunct participant in the GridWise Architecture Council (with Ken Wacks serving as primary company representative).

Developed complete customer-centric system for providing “Smart Grid” DR and AMI capabilities combined with consumer conservation for Energy and Water for universal deployment with utilities and “Green Communities”.