Consumer Electronics

Technology Megatrends 2000

Presentation to

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Abstract

Given that we are at the start of a new millennium it seems appropriate to consider what the future has in store for us. Our consulting practice involves working with clients to use technology to create a strategic business advantage utilizing technology related issues and trends. Many of these technology trends are evolutionary in nature and do provide important incremental benefits in cost reduction and/or product improvement. However, to achieve a significant and sustainable business advantage, it is far more interesting to look for more than just evolutionary trends. In the IEEE Consumer Electronics Society February 2002 Newsletter I introduced the idea of a technology megatrend. By analogy to John Naisbitt 's definition of megatrends, I consider a trend, or technology theme to be a candidate for my list if bringing the technology into the market has the potential to be disruptive to business as usual--something much more than just evolutionary improvement. By disruptive I mean it can change the rules of the game by negating the competitive advantage of the industry leaders, by changing the basic economics of the business, and/or by creating new opportunities that never existed before. I have identified 21 such megatrends of particular importance to the consumer electronics industry but also of general interest to other industries as well. This presentation will further define and characterize each trend and discuss the bases for selection as a megatrend. A web based survey of CE member votes on the importance of each megatrend was also conducted and a statistical analysis of the votes will be presented.
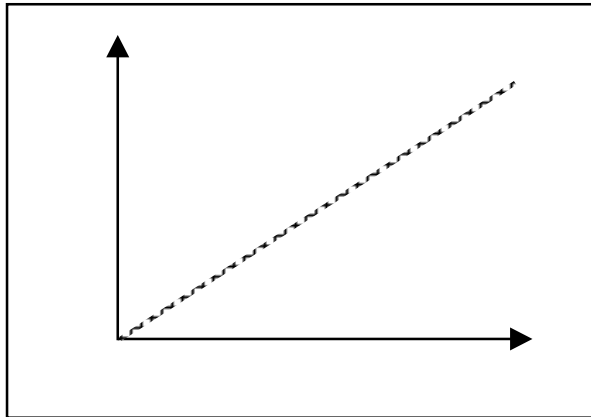
Outline

- Megatrends Defined

- The List

- CE Society Member Survey

Technology Megatrends Defined

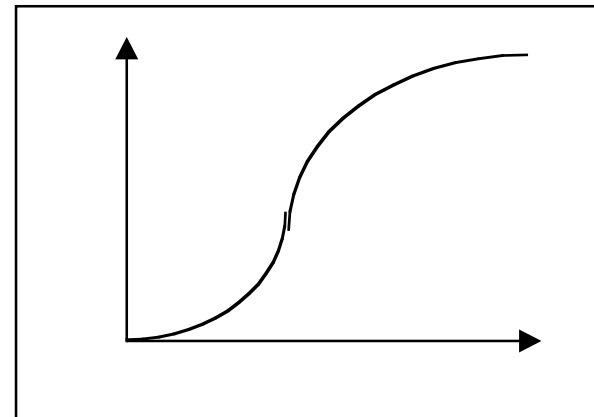## Megatrend=potential to be disruptive to business as usual

Change the Rules!

- New economics

- Enhanced performance

- Increased functionality

- New business models

Evolution ➡ **Revolution**

Technology Megatrends Defined

Visions (video clip visions of the future)

Utility

Fun

Megatrend List

I identified 21 themes with potential to *change the rules*

1. Advanced Audio and Video Compression
2. Advanced Battery & Micro Fuel Cells
3. Advanced Man/Machine Interfaces & I/O
4. Artificial Intelligence Expert & Agent Systems
5. Autoconfiguration and Self Discovery Algorithms
6. Automatic Aesthetic Driven Media Conversion
7. Bandwidth/QoS on Demand Resource Allocation
8. Biometrics
9. Broadband Residential Multimedia
10. Broadband Wireless Packet
11. Context Addressable Storage
12. Digital Rights Management
13. Distributed, Remote, & Peer-to-Peer Computing
14. Fault Tolerant Systems
15. Highly Parallel Computing Architectures
16. Home Networking
17. Integrated Optics and All Optical Networks
18. Micropayment Systems
19. Quality of Service over IP Networks
20. Software Defined Products
21. Virtual Reality

CE Member Survey

CE Society Members Were Polled for Their Opinions

Your Email Address: [   ]

Type of Your Company or Institution

please select only one best category>

	CE Product Manufacturer	Component Manufacturer	Service Provider	Academic or Research Institution	Other
	◉	○	○	○	○

<Least Important   Most Important>

Candidate Technology Megatrend	1	2	3	4	5
1 Advanced Audio and Video Compression	◉	○	○	○	○
2 Advanced Battery & Micro Fuel Cells	◉	○	○	○	○
3 Advanced Man/Machine Interfaces & I/O	◉	○	○	○	○
4 A	◉	○	○	○	○

WRITE INs	1	2	3	4	5
22	◉	○	○	○	○
23	◉	○	○	○	○
24	◉	○	○	○	○
25	◉	○	○	○	○

Enter any comments or remarks in the space below

[   ]

[Submit]   Click Here to record your vote

CE Member Survey

While most trends scored high, there were some clear leaders
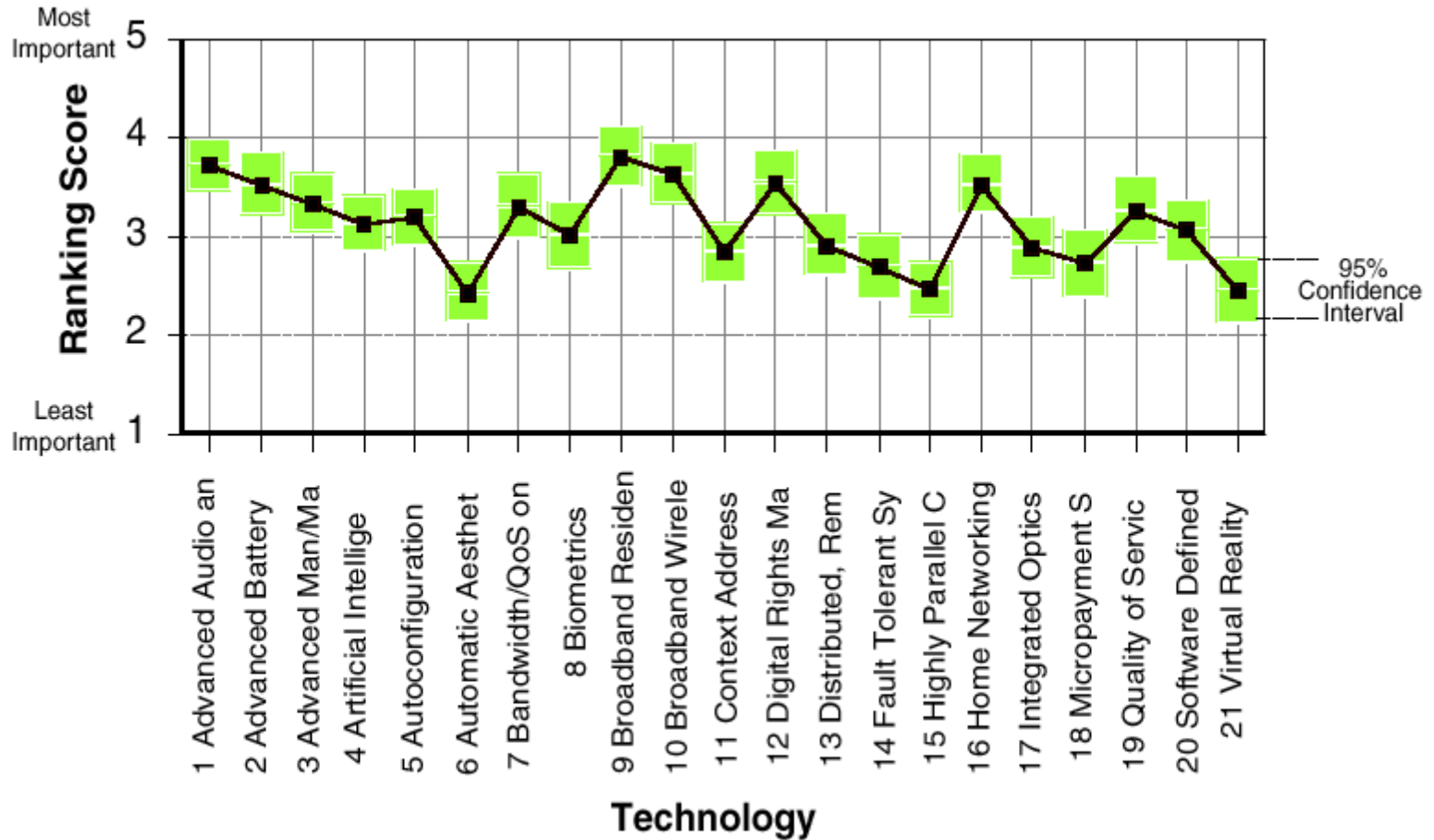
What's Ahead for the CE Industry

Technology Megatrends ⟹
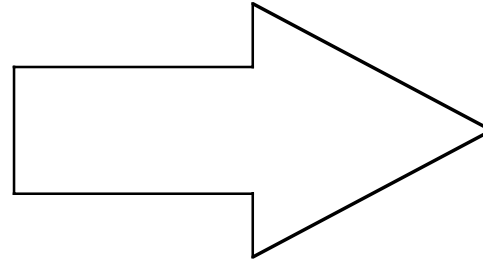
- New economics
- Enhanced performance
- Increased functionality
- New business models

- Feature rich and fun
- Software defined
- Easy to *use* and *learn to use*
- Personal and Portable
- Long run times
- Broadband connected
- Accommodates us versus forces adaptation
- Multifunction multimedia
- Anticipates and automates
- Smart
- Low cost to sell and configure
- Low aftersale lifecycle cost for care and feeding
- Secure and content rich
- Platform for growth

IEEE

Thank you for Listening

Questions? Comments!

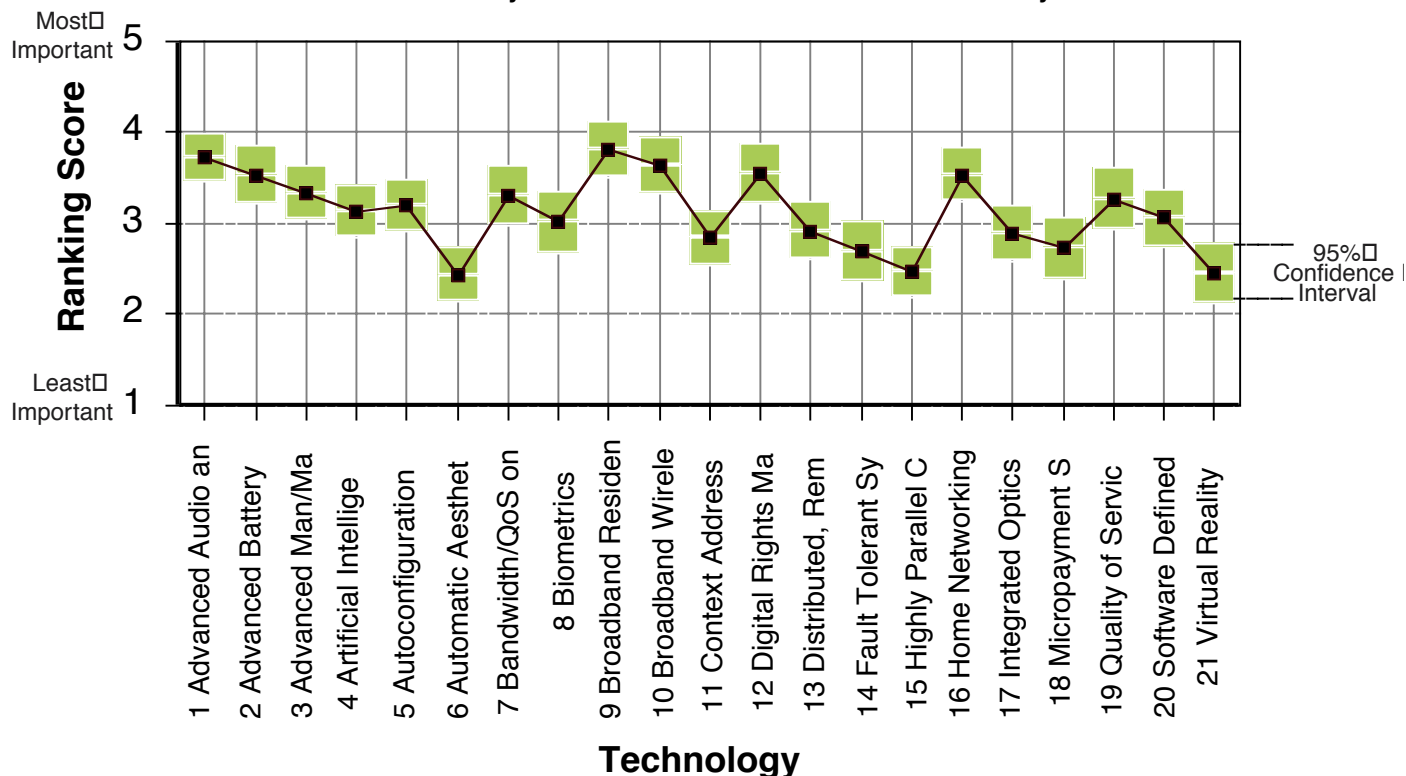|	
Advanced Audio and Video Compression	Algorithms that not only approach near lossless coding but are also computationally aligned with the limited processing power of inexpensive, portable, battery powered devices. The algorithms should be low delay and insensitive to channel transmission impairments and errors.
Advanced Battery & Micro Fuel Cells	Next generation electrochemical devices including batteries and micro fuel cells (e.g. alcohol) that provide increased volumetric and gravimetric energy density, high degree of safety, rapid recharge rates, and long cycle life at low cost
Advanced Man/Machine Interfaces & I/O	As devices get physically smaller and more complex it will be vital to find innovative input/output technologies and displays that provide the resolution at low power drain and small size and weight (e.g. offscreen, projection, and virtual displays perhaps combined with pen input or voice I/O
Artificial Intelligence Expert & Agent Systems	We can build many more features into today's products and services then we can take the time to learn to use. To realize the visions of next generation products and services, we need to incorporate intelligence into the products that adapt to each unique user with a natural language interface and can use agent technology to anticipate and automate routine tasks.
Autoconfiguration and Self Discovery Algorithms	Today's products are moving rapidly toward being but one node in a network of public and private peer-to-peer devices and network access points which need to reconfigure as we move from home, to the street, to the automobile, to the office, and between other islands of connectivity. We need technology that can manage the security, privacy, and billing that supports this mobility.
Automatic Aesthetic Driven Media Conversion	Content providers invest as much or more in the production values of their content. Today's trend to repurposing this content between publications, audio, video, movies, computers, internet appliances, etc-- will be become even more intense as the variety of delivery systems and delivery platforms expand into the future. We need technology that can reformat and repurpose content adding navigation and finding aids that is low cost and automatic.
Bandwidth/QoS on Demand Resource Allocation	The benefits of connectionless packet switched networks for wired and wireless applications is clear, but these networks were not designed to support the quality of service needs of streaming and delay sensitive information such as video, music, and voice telephony. Also many wireless networks, and wired networks, are resource limited and only economic if bandwidth is allocated as needed. We need modulation, coding, and protocol technology that allows demand assignment of QoS and bandwidth with a compatible billing system.
Biometrics	As much of the valuable content and information migrates from physical to electronic form access control and conditional access systems will become critical technologies that give comfort to content owners and consumer users of personal information devices that their content and data are safely locked away with the key being the end user biometrics.
Broadband Residential Multimedia	We are already seeing cable operators offering multimedia bundles of video, internet, and telephony but still lack technologies that take advantage of the possible synergies in cost, performance, and features. Today's solutions suffer from limitations in reliability, difficulties in powering, and high maintenance and logistics costs. We need new architectures and technologies to deal with the limitations of today's solutions.
Broadband Wireless Packet	The promise of 3G wireless for anything, anywhere, anytime is still a promise and while consumers are excited about the vision; today's technology can not deliver the coverage, capacity, cost, convenience, or control that meets the minimum threshold for mass market acceptance.
Context Addressable Storage	While we have advanced technologies available to index, store, and retrieve text based electronically coded content we need parallel indexing and retrieval technologies for non-textual material such as music, video, pictures, voice, fax, and compound documents.
Digital Rights Management	To provide commercial support for electronic sale, distribution, and management of content we need systems that are secure and robust against piracy, renewable, low cost, simple to use, and flexible enough to work in a world of mixed physical, broadcast, and unicast content distribution. The technology must scale to work from content servers to personal and portable battery efficient multimedia devices.
Distributed, Remote, & Peer-to-Peer Computing	Already we see the emergence of networked computing with many consumers sharing databases and content between their PDA, home computer, and office systems. This technology will need to grow to accommodate wireless devices, internet appliances, and new applications.
Fault Tolerant Systems	The vision of a home server or home automation system is not aligned with today's computing devices which exhibit high degrees of hardware and software failures. We need both hardware and software architectures which are fault tolerant, self recovering/repairing, and support remote diagnostics.
Highly Parallel Computing Architectures	To support the demands of multimedia computing, artificial intelligence, agent technology, media conversion, and other nonlinear computing tasks, we need new computing architectures and applications development tools that automatically translate linear code into code suitable for these special highly parallel architectures
Home Networking	With many computers, printers, TV outlets, telephones, etc in the home there is already a need for multipurpose networks. As new home servers and broadband residential access services grow there will be a need for next generation networks which scale in cost and performance from low bit rate control signals up to HDTV rates.
Integrated Optics and All Optical Networks	All optical and passive optical networks offer the promise of very low cost and highly reliable infrastructure for supporting next generation residential multimedia services. Integrated optical devices serving as transceivers and mux/demux functions at the subscriber premises offer the promise of meeting the demands of high performance at low cost.
Micropayment Systems	As a large fraction of today's transactions are in cash and often small value, an efficient and secure micropayments system is needed to support ebusiness as well as point-of-sale transactions with electronic media
Quality of Service over IP Networks	Networks need fully compatible end to end control of quality to support the mix of streaming and non-streaming content
Software Defined Products	Given deregulation and intense competition along with uncertain consumer market requirements for new products and services it is necessary to launch and fine tune products after sale well into their life cycle. By having the product be defined by software, it can be adapted to support evolution of the products and services as well as create attractive recurring revenue streams for the seller
Virtual Reality	With the power of today's computing devices we can now render near photorealistic animated virtual worlds creation new and exciting opportunities for games, information services, and remote telepresence applications.

CE Society Member Feedback from Web Survey

Chart showing Ranking Score (1 = Least Important, 5 = Most Important) for 21 technologies with 95% Confidence Interval bands:

- 1 Advanced Audio an
- 2 Advanced Battery
- 3 Advanced Man/Ma
- 4 Artificial Intellige
- 5 Autoconfiguration
- 6 Automatic Aesthet
- 7 Bandwidth/QoS on
- 8 Biometrics
- 9 Broadband Residen
- 10 Broadband Wirele
- 11 Context Address
- 12 Digital Rights Ma
- 13 Distributed, Rem
- 14 Fault Tolerant Sy
- 15 Highly Parallel C
- 16 Home Networking
- 17 Integrated Optics
- 18 Micropayment S
- 19 Quality of Servic
- 20 Software Defined
- 21 Virtual Reality

Technology

Stuart J. Lipoff CV

Stuart Lipoff is a partner at the technology and management consulting firm of Applied Value (AV) where he is responsible for the firm's practice in communications, information technology, media, and electronics. He assists clients to develop business plans and product strategies where technology is a key factor in the success of the venture. His clients include service providers and manufacturers in media, cable TV, consumer electronics, and wired/wireless communications. Prior to joining AV, Mr. Lipoff spent 25 years at Arthur D Little as VP in The Technology and Innovation Division preceded by 7 years at Motorola and Bell & Howell in wireless communications equipment R&D. Among his accomplishments are leadership of projects that developed the hybrid fiber coax architectures in cable TV, developing the international standards for DOCSIS compatible cable modems, a co-inventor of Commercial Free technology in today's VCRs, and developing the recommendations just adopted by the FCC to accelerate the introduction of digital television in the US marketplace. He is currently working on projects looking at digital rights management technologies for the secure electronic distribution of valuable content and also exploring business opportunities in telematic services.

Stuart Lipoff has BS degrees in EE and Engineering Physics from Lehigh University, an MSEE from Northeastern, and an MBA from Suffolk University. He is an IEEE Fellow, past president of the IEEE Consumer Electronics Society, a current member of the CE Adcom, and present chair of the IEEE CE standards committee. Other IEEE activities have included chair of The Boston Fall 2000 Vehicular Technology Conference and organizer/lecturer of an IEEE Boston short course on fiber optics technology. He is a registered professional engineer in Massachusetts and holds a Certificate in Data Processing (CDP) from the ACM sponsored ICCP.

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