

# The History of IEEE and Electrotechnologies

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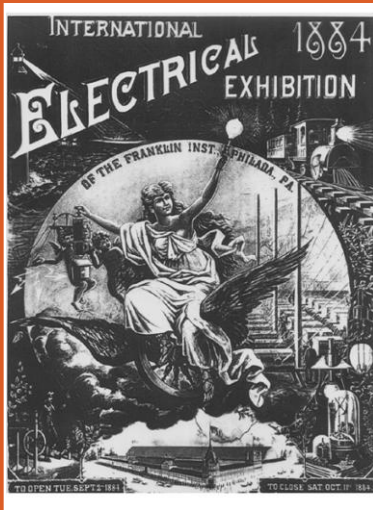
Celebrating 125 Years  
of Engineering the Future

**Since 1884, IEEE has been fostering technical innovation for the benefit of humanity.**

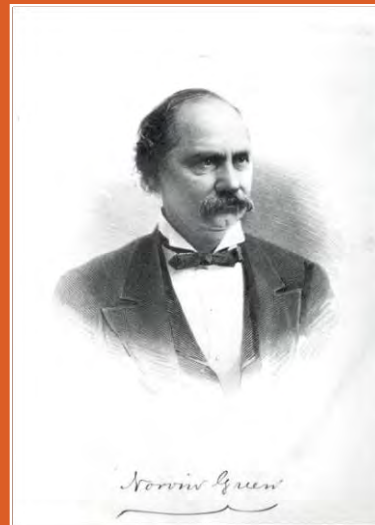


# 1884: The American Institute of Electrical Engineers is founded

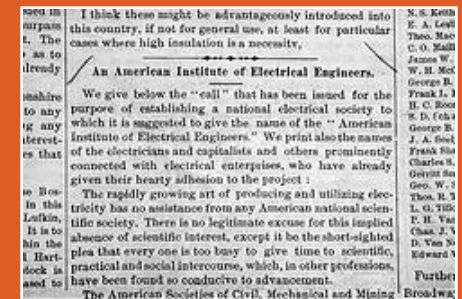
A small group of individuals met in New York and founded the AIEE to advance the new field and represent the US at the 1884 International Electrical Exhibition in Philadelphia. Norvin Green of Western Union became the first president.



Program of the 1884 International Electrical Exhibition, Franklin Institute, Philadelphia



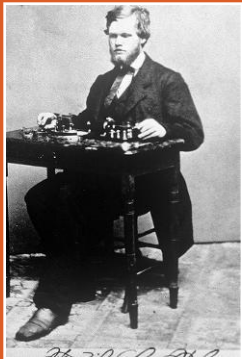
**Norvin Green**, President of Western Union Telegraph and first president of the AIEE



Invitation to the AIEEE organizational meeting, Electrical World, 5 April 1884

# Communications: The first important electrical technology

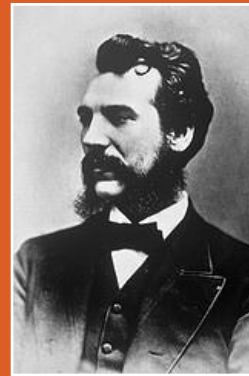
**Samuel Morse's first US telegraph line connected Washington and Baltimore in 1844.** By 1866, a telegraph cable connected the United States and Europe. Alexander Graham Bell followed in 1876 with a telegraph that talked—the telephone.



Franklin Pope,  
telegraph  
operator



Telegraph line  
congestion



A. G. Bell



1882  
Telephone set

# A New Industry: Electric Power and Light

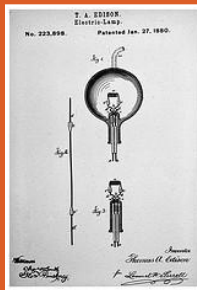
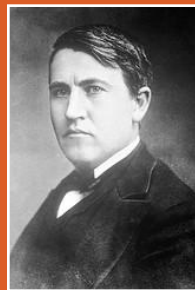
Electric power and light systems arose primarily from Thomas Edison's work. Edison opened his first electric power plant in New York in 1882. Within a decade, electric power had spread to every corner of the globe, with many new applications. The AIEE became dominated by power engineers.



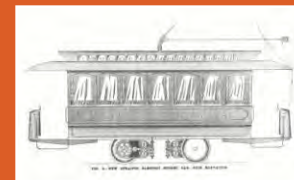
**1882**  
Edison's first commercial plant, Pearl St., NY



**1906**  
Using an electric iron by an electric light



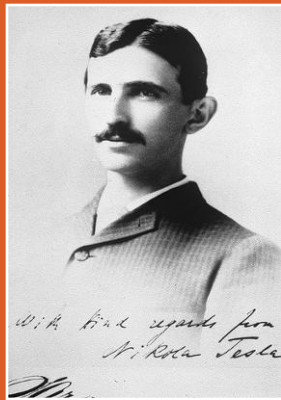
**Thomas Edison**  
and his incandescent light patent



**Frank Sprague**  
worked for Edison before leaving to develop the first commercially practical electric streetcar.

# AC vs. DC Power

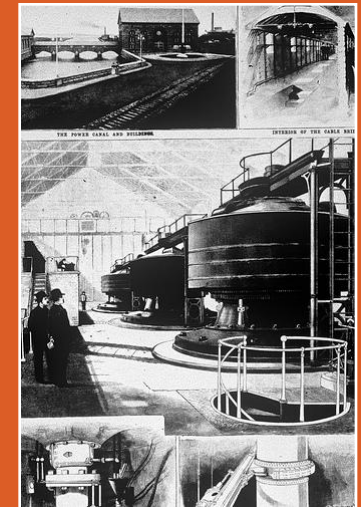
In the 1890s, AC power, championed by George Westinghouse working from inventions by Nikola Tesla, became standard because it could be efficiently transmitted over long distances from massive power plants, such as that built at Niagara Falls, which began sending power to Buffalo in 1896.



**Nikola Tesla,**  
inventor of the  
induction motor and  
a comprehensive  
system for polyphase  
AC power.



**1905**  
Power Generation at Niagara Falls



**1895**  
Niagara Falls Power Plant

# The AIEE serves the profession

Through standards, codes of ethics, technical conferences and publications, the AIEE served its members and their growing profession.

1893

AIEE badge



1899

Committee report



First AIEE standard

[Supplement to TRANSACTIONS October 1893]

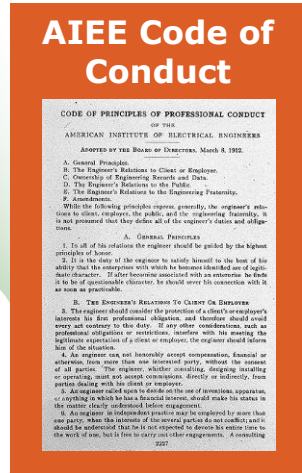
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS  
COPPER WIRE TABLE.

Giving weights, lengths, and resistances of solid, wire, and hot wire, of Mendenhall's standard conductivity, for both A. W. G. (Brown) and R. W. G.

SIZES of both systems dia.	WEIGHTS			LENGTHS			RESISTANCE		
	Area	Wt. per foot	Wt. per 1000 ft.	Feet per Ohm	Feet per 100 Ohms	Ohms per ft.	Ohms per 1000 ft.	Ohms per mil.	Ohms per mil. ft.
1/16	0.00442	0.00014	0.133	1000	1000	1000	1000	1000	1000
3/32	0.00805	0.00027	0.266	500	500	500	500	500	500
1/8	0.0126	0.00041	0.399	333	333	333	333	333	333
5/32	0.0197	0.00062	0.594	200	200	200	200	200	200
3/16	0.0287	0.00091	0.867	133	133	133	133	133	133
7/32	0.0443	0.00137	1.29	80	80	80	80	80	80
1/4	0.0636	0.00193	1.83	55	55	55	55	55	55
5/16	0.087	0.00264	2.54	40	40	40	40	40	40
3/8	0.117	0.00354	3.41	30	30	30	30	30	30
7/16	0.159	0.0048	4.6	22	22	22	22	22	22
1/2	0.217	0.0065	6.1	16	16	16	16	16	16
5/8	0.297	0.0087	8.2	12	12	12	12	12	12
3/4	0.404	0.0117	11.1	9	9	9	9	9	9
7/8	0.54	0.0156	14.7	7	7	7	7	7	7
1	0.707	0.0207	19.6	5	5	5	5	5	5

1912

AIEE Code of Conduct



# Electrical Engineering Education becomes established

**MIT established the first electrical engineering program in 1882 in the physics department.** By the 1920s there were dozens of independent departments in universities across the country, and young engineers typically began their careers with university educations. Curricula were generally heavily oriented towards power engineering.



Early electrical engineering lab, MIT



**Professor Dugald Jackson** chaired the EE departments first at Wisconsin and then at MIT



Electrical Engineering Class, Cornell U., 1916

# The Birth of Radio

**Radio, a new electrical technology, arose in the first decade of the twentieth century.** Wireless telegraphy using spark transmitters was the original application, but particularly after the invention of the vacuum tube amplifier, it began to be used to transmit speech and music.



**1901**  
**Guglielmo Marconi** and  
**George Kemp** with  
equipment used in  
transatlantic wireless  
telegraphy



**1912**  
Radio telegraph operators'  
communications with the  
sinking Titanic demonstrated  
the power of radio



**1922**  
Triode vacuum tube  
inventor **Lee de Forest**  
with a radio

# Formation of the IRE, 1912

With the new industry came a new society in 1912, the Institute of Radio Engineers or IRE, modeled on the AIEE, but devoted to radio, and later increasingly to electronics.



IRE logo



**Alfred Goldsmith**  
IRE Co-founder and first  
journal editor



IRE annual banquet, NY, 1915. Among those attending were **Tesla**, **Sarnoff**, **de Forest**, and **Alexanderson**

# Media Becomes Electronic

**In the 1920s, Radio broadcasting swept the world.** Between 1921 and 1930 the number of US households with radios grew from close to zero to almost 14 million. And a still newer technology, television, was moving from experiment to reality. IRE members led the way in these developments.



Vacuum tubes, the first electronic amplifiers, made radio broadcasting and transcontinental telephony possible.



**1921**  
WJZ Studio, Newark NJ



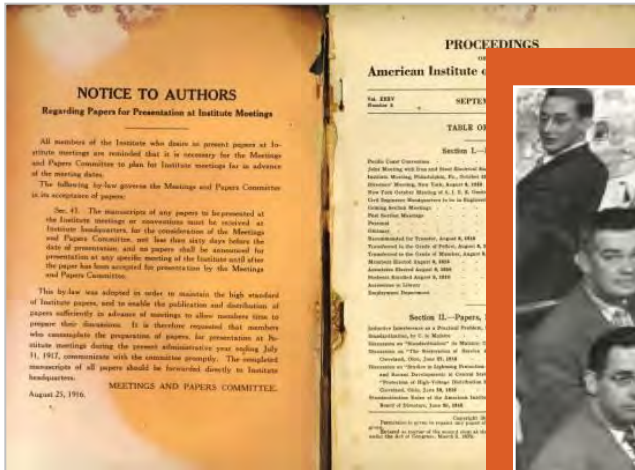
**1930s**  
Listening to radio



**1939**  
RCA President **David Sarnoff** opening commercial TV service, NY

# AIEE and IRE serve their members and their professions

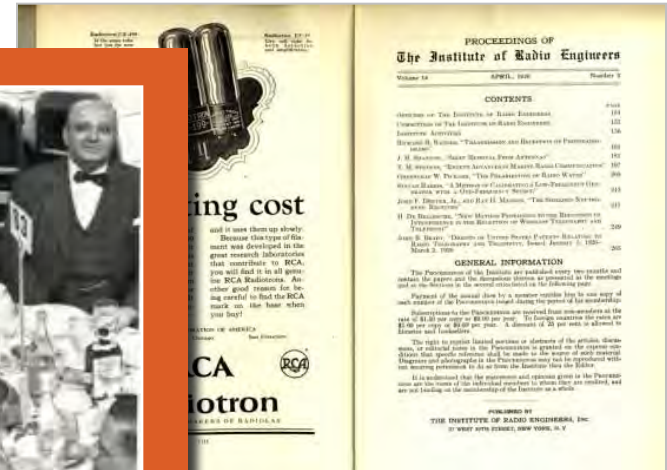
Both societies ran technical conferences, published journals, promulgated standards, developed codes of ethics, and encouraged the training of student engineers.



Proceedings of the AIEE, September 1916



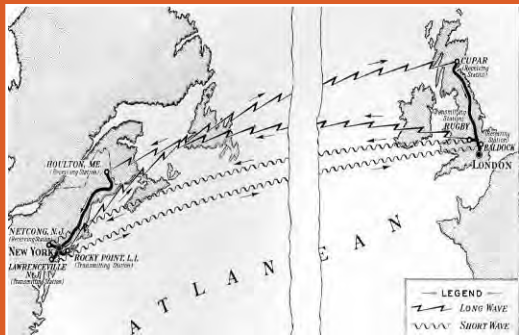
NBC engineers at an IRE banquet



Proceedings of the IRE September 1926

# Growth of Technological Systems

Increasingly, electrical technologies were applied as part of complex and geographically dispersed technological systems such as electric power grids, globe spanning telecommunications systems, and radio networks.

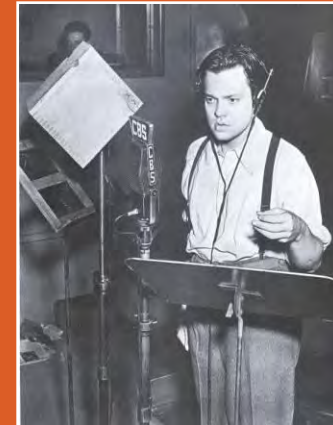


Transatlantic radio-telephone circuits connected AT&T's US telephone network with Britain beginning in 1927.



**1930s**

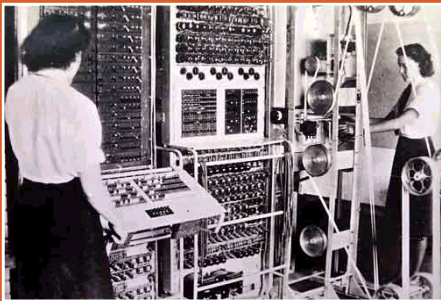
Transmission lines of the Tennessee Valley Authority brought electricity to a wide swath of rural America



Orson Welles caused a panic in 1938 when his radio program "War of the Worlds" convinced people listening across the US that Mars had invaded New Jersey.

# War and Technological Growth

**Governments throughout the world organized their scientists and engineers to devise technologies for use in World War II.** This not only contributed to the war effort in areas including radar, computing and weaponry, but produced major advances in technologies from electronics to signal processing that would have broad implications for the succeeding years.



Colossus, one of the first electronic computers, was among the machines used at Bletchley Park, England to break the German codes.



Director **Dr. Vannevar Bush** (center), an electrical engineer, and other members of the US Office of Science Research and Development. The OSRD mobilized and directed US R&D during World War II.



The OSRD established the Radiation Laboratory at MIT to develop radar into an effective technology for use in World War II.

# Solid State Electronics

The transistor and its progeny, the integrated circuit, opened enormous possibilities for new technologies ranging from the iconic portable radio to increasingly powerful computers. Solid state electronics became a hot field in the post war years.



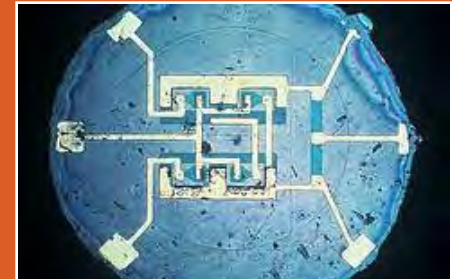
**1947**  
**William Shockley, John Bardeen, and Walter Brattain** invented the transistor, the first solid state amplifier and switch at Bell Labs



**1958**  
**Jack Kilby's** first integrated circuit



**1958**  
Transistor radio



**1961**  
First commercial monolithic integrated circuit, Fairchild

# Computers and Computing

By the late 1950s electronic computers had evolved from science fiction to tools for scientific research and large business applications. Alongside rose a new profession, that of the computer engineer.

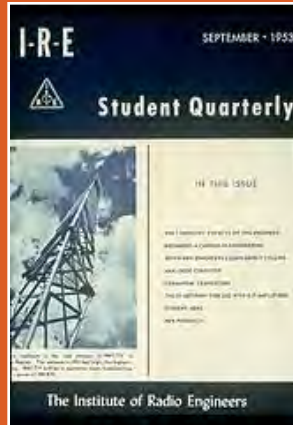


**1943-1946**  
ENIAC, widely regarded as the first general purpose electronic digital computer. The project was led by J. Presper Eckert and John Mauchly at the University of Pennsylvania.

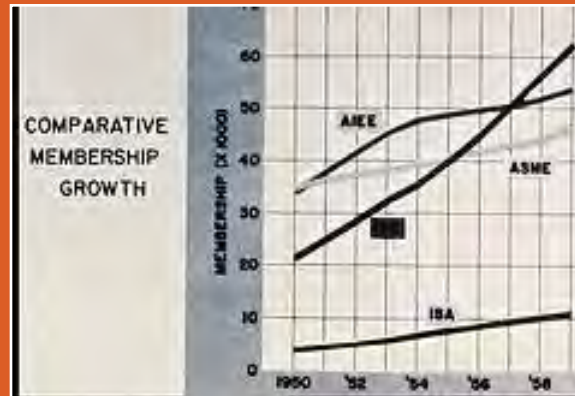
11 John von Neumann with his experimental IAS computer

# Organizational Growth and Specialization

Both the AIEE and IRE grew in the post-war period. But the IRE, fueled by increasing interest in electronics, grew much faster. It became the larger organization in 1957. Both institutes increased their scope, forming student branches and groups devoted to different technical specialties. They explored ways to work together.



Early electrical engineering lab, MIT



1950-59  
Engineering Society Growth



1956  
Participants in the IRE awards ceremony

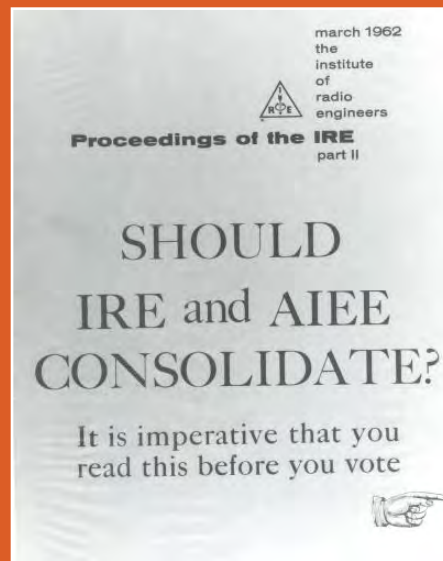
# AIEE + IRE = IEEE

The idea that there should be one organization for all electrical engineers was an old one, and became more powerful as the profession expanded beyond its separate roots in power and radio. In 1962, the boards and memberships of the two institutes agreed to merge. On January 1, 1963, the IEEE, or Institute of Electrical and Electronic Engineers was born with 150,000 members, 140,000 of whom were in the United States.

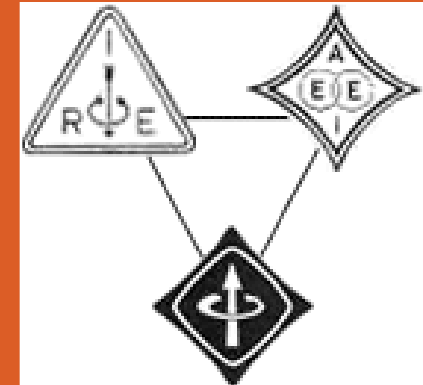


1962

Symposium on the proposed merger, IRE National Convention



Special merger issue of the Proceedings of the IRE



The badge of the new IEEE combined the right hand rule from the IRE with the kite from the AIEE

# Satellites and Space Exploration

**The space race began when the USSR launched Sputnik in 1957.**

Space exploration was heavily based on advances in electronics, including transistors, solar cells, and increasingly powerful computers.



**1962**

Telstar I, the first active communications satellite, launched by NASA for AT&T yielded the first live transatlantic television transmission.



**1957**

Sputnik, the first space satellite, launched by the USSR



**1969**

Buzz Aldrin on the Moon, Project Apollo



**1982**

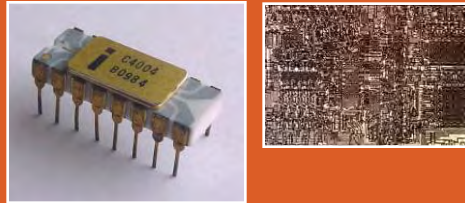
NASA mission control, Houston

# Microelectronics

As integrated circuits evolved into (among other things) microprocessors, or computers on a chip, the costs dropped dramatically to the point where a student in the early 1970s could own an electronic calculator, and the student of the early 1980s an entire computer. Gordon Moore predicted in 1965 that the number of transistors that could be placed on a single chip would double every two years. Moore's law has held true for over forty years.



Andrew Grove, Gordon Moore, and Robert Noyce, founders of the Intel Corporation



Intel's first microprocessor, the 4004 introduced in 1971, contained 2300 transistors on a single chip



**1972**  
Hewlett-Packard HP35 calculator



The Apple II computer, introduced in 1978, brought computing power to desktops.

# Medical Electronics

While the application of electricity to medicine began in the 19<sup>th</sup> century, and a few techniques such as X-Rays became standard early in the 20<sup>th</sup>, applications spread widely beginning in the 1960s in areas from diagnosis to surgery to treatment to a range computer applications.



**1960**  
First Implantable  
pacemaker



**1978**  
CAT scan



**1971**  
A ruby laser in use  
in surgery

# IEEE expands its activities

In the 1970s, a variety of crises led many in society to question the worth of technology. Also, employment declined in some technological sectors for the first time since the 1930s. The IEEE responded by starting programs to raise the visibility of its technologies, and by becoming a professional in addition to a technical institution to better serve its members. It also had developed multiple IEEE professional societies to serve the needs of its various communities.



The Three Mile Island Power Plant in Pennsylvania, which in 1979 was site of the worst nuclear power plant incident in US history.



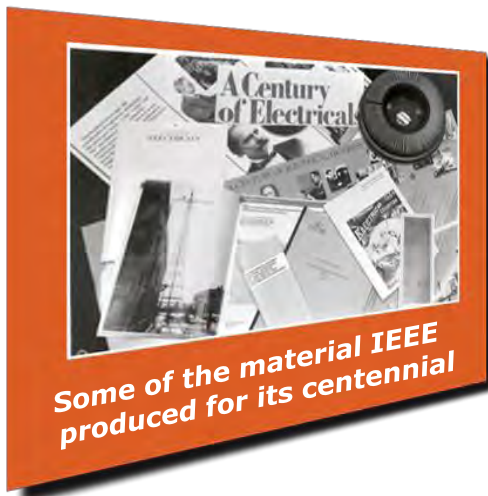
War Protestors, Boston.



Engineers at XEROX PARC, 1972. Birthplace of the Ethernet, the laser printer, and personal computer

# IEEE Centennial 1884-1984

IEEE celebrated its centennial with celebrations of its members' accomplishments for the betterment of society. By 1984, it was well on its way in its transformation from a United States centered to a global institution.

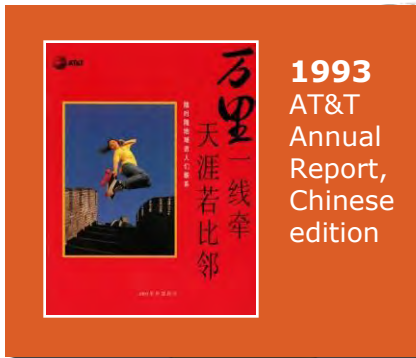


Centennial Logo

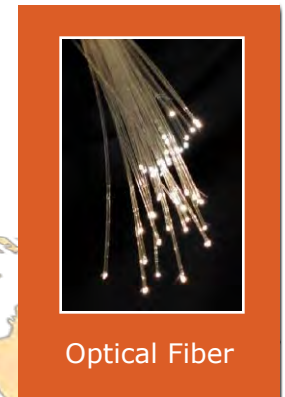


# The Global Village

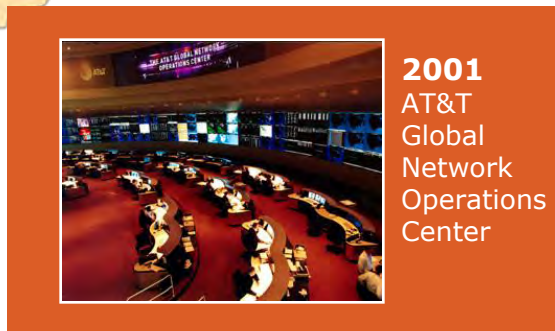
**In the last 25 years, computing and communications have converged.** Multiple fiber optic cables sending packet switched information dropped global transmission costs to close to zero. The world became more closely knit into a single global community. Call centers in India served customers in Indiana. Information and commerce traversed the globe via the Internet.



1993  
AT&T  
Annual  
Report,  
Chinese  
edition



Optical Fiber



2001  
AT&T  
Global  
Network  
Operations  
Center



Internet website, circa 1996

# The Globalization of IEEE

IEEE responded to the emerging global village by becoming more global itself. By 2008, 43% of its 375,000 members resided in 159 countries besides the United States.

2003

Students at Nigeria's Federal University of Technology Werra (FUTO) greet IEEE Spectrum Senior Editor Harry Goldstein

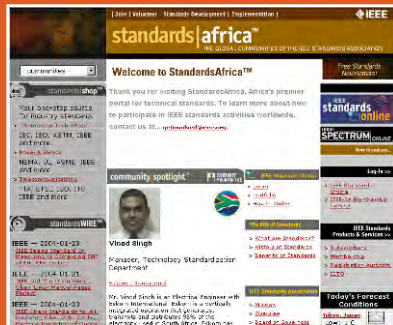


1994

Staff at the IEEE Beijing Section office

2003

IEEE Standards regional web portal



# IEEE Today

- More than 375,000 members, including nearly 80,000 student members in more than 160 countries
- 324 sections in ten geographic regions worldwide
- 1,784 chapters that unite local members with similar technical interests
- 1,616 student branches and 452 student branch chapters at colleges and universities in 80 countries
- 38 societies and 7 technical councils representing the wide range of technical interests
- 390 affinity groups consisting of Consultants' Network, Graduates of the Last Decade (GOLD), Women in Engineering (WIE) and Life Members (LM) groups
- Nearly 1,300 standards and projects under development
- Nearly 2 million documents in the IEEE *Xplore*® digital library
- Publishes a total of 144 transactions, journals and magazines
- Sponsors more than 850 conferences annually

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