

# Index

- Abell, Peter, 133, 134, 135  
Abraham, Michelle, 129  
Abraham, Spencer, 108  
Aho, Al, 168  
Airline services, telecommunications on,  
14–15  
Aizenberg, Joanna, 85, 86  
Allocation approach, interference,  
149–150  
Antennas, 143–149  
balloons, 147–149  
fractal, 145–147  
high dielectric, 143–144  
nanotube, 144–145  
optical, fiber-optical technology,  
101–102  
Appliances, smart, 67–68  
Apre, Raj, 205  
Artificial intelligence, infostructure,  
119–120  
Asset tracking, 131–135. *See also* Radio  
Frequency Identification (RFID)  
AT&T, xiv–xvi  
Aubin, Keith, 56  
Audio output, input/output technologies,  
194–195  
Automobile. *See* Vehicular telematics  
Avouris, Phaedon, 94  
Axelsson, Thord, 136  
Bailey, Ron, 80  
Baldwin, Roy, 180–181  
Balloons, antennas, 147–149  
Ban, Dayan, 100  
Bardeen, John, 95, 96  
BARN project, 40–41  
Barrett, John, 105  
Barry, Jim, 28–29  
Base station technology, improvements  
in, 60–62  
Bawendi, Moungi, 207  
Becher, David, 53  
Bell Systems Pavilion (World's Fair,  
New York City, 1964), xiv–xvi  
Bhavnani, Sam, 204  
Bickerstaff, Mark, 45  
bin Laden, Osama, 169  
Biohazards, mesh networks, 71–72  
Bird, Jonathan, xvii–xviii  
Blind people. *See* Disabled people;  
Visual impairment  
Blossom, Eric, 130  
Blumenthal, Daniel, 79

- Boneh, Dan, 156, 157  
 Brattain, Walter, 96  
 Bricks, smart, 66–67  
 Broadband over power lines (BPL), possibilities of, 4–5  
 Broadband service, growth in, 3–5  
 Brow, Richard, 90  
 Brown, Maxine, 115  
 Bryan, Roland, 70  
 Buckyballs, fiber-optical technology, 88–89  
 Buehrer, Michael, 130, 131  
 Building industry:  
   radio technology, 141–142  
   smart brick, 66–67  
 Bulovic, Vladimir, 208  
 Burney, Kneko, 106  
 Bus service accessibility, 68
- Camera phones, 157–163  
   legal issues, 158–159  
   motion-tracking cameras, 162–163  
   observation camera, 158  
   precrime focus, 159–160  
   smart software, 160–162  
   video network, 159  
 Capasso, Frederico, 99  
 Carbon nanotube batteries, power sources, 177–178  
 Cathode ray tube (CRT), 200–201  
 Catlett, Jason, 155  
 Chan, Richard, 53  
 Chapin, John, 61  
 Chen, T. C., 46  
 Chien, Andrew, 117  
 Chip, wireless, turbocharged data, 47–49  
 Chip implants, human, 164–165  
 Cho, Ai, 99  
 Choquette, Kent D., 97–98  
 Clothing:  
   health care monitoring, 76–77  
   smart fabrics, 31–32  
 Code division multiple access (CDMA), fiber-optical technology, 93  
 Cognitive software:  
   described, 41–43  
   personal assistance link (PAL), 43–44  
 Coho, Amanda, 123  
 Coifman, Benjamin, 163–164  
 Collaborative sensing, networks, 74  
 Communications satellites, xv–xvi  
 Computer simulations, Internet, 125–126  
 Computer speech, voice input, 193–194  
 Constance, Joe, 75, 206  
 Construction industry:  
   radio technology, 141–142  
   smart brick, 66–67  
 Cooling technologies, 185–189  
   SynJets, 185–186, 187  
   VIDA, 186–187  
   wiggling fans, 187–189  
 Copper wire, fiber-optical technology, 102–103  
 Corteil, Philippe, 22  
 Costello, Brian, 64  
 Cottrell, Les, 111  
 Cramoysan, Steve, 15  
 Crews, Wayne, 158–159  
 CRT (cathode ray tube), 200–201  
 Culler, David, 73  
 Courtesy technology, telecommunications services, 8–9
- Dalton, Larry, 82–83  
 Dansky, Kathryn, 19, 20  
 Data hiding, encryption, 169–171  
 Davis, William, 130  
 DeCoste, Steve, 21  
 Degertekin, Levent, 195  
 Dense wavelength division multiplexing (DWDM), 80  
 Dertouzos, Michael, 33  
 Digital radio technology, 128–129  
 Digital subscriber line (DSL), growth in, 2, 3  
 Ding, Zhi, 93  
 Disabled people:  
   input/output technologies, 210–213  
     GPS guidance, 211  
     hearing loss, audio output, 195  
     mobile phones, 210–211  
     speech-controlled arms, 212–213  
   navigation assistance, visual impairment, 75–76  
 Distance records, quantum cryptography, 173–174  
 Dixon, David, 133–134  
 Dixon-Warren, St. John, 100  
 Dominguez, Ruben, 211  
 d’Oriano, Bernard, 22  
 Double-shot security software, 167–169  
 Doyle, John, 111  
 Drew, Barbara, 22–23  
 Dunigan, Tom, 109  
 Dupont, Bob, 16–17

- Earthquake, smart brick, 66–67  
 Education, Internet tele-learning, 120–121  
 E-glass, fiber-optical technology, 89–90  
 Ehrensvärd, Jakob, 136  
 Electromagnetic interference, thermocouples, 75  
 Electrowetting technology, output (paper-like displays), 203–204  
 Ellis, Larry, 42  
 Elvin, George, 30–31  
 E-mail. *See also* Internet  
   cluster bombs, security, 174–175  
   encryption, 166–171  
   future of, 9–13  
   information finding, input/output technologies, 208–209  
   sincerity research, 124–125  
   spam blocking, 123–124  
 Embedded collaborative sensing, networks, 74  
 Embedded systems, 32–33  
 Emergency situations:  
   communications, WLANs, 65–66  
   mesh networks, 71–72  
 Encryption, 166–171  
   data hiding, 169–171  
   security software, double-shot, 167–169  
 Engel, Jon, 66–67  
 Entertainment, telecommunications services, 13–14  
*Euplectella* (Venus Flower Basket, sponge), 85–86  
  
 Fabrics, smart, 31–32  
 Fahlman, Scott, 119  
 Fans, wiggling, cooling technologies, 187–189  
 Feigenbaum, Joan, 156, 157  
 Feng, Milton, 52–53, 95  
 Fiber-optical technology, 78–103  
   code division multiple access (CDMA), 93  
   copper wire, 102–103  
   light emitters, 93–101  
     laser, 98–100  
     manipulating light, 100–101  
     nanotubes, 93–94  
     transistor, 94–96  
     VCSEL, 96–98  
   materials, 82–90  
     advances in, 82–83  
     buckyballs, 88–89  
     E-glass, 89–90  
     glasses, 83–85  
     hybrid plastic, 87–88  
     mineral wire, 87  
     sponges, 85–87  
     nanophotonics, 90–92  
     optical antenna, 101–102  
     sensors, 74–75  
     speed, 78–82  
     wave polarization, 92–93  
 Finger phone, input/output technologies, 190–191  
 Fingerprinting, wireless, 165–166  
 Firefighting, smart brick, 66–67  
 Flake technology, output (paper-like displays), 201–203  
 Flexible organic light-emitting device (FOLED), output, 204–205  
 Fogarty, James, 8–9  
 Forrest, Stephen, 58–59  
 Forsythe, Chris, 42–43  
 Fourth-generation wireless service. *See also* Turbocharged data  
   described, 6–7  
   turbocharged data, 44–52  
 Fractal antenna, 145–147  
 Frische, Eric, 148  
 Fuel cells, power sources, 182–183  
 Fujimoto, Richard, 125  
 Fuller, Buckminster, 89  
 Fung, Brian, 205  
 Futhey, Tracey, 108  
  
 Galilea, Juan Carlos, 62  
 Gaming, telecommunications services, 13–14  
 Garimella, Suresh, 188, 189  
 Gilgenbach, Ronald, 151  
 Giordano, Joe, 134  
 Glass battery, power adapter, 180–181  
 Glasses, fiber-optical technology, 83–85  
 Glezer, Ari, 185, 186  
 Global positioning system (GPS):  
   disabled access, input/output technologies, 211  
   human chip implants, 164–165  
   vehicular telematics, 137  
 Goldman, Jonathan, 186  
 Gomez, Alessandro, 183–184  
 Gray, Stephen, 101  
 Green, Roger, 102  
 Grid computing, Internet, 114  
 Gross, Karl, 177

- Grosse, Eric, 168  
 Grossman, Barry, 80  
 Gruber, Harry E., 115  
 Guerin, Roch, 126  
 Guitar, nanoguitar, MEMS, 55–57  
 Gupta, Prabhat K., 89–90
- Hafez, Walid, 95  
 Hajimiri, Ali, 138  
 Han, Sijin, 205  
 Hard drive, storage space, 57  
 Harrup, Mason, 181–182  
 Hartman, Christine, 105  
 Haynie, Jim, 4–5  
 Health care:  
   speech-controlled arms, input/output technologies, 212–213  
   telecommunication applications of, 19–24, 76–77  
   touch input, 197  
 Health Insurance Portability and Accountability Act (HIPAA), 157  
 Hearing loss, audio output, 195.  
   *See also* Disabled people  
 Heffington, Samuel, 187  
 Hidley, Greg, 68  
 High dielectric antenna, 143–144  
 Hofeller, Jonathan, 212, 213  
 Hoffberger, Jan, 213  
 Holly, Krisztina, 107  
 Holonyak, Nick, 95, 96  
 Home automation, 28–29  
 Hopkins, Ken, 137  
 Hotspots, WLANs, 64  
 Hou, Thomas, 159  
 Huang, Jingqing, 56  
 Hudson, Scott, 8–9  
 Hull, Rick, 155  
 Human chip implants, 164–165  
 Hutchinson, Chuck, 141  
 Hybrid plastic, fiber-optical technology, 87–88
- Industrial accidents, mesh networks, 71–72  
 Information finding, input/output technologies, 208–210  
 Information technology, modular software, 7–8  
 Infostructure, 114–120  
   artificial intelligence, 119–120  
   intelligent agents, 118–119  
   research in, 114–118
- Input/output technologies, 190–213  
   audio output, 194–195  
   disabled access, 210–213  
     GPS guidance, 211  
     mobile phones, 210–211  
     speech-controlled arms, 212–213  
   finger phone, 190–191  
   information finding, 208–210  
   output, 200–208  
     CRTs, 200–201  
     miniature screens, 201  
   output (paper-like displays), 201–208  
     electrowetting technology, 203–204  
     flake technology, 201–203  
     OLEDs, 204–205  
     polymer displays, 205–207  
     quantum displays, 207–208  
   projection keyboards, 199–200  
   thought input, 200  
   touch input, 196–199  
   voice input, 191–194  
     advances in, 192  
     computer speech, 193–194  
     objects, 193
- Instant messaging:  
   growth of, 10–11  
   security risks, 11–13
- Intelligent agents, infostructure, 118–119  
 Interference, 149–151  
   allocation approach, 149–150  
   microwave ovens, 151
- Internet, 104–127. *See also* E-mail  
   bus service accessibility, 68  
   computer simulations, 125–126  
   encryption, 166–171  
   grid computing, 114  
   infostructure, 114–120  
     artificial intelligence, 119–120  
     intelligent agents, 118–119  
     research in, 114–118  
   sincerity research, 124–125  
   spam, 123–124  
   speed, 106–114  
     importance of, 110–114  
     National LambdaRail (NLR), 107–110  
   tangled nets, 126–127  
   tele-learning, 120–121  
   virus scanning, 121–123  
   voice-over Internet protocol (VoIP), 104–106  
   WLAN hotspots, 64
- Interruption, curtesy technology, telecommunications services, 8–9  
 Ions, lithium, power adapter, 181–182

- Jakobsson, Jarkus, 175  
 Jayaraman, Sundaresan, 32  
 Jennings, Nick, 119–120  
 Jochim, Ken, 14  
 Jones, Douglas, 195
- Kalehoff, Max, 10, 11  
 Kareemi, Nazim, 199  
 Kavehrad, Mohsen, 102–103, 149–150  
 Keefer, Keith, 181  
 Kesavadas, Thenkurussi, 197  
 Keyboards, projection, input/output technologies, 199–200  
 Knoblach, first name, 147–148  
 Kosc, Tanya, 202, 203  
 Kosko, Bart, 144–145  
 Koslowski, Thilo, 71  
 Kriegman, David, 117  
 Kuhirun, Waroth, 146  
 Kuhn, Jeffrey, 18  
 Kurkjian, Charles, 90
- Lane, Doc, 141  
 Laser, light emitters, 98–100  
 Lau, Y. Y., 151  
 Lee, Ian, 144  
 Lee, Kai-Fu, 18  
 Lee, Wenke, 123–124  
 Legal issues, camera phones, 158–159  
 Leigh, Jason, 115  
 Leuski, Anton, 208–209  
 Levitt, Mark, 10  
 Lieber, Charles M., 51–52  
 Light emitters, 93–101  
   laser, 98–100  
   manipulating light, 100–101  
   nanotubes, 93–94  
   transistor, 94–96  
   VCSEL, 96–98  
 Light-emitting polymers (LEPs), output (paper-like displays), 205–207  
 Linden, Alex, 120  
 Lipson, Michael, 90–92  
 Lipton, Richard, 123–124  
 Lithium ions, power adapter, 181–182  
 Lithography, 47  
 Liu, Chang, 66–67  
 Local area networks (LANs). *See* Wireless local area networks (WLANs)  
 Location-based privacy software, security, 154–156  
 Locker, Howard, 27, 183
- Lockwood, John, 121–123  
 Low, Steven, 111  
 Lower, Nathan, 90  
 Low-loss, wide-bandwidth MEMS, 52–53  
 Lu, Zheng-Hong, 204–205  
 Luther, Thomas, 181–182
- Maeda, Mari, 153  
 Mahalingam, Raghav, 185–186  
 Manipulating light, light emitters, 100–101  
 Manufacturing techniques, turbocharged data, 46–47  
 Marsh, Stuart, 141  
 Marshall, Kenneth L., 202  
 Materials:  
   fiber-optical technology, 82–90  
     advances in, 82–83  
     buckyballs, 88–89  
     E-glass, 89–90  
     glasses, 83–85  
     hybrid plastic, 87–88  
     mineral wire, 87  
     sponges, 85–87  
   power sources, 176–179  
     carbon nanotube batteries, 177–178  
     thin films, 178–179
- Mazur, Eric, 87  
 McKinsey & Company report, 7–8  
 Medical care:  
   speech-controlled arms, input/output technologies, 212–213  
   telecommunication applications, 19–24, 76–77  
   touch input, 197  
 MEEP membrane, lithium ions, 181–182  
 Memory storage. *See* Storage space  
 MEMS. *See* Micro-electro-mechanical systems (MEMS)  
 Menczer, Filippo, 174–175  
 Merkle, Peter, 43–44  
 Mermelstein, Julia, 105  
 Merryfield, Merry, 120–121  
 Mesh networks:  
   described, 68–71  
   emergency conditions, 71–72  
   sensors (Spec), 73–74  
 Michielsen, Erik, 28, 132  
 Microcombustion battery, power sources, 183–184  
 Micro-electro-mechanical systems (MEMS), 52–57  
   low-loss, wide-bandwidth, 52–53  
   nanoguitar, 55–57  
   StressedMetal, 53–55

- Microscillator, radio technology, 142–143
- Microwave ovens, interference, 151
- Midkiff, Scott, 159
- Miles, Ron, 194–195
- Mineral wire, fiber-optical technology, 87
- Miniature screens, output, 201
- Mobile phones, disabled access,  
input/output technologies, 210–211.  
*See also* Wireless service
- Mobile service. *See* Wireless service
- Modular software, telecommunications  
services, 7–8
- Möller, Sven, 58
- Monitoring:  
health care telecommunications,  
20–24, 76–77  
of power, 184–185  
radio technology, 136
- Motion-tracking cameras, 162–163
- Mottley, Jack, 76
- Moulin, Pierre, 169
- Moving objects, collaborative sensing, 74
- Multiple service operators (MSO),  
growth in, 3
- Murray, Cherry, 86, 98
- Murshid, Syed, 80
- Nanoguitar, MEMS, 55–57
- Nanophotonics, fiber-optical technology,  
90–92
- Nanoring memory, storage space, 59–60
- Nanotube(s), light emitters, fiber-optical  
technology, 93–94
- Nanotube antenna, 144–145
- Nanotube batteries, carbon, power  
sources, 177–178
- Nanowiring, turbocharged data, 51–52
- Narakorn, Puntada, 80
- National Institute of Standards and  
Technology (NIST), 66, 141–142, 172
- National LambdaRail (NLR), Internet,  
107–110
- National Science Foundation (NSF), 152
- Navab, Nassir, 193
- Navigation assistance, networks, 75–76
- Nealey, Paul, 47
- Neculaes, Bogdan, 151
- Nelson, Colin, 106
- Nelson, Randal, 160–161
- Nerlove, Sarah, 61
- Networks, 63–77. *See also* Wireless local  
area networks (WLANs)  
advances in, 63  
appliances, 67–68  
bus service accessibility, 68  
collaborative sensing, 74  
fiber-optical technology, 81–82  
mesh networks, 68–72  
described, 68–71  
emergency conditions, 71–72  
navigation assistance, 75–76  
optical sensors, 74–75  
sensors (Spec), 73–74  
smart brick, 66–67  
wireless local area networks  
(WLANs), 64–66  
emergency communications,  
65–66  
future trends, 64–65  
hotspots, 64
- Newman, Harvey, 111, 112
- Nguyen, Van, 12–13
- Nicol, Chris, 45
- Nicol, David, 169
- Nock, Kerry, 148–149
- Notebook systems:  
fuel cells, 182–183  
personal computers (PCs), 26–27  
power adapter, 179–182
- Nussbaum, Maury, 210
- O, Kenneth, 48–49
- Oard, Douglas, 209
- Objects, voice input, 193
- Objc software architecture, 38–40
- O'Brien, Bob, 13
- Observation camera, camera phones,  
158
- OLEDs, output (paper-like displays),  
204–205
- Online shopping, 29
- Open-source smart phone operating  
system, turbocharged data, 50–51
- Optical antenna, fiber-optical technology,  
101–102
- Optical sensors, 74–75
- Optical storage space, 57–59
- Orbach, Raymond L., 108
- Organic light-emitting devices (OLEDs),  
output (paper-like displays),  
204–205
- Oriano, Bernard d', 22
- Ormia ochracea*, 195
- Orr, Barron, 141
- Osterman, Michael, 10, 11, 12, 13
- O'Sullivan, Jody, 169–170

- Output, 200–208  
 audio, input/output technologies, 194–195  
 CRTs, 200–201  
 miniature screens, 201
- Output (paper-like displays), 201–208  
 electrowetting technology, 203–204  
 flake technology, 201–203  
 OLEDs, 204–205  
 polymer displays, 205–207  
 quantum displays, 207–208
- Oviatt, Sharon, 193–194
- Owens, Bob, 134–135
- Paganini, Fernando, 111
- Papadopoulos, Philip, 115
- Park, Jonghun, 110–111
- Parker, Jay, 183
- Pasquale, Joseph, 117
- Paturi, Ramamohan, 118
- Peace, Christina, 212, 213
- Pepper, Michael, 174
- Personal assistance link (PAL), cognitive software, 43–44
- Personal computer (PC), 25–27  
 portable systems, 26–27  
 processor advances, 25–26
- Personal digital assistant (PDA), 66
- Phillips, Michael, 17
- Phone operating system, smart, turbocharged data, 50–51
- Photon detector, quantum cryptography, 172–173
- Photonics. *See* Fiber-optical technology
- Photon source, quantum cryptography, 172
- Piezoelectric fans, cooling technologies, 188
- Piezoelectric motor/transformer, power adapter, 180
- Pirzadeh, Joe, 166
- Pister, Kris, 73, 74
- Plain old telephone service (POTS):  
 decline in, 2  
 Internet access, 106
- Plastic, hybrid, fiber-optical technology, 87–88
- Polymer displays, output (paper-like displays), 205–207
- Portable systems, personal computers (PCs), 26–27
- Powell, Michael, 4
- Power adapter, 179–182  
 glass battery, 180–181  
 lithium ions, 181–182
- Power lines, broadband service over, 4–5
- Power monitor, 184–185
- Power sources, 176–189  
 cooling technologies, 185–189  
 SynJets, 185–186, 187  
 VIDA, 186–187  
 wiggling fans, 187–189
- fuel cells, 182–183
- materials, 176–179  
 carbon nanotube batteries, 177–178  
 thin films, 178–179
- microcombustion battery, 183–184
- power adapter, 179–182  
 glass battery, 180–181  
 lithium ions, 181–182
- power monitor, 184–185
- Precrime focus, camera phones, 159–160
- Price, Ed, 29
- Privacy. *See also* Camera phones; Security  
 camera phones, 157–163  
 fingerprinting, 165–166  
 human chip implants, 164–165  
 location-based privacy software, 154–156  
 personal assistance link (PAL), 44
- Project Oxygen, 38  
 securing of, 156–157
- Programmable networks, wireless service, 41
- Projection keyboards, input/output technologies, 199–200
- Project Oxygen, 33–38  
 applications of, 36–37  
 benefits of, 38  
 goals of, 34–35  
 hurdles in, 37–38  
 user technologies, 35–36  
 vision of, 34
- Quantum cryptography, 171–174  
 distance records, 173–174  
 photon detector, 172–173  
 photon source, 172
- Quantum displays, output (paper-like displays), 207–208
- Rabby, Michael, 123–124
- Rabiner, Lawrence R., 192

- Radar, vehicular telematics, 137–138
- Radio Frequency Identification (RFID), 131–135
- components of, 133–134
  - generally, 131–133
  - retail business applications, 135
  - tag and read, 134–135
- Radio technology, 128–151
- antennas, 143–149
    - balloons, 147–149
    - fractal, 145–147
    - high dielectric, 143–144
    - nanotube, 144–145
  - building industry, 141–142
  - digital, 128–129
  - interference, 149–151
    - allocation approach, 149–150
    - microwave ovens, 151
  - microscillator, 142–143
  - monitors, 136
  - Radio Frequency Identification (RFID), 131–135
    - components of, 133–134
    - generally, 131–133
    - retail business applications, 135
    - tag and read, 134–135
  - ranch animals, 140–141
  - software-defined, 129–130
  - ultrawideband, 130–131
  - vehicular telematics, 136–140
    - generally, 136–137
    - radar, 137–138
    - toll payments, 139–140
    - train travel, 138–139
- Rahmat-Samii, Yahya, 145–146
- Rajan, Raju, 126
- Raman, Arvind, 188–189
- Ramirez-Iniguez, Roberto, 102
- Ranch animals, radio tracking technology, 140–141
- Rao, Nageswara, 109–110
- Reed, Evan J., 79
- Reisi, Edward, 15
- Retail business applications, Radio Frequency Identification (RFID), 135
- Reynolds, Martin, 27
- Ribton, Colin, 143–144
- Ringel, Steven, 178–179
- Rippard, William, 142–143
- Rooms, smart, BARN project, 40–41
- Rosinski, Jarek, 139
- Roy, Rajarshi, 92
- Safaa-Jazi, Ahmad, 130
- Sargeant, Winslow, 83–85, 87–88, 89
- Sargent, Ted, 99, 100
- Savage, Stefan, 117
- Schilling, Ken, 200
- Scholes, Gregory, 88
- Schoolar, Daryl, 105, 106
- Security, 152–175. *See also* Privacy; Terrorism
- camera phones, 157–163
    - legal issues, 158–159
    - motion-tracking cameras, 162–163
    - observation camera, 158
    - precrime focus, 159–160
    - smart software, 160–162
    - video network, 159
  - code division multiple access (CDMA), 93
  - collaborative sensing, 74
  - E-mail cluster bombs, 174–175
  - encryption, 166–171
    - data hiding, 169–171
    - security software, double-shot, 167–169
  - fingerprinting, 165–166
  - human chip implants, 164–165
  - instant messaging, 11–13
  - location-based privacy software, 154–156
  - mesh networks, 71–72
  - privacy, 156–157
  - Project Oxygen, 38
  - quantum cryptography, 171–174
    - distance records, 173–174
    - photon detector, 172–173
    - photon source, 172
  - testing research, 152–154
  - traffic control, 163–164
- Sekaric, Lidija, 56
- Self-assembly techniques, 47
- Sensors:
- collaborative sensing, 74
  - optical, 74–75
  - Spec, mesh networks, 73–74
- Shahidi, Ghavam, 46
- Shark, Alan, 4–5
- Sharma, Gaurav, 170–171
- Shen, Shyh-Chiang, 53
- Shields, Andrew, 173–174
- Shipley, Chris, 27
- Shlesinger, Mike, 93
- Shopping, online, 29
- Shukla, Sandeep, 32–33

- Siewiorek, Daniel P., 119
- Silicon chip, wireless, turbocharged data, 47–49
- Simpson, Paul, 161
- Sincerity research, E-mail communication, 124–125
- Slater, Mel, 198
- Smailagic, Asim, 40
- Small screens, output, 201
- Smarr, Larry, 115
- Smart appliances, 67–68
- Smart brick, 66–67
- Smart fabrics, 31–32
- Smart phone operating system, turbocharged data, 50–51
- Smart rooms, BARN project, 40–41
- Smart surveillance camera software, 160–162
- Smith, James, 167
- Smith-Jackson, Tonya, 210
- Software-defined radio (SDR) technology, 129–130
- Spam. *See also* Security; Virus scanning  
blocking of, 123–124  
E-mail service, 9–10
- Speech, computer, voice input, 193–194
- Speech-controlled arms, disabled access, input/output technologies, 212–213
- Speech integration service, applications of, 15–19
- Sponges, fiber-optical technology, 85–87
- Srinivasan, Mandayam A., 198–199
- Stabile, Robert, 11–12
- Stearns, Ron, 165
- Stephenson, Robert, 139
- Sterns, Jenifer, 68
- Stewart, Fred, 181–182
- Stinson, Mike, 27
- Storage space, 57–60  
hard drive, 57  
nanoring memory, 59–60  
optical, 57–59
- Strachman, Brian, 17, 18
- Street, Richard L., 23–24
- StressedMetal MEMS, 53–55
- Strother, Neil, 50–51
- Sun, Ying, 162–163
- Surveillance. *See* Security
- Surveillance camera software, smart, 160–162. *See also* Security
- Sweeney, Dennis, 130
- Sweldens, Wim, 29, 118, 201
- SynJets, cooling technologies, 185–186, 187
- Tekalp, Murat, 171
- Telecommunications Act of 1996, 210
- Telecommunications services, 1–24.  
*See also* specific services and applications  
advances in, 1–2  
airline services, 14–15  
broadband service, 3–5  
curtesy technology, 8–9  
E-mail and instant messaging, 9–13  
entertainment, 13–14  
fourth-generation, 6–7  
health care industry, 19–24  
modular software, 7–8  
speech integration, 15–19  
wireless service, 5–6  
wireline service, 2–3
- Tele-learning, Internet, 120–121
- Telstar communications satellite, xv–xvi
- Terrorism. *See also* Security  
data hiding, 169–170  
mesh networks, 71–72  
security testing, 152–154
- Testing research, security, 152–154
- Text-to-speech (TTS) output, voice input, 194
- Thermocouples, electromagnetic interference, 75
- Thin films, power sources, 178–179
- Thorat, Dana, 14
- Thought input, input/output technologies, 200
- Tolea, Mugur, 166
- Toll payments, vehicular telematics, 139–140
- Tong, Limin, 87
- Touch input, research in, 196–199
- Tracking. *See also* Radio technology  
collaborative sensing, 74  
Radio Frequency Identification (RFID), tag and read, 134–135  
ranch animals, radio technology, 140–141  
vehicular telematics, 136–140
- Traffic control, security, 163–164.  
*See also* Vehicular telematics
- Train travel, vehicular telematics, 138–139. *See also* Vehicular telematics
- Transistor:  
light emitters, 94–96  
turbocharged data, 46

- Turbocharged data, 44–52  
 generally, 44–45  
 manufacturing techniques, 46–47  
 nanowiring, 51–52  
 smart phone operating system, 50–51  
 transistor, 46  
 wireless chip, 47–49  
 Turney, Thomas, 70
- Uchino, Kenji, 179–180  
 Ultrawideband radio technology, 130–131  
 Underwear, health care monitoring,  
 76–77  
 Ussher, Elizabeth, 16
- Valenti, Michael, 78  
 Van Wiggeren, Gregory, 92  
 Vaupen, Scott, 177  
 VCSEL, light emitters, 96–98  
 Vehicular telematics, 136–140  
 generally, 136–137  
 radar, 137–138  
 toll payments, 139–140  
 traffic control, 163–164  
 train travel, 138–139  
 Velastin, Sergio, 160  
 Venus Flower Basket  
 (*Euplectella*, sponge), 85–86  
 Vibration-induced droplet atomization  
 (VIDA), cooling technologies,  
 186–187  
 Video network, camera phones, 159  
 Video-over-DSL, growth in, 3  
 Virus scanning:  
 E-mail cluster bombs, 174–175  
 Internet, 121–123  
 Visual impairment. *See also* Disabled  
 people  
 input/output technologies, mobile  
 phones, 210–211  
 navigation assistance, 75–76  
 Voice input, 191–194  
 advances in, 192  
 computer speech, 193–194  
 objects, 193  
 Voice-over Internet protocol (VoIP),  
 104–106
- Wagner, John, 42  
 Wang, James, 176–177, 209
- Wang, Wayne, 89  
 Wave polarization, fiber-optical  
 technology, 92–93  
 Wearable computers, 29–31  
 Weber, Werner, 31  
 Wei, Alexander, 59–60  
 Weiss, Martin, 64  
 Werner, Douglas H., 146–147  
 Wicker, Stephen, 71  
 Wiederrecht, Gary, 101  
 Wi-Fi networks:  
 security testing, 153  
 WLAN hotspots, 64  
 Wiggling fans, cooling technologies,  
 187–189  
 Wilson, Derick, 102  
 Wing, Bill, 109  
 Wireless chip, turbocharged data, 47–49  
 Wireless local area networks (WLANs),  
 64–66. *See also* Networks  
 emergency communications, 65–66  
 future trends, 64–65  
 hotspots, 64  
 Wireless networks. *See* Networks  
 Wireless PAN technology, 65  
 Wireless service. *See also* specific  
 services and applications  
 airline services, 14–15  
 base station technology, 60–62  
 fourth-generation, 6–7  
 modular software, 7–8  
 nanowiring, 51–52  
 open-source smart phone operating  
 system, 50–51  
 output (paper-like displays), 203–204  
 programmable networks, 41  
 silicon chip, turbocharged data, 47–49  
 stagnation in, 5–6  
 Wireline service, decline in, 2–3  
 Wolff, Richard S., 117  
 Woods, Gartner, 133, 134  
 Woods, Jeff, 131–132  
 World's Fair (New York City, 1964),  
 xiv–xvi
- Yang, Ming, 196  
 Yoo, Ben, 93  
 Young, Nathaniel, 212, 213
- Zhang, Hui, 81–82  
 Zhou, Peter, 165, 177–178