

index

A

- accessories and packaging, 200–201
- adaptations, influenza, 333–335
- Akiba, 64–65
- all-in-one desktop Novena, 218, 242–243
- Amendment 1092 to National Defense Authorization Act, 149–150
- American vs. Chinese manufacturing, 35–36
- amino acids, 328–329
- anisotropic tape, 257–259
- antibiotic-resistant superbugs, 342–343
- anticounterfeit measures for
 - US military, 149, 154–156
- Apple
 - Apple II, 207, 326–327, 373
 - Foxconn, 18, 20
 - quality control, 37
 - refinement costs, 202
- AppoTech chips, 293
- approved vendor list (AVL), 76
- Arduino, 213, 360
 - Arduino Uno, 104–105, 127
 - manufacturing, 44–57
 - copper sheets, 46–48
 - etching PCBs, 51–53
 - PCB pattern, applying to copper, 49–50
 - soldermask and silkscreen, 53–54
 - testing and finishing, 54–57
- artisan engineering, 213
- Asanović, Krste, 310–311
- Ashby chart, 230
- audit logs for test programs, 96
- authentic parts, keeping reserve of, 156
- automation
 - for electronics assembly, 29–31
 - test program, 96
 - in zipper factory, 67–70
- AVL (approved vendor list), 76

B

- bacteria
 - CRISPRs in, 347–350
 - metabolic pathways, 325–327
- barcode, embedding in chips, 154
- battery board, Novena, 223–224
- battery pack, Novena, 243–244
- beachhead, building, 315–317
- bicycle safety light, 74–75, 79–82
- bill of materials (BOM), 74–84
 - approved vendor list, 76
 - for bicycle safety light, 74–75, 79–82
 - change, planning for, 82–84
 - extended part numbers, 78–79
 - form factor, 77–78
 - quotations, 107–108
 - tolerance, composition, and voltage specification, 76–77
- biology and bioinformatics, 277–278
 - comparing H1N1 to computer virus, 327–335
 - adaptable influenza, 333–335
 - DNA and RNA as bits, 328–330
 - hacking swine flu, 331–332
 - silver lining, 335
 - unique access ports, 330–331
 - patching genome, 346–354
 - CRISPRs in bacteria, 347–350
 - gene drive, 352–354
 - human engineering, 351–352
 - where to cut genes, 350–351
 - personalized genomics, 344–346
 - reverse engineering superbugs, 335–344
 - antibiotic resistance, 342–344
 - O104:H4 DNA sequence, 336–338
 - reversing tools for biology, 338–340
 - UNIX Shell Scripts, 340–342
- BLASTX decompiler, 339–340

Blueprint interview, 372–382
 BOM. *See* bill of materials
 bonding USB chips to PCBs, 61
 booting OS, 321
 bootstrapping, 197, 203
 boot structure, reverse engineering,
 311–315
 bottom line, and DFM, 88–91
 breakout board for beginners, 241–242
 building technology without using it,
 23–24
 business model, 363

C

capacitors, 12, 76–77
 case construction
 chumby, 26–28
 Novena, 233–236
 cash flow, Chumby, 193
 cell phones
 hacking, 306–324
 attaching debugger, 317–320
 beachhead, building, 315–317
 booting OS, 321
 building new toolchains,
 321–323
 results, 323–324
 reverse engineering boot
 structure, 311–315
 system architecture, 306–311
 screen replacement, 120–121
 \$12 phone, 126–140
 engineer rights, 135–140
 from gongkai to open source,
 134–135
 hardware, 128–131
 CFT (Cyber Fast Track) initiative, 289
 change, planning for and coping with,
 82–84
 check plots, 268
 Chibitronics, 251–274
 background, 251–259
 check plots, 268
 Chinese New Year, impact on
 supply chain, 272–273
 complications regarding simple
 requests, 267–268
 delivery, 264–266
 developing new process, 259
 incorrect placement of components,
 268–269
 last-minute changes, 271–272
 process capability test, 261–264
 shipping, 273–274
 single points of failure,
 eliminating, 271
 stencil of sticker patterns, 271–272
 test program, 92–94
 translation issues, 270–271
 visiting factory, 260–261
 China. *See also* factories; Shenzhen,
 China
 Chinese New Year, impact on
 supply chain, 272–273
 Chinese translation problems,
 270–271
 technology growth, 364–366
China Software Developer Network
 (CSDN) interview, 357–372
 about hardware hackers, 367–372
 about open hardware and maker
 movement, 358–367
 chip-on-board (CoB) technology, 29
 chips
 bonding to PCBs, 61
 counterfeit, 143–148. *See also*
 US military hardware,
 counterfeit chips in
 decapping, 282–283
 hand-placing on PCBs, 59–61
 SEG Electronics Market, 11–14
 for USB memory sticks, 57–59
 chip shooters, 30
 Chipworks, 246
 chroma keying, 303–304
 Chumby, 1–2, 181
 automation in assembly, 29–31
 case production, 26–28
 cash flow, 193
 chumby classic, 183–184

Chumby (*continued*)

- chumby One
 - development of, 184–189
 - trim and finish, 101–104
 - connector placement, 25–26
 - contracts, 193–205
 - counterfeit microSD cards
 - authenticity, 159–160
 - electronic card ID data, 158–159
 - forensic investigation, 160–162
 - gathering data, 162–165
 - summarizing findings, 166–168
 - visible differences, 157–158
 - factory testing, 41
 - factory tours, 16–17
 - hacker-friendly platform, 182–184
 - injection molding, 31–34
 - interview with Phil Torrone, 189–205
 - lessons learned from, 374–375
 - margin, 192–193
 - merchant buyers, 192
 - microphone factory installation, 20–23
 - motherboard, 188–189
 - NeTV. *See* NeTV
 - quality control, 36–39
 - remote testing, 39–40
 - reverse logistics and returns, 193
 - test points, 187–188
- circuit stickers, 251–274. *See also*
- Chibitronics
 - background, 251–259
 - check plots, 268
 - Chinese New Year, impact on supply chain, 272–273
 - complications for simple requests, 267–268
 - delivery, 264–266
 - developing new process, 259
 - incorrect placement of components, 268–269
 - last-minute changes, 271–272
 - process capability test, 261–264
 - shipping, 273–274
 - single points of failure, eliminating, 271
 - stencils of, 271–272
 - translation issues, 270–271
 - visiting factory, 260–261
 - Circuit Sticker Sketchbook*, 256–257, 267–268
 - clamshell testing, 54
 - cloning, 116
 - CoB (chip-on-board) technology, 29
 - Coders' Rights Project, 137
 - COGS (cost of goods sold), 90–92
 - colors, communicating with operators through, 96
 - community-enforced IP rules, 124–125
 - community support for Novena, 247–249
 - company structure, 202–203
 - composition, BOM, 76–77
 - computer virus, comparing H1N1 virus to, 327–335
 - adaptability, 333–335
 - antibodies, 335
 - DNA and RNA as bits, 328–330
 - hacking H1N1 virus 331–332
 - unique access ports in organisms, 330–331
 - configuration fuses, 281
 - contracts, negotiating, 193–205
 - copper sheets, for PCBs, 46–50
 - copying, 116
 - copyrights, 137, 138, 175–177
 - cosmetic blemishes, 87–88
 - cost of goods sold (COGS), 90–92
 - counterfeit goods. *See* fake goods
 - couriers, 112
 - coverlay, 260–261
 - craftspeople, need for, 26–28
 - CRISPR/Cas system, 347–352
 - Cross, Sean “xobs”, 134–135, 215–216, 289–290. *See also* Novena; SD cards, hacking
 - crowdfunding, 197–198, 265, 266, 382
 - Crowd Supply, 250, 264, 265
 - CrypTech, 248–249

custom battery pack problems, 243–244
 Cyber Fast Track (CFT) initiative, 289

D

data display channel (DDC), 304
 Debian, 246
 debugger, attaching, 317–320
 decapping IC, 282–283
 decompiler, 339–340
 dedicated hardware real-time clock (RTC) module, 238–239
 dedication to quality, 20–23
 defective units, paying for, 3
 delivery of circuit stickers, 264–266
 design files, sharing, 363
 design for manufacturing (DFM), 84–100. *See also* test program
 bottom line, 88–91
 overview, 85–86
 testing vs. validation, 97–100
 tolerances, 86–88
 design process, 105–106
 design vocabulary, 101
 desktop Novena, 218, 242–243
 DFM. *See* design for manufacturing
 Digital Millennium Copyright Act (DMCA), 137
 direct repeat sequence, 348
 direct-to-consumer (DTC) personal genomics, 344–345
 disease predictions based on mutations, 345
 distribution channel, 196
 DIY speakers, 237–238
 DMCA (Digital Millennium Copyright Act), 137
 DNA, 328–330. *See also* genome
 double-shot molds, 103–104
 DRAM chips, 12–13
 drilling process, PCB boards, 46–48
 drug resistance, 338–341
 DTC (direct-to-consumer) personal genomics, 344–345

E

ECO (engineering change orders), 82–84
E. coli, 342
 EDID (extended display identification data), 304
 EDK (embedded development kit), 135
 EDM (electrical discharge machine), 33
 EFF (Electronic Frontier Foundation), 137
 effects stickers, 263
 EHEC O104:H4, 335–344
 answering questions with UNIX shell scripts, 340–342
 antibiotic resistance, 342–344
 DNA sequence, 336–338
 reversing tools for biology, 338–340
 electrical discharge machine (EDM), 33
 electronic card ID data, 158–159
 Electronic Frontier Foundation (EFF), 137
 electronic tolerances, 86–87
 embedded development kit (EDK), 135
 enclosure, Novena, 224–227
 end-of-life (EOL), 82
 engineering change orders (ECO), 82–84
 engineering humans, 351–352
 engineering samples, 170–172
 engineer rights, 135–140
 copyrights, 138
 patents and other laws, 136–137
 programming languages, 138–140
 EOL (end-of-life), 82
 erasing
 flash memory, 284–285
 memory cards, 298
 security bits, 285–287
 etching PCBs, 51–53
 e-waste, handling, 155–156
 extended display identification data (EDID), 304
 extended part numbers, 78–79
 external mimicry, 150–151

F

- factories, 2–3, 43–44. *See also* quality; *specific factories by name*
 - automation, 29–31
 - building technology without using it, 23–24
 - dedication to quality, 20–23
 - defective units, paying for, 3
 - feeding workers, 18–20
 - injection molding, 31–34
 - mistakes in manufacturing, 34, 41–42
 - need for craftspeople, 26–28
 - partnerships with, 107–113
 - import duties, 113
 - ordering more units than proven demand, 112
 - quotations, 108–111
 - scrap and yield, 111–112
 - shipping costs, 112
 - tips for forming, 107–108
 - scale in Shenzhen, 17–18
 - scrap, 152
 - searching for, 378
 - skilled workers, 24–26
 - testing, 41
- failure analysis services, 281
- failures, learning from, 368–369
- Fairchild 74LCX244, 146–147
- fake goods, 143–174
 - chips, well-executed, 143–148
 - chips in US military hardware, 149–156
 - anticounterfeit measures, 154–156
 - types of counterfeit parts, 150–153
 - US military designs, 153–154
- FPGAs, 168–174
 - incorrect ID codes, 170–172
 - solutions, 172–174
 - white screen issue, 168–170
- microSD cards, 156–168
 - authenticity, 159–160
 - electronic card ID data, 158–159
 - forensic investigation, 160–162
 - gathering data, 162–165
 - summarizing findings, 166–168
 - visible differences, 157–158
- feeding factory workers, 18–20
- Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 138
- Fernly shell, 315–316, 317–319
- Fernvale, 306
 - attaching debugger, 317–320
 - beachhead, building, 315–317
 - booting OS, 321
 - FronD, 307–308
 - legal tasks, 134–136
 - peripheral connectors, 308–309
 - results, 323–324
 - reverse engineering boot structure, 311–315
 - system architecture, 306–311
 - system diagram, 309
 - toolchains, building new, 321–323
- field programmable gate array. *See* FPGAs
- film imaging, 49–50
- firmware
 - in memory cards, 292
 - Novena, 246–247
- five-digit multimeter, 98
- flash chips, for USB memory sticks, 57–59
- flash memory, erasing, 284–285
- flat patterns, 26–28
- flex circuits, 252–253
- flex PCB factory, 260–261
- flow marks, 236
- flying head testing, 54
- form factor, 77–78
- forward bias voltage, 88, 89
- founders, suggestions for, 199
- Foxconn, 18, 20
- FPC (internal flexible printed circuit)
 - header, 238–239

FPGAs (field programmable gate array)

- counterfeit, 168–174
 - incorrect ID codes, 170–172
 - solutions, 172–174
 - white screen issue, 168–170
- future trends, 212–213
- Novena, 239
- Freescale/NXP iMX6 CPU, 220
- front bezel, Novena, 237–238
- fully decapped chips, 282
- functionally decapped chips, 282–283
- fuzzing, 293

G

- gene drive, 352–354
- General-Purpose Breakout Board (GPBB), 241–242
- genome
 - disease predictions based on mutations, 345
 - genotyping, 344–345
 - patching, 346–354
 - CRISPRs in bacteria, 347–350
 - engineering humans, 351–352
 - gene drive, 352–354
 - where to cut genes, 350–351
 - reference, 345–346
 - genotyping, 344–345
 - ghost shift, 115, 152
 - golden samples, 36, 82
 - gongkai (公开), 117–118, 119–120.
 - See also* shanzhai
 - cell phone screen replacement, 120–121
 - defined, 131–134
 - vs. kai fang yuan dai ma (开放源代码), 372
 - \$12 phone, 126–140
 - engineer rights, 135–140
 - from gongkai to open source, 134–135
 - hardware, 128–131
- GPBB (General-Purpose Breakout Board), 241–242
- gray markets, 154

H

- H1N1 virus, comparing to computer virus, 327–335
 - adaptability, 333–335
 - antibodies, 335
 - DNA and RNA as bits, 328–330
 - hacking H1N1 virus 331–332
 - unique access ports in organisms, 330–331
- H5 port, 330
- hacker-friendly platform, 182–184
- hacker spirit, 371
- hacking hardware. *See* hardware hacking
- hand-placing chips on PCBs, 59–61
- hard drive, choosing, 244–246
- hardware hacking, 279–281
 - CSDN* interview about, 367–372
 - general discussion, 275–278
 - HDCP-secured links to allow custom overlays, 298–306
 - of PI C18F1320, 281–289
 - closer look, 283–284
 - decapping IC, 282–283
 - erasing flash memory, 284–285
 - erasing security bits, 285–287
 - protecting other data, 287–289
 - of SD cards, 289–298
 - potential security issues, 298
 - resource for hobbyists, 298
 - reverse engineering microcontroller, 293–297
 - shanzhai phones, 306–324
 - attaching debugger, 317–320
 - beachhead, building, 315–317
 - booting OS, 321
 - building new toolchains, 321–323
 - Fernvale results, 323–324
 - reverse engineering boot structure, 311–315
 - system architecture, 306–311
 - structure of cards, 290–293
- hardware startups, 378–380
- hash function, 315
- HDCP-secured links, hacking, 298–306

health, caring for, 205
 heirloom laptops, 210–211
 Heirloom Novena, 218, 227–232
 hard drive, 245–246
 mechanical engineering details,
 229–232
 wood for enclosure, 228–229
 honest finishes, 101
 horizontal gene transfer, 343
 human engineering, 351–352

I

ID codes, FPGA, 170–172
 import duties and licenses, 113
 i.MX233, 184
 incoming quality control (IQC)
 guidelines, 160
 incorrect placement of components on
 circuit stickers, 268–269
 industrial design, 100–106
 Arduino Uno silkscreen art, 104–105
 chumby One trim and finish,
 101–104
 personal design process, 105–106
 injection molding
 general discussion, 31–34
 in Novena manufacturing, 233–236
 innovation, 359
 input networks, 87
 intellectual property (IP). *See also*
 gongkai; shanzhai
 general discussion, 115–118
 Western vs. Chinese models,
 131–132
 internal flexible printed circuit (FPC)
 header, 238–239
 interoperability, 380
 interviews, 357–382
 Blueprint, 372–382
 China Software Developer Network
 (*CSDN*), 357–372
 about hardware hackers, 367–372
 about open hardware and maker
 movement, 358–367
 Make., 189–205

inventory turning, 196–197
 investigating fake microSD cards,
 158–159, 160–162
 involvement in manufacturing process,
 36–39
 IP. *See* intellectual property
 IQC (incoming quality control)
 guidelines, 160
 Ito, Joi, 264

J

Japan, economic development of, 365
 JTAG, 170

K

kai fang yuan dai ma
 (开放源代码), 372
 keystreams, 304–306
 Kare, Susan, 39
 Kickstarter, 197–198, 377
 Kingston microSD cards, 156–168
 authenticity, 159–160
 electronic card ID data, 158–159
 forensic investigation of, 160–162
 gathering data, 162–165
 summarizing findings, 166–168
 visible differences, 157–158
 knit lines, 235
 Kovan, 169

L

labor costs, 110
 laptop Novena, 218
 laser imaging, 49
 last-minute changes, 271–272
 LCA (Linux Conference Australia), 57
 LCD bezel, Novena, 226
 LEDs, in bicycle safety light, 74–75,
 79–82
 Li, Xiao, 23–24
 LinkIT ONE, MediaTek, 323–324
 Linux Conference Australia (LCA), 57
 logs for test programs, 96

M

Make: interview, 189–205
 MakerBot, 203
 maker movement, 358–367
 managed NAND system, 186–187
 man-in-the-middle (MITM) attacks, 290, 298, 301
 manufacturer ID, 158–159
 manufacturing. *See* factories
 margins
 chumby, 192–193
 factory, 110–111
 Master Chao, 26–28
 MCM (multichip module), 310
 mechanical engineering, Novena, 229–232
 mechanical tolerances, 87–88
 MediaTek LinkIT ONE, 323–324
 MediaTek MT6250DA, 130–131
 MediaTek MT6260, 140, 310–311
 merchant buyers, 192
 metal spiral binding, *Circuit Sticker Sketchbook*, 267–268
 microcontroller
 in memory cards, 292
 reverse engineering, 293–297
 test program, 92–94
 microphone, chumby, 20–23
 microSD cards
 chumby One, 186
 counterfeit, 156–168
 authenticity, 159–160
 electronic card ID data, 158–159
 forensic investigation, 160–162
 gathering data, 162–165
 summarizing findings, 166–168
 visible differences, 157–158
 military hardware, counterfeit chips in, 149–156
 anticounterfeit measures, 154–156
 types of counterfeit parts, 150–153
 US military designs, 153–154
 minimum order quantity (MOQ), 81

min-max spread, 86–87
 mirror-finished plastic, 70–71
 mistakes in manufacturing, 34, 41–42
 MITM (man-in-the-middle) attacks, 290, 298, 301
 MIT Media Lab, 264
 monastic design, 100
 Moore’s law, 206–212, 359
 MOQ (minimum order quantity), 81
 motherboard
 chumby One, 188–189
 Novena, 221–222, 238–239
 Mottweiler, Kurt, 228, 238
 multichip module (MCM), 310
 mutations, disease predictions
 based on, 345
Mycoplasma pneumoniae, 325–327
 MyriadRF, 248

N

NAND flash chips, 13
 National Defense Authorization Act, 149–150
 NeTV, 280
 background on HDCP, 300–301
 conceptual diagram of, 303
 development of, 299–300
 FPGA diagram, 305
 goals for, 301
 how it worked, 302–303
 keystream, creating, 304–305
 user overlay content, creating, 303–304
 New Balance factory, 17–18
 Ng, P.C., 344–345
 nonrecurring engineering (NRE)
 costs, 111
 Novena, 133, 215–250
 all-in-one desktop, 218, 242–243
 breakout board for beginners, 241–242
 case construction, 233–236
 community support, 247–249
 custom battery pack, 243–244

Novena (*continued*)

- design, 219–227
 - battery board, 223–224
 - enclosure, 224–227
 - motherboard, 221–222
- dimensions, 219
- DIY speakers, 237–238
- firmware, 246–247
- front bezel changes, 237–238
- hard drive, choosing, 244–246
- Heirloom, 218, 227–232
 - hard drive, 245–246
 - mechanical engineering details, 229–232
 - wood for enclosure, 228–229
- injection molding, 233–236
- laptop, 218
- motherboard, 238–239
- power pass-through board, 242–243
- pricing, 218
- PVT2 mainboard, 238–240
- users, 217–218

NRE (nonrecurring engineering)

- costs, 111

NuttX, 141

O

- O104:H4 DNA sequence, 336–338
- ocean freight, 273–274
- ODMs (original design manufacturers), 379–380
- online hardware startups, 378–380
- on-time delivery, 266
- open BOM, 124–125
- open source, 117, 134–135
 - hardware, 176–178, 205–214. *See also* Chibitronics; Chumby; Fernvale; Kovan; NeTV; Novena
 - CSDN interview about, 358–367
 - heirloom laptops, 210–211
 - monetization, 195–196
 - opportunities for, 211–214
 - trends in, 206–209
 - software, 362

- ordering more units than proven demand, 112
- original design manufacturers (ODMs), 379–380
- overlay, creating, 303–304
- overmolding, 34

P

- package type, 77–78
- pad printing, 102
- palindromic sequences, 348
- PAM (proto-space adjacent motif), 350–351
- Particle’s Spark Core, 306–307
- partnerships with factories, 107–113
 - import duties, 113
 - order more units than proven demand, 112
 - quotations, 108–111
 - scrap and yield, 111–112
 - shipping costs, 112
 - tips for forming, 107–108
- part numbers, 78–79
- patching genome, 346–354
 - CRISPRs in bacteria, 347–350
 - engineering humans, 351–352
 - gene drive, 352–354
 - where to cut genes, 350–351
- patents, 136–137, 194–195
- patterning, 46
- pattern makers, 26–28
- PB2 influenza gene, 331–332
- PCBs, 44–57
 - applying pattern to copper, 49–50
 - bonding chips to, 61
 - for circuit stickers, 260–261
 - copper sheets, 46–48
 - etching, 51–53
 - Fernvale Frond, 307–308
 - hand-placing chips on, 59–61
 - soldermask and silkscreen, 53–54
 - testing and finishing, 54–57
- PCH China Solutions, 17, 37
- Peek, Nadya, 226
- Peek array, 226

penicillin resistance, 338–339
 Perrott, Joe, 27
 personal design process, 105–106
 personalized genomics, 344–346
 Phase Locked Loop (PLL), 140
 photoresist, 49–50
 physical identifiers, embedding,
 154–155
 physical programming, 263
 PIC18F1320, hacking, 281–289
 closer look at, 283–284
 decapping IC, 282–283
 erasing flash memory, 284–285
 erasing security bits, 285–287
 protecting other data, 287–289
 plastic finishes, 70–71
 PLL (Phase Locked Loop), 140
 poison pills, 136–137
 polyimide, 260–261
 power pass-through board, 242–243
 pragmatic design, 100
 precision, 31–34
 pricing
 aiming high, 199–200
 Novena, 218
 quality control, 34–35
 probe card, 58
 process capability test, 261–264
 process geometry, 144–145
 production candidate stickers, 263
 programming languages, 138–140
 protecting data when hacking, 287–289
 protein database, 338–339
 proteins, 329, 337
 proto-space adjacent motif (PAM),
 350–351

Q

QC (quality control) room, 36–39
 QEMU, 317–318
 Qi, Jie, 253–256, 263–264, 270–271.
See also Chibitronics
 quality, 34–35
 American vs. Chinese
 manufacturing, 35–36

dedication to, 20–23
 factory testing, 41
 involvement in manufacturing
 process, 36–39
 mistakes, 41–42
 remote testing, 39–40
 quality control (QC) room, 36–39
 quaternary structure, 350
 quotations, evaluating, 108–111

R

Radio Electronics (无线电), 369
 Raspberry Pi, 360
 read-evaluate-print-loop (REPL) shell,
 293–297
 real-time clock (RTC) module, 238–239
 reballing, 155
 rebinned parts, 151–152
 recycling, 154–155
 red ring of death, 42
 reference genome, 345–346
 refurbished parts, 150–151, 154
 remote testing, 39–40
 repair culture, 213
 REPL (read-evaluate-print-loop) shell,
 293–297
 resistive current limiting, 88
 resistors, 76
 Restriction of Hazardous Substances
 (RoHS) testing, 41
 retailers, engaging, 200, 378
 returns, in retail, 193
 reverse engineering, 137
 boot structure, 311–315
 general discussion, 275–278
 microcontroller, 293–297
 superbugs, 335–344
 antibiotic resistance, 342–344
 O104:H4 DNA sequence,
 336–338
 reversing tools, 338–340
 UNIX shell scripts, 340–342
 reverse logistics, 193
 RNA, 328–330
 RNA-dependent RNA polymerase, 333

robotics controller, 78
 RoHS (Restriction of Hazardous Substances) testing, 41
 ROM, dumping, 312–316
 rooting, user, 370
 routing PCBs, 55
 RTC (real-time clock) module, 238–239
 rubberized tags, 25

S

Samsung microSD cards, 163–168
 SanDisk microSD cards, 163–168
 satin-finished plastic, 70–71
 scale in factories, 17–18
 scarcity and demand, 70–71
 Scarmagno, Italy, 44–45
 scrap, handling, 111–112
 scriptic language, 139–140
 SD cards, hacking, 289–298
 potential security issues, 298
 resource for hobbyists, 298
 reverse engineering microcontroller, 293–297
 structure of cards, 290–293
 vulnerabilities, 290
 secondary structure, 349–350
 second-sourcing, 153
 security bits, erasing, 285–287
 security issues, SD cards, 298
 semiautomated process, in zipper factory, 68–70
 sensor and microcontroller stickers, 263
 shanzhai (山寨), 116–117, 121–125, 177, 371–372. *See also* gongkai
 cell phones, 2
 community-enforced IP rules, 124–125
 hacking phones, 306–324
 attaching debugger, 317–320
 beachhead, building, 315–317
 booting OS, 321
 building new toolchains, 321–323

 Fernvale results, 323–324
 reverse engineering boot structure, 311–315
 system architecture, 306–311
 more than copycats, 123–124
 sharing design files, 363
 Shenzhen, China, 1–4. *See also* factories
 screen replacement, 120–121
 SEG Electronics Market, 8–14
 shanzhai organizations in, 123
 Shenzhen Bookstore, 14–15
 “ship or die” motto, 198–199
 shipping products, 112, 273–274
 side-by-side bonding, 166
 signatures, in memory, 319–320
 silkscreen, 53–54, 57
 single nucleotide polymorphisms (SNPs), 345–346
 single points of failure, eliminating, 271
 sink marks, 235
 skilled workers, 24–26
 smartcards, 144–145
 smart watches, 124
 SMT (surface mount technology), 55, 77–78
 SNPs (single nucleotide polymorphisms), 345–346
 soldermask, 53–54, 57
 Song Jiang, 122
 smartphones. *See* cell phones
 spacers, 348
 speakers, Novena, 237–238
 SPI ROMulator FPGA, 313
 ST19CF68 chips, 144–148
 stacked CSPs, 166
 standardization of platforms, 212
 stencil of circuit sticker patterns, 271–272
 superbugs, reverse engineering, 335–344
 antibiotic resistance, 342–344
 O104:H4 DNA sequence, 336–338
 reversing tools, 338–340
 UNIX shell scripts, 340–342

supply chain, impact of Chinese New Year on, 272–273

surface mount technology (SMT), 55, 77–78

swine flu. *See* H1N1 virus, comparing to computer virus

switches

- Novena, 237
- validating, 98–99

system architecture, 306–311

System Elettronica, 44–57

- applying PCB pattern to copper sheet, 49–50
- applying soldermask and silkscreen, 53–54
- copper sheets, 46–48
- etching PCBs, 51–53
- testing and finishing, 54–57

System-on-Chip devices, 310–311

T

tampo printing, 102

technology level, in China, 364–366

Tek MDO4104B-6 oscilloscope, 313

tertiary structure, 350

testing

- flash chips, 58–59
- PCBs, 54–57
- vs. validation, 97–100

test jigs, 99–100, 271

test points, chumby One, 187–188

test program, 91–95

- guidelines for, 94–97
- icons, communicating with operators through, 96
- real-world, 92–94
- setup of, 95–96
- update mechanisms for, 97

3D transistors, 245

through-hole packages, 77–78

tolerances, 76–77, 86–88

Tomlin, Steve, 39, 299

toolchains, building new, 321–323

tooling, 233–234

Torrone, Phil, 189–205

toy factories, 29–30

transistor scaling, 210–211

translation problems, 270–271

transparency in factory relationships, 107–108

trim and finish, chumby, 101–104

triple-reassortant virus, 334–335

\$12 phone, 126–140

- engineer rights, 135–140
- from gongkai to open source, 134–135
- hardware, 128–131

U

U-Boot (Universal Bootloader), 246

Ubuntu Edge, 382

unique access ports, in organisms, 330–331

Universal Protein Resource (UniProt), 338–339, 341

UNIX shell scripts, answering biological questions with, 340–342

upstreaming, 246

USB flashing tool, open version of, 320–322

USB memory stick factory, 57–64

- beginning of USB sticks, 57–59
- bonding chips to PCBs, 61
- close look at USB stick boards, 61–64
- hand-placing chips on PCBs, 59–61

USB ports, Novena, 237

US military hardware, counterfeit chips in, 149–156

- anticounterfeit measures, 154–156
- types of counterfeit parts, 150–153
- US military designs, 153–154

UV dye in chips, 154–155

UV-erasable programmable read-only memory (UV-EPROM), 284–285, 286

V

vacuum-tube radio schematic, 207
validation vs. testing, 97–100
Vanchip VC5276, 130
Vasut, Marek, 246, 248
venture capitalist funding, 195–196,
197–199
vibrapots, 67–68
viruses. *See* H1N1 virus, comparing to
computer virus
V-NAND, 245, 246
voltage specification, BOM, 76–77

W

Wang, Chris “Akiba”, 64–65
waste, handling, 155–156
white screen issue, 168–170
wire bonding, 29–30, 61
wood enclosure for Novena, 228–229

X

Xbox 360, 42
Xbox One, 369
Xilinx, 170–174
xobs, 134–135, 215–216, 289–290.
See also Novena; SD cards,
hacking

Y

yield, 84–85, 90, 111–112
Young’s modulus, 229–230

Z

zipper factory, 64–71
fully automated process, 67–68
irony of scarcity and demand, 70–71
semiautomated process, 68–70
Z-tape, 257–259