The reporter knocked on the door a little after 6:00 A.M. The tall, slightly stooped elderly man who answered the door had obviously just gotten up, and he was still dressed in a worn bathrobe. The reporter excitedly asked what he was going to do next. The man paused and thought about it, and then answered that he thought he’d make a pot of coffee. The reporter pressed on, until it became obvious the man had no idea what he was talking about, or why this should be any kind of a special day. Finally, the reporter broke the news to him—he had just won the Nobel Prize for Physics. It turns out that Jack Kilby, who was the man who had answered the door, had taken out his hearing aids when going to sleep and had missed the official call from Sweden.

This is only the latest in a continuing line of dispatches from one of the most exciting areas of new folktales, the electronic front lines. It is peopled by exciting, eccentric, energetic, enthusiastic, entrepreneurial, egotistic, exuberant explorers who are inventing a new industry and changing our very world while they do it. They are engineers, dreamers, medicine show pitchmen, computer geeks (and isn’t it interesting how much carnival slang has drifted over into this industry), sleight-of-hand (or perhaps sleight-of-mind) artists, and other assorted types who have embraced the latest of the get-rich-quick mother lodes. It is a profoundly young industry, and to this point, no one has written the definitive biography of it. Tracy Kidder has come the closest, but he has only captured a moment in time, which was largely obsolete by the time his books were published. It
is a profoundly mobile industry, where employees have a loyalty to
the industry rather than to a company, and no one expects to spend
their entire career working for one company. Quite the opposite—
there’s a curious stigma attached to that, like “How come you never
moved, aren’t you good enough to work somewhere else?” The suc-
cessful firms have countered this by encouraging movement within
the company, so very few have worked with the same people in the
same group more than a decade. The net result of this is that corpo-
rate (and industry) culture get transmitted by story—kind of a classic
definition of folklore and folktales.

This paper will share some of those folktales. I make no pre-
tense of presenting a scholarly examination of the way traditions
developed, nor any coherent tracing of their growth. It is instead a
collection of those stories garnered from thirty-plus years working
in the industry. Actually, I’ve had the incredible good fortune to
have worked for two of the deepest lodes of the electronic story
mines, Fairchild Semiconductor and Texas Instruments. So, let me
launch off in the way I do when introducing the history of TI to
TIers, with a little bit of swing music.

What does the music of Artie Shaw have to do with semicon-
ductors? To understand the answer to that question, you have to
go back to Christmas Eve in 1947 to a small town in New Jersey.
The world had just been through a devastating world war, a war
that in the minds of the public had largely been won through the
efforts of the scientists. Further, the people expected the scientists
to now lead them into an era of unprecedented peace and prosper-
ity. On that snowy December afternoon, many of those hopes were
about to be realized.

Three men were gathered around a crude piece of scientific
apparatus. The tall, shy-looking man in the back was John
Bardeen, probably the most outstanding physicist America has ever
produced. He would go on to win two Nobel prizes—one for his
work here, and one in another, separate field. The kindly looking
man standing next to him was Walter Britain, experimenter extra-
ordinaire, and the man who actually constructed the apparatus of
interest. The man sitting down at the microscope was William
Shockley, who was to play a key role in the industry being born in that room. He was the leader of that extraordinary group of scientists, and they were putting on a dog-and-pony show for him.

The object beneath the scope was a piece of grayish metal with an odd looking arrow-head of Lucite covered with gold foil pressed down against it. It was connected (with a bent paper clip) to a microphone, forming a crude amplifier. Shockley picked up the microphone, said “Hello” into it, “Hello” boomed back from a speaker across the room, and the world was forever changed.

Not, however, right away. The grayish metal was germanium, and the scientists at Bell Labs in Murray Hill, New Jersey (which was the name of the small town) had just demonstrated the world’s first point contact transistor. The world reacted—with monumental indifference. In point of fact, Bell Labs had somewhat of a problem figuring out what to do with it. They had been locked in a tight race with several other labs, most notably Purdue University, to demonstrate the transistor. The idea was not new; the first patents on the transistor go back to the 1920s. Bell Labs did some characterization, and announced it at the end of June in 1948. The *New York Times* gave it a short paragraph, right below the times for the Boston Braves/Brooklyn Dodgers and Philadelphia Athletics/St. Louis Browns double headers and traffic reports for the upcoming Fourth of July weekend. Bell decided to issue some licenses and let others figure out how to use it.

Among those applying for a license was a small company in Dallas, Texas. They had been an oilfield service company, specializing in seismographic work. During the war, they had worked closely with the navy developing anti-submarine technology, and they were ready to expand. One of the contacts they had made at the Department of the Navy was instrumental in overcoming Bell Lab’s reluctance to grant a license to this newcomer, and he even agreed to become their president. They had changed their name to Texas Instruments, and Pat Haggerty believed in them enough to join them. TI promptly hired a Bell Labs scientist name Gordon Teale and boldly launched off in a new direction: silicon.
The first transistors were germanium, but germanium has some severe technical limitations, mostly in temperature range. Everyone knew that the silicon was the more promising material, but it was hard to work with and very difficult to process. Every so often, Bell sponsored a meeting of all the license holders and, in 1954, Gordon sat and listened as all the big companies—DuMont, RCA, General Electric, Zenith, etc.—explained that while silicon was obviously the material of choice, it was at least two years away. No, another speaker would say, it’s four years away, and another would say it’s at least ten years away. That afternoon, Gordon Teale calmly got up and announced that TI had silicon transistors in production and pulled some out of his pocket. He then arranged a demonstration. A record player was set up next to a glass of hot oil. A germanium transistor was put in the circuit, and when it was plunged into the hot oil, the music stopped. Teale then unplugged the germanium transistor and plugged in a silicon transistor. When he plunged that into the hot oil, in Teale’s words, “The swinging notes of ‘Summit Ridge Drive’ continued unabated.” The meeting broke up in pandemonium amid calls for samples and prices, and a small company in Texas had set the world on its ear.
But the story does not end there. Most people saw the transistor as a super small vacuum tube, and that was the way it was produced and sold. However, the Air Force saw it in a slightly different light. They were in the midst of designing the Minuteman missile, and needed everything small, smaller, and smallest. The thing that got in their way was what was called the tyranny of numbers. All the components had to be soldered together, and solder joints were only 98% or so reliable. If you have hundreds of joints, that means your chance of anything working on the first try was slim or none—not a good thing if you’re talking about a missile with a lifetime of one shot. In the summer of 1958, TI hired a young engineer away from Centralab in Wisconsin. They told him to work on the interconnection problem, and then left him alone for two weeks. That happened because in those days, TI had mass vacation the first two weeks of July, and since the new guy didn’t have any vacation, he was left alone in the lab. It was at that time that he had the flash of insight that was to lead to the Nobel Prize forty years later. That young engineer, who was of course Jack Kilby, reasoned that if he could make all of the circuit components out of silicon, he could interconnect them with thin metal layers, which are orders of magnitude more reliable than wires. He built a sample circuit, and on September 12, 1958, he hooked up a crude device to a battery and an oscilloscope. A perfect curve showed up on the oscilloscope, and in that quiet moment, the world was forever changed. Jack had demonstrated the first integrated circuit, and the rest, as they say, is history. By the way, to give you some concept of just how much it has changed, if a digital cell phone were made with vacuum tubes, it would be the size of the Washington Monument.

Speaking of Jack and cell phones and the general uses to which his invention has been put, it is somewhat ironic that Jack did not own a cell phone, nor for that matter, much advanced technology. Jack has commented, “Communication between people has become much easier. Cell phones, that sort of thing, are now very common. If you don’t like the telephone much, and I don’t, you may not consider that a plus.” Once, when asked what he thought was the best thing to have come out of the invention of the IC,
Jack, who is hard of hearing, replied that the hearing aid had to be up there. Jack also developed the hand-held calculator. Later, when I had the privilege of working with him on another project, we would sometimes meet in his office. Whenever a question came up that needed calculation, Jack would reach into his desk drawer and pull out a circular slide rule and figure the answer. Now, as far as I am concerned, being able to use a circular slide rule is proof enough of genius, but we asked Jack one day why he used the slide rule when he had invented the hand-held calculator. In his careful, soft-spoken way, he replied that while the answer might be more exact with a calculator, you had no way of knowing if you had put the number in correctly, and you might be off by an order of magnitude. On the other hand, his answer on the slide rule might not be as exact, but it was going to be awfully close.

Jack Kilby with the solar energy system he invented
Jack was a gentleman in every sense of that word, and it is somewhat ironic that even if he had known he had won the Nobel Prize, his reply to the reporter at six in the morning might well have been the same. Not that he can’t be a little ironic himself on occasion. Tom Engibous, the present CEO of TI, tells of the time that he and some of his fellow vice-presidents made a pitch to Jerry Junkins, who was then president. At the time, business was in a downturn, and TI was scrambling to recover. The pitch was impressive, with full-color foils and dynamic action plans. After it had been made, Jerry went around the table and asked for comments. Everyone said how impressed they were, until he got to Jack. Jack leaned back and asked, “Aren’t these the same guys who got us into the ditch in the first place?” (Since this paper was presented, Jack Kilby has passed away. The world is a poorer place.)

In many ways, TI culture was the antithesis of Jack’s personality. Born in the oilfields of the ’30s, it started life as a seismographic oil exploration company called GSI. There is a story about a visiting number-cruncher who was pressed into emergency service at a drilling site, to lend a hand turning a hand auger. The disconcerted and momentarily demoted professional cursed and grumbled that when he joined GSI, he was supposed to be a numbers man and that he hadn’t hired out as a field hand for a beastly job like that. “And neither did I,” mumbled the mud-stained man on the other end of the auger handle. “What job did they hire you for?” asked the computer man sympathetically. “President,” croaked J. Clarance “Doc” Karcher, Ph.D. and co-founder, as he strained to bear down on the auger.

That tradition of hard work and rough-and-tumble tactics carried over into the new company Texas Instruments. Hours were long—twelve- and fourteen-hour days were common, and weekend work was more likely than not. Meetings were often adventures where the faint-hearted dare not go, and disputes were settled by who had the loudest voice. Old timers talk in awe of a meeting where Mark Shepard got so mad he threw a chair through a window, and another one where another high-ranking officer got up on the table and mooned the other participants.
had a female tech who told about being in meetings with the Department Manager and Head of Silicon Production over die sizes. Things would get heated and the language would get rougher and rougher. Finally, when they were mad enough to get up and stomp and pound, they would notice the girls and tell them they were excused.

They also used to tell about Head of the Hermetic Seal Department Paul Goundry. (Hermetic Seals are small packages with vacuum-tight seals made for electronic components; they particularly keep out moisture, which is very detrimental to reliability.) He would have weekly production meetings in HSD where he would verbally beat up on his line foremen when they were behind in production, which they inevitably were. One of them, however, would always tell Paul he was right on schedule until the last week of the month, when he, too would be behind. His fellow supervisors asked him one time why he did that, and he told them that while they got beat up four times a month, he only got it once.

Not all was rough, and there were plenty of opportunities for fun. Pat Haggerty was pushing hard one time to get an order shipped. The production engineer and foreman had had enough of it, and they loaded all the rejects into a wheelbarrow. After the order was safely in shipping, they rushed the wheelbarrow into Pat’s office, dumped them on the floor and said here they were, what did he want to do with them? For a long time, the company also provided free donuts and coffee at break time, and nearly twenty years later, some of those old donuts were still around, kept as mementos along with old packages and rejected silicon slices.

And then there was The Creek. The TI plant was in a dry area, and the nearest bar was a ramshackle joint on Greenville Avenue called The Creek. The Dallas Cowboys were in their early years at that time as well, and the Cowboy coaches and TI engineers spent many an interesting evening telling war stories while sitting on the empty beer cases that were the seating at The Creek. Unfortunately, it burned before I had a chance to go there, but I did see the end of one of the other institutions, The Dallas Inn. It was
right across the freeway from TI, and it was the sort of place where you rented rooms by the hour, clean sheets extra. It was heavily used during the day for that purpose, and for card games at night. TI Security sponsored a workshop on plant protection one time, and invited an FBI agent to be the main speaker. His secretary, being totally unfamiliar with Dallas, booked him into the closest motel to TI—The Dallas Inn. The next day, one of the local law officers took him aside, quietly explained to him they had him on surveillance tape, and suggested he might want to find more suitable quarters. He did. It changed hands soon after I moved to Dallas and three nights after it changed hands, it burned in a rather spectacular fire.

But TI was a quiet haven compared to the West Coast, and Silicon Valley. My days at Fairchild were amazing to a sheltered farm boy from upstate New York who thought that because he’d gone to college, worked in the Atomic Energy Commission and for Coors Porcelain that he was a man of the world. Wrong. Silicon Valley was the wildest place I have ever worked. Fairchild was full of brilliant people, good line supervisors and top management, but was totally mismanaged at the mid-levels. I worked in the Hybrid Department, which had three groups: Sales, Production, and Engineering. The Sales Manager and the Production Manager were continually at each other’s throats. So, one day the Department Manager called a meeting and announced that the Sales Manager was now head of production and the Production Manager was now head of sales. It was a disaster. While they were suited by personality for their original jobs, they were totally unsuited for their new ones, and the department never recovered.

To give you some flavor of the Production guy, Fairchild won a program to produce units for the 747 in-seat entertainment module. It was a big job, both in terms of the size of the contract and the size of the module. The production floor didn’t have a screen printer large enough to handle the module, so this guy went out to a screen printer vendor and told them he was interested in buying one of their larger machines, and could he try it out for a while?
They were most happy to do so, and he brought it in and ran the production across it. Then, when he had finished, he brought in the salesman, told him the machine was a pile of crap, and to get it out of his sight. That was fine until some of the modules came back and he had to replace them. He then called the screen printer company back, told them he had been hasty, and asked could he borrow it again? They declined.

Not that it made a lot of difference to the engineers. My office-mate in my time in Mountain View was a young engineer who had developed an interesting twist on a product. Instead of trying to get it produced at Fairchild (which admittedly would have been difficult), he spent most of his time during the day calling potential investors to start his own company. The most interested investor was . . . Sherman Fairchild. And while Dallas had The Creek, Silicon Valley had Walker’s Wagon Wheel and Ricky’s. They were sort of industry conference rooms, where engineers from all companies could meet and work out problems, with the added bonus of picking up line girls when the technical talk got boring. This camaraderie fostered a loyalty to the industry, which was good for the technical progress of semiconductors, but poor for any individual company. Fairchild does not exist anymore, but the entrepreneurial spirit is alive and well. Of the eight engineers in my section, one year later, only four were still in engineering (one of them owned a motorcycle dealership in New Jersey and the rest were in supervision), and none of us worked for Fairchild in Mountain View. Two had started their own companies, neither of which exists anymore.

In this paper, I have only scratched the surface of the vein of stories leading to the mother lode. I could have told about the guy who used to regularly send parts out of Fairchild to National to help them get started, and then got fired from Fairchild for taking a door out of the scrap heap. Or how TI got started in the crystal pulling business, when a scientist from a national lab told a TIer that he had some single crystals on his desk, that he didn’t have them counted, and would the Tier excuse him while he went to the
bathroom? (I should explain here that in the early days, single crystal silicon was very difficult to grow, and only a few people knew how. Now, it’s the basis for the industry.) Or I could have told about the stuffed squirrel award a TI plant manager used to pass around to his underlings whom he thought had done a particularly dumb thing. But those are different stories for a different day.