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# FORTUNE

EXCERPT

As cellphones continue their takeover of the world, one company is certain to succeed: Here's how **Qualcomm** does it. by James Aley

# Heads we win, tails we win

IF YOU'RE LUCKY ENOUGH TO FIND YOURSELF in the 18th-floor ballroom of the Beijing Hotel when the weather is clear and sunny, as it was one crisp day this past December, you'll be treated to an amazing view of the Forbidden City, Tiananmen Square, and, if you lean way out over the terrace railing, the famous portrait of Mao Zedong. I, however, wasn't looking at any of that, because the Korean

guy in the chair in front of me was showing me a porno movie on his cellphone. Pretty good picture quality too.

There we were, waiting for a speech by Irwin Jacobs, CEO of Qualcomm, the wireless technology company. The official topic of these proceedings was third-generation, or 3G, wireless technology. You remember 3G. It was hyped relentlessly back in the bubble days: We would all

soon be watching TV on our mobile devices—which wouldn't just be phones. We'd be downloading and listening to music, using real-time global-positioning-system maps, shopping for shoes while we waited for the bus, and on and on. European carriers spent upwards of \$100 billion just on licenses for the radio spectrum necessary to offer 3G. Yet the planetary 3G transformation simply hasn't happened as fast as predicted. As problems with equipment and even more problems with rolling out a worldwide technical upgrade set back the industry's plans, hype over 3G reversed into extreme skepticism. But now, one recession later, I had just caught my first really good look at our future. For there is no more convincing sign of a technology's impending arrival than a naked woman writhing on a color screen.

At least, that's the hope of the wireless industry, which needs help. Consumers around the world will buy 460 million cellphones this year and spend \$390 billion on their cell services, according to an estimate from Yankee Group, a research firm in Boston. Yet competition among carriers has driven down the average per-minute revenue they collect from their users. In the U.S., wireless calls cost close to 10 cents a minute—about half what they were three years ago, according to Mark Lowenstein, head of Mobile Ecosystem, a consulting firm in Wellesley, Mass. Enabling users to buy games or pay for add-ons like multimedia messaging, the thinking goes, will increase bills.

Wireless technology—even the G-rated first- and second-generation kind—is about as close as most of us get to an everyday miracle. The fact that it works at all is a triumph of mathematics, physics, and fantastic sums of money. The system we have today is also a product of protracted strife. Technology has a way of making itself widespread and practical only after going through a period of struggle between competing standards. Think VHS vs. Betamax, Microsoft vs. everyone else—those have been some of the most dramatic stories in business. As it staggers into 3G, the wireless industry is going through the same travails. The process resembles nothing so much as a three-dimensional game of Twister, with a scrum of transnational companies frantically contorting themselves into favorable positions to influence how 3G will unfold.

There is a discernible order here, however, and it comes down to two loose, overlapping alliances of carriers and governments and network-equipment and handset manufacturers. On one side are Verizon Wireless, Sprint, all of South Korea, and various other companies abroad, which all rely on a standard called CDMA (code division multiple access). On the other, much larger side, are Nokia, the biggest manufacturer, and pretty much the rest of Europe; AT&T Wireless, Cingular, and T-Mobile in the U.S.; and a whole lot of carriers and manufacturers from even more parts of the world, which all adhere to a standard called GSM. (This used to stand for “Groupe Système Mo-

bile” but changed to the more ambitious-sounding “global system for mobile.”) Along the way to 3G, each side is arguing about what's real 3G and what's merely “2.5G.” These arguments involve even uglier thickets of acronymic horrors—we'll spare you. But the end result is that 3G is coming in two flavors: CDMA2000 in the CDMA world and WCDMA among the GSMers. (For more on the brave new world of cellphones in the U.S., see Alsop on Infotech.)

Here's what makes Irwin Jacobs more excited than the man sitting in front of me: No matter which of those alphabet soups comes out on top, Qualcomm wins. The company's technology and patents reside at the heart of both standards. For years Jacobs was the outsider fighting to be

accepted in the wireless world; now his company is essential to its future. The story of how he pulled off this transition provides a lesson for any company struggling to

succeed in tech: Fielding great technology helps; owning the playing field is even better. “Qualcomm has largely won the war,” says Lowenstein. “Every major vendor of equipment and devices for 3G has to use CDMA. To live and breathe, they have to use CDMA. And to do that, they have to license from Qualcomm.”

So Qualcomm knows it has a sizable stake in 3G, but how big it will be—ah, there's the question. Of course, other major players, most notably Nokia, are betting huge amounts in this game as well. And right now the most furious action is taking place in China, which helps explain why Jacobs had flown all the way from California to attend this one-day meeting in Beijing. But we're getting ahead of ourselves.

IN THE BEGINNING—OR, ANYWAY, IN THE EARLY 1990s, which was about when the standards battle began—there was GSM. GSM had long been the focus of the European telecom industry, with equipment manufacturers, carriers, and governments devoting roughly a decade to hammering it out. The initial goals, among others, were to offer digital service and continent-wide roaming; the result was a standard that swept the world. Today about three of every four of the world's cellphone subscribers use GSM. And the standard's rise launched at least one name into the Marlboro/Coca-Cola class of global brand recognition—Nokia, which rode the GSM wave better than anyone. There's probably no better example than GSM of how governments and industry can come together to create something truly useful, lasting, and profitable. There's also probably no other type of technology that gives Europeans as warm a feeling of superiority over Americans.

That feeling would be even more satisfying if Irwin Jacobs hadn't come out of retirement. A tall, rangy man, Jacobs, who will turn 70 in October, grew up in New Bedford, Mass., and still has the accent: His speech in Beijing referred to “lahge mahkets,” and “data” was rendered

**Qualcomm says publicly that it has no favorite standard. But its dream? That we all turn Korean.**

“dater.” Jacobs has a calm and patient demeanor that’s somewhat surprising given the intensity of the industry he’s in. If anything, he comes across much more as the professor he used to be than the high-tech potentate he is now.

By the time he founded Qualcomm, Jacobs had already built a name for himself in telecom. He had taught electrical engineering at the Massachusetts Institute of Technology and the University of California at San Diego and had started and run a company, Linkabit, that developed, among other technologies, satellite communications for the military. In April 1985, at age 51, he began his retirement. It lasted until that July, when he and six associates launched Quality Communications, now Qualcomm, in San Diego. Jacobs had long been familiar with CDMA. (The idea of CDMA has been around a long time. In fact, an early patent for one of the technological building blocks of CDMA was granted to, of all people, the Hollywood actress Hedy Lamarr. She’s much more famous for appearing in one of the first nude scenes in film history, proving once again that there’s no more convincing evidence of a technology’s arrival than a woman writhing on a screen.) Jacobs says that one day as he was driving down Interstate 5 from Los Angeles to San Diego, it just kind of dawned on him to use CDMA for commercial purposes.

It was not an obvious idea. The telecom industry at the time was already in the middle of planning its upgrade from analog to digital networks, and the front-running technology in the U.S. was TDMA, which stands for “time division multiple access.” (TDMA is also a part of the GSM standard.) Jacobs and his team experimented with CDMA and became convinced that it was a better choice. They spent a year developing a prototype system, which they brought to an industry conference in Chicago in 1989. Then came the really hard part for Jacobs and his engineers: finding a huge customer willing to trust their tiny firm to create a real, live CDMA network.

Thus began what industry people, especially Americans, call the “holy war” era. Qualcomm was just a small group of commandos trying to secure a beachhead in a world dominated by an entrenched rival, GSM. At conferences and in the press, Jacobs and his crew took every opportunity to proclaim that CDMA offered better voice quality and was cheaper to run. That is, it gave carriers more capacity for a given slice of the radio spectrum. Qualcomm also touted its technology’s ability to do a “soft handoff,” which is technical jargon for the network activities that occur when you and your cellphone move out of one cellular tower’s range and into another’s.

After having invested so much effort and money (and pride) in GSM, the Europeans and their technological fellow travelers were, understandably, not very receptive to a bunch of smarty-pants Americans. “Everyone knows CDMA is technologically superior to the early GSM,” says Lauri Rosendahl, a telecommunications analyst for

Deutsche Bank in Helsinki. “But it’s like having a railroad built in your country. Say the railroad has three feet between the rails. Someone comes by five years later with a better system, but that system demands four feet between the rails. It’s irrational to rip out track that’s already been built. It’s not practical to replace one thing with something slightly better. It has to be *hugely* better.”

Jacobs did manage to sell his technology outside Europe. Six years and much pavement-pounding after that demo in Chicago, the first commercial CDMA network was launched in Hong Kong in 1995. Bell Atlantic (later absorbed into Verizon) rolled out the first U.S. network the following year; today about 40% of the cellphone subscribers in the U.S. are on CDMA systems.

Since that time, Qualcomm’s business changed too. It used to manufacture both handsets and network equipment, but by 2000 had sold off both businesses to Kyocera and Ericsson, respectively. Those moves have left Qualcomm with two big-money businesses that provide

## With 3G, carriers hope to sell new services like games, photo messaging, and mapping.

84% of its \$3 billion in annual revenues and 98% of its \$360 million in earnings: CDMA chipsets for cellphones (Qualcomm designs the chips and outsources their manufacture)

and technology licensing. Since Qualcomm owns many of the core processes that make CDMA cellular systems work, anyone who wants to get into the CDMA game will at some point have to pay up. That’s translated into healthy 12% net margins in an industry known today mostly for its financial wreckage.

If Qualcomm does nothing in a 3G world but license its technology, it thrives. If it does that and continues to sell a lot of chipsets for all those new phones—whether they’re for the U.S. or Europe or anywhere else—it thrives even more. And the best case of all? That we all turn Korean.

IF SOUTH KOREA WERE part of the U.S., its license-plate motto would be THE CDMA STATE. It is a nation of early adopters who possess the tech savvy to rival that of anyone else on earth. Korea was the second country to launch CDMA networks—in 1996—and it’s been all-CDMA ever since. It’s also the best place to see CDMA2000 in action.

One thing you notice in Seoul is that Koreans don’t seem to regard their cellphones as cellphones but rather as miniature multimedia entertainment/information centers. Koreans use their phones for multiplayer games over the network, snapping and sending pictures or videoclips, and soon they’ll be using them as maps.

Korean carriers don’t just sell minutes and free weekends; they sell whole lifestyles. If women in their 20s or 30s buy a wireless package called Drama from one of the big local carriers, for example, they get access to Drama House, a chain of exclusive clubs for which the closest American analog would be an airline’s red-carpet lounge. Despite being male and a Drama noncustomer, I was permitted entry into a Drama House in Seoul. The luxe

décor is variations on white, sprinkled with random sayings in English. (The wall in the Internet café area inexplicably reads A FRIEND IN NEED IS A FRIEND INDEED.) There's a cosmetics counter, a library, an ATM-like contraption called a Drama Health-Age Analysis machine, and a cappuccino bar.

At Sang Moon High School in Seoul, I met a whole classroom of 16-year-old boys on their lunch break. When the teacher asked for volunteers to show off their cellphones, none of the students moved. It could have been that the windows were all open and the temperature was not much above freezing. More likely it was the fact that cellphones are not allowed on campus. So the teacher made it clear that he was offering a kind of temporary cellphone amnesty, and phones magically appeared around the classroom. Out of 30 or so kids, maybe three or four weren't carrying phones. Those weren't crummy units either—they had color screens and lots of bells and whistles. A couple of the kids broke into a multi-user game, one phone against the other. Several were taking pictures.

Korean carriers as a group have watched their data revenue, as a percentage of total revenues, triple over the past two years, according to Merrill Lynch. The country is a living example of the "tastes great" rationale for 3G, as one industry executive, Don Listwin of mobile-phone software company Openwave, puts it. That is, 3G promises to let telecom providers sell all manner of lucrative new services based on data—games, photo and video messaging, mapping. Then there's the "less filling" part of 3G: It allows much more traffic to be carried over the same amount of spectrum. If there's one thing the wireless industry tends to agree on, it's that a 3G world would be a good and profitable world.

THE QUESTION IN GSM-LAND WAS HOW TO GET THERE. Over the years GSM proved an amazingly successful workhorse of a standard. But the technology was based on a circuit-switched approach, allowing voice to travel as one continuous stream. To send data efficiently, the network needed to be able to chop information up in packets, which the original GSM didn't allow. In the mid-1990s the GSM world started the painstaking process of plotting its future. The players considered a handful of technologies, and after a period of deliberation, a consensus emerged. The third generation of cellular technology would be called UMTS—universal mobile telecommunications system—and would use a CDMA-based technology called wideband CDMA, or WCDMA.

You'd think Qualcomm would have been delighted with the Europeans' decision to embrace CDMA. But no. The details are complicated here, but Qualcomm thought they were going about it all wrong. For one thing, WCDMA wasn't completely compatible with existing CDMA networks. More than that, Qualcomm insists that the WCDMA decision was an attempted end run around the company's patents. "The only reason WCDMA exists is because Europe wanted to do something different that wasn't done by Qualcomm," says Rich Sulpizio, Qualcomm's former pres-

ident and current head of its China operations.

Yes, well, only their hairdressers know for sure. The result is the same: By summer 2002, Qualcomm says it had signed licensing agreements with virtually all companies planning to use WCDMA technology—deals that Qualcomm says provide royalty rates comparable to those that it earns from CDMA2000 contracts. Not satisfied with just clipping coupons from his patents, Jacobs quickly set out to create the chipsets for the phones and equipment the GSM world will need to power its 3G upgrade. Qualcomm has introduced a line of chipsets for WCDMA phones, which are already sold in Japan, and is working on chipsets that will run both WCDMA and CDMA2000.

Qualcomm says it is happy with both standards, but pull executives aside and they'll admit that they would rather see CDMA2000 flower across the globe. The company makes money in both worlds but will make more of it—and make it faster—with CDMA2000, for two reasons. The first is that CDMA2000 has already taken off, with 37 CDMA2000 networks up and running around the world, vs. two WCDMA networks. (To be fair, GSM partisans say most of today's CDMA2000 networks haven't attained true 3G status yet.) In the U.S., where the technology has taken longer to get off the ground than in Korea, Sprint has completed the first phase of its upgrade, and Verizon is most of the way there. The second reason is that Qualcomm has fewer competitors turning out CDMA-2000 chipsets. Last year the company sold 79 million cellphone chipsets; most were CDMA2000. "Qualcomm has a commercial interest in pushing CDMA2000. The market is there," says Herschel Shosteck, chairman of the Shosteck Group, a telecommunications consulting firm in Wheaton, Md.

Investors appear to be expecting nothing less than perfection. Qualcomm was one of the best-performing stocks of the 1990s, reaching a high of \$179 in 2000. At a recent \$37.65, Qualcomm was still trading at 27 times expected 2003 earnings, vs. 16 for the S&P.

So Qualcomm has come full circle. A decade ago its main task was to prove that CDMA would work commercially. Today the issue is how big it's going to win in the next generation of wireless. "Irwin Jacobs is my hero," says Joe Nordgaard, who runs wireless-industry consulting firm Spectral Advantage in Fair Haven, N.J. "Dr. Jacobs and his team have had to maneuver among some of the largest corporations in the world. A number of these companies went to great lengths to try to muscle Qualcomm out of the game." Does Dr. Jacobs feel vindicated by all this? "Well," he says, "let's say I'm pleased."

NOKIA IS NOT OUT TO PLEASE Irwin Jacobs, but you won't hear much of that kind of talk in Nokia's peaceful headquarters. In fact, one of the most common words you'll hear from Nokians—actually, from wireless types in general—is "agnostic." As in "Our view has always been technology agnostic"—those being the words of Jorma Ollila, Nokia's CEO. He's sitting in a conference room outside his office in the de facto seat of the GSM world, also known

as Nokia House, the company headquarters complex just outside Helsinki. The building is lovely—lots of glass, steel, and soaring walkways, all of it warmed by a liberal use of wood. Imagine an atrium hotel designed by Ikea. It's a practical, unassailably reasonable place, just like the words that come from Ollila. "We always saw CDMA as a technology that has a role," he says. "I was there in 1991 when we signed our first technology-licensing agreements with Qualcomm. We've had a cordial relationship ever since. I see Irwin Jacobs twice a year. He flew to Helsinki last year, and we had dinner together with our wives."

Nokia executives persistently emphasize that "radio protocols" like WCDMA or CDMA2000 are of secondary importance. "We need to make the next phase happen," says Sari Baldauf, president of Nokia Networks. "The next phase is less about radio protocols than about the services that people want to pay for to make their lives better." Nokia even has a whole CDMA division (in San Diego, of course) that has been making CDMA handsets for years.

Yet for all its talk of cordiality and agnosticism, the \$32-billion-a-year giant would really prefer that the planet bloom with WCDMA systems. Nokia was one of the main powers behind the push to get GSM to go WCDMA. By having had a major hand in the development of the standard, it knows the technology inside and out. For the past eight years or so, the company has spent billions of dollars in R&D on WCDMA products. The WCDMA world offers Nokia vast new markets for its handsets and network equipment.

Most industry observers predict that WCDMA will eventually run 70% to 80% of the world's 3G networks simply because GSM already has such a market-share advantage. The actual number will depend largely on several factors, the most important being what happens in China.

CHINA HAS ALREADY OVERTAKEN THE U.S. AS THE LARG-est mobile-communications market on earth. In the past two years Jacobs has flown countless trips to China on his personal Global Express jet to meet with government officials or joint venture partners, or to go to the occasional conference, like the one in Beijing, which represented Jacobs's sixth trip to China in 2002 alone. (Ollila went four times last year.) One big reason for all the face time is that the Chinese government is planning to award 3G licenses sometime this year.

Yes, that's vague. As with everything that involves the Chinese government, the situation is a bit murky. The government may decide to make the licenses WCDMA-only, or CDMA2000-only, or, most likely, to allow both technologies. (To make matters even murkier, China is considering a third 3G standard, called TDS-CDMA. However, few observers outside the country believe that standard is much more than a negotiating tool for the Chinese to wring better licensing terms from foreign vendors.) Whatever happens, whenever it happens, China's choice of a standard will probably affect decisions made elsewhere in Asia and beyond.

Most of China's 200 million customers are now using GSM phones, but during the past couple of years CDMA has been growing rapidly too. Around 80% of China's citizens don't have mobile phones, so the competing standards have a lot of territory to fight over. And if Kurt and Mr. Zhang are any indication, this market is still up for grabs.

Kurt and Mr. Zhang were the guide and driver, respectively, for a tour I had booked to the Great Wall. Chinese consumers, like Korean consumers, seem to know all these acronyms, so I ask Kurt, who's in his late 20s, what he thinks of GSM vs. CDMA. He says a lot of his friends are switching to CDMA because it's cheaper and they like the ring tones better, but that he won't switch until CDMA covers as much area as GSM. "A lot of our drivers are switching to CDMA," Kurt adds. Even Mr. Zhang, who as we speak is gabbing on a GSM phone? Kurt asks Mr. Zhang in Chinese. "He hasn't changed phones because there isn't enough coverage yet. He says he'll change maybe in a year."

THE 3G GAME IS FAR FROM over, But one thing we can be sure of is that technology won't stop there. Qualcomm and Nokia certainly aren't going to quit researching and developing, nor will entrepreneurs stop coming up with whole new technologies and companies to make them.

A specimen of the latter category is a three-year-old startup in Bedminster, N.J., called Flarion. As Qualcomm once did, Flarion is working on a wireless technology based on a communication method invented many years ago, this one called OFDM. The idea is wireless Internet access that's twice as fast as the best 3G speeds and faster even than Wi-Fi. The technology is still in trials, with one test network operating in the U.S. and three others in, of course, South Korea.

Flarion CEO Ray Dolan, a former Bell Atlantic executive who saw plenty of action in the holy wars, is careful not to make incendiary proclamations. Flarion is "pre-revenue," he says, meaning "no customers yet." There's no way to predict how the company will fare, or even whether the technology will work commercially. Dolan just wants to fine-tune his product and make some sales. If it all works, maybe we'll witness a whole new standards war.

But that's several years off at the earliest. Meanwhile, Jacobs has 3G to worry about.

The Beijing summit has just ended, and Jacobs sits back in his seat as his hired Mercedes rolls past the gigantic portrait of Mao. He's asked the driver to make a scenic U-turn around Tiananmen Square on the way back to the hotel. We talk about China, its economy, and Qualcomm's prospects there. He's very much at ease, despite having just spent a long day in evangelizing and glad-handing mode—and despite the fact that what happens in China will have a profound impact on his company's future. He's been through this before. Then, as we complete the detour and again pass the portrait of that most cunning of master strategists, he says, "What would Mao think of all this?" **E**