

Smart Cards: What Lies Ahead In 2002?

By Donald Davis and Dan Balaban

There is uncertainty about the global economy and the critical mobile phone market. But smart cards will likely make big strides in banking, identification and mass transit.

Like a child reaching adolescence, the smart card industry has enjoyed healthy growth rates, in the range of 30% over the past few years. While still not a mature industry, smart cards generate more than \$2 billion a year in revenue, with prospects for more growth ahead. Card issuers of all types, from banks to governments, have generally benefited from the growth, as vendors have become stronger and invested in new technology. But most of that revenue has come from one kind of smart card—the miniature SIM cards that identify users of the 600 million GSM mobile phones worldwide to their mobile service providers. Sales of those SIM (subscriber identity module) cards accounts for anywhere from a third to more than half of the revenue for many smart card vendors and their chip suppliers. And so, it was no small matter when mobile handset sales fell far short of expectations in 2001, taking demand for SIM cards with it. “It was certainly the worst year for the smart card industry, which was not used to this kind of slowdown,” says Maurizio Felici, general manager of the smart card division at chipmaker STMicroelectronics. Just how far SIM card sales fell below expectations was in dispute late last year. Some estimates were as low as 320 million units shipped. By all accounts, the numbers were disappointing, given that at the beginning of the year some observers predicted the wireless boom would drive SIM sales to a lofty 500 million units.

With SIM card prices averaging nearly \$4, reaching the 500-million-unit mark would have boosted smart card vendors’ sales by roughly another half billion dollars as compared with 2000. Instead, they had to make do with much less. Moreover, the downturn drained some momentum from the smart card industry as a whole, says analyst Panni Kanyuk of London-based research firm Datamonitor plc. “Wireless was the first real chance for smart cards to make it on a broad basis, and the advances made in the sector in terms of technology development, driving memory capacity and applications, in a way revolutionized the industry,” she says. Given the importance of SIM cards for the health of the chip card industry, the outlook for mobile phone sales is being watched closely by smart card executives as they assess their prospects for 2002. They were at the end of 2001 guardedly optimistic. “The general view is we’re coming out of the worst of the high-tech industry slowdown and we should see some growth next year,” says John Atkinson, head of strategic marketing at Munich-based card maker Giesecke & Devrient. Apart from the crucial SIM card market, however, there are signs of major advances, and possibly breakthroughs, in such key markets as banking, government identification and transit. In fact, these sectors are expected to grow so much faster than SIM cards this year that the mobile phone cards are likely to represent only 45% of the sales of microprocessor-based smart cards which are used in banking, mobile phones, computer security and other arenas, according to U.S.-based Giga Information Group. That would be far lower than SIM cards’ 67% share of the microprocessor card market in 2000.

Fallout From 11 September

In banking, the big gains will come from the slowly accelerating conversion of magnetic-stripe payment cards to chip cards in Europe, Asia and Latin America, along with some sizable rollouts of multiapplication cards in the Asia/Pacific region and the United States. Several nations are accepting bids for chip-based national ID cards, as Malaysia rolls out its 19-million card program. And the fallout from the Sept. 11 terrorist attacks in the United States could lead to some sizable airport security programs. Besides microprocessor cards, the other major market segment is memory cards. These cards are hard-wired to store data and perform such tasks as deducting value from a prepaid pay phone or transit card. With mobile phones reducing use of pay phones, demand for memory cards is slowing. Datamonitor predicts sales of memory cards will grow by 11%, from 1.1 billion units in 2001 to nearly 1.3 billion units this year. U.S.-based Frost & Sullivan foresees 17% growth from more than 1.3 billion units in 2001 to nearly 1.6 billion this year.

But the big unit sales do not produce big revenues, as large telephone companies often pay less than 20 cents per card. Thus, while memory cards account for more than half of chip card unit sales, they provide only about 20% of vendor revenue. Datamonitor predicts total smart card sales in 2002 will reach 2.36 billion units, an 18% increase over 1.99 billion units in 2001. Frost & Sullivan pegs unit sales in 2002 at 2.55 billion cards, 21% higher than 2001 sales of 2.11 billion chip cards. The excess SIM card inventory brought prices down last year. That was especially true for the less-expensive cards, those carrying only 8 kilobytes of the EEPROM memory that holds applications and data. Prices for these cards fell by as much as 20% during the second half of the year, with cards with 16K and 32K showing price declines of about 10%. Telcos will buy higher-memory SIMs this year, taking some of the downward pressure off of prices. The higher-memory cards are also more likely to carry the Java Card software that all major smart card suppliers now offer. Java Card allows downloading of new applications to cards in the field, although limited bandwidth keeps most operators from “dynamically downloading” applications to SIMs. Java Card showed up on 24% of SIM cards shipped in 2000, including on 45% of the higher-memory cards, according to U.S.-based Gartner Dataquest.

Roughly 200 million cards with Java software are in use, and vendors estimate they represent 80% to 90% of cards sold with “open system” software available from multiple vendors. Multos, now wholly owned by MasterCard International, provides the bulk of the remainder, mostly to banks in Asia. While Microsoft Corp. halted development of its smart card software last spring, French smart card vendor Sagem SA is spearheading an effort to keep alive the code Microsoft developed (Card Technology, December 2001). Most observers are skeptical that issuers will be interested in that software if Microsoft is not backing it. But Sagem’s W-OS will get a chance to prove the skeptics wrong in 2002. Here is the outlook for smart cards in key market segments:

Mobile Phones

By all accounts, SIM cards were a big disappointment last year. The cause: GSM operators built up large inventories expecting a repeat of their fairy-tale year of 2000. Instead, mobile phone sales, and by extension demand for SIMs, slumped badly thanks to a worsening economy, saturating markets in Western Europe and delays in the rollout of broadband services. “This was not the best year we have ever seen,” says Felici of chip maker STMicroelectronics, in a considerable understatement.

Same Old SIM

The SIM card chip is fast becoming a commodity as third-generation networks have been slow to arrive, reducing operators’ needs for high-powered SIM cards, says Amedeo d’Angelo, Oberthur’s chief operating officer. “Now the same chip will be used for 2000 to 2002,” he says. “When a product lasts for three years in high tech, it’s a disaster.” It also pushes down average selling prices for SIMs, which dropped by 10% overall or more in 2001, mainly during the second half of the year, estimate vendors. Prices for SIMs with like

memory sizes will fall another 15% this year, predicts d'Angelo. SIMs cost on average \$3.50 to \$4 apiece last year, say sources. So, how bad a year was 2001? Andrew Phillips of market research firm Dataquest estimates SIM shipments for 2001 will total 433 million, compared with 435 million in 2000. "If anything I'm high," he says, noting the real number for 2001 could end up at 400 million. But others are not even that generous with their estimates, including some major card vendors. Eurosmart, an association of the vendors, estimates card makers sold about 200 million SIMs during the first half of 2001. But demand for SIMs plummeted in the second half. Bernt Ostergaard, Denmark-based research director for the European telecom and global wireless unit of U.S.-based Giga, believes a paltry 320 million SIMs were sold for the entire year. That would be 14% less than the 370 million SIMs Eurosmart says were shipped in 2000. In the more heady days of GSM growth, Eurosmart had projected vendors would ship 500 million SIM cards in 2001.

A Saturated Market

Most analysts expect SIM shipments to rise only about 10% in 2002, as operators finally exhaust excess inventories early in the year. They expect overall growth of new customers to stagnate this year, despite new markets opening up in North and South America. This means the replacement market for SIM cards will grow in importance. This market, made up of SIMs issued to customers who switch operators seeking better deals or who upgrade their existing service, equaled the number of SIMs sold for new GSM customers for the first time in 2001, say observers. Replacement SIMs will significantly outstrip SIMs for new customers this year, especially in Western Europe, as operators try increase their revenue per customer, instead of focusing on new, prepaid customer counts. "To grow revenue from existing subscribers, they need to offer more service, and to do that, they will have to change the cards," predicts Xavier Chanay, a leading executive in card vendor SchlumbergerSema's mobile telecom unit. Increasing revenue per user does not necessarily require new SIMs. So, card vendors are offering new applications and services to convince operators to upgrade the cards.

If they are successful, it will increase the importance of higher-memory SIMs, those with 32K or 64K of EEPROM. This is the place new SIM Toolkit applications, such as information on demand and mobile banking, are stored, as well as data, such as phone directories. One operator is planning to offer customers a phone book with space for 2,000 names on one of the new 64K chips, says Oberthur's d'Angelo. Sales of 64K cards will account for about 5% of SIM sales this year, he says. All told, 64K and 32K cards will make up nearly half of all SIM shipments in 2002, SchlumbergerSema's Chanay predicts. That compares with the 30% to 35% of sales of high-memory cards—that is, 32K—made up during 2001, he estimates. Dataquest's Phillips is more conservative in his forecasts for the 64K chip, the largest in the industry. Sales will represent only 2% of total shipments this year. But, he predicts 32K will become the most common type of SIM, growing from 28% of shipments in 2000 to 56% in 2002.

A Workhorse Nears Retirement

One major vendor is ready to predict the demise of the 8K SIM, the former industry workhorse, which will begin to be "phased out," this year. "We think 8K cards are becoming a fairly obsolete product in the new environment," says Philippe Vallée, vice president of marketing for the telecom unit of Gemplus International. That may be a little premature, and it depends a lot on what happens in the giant Chinese market this year. In the past, most cards shipped to China carried 8K of EEPROM, which allows little room for value-added services. "8K next year will represent something like one-third of the Chinese market, and will not be very big elsewhere," says STMicroelectronics' Felici. He estimates vendors will ship no more than 40 million 8K cards worldwide.

Java Card Advances

As card sizes and transmission speeds of networks grow, so will the importance of Java Card software. Java is designed to allow operators to buy their cards from multiple suppliers and expect new applications to run the same on each. That has been an elusive target in the past, and complaints from operators have forced the major card vendors to cooperate to ensure interoperability. They are discussing drafting common testing procedures or even launching a "certification" process to reassure skeptical operators that their Java cards are interoperable. One reason operators want to offer new revenue-generating services, with or without Java, is to help pay lofty bills for 3G licenses, says Datamonitor's Kanyuk. Handsets with color screens are due to arrive next year in volumes, and operators will push more mobile commerce programs.

But most observers agree widespread rollouts of high-speed third generation services are at least a few years off. Until then, operators will expand their interim broadband service, GPRS. While Nokia, the largest handset manufacturer, shipped only about 10 million GPRS units in 2001, that is expected to grow this year. Although GPRS does not require new SIMs, its potential for offering new services, including mobile payment, could create demand for new cards. GPRS increases data transmission speeds by up to 10 times from standard GSM, making it practical for operators to download new applications to cards already in the handsets of customers. This high-speed GPRS connection will enable operators to offer multimedia applications, such as allowing customers to download music and games or to send e-mail with photos attached.

More and more operators plan to use the handset to store and run applications, with more handset makers outfitting their devices with software such as Java. This promises to leave the card out of the loop, except for authenticating users to the networks. Card makers are trying to convince operators that SIMs should play a larger role. For example, a SIM could store the codes necessary to enable users to download music or games, perhaps for a limited period, says Gemplus' Vallée. It could hold the digital ID needed by customers to make purchases of this music, games or other merchandise. Or, it could alert the operator when the customer is likely to switch to a competing telco. Moreover, it could regulate the customer's use of the mobile Internet, expected to grow dramatically with broadband, he says. "The card will complete whatever application is on the handset," he says. Time will tell whether 2002 surprises analysts and vendors the way 2001 did. But one thing seems certain: If operators do not give SIMs an important role in offering new services, the card will go the way of the PCs as just another commodity.

Banking

Datamonitor projects a 46% growth in banking cards to 224 million units, while Giga foresees a smaller, but still healthy, 33% increase to 200 million cards. There are two distinct reasons banks are issuing chip cards: fraud reduction or product differentiation. In Europe and a few other countries, such as Brazil, the driver for smart cards is fraud, since chip cards are harder to counterfeit than magnetic-stripe cards. The United Kingdom leads the way, as UK banks had issued 22 million cards with EMV-compliant payment applications as of October, according to Europay International, the Waterloo, Belgium-based subsidiary of MasterCard International. (EMV is the international standard for credit and debit cards set by Europay, MasterCard and Visa International.) Card associations are

pressing member banks in Europe to move to smart cards by 2005, and more countries will begin that transition this year. That includes Italy, where Europay projects 4 million EMV cards will be issued this year.

Several other countries—including Spain, France, the Netherlands and Belgium—will see some EMV cards issued this year. But in most cases they will be in pilots, with large volumes not expected until 2003. And with most payment terminals not yet equipped to handle EMV cards, banks have little reason to issue sophisticated multiapplication smart cards that cost \$3 and up. Instead they mostly are offering EMV cards with payment and perhaps a loyalty program. Such cards cost around \$1.50 each.

Something Different

But banks and merchants in the United States and the Asia/Pacific region are breaking ground with sophisticated smart cards that they hope will stand out in their highly competitive markets. “A lot of credit card issuers are coming around to the idea that smart cards are going to be an additional tool in the battle to acquire new customers and retain them,” says Greg Pote, managing director of the Asia Pacific Smart Card Association. For instance, consumers in South Korea are being offered payment cards they can stick into a slot in their mobile phones to make purchases. Five Visa banks are issuing the Moneta card that will carry an EMV credit and debit feature along with a Visa Cash electronic purse and a loyalty program offered by telco SK Telecom. Some issuers also will let cardholders store the addresses of their favorite Web sites on the cards and use the same card to pay transit fares in such cities as Seoul and Pusan.

The five issuers ordered 1 million cards late last year and expect to issue 2.5 million to 3 million cards by the end of 2002, says Paul Jung, director of product marketing and emerging technology at Visa Korea. Similar multiapplication cards with the MasterCard brand and Mondex electronic purse will be issued by two other South Korean mobile operators, KT Freetel and LG Telecom, says K. B. Kim, president and CEO of Mondex Korea. He projects the telcos will issue 6 million cards. Seoul National University Hospital and Chohung Bank will issue another 2 million multiapplication cards that carry prescriptions, medical records and a Mondex e-purse.

Contactless Payment Cards

In Japan, credit card issuers are offering cards with a radio-frequency interface that requires no contact with a terminal, as well as with the standard contact interface. Contactless cards are better suited for mass transit and other programs that must move people quickly through entrances, and contactless readers last longer because they have no moving parts. Sony Corp. has been a leader in contactless cards—its FeliCa card is used by millions of Hong Kong commuters to pay transit fares. Late last year, Sony’s credit card subsidiary, Sony Financial International Inc., announced it would launch a card called eLIO sporting an Internet security feature and Sony’s Edy e-purse on the chip, both of which run in contactless mode. JCB International Co. Ltd., Japan’s leading credit card issuer, with 36 million accounts, also is working with Sony and card maker Toppan Printing on a dual-interface smart card, combining JCB’s EMV payment application with Sony’s FeliCa operating system. Besides the credit card application, the card, to be released in mid-2002, will be able to hold loyalty, ticketing and access control features, says Masahiro Omoto, senior vice president and head of IC Strategy at JCB.

Japanese banks are beginning to convert mag-stripe payment cards to chip, and JCB will be among the leaders. Starting this year, all new and reissued JCB cards in Japan will be smart cards, with volumes expected in the millions, Omoto says. Australia also will see new multiapplication cards, as Melbourne-based ANZ becomes the first major Australian bank to begin converting to smart cards. The bank announced its chip card plans last year, three months after American Express launched its chip-based Blue credit card in Australia, as it has in several major markets worldwide. ANZ says it will spend US\$25 million to upgrade 1 million Visa-branded credit cards and convert 80,000 point-of-sale terminals to accept chip cards. Features on the card include added security when making purchases online and a merchant loyalty program.

U.S. Activity

The United States, the world’s biggest credit card market, will see the first major introduction of smart card-reading point-of-sale terminals, when Target Corp. converts 37,000 terminals at 990 department stores to accept chip cards. Holders of a cobranded Target Visa card, which the retailer began offering late last year, will be able to use their smart cards at those devices. The big question is: What will Target do with the chip to make those customers more loyal? Target executives are not talking, but sources say the retailer is looking at ways to use the chip to allow customers to customize the rewards they receive for steady patronage.

Three Visa issuers, who have distributed some 8 million chip-based credit cards over the last year, also may try to cut deals with Target to enhance the attractiveness of their smart cards.

Meanwhile, the No. 1 U.S. credit card issuer, New York-based Citibank, expects to introduce its first smart credit card by spring. Citibank began testing two smart cards last fall (see story on page 10). The chip initially offers convenience and security for online shoppers, who will be able to store such information as their shipping addresses, credit card numbers and favorite Web sites on the card. With 32K of memory and Java Card software on the MasterCard-branded card, Citibank will be able to download new features to cards after they are in customers’ hands, says Toni Merschen, director of chip card and access technologies.

Security

In the aftermath of the Sept. 11 terrorist attacks, smart cards and biometrics became front-page news, as prominent government officials and business leaders in United States, United Kingdom and elsewhere called for mass issuance of chip cards carrying biometric identifiers, such as digitized versions of fingerprints or iris scans. Talk of a national ID card in those two countries—neither of which has a national ID card—has calmed down. But there remain active discussions about offering such cards to individuals who submit to a voluntary background check. That would allow, for instance, business travelers to pass through security checkpoints quickly. Thousands of travelers will test the concept this year at Amsterdam’s Schiphol Airport, where a holder of the new Privium card will be able to enter the country after inserting the smart card and verifying his or her identity with an iris scan. A similar pilot at London’s Heathrow Airport also uses iris recognition, but there is no smart card. Instead, the biometric files are stored on a database.

These and similar pilot programs are not expected to issue large numbers of cards this year, although they could set the stage for major projects in 2003 and beyond. Several government projects will generate significant volumes in 2002. Malaysia, which last year became the first sizable country to issue a mandatory chip-based national ID card, expects to have 2 million of its Government Multi-Purpose Card in the hands of citizens by midyear, with 19 million citizens slated to have the card by 2008. Estonia expects to issue chip-

based ID cards to 1.3 million citizens, and 21 cities in Japan are issuing smart cards to 1.2 million citizens in a test of a voluntary ID card. Several other countries have smart card ID projects out to bid, including Hong Kong, Oman, the United Arab Emirates and South Africa.

Some of the largest government projects involve smart cards for health insurance verification. Taiwan plans to distribute 24 million cards to its citizens plus another 345,000 cards to doctors and other professionals who will use the chip cards to digitally sign documents, say officials at Giesecke & Devrient, which will supply the cards along with Taiwan's Teco Electric & Machinery Ltd. German card maker Orga Kartensysteme says it will supply 8 million smart cards by early 2003 for a health insurance project in Austria. A pilot of a smart card for accessing government benefits, involving several hundreds thousand chip cards, is expected to get underway this year in Shanghai.

Building And Network Security

The use of multifunction smart cards to secure access to buildings and computer networks has grown more slowly than many expected a few years ago. But there are some significant projects in both government and the private sector. Probably the biggest issuer is the U.S. Department of Defense, which is in the process of rolling out 4 million smart cards to civilian and military employees and outside contractors. (See story on page 24). Another agency moving forward this year is the U.S. State Department, which plans to issue smart cards for building and network security to 15,000 employees in the Washington, D.C., area. And Atmel Corp. says it will supply chips this year for 1.2 million smart cards with sophisticated encryption features for government employees who must securely sign and scramble documents they transmit electronically. The high-end cards use 32-bit chips that process data much faster than the 8-bit chip used in most smart cards. The agencies deploying the cards have not been identified.

Several major companies are issuing smart cards with digital certificates, taking the plunge into the complex and costly world of PKI-public key infrastructure, a technology that allows individuals to encrypt documents and identify themselves securely in cyberspace (Card Technology, May 2001). But the hassles of PKI, and the lack of applications that can take advantage of digital certificates, is slowing implementation, says Datamonitor's Kanyuk. She sees many organizations limiting the use of smart cards with digital certificates to top layers of management for now. Nonetheless, Kanyuk predicts network and physical security will steadily grow as a smart card application, from 32 million cards this year to 97 million cards in 2006, an annual growth rate of 37%.

Transit

For all the buzz surrounding smart cards in mass transit, there are only three projects of any size: Hong Kong and the South Korean cities of Seoul and Pusan. All the others are in a state of becoming, notes David deKozan, vice president of marketing for U.S.-based automated fare collection vendor Cubic Transportation Systems, who adds Cubic's Washington, D.C. chip-based transit project to the list. "It could be that in the next 18 or 24 months, instead of having three, going on four big operational systems, you could have 10 to 12 projects," he says. Major rollouts or launches are planned this year in London, Paris, Tokyo, Singapore and Chicago, among other cities. Even in such developing countries as China, Mexico and Thailand, operators are moving to contactless chip cards to collect fares on buses, underground trains and other modes of transportation. In fact, observers can find few of the world's major cities where a chip-based fare collection project is not at least on the drawing boards.

The operators see chip cards as a way to cut equipment maintenance and other operating costs, move passengers more smoothly through gates, acquire better ridership data and beef up security. Most of the projects will use chip cards without microprocessors, just memory, so they cannot process multiple applications or the most secure encryption algorithms.

China Projects

Philips Semiconductors, whose Mifare contactless technology is used in most of today's chip-based fare collection projects, predicts 200 million Mifare cards will be shipped this year, twice as many as in 2001. Most will go to transit operators, which will use them to either launch new transit projects or to expand or replace cards in existing schemes, says Thomas Riener, marketing manager for the vendors' chip card business unit. In such hot spots as China, 25 cities now use Mifare cards to collect fares. Philips' growth projections are higher than those of some analysts, but the transit market is undeniably healthy. Datamonitor projects 87 million transit chip cards will be issued this year, compared with 65 million in 2001.

The vast majority of the Mifare and other transit chip cards have a simple contactless interface and not much memory. But that is changing. Philips predicts 20 million to 30 million of the Mifare cards shipping this year will carry microprocessors and a dual-interface, says Riener. This clears the way for additional applications that could be used in either contactless mode, for transit or access control to buildings, for example; or in contact mode, which lets card issuers make use of contact readers, including those already installed for e-purse, credit and loyalty schemes. Giga Information Group, extrapolating from figures provided by vendor association Eurosmart, projects 18 million transit cards with microprocessors will be issued this year, up from 12 million in 2001. That is conservative according to Datamonitor, which predicts 36 million microprocessor transport or e-ticketing cards will be issued this year. Banks in South Korea, for example, are issuing cards that combine transit and payment.

Obstacles Ahead

Still, the coming of multiapplication cards has been heralded before, only to have failed to materialize. While more multiapplication software is available for dual-interface cards, such as Java Card, these cards have yet to be certified as secure by major card associations, such as Visa International and MasterCard International. Most of all, business cases and viable commercial arrangements have been lacking, point out observers. "First the technology has to be finished," says deKozan of Cubic. "There's a lot of banks that see that as a vision, and they see that as a long-term vision." One multiapplication project due to start early this year is in Manchester, England, where operators plan to issue up to 1 million dual-interface cards. After June, the cards will carry a Proton electronic e-purse and perhaps other applications, such as loyalty that work in contactless mode, says Peter Fogarty, head of Australia-based fare-collection system specialist ERG Group, the key vendor on the project. ERG is betting heavily that transit cards can profitably share space with other applications, having bought smart card software provider Proton World International in November for about \$55 million in cash and stock. Among ERG's other existing or planned dual-interface projects are those in R