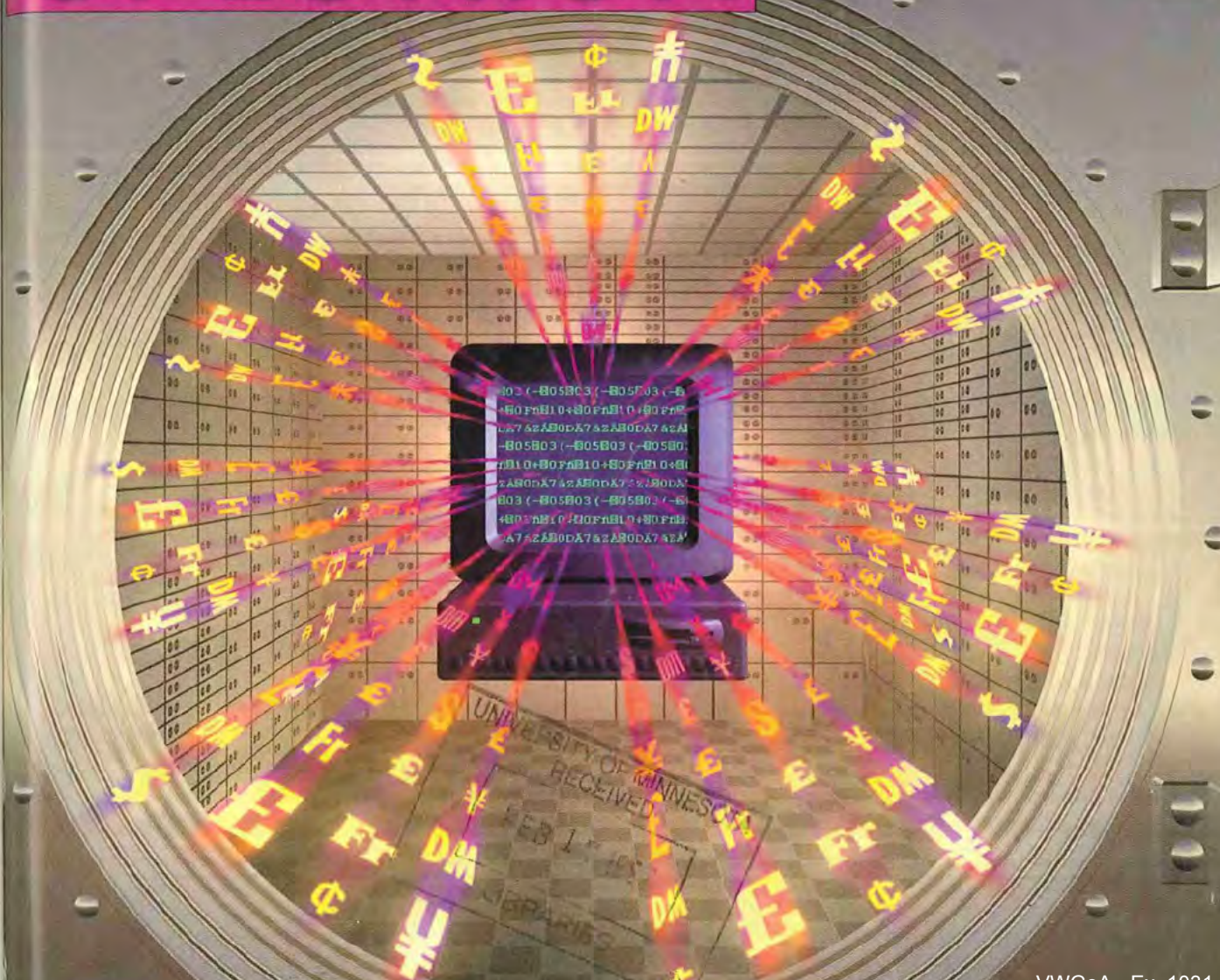


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In the world of finance and commerce to come, cash will be stored, not in a bank vault, but as bits in a computer.
Cover illustration: Rob Magiera

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 BUSINESS SECTION E-MAIL:
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 Christine Demchak c.demchak@ieee.org
 Theresa Fitzpatrick t.fitzpatrick@ieee.org
 Shelly Newman s.newman@ieee.org
 William R. Saunders w.saunders@ieee.org
 Alan B. Schafer a.schafer@ieee.org
 Eric Sonntag e.sonntag@ieee.org
 Felicia Spagnoli f.spagnoli@ieee.org
 Michael Triunfo m.triunfo@ieee.org
 Elizabeth Williams e.a.williams@ieee.org
 EDITORS BY E-MAIL:
 Trudy E. Bell t.bell@ieee.org
 Robert Braham r.braham@ieee.org
 Richard Comerford r.comerford@ieee.org
 Craig E. Engler c.engler@ieee.org
 Linda Geppert l.geppert@ieee.org
 Gadi Kaplan g.kaplan@ieee.org
 Tekla S. Perry t.perry@ieee.org
 Michael J. Riezenman m.riezenman@ieee.org
 Alfred Rosenblatt a.rosenblatt@ieee.org
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ELECTRONIC PAYMENTS

In your pocket: smartcards

The worldwide boom in smartcard deployment is accelerating their evolution

Take a look in your wallet and what do you find? In all likelihood, bills and coins. A variety of credit cards. A driver's license. A transit pass. A voter registration card. A library card. A video rental card. Insurance cards. Frequent flyer and car rental cards. A telephone charge card.

By the end of the century, all of these documents might be replaced by just two or three smartcards. Because they can store and protect relatively large amounts of data, smartcards are being used in a number of ways around the world, replacing a wallet's contents bit by bit. Stored-value cards were in place last year in Atlanta, Ga., at Olympic venues standing in for coins and bills. A health card identifying the holder's insurance provider and account number has been issued to every citizen of Germany, and plans are in place to add such medical information as the name of the holder's doctor, blood type, allergic reactions, medications, next of kin, and instructions in case of emergency. Smart social security cards in Spain interface with a kiosk system that can provide updated information on benefits and eligibility, as well as pertinent job opportunities.

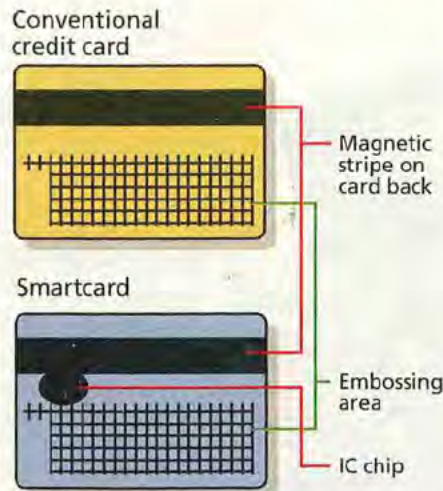
Today, most smartcards handle a single application, but will realize their true value when a single card can address multiple applications. For example, a credit card could have a stored-value function for small purchases, in

CAROL HOVENGA FANCHER, *Motorola Inc.*

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[1] An area in the smartcard has been defined to hold the module containing the integrated circuit. The smartcard complies with the magnetic-stripe and embossing areas defined in the ISO 7813 standard for financial-transaction cards. This module provides contact with the card reader.



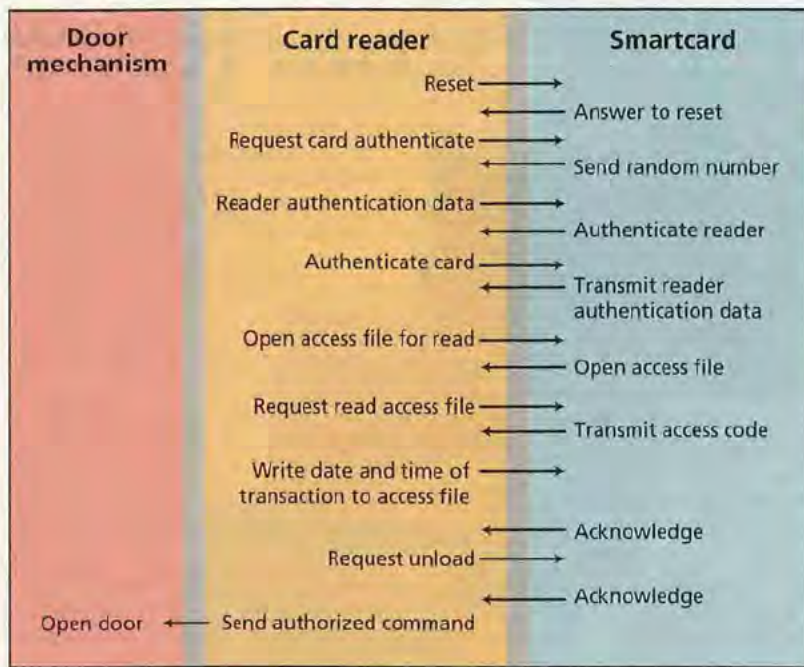
addition to frequent flyer and rental car information. It might work with a cellular phone to connect the user to a home banking service. One step toward this goal was last fall's announcement by VeriFone Inc., Redwood City, Calif., of a system called VeriSmart, which permits a smart phone or a PC to act as a "personal ATM" (automatic teller machine) in the home, loading cash value onto a smartcard.

The smartcard will also be a tool for addressing the "customer of one": applications of special interest to the card holder will be loaded onto the card to make life easier. Eventually, people may customize generic cards themselves from a menu of applications. In a report on the smartcard industry, semiconductor industry analyst Dataquest Inc., San Jose, Calif., recently wrote, "Although some standards issues, infrastructure issues, and software issues remain to be resolved, chip cards hold the promise of being one of the world's highest-volume markets for semiconductors."

As a single card comes to hold more information and relates to more aspects of its holder's life, privacy concerns will have to be addressed. Note, however, that the information stored in a smartcard is usually already available in some format or another; the smartcard merely makes that information portable and puts it at the disposal of the card carrier.

The smartcard application that will be most popular in North America may involve a portable token—a card, a key, or some other familiar shape—for conducting transactions over the Internet, particularly for home shopping and home banking. How can such sensitive information as financial transaction data be safely communicated across a hacker's paradise like the Internet?

Advanced cryptographic functions will be required. Public key encryption (PKE) will be part of the solution in at least two ways [see "Locking the e-safe," pp. 40-46]. First, PKE (often a one-session key) will be used to encrypt data to be transferred with the receiver's public key. This data will be readable only by a receiver with the secret



[2] The interaction between the card reader and the smartcard ensures that both are authorized to undertake operations. When the reader has a card inserted in it, it resets the card, which responds with an answer to reset (ATR). Its ATR provides specific information and often conforms to the ATR described in the ISO 7816 standard. Both the reader and the card use a random number in an algorithm to obtain a result that, when successfully compared, authorizes the card and the reader to continue with the desired operation.

Defining terms

Access card: a machine-readable card that is used to achieve computer access, physical entry, or passage.

Contactless card: an integrated-circuit card that enables energy to flow between it and the interfacing device without needing contacts. Instead, induction or high-frequency transmission techniques are used through a radio frequency interface.

application that stores value for small transactions. A card may be dedicated to the purse function or contain memory and programs for other applications, as well.

Electronic wallet: in general, an IC card or super smartcard that can execute a variety of financial transactions and identification functions. More sophisticated than an electronic purse, an electronic wallet may serve debit,

card, and other functions.

Integrated-circuit card (ICC), IC card, or micro-circuit card: a card containing one or more embedded integrated circuits. The category includes both memory cards and smartcards.

Memory card: an IC card that can store information but that lacks a calculating capability—that is, it lacks a microprocessor.

Multi-application card or

card: a card that can support a number of applications, which may be provided by different parties.

Prepayment card, cash card, stored-value card, or decrementing-value card: a card purchased complete with stored value, which is decremented whenever the card is used.

Smartcard: an IC card with memory and a microcontroller, so that the card is

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