

Austria Starts Trials for National Electronic Purse

Trials have started in Austria for a national electronic purse scheme to be launched early in 1996. It will be called Bankomat Quick and is being operated by Europay Austria who will convert all their 2.5 million eurocheque cards to chip cards at the end of this year.

Two electronic purses are available - one linked to a bank account and the other anonymous, the latter being loaded by cash payment.

The scheme is being operated by Europay Austria with the co-operation of all 1,000 Austrian banks and their 2,500-3,000 branches.

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A young Russian couple displaying the new Smart bank card being used by 50 banks. (See page 26)

Smart Card News

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Next Month

Smart Card Tutorial - Part 2 -
The Making of a Chip

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Austrian Electronic Purse

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Eisenstadt, a town about 50 kms from Vienna has been chosen for the field trials. About 15,000 cards are being issued for making small payments at some 100 participating retailers. It can also be used in parking meters.

As the national electronic purse is rolled out other applications will be added, for example, payment on public transport and at garages. The telephone company has also been invited to participate in the national card scheme instead of launching a separate chip card.

The Smart Card is an 8K bytes EEPROM microprocessor card with a Siemens chip from Austria Card who produce the eurocheque card for Austrian banks.

During the trial cards can be loaded with 1000 to 1999 Austrian Schillings only at banks. Next year it will be possible to load the cards at ATMs.

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Sydney Electricity Pilot

Sydney Electricity will be the first user in Australia of Landis & Gyr's Smart Card-based Pisces electricity payment system which is being installed in 200 homes in the Sydney suburb of Bondi during the first few months of this year.

Customers will be issued with their own unique Smart Card which they will charge up at three point-of-sale terminals at Sydney Electricity offices nearby. The card is then inserted into the meter at the customer's home and credits the meter with the number of electricity units purchased. The card is unique to the meter so theft of the card is pointless.

The Pisces prepayment metering system is manufactured at Landis & Gyr Energy Management's UK headquarters in Telford, Shropshire.

Sydney Electricity serves a population of 2.4

New Cards from Racom

million and is the largest provider of domestic electricity in Australia. The pilot scheme will run for about six months.

The Smart Card is a 1K byte microprocessor card, but the manufacturer has not been disclosed.

In the UK, a number of electricity authorities are using the Landis & Gyr system, including Midlands and Yorkshire Electricity, and a number of other schemes are in pilot stage.

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Card Systems Expand

Cards Systems (UK) is moving to new purpose built offices on 20 February. A feature of the new premises is a customer showroom and technical training department where customers can see an extensive range of products in operation.

The company is the sole UK distributor for the OMRON cardware product range which includes Smart Card readers. As an OEM supplier, it has created a new technical support department to ensure fast and efficient after-sales support to speed turnaround time for repairs and servicing.

The new address is Card Systems (UK) Ltd., Henfield Business Park, Shoreham Road, Henfield, West Sussex, BN5 9SL, England. Tel: +44 (0)1273 495034. Fax: +44 (0)1273 495234.

ID Card Secrets Found in Store

Plans for the UK national ID card system were found in a second-hand filing cabinet sold for around £35 in a government surplus store, according to a report in the *Manchester Guardian Weekly* last month. It said that memos dealing with an investigation into the feasibility of using Smart Card technology in a national ID card system, together with a detailed card design and Cabinet level letters exchanged on the subject, were discovered.

A next generation series of contactless Smart Cards

with a magnetic stripe has been announced by Racom Systems Inc.

The inductively powered contactless digital radio frequency Smart Cards in the LF Series offer increased memory capacity, security, and higher transaction speeds than the RF series introduced in April 1993.

ISO compliant, the LF Series is targeted at the rapidly developing markets for stored value financial transactions in the transportation, leisure and health card markets which require both the speed, reliability and convenience of a contactless interface, and the functionality of a magnetic stripe and embossing for use in existing bank card applications.

LF product shipments began during the fourth quarter of 1994 to customer beta sites in North America, Europe and Asia, and Racom has now started volume production.

LF Series cards now available are the LF 1K and the LF 4K with 1024 and 4096 bits respectively of non-volatile Ferroelectric RAM (FRAM). The cards are inductively powered by a 125KHz incident magnetic field generated by the LF Series controller.

No battery, contact or insertion of the card into a slot is required and the typical operating range is 0-10cms between card and controller.

Commands and data are transmitted from the controller to the card using FSK modulation, with the response from the card to controller PSK modulated, Miller encoded. The data rate in both directions is 7.812 Kbps including both read and write operations to the card's non-volatile FRAM.

Racom says the LF Series cards have a guaranteed minimum endurance of 10 billion transactions with a minimum data retention, without power, of 10 years.

According to the company, a typical read/modify/write and verify transaction of 16-32 bytes between the card and the controller will complete in less than 200 milliseconds (0.2 seconds) including communication overhead.

Multi-service Card at Multicard

A multi-service single function Smart Card which

Additional LF Series features include:

- * unique addressability
- * anti-collision protocol
- * password protection
- * error detection
- * irreversible card write protection
- * optional data encryption with authentication.

The new cards are offered in two ISO versions - a 1.52mm thickness heavy duty ID type card, and a 0.76mm thickness card with optional magnetic stripe. Both types are four colour thermal imaging compatible.

Companion to the new cards is the LFC-110 contactless communications subsystem consisting of an RF modem with communications controller and RF antenna module. It operates as a peripheral on the serial port of a host computer and provides wireless 8 bit asynchronous communications between the host computer and the LF Series cards.

Development subsystem

To facilitate evaluation and applications development, Racom offers the DSS1100 development subsystem which includes six 4K cards, software and technical manuals. It connects to any IBM compatible PC with minimum 386 processor running DOS 3.0 or higher.

Prices

The 1K and 4K cards are priced at US\$ 4.26 to US\$ 8.46 for quantities of 10,000 upwards depending on specific version and quantity ordered. Unit price of the DSS1100 is US\$ 1,800.

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can be used in a range of different service outlets demonstrated the versatility of the chip card to visitors to the Multicard '95 Congress in Berlin last month.

Participants received the card which was imprinted with their name, address and company/institution, and stored DM10 free credit. It was jointly personalised by systems from DataCard Deutschland GmbH and ORGA Kartensysteme GmbH.

Intended primarily as a "name tag" for the conference, it was also used at a checkpoint to authorise entry to the restaurant, and as a business card at the numerous exhibition stands. If the visitor wished to be sent further information, he or she inserted the card into a Hagenuk table-top reading device and a visitor report was automatically prepared.

The card was used to pay for a range of services such as buying drinks. At the bar, the Handy terminal from Hagenuk was used for deducting the amount on the bill from the prepaid card which could also be used at three card telephones provided by Deutsche Fernsprecher GmbH, and to operate a video game with a debiting device from Bergmann Systems.

A card status report could be obtained by inserting the card in a Siemens Nixdorf terminal which displayed or provided a print-out of the log of all personal card transactions stored in the chip's memory.

The most interesting device was the cash loading machine from Bergmann Systems at which cards could be reloaded with value. At the end of the congress, visitors could return the card to the machine and collect any remaining credit and money for deposits (See page 30).

Four different card types were used: the participant's card containing personal data, a prepaid purse and a transaction memory; the exhibitor's card containing only data relating to the exhibitor; the waiter's card on which the prices of meals and drinks were stored allowing visitors to pay quickly and easily, and an anonymous card with an electronic purse for late-comers to the congress who paid a deposit at the card output machine.

Smart Russians Bank by Card

After only 18 months' involvement in Smart Card technology, the Novosibirsk, Russia based Centre

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Tourist Loyalty Card in Jersey

JerseyCard is to run a new tourist loyalty scheme, called the Duty-Free Club, using Smart Cards in Jersey during the 1995 season.

Mission Management, in association with Jersey Pearl, Jersey Goldsmiths, Jersey Woollen Mills, Victor Hugo Wines, Fotosound and Sennett & Spears, took part in a successful pilot scheme last year and now plan to increase the number of Smart Cards issued to tourists as they visit participating outlets.

As tourists make purchases at the points-of-sale, points will be added to the card and at the end of their stay on the island, the points can be redeemed for Duty Free goods. A point, valued at £1, is added to the card for every £10 spent.

The objectives are to increase significantly the market share available to participating stores and to increase the average spend. All of the Smart Card terminals communicate with the JerseyCard host computer nightly so data can be obtained on spending patterns providing useful marketing data and allowing the participating outlets to fine-tune the details of the scheme as required.

Chris Parlett, Executive Manager, JerseyCard, says that being a "closed environment," Jersey is a particularly simple marketplace in which to measure the effects of such a scheme, and unlike many loyalty schemes, the results are immediate as the average stay is less than two weeks.

JerseyCard, which has been supplying Smart Card systems in the Channel Islands since 1990, is using Thyron TPSCAM terminals, GPM 416 Gemplus cards and its own proprietary software.

Contact: Chris Parlett, Executive Manager, JerseyCard - Tel: +44 (0)1534 37713. Fax: +44 (0)1534 89665.

of Financial Technologies (CFT) is reporting success in its first stage of system elaboration.

CFT has offices in Chicago, Moscow and Novosibirsk and specialises in automisation of

banks, financial and stock companies, electronic funds transfer and Smart Card payments system development.

Its largest project, Zolotaya Korona, was launched in April 1994. A Smart Card payment system, it is used by 50 large banks with a geographical coverage ranging from Vladivostok to Kaliningrad and taking in Moscow and St Petersburg.

The system architecture is based on the principle of free joining, which allows any bank with a CFT software licence to acquire standard equipment and cards. All participating banks accept cards from other issuers, and the cards are also accepted in shops and service suppliers. In future, cardholders will be able to withdraw cash in western countries.

Expanding rapidly

Currently some 15,000 cards have been issued but the system is expanding rapidly and orders have been placed for 200,000 Solaic E3744 microprocessor cards with the Motorola 68 HCO5SC24 chip (3K bytes ROM, 128 bytes RAM, 1K bytes EEPROM), and 3,000 terminals.

Equipment involved includes point-of-sale terminals from DataCard (680-IC), VeriFone (Omni 390, 395), Innovatron (TPSCAM 1000,2000) and Bull (Questar 10) and ATMs from Bull (Questar 1410) and Olivetti (CD 6300).

In other developments, CFT's Integrated Bank (IB) system software is installed in over 20 large Russian banks. A typical user is the Siberian Trade Bank (Novosibirsk), in which more than 600 clients exchange financial documents electronically. Access control to the system and client self-service (account statements, payments etc) is provided via the E 3744 Smart Card.

The Integrated Fund (IF) System consists of two independent but logically bound software products, Electronic Depository (ED) and Locked-in Trades Settlement Systems (LTSS).

ED is a source of statistical and analytical information. One of its key modes is the transfer of

Everyone Wants Smart Cards

People the world over favour a reloadable Smart Card for those everyday small purchases which collectively account for much of their petty cash.

dividends to the Smart Card. LTSS is an electronic exchange, allowing the conduct of securities operations without leaving the office.

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Rush to Join Internet

A number of major financial institutions are moving quickly to develop electronic payment systems on the Internet. They include MasterCard, BankAmerica, First Data Corporation, First Interstate, and Mondex, the Smart Card-based electronic cash payment system.

Mondex, being launched in Swindon in the UK in July by National Westminster Bank, Midland Bank and BT, says it has already successfully demonstrated Mondex transfers across the Internet and is currently developing the software interface.

A spokesman said that it would be possible for Mondex cardholders with a Smart Card reader attached to their PC to load their card with money and to pay bills via the Internet.

MasterCard anticipates that its interface for bank card transactions over the Internet will be operational by mid-1995. Senior Vice President Edward J Hodgan, says: "The popularity of the Internet is a prime example of how technology is moving transactions from the traditional point-of-sale to wherever the customer is - or what we call the point of interaction."

All this activity is good news for Netscape Communications Corporation, a premiere provider of open software for the Internet. The California-based company is working with MasterCard and a number of other financial institutions to provide the software for a standard and secure means of on-line payment and card authorisation.

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MasterCard International, the global payments franchise with nearly 22,000 member financial institutions, conducted a six month study last year in the United States, Canada, Germany France,

United Kingdom, Italy, Spain, Mexico, Taiwan and Australia.

The results of its qualitative research into consumer interest in stored value cards showed a surprising consensus worldwide.

What most people wanted was a card with a reloadable stored value of about £10-16 (US\$ 20-25), which they could use at newspaper/magazine stands, in parking meters, on buses, taxis and trains, for postage, telephones, video rental and for copy and vending machines. They also stressed the need for multiple loading facilities in convenient places, from point of sale sites to ATMs.

This card would be used instead of cash - not as a substitute credit card.

The benefits of the reloadable stored value card were perceived as:

- * an alternative to change/exact change and frequent cash replenishment
- * easier to carry than cash, cheques or multiple cards
- * safer and more secure than cash
- * an easier way to budget and keep records, or to manage children's spending
- * an emergency source of cash.

The study identified three sets of people with a particular interest in stored value cards. These are frequent business travellers who need help in organising their travel-related details; parents who want to control the spending of their teenage children, and students on strict budgets who want an acceptable form of payment available and accessible at all times.

Business travellers were particularly likely to stress the convenience of currency conversion, and the need to increase the value amount for travel needs.

MeridienCard Expansion

Meridien BIAO, the largest banking network in sub-Saharan Africa, is pushing ahead with the roll-out of its Smart MeridienCard in African countries.

Year of Growth for Gemplus

The Gemplus Group reached its 1994 target of corporate revenue topping one billion francs, says its annual report.

Exports to over 70 countries worldwide accounted for nearly three-quarters of its FF1.080 million, representing a 43.6 % increase on 1993. New sales subsidiaries in Mexico, Australia, Venezuela, Japan and China were created.

Gemplus International now has a production capacity of up to 20 million cards per month at its facilities in France (Gémenos and La Ciotat in Provence) and Stuttgart, Germany. It produced 140 million cards in 1994 and created nearly 200 jobs - 1,042 of its 1,174 employees are based in France.

Created in 1988, Gemplus offers Smart Card solutions for applications in payphones and GSM, banking, healthcare, POS transactions, customer loyalty, public transport, pay-TV, physical and logical access control, etc. It was chosen to supply the Smart phonecards for initial trials in the United States, Canada and Japan last year, and is the only manufacturer supplying Smart Cards to all four of the largest European telecommunications operators - BT, France Télécom, Deutsche Telekom and OTE (Greece).

Contracts for the supply of phonecards have been signed with operators in Hungary, Romania, the Czech Republic and Croatia, and for GSM cards in the Baltic States and Russia.

Gemplus has been chosen to take part in the international technology group created by VISA to launch its electronic purse.

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A Smart Bank card and electronic wallet, the card was launched in Lusaka, Zambia last year (October 1994 SCN) with plans to offer it through over 100 bank branches in 18 African countries.

There are now over 8,000 MeridienCard holders and 170 retail outlets in Lusaka where the card can be used, and the scheme is being extended to

customers and retailers in the Copperbelt.

Seyed Anzsar, Managing Director of Meridien BIAO Bank Zambia, says: "The system is running so smoothly in Lusaka, we felt the time is now right to expand MeridienCard operations to other areas of Zambia where Meridien has a presence."

Stelios Sardanis, Senior Vice President of Business Development, says they are stepping up their schedule to release the card continent-wide with the launch in the Central African Republic this month and in Ghana next month.

A safe in your pocket

In the bank's promotional literature, potential cardholders are invited to "put a safe in your pocket" saying it virtually eliminates the burden and risk of carrying large amounts of cash while PIN protection and transaction information enables lost cards to be replaced without loss to the cardholder.

"The special security features built into the card are proving their worth," says Sardanis. "People appreciate keeping their money in a form that is impervious to theft. We have had a few cards reported stolen or missing, but our ability to reconstruct transactions has allowed us to replace the cards with their funds intact."

The card is the Bull CP8 TB100 3K bytes EEPROM microprocessor card and some 70,000 have been ordered for the first phase. A feature of the card is the ability to hold up to 10 foreign currencies. It is not necessary to have a bank account to obtain the card.

Contact: Rory Faber, Tavistock Communications UK - Tel: +44 (0)171 600 2288.

Cashless Access Control Taiwan GSM Contract for ORGA

ORGA Card Systems (UK) has been awarded a contract to supply over 550,000 Smart Card SIMs (Subscriber Identity Modules) and personalisation equipment for Taiwan's GSM network to be launched later this year.

The contract, worth over \$US 5 million, is believed to be the largest for the supply of GSM

New from EMOS Information Systems, sole UK distributors for InterCard GmbH Kartensysteme in Germany, is the AS6200 chip card terminal for controlling the use of copiers, fax machines, laser and plan printers.

Once the terminal is connected to the machine, copies can only be made with the use of a valid Smart Card - a Gemplus GPM 896 card.

The user purchases a Smart Card either over the counter or from a wall-mounted card dispenser which is coin or note operated. The card can have an initial value included in the purchase price or can be blank in which case it has to be loaded with cash value.

When the card is inserted into the terminal, the value on the card is displayed on the LCD. Copies are made in the usual way and the cost deducted from the card and from the display.

The AS 6200 terminal is designed to replace coin operated mechanisms in libraries. It fits all makes and models of copiers, laser printer, and most fax machines. If a copier is changed the unit is simply disconnected and refitted to the new machines.

Contact: Jonathan Torode, Marketing Co-ordinator, EMOS Information Systems, UK - Tel: +44 (0)1628 850400. Fax: +44 (0)1628 850251.

cards outside Europe. It was awarded to ORGA UK by Northern Telecom (Asia) who will install and commission the Taiwanese GSM network. ORGA will also instal a personalisation centre for individual programming and printing of the SIMs in Taiwan.

The UK office had a record 1994 turnover of £5 million. In addition to the Taiwan order, ORGA is expanding its mask development and PCN card

supply for the Hutchison Telecom Orange PCN service throughout this year.

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- Tel: +44 (0)1491 410997. Fax: +44 (0)1491 410295.

Getting Smart from MasterCard

A new interactive computer software program called Getting Smart About Smart Cards has been developed by MasterCard International as a primer on Smart Cards for people in the bank card industry who need an easy, convenient way of learning the basics of microchip technology as the industry moves towards chip cards.

The user-friendly program relies on icons and video graphics to educate the user on terms and concepts unique to the Smart Card industry.

Topics covered in the program include: the security aspects of the microchip, examples of existing applications and implementations, the flow of payment transactions, details on chip cards and reading terminals, and industry specifications for global interoperability.

The software will be available for MasterCard members later this month. It requires a 486-based PC or better, with a 256-colour display and at least 4Mb of RAM.

Robin Townend, MasterCard Senior Vice President Chip Technology, says: "By putting this information into a software program, we can offer it to interested members around the world and help them quickly build their Smart Card expertise." Upgrades will be developed to keep users up to date.

Smart Card News has not seen the program to review it yet, but Chuck Kitchen, CEO of

Cash Loading/Dispensing Unit

Canadian-based CU Electronic Transaction Services, says: "It contains a remarkable amount of information, and the program format makes it very easy to use. I expect anyone in the banking industry interested in learning about and keeping current on Smart Cards will view this as a 'must have' resource."

Contact: Jana Weatherbee, MasterCard, USA -
Tel: +1 212 649 5206.

Tesco's Launch Reward Scheme

Tesco is launching a customer reward scheme throughout its chain of supermarkets in the UK on 13 February.

The company is using a magnetic stripe card from ID Data and has not taken the Smart Card route as yet. However, in a recent announcement, Ian O'Reilly, Director of Computing, said that Siemens Nixdorf has been awarded a systems integration contract to work with them to identify, develop and integrate the next generation of systems which will include Smart Cards for an undisclosed purpose.

The new card, called the Tesco Clubcard, enables customers to collect points on the amount they spend and to benefit from promotions and in-store events such as cheese and wine evenings and food tastings.

Customers receive two points for the first £10 spent and one point for every £5 thereafter. Points are converted every quarter into money-off vouchers which are sent to the Clubcard holder's home address.

Contact: Karen Marshall, Tesco Corporate Affairs Department, UK - Tel: +44 (0)1992 644743.

A Smart Card cash loading machine from Bergmann Systems, Germany, can also be used for

withdrawing money from an electronic purse.

It will accept banknotes and coins for the loading of credit onto chip cards. It will also dispense and withdraw chip cards and pay out any deposit on the card together with any remaining credit.

The machine has a 2 x 20 digit, alphanumeric display and software for chip card handling.

The software can be adapted on request for almost every type of Smart Card in closed or

public applications. In most cases the units are sold as OEM components for system houses.

The PKA models, which can operate in either on-line or off-line mode, are in use in closed applications such as hospitals and canteens.

Technical data:

- Dimensions: 1700 x 700 x 370mm including stand safe
- Lockable stand safe: 700 x 700 x 370mm
- Safe thickness: 4mm steel, ST3702/door 5mm steel, ST3702
- Weight (empty): 225 kg
- Power supply: 230V, 150W
- Printer: 60mm paper width, 300 m paper roll
- Capacity of bank note stacker: 600-800 notes
- Capacity of card dispenser: 400 ISO 3024-0.

Contact: Karsten Niehusen, Product Manager, Bergmann Systems, Germany - Tel: +49 41 01 30240. Fax: +49 4101 302438.

| | PKA-3204 | PKAD-3224 | PKA-3314 | PKAD-3324 | PKAD-3334 |
|----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Chip card reader | Motorised input |
| Coin acceptance | - | - | 3 | 3 | 3 |
| Bank note acceptance | 5 | 5 | 5 | 5 | 5 |
| Coin pay out | 4 | 4 | 4 | 4 | 4 |
| Thermal printer | - | - | 4 | 4 | 4 |
| Card distribution | - | Yes | - | Yes | Yes |

PROTON Launch in Belgium

PROTON, the Belgian national electronic purse system, will be launched in the towns of Leuven

and Wavre on 18 February.

The first transactions will be made by the Mayors, Charles Aubecq in Wavre and Louis Tobback in Leuven, in their respective town halls where the municipal services have been equipped with PROTON terminals.

Around 1,200 payment terminals have been installed in stores and some 200 vending machines modified to accept the electronic purse card.

Banksys, operator of the Belgian national network for electronic payment Bancontact/Mister Cash, and developers of the scheme, says over 50% of the merchants in both pilot towns have decided to equip their stores.

Fixed terminal

Residents will be able to obtain their PROTON cards at their local bank from 10 February and can load the purse from their bank account with amounts ranging from 100 to 5,000 BEF.

The pilot phase will run until the autumn when it is expected that some 100,000 cards will be in use in the neighbourhood shops, vending machines, phone booths and payphones, parking meters, public transport, taxis etc. National roll-out is scheduled for the end of the year.

Portable terminal

Initially, PROTON will operate independently from the Bancontact/Mister Cash card but when the scheme is extended nationwide both means of payment may be joined in one card.

As the card is intended for small purchases no PIN is involved and cardholders can lend the cards to anyone they choose. As there is no PIN protection the cardholder will not be reimbursed if the card is lost or stolen and is expected to look after his card in the same way he takes care of his cash.

New payment terminals

Integratable module

Two new types of payment terminals have been developed for service providers - a terminal for small retail outlets in a fixed or portable/cordless version; and an integratable module for vending machines, automatic ticket dispensers, parking meters and payphones etc.

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Two Hundred Booths at CTST

All 200 exhibitor booths have been sold for the CardTech/SecurTech '95 conference and exhibition in Washington DC from 10-13 April, compared with 125 at the show last year.

The largest increases in exhibitors come in the Smart Card and biometric areas. Over half the booths will feature Smart Card related technology and applications, including displays by major suppliers of cards, terminals and card production equipment.

The strong showing by Smart Card companies reflects increased interest in the US market arising from commitments to the technology by banks, telecommunications companies and the government.

New products on show will include a fingerprint verification system from Central Research Laboratories (CRL).

The product has been redesigned to offer greater flexibility to users and installers of biometric systems and includes a fingerprint capture unit which interfaces with a standard PC and can be used in conjunction with a PIN pad and a magnetic or Smart Card reader.

CRL says there is significantly improved performance and the system is ideal for use in a range of applications from access control to financial transaction security, for example, at ATMs and points-of-sale.

Contact: Muriel Guilbert, CRL, UK - Tel: +44

Interface/Couplers from Philips

Philips Semiconductors has announced three new interface/couplers which simplify the design of Smart Card readers for applications such as pay-TV, logical access control to PCs, cashless payment terminals, GSM mobile phone systems and general identification applications.

The TDA8000 and TDA8001 provide a fully protected ISO7816 compatible interface to Microcontroller and Memory cards with single and twin I/O lines respectively. They feature an on-chip sequencer which controls the application and removal of the supply voltage (Vcc), an EPROM programming voltage (Vpp), a clock and reset signal to the card according to ISO 7816 recommendations.

The TDA8000 generates card clock signals up to 8MHz derived from an external crystal or ceramic resonator, while the TDA8001 features synchronous frequency doubling to produce card clocks up to 12MHz. Both devices can be programmed to generate Vpp voltages as high as 21V and incorporate on-chip voltage supervisors to enable card suppliers to ensure that no spurious signals reach the card.

The TDA8005, which has the main features of the other two devices, is a unique mixed analog and digital one chip solution and features an on-chip ISO7816 compatible UART, an 80CL51 compatible microcontroller core, a keyboard and display driver interface and a step-up voltage converter making it ideal for use in portable battery-powered card readers.

Hardware logic in the UART automatically selects direct/inverse convention settings and performs error management at character level, resulting in a requirement for little or no knowledge of ISO7816 protocols on the part of the card reader designer. By relieving the on-chip microcontroller of the processing overhead normally required to achieve these protocol tasks it also leaves the TDA8005's 4K bytes of program ROM and 256 bytes of RAM free to control the application. The microcontroller's normal serial I/O lines are available to implement a standard full-duplex, RS-232 style interface for communication and control of the card reader.

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To keep battery powered card readers operating for the maximum amount of time, the TDA8005 operates at supply voltages as low as 2.5V. Under these conditions its on-chip step-up converter is automatically activated before card transactions to ensure that the card's Vcc supply voltage remains within specified limits, even during short-term load transients.

In between card transactions, the TDA8005 can be programmed into power-down and sleep modes to reduce the current drain from the card reader's batteries.

On-chip fault detection automatically activates the Smart Card interface in the event of hardware problems, supply drop-outs or card removals.

The TDA8000 and TDA8001 operate over a supply voltage range of 6.7V to 18V. The TDA8005 has an operating supply voltage range of 2.5V to 6V.

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City Transport Exhibition

The world congress and exhibition for Public Transport is to be held in Paris this year from 28 May - 1 June.

Apart from the latest models of buses and trains, exhibits will include the development of telematics for transport, the latest payment systems based on Smart Cards and the electronic purse as an integrated payment system, automatic debiting systems for tolls, payment of parking fees, and park and ride systems.

The event is organised by the International Union for Public Transport (UITP) which has about 1,700 members representing public transport operators, authorities and suppliers in more than 70 countries in five continents. It will be held at the Porte de Versailles in the centre of Paris.

Contact: UITP, Brussels, Belgium - Tel: +32 2 673 6105. Fax: +32 2 660 1072.

ORGA Expands in the UK

ORGA Card Systems (UK), which had a record turnover of £5 million in 1994, has announced new appointments in sales, marketing and product engineering support.

Mark Castle, an electronic engineer with experience at British Aerospace and in the electronic component distribution industry, has been appointed Business Development Engineer. He will be account managing many of ORGA's GSM/PCN (Global System for Mobile Communications/Personal Communication Network) customers and developing new outlets for the SIM (Subscriber Identity Module) analysis, personalisation and point of sale support equipment.

Fahmi Kamal has joined the development team and will provide technical support and project development skills. He joins ORGA from Thorn Secure Sciences, watermark tape and card reader specialists.

Simon Reed, formerly with Cardinal (UK), has been appointed Business Development Manager and will explore new business opportunities and develop third party relationships for the group specifically within the UK market. He will also be handling marketing strategy.

Contact: Simon Reed, ORGA Card Systems (UK)
- Tel: +44 (0)1491 410997. Fax: +44 (0)1491 410295.

MasterCard Smart Card Team

MasterCard has announced the appointment of two new executives to its Smart Card team. Margaret Crank, Director of Marketing for MCI Telecommunications Corporation's Wireless Services Group, joins as Vice President, Chip Card Consumer Marketing, and Chris Jarman, Vice President, Corporate Strategy and International Business Development with the ORGA Group, becomes Vice President, Chip Card Technology.

Crank is responsible for MasterCard's global consumer marketing programmes for Smart Cards,

Smart Card Diary

including application concept development, marketing research and consumer pilots.

At MCI she spearheaded the industry's most extensive personal communications consumer market trials and directed the company's consumer marketing alliances with financial services partners including MasterCard and the GM Card, Citibank and HongKong Bank. Prior to that she was Vice President, Marketing Director for Citibank where she developed marketing strategies for several of Citibank's target customer markets. She holds a BA from the University of North Carolina and a MS in management from the Georgia Institute of Technology.

Jarman, with more than 14 years' experience of microcomputer systems and chip cards, is responsible for the technical development of the chip and operating system platforms to be used in MasterCard card products with emphasis on the certification, security and personalisation of the chips as well as development of the member requirements for production of chip cards and evaluation of new technologies.

At ORGA, Jarman was responsible for the establishment and management of worldwide agent companies, distributors and market development of chip card products. Prior to joining ORGA, he was with the TSB, UK, where he was responsible for identification and evaluation of business opportunities using new card technologies.

Jarman is the author of numerous articles and papers on Smart Cards and is an editorial consultant to *Smart Card News* - a position held since its launch in 1992.

Appointments at DataCard

Bill Waller has joined DataCard in the UK as Smart Card Business Development Manager from McCorquodale Card Technology where he held a similar position.

Ian Fagg has been appointed Smart Card Product Support Specialist and is also from McCorquodale where he was Technical Support Manager.

CeBIT '95, Hannover, Germany 8-15 March.

More than 6,000 exhibitors and around 700,000 visitors are expected at this annual fair. Contact: Deutsche Messe AG - Tel: +49 511 89 312 41. Fax: +49 511 89 312 49.

The 1995 Asian Smart Card Summit, The Pan-Pacific Hotel, Singapore, 22-24 March.

Contact: Joyce Wi, AIC Conferences, Singapore -Tel: +65 222 8550. Fax: +65 225 5906.

CardTech/SecurTech '95, Washington Hilton, Washington, DC, USA, 10-13 April.

The world's largest advanced card and security technology conference and exhibition featuring over 130 presentations and more than 190 exhibitors. Contact: CTST - Tel: +1 301 881 3383. Fax: +1 301 881 2430.

Payment Cards '95, The Hyde Park Hotel, London, England, 27/28 April.

2nd annual conference looking at the commercial opportunities and applications in prepayment and electronic purse schemes. Contact: AIC Conferences - Tel: +44 (0)171 242 2324. Fax: +44 (0)171 242 2320 .

Electronic Card Payments '95, The Atrium Hyatt Hotel, Budapest, Hungary, 27/28 April.

The 7th European Conference on EFTPOS will this year place emphasis on Eastern European needs and on the electronic purse. Preceded by a half-day tutorial on chip cards, fraud and security, database marketing and EDI. Contact: IBC Technical Services, UK - Tel: +44 (0)171 637 4383. Fax: +44 (0)171 631 3215.

Retail Solutions '95, NEC Birmingham, England, 2-4 May.

Now in its fifth year, the conference includes half a day on Smart Cards in retailing involving a critical comparison of the design of different electronic purse systems and the role of Smart Cards in customer loyalty schemes. Contact: Pat

Chard, RMDP, UK - Tel: +44 (0)1273 722687. Fax: +44 (0)1273 821463. Accompanying exhibition. Information from emap Business Communications - Tel: +44 (0)181 688 7788. Fax: +44 (0)181 680 0306.

Customer Loyalty Asia '95, Sheraton Towers, Singapore, 17-18 May.

Presentations on how to keep customers happy and loyal, followed by a separately bookable workshop conducted by Brian Skirving, Principal, Loyalty Programmes International, Australia. Contact: AIC Conferences - Tel: +65 222 8550. Fax: +65 226 3264.

Co-Branded, Loyalty & Affinity Cards, Harrington Hall, London, 22/23 May.

Second annual conference giving an update on card-based loyalty schemes including loyalty Smart Cards. Contact: AIC Conferences - Tel: +44 (0)171 242 2324. Fax: +44 (0)171 242 2320.

The 9th European Financial Self-Service '95, Sheraton Grand Hotel, Edinburgh, Scotland, 23/24 May.

Conference and exhibition preceded on 22 May with a tutorial on Smart and Prepay Cards chaired by Bob Carter of Orchard International. Contact: SETG, Scotland - Tel: +44 (0)141 553 1930. Fax +44 (0)141 552 0511.

Ensuring Sustained Momentum in Affinity, Loyalty and Co-Branded Cards, Euston Plaza Hotel, London, England, 25/26 May.

Latest market developments and case study presentations. Interactive workshop on 24 May. Contact: Smi Conferences - Tel: +44 (0)171 417 7790. Fax: +44 (0)171 417 7791.

Smart Cards From There to Here - part 1

There is something about the concept of a Smart Card that captures the imagination. If you talk to anybody in the business they invariably enthuse about this new technology yet its not really that new.

The Smart Card concept is based on the idea of embedding an integrated circuit chip within the ubiquitous plastic card that has become a part of our everyday life. The expression Smart Card was actually coined to describe a plastic card containing a microchip with processing capability. Today there are still more such cards containing just a memory chip which form the core of the telephone cards that have been so widely used in France and Germany. The more correct expression to cover all such cards is an integrated circuit card (ICC) as defined in the current ISO standards. However, in tracing the story of the technology we will be a little lax in our terminology to reflect the public's perception of these novel pieces of plastic.

One cannot help but wonder how it all happened. In fact the history of the Smart Card is really steeped in the development of chip technology over the last 40 years. Today we have small pieces of silicon just 5mm × 5mm fabricated to provide a full microprocessor with various classes of memory. These chips are more powerful than the early personal computers that emerged in the early 70's. Some of these chips are capable of performing the latest public key cryptographic algorithms in fractions of a second that just 10 years ago would have seemed impossible.

Although the modern history of the Smart Card has seen its successful commercialisation promoted by Roland Moreno through his patents starting in 1974 there is much more to the story. Today we are faced with a number of organisations promoting standards. In the field of Smart Cards we have various offerings from competing organisations in the definition of their products. Recently Europay, Mastercard and Visa (EMV) have published their specifications for Smart Cards as have Mondex (the National Westminster bank global payments electronic purse initiative). But here is the point they are specifications not standards. All these organisations are basing their products on the

Other pioneers such as Dethloff and Arimura whose work predated Moreno's patent each played an important part in the invention of the Smart Card and its applications. This story is both interesting and complicated and we shall describe the plot in a separate subsequent article.

One cannot help but ask, why put a chip in a plastic card. The engineers amongst us would probably point out how much easier it would be to fabricate a chip in a more solid module. It potentially would be more reliable because of the less stringent mechanical environment. There are in fact a large number of such devices fabricated in different form factors such as small plastic keys as would be synonymous with an access control device. The answer lies in the world of standards. A subject that to many people is both boring and unnecessary because the best product makers its own de-facto standard. Well of course this is partially true, International standards are invariably based on an existing product that has become the winner in its field. However the full commercial exploitation of a product needs interoperability without which the market becomes very fragmented. The competition between Betamax and VHS for the video tape recording standard was so significant that the loser, in this case Sony became very wary of ever again ending up with an unsupported product. Today we can see a very different approach in the development of digital video discs (DVD) where the major players are in close discussion to try to agree a common standard.

So on to the Smart Card, where are the standards? Well of course the form of the common plastic bank card that most of us have in our pockets is a widely accepted International standard. Its not just the card itself but the surrounding infrastructure through which the true interoperability can be achieved.

appropriate ISO standards but they define a more precise specification which describes exactly how their product works within the various options offered by the standards. These specifications allow interoperability in terms of the infrastructure (i.e the terminal interface) but may well be different at the application level. For example the Mondex purse at the application level operates differently to the proposed EMV product but a terminal designed to meet ISO standards can easily operate with both products.

It is this common infrastructure which is the key factor to the success of a new technology and as we shall see ISO has developed a number of standards that are sufficient for the adoption of the Smart Card technology such that within a few years we shall probably all have one in our pocket. Marketeers might just like to add this up around the world, and please include China in your figures.

ISO uses the term, Integrated Circuit Card (ICC) to encompass all those devices where an integrated circuit is contained within an ISO ID1 identification card piece of plastic. The card is 85.6mm x 53.98mm x 0.76mm and is the same as the ubiquitous bank card with its magnetic stripe that is used as the payment instrument for numerous financial schemes.

Integrated Circuit Cards come in two forms, contact and contactless. The former is easy to identify because of its gold connector plate (fig 1). Although the ISO Standard (7816-2) defines eight contacts, only 6 are actually used to

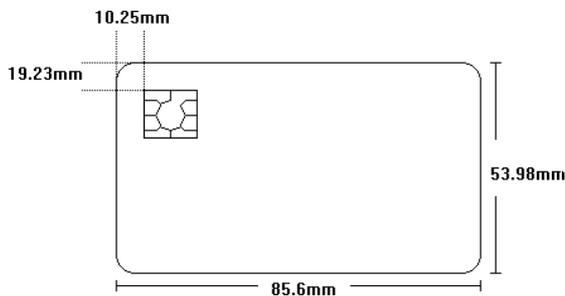


Fig 1. ISO ID 1 CARD

communicate with the outside world. The Contactless card may contain its own battery, particularly in the case of a "Super Smart Card" which has an integrated keyboard and LCD. The clock signal is used to drive the logic of the IC and is also used as the reference for the serial communications link. There are two commonly used clock speeds, 3.5795 MHz and 4.9152 MHz. The lower speed is most commonly used to date in Europe but this may change in the future. One may be tempted to ask why these strange frequencies were chosen, why not just a straight 5 MHz. The reason lies in the availability of cheap crystals used in the television world. For example the American NTSC colour subcarrier frequency

display. In general however the operating power is supplied to the contactless card electronics by an inductive loop using low frequency electronic magnetic radiation. The communications signal may be transmitted in a similar way or can use capacitive coupling or even an optical connection.

The Contact Card is the most commonly seen ICC to date largely because of its use in France and now other parts of Europe as a telephone prepayment card. Most contact cards contain a simple integrated circuit although various experiments have taken place using two chips. The chip itself varies considerably between different manufacturers and for a whole gambit of applications. Let us consider first the purpose for the 6 contacts used by the ICC (fig 2)

Vcc is the supply voltage that drives the chips and is generally 5 volts. It should be noted however that in the future we are likely to see a move towards 3 volts taking advantage of advanced semiconductor technology and allowing much lower current levels to be consumed by the integrated circuit. Vss is the substrate or ground reference voltage against which the Vcc potential is measured. Reset is the signal line that is used to initiate the state of the integrated circuit after power on. This is in itself an integral and complex process that we shall describe later in more detail.

is exactly 3.579545 MHz. The Vpp connector is used for the high voltage signal that is necessary to program the EPROM memory. Last, but by no means least is the serial input/output (SIO) connector. This is the signal line by which the chip receives commands and interchanges data with the outside world. This is also a fairly complex operation and will be the subject of a more detailed discussion where symbols such as T=0 and T=1 will be fully explained.

So what does the chip contain, well the primary use of the IC card is for the portable storage and retrieval of data. Hence the fundamental component of the IC is a memory module. The following list represents the more commonly used memory types,

| | |
|--------|-------------------------------|
| ROM | Read only memory (mask ROM) |
| PROM | Programmable read only memory |
| EPROM | Erasable programmable ROM |
| EEPROM | Electrically erasable PROM |
| RAM | Random access memory |

A particular chip may have one or more of these memory types. These memory types have particular characteristics that control their method of use. The ROM type of memory is fixed and can not be changed once manufactured by the semiconductor company. This is a low cost memory, in that, it occupies minimum space on the silicon substrate. The use of the silicon is often referred to as real estate because clearly one wants to get as much as possible into the smallest possible space. The snag however is that it cannot be changed and takes several months to be produced by the semiconductor company. There is also effectively a minimum order quantity in order to achieve this low cost.

In order of increasing real estate the PROM comes next. This memory is programmable by the user through the use of fusible links. However high voltage and currents are required for the programming cycle and such devices are not normally used in Integrated Circuit Cards. The EPROM has been widely used in the past but the name for this application is something of a misnomer. Whilst the memory is erasable, by means of ultra violet light, the necessary quartz window is never available in the ICC and the memory is really used in one time programmable mode (OTP). Getting pretty heavy in real estate terms is the EEPROM. This memory is indeed erasable by the user and can be rewritten many times (between 10,000 and 1,000,000 in a typical implementation) All of these memories described so far are non volatile. In other words when the So now we can differentiate the different types of ICC by their content,

- Memory only
- Memory with security logic
- Memory with CPU

The security logic can be used to control access to the memory for authorised use only. This is usually accomplished by some form of access

power is removed they still retain their contents. The random access memory (RAM) is a different kettle of fish, this is volatile memory and as soon as the power is removed the data content is lost.

In order to pursue our studies further we must note that the cost of the IC at saturation (i.e when development costs have been recouped) is proportional to the square area of silicon used (assuming constant yield). The ISO connector is so designed to constrain the silicon die size to about 25mm² (although it is possible to handle 35mm² or more). However the important point is more concerned with reliability where clearly the larger die will be more prone to mechanical fracture. There is another bi-product that we will consider later where the cost of testing and personalisation are considerably altered by the complexity of the particular chip. It is clear however that we should attempt to minimise the contents of the chip on both cost and reliability grounds commensurate with the particular application.

Well of course you cannot have something for nothing and although a telephone card may operate with a little EEPROM memory (128 - 512 bytes) and the memory control logic, more sophisticated applications will demand ROM, EEPROM, RAM and a CPU (Central Processing Unit) to achieve the necessary business. It is the addition of the CPU or micro-controller that really leads to the term "Smart" although as mentioned previously we will not be rigorous in our use of the term.

The control logic should not be overlooked as this is necessary not only for communication protocols but also to offer some protection of the memory against fraudulent use. The ICC is probably the security man's dream because unlike most electronic storage and processing devices it has security intrinsically built in. The ICC really does provide a tamper resistant domain that is difficult to match with the somewhat larger security boxes that handle cryptographic processes.

code which may be quite large (64 bits or more). Clearly the use of EEPROM memory must be strictly controlled where fraudsters can obtain a financial advantage by unauthorised use. This applies as much to telephone cards as applications using ICCs for cryptographic key carriers. The security advantage of the CPU device is of course more significant because the CPU is capable of

implementing cryptographic algorithms in its own right, but we will discuss this in more detail in due course.

In the Smart Card world the term application is

widely used to describe the software or programs that the IC implements. In the simplest case the application may be just a file manager for organising the storage and retrieval of data. Such an application may be totally implemented in the logic of the chip. Similarly the chip must contain the communications logic by which it accepts commands from the card acceptance device (CAD) and through which it receives and transmits the application data. The ICC which contains a CPU can handle more sophisticated applications and even multi applications since the CPU is also capable of processing the data and taking decisions upon the various actions that may be invoked. The subject of multi-applications and particularly the implementation of security segregation is another subject for more detailed discussion in subsequent parts.

by Dr. David B Everett

Next Month: Part 2 - The Making of a Chip

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