**The Future Technology of Money**

**Introduction**

Where are we today with respect to the different technologies for electronic

payments and money? What has been tried and failed? What are the critical success factors? What new opportunities will arise, how will technologies enable

them, and with what prospects for success?

Over the past ten years there have been hundreds of electronic payment

schemes – some representing new forms of money, others re-inventions of old –

that have sought commercial acceptance. The list is long and notable for its successes and failures. Digital cash, digital wallets, stored value cards, micropayments have all, to date, failed to establish any significant beachhead or presence in the United States. Although P2P systems are emerging with interesting speed, 93% of all online transactions in the United States are still credit card-based.

Today, what do we have? Credit cards, cash and cheques dominate our

money technologies. We do not expect any of them to disappear. In the coming

few years some combination of today’s electronic payment instruments (card,

chip, and PC based), cheques, and cash will continue to dominate, though perhaps

in a different mix.

It is important to note that the non-cash technologies – when used online –

are still principally linked to slow-moving book-entry clearing and settlement

systems. When a consumer makes an online purchase using a credit card, for

example, the only information actually moving over the Internet is the credit card

information itself.

This fact represents both the most significant challenge and opportunity for

change in payment systems in the coming few years. Indeed, the opportunities

and drivers for change are best seen to exist in the inefficiencies and other non monetary cost aspects of current payment systems and schemes. We expect the

market to drive developments in these areas – including innovations to address

how fraud can be managed and who will bear its risk, the cost of hand-offs and

processing times in complex payment systems, and changing profiles of customer

concern for ease of use and security. Some of these may drive the development of

new devices or chips that will create alternative payment methods in electronic

commerce. Certainly, we do expect to see more and more computers, networks,

and transitions to Internet technologies. Whether the technology now exists to do

most everything we want on an Internet payment system can be argued. But the

increasing acceptance and use of computers, networks and the Internet, coupled

with the cost and risk of doing Internet-based business that is tied to book-entry

type clearing and settlement systems, should open the door to a series of

interesting technology-enabled solutions that will provide alternatives to today’s

payment schemes.

These may do nothing more than take advantage of refinements in current

technologies or a new willingness of customers to use them to gain favour in the

marketplace by rinsing costs out of the payment system, reducing or reapportioning risk, and engaging consumers with their ease of use, security and privacy.

**A track record of innovation and market indifference**

The marketplace for new money technologies has been filled with excitement

and promise over the past decade. Yet it has also been filled with risk.

One recent MIT survey reported that by 1999, 50 e-money startups had in fact

failed as businesses.1

Perhaps the greatest promise and failure in recent years has been electronic

token currencies such as digital cash. Spurred on by the inventions of

David Chaum and others, Digicash’s “blind signature” encryption promised something much more than credit cards: anonymity of payment in online commerce, low transaction costs (one-third to one-half of a cheque or paper payment by some estimates), and immediate transaction processing. It also might make possible a new economy of micropayments for Internet-based commodities whose price was too low to warrant transactions via credit cards. If instead a system of micropayments could be devised that kept per transaction costs low, new realms of commodities could be priced and purchased with the currency – web clicks, software applets, pictures; music, articles, web services.2

Its promise of low transaction action costs, anonymity of payment, and immediate

transaction processing notwithstanding, the market for micropayments did

not materialise sufficiently to sustain companies that counted on it. Perhaps it was

too early, but consumers balked at paying for digital content on a per-click or unit

cost basis. Perhaps it was the requirement that consumers use a bank to convert their regular money into e-cash, or that banks shied from the commerce inasmuch as pornography was the huge and surprising beneficiary of such e-coinage. At the

same time, card associations began to guarantee cardholders that they could shop

online with no risk, with the result that consumers became increasingly comfortable with credit card purchases on the Internet. Moreover, the value of the average Internet purchase (which is now about $80) obviated the need for micropayments for most consumer transactions.3 As a result, there was and continues to be difficulty in generating any critical mass for micropayments. Now, about $10 billion in credit card transactions occur using 128-bit encrypted SSL, at far less cost than the same result from SET – the credit card associations’ first digital signature-enabled technology .4

Digicash in fact never achieved the critical mass of consumers, banks and

merchants it needed to accept and use its electronic currency. As is well known, it

filed for bankruptcy in 1998 and sold its patents and domain name. It might be

said that consumers, at least in the United States, took Scott McNealy’s admonition

regarding the absence of any privacy to heart. They got over it in a hurry, and

with new guarantees of security in this established channel, never lost their strong

preference for credit card purchases.

Other micropayment or digital cash alternatives such as those offered by

e-money issuers Cybercash and First Virtual holdings – the other two digital cash

enterprises – also fell on fallow ground. Both concerns are also now out of the

business, making the digital cash enterprises, in some respects, a perfect failure.

Comparable efforts have run into different and more difficult seas. E-gold – which

stores gold in vaults and issues e-gold cyber money against customer’s bank drafts –

can be used to send money to other users or to pay for online services that accept

it. E-gold is completely anonymous, offshore – and in all likelihood seems likely to

fall under the steady rain of international efforts to counter money-laundering.

This past spring an e-gold reseller in Syracuse, New York was raided by federal

agents.

Some seem bound for the ash heap of history. Quirky Beenz, Flooz and I-dollars

– all essentially minting their own virtual currencies – have failed to find profitable

niches.5 Barter sites Bartertrust, BigVine and Lassobucks are similarly interesting

but limited.6

In the United States, stored value technology – chip-based transaction cards

pre-loaded with electronic cash – has found nearly no acceptance.7 With respect to

credit cards, in the United States credit cards account for nearly all (93%) online

transactions. Yet SET is itself moribund, and now accounts for fewer than 10% of all

online transactions. Not surprisingly, banks were unwilling to pay to deploy the

new technology inasmuch as it transferred risk from merchant to bank. Rather,

there is every indication that vendors and card associations will soon shift their

focus to promotion and enhancing online transactions using SSL.8

***Peer-to-Peer/Person-to-Person (P2P) payments***

There has been tremendous growth in this niche, dominated by PayPal, which

rode the EBay auction wave to success deploying an online payments technology

people could use with credit card-like ease to pay for their purchases. In P2P, I can

transfer funds to you by an email that includes access to the transferor’s current

account or credit card. You open the email, and funds go to your account.

Currently, PayPal, the leading P2P service (and the spawning progenitor to

comparable services from banks such as C2it) claims 8 million customers and

$7 million of transactions daily, which must be something of a record for new

account generation unmatched by banks.9 Most PayPal account holders are private

individuals rather than corporations, and use PayPal for transactions under $20.

Indeed, consumer-to-consumer commerce now comprises nearly 10% of all online

commerce that involves consumers, with P2P payments the payment method of

choice. PayPal’s relatively low transaction fee –2.2% plus 30 cents, compared to

Visa which charges up to 2.5%, makes it attractive. But credit card companies are

not breaking a sweat responding to PayPal, which really is not a threat: although it

is eating into the credit card dominance online, online sales still account for no

more than 2% of all credit card transactions.10 The vast majority continues to be

mail order/telephone order and point of sale.11

***Mobile payments***

Mobile payments are receiving a frosty treatment in the United States. Currently,

there is no end-to-end security infrastructure for wireless in the United

States – no means to authorise or authenticate transactions at high levels of integrity,

with non-repudiation, integrity, and confidentiality built in. While some

research organisations are indicating that mobile commerce will become an

important revenue stream in the US wireless sector, others are telling their financial

services audiences that, for now, m-commerce is not yet practical. Nonetheless,

it is expected that the mobile phone and handheld computer will merge

forcefully very quickly, with biometric security built into the wireless financial

device, reading fingerprints and voice, and creating a pathway to ubiquitous use.

For now, then, cash, cheques – Americans write nearly 70 billion cheques each

year – and credit cards have survived the onslaught of digital money and electronic

payments. For the most part, these payment methods, even when applied

over the Internet, are quite conservative, inasmuch as they use the established

underlying clearing and settlement systems that sustain traditional point of sale,

mail order, and telephone order transactions via book-entry methods. They have

simply moved the exchange of information to the Internet, while maintaining the

established backend systems – with all their inefficiencies, cost and risk – to clear

and settle the transactions.

The attributes of established transaction modes hold important lessons for

any future money or payments technology. But the very success of established

payment technologies such as credit cards and cheques may also hold the ingredients

of change as new technologies look to capture efficiencies from antiquated

systems left for granted.

**Critical success factors**

New payment products are notoriously difficult to introduce. From a business

perspective, the barriers to entry, acceptance, and ubiquity are high. As analysts

point out, new payment products must be low margin to compete, high volume to

build critical mass and be profitable, receive favourable press treatment, be wellbranded

to gain customer confidence, achieve rapid uptake, and be differentiated

from check and credit card so that consumers and merchants find reason to prefer

and use them.12

As a result, there is a great deal of risk in rolling out new payment products or

infrastructures. Few of these business factors have in fact come together for new

payment products, and consumers have shown a notorious reluctance to switch

too far out of their preferred channels. One would surmise that products (such as

smart cards) that have incremental roll-out benefits would ordinarily be more

likely to attract investment and succeed in the marketplace.13

Technically, the underlying attributes of new payment products also require

certain factors to come together to succeed – if only because customers now enjoy

these same attributes of financial transactions when they transact business faceto-

face, with third parties present:

• *Integrity:* transaction data are transmitted and received unchanged and as

intended.

• *Non-repudiation:* transactions have the quality of non-deniable proof or

receipts.

• *Authentication:* identities and attributes of parties engaged in commerce are

established at some tolerable level of risk.

• *Authorisation:* individuals are established and recognised as entitled to

receive, send or view transactions.

• *Confidentiality:* transactions can be protected from view except by those who

are authorised.

Functionally, money technologies also need to achieve these operating

characteristics:

• *Privacy.*

• *Reliability:* probability of failure in the transmission – send, receive,

acknowledge – is low.

• *Scalability:* ability to raise capacity over time: technologies can be brought

forward and replicate transactions thousands or millions of times, as necessary.

• *Ease of use:* probability of customer acceptance is high – predictors are comfort,

convenience, confidence and cost, as well as technology interface.

• *Vendor/device/mode agnostic:* works no matter whether handheld, ear-borne,

desktop, card-based.

• *Personalise-able:* device use, operations, interfaces can be tailored to individual

preferences.

• *Seamlessness:* front-ground user interface operates with no impact from any

vagaries of background infrastructure.

• *Interoperability:* distinct hardware/software infrastructures can communicate

and exchange data as if they were identical.

• *Write once, apply anywhere:* interfaces, algorithms can be mapped to multiple

modes, devices, systems with indifference.

• *Cost-effective:* risk/reward ratio is within tolerable business bounds.14

Against these requirements, we have an opportunity to understand some of

the limits and possibilities of current and future technologies to generate needed

critical mass in the marketplace.

***Reduce the money cost of clearing and settlement***

Established clearing and settlement systems impose significant costs on

transactions. Today’s payment systems typically comprise four-party interactions

between merchant, merchant’s bank, consumer and consumer’s bank, with constant

handoffs and transactions costs at each. As they are principally batch-process

systems, delays in clearing and settlement that can be counted in days are

to be expected.15

Any system that promises more direct clearance and settlement – approaching

nearly simultaneous clearing and settlement in the transaction – has the promise

of driving unit transaction costs down and will be attractive in the marketplace. An

immediately settled transaction should also reduce risk to the payee and be

attractive on that score, as well as improve cash management for the payer. In the

B2B space, immediate settlement – electronic, cash-like payment – could facilitate

commerce in goods as diverse as utilities and securities, where transaction

costs and risks of delayed settlement may be high and the benefits of immediate

settlement large.16

***Reduce the money cost of fraud and risk***

To promote consumer confidence and use of online credit cards, card associations

have lately guaranteed consumers that they will have no risk. But that risk is

now borne entirely by the merchant, and it is quite high and costly.

Data now suggest, for example, that fraud in online credit card transactions

exceeds 100 basis points – a full 1% (some estimates place online credit card fraud

at 3% – 300 basis points.) At 1%, the online fraud rate is still 10 times greater than

POS or MOTO rates. Indeed, online credit card fraud now comprises nearly half of

all online chargebacks. Peter Thiel, a PayPal founder, refers to the “tsunami of

fraud” and has expressed fears that it will overwhelm the entire company.17 Worse

still for the merchant, because of the possibility of fraud, some credit card transactions

may not clear – meaning the seller will go unpaid – for up to 90 days.18

***Reduce the exposure, risk and cost of paper instruments***

The cost of paper cheque processing argues for electronic versions. US Federal

Reserve Bank studies show that the fully loaded unit processing cost of a

paper cheque is $1. Any payment system that can reduce costs by truncating or

using digitally signed authorisations instead of paper cheque transactions, even if

they remain associated with established clearance and settlement systems such

as ACH, stands a reasonable chance of finding a market.

***Add convenience, comfort, security***

Consumers are slow to move to technologies they consider risky, frivolous, or

lacking in convenience. But where consumers have balked at online purchase

because of privacy fears, or where consumers may have online access, disposable

income, but no available credit, or have credit but are concerned about the security

of their accounts, the potential exists for new payment products to take hold

that address all three concerns. This applies, also, to the unbanked – the roughly

25% of US citizens who do not have bank accounts at all.

***Provide consumer protections, even at the extremes of anonymity***

The paradox of anonymity is this: true anonymity of cash may be self-extinguishing.

It not only risks the wrath of money laundering-conscious governments,19

it also makes possible fraud and theft that have no recourse in the system, and so

should, by its nature some argue, fail to attract consumers whose digital cash

would be valueless if the issuer went broke without any recourse. As several analysts

have put it, the fact is that any money system, to enjoy consumer confidence

and to compete for market acceptance, must be able to deal with the “bank rob bery problem” – provide the assurance that at the end of the day fraud and theft

risk being discovered and punished.20

To gain ubiquity, consumer protections for electronic payment products must

be comparable to paper transactions. As in paper transactions, “… and then you

go to jail” must be the ultimate backstop to any electronic payment product. This

suggests that to prevail, anonymous electronic payment systems must therefore

provide consumer protections that rely on some degree of traceable identities in

transactions, or risk loss of marketability.21

What are some developments that could gain acceptance with merchants and

consumers – the critical legs of the strategic triangle of electronic payments?

***Digital bearer settlement***

What if trades – financial exchanges – cleared and settled instantly? As

conceptualised by Robert Hettinga (*www.ibuc.com*), digital bearer trades of

“cryptographically secure value-objects” can make possible instantaneous

trades of everything from micropayments to macrobonds. Such transactions can, in

principle, execute, clear and settle instantly, securely, and often anonymously.

The trading process relies on traditional securities underwriter/trustee business

models. A consumer purchases a digital bearer certificate, or digital cash

from an underwriter, via request and authorisation over the Internet through an

underwriter, the underwriter’s guaranteeing bank, and the consumer’s bank. With

good funds, the consumer’s bank messages the underwriter to disburse the digital

certificate or digital cash as per the consumer’s request.

A merchant accepts the digital bearer certificates or cash in exchange or

payment for other things of value, and in turn can use the certificate for his/her

own purchases or redeem it at par from the underwriter.

Underwriters issue the certificates on the Internet, and have fiduciary

responsibility for exchanging them into cash (or, as this might evolve, into other

digital bearer instruments), and for building the market for the purchase and sale

of certificates.

Trustees – in this instance, banks – hold the actual money that backs the

underwriters’ certificates, and are responsible for exchanging digital bearer certificates

into book-entry assets. Thus the digital bearer certificates, issued by

underwriters on the Internet, are collateralised by bank book entries.

The allure of instantaneous settlement is reduced cost and risk. If it can

reduce or eliminate the multiple intermediaries involved in the execution of a

credit card transaction – contrasted with the single intermediary of a digital bearer

trade – the guess is that transaction costs will be orders of magnitude cheaper, as

it must be if the true cost of a digital trade is, effectively, the cost of microprocessing and bandwidth. Such trades, whether in micropayments or macrobonds, inasmuch

as they either clear instantly or not at all, are essentially non-repudiable, are quite

low-cost, reduce risk to all parties considerably, and enhance cash management

capability.22

***Payment cards***

It is interesting to note that prepaid scratch cards are attractive to merchants

and consumers for a variety of purposes, and are being redesigned and targeted

for online use by those who have disposable cash but no credit (young people), or

who have credit but who limit online purchases because of their fears relative to

privacy or security.23

While there appears to be little consensus about the size of the market, the

opportunity is driving an acceleration in the design and roll-out of prepaid cards

as an online payment product. Cards that are already in one’s physical possession

can be activated via website (driving more web traffic to merchant’s sites),

or by magnetic strip and swipe at the point of sale.

As an alternative payment technology, the cards are quite attractive in terms

of float, anonymity, low transaction costs, and building brand and customer loyalty.

The trick is not in the technology *per se*, but inasmuch as barriers to entry are

low, defending turf from competitors seeking to capitalise on successful roll-outs

by early adopters is critical to success. Still, the challenge to ubiquity lies in aligning

retailers, merchants and consumers. Large firms with established merchant

relationships and processing infrastructures such as American Express have an

advantage in this respect – in signing up merchants *(e.g.,* 7-Eleven Stores) to create

and distribute a store-branded Internet shopping card that will be accepted

by any merchant who accepts American Express. Merchant-branded gift cards

*(e.g.,* the Gap) have also gained market traction for POS sales, and are now being

migrated to online use, providing consumers with brand confidence and issuers

with float.

***Retailer payment systems***

Large retailers such as Wal-Mart and food store chains are in the forefront of

pioneering new in-store payment products and systems. Insofar as they are

extremely consumer-focused and in highly competitive markets, these retailers

are good predictors of leading edge change. The reasons are clear: price pressure

and competition keeps retailers’ margins extremely low – 1% in some instances. At

the same time, the cost of credit cards and debit card fees are quite high, sometimes

exceeding the retailer’s own profit. Indeed, some retailers report that bank

card fees are the second highest expense after the cost of labour.24

Retailers are taking advantage of new technologies to explore lower-cost alternative

payment paths. Smart cards are attractive but require settling on national

and international standards before acceptance and use can be at all ubiquitous.

Other technologies involve the use of radio frequencies and microtags

embedded in each and every product on store shelves so that consumers might

never have to enter a checkout line to make their purchases. Wal-Mart for example

is exploring the use of tiny radio identifiers on everything it sells. Not only can

they do all inventory logistics over bar code by wireless, but products will “talk” to

everything on your card and come up with your bill.

Food chains are also embracing electronic cheque conversion to truncate the

cheque at point of sale, benefiting both merchant and consumer with reduced

handling, improved speed and lower costs. Store-branded ACH debit uses the

ACH system for electronic debit from consumer’s checking accounts at point of

sale, initiated when the consumer swipes a store loyalty card, a bar-coded key tag,

or a radio frequency wand such as the Mobil Speed Pass.

The opportunities in retailing may also drive the development of nonreconfigurable

handheld devices – not the Palm itself, which is reconfigurable, but

something that uses Palm technology to deliver “round trip” reconciliation data

back into the device. This would amount to an electronic audit trail to the parties

involved, a bi-directional handshake that relies on a capability, using a dedicated

tiny platform on the consumer electronics side, to detect everything going on in

the background (and to signal failure when it occurs). Infrared transceivers have

become a commodity item, but await the development of a tiny communication

module that has infrared and Blue Tooth capability and other short-haul wireless

capabilities on a single chip, which will drive the cost of these devices downward

and promote ubiquity.

***Electronic cheques***

The original electronic cheque, designed by the Financial Services Technology

Consortium, has spawned pilots and commercial applications. As a product,

the eCheck was mapped to work with establishment payment systems. But it can

also accommodate digital signatures as authorisations for ACH debits and credits.

As such, it has the promise of ubiquity – anyone can use it to pay anyone else via

electronic cheque – whether C2C, C2B, or B2B.

Applications so far include US Treasury department pilots, and B2B payment

services offered by Xign and Clareon. Clareon Corporation and FleetBoston

Financial, for example, recently announced a strategic alliance in which Fleet will

offer its 500 000 customers PayMode, Clareon’s business-to-business payment

solution based on the FSTC eCheck technology.25

**Summary**

Recent efforts to introduce new money technologies – principally, digital currencies

– have encountered resistance in the marketplace and have failed, in their

initial run, to gather a critical mass of acceptance. Technologies in use today such

as credit cards and cheques may use the Internet to send information securely,

but they still rely on backend clearing and settlement systems that are derived

from the requirements of book-entry protocols. It is expected that the move to

electronic forms of payment will continue as computers, networks and the Internet

become increasingly ubiquitous. With that, opportunities exist to create new payment

products that solve problems associated with the established clearing and

settlement systems. Immediate settlement of micro and macro trades, prepaid

cards, and innovations in retail payment systems, for example, all hold promise

against the cost and risk of e-commerce by credit card or cheque. In the near term,

cash, credit card and cheque will continue to dominate. Yet emerging opportunities

presage the possibility of new payment products that target inefficiency, cost,

and risk in current payment products and systems.