

Octopus: An E-Cash Payment System Success Story

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E-commerce would go bust without electronic cash payment systems, yet few of the dozens of systems introduced in various world markets over the last decade has been reliable enough to be embraced by large numbers. One exception is Hong Kong's Octopus system. By mid-2001, nearly 70 percent of Hong Kong's seven million residents used an Octopus card to make over six million daily transactions worth billions of dollars. Why is the Octopus card so successful when even e-cash systems backed by major credit card operators, including Mondex and Visa Cash, have struggled? This article explores what the Octopus experience can teach us about e-payment.

Octopus, a smart card used in Hong Kong's passenger transportation system, was born in June 1994 when the Mass Transit Railway Corporation (MTRC), the operator of the underground railway system in Hong Kong, persuaded four local public transportation operators of buses, ferries and mini-vans to form a joint venture company, Creative Star Limited (CS), to develop an automated fare collection system based on contactless smart cards. The fare collection contract, valued at U.S. \$55 million, was awarded to ERG Australia Limited and its subsidiary AES Prodata, which subsequently awarded the contactless card portion of the contract to Sony and Mitsubishi Corporation in Japan.

The contactless, rechargeable smart cards known as Octopus cards were introduced to the general public in September of 1997, as illustrated in Figure 1, which depicts the timeline of the development of Octopus. Card users can now use their cards in almost all modes of public transportation in Hong Kong and can recharge their cards up to H.K. \$1,000 (about U.S. \$130) in railway stations as well as in more than four hundred 7-Eleven convenience stores within the territory. Unlike slot-based cards that require the user to insert the card into a physical slot, the Octopus card is a proximity card; it can be read by operators without physical contact. All operators' computer networks are linked to the CS Clearing House, which is responsible for revenue apportionment and fund transfer.

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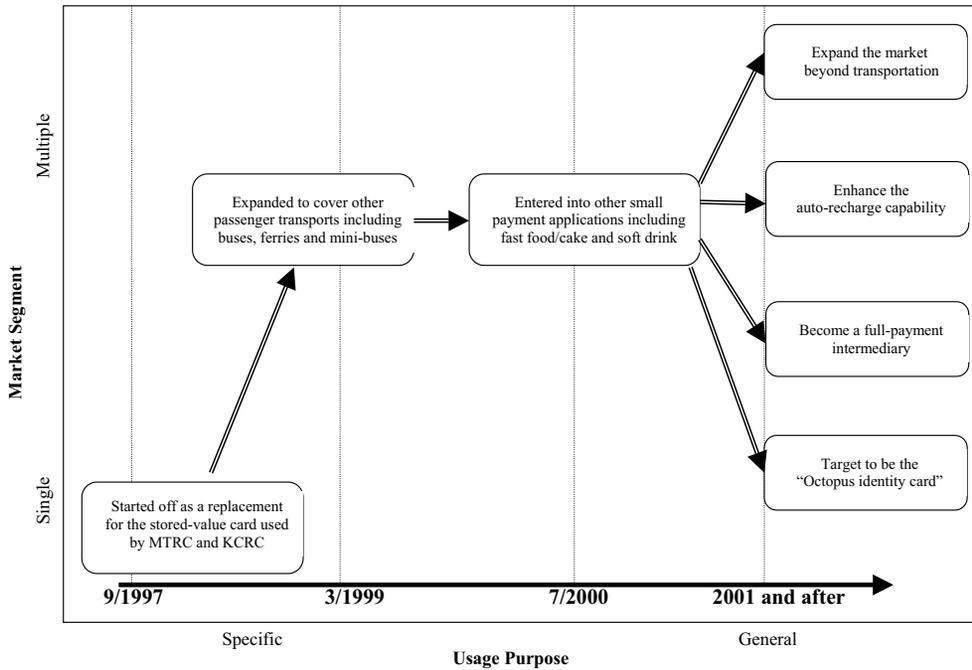


Figure 1. The chronology of Octopus.

Using smart card technology to replace cash was not new in Hong Kong. Major credit card operators and financial institutions, including MasterCard (Mondex) and VISA (Visa Cash), had been trying to capitalize on such business opportunities since the late 1980s [3]. The economies of scale in card production and application that require a user base of at least one million before a smart card system becomes viable [1] would seem to favor VISA and MasterCard, which enjoyed huge penetration before their e-card systems launched. By late 2000, about 5.8 million VISA cards and 3.3 million MasterCards were in circulation in Hong Kong, while Octopus had no existing client base when initiated. But after several years of trials and development, Mondex and Visa Cash have attained only limited market share compared to the Octopus card. Its extraordinary success is not due to the Octopus card being more technologically secure—in fact, it has fewer security measures than the Mondex and Visa Cash cards—but rather due to the four factors outlined here:

A captive market with high transaction volume. Like other metropolitan-area residents, Hong Kong residents must often commute some distance to work, often using multiple forms of transport. High import tariffs coupled with exorbitant fuel and maintenance costs make car ownership impossible for most Hong Kong residents, and three-quarters of the population of seven million travels by public transportation to work or school. Before the Octopus card, it was possible to use a magnetic strip ticket within the railway systems, but customers paid for connecting services in coins. It was difficult to expand the use of the magnetic strip tickets to other modes of public transport because of the required use of the bulky turnstile with the tickets.

By including the Kowloon-Canton Railway Corporation (KCRC), the Kowloon Motor Bus Company (KMB), the Hong Kong and Yaumatei Ferry (HKF), and City-

bus Ltd in the Octopus consortium, the MTRC reached almost all the passenger transit modes in Hong Kong. Octopus represented a win-win for all involved. Users and transit operators welcomed the relief from coins the smart card system gave them. And with approximately 11 million daily passenger journeys on Hong Kong's public transport services, operators recognized the Octopus system would decrease their processing costs per transaction, and their investment into the infrastructure would turn a profit in due course.

The superior efficiency of contactless smart cards. The passenger flow rate in busy Hong Kong can be as high as one thousand passengers per second during peak hours. Regardless of how fast the data read time of slot-based cards, the physical handling of such a card is always a bottleneck in the processing cycle. With contactless cards, the handling time is sharply reduced. Passengers need not remove the card from their wallets or purses—they simply wave their wallets and purses over the reader. This not only improves processing efficiency and convenience but also lowers the risk of losing the card due to carelessness.

The direct-conversion approach. Experiences of other countries making similar infrastructure transitions suggests that if the system being phased out coexists with new system, it jeopardizes adoption of the new system, because of existing infrastructure and habitual usage. In the case of Octopus, the deployment was a quick, direct conversion over several months with public announcements of the expiration date of the old stored-value tickets. Users had no choice but to buy a new card as quickly as possible. Although there were a few technological and logistical glitches during the initial launch, the consortium managed to resolve these problems satisfactorily over time. One unexpected problem was that almost 20 percent of users owned two or more Octopus cards due to convenience reasons, which led to a run on the cards at one stage, even though 3.5 million cards were produced for the initial launch. It took more than four weeks for the operator to replenish the stock [2].

Trust among the Octopus stakeholders. Octopus was first orchestrated by the MTRC, which subsequently became the first company to implement the system. The ability of MTRC to coordinate with the other transport operators to deploy the same system was critical to the success of Octopus because it laid the foundation of standardization, which is usually the most difficult step in deploying any sector-wide system. Because of Octopus's a simple and efficient clearing system, and the potential it offered for tremendous system-wide profits, transport operators overcame fears of partnering with direct competitors, recognizing that such partnerships would work to their advantage.

Spreading Its Tentacles

To begin to spread the Octopus tentacles to non-transport areas, Octopus operator CS acquired a license from the Hong Kong Monetary Authority in early 2000 to allow the company to operate as a Deposit Taking Company (DTC). With DTC status, which enables Octopus to receive up to 50 percent of its total revenue from other sources, CS moved into the fast-food sector. Fast food in Hong Kong extends far beyond McDonald's and Kentucky Fried Chicken. Thousands of snack and noodle shops sell Chinese fast food, and the low prices and speed that characterize this industry are familiar territory for Octopus. It seems natural that Octopus customers will feel comfortable paying for their hamburgers and noodles with a sweep of their cards. Since mid-2000, all Maxim's fast-food/cake shops, a local chain with approximately

200 shops, and 7-Eleven convenience stores, with more than 400 Hong Kong outlets, have begun to install the Octopus system, as have thousands of soft drink and snack vending machines.

Expanding Octopus is now a priority, for the original transportation customer base is now reaching saturation. With its ability to successfully cope with micro-payments, there is no reason, at least from a technical point of view, to limit the use of the Octopus system to the public transportation arena. Although the Mondex and Visa Cash systems are aiming to address this level of e-payment, neither seems close to capturing the kind of market share enjoyed by the Octopus system. But to move to the next phase of business development, Octopus must address several of the following challenges:

Enhance its auto-recharge capability. Octopus must find ways to minimize the frequency and hassle of recharging the card. When analyzing the lower usage groups of the Octopus system within the passenger communities, CS found these groups often live in areas lacking recharging facilities, such as MTR or KCR stations, 7-Eleven stores, or Maxim's shops. Even with recharge facilities nearby, the recharge process can be inconvenient and time consuming for customers traveling in a hurry, or for those who lack sufficient cash to pay for the recharge, who must find an ATM to withdraw cash for payment.

To expand Octopus's micro-payment dominance, CS must form alliances with banks and/or credit card operators to develop its auto-recharge capability. Configured as a personalized Octopus card linked with a bank/credit account, the card could be recharged once the balance dropped below zero. Technology is not an issue. All Octopus card readers have an auto-recharge capability that can be activated at any time. Since April 2000, CS started to work on making strategic alliances with local banks and by August 2001, nine banks had come on board.

Become a full payment intermediary. CS knows that a valuable aspect of the Octopus system is its real-time transaction processing and clearing capability. Although Octopus is essentially a fare-payment system for transport, its core competence in handling multiple merchants with high transaction volumes and short processing times can be applied elsewhere. One possibility is to deploy the Octopus system as a high-speed transaction processing and clearing house system for companies that require such services, such as banks and ticketing operators. If adopted, Octopus might serve as a card not only for transaction processing but also for identifying transactions.

Become the Octopus identity card for e-commerce. An ultimate goal of Octopus is to become the identity card of the whole Hong Kong population. With more than 70 percent of the population already Octopus cardholders, and with CS already pushing the card to segments beyond the passenger transportation sector, Octopus already has comparative advantage to become the Hong Kong identity card for electronic commerce. Several pilot projects in new housing developments are testing use of the Octopus card as a security card key for entrance to residential buildings and clubhouses. The Hong Kong SAR Government has announced a plan to replace its existing plastic Hong Kong identity cards with smart card-based identity cards with the capacity to support multiple applications beginning this year. The Octopus card can surely be the foundation for this new card.

Conclusion

E-cash payment systems are essential to electronic commerce, especially in the business-to-consumer segment. While it seems sensible to develop a global e-cash payment system to reflect the borderless Internet world, one must also create a system that suits local environments. The Octopus experience in Hong Kong offers rich lessons that can extend to the wider e-commerce project. Its success suggests that a system so “smart” that it makes the human input process quick and easy will be embraced by stakeholders, and will face few obstacles to immediate adoption when exposed to a captive market with a high transaction volume.

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