The Green Commerce Model

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Status of this Memo

1. Abstract

This memo defines a "Green Model" for information commerce using the Internet. In this model, the information merchant carries all risk of non-payment. By shifting the risk of non-payment, we do not require guarantees of credit worthiness for a merchant. This allows every participant to be both a buyer and a merchant of information on the Internet. Transactions relating to accounting and settlement are performed through either the exchange of store-and-forward messages (using the "application/green-commerce" format defined in [1]), or interactive protocol exchanges (using the "Simple Green Commerce Protocol" defined in [2]).

2. The Green Commerce Model

We propose a new model for Internet commerce in which the information merchant carries all risk of non-payment. By shifting the risk of non-payment, we do not require guarantees of credit worthiness for a merchant. This allows every participant to be both a buyer and a merchant of information on the Internet. However, it should be noted that various aspects of the model (e.g., buyer confirmation, discussed below) seek to minimize the merchant's risk to the point where it is offset by the expanded commerce base created.

To participate an Internet user first establishes a "cardholder" account. A cardholder account is identified by a "cardnumber" which is an alphanumeric string. A cardnumber must satisfy four properties:

(1) it must uniquely identify a cardholder account;

(2) it must be easily typed and read by a human;

(3) it must be relatively hard to guess; and,

(4) it must bear no deducible relationship to any real-world financial instrument, such as a bankcard number or a checking account number.

In addition, associated with each cardholder account is:

(1) an Internet electronic mail address;

(2) a "state", one of "active", "seller-only", "suspended", or, "invalid".

(3) a "pay-in" method (how the cardholder transfers funds to a Green Commerce server, e.g., using a bankcard);

(4) a "pay-out" method (how a Green Commerce server transfers funds to the cardholder, e.g., using a direct deposit checking account); and,

(5) a currency used for pay-in and pay-out.

(Once again, please note that the identities of the pay-in and pay-out methods are neither encoded in, nor derivable from, the cardnumber.)

Finally, cardnumbers are bi-directional for the purposes of Internet commerce. That is, a cardholder may engage in commerce as both a buyer or a merchant. Hence, the terms "merchant" and "buyer" are merely role-descriptors with respect to a given transaction, e.g., the cardnumber acting as a buyer in one transaction might be used in the merchant role for another transaction. Further, the term merchant and buyer are generic in that they refer only to the direction of the funds transfer for a transaction. Hence, if a cardholder makes a charitable contribution to a non-profit organization, we still refer to the cardholder as the buyer and to the non-profit as the merchant, even though no actual "sale" is occuring. (The terms "payer" and "payee" are neutral in this respect; however, these two terms are two similar in their spelling.)

3. Transactions

We now consider the eight transactions found in the Green Commerce model:

(1) how funds are transferred between cardholders;

(2) how the status of a cardnumber is determined;

(3) how the status of a transaction is determined;

(4) how cardholders are notified of funds chargebacks;

(5) how the capabilities of a server may be determined;

(6) how cardholders apply for accounts;

(7) how cardholders change attributes of their accounts; and,

(8) how cardholders retrieve messages relating to their activity.

In the discussion which follows, transactions are described in terms of the exchange of messages between a cardholder and a Green Commerce server. Messages are named with a "verb-modifier" pair. The verb refers to the high-level transaction, whilst the modifier refers to the role of the message in the transaction: a cardholder sends a "-request" message to a Green Commerce server, which returns a "-result" message; in addition, a Green Commerce server may send unsolicited messages to a cardholder -- a "-query" message is sent if the cardholder is expected to return a "-response" message, otherwise a "-notification" message is sent when no response is expected from the cardholder.

Finally, if a message is unacceptable to the server, e.g., because it is unexpected or non-sensical, the server responds with an "error-report" message to the cardholder. The message contains: an error indication, a copy of the message which generated the error-report message; and, optionally, a transaction-id along with further parameters to identify the error condition. Of course, a server will never respond to an error-report message.

3.1. Funds Transfer

This transaction occurs when one cardholder, acting in the merchant role, requests funds from another cardholder, acting in the buyer role. Typically, a funds transfer transaction occurs when a buyer purchases information over the Internet. However, this transaction may result for other reasons, e.g., to facilitate charitable contributions.

(1) The buyer uses their cardnumber to initiate the transaction. For example, the cardnumber might be contained within an electronic mail message, or given as a password to FTP, etc.

(2) A "transfer-request" message is sent to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

The message contains: the merchant and buyer cardnumbers; the transfer type (e.g., sale of information); the textual description of the transaction; the transfer amount and currency (e.g., 1.00 usd); and, optionally, the merchant's transaction-identifier.

(3) The Green Commerce server sends a "transfer-query" message to the electronic mail address associated with the buyer's account.

The message contains: a transaction-identifier uniquely-generated by the server; the merchant and buyer names; the transfer type; the textual description of the transaction; the transfer amount in the currency associated with the buyer's account (which fixes the transfer amount, with respect to currency fluctuations, in the currency used by the buyer); and, if present in the corresponding "transfer-request" message, the merchant's transaction-identifier. In addition, if currency translation occurred, the original currency and amount are noted in the message.

(4) The Green Commerce server waits for a response. If more than a certain number of days elapses, or more than a certain number of transfer-query messages are outstanding for the buyer, then the buyer's cardnumber enters the suspended state. (Whenever a response is received and the number of outstanding transfer-query messages for the buyer drops to less than a certain threshold, the buyer's cardnumber returns to the active state; further, any outstanding transfer-query messages are re-sent some time later.)

(5) If the buyer responds, then a "transfer-response" message is sent to the Green Commerce server.

The message contains: the server's transaction-identifier; and, an indication of the buyer's willingness to allow transfer of funds, one of "yes", "no", or, "fraud".

(6) The Green Commerce server sends a "transfer-result" message to the electronic mail address associated with the merchant's account.

The message contains: the server's transaction-identifier; the merchant and buyer names; the transfer type; the textual description of the transaction; the transfer amount in the currency associated with the buyer's account; an indication of the buyer's willingness to allow transfer of funds; and, if present in the originating "transfer-request" message, the merchant's transaction-identifier. In addition, if currency translation occurred, the original currency and amount are noted in the message.

If the buyer indicated "yes", then the transaction is added to the Green Commerce server's settlement queue for the buyer.

If the buyer indicated "no", then a "service charge" may be added to the Green Commerce server's settlement queue for the buyer. Further, if a "no" indication is received more than a certain number of times in a certain number of transactions, then the buyer's cardnumber enters the suspended state.

If the buyer indicates "fraud", then the buyer's cardnumber enters the invalid state.

3.1.1. Settlement

The Green Commerce server periodically checks its settlement queue for each cardholder. At some point, it will batch the accumulated transactions into a single real-world transaction, using the pay-in method associated with the cardholder's account.

(1) The Green Commerce server initiates real-world funds transfer using the cardholder's pay-in method.

If this fails, then the buyer's cardnumber enters the suspended state and the Green Commerce server sends a "payin-failure-notification" message to the electronic mail address associated with the cardholder's account.

The message contains: the notification-identifier associated with the pay-in method; and, the transfer amount and currency.

In addition, for each accumulated transaction associated with the "payin-failure-notification" message, the Green Commerce server sends a "collection-failure-notification" message to the electronic mail address associated with the cardholder's account which acted in the merchant role.

The message contains: the server's transaction-identifier; and, the amount and currency associated with the transaction.

(2) If the real-world funds transfer succeeds, the Green Commerce server sends a "payin-notification" message to the electronic mail address associated with the cardholder's account.

The message contains: the cardholder's name; the pay-in amount in the currency associated with the cardholder's account; the notification-identifier associated with the pay-in method; the list of accumulated transactions; and, optionally, a service charge.

The Green Commerce server periodically checks to see if it has received payment destined for the cardholder. At some point, it will batch the accumulated transactions into a single real-world transaction, using the pay-out method associated with the cardholder's account.

(1) The Green Commerce server initiates real-world funds transfer using the cardholder's pay-out method.

(2) The Green Commerce server sends a "payout-notification" message to the electronic mail address associated with the cardholder's account.

The message contains: the cardholder's name; the pay-out amount in the currency associated with the cardholder's account; the notification-identifier associated with the pay-out method; the list of accumulated transactions; and, optionally, a service charge.

3.1.2. Summary

```
     cardholder acting in      green commerce      cardholder acting in
      the merchant role            server             the buyer role
     --------------------      --------------      --------------------
     transfer
     request ----------------->

                               transfer
                               query -------------->

                                                               transfer
                                             <---------------- response

                               transfer
                        <----- result

                                     ...

                          <sweep settlement queue>

                                         <----- <real-world funds transfer>

                               payin
                               notification ------->

                                     ...

                        <settlement cycle completes>

                 <----- <real-world funds transfer>

                               payout
                        <----- notification
```

alternately, if the pay-in method fails:

```
     cardholder acting in      green commerce      cardholder acting in
      the merchant role            server             the buyer role
     --------------------      --------------      --------------------
     transfer
     request ----------------->

                               transfer
                               query -------------->

                                                               transfer
                                             <---------------- response

                               transfer
                        <----- result


                                     ...


                          <sweep settlement queue>

                                   <----- <real-world funds transfer fails>

                               payin-failure
                               notification ------->

                               collection-failure
                        <----- notification
```

3.2. Cardnumber Inquiries

This transaction occurs when one cardholder wishes to ascertain the state of another cardholder's account. Typically, a cardnumber inquiry transaction occurs when one cardholder, acting in the merchant role, is deciding whether to sell information to another cardholder, acting in the buyer role (e.g., prior to Step 2 in Section 3.1 above).

(1) The merchant sends a "inquiry-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

     The message contains: the buyer cardnumber.

(2) The Green Commerce server replies with a "inquiry-result" message.

     The message contains: the buyer cardnumber; and, the state associated with the cardholder's account.

3.2.1. Summary

```
     cardholder acting in      green commerce
      the merchant role            server
     --------------------      --------------
     inquiry
     request ------------------>

                               inquiry
                        <----- result
```

3.3. Transfer Inquiries

This transaction occurs when a cardholder wishes to ascertain the status of a funds transfer. Typically, a transfer inquiry transaction occurs when one cardholder, acting in the merchant role, wishes to determine the last action taken by a Green Commerce server.

(1) The merchant sends a "status-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

The message contains: the merchant's transaction-identifier.

(2) The Green Commerce server replies with a "status-result" message.

The message contains: the merchant's transaction-identifier; and, information about the last message sent by the Green Commerce server with respect to this transaction.

For a funds transfer, one of two responses is possible:

(1) A "transfer-query" response, which indicates that the Green Commerce server is waiting for "transfer-response" from the cardholder acting in the buyer role.

(2) A "transfer-result" response, which indicates that the Green Commerce server has placed the transaction into the settlement queue. The response also contains information about the "transfer-result" message which was previously sent to the cardholder which acted in the merchant role.

Note that once a transaction has been placed into the settlement queue, no additional information is available.

3.3.1. Summary

```
     cardholder acting in      green commerce
      the merchant role            server
     --------------------      --------------
     status
     request ----------------->

                               status
                        <----- result
```

3.4. Chargebacks

This transaction occurs when a real-world funds transfer associated with a previous "payin-notification" message results in a chargeback. Typically, this occurs when a cardholder whose pay-in method is a bankcard disputes a charge from a Green Commerce server after the server generates a real-world transaction using the pay-in method.

(1) The Green Commerce server sends a "payin-chargeback-notification" message to the electronic mail address associated with the buyer's account.

The message contains: the notification-identifier associated with the pay-in method; and, the pay-in amount in the currency associated with the cardholder's account.

(2) For each accumulated transaction associated with the "payin-notification" message associated with this chargeback, the Green Commerce server sends a "payout-chargeback-notification" message to the electronic mail address associated with the cardholder's account which acted in the merchant role.

The message contains: the server's transaction-identifier; and, the amount and currency charged back to the buyer which corresponds to this transaction.

3.4.1. Summary

```
     cardholder acting in      green commerce      cardholder acting in
      the merchant role            server             the buyer role
     --------------------      --------------      --------------------
                               payin-chargeback
                               notification ------->

                               payout-chargeback
                        <----- notification
```

3.5. Server Capabilities

This transaction occurs when a cardholder wishes to ascertain the capabilities of a Green Commerce server.

(1) The cardholder sends a "capabilities-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

(2) The Green Commerce server replies with a "capabilities-result" message.

The message contains: a list of supported transaction types and parameters; and, a list of supported currencies.

3.5.1. Summary

```
                          green commerce
cardholder                server
--------------------      --------------
capabilities
request ----------------->

                          capabilities
                   <----- result
```

3.6. Cardholder Applications

This transaction occurs when an Internet user wishes to establish a cardholder account.

(1) The applicant sends a "application-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

(2) The Green Commerce server replies with a "application-result" message.

The message contains: a set of cardholder account parameters to be filled-in by the user.

(3) The applicant fills in the parameters, and sends a "newacct-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

(4) The Green Commerce server replies with a "newacct-result" message.

The message contains: the status of the application; and, optionally, the cardnumber assigned to the applicant.

3.6.1. Summary

```
                             green commerce
     applicant               server
     --------------------    --------------
     application
     request ----------------->

                             application
                       <----- result

     newacct
     request ----------------->

                             newacct
                       <----- result
```

3.7. Account Maintenance

This transaction occurs when a cardholder wishes to change information associated with an account.

(1) The cardholder sends a "initchg-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol. The message contains: the cardnumber.

(2) The Green Commerce server replies with a "initchg-result" message.

The message contains: the cardnumber; and, a set of cardholder account parameters to be filled-in by the user.

(3) The cardholder fills in the parameters, and sends a "chgacct-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

(4) The Green Commerce server sends a "chgacct-query" message to the electronic mail address associated with the cardholder's account.

The message contains: a transaction-identifier uniquely-generated by the server; and, a list of attributes to be changed.

(5) The Green Commerce server waits for a response.

(6) If the cardholder responds, then a "chgacct-response" message is sent to the Green Commerce server.

The message contains: the server's transaction-identifier; and, an indication of the cardholder's willingness to allow updating the account, one of "yes", "no", or, "fraud".

(7) If the cardholder indicated "yes", then the Green Commerce server sends a "chgacct-result" message to the electronic mail address associated with the cardholder's account.

The message contains: the server's transaction-identifier; a list of attributes to be changed.

If the cardholder indicated "no", then no action is taken.

If the cardholder indicates "fraud", then the cardholder's cardnumber enters the invalid state.

3.7.1. Summary

```
                               green commerce
     cardholder                server
     --------------------      --------------
     initchg
     request ----------------->

                               initchg
                        <----- result

     chgacct
     request ----------------->

                               chgacct
                        <----- query

     chgacct
     response ---------------->

                               chgacct
                        <----- result
```

3.8. Account History

This transaction occurs when a cardholder wishes to retrieve messages relating to their activity.

(1) The cardholder sends a "history-request" message to a Green Commerce server. This request may be sent by either electronic mail or using an interactive protocol.

The message contains: the cardnumber.

(2) The Green Commerce server responds by sending a "multipart/mixed" message to the electronic mail address associated with the account.

The message contains recent messages sent to the cardholder by the Green Commerce server.

3.8.1. Summary

```
                            green commerce
     cardholder             server
     --------------------   --------------
     history
     request ------------------>

                       <----- multipart/mixed
```

4. Security Considerations

Given that an information merchant carries all risk of non-payment, the key security issue is authenticating the transfer-response message sent by the cardholder acting in the buyer role.

Although use of cryptographic services could provide protection against masquerade, replay, and manipulation of the transfer-response message, the Internet community presently lacks the supporting infrastructure to deploy these services on a widespread basis.

As such, the Green Commerce model makes no requirements for the use of these services. Instead, a two-pronged approach is taken:

(1) the transfer-response message contains the uniquely-generated transaction-identifier in the transfer-query message which was sent to the cardholder acting in the buyer role; and,

(2) care is taken to minimize the likelihood that electronic mail sent to the cardholder acting in the buyer role is intercepted (e.g., only authoritative DNS servers are consulted).

Of course, in the event of a third-party masquerading as a cardholder in the buyer role, that cardholder might initiate a chargeback.

Finally, as cryptographic services become widespread in the Internet, their use will be encouraged.

5. References

[1] Borenstein, N.S., and M.T. Rose, "The application/green-commerce MIME Content-type", First Virtual Holdings Incorporated, June, 1995.

[2] Rose, M.T., and N.S. Borenstein, "The Simple MIME eXchange Protocol (SMXP)", First Virtual Holdings Incorporated, June, 1995.

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