The Electronic Payment Industry

In today's fast-paced consumer retail market, analog dial-up payment processing systems account for the majority of all electronic payment configurations. The analog dial-up technology, among others offered by GAO Research, continually support systems such as Point-of-Sale (POS), Automated Teller Machines (ATMs), Multi-purpose Kiosks, Vending Machines and internal transactions processing, which are the back-office and ubiquitous transactions that are largely unnoticed by the general public. The majority of dial-up payment systems operate at low speeds, ranging from 300 kbps to 2.4 kbps. Some full-featured dial-up terminals and back-office systems are capable of high data rates of up to 56 kbps. This conventional analog dial-up communication channel is the foundation and will continue to be the mainstay of today's businesses.

POS Market Facts

- 28 billion transactions are made using dial-up POS systems in North America, as well as multi-billion transactions in EMEA.
- In the United States, there are 10 million payment terminals, over 60% currently dial-up terminals.
- POS terminals have a long shelf life, on average of 8 years.

Dial-up POS
• Accounts for 60% or more of all payment terminals in the world. • 8-12 seconds transaction time • Legacy systems are reliable and trusted • Low start-up costs • Security is not a concern

The Electronic Payment Process

When customers swipe their debit or credit card through the POS terminal, the transaction begins with the card reader extracting the Bank Identification Number (BIN). The BIN identifies the type of card, either debit or credit, as well as the issuing organization (VISA, MasterCard, American Express, etc.). The POS system then, based on the BIN, determines the network that should be accessed, the telephone number(s) for that network, and other operational parameters required to complete the transaction as quickly and securely as possible. These parameters include the data transfer rate, the line protocol, either synchronous or asynchronous, and the type of encryption and the encryption key to use.

POS terminals contain an embedded analog dial-up modem which operates through a 2-wire, analog voice-grade telephone line. Upon obtaining all required information, the POS terminal initializes the embedded modem and dials the appropriate number. Once the call is answered by the host, the two sides must negotiate parameters and synchronize their modems, in what is called the "hand-shaking" process.

POS modems typically are in compliance with the ITU-T V.21, V.22 and V.22bis standards, which use data rate of 300 bps, 1.2 kbps and 2.4 kbps respectively. Other high-speed specifications include V.32bis, V.34, and V.90, which have maximum data rates of 14.4 kbps, 33.6 kbps, and 56 kbps respectively. The widely used V.21, V.22 and V.22bis standards provide a speedy hand-shaking process, and because a typical transaction data message is only in the area of 300 bytes or less, these standards also provide a sufficient data rate to complete transactions within 8-12 seconds. The higher speed modems are typically used on specialized payment and banking systems and back-office, internal transaction processing systems that require the transfer of large amounts of data.

To control data flow and ensure error-free transmission, one of two lines protocols are negotiated: Asynchronous or Synchronous.

POS – Data Flow Control

Asynchronous Line Protocol

Most POS terminals operate on the asynchronous line interface. This protocol uses a seven-bit data packet, odd parity, plus one stop bit interface. The parity bit is used to detect errors in transmission. In addition, the asynchronous interface also uses a longitudinal redundancy character (LRC). The LRC is a single character that uses a simple XOR algorithm against the data stream to further detect incorrect transmissions. An ACK/NAK protocol is also used to allow the receiving end to notify the transmitting end of a bad transmission. If an ACK character is returned after a transmission, the transmitter knows that the data was successfully received. If a NAK is returned, the transmitter will know that that the data was not successfully received and will retransmit the data.

Synchronous Line Protocol

Some terminals operate using the synchronous line interface. In this case, an SDLC protocol is used as a polling interface to ensure successful transmission between host and terminal. SDLC is a bit-oriented interface. The SDLC also uses a 16-bit CRC to ensure data integrity. This allows for transmission of a full 8-bit character, as opposed to the asynchronous line protocol which can only support 7-bit characters. The payment processor needs to determine whether the transaction can be processed locally or if it must be transmitted to another site for processing. This determination process often consumes valuable time.

Local Authorization

If the decision were made that the transaction can be processed locally, this would be the last stop for the transaction. This "processing" may only involve the creation of a transaction log and an audit file which are used to provide a gross estimate of the available balance. The customer's account is updated at a later time. For a local authorization, the time taken to process the transaction is relatively fast.

Remote Authorization

When the transaction or a portion of it must be processed elsewhere, the transaction times and path is much more complicated. This is often handled by backend systems so the data must be repackaged into the appropriate format used by backend systems and is then sent to another site. The original incoming transaction is held by the payment processor while the backend transactions occur. This starts an additional clock on the transaction and can greatly extend the time of response for the original request. It is not uncommon for backend transactions to circle the globe as the processing occurs. This can potentially add up to 30 seconds to the total transaction time.

Eventually, whether locally or by a remote site, a response is returned. This response is routed back to the originating host and sent back to the originating device. The response message is transmitted and acknowledgement is received signifying the successful reception at the terminal. The final step of the transaction process is for the device to disconnect from the line and put back on-hook.

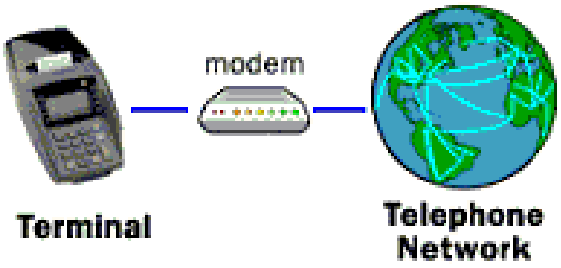

Figure 1 – POS Payment

GAO's POS Solution

GAO Research is currently the market leader, and a major supplier of embedded modem and telephony software that runs on many dial-up POS terminals. GAO software that powers the dial-up process includes a V.21 modem data-pump, DTMF detection and/or generation, Call Progress, Multi-frequency R1/R2, and others. Such software modules exist on dial-up POS terminals, transaction hosts and payment processors. Many POS manufacturers are still seeking dial-up communications software from GAO, and we are seeing millions of dial-up POS units still being deployed today. The reality remains that dial-up technology is the backbone of today's businesses.

As a long-standing pioneer and forerunner in the embedded communications industry, GAO Research provides a full range of telecommunications software, which powers current, and future electronic payment technologies.

Leadership in Embedded Communications Software

With over a decade of experience, GAO leads the embedded communications software market by providing comprehensive modem, fax, speech, and telephony technologies; broad technical expertise; and unsurpassed support to our world-class customers including electronics, communications, and semiconductor companies across the globe. GAO’s software integrates easily with MP3, MPEG, TCP/IP, and most popular real-time operating systems.

Rigorous Testing

GAO's testing facilities are equipped with state-of-the-art test equipment. Our software is rigorously tested on TAS, Consultronics, Rochelle, Advent and Telegra equipment under various channel models according to the relevant ITU or TIA standards. All GAO's speech software has passed the test vectors specified by the ITU. Our telephony software meets all appropriate TIA, EIA, BellCore, and Mitel standards.

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