MINIMISING OVERALL TRANSACTION TIME

Dial-up POS terminals can complete transactions in ten seconds or less. Surprisingly, it is less about faster modems and more about optimisations in call setup and handshakes. In this report, we review the regulatory requirements and then consider the options that can be used to drive down the overall transaction time. We also include a note on FastConnect and FastPOS technologies.

INTRODUCTION TO DIAL-UP POS

The time it takes a dial-up POS terminal to complete a transaction needs to be as low as possible. For the merchant, short transaction times speed up the checkout process, while for the network operator, it minimises congestion at peak times, thereby requiring less telecommunications resources.

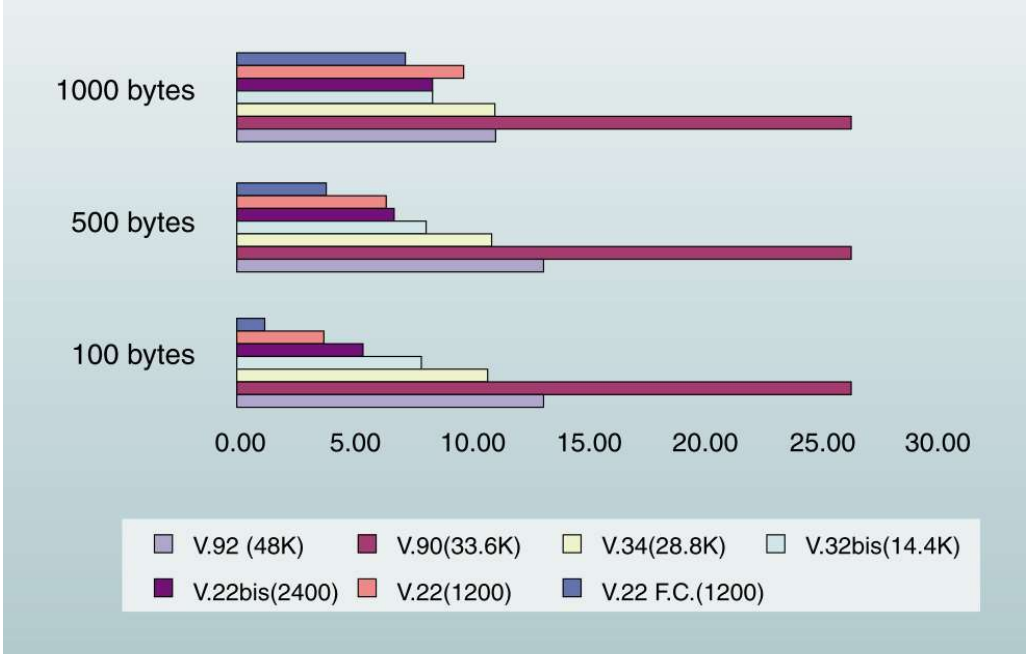
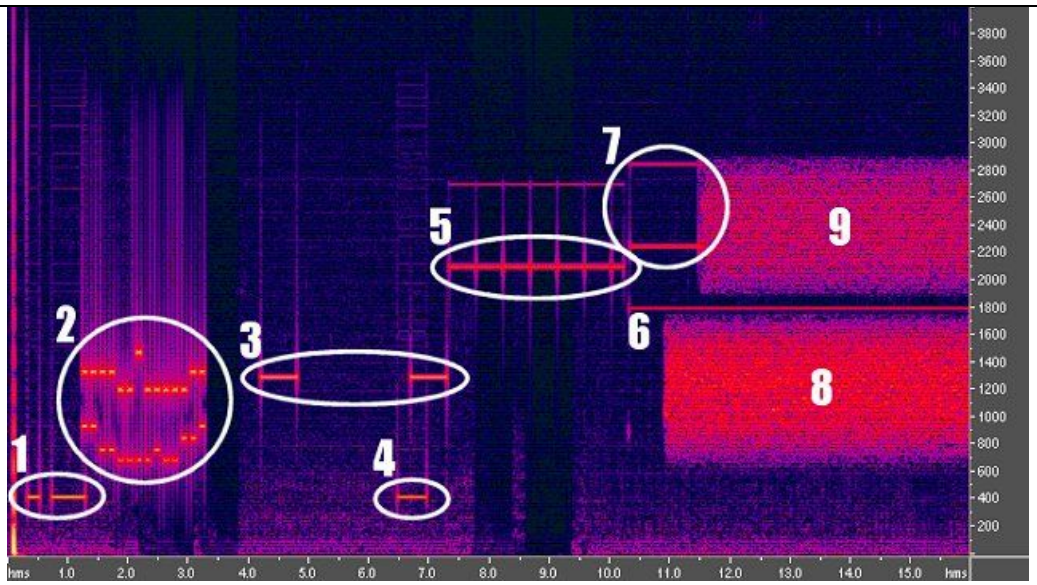


Figure 1 - Total transaction time for different modems [ss01]

Starting with Figure 1, the total transaction time for various modems is shown. The surprising result is that for exchanges of about 1 KB, typical of card transactions, faster modems actually fare worse, with the principal reason being the prolonged handshake and training times of their more advanced protocols.

Moving on to Figure 2, looking at the time diagram of an ITU-T compliant V.22 call, it is evident that a number of call phases can be shortened. Some phases are subject to regulatory rules, while some others are determined by the remote NAC.



Source: ■ PSTN, ■ Calling modem (terminal), ■ Answering modem (host)

1. ■ Dial tone
2. ■ DTMF dialling
3. ■ Calling tone
4. ■ Ringback tone
5. ■ Answer tone (2100 Hz)
6. ■ Guard tone (1800 Hz)
7. ■ Unscrambled 'high-band' marks
8. ■ Originate 'low-band' carrier
9. ■ Answer 'high-band' carrier

Figure 2 – Time diagram of an ITU-T compliant V.22 call

Terminal side setup

Telephone network operators will have a minimum time requirement from pick-up to dialling. This in turn depends on whether a dial tone is detected or blind dialling is used. The minimum off-hook delay is typically 30 ms,

while the minimum blind dialling delay is 2-3 s. Dialling may fail if the required delay is not observed. The DTMF digit on/off duration is typically 100 ms.

Host side setup

Looking at the time diagram of a standard ITU-T V.22 call, there are several time-intensive phases that can be shortened. When the host modem picks up the incoming call, it observes a billing silence (1.8-2.5 s). It then responds with the V.25 answering procedure. This basically consists of an answer tone with regular phase reversals for up to 4 s.

Handshake

Once the answer tone is sent, the handshake proper commences. The answering modem sends unscrambled marks, to which the calling modem responds with scrambled marks. Then, the answering modem responds in turn with scrambled marks, and after a synchronization delay, the V.22 link is established.

IMPROVING PERFORMANCE

Dialling speed can be optimized by avoiding blind-dialling and by shortening the DTMF digit on/off duration to around 60 ms.

The V.25 procedure can be shortened in a number of ways. On the terminal side, the calling tone can be disabled, while on the answering side, the answer tone can be shortened to 400 ms. Alternatively, modems can be configured to use Bell212A or FastConnect. With Bell212A, the answer tone doubles as unscrambled marks, while FastConnect improves on this by compressing the synchronization phases of the handshake.

Success depends on the correct configuration of both the host-side NAC and the terminal-side modem with proprietary AT commands.

FastConnect & FastPOS

FastConnect and FastPOS are proprietary technologies originally developed by Hypercom, a former maker of concentrators (e.g. MegaNAC series) as well as terminals. Hypercom was acquired by Verifone in 2011.

FastConnect refers to a compressed call setup procedure based on V.22 (1200 bps). To interoperate with a NAC supporting FastConnect, terminals may need to send HDLC flags instead of scrambled marks during the handshake. This can usually be achieved through proprietary AT commands.

FastPOS is based on V.29, a half-duplex 9600 bps protocol. It is not widely deployed because it is less resilient than V.22 on low-grade telephone lines.

Acronyms

bps	bits per second
DTMF	Dual-tone multi-frequency (dialling)
ITU	International telecommunications union
ITU-T	ITU telecommunication standardization sector
NAC	Network access controller
POS	Point of sale (terminal)
PSTN	Public switched telephone network
SDLC	Synchronous data link control

Recommendations / standards

Bell212A	1200 bps duplex modem standardized for use in the PSTN (USA)
V.22	1200 bps duplex modem standardized for use in the PSTN
V.22bis	2400 bps duplex modem using the frequency division technique
V.25	Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls
V.29	9600 bps modem standardized for use on point-to-point 4-wire leased telephone-type circuits

References

[ss01] "Embedded modems: When slow is fast and fast is slow"
Sanders S; TDK Semiconductor, Feb-2001