# Fairisle/Yes/Maybe ATM Taxi Link Protocol

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Discussions between the Computer lab and Olivetti have suggested a few changes and extensions to the ATM drop cable interface proposed by Sun/Xerox. These include extensions to the commands used between the Taxi chips to allow hardware handshaking. In addition to the use of optical fiber, as proposed in the Sun/Xerox document, we propose to use twisted pair links for shorter distances. In both cases the link distance is short, with an upper limit of 500M for a fiber link and 100M for a copper link. The TAXIchip family allow both systems to be used, having compatibility between the FOXI and TAXI devices.

## 1 Cell Format

The cell format is essentially the same as for B-ISDN, except nothing is said about the header data format. Thus a cell has a 4 octet header, followed by a single octet Header Error Check (HEC) and a 48 octet payload. The HEC may be omitted since there is dispute about its usefulness on a Taxi link. If present the HEC is formed from the CCITT CRC polynomial $x^8 + x^2 + x + 1$, initialised to zero and exclusive-ored with 01010101 before insertion.

The start of cell that includes the HEC is indicated by transmission of a TAXI TT command, the 53 octets of the cell will follow this. A cell that does not contain a HEC is started with a Taxi SR character which is followed by 52 data octets. Thus receiver can determine whether to check for the HEC based on the start mark, and receivers which only accept one form can drop cells of the other type. At least one TAXI Sync character should be inserted between cells[1]. Note that the TAXIchips cannot be told to transmit a Sync character, instead a cycle with no transmission should be used.

[1] This is not needed by our hardware, but maintains compatibility with the Sun/Xerox proposals.

## 2 TAXI command characters

The following TAXIchip command characters are used:

| Name | Taxi Mnemonic | Taxi code | Use |
|---|---|---|---|
| Sync | JK | 0000 | Pad when no transmission, line synchronisation |
| Xon | II | 0001 | continue transmission (see text) |
| Soc | TT | 0010 | Start of Cell with HEC - precedes 53 data octets |
| Xoff | TS | 0011 | Stop transmission (see text) |
| Held | TR | 0101 | Transmission has been stopped (see text) |
| Sno | SR | 0110 | Start of Cell with no HEC - precedes 52 octets |

With the exception of Soc/Sno, commands may be sent at any time. Receiving hardware should be able to continue assembling a cell even if the data component is interrupted by a command. This is useful for several reasons. Firstly it enables data to be injected onto the link at a slower speed than the TAXIchip is being clocked - the chip will automatically insert Sync commands between data items in this case. Secondly it enables the handshake commands (which apply to the other side of the link) to be sent in a timely manner even if the sender is also transmitting data.

The handshake commands Xoff and Xon are generated by a receiving node to request the transmitter to stop or continue sending. Since the link distance is short this simple protocol can be used, for links with several cells delay in the transmission media other techniques would be required. The Xoff command requests that the transmitter stops sending at the end of the current cell or before. Thus a transmitter may choose to respond to an Xoff by stopping immediately, but the cell seems the natural unit to use for this activity. A transmitter which has been stopped may continue to send all commands except Soc/Sno. When a transmitter is stopped it should periodically send Held commands to prevent loss of an Xon from stalling the system. A receiver should send the Xon command when it has sent an Xoff and is now prepared to receive another cell, or if it sees a Held command and is prepared to receive a cell. The Xon/Xoff handshaking is only advisory – thus Xoff is a suggestion that the transmitter stop to avoid data loss, but it may be ignored by simple implementations.

The Taxi use of 4B/5B and NRZI encoding ensures that the transmitted data will always have the same average amount of high and low times, so the DC balance of the line is ensured. The Taxi command set has this property when averaged over the transmission of a single character. However some of the command characters have few transitions, so there use is not recommended - these characters have been avoided when selecting the codes used above.

## 3 Implementation

The protocol has been implemented in a Xilinx 3020 programmable gate array, which generates the CRC, controls handshaking and provides data buffering between fifos and the Taxi chips.