Theory of XY-modem Protocol

This application note describes the theory of XY-modem protocol used for the “UART and 2-wire Interface Reconfiguration of the AT94K FPSLIC using an AT17 Series EEPROM” application note, available on the Atmel web site, at http://www.atmel.com/atmel/acrobat/doc3012.pdf. The XY-modem protocol provides a set of rules for half-duplex communication. This protocol is considered to be receiver driven, which requires the receiver to initialize the packet transmission by sending a “C” character to the transceiver. The “C” character represents the cyclic redundancy checksum (CRC) method for verifying the transferred data packet, see Table 1.

After the “C” character is received by the transceiver, the first packet, which contains file information, will be delivered to the receiver. After the package is validated, the receiver will either signal the transceiver with the acknowledge (ACK) byte or the not acknowledge (NACK) byte. If the receiver sends the NACK byte to the transceiver due to the detection of the incorrect packet, the correct packet will be delivered to the receiver again. On the other hand, if the packet is validated to be a good packet and the ACK byte is sent to the transceiver, the receiver will send another “C” character to the transceiver to indicate that the actual data transmission from a file can be started. Then, the transceiver will send out the second packet, which contains the actual data from a transmission file. The receiver validates the second packet and responds with an ACK or a NACK byte, and then the transceiver will either send the next packet or re-send the last packet. This process will continue until an EOT (end of packet byte) is received at the receiver side and properly acknowledged, and sent back to the transceiver, see Table 2 and Table 3.

Table 1. Table 1. XY-model (CRC Mode) Packet Format

Byte 1	Byte 2	Byte 3	Bytes 4-131	Bytes 132-133
Start of Header	Packet Number	~(Packet Number)	Packet Data	16-bit CRC

Table 2. XY-model Protocol Flow Control

Symbol	Description	Hexadecimal Value
SOH	Start of Header	0x01
EOT	End of Transmission	0x04
C	ASCII “C”	0x67
ACK	Acknowledge	0x06
NAK	Not Acknowledge	0x25

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Table 3. XY-modem (CRC mode) Data Flow Example

Transceiver						Receiver
					<----------	Send First “C” Character[1]
SOH	0x01	0xFE	Data	CRC	---------->	Packet Not OK
					<----------	NAK
SOH	0x01	0xFE	Data	CRC	---------->	Packet OK
					<----------	ACK
					<----------	Send Second “C” Character[1]
SOH	0x02	0xFD	Data	CRC	---------->	Packet Not OK
					<----------	NAK
SOH	0x02	0xFD	Data	CRC	---------->	Packet OK
					<----------	ACK
SOH	0x03	0xFC	Data	CRC	---------->	Packet OK
					<----------	ACK
...	...	...	...	...	...	…
					<----------	ACK
EOT					---------->	Packet OK
Finished					<----------	ACK

Note: 1. The first packet always contains the file information. Therefore, another “C” character must be used to signal the transceiver that the receiver is ready to receive the actual data from the file.

Theory of Cyclic Redundancy Check

The cyclic redundancy check (CRC) method operates on blocks of data, called frames. The transceiver appends a bit sequence to every frame called the frame check sequence (FCS). The resulting frame is exactly divisible by a predetermined number. After receiving the frame, the receiver will also divide the frame by the predetermined number. If there is a remainder, the frame is considered corrupted and a retransmission is requested. This method is commonly used in many protocols of communication. It provides a high level of error-detection with speed and ease of use.

Reference

Sheldon, Tom. “Encyclopedia of Networking”, (http://www.tec-ref.com).

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