memorandum

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To	From	Subject	Date
INCITS T10 Committee	Michael Banther, HP	ADT-2 Negotiable Time-Outs	1 November 2006

Revision History

Revision 0 – Initial document.

Revision 1 – Changes to the timeout formula. Provide asymmetric timeouts using new link service information units.

Revision 2 – Added a usage model. Changed the Timeout IU format consistent with comments received at the September, 2006 ADI-2 working group meeting.

Related documents

Automation/Drive Interface – Transport Protocol – 2 (ADT-2), T10/1742-D, revision 3, 20 July 2006.

Background

During the development of ADT, the ADI working group sought to find a formula for the acknowledgment time-out that would suit all of the known connection strategies used between existing automation devices and DT devices. Short time-out values favor time-division multiplexing connections between one automation device and several DT devices. Longer time-out values favor continuous connections between one automation device and one DT device or event-driven multiplexing connections between one automation device and several DT devices.

Experience has shown that the acknowledgement time-out formula chosen for ADT does not provide the flexibility desired by automation device developers. HP proposes replacing certain constants in the existing formula with negotiable parameters to allow run-time customization to the acknowledgement time-out value chosen.

Changes to the ADT-2 draft standard

4.6.1.2.2 Acknowledgement IU time-out

The sender of a frame, other than an acknowledgement IU, shall time-out the resulting acknowledgement. It shall be considered an error condition if a corresponding acknowledgement IU is not received within the time-out period. The time-out period shall start after the EOF of the frame has been sent. When operating with a maximum ACK offset greater than one, a port may start the time-out period for a frame that has completed transmission after the acknowledgement IU for a previously sent frame has been received. ~~The minimum acknowledgement IU time-out period shall be calculated using the formula in figure 9.~~

When changing operating parameters (see 3.1.31), a port shall calculate its acknowledgement IU time-out period using the formula in figure 9.

$Timeout_{ACK}$ = (Period * $Size_{MAX}$ * 2) + (Period * ($Offset_{MAX}$ * $Size_{NAK}$ * 2)) + 0,1 ~~seconds~~

Where:

$Timeout_{ACK}$ is the minimum time-out period in seconds.

Period is the time per byte calculated as (10 / Baud Rate) and is expressed in seconds per byte.

$Size_{MAX}$ is the ~~M~~maximum ~~P~~payload ~~S~~size negotiated with the Port Login process, plus SOF, EOF, ADT Header, and checksum bytes (see 6.1).

$Offset_{MAX}$ is the maximum ACK offset negotiated with the Port Login process (see 4.4).

$Size_{NAK}$ is the size in bytes of the NAK IU including SOF, EOF, and checksum bytes (see 6.5.3.3).

For example, at 9 600 Baud with a negotiated Maximum Payload Size of 1 024 and Maximum ACK Offset of 2, the minimum timeout period would be approximately 2,28 seconds.

Figure 9 — Minimum acknowledgement time-out period

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A port may request a change to another port's acknowledgement IU time-out using the Time-out IU (see 6.5.13). The port requesting the change originates an exchange by sending a Time-out IU to the other port with the DESCRIBE bit set to one. The receiving port responds with a Time-out IU that describes its current, minimum, and maximum acknowledgement IU time-outs and its acknowledgement IU time-out resolution. From this information, the originating port determines the acknowledgement IU time-out value it will request the responding port to use. The originating port makes its request by sending a second Time-out IU with the REQUEST bit set to one and the requested acknowledgement IU time-out value in the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field.

6.5.1 Link service frames overview

Table 12 – Link service information units

Frame Type	Description
0h	ACK (acknowledge)
1h	NAK (negative acknowledge)
2h	Port login
3h	Port logout
4h	Pause
5h	NOP (no operation)
6h	Initiate recovery
7h	Initiate recovery ACK (acknowledgement)
8h	Initiate recovery NAK (negative acknowledgement)
9h	Device Reset IU
Ah	Time-out
~~A~~Bh - Fh	Reserved

6.5.X Time-out information unit

A port may send a Time-out IU to:

a) Request that the other device's port send a description of the acknowledgement IU time-out values that it supports;
b) Set the acknowledgement IU time-out value of the other device's port; or
c) Send a description of the acknowledgement IU time-out values that the sending port supports.

Table Y defines the payload of the Time-out parameters IU.

Table Y – Time-out IU payload contents

Bit / Byte	7	6	5	4	3	2	1	0
0	REQUEST	DESCRIBE	Reserved				Vendor Specific	
1	Reserved							
2	Reserved							
3	Reserved							
4	(MSB)	CURRENT ACKNOWLEDGEMENT IU TIME-OUT						
5								(LSB)
6	(MSB)	MAXIMUM ACKNOWLEDGEMENT IU TIME-OUT						
7								(LSB)
8	(MSB)	MINIMUM ACKNOWLEDGEMENT IU TIME-OUT						
9								(LSB)
10	(MSB)	TIME-OUT RESOLUTION						
11								(LSB)

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A DESCRIBE bit set to one specifies that the receiving port shall send a Time-out IU containing a description of the acknowledgement IU time-out values it supports. The Time-out IU containing the description of time-out values shall have the DESCRIBE and REQUEST bits set to zero. A port receiving a Time-out IU with the DESCRIBE bit set to one shall ignore the CURRENT ACKNOWLEDGEMENT IU TIME-OUT, MAXIMUM ACKNOWLEDGEMENT IU TIME-OUT, MINIMUM ACKNOWLEDGEMENT IU TIME-OUT and TIME-OUT RESOLUTION fields. A DESCRIBE bit set to zero specifies that the receiving port shall not send a Time-out IU containing a description of the acknowledgement IU time-out values it supports.

If the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field contains a supported value and the REQUEST bit is set to one, the receiving port shall set its acknowledgement IU time-out to the value contained in the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field. If the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field contains an unsupported value and the REQUEST bit is set to one, the receiving port may set its acknowledgement IU time-out to the closest supported acknowledgement IU time-out value greater than the value contained in the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field. If the port sets its acknowledgement IU time-out to the closest supported acknowledgement IU time-out value greater than the value contained in the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field, the port shall send an ACK IU in response to the Time-out IU. A REQUEST bit set to zero specifies that the receiving port shall not alter the value of its acknowledgement IU time-out.

> Editor's Note: When does the new value of the acknowledgement IU time-out come into effect? Where is the best place in the standard to describe when it comes into effect, here or the model clause?
>
> Editor's Note: I've received a suggestion that a port that alters its acknowledgement IU time-out due to receipt of a Time-out IU should send a Time-out IU containing the new acknowledgement IU time-out value in the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field. Should I alter the proposal to include this behaviour?

If the REQUEST bit is set to zero and the DESCRIBE bit is set to zero, the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field specifies the current acknowledgement IU time-out value in milliseconds of the responding port (see 4.6.1.2.2). If the REQUEST bit is set to one and the DESCRIBE bit is set to zero, the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field specifies the acknowledgement IU time-out value for the responding port requested by the originating port. If the DESCRIBE bit is set to one, the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field is reserved.

If the REQUEST bit is set to zero and the DESCRIBE bit is set to zero, the MAXIMUM ACKNOWLEDGEMENT IU TIME-OUT field specifies the maximum acknowledgement IU time-out value in milliseconds supported by the responding port (see 4.6.1.2.2). If the REQUEST bit is set to one and the DESCRIBE bit is set to zero or if the DESCRIBE bit is set to one, the MAXIMUM ACKNOWLEDGEMENT IU TIME-OUT field is reserved.

If the REQUEST bit is set to zero and the DESCRIBE bit is set to zero, the MINIMUM ACKNOWLEDGEMENT IU TIME-OUT field specifies the minimum acknowledgement IU time-out value in milliseconds supported by the responding port (see 4.6.1.2.2). If the REQUEST bit is set to one and the DESCRIBE bit is set to zero or if the DESCRIBE bit is set to one, the MINIMUM ACKNOWLEDGEMENT IU TIME-OUT field is reserved.

If the REQUEST bit is set to zero and the DESCRIBE bit is set to zero, the TIME-OUT RESOLUTION field specifies the minimum change to the acknowledgement IU time-out value in milliseconds supported by the responding port (see 4.6.1.2.2). If the REQUEST bit is set to one and the DESCRIBE bit is set to zero or if the DESCRIBE bit is set to one, the TIME-OUT RESOLUTION field is reserved.

Upon receiving a Time-out IU with the DESCRIBE bit set to one and the REQUEST bit set to one, a port shall send a NAK IU with a status code of INVALID OR ILLEGAL IU RECEIVED (see table 14).

Upon receiving a Time-out IU with the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field set to an unsupported value and the REQUEST bit is set to one, a port may send a NAK IU with a status code of INVALID OR ILLEGAL IU RECEIVED (see table 14). If the port sends a NAK IU for this reason, it shall not alter the value of the acknowledgement IU time-out.

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6.5.12.1 Link service exchange types

Link service exchanges may be negotiation exchanges, port logout exchanges, pause exchanges, NOP exchanges, ~~or~~ device reset exchanges, or time-out exchanges.

6.5.12.4 Time-out exchange lifetime

In a port initiating a time-out exchange, the exchange begins when the port transmits a Time-out IU with the REQUEST bit set to zero and the DESCRIBE bit set to one in a nonexistent exchange. In a port not initiating a time-out exchange, the exchange begins when the port receives a Time-out IU with the REQUEST bit set to zero and the DESCRIBE bit set to one in a nonexistent exchange. A time-out exchange ends in a port when either:

a) the port has sent a Time-out IU with the REQUEST bit set to one and the DESCRIBE bit set to zero in an existing exchange and received an acknowledgement IU in response to it;

b) the port has received a Time-out IU with the REQUEST bit set to one and the DESCRIBE bit set to zero in an existing exchange and sent an acknowledgement IU in response to it;

c) the port has sent a Time-out IU and received a NAK IU in response to it;

d) the port has received a Time-out IU and sent a NAK IU in response to it;

e) the port has received a Time-out IU with a different exchange ID, indicating that a new time-out exchange has started.

If a port receives a Time-out IU with the DESCRIBE bit set to zero in a nonexistent exchange, it shall transmit a NAK IU with a status code of INVALID EXCHANGE ID (see table 14) and discard the Time-out IU.

Editorial Note: How does a port respond when it receives a Time-out IU with the CURRENT ACKNOWLEDGEMENT IU TIME-OUT field set to an unsupported value, the REQUEST bit is set to one, and the DESCRIBE bit set to zero in a nonexistent exchange (see last paragraph of 6.5.X)?