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TITLE: G.hs.bis: Optional Addition of Information Fields to MR Message

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ABSTRACT

This contribution proposes the addition of optional information fields to the MR message to support the initiation of power backoff measurement and line probing from G.994.1.

1.   Introduction

In G.shdsl, Agreed Items 7.3.1 and 7.3.2 state that the power backoff measurement and line probing sequence shall be initiated and completed by G.hs. Contributions NG-062 and NG-103 note that the initiation of such a sequence for G.shdsl (and other recommendations) from G.hs requires the extension of the messaging protocol or definitions. Unlike a normal parameter exchange, initiation of power backoff measurement and line probing requires that both ends be able to set the parameters for the probe sequence into their own receiver. G.hs, as currently defined, contains no mechanism for this bidirectional parameter selection. This contribution proposes that the MR message be extended with optional information fields to address this shortcoming. This extended MR with parameters is termed an "MR-P" message.

2.   Discussion

In the recently approved G.994.1, the only message that can send a request with parameters is the MS message. Although messages such as MR, REQ-MR, REQ-MR, and REQ-CLR "request" action by the opposite HSTU-X, those messages do not contain parameter octets. Similarly, while a CLR message requests the HSTU-C to send a CL, the parameters in the CLR message only describe the capabilities of the HSTU-R. The HSTU-C has no means to ACK/NAK "requests" that might attempted in CLR parameter fields. Only CLR protocol errors can be NAK'd, not the contents of the octets. In the current G.994.1, that leaves only MS messages to make parameter and mode requests. The unit sending the MS message can select any parameter set that is allowable, based on either *a priori* knowledge or the contents of the CLR/CL exchange, but the other end has no mechanism for influencing the selected set of parameters (other than "NAKing" the choice).

A simple approach to resolving this issue is to extend the MR message, allowing the optional inclusion of parameter fields. Such an expanded "MR-P" message, in conjunction with the existing MS message could be used to allow a bidirectional parameter negotiation. No other modifications would be required to the existing G.hs protocol definitions and transactions, and existing units could continue to use the short version of MR without the parameter fields.

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2.1 Session Summary

The expanded MR-P message would be used to initiate a **Transaction B** (§10.1.2/G.994.1) to negotiate and select the parameters for a Power Backoff / Line Probe (PBO/LP) mode of an xDSL. At the termination of Transaction B, the HSTU-X would perform a cleardown (§11.3/G.994.1) and initiate the PBO/LP, in which signals would be transmitted from the HSTU-X to measure power backoff and line characteristics. After the PBO/LP, the HSTU-R would restart G.944.1 and again initiate a Transaction B with the MR-P message. In this transaction, the parameters from the PBO/LP would be exchanged and the final xDSL mode of operation selected. Following the G.994.1 cleardown, the selected xDSL would begin training. The entire sequence is illustrated in Figure 1.
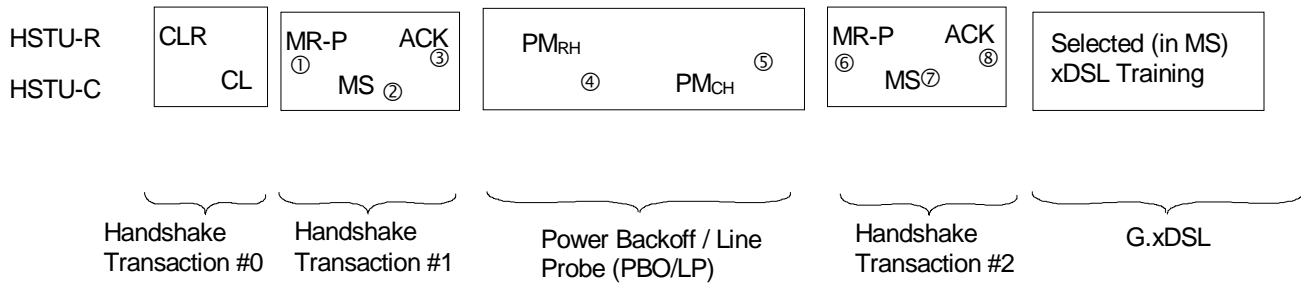

Figure 1. xDSL Start Sequence Including G.994.1 Sessions and PBO/LP Mode

2.2 Message Construction Summary

In the MR-P message, the HSTU-R requests a PBO/LP by setting a NPar(2) bit. The downstream PBO/LP parameters are requested through SPar(2) and NPar(3) octets. The HSTU-C responds with an MS message, containing both upstream and downstream PBO/LP parameters. After the HSTU-R sends the ACK message, the G.994.1 session sends cleardown as per §11.3 and then the PBO/LP signals are sent. The procedure assumes that, after the PBO/LP mode completes, each xTU-X will return control to G.994.1. The characteristics and timing of the PBO/LP signals are predetermined in the G.994.1 transaction B exchange.

After each side has performed its measurements and analysis, it must inform the opposite side of its specific value request of the PBO and other probe parameters (e.g., data rate). Again, this is a request with parameters requiring the MR-P/MS version of transaction B.

An overview of the contents of each message is given in Table 1. Note that "#" corresponds to the step number in Figure 1.

Table 1. PBO/LP Message Sequence

Transmit Unit	Message / Signal Name	#	Description
HSTU-R (optional)	CLR	0a	The message includes: • Information on the capabilities of types of PBO/LP signals that the HSTU-R can transmit.
HSTU-C (optional)	CL	0b	The message includes: • Information on the capabilities of types of PBO/LP signals that the HSTU-C can transmit.
HSTU-R	MR-P	1	The message: • is a request for the PBO/LP. • includes the parameters of the signal(s) to be transmitted by the HSTU-C.
HSTU-C	MS	2	The message: • is a selection of the PBO/LP. • includes the parameters of the signal(s) to be transmitted by the HSTU-R. • echoes the parameters of the signal(s) to be transmitted by the HSTU-C.
HSTU-R	ACK	3	The message Acknowledges selection of PBO/LP.
HSTU-R	PM_{RH}	4	HSTU-R PBO/LP signal(s),as defined in the associated xDSL Recommendation and selected by the HSTU-C.
HSTU-C	PM_{CH}	5	HSTU-C PBO/LP signal(s),as defined in the associated xDSL Recommendation and selected by the HSTU-R.
HSTU-R	MR-P	6	The message: • acknowledges reception of PM_{CH}. • is a request for a specific xDSL modulation mode (with possible data rate preferences). • contains parameter requests based on the analysis of downstream PBO/LP signal(s).
HSTU-C	MS	7	The message: • acknowledges reception of PM_{RH}. • is a selection for a specific xDSL modulation mode (with possible data rate preferences). • contains parameter selections based on the analysis of upstream PBO/LP signal(s). • contains parameter selections based on the content of the MR-P message.
HSTU-R	ACK	8	The message Acknowledges the MS parameter and mode selections.
-	Training	-	Training begins

2.3 Additional Considerations

In "revision 1" of G.994.1, an HSTU-X generating its MS message contents never needed to consider input from the opposite HSTU-X. In order to preserve backward compatibility with revision 1 of G.994.1, the contents of an MS message should always be able to override the parameters and mode suggested in MR-P. (Obviously, this should be done cautiously so as to avoid receiving a NAK). This implies that HSTU-R would always be submissive, giving the HSTU-C the "final say" on all PBO/LP parameters.

Before selecting the power level of the PBO/LP signals, the HSTU-X should make a rough estimation of the line length/attenuation by examining the received power levels of the G.994.1 carrier(s). In general, for politeness reasons, power levels should be selected so as to error on the side of caution.

The following special cases should also be considered:

(1) How does an HSTU-C indicate it wants to do a PBO/LP session? (In other words, what should an HSTU-C do when the HSTU-R initiates the transaction with a plain MR or MS?)

- If the HSTU-C receives a MR-only message:
  - *Recommended Solution:* Respond with MS with PBO/LP mode selected. This notifies the HSTU-R that the PBO/LP will begin unless NAKed. If the HSTU-R now decides that it does want to suggest the PBO/LP parameters, it can then send a NAK-NR (Not ready) to conclude that transaction and then immediately initiate a new transaction by sending MR-P with it's suggestions.
- If the HSTU-C receives a MS message:
  - *Recommended Solution:* Respond with REQ-MR. HSTU-R will respond with MR, then HSTU-C will respond with MS with PBO/LP mode selected. (Then this becomes the same scenario as above).

(2) If PBO/LP measurements are not successful, how can another session be initiated?

- If the HSTU-R was unable to determine an appropriate PBO level from the received PM_{CH}, it can again suggest PBO/LP mode in the MR-P message sent after the PBO/LP (where the PBO downstream value normally would have been transmitted).
- If the HSTU-C was unable to determine an appropriate PBO level from the received PM_{RH}, it can again suggest PBO/LP mode in the MS message sent after the PBO/LP (where the PBO value normally would have been transmitted).

3.   Summary

This contribution should be presented under agenda item G.hs.bis.

It addresses Open Items 7.1 and 7.1.1, and it proposes a new Agreed Item, as follows:

- Agreed that the MR message shall be extended to include optional parameter fields for use in bidirectional parameter negotiations.

It proposes that the text modifications shown in Annex A, below, be included in the body of G.hs.bis.

It is further proposed that additional explanatory text be added, either as an informative Appendix to G.hs.bis or as a part of the PBO/LP text within the various xDSL recommendations.

Annex A: Proposed Text Changes for G.hs.bis

TABLE 12/G.994.1

Overall message composition

Messages	IDENTIFICATION			STANDARD INFORMATION	NON-STANDARD INFORMATION
	Message type and revision **(2 octets)**	**Vendor ID** **(8 octets)**	**Service and channel parameters** **(NOTE 1)**	**Modulations and Protocols available** **(NOTE 2)**	**(NOTE 3)** $(1+ \sum_{i=1}^{N}(7 + M_i))$ **octets**
MR	X	Optional	Optional	Optional	Optional
CLR	X	X	X	X	as necessary
CL	X	X	X	X	as necessary
MS	X	-	X	X	as necessary
ACK	X	-	-	-	-
NAK	X	-	-	-	-
REQ	X	-	-	-	-
NOTE 1 - As defined in Table 8/G.994.1 through Table 9.6/G.994.1. NOTE 2 - As defined in Table 10/G.994.1 through Table 11.10.2.3/G.994.1. NOTE 3 - As defined in Figure 10/G.994.1 and Figure 11/G.994.1.					

10.1.2 Transaction B

In Transaction B, the HSTU-R requests that the HSTU-C select the mode of operation. The HSTU-C selects the mode by transmitting an MS message. When the HSTU-R responds with an ACK(1) message, both stations shall transition to the selected mode.

The HSTU-R may optionally include parameter fields in the MR message. Any such parameters shall be treated as requests by the HSTU-C. Parameter included in the MS message shall be considered authoritative.

If the HSTU-C cannot determine a common mode of operation (either standard or non-standard) from previous capabilities exchanges, or is not prepared to select a mode at this time, it shall send an MS message with the Non-standard field bit in Table 8 and all coding points in Table 22 and Table 23 set to binary ZERO. When the HSTU-R receives this message, it shall respond with an ACK(1) message. The HSTU-C shall then initiate the cleardown procedure specified in § 11.3.