

TR-371

G.fast Vector of Profiles (VoP) Managed Object Structure

Issue: 01
Issue Date: July 2016

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Issue History

Issue Number	Approval Date	Publication Date	Issue Editor	Changes
1	18 July 2016	5 August 2016	Joey Boyd, ADTRAN	Original

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Executive Summary

The purpose of this Technical Report is to provide a management model for G.fast based on the parameters described in the ITU-T Recommendation G.997.2 [6]. The management model is independent of any protocol.

1 Purpose and Scope

1.1 Purpose

The purpose of this Technical Report is to provide a management model for G.fast based on the parameters described in the ITU-T Recommendation G.997.2 [6]. The management model is independent of any protocol.

1.2 Scope

This Technical Report places into an object model all the parameters specified in G.997.1 for:

- Configuration Management
- Status Monitoring
- Performance Monitoring including thresholds
- Test/Diagnostics
- Inventory data

The model contains only the parameters in the version of G.997.2 listed in the references [6] and excludes any in later amendments.

2 References and Terminology

2.1 Conventions

In this Technical Report, several words are used to signify the requirements of the specification. These words are always capitalized. More information can be found in RFC 2119 [1].

MUST	This word, or the term “REQUIRED”, means that the definition is an absolute requirement of the specification.
MUST NOT	This phrase means that the definition is an absolute prohibition of the specification.
SHOULD	This word, or the term “RECOMMENDED”, means that there could exist valid reasons in particular circumstances to ignore this item, but the full implications need to be understood and carefully weighed before choosing a different course.
SHOULD NOT	This phrase, or the phrase "NOT RECOMMENDED" means that there could exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications need to be understood and the case carefully weighed before implementing any behavior described with this label.
MAY	This word, or the term “OPTIONAL”, means that this item is one of an allowed set of alternatives. An implementation that does not include this option MUST be prepared to inter-operate with another implementation that does include the option.

2.2 References

The following references are of relevance to this Technical Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

Document	Title	Source	Year
[1] RFC 2119	<i>Key words for use in RFCs to Indicate Requirement Levels</i>	IETF	1997
[2] TR-252i3	<i>xDSL Protocol-Independent Management Model</i>	BBF	2013
[3] G.9700	<i>Fast access to subscriber terminals (G.fast) – Power spectral density specification</i>	ITU-T	2014
[4] G.9701	<i>Fast access to user terminals (FAST) - Physical</i>	ITU-T	2014

layer specification

- | | | | | |
|-----|-------------------------|---|-------|------|
| [5] | G.997.1 | <i>Physical layer management for digital subscriber line (DSL) transceivers</i> | ITU-T | 2012 |
| [6] | G.997.2 | <i>Physical layer management for G.fast transceivers</i> | ITU-T | 2015 |
| [7] | G.994.1 | <i>Handshake procedures for digital subscriber line (DSL) transceivers</i> | ITU-T | 2012 |
| [8] | TR-165 | <i>Vector of Profiles</i> | BBF | 2009 |

2.3 Definitions

The following terminology is used throughout this Technical Report.

DPU Distribution Point Unit. The node that resides at the DP in the Fiber To The Distribution Point architecture.

2.4 Abbreviations

This Technical Report uses the following abbreviations:

FAST	Fast Access To Subscriber Terminals
FTU-O	FAST Transceiver Unit - Office
FTU-R	FAST Transceiver Unit - Remote
NDR	Net Data Rate
NT	Network Termination
QLN	Quiet Line Noise
VoP	Vector of Profiles
xDSL	Any Digital Subscriber Line Service

3 Technical Report Impact

3.1 Energy Efficiency

TR-371 has no impact on energy efficiency.

3.2 IPv6

TR-371 has no impact on IPv6.

3.3 Security

TR-371 has no impact on security.

3.4 Privacy

Any issues regarding privacy are not affected by TR-371.

4 FAST managed object model

4.1 Overview

This specification is based on the managed objects listed in ITU-T Recommendation G.997.2 [6]. The object model in this specification only specifies the structure of the managed objects. The detailed parameter definitions and their access modes (read-only vs read-write) are specified in ITU-T recommendations G.9700 [3], G.9701 [4], and G.997.2 [6].

The FAST Configuration Profiles and FAST Line Configuration (see section 4.2 and section 4.4), FAST Inventory (see section 4.2.3), FAST Status Monitoring (see section 4.3), FAST Performance Management (see section 5), and FAST Test/Diagnostics (see section 4.6) are at the highest level of the FAST managed object model. These objects are defined in subsequent sections.

NOTE - Where TR-252i3 [2] uses the terminology “xDSL” in many instances, the corresponding terminology “FAST” is used here. Similarly, where TR-252i3 [2] uses the terminology “xTU” in many instances, the corresponding terminology “FTU” is used here.

4.2 Object Model for FAST Configuration Management

4.2.1 FAST Line

The FAST Line object represents an individual physical transmission line and its associated parameters and states.

The FAST Line Configuration level is shown in Figure 1.

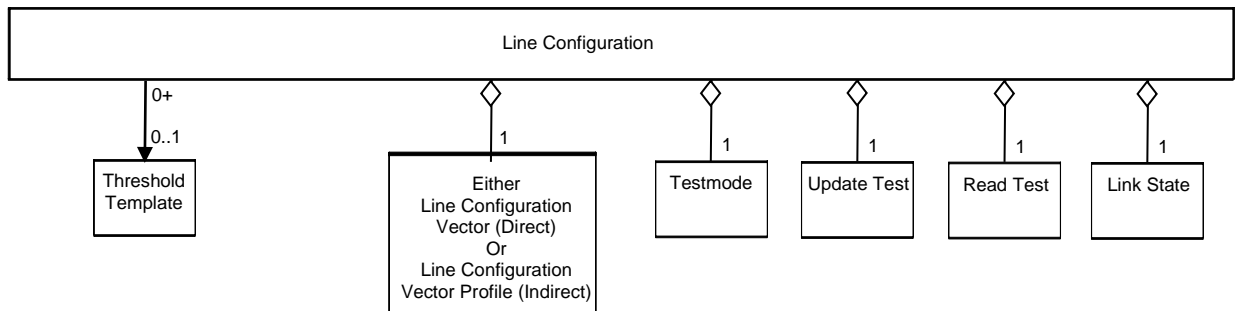


Figure 1/TR-371 – FAST Managed Object Model: Line Configuration

The FAST Line Configuration can be in one of two modes:

- In ‘direct’ attachment mode, the FAST Line Configuration MUST contain a Line Configuration Vector. All pointers in the Line Configuration Vector MUST be different from NULL (see Figure 6).

- In ‘indirect’ attachment mode, the FAST Line Configuration MUST contain a pointer to a Line Configuration Vector Profile. The Line Configuration Vector Profile pointer MUST be different from NULL (see section 4.2.4).

If none of the above modes apply the FAST Line Configuration is undefined.

The following attributes MUST be supported at the FAST Line Configuration level. All attributes are read/write.

interface [name]

- name (string)
- line-configuration
 - pointer-to-threshold-template
 - If ‘direct’ attachment
 - line-configuration-vector (see section 4.2.4)
 - Else if ‘indirect’ attachment
 - pointer-to-line-configuration-vector-profile
 - Endif
 - testmode
 - rtx-tc-test-mode (RTX_TESTMODEds)
 - tps-tc-test-mode (TPS_TESTMODEds)
 - dra-test-mode (DRA_TESTMODEds)
 - update-test
 - ftu-o
 - update-ne-test (UPDATE-NE-TEST)
 - ftu-r
 - update-fe-test (UPDATE-FE-TEST)
 - read-test
 - downstream
 - xlog-disturber-vce-port-index
 - link-state
 - link-state-forced (LS-FORCED)

The attributes related to “testmode” and “update” MUST be read/write while the FAST line has the FTU-O and FTU-R in Showtime, without causing a re-initialization of the FAST line.

4.2.2 FAST Channel

The FAST Channel object represents an individual logical transmission channel over the FAST Line and its associated parameters and states. The FAST interface has only one channel. Therefore, unlike the xDSL interface defined in TR-252i3 [2], the FAST interface does not have a FAST Channel managed object.

4.2.3 FAST Termination Unit (FTU)

The following attributes **MUST** be supported for FAST Termination Units. All attributes are read-only.

- inventory
 - ftu-o
 - g.994.1-vendor-id (FTUO_GHS_VENDOR)
 - version-number (FTUO_VERSION)
 - self-test-result (FTUO-SELFTEST)
 - system-vendor-id (DPU_SYSTEM_VENDOR)
 - serial-number (DPU_SYSTEM_SERIALNR)
 - vce-id
 - vce-port-index
 - profiles-supported
 - ftu-r
 - g.994.1-vendor-id (FTUR_GHS_VENDOR)
 - version-number (FTUR_VERSION)
 - self-test-result (FTUR-SELFTEST)
 - system-vendor-id (NT_SYSTEM_VENDOR)
 - serial-number (NT_SYSTEM_SERIALNR)
 - profiles-supported

NOTE - While inventory data are not related to configuration, knowledge of these data may facilitate configuration.

4.2.4 Line Configuration Vector

A Line Configuration Vector (see Figure 2) is a set of pointers to each of the service related profiles, spectrum related profiles, and DQM related profiles (i.e., the Line Configuration Profiles) defined in sections 4.2.5, 4.2.6, and 4.2.7 respectively. The Vector of Profiles (VoP) concept was first developed in Broadband Forum TR-165 [8]. In the VoP concept, the configuration parameters are divided into independent sets or profiles which are addressed by a vector of pointers, i.e., a Line Configuration Vector (see Figure 3).

The Line Configuration Vector Profile contains a Line Configuration Vector. Instances of the Line Configuration Vector Profile may be created at the FAST Configuration Profiles level.

A Line Configuration Vector Profile is assigned to a FAST line only in the indirect attachment mode. In the direct attachment mode, the Line Configuration Vector is part of the FAST Line Configuration (see section 4.2.1).

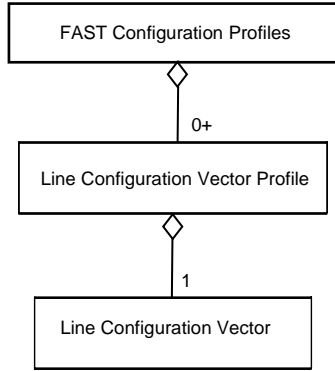


Figure 2/TR-371 – FAST Managed Object Model: Line Configuration Vector Profile

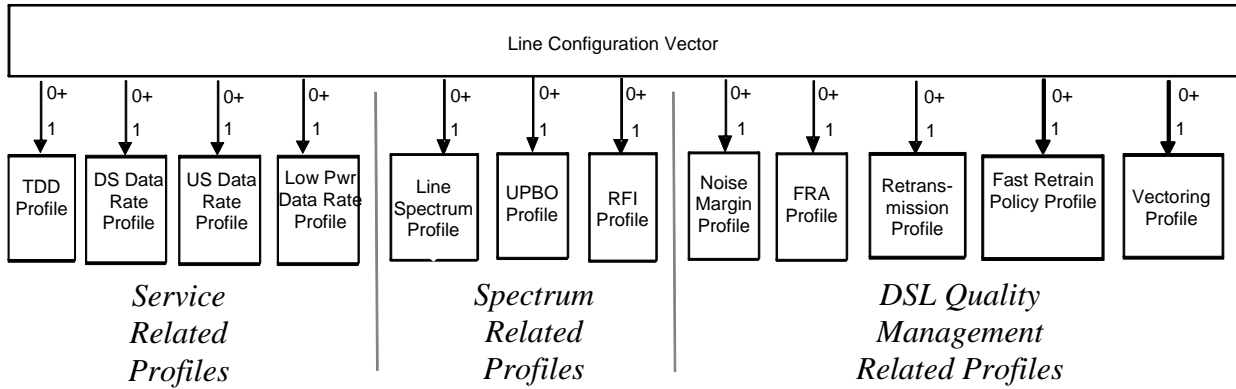


Figure 3/TR-371 – FAST Managed Object Model: Line Configuration Vector

Instances of each Line Configuration Profile may be created at the FAST Configuration Profiles level (see Figure 4).

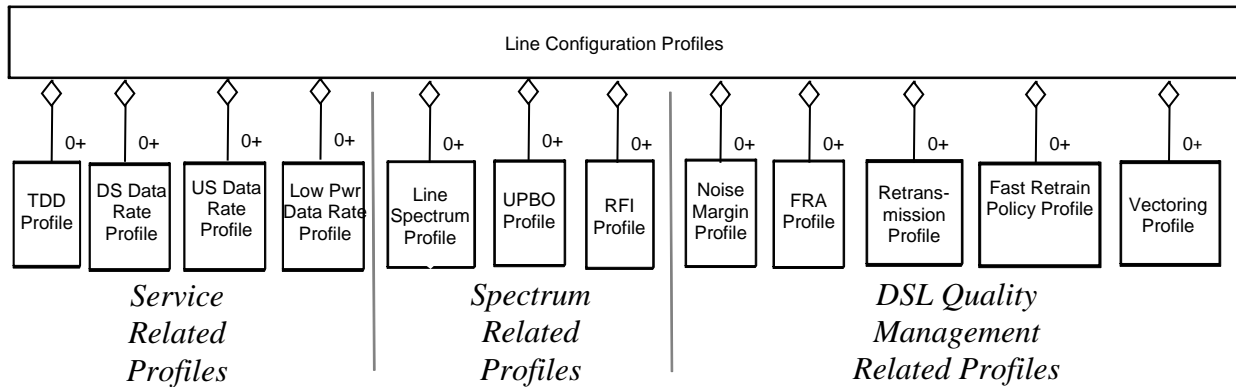


Figure 4/TR-371 – FAST Managed Object Model: Line Configuration Profiles

The following attributes **MUST** be supported by a Line Configuration Vector Profile. All attributes are read/write.

line-configuration-vector-profile [name]

- name (string)
- line-configuration-vector
 - pointer-to-tdd-profile
 - pointer-to-downstream-data-rate-profile
 - pointer-to-upstream-data-rate-profile
 - pointer-to-low-power-data-rate-profile
 - pointer-to-line-spectrum-profile
 - pointer-to-upbo-profile
 - pointer-to-rfi-profile
 - pointer-to-noise-margin-profile
 - pointer-to-fra-profile
 - pointer-to-retransmission-profile
 - pointer-to-fast-retrain-policy-profile
 - pointer-to-vectoring-profile

When a Line Configuration Vector Profile is created, all of its attributes **MUST** be configured.

4.2.5 Service related profiles

The service related profiles are the Time Division Multiplexing (TDD) profile, the downstream data rate profile, the upstream data rate profile, and the low power data rate profile.

4.2.5.1 Time Division Duplexing Profile

A Time Division Duplexing Profile contains the configuration objects for the duration of the TDD frame and the split of the number of symbols in a TDD frame over downstream and upstream.

The following attributes **MUST** be supported by a TDD Profile. All attributes are read/write.

tdd-profile [name]

- name (string)
- total-symbol-periods (MF)
- downstream-symbol-periods (Mds)
- cyclic-extension (CE)

4.2.5.2 Downstream Data Rate Profile

A Downstream Data Rate Profile contains the configuration objects for the minimum and maximum data rates for the channel for the downstream direction.

The following attributes **MUST** be supported by a Downstream Data Rate Profile. All attributes are read/write.

downstream-data-rate-profile [name]

- name (string)
 - maximum-net-data-rate (MAXNDRds)
 - minimum-expected-throughput (MINETRds)
 - maximum-gamma-data-rate (MAXGDRds)
 - minimum-gamma-data-rate (MINGDRds)

4.2.5.3 Upstream Data Rate Profile

An Upstream Data Rate Profile contains the configuration objects for the minimum and maximum data rates for the channel for the upstream direction.

The following attributes **MUST** be supported by an Upstream Data Rate Profile. All attributes are read/write.

upstream-data-rate-profile [name]

- name (string)
 - maximum-net-data-rate (MAXNDRus)
 - minimum-expected-throughput (MINETRus)
 - maximum-gamma-data-rate (MAXGDRus)
 - minimum-gamma-data-rate (MINGDRus)

4.2.5.4 Low Power Data Rate Profile

A Low Power Data Rate Profile contains the configuration objects for the data rates and expected throughput applicable when running in low power mode. Each object applies for both upstream and downstream directions

The following attributes **MUST** be supported by a Low Power Data Rate Profile. All attributes are read/write.

low-power-data-rate-profile [name]

- name (string)
 - maximum-net-data-rate-in-l2.1 (L2.1-MAXNDR)
 - maximum-net-data-rate-in-l2.2 (L2.2-MAXNDR)
 - minimum-expected-throughput-in-l2.1 (L2.1-MINETR)
 - minimum-expected-throughput-in-l2.2 (L2.2-MINETR)
 - minimum-expected-throughput-after-exit-from-l2.1 (L2.1-MINETR-EXIT)

4.2.6 Spectrum related profiles

The spectrum related profiles are the Line Spectrum Profile, UPBO profile, and RFI Profile.

4.2.6.1 Line Spectrum Profile

A Line Spectrum Profile contained the configuration objects for enabling of FAST Profiles (e.g., 106a), and the Maximum ATP, Carrier Mask, and PSD Mask for the downstream and upstream direction.

The following attributes **MUST** be supported by a Line Spectrum Profile. All attributes are read/write.

line-spectrum-profile [name]

- name (string)
- profiles (PROFILES) (bits)
- maximum-psd-reduction-l2.1 (L2.1-MAXPSDR)
- downstream
 - maximum-aggregate-transmit-power (MAXATPds)
 - carrier-mask [start-carrier-index] (CARMASKds)
 - start-index (integer)
 - stop-index (integer)
 - mibpsdmask [sub-carrier-index] (MIBPSDMASKds)
 - sub-carrier-index (integer)
 - psd-level (integer)
- upstream
 - maximum-aggregate-transmit-power (MAXATPus)
 - carmask [start-index] (CARMASKus)
 - start-index (integer)
 - stop-index (integer)
 - mibpsdmask [sub-carrier-index] (MIBPSDMASKus)
 - sub-carrier-index (integer)
 - psd-level (integer)

4.2.6.2 UPBO Profile

A UPBO Profile contains the configuration objects for the upstream power back-off.

The following attributes **MUST** be supported by a UPBO Profile. All attributes are read/write.

upbo-profile [name]

- name (string)
- upbopsd-a (UPBOPSDA)
- upbopsd-b (UPBOPSDB)

- upbo-upstream-electrical-length (UPBOKL)
- upbo-force-electrical-length (UPBOKLF)
- upbo-reference-electrical-length (UPBOKLREF)

4.2.6.3 RFI Profile

A Radio Frequency Interference (RFI) Profile contains the configuration objects for the transmit PSD reduction in the RFI bands and the IAR bands. The same configuration applies for the downstream and upstream direction.

The following attributes **MUST** be supported by the RFI Profile. All attributes are read/write.

rfi-profile [name]

- name (string)
- rfi-band [start-index] (RFIBANDS)
 - start-index (integer)
 - stop-index (integer)
- iar-band (IARBANDS) (bits)

4.2.7 DSL Quality Management related profiles

The DSL Quality Management (DQM) related profiles are the Noise Margin Profile, Fast Rate Adaptation Profile, Retransmission Profile, Fast Retrain Policy Profile, and Vectoring Profile.

4.2.7.1 Noise Margin Profile

A Noise Margin Profile contains the configuration objects for the signal-to-noise-ratio (SNR) for the downstream and upstream direction.

The following attributes **MUST** be supported by a Noise Margin Profile. All attributes are read/write.

noise-margin-profile [name]

- name (string)
- downstream
 - noise-margin
 - target-noise-margin (TARSNRMds)
 - target-noise-margin-in-l2 (L2-TARSNRMds)
 - maximum-noise-margin-in-l2 (L2-MAXSNRMds)
 - minimum-noise-margin (MINSNRMds)
 - seamless-rate-adaptation
 - upshift-noise-margin (SRA-USNRMds)
 - upshift-noise-margin-in-l2.1 (L2.1-SRA-USNRMds)

- minimum-time-interval-upshift-sra (SRA-UTIMEds)
- downshift-noise-margin (SRA-DSNRMds)
- downshift-noise-margin-in-l2.1 (L2.1-SRA-DSNRMds)
- minimum-time-interval-downshift-sra (SRA-DTIMEds)
- robust-management-channel
 - target-noise-margin (TARSNRM-RMCds)
 - minimum-noise-margin (MINSNRM-RMCds)
 - maximum-bit-loading (MAXBL-RMCds)
- upstream
 - noise-margin
 - target-noise-margin (TARSNRMus)
 - target-noise-margin-in-l2 (L2-TARSNRMus)
 - maximum-noise-margin (MAXSNRMus)
 - maximum-noise-margin-in-l2 (L2-MAXSNRMus)
 - minimum-noise-margin (MINSNRMus)
 - seamless-rate-adaptation
 - upshift-noise-margin (SRA-USNRMus)
 - upshift-noise-margin-in-l2.1 (L2.1-SRA-USNRMus)
 - minimum-time-interval-upshift-sra (SRA-UTIMEus)
 - downshift-noise-margin (SRA-DSNRMus)
 - downshift-noise-margin-in-l2.1 (L2.1-SRA-DSNRMus)
 - minimum-time-interval-downshift-sra (SRA-DTIMEus)
 - robust-management-channel
 - target-noise-margin (TARSNRM-RMCus)
 - minimum-noise-margin (MINSNRM-RMCus)
 - maximum-bit-loading (MAXBL-RMCus)

4.2.7.2 Fast Rate Adaptation Profile

A Fast Rate Adaptation (FRA) profile contains the configuration objects for the Fast Rate Adaptation for the downstream and upstream direction.

The following attributes **MUST** be supported by an FRA Profile. All attributes are read/write.

fast-rate-adaptation-profile [name]

- name (string)
- downstream
 - time-window (FRA-TIMEds)
 - minimum-degraded-tones (FRA-NTONESds)
 - uncorrectable-dtu (FRA-RTXUCds)
 - vendor-discretionary-fra-triggering-criteria (FRA-VENDISCds)
- upstream
 - time-window (FRA-TIMEus)
 - minimum-degraded-tones (FRA-NTONESus)
 - uncorrectable-dtu (FRA-RTXUCus)

- vendor-discretionary-fra-triggering-criteria (FRA-VENDISCus)

4.2.7.3 Retransmission Profile

A Retransmission Profile contains the configuration objects for the downstream and upstream direction related to retransmission.

NOTE – The Retransmission Profile corresponds to the INP-DELAY profile defined in TR-252i3 [2].

The following attributes MUST be supported by a Retransmission Profile. All attributes are read/write.

retransmission-profile [name]

- name (string)
- downstream
 - maximum-delay (DELAYMAXds)
 - minimum-inp-against-shine (INPMIN_SHINEds)
 - shine-ratio (SHINERATIOds)
 - minimum-inp-against-rein (INPMIN_REINds)
 - rein-inter-arrival-time (IAT_REINds)
 - minimum-rfec-nfec-ratio (RNRATIOds)
- upstream
 - maximum-delay (DELAYMAXus)
 - minimum-inp-against-shine (INPMIN_SHINEus)
 - shine-ratio (SHINERATIOus)
 - minimum-inp-against-rein (INPMIN_REINus)
 - rein-inter-arrival-time (IAT_REINus)
 - minimum-rfec-nfec-ratio (RNRATIOus)

4.2.7.4 Fast Retrain Policy Profile

A Fast Retrain Policy Profile contains the configuration objects for the downstream and upstream direction related to fast retrain.

The following attributes MUST be supported by a Fast Retrain Policy Profile. All attributes are read/write.

fast-retrain-policy-profile [name]

- name (string)
- downstream
 - los-defect-persistence (LOS-PERSISTENCYds)
 - lom-defect-persistence (LOM-PERSISTENCYds)
 - lor-defect-persistence (LOR-PERSISTENCYds)

- re-initialization-time-threshold (REINIT_TIME_THRESHOLDds)
- low-etr-threshold (LOW_ETR_THRESHOLDds)
- upstream
 - los-defect-persistence (LOS-PERSISTENCYus)
 - lom-defect-persistence (LOM-PERSISTENCYus)
 - lor-defect-persistence (LOR-PERSISTENCYus)
 - re-initialization-time-threshold (REINIT_TIME_THRESHOLDus)
 - low-etr-threshold (LOW_ETR_THRESHOLDus)

4.2.7.5 Vectoring Profile

A Vectoring Profile contains the configuration objects for the downstream and upstream direction related to vectoring.

The following attributes **MUST** be supported by the Vectoring Profile. All attributes are read/write.

vectoring-profile [name]

- name (string)
- downstream
 - fext-to-cancel-enable (FEXT_CANCEL_ENABLEds)
 - xlog-group-size-req (XLOGGREQds)
- upstream
 - fext-to-cancel-enable (FEXT_CANCEL_ENABLEus)

4.3 Object model for FAST Status Monitoring

The FAST objects related to status monitoring.

4.3.1 FAST Line Status

The FAST Line Status object represents current line status / measurements at a particular FTU or for a particular direction.

The following attributes **MUST** be supported for the FTU Line Status object:

- G.9701 profile (PROFILE)
- link-state (LINK_STATE)
- initialization-success-failure-cause (INITSFCAUSE)
- FTU-O
 - update-test
 - time-stamp-at-g1-update (STAMP-TEST-NE-G1)
 - time-stamp-at-g2-update (STAMP-TEST-NE-G2)
 - link-state-at-g1-update (LINK-STATE-TEST-NE-G1)

- failures
 - line-initialization-failure (LINIT)
 - loss-of-signal (LOS)
 - loss-of-rmc (LOR)
 - loss-of-margin (LOM)
 - loss-of-power (LPR)
- FTU-R
 - update-test
 - time-stamp-at-g1-update (STAMP-TEST-FE-G1)
 - time-stamp-at-g2-update (STAMP-TEST-FE-G2)
 - link-state-at-g1-update (LINK-STATE-TEST-FE-G1)
 - failures
 - loss-of-signal (LOS-FE)
 - loss-of-rmc (LOR-FE)
 - loss-of-margin (LOM-FE)
 - loss-of-power (LPR-FE)
- downstream
 - initialization-last-transmitted-signal (INITLASTSSIGNALds)
 - snr-margin (SNRMds)
 - snr-margin-in-l2.1 (L2.1-SNRMds)
 - snr-margin-in-l2.2 (L2.2-SNRMds)
 - upbo-electrical-length (UPBOKLE)
 - actual-aggregate-transmit-power (ACTATPds)
 - robust-management-channel
 - snr-margin (SNRMRMCds)
 - snr-margin-in-l2 (L2-SNRM-RMCds)
 - signal-attenuation (SATN)
 - time-stamps
 - time-stamp-last-successful-bitswap (STAMP-BSWds)
 - time-stamp-last-successful-autonomous-sra (STAMP-SRAdS)
 - time-stamp-last-successful-fra (STAMP-FRAdS)
 - time-stamp-last-successful-rpa (STAMP-RPAdS)
 - time-stamp-last-successful-tiga (STAMP-TIGAdS)
- upstream
 - initialization-last-received-signal (INITLASTSSIGNALus)
 - snr-margin (SNRMus)
 - snr-margin-in-l2.1 (L2.1-SNRMus)
 - snr-margin-in-l2.2 (L2.2-SNRMus)
 - upbo-electrical-length (UPBOKLE-R)
 - actual-aggregate-transmit-power (ACTATPus)
 - robust-management-channel
 - snr-margin (SNRMRMCus)
 - snr-margin-in-l2 (L2-SNRM-RMCus)
 - signal-attenuation (SATN)
 - time-stamps
 - time-stamp-last-successful-bitswap (STAMP-BSWus)

- time-stamp-last-successful-autonomous-sra (STAMP-SRAus)
- time-stamp-last-successful-fra (STAMP-FRAus)
- time-stamp-last-successful-rpa (STAMP-RPAus)

4.3.2 FAST Channel Status

The FTU Channel Status object represents current channel status / measurements at a particular FTU.

The following attributes MUST be supported for the FTU Channel Status object:

- downstream
 - net-data-rate (NDR)
 - net-data-rate-in-l2.1 (L2.1-NDRds)
 - net-data-rate-in-l2.2 (L2.2-NDRds)
 - expected-throughput (ETR)
 - expected-throughput-in-l2.1 (L2.1-ETRs)
 - expected-throughput-in-l2.2 (L2.2-ETRs)
 - gamma-data-rate (GDR)
 - attainable-net-data-rate (ATTNDR)
 - attainable-expected-throughput (ATTETR)
 - attainable-gamma-data-rate (ATTGDR)
 - actual-inp-against-shine (ACTINP)
 - actual-inp-against-rein (ACT_REIN)
 - dtu-fec-codeword-length (DTU-NFEC)
 - dtu-fec-redundancy (DTU-RFEC)
 - fec-codewords-per-dtu (DTU-Q)
- upstream
 - net-data-rate (NDR)
 - net-data-rate-in-l2.1 (L2.1-NDRus)
 - net-data-rate-in-l2.2 (L2.2-NDRus)
 - expected-throughput (ETR)
 - expected-throughput-in-l2.1 (L2.1-ETRus)
 - expected-throughput-in-l2.2 (L2.2-ETRus)
 - gamma-data-rate (GDR)
 - attainable-net-data-rate (ATTNDR)
 - attainable-expected-throughput (ATTETR)
 - attainable-gamma-data-rate (ATTGDR)
 - actual-inp-against-shine (ACTINP)
 - actual-inp-against-rein (ACT_REIN)
 - dtu-fec-codeword-length (DTU-NFEC)
 - dtu-fec-redundancy (DTU-RFEC)
 - fec-codewords-per-dtu (DTU-Q)

4.4 Object model for FAST Performance Management

Figure 5 shows the object model relating to FAST performance management

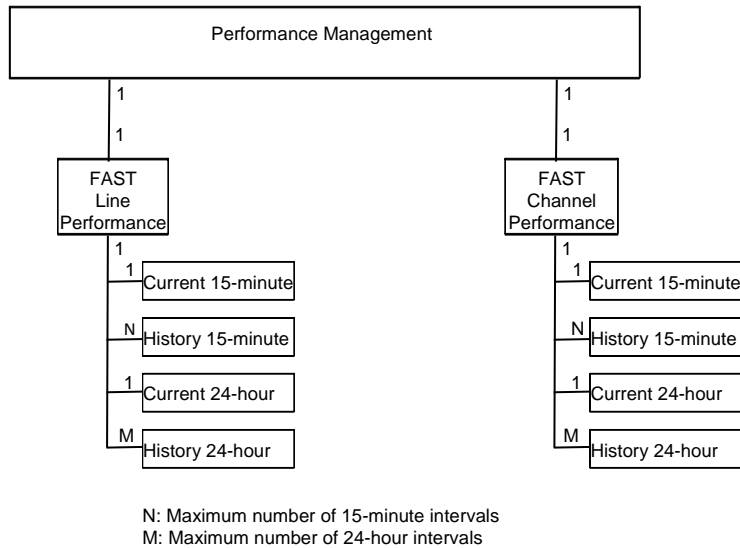


Figure 5/TR-371 – FAST Managed Object Model: Performance Management

4.4.1 FTU Line Performance

The FTU Line Performance object represents line performance related data for a given FTU. It supports the following sub-classes:

- Current 15-min Performance
- History 15-min Performance
- Current 24-hour Performance
- History 24-hour Performance

NOTE – TR-252i3 [2] uses current/history, whereas G.997.2 [6] uses current/previous notation. Herein the TR-252i3 [2] notation is used for the objects, but the G.997.2 [6] name is shown in parentheses. In the following, CURR/PREV means that the object may apply separately for the current interval and the previous interval, NE/FE means that the object may apply separately for NE and FE, and 15/24 means that the object may apply separately for 15-minute and 24-hour intervals.

The following objects **MUST** be supported only for history, for the FTU-O and FTU-R, and for both 15-minute and 24-hour

- invalid-data-flag (PREV_NE/FE_15/24_L_INVALID)
- time-stamp (PREV_NE/FE_15/24_L_STAMP)

The following objects **MUST** be supported for both current and history, for the FTU-O only, and for both 15-minute and 24-hour:

- successful-tiga (CURR/PREV_15/24_TIGA)

- full-initializations(CURR/PREV_15/24_FULL_INITS)
- failed-full-initializations (CURR/PREV_15/24_FAILEDFULL_INITS)
- fast-initializations (CURR/PREV_15/24_FAST_INITS)
- failed-fast-initializations (CURR/PREV_15/24_FAILEDFAST_INITS)
- link-state-l2.1n-seconds (CURR/PREV_15/24_L21N)
- link-state-l2.1b-seconds (CURR/PREV_15/24_L21B)
- link-state-l2.2-seconds (CURR/PREV_15/24_L22)
- loss-of-power-interruptions (CURR/PREV_15/24_LPR_INTRPT)
- host-reinit-interruptions (CURR/PREV_15/24_HRI_INTRPT)
- spontaneous-interruptions (CURR/PREV_15/24_SPONT_INTRPT)

The following objects MUST be supported for current and history, for both the FTU-O and FTU-R, and for both 15-minute and 24-hour:

- measured-time (CURR/PREV_NE/FE_15/24_L_TIME)
- loss-of-signal (CURR/PREV_NE/FE_15/24_LOS)
- loss-of-margin (CURR/PREV_NE/FE_15/24_LOM)
- loss-of-rmc (CURR/PREV_NE/FE_15/24_LOR)
- loss-of-power (CURR/PREV_NE/FE_15/24_LPR)
- errored-seconds (CURR/PREV_NE/FE_15/24_ES)
- severely-errored-seconds (CURR/PREV_NE/FE_15/24_SES)
- loss-of-signal-seconds (CURR/PREV_NE/FE_15/24_LOSS)
- loss-of-rmc-seconds (CURR/PREV_NE/FE_15/24_LORS)
- unavailable-seconds (CURR/PREV_NE/FE_15/24_UAS)
- successful-bit-swaps (CURR/PREV_NE/FE_15/24_BSW)
- successful-autonomous-sra (CURR/PREV_NE/FE_15/24_SRA)
- successful-fra (CURR/PREV_NE/FE_15/24_FRA)
- successful-rpa (CURR/PREV_NE/FE_15/24_RPA)

4.4.2 FTU Channel Performance

The FTU Channel Performance object represents channel performance related data for a given FTU. It supports the following sub-classes:

- Current 15-min Performance
- History 15-min Performance
- Current 24-hour Performance
- History 24-hour Performance

The following objects MUST be supported only for history, for the FTU-O and FTU-R, and for both 15-minute and 24-hour

- invalid-data-flag (PREV_NE/FE_15/24_C_INVALID)
- time-stamp (PREV_NE/FE_15/24_C_STAMP)

The following objects MUST be supported for current and history, for both the FTU-O and FTU-R, and for both 15-minute and 24-hour:

- measured-time (CURR/PREV_NE/FE_15/24_C_TIME)
- error-free-bits (EFB-C/P15M/24H/us/ds)
- minimum-error-free-throughput (MINEFTR-C/P15M/24H/us/ds)
- code-violations (CURR/PREV_NE/FE_15/24_CV)
- uncorrected-dtus (CURR/PREV_NE/FE_15/24_RTXUC)
- retransmitted-dtus (CURR/PREV_NE/FE_15/24_RTXTX)

NOTE – “error-free-bits” and “minimum-error-free-throughput” are from Table 7-11 of G.997.2 [6] and are associated with the channel. In TR-252i3 [2], they are included in the line performance section, not in the channel performance section. We put them under channel to be consistent with G.997.2 [6].

4.5 Object model for FAST Performance Threshold Management

The threshold related profiles are the Line Thresholds Profile and the Channel Thresholds Profile.

4.5.1 FAST Threshold Template

A Thresholds Template (see Figure 6) contains 4 pointers to a Line Threshold Profile (for near-end 15min, near-end 24hrs, far-end 15min, and far-end 24hrs) and 4 pointers to a Channel Threshold Profile (for near-end 15min, near-end 24hrs, far-end 15min, and far-end 24hrs). The Line Threshold Profile and Channel Threshold Profile are defined in sections 4.5.2 and 4.5.3, respectively. Instances of the Thresholds Template may be created at the Line Configuration Profiles level.

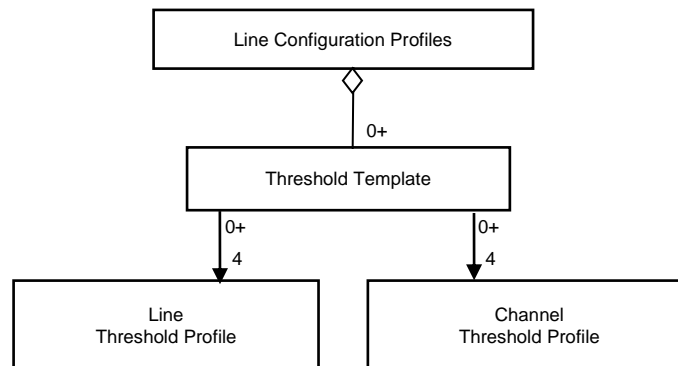


Figure 6/TR-371 – FAST Managed Object Model: Threshold Management

The following attributes **MUST** be supported by a Threshold Template. All attributes are read/write.

threshold-template [name]

- name (string)
- line
 - pointer-to-line-thresholds-profile-for-ne-15m

- pointer-to-line-thresholds-profile-for-ne-24h
- pointer-to-line-thresholds-profile-for-fe-15m
- pointer-to-line-thresholds-profile-for-fe-24h
- channel
 - pointer-to-channel-thresholds-profile-for-ne-15m
 - pointer-to-channel-thresholds-profile-for-ne-24h
 - pointer-to-channel-thresholds-profile-for-fe-15m
 - pointer-to-channel-thresholds-profile-for-fe-24h

When a Threshold Template profile is created, all its attributes **MUST** be configured.

4.5.2 FAST Line Threshold Profile

A Line Threshold Profile contains the thresholds for the Line Performance Monitoring objects.

The following attributes **MUST** be supported by the Line Threshold Profile. All attributes are read/write.

line-threshold-profile [name]

- name (string)
- errored-seconds-threshold (THRESHOLD_NE/FE_15/24_ES)
- severely-errored-seconds-threshold (THRESHOLD_NE/FE_15/24_SES)
- unavailable-seconds-threshold (THRESHOLD_NE/FE_15/24_UAS)

The following additional attributes **MAY** be supported by the Line Threshold Profile:

- loss-of-signal-seconds-threshold (THRESHOLD_NE/FE_15/24_LOSS)
- loss-of-rmc-seconds-threshold (THRESHOLD_NE/FE_15/24_LORS)
- full-initializations-threshold (THRESHOLD_NE_15/24_FULL_INITS)
- failed-initializations-threshold (THRESHOLD_NE_15/24_FAILEDFULL_INITS)
- fast-initializations-threshold (THRESHOLD_NE_15/24_FAST_INITS)
- failed-fast-initializations-threshold (THRESHOLD_NE_15/24_FAILEDFAST_INITS)
- spontaneous-interruptions-threshold (THRESHOLD_NE_24_SPONT_INTRPT)

Some of the performance counters are not defined for the far-end or not defined for the 15-minute interval. The related far-end thresholds or 15-minute thresholds **MUST** be ignored.

4.5.3 FAST Channel Threshold Profile

A Channel Thresholds Profile contains the thresholds for the Channel Performance Monitoring objects.

The following attributes **MAY** be supported by the Channel Threshold Profile. All attributes are read/write.

channel-threshold-profile [name]

- name (string)
- code-violations-threshold (THRESHOLD_NE/FE_15/24_CV)
- uncorrectable-dtus-threshold (THRESHOLD_NE/FE_15/24_RTXUC)
- retransmitted-dtus-threshold (THRESHOLD_NE/FE_15/24_RTXTX)

4.6 Object model for FAST Testing / Diagnostics

4.6.1 FAST Sub-Carrier Status

The FAST Sub-carrier Status object represents current per sub-carrier status / measurements for a particular direction.

The following attributes MUST be supported for the FTU Sub-carrier Status object:

- downstream
 - actual-tx-psd (ACTPSDpsds)
 - signal-to-noise-ratio
 - snr-measurement-time (SNRMTds)
 - snr-sub-carrier-group-size (SNRGds)
 - snr[n] (SNRpsds)
 - bits-allocation (BITSpsds)
 - robust-management-channel
 - sub-carrier-bits-allocation[n] (BITSRMCpsds)
 - sub-carrier-index
 - bits-allocation
 - qln-measurement-time (QLNMT)
 - qln-sub-carrier-group-size (QLNG)
 - qln (QLNps)
 - sub-carrier-group-index
 - value
 - hlog-measurement-time (HLOGMT)
 - hlog-sub-carrier-group-size (HLOGG)
 - hlog (HLOGps)
 - sub-carrier-group-index
 - value
 - aln-measurement-time (ALNMT)
 - aln-sub-carrier-group-size (ALNG)
 - aln (ALNps)
 - sub-carrier-group-index
 - value
 - xlogdisturber
 - vce-port-index
 - xlogbands (XLOGBANDSds)
 - start-index
 - stop-index

- xlogps (XLOGpsds)
 - group-size
 - xlog[n]
 - sc
 - pk
- upstream
 - actual-tx-psd (ACTPSDpsus)
 - signal-to-noise-ratio
 - snr-measurement-time (SNRMTus)
 - snr-group-size (SNRGus)
 - snr[n] (SNRpsus)
 - bit-allocation (BITSpsus)
 - robust-management-channel
 - sub-carrier-bit-allocation[n] (BITSRMCpsus)
 - sub-carrier-index
 - bits-allocation
 - qln-measurement-time (QLNMT)
 - qln-sub-carrier-group-size (QLNG)
 - qln (QLNps)
 - sub-carrier-group-index
 - value
 - hlog-measurement-time (HLOGMT)
 - hlog-sub-carrier-group-size (HLOGG)
 - hlog (HLOGps)
 - sub-carrier-group-index
 - value

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