



**Product Specification for the
Functional Requirements of an MSF Trunking
Gateway**

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Multiservice Switching Forum
Product Specification

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Abstract:

This contribution is a Product Specification for the Functional Requirements of an MSF Trunking Gateway. This is an MSF Target Specification.

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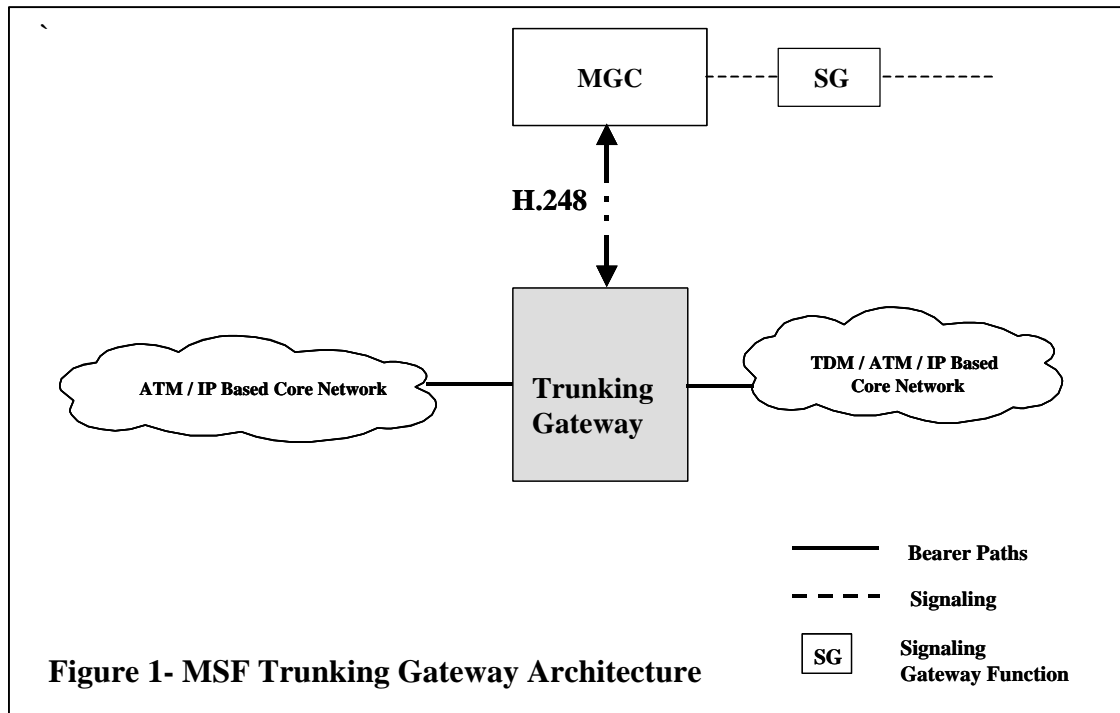
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1. INTRODUCTION:

This Product Specifications (PS) identifies and lists the baseline physical and functional requirements for a MSF Trunking Gateway (MTG). The MTG shall provide connectivity and bearer mediation between the carrier's ATM, IP and TDM core networks. No subscriber interfaces are required on this gateway.

The PG is intended to give guidance to suppliers on generic customer requirements, and to be used by operators in support of their tendering and procurement processes. This PS specifies those attributes of an MTG that are largely independent of the network in which the MTG is used. It is recognized that vendors may wish to differentiate their products by offering features over and above those specified here. Operators will also have individual requirements in addition to those specified in this PS. Some of these will be dependant on the network configuration in which the MTG is to operate, and the services carried. There will be cases where requirements shown as optional in this PS become mandatory, (e.g. A-law to mu-law transformations may be essential on particular international gateways).

The requirements for the handling of voice, data and multi-media traffic within and between ATM and IP-based core networks is outside the scope of this PS. H248 profiles supporting the mediation of voice between different ATM or IP-based networks is subject to further study within the MSF. An MTG may include signaling gateway functionality (SG) for the termination of signaling messages. The requirement for this functionality is outside the scope of this PS.



2. CONVENTIONS:

This document employs the following terminology:

Shall, or Mandatory (M)	–	Such features are an absolute requirement of a compliant MTG.
Optional (O)	–	Such features are not compulsory. Optional requirements are generally qualified by the terms “should” and “may” as follows. Gateways with and without such features must be able to inter-operate.
Should	–	Such features are not compulsory but highly desirable, it is however intended that their inclusion within an MTG be regarded as normative.
May	–	Such features are not compulsory; their inclusion within an MTG may however be a requirement for a particular market, or for a specific application of an MTG. Equally the feature may be used to differentiate the product within the market.

3. REQUIREMENTS:

The following is a basic set of physical/functional requirements to identify a MTG. These requirements have standards listed where appropriate, which should be referenced for more detailed information.

3.1. Media Mapping Capabilities:

(M) An MTG shall support one or more of the following media mappings:

TDM – ATM AAL1	ATM AAL1 – ATM AAL2
TDM – ATM AAL2	ATM AAL1 – IP UDP RTP
TDM – IP UDP RTP	ATM AAL2 – IP UDP RTP
TDM – IP UDP/UDPTL	IP UDP RTP – IP UDP RTP

3.2. Codecs

The following requirements apply to all bearer types

- 3.2.1. (M) An MTG that supports interworking of bearers that use different voice codecs shall support transcoding of the voice media streams between the voice codecs used on each bearer.
- 3.2.2. (M) The MTG shall support a G.711 voice codec in accordance with Appendix II
- 3.2.3. (M) Where an MTG supports codecs other than G711, it shall also support Fax/Modem tone detection and fallback to G.711. Such an MTG shall also support fallback to G.711 under the direction of the MGC.
- 3.2.4. (O) The MTG may support fax relay according T.38.
- 3.2.5. (M) The MTG shall generate packets whose size matches the codec frame length.
- 3.2.6. (O) The MTG may support Codec negotiation.
- 3.2.7. (M) The MTG shall support Voice Activity Detection, Silence Suppression, Compression and Comfort Noise Generations (CNG) in all cases except where G711 is used in the context of a TDM bearer.
- 3.2.8. (O) The MTG may support A-law to mu-law transformations.

3.3. TDM Bearer Functionality Supported:

Where An MTG supports TDM bearer interfaces, the following shall apply:

- 3.3.1. (M) Such an MTG shall support Echo Cancellation compliant with G.168.
- 3.3.2. (M) Such an MTG shall support tail-path of echo cancellation facing the TDM network termination with an echo tail of at least 64ms.
- 3.3.3. (M) Such an MTG shall support a variable-sized jitter buffer with a range of at least 0 to 50ms.
- 3.3.4. (O) Such an MTG should provide automatic adaptive control of the jitter buffer size.
- 3.3.5. (O) Further to the above requirements, such an MTG may allow limitation of jitter buffer size to a subset of the permitted range.

3.4. ATM Bearer Functionality Supported:

- 3.4.1. (O) Such an MTG may support a G.726 voice codec at data rates of 40kb, 32kb, 24kb or 16kb.
- 3.4.2. (M) MTGs supporting ATM bearer interfaces shall support at least one of the following:
 - AAL1 encoded Voice over ATM in accordance with ITU I.363.1
 - AAL2 encoded Voice over ATM in accordance with ITU I.363.2 & 366.1/2
- 3.4.3. (O) MTGs that set up SVCs shall do so using either PNNI V1.0 as per af-pnni-0055.000 or for interconnect AINI as per af-cs-0125.000.
- 3.4.4. (M) MTGs that set up SVCs shall do so using UNI 4.0 – af-sig-0061.00
- 3.4.5. (M) Such an MTG shall allow codec packetization size in use on a bearer to be configured in the range of 5-30ms, subject to the configured size being a simple multiple of the basic frame size of the specific codec in use.

3.5. IP Bearer Functionality Supported:

Where an MTG supports IP bearer interfaces, the following shall apply:

- 3.5.1. (O) Such an MTG may support a G.726 voice codec at data rates of 40kb, 32kb, 24kb or 16kb.
- 3.5.2. (O) Such an MTG may support a G.729 voice codec in accordance with Annex A and/or B.
- 3.5.3. (O) Such an MTG may support a G.728 and G.729E codecs for compatibility with PacketCable networks.
- 3.5.4. (O) The MTG may support a G.723.1 voice codec in accordance with Annex A
- 3.5.5. (M) Such an MTG shall support RTP in accordance with RFC 1889 on all IP media interfaces.
- 3.5.6. (M) Such an MTG shall support RTCP in accordance with RFC 2889 on all IP media interfaces.
- 3.5.7. (O) Such an MTG may support the RTP Profile AVP as per RFC 1890 on IP media interfaces.
- 3.5.8. (M) Such an MTG shall support UDP in accordance with RFC 768 on all IP media interfaces.
- 3.5.9. (O) Such an MTG may support SCTP in accordance with RFC 2960 on IP media interfaces.
- 3.5.10. (O) Such an MTG may support RSVP in accordance with RFC 2205 on IP media interfaces.

- 3.5.11. (M) Such an MTG shall support IPv4 in accordance with RFC 791 on all IP media interfaces.
- 3.5.12. (O) Such an MTG may support IPv6 in accordance with RFC 2460 on IP media interfaces.
- 3.5.13. (M) Such an MTG shall allow codec packetization size in use on a bearer to be configured in the range of 10-30ms, subject to the configured size being a simple multiple of the basic frame size of the specific codec in use.
- 3.5.14. (M) Such an MTG shall support the transport of DTMF tones, other tone signals and telephony events, across a network in accordance with RFC 2833.
- 3.5.15. (M) Such an MTG shall also support the transit of DTMF tones, other tone signals and telephony events inband via G711
- 3.5.16. (M) Such an MTG shall support 'RTP Payload for Comfort Noise' <draft-ietf-avt-rtp-cn-06.txt> generic comfort noise and silence insertion descriptor frame for G.711 codecs.

3.6. Gateway/Controller Control, Signaling Management and Transport Protocols

- 3.6.1. (M) An MTG shall support UDP/IP in accordance with RFC 768 on all signaling, management and control interfaces.
- 3.6.2. (O) An MTG should support SCTP in accordance with RFC 2960 on all signaling, management and control interfaces.
- 3.6.3. (M) When interfacing between TDM and ATM trunks MTGs shall use H248 profiled in accordance with the MSF Implementation Agreement MSF-IA-MEGACO-002.
- 3.6.4. (M) When interfacing between TDM and IP trunks MTGs shall use H248 profiled in accordance with the MSF Implementation Agreement MSF-IA-MEGACO-003.
- 3.6.5. (M) The management interface for the MTG shall support the transport of MTG management protocols as defined in the section on Management Requirements.
- 3.6.6. (O) For MTG deployed entirely in an ATM network, af-sig-0061.00 shall be used in support of ATM PVCs (AAL5) used for control signaling and management using AAL5.

3.7. Synchronization Requirements

- 3.7.1. (M) An MTG shall provide a Stratum 3 or 3E internal clock or higher as per ANSI T1.101 and the sections of ITU G.812 and ITU G.813 specified as appropriate, to the positioning of the MTG within the network.
- 3.7.2. (M) MTGs used for International applications shall support a G.813 SEC w/options for Type 1 G.812 clock.
- 3.7.3. (M) An MTG shall distribute synchronization from the internal Clock to all connected TDM and SONET/SDH interfaces.
- 3.7.4. (M) The MTG shall support the recovery of clock synchronization from any electrical or SONET/SDH interface and use it to generate a precise local clock, synchronized to remote TDM clock.
- 3.7.5. (M) The MTG shall support a primary and secondary synchronization reference input for each clock.
- 3.7.6. (O) The MTG may support the transportation of timing information between two network domains.

3.8. Security Requirements:

The MSF is evaluating security requirements and recommendations will be made in future publications.

3.9. General Operational and Performance Requirements

- 3.9.1. (M) An MTG shall support the of provision tones on the bearer streams.
- 3.9.2. (O) An MTG may support the provision of announcements on the bearer streams.
- 3.9.3. (M) An MTG shall support the monitoring of the audio/data stream on active calls on specific ports and addresses in one or both directions, in order to establish performance quality etc. for operational needs.
- 3.9.4. (M) An MTG shall support Congestion Control Handling in accordance with H.248.10
- 3.9.5. (M) An MTG shall have System Redundancy capability on all major elements, modules and cards.
- 3.9.6. (M) An MTG shall be designed to have no single point of failure.
- 3.9.7. (M) An MTG shall have environmental & physical characteristics compliant with ETS 300 019-1 as well as the equivalent of NEBS3 and ANSI specifications.
- 3.9.8. (M) An MTG shall be capable of normal operation whilst any major element/module/card is removed, and an alternative replaced. The MTG may operate at reduced capacity during this procedure
- 3.9.9. (M) An MTG shall have the capability for software and hardware upgrades to be undertaken without interrupting normal operation. The MTG may operate at reduced capacity during this procedure.
- 3.9.10. (M) In the event of an external failure that prevents an MTG from operating normally (e.g. loss of power, cooling, transmission), the MTG shall have the capability, once the external environment has been restored, to restore normal operation without external stimulus.
- 3.9.11. (M) In the event of multiple internal failures that prevent an MTG from operating normally, the MTG shall have the capability, once these faults have been rectified, to restore normal operation without further external stimulus. The MTG shall also have the capability to defer restoration of normal operation until instructed by the management plane.
- 3.9.12. (M) An MTG shall conform to the telephony control performances defined in G.114.

4. MANAGEMENT REQUIREMENTS

4.1. General Management Requirements:

The following requirements relate to an MTG operating in conjunction with appropriate management plane elements. These may be realized separately.

- 4.1.1. (M) These elements shall inter-operate with either a TMN or an SNMPv2 management system.
- 4.1.2. (O) These elements may inter-operate with an SNMPv3 management system.
- 4.1.3. (M) These elements shall provide secure, redundant, management access interfaces giving access to all other operational functions, including alarms, performance, and configuration functions.
- 4.1.4. (M) These elements shall have the capability to permit event logs and event reports that include timestamp information.

- 4.1.5. (M) These elements shall have the capability to permit the creation of call event records (e.g. by the inclusion of timestamps on event messages).
- 4.1.6. (M) These elements shall have the capability to permit the number of calls active within the gateway at any given time to be determined.
- 4.1.7. (M) These elements shall have the capability to permit call failures and uncompleted calls to be logged, together with an indication of the failure cause.
- 4.1.8. (M) These elements shall have the capability to permit incorrectly formatted received messages to be logged.
- 4.1.9. (M) These elements shall have the capability to permit real-time statistics and counters concerning the quality of voice stream to be collected.

4.2. Configuration Management:

- 4.2.1. (M) The line rates, frame formats features and format options on each media interface on a MTG shall be configurable.
- 4.2.2. (M) An MTG shall support the capability to retrieve the Hardware and Software inventory.
- 4.2.3. (M) An MTG shall support the remote manual switching of hardware and software modules between active and standby with no impact on stable calls during graceful switching, and minimal impact on stable calls or new calls in the case of a forced immediate switchover.

4.3. Fault Management:

- 4.3.1. (M) An MTG operating in conjunction with appropriate management plane elements, which may be separately realized, shall generate alarm reports for all identified hardware and software faults, problems and failures. These shall contain the following data:
 - Severity, including data classifying it as Critical, Major or Minor
 - Type
 - Time/Date
 - Cause
 - Entity (file, log, device, subsystem etc.)

4.4. Performance Management:

- 4.4.1. (M) An MTG operating in conjunction with appropriate management plane elements, which may be separately realized, shall have the capability to maintain, output and report the following performance data for all active modules, systems, trunks, circuits and calls
 - Packets sent/received
 - Octets sent/received
 - Packets loss
 - Packets out of sequence
 - Error packets
 - Delay
 - Jitter

Such reports and output shall be generated on request, periodically and as the result of an event (e.g. a threshold being exceeded).

- 4.4.2. (O) An MTG may have the capability to output and report the above performance data in real time.

4.5. Security Management:

The following requirements relate to an MTG operating in conjunction with appropriate management plane elements. These may be realized separately.

- 4.5.1. (M) These elements shall have the capability to authenticate user access, files access and command access for the management interface.
- 4.5.2. (M) These elements shall have the capability to maintain and output management activity logs, which shall include details of user access and command usage.
- 4.5.3. (O) These elements may have the capability to provide a management interface that supports SSH.
- 4.5.4. (O) These elements may have the capability to provide a management interface that supports SSL.
- 4.5.5. (O) All management and control interfaces to an MTG that utilize IP should include mechanisms for the detection, reporting and prevention of DoS attacks.
- 4.5.6. (O) All management and control interfaces to an MTG that utilize IP should support the encryption and authentication of IP packets on all interfaces that support IP.
- 4.5.7. (M) These elements shall have the capability to authorize user access, files access, and command access for the management interface.

5. REFERENCE STANDARDS

The following list of standards, which is provided for guidance only, may be applicable to the MTG and should be reference in support of the appropriate requirement listed in this PS:

ITU:

ITU-T G.703-Physical characteristics of hierarchical digital interfaces

ITU-T G.704-Synchronous frame structures used at 1544, 6312, 2048, 8488 and 44,736 kbits/hierarchical levels

ITU-T G.707-Network Node Interface for the Synchronous Digital Hierarchy (SDH)

ITU-T/CCITT G.711/Appendix I & II – PCM of voice frequencies, high quality low-complexity algorithm for packet loss concealment and comfort noise payload definition for G.711 used in packet-based multimedia communication systems

ITU-T G.114-One-Way Transmission Time

ITU-T G.723/Annex - dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s; the high rate coder is Multipulse Maximum Likelihood Quantization (MP-MLQ) and the low rate coder is Algebraic-Code-Excited Linear-Prediction (ACELP)

ITU-T G.726-40,32,24,16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)

ITU-T G.729/Annex A+B+E-Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-predication and silence compression scheme

ITU-T G.168-Digital Network Echo Cancellers

ITU-T H.248-Gateway Control Protocol Corrigendum 1 to Recommendation H.248 (6/00)

ITU-T I.363.1-B-ISDN ATM Adaptation Layer specification: Type 1 AAL

ITU-T I.363.2-B-ISDN ATM Adaptation Layer (AAL) type 2 specification

ITU-T I.366.1/2-Convergence sublayer for AAL2

ITU-T T.38 Procedures for real-time Group 3 facsimile communication over IP networks
Corrigendum 1 to recommendation H248 (06/00)

IETF:

RFC 768-User Datagram Protocol
RFC 791-Internet Protocol
RFC 792-Internet Control Message Protocol
RFC 793-Transmission Control Protocol
RFC 959-File Transfer Protocol
RFC 1661-Point-to-Point Protocol (PPP)
RFC 1771-A Border Gateway Protocol 4 (BGP-4)
RFC 1812-Requirements for IP Version 4 Routers
RFC 1889-RTP: Transport Protocol for Real-Time Applications
RFC 1890-RTP Profile for Audio and Video Audio and Video Conferences
RFC 2131-Dynamic Host Configuration Protocol
RFC 2205-Resource ReSerVation Protocol (RSVP)
RFC 2328-OSPF Version 2
RFC 2401-Security Architecture for the Internet Protocol
RFC 2402-IP Authentication Header
RFC 2406-IP Encapsulating Security Payload (ESP)
RFC 2408-Internet Security Association and Key Management Protocol
RFC 2409-The Internet Key Exchange (IKE)
RFC 2410-The NULL Encryption Algorithm and Its Use With IPsec
RFC 2411-IP Security Document Roadmap
RFC 2460-IP Version 6
RFC 2475-An Architecture for Differentiated Service
RFC 2719 Framework for Signaling Architecture
RFC 2833-RTP Payload for DTMF Digits Telephony Tones and Telephony Signals
RFC 2960-Stream Control Transmission Protocol (SCTP)
RFC 3031-MPLS Architecture
RFC 3032-MPLS Encapsulation
RFC 3057-ISDN Q.921-User Adaptation Layer
RFC 3389-Comfort Noise

ANSI:

T1.101-Synchronization Interface Standards for Digital Networks
T1.105-Digital Hierarchy Optical Interface
T1.107-Digital Hierarchy Optical Format specifications
T1.520-IP Packet Transfer and Availability Performance Parameters

ATM Forum:

af-pnni-0055.000-PNNI