

ISO/IEC/IEEE 8802-21:2018-04 (E)

Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 21: Media independent services framework

Contents

- 1. Overview 16
 - 1.1 Scope 16
 - 1.2 Purpose 16
 - 1.3 General 16
 - 1.4 Assumptions 18
 - 1.5 Media independence 18

- 2. Normative references 19

- 3. Definitions 22

- 4. Abbreviations and acronyms 26

- 5. General architecture 31
 - 5.1 Introduction 31
 - 5.2 General design principles 33
 - 5.3 MISF service overview 33
 - 5.4 Media independent service reference framework 36
 - 5.5 MISF reference models for link-layer technologies 38
 - 5.6 Service access points (SAPs) 44
 - 5.7 MIS protocol 46

- 6. MISF services 48
 - 6.1 General 48
 - 6.2 Service management 48
 - 6.3 Media independent event service 50
 - 6.4 Media independent command service 54
 - 6.5 Media independent information service 58

- 7. Service access point (SAPs) and primitives 70
 - 7.1 Introduction 70
 - 7.2 SAPs 71
 - 7.3 MIS_LINK_SAP primitives 73
 - 7.4 MIS_SAP primitive 85
 - 7.5 MIS_NET_SAP primitive 136

- 8. Media independent service protocol 138
 - 8.1 Introduction 138
 - 8.2 MIS protocol description 138
 - 8.3 MIS protocol identifier 150
 - 8.4 MIS protocol frame format 152
 - 8.5 Message parameter TLV encoding 159
 - 8.6 MIS protocol messages 159

- 9. MIS protocol protection 179
 - 9.1 Protection established through MIS (D)TLS 179
 - 9.2 Key establishment through an MIS service access authentication 180
 - 9.3 MIS message protection mechanisms for EAP-generated SAs 189
 - 9.4 Common procedures 196
 - 9.5 Group manipulation for group addressed messages 197
 - 9.6 Group addressed message protection 223

10. Proactive authentication	231
10.1 Media-specific proactive authentication	232
10.2 Bundling media access authentication with MIS service access authentication	233
Annex A (informative) Bibliography	236
Annex B (normative) Quality of service mapping.....	237
B.1 Generic IEEE 802.21 QoS flow diagram	238
B.2 Generic IEEE 802.21 QoS parameter mappings	239
B.3 Deriving generic IEEE 802.21 QoS parameters.....	241
Annex C (normative) Mapping media independent service (MIS) messages to reference points	244
Annex D (normative) Media-specific mapping for service access points (SAPs).....	245
D.1 MIS_LINK_SAP mapping to specific technologies	245
D.2 Mapping from MIS_LINK_SAP to media-specific SAPs	247
Annex E (normative) Data type definitions.....	249
E.1 General	249
E.2 Basic data types.....	249
E.3 Derived data types.....	251
Annex F (normative) Information element identifiers.....	282
Annex G (normative) Media independent information service (MIIS) basic schema	283
Annex H (informative) Making user extensions to media independent information service (MIIS) schema	284
Annex I (normative) IEEE 802.21 management information base (MIB).....	285
I.1 Parameters requiring MIB definition.....	285
I.2 IEEE 802.21 MIB definition	286
Annex J (informative) Example media independent service (MIS) message fragmentation.....	287
J.1 Example of original MIS message fragmentation	287
J.2 Calculation of securityOverhead when there is an MIS security association (SA)	287
Annex K (normative) Media independent service (MIS) protocol message code assignments.....	290
Annex L (normative) Protocol implementation conformance statement (PICS) proforma	294
L.1 Introduction	294
L.2 Scope.....	294
L.3 Conformance	294
L.4 Instructions.....	294
L.5 Identification of the implementation	297
L.6 Identification of the protocol.....	297
L.7 Identification of corrigenda to the protocol.....	297
L.8 PICS proforma tables	297
Annex M (informative) Authentication and key distribution procedures.....	303
M.1 Media independent service (MIS) service access authentication	303
M.2 Push key distribution.....	305
M.3 Proactive authentication	306
M.4 Optimized pull key distribution.....	307
M.5 Termination phase.....	308
Annex N (informative) Protection through transport protocols.....	309
N.1 Protection through layer 2.....	309
N.2 Protection through internet protocol security (IPsec)	309
Annex O (informative) Examples of fragmented group key block (GKB) operation	310
Annex P (normative) Use of Bloom Filter for certificate revocation	312
P.1 Calculating Bloom Filter output for revoked certificates	312
P.2 Certificate revocation check	312
P.3 False positive case	312

List of Figures

Figure 1—MIS services and their initiations.....	18
Figure 2—Group communication functional entities	32
Figure 3—MISF communication model.....	37
Figure 4—General MISF reference model and SAPs	39
Figure 5—Types of MISF relationships.....	40
Figure 6—MIS reference model for IEEE 802.3.....	41
Figure 7—MIS reference model for IEEE 802.11.....	42
Figure 8—MIS reference model for IEEE 802.16.....	42
Figure 9—MIS reference model for 3GPP systems	43
Figure 10—MIS reference model for 3GPP2 systems	44
Figure 11—Relationship between different MISF SAPs.....	45
Figure 12—Link events and MIS events.....	51
Figure 13—Remote MIS events.....	51
Figure 14—MIS events subscription and flow.....	52
Figure 15—Link commands and MIS commands.....	55
Figure 16—Remote MIS command	56
Figure 17—Command service flow	57
Figure 18—Depicting a list of neighboring networks with information elements	63
Figure 19—TLV representation of information elements	64
Figure 20—MIS information flow.....	70
Figure 21—State machines interactions.....	140
Figure 22—Transaction timers state machine	145
Figure 23—Transaction source state machine.....	146
Figure 24—Transaction destination state machine.....	147
Figure 25—ACK requestor state machine.....	148
Figure 26—ACK responder state machine.....	149
Figure 27—MIS protocol general frame format.....	152
Figure 28—MIS protocol header format	152
Figure 29—Protected MIS frame format.....	154
Figure 30—MIS PDU during TLS handshake	155
Figure 31—MIS PDU in existence of MIS SA by TLS	155
Figure 32—MIS PDU protected by an EAP-generated MIS SA.....	156
Figure 33—MIS PDU upon Transport Address Change	156
Figure 34—MIS PDU protected by a GKB-generated MIS SA with a signature TLV	156
Figure 35—MIS PDU protected by digital signature only	157
Figure 36—Fragmented MIS protocol frame format	157
Figure 37—Protected fragmented MIS protocol frame format	158
Figure 38—Message parameter TLV encoding.....	159
Figure 39—The TLV encoding for the vendor-specific TLV (Type = 111)	159
Figure 40—Protocol stack of service access authentication (with an EAP server)	180
Figure 41—Main stages with MN initiated EAP execution	182
Figure 42—Main stages with PoS initiated EAP execution	183
Figure 43—Main stages with MN initiated ERP execution	184
Figure 44—Main stages with PoS initiated ERP execution (1).....	185
Figure 45—Main stages with PoS initiated ERP execution (2).....	186
Figure 46—MIS Key Hierarchy.....	188
Figure 47—MIS PDU protection procedure.....	191
Figure 48—AES-CCM nonce construction.....	192
Figure 49—Format of $B0$	192
Figure 50—Format of counter $Ctr(i)$	193
Figure 51—Security TLV for AES-CCM	193
Figure 52—Security TLV for AES CBC and HMAC-SHA1-96	195
Figure 53—Security TLV for HMAC-SHA1-96.....	195
Figure 54—Security TLV for AES-CMAC	196

Figure 55—Sending and receiving protected MIS PDU	197
Figure 56—A group of management tree of depth 3	199
Figure 57—Three complete subtrees for the group with nodes 000, 001, 010, 011, 101, and 111	200
Figure 58—GKB for the group with nodes 000, 001, 010, 011, 101, and 111	202
Figure 59—Flow diagram of the verify group code generation	203
Figure 60—Flow diagram of the group key wrapping	204
Figure 61—Selection of <i>master group key unwrapping</i> or <i>no group key procedures</i>	205
Figure 62—Flow diagram of the group key unwrapping	205
Figure 63—Flow diagram of <i>no group key data procedure</i>	206
Figure 64—Flow diagram of the <i>master group key unwrapping procedure 1</i>	207
Figure 65—Flow diagram of the <i>master group key unwrapping procedure 2</i>	209
Figure 66—Flow diagram of the <i>master group key unwrapping procedure 3</i>	210
Figure 67—Example of group manipulation distribution using multicast mechanisms	213
Figure 68—Summary of steps performed by MIS user of PoS with group manager	215
Figure 69—Summary of steps performed by MIS user of PoS with group manager (continued from Figure 68).....	216
Figure 70—Flow diagram of CreateCompleteSubtree and CreateCompleteSubtreeFragments procedure	217
Figure 71—Summary of steps performed by MISF of PoS with group manager	219
Figure 72—Summary of steps performed by the recipient MISF	222
Figure 73—Key derivation example	223
Figure 74—MIS PDU protection procedure with the GKB-generated MIS SA	225
Figure 75—Format of <i>B0</i> with associated data	226
Figure 76—Signing with confidentiality	228
Figure 77—Signing without confidentiality	228
Figure 78—Signature verification with confidentiality	229
Figure 79—Signature verification without confidentiality	229
Figure 80—Protocol stack for MIS supported proactive authentication	232
Figure 81—Protocol stack for MIS supported optimized pull key distribution with two points of service	232
Figure 82—Key hierarchy for bundle case.....	235
Figure B.1—An example flow for setting application QoS requirements.....	239
Figure E.1—Encoding example of a LIST with two LINK_ID elements	250
Figure J.1—MIS fragmentation example for Maximum Transmission Unit (MTU) of 1500 octets	287
Figure J.2—Example of protected MIS fragment message	289
Figure M.1—Mobile initiated access authentication phase.....	303
Figure M.2—Network initiated access authentication phase	304
Figure M.3—Push key distribution	305
Figure M.4—Proactive authentication.....	306
Figure M.5—Optimized pull key distribution	307
Figure M.6—Mobile node (MN) initiated termination phase	308
Figure O.1—Example of fragmented complete subtrees with Subgroup Ranges	311
Figure P.1—Bloom Filter example ($k = 3$, $m = 32$)	312

List of Tables

Table 1—Summary of reference points.....	38
Table 2—MIS protocol Ethernet type	47
Table 3—Service management primitives.....	49
Table 4—Link events	53
Table 5—MIS events.....	54
Table 6—Link commands	58
Table 7—MIS commands.....	58
Table 8—Information element containers	60
Table 9—Information elements.....	61
Table 10—Information element namespace	64
Table 11—IE_CONTAINER_LIST_OF_NETWORKS definition	65
Table 12—IE_CONTAINER_NETWORKS definition.....	66
Table 13—IE_CONTAINER_POA definition.....	67
Table 14—MIS_LINK_SAP primitives	71
Table 15—MIS_NET_SAP primitive	71
Table 16—MIS_SAP primitives	72
Table 17—State machine symbols	141
Table 18—Inter-state-machine variables.....	142
Table 19—Exported state machine variables	142
Table 20—State Machines to be searched for incoming message.....	143
Table 21—State Machines to be searched for outgoing message.....	143
Table 22—Description of MIS protocol header fields	153
Table 23—Valid combination of S-bit and security-related TLVs.....	154
Table 24—Cryptographic algorithms	188
Table 25—Ciphersuites	189
Table 26—Device key assignments for recipients through a depth-3 group management tree.....	199
Table 27—Group ciphersuites.....	230
Table 28—Group key distribution ciphersuites.....	231
Table B.1—QoS parameter mapping for IEEE 802.11	240
Table B.2—QoS parameter mapping for IEEE 802.16 and 3GPP2	241
Table B.3—QoS parameter mapping for 3GPP.....	241
Table C.1—Mapping MIS messages to reference points	244
Table D.1—MIS_Link_SAP/IEEE 802.16 primitives mapping.....	245
Table D.2—MIS_LINK_SAP/IEEE 802.11/IEEE 802.3/IEEE 802.1Q primitives mapping.....	246
Table D.3—MIS_LINK_SAP/3GPP/3GPP2 primitives mapping.....	247
Table E.1—Basic data types.....	249
Table E.2—General data types	251
Table E.3—Data types for address	252
Table E.4—Data types for links	253
Table E.5—Link actions.....	261
Table E.6—Link action attributes	261
Table E.7—Link down reason code	262
Table E.8—Link going down reason code	262
Table E.9—Data types for QoS.....	263
Table E.10—Data types for location	263
Table E.11—Value field format of PoA location information (geospatial location).....	264
Table E.12—Data types for IP configuration.....	265
Table E.13—Data types for information elements	265
Table E.14—Network type and subtype representation	270
Table E.15—Data types for binary query.....	272
Table E.16—Data type for RDF query.....	273
Table E.17—Data type for binary information query response.....	273
Table E.18—Data type for RDF information query response	273
Table E.19—Data type for MISF identification	274
Table E.20—Data type for MIS capabilities	274
Table E.21—Data type for MIS registration	276
Table E.22—Data type for handover operations	277
Table E.23—Data type for MIS_NET_SAP primitives	277
Table E.24—Data type for security	277
Table E.25—Delivery types for delivery of control messages	281
Table F.1—Information element identifier values	282
Table J.1—Protection overhead for EAP-generated SAs.....	288
Table K.1—AID assignments.....	290
Table K.2—Type values for TLV encoding.....	291