        The Media Gateway Control Protocol (MGCP) Bulk Audit Package

Status of this Memo

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IESG Note

   This document is being published for the information of the
   community. It describes a non-IETF protocol that is currently being
   deployed in a number of products. Implementers should be aware of
   RFC 3015, which was developed in the IETF Megaco Working Group and
   the ITU-T SG16, and which is considered by the IETF and the ITU-T to
   be the standards-based (including reviewed security considerations)
   way to meet the needs that MGCP was designed to address.

Abstract

   The base Media Gateway Control Protocol (MGCP) includes audit
   commands that only allow a Call Agent to audit endpoint and/or
   connection state one endpoint at a time. This document describes a
   new MGCP package for bulk auditing of a group of gateway endpoints.
   It allows a Call Agent to determine the endpoint naming convention,
   the list of instantiated endpoints as well connection and endpoint
   state for the group of endpoints.

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1.   Introduction

   The reader is assumed to be familiar with the base MGCP protocol [3].

   The base Media Gateway Control Protocol (MGCP) [3] includes audit
   commands that only allow a Call Agent to audit an endpoint and/or a
   connection state, one endpoint at a time. This document describes a
   new MGCP package for bulk auditing of a group of gateway endpoints.
   It allows a Call Agent to determine the endpoint naming convention,
   to determine the list of instantiated endpoints, and to determine the
   connection and endpoint state for the group of endpoints. This is
   particularly important in fail-over situations in which there are
   gateways that have large numbers of endpoints.

   Conventions Used in this Document

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [2].

2. Bulk Audit Package

2.1. Package Definition

   Package Name: BA

   Package Version: 0

   Package Description: This package provides the Call Agent the ability
   to audit and obtain high-level view of endpoint and connection state
   for a group of endpoints in a gateway.

2.1.1. Package Parameters

   A new BulkRequestedInfo parameter is defined for use in the
   AuditEndpoint command. The parameter can be used to request a
   compact list of EndpointIds or to request a high level view of
   endpoint or connection state for a group of endpoints as defined
   below:

      ReturnCode,
      [EndPointNameList,]
      [InstantiatedEndpointList,]
      [ConnectionCountList,]
      [ConnectionModeList,]
      [EndpointStateList,]
      [NextEndpointName,]
      [ReportedEndpointList]
      <-- AuditEndPoint(EndpointId,
                        [StartEndpointName,]
                        [MaxNumEndpoints,]
                        [BulkRequestedInfo])

   Unlike the normal RequestedInfo parameter in the base MGCP
   specification, the BulkRequestedInfo parameter associated with the
   Bulk Audits package can be used with "all-of" wildcards for auditing
   a collection of endpoints. However, it is not an error to specify an
   EndpointId without wildcards.

   The following sub-sections describe the parameters associated with
   the Bulk Audit Command in detail. Sections 2.1.1.1 and 2.1.1.2
   describe the parameters that can be included with a request and
   sections 2.1.1.3 to 2.1.1.8 describe return parameters.

2.1.1.1. StartEndpointName and MaxNumEndpoints Parameters

   Because wild-carding may not be sufficient to qualify the endpoints
   of interest, further qualification can be provided by including a
   StartEndpointName (the first endpoint of interest) and
   MaxNumEndPoints (the maximum number of endpoints of interest). These
   parameters are described according to the following Augmented BNF
   (ABNF) Syntax (refer to RFC 2234 for ABNF syntax definitions [1]):

      "BA/SE" ":" 0*WSP LocalEndpointName

      "BA/NU" ":" 0*WSP MaxNumEndpoints

where MaxNumEndpoints is the decimal number of endpoints with a value
in the range 1 to 65535. The MaxNumEndpoints parameter SHOULD only
be included when requesting an audit for an EndpointStateList and/or
ConnectionCountList. If included in a request for the
EndPointNameList or InstantiatedEndpointList, it MAY be ignored.

Note that only the LocalEndpointName (see ABNF grammar in [3]) is
provided in request and response parameter lines for this package
rather than the full EndpointName. This is done for the sake of
compactness, i.e., the domain name portion is left out since it is
already available in the command line portion of a given request.

If the list of endpoints defined by the StartEndpointName and
MaxNumEndPoints is outside the range designated by the wild-carding,
a report will only be returned for endpoints up to those specified
within the wild-card range.

2.1.1.2. BulkRequestedInfo Parameter

The BulkRequestedInfo parameter line is described according to the
following ABNF syntax definitions:

    BulkRequestedInfo = "BA/F:" 0*WSP
          *(EndpointOrInstantList *("," EndpointOrInstantList))
        / *(EndpointOrConnState *("," EndpointOrConnState))

    EndpointOrConnState = "BA/C" / "BA/M" / EndpointStateParam

    EndpointOrInstantList = "BA/Z" / "BA/X"

    EndpointStateParam = "BA/S" "(" StateType
                                    0*("," 0*(WSP) StateType)")"

    StateType = "I" / "D" / "N" / "S" / "H"

where the BulkRequestedInfo parameters have the following meaning:

    * "BA/Z" is a request to return EndPointNameList
    * "BA/X" is a request to return InstantiatedEndpointList
    * "BA/C" is a request to return the ConnectionCountList
    * "BA/M" is a request to return the ConnectionModeList
    * "BA/S" is a request to return the EndpointStateList

Each of the parameters can be provided at most once in the
BulkRequestedInfo.

EndpointStateParam Parameter:

As indicated in the above ABNF, the EndpointStateParam parameter is
itself parameterized with one or more StateType parameters that
define the conditions to be evaluated for the endpoint:

* "I" - the endpoint is in-service,
* "D" - the endpoint is disconnected (see sections 4.3 and 4.4.7 of
   [3] for a discussion on disconnected endpoints),
* "N" - the endpoint is in the notification state,
* "L" - the endpoint is in lockstep state (i.e., waiting for an RQNT
   after a response to a NTFY has occurred while in lockstep mode)
* "S" - there is an active on-off (OO) or timeout (TO) signal on the
   endpoint,
* "H" - the endpoint is in some state other than "idle". The
   meaning of this last parameter depends on the type of endpoint:
   * The parameter has no meaning for endpoints that only provide
      bearer services (with no state that the endpoint is aware of).
      In this case, the condition is always evaluated to false
      (corresponding to "idle").
   * For endpoints that have a state machine associated with them
      (such as a CAS endpoint), the endpoint MUST be in some state
      other than the "idle" state in order for the condition to be
      evaluated as true.
   * In the case where the endpoint has hook-state associated with
      it, the hook-state MUST be off-hook. In the case of digital
      channel associated signaling (CAS) connections, hook-state may
      be provided in either direction. If the hook-state in either
      direction is off-hook, the endpoint is considered non-idle,
      i.e., the condition is satisfied.

The list of StateTypes may be extended in the future. If an unknown
StateType is encountered, the command MUST be rejected with error
code 803 (i.e., "unsupported StateType").

The report, provided as a result of this request, yields an
indication of either "True", "False", or "Out of Service" for each
endpoint. If the endpoint is in-service and any one of the criteria
holds true, then the report for the endpoint will evaluate to "True".
A "False" indication will only be reported if the endpoint is in-
service and all criteria evaluate to false. The report thus provides
the logical "OR" function over the conditions audited for endpoints
in-service. Irrespective of the state being audited, an "Out of
Service" indication will always be reported if the endpoint is
considered out-of-service.

Note that the criteria "D", "N", "L", "S" and "H" can only be true if
the endpoint is in-service, so that requesting "I" at the same time
(although allowed) would be unnecessary (i.e., redundant).

Example: If the request for EndpointStateList for one or more
endpoints includes the parameter line:

    BA/F: BA/S(D,N)

indicating a request for a report on whether endpoints are
disconnected or in the notification state. If a given endpoint is in
either a "disconnected" or "notification" state, then the report will
indicate "True" for that endpoint. If the endpoint is neither in a
disconnected state nor in a notification state, but is in-service,
then the report for that endpoint will indicate "False". If the
endpoint is out-of-service, then the report for that endpoint will
indicate "Out of Service".

In order to only determine whether an endpoint is in-service or out-
of service, the Call Agent should make a request with only the "I"
StateType parameter.

2.1.1.3. EndPointNameList and InstantiatedEndpointList Parameters

EndPointNameList Parameter:

The EndPointNameList is a list of the endpoint names (i.e., the
endpoint naming convention for the endpoints configured for service)
supported by the gateway as qualified by the wildcarded EndPointId,
and possibly StartEndPointName and MaxNumEndpoints parameters. This
list can include one or more lines in the following ABNF format:

    "BA/Z:" 0*WSP RangedLocalName 0*("," 0*WSP RangedLocalName)

where RangedLocalName is a LocalEndpointName that may include the
ranged wildcard notation described in Appendix E (section E.5) of
[3], i.e.,:

    RangeWildcard = "[" NumericalRange *("," NumericalRange) "]"
    NumericalRange   = 1*(DIGIT) ["-" 1*(DIGIT)].

Example:

    ba/z: ds/ds1-1/[1-24], ds/ds1-2/[1-24], ds/ds1-3/[1-24]

or simply:

    ba/z: ds/ds1-[1-3]/[1-24]

Note that, since range wildcards use the character "[" to indicate
the start of a range, the "[" character MUST NOT be used in endpoint
names that use range wildcards.

Note that the ranged wildcard notation (RangeWildcard above) also
allows commas between ranges like:

    ba/z: ds/ds1-1/[1,3-5,8-24]

For virtual endpoints, that are automatically created and deleted on
the fly by the gateway, there is a difference between reporting the
endpoint names (i.e., the "naming convention") used in describing the
endpoints and reporting the actual endpoints that are instantiated at
the time the request is made. For this case:

* EndPointNameList is a request to return the naming convention and

* InstantiatedEndpointList is a request to return the "real" (or
   instantiated) endpoints.

InstantiatedEndpointList Parameter:

    The syntax of the InstantiatedEndpointList value is the same as
    the EndPointNameList value returned with EndPointNameList, i.e., a
    number of lines may be returned with the following syntax:

        "BA/X:" 0*WSP RangedLocalName 0*("," 0*WSP RangedLocalName)

In the case of hard-wired/physical endpoints (such as DS0's) or other
persistent endpoints, the InstantiatedEndpointList would normally not
be requested. However, if it is requested, the
InstantiatedEndpointList and the EndPointNameList will be the same.

For virtual endpoints that are not persistent, an "all of" wild card
("*") is returned for the leftmost term of the name, which is
dynamically assigned in the EndPointNameList to indicate that
arbitrary names apply, and that the endpoints are virtual and non-
persistent. The "all of" wild card notation MUST NOT be used when
returning the EndPointNameList for persistent endpoints however. The
following example illustrates this:

ba/z: announcement/*
ba/z: foo/bar/*
ba/z: foo/foo/*

The "all of" wildcard tells us, that "announcement" is simply the
leftmost term for a dynamic set of non-persistent virtual endpoints.
To instantiate one of these endpoints, we would include the "any of"
wildcard (e.g., "announcement/$") as the LocalEndpointName in the
EndpointId of a request (e.g., NotificationRequest or
CreateConnection). The response would then include the
SpecificEndpointId indicating the instantiated endpoint. Also, note
in the above example that "foo" defines two different levels of non-
persistent virtual endpoints.

2.1.1.4. ConnectionCountList

The ConnectionCountList indicates the number of connections on a
series of endpoints. It consists of a number of lines with the
following ABNF syntax:

    "BA/C:" 0*WSP NumConnections 0*(NumConnections)

where NumConnections is either:

*   a hexadecimal digit indicating the number of connections on the
    endpoint corresponding to the position on the list, or

*   the letter "Z" indicating that there are more than 15 connections
    on this endpoint.

2.1.1.5. ConnectionModeList

The ConnectionModeList indicates the connection modes for all the
connections on a series of endpoints. It consists of a number of
lines with the following ABNF syntax:

    "BA/M:" 0*WSP ModeOrCount 0*(ModeOrCount)

    ModeOrCount = ConnCount / ConnMode

    ConnMode = "I" / "S" / "R" / "B" / "C" / "L" / "T" / "N" / "U"

where ConnCount is either hexadecimal value corresponding to 0-15
connections on an endpoint or the value "Z", indicating that more
than 15 connections are present.

ConnMode indicates the connection mode where:

    * "I" indicates "inactive" connection mode
    * "S" indicates "sendonly" connection mode
    * "R" indicates "recvonly" connection mode
    * "B" indicates "sendrecv" connection mode
    * "C" indicates "confrnce" connection mode
    * "L" indicates "loopback" connection mode
    * "T" indicates "conttest" connection mode
    * "N" indicates "netwloop" connection mode
    * "U" indicates some other connection mode

For a definition of MGCP connection modes, refer to section 3.2.2.6
of [3].

If an endpoint has no connections on it, ModeOrCount is given the
value "0". If there is one connection associated with the endpoint,
the symbol for the connection mode (ConnMode) is provided. If, on
the other hand, there are from 2 to 15 connections, a symbol
representing the number of connections (ConnCount) is provided
followed by a list of symbols indicating the connection mode
(ConnMode) for each connection. If there are more than 15
connections, "Z" is indicated for ConnCount and no connection modes
are provided for the connections on that endpoint.

2.1.1.6. EndpointStateList Parameter

The EndpointStateList gives an overview of the endpoint state for a
series of endpoints. It consists of a number of lines with the
following ABNF syntax:

    "BA/S:" 0*WSP EndPointState 0*(EndPointState)

    EndPointState = "T" / "F" / "O"

where:

    * "T" indicates "True"
    * "F" indicates "False"
    * "O" indicates "Out of Service"

The "True" or "False" determination is based on the criteria supplied
in StateType parameters when the request is made.

Note that the EndPointState indicator does not say anything about the
connection state of the endpoint.

2.1.1.7. NextEndpointName Parameter

   The NextEndpointName parameter will be included in the return, if
   there are additional endpoints in this gateway covered by the wild-
   carded endpoint name that were not reported, but for which
   information was available to be reported.

   Note that the NextEndpointName is the LocalEndpointName (as opposed
   to EndpointName) of the next endpoint after the last endpoint
   reported. The syntax is as follows:

      "BA/NE" ":" 0*WSP LocalEndpointName

   A gateway may supply a report that is shorter than the request if the
   resulting report would have resulted in a message that would be too
   large (i.e., such that the report is larger than the maximum datagram
   size). In the case where the gateway supplied a response for less
   endpoints than requested, the gateway MUST supply NextEndpointName in
   the response.

   In order to continue the audit on a following set of endpoints, the
   Call Agent can make a further request by using the NextEndpointName
   as the starting point (e.g., as the StartEndpointName in a following
   request).

2.1.1.8. ReportedEndpointList Parameter

   A ReportedEndpointList MUST be provided in a response line before
   list(s) of EndpointStateList and/or ConnectionCountList in order to
   clearly specify the list of endpoints that are being reported. The
   ABNF syntax is as follows:

      "BA/EL:" 0*WSP LimitedRangedName 0*("," 0*WSP LimitRangedName)

   where LimitedRangedName is a LocalEndpointName that may include a
   ranged wildcard notation (RangeWildcard syntax indicated earlier).
   However, unlike the RangedLocalName that allows the range wildcard
   notation to be used on multiple terms of the local name at the same
   time, LimitedRangedName only allows the range notation to be used for
   the last term, i.e., the following is valid:

      ba/el: ds/ds1-1/[1,3-5,8-24]

   or

      ba/el: ds/ds1-1/[1-24], ds/ds1-2/[1-24], ds/ds1-3/[1-24]

However, the following is not valid:

    ba/el: ds/ds1-[1-3]/[1-24]

Note that a single bulk audit request may include a request to return
both ConnectionCountList and EndpointStateList. However, the
resulting report that includes both MUST cover the same endpoints.

A single bulk audit request may also include a request to return both
EndPointNameList and InstantiatedEndpointList. However, requests for
either an EndPointNameList and/or an InstantiatedEndpointList MUST
NOT include a request for either ConnectionCountList or
EndpointStateList.

2.1.2. Bulk Auditing of Non-persistent Virtual Endpoints

Note that gateways that have non-persistent virtual endpoints may
have instantiated endpoints that are disjoint with respect to the
name space. The ReportedEndpointList in front of a
ConnectionCountList and/or EndpointStateList describes exactly which
endpoints are being reported.

    Example:

        A Call Agent requests to know about the EndPointNameList for the
        endpoints on a conference bridge:

        AUEP 1200 *@gw1.x.net MGCP 1.0
        BA/F: BA/Z

    Response:

        200 1200 OK
        ba/z: cnf/*

This indicates the naming convention but in fact not all of these
endpoints are instantiated. A request for the list of instantiated
endpoints, i.e.,:

        AUEP 1201 cnf/*@gw1.x.net MGCP 1.0
        BA/F: BA/X

    might yield:

        200 1201 OK
        ba/x: cnf/[1-3]
        ba/x: cnf/[6-12]

   indicating that only these particular endpoints are instantiated.

   Suppose the Call Agent now asks for the ConnectionCountList i.e.,:

      AUEP 1202 cnf/*@gw1.x.net MGCP 1.0
      BA/F: BA/C

   The resulting instantiated virtual endpoints may be disjoint, which
   would be indicated by the ReportedEndpointList in front of the
   ConnectionCountList, e.g.,:

      200 1202 OK
      ba/el: cnf/[1-3]
      ba/c: 035
      ba/el: cnf/[6-12]
      ba/c: 3450333

   or alternatively:

      200 1202 OK
      ba/el: cnf/[1-3], ba/el: cnf/[6-12]
      ba/c: 035
      ba/c: 3450333

   or

      200 1202 OK
      ba/el: cnf/[1-3], ba/el: cnf/[6-12]
      ba/c: 0353450333

2.1.3. Package Specific Return Codes

   The following return codes are specific to this package:

      800   Invalid NextEndpointName
      801   Invalid StartEndpointName
      802   Invalid or unsupported BulkRequestInfo Parameter
      803   Invalid or unsupported StateType
      804   Bulk Audit Type not supported
      805   Incorrectly specified endpoint range
      806   Requested StartEndpoint unknown or unavailable

   Note that package specific error codes includes the package name
   following the error code. For example, if error code 801 occurs in
   response to a request with a transaction ID of 1001 it would be sent
   as:

      801 1001 /BA

2.2. Examples of Package Use

2.2.1. Endpoint List

   This section contains examples of how to obtain a list of endpoints.

   Example 1: This is an example of a gateway that contains a single OC3
   that contains a single level of hierarchy at the T1 level.

   The request is made:

      AUEP 1200 *@gw1.x.net MGCP 1.0
      BA/F: BA/Z

   This may result in a single "BA/Z" term with ranges specifying all of
   the endpoints.

      200 1200 OK
      ba/z: ds/ds1-[1-84]/[1-24]

   Example 2: In this example the gateway has 10 analog lines and a
   single T1. The same request is made as in example 1, but now the
   response is:

      200 1200 OK
      ba/z: aaln/[1-10]
      ba/z: ds/ds1-1/[1-24]

2.2.2. Connection Count List

   Example1: Audit the number of connections on endpoints of a single
   E1:

      AUEP 2111 ds/e1-3/*@gw1.net
      BA/F: BA/C

   Response:

      200 2111 OK
      BA/EL: ds/e1-3/[1-30]
      BA/C: 012111210001000001000001000010

   Example 2: Audit the number of connections on endpoints of a DS3:

      AUEP 1144 ds/ds3-1/*@gateway.net
      BA/F: BA/C

   Response:

      200 1144 OK
      BA/EL: ds/ds3-1/[1-192]
      BA/C: 01000001000100001000001
      BA/C: 00100000010100000001001
      :
      BA/C: 01100010001000001000010
      BA/C: 01111101000100001000001
      BA/C: 01100000110000001000001
      BA/NE: ds/ds3-1/193

   In this case, the response provided by the gateway contained
   information about the first 192 endpoints. If the ds-3 contained a
   T1 hierarchy, the "BA/EL" and "BA/NE" values would indicate that
   hierarchy e.g.,:

      200 1144 OK
      BA/EL: ds/ds3-1/ds1-1/[1-24]
      BA/C: 01000001000100001000001
      BA/EL: ds/ds3-1/ds1-2/[1-24]
      BA/C: 00100000010100000001001
      :
      BA/EL: ds/ds3-1/ds1-6/[1-24]
      BA/C: 01100010001000001000010
      BA/EL: ds/ds3-1/ds1-7/[1-24]
      BA/C: 01111101000100001000001
      BA/EL: ds/ds3-1/ds1-8/[1-24]
      BA/C: 01100000110000001000001
      BA/NE: ds/ds3-1/ds1-9/1

   The Call Agent could continue to request endpoints by indicating the
   starting endpoint where it left off, i.e., simply using the returned
   "BE/NE" value as the "BA/SE" value for the next request:

      AUEP 1145 ds/ds3-3/*@gw1.net
      BA/F: BA/C
      BA/SE: ds/ds3-1/ds1-9/1

Example 3: In this case, the Call Agent wants to know about the
connection state of 12 DS0's starting with the endpoint with the
LocalEndpointName "ds/ds3-1/ds1-6/4":

    AUEP 1146 ds/ds3-1/*@gw1.net
    BA/F: BA/C
    BA/SE: ds/ds3-1/ds1-6/4
    BA/NU: 12

Response:

    200 1144 OK
    BA/EL: ds/ds3-1/ds1-6/[4-15]
    BA/C: 011000010001
    BA/NE: ds/ds3-1/ds1-6/16

2.2.3. Connection Mode List

Example: Audit the connection modes for connections on the endpoints
of a single E1:

    AUEP 2111 ds/e1-3/*@gw1.net
    BA/F: BA/M

Response:

    200 2111 OK
    BA/EL: ds/e1-3/[1-30]
    BA/M: 0R2BRBBB2RRB000B00000B00000B0000B0

This shows that:

*   Endpoint ds/e1-3/1 has no connections
*   Endpoint ds/e1-3/2 has one connection and it is in "recvonly"
    mode.
*   Endpoint ds/e1-3/3 has two connections which are in "sendrecv" and
    "recvonly" mode
*   Endpoints ds/e1-3/4 to ds/e1-3/6 each have one connection - in
    "sendrecv" mode in all cases
*   Endpoints ds/e1-3/7 has two connections, both in "recvonly" mode
*   etc.

2.2.4. Endpoint State

Endpoint state requests and responses are similar. An example of
requesting endpoint state similar to example 3 in the previous
section:

```
   AUEP 1150 ds/ds3-1/*@gw1.net
   BA/F: BA/S(I)
   BA/SE: ds/ds3-1/ds1-6/4
   BA/NU: 12
```

Response:

```
   200 1150 OK
   BA/EL: ds/ds3-1/ds1-6/[4-15]
   BA/S:  TOOTTOOTTOOT
   BA/NE: ds/ds3-1/ds1-6/16
```

The request for in-service endpoints returns "True" for all endpoints
in-service, and "O" for all endpoints "Out of Service".

A similar request but with additional parameters might be:

```
   AUEP 1151 ds/ds3-1/*@gw1.net
   BA/F: BA/S(H,N)
   BA/SE: ds/ds3-1/ds1-6/4
   BA/NU: 12
```

Response:

```
   200 1151 OK
   BA/EL: ds/ds3-1/ds1-6/[4-15]
   BA/S:  FFFTFFFFFFFO
   BA/NE: ds/ds3-1/ds1-6/16
```

This indicates that at least one of the StateType parameters "H"
(off-hook) and "N" (notification state) evaluated to true for the
endpoints that have a "T" associated with then (i.e., ds/ds3-1/ds1-
6/7 and ds/ds3-1/ds1-6/16 since the request started from ds/ds3-
1/ds1-6/4). All other endpoints are neither off-hook nor in the
"notification state". Note that endpoint ds/ds3-1/ds1-6/15 is marked
as being out-of-service.

It is possible to request both connection state and endpoint state in
the same request such as:

```
   AUEP 1151 ds/ds3-1/*@gw1.net
   BA/F: BA/S(H,N), BA/C
   BA/SE: ds/ds3-1/ds1-6/4
   BA/NU: 12
```

   In this case, the response might be:

      200 1151 OK
      BA/EL: ds/ds3-1/ds1-6/[4-15]
      BA/S: FFFTFFFFFFFO
      BA/C: 011000010001
      BA/NE: ds/ds3-1/ds1-6/16

3. IANA Considerations

   The MGCP package title, "Bulk Audit", with the name, "BA", has been
   registered with IANA as indicated in Appendix C.1 in [3].

4. Security Considerations

   Section 5 of the base MGCP specification [3] discusses security
   requirements for the base protocol, which apply equally to the
   package defined in this document. Use of a security Protocol such as
   IPsec [4, 5] that provides per message authentication and integrity
   services is required in order to ensure that requests and responses
   are obtained from authenticated sources and that messages have not
   been modified. Without such services, gateways and Call Agents are
   open to attacks.

   For example, although audit requests from unauthorized sources will
   not modify media gateway state, the information provided could be
   used to locate idle endpoints, which could then lead to making
   unauthorized calls. Similarly, an attack that modifies a response to
   an audit returned to a Call Agent could lead to a denial of service
   attack in which a Call Agent that is provided misinformation as to
   endpoint state could take some incorrect action such as taking valid
   calls out of service.

5. References

   [1] Crocker, D. and P. Overell, "Augmented BNF for Syntax
        Specifications: ABNF", RFC 2234, November 1997.

   [2] Bradner, S., "Key words for use in RFCs to Indicate Requirement
        Levels", BCP 14, RFC 2119, March 1997.

   [3] Andreasen, F. and B. Foster, "Media Gateway Control Protocol
        (MGCP) Version 1.0", RFC 3435, January 2003.

   [4] Kent, S. and R. Atkinson, "Security Architecture for the
        Internet Protocol", RFC 2401, November 1998.

   [5] Kent, S. and R. Atkinson, "IP Encapsulating Security Payload
        (ESP)", RFC 2406, November 1998.

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7. Full Copyright Statement

Acknowledgement