Media Gateway Control Protocol (MGCP) Return Code Usage

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Abstract

   This document provides implementation guidelines for the use of
   return codes in RFC 3435, Media Gateway Control Protocol (MGCP)
   Version 1.0. Return codes in RFC 3435 do not cover all possible
   specific situations that may ever occur in a gateway. That is not
   possible and not necessary. What is important is to ensure that the
   Call Agent that receives a return code behaves appropriately and
   consistently for the given situation. The purpose of this document
   is to provide implementation guidelines to ensure that consistency.

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1. Introduction

   This document provides implementation guidelines for the use of
   return codes in the Media Gateway Control Protocol MGCP 1.0 [1].
   Return codes in [1] do not cover all possible specific situations
   that may ever occur in the gateway. That is not possible and not
   necessary. What is important is to ensure that the Call Agent that
   receives that return code behaves appropriately and consistently for
   the situation that occurred. The solution described in this document
   is to categorize return codes that gateways return based on the
   expected behavior for the Call Agents that receive them.

   Categorizing errors helps both Call Agent and gateway developers: it
   helps gateway developers choose an appropriate return code when a
   specific one for the situation is not available; it also helps Call
   Agent developers ensure that there is consistent behavior for the
   return code that is received.

1.2. Document Organization

   In addition to categorizing return codes (section 2.1), section 2.2
   provides a consolidated list of return codes in terms of "situations"
   that may have triggered and the "categories" that they fall under.
   This provides some additional implementation guidelines for the use
   of these return codes. Section 2.3 includes a summary of the return
   codes and their categories. Section 3 provides some additional
   implementation guidelines for Call Agent and gateway developers.

2. Return Code Usage

2.1. Return Code Categories

   The following categorizes return codes from gateways based on
   expected Call Agent behavior.

   Category normal: These return codes are used in normal operation and
      do not represent error conditions.

   Category none (specific errors requiring specific action): A return
      code associated with a specific situation in the gateway that will
      invoke a corresponding specific Call Agent behavior. As such,
      these return codes are not categorized into a common behavioral
      category.

   Category "Service Failure": A category in which the endpoint is
      either out-of-service or the treatment by the Call Agent is
      expected to be the same as for an out-of-service endpoint.

Category "Provisioning Mismatch": A situation where the gateway has
    indicated that it does not support what the Call Agent has asked
    it to do. This may be caused by a lack of synchronization between
    the provisioning of the Call Agent and the gateway. Note that
    attempts should be made to weed out these types of error
    situations during integration testing.

Category "Temporary Failure": The transient nature of this error is
    such that this particular call is likely to be permanently
    affected but later calls on the same endpoint may proceed
    successfully. Typically the situation that caused this error is
    not going to disappear unless there is some change in state in the
    gateway or network (e.g., more bandwidth becomes available, more
    CPU resources become available etc.). This situation is not
    likely to change in a few 10's of milliseconds but could change
    within some number of seconds or minutes later (as resources
    become free), i.e., within the time period that you might expect a
    different call to be tried on that endpoint.

Category "State Mismatch": A case where there is a state mismatch
    between the Call Agent and the gateway that can be resolved by the
    Call Agent making a request that is more appropriate to the
    gateway state. Although categorized with a common category
    indicator the behavior of the Call Agent will depend on the
    situation (the type of state mismatch that has occurred as well as
    other state information, e.g., call state).

Category "Remote Connection Descriptor Error": This indicates some
    mismatch between the two gateways involved in the call. Note that
    per RFC 2327, all gateways should ignore SDP attributes that they
    do not recognize (i.e., lack of recognition of an SDP attribute
    should not be the cause of an error indication).

The exact behavior of the Call Agent for the above categories may
depend on the type of endpoint (analog, ISUP trunk, CAS trunk, etc.),
whether this is the originating or terminating endpoint in the call
and possibly other information related to call state. This document
does not attempt to outline the Call Agent behavior based on call
state. Instead, it just recommends that the Call Agent behavior be
consistent based on a combination of call state and the specific
category of error received.

2.2. Return Code Situations and Categories

This section describes return codes in MGCP 1.0 [1] in terms of
"situations" that may have triggered that return code and
"categories" to which the return code belongs. The purpose is to
provide developers additional guidelines for return code use.

Note that any indication that a response is valid for a
NotificationRequest (RQNT) is also an indication that it is valid for
a connection handling request, i.e., CreateConnection (CRCX),
ModifyConnection (MDCX), or DeleteConnection (DLCX) with an
encapsulated RQNT. The same holds for the EndpointConfiguration
(EPCF) command.

000 - Response acknowledgement

    Response valid for: Confirmation of a final response after a
    provisional response (3-way handshake).

    Situation: If the final response that follows a provisional
    response contains an empty response acknowledgement parameter, a
    Response Acknowledgement is used to acknowledge the final
    response (section 3.5.6 of [1]).

    Category: normal.

100 - Transaction in progress

    Response valid for: Any command that may result in a long
    transaction execution time, e.g., more than 200 ms.

    Situation: When a transaction is expected to take a processing
    time that is beyond the normal retry timer, the gateway will
    return a provisional response. A final response will be
    provided later, after the transaction has completed. Refer to
    section 3.5.6 of [1]. An example of this might be a
    CreateConnection command using RSVP, where the time to create
    the connection may be longer than usual because of the need to
    perform the network resource reservation.

    Category: normal.

101 - Transaction has been queued for execution

    Response valid for: Any command.

    Situation: As described in [1], Section 4.4.8, we assume that
    Call Agents and gateways conceptually maintain a queue of
    incoming transactions to be executed. Associated with this
    transaction queue is a high-water and a low-water mark. Once
    the queue length reaches the high-water mark, the entity should
    start issuing 101 provisional responses (transaction queued)
    until the queue length drops to the low-water mark. This
    applies to new transactions as well as to retransmissions. A

final response will be provided later, after the transaction has
completed. In this case, the Call Agent should throttle back
its request rate for this gateway.

Category: normal.

200 - Transaction executed normally

Response valid for: Any command (including DeleteConnection).

Situation: Normal response as a result of successful
execution. The 250 response code can be used to acknowledge a
successful completion of a DeleteConnection command. However, a
200 response code is also appropriate.

Category: normal

250 - The connection was deleted

Response valid for: DeleteConnection.

Situation: Response to a successful DeleteConnection command.

Category: normal

400 - Unspecified transient error

Response valid for: Any command.

Situation: Unspecified transient error. A more specific error
code should be used if one is available since this error code
provides very little information. If used, some specific
commentary should be included to aid in debug.

Category: "Temporary Failure".

401 - The phone is already off-hook

Response valid for: NotificationRequest.

Situation: This is returned in response to a request for an
off-hook transition requested event when the phone is already
off-hook. It is also returned when a request is made to
generate a signal that has an explicit on-hook precondition in
the signal definition, such as the ringing signal ("rg") in the
Line package [2]. It is also returned when requesting an

incoming off-hook/seizure indication for a Channel Associated
Signaling (CAS) trunk when the incoming hook-state for that
trunk is already off-hook.

Category: "State Mismatch". If the Call Agent makes the request
with a requested event indicating a different hook-state, the
request should not result in this return code again.

402 - The phone is already on-hook

Response valid for: NotificationRequest.

Situation: This is returned in response to a request for an on-
hook or hook-flash requested event when the phone is already
on-hook. It is also returned when a request is made to generate
a signal that has an explicit off-hook precondition in the
signal definition, such as the dial tone ("dl") in the Line
package [2]. It is also returned when requesting an incoming
on-hook indication for a CAS trunk when the incoming hook-state
for that trunk is already on-hook.

Category: "State Mismatch". If the Call Agent makes the
request with a requested event indicating a different hook-
state, the request should not result in this error again.

403 - Insufficient resources available at this time

Response valid for: Any command.

Situation: This is returned if the request cannot be processed
due to a temporary lack of gateway resources, such as CPU
utilization, DSP resources, memory etc; however, the command may
succeed at a later time when resources free up. Note that lack
of network resources should not result in this code (i.e.,
return code 404 would be more appropriate).

Category: "Temporary Failure".

404 - Insufficient bandwidth at this time.

Response valid for: CreateConnection, ModifyConnection.

Situation: This is an indication that there is not enough
bandwidth available to sustain the call. It is as a result of
some failed bandwidth check (could be RSVP or some other
mechanism). It is possible that the Call Agent could request a

codec requiring lower bandwidth codec and have a successful
result. Alternatively, it could treat this as a "Temporary
Failure" for this codec.

Category: "Temporary Failure". Although categorized under
this general category, note that the Call Agent could apply some
specific behavior (try a lower bandwidth codec) depending on
policy.

405 - Endpoint is restarting

Response valid for: Any command.

Situation: It may be returned to requests made when the
endpoint is in-service and has initiated the restart procedures
(see [1], Section 4.4.6) but the procedure has not yet
completed. If the request is made at a later time, it may be
"successful" but may not be appropriate (because of possible
state mismatch). The Call Agent should proceed after it
believes the restart procedure has completed.

Category: "Temporary Failure"

406 - Transaction Timeout

Response valid for: Any command.

Situation: The transaction took longer than expected and has
been aborted. An example might be a transaction where a
provisional response (100 response code) was returned.
Following that, the gateway determined that the actual
transaction was taking longer than should reasonably be expected
and as a result it aborted the transaction and returned 406 as
the final response.

Category: "Temporary Failure". If this error code is
returned repeatedly, it could indicate a more serious problem.

407 - Transaction aborted by some external action.

Response valid for: Any command.

Situation: This is returned to indicate cancellation of a
pending request (see [1] Section 4.4.4). For example,
DeleteConnection is received while processing a CreateConnection
or ModifyConnection. Also, if either a ModifyConnection,

NotificationRequest, or EndpointConfiguration command is in progress, and the same command is received with a different transaction Id, 407 will be returned.

Category: none (specific situation and behavior).

409 - Internal overload

Response valid for: Any command.

Situation: Gateway is overloaded (e.g., too many requests per second from the Call Agent) and is unable to process any more transactions at this time. In this case, the Call Agent SHOULD throttle back its request rate for this gateway as described in [1], Section 4.4.8.

Category: "Temporary Failure". Note that although the Call Agent behavior with respect to the call being set up corresponds to this general category, there is some specific Call Agent behavior implied as well (i.e., the Call Agent throttling back).

410 - No endpoint available

Response valid for: CreateConnection using an "any of" wildcard.

Situation: A CreateConnection request was made with an "any of" ("$") wildcard and no endpoint was available to execute the request. As described in [1], Section 2.3.5, when the "any of" wildcard is used with the CreateConnection command, the endpoint assigned MUST be in-service and MUST NOT already have any connections on it.

Category: none (specific situation and behavior).

500 - Endpoint unknown

Response valid for: Any command.

Situation: There is no endpoint matching the EndpointId provided with the command. This could be the result of a provisioning mismatch between the Call Agent and the gateway or it could be because a card was removed from the gateway so that the endpoint is no longer available (in which case a RestartInProgress should be received, although the Call Agent cannot depend on this). Note that the endpoint is not just out-of-service (in which case 501 would be used); it is completely unknown/unavailable to the MGCP.

Category: "Provisioning Mismatch".

501 - Endpoint is not ready or is out of service

Response valid for: Any command.

Situation: This is returned if the endpoint is in a permanent "not ready" state. This includes maintenance states such as out-of-service. Note that an endpoint that has initiated the restart procedure is in-service, and hence should not use this return code, even if the restart procedure has not yet completed (see [1], Section 4.4.5).

Category: "Service Failure".

502 - Insufficient resources (permanent).

Response valid for: Any command.

Situation: This is returned when the endpoint does not have sufficient resources and future requests on this endpoint are expected to fail, meaning some resources dedicated to the endpoint are broken (e.g., return code 529 - "hardware failure" might be a more specific indication). For situations where resources may become available in the future (i.e., resources are pooled and not available at the present time), return code 403 should be used instead.

Category: "Service Failure".

503 - "All of" wildcard too complicated.

Response valid for: Any command.

Situation: This is returned when the wildcard convention used in the request is understood, but the requested command cannot be processed with the specified wildcarding. An example of this would be a NotificationRequest with a request such that a failure would make it too difficult to roll back the state of all the endpoints to what they were prior to the request.

Category: Normally treated as a "Provisioning Mismatch". Note however, that the Call Agent could treat it differently by recovering with some specific behavior (e.g., generate a number of individual requests without wildcards instead of a single one with the wildcard).

504 - Unknown or unsupported command.

    Response valid for: Any unknown command.

    Situation: A command was requested other than those specified
    in the MGCP specification [1], and the command is not supported.

    Category: "Provisioning Mismatch".

505 - Unsupported remote connection descriptor.

    Response valid for: CreateConnection, ModifyConnection.

    Situation: One or more mandatory parameters or values in the
    RemoteConnectionDescriptor are not supported by the gateway.
    Note that, per [3], unsupported attribute lines must be ignored
    and hence should not result in any errors.

    Category: "Remote Connection Descriptor Error".

506 - Inability to satisfy both local connection options and remote
    connection descriptor simultaneously.

    Response valid for: CreateConnection, ModifyConnection.

    Situation: The LocalConnectionOptions and
    RemoteConnectionDescriptor contain one or more mandatory
    parameters or values that conflict with each other and/or cannot
    be supported at the same time (except for codec negotiation
    failure - see error code 534).

    Category: "Remote Connection Descriptor Error".

507 - Unsupported Functionality. Note that this error code SHOULD
    only be used if there is no other more specific error code for
    the unsupported functionality.

    Response valid for: Any command.

    Situation: Any situation where a request from the Call Agent
    is not supported by the gateway - beyond the situations already
    covered by other more specific return codes.

    Category: "Provisioning Mismatch".

508 - Unknown or unsupported quarantine handling.

    Response valid for: NotificationRequest.

   Situation: The endpoint does not support or does not recognize
   the requested quarantine handling.

   Category: "Provisioning Mismatch".

509 - Error in RemoteConnectionDescriptor

   Response valid for: CreateConnection, ModifyConnection.

   Situation: There is a syntax or semantic error in the Remote
   Connection Descriptor. For example, there is no IP address for
   an RTP media stream.

   Category: "Remote Connection Descriptor Error".

510 - Protocol error

   Response valid for: Any command.

   Situation: Some unspecified protocol error was detected.
   Gateways should use this error as a last resort since it
   provides very little information. If used, some specific
   commentary should be included to aid in debug.

   Category: "Provisioning Mismatch".

511 - Unrecognized parameter extension.

   Response valid for: Any command.

   Situation: It is returned if the requested command contains an
   unrecognized mandatory parameter extension ("X+"). In MGCP 1.0,
   this specifically refers to unrecognized parameters, since other
   error codes are available for unrecognized connection modes
   (517), unrecognized packages (518), unrecognized local
   connection options (541), etc.

   Category: "Provisioning Mismatch".

512 - Gateway not equipped to detect one of the requested events.

   Response valid for: NotificationRequest.

   Situation: A valid event was requested however the gateway is
   not equipped to detect this event (i.e., the package is only
   implemented partially). Of course, such an implementation would
   not conform to [1]. Note that if an invalid event was
   requested, i.e., an event not defined in the relevant package,

then error code 522 should be used. Also note, that if the
package is unknown or unsupported, then error code 518 should be
used.

Category: "Provisioning Mismatch".

513 - gateway is not equipped to generate one of the requested
      signals.

Response valid for: NotificationRequest.

Situation: A valid signal was requested, however the gateway is
not equipped to generate this signal (i.e., the package is only
implemented partially). Of course, such an implementation would
not conform to [1]. Note that if an invalid signal was
requested, i.e., a signal not defined in the relevant package,
then error code 522 should be used. Also note, that if the
package is unknown or unsupported, then error code 518 should be
used.

Category: "Provisioning Mismatch".

514 - The gateway cannot send the specified announcement.

Response valid for: NotificationRequest with a request for an
announcement to be played.

Situation: This is a specific situation with respect to
playing announcements on an endpoint or connection associated
with the endpoint. Error code 538 could be used instead.

Category: "Provisioning Mismatch".

515 - Incorrect connection-id.

Response valid for: CreateConnection, ModifyConnection,
DeleteConnection, NotificationRequest, AuditConnection.

Situation: An unknown connection-id has been specified. It is
possible that the connection has already been deleted. It
should be noted that a connection-id can also supplied with
events and signals (e.g., "S: L/rt@connId"). Note that a
mismatch between connection-id and call-id should use error code
516.

Category: "State Mismatch".

516 - Unknown or incorrect call-id.

   Response valid for: ModifyConnection, DeleteConnection.

   Situation: Unknown call-id, or the call-id supplied is
   incorrect (e.g., connection-id not associated with this call-
   id).

   Category: "State Mismatch".

517 - Invalid or unsupported mode.

   Response valid for: CreateConnection, ModifyConnection.

   Situation: This is returned if the command specifies a
   connection mode that the endpoint does not support (note that
   not all endpoints will support all modes). Note that if the
   unsupported mode is an extension connection mode, error code 518
   (unsupported package) should be used instead.

   Category: "Provisioning Mismatch".

518 - Unsupported or unknown package.

   Response valid for: Any command

   Situation: A package name included in a request is not
   supported (or unknown). Note that the package name may be a
   prefix to an event or other things (e.g., a parameter) as
   defined in [1]. Note that it is recommended to include a
   PackageList parameter with a list of supported packages in the
   response.

   Category: "Provisioning Mismatch".

519 - Endpoint does not have a digit map.

   Response valid for: NotificationRequest.

   Situation: Request was made to detect digits based on a digit
   map and the gateway does not have a digit map.

   Category: "State Mismatch". The Call Agent needs to send
   down a digit map in order to continue with the call.

520 - Endpoint is restarting.

   Situation: This is normally a transient error in which error
   code 405 SHOULD be used. Gateways SHOULD not use this error
   code unless there is some relevant situation that warrants the
   category of "Service Failure". Note that this was included in
   [1] only to maintain backwards compatibility with previous
   releases of the MGCP specification.

   Category: If it is returned, this return code will be treated
   as category "Service Failure", i.e., as if this endpoint is
   out-of-service.

521 - Endpoint re-directed to another Call Agent.

   Response valid for: RestartInProgress.

   Situation: A RestartInProgress command was sent to the Call
   Agent and the Call Agent returns this return code along with a
   NotifiedEntity parameter pointing to another Call Agent. The
   gateway then sends a new RestartInProgress command to the Call
   Agent specified in the Notified Entity.

   Category: none (specific situation and behavior).

522 - No such event or signal.

   Response valid for: NotificationRequest.

   Situation: This is returned if the requested event/signal name
   is not registered with this package. If on the other hand the
   signal or event is part of the package but is not supported by
   the gateway, then return code 512 or 513 SHOULD be provided
   instead. If the package is not supported, return code 518
   SHOULD be returned.

   Category: "Provisioning Mismatch".

523 - Unknown action or illegal combination of actions.

   Response valid for: NotificationRequest with one or more
   requested events.

   Situation: Request was made with a requested event(s) that
   included an action or actions defined in [1] that are either
   unknown, unsupported or an illegal combination as indicated in
   section 2.3.3 of [1]. Note that unsupported extension actions
   should generate error code 518 (unsupported package).

Category: "Provisioning Mismatch".

524 - Internal inconsistency in Local Connection Options

Response valid for: CreateConnection, ModifyConnection.

Situation: This is returned if one or more of the
LocalConnectionOptions (LCO) parameters are coded with values
that are not consistent with each other (e.g., other LCO
parameters inconsistent with the network type).

Category: "Provisioning Mismatch".

525 - Unknown extension in Local Connection Options.

Response valid for: CreateConnection, ModifyConnection.

Situation: This is returned if the request contains a Local
Connection Option with one or more unrecognized mandatory ("x+")
extensions. Note that unsupported package extensions should use
error code 518 (unsupported package) instead.

Category: "Provisioning Mismatch".

526 - Insufficient bandwidth

Response valid for: CreateConnection, ModifyConnection.

Situation: In most cases where there is insufficient
bandwidth, a 404 return code should be used. 526 would be used
in cases where future requests are destined to fail. An example
might be a very restricted bandwidth case, where there is not
enough bandwidth available for the codec requested even for a
single endpoint. Making a request with the same codec in the
future will fail. However, making a request for some other
codec (with a higher degree of compression) may pass. For
cases, where the bandwidth is pooled over multiple endpoints and
could free up at some future time (because an endpoint becomes
inactive), then 404 is more appropriate.

Category: If it is returned, this return code will be treated
as category "Provisioning Mismatch", e.g., the codec was
incorrectly provisioned for the bandwidth available.

527 - Missing RemoteConnectionDescriptor.

Response valid for: CreateConnection, ModifyConnection,
NotificationRequest.

Situation: This is returned if the connection has not yet
received a RemoteConnectionDescriptor when one is required to
support the request. This can for example happen if a
connection is attempted to be placed in "send/receive mode", or
if a signal is applied on a connection.

Category: "Remote Connection Descriptor Error" in the case
where the other end did not provide a connection descriptor.
Alternatively, if this is an initial request made by a Call
Agent (such there is no remote connection descriptor), then this
is a "State Mismatch" problem.

528 -Incompatible protocol version

Response valid for: Any command.

Situation: A command was received with a protocol version that
was not supported.

Category: "Provisioning Mismatch". This could also be
treated as a "State Mismatch" problem if the there is a recovery
mechanism (e.g., Call Agent recognizes the protocol version
mismatch and switches to the correct protocol version)

529 - Internal Hardware Error.

Response valid for: Any command.

Situation: A hardware fault occurred during the execution of a
command such that repeating this command will result in a
failure indication once again. This is a slightly more specific
error code than error 502, although more commentary should be
provided (for debug purposes) if possible.

Category: "Service Failure".

530 - CAS Signaling Protocol Error.

Response valid for: NotificationRequest.

Situation: This is specific to Channel Associated Signaling
(CAS) interfaces. A typical example might be an attempt to
outpulse digits failed for some reason.

Category: none (specific situation and behavior).

531 - Failure of a grouping of trunks (e.g., facility failure)

 Response valid for: CreateConnection, ModifyConnection,
NotificationRequest.

 Situation: Request made to an endpoint that has a failed trunk
connection (e.g., T1 or E1 failed). Note that an RSIP should
have been sent as a result of the facility failure. This is a
more specific response than return code 501.

 Category: "Service Failure".

532 - Unsupported value(s) in Local Connection Options.

 Response valid for: CreateConnection, ModifyConnection.

 Situation: This is returned if one or more of the
LocalConnectionOptions parameters are coded with a value that
the gateway does not support.

 Category: "Provisioning Mismatch".

533 - Response too large

 Response valid for: Any command.

 Situation: This would only be likely to occur in the case of an
audit where the maximum response packet size would end up being
too large.

 Category: none (specific situation and behavior).

534 - Codec negotiation failure

 Response valid for: CreateConnection, ModifyConnection.

 Situation: The intersection between the list of codecs that
the gateway supports, the codecs allowed by the local connection
options and the codecs supplied in the Remote Connection
Descriptor (if provided) is empty.

 Category: "Provisioning Mismatch" if the error resulted from
an empty approved list of codes as described in [1], Section
2.6). "Remote Connection Descriptor Error" if the error
resulted from an empty negotiated list of codecs, as described
in [1], Section 2.6.

535 - Packetization period not supported

    Response valid for: CreateConnection, ModifyConnection.

    Situation: Normally this error should not be generated since
    if the gateway is unable to support the packetization period
    specified in the local connection options for the codec
    indicated, it should follow the behavior specified in [1] (which
    is to pick an appropriate value rather than failing the
    request).

    Category: "none".

536 - Unknown or unsupported Restart Method

    Response valid for: RestartInProgress.

    Situation: This error is generated by the Call Agent if it
    receives a RestartInProgress command with an unsupported restart
    method. Note that if the restart method is an extension restart
    method, error code 518 (unsupported package) should be used
    instead.

    Category: "Provisioning Mismatch".

537 - Unknown or unsupported digit map extension

    Response valid for: NotificationRequest.

    Situation: Digit map letter in the digit map unknown or
    unsupported. Note that this code does apply to extension digit
    map letters as well.

    Category: "Provisioning Mismatch".

538 - Event/signal parameter error

    Response valid for: NotificationRequest.

    Situation: It is returned if the event/signal parameter is in
    error or not supported. If the event/signal or a package is not
    supported, then one of 512, 513, 518, or 522 should be used
    instead.

    Category: "Provisioning Mismatch".

539 - Invalid or unsupported command parameter

    Response valid for: Any command.

    Situation: This is returned if the command contains an invalid
    or unsupported parameter, which is neither a package (which
    would use return code 518) nor vendor specific extension (which
    would use return code 511). For example, if an endpoint does
    not support the BearerInformation parameter of the
    EndpointConfiguration command, this return code could be used.
    Of course, such an implementation would not conform to [1].

    Category: "Provisioning Mismatch".

540 - Per endpoint connection limit exceeded

    Response valid for: CreateConnection.

    Situation: A CreateConnection command was made, but the
    gateway cannot support any additional connections on that
    endpoint.

    Category: "State Mismatch".

541 - Invalid or unsupported Local Connection Options

    Response valid for: CreateConnection, ModifyConnection.

    Situation: This is returned if the command contains an invalid
    or unsupported LocalConnectionOption, which is neither a package
    (which would use return code 518) nor vendor specific extension
    (which would use return code 511).

    Category: "Provisioning Mismatch".

2.3. Summary of Return Code Categories

A summary of the categories of the various error codes is included in
the following table. This information is also repeated in the
detailed error descriptions in the next section.

```
-----------------------------------------------------------------
|  Category    | Return Codes                                    |
|--------------|--------------------------------------------------|
|   normal     | 000, 100, 101, 200, 250                         |
|--------------|--------------------------------------------------|
|   none       | 405, 407, 410, 510, 521, 530, 533, 535          |
|--------------|--------------------------------------------------|
| "Service     | 501, 502, 520, 529, 531                         |
|  Failure"    |                                                 |
|--------------|--------------------------------------------------|
|"Provisioning | 500, 503*, 504, 507, 508, 510, 511, 512, 513, 514,|
| Mismatch"    | 517, 518, 522, 523, 524, 525, 526, 528*, 532, 534*,|
|              | 536, 537, 538, 539, 541                         |
|--------------|--------------------------------------------------|
| "Temporary   | 400, 403, 404*, 405, 406, 409                   |
|  Failure"    |                                                 |
|--------------|--------------------------------------------------|
| "State       | 401, 402, 515, 516, 519, 540                    |
|  Mismatch"   |                                                 |
|--------------|--------------------------------------------------|
| "Remote      | 505, 506, 509, 527*                             |
|  Connection  |                                                 |
|  Descriptor  |                                                 |
|  Error"      |                                                 |
-----------------------------------------------------------------
```

Notes:

* 404: may be treated as a "Temporary Failure", but specific
  behavior is possible (e.g., trying an alternate codec with lower
  bandwidth requirement rather than failing this call).

* 503: rather than treating this as a "Provisioning Mismatch", it is
  possible for the Call Agent to recover from this error.

* 527: See the detailed description for this error code in section
  2.2. This could be treated as a "State Mismatch" depending on the
  circumstances.

* 528: See the detailed description for this error code in section
  2.2. This could be treated as a "State Mismatch" depending on the
  circumstances.

* 534: See the note on error code 534 in the detailed description
  section (2.2) of this document (may be treated as a "Remote
  Connection Descriptor Error" if no local connection options were
  supplied).

3. Additional Guidelines

   This section provides additional guidelines to Gateway and Call Agent
   developers.

3.1. Gateway Recommendations

   The following guidelines are recommended for gateway implementations:

   * For uncategorized return codes (category "none") that involve
      specific situations, gateways should make sure they do an accurate
      mapping between the situation and the return code.

   * Also for category "State Mismatch", it is equally important that
      the situation (and state) is accurately mapped to the specific
      error code.

   * For situations similar to those involving return codes in "Service
      Failure", Provisioning Mismatch", "Temporary Failure" and "Remote
      Connection Descriptor Error" categories, the gateway should make
      sure that it uses a return code in the correct category.

   * MGCP allows additional commentary to be included with the return
      code. It is important that the gateway includes more specific
      information concerning the situation for debug purposes.

   * It is recommended that return codes 502, 520 and 526 not be used
      unless there is something that makes these permanent situations.
      As indicated in the detailed description of these return codes,
      403, 405 and 404 respectively are more appropriate in almost all
      situations. If a gateway presently uses 502, 520 and 526 for
      temporary situations and expects to upgrade to 403, 405 and 404,
      the gateway should refrain from using 502, 520 and 526 for some
      other use immediately after the upgrade. This is to avoid problems
      where a Call Agent is expected to treat the same error code in two
      different ways, e.g., 403 is a category "Temporary Failure" which
      requires a different Call Agent behavior from 502 which is in
      category "Service Failure".

3.2. Call Agent Recommendations

   The following guidelines are recommended for gateway implementations:

   * Call Agents should handle return codes they do not recognize (or
      do not expect) based on the first digit in the return code as
      outlined in [1].

   * For categories "Service Failure", "Provisioning Mismatch",
      "Temporary Failure", and "Remote Connection Descriptor Error",
      Call Agents are expected to treat return codes that are within the
      same category in the same way (i.e., make the same decision, based
      on the return code and other state information available to them).

   * Because there was little guidance given for return codes 502, 520
      and 526 in RFC 2705 [4], Call Agents may have to treat these as
      403, 405 and 404 respectively for gateways that have not been
      updated according to [1] and these recommendations. The gateway
      implementer should be consulted for information on the gateway
      behavior for (now and in the future) for these return codes (i.e.,
      it may be that return codes 502, 520 and 526 are presently used
      incorrectly but will be replaced with 403, 405 and 404 in the
      future).

4. Security Considerations

   This document merely provides a convenient way to categorize MGCP
   return codes in order to facilitate decisions related to failure
   conditions; it does not impact MGCP security in any way.

5. Acknowledgements

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6. Normative References

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   [4] Arango, M., Dugan, A., Elliott, I., Huitema, C. and S. Pickett,
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Acknowledgement