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Definitions of Managed Objects for Path Computation Element Discovery

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes objects used for managing Path Computation Elements Discovery.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes objects used for managing Path Computation Elements Discovery.

For an introduction to the concepts of PCE, see [RFC4655].

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. 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 0.

4. Terminology

The terminology used in this document is built on notions introduced and discussed in PCE WG documents. The reader should be familiar with these documents

Domain: any collection of network elements within a common sphere of address management or path computational responsibility.

IGP Area: OSPF Area or ISIS level.

PCC: Path Computation Client: any client application requesting a path computation to be performed by a Path Computation Element.

PCE: Path Computation Element: an entity (component, application, or network node) that is capable of computing a

network path or route based on a network graph, and applying computational constraints.

5. Overview

[RFC4655] describes the architecture for a PCE-based path computation model for MPLS and GMPLS TE LSPs. The architecture allows the separation of PCE from PCC. It requires that a PCC be aware of the location of one or more PCEs. This relies on a communication protocol between PCC and PCE for automatic and dynamic PCE discovery.

[RFC4674] defines the PCE discovery mechanism and information elements which are derived as an extension for OSPF in [RFC5089] and as an extension for ISIS in [RFC5089] .

The current MIB module defines the objects the section "6.10.2.1. PCC MIB module " of [RFC4674] identifies as to be disclosed on the management interface of the PCC.

6. Structure of the MIB Module

This MIB module is arranged into groups. Each group is organized as a set of related objects. The overall structure and assignment of objects to their groups, and the intended purpose of each group, is shown below.

6.1. The Discovery objects

Objects of pceDiscoveryObjects provide general information on the PCEs discovered and on their status.

This includes:
- A control to disable the automatic discovery mechanism;
- The number of known PCEs;
- The number of discovered PCEs;
- The pceDiscoveryTable which details information per PCE:
  - Addresses, discovery Mechanism type;
  - Discovery time, last activity time;
  - Congestion and congestion duration.

6.2. PCEs capabilities objects

These objects report on computation capabilities per PCE as defined in PCE-PATHSCOPE, PCE-DOMAINS and PCE-NEIG-DOMAINS information elements.

Objects of pceDiscPathScopeTable collect the computation capabilities and preferences fo the PCEs discovered.

Objects of pceDiscDomainTable list the domains for which the PCE discovered have topology visibility and path computation facilities.

Objects of pceDiscNeighborDomainTable define domains toward which a PCE can compute path.

6.3. PCEs options capabilities objects

Objects of pceDiscOptionalCapabilitiesTable provides computation options per PCE as defined in The PCE-CAP-FLAGS information elements.

6.4. PCEs Activity Objects

The objects of pceDiscActivityTable monitor the activity of the discovery mechanism of each PCE to enable effective analysis of the operation of the protocols.

pceDiscActivityTable reports on the activity of the discovery protocol per PCE:

- Modification of PCE discovery;
- The average and maximum rates of arrival, departure of PCE discovery information;
- The number of unacceptable and incomprehensible discovery information exchanges.

6.5. The Notification Group

This group defines notifications to inform of important events related to the monitoring of the PCE Discovery sessions such as the ending of all the sessions and abnormal rate of unacceptable messages.

7. Relationship to Other MIB Modules

7.1. Relationship to IGP MIB modules

PCE Discovery relies on existing protocols which have specialized MIB objects to monitor their own activities. Consequently this document considers that monitoring underlying protocols in out of the scope of the current MIB module.

7.2. MIB modules required for IMPORTS

The following MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], and IF-MIB [RFC2863] and also REFERENCEs document RFC0768 [RFC0768]

8. Definitions

```
PCE-DISC-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
   Counter32, Unsigned32, Integer32, IpAddress
      FROM SNMPv2-SMI
   TimeStamp,
   TruthValue

      FROM SNMPv2-TC
   Ipv6Address
      FROM IPV6-TC
   MODULE-COMPLIANCE,
   OBJECT-GROUP,
   NOTIFICATION-GROUP
      FROM SNMPv2-CONF
   AddressFamilyNumbers
      FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB
   IANAipRouteProtocol
      FROM IANA-RTPROTO-MIB
   pceStdMIB, PceRoutingDomainID
      FROM PCE-TC-STD-MIB; -- [xxxx]
      -- rfc editor replace xxxx with the rfc number

pceDiscDraftMIB MODULE-IDENTITY
   LAST-UPDATED "200810240000Z" -- October 24, 2008
   ORGANIZATION "Path Computation Element (PCE) Working Group"
   CONTACT-INFO "
      Stephan Emile
      France Telecom
   Email: emile.stephan@orange-ftgroup.com
   Email comments directly to the PCE WG Mailing List at pce@ietf.org
   WG-URL: http://www.ietf.org/html.charters/pce-charter.html
   "
DESCRIPTION
   "This MIB module defines a collection of objects for managing Path
   Computation Elements (PCEs) Discovery."
::= { pceStdMIB 2 }

pceDiscNotifications OBJECT IDENTIFIER ::= { pceDiscDraftMIB 0 }

pceDiscMIBObjects OBJECT IDENTIFIER ::= { pceDiscDraftMIB 1 }

pceDiscoveryObjects OBJECT IDENTIFIER ::= { pceDiscMIBObjects 1 }
```

```
   pceDiscoveryAdminStatus OBJECT-TYPE
      SYNTAX INTEGER {
         enabled(1),
         disabled(2)
      }
      MAX-ACCESS read-write
      STATUS current
      DESCRIPTION
         "Setting this object to disabled(2) disables the discovery of
         PCEs.  Once disabled, The discovery must be explicitly enabled
         to restore discovery of PCEs.  Setting this object to
         enabled(1) enables the discovery of PCEs."
      ::= { pceDiscoveryObjects 1 }

   pceDiscoveryKnownPCEs OBJECT-TYPE
      SYNTAX Counter32
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The number of PCEs the PCC is potentially in relation with.
         This includes PCE manually declared and active PCEs"
      ::= { pceDiscoveryObjects 2 }

   pceDiscoveryActivePCEs OBJECT-TYPE
      SYNTAX Counter32
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The number of active PCEs.
         The detection of the activity a a PCE depends on the nature
         discovery mechanism.
         PCE discovered using PCED information received:
            The relation between the PCC and a PCE is active while the
            PCE discovery protocol maintains a communication between the
            PCC and this PCE.
         PCE Manually declared:
            The relation between the PCC and a PCE is active and the
            discovery mechanism is implementation specific;
         "
      ::= { pceDiscoveryObjects 3 }

   pceDiscoveryTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscoveryEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing the PCEs discovered."
      ::= { pceDiscoveryObjects 4 }
```

```
   pceDiscoveryEntry OBJECT-TYPE
      SYNTAX PceDiscoveryEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing general information of each PCE
         discovered."
      INDEX { pceDiscoveryIndex }
      ::= { pceDiscoveryTable 1 }

   PceDiscoveryEntry ::= SEQUENCE {
      pceDiscoveryIndex Integer32,
      pceDiscoveryMechanism IANAipRouteProtocol,
      pceDiscoveryIPv4Address IpAddress,
      pceDiscoveryIPv6Address Ipv6Address,
      pceDiscoveryTime TimeStamp,
      pceDiscoveryLastUpdated TimeStamp,
      pceDiscoveryCongestion TruthValue,
      pceDiscoveryCongestionDuration Unsigned32
   }

   pceDiscoveryIndex OBJECT-TYPE
      SYNTAX Integer32 (1..2147483647)
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This object identifies locally the PCE for which this entry
         contains information."
      ::= { pceDiscoveryEntry 1 }

   pceDiscoveryMechanism OBJECT-TYPE
      SYNTAX IANAipRouteProtocol
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object identifies the type of discovery mechanism used to
         discover the PCE.
         The discovery mechanisms covered by PCE WG at the time of the
         specification are :
            other (1), --not specified
            local (2), -- local interface
            isIs (9), -- Dual IS-IS
            ospf (13), -- Open Shortest Path First
            bgp (14), -- Border Gateway Protocol
         It does not preclude the usage of another routing protocol
         numbered by this IANAipRouteProtocol
         "
      ::= { pceDiscoveryEntry 2 }
```

```
   pceDiscoveryIPv4Address OBJECT-TYPE
      SYNTAX IpAddress
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object is the IP address to be used to reach the PCE.  It
         corresponds to the PCED PCE-ADDRESS.
         .
         A value of 0.0.0.0 indicates the absence of this address."
      ::= { pceDiscoveryEntry 3 }

   pceDiscoveryIPv6Address OBJECT-TYPE
      SYNTAX Ipv6Address
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object is the IPv6 address to be used to reach the PCE.
         It corresponds to the PCED PCE-ADDRESS.
         A value of ::0 indicates the absence of this address."
      ::= { pceDiscoveryEntry 4 }

   pceDiscoveryTime OBJECT-TYPE
      SYNTAX TimeStamp
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The value of sysUpTime at the time this entry was created.
         local entry: the value of sysUpTime at the time the PCC
         restarted."
      ::= { pceDiscoveryEntry 5 }


   pceDiscoveryLastUpdated OBJECT-TYPE
      SYNTAX TimeStamp
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The value of sysUpTime at the time this entry was last
         updated.
         Static entry: if the entry values keep unchanged since the re-
         initialization of the PCC then this object contains a zero
         value."
      ::= { pceDiscoveryEntry 6 }

   pceDiscoveryCongestion OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object indicates whether a PCE experiences a processing
         congestion state or not.
```

```
          "
      ::= { pceDiscoveryEntry 7 }
```

```
   pceDiscoveryCongestionDuration OBJECT-TYPE
      SYNTAX Unsigned32
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object specifies, in seconds, the congestion duration.
         When the value of pceDiscoveryCongestion is 'false' then this
         objet MUST be to '0'"
      ::= { pceDiscoveryEntry 8 }

   pceDiscCapabilityObjects OBJECT IDENTIFIER ::= { pceDiscMIBObjects 2
   }

   --

   -- PCE-PATHSCOPE informations elements

   --

   pceDiscPathScopeTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscPathScopeEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "PCEs may be involved in various path computations such that
         dedicaced to one AS or one area, or specialized in inter AS,
         inter area or inter layer.  This table describe the path
         computation capacities and preferences of the PCEs discovered."
      ::= { pceDiscCapabilityObjects 1 }

   pceDiscPathScopeEntry OBJECT-TYPE
      SYNTAX PceDiscPathScopeEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This object describes the path computation capacities and
         preferences of the PCE identified with pceDiscoveryIndex."
      INDEX { pceDiscoveryIndex }
      ::= { pceDiscPathScopeTable 1 }
```

```
   PceDiscPathScopeEntry ::= SEQUENCE {
      pceDiscPathScopeIntraArea TruthValue,
      pceDiscPathScopeInterArea TruthValue,
      pceDiscPathScopeDefInterArea TruthValue,
      pceDiscPathScopeInterAS TruthValue,
      pceDiscPathScopeDefInterAS TruthValue,
      pceDiscPathScopeInterLayer TruthValue,
      pceDiscPathScopePrefIntraArea Integer32,
      pceDiscPathScopePrefInterArea Integer32,
      pceDiscPathScopePrefInterAS Integer32,
      pceDiscPathScopePrefIntLayer Integer32
   }

   pceDiscPathScopeIntraArea OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the L option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can compute intra-area path."
      ::= { pceDiscPathScopeEntry 1 }

   pceDiscPathScopeInterArea OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the R option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can act as PCE for inter-area
            TE LSPs computation."
      ::= { pceDiscPathScopeEntry 2 }

   pceDiscPathScopeDefInterArea OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the Rd option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can act as a default PCE for
            inter-area TE LSPs computation."
      ::= { pceDiscPathScopeEntry 3 }
```

```
   pceDiscPathScopeInterAS OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the S option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can act as PCE for inter-AS
            TE LSPs computation."
      ::= { pceDiscPathScopeEntry 4 }

   pceDiscPathScopeDefInterAS OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the Sd option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can act as a default PCE for
            inter-AS TE LSPs computation."
      ::= { pceDiscPathScopeEntry 5 }

   pceDiscPathScopeInterLayer OBJECT-TYPE
      SYNTAX TruthValue
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates whether the PCE supports the Y option of the PATH-
         SCOPE sub TLV:
            The value is 'true' if the PCE can compute or take part into
            the computation of paths across layers."
      ::= { pceDiscPathScopeEntry 6}

   pceDiscPathScopePrefIntraArea OBJECT-TYPE
      SYNTAX Integer32 (0..7)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates the level of preference of the option of computation
         'L' compared to other computation options:
            A value of 7 reflects the highest preference.
            When the value of PceDiscPathScopeIntraArea is 'false' then
            this objet MUST be to '0'."
      ::= { pceDiscPathScopeEntry 7}
```

```
   pceDiscPathScopePrefInterArea OBJECT-TYPE
      SYNTAX Integer32 (0..7)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates the level of preference of the option of computation
         'R' compared to other computation options:
            A value of 7 reflects the highest preference.
            When the value of PceDiscPathScopeInterArea is 'false' then
            this objet MUST be to '0'."
      ::= { pceDiscPathScopeEntry 8}

   pceDiscPathScopePrefInterAS OBJECT-TYPE
      SYNTAX Integer32 (0..7)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates the level of preference of the option of computation
         'S' compared to other computation options:
            A value of 7 reflects the highest preference.
            When the value of PceDiscPathScopeInterAS is 'false' then
            this objet MUST be to '0'."
      ::= { pceDiscPathScopeEntry 9}

   pceDiscPathScopePrefIntLayer OBJECT-TYPE
      SYNTAX Integer32 (0..7)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "Indicates the level of preference of the option of computation
         'Y' compared to other computation options:
            A value of 7 reflects the highest preference.
            When the value of PceDiscPathScopeInterLayer is 'false' then
            this objet MUST be to '0'."
      ::= { pceDiscPathScopeEntry 10}

   --

   -- PCE-DOMAINS information elements

   --

   pceDiscDomainTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscDomainEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing the set of domains where the PCE has
         topology visibility and can compute paths."
      ::= { pceDiscCapabilityObjects 2 }
```

```
   pceDiscDomainEntry OBJECT-TYPE
      SYNTAX PceDiscDomainEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This information describes a domain where the PCE identified
         with pceDiscoveryIndex has topology visibility and can compute
         paths."
      INDEX { pceDiscoveryIndex, pceDiscDomainIndex }
      ::= { pceDiscDomainTable 1 }

   PceDiscDomainEntry ::= SEQUENCE {
      pceDiscDomainIndex Integer32,
      pceDiscDomainIDType AddressFamilyNumbers,
      pceDiscDomainID PceRoutingDomainID
   }

   pceDiscDomainIndex OBJECT-TYPE
      SYNTAX Integer32 (1..2147483647)
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This object identifies locally a domain for which the PCE
         identified by pceDiscoveryIndex has topology visibility and can
         compute paths.  "
      ::= { pceDiscDomainEntry 1 }

   pceDiscDomainIDType OBJECT-TYPE
      SYNTAX AddressFamilyNumbers
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object identifies the type of the domainID of a PCE-
         DOMAIN SUB TLV.
         Acceptable types are :
            ipV4(1) and ipV6(2) for an OSPF area ID;
            nsap(3) for and ISIS area ID;
            asNumber(18) for an BGP AS number"
      ::= { pceDiscDomainEntry 2 }

   pceDiscDomainID OBJECT-TYPE
      SYNTAX PceRoutingDomainID
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The ID (area,AS) of the routing domain for which this entry
         contains information."
      ::= { pceDiscDomainEntry 3 }
```

```
   --

   -- NEIG-PCE-DOMAINS information elements

   --

   pceDiscNeighborDomainTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscNeighborDomainEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing the set of destination domains toward
         which a PCE can compute paths."
      ::= { pceDiscCapabilityObjects 3 }

   pceDiscNeighborDomainEntry OBJECT-TYPE
      SYNTAX PceDiscNeighborDomainEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing the destination domains of each PCE."
      INDEX { pceDiscoveryIndex, pceDiscNeighborDomainIndex }
      ::= { pceDiscNeighborDomainTable 1 }

   PceDiscNeighborDomainEntry ::= SEQUENCE {
      pceDiscNeighborDomainIndex Integer32,
      pceDiscNeighborDomainIDType AddressFamilyNumbers,
      pceDiscNeighborDomainID PceRoutingDomainID
   }

   pceDiscNeighborDomainIndex OBJECT-TYPE
      SYNTAX Integer32 (1..2147483647)
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This object identifies locally a destination domain toward
         which a PCE identified by pceDiscoveryIndex can compute path."
      ::= { pceDiscNeighborDomainEntry 1 }

   pceDiscNeighborDomainIDType OBJECT-TYPE
      SYNTAX AddressFamilyNumbers
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object identifies the type of the routing domain.
         Acceptable types are :
            ipV4(1) and ipV6(2) for an OSPF area ID;
            nsap(3) for and ISIS area ID;
            asNumber(18) for an BGP AS number"
      ::= { pceDiscNeighborDomainEntry 2 }
```

```
   pceDiscNeighborDomainID OBJECT-TYPE
      SYNTAX PceRoutingDomainID
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "The ID (area,AS) of the routing domain for which this entry
         contains information."
      ::= { pceDiscNeighborDomainEntry 3 }


   pceDiscOptionalCapabilitiesObjects OBJECT IDENTIFIER ::= {
   pceDiscMIBObjects 3 }

   -- PCE-CAP-FLAGS

   pceDiscOptionalCapabilitiesTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscOptionalCapabilitiesEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This table describes various capabilities supported by the
         PCEs discovered, such as path computation options, requests
         processing options or new options added in the future in IANA
         registry named 'PCE Capability Flags'."
      ::= { pceDiscOptionalCapabilitiesObjects 1 }

   pceDiscOptionalCapabilitiesEntry OBJECT-TYPE
      SYNTAX PceDiscOptionalCapabilitiesEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This objet describes an atomic capability the PCE identified
         by pceDiscoveryIndex supports.  "
      INDEX { pceDiscoveryIndex }
      ::= { pceDiscOptionalCapabilitiesTable 1 }

   PceDiscOptionalCapabilitiesEntry ::= SEQUENCE {
      pceDiscOptionalCapability Integer32
      }
```

```
  pceDiscOptionalCapability OBJECT-TYPE
      SYNTAX Integer32 (0..31)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This objet describes an atomic option the PCE identified by
         pceDiscoveryIndex supports.  The IANA registry 'PCE Capability
         Flags' handles current capabilities and the definition of new
         options in the future.  At the time being the value is
         restricted to one of the following:
            0 Path computation with GMPLS link constraints;
            1 Bidirectional path computation;
            2 Diverse path computation;
            3 Load-balanced path computation;
            4 Synchronized path computation;
            5 Support for multiple objective functions;
            6 Support for additive path constraints (max hop count,
            etc.);
            7 Support for request prioritization;
            8 Support for multiple requests per message.

         NOTE: This object type is not enumerated because new options,
         like p2mp capabilities, may be defined in the future.  "
      ::= { pceDiscOptionalCapabilitiesEntry 1 }

   -- Activity objects

   pceDiscActivityObjects OBJECT IDENTIFIER ::= { pceDiscMIBObjects 4 }

   pceDiscActivityTable OBJECT-TYPE
      SYNTAX SEQUENCE OF PceDiscActivityEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "Information describing the discovery mechanisms activities."
      ::= { pceDiscActivityObjects 1 }

   pceDiscActivityEntry OBJECT-TYPE
      SYNTAX PceDiscActivityEntry
      MAX-ACCESS not-accessible
      STATUS current
      DESCRIPTION
         "This object describes the discovery activity of the PCE
         identified by pceDiscoveryIndex.  "
      INDEX { pceDiscoveryIndex }
      ::= { pceDiscActivityTable 1 }

   PceDiscActivityEntry ::= SEQUENCE {
      pceDiscActivityTlvReceived Integer32,
      pceDiscActivityErroredTlvReceived Integer32,
      pceDiscActivityErroredTlvLastMinutePercentage Integer32,
```

```
      pceDiscActivityErroredTlvRisingThreshold Integer32
      }
```

```
   pceDiscActivityTlvReceived OBJECT-TYPE
      SYNTAX Integer32 (1..2147483647)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object counts the number of information elements received
         since the discovery of the PCE."
      ::= { pceDiscActivityEntry 1 }

   pceDiscActivityErroredTlvReceived OBJECT-TYPE
      SYNTAX Integer32 (1..2147483647)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object counts the number of Errored information elements
         received since the discovery of the PCE."
      ::= { pceDiscActivityEntry 2 }

   pceDiscActivityErroredTlvLastMinutePercentage OBJECT-TYPE
      SYNTAX Integer32 (0..100)
      MAX-ACCESS read-only
      STATUS current
      DESCRIPTION
         "This object reports the percentage of the errored information
         elements received over a one-minute average."
      ::= { pceDiscActivityEntry 3 }

   pceDiscActivityErroredTlvRisingThreshold OBJECT-TYPE
      SYNTAX Integer32 (0..100)
      MAX-ACCESS read-write
      STATUS current
      DESCRIPTION
         "This object specifies the percentage of information elements
         errors limit to be reach before triggering the sending of the
         notification 'pceDiscAbnormalErroredTlvPercentage'."
      ::= { pceDiscActivityEntry 4 }
```

```
   --

   -- Notification --

   --

   pceDiscNotAnyPceIdentified NOTIFICATION-TYPE
      OBJECTS {
         pceDiscoveryKnownPCEs
      }
      STATUS current
      DESCRIPTION
         "This notification is sent when the value of
         'pceDiscoveryKnownPCEs' decreases to zero.
         This occurs typically when, after modification of
         configuration, there is no more PCE manually declared and when
         there is no more PCE discovery sessions configured."
      ::= { pceDiscNotifications 1 }

   pceDiscAllPcesInactive NOTIFICATION-TYPE
      OBJECTS {
         pceDiscoveryKnownPCEs,
         pceDiscoveryActivePCEs
      }
      STATUS current
      DESCRIPTION
         "This notification is sent when the value of
         'pceDiscoveryActivePCEs' decreases to zero.
         This occurs when all the PCE discovery sessions come inactive."
      ::= { pceDiscNotifications 2 }

   pceDiscAbnormalErroredTlvPercentage NOTIFICATION-TYPE
      OBJECTS {
         pceDiscActivityErroredTlvLastMinutePercentage,
         pceDiscActivityErroredTlvRisingThreshold
      }
      STATUS current
      DESCRIPTION
         "This notification is sent when the value of
         'pceDiscActivityErroredTlvLastMinutePercentage' rises over the
         value of pceDiscActivityErroredTlvRisingThreshold."
      ::= { pceDiscNotifications 3 }
```

```
--

-- PCE DISC agents conformance statement

--

pceDiscConformance OBJECT IDENTIFIER ::= { pceDiscDraftMIB 2 }

pceDiscCompliances OBJECT IDENTIFIER ::= { pceDiscConformance 1 }

pceDiscGroups OBJECT IDENTIFIER ::= { pceDiscConformance 2 }

-- PCE DISC agent compliance statements

pceDiscGeneralPceInformation MODULE-COMPLIANCE
   STATUS current
   DESCRIPTION
   "The compliance statement for SNMP entities that implement only
   general monitoring information as proposed in the 2nd S. of the
   section 6.1 of [RFC4674]."
   MODULE
   MANDATORY-GROUPS {
      pceDiscDiscoveryGroup,
      pceDiscActivityGroup,
      pceDiscPathScopeGroup,
      pceDiscDomainsGroup,
      pceDiscOptionsGroup,
      pceDiscNotificationGroup
   }
::= { pceDiscCompliances 1 }

pceDiscDiscoveryGroup OBJECT-GROUP
   OBJECTS {
      pceDiscoveryAdminStatus,
      pceDiscoveryKnownPCEs,
      pceDiscoveryActivePCEs,
      pceDiscoveryMechanism,
      pceDiscoveryIPv4Address,
      pceDiscoveryIPv6Address,
      pceDiscoveryTime,
      pceDiscoveryLastUpdated,
      pceDiscoveryCongestion,
      pceDiscoveryCongestionDuration
   }
   STATUS current
   DESCRIPTION
      "Hight level objects for monitoring the PCEs sessions.  "
   ::= { pceDiscGroups 1 }
```

```
   pceDiscActivityGroup OBJECT-GROUP
      OBJECTS {
         pceDiscActivityTlvReceived,
         pceDiscActivityErroredTlvReceived,
         pceDiscActivityErroredTlvLastMinutePercentage,
         pceDiscActivityErroredTlvRisingThreshold
      }
      STATUS current
      DESCRIPTION
         "Objects for monitoring PCEs sessions activity.  "
      ::= { pceDiscGroups 2 }

   pceDiscPathScopeGroup OBJECT-GROUP
      OBJECTS {
         pceDiscPathScopeIntraArea,
         pceDiscPathScopeInterArea,
         pceDiscPathScopeDefInterArea,
         pceDiscPathScopeInterAS,
         pceDiscPathScopeDefInterAS,
         pceDiscPathScopeInterLayer,
         pceDiscPathScopePrefIntraArea,
         pceDiscPathScopePrefInterArea,
         pceDiscPathScopePrefInterAS,
         pceDiscPathScopePrefIntLayer
      }
      STATUS current
      DESCRIPTION
         "Objects describing the path computation capabilities.  "
      ::= { pceDiscGroups 3 }

   pceDiscDomainsGroup OBJECT-GROUP
      OBJECTS {
         pceDiscDomainIDType,
         pceDiscDomainID,
         pceDiscNeighborDomainIDType,
         pceDiscNeighborDomainID
      }
      STATUS current
      DESCRIPTION
         "Objects describing the domains the PCEs compute paths on and
         are in relation with.  "
      ::= { pceDiscGroups 4 }

   pceDiscOptionsGroup OBJECT-GROUP
      OBJECTS {
         pceDiscOptionalCapability
      }
      STATUS current
      DESCRIPTION
         "Objects describing PCEs options capabilities.  "
      ::= { pceDiscGroups 5 }
```

```
pceDiscNotificationGroup NOTIFICATION-GROUP
   NOTIFICATIONS {
      pceDiscNotAnyPceIdentified,
      pceDiscAllPcesInactive,
      pceDiscAbnormalErroredTlvPercentage
   }
   STATUS current
   DESCRIPTION
      "Set of notifications implemented in this module.  "
   ::= { pceDiscGroups 6 }

END
```

9. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

- on/off of discovery : Unauthorized changes to pceDiscoveryAdminStatus could result in a temporary interruption of the discovery ;

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- IP addresses of PCE.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

10. IANA Considerations

11. References

11.1. Normative References

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[RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

[RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.

[RFC5089] Le Roux, JL., Vasseur, JP., Ikejiri, Y., and R. Zhang, "IS-IS Protocol Extensions for Path Computation Element (PCE) Discovery", RFC 5089, January 2008.

11.2. Informative References

[RFC0768] Postel, J., "User Datagram Protocol", STD 6, RFC 768, August 1980.

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.

[RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

[RFC4655] Farrel, A., Vasseur, J., and J. Ash, "A Path Computation Element (PCE)-Based Architecture", RFC 4655, August 2006.

[RFC4674] Le Roux, J., "Requirements for Path Computation Element (PCE) Discovery", RFC 4674, October 2006.

Appendix A. Open Issues

This list of open issues should be cleared and removed before this document hits the IESG.

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