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Framework Policy Information Base for Usage Feedback

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Abstract

This document describes a portion of the Policy Information Base (PIB) to control policy usage collection and reporting in a device.

The provisioning classes specified here allow a Policy Decision Point (PDP) to select which policy objects should collect usage information, what information should be collected and when it should be reported.

This PIB requires the presence of other PIBs (defined elsewhere) that provide the policy objects from which usage information is collected.

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1. Introduction

The Framework of Common Open Policy Service with Policy Provisioning (COPS-PR) Usage Feedback describes the overall approach to policy usage monitoring and reporting. This document defines the specific Policy Information Base (PIB) framework for policy usage feedback. The policy classes for monitoring and reporting policy usage feedback, as well as policy classes for controlling reporting intervals, suspension, resumption and solicitation are defined.

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 [RFC2119].

2. General Concepts

2.1. Selection, Usage and Linkage Policies

There are three basic types of policies used to define what the PEP is to monitor, record and report. These are the selection criteria policy, the usage policy and the feedback report linkage policy.

The selection criteria policy is installed by the PDP. It defines the conditions used by the PEP to monitor and record a usage policy. The selection criteria policy may only be used for defining usage feedback selection criteria. However, a more general case is a policy that already exists for policy enforcement that may also be used for specifying feedback usage selection criteria. An example of this is the frwkRoleCombo instance, which may be used in defining QoS enforcement policies, but may also be used to specify conditions on which to base usage - i.e. count the number of packets meeting the criterion of an interface capability set name and role combination.

The usage policy defines what attributes are recorded by the PEP. These policies have an ACCESS clause of 'report-only'. Generally, the usage policies specify counts related to a specific action such as a packet being dropped. The feedback framework PIB defines two usage policy classes, frwkFeedbackTraffic and frwkFeedbackIfTraffic. Usage PRCs may be generic, collecting basic statistics, or they may be specific to a particular usage. The PDP decides which PRC(s) best suit(s) its requirements. The PEP may support only one usage feedback PRC, in which case all statistics are gathered using instances of that PRC. Alternatively, the PEP may support multiple usage feedback PRCs. The PDP then decides which PRC to associate with a particular selection criterion.

A usage feedback policy and selection policy are tightly associated with one another. A third policy, the frwkFeedbackLinkTable, is used to associate, or provide a linkage for the selection and usage policies. The frwkFeedbackLinkTable also specifies when to report the usage feedback. The frwkFeedbackLinkTable entry permits the same selection criteria instance to be re-used for various usage feedback policies. The frwkFeedbackLinkTable contains the value of the selection criteria instance as well as the value of the usage feedback PRC.

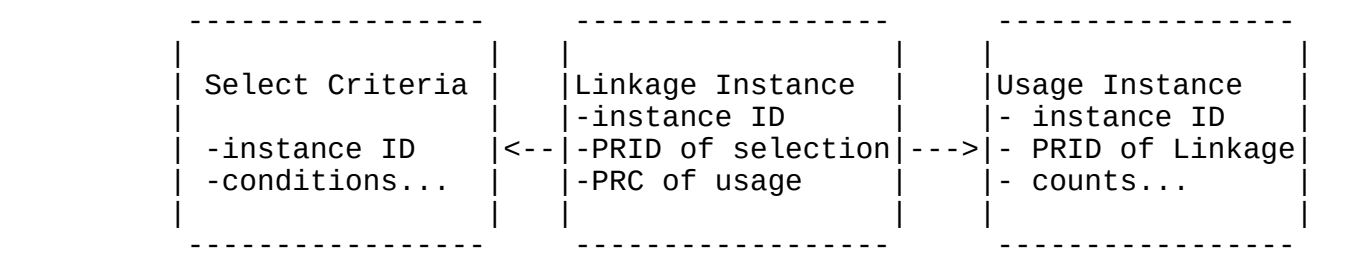

Figure 1

Figure 1 illustrates the relationship between the selection criteria, linkage and usage policies.

The PDP is not aware of the instance identifier of the usage feedback policy when installing the selection criteria and feedback linkage policies. The usage feedback policy is instantiated on the PEP by the installation of a feedback report linkage and the PEP designates the instance identifier. The usage feedback policy class always contains an attribute of type ReferenceId that contains the instance value of the associated frwkFeedbackLinkTable instance installed by the PDP. An example of this is the attribute frwkFeedbackTrafficLinkRef.

2.2. Normal Operations

2.2.1. Connection Establishment and Initial Configuration Request

The Accounting Timer object in the COPS Connection Accept message contains the minimum number of seconds between reporting intervals as described in [COPS] and [FEEDBACKFWK]. This is used as the basic unit of measurement in defining intervals for specific usage policies with the frwkFeedbackLinkInterval attribute.

The PEP notifies the PDP of the selection criteria policy classes and usage policy classes it supports during the initial request for configuration data using frwkPRCSupport instances [FR-PIB]. The PEP also indicates whether it supports the frwkFeedbackLinkTable as well.

The PDP responds to the initial request for configuration with a DECISION that installs policies. The PDP may also specify maximum reporting intervals associated with each of the usage policies. This is done with the frwkFeedbackLinkInterval attribute in the frwkFeedbackLink class. It may also specify reporting thresholds by including an instance of a threshold class (e.g. frwkFeedbackTrafficThreshold) in the decision. The PEP monitors and records the usage per the conditions defined by its associated selection criteria policy. Periodically the PEP reports the usage

with a REPORT message or provides a REPORT when solicited by the PDP. The PDP solicits usage feedback with the frwkFeedbackActionIndicator attribute of the frwkFeedbackAction class.

2.2.2. Unsolicited Reports - Periodic Reporting

Reporting may be periodic in nature and unsolicited. The intervals at which the unsolicited reports are provided by the PEP are defined in the specific Linkage policies. The defined intervals are based on the number of seconds specified by the PDP in the ACCT Timer value. The PDP may specify that the associated usage instance be included in a periodic unsolicited report only if the threshold is reached and/or if the usage value has changed from the previous reporting interval.

There are cases when the PEP must supply unsolicited feedback reports that may not fall on an interval boundary. The PEP MUST provide an unsolicited REPORT containing all defined usage instances just prior to the PEP issuing a Delete Request State and just prior to the PEP de-activating a PIB instance context.

2.2.3. Unsolicited Reports - Reporting Conditions

Periodic unsolicited reports for individual usage feedback instances can be suppressed by specifying additional conditions in the frwkFeedbackLink instances. Supported conditions are:

ChangeOnly
: If this flag is set in the frwkFeedbackLinkFlags attribute, the associated usage instance is only included in a periodic unsolicited report if its value changed since the last unsolicited report.

Threshold
: If this flag is set in the frwkFeedbackLinkFlags attribute, the associated usage instance is only included in a periodic unsolicited report if the threshold condition referenced in the frwkLinkThreshold field evaluates successfully for the associated usage instance.

Both conditions can be combined in one frwkFeedbackLinkUsage object. In this case, both conditions need to succeed for the usage instance to be reported.

Unsolicited reports triggered by a Delete Request State or the deactivation of a PIB instance are not subject to these conditions - all usage objects must be included in these cases.

2.2.4. Solicited Reports

The PDP may solicit policy usage feedback by issuing an unsolicited Decision containing the frwkFeedbackActionIndicator set to 'solicitReport'. The PEP is to provide a solicited REPORT feedback containing usage feedback. The PEP shall continue to provide periodic feedback at the specified intervals established at client connection acceptance.

The reporting conditions (ChangeOnly and Threshold) do not affect solicited reports - all requested usage instances must be included.

2.2.5. Resuming and Suspending Periodic Feedback Reporting

The PDP may suspend usage monitoring and tracking at the PEP with the frwkFeedbackActionIndicator set to 'suspendMonitoringAndReports'. The PEP must stop tracking usage information and must not issue any feedback reports. The PDP may only suspend feedback reporting by setting the ActionIndicator to 'suspendReports'. The PEP must cease sending unsolicited reports but is to continue monitoring and tracking usage. The PDP may resume the sending of feedback reports and may resume usage monitoring by setting the ActionIndicator to 'resume'.

The PDP may suspend or resume all usage instances or the PDP may specify one or more instances that are to be suspended or resumed. The frwkFeedbackActionList attribute contains a tag identifier that references a list of one or more frwkFeedbackActionList instances.

The PDP may halt usage monitoring, tracking and reporting of usage policies by removing the associated Linkage entry.

2.2.6. Failover

In the event that the connection is lost between the PEP and PDP, the PEP continues to track usage information as long as it continues to operate with the installed policy. When the locally installed policy at the PEP expires, the usage policy data also expires.

Upon successful reconnection where the PEP is still caching policy, the PDP indicates to the PEP that the PEP may resume sending of the COPS accounting type report messages. The PDP does this by issuing an unsolicited decision containing the frwkFeedbackResumeIndicator set to 'resume'. The PEP should resume reporting at the next appropriate feedback interval established upon the acceptance of the re-connection. The PDP is aware of the request state Handle(s) and

the supported PRCs either through the state synchronization mechanism or because the PDP considers itself synchronized with the PEP upon reconnection.

2.3. Usage Policy and Under-specified Selection Criteria

Some of the usage policy objects created in the PEP with COPS-PR can be used by the PEP multiple times - they effectively act as templates for the objects created by the PEP. COPS-PR only has the identity (OID) of the object that is shared between all the assignments the PEP created. However it is desirable to collect usage information for each of the derived objects individually.

This capability is achieved in the feedback framework PIB by distributing additional information to qualify a specific assignment of an object between the selection criteria PRC and the feedback usage PRC.

A selection criteria PRC that refers to a shared object, but contains no qualifying information, selects all of the object's assignments. Such a selection criteria PRC SHOULD be combined with a feedback usage PRC that includes all the necessary information to identify a specific assignment - a single selection criteria policy can then result in the generation of many feedback usage objects, one for each derived object.

If the selection criteria PRC contains all the required qualifying attributes for a specific assignment, it is combined with a feedback usage PRC that only contains the desired metrics but no additional attributes.

Example:

> A frwkRoleCombo instance may be used as a selection criteria, identifying a set of interfaces through their role combination and capability set. If it is desired to get per-interface traffic statistics, the usage PRC has to include an additional attribute to qualify the specific interface.
>
> This could be achieved by linking the frwkFeedbackIfTraffic class with a frwkRoleCombo instance in a frwkFeedbackLink instance. Multiple frwkFeedbackIfTraffic instances will be created by the PEP, one for each interface selected by the frwkRoleCombo instance. The frwkFeedbackIfTraffic class contains the frwkFeedbackIfTrafficIfIndex attribute that allows the PDP to identify each interface's individual counters when the PEP reports the frwkFeedbackIfTraffic instances.

If traffic usage collection is only desired for an individual interface, a selection criteria should be used that qualifies the interface completely, for example a frwkIfRoleCombo instance. In this case, it can be linked to the usage class that has no additional qualifying attributes, frwkFeedbackTraffic.

3. Summary of the Feedback Framework Policy Information Base

3.1. SPPI ACCESS Clause Report-Only

The selection criteria and linkage policy classes follow the definitions specified by [SPPI]. This structure specifies well-defined policy classes and their instances residing in a common, virtual repository [FR-PIB]. The additional PIB-ACCESS clause attribute of "report-only" denotes the usage policy class reported by the PEP.

3.2. Usage32 and Usage64 Textual Conventions

The SPPI does not support the Counter32/64 textual conventions (TC) of SNMP - for feedback collection two similar textual conventions have been defined in this PIB: Usage32 and Usage64.

In addition to the differential functionality of 'Counter', where only the difference between two samples generally carries information, a single value of a 'Usage' attribute usually provides absolute information, since

- its initial value is known (0)
- no wrap-around events should occur
- the time or event when the initial value was set should be available directly or indirectly from other objects.

When 'Usage' attributes are defined in a PRC, events that could cause a reset of the attribute to its initial value should be defined in the description as well as the mechanism that allows the PDP to detect the time of the last reset.

No usual COPS activity however should cause the reset of a Usage attribute. In the case of a suspension of monitoring activity (frwkFeedbackActionIndicator set to 'suspendMonitoringAndReports'), 'Usage' attributes should keep their values and continue counting after monitoring is resumed.

3.3. Feedback Groups and PRCs

These policy classes defined in this PIB are common to account type reporting for various technologies and apply to ALL SUBJECT-CATEGORIES. The policy classes are divided into three new groups, namely, The Feedback Report Group, The Feedback Usage Group and The Feedback Selection Group.

The policy classes in the Feedback Report Group are:

- Feedback Action
- Feedback Action List
- Feedback Selection Usage Combination Capability
- Feedback Linkage
- Feedback Traffic Statistics Threshold

The policy classes in the Feedback Usage Group are:

- Feedback Traffic
- Feedback Interface Traffic

The policy class in the Feedback Selection Group is:

- Feedback RoleCombo Filter Selection

3.3.1. Feedback Action

The Feedback Action class contains the attributes that specify action that the PEP is to take regarding policy usage, monitoring and tracking. The PDP may suspend usage monitoring and periodic reporting, suspend periodic reporting only, resume usage and periodic reporting or solicit immediate reporting. The action may affect all feedback policies or be associated with one or more frwkFeedbackLink instances.

The frwkFeedbackActionIndicator attribute defines the action. The frwkFeedbackActionPri attribute indicates whether the action applies to all of the usage policies or to a list. The frwkFeedbackActionList attribute is the identifier of the list of Linkage policy instances to which the action is to be applied.

The PDP can solicit the PEP for immediate usage feedback. The PEP shall respond with a solicited report containing the usage feedback.

The PDP can direct the resumption of usage monitoring and reporting per the defined intervals. For example, the PEP may have re-connected to a PDP and has cached usage policies. The PDP indicates to the PEP to resume usage tracking and monitoring and to send all

the cached usage policy. The PEP shall respond at the next appropriate interval with an unsolicited report containing the usage feedback.

The PDP can suspend the monitoring of usage policy. The PEP maintains the current usage that has been monitored, but discontinues any further monitoring until the PDP directs the PEP to resume monitoring in a subsequent Decision.

The PDP can also suspend just the reporting of usage, but not interrupt the monitoring and tracking of usage. The PEP shall discontinue sending Report messages with usage feedback until the PDP directs the PEP to resume. The PEP then begins reporting the usage feedback at the next interval.

3.3.2. Feedback Action List

This class defines sets of linkage instances that can be referred to from the frwkFeedbackActionList attribute.

3.3.3. Feedback Linkage Capability

This class defines the valid selection criteria PRC, usage PRC and threshold PRC combinations supported by the PEP.

3.3.4. Feedback Linkage

This class links the selection criteria instance with the usage class. This table permits the reuse of a selection criteria instance for multiple usage policies.

The linkage table also permits the definition of a maximum reporting interval to use when issuing the COPS accounting type reports for the usage instance. A value of 0 in this attribute indicates that the usage policy must be solicited.

3.3.5. Feedback Traffic Statistics Threshold

This class is used to provide threshold values for the attributes described in the traffic usage classes below.

3.3.6. Feedback Traffic

This class includes the packet counts, byte counts and a reference to the associated Linkage instance.

3.3.7. Feedback Interface Traffic

This class is similar to the previous Feedback Traffic class, except that it includes an additional reference to an interface index. This class should be used with a selection criteria instance that matches an element that is assigned to multiple interfaces. The interface field can be used to associate the instances of this table with the specific element's assignment.

3.3.8. Feedback RoleCombo Filter Selection

This class is used as selection criteria based on role combination, capability set and a filter instance.

4. The Feedback Framework PIB Module

```
FRAMEWORK-FEEDBACK-PIB PIB-DEFINITIONS ::= BEGIN

   IMPORTS
       pib, Unsigned32, Unsigned64, Integer32,
       MODULE-IDENTITY, OBJECT-TYPE, MODULE-COMPLIANCE, OBJECT-GROUP
               FROM COPS-PR-SPPI
       TruthValue, TEXTUAL-CONVENTION
               FROM SNMPv2-TC
       InstanceId, ReferenceId, Prid,
       TagId, TagReferenceId
               FROM COPS-PR-SPPI-TC
       PrcIdentifierOid, PrcIdentifierOidOrZero
               FROM FRAMEWORK-TC-PIB
       frwkRoleComboEntry
               FROM FRAMEWORK-PIB
       InterfaceIndex
               FROM IF-MIB;

   frwkFeedbackPib  MODULE-IDENTITY
       SUBJECT-CATEGORIES  { all }
       LAST-UPDATED "200307140000Z"  -- 14 July 2003
       ORGANIZATION "IETF RAP WG"
       CONTACT-INFO "IETF RAP WG
                     Email: rap@ops.ietf.org

                     Diana Rawlins
                     MCI
                     400 International Parkway
                     Richardson, Texas 75081
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```

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```
      DESCRIPTION
              "The PIB module containing the base set of policy rule
              classes that are required for support of all policy
              usage monitoring, tracking and reporting policies.

              Copyright (C) The Internet Society (2003). This version
              of this PIB module is part of RFC 3571; see the RFC
              itself for full legal notices."
      REVISION     "200307140000Z"
      DESCRIPTION
               "Initial version, published in RFC 3571."

            ::= { pib 5 }

   --
   -- Textual Conventions
   --

   Usage32 ::= TEXTUAL-CONVENTION
        STATUS    current
```

```
        DESCRIPTION
                "The Usage32 type represents a non-negative integer
                which monotonically increases.
                Usage32 initial value is 0 and the object-type using
                Usage32 needs to specify when it is initialized.

                The Usage32 type is intended to reflect the absolute
                number of counted events, so that even a new PDP
                after a COPS reconnect can use the value directly.

                If there is the possibility that the maximum Usage32
                value of 2^32-1 is exceeded during the lifetime
                of the Usage32 object, the larger Usage64 type
                should be used.

                If conditions other than the reset of the COPS
                subsystem exist that disrupt the monotonic
                characteristics of Usage32, these conditions and a
                method how to detect their presence should be
                specified in the description of the object-type using
                Usage32 or its enclosing object-types (e.g. the
                Entry or Table object-type of the Usage32
                object-type).

                Whenever the monotonic increase of Usage32 is violated,
                it should be reset to 0 and the fact that this occurred
                should be indicated through an appropriate mechanism,
                for example a corresponding object of type TimeStamp
                or TimeAndDate."
        SYNTAX Unsigned32

    Usage64 ::= TEXTUAL-CONVENTION
        STATUS    current
        DESCRIPTION
                "The Usage64 type represents a non-negative integer
                which monotonically increases.
                Usage64 initial value is 0 and the object-type using
                Usage64 needs to specify when it is initialized.

                The Usage64 type is intended to reflect the absolute
                number of counted events, so that even a new PDP
                after a COPS reconnect can use the value directly.

                The lifetime of the Usage64 object should be defined
                in a way that ensures the maximum Usage64 value of
                2^64-1 is never exceeded.

                If conditions other than the reset of the COPS
```

```
                subsystem exist that disrupt the monotonic
                characteristics of Usage64, these conditions and a
                method how to detect their presence should be
                specified in the description of the object-type using
                Usage64 or its enclosing object-types (e.g. the
                Entry or Table object-type of the Usage64
                object-type).

                Whenever the monotonic increase of Usage64 is violated,
                it should be reset to 0 and the fact that this occurred
                should be indicated through an appropriate mechanism,
                for example a corresponding object of type TimeStamp
                or TimeAndDate."
        SYNTAX Unsigned64

   --
   -- The feedback report group
   --

   frwkFeedbackGroupClasses
                  OBJECT IDENTIFIER ::= { frwkFeedbackPib  1 }

   --
   --  Feedback Action Table
   --

   frwkFeedbackActionTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackActionEntry
        PIB-ACCESS      install
        STATUS          current
        DESCRIPTION
                "This class represents commands that the PDP sends to
                suspend, resume or solicit collection or reporting of
                usage data."

           ::= { frwkFeedbackGroupClasses  1}

   frwkFeedbackActionEntry OBJECT-TYPE
        SYNTAX  FrwkFeedbackActionEntry
        STATUS  current
        DESCRIPTION
                "Each frwkFeedbackActionEntry represents a command from
                the PDP. FrwkFeedbackActionIndicator specifies the
                command itself while frwkFeedbackActionSpecificPri
                indicates if all frwkFeedbackLink objects in the system
                are affected by the command, or just the set that is
                referenced by frwkFeedbackActionList."
```

```
        PIB-INDEX { frwkFeedbackActionId}

        ::= { frwkFeedbackActionTable 1}

   FrwkFeedbackActionEntry ::= SEQUENCE {
           frwkFeedbackActionId                InstanceId,
           frwkFeedbackActionIndicator         INTEGER,
           frwkFeedbackActionSpecificPri       TruthValue,
           frwkFeedbackActionList              TagReferenceId
        }

   frwkFeedbackActionId  OBJECT-TYPE
        SYNTAX        InstanceId
        STATUS        current
        DESCRIPTION
           "An arbitrary integer index that uniquely identifies an
            instance of the frwkFeedbackAction class."

        ::= { frwkFeedbackActionEntry 1}

   frwkFeedbackActionIndicator OBJECT-TYPE
        SYNTAX  INTEGER {
                   suspendMonitoringAndReports(1),
                   suspendReports(2),
                   resume(3),
                   solicitReport(4)
        }
        STATUS  current
        DESCRIPTION
                  "The value indicates if the PEP is to send cached
                   usage policies via COPS accounting type report
                   messages.
                   The enumeration values are:
                   (1)  suspendMonitoringAndReports
                   (2)  suspendReports
                   (3)  resume
                   (4)  solicitReport "

          ::= { frwkFeedbackActionEntry 2 }

   frwkFeedbackActionSpecificPri OBJECT-TYPE
           SYNTAX        TruthValue
           STATUS        current
           DESCRIPTION
                    "A value of 0 indicates that the
                    frwkFeedbackActionList attribute should be ignored,
                    and the action applied to all policies. A value of
                    1 indicates that the action entry has a specific
```

```
                list of policies to which it is to be applied."
        ::= { frwkFeedbackActionEntry 3}

   frwkFeedbackActionList OBJECT-TYPE
        SYNTAX        TagReferenceId
        PIB-TAG       { frwkFeedbackActionListTag }
        STATUS        current
        DESCRIPTION
                "Identifies a group of frwkFeedbackLink instances
                that this action should affect. The group is
                identified through a tag reference in the
                frwkFeedbackList class."
        ::= { frwkFeedbackActionEntry 4}

   --
   --  Feedback Action List Table
   --

   frwkFeedbackActionListTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackActionListEntry
        PIB-ACCESS      install
        STATUS          current
        DESCRIPTION
                "This class defines groups of linkage instances.
                Groups can be referenced by commands sent by the
                PDP in a frwkFeedbackActionEntry -in this case the
                command affects all linkage instances that are part
                of the group.
                A group can be referred to by its tag stored in
                frwkFeedbackActionListTag."
        ::= { frwkFeedbackGroupClasses  2}

   frwkFeedbackActionListEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackActionListEntry
        STATUS          current
        DESCRIPTION
                "Each instance associates a linkage instance with a
                 specific ActionListGroup."

        PIB-INDEX {frwkFeedbackActionListId }
        UNIQUENESS { frwkFeedbackActionListTag,
                     frwkFeedbackActionListRefID
                   }
        ::= { frwkFeedbackActionListTable 1}

   FrwkFeedbackActionListEntry::= SEQUENCE {
           frwkFeedbackActionListId          InstanceId,
           frwkFeedbackActionListTag         TagId,
```

```
            frwkFeedbackActionListRefID       ReferenceId
        }

   frwkFeedbackActionListId OBJECT-TYPE
           SYNTAX       InstanceId
           STATUS       current
           DESCRIPTION
                    "Arbitrary integer index that uniquely
                    identifies an instance of the class."

           ::= { frwkFeedbackActionListEntry 1 }

   frwkFeedbackActionListTag OBJECT-TYPE
           SYNTAX       TagId
           STATUS       current
           DESCRIPTION
                    "Identifies a group of linkage instances that can
                    be referenced from the Action class."

           ::= { frwkFeedbackActionListEntry 2 }

   frwkFeedbackActionListRefID   OBJECT-TYPE
           SYNTAX       ReferenceId
           PIB-REFERENCES { frwkFeedbackLinkEntry }
           STATUS       current
           DESCRIPTION
                    "A frwkFeedbackLink instance that is referred to
                    by this ReferenceId becomes part of the group,
                    that is identified by the
                    frwkFeedbackActionListTag."

           ::= { frwkFeedbackActionListEntry 3 }

   --
   -- The Feedback Link Capability Table
   --

   frwkFeedbackLinkCapsTable OBJECT-TYPE
        SYNTAX           SEQUENCE OF FrwkFeedbackLinkCapsEntry
        PIB-ACCESS       notify
        STATUS           current
        DESCRIPTION
                "Instances of the frwkFeedbackLink class reference
                 instances of selection and threshold classes and a
                 usage class.
                 This class allows the PEP to communicate valid
                 combinations of these three classes to the PDP."
         ::= { frwkFeedbackGroupClasses 3}
```

```
   frwkFeedbackLinkCapsEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackLinkCapsEntry
        STATUS          current
        DESCRIPTION
                 "The attributes of this class identify valid
                  combinations of selection criteria, usage and
                  threshold classes for feedback."
        PIB-INDEX { frwkFeedbackLinkCapsId }
        UNIQUENESS {
                    frwkFeedbackLinkCapsSelection,
                    frwkFeedbackLinkCapsUsage,
                    frwkFeedbackLinkCapsThreshold
                  }

        ::= {frwkFeedbackLinkCapsTable 1}

   FrwkFeedbackLinkCapsEntry ::= SEQUENCE {
          frwkFeedbackLinkCapsId         InstanceId,
          frwkFeedbackLinkCapsSelection  PrcIdentifierOid,
          frwkFeedbackLinkCapsUsage      PrcIdentifierOid,
          frwkFeedbackLinkCapsThreshold  PrcIdentifierOidOrZero
   }

   frwkFeedbackLinkCapsId OBJECT-TYPE
        SYNTAX        InstanceId
        STATUS        current
        DESCRIPTION
             "An arbitrary integer index that uniquely identifies an
             instance of the frwkFeedbackLinkCaps class."
        ::= { frwkFeedbackLinkCapsEntry 1}

   frwkFeedbackLinkCapsSelection OBJECT-TYPE
        SYNTAX        PrcIdentifierOid
        STATUS        current
        DESCRIPTION
               "The identifier of a class that is supported by the
                device for feedback selection in combination with the
                usage and threshold classes referenced in this
                instance."
        ::= { frwkFeedbackLinkCapsEntry 2}

   frwkFeedbackLinkCapsUsage OBJECT-TYPE
        SYNTAX        PrcIdentifierOid
        STATUS        current
        DESCRIPTION
                "The identifier of the usage class that is supported by
                the PEP in combination with the selection and threshold
                classes referenced in this instance."
```

```
        ::= { frwkFeedbackLinkCapsEntry 3}


   frwkFeedbackLinkCapsThreshold OBJECT-TYPE
           SYNTAX        PrcIdentifierOidOrZero
           STATUS        current
           DESCRIPTION
                "The identifier of the threshold class that is
                supported by the PEP in combination with the selection
                and usage classes referenced in this instance.
                0.0 is used if this combination does not allow a
                threshold."
           ::= { frwkFeedbackLinkCapsEntry 4}

   --
   -- The Feedback Report Linkage Table
   --

   frwkFeedbackLinkTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackLinkEntry
        PIB-ACCESS      install
        STATUS          current
        DESCRIPTION
                 "This class associates the selection criteria with the
                  usage policy. It also permits the defining of the max
                  interval used for reporting the usage instance."

        ::= { frwkFeedbackGroupClasses  4}

   frwkFeedbackLinkEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackLinkEntry
        STATUS          current
        DESCRIPTION
                 "This class associates the selection criteria with the
                  usage policy. It also permits the defining of the max
                  interval used for reporting the usage instance."
        PIB-INDEX { frwkFeedbackLinkId }
        UNIQUENESS {frwkFeedbackLinkSel,
                    frwkFeedbackLinkUsage }
        ::= {frwkFeedbackLinkTable 1}

   FrwkFeedbackLinkEntry ::= SEQUENCE {
          frwkFeedbackLinkId         InstanceId,
          frwkFeedbackLinkSel        Prid,
          frwkFeedbackLinkUsage      PrcIdentifierOid,
          frwkFeedbackLinkInterval   Integer32,
          frwkFeedbackLinkThreshold  Prid,
          frwkFeedbackLinkFlags      BITS
```

```
   }

   frwkFeedbackLinkId OBJECT-TYPE
        SYNTAX        InstanceId
        STATUS        current
        DESCRIPTION
            "An arbitrary integer index that uniquely identifies an
             instance of the frwkFeedbackLinkTable class."
        ::= { frwkFeedbackLinkEntry 1}

   frwkFeedbackLinkSel OBJECT-TYPE
        SYNTAX       Prid
        STATUS       current
        DESCRIPTION
            "The PRID of the Policy Class instance as the monitoring
             point, or the PRID of the selection criteria instance that
             defines the conditions for monitoring, to be use by the
             PEP for usage reporting."

        ::= { frwkFeedbackLinkEntry 2}

   frwkFeedbackLinkUsage OBJECT-TYPE
        SYNTAX      PrcIdentifierOid
        STATUS      current
        DESCRIPTION
             "The identifier of the usage class that the PEP uses to
             monitor, record and report."

        ::= { frwkFeedbackLinkEntry 3}

   frwkFeedbackLinkInterval  OBJECT-TYPE
        SYNTAX   Integer32
        STATUS   current
        DESCRIPTION
                "Maximum interval in units of the value of the
                 Accounting Timer specified by the PDP in the client
                 accept message. A frwkFeedbackLinkInterval of 1 is
                 equal to the value of the Accounting Timer. This value
                 must be 1 or greater. "

        ::= { frwkFeedbackLinkEntry 4}

   frwkFeedbackLinkThreshold  OBJECT-TYPE
        SYNTAX   Prid
        STATUS   current
        DESCRIPTION
                "The PRID of a threshold class instance. This instance
                 specifies the threshold values for the usage policy."
```

```
        ::= { frwkFeedbackLinkEntry 5}

   frwkFeedbackLinkFlags  OBJECT-TYPE
        SYNTAX   BITS {
                        periodic(0),
                        threshold(1),
                        changeOnly(2)
                 }
        STATUS   current
        DESCRIPTION
               "This value indicates the reporting basis of the usage
                policy. The feed back may be generated on demand, on a
                periodic basis regardless of a change in value from the
                previous report, on a periodic basis if a change in
                value has occurred, or the usage is reported when an
                identified threshold value in the usage instance has
                been reached.
               If the 'periodic' flag is set, the PEP will provide
                unsolicited reports at the rate specified in
                frwkFeedbackLinkInterval.
               If the 'periodic' flag is not set, reports will only be
                generated when solicited by the PDP.
               The 'threshold' and 'changeOnly' flags make the
                periodic reports conditional - these flags only make
                sense in combination with the 'periodic' flag."

           ::= { frwkFeedbackLinkEntry 6}

   --
   -- The Threshold class that accompanies the above Usage PRCs
   --

   frwkFeedbackTrafficThresTable OBJECT-TYPE
           SYNTAX         SEQUENCE OF FrwkFeedbackTrafficThresEntry
           PIB-ACCESS     install
           STATUS         current
           DESCRIPTION
                 "This class defines the threshold attributes
                  corresponding to usage attributes specified in
                  frwkFeedbackTrafficTable, frwkFeedbackIfTrafficTable
                  and other similar usage classes.

                  The usage object is considered to match the threshold
                  condition if at least one of the packet or byte
                  threshold conditions match.

                  The byte and packet thresholds are considered to
                  match, if the threshold is present (not ASN1 NULL)
```

```
                and the corresponding usage value exceeds the
                threshold."

        ::= { frwkFeedbackGroupClasses  5}

   frwkFeedbackTrafficThresEntry OBJECT-TYPE
           SYNTAX          FrwkFeedbackTrafficThresEntry
           STATUS          current
           DESCRIPTION
                    "Defines the attributes to hold threshold values."
           PIB-INDEX {frwkFeedbackTrafficThresId}

           ::= {frwkFeedbackTrafficThresTable 1}

   FrwkFeedbackTrafficThresEntry ::= SEQUENCE {
            frwkFeedbackTrafficThresId                 InstanceId,
            frwkFeedbackTrafficThresPackets           Unsigned64,
            frwkFeedbackTrafficThresBytes             Unsigned64
   }

   frwkFeedbackTrafficThresId   OBJECT-TYPE
           SYNTAX       InstanceId
           STATUS       current
           DESCRIPTION
                     "Arbitrary integer index that uniquely identifies
                      an instance of the class."
           ::= { frwkFeedbackTrafficThresEntry 1 }

   frwkFeedbackTrafficThresPackets   OBJECT-TYPE
           SYNTAX       Unsigned64
           STATUS       current
           DESCRIPTION
                     "The threshold, in terms of packets, that must be
                      matched or exceeded to trigger a report in the
                      next reporting interval."
           ::= { frwkFeedbackTrafficThresEntry 2 }

   frwkFeedbackTrafficThresBytes   OBJECT-TYPE
           SYNTAX       Unsigned64
           STATUS       current
           DESCRIPTION
                    "The threshold, in terms of bytes, that must be
                     exceeded to trigger a report in the next reporting
                     interval."
           ::= { frwkFeedbackTrafficThresEntry 3 }


   --
```

```
   -- All actual usage classes are in the separate
   -- frwkFeedbackUsageClasses group
   --

   frwkFeedbackUsageClasses
       OBJECT IDENTIFIER ::= { frwkFeedbackPib  2 }


   --
   -- The generic traffic (byte & packet count) usage class
   --

   frwkFeedbackTrafficTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackTrafficEntry
        PIB-ACCESS      report-only
        STATUS          current
        DESCRIPTION
                  "This class defines the usage attributes that the PEP
                   is to monitor for plain traffic handling elements
                   like filters. All packets and the bytes contained in
                   these packets are counted. It also contains the PRID
                   of the linkage instance associating the selection
                   criteria instance with the usage instance."

        ::= { frwkFeedbackUsageClasses  1}

   frwkFeedbackTrafficEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackTrafficEntry
        STATUS          current
        DESCRIPTION
                  "Defines the attributes the PEP is to monitor,
                   record and report."
        PIB-INDEX {frwkFeedbackTrafficId}
        UNIQUENESS { frwkFeedbackTrafficLinkRefID }

        ::= {frwkFeedbackTrafficTable 1}

   FrwkFeedbackTrafficEntry ::= SEQUENCE {
         frwkFeedbackTrafficId              InstanceId,
         frwkFeedbackTrafficLinkRefID       ReferenceId,
         frwkFeedbackTrafficPacketCount     Usage64,
         frwkFeedbackTrafficByteCount       Usage64

   }

   frwkFeedbackTrafficId   OBJECT-TYPE
        SYNTAX       InstanceId
        STATUS       current
```

```
        DESCRIPTION
                  "Arbitrary integer index that uniquely identifies
                   an instance of the class."
        ::= { frwkFeedbackTrafficEntry 1 }

   frwkFeedbackTrafficLinkRefID  OBJECT-TYPE
        SYNTAX      ReferenceId
        PIB-REFERENCES { frwkFeedbackLinkEntry }
        STATUS      current
        DESCRIPTION
                  "The ReferenceId of the Linkage policy instance used
                   to base this usage policy instance upon."

        ::= { frwkFeedbackTrafficEntry 2 }

   frwkFeedbackTrafficPacketCount OBJECT-TYPE
        SYNTAX       Usage64
        STATUS       current
        DESCRIPTION
                  "The count of packets handled by the associated
                   element. The initial value of 0 is set when the
                   frwkFeedbackTraffic instance is created, for example
                   triggered through the creation of a frwkFeedbackLink
                   instance."

        ::= {frwkFeedbackTrafficEntry 3}

   frwkFeedbackTrafficByteCount OBJECT-TYPE
        SYNTAX       Usage64
        STATUS       current
        DESCRIPTION
                   "The byte count of packets handled by the associated
                    element. The initial value of 0 is set when the
                    frwkFeedbackTraffic instance is created."
        ::= { frwkFeedbackTrafficEntry 4}



   --
   -- The traffic usage class, qualified for an interface
   --
   frwkFeedbackIfTrafficTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackIfTrafficEntry
        PIB-ACCESS      report-only
        STATUS          current
        DESCRIPTION
                "A usage class similar to the basic Traffic class that
                also contains a reference to an interface index. This
```

```
                class should be used with an underspecified selection
                criteria entry from the frwkRoleComboTable that matches
                an element that can be assigned to multiple interface
                indices. The interface field can be used to associate
                the instances of this class with the specific element's
                assignment."
        ::= { frwkFeedbackUsageClasses  2 }

   frwkFeedbackIfTrafficEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackIfTrafficEntry
        STATUS          current
        DESCRIPTION
                 "Defines the attributes the PEP is to monitor,
                  record and report."
        PIB-INDEX {frwkFeedbackIfTrafficId}
        UNIQUENESS { frwkFeedbackIfTrafficLinkRefID,
                     frwkFeedbackIfTrafficIfIndex }

        ::= {frwkFeedbackIfTrafficTable 1}

   FrwkFeedbackIfTrafficEntry ::= SEQUENCE {
         frwkFeedbackIfTrafficId              InstanceId,
         frwkFeedbackIfTrafficLinkRefID       ReferenceId,
         frwkFeedbackIfTrafficIfIndex         InterfaceIndex,
         frwkFeedbackIfTrafficPacketCount     Usage64,
         frwkFeedbackIfTrafficByteCount       Usage64

   }

   frwkFeedbackIfTrafficId   OBJECT-TYPE
        SYNTAX       InstanceId
        STATUS       current
        DESCRIPTION
                  "Arbitrary integer index that uniquely identifies
                   an instance of the class."
        ::= { frwkFeedbackIfTrafficEntry 1 }

   frwkFeedbackIfTrafficLinkRefID  OBJECT-TYPE
        SYNTAX      ReferenceId
        PIB-REFERENCES { frwkFeedbackLinkEntry }
        STATUS      current
        DESCRIPTION
                  "The ReferenceId of the Linkage policy instance used
                   to base this usage policy instance upon."
        ::= { frwkFeedbackIfTrafficEntry 2 }

   frwkFeedbackIfTrafficIfIndex  OBJECT-TYPE
          SYNTAX         InterfaceIndex
```

```
          STATUS         current
          DESCRIPTION
              "The value of this attribute is the ifIndex which is
              associated with the specified RoleCombination and
              interface capability set name."

          ::= { frwkFeedbackIfTrafficEntry 3 }

   frwkFeedbackIfTrafficPacketCount OBJECT-TYPE
        SYNTAX       Usage64
        STATUS       current
        DESCRIPTION
                "The count of packets handled by the associated
                element. The initial value of 0 is set when the
                frwkFeedbackIfTraffic instance is created."
        ::= { frwkFeedbackIfTrafficEntry 4 }

   frwkFeedbackIfTrafficByteCount OBJECT-TYPE
        SYNTAX       Usage64
        STATUS       current
        DESCRIPTION
                  "The byte count of packets handled by the associated
                  element. The initial value of 0 is set when the
                  frwkFeedbackIfTraffic instance is created."
        ::= { frwkFeedbackIfTrafficEntry 5 }


   --
   -- All Selection classes are in the separate
   -- FrwkFeedbackSelectionClasses group
   --

   frwkFeedbackSelectionClasses
       OBJECT IDENTIFIER ::= { frwkFeedbackPib  3 }

   --
   -- The Role Combination Filter Selection Table
   --

   frwkFeedbackRoleFilterSelTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF FrwkFeedbackRoleFilterSelEntry
        PIB-ACCESS      install
        STATUS          current
        DESCRIPTION
                "A selection class that defines selection of objects
                for monitoring based on the role combination,
                capability set and a filter."
        ::= { frwkFeedbackSelectionClasses  1 }
```

```
   frwkFeedbackRoleFilterSelEntry OBJECT-TYPE
        SYNTAX          FrwkFeedbackRoleFilterSelEntry
        STATUS          current
        DESCRIPTION
                "Each instance selects a filter on multiple interfaces
                that share the same frwkRoleCombo instance."
        PIB-INDEX { frwkFeedbackRoleFilterSelId}
        UNIQUENESS { frwkFeedbackRoleFilterSelRCombo,
                     frwkFeedbackRoleFilterSelFilter
                   }

        ::= {frwkFeedbackRoleFilterSelTable 1}

   FrwkFeedbackRoleFilterSelEntry ::= SEQUENCE {
         frwkFeedbackRoleFilterSelId          InstanceId,
         frwkFeedbackRoleFilterSelRCombo      ReferenceId,
         frwkFeedbackRoleFilterSelFilter      Prid
   }

   frwkFeedbackRoleFilterSelId   OBJECT-TYPE
        SYNTAX       InstanceId
        STATUS       current
        DESCRIPTION
                  "Arbitrary integer index that uniquely identifies
                   an instance of the class."
        ::= { frwkFeedbackRoleFilterSelEntry 1 }

   frwkFeedbackRoleFilterSelRCombo  OBJECT-TYPE
        SYNTAX      ReferenceId
        PIB-REFERENCES { frwkRoleComboEntry }
        STATUS      current
        DESCRIPTION
                  "The ReferenceId of the frwkRoleComboTable policy
                   instance used for selection."
        ::= { frwkFeedbackRoleFilterSelEntry 2 }

   frwkFeedbackRoleFilterSelFilter     OBJECT-TYPE
        SYNTAX      Prid
        STATUS      current
        DESCRIPTION
                  "The identifier of a filter instance. Valid classes
                   are the subclasses of frwkBaseFilter:
                   - frwkIpFilter
                   - frwk802Filter
                   - frwkILabelFilter"
        ::= { frwkFeedbackRoleFilterSelEntry 3 }
```

```
   --
   -- Compliance Section
   --

   frwkFeedbackPibConformance
               OBJECT IDENTIFIER ::= { frwkFeedbackPib 4 }

   frwkFeedbackPibCompliances
               OBJECT IDENTIFIER ::= { frwkFeedbackPibConformance 1 }

   frwkFeedbackPibGroups
               OBJECT IDENTIFIER ::= { frwkFeedbackPibConformance 2 }


   frwkFeedbackPibCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
        "Describes the requirements for conformance to the feedback
        framework PIB"

      MODULE   -- this module
         MANDATORY-GROUPS { frwkFeedbackLinkCapsGroup,
                            frwkFeedbackLinkGroup,
                            frwkFeedbackActionGroup }

      GROUP frwkFeedbackActionListGroup
         DESCRIPTION
                     "The frwkFeedbackActionListGroup is mandatory if
                     actions on subsets linkEntries are to be
                     supported."

      GROUP frwkFeedbackTrafficGroup
         DESCRIPTION
                     "The frwkFeedbackTrafficGroup is mandatory if
                     monitoring of traffic data is to be supported."

      GROUP frwkFeedbackTrafficThresGroup
         DESCRIPTION
                     "The frwkFeedbackTrafficThresGroup is mandatory
                     if conditional reporting of traffic usage
                     thresholds is to be supported."

      GROUP frwkFeedbackIfTrafficGroup
         DESCRIPTION
                     "The frwkFeedbackIfTrafficGroup is mandatory if
                     per-interface usage collection of traffic data is
                     to be supported."
```

```
      GROUP frwkFeedbackRoleFilterSelGroup
         DESCRIPTION
                     "The frwkFeedbackRoleFilterSelGroup is mandatory
                     if monitoring of filters referenced through the
                     frwkRoleCombo class is to be supported."

      ::= { frwkFeedbackPibCompliances 1 }

    frwkFeedbackLinkCapsGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackLinkCapsId,
                frwkFeedbackLinkCapsSelection,
                frwkFeedbackLinkCapsUsage,
                frwkFeedbackLinkCapsThreshold }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackLinkCapsTable."

        ::= { frwkFeedbackPibGroups 1 }

    frwkFeedbackLinkGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackLinkId,
                frwkFeedbackLinkSel,
                frwkFeedbackLinkUsage,
                frwkFeedbackLinkInterval,
                frwkFeedbackLinkThreshold,
                frwkFeedbackLinkFlags }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackLinkTable."

        ::= { frwkFeedbackPibGroups 2 }

    frwkFeedbackActionGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackActionId,
                frwkFeedbackActionIndicator,
                frwkFeedbackActionSpecificPri,
                frwkFeedbackActionList }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackActionTable."

        ::= { frwkFeedbackPibGroups 3 }

    frwkFeedbackActionListGroup OBJECT-GROUP
        OBJECTS {
```

```
                frwkFeedbackActionListId,
                frwkFeedbackActionListTag,
                frwkFeedbackActionListRefID }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackActionListTable."

        ::= { frwkFeedbackPibGroups 4 }

    frwkFeedbackTrafficGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackTrafficId,
                frwkFeedbackTrafficLinkRefID,
                frwkFeedbackTrafficPacketCount,
                frwkFeedbackTrafficByteCount }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackTrafficTable."

        ::= { frwkFeedbackPibGroups 5 }

    frwkFeedbackTrafficThresGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackTrafficThresId,
                frwkFeedbackTrafficThresPackets,
                frwkFeedbackTrafficThresBytes }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackTrafficThresTable."

        ::= { frwkFeedbackPibGroups 6 }

    frwkFeedbackIfTrafficGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackIfTrafficId,
                frwkFeedbackIfTrafficLinkRefID,
                frwkFeedbackIfTrafficIfIndex,
                frwkFeedbackIfTrafficPacketCount,
                frwkFeedbackIfTrafficByteCount }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackIfTrafficTable."

        ::= { frwkFeedbackPibGroups 7 }

    frwkFeedbackRoleFilterSelGroup OBJECT-GROUP
        OBJECTS {
                frwkFeedbackRoleFilterSelId,
```

```
                frwkFeedbackRoleFilterSelRCombo,
                frwkFeedbackRoleFilterSelFilter }
        STATUS  current
        DESCRIPTION
             "Objects from the frwkFeedbackRoleFilterSelTable."

        ::= { frwkFeedbackPibGroups 8 }

    END
```

5. Security Considerations

This PIB defines structured information that may be sensitive when transported by the COPS protocol [COPS-PR].

This PIB does not contain classes that directly contain security relevant information like passwords or monetary amounts. However, unauthorized access or changes to information defined in this PIB could compromise network operations or reveal sensitive business or personal information.

Specifically for the classes:

frwkFeedbackLinkCaps

> This class has the ACCESS clause 'notify'. Access to this information reveals feedback collection capabilities of the COPS client and malicious changes could affect feedback operation by misleading the server to generate corrupt feedback configuration.

frwkFeedbackLinkTable, frwkFeedbackAction, frwkFeedbackActionList, frwkFeedbackTrafficThres, frwkFeedbackRoleFilterSel

> These classes have the ACCESS clause 'install' and allow the COPS server to control feedback collection and reporting on the client. Access to this information exposes the client's configuration; malicious changes could disrupt network or business operations and raise privacy issues.

frwkFeedbackTraffic, frwkFeedbackIfTraffic

> These classes have the ACCESS clause 'report-only' and contain the usage information delivered from the COPS client to the server. Unauthorized access to this information may reveal detailed information on the network and its users. Malicious changes may affect network and business operations.

[COPS] and [COPS-PR] define mechanisms to secure the COPS protocol communication and implementations of COPS servers or clients supporting this PIB MUST follow the security guidelines specified there.

6. IANA Considerations

This document describes the frwkFeedbackPib Policy Information Base (PIB) module for registration under the "pib" branch registered with IANA. The IANA has assigned PIB number 5.

This PIB uses "all" in the SUBJECT-CATEGORY clause, so it applies to all COPS client types. No new COPS client type is requested for this PIB.

7. Acknowledgements

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