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2. Abstract

This document describes an extension to BGP [BGP-4] which may be used to provide flexible control over the distribution of routing information.
3. Introduction

The Extended Community Attribute provides two important enhancements over the existing BGP Community Attribute:

- It provides an extended range, ensuring that communities can be assigned for a plethora of uses, without fear of overlap.

- The addition of a Type field provides structure for the community space.

The addition of structure allows the usage of policy based on the application for which the community value will be used. For example, one can filter out all communities of a particular type, or allow only certain values for a particular type of community. It also allows one to specify whether a particular community is transitive or non-transitive across Autonomous system boundary. Without structure, this can only be accomplished by explicitly enumerating all community values which will be denied or allowed and passed to BGP speakers in neighboring ASes based on the transitive property.

4. BGP Extended Communities Attribute

The Extended Communities Attribute is a transitive optional BGP attribute. The attribute consists of a set of "extended communities". Each extended community is coded as an eight octet value. All routes with the Extended Communities attribute belong to the communities listed in the attribute.

The Extended Communities Attribute has Type Code 16.

Each Extended Community is encoded as an eight octet quantity, as follows:

- Type Field : 1 or 2 octets
- Value Field : Remaining octets

Type Field:

Two classes of Type Field are introduced: Regular type and Extended type.

The size of Type Field for Regular types is 1 octet and the size of the Type Field for Extended types is 2 octets.

The value of the high-order octet will determine if its a regular type or an extended type. The value of the high-order
octet of the Type Field defined as regular type (or extended
type) for a extended community MUST NOT be reused as the value
of the high-order octet of the Type Field defined as extended
type (or regular type). In other words, a new extended
community of regular type (extended type) should have unique
(and new) value for the high-order octet (high-order and low-
order octet).

The high-order octet of the Type Field is as shown below:

- **First bit (MSB)**: IANA authority bit
  - Value 0: IANA assignable type
  - Value 1: Vendor-specific types

- **Second bit**: Transitive bit
  - Value 0: The community is Transitive across ASes
  - Value 1: The community is Non-Transitive across ASes

- **Remaining 6 bits**: Indicates the structure of the community

**Value Field:**

The encoding of the Value Field is dependent on the "type" of
the community as specified by the Type Field. The encoding of
the community for the transitive communities should be such
that it is unique globally (i.e. across the Autonomous Systems).

Two extended communities are declared equal only when entire 8
octets are equal.

The two members in the tuple <Type, Value> should be enumerated to
specify any community value. Based on the value of the Type field,
the remaining octets of the community should be interpreted.
5. New BGP Extended Community Types.

This document introduces a few extended types and defines the Value Field for those types.

Type 0x00:

This is an extended type with Type Field comprising of 2 octets and Value Field comprising of 6 octets.

The value of the high-order octet of this extended type is 0x00. The low-order octet of this extended type is used to indicate sub-types.

The Value Field consists of two sub-fields:

Global Administrator sub-field: 2 octets

This sub-field contains an Autonomous System number assigned by IANA.

Local Administrator sub-field: 4 octets

The organization identified by Autonomous System number in the Global Administrator sub-field, can encode any information in this sub-field. The value and meaning of the value encoded in this sub-field should be defined by the sub-type of the community.

Type 0x01:

This is an extended type with Type Field comprising of 2 octets and Value Field comprising of 6 octets.

The value of the high-order octet of this extended type is 0x01. The low-order octet of this extended type is used to indicate sub-types.

The Value field consists of two sub-fields.

Global Administrator sub-field: 4 octets

This sub-field contains an IPv4 address assigned by IANA.

Local Administrator sub-field: 2 octets

The organization which has been assigned the IPv4 address in the Global Administrator sub-field, can encode any
information in this sub-field. The value and meaning of this value encoded in this sub-field should be defined by the sub-type of the community.

Type 0x02:

This is an extended type with Type Field comprising of 2 octets and Value Field comprising of 6 octets.

The value of the high-order octet of this extended type is 0x02. The low-order octet of this extended type is used to indicate sub-types.

The Value Field consists of two sub-fields.

Global Administrator sub-field: 4 octets

This sub-field contains a 4-octets Autonomous System number assigned by IANA.

Local Administrator sub-field: 2 octets

The organization identified by Autonomous System number in the Global Administrator sub-field, can encode any information in this sub-field. The value and meaning of the value encoded in this sub-field should be defined by the sub-type of the community.

Type 0x03:

This is an extended type with Type Field comprising of 2 octets and Value Field comprising of 6 octets.

The value of the high-order octet of this extended type is 0x03. The low-order octet of this extended type is used to indicate sub-types.

The Value Field contains a 6 byte value of structure with sub-fields.

This is a generic community of extended type. The value of the sub-type which should define the Value Field is to be assigned by IANA.
6. Route Target Community

The Route Target Community identifies one or more routers that may receive a set of routes (that carry this Community) carried by BGP. This is transitive across the Autonomous system boundary.

The value of the Type field for the Route Target Community can be 0x00, 0x01 or 0x02. The value of the low-order octet of the extended type field for this community is 0x02.

When the value of the Type field is 0x00 or 0x02, the value of the Local Administrator sub-field in the Value Field MUST be unique within the Autonomous system carried in the Global Administrator sub-field.

7. Route Origin Community

The Route Origin Community identifies one or more routers that inject a set of routes (that carry this Community) into BGP. This is transitive across the Autonomous system boundary.

The value of the Type field for the Route Origin Community can be 0x00, 0x01 or 0x02. The value of the low-order octet of the extended type field for this community is 0x03.

When the value of the Type field is 0x00 or 0x02, the value of the Local Administrator sub-field in the Value Field MUST be unique within the Autonomous system carried in the Global Administrator sub-field.

8. Link Bandwidth Community

When a router receives a route from a directly connected external neighbor (the external neighbor that is one IP hop away), and advertises this route (via IBGP) to internal neighbors, as part of this advertisement the router may carry the bandwidth of the link that connects the router with the external neighbor. The bandwidth of such a link is carried in the Link Bandwidth Community. The community MAY be marked as non-transitive across the Autonomous system boundary.

If the community is marked as non-transitive, then the value of the high-order octet of the extended Type Field is 0x40, otherwise it is 0x00. The value of the low-order octet of the extended type field for this community is 0x04.
The value of the Global Administrator sub-field in the Value Field MUST represent the Autonomous System of the router that attaches the Link Bandwidth Community. When a router receives a route with the community, the router may check the AS number in the Global Administrator sub-field to see if it's not the local AS and hence ignore the information carried in the Link Bandwidth Community.

The bandwidth of the link is expressed as 4 octets in IEEE floating point format, units being bytes per second. It is carried in the Local Administrator sub-field of the Value Field.

9. Operations

A BGP speaker may use the Extended Communities attribute to control which routing information it accepts, prefers or distributes to its peers.

A BGP speaker receiving a route that doesn't have the Extended Communities attribute may append this attribute to the route when propagating it to its peers.

A BGP speaker receiving a route with the Extended Communities attribute may modify this attribute according to the local policy.

A BGP speaker should not propagate a non-transitive extended community across the Autonomous system boundary.

A route may carry both the BGP Communities attribute as defined in [RFC1997]), and the Extended BGP Communities attribute. In this case the BGP Communities attribute is handled as specified in [RFC1997], and the Extended BGP Communities attribute is handled as specified in this document.

10. IANA Considerations

For the high-order octet of the Type Field, values 0x00 through 0x03 are assigned in this document and are defined as extended types. For the combination of the high-order and low-order octets of the Type Field values 0x0002-0x0004, 0x0102-0x0103, and 0x0202-0x0203 are assigned in this document.

The Type Field values 0x04-0x3f for regular types (0x0400-0x3fff when expressed as extended types) are to be assigned by IANA, using the "First Come First Served" policy defined in RFC 2434. The extended type field values 0x0000-0x0001, 0x0005-0x00ff, 0x0100-0x0101, 0x0104-0x01ff, 0x0200-0x0201, 0x0204-0x02ff and 0x0300-0x03ff are to
be assigned by IANA, using the "First Come First Served" policy
defined in RFC 2434. Type values 0x80-0xbf for regular types
(0x8000-0xbfff when expressed as extended types) are vendor-specific
types, and values in this range are not to be assigned by IANA.

11. Security Considerations

This extension to BGP does not change the underlying security issues.

12. Acknowledgements

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13. References


[RFC1997] Chandra, R., Traina, P., Li, T., "BGP Communities

14. Author Information

Srihari R. Sangli
Procket Networks, Inc.
1100 Cadillac Court
Milpitas, CA - 95035
e-mail: srihari@procket.com

Dan Tappan
Cisco Systems, Inc.
250 Apollo Drive
Chelmsford, MA 01824
e-mail: tappan@cisco.com

Yakov Rekhter
Juniper Networks, Inc.
1194 N. Mathilda Ave
Sunnyvale, CA 94089
e-mail: yakov@juniper.net