IEEE 802.19.1a
Wireless Coexistence

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| CID 162 resolution:Text proposal on the algorithm and parameters for spectrum allocation based on graph  |
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Abstract

This contribution provides text proposals for coexistence algorithm based on graph information.

 

* + - 1. Obtaining coexistence set information

When a CM requires to obtain coexistence set information, the CM shall perform the obtaining coexistence set information procedure described in clause 5.2.3.1. The CM shall generate and send the ***CoexistenceSetInformationRequest*** message to the CDIS to which this CM is subscribed.

Table below shows ***CxMessage*** fields in ***CoexistenceSetInformationRequest*** message.

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***~~Header~~header*** | ***CxHeader*** | ***requestID*** |
| ***~~Payload~~payload*** | ***CxPayload*** | ***coexistenceSetInformationRequest*** |

Table below shows the parameters in the ***coexistenceSetInformationRequest*** payload.

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Data type* | *Value* |
| ***listOfNetworkID*** | ***SEQUENCE OF OCTET STRING*** | List of network ID |
| ***interferenceGraph*** | ***InterferenceGraph*** | If present the parameter shall be set to represent the interference relationship among GCOs. The example algorithm is given in 7.2.2.x. |
| ***operationCode*** | ***OperationCode*** | Shall be set to indicate that is new-request/update-request/stop-request. |

7.2.2.x Algorithm for spectrum allocation based on graph information

7.2.2.x.1 Introduction

Different GCOs have different QoS requirements. Making spectrum allocation, the desired QoS shall be considered in order to satisfy as many GCOs as possible. Graph has been used commonly to describe the interference relationship among GCOs. The weight of the graph edge shall take into account the desired QoS of different GCOs.

7.2.2.x.2 Channel assignment using graph representation of interference relationship among GCOs and their expected QoS

In Figure xx, there are multiple GCOs with different QoS requirements, which are desired SINRs. The weight of the edge is defined using the transmit power of each GCO *Pmax* and the distance *dij* between different GCOs as well as their SINR threshold represented by *SINRth*. Here, *i* and *j* are the index of the GCOs.



The actual SINR observed at each GCO is represented by



where, *N*0 is the power of AWGN.



Figure XX Graph representation of interference relationship among GCOs.

The channel assignment procedure tries to allocate as many GCOs into one cluster that will be using the same channel as possible while considering the interference threshold of each individual GCO. The procedure can be illustrated in the following figure. After selecting the first GCO (GCO1), the next GCO (GCO3) is selected that the sum of the weight of edges among the selected GCOs is maximized.



Figure xx procedure of the clustering based on graph information

Once the channel is allocated, the desired SINR shall be checked among against the actual SINR observed at each GCO. If there is any margin between desired and actual SINRs, the transmit power of GCO shall be reduced in order to reduce the interference among GCOs as much as possible.

7.2.2.x.3 Algorithm description

The processes are as follows.

* P#1
P#1 is the procedure operated at the CDIS where the CDIS receives the receiver information of the GCO through the GCO registration procedure as specified in 5.2.3.1.
* P#2
In this process, the interference set is determined. If there are multiple CMs, the graph presentation of interference relationship can be exchanged using procedure in 6.3.4.8.
* P#3
In this procedure the graph representation is established based on the location of GCOs.
* P#4
In this procedure, the weight of each edge is determined based on the pathloss, transmit power, location and desired SINR information.
* P#5
Allocate the spectrum of GCOs and also calculate the margin between the actual SINR and the desired SINR. According to the margin the power reduction value can be decided.
* P#6
The channel assignment and power reduction margin will be sent in 5.2.10.1.
* P#6
No configuration is made.

The branch conditions are as follows.

* BC#1
This branch condition shall be conducted based on the information of GCOs registered at the CDIS. If coexistence is needed, go to BC#2. If not go to P#6. No reconfiguration is needed.



Figure XX Algorithm of graph based resource allocation

**Annex A** (normative) **Data types**

## Data types for IEEE 802.19.1a

IEEE802191aDataType DEFINITIONS AUTOMATIC TAGS ::= BEGIN

**-----------------------------------------------------------**

**--Exported data types**

**-----------------------------------------------------------**

--Exported data types

EXPORTS

--Coexistence protocol entity ID

 CxID,

 --Status

 Status,

 --Cx Media status

 CxMediaStatus,

 --Coexistence service

 CoexistenceService,

 --Network technology

 NetworkTechnology,

 --Network type

 NetworkType,

 --Geolocation

 Geolocation,

 --Coverage area

 CoverageArea,

 --Installation parameters

 InstallationParameters,

 --Frequency range

 FrequencyRange,

 --List of available frequencies

 ListOfAvailableFrequencies,

 --List of operating frequencies

 ListOfOperatingFrequencies,

 --List of supported frequencies

ListOfSupportedFrequencies,

 --Required resource

RequiredResource,

 --Operation code for registration

 OperationCode,

 --Measurement capability

 MeasurementCapability,

 --CM registration

 CMRegistration,

 --CE registration

 CERegistration,

 --Coexistence report

 CoexistenceReport,

 --List of coexistence reports

 ListOfCoexistenceReports,

 --Mobility Information

 MobilityInformation,

 --Entity profile

 EntityProfile,

 --List of master CM candidates

 ListOfMasterCMCandidates,

 --List of neighbor CMs

 ListOfNeighborCMs,

 --List of GCOs

 ListOfGCOs,

--Coordinates

Coordinates,

--Antenna Characteristics

AntennaCharacteristics,

--Type of frequency

TypeOfFrequency,

--GCO Descriptor

GCODescriptor,

--Receiver information

ReceiverInfo,

--Modulation type

ModulationType,

--Filter characteristics

FilterCharacteristics,

--Energy detection information

EnergyDetectionInfo,

SpecRequestModification,

GraphEdge,

InterferenceRelationshipGraph

**-----------------------------------------------------------**

**--GraphEdge**

**-----------------------------------------------------------**

--GraphEdge parameters

GraphEdge ::= SEQUENCE {

 --Head vertex of edge

 head OCTET STRING,

 --tail vertex of edge

 tail OCTET STRING,

 --weight of the edge

 weight REAL}

**-----------------------------------------------------------**

**--Graph of interference relationship**

**-----------------------------------------------------------**

--Graph representation of interference relationship among GCOs

InterferenceRelationshipGraph ::= SEQUENCE {

 --GraphEdge

 edge GraphEdge,

...

}

**Annex C** (normative) **Messages8**

--Response for coexistence set information

CoexistenceSetInformationResponse ::= SEQUENCE {

 --Network ID

 networkID OCTET STRING OPTIONAL,

 --List of neighbor CMs

 listOfNeighborCMs listOfNeighborCMs OPTIONAL,

 --List of master CM candidates

 listOfMasterCMCandidates ListOfMasterCMCandidates OPTIONAL,

 --Graph representation of interference relationship

 interferenceGraph InterferenceRelationshipGraph

}