


**Boundless  
Communications**



**SkyEdge Inbound QoS DiffServ**

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## Session Objectives

- By the end of this session, we will:
  - Become acquainted with SkyEdge II DiffServ implementation
  - Know the different queue types and algorithms
  - Know how to configure Diffserv operations within a VSAT

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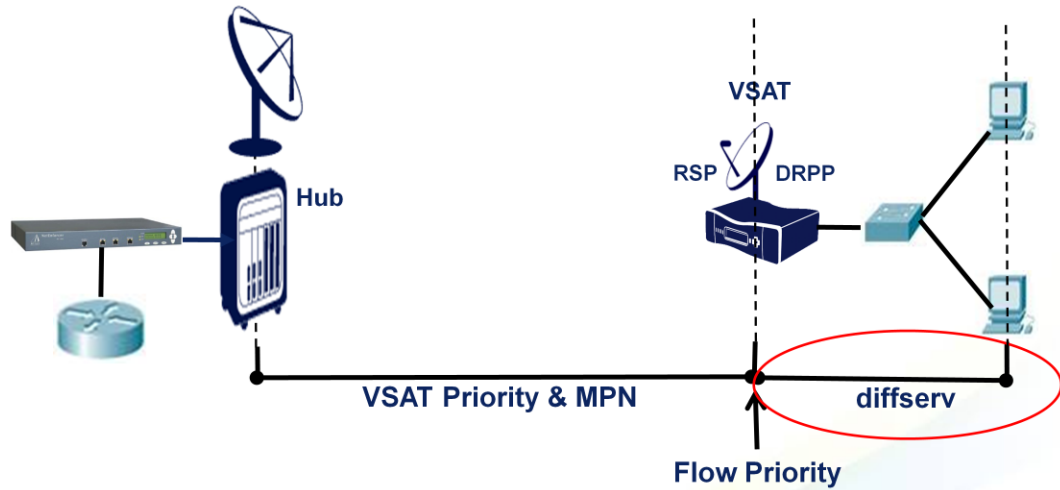
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Overview



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## What's Diffserv?

- Diffserv is a QoS model that enables traffic prioritization
- The process of Diffserv operation is:
  1. Classify the IP packet, based on different parameters, according to user configuration
  2. Define a specific action for a packet that meets a specific condition
  3. Stamp the selected IP packets with a new DSCP Value (Optional)
  4. Send on the IP packet according to the action selected in step two

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4

The Diffserv QoS Model is based upon 6 RFCs:

1. RFC 2474 — Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
2. RFC 2475 — An Architecture for Differentiated Services
3. RFC 2597 — Assured Forwarding PHB Group
4. RFC 3140 — Per Hop Behavior Identification Codes
5. RFC 3246 — An Expedited Forwarding PHB
6. RFC 4594 — Configuration Guidelines for DiffServ Service Classes

**Per Hop Behavior** – since Diffserv operate at layer 3 of the OSI model, any behavior defined on any IP Diffserv component, will be effective only until the IP packet arrive to another IP Diffserv component.

**DSCP** – differentiate Service Code Point, is a field in the IP header, within the TOS Byte. The DSCP length is 6 bits.





## Step I

### IP Classifier

- The classifiers can be defined in the specific VSAT and/or in the data template
- The order of the classifiers is critical: The first condition that is met will determine the Per Hop Behavior for the packet
- It is possible to configure which classifier table will be checked first – specific VSAT or Template classifier

IP Classifier Table Order	Specific, then Template
Default Traffic Class	Specific, then Template
	Template, then Specific
	Specific only
	Template only

- IP Packets which do not match any condition, will receive the default operation

Default Traffic Class	CS1
	CS1
	CS2
	CS3
	CS4
	CS5
	CS6
	AF1
	AF2

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6

The IP classifier can be configured in the specific VSAT configuration and in the Data template. Since there can be two operational tables of IP Classifier, the operator has to decide which table will be checked first by the IP classifier mechanism. In order to choose which of the tables will be checked first, in the Data Tab of the VSAT configuration, under *Router Configuration specific – VR Instances – VR # – LAN – IPv4 - classifier & QoS*, we can choose one of the following options:

- *Specific, then Template* – first the VSAT’s specific IP Classifier table will be checked and then (if there is no match found), the Template IP Classifier table will be checked.
- *Template, then Specific* – first the Template IP Classifier table will be checked and then (if there is no match found), the VSAT specific IP Classifier table will be checked.
- *Specific only* – Only the VSAT specific IP classifier table will be checked.
- *Template only* – Only the Template IP classifier table will be checked.

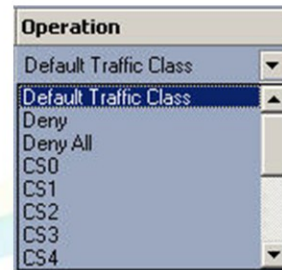
The IP classifier mechanism will stop checking the list if it finds a match between the condition defined and an IP Packet arriving to the VSAT from the LAN port. Therefore, it is recommended that the list will be structured from the specific rule at the top of the classifier to the generic rule at the bottom of the classifier.



## Step II

Per Hop Behavior

- Deciding the Operation, Per Hop Behavior, the classified traffic will get
  - This should be done at the IP classifier, *in the Operation* field
  - Traffic can be denied or sent to a queue for prioritization
- DiffServ standard defines 4 queue algorithms:
  - EF - Expedite forwarding, Absolute priority queue
  - CS – Class Selectors, Priority or Rate queues
  - AF – Assured Forwarding, Rate queues
  - Best effort queue



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All three queue algorithms are implemented in SkyEdge systems.

### Operation field explanation:

*Default Traffic Class* – The IP Packets which match the criteria defined will be sent to a default traffic queue, as defined in *Router Configuration specific – VR Instances – VR # – LAN – IPv4 - classifier & QoS*

*Deny* - will Deny the IP packets which match the criteria defined.

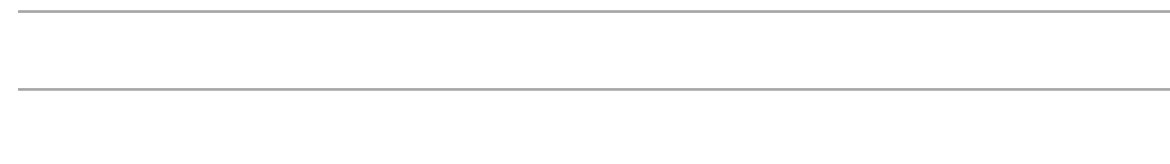
*Deny All* – The IP Classifier will not check other conditions defined after a condition which its operation field is defined as *Deny All*, therefore this option should be used only at the last line of the IP Classifier table and is equivalent to an *explicit deny* placed in the end of an access list.

The other queues (as explained in the next slides) are:

CS1 – CS7 are priority or rate queues.

AF1 – AF4 are rate queues.

EF is expedite forwarding queue.



CS0 is best effort queue.



## Step II - Queuing Algorithms

Absolute Priority

- **Absolute priority queue:**
  - This queue is named EF and is not configurable
  - This queue has the highest priority
  - Packets on this queue are sent to the satellite ASAP
- **Example**
  - Real time applications such as
    - VoIP
    - Videoconferencing
    - Gaming

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8

EF stands for Expedite forwarding (RFC-2598). EF Per Hop Behavior provides a premium service. It is specifically targeted towards the most critical applications, where jitter, delay and loss should be minimal. For Example: VoIP, Video and Online Trading. EF Codepoint value is 101110.

In SEII VoIP is automatically identified and sent to EF (based on SIP signaling or the RTP stream) and thus doesn't need to be configured to EF. Other traffic requiring real time treatment can be classified to EF, however use this queue with great caution as it receives absolute highest priority.

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## Step II - Queuing Algorithms

### Priority Queues

- **Priority queues: CS**
  - These queues are user configurable
  - Priority queues are served according to their priority level (which is the queue number) and should be limited by a maximum bit rate
  - Higher priority queue will get all available bandwidth, up to its maximal bit rate. Then, lower priority queues will be served
- **Example**
  - Internet browsing will get a higher priority than FTP at most networks

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CS stands for Class selector (RFC-2474). These are DSCP values of the form `xxx000`. There are 8 CS values: CS7, CS6, CS5, etc. Higher values have priority over the lower (eg. CS7 have higher priority over CS6).

A major drawback for such an algorithm is 'application starvation' which means: as long as there are any packets to send from a higher priority queue, lower priority queue will not be served. To avoid such a problem it is recommended to limit the priority queues bandwidth.

The CS queues are shared queues between all VRs configured at the VSAT. Each VR has its own IP classifier. But all CS queues are shared. The CS queues are configured at the Data Template.

In SEII the CS queues can also be configured as Rate queues, which means they will operate with the same algorithm as AF queues.



## Step II - Queuing Algorithms

### Rate Queues

- **Rate queues: AF (and optionally CS)**
  - **All queues configured as Rate Queues will compete for the available resources remaining after the priority queues**
  - **The user provides each queue with a relative weight**
  - **Packets in each queue will get the bandwidth and resources proportional to the queue's relative weight**
- **Example**
  - **3 advertising applications working on 3 different ports when one application needs more BW**
    - **The configuration can be three rate queues using the weights 20:40:60**

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10

AF stand for Assured Forwarding PHB (RFC-2597) defines a method by which Behavior Aggregates can be given different forwarding assurances, different resource priorities and even different drop-off probabilities at network congestion situations.

AF are defined with a AFxy value, such as AF11, AF23, etc.

There are four AFxy PHB primary values,  $(1 < x < 4, 1 < y < 3)$ . which are defined by the four AFx classes; namely, AF1y, AF2y, AF3y, and AF4y. Each class is assigned a certain amount of buffer space and interface bandwidth, dependent on the SLA with the Service Provider/policy.

X is the decimal value of the first 3 bits of the codepoint while Y is the decimal value of the last 3 bits if the codepoint. In Gilat SkyEdge systems we use default Y Value of 1.

Once the absolute priority queue (EF) and all other priority queues (CS) have been served, the remaining Inbound bandwidth will be divided between the rate queues.

The rate queues with data to send, will compete according to their associated weight.

The weights can, but do not necessarily have to be in percentage, and they have no units – only the proportional ratio between the different weights matters. For example, configuring three rate queues using the weights 20:40:60, will yield the same results as using the weights 1:2:3 or 17:34:51.

The AF queues are shared queues between all VRs configured at the VSAT. Each VR has its own IP classifier. But all AF queues are shared. The AF queues are being configured at the Data Template.



## Step II - Queuing Algorithms

### Best Effort Queue

- **Best effort queue**
  - This queue is the last to be served
  - Data from this queue will be sent only if all other queues are empty
- **Example**
  - Low priority application such as file sharing P2P platforms

A packet arriving with the default codepoint value of 000000 gets the standard best-effort service.

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## Step II - Queuing Algorithms

### Queue Configuration

- EF and CS0 queues are not configurable
- All other queues are configured in the data template
  - For each AF queue a relative weight must be configured
  - For each CS queue you must first decide if it is a rate or priority queue
    - Priority CS queues – Consider queue number and maximal bit rate
    - Rate CS queues – Consider only relative weight
  - For each queue, optionally configure flow priority (medium by default)

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12

Flow priority affects the priority of the capacity request that will be sent for this traffic (High, Medium or Low). The affects of this priority will be taught in the next presentation.

The queue configuration is located in the Data Template, under “common VRs parameters”.

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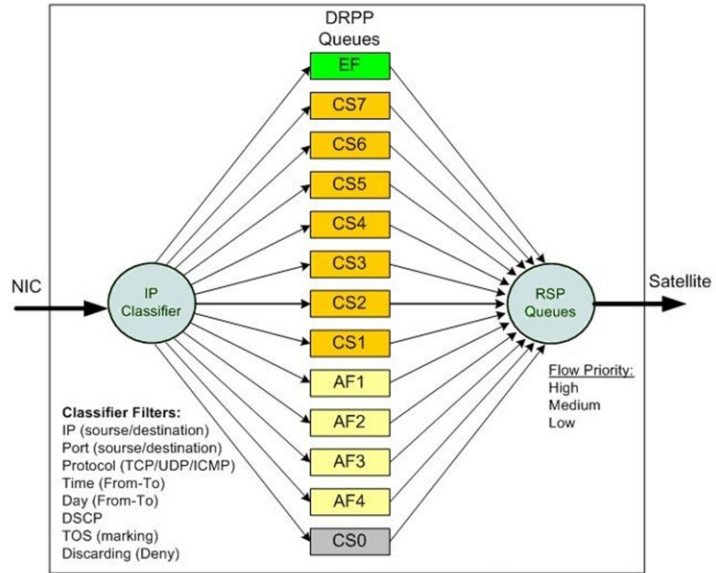
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# Step II - Queuing Algorithms

Summary



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## Step III – Stamping TOS Value

- Step III - Stamping the selected IP packets with a Diffserv value is optional and is implemented at each classifier
- Each IP packet which matches the criteria defined can:
  - Remain with the same TOS value it had before
  - Be stamped with a new TOS value (entered manually)
  - Be stamped with a new TOS value automatically, according to the queue the packet was sent to (see next slide)

SET New ToS	New TOS
No	0
No	
Manual Tos	
Automatic Tos	



## Step III – Stamping ToS Value

Automatic ToS Byte re-stamping

Queue	DSCP Value	ToS
EF	101110	184
CS7	111000	224
CS6	110000	192
CS5	101000	160
CS4	100000	128
CS3	011000	96
CS2	010000	64
CS1	001000	32
AF4	100010	136
AF3	011010	104
AF2	010010	72
AF1	001010	40
CS0	000000	0

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SEII only uses part of the Diffserv queues. The full Diffserv standard queues can be seen below

Traffic Queue	Queue Type	DSCP Value	ToS	Typical Types of Traffic
CS0	Rate	000000	0	Standard (a bit of everything)
CS1	Rate	001000	32	Low Priority Data; Flow Without BW Assurance
AF1	Rate	Values are the same as AF11 or AF12 or AF13		
AF11	Rate	001010	40	High Throughput Data; Store and Forward Applications
AF12	Rate	001100	48	
AF13	Rate	001110	56	
CS2	Rate	010000	64	Network Operations, Administration/Management
AF2	Rate	Values are the same as AF21 or AF22 or AF23		
AF21	Rate	010010	72	Low Latency Data; Client-Server Transactions, Web-based Ordering
AF22	Rate	010100	80	
AF23	Rate	010110	88	
CS3	Rate	011000	96	Broadcast Video/TV; Live Events
AF3	Rate	Values are the same as AF31 or AF32 or AF33		
AF31	Rate	011010	104	Multimedia; Streaming Video, Audio on Demand
AF32	Rate	011100	112	
AF33	Rate	011110	120	
CS4	Rate	100000	128	Real Time Interactive; Interactive Gaming
AF4	Rate	Values are the same as AF41 or AF42 or AF43		
AF41	Rate	100010	136	Multimedia Conferencing; Video Conferencing
AF42	Rate	100100	144	
AF43	Rate	100110	152	
CS5	Rate	101000	160	Signaling; IP Telephony Signaling
EF	Priority	101110	184	Telephony; IP Telephony Bearer
CS6	Rate	110000	192	Network Control; Network Routing
CS7	Priority	111000	224	Administrative Services; Heartbeats



## Step IV – Queue Priority

- The DRPP will send to the RSP the queue's content according to the queue priority
- The following is the order in which the queues are served:
  - EF
  - Priority Queues from high queue number to low
  - Rate Queues (both AF and CS) according to their relative weight
  - CS0 – only if all other queues are empty

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16

Packet which enter the EF queue, will be transmitted as soon as the VSAT can transmit them. After the EF queue is empty, the VSAT checks the rest of the CS Priority queues, from CS7 to CS1.

Only when all CS priority queues are empty, the VSAT starts checking the CS Rate and AF queues, and distributes BW according to relative weight.

CS0 queue is checked when all the queues mentioned above are empty.

CS (Class Selector) traffic configuration contains 7 queues: CS1-CS7.

The CS1-CS7 Traffic Class Descriptors configuration is available at the level of the VSAT Data template, it is not available for specific VSATs.

CS0 Traffic Class is not configurable and is 'best effort' by definition.

CS Traffic Class descriptors can be configured either as priority queues or as rate queues. When configured as Rate queues, the CS queues will behave like AF queues (and then the CS number has no meaning – only its weight).

AF1-AF4 Traffic Class Descriptors can only be configured as rate queues.



**Thank You**



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