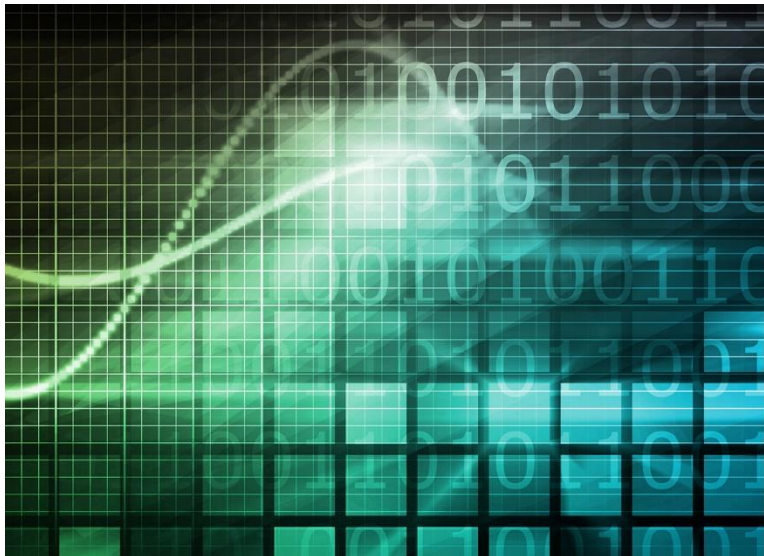


VITA Radio Transport Standard (ANSI/VITA 49) IF Data Packet Format



Red Rapids

797 North Grove Rd, Suite 101
Richardson, TX 75081
Phone: (972) 671-9570
www.redrapids.com

Copyright © 2018, Red Rapids, Inc. All rights reserved.

VITA Radio Transport Standard (ANSI/VITA 49.0)

Red Rapids has adopted the IF Data Packet defined by the VITA Radio Transport (VRT) Standard (ANSI/VITA 49.0) as the data format for all products that produce a digitized stream of data. A detailed description of the IF Data Packet can be found in Section 6 of the VITA Radio Transport document available from VITA. A summary of the specification is provided here as an introduction to the standard.

The template for an IF Data Packet is show in Figure 1, all fields are aligned to a 32-bit boundary. The packet consists of a mandatory Header and Data Payload along with five optional fields that convey additional information about the payload. Optional fields are completely absent from the packet if there is no information to convey. Remaining fields simply move up toward the header with no padding.

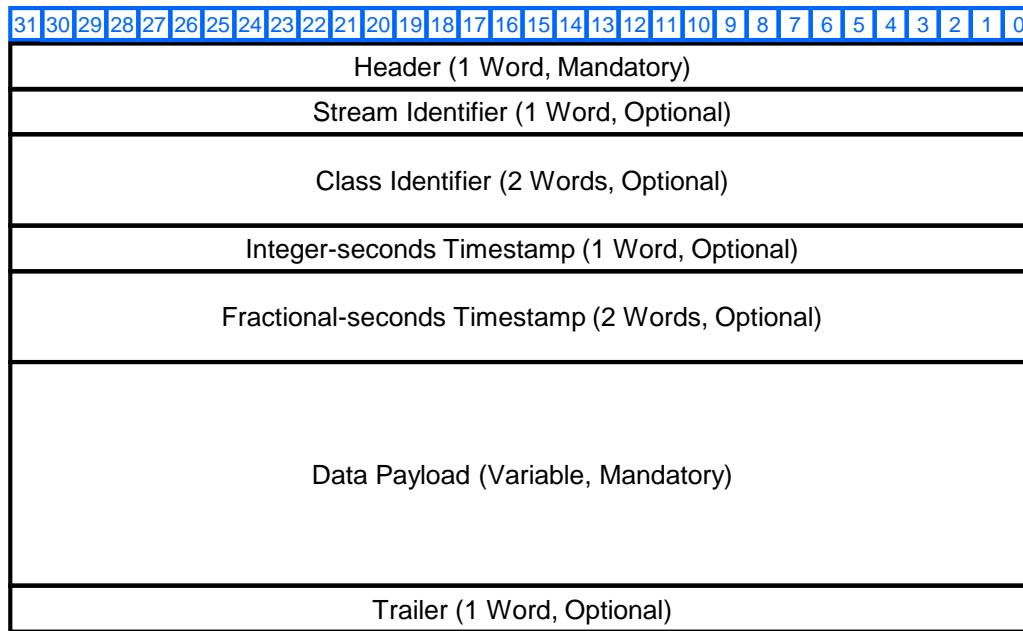


Figure 1 VRT (VITA 49.0) IF Data Packet Format

Header

The format of the 32-bit Data Packet Header is shown in Figure 2.

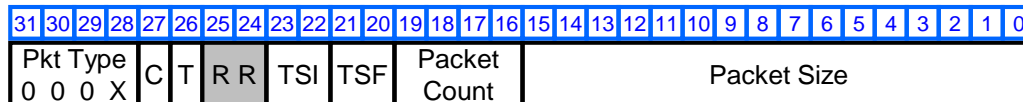


Figure 2 Data Packet Header Format

There are only two valid packet type codes assigned to an IF Data Packet. The value “0000” designates a packet without the optional Stream Identifier and “0001” indicates that a Stream Identifier is present in the packet.

The “C” bit field is set to one if a Class Identifier is present in the packet or set to zero if it is not included.

The “T” bit field is set to one if a Trailer is included at the end of the packet or set to zero if it is not.

The TSI and TSF codes indicate whether the timestamps are included in the packet. If timestamps are present, these codes also convey the origin of each value as shown in Table 1.

Table 1 TSI/TSF Code Meaning

Code	TSI	TSF
0	Integer Timestamp Not Present	Fractional Timestamp Not Present
1	Coordinated Universal Time (UTC)	Sample Count
2	GPS Time	Real Time (Not Supported)
3	Other	Free Running Count

The Packet Count field increments with each new IF Data Packet produced for a specific stream. The least significant bit of the modulo-16 count is the right-most bit in the field.

The Packet Size field indicates the total number of 32-bit words in the current IF Data Packet; including header, payload, and optional fields. The 16-bit field size limits the maximum packet size to 65,535 words.

Stream and Class Identifier

The Stream Identifier is an optional 32-bit number assigned to a packet stream. This designation can help back-end processes identify the source of IF data in a multi-stream environment.

The optional 64-bit Class Identifier field makes it possible to identify the Information Class used for the application and the Packet Class used to create each packet. Figure 6.1.3-1 shows the three subfields included in the Class ID field. The first subfield contains the Organizationally Unique Identifier (OUI), an IEEE-assigned 24-bit number which indicates the identity of the company that created the Information Class and the Packet Class generating the IF Data Packet. The second field contains the Information Class code indicating which of that company’s Information Classes defines the Information Stream containing the Packet Stream. The third field contains the Packet Class code that identifies which of the company’s Packet Classes was used to make the packet.

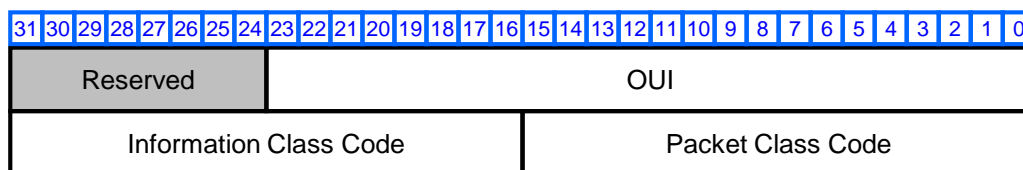


Figure 3 Class Identifier Contents

Timestamps

The optional Timestamp in an IF Data Packet is divided into an integer-seconds component and a fractional-seconds component. Together these two components precisely specify a reference time point for the first data sample contained in the packet.

The integer-seconds part consists of a single 32-bit word that specifies the reference time point only to one-second resolution. It may be used to convey UTC time, GPS time, or some user-specified time-code.

The fractional-seconds part consists of an unsigned 64-bit integer which occupies two consecutive 32-bit words. The first 32-bit word in the packet contains the most significant

bits of the overall 64-bit value. It may be expressed as a number of sample count periods, a real-time value in picoseconds, or a free running modulo-N counter where N can be any positive integer up to 64.

Data Payload

The Data Payload contains a contiguous sequence of data samples encapsulated in a virtual container called the Item Packing Field. The Item Packing Field, shown in Figure 4, can occupy any size from one to sixty-four bits.

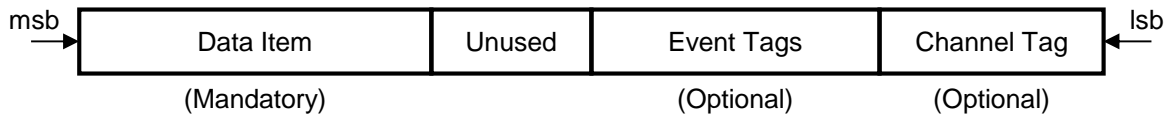


Figure 4 Item Packing Field

An Item Packing Field must contain exactly one Data Item that can occupy the entire field if no Event Tags or Channel Tags are present. The Data Item can be a real-valued sample, the real or imaginary component of a complex Cartesian sample, or the amplitude or phase component of a complex polar sample. The Data Item is always left justified in the Item Packing Field.

A Channel Tag is a label associating a Data Item with a particular signal conveyed by an IF Data Packet. Only one optional channel tag may be included in the Item Packing Field. It is always right justified in the Item Packing Field and must be no larger than fifteen bits.

An Event Tag is a bit used to indicate that a signal-related or processing-related event has occurred coincident with a Data Item in the payload. The Event Tag field can be no larger than seven bits and is located immediately to the left of the Channel Tag if it is present.

The size of the Item Packing Field may be larger than required to contain the included fields. In this case, the unused bits shall reside immediately to the right of the Data Item.

There are two methods of organizing the Item Packing Fields within the 32-bit payload words. Figure 5 illustrates the processing efficient method using a 15-bit Item Packing Field as an example. This approach simply left justifies the maximum number of Item Packing Fields that will fit in a 32-bit word without truncation, any remaining bits are set to zero.

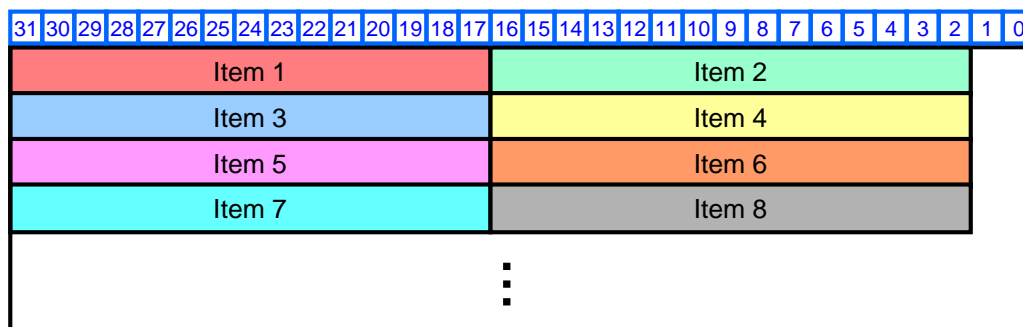


Figure 5 Processing Efficient Payload Organization

Figure 6 illustrates the link efficient method using the same 15-bit Item Packing Field as an example. This approach utilizes all of the available payload space by wrapping Item Packing Fields between 32-bit word boundaries. This eliminates the zero padding of the

processing efficient organization. The payload always ends with a complete Item Packing Field, so there may be some zero padding at the end of the final 32-bit word.

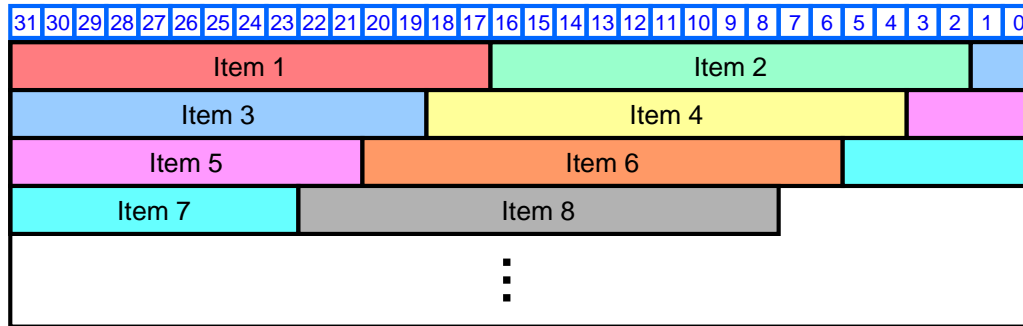


Figure 6 Link Efficient Payload Organization

When the Item Packing Fields contain complex samples, the in-phase value always precedes the quadrature value for Cartesian coordinates and the magnitude always precedes phase for polar coordinates.

Trailer

The trailer, shown in Figure 7, contains fields that indicate the validity of the data and the status of the processes producing that data. It also contains a field that indicates whether related context is being sent in one or more separate Context Packets.

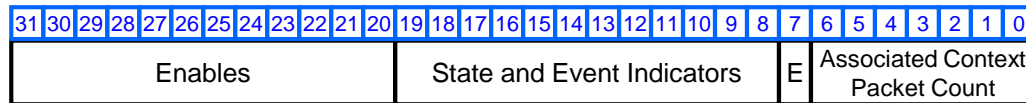


Figure 7 Trailer

The bits assigned to the Enables field act as a mask to the corresponding bit location in the State and Event Indicators field. An enable bit is set to zero when there is nothing to report in the associated State and Event Indicators bit. The enable bit is set to one when there is information available in one of the indicator bits listed in Table 2.

Table 2 State and Event Indicators

Enables Bit	Indicators Bit	Description
31	19	Calibrated Time Indicator
30	18	Valid Data Indicator
29	17	Reference Lock Indicator
28	16	AGC/MGC Indicator
27	15	Detected Signal Indicator
26	14	Spectral Inversion Indicator
25	13	Over-range Indicator
24	12	Sample Loss Indicator
23...20	11...8	User Defined Indicators

When the “E” bit is set to one the Associated Context Packet Count filed contains a count of all of transmitted Context packets that are directly or indirectly associated with the IF

Data Packet. When the “E” bit is set to zero, the Associated Context Packet Count is undefined.