

1 Sound Output (sndout)

The program extracts a list of communication events from a stream of Distributed Interactive Simulation (DIS) Protocol Data Unit(s).

1.1 Considerations

The Distributed Interactive Simulation (DIS) protocol uses two mechanisms for publishing communication events to the network.

When an operator engages the push-to-talk button and speaks into the microphone, the computer performs a complex series of actions. The simulator sends a Transmitter State PDU indicating that the radio is now transmitting. Then, at regular time intervals, the simulator sends Signal PDUs buffers of compressed audio. On release of the push-to-talk button, the simulator sends another Transmitter State PDU indicating that the radio is no longer transmitter.

The total transmit duration intended by the operator, is calculated by comparing the times at which the Transmitter PDUs were sent.

The duration of audio sent by the simulator calculated by totalling the Signal PDU buffers sent. This duration is almost always different to the total transmit duration. This discrepancy occurs because the task of digitizing audio from the microphone is performed in discrete block sizes (between 20-100 milliseconds depending on the radio implementation). As such, when the push-to-talk is engage there may be a short delay in the computer responding, and a similar delay on push-to-talk release.

1.2 Filtering

Communication events sometimes contain no meaningful information. This situation occurs when the operator engages the push-to-talk button but fails to speak, or when engaging the push-to-talk button bounces his/her foot on the pedal resulting in erroneous communication events.

The software uses two techniques to flag such events:

1. *Duration threshold.* Communication events are too short to contain meaningful information.
2. *Voice activity.* Communication events where the Signal PDU contains no voice activity. The Voice Activity Detection (VAD) algorithm from the Adaptive Multi-Rate (AMR) audio codec is used. This algorithm examines energy levels at different frequencies [?].

1.3 Output

The module outputs comma separated values (CSV) to the standard output. It will optionally write the audio content of each communication event to disk.

| Field | Description |
|-----------------|--|
| DIS-ID-NAME | DIS Identifier name (if available). |
| DIS-ID | DIS Identifier. |
| RADIO-ID | Radio Identifier. |
| FREQUENCY-NAME | Transmit frequency name (if available). |
| FREQUENCY | Transmit frequency (Hz). |
| PTT-ON, PTT-OFF | Push to talk event times (HH:MM:SS.sss or seconds). |
| PTT-DURATION | Push to talk duration (seconds). |
| DAC-SAMPLES | Audio duration (seconds). |
| VAD | Proportion of audio frames containing voice activity ([0-1]). |
| FILENAME | Sound filename. |
| TRUNCATED? | Set to 1 if the PTT never returns to not-transmitting state. This occurs when the input (log file) terminates before an operator has finished transmitting. |
| CONTENT? | When set to 1, the event is regarded as <i>having meaningful content</i> . This is equivalent to testing that the PTT-DURATION and VAD fields are greater than the respective thresholds. When set to 0, the event is regarded as having no meaningful content , and can be ignored from further analysis. |

Note: the program will output human readable descriptions of DIS Identifiers and Transmit Frequencies if they exist in the enumerations document. See **SISO-REF-010-AL1.xml**.

1.4 Options

| Option | Description | Default value |
|---------------------------------------|--|---------------|
| <code>-format-time INTEGER</code> | format time using 'hours:minutes:seconds' notation | 1 |
| <code>-hyperlink INTEGER</code> | embed hyperlinks into CSV output | 1 |
| <code>-write-network INTEGER</code> | write network audio bitstream (.au) | 1 |
| <code>-write-decoded INTEGER</code> | write decoded audio bitstream (.au) | 0 |
| <code>-write-prefix STRING</code> | audio bitstream filename prefix | |
| <code>-vad INTEGER</code> | perform Voice Activity Detection | 1 |
| <code>-duration-threshold REAL</code> | duration threshold (seconds) | 0.100 |
| <code>-vad-threshold REAL</code> | vad score threshold | 0.000 |
| <code>-exclude INTEGER</code> | exclude events that have no meaningful content from CSV output | 0 |

1.5 Usage examples

1. Process the **E1.lgr** input file, extract events to **E1.csv**, and write .au audio files to **E1_audio/** directory.

```
mkdir E1_audio
log.exe .taardis E1 .sndout -write-prefix E1_audio > E1.csv
```

2. Process the **E2.lgr** input file, extract events to **E2.csv**, exclude events below the duration and VAD thresholds, and do not write any sound files to disk.

```
log.exe .taardis E2 .sndout -write-network 0 -exclude 1 > E2.csv
```

3. Extract events from a DIS exercise in real-time, but do not write any sound files to disk. This example assumes the DIS exercise is running on multicast group 224.1.1.1, UDP port 3000.

```
log.exe .udp -maddr 224.1.1.1 3000 .sndout -write-network 0
```