

1 Introduction

The **nanocode** family of lossless data compressors ranges from extremely fast to extremely compact compression, with very low latency and modest resource requirements - targeted at data-intensive industries (e.g. automotive).

The compressors differ in the size of data segments compressed in each step, trading off compression speed, compression ratio achieved, and latency. They exploit specific features of AMD and Intel CPUs for their speed.

2 Features

- mathematically lossless compression
- for images, videos, radar, and other sensor data
- typical compression ratio of 50%
- up to 5 GB/s compression speed (single thread)
- up to 13 GB/s decompression speed (single thread)
- low latency, no heap use, from 3 KiB per stream
- C/C++ libraries and Python interfaces

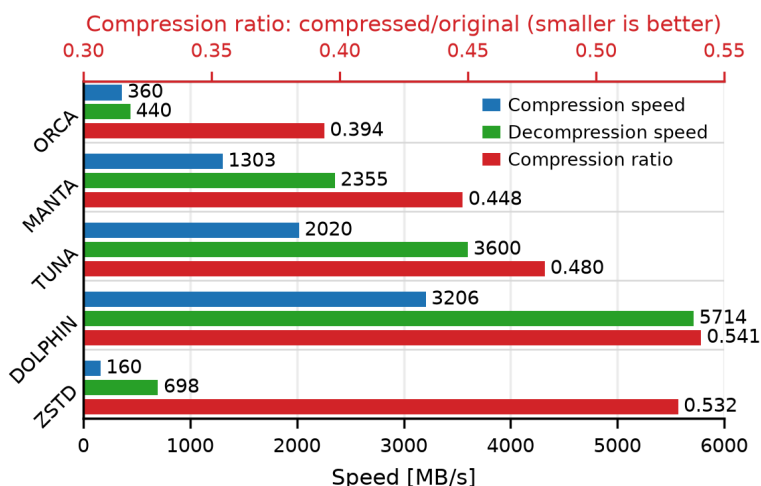
3 Performance

The compressors span a wide range between speed and compression ratio: some run at several GB/s per thread, others are slower but compress considerably better.

	ORCA	MANTA	TUNA	DOLPHIN
Compression ratio	0.394	0.448	0.480	0.541
Compr. speed, MB/s	360	1303	2020	3206
Decompr. speed, MB/s	440	2355	3600	5714

Mean over the benchmark data sets, one thread.

This makes a suitable compressor available for every application: from on-the-fly compression, e.g. in vehicles, to long-term storage of petabytes in the cloud, where storage costs make the highest compression ratio count.



Latency is a small fraction of the frame rate. Compression ratios and speeds depend on the data. Benchmarking with your own data is recommended; test versions can be provided.

4 Supported input formats

- almost any image and radar raw data
- pixel depths up to 16 bit, color and grayscale
- interleaved 8-bit input with 1 to 4 channels
- Bayer patterns (RGGB, RYYC, CCCR, ...)
- big endian and little endian
- MIPI CSI2 encoded images, YUV formats, TDMS files
- custom input formats on request

The TUNA compressor is also available in firmware (LabView, VeriLog). Its footprint on a Xilinx z7020 (Artix-7 compatible) is $\approx$ 11k slice LUTs for the compressor and $\approx$ 9k slice LUTs for the decompressor.

Input	ORCA	MANTA	TUNA	DOLPHIN
8 bit $\pm$, 1–4 ch.	✓	✓		✓
12 bit CSI-2 Bayer	✓	✓	✓	✓
16 bit LE $\pm$, 1–2 ch.	✓	✓	✓	✓
16 bit LE $\pm$, 3–4 ch.	✓	✓		✓
16 bit BE, 1–2 ch.	✓	✓	✓	✓
YUV 4:2:2 UYVY	✓	✓		✓
16 bit near zero [*] $\pm$, 1–4 ch.				✓

$\pm$: unsigned and signed; LE/BE: little/big endian; ch.: channels. ^{*}Data centred on or close to zero, e.g. radar raw data (real or I/Q).

The software compressor supports all available input formats. For firmware, the input format must be specified.

5 System requirements

- **CPU:** 64-bit Intel/AMD x86-64; Linux or Windows 10+.
AVX2 acceleration with a scalar fallback.
- **FPGA:** Xilinx compatible; IP cores for Vivado, LabView

6 Licensing models

Licences differ in where the software may be used:

- **single:** one machine
- **site:** all machines across the site
- **project:** all machines within a specified project
- **company:** all machines throughout the company

Your data stays readable after a licence ends: streams still decompress (with slower speed).

7 Requests

Requests stating compressor, input formats, platform and licensing model can be sent to info@nanocode.com.