CDF Storage Precision

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Version 1

2018-01-17

Summary

The CDF_STORAGE_PRECISION experiment reduces the precision of the entropy coder CDFs as stored in the entropy context, by reducing the CDF_PROB_TOP and CDF_PROB_BITS. The exact reduction is as of yet undecided, but currently enabling the experiment will set CDF_PROB_BITS to 14 (from the original 15).

Implementation

The entropy coder normally does a Q15 multiply and rounding:

```
    u = ((r >> 8) * (uint32_t)(fl >> EC_PROB_SHIFT) >>
         (7 - EC_PROB_SHIFT)) +
        EC_MIN_PROB * (N - (s – 1));
```

When CDF_PROB_BITS is reduced, the rounding likewise needs to be adjusted to account for the reduced precision. The value CDF_SHIFT is defined by (15 – CDF_PROB_BITS).

```
u = ((r >> 8) * (uint32_t)(fl >> EC_PROB_SHIFT) >>
         (7 – EC_PROB_SHIFT - CDF_SHIFT)) +
        EC_MIN_PROB * (N - (s – 1));
```

As a consequence, the sum of EC_PROB_SHIFT + CDF_SHIFT must never be greater than 7.

Initialization

The initialization tables must also have their precision reduced to match. Because the final precision hasn’t been decided, the tables in the code are left at Q15 precision. A macro reduces their precision at compile time.

Adaptation

As a result of reducing the precision, probability adaptation also needs to be adjusted, or it will be too fast. As the constants in the probability adaptation are already very low, they need to be manually tuned for lower precision. This will likely be the main constraint for further reductions.

Q15 coder

There is a boolean coder in the codebase for non-adaptive symbols (od_ec_encode_bool_q15), however it is only used for equiprobable values. It is currently not affected by CDF_SHIFT,.

Results

TBD