x266 – An Open-Source VVC Encoder

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multicoreware

AGENDA

Media & AI
Analytics

1. VVC vs HEVC
2. An introduction to x266
3. x266 Design Philosophy
4. Architecture of x266
5. x266 – v0.1
6. Impact of parallelism in x266
7. x266 – Next Steps

VVC vs HEVC

1. VVC can provide about 2x the Coding Efficiency over HEVC
   - 40% to 50% bitrate savings for the similar visual quality (Average), or
   - Significantly better Visual Quality at similar bitrates
2. Apart from traditional camera captured 2D videos, has advanced tools for
   - Immersive videos(360° videos)
   - Online gaming
   - E-sports video streaming
   - Screen-sharing applications
   - …and many more

An Introduction to x266

1. x266 is an Open-Source VVC complaint encoder
   - Will be publicly available under GNU GPL v2 licensing terms
   - An application/library software with required APIs
   - High Performing VVC Encoder - speed with equivalent quality of VTM
2. Features - Speed and Compression Efficiency (Trade-off options)
   - CLI(Command Line Inputs) and API Functions
   - Pre-defined presets(like ultrafast, very slow etc)

x266 Design Philosophy

1. High performance
   - Coding efficiency
   - Optimal use of platform's architecture and resources
2. Good scalability
   - Scale to match available processing power / resources
3. Flexible architecture
   - Cloud vs Stand-alone
   - Real-time vs Off-line
   - Speed vs Quality trade offs
4. Rich APIs - Simple integration for multiple applications
   - OTT streaming, Broadcasting, VR/Immersive, Video conferencing, eSports, Cloud Gaming etc

Basic API Functions (Similar to x265)

Encoder_open() – *API that simply creates a handle to the encoder*

Encoder_encode() – *API that receives the encoder handle, pointer to output picture*

Encoder_close() – *API that frees up the encoder handle*

Encoder_stats() – *API that provides encoder statistics for the given encoder handle*

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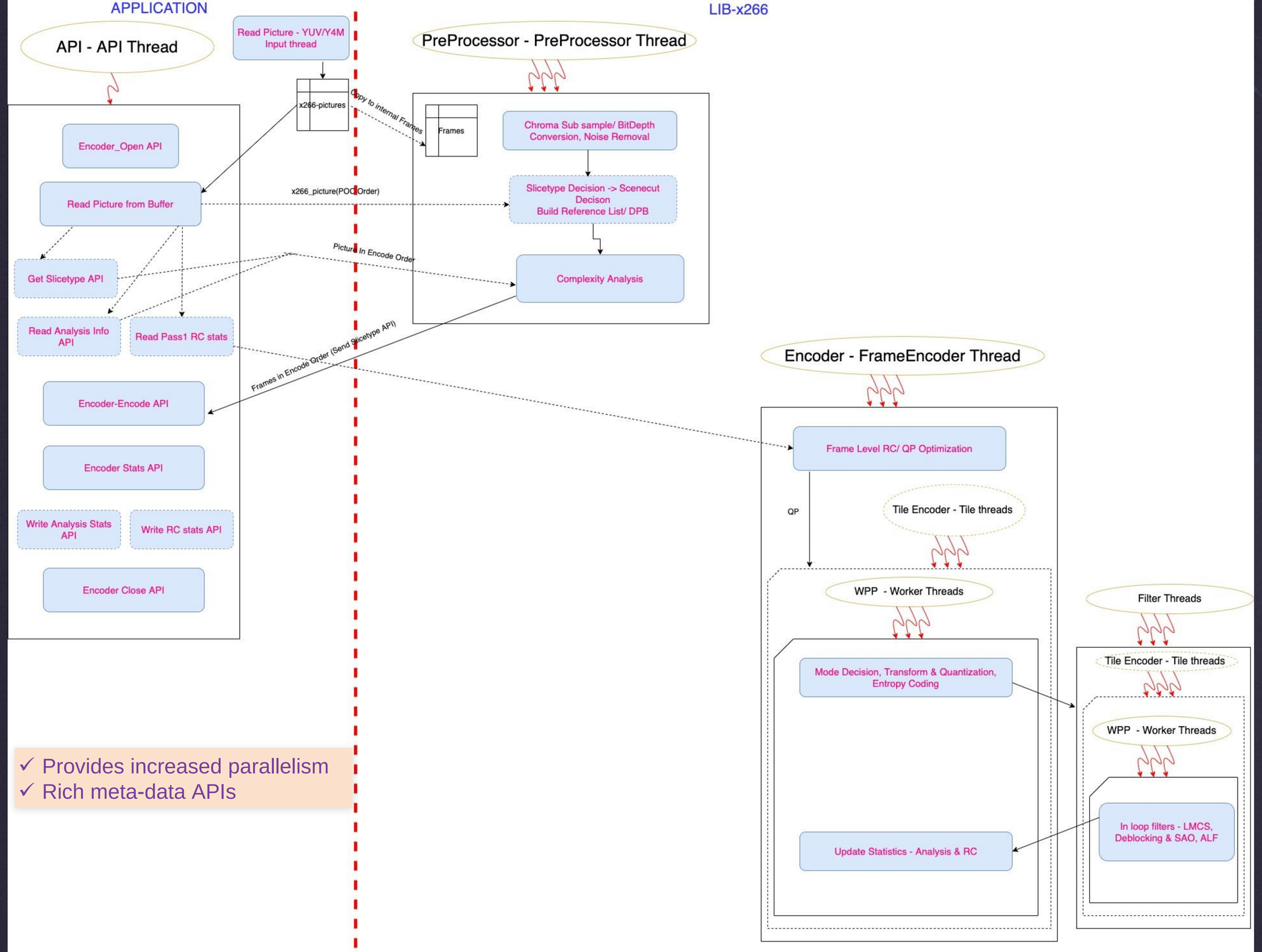
x266 Architecture



- ✓ Provides increased parallelism
- ✓ Rich meta-data APIs

X266 Architecture – Improvement over x265

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1. Pre-processing can be handled using separate API functions
   - Data - Including Slice information, Rate Control, Motion Estimation, Intra modes
   - Enables us to leverage encode information from GPU
2. API to receive ROI information
3. Increased level of parallelism
   - Frames and tiles/slices handled by separate threads (apart from WPP worker threads)
   - With increased complexity of the loop filters CABAC engine and loop filters (post processing) are decoupled and handled by separate threads.

x266- v0.1 – What is it ?

1. First step in building x266 with Intra only features
    - All directional modes including wide angle prediction
    - Support for mtt partitions.
2. Frame-level parallelism and wpp
3. Constant QP with fixed GOP structure
4. Assembly level optimizations on x86-based architectures
    - Complex algorithms like DCT-II and iDCT-II

Impact of parallelism in x266

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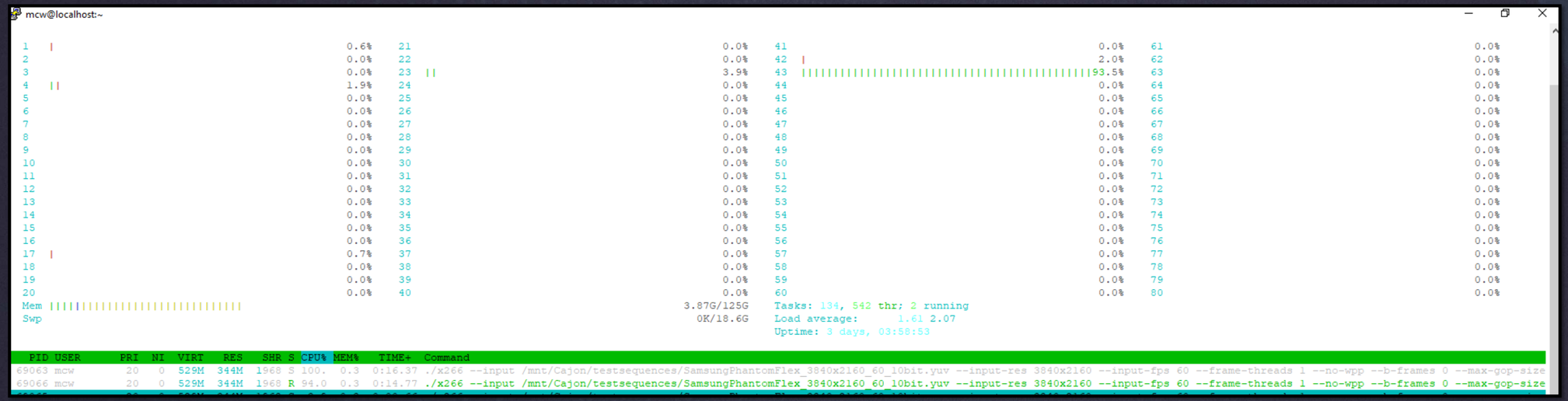
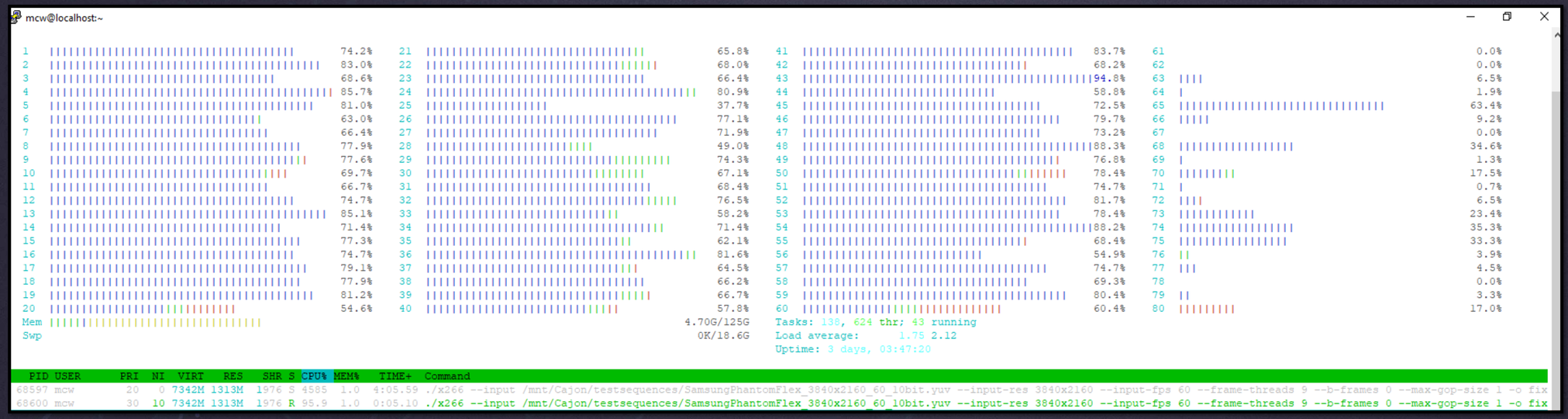
Thread Utilization on Intel Xeon 6148 server



FrameThreads – 1
no-wpp



FrameThreads – 9
wpp–rows - 17

x266- Next steps

Additional VVC coding tools to improve compression efficiency

Rate control mechanisms

Adaptive quantization techniques

Motion search methods

Scene change detection algorithms

More assembly level optimizations

SUMMARY

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- ✓x266 – Next Steps

Thanks!

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