Parallelizing OFDM based communication

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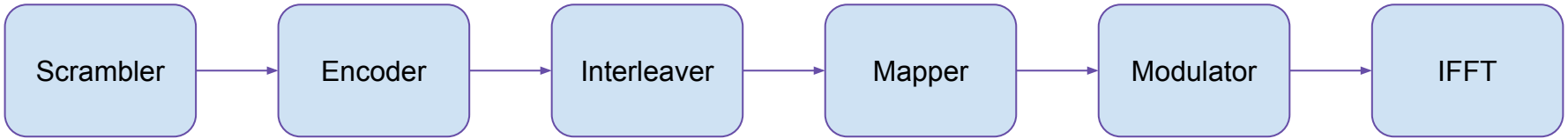
Accelerating OFDM based communication (WiFi, LTE, etc)

- Design of OFDM based wireless communication systems often involve running simulations on millions of packets,
- The simulation usually take days.
- Speeding up these simulations will help in
  - faster calculations for packet error rate
  - help test experimental algorithms faster
  - faster full system simulations where throughput also needs be assessed for higher OSI layers.

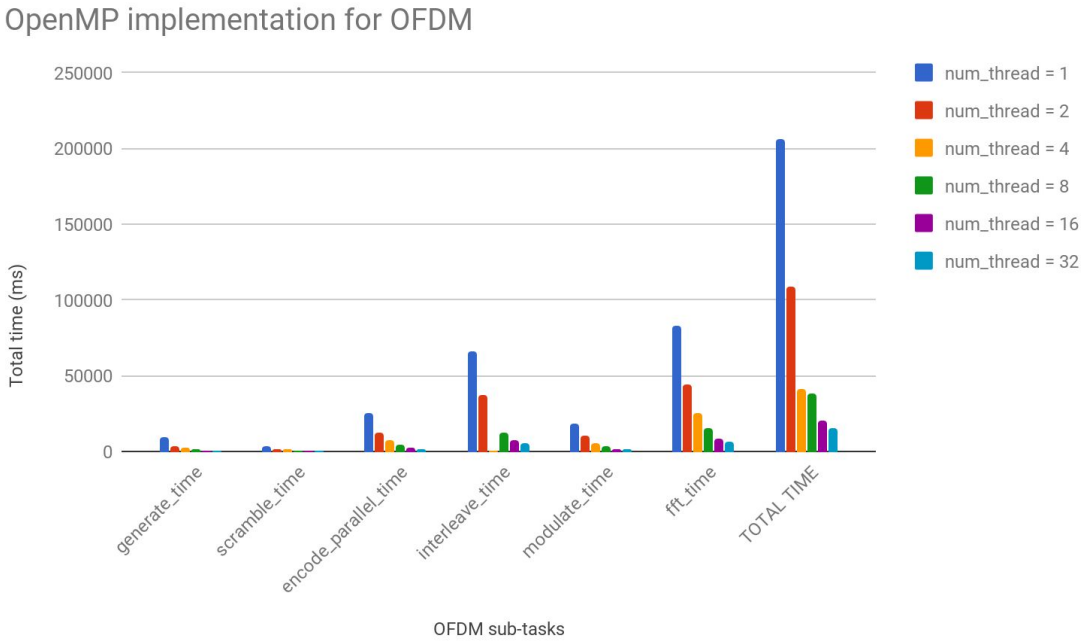
OFDM Transmitter sub-blocks



- First we design an OFDM based simulator which involves several data processing stages as shown in the above figure.
- Next we accelerate the OFDM transmitter code using OpenMP and Cuda.
- We parallelize individual sub modules of the OFDM transmitter. Using the results, we conclusively show that the workload is highly parallelizable across processors, and able to achieve significant gain in OFDM simulations.

Openmp implementation

- Based on timing analysis of OFDM simulation, “interleave” and “fft” processing took about 70% of total processing time.
- Based on Amdahl’s law we first focussed on parallelising “fft” and “interleave” stages.
- We also subsequently parallelised the other stages of OFDM operation.
- Using the OpenMP library to parallelise we observed a speedup 13x with 32 threads.(Results shown on the right)



Serial vs Openmp vs Cuda

- After running simulations on OpenMP and getting significant speedup, we were convinced about our theorised speedup on CUDA.
- OFDM simulations on CUDA gave us a speed up of 900x compared to single thread and 70x compared to OpenMP (32 threads)
- Results of our timing analysis are shown on the diagram on the right