The Evolution of FPGAs in Trading

HPC on Wall Street
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FPGAs in Finance

• FPGA are used in several areas in Finance:
  – **Tick to Trade**: Feed-handler, Data Distribution, Risk Management, Order Execution
  – **Telecom**: Capturing, Time-stamping, Bandwidth management...
  – **Asset Portfolio Evaluation**

• Most common objective:
  – **Reduce Latency** and **Increase Determinism**

• But also:
  – **Reduce server foot-print** in datacenter (for example with an OPRA feed-handler)
Why FPGAs?

- **Low Latency**
- **Deterministic Latency**
- **High Throughput**

**Parallel Computation**

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**Pipelined Computation**

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**Any combination of the above**

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**But also:**

- Low latency Memories (**QDR SRAM**)
- **Network** (NIC card, switch, routers) and the **Computation** (CPUs) in the same chip
# Future Evolution of CPU Vs FPGA

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<thead>
<tr>
<th>Good</th>
<th>CPU</th>
<th>FPGA</th>
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<tr>
<td></td>
<td>New more powerful chips every year</td>
<td>Capacity doubling every two years</td>
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<td>Increasing number of cores</td>
<td>Higher speed: 20% faster every 2 years for the same hardware design</td>
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<td>Possible integration of NIC or other functions in future chips</td>
<td>(same as 15% lower latency)</td>
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<td>Less Good</td>
<td>CPU frequency not improving anymore.</td>
<td>Little progress in the programming tools, at least for the low latency space.</td>
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<td>High latency memory (DRAM) for 99% of the needs</td>
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Challenges of Building FPGA solutions

1. **Programing challenges:** Verilog/VHDL are very low level languages.

2. **People challenges:** Verilog/VHDL programmers are a scarce resource compare to C or C++ programmers.

3. **Arbitration between software and hardware:** Not everything will benefit from a hardware implementation.

4. **Testing and integrations:** Programming, testing and integrating FPGA solutions require a unique set of tools.
Evolution of FPGAs for Feed Handlers

• Ability to handle more of the processing:
  – From A/B Arbitration and Filtering only to the inclusion of Book Building and Distribution functions.

• More capacity means increased instrument and feed density
  – Tackling of more heavy tasks such as NBBO calculations, cash equity options, advanced data distribution tasks

• Latency will keep going down, probably 15% faster every 2 years for a same design as frequency goes 20% in the same time frame.
Conclusion

• **FPGA** is and will be **part of every trading infrastructure** for which latency is a competitive necessity.

• High execution **risk** to FPGA project

• **Choose wisely** what needs to be done in-house and what needs to be outsourced to **reduce risk of execution** and optimize ROI.
THANK YOU. QUESTIONS & ANSWERS...