

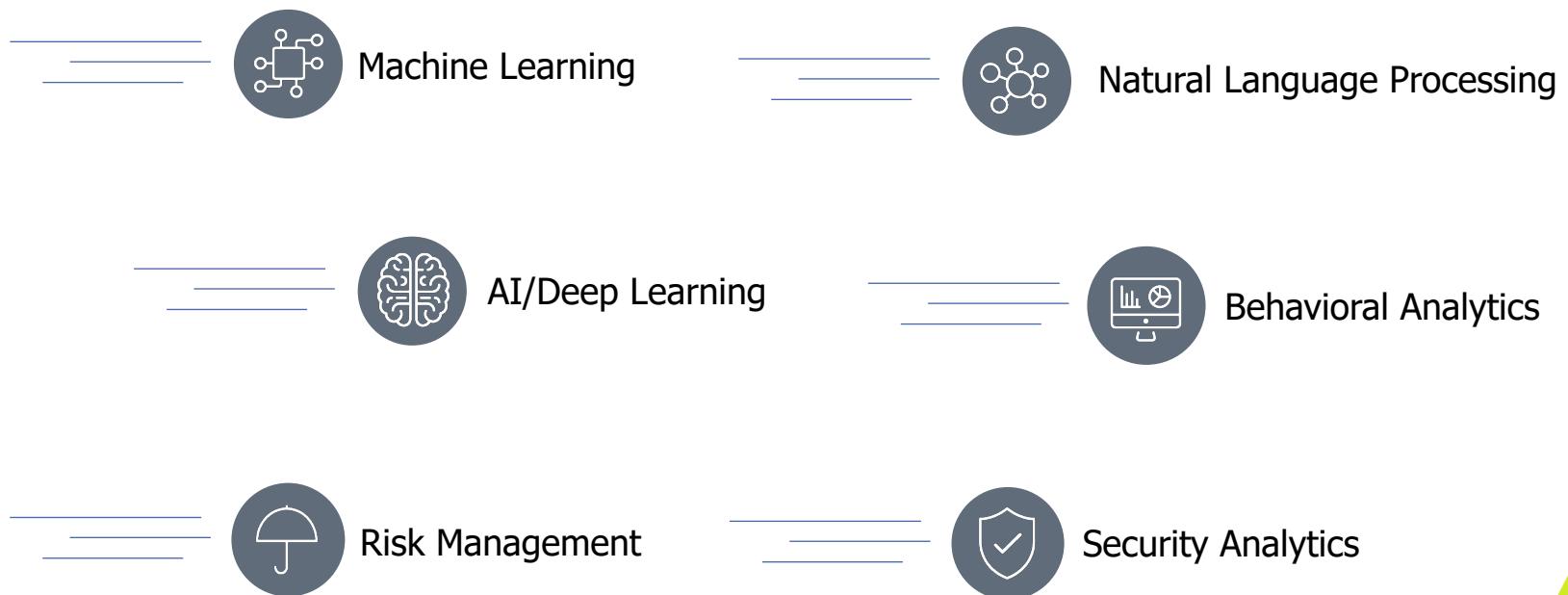


Hyper-acceleration of Apache Spark with Intel® Arria® 10 FPGAs

*Bala Samynathan, Bigstream
Intel® HPC Developer Conference 2017*



More than Moore's Law



Hardware Accelerators Break Through the Processing Wall



Microsoft Azure



On track to millions of servers w/FPGAs



amazon web services



Introduces FPGA powered server instances



Google Cloud Platform



TPUs help avoid cost of 12-15 data centers



intel FPGA



\$16.7B acquisition of Altera



XILINX



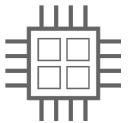
\$1B in datacenter revenues



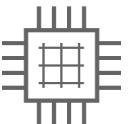
NVIDIA



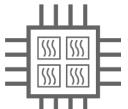
193% growth in datacenter segment



FPGA



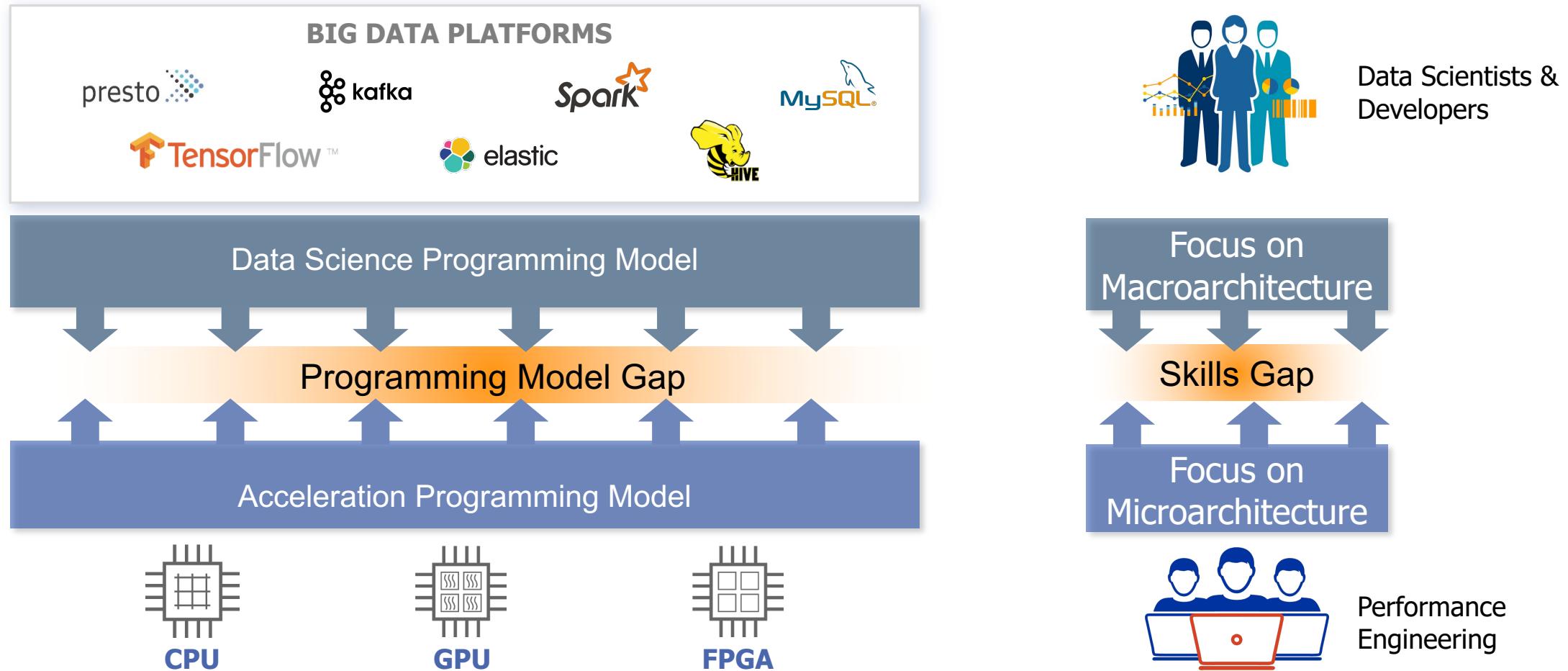
ASIC



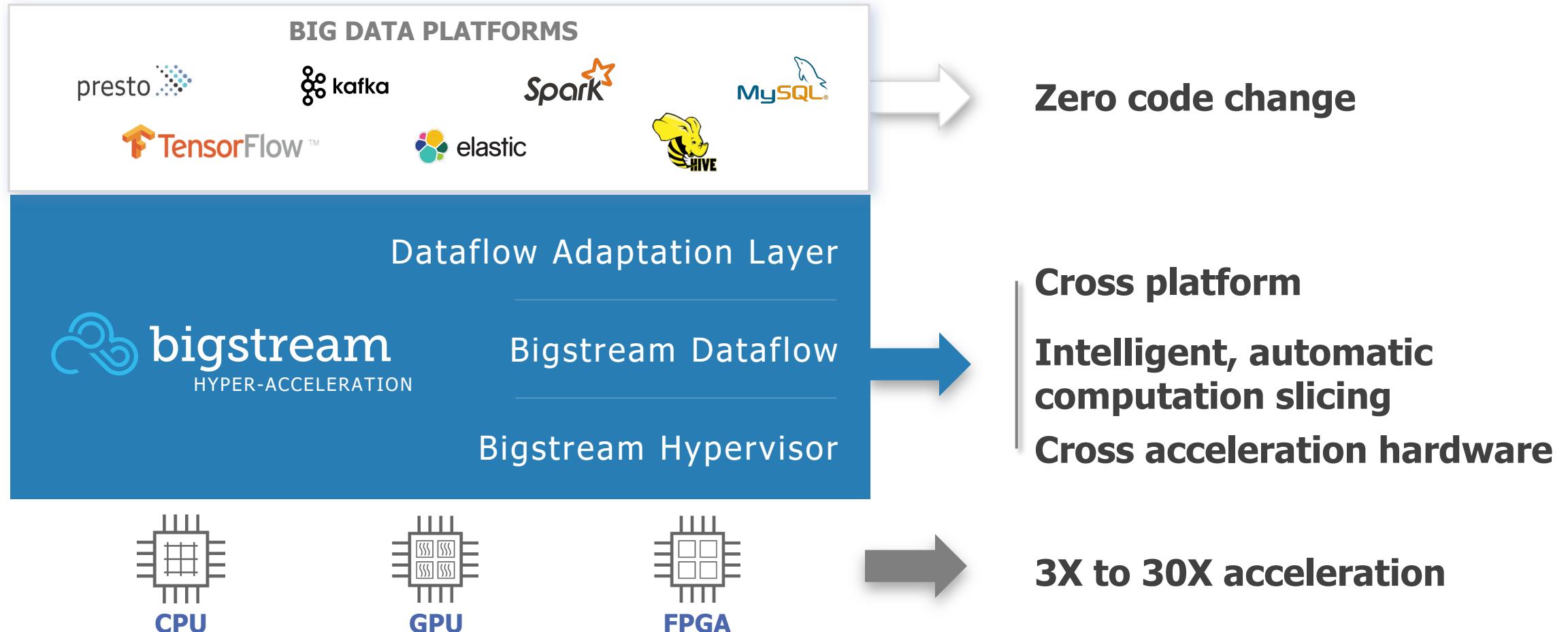
GPU



Inhibitor: Programming Model Gap for Hardware Accelerators



Introducing: Bigstream Hyper-acceleration Layer

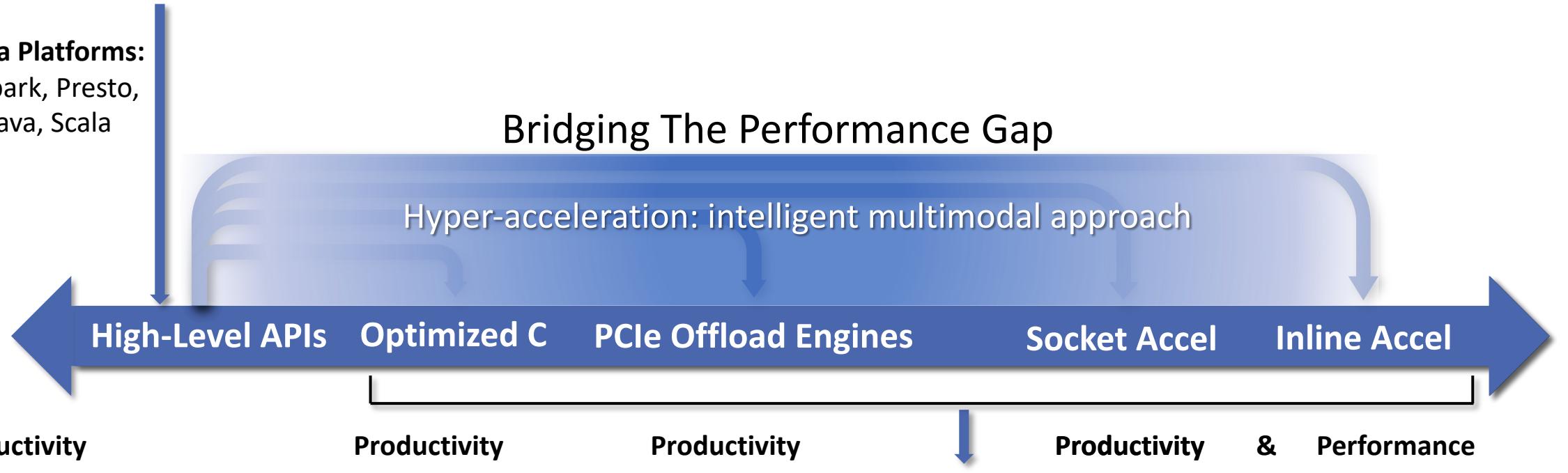


Goal: Accelerate Big Data Applications with Ease

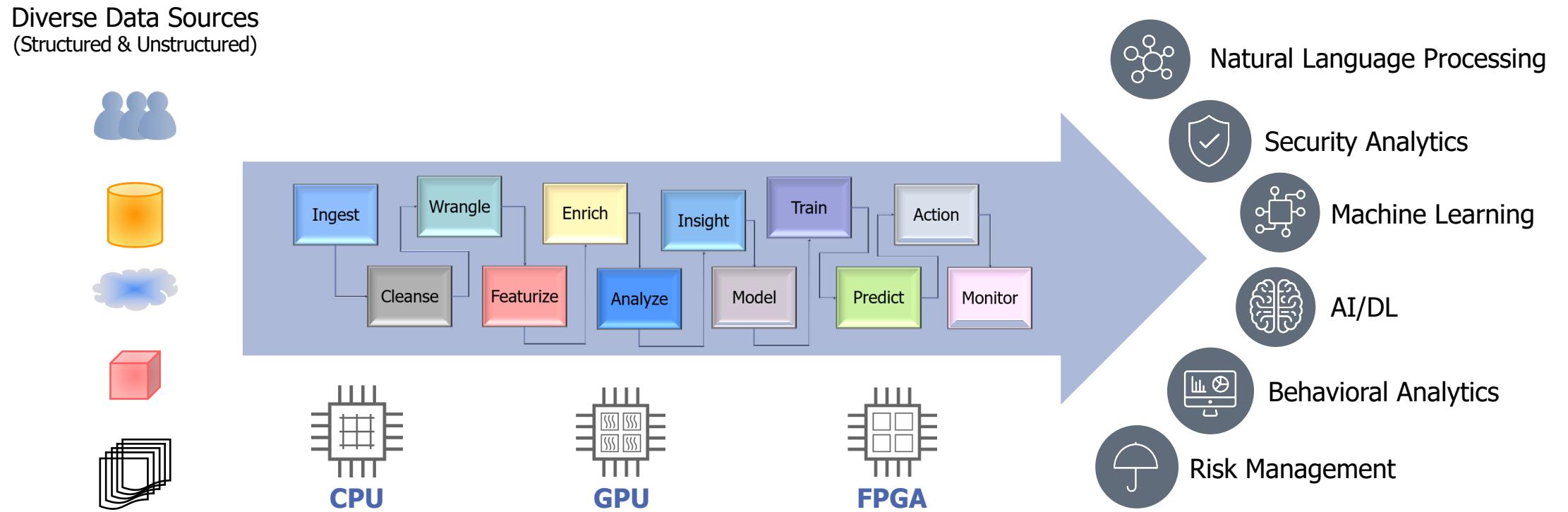
- Seamless customer journey from application to acceleration

High productivity software development

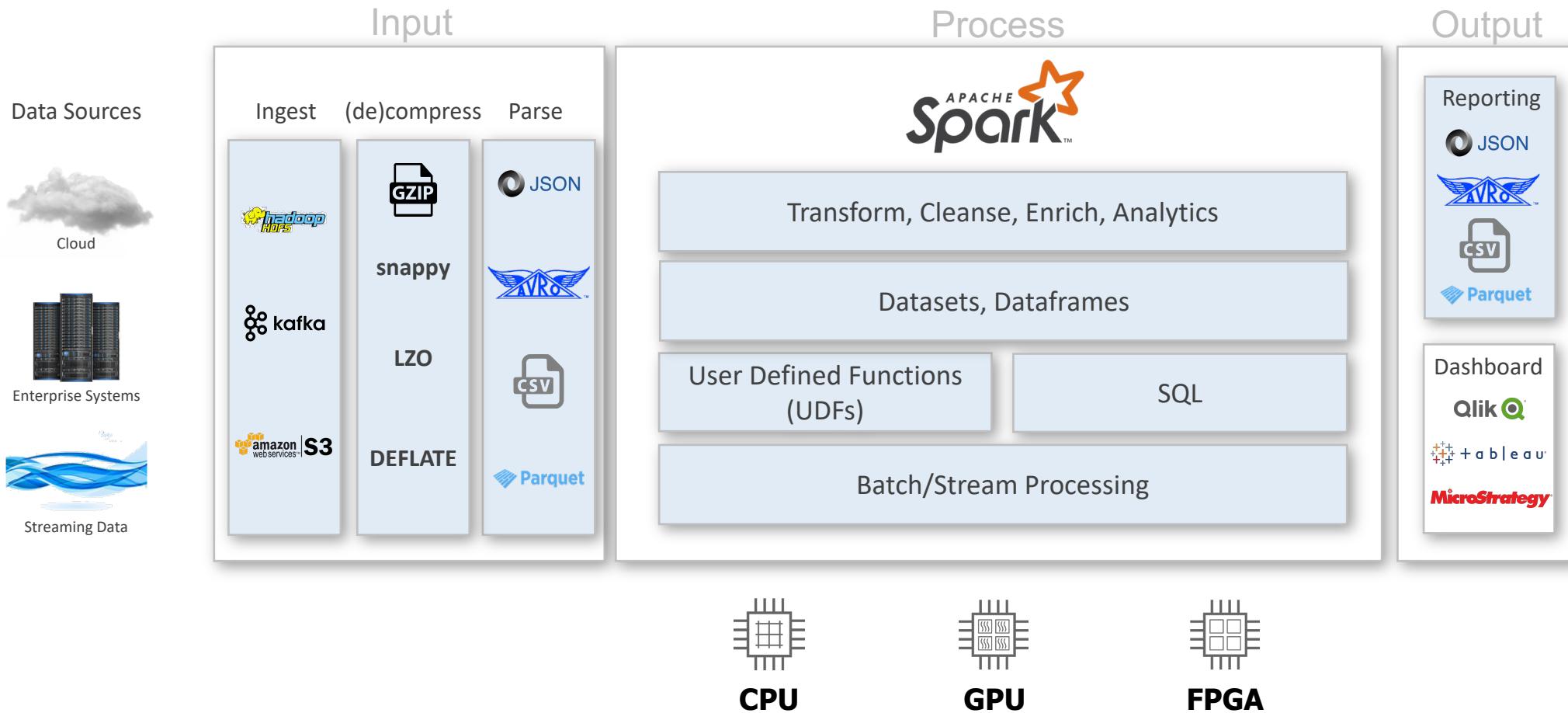
Big Data Platforms:
SQL, Spark, Presto,
C#, Java, Scala



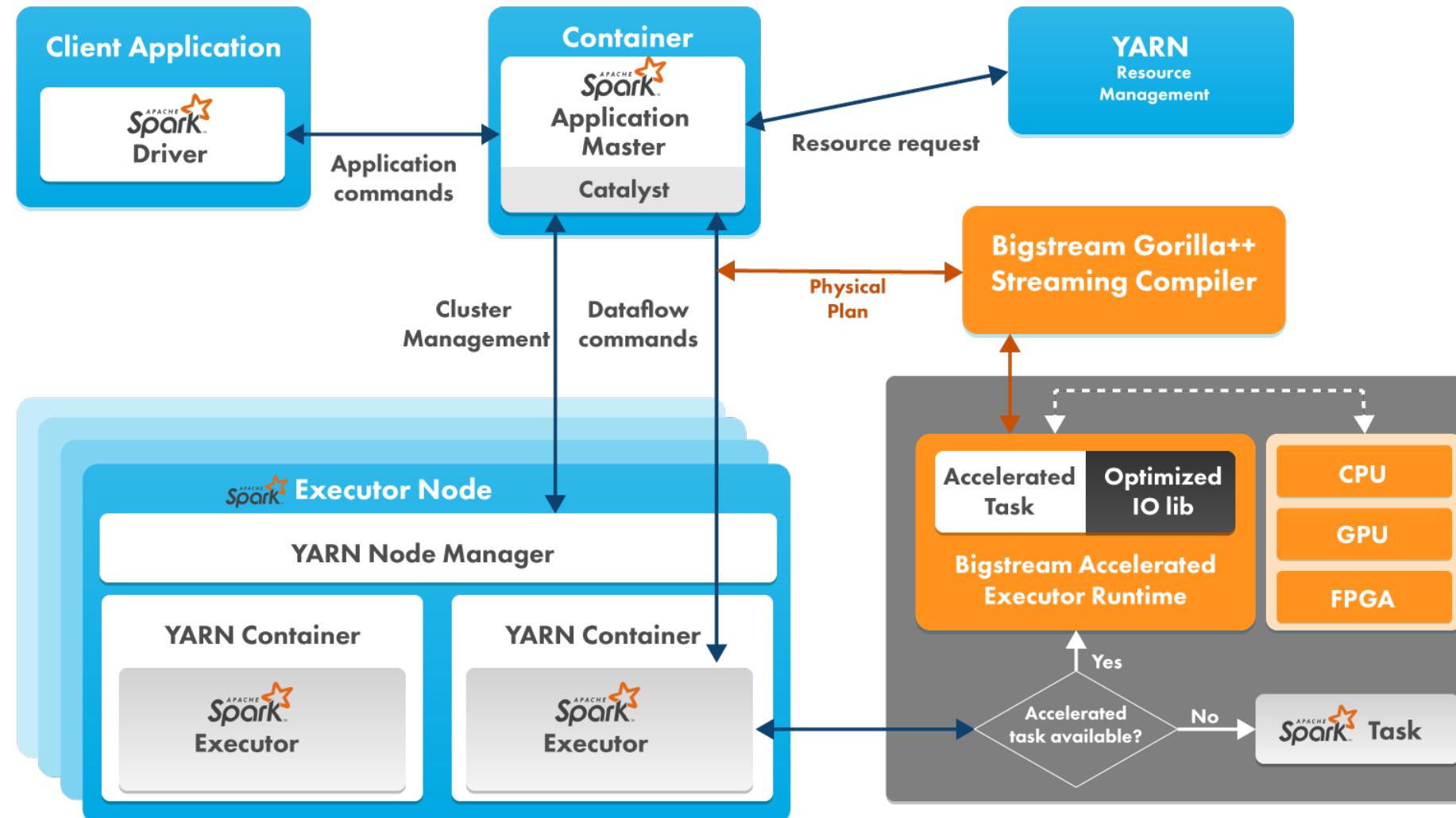
Bigstream Accelerates Big Data Platforms on Any HW



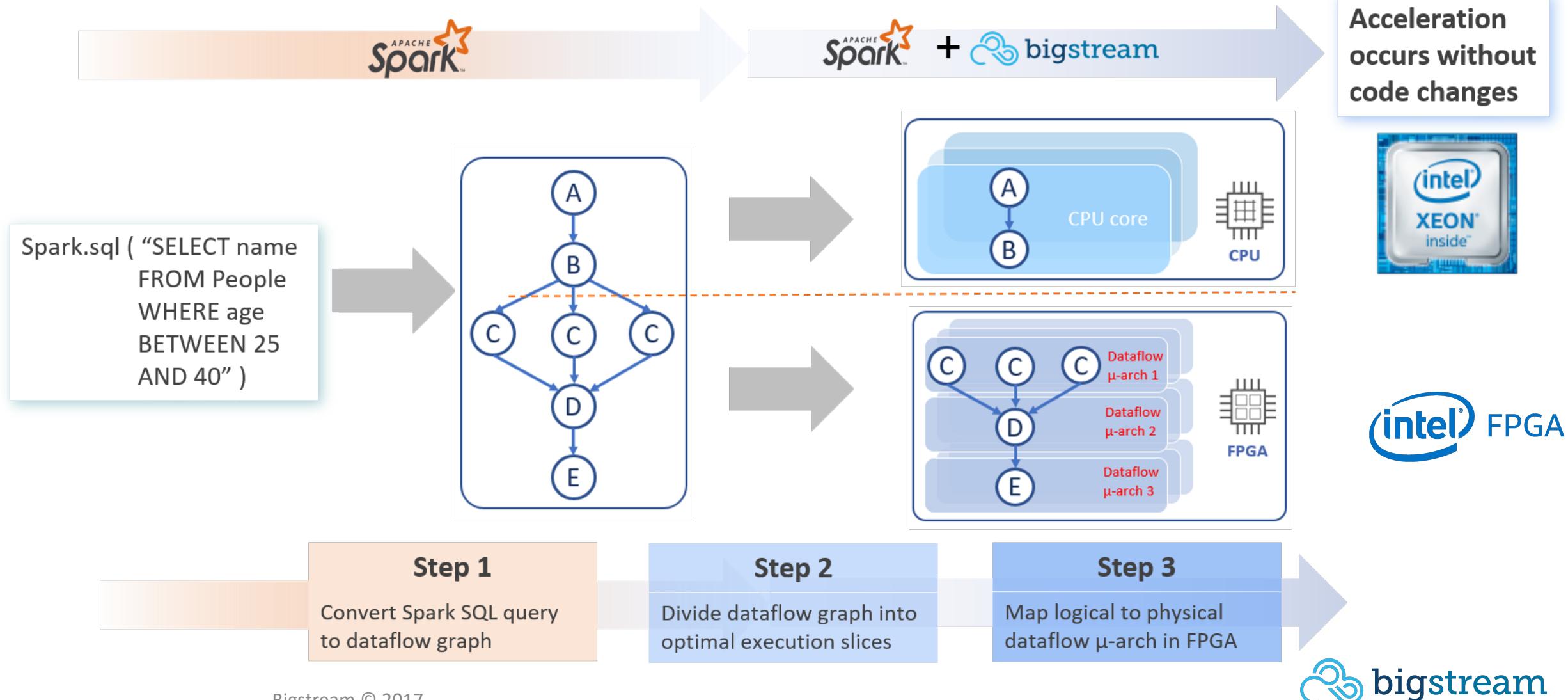
Spark + Bigstream Hyper-acceleration



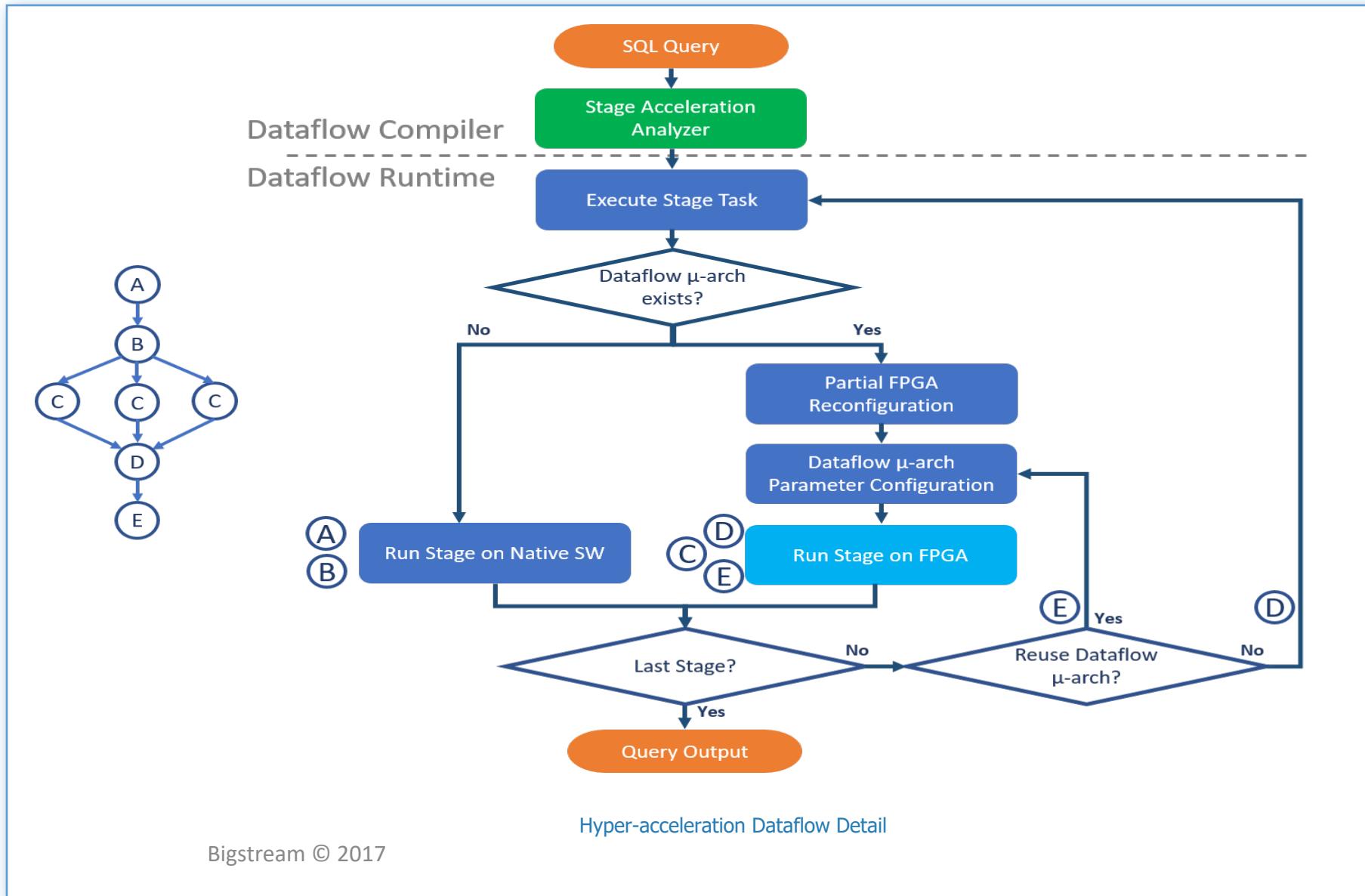
Bigstream Spark Architecture



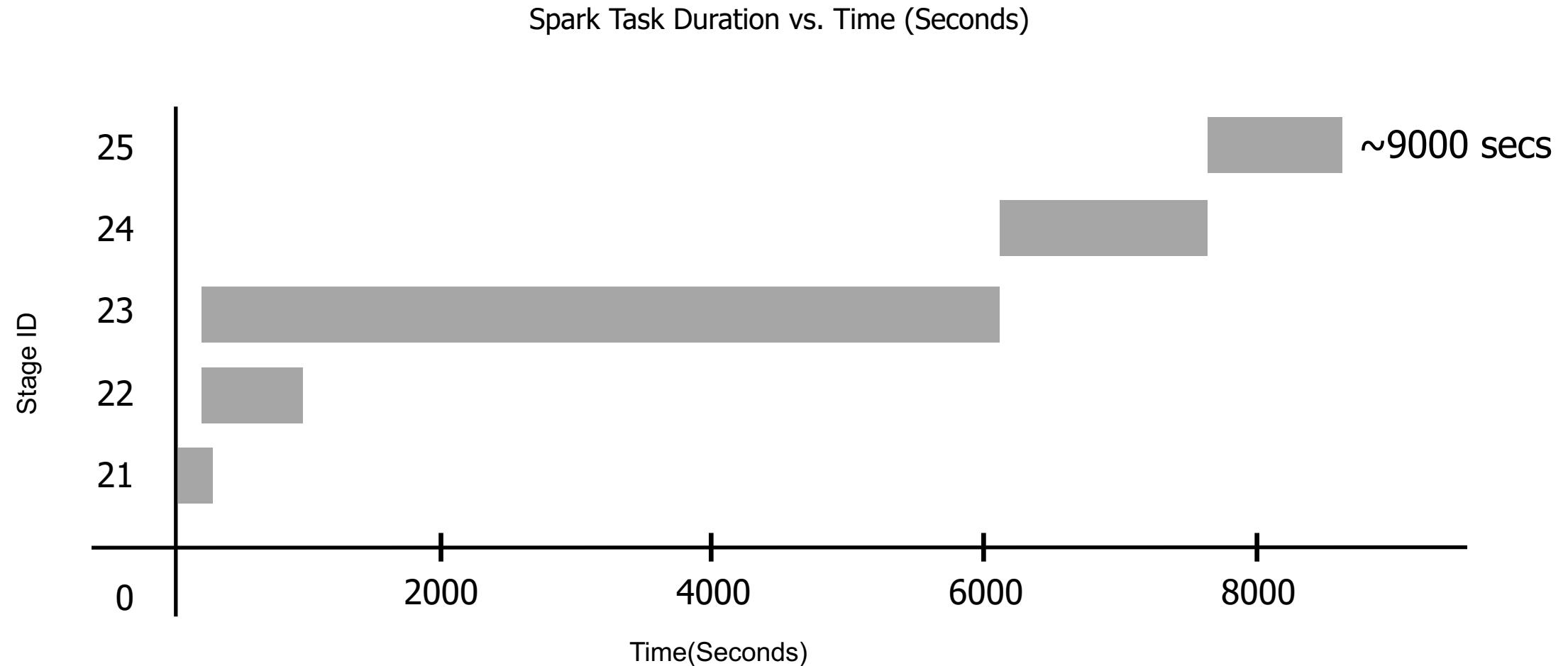
Hyper-acceleration with FPGAs



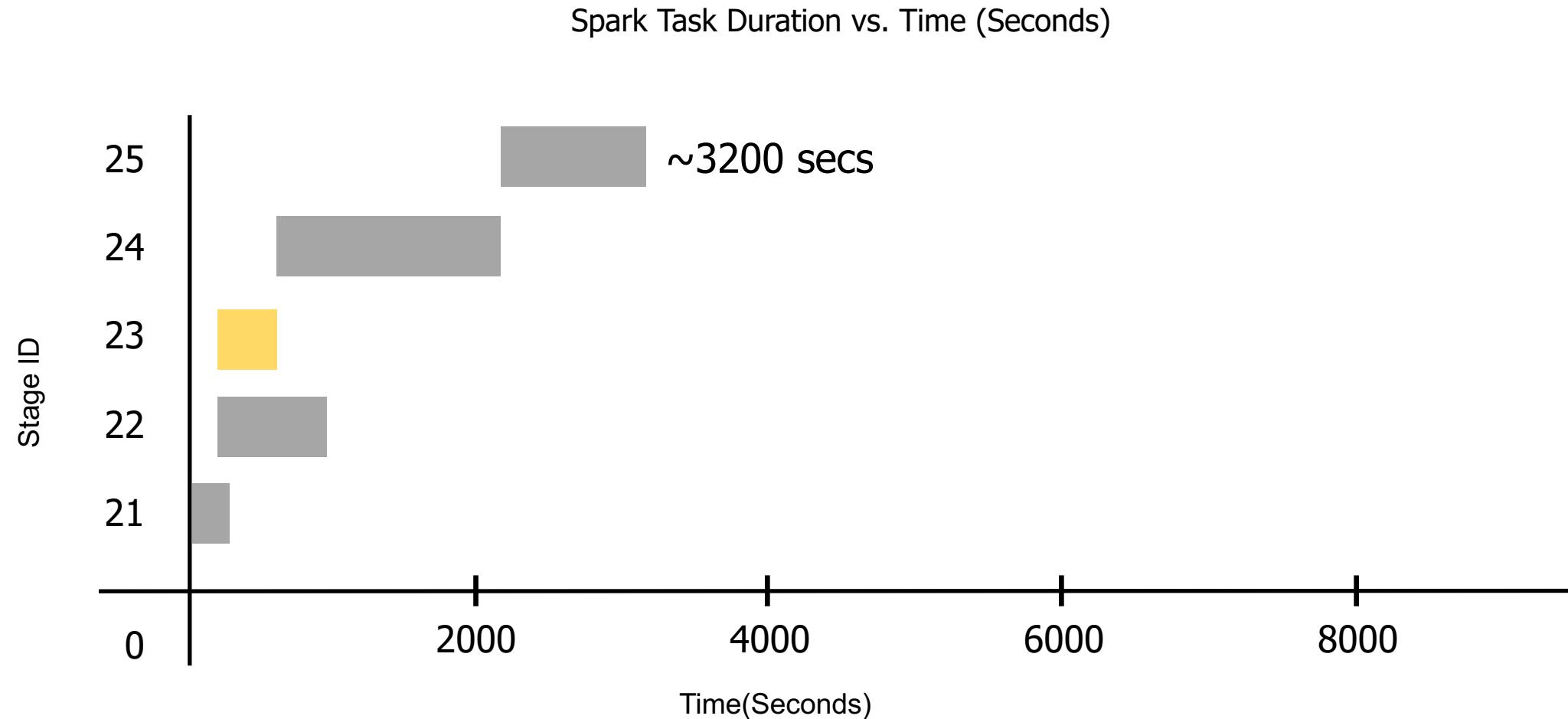
Transparent Hyper-acceleration at Runtime



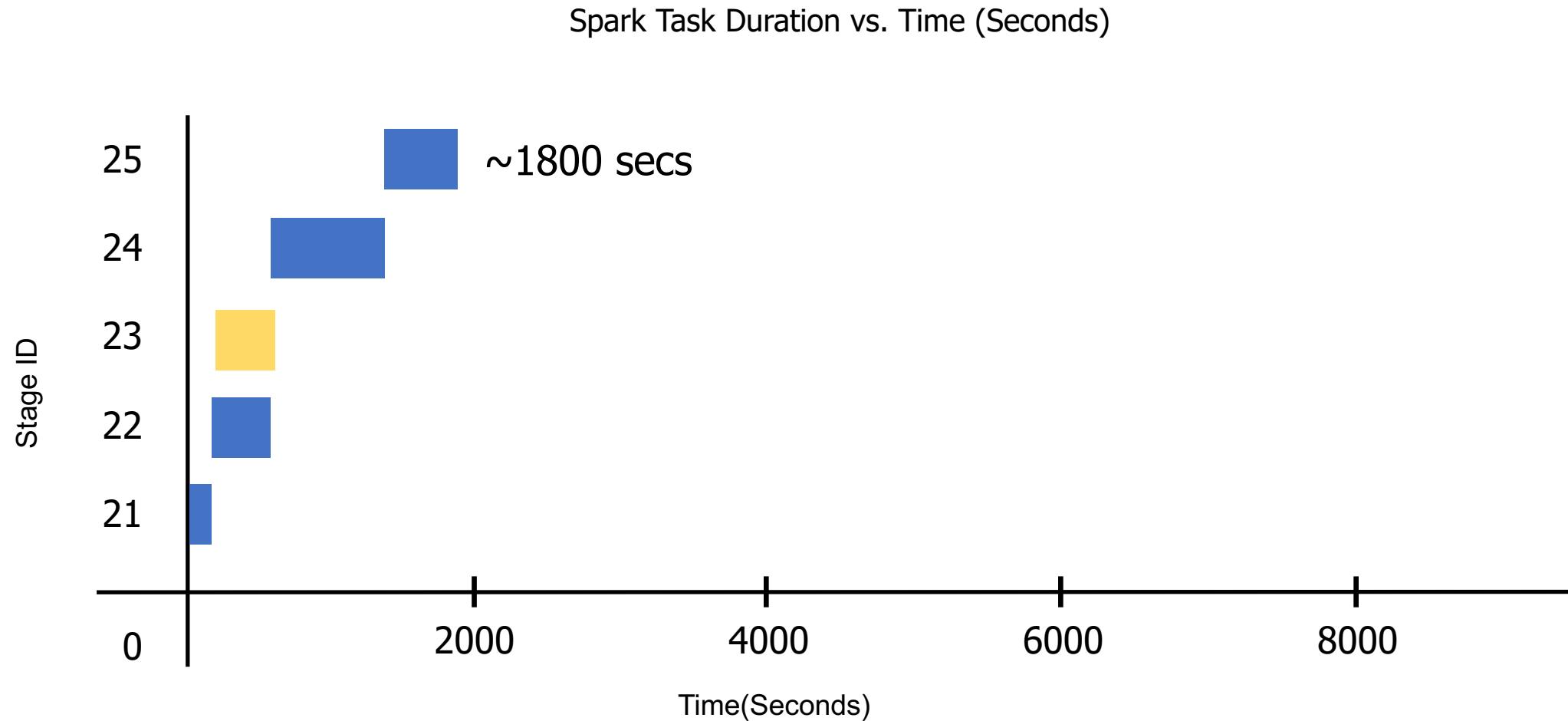
Baseline – No Acceleration



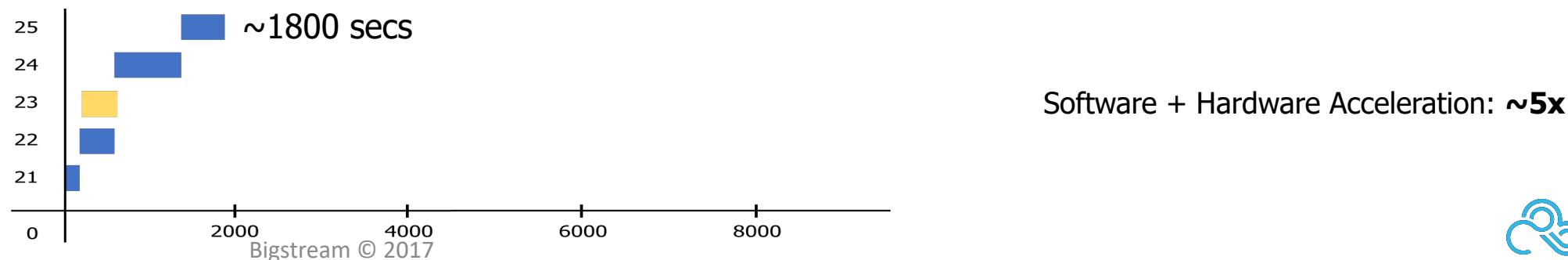
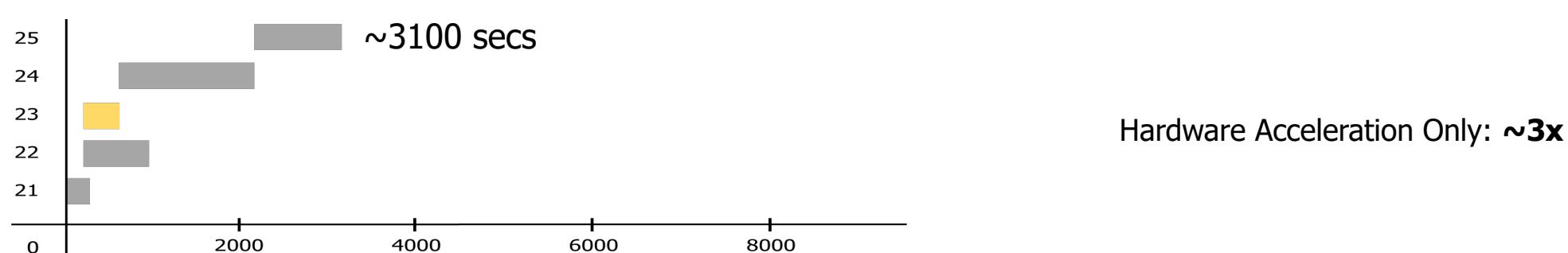
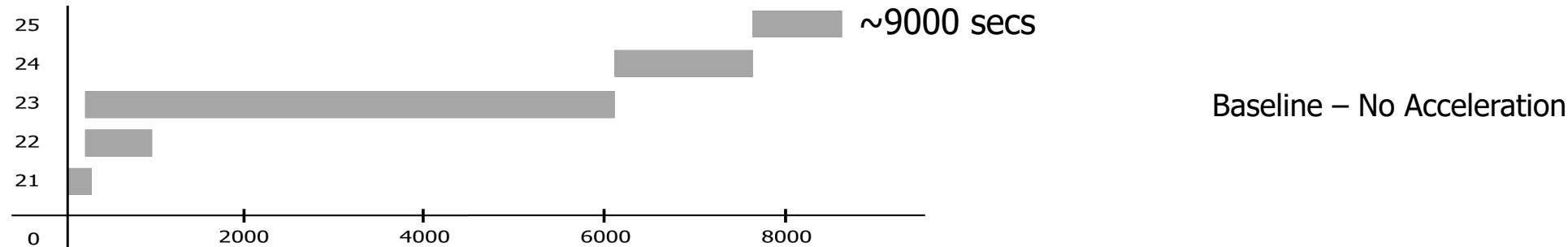
Hardware Acceleration Only



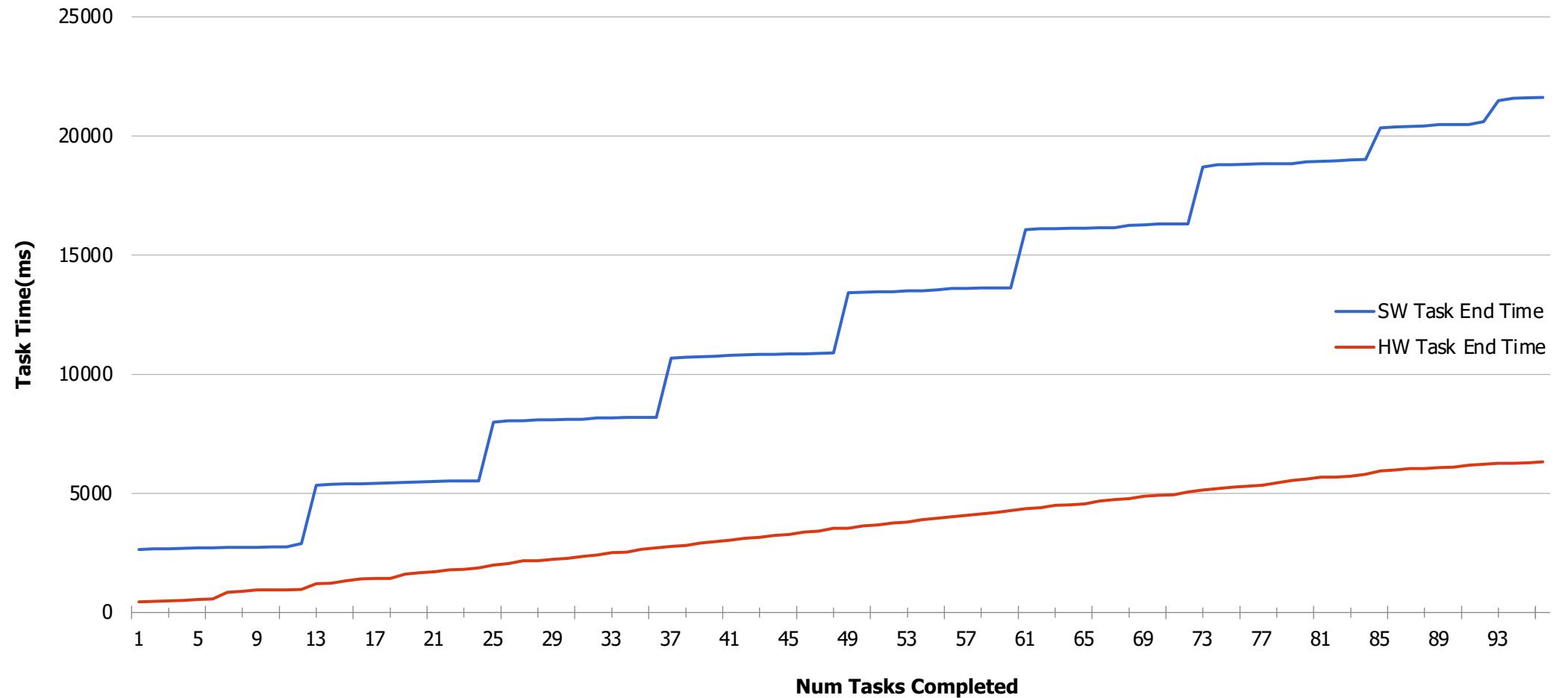
Software + Hardware Acceleration



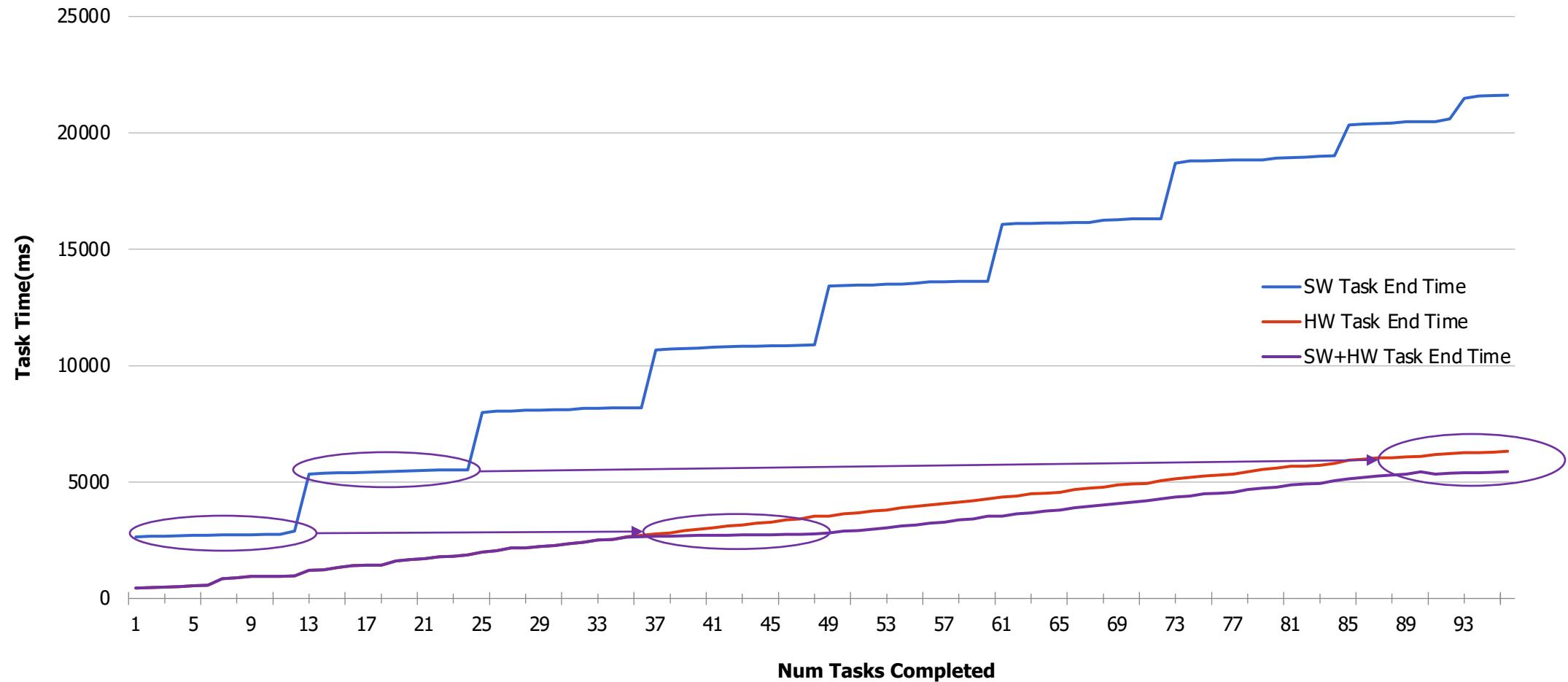
Comparison



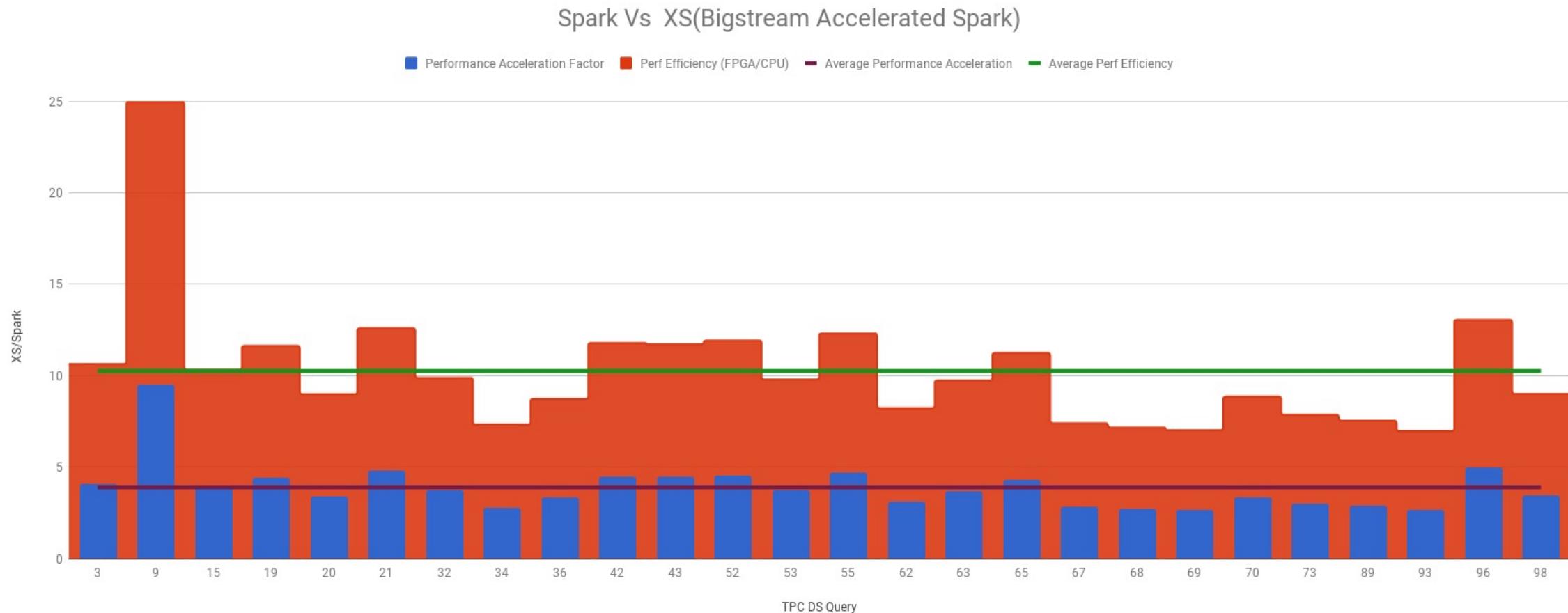
HW/SW Task Acceleration



HW+ SW Collaborative Task Acceleration

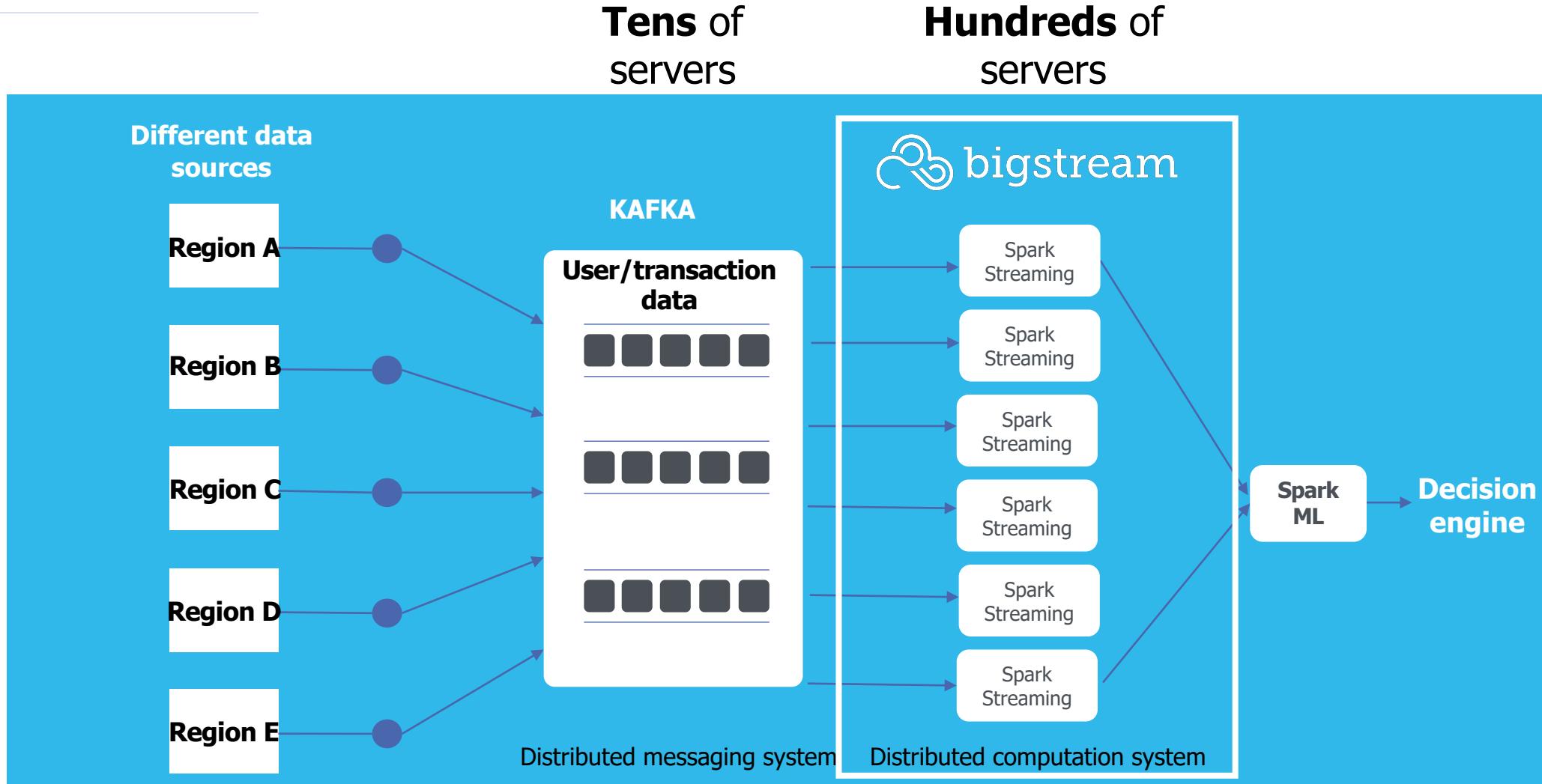


Accelerating Ingest-focused TPC-DS Queries



These results were generated with 79% logic utilization and 15% Block RAM utilization on a Arria 10 FPGA compared to software results from a 10-Core (2x) Intel Xeon E5-2650 v3 CPU running Spark 2.1.1.

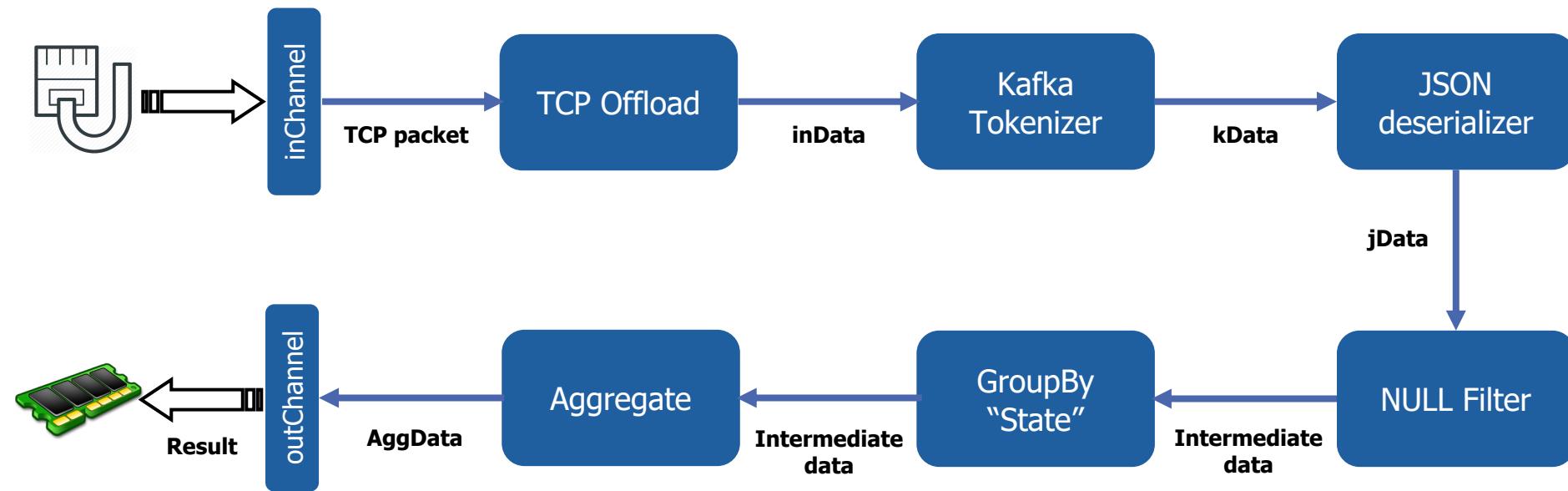
User Behavioral Pipeline

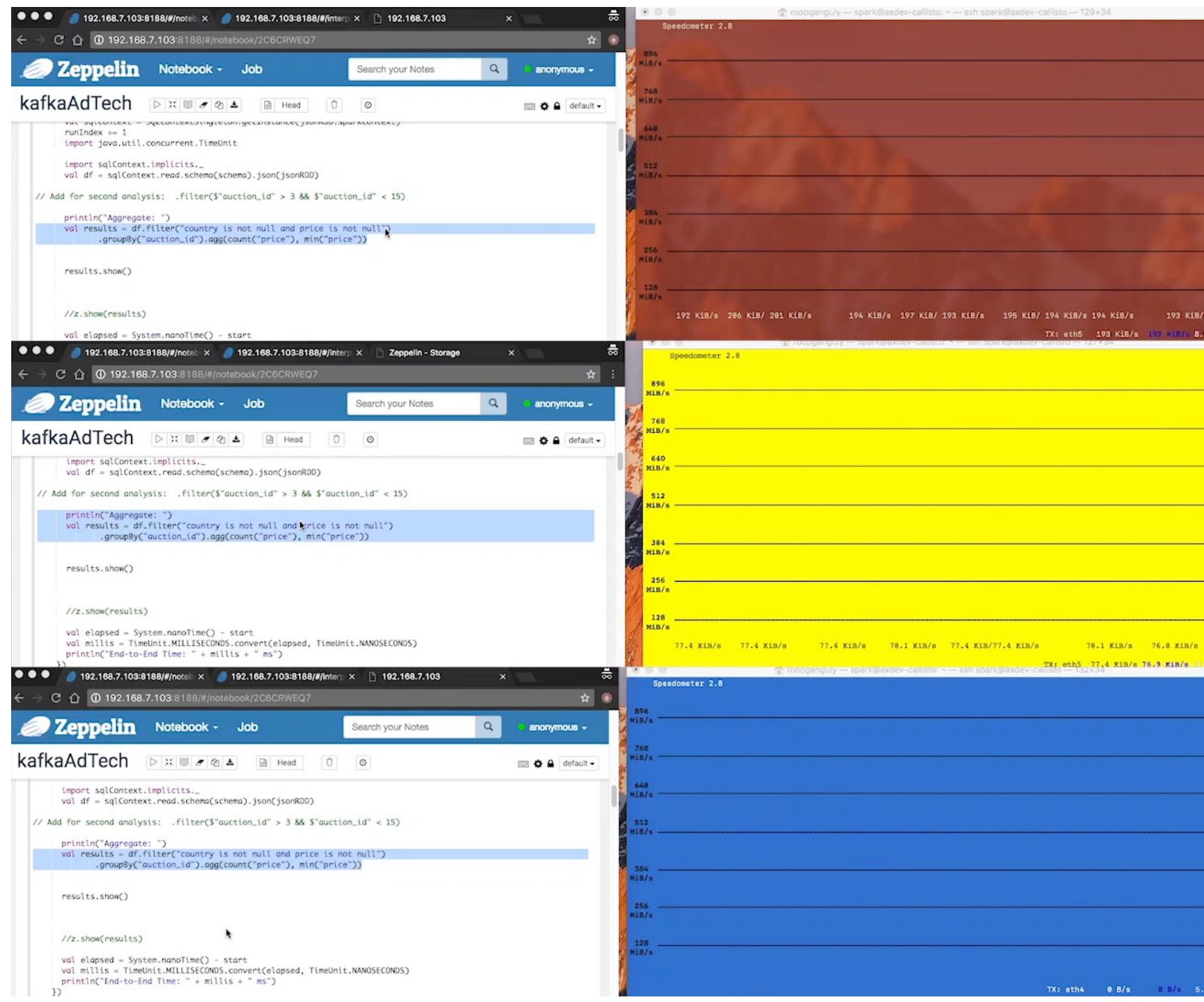


Spark Code for an User Behavior Pipeline

```
val lines =  
    KafkaUtils.createDirectStream  
        [String, String, StringDecoder, StringDecoder]  
        (ssc, kafkaParams.toMap, topicsSet).map(_.value)  
  
lines.foreachRDD((jsonRDD: RDD[String]) => {  
    val sparkSession =  
        SparkSessionSingleton.getInstance(sparkConf)  
    val df = sparkSession.read.schema(schema).json(jsonRDD)  
  
    df.filter("country is not null and price is not null")  
        .filter(df("country").equalTo("US"))  
        .groupBy("country").agg(count("price"), min("price"),  
        max("price")).show()  
})
```

Architecture for an User Behavior Pipeline In-line Accelerator





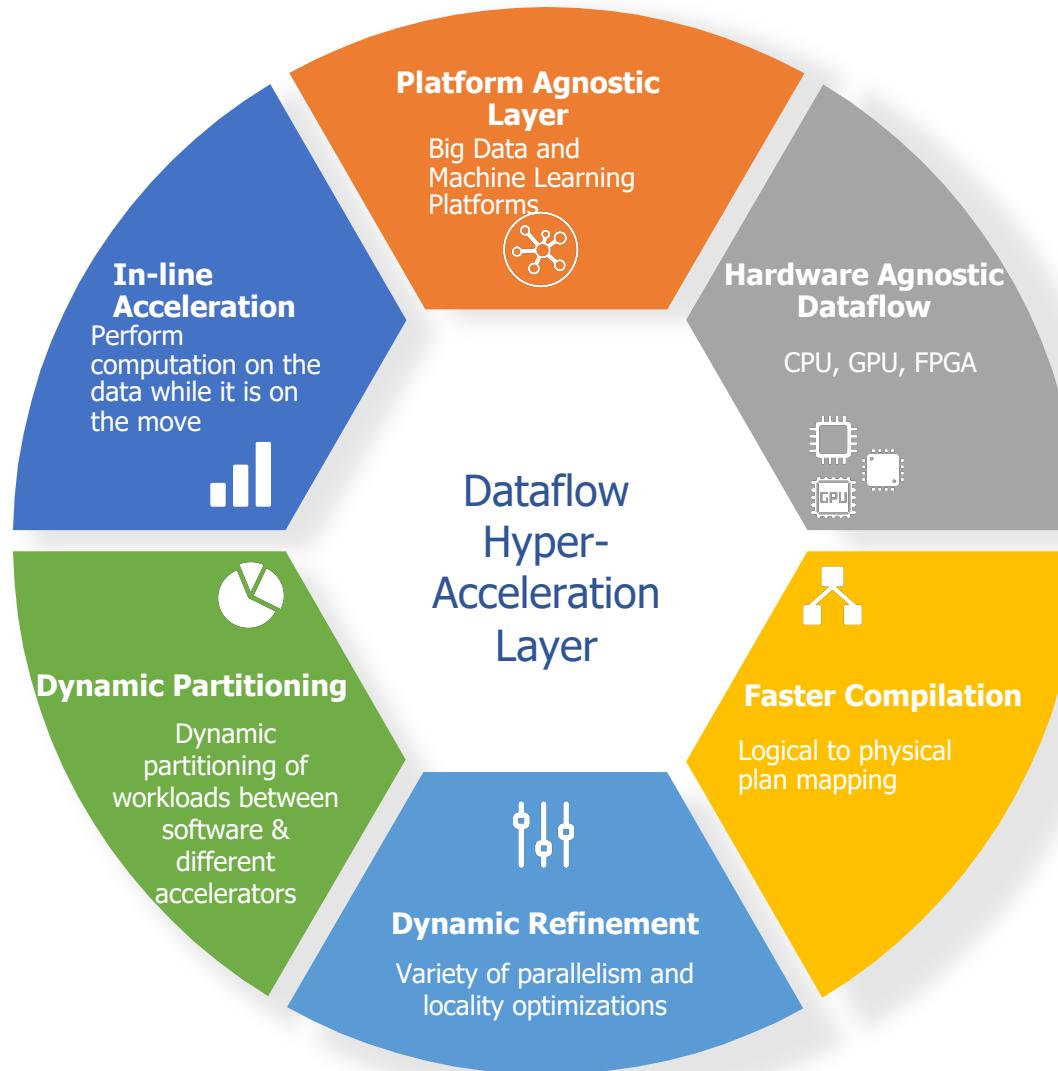
Apache Spark



~2.7X

+ bigstream
+ FPGA ~6.9X
bigstream

Technology



Conclusions

- Acceleration made easy
 - Zero code change
 - Software **and** hardware acceleration
 - Hardware and platform agnostic
- Preliminary Results on Intel FPGAs
 - Up to ~25X and ~10X on average perf/watt advantage for TPC-DS – Offload mode
 - ~7X performance improvement for Kafka streaming – Inline mode



Bigstream Website

bigstream.co

Bigstream on AWS EMR

<https://aws.amazon.com/marketplace/pp/B06X3R791S/>

Whitepaper

<http://bigstream.co/wp-content/uploads/2017/03/Bigstream-whitepaper-v1.3.pdf>



Thank You

Backup