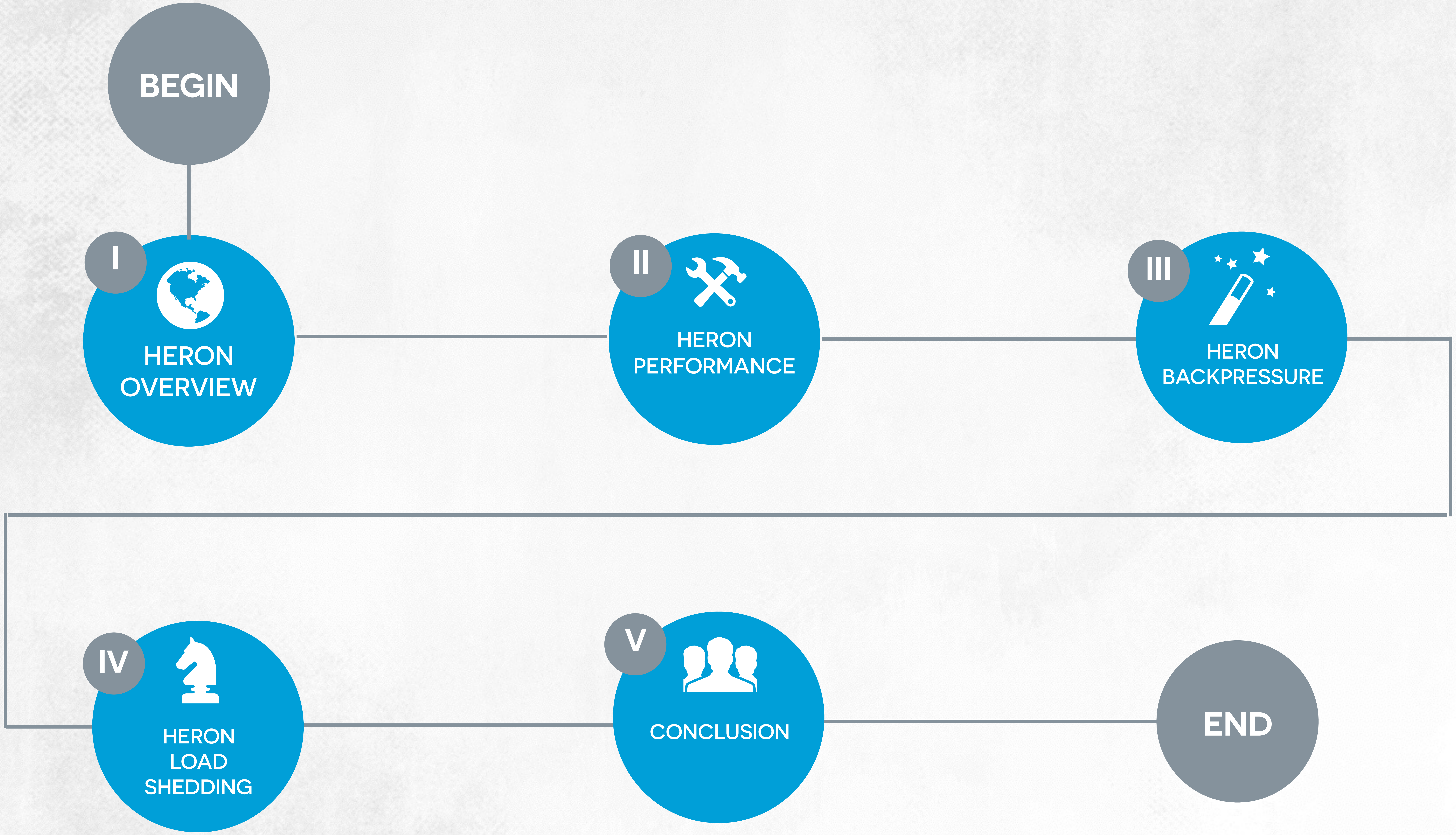
Streaming In Practice

KARTHIK RAMASAMY
@KARTHIKZ

#TwitterHeron

TALK OUTLINE



BEGIN

I HERON OVERVIEW

II HERON PERFORMANCE

III HERON BACKPRESSURE

IV HERON LOAD SHEDDING

V CONCLUSION

END

HERON OVERVIEW

STORM/HERON TERMINOLOGY

TOPOLOGY

Directed acyclic graph

Vertices=computation, and edges=streams of data tuples

SPOUTS

Sources of data tuples for the topology

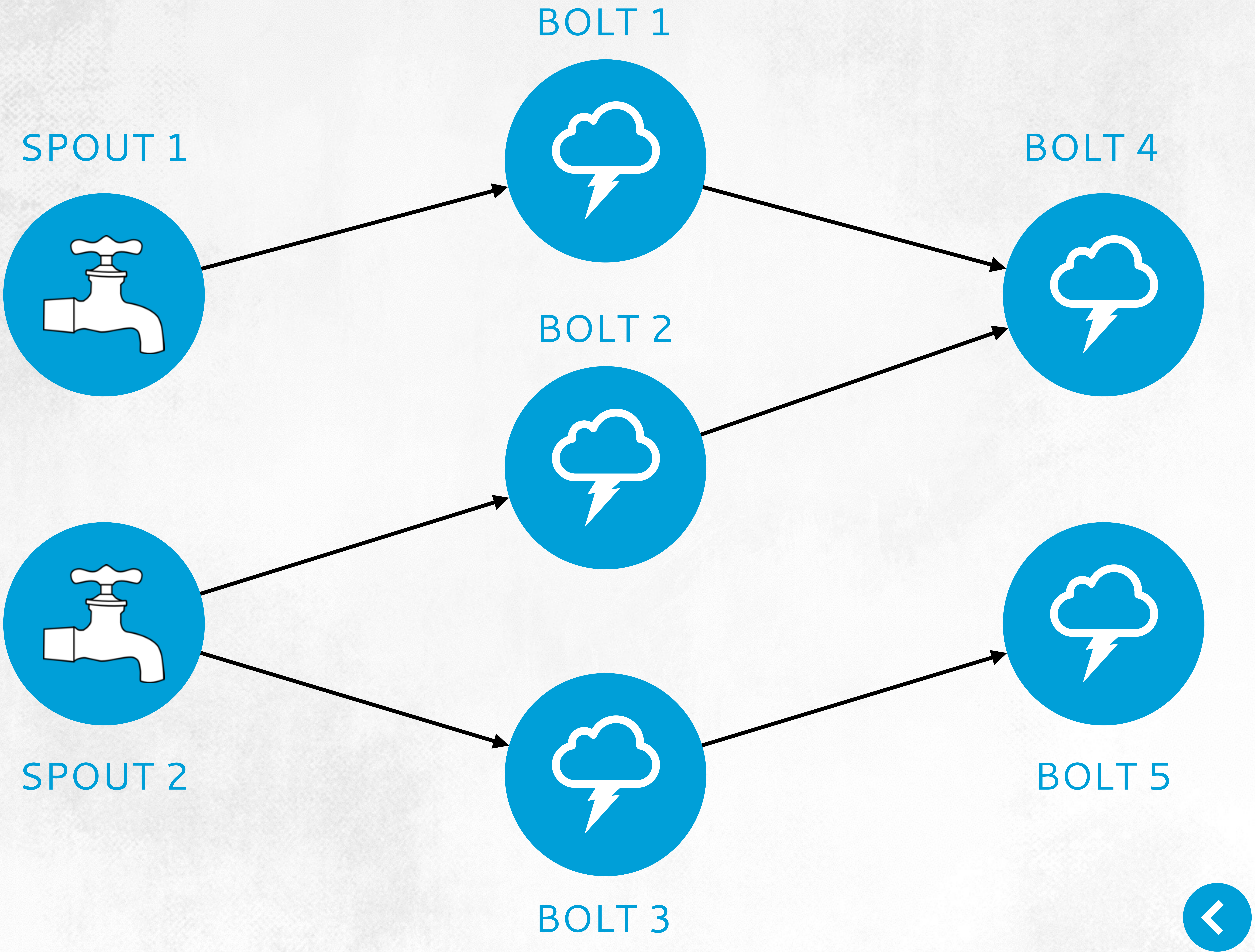
Examples - Kafka/Kestrel/MySQL/Postgres

BOLTS

Process incoming tuples and emit outgoing tuples

Examples - filtering/aggregation/join/arbitrary function

STORM/HERON TOPOLOGY



WHY HERON?

PERFORMANCE PREDICTABILITY

IMPROVE DEVELOPER PRODUCTIVITY

EASE OF MANAGEABILITY

HERON DESIGN DECISIONS

FULLY API COMPATIBLE WITH STORM

Directed acyclic graph

Topologies, spouts and bolts

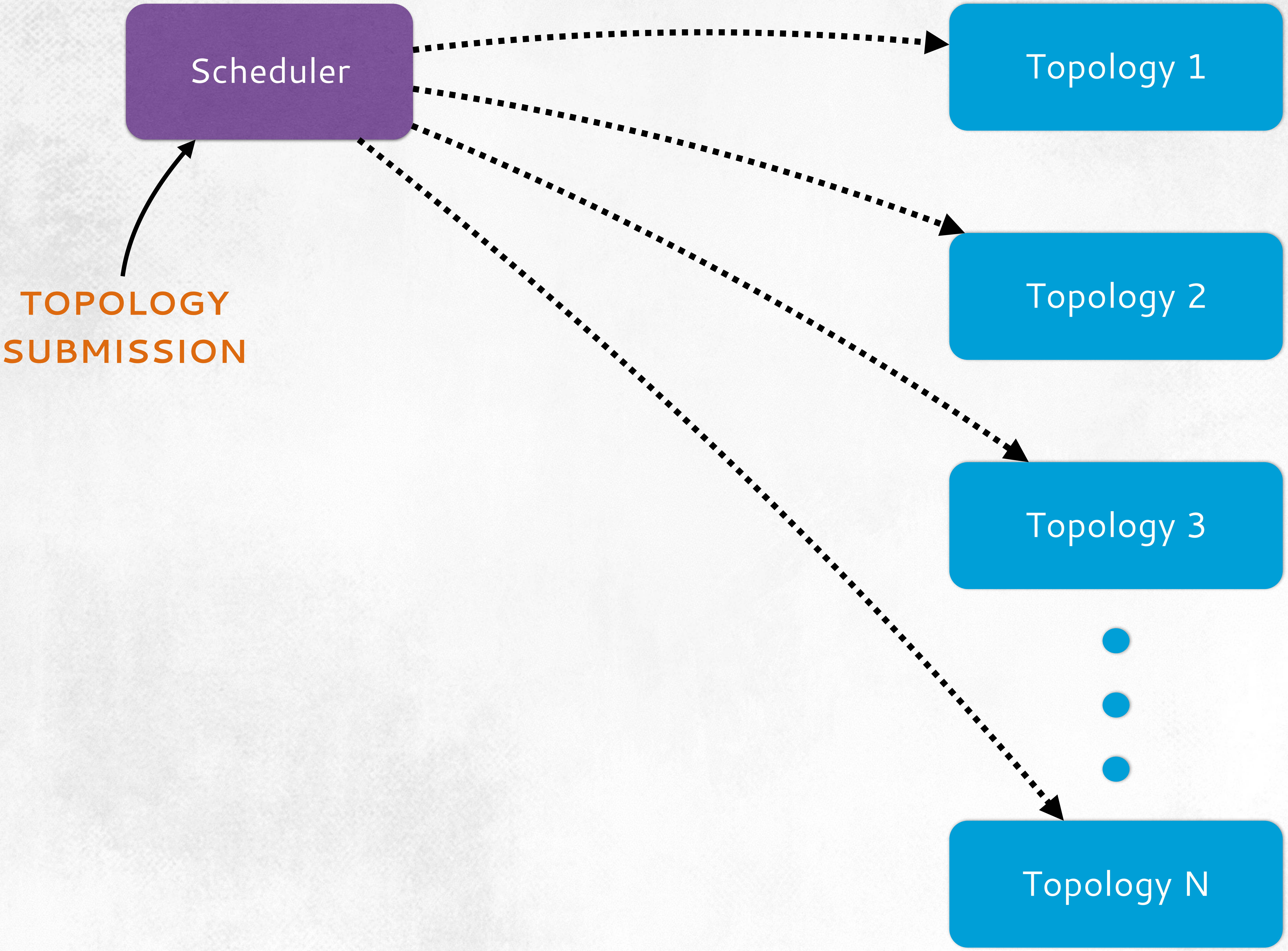
TASK ISOLATION

Ease of debug ability/resource isolation/profiling

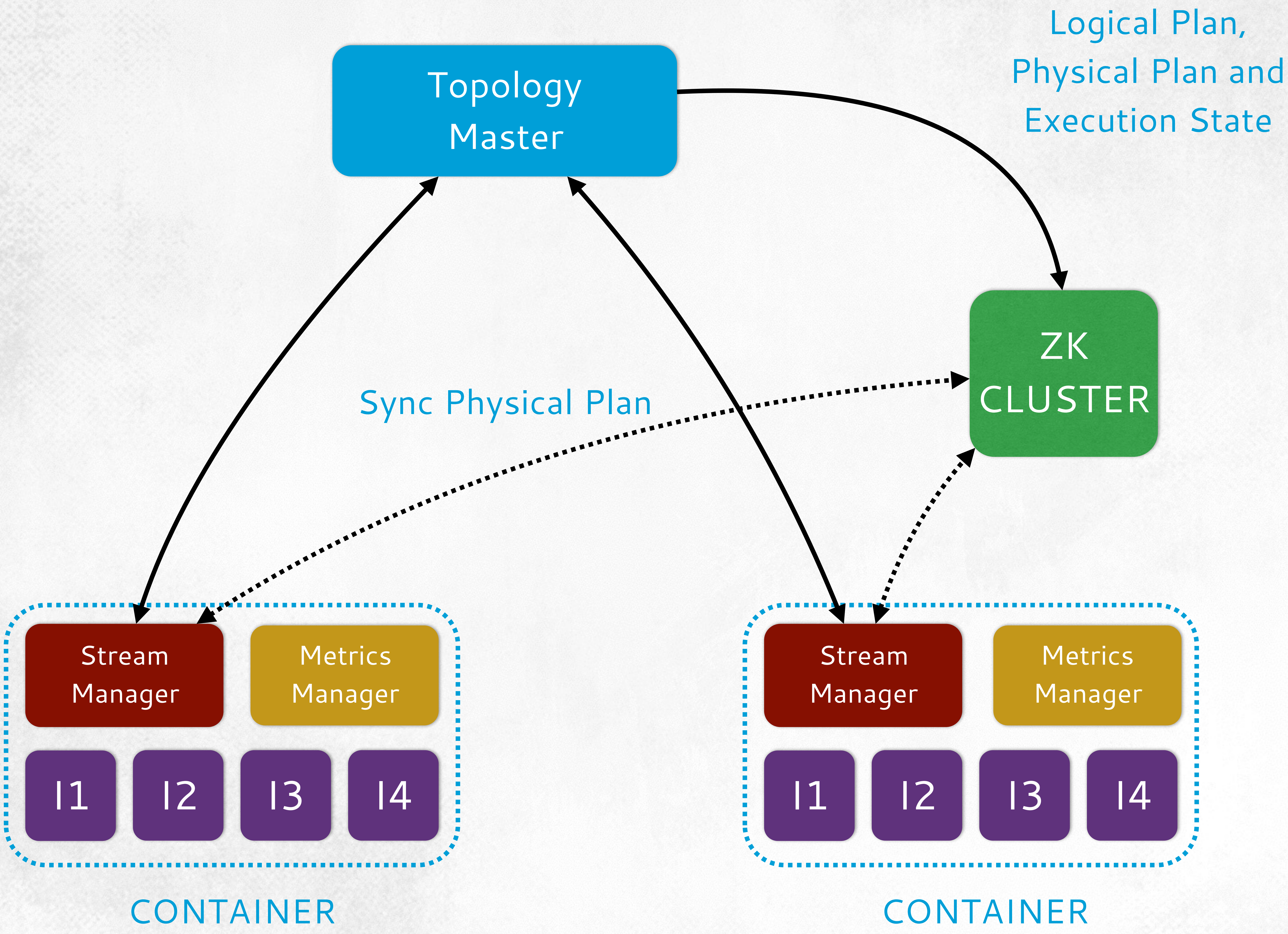
USE OF MAIN STREAM LANGUAGES

C++/JAVA/Python

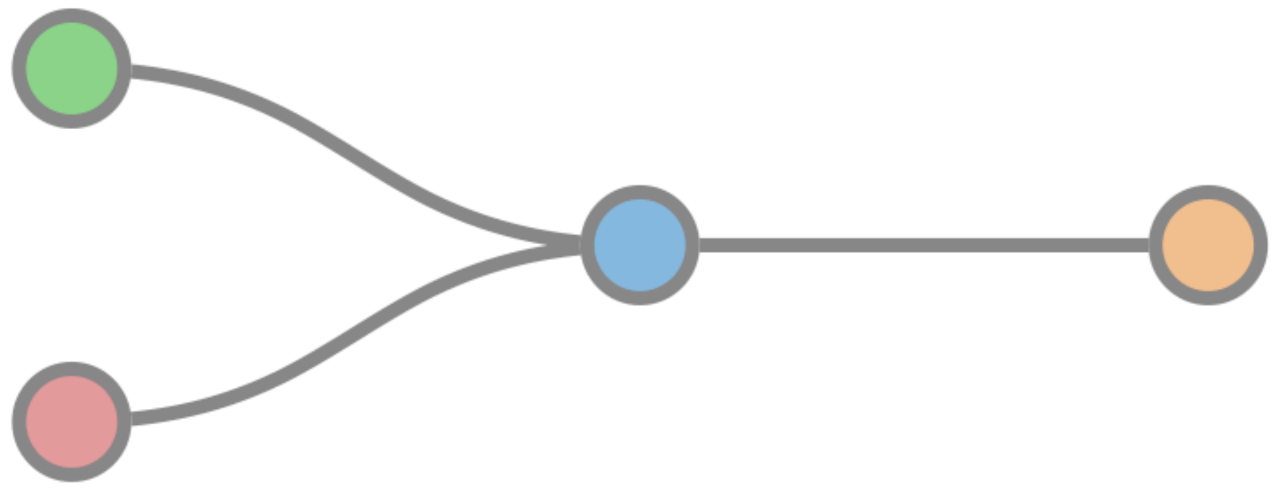
HERON ARCHITECTURE

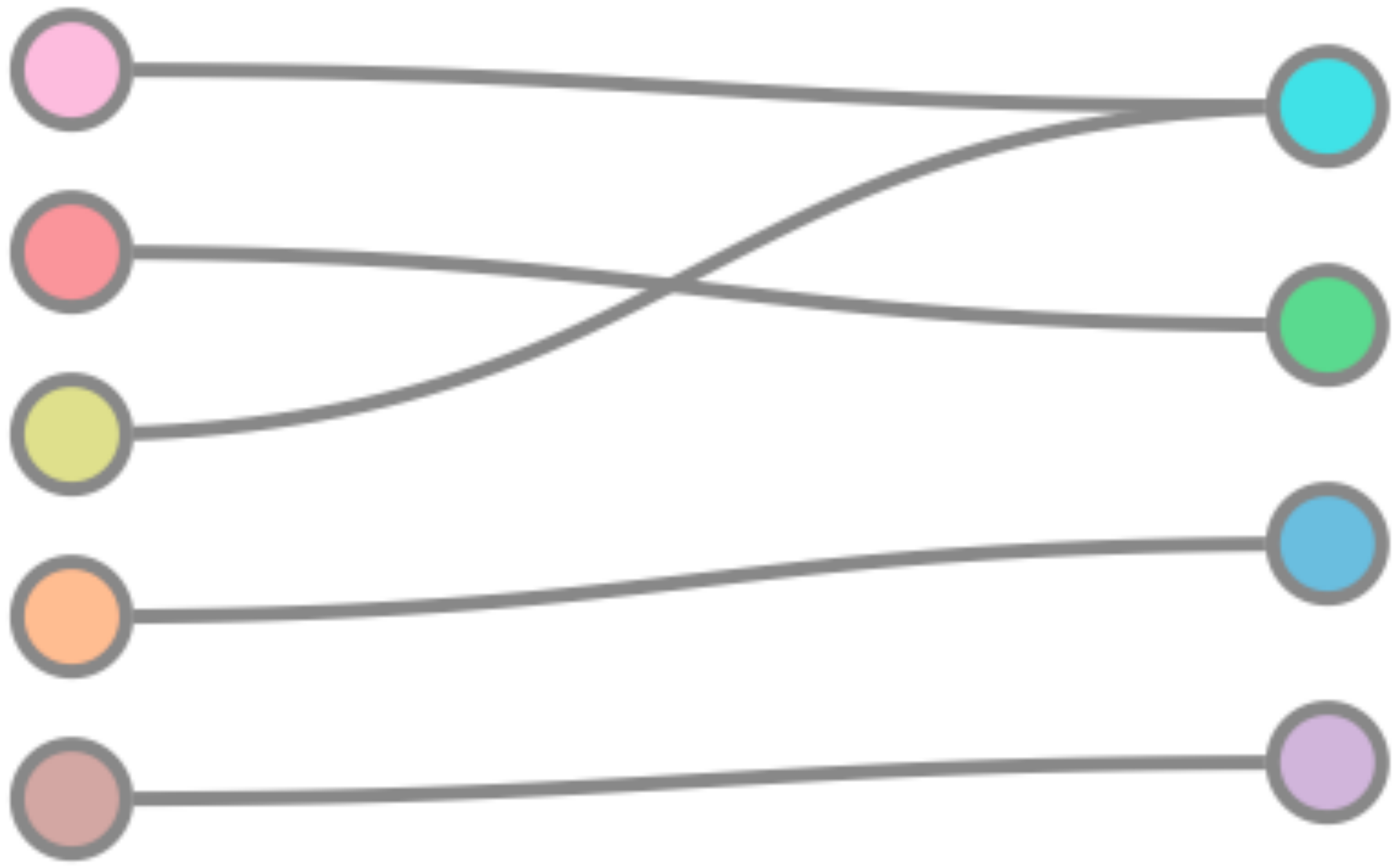


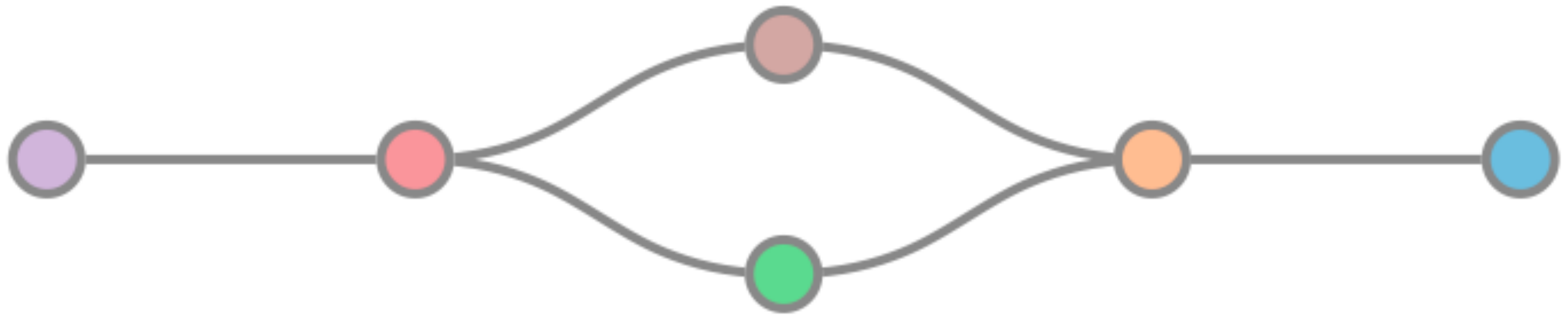
TOPOLOGY ARCHITECTURE

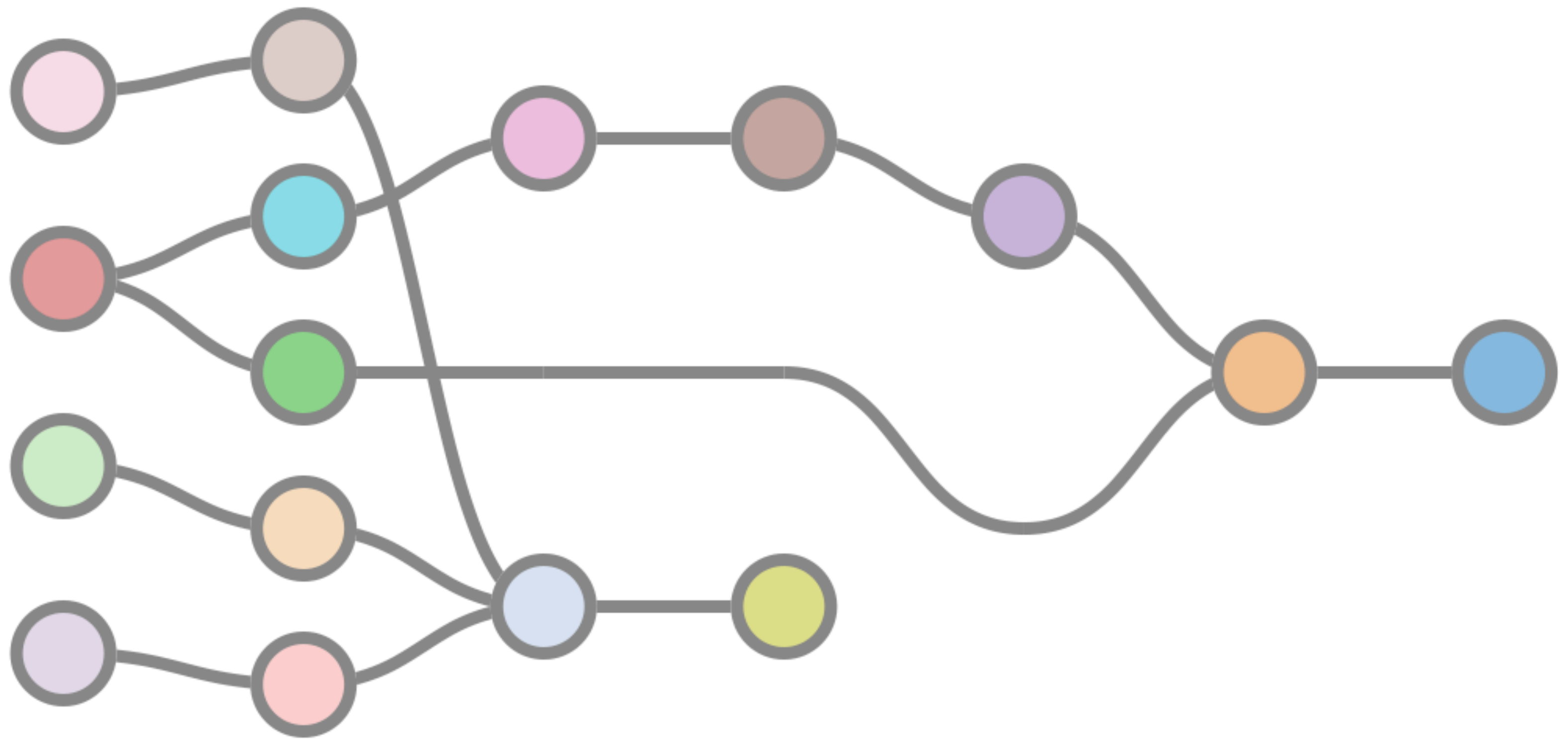


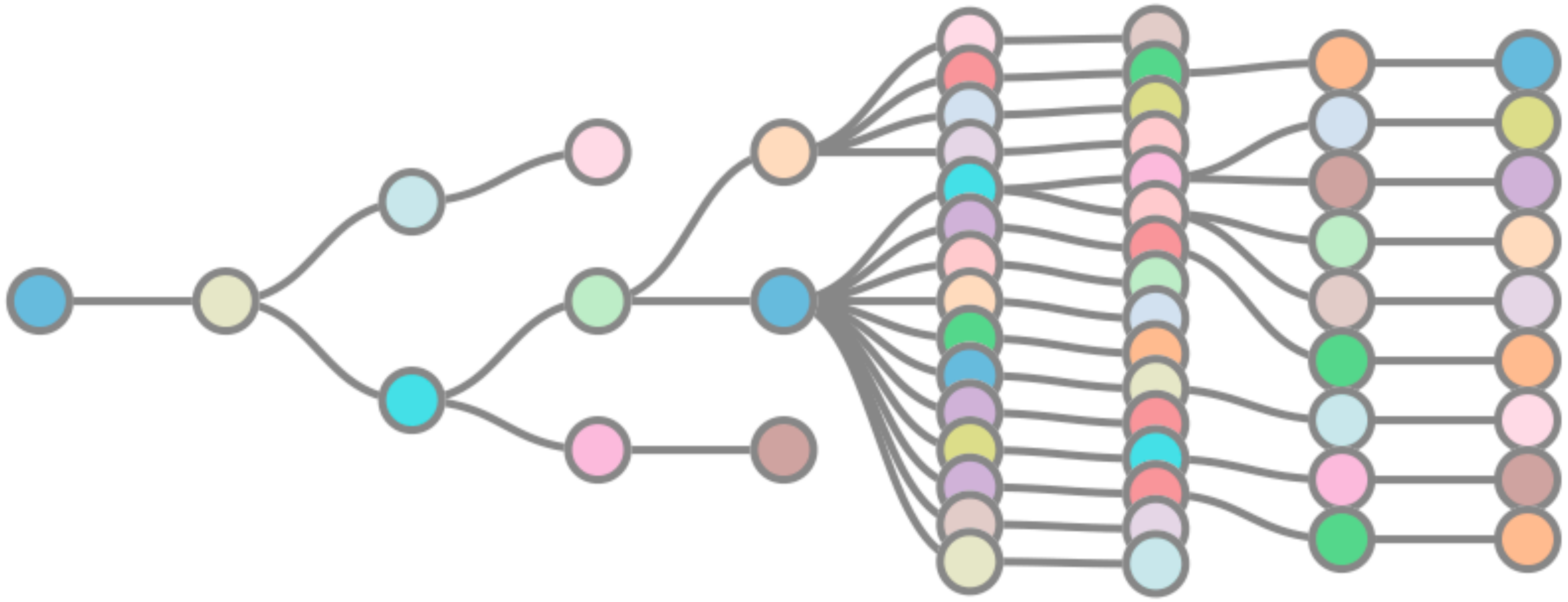
HERON SAMPLE TOPOLOGIES











HERON @TWITTER

Heron has been in production for 2 years

Large amount of data produced every day

Large cluster

Several hundred topologies deployed

Several billion messages every day

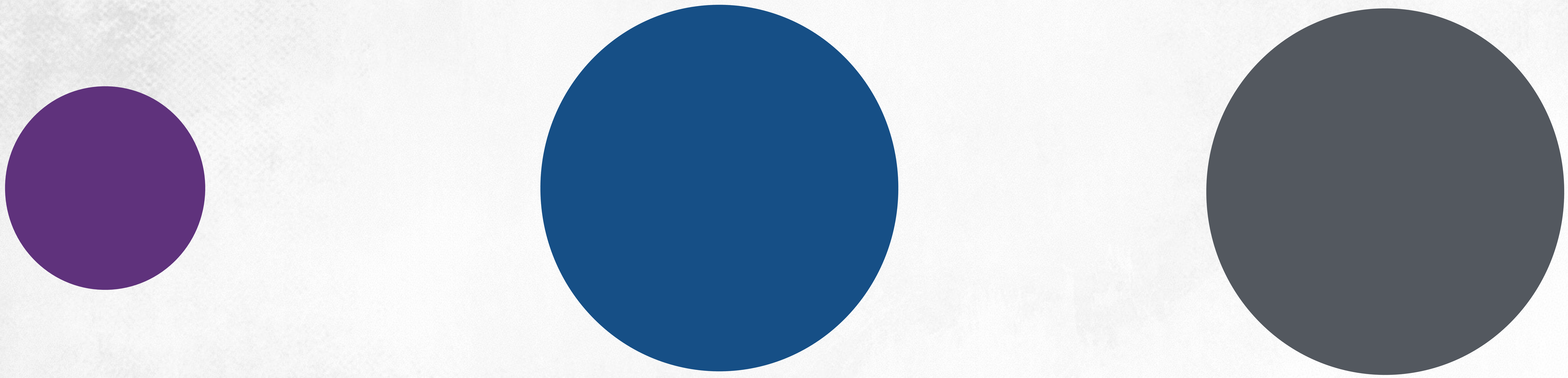
1 stage
10 stages

3x reduction in cores and memory

HERON USE CASES

- REALTIME ETL
- REAL TIME BI
- SPAM DETECTION
- REAL TIME TRENDS
- REALTIME ML
- REAL TIME MEDIA
- REAL TIME OPS

HERON ENVIRONMENT



Laptop/Server

Cluster/Aurora

Cluster/Mesos

HERON RESOURCE USAGE

HERON PERFORMANCE

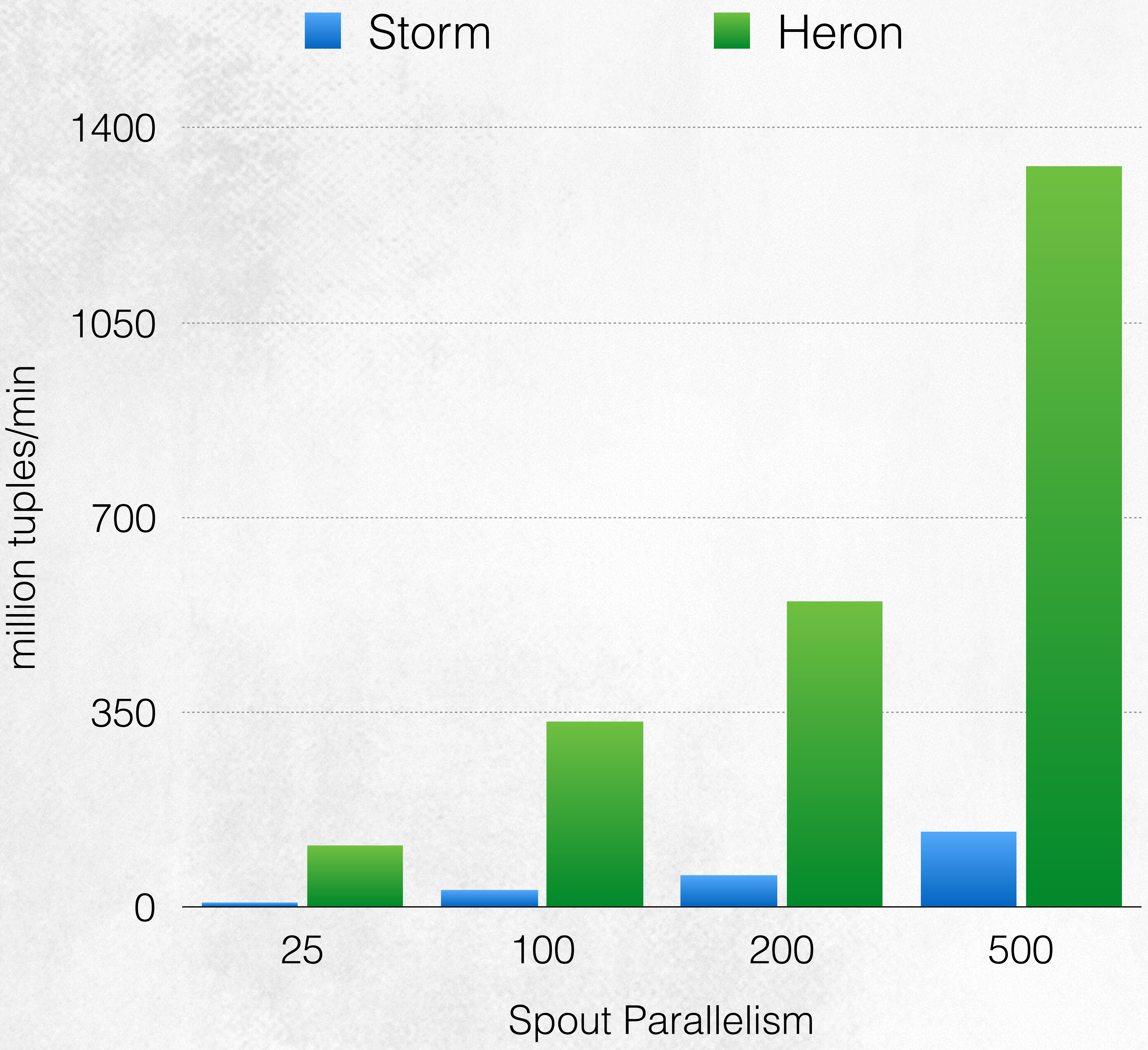
Settings

COMPONENTS	EXPT #1	EXPT #2	EXPT #3	EXPT #4
Spout	25	100	200	300
Bolt	25	100	200	300
# Heron containers	25	100	200	300
# Storm workers	25	100	200	300

HERON PERFORMANCE

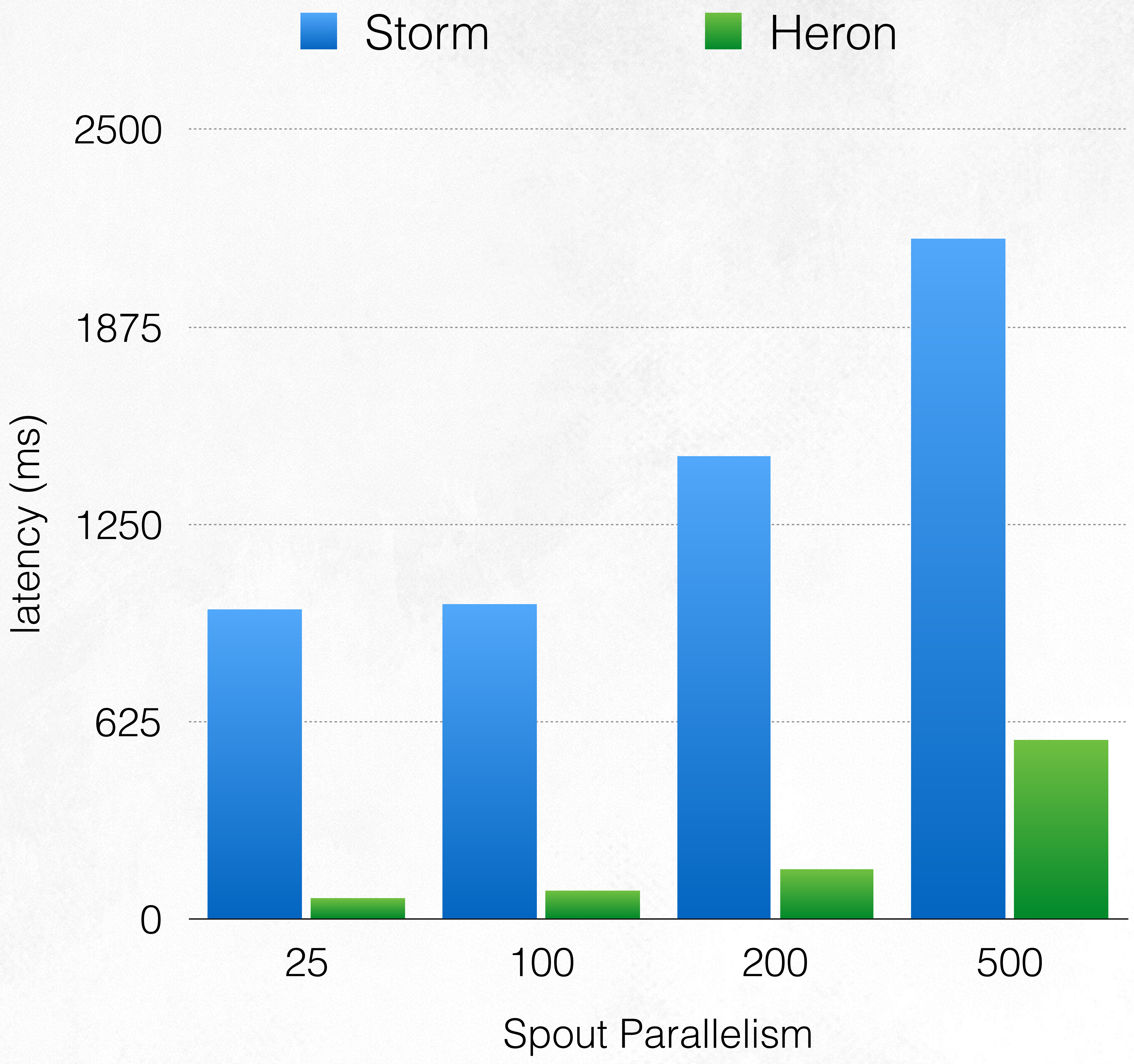
Word count topology - Acknowledgements enabled

Throughput



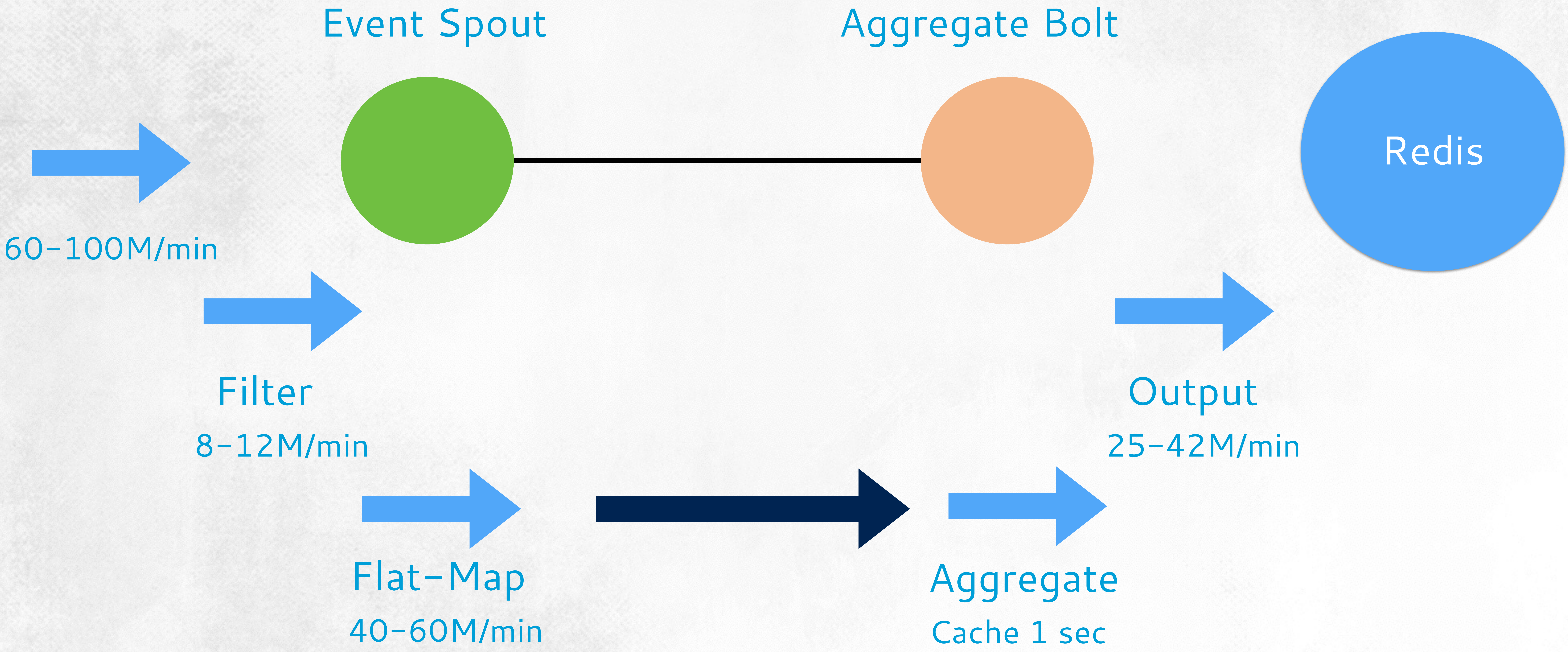
10-14x

Latency



5-15x

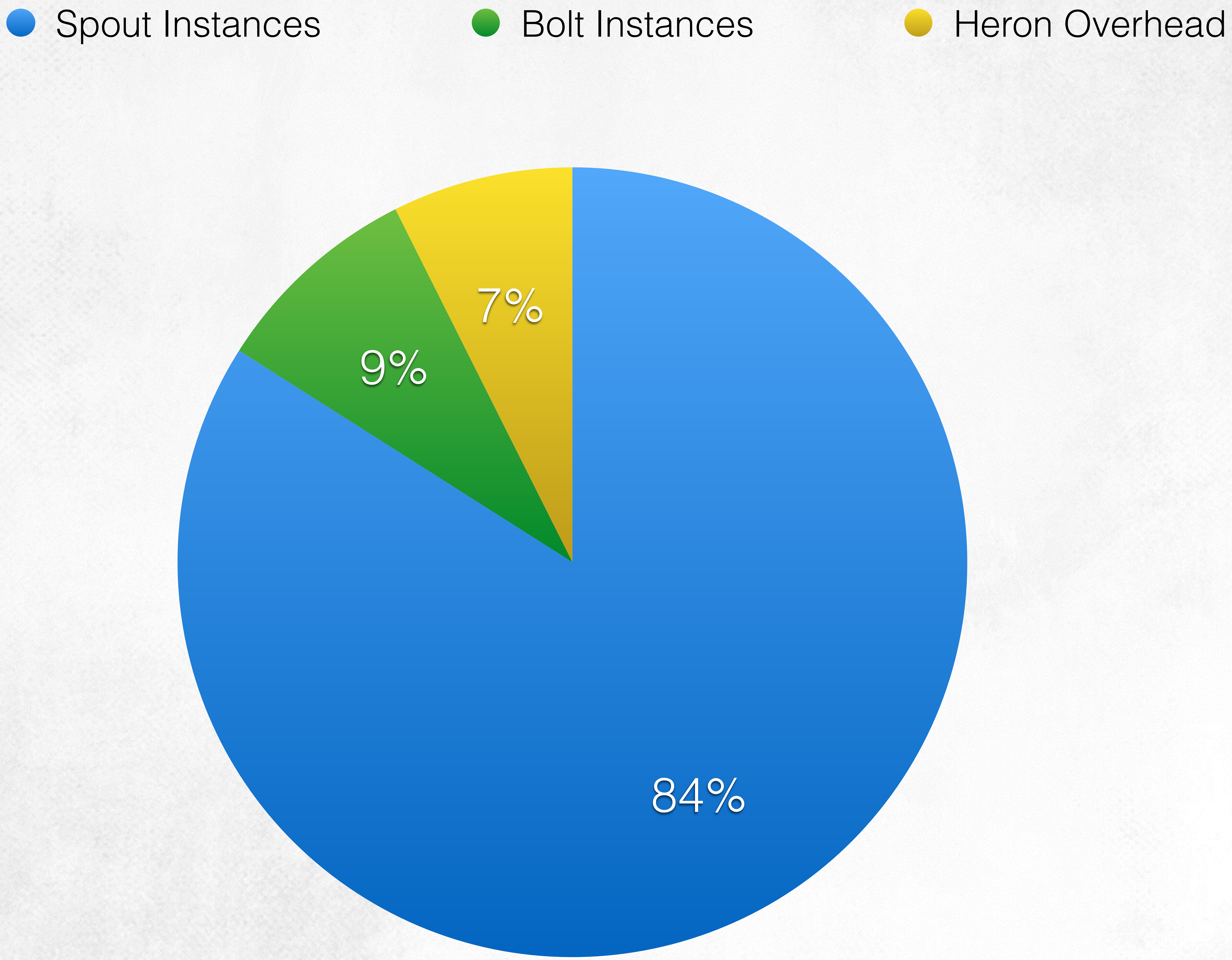
HERON RESOURCE USAGE



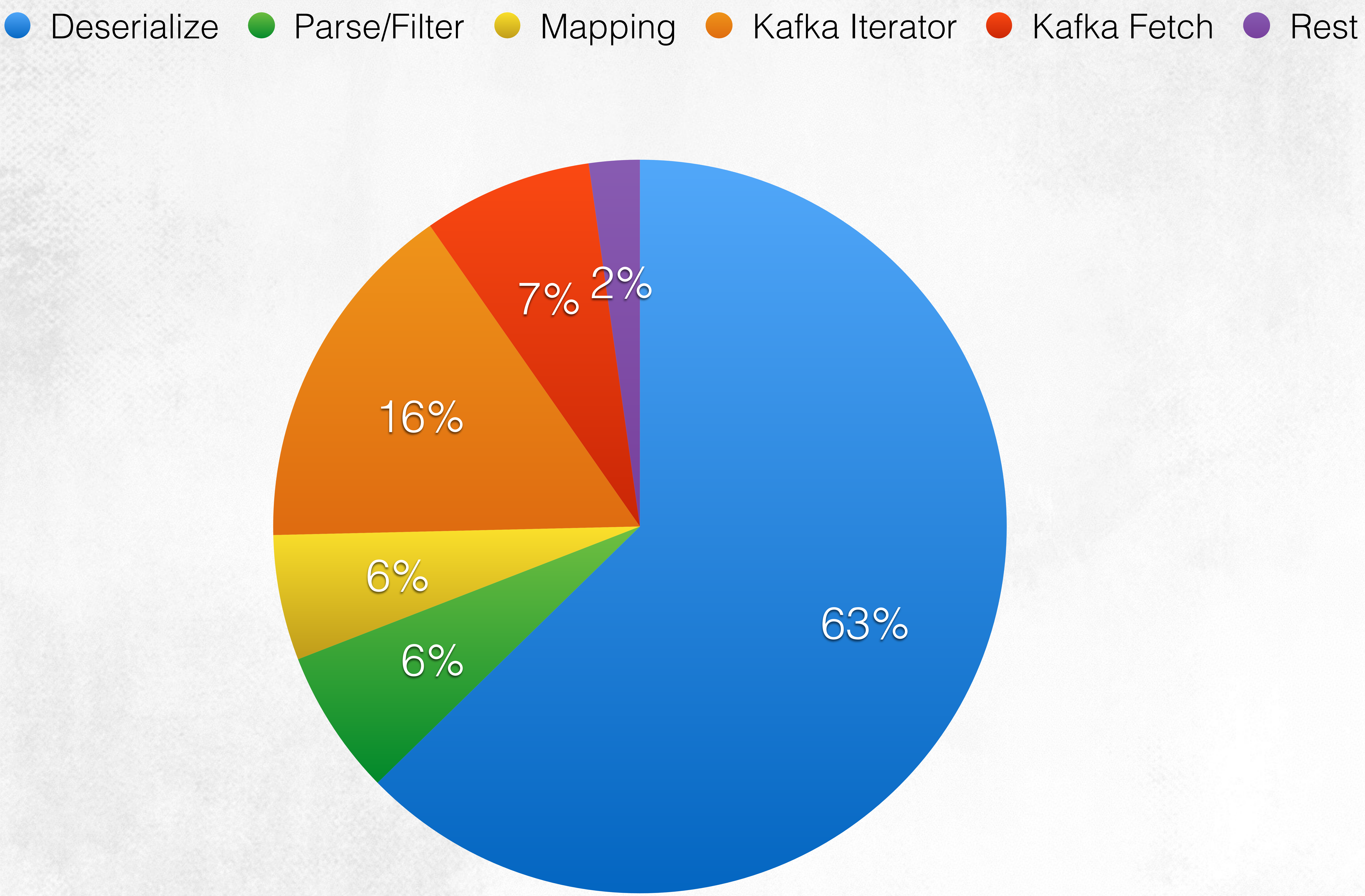
RESOURCE CONSUMPTION

	Cores Requested	Cores Used	Memory Requested (GB)	Memory Used
Redis	24	2-4	48	N/A
Heron	120	30-50	200	180

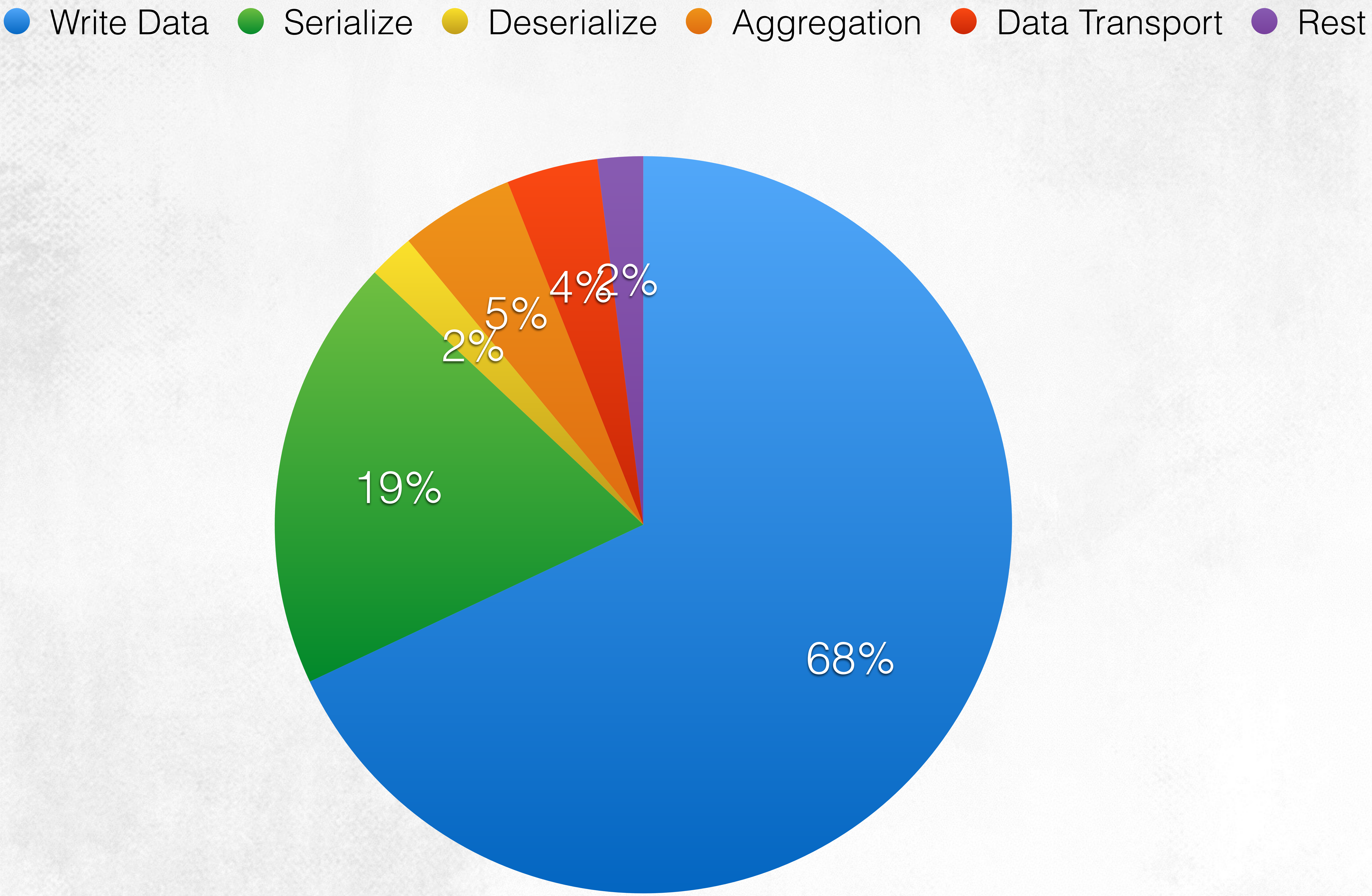
RESOURCE CONSUMPTION



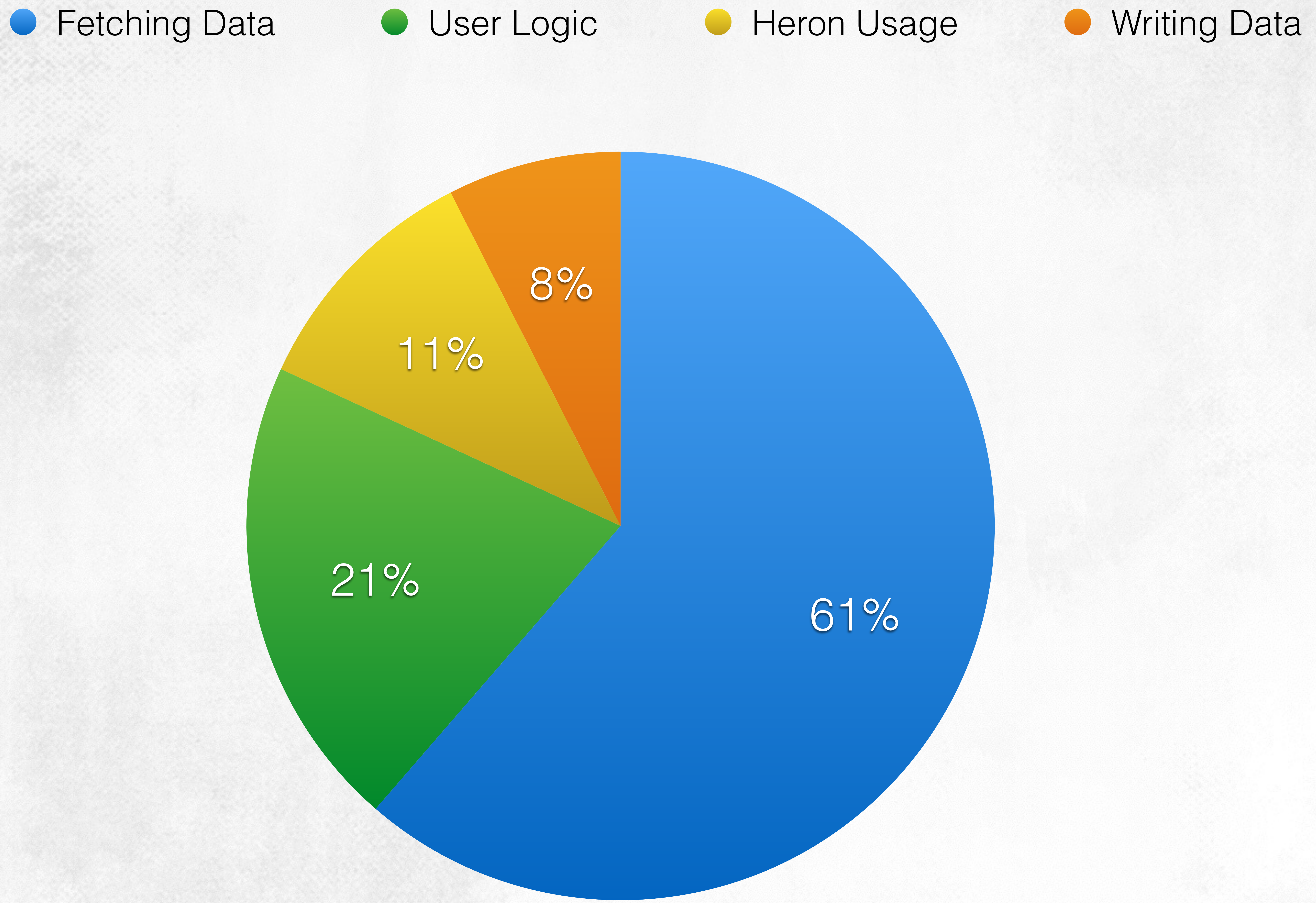
PROFILING SPOUTS



PROFILING BOLTS



RESOURCE CONSUMPTION - BREAKDOWN



HERON BACK PRESSURE

BACK PRESSURE AND STRAGGLERS

Stragglers are the norm in a multi-tenant distributed systems

Bad machine, inadequate provisioning and hot keys

PROVIDES PREDICTABILITY

PROCESSES DATA AT MAXIMUM RATE

REDUCE RECOVERY TIMES

HANDLES TEMPORARY SPIKES

BACK PRESSURE AND STRAGGLERS

MOST SCENARIOS BACK PRESSURE RECOVERS

Without any manual intervention

SUSTAINED BACK PRESSURE

Irrecoverable GC cycles

Bad or faulty host

SOMETIMES USER PREFER DROPPING OF DATA

Care about only latest data

LOAD SHEDDING

SAMPLING BASED APPROACHES

Down sample the incoming stream and scale up the results

Easy to reason if the sampling is uniform

Hard to achieve uniformity across distributed spouts

DROP BASED APPROACHES

Simply drop older data

Spouts takes a lag threshold and a lag adjustment value

Works well in practice

CURIOUS TO LEARN MORE...

Streaming@Twitter

Maosong Fu, Sailesh Mittal, Vikas Kedigehalli, Karthik Ramasamy, Michael Barry, Andrew Jorgensen, Christopher Kellogg, Neng Lu, Bill Graham, Jingwei Wu

Twitter, Inc.

Twitter Heron: Stream Processing at Scale

Sanjeev Kulkarni, Nikunj Bhagat, Maosong Fu, Vikas Kedigehalli, Christopher Kellogg, Sailesh Mittal, Jignesh M. Patel[*,1], Karthik Ramasamy, Siddarth Taneja

@sanjeevrk, @challenger_nik, @Louis_Fumaosong, @vikkyrk, @cckellogg, @saileshmittal, @pateljm, @karthikz, @staneja

Twitter, Inc., *University of Wisconsin – Madison

Storm @Twitter

Ankit Toshniwal, Siddarth Taneja, Amit Shukla, Karthik Ramasamy, Jignesh M. Patel*, Sanjeev Kulkarni, Jason Jackson, Krishna Gade, Maosong Fu, Jake Donham, Nikunj Bhagat, Sailesh Mittal, Dmitriy Ryaboy

@ankitoshniwal, @staneja, @amits, @karthikz, @pateljm, @sanjeevrk, @jason_j, @krishnagade, @Louis_Fumaosong, @jakedonham, @challenger_nik, @saileshmittal, @squarecog

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#ThankYou

FOR LISTENING

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QUESTIONS AND ANSWERS

Go ahead. Ask away.

HERON LOAD SHEDDING