FAAS ORCHESTRATION OF PARALLEL WORKLOADS

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H2020 CLOUDPATTERN: SERVERLESS DATA ANALYTICS

• Large Serverless European Research Project (4.3M)
• The main goal is to create CloudButton: a Serverless Data Analytics Platform. CloudButton will “democratize big data” by overly simplifying the overall life cycle and programming model thanks to serverless technologies
• To demonstrate the impact of the project, we target two settings with large data volumes: bioinformatics (genomics, metabolomics) and geospatial data (LiDAR, satellital)
The Serverless Supercomputer Stack

Applications: Big data, analytics, ML/AI, simulations, r/t video transcoding, ...

Video | ML | LinPack | Monte Carlo | M-R | Analytics | CRISPR

Serverless Dataflow Graphs (SDGs)

Real-time Scheduler | Low-latency serverless storage

Networking

The ExCamera stack

Cloud Vendors: Functions, APIs, Managed Service Portfolios
### ServerMix Applications

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COMPARISON (WOSC4)
Is IBM Composer the answer now?
OPENWHISK AND COMPOSER
COMPOSER LIMITATIONS

- Coupled Design with OpenWhisk Conductor Actions
- Resource inefficiencies when launching parallel functions
  - High Variability in experiments
- Difficult billing of conductor and secondary actions
- Designed for short-running workflows
- Limited fault-tolerance
- It relies on a user-provided serverful Redis Service for fork-join aggregation
FISSION WORKFLOWS, AIRFLOW
AWS EXPRESS WORKFLOWS (BONUS)

- Amazing performance for 320 workers, overheads below 1 second
- Valid for short-running workflows (5 mins), function working all time
- It is relaxing fault-tolerance and checkpointing
  - At-least-once workflow execution vs Exactly-once workflow execution.
  - Message logs, not current state
- Different pricing model
  - Express Workflows: Priced by the number of executions you run, their duration, and memory consumption.
  - Standard Workflows Priced per state transition. A state transition is counted each time a step in your execution is completed.
CONCLUSIONS

- **Innovation in the Cloud providers is needed !!!**
  - Existing FaaS Orchestration systems are not currently designed for supporting parallel Big Data pipelines
    - Both IBM Composer and Amazon Express Functions have now good performance
    - But they are both designed for short-running workflows
  - **Messages to Cloud providers:**
    - Cloud providers must offer the required tools to orchestrate parallel Data Analytics tasks
    - Cloud providers must offer event-based building blocks to enable the construction of third-party schedulers
    - Multi-tenancy, cost, and resource efficiency will be of paramount importance for these services