

Talk Outline

- Paper Overview
- Introduction to serverless Computing
- Programming model / Advantages of lambda
- Lambda workloads and design implications
- Summary of new technology
- Towards OpenLambda
- Author's Evaluation and conclusion
- Critique: Strengths
- Critique: Weakness
- Critique: Evaluation





Introduction(contd..)

• Evolution of sharing

(1) no sharing	haring (2) virtual machines (3) containers		tainers	(4) lambdas		
app	app	арр	app	app	арр	арр
runtime	runtime	runtime	runtime	runtime	runtime	
OS	OS	OS	OS		os	
	VM	VM				
H/W	H/W		HAW		H/W	



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Introduction - Lambda Model Many benefits when compared to traditional, server based approachesNo need to worry about server management. Very fast startup. Functions share the runtime environment. Auto-scaling.

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Background/Related Work contd....

Advantages of lambda over containers

- Auto-scaling when load increases.
- In the above CDF it was clear that, AWS lambda was able to start 100 unique worker instances within 1.6s to serve the requests, all Elastic BS requests were served by the same instance; as a result, each request in Elastic BS had to wait behind 99 other 200ms requests.
- No need of configuration for scaling. In contrast, Elastic BS configuration is complex.

Understanding Lambda Workloads •Analyze Client-to-server patterns in existing RPC-based application e.g. Google Gmail •Trace the RPCs using a chrome extension and correlate with chrome's network





Design Implications

•RPCs are shorter than 100ms.

•On AWS Lambda, Cost of requests are at least 3.7 x more .

•Designing applications with fewer, longer RPCs is a possible solution .

•Idle Handlers dominate the cost of application unless special support is provided.

Research Challenges

- 1. Execution Engine
- 2. Interpreted Languages
- 3. Package Support
- 4. Cookies and Sessions
- 5. Databases
- 6. Data Aggregators
- 7. Load Balancers
- 8. Cost Debugging
- 9. Legacy Decomposition









5. Databases

- ✤ Lambda handlers can be UDFs to databases
- Currently lambda acts as triggers for inserts into S3 or DynamoDB
- Change Feed Abstraction with lambda incurs same challenges as that of long lived sessions

Research Solution:

 \star Integrate lambda state transitions with the change feed of databases.







Towards Open Lambda	
• In order to make research easier in all the areas described earlier, an open source implementation of platform was built - "OpenLambda". OpenLambda is a serverless computing project based on containers. Its main goal is to enable exploration of new approaches to serverless computing.	lambda Linux
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OpenLambda Components-

- Lambda Store
- Local execution engine
- Load balancer
- Lambda aware distributed database



Workflow:

- First, developers uploads the lambda code to the lambda service, which stores it in a code store.
- Second, a client may issue an RPC to the service. A **load balancer** must decide which worker machine should service request.
- A load balancer many need to request the RPC schema from the code store in order to perform deep inspection on the RPC field.
- The **OpenLambda worker** that receives the request will then fetch the RPC handling code from the code store if it is not already cached locally.
- The openLambda worker will initialize a sandbox in which the handler runs. The handler may issue queries to a **Distributed Database**.
- If the balancer and the database are integrated, this will hopefully involve I/O to a local shard.











Jdentify GAPS Only RPC trigger events evaluated Dynamic profiling is not possible No benchmark tools Open lambda is not materialized In the evaluation between AWS lambda and BeanStalk in execution Engine research challenge, the author missed to mention the request volumes. He just mentioned low request volumes.







Thank you! 35 35