Highly Scalable Cognitive Storage Management Platform Using Cloud Native Services

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Agenda

• Server Downtimes and Consequences

• Storage Management Evolution

• Next Generation Storage Management Platform

• Cognitive (AI) Storage Management Platform

• Predictive Analytics

• Scalability
Server Downtimes and Consequences

Average cost per hour of enterprise server downtime worldwide in 2017 and 2018

![Bar chart showing the average cost per hour of enterprise server downtime worldwide in 2017 and 2018, with categories ranging from 'Up to $10,000' to '>$5M', and corresponding percentages for each category.]

Source: statista.com
Storage Management Evolution

Each storage device type has its own management module

Challenges
- No consolidated view of the storage
- Management complexity – Login to multiple consoles to monitor the devices
- Difficult to debug the problems those are part of the other devices

Consolidated view of all the storage devices including third party devices
On-premise deployment on dedicated server

Challenges
- Dedicated resources for deployment
- Support issues – turn around time is more to debug the issues
- No information about the other deployments
- Scalability is the challenge
- High TCO
- Running predictive analytics
Next Generation Storage Management Platform

- Deploy thin Meta Data Collection Service in client data center that connects to storage devices
- Run all the data processing micro services on the cloud
- Supports thousands of tenants with less resources
- Highly Scalable and reliable using cloud auto scale feature
  - Horizontally
  - Vertically
- Processing of billions of metrics per minute
- Recover from site disasters (DR)
- Secure – data in motion, data at rest, RBAC
- Data lake based on NoSQL such as Cassandra deployed on the cloud.
- Predictive analytics
- Proactive support - faster time to resolution
- Different roles of the organization can view the same details

Send data to cloud
Cloud Native Services Based Architecture

✓ Microservice based architecture
  ✓ Data Services – Kubernetes and Containers
    • Highly scalable using advanced auto scale features
    • High Availability and reliability
  ✓ Lambda/Cloud functions – Used for small repetitive tasks that can be processed in less time

✓ Data Lake – No SQL such as Cassandra database, AWS DynamoDB, Azure datalake

✓ Meta Data Storage – Object storages such as IBM Cloud Object storage, AWS S3, Azure object store

✓ Messaging Service - Kafka-as-a-service platform from IBM Cloud, AWS Streaming service

✓ LogAnalytics – Elasticsearch (ELK) service from Cloud - Elastic, IBM Cloud, AWS

✓ ML/DL service using IBM Watson/ Amazon Sagemaker /MS Azure ML
Cognitive (AI) Storage Management Platform

- Predict Data Traffic issues – high response times/declines in throughput
  - Noisy neighbor (Correlation Analysis)
  - Slow responding Hosts (Correlation Analysis)
- Analyze patterns and correlate with other customer datasets
  - Performance prediction in heterogeneous environments
  - Tracking of known issues - Learn from other customer issues - (Classification)
  - Classify the workload types based on the performance data patterns
- Predictive Analytics
  - Capacity Forecasting – (Regression)
  - Power consumption in data centers – (Regression)
- Performance anomaly detection
  - Performance metrics analysis (Time-series data analysis)
  - Automated Triaging and Root Cause Analysis (Classification)
  - Log analysis - (Clustering)
- Configuration best practices recommendations
  - Manual upgrades/Automated upgrades
  - Configuration validation to avoid interruptions in service
- Intelligent Performance Tuning
- Monitoring and improving SLAs

Failures
- Device Failures
- Network Failures
- Protocol Failures
- Application Failures
AI Based Predictive Analytics
Predict Data Traffic Issues – High response times/Declines in throughput

Goal – Find a host that causes data traffic issues - high response times/decline in throughput
AI Based Predictive Analytics

Predict Data Traffic Issues – High response times/Declines in throughput

➢ Goal – Find a host that causes data traffic issues - high response times/decline in throughput

Slow responding hosts

• FC port buffer is not utilized properly by hosts
• Difficult to find the host.
• Host with highest correlation is the culprit

Noisy neighbor

• Extremely busy volumes create problems for other volumes in the cluster

Correlation using Heatmap

Volume

Host

Pool
Configuration & Log Analytics

✓ Configuration Analytics
  ✓ Different versions of storage devices deployment report
  ✓ Total amount of storage (PB) deployed across the customers
  ✓ Different type of storage devices deployed
  ✓ No. of devices deployed across geo
  ✓ Customers require upgrades

✓ Log Analytics
  ✓ Errors
  ✓ Warning

Elastic - Opensource distributed real time data search and analytics index based database engine with schema free JSON documents
Logstash – Ship logs from any source, parse them, get the right timestamp, index them, and search them.
Kibana – Data visualization engine allows to natively interact with data via custom dashboards
Highly Scalable Platform

Scalability based on Cloud native micro services – Kubernetes & containers

- Application expected to be available 24/7, Frequent Deployment of new versions
- Containers help avoiding downtime
- Kubernetes does container orchestration by managing pods
- Pods can control one or more containers
- Replica sets responsible for specified number of active pods during scale out or in
- Deployment controller changes the actual state to desired state
- Service is an abstraction which defines logical set of pods and policy to access them
Highly Scalable Platform

Scalability based on Cloud native micro services – Kubernetes & containers

- Scale a deployment to fixed number of replicas: `--replicas=10`
- Horizontal pod autoscaling
  - `--min –max –cpu-percent`
- Proportional scaling:
  - support running multiple versions of an application at the same time
  - When rolling update is in progress, balances the additional replicas in the existing active ReplicaSets.
- Exposing the service:
  - NodePort
  - Load Balancer
  - Kubernetes Ingress
Q & A
Thank You