

# APPLYING PERFORMANCE TESTING AND MODELING FOR SELECTION OF THE APPROPRIATE CLOUD PLATFORM DURING DEVOPS

BORIS ZIBITSKER AND ALEX PODELKO



## ABOUT THE SPEAKERS



Boris Zibitsker

- CEO BEZNext
- Manage development of Dynamic Capacity Management Software for Hybrid Multi-Cloud Environments



Alexander Podelko

- Consulting Member of Technical Staff at Oracle
- Focus on Performance Testing and Optimization of Enterprise Performance Management Products
- Board Director at Computer Measurement Group (CMG)

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## OUTLINE

- DevOps Problems we Address
- Performance Testing Strategies
- Performance Measurements during DevOps
- Modeling and Optimization expand results of Performance Testing:
  - Cloud platform selection for new applications
  - **Cost Performance Optimization and Dynamic Capacity Management in the Cloud**
- Summary



## DevOps Problems we Address

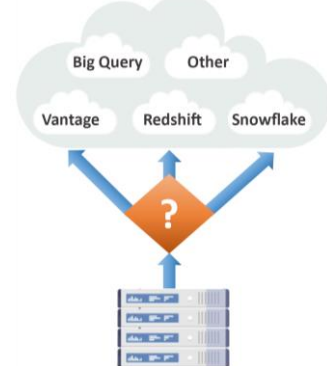
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## BUSINESS PROSPECTIVE

- How new applications will work after deployment in the Cloud and how they will affect performance of existing applications?
- How to select appropriate Cloud platform to meet applications Service Level Objectives with lowest cost?
- How to Effectively Manage Analytics Applications in Hybrid Multi-Cloud Environment?

Cloud Options:  
AWS, Azure, Google, Oracle



Testing New Analytics  
Applications During DevOps

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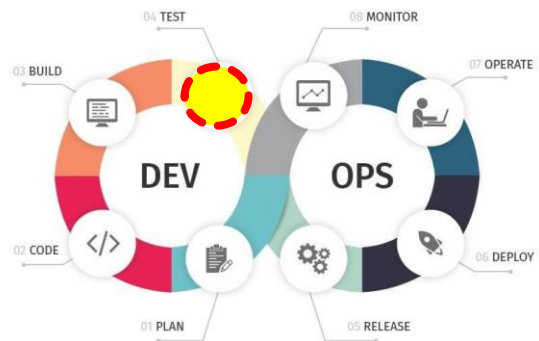


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## TECHNOLOGICAL PROSPECTIVE

- Full scale performance testing during DevOps often is not viable
- Many decisions during DevOps done with high level of uncertainty and risk of performance and financial surprises

Performance Testing During DevOps



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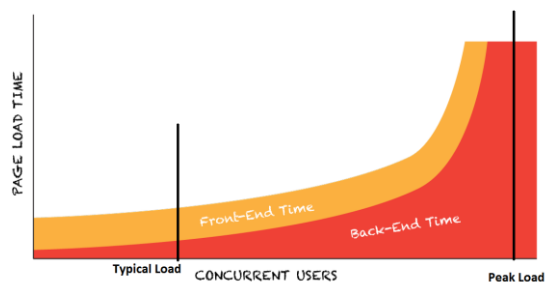
# Performance Testing Strategies



## PERFORMANCE TESTING GOALS DURING DEVOPS

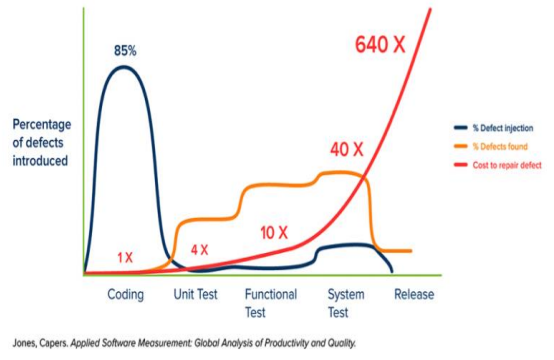
- Confirm that system can handle peak load
- Finding issues early
- Catching regressions quickly

Can the System Handle Peak Load?



## COST OF FIXING ISSUES DURING DEVOPS PROCESS

- Cost of fixing issues during earlier phases of application life cycle is significantly lower
  - Barry Boehm introduced the idea in 1976
  - Early performance testing allows to find costly performance bugs



## TESTING METHODS

New System



Well-Known System

### Goals

- Finding issues early
- Performance optimization / troubleshooting
- Peak load handling
- Finding leaks
- Catching regressions quickly

### Approach

- Exploratory tests
- Targeted tests
- Full-scale realistic tests
- Endurance / longevity tests
- Continuous testing



# ENVIRONMENT, SCOPE

## Environment

- Test vs. Production
- Lab On Premises
- Cloud
  - No more excuse of not having hardware
- Lab vs. Service (SaaS) vs. Cloud (IaaS)
  - For both the system and load generators



## Scope

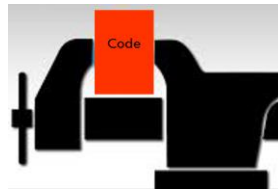
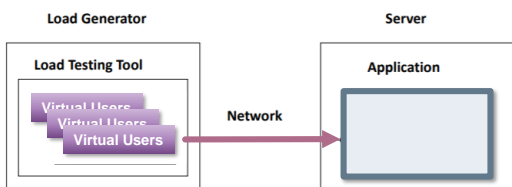
- System
- Sub System
- Component
- Service (Microservice)
- Unit

Testing during DevOps in Multi-Cloud environment

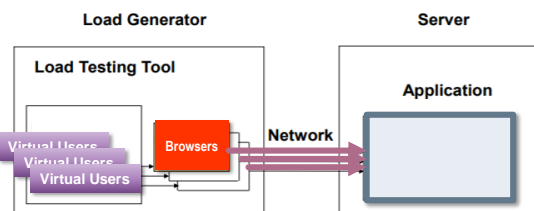


# PERFORMANCE TESTING - LOAD GENERATION

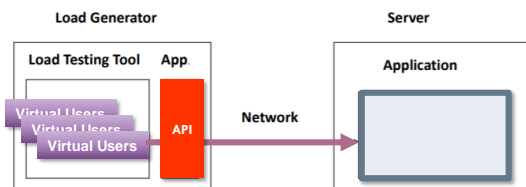
## Record and Playback: Protocol Level



## Record and Playback: UI Level



## Programming



## MOST POPULAR PERFORMANCE / LOAD TESTING TOOLS

### Commercial

- Microfocus LoadRunner family
- Microfocus Silk Performer
- Neotys NeoLoad
- IBM Rational Performance Tester
- RadView WebLoad
- SmartBear LoadNinja

### Commercial on the top of Open Source

- Broadcom/CA BlazeMeter
- Tricentis Flood.io
- RedLine13
- Octoperf

### Open Source

- Apache JMeter
- Gatling
- k6
- Locust



## Performance Measurements During DevOps

# DATA COLLECTION DURING DEVOPS

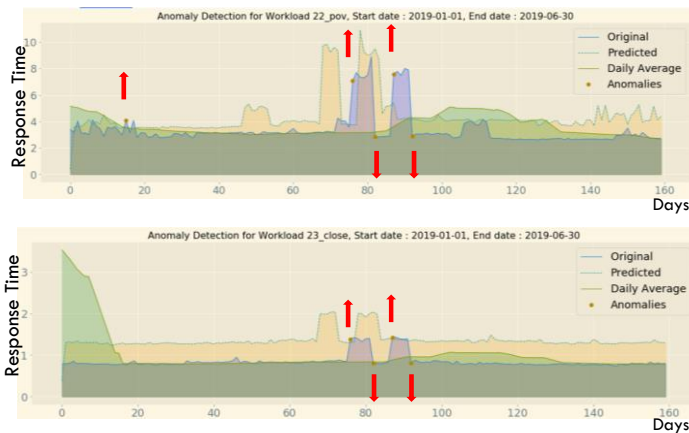
Data Collection During Performance Testing



Measurement Data Types

- Hardware and Software Configuration
- Performance: Response Time & Throughput
- Resource Utilization: CPU, # I/O operations, KB/Request, Memory utilization, Network

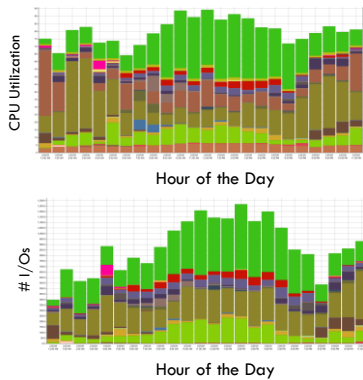
# ANOMALY DETECTION



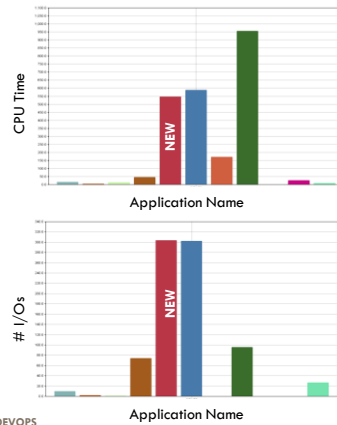


# WORKLOAD CHARACTERIZATION

CPU Utilization and # I/Os by **Production Workloads** During 24 Hours On Prem



CPU Time and #I/Os for **New Application** During DevOps Performance Test



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# VALUE AND LIMITS OF PERFORMANCE / LOAD TESTING

## Value



- Pro-active way to mitigate performance risk
- Early problem detections prevents costly redesigns and delays
- Flexibility – strategy may be optimized for specific context
- Constant stream of performance-related information

## Limits



- Expensive on a high-scale level
- Partial info, lack of a holistic view
- Modeling is a perfect complement
  - Creating a big picture view
  - Answering what if questions and evaluating options
  - Factoring in costs
  - Development proactive recommendations

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# Modeling and Optimization Expand Results of Performance Testing

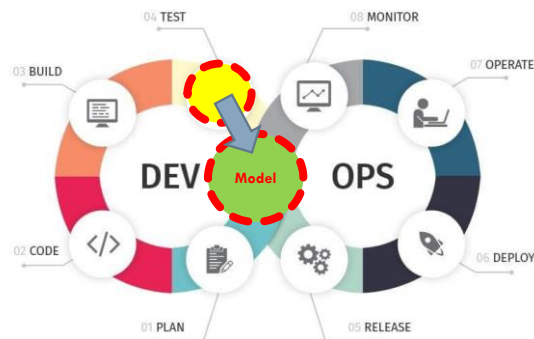


## MODELING AND OPTIMIZATION EXPANDS RESULTS OF PERFORMANCE TESTING

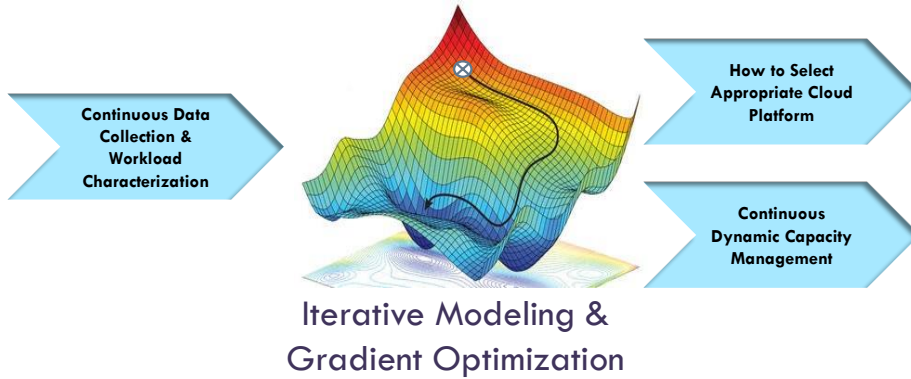
### Closed Loop Control

- Plan
  - Code
  - Build
  - Test
- 
- **Model**
    - Recommendations for App Dev
    - Recommendations for Ops
  - Release
  - Deploy
- 
- Operate / **Verify**
  - Monitor / **Correct**

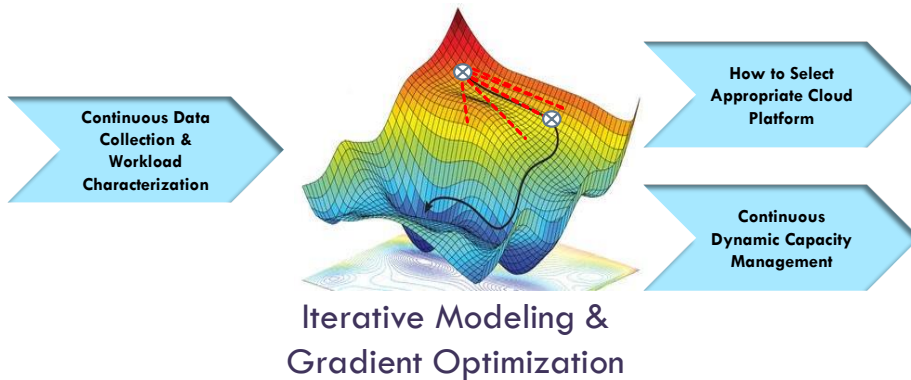
### Modeling Complements Performance Testing During DevOps



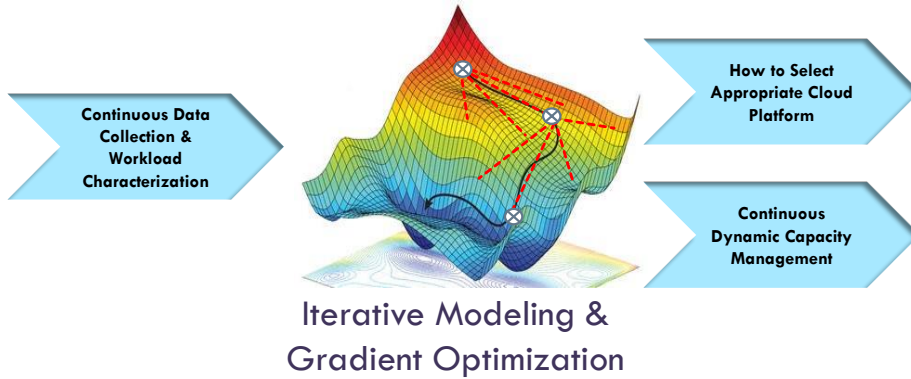
# HOW DOES MODELING AND OPTIMIZATION WORK?



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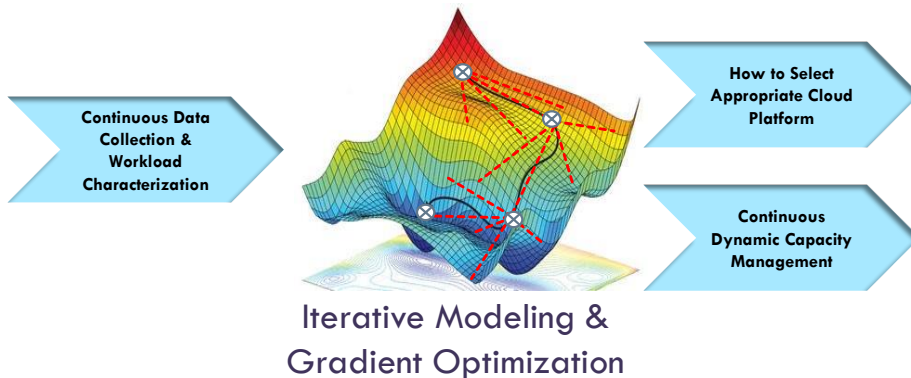


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# HOW DOES MODELING AND OPTIMIZATION WORK?

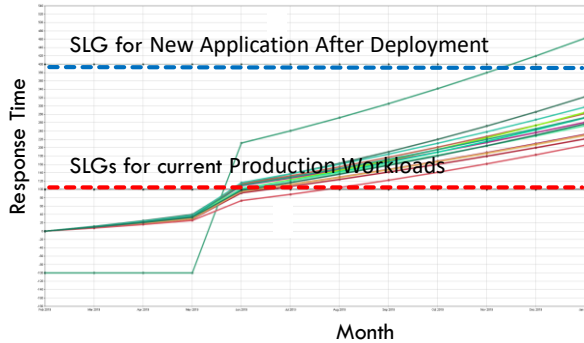
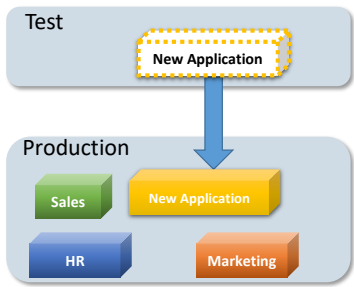


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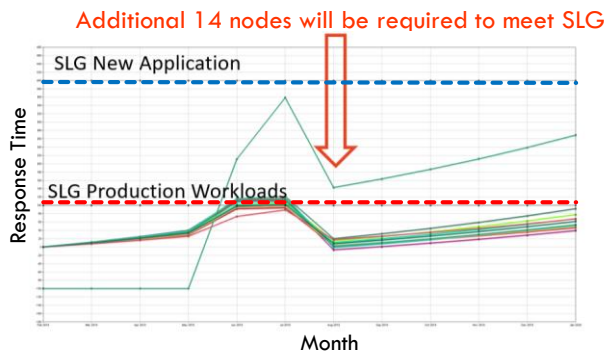
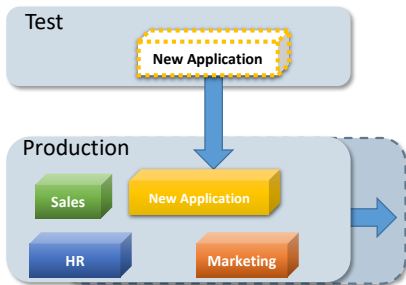


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# HOW WILL NEW APPLICATION PERFORM AFTER DEPLOYMENT ON PREM?

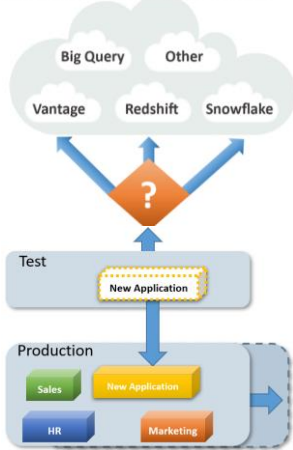


# WHAT WILL THE MINIMUM UPGRADE REQUIRED TO MEET SLG AFTER NEW APPLICATION IMPLEMENTATION ON PREM?



# CLOUD PLATFORM SELECTION FOR NEW APPLICATION

Cloud Options:  
AWS, Azure, Google, Oracle



## BEZNext Approach to Selection of the Appropriate Cloud

- Predict the minimum configuration required to meet SLGs for new Application during DevOps prior to deployment
- Instance type and # of instances which will be required Hour by Hour, Shift by Shift, Month by Month to meet SLGs for New Application on each of the optional Cloud Platform
- Predict cost of running New Application on each of the optional Cloud Platforms
- Select Cloud platform capable to meet SLGs for new and existing growing workloads with the lowest cost

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# Predicted Instance Type and # Instances for each Cloud Required to meet SLGs during next 12 Months

Platform	Instance Type	Shift	Month												Number of Instances/Clusters	
			1	2	3	4	5	6	7	8	9	10	11	12		
Vantage	m4.16xlarge	1st	10	10	10	10	10	10	10	10	10	10	10	11	11	}
	m4.16xlarge	2nd	32	34	34	34	34	34	36	36	36	36	38	38	}	
	m4.16xlarge	3rd	13	13	13	13	13	13	13	13	14	14	14	14		
Redshift	ra3.16Xlarge	1st	52	52	52	54	54	54	56	56	58	58	58	60	}	
	ra3.16Xlarge	2nd	130	130	130	140	140	140	140	150	150	150	150	150		}
	ra3.16Xlarge	3rd	72	74	74	76	76	78	78	80	80	82	82	82		
Snowflake	WK LDS 2XL	1st	5	5	6	6	6	6	6	6	6	6	6	6	}	
	WK LDS 4XL	2nd	3	3	3	3	3	3	3	3	3	3	3	3		}
	WK LDS 3XL	3rd	5	5	5	5	5	5	5	5	5	5	5	5		

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# Predict Monthly and Yearly Cost / Budget to run new Application on different Cloud Platforms

## Cost Assumptions

Instance Configurations	Total		
	Instance Cost per Hour	Instance Cost per Hour	Software Cost per Hour
Vantage m4.16xlarge	\$18.86	\$3.20	\$15.66
Redshift dc2.8xlarge	\$5.52	\$5.52	\$0.00
Redshift ra3.16xlarge	\$13.00	\$13.00	\$0.00
Snowflake 4 WKLDS L	\$48.00	\$48.00	\$0.00
Snowflake 4 WKLDS XL	\$96.00	\$96.00	\$0.00
Snowflake 4 WKLDS 2XL	\$192.00	\$192.00	\$0.00
Snowflake 4 WKLDS 3XL	\$384.00	\$384.00	\$0.00
Snowflake 4 WKLDS 4XL	\$768.00	\$768.00	\$0.00

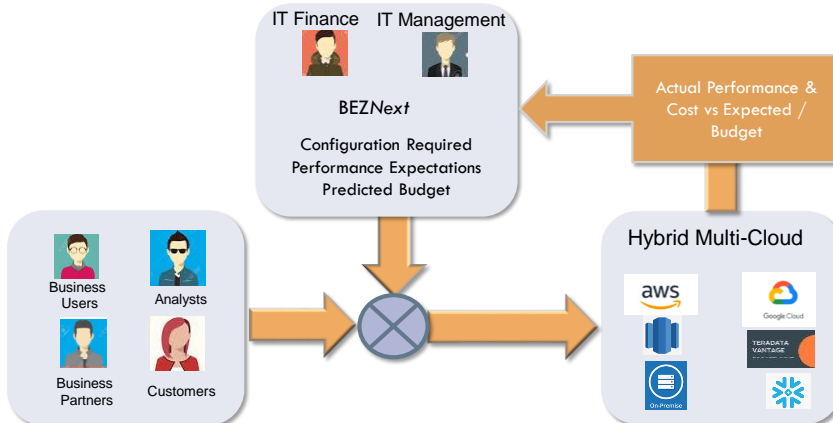
Storage Configurations	Terabyte Cost per 100 Hours
Vantage SSD Attached	\$14.22
Redshift AWS S3	\$3.33
Snowflake AWS S3	\$3.19

Month	1	2	3	4	5	6	7	8	9	10	11	12
Vantage	Hidden are Customer's Specific Data											
Redshift												
Snowflake												

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# COST PERFORMANCE OPTIMIZATION AND DYNAMIC CAPACITY MANAGEMENT FOR HYBRID MULTI-CLOUDS

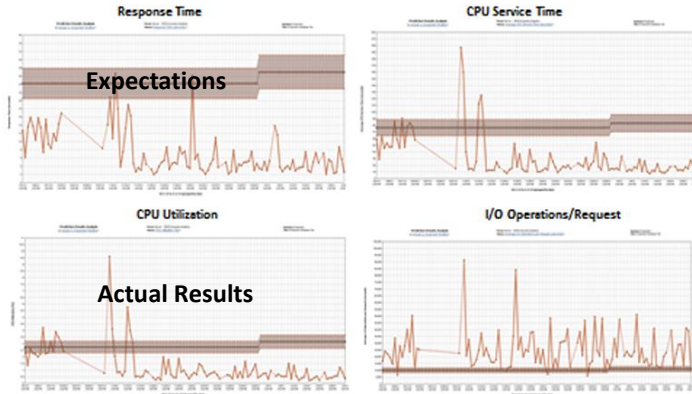


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# AUTOMATIC RESULT VERIFICATION

COMPARING ACTUAL COST / PERFORMANCE RESULTS FOR EACH WORKLOAD AND CLOUD WITH EXPECTED



Monthly Performance Actual vs SLG  
% of time SLG were NOT met

	Vantage	Snowflake	Redshift	On Prem
Sales	5%	3%	NA	0
Marketing	0	0	3%	2%
Finance	0	10%	NA	0
HR	0	0	3%	0

Monthly Cost vs Budget  
% over the Budget

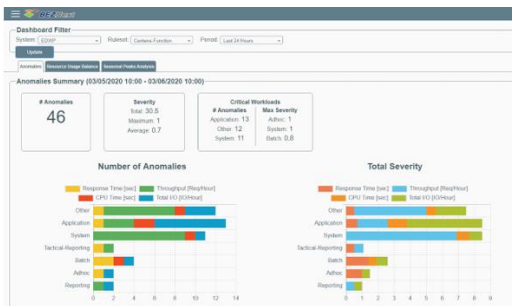
	Vantage	Snowflake	Redshift	On Prem
Sales	2%	5%	NA	0
Marketing	0	3%	4%	0
Finance	0	5%	NA	0
HR	0	0	0	0

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# Anomaly Detection and Root Cause Determination

## ANOMALY DETECTION



## ROOT CAUSE DETERMINATION

**Anomalies Summary**

Time	Workload Name	Parameter Name	Amplitude	Severity	# of Root Causes
02:00	Adhoc	Response Time [sec]	697,176	1	3
13:00	System	Throughput [Req/Hour]	6,031	1	1
14:00	System	Throughput [Req/Hour]	9,430	0.9	3
18:00	System	Throughput [Req/Hour]	12,359	0.9	1
03:00	Batch	Response Time [sec]	13,033	0.8	3
18:00	Other	Throughput [Req/Hour]	225,277	0.8	1
21:00	System	Throughput [Req/Hour]	7,608	0.8	1
22:00	System	Throughput [Req/Hour]	8,704	0.8	1
16:00	System	CPU Time [sec]	25,340	0.8	1
00:00	Other	Total I/O [GB/Hour]	176,985,895	0.8	3

**Root Causes Summary**

Workload Cause	Parameter Cause	User Cause	Program Cause	# Anomalies Caused	Total Severity	# Workloads affected
System	Throughput [Req/Hour]	SPY200A	ADWAP0010	17	8.04	1
Application	Throughput [Req/Hour]	CMPL_APP_USER	JDBC16.20.00.06.1.8.0_212	8	3.88	1
Other	Throughput [Req/Hour]	CNCR_DATA_XCHNGE_ETL_USER	PL0700	8	3.75	1
Other	Throughput [Req/Hour]	CNCR3004	SAS	3	2.30	1
Other	Throughput [Req/Hour]	CNCR_DATA_XCHNGE_ETL_USER	PL0700MVC2	3	2.28	1
Other	Avg CPU Time [sec]	HE_APP_USER	JDBC15.10.00.22.1.8.0_202	4	2.24	1
Other	I/O Rate [GB/Hour]	CLOUD_ETL_USER	JDBC16.20.00.02.1.8.0_171	3	1.79	1
Tactical Reporting	Throughput [Req/Hour]	DNCR00LS	SQLA.NET.SS.19.20.04.000	2	1.69	1
Other	I/O Rate [GB/Hour]	CNCR1616	SQLA.NET.SS.19.20.04.000	2	1.33	1
Other	Avg CPU Time [sec]	CNCR4010	SQLA.NET.SS.19.20.03.000	2	1.33	1

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# SEASONALITY DETERMINATION

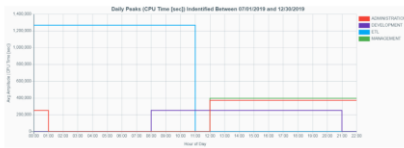


Figure 17. Daily Peaks Graph

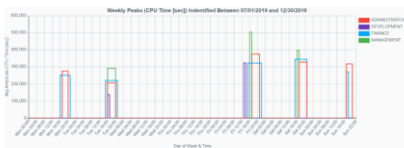


Figure 18. Weekly Peaks Graph

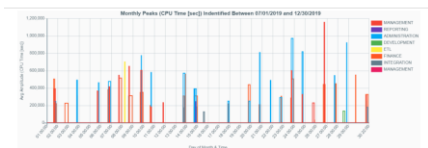


Figure 19. Monthly Peaks Graph

## Seasonal Peaks Determination Results

Seasonal Peaks (CPU Time [sec]) Identified Between 07/01/2019 and 12/30/2019

Show 1 to 15 of 63 entries

Workload Name	Parameter Name	Peak Type	Peak Start Date	Duration (hours)	Avg Amplitude	Standard Deviation	Min Value	Max Value	95 Percentile	Peak Length STD
ADMINISTRATION	CPU Time [sec]	Daily	07/01 00:00	1	253,530	266,920	4,268	1,495,643	816,154	0.00
ADMINISTRATION	CPU Time [sec]	Daily	07/01 12:00	12	370,442	456,135	448	3,202,553	1,176,433	0.00
ADMINISTRATION	CPU Time [sec]	Weekly	07/01 17:00	3	274,966	300,165	3,906	1,436,712	785,206	0.00
ADMINISTRATION	CPU Time [sec]	Weekly	07/02 16:00	4	297,969	250,607	3,525	926,795	746,653	0.00
ADMINISTRATION	CPU Time [sec]	Weekly	07/05 17:00	4	375,963	504,680	4,965	2,233,627	1,483,880	0.00
ADMINISTRATION	CPU Time [sec]	Weekly	07/06 17:00	4	327,697	358,909	4,764	1,304,506	1,059,678	0.00
ADMINISTRATION	CPU Time [sec]	Weekly	07/07 17:00	3	317,961	301,077	4,771	1,800,044	876,820	0.00
ADMINISTRATION	CPU Time [sec]	Monthly	07/01 18:00	4	246,417	197,743	3,852	964,970	516,313	0.00
ADMINISTRATION	CPU Time [sec]	Monthly	07/03 18:00	2	490,207	469,369	8,947	1,416,336	1,301,702	0.00
ADMINISTRATION	CPU Time [sec]	Monthly	07/05 19:00	1	481,822	411,363	27,417	1,213,373	1,091,037	0.00

Showing 1 to 15 of 63 entries

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## Key Takeaways



APPLYING PERFORMANCE TESTING AND MODELING FOR SELECTION OF THE APPROPRIATE CLOUD PLATFORM DURING DEVOPS



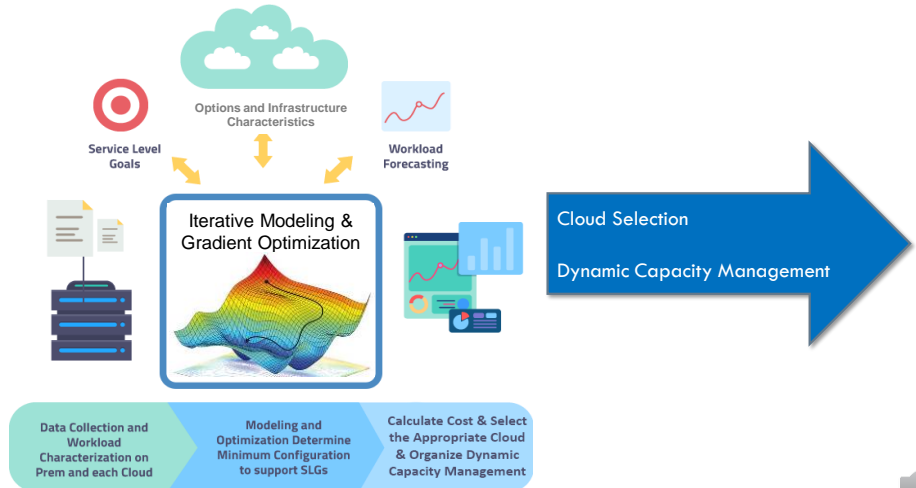
# KEY TAKEAWAYS

- Modeling and Optimization compliments Performance Testing during DevOps
- Reduce time and cost of Performance Testing, finding Anomalies and Root Causes
- Evaluate options and recommend performance management measures
- Takes Days instead of Months to select appropriate Cloud Platform
- Enables organization of Closed Loop Dynamic Capacity Management for Hybrid, Multi-Cloud environment
- Reduce uncertainty and risk of performance and financial surprises.



# KEY TAKEAWAYS

## ITERATIVE MODELING AND GRADIENT OPTIMIZATION FINDING MINIMUM CONFIGURATION REQUIRED MEETING SLGS WITH LOWEST COST





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# THANK YOU! QUESTIONS?



[bzibitsker@beznext.com](mailto:bzibitsker@beznext.com)  
[apodelko@yahoo.com](mailto:apodelko@yahoo.com)