Vāyu
The Lord of the Winds

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Application management: The Shift

Cloud:
- Minutes
- Automatic

Observe/Estimate performance and demand

Deploy

Capacity Planning
Application management: The cloud promise

- Availability and Performance
- Cost optimization
- Resource optimization

The Danger!

“Not understanding how an application behaves under load may result in an ineffective or even destructive auto scaling configuration.”

Netflix blog
Vayu

Automatically *learns* cloud application behavior and analyzes the tradeoffs between:

- Demand
- Performance
- Cloud cost
A large flower online retailer is deployed in the cloud.
Joe, the app manager, is doing February’s budget planning using Vayu.
He sets the cloud providers to compare.

He sets special scenarios for special days.
He runs the analysis with the scenarios chosen.
Vayu runs on the different cloud vendors, learning the site’s behavior.
Vayu informs Joe when done
Vayu summarizes overall cost + performance
... and for particular days
Joe can check what if scenarios...
... on various parameters
John, the deployment manager, views the sizing analysis based on Joe’s choices... and applies them to production!
VAYU: How

Demand → Application

Application Monitoring

Performance Problem Detection & Characterization

Action Learning

Action Recommendation

Vayu Knowledge Base
Performance Problem Detection & Characterization

Metric normal behavior learning

Anomaly Detection
Combines temporal metric deviation patterns with topological information

Anomaly Fingerprint Representation
Representation of anomaly as a graph
Metric normal behavior learning

Statistical baseline algorithm:
• Automatic seasonal pattern detection
• Automatic trend detection
• Adaptive
• Zero configuration
Why detect season?

46,000 different monitors (business + system)
Seasonality Detection Algorithm

- Iterate over a set of possible seasons.
  
  0, 1, 2, 3, 4 ..... 12....24.....36......48.....168 (hours)

- For each possible season compute the **likelihood** of the season to be present in the data

- **Choose the season which maximizes the likelihood** (minimizes the negative likelihood)
Algorithm properties

- Applies to real-valued and discrete metrics.
- High robustness to noise.

Example of noisy signal (-23dB), 2 hour seasonality was correctly detected.
Algorithm properties

- High robustness to missing data.
  Example of noisy signal (−15dB), 12 hour seasonality, and 50% missing data. Season was correctly detected.
Anomaly Detection

- Keep track of all metrics exceeding their baseline
- Group related metrics exceeding their baseline using the topology.
- Compute the probability that the abnormal behavior is significant to determine if to open an anomaly incident

\[
Significance(A) = 1 - \text{Prob(Normal behavior given observed abnormal metrics and topology)}
\]

Achieved reduction of events from 1500 to 35 at customer site!
Action Learning

Classify
- K-Nearest Neighbor
- Topology based distance
- Cost sensitive classification

Apply
- Most likely action executed
- Vayu observes effect on problem

Learn
- Store positive effect
- Store negative effect and take next most likely action
Summary