



# PREDICTIVE AND SELF-HEALING DATA CENTER MANAGEMENT

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## **Introduction**

Existing Data Center Monitoring and Reporting tools can only raise an alert after the problem has occurred in the data center. Root Cause Analysis (RCA) is done only after the issue is raised. This leads to reactive rather than pro-active troubleshooting or customer service.

There are multiple sources from which Network/Storage/Virtualized IT resource utilization event details can be obtained. The information gathered is used to generate reports on these observed events which give the details of problems that occur in a production setup. However, extending this data usage to the next level enable predictions to be made based on the observed events and statistical parameters, analyze the impact on the data center, and alert the user before users or service is impacted. With this new model, we can become aware of the problem in advance by applying statistical analysis on network and storage parameters. The prediction will be used to take corrective action on the data center before service is impacted. It's similar to taking precautionary action before a storm occurs in a city.

## **Why now?**

Data center infrastructure has moved to software-defined data centers to deliver new capabilities quickly for business advantage and competitive edge. Due to data center consolidation and rapid data explosion, a huge amount of data is available in the customer environment for data analysis. There is a greater need for value-added and analytical services on the available Big Data than ever before. EMC is in a unique position with products and platforms such as Greenplum<sup>®</sup>, Pivotal initiatives, and open source APIs for developers on technologies such as Hive, Hadoop, and others. Meanwhile, EMC Infrastructure solutions have a unique combination of products such as Smarts, NCM, Vcops, and Watch4net. The data from each of these products is part of the data center and there is a need for integrating, analyzing, predicting, and self-healing customer problems pro-actively and with speed.

## **Solution**

### **Modeling using Smart**

- Events and performance metrics are collected from network/storage/virtualized infrastructure by Watch4net using standard protocols such as SNMP/SMI-S/REST.
- Modeling of IT infrastructure will be done using EMC Smarts ICIM model, which explains the relationship and dependency between the network/storage/virtualized infrastructures. The modeling will consider the relationship with other objects, event condition, associated problems, symptoms, and thresholds.
- The model will self-learn based on the trending data and apply analytics to predict behavior of performance metrics in real-time.

### **Hive / Hadoop / R processing**

- Historical performance trending data and object model relationships will be fed into a Hive DB through the Hadoop framework. A Correlation engine which uses R Model will obtain the inputs from Hive DB to analyze the current retrieved metrics against historical metric records and events.

### **Prediction & Statistical Analyzer**

- Prediction Engine in statistical analyzer will make predictions on behavior of performance metrics, based on forecasting formulas and probability statistics. A predicted event will be raised based on statistical analysis and will provide detail about impacted objects in the data center network.

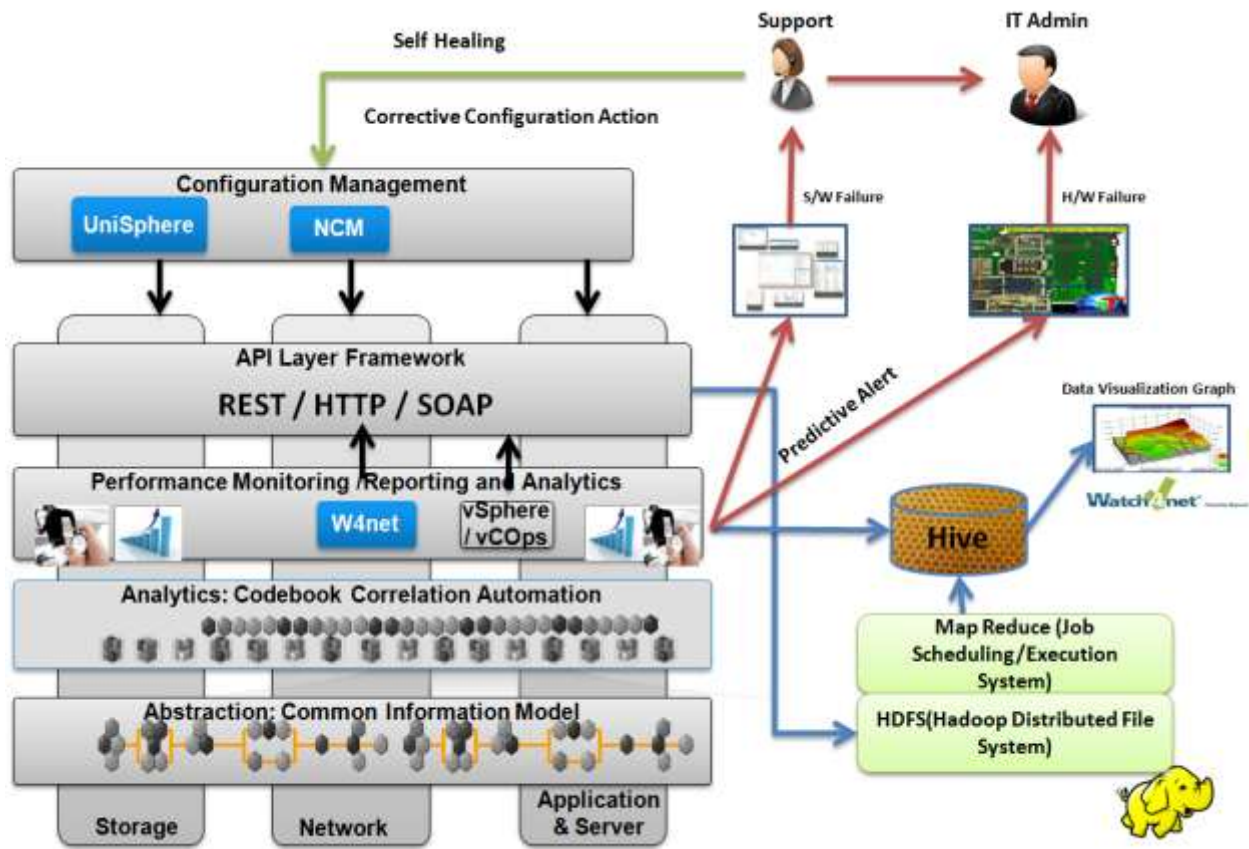
### **Data Visualization**

- With a new Watch4net report pack, Data Visualization graphs will be integrated for customers to visualize the statistical data available in their data center. The report pack will implement new graphs for visualization techniques like binomial distribution, frequency distribution, histograms, cumulative plots, etc.

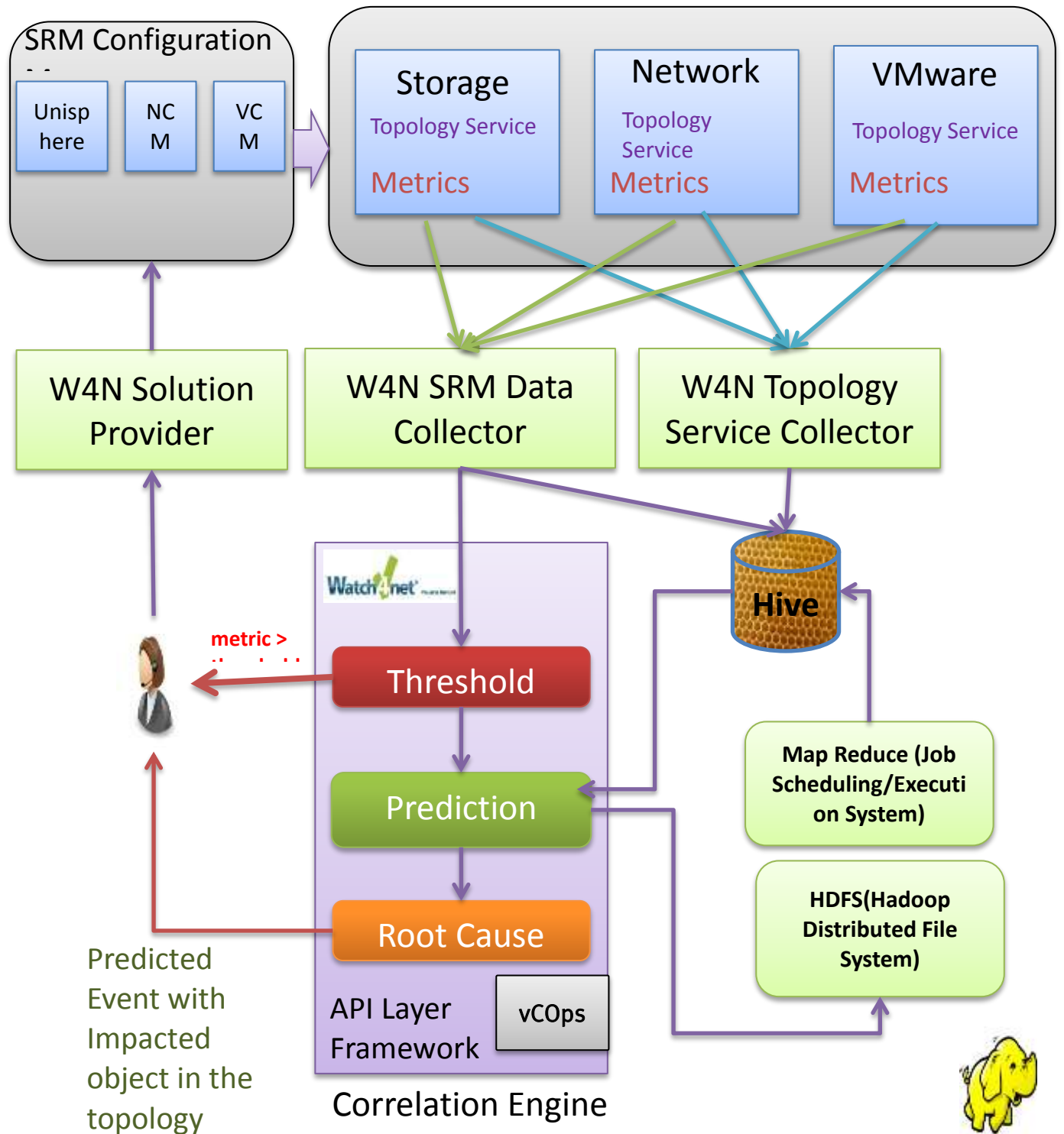
### **Self-Healing**

- Once the prediction alert is raised in the system, corrective action can be applied on the device through NCM/Unisphere/REST API commands execution with the prior approval from the administrator.

# Proposed New Model for the Statistical Analysis

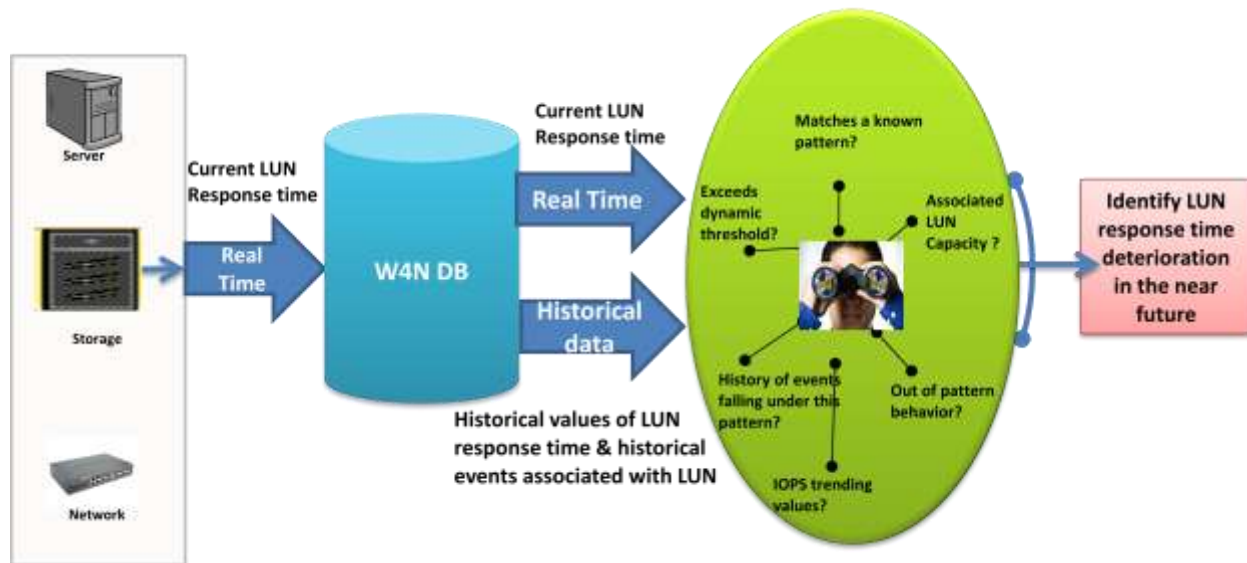


## Work Flow





## Prediction of deterioration of LUN response time



## Benefits

- Critical issues such as Device Down state can be handled smartly.
- Rather than performing RCA analysis after facing an issue, this new model will help avoid critical unexpected issues.
- Predicting problems ahead of time and providing proactive solutions rather than reactive fixes.
- Quick corrective actions can be taken based on the prediction to avoid issues in the data center.
- Historical trending data is utilized to predict patterns.
- Reduced downtime cost per year and data center maintenance cost.
- Increased reliability of data center components due to early prediction of issues and correction.
- Networks, storage, and virtual infrastructure inside a data center will be better prepared to handle flood of events, latency issues, and breakdowns.
- Better customer satisfaction drives product revenues.
- Improves business-critical application availability.

## **Conclusion**

With the proposed new model, most issues will be identified ahead of time and can be proactively resolved before impacting the environment. With this proactive approach, downtime can be reduced.

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