The Beginner's Guide To RAIN & Fog

WHITE PAPER

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The beginner's guide to RAIN & Fog

Abstract

Every business today uses the internet. This naturally involves the use of networks. The network is an interconnection of multiple devices, termed as hosts connected using multiple paths for the purpose of transmission and reception of data. When the centralized server fails, the organization's data is at risk. The performance of the entire network degrades when control plane processes fail, as is the case when routing convergence requires additional memory.

These challenges compromise network performance, thereby creating a need for an architecture that combines standard computing and networking hardware with management software to create a system that is more distributed and scalable.

This whitepaper identifies the challenges faced by IT professional's inefficient migration of business applications to Cloud, and provides an efficient business strategy for delivery of application transformation. Additionally, the white paper addresses different cross-slicing issues that are integral to application transformation.

Most organizations today run on the internet. From marketing and sales to IT infrastructure and operations, everything involves the internet. However, there are challenges organizations face when using networks. For starters, failure of a centralized server can put the availability of an organization's data at risk. Secondly, bottlenecks are created in the network when devices with insufficient processing power receive data which is more than they can handle. These two challenges diminish the reliability and performance of the network. Hence, a network architecture that promises resilience is now needed. This is where the Reliable Array of Independent Nodes (RAIN) architecture comes in.

What is Rain?

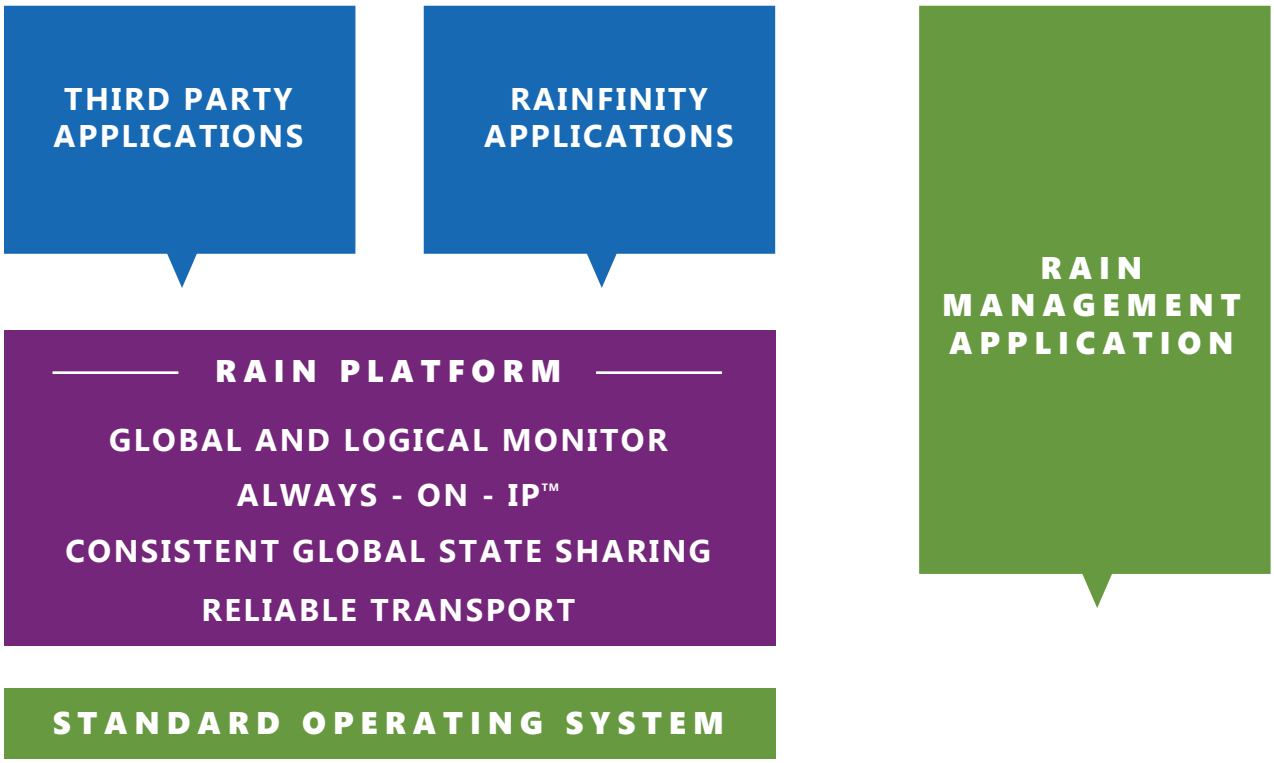
RAIN is a technology platform that consists of a diverse cluster of storage and/or computing nodes which are connected with multiple interfaces to networks. These networks are configured using fault-tolerant topologies.

RAIN removes the client-server relationship between different nodes in the network by making them independent and more robust. Instead of some nodes depending on others, all nodes are active and can participate in load balancing. Any node can fail-over to any node. A RAIN cluster can tolerate multiple nodes, link or switch failures, as long as at least one node is healthy, thus having no single point of bottlenecks or failures. This is because the fault tolerance is software implemented. The goal of RAIN is to ensure continuous data availability even in times of server failure.

RAIN employs highly efficient, consistent state sharing and decision-making protocols so that the entire cluster can function as one system. To achieve this, it focuses on identifying and developing key building blocks for distributed computing systems to provide efficient, reliable distributed computing and storage systems using off-the-shelf components. The key building blocks include information stockpiling, storage, fault tolerance & management, and communication.

A few applications actualized on the RAIN building blocks include a video server (RAINVideo) based on communication and storage components, a web server (SNOW-stable network of web server) based on fault management, and a distributed checkpointing framework (IOU) based on leader election protocol and storage components.

Architecture



Another case that can increasingly benefit using RAIN architecture and building components in today's era is the cloud. Today's IT infrastructure has essentially moved towards the cloud as it can handle large amounts of data efficiently across the globe. However, when it comes to the internet of things (IoT), most cloud models are not designed for the extent, range, and velocity of information that IoT generates due to limited bandwidth. As a result, there is a need to process data at the source and edge of the network.

The way RAIN enhances the ability of the cloud to handle and process these large amounts of data is using Fog computing.

What is Fog computing and how does it work?

Fog is a hybrid system-stage structure approach wherein the possibilities of cloud computing and allotted processing and analytics power are introduced to the brink or edges of a network. Fog computing moves the application, storage, data computing, and decision making away from the central nodes towards the logical and edge nodes of the network. When it comes to cloud and IoT, it enables a few operations to be performed in nodes called Fog nodes placed in proximity to the IoT devices or data sources, applications, and the edges of the network.

Fog computing offers several benefits such as effective utilization of available bandwidth without unnecessarily increasing the bandwidth or the price associated with it, low latency on the network, fewer bottlenecks, a discounted risk of connectivity disasters, deeper insights with greater privacy control and security, and greater business agility.

RAIN & Fog - A solution for future IoT, Cloud Applications

RAIN technology is the most scalable software cluster technology for the Internet marketplace today as there is no limit on the size or the performance of a RAIN cluster. Moreover, a RAIN cluster employs highly efficient consistent state sharing and decision-making protocols

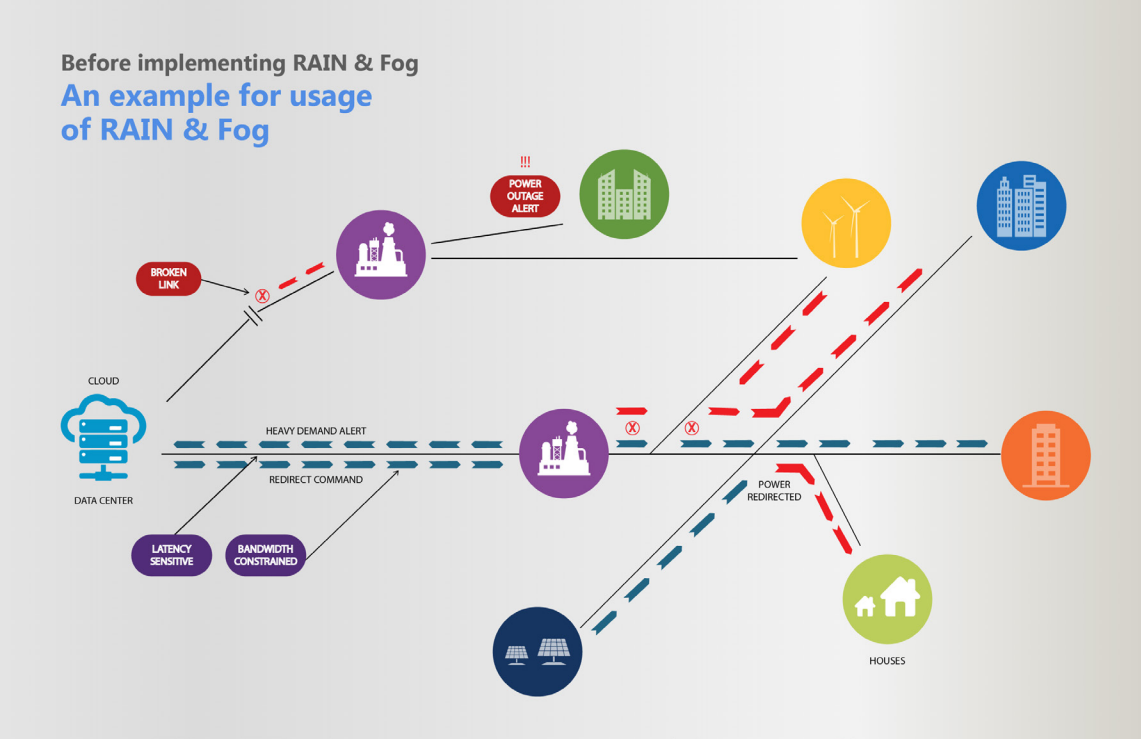
The Internet of Things (IoT) is rapidly becoming a reality. However, like any emerging technology, IoT devices and core processing platforms are often resource-constrained, making security and trust a challenge. This is where RAIN and Fog computing can offer a solution for availability, reliability and a frictionless log-on experience to organizations.

This sort of outage, bandwidth and latency issues can be avoided using RAIN and Fog architecture. RAIN's architecture can be used to eliminate any sort of broken links and hence, power outage. Additionally, the data center cloud can be connected to different Fog centers which are further connected to different RAIN systems, thus avoiding latency and bandwidth issues.

An example for usage of RAIN & Fog

Before implementing RAIN & Fog

Consider a smart power grid consisting of different power generation systems and several miles of high-voltage as well as low-voltage power lines with distribution transformers that connect thousands of power plants to millions of customers across a region. In such a scenario, any sort of broken link from the central power grid can lead to a power outage in a particular area.



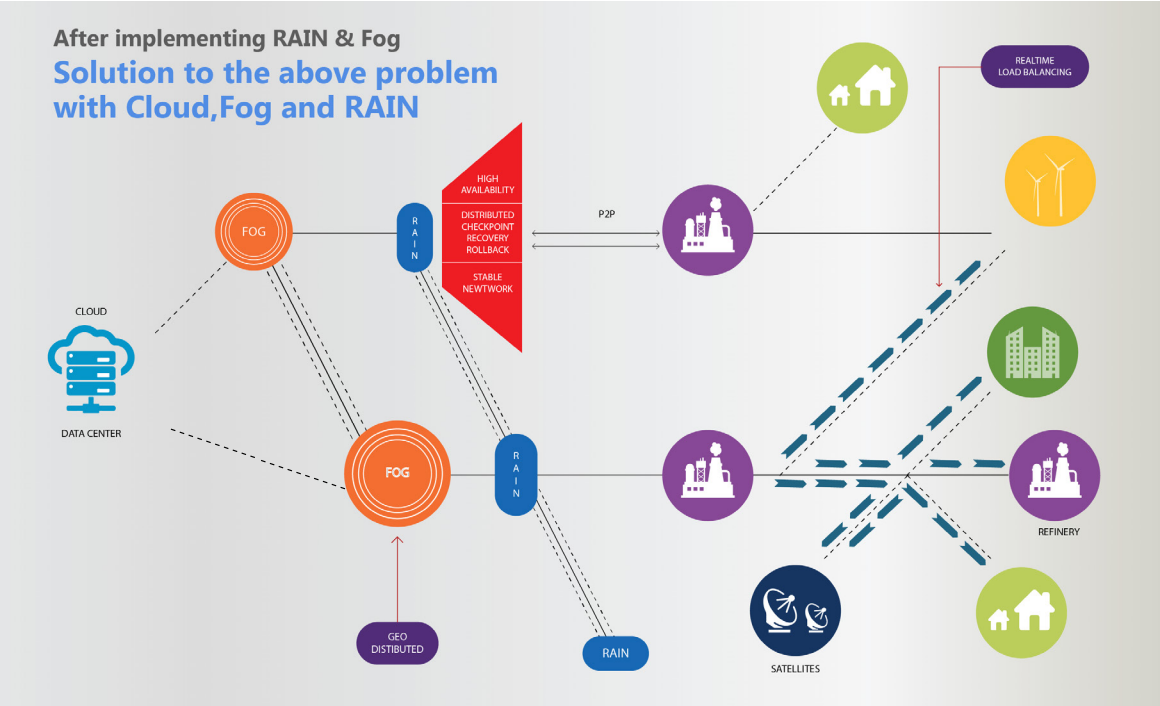
Here electrical, cloud data center, wind mills & solar power systems provide electricity to different areas – homes, offices, factories as shown above point 1,2,3. Point 4 shows a broken link from center thus leading to a power outage in a building. This outage can be avoided using RAIN.

Also, due to one datacenter fulfilling requests for all the systems, there is a bandwidth and latency issue. This bandwidth and latency issue can be avoided using Fog.

After implementing RAIN & Fog

Solution to the above problem with Cloud,Fog and RAIN

In the diagram, RAIN will avoid outages due to a broken link owing to its inherent architecture features. Datacenter cloud is connected to two different Fog centers, which are connected to different RAIN systems avoiding latency and bandwidth issues. Fog will analyze all the requests of electricity through RAIN.



Here RAIN is behaving like an application, where a request is made and is fulfilled if it is available, if not it will approach the Fog center to fulfill the request. Fog acts as an intermediate layer between the Edge devices and the Cloud. Edge devices request storage and communication services from the Fog and persistent storage to the cloud that will be communicated consequently as per demand and failover.

This example addresses security concerns, trust mechanism, stability transmission and availability distribution in the areas of electricity generation and provides a frictionless, secure log-on experience with location-related benefits.

Conclusion

RAIN is a technology platform that is developed to increase fault tolerance in a network by removing the primary dependence on one central node, and instead uses different nodes to improve resilience.

In the modern era, cloud and IoT can hugely benefit from the RAIN platform. While cloud is designed to handle massive data from IoT clusters, it presents a challenge of latency due to limited bandwidth. Considering the fact that increasing the bandwidth continuously may not be a viable solution, an additional layer of Fog computing on RAIN eliminates bandwidth and latency-related issues. In essence, a combination of RAIN and Fog computing in cloud technology can make network 99.9% reliable while reducing the traffic and offering a fast response.

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About the author

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Ravi Prakash is a Senior Lead Architect for Cloud, DevOps and Middleware practices at Microland and is responsible for conceptualizing and building various technology service offerings. With close to a decade of experience in the IT industry, Ravi has played a pivotal role in IT R & D, Technology Consulting, offering creation, transition of complex areas and service delivery. Ravi also works closely with several customer-facing teams as an advisor for engagements involving middleware, DevOps and cloud services, including consulting and assessments, implementation, transformation and operations.

Ravi's other responsibilities include building service capabilities in the areas of Digital Workplace, Middleware, Cloud-API Management, DevOps-API Management and Application Optimization. In this role, Ravi brings in innovative ideas, strategic technology and initiatives that aim to improve the employee experience with various technology solutions.
He is a Microsoft Azure Solutions certified architect, AWS Technical Professional certified, ITIL®V3 Foundation Certified and is also certified by International Leadership and Organizational Behavior, Bocconi University.

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About Microland

Microland accelerates the digital transformation journey for global enterprises enabling them to deliver high-value business outcomesand superior customer experience.Headquartered in Bangalore, India, Microland has more than 3,800 professionals across its offices in Australia, Europe, India, Middle East and North America. Microland partners with global enterprises to help them become more agile and innovative by integrating emerging technologies and applying automation, analytics and predictive intelligence to business processes.

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