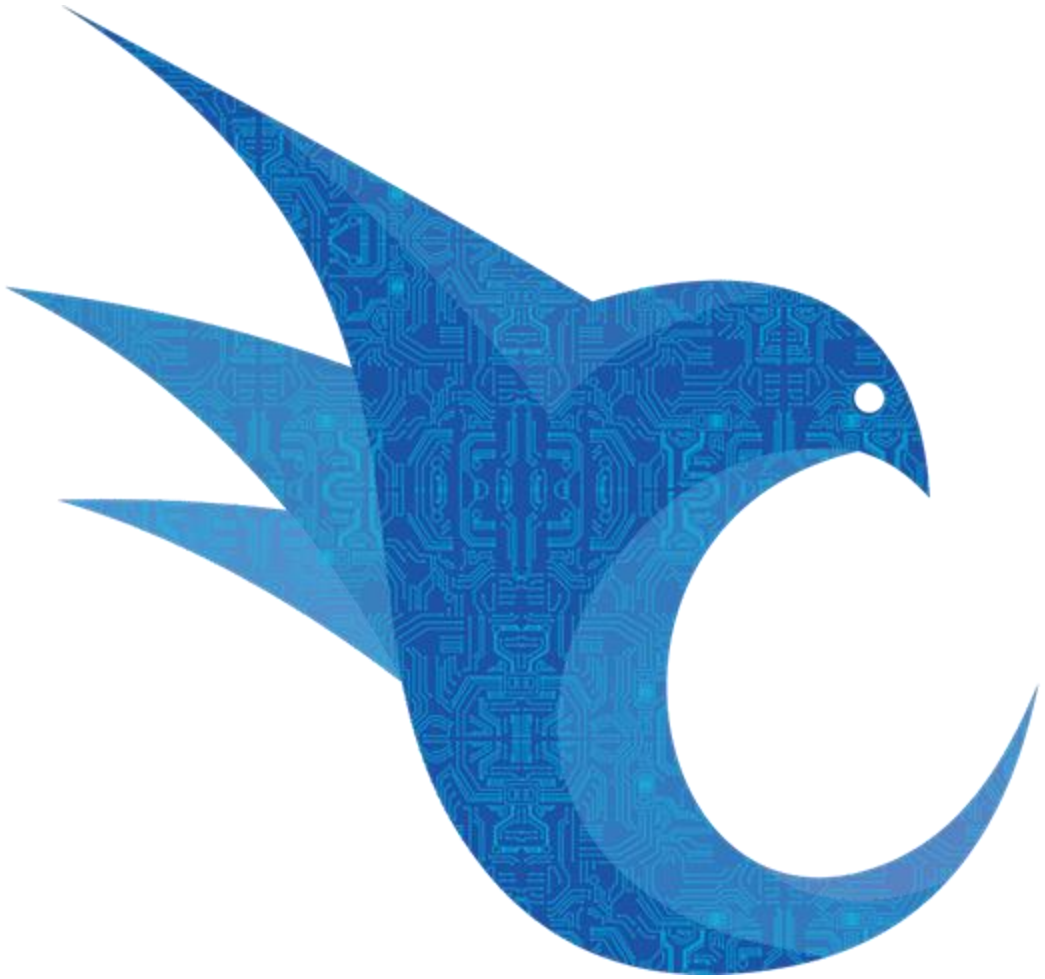


Introduction to OpenResty Edge

OpenResty Inc.

2024.3

Request a free trial of OpenResty Edge

What is OpenResty Edge

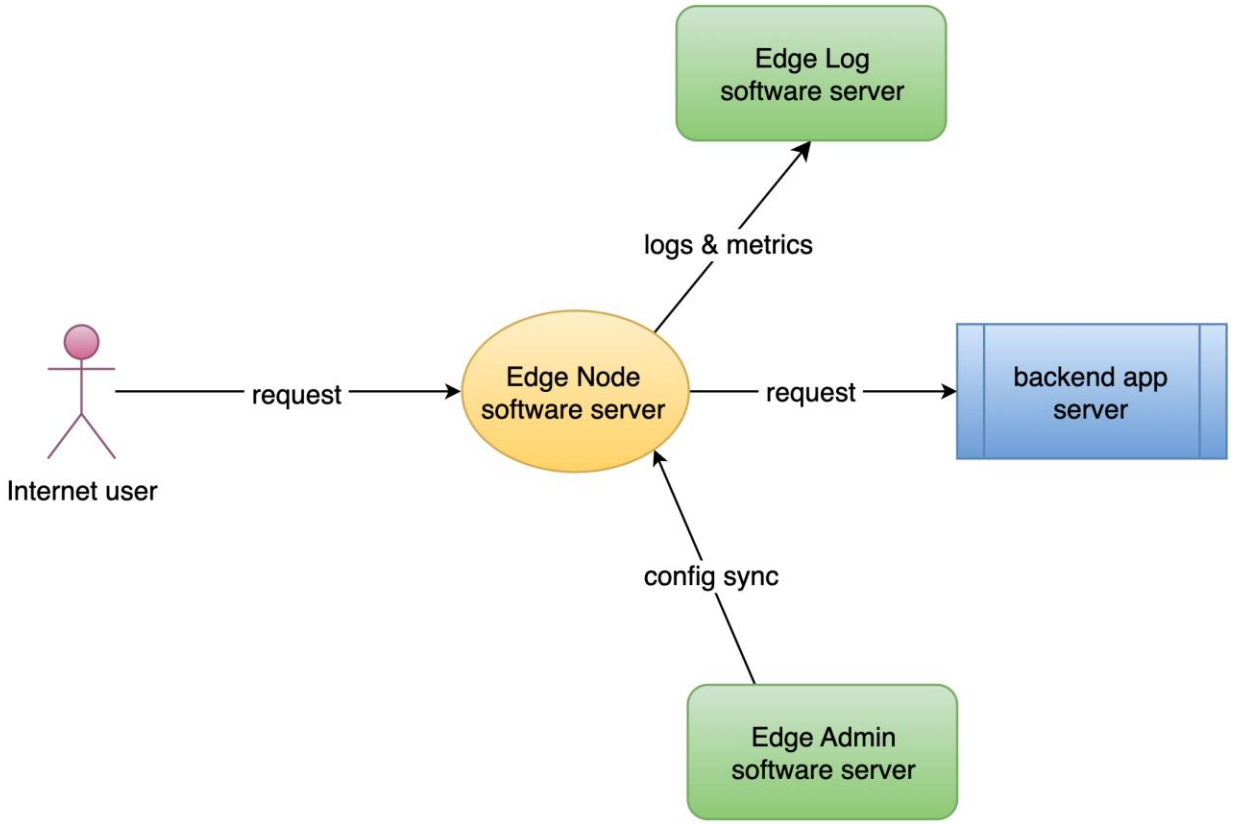
- Enterprise-level distributed traffic management platform for business-critical applications
- Next-generation management platform for multi-cloud and hybrid organizations
- Enterprise-level traffic management and load-balancing software
- API gateway software
- Distributed private CDN software
- Web firewall (WAF) software

Created by OpenResty open-source author Yichun Zhang

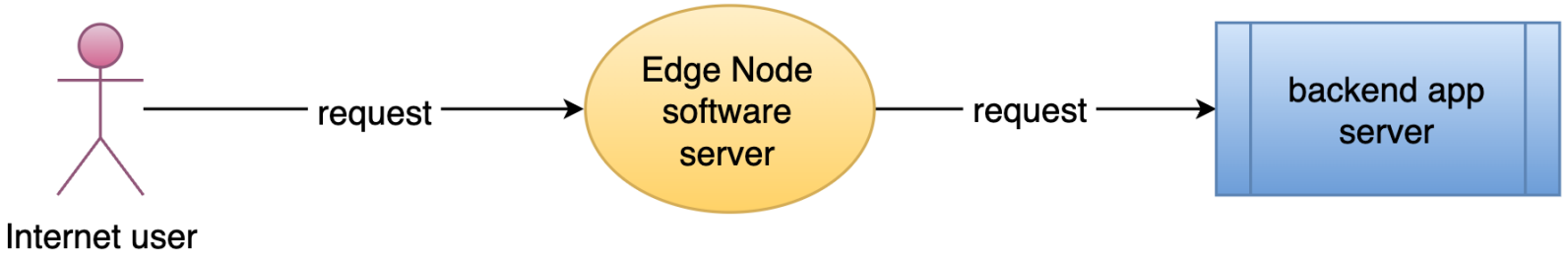
- Based on the mature open source OpenResty technologies.
- OpenResty open-source has 40 million users worldwide.
- Ranked No. 3 in the global server market share.
- Uses various leading proprietary technologies and algorithms invented by the OpenResty Inc. company.

Composition of the OpenResty Edge

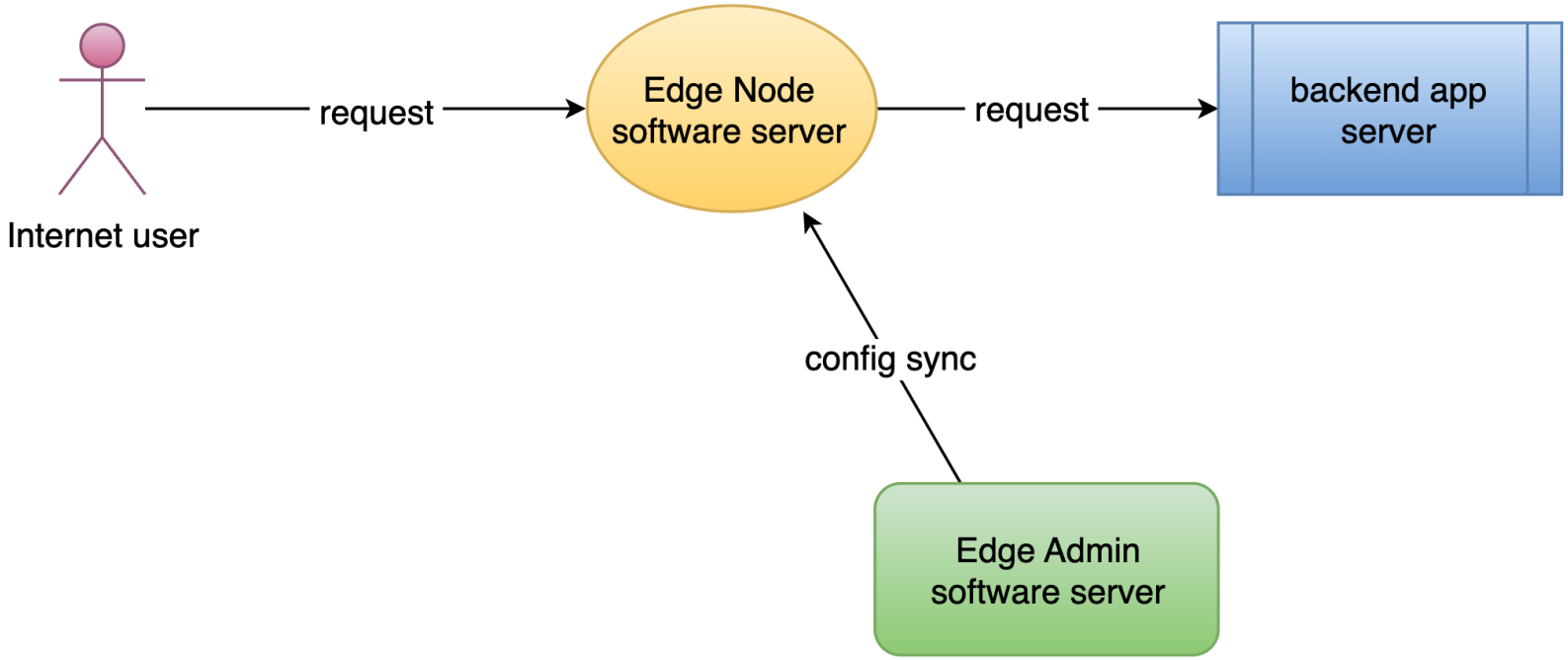
- Edge Node
- Edge Admin
- Edge Log Server



On the highest level, the Edge Node software is a traffic proxy

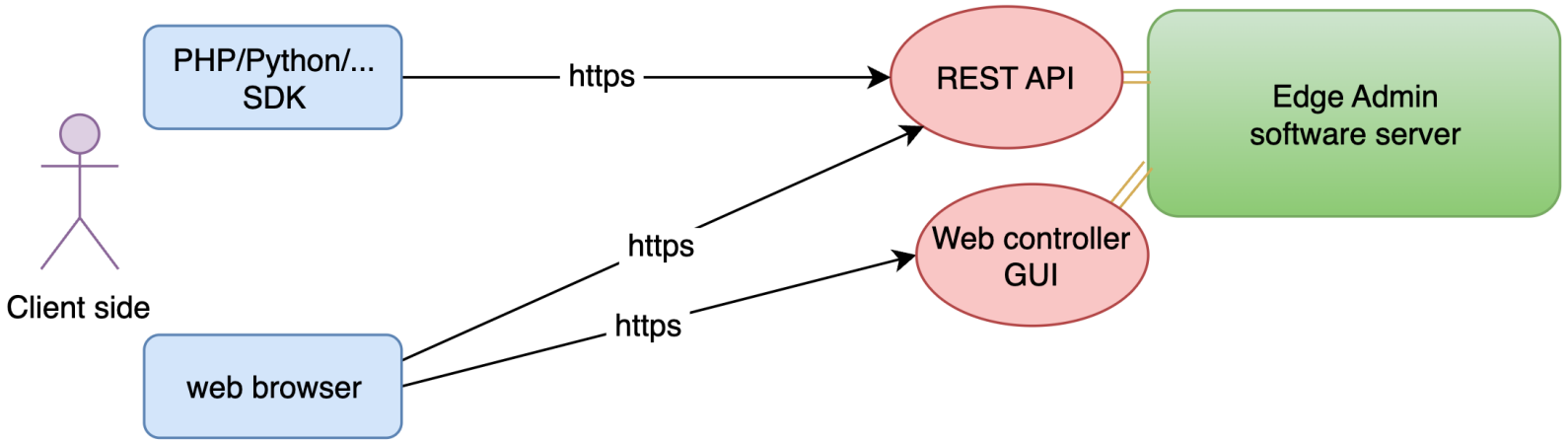


Edge Admin synchronizes configurations to Edge Node

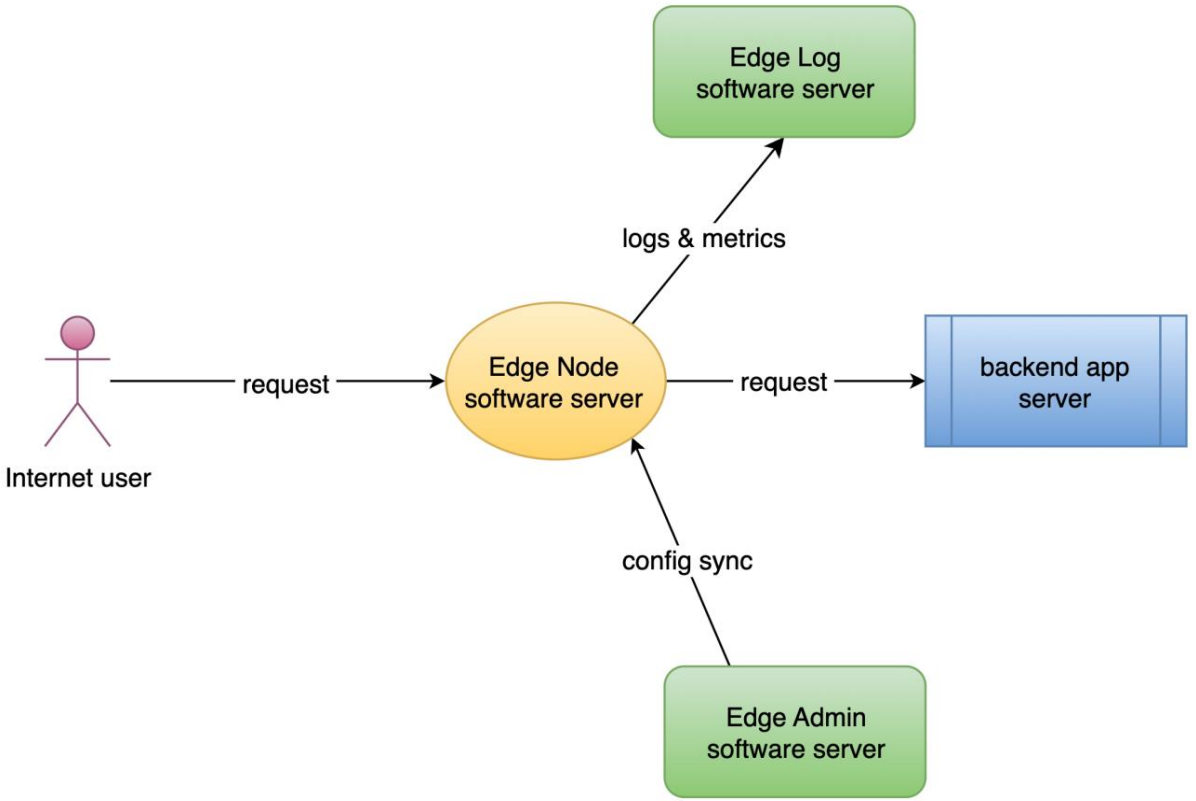


Edge Admin provides multiple interfaces

- Supports client automation SDK that supports REST API and PHP/Python.
- Provides APIs for all functions.
- Provides a web-based GUI (Graphical User Interface) for the administrative console.



Real-time aggregated logs and metrics push based on the Edge Log server

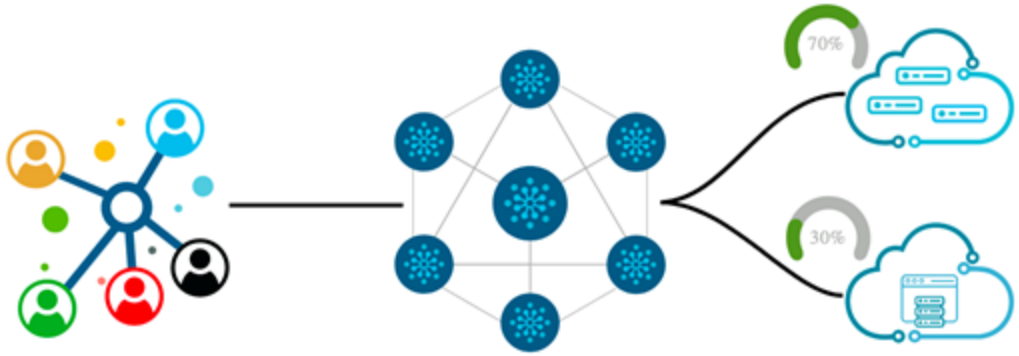


Features of OpenResty Edge

- High-performance distributed load balancer
- Distributed node management
- Partitioned network
- Multi-tier network
- Tiered caching
- Real-time cache management
- Distributed resource caching
- Built-in WAF platform and custom rules
- Arbitrarily complex gateway rule
- Flexible automatic SSL certificate issuance and management
- Dynamic rewriting of requests and responses
- Version control of configuration data
- Multi-role network
- Real-time custom metrics
- Fine-grained access control
- GSLB Global Server Load Balancing
- Proactive pushing of static resources
- SOCKS5 proxy
- TCP/SNI/HTTP proxy
- Built-in geo-sensitive authoritative DNS server
- Flexible network-wide real-time cache purge
- Native Kubernetes (k8s) integration

High-performance distributed load balancer

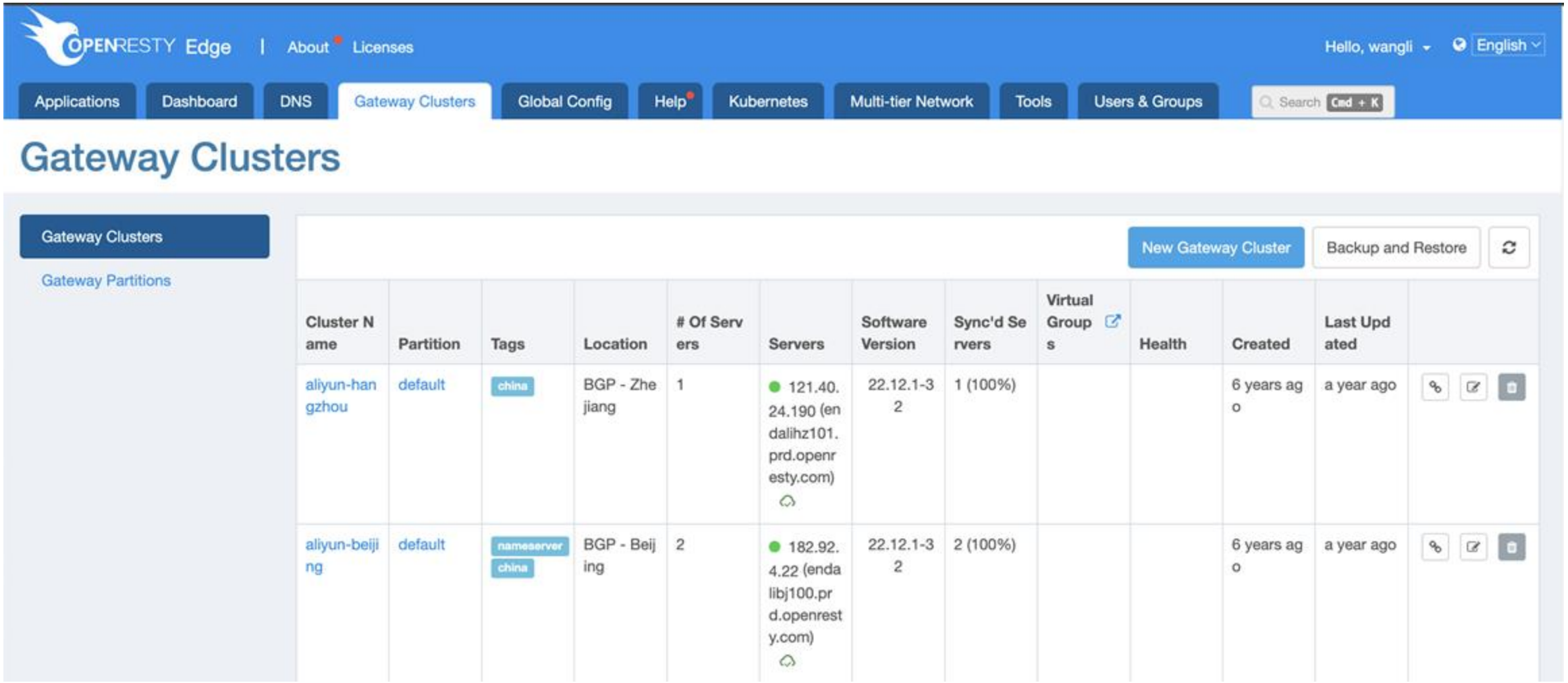
- Dynamic web traffic caching and load balancing.
- Instant reconfiguration of the original server pools.
- Dynamic HTTP/HTTPS reverse. proxy and dynamic load balancing policies.
- Dynamic reverse proxy for TLS applications.
- Dynamic reverse proxy for TCP applications.



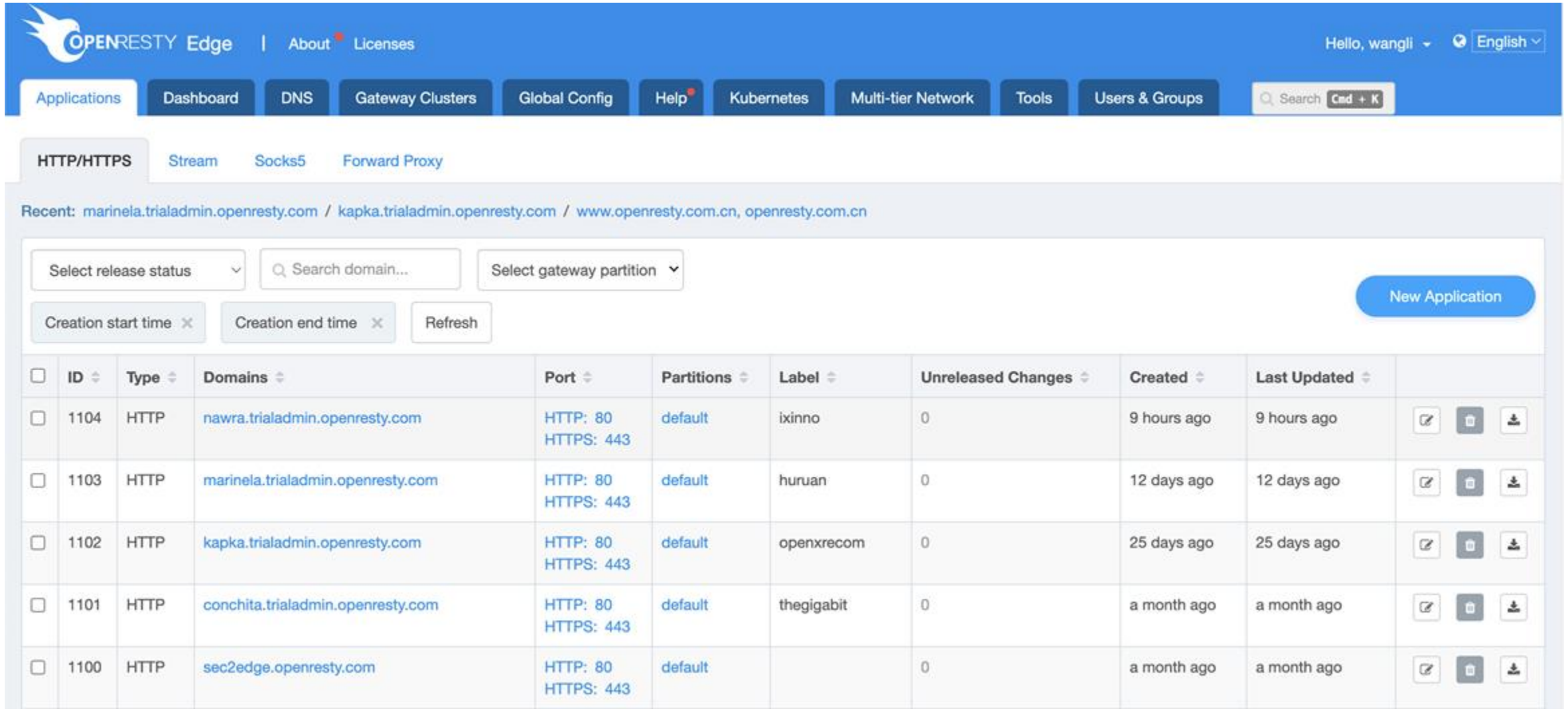
100% on-premise deployment mode

- OpenResty Inc. doesn’t have access to any customer data (including configuration data).
- OpenResty Edge can be deployed in any environment (public cloud, private cloud, private servers).

One master control system manages multiple gateway networks



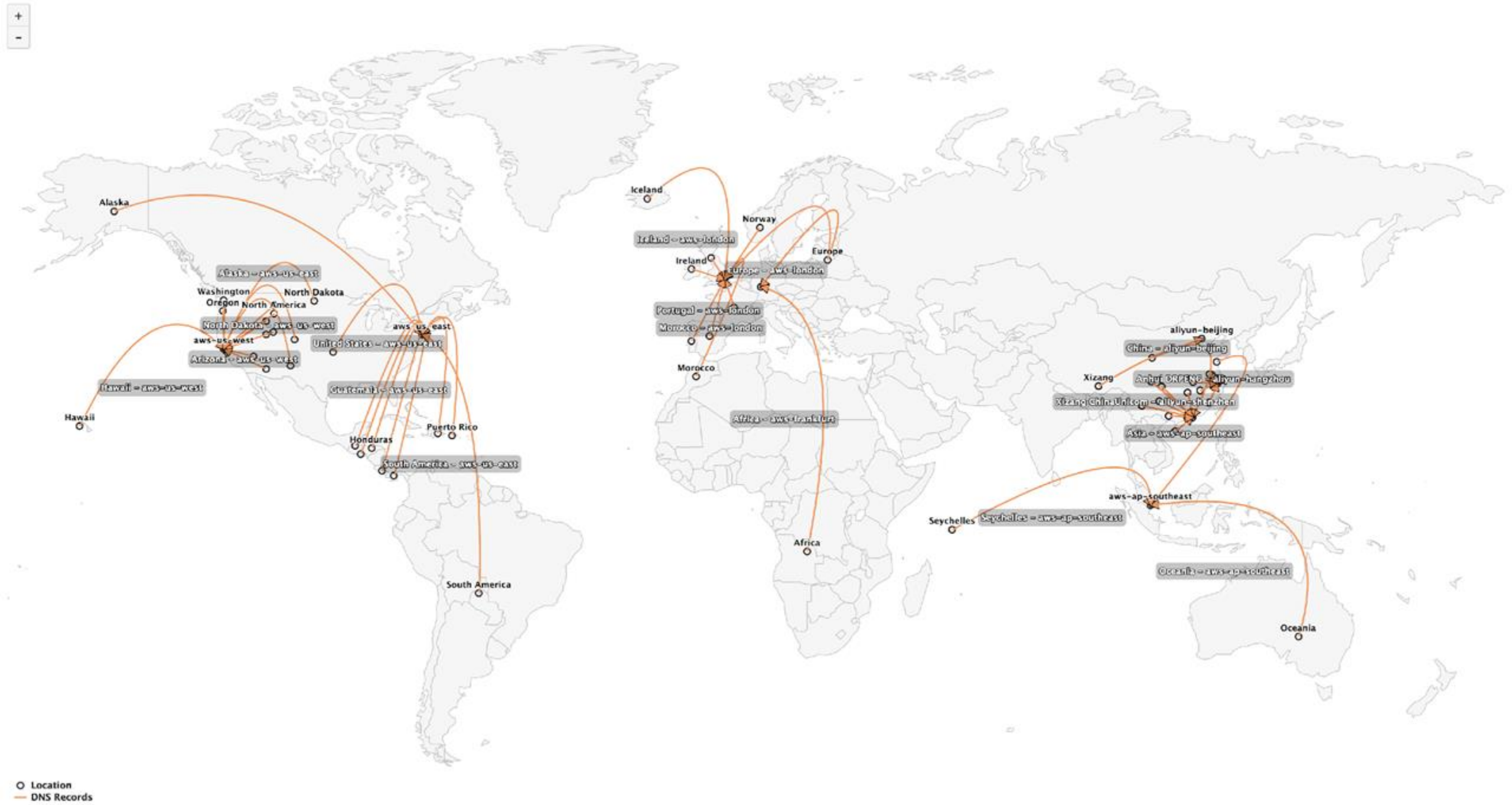
Easily manage millions of domains and virtual servers



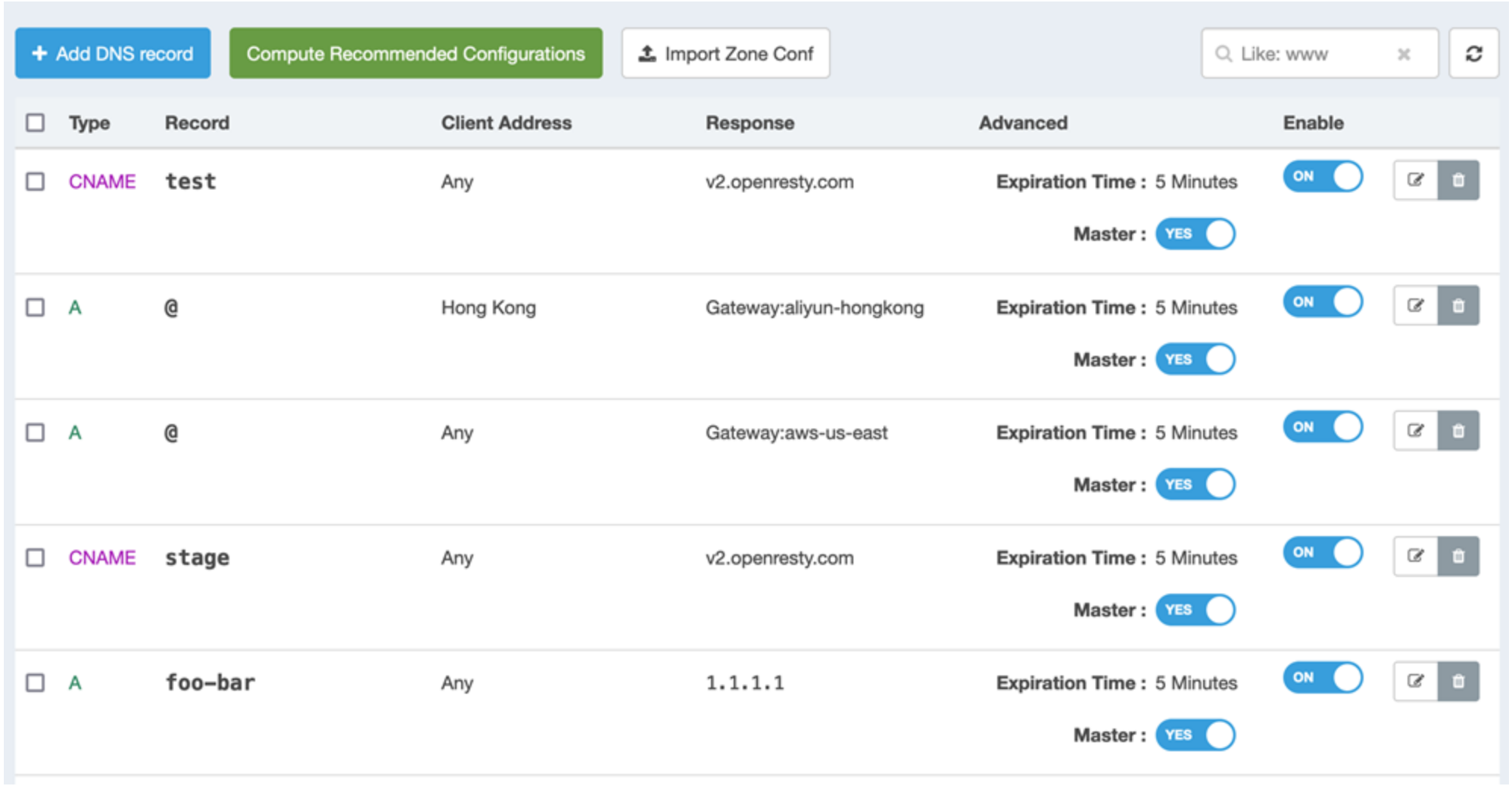
Built-in implementation of authoritative DNS server

- All the gateway nodes can be DNS authoritative servers at the same time (can be disabled).
- Gateway nodes going online or offline will reflect in the DNS services automatically.
- Collaborates with automatic wildcard Let's Encrypt SSL certificate issuing.
- EDNS client Subnet support.
- Customizes geo-sensitive and ISP-sensitive rules.

DNS Records Map



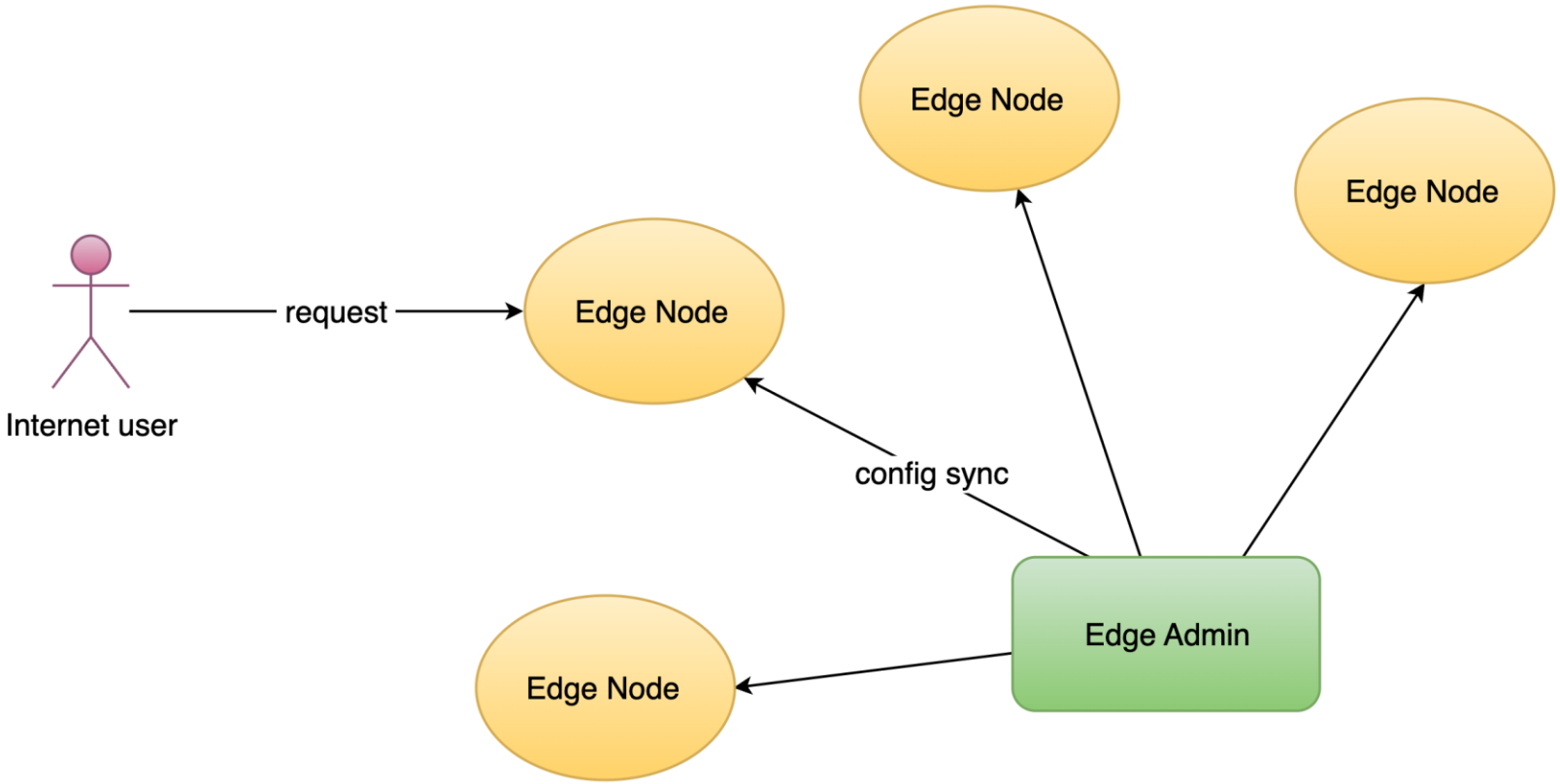
Built-in DNS supports arbitrary record type or custom dispatching rules



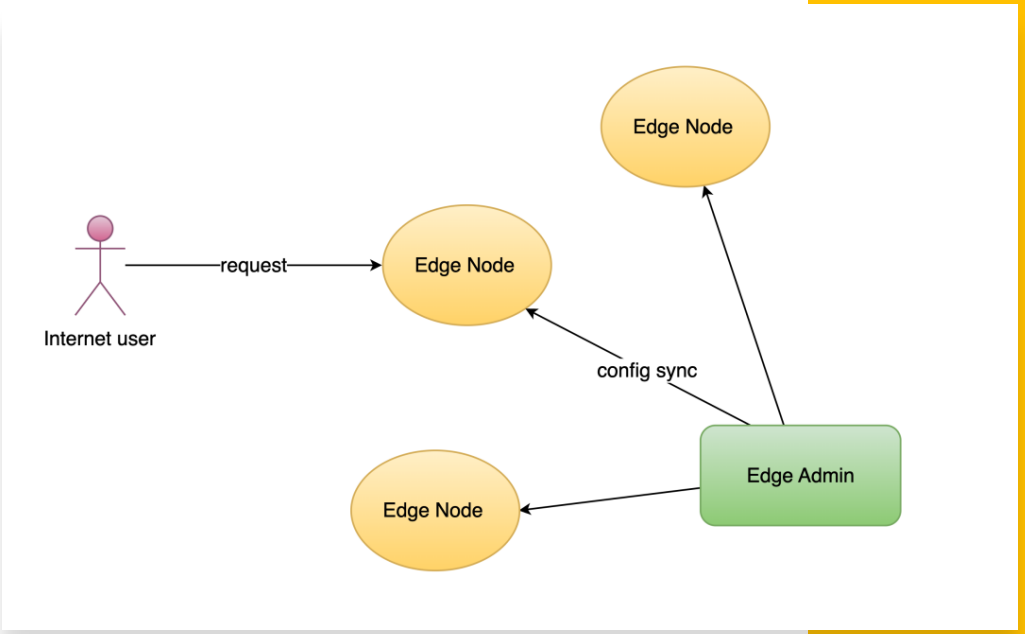
Distributed node management

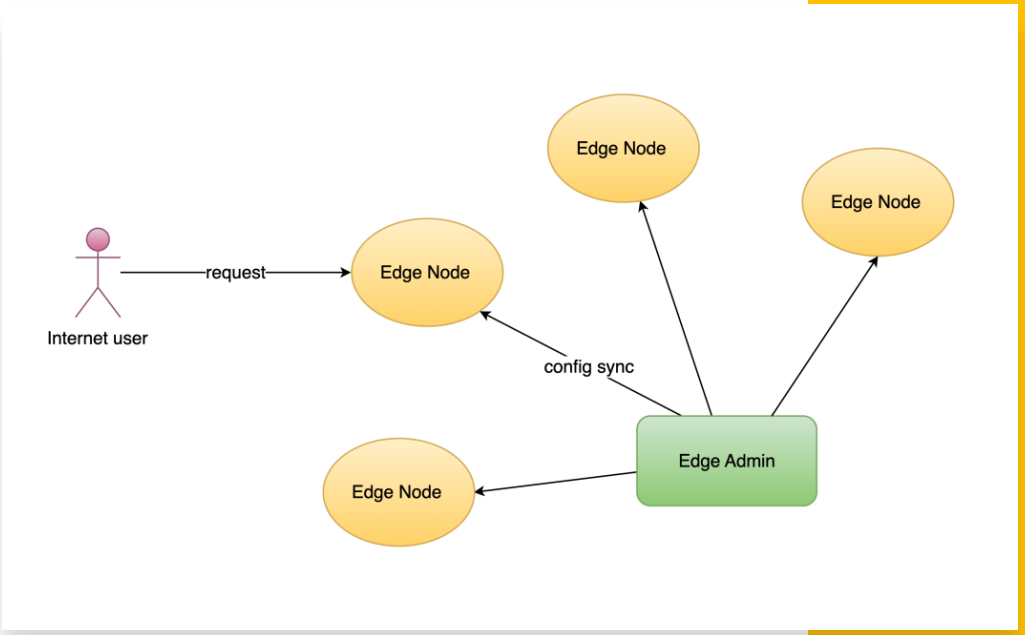
- Automatic optimization of code published on gateway nodes based on current configurations.
- Leverages the latest Just-In-Time (JIT) compilation technologies to unleash the raw performance of the underlying hardware according to the current characteristics of the actual traffic.
- Easily perform actions on all gateway nodes, such as dynamically adding and removing nodes in the OpenResty admin console.
- Real-time display of the current configuration synchronization status of all gateway nodes.
- Proactive health checks for back-end nodes and gateway nodes.
- Real-time gateway configuration distribution system supporting global-scale networks.

Support arbitrarily many Edge Node servers

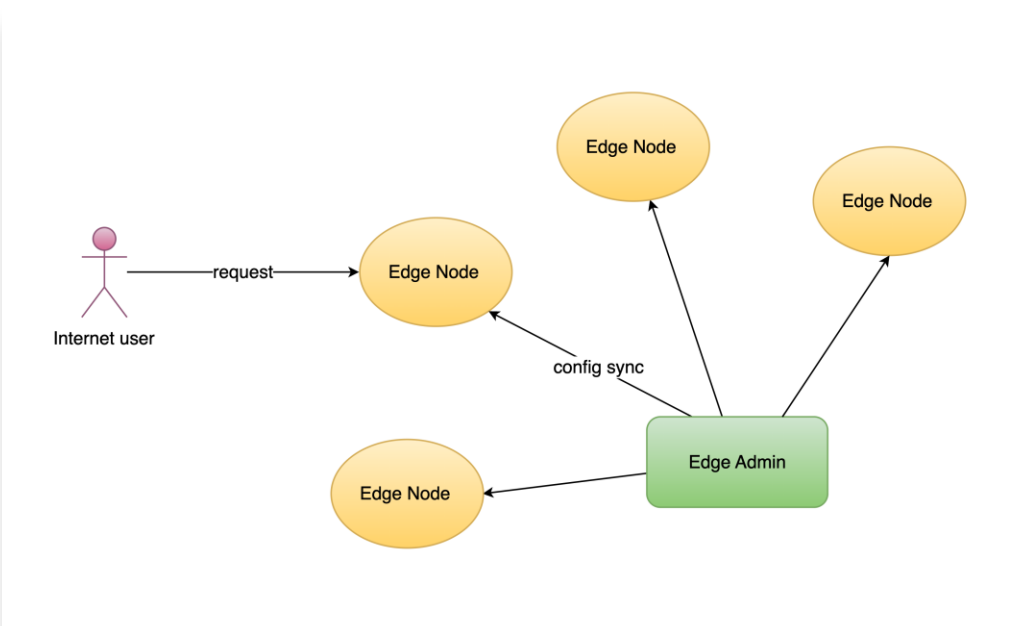


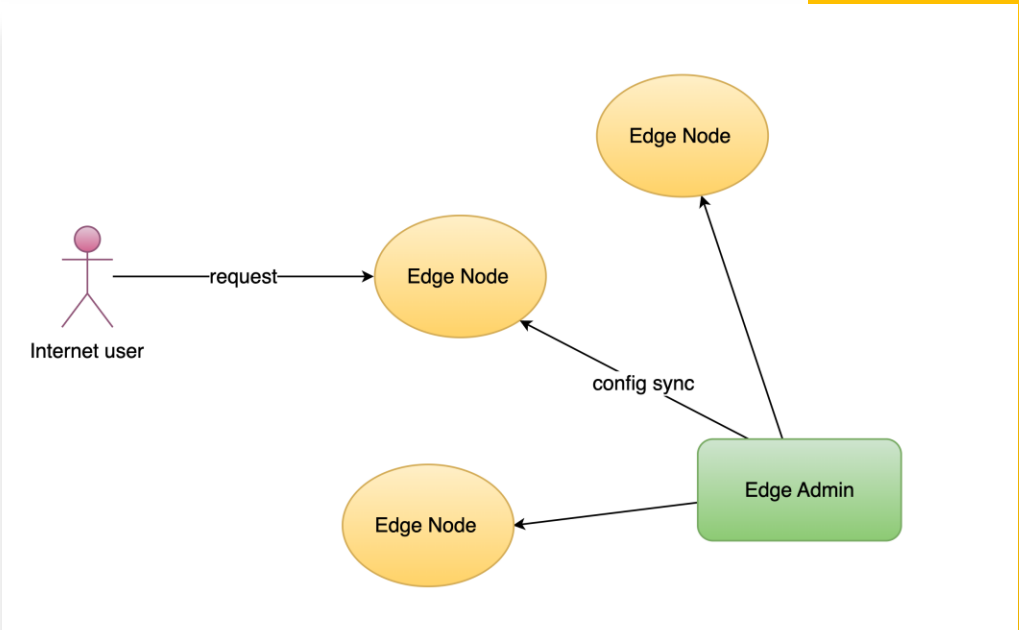
Support adding new Edge Nodes online



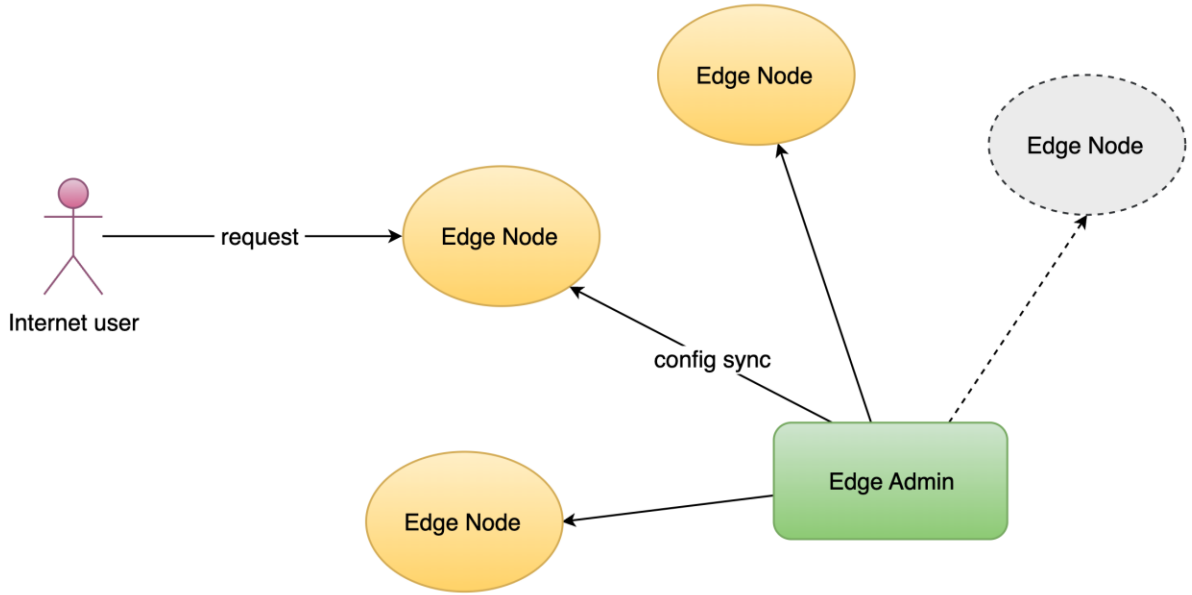


Support removing Edge Node servers online

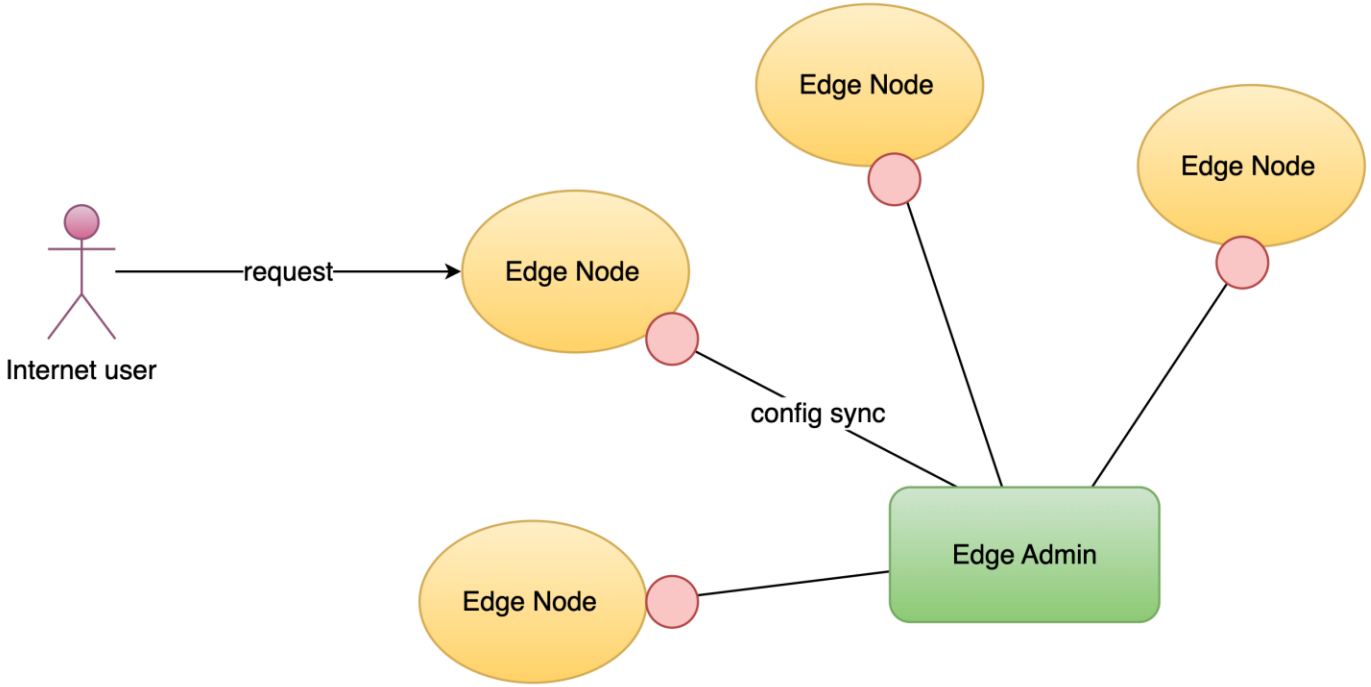




Also support marking a node offline without actually removing it

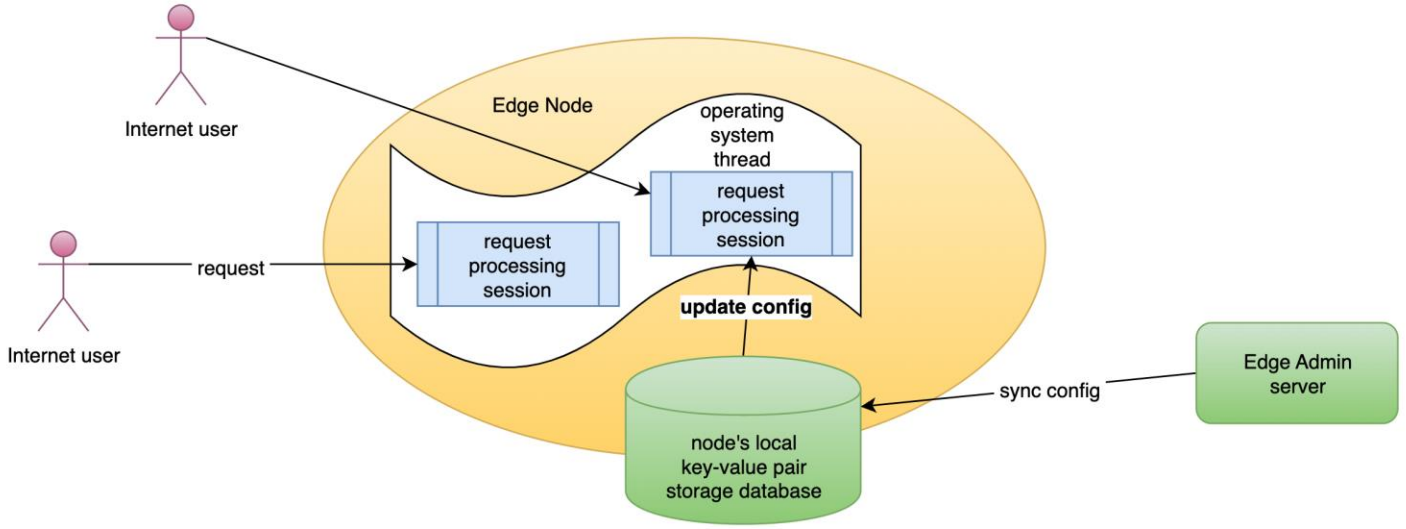


Real-time incremental config synchronization

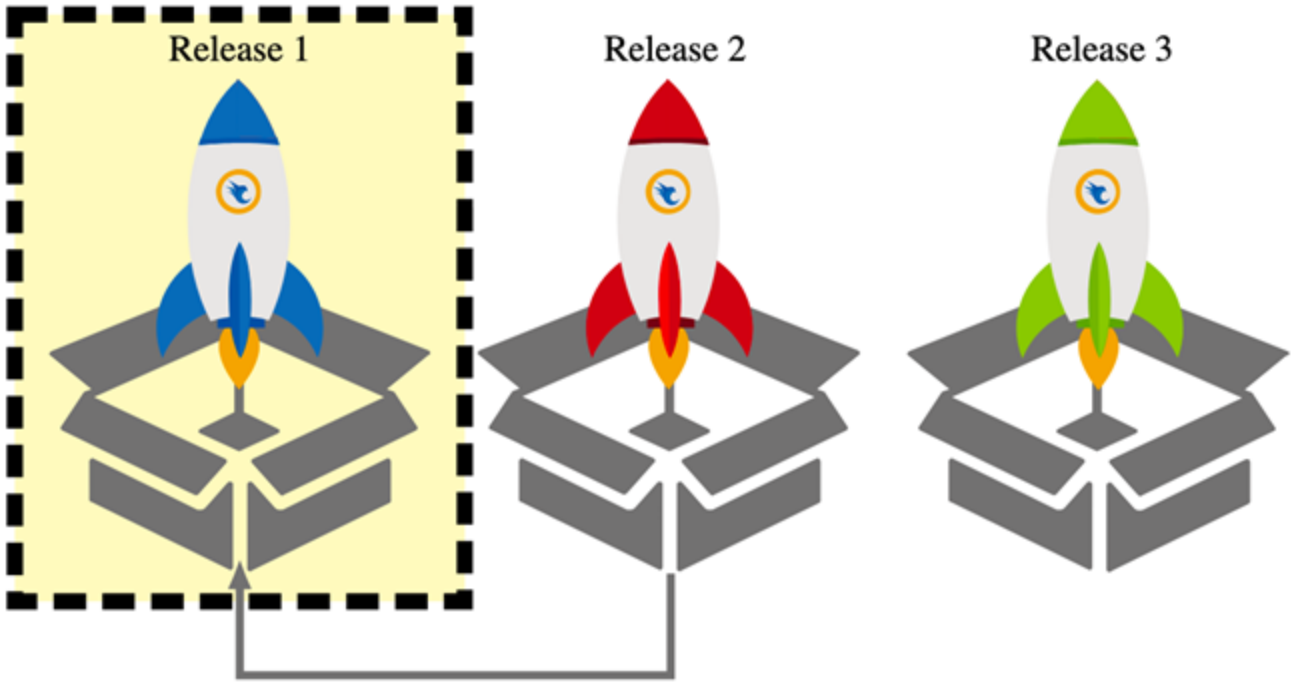


Site config can be live updated on the client request level

Every Edge Node has a local key-value database with transaction protection and in-memory caching. While a request picks up the new version of the site config, other concurrent requests in the same operating system thread won't get interrupted or affected.



Version control of configuration data



- Built-in version control algorithm with strong atomicity and consistency.
- Keeps track of all historical revisions and changes to the configurations.
- Can revert to any previous version if a problem occurs.
- Avoids unexpected risks by pushing configurations online through independent releases.

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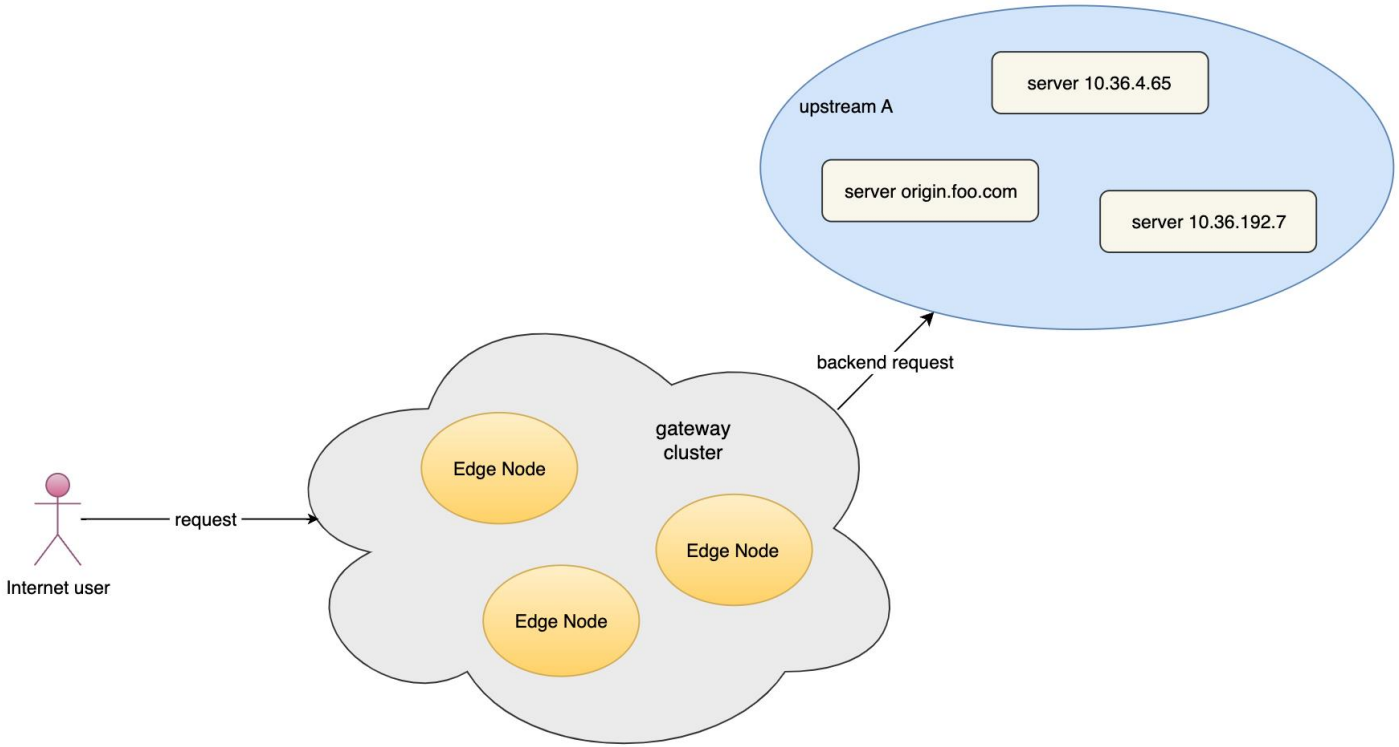
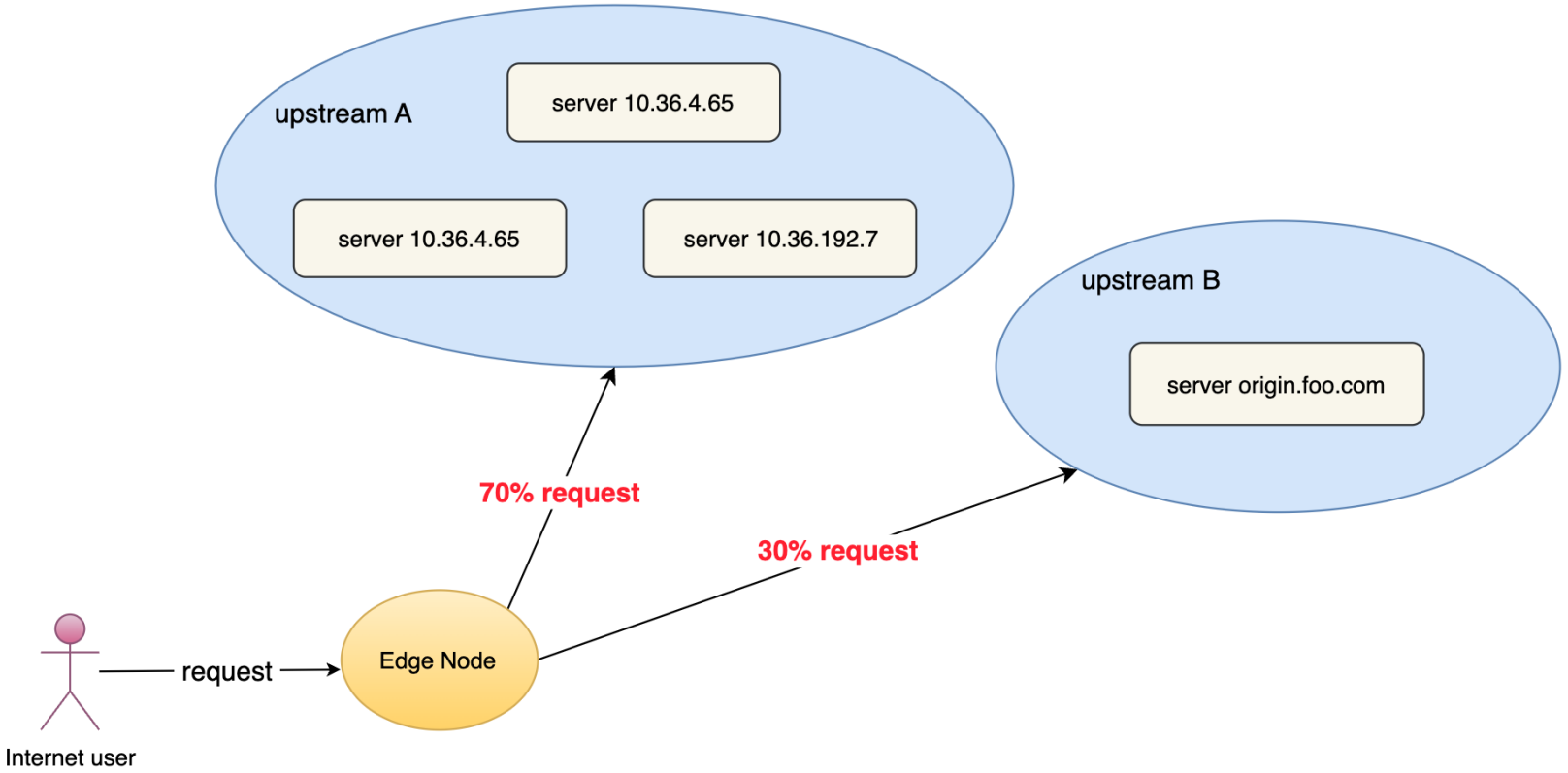
The administrator can define groups of backend servers online

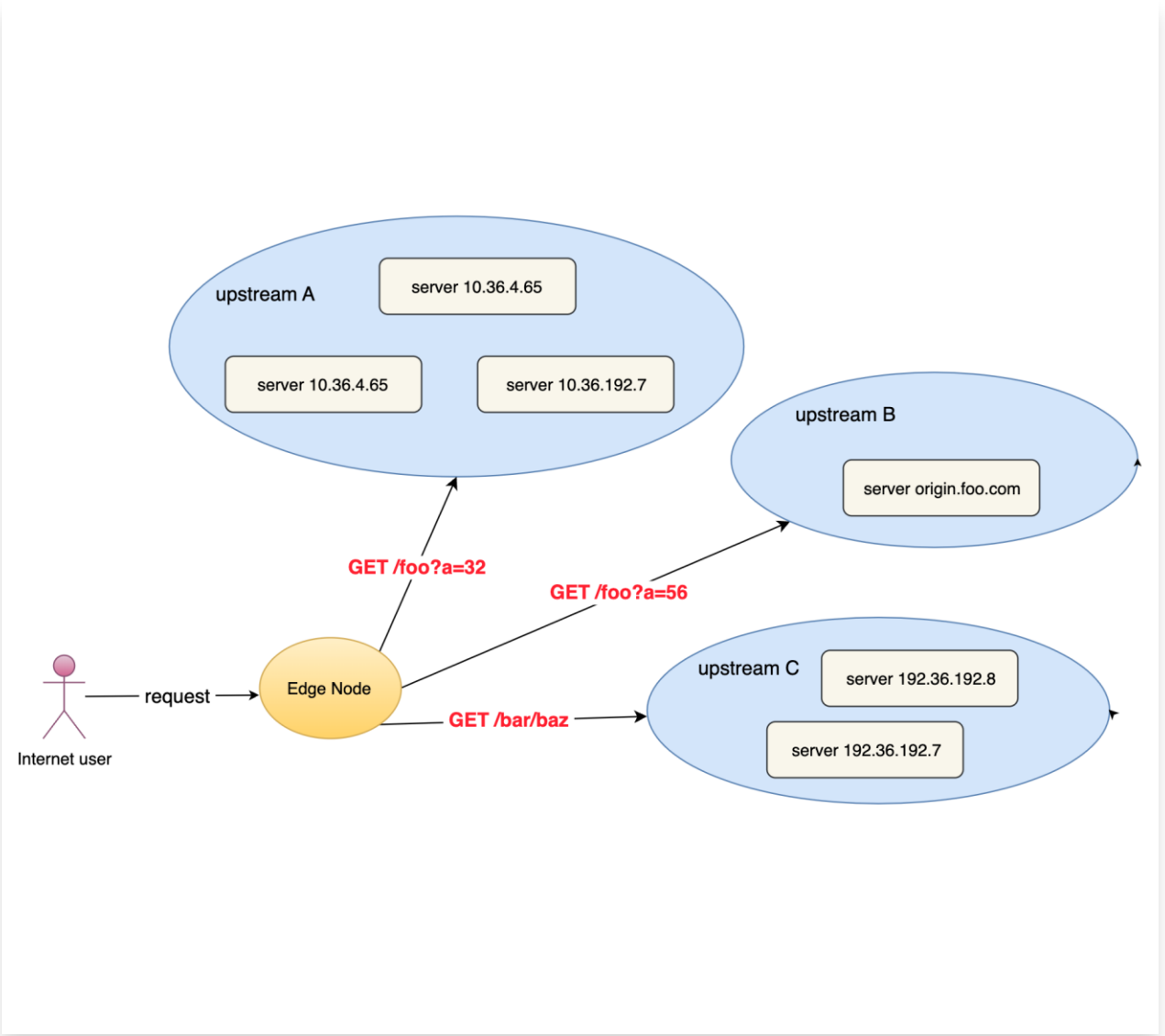
Backend servers providing the same services are grouped together. Such groups are called "upstreams".



Support distributing traffic among multiple "upstreams" by specified ratios.

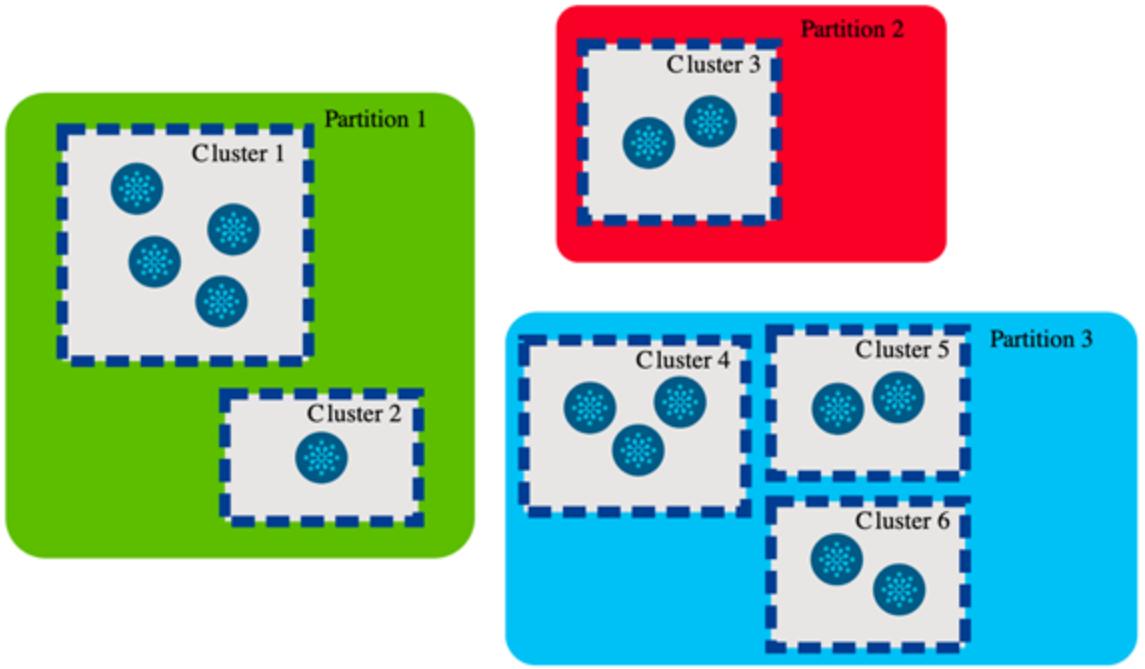


Support directing requests to different upstreams according to any user-specified conditions.



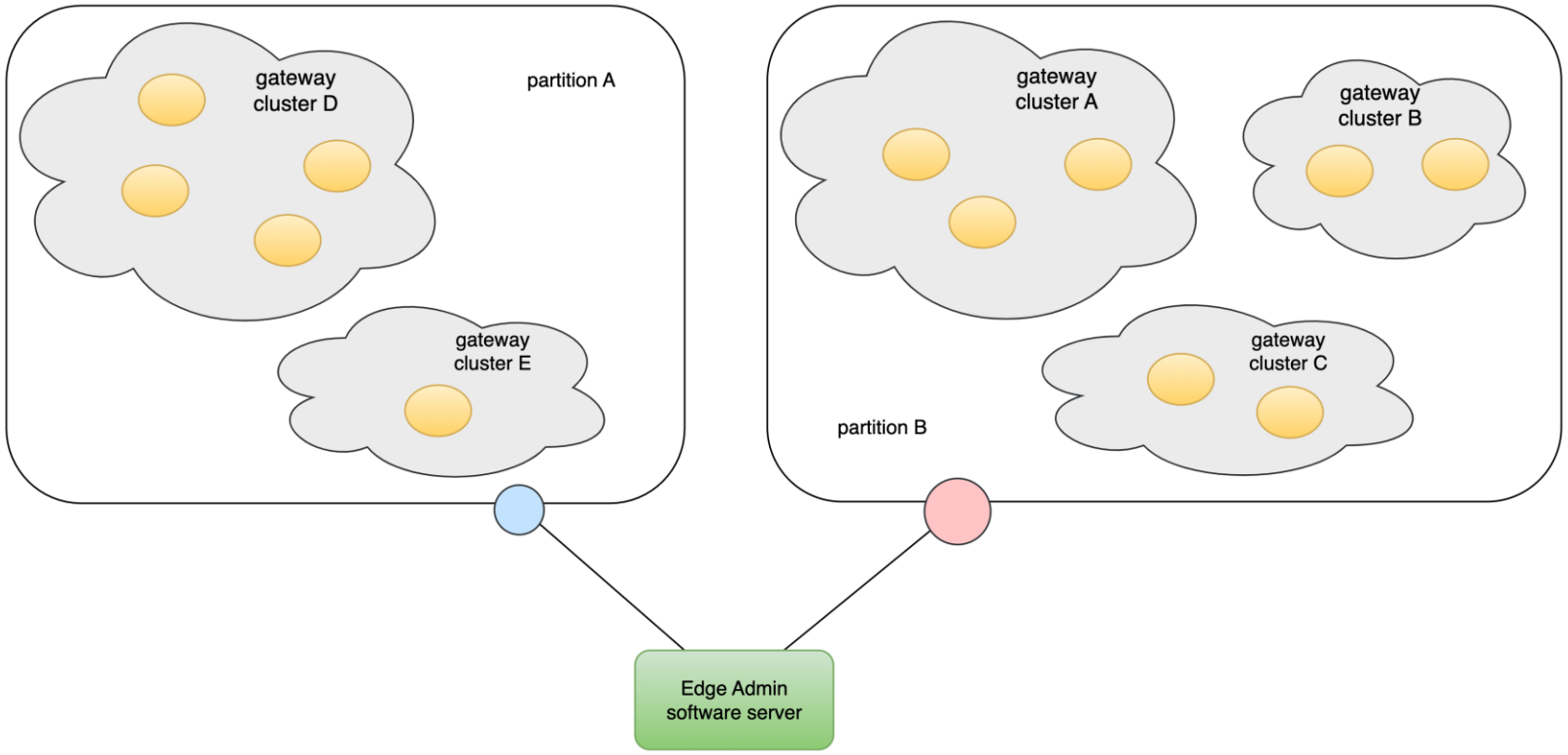
Partitioned Networks

- Defines multiple different partitions on the same gateway network.
- Pushes different configurations to different partitions on the same network.
- Performs A/B test releases on dedicated parts of the gateway network before production deployment.
- Distributes configurations of different virtual hosts across different dedicated production gateway servers.



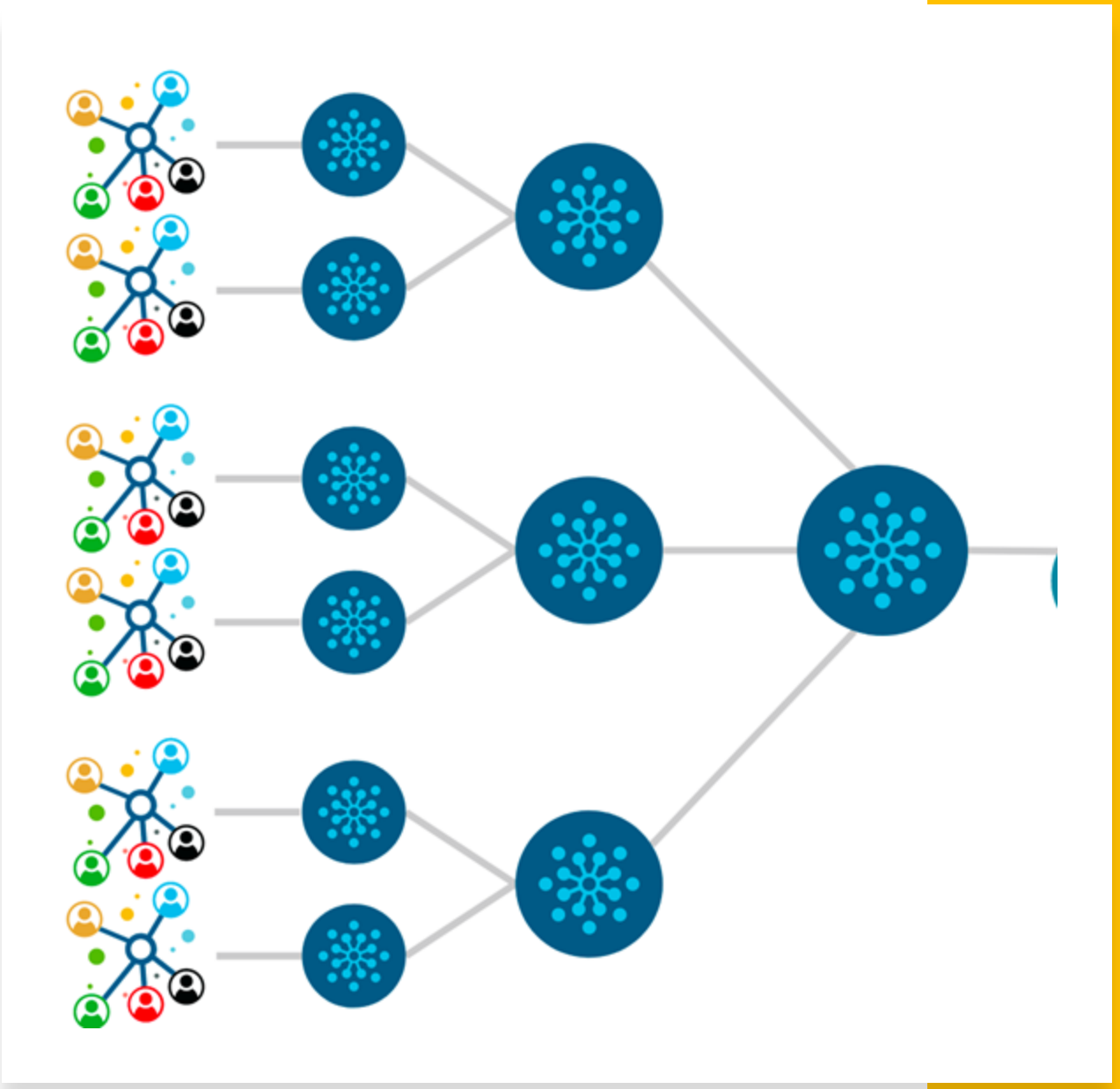
Edge Admin can push different configurations to different partitions.

- Can be used to distinguish internal and external web apps
- Can also be used to do A/B testing.

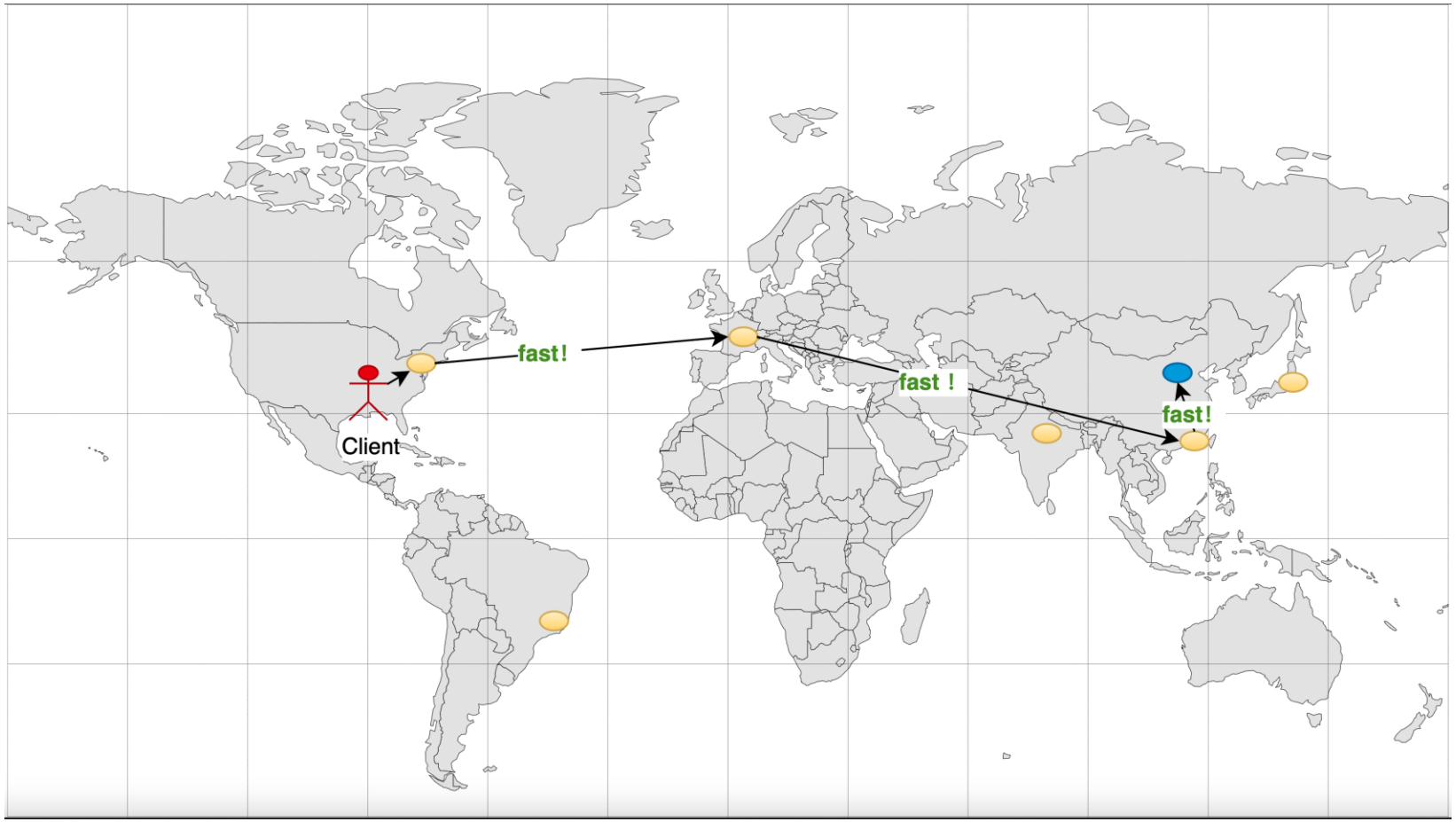


Multi-layer network

- Configures custom multilayer networks and custom traffic routing rules dynamically.
- Customizes multi-layer network policy.

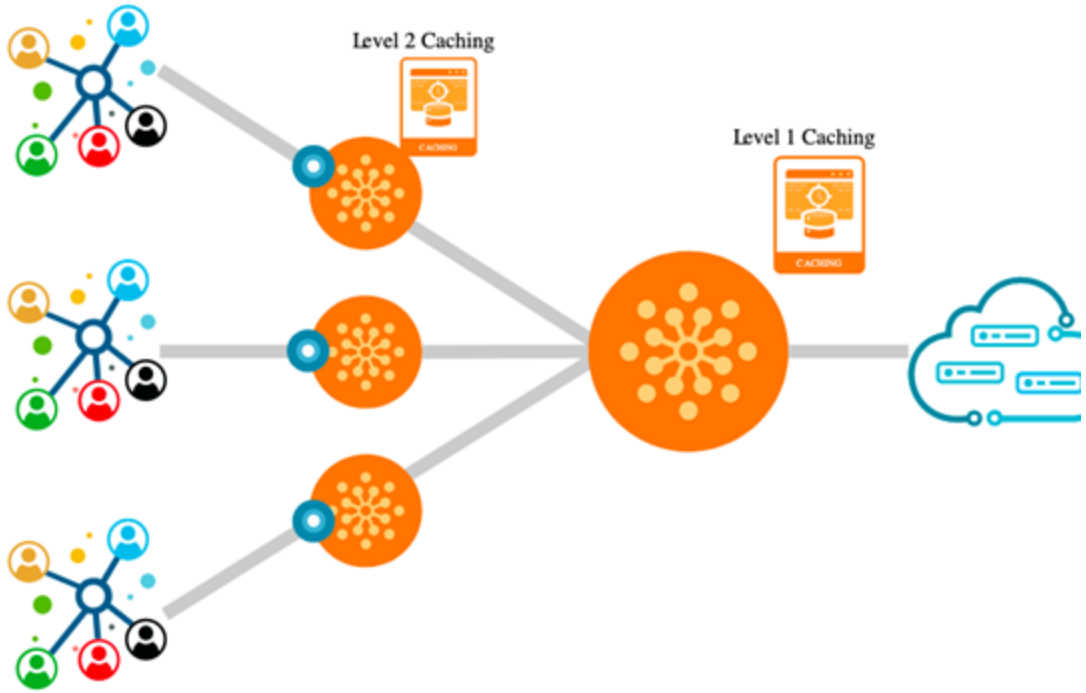


Support tiered networks and controlling long-distance routing yourself.



Tiered caching

- Distributed web caching at the gateway cluster level and custom cache key and cache rule configuration.
- Reduces latency and server load.
- Maintains data integrity without sacrificing scalability.

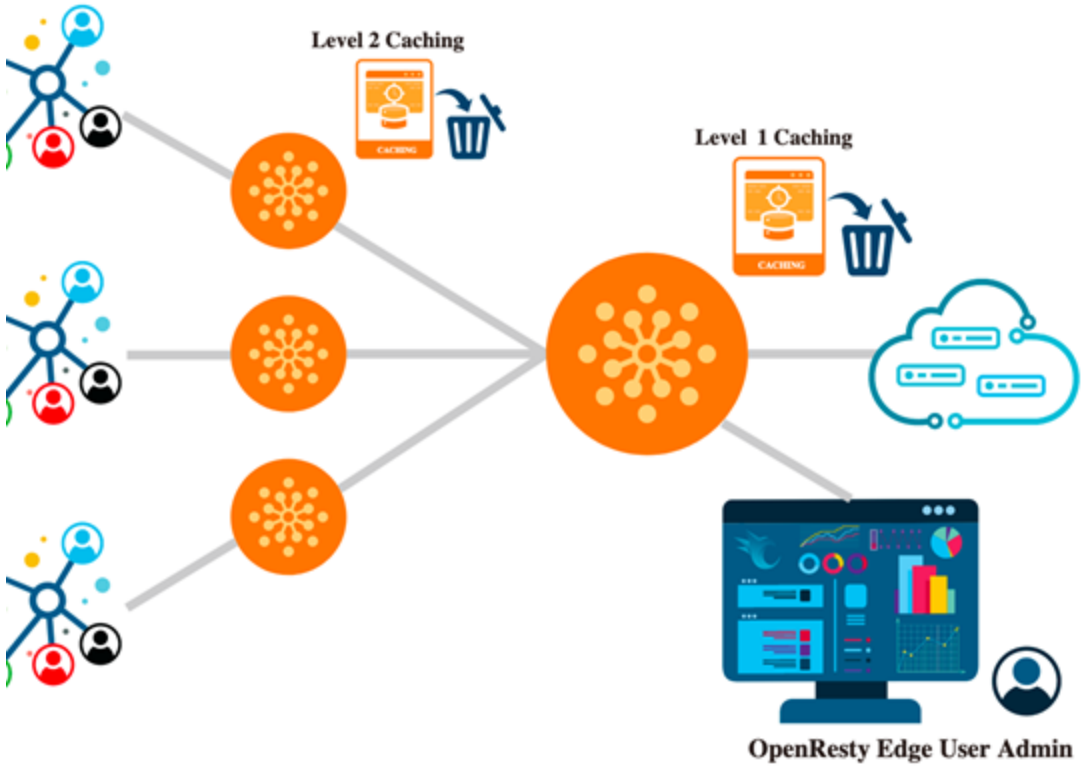


Tiered caching: every level of nodes can cache resources

It is easier to hit the cache for nodes closer to the origin servers or backend application servers

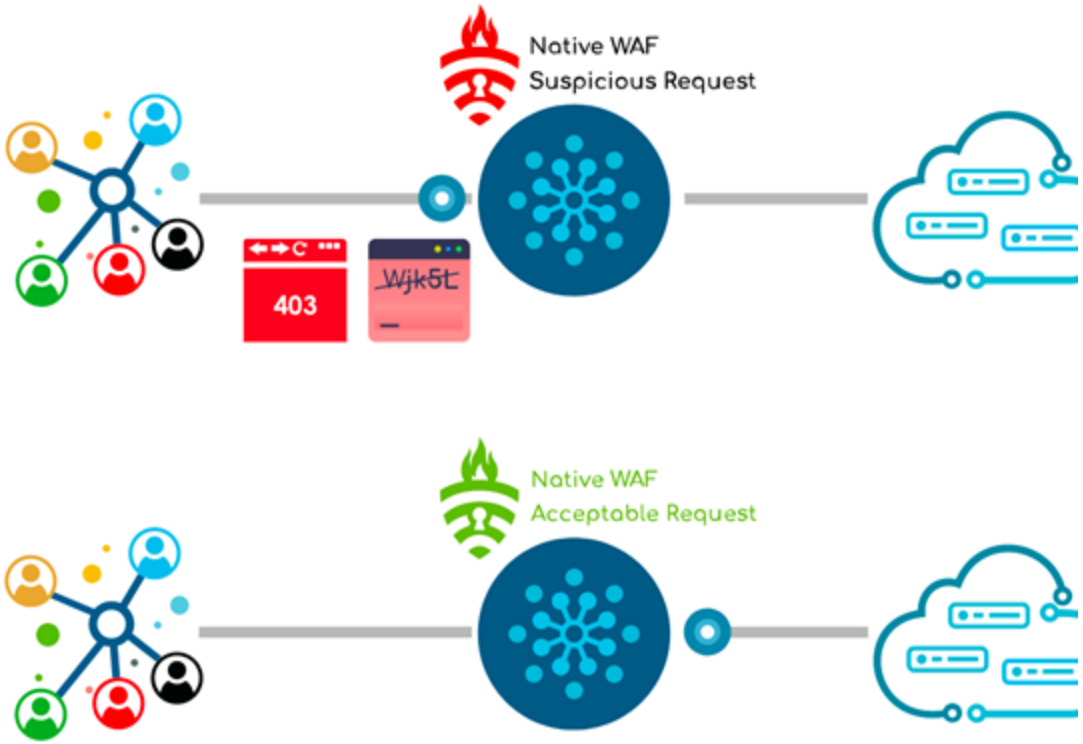
Real-time whole-network cache purge

- Immediate network-wide purging operations in a matter of seconds.
- Clears the cached resources using exact URLs, URL prefixes, and other arbitrarily complicated conditions.
- Distributed web caching at the gateway cluster level.
- Customize cache keys and caching applicable rules.

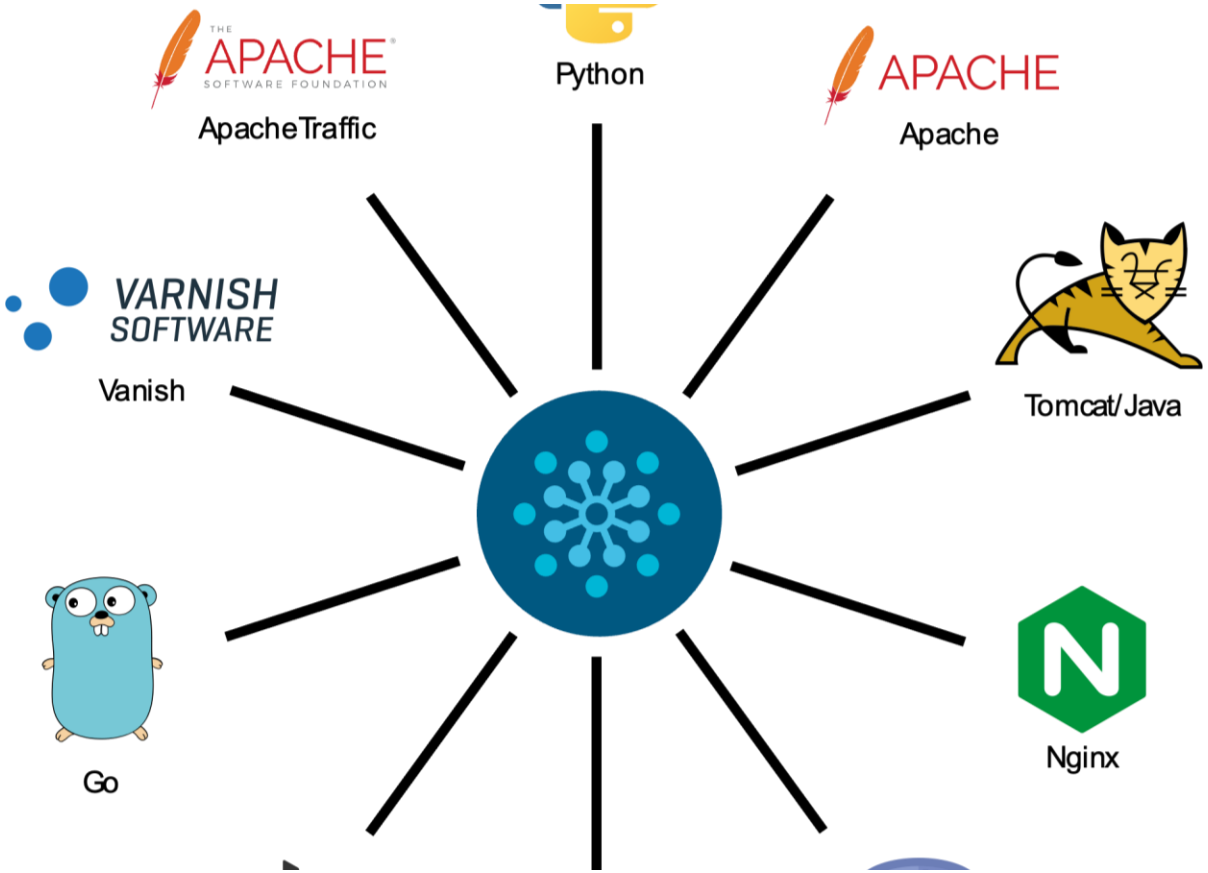


Built-in Web Application Firewall (WAF)

- Dynamically configurable Web Application Firewall (WAF).
- Efficiently and effortlessly intercepts malicious requests via WAF.
- Dynamic activation or deactivation of the specified WAF rule or rule set.
- WAF real-time hit log reports and summaries.
- Customize WAF defense rules with Edge domain-specific language.
- Customize WAF whitelist to skip static resources.
- Up to 10x higher performance than open-source implementations such as ModSecurity.

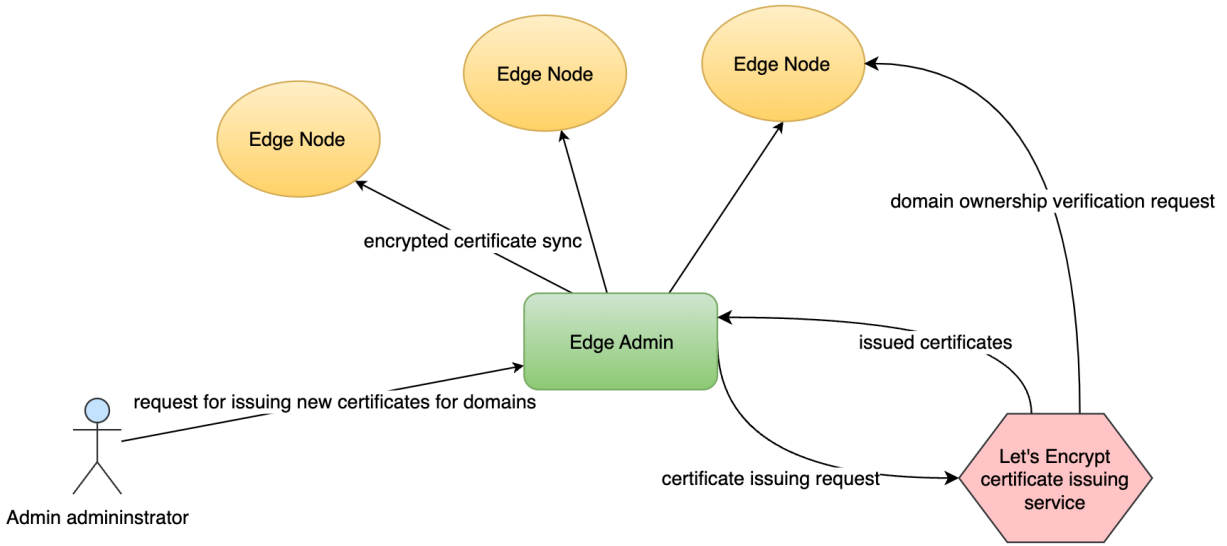


Support various kinds of backend servers and applications



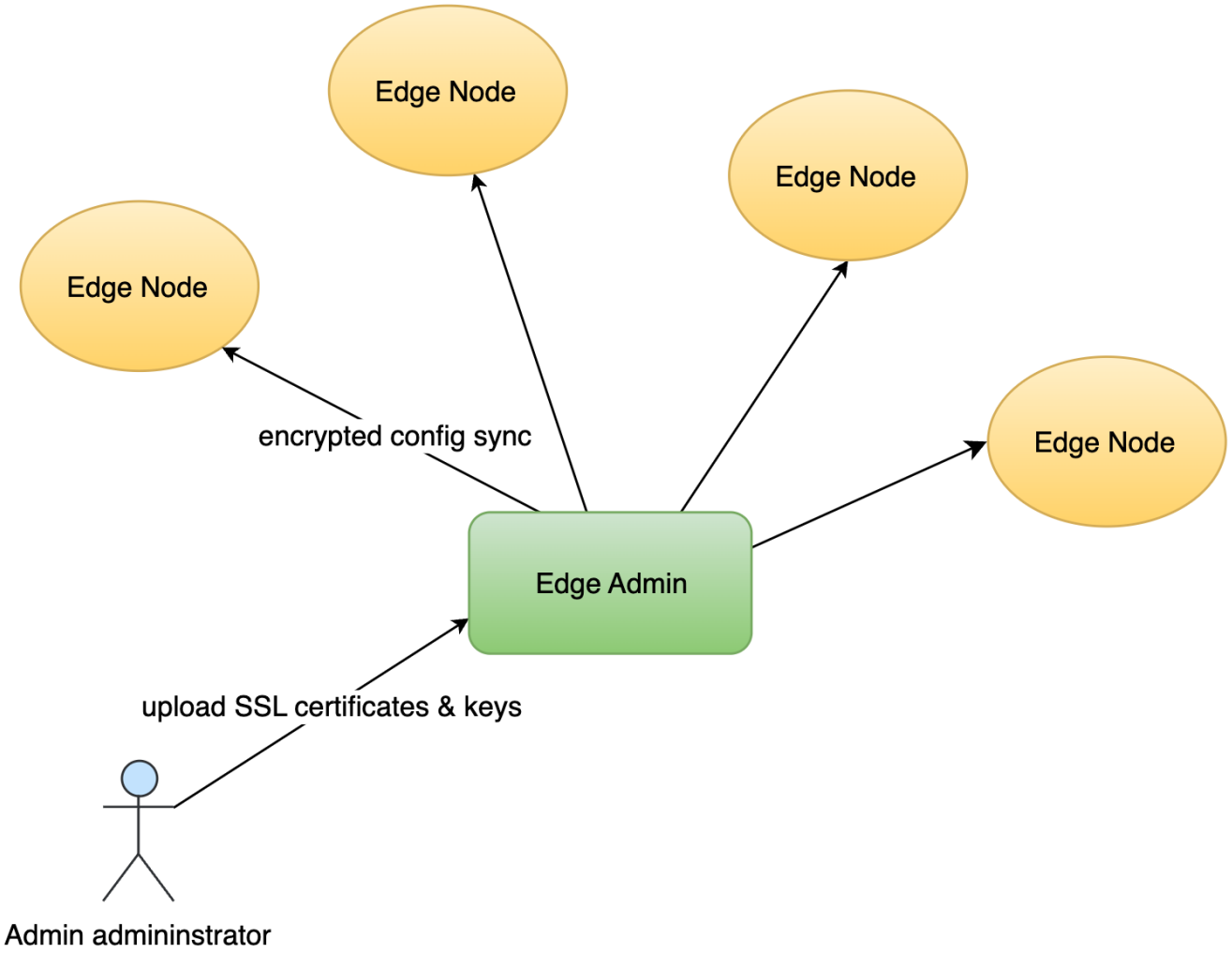
Flexible SSL certificate and communication management

- Customize SSL handshake spee-limiting rules.
- Customize SSL certificates upload and management.
- Automatic SSL certificate issuance, renewal, and management.
- Support for multiple domains and wildcard domains.
- Superior performance even with hundreds of thousands of configurations and SSL certificates.



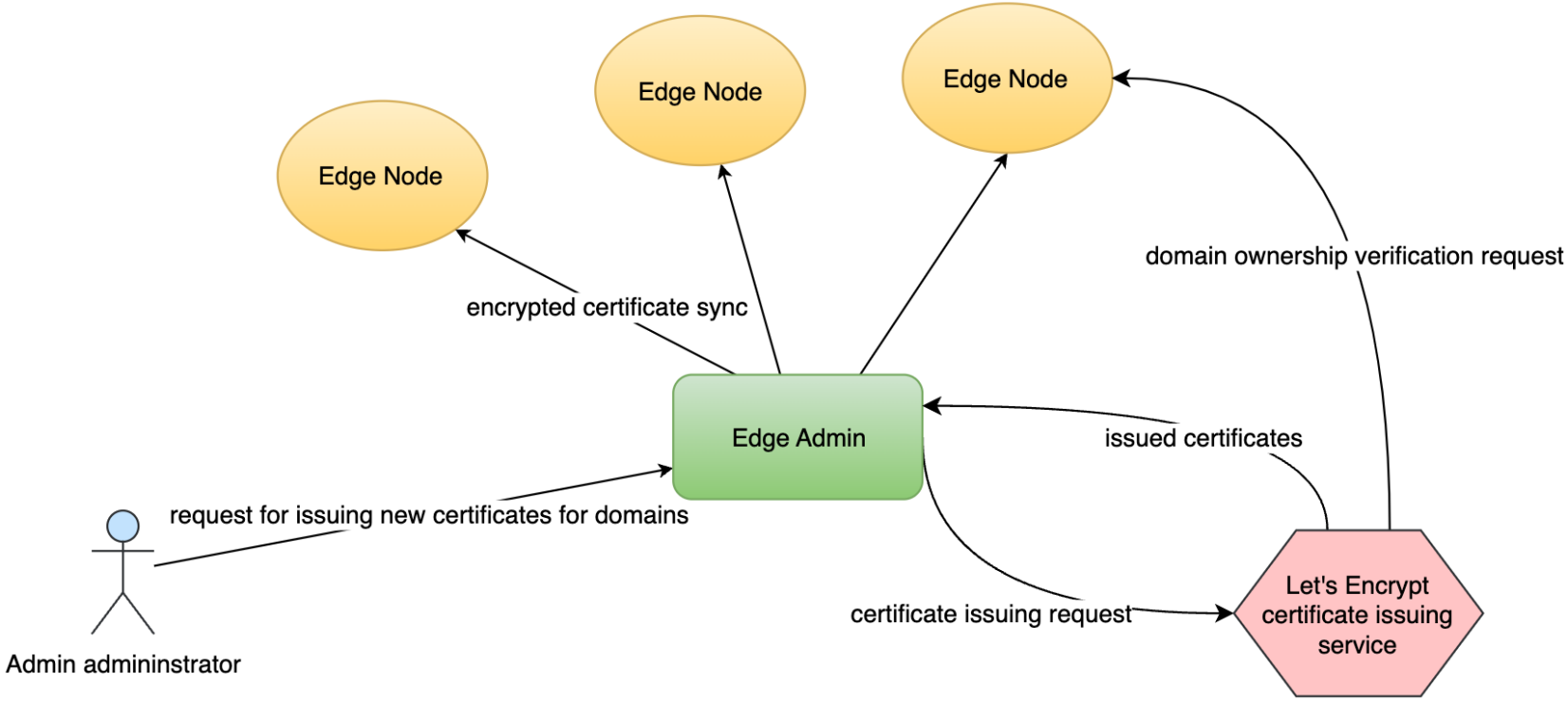
The administrator can upload any number of SSL certificates and private keys on the fly.

The uploaded certificates and private keys will get synchronized at real time to all the nodes in an encrypted manner.
Each site can have multiple certificates.



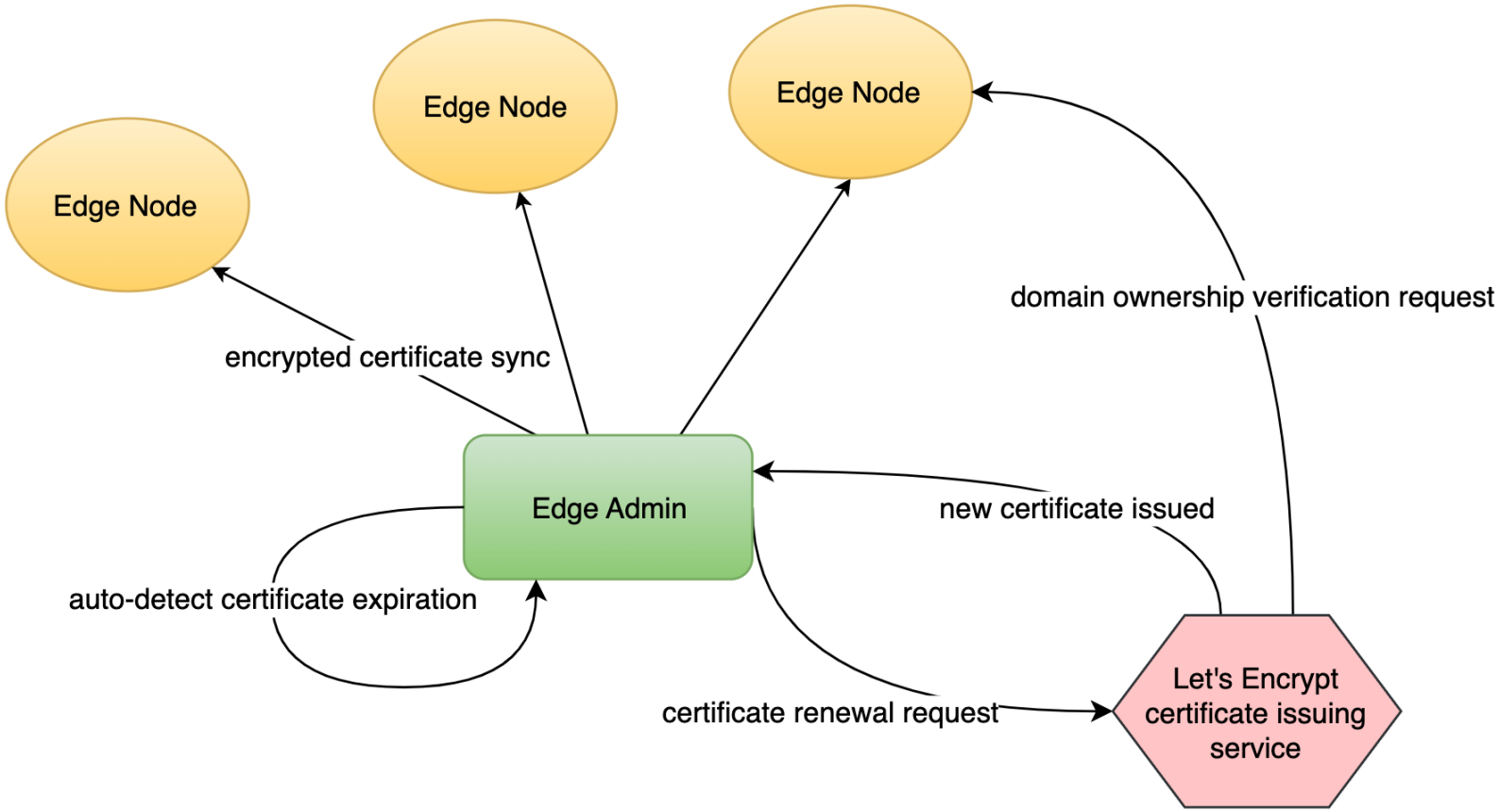
Support auto-generating free SSL certificates

Integrated the non-profit Let's Encrypt certificate issuing services.

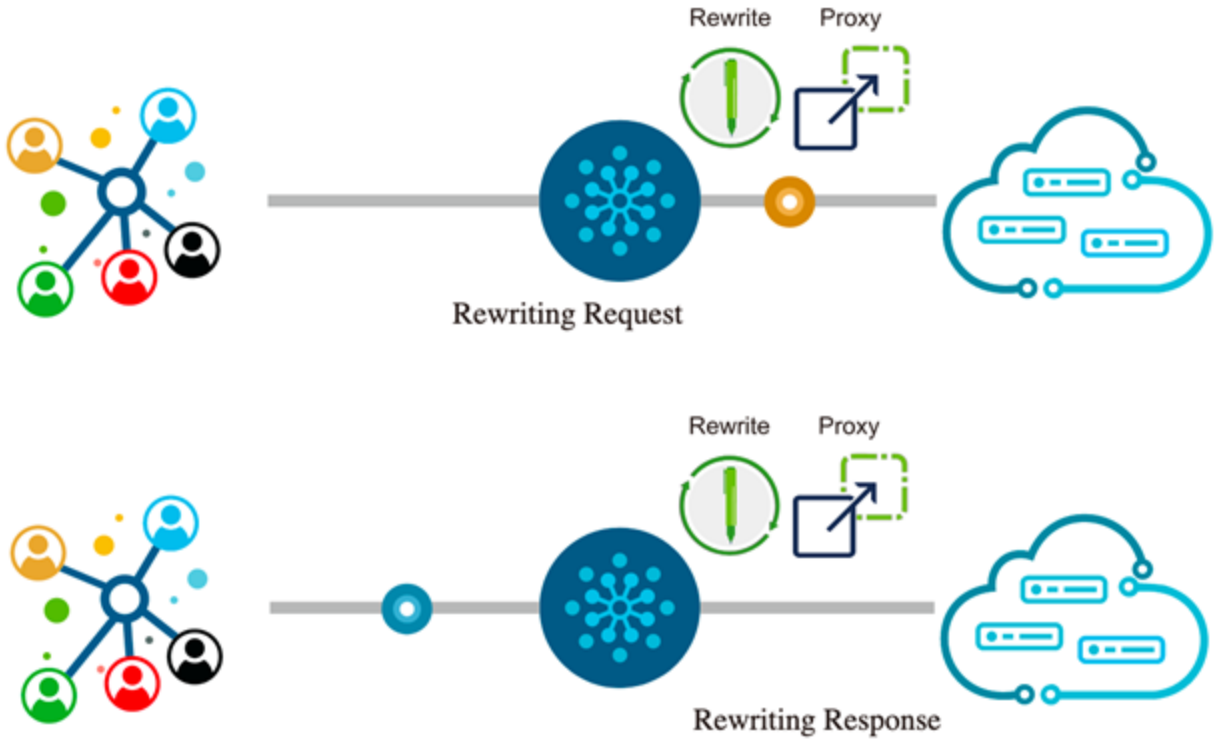


Auto-update all free SSL certificates issued by Let's Encrypt

When the certificates are about to expire, the Edge Admin controller will automatically request Let's Encrypt services to update them.



Request and response rewriting



- Custom rules for modifying, deleting, and inserting response headers.
- Custom rules for modifying, deleting, and inserting request headers.
- Custom rules for modifying, deleting, and inserting URIs and URI parameters.

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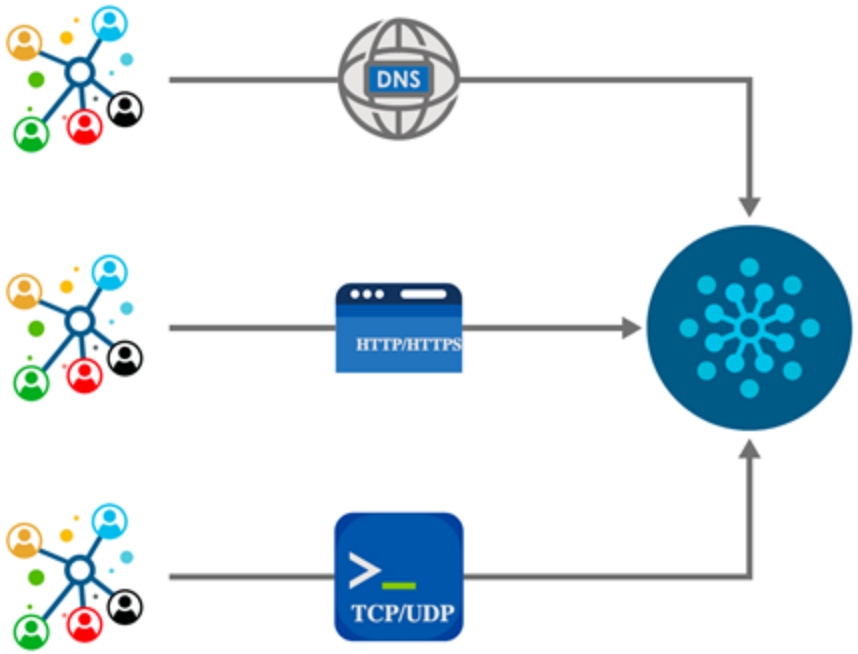
Multi-role network

The OpenResty node network can handle the following request types:

- DNS
- HTTP, HTTPS
- WebSocket
- gRPC
- TCP
- SNI proxy
- Socks5 proxy

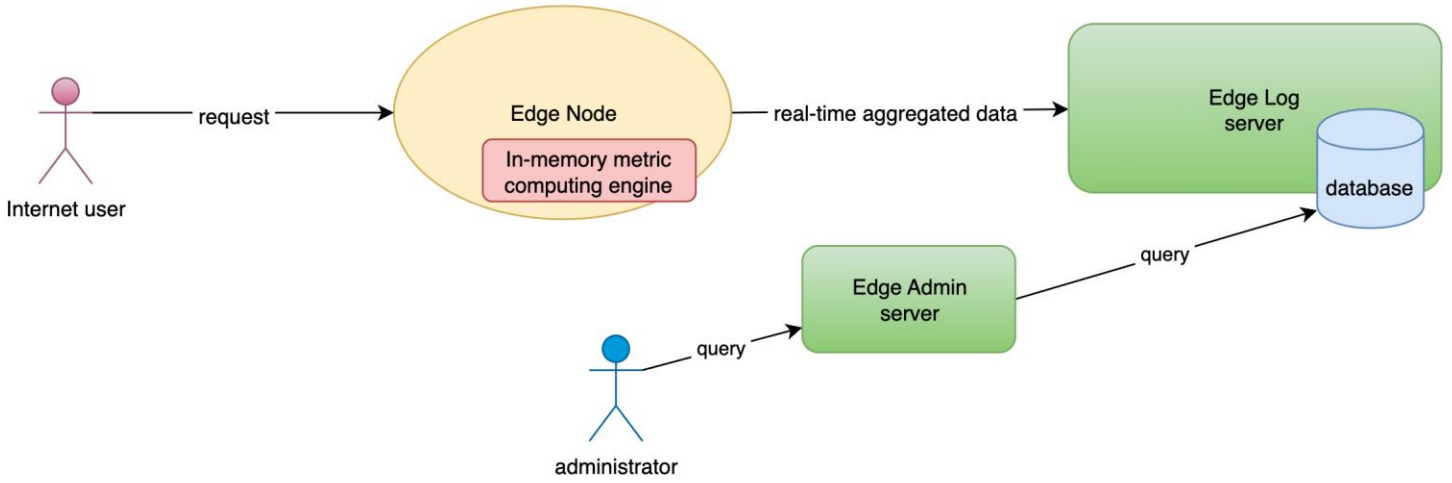


Efficient real-time statistics

- Real-time statistics of network response status codes.
- Real-time statistics of network error logs.
- Real-time statistical information: CPU, hard disk, network, memory usage.
- Back-end nodes and gateway nodes health check.
- Proactive status check of gateway nodes by automatically adjusting DNS settings.
- Create and manage custom dynamic metrics using SQL language.

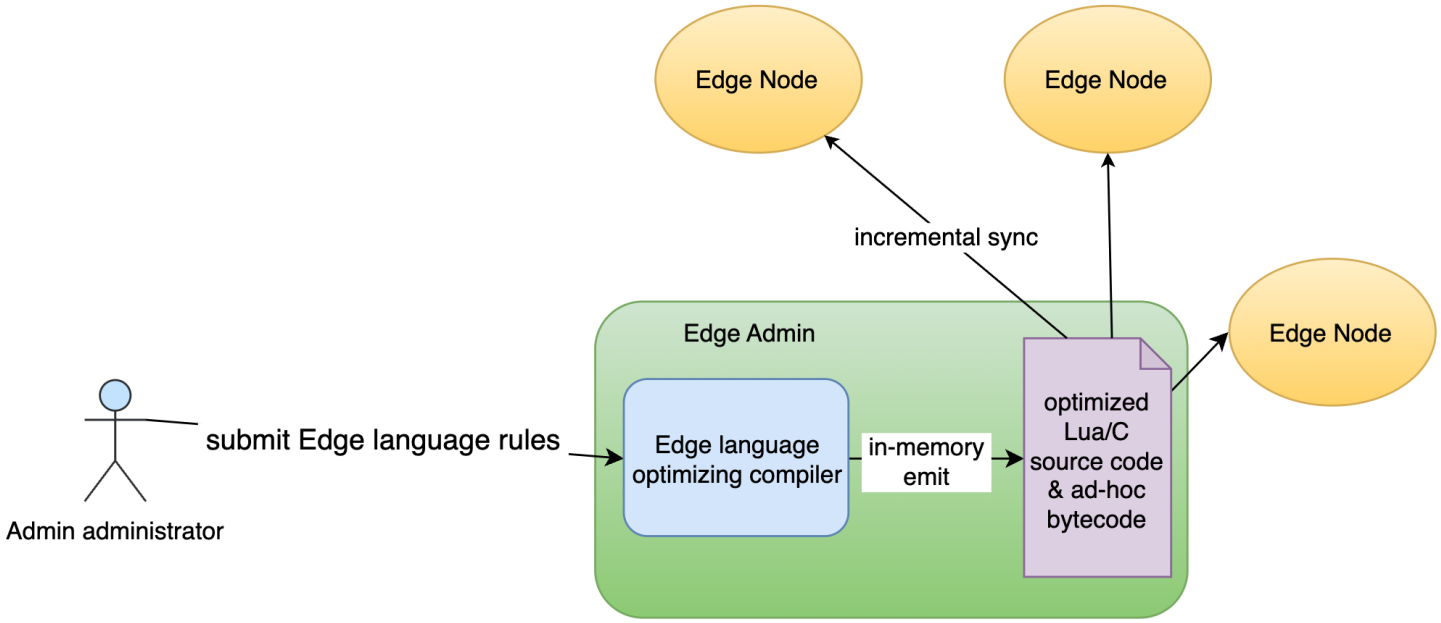
Support custom real-time metrics, multi-tiered metric aggregation computing

- Avoid huge overhead in generating and transfering large log files.
- Directly perform complex aggregated computations at or near the data sources.



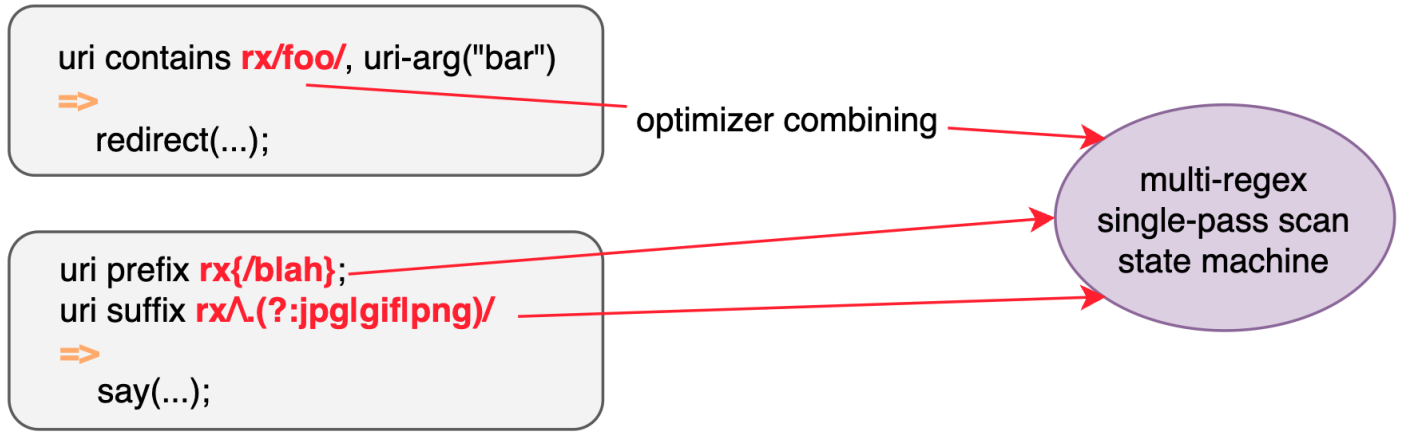
Provide a rule-based "domain-specific language", the Edge language, invented by OpenResty Inc.

- Can be used to express very complicated gateway business logic.
- Can be used for "edge computing"



The Edge language optimizing compiler can combine regular expressions across different user rules

- Can combine and merge many regular expressions into a single statement.
- No matter how many regular expressions are specified, only a single data scan is needed.



OpenResty XRay plugin

Noninvasive troubleshooting and performance monitoring of OpenResty Edge online instances without blind spots.

OpenResty DDoS protective plugin

- Effective protection against almost all common DDoS attacks like SYN flood, DNS, ACK, TLS flood, slow connections, etc., based on our proprietary eBPF+ and Linux XDP technologies.
- Tested in real DDoS attacks.

Trusted by many enterprise users

User stories

OpenResty Edge is suitable for different scenarios, providing security hardening, performance enhancement, and high availability for enterprise websites of different sizes. It can cost-effectively meet common business requirements such as:

- Complete control of traffic data and load balancing to build traffic management for public network or intranet services.
- Build a private CDN network.
- Build a Kubernetes (K8s) ingress controller and service mesh management.
- Replace F5, Nginx and AWS CloudFront with a powerful, distributed load balancer.
- Create and deploy a private CDN network with full control.
- Improve website speed and save labor costs.

A large travel site

Business scenarios

- Daily peak traffic peaks exceed 50G bps.
- Over 100 million daily transactions.
- High user response speed requirements.
- Backend data sources from multiple vendors.
- Traffic peaks can be as high as 10 times during sales.

Challenges

- Large number of users.
- One request needs to be sent to multiple backends.
- High speed demand.
- Large traffic fluctuations in high and low seasons
- The website has been established for a long time. The old system lacks update protection. There are often potential security problems, and the ability to handle high traffic is weak. The new system is constantly being built and pushed online.
- Different departments in the company have different release cycles and maintenance requirements. The development and testing release cycles are complicated.

A large travel site

Solutions

- Deployed over 100 OpenResty Edge nodes of the pro version.
- Network partitioning + virtualization covers production, test, and development environments. Separated environments can solve messy configuration issues.
- Self-built CDN network provides smooth access for domestic and overseas users.
- Request rewrite functionality can successfully protect and encapsulate obsolete enterprise systems.
- Rate limiting ensures smooth service overloads during the sales.
- HTTP/TCP/UDP multi-protocol parallel services.

Results

- Edge's internal permission system allows different business departments to be responsible for different applications and sub-domains, making O&M (operations and maintenance) management very clear, avoiding the problem of excessive concentration of pressure on the operations and maintenance department.
- The number of employees in the department of Operations and Maintenance was reduced from 7 to 1.
- Edge computing eliminates the intermediate encryption layer, reducing the overall average response time of websites and mobile apps by more than 100 milliseconds.
- Built-in WAF protects against over a thousand malicious attacks per day successfully.
- Built-in SSL certificate ensures network security.

A large news website

Business Scenarios

- Caching for global CDN networks.
- Publishing and updating caching of autonomous content.
- Fast and accurate real-time purging of massive amounts of CDN cached content.
- Fast response to network-wide user access.

Challenges

- Third-party CDNs cannot respond to fast cache purges with arbitrarily complex conditions.
- The total costs of third-party CDN are far over the budget.

A large news site

Solutions

- Deployment of over 50 OpenResty edge nodes.
- Self-built CDN network to serve the whole world
- Fast cache purging with high frequency and complex conditions
- Multi-domain SSL autonomous services

Results

- Greatly simplified operations and maintenance.
- Fine control of configurations
- Improved the response speed dramatically.
- Deleted web cache arbitrarily.

A music platform site

Business scenarios

- Integrate the security management of Active Directory within the enterprise.
- SSL self-issued certificates
- Interoperability certification with cell phone manufacturers.
- Supports HTTP protocol and TCP protocols.
- Intranet access to the internet through a unified outlet.
- Requires fast and accurate business statistics.

Challenges

- Other products on the market lack integration with high-performance versions of LDAP and Active Directory.
- Manually maintaining multiple fragmented deployments of Nginx servers is expensive.
- Manual management of self-signed SSL certificates is too complex.
- Need to add the expanded modules with the cell phone manufacturer's signature algorithm.
- Requires supporting WebSocket to customize protocol headers.
- Requires real-time traffic monitoring and statistics.

A music platform site

Solutions

- Deployment of over 20 OpenResty Edge nodes.
- Support proxy access of intranet using Socks5.
- Integrate transparent LDAP and Active Directory permissions.
- Integrate automatic SSL certificate maintenance.
- TCP/HTTP multi-protocols build powerful API gateways to support mobile platforms.
- Flexible creation of arbitrary metrics for real-time insight into the current and historical state of the business.
- Centralized and unified management of different business applications.

Results

- Operations and maintenance are greatly simplified.
- Easy and fast permission management.
- Thousands of free SSL certificates are issued and renewed automatically.
- Intranet access to the public network is unified, managed, and restricted.
- Seamless integration of APIs from third-party mobile vendors.
- Clear, flexible, and real-time display of statistics.

A large HR SaaS service site

Business Scenarios

- Collection and dissemination of corporate HR and financial data.
- Rapid customization and release of APIs.
- A huge volume of traffic and data, numerous channels to collect and distribute data.
- High demand for security.

Challenges

- The management and evolution of API.
- High performance and high concurrency.
- Costs are high and the response speed is slow.
- Hardware devices don’t have good scalability and exploitability.
- Public cloud services don’t meet security requirements.
- F5 equipment is too expensive and not flexible enough.

A large HR SaaS service site

Solutions

- Self-deployment of over 50 OpenResty Edge nodes (will expand to 200 ~ 500 nodes in the future).
- Replace the expensive F5 devices.
- Build API services.
- Multi-protocol supports HTTP/TCP/UDP.
- SSL certificate extension management.
- Expand clusters and reschedule traffic automatically based on real-time load metrics.

Results

- Costs have been reduced by 80%.
- Features increase with upgrades.
- Performance continues to improve with upgrades.
- Self-deployment ensures autonomous control.
- Regular upgrades solve security vulnerabilities.

The website of a well-known fast-food chain

Business scenarios

- A huge number of network terminals.
- High demand for the speed of response.
- Internet- and API-enabled food ordering business.

Challenges

- High concurrency, a large volume of users and throughput.
- Requires a high-performance, easy-to-manage API.
- Don't want to build a large IT technical team.
- Need for rapidly scalable server capacity.

The website of a well-known fast-food chain

Solutions

- Deployment of 20 OpenResty Edge nodes.
- Dynamic expansion of API gateway servers.
- Tiered web caching improves the response time.
- 100% self-deployment ensures data security.
- Redundant server capacity to cover instantaneous system load spikes.

Results

- The online business is secure, complete, efficient, and controllable.
- Online orders have increased significantly.
- IT investments are completely under budget.
- The efficiency of API development, extension, and management has more than doubled.
- No need to create a large IT team. Focus on the main restaurant business.

Request a free trial of OpenResty Edge

View the documentation of OpenResty Edge

Watch the video tutorials of OpenResty Edge

- High-performance distributed enterprise network gateway and web application firewall.
- Easy to deploy private enterprise traffic entry or private CDN networks.
- Simply click on the web user interface to configure without messing with any configuration files.
- Real-time configuration update, no need to restart or reload the service processes.