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Application-centric DNS for the Morden Internet

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Content

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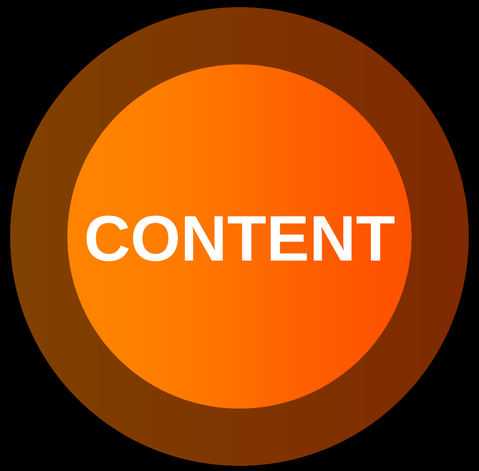

- Modern DNS as a online service
- What we do in DNS
- Conclusion

An analogy：The Skyscraper and the base

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A solid and stable base is a matter most for the building

The details of the base...

Complicated structures
and reinforced concrete with steel bars

Internet evolving with DNS

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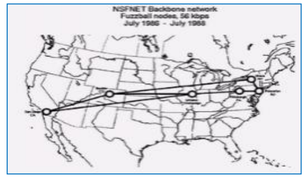
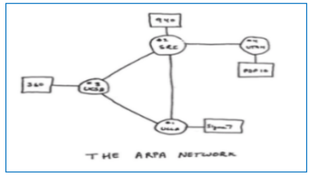
Birth

- Start from ARPANET
- Map name to address with HOST.TXT
- **4 machines**



1969



Growth

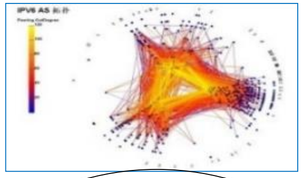
1980s

- TCP/IP enable the network to scale to thousands of machines
- **DNS invented to manage the naming**
- **Rapid growth： thousands of machines**

Internet Popularity

- **PC , website and Internet**
- WWW, HTTP，Web service, domain business popularity
- **Explosion：millions machines, huge connections**

1990s



Mobile Internet and Cloud

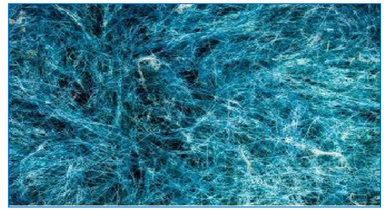
2000s

- 4G、Smart Phone，APP，H5，cloud
- Millions of domains and Apps
- **Billions of mobile devices, dynamic recourses and ten billions of connections**

Internet of everything

- 5G， IoT，IPv6, M2M
- **Everything connected，trillion of connections**

Future



Connection-centric, Domain/IP/RR database

Application-centric , Intelligent Brain

The hot topics in modern DNS

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Combined with Cloud technologies

- Cloud-Based DNS
  (resilience、Rapid Deployment、Easy operation)
- Hybrid DNS Cloud
  (One DNS for ADNS and RDNS, private and public domain)
- Cloud-Native DNS
  (Cloud native design：CoreDNS)

Fine-grained Intelligence

- Fine-grained users separation
- Rich scheduling policies

Application-Centric DNS

- Native APP DNS：
  HTTPDNS/SDK
- HTTPS/SVCB

Privacy and Security

- DoH/DoT
  (Android , iOS, Windows， Firefox, Chrome)
- DNS Firewall
  (PassiveDNS, DNS filtering)

What we do DNS in Alibaba Cloud

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Serve ~1 billion users, 1 Trillion queries per day（IDC，Public DNS, ADNS etc），serve 20 regions and Millions VMs

Alibaba DNS has a series of products that covers the **Alibaba Cloud DNS**, Alibaba Cloud PrivateZone, Alibaba Cloud Public DNS, Apsara Stack DNS, and Global Traffic Manager , Cached Public Zone

Alibaba Cloud DNS

Alibaba Cloud PrivateZone

Global Traffic Manager

Apsara Stack DNS

Alibaba Cloud Public DNS

Cached Public Zone

More Capacities

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Alibaba Cloud DNS developed the advance services based on customers' requirements

Authoritative DNS in June 2018

Public DNS in Oct 2019

Alibaba Public DNS

Online in Jan 2020

For DNS data integrity

Supporter of DNS Flag Day

Public DoH/DoT in April 2020

Consideration on Data privacy and security

Alibaba Public DNS: www.alidns.com

The Major challenges – Stability and security

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It is a big challenge to operate a large-scale DNS system

- DDoS attack on ADNS
- DNS water torture attack on RDNS
- Anycast network operation/scheduling
- Hung server issue
- Data consistency in large system
- Bugs on DNS software
- DNS Hijacking between stub and resolvers
- External/Third-part interference(Stale DNS data)
- …

There are always uncertainties and risks in current DNS architecture

Case：Mitigation of DDoS on Live signing

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Alibaba Cloud DNS uses sign-on-the-fly in DNSSEC

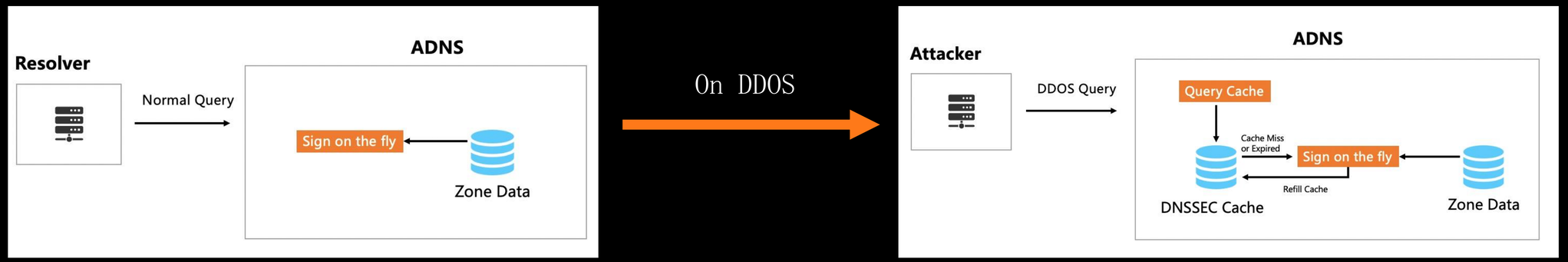
Why

- Huge zones and domains
- Multiple dynamic resolution policy
- Large global distributed system

Extra pay

- Security challenge in key distribute
- Significant increase CPU load

Mitigation solution on DDOS



Overall performance has increased by **50 times** than without DNSSEC cache

The Major challenges : fine grained control in time

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To meet the requirement of Application-centric DNS in Mobile Internet

- Multiple policy, fine-grained scheduling and control

To achieve precise GrayRelease for example.

- End-to-End Propagation time （in seconds or less)

To achieve fast Failover for example

Traffic scheduling scenarios of Alibaba Cloud DNS

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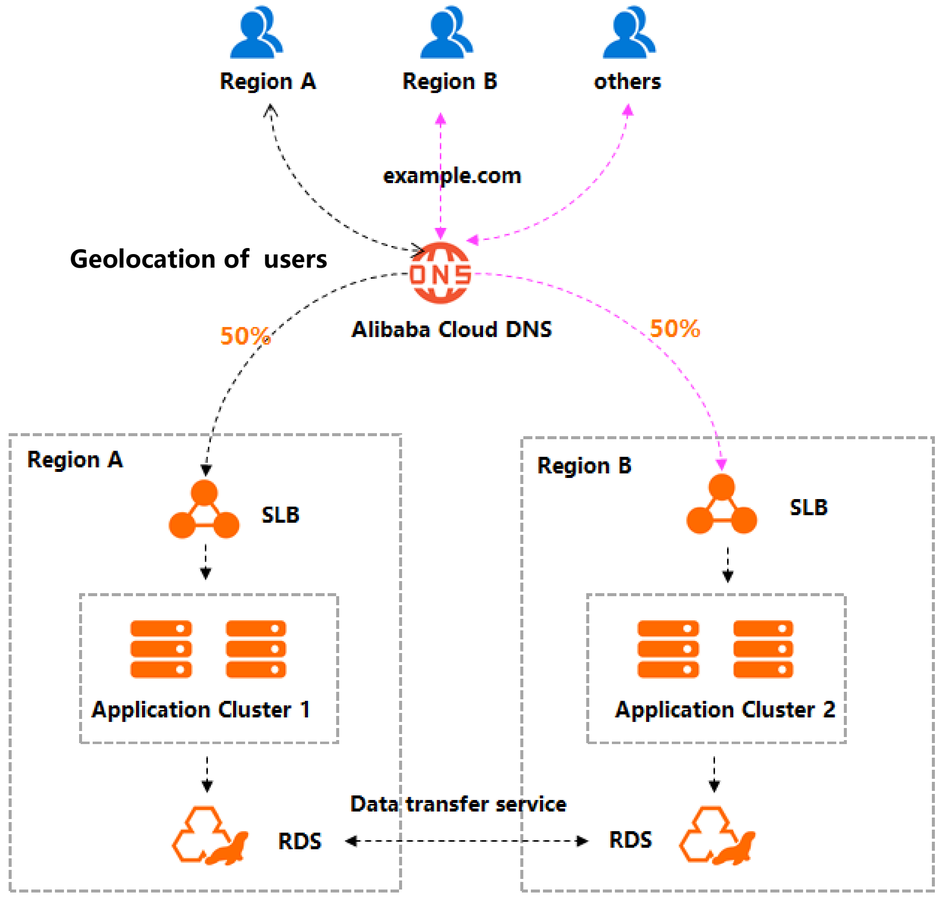
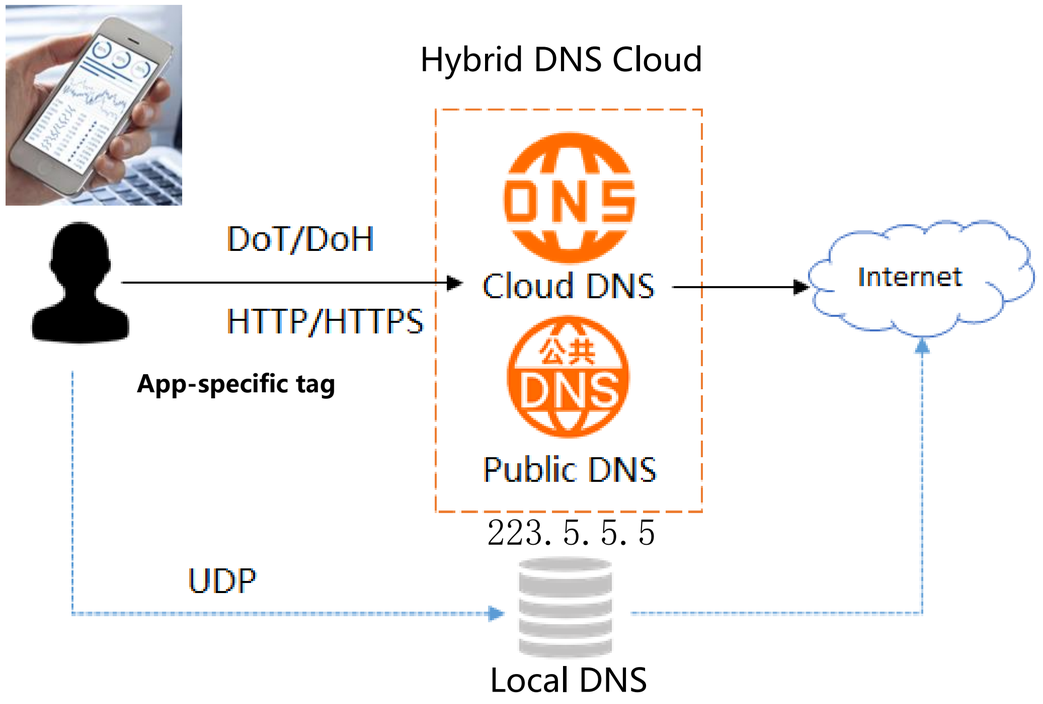
Intelligent traffic scheduling base on Geo-location and App-specific tag



General public network resolution scenarios



To achieve fine-grained scheduling

Application-level DNS for Mobile Internet

Hybrid DNS solution for Failover scenarios

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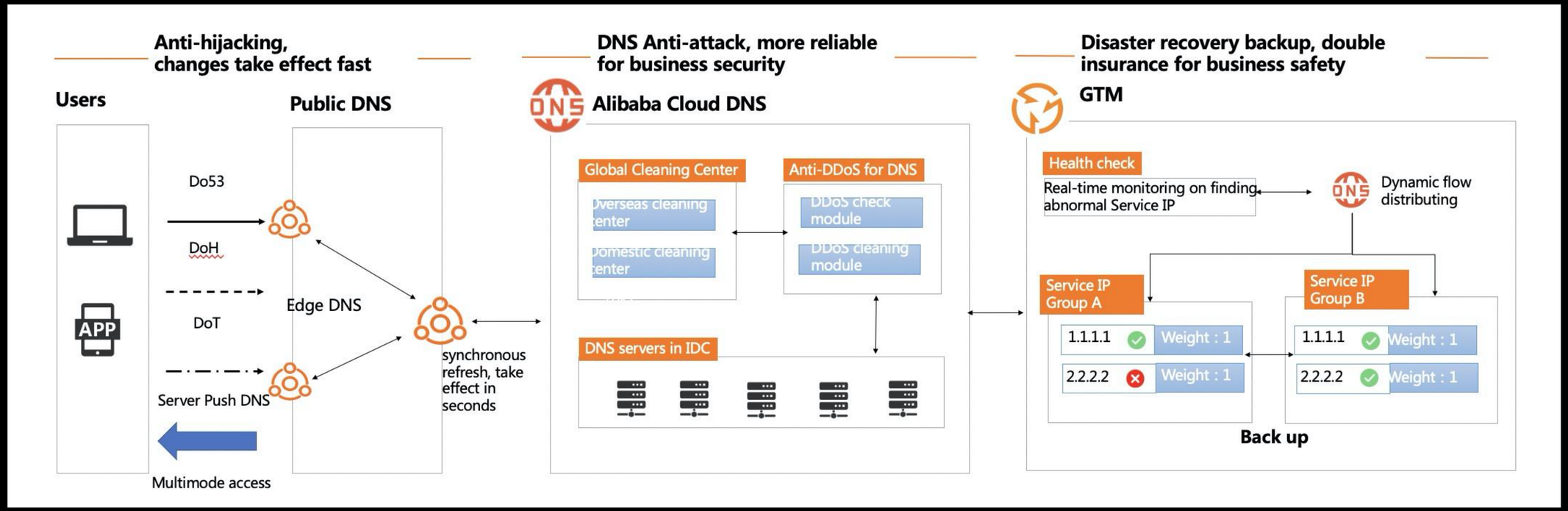
For the situation that Internet online services are not available due to attack or system failures, Alibaba Public DNS + Alibaba Cloud DNS + GTM collocation can be used to improve the overall protection capability.



Advantages

- No Hijacking: Bypass the middle box to avoid domain name hijacking.
- Accelerated access: Access to direct requests without layers of recursion by pushing authoritative data to recursive .
- Security and privacy: Support DoT/DoH access to ensure users' privacy.

Advantages

- One - stop resolution: To achieve domain name change and propagation in seconds through the sync between recursive and authoritative DNS
- Intelligent resolution: Carry app-specific info via HTTP or EDNS0 Tag from end client to DNS server, with more intelligent traffic scheduling

Conclusion and thoughts

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- DNS is the base of the whole Internet evolving to next stage
- Different from Connection-Centric DB, Application Centric DNS provides:
  - ✓ Multiple policies, fine-grained scheduling and control
  - ✓ End-to-End Propagation time（in seconds or less）
  - ✓ and more features of resilience, security, and stability
- Alibaba Cloud DNS provide Application-Centric DNS solution
  - ✓ Now it is proprietary solution with Alibaba Cloud’ s ADNS, Public DNS, GTM, CDN, DDoS protection, HTTPDNS/SDK…
- It is a promising field to define some use cases of Application-Centric DNS with multiple vendors
  - ✓ EDNS0 Tag (draft-bellis-dnsop-edns-tags) is one example for firewall application

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