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DNS Extension for Autonomous Internet(AIP)
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Abstract

With the reality of Internet, Autonomous Internet technology in this article constructs independent autonomous extensible domain name architecture and domain name hierarchy through current domain name architecture, provides independent root DNS server, inner/outer DNS resolution mechanism for each autonomous internet network system, and provides reformation and transition solution from current Internet to realize autonomy even in unilateral action.

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1. Introduction

Internet Domain Name System (DNS) distributes domain name and IP address for the host on the Internet. DNS automatically translates the domain name into IP address when user accesses Internet using domain name. In current Internet domain name hierarchy, the root DNS server authorizes and distributes all sub-layer DNS servers. And by default it is to request the root DNS server service when any other DNS servers receive a non local domain name resolution request. DNS supports the Internet running normally. But its central control method is not suitable to autonomy and scalability and can't keep up with the fast development of Internet. To national internet network, owning its independent root DNS server and realize autonomy in Internet is a problem not only for the cost but also for the technical difficulty. It is almost impossible in current DNS architecture.

1.1. Specification of Requirements

In this document, several words are used to signify the requirements of the specification. These words are often capitalized. The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

2. Autonomous Internet DNS Design

2.1. AIP DNS Design Goal

Based on Internet practice, autonomous internet (AIP) technology should even unilaterally transform the Internet into Autonomous Internet (AIP) without protocol change, using mode change, transition period. In the same time, Autonomous Internet system architecture designed should be safe and extensible; the reformation is the least possibly and the transition is smooth and feasible.

To achieve the goal of Internet autonomy, AIP technology will construct an independent autonomous extensible domain name system and hierarchy based on current DNS, so that each AIP network has its own independent domain name hierarchy and root DNS servers; It provides the domain name resolution mechanism inner/outer AIP network system, so that the internal domain name resolution is no longer via the DNS outside this AIP network. Thus, the new generation Internet which uses the AIP technology will become a multi-polar system and provide full self-control ability to each AIP network.

2.2. AIP DNS Hierarchy

The main rules of the Autonomous Internet DNS are defined as following:

Rule 1: Each AIP network itself has a complete set of Domain Name System, which support traditional domain name resolution within the AIP.

Rule 2: Each AIP network has its own numbered name that is different from the others. The numbered name is taken as the default domain name suffix when the internal domain name of this AIP network is cited by external AIP network. Any IP node's external domain name consists of its internal domain name and its AIP network default domain name suffix.

Rule 3: When communicate between AIP networks, the access to IP node of external AIP network must use the IP node's external domain name.

AIP Domain name system is autonomous, extensible.

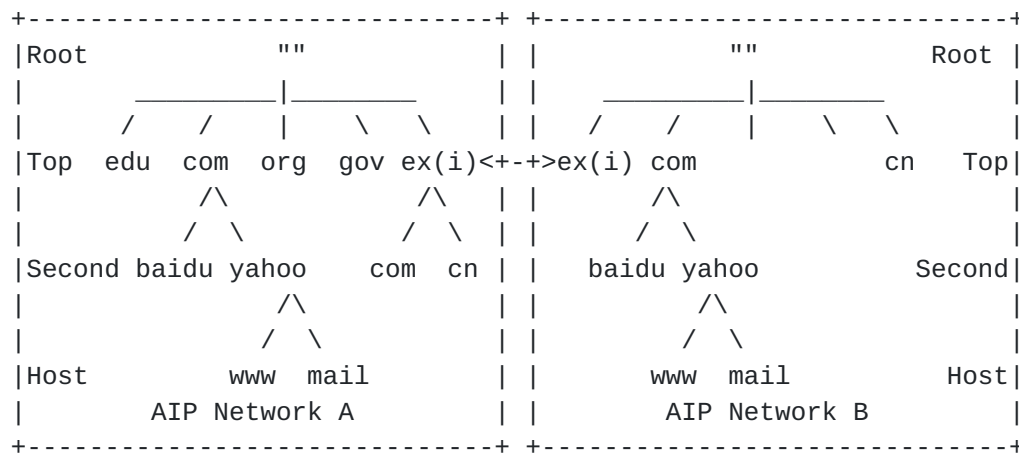


Figure 1: Autonomous Internet domain name hierarchy

According to the goal and DNS rules of AIP, the AIP domain name hierarchy of AIP can be designed as Fig. 1. In this figure, network A, B and ... are AIP networks; Domain node "www.yahoo.com" in network B is expressed as "www.yahoo.com.B" for its external domain name. At the same time, each AIP network domain name hierarchy tree adds the top-level domain name "ex(i)", so as to map the other external AIP network domain name hierarchy trees accessible from this AIP network. When ex(i)=B, it means the other AIP network B is accessible from this AIP network.

2.3. AIP DNS Architecture and Transformation

According to the AIP DNS, we can construct AIP DNS architecture show as Fig. 2. Each AIP DNS has its root DNS servers, which are responsible for all the DNS resolution in this AIP network. Other DNS servers of this AIP point to these root DNS servers by default.

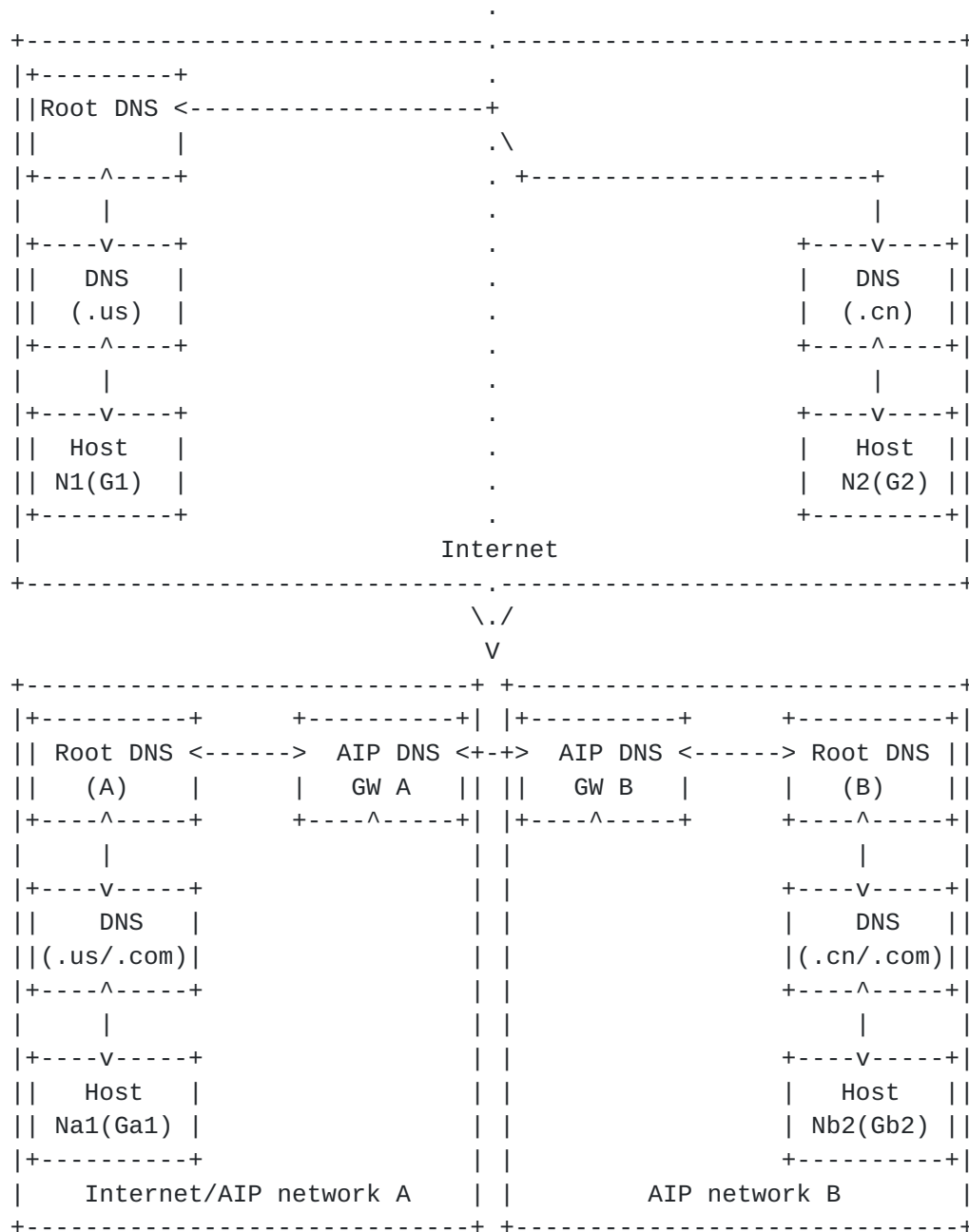


Figure 2: AIP DNS architecture and transformation

Each AIP network is almost the same as the current Internet, and the internal domain name resolution and IP node communication have not any change. The only change is that the destination domain name need add domain name suffix of the destination AIP network when IP nodes communicate between different AIP networks. Therefore, each AIP network will add a device called "AIP DNS gateway" (AIP DNS GW) to support domain name resolution between AIP networks. On one hand, it forwards its external DNS resolution request to the destination AIP network, returns the DNS resolution result to internal requester; On the other hand, it receives DNS resolution request from external AIP networks, feedback the DNS resolution result to the external AIP network requester, which at first it would get the internal DNS resolution result according to the traditional way.

In order to realize the transition from Internet to Autonomous Internet, each partition of current Internet should first realize possible self-government and gradually reduce its dependence on the foreign domain names, such as COM, NET et al.

Then to each AIP network, we can establish a new autonomous DNS, or Upgrade one part of current Internet DNS (core part or non core part) to a new autonomous DNS.

Unilateral action: It is not likely the whole Internet can be transformed synchronally in one time. In order not to affect existing domain name resolution before the Internet core part transforms into an AIP network, any country can set up an AIP DNS independently and connect to the Internet through the original link; or any two countries in agreement can set up their AIP networks and connect to each others. There is something different in the unilateral action. On one hand, the upgrade work is including of new added local AIP network root DNS server to construct an independent DNS, and an AIP DNS GW deployment to support domain name resolution between AIP networks. On the other hand, it is necessary to add a pre-transformed AIP DNS GW in each AIP network connecting to the Internet (core part) DNS instead of the original transformation requirement for Internet core part. The pre-transformed AIP DNS GW would initiatively add the domain name suffix to the domain name from the existing Internet (core part), which is the only difference from normal AIP DNS GW.

3. AIP DNS Resolution Procedure

3.1. Domain Name Resolution within AIP Network

Within each AIP network, domain name resolution keeps traditional method.

3.2. Domain Name Resolution between AIP Networks

Between AIP networks, external domain name of destination IP node should be provided for domain name resolution. Assume that a host in AIP network A has domain name Na1 and global IP address Ga1. Another host in AIP network B has domain name Nb2=www.yahoo.com, whose external domain name is www.yahoo.com.B. Fig. 3 shows the DNS query procedure between AIP network A and B when host Na1 request for the domain name resolution of host Nb2. This domain name resolution procedure between AIP networks is described as following:

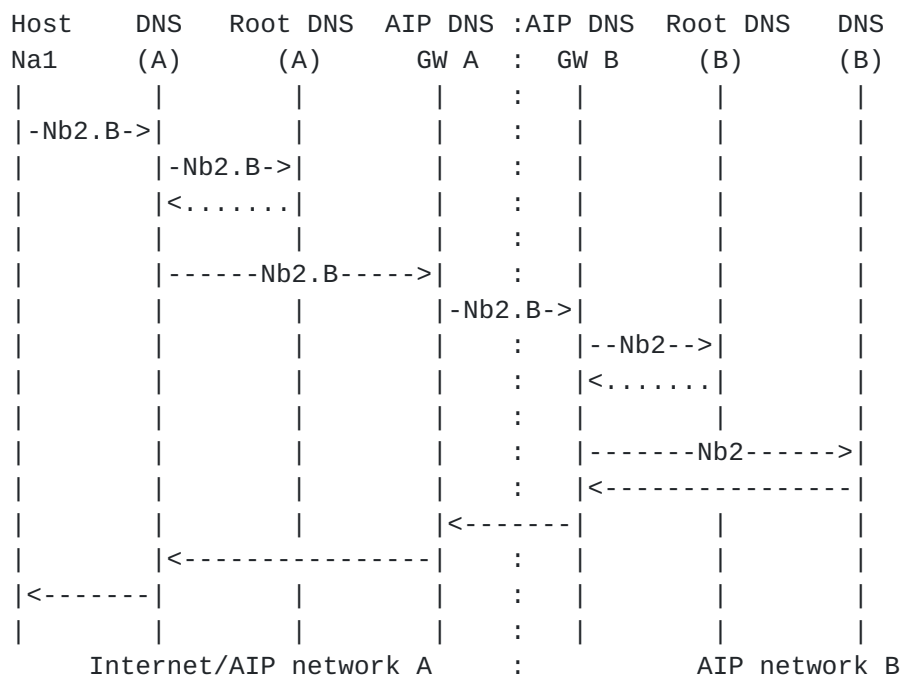


Figure 3: DNS query procedure between AIP networks

Step 1: Source host Na1 request for the resolution of external domain name "Nb2.B", and send the query to local DNS server through host's resolver.

Step 2: When receive the query, Local DNS server inquire its cache and return the result. But if there is no record for the query, local DNS server would send query to root DNS server of local AIP network A.

Step 3: Root DNS server of local AIP network A return a primary DNS server IP address of queried domain (sub-domain of AIP network A's root domain name, here is B, which mirrors external DNS hierarchy of another AIP network B) to local DNS server, namely the IP address of AIP DNS GW A in AIP network A.

Step 4: Local DNS server send the query to the returned DNS server (AIP DNS GW A) IP address again.

- 1) When receive the query, AIP DNS GW A inquire its cache and return the result. But if there is no record for the query, AIP DNS GW A would send query to AIP DNS GW B in AIP network B.
- 2) When receive the query, AIP DNS GW B inquire its cache and return the result. But if there is no record for the query, AIP DNS GW B would get rid of the local AIP network domain name suffix ".B" from external domain name "Nb2.B", then send query with the internal domain name "Nb2" to root DNS server of local AIP network B.
- 3) Root DNS server of local AIP network B return a primary DNS server IP address of queried domain (sub-domain of root domain name, such as COM) to AIP DNS GW B.
- 4) AIP DNS GW B sends the query to the last step 3) returned DNS server IP address again. After receive the query, this DNS server inquire (its cache) and return the corresponding record or the corresponding lower-level DNS server IP address.
- 5) AIP DNS GW B repeats last step 4) until it finds the correct record, namely the IP address Gb2 of the domain name Nb2.
- 6) AIP DNS GW B turns the internal domain name "Nb2" into external domain name "Nb2.B" in the returned result by adding local AIP network domain name suffix "B", and then caches the result and return the result to AIP DNS GW A.

Step 5: AIP DNS GW A caches the returned result and return the result to local DNS server.

Step 6: Local DNS server caches the returned result and returns the result to source host Na1.

Therefore, host Na1 (Ga1) now can communicate with host Nb2 (Gb2) after it gets the IP address of the destination host Nb2.

4. Conclusion

Autonomous Internet DNS provides a technology to realize Internet autonomy, which can own independent root DNS server even in unilateral action. And it could be realized in high independence, extensible usage, the least cost and non transition period. It is hopeful to establish future autonomous extensible multi-polar Internet and resolve the autonomous problem of Internet.

5. Security Considerations

There is no additional security requirement than current domain name system. Security issues are not discussed in this memo.

6. IANA Considerations

As described by AIP DNS rule 2 in [Section 2.2](#), different AIP network default domain name suffix needs to be assigned by IANA.

7. Acknowledgments

The authors would like to thank everybody for their valuable opinion and evaluation to this document.

Following are some FAQs:

- 1).The I-D does not split the DNS at all. It plays with words by pretending it will allow several roots but this is not true. Instead, it creates a super-root (the one which will allocate the AIPs, the .A and .B in the examples) and therefore just displaces the (real) problems to the super-root.

A:Yes, this I-D does not split the DNS at all and just make it more extensible and flexible! It is ridiculous rumor to say that anybody could and wanted to split the Internet too!

Here is a super-root in this draft in mathematical sense. It is the way to smoothly transfer to AIP DNS and provides DNS resolution among all these AIP networks. If we provide the domain name suffix, common sense is available globally. It satisfies the two essential preconditions in [RFC 2826](#):

- The existence of a common symbol set, and
- The existence of a common semantic interpretation of these symbols.

But in practical you can run your own root in each AIP network. It provides autonomy and extensibility.

Technically, it is extensible choice for countries, global operators, and specific internet networks such as Things of Internet.

Of course, there are more other applications as you need.

2).Has the AIP technology considered the possibility of disruption to Internet communications?

A:This would not affect Internet communications in traditional ways. Based on Internet practice, autonomous internet (AIP) technology can transform the Internet into Autonomous Internet (AIP) without protocol change, using mode change, transition period.

It would be more reasonable and efficient that internal domain name resolution is no longer via the DNS outside this AIP network.

And as described by AIP DNS rule 2 in [Section 2.2](#), different AIP network's default domain name suffix needs to be assigned by IANA, or other international organization, or it can be negotiated directly by multi-stakeholder organizations like ICANN.

3).Does the AIP technology propose to use recursive DNS access between AIPs? It is likely to have serious scaling issues.

A:This recursive translation would happen only in local DNS server and AIP DNS GW but not AIP DNS roots.

4).If, for example, I am in a Chinese AIP and want to access www.example.com, but I want to get to the one that would be accessible from Brazil, do I access "www.example.com", "www.example.com.ex", www.example.com.br.ex", or something else? Is there any reason to believe that the resource record for www.example.com within the AIP is the same as the one for the same name in some other AIP? I worry about that, as much as anything, because international business and communication depends on a common understanding of resource records; if a vendor in country A wants to make a product or service available to a potential customer in country B (or for that matter in all countries), it gives one URI/URL to all of them and they all have access to it. If there is significant confusion at this level, sending for example requests intended for Google to Baidu, it will have a significant and negative effect on international business and communications.

A:AIP just provides more flexibility and possibility to international business and communications. For Google or Baidu, they can apply different local URL for different country to provide differentiate services as usual(for example www.google.cn, www.google.com.hk...); or they can apply a unified URL for all countries such as www.google.com and just provide a link for different countries.

In AIP, The another additional possibility is to apply identical

local URL for different country to provide differentiate services.

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5).Do you agree that the economic importance of international trade far outweighed the value of having an autonomous naming system...?

A:I agree thoroughly that new technologies should provide more flexibility and possibility for people equally but not limit the free and equal international communication right-it is the soul of Internet forever!

6).Could you comment on the proposal, explaining in more detail what you have in mind, and how (a) the service remains scalable, and (b) the service supports the international objectives of business interests that use it?

A:AIP technology is so simple as it describe in this draft.
The prospect of future Internet would be more open and scalable if we can just imagine openly!

8. References

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