



IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

DNS RESTification

PhD fully funded by IMT Atlantique

Context of the PhD

DiNS ANR research project <https://dins.imag.fr>

Keywords: Internet, DNS, REST, DoH, IoT

Supervisors

- Laurent Toutain - IRISA/D2/OCIF (<https://scholar.google.fr/citations?hl=fr&user=d31SB5UAAAAJ>)
- Ahmed Bouabdallah - IRISA/D2/OCIF (<https://cv.archives-ouvertes.fr/ahmed-bouabdallah>)

Required profile

The candidate must hold a Master degree (or 5-year university / engineering school equivalent degree) with a specialization in network engineering (Internet architecture and protocols, IoT, QoS, etc.). A strong background in theoretical analysis and experimental implementation through PoC development with good english writing and oral communication skills is required.

Location

IMT Atlantique - Campus de Rennes - Département SRCD
2, rue de la Châtaigneraie - CS 17607 - 35576 Cesson Sévigné
Cedex. France
<https://www.imt-atlantique.fr/>

Application documents

- CV + motivation letter
- Abstract of the master thesis
- Academic records

Contacts

Laurent.Toutain@imt-atlantique.fr
Ahmed Bouabdallah : ahmed.bouabdallah@imt-atlantique.fr

Subject description

DNS protocols were designed in the early 90s to allow name resolution in a distributed and reliable way [1, 2, 3]. The original design proved its accuracy and remains almost unchanged in the current Internet. The introduction of anycast [4] allowed it to spread the

IMT Atlantique Bretagne-Pays de la Loire - www.imt-atlantique.fr

Campus de Brest
Technopôle Brest-Iroise
CS 83818
29238 Brest Cedex 03
T +33 (0)2 29 00 11 11
F +33 (0)2 29 00 10 00

Campus de Nantes
4, rue Alfred Kastler - La Chantrerie
CS 20722
44307 Nantes Cedex 3
T +33 (0)2 51 85 81 00
F +33 (0)2 51 85 81 99

Campus de Rennes
2, rue de la Châtaigneraie
CS 17607
35576 Cesson Sévigné Cedex
T +33 (0)2 99 12 70 00
F +33 (0)2 99 12 70 08



load around the globe and be more resilient to attacks. The development of the web has made the DNS a critical part of the Internet, which suffers regular security attacks. By relying on a public key infrastructure, DANE/DNSSEC offer extensions to the original protocol to secure the resolutions by guaranteeing entities authentication [5] and end-to-end integrity with data origin authentication [6].

Since the DNS introduction, the rest of the internet has also evolved and the dominant model is based on REST [7]. REST introduces the notion of resources, identified by a global and uniform name. Caching is also present in the architecture. The use of HTTP and TCP to implement the REST paradigm doesn't fit well with light resolution and both models evolved separately.

In the last years, new evolutions occurred. Developed for the IoT, CoAP [8] provides a lightweight implementation of the REST model mainly based on UDP. DoH [9] is making a move to REST allowing applications and operating systems to use HTTPS to dialog with resolvers.

The goal of the thesis will be to study the architectural impact and the performances of generalizing the REST principle and associated protocols to the DNS. In particular, compare the reliability, the resilience, and performances of a REST approach. What will be the benefit in terms of flexibility and deployment of new services over the DNS of the REST approach? One specific subject is related to the IoT roaming as described in the DiNS ARN project. Is CoAP a better candidate for the DoH-like approach in terms of security and performances.

References

- [1] Domain names - concepts and facilities. P. Mockapetris - RFC 1034 - Nov. 1987. IETF.
- [2] Domain names - implementation and specification. P. Mockapetris - RFC 1035 - Nov. 1987. IETF.
- [3] DNS Terminology. P. Hoffman, A. Sullivan, K. Fujiwara - RFC8499 - Jan. 2019.
- [4] Distributing Authoritative Name Servers via Shared Unicast Addresses. T. Hardie - RFC3258 - Apr. 2002.
- [5] Use Cases and Requirements for DNS-Based Authentication of Named Entities (DANE). R. Barnes - RFC 6394 - Oct. 2011.
- [6] DNS Security Introduction and Requirements. R. Arends, R. Austein, M. Larson, D. Massey, S. Rose - RFC4033 - March 2005.



IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

[7] REST in Practice. J. Webber, S. Parastatidis and I. Robinson, O'Reilly Media, 2010.

[8] The Constrained Application Protocol (CoAP). Z. Shelby, K. Hartke and C. Bormann - RFC 7252 June 2014

[9] DNS Queries over HTTPS (DoH). P. Hoffman and P. McManus. RFC 8484 - Oct. 2018.