

afnic

internet
made in france

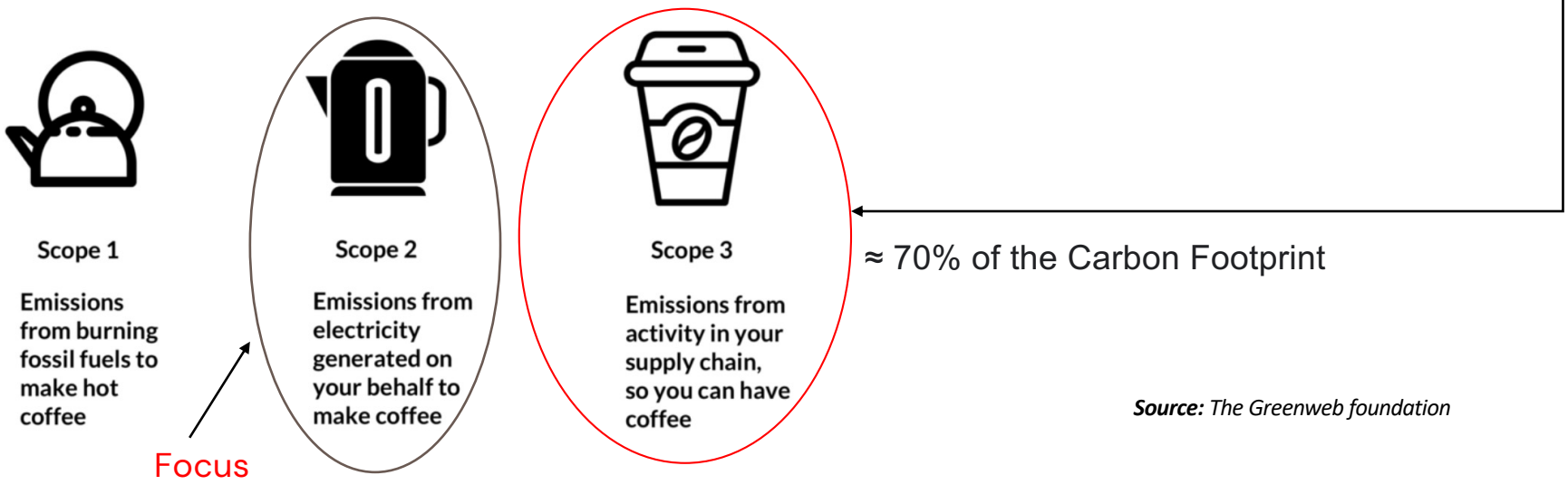
Collège International – Juin 05 2025

DNS Energy Consumption

- *Sandoche BALAKRICHENAN*

Afnic's CSR effort

	Total Emission	Emission/Domain Name
2018	867 tCO2e	252 gCO2e
2022	690 tCO2e	153 gCO2e
2023	625 tCO2e	147 gCO2e ≈ 0.6 Km by Car

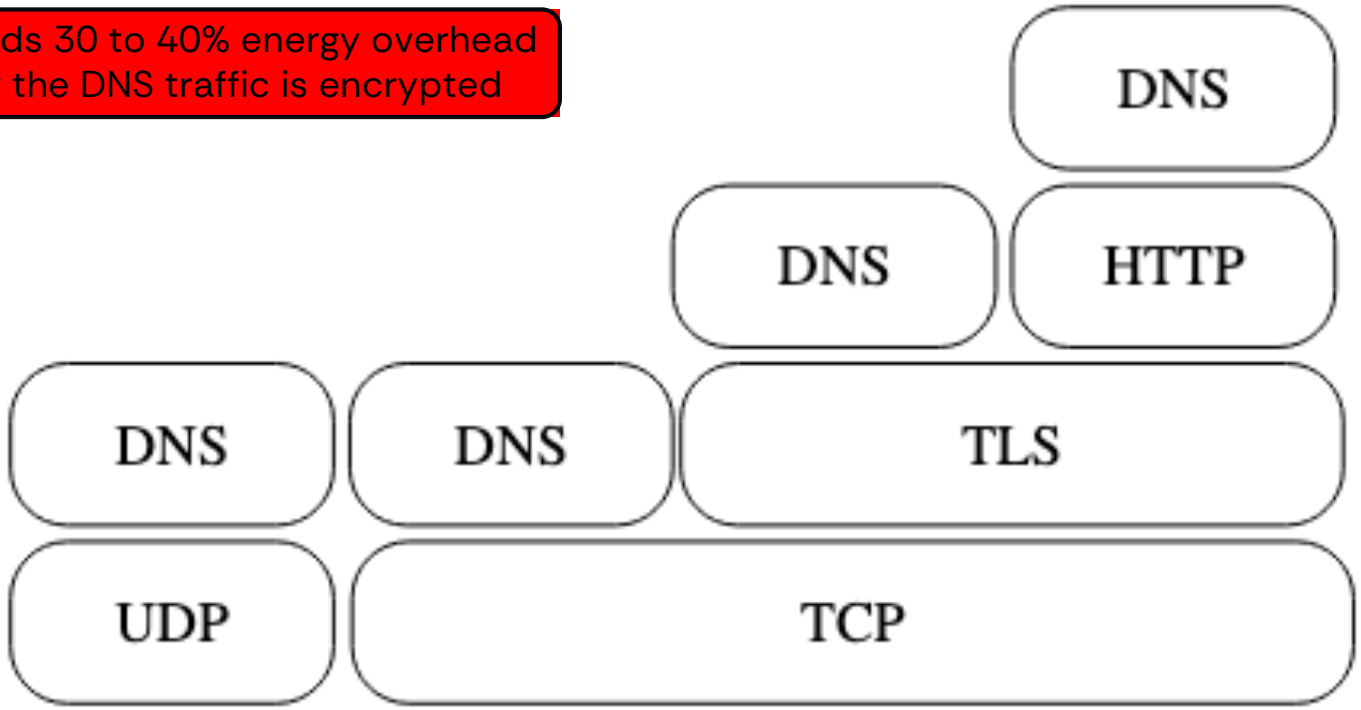


Source: *The Greenweb foundation*

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DNS evolutions

TLS adds 30 to 40% energy overhead
24% of the DNS traffic is encrypted



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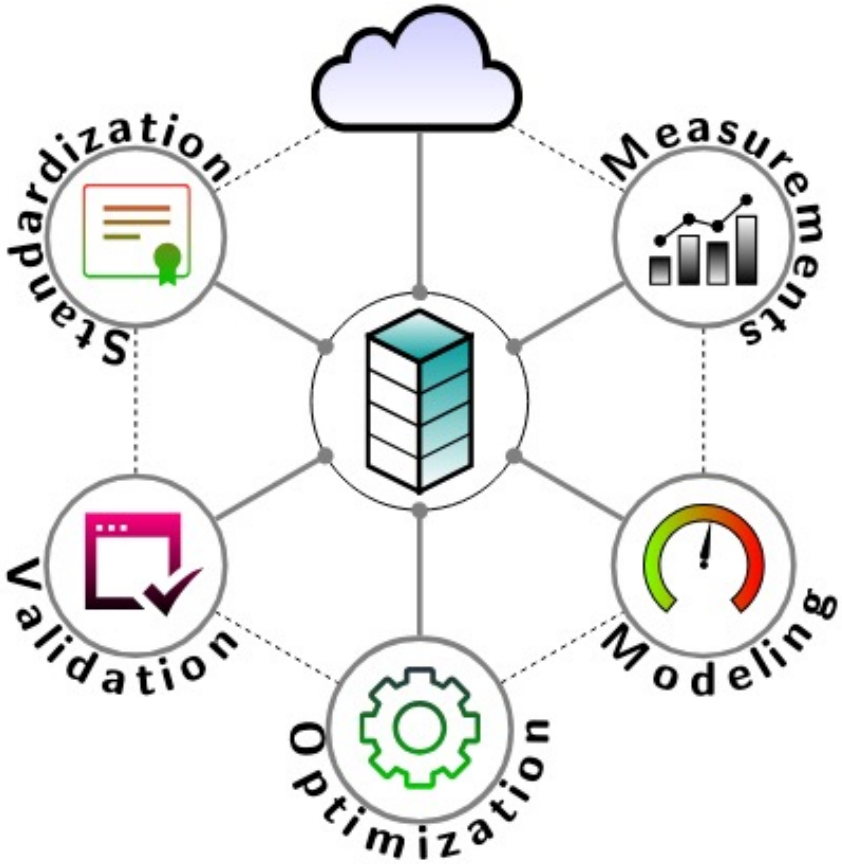
DNS energy consumption - Hypothesis

Component	Estimated energy share
Data Center	2% of global electricity demand
DNS Network infrastructure	3 – 9% of DNS Data center energy
Encryption in the DNS	10 – 15% of DNS Data center energy **~30% of La Rochelle's total electricity usage***

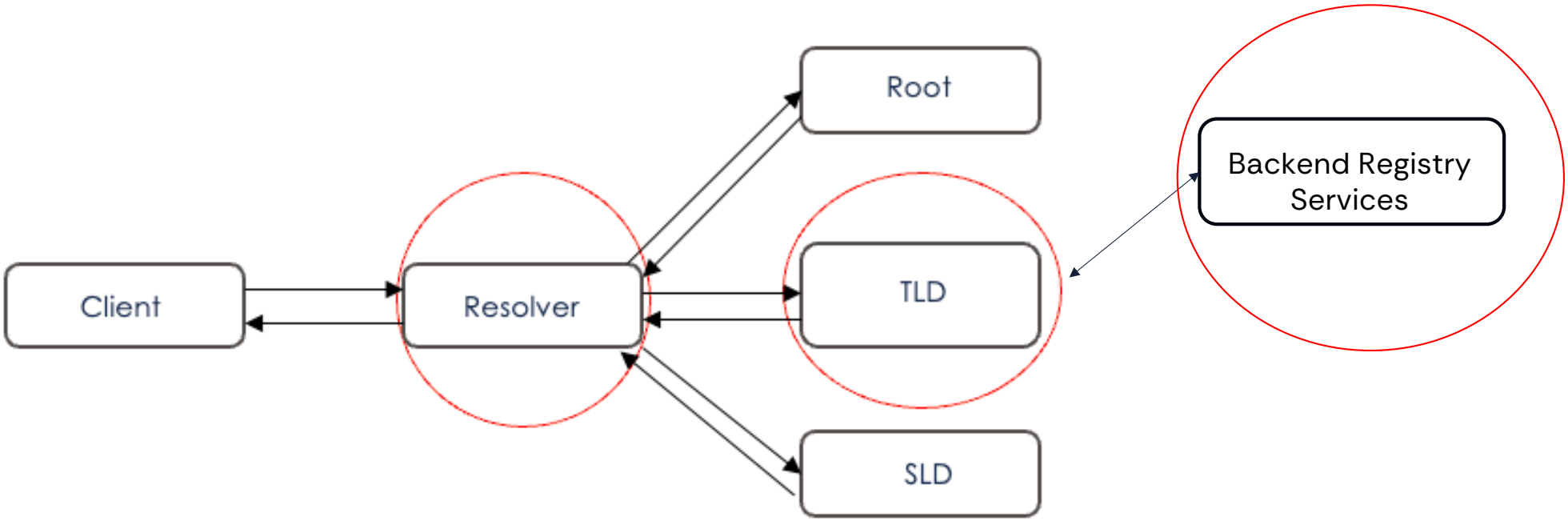
** Calculation done here is a conservative estimate that DNS-related infrastructure makes 1% of the total consumption of data center energy usage*

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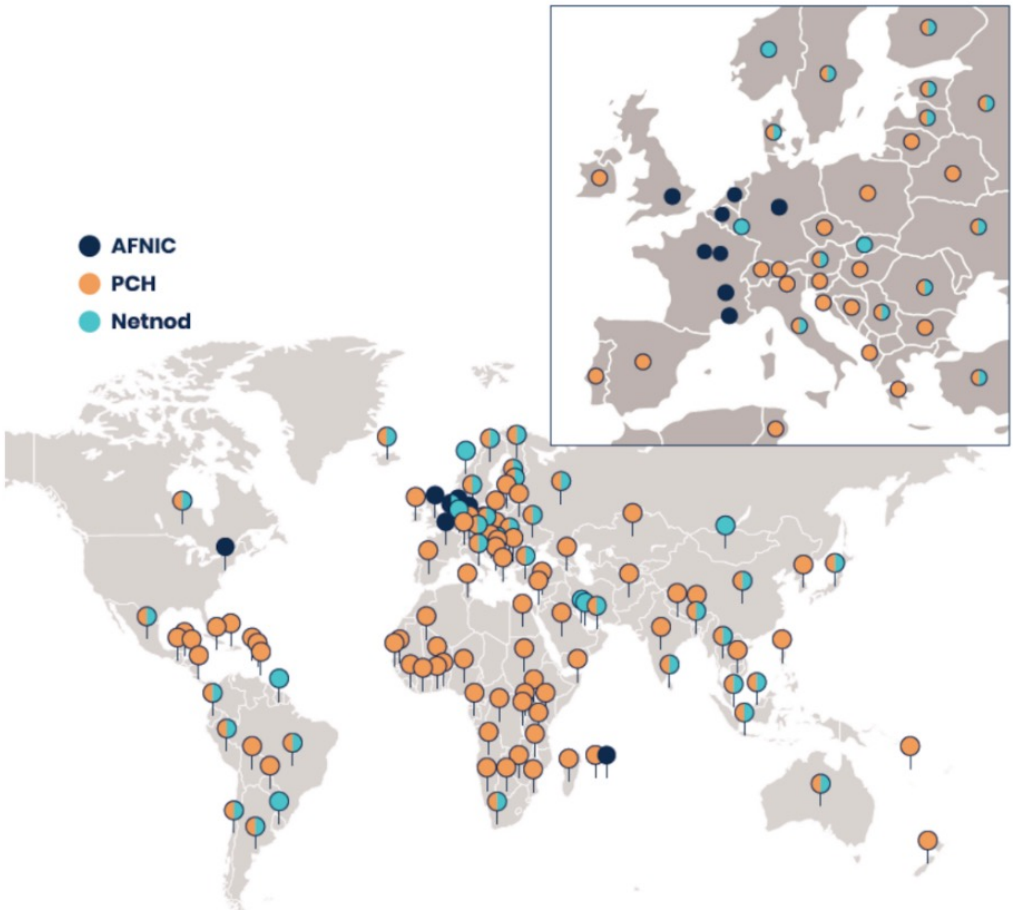
Our approach



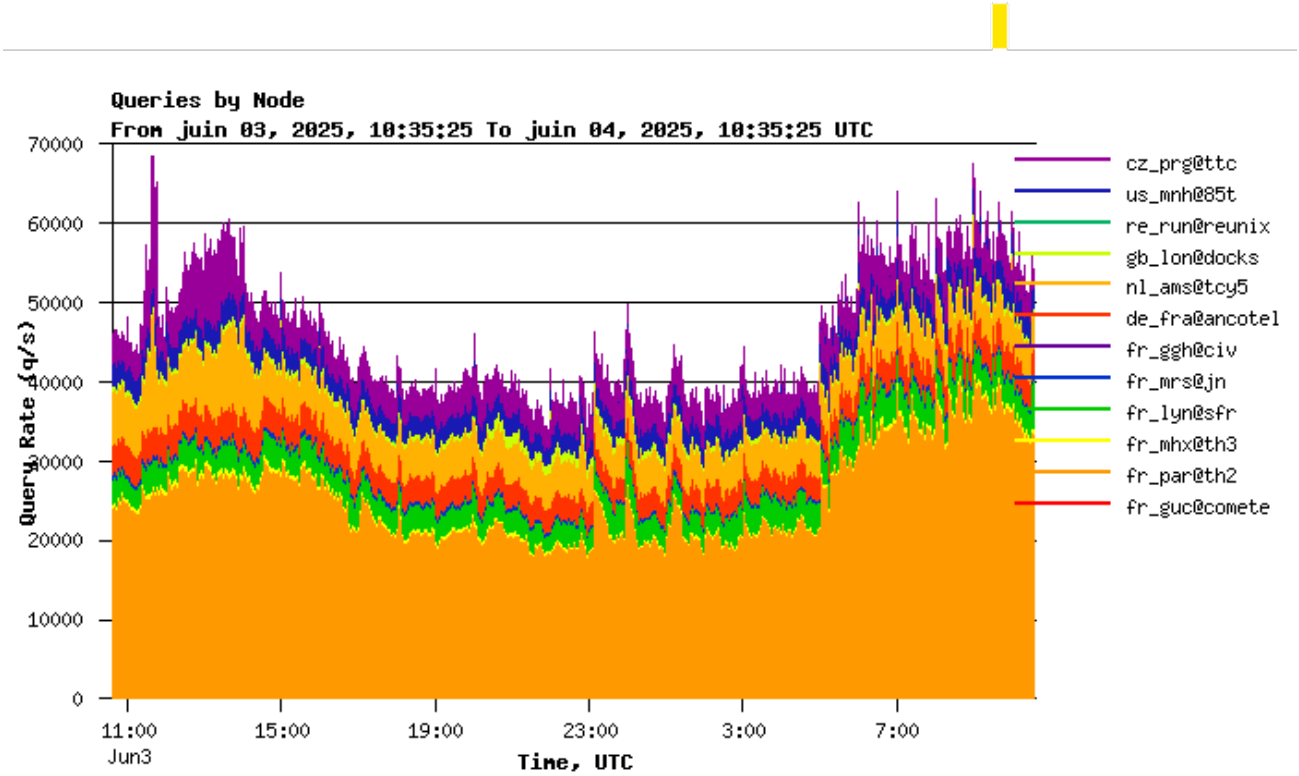
Where to measure



Our instances

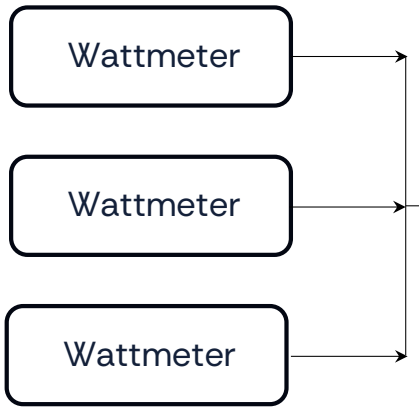


DNS load in one of the instance in Afnic’s data center



Authoritative server measurements

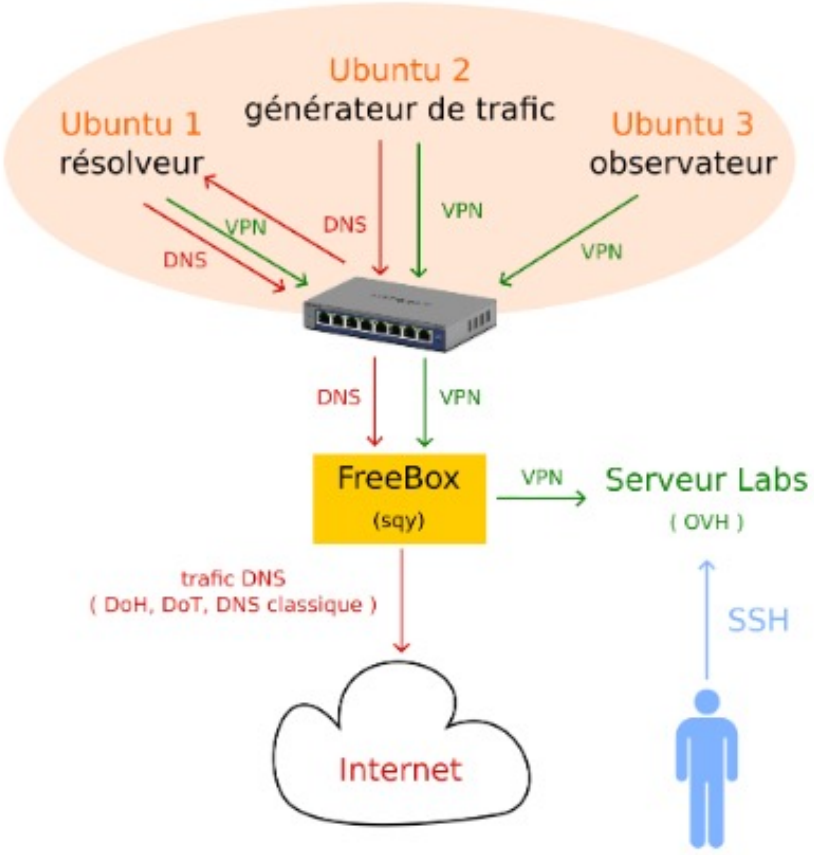
At Two of Afnic's Data Centers, the Authoritative Servers are attached with Wattmeter's



Grafana



Resolver measurements



Results

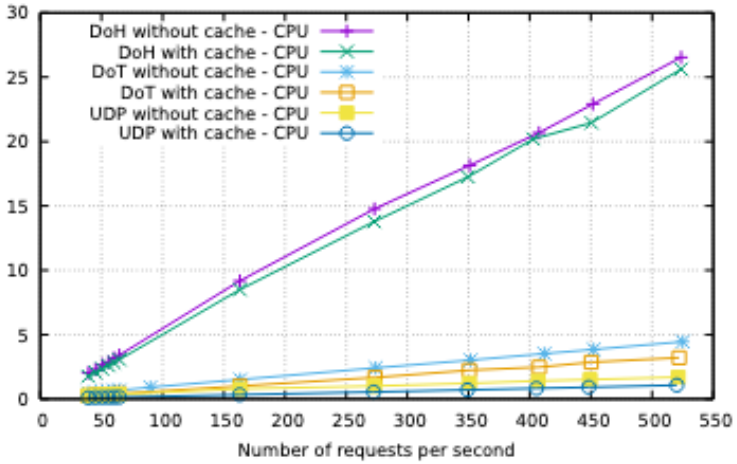


Fig. 2: DNS consumption of CPU

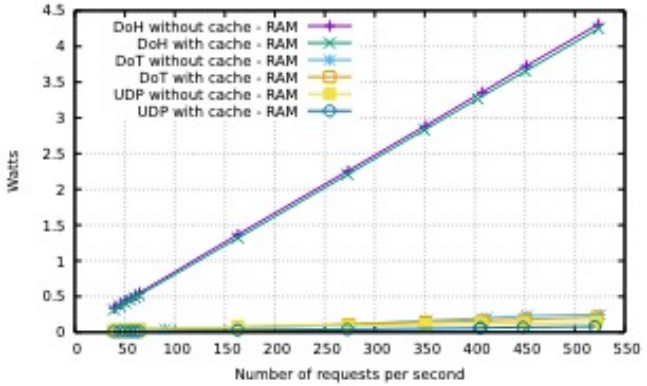


Fig. 3: DNS consumption of RAM

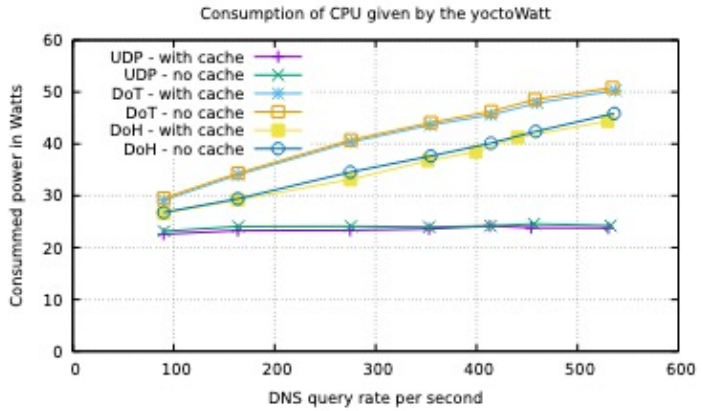
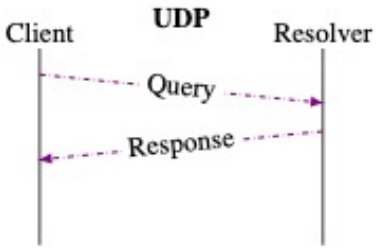
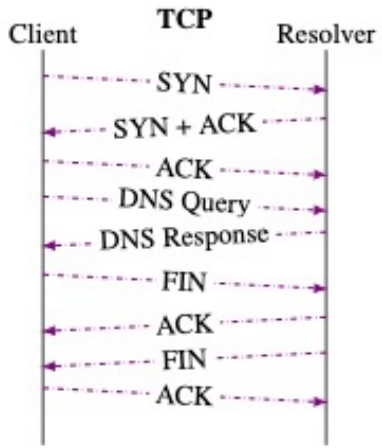


Fig. 4: Comparison of the DNS consumption given by the yoctoWatt in function of the received query rate, for UDP, DoH and DoT, with and without cache

Mathematical Model & Results



(a) UDP query modeling.



(b) TCP query modeling.

TABLE I: Estimated packet count for DNS resolution under certain assumptions

	DNS UDP	DNS TCP	DoT		DoH	
With Cache	2	11	21	4*	25	4*
Without Cache	8	17	27	10*	31	10*
DNSSEC†	18	27	37	20*	41	20*

Disseminations & Standardisation



Thank you for your attention

Do not hesitate to reach out

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