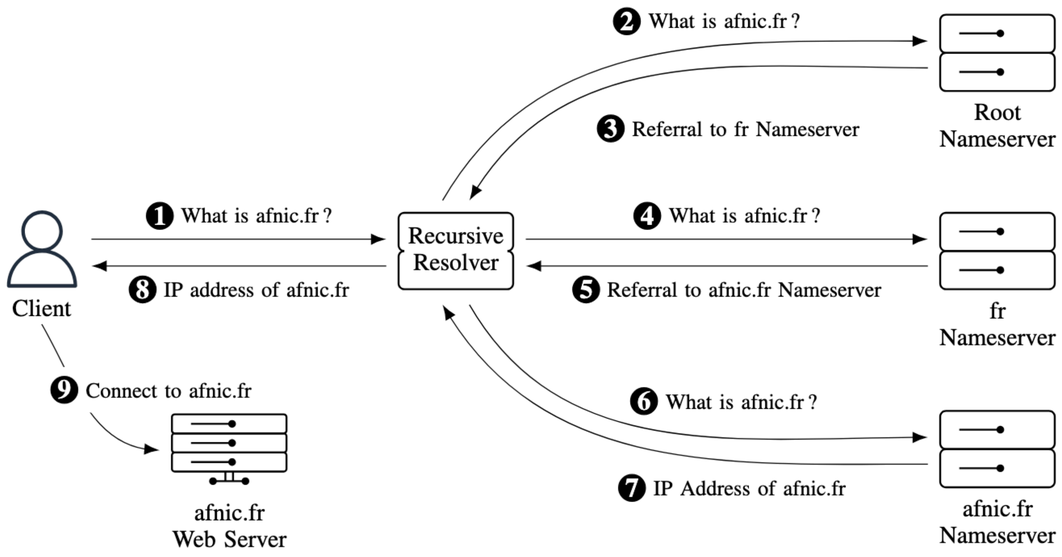
Analysing the energy consumption of a DNS resolver

sandoche.balakrichenan@afnic.fr

Research Area and Open Problems

DNS, the first step in any Internet communication, is a fundamental yet often overlooked aspect of data center energy consumption. The hypothesis is that DNS Security evolutions (DoT, DoH) will approximately increase 35% energy overhead.

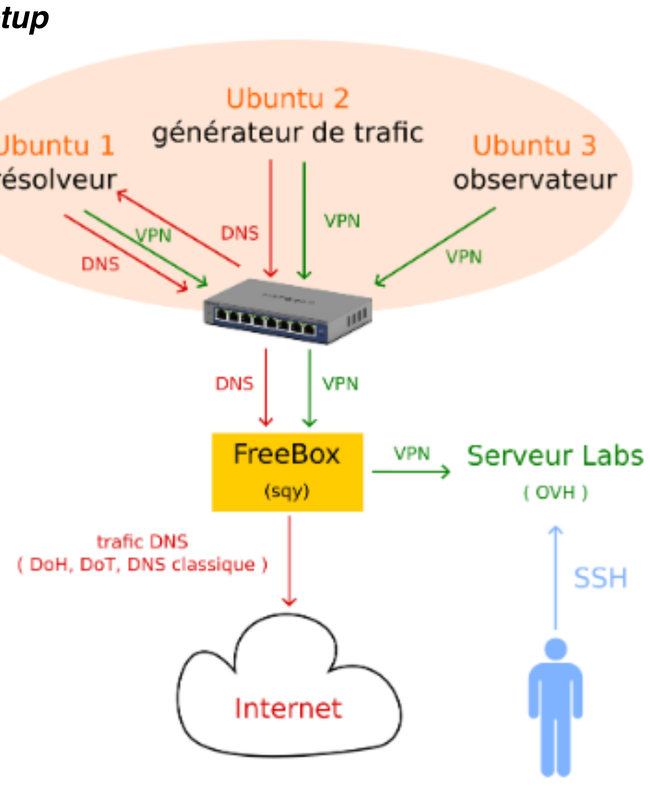


Research questions

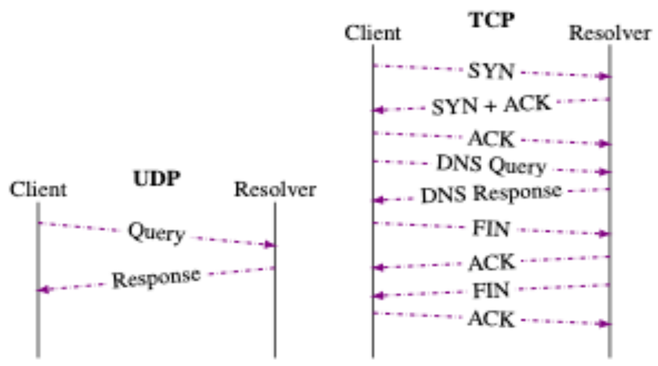
- Can the energy consumption attributable to DNS traffic be isolated?
- If yes, how can a standardised methodology be developed for measuring this consumption using DNS-specific measurements?

Methodology

Experimental Setup



Modelling

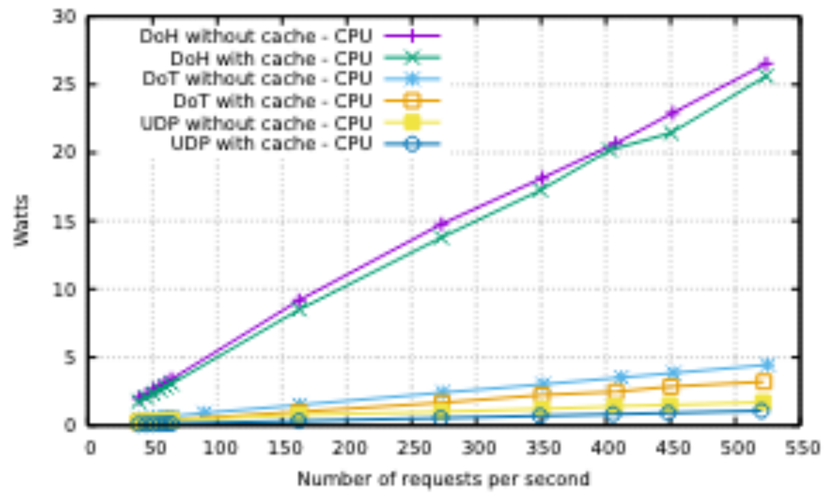


	DNS UDP	DNS TCP	DoT		DoH	
With Cache	2	11	21	4*	25	4*
Without Cache	8	17	27	10*	31	10*
DNSSEC†	18	27	37	20*	41	20*

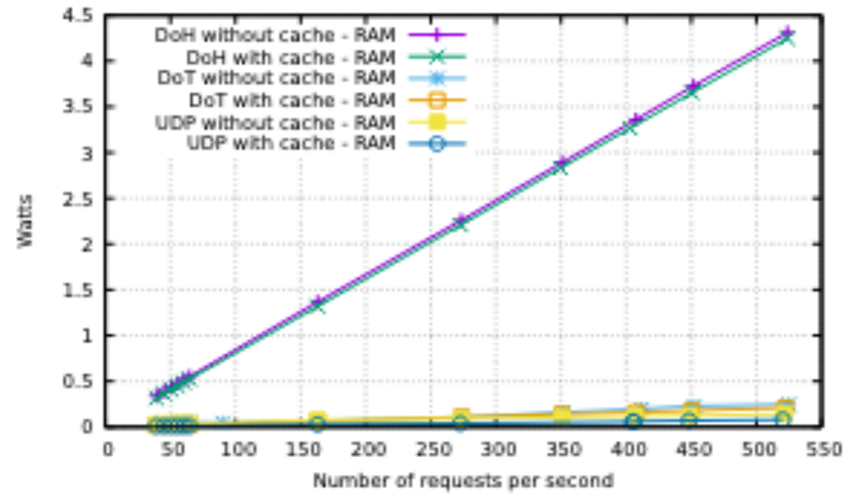
Estimate packet count for DNS resolution under certain assumptions

Results

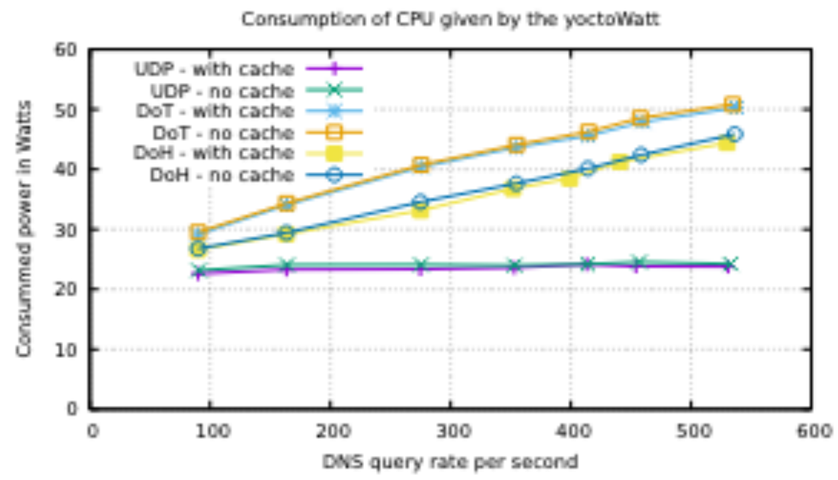
CPU consumption



RAM consumption



Total energy consumption



Discussion & Future Work

- **CPU vs RAM impact:** As expected, CPU usage plays a significant role in energy consumption, whereas RAM usage has a negligible effect.
- **Protocol comparison:**
  - DoH consumes approximately *'six'* times more CPU than DoT
  - DoT, in turn, consumes about *'three'* times more CPU than UDP
- **Caching:** Cache usage shows only a marginal influence on power consumption
- **Measurement consistency:**
  - Results from software-based tools correlate well with HW Wattmeter data for DoH & UDP
  - Discrepancy in DoT measurements indicates a need for deeper investigation
- **Model vs Measurements**
  - Mathematical model estimated a 4:1 packet ration between DoH & UDP, while measurements show a '*sixteen*' fold difference
  - Significant mismatch was observed between modelled and measured values for DoT, warranting further refinement
- **Short-term:** We plan to refine the mathematical model by incorporating packet sizes
- **Long-term:**
  - Analyse the DNS impact on authoritative server and from client perspective
  - Use the insights from measurements to provide optimisation scenarios and validate in real environments