pWeb : A Personal Interface to the World Wide Web

Presented by

Reaz Ahmed
School of Computer Science
University of Waterloo

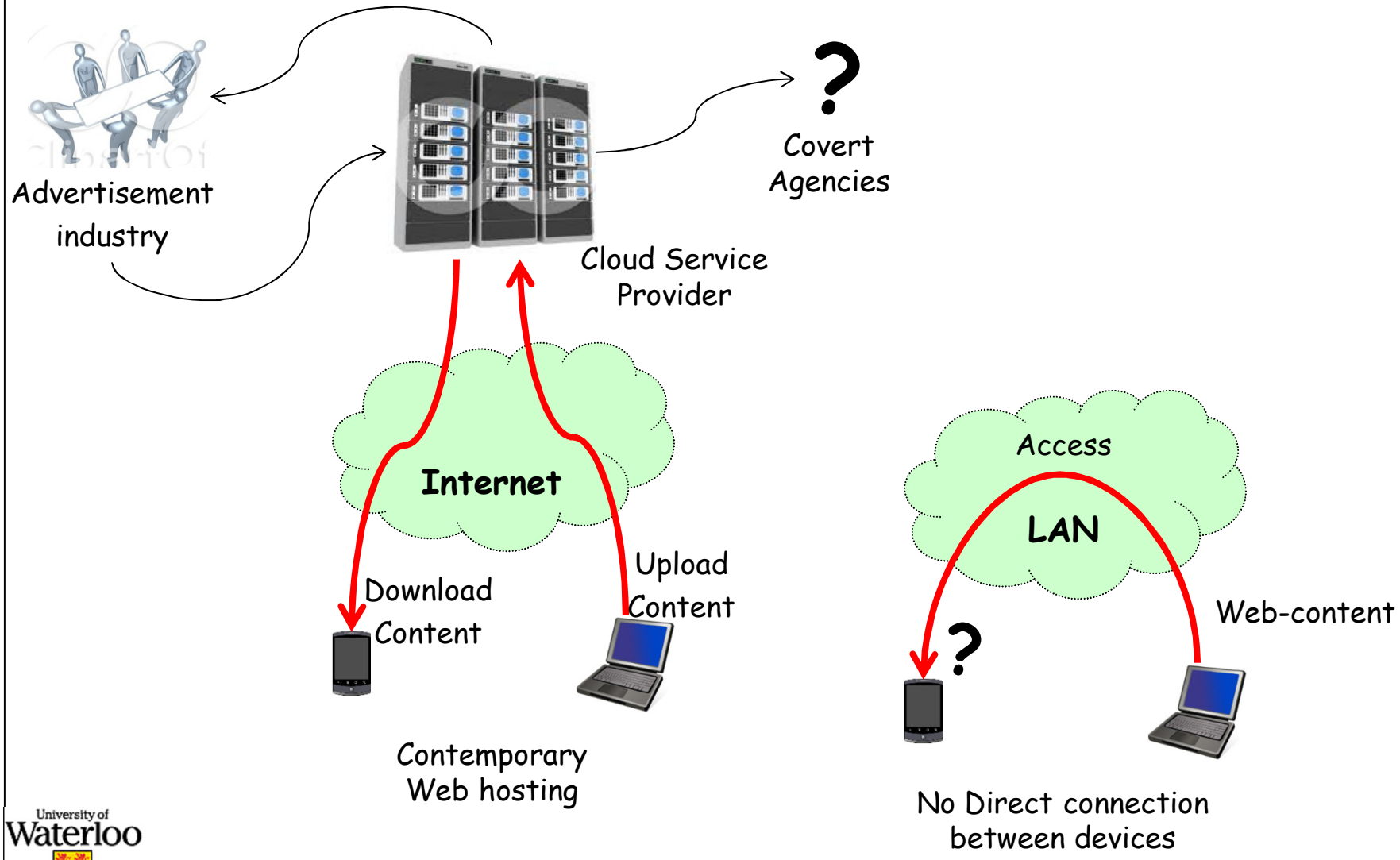
Joint work with Shihabur Rahman Chowdhury, Alexander Pokluda, Md. Faizul Bari, Raouf Boutaba and Bertrand Mathieu

Outline

- Motivation
- Technical challenges
- Architecture
- Evaluation
- Summary

University of Waterloo

Motivation


Advertisement industry
Cloud Service Provider
?
Covert Agencies
Internet
Download Content
Upload Content
Contemporary Web hosting
Access
LAN
?
Web-content
No Direct connection between devices

Motivation

- Censorship resistance
  - "Broadcast yourself" without censorship
- Access control
  - Define who can access what and when.
- Content Ownership
  - Add, delete, modify as / when you like
- Flexibility
  - Restriction on content/service type/format

Our goal is to free users from these limitations

University of Waterloo

Technical Chellenges

- Naming:
  - User devices don't have global/unique names
  - Frequent IP change
- Availability:
  - User devices are not persistent as Internet hosts
  - How to ensure content availability
- Discovery:
  - How to find a device and its hosted contents?
- Dynamic content/service hosting:
  - How to generate & serve computationally expensive dynamic web content from low-end user devices?
- NAT:
  - Usually non-public IP and behind the NAT.

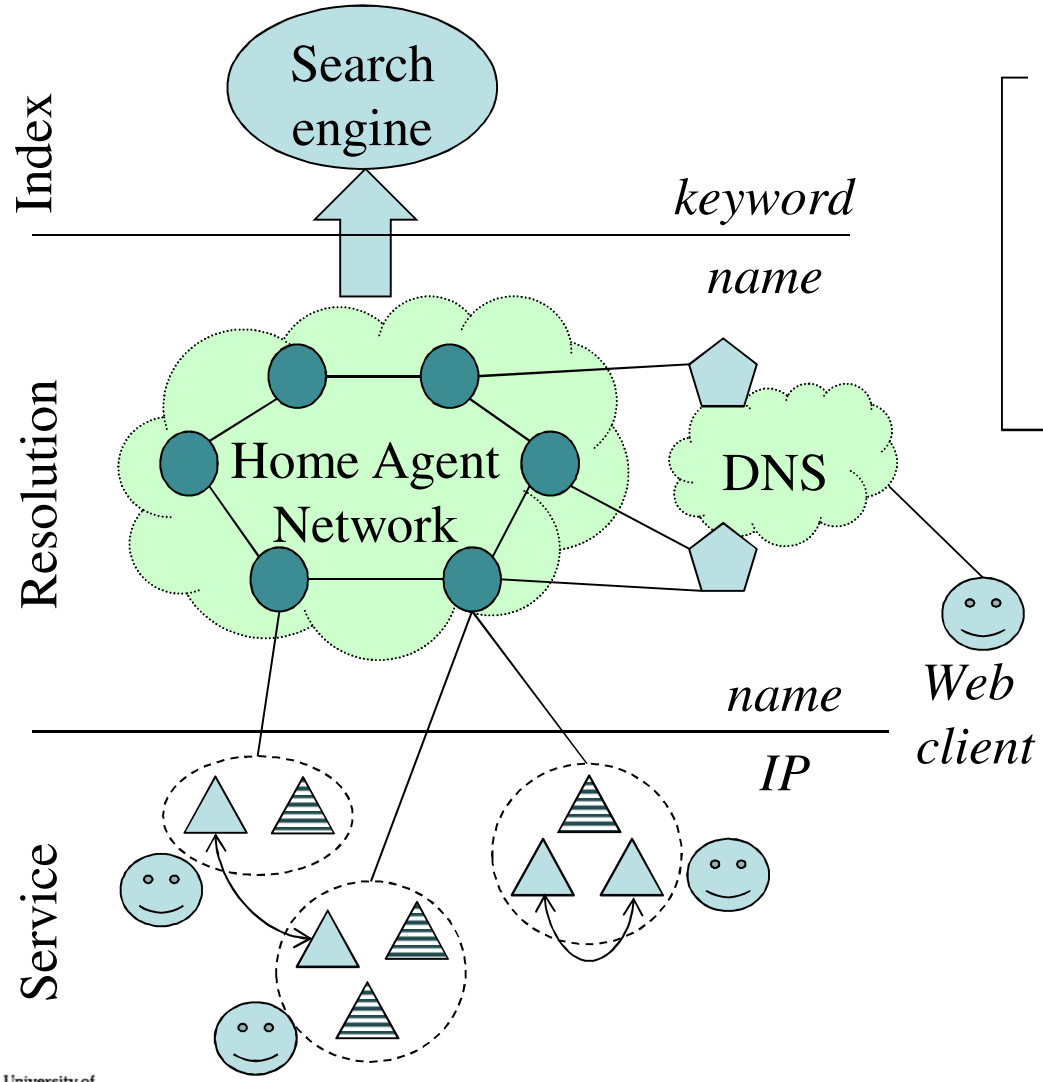
University of Waterloo

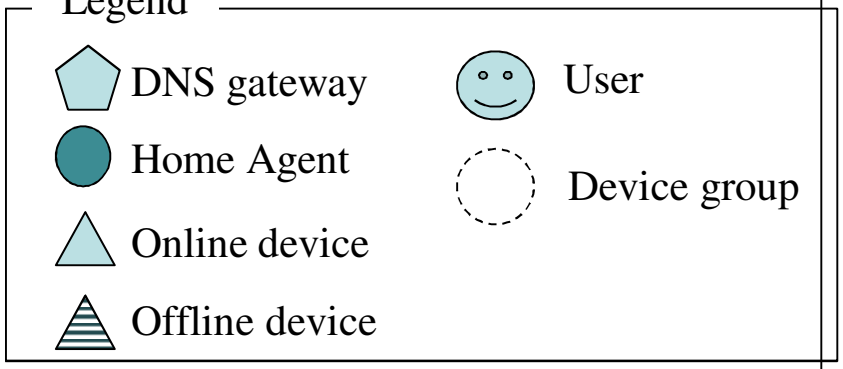
Design Philosophy

- Compatibility with current Web technology.
- Naming:
  - Unique, persistent, DNS compatible names
  - Efficient, scalable name resolution infrastructure
- Availability:
  - Group by user and replicate
  - Cache popular contents at search/indexing servers
- Discovery:
  - Open interface for name/content crawlers
- Dynamic content/service hosting:
  - Light-weight http server w/ dynamic ip updater capability
- NAT:
  - use STUNT or ***URL forward***

University of Waterloo

pWeb Architecture

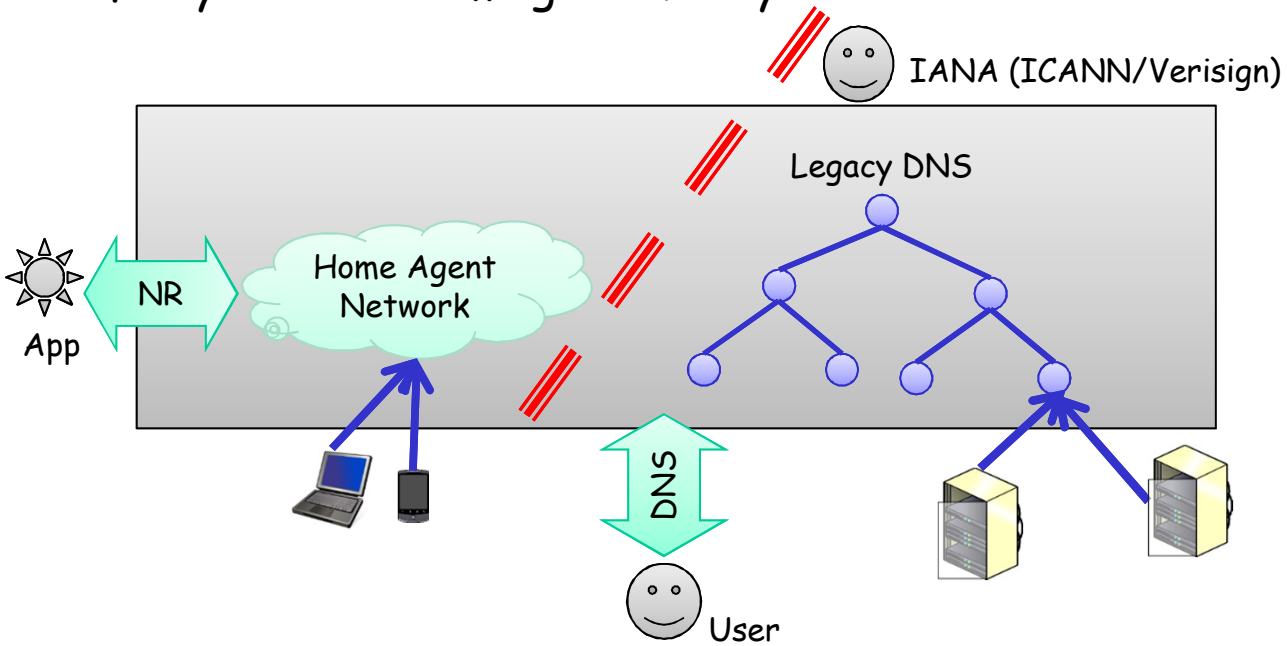




University of Waterloo

pWeb Naming: Our Stand

- low latency, scalable, robust and independent naming system
- compatible with legacy DNS
- independent of any central naming authority



http://device.user.home-agent.dns-suffix/content-path

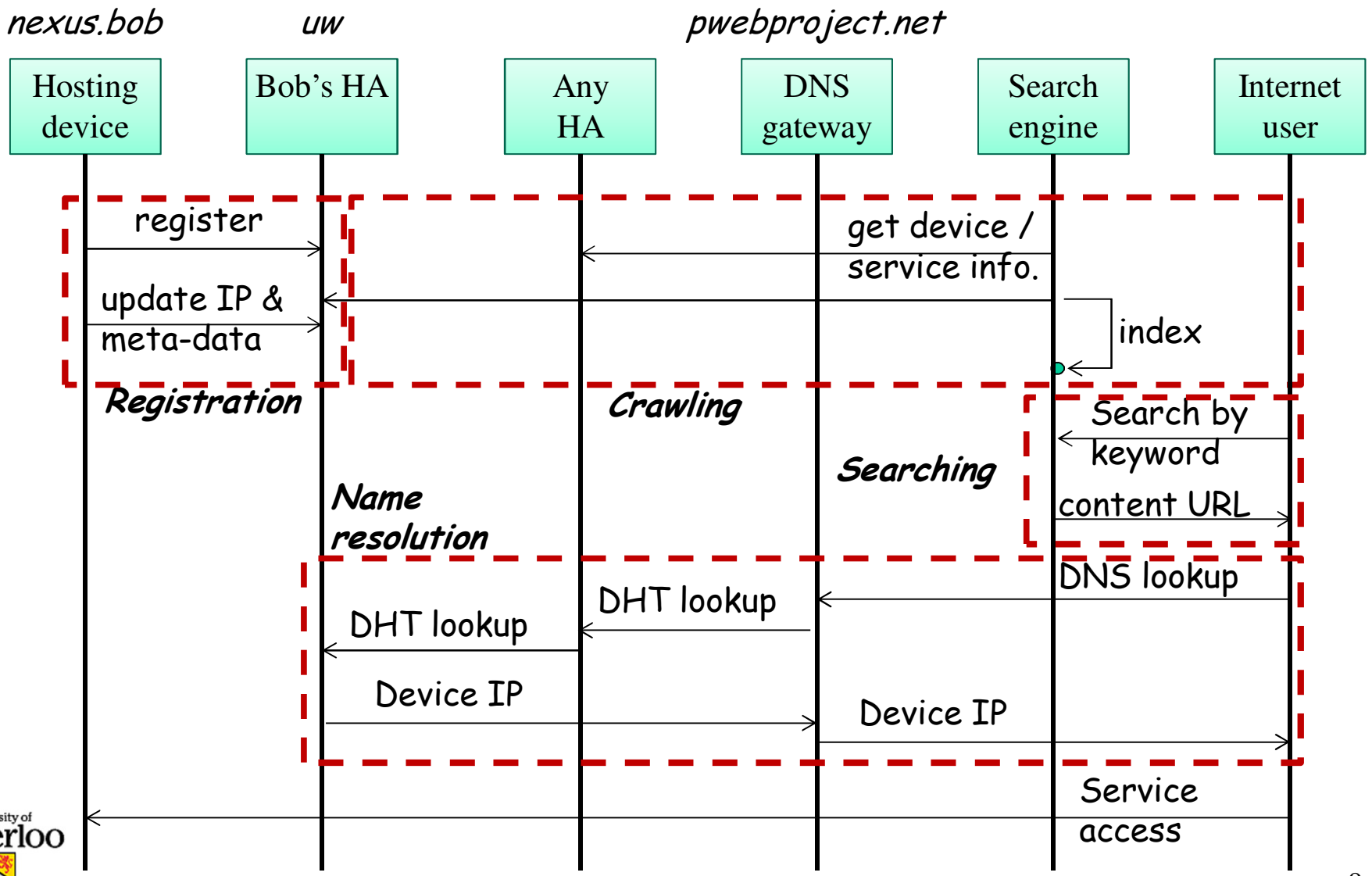
http://nexus.bob.uw1.dht.pwebproject.net/public/vdo/sample1.flv

unique name within pWeb

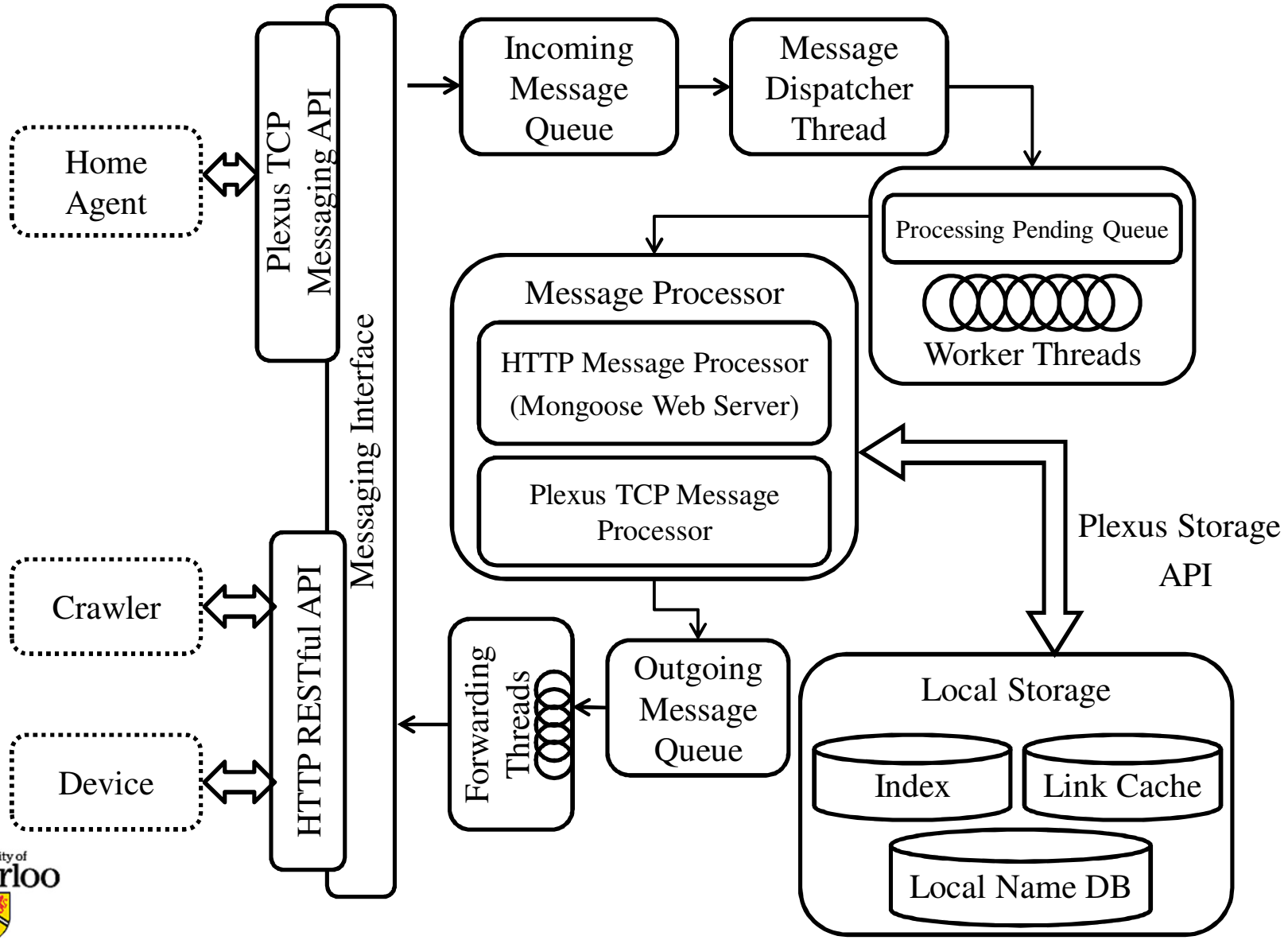
for DNS compatibility

University of Waterloo

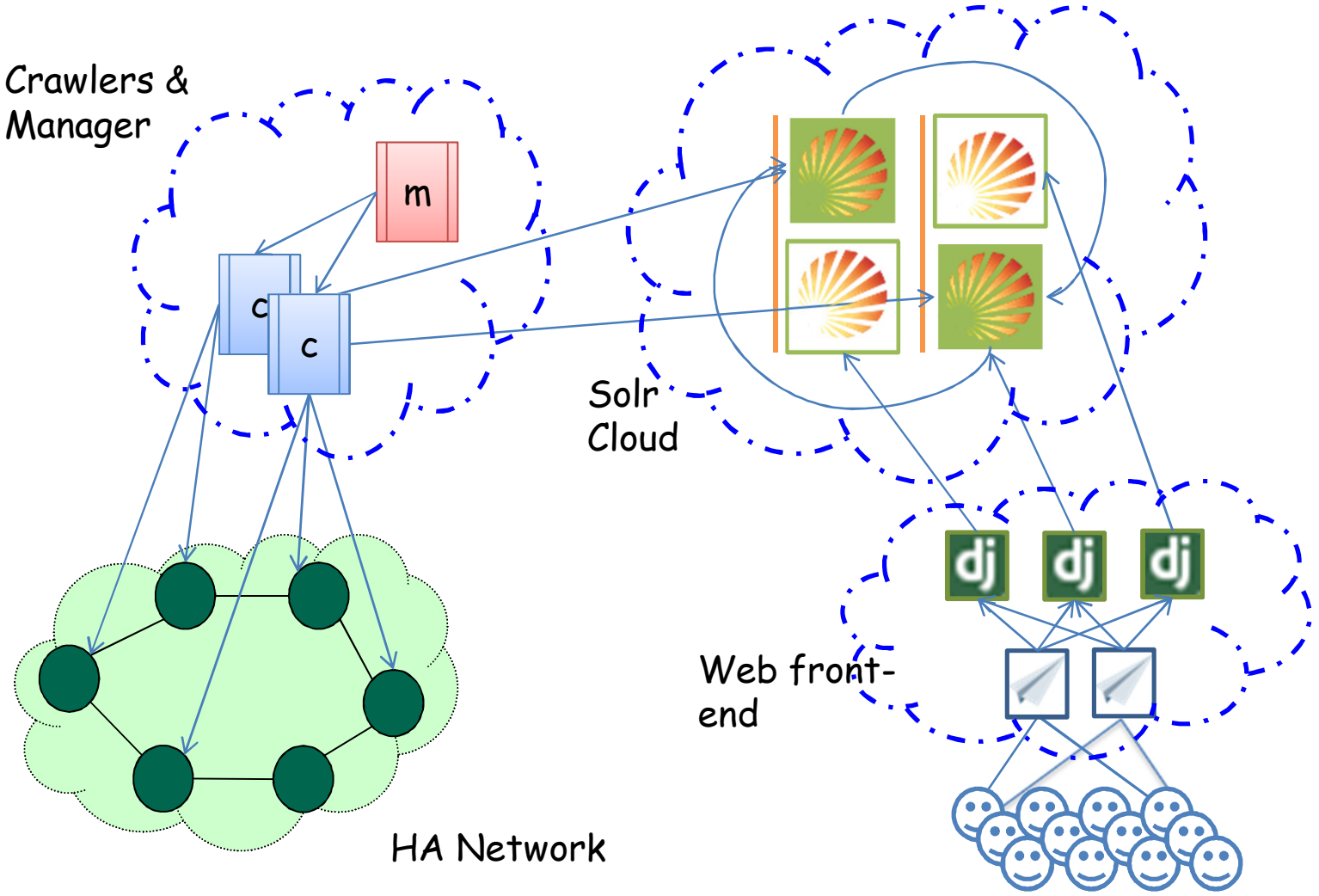
Functional Overview



Home Agent Architecture

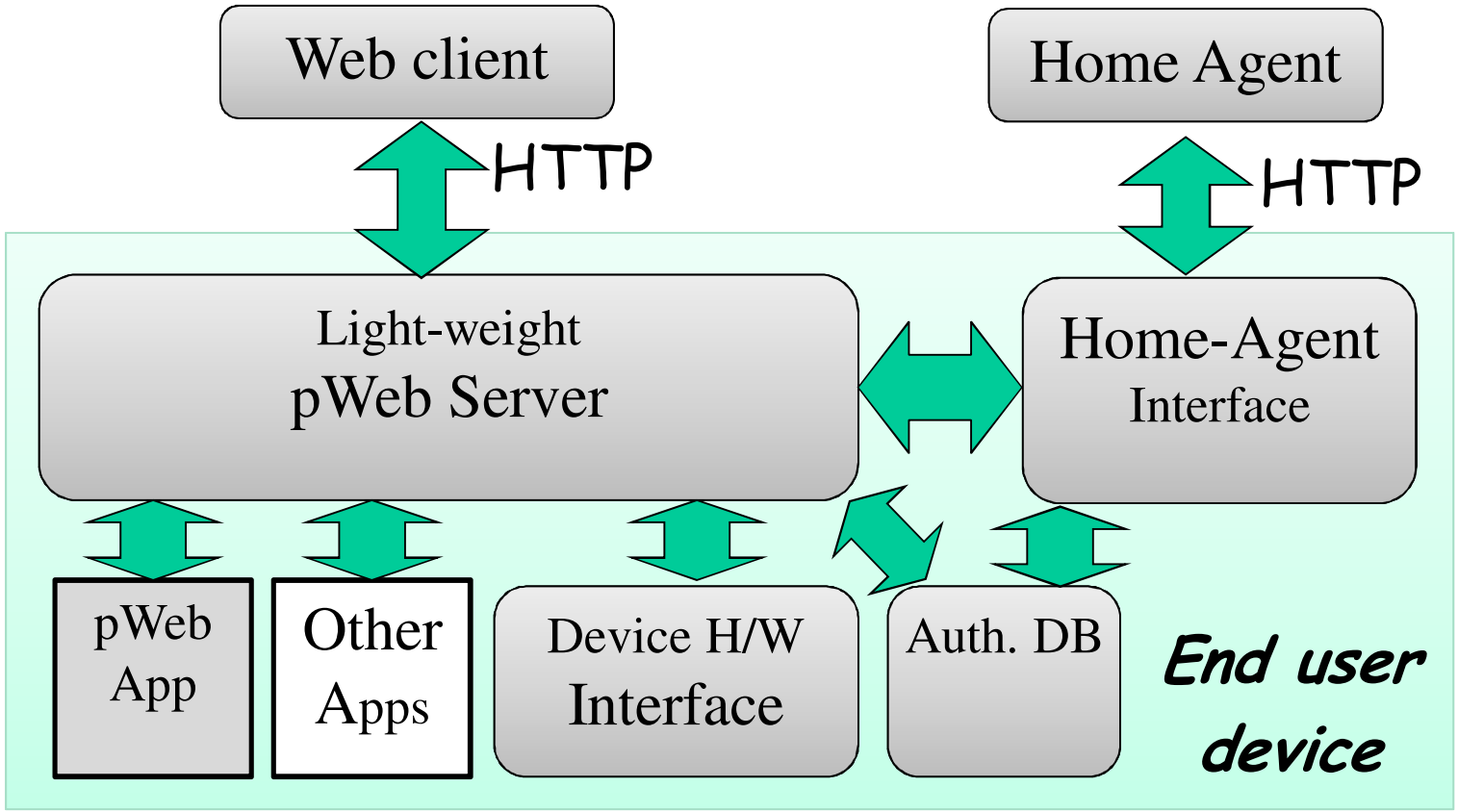


Crawler Architecture

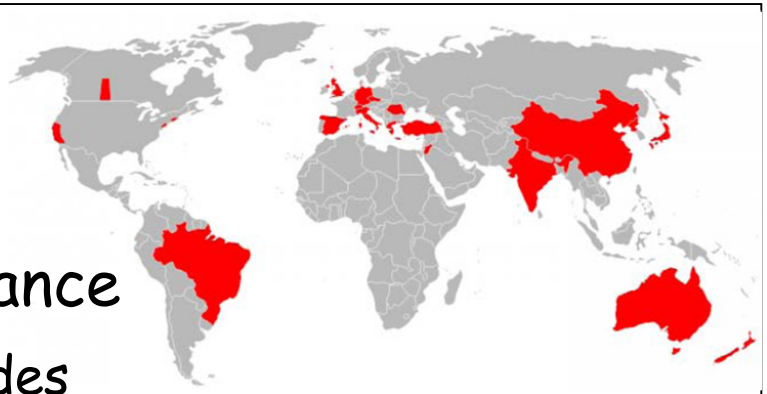


University of Waterloo

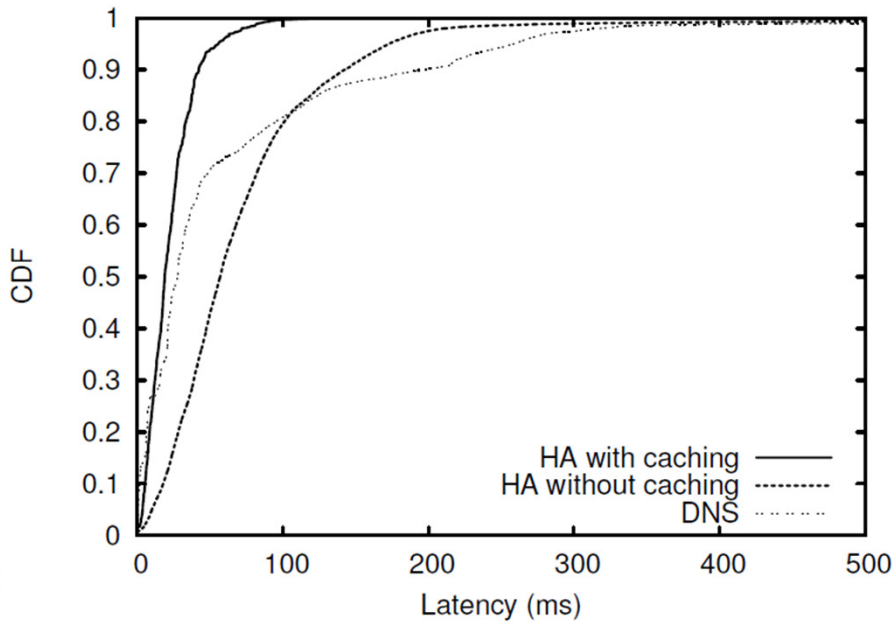
Client Software



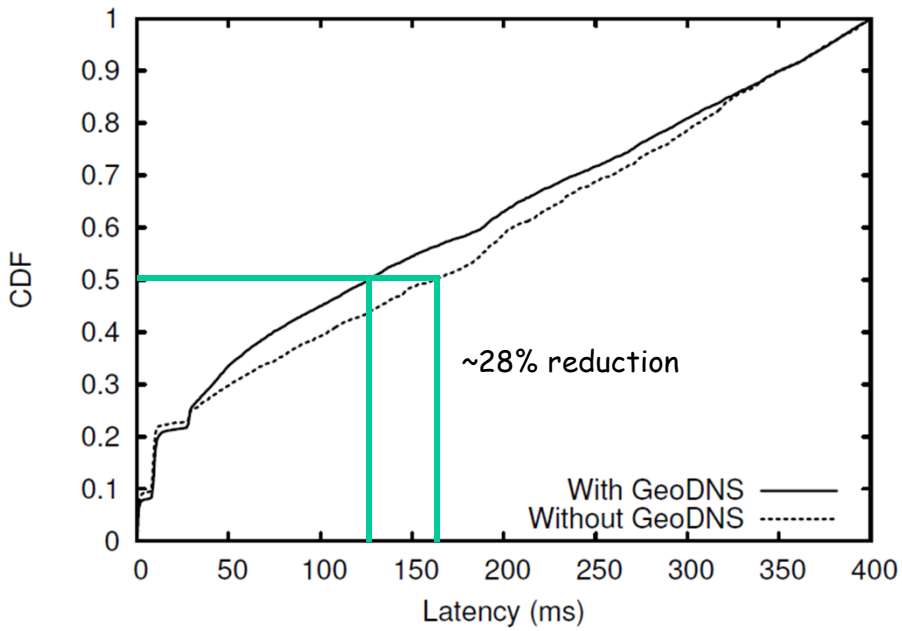
Results



- Home Agent Network Performance
  - HA/DNS-GW in 25 PlanetLab Nodes
  - Clients (using Dig) in 30 PlanetLab Nodes
  - 2.5X10^5 unique names, 5X10^5 queries in parallel
  - GeoAwareness : Maxmind GeoIP DB



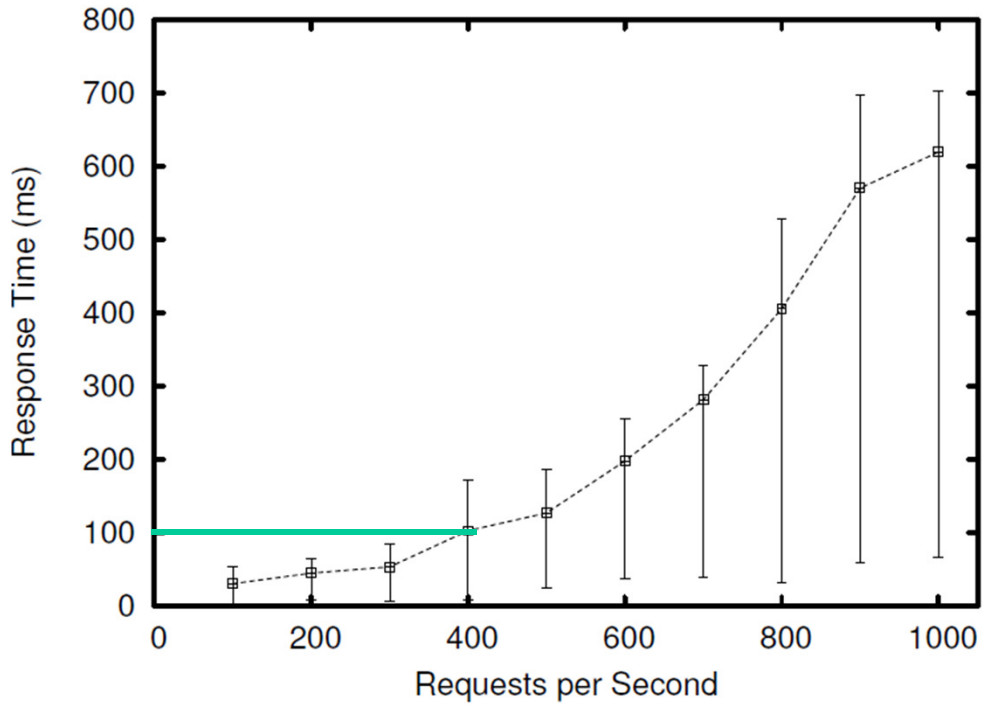
Name Lookup Efficiency



Impact of GeoAwareness

Results

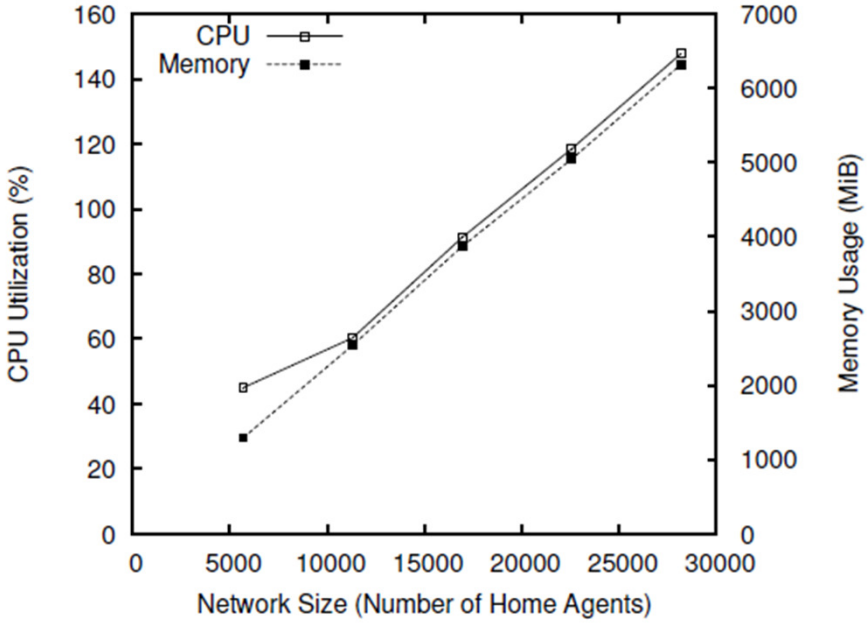
- Home Agent Scalability
  - One HA hammered by a micro-benchmarking tool
  - ≤ 100ms response time for up to 400 requests/sec
  - Mostly Due to raw file access. Better results with DB

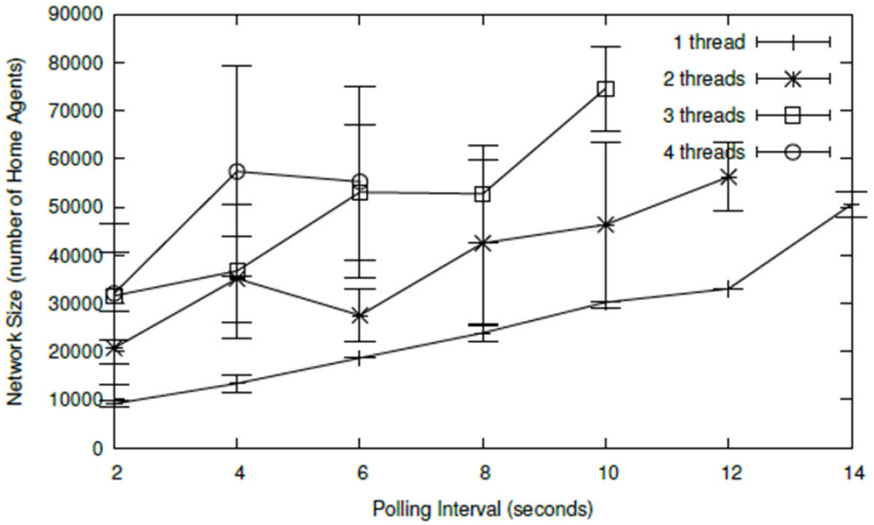


University of Waterloo

Results

- Performance of a single Crawler
  - Synthetic HA network
    - RTT from King Dataset
    - Geographic distribution from World Bank Open Data





Max. no. of HA a single crawler can handle—at which network size 2 HAs were not polled

University of Waterloo

Summary

- pWeb characteristics
  - A hybrid architecture
  - Seamless integration with Web technology
  - Open platform for independent development
- Other applications:
  - Remote access for Configuration, NAS, IP camera, Sensors, etc.
  - Personal sync and backup solutions
  - VoIP by name: call **215-492-3971** vs call **cell.alice.uw**
  - Passive device: NFC tag/QRcode /Barcode for IoT
- Ongoing project at ***http://pwebproject.net***

University of Waterloo

THANK YOU

QUESTIONS?

University of Waterloo

Evaluation Scenario

- Home Agent Network
  - HA/DNS-GW in 25 PlanetLab Nodes
  - Clients (using Dig) in 30 PlanetLab Nodes
  - $2.5X10^5$ unique names, $5X10^5$ queries in parallel
  - GeoAwareness : Maxmind GeoIP DB
- Home Agent
  - One HA with varying load
- Crawler
  - Synthetic HA network
    - RTT from King Dataset
    - Geographic distribution from World Bank Open Data

University of Waterloo