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CENTRE FOR ADVANCED INTERNET ARCHITECTURES

Internet Archeology: Estimating Individual Application Trends in Incomplete Historic Traffic Traces

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Cisco Systems

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Motivation

- Uncover past network application traffic trends
- Available traces usually anonymised and without payload information
  - Payload-based analysis impossible
  - Port-based identification inaccurate for applications such as p2p file-sharing, multiplayer games
- Machine learning (ML) classification based on payload-independent features could be solution
  - Train classifier to detect applications of interest
  - Use classifier on historic traces

Approach

- Obtain representative data for **applications of interest** (positive training examples)
- Can similar applications be separated?
  - 10-fold cross-validation for each trace separately
  - Classes in historic traces based on default ports
- Can recent traffic represent past traffic?
  - Train on recent hand-classified data, test on historic data
  - Train and test between historic data
  - Classes in historic traces based on default ports

Approach cont'd

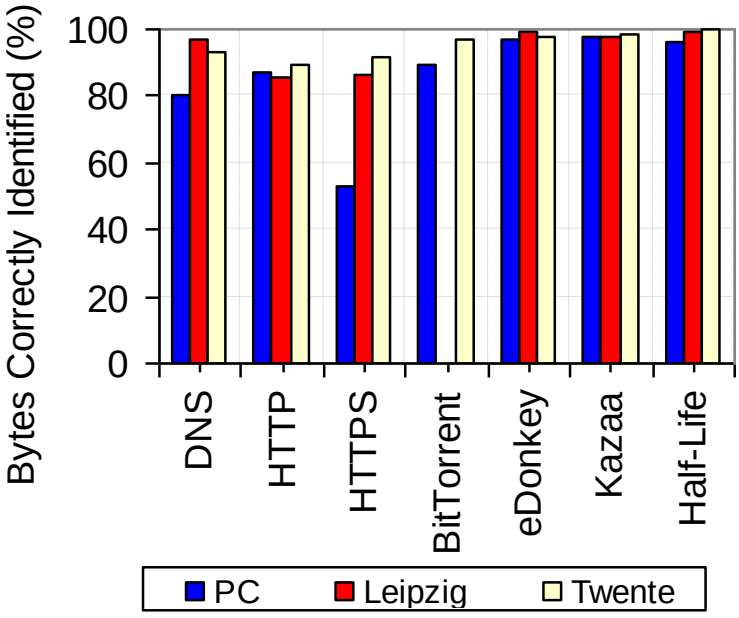
- Obtain representative data for **all other applications** (negative training examples)
  - Problem: traffic mix in historic trace unknown
- Use ML classifier to identify traffic from historic trace that is not the applications of interest
  - Train classifier with one class for each application plus one class for each port from historic trace
  - Compute *overlap* (false positive/negative rates) between applications of interest and each port
  - If *overlap* > *threshold* $\Rightarrow$ positive examples
    otherwise $\Rightarrow$ negative examples

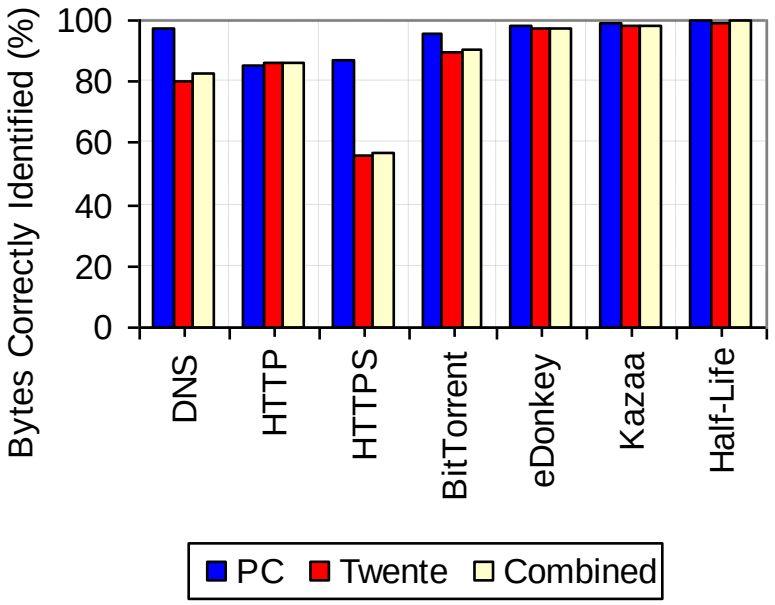
ML Algorithm and Data Sets

- C4.5 decision tree algorithm
- Features: packet length, inter-arrival time, active/ idle times, duration, protocol, volume, TCP push
- Traces
  - Payload-classified trace as positive examples (**PC**)
  - Two public anonymised traces as historic traces (**Twente**, **Leipzig**)
- Applications: HTTP/HTTPS, DNS, p2p file-sharing (eDonkey, Kazaa, BitTorrent), game (Half-Life)

Separating Applications

- Each trace separately
- Combine classes of PC and Twente*

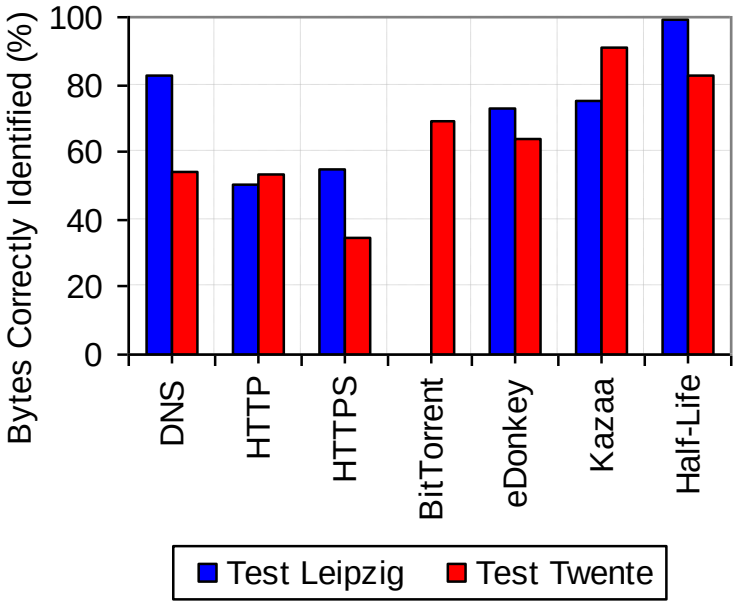




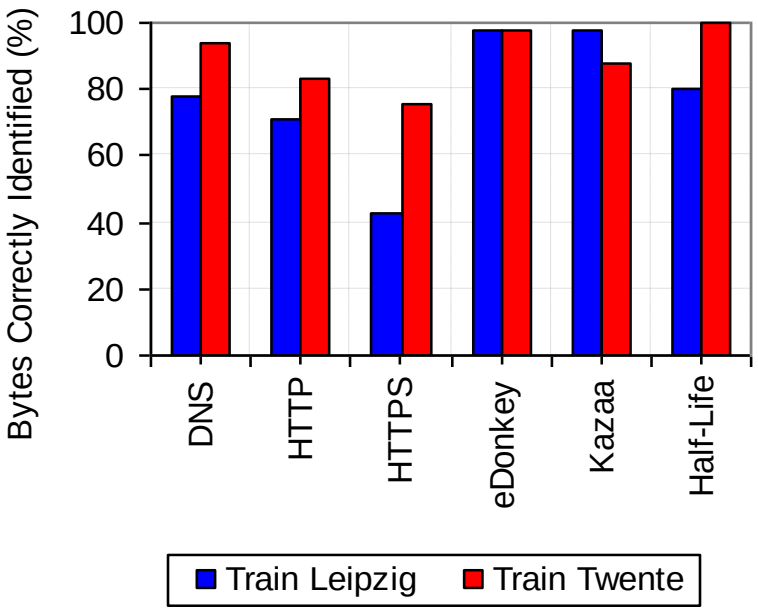
* Similar trends for Leizpig [1]

Predicting Applications

- Train on PC, test Twente and Leipzig

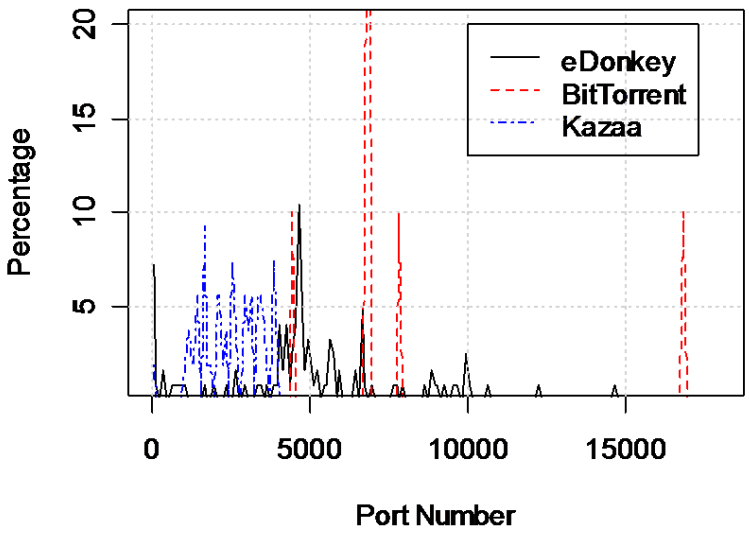


- Train Twente, test Leipzig and vice versa

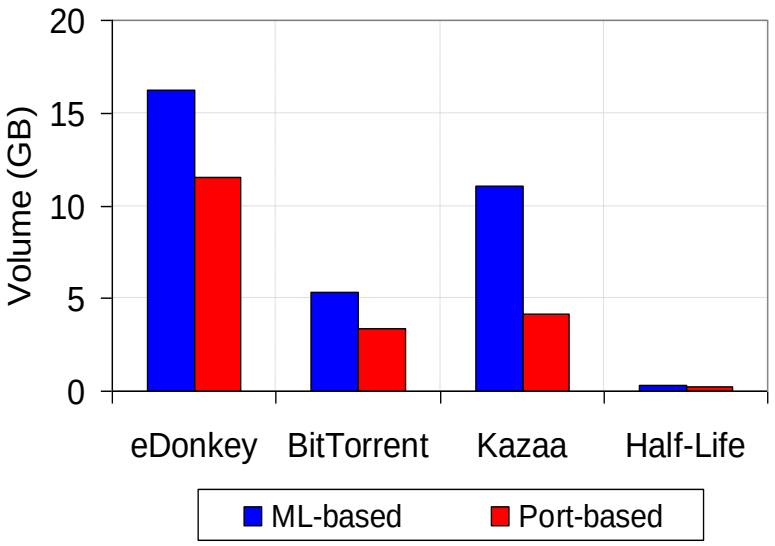


Estimating Historic Trends

- Non-default port numbers Twente* (ports >20,000 omitted)



- ML-based vs. default port estimated traffic volume Twente*



* Similar trends for Leizpig [1]

Conclusions & Future Work

- Similar network applications can be separated
- Application features remain relatively representative between different datasets; but limited variance is problematic
- Approach for obtaining negative examples is somewhat ad-hoc and has limitations; investigate other approaches
- Need historic traces with payload for verification

- Tech Report

[1] http://caia.swin.edu.au/reports/060313A/CAIA-TR-060313A.pdf

Poster Arrangement (A1)