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Cybermetrics: User Identification Through Network Flow Analysis

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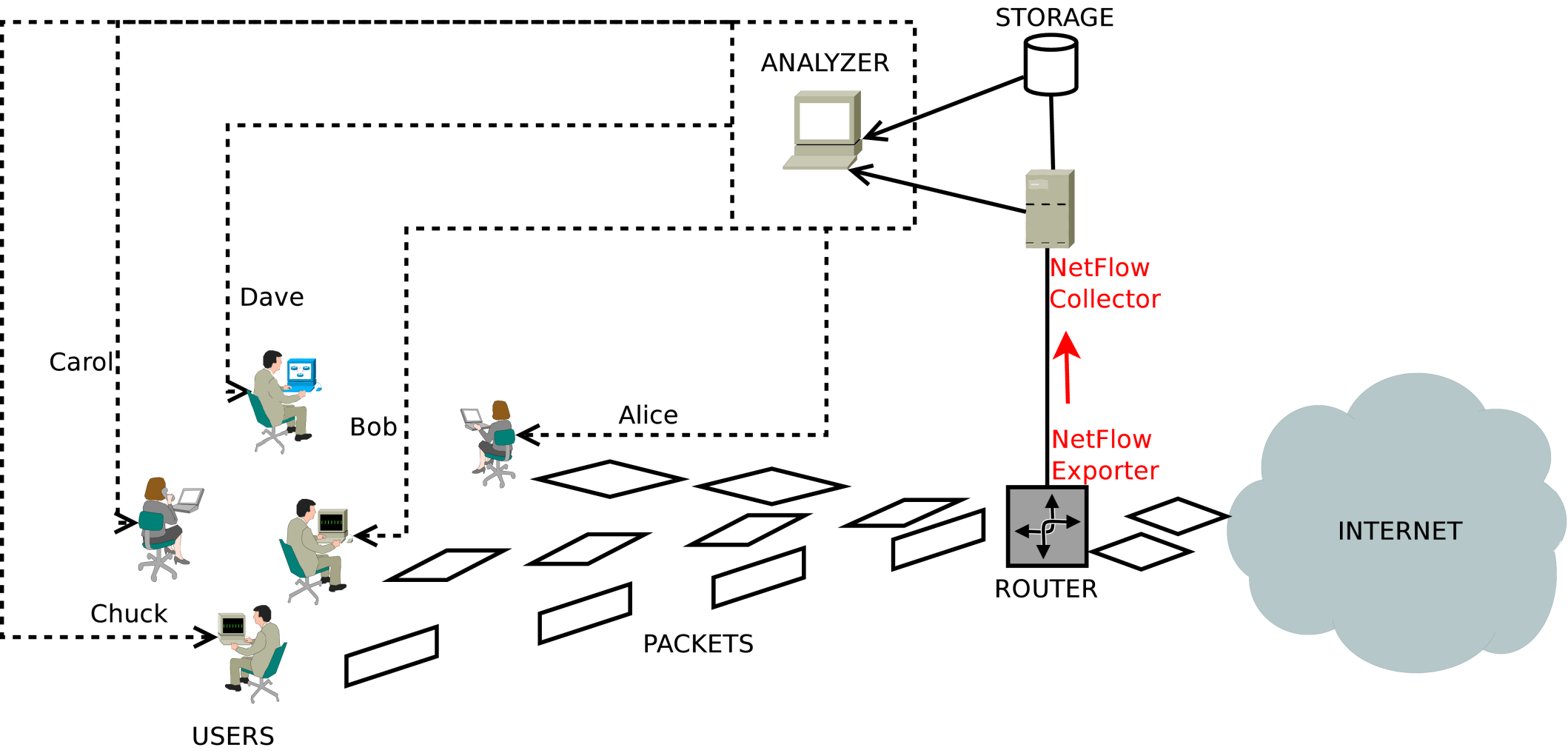
Overview

- Problem statement
- Chosen approach and results to date
- Why is the problem hard/important/relevant?
- Future research plan

Problem Statement

Identify users based on their network activity (expressed in flow records)



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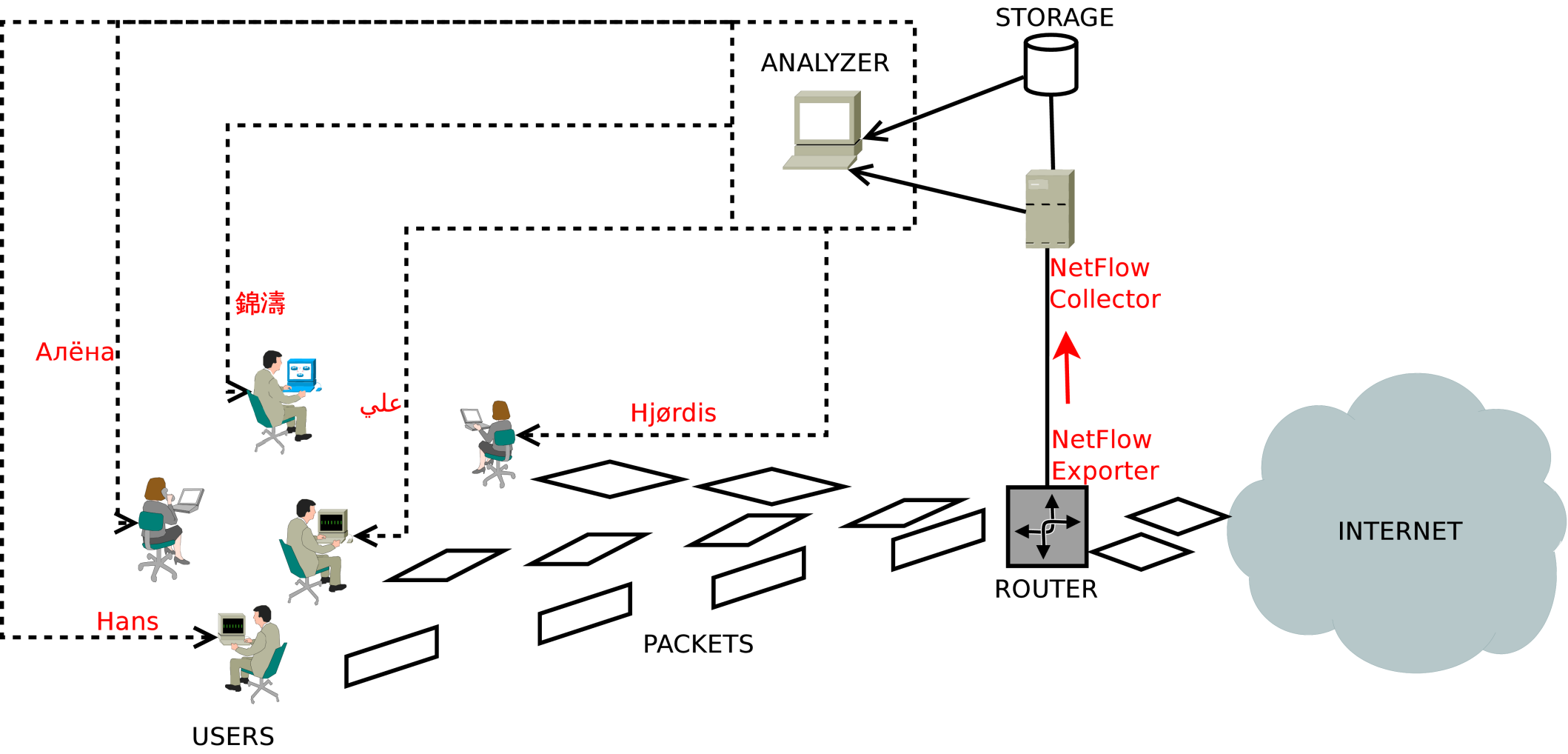

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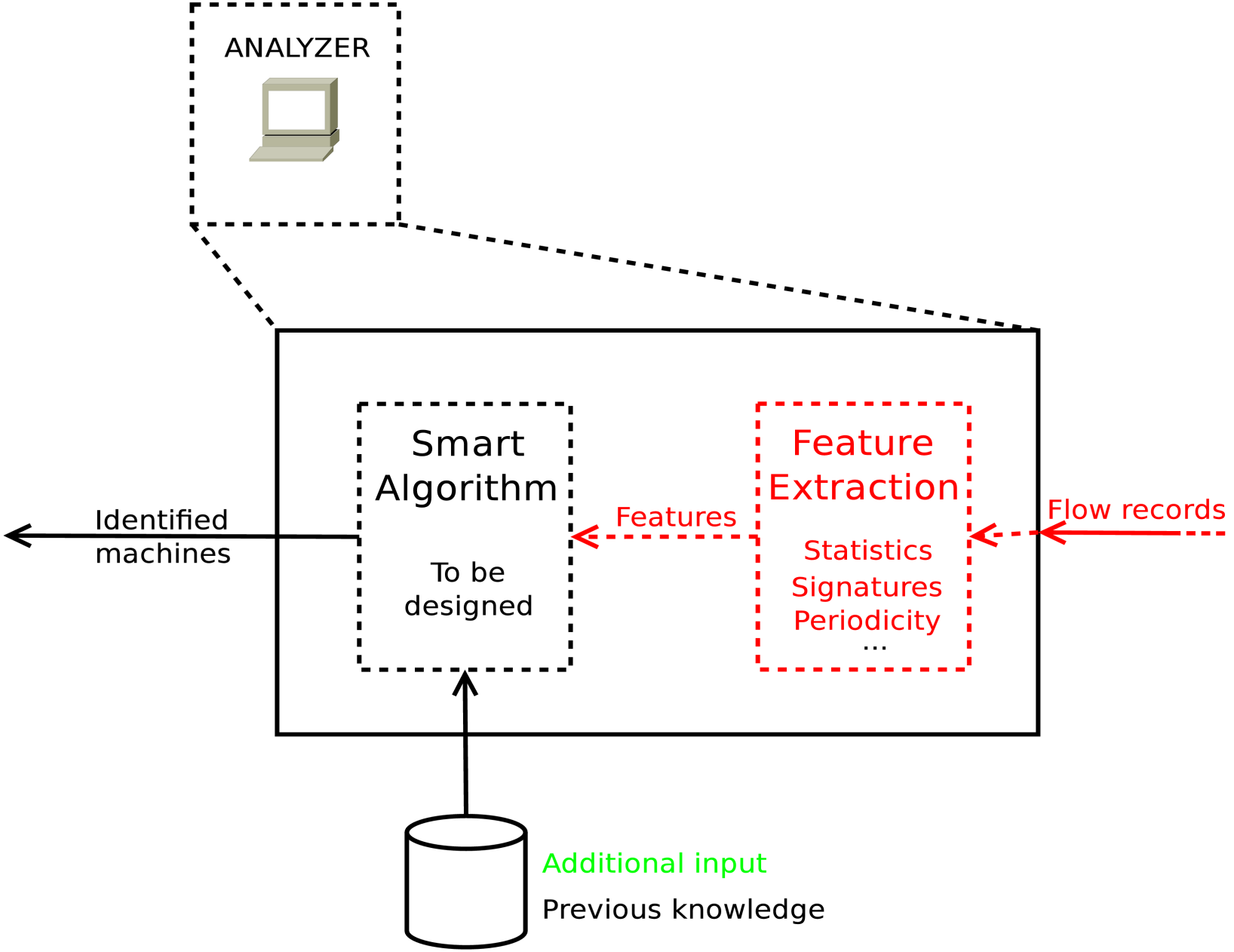

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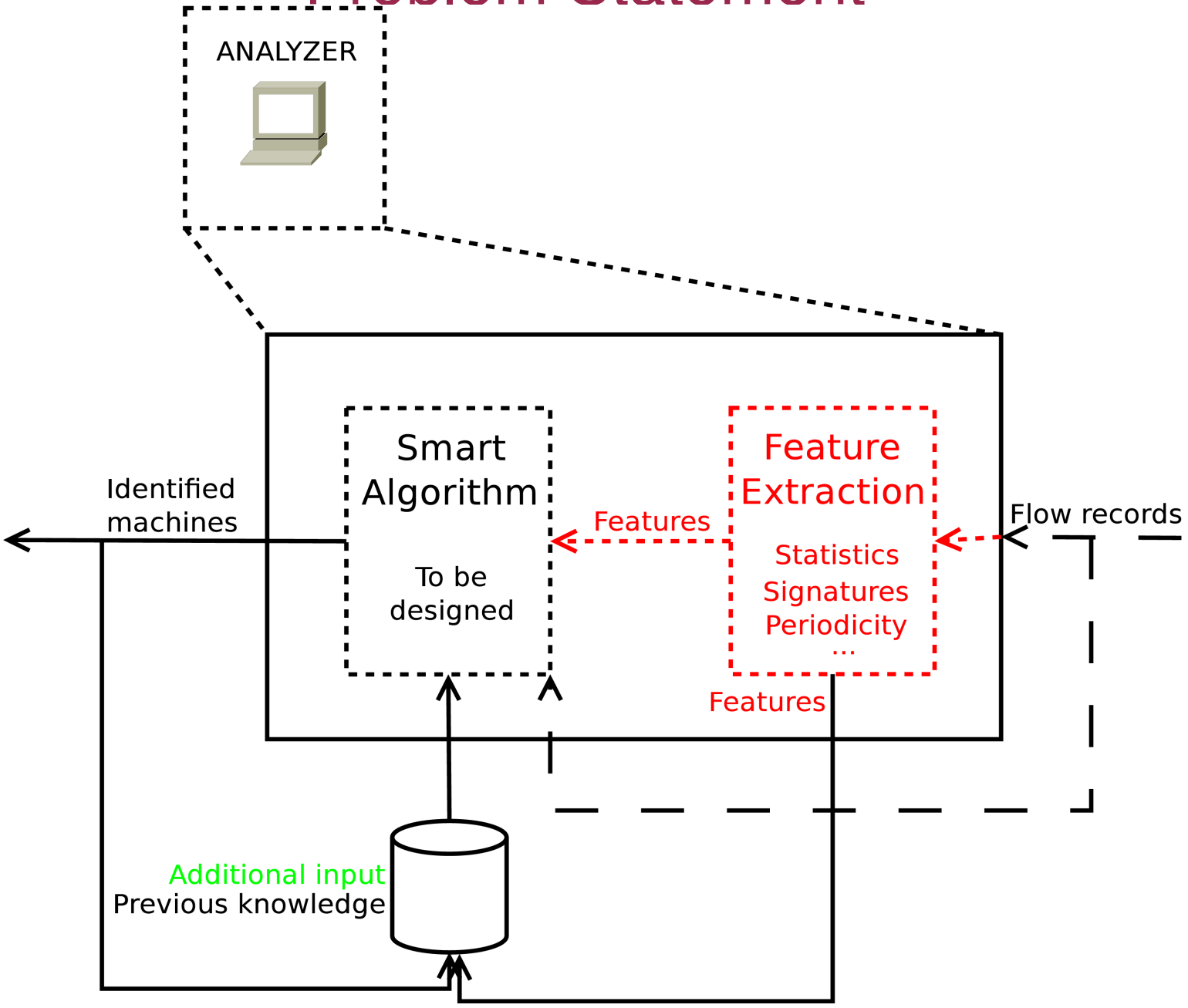
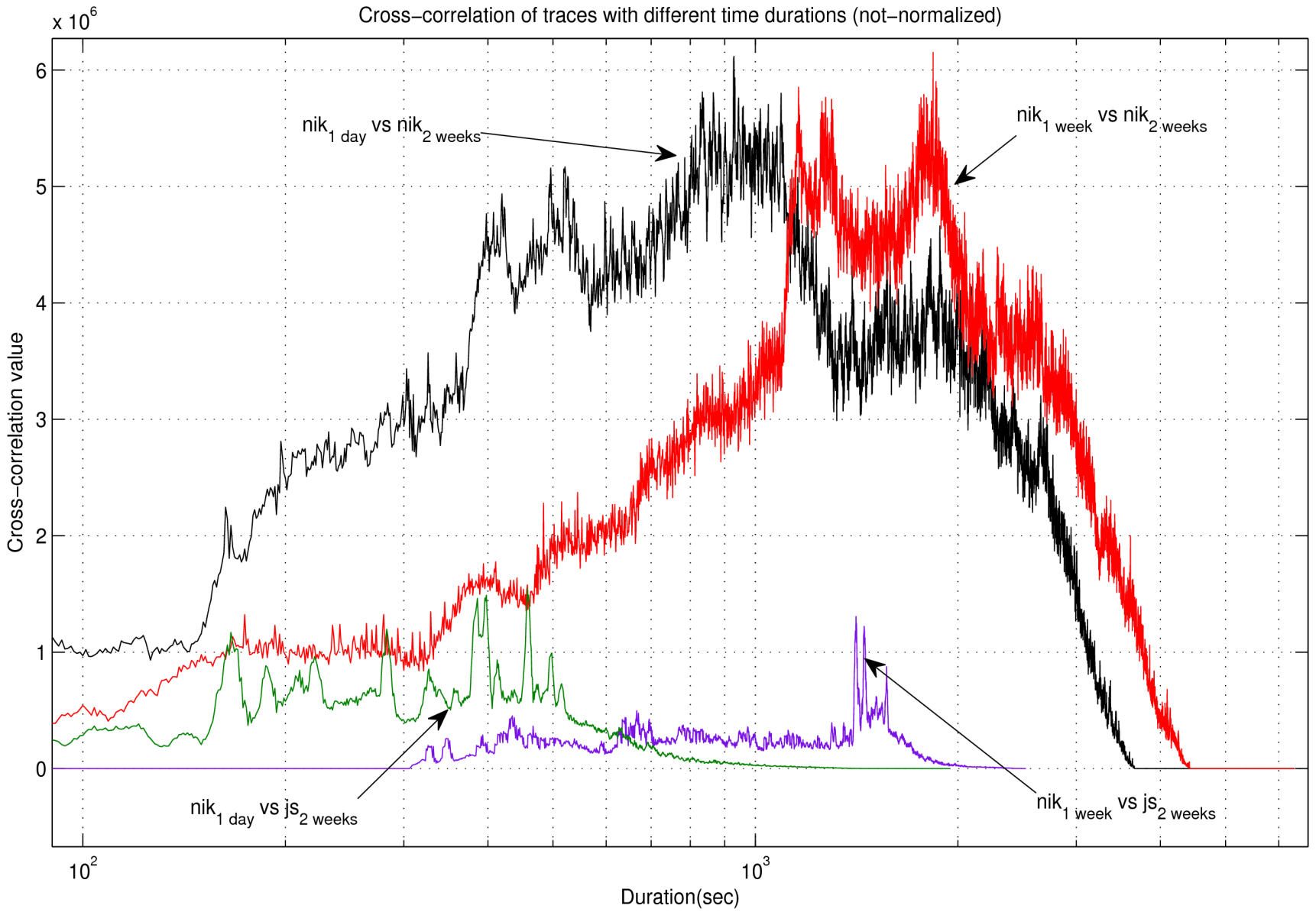


Chosen Approach - Statistics



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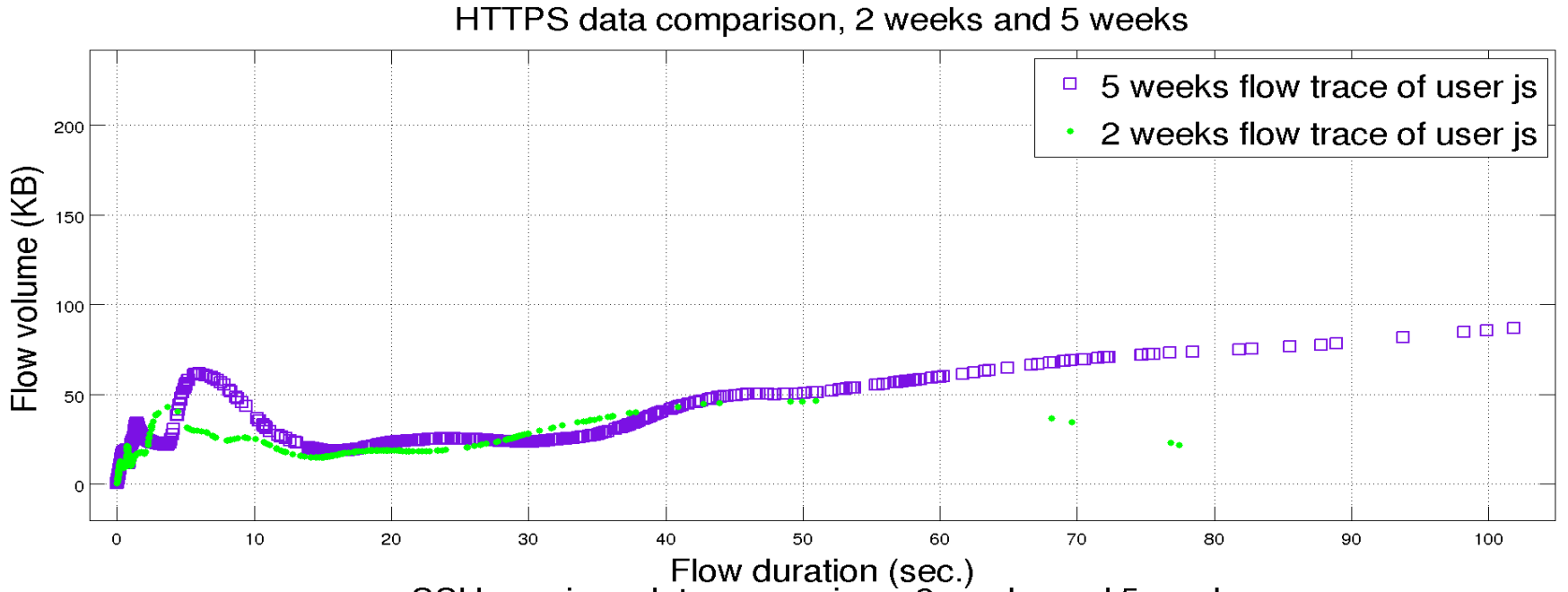
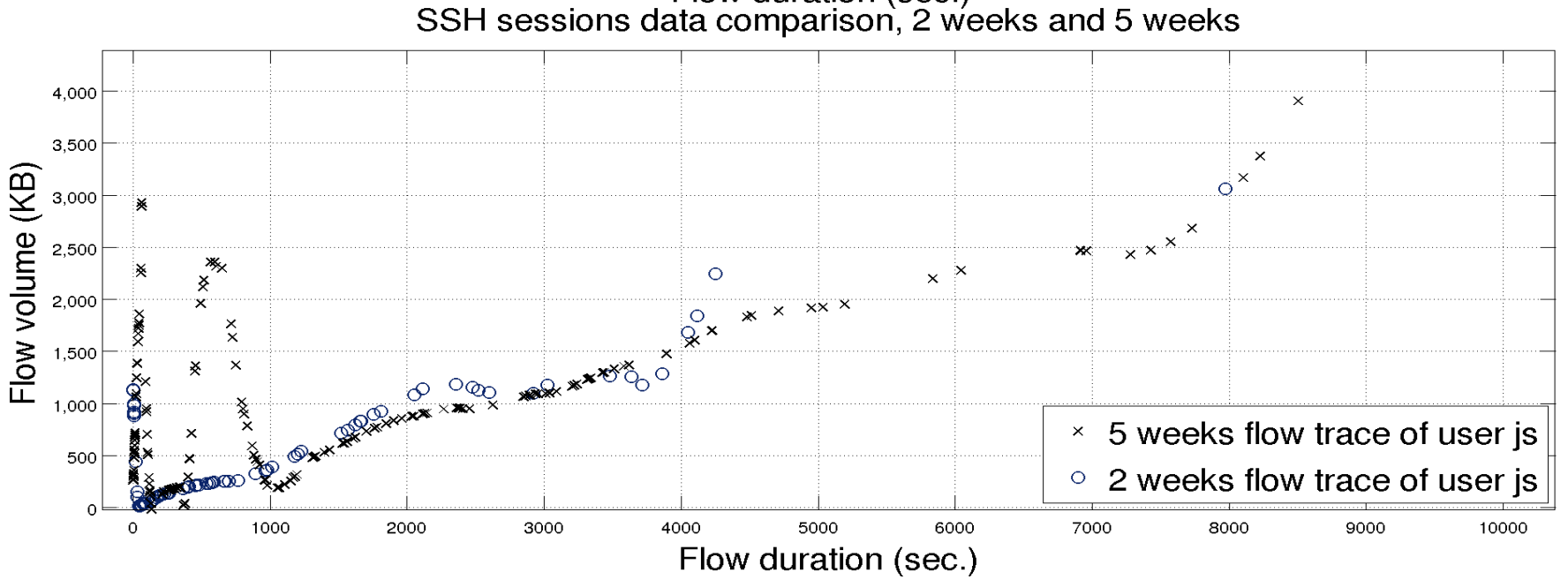
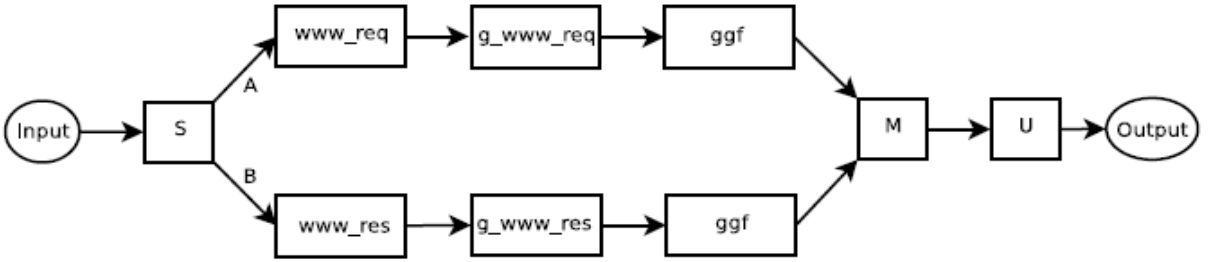




Chosen Approach - Signatures

- *We defined application signatures using a stream-based flow query language Flowy*

```
 1 splitter S {}
 2
 3 filter www_req {
 4    dstport = 80
 5 }
 6
 7 filter www_res {
 8    srcport = 80
 9 }
10
11 grouper g_www_req {
12    module g1 {
13       srcip = srcip
14       dstip = dstip
15       etime < stime delta 1s
16    }
17    aggregate srcip, dstip, sum(bytes) as bytes, count(rec_id) as n,
18              bitOR(tcp_flags) as flags, union(srcport) as srcports
19 }
20
21 grouper g_www_res {
22    module g1 {
23       srcip = srcip
24       dstip = dstip
25       etime < stime delta 1s
26    }
27    aggregate srcip, dstip, sum(bytes) as bytes, count(rec_id) as n,
28              bitOR(tcp_flags) as flags, union(dstport) as dstports
```



Chosen Approach - Signatures

- *We defined application signatures using a stream-based flow query language Flowy*

```
31 groupfilter ggf {
32    bitAND(flags, 0x13) = 0x13
33 }
34
35 merger M {
36    module m1 {
37       branches B, A
38       A.srcip = B.dstip
39       A.srcports = B.dstports
40       A.bytes < B.bytes
41       B oi A OR B d A
42    }
43    export m1
44 }
45
46 ungrouper U {}
47
48 "./netflow-trace.h5" -> S
49 S branch A -> www_req -> g_www_req -> ggf -> M
50 S branch B -> www_res -> g_www_res -> ggf -> M
51 M->U->"./ungrouped.h5"
```

Chosen Approach - Features

User	Skype	Opera	Amarok	Chrome	Live
U0	⊙	○	⊡	○	○
U1	⊙	○	○	○	○
U2	○	○	○	○	○
U3	⊙	○	⊡	○	○
U4	○	○	○	○	○
U5	⊙	○	⊙	⊙	○
U6	○	○	○	○	○
U7	○	⊙	⊙	○	○
U8	○	○	○	○	○
U9	⊙	⊙	⊙	⊙	○

TABLE I

RESULTS OF APPLICATION SIGNATURE IDENTIFICATIONS

Why is the problem hard/important/relevant?

No “step-by-step” methodology exists; large amounts of data

First ones to address it

As the application-generated traffic evolves and becomes specific

A shift from traffic just being used to being more network-aware

Think in terms of electric grid monitoring (appliances as apps): better job of distributing traffic where, what type of and how much of it is required

QoS, traffic engineering, monitoring

Future research plan

- *Establish more application signatures for Flowy*
- *Observation phase*
  - *Observe and understand dynamics of application signatures*
- *“Uncontrolled” testing phase for signatures*
  - *Using real-life flow records*
  - *Span several days/weeks to detect correlated variations*
  - *Day-time analysis of application employment*
- *Resolve some scalability issues (e.g., possible application of Map/Reduce)*

¡Thank you for attention!