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Transport Evolution on top of the BSD's

[tj]
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NEAT is funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 644334.

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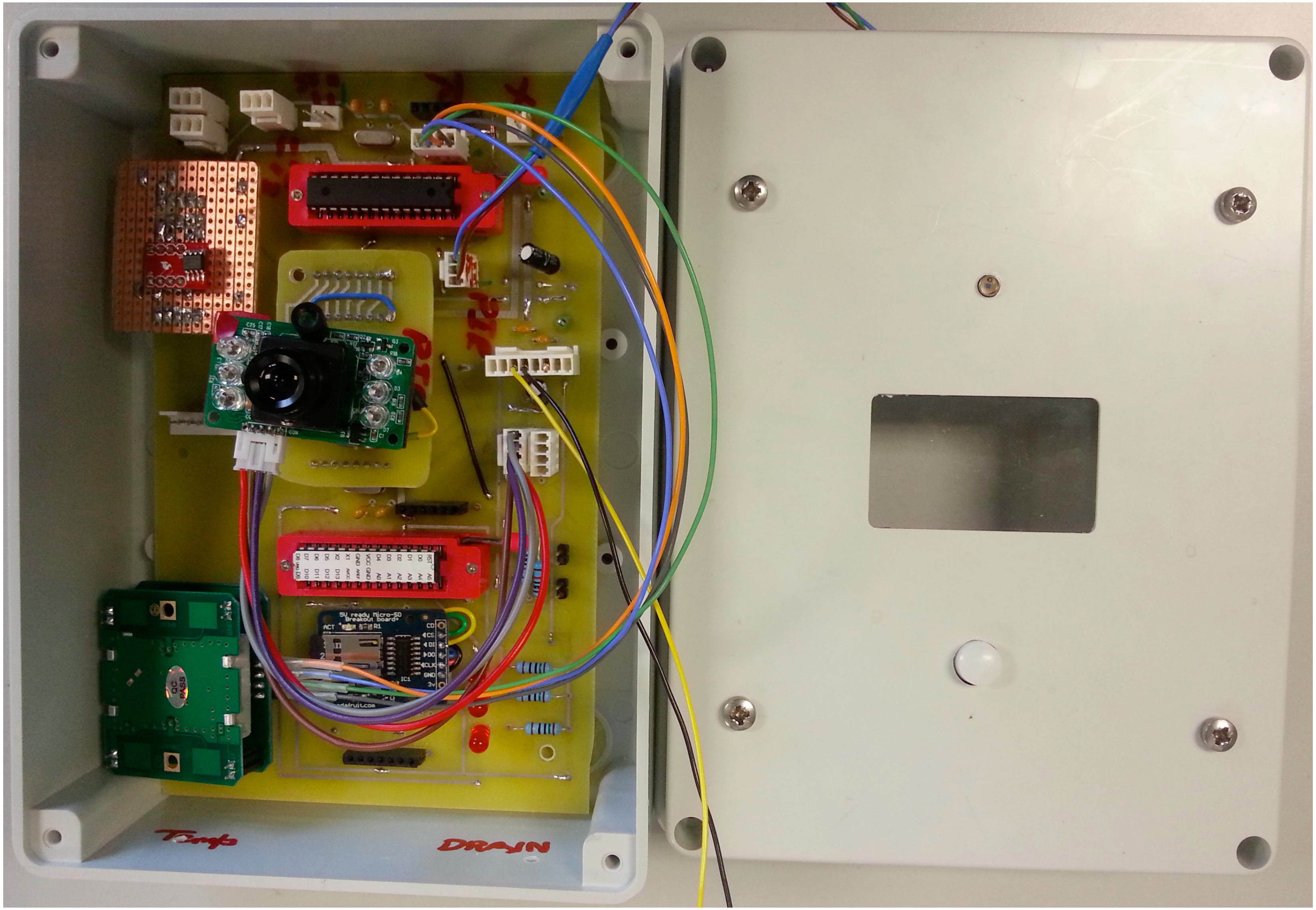
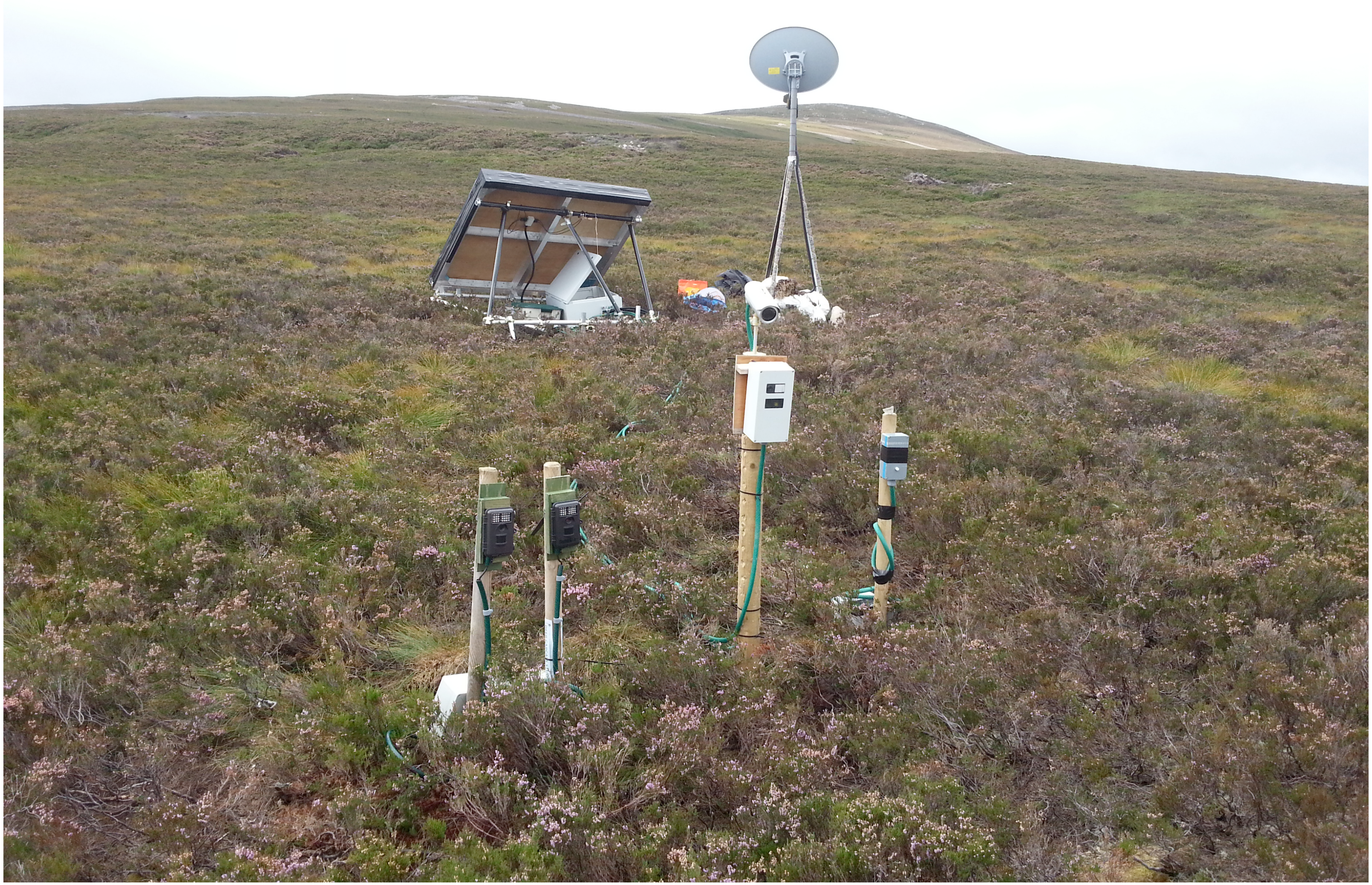

5V ready Micro-SD
Breakout board+
Temp
DRAIN



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TCP Congestion Control

- Slow Start Phase
- Steady State
- Multiplicative Reduction to Loss

HTTP Video Workloads

- Bursty
- Terrible Reaction to loss
  - ‘Confused, Timid and Unstable’
- Very long connection life time
- Lots of packets in flight

NewCWV

- TCP Adaptation for Rate Limited Traffic
- Improved window validation
- FreeBSD Implementation here:
  - https://bugs.freebsd.org/bugzilla/show_bug.cgi?id=191520

TCP Congestion Window

```
TCP Congestion Window (Bytes)
 ^
 |
 |
 |
 |         _______________________________        ________
 |        |                               \      |
 |       /                                 \    /
 |      /                                  |   /
 |     /                                   |  /
 |    /                                    |_/
 +//-+----------+---------\+----/ /----+/---------+------------->
Time

                              5 Minutes
```

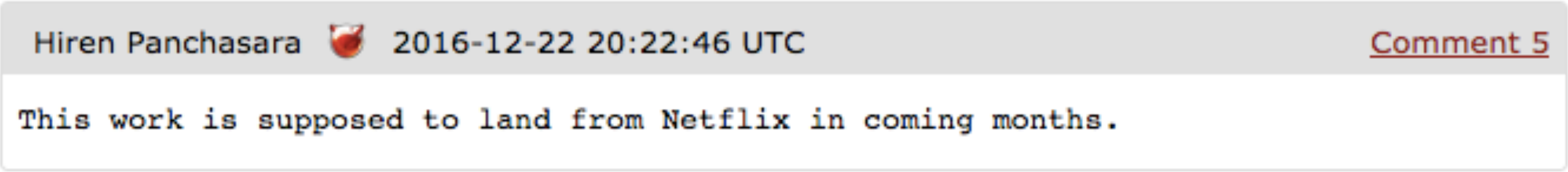
Pipe ack

```
  pipeACK sample (Bytes)
   ^
   |   +----------+----------+           +----------+---......
   |   | Sample A | Sample B | No        | Sample C | Sample D
   |   |          |          | Sample    |          |
   |   | |\ 5     |          |           |          |
   |   | | |      |          |           |  /\ 4    |
   |   | | |      |  |\ 3    |           |  | \     |
   |   | | \      | |  \---  |           |  /  \    |   /| 2
   |   |/   \------|       - |           | /    \------/ \...
   +//-+----------+---------\+----/ /----+/---------
+-------------> Time

    <------------------------------------------------|
                        Sampling Period          Current Time
```

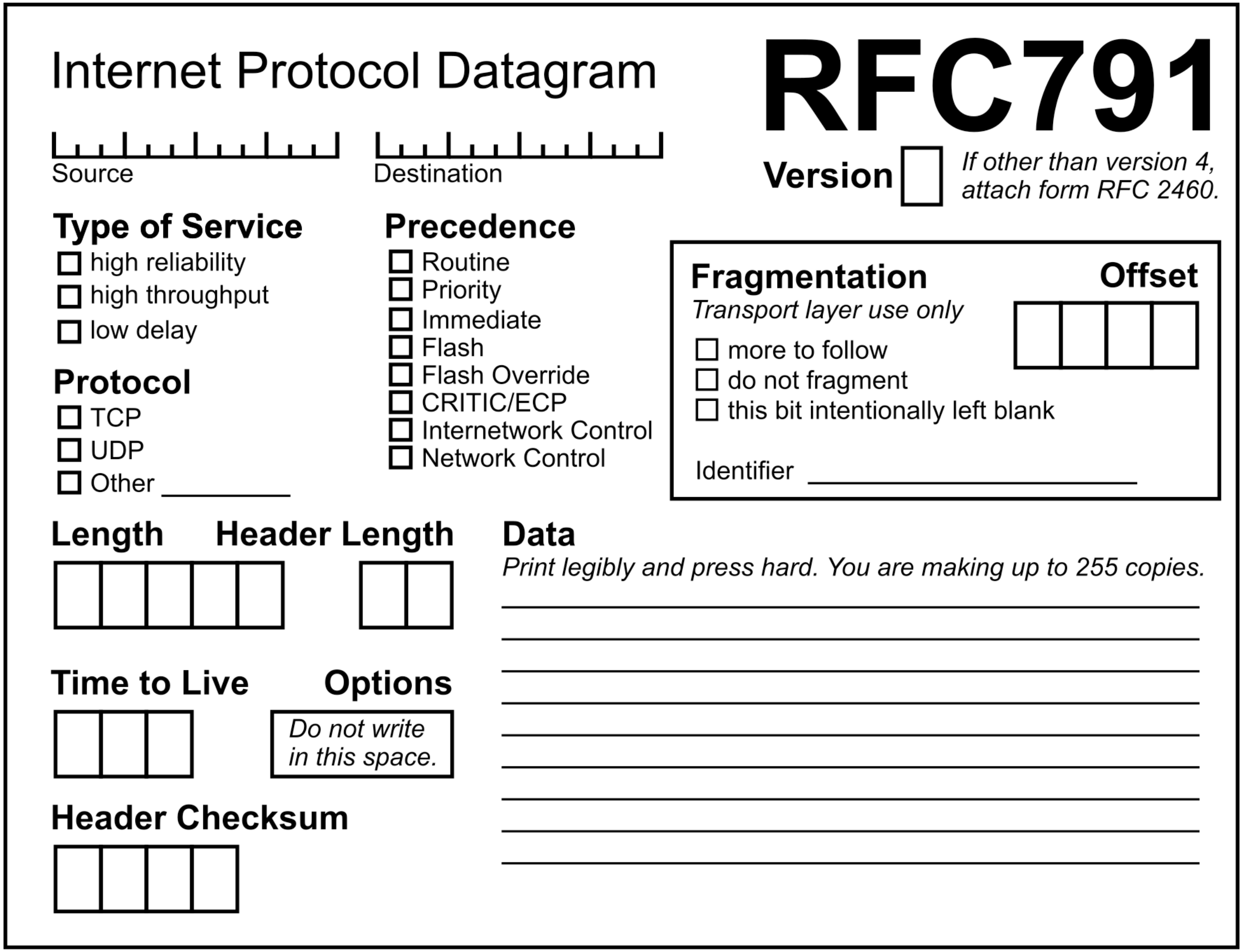
Figure 1: Example of Measuring pipeACK Samples

NewCWV Status



Hiren Panchasara 2016-12-22 20:22:46 UTC

This work is supposed to land from Netflix in coming months.



Internet Protocol Datagram

RFC791

Source

Destination

Version □ *If other than version 4, attach form RFC 2460.*

Type of Service
- □ high reliability
- □ high throughput
- □ low delay

Precedence
- □ Routine
- □ Priority
- □ Immediate
- □ Flash
- □ Flash Override
- □ CRITIC/ECP
- □ Internetwork Control
- □ Network Control

Fragmentation **Offset**

Transport layer use only

- □ more to follow
- □ do not fragment
- □ this bit intentionally left blank

Identifier ______________________

Protocol
- □ TCP
- □ UDP
- □ Other __________

Length □□□□□

Header Length □□

Time to Live □□□

Options

Do not write in this space.

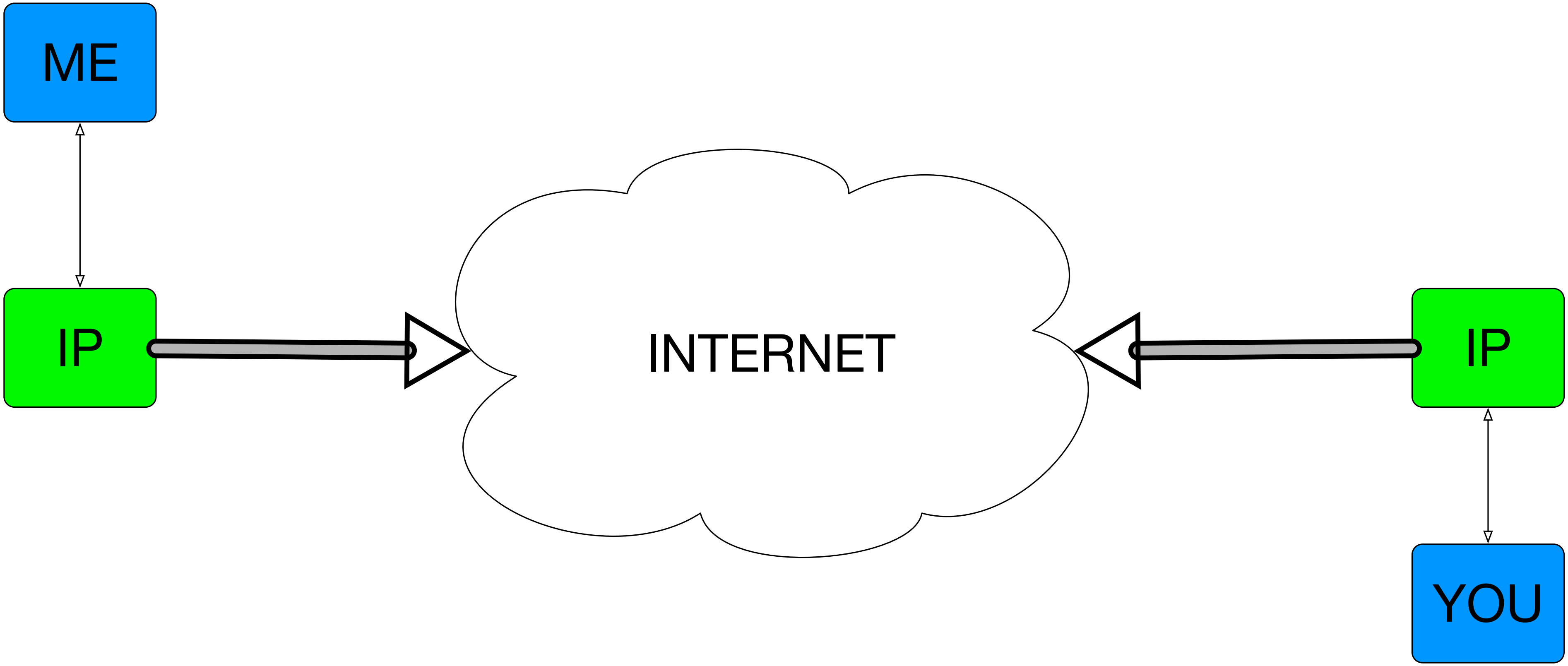
Header Checksum □□□□

Data

Print legibly and press hard. You are making up to 255 copies.

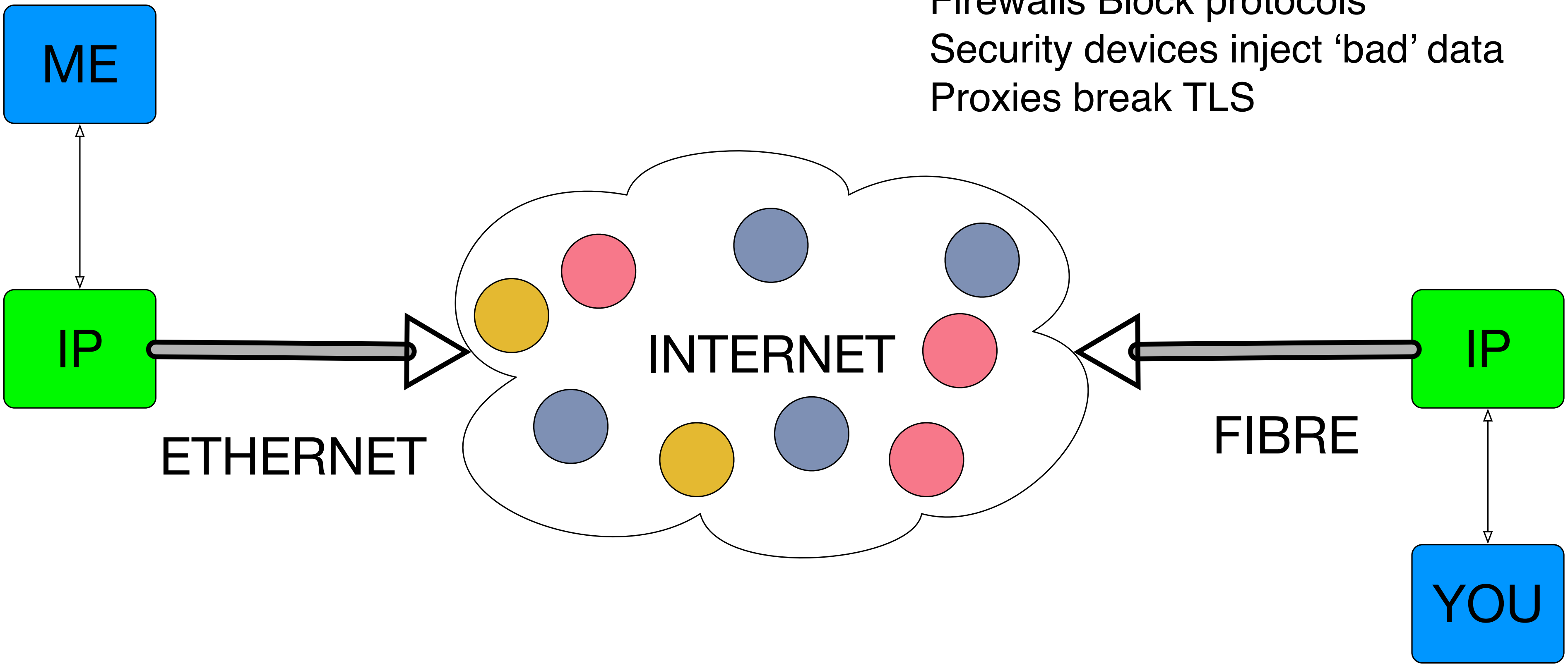
for more info, check IPv4 specifications at http://www.ietf.org/rfc/rfc0791.txt

The Naive View of the Network



The Reality of the Network

Middleboxes drop non http traffic
Firewalls Block protocols
Security devices inject ‘bad’ data
Proxies break TLS



Networks vary a ton

Middleboxes drop non http traffic
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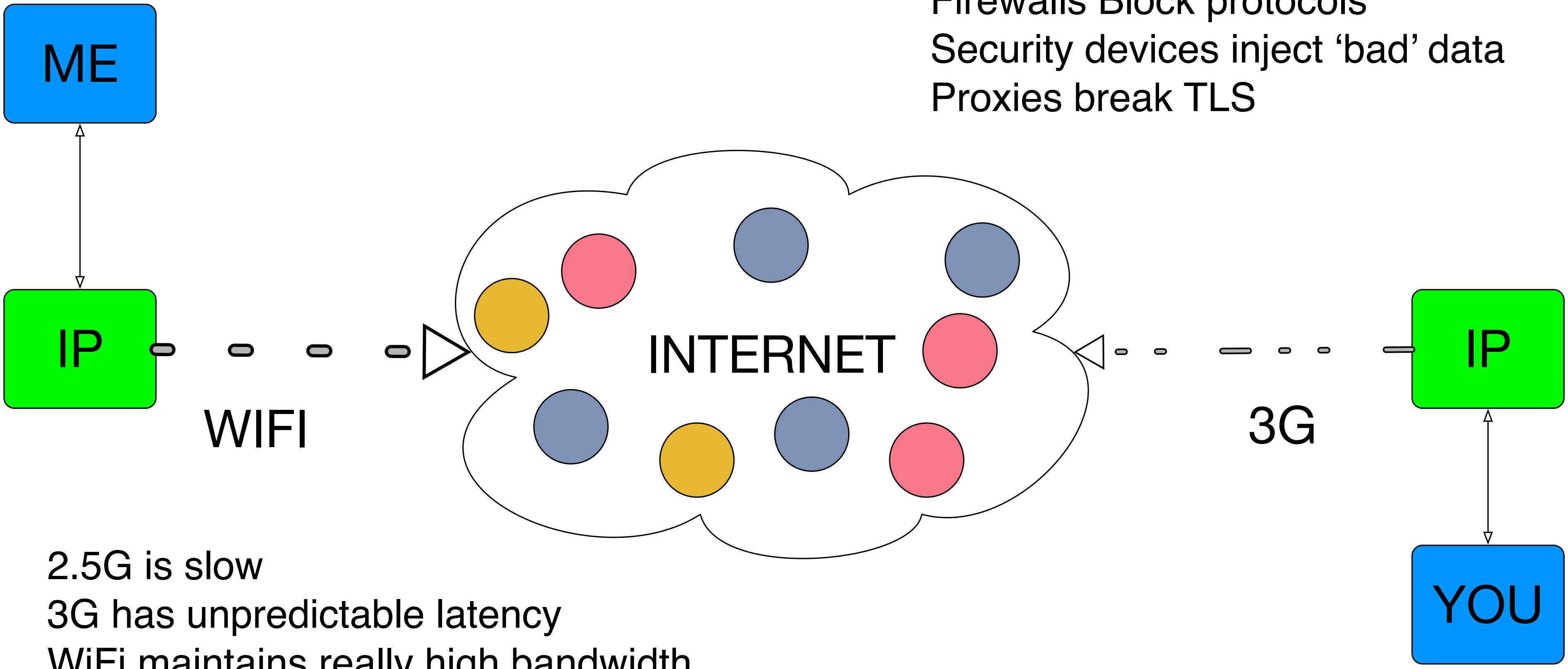


2.5G is slow
3G has unpredictable latency
WiFi maintains really high bandwidth
4G has high, but variability in bandwidth

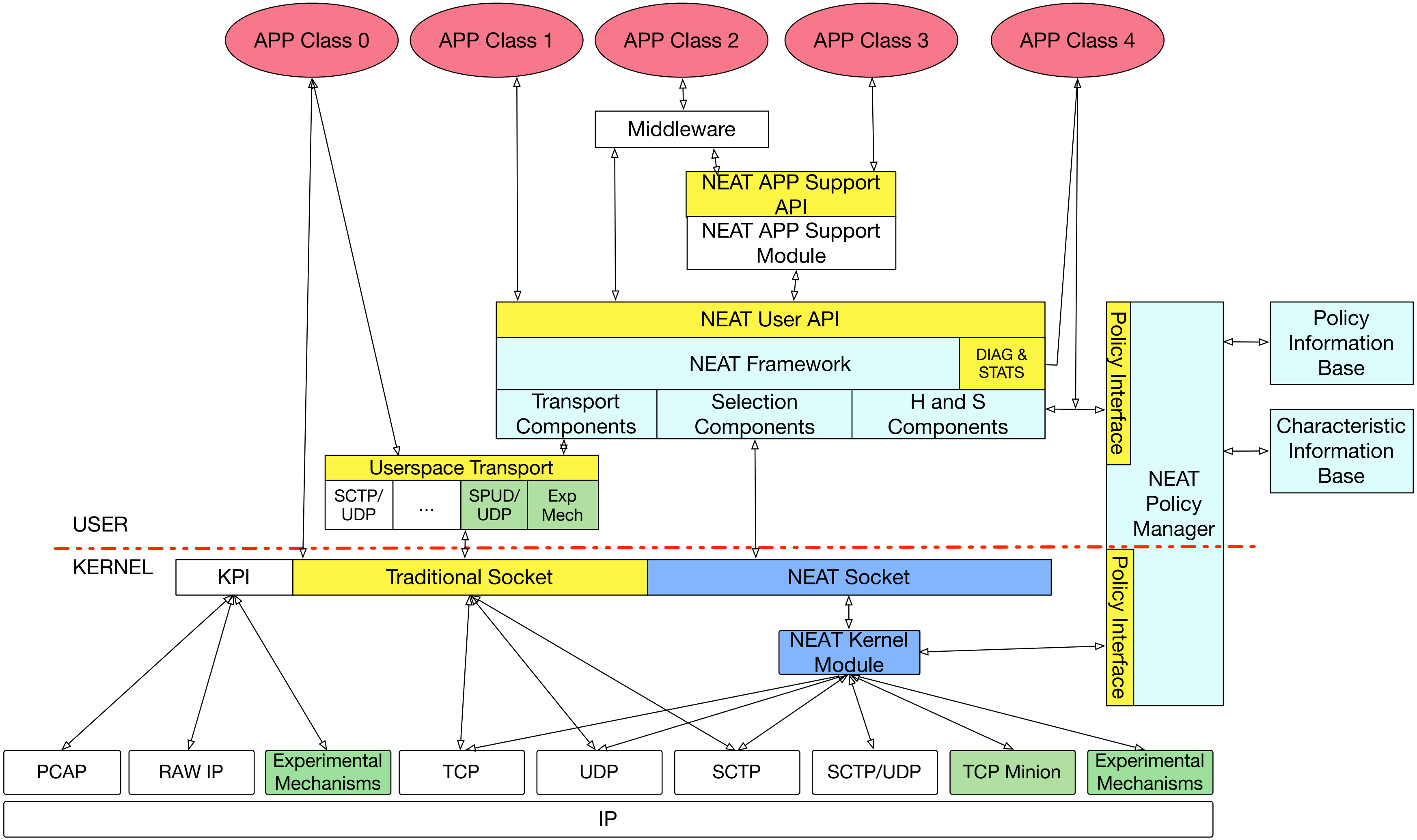
The socket API has ossified

```
getaddrinfo();  // Look up host
socket();       // Create a socket

setsockopt();   // Configure the socket
getsockopt();   // Check parameters

connect();      // Start connection

send();
recv();
```

Do it in userspace

- usersctp
- QUIC
  - draft-ietf-quic-transport-01
- GUE
  - draft-ietf-nvo3-gue-05
- TCP over UDP

The NEAT System



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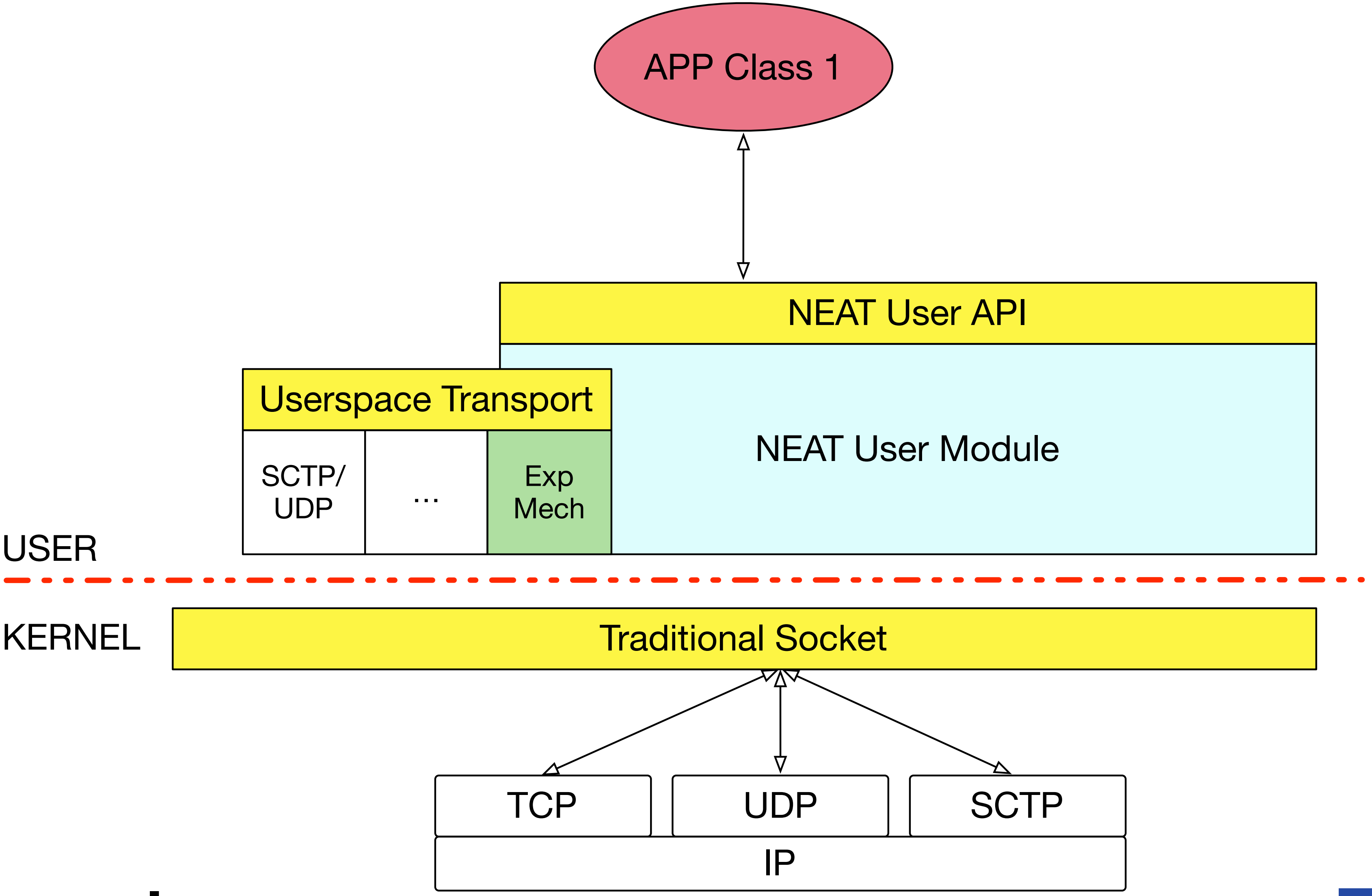
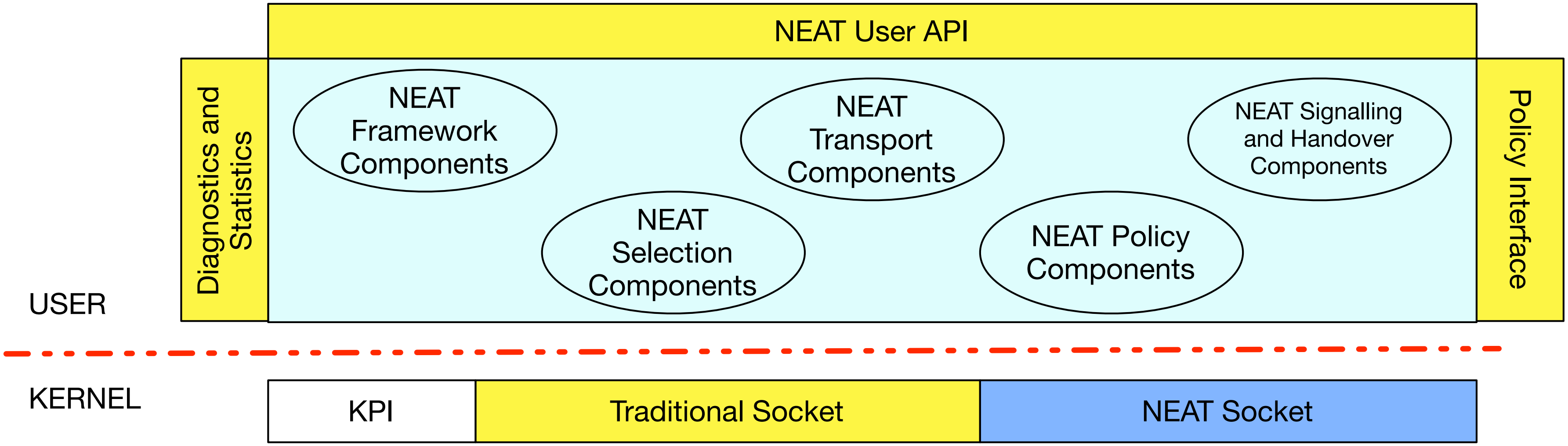
NEAT Application

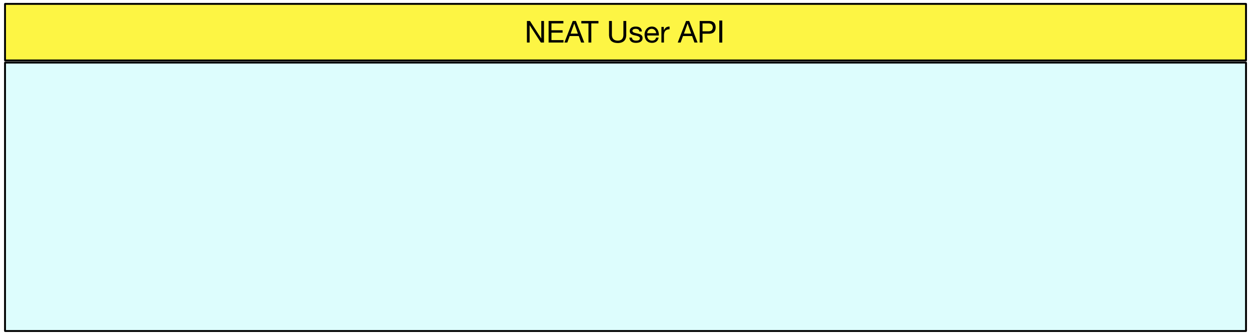


The NEAT User Module

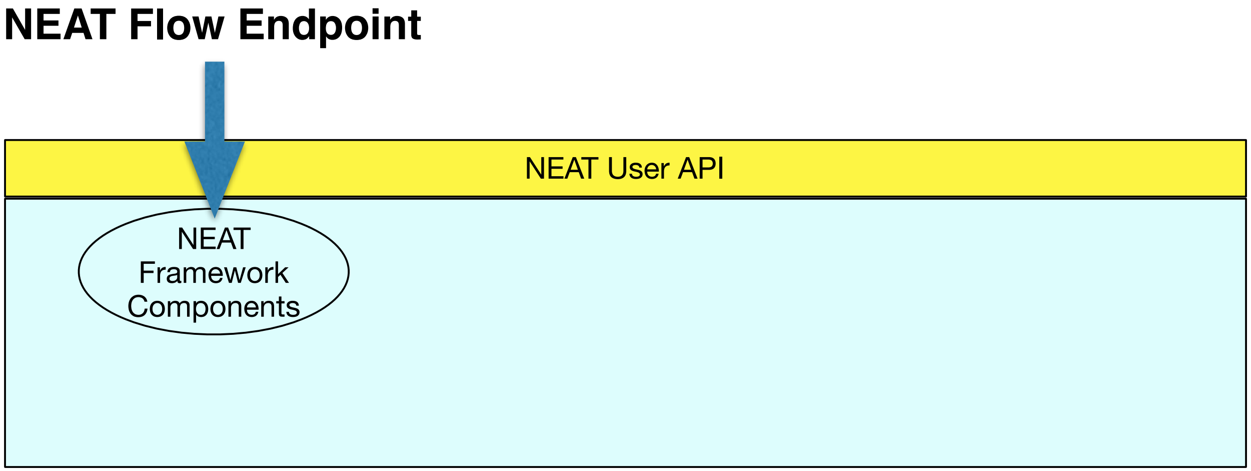

NEAT User API
Diagnostics and Statistics
NEAT Framework Components
NEAT Transport Components
NEAT Signalling and Handover Components
NEAT Selection Components
NEAT Policy Components
Policy Interface
USER
KERNEL
KPI
Traditional Socket
NEAT Socket

The NEAT User Module

NEAT Flow Endpoint

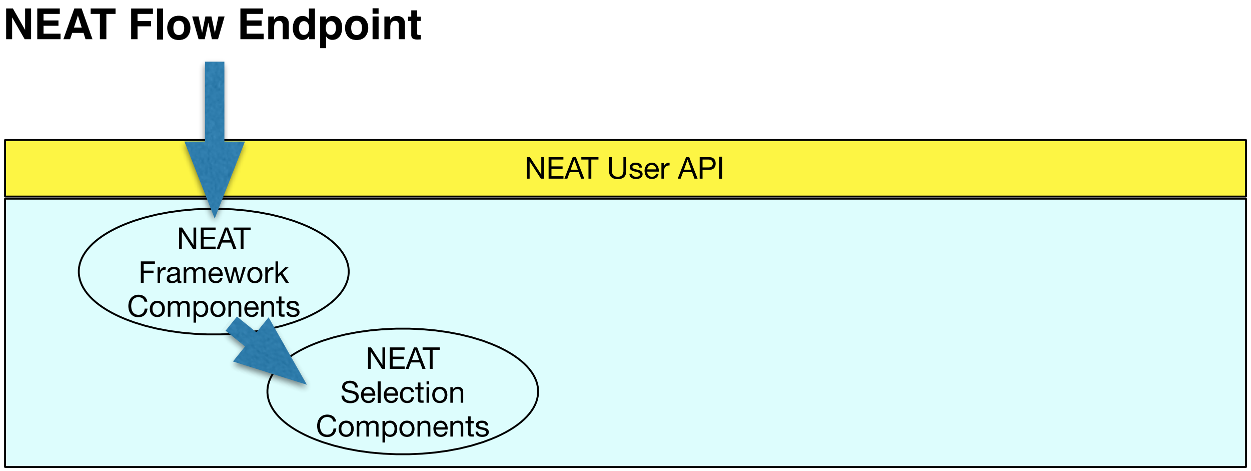


The NEAT User Module



5 Groups of components:

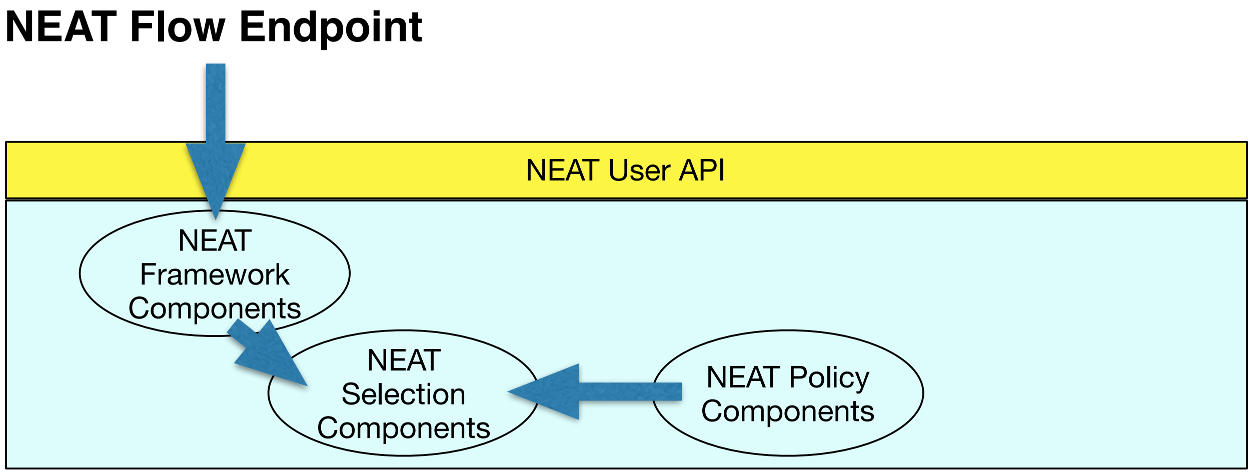
The NEAT User Module



5 Groups of components:

- NEAT Framework Component: API, Logic

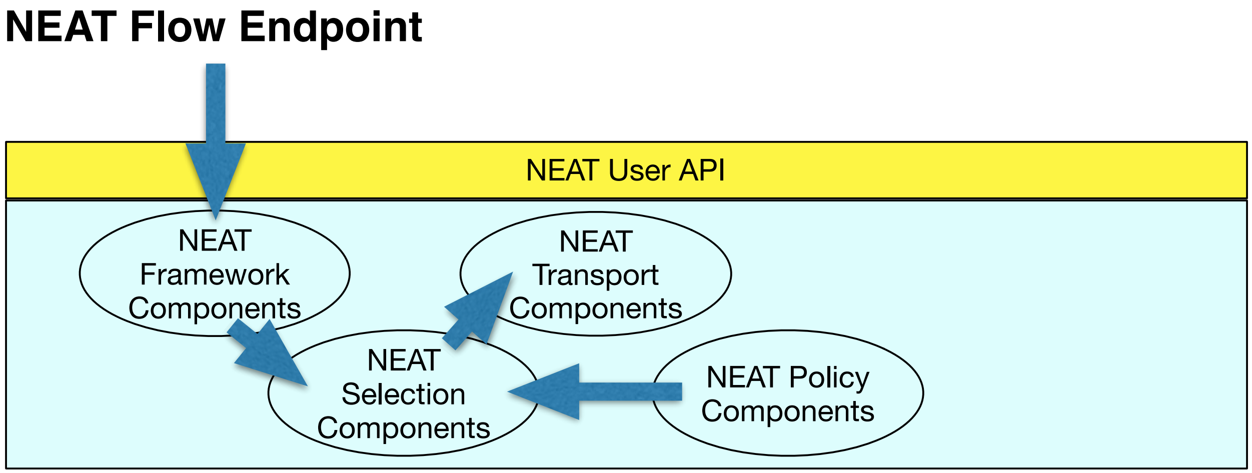
The NEAT User Module



5 Groups of components:

- NEAT Framework Component: API, Logic
- NEAT Selection Components: Choose candidates

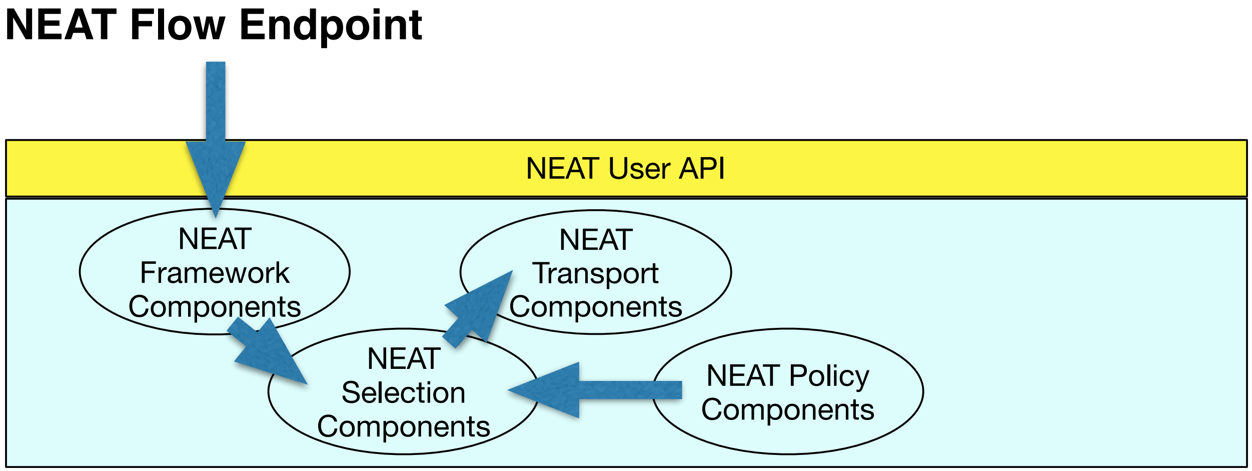
The NEAT User Module


NEAT Flow Endpoint
NEAT User API
NEAT Framework Components
NEAT Transport Components
NEAT Selection Components
NEAT Policy Components

5 Groups of components:

- NEAT Framework Component: API, Logic
- NEAT Selection Components: Choose candidates
- NEAT Policy Components: Policy and Characteristics

The NEAT User Module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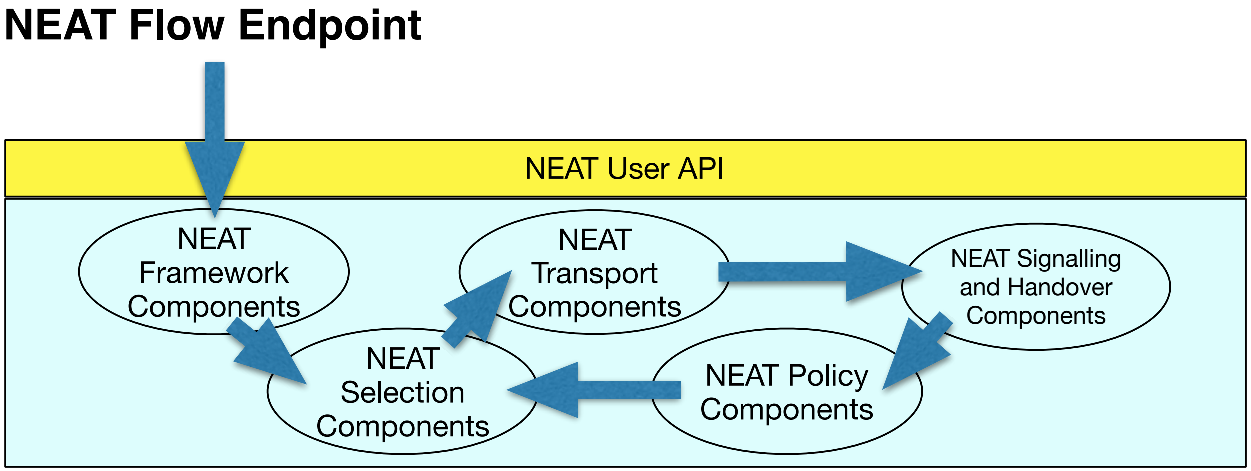
- NEAT Policy Components: Policy and Characteristics
- NEAT Transport Components: Instantiate transports

The NEAT User Module


NEAT Flow Endpoint
NEAT User API
NEAT Framework Components
NEAT Transport Components
NEAT Signalling and Handover Components
NEAT Selection Components
NEAT Policy Components

5 Groups of components:

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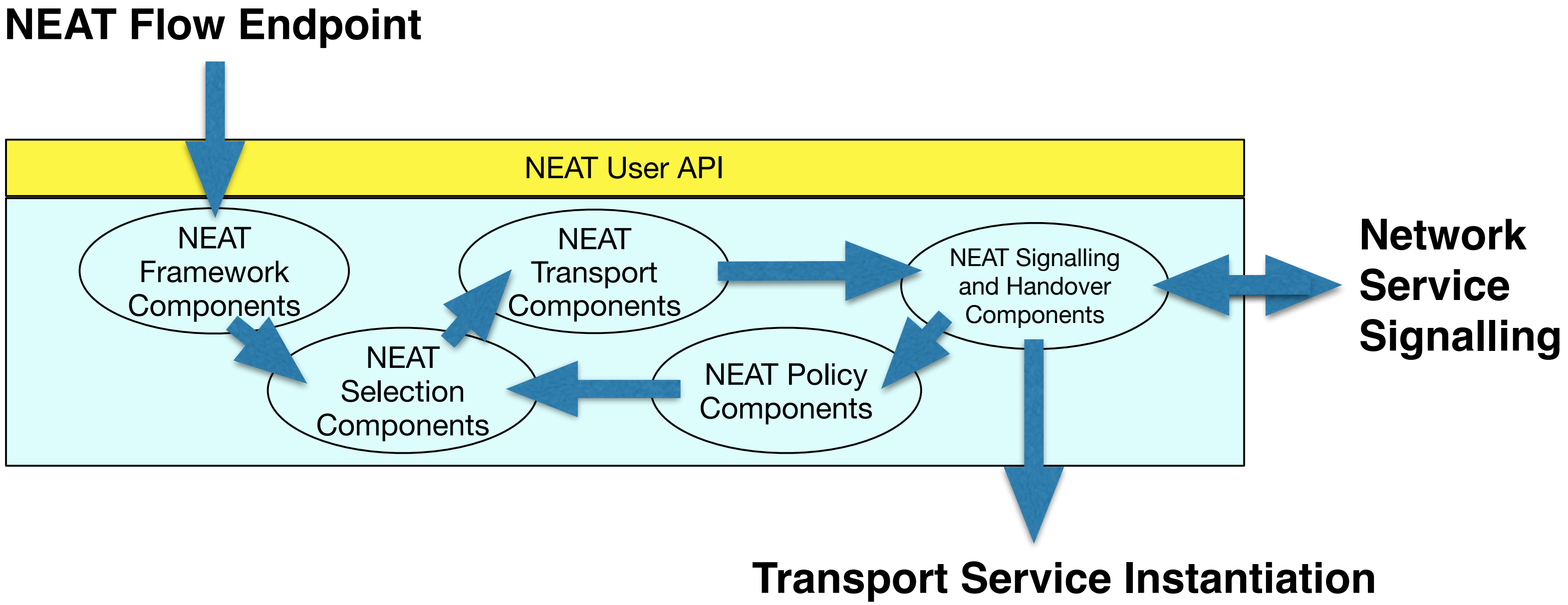
- NEAT Policy Components: Policy and Characteristics
- NEAT Transport Components: Instantiate transports
- NEAT Handover and Signalling Components

The NEAT User Module


NEAT Flow Endpoint
NEAT User API
NEAT Framework Components
NEAT Transport Components
NEAT Signalling and Handover Components
NEAT Selection Components
NEAT Policy Components
Network Service Signalling
Transport Service Instantiation

5 Groups of components:

- NEAT Framework Component: API, Logic
- NEAT Selection Components: Choose candidates
- NEAT Policy Components: Policy and Characteristics
- NEAT Transport Components: Instantiate transports
- NEAT Handover and Signalling Components

NEAT Application

```
static struct neat_flow_operations ops;
static struct neat_ctx *ctx = NULL;
static struct neat_flow *flow = NULL;

ctx = neat_init_ctx()
flow = neat_new_flow(ctx)

prop = NEAT_PROPERTY_UDP_REQUIRED | NEAT_PROPERTY_IPV6_REQUIRED;
neat_set_property(ctx, flow, &prop)

ops.on_writable = on_writable;
ops.on_readable = on_readable;
ops.on_error = on_error;

neat_set_operations(ctx, flow, &ops)
neat_open(ctx, flow, argv[argc - 2], argv[argc - 1])

neat_start_event_loop(ctx, NEAT_RUN_DEFAULT);
```

NEAT Application

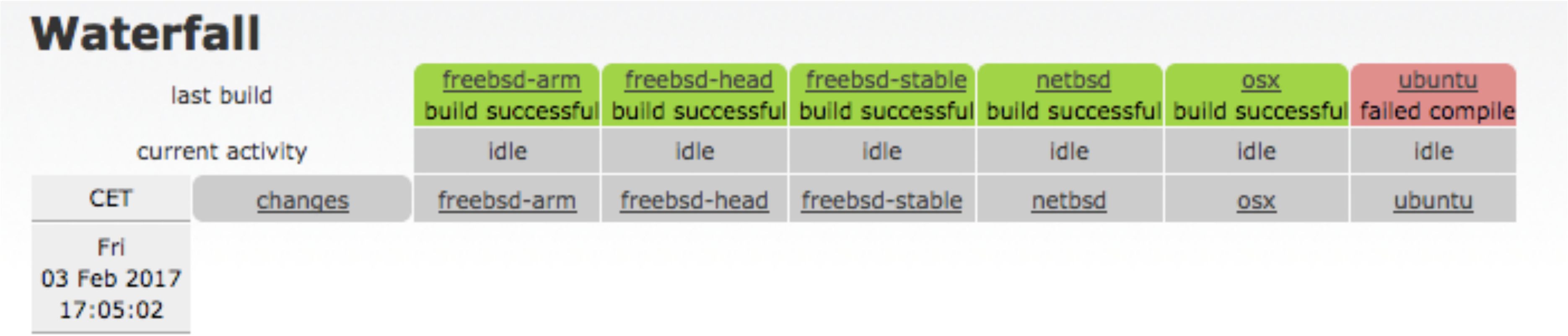
```
static neat_error_code
on_writable(struct neat_flow_operations *opCB)
{
    neat_write(opCB->ctx, opCB->flow, buf)
    return NEAT_OK;
}

static neat_error_code
on_readable(struct neat_flow_operations *opCB)
{
    neat_read(opCB->ctx, opCB->flow, buf)
    return NEAT_OK;
}
```

https://github.com/NEAT-project/neat/blob/master/examples/client.c

Porting Apps

- Firefox
- rsync

buildbot



Waterfall

last build		freebsd-arm build successful	freebsd-head build successful	freebsd-stable build successful	netbsd build successful	osx build successful	ubuntu failed compile
current activity		idle	idle	idle	idle	idle	idle
CET	changes	freebsd-arm	freebsd-head	freebsd-stable	netbsd	osx	ubuntu
Fri 03 Feb 2017 17:05:02							

Fork me on GitHub

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https://www.neat-project.org

https://github.com/neat-project/neat

NEAT is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement no. 644334.

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