Peeking into the Future of the Internet: IPv6, Encrypted Web and Beyond

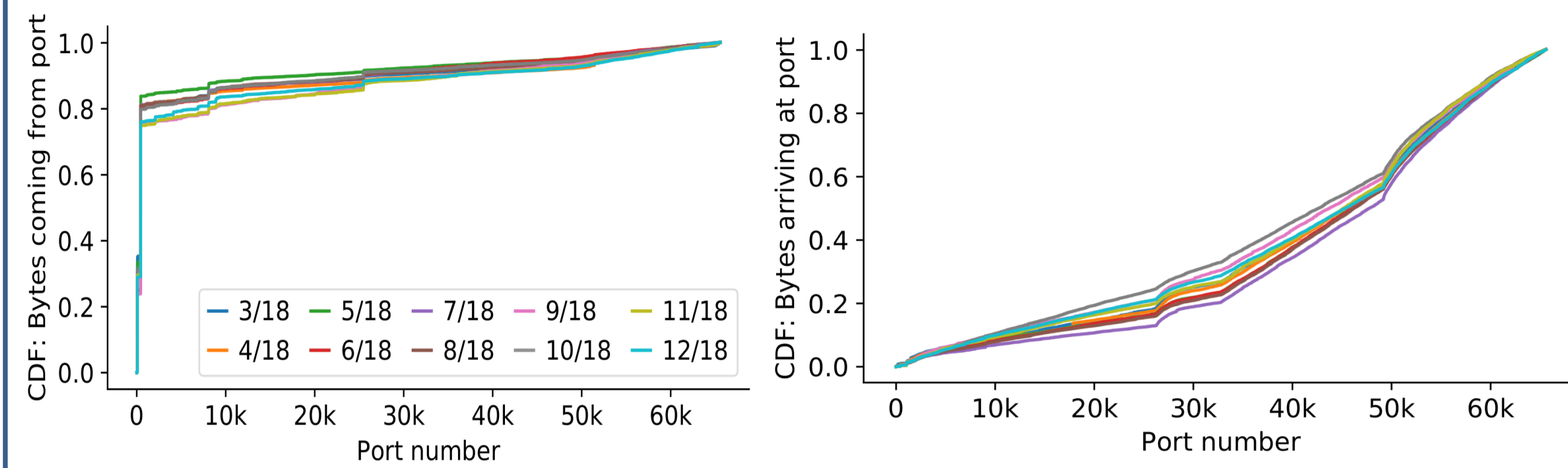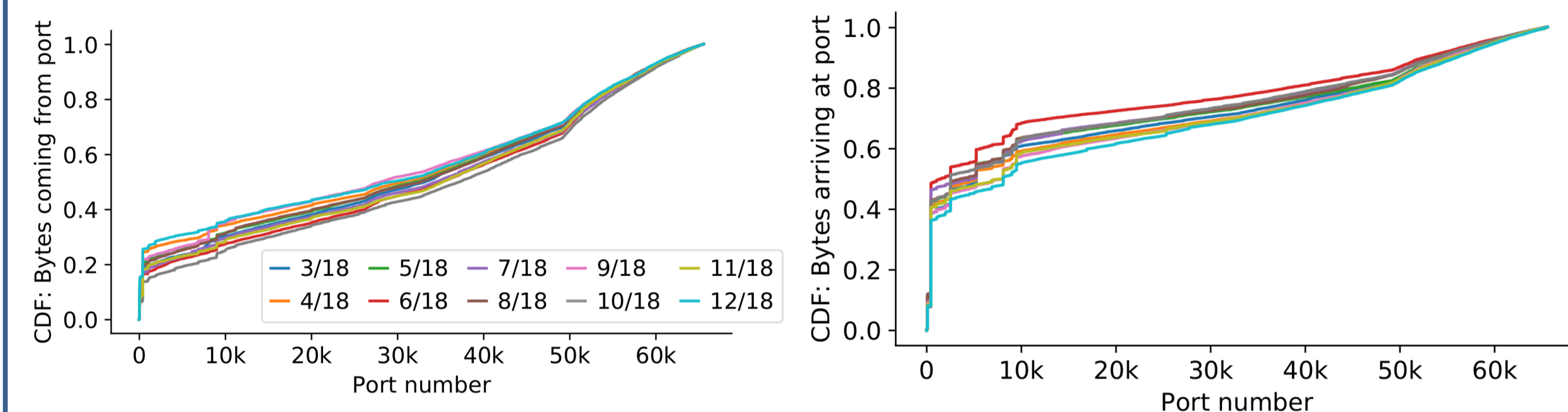Luca Schumann, Trinh Viet Doan, Vaibhav Bajpai, Ka Pui Mok

Datasets

- **Anonymized Internet traces** from two **passive monitors** (MAWI: Japan and CAIDA: New York ↔ São Paulo) between March and December 2018
- **IPv4 traffic distribution** for CAIDA direction A: São Paulo → New York

- **IPv4 traffic distribution** for CAIDA direction B: New York → São Paulo

Research Questions

- **Where is IPv6 traffic usage today?**
- **Has HTTPS already replaced HTTP?**
- **What other applications are using the Internet?**

IPv6 adoption

- **Quantifying IPv6 adoption** relies heavily on the metric used:
- **Google: 25% IPv6 connectivity** on their clients in December 2018
- **APNIC: 18% IPv6 capability** worldwide in December 2018
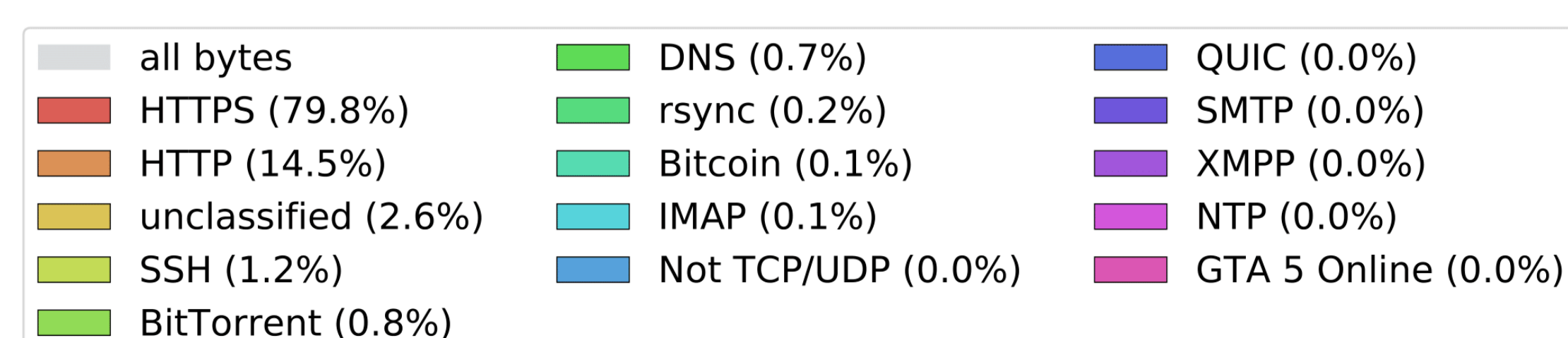- **Akamai: 11% IPv6 traffic** in July 2017

IPv6 traffic increases throughout the CAIDA dataset, however there is **no visible trend on MAWI.**

CAIDA	Byte Distrib. IPv4	IPv6
Mar 2018	98.9%	1.1%
Apr	97.7%	2.3%
May	97.5%	2.5%
Jun	96.4%	3.6%
Jul	96.2%	3.8%
Aug	96.6%	3.4%
Sep	96.3%	3.7%
Oct	97.0%	3.0%
Nov	96.4%	3.6%
Dec 2018	93.9%	6.1%

MAWI	Byte Distrib. IPv4	IPv6
Mar 2018	92.9%	7.1%
Apr	92.7%	7.3%
May	92.9%	7.1%
Jun	93.0%	7.0%
Jul	91.5%	8.5%
Aug	93.9%	6.1%
Sep	89.9%	10.1%
Oct	92.9%	7.1%
Nov	89.9%	10.1%
Dec 2018	93.1%	6.9%

CAIDA: On average, **only 0.3%** of traffic from São Paulo to New York is **IPv6**.

| Direction A	Byte Distrib. IPv4	IPv6
Mar 2018	99.8%	0.2%
Apr	99.8%	0.2%
May	99.7%	0.3%
Jun	99.8%	0.2%
Jul	99.7%	0.3%
Aug	99.6%	0.4%
Sep	99.5%	0.5%
Oct	99.7%	0.3%
Nov	99.7%	0.3%
Dec 2018	99.7%	0.3%

Direction B	Byte Distrib. IPv4	IPv6
Mar 2018	97.9%	2.1%
Apr	95.9%	4.1%
May	95.4%	4.6%
Jun	93.5%	6.5%
Jul	93.3%	6.7%
Aug	94.3%	5.7%
Sep	94.2%	5.8%
Oct	94.5%	5.5%
Nov	92.9%	7.1%
Dec 2018	89.0%	11.0%

Beyond the Web - MAWI IPv6

all bytes
HTTPS (79.8%) — HTTP (14.5%) — unclassified (2.6%) — SSH (1.2%) — BitTorrent (0.8%) — DNS (0.7%) — rsync (0.2%) — Bitcoin (0.1%) — IMAP (0.1%) — Not TCP/UDP (0.0%) — QUIC (0.0%) — SMTP (0.0%) — XMPP (0.0%) — NTP (0.0%) — GTA 5 Online (0.0%)
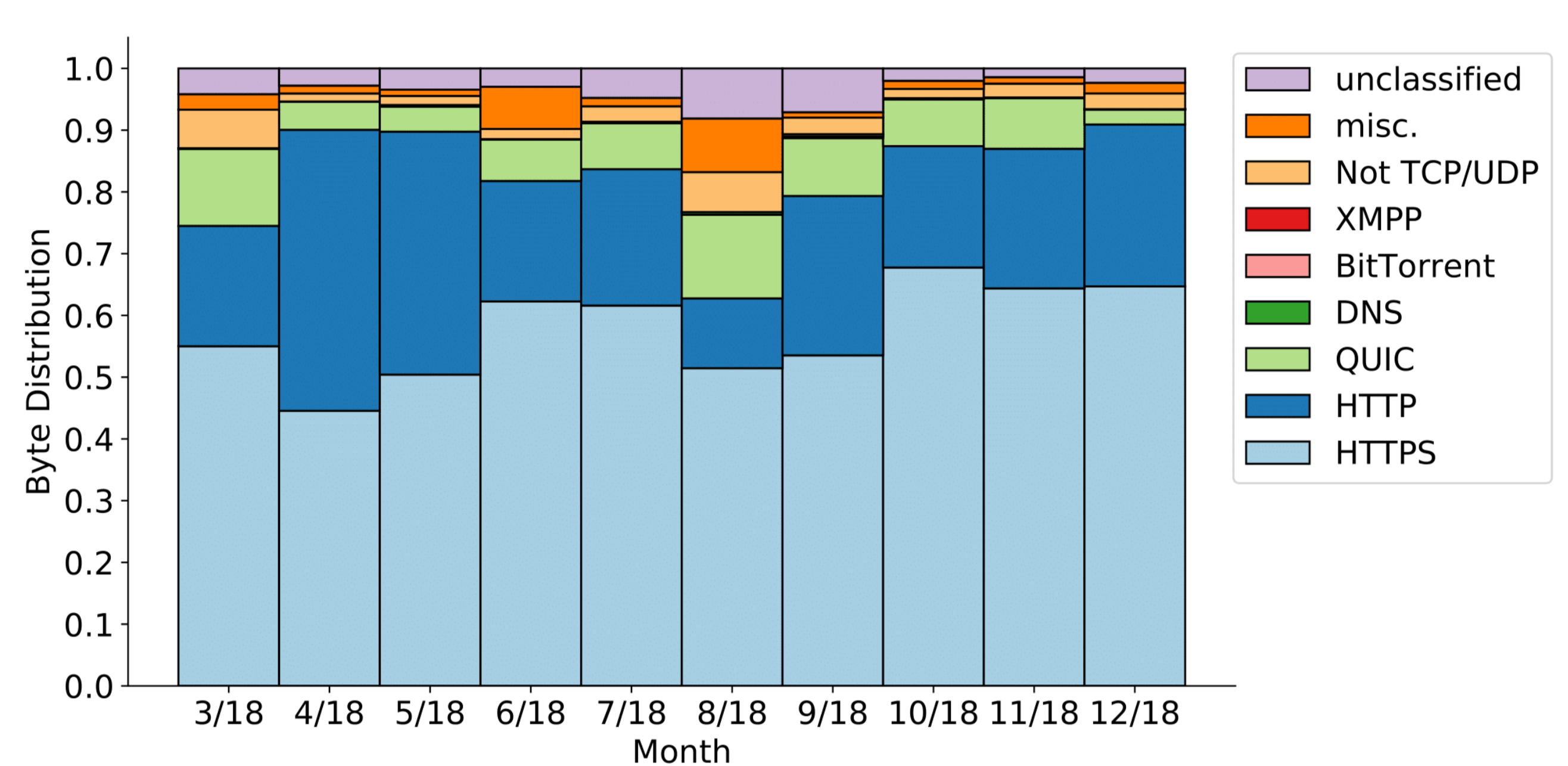

Encrypted Web - IPv4

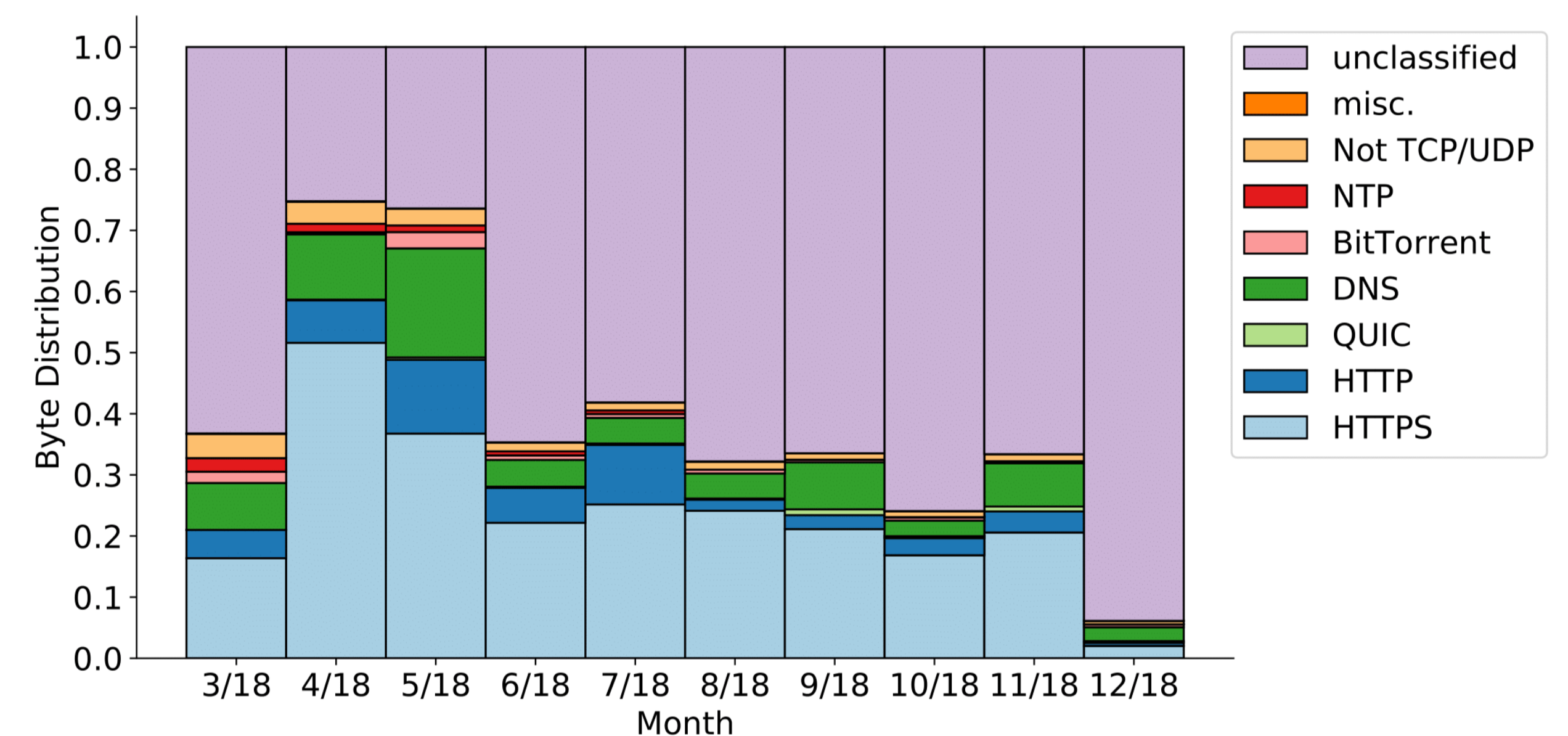**IPv4 application mix for CAIDA** with a 2-to-1 encrypted HTTP to HTTP ratio.
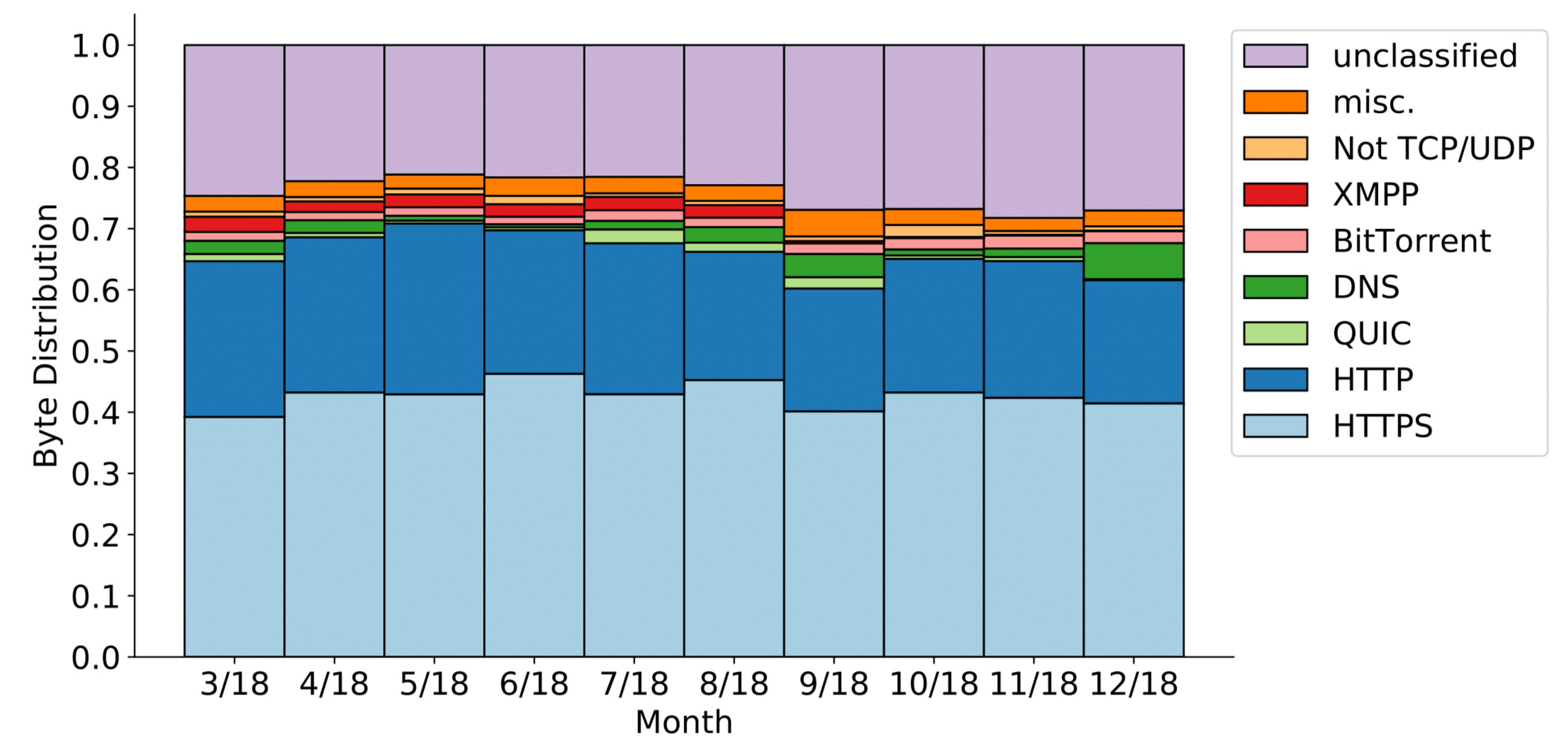
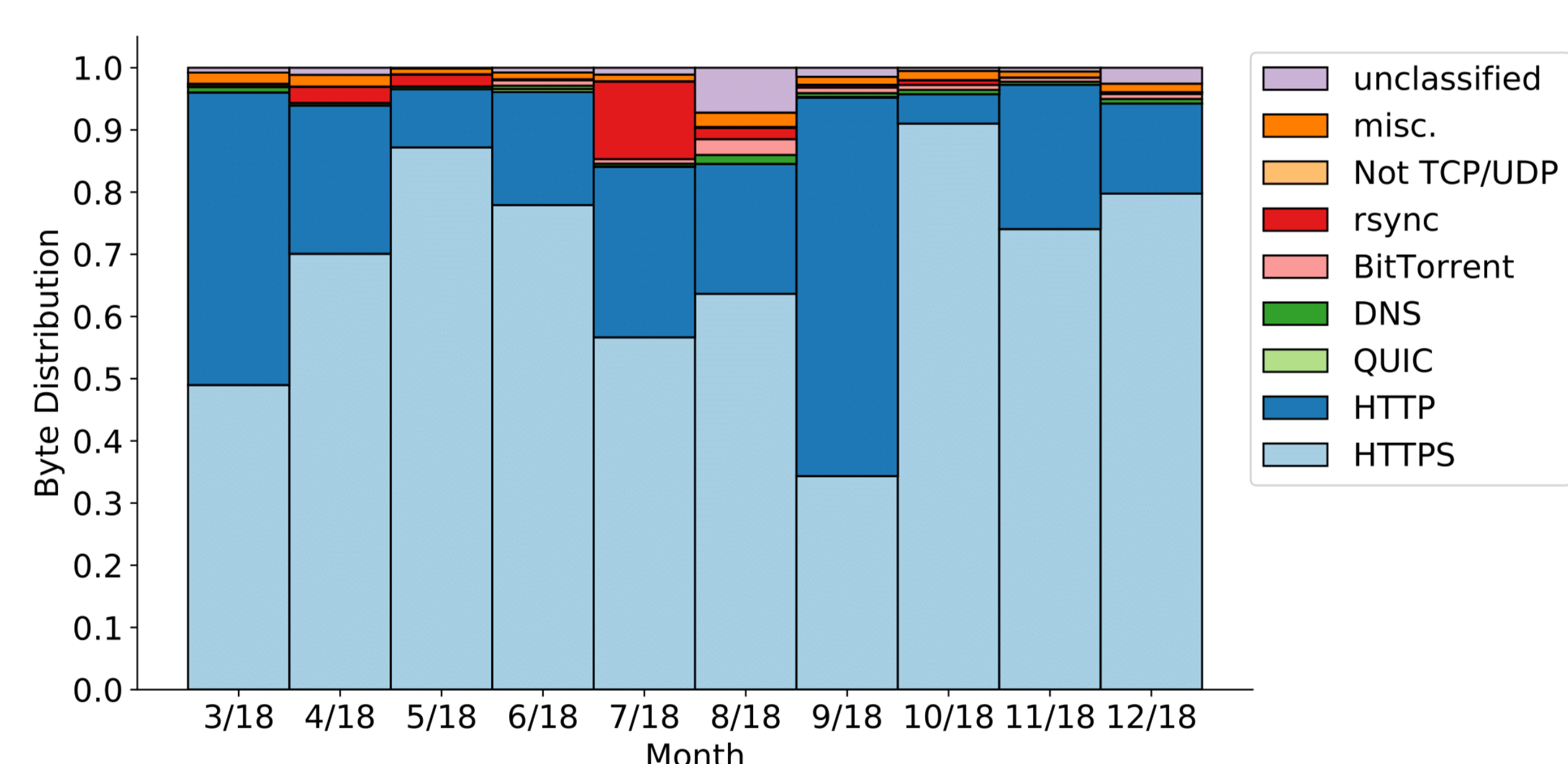**IPv4 application mix for MAWI** with a 3-to-1 encrypted HTTP to HTTP ratio.

Encrypted Web - IPv6

The **IPv6 application mix for CAIDA** is mostly unclassified applications on ports 5443 and 9501, DNS, HTTPS and HTTP.

The **IPv6 application mix for MAWI** looks very similar to the IPv4 mix

Beyond the Web - MAWI IPv4

all bytes
HTTPS (64.7%) — HTTP (26.2%) — Not TCP/UDP (2.6%) — QUIC (2.4%) — unclassified (2.3%) — NTP (0.7%) — IMAP (0.3%) — IPSec NAT Traversal (0.3%) — SSH (0.2%) — rsync (0.2%) — Bitcoin (0.1%) — DNS (0.1%) — SMTP (0.0%) — Microsoft DS (0.0%) — XMPP (0.0%) — BitTorrent (0.0%) — OpenVPN (0.0%) — LDAP (0.0%) — Tor (0.0%) — RTSP (0.0%) — RTMP (0.0%) — GTA 5 Online (0.0%)