An Empirical Analysis of the Commercial VPN Ecosystem
Mohammad Taha Khan, Joe DeBlasio, Geoffrey M. Voelker, Alex C. Snoeren, Chris Kanich and Narseo Vallina-Rodriguez

Commercial VPN Services
- VPNs services are a **primary tool** used by Internet users to:
  - Achieve online anonymity
  - Evade Internet censorship
  - Access geo-filtered content
- VPNs are currently a **15 billion** dollar industry which is expected to grow
- Vastly preferred over free services like Tor due to **convenience reasons**

VPN Ecosystem Insights
- VPNs are an **emerging industry**, 90% of services established since 2005
- **Affiliate programs** are widely used by VPNs for promotion and rankings
- Less popular VPN services do not follow standards e.g. lack privacy policies
- VPNs tend to maximize coverage of payment methods and OS platforms.

The Problem
- These services make certain **security and privacy claims**!
- Regular users lack any methodical means to verify them
- There have been numerous instances of **traffic manipulation and leakage** in VPN services

Evaluation Methodology
1. Shortlisted **203 VPN services** on metrics of usage and Internet popularity
2. Performed **data collection** from websites of the shortlisted VPN services
3. Developed a test suite of 3 categories to evaluate the VPN services
   - Leakage detection
   - Traffic manipulation/interception
   - Infrastructure/geolocation evaluation

Evaluation Results
- Executed tests on **62 VPN clients** across 1046 vantage locations
- Out of the 62 VPNs, 12 VPNs leaked any IPv6 and 2 VPNs leaked DNS traffic
- We did not observe traffic manipulation and **TLS interception** in the tested VPNs
- VPNs share infrastructure due to sharing **cloud hosting or partnerships**
- Ping tests demonstrate VPNs falsely claim the **geolocation** of their vantage points

The Way Forward
- Results will be published online on **vpnselection.guide** for public reference
- **Future Investigations**
  - Network based VPN exploits
  - VPN policies and data monetization