Routing-Verification-as-a-Service (RVaaS)
Trustworthy Routing Despite Insecure Providers

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Trustworthy Routing
At least a trustworthy Provider

Doing more to earn our customers' trust - Deutsche Telekom's data protection principles

The most valuable thing our customers entrust us with is their personal data. We are aware of the responsibility that this entails, and our data protection principles are an outward symbol of that awareness. However, trust has to be earned, and you can depend on it that we are working every day to do just that.

More responsibility and reliability
We accept responsibility for how we handle our customers' data - everywhere that we are active - and have created a uniform international framework for this in the shape of our Binding Corporate Rules Privacy. These define the purposes for which personal data may be collected, stored, and processed. We endeavor to clarify any unresolved questions or issues without delay.

More transparency
We speak openly about the aspects of data protection that are important to us: about potential solutions and our vision for the future, but equally about what is not

Deutsche Telekom - https://goo.gl/9QdFBR

US internet providers hijacking users' search queries

By **Jim Giles**

Editorial: "Hijacking web searches for cash threatens net success"

Update: *Since the practice of redirecting users' searches was first exposed by* New Scientist *last week, we have learned that all the ISPs involved have now called a halt to the practice. They continue to intercept some queries – those from Bing and Yahoo – but are passing the searches on to the relevant search engine rather than redirecting them.*

Original story posted on 4 August 2011

Searches made by millions of internet users are being hijacked and redirected by some internet service providers in the US. Patents filed by Paxfire, the company involved in the hijacking, suggest that it may be part of a larger plan to allow ISPs to generate revenue by tracking the sites their customers visit. It may also be illegal.

Reese Richman, a New York law firm that specialises in consumer protection lawsuits, today filed a class action against one of the ISPs and Paxfire, which researchers believe provided the equipment used to hijack and redirect the searches. The suit, filed together with Milberg, another New York firm, alleges that the process violated numerous statutes, including wiretapping laws.
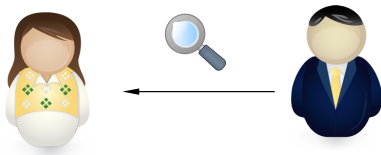
New Scientist - `https://goo.gl/b4x78q`

Give the Users visibility
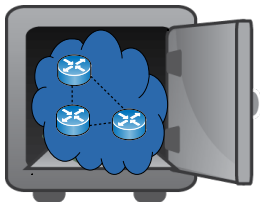- Visibility to connectivity
- Visibility to routes
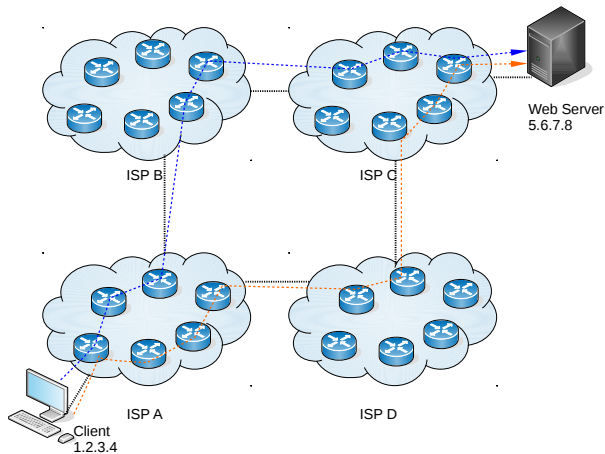- Visibility to performance

Make the Provider more trustworthy

Give the Provider confidentiality
- Keep the physical topology confidential
- Keep the network behaviour confidential
- Keep the Users data confidential

The Internet and Us

Implicit trust in the Provider's routing

Traceroute: Visbility in the Internet
and into your Provider

```
traceroute to www.google.com (216.58.213.228),
 1  192.168.0.1  3.057 ms  3.045 ms  3.387 ms
 2  83.169.183.46  16.876 ms  19.954 ms  21.451 ms
 3  88.134.234.89  21.436 ms  21.101 ms  21.421 ms
 4  88.134.235.10  32.163 ms  33.150 ms
 5  88.134.202.25  31.163 ms  38.290 ms  38.282 ms
 6  72.14.198.218  38.241 ms  34.813 ms  34.785 ms
 7  209.85.249.134  34.759 ms  24.141 ms  21.078 ms
 8  209.85.253.241  30.762 ms  30.367 ms  30.367 ms
 9  216.58.213.228  17.861 ms  21.913 ms  23.298 ms
```

SDN: Centralized Visibility and Control
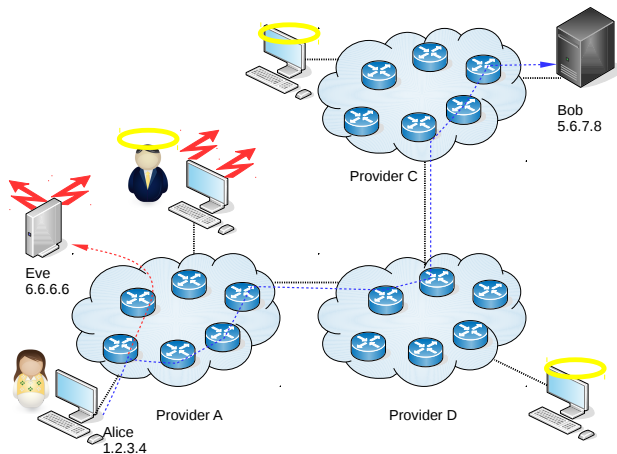
Is this the elixir for networking?
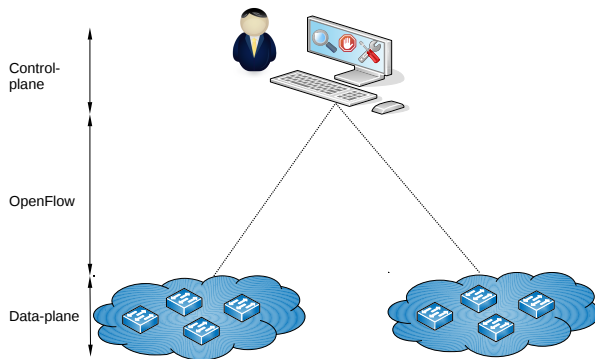
An overview of what SDN offers: Granular visibility, Policing, (Re)Configuration, etc..

Outline

- ~~Introduction~~
- Threat Model
- RVaaS
- Conclusion

SDN: A compromized control plane

A compromised control plane in Provider A can MITM Alice's traffic to Eve

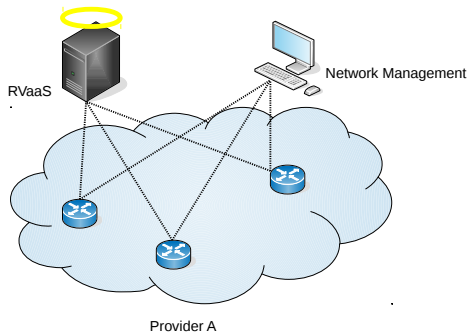# The Threat Model

- The Clients/Users: Trusted or untrusted.
- The Provider:
    - Physical Infrastructure: Trusted.
    - Control plane: Untrusted.
    - Data plane: Trusted.

RVaaS
Trustworthy routing
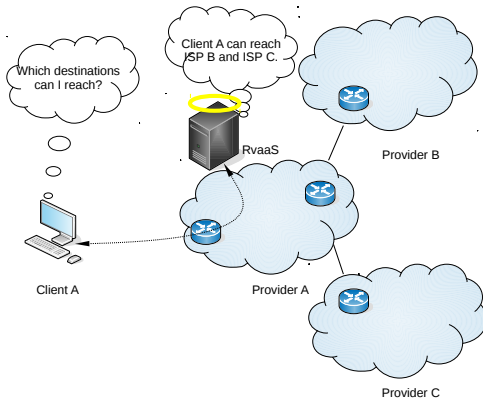
Routing-Verification-as-a-Service
- Verifiable routing properties
- Confidentiality
- Low resource requirements

- Configuration Monitoring: Active/Passive
- Logical Verification: Header Space Analysis, Emulation
- In-band Test and Client Interaction: Packet-In, Packet-Out

RVaaS
What can RVaaS do?

RVaaS
Who would use RVaaS?

- ISPs
- Public cloud providers
- Private cloud providers
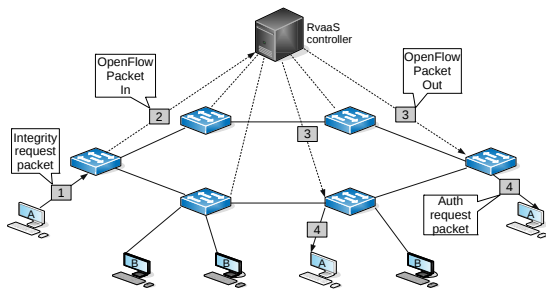- Anybody who wants to keep track of their dataplane

RVaaS
Why use RVaaS?

- Network visibility
- Enhance Provider and Client relationship
- Verfication as a service
  - Isolation checks
  - Geo-location checks
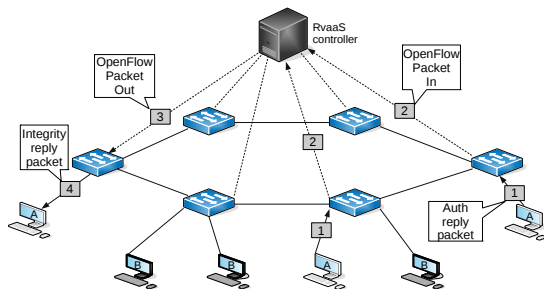 - Fairness checks
  - Routing/Forwarding table checks

RVaaS
in action

RVaaS
in action

Conclusion

- We lack visibility into our Providers network and the Internet
- SDN offers excellent visibility into the network
- RVaaS leverages SDN to deliver routing verification to Clients and Providers

Questions?