Big Aggregation and Intermediaries: threat or menace?

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(Moderated by Barry Leiba)

One take on the problem

- **Most Secure Communication Protocols have been designed with strict end-to-end security in mind**
  - No intermediary entity on the path is supposed to read or modify communications exchanged over these protocols
  - This is the security paradigm behind the design of TLS, IPSec, ...
    - Valid at the time when these protocols were designed
- **Reality has significantly changed since the design of these protocols**
  - Very often these days, middleboxes on the path need to read and modify communications
    - Caching, (dynamic) web traffic optimizations, congestion handling, ...
- **Result**
  - 'Good Guys' are forced to bypass the end-to-end security mechanisms
    - Option 1: Employ Man-in-the-Middle attacks to redirect traffic over a proxy under their control
    - Option 2: Provide full keying material to middleboxes, enabling these entities to fully impersonate a server

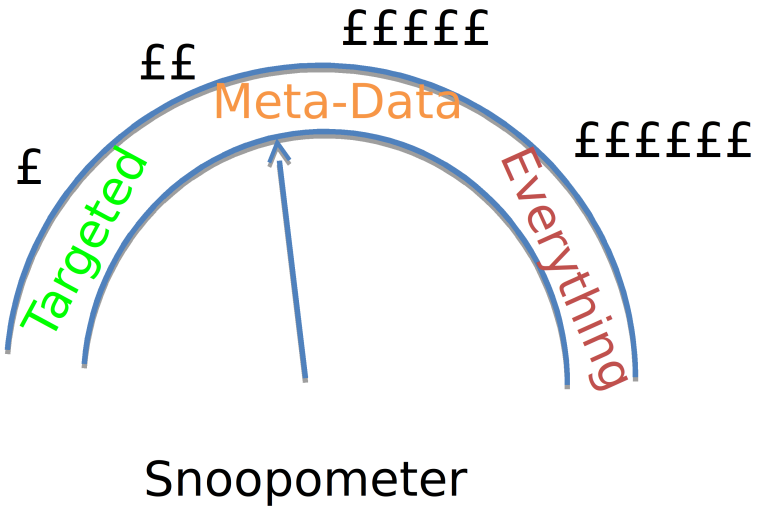
↳ **Obviously, both options are not desirable!**

Assumptions

- Meta-data matters
  - When you communicate
  - With whom
  - What protocol you use to communicate
  - How much data you transmit

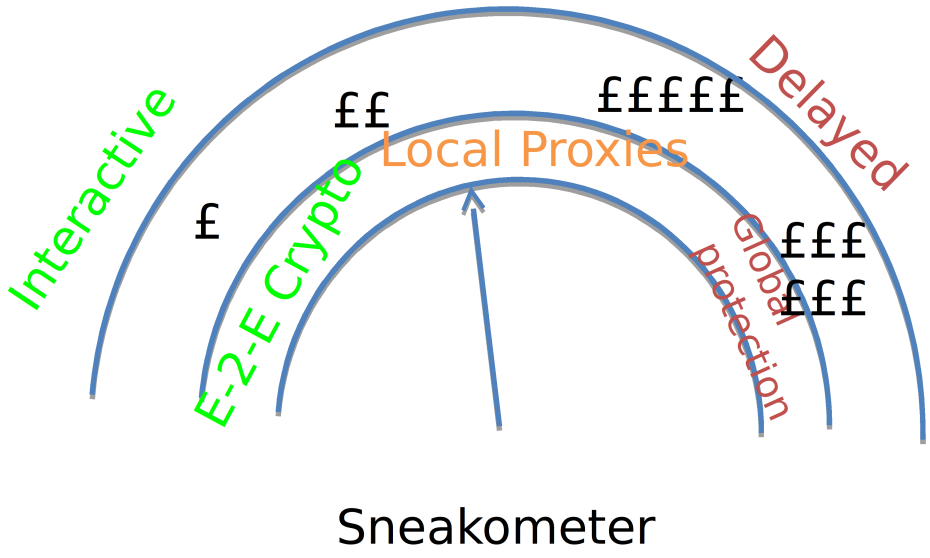
A view of the attacker

- Targeted means that efforts may be focused
- Meta-data includes pervasive surveillance
- Everything means processing of **content**
- Costs go up at least geometrically



Defending through Intermediaries

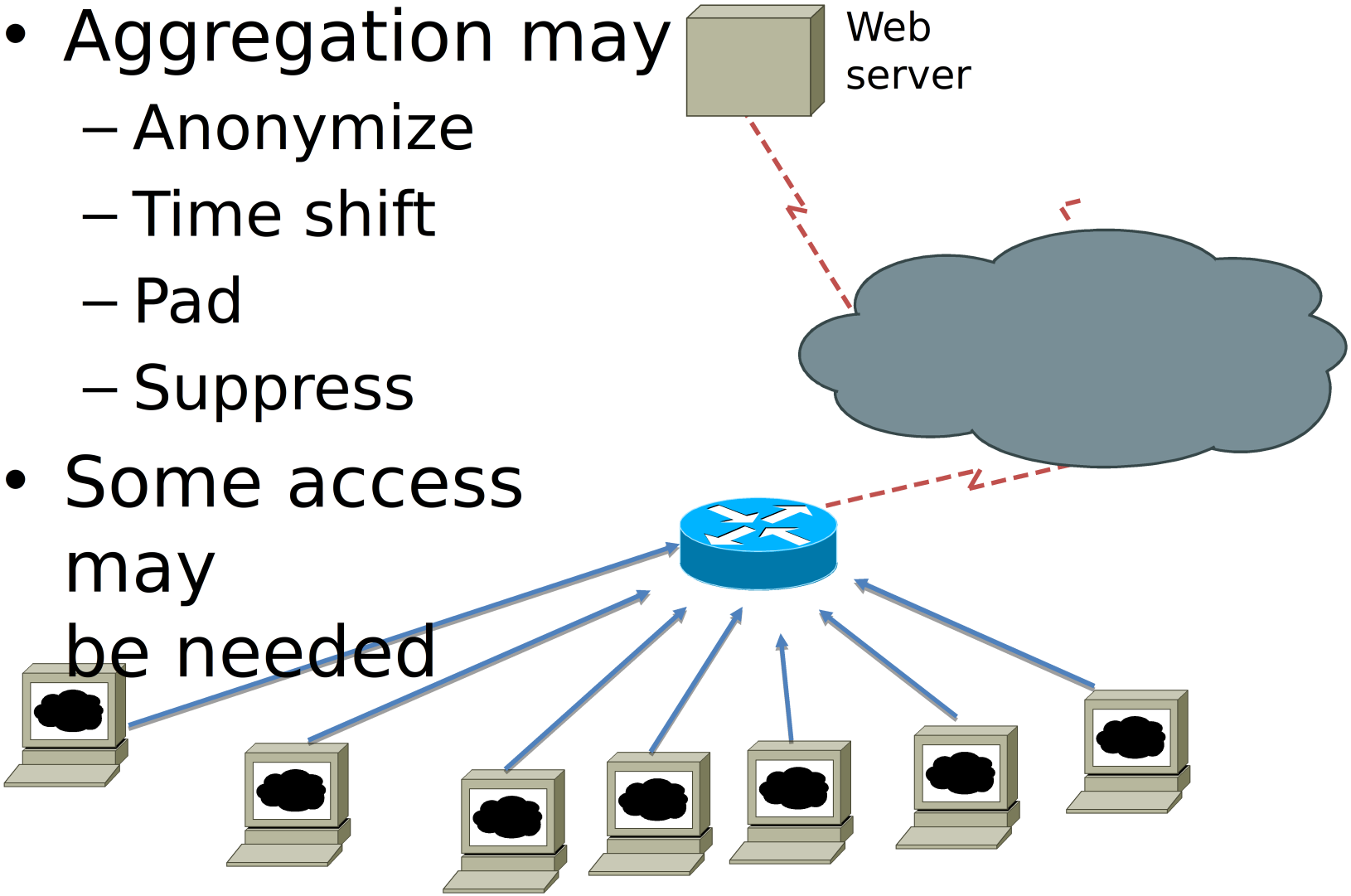
- End to end crypto **will** expose a lot of meta-data
- Local proxies provide **some** aggregation, but will still leak **some** meta data
- Global protection means complete L3 overlay



Sneakometer

Aggregation

- Aggregation may
  - Anonymize
  - Time shift
  - Pad
  - Suppress
- Some access may be needed



Concentration versus Distribution?

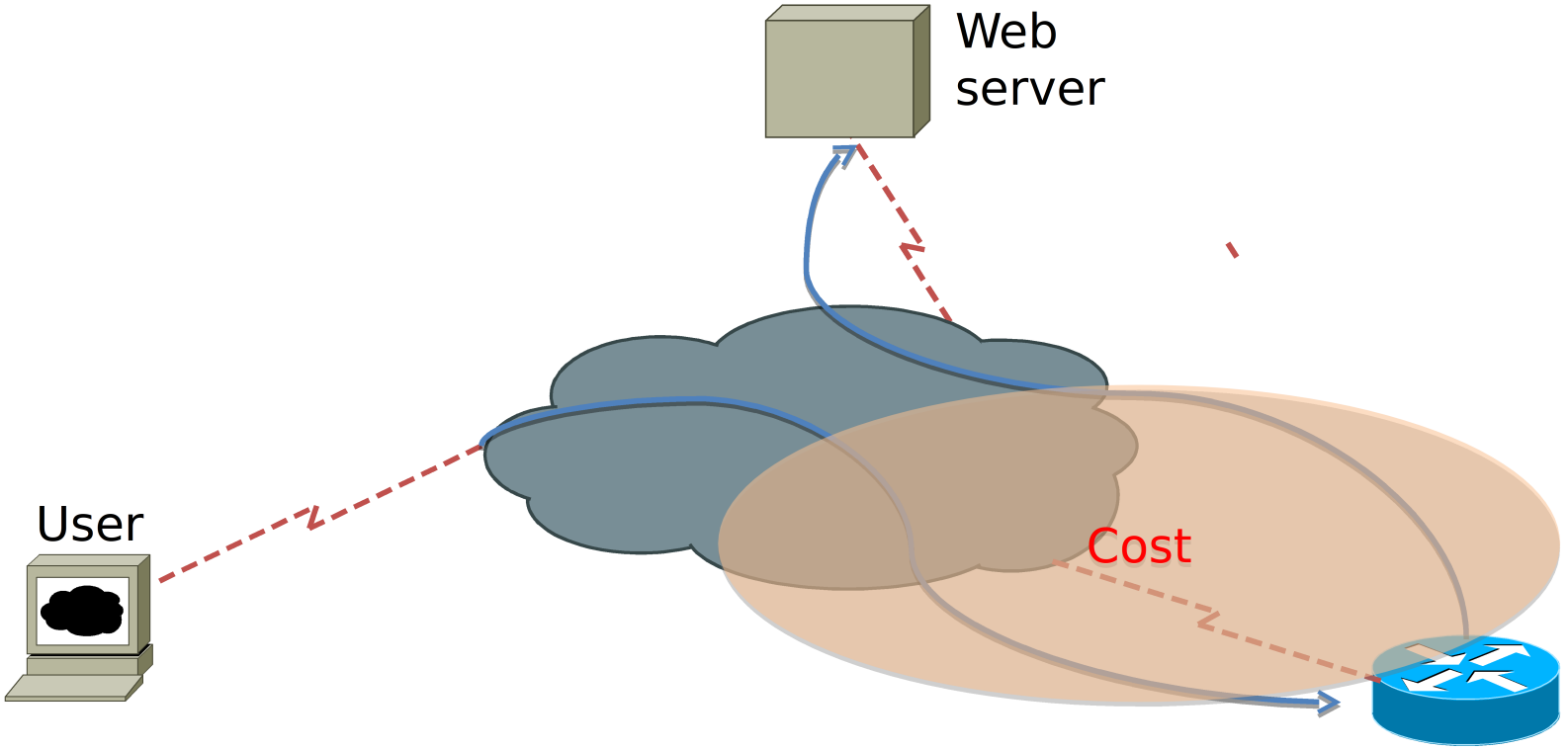
- Whose service is more secure?

GMAIL/Yahoo!

Eliot’s Email Service

- Whose service will get attacked more?

Stretch



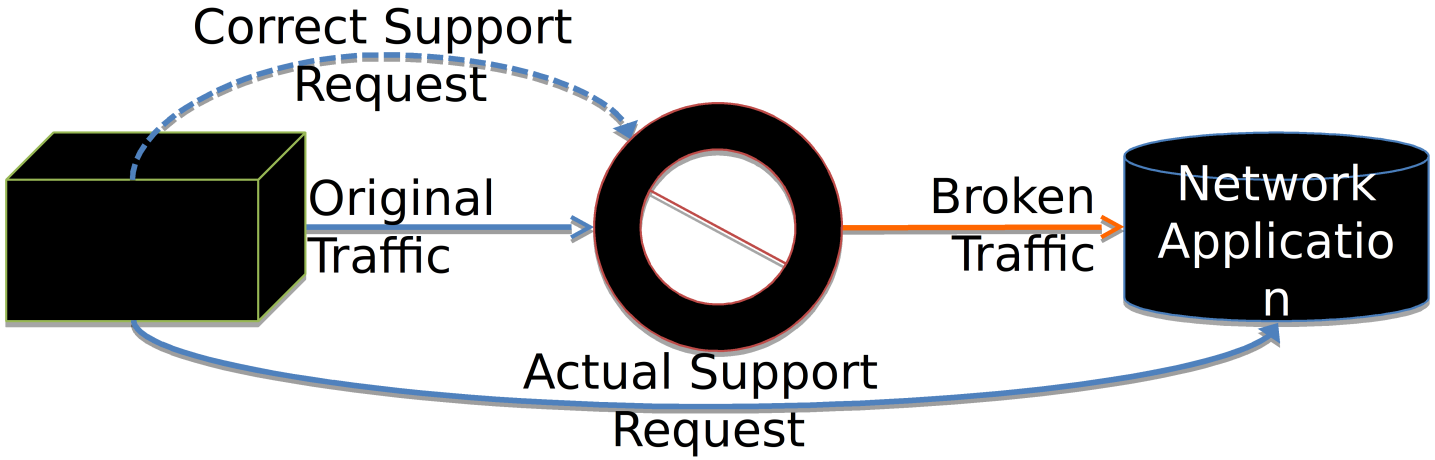
Some Key Points

- It is highly unlikely that the attacker has access to everything
- Every user/admin will have their own risk tolerance
  - The threat will differ for different users
  - The cost to mitigate that threat will vary
- Overlay networks do not come for free
- Cost is not always in £ but may be in trust
  - Do you trust Google with your mail?
  - Do you mind some monetization of your information?
- Problem can be considered at different layers

One Way Forward: ‘Interferable Secure Communication’?

- **Fact is: Internet reality has changed**
  - e.g. more middleboxes, traffic optimizations also needed for encrypted traffic, ...
- **But at the same time: Cryptography has advanced recently**
  - Functional Signatures / MACs
    - Sender can allow intermediary to modify certain parts of a message, while client can verify that any modification was done with consent of the sender
  - Functional Encryption:
    - Decrypted ciphertext is plaintext modified with a given function
  - (Fully) Homomorphic Encryption:
    - Applying a function on the plaintext without decryption
- **General Solution: ‘Interferable Secure Communication’**
  - *Dedicated*, *controlled* decryption and/or modification of *certain parts* of the payload by intermediate entities, while preserving message integrity and confidentiality for the rest of the payload
  - This would allow to *technically* distinguish between dedicated intermediaries that are allowed to read/alter certain parts of messages and actual attackers that intend to monitor/modify encrypted communications

On the other hand... Middlebox Hit and Run



- Can't tell if this is an attack or not
- Many different breakages = developer $$
- Complex to diagnose
- Shifts support costs

Questions

- What knobs do we need in our protocols to allow users to satisfy their own risk tolerance?
  - Do we need knobs to deal with different jurisdictions?
    - I might trust Country A but not Country B
- What are the user interface issues associated with those knobs?
- From an attacker perspective, when is PS a good use of resources?
- Can aggregation/concentration actually harm the end to end model from a development perspective?
  - Arguably it may have already