Discussion

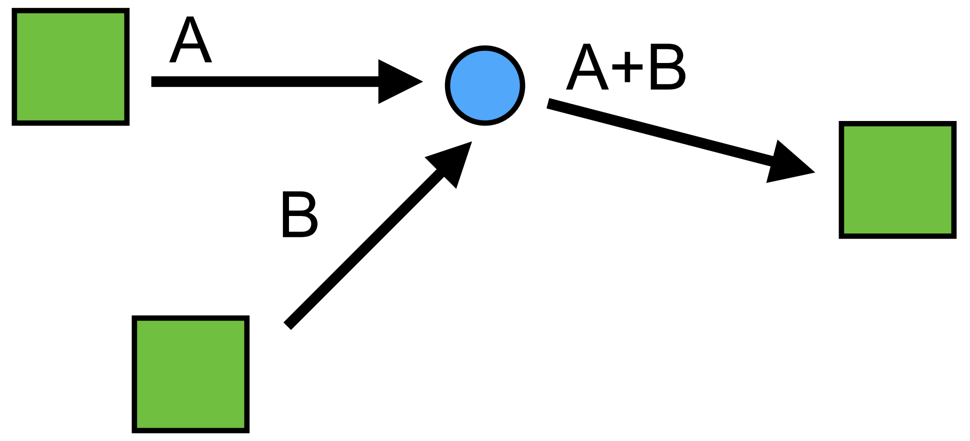
- End-to-end security
- Robustness principle
- Validating input data
- Writing secure code

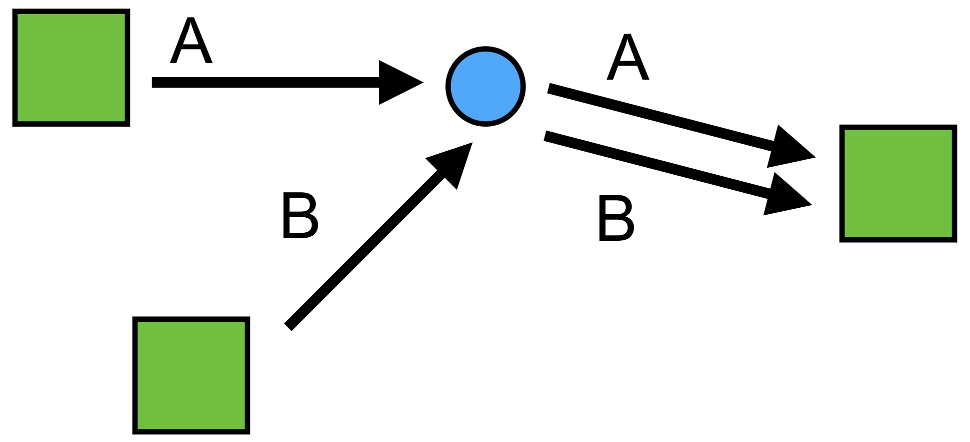
End-to-end Security? (1/2)

- For communication to be secure, it must be **end-to-end**
- The two endpoints are the sender and the final recipient
  - With a data centre or CDN, what is the final recipient?
    - Is it the load balancer at the entrance to the data centre, or the server within the data centre that processes the request?
    - If the request is directed to a content distribution network (CDN), is the end the local cache that serves the request? If so, how are the encryption keys shared?
  - If the data is moving between two users, is it encrypted between the two users or between each user and the data centre?
    - i.e., can the data centre see user-to-user data flows?
    - (This is normal if you run TLS from user-to-data centre then from data centre-to-user)

End-to-end Security? (2/2)

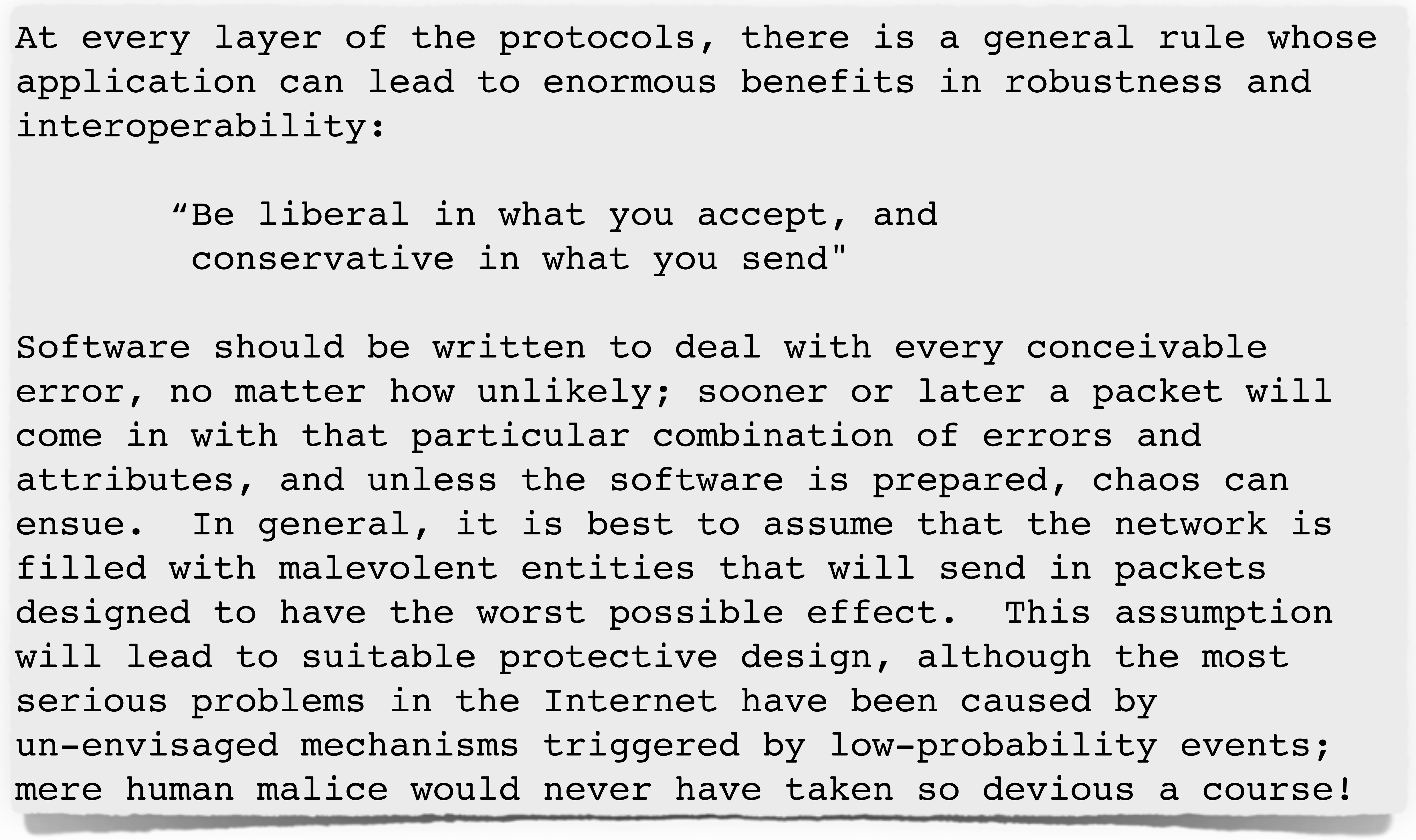
- Is there in-network processing? How much data is revealed to the in-network server?
  - e.g., video conference with privacy protection vs. without
  - Does the central server decrypt the speech data, mix into one stream and send to the receiver, or does it forward all active streams in encrypted form





- Trades-off security vs bandwidth
  - For audio the bandwidth is small enough this doesn't matter
  - For video conferencing, the combined bandwidth may be significant

The Robustness Principle (Postel's Law)



At every layer of the protocols, there is a general rule whose application can lead to enormous benefits in robustness and interoperability:

> "Be liberal in what you accept, and
> conservative in what you send"

Software should be written to deal with every conceivable error, no matter how unlikely; sooner or later a packet will come in with that particular combination of errors and attributes, and unless the software is prepared, chaos can ensue. In general, it is best to assume that the network is filled with malevolent entities that will send in packets designed to have the worst possible effect. This assumption will lead to suitable protective design, although the most serious problems in the Internet have been caused by un-envisaged mechanisms triggered by low-probability events; mere human malice would never have taken so devious a course!

RFC1122

Balance interoperability with security – don't be *too* liberal in what you accept; a clear specification of how and when you will fail might be more appropriate

The Robustness Principle (Postel’s Law)

“Be liberal in what you accept, and
conservative in what you send"

The Robustness Principle (Postel's Law)

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“Be liberal in what you accept, and
 conservative in what you send"
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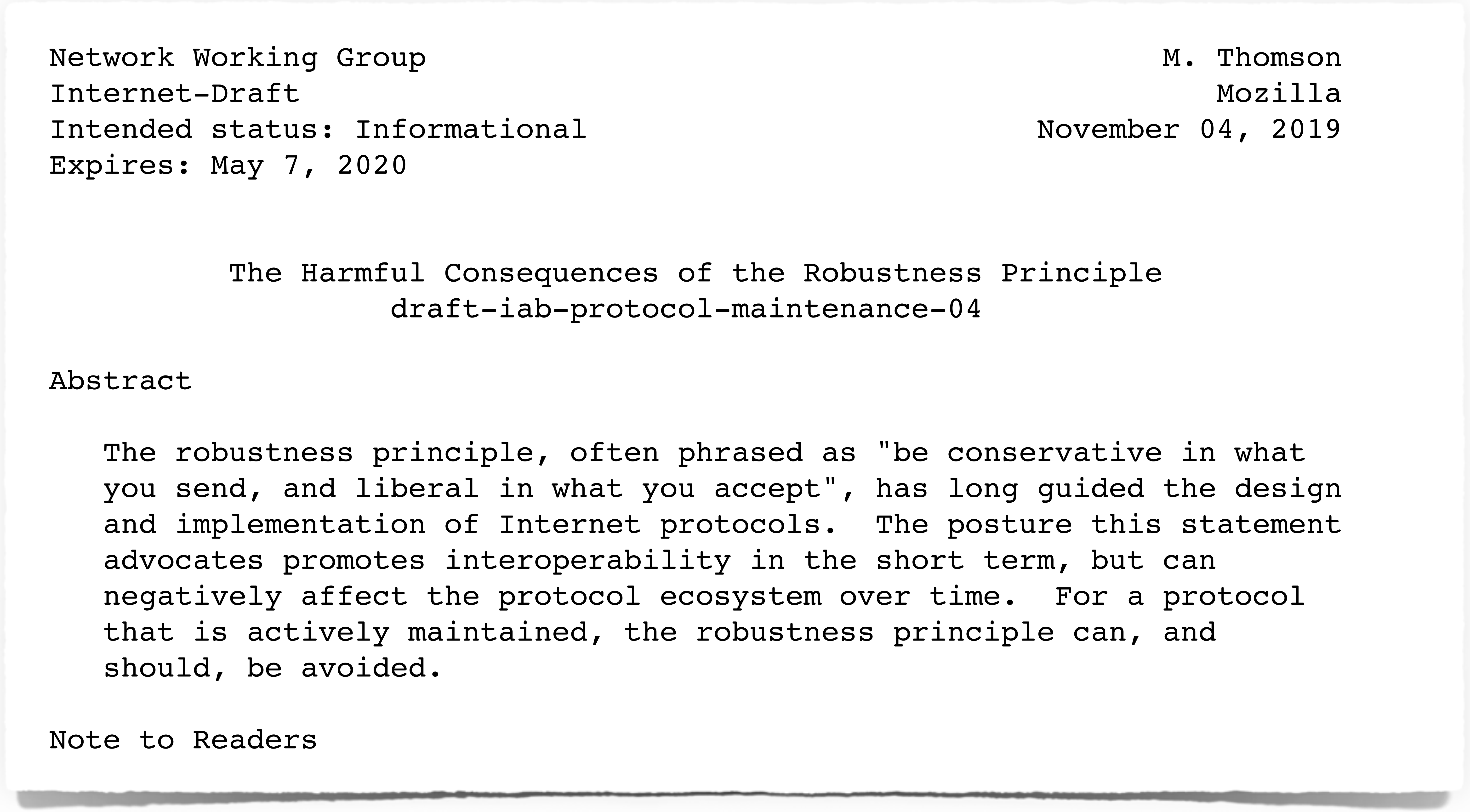
**“Postel lived on a network with all his friends.
We live on a network with all our enemies.
Postel was wrong for todays internet.”**

Poul-Henning Kamp

The Robustness Principle (Postel's Law)



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Network Working Group                                         M. Thomson
Internet-Draft                                                   Mozilla
Intended status: Informational                         November 04, 2019
Expires: May 7, 2020


          The Harmful Consequences of the Robustness Principle
                   draft-iab-protocol-maintenance-04

Abstract

   The robustness principle, often phrased as "be conservative in what
   you send, and liberal in what you accept", has long guided the design
   and implementation of Internet protocols.  The posture this statement
   advocates promotes interoperability in the short term, but can
   negatively affect the protocol ecosystem over time.  For a protocol
   that is actively maintained, the robustness principle can, and
   should, be avoided.

Note to Readers
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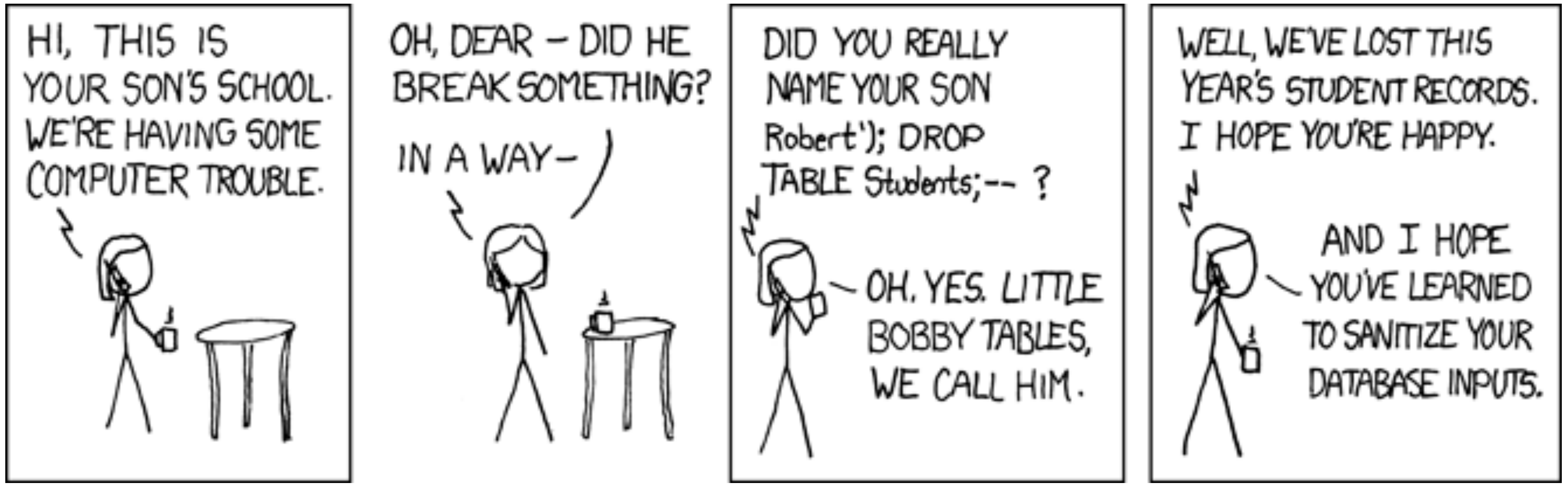
https://tools.ietf.org/html/draft-iab-protocol-maintenance-04

Validating Input Data


HI, THIS IS YOUR SON'S SCHOOL. WE'RE HAVING SOME COMPUTER TROUBLE.
OH, DEAR – DID HE BREAK SOMETHING?
IN A WAY–
DID YOU REALLY NAME YOUR SON Robert'); DROP TABLE Students;-- ?
OH. YES. LITTLE BOBBY TABLES, WE CALL HIM.
WELL, WE'VE LOST THIS YEAR'S STUDENT RECORDS. I HOPE YOU'RE HAPPY.
AND I HOPE YOU'VE LEARNED TO SANITIZE YOUR DATABASE INPUTS.

http://xkcd.com/327/

- Networked applications work with data supplied by un-trusted third parties
- Data read from the network may not conform to the protocol specification
- Due to ignorance, bugs, malice, or a desire to disrupt services
- **Must carefully validate all data before use**

Writing Secure Code

- The network is hostile: any networked application is security critical
  - Must carefully specify behaviour with both correct and incorrect inputs
  - Must carefully validate inputs and handle errors
  - Must take additional care if using type- and memory-unsafe languages, such as C and C++, since these have additional failure modes
- **The best encryption doesn't help if the endpoints can be compromised**

Secure Communications

- The need for secure communication
- Principles of secure communication
- TLS v1.3
- Discussion