PISA - P2P Internet Sharing Architecture

draft-heer-hip-midauth-00.txt

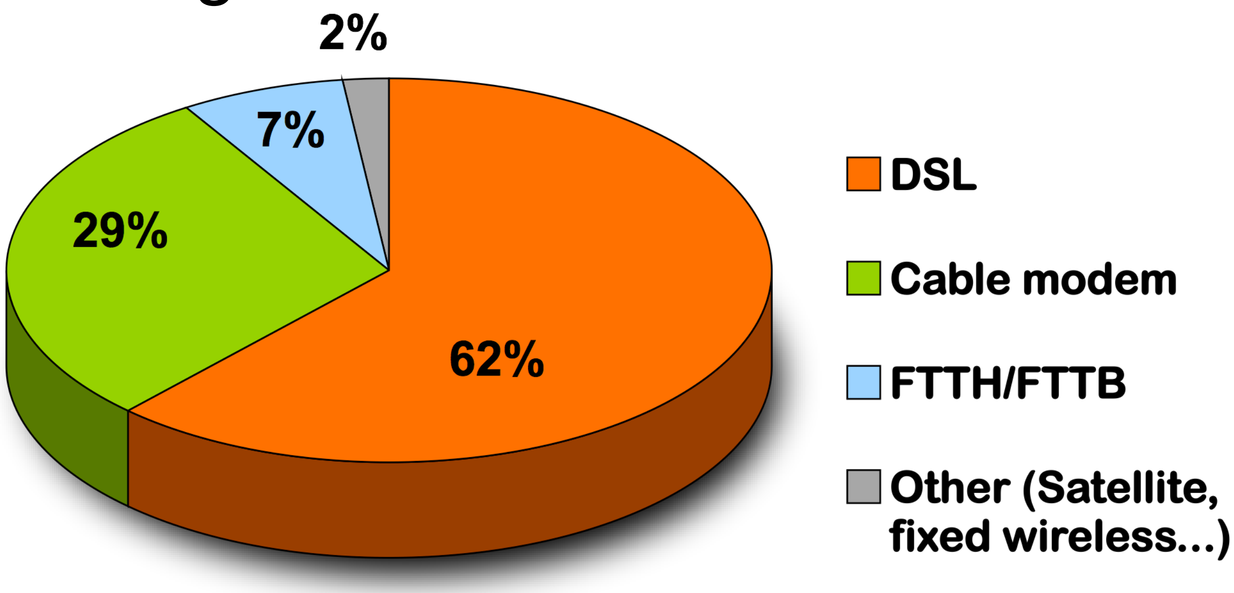
Tobias Heer

Distributed Systems Group
Chair of Computer Science IV
RWTH Aachen University

http://ds.cs.rwth-aachen.de

OECD Broadband Statistics (December 2006)

- In OECD countries:
  - 197.000.000 broadband subscribers
- Finland, Denmark, Norway, Korea, etc.:
  - More than **26** broadband subscribers per **100** inhabitants
- Access technologies:



Ubiquitous Wired vs. Scarce Wireless Internet

- Publicly accessible Wi-Fi access points
  - Only in selected areas (airports, hotels, ...)
    - High density of users expected
  - At high prices
    - Mostly for busyness users

- Users start to share their Wi-Fi with others

Work Published So Far

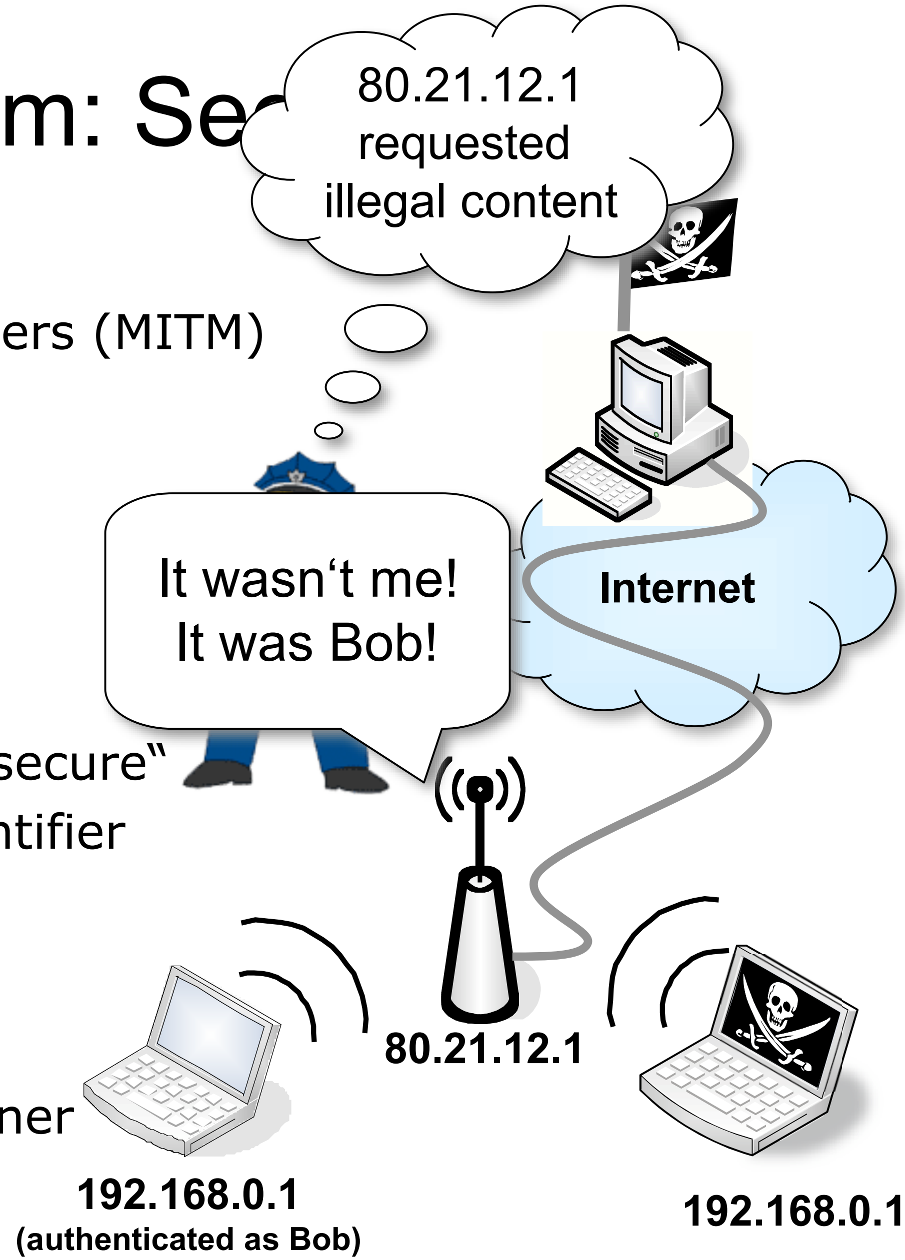
Tobias Heer, Shaohui Li, and Klaus Wehrle. **PISA: P2P Wi-Fi Internet Sharing Architecture**. In Seventh IEEE International Conference on Peer-to-Peer Computing, Galway, Ireland, 2007.

Nishanth Sastry, Jon Crowcroft, and Karen Sollins. **Architecting Citywide Ubiquitous Wi-Fi Access.** In Proc of HotNets 2007.

- Tunneling as basic building block
- Utilize router at mobile user‘s home
- Goal: increased security

One Problem: Se

- Web-based authentication
  - Easy to trick inexperienced users (MITM)
- Unencrypted public Wi-Fi
  - Eavesdropping
- No continuous authentication
  - Only initial authentication is „secure“
  - IP address is a very weak identifier
  - Impersonation
- Responsibility issue
  - Illegal actions relate to AP owner
  - Result of weak authentication



Wi-Fi Sharing and HIP

- HIP is **just one possible solution**...
  ... but matches the requirements nicely:

- Support for strong authentication
  - Public keys as host identities

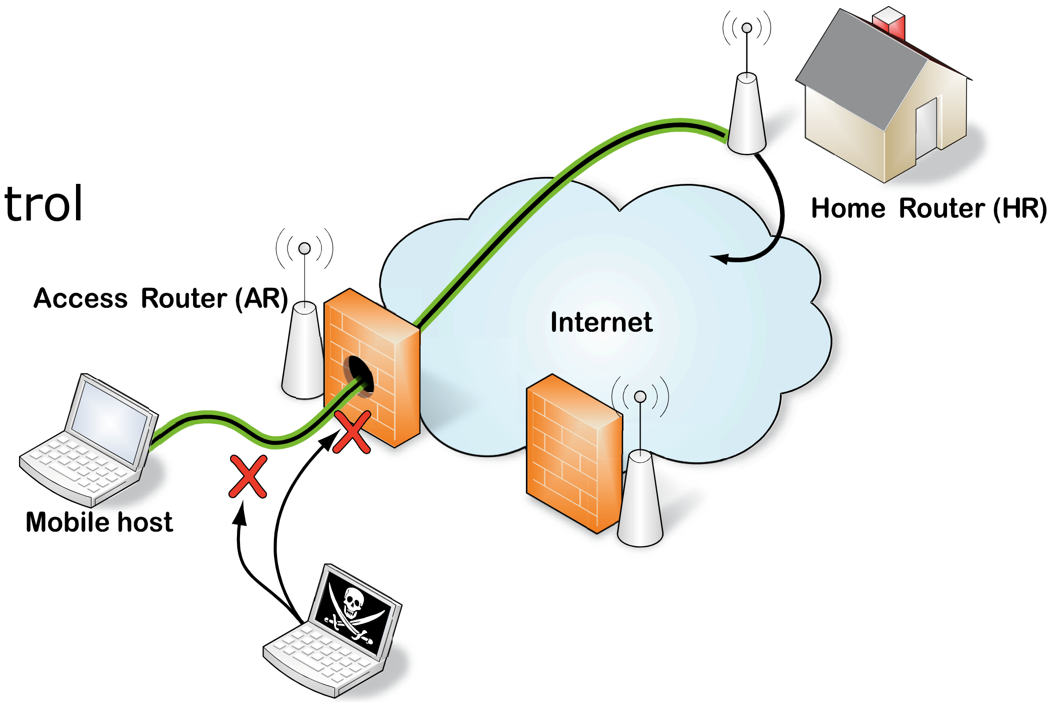
- End-to-end security
  - No eavesdropping anymore
  - No MITM attacks

- Support for mobility
  - Transport layer is happy

- Authentication without passwords
  - Better support for key-less and screen-less devices

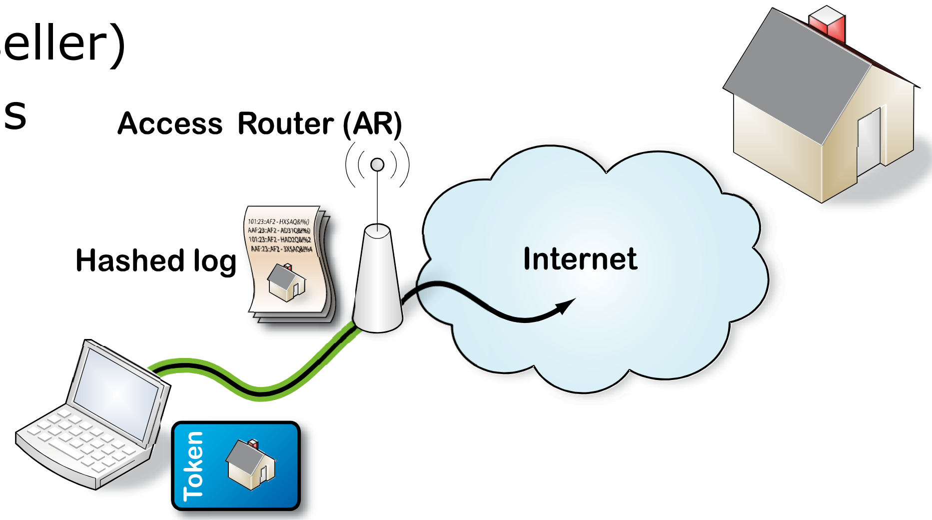
PISA – Mode 1: Use User's Home Router as Traffic Relay

- Users use their routers at home to relay traffic
  - Illegal actions point to the HR
- Cryptographic identities
  - Allow verifying the ID of the HR
- Community certificates
  - HR membership
  - Decentralized access control
- Encrypted tunnel
  - No eavesdropping from
    - Other users
    - AP owners (MITM)
  - HIP association

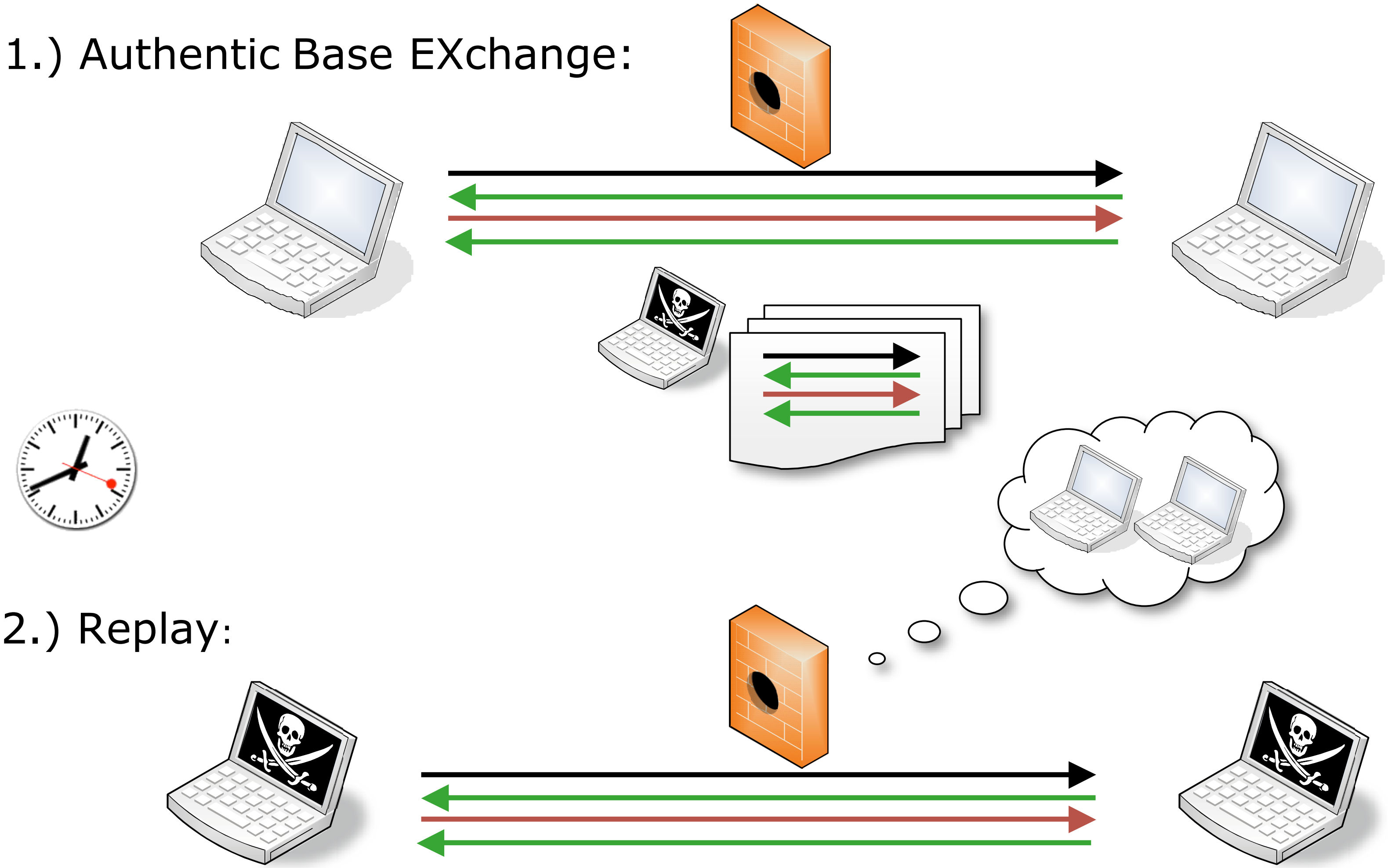


PISA – Mode 2: Direct Internet Access

- Mode 2 is used when...
  - HR is down
  - Larger bandwidth / low latency is required
- Home router issues digitally signed token
  - AR can verify relationship
  - HR can issue several tokens (reseller)
  - Mobile client can stay anonymous
- AR logs actions of mobile user
  - Cryptographic logging
- Illegal actions relate to AR
  - AR can prove that HR is responsible



HIP Authentication on Middleboxes



draft-heer-hip-middle-auth

Version 00

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- Scope (not restricted to PISA)
  - MB that authenticate packets/hosts „on the fly“
  - No explicit registration
  - No explicit middlebox detection
- Examples for middleboxes
  - Firewalls
  - Rate-limiting MB
  - Accounting, logging
- Support for authentication by MB during
  - BEX
  - Mobility signaling

Authentication Mechanism

- Let MB „particpate“ in BEX, UPDATE
- MB injects parameters to HIP control packets
- Challenge - response
  - Pretty much like ECHO_REQUEST / RESPONSE
- ECHO_REQUEST_M, ECHO_RESPONSE_M
  - Middlebox adds ER_M parameter to control packet
  - Receiving host echoes parameter in **signed part** of response packet
- DoS protection for middleboxes
  - Puzzle mechanism

New Parameters

- ECHO_REQUEST_M
  - Identical to ECHO_REQUEST
  - In unsigned part of packet (65332)
  - SHOULD be small (< 32 bytes)

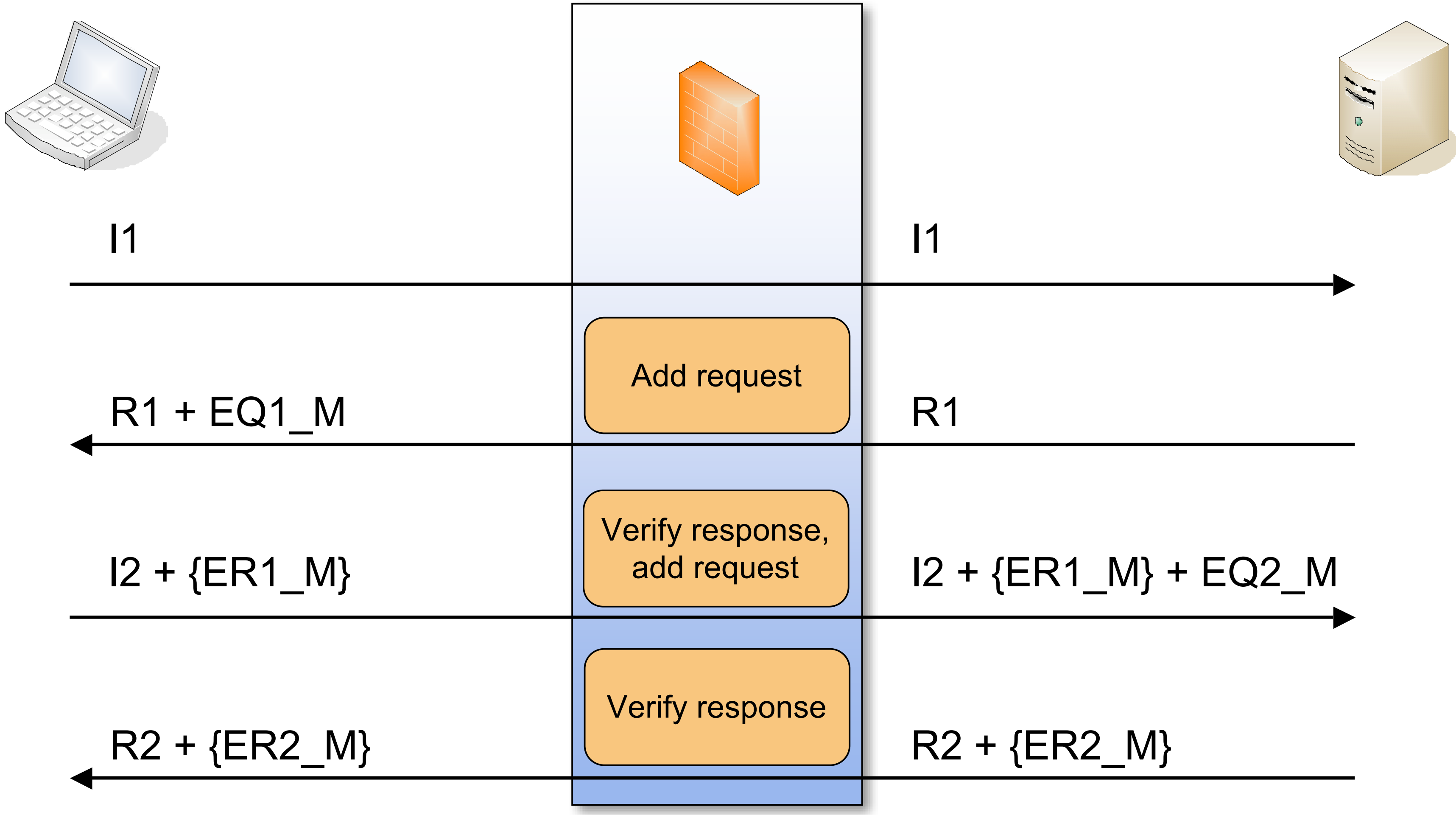
- ECHO_RESPONSE_M
  - Identical to ECHO_RESPONSE_SIGNED
  - In signed part of packet (962)

New Parameters (cont‘d)

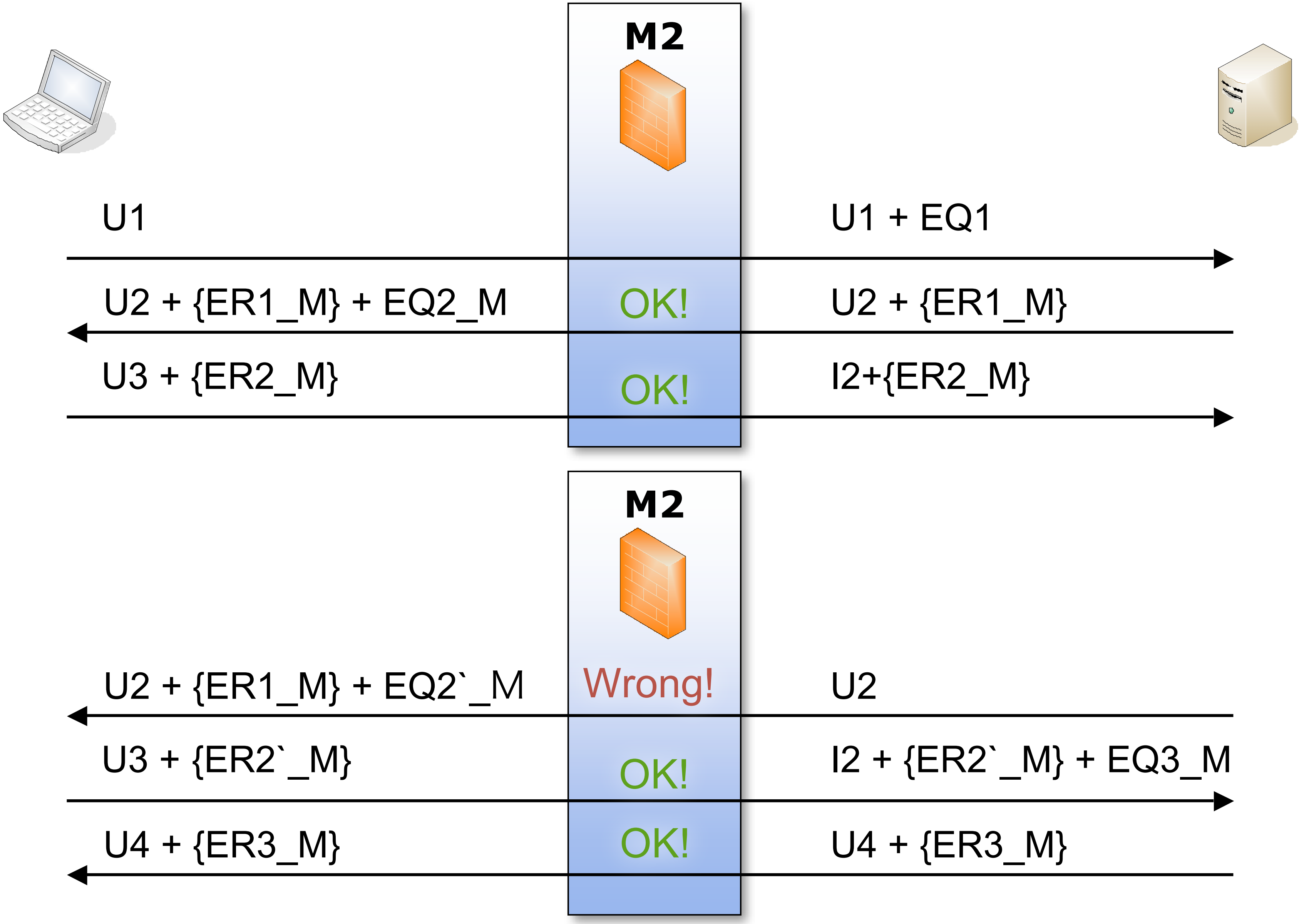
- PUZZLE_M
  - Similar to PUZZLE
  - Larger opaque data field (6 bytes vs. 2 bytes)
  - In unsigned part of packet (65334)

- SOLUTION_M
  - Similar to SOLUTION
  - Larger opaque data field (6 bytes)
  - In signed part of packet (322)

Authentication: BEX



Authentication: UPDATE



Parameter Handling

- Middleboxes
  - MUST preserve order of parameters
  - MUST add further parameters after present ones
  - Helps host to determine location of MB

- End-hosts
  - MUST preserve order when copying to response
  - Sign packet
  - Helps MB to find paramter

Missing HOST_ID

- Problem: no HOST_ID in UPDATE packet
  - But: MB must figure out PKs
  - Request from URL
    - Slow (1 RTT)
    - Insecure (resource exhaustion, reflection, amplification)

- Solution: send HOST_ID in UPDATEs
  - Carrying ECHO_RESPONSE_M
  - Carrying SOLUTION_M

- BUT: larger packets

Middlebox Policies - Why so many MAYs and SHOULDs?

- Not part of the draft
- Intentionally kept open
- Possible outcomes of failed auth
  - No service
  - Degraded service
  - No better service
  - No difference

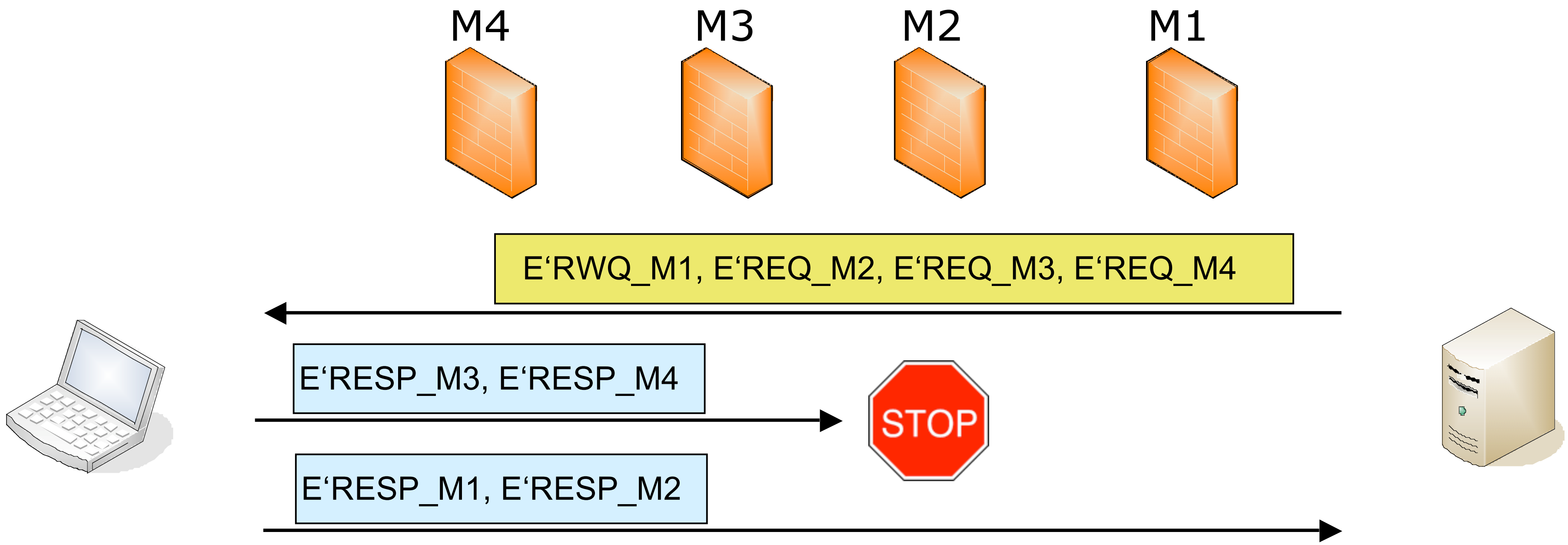
- We don‘t want to tell people what to do with their middleboxes.

Open Issues

- Number of PUZZLE_M and ECHO_REQUEST_M per packet
  - Huge NAT / firewall cascades (requiring authentication each)
  - DoS Attack (Middlebox adds numerous parameters)
- Problem we should handle?
  - Is it likely to have deep cascades?
  - Wouldn‘t it be easier to drop packets?

Open Issues (cont‘d)

- Size of S‘_M / E‘_RESPONSE_M exceeds response packet size
  - Send two responses with parameters in reverse order.
  - First clears way for second one.



Conclusion

- PISA offers
  - Secure Internet connection sharing
  - Authentication by middleboxes
  - Support for roaming / mobility
  - Support for display- and key-less devices

- draft-heer-hip-middle-auth
  - Prevent replay attacks
  - Use BEX and UPDATE to authenticate communicating peers
  - Enables secure access control without explicit registration
  - Protection from DoS
  - Is this useful for the RG?