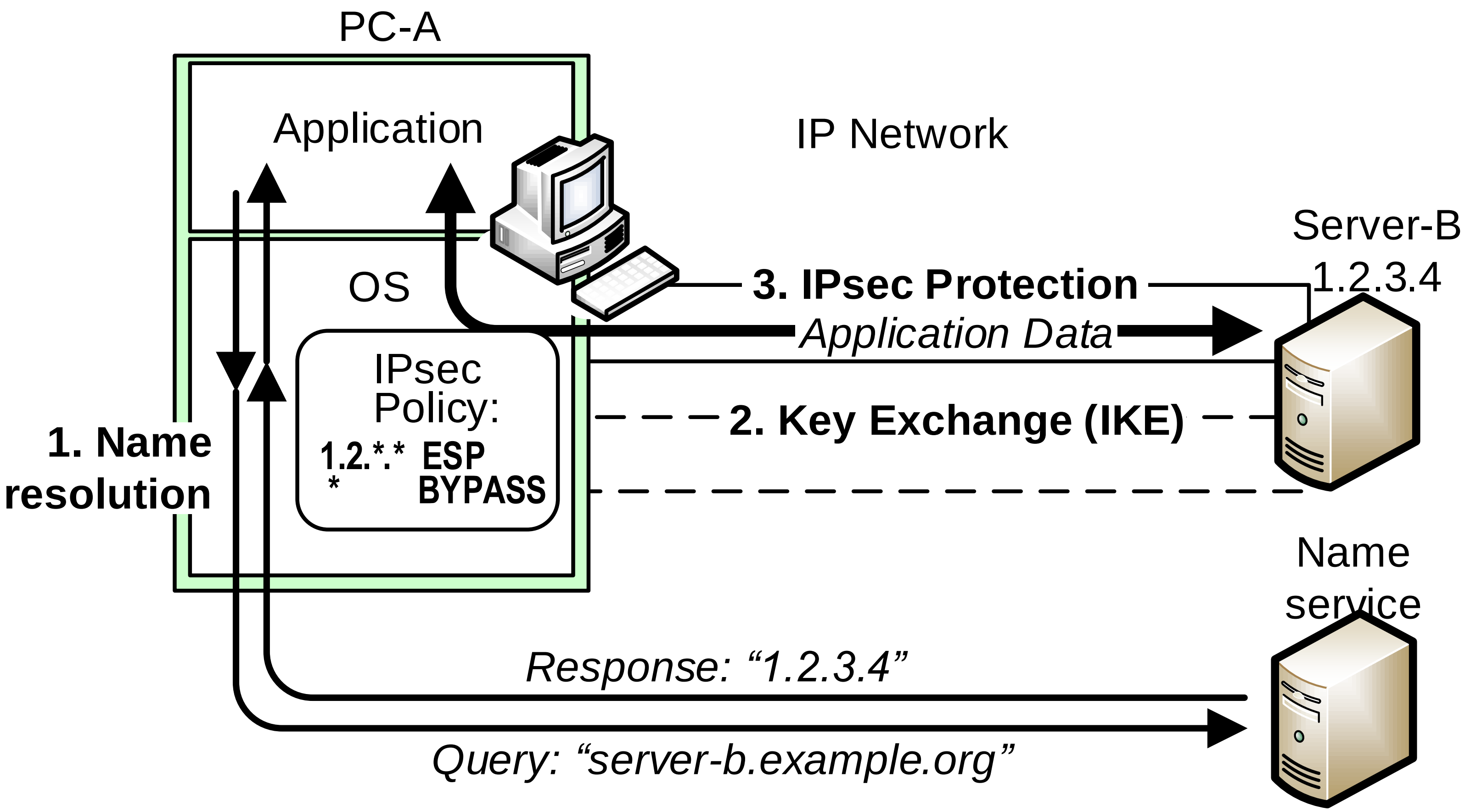
Aalto University

Network Security: Issues with host-to-host IPsec

Tuomas Aura

CS-E4300 Network security
Aalto University

IPsec and name resolution



- TCP socket API: resolve name into an IP address; then connect to it
- TCP SYN to the address triggers IKEv2 (if the ESP SA does not yet exist)

IPsec and identifiers

1. Application opens a connection to an IP address. IPsec uses the IP addresses as policy selector
2. Application actually wants to connect to a specific name, and IKE usually authenticates the remote node by its DNS name

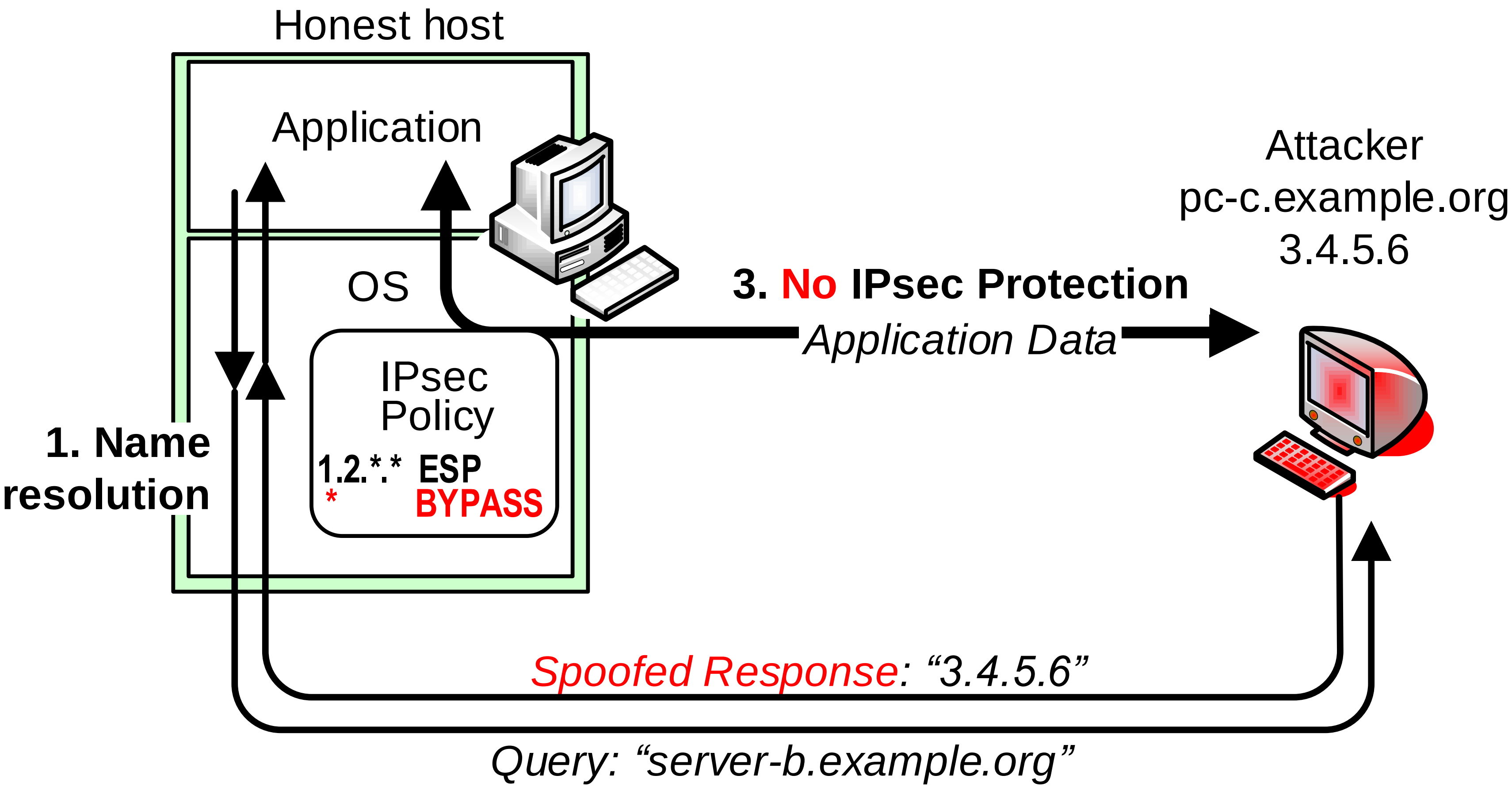
- Problem: No secure mapping between the two identifier spaces: DNS names and IP addresses

IPsec and DNS spoofing

- Practically all host-to-host IPsec policies have BYPASS action for some remote addresses
  - Internet outside the intranet, e.g. web servers
  - Devices that do not support IPsec, e.g. printers, sensors

  → Spoofed DNS response can cause any any hostname to map to a BYPASS action
- Thus, IPsec policy selection depends on secure name resolution

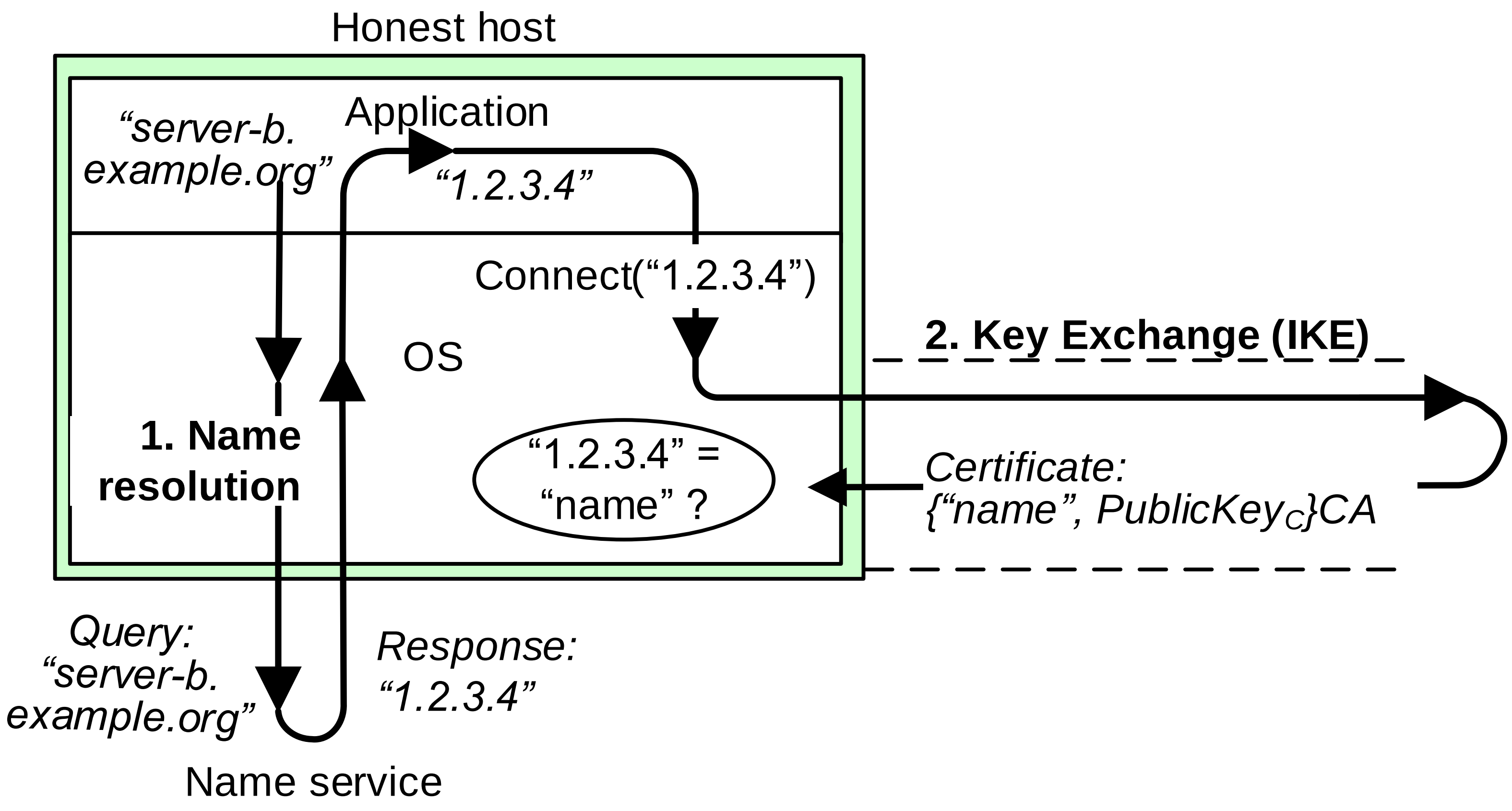
Classic IPsec/DNS Vulnerability



- Attacker spoofs DNS response to circumvent the IPsec policy

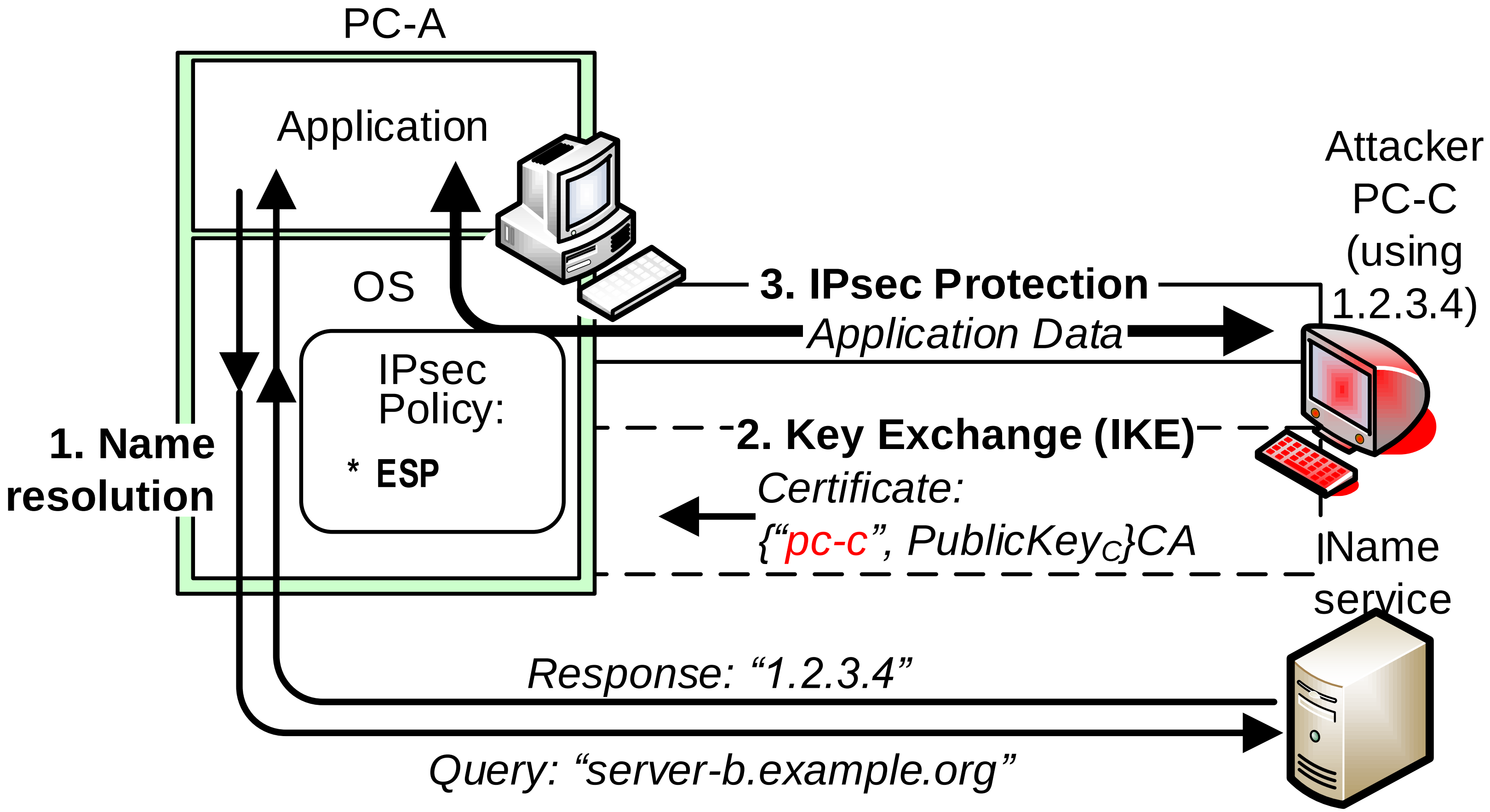
Let's assume secure DNS. Does it solve the problems?

Further problem: IPsec and Certificates



- Name resolution is done in a separate step. IKE knows the peer's IP address, not its name. The certificate, on the other hand, only contains the name. Is the certificate ok?

Further problem: IPsec and Certificates



- IKE knows the peer’s IP address, not its name. The certificate only contains the name. Is the certificate ok?

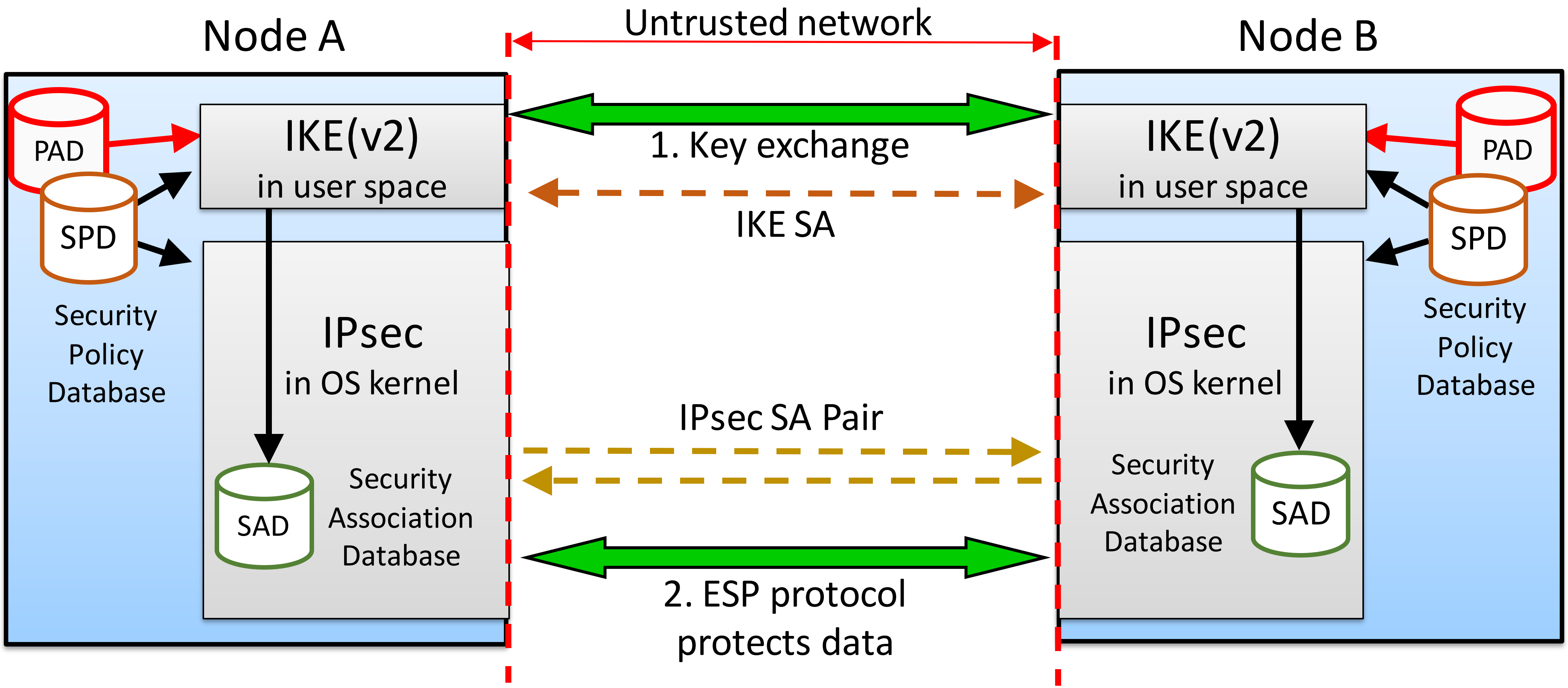
IPsec and Certificates – solutions?

- Secure DNS (forward lookup) does not help — why?
- Secure reverse DNS would be a solution — but it does not exist

Other solutions:

- Connect by name — change the socket API so that the connect() call specifies the host name, not the IP address
- Give up IPsec transparency: applications query the socket API for the authenticated name
  - VPN applications do this to check the VPN gateway name from the certificate
- Ignore the hostname: use IPsec only to isolate certified intranet hosts from outsiders/intruders
  - Example: NAP in a Windows domain uses IPsec for network access control and not for end-to-end authentication of the individual host identities

IPsec architecture [RFC 4301]



Peer authorization database (PAD)

- IPsec specification [RFC4301] defines a database that maps authenticated names to allowed IP addresses
- How is PAD implemented?
  - VPN applications check that the name on the certificate matches a known VPN gateway
  - For host-to-host IPsec in a closed domain, such as intranet, PAD could theoretically be implemented – but it has not been
  - No solution for general host-to-host IPsec in the open Internet

This is why IPsec is really only used for VPN and not host-to-host