Routing Security Economics

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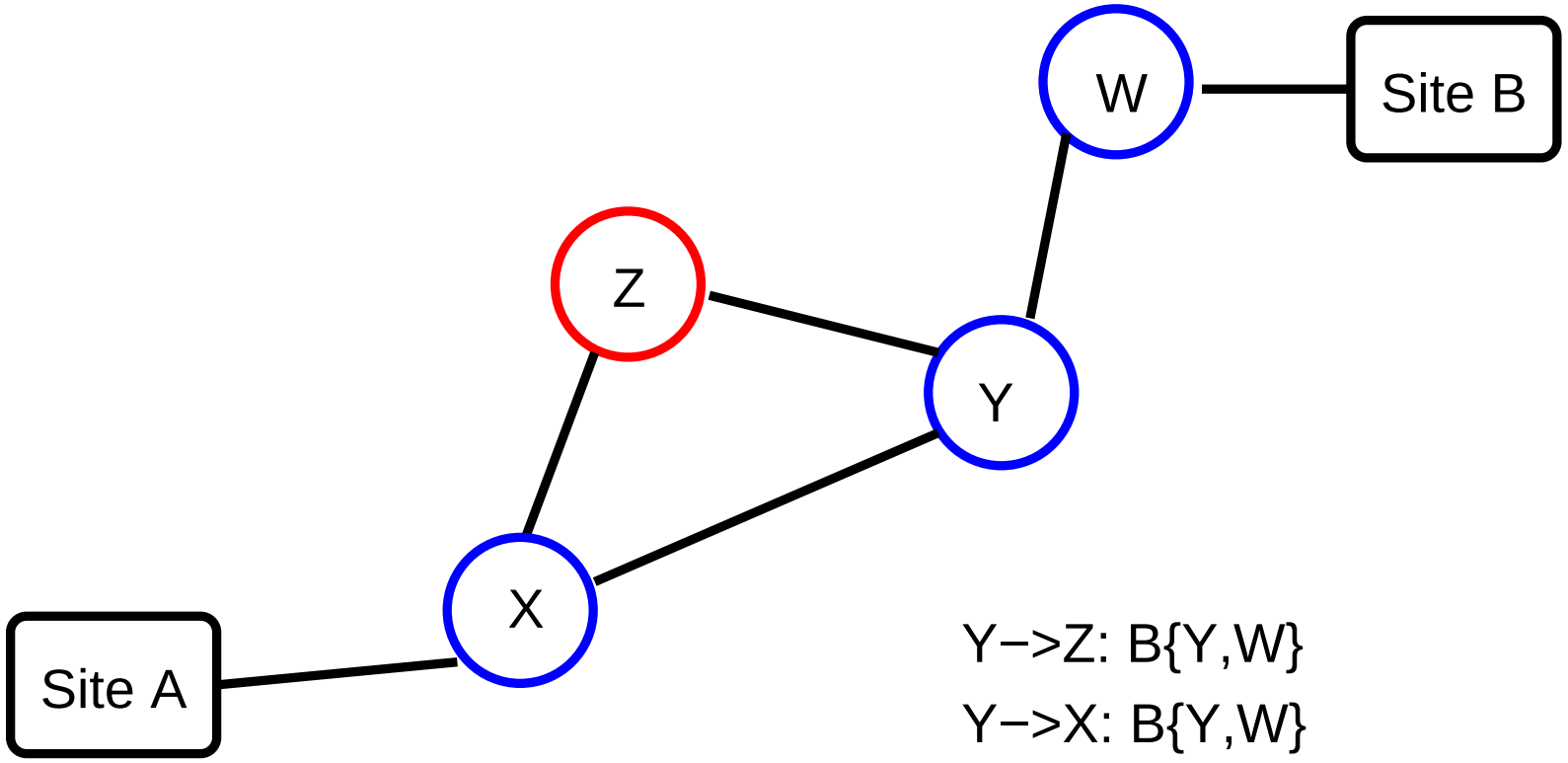
What is Routing Security?

- Bad guys play games with routing protocols.
- Traffic is diverted.
  - Enemy can see the traffic.
  - Enemy can easily modify the traffic.
  - Enemy can drop the traffic.
- End-to-end cryptography can mitigate the effects, but not prevent them.

How is it Different?

- Most communications security failures happen because of buggy code or broken protocols.
- Routing security failures happen despite good code and functioning protocols. The problem is a dishonest participant.
- Hop-by-hop authentication isn't sufficient.

Lying Routers



Problems Caused

- Reachability
- Spoofing
- Denial of service
- Spam or other attacks
- Traffic analysis

Costs

- Cost of dealing with the attacks (what is traffic privacy worth?)
- Cost of clean-up
- Cost of route advertisement filtering

Cost of Defenses

- All proposed defenses involve lots of cryptography, and frequently public key cryptography
- This implies capital expenditures for router upgrades: memory, CPU power, modular exponentiation hardware, etc.
- Most Internet users get IP address ranges from their ISPs; this means that ISPs need to
  1. Obtain certificates for their own address ranges
  2. Operate (or outsource) a CA and help desk to issue address-based certificates to their customers

Deaggregation

- Routers use a "longest prefix" match to select a routing table entry
- Some sites are advertising redundant, longer prefixes to forestall (inadvertent?) attacks
- Example: AT&T currently advertises 12.0.0.0/8, 12.0.0.0/9, and 12.128.0.0/9
- Result: three RIB entries instead of one; more importantly, two FIB entries instead of one
- (Note: this was the direct consequence of a routing incident in 2005.)
- What if they need to switch to 256 /16s? (Some of that already for traffic engineering and multihoming.)

Economic Choices

Do nothing Continue to absorb the cost of attacks — low thus far, except for spam, but the spammers currently favor botnets.

Full-scale crypto ISPs spend a lot — can they recover their costs? None of the proposed solutions provide economic incentives for early adopters. (Of course, without ISP demand, vendors haven't built any hardware.)

Deaggregation The cost of deaggregating is low for the originator, but it increases everyone else's costs. Furthermore, we are seeing increasing pressure on router FIB sizes for other reasons.