analyzing origins

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adding origins to our model

HTTPEvent

from, to, origin

causes

Request

Response

Response

Redirect Response

Embedded Request

Client

Server
analysis steps

› define origin tracking & policy
› express security property
› check that policy implies property
define origin tracking

abstract sig EndPoint { causes: set HTTPEvent }
sig Client, Server extends EndPoint {}
abstract sig HTTPEvent { from, to: EndPoint}
sig Request extends HTTPEvent { response: Response }
sig Response extends HTTPEvent { embeds: set Request }
sig Embedded extends Request {}
sig Redirect extends Response {}

fact Origin {
   // for a redirect, origin is same as request; else server
   all r: Request | r.response.origin =
       (r.response in Redirect implies r.origin else r.response.from)
   // embedded requests have the same origin as the response
   all r: Response, e: r.embeds | e.origin = r.origin
   // requests that are not embedded come from the client
   all r: Request - Embedded | r.origin = r.from
}
define policy

pred appliesSOP (s: Server) {
    // request is only accepted if origin is server itself or sender
    all r: Request | r.to = s implies r.origin = r.to or r.origin = r.from
}
express policy

check {
  no server: Server, attacker: Server - server {
    // no direct request to attacker
    no r: Request | r.to = attacker and r.origin in Client
    // trusted server obeys origin policy
    server.appliesSOP
    // and attacker still gets request through
    some r: attacker.causes | r.to = server
  }
} for 6 but 1 Client, 2 Server
attack!