Resilient Cyber Security and Privacy

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Security: What we know how to do

- Secure something simple very well
- Protect complexity by isolation and sanitization
- Stage security theatre

What we **don't** know how to do

- Make something complex secure
- Make something big secure
- Keep something secure when it changes
  - "*When it comes to security, a change is unlikely to be an improvement.*" —Doug McIlroy
- Get users to make judgments about security

Lots of hype

- Not much hard evidence of actual harm
  - As opposed to scare stories and uneasiness
  - Ex: Scale of identity theft, losses from cybercrime
- Most numbers come from interested parties
  - who are in business to sell you security stuff
- Rarely, we see business decisions backed by data
  - Verifying credit card transactions
- Most costs are in prevention, not in harm

Approaches to rational security

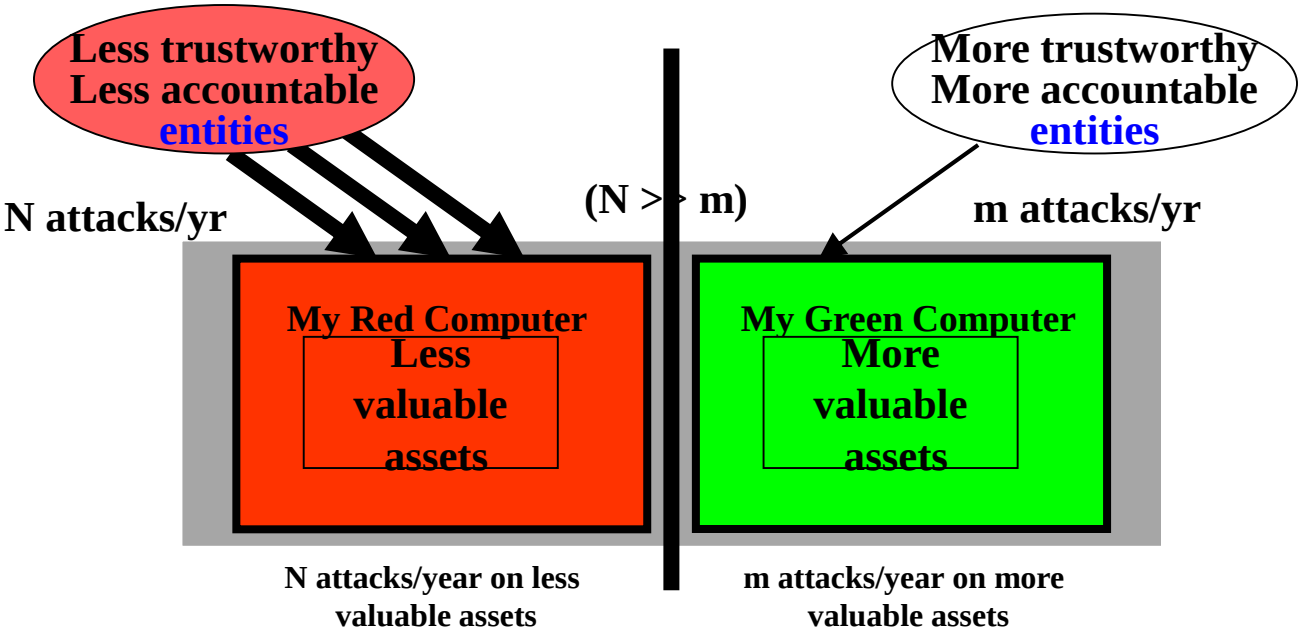
- Limited aspirations
  - In the real world, good security means a bank vault
    - There's nothing like this in most computer systems
  - Requires setting priorities—what's *really* important
- Retroactive security
  - React, don't anticipate—work on actual problems
  - Deterrence and undo rather than prevention
    - Deterrence needs punishment
    - Punishment needs accountability

Deterrence, punishment, accountability

- Real world security is retroactive, about deterrence, not about locks
- On the net, can't find bad guys, so can't deter them
- Fix? End nodes enforce **accountability**
  - Refuse messages that aren't accountable enough
    - or strongly isolate those messages
  - Senders are accountable if you can **punish** them
    - With dollars, ostracism, firing, jail, ...
- **All trust is local**

Limiting aspirations: Red | Green

- Partition world into two parts:
  - Green: More safe/accountable
  - Red : Less safe/unaccountable
- Green world needs professional management



What about bugs? Control inputs

- Bugs will always subvert security
  - Can't get rid of bugs in full-function systems
    - There's too much code, changing too fast
    - Timeliness and functionality trump security
- A bug is only dangerous if it gets tickled
  - So keep the bugs from getting tickled
  - Bugs get tickled by inputs to the program
  - So refuse dangerous inputs
    - or strongly isolate or sanitize those inputs
- To control possible inputs, isolate the program
  - Airgap, VM, process isolation, sandbox

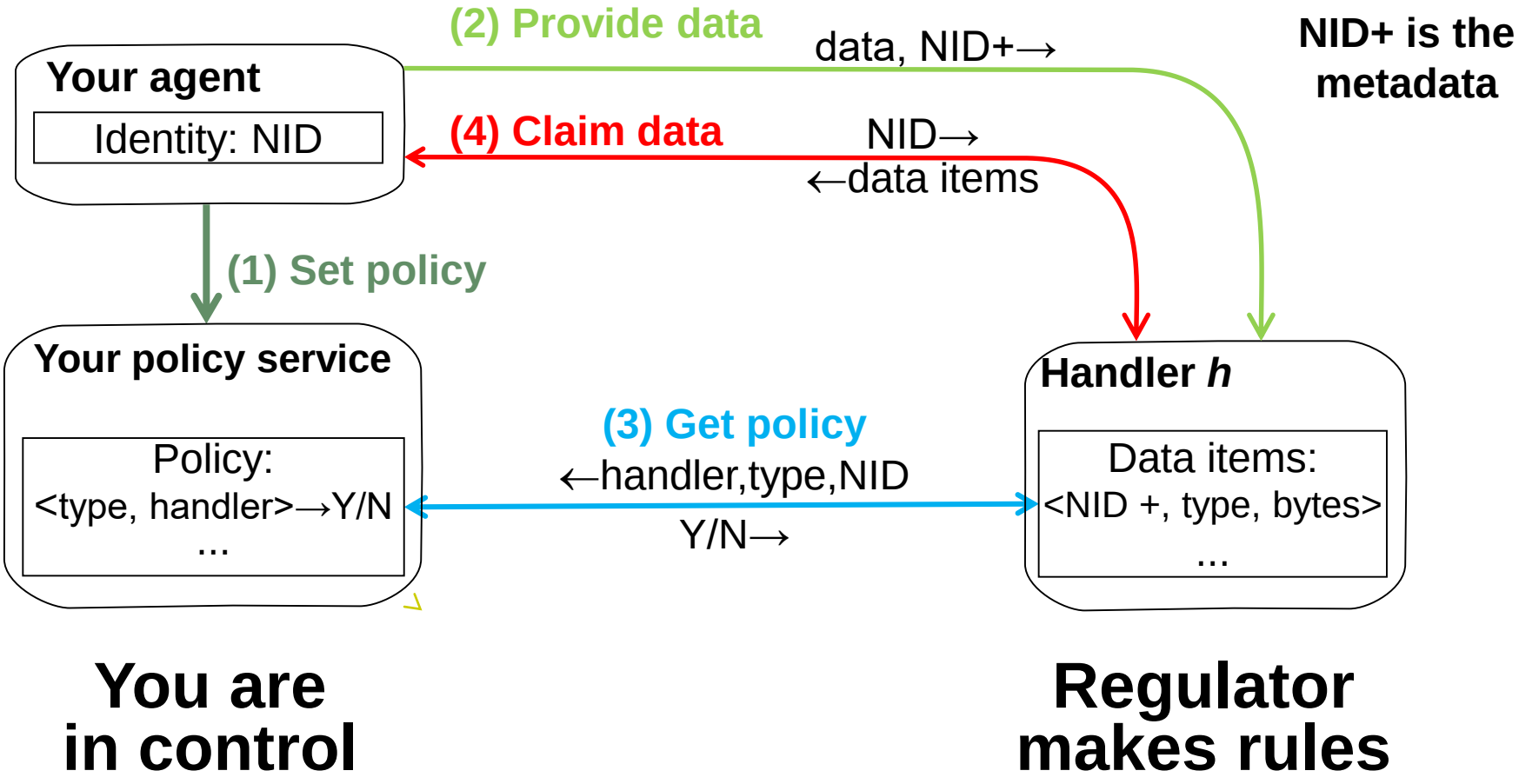
Privacy: Personal control of data

- You are empowered to **control** your data
  - **Find** it, limit its **use**, **claim** it
  - **Everywhere**—Across the whole internet
  - **Anytime**, not just when it's collected
  - **Consistently** for all data handlers and devices
  - Remaining **anonymous** if you wish

Personal control of data: Mechanisms

- **Ideal**: All your data is in a vault you control
  - I bring you a query
  - If you like the query, you return a result
    - Otherwise you tell me to go away
- **Practical**: Data has **metadata** tag: link to policy
  - Two kinds of players:
    - **Agents you choose**—like an email provider
      - **Personal Agent** on your device
      - **Policy Service** online
    - **Data handlers**, subject to regulation
      - Anyone who handles your data and follows the rules
      - Must fetch and obey your current policy

How it works

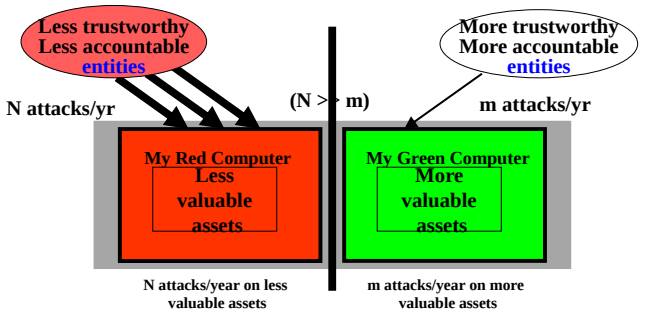

(2) Provide data
data, NID+→
NID+ is the metadata
Your agent
Identity: NID
(4) Claim data
NID→
←data items
(1) Set policy
Your policy service
Policy:
<type, handler>→Y/N
...
(3) Get policy
←handler,type,NID
Y/N→
Handler h
Data items:
<NID +, type, bytes>
...
You are in control
Regulator makes rules

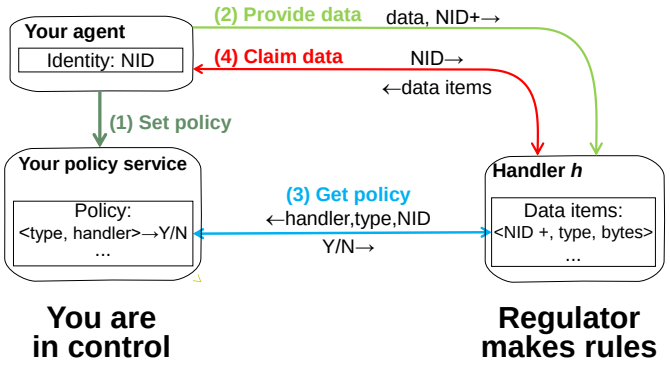
Policy

- **Data-centric**, not device or service centric
  - Metadata stays with the data, points to data's policy
- Standard policy is very simple
  - 7 ± 2 types of data: contact, location, transaction, ...
    - Can extend a type with an optional tree of subtypes
  - **Basic policy**: handler *h* can/can't use data type *t*
- **One screen** shows most policies (in big type)
  - **Templates** (from 3rd parties) + your exceptions
- Encode complex policy in **apps**
  - An app is a handler that tags its output suitably

Conclusions

- Rational security
  - Limited aspirations
    - Red | Green
  - Retroactive security
    - React—work on actual problems
    - Deterrence and undo over prevention
- Personal control of data
  - Data tagged with metadata: a link to your policy
  - Handlers must obey policy

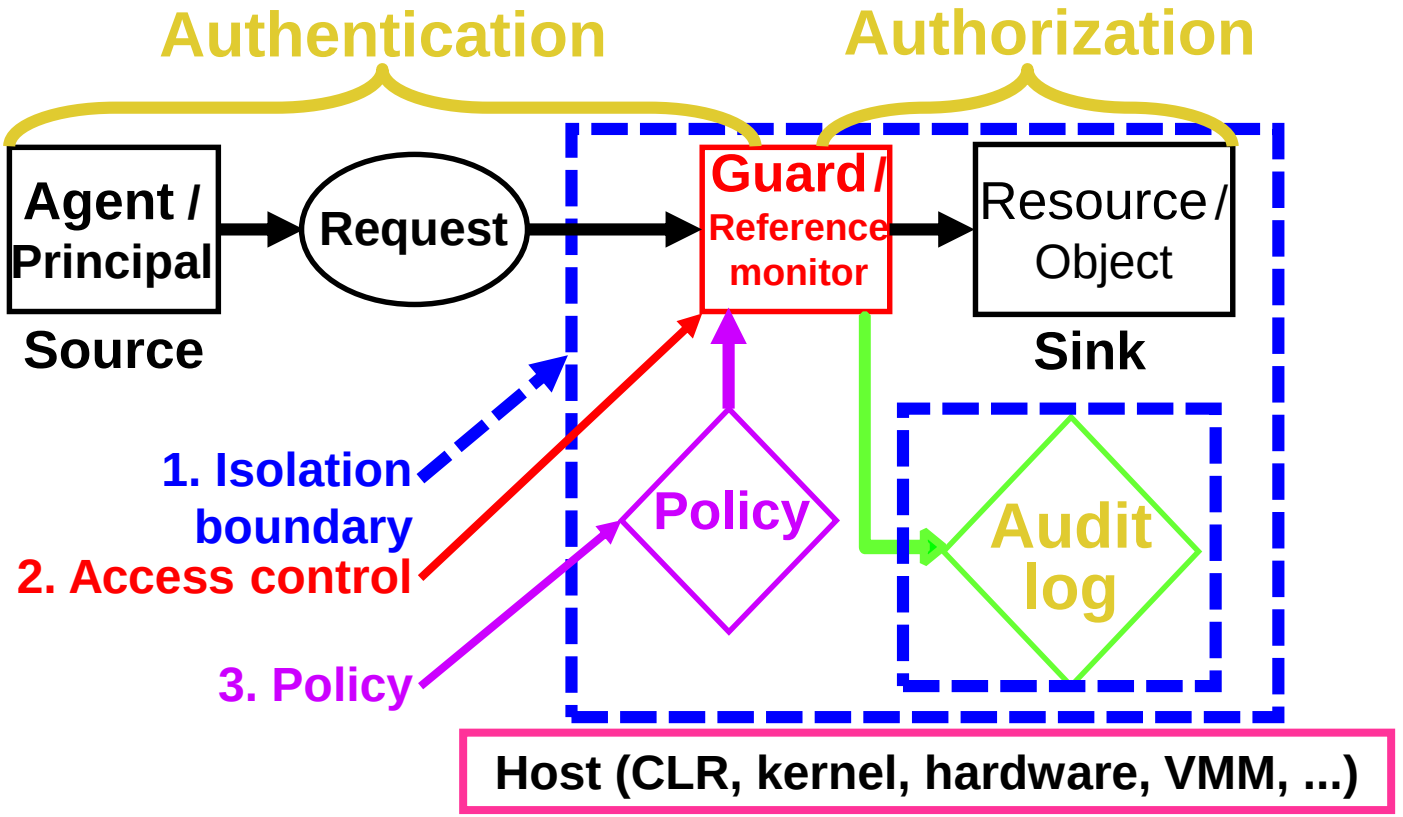




Backup

Access Control

1. **Isolation boundary** limits attacks to channels (no bugs)
2. **Access Control** for channel traffic
3. **Policy** management



Incentives

- **Perceived** threat of harm, or regulation
  - Harm: loss of money or reputation
  - For vendors, customer demand, which is weak
- Perception is based on **past experience**
  - not on possible futures
  - because too many things might go wrong
  - and you'll have a different job by then
- Regulation is a blunt instrument
  - slow, behind changing technology and threats
  - expensive
  - prone to unintended consequences.
  - But it can work. Ex: US state laws on PII disclosure

Are people irrational? No

- Goals are unrealistic, ignoring:
  - What is technically possible
  - What users will actually do
  - Conflicting desires for
    - security, anonymity, convenience, features
- Actual damage is small
  - Evidence of damage is weak
  - Hence not much customer demand
- Incentives are lacking
  - Experience trumps imagination
  - Convenience trumps security
  - Externalites: who benefits ≠ who pays

What is technically possible?

- **Security requires simplicity**
- Most processes add complexity
  - SSL/TLS recently discovered bugs
  - EMV chip-and-PIN system
  - Windows printing system
  - SET “standard” for internet credit card transactions
- “Too complex” is a judgment call
  - Why? No good metrics for complexity or security
  - So desire outruns performance

What will users actually do?

- What gets the job done
  - Disabling or evading security in the process
- What is easy
  - 2-factor auth for banking → password + device
    - But in Norway, one time passwords for banking
- What works everywhere
  - For security, that's **nothing**
  - So "educating" users doesn't work
- What solves a problem they (or a friend) **actually** had
- "*If you want security, you must be prepared for inconvenience*."
  —Gen. Benjamin W. Chidlaw, 1954