Registry Vulnerabilities

An Overview

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Goal of the Presentation

- High-level overview of where security matters
  - Reduce the chances that something (big) is missed
  - To help identify how other presentations can help

What is Security?

- Component of reliability, availability
  - Available means being “up”
  - Security means “not being taken down” or “corrupted”

- Security blends with general availability issues
  - What’s covered here is related to malicious threats, not environmental threats (like power outages)

What Does Security Do?

- Limits the damage caused by malicious(-like) activity
- Never prevents an attack
  - To attack or not is someone else's decision
- Not absolute
  - What an attacker is willing to do versus how well a defense is constructed
- "Risk management"

Where To Start?

- What needs protecting?
- How much can be allocated to defense?

- Analyze the operation (architecturally)
- Define the normal states of operation
- Define what activity represents a risk and monitor
- Automate responses and clean up

Where To Stop?

- Needed but not desired
  - Balance!
- Avoid
  - Preventing valid uses of the network
  - Becoming a burden on legitimate users
- State goals in planning so “done” can be accomplished
  - Done being “good enough for now”

What Is Most Important

- A registry’s role is to match objects to entities
  - Reliably, always available

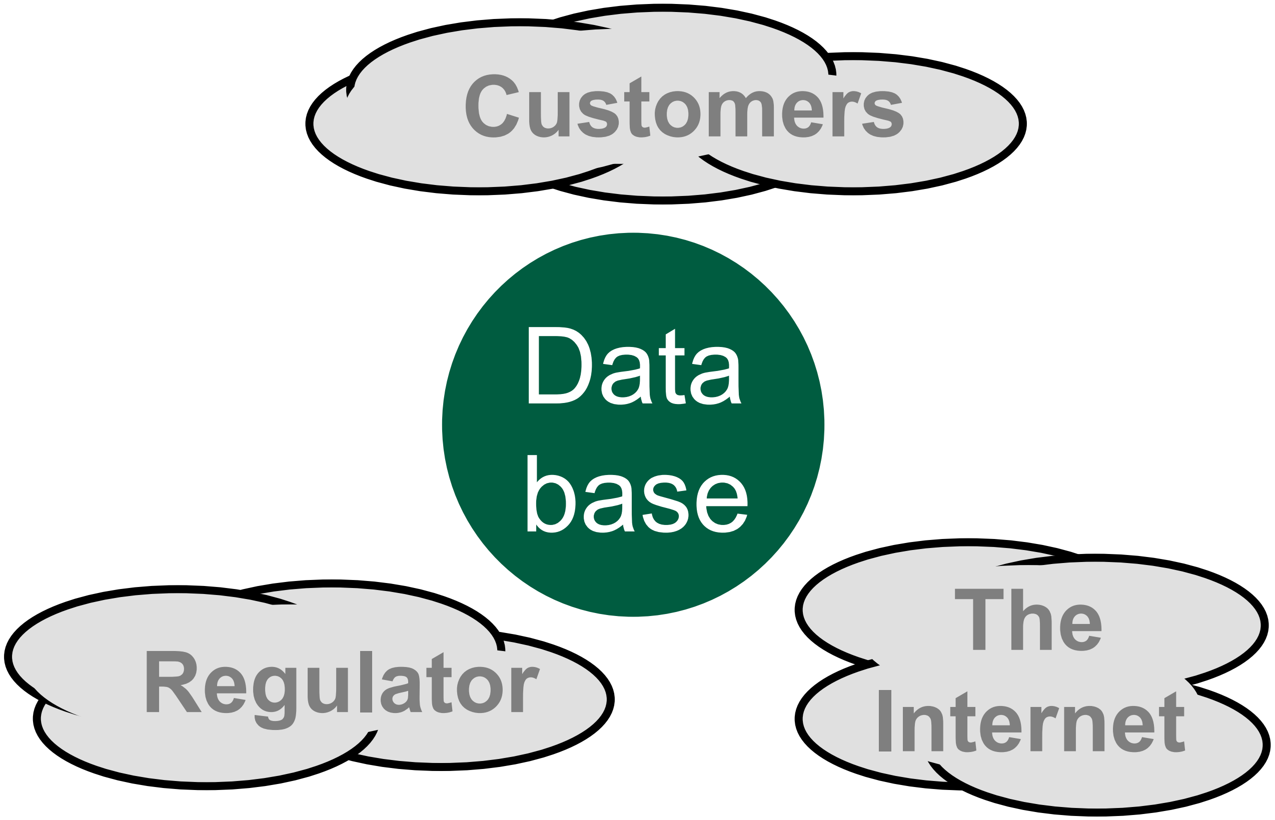
- Domain Name Industry
  - Mapping domain names to registrants
  - In DNS time
  - Enforcement of policies
- For Number Resources (the RIRs)
  - Except that the names are numbers (IP, AS)
  - The rest is the same

Think About Normal

- The heart is “the” database
- Services provided surrounding this database
  - To input data (provisioning)
  - To export data (e.g., DNS)
  - How do these interact on a “as expected” basis?
- Specifics can differ from registry to registry

Domain Name Registry

An Ecosystem View



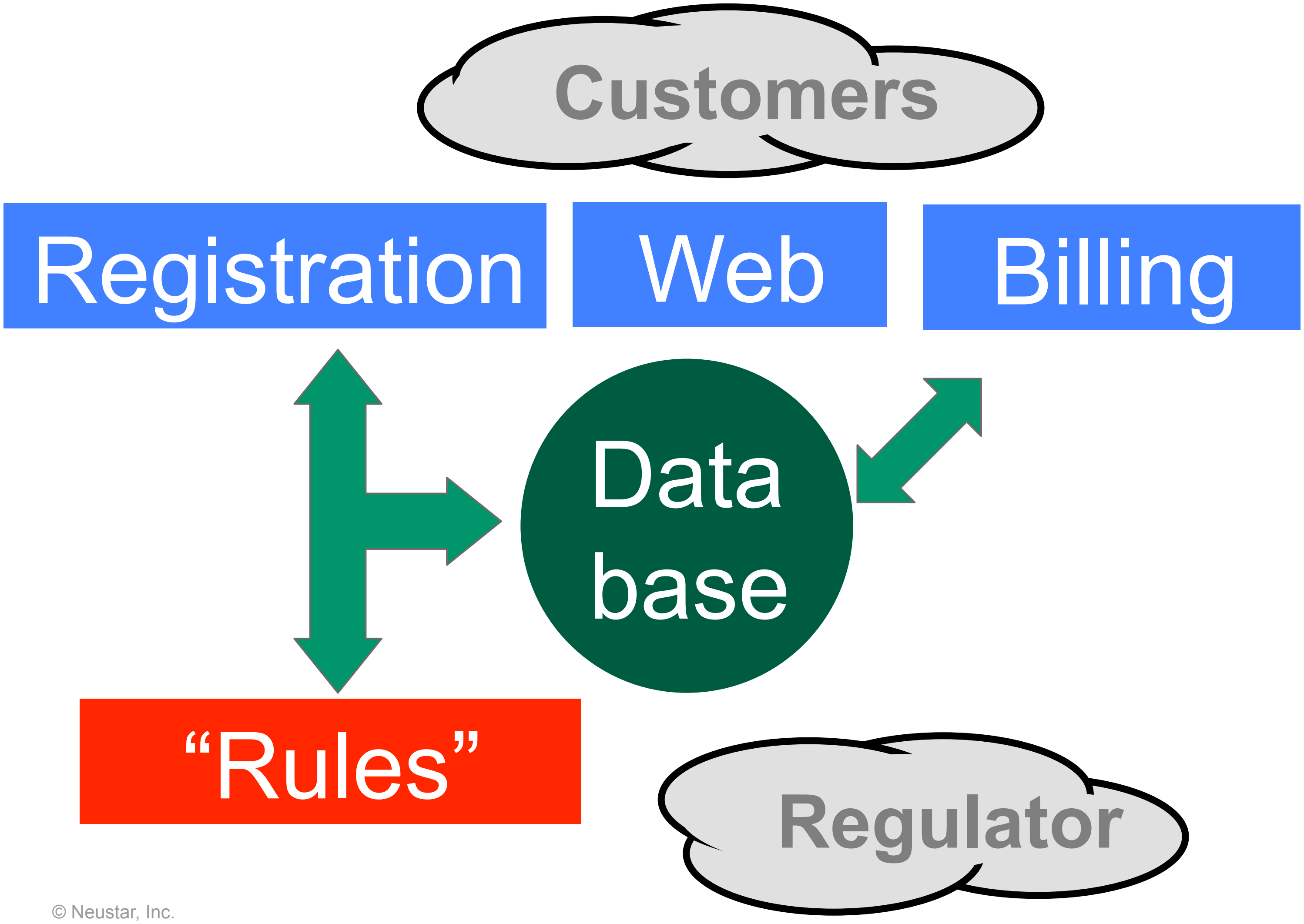
Customers

Data base

Regulator

The Internet

Provisioning Services



Customers

Registration

Web

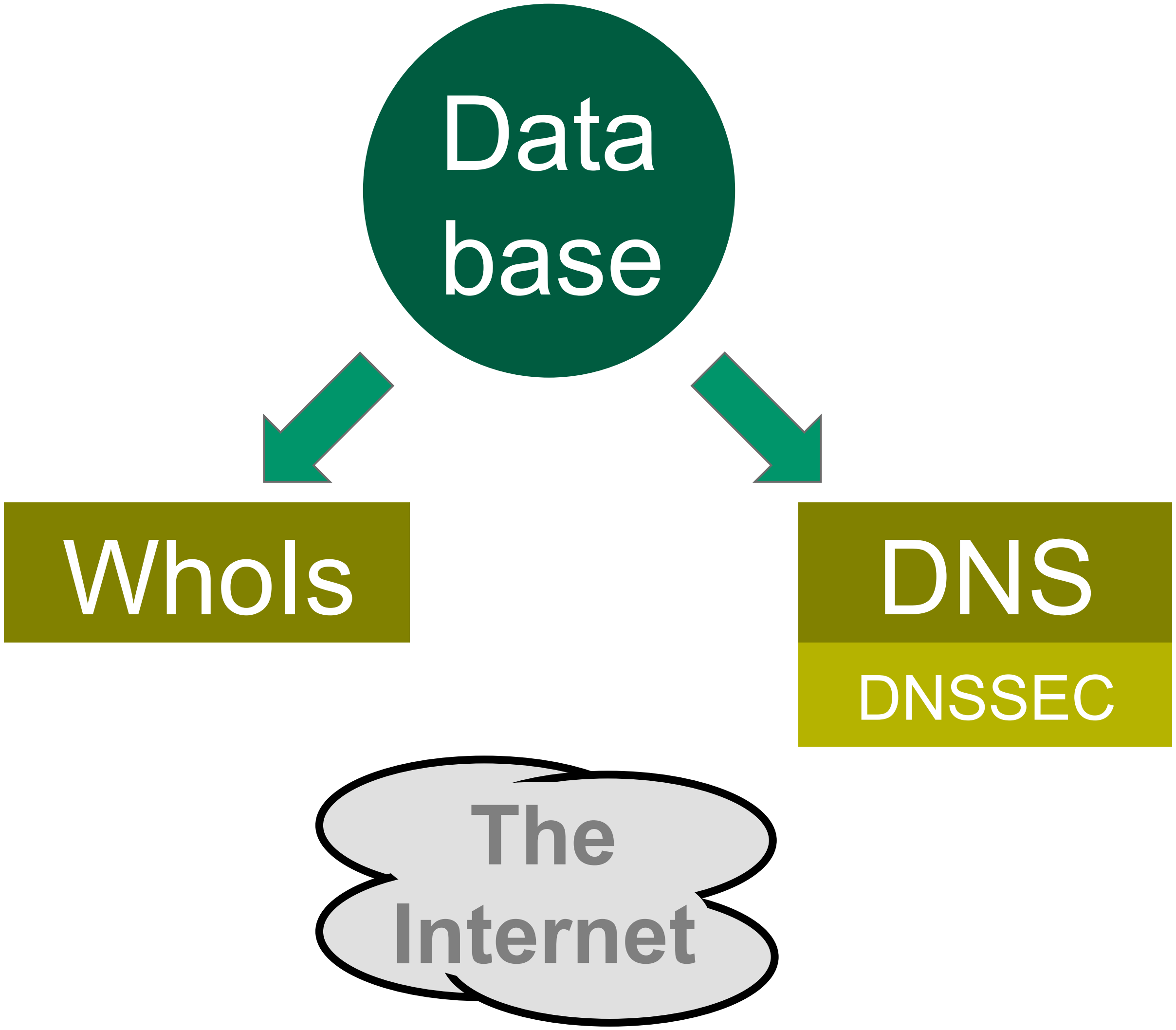
Billing

Data base

“Rules”

Regulator

Reporting Services



Basic Security

- All organizations must have basic security
  - Physical security such as locks, video cameras
  - Financial security such as business continuity
  - Personnel security such as “HR” rules and regulations
  - Information Technology security such as firewalls
- And make sure it works
  - Security audits
  - Penetration tests, other security exercises

When All Else Fails, Escrow

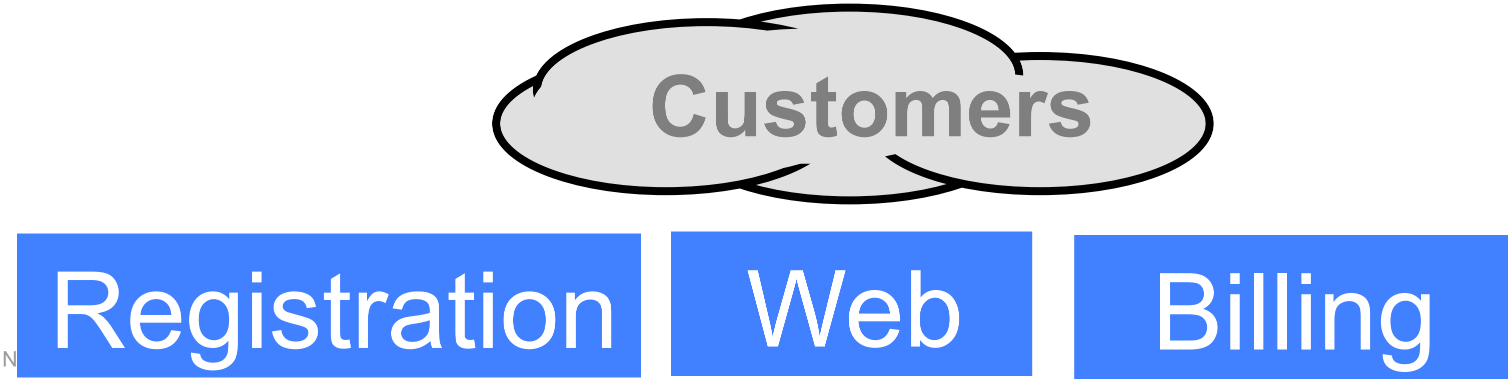
- If everything else comes “crashing down”
  - A well planned escrow system is needed

- Escrow means a copy of the database held in a secured location away from the registry

- Test escrow
  - But hope to never use it!

Provisioning Services

- The Registration Interface
  - This might be EPP (doesn’t have to be)
- General Information Website
  - Low-profile but a service nonetheless
- Billing
  - Not often considered by engineers



Provisioning Vulnerabilities

- Denial of Service or “Hogging”
  - Access has to be guaranteed for customers
  - Need to prevent one from blocking out others
- Poorly formatted Data
  - Such as an “SQL injection” attack
- “Corrupt” Data
  - Stolen credentials
  - Fraudulent registrations

Registration

Techniques

- For registry website
  - Basic security
- For registration protocol
  - Traffic shaping
  - Restricting addresses
- For poorly formatted data
  - Better software, proven tools, limit testing
- For corrupt data
  - Business transaction security
  - Malicious domain name takedown process

Web

Registration

For Billing

- Protect credit card numbers (if applicable)!
  - Learn about the PCI Security Standards Council

- Protect any kind of account information
  - An attack might target the accounts of customers
  - Or the attack might use stolen credits to register names

Billing

Internal Systems

- Database
  - Contains the resource to holder mapping
  - Might contain contact information
  - Might contain credentials
  - Contains all other needed operational information
- Business rules enforcement
  - Who is allowed to register what
  - What enforcement is needed?

Data base

“Rules”

Regulator

Database Threats

Data
base

- Beyond fraudulent data
- Structure database appropriately
- Limit access by anyone, even staff
  - Even “read only”
  - Limit “insider attacks”
  - Limit damage from “social engineering” – persuading staff to give out information that should not be reported

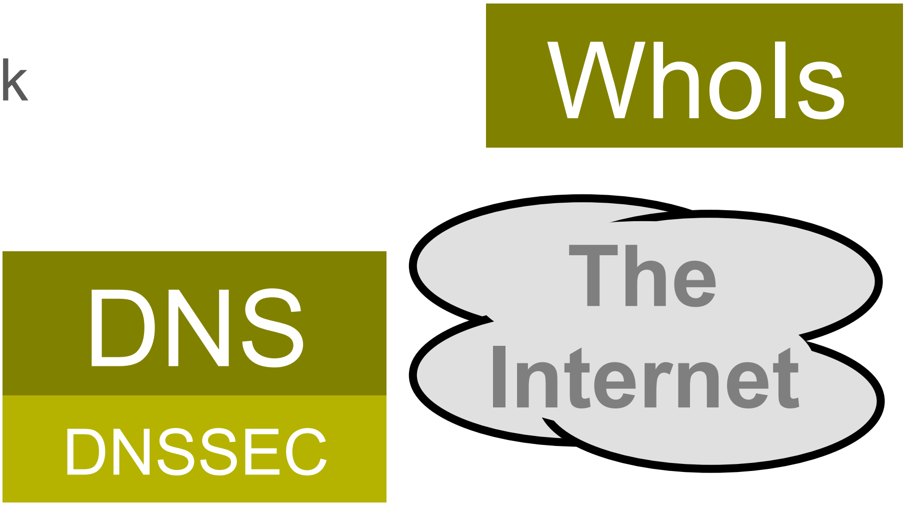
“Rules”

- Ensure they are properly followed
- Available and functioning
- Work with regulators to ensure policies are sensible, well understood and achieving the right goals

“Rules”
Regulator

Reporting Services

- WhoIs
  - Directory Inspection/Access Services
- DNS
  - The reason for all of this work
- DNSSEC
  - Key management is new
  - HSM or not?



WhoIs Threats

WhoIs

- TCP based attacks
  - Well understood, not so scary anymore
- Data Mining
- For some registries, WhoIs is not a target
  - Bulk access is provided within terms of use
  - “Abusing” WhoIs is just “annoying”

WhoIs Defenses

- Host security for TCP issues
- General availability techniques (multiple sites, servers)
  - Rate limits when a source is a nuisance

- For data mining
  - Bulk access agreement limiting data use
  - Captcha in the UI
  - Monitoring and throttling of requests

WhoIs

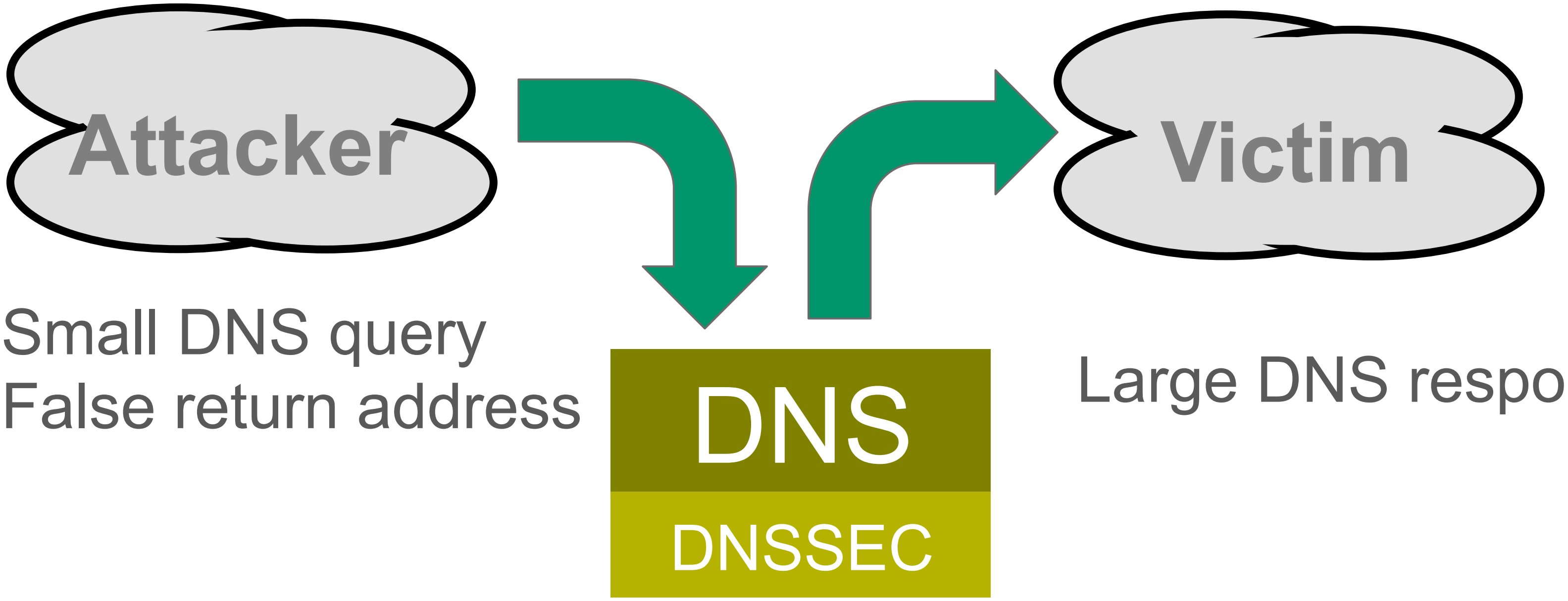
DNS Threats

DNS

- Popular target
  - Denying service by knocking out servers
    - “Kill packets” are possible
  - Packet flood attacks (DDoS)
    - Registry as victim
    - Registry as unwitting accomplice
  - Cache Poisoning
    - Not a threat to registry servers, but registries can help limit it
  - Data Disclosure
    - Some jurisdictions consider the list of domains sensitive

Reflection/Amplification Attack

» One class of attacks uses registries as unwitting accomplices.



Attacker

Victim

Small DNS query
False return address

DNS

DNSSEC

Large DNS response

What Does This Mean to DDoS

- Traditionally plans assume that one is the victim
  - Can my systems withstand a DDoS attack?
  - Do I need more capacity?

- Reflection attacks change this
  - More capacity might mean more ammunition for the attack

- What an operator can do now
  - Rate Limiting, specifically Response Rate Limiting, now implemented in various distributions: BIND, NSD, Knot

DNS Defenses

- Host security, up to date/customized name server code
- Dispersed set … limit shared fate
- Anycast can isolate attack regions
- Rate limiting of responses
- DNSSEC

DNSSEC Considerations

- The key management function
  - Many documents dedicated to this topic (e.g. US NIST)

- DNSSEC private key material has to be kept a secret
  - Poorly derived
  - Exported via an employee, lost hardware
  - Crypt-analysis

DNSSEC

- Signature generation process
  - False data submitted for signing

DNSSEC Techniques

- Use of NSEC3 or NSEC
- Choose parameters well, decide on workload
  - Too much, it's a burden
  - Too little, it's forgotten
- HSM or not?
  - Data is more important than the private key
  - Complicate "high availability" plans

DNSSEC

DNSSEC and Amplification

- Improvements make it more useful to malicious use
  - IPv6, more data
  - DNSSEC
  - Larger NXDOMAIN responses

DNSSEC

- What can be done?
  - Ignore DNSSEC and go insecure is not a desirable choice
  - Look for ways to limit size of responses
    - Be efficient on records, choose key sizes wisely
  - Response rate limiting

Conclusion

- There are a lot of “attack surfaces” in a registry
- There are a lot of techniques in defense

- Security needs to be planned ahead of time
  - Too little and - panic
  - Too much and - inhibiting

- …Questions?