DNSSEC
Why, how, why now?

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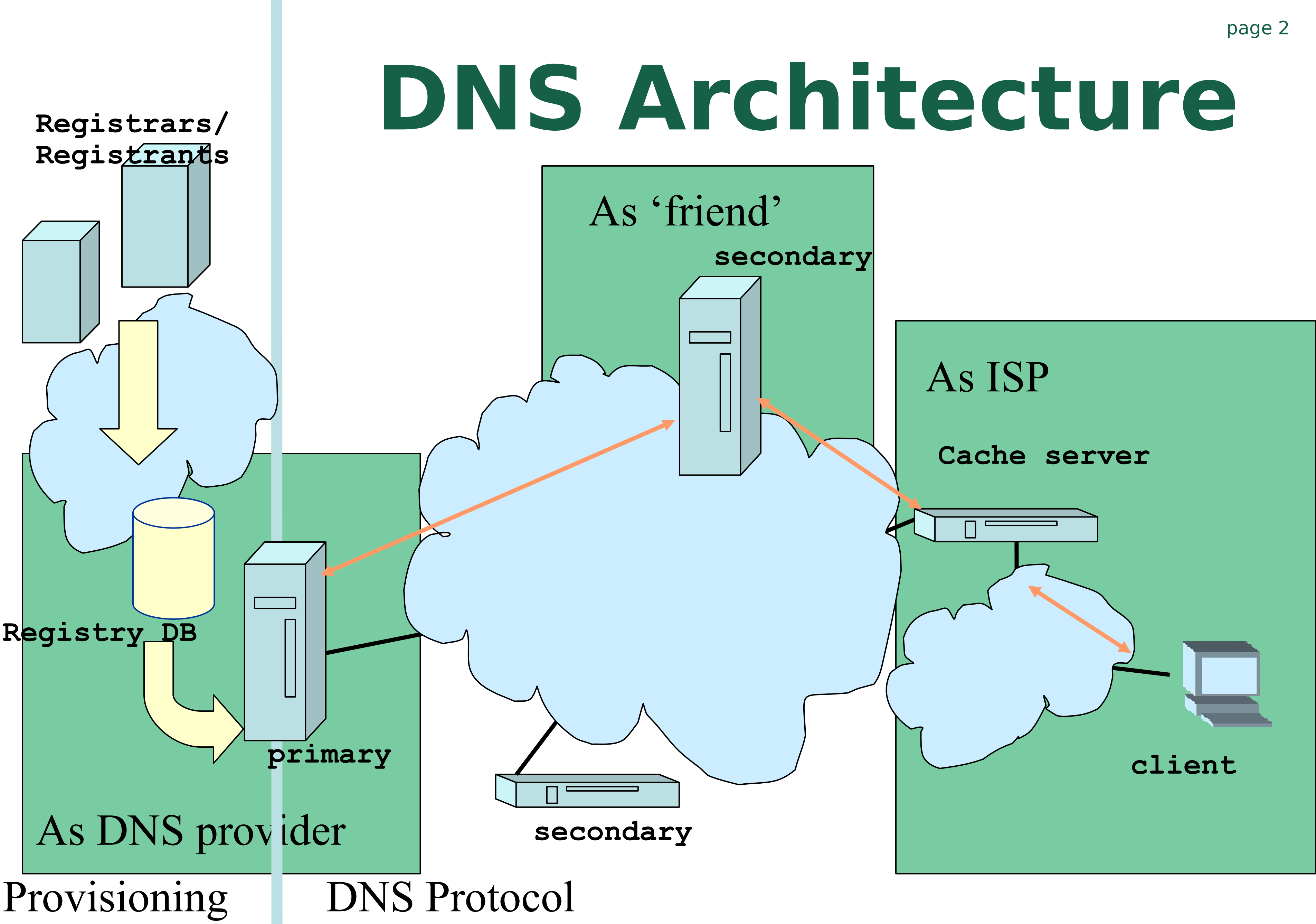
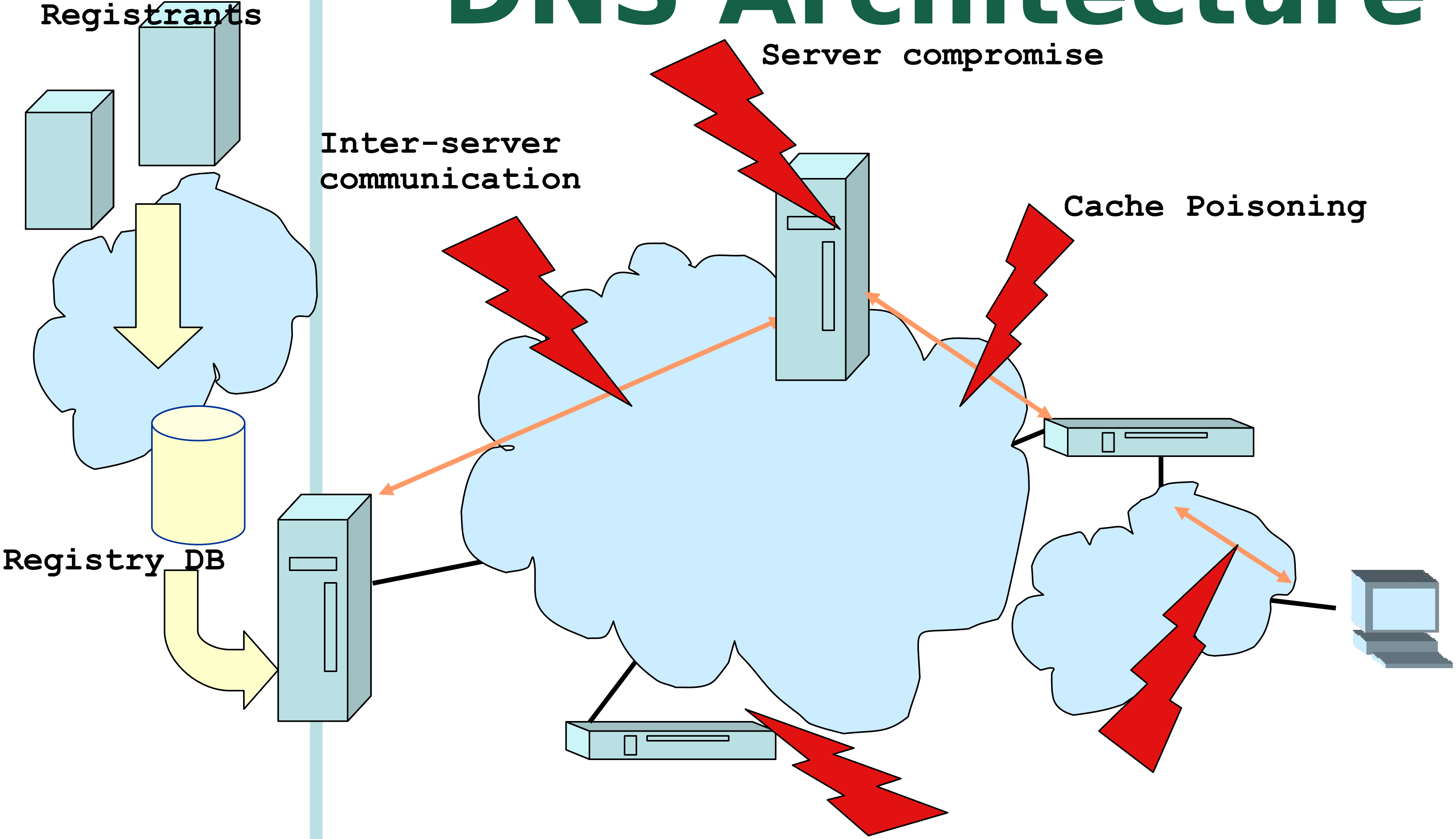
DNS Architecture



DNS Architecture



Registrars
Registrants

Registry DB

Inter-server
communication

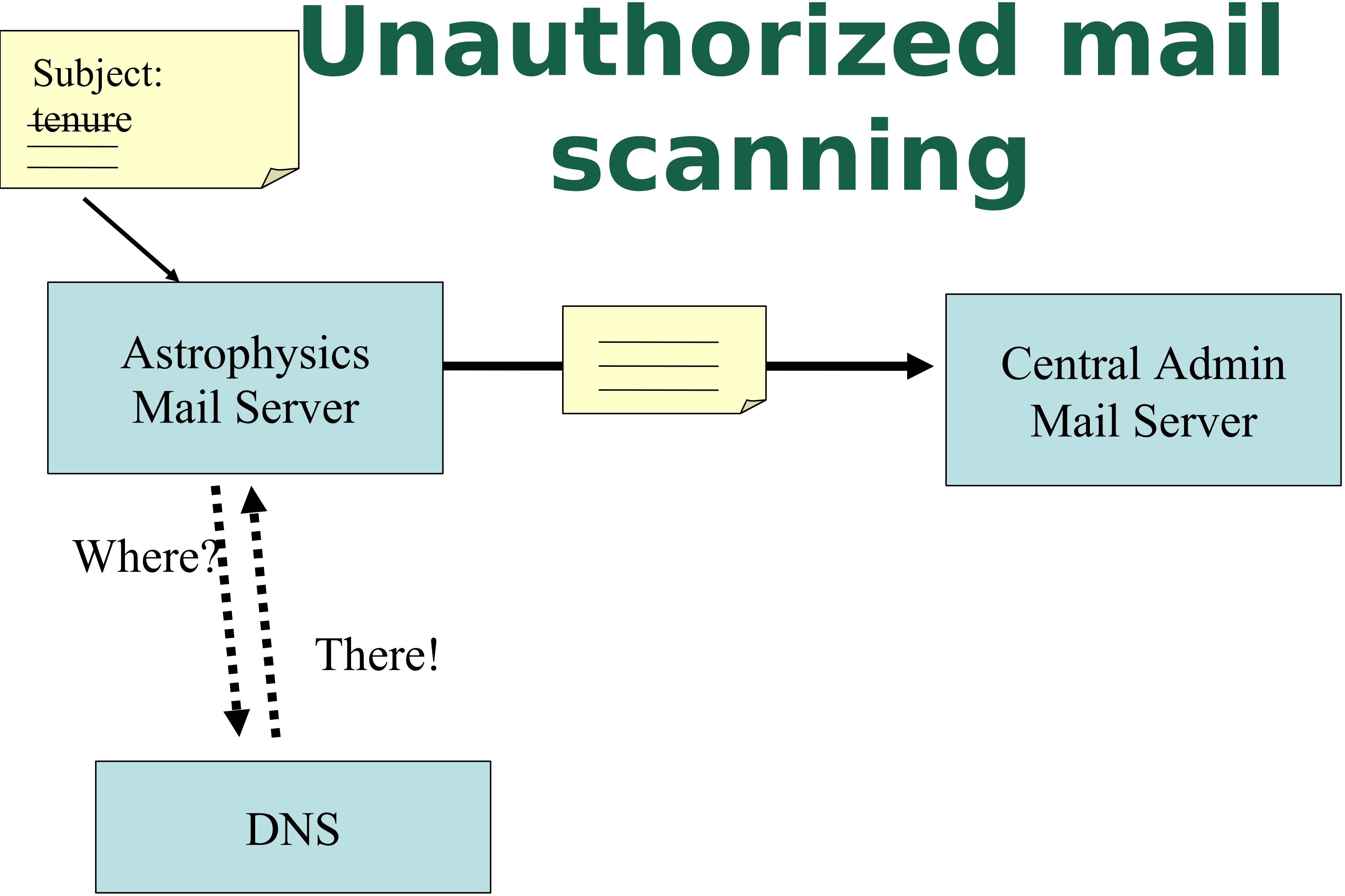
Server compromise

Cache Poisoning

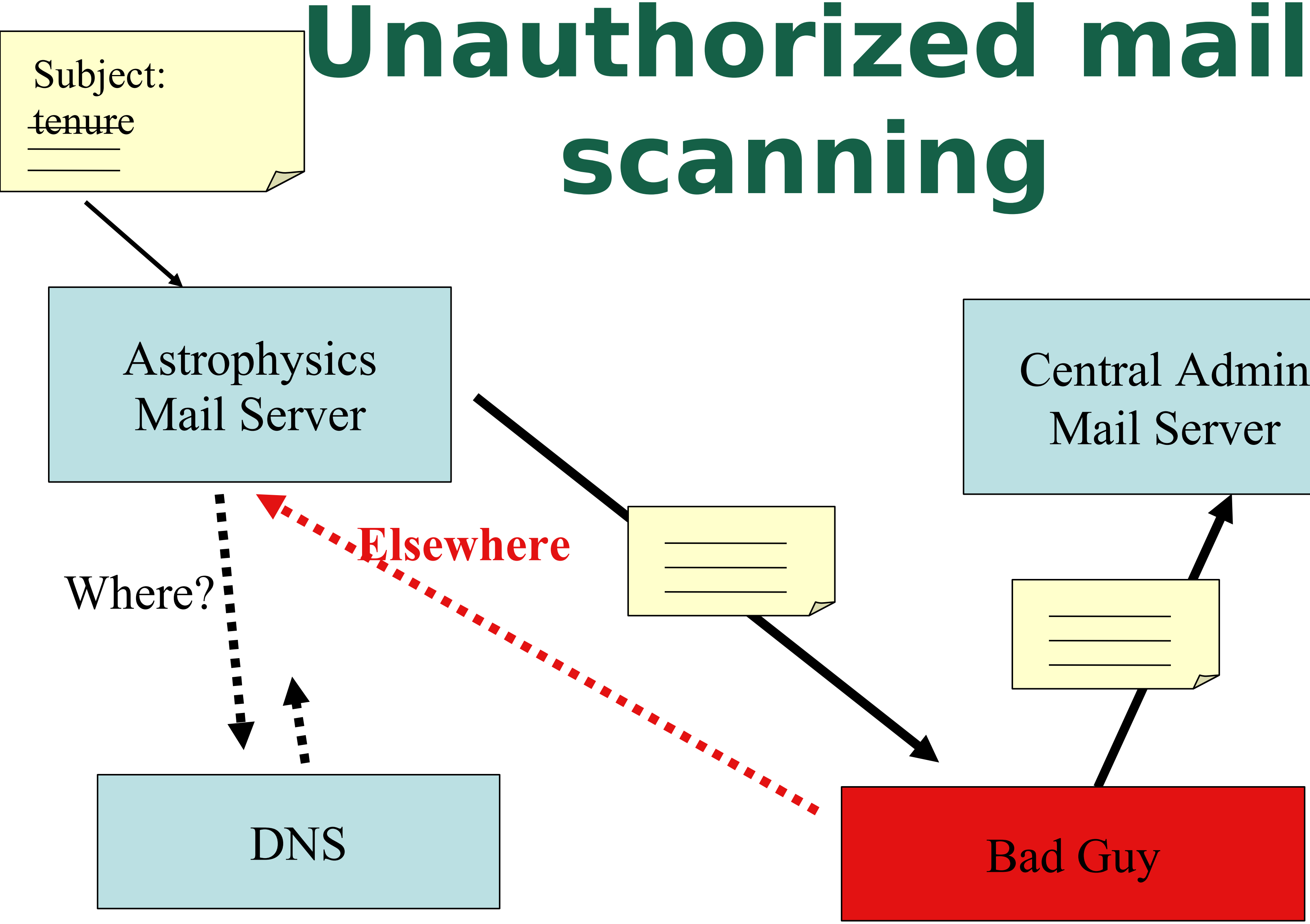
Provisioning

DNS Protocol

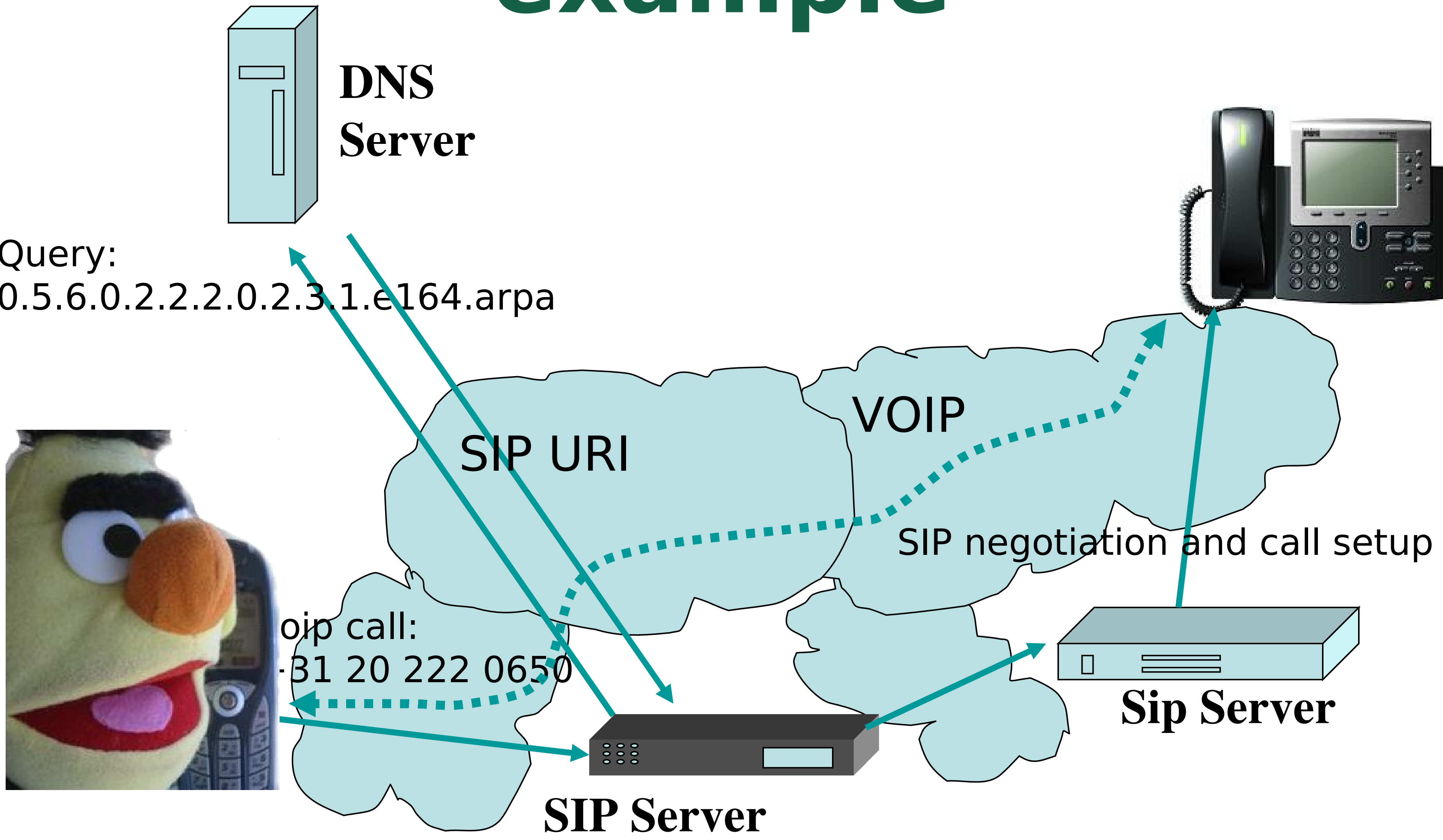
Example: Unauthorized mail scanning



Example: Unauthorized mail scanning



voip2voip as an example



DNS Server

Query:
0.5.6.0.2.2.2.0.2.3.1.e164.arpa

SIP URI

VOIP

SIP negotiation and call setup

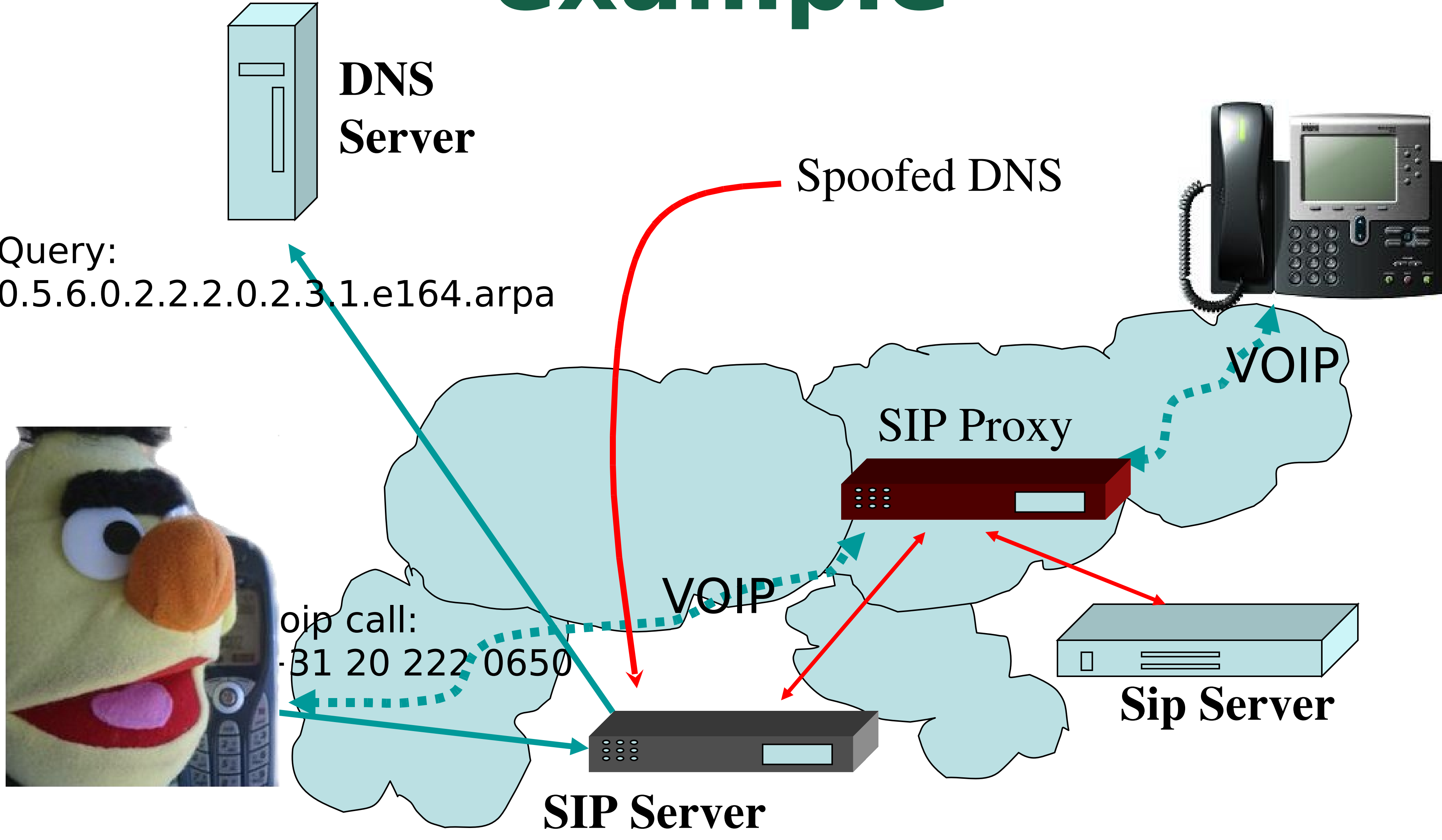
oip call:
+31 20 222 0650

SIP Server

Sip Server

Slide courtesy: Patrik Fältström

voip2voip as an example



DNS Server

Spoofed DNS

Query:
0.5.6.0.2.2.2.0.2.3.1.e164.arpa

VOIP

SIP Proxy

VOIP

oip call:
31 20 222 0650

Sip Server

SIP Server

Slide courtesy: Patrik Fältsröm

Why DNSSEC

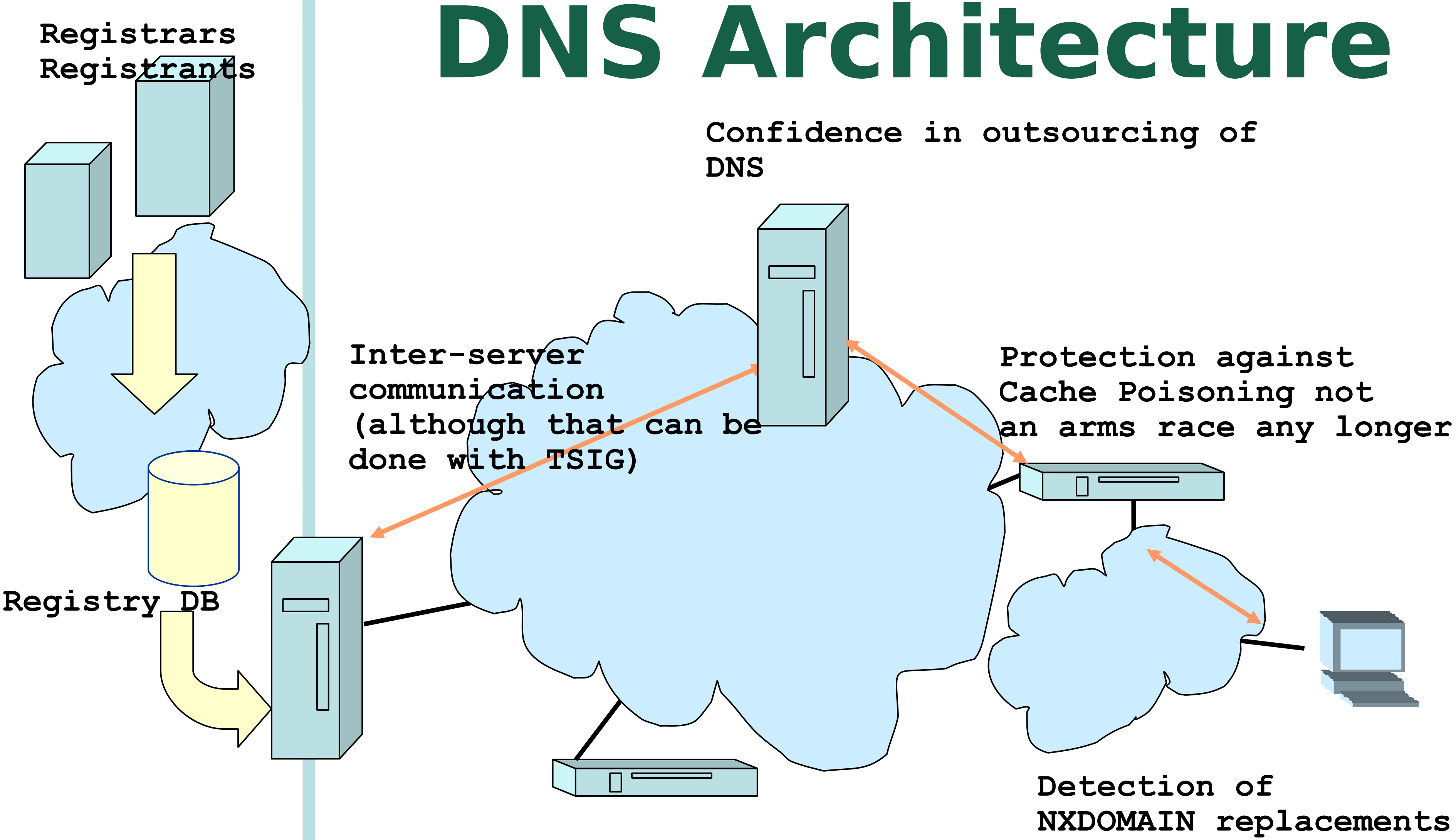
- Good security is multi-layered
  - Multiple defence rings in physical secured systems
  - Multiple ‘layers’ in the networking world
- DNS infrastructure
  - Providing DNSSEC to raise the barrier for DNS based attacks
  - Provides a security ‘ring’ around many systems and applications

Bourtange, source Wikipedia

Where Does DNSSEC Come In?

- DNSSEC secures the name to address mapping
- We still need:
  - Routing Security
  - Application Level Security
  - Secure Systems
- Having DNSSEC available may help with the provisioning of say Application security

DNS Architecture



Registrars
Registrants

Confidence in outsourcing of DNS

Inter-server communication (although that can be done with TSIG)

Protection against Cache Poisoning not an arms race any longer

Registry DB

Detection of NXDOMAIN replacements

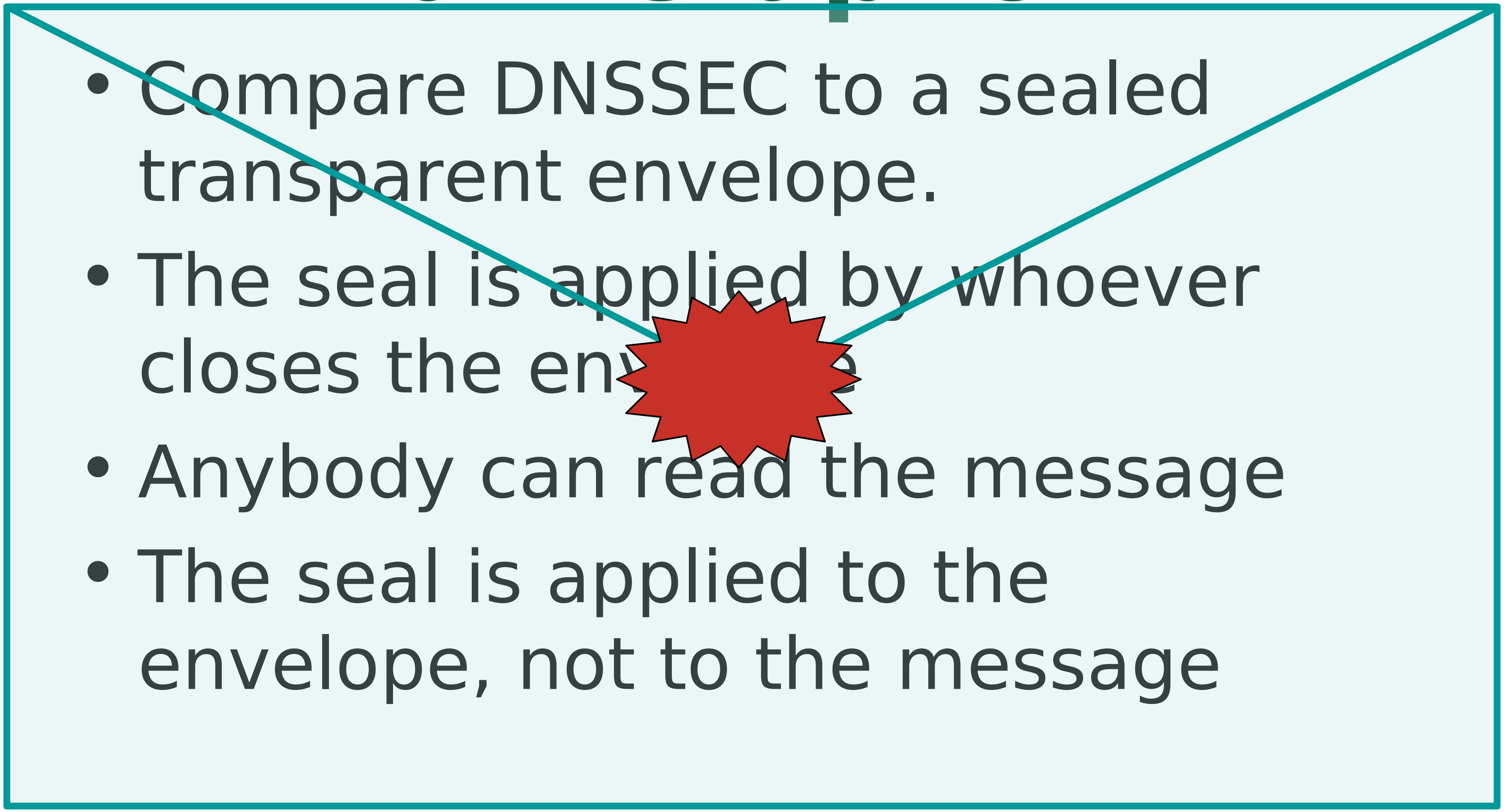
Provisioning

DNS Protocol

Application Benefits

- With reasonable confidence perform opportunistic key exchanges
  - SSHFP and IPSECKEY Resource Records
- With DNSSEC one could use the DNS for a priori negotiation of security requirements.
  - “You can only access this service over a secure channel”

Solution
a Metaphor



- Compare DNSSEC to a sealed transparent envelope.
- The seal is applied by whoever closes the envelope
- Anybody can read the message
- The seal is applied to the envelope, not to the message

DNSSEC properties

- DNSSEC provides message authentication and integrity verification through cryptographic signatures
  - Authentic DNS source
  - No modifications between signing and validation
- It does not provide authorization
- It does not provide confidentiality

Other DNS security

- We talked about data protection
  - The sealed envelope technology
  - RRSIG, DNSKEY, NSEC[3] and DS RRs
- There is also a transport security component
  - TSIG
  - Useful for bilateral communication between machines
  - Trivial to deploy today

Methods to prevent Cache Poisoning

`<Qname, Qclass, Qtype, IP-quad, query-ID>`

- Careful matching against all of the above
  - Utilize the maximum amount of variation possible
  - Not predictable
- Qname: 0x20 proposal
  - Qname: Www.ExaMpLE.coM.
- Also, only allowing information in the cache that is related to the question

Wait-a-minute

- Given previous slide: is DNSSEC still needed?
  - Aren’t the methods to prevent cache poisoning sufficient?
    - Yes, prudently written software makes the possibility to poison caches less likely
  - Recognize an arms-race?
    - Only untill the next clever trick is announced.
    - DNS is inherently insecure
- The other attack vectors still exist
  - Access to the wire e.g. hijack of DNS server addresses
  - Secondary server access

Status of Deployment

- A sad state of affairs
  - http://secspider.cs.ucla.edu/ reports a little over 10.000 zones signed, only little under 1000 are production zones
  - RIPE Reverse zones
  - .se, .pr, .br and .bg are signed top level domains
  - .uk, .arpa, .org have voiced some form of commitment
  - There is a testbed for the root and a lot of layer 9

Chicken and Egg
Why so little deployment?

- Little deployment means little experience and few tools.
- Little experience and few tools increase the cost of deployment

- Little infrastructure to justify cost of validation
- Little validators to justify the infrastructure
- No short term benefits, only long term
  - No immediate benefit to oneself

Breaking the egg: who and how?

- Deployment by the custodians of the DNS infrastructure: TLD operators and the root
  - Taking responsibility for the public space and act as enablers
- But also at the ISP level, gaining experience
- Providing tools and software
- Sharing Experience

Closing words

- Acting responsible with the network will allow users to keep trusting the network
- Deployment of infrastructure security is one of those measures
  - DNSSEC is a part of the picture, not a magic security bullet (no security tool is)