DNSSEC

From a protocol bug to a security advantage

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db089309: 1c1c 6311 ef09 d819 e029 65be bfb6 c9cb

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A protocol from better times

- An ancient protocol
  - People were friendly and trustworthy
  - Internet was a warm and fuzzy place
- *DNS is a protocol from admins for admins*
  - Main assumption: Computers do not lie
  - Idea: A hierarchical distributed database
- Store locally, read globally

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Playground to extend

- DNS **works**, so use is as a container
  - http://tools.ietf.org/wg/dnsext/
- DNS **scales**, so push a lot of data in
  - in-addr.arpa
- DNS can be **misused** as a catchword repository: www.*catchword*.com
- DNS may have **multiple roots**, so introduce private name spaces

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Playground to manipulate

- Push all initial requests to a payment site
- Prevent requests to *bad* sites
- Offer own search engine for NXDOMAIN
- Geolocation for efficient content delivery
- Geolocation for lawful content selection
- Provide different software updates
- Prevent worm updates

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trustroute +trace

- *Modelling* real world data as DNS records
- Transferring data into DNS *primary* server
- Transferring data into DNS *secondaries*
- Updating meta data in *parent zone*
- Delivering data to *recursive servers*
- *Processing* by resolver code
- Providing structures to *applications*
- *Interpreting* data by users

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Securing the data flow

- Two possible design goals:
  - Detect manipulation
  - Prevent wire-tapping
- Facing typical problems
  - The compatibility hydra
  - Partial roll-out
  - Satellite networks
- Still designed by admins: NSEC(3)

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DNS SECurity

- Trust the primary name server data
  - Signed by the zone-c
- A framework to verify integrity
  - Signature chains up to a trust anchor
- In band key management
  - DS records in parent zone (but glue!)
- Supports caching as well as offloading
- Provides peer authentication

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Trust anchor management

- The root **is** signed
- In band key roll-overs: RFC 5011
- Fill the gaps (parent zone not signed)
  - Manual trust anchors: Edit files on disk
  - Trust Anchor Repositories: Look aside zones
    DS *do.main* => DLV *do.main*.dlv.pro.vi.der
  - Question: Precedence of sources?

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The last mile

- In an ideal world, apps use a new API
  - Error messages might become helpful
  - Validation errors are SERVFAIL
- Resolver offloading
  - Provide validated data with AD
  - Allow validator chaining with CD
  - Question: Provide bogus data at all?
- Attacks on the last mile even for LEAs

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Finally gain benefits

- *DNSSEC adds trust to DNS*
- Use DNS as a hierarchical distributed DB
  - Manage your SSHFPs centrally
  - Manage your CERTs distributed
  - Manage your OpenPGP keys distributed
- Do not deliver poisoned data to clients
  - Validate late, validate centrally

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Further Consequences

- Current practice for Intranets
  - Build a separate network using site specific names and numbers
  - Provide application layer gateways, NAT, Split-DNS, and VPN for non-local access
  - Hide internal structure
  - Statically map necessary services (Firewall)
  - Provide local “root” services (Active Directory)

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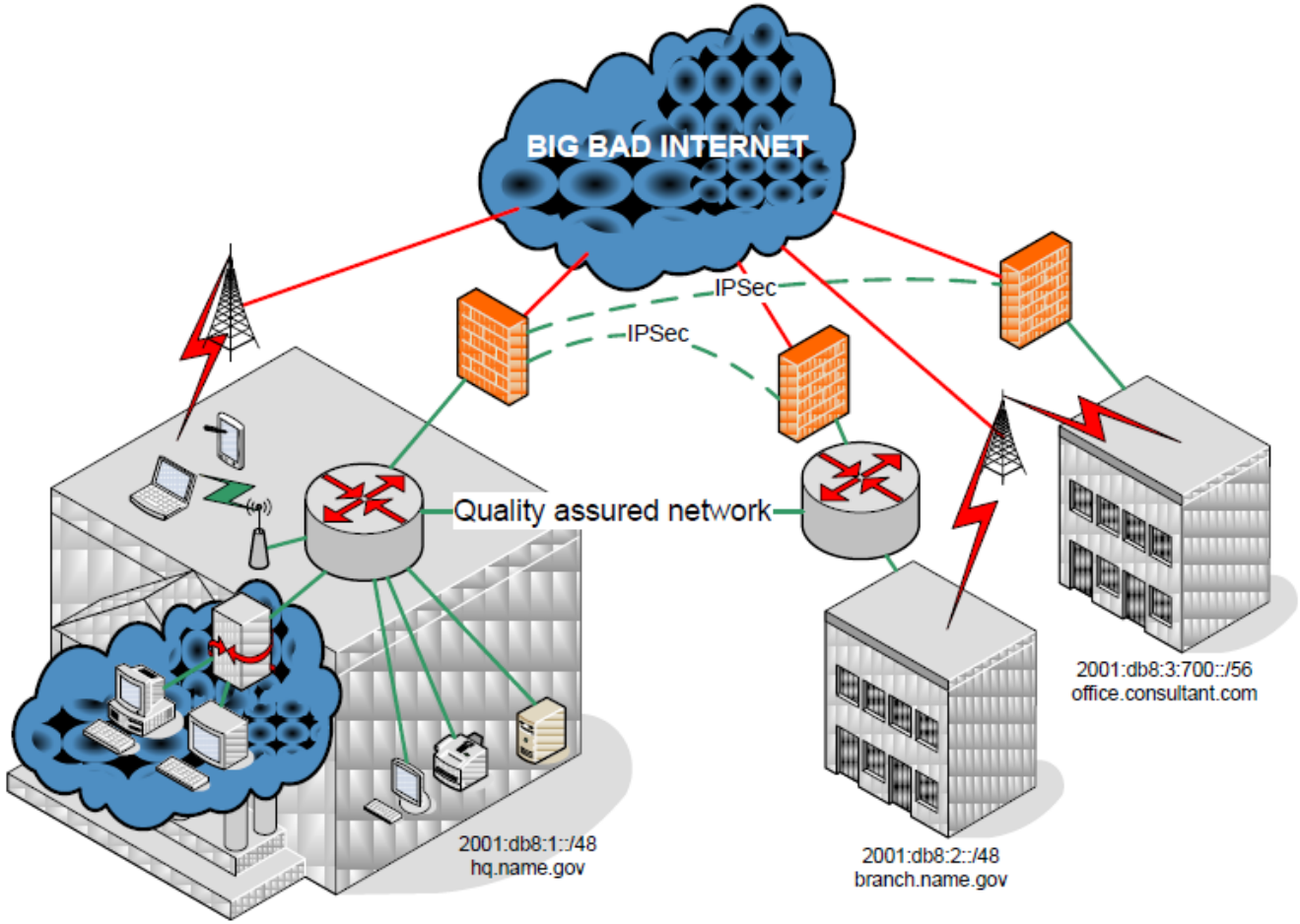
Current Intranets



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The IPv6 impact

- IPv6 provides **public, globally routable IPs**
  - Clients do IPv6 automatically (even tunnel)
- IPv6 provides **end-to-end communication**
- IPv6 is *not designed to be translated*
- Future protocols rely on **direct channels**
  - Web 2.0: Numerous bits from different servers
  - Client to client communication
  - Shortest routing for “quality enhancements”

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The DNSSEC impact

- Validation chain from a **well-known key**
  - Clients may have the key hardcoded
- Only **one root** possible
  - *No local names*
- Prevents rdata and NXDOMAIN rewriting
  - **Consistent** external and internal view
- Enterprise DNS rely on DNSSEC from everywhere (DirectAccess, SSH, _tcp …)

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The horrible mobile client

- Public mobile networks are everywhere
- Mobile clients
  - Important status symbols
  - Roam in and out quickly
  - Always on: Cloud services
  - **Can’t be configured**
- IPv6
  - Exposes internal DNS servers
  - Create mobile peer-to-peer networks

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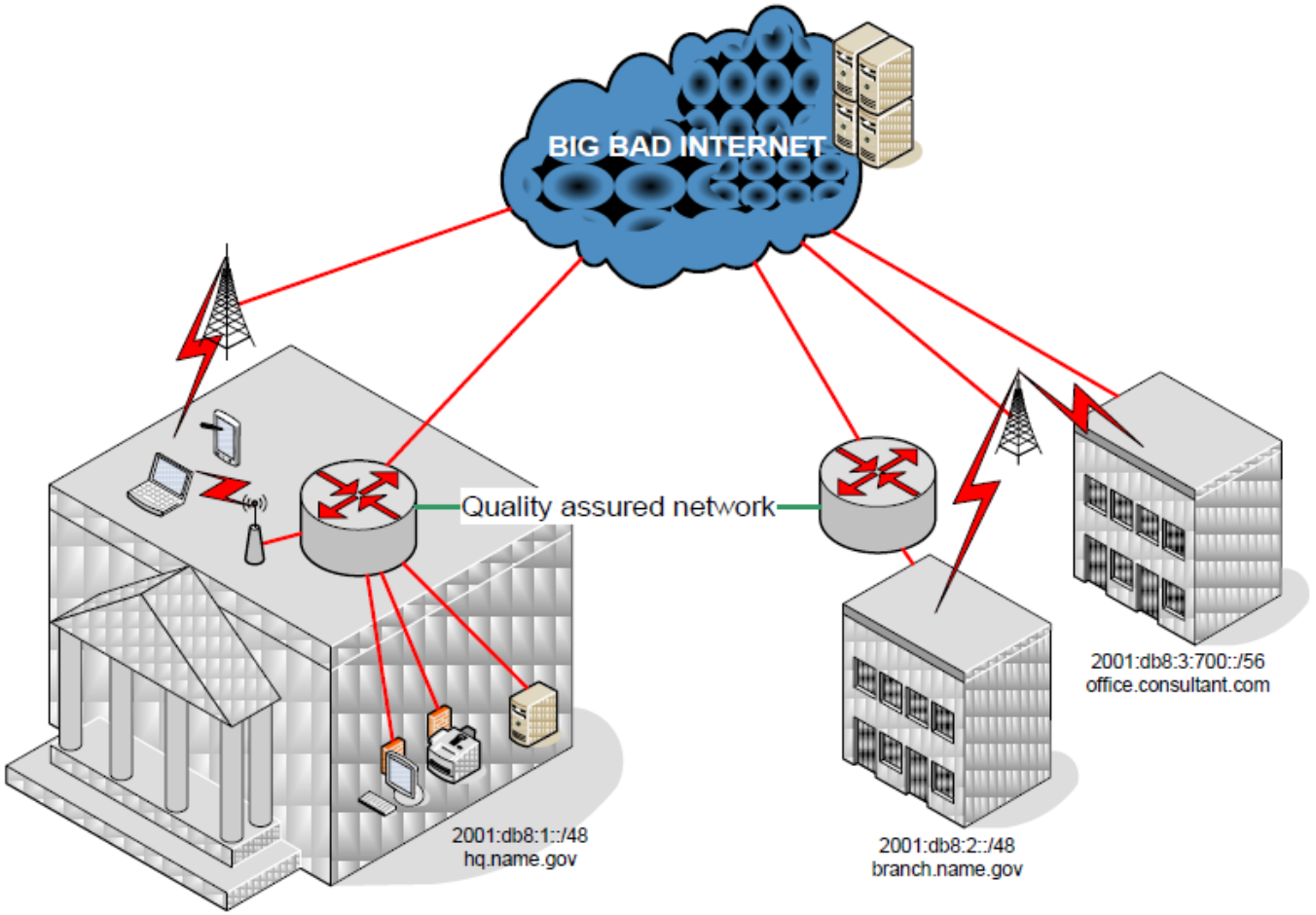
Future (Intra)Nets



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Modern intranets

- **Accept** consistency requirement
  - Local WLAN *and* mobile networks
  - REST web applications instead of VPN
- Secure the services, not the networks
- Secure the data, not the servers (cloud)
- Authenticate the user, not the computer
- Use DNS as trustworthy resource
- Always use direct communication

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Conclusion

- IPv6 and DNSSEC dramatically change the design of modern networks
  - Information hiding policies do not work
  - Centralized policy enforcement unusable
- Concentrate on benefits
  - Build stable, globally routable networks
  - Enforce data security at the data level
  - Trust the people, not the devices

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Did you sign your zones?

Why not?