

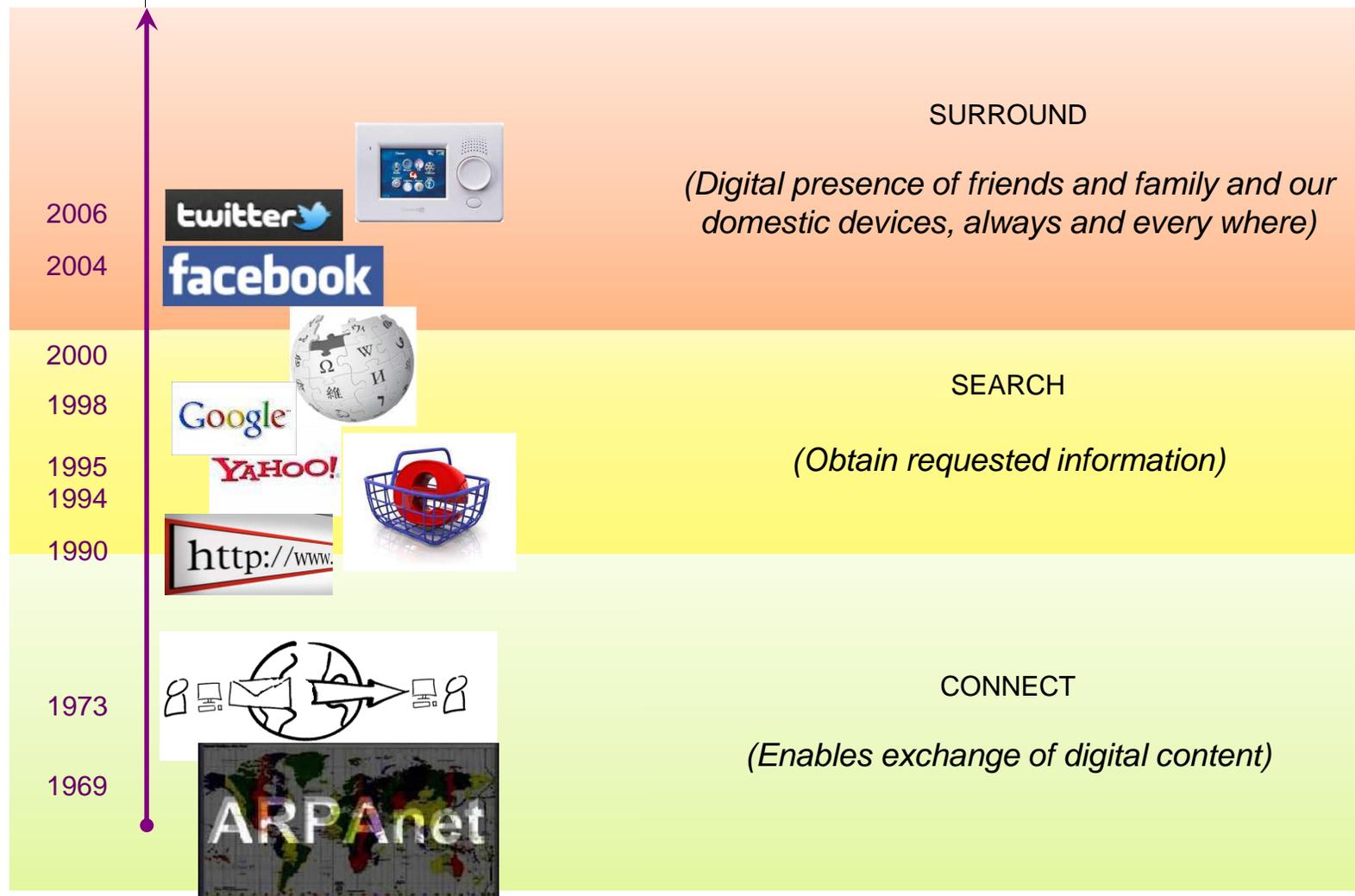
Building (inter)dependable ICT systems

Lessons learned from the DNS



MOTIA final meeting,
March 2012,
Bart Gijsen

Future internet: the “surround vision”



Interdependence is a good thing ...

- › It brings us wealth



- › Yes, it does pose some challenges ...

“Suppose ...”



How to build large scale, interdependable ICT systems?

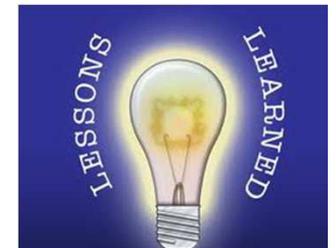
- › **Example: the Domain Name System (DNS) has been a “zero error” system for the past decades**



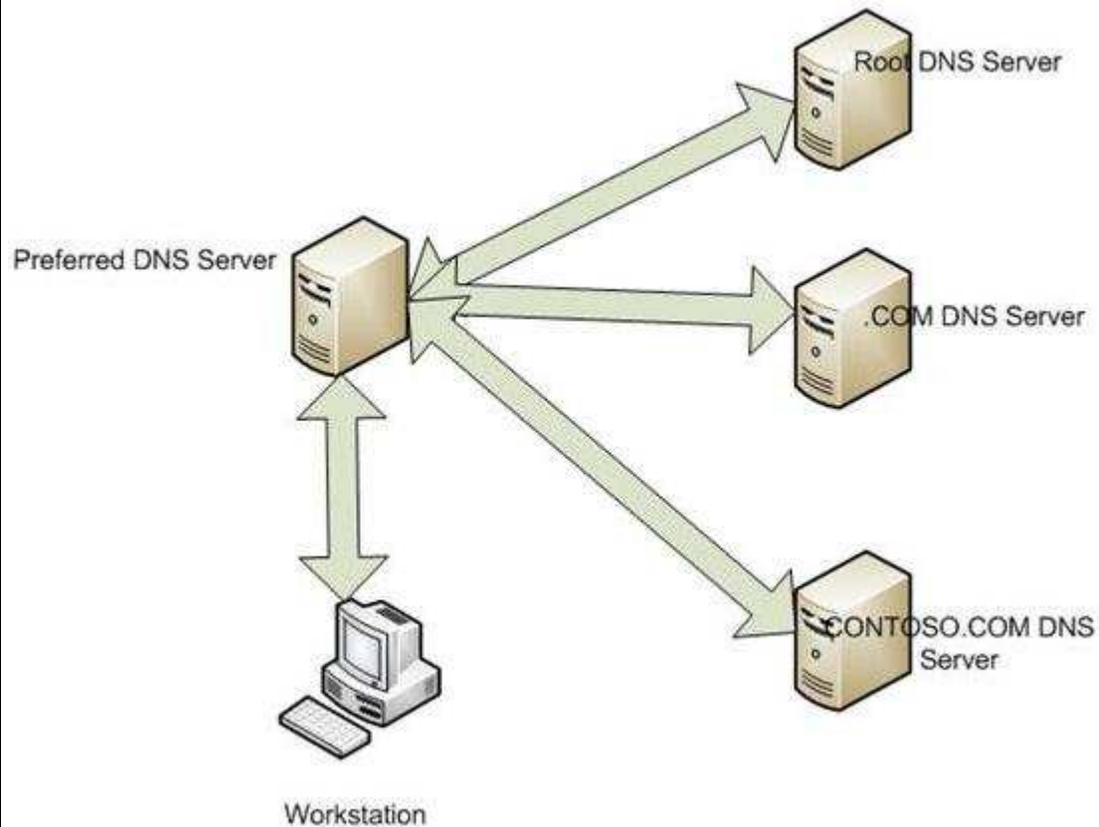
- › ***Use DNS lessons for inspiration, not for copying***

KISS principle

- › DNS functionality is very focussed
 - › '80s: Translating domain names and IP addresses
 - › Typically <512 Bytes long, standard format messages
 - › '90s: Translating domain names and IP addresses
 - › Typically <512 Bytes long, standard format messages
 - › '00s: Translating domain names and IP addresses
 - › Typically <512 Bytes long, standard format messages
 - › '10s: Translating domain names and IP addresses
- › '10s: added DNSSEC and new gTLD
 - › More >512 Bytes long, more dynamic msgs



Hierarchical, autonomous systems and organisations



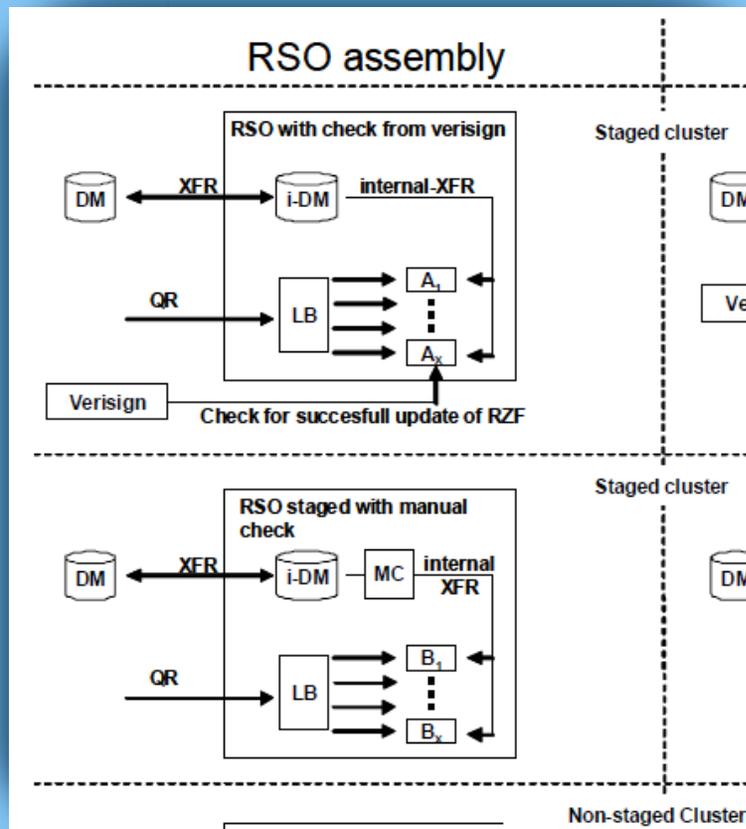
Diversity

From “Scaling the Root simulation model” (MOTIA alike)

Contributed by TNO in international team, commissioned by ICANN

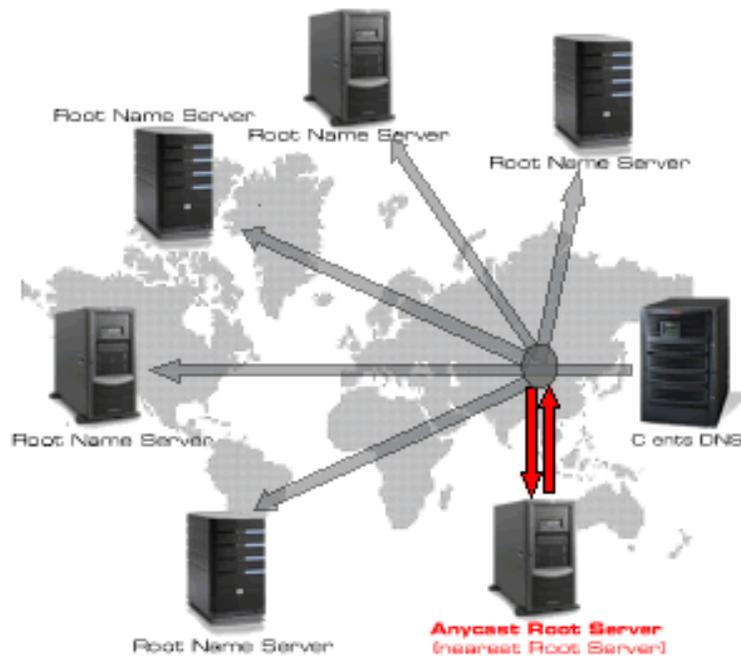


- 13 independent DNS root operators
- *coordination is kept to bear minimum: standardised interface, different implementation*



Anycast scalability

- › After the October 2002 DDOS attack at the DNS root anycasting was introduced
- › Proved to be highly effective when this ‘experiment’ was repeated in February 2007

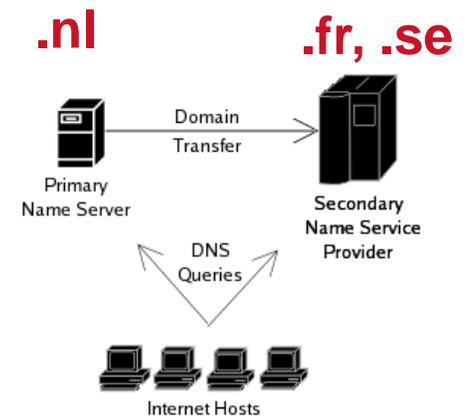


Cooperation: primary / secondary concept

- › Effective protection:
 - › *active-active redundancy*
 - › *reduces common-cause failures*
 - › *maintenance never impacts the entire zone availability ⇔ truly no spof*

- › Risk: inconsistency of data
 - › *availability prioritized over consistency*

- › Requires: cooperative parties



Technical resilience measures

- › DNS works at the grace of caching
 - › caching creates a (temporary) resilient survival system
 - › tremendous reduction of traffic to the top hierarchy (DNS root) => scalability
 - › ... but also: pollution by non-cachable requests: 98% of traffic at the Root is bogus
- › Requires semi-real-time nature of DNS data

Quantitative modelling and analysis via “DNS impact prediction model” (another MOTIA alike tool)

Contribution by TNO to DNS EASY workshop organised by GCSEC&ICANN



Summary

- › Interdependent ICT systems will bring us wealth
- › We need to learn how to build dependable, interdependent ICT systems
 - › *model-based, quantitative tools are essential for their assessment*
- › MOTIA and best practise examples show us the way

Do you need more proof?

This Saturday in all theatres:



Operation Global Black-out

Questions?

