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A Self-organising P2P-based Framework for Distributed Network Management

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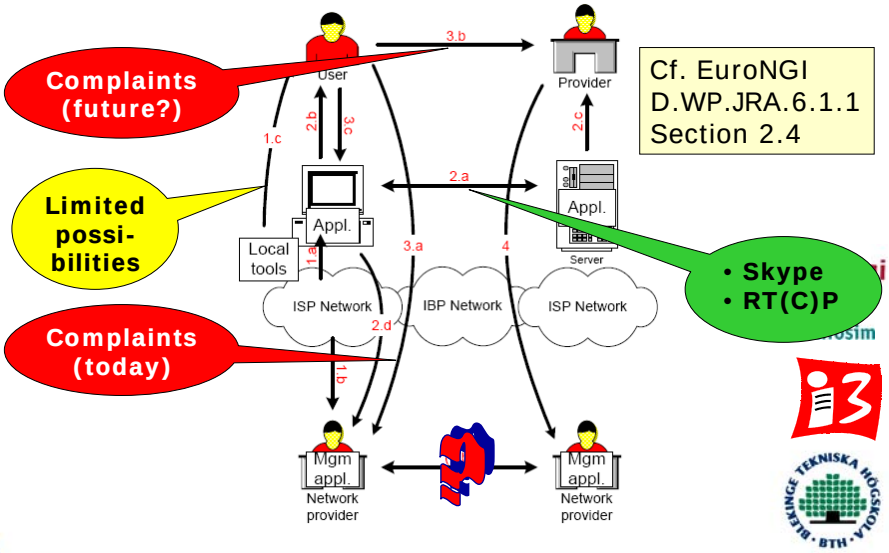
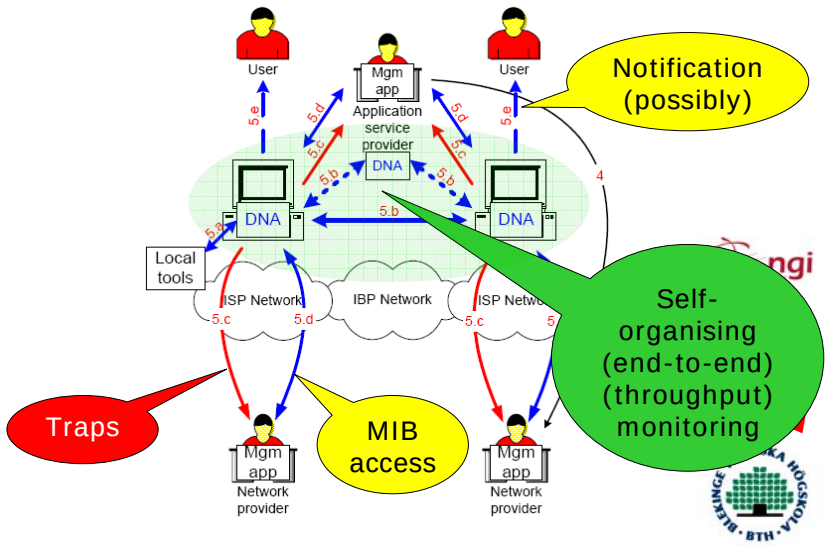
Typical Situation



Cf. EuroNGI D.WP.JRA.6.1.1 Section 2.4

The AutoMon Approach



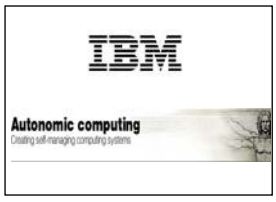
The AutoMon Project

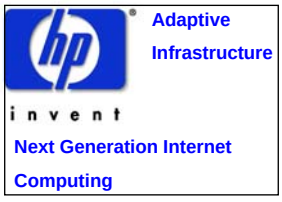
- Design and Evaluation of Distributed, Self-Organized QoS Monitoring for Autonomous Network Operation (http://www.informatik.uni-wuerzburg.de/staff/automon)
- Sponsored by the Network of Excellence EuroNGI (http://www.eurongi.org)
- Partners (and Prime Investigators)
  - Infosim GmbH & Co. KG, Würzburg (S. Köhler, M. Schmid)
  - University of Würzburg, Dept. of Distributed Systems (K. Tutschku, A. Binzenhöfer)
  - Blekinge Institute of Technology, Dept. Of Telecomm. Systems (M. Fiedler, S. Chevul)

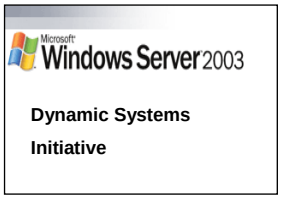
The AutoMon Concept

1. DNA = Distributed Network Agent
   - Self-organising
   - Prototype available
     - Network operations
     - Simulations
2. NUF = Network Utility Function
   - Quality evaluation:
     user impairment = f(network problems)
   - Focus on throughput (TUF)
3. QJudge = Demonstrator for
   - Quality evaluation (traffic-lights approach)
   - Feedback generation (traps)
   - MIB

Background: Autonomic Computing



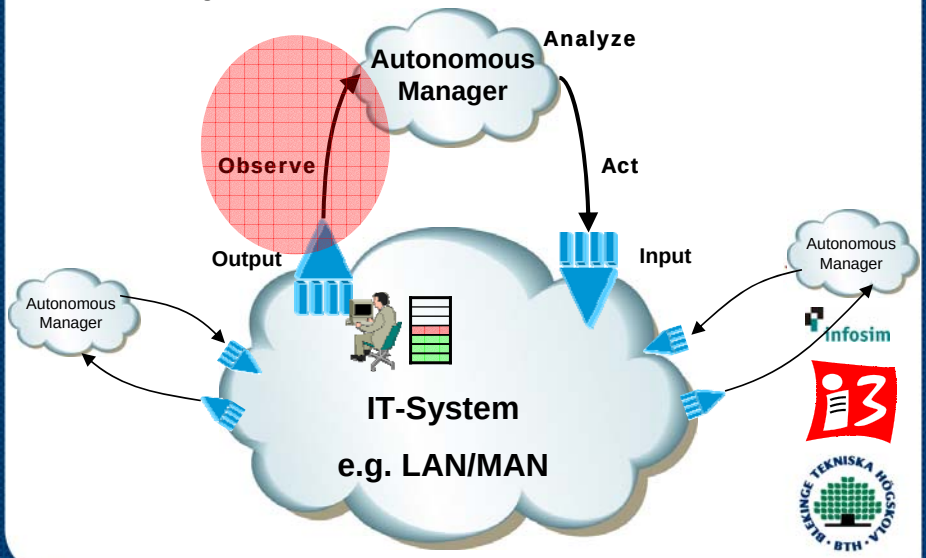




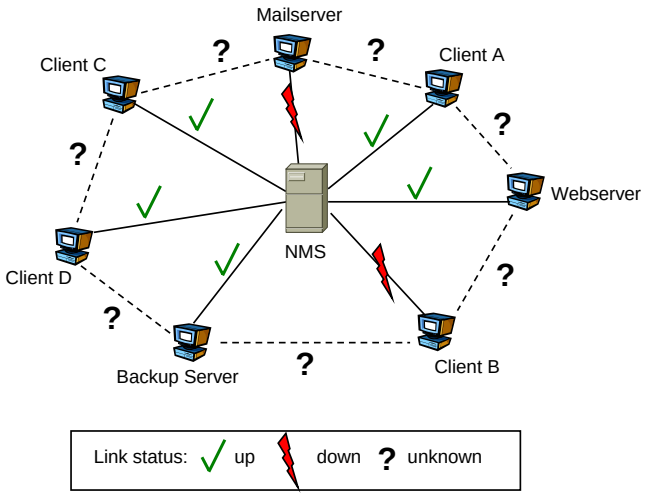
Numerous companies use different names for the same goal:

Autonomous and Self-Managed IT-Systems

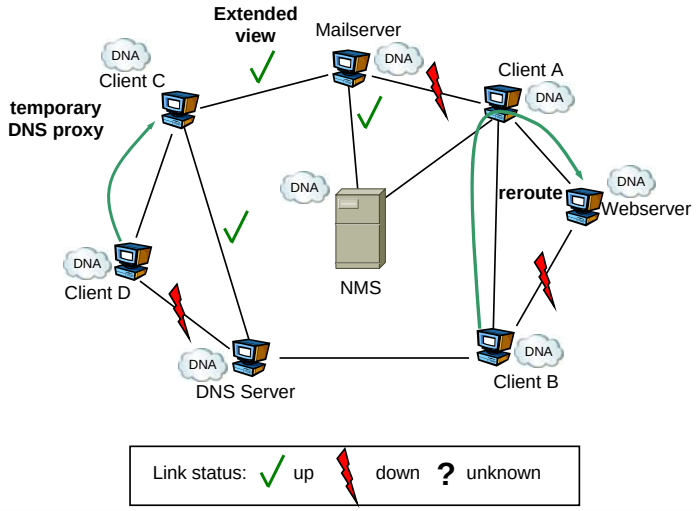
The Way To Autonomous Networks



Disadvantages of a Central Monitor Station

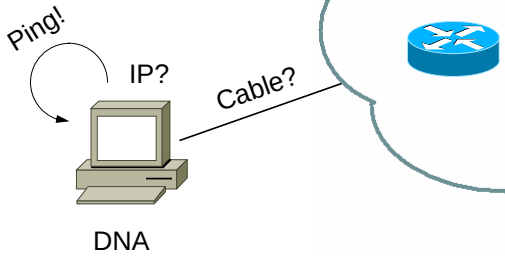


Advantages of Distributed Monitoring

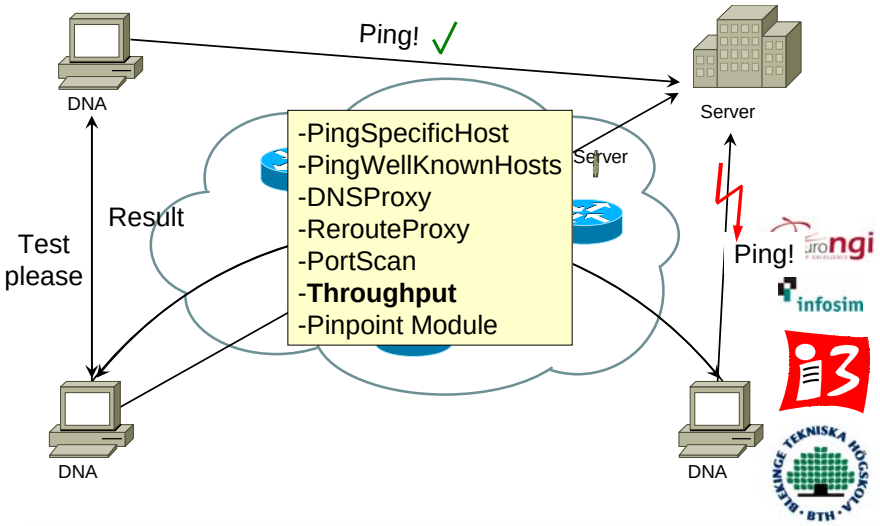


DNA Phase 1: Local Tests

- -NIC-Status
- -NetConnectionStatus
- -PingLocalHost
- -IPConfiguration
- -DNSConfiguration
- -DHCPLease
- -EventViewer
- -HostsAndLmHosts
- -RoutingTable
- -PingOwnIP
- -PingWellKnownHost

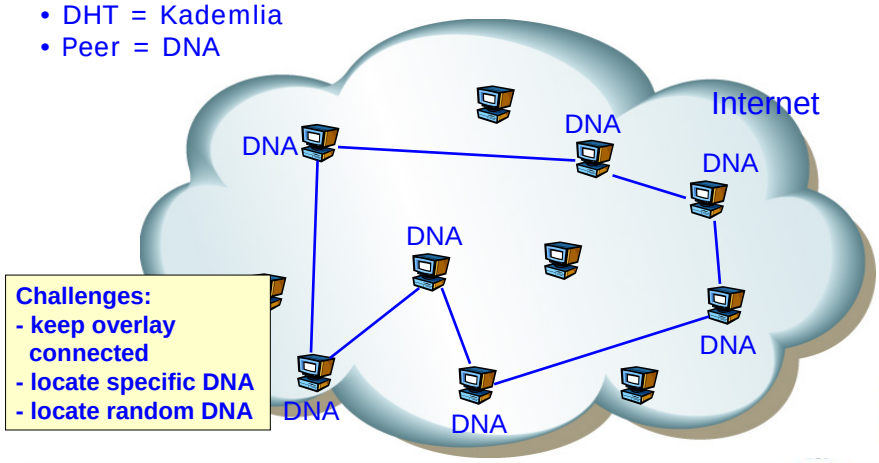


DNA Phase 2: Distributed Tests



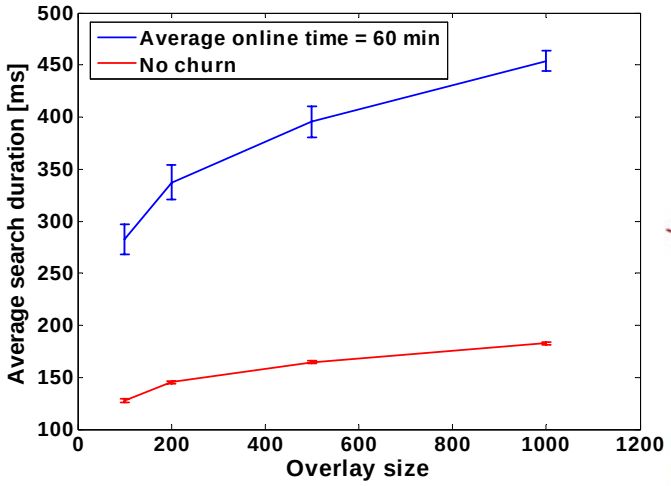
The DNA Overlay Network

Use of a P22-based overlay network
- DHT = Kademlia
- Peer = DNA

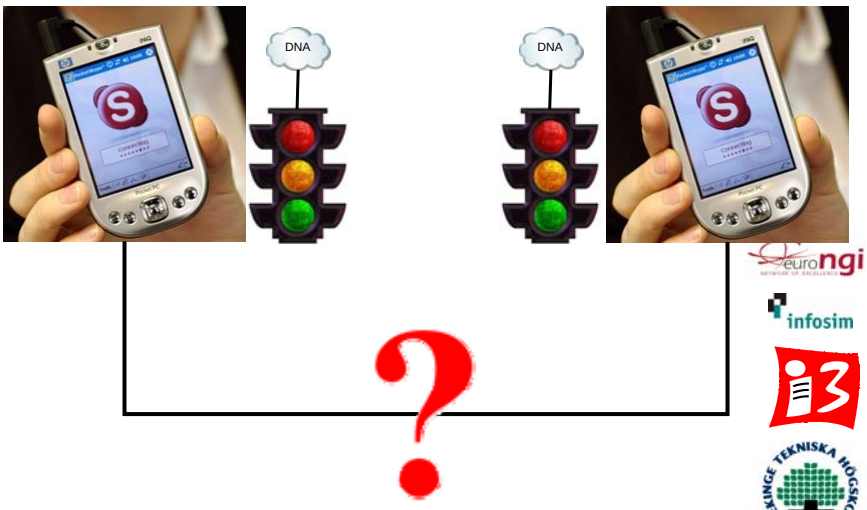


Challenges:
- keep overlay connected
- locate specific DNA
- locate random DNA

Scalability Results Using the DNA Prototype

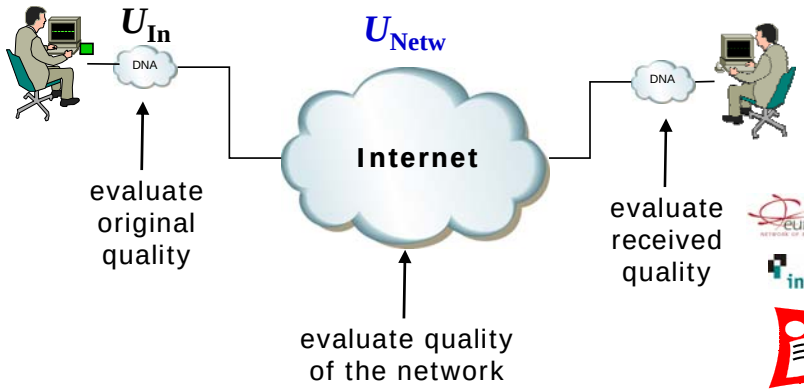


Evaluation of User-perceived VoIP Quality



Network Utility Function

$$U_{Out} = U_{Netw} \bullet U_{In}$$



Network Utility Function

$$U_{Out} = U_{Netw} \bullet U_{In}$$

- Range of U: 0 (worst) ... 100 % (best) – intuitive for
  - Users
  - Providers
  - Operators
- Captures performance-damping effect of the network
  - $U_{Netw} = 1 \Leftrightarrow$ network "transparent"
- Bad service perception ($U_{out} \rightarrow 0$) can have its roots in
  - Badly performing network ($U_{Netw} \rightarrow 0$)
  - Badly performing application ($U_{in} \rightarrow 0$)

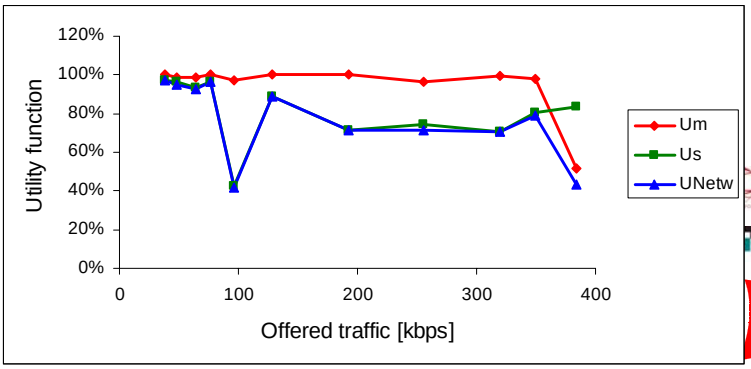
Throughput Utility Function

$$U_{Netw} = U_m \bullet U_s$$

- Basis: Throughput
  - on small time scales ΔT
  - during observation interval ΔW
- **m-utility function U_m:**
  captures impact of changes in traffic volume
  - Overdue traffic (← late or lost)
- **s-utility function U_s:**
  captures impact of changes in traffic burstiness
  - Shaping = reduction (← throttle)
  - Sharing = increase (← interfering traffic)

Current QJudge parameters:
$\Delta T = 1$ s, $\Delta W = 10$ s
$U_m = 1 - |1 - m^{out}/m^{in}|$


Example: TUF on UMTS Downlink




SNMP Interface

- Trap generation
  - Upon threshold crossing, e.g.
    - Green ⇔ Yellow
    - Yellow ⇔ Red

QJudge parameters for monitoring of Skype:

$U_{Netw} = U_m \geq 80\ \%$

$U_{Netw} = U_m \geq 50\ \%$

$U_{Netw} = U_m < 50\ \%$

- (Enterprise) MIB
  - Not yet designed
  - Cf. RMON history group
    - Statistics (m, s)?
    - Array with values?
    - Histograms

QJudge Demonstration

- 2 Laptops, each running QJudge and a UDP generator
- 10 Mbps half-duplex link
  → Measurement traffic towards shown QJudge (port 8002)
  ← Disturbing traffic (port 8004)

Thanks for your interest!

Q&A?