

# The Death of the Internet

## Threats to a now critical Infrastructure



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# Why Internet mustn't die

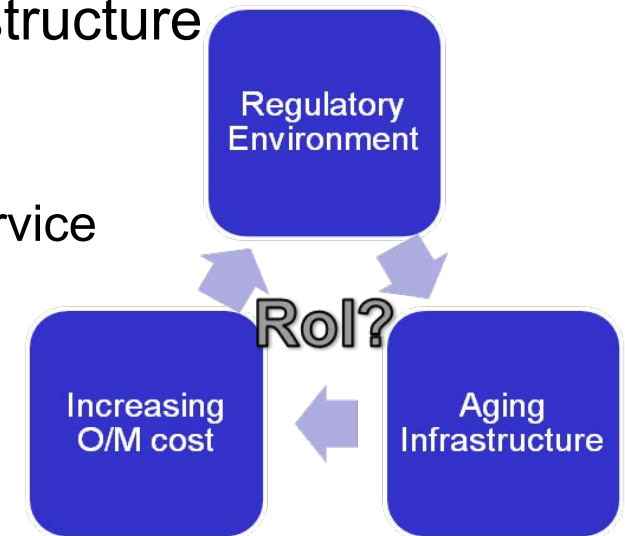


- ❖ The Internet has become **the** dominating communications platform for various reason including convergence and cost optimization
- ❖ Already today, and even more so tomorrow, it carries services which are critical for the world's economy and the society as a whole
  - ❖ Transport of mission critical data between e.g. banks or stock exchanges
  - ❖ E-commerce for both businesses and individuals from Salesforce to Amazon
  - ❖ Everyday communications (Telephony, Email), TV, Information (Google, Wikipedia etc.), social life (Facebook and other social networks) and more
    - ❖ In a recent survey issued by Bitkom young Germans between 14 and 29 rate the Internet and their cellphone higher in importance than their current partner
- ❖ Clearly we rely on the Internet. The question is, are there threads to the Internet which might lead to its collapse?

# Lack of Investment



- ❖ **Commoditisation**
  - ❖ The network infrastructure is becoming a commodity for an ever increasing fraction of society, increasing our reliance on it
- ❖ **No incentives to invest in upgrading this infrastructure**
  - ❖ Unfavorable regulatory landscape
    - ❖ Any upgrade has to be made available by the incumbents to the rest
  - ❖ Restricted possibilities to build a differentiated service offering by innovating the infrastructure
  - ❖ Uncertain outlook on RoI
  - ❖ Upgrades make no P-R
- ❖ **An over-aged infrastructure is an obstacle for innovation**
  - ❖ As with an old car, it will finally break beyond repair
  - ❖ Too hard to find replacements
  - ❖ Too hard to find the expertise to repair it



# Sudden Meltdown



## ❖ Current threads

- ❖ Too many open backdoors to control the IP infrastructure

- ❖ IPv4 is too patched to get the general picture

- ❖ Easy to implement threads: DDoS, trojans, etc.

- ❖ Accidental misconfiguration

- ❖ Pakistan's accidental hijacking of YouTube

- ❖ Recent BGP path prepending misconfiguration

- ❖ Economic and political quarrels

- ❖ Peering wars

- ❖ Net neutrality discussions



## ❖ Attacks on critical infrastructure bring everything to a halt

- ❖ E-government: Baltic countries in 2008, Cyber-army demonstrations, etc.

- ❖ Economic institutions: banks, stock exchanges

- ❖ Dow Jones depends on the Internet (Madoff put it there)

# Increasing Complexity

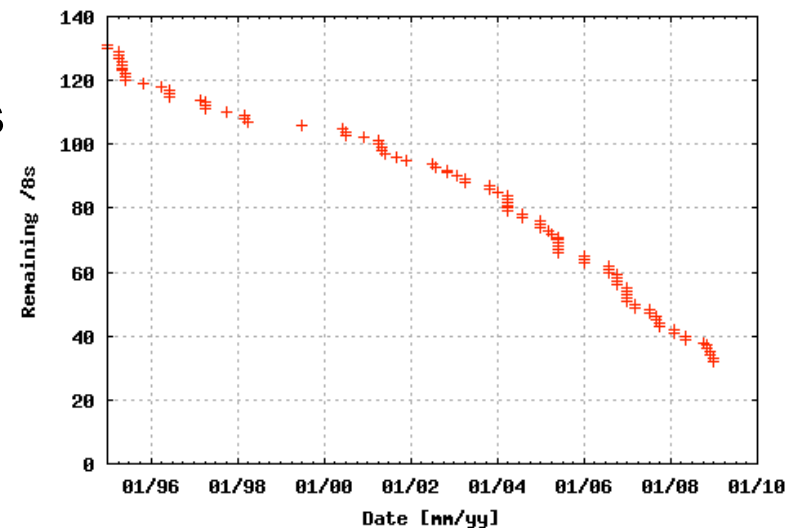


- ❖ Trying to cater for current and future requirements of the Internet may lead to:
  - ❖ A proliferation of coexisting incompatible protocol stacks
  - ❖ Deployment of a **plethora of ad-hoc solutions** to control E2E QoS in mobile ubiquitous environments
  - ❖ Emergence of independent sources **trying to control the network** (like the applications themselves)
  - ❖ Deployment of more and more **policies** without the appropriate mechanisms to have a clear view of the consequences and impact on all the affected resources and supported services
  - ❖ Allowing for complex negotiation and cooperation mechanisms between parties involved in service offering
- ❖ The attempt to address the **ever increasing number of requirements causes** the network to become **too complex to be properly managed** resulting in unpredictable behavior or even collapse

# Lack of Innovation



- ❖ Enduring growth rather than creating innovations to cope with it
  - ❖ E.g. BGP routing table growth and churn
  - ❖ Does Moore's Law solve the problem???
- ❖ Late realization for the need for innovation
  - ❖ IPv4 and 16bit AS number shortage
  - ❖ Last minute, ad hoc fixes breaking the architecture (again) with e.g. Carrier Grade NAT or A+P
    - ❖ Dealing with the consequences for the unforeseeable future
- ❖ Avoiding innovation
  - ❖ Due to IPR reasons
  - ❖ Due to shortsighted business decisions
  - ❖ Due to economic crisis
- ❖ Prevent innovation
  - ❖ Building e.g. walled gardens
  - ❖ Application Overlays (Skype, ...)
- ❖ Innovation asymmetry
  - ❖ Access technology speed increase surpassing speeds at the core of the Net



IPv4 address depletion

# The Death of the Internet



- ❖ Commonalities between scenarios
  - ❖ High dependance on the Internet
  - ❖ It runs, so why fix it?
  - ❖ And when it doesn't, a cheap fix will make it run again (history *does* repeat itself)
  - ❖ Latent problems start to appear jointly and a domino effect might result in heavy disruptions of the Internet (Similar to what has happened with the current economic crisis)
- ❖ What is needed?
  - ❖ Create incentives to improve, invest and innovate
    - ❖ E.g. a innovation friendly regulatory environment
  - ❖ Educate
    - ❖ Decision makers need to look past a 6 month budget horizon
  - ❖ Research
    - ❖ Foster research activities that lead to solutions for current and emerging difficiencies that might lead to the death of the Internet

# The End of the Internet

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