



**Position Statement for Panel:
“Future Internet visions and
their impact on Network Management“**

**Evolution happens around IP,
while IP stays almost as it is**

Georg Carle
TU München
carle@in.tum.de

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Introduction

- Panel Invitation
 - a) replacement of the current Internet with a 'clean slate' design
 - b) many parallel / federated Internets instead of a single one
 - c) evolution happens on the content layer, the core stays almost as it is
- My answer
 - d) evolution happens around IP, while IP stays almost as it is
 - i.e. there may be innovation in the core of the network, but possibly above IP (by proxies / firewalls / servers) or below IP (e.g. all optical networks interconnected with other networks)
- My attempt of reporting on a Workshop at 17 June 2008 on Future Internet Activities by the German GI/ITG specialists group on Communications and Distributed Systems



Outline

- ❑ Requirements for the Internet in the Future
- ❑ The Future Internet
- ❑ Arguments for Developing a new Internet Protocol
- ❑ Problems and Solutions
- ❑ Assessment
- ❑ Topics for Further Research



Requirements for the Internet in the Future

- Please note: this is not: “requirements for the future Internet”
- What are the real needs?
 - Being able to build fast routers
 - Having routing protocols that allow operation of a stable internet
 - Having a flexible architecture that allows for functional extensions at the appropriate layer
 - Being able to add many many more additional nodes
- Which services do we need from IP?
 - Interconnection of networks with heterogenous network technology
 - Best effort delivery service to destination address
 - Restoration in case of failure
- Which additional services do some people expect from IP?
 - QoS (note: we have solutions for it, but not many willing to pay for it)
 - ...
- Do we have reasons to change IP?



Future Internet Hype

- Keywords in Future Internet work
 - Reinvent IP
 - Green Field / Clean Slate approach
 - Disintegrate the protocol stack, and allow (almost arbitrary) composition of protocol mechanisms

- If we have to decide about a replacement of the current Internet, we could ask about why to do it.
Possible reasons:
 - Because we can.
 - Because the architecture becomes more beautiful.
(We could apply this argument to many existing buildings. However, only few of them get rebuilt for that reason.)
 - Because we get research money for working on doing it.
 - Because PhD students can write papers about how it possibly can be done.



Arguments for Developing a new Internet Protocol

- Good reasons would be:
 - because there is an economically viable business case behind it.
(I very much doubt about it.)
 - because it will become an enabler of new applications ("killer apps") we cannot build without it.
(I cannot see how this is true.)
 - what else...?

- ⇒ Who sees a really good reason why we need to replace IP by a new Internet Protocol?



Problems and Solutions

- Addresses
 - for the Internet of things, use either IPv4 + NAT or IPv6
 - Security
 - We do not need to change IP, but rather to extend different protocols by Authentication, Authorisation and Accounting, including cryptographic node identifiers (c.f. HIP)
 - Resilience
 - Solve it ***around*** IP, but do not change IP
 - Mobility
 - Can be solved above IP, and below IP
 - Support mobility on the application layer, combined with DHCP etc.
 - Routing table growth
 - Adequate address management (c.f. IPv6)
 - Technological progress
- ⇒ My claim: solving these problems does not require to replace IP



Assessment

- Personal assessment
 - Mismatch of needs and new ideas
 - Of course it is fashionable to talk about a "green field" / "clean slate" approach
- The alternative
 - Do it the "hard" way
 - Develop improved mechanisms
 - Integrate them in suitable (existing) Internet protocols, thereby developing new versions of these protocols
 - Publish open-source implementations of these improved protocols
 - Standardize them in IETF
- My suggestion
 - Prioritize problems
 - Address the real needs first
 - Develop solutions that work with IPv4/IPv6
 - Then see whether these solutions cannot work in a Future Internet



Conclusion - Topics for Further Research

- Network Resilience
 - Routing protocols with faster convergence
 - Security
 - Authentication, Authorisation and Accounting at many levels
 - Introduce useful mechanisms above IP
 - e.g. network-level peer-to-peer support
 - Improve signalling
 - e.g., Next Generation SIP
 - NAT evolution
 - Future NAT techniques and NAT traversal techniques
 - Development of NAT-tolerant protocols
 - Improved IPv4/IPv6 co-existence
- ⇒ Suggestion: work on real problems without replacing IP