5G AND THE EVOLUTION OF INTERNET PROTOCOLS

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OUTLINE

- 5G has an impact on the Internet? Or Internet evolution has an impact on 5G?
- Examples of ongoing evolution of the Internet
- What makes for a successful protocol?
- Working with and in the IETF
ONGOING EVOLUTION

Some areas of active Internet evolution
ONGOING EVOLUTION

• Web protocol stack (HTTP2, QUIC)
• Security and privacy (increasing TLS usage, IETF developments)
• Real-time communications from browsers (WebRTC)
• Management, orchestration, virtualisation, software- and data-model driven networking (NVO, SFC, YANG, SDN)
• Latency improvements
• Internet of Things
• Running code and open source
OBSERVATIONS ON THE FAST PACE OF EVOLUTION

• Why? We needed all those things... and everything runs on the web today; but market & traffic consolidation also played a role
• Prediction: Big shifts so far, even bigger ahead
• Functionality moves to applications & browsers, even faster change ahead! What’s next?
• At the same time, virtualization and SDN are driving another quick change in networks
• 5G needs to embrace these changes (and has)
OTHER NOTABLE TRENDS

• Smart objects shifting from closed, vertical solutions to more general networking solutions (mobile networks & WLAN, Internet)
  • New challenges found on higher layers (security, semantic interoperability)

• Low latency as a cross-cutting issue in many developments

• Open source development & working methods; effect on standards?
WHAT MAKES FOR A SUCCESSFUL PROTOCOL?
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• Why think about this?
• So many technology developments never get widely deployed, or even used at all
• Yet some are wildly successful
• RFC 5218 (Thaler & Aboba)
• I’m sure we all also have personal experiences
THE ADVICE

Important initially
- Very positive net value
- Incremental deployability
- Availability of code, specs

Less important initially
- Technical design
- Maintenance

Important for wild success
- Extensibility
- No hard scalability limits
- Good enough security
EXAMPLES

- Wild successes: IP, Web, ...
- How about IPv6? Lessons?
- Failures: many
  - E.g., why did Mobile IP fail? Market squeezed from two sides, link layers started hiding (most) movements; apps learned to not care about address changes
  - Many QoS designs failed. Lessons?
WORKING IN OR WITH THE IETF
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- You are not alone: lot of related work at the IETF: transport evolution, identifier-based designs + more
- Simplicity of clean slate is seductive, but historically, change is evolutionary; deployment and co-existence strategies are as important as the protocol designs
- IETF will happily work with others; bring problems!
- Early!
- Real world issues from operators much appreciated & debated from multiple angles
- See also https://datatracker.ietf.org/liaison/1502/
CONCLUSIONS
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• Take note of the changing traffic patterns; 5G needs to match tomorrow’s traffic
• Trend for more encryption will continue, and will affect work for many network optimizations
• Note past failures with designs that assume large-scale coordination (e.g., QoS) or flag days
• Not everything will fly. Do others want to play?
• Problems appreciated at the IETF, bring them! Early!
• What can we all do to help make 5G an innovation engine and speed up evolution in the network?
THANK YOU!