Directions for COIN
draft-kutscher-coinrg-dir-02

Dirk Kutscher, Jörg Ott, Teemu Kärkkäinen

19 November 2020 – IRTF COINRG

Intention

- What does in-network really mean?
  - Exploring numerous (present and future) options

- Some thoughts on computing
  - Looking at code and its provisioning, execution, etc.

- What could/should COIN look at?

This Draft

Different types of in-network computing systems

Examples: CFN-ICN & Akka

Terminology

Research Challenges

Characterizing Computing in the Network vs. Packet Processing & Networked Computing

Status update

- Accepted as RG item
- Received feedback by Xavier (THANKS!)
- Had additionals rounds of discussions with co-authors and collaborators
- Currently working with application developers on new use cases (beyond Data Center and MEC)

Feedback and Relevant Questions

- Editorial comments and terminology clarification
- The extent and relevance of packet processing
- Discovery aspects in research challenges

- Who is the user?
  - Already discussed source of code (user vs. service provider)
    - Instantiator may or may not be distinct from user
  - Add more discussion of who invokes in-network compute functions
    - "Foreground" operation: End user (human, device, …) vs. other (in-network) function
    - "Background" operation: daemon, cron job, service

- Related: lifetime / lifecycle of in-network compute functions?
- Result provenance?
  - Usability of intermediate results across versions?
- Impact of Mobility?

Computing in the Network vs. In-Network Computing

- Not (just) about integrating computing in the "capital I" Internet
- Not as an alternative to present cloud architectures

- Rather: applying Internet principle to distributed computing
  - But also employing distributed computing principles for overall system design
- And then building solutions for different environments (on similar principles?)
- Not necessarily constrained by TCP/IP limitations…

- Think also about exploring domain-specific solutions
  - E.g., Industrial IoT use case, …

Authors' View

(not explicitly pronounced in draft yet)

- **Computing in the Network: More than just forwarding packets to nodes that happen host VMs or processes**
  - Can be done today with various tools
- **Embrace the idea of supporting distributed computing by leveraging networking concepts and mechanisms**
  - Instead of building better pipes between processes
- **Enhancing TCP to support in-network computing not promising**
  - e2e (stream) model in conflict with hop-by-hop processing
  - Could possibly do better by rethinking requirements fundamentally
  - Security model unclear
  - Not sure a Research Group should fiddle with TCP

Future Additions

- More use cases?
  - especially divert from classic cloud / edge scenarios
  - reference the use cases draft

- Beefing up related work towards diversity – in progress

- Some form of taxonomy to aid discussion in COINRG?

- Outline and structure the space that COIN work considers/addresses?

- Overall goal remains:
  help us understand problem – not so much prescribing solutions

- One size unlikely fits all – call for broad exploration

Acknowledgments

PICCOLO

www.piccolo-project.org

Federal Ministry for Economic Affairs and Energy

Deutsches Zentrum für Luft- und Raumfahrt
DLR German Aerospace Center