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

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31 July 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?

What does "in-network" really mean?

Lots of Computing "in the Network" Today

- SmartNICs

- Web servers

- CDNs

- Cloud platforms

- Note: Some forms of „Edge Computing" are merely about extending the cloud computing concept to specific hosts at the edge

- These approaches are applied (more or less) successfully today and do not need COIN research…
  - …but there is lots of engineering to be done in the IETF

Computing in the Network

- Do not require fixed locations of data and computation

- Can lay out processing graphs flexibly – meeting requirements optimally

  - Sometimes we can move functions (to be close to large data assets)

  - Sometimes we gradually move data where it is needed (e.g., where specific computations run)

- Conditions may change dynamically and constantly: network to adapt to application requirements, network conditions etc.

- Optimization based on application requirements & view of all relevant resources
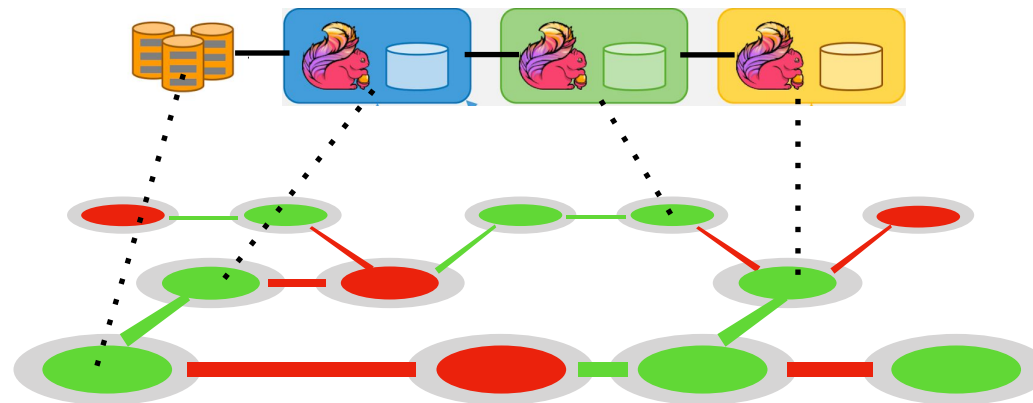
This Draft

Different types of in-network computing systems

Examples: CFN-ICN & Akka

Terminology

Research Challenges

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

Version 02 Updates

- New example: Akka toolkit
  - Example of a widely used actor-based toolkit

- New research challenge: coordination
  - For services such as configuration management, service discovery, application state management and consensus building
  - Fundamental mechanisms well understood
  - But important aspect in most systems -- should be kept in mind

- Added references, misc. fixes

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

Suggestions for COIN

- Develop good understanding about different approaches, schools of thought
  - Unlikely there is only correct way…
- Develop criteria and taxonomy to discuss different
  - key concepts
  - use cases
  - ways of implementing typical features
- Possible research contribution
  - Understanding where new research is needed
  - Identifying possible commonalities and orthogonal approaches

Next Steps for the Draft

- Document more representative use cases
- Beef up related work towards diversity
  - Delineate from possibly related areas: edge computing, PEPs, …
  - Architectural work: NFN, + 2–3 more
  - Examples for joint resource management work
- Mention segment routing as another packet steering technology
- Some form of taxonomy to aid discussion in COINRG
- Outline and structure the space that COIN work considers/addresses
- Overall goal: help us understand problem – not so much prescribing solutions

Questions to Group and Chairs

- Future of this draft?
- Useful enough basis for framing scope and directions?