Data center resource management for in-network processing

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Outline

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3. FIXME Requirements? It is necessary?
4. Design
5. Conclusions

Introduction

Introduction

- (NetCache introduction: "modern Internet services, such as search, social networking and e-commerce, critically depend on high-performance key-value stores. Rendering even a single web page often requires hundreds or even thousands of storage accesses." [2]
- need to scale up (SHArP introduction, *justifying INP*: "As the number of compute elements grows, and the need to expose and utilize higher levels of parallelism grows, it is essential to reconsider system architectures, and focus on developing architectures that lend themselves better to providing extreme-scale simulation capabilities.") [1]
- However, modern-day data centers only exploit servers to perform computation

In-Network Processing (INP)

- Offloading computation to network devices (e.g., programmable switches, network accelerators, middleboxes, etc.), hence reducing load on servers
- (Daiet introduction: "The functionality of networks can now be enriched without hardware changes while retaining the capability of processing packets at very high rates, even above Terabits per second") [4]
- Few solutions out there already: Daiet [4], SHArP [1], NetChain [2], IncBricks [3]

Problem statement

- there is no Resource Manager (RM) that considering server and switch resources **conjunctly**...

Goals

(abstract)

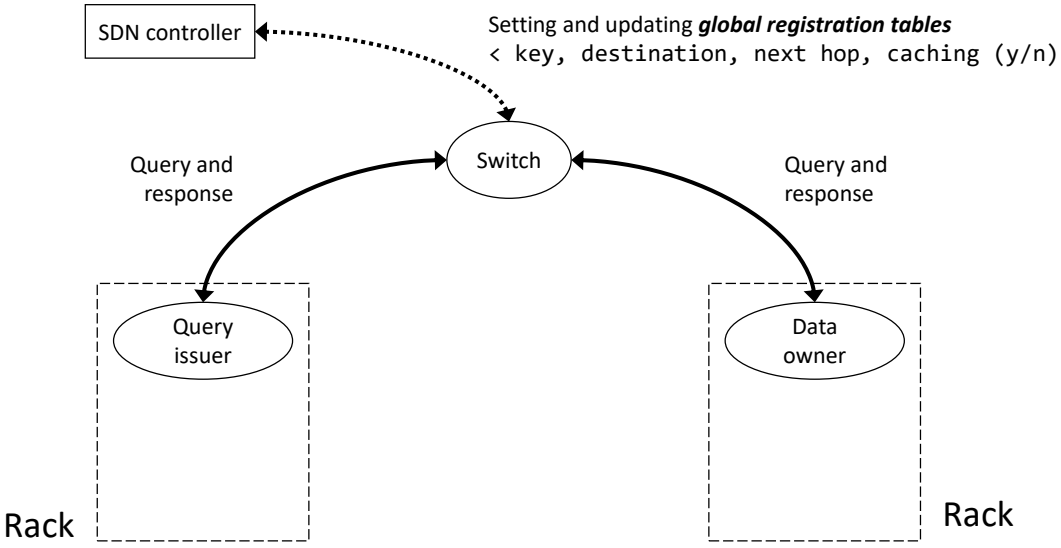
1. Model and evaluate an API through which applications can ask for INP resources
2. Discuss the importance of a scheduler which can reject INP requests and propose their server-only equivalent when needed (e.g., high switch utilization)

Analysis

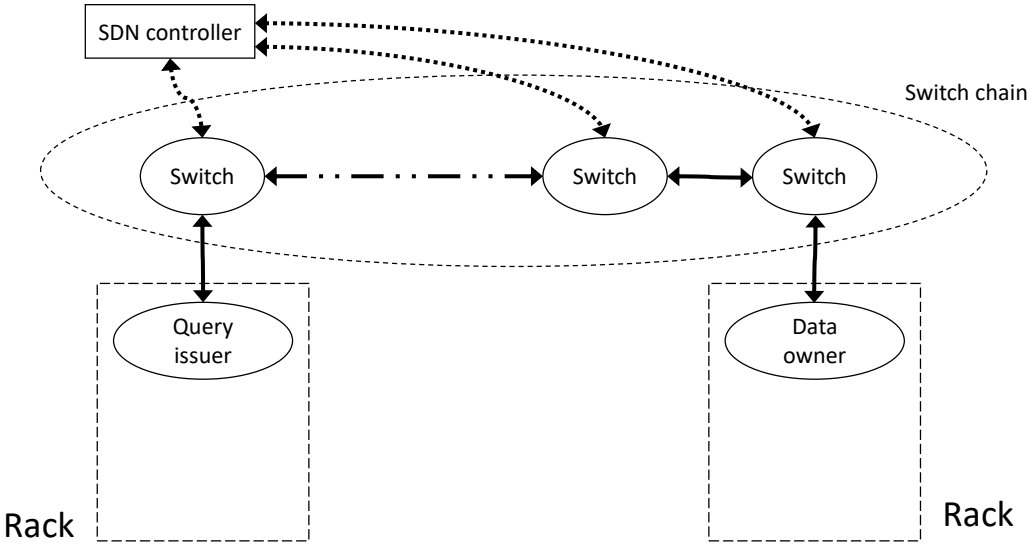
Currently existing In-Network Processing (INP) solutions

- In-network **storage**
  - Switches must
    - dedicate part of their local memory to store a distributed map
    - form a chain
  - IncBricks [3], NetChain [2]
- In-network **data aggregation**
  - Switches must
    - form a tree whose root is connected to data consumers and whose leaves are connected to data producers
    - dedicate part of their local memory to store a key-value map
    - be able to perform basic operations on data, such as writing and hashing
    - wait for all its children to send aggregated data
  - Daiet [4], SHArP [1]

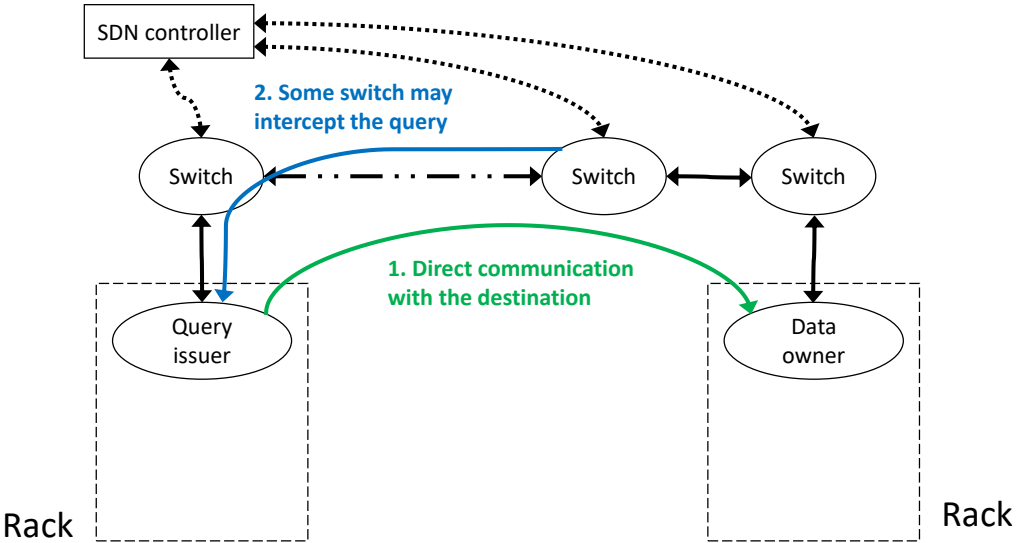
In-network caching system: IncBricks



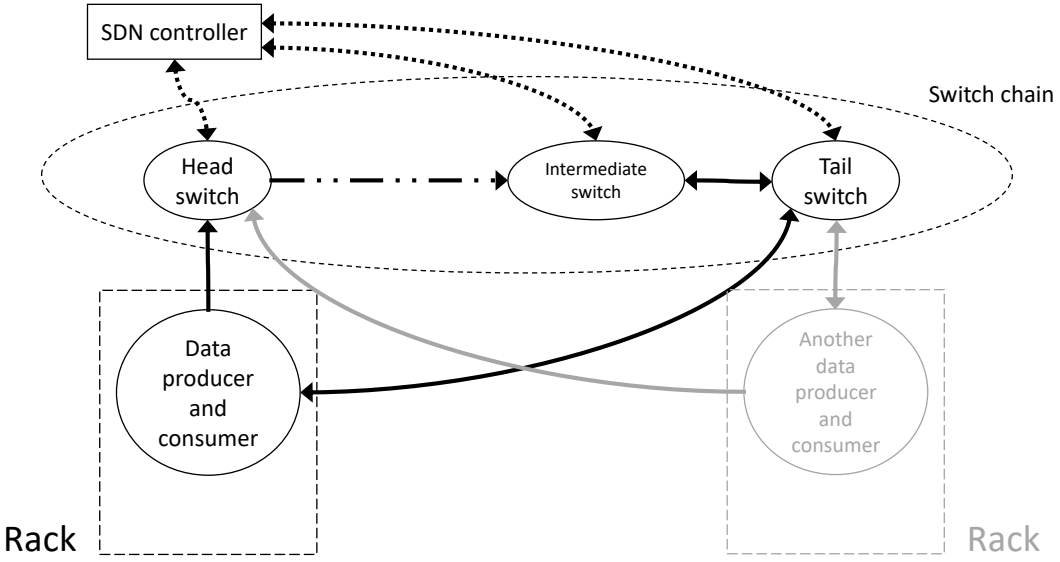
In-network caching system: IncBricks



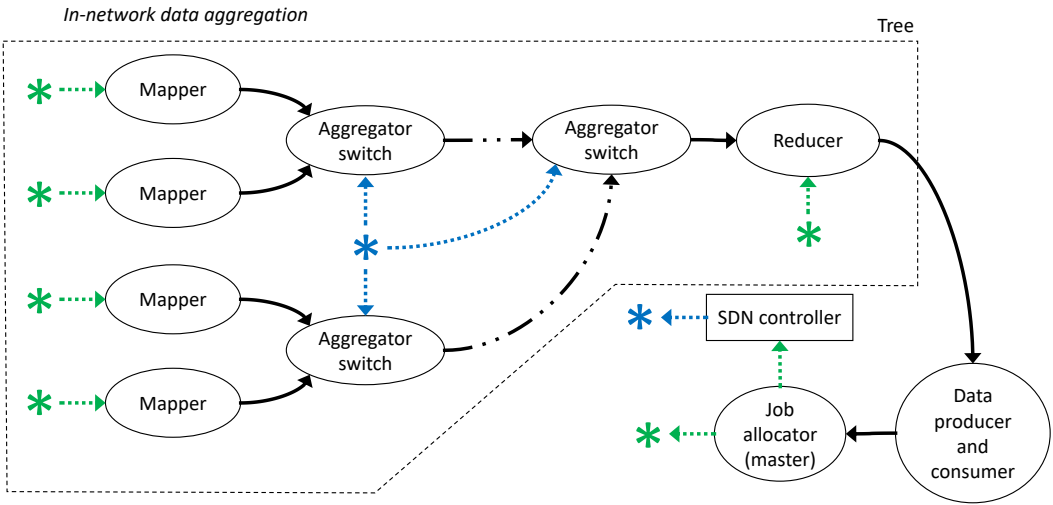
In-network caching system: IncBricks



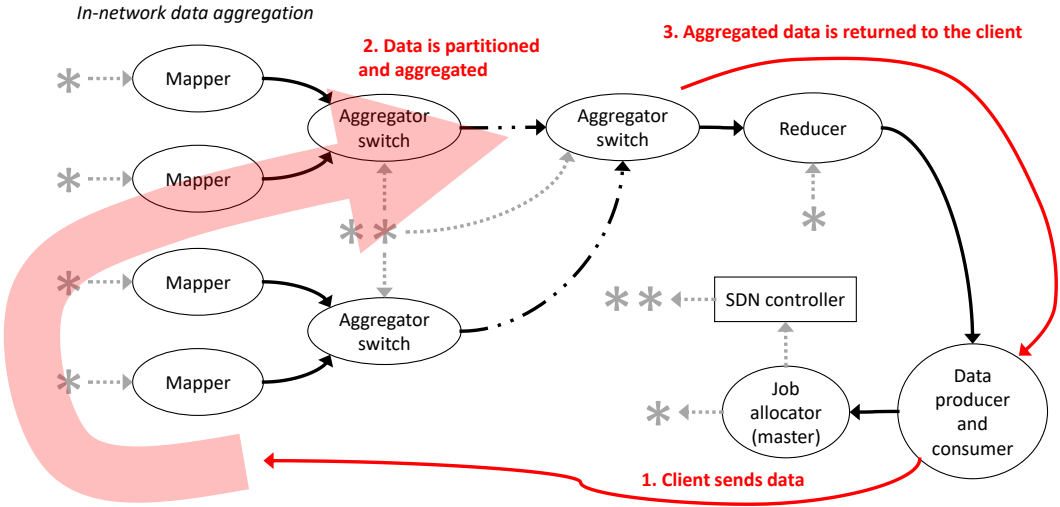
Coordination services: NetChain



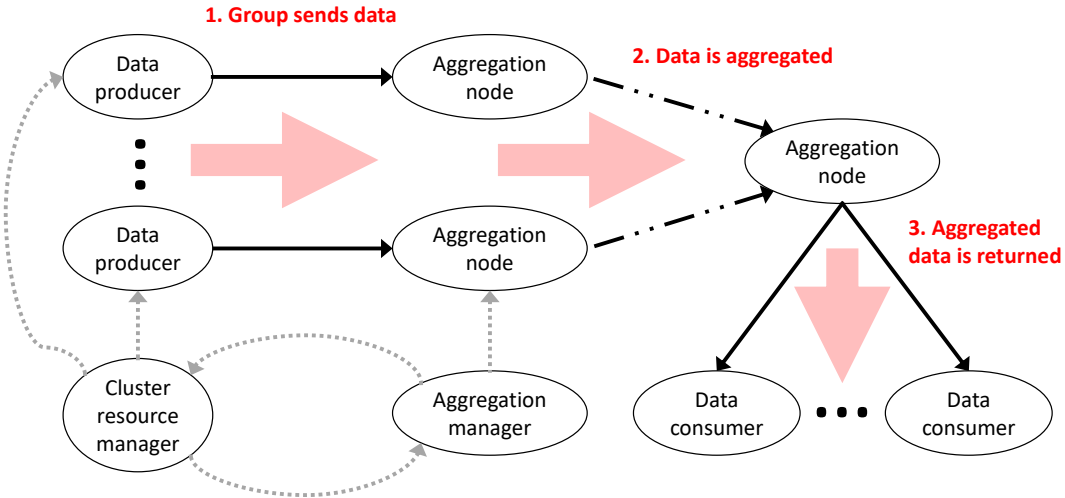
In-network aggregation: Daiet



In-network aggregation: Daiet

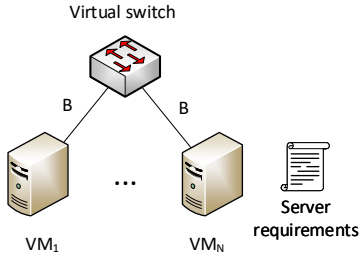


Aggregation protocol: SHArP

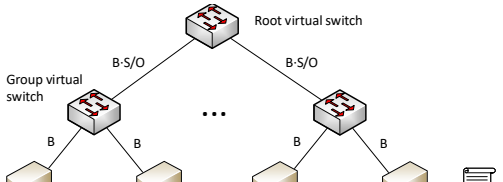


Resource models (3.4)

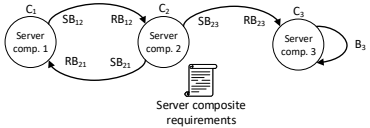
- Virtual Cluster (VC)



- Virtual Oversubscribed Cluster (VOC)



- Tenant Application Graph (TAG)



- Fine-grained resource requests
- High-level goals

Intregrating INP resources in RMs

(3.3)

FIXME: the only “network-aware” RM + its problems

(3.3.2)

FIXME Requirements? It is necessary?

Design

Composites

(Thesis repository `dock/thesis/figures/design/model/presentation.pdf`)

The extended-Tenant Application Graph (eTag)

- (5.2.1 why existing resource models do not satisfy all requirements)
- (5.2.2 eTag)

The template database

- (5.3 generic groups)
- (5.1.2 template database role)(5.1.2 template database role)

FIXME I should introduce composites earlier

Bibliography

Some references to showcase [allowframebreaks] [2, 3, 4, 1]

Conclusions

Questions?

Thank you

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