Course Projects

CS219, Spring 2012

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Note: internal reports cited in the references are available upon requests

Topic List

- data center networking
  1. Reconfigurable data centers via wireless links
  2. Monitoring tool for data centers
  3. Anycast support in data centers
  4. Energy saving for large data centers using MDCs
  5. Optical data centers for many-to-one & one-to-many communications
  6. NDN over data centers 1: Leveraging runtime computation results
  7. NDN over DC 2: improve stateful date forwarding
- cloud computing services and applications
  8. Secure content sharing
  9. Balancing consistency and availability in social network sharing among smartphone devices
  10. Mobile search

1. Reconfigurable data centers

- Problem: make the data center topology highly reconfigurable
- Motivation:
  - Different topology for one-to-many, many-to-one, and unicast communication patterns
  - Handle node failures (optional)
- Solution idea:
  - Adaptive topology using the added wireless links (60GHz links)
- References:
  - Augmenting data center networks with multi-gigabit wireless links, sigcomm'11
  - **3D Beamforming for Wireless Data Centers** , Weile Zhang, Xia Zhou, Lei Yang, Zengbin Zhang, Ben Y. Zhao and Haitao Zheng HotNets-X, 2011
  - Tri-mesh, internal report

2. Monitoring tool

- Problem: Provide traffic monitoring (traffic volume, average delay, etc) or failures (only focus on one) in data centers
- Challenge:
  - Scaling,
- Solution: (1) multi-resolution via wavelets or other techniques; (2) exploit the underlying physical topology of data centers

- References:
- 1. Towards Automated Performance Diagnosis in a Large
- IPTV Network, sigcomm' 09
- 2. A non-intrusive, **wavelet**-based approach to **...** - Events

3. Providing Anycast Service in data centers

- Problem: how to support anycast communication (any of many) in data centers
- Issues:
  - Show two examples of using anycast in data centers
  - Handling fault-tolerance and inter-server capacity
- Solutions: topology-aware anycast that works in (1) scalable large data centers; (2) work with node/link failures; (3) offer large capacity between servers in anycast mode
- References:
- 1. Bcube and Dcell, sigcomm
- 2. http://conferences.sigcomm.org/sigcomm/2005/slides-BalFra.pdf
- 3. **A framework for scalable global IP-anycast, sigcomm**

4. Energy saving for interconnected MDCs

- Problem: saving energy at large data centers based on modular data centers
- Issues:
  - Making data centers energy proportional to traffic load
- Solution:
  - Aggregate traffic to a few MDCs and power off others
  - Prefetching data to working MDCs
- References:
- 1. Mcube, conext'10
- 2. power measurement at data centers, ISCA

5. Optical Data Centers for N-1 and 1-N communications

- Problem: extend data centers for 1-to-N and N-to-1 communications
- Issues:
  - Wavelength assignment
- Solutions: extend the NSDI'12 work, and leverage Helios and C-through
- References:
- 1. OSA: An Optical Switching Architecture for Data Center Networks with Unprecedented Flexibility, NSDI'12
- 2. c-Through: Part-time **Optics** in **Data Centers**, **sigcomm'10**
- **3.** Helios: A Hybrid Electrical/**Optical** Switch Architecture for Modular DCs, sigcomm'10

6. NDN over Data Centers 1: leverage intermediate computation results

- Problem: extend the NDN concept by leveraging intermediate computations at data centers
- Issues: 1. how to leverage such intermediate computation results via caches; 2. compare its efficiency with traditional cache results (e.g., nectar)
- Solutions: cache the intermediate results and make them accessible to PITs
- References: 1. NDN proposal online; 2. internal report on stateful data forwarding at NDN; 3. **Nectar**: Automatic Management of Data and Computation in Data Centers, NSDI'10; 4. VDN: Virtual Machine Image Distribution Network for Cloud Data Centers, infocom'12

7. NDN over Data Centers 2: improve stateful data plane forwarding

- Problem: extend the NDN concept by improving its stateful data plane forwarding at data centers
- Issues: 1. how to make it scalable; 2. how to exploit the underlying topology at data-plane forwarding
- Solutions: 1. aggregation of entries; 2. encode physical topology at FIT and PIT
- References: 1. NDN proposal online; 2. internal report on stateful data forwarding at NDN; 3.

8. Secure Content Sharing

- Problem: Sharing contents among smartphone/cloud users without revealing other unshared files
- Goals:
  - 1. preserve privacy for contents that are not shared among the given two users
  - 2. energy-efficiency for smartphones
- Solutions:
  - Use techniques of CC and MAC
  - Build access-right graph
- References:
- 1. Commutative **Cipher** Based En-route Filtering in Wireless Sensor
- 2. **Reliable Group Rekeying: A Performance Analysis** , sigcomm'01

Target Advertising

- Problem: how to propagate ads via targeted advertising
- Issues: (1) cloud platform to streamline the processing and propagation; (2) mobile phones update regularly
- Solution: 3-D (in time, space, and social nets) to speed up propagation

9. Balancing Consistency and Availability for Cloud-based Smartphones

- Problem: how to share hypermedia (text/images/audios/videos) among different phones to access cloud service
- Issues:
  - 1. share different versions and updates of the same file
  - 2. sync and deduplicate multiple-versions of files
- Solutions: transcoding, versioning and synch-up
- References: two internal reports (available upon requests)

10. Mobile Search

- Problem: use clouds to improve mobile search
- Issues:
  - 1. handling mobility; 2. intermittent connectivity
- Solution:
  - Adaptive scheme to mobility and prefetch
- References:
- 1. internal report on mobile search survey
- 2. Hapori: Context-based Local Search for Mobile Phones using Community Behavioral Modeling and Similarity", Ubicomp'10.