

PnC: Predict and Cache in Content Centric Networks

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Objective: Content placement in content centric networks (CCN) that offer high hit rate with minimal replacements in order to achieve high operational efficiency.

Solution: Predict and Cache (PnC) policy for proactively caching relevant contents close to users for future access requests.

How Does it Work?

Offline phase

Learning potential demand /router

Build a model for ranking contents per user¹e.g.

- a) Estimate demand of user u for content j , r_{uj}
- b) Rank contents per user (get top K content list T_u)

Utility score for content j @router k

$$d_{jk} = \sum_{u \in Router_k} 1(j \in T_u) r_{uj}$$

Online phase

Placement/replacement algorithm

Input: content j arrives at router k

Output: cache content j or not

- 1: **if** cache is not full, **then** cache j
- 2: **else**
- 3: look-up utility score for j
- 4: **if** $d_{jk} > d_{\min} = \min_{i \in Router_k} d_{ik}$ **then**
- 5: cache content j
- 6: drop content with d_{\min}
- 7: **else**
- 8: do not cache j
- 9: **end if**
- 10: **end if**

Evaluation

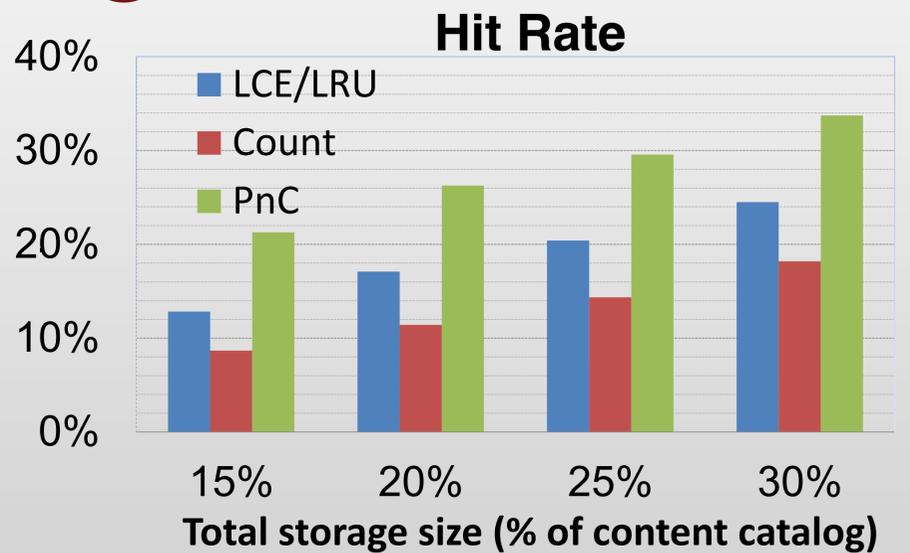
MovieLens data²

- 943 end hosts
- 1682 contents

Topology

(simulated in ndnSim):

- 3 core routers
- 10 edge routers/core



Replacement rate

Storage	15%	20%	25%	30%
LCE/LRU	2.45	2.37	2.31	2.23
Count	0.077	0.110	0.119	0.142
PnC	0.064	0.091	0.101	0.120

Count: online placement w/o prediction ($d_{jk} = \# \text{times } j \text{ accessed before}$)
LCE: leave copy everywhere

Conclusion

PnC achieves a balance between content caching and replacements by estimating potential likelihood of content popularity.

For future work, we plan to extend this policy with some coordination among routers. We also intend to study PnC in ICN architectures employing name resolution systems.

¹ Y. Hu, Y. Koren, C. Volinsky, Collaborative filtering for implicit feedback datasets, in ICDM 2008, pp 263 -272, Dec. 2008

² <http://grouplens.org/datasets/movielens/>
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