ITU KALEIDOSCOPE
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Challenges for a data-driven society

CONTRACT THEORY BASED CACHING AND PRICING STRATEGY FOR CONTENT CENTRIC NETWORKS

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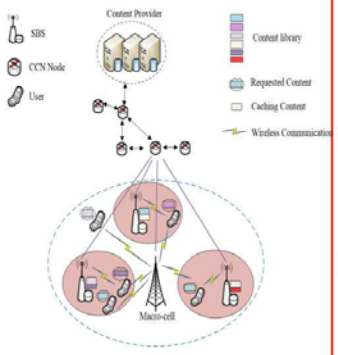
Introduction

Backgroud & Motivation

- An ever-increasing number of contents
- High pressures to provide users with a satisfied quality of experience
- How to find the appropriate caching and pricing strategy?
  - Caching strategy in CCN nodes.
  - Contract theory based pricing strategy.

System Model



- **Content Provider:** The content provider stores the original contents in the content servers, which are placed far away from users.
- **CCN node:** CCN node can be seen as the agent of content server to cache contents for users.
- **Users:** Users can achieves contents from BSs and CCN nodes. $\{\theta_1, \theta_2, \cdots, \theta_I\}$

Solution

Constraints for feasibility of contracts:

Individual Rationality constraints

$$w\ln\left(1+\frac{1}{d_1}\theta q(\theta_i)+\frac{1}{d_2}(1-\theta_i)q(\theta_i)\right)-T(\theta_i)\geq 0$$

$$w\ln\left(1+\frac{1}{d_1}\theta_i q(\theta_i)+\frac{1}{d_2}(1-\theta_i)q(\theta_i)\right)-T(\theta_i)\geq w\ln\left(1+\frac{1}{d_1}\theta_i q(\theta_j)+\frac{1}{d_2}(1-\theta_i)q(\theta_j)\right)-T(\theta_j)$$

$$\forall i,j\in\{1,\cdots,I\}, i\neq j$$

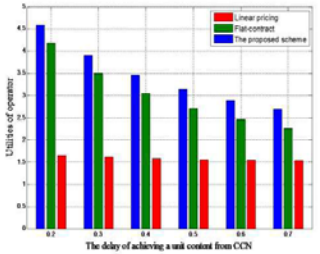
Incentive Compatible constraints

- Based on the Lagrangian function, the optimal price in the contract for user θ_1 can be shown as

$$q^*(\theta_1)=\begin{cases}\dfrac{wp_1a_1a_2-(a_1+a_2)p_1(c_1\theta_1+c_2(1-\theta_1))+\sqrt{\Delta_1}}{2p_1(c_1\theta_1+c_2(1-\theta_1))a_1a_2}, & \Delta_1>0\\ 0, & o.w.\end{cases}$$

Simulation Results

- Comparison of the utilities with three schemes



- The operator can obtain the maximum utility with different transmission delay in the proposed pricing and caching scheme.

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