Mechanisms to support QoS in MobileCDN

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Outline

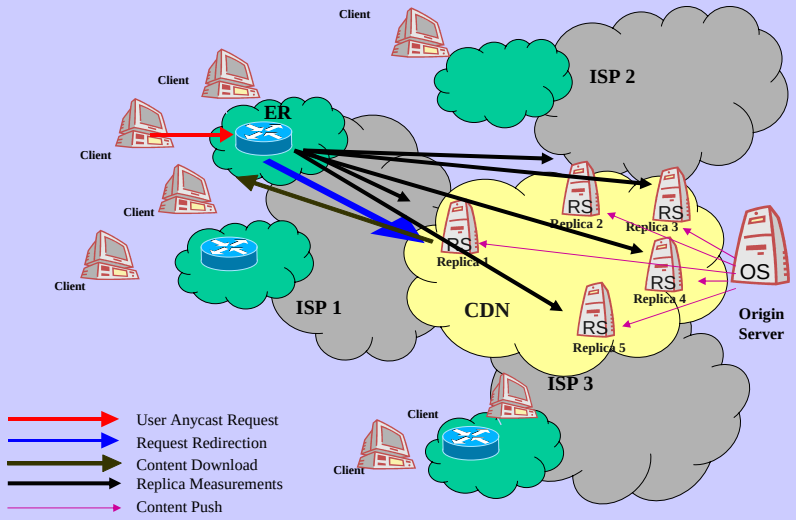
- Content Delivery Networks (CDNs)
  - Goals & Architecture
- Motivations and Problem description
  - Supporting mobility in CDN
- Proposed architecture
- Context Transfer Protocol (CTP)
- Analytical performance model of CTP
- Numerical Results
- Conclusions e Future Works

Content Delivery Networks

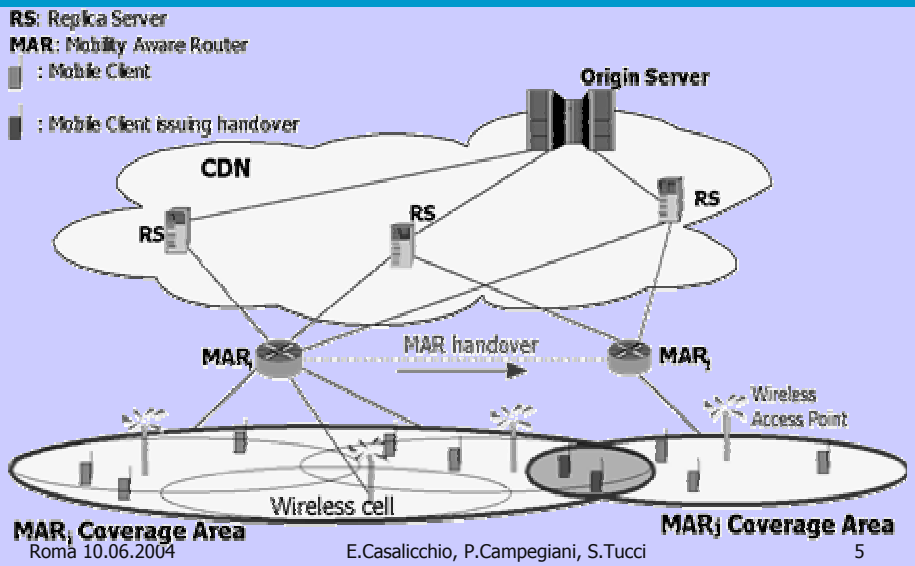
Designed to deliver content from the best point in the network thus **improving performance and availability**

- CDNs provide QoS
  - **Proximity of the content to the users**
    - Guarantee SLAs, e2e delay, …
  - **High Resource and service availability**

Content Delivery Networks: arch.



System architecture



User Mobility in CDNs: performance issues

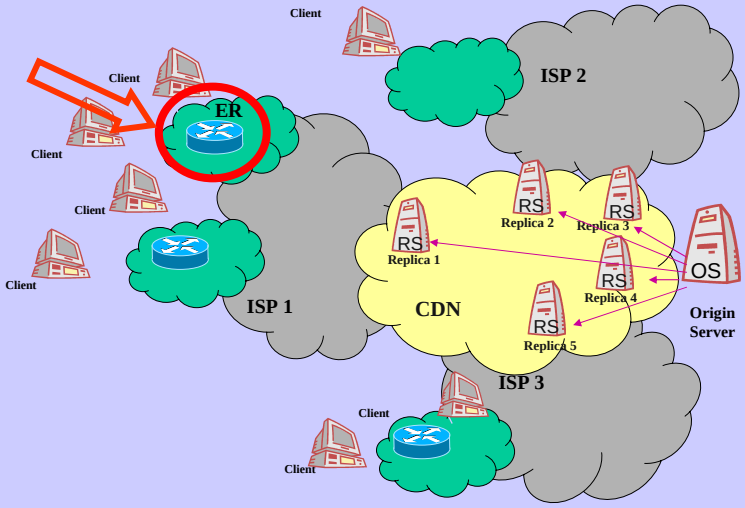
Mobility compromises the benefit of CDNs

– Users move and change access point to the CDN ⇨ edge router and replica selection mechanism must be aware of users movement

– Users movement can cause session disruption ⇨ L2/3 handoff and new mechanism at the edge router to support session persistence

– SLA must be guaranteed during the entire session ⇨ edge router must cooperate to support users movement

Content Delivery Networks

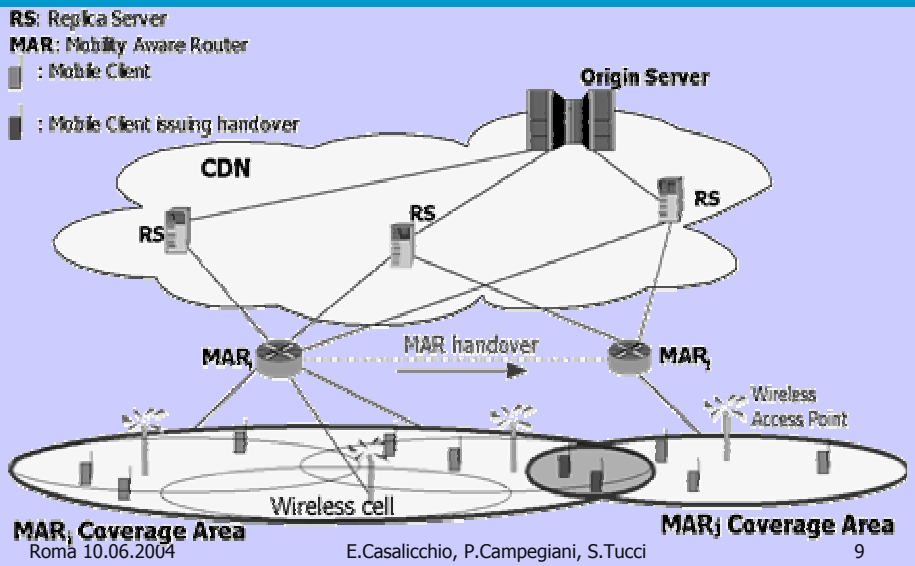


Mobility Aware Router (MAR)

A **MAR** is and Edge Router enhanced with new capability

- Identification and classification of content delivery service requests
- Replica Server selection mechanism
- Active measurement mechanisms
- Users requests classification on the basis of SLA *(NEW)*
- Admission Control mechanisms for mobile users requests *(NEW)*
- Cooperation mechanisms based on users/service context transfer *(NEW)*

System architecture



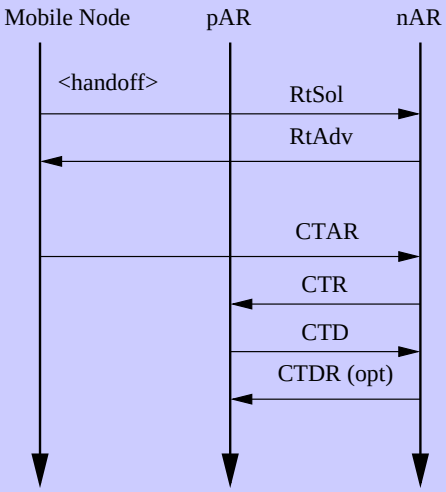
General Motivation for Context Transfer

- Authentication, Authorization and Accounting
- Header compression information
- Network QoS information

IETF Network WG, RFC3374, sept. 2002

- Application level QoS parameters
  - e2e delay, image resolution, max/min bit rate, …
- Session state information
  - Basket status, next phase (on-line games, on-line shops, …), mail-box state,…

Context Transfer Protocol



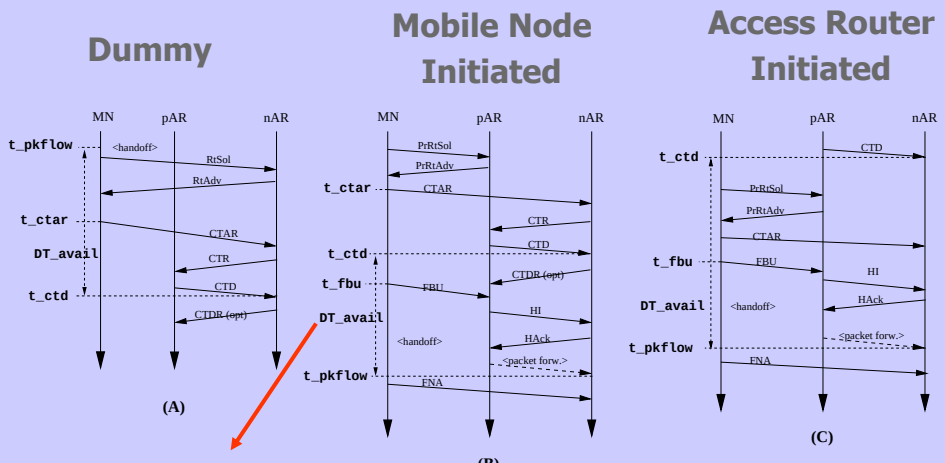
IETF Seamoby WG, Internet-Draft

- CTAR: Context Transfer Activation Request
- CTR: Context Transfer Activation
- CTD: Context Transfer Data
- CTDR: Context Transfer Data Replay

Network Support for CTP

- Mobile IPv4
- Mobile IPv6
- Fast Handover

Three scenarios for CTP

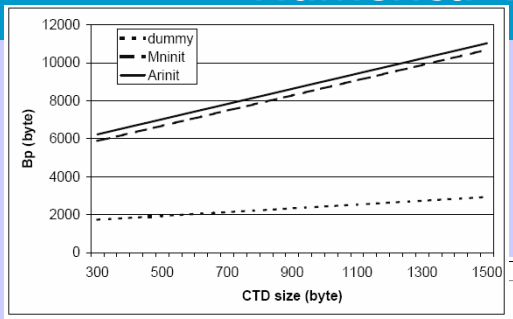


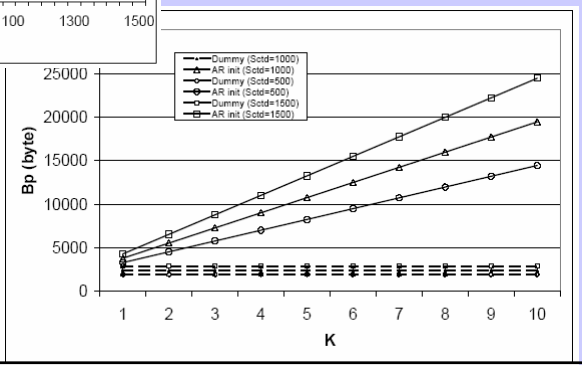
$\Delta T_{avail} = t_{ctd} - t_{pkflow} = f(t_{fbu} - t_{ctar})$

Performance Metrics

- Bandwidth consumed by the CTP
  - $Bp = f(S_{CTD}, S, K)$, K=# of candidates nARs
- Number of packet lost
  - $N_{lost} \propto T_{hoff} + T_{conn}$
  - Only in absence of fast handover mechanism
- Number of packet processed as default
  - $N_{default} \propto \Delta T_{avail} * Packet\_rate$
  - $\Delta T_{avail} = f(t_{fbu} - t_{ctar})$

Numerical Results





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Numerical Results (1)

$$\Delta T_{avail} < 0 \Rightarrow N_{default} = 0$$

S_{ctd}	$Dummy$	$MN_{init}(A)$	$MN_{init}(B)$	$MN_{init}(C)$	$MN_{init}(D)$
300	0.026073	-0.0015	-0.0105	-0.1005	-1.0005
380	0.026393	-0.00086	-0.00986	-0.09986	-0.99986
460	0.026713	-0.00022	-0.00922	-0.09922	-0.99922
500	0.026873	0.0001	-0.0089	-0.0989	-0.9989
540	0.027033	0.00042	-0.00858	-0.09858	-0.99858
620	0.027353	0.00106	-0.00794	-0.09794	-0.99794
780	0.027993	0.00234	-0.00666	-0.09666	-0.99666
860	0.028313	0.00298	-0.00602	-0.09602	-0.99602
1100	0.029273	0.0049	-0.0041	-0.0941	-0.9941

$t_{fbu} - t_{ctar}$ = 0.001″ 0.01″ 0.1″ 1″

Work in Progress

- We propose a simple analytical performance model
- We plane
  - To refine the model
  - To give simulation results
- Related open issues:
  - Context Representation and Encoding
  - Context-based Admission Control
  - Context-based and Mobility-Aware Replica Selection