

MP2P 2008

Distributed Video Adaptation and Streaming for Heterogeneous Devices

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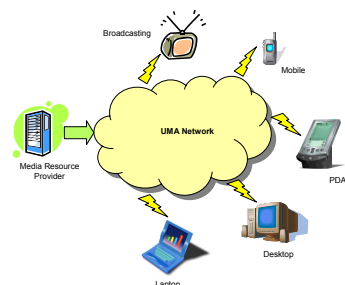

OUTLINE

- Motivation
- Objective
- Background
- Proposed Approach
 - DAG-stream
- Benefit
- Drawback
- Future Work





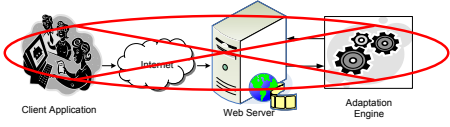
MOTIVATION







OBJECTIVE



- Avoid dedicated media-adaptation and streaming servers
- Apply compressed domain adaptation using gBSD
- Utilize the resources available in the internet
 - Bandwidth
 - CPU power





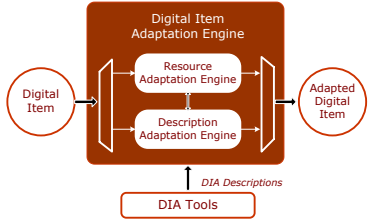
BACKGROUND

MPEG-21 gBSD And Compressed-domain Adaptation

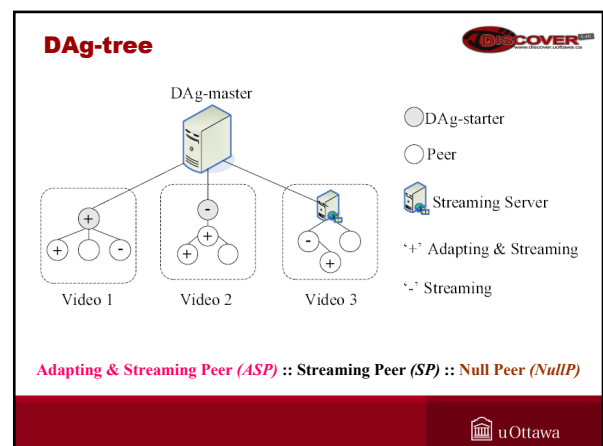
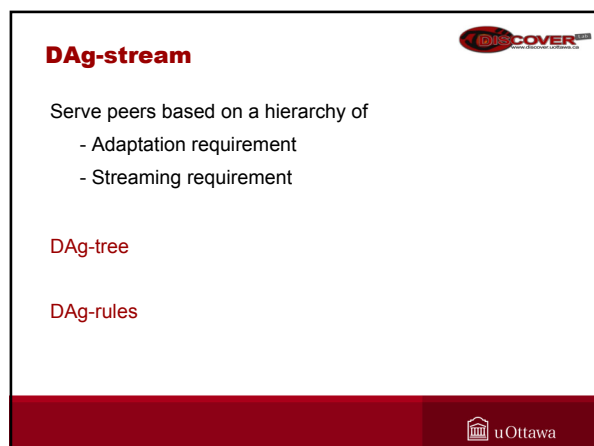
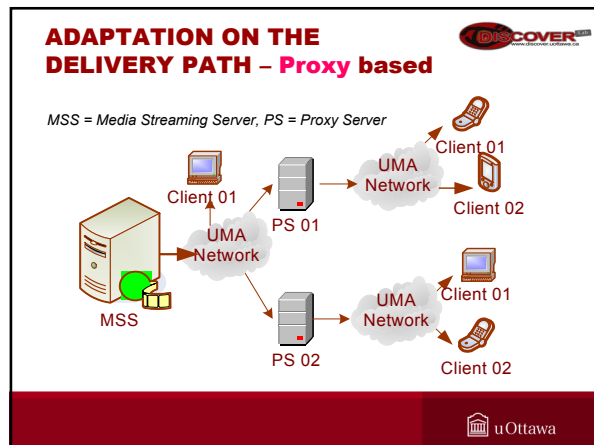
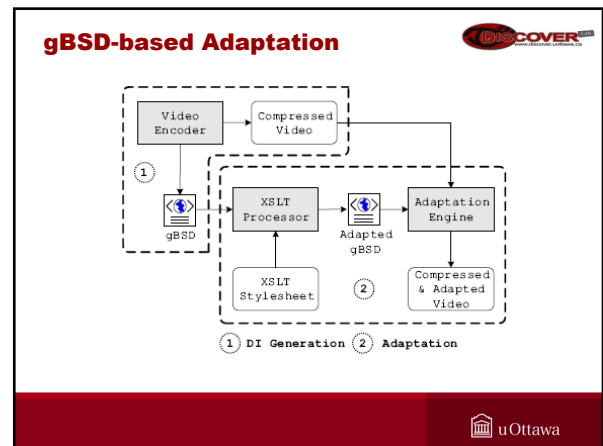
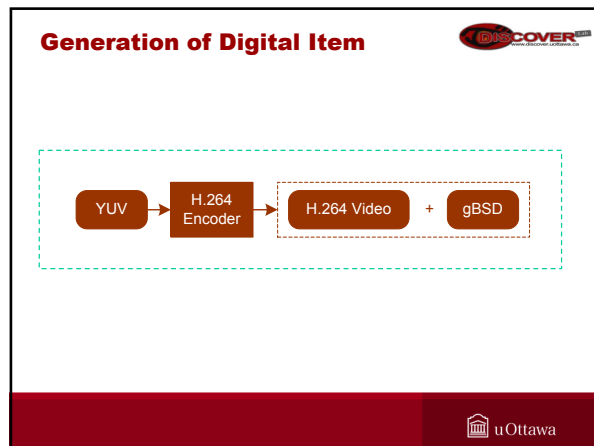




MPEG-21 Part 7 Digital Item Adaptation (DIA)







Tree Administration

- DAG-master determines incoming peer's parental eligibility
 - Fan-out
 - CPUP
- ASP and SP may be intermixed based on the order of join requests

New node joining

- DAG-rules 1

```

DAG-RULES 1
1 begin
2 if Tree, T, has peer(s)
3 then
4     Select a set of potential parents, SS, such that
5      $SS = \{p \mid p \in T, availableVideo(p) = requestedVideo\}$ 
6     Based on uBW, select a subset of SS, SS', i.e.,
7      $SS' = \{p \mid p \in SS, freefanout(p) = true\}$ 
8     if  $ADPTR(p) == ADPTR(NC)$ , for any p,  $p \in SS'$ 
9     then
10        adaptation is not required,  $adaptreq \leftarrow 0$ 
11    if  $adaptreq \neq 0$ 
12    then
13        Select a subset of  $SS', SS''$ , based on CPUP, i.e.,
14         $SS'' = \{p \mid p \in SS', CPUP(p) \geq min\_CPU\_rating\}$ 
15        Calculate the cumulative delay of each peer p,  $p \in SS''$ 
16    if  $adaptreq == 0$ 
17    then
18        Calculate the cumulative delay of each peer p,  $p \in SS'$ 
19    Pick a parent, X, that has minimum delay
20 else
21    NC is served by the DAG-starter
22 end
    
```

Node joining constraints

Parent	NullP	SP
DAG-starter	Fan-out > 2	Fan-out > 1
ASP	Fan-out ≥ 2	-

Node Departure

```

DAG-RULES 2
1 begin
2 if Departing node, DC, is a leaf node
3 then
4     Update  $Set_p$ , CPUP, and fanout of the parent,  $X_{DC}$ 
5     Inform  $X_{DC}$ 
6 if A peer, DC, is disconnected and requests a new link
7 then
8     Check the parent,  $X_{DC}$ 
9     if  $X_{DC}$  is alive
10    then
11        Connect DC,  $X_{DC}$ 
12    else
13        if  $X_{DC}$  is the DAG-starter
14        then
15            Dissolve Tree, T
16        if  $X_{DC}$  is root of a subtree
17        then
18            Choose a capable peer,  $X_{new}$ , from
19            the same level or the ancestors of  $X_{DC}$ 
20            and replace  $X_{DC}$ 
21        else
22            Distribute the children of  $X_{DC}$  in the overlay
23 end
    
```

Tree Refinement

Refine tree based on -

- Fan-out
- CPUP
- Stability Factor
- Delay

Experimental Results

ASP: 15%, SP: 35%, NullP: 50%, minCPU: 0.2

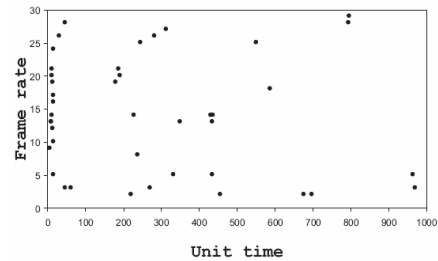
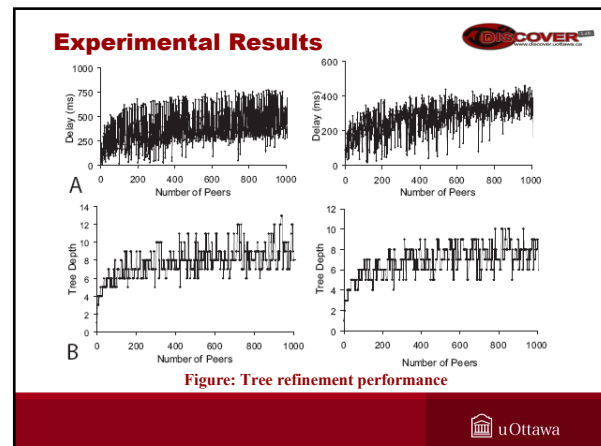
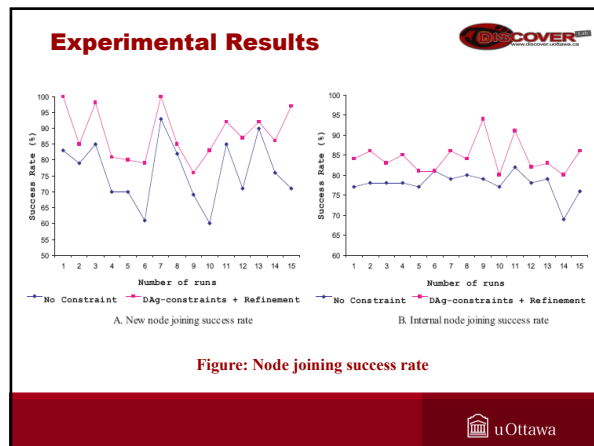


Figure: Nodes receiving adapted video



BENEFIT

- Simple design
- It does not require an application or codec-specific schema so it is for intermediary nodes to adapt the video based on its gBSD.
- Small handheld devices are free from any adaptation operation

DRAWBACK

- Node failure
- Total utilization of resources
 - **Bandwidth:** Optimum – 38%, Simulation – 33%
 - **CPU:** Optimum – 45%, Simulation – 41%

FUTURE WORK

- Multiple Provider for a single peer
- Virtual resource concatenation

THANK YOU