2013 17th International Conference on Intelligence in Next Generation Networks
icin 2013
Unlocking Value from the Networks
Smarter Networks for Smarter Things 15-16 October 2013, Venice, Italy

S4-3
A Web Synchronization Method for Supporting Real and Non-Real-Time Web Communication

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Outline

- Introduction
- Typical Web Synchronization
- Architecture for Synchronization
- Issues of Conventional Technologies
- Proposed Functions
- Experimental Environment
- Experimental Results and Evaluation
- Conclusion

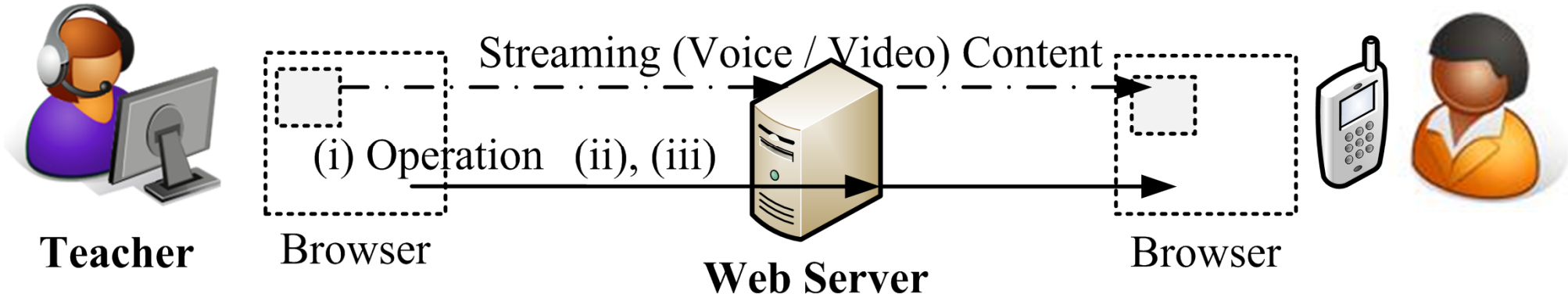
Introduction

- Web communication services such as voice/video conference and remote operation to support the conference service have been gaining wide acceptance in the Internet.

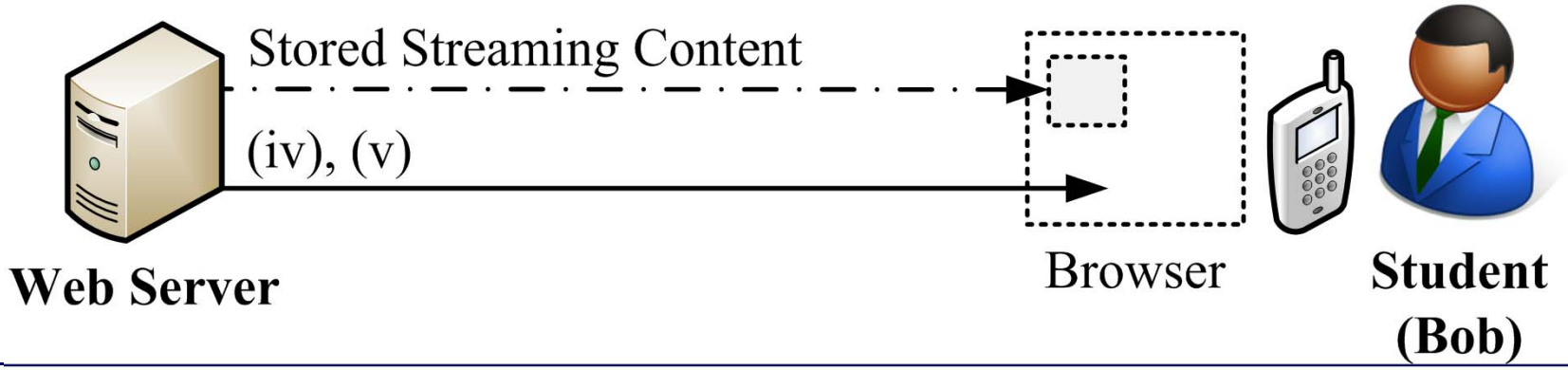
- Web communication services help smooth communication with support by an operator even if users are inexperienced at browser operations in the services.

Two Use Cases As Our Goal

Use Case 1: real-time web communication as a conventional service

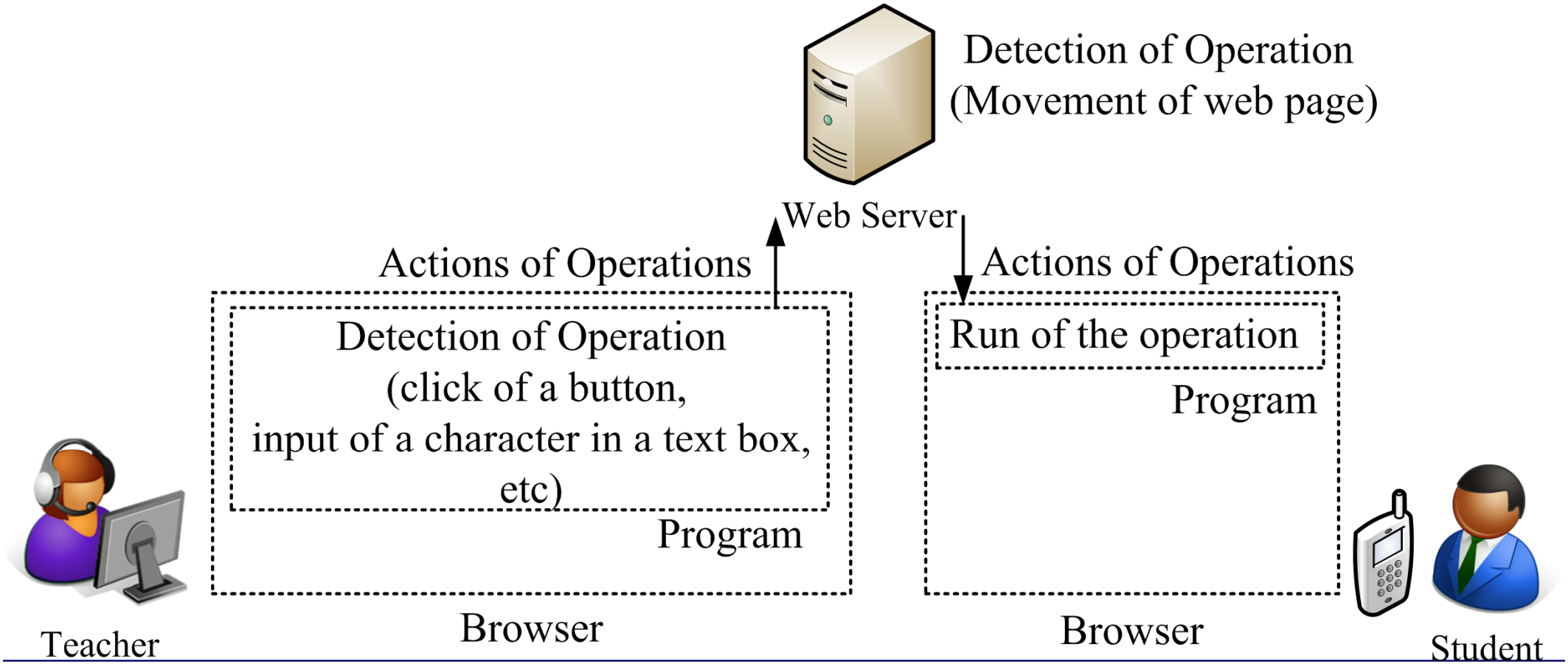


Use Case 2: non-real-time web communication as an extended services

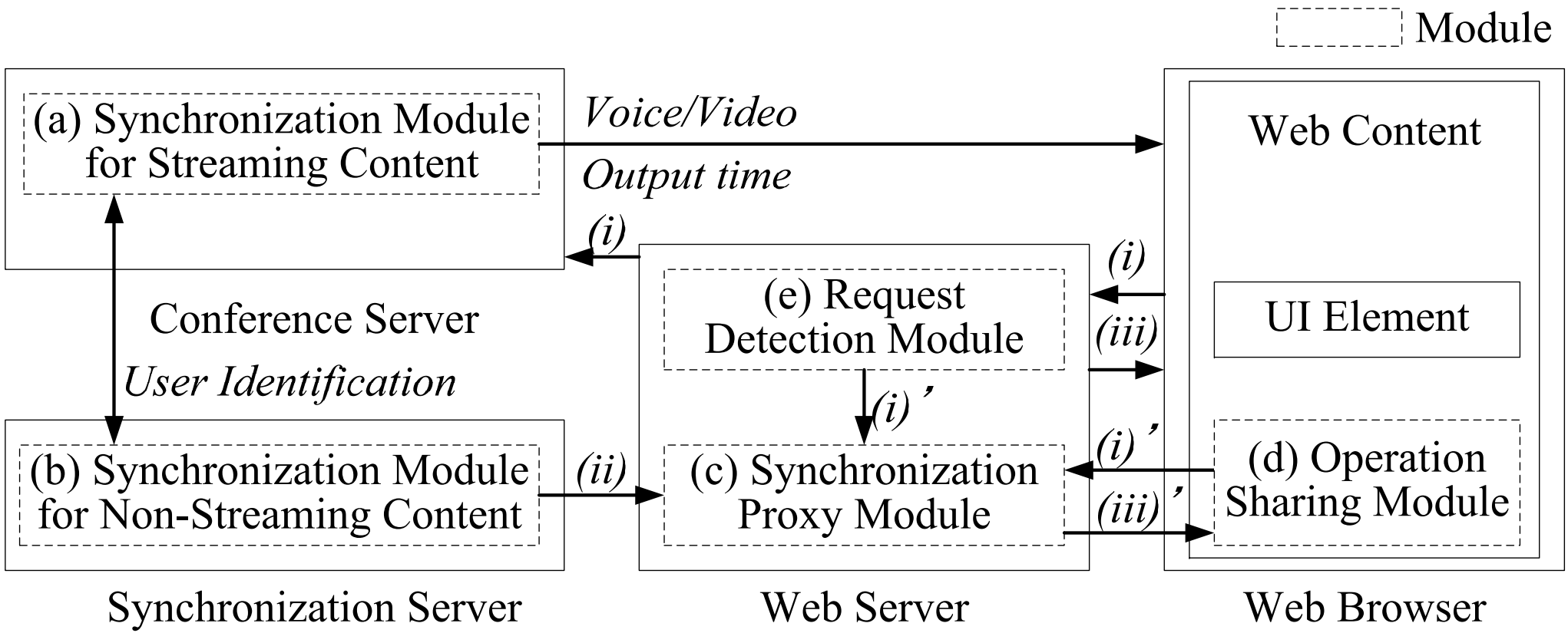


Typical Web Synchronization

1. Detection of Browser Operations
2. Check of Conversational Partners
3. Share of Browser Operations



Architecture for Synchronization



(i) Request for Web Content

(i)' Actions of Operations

(ii) Control of Time to Send/Output (iii) and (iii)'

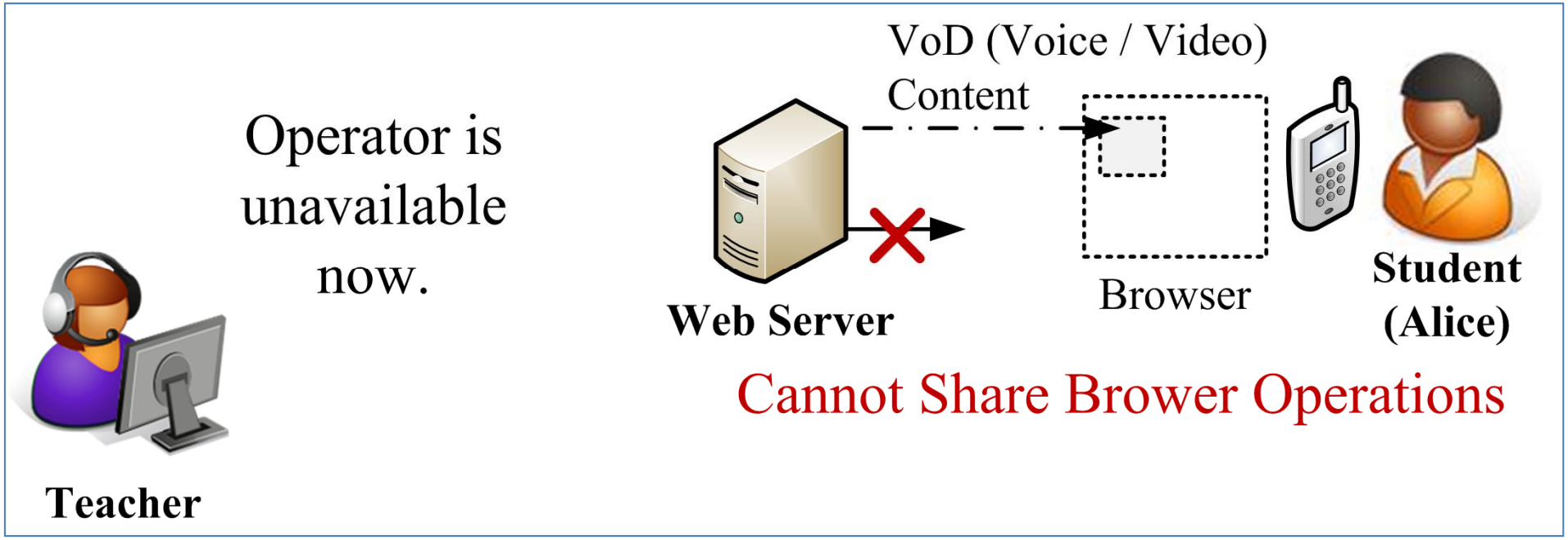
(iii) Web Content

(iii)' Actions of Operations

Issues of Typical Web Synchronization

- Issue1

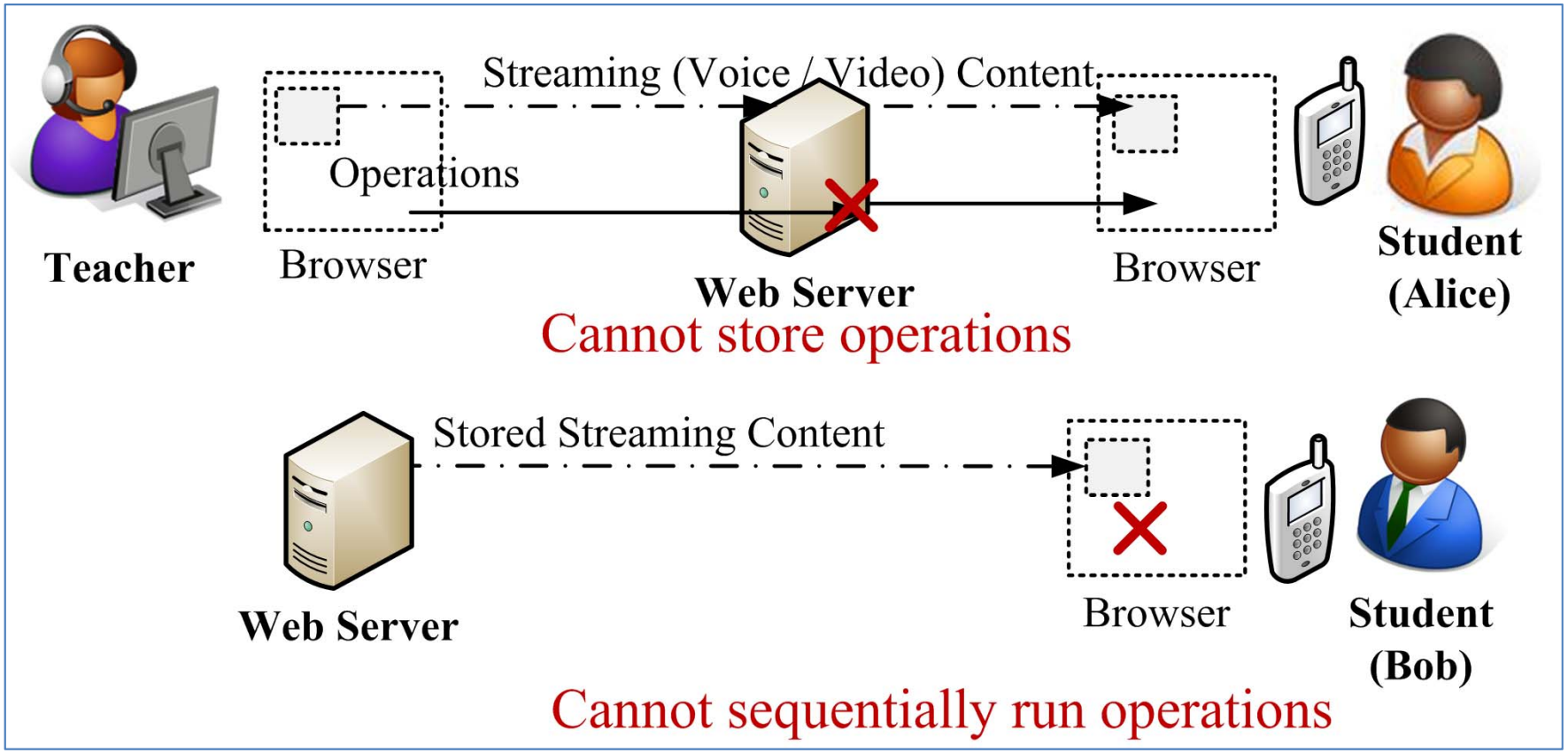
The browser cannot receive the actions of operations in non-real-time web communication.



Issues of Typical Web Synchronization

- Issue2

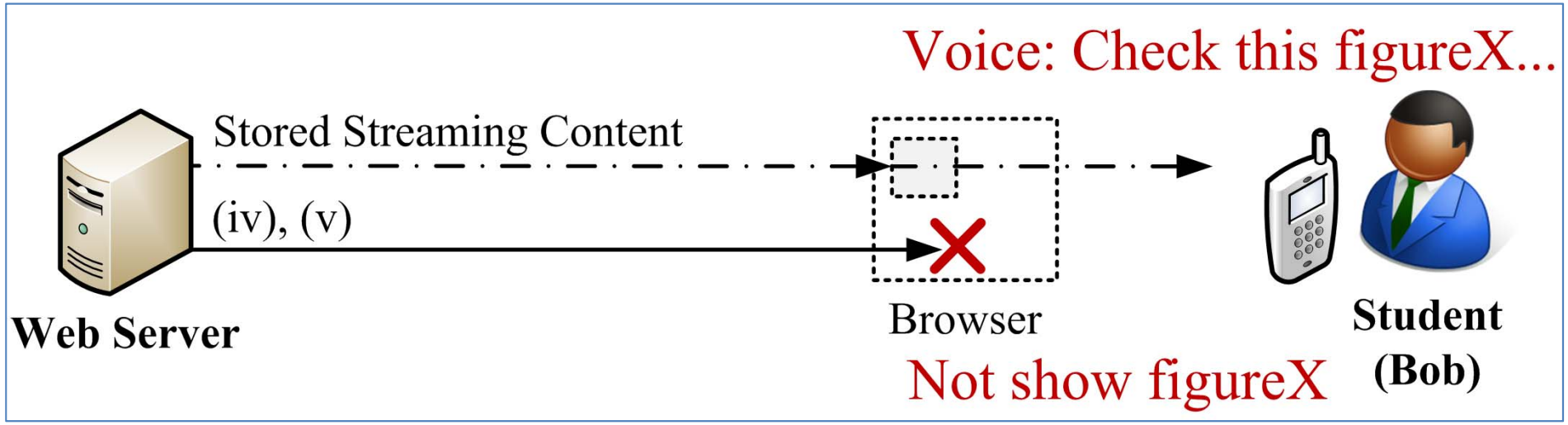
The web server cannot store browser operations and sequentially run the operations on the browser.



Issues of Typical Web Synchronization

- Issue3

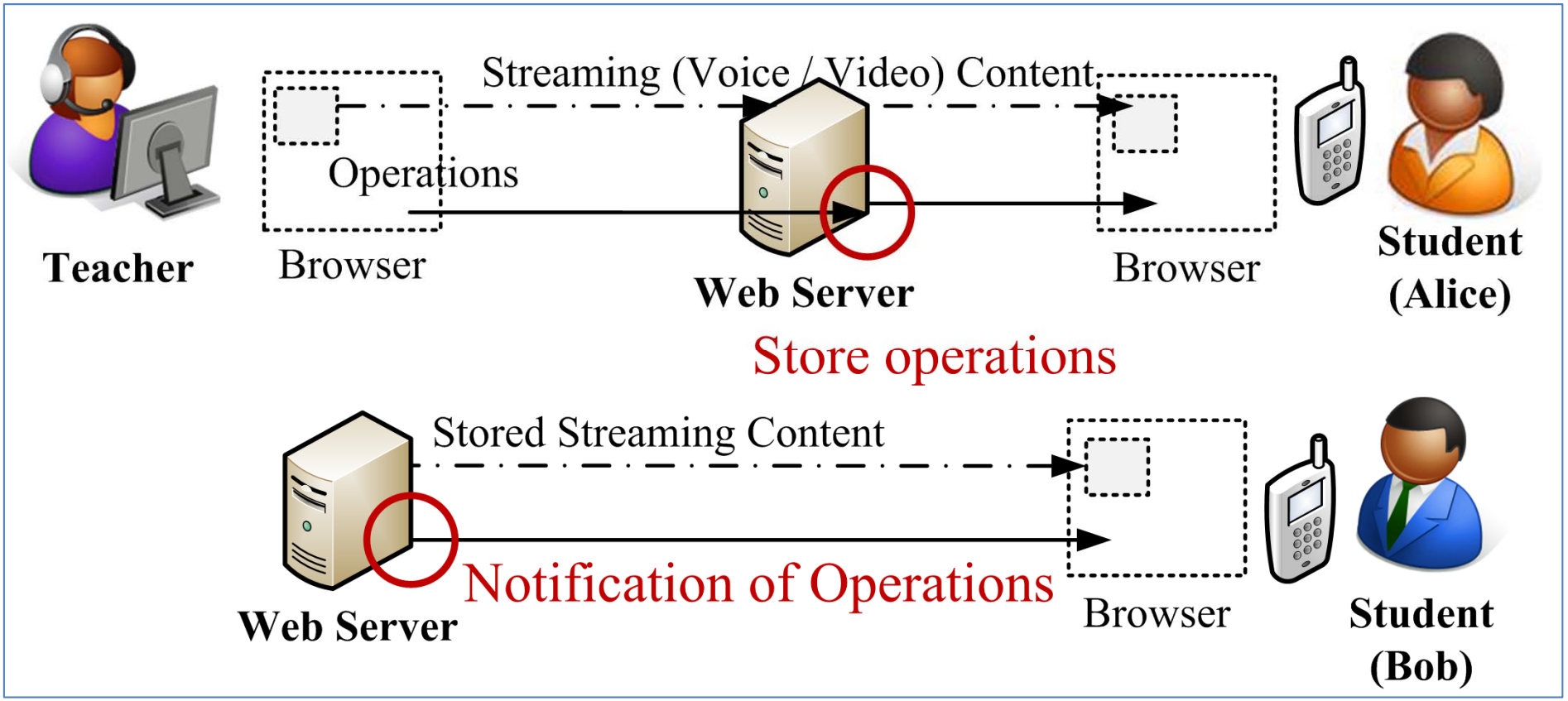
The output time between each web content is different and the difference causes out-of-synchronization.



Proposed Functions (1/3)

- Function 1: Share of delay tolerant operations

A web automatically stores the operations as data set and shifts timing to share the stored data.



Function1: Share of Delay Tolerant Operations

Sequence of web synchronization for real-time web communication

Step1: Synchronization Start

Process 1 to 6

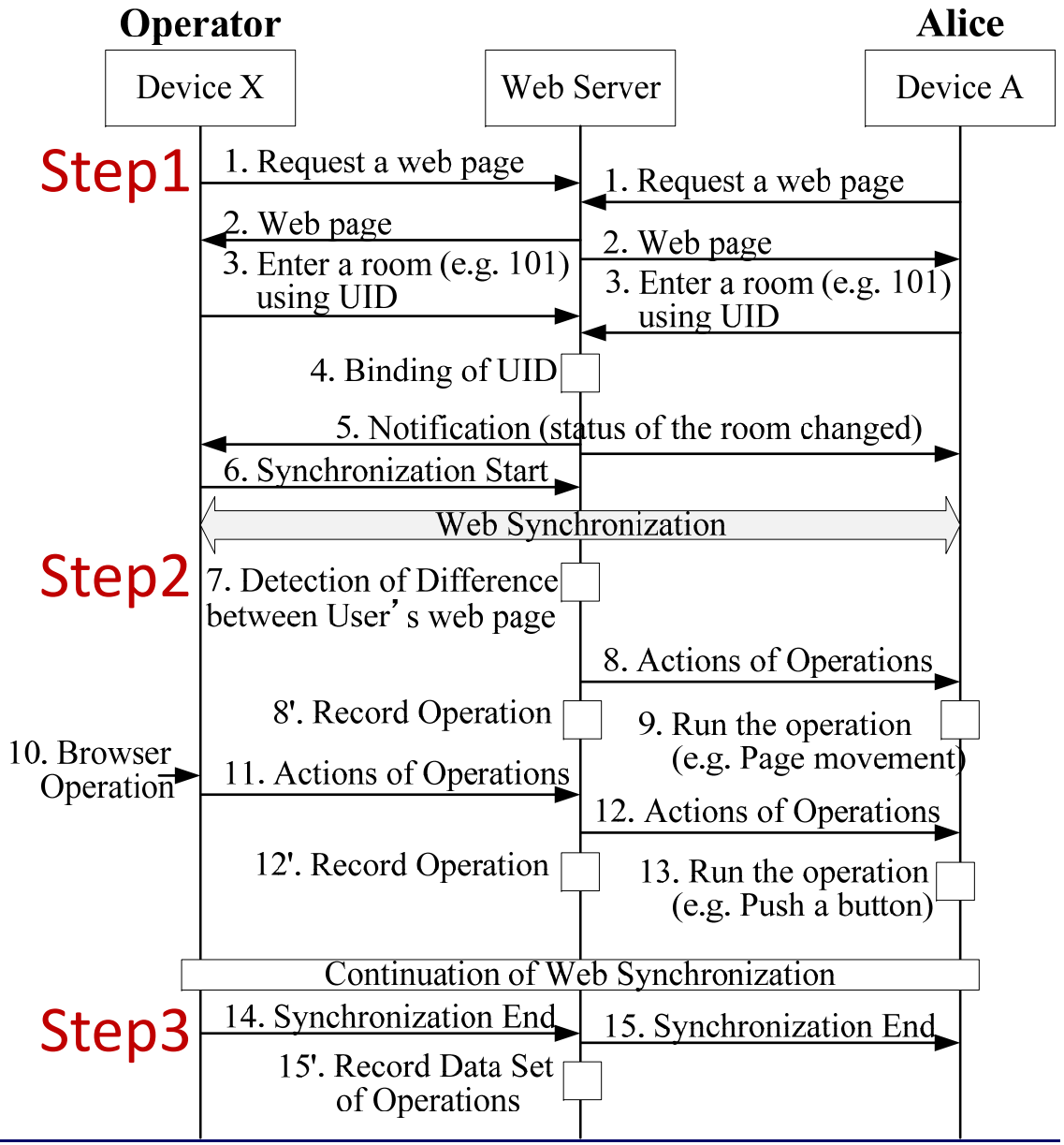
Step2: Web Synchronization

Process 7 to 13 (Sharing)

Process 8’, 12’ (Store)

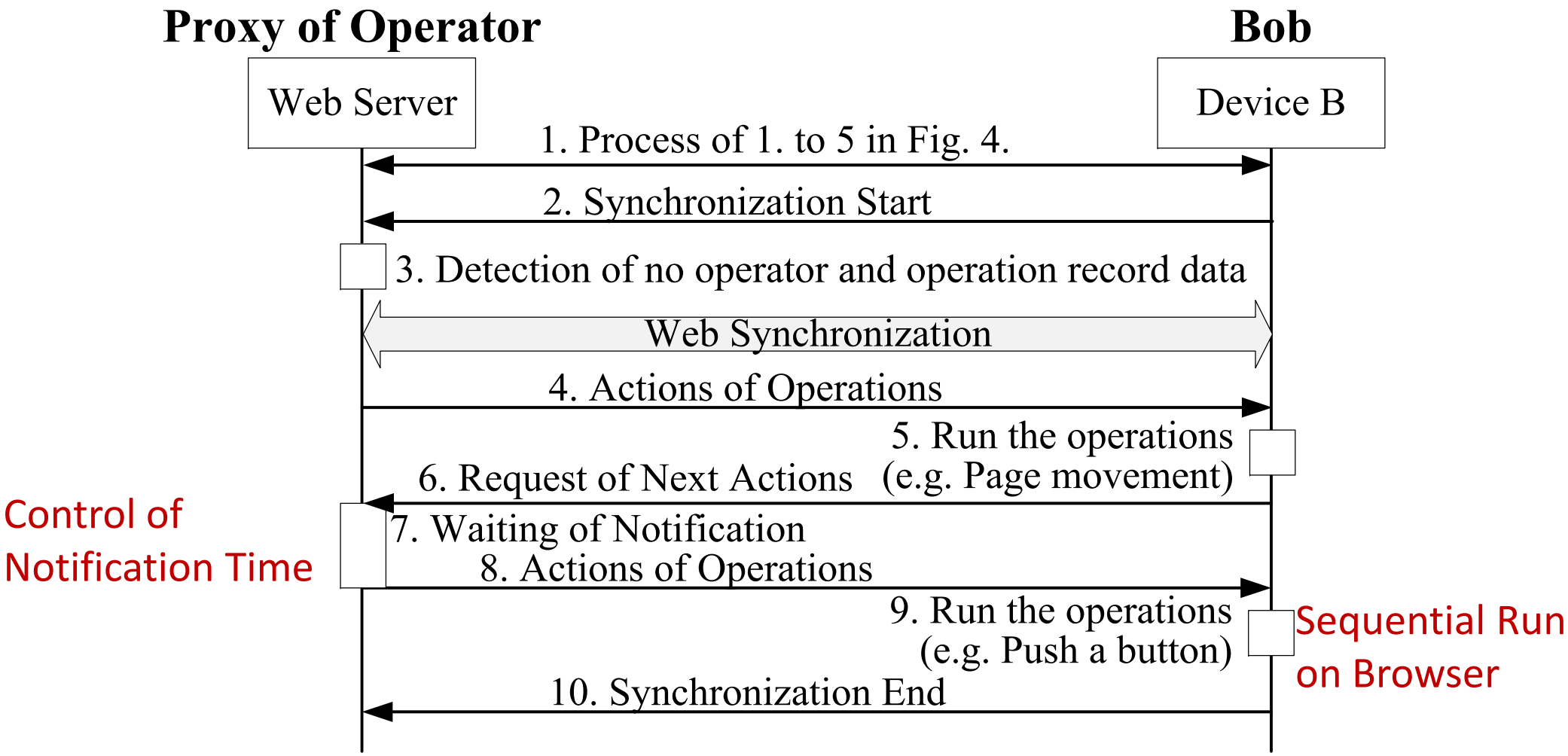
Step3: Synchronization End

Process 14 to 15, 15’



Function1: Share of Delay Tolerant Operations

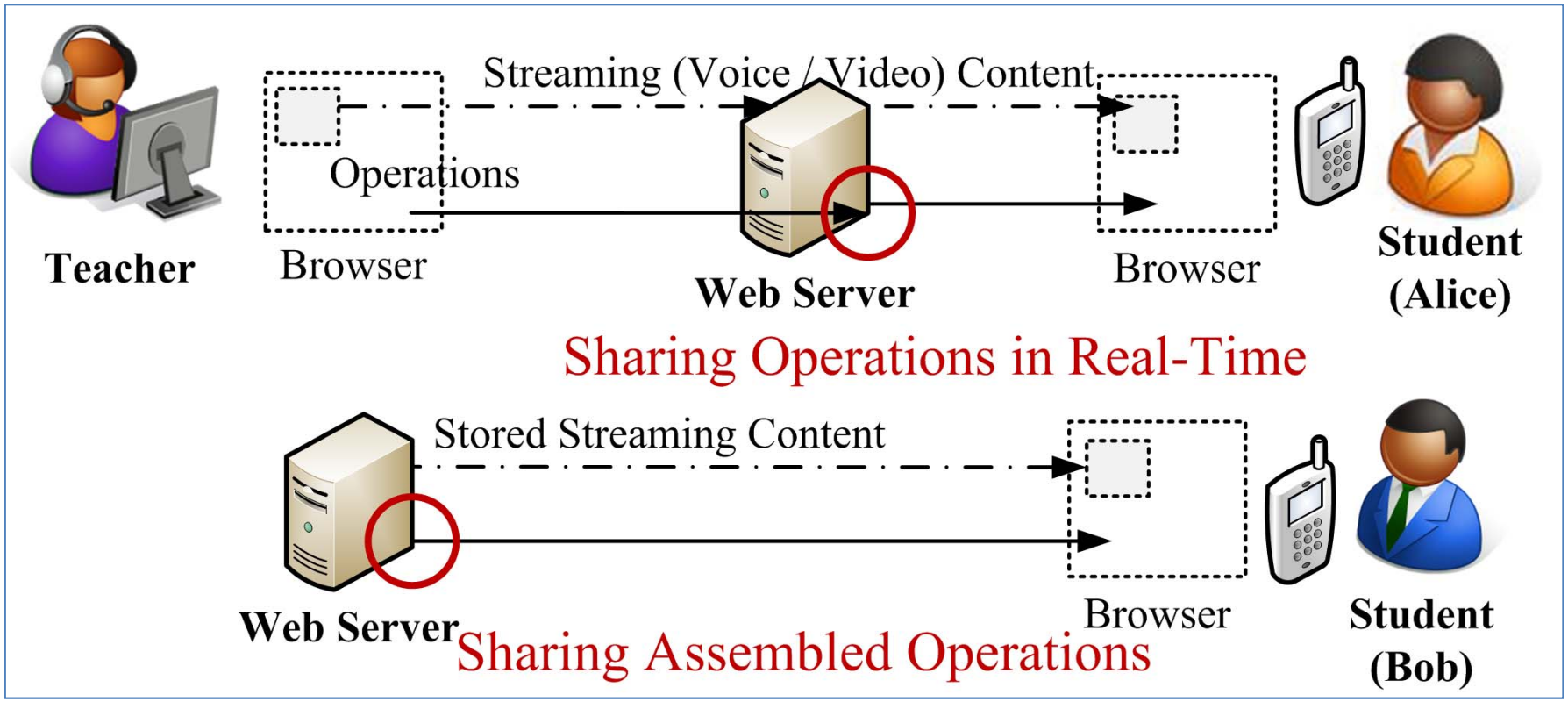
Sequence of web synchronization for non real-time web communication



Proposed Functions (2/3)

- Function 2: Change of synchronization methods

The web server and browsers decide and change the way to assemble some scripts in a webpage.



Function2: Change of Synchronization Methods

Web Content

(ii) Scripts for web synchronization

[Initiation]
Load of module for detection, sharing, action of web operations
e.g.
<script type="text/javascript" src="./js/websync.js">

Fig. 3(d) Operation Sharing

(iii) [Registration of UI Element]
List of UI Element monitored by JavaScript
e.g. registration of textbox
webSyncRegisterComponent(document.get-ElementById("textBox01"), "textBox01", "1");

(i) HTML Body

UI Element (e.g. text area and button)
e.g. text box
<input type="text" id="textBox01" size="10">

UI: User Interface

(iii) Registration of UI Element
webSyncRegisterComponent(a, b, c, d)
a: Object of UI Element
b: Name of UI Element
c: Type of UI Element(*)
d: Window Name Set UI Element (option)

(*) Type of UI Element
"1"=Text Area
"2"=Radio Button
"3"=Check Box
"4"=Select Box
"5"=Button
"6"=Submit Button
"7"=Reset Button

Real-Time Communication

Addition of Scripts for Synchronization of Each UI Element

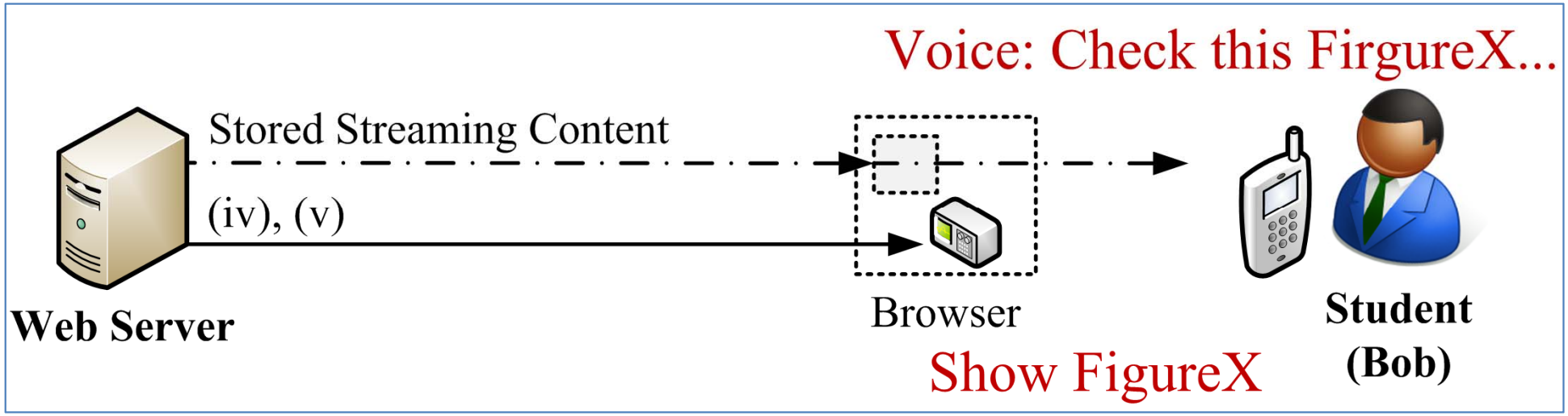
Non-Real-Time Communication

Assembling of Scripts for Synchronization of Some UI Elements

Proposed Functions (3/3)

- Function 3: Synchronization for different content

This function achieves web synchronization between different types of web content.



Function3: Synchronization for Different Content

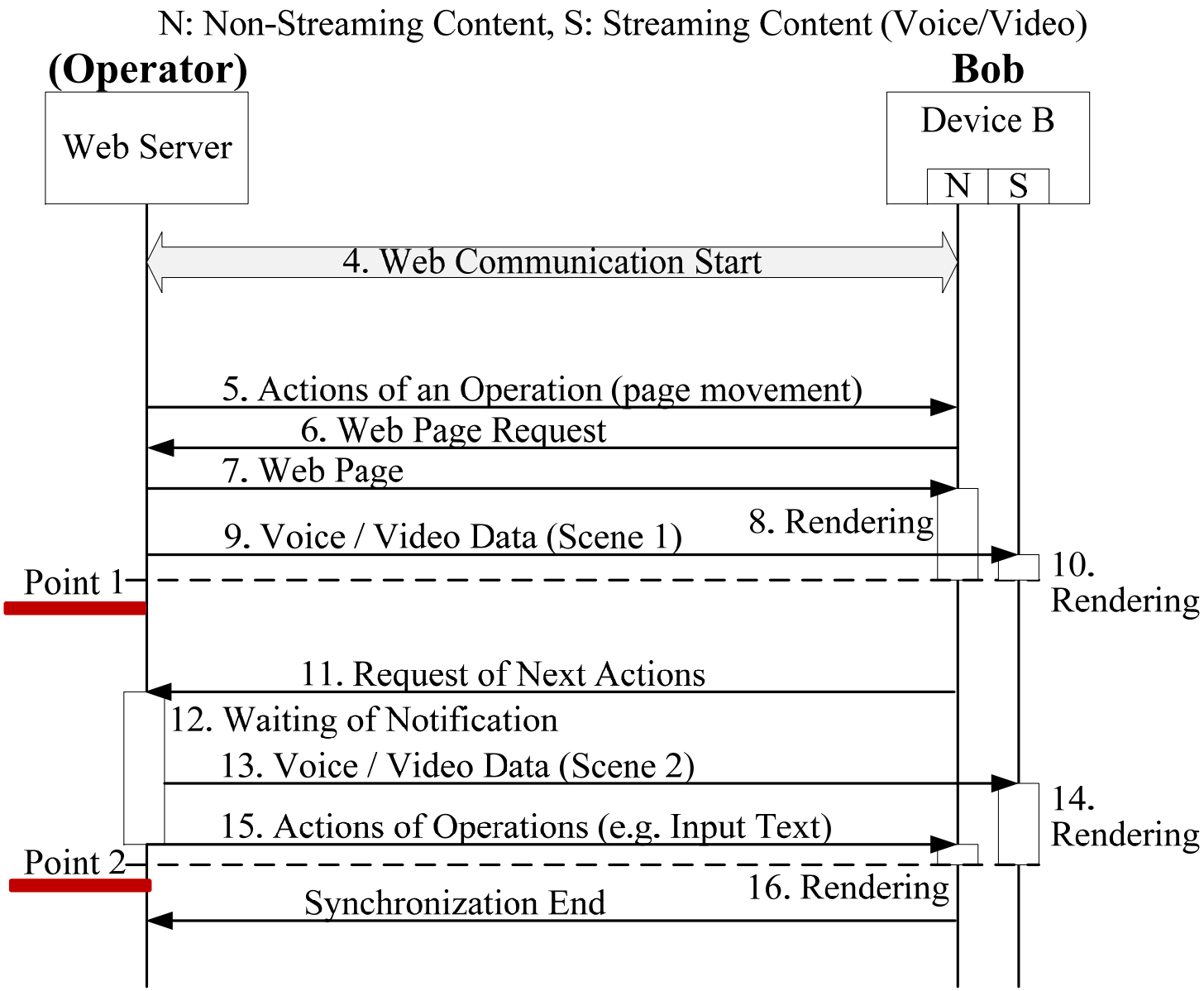
Control of Notification Time For Sharing of Operations

Point1:

Notification Timing of Operations < Sending Timing of Streaming Content

Point2:

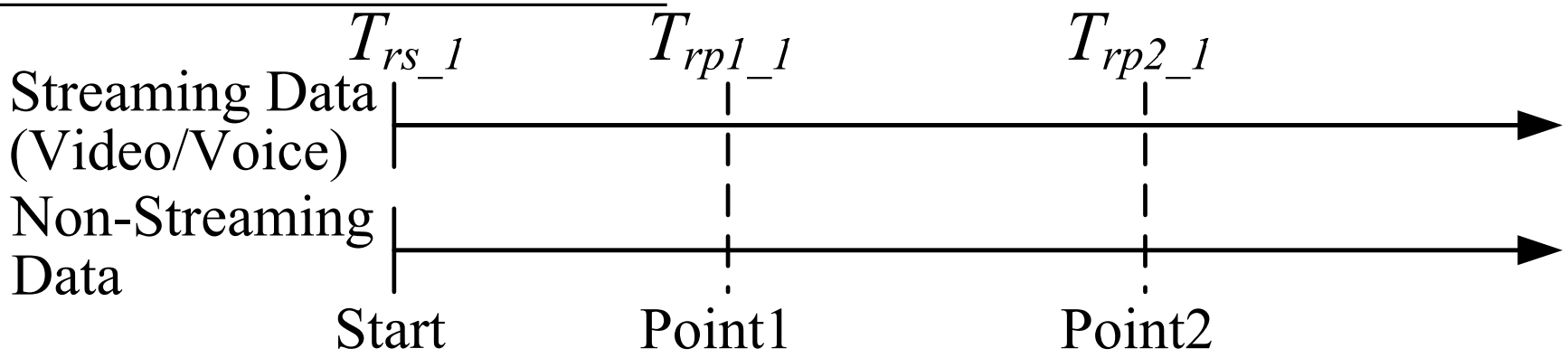
Notification Timing of Operations > Sending Timing of Streaming Content



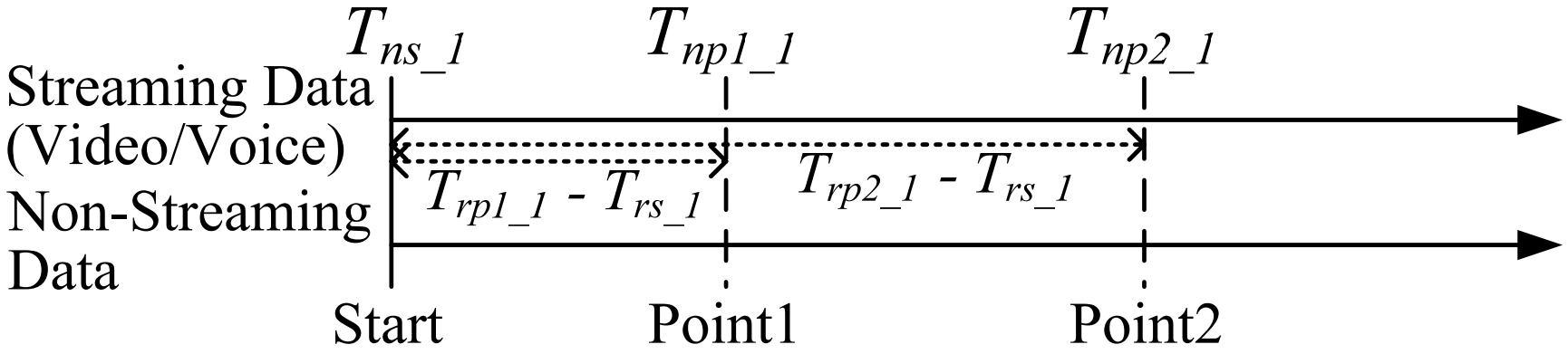
Function3: Synchronization for Different Content

T_{rs_1}, T_{ns_1} : Output Time in Communication Start
T_{rp1_1}, T_{np1_1} : Output Time in Point 1
T_{rp2_1}, T_{np2_1} : Output Time in Point 2

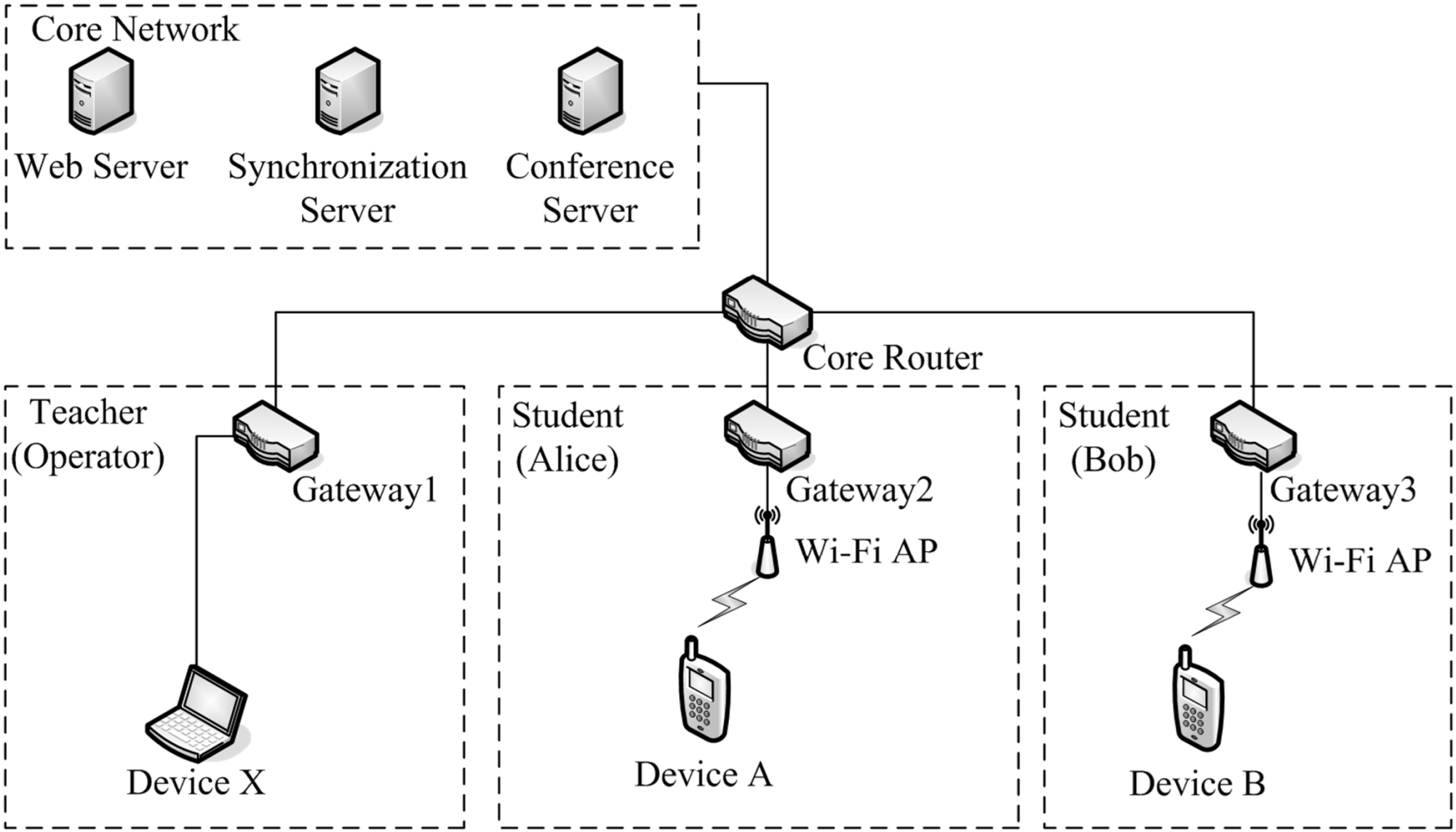
Real-Time Web Communication



Non-Real-Time Web Communication



Experimental Test Bed Setup



Experimental Items

- Item1

Difference in output time of web content among browsers according to increase of difference in bandwidth among devices.

- Item2

Difference in output time of web content among browsers according to increase of web content size.

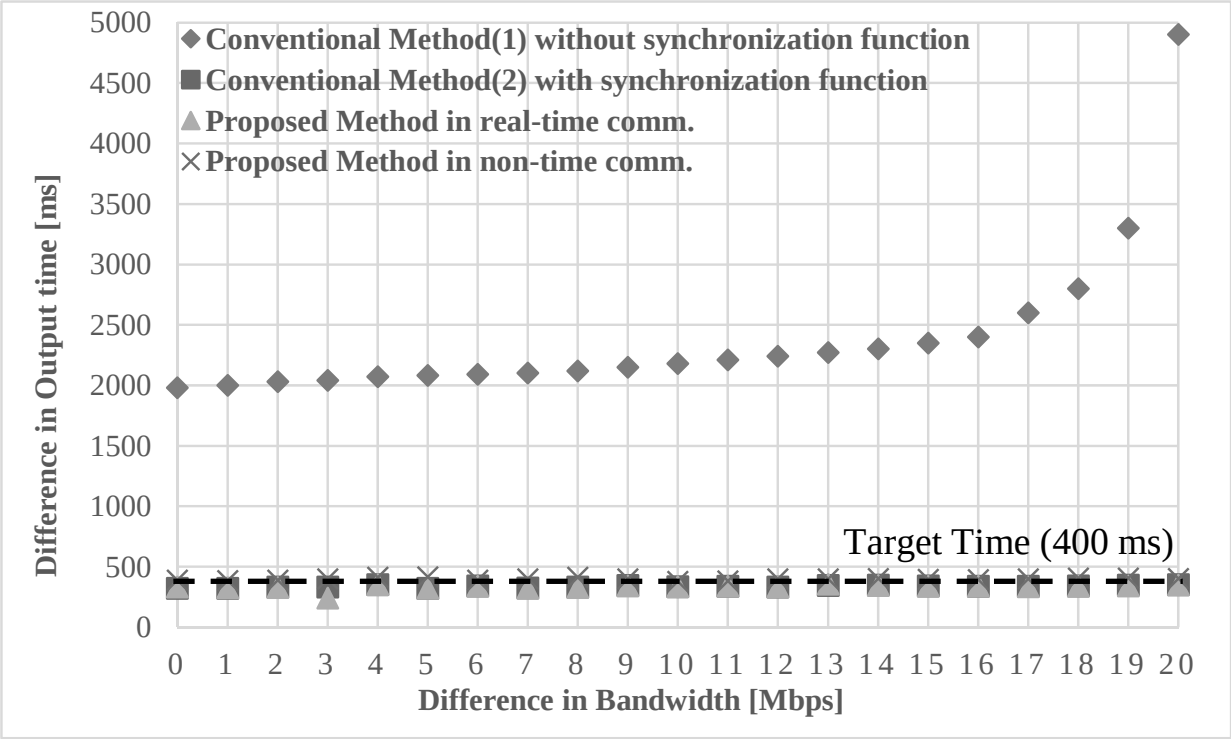
- Item3

Difference between the output time of streaming data and the output time of non-streaming data.

Experimental Result1

- Difference in output time of web content among browsers according to increase of difference in bandwidth among devices.

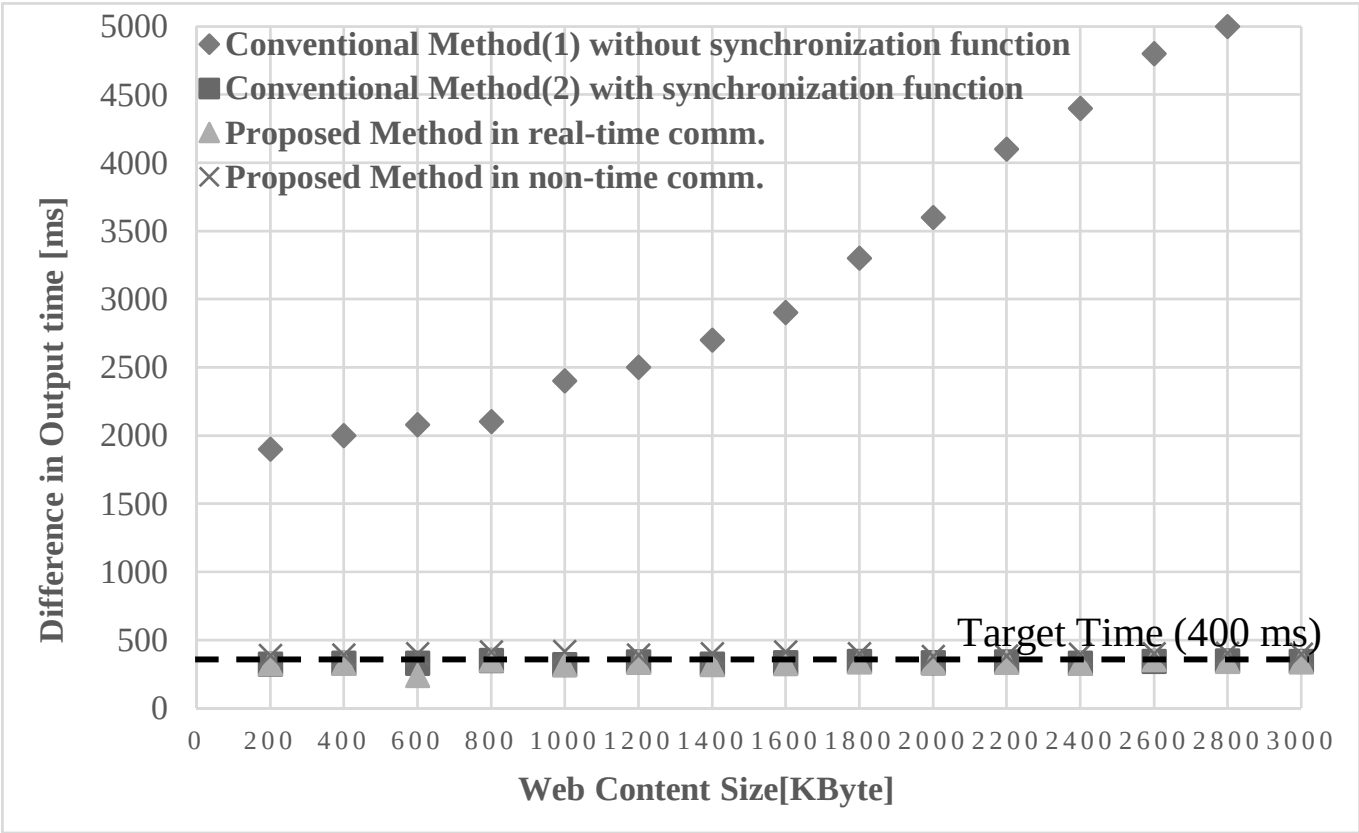
The proposed method: keeping synchronization in real-time and non-real communications



Experimental Result2

- Difference in output time of web content among browsers according to increase of web content size.

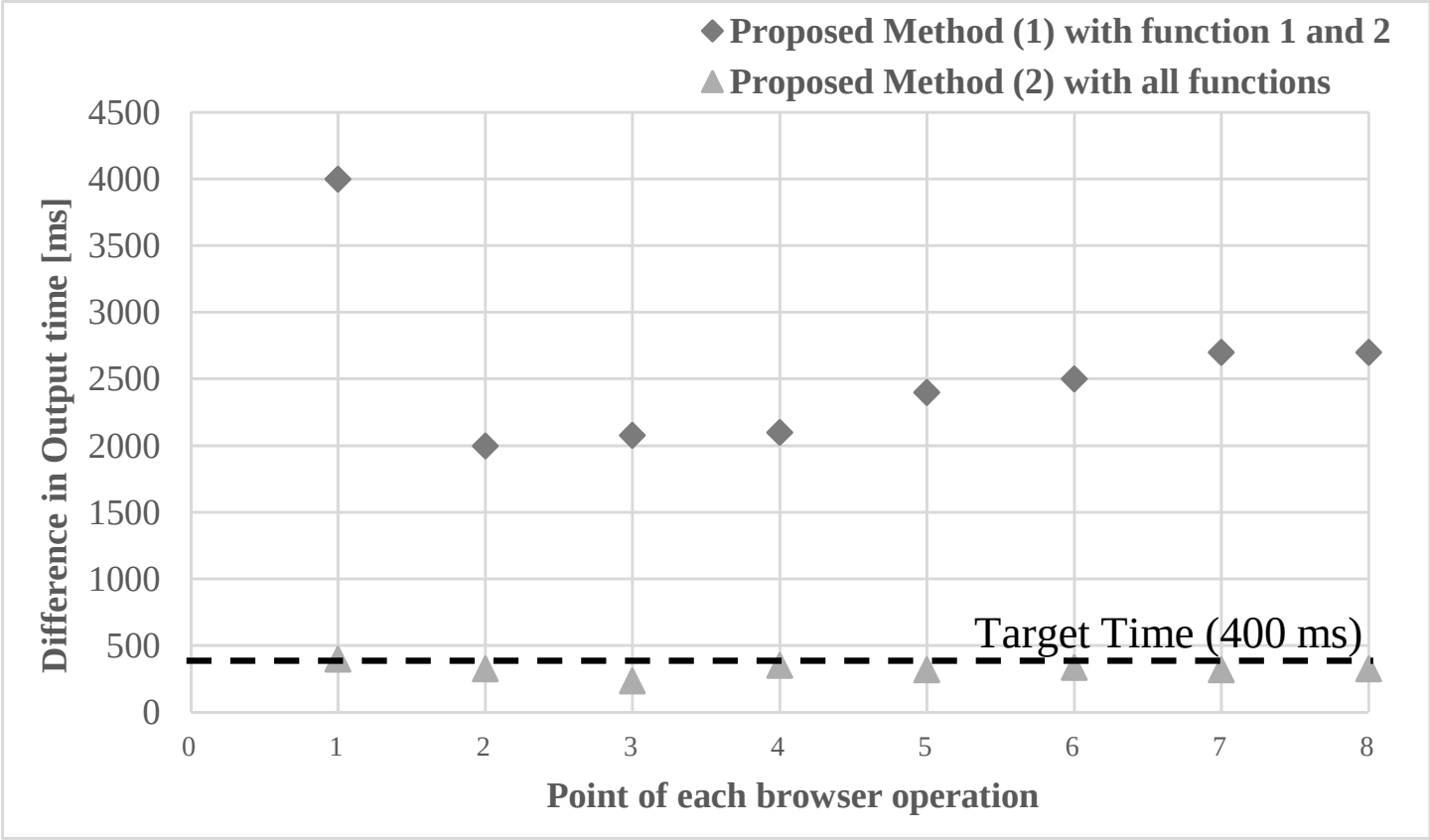
  The proposed method: keeping synchronization in real-time and non-real communications



Experimental Result3

- Difference between the output time of streaming data and the output time of non-streaming data.

The proposed method: keeping synchronization in real-time and non-real communications



Conclusion

- We proposed a web synchronization method for supporting real and non-real-time web communication among browsers.

- The proposed method shifts the output time on browsers according to operator's situation and the network delay and rendering performance.

The End

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