

RCB: A Simple and Practical Framework for Real-time Collaborative Browsing

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End-user Real-time Communication



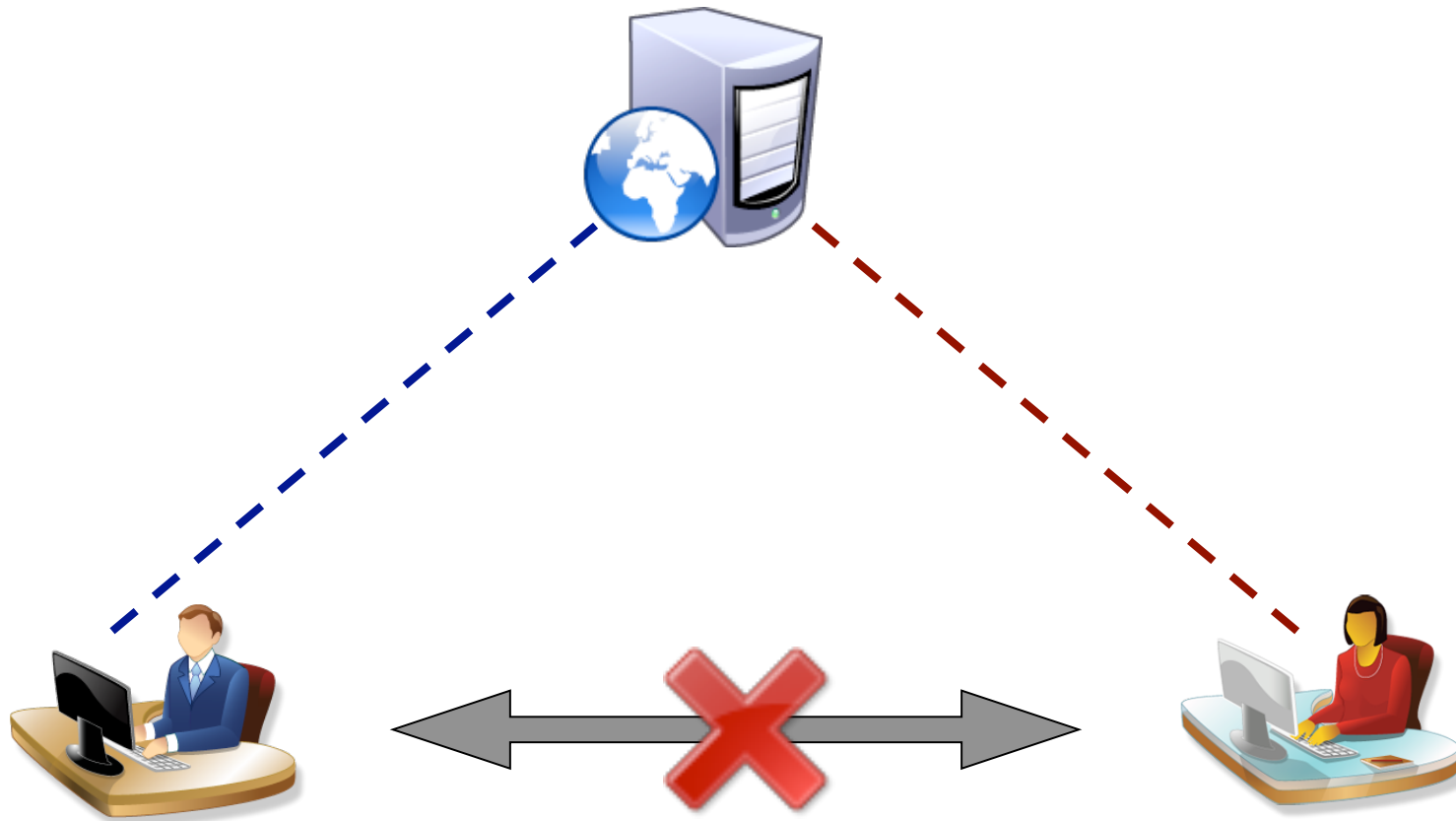
Document Sharing and Collaboration



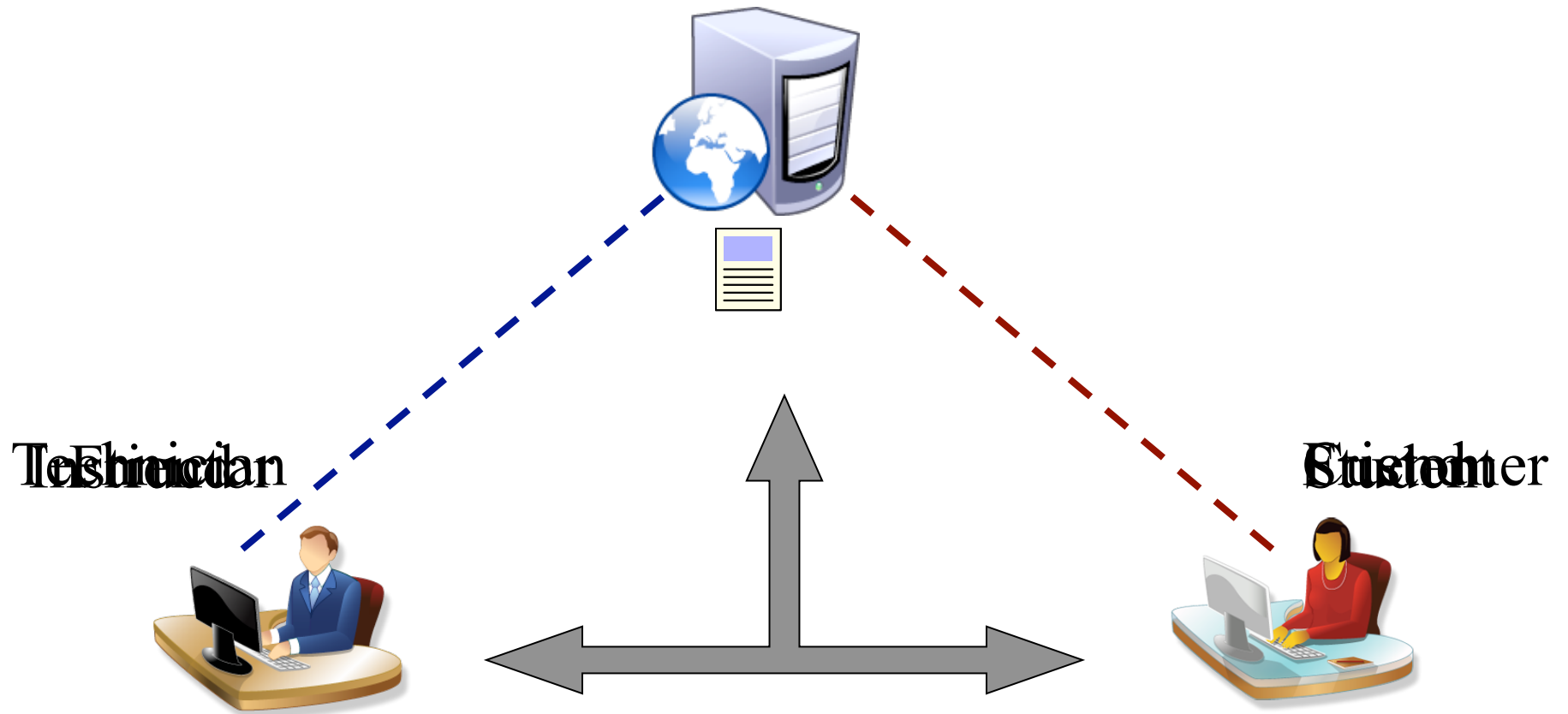
Adobe
Buzzword



Web Browsing: Heavily Isolated



Collaborative Browsing (Co-browsing)



Simple Co-browsing via URL sharing



- E.g., instant messenger tools/browser extensions
- **Limited collaboration**
 - Can at most view webpages
- **Narrow scope of webpages**
 - Cannot access session-protected or dynamic webpages

Complex Co-browsing via Screen Sharing

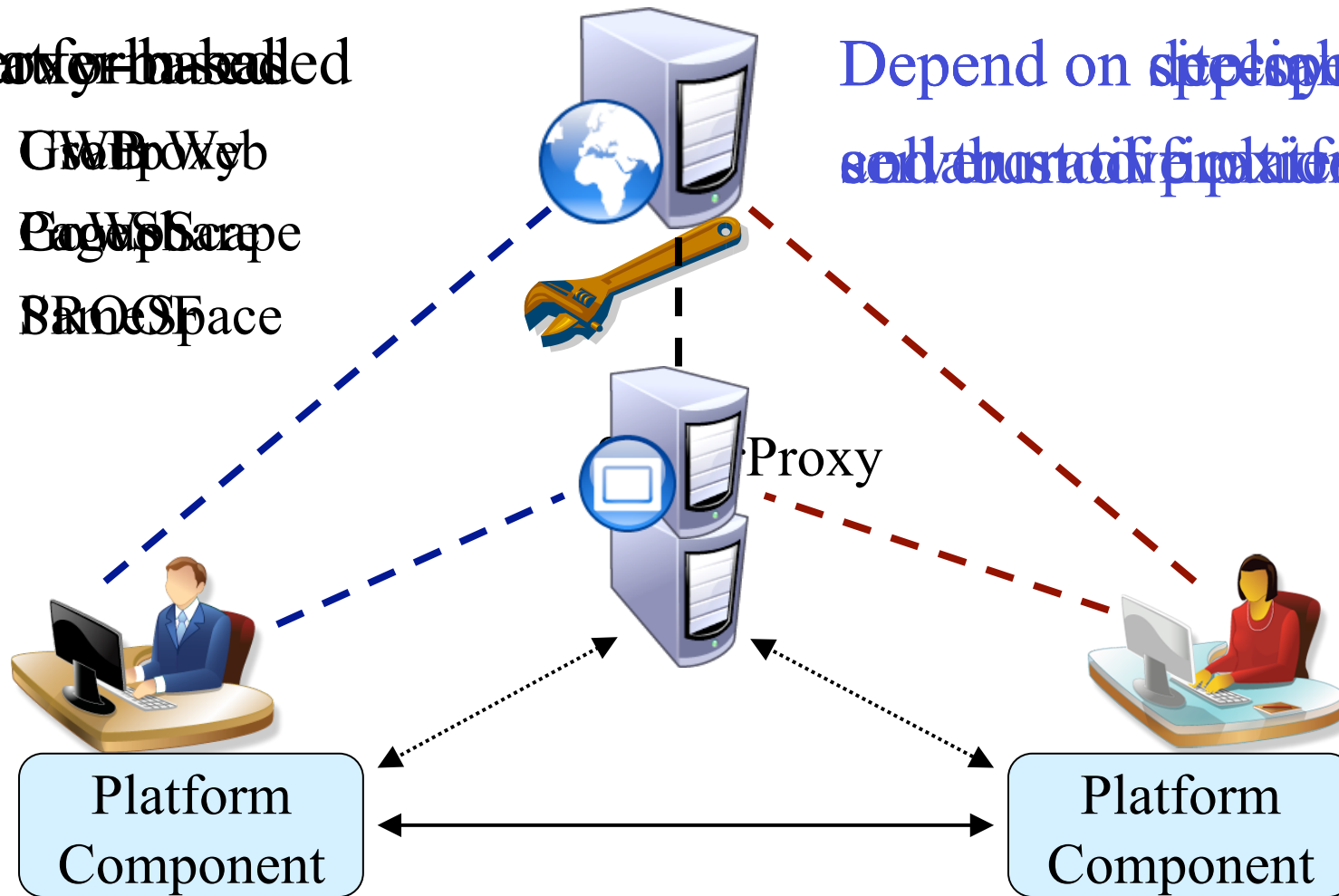


- E.g., screen or application sharing software
- High demands on network bandwidth and security
 - Grant the control of a whole screen or application

Specific Co-browsing Solutions

- Browser based
 - Web Proxy
 - Page Scrape
 - BrowserSpace

Depend on site specific
solution for applications



Our RCB Solution

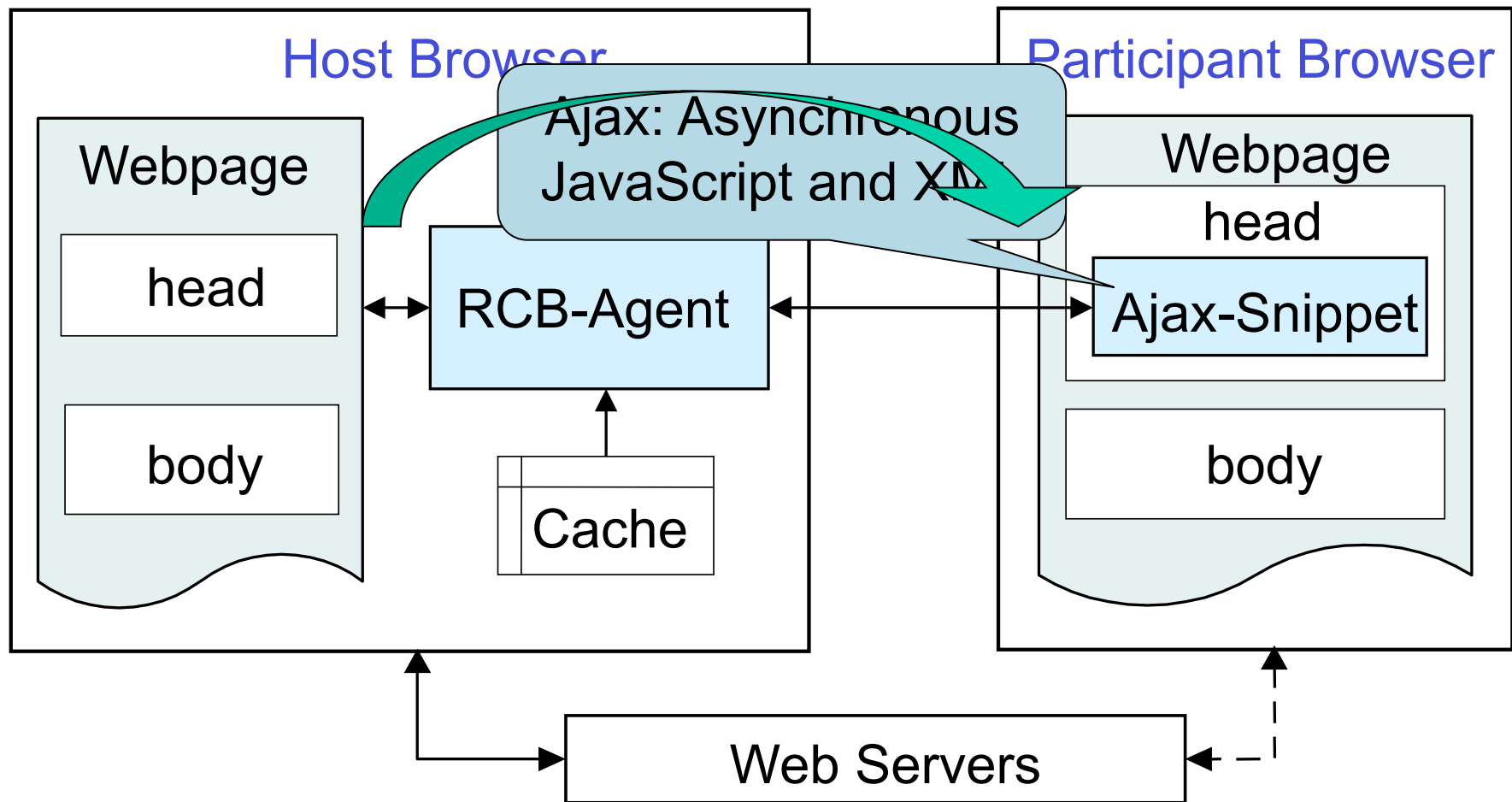


- Pure browser-based solution
- Simple and Practical
- Almost everywhere, various webpages
- Fine-grained, high-quality

Outline

- Introduction
- Framework Design
- Implementation
- Evaluation

Architecture of the RCB Framework

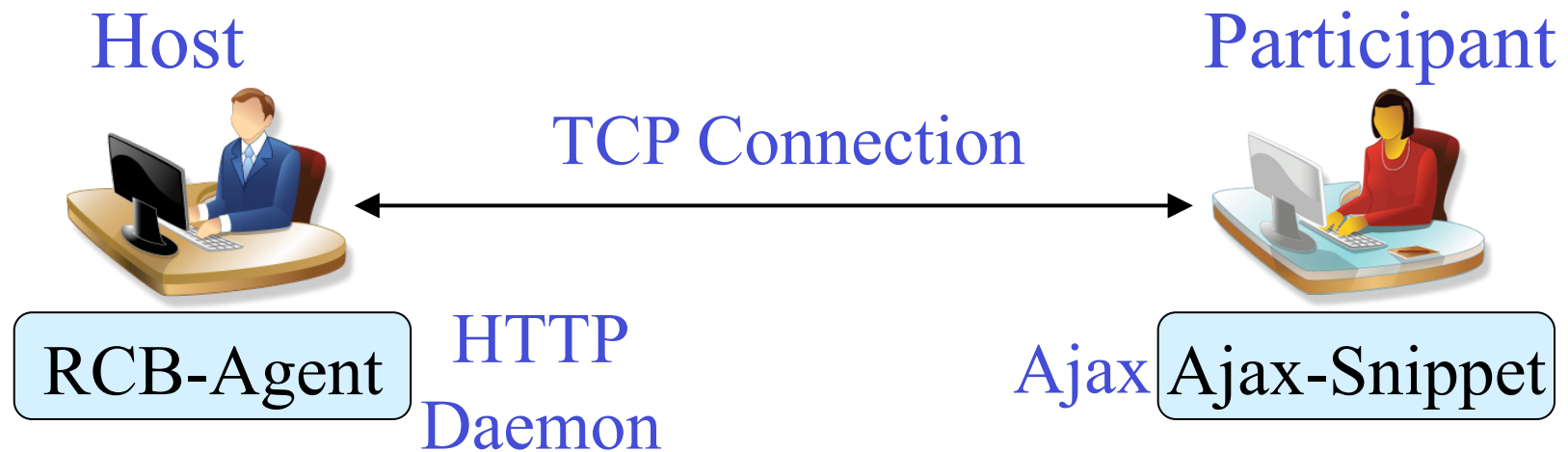


A Typical RCB Co-browsing Session



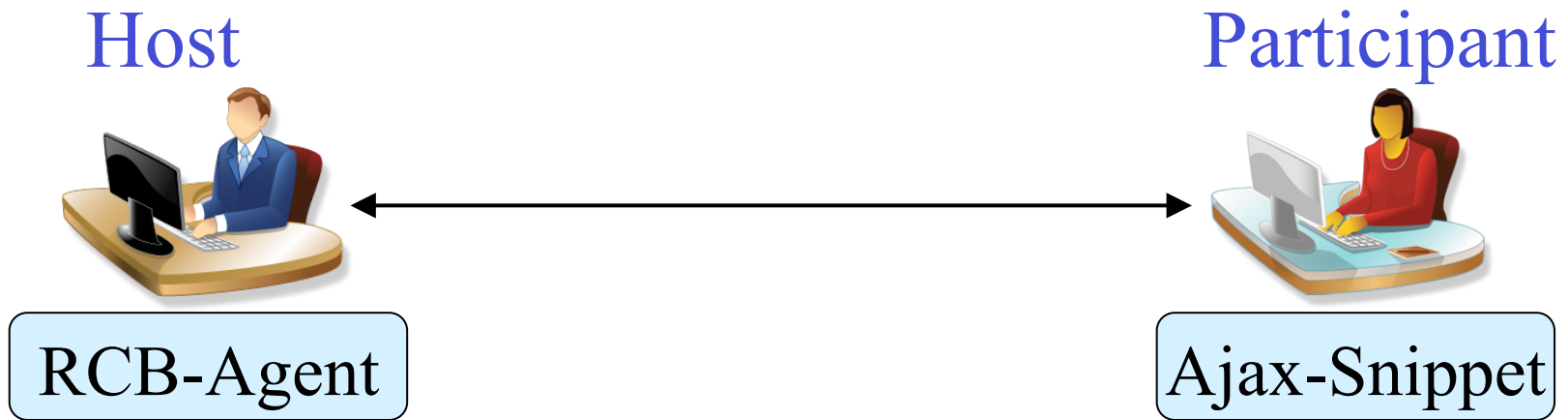
1. Start the agent
 2. Establish connection
 3. Visit a webpage
 4. Clone and modify
 5. Synchronize document
 6. Replace HTML elements
 7. Download object (non-cache)
 8. Download object (cache)
 9. Synchronize changes/actions
- Repeat steps 3 ~ 9 !**

Three Design Decisions



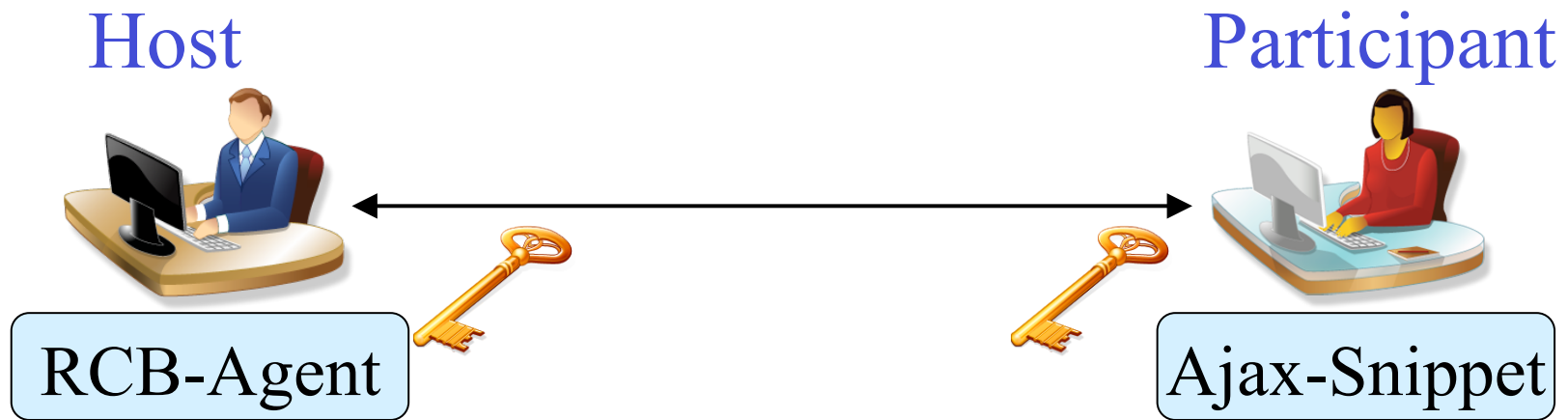
- Direct communication model
- HTTP-based service model
- Poll-based synchronization model

Co-browsing Topologies and Policies



- Multiple participants, free join/leave, awareness
- RCB-Agent enforces high-level policies

Security Design



- Similar to visiting a trusted HTTP website
- Protect RCB-Agent by authenticating requests
 - **HMAC** (keyed-Hash Message Authentication Code)

Implementation Overview

- RCB-Agent

- Firefox Extension



- Pure JavaScript

- Possible for other browsers

- Ajax-Snippet

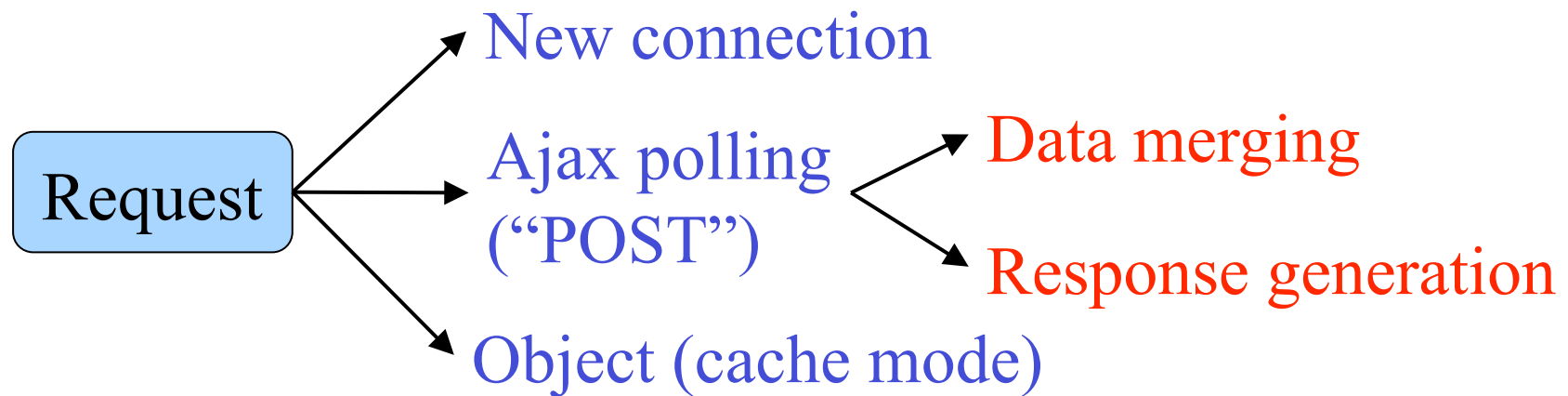
- JavaScript objects/functions

- Support different browsers



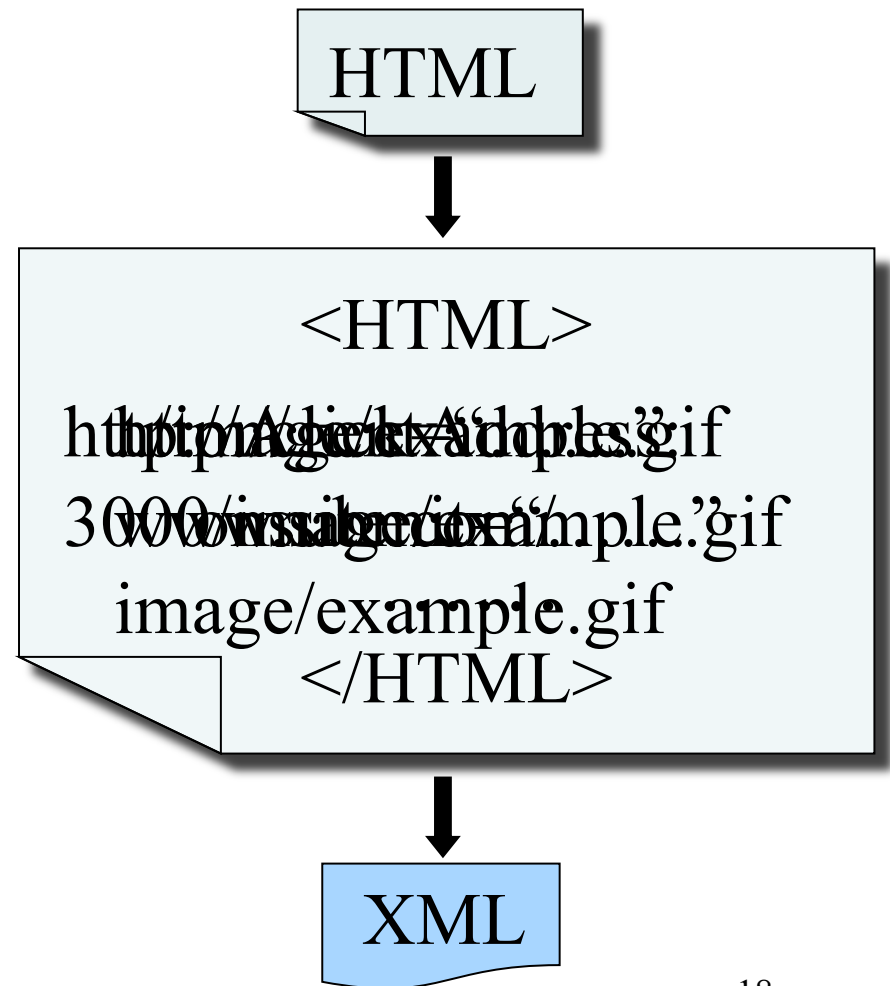
RCB-Agent Request Processing

- Implement a **server socket** object
 - Asynchronously accept new TCP connections
 - Asynchronously process HTTP requests
- Three types of HTTP requests



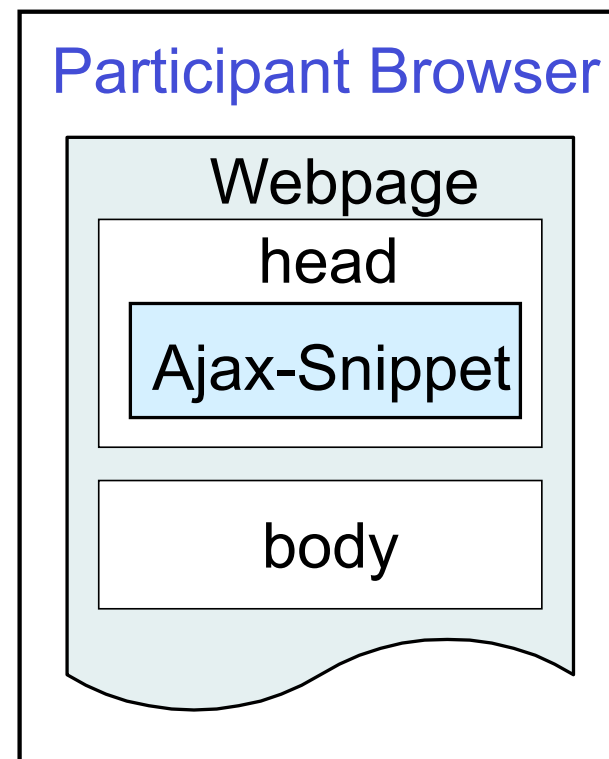
RCB-Agent Response Content Generation

1. Clone
2. Change object URL
(Relative → Absolute)
3. Change object URL
(Absolute → Agent)
4. Rewrite event handler
5. Generate response



Ajax-Snippet

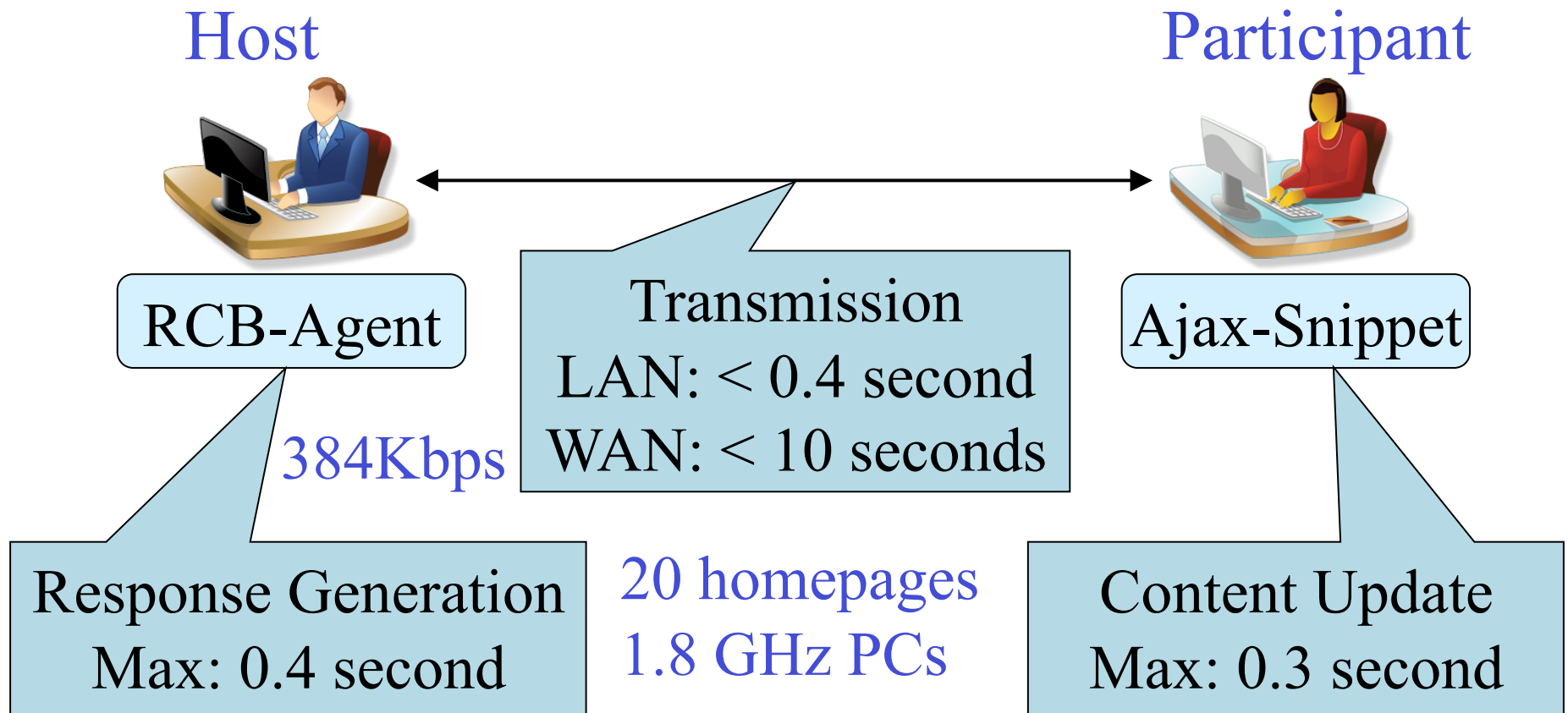
- Request Sending
 - XMLHttpRequest
 - “POST”, asynchronous
- Response Processing
 - Clean up and set head
 - Clean up and set other



Evaluation of RCB

- Performance Evaluation
 - The real-time performance of RCB
 - LAN environment and WAN environment
- Usability Evaluation
 - Whether RCB is helpful and easy to use
 - Using Google Maps and shopping online

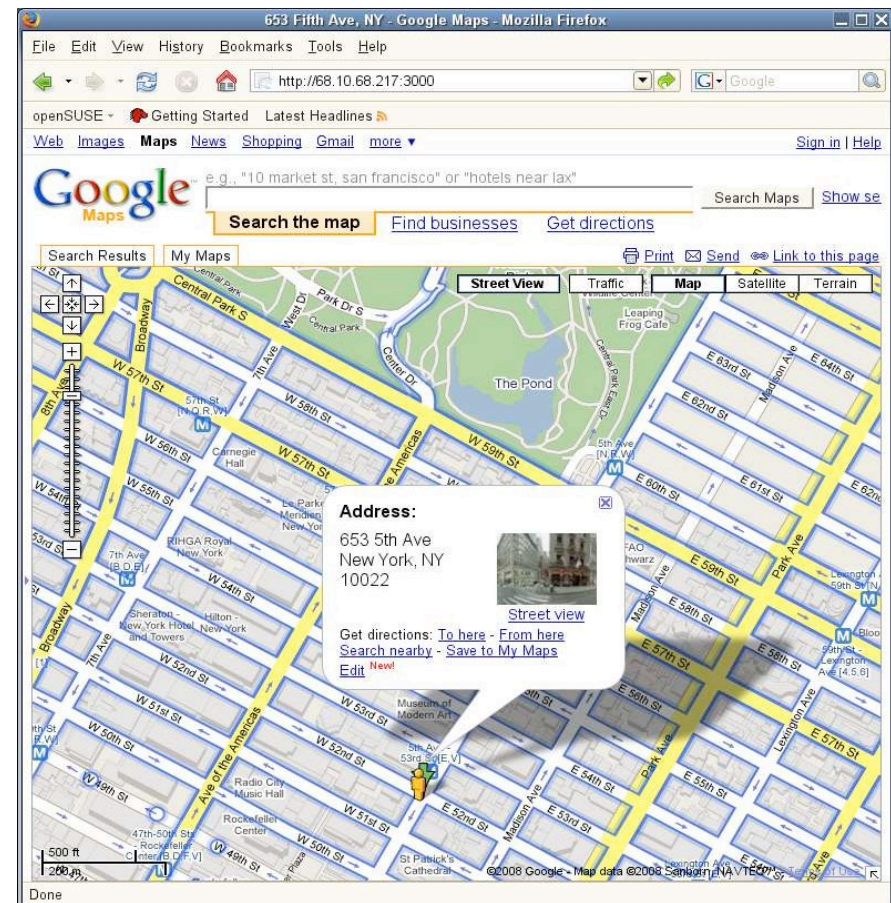
Performance Evaluation



Coordinating a Meeting Spot via Google Maps

- Bob hosts
- Alice joins
- Bob may
 - Search, zoom in/out, drag, switch views
- Alice sees same pages

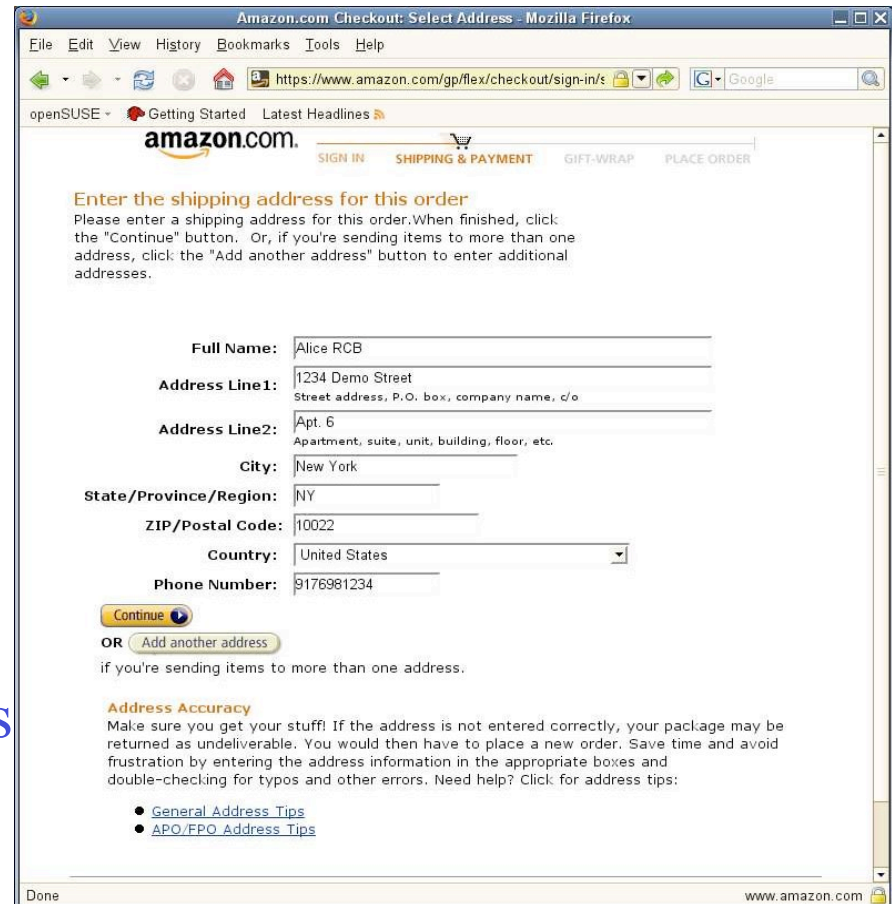
Rich content, communication intensive webpages



Online Co-shopping at Amazon.com

- Bob hosts
- Alice joins
- Bob or Alice may
 - Type in, search, click, fill/submit form

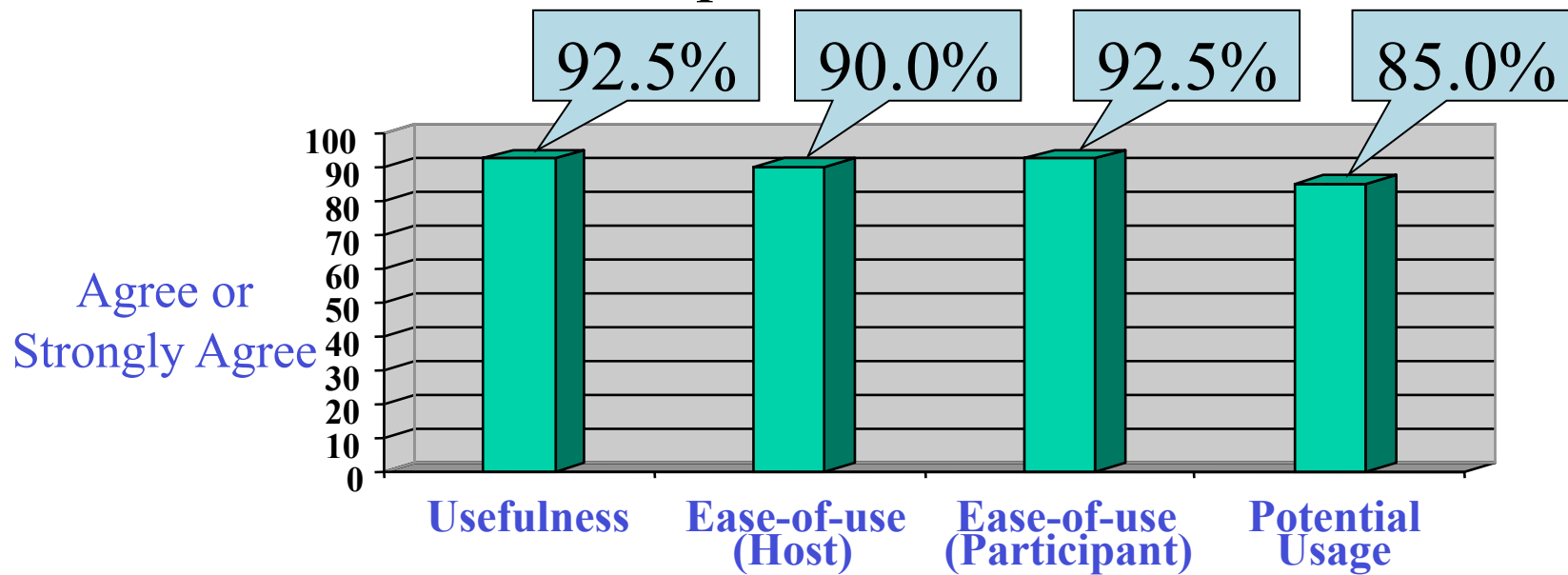
Dynamic/session-protected webpages, various interactions



The screenshot shows the Amazon.com checkout page in a Mozilla Firefox browser window. The page title is "Amazon.com Checkout: Select Address - Mozilla Firefox". The browser's address bar shows the URL "https://www.amazon.com/gp/flex/checkout/sign-in/". The page content includes the Amazon logo, navigation links for "SIGN IN", "SHIPPING & PAYMENT", "GIFT-WRAP", and "PLACE ORDER". The main heading is "Enter the shipping address for this order". Below this, there is a form with the following fields: "Full Name" (Alice RCB), "Address Line 1" (1234 Demo Street), "Address Line 2" (Apt. 6), "City" (New York), "State/Province/Region" (NY), "ZIP/Postal Code" (10022), "Country" (United States), and "Phone Number" (9176981234). There are "Continue" and "Add another address" buttons. Below the form, there is an "Address Accuracy" section with a warning and two links: "General Address Tips" and "APO/FPO Address Tips".

Usability Evaluation

- Twenty students come from nine degree programs
- Ten pairs perform the two scenarios in a session
- Observation and questionnaire results



Summary

- Pure browser-based co-browsing solution
- Simple and Practical
- Implemented as a Firefox extension
- Efficient, high-quality, helpful and easy to use

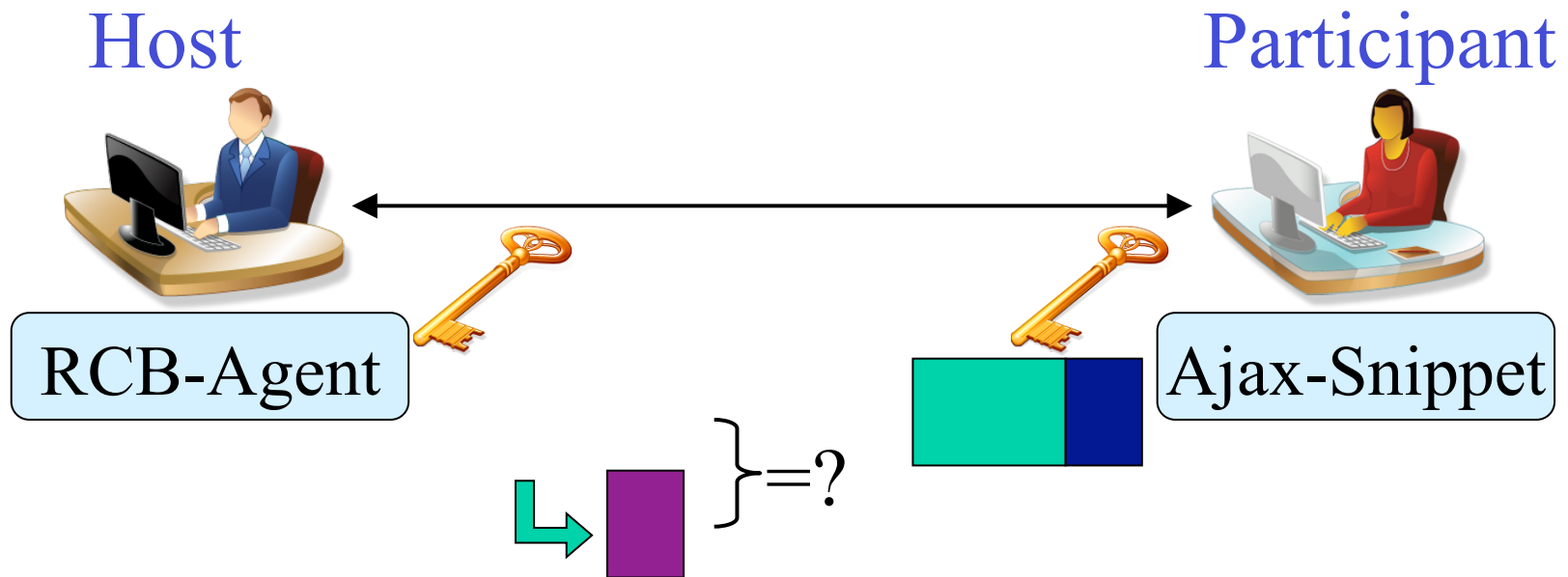
Thank You!

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<http://www.cs.wm.edu/~cyue>

Backup Slides

Security Design



- Similar to visiting a trusted HTTP website
- Protect RCB-Agent by authenticating requests
 - HMAC (keyed-Hash Message Authentication Code)

XML Format Response Content

```
<?xml version='1.0' encoding='utf-8'?>
<newContent>
  <docTime>documentTimestamp</docTime>
  <docContent>
    <docHead>
      <hChild1><![CDATA[escape(hData1)]]></hChild1>
      <hChild2><![CDATA[escape(hData2)]]></hChild2>
    </docHead>
    <docBody><![CDATA[escape(bData)]]></docBody>
  </docContent>
  <userActions>userActionData</userActions>
</newContent>
```