Let Our Browsers Socialize: Building User-centric Content Communities on WebRTC

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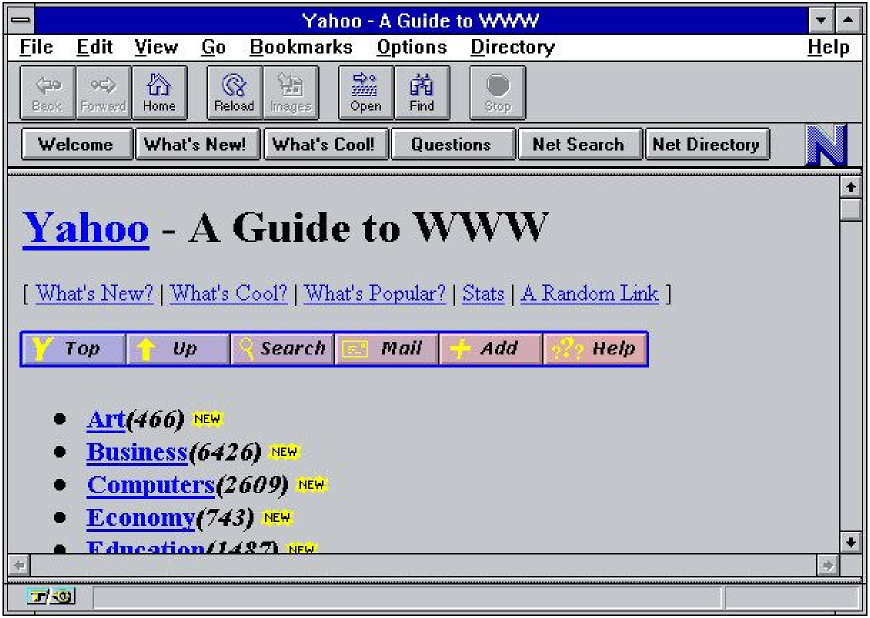
Agenda

The Web Platform

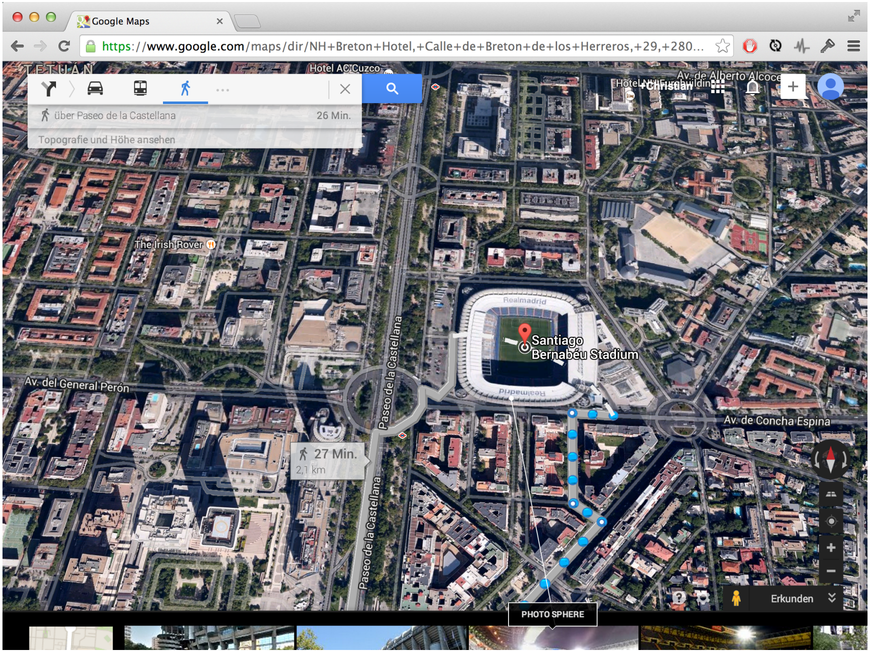
- All of us probably use the Web daily
- Current browser communication is client/server only
- Based on the traditional client/server paradigm (HTTP)
- Browser evolved from simple markup viewer to application platform


Yahoo - A Guide to WWW
File Edit View Go Bookmarks Options Directory Help
Back Forward Home Reload Images Open Find Stop
Welcome What's New! What's Cool! Questions Net Search Net Directory
Top Up Search Mail Add Help

Yahoo - A Guide to WWW

[What's New? | What's Cool? | What's Popular? | Stats | A Random Link]

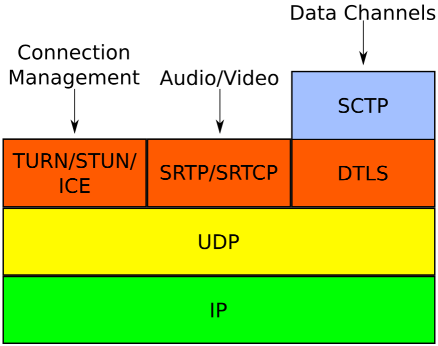
- Art(466) NEW
- Business(6426) NEW
- Computers(2609) NEW
- Economy(743) NEW
- Education(1487) NEW

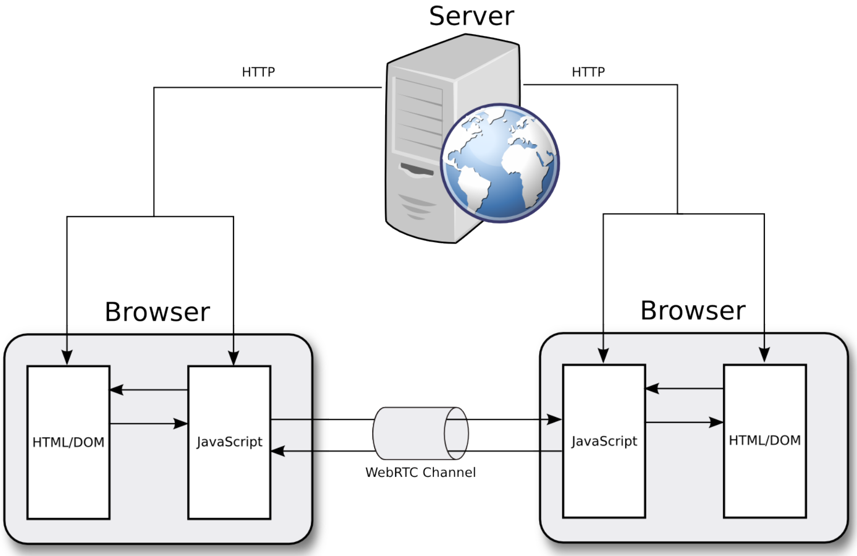

Google Maps
https://www.google.com/maps/dir/NH+Breton+Hotel,+Calle+de+Breton+de+los+Herreros,+29,+280...
über Paseo de la Castellana
26 Min.
Topografie und Höhe ansehen
TETUAN
Hotel AC Cuzco
Av. de Alberto Alcoce
Hotel NH Eurobuilding
+Christian
The Irish Rover
Santiago Bernabéu Stadium
Av. del General Perón
Paseo de la Castellana
27 Min.
2,1 km
Av. de Concha Espina
Erkunden
PHOTO SPHERE

WebRTC

Web Real-Time Communications

- Allows peer-to-peer communication between browsers
- Major paradigmatic change in Web technologies
- Support for media and data channels
- Opportunistic Security (OS)
- Joint effort of IETF (protocols) and W3C (APIs)




Server
HTTP
HTTP
Browser
Browser
HTML/DOM
JavaScript
WebRTC Channel
JavaScript
HTML/DOM

WebRTC Usages

- Mostly media focused
  - Integration of real-time communication into websites[1]
  - Web-based conferencing[2]

- Experimenal data applications
  - Instant 1-to-1 file sharing[3]
  - CDN based on a centralized P2P system[4]

[1]`https://tokbox.com/`
[2]`https://jitsi.org/`
[3]`https://sharefest.me/`
[4]`https://peercdn.com/`

Our Motivation

- Started off by investigating new use cases
- Build a user-centric layer that avoids centralization
- Give control over content back to the user
- Provide an extentable framework for community-based WebRTC use cases

Goals in a nutshell: serverless, privacy aware, open platform

Use Cases

Example: Document sharing on the Web

Traditional

- Server-based (e.g., Dropbox[5])
- Upload the content to a central server/service
- Can you trust the service provider?

User-centric

- Content centers around the user, not the service provider
- Direct sharing from one browser/user to another
- No intermediate party involved

[5]https://dropbox.com/

Introducing BOPlish

Browser-based Open Publishing

- Build a community layer soley from Web browsers
- Implement your own protocols on top of BOPlish
- Privacy aware by avoiding central components and using OS
- Drop-in JavaScript library for P2P web applications[6]

[6]https://github.com/boplish

Naming Content

- URIs that are bound to location:
  - `http://example.org/file-xyz`
  - `mailto:hi@chris.ac`
- Bound to a specific host via its IP address
- Inflexible when the location changes
- **Idea: Bind content to user, not location**

BOPlish Naming Scheme

Idea: Bind content to user, not location

BOPlish URI scheme

`bop:username@idp:protocol[/path[?parameters]]`

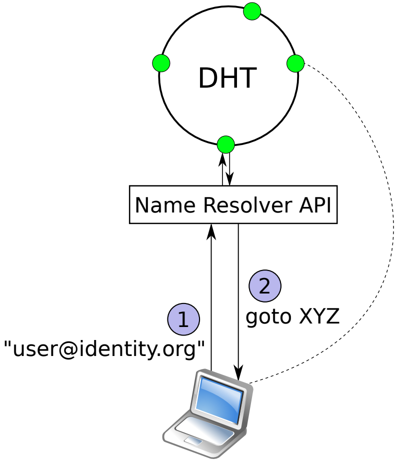
Examples

```
bop:alice@example.org:chat/nightOut
bop:bob@example.de:pacman/room1337
bop:me@chris.ac:file/hotpost-slides?ext=pdf
```

BOPlish Building Blocks

Task: Name Resolution

- Resolve user-identifying URI part to a host that holds the content
- Solution based on a Distributed Hash Table (DHT)
- Built soley from BOPlish peers



Mobility and Offloading

- Users are expected to frequently change content location
- Transparent handover by updating the name resolution service
- BOPlish URIs do not have to be changed when content location changes
- Support for offloading data to other hosts
- Future Work: Extend name resolution to support multiple active hosts

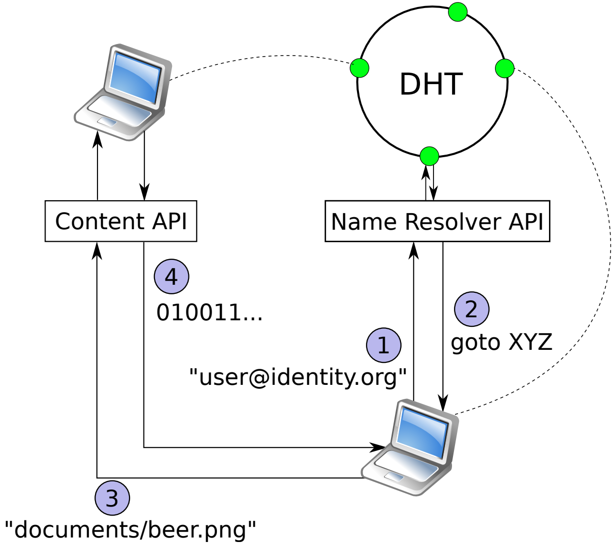
BOPlish Building Blocks

Task: Data Routing

- Transfer the actual content from the resolved peer
- Uses WebRTC DataChannel for textual and binary transfer

Procedure

1. Exchange offer/answer messages via overlay
2. Establish DataChannel connection between provider and receiver
3. Start communication using the specified protocol (e.g., `pacman`)

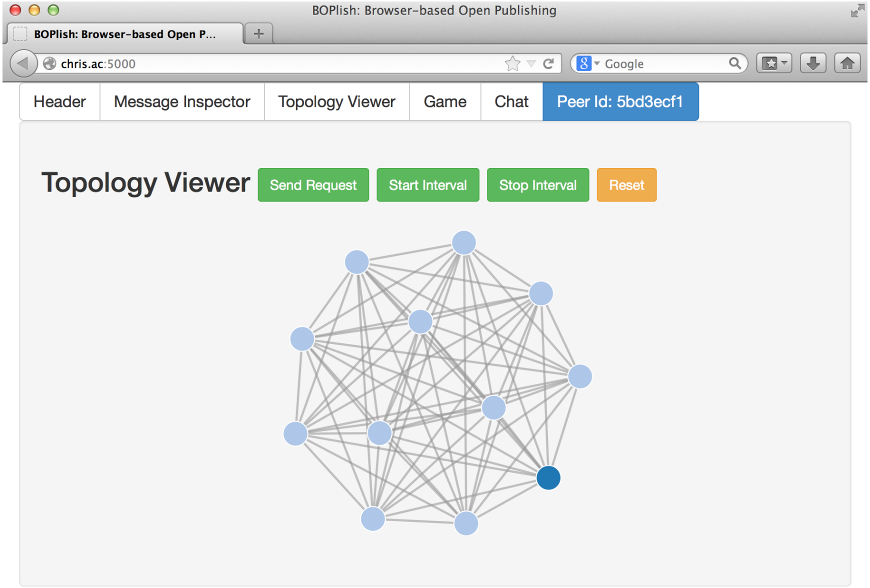

DHT
Content API
Name Resolver API
1
"user@identity.org"
2
goto XYZ
3
"documents/beer.png"
4
010011...

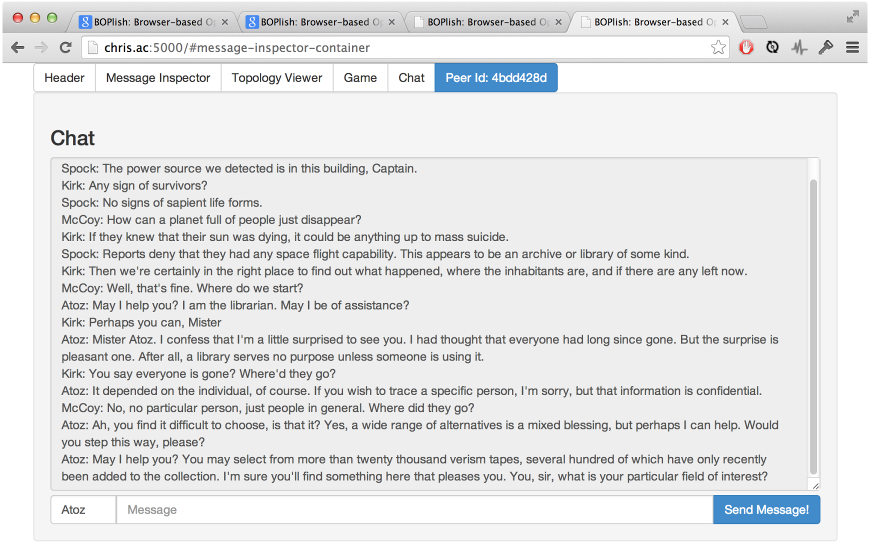
BOPlish API

API hides all the complexity from the developer (WIP)

```
var bc = new BOPlishClient("wss://chris.ac:5000");
var pacman = bc.registerProtocol("pacman");

pacman.setOnMessageHandler(function(bopuri, from, msg) {
    // handle incoming pacman messages
});
pacman.send(
    BopURI("bop:alice@example.org:pacman/game1"),
    {movePacMan: {x:1, y:2}}
);
```


BOPlish: Browser-based Open Publishing
BOPlish: Browser-based Open P...
chris.ac:5000
Google
Header
Message Inspector
Topology Viewer
Game
Chat
Peer Id: 5bd3ecf1
Topology Viewer
Send Request
Start Interval
Stop Interval
Reset



Chat

Spock: The power source we detected is in this building, Captain.
Kirk: Any sign of survivors?
Spock: No signs of sapient life forms.
McCoy: How can a planet full of people just disappear?
Kirk: If they knew that their sun was dying, it could be anything up to mass suicide.
Spock: Reports deny that they had any space flight capability. This appears to be an archive or library of some kind.
Kirk: Then we're certainly in the right place to find out what happened, where the inhabitants are, and if there are any left now.
McCoy: Well, that's fine. Where do we start?
Atoz: May I help you? I am the librarian. May I be of assistance?
Kirk: Perhaps you can, Mister
Atoz: Mister Atoz. I confess that I'm a little surprised to see you. I had thought that everyone had long since gone. But the surprise is pleasant one. After all, a library serves no purpose unless someone is using it.
Kirk: You say everyone is gone? Where'd they go?
Atoz: It depended on the individual, of course. If you wish to trace a specific person, I'm sorry, but that information is confidential.
McCoy: No, no particular person, just people in general. Where did they go?
Atoz: Ah, you find it difficult to choose, is that it? Yes, a wide range of alternatives is a mixed blessing, but perhaps I can help. Would you step this way, please?
Atoz: May I help you? You may select from more than twenty thousand verism tapes, several hundred of which have only recently been added to the collection. I'm sure you'll find something here that pleases you. You, sir, what is your particular field of interest?

Atoz | Message | Send Message!

Conclusions

- Provide a common layer for community-based WebRTC applications
- Open to custom application protocols
- Browser-to-browser overlay network evades centralization
- Some of the use cases have successfully been implemented

Outlook

- Support pluggable overlay schemes for name resolution service according to community size
- Implement Pub/Sub interface
- Finalize and refine API

Thank you!
Questions?

Visit us at `http://inet.cpt.haw-hamburg.de/`
Github: `https://github.com/boplish`