VŠB TECHNICKÁ UNIVERZITA OSTRAVA | FAKULTA ELEKTROTECHNIKY A INFORMATIKY

Web Application Development

XPATH and JSON

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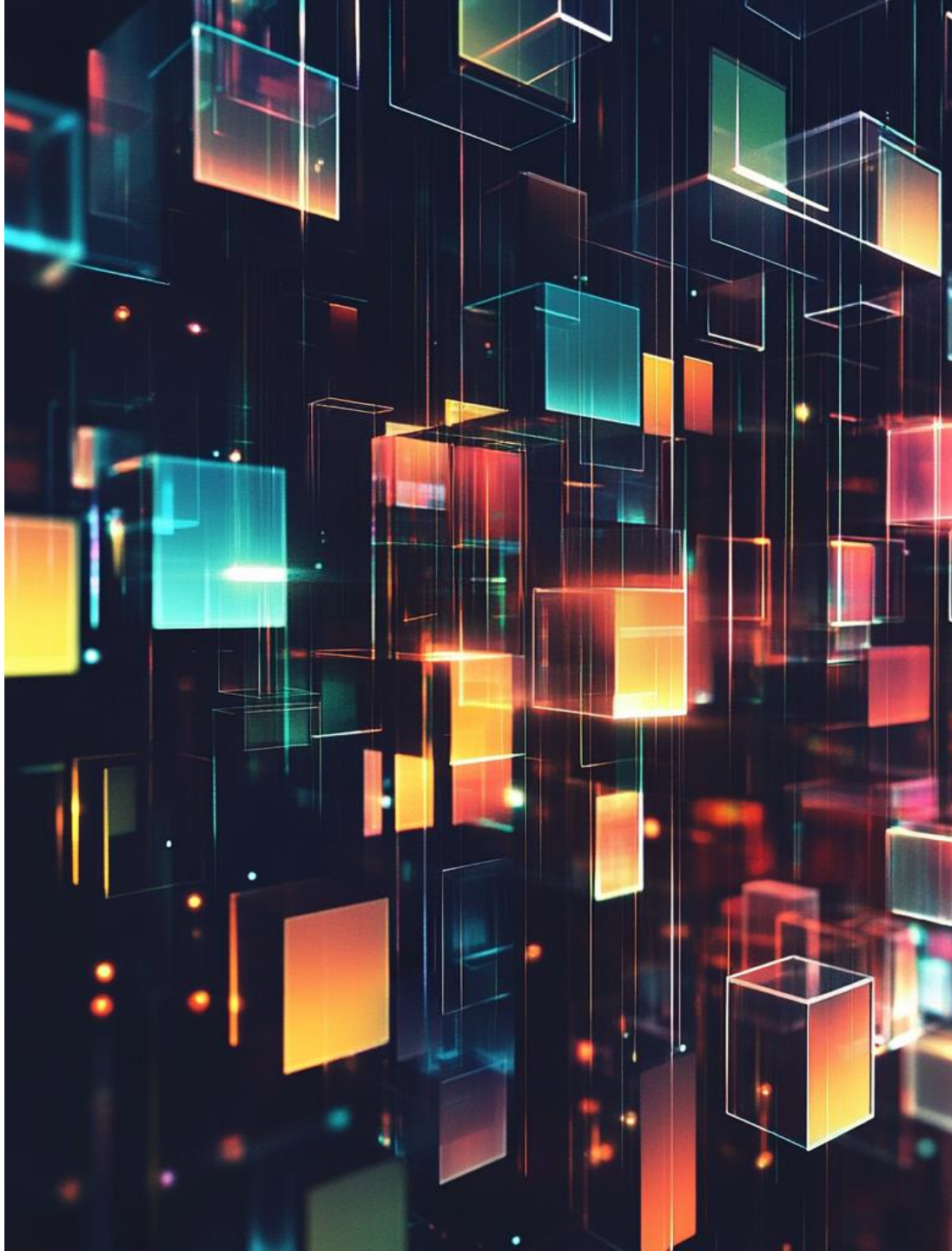


Storage

Cookies replacement

- Data is not a part of each request
- Possible to store huge set of data
- Accessible only by author/web page
- Event-driven model

```
if(typeof(Storage)!=="undefined")
  {
  // Yes!
  }
else
  {
  // Sorry! No web storage support..
  }
```

Principle – couple key/value (string)

LocalStorage – data stored for unlimited time

SessionStorage – data stored for limited time defined by one session

Access by interface (object) or indexes (keys)

Web database

Web SQL Database

- API for data processing on client-side based on relation DB principles (SQL)
- No longer supported as a part of HTML 5 (no longer available)
- Methods: *openDatabase*, *db.transaction*, *tr.executeSQL*

IndexedDB

- Solution to store a huge amount of structured data
- Fast searching based on indexing
- Synchronous and asynchronous approach
- Objective and transactional oriented, use couple key/value (object)
- API interface: **indexedDB**

Off-line applications

Off-line operation of web pages using caching

Decreasing of demands of speed and data size

Cache Manifest (text/cache-manifest)

- Stand-alone file includes cache rules
- CACHE – cache specified files for further usage
- NETWORK – specified files are never cached
- FALLBACK – replacement for non-cached files

Update of files

- Cleaning of cache repository
- Programmatically
- Cache manifest update

Deprecated, usage of Service Workers

Web Workers

- Implementation of „Threads“ in web page environment – run the algorithm in the background without affecting interaction with the user
- External JS files are used for WebWorkers operation – synchronic approach
- Object **Worker**
- Worker works on global level, communication is based on events and messages (*postmessage* – *onmessage*)
- No access to native objects *window*, *document*, *parent*
- *Worklet* - independent access to the rendering thread for more complex multimedia operations
- *ServiceWorker* - independent code processing with a complex lifecycle, the primary role is as a proxy between the application and the network

Web Sockets

- Advanced interface for bidirectional asynchronous communication (client – server), each side can send message during the time
- Both side implementation is necessary
- Effective usage together with WebWorkers
- Object **WebSocket**
- Implementation of events *onopen*, *onmessage*, *onclose* and method *send*
- Alternatives: Server Sent Event, MQTT, WebRTC, … https://ably.com/topic/websocket-alternatives

Drag & Drop

- One of fundamental users features from the desktop app domain
- It is possible to move any content element – **draggable=„true“**
- Implementation of events *ondragstart*, *ondrop*, *ondragover*
- Work with (transmitted within events) object *dataTransfer.SetData* (*GetData*)

Drag-In (File API)

- Ability to move object (file) from local computer inside the web page content
- Based on Drag & Drop approach – event *ondrop* on specified element
- Access to moved content (file) via *DataTransfer.files* (similar to process input type „file“)
- File API offers objects **File, FileList, Blob, FileReader, URL**
- File API is suitable to work with files directly inside web page, cover also the reading of the file content (text, binary, Base64)

FileSystem API

- Extends File API capabilities to write to file (**BlobBuilder**, **FileWriter**) and their organization (**DirectoryReader, FileEntry/DirectoryEntry, LocalFileSystem**)
- Based on virtual file system inside the browser sandbox – access via method *requestFileSystem*
- Suitable for Binary data (temporary or persistent) – files upload, temporary storage, file content edit, off-line working

Geo-localization

- Possibility to obtain the GPS position of the user (latitude, longitude, altitude, accuracy, speed, timestamp)
- Necessity of user permission and secured connectivity
- Based on technical capabilities od device (GPS, Wifi, IP address)
- Object **navigator.geolocation**
- Methods *getCurrentPosition* and *watchPosition*

```
if ("geolocation" in navigator)
{
  /* geolocation is available */
}
else
{
  /* geolocation IS NOT available */
}
```

Access to hardware

- Device orientation and position in environment
- Camera and microphone
- Voice input
- Gestures
- Full-screen mode
- Print
- Authentification
- NFC, Bluetooth
- https://web.dev/articles/devices-introduction

Graphics

Bitmap graphics – Canvas element

- The context is operated over the element – method *getContext(„2d“)*
- The context offers API for drawing, drawing is sequentiual
- Animation uses methods *setTimeout* a *setInterval*. Most effective way is to use *requestAnimationFrame* – utilization of standard animation loop

Vector graphics – SVG format

- Modification of DOM – specific XML as a part of DOM
- Ability to link visual components and CSS/JS

3D graphics – WebGL technology

- Context „webgl“
- API is based on OpenGL approach
- WebVR, WebAR, WebXR

Specific data- attributes

- Possibility to store of specific, application related, data within standard HTML code
- Utilization of prefix **data-*** (these attributes are ignored)
- Access through property *dataset* of a given element
- Suitable for storing work or state values, settings, data for analysis, etc.

Progressive Web Applications (PWA)

A web application (HTML, CSS, JS) that is supplemented/extended with features that allow the application to be used as mobile (native).

1. **Progressive** - does not differentiate what environment the user is working in (thin client)
2. **Responsive** - adapt to different devices with different display options
3. **Connection independent** - ability to work (albeit limited) even offline
4. **App-Like** - user experience is close or equal to using a native app
5. **Up-to-date** - the process of updating with Service workers, not only the data but also the application itself
6. **Secure** - only on HTTPS protocol
7. **Traceable** - they are traceable and indexable (thanks to the manifest)
8. **Installable** - no need to download from application "stores", you just need to know the address and the "installation" process is provided by the application itself (icon on the desktop, etc.)
9. **Available** - easily shared via URL, does not require complex installation

https://web.dev/pwa-checklist/

https://www.vzhurudolu.cz/prirucka/pwa

https://www.rascasone.com/cs/blog/progresivni-webova-aplikace-vyhody

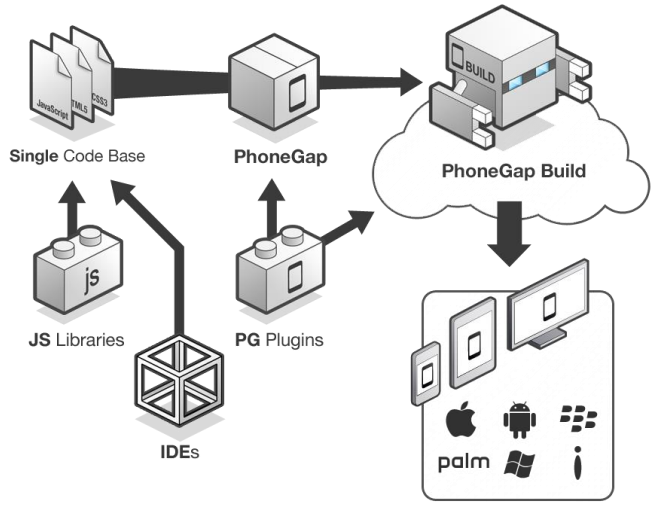
Mobile applications

HTML 5 is suitable for implementation of native mobile apps – thanks to middleware

Web app based on HTML5+JS+CSS is fundamental.

It is extended by features offered by specific API (PhoneGap, Xamarin, etc.).

The result is native cross-platform app – web browser with extended features as environment.



The abstract layer (middleware) is used. It offers connection between app and HW/OS level.

Camera, Geolocation, Compass, Contacts, Media, Accelerometer, Network, Notification, Storage, Filesystem

http://www.youtube.com/watch?v=wOH4aGows40