

AGSC 475: WEB MEDIA TECHNOLOGIES

Definition of Concepts

1) Web Media technologies

Encompass tools, platforms & standards used to create display and manage multimedia content e.g. Examples of web media include:

Images,

Animations

Video clips

Interactive elements e.g. web forms & games.

2) History and evolution of web media.

* Web 1.0 → Early web pages

They were static, web-based text-based & lack multimedia content. They relied on basic HTML for the structure & were primarily designed for info sharing.

* Web 2.0 → Dynamic web pages

They introduced dynamic content & user interactivity e.g. social media

Rich media became central to user experience with wide-spread use of images, videos & interactive

* Web 3.0 Current trend and use of web 3.0

They are AI driven for personalization and immersive technologies like virtual realities, augmented reality & 360° videos

Types of web media

Text

Images

Audio

Video

Interactive elements



web

show user perception & interaction

- Text form the foundation part of web media i.e. blogs, articles
 - Images are for enhancing user engagement e.g. infographics
 - Audio is used in background broadcast background music & interactive user experience.
 - Videos form major form of content today e.g. live streaming, intros
 - Interactive elements forms that user can feed in web based games or dynamic infographics
- The role of web media in user experience
- Visual & and Multimedia elements significantly impact how user perceive & interact with web media tech while integrated media increase engagement, retention & user satisfaction.

5 challenges in web media delivery:

1) Performance:

large media firms can slow down page load

2) Compatibility:

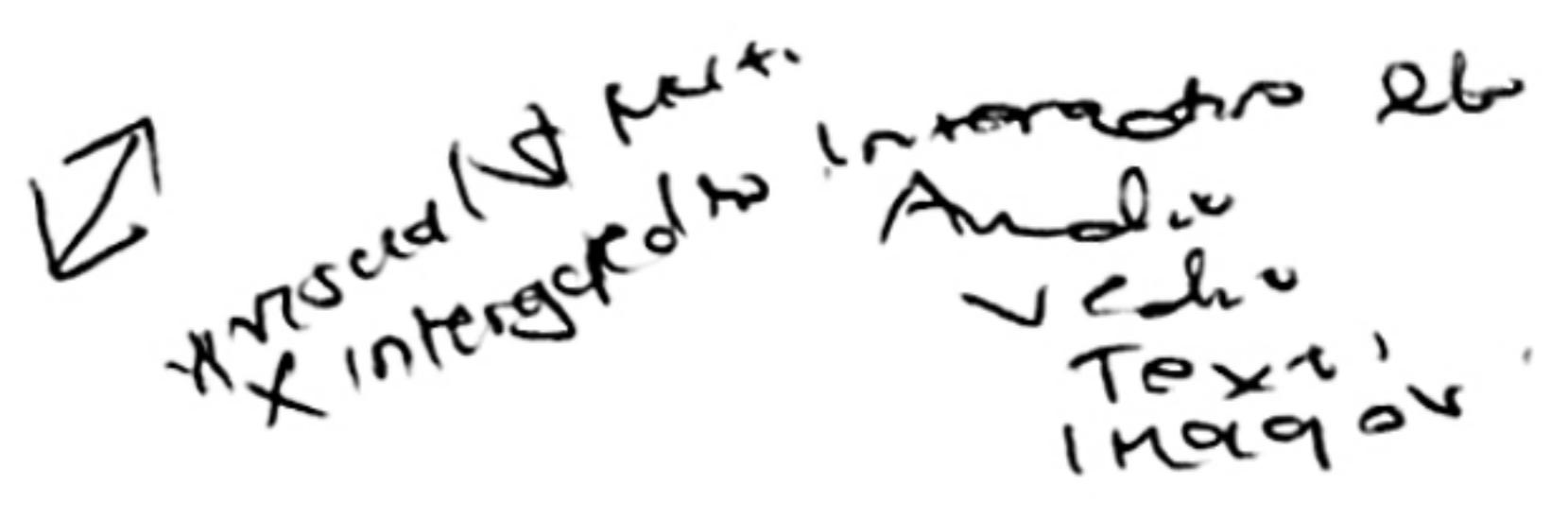
Different media types may require a cross browser compatibility solution.

3) Security & licensing:

Handling media distribution while respecting copyright rules and protecting content from unauthorized use.

Task:

- 1) Review modern websites e.g. social media, ecommerce & examine how they use media technology
Identify what works well for them & challenges



Analyse static HTML web Pages propose how to transform it using modern web media technologies

GRAPHICS & IMAGE COMMON FORMATS ON THE WEB

The Bachelor of web graphics include common images & formats, compression & optimization strategies to ensure performance.

1) Raster vs Vector graphics

Raster graphics

Comprised of pixels making them resolution dependent.

Best suited for complex imagers like

Common images are JPEG, JPG, PNG, GIF.

Vector graphics

Defined by mathematical equation, allowing for scalability without loss of quality.

They are ideals for logos, icons + illustrations.

Garrison format .svg

Image formats

- JPEG - Joint photographic Expert Group
Best for photographs & images with a lot of colour
lossy compression which supports
widely supported by all web platform.
 - PNG - Portable Network graphic
supports lossless compression & transparency
Best for images that require high quality transparency
Has got size that are larger than JPEG
 - GIF Graphic Interchange format
Support limited colors i.e. 256 colours & simple Animation
Suitable for icons small graphics & animated com

SVG - Scalable vector graphics

Vector based format that allows scalability without loss of quality

Ideal for logos, images & graphics that needs to be resized graphically

WebP

Modern image format developed by Google that provides both lossy & lossless compression

Produces small file sizes compared to JPEG & PNG with comparable qualities

Compression strategies

Lossy compression

Reduces file sizes by removing some data often resulting to minor quality loss e.g. JPEG

Lossless compression

Compresses images without losing any quality retaining all the original data

Image optimization for web performance

→ lazy loading

Delays loading of images until needed this reduces page load time

- responsive images

Uses HTML tags for <picture> element or <srcset> to serve different image sizes based on the user's model. This ensures that devices download appropriate size images

Tools of compression of images

TIFF

TIFF PKG ✓

Image optimization

WEB AUDIO TECHNOLOGIES

The web audio API is an advanced tool that allows developers to control audio elements within web applications, providing more flexibility than the traditional HTML5 audio element.

Allows creation of complex audio features such as

- sound mixing
- spatialization
- real time processing

With growing adoption of VR & media massive web, media experiences, Web audio plays an increasingly important role in Web media technologies.

Key concepts

1. Audio Context - Central to Web Audio API i.e. Audio Content which rep the environment where audio is created & processed.

Also used to control & manage different audio ^{nodes} ~~terms~~.

2. Audio nodes

These are building blocks connected to a graph to produce sounds. They include, Microphone (audio files)

Latest developments

x spatial audio

With rise of technologies like ^{dolby} Atmos, spatial audio is a major trend that allows for immersive 3D audio experience. These can also be integrated or support for VR & AR

→ AI-driven Audio enhancement

AI is being used to enhance web audio features, noise reduction & sound optimization for multi-rapid work environment.

WEB RADIO TECHNOLOGY

WRT has evolved significantly transitioning from basic embedded radio to highly interactive responsive and optimized media delivery platform.

Modern web technologies allow seamless integration of radio with custom control, adaptive training & 360° immersive radios.

(a) HTML5 radio - The Video

It is the foundational but modern web app go beyond it in integrating javascript API's to manage media sources dynamically.

(b) Radio streaming

Adaptive streaming protocols such as HLS (HTTP Live Streaming) and MPEG-DASH have become the standards for building web technologies on web media to provide smooth streaming experience by adjusting radio quality based on network condition.

(c) Web RTC

Powerful tool for peer-to-peer video communication in real time e.g. video conferencing & live streaming latest development.

The lated development in VI will see the cooperation of the following:

① Extended Reality (XR) and 360°

Radio content is increasingly being integrated in AR & VR and 360° to provide immersive experience.

~~for
5G/5G+~~

Audion content
audio tools
(art) technology
spatial enhancement
AI driven audio enhance

web XR devices API allow developers to bring radio in virtual spaces for app in industries like education, entertainment & training

② AI in radio compression

The use of AI in optimizing radio quality ~~so that minimizing band-width is gaining momentum.~~

These is particularly useful in live streaming where bandwidth is low.

ANIMATION AND VISUAL EFFECT ON THE WEB

Web animation have become prevalent for creating dynamic and engaging user experiences. Developers can animate elements on a web page using technologies like CSS, SVG & Javascript.

Web animations API offers greater control & flexibility allowing for more complex anime sequences & interaction.

- CSS animations offers simpler ^{declarative} way to animate HTML elements using CSS properties like @keyframe, transition & animation.

- SVG animations offer scalable vector graphics animations that allows for intricate & performance optimized interactions directly with the user this is ideal for interactive interfaces & visualization.

- Web Animation API offers ^{pragmatic} primitive way to create sophisticated animation using Javascript giving developer ability to control.

The latest development we see the incorporation of

(1) 3D Animation & interactivity

with libraries like Three.js, ^{webGL} etc they bring more 3D animation capability to web this will be

webGL

etc they bring more

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Of particular important for web app requiring high end graphics e.g. virtual

② AI in Animation

Going to future AI will be used to streamline the animation process from automating test to generating more responsive videos

ACTIVITY

Required to design a web page that incorporates web media technologies and the target is training the young children in the primary schools.

SERVER TECHNOLOGIES

Refers to hardware software & protocols that provide services & resources to connect devices over a network.

It plays a critical role in hosting websites, db, app etc forming the backbone of modern networked environment within Internet

Classification is based on functions performed by web server

- It hosts websites of organization & serve web pages via HTTP/HTTPS protocols.
e.g. Apache HTTP server; Microsoft IIS server; Nginx server.

a) Database server

Manages db & processes queries from clients
e.g. MySQL, Microsoft SQL, Oracle, Microsoft Access



~~1) Web server~~

3) Application server

- Executor App. logic & Manager interactions b/w clients & the db. e.g. Tomcat, JBoss, websphere.

4) file server

- Stores & manages files allowing user to share & access & share them over the network e.g. - samba, NFS

5) Proxy server

Provide security

6) DNS server/Domain

Converts the url URL into an IP address.

Resolve IP Address against the URL.

SERVER HARDWARE

Designed for large workloads reliability & uptime

Key hardware Components:

1) CPU

The server CPU must be a high performance capable of handling concurrent effects & complex computation

2) Memory

(RAM) server requires large amount of RAM for faster data access and the running

for any functional (16 GB) is required.

3) Storage

Server uses fast & reliable storage including SSDs & harddrives for storing data.

RAID (Redundant Array)

their configurations for redundancy & performance.

4) Network Interface Card.

Server has (2)

Distinguishing between

Multiple high speed NICs) that is 10 Gbps are used in network connectivity & load balancers.

bits
↑

5) Power supply.

Server requires redundant power supply to ensure continuous power & operation in case of a failure

6) Cooling - Racks systems.

7) file suppression system.

Detection

threshold

Server Software.

Server OS manages the hardware & provide environment to run server app.

Popular servers : Involves

Linux-based servers

They are open-source highly customizable & commonly used for web, db, & app servers.

a) Ubuntu server

b) Windows server

No graphical components.

Examples windows server 2019, 2022 (current)

Graphical user interface which interact with the User.



Virtualization software.

Virtual Machines enable MUs to run on the same physical server.

(a) Hypervisor

Manages the VM e.g. VMware vSphere, Microsoft HyperV, KVM.

(b) Containerization

Containers e.g. Docker, Kubernetes provide light weight alternatives to VM.

SERVER ARCHITECTURES

(1) Client-Server architecture

Server provides resources/services to the Client.

Server processes Client requests & return appropriate data.

(2) Peer-to-peer architecture

It is a decentralized model where any device can anytime act as a server or a client common in file sharing systems.

(3) Cloud Based architecture

Cloud servers also host data

^

Accessible via Internet, servers are highly available, highly redundant.

e.g. AWS, Microsoft Azure, Google cloud.

SERVER PROTOCOLS

Various protocols facilitate communication between clients & servers

(1) HTTP/HTTPS (80/443 port)

Used by web servers to serve web components over web protocols

HTTP secures data using SSL/TLS encryption



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→ Well known

② FTP

enables transfer of files between a client & a server.

③ SMTP : simple mail T

Used by Mail servers for sending & receiving emails.

④ SSH (secure shell)

Provides secure login and management of servers.

⑤ SNMP (Simple network Management protocol)

Used for network management & monitoring.

In server virtualization and Cloud technologies

Virtualization allows multiple servers to run on a single physical server.

provides benefit like resource optimization, isolation.

Cloud servers offers On demand Computing resources over internet

Cloud servers model

① Infrastructure as a service

Virtualized computing resources

② Platform as a service

Helps us platforms for ^{developers} to build & run apps

③ Software as a service

Offer app such as ~~app~~ software application etc.

Server security

(comes from the following threats)

DDOS (Distributed denial of services)

Many comp instructed to ping a particular command making comp to jam.



Malware - Virus ✓

Malware

Malicious software which will compromise data security & service.

④ Brachhore Unauthorized access:

Servers are vulnerable to unauthorized access if they lack authentication & proper security mechanisms.

Security based practices:

① Firewall:

Protect servers from unauthorized access by filtering the traffic.

Encryption:

Uses SSL/TLS for secure communication over the network.

Backup & recovery redundancy:

Do regular backups & failover of a system for data recovery & business continuity.

Access control:

Strong authentication, regular password update, physical

Server Maintenance

- * Log Management
- * Performance tuning
- * Software update
- *

Emerging server technologies

- 1) Serverless computing
- 2) Micro services architecture
- 3) Edge servers & IoT



Computer Hacking

- Hacking refers to Unauthorized access to systems or devices to steal, manipulate or expose sensitive information. Hackers may exploit system vulnerabilities, weaknesses in security protocol or even human factors (social engineering).
- Understanding hacking is essential for developing cybersecurity measures that prevent data leakage, financial losses & compromised systems.

Types of hackers:

- ① White hat hacker
- ② Black hat hacker
- ③ Grey hat hacker
- ④ Script kiddies
- ⑤ Hacktivist / Hacktiniot

White hat hackers (Ethical hackers)

- Work legally to find vulnerabilities in systems & report or fix them.

Black hat hackers

Idiots who break into system with malicious intention
Often aiming for personal gain or cause harm.

Grey hat hackers

Operate in grey area sometimes breaching the system without permission but without malicious intention

Often disclosing findings to affected organization

Script kiddies

Inexperienced individuals who use existing tools/scripts created by others to hack system without being technical knowledge.



Hacking

Hackers Motivated by political or social sources often target government or corporation to expose info or make a statement.

Nation state hacker

Often funded by government & engage in Cyber espionage, surveillance or cyber warfare.

Common tools & techniques used

① Password cracking tool

② John the Ripper

Used for cracking passwords through a dictionary attack.

③ Hashcat

Fast & powerful password cracking tool

④ Network scanning tool

⑤ Nmap (Network mapper)

Used for network discovery & security auditing & scanning open ports & services.

⑥ Wireshark

Network analyzer that captures network traffic.

Mainly used for:

⑦ Vulnerability scanner

⑧ Nessus

Scan for known vulnerabilities in network devices & application.

⑨ OpenVAS

Open source vulnerability scanner for detecting security



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④ Exploitation tools

① Metasploit

Penetration testing framework that provides exploits for wide variety of vulnerabilities.

② Burp suite

Primarily used for web application system including vulnerability identification & exploitation.

⑤ Social engineering tools

① SET

Automates a part task a like ~~phishing~~ and

⑥ Wireless hacking tools

① Aircrack - Ing.

Used to crack & gain unauthorized access to wifi network.

⑦ Rootkit and Malware

Used to add Malware on an infected system often for long-term control

⑧ @RAT

Allows a hacker to control a ^{comp} system remotely.

Types of cyber attacks

Phishing

Ransomware

Attack 101

Hacker 101



FULLSTACK WEB DEVELOPER

It is a versatile developer proficient in both the front end (client side) & back end (server) aspect of app or web dev.

This law allows them manage & develop complete web applications or systems from start to finish.

Core skills of fullstack web dev

- 1) Frontend development:
 - languages & technologies
 - HTML/CSS for structuring & styling web page
 - JavaScript interactivity & dynamism on web page
- 2) Frameworks & libraries
 - for building responsive dynamic web page
- 3) User experience (UX)
 - Understanding design principles to check & track create an interactive.
- 4) Backend Development:
 - a) languages - common choices - JavaScript, node.js, python, PHP
 - b) frameworks - express (node.js), Django (python), Ruby on Rails (Ruby), Spring (Java)
 - c) databases - SQL, MySQL, MongoDB
 - server management - APIs, server technologies
- 5) Devops and deployment
 - version control familiarity with git, git hub and platform like github or gitlab for managing code repositories
 - deployment experience with cloud providers e.g. AWS, Azure, google cloud
 - experience with using containerization tools like docker for creating portable development environments

⑥ Continuous Integration & Deployment

- Implementing CI/CD pipeline to automate testing & deployment.

Key responsibilities of full stack developer:

1) Designing & building

Planning & building user interfaces & server architectures to create full web application.

2) Integrating backend & frontend

- ensuring smooth interaction between client & server sides

3) DB management

Structuring storing & retrieving & securing data efficiently

4) Debugging & optimization

Troubleshooting issues across the stack & optimizing code for performance.

5) Keeping up to date

Staying current with emerging technologies frameworks & practices to maintain modern software applications.

Benefits of full stack developer

1) Flexibility

2) Efficiency

3) Versatility

4) Better communication

flexibility

Work through various parts of the development stack adapting to project needs

Efficiency

Reduces dependency on multiple specialized developers which lower cost



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Versatility

- Bridge the gap b/w front end & backend making it easier to implement end-to-end encryption Better comm.

Understanding both Client side & side, improving Comm b/w cross functional teams

Key challenges:

- 1) Scope: wide scope.

The need to stay updated wth both frontend & backend technologies can be challenging & time consuming.

- 2) Depth: vs depth..

May lack the dept. specialization found in ofecates dedicated front end & back end developer

- 3) Resource Management

Handling both server & client based complications can be overwhelming

Key Technologies:

- 1) MEAN stack = M

MongoDB, Express, Angular, Node.js

- 2) MERN stack = M

MongoDB, Express, React, Node.js

- 3) LAMP stack

Linux, Apache, MySQL, PHP

- 4) Serverless architecture

Usage of cloud eg AWS, Azure, Google Cloud

+ Designing & building
+ Integrating & testing
+ Optimizing & scaling
+ Managing & monitoring
DB migration

Conclusion



Career path for full stack developer

- 1) Junior path full stack dev - entry level for small projects with close supervision.
- 2) mid-level Full stack Developer - more experience in normally small projects
- 3) senior full stack Developer - handles complex projects which involve ~~full stack~~ architecture.
- 4) Full stack Architectural lead - Oversees projects

Building SEO websites

Search engine optimization

In context of websites SEO stands for (Search engine optimization) - Report to practitioners strategies used to optimize website visibility in search engine result pages i.e (SERPs) with the aim to increase organic graphic on the site effect.

Effective SEO involves improving Content & technical aspect of a website to make it more attractive to search engines like google, bing & yahoo. This includes key words research, Content creation, On page SEO elements such as Metatags & text as well as offpage element like link building & social media signals.

The goal is to help search engines better understand content of website so that it appears higher in search results when the user enters

The SEO website is therefore designed & optimized to look white in search engines, result page & attract organic traffic for users searching for relevant content product or service.

The aim is to make it friendly website so that search engines can understand content, structure & their purpose while also offering a positive & useful experience for visitors.

Key factors:

1) Search-engine friendly structure

Site is structured to allow search engine to go & index pages efficiently thus includes clear code, clear hierarchy & logical organization of pages.

2) Keyword optimization:

Content on SEO website is drafted around clear flat user search for allowing the site to align with search intent for potential visitors.

3) Technical SEO

Essentials behind the scenes optimization like 1st page loading speed, mobile-friendliness, secure https & clear URL structure are implemented to improve the site ranking potential.

4) Quality content

SEO website offers retrievable, relevant & unique content that addresses user needs making it more likely to rank higher in search result.

5) User experience

SEO website is easy to navigate, appealing & engaging while also encouraging visitors to stay longer & explore more pages.

6) Backlinking strategy

SEO website may deploy this earning links from sources which signal trustworthiness & authority to search engines.

Creating SEO friendly website is crucial for driving organic traffic, improving visibility on search engines & ultimately enhancing user experience. They allow key characteristics that contribute to SEO optimized websites.

1) High quality content

- Content unique & valuable
- Content is Deep & Accurate
- Content keywords optimization
- Good content structure

2) Mobile friendliness

- Responsive design
- mobile first indexing

3) Fast loading speed

- Optimized
- Efficient code and caching
- Page speed tools

4) User friendly structure

- Clear navigation
- logical hierarchy - site map

5) On page SEO elements

- title tags
- Meta descriptions
- Header tags
- Alt text for images

6) Technical SEO

- URL structure
- Sitemap
- Schema markup
- Robots.txt file
- Canonical tags



- 7) Optimized for search internet
 - Content that matches search, internet.
 - long tail keywords
- 8) Internal linking and backlinks
- 9) Social media integration
- 10) User Engagement Metrics
 - each gen has its own metric
- 11) Regular monitoring & optimization

SCHNEIDERMAN'S GOLDEN RULES OF INTERFACE

These are a set of principles for creating user interfaces that are efficient, user friendly & accessible. They are developed to improve user experience across different types of interfaces. These rules help guide designers in creating systems that are: Intuitive & Minimize user error.

1) strive for consistency

Maintaining consistency in design, terminology

Colour, layout & behavior throughout the interface.

Consistent interfaces are easier to learn & understand allowing users to predict what will happen based on prior experience.

2) enable frequent user to use shortcuts

Provide shortcuts e.g. keyboard commands & macros for experienced users to speed up interaction.

Shortcuts make tasks more efficient for power users improving productivity.

3) Offer informative feedback

For every user action the system should provide feedback to inform user about what is happening there.

Resources users confirm action & help them interact understand the effect of interaction with

7) Design dialogs

Organize task so that they have clear beginning, middle & end with confirmation or running to the end creating a sense of accomplishment & reassures users that they have completed the tasks successfully

8) Offer simple error handling

Design systems that prevent errors where possible and if error occur offer ways to understand & fix them & minimizing the error messages.

9) Permit easy reversal of actions

Allows user to undo & redo actions to give them confidence & flexibility when using their system. The ability to reverse actions reduce the risk of errors & make users more willing to explore features knowing they can easily backtrack.

10) Support Interral focus of control

Design system that let users feel in control allowing them to initiate & direct action rather than feel like passive participants. When they feel in control they are more comfortable, confident with the system.

11) Reduce Short-term Memory

Minimize the amount of information user needs to remember from one part of a system to another often by providing cues or simple interface. Reducing cognitive load make task easier to complete & produce user frustration.

The above are

The 8 golden rules of user interface design