CSE- 321

Software Engineering

Lecture : 03

Introduction

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Lecture Outlines

- What is software engineering?
- Web based Software Engineering
- Web 3.0
- Web service
- Software Engineering Ethics
- Cloud-Based Software Engineering
- Modern Software Engineering Methodologies for Mobile Environments

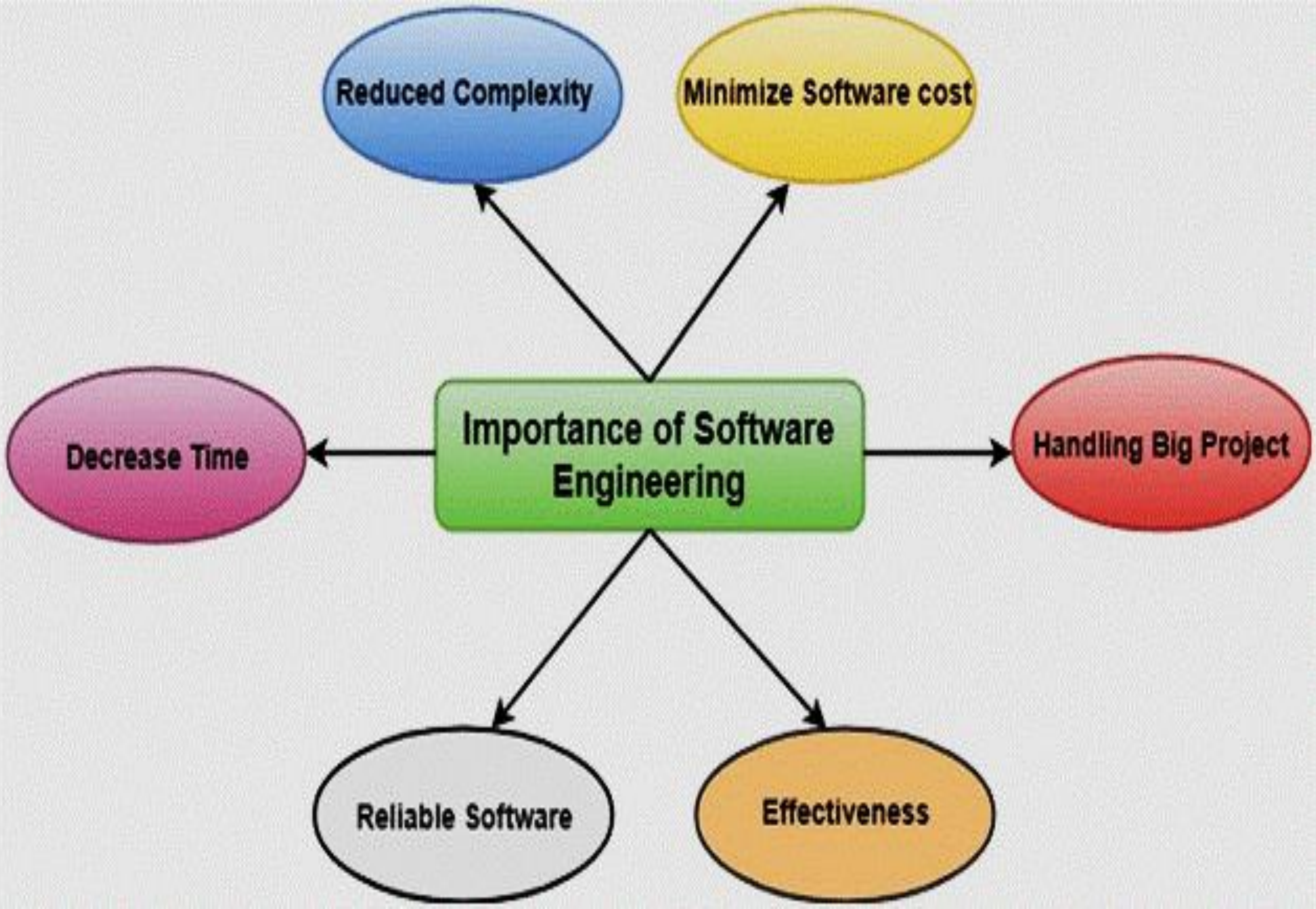
Software Engineering

What is software engineering?

- Software engineering is an **engineering discipline** that is concerned with **all aspects of software production** from the early stages of system specification through to maintaining the system after it has gone into use.

- Software engineering is an engineering discipline whose focus is the cost effective development of the high quality software system.
- **IEEE**, in its standard **610.12-1990**, defines software engineering as the application of a systematic, disciplined, which is a computable approach for the development, operation, and maintenance of software.

Importance of Software Engineering



Program vs Software Product

- Program is a set of instruction related each other where as Software Product is a collection of program designed for specific task.

- Programs are developed by individuals that means single user where as Software Product are developed by large no of users.

- In program, there is no documentation or lack in proper documentation. In Software Product, Proper documentation and well documented and user manual prepared.

- Development of program is Unplanned, not Systematic etc. but Development of Software Product is well Systematic, organized, planned approach.

- Programs provide Limited functionality and less features where as Software Products provides more functionality as they are big in size (lines of codes) more options and features.

Software Engineering and System Engineering

What is the difference between software engineering and system engineering?

System engineering is concerned with all aspects of computer-based systems development including hardware, software and process engineering.

Software engineering is part of this more general process.

System engineers are involved in **(overall)** system specification, architectural design, integration, and deployment

Software process

What is a software process?

A software process is **a sequence of activities** that leads to the production of a software product.

Generic activities in all software processes are:

- Software Specification
- Software Development
- Software Validation
- Software Evolution

General issues that affect software

General issues that affect software

- Heterogeneity
- Business and social change
- Security and trust
- Scale

Software Process Model

What is a software process model?

A software process model is **a simplified description** of a software process that presents one view of that process. Process models may include activities that are part of the software process, software products and the roles of people involved in software engineering.

Examples of process perspectives are:

- ❖ Workflow perspective - sequence of activities, **UML Sequence Diagrams**
- ❖ Data-flow perspective - information flow, **DFD's**
- ❖ Role/action perspective - who does what. **Gantt Charts**

Most software process models are based on one of three general models or paradigms of software development:

- ❖ The waterfall approach
- ❖ Iterative development
- ❖ Component-based software engineering (CBSE)

Key challenges facing software engineering

What are the key challenges facing software engineering?

Coping with legacy systems, coping with increasing diversity and coping with demands for reduced delivery times.

- **Legacy systems** – old, valuable systems must be maintained and updated.
- **Heterogeneity** – systems are distributed and include a mix of hardware and software.
- **Delivery** – there is increasing pressure for faster delivery of software.

Key challenges facing software engineering

What are the key challenges facing software engineering?

1. Advancement in Rapid Technologies
2. Change in Culture
3. Lack of Alignment between the User and Sponsor Needs
4. Cybersecurity
5. Artificial Intelligence and Automation
6. Mismanaged Timelines
7. Importance of Quality Assurance
8. Conflicting requirements
9. Limited infrastructure/ resources
10. Communication Breakdown

Reference Link:
https://xperti.io/blogs/software-development-challenges/

Software Engineering (Web Concept)

The Web is now a platform for running application and organizations are increasingly developing web-based systems rather than local systems.

Web 1.0: The Static Web

Web 1.0 offered little beyond browsing static pages. Content generation was handled by a select few, and information was hard to find.

Web 2.0: The Dynamic Web

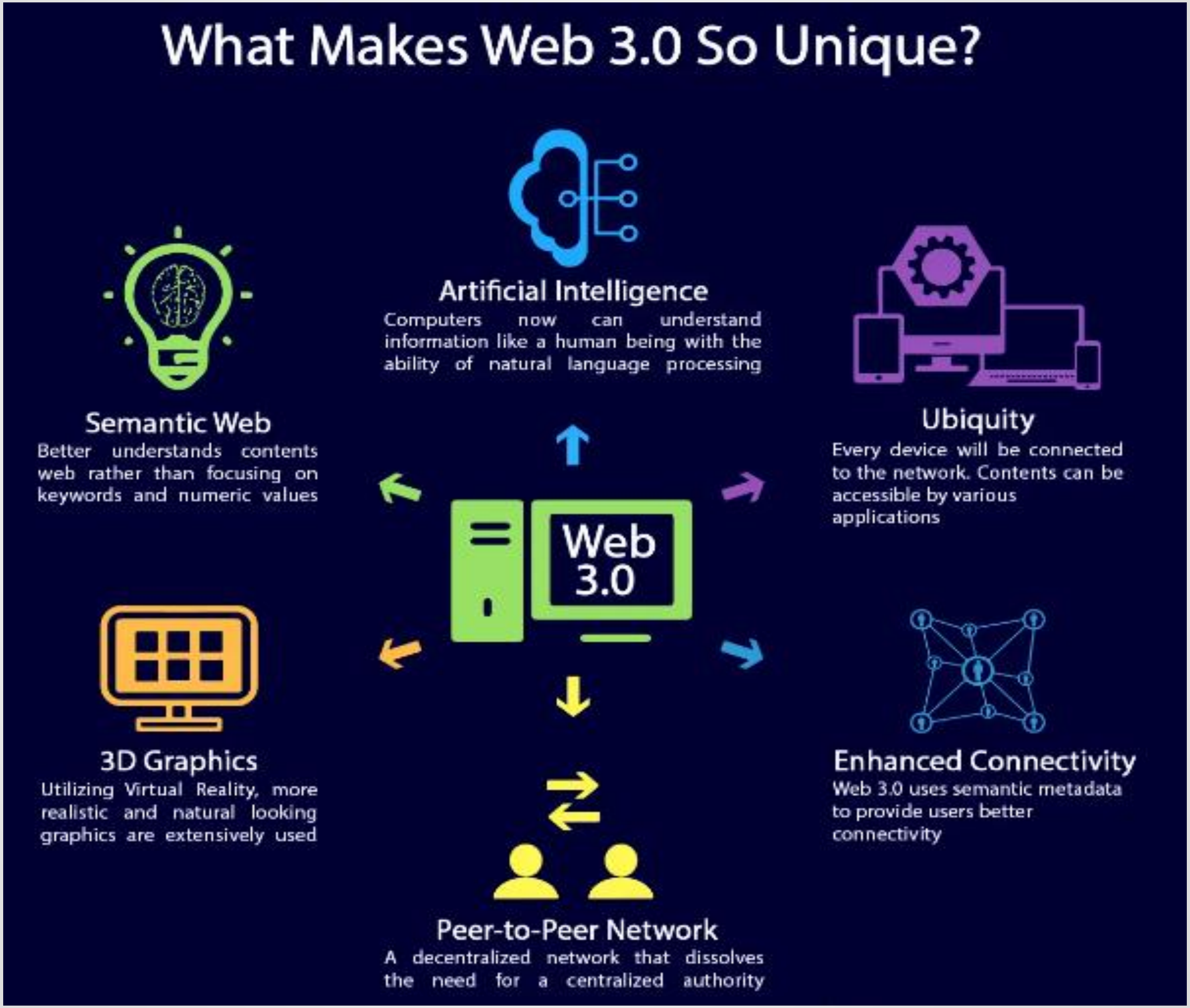
we were all creating, sharing and commenting on content instantaneously from the palms of our hands. If Web 1.0 was the read-only iteration, Web 2.0 could be seen as the read/write upgrade, or what we know as the internet today.

Web 3.0: Decentralized Web

Web 3.0: Decentralized Web

- **Web 3.0** is defined by intelligence. This intelligence is not just in interactions between people and websites, but between software and there's more than that.
  - **Semantic Web:** "a web that understands humans," works on improving online technologies with additional functionalities.
  - bullet-proof **Digital IDs** and a **distributed file system**.
  - **Cryptocurrency-enabled**
  - **Three-dimensional virtual worlds**
  - **Autonomous and artificially intelligent**
  - Software Negotiating With Software, **Bots for Everyone**
  - Complete Connectivity (**Ubiquity**)

Web 3.0: Decentralized Web



What Makes Web 3.0 So Unique?

Artificial Intelligence
Computers now can understand information like a human being with the ability of natural language processing

Semantic Web
Better understands contents web rather than focusing on keywords and numeric values

Ubiquity
Every device will be connected to the network. Contents can be accessible by various applications

3D Graphics
Utilizing Virtual Reality, more realistic and natural looking graphics are extensively used

Enhanced Connectivity
Web 3.0 uses semantic metadata to provide users better connectivity

Peer-to-Peer Network
A decentralized network that dissolves the need for a centralized authority

Software Engineering (Web Concept)

Web 1.0	**Web 2.0**	**Web 3.0**
Created in 1989 by Tim Berners-Lee	Term coined by Tim O'Reilly in 2004	Modern usage with blockchain defined by Gavin Wood, co-founder of **Ethereum,** in 2014
Static website content	Dynamic content and user input	Semantic content (**a content made of concepts**) that can benefit from AI
Information delivery	Social networks	**Metaverse** worlds
Centralized infrastructure	Cloud utility infrastructure that is still largely centralized	**Decentralized**, edge computing and peer-to-peer
Relational database-driven content and application delivery		**Blockchain-based** distributed services

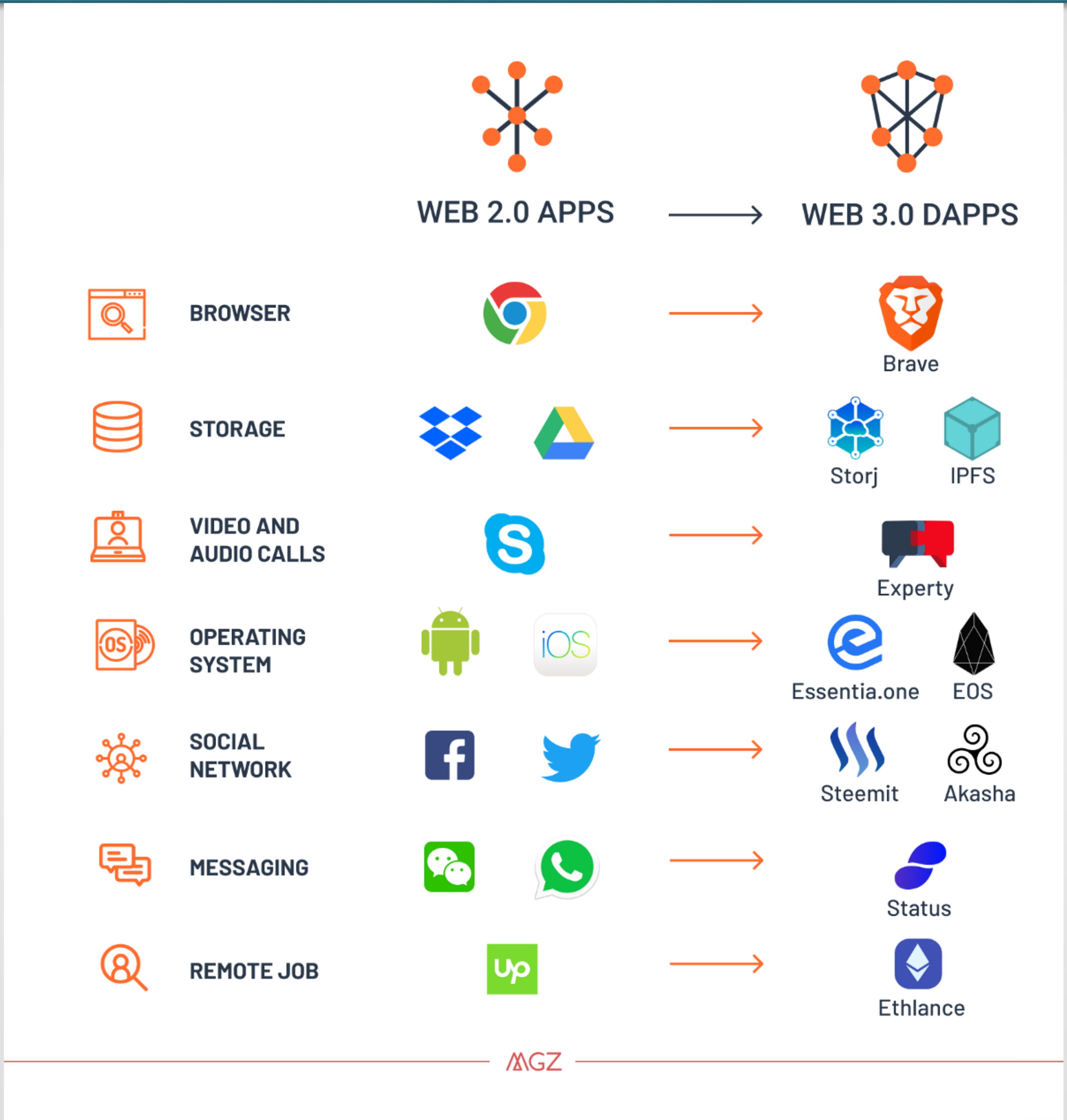
Software Engineering (Web Concept)

S. No.	Web 1.0	Web 2.0	Web 3.0
1.	Mostly Read-Only	Wildly Read-Write	Portable and Personal
2.	Company Focus	Community Focus	Individual Focus
3.	Home Pages	Blogs / Wikis	Live-streams / Waves
4.	Owning Content	Sharing Content	Consolidating Content
5.	WebForms	Web Applications	Smart Applications
6.	Directories	Tagging	User behavior
7.	Page Views	Cost Per Click	User Engagement
8.	Banner Advertising	Interactive Advertising	Behavioral Advertising
9.	Britannica Online	Wikipedia	The Semantic Web
10.	HTML/Portals	XML / RSS	RDF / RDFS / OWL

Software Engineering (Web Concept)

S. No.	Web 1.0	Web 2.0	Web 3.0
11.	Data was not Focused.	Data of many was controlled by some mediatory.	Data was personalized and no use of mediatory.
12.	Information sharing is the goal.	Interaction is the goal.	Immersion is the goal.
13.	It connects information as its primary goal.	It aims to connect people.	Focuses on relating knowledge.
14.	Static websites	Introduction of web applications	Intelligent web-based functions and apps
15.	A simpler, more passive web.	An enhanced social Web	A semantic web exists.
16.	Web and File Servers, HTML, and Portals are technologies connected to Web 1.0.	AJAX, JavaScript, CSS, and HTML5 are examples of related technology.	Web 3.0 technologies include blockchain, artificial intelligence, and decentralized protocols.

Software Engineering (Web Concept)



	WEB 2.0 APPS	→	WEB 3.0 DAPPS
BROWSER		→	Brave
STORAGE		→	Storj IPFS
VIDEO AND AUDIO CALLS		→	Experty
OPERATING SYSTEM		→	Essentia.one EOS
SOCIAL NETWORK		→	Steemit Akasha
MESSAGING		→	Status
REMOTE JOB		→	Ethlance

Examples of Web 3.0 applications

•**Cashaa.** A global banking platform for managing crypto and traditional currencies. It serves corporate clients and individuals. An app provides crypto loans, investment, and NTF trading.

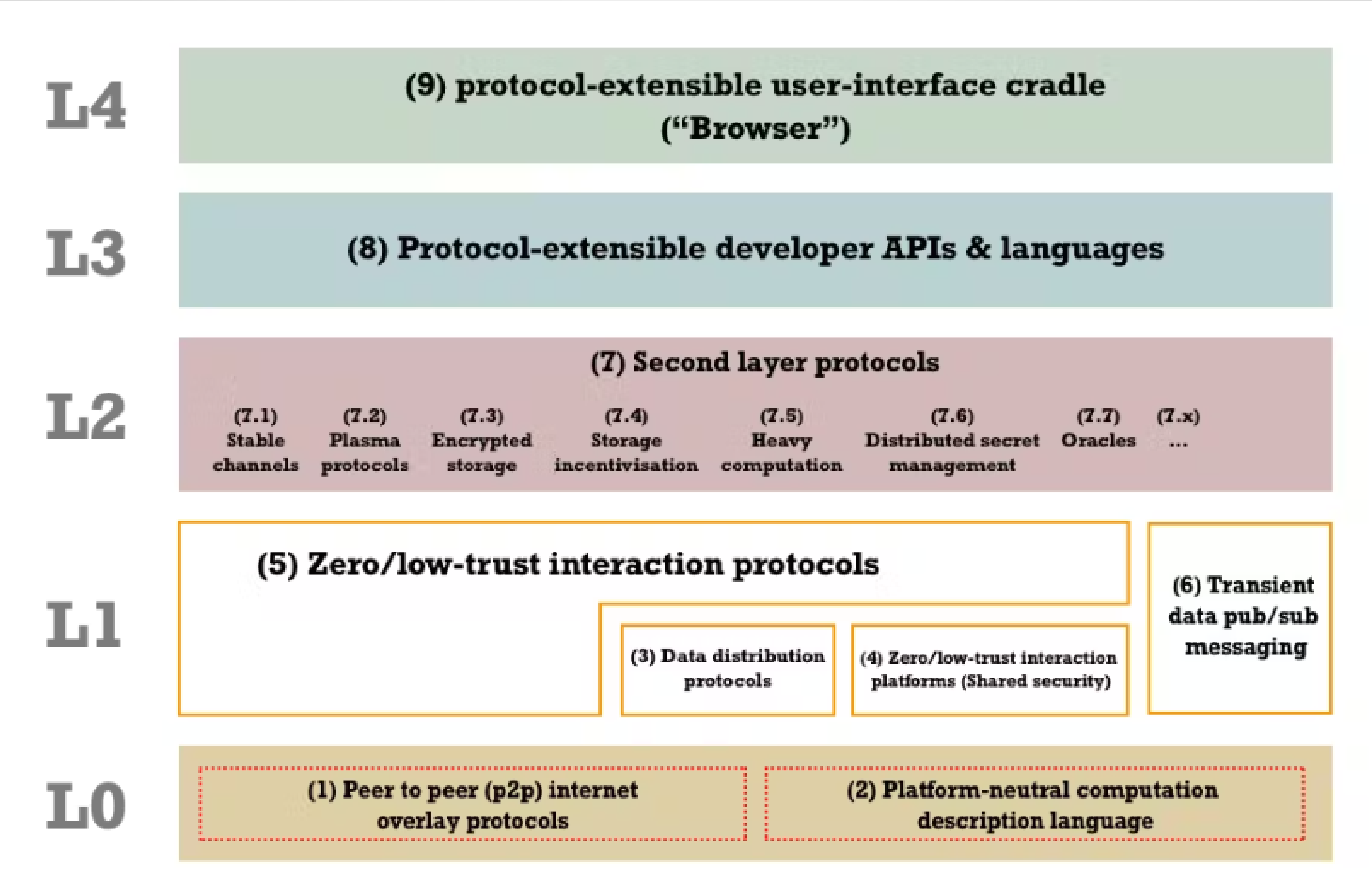
•**Everledger.** A globally distributed registry that bankers and insurers may use to prevent fraud. It aims to deliver transparency in global supply chains by providing participants with verified information about their organizations and products.

Livepeer. A distributed and open-source video streaming network that is built on the Ethereum blockchain. It aims to provide a stack and an infrastructure for Web3 blockchain video streaming.

UjoMusic. It enables musicians to upload their works on the web. The application also eliminates copyright issues.

Brave. A browser, which is 3x faster than Chrome and offers enhanced security and privacy. Additionally, it has protection from intrusive ads. It features a built-in crypto wallet.

Web3 stack



L4

(9) protocol-extensible user-interface cradle ("Browser")

L3

(8) Protocol-extensible developer APIs & languages

L2

(7) Second layer protocols

(7.1) Stable channels

(7.2) Plasma protocols

(7.3) Encrypted storage

(7.4) Storage incentivisation

(7.5) Heavy computation

(7.6) Distributed secret management

(7.7) Oracles

(7.x) ...

L1

(5) Zero/low-trust interaction protocols

(3) Data distribution protocols

(4) Zero/low-trust interaction platforms (Shared security)

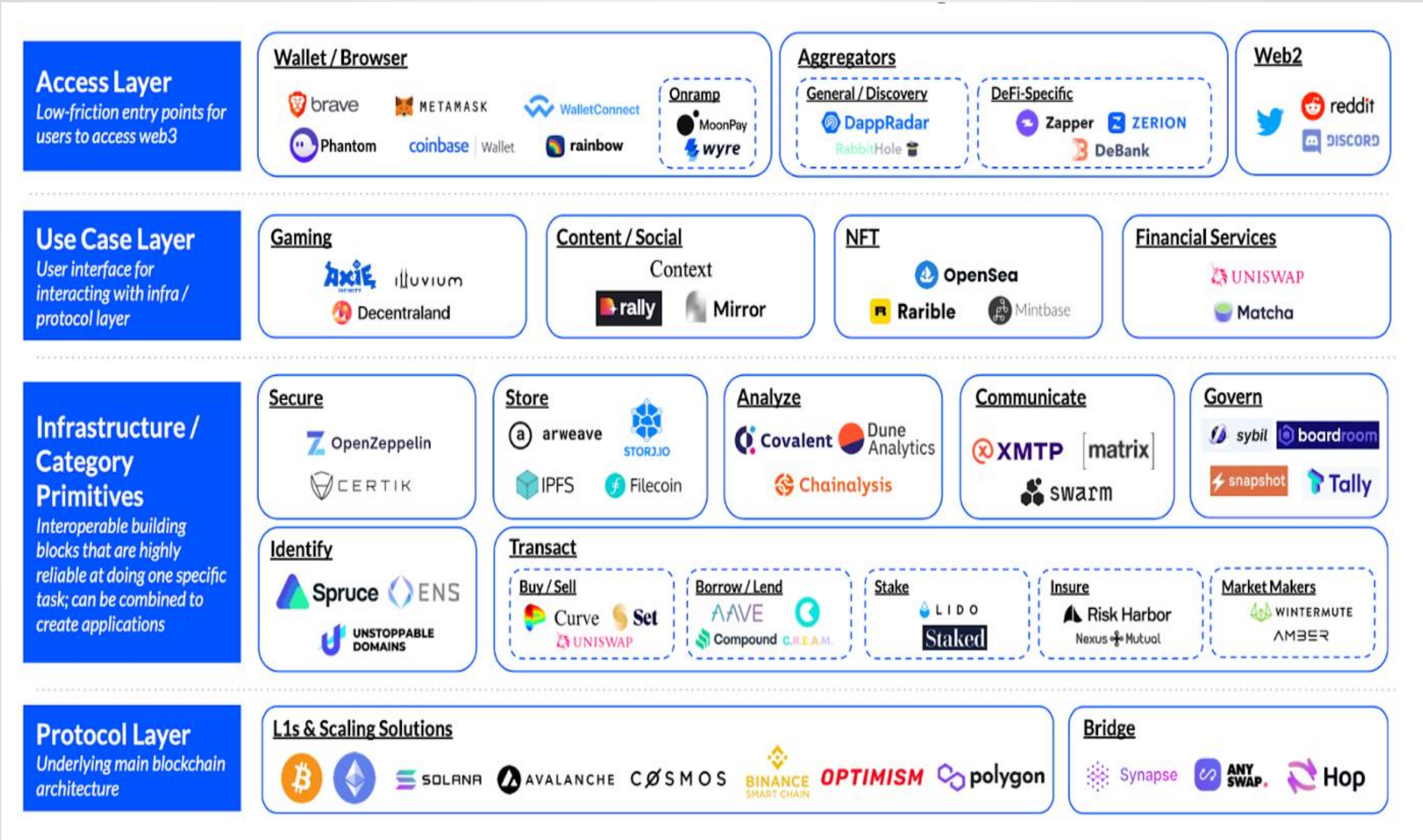
(6) Transient data pub/sub messaging

L0

(1) Peer to peer (p2p) internet overlay protocols

(2) Platform-neutral computation description language

Web3 stack



Access Layer
Low-friction entry points for users to access web3

Wallet / Browser
brave · METAMASK · WalletConnect · Phantom · coinbase Wallet · rainbow

Onramp
MoonPay · wyre

Aggregators

General / Discovery
DappRadar · RabbitHole

DeFi-Specific
Zapper · ZERION · DeBank

Web2
reddit · DISCORD

Use Case Layer
User interface for interacting with infra / protocol layer

Gaming
Axie Infinity · illuvium · Decentraland

Content / Social
Context · rally · Mirror

NFT
OpenSea · Rarible · Mintbase

Financial Services
UNISWAP · Matcha

Infrastructure / Category Primitives
Interoperable building blocks that are highly reliable at doing one specific task; can be combined to create applications

Secure
OpenZeppelin · CERTIK

Store
arweave · STORJ.IO · IPFS · Filecoin

Analyze
Covalent · Dune Analytics · Chainalysis

Communicate
XMTP · matrix · swarm

Govern
sybil · boardroom · snapshot · Tally

Identify
Spruce · ENS · UNSTOPPABLE DOMAINS

Transact

Buy / Sell
Curve · Set · UNISWAP

Borrow / Lend
AAVE · Compound · C.R.E.A.M.

Stake
LIDO · Staked

Insure
Risk Harbor · Nexus Mutual

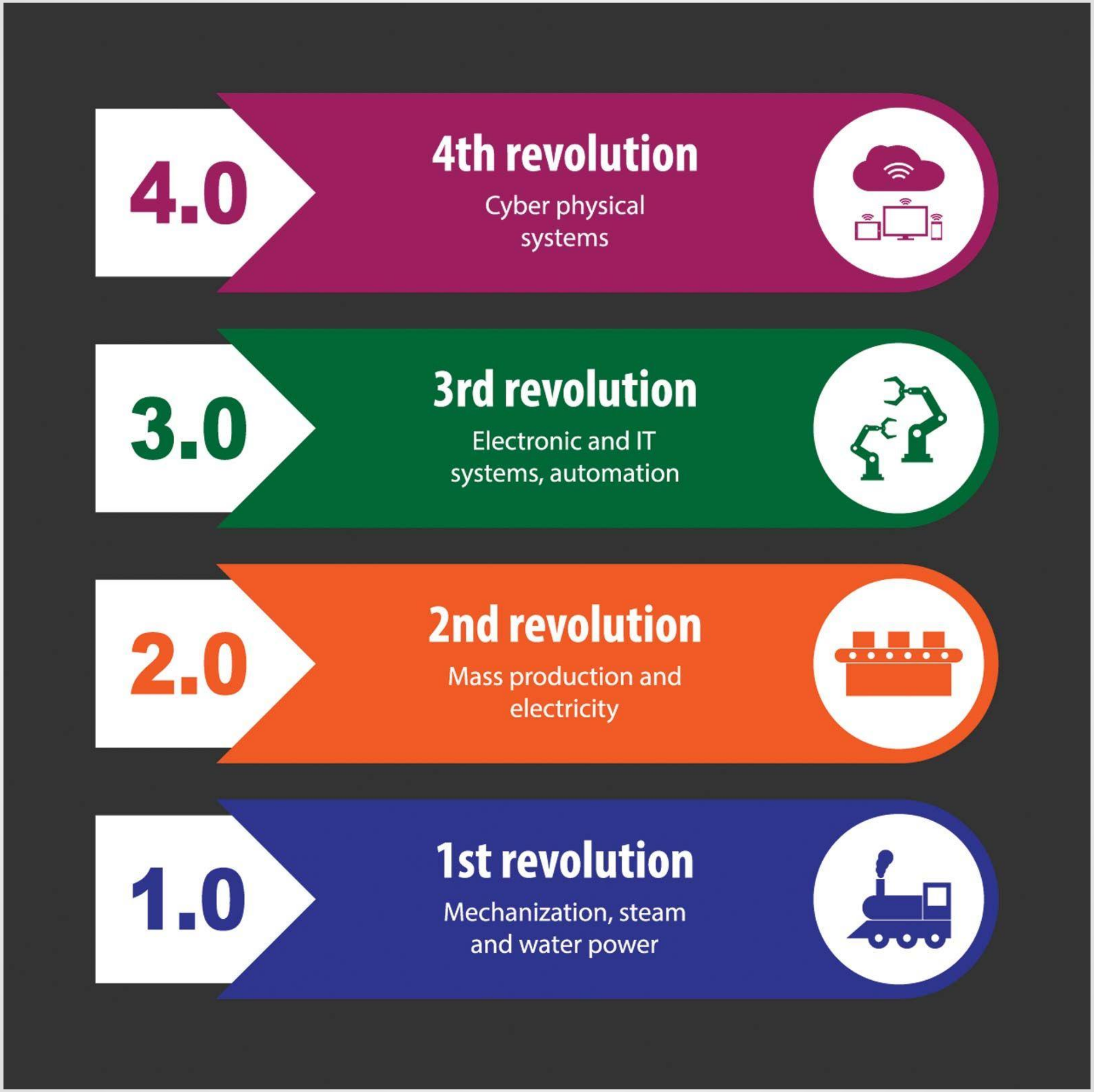
Market Makers
WINTERMUTE · AMBER

Protocol Layer
Underlying main blockchain architecture

L1s & Scaling Solutions
SOLANA · AVALANCHE · COSMOS · BINANCE SMART CHAIN · OPTIMISM · polygon

Bridge
Synapse · ANY SWAP. · Hop

Fourth Industrial Revolution - 4IR



4.0

4th revolution

Cyber physical systems

3.0

3rd revolution

Electronic and IT systems, automation

2.0

2nd revolution

Mass production and electricity

1.0

1st revolution

Mechanization, steam and water power

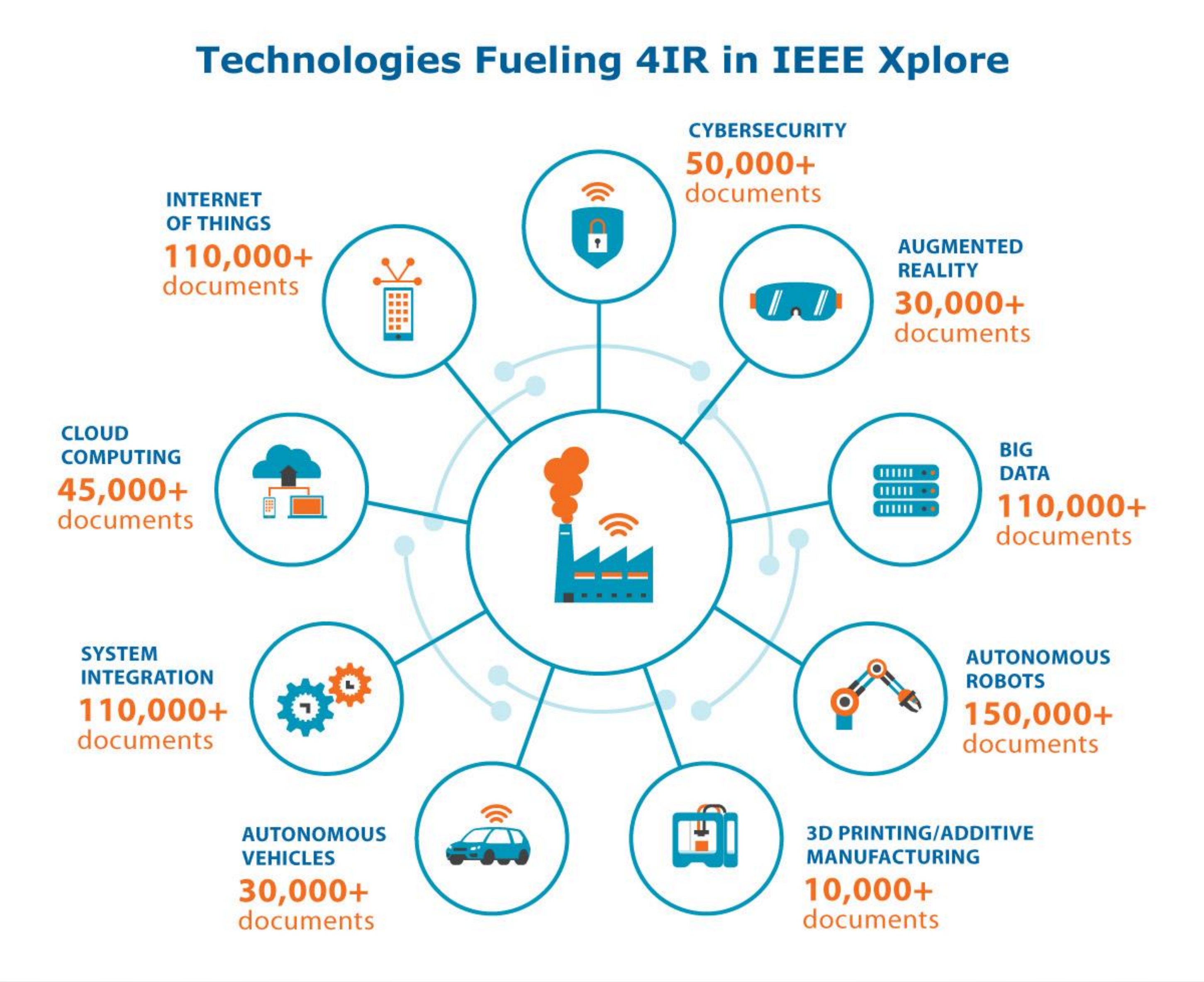
Fourth Industrial Revolution - 4IR

The **Fourth Industrial Revolution**, **4IR**, or **Industry 4.0**,conceptualizes rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart automation.

Specific technologies of the Fourth Industrial Revolution include, but are not limited to:

artificial intelligence
Internet of Things
robotics
virtual reality
mobile devices
3D printing
smart sensors
big data/analytics
augmented reality (AR)
data visualization
cognitive computing
location detection
customer profiling
blockchain
quantum computing
cloud computing

Fourth Industrial Revolution - 4IR



Technologies Fueling 4IR in IEEE Xplore

CYBERSECURITY
50,000+
documents

INTERNET OF THINGS
110,000+
documents

AUGMENTED REALITY
30,000+
documents

CLOUD COMPUTING
45,000+
documents

BIG DATA
110,000+
documents

SYSTEM INTEGRATION
110,000+
documents

AUTONOMOUS ROBOTS
150,000+
documents

AUTONOMOUS VEHICLES
30,000+
documents

3D PRINTING/ADDITIVE MANUFACTURING
10,000+
documents

Software Engineering (Web Concept)

- **Web service** is a standardized medium to propagate communication between the client and server applications on the WWW (World Wide Web). The basic web services platform is **XML + HTTP**

- A web service is **a set of open protocols** and standards that allow data to be **exchanged between different applications or systems.**
- Web services can be used by software programs written in a **variety of programming languages** and **running on a variety of platforms** to exchange data via computer networks such as the Internet in a similar way to inter-process communication on a single computer.

Software Engineering (Web Concept)

- Components of Web Services
  - SOAP (Simple Object Access Protocol)
  - UDDI (Universal Description, Discovery and Integration)
  - WSDL (Web Services Description Language)

Software Engineering (Web Concept)

- What exactly do you mean when you say you’re going to upload a file on the internet? The name of the protocol that was utilized for it.
- *Uploading a file to a server is the process of transferring a file from your computer to a server through the Internet. FTP(File Transfer Protocol) is the protocol that is used for this. An FTP client application allows a user to communicate with an FTP server program in order to gain access to data and services on the server machine. Users must be able to connect to the Internet or communicate with an FTP client application in order to use the FTP server program.*

Cloud-Based Software Engineering

Cloud-Based Software Engineering

- **Cloud computing** is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

- **Cloud computing** is the delivery of **on-demand computing services over the internet** on a **pay-as-you-go basis**.

- Most cloud computing services fall into five broad categories:
  - **Software as a service (SaaS)**
  - **Platform as a service (PaaS)**
  - **Infrastructure as a service (IaaS)**
  - Anything/Everything as a service (XaaS)
  - Function as a Service (FaaS)

A **mobile application development platform** (MADP) is a type of software that allows a business to rapidly build, test and perhaps deploy mobile apps for smartphones or tablets.

Mobile App Development Platforms Market Size Worth **USD 47.82 Billion in 2028** **[Vancouver, B.C., March 28, 2022]**

Mobile apps are majorly developed for 3 Operating System. :

- Android
- IOS
- Windows

There are 3 different ways to develop Mobile apps: –

1. **1st Party Native App development**
2. Progressive web Application
3. **Cross-Platform Application**

LOREM IPSUM
LOREM IPSUM
LOREM IPSUM
Lorem ipsum dolor sit amet, quo sale putant molestie an, ei assum voluptua tractatos duo, in vel nihil ridens malorum.
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LOREM IPSUM
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APP
Development

1st Party Native App development: –

These types of apps normally run in the native devices, that is, it runs only in the OS that it is specifically designed for it. These apps cannot be used on different devices using a different OS.

Cross-Platform Application: –

These are frameworks that allow developing total native applications which have access to all the native features of IOS and Android but with the same code base. These apps run on both Android and IOS. So normally the development speeds of these apps are very fast and the maintenance cost is low. The performance speed is comparatively low to 1st party native apps.

Xamrine is Microsoft cross-platform solution that uses the programming languages like .NET, C#, F#.

Top Mobile App Development Frameworks in 2022

- **Ionic-** built with Angular and Apache Cordova, cross-platform
- **Flutter-** launched by Google, cross-platform
- **React Native-** Developed and maintained by Facebook, Tesla, Airbnb, Skype, and Amazon Prime are the best examples of React Native apps
- **Xamarin-** Microsoft-owned open-source framework
- **JQuery Mobile-**Accessible Rich Internet Applications (ARIA)
- **Corona SDK-** related to games for mobile devices
- **Native Scripts-**uses Typescript, Angular, JavaScript, CSS, and Vue.js

Thanks to All