DIGITAL TRANSFORMATION: FROM AI AND IOT TO CLOUD, BLOCKCHAIN AND CYBERSECURITY

SUMMARY OF BRANDED TECHNOLOGIES AND TOOLS REVIEWED / DISCUSSED DURING THE COURSE (V 1.00)

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Blockchain
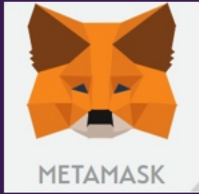
✓ **Distributed digital wallet (no hardware), in the format of a Chrome / Firefox Browser plug-in (MetaMask.io).**
  ▪ *Operates newly created and pre-existing Ethers and related digital currencies (receive-store-send), and also keeps track of Smart Contracts affecting the different currencies' balance, by 1) submitting information to the transaction pools and 2) sending / receiving information to/from the Ethereum Blockchains themselves (real Ethereum or test environments such as Rinkeby).*

✓ **Live, public register of worldwide Ethereum-related transactions, contracts and blocks (Etherscan.io).**
  ▪ *All information is hashed (ie identified with a unique ID number), including intervening parties, but is otherwise transparent, traceable and searchable via hashes.*

✓ **Ethereum test environment (Rinkeby.io), used to 1) try transactions and track them publicly** along with processing statistics, and **2) create 'dummy' Ethers for trial purposes** via a "Faucet" feature (requires a temporary or permanent Twitter / FB account).

✓ **User interface and programming tool (Remix.io) used to create and execute Smart Contracts, and send newly created currencies to an Ethereum wallet (MetaMask or other) –** *by compiling initial code, executing it, submitting information to the transaction pools and sending / receiving information to/ from the Ethereum Blockchains (real Ethereum or test environments such as Rinkeby).*
  It uses the "Solidity" programming language and can deploy standard predefined code (ERC20 for token creation, etc.).

Cloud technologies

✓ **Set of PaaS products that use OS-level virtualization to deliver software in packages called containers,** isolated from one another and bundling own software, libraries and configuration files; they can communicate with each other with well-defined channels.
  ▪ ***All containers are run by a single operating-system*** *kernel and are thus **more lightweight than Virtual Machines**.*
  ▪ *Docker Hub (www.Docker.com) is the world's largest library and community for container images (source of this info: Wikipedia).*

✓ **Open-source system for automating deployment, scaling, and management of "containerized" applications ("production-grade container orchestration")** (source: Kubernetes).
  ▪ *Also known as K8s, it has become the most widely used tool for container management (IT industry standard).*

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Cloud technologies (cont.)

- ✓ **"Serverless Model" service by Amazon, by which any creator of code ("function") can execute it directly on the AWS cloud, paying only for the code execution time (not even storage), often measured in milliseconds.**
  - *Requires an AWS account. Code is written directly on a screen connecting via API to servers which "consume" (execute) the code.*
  - *No need to worry about runtime environments (ie software 'context' in which to run the code), security updates, OS patches, scaling, capacity, robustness, etc.*
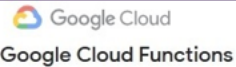
- ✓ **Tools similar to AWS Lambda by Google and Microsoft, respectively.** *Require the corresponding account / subscription.*
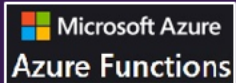
- ✓ **JavaScript interpreter / runtime environment able to 1) work as a server** *and* **2) stitch and run applications together.**
  - *First designed to* **enable the writing of scalable network programs**, *Node.js (* **https://nodejs.org** *) is built on the Chrome's V8 JavaScript engine and was originally taken out of the Chromium project (precursor of Chrome), itself based on Mozilla's Firefox idea of a* **web browser that could process applications, with a large added value vs. "flat" navigation.**
  - *Node.js brought significant webserver improvement via parallel operation processing, modularity and relative lightweight, and the* **possibility of writing cross-platform apps with different code bases on top of the browser**, *thus unifying user interfaces (source of this info: Wikipedia).*
  - *Its success made it spread laterally to serve as a* **generalized virtual server platform today**, *able to* **manage any networked devices.**

- ✓ **"Node Package Manager" – Registry to install, publish and manage Node.js modules**, *created by the developer community.*

- ✓ **Lodash – JavaScript library which provides utility functions for common JavaScript programming tasks**, *delivering modularity and performance (source of this info: Wikipedia and its own web page).*

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Cloud technologies (cont.)

GitHub

✓ **Web platform to create, administer and share open source software development projects across developer teams and community contributors;** *its core is still being a place to store & control versions of code / programs.*
✓ It allows **tracking of changes during software development** and **collaborative work**, thus harnessing **large crowdsourcing of talent** – it has become the **worldwide standard platform for the sharing of software development** in companies and academia.

- *Users can create free or paid accounts to create software project repositories ("repos"), and upload / download files ("commit/pull").*
- *Tracking of code is done with the Git tool, which supports distributed, non-linear workflows with high speed and data integrity.*
- *Git was created by Linus Torvalds in 2005 for development of the Linux kernel, and is distributed under the terms of the GNU General Public License v. 2 (source: Wikipedia).*

aws Amazon S3

✓ **SW storage and deployment** – "buckets" can be created, where applications or data ("objects") are to be stored and become accessible according to needs. Data can be private, for a group only, or public, web-deployed. Charges are by cloud use time only.

Artificial Intelligence & Cybersecurity

aws Amazon Rekognition

✓ **AWS user-friendly functionality for image recognition using Machine Learning.**
- *It allows 1) Object and scene detection, 2) Facial analysis, 3) Face comparison, 4) Celebrity recognition and 5) other similar features.*

TensorFlow

✓ **Free and open-source symbolic math library** (SW module) **for dataflow and differentiable programming** (ie programming useful for optimization problems), **deployed in many machine learning applications and neural networks** (source: Wikipedia).
- *Originally created and used internally by Google, it is now an industry standard for many ML developments.*
- *Additional versions exist: demo-type in browsers for free (**https://playground.tensorflow.org**), for mobile phones locally, etc.*

Lightbeam for Firefox

✓ **Browser add-on for Chrome that shows a graph with 3rd party tracking cookies placed on a computer while visiting websites.**
- *Created by Mozilla but discontinued, it displays interactions with sites visited and tracking sites to which they provide information.*

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Internet of Things (IoT)

SHODAN Computer Search Engine

- ✓ **Website used to search for any device open to the Internet (**https://www.shodan.io**; free subscription offers limited capability).**
  - ▪ *It shows device ports open and even access screens; used by commercial interest people, researchers, and other parties.*

Atmega 328
Arduino
Tessel
Raspberry Pi

- ✓ **Wi-fi enabled, programmable micro-computers** (from more app-specific to more general purpose), holding CPUs and other hardware inside depending on model, **embedded into other items**, that can **run servers** and **talk to other devices via HTTP**.

HTTP's RESTful Interface

- ✓ **A standard of device communications by using extended URLs, ensuring interoperability – "requests" are sent to the device.**
  - ▪ *Responses can be in HTML, XML, JSON or other formats, confirm device changes, and/or link to other web resources.*

Messaging Queuing Telemetry Transport (MQTT)

- ✓ **Another connectivity protocol that allows to Publish/Subscribe "events" or commands b/w app and client sides via a "broker".**
  - ▪ *Open, lightweight and ISO-standard, it was created back in 1999 to "talk" to remote, low bandwidth/low power sensors and devices.*

Annexe: Some software development, testing and database tools

Travis CI
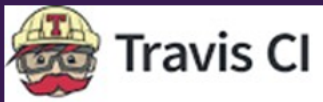
- ✓ **Hosted "continuous integration" (CI) environment used to build and test software projects inside GitHub.**
  - ▪ *CI means merging all SW developers' copies of work on a given project, to a shared mainline/master/"trunk" several times a day.*
  - ▪ *Adding a xxxx.travis.yml file to a root directory of a GitHub repository specifies programming language and desired building/testing/other parameters (including SW internal dependencies). GitHub alerts when uploads / downloads happen.*
  - ▪ *Travis CI then 1) runs the commands specified in xxxx.travis.yml (build SW/run tests), and 2) let developers know about results.*
  - ▪ *It works with most major / common machine configurations and software languages (source: Wikipedia).*

mocha **chai**

- ✓ **Mocha: Specialized JavaScript test framework for Node.js programs**, *with several tester-friendly characteristics. It often accommodates Chai and other testing tools.*
- ✓ **Chai: An 'assertion' collection to run against JS code to test it** *("BDD / TDD assertion library") – either against how it was built (Test Driven Development), or how it behaves or serves user need (Behavior Driven Development) (source: Wikipedia; www.chaijs.com).*

mongoDB

- ✓ **Cross-platform NoSQL, document-oriented database program and tools** (*source: Wikipedia*).
- ✓ *It has many advantages: JavaScript can be used inside for queries and other operations, supports multi-document transactions, it can be indexed, escalated, aggregated or distributed effectively, it can be used as a file manager or to store software testing results, etc.*