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Architecting an Equitable Data Network for the Digital Economy of the New Cyber Civilization: A New Layer to Meet Need

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The hypothesis this paper supports is that a significantly new technical architecture and approach is critical to addressing the current and emergent needs of, and opportunities within, an equitable data network for the digital economy of the new Cyber Civilization.

DEMOCRATIZING DATA

The need to level the playing field for data ownership

While the Web was designed to be decentralized it is currently highly centralized around a few major consumer platforms that rely on 'surveillance capitalism' - a term coined in 2019 by Professor Shoshana Zuboff. As their primary business model there is an implicit and explicit assumption that the organization owns all data – including customer data and interactions.

In her in masterwork, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, Professor Zuboff notes, "*surveillance capitalists are impelled to pursue lawlessness by the logic of their own creation. Google and Facebook vigorously lobby to kill online privacy protection, limit regulations, weaken or block privacy-enhancing legislation, and thwart every attempt to circumscribe their practices…*"

Crucially, without a rethinking of how we architect and approach this new frontier of data/digital assets, we are going to move to increasingly feudal fiefdoms of hoarded data propagated by prostrated peons.

With this rethinking in mind, we envisage a safe, fully-functioning digital economy that empowers the approaching Cyber Civilization.

This presentation will explore the imperatives for such a shift, what is entailed in the new approach and how it can empower stakeholders with the tools and the infrastructure that: a) enables them to participate in the data/digital economy; and b) enforces their data rights automatically, on their behalf, so they can participate without the need to have high-level digital skills or the power of a large multi-national.

An inclusive digital "language" and tools that works for all levels of society

The internet was initially designed by the overarching organizations of the military and scientific communities. It was an invented reality of the digital universe, focused on abstraction and standardization as its core pillars, with only a small, highly educated and skilled set of participants.

Conversely, its "successor" - the World Wide Web - enabled society at large to participate in the digital realm, both personally and professionally. However, within the web there are few, if any overarching standards that are universally accepted, let alone implemented and adhered to. Expectations of this happening in any meaningful way are, at best, impractical. One need only look at the metric vs imperial units debate, the confusion around data formatting (dd:mm:year or mm:dd:yr - depends entirely on where you are at the time) or 'the beautiful game' of football - unless you live in North America, wherein, instead you play soccer - as exemplars of the reality of this challenge.

MOVING FROM CHAOS TO COLLABORATION

Within the digital economy of the new Cyber Civilization a solution must be found that can deal with 'chaos' at scale, for the myriad of different societal and skill levels within it. To do this will require us to accept that, with all the best efforts and will in the world, standardization does not work well in 'cyber-world' other than for basic communication such as TCP/IP and HTTP. That said we still need to interact.

Following on from the basic communication premise above, we can draw a parallel to the human method of verbal communication - i.e. we can all, in the main, use our voice boxes to transmit sounds and our ears to listen to the vibrations make by said sounds – it is, if you will, the 'agreed upon' system we use to speak to each other. That said, there are more than 7000 different languages in the world so tools of translation are often required to enable us to understand one another. This is no different in the digital world.

In this digital arena every combination of company, application and user has their own preferred/specific set of ontologies that they, naturally, want to use to communicate. In human speech this is parallel to each of us having our own languages, dialects and jargon. If we are able to speak each other's languages it makes communicating and collaborating much simpler - if we can't, communication can be difficult if not impossible and the impetus to collaborate drastically diminishes. The impediments to collaboration do not stop with a lack of understanding, they also include lack of trust.

The imperative of trust

Successful trade (be it at a local, national or international level) is underpinned by contractural law, which gives parties the trust and confidence that there is a framework to execute an impartial trade where their rights of ownership and conditions of use are maintained and enforced.

This concept is no less imperative in a data sharing digital economy - be it in relation to professional data ecosystems or the Personal Area Networks (PANS) of the hyperconnected Cyber-Citizen.

The expectation of a Cyber-Citizen will be seamless collaboration between smart tools and digital devices through highly secure, personalized portals. These connections will enable access to public/private services via permission-based integration of live, interoperable, real-world data through the use of sensors, meters, appliances, personal devices, and other tools and technical capabilities woven together.

To enable this collaboration - along with the presupposed maintenance and enforcement of the rights, trust and confidence across digital assets - a new architectural model must be created. With this architecture, a Cyber-Citizen will have continuity of control and sovereignty across their data assets - wherein any individual, organization, application and or/process must have permission from the data-owner to use said data asset(s) - and has realtime transparency on how their data is being accessed and used. In addition, the data-owner can revoke/alter this permission at any time - including, but not limited to the right to be forgotten.

THE LACK IN THE CURRENT STACK

While the premise that data-is-the-new-oil (or soil for growth) is, conceptually, the currency that underpins the digital economy, the technology/architecture stack currently in use is based upon architectures and approaches that date back to the mid-20th Century. Thus, current technology is based upon a foundational premise wherein:

- computer memory is limited and expensive, resulting in complex programs and architectures that deal with the processing and management of data for each particular application;

- disk space is slow, resulting in data caching on data storage devices for the optimization of the process, and is unlikely to have the concept of data-ownership and permission.

- computer networking is treated as a transport layer between two or more network end-points – there is no concept of data-owners and permissions; and

- organizations are architected as “islands of business process automation” with tightly controlled /slowly changing supply chains.

The result of which is that there are still millions of applications and programs being developed, which are focused on optimizing the process of a particular business function, while not focusing on the security of the data or the data’s interoperability, which required to drive the business itself.

Consequently, developers are designing a multitude of misaligned, proprietary technologies and internet/web facing applications that are expensive, potentially insecure and, thus, unable to provide stakeholders in the digital economy - be they customers, clients or CEOs - any consistent semblance of trust/confidence that their data is safe.

The turbine engine, the radical replacement of the propeller, enabled the age of modern travel for the general population, with the affordable tickets, reliability, safety and speed that was impossible for propellered flight - and ultimately creating confidence in intercontinental transport. An equally revolutionary shift, via a completely new technical architecture and approach, is required to democratize and utilize data-at-scale for the digital economy and its Cyber-Citizens.

As stated above, the basics of developing technology and the technological approaches to solving business problems have not fundamentally changed since the 1960’s - you write some code that takes in data and/or produces data, which you run on a CPU and then store the results to disk. The approach to the internet and then the web etc. was to extend/enhance the networking capability that enabled these applications and programs to communicate with other applications and programs over a network.

Subsequently, while we have substantially more CPU, disk space and networking capacity than we had in the 60s the basics are, essentially, still the same - i.e. programs and applications are still process focussed, with data essentially supporting the process. Currently any concept of data permissions, sovereignty and security must be, when possible, "bolted on" as an add-on to this approach. This is done discordantly/inconsistently for most programs and applications in existence, resulting in it being virtually impossible for a company of any significant size to discern, and thus mitigate their risk across - let alone accountability for - what their potential exposure is when utilizing data from these programs and applications. Given the explosion of Software as a Service, it is quite possible that even small companies and individuals have their data stored in a number of different geographic jurisdictions with varying data laws and with each application providing their own proprietary set of data security controls. thus making it very difficult for them to understand what data security and compliance issues they may be deficit in.

ADDING A NEW LAYER

Our premise is that to enable a controllable, scalable and secure digital economy for the Cyber Civilization, accountability for data interoperability, permission-based sharing and security should be removed from the remit of application/product developers. Instead, when there is a requirement for interoperation and sharing we propose that the simplest way to do this is to create a new, vendor neutral, platform agnostic, Data Presentation layer, which is designed to

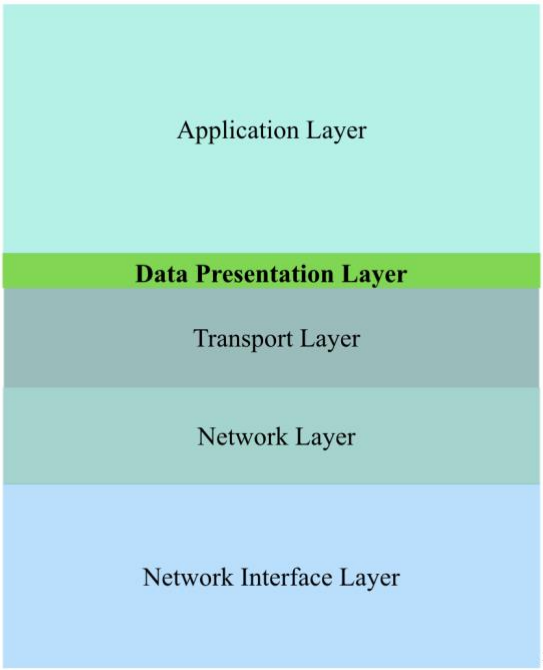

Fig 1

satisfy these requirements.

The concept, as illustrated above (Fig 1), shows this as a protocol enhancement to the TCP/IP model protocol stack. The adjustment is, conceptually, analogous to adding a new 'Data Presentation' layer between the Application and Transport layers in the stack.

The objective of this is to 'democratize' and simplify data-at-scale, while enabling participating stakeholders/Cyber-Citizens to communicate in their own data language/dialect as well as, and perhaps most importantly, enforcing and protecting their data rights in a vendor neutral, scalable and consistent manner. In addition, organizations of any size and scale are able to mitigate and control their cyber security risk, while enabling real-time, permission-based, seamless data interoperability and interconnection.

For interconnections between the general populace of the approaching Cyber Civilization to flourish, they must be empowered with multi-jurisdictional, data-at-scale governance capabilities that, currently, are confined to entrenched tech giants and multi-nationals. These capabilities must be extended to ensure 1) a data-owner's control of personal and sensitive data at all levels; and 2) that said data can, with permission, be securely shared/utilized without the current considerable costs and lengthy delivery times.

A 2020 global, cross-sector survey of seasoned data professionals found that more than 92% of respondents suffered from disconnected and fragmented data and that it would typically take their organizations more than 1 month to implement a single, new, interoperational data flow - more than 60% noted it could take anywhere between 3 and 12+ months for each connection to be implemented. *(Interoperational Data Flow (aka data integration) Survey, Q3, 2020, FlatWorld Integration Pty Ltd.).*

It is our contention that the underlying problem should be redefined as one of friction. The dimensions of this friction are: technical/implementation, business/user, financial, commercial (Intellectual Property permissions), legal/jurisdictional, scalability, compliance and risk mitigation. From extensive cross-industry experience we have seen that, unless all of these friction issues are solved, data integration/interoperation projects generally fail to deliver on promised results. While we have seen that there is often a large focus placed on technical friction, the other dimensions are not normally addressed adequately.

We believe it is unlikely that there will be any successful form of equitable, secure, data interoperable capability for the digital economy of the new Cyber Civilization, unless all of the friction dimensions are solved.

Solving friction as scale - the Architectural Solution / Data Presentation Layer

The new, Data Presentation Layer architectural solution, mentioned above, can be characterized as a Universal Translator and/or Babel Fish for data. It is (Fig 2 below):

- Vendor neutral and platform agnostic, enabling systems to communicate using their native formats and taxonomies, while also enabling that data to be utilized in the native formats and taxonomies of consuming systems as per the users requirements/preference.

- Horizontally scalable and able to be deployed on premise, in the cloud, and/or a hybrid of both of these.

- Able to ensure distributed data connections can be made by non-IT resources.

- API accessible by technologies such as Machine Learning and AI.

- No Code/Low Code, removing the requirement of significant and expensive technology skillsets to perform data integration/management work.

- Quickly and easily implementable (minutes instead of months), while satisfying the stringent and complex business demands of data integration.

- Able to automatically and transparently enforce permissions, security and compliance/governance regulations, while meeting the exacting requirements of sharing highly valuable/sensitive data between systems, irrespective of geographic location or company.

- Inexpensive to operate - including a low carbon-footprint.

Perhaps most importantly, the Data Presentation Layer is focused on data sovereignty, enabling data-owners to control how their data is to be used and/or shared; thus facilitating the effective

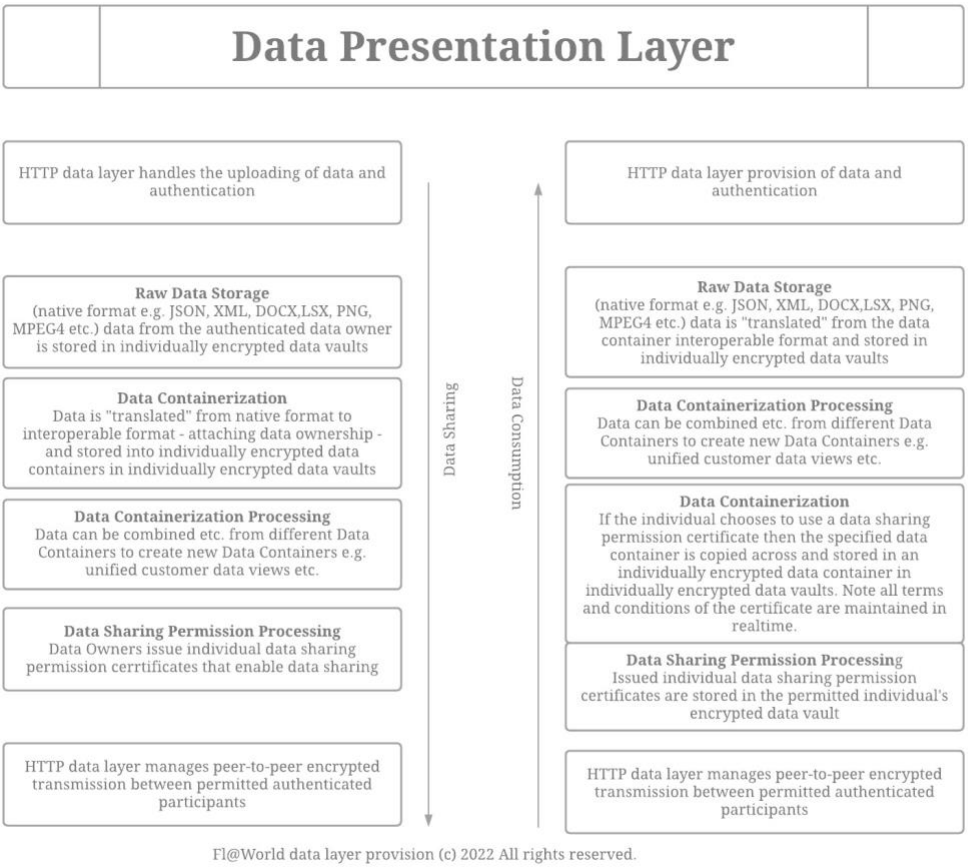

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Fig 2

utilization of external/multi-jurisdictional data sources.

Moving from Star Wars to Star Trek

By implementing a Data Presentation layer we can, colloquially speaking, say that it will transform Cyber Civilization from the realms of Star Wars to that of Star Trek.

By way of illustration, when thinking of the Star Wars saga, one cannot escape the reality of a dysfunctional ecosystem of disparate entities who wanted to work together to accomplish a goal (be it to create a trade federation or blow up a Death Star). However, their problem was that each of the stakeholder organizations within the ecosystem had their own tools and technologies

which, in the main, did not work together - if they did it was, more likely than not, a random/accidental success with risk mitigation little more than fingers being crossed.

Conversely, the United Federation of Planets represented in Star Trek was a vast collaborative affiliation of planets that were able to work together, efficiently and equitably, in realtime, while using their own tools, technologies and languages. One of the reasons for this was the Universal Translator which enabled constant, consistent collaboration capability and realtime interoperability.

If, rather than Star Wars or Star Trek, one has a penchant for Douglas Adams, one might reference the Babel Fish - which enabled immediate understanding of any and all languages for any user.

That said, Star Wars, Star Trek and the Hitchhikers Guide to the Galaxy are works of fiction but what Cyber-Citizens of the Digital Economy require are facts and tools they can use now.

TIMING IS EVERYTHING

Conventional thinking and technologies paint this as a problem set of 'Gordian Knot' propensities; however, this Data Presentation layer solution can be achieved, on a global scale, relatively quickly and surprisingly inexpensively - not unlike the successful implementation of remote working.

Much as an established, pre-Covid estimate as to how long it would like take to implement remote working was 454 days - in actuality, it took a mere11 days, when working from home became compulsory. (*See McKinsey Publishing's year in review, 2021 for more detail*). Why? Because needs must.

The need is no less imperative for the Data Presentation layer to enable an equitable data network for the digital economy of the new Cyber Civilization. Critically, it can be implemented in minutes, rather than months. Why? Because needs must.