Defining Digital Trust Ecosystems

Version 1.0

13 October 2022

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The mission of the Trust over IP (ToIP) Foundation is to define a complete architecture for Internet-scale digital trust that combines cryptographic assurance at the machine layer with human accountability at the business, legal, and social layers. Founded in May 2020 as a non-profit hosted by the Linux Foundation, the ToIP Foundation has over 400 organizational and 100 individual members from around the world.

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1. Document Information

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Revision History

Version	Date Approved	Revisions
1.0	13 OCTOBER 2022	Initial Publication

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RFC 2119

The Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and to ensure maximal efficiency in operation. IETF has been operating since the advent of the Internet using a Request for Comments (RFC) to convey "current best practice" to those organizations seeking its guidance for conformance purposes.

The IETF uses RFC 2119 to define keywords for use in RFC documents; these keywords are used to signify applicability requirements. ToIP has adapted the IETF RFC 2119 for use in the <name of this document>, and therefore its applicable use in ToIP-compliant governance frameworks.

The RFC 2119[1] keyword definitions and interpretation have been adopted. Those users who follow these guidelines SHOULD incorporate the following phrase near the beginning of their document:

> **The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.**

RFC 2119 defines these keywords as follows:

- **MUST**: This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- **MUST NOT:** This phrase, or the phrase "SHALL NOT", means that the definition is an absolute prohibition of the specification.
- **SHOULD:** This word, or the adjective "RECOMMENDED", means that there MAY exist valid reasons in particular circumstances to ignore a particular item, but the full implications MUST be understood and carefully weighed before choosing a different course.
- **SHOULD NOT:** This phrase, or the phrase "NOT RECOMMENDED" means that there MAY exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications SHOULD be understood, and the case carefully weighed before implementing any behavior described with this label.
- **MAY:** This word, or the adjective "OPTIONAL", means that an item is truly optional. One vendor MAY choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor MAY omit the same item.

Requirements include any combination of Machine-Testable Requirements and Human-Auditable Requirements. Unless otherwise stated, all Requirements MUST be expressed as defined in RFC 2119.

- **Mandatories** are Requirements that use a MUST, MUST NOT, SHALL, SHALL NOT or REQUIRED keyword**.**

[1] https://datatracker.ietf.org/doc/html/rfc2119. Accessed June, 2021.

- **Recommendations** are Requirements that use a SHOULD, SHOULD NOT, or RECOMMENDED keyword.
- **Options** are Requirements that use a MAY or OPTIONAL keyword.

An implementation which does not include a particular option MUST be prepared to interoperate with other implementations which include the option, recognizing the potential for reduced functionality. As well, implementations which include a particular option MUST be prepared to interoperate with implementations which do not include the option and the subsequent lack of function the feature provides.

2. Executive Summary

The concept of “ecosystem” has been increasingly adopted in data management, innovation, and business strategy. Yet, more often it is used metaphorically without a specific reference to the literature. At the Trust over IP Foundation, defining **digital trust ecosystems** is crucial in crafting a digital governance framework. This paper draws on the characteristics of natural ecosystems and human economies to propose a definition of digital trust ecosystems as interconnected communities of diverse institutional and individual participants in a trust environment sustained by the combined governance of technology and human actors. Characteristics of digital trust ecosystems, the role of the ToIP Foundation, and the challenges of sustaining digital trust ecosystems are discussed.

3. Introduction

What is a digital trust ecosystem? Firstly, an "Ecosystem" is a central concept in the design principles of the Trust over IP stack as well as many other disciplines[2]. Recently, the concept of "ecosystem" has been notably adopted in data management, innovation, and business strategy. Yet, more often it is used metaphorically without a specific reference to the literature. Likewise, we have not had a definition of a Digital Trust Ecosystem. A clear definition assures everyone means the same thing when they discuss it. Without a consensus on a conceptual framework of the Digital Trust Ecosystem, it is difficult to advance in the technical and governing framework of such a concept.

This paper attempts to define the Digital Trust Ecosystem. Given that multiple disciplines use the term "ecosystem" with an implied reference to its biological root, we asked a biodiversity scientist, Dr. Autumn Watkinson, to introduce us to ecology as a discipline. We saw parallels to the work we do in the ToIP Ecosystems Foundry working group. Some argue that innovation in a technological ecosystem shares many similarities with biological evolution, such as the features of trial and error (nature through genetic mutation; technology through experiments), extinction and replacement of new technology/new species, descent with modification (genetic inheritance in nature; new invention incorporates and modified ideas from previous ones in technology) just to name a few (Wagner & Rosen, 2014). Along the lines of the inspiration from biology, will digital trust ecosystems share similar features with biological ecosystems? Reflecting on the framework of ecosystems from biology, social ecosystems, data ecosystems, and human economies, this paper suggests key features of digital trust ecosystems, the challenges they faces, and the strategy to sustain digital trust ecosystems.

The paper is structured as follows:

- Part I discusses the term "Ecosystem" in biodiversity and other fields;
- Part II examines the differences between natural ecosystems and human socio-economies;
- Part III discusses the roles of ToIP Foundation and the design principles of the ToIP stack in the Digital Trust Ecosystem.

The paper concludes with the challenges to the evolution of Digital Trust Ecosystems and strategies to overcome these challenges.

[2] The diffusion of the biological concept to other fields is not a new phenomenon. It is called "universal Darwinism" and has been rooted since Charles Darwin's publication, Origin of Species, in 1859 (Wagner & Rosen, 2014).

4. "Ecosystems" in different disciplines

Ecosystems in biology

One of the first contemporary descriptions of ecosystems was formalized by A.G. Tansley in 1935 (Pirot, Maynell, & Elder, 2000; Tansley, 1935). It defines an ecosystem as a unit of vegetation that includes the plants, their associated animals, and all the physical and chemical components in that immediate environment. In the 1950s and 1960s, "ecology" was formed as a discipline devoted to understanding the Earth, its systems, and processes in a holistic way (Pirot, Maynell, & Elder, 2000).

In the Guide for ecosystem management published by the World Conservation Union, ecosystems are defined as the *"interaction between plant and animal species and their geophysical environment"* (Pirot et al., 2000, p. 8).

- All ecosystems have boundaries; however, these boundaries are human concepts rather than natural. In other words, an ecosystem can exist at any scale depending on the researcher's interest, from a few square inches to an entire biosphere.
- A large ecosystem consists of smaller ones.
- Ecosystems include both living and non-living components, and each has its function. In Earth's ecosystem, energy from solar radiation is obtained and processed by plants which become food for herbivores, which sustain carnivores. Dead components (plants and animals) are recycled and registered back into the systems by the decomposers and microbivores.

Three important characteristics of natural ecosystems include constant change, resilience, and biological diversity.

- The concept of change is probably the most significant characteristic of ecosystems because ecosystems are constantly changing, either because of external disturbance or the dynamics of the species within the ecosystem. Thus, there is no pristine state of an ecosystem, meaning the many efforts to restore perturbed ecosystems to their "original, pristine" state is ill-fated. Biological diversity (or biodiversity) refers to the variability among living organisms within species, between species, and between ecosystems.
- The more diverse an ecosystem is, the more chance it has to survive radical change.
- Resilience refers to the degree to which an ecosystem can recover from disturbance. The lower resilience a system has, the less likely it can recover from disturbance. Higher level of biodiversity translates to higher levels of resilience for an ecosystem.

Two other vital features of natural ecosystems are the ruthless competition for survival between species and the innate behaviors of these species to protect their ecosystems from overexploitation as put by the renowned author and forester Peter Wohlleben.

> *"The forest ecosystem is held in a delicate balance. Every being has its niche and its function, which contribute to the well-being of all. Nature is often described like that, or something along those lines; however, that is, unfortunately, false. For out there under the trees, the law of the jungle rules. Every species wants to survive, and each takes from the others what it needs. All are basically ruthless, and the*

> *only reason everything doesn't collapse is because there are safeguards against those who demand more than their due. And one final limitation is an organism's own genetics: an organism that is too greedy and takes too much without giving anything in return destroys what it needs for life and dies out. Most species, therefore, have developed innate behaviors that protect the forest from overexploitation."* (Wohlleben, 2015, p. 113)

Safeguards against overexploitation are more effective in ecosystems with high functional diversity and a co-evolved species community (Vuorinen, Oksanen, Oksanen, Vuorisalo, & Speed, 2021) (Neutel et al., 2007). An example of a sustainability mechanism is the jay that eats acorns and beechnuts and buries many of these nuts underground. This behavior ensures that these trees can benefit and multiply with the help of the jay (Wohlleben, 2015).

Psychologists and "Social Ecosystems"

Bronfenbrenner's (1979) Ecological Systems Theory (EST) is also referred to as Social Ecosystem Theory (SET) (Peng et al., 2021). Social ecosystem theory concerns humans and their living environments and sees individual behavior as influenced by many internal and external/environmental factors.

The umbrella term "social ecosystem" consists of three sub-ecosystems: the micro, meso, and macro ecosystems. The microsystem is the first layer of social influence on the individual; it entails the direct relationship between an individual such as his family, his school, peer groups, and the neighborhood. The exosystem is the next layer which deals with the settings that indirectly affect the development of an individual, such as events in the labor market that result in financial hardship of the parents and their parenting capabilities. The macrosystem is the highest level of Bronfenbrenner's (1979) social ecosystem model which concerns with social, cultural norms, beliefs, and ideologies (quoted by (Boxer et al., 2013) from (Bronfenbrenner, 1979)

In Bronfenbrenner's (1979) social ecosystem, the individual holds the center position with his "personal, dispositional, and genetic factors" (Boxer et al., 2013, p. 164). Notably, the social ecosystem theory also focuses on three key factors: the focal individual, the relationship between the individual and other actors in different layers, and the environment where when all of these interactions happen. The Social Ecosystem model views the human ecosystem in layers rather than in a spatial relationship. Notably, it recognizes the role of cultures, norms, and institutions in the social ecosystems.

Ecosystems in business strategy

Nowadays, it is rare for a publication about business models to not include the word "ecosystem". The use of the concept "ecosystem" marks a change in business mindset, from a pipeline business model to a platform model (Parker, Van Arlstyne, & Choudary, 2016). Many long-standing business practices such as the Japanese keiretsu and zaibatsu, the Korean chaebol, the Western concepts of cartel and trade associations also reflect a network mindset that extends beyond the boundaries of a singular organization.

However, the formal adaptation of the concept of "ecosystem" from biology to business was initiated by Moore (1993) in his article in HBR according to the systematic literature review by Aarikka-Stenroos and Ritala (2017).

During the 2010s, the "ecosystem" approach gained exponential use in business literature *(the literature referenced in the systematic review quoted by Aarikka-Stenroos & Ritala, 2017)* and somehow became a buzzword with no specific reference to the literature. There have been many major ecosystem streams in business management research, including business ecosystems, innovation ecosystems, entrepreneurial and start-up ecosystems, platform ecosystems, and service ecosystems.

The ecosystem approach in business management embraces two logics, namely the co-evolutionary logic and boundaries and composition. Co-evolutionary refers to the dynamics of multiple actors in an ecosystem and boundaries and compositions examine the ecosystem beyond a network of actors. As shown in Figure 1, these two overarching logics cross four main categories in the ecosystem approach: competition and evolution, emergence and disruption, stable business exchange, and value co-creation. These categories are not mutually exclusive.

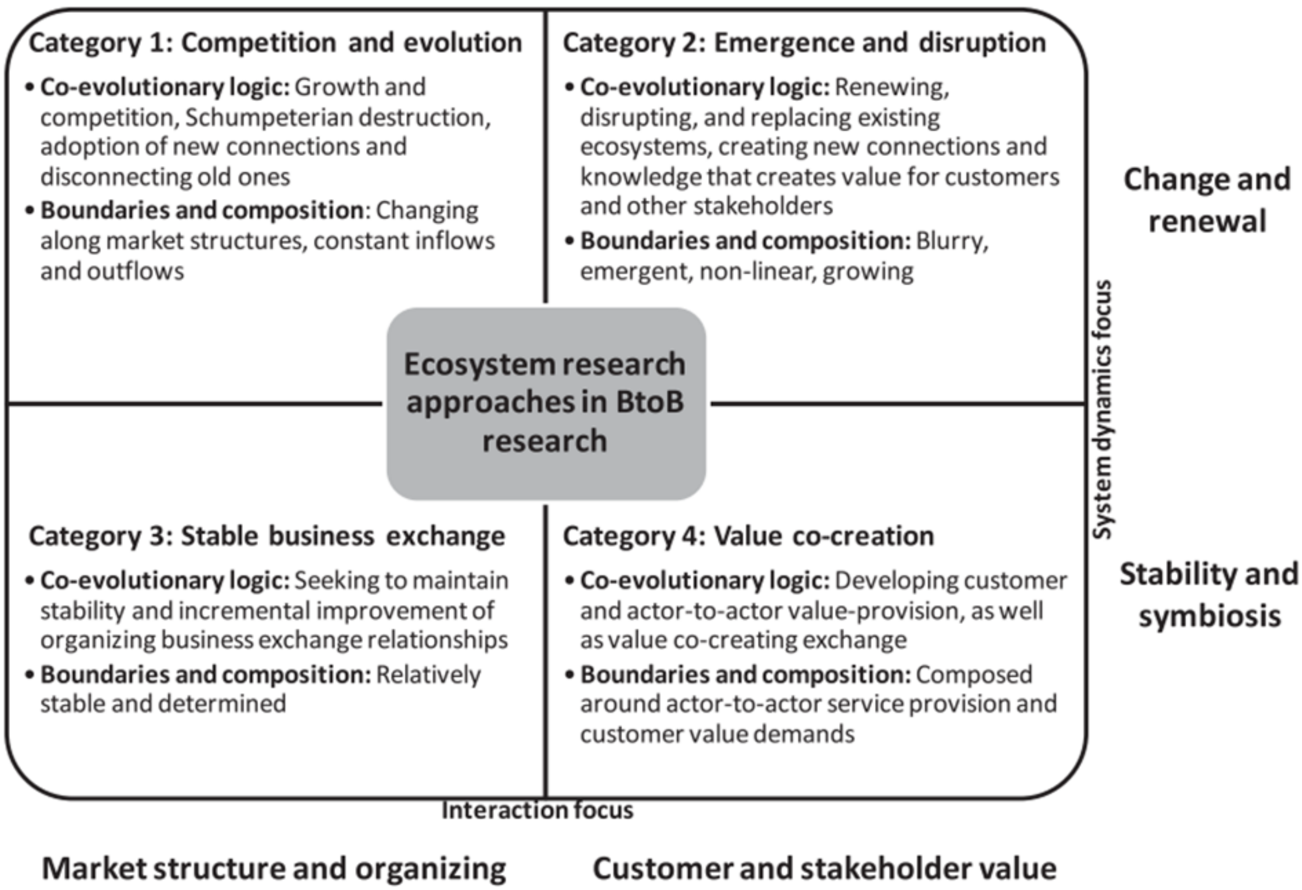


Figure 1. Ecosystem research approaches in B2B research (Aarikka-Stenroos & Ritala, 2017)

Data ecosystems

Data ecosystems is a nascent research field where academic publication is still scant. The majority of the extant literature on data ecosystems was published in 2014. The emergence of the Data Ecosystems is espoused by the development of digital technologies and political/institutional initiatives, such as the Open Government Data (OGD) program (Marcelo, Barros Lima, & Farias Lóscio, 2019).

There is little agreement on a definition of data ecosystems and there do not seem to be conceptual models nor governance frameworks yet. In their systematic mapping literature review, Marcelo, Barros Lima, and Farias Loscio (Marcelo et al., 2019, p. 1) drew a definition of data ecosystems from multiple studies:

> *"Data Ecosystems are socio-technical complex networks in which actors interact and collaborate with each other to find, archive, publish, consume, or reuse data as well as to foster innovation, create value, and support new businesses."*

An important element in data ecosystems is the material infrastructure which consists of Information and Communications Technology (ICT) resources and services (i.e. hosting or storage capacity) that facilitate the access and exchange of data. The most cited benefits of Data Ecosystems are enhancing political and social life and improving social trust followed by the ease of production and consumption of data, an increase in coordination and collaboration between various actors, and better data.

5. Similarities and differences between natural ecosystems and human economies

A survey of psychology, business, and data management reveals that the concept of "ecosystem" has been widely adopted outside biology since the mid-2010s. However, the term "ecosystem" is used rather loosely and metaphorically, and mostly refers to the interconnectedness of various components in an environment and the constantly changing nature of the ecosystems caused by external factors and the dynamics of the components within it. The boundaries of ecosystems are less discussed in other disciplines outside biology, which implicitly acknowledges the artificial nature of these boundaries.

Despite being inspired by the biological ecosystem, different disciplines focus on different aspects of nature. Business ecosystems tend to focus on the co-evolutionary logic between elements via cooperation and competition with special attention to competition; data ecosystems emphasizes the environment (represented by the infrastructure) and the connection between elements that facilitate the exchange of data; psychology integrates the metaphysical elements of cultural, norms, and beliefs in its macrosystems.

The departure from physical and biological elements is an important point in human socio-economic ecosystems. The addition of the human factors infuses a dramatic change to the dynamics of the business, data, and social ecosystems: the human agency and the metaphysical factors of beliefs, cultures, and norms. Table 1 summarizes the similarities and differences between natural ecosystems and other "forms" of ecosystems.

Characteristics	Natural ecosystem	Business ecosystem	Data ecosystem	Social ecosystem
Boundaries are defined by research interest, not naturally occur	Y	Y	Y	Y
Constant change	Y	Y	Y	Y
Favors diversity	Y			
Resilience	Y	Y		
Co-evolution	Y	Y	Y	
Competition	Y	Y		
Interconnectedness	Y	Y	Y	Y

Mechanism to counteract overexploitation	Y			
Human agency		Y	Y	Y
Metaphysical factors (beliefs, norms, cultures)		Y	Y	Y

Table 1. Comparison table of ecosystems concepts in different disciplines

To be clear, cultural transmission is not exclusively a product of human development. In the animal kingdom, animals with strong observation skills do learn and copy others' behavior and species also invade new habitats. Notwithstanding these forms of cultural transmission, genetic mutation and adaptation remain the key nature rule (Vermeij & Leigh, 2011).

The picture is vastly different in human socio-economies as the human agency and beliefs, norms, and cultures play a dominant role. Whereas plants and animals adapt genetically to nature, humans adapt culturally to their society and economy. In addition, technology helps accelerate the pace and expand the scale of change and adaptation in human economies, as put by Vermeij and Leigh (2011), *"Cultural transmission of adaptation has propelled humanity to its current status as the dominant economic agent on Earth."* (Vermeij & Leigh, 2011, p. 7)

This main divergence between natural ecosystems and human economies was also highlighted by Vermeij and Leigh (2011) who asserts that the human agency equipped with advancement in technology has brought two main unique threats to the human economies: the unchecked overexploitation of resources and the raising of monopolies, leading to easily destabilized human economies.

The tendency to exploit resources as much as possible is not exclusive to the human species. However, nature sustains a mechanism to counteract such overexploitation, such as through predators and prey relationship or cannibalism and infanticide in some predators (Vuorinen et al., 2021). This mechanism enables natural ecosystems to be so resilient and robust that they can absorb significant change such as the arrival of new species. On the other hand, the predominantly cultural adaptation backed by technology advancement in human economies diminish the role of the natural overexploitation control mechanism. Economic and technical advantages then give rise to monopolies – agents with overwhelming power – which can exacerbate the inefficient resource allocation through consolidating power and suppressing competition (Vermeij & Leigh, 2011).

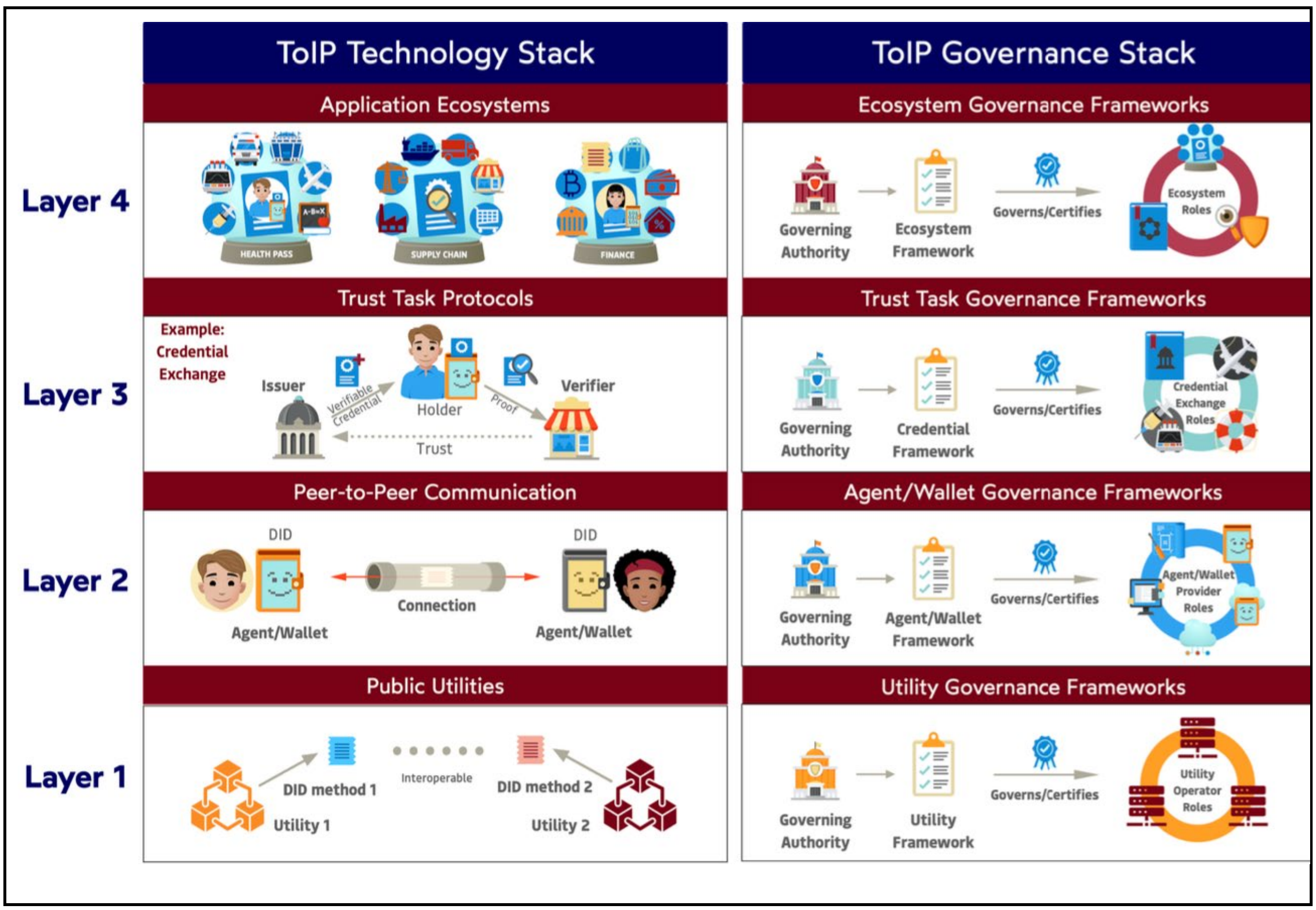
Consequently, human economies are more likely to be collapsed by internal causes than external causes. Unchecked overexploitation of resources, monopolies, and armed conflicts are chiefly human internal threats that can destabilize human economies (Vermeij & Leigh, 2011). The notorious Tulip mania in the seventeenth century and the feverous speculation in stock prices that caused the Great Depression are examples of the culturally driven adaptation in the human economies. Monopolies and overexploitation of resources create a negative feedback loop since harmful actions of monopolies are difficult to be detected or corrected due to their dominant power, leading to further overexploitation and higher instability. Only catastrophic external events like severe shortages of food or weather disasters can constrain humans' collective monopoly of the biosphere, which will bring massive destruction and suffering to the whole. An effective mechanism to preempt members of ecosystems from overexploiting the system is crucial in sustaining the ecosystems.

6. Digital Trust Ecosystems

From designing ToIP principles to defining Digital Trust Ecosystem

The ToIP design principles is a collective work of 22 authors from two working groups, the Technical Stack Working Group and Governance Stack Working Group, published in November 2021 (ToIP Foundation, 2021). The goal of the design principles is to serve as guidance for the development of interoperable decentralized digital trust infrastructure, not just within one ecosystems but between thousands or millions of diverse digital trust ecosystems.

The design principles of ToIP are broadly categorized using the concept of “dry code” (computer code executed by machines) and “wet code” (code written in human language and subjected to humans’ governance and interpretation), an approach suggested by cryptography pioneer Nick Szabo (Szabo, 2006) and the Architectural Principles of the Internet (Network Working Group, 1958). There are 17 design principles in three groups, including the “Dry code” principles (applied to the Technology stack), “Wet code” principles (applied to the Governance Stack), and Overall principles (applied to both stacks). These principles are presented in parallel with their ToIP stack in Figure 2.



"Dry code" principles	"Wet code" principles
1. The End-to-End Principle 2. Connectivity Is Its Own Reward 3. The Hourglass Model 4. Decentralization by Design and Default 5. Cryptographic Verifiability 6. Confidentiality by Design and Default 7. Keys at the Edge	8. Trust is Human 9. Trust is Relational 10. Trust is Directional 11. Trust is Contextual 12. Trust has Limits 13. Trust can be Transitive 14. Trust and Technology have a reciprocal relationship.
General principles 15. Design for Ethical values 16. Design for Simplicity 17. Design for Constant change	

Figure 2. The ToIP Stack (Davie et al., 2019) and its design principles

There are multiple roles within the system as depicted in Table 2. The sophisticated participation and dynamic connection among them align with the diversity and constant change nature of natural ecosystems. Notably, "trust" permeates both Technology and Governance stack, which resembles the role of the environment in natural ecosystems. Yet, the Digital Trust Ecosystems have a significant portion of the human agency reflected through the "Wet code" stack and the general principles of "Ethical values".

Layer	Role	Description
Layer Four: Governance Frameworks	Governance Authority	Specifies a governance framework (GF)
	Auditor	Audits participants for compliance with a GF
	Auditor Accreditor	Accredits auditors for a GF
Layer Three: Credential Exchange	Trust Anchor	Authoritative issuer of a credential under a GF
	Credential Registry	Authoritative holder of credentials for discovery
	Insurer	Insures issuers operating under the terms of a GF
Layer Two: DIDComm	Hardware Developer	Provides ToIP-compliant hardware
	Software Developer	Provides ToIP-compliant edge agents and wallets
	Agency	Hosts ToIP-compliant cloud agents
Layer One: DID Networks	Transaction Author	Initiates a transaction on a DID network
	Transaction Endorser	Facilitates transaction author transactions
	Steward	Operates a node of a permissioned DID network

Table 2. The ToIP Stack (Davie et al., 2019, p. 50) and its design principles

Reflecting on the human economies and learning from natural ecosystems, I propose a definition for a Digital Trust Ecosystem:

> **Digital Trust Ecosystems are interconnected communities of diverse institutional and individual participants in a trust environment sustained by the combined governance of technology and human actors.**

Characteristics of Digital Trust Ecosystems and the role of the ToIP Foundation

The comparison table in Table 1 illustrates the convergence and divergence between natural ecosystems and human socio-economic ecosystems in business, data management, and psychology. Even though none of the man-made disciplines have thoroughly constructed a full definition and characteristics of its "ecosystem", all explicitly acknowledge its shared features of constant change and interconnectedness between components.

The mechanism to counteract overexploitation, a unique feature of natural ecosystems overlooked by other disciplines, is a crucial factor in sustaining any ecosystem. Several authors have suggested implementing a natural strategy to self-check greedy actors (Vuorinen et al., 2021; Vermeij & Leigh, 2011) to prevent the collapse of the ecosystems for all. Thus, sustainability is a vital characteristic of a Digital Trust Ecosystem.

Let's draw three lessons from nature.

First, the ecosystems must optimize the diversity of its membership. Interconnectedness and cooperation are vital to the survival of the whole. The more diverse a Digital Trust Ecosystem's community, the better chance it has to survive and enable co-evolution of its member species.

Second, ecosystems survive and thrive without clear-cut boundaries and no ecosystem is completely independent of others. Digital Trust Ecosystems need to address the hard boundaries that exist between systems caused by technical incompatibility. This can be achieved by ensuring interoperability exists between systems.

Third, and most importantly, Digital Trust Ecosystems must have a built-in mechanism to counteract overexploitation. Overexploitation in Digital Trust Ecosystems is as detrimental as in natural ecosystems. The depleting resource here is trust; once trust deteriorates, it is timely and costly to restore it, just as for the natural environment. As the risk of unchecked overexploitation is uniquely human, the combination of wet code and dry code governance is crucial in minimizing the impact of monopolies and exploiters.

We map Digital Trust Ecosystems characteristics to their respective design principles in Table 3:

Characteristics	**Natural ecosystems**	**Digital Trust Ecosystems**	**ToIP Design principles**
Boundaries are defined by research interest, not naturally occur	Y		Interoperability?
Constant change	Y		Principle #17: Design for constant change
Favors diversity	Y		Design for diversifying?
Resilience	Y		Principle #16: Design for Simplicity
Co-evolution	Y		"Dry code" principles 1. The End-to-End Principle

<table>
<tr><td>Competition</td><td>Y</td><td></td><td rowspan="2">2. Connectivity Is Its Own Reward
3. The Hourglass Model
4. Decentralization by Design and Default
5. Cryptographic Verifiability
6. Confidentiality by Design and Default
7. Keys at the Edge</td></tr>
<tr><td>Interconnectedness</td><td>Y</td><td></td></tr>
<tr><td>Mechanism to counteract overexploitation</td><td>Y</td><td></td><td>Principle #15: Design for Ethical values</td></tr>
<tr><td>Human agency</td><td></td><td></td><td rowspan="2">“Wet code” principles:
1. Trust is Human
2. Trust is Relational
3. Trust is Directional
4. Trust is Contextual
5. Trust has Limits
6. Trust can be Transitive
7. Trust and Technology have a reciprocal relationship.</td></tr>
<tr><td>Metaphysical factors (beliefs, norms, cultures)</td><td></td><td></td></tr>
</table>

Table 3. Mapping ecosystem ideas to the ToIP design principles.

7. Conclusion

Darwinism migrated the concept of “ecosystem” far beyond biology. An “ecosystem” approach gained traction in several disciplines since the 2010s, including business and data management. However, most references to “ecosystem” are used loosely and metaphorically, with an emphasis on the interconnectedness and dynamic relationship between components and the constant change of the environment.

Trust Over IP aspires to foster decentralized digital trust, not just within an ecosystem but between different digital trust ecosystems. This paper attempts to study the construct of ecosystems in its biological roots and other fields to define digital trust ecosystems and their characteristics.

Reflecting on the framework of natural ecosystems and human socio-economic ecosystem, Digital Trust Ecosystems inherit the unique feature of the human socio-economic ecosystem, that is the involvement of human agency. This means Digital Trust Ecosystems are also threatened by the risk of self-destructive behavior of humans through overexploitation and monopolies. This makes the system more susceptible to internal threats caused by cultural, institutional, and behavioral forces of intuitions and individuals.

To counter this threat and maximize sustainability, the design of Digital Trust Ecosystems can optimize the diversity of participants, maximize interoperability, and minimize overexploitation.

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The Trust Over IP Foundation (ToIP) is hosted by the Linux Foundation under its Joint Development Foundation legal structure. We produce a wide range of tools and deliverables organized into five categories:

- Specifications to be implemented in code
- Recommendations to be followed in practice
- Guides to be executed in operation
- White Papers to assist in decision making
- Glossaries to be incorporated in other documents

ToIP is a membership organization with three classes—Contributor, General, and Steering.

The work of the Foundation all takes place in Working Groups, within which there are Task Forces self-organized around specific interests. All ToIP members regardless of membership class may participate in all ToIP Working Groups and Task Forces.

When you join ToIP, you are joining a community of individuals and organizations committed to solving the toughest technical and human centric problems of digital trust. Your involvement will shape the future of how trust is managed across the Internet, in commerce, and throughout our digital lives. The benefits of joining our collaborative community are that together we can tackle issues that no single organization, governmental jurisdiction, or project ecosystem can solve by themselves. The results are lower costs for security, privacy, and compliance; dramatically improved customer experience, accelerated digital transformation, and simplified cross-system integration.

To learn more about the Trust Over IP Foundation please visit our website, https://trustoverip.org.

