THE ECONOMICS OF DECENTRALIZATION
THE SECOND REFORMATION

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Abstract

Computing is undergoing a seismic shift from client/server and cloud computing to decentralization, a change of greater importance and impact compared to the transition from i) mainframe to client/server and ii) client/server to cloud computing. Speculation abounds on how this new era will evolve in the coming years, and IT leaders have a critical need for an unclouded vision of where the industry is heading. The author believes the best way to form this vision is to understand the underlying economics driving the long-term trend toward decentralization. In this report, we describe the importance of decentralization and assess its economics through in-depth modelling. This report builds on the economic knowledge of several researchers and practitioners. The report draws on landmark works in platform economics, network effects, and technology disruption to build a rigorous framework for understanding the long-term implications of decentralization for Information Technology[1].

Post-anthropocentric Era

Post-anthropocentric society describes a worldview, system, or society in which humans are no longer treated as the sole, default, or supreme center of value, agency, or decision-making. Post-anthropocentric does not mean anti-human or anti-humanity. It means humans are no longer the only meaningful actors. Humans are one class of actors among several. This era is also known as *The Second Reformation*.

The Second Reformation

The impact of decentralization will be greater than anything we have witnessed in the last 500 years. The first technology-fueled reformation was the 16th-century Protestant Reformation, a sweeping religious movement that began in 1517 (500 years ago) when Martin Luther challenged the authority and corruption of the Catholic Church. The First Reformation spread rapidly across Europe through the newly invented printing press. The printing press inspired reformers to promote salvation by faith alone, the authority of Scripture over church tradition, and simpler forms of worship.

The Second Reformation is the rapid, actor-driven reshaping of systems, organizations, and practices in which autonomous agents (human and digital) initiate and sustain reformative change – through decentralization. The Second Reformation parallels the First Reformation in its scope, social impact, and its technology-driven origins. The Second Reformation and the planet's transformation into a post-anthropocentric society are fully underway as you read this.

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[1] *Platform Scale*. Sangeet Paul Choudary. 2015.

Intended Audience

The intended audience for this report is a broad range of professionals interested in furthering the use of decentralization in software apps, agents, and services across end-to-end systems of work. This includes visionaries, software architects, application developers, and user experience specialists, as well as people involved in a broad range of standards efforts related to decentralized identity, verifiable credentials, secure storage, and decentralized networks.

Key Concepts

Core Value Unit

The core value unit (CVU) is the minimum standalone unit of value that is created on top of the platform. It represents supply or inventory created on top of the platform. Without this supply, the platform has little value in and of itself.[2]

Decentralization

Decentralization refers to the *shift from centralized control* of identity, data, compute, and decision-making toward a distributed ecosystem where trust emerges from cryptographic proofs, verifiable credentials, and autonomous agents—not institutions. Instead of relying on a single platform or cloud to authenticate users, store data, run applications, or mediate transactions, decentralization enables individuals, organizations, and intelligent agents to interact through open protocols, self-sovereign identities, shared governance, and value-aligned automation. This creates a more resilient, equitable, and interoperable digital environment where trust is built into the architecture, users retain control over their digital existence, and intelligent agents operate collaboratively rather than being owned or constrained by proprietary platforms.[3]

Pipe Scale

Business scale is powered by the ability to coordinate internal labour and resources toward efficient value creation and toward the delivery of the created value to an aggregated consumer base.[4]

Pipe scale businesses are characterized by the building and sustaining of huge factories and warehouses that process inputs and spew outputs (chew and spew). Most hyperscale AI and cloud providers (hyperscalers) are examples of pipe-scale organizations.

Platform Scale

Business scale powered by the ability to leverage and orchestrate a global connected ecosystem of producers and consumers toward efficient value creation and exchange. The management of platform scale is most concerned with the design and optimization of value-exchange interactions between producers and consumers.[5] The architecture and design of a platform-scale network is focused on the exchange of core value units (CVUs) between producers, consumers, and application developers.

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[2] *Platform Scale*. Sangeet Paul Choudry. 2015.
[3] *Decentralization*. Michael Herman. November 2025. https://hyperonomy.com/2025/11/24/decentralization/
[4] *Platform Scale*. Sangeet Paul Choudry. 2015.
[5] Ibid.

Web 7.0

"Web 7.0 is a unified software and hardware ecosystem for building resilient, trusted, decentralized systems using decentralized identifiers, DIDComm agents, and verifiable credentials."[6]

Web 7.0 Pando

"Web 7.0 Pando™ is a modular, biologically-inspired agent platform — designed to grow and adapt like a living system — for coordinating and executing complex systems of work that is: Secure, Trusted, Open, and Resilient."[7]

Acknowledgements

This report is an amalgamation of several top-shelf business articles, books and whitepapers written by a cohort of highly regarded and respected researchers and practitioners (in chronological order):

1. "Innovation: The Attacker's Advantage," authored by Richard Foster – originally published by Summit Books in 1986. Foster's S-curve framework remains one of the most powerful analytical tools for understanding why incumbents consistently fail to respond to disruptive technologies.
   - "The Innovator's Dilemma," authored by Clayton Christensen – originally published by Harvard Business Review Press in April 1997.
2. "Platform Scale," authored by Sangeet Paul Choudary – self-published in 2015.
3. "The Economics of the Cloud," authored by Rolf Harms et al. and published by Microsoft Corporation in November 2020. The author is grateful to Microsoft for making this white paper publicly available.
4. "The Cold Start Problem," authored by Andrew Chen and published by HarperCollins in 2021. This is the bible for understanding how network effects can propel products and services from Cold Start to the Tipping Point, Escape Velocity, and the Ceiling.
5. "Reshuffle," authored by Sangeet Paul Choudary (and team) – self-published in 2025. Reshuffle is an amazing *business* book written for our AI times. Choudary highlights concepts like the value differentiation between Coordination and Task Execution, and the Bundling and Unbundling of work in the age of AI agents.

[6] *Web 7.0 Pando™: Agent Architecture Reference Model (AARM).* Michael Herman, Trusted Digital Web Project, Hyperonomy Digital Identity Lab, Web 7.0 Foundation. January 2023. https://hyperonomy.com/2025/10/14/web-7-0-agentic-os-agent-architecture-reference-model-aarm/
[7] Ibid.

1. INTRODUCTION[8]

When cars emerged in the early 20th century, they were initially called “horseless carriages”[9]. Understandably, people were skeptical at first, and they viewed the invention through the lens of the paradigm that had been dominant for centuries: the horse and carriage. The first cars also looked similar to the horse and carriage (just without the horse), as engineers initially failed to understand the new possibilities of the new paradigm, such as building for higher speed operations or greater safety. Incredibly, engineers kept designing the whip holder into the early models before realizing that it wasn‘t necessary.

Initially, there was a broad failure to fully comprehend the new paradigm. Banks claimed that “*The horse is here to stay, but the automobile is only a novelty, a fad.”*

Even the early pioneers of the car did not fully grasp the potential impact their work could have on the world. When Daimler, arguably the inventor of the automobile, attempted to estimate the long-term auto market opportunity, he concluded there could never be more than 1 million cars, because of their high cost and the shortage of capable chauffeurs[10].

By the 1920s, the number of cars had already reached 8 million, and today there are over 600 million cars – proving Daimler wrong hundreds of times over. What the early pioneers failed to realize was that profound reductions in both the cost and complexity of operating cars and a dramatic increase in their importance in daily life would overwhelm prior constraints and bring cars to the masses.

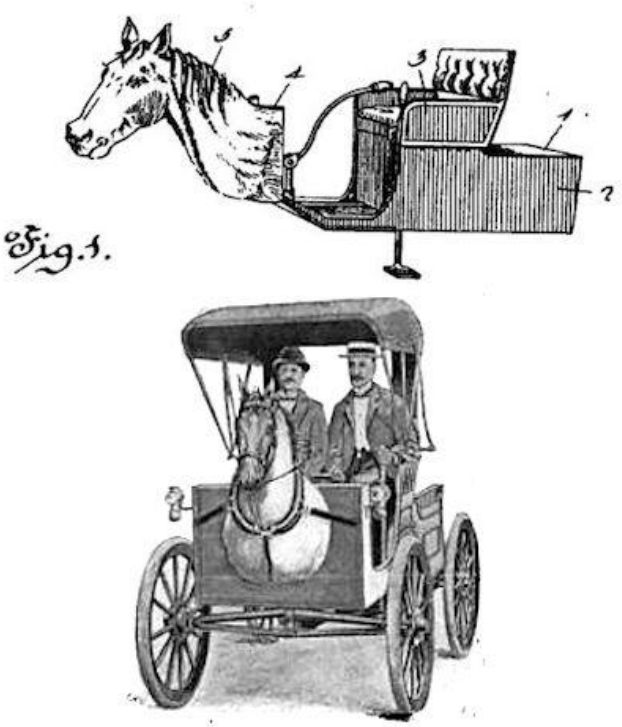


Figure 1. Horseless Carriage Syndrome

Today, IT is going through a similar change: the shift from client-server and cloud computing to decentralization. Decentralization promises not just cheaper IT, but also faster, easier, more flexible, and more effective IT.

Just as in the early days of the car industry, it‘s difficult to see where this new paradigm will take us. *The goal of this report is to help build a framework that allows IT leaders to plan for the transition to decentralization*. We take a long-term view in our analysis, as this is a prerequisite when evaluating decisions and investments that could last for decades. As a result, we focus on the tangible benefits and economics of

[8] Inspiration: *The Economics of the Cloud*, Rolf Harms et al. Microsoft. November 2010.
[9] "Horsey Horseless," an invention patented in 1899 by Uriah Smith of Battle Creek, Michigan.
[10] Source: Horseless Carriage Thinking, William Horton Consulting.

decentralization rather than on specific technologies or other driving factors like organizational change, as economics often provides a clearer understanding of transformations that are underway.

In Section 2, we examine what history and the established literature tell us about technology disruptions of this nature. In Section 3, we outline the underlying economics of decentralization, focusing on what makes it truly different from cloud computing and client/server. In Section 4, we present the five-year TCO economic model. In Section 5, we will assess the implications of these economics for the future of IT. We will discuss the positive impact decentralization will have but will also discuss the obstacles that still exist today. Finally, in Section 6, we will discuss what is important to consider as IT leaders embark on the journey to decentralization.

2. WHAT HISTORY HAS TAUGHT US

Three landmark works in technology economics help explain both why the transition to decentralization is inevitable and why the incumbents cannot stop it.

Innovation: The Attacker's Advantage (Richard Foster, 1986) introduced the S-curve — the observation that every technology follows a predictable arc: slow progress in early development, rapid improvement at maturity, and then diminishing returns as the technology approaches its physical limits. The critical insight is that defenders — the companies that built their businesses on the existing S-curve — continue investing harder precisely as returns begin to decline. They cannot stop. Their organizations, their revenue models, and their competitive identity are all built around the current technology. The attacker, starting fresh on a new S-curve with no sunk investment to defend, has the structural advantage.

The Innovator's Dilemma (Clayton Christensen, 1997) explained why large, well-managed companies consistently fail to respond to disruptive technologies even when they can see them coming. The answer is not incompetence — it is rationality. Disruptive technologies initially underperform on the dimensions established customers care about. No mainstream enterprise buyer in 2010 would have traded a managed corporate data center for the early cloud. But the disruptor competes on different dimensions — cost, accessibility, sovereignty — and improves along its own trajectory until it displaces the incumbent entirely. By then, the incumbent's response is structurally impossible: it would require cannibalizing the revenue stream the entire organization exists to protect.

Platform Scale (Sangeet Paul Choudary, 2015) identified the deeper economic shift underneath disruption: the move from *pipe* businesses to *platform* businesses. Pipe businesses create value linearly — they manufacture something and deliver it to a customer. The value flows one way and the provider extracts margin at every step. Platform businesses orchestrate value creation across a network of participants. The economics are fundamentally different: the platform does not own the means of production, value accrues to participants rather than to the intermediary, and the network becomes more valuable with every new participant who joins.

Taken together, these three frameworks describe exactly what is happening in enterprise computing today — and exactly what Microsoft confirmed at its Build 2026 developer conference in San Francisco this week.

Microsoft unveiled what it calls the "Agent Computer" — a vision for embedding autonomous AI agents into Windows, Azure, and Microsoft 365, governed by a new Agent Trust Fabric that ties agent identity, policy, and audit to Microsoft Entra and Microsoft Intune. It is technically impressive. It is also a textbook illustration of all three frameworks operating simultaneously.

From Foster's perspective, Microsoft is a defender at the top of its S-curve. Every agent Microsoft deploys creates a new Azure consumption unit, a new Entra identity seat, a new Intune governance license. The agent strategy is not a new S-curve — it is a more elaborate climb on the existing one, intensifying investment precisely as the underlying economics of centralized infrastructure approach their limits.

From Christensen's perspective, Microsoft cannot offer what decentralization offers — because the offer would destroy the business. Sovereign agent identity means no Entra seat. Zero-integration economics means no Azure API Management revenue. Citizen-owned compute means no Azure consumption bill. The Agent Trust Fabric is a compliance and governance story because compliance and governance is the one dimension Microsoft can compete on that decentralization does not yet own. This is rational. It is also, as Christensen would recognize, the beginning of the end for the current model.

From Choudary's perspective, Microsoft's agent model is a pipe masquerading as a platform. Agents are provisioned through Azure, governed through Entra, billed through Microsoft. Every agent is a new Microsoft revenue unit. The Agent Trust Fabric is the control plane — and Microsoft owns it. Web 7.0 Pando™ is a genuine platform in Choudary's sense: participants own the infrastructure, value accrues to the network rather than to an intermediary, and the protocol — did:drn — is the control plane. Nobody owns it because it is owned by mathematics.

The economics described in this report are not a prediction. The only question is timing.

3. ECONOMICS OF DECENTRALIZATION[11]

Economics is a powerful force in shaping industry transformations. Today's discussions on decentralization have focused on technical complexities and adoption hurdles. While we acknowledge that such concerns exist and are important, historically, underlying economics have a much stronger impact on the direction and speed of disruptions, as technological challenges are resolved or overcome through the rapid innovation we've grown accustomed to (Fig. 2). During the mainframe era, client/server was initially viewed as a "toy technology" - not viable as a mainframe replacement. Yet, over time, the client/server technology found its way into the enterprise. Similarly, when virtualization technology was first proposed, application compatibility concerns and potential vendor lock-in were cited as barriers to adoption. Yet underlying economics of 20 to 30 percent savings[12] compelled CIOs to overcome these concerns, and adoption quickly accelerated.

The emergence of cloud services again shifted the economics of IT. Cloud technology has standardized and pooled IT resources and automated many of the maintenance tasks done manually today. Cloud architectures facilitated elastic consumption, self-service, and pay-as-you-go pricing.

Decentralization, on the other hand, refers to the shift from centralized control of identity, data, compute, and decision-making toward a distributed ecosystem where trust emerges from cryptographic proofs, verifiable credentials, and autonomous agents—not institutions. Instead of relying on a single platform or cloud to authenticate users, store data, run applications, or mediate transactions, decentralization enables individuals, organizations, and intelligent agents to interact through open protocols, self-sovereign identities, shared governance, and value-aligned automation. This creates a more resilient, equitable, and

[11] Inspiration: *The Economics of the Cloud*, Rolf Harms et al. Microsoft. November 2010.
[12] Source: *Dataquest Insight: Many Midsize Businesses Looking Toward 100% Server Virtualization*. Gartner, May 8, 2009.

interoperable digital environment where trust is built into the architecture, users retain control over their digital existence, and intelligent agents operate collaboratively rather than being owned or constrained by proprietary platforms[13].

Decentralization does not require anyone to build a bigger data center. It requires citizens, organizations, and intelligent agents to run Trusted Digital Assistants (TDAs) on devices that they already own — personal computers, smartphones, home servers, or low-cost hosted nodes. The economics of decentralization therefore operate on a fundamentally different principle than the economics of cloud. Cloud economics improve as infrastructure grows larger. Decentralization economics improve as participation grows wider. Web 7.0 Pando does not scale upward — it spreads outward, like the Pando aspen grove in Utah: 47,000 stems, one root system, growing wider without growing taller. Decentralization delivers significant economic advantages across the following three dimensions:

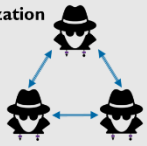
	Technology	Economics	Business Model
Mainframe 	Centralized compute and storage.Thin clients.	Optimized for efficiency due to high costs. Cost center.	High up-front costs for hardware and software.
Client-Server 	PC clients and servers for distributed compute, storage, etc.	Optimized for agility because of the lower costs. Cost center.	Perpetual license for OS and application software.
Cloud 	Large data centers, ability to scale, commodity hardware, client devices.	Efficiency and agility - an order of magnitude better. Cost center.	Ability to pay as you go, and only for what you use.
Decentralization 	Personal computers and mobile devices. Always-in DIDComm Agent.	Cost decentralization. Reduced/zero middleware. Data ownership monetization. Self-optimizing.	Autonomous value generation. No integration tax. High market liquidity and network effects. Value-generating.

Figure 2. Decentralization Advantages

Sovereign infrastructure savings. Citizens and organizations run TDAs on devices they already own, eliminating cloud consumption fees. At citizen scale, this means no platform fee, no per-seat license, no identity management subscription. At industry scale, it means the world does not need to keep building and refreshing massive hyperscale data center infrastructure — and the enormous capital and operating costs of that infrastructure cycle cease to be passed on to customers through consumption pricing.

Decentralized network society economics. As more citizens, organizations, and digital agents join the Web 7.0 Pando network, the value of the network grows without any corresponding growth in central infrastructure costs. Each new TDA, each new Society, each new LOBE added to the ecosystem increases the economic surface area of the network at near-zero marginal cost. With cloud computing, more usage means more cost. With Web 7.0 Pando, more participation creates more value - value that accrues to people; not the platforms.

Zero-integration economics. Because every TDA communicates natively over DIDComm V2, the integration tax — the API gateways, IAM platforms, middleware stacks, and ETL pipelines that consume between 40 and 65 percent of enterprise IT budgets today — is eliminated by architecture, not by effort. Organizations no longer pay to connect systems. Trusted, verifiable interoperability is the default.

[13] *Decentralization*. Michael Herman. November 2025. https://hyperonomy.com/2025/11/24/decentralization/

3.1 Sovereign Infrastructure Savings

Cloud computing shifted IT infrastructure from the corporate data center to the hyperscaler data center. It reduced some costs and added elasticity, but it did not return infrastructure ownership to the people and organizations that depend on it. Citizens and businesses trading one landlord for another — the corporate IT department for Amazon or Microsoft — is not sovereignty. It is a change of address.

Web 7.0 Pando changes the underlying model. A Trusted Digital Assistant (TDA) is a sovereign agent runtime that operates on hardware the citizen or organization already owns: a personal computer at home, a smartphone, a small, hosted node at a trusted provider. Citizens do not rent compute from a hyperscaler. The citizen owns their compute, their identity, and their data.

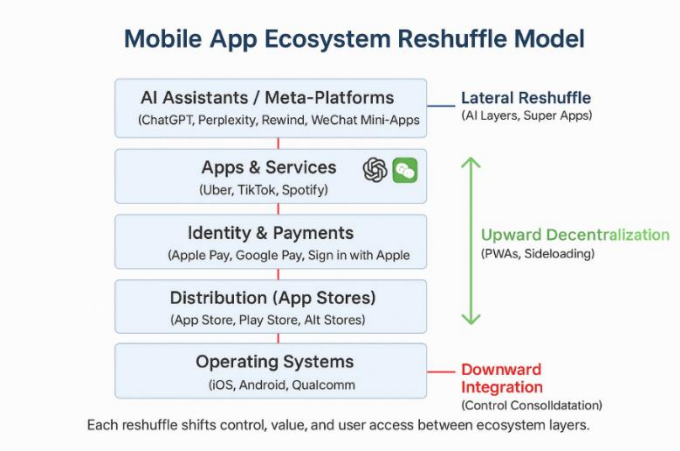


Figure 3. Reshuffle Mobile App Ecosystem Model[14]

The economic consequence operates at two levels simultaneously. At the citizen and organization level, every dollar currently paid to a cloud provider for compute, storage, identity management, and API access bundles two costs together: the cost of the actual service, and the cost of the hyperscaler's own internal scaling infrastructure — the redundancy layers, the global distribution, the management overhead required to operate at planetary scale and sell that scale back to customers at a margin. Web 7.0 Pando eliminates the second cost entirely. A TDA running on a citizen's home server or personal device pays no platform fee, no per-seat license, no identity management subscription.

At the industry level, the implications are more profound. The global hyperscale data center buildout — hundreds of billions of dollars of capital investment, refreshed on 3-to-5-year cycles, consuming an ever-growing share of the world's electricity supply — exists to sell centralized compute back to a world that, under the cloud model, has no alternative. Web 7.0 Pando provides the alternative. As TDAs spread across the 10 billion personal smart devices already in citizens' hands, the aggregate demand for hyperscale cloud infrastructure contracts. The capital investment cycle — build bigger, refresh sooner, and pass the cost to customers — breaks. This is the same structural disruption that cloud inflicted on the corporate data center in the 2010s, now directed at the hyperscalers themselves.

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[14] *Reshuffle model applied to the (decentralized) mobile app ecosystem*. Michael Herman. https://hyperonomy.com/2025/10/10/reshuffle-model-applied-to-the-mobile-app-ecosystem/. 2025.

Globally, there are approximately 10 billion personal smart devices in the market:

- 1-3 billion personal computers with 200-300 million new computers being purchased annually
- More than 7 billion smartphones and tablets with more than 1 billion new devices bought annually.

Estimated past, present, and future global smartphone shipments are illustrated below.

This is not a marginal saving. For organizations that have moved significant workloads to cloud, infrastructure and licensing fees represent the largest and fastest-growing component of IT expenditure. The Web 7.0 Pando model replaces this recurring extraction with sovereign infrastructure: infrastructure that compounds in value as the network grows, rather than recurring as an operating cost that grows with usage.

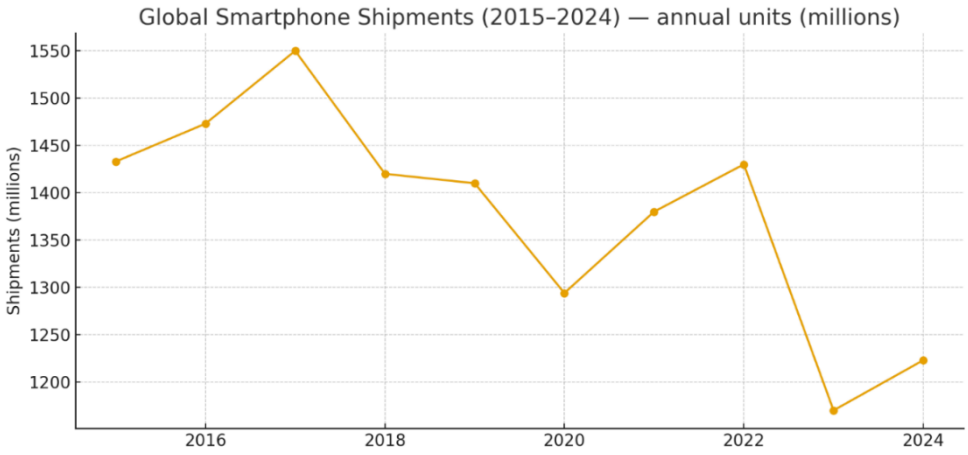

Figure 4.Global Smartphone Shipments (2014-2024)

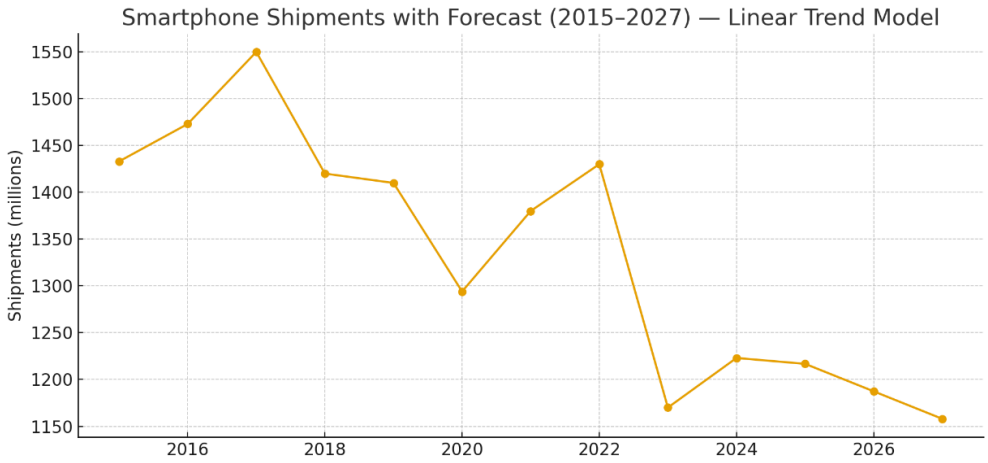

Figure 5. Global Smartphone Shipments: Present and Forecast (2015-2027)

3.2 Decentralized Network Society Economics

The overall cost trajectory of cloud computing is determined not just by the price of individual services, but by a structural reality: every new user, every new application, and every new data flow adds to the

organization's recurring costs. Cloud is a consumption model. Costs and usage grow together, and the platform captures value from every transaction.

Web 7.0 Pando operates on the opposite principle. When a new citizen joins a Society and activates a TDA, the marginal infrastructure cost to the network is effectively zero — the citizen's own device provides the compute. What grows is not the cost, but the economic surface area of the network: the number of agents that can transact, the number of credentials that can be verified, the number of workflows that can be automated across organizational boundaries without a central intermediary taking a margin.

This is the economics of a decentralized network society. Business value accrues to participants, not to platforms. The Web 7.0 Foundation governs the Shared Reserve Currency (SRC) supply without extracting a transaction fee. Societies govern their own citizen registries without paying per-seat licenses. Citizens hold their identities as cryptographic key pairs, not as rented accounts on a platform they do not control. The network becomes more valuable as it spreads — which costs almost nothing, because the infrastructure is already in citizens' hands.

The practical financial consequence for a mid-sized organization is illustrated in the five-year TCO comparison presented in Section 4. The assumptions are conservative and modifiable; the structural direction is not.

3.3 Zero-Integration Economics

The sovereign infrastructure and network society economics described above address the cost of running and participating in digital infrastructure. There is a third, equally significant source of economic advantage that can only be fully realized when an organization commits to a decentralized architecture end to end: the elimination of the integration tax.

Today, between 40 and 65 percent of enterprise IT budgets are consumed not by building new capabilities, but by connecting existing ones. API gateways, identity and access management platforms, middleware stacks, ETL pipelines, and the armies of integration engineers who maintain them — these are the hidden infrastructure of the cloud era. Every time two organizations need to exchange data or coordinate a workflow, they negotiate APIs, manage credentials, build adapters, and then maintain all of it indefinitely. This integration tax compounds over time: the more complex the application portfolio, the higher the maintenance burden, and the less budget remains for innovation.

Eliminated integration labor. In traditional enterprise architecture, each connection between systems requires custom development and ongoing maintenance. As organizations grow and acquire new systems, the integration surface area expands combinatorially — not linearly. A portfolio of 50 applications may require hundreds of point-to-point integrations, each with its own credential management, error handling, and versioning. In Web 7.0 Pando™, TDAs communicate natively over DIDComm V2 using a shared, open protocol. The connection cost between any pair of TDAs is effectively zero — no custom adapter, no API negotiation, no credential brokering required.

Protocol-native identity and trust. In the cloud era, identity is a platform service — a cost center managed by IAM vendors, OAuth providers, and directory services. In Web 7.0 Pando™, identity is architectural: every TDA holds a cryptographic DID, every message is authenticated by construction, and every credential is a W3C Verifiable Credential that any counterparty can verify without calling home to a central authority. The IAM cost center is not reduced — it is eliminated. Trust is not a service you subscribe to; it is a property of the protocol.

The combined economic impact of these two effects is significant and grows over time. In the cloud era, integration costs compound as systems proliferate. In the Web 7.0 Pando™ era, the opposite is true: as more participants adopt the protocol, interoperability becomes richer and the value of each TDA increases — without any additional integration investment. This is the decentralization equivalent of the network effect, applied to enterprise economics rather than consumer adoption.

4. 5-YEAR TCO ECONOMIC MODEL: CLOUD vs. WEB 7.0 PANDO

5-Year TCO Economic Model: Cloud vs. Web 7.0 Pando

1. Cost Structure Shift

Category	Cloud Computing	Web 7.0 Pando	Impact
Compute & Storage	Recurring consumption fees	Distributed/edge + shared agent networks	↓ Operating costs
Licensing & SaaS	Per-seat subscriptions	Agents operate autonomously, no per-user billing	↓ Software licensing costs
Identity & IAM	Centralized identity systems	DID + verifiable credentials infrastructure	↓ IAM costs & lock-in
Integration & Middleware	APIs, gateways, ETL pipelines	DIDComm interoperable messaging	↓ Integration cost (50–90%)

2. Value Creation Shift

Dimension	Cloud	Web 7.0 Pando
Automation	Internal processes only	Cross-organization, cross-system autonomous workflows
Data Economics	Platforms capture value	Data owners negotiate, license, and restrict usage
Intelligence	SaaS-bound AI	Self-sovereign agents gain new skills (LOBEs)
Scalability	Costs scale with usage	Costs scale with agent population, not compute load

3. Productivity & Efficiency Gains

- Autonomous negotiation, orchestration, and monitoring
- Reduced interoperability friction
- Persistent digital agents replacing repetitive labor

Estimated labor efficiency uplift: 3× to 20× depending on industry maturity.

4. System Lifespan & Adaptability

- Agents evolve through modular capability additions rather than rewrites or migrations.
- System lifespan increases from **3–7 years** → **15–30 years**, similar to public infrastructure.

Net Expected Outcome

Web 7.0 Pando transitions digital infrastructure from a recurring cost model into a value-generating autonomous economy.

Five-Year TCO Economic Model: Comparison

Assumptions: (All values are conservative):

- Mid-enterprise: 1,000 employees
- 50 key workflows automated
- Moderate AI usage
- Global operations

Cloud Year-by-Year Total Cost of Ownership (USD, in Millions)

Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total
Cloud: Infrastructure + Usage	2.8	3.1	3.5	4.0	4.6	**18.0**
Cloud: Licensing (SaaS + API)	1.2	1.3	1.4	1.6	1.8	**7.3**
Cloud: Integration + Middleware	2.4	1.6	1.4	1.4	1.4	**8.2**
Cloud: Identity & Compliance	0.8	0.9	1.0	1.2	1.3	**5.2**
Cloud: Labor for Operation & Automation	3.0	2.8	2.5	2.3	2.1	**12.7**

Total Cloud TCO (5 years): ≈ $51.4M

Web 7.0 Pando Year-by-Year Total Cost of Ownership (USD, in Millions)

Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total
Web 7.0 Pando Infrastructure (Hybrid + Edge)	2.5	2.2	2.0	2.0	2.0	**10.7**
DID & Credential Network Governance	0.6	0.4	0.4	0.4	0.4	**2.2**
Capability Expansion (LOBEs)	1.0	0.8	0.7	0.7	0.7	**3.9**
Automation & Autonomy Benefits *(negative cost — savings)*	-2.2	-3.8	-5.6	-7.0	-8.1	**-26.7**
Operations & Maintenance	1.6	1.5	1.5	1.4	1.4	**7.4**

Total Web 7.0 Pando TCO (5 years): ≈ $-2.5M (net positive)

Interpretation

1. Cloud computing remains a recurring extraction model: costs grow as use grows.
2. Web 7.0 Pando shifts to a sovereign compounding economics model:
    - Automation savings grow each year,
    - Interoperability eliminates integration waste,
    - Identity sovereignty reduces compliance and IAM burden.

Net 5-Year Economic Delta

Model	5-Year Outcome
Cloud	–$51.4M net cost
Web 7.0 Pando	+$2.5M net value generated

Total economic swing: ≈ $53.9M improvement.

4.1 Overall Impact

The combination of sovereign infrastructure savings, decentralized network society economics, and zero-integration economics leads to a powerful and compounding improvement in the total cost of digital infrastructure. The five-year TCO comparison detailed above models the long-term behavior of costs across both the cloud and Web 7.0 Pando™ trajectories, showing a total economic swing of approximately $53.9M for a mid-sized enterprise over five years.

The economic benefits of decentralization described above will have a significant impact on the overall IT budget. From customer data, we know the approximate breakdown between infrastructure costs, costs of supporting and maintaining existing applications, and new application development costs. Web 7.0 Pando addresses all three of these areas. Sovereign infrastructure savings reduce the infrastructure portion, which today comprises over half of IT spending. The elimination of per-tenant application management costs — through protocol-native interoperability replacing bespoke integrations — addresses the existing application

maintenance portion, which accounts for roughly a third of spending. And by freeing budget previously consumed by integration overhead and platform fees, decentralization creates room for new application development, which today accounts for barely a tenth of IT spending despite being the primary source of competitive differentiation.[15]

4.2 Harnessing Decentralization Economics

Capturing the benefits described above is not a straightforward task. Just as engineers had to fundamentally rethink design in the early days of the car, so too will developers and IT leaders have to rethink the design of applications and systems. Sovereign identity, DIDComm-native communication, and protocol-driven interoperability require a different architectural mindset than the platform-centric, API-driven approach that cloud computing normalized. If the transition is not done thoughtfully, organizations risk rebuilding cloud-style dependencies inside a decentralized wrapper — capturing none of the economic benefits previously described. The best approach to harnessing decentralization economics differs for legacy packaged applications versus new custom applications.

Legacy packaged applications. Moving a legacy application to a decentralized architecture without rethinking its design captures only a fraction of the available savings. Applications that were designed for a centralized, request-response model will not natively benefit from DIDComm-native communication or protocol-native identity until they are re-architected. For these applications, the most pragmatic path is to expose their outputs through TDA LOBEs — treating the legacy system as a capability source while the sovereign infrastructure layer handles identity, communication, and trust.

New and custom applications. New applications built natively on the TDA LOBE architecture capture the full economic benefits from day one. Identity is sovereign by default. Communication is DIDComm V2 by default. Integration with any other TDA in the network requires no custom adapter. The developer focuses on application logic; the platform handles protocol, identity, and trust. This is the decentralization equivalent of building cloud-native rather than lifting and shifting — and the economic difference compounds significantly over the application lifecycle.

5. IMPLICATIONS

The economics we described in Sections 3 and 4 will have a profound impact on IT. The direction is clear: decentralization delivers compounding economic advantages that no incremental improvement to the cloud model can match. But economics alone do not determine the speed of a transition. Real obstacles exist today, and IT leaders need to understand both what those obstacles are and why — following the same pattern seen in every prior platform transition — they will diminish over time.

5.1 Possibilities & Obstacles

Many IT leaders today are faced with the problem that 80 percent of the budget is spent keeping the lights on — maintaining existing services, renewing licenses, and managing integrations — with few resources left for innovation. Decentralization changes this calculus structurally. Sovereign infrastructure savings eliminate the recurring extraction model. Zero-integration economics return the middleware budget to productive use.

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[15] New application development costs include only the cost of designing and writing the application, excluding the cost of hosting on new infrastructure.

Decentralized network society economics make the value of the platform grow with participation rather than with spend. However, realizing these benefits requires navigating four significant obstacles that exist today.

The cold start problem. Decentralized network society economics only works once the network has participants. A single TDA operating in isolation captures only the sovereign infrastructure savings — it cannot realize zero-integration economics or network value growth until counterparties exist to communicate with. This is the same cold start challenge that faced every network platform before it reached critical mass: the telephone was useless until enough people had one; email was niche until enough organizations adopted it. The mitigation is the Epoch strategy: Epoch 0 establishes the reference implementation and proves out the architecture; Epoch 1 opens peer-to-peer transfers and makes the LOBE marketplace commercially viable; Epoch 2 achieves the scale at which network economics become self-reinforcing. The cold start problem is real, but it is a sequencing challenge, not a structural one.

Developer mindset shift. DIDComm-native, identity-first development is genuinely different from the API-first, platform-centric approach that cloud computing normalized over the past fifteen years. Developers who have spent their careers building OAuth integrations, REST APIs, and cloud-hosted microservices will need to internalize a different architectural logic — one in which identity precedes participation, trust is a property of the protocol rather than a service to subscribe to, and communication is message-driven rather than request-response. Just as client/server developers initially struggled to think in cloud-native terms, there will be a transition period during which the new paradigm feels unfamiliar. The LOBE architecture directly addresses this: LOBE developers implement PowerShell cmdlet pipelines and are insulated from the underlying protocol mechanics and cryptographic infrastructure entirely. The TDA handles the protocol; the developer handles the logic. This is the same division of labor that made Visual Basic accessible to a generation of developers who never needed to understand the Windows message pump.

Regulatory and compliance uncertainty. Sovereign identity is architecturally ahead of most legal and regulatory frameworks. Many compliance regimes were written assuming a central authority — a certificate authority, an identity provider, a regulated financial institution — sits between transacting parties. Web 7.0 Pando removes that intermediary by design. In the short term, this creates friction: legal teams ask which authority is responsible, auditors ask which system of record to examine, regulators ask which authority applies. These are legitimate questions. But they are the same questions that were asked about e-signatures in the early days of the Internet, about cloud data residency in the early days of Azure and AWS, and about digital payments before regulatory frameworks caught up with reality. In each case, the underlying economics were so compelling that compliance frameworks adapted rather than blocked adoption. The cryptographic auditability of Web 7.0 Pando — every significant state change appended to an RFC 6962 Merkle audit log, GDPR erasure provable by cryptographic proof — provides regulators with more verifiable evidence than most centralized systems can offer. Compliance frameworks will follow the economics.

Enterprise inertia. Large organizations have made substantial investments in cloud infrastructure, SaaS contracts, and the integration layers that connect them. These are not sunk costs in the accounting sense — they are ongoing commitments with contractual terms, organizational dependencies, and institutional knowledge built around them. The transition to decentralization will not happen overnight, and it should not. Just as some mainframe applications were never migrated to client/server because the economics did not justify it, some existing cloud workloads will remain on cloud indefinitely. The right approach is portfolio segmentation: identify the workloads where decentralization economics are immediately compelling — new agent-native applications, cross-organizational workflows, identity-sensitive processes — and begin there. Let the economic evidence accumulate. As it does, the calculus on legacy workloads will shift.

5.2 The Long View: Decentralization Over Time

As we pointed out in the introduction, it is dangerous to make decisions during the early stages of disruption without a clear vision of the end state. The four obstacles described above are real today. But each of them follows the same pattern seen in every prior platform transition: they are transitional, not permanent.

The cold start problem resolves as adoption spreads — and the economic incentive to join a growing network is self-reinforcing. The developer mindset shift accelerates as tooling matures, as the LOBE marketplace provides ready-made capability, and as a generation of developers builds their first TDA and discovers that sovereign identity requires less ceremony, not more. Regulatory uncertainty resolves as compliance frameworks adapt to cryptographic auditability — a process already underway in digital identity legislation in the EU, Canada, and emerging markets. Enterprise inertia dissolves as the cost gap between cloud and decentralization widens: when the five-year TCO swing reaches $50M for a mid-sized enterprise, the conversation about legacy contracts changes character entirely.

The economic advantage of decentralization does not diminish as these barriers fall — it compounds. Each new participant reduces the cold start problem for the next. Each new LOBE reduces the development effort required. Each regulatory clarification opens new workload categories. Each enterprise migration demonstrated reduces the perceived risk for the next organization considering the transition.

This is the same virtuous cycle that drove cloud adoption from 2008 to 2020, now operating in favor of decentralization. The difference is that cloud's economic advantage was primarily a cost argument — cheaper infrastructure at scale. Decentralization's economic advantage is structural: it eliminates entire cost categories that cloud not only preserves but depends on for its business model. That is a more durable economic position.

6. THE JOURNEY

Because we are in the early days of the Second Reformation, there is much confusion about the direction of this ongoing transformation. In this report, we looked beyond the current technology and focused on the underlying economics of decentralization to define the destination – where all of this disruption and innovation is leading our industry.

Based on our analysis, we see a long-term shift to decentralization driven by three important economic advantages:

1. **Sovereign infrastructure savings** — citizens and organizations run TDAs on devices they already own, eliminating the hyperscaler extraction model at both the individual and industry level;
2. **Decentralized network society economics** — participation grows value without growing infrastructure cost; and
3. **Zero-integration economics** — DIDComm-native communication eliminates the integration tax that consumes 40–65 percent of enterprise IT budgets today.

Together, these three economic advantages offer a compounding improvement that no incremental cloud optimization can match.

For businesses of all sizes, decentralization represents tremendous opportunity. It represents an opportunity to break out of the longstanding tradition of IT professionals spending 80 percent of their time and budget "keeping the lights on," with few resources left to focus on innovation. Web 7.0 Pando will enable IT groups

to focus more on innovation while leaving non-differentiating activities to sovereign, protocol-native infrastructure. Web 7.0 Pando will enable IT leaders to offer new solutions that were previously seen as either cost prohibitive or too difficult to implement. This is especially true of the TDA LOBE architecture, which significantly reduces the time and complexity of building new agent-native applications that take full advantage of decentralization economics.

A future like this does not materialize overnight. IT leaders need to develop a new 5- to 10-year vision of the future, recognizing that they and their organizations will play a fundamentally new role in their company. They need to plot a path that connects where they are today to that future. An important first step in this is to segment their portfolio of existing applications . For some apps, the economic and agility benefits may be very strong so they should be migrated quickly. However, barriers do exist today, and while we outlined in section 5 that many of them will be overcome over time, decentralization may not be ready for some apps today. For tightly integrated apps with fairly stable usage patterns, it may not make sense to move them at all, similar to how some mainframe apps were never migrated to client/server. While new custom apps don‘t have the legacy problem, designing them in a scalable, robust fashion is not always an easy task. TDA-native development, using the LOBE architecture and DIDComm protocol, can dramatically simplify this task.

This transition is a delicate balancing act. If the IT organization moves too quickly in areas where decentralization is not ready, it can compromise business continuity, security, and compliance. If it moves too slowly, it can put the company at a significant competitive disadvantage versus competitors who do take full advantage of decentralized capabilities, giving up a cost, agility, or value advantage. Moving too slowly also increases the risk that separate groups or individuals within the company will each adopt their own fragmented point solutions outside IT governance (“rogue IT”), wresting control over IT from the CIO. IT leaders who stay ahead of the decentralization trend will be able to control and shape this transition; those who lag behind will increasingly lose control.

To lead the transition, IT leaders need to think about the long term architecture of their IT. Some see a new role emerging, that of a Decentralized Systems Architect, who determines which applications and services move to decentralization and exactly when such a move takes place based on a business case and a detailed understanding of decentralized system capabilities available. This should start by taking inventory of the organization‘s resources and policies. This includes an application and data classification exercise to determine which policy or performance requirements (such as confidential or top secret data retention requirements) apply to which applications and data. Based on this, IT leaders can determine which workloads are candidates for immediate migration to sovereign infrastructure, which benefit from a phased transition, and which remain on existing platforms indefinitely. Beginning in this manner takes advantage of the full economic opportunity of decentralization while managing business continuity, security, and compliance at each step.

To accomplish this, IT leaders need a partner who is passionately committed to the long-term vision of decentralization and its opportunities, one who is not hanging on to legacy IT architectures. At the same time, this partner needs to be firmly rooted in the realities of today‘s IT so it understands current challenges and how to best navigate the journey to decentralization. IT leaders need a partner who is neither incentivized to push for change faster than is responsible nor to keep IT the same. Customers need a partner who has done the work of figuring out how best to marry legacy IT with decentralization, rather than placing that burden on the customer by ignoring the complexities of this transformation.

At the Web 7.0 Foundation, we are “all in” on decentralization. Web 7.0 brings decentralization to the richest partner community in the world. We have 100s of partners in more than 200 countries servicing businesses. We are already collaborating with thousands of our partners on the transition to decentralization. Together, we are building the most secure, reliable, scalable, available, decentralized platform, network, and ecosystem on the planet.

The Web 7.0 Foundation is building on three decades of open standards work in decentralized identity, verifiable credentials, and secure communication protocols. The architecture of Web 7.0 Pando is grounded in this accumulated expertise — and in the conviction that the next generation of digital infrastructure should be owned by the people and organizations that depend on it, not rented from intermediaries whose business model requires their dependence.

Now, we have a vision of bringing the power of decentralized computing to every home, every office, and every mobile device. The powerful economics of decentralization drive all of us towards this vision. Join Web 7.0 and our partners on the journey to bring this vision to life.

7. DECENTRALIZATION and WEB 7.0 PANDO

Web 7.0 is a unified software and hardware ecosystem for building resilient, trusted, decentralized systems using decentralized identifiers, DIDComm agents, and verifiable credentials. Web 7.0 Pando is a modular, biologically-inspired agent platform — designed to grow and adapt like a living system — for coordinating and executing complex systems of work that are: Secure, Trusted, Open, and Resilient.[16]

Benefits

What follows is a breakdown of what the Web 7.0 Pando offers — and why these benefits matter for organizations building next-generation systems. The economic benefits of decentralization are discussed in the next section.

Key Benefits of Decentralization

1. Decentralized Trusted Identity and Communication
    - The system uses Decentralized Identifiers (DIDs) as persistent, self-controlled identifiers.
    - Messaging is handled over DIDComm protocols – enabling secure, peer-to-peer agent interactions without depending on central servers.
    - Benefit: Agents (or systems) can communicate, prove identity/trust, exchange credentials, all under a model of “trust that doesn’t rely on one central gatekeeper.”
2. Modular, Evolving Agent Architecture
    - The architecture introduces “LOBEs” (Loadable Object Brain Extensions) that allow agents to add new capabilities over time.
    - Horizontal unbundling and rebundling of coordination/execution modules allow flexible deployment: you might have many lightweight micro-agents or a more consolidated agent depending on context.
    - Benefit: Systems built on this can evolve incrementally, adapt to new tasks, scale up or down, rather than being rigid monoliths.

[16] Michael Herman, Trusted Digital Web Project, Hyperonomy Digital Identity Lab, Web 7.0 Foundation. January 2023. https://hyperonomy.com/2025/10/14/web-7-0-agentic-os-agent-architecture-reference-model-aarm/

3. Resilience, Openness & Trustworthiness
    - The platform emphasizes “secure, trusted, open, resilient” systems.
    - Because identity, communication and credentialing are decentralized, the design reduces single points of failure or control.
    - Benefit: Better continuity, less vendor lock-in, more robust to disruptions. Good for distributed enterprises, ecosystems, or IoT/edge scenarios.
4. Fine-grained Control of Personas, Agents, and Trust Relationships
    - The architecture includes models where an individual or system can have multiple digital personas, each with its own agent identity.
    - There is a model of “Beneficiary / Trustee / fiduciary duty” relationships among agents — meaning trust relationships can be explicitly modelled.
    - Benefit: Organizations can model complex interaction flows, delegation, and agent-based automation with clarity about authority, identity, trust. Useful for autonomous systems, regulated industries, etc.
5. Interoperability & Workflow Enablement
    - By building on standard identity/credential stacks (DIDs, Verifiable Credentials) and agent-to-agent messaging, the platform aims to support cross-domain workflows (e.g., agents representing different organizations interacting).
    - For example, agents can exchange credentials, negotiate, and coordinate tasks. The architecture hints at this.
    - Benefit: Enables ecosystem-scale automation, where different actors (companies, devices, services) can plug in with fewer integration hurdles.

When & Where This Is Particularly Valuable

Considerations for Adopters

- The concept is quite architectural and aspirational: while the article presents a reference model for the Web 7.0 Pando, implementing it in the wild will require tooling, governance, and standards maturity.
- Interoperability still depends on standards adoption: DIDs, VCs, DIDComm are emerging/ evolving standards.
- Complexity: The modular, agent-based architecture adds an extra layer of design/management overhead compared to simpler monolithic systems. You will want to ensure your team is equipped for that.
- Trust still needs governance: Even with decentralized identity, trust does not appear magically — credential issuers, agents, behaviors still need oversight, policy, audit. (See related academic work on agentic identity frameworks).

Summary

In short, adopting a decentralized platform like Web 7.0 Pando provides you with a *diversified architecture* for building agent-based systems that are decentralized, identity-centric, modular and future-proof. It supports scenarios where many autonomous agents need to interoperate, trust each other, and evolve — rather than being locked into centralized monolithic infrastructures.

APPENDIX A. ECONOMIC BENEFITS of WEB 7.0 PANDO vs. CLOUD COMPUTING

Here is a clear breakdown of the economic benefits of Web 7.0 Pando compared to traditional cloud-centric computing models.

Economic Benefits of Web 7.0 Pando vs. Cloud Computing

Dimension	Traditional Cloud Model	Web 7.0 Pando	Economic Result
Infrastructure Costs	Centralized compute, storage, access fees billed per use.	Distributed compute across edge devices and shared agent networks with selective cloud use.	↓ Lower infrastructure costs (sometimes 40–80% reduction depending on workload type).
Vendor Lock-In	Switching providers is costly and risky. APIs proprietary.	Open standards (DIDs, VC, DIDComm, decentralized identity & messaging).	↓ Reduced switching costs and ↑ competitive choice.
Automation Efficiency	Cloud AI services automate within siloed apps, not across organizations.	Autonomous multi-agent systems automate workflows that cross org boundaries.	↑ Massive labor efficiency and ↓ integration costs.
Data Ownership & Monetization	Cloud providers extract data value (hidden externality).	Data remains sovereign with parties; agents can negotiate usage rights and contracts.	↑ New revenue streams + reduced data brokerage loss.
Interoperability Costs	Custom integrations and API management (expensive to maintain).	Agents interoperate using decentralized trust and shared communication models.	↓ Integration and maintenance costs by 50–90% over lifecycle.
Scalability Economics	Scaling means scaling cloud compute spend proportionally.	Scaling increases agent population—not necessarily compute cost (edge and peer compute offsets).	↑ Non-linear scaling efficiency (hyper-scaling without hyper-spend).
Security & Compliance Spend	Centralized systems = high breach surface + high compliance burden.	Identity-native, cryptographically authorized communication and credential exchange.	↓ Security, audit, identity, and compliance costs (20–60% reduction).
Lifecycle Longevity	Cloud software is tied to product cycles and may require rewrites.	Agents evolve via modular capability extensions (LOBEs), not rewrites.	↑ Long-term asset retention + lower refactor costs.

Summary of Economic Advantages

1. Cost Decentralization

Instead of making recurring payments to a centralized compute company, compute becomes a shared, federated cost across edge, peer nodes, and sovereign infrastructures.

Result: Operating expenditure shifts from recurring cloud bills to amortized distributed compute.

2. Autonomous Value Generation

Agents act as economic actors — negotiating prices, executing contracts, and arbitrage options.

Result: Systems that generate economic value continuously, not just execute instructions.

3. Reduced Middleware + Integration Tax

Today, ~40–65% of IT budget in large organizations goes to:

- Integration
- API gateways
- IAM systems
- Maintenance of brittle workflows

Web 7.0 Pando replaces these with identity-native interoperability.

Result: Lower TCO and lower integration compound costs over decades.

4. Better Alignment Between Data Value and Cost

Cloud economics today: You pay for storage and compute for your data; platforms extract disproportionate value from it.

Web 7.0 Pando flips this: Data owners retain rights and can negotiate access, monetize insights, or control use dynamically.

Result: Data becomes an asset class instead of overhead.

5. Market Liquidity and Network Effects

As more agents, identities, and capabilities exist, markets form:

- Autonomous procurement
- Autonomous labor markets
- Autonomous service negotiation
- Machine-to-machine commerce

Result: Economic activity grows without proportional human coordination cost.

The Macro-Economic Shift

Cloud computing is a cost center; Web 7.0 Pando turns digital infrastructure into a self-optimizing value-generating economy.

APPENDIX B – CENTRALIZATION, DECENTRALIZATION, HYPER-CENTRALIZATION, AND CIRCULAR HYPER-CENTRALIZATION

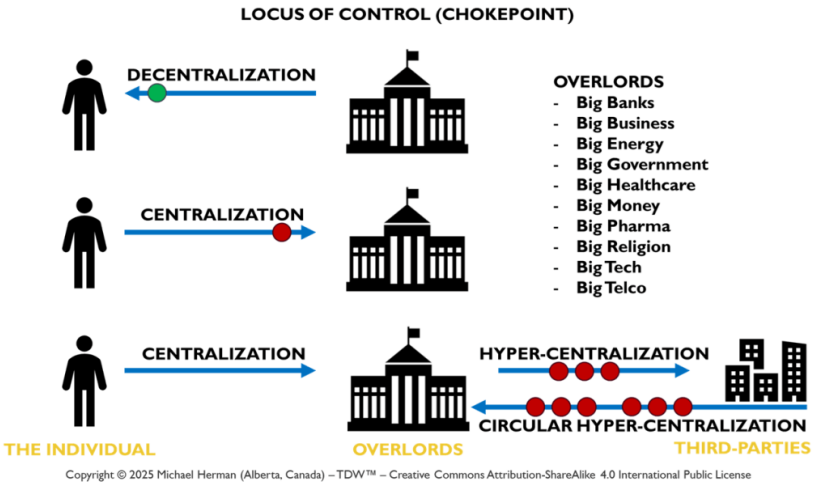

Figure B-1. Centralization, Decentralization, Hyper-Centralization, and Circular Hyper-Centralization

Decentralization

Decentralization refers to the *shift from centralized control* of identity, data, compute, and decision-making toward a distributed ecosystem where trust emerges from cryptographic proofs, verifiable credentials, and autonomous agents—not institutions. Instead of relying on a single platform or cloud to authenticate users, store data, run applications, or mediate transactions, decentralization enables individuals, organizations, and intelligent agents to interact through open protocols, self-sovereign identities, shared governance, and value-aligned automation. This creates a more resilient, equitable, and interoperable digital environment where trust is built into the architecture, users retain control over their digital existence, and intelligent agents operate collaboratively rather than being owned or constrained by proprietary platforms.[17]

Hyper-Centralization

- **Banks** that aggregate customer data, then sell/lease it to 3rd parties without compensating customers
- **Energy** companies that trade energy products but neither produce, distribute, nor consume any of the products they trade in: electricity, nuclear, coal, gas, oil, …
- **Governments** that outsource to IDPs

Circular Hyper-Centralization

- **Healthcare** providers and insurers who jointly pool and mine their patient data
- **Big Tech** companies that invest in each other – taking equity positions and payments in a circular loop
- **Telco**, **Big Tech**, and **Governments** that prevent individuals from having a personal presence (static address) on the Internet

NOTE: Circular Hyper-Centralization is the worst possible/deadly societal configuration.

[17] *Decentralization*. Michael Herman. November 2025. https://hyperonomy.com/2025/11/24/decentralization/