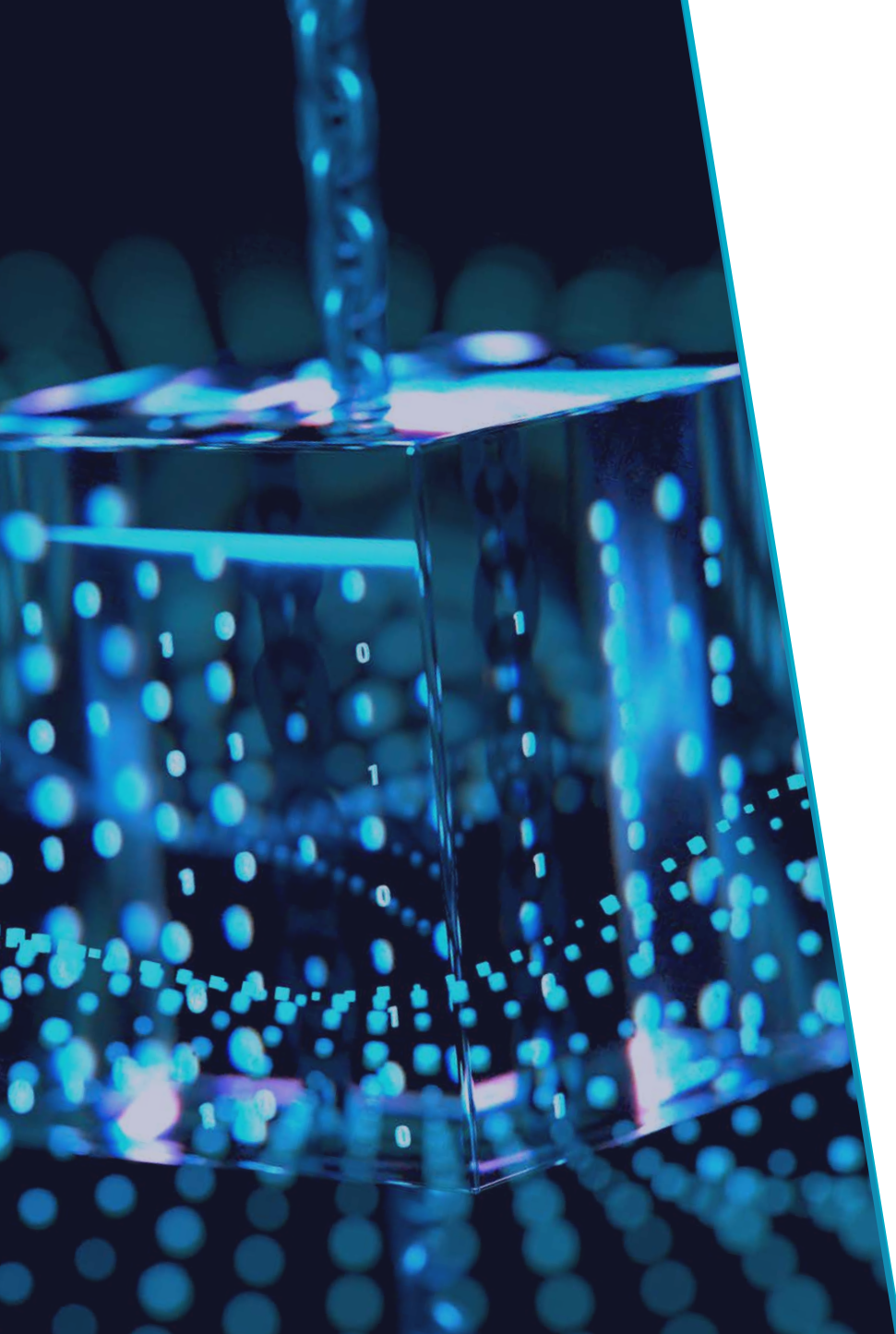


WHITE PAPER

# RETAILING AT SCALE

Achieving scalable airline dynamic offers using blockchain

atpco



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## INTRODUCTION

# BLOCKCHAIN PRICING INFRASTRUCTURE

Our focus is exploring a new type of infrastructure and process—  
**using blockchain**  
—to solve the industry's offer scalability challenge.

This paper focuses on the foundational elements to implement an industry-wide, scalable, dynamic pricing infrastructure using blockchain technology.

The need for a new infrastructure originates from two realities that we, as an industry, must face:

- Current airline offer and pricing management methods cannot scale to the level required for industry-wide dynamic retailing. The current pricing and distribution model is a complex orchestration of pre-defined pricing points based on complex fare data coupled with real-time inventory numbers. This process has served well and has evolved for decades—including through these early days of NDC. However, the exponential volumes of data, heavy up-front processing, and pressure on existing networks make further scaling virtually impossible.
- Any new methodology for scalable, dynamic offers must be able to co-exist with traditional systems for an extended transition period. Knife-edge cutover transitions are a non-starter for an industry so large, established, and vital worldwide.

ATPCO is exploring multiple paths forward to meet these challenges. One of them is the creation of a new, industry-wide distributed computation platform for dynamic offers using blockchain technology. The Next Generation Distribution Network (NGDN) introduces a second layer to augment, not disrupt, traditional pricing processes. We believe this is a possible path forward for scalable, dynamic offers for the benefit of everyone in the distribution value chain.

It should be noted that we are not proposing or prescribing a specific methodology for dynamic pricing. Our focus is exploring a new type of infrastructure and process—using blockchain—to solve the industry's offer scalability challenge.

This paper aims to open an industry dialog on this topic. We seek feedback from industry stakeholders to help determine whether this topic advances for further consideration, such as in the ATPCO Dynamic Offers Design Team.

## SECTION 1

# Executive Summary

Although early in the journey, airline retailing is gaining speed, traction, and investment. Dynamic and customized offers are a priority for most airlines striving to maximize revenue and compete for traveler loyalty.

**At ATPCO, we believe 80 percent of offers sold in the market will be dynamic by 2026.** But to achieve this level of scale, changes are needed to existing pricing and offer infrastructure.

Present-day airline pricing relies on an extensive orchestration of fares, rules, availability, and heavy process computation. This system has been an industry backbone for decades and is embedded in the worldwide distribution value chain. But the industry faces a problem: today's pricing processes cannot possibly scale to support the coming wave of dynamic offers. So now what?

As an industry, how can we maintain needed support for traditional pricing methods and simultaneously shift to a world where 80 percent or more of the offers sold are dynamic? ATPCO believes the answer to this question is vital to the success of airline retailing. One intriguing possibility—the Next Generation Distribution Network (NGDN)—is the subject of this paper.

NGDN is a proposed industry-wide computation platform that augments traditional pricing processes to enable dynamic offers at scale. Based on blockchain technology, the NGDN would price dynamic offers at scale without disrupting existing systems. This is achieved by moving the “heavy lifting” demanded of today's traditional pricing systems to a new, robust, blockchain network.

Blockchain is a transformative technology recognized in many industries for improving efficiency, reducing costs, and increasing transparency. These and other attributes suggest that blockchain is exceptionally well-suited for the requirements of airline distribution.

In this proposed NGDN scenario, traditional airline pricing processes would continue. Airlines would still file fare and rules data; availability would still be queried; airline shopping systems would still calculate base fares using familiar ingredients.

However, with the NGDN approach, the volume of data and the amount of processing (that is, the “heavy lifting”) by existing systems would be substantially reduced. This is because the adjusted price calculation would be executed in the blockchain, where airlines would have coded rules for dynamic pricing (DP) following new industry standards.

Each node on the blockchain network would contain the logic required to execute price calculations locally, in real-time, without cache or network delays. Prices computed by NGDN would be received directly by channels and tech providers, who would use them to generate targeted offers to travelers. Airlines would receive real-time market feedback from NGDN, providing robust data for offer optimization. Challenges of high search volumes and extreme look-to-book ratios would be solved because responses are provided locally without drowning the airline in search requests. In the truest sense, NGDN would offer benefits to all participants in the distribution supply chain.

At its core, NGDN must be a flexible and futureproof solution, designed to adapt as the nature of airline dynamic offers change. In the years ahead, artificial intelligence and machine learning will mature and transform how dynamic pricing happens. We will witness the eventual phasing out of today's traditional processes. If built properly, NGDN will adapt, improve, and continue as a cornerstone for dynamic offers at scale.

ATPCO's objective with this paper is to begin an industry dialogue to discuss, debate, and refine this approach. We invite all industry stakeholders to join in the conversation.

SECTION 2

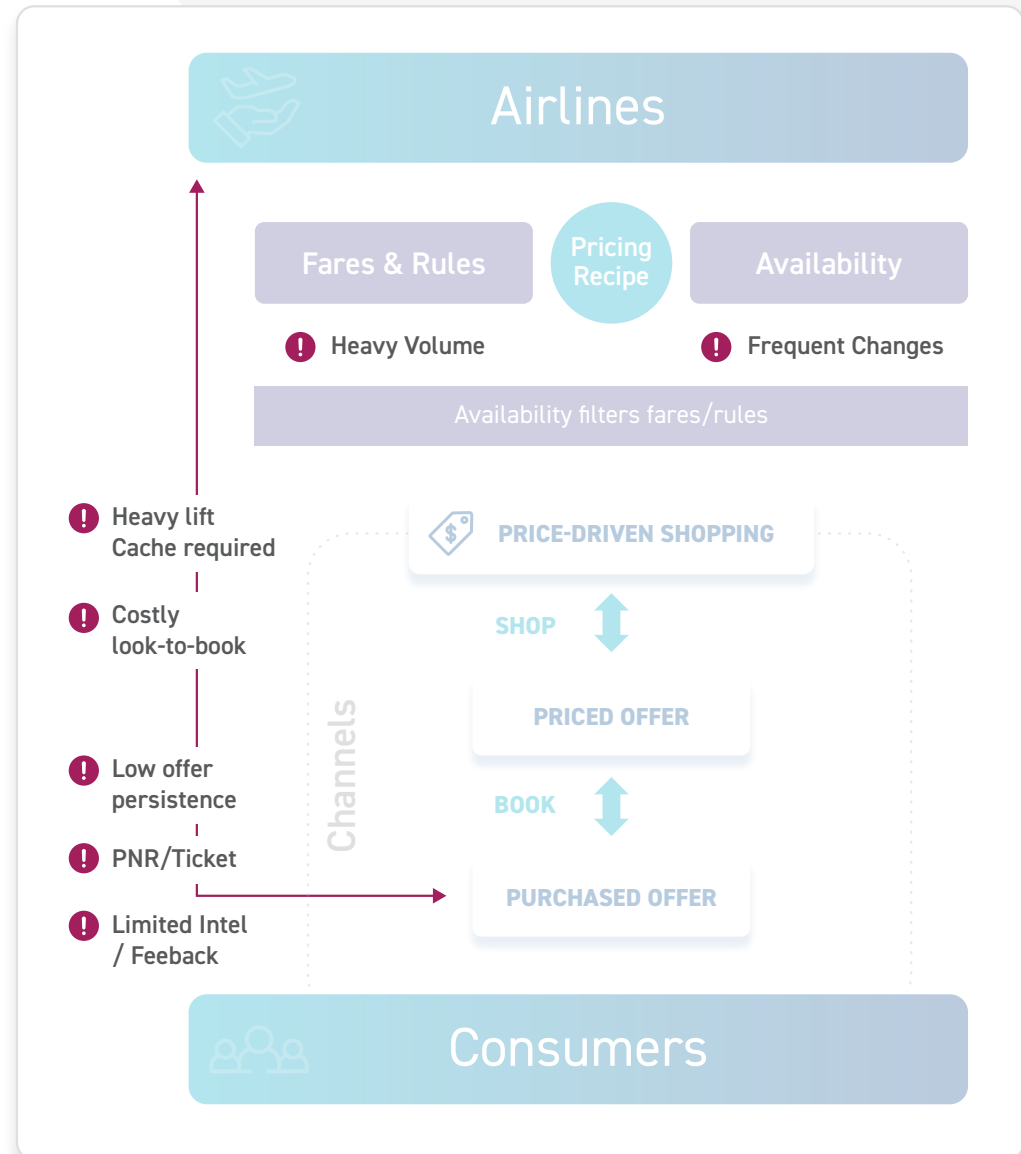
# THE OFFER SCALABILITY CHALLENGE

## THE OFFER SCALABILITY CHALLENGE

Although recent decades have witnessed multiple technology advancements in airline distribution, the industry's core shopping and pricing processes have remained unchanged:

- Airlines apply proprietary algorithms to availability and revenue management data to obtain bid prices and cabin counts aligned with a finite number of reservation booking designators (RBDs). Although dual RBD capabilities make it possible to surpass the standard set of 26 characters, there is still a cap on the maximum number of booking classes.
- Vast numbers of fares and rules are filed and maintained—per market—to accommodate every conceivable flight shopping scenario.
- The set of “pricing ingredients” is processed by either an intermediary (traditional GDS model) or by the airline itself (NDC model and direct channel) to calculate a price, using a heavy process of computation and filtering on availability (referred to in this paper as “price-driven shopping”).
- The system is characterized by frequent data transfers (sometimes hourly), extreme network traffic, transaction-heavy shopping engines, slower-than-desired response times, and a large amount of technical debt.

### Traditional Distribution Network



This well-maintained orchestration of fares, rules, and availability is foundational to today's industry. It is not going away anytime soon. However, there is no way that today's process on its own can effectively support the airline industry's next retailing horizon of dynamic offers at scale. It is simply too heavy—particularly when it comes to cost, efficiency, and capacity for innovation:

- Extreme amounts of data, computation, and filtering are required before, and as a prerequisite for, focusing on what exact product the shopper desires (that is, price-driven shopping). This drives up traffic volumes and infrastructure costs for airlines.
- The need to constantly filter by availability inevitably leads to cache, which drives inaccuracies, high look-to-book ratios, and low offer persistence.
- Existing processes limit access to offer uptake and conversion data, making it impossible for airlines to intelligently automate offer optimization across channels.

## SUCCESS CRITERIA FOR MEETING THE CHALLENGE

To effectively scale retailing and dynamic offers, a new infrastructure with these abilities is required:

- Enable real-time, accurate shopping/pricing of all flavors of dynamic airline offers (fares, bundles, à la carte) for both public and private distribution
- Be relatively easy to adopt by the value chain in terms of technology integration, human capital, and distributed/shared costs
- Co-exist with existing pricing systems for years, making it possible for change to happen without disrupting today's industry flow
- Reflect shared, trusted governance across the industry in much the same fashion as has existed for decades via ATPCO for traditional pricing and fares
- Quickly adapt to innovation and change as artificial intelligence, machine learning, and ONE Order reach maturation

In the next section, we introduce the concept of a Next Generation Distribution Network (NGDN) that would achieve the above objectives using blockchain technology.

SECTION 3

# **NON-DISRUPTIVE SOLUTION: NEXT GENERATION DISTRIBUTION NETWORK**



## OVERVIEW

The Next Generation Distribution Network (NGDN) is a proposed new layer that augments the existing distribution model to enable cost-effective, accurate, real-time pricing of dynamic offers without disrupting existing processes.

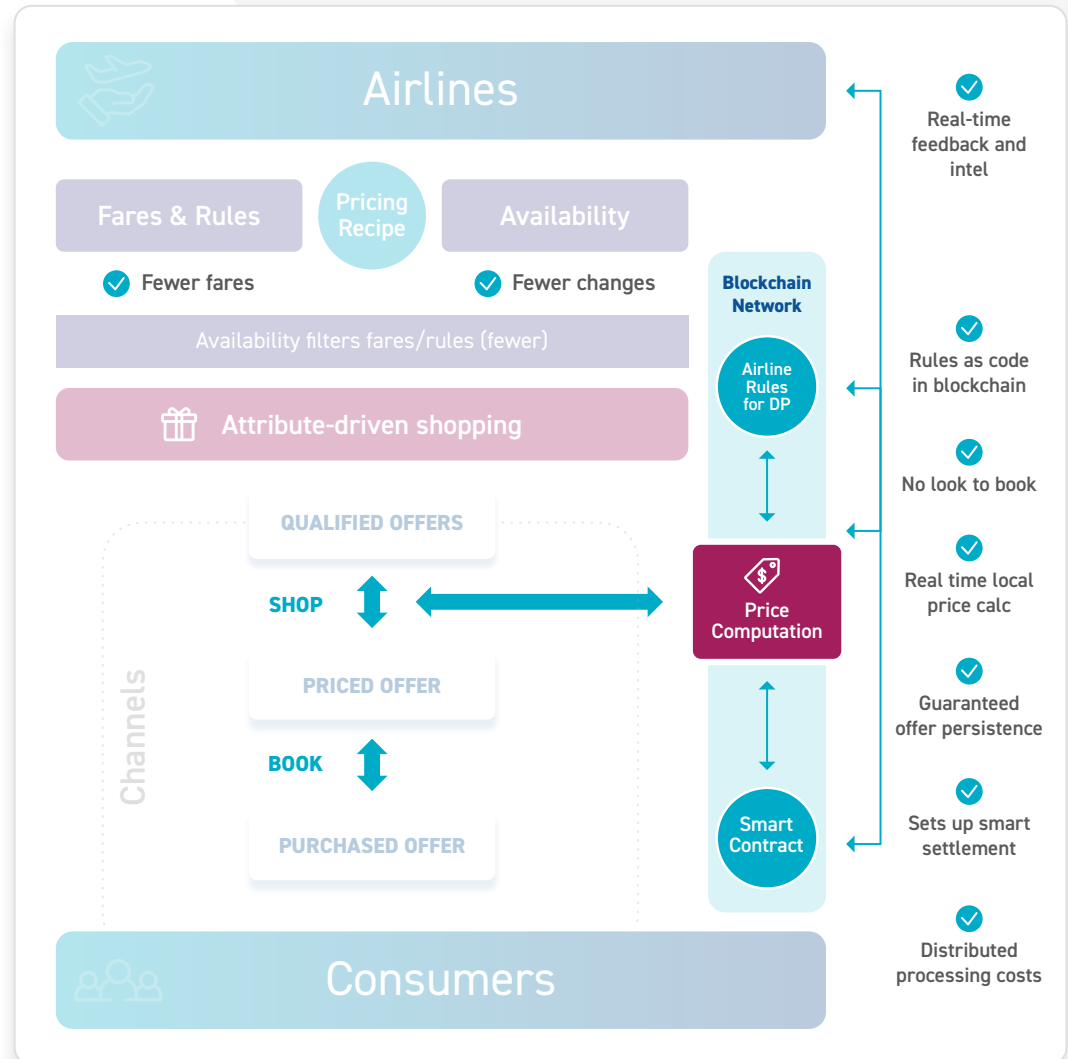
Based on blockchain technology, this new layer bypasses the heavy lifting of traditional pricing. It replaces it with a distributed computational platform that delivers real-time dynamic price calculation locally for all participants in the blockchain network. Airlines retain complete control over their pricing logic and rules, which exist as signed code inside the blockchain.

The existence of two complementary layers (traditional and blockchain) in the NGDN makes it possible to simultaneously reduce “heaviness” in the traditional system and introduce new capabilities that provide the performance, scalability, and robustness required for retailing at scale.

The NGDN attempts to separate Product Definition (attribute-driven shopping) and Price Computation.



## Network Generation Distribution Network



## Traditional processes would continue, with a focus on Product Definition

Airlines would continue to maintain and file fare and rules data as they do today, including proprietary revenue management algorithms, bid prices, and inventory control. Availability would still be queried to identify where spaces are available on a plane. However, the NGDN world requires fewer traditional fares, rules, and availability changes (open/closing of classes) as price levers. This is because rules and conditions associated with price adjustments will now be handled in the blockchain network.

Airline shopping systems would continue to generate base fares using the mechanisms in play today. However, instead of attempting to filter and compute every possible price (“heavy-lifting”), shopping systems will focus on generating qualified offers that align with what the shopper is seeking (that is, attribute-based shopping and fares associated with product definition). In this regard, the NGDN aligns with the Product Catalogue concept already in the advanced research phase by ATPCO in collaboration with the industry.

Qualified offers (base fares) generated by the traditional process would be either

- Sent to the blockchain network for price adjustment (dynamic offers)
- Carried forward for pricing and booking in the traditional fashion (static offers)

## dynamic pricing rules and computation

Airlines would enter rules for dynamic pricing (DP) into the blockchain network

- Unlike current fare and rules filings, DP rule information would be distributed as signed code, following new industry standards to be defined collaboratively by the industry as part of this project.
- DP rules would include conditions for price adjustment (such as discounts, surcharges, seasonality, and markets) and more robust dynamic pricing logic.
- As retailing matures, the data, inputs, and standards for DP rules would evolve quickly. Rapid development and speedy implementation will be crucial for the success of the NGDN model.

The blockchain network would execute price computation by applying DP rules

- The blockchain logic would apply the DP rules to the input received from the traditional process (that is, fare-based qualified offers created by a shopping system and sent to the blockchain network)

Price computation would be executed locally, in real-time, by local nodes

- Each node of the blockchain network can calculate dynamic pricing using the airline-defined and coded rules, or “secret recipe.” Each node would be an API endpoint. This

is how local, real-time pricing would occur and how network delays would be wholly eliminated with the NGDN solution.

- Airlines could allow all nodes or only targeted nodes to see data, thus facilitating private distribution (also known as private fares) within the NGDN environment.
- Price computation would be the same on all nodes that have access to a particular DP rule. DP rules would play the role of a contract between the airline and the channel. Prices calculated on a channel node could be validated by the airline.
- Because the solution would operate in real time, accuracy is guaranteed, eliminating problems of offer persistence.

## Airlines would receive real-time feedback for offer optimization

The distributed blockchain network supports a feedback loop to provide airlines with real-time business intelligence and offer/pricing data from across the marketplace.

Unlike NDC or other channel-specific solutions, the NGDN blockchain can provide market insights across all airlines, reducing or eliminating the need for channel-specific market intelligence tools.



## Why blockchain?

**Blockchain is a class of technology solutions that is particularly well-suited to the needs of airline distribution and the industry. Built on distributed ledger technology, blockchain provides immediate, shared, and fully transparent information accessible only by permissioned network members.**

Blockchain records are immutable (non-changeable), and members share a single view of the truth. Each transaction is recorded only once, eliminating the duplication of data that so often leads to redundancy, extra expense, and inconsistencies. If a record includes an error, a new transaction must be added to correct the error, and both transactions are then visible to all who have access.

For a growing number of industries, blockchain is an optimal way to create a robust, autonomous, distributed, and trusted network that lacks a central authority or any single point of failure. **For the airline industry, blockchain offers the opportunity to build an entire distributed computational platform with the same or even greater degree of trust in fair, equitable governance.**

## ADVANTAGES

### Faster access to data without network delays

Each node is an API endpoint with local access to the data, thereby eliminating network delays as a concern. Each node on the network contains all the required logic to execute price computation.

Distribution is so often presented as flow—from the airlines to channels/consumers—but this model enables a faster, more accurate analogy of a round table where everything is calculated and exchanged in real time. Not only would channels have quicker and more accurate offers, but airlines would also receive faster and more accurate, real-time feedback.

### Private distribution capability

Each user is identifiable in the unified environment, so airlines could determine which users (nodes) can see which data. In this way, each airline could differentiate its pricing strategy by channel or individual account.

### Local control for shared costs, flexible priorities, and scalability

Computation on local nodes takes place on local hardware—meaning each network participant decides how many nodes to install and how much computing resource to provision. This is a fair and shared distribution of resources and cost, and we believe it to be the best solution to scalability.

Local control also enables each network member to focus on its highest priorities. For example, airlines may concentrate efforts on optimizing pricing logic instead of handling incoming traffic, now the “problem” of the channels. In contrast, channels may prioritize building infrastructure to process extreme volumes of requests in real time for optimal accuracy, without cache, and ultimately with lower look-to-book ratios.

### Faster innovation and deployment of changes

Dynamic pricing is still nascent in this industry. Whatever methods are employed now will most certainly change and mature over time. Blockchain's capability to quickly adapt and deploy new standard data structures and programming logic offers a tremendous advantage over today's milestone-based solution rollouts.

### High performance without cache

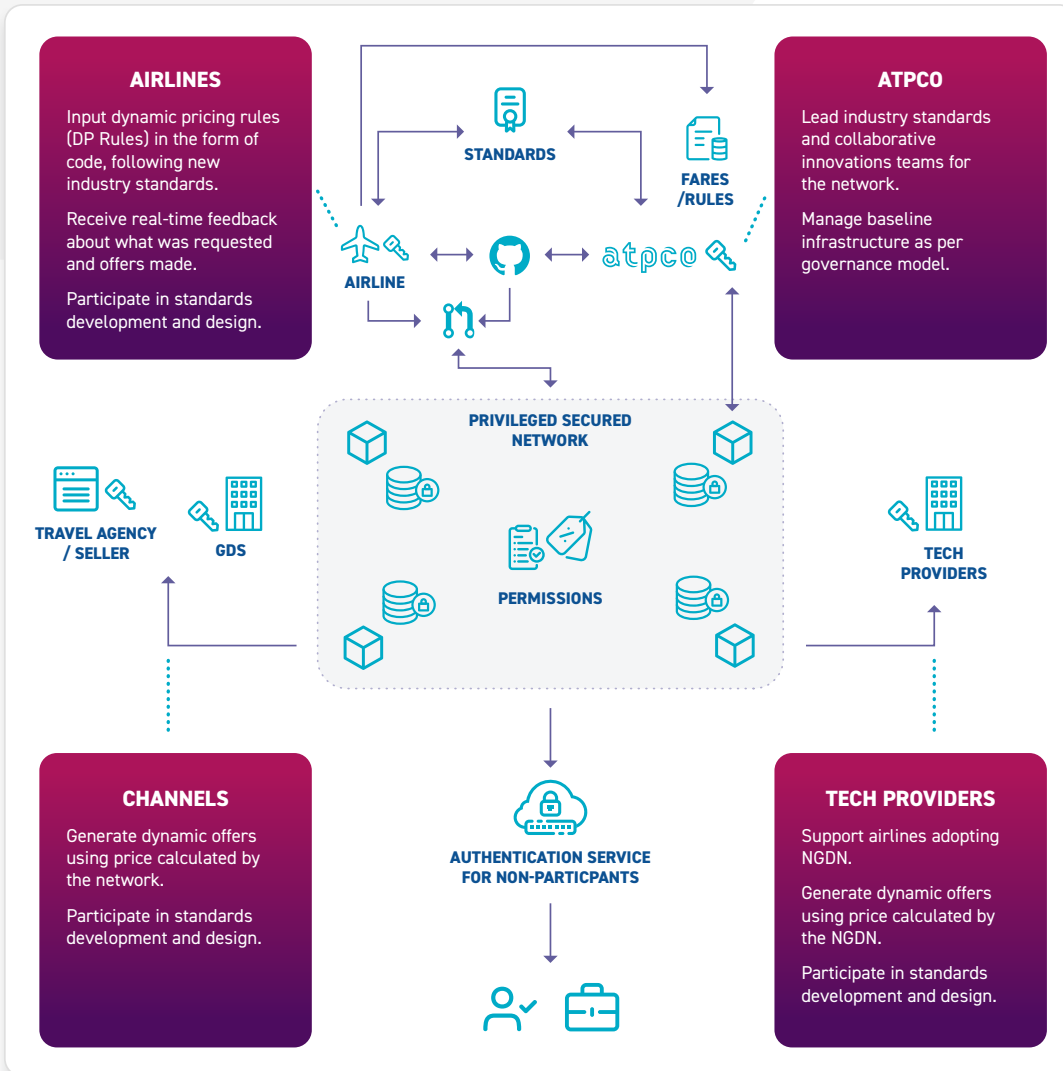
Enabling local access for real-time data eliminates the need for cache, including the “smart cache using machine learning” concept. This is because all cache solutions are costly to maintain. Knowing the fast pace of change coming to dynamic pricing makes it illogical to invest in any cache solution when a strong, more easily maintained alternative is available.

### Potential to solve NDC or dynamically priced interlining

In the existing system, dynamic pricing of two or more airlines on an interline itinerary is practically impossible. However, dynamically priced interline could be supported using the blockchain network. The data coded into the blockchain would be purely pricing-oriented, enabling other interline rules to remain with pre-defined fares.



## Distributed Blockchain Network - Dynamic Offers



## NETWORK PARTICIPANTS

The introduction of NGDN would involve multiple players in airline distribution, including airlines, channels, and tech providers. The diagram to left provides initial thoughts on how each entity would engage with NGDN. Each player in the value chain would have defined access to the network, with security and access to the data corresponding to their role and agreed-upon access.

The global, interdependent nature of the distribution supply chain makes it especially important that all players be involved in the design and development of NGDN.

## GOVERNANCE

As an industry-wide solution, the proposed Next Generation Distribution Network (NGDN) requires careful, transparent governance in which all industry players, including competitors, place their trust.

Considering the established blockchain governance strategies (public, private, and consortium), we recommend a consortium model for NGDN.

- Consortium blockchains are permissioned blockchains governed by a group of organizations.
- Consortium blockchains benefit from high levels of decentralization and security.
- The consortium model offers many benefits of private blockchains (such as efficiency and transaction privacy) but does not consolidate power with only one party.

The consortium operating model requires establishing a governance board responsible for data standards, issuing access keys to participants, software development, and operations support.

Through this paper, ATPCO is seeking industry input on the overall concept of the NGDN. If the project moves forward, ATPCO will volunteer to organize the initial project and assemble a board of industry players and contributors. At the mature stage, we see ATPCO's role as a standards conductor and technology provider.

## UNDERLYING TECHNOLOGY

There are multiple blockchain technologies on the market; however, some existing platforms could impose significant limitations. On the other hand, building brand-new technology does not make sense. Therefore, we propose using a highly customizable modular framework for platform development:

- Substrate technology (<https://substrate.io/>) is a Software Development Kit (SDK) specifically designed to provide all the fundamental components a blockchain requires so developers can focus on crafting the logic that makes the chain unique and innovative.
- We propose a shared multi-chain network for interoperability, security, and governance.

There is a general concern about blockchain and its performance and resource requirements because each node must keep the entire transaction history. With modern implementations, however, such concerns are no longer valid. Of course, one must keep a complete history, but each node is not required to have this responsibility. There will be two flavors of nodes:

- Lightweight nodes keep only a tiny fraction of the chain history. We expect these nodes to be the preferred flavor for channels and most airlines.
- Archive nodes keep the entire history of transactions. These nodes are needed by the companies forming the backbone of the network.

## SPECIFIC REQUIREMENTS FOR DYNAMIC PRICING

Building a distribution platform for dynamic pricing adds two specific requirements to blockchain technology.

### Allow forkless upgrades

Each node of a blockchain network has a software core that contains the logic controlling the interaction with the chain. In the case of NGDN, this core would include functionality for executing dynamic pricing calculations, that is, for matching the on-chain distributed data to fare-based “qualified offers” received from traditional shopping systems.

Putting this logic in the runtime means that upgrading nodes often will be required and essential for making the solution feasible. Historically, updating a blockchain network in this way is a notoriously difficult task because, until recently, it required a “hard fork.” Fortunately, the last generation of blockchain technologies allows for forkless upgrades without downtime. Using the forkless approach, the blockchain’s consensus mechanisms and cryptographic guarantees validated updates to the runtime state. Network participants can use the blockchain to distribute updated or extended runtime logic without forking the chain or releasing a new blockchain client.

### Support multiple chains

Because of the complexities and high transaction volumes of the airline industry, we recommend parallel chains to distribute data.



## INDUSTRY-WIDE BENEFITS (WHAT'S IN IT FOR ME?)

The shift to dynamic offers is an industry-wide change, impacting and benefiting all distribution supply chain participants, including travelers. The Next Generation Distribution Network (NGDN) is no different. If executed well, NGDN benefits all.

### Airlines

- Faster execution of retailing strategy and propagation of dynamic offers
- Control of proprietary pricing strategies with simplified tactical rule distribution
- Focus on offer innovation instead of scaling IT infrastructure and network
- Reduced investment in fare filing
- Less noise and traffic in availability streams, with less reliance on RBD and inventory data as a price-control lever
- Solution for handling high search volume and extreme look-to-book
- Incorporation of real-time market feedback for offer optimization
- Solutions for interlining that take advantage of the distributed network for pricing

### Channels

- Faster and simplified access to new airline dynamic content
- Higher offer persistence (accuracy) and improved response time
- Lower look-to-book
- Higher customer satisfaction due to custom-offers

### Tech and shopping system providers

- Increased ability to focus on the overall shopping experience, including attribute-based shopping
- Reduced "data bloat"
- Reduced processing burden and elimination of the need for cache
- Higher offer persistence (accuracy) and improved response time

### Benefits to industry-at-large

- Accelerated retailing without disruption to existing systems
- Investment in a system designed to evolve

The shift to dynamic offers is an industry-wide change, impacting and benefiting all distribution supply chain participants, including travelers.

The Next Generation Distribution Network (NGDN) is no different.  
**If executed well, NGDN benefits all.**

## CONCLUSION

# NEXT STEPS

Industry collaboration is an ATPCO pillar, and we invite you and all industry stakeholders to join this conversation about the future of NGDN and how blockchain could support dynamic offers. Contact us to share your feedback, express interest in a follow-up conversation, or become part of the design teams working on solutions like these.



  
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