



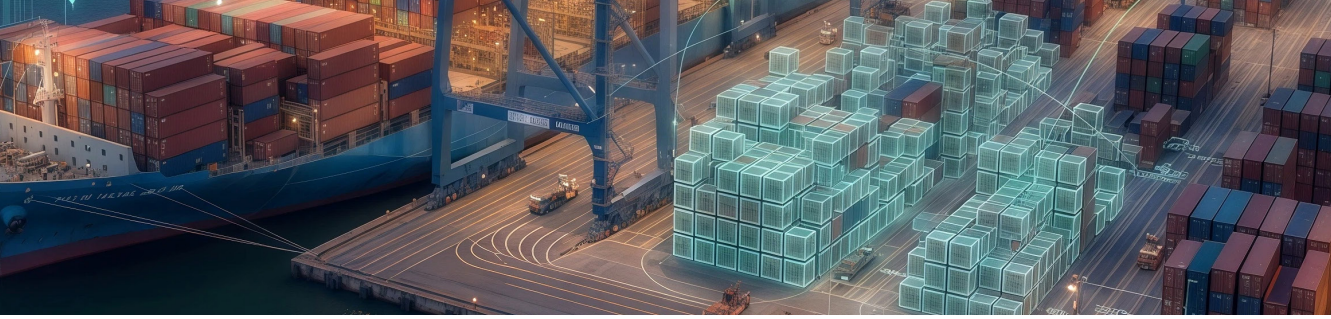
The unbreakable enterprise

Scaling operational resilience
in aviation and logistics

 **thoughtworks**

Design. Engineering. AI.

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When does optimization become fragility?

Aviation and logistics leaders have spent many years and millions of dollars optimizing their operations to maximize capacity and resource utilization. The result is high efficiency and near-seamless handoffs across extremely complex networks of processes and touchpoints.

In many ways, it's a dream come true. With a huge range of data-driven capabilities and techniques at their disposal, digital leaders have significantly reduced 'slack' and eliminated gaps between steps in high-precision processes.

But when we naively optimize for utilization without fortifying our resilience, we create fragility.

The tight coupling between systems and processes that support aviation and logistics operations means that, when one part of the process is disrupted, the resulting ripple effect can cause widespread disruption. One small issue can quickly spiral into something far bigger — and more costly. Our processes looked good for the happy case, but were unprepared for the unhappy case.

Take ground crew operations in commercial aviation, for example. Let's say there's a mechanical issue that delays the delivery of passenger luggage to the aircraft. The ground crew's target loading time slips, and in turn, so does the plane's departure. That causes the flight to miss its target departure time. Once it finally arrives at its destination, its planned gate of arrival is occupied by another aircraft, causing further delays.

Or take a supply chain example. A delay in unloading a container ship at port can cause a missed rail connection inland. That disruption propagates through the network: distribution centers receive inventory late, truck allocations become misaligned and retailers ultimately face stockouts. What begins as a localized delay at the port ripples all the way to the customer.

In both cases, a single upstream disruption triggers a chain of downstream effects. The result is not just delay, but amplification — missed connections, idle assets, increased costs and degraded customer experience. What started as a minor issue can end up costing thousands and cause significant reputational damage.

Operational resilience: Your new competitive differentiator

Disruptive events like that aren't just common; they're everyday occurrences for aviation and logistics organizations. With firms already doing all they can to reduce these events, a new competitive differentiator has emerged in their markets: operational resilience.

Today, the most successful aviation and logistics firms aren't the ones with the fastest, most optimized processes. They're the ones that can respond fastest when disruption happens and prevent its cascading impacts.

Most firms already understand the value of increasing operational resilience. But one huge question remains: How can they make operations more resilient to disruption without sacrificing the optimization and coupling of systems and processes they've worked toward for years?

In this paper, we'll explore how you can achieve that complex trade-off, examine the steps to take to become resilient and optimized, and evolve into an unbreakable enterprise.



The costs and causes of low operational resilience

Low operational resilience isn't just an abstract risk; it carries very significant and tangible costs:



Direct financial costs

Operational disruption costs airlines around \$80 billion every year — representing 8% of their total revenue.¹ Logistics networks face a comparable burden: supply chain disruptions are estimated to cost companies 6–10% of annual revenue², making disruption one of firms' largest cost drivers.



Reputational costs

According to research by CMAC Group³, 46% of UK travelers say an experience of flight delays or cancellations, and the corresponding service received, made them less likely to choose the same airline for future travel. In logistics, a disruption doesn't just annoy a traveler, it can halt a manufacturing line, leading to contractual penalties.



Opportunity cost

Organizations must measure the impact of disruption by accounting for the full cost of recovery, including everything that wasn't achieved while restoring operations to the baseline. Every minute spent tackling disruption and return operations to their average level is a missed opportunity to create value for your business or your customers.



Contract issues

When disruption causes you to miss contracted SLAs, you'll quickly incur penalty clauses on top of the direct financial cost of disruption.

1 The True Cost of Aviation Disruption, CMAC Group, 2024

2 The Business Costs of Supply Chain Disruption, The Economist Intelligence Unit, 2021

3 The True Cost of Aviation Disruption, CMAC Group, 2024

The negative impacts of disruptive events all depend on how quickly and effectively you respond to them. Reducing the size and severity of the ripple effect that follows depends on rapid, informed decision-making across your operations. So, at its heart, operational resilience is **primarily a data issue**.

To make the right decisions at the right time — whether they're automated or made by humans — and respond to disruption appropriately, the right data must be available to the right people and systems.

Three reasons why operational resilience is a data issue

Siloed data hides valuable insights for risk mitigation

Siloed data also leads organizations to miss opportunities that could help them avoid disruption and improve operational resilience.

By joining up data, you can improve integration between the different areas of global operations, enhance your ability to sense disruption and reduce downtime.

Rapid recovery demands high data accessibility and visibility

Aviation and logistics organizations themselves are sprawling 'systems of systems' with numerous domains responsible for different steps of precise processes. When something goes wrong in one of those processes, every domain needs access to relevant data to get things back on track.

Data must be highly integrated and readily available, so everyone can see the full extent of disruption, understand its source, model its projected impact, and identify exactly what they can do to prevent the ripples from spreading further downstream.

Data-driven operational resilience is now practically within reach

Data-driven systems and capabilities have recently reached a tipping point of effectiveness. With the advent of AI and the advances in data management that support it, it's now possible to build organizations that are functionally unbreakable and highly resilient against disruption.

In the past, even the best capabilities weren't fast enough, or didn't empower teams enough to achieve this goal. But today, proactive response and immediate, informed decision-making are within reach. If you close the data gaps between processes and domains, you can unlock previously unimaginable levels of operational resilience and competitive advantage.



Case study: Evolving from paper-based processes to an AI-optimized ecosystem

Increasingly, airlines and logistics operators understand that tackling their underlying data challenges can improve operational optimization and resilience.

When Thoughtworks began working with LATAM Airlines, that's exactly the position the company was in. LATAM recognized the urgent need to develop its aviation maintenance technology and saw that becoming a digital-at-core organization could help ensure the safety, reliability and availability of its fleet for customers worldwide.

To achieve that goal, LATAM launched eMantto — a new initiative designed to transform and accelerate digital maintenance. The eMantto team was focused on closely examining and transforming aircraft maintenance operations, and they quickly identified four key areas for operations optimization:

- Maximizing reliability and availability through aircraft maintenance.
- Optimizing total maintenance costs.
- Adhering to the highest levels of safety.
- Avoiding impact on passenger experiences.

After Thoughtworks was brought in to support eMantto, our first action was creating a Lean Value Tree framework that connected LATAM's four key areas for optimization to specific aircraft maintenance challenges.

Quickly, we built, tested and validated hypotheses for transformation, and began digitizing paper-based processes to help achieve eMantto's goals. Our team's varied skill set combined design and product methodologies with data analysis, as well as AI tools such as Dovetail, to analyze qualitative information and further optimize the maintenance process.

“Evolving a system isn’t something that can happen overnight; the team at Thoughtworks knew exactly how to track our impact so we could adopt an iterative approach, learn as we go and improve our processes in the long term.”

Robert Fischer, Operations IT VP, LATAM

The collaboration between LATAM eMantto and Thoughtworks brought significant financial gains and process optimizations, including:

- \$50 million in savings in the eMantto initiative.
- A 92% adoption rate of new technology by digital maintenance teams.
- A team satisfaction score of 4.7 out of 5 across eMantto operations.

In partnership with Thoughtworks, eMantto’s focus on process optimization has reduced the time to activate new touchpoints by over 50%, lowering costs and enabling more cost-effective discovery and development — so LATAM Airlines can continue its purpose to elevate every trip, always.



But most importantly, our work with eMantto has established a new data-driven foundation for LATAM. The new eMantto toolset will support the entire digital process, from centralized planning of aircraft maintenance through to on-the-ground engineering work.

With all those processes digitized in a coherent and strategic way, LATAM can ensure relevant data is always accessible, even for teams beyond maintenance. Plus, LATAM’s new connected tools and systems have been created with future AI use cases in mind, laying a foundation for the AI-optimized ecosystem of tomorrow.



This is the unbreakable enterprise

By taking a strategic approach to digital operations transformation that begins at the data level, organizations can progress through a five-stage maturity roadmap that optimizes operations — and makes them extremely resilient to disruption:

- 1 Stage 1 — Pre-digital:** Operations are paper-based and siloed, leading to limited data visibility and accessibility and restricting decision-making before, during and after disruption.
- 2 Stage 2 — Digitized:** Integrated digital tools increase visibility of operations and bring new levels of optimization, driven by supporting capabilities such as AI.
- 3 Stage 3 — Connected:** Tools are connected to one another, enabling wide visibility into supply chain and maintenance operations. At this stage, teams beyond the domain responsible for each system and tool can begin using data held within them, making the impacts of emerging disruptions more visible and enabling rapid decision-making.
- 4 Stage 4 — Predictive:** Once all relevant systems and tools are connected, teams can move toward automatic, telemetry-led failure prevention. Alerts flag issues early, and trend detection enables teams to evolve from reactive response to proactive disruption prevention.
- 5 Stage 5 — Resilient:** Using their connected, optimized digital foundations, organizations can implement full AI orchestration and completely autonomous workflows. Issues are detected early, actions are taken automatically, and disruptions can often be prevented, making operations extremely resilient. When disruptions do happen, automated recovery minimizes their impact and prevents issues from rippling outward.

At every stage, organizations take steps to make data more accessible and usable, ensuring it's understandable, of good quality and consumable by the systems that need it. To achieve that, Thoughtworks uses the data mesh architectural paradigm.

In a data mesh, data is structured as a set of ‘products’ built for specific purposes or use cases. Each product is owned and maintained by the domain closest to it — typically the team that hypothesized the use case and developed the product to meet its own needs.

Governance is federated across the data mesh rather than centralized, giving domain teams greater freedom to use their data as they see fit. However, strong guardrails and policy-as-code ensure data remains portable and accessible across the data mesh, and that every domain and product adheres to the same standards.

The result is an ecosystem where domain teams can ensure data is fit for their purposes, while other teams can easily discover and access it too. It breaks down silos and gaps between teams’ data and systems, without removing the precise control over data products that aviation and logistics teams need to optimize processes and operations.

Why data mesh thrives in aviation and logistics environments

Aviation and logistics operators are ‘systems of systems’

Data meshes are most valuable in organizations with a wide range of domains, each with diverse data demands, but that also benefit from access to one another’s data. That’s the case in aviation and logistics, where domains are responsible for their own complex systems, but must be able to work in harmony and function as a ‘system of systems’ to deliver optimal performance and outcomes. In both aviation and logistics, these domains often extend beyond a single organization, spanning airlines, airports and ground handlers, or carriers, warehouses and brokers. Building on the principles of the data mesh, data product-based interfaces can enable independent actors to integrate and share data without relinquishing control over their own systems.

Each domain has specific data demands

One of the key benefits of data mesh is that it gives domain teams greater freedom to experiment with their data and build new data products when needed. Empowered with this level of control, teams can continuously develop new ways to use their data and combine it with products from other domains to enable new efficiencies in complex processes. Data becomes standardized and accessible throughout the enterprise, without any domain having to compromise on its specific technical data demands.

High data accessibility supports governance and compliance

In highly regulated fields like aviation, data discoverability is essential for increasing insight and improving decision-making. It also supports compliance and ensures that when organizations are asked to provide data to a regulatory body, they can do so quickly and easily. By breaking down silos, operations also become more visible and explorable, bringing significant governance benefits.

It provides a robust foundation for AI-driven success

By putting domains in control of the data closest to them and making them responsible for its maintenance, data mesh fosters ecosystems of high-quality, usable and discoverable data. This provides the ideal foundation for AI use cases that will define the future of aviation and logistics operations. Data products can be quickly created to support AI use cases, enabling rapid experimentation and allowing domains to apply AI in practical ways to augment their operations.





How Thoughtworks enables the unbreakable enterprise

As the pioneers of data mesh, and with extensive experience enabling data-driven optimization and transformation in the aviation and logistics industries, Thoughtworks has become adept at helping organizations navigate their journey to high operational resilience.

Here are the cornerstones of our approach.

We start with your aspirations and work backward to devise and design the ideal solutions

Achieving high operational resilience, a complex and multifaceted goal, demands a strategic approach. By starting with a clear view of our clients' desired future states — whether that's an aspirational 'new normal' or resolving a specific challenge — we plan the best possible route to deliver it.

Instead of going in with a specific technology we want to deploy, we shape the transformation strategy around you. This technology-agnostic approach ensures we can deliver the right results for every organization we work with, regardless of its goals, current digital estate, or existing challenges.

We tackle underlying data challenges first, so you can build transformational capabilities on a strong foundation

As the originators of data mesh, Thoughtworks has unmatched experience building federated, domain-driven data architectures that enhance data quality, accessibility, visibility and usability. By constructing these foundations first, we ensure organizations have the means to generate maximum value from their data.

Through that approach, we also set up organizations for long-term, AI-driven success. A robust data foundation that's free of silos helps them pursue new AI use cases with confidence and unlock powerful capabilities that span diverse domains.

We understand that technology alone won't drive transformation at scale

To enable change that spans domains, it isn't enough to deploy the right technology. Operational resilience depends on how well domain teams can work together. If they're aligned around shared goals and speak a common language, they'll be far better equipped to collaboratively combat disruption and downtime.

Thoughtworks spends a lot of time and effort ensuring this cultural transformation takes hold alongside digital and data-level transformation. Our goal is to help every team get the most from their new capabilities and create a culture of continuous learning and improvement. By doing that, we help organizations iteratively reduce downtime and continue bolstering their operational resilience for years to come.

We never compromise on security, governance or compliance

Using innovative technologies in highly regulated industries isn't without its risks. If it isn't well governed, the technology you've deployed to combat disruption can itself become a new and potent disruptive risk to your operations.

To help, we build active guardrails and embed policy-as-code to enforce compliant, responsible use of data and AI, and to ensure data quality and accessibility don't slip over time.

We're transforming software and model development with AI/works™

AI/works™ is Thoughtworks' new standard for building and running industrial-grade systems in the AI era. It creates a new software development lifecycle accelerated by AI. It allows us to:

- Extract raw business logic from legacy systems and accelerate modernization.
- Enrich specifications and develop high-quality software at speed.
- Apply validated code and capabilities in new contexts instead of continuously building everything from scratch.
- The result is a development pipeline that can help you turn AI ideas and use cases into running systems that generate real value incredibly quickly. To learn more about AI/works™, visit <https://www.thoughtworks.com/ai/works/>.



Start scaling operational resilience — without sacrificing optimization

Highly optimized processes and operations are critical to your commercial success. But now, with the right approach to integration and data operations, you can smooth the gaps between operational domains, unite your ‘system of systems’, and act on disruption before it ripples outward.

By breaking down silos and increasing the visibility, accessibility and usability of data across your enterprise, you can enable every team to see the same big picture of your operations at the same time. Consider two parallel scenarios: ground operations in aviation and inbound logistics at a port.

In aviation, a mechanical issue delays baggage loading. As soon as it's detected, scheduling and dispatch teams see it immediately through shared data products exposed via the organization's data mesh. Purpose-built scheduling views which utilize data curated by ground operations managers enable decision-makers to see the impact this will have on departure times if they choose to hold the flight until the mechanical issue is resolved.

In logistics, a delay in unloading a container ship threatens a rail connection inland. That signal is surfaced in real time to rail planners, warehouse operators and transport coordinators. Inventory and transport data products reveal which downstream nodes will be affected — distribution centers expecting stock, truck allocations already planned and retail demand signals at risk.

In both cases, AI-assisted decision support helps teams understand the downstream consequences and evaluate alternatives. In aviation, another flight to the same destination with spare luggage capacity is identified, enabling baggage to be reallocated while the original flight departs on time. In logistics, shipments are dynamically re-routed — containers are reassigned to later rail departures or redirected to alternative distribution centers with available capacity.

By making small, timely adjustments at the point of disruption, decision-makers prevent local issues from becoming system-wide failures. Passengers may wait a little longer for their luggage, and some shipments may arrive

slightly later than planned, but the wider system continues to run smoothly, sparing thousands of other passengers, customers and stakeholders from disruption.

Within an AI-optimized ecosystem built on a data mesh, teams can:

- Spot emerging issues earlier and proactively prevent disruption.
- Make informed response decisions faster to reduce the ripple effect following a disruptive event.
- Continuously identify opportunities to improve operations and processes that span multiple domain teams.
- Innovate with data and build powerful new capabilities and use cases to meet emerging needs.
- Streamline compliance and ensure all teams speak a consistent language and work towards common goals.
- Adopt AI with confidence, and use it to augment decision-making and tightly couple process steps without increasing the risk of cascading operational disruption.

Together, those changes create a truly unbreakable enterprise. Whatever tomorrow brings, your teams will be equipped to respond quickly and effectively. You're free to optimize your processes as tightly as you wish, safe in the knowledge that data and AI can help you identify, respond to and prevent disruption across complex operations.

To learn more about Thoughtworks' data-driven approach to increasing operational resilience, and discover what we could help your organization achieve **[TALK TO US] today.**

Authors



Chris Ford

**Technology Director Retail,
Consumer, Travel and
Transportation Thoughtworks**

Chris is a Technology Director at Thoughtworks, responsible for Aviation, Retail, Consumer, Travel, and Transportation across Europe. He is a veteran with more than a decade as a Thoughtworks consultant and leverages our global expertise to deliver impactful solutions for his clients.



Robert Drotar

**Domain Specialist, Principal
Consultant–Travel,
Transportation and Hospitality**

With over 25 years of senior leadership experience spanning airport operations, merchandising and fulfillment, product management, and sales strategy, Rob has helped some of the world's leading airlines, cruise lines, hotels, airport retailers, and GDS providers unlock new opportunities through technology-driven transformation.

We are a global technology consultancy that delivers extraordinary impact by blending design, engineering and AI expertise.

For over 30 years, our culture of innovation and technological excellence has helped clients strengthen their enterprise systems, scale with agility and create seamless digital experiences.

We're dedicated to solving our clients' most critical challenges, combining AI and human ingenuity to turn their ambitious ideas into reality.

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