

Operational Resilience in the Cloud: From Reactive to Proactive in the AI Era

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Contents

Operational resilience in the cloud.	3
The evolution of cloud architecture	4
AI and automation: Maximizing engineering value.....	5
Building intelligent operations	6
From technology to business impact	7
Measuring economic impact.....	8
Principles of resilience	10
Building greater resilience with the PagerDuty Operations Cloud	12
The future of operational resilience	13
Conclusion	14

Operational resilience in the cloud

Enterprises face unprecedented complexity in managing digital infrastructure across interconnected cloud architectures. While artificial intelligence (AI) has transformed these systems to process massive volumes of data and scale service delivery, it has also created new vulnerabilities that allow disruptions to ripple across the enterprise. Companies must adapt their resilience strategies to match this new reality.

In PagerDuty's **2025 State of Digital Operations report**, research with over 1,100 operational leaders demonstrated the impact of this transformation: 37% of respondents reported increased operational efficiency from AI implementation, while 36% cited improved customer experiences.¹ Moreover, 53% of CIOs and CTOs expect agentic AI to be core to their digital operations within the next two years.

The financial impact is substantial. Research from Splunk and Oxford Economics shows that **Global 2000 companies lose \$400 billion to system failure each year**, representing 9% of their annual profits.² A separate PagerDuty study of 500 IT leaders found that customer-impacting incidents rose 43% year-over-year, leading to disruptions lasting nearly three hours and losses amounting to \$800,000 on average per incident.³

True resilience extends beyond mitigating disruptions. Enterprises must continuously learn from incidents and improve their prevention capabilities. AI powers this transformation by enabling real-time adaptation and better preparation for future challenges. This proactive approach empowers organizations to do more than simply apply lessons learned from past experiences. Instead, it allows companies to anticipate and evolve in response to emerging threats, turning potential disruptions into opportunities for growth and greater resilience.

¹<https://www.pagerduty.com/assets/2025/state-of-digital-operations-2025.pdf>

²<https://www.pagerduty.com/resources/learn/cost-of-downtime/>

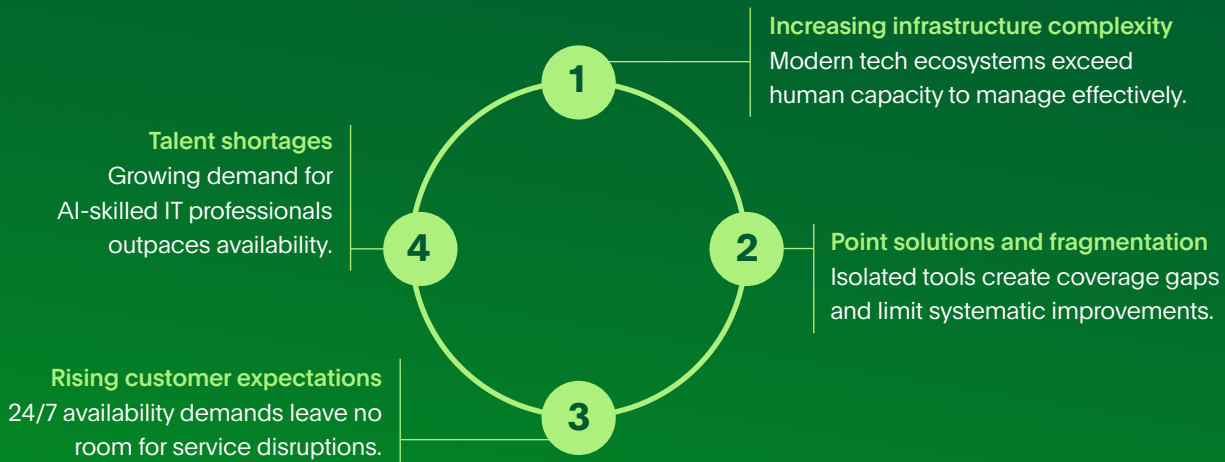
³<https://www.pagerduty.com/resources/learn/cost-of-downtime/>

The evolution of cloud architecture

Cloud resilience has evolved far beyond basic availability and reliability measures. As organizations shift to diverse cloud architectures, operational resilience has become fundamental to business continuity. While distributed operations enable redundancy, several key challenges remain.

- 1 Increasing infrastructure complexity:** Enterprises operate across single-cloud, multi-cloud, and hybrid environments, connecting multiple data warehousing platforms with hundreds of SaaS applications and internal services. The expanding technological ecosystem exceeds human capacity to manage it effectively.
- 2 Point solutions and fragmented responses:** Organizations often deploy isolated tools and reactive measures that address immediate issues but fail to support system-wide resilience. This fragmented approach creates gaps in coverage, introduces risk, and misses opportunities for systemic improvements.
- 3 Rising customer expectations:** Customers, conditioned by the benchmarks set by consumer services like Amazon and Netflix, expect 24/7 “always-on” availability and flawless performance. Any disruption can lead to lost revenue, reputational risk, and diminished shareholder value.
- 4 Talent shortages:** As highlighted in [PagerDuty’s 2025 State of Digital Operations report](#), there is a growing demand for skilled IT professionals who can integrate AI into current infrastructure.⁴

The four core challenges of cloud resilience



New technologies are emerging to address these challenges. AWS’s [Resilience Analysis Framework](#) provides diagnostic tools for failure prevention and mitigation.⁵ The platform’s Amazon Bedrock includes enhanced guardrails and safeguards for secure, accurate AI implementation in high-stakes operations like incident management.⁶

⁴ <https://www.pagerduty.com/state-of-digital-ops/>

⁵ <https://docs.aws.amazon.com/pdfs/prescriptive-guidance/latest/resilience-analysis-framework/resilience-analysis-framework.pdf#mitigating-failures>

⁶ <https://www.youtube.com/watch?v=fEOeP08cQdk>

AI and automation: Maximizing engineering value

Industry leaders are demonstrating how AI and automation can break down organizational silos and create foundations for better decision-making, enhanced product velocity, and improved customer experiences.⁷ Let's look at two examples companies shared at AWS re:Invent:

Sunrun, a leading US-based renewable energy company, showcased the impact of strategic automation. Despite economic headwinds, the company's engineering leadership maintains momentum by leveraging AI and automation across its day-to-day operations. By automating routine tasks like runbook assembly, engineers focus on high-value features and innovative projects that drive sustainable business growth. The company's engineering teams use machine learning (ML) and AI to analyze data continuously, generating time-saving insights that enhance operational and reporting workflows. Its implementation emphasizes human oversight in testing AI systems before deployment to prevent adverse impacts.

Likewise, DXC Technologies demonstrated the power of targeted automation goals. With 3,000 employees, the multinational IT technology and consulting company's engineering organization tracks and incentivizes the reduction of routine maintenance work. This approach enables engineers to minimize the time spent on low-level operational tasks while maintaining security and resilience. The company's unified platform approach brings together data, AI, and automation-focused engineers, creating a seamless operational view across the entire organization.

Shifting left: Proactive operations

At the operational speed of most enterprises, milliseconds can make the difference between delighting customers and losing their trust. Waiting for systems to fail before taking action puts organizations at serious risk of service degradation and customer churn. Modern operations teams can't waste resources on alerts, dashboards, or runbooks that go unnoticed or unused – they need actionable intelligence that drives real-time response.

Growing complexity and scale have rendered traditional incident management practices insufficient.

Organizations must develop systematic approaches to identify and address potential failures before they impact operations.

The concept of "shifting left" originated in data security, where teams move security practices earlier in the software development lifecycle. This principle now extends to cloud operations, transforming reactive firefighting into proactive prevention through system design and automated resolution.

While early adopters like Meta and Google pioneered Site Reliability Engineering (SRE) practices using AI-powered systems for predictive analysis, today's solutions make intelligent resilience accessible across industries. Effective implementation requires aligning tools with operational requirements.

⁷ <https://www.youtube.com/watch?v=Lh0fcYSx0So>



Building intelligent operations

Advanced AI and automation platforms are transforming the ways that companies build operational resilience. These technologies analyze extensive historical incident data and behavior patterns to anticipate issues before user impact, enabling teams to address emerging issues at their earliest stages – often before traditional monitoring systems detect them.

For instance, AI-driven platforms detect subtle patterns in systems metrics that signal potential database overload. These systems can automatically initiate load-balancing measures or provision additional resources to handle increased demand, preventing outages and maintaining consistent service delivery.

AIOps platforms strengthen this proactive approach by combining ML with automated operations. Through intelligent runbooks, these platforms codify best

practices into executable workflows that adapt based on real-time conditions. When potential issues are detected, digital playbooks automatically implement predefined remediation steps – from restarting services to scaling resources – while continuously learning from each incident. This automation reduces response time from minutes or hours to seconds while ensuring consistent execution of proven solutions across complex digital operations.

By automating routine maintenance tasks and streamlining incident management processes, **AI-powered resilience enables teams to focus on strategic initiatives rather than repetitive work.** The shift from reactive to proactive operations fundamentally changes how organizations maintain digital service delivery.



From technology to business impact

Operational resilience isn't just about keeping the lights on or avoiding downtime – it's a critical driver of business success. Organizations that adopt resilience frameworks for cloud operations see tangible benefits, including enhanced customer experiences, cost savings, greater agility, and improved decision-making. These capabilities create distinct competitive advantages in digital markets.

Delivering seamless customer experiences

Customer loyalty often hinges on consistent, high-quality digital experiences. **As a global leader in tourism, TUI manages a vast portfolio** of 400 hotels, 17 cruise ships, 5 airlines, and online travel brands.⁸ Growth through acquisition created a fragmented technology landscape, with separate IT functions operating in silos and relying on manual processes.

To address these challenges, TUI consolidated its IT organization and **rebuilt its customer journey** using AWS cloud infrastructure. Working with PagerDuty, the company modernized its service delivery model by transforming its incident management processes and automated response capabilities.⁹

The transformation delivered measurable results. By implementing AIOps and automated incident resolution, TUI significantly reduced recovery times, often resolving issues before customers noticed any impact. As a result, engineering teams could shift focus from reactive support to innovative product development, leading to improved customer experiences and increased bookings.

⁸ <https://www.tuigroup.com/en-en/about-us/about-tui-group>

⁹ <https://www.pagerduty.com/in-perspective/qa-tui-leadership/>

Measuring economic impact

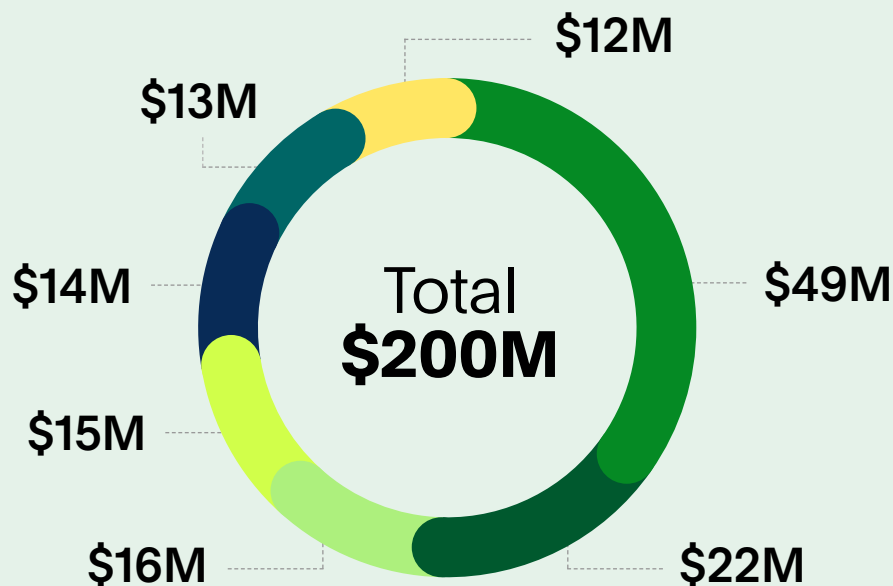
McKinsey research indicates that cloud-based operations will drive significant revenue growth for companies globally.¹⁰ However, these gains depend on adopting resilience principles, including deliberately calibrated service tiers, specific KPIs aligned with organizational goals, and clear implementation roadmaps.

While the upfront investment in advanced operational resilience solutions may seem significant in both time and money, the long-term cost savings can outweigh the initial expenditure. Organizations can realize substantial financial benefits by reducing the frequency and duration of outages, automating routine tasks, and optimizing resource allocation.

Global 2000 companies lose an average of \$200 million annually from downtime, broken down as follows:

- \$49 million in lost revenue
- \$22 million from compliance-related fees
- \$16 million due to missed SLAs
- \$15 million in settlement/legal costs
- \$14 million in brand recovery campaigns
- \$13 million in PR/investor relations
- \$12 million in lost employee productivity

The cost of downtime



¹⁰ <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-new-era-of-resiliency-in-the-cloud>

No company can completely eliminate downtime. By strengthening operational resilience through transformed incident management, organizations can minimize the impact of costly disruptions.

While revenue loss and decreased productivity impacts are readily apparent, other economic benefits are perhaps less obvious. Many enterprises accept missed compliance targets or SLAs as a “cost of doing business.” They assume that to routinely meet these requirements, they would need to hire larger teams and spend more time resolving incidents.

However, **unified operations and AI-enhanced incident management can make compliance and SLA targets more achievable.** When teams shift away from routine support tasks, the resulting cost savings often match or exceed the benefits of increased engineering productivity.

These numbers underscore how operational resilience can impact not just IT efficiency but overall business performance.

Maintaining competitive advantage

Cloud resilience can directly impact market competitiveness. As organizations automate key processes and remove operational barriers, they gain the ability to make data-driven decisions at speed. This operational excellence enables rapid scaling, faster market response, and consistent service delivery.

FOX Corporation demonstrates this competitiveness in action.¹¹ The company leverages automation to reduce operational costs and enhance agility. Through the PagerDuty Operations Cloud platform, **teams orchestrate real-time responses across departments.** This continuous monitoring enables decision-makers to act on consumption spikes and customer feedback immediately, rapidly adjusting performance based on live data.

As part of its technology consulting practices, industry experts at PwC advocate a structured framework for cloud resiliency that emphasizes continuous evaluation, planning, and execution.¹² Their approach focuses on automated disaster recovery across multiple regions, allowing organizations to restore operations within minutes of an outage without manual intervention.

PwC stepped in to help a North American insurance brand bolster its resilience after a costly outage.¹³ An outage with its primary cloud service provider disrupted its entire call center operations. The incident left 4,500 agents unable to provide crucial services to customers for more than 10 hours as the company struggled to coordinate a manual recovery effort. This case illustrates how cloud failures can severely impact both digital and human service channels, directly affecting customer experience and business continuity.

These real-world examples underscore why operational resilience must be viewed as a strategic asset that drives competitive advantage.

¹¹ <https://www.pagerduty.com/in-perspective/qa-fox-leadership/>

¹² <https://www.youtube.com/watch?v=LLhnbo6a5e8>

¹³ <https://www.pwc.com/us/en/technology/alliances/library/aws-enhance-resiliency-through-automated-disaster-recovery.html>

Principles of resilience

While there is no single strategy that will ensure resilience for a given organization, there is no doubt that the solutions straddle people, processes, and technology.

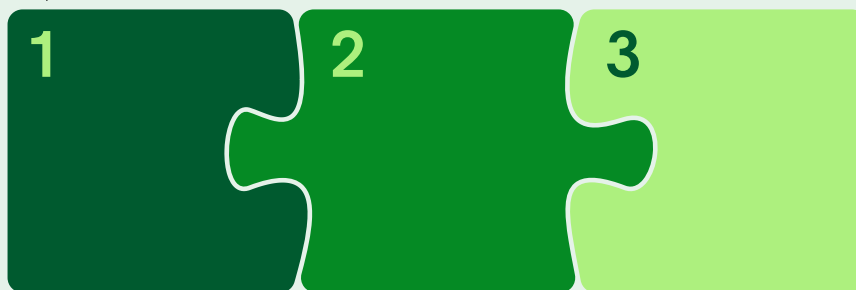
Enterprises face three key challenges in building resilience. First, siloed teams struggle to share critical information, preventing a holistic view of operations. Second, reactive problem-solving leads to repeated mistakes as teams fail to apply past learnings to future incidents. Third, IT teams are overwhelmed by alerts, making it challenging to prioritize and address real threats.

Here is how these principles work together to build resilience.

The pillars of cloud resilience

Unified view

- Creates single source of truth
- Enables cross-team coordination
- Correlates data for faster root cause analysis



Human-AI collaboration

- AI triages and prioritizes alerts
- Automates routine responses
- Maintains human oversight for critical decisions

Continuous learning

- Captures data from incidents
- Identifies patterns through ML analysis
- Drives systematic improvements

Creating a unified view

To address siloed operations, a modern approach to operational resilience requires a platform that can integrate with hundreds of tools across the entire tech stack – from monitoring and customer service solutions to security tools and business applications.

By centralizing data from these disparate sources, organizations can create a single source of truth for their operations. Even with individual teams responsible for specific services, a unified view enables a more effective response to incidents, providing valuable context for coordination and decision-making.

For example, when an e-commerce platform experiences a sudden spike in error rates, an integrated operations platform can correlate this information with recent code deployments, infrastructure changes across all environments, and customer support tickets to quickly identify the root cause and guide remediation efforts.

Human-AI collaboration

To help overwhelmed IT teams prioritize effectively, AI and automation are transforming operational resilience while maintaining the crucial human element. Research shows that **31% of leaders identify a current-state skills gap as a key challenge in driving greater automation**, highlighting why the most effective approaches leverage AI to augment human expertise rather than replace it entirely¹⁴

AI is increasingly integrated into key workflows, from initial alert triage to incident resolution. For instance, AI can automatically categorize and prioritize incoming alerts, ensuring critical issues receive immediate attention. It can also suggest potential remediation steps based on historical data and current system states.

However, the concept of “human in the loop” remains vital for critical decision-making. In complex or novel situations, AI systems can provide recommendations and insights while managing routine tasks and responses. Human judgment is often necessary to make final decisions or handle nuanced scenarios that require contextual understanding or ethical considerations.

This approach allows organizations to leverage the strengths of both AI and human expertise. AI excels at processing vast amounts of data quickly and identifying patterns that might escape human notice, while humans bring creativity, adaptability, and nuanced understanding to the high-level problems they tackle best.

Continuous learning

To break the cycle of reactive problem-solving, a resilient operation depends on the ability to learn and improve constantly. This is where automated post-incident reporting and analysis become crucial. By systematically capturing and analyzing data from each incident, organizations can identify trends, recurring issues, and areas for improvement.

AI plays a pivotal role in this process. Advanced ML algorithms can sift through vast amounts of incident data, identifying subtle patterns and correlations that human analysts might miss. This analysis can drive ongoing improvements in resilience, making an organization more robust over time. As a result, increased scale becomes less threatening. If a customer base grows exponentially, AI-driven resilience means more information on potential risks and opportunities to learn and adapt.

¹⁴ <https://www.pagerduty.com/assets/2025/state-of-digital-operations-2025.pdf>



Building greater resilience with the PagerDuty Operations Cloud

The PagerDuty Operations Cloud puts resilience principles into practice through an AI and automation-first platform that keeps human expertise at its core. By processing vast volumes of events across centralized and distributed systems, the platform leverages data from 700+ integrations to drive intelligent operations.

This comprehensive approach addresses the core challenges of modern operations. PagerDuty automatically processes and correlates incidents, reducing alert fatigue while ensuring critical issues receive immediate attention. Teams across organizational silos can communicate and coordinate effectively, with clear accountability and streamlined response protocols.

The PagerDuty Operations Cloud's capabilities extend across the entire operational lifecycle:

- Real-time incident management automates response workflows, ensuring the right teams are engaged at the right time.
- AI-driven pattern recognition identifies potential issues before they impact services.

- Automated diagnostics gather relevant context from multiple systems, accelerating issue resolution.
- Cross-team collaboration tools enable a coordinated response.

Organizations using the PagerDuty Operations Cloud report significant improvements. MTTR decreases as teams leverage automated diagnostics and AI-assisted troubleshooting. Service reliability improves through proactive issue detection and streamlined incident response. Team efficiency increases as routine tasks are automated, allowing subject matter experts to focus on complex challenges.

The platform's AI capabilities free teams from routine tasks, enabling them to focus on innovation and revenue-generating initiatives. This shift from reactive to proactive operations helps companies scale efficiently while maintaining service reliability. As systems grow more complex and customer expectations increase, this combination of automated intelligence and human expertise becomes increasingly crucial for maintaining competitive advantage.



The future of operational resilience

Cloud environments continue to expand and evolve. Security infrastructure, GenAI platforms, and emerging technologies add new layers of complexity to already intricate cloud, multi-cloud, and hybrid infrastructures. This evolution demands a more sophisticated approach to operational resilience, one that combines human expertise with AI-driven intelligence to maintain service reliability at scale.

Organizations must balance two critical factors in their cloud operations: leveraging AI capabilities while managing inherent risks. While advanced AI algorithms enable sophisticated predictive analysis and automated environments across cloud environments, they also introduce new complexities and potential security vulnerabilities.

Success in modern cloud operations requires:

- Unified visibility across distributed cloud environments
- Automated processes that scale with growing complexity
- AI-enhanced monitoring and response capabilities
- Continuous learning systems that improve operational efficiency

Enterprises that master cloud resilience gain significant competitive advantage by responding faster to disruptions, adapting quickly to new technologies, and delivering persistently reliable services to customers. As cloud adoption continues to accelerate and systems become more complex, this resilient foundation becomes increasingly crucial for sustainable growth.

Conclusion

Cloud operations will continue to evolve at an unprecedented pace. As organizations expand their digital capabilities and embrace new technologies, operational resilience becomes increasingly crucial for business success. The integration of AI and automation with human expertise creates a foundation for proactive operations that can anticipate and prevent disruptions before they impact customers.

The transformation extends beyond technology implementation. Research shows that PagerDuty customers achieve higher operational maturity (77% vs. 73%) and faster time to market (81% vs. 70%) compared to non-customers.¹⁵ These advantages translate into reduced costs, improved customer experiences, and the ability to scale efficiently. Their teams will spend less time firefighting incidents and more time driving innovation and revenue growth.

The journey to operational resilience requires a clear framework that addresses people, processes, and technology. By breaking down silos, automating routine tasks, and enabling data-driven decisions, organizations can build operations that not only withstand disruption but emerge stronger from each challenge.

To learn how your organization can strengthen its operational resilience, **Speak with a PagerDuty representative today**. Our experts can help you assess your current capabilities and develop a roadmap for building more resilient operations.

¹⁵ <https://www.pagerduty.com/assets/2025/state-of-digital-operations-2025.pdf>

About PagerDuty

PagerDuty, Inc. (NYSE:PD) is a global leader in digital operations management, enabling customers to achieve operational efficiency at scale with the PagerDuty Operations Cloud. The PagerDuty Operations Cloud combines AIOps, Automation, Customer Service Operations and Incident Management with a powerful generative AI assistant to create a flexible, resilient, and scalable platform to increase innovation velocity, grow revenue, reduce cost, and mitigate the risk of operational failure. Half of the Fortune 500 and nearly 70% of the Fortune 100 rely on PagerDuty as essential infrastructure for the modern enterprise. To learn more and try PagerDuty for free, visit www.pagerduty.com.