



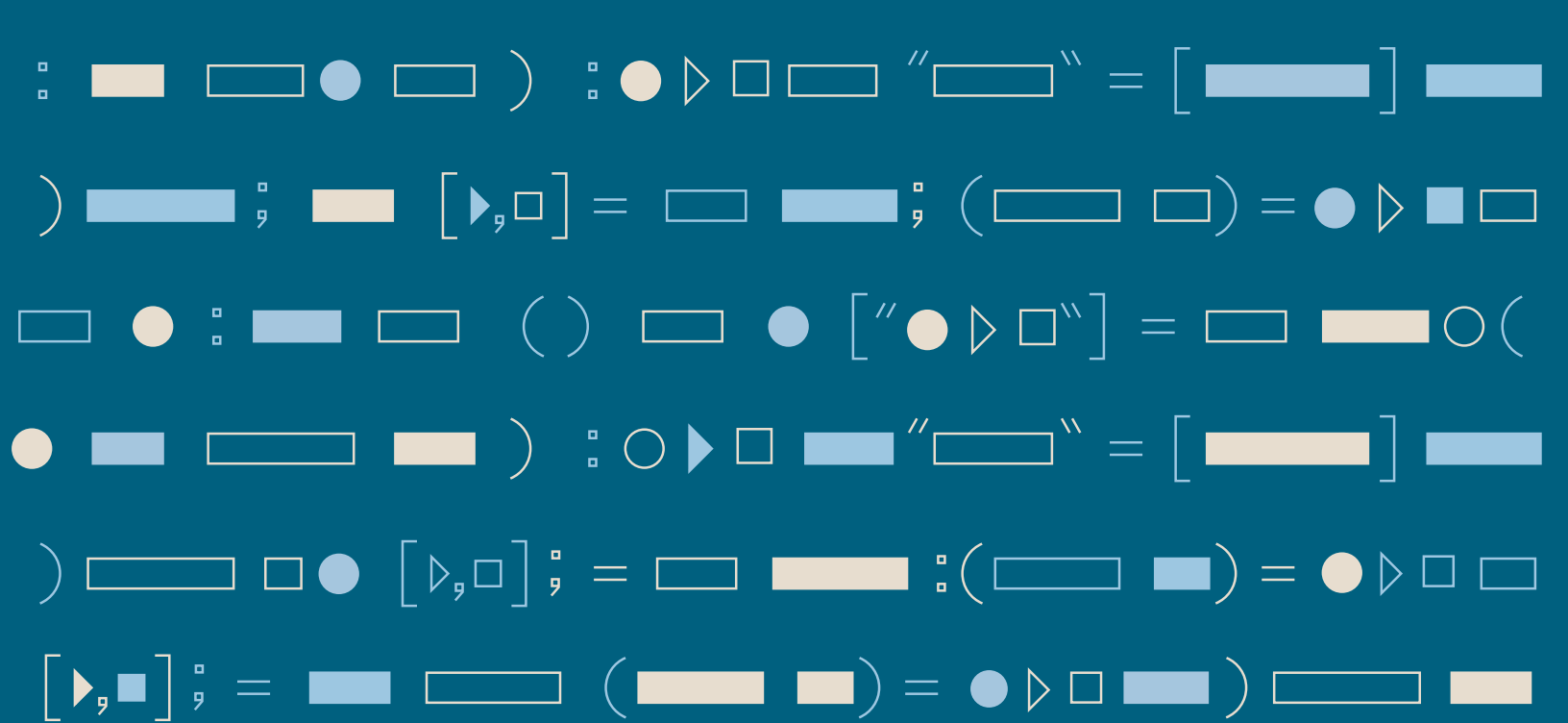
PagerDuty

# The State of Digital Operations

Issue 1: July 2021

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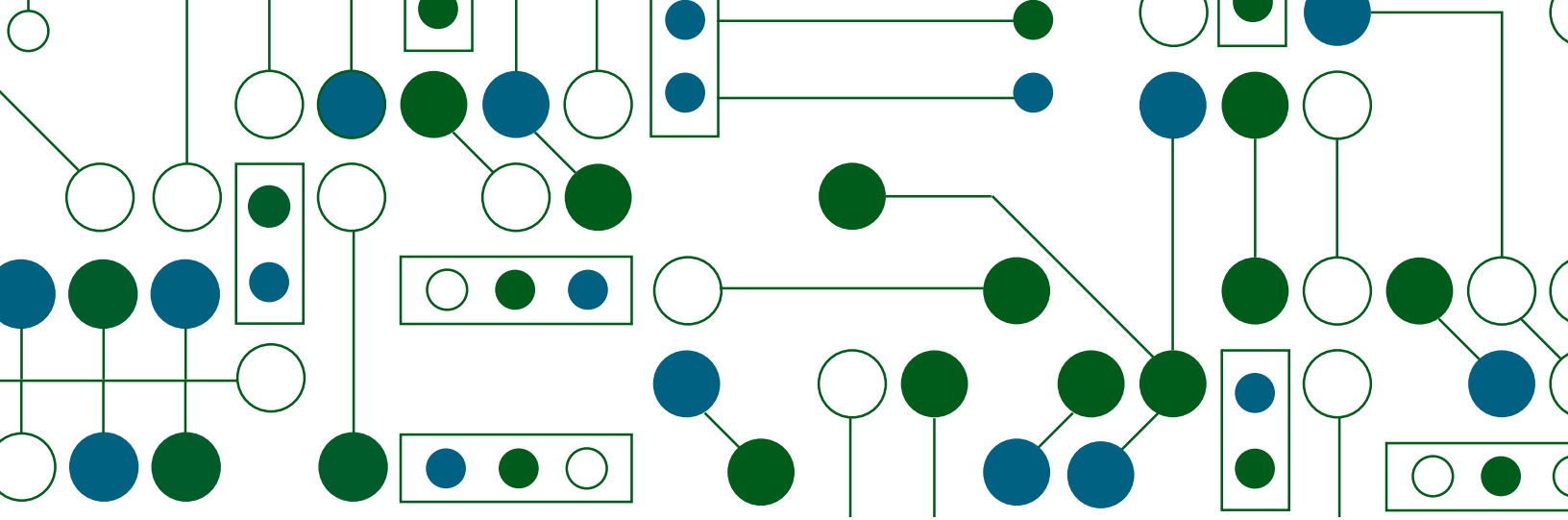
# Introduction

The digital systems that power our world are becoming increasingly complex and difficult to manage. And complex systems often break down. With the rate of change and speed of innovation that come with a shift to digital, incidents – and outages – are bound to occur.

We developed this inaugural report, *The State of Digital Operations*, to present an aggregated view of [what we're seeing across our platform](#) with the goal to shed light into the volume of real-time work, its growth over time, and how that increasingly burdens technical teams.

As complexity increases, digital leaders everywhere should understand the importance of good operations practices on business impact, operational health, and human factors.

Read on to see what we learned. —>



# Methodology

PagerDuty combines the power of machine automation with human action, providing our customers with bespoke, intelligent recommendations based on observed behaviors taken within the platform.

Hosting over 16,000 companies, from the earliest startups to the world's largest enterprises, PagerDuty is trusted by some of the most innovative companies in the world. These companies rely on our platform to ensure their digital operations are always on and available for their customers (What is a critical incident? Read on to find out).

Our platform ingests roughly 30 million events per day, which we filter into about 1 million alerts, resulting in over 500,000 interruptions (non-email notifications generated by an incident) – amounting to over 55,000 critical incidents a day.

This is why we have the richest data available about digital operations. We not only have the data on issues that occur in digital systems, we also have insight on the actions taken to resolve them—who and how many people were involved, the level of coordination required among them, and the automation used to help.

To generate this report, we analyzed anonymized data from PagerDuty customers, building around three key axes:



Unless otherwise stated, for the purposes of the metrics in this report, we looked at platform data from January 2019 to April 2021.

# Summary of Key Findings

As complexity increases, we all need to understand the growing volume of real-time work and the burden it places on technical teams. Below are just a few of the highlights from the report.



## 19% growth in critical incidents YoY from 2019-2020

Critical incidents are defined as those from high-urgency services, not auto-resolved within five minutes, but acknowledged within four hours and resolved within 24 hours.



## Working hours were considerably less consistent in 2020 than in 2019

Humans ultimately sit at the center of incident response, so staying cognizant of overwork that might be happening at organizations is critical for business and technical teams alike.



## Not managing burnout can lead to attrition

Our data science team looked at the relationship between users leaving the platform and how often they were involved in off-hour incident resolution. We found a statistically significant correlation: the more frequently users are involved in fixing problems off hours, the more likely they are to quit.



## Continued use of PagerDuty helps improve digital operations maturity over time

Looking at customers using PagerDuty over five years, there is a clear improvement of mean time to acknowledge (MTTA), mean time to resolve (MTTR) and rate of acknowledgment (Ack%) over time, showing that investing in operational practices pays off with better coordinated response.

# Market Context: The Importance of Real-time Digital Operations

2020 saw increased pressure on digital services. Yet the trend had been underway for a long time; the COVID-19 pandemic merely accelerated digital transformation efforts that have been active for a decade or longer. Perhaps Microsoft CEO Satya Nadella put it best when he said, “We’ve seen two years’ worth of digital transformation in two months.”<sup>1</sup>

With today’s businesses relying on hundreds and thousands of complex digital services to deliver critical customer experiences, those services need to stay always-on. But complex systems will break, and when they do, organizations struggle to react to incidents that require real-time response.

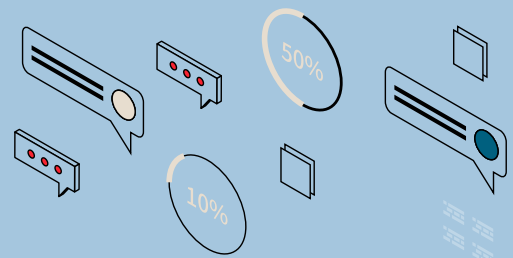
Without modern approaches to identify, resolve, and prevent critical incidents, organizations risk negative impact to revenue and customer relationships. Many struggle to respond quickly and effectively due to delays caused by manual incident routing and inefficient cross-team collaboration during an incident. Teams are stuck burning time firefighting to troubleshoot and resolve incidents.

The companies that will thrive in the new economy are the ones that excel at digital operations management, prioritizing workload balance for their people to keep them happy and productive in order to deliver the highest quality customer experiences and mitigate risk for their business.

## What do we mean by “real time”?

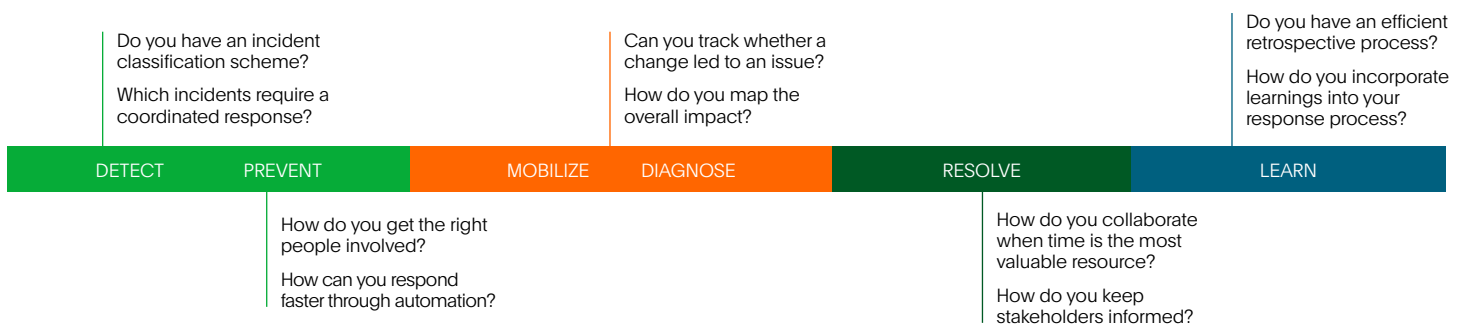
“Real-time” is anything that is urgent or unpredictable—an unplanned task, event, or opportunity that needs to be handled right away, such as:

- a service issue that may impact customers and business, like downtime, or
- a critical delivery, where the status must be assured at multiple touchpoints



## The incident response lifecycle for real-time work

Incident response refers to the processes in place in order to take immediate action on high urgency issues without going through a queued process that’s typically used for non-critical items.

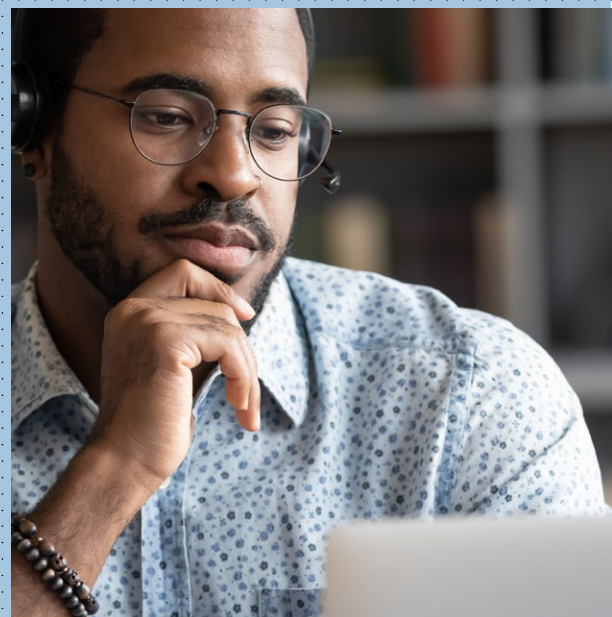
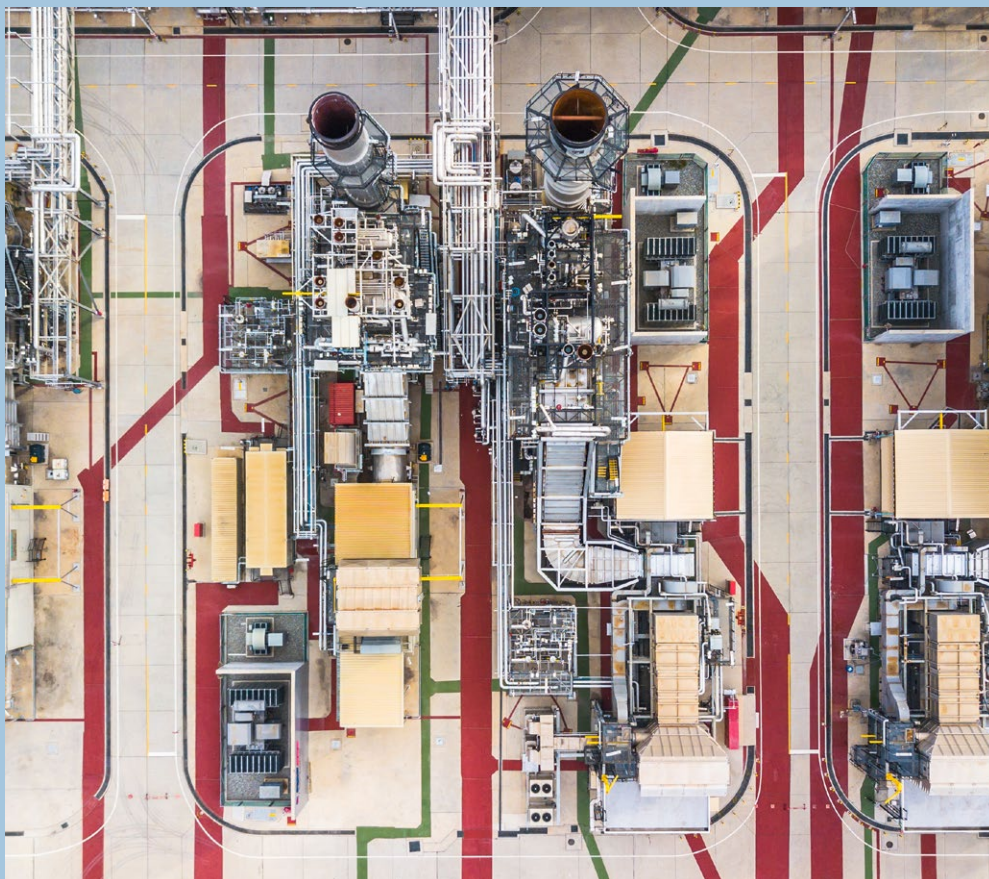




# Business Impact

It should come as no surprise that we expect incident volumes – both per organization and per responder – to continue to rise as digital adoption grows and more companies shift from digital transformation and implementation to true business optimization.

To avoid burning out employees, organizations need a modern approach to managing digital operations by streamlining the incident response lifecycle in order to shorten incident durations, automatically assign priorities only to the incidents that need immediate attention, and create fewer escalations (the number of people needed to solve a problem). While incident volumes may increase, the ideal scenario would keep overall time spent on response constant, or even decreasing over time.



## Incidents Are on the Rise

For the purposes of this report, we focused on **critical incident** volume, defined as incidents from high urgency services, not auto-resolved within five minutes, but acknowledged within four hours, and resolved within 24 hours.

Critical incident volume is rising and shows no sign of stopping. Over the last five years, we have seen a steady increase in critical incident volume year over year, which is unsurprising. As technology stacks become more complex and more digital initiatives are planned, more change is introduced, which naturally increases the rate of critical incidents.

Critical incident volume across the platform rose 19% from 2019 to 2020, and it's been trending upward over time across most industries.

Shortly after the start of the COVID-19 pandemic, we looked across the platform to see where the greatest impact from the initial shift to digital services was taking place. In late March 2020, we saw that highly stressed cohorts, including online learning platforms, collaboration services, travel, non-essential retail, and entertainment services, were experiencing up to 11x the number of critical incidents, meaning their teams were likely in crisis mode, handling a huge increase in workload, and constantly taking action to prevent service interruptions.

After seeing the initial spike, companies adapted and adjusted to the higher load on digital services, but their teams are still under pressure from the business to accelerate efforts to innovate and meet customer demands, which only continues to generate more change and incidents.

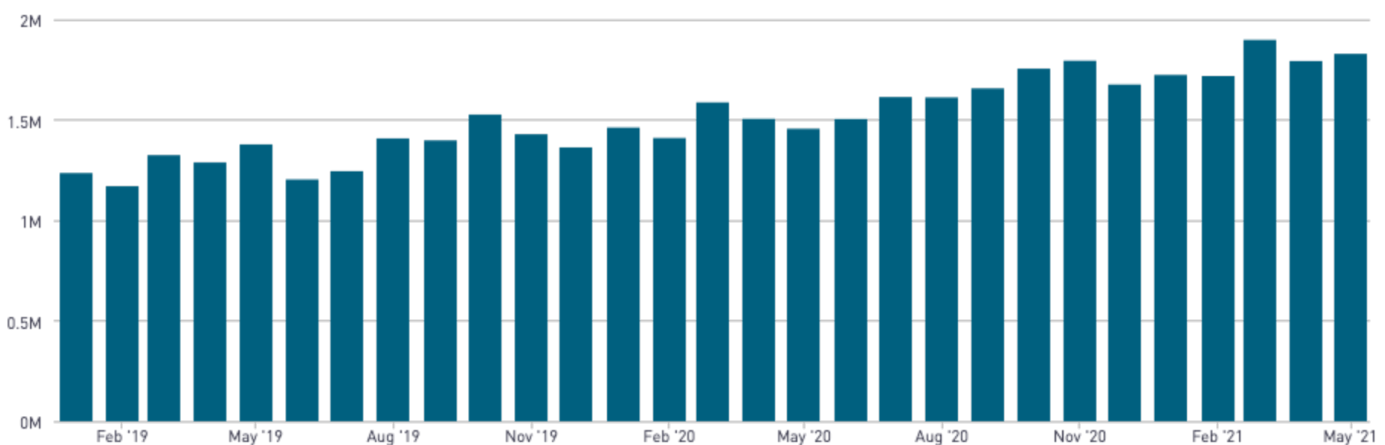
Zooming out to compare 2019 and 2020, the highest lift in critical incident volume was seen in the Travel & Hospitality and Telecom industries, with 20% more critical incidents. This makes sense given the disruption seen in the travel industry from cancellations and altered plans due to pandemic-related changes and policies around shelter in place. Meanwhile, Telecom likely saw its uptick as a result of the heavy reliance on internet service providers for remote work and all aspects of life moving online.

On a positive note, we saw that critical incidents for the Retail industry decreased by 4% on average and Media & Entertainment was largely flat in critical incident volume between 2019 and 2020, suggesting that existing investments in best practices like hypercare in preparation for peak traffic periods are improving their operational processes.

From 2019 to 2020, companies with over \$1B in revenue (what we label as enterprise) and very small businesses (those with less than \$10 million in revenue) experienced an increase in critical incidents of 14% and 16% respectively.

Meanwhile, critical incidents decreased for small and medium businesses (SMB) by 10% from 2019 to 2020, and mid-market companies also benefited from a 2% average decrease in incidents.

Figure 1. Overall Critical Incident Volume







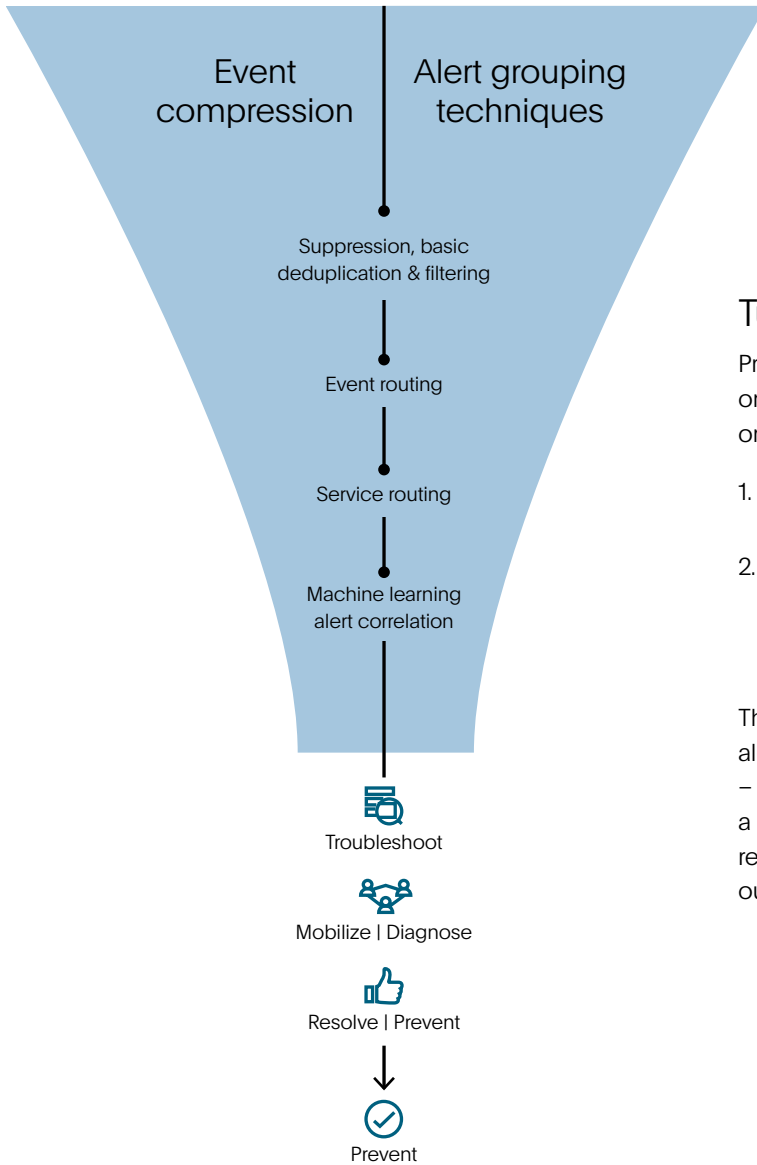
## Home for the Holidays

We were curious about holiday critical incident volume compared to regular, non-holiday critical incident volume load. Were on-call responders hit extra hard during holidays?

To get a closer look, we zoomed in on critical incident volume for organizations in the United States (US) during US holidays and saw that for the majority of holidays, critical incident volume was lower than non-holiday periods. This is actually not too surprising, since critical incidents are commonly triggered by deploying new code or fixes into production, and there are fewer people working during the holidays.

One practice often used by retailers to mitigate incident volume is [hypercare practices](#) and the implementation of code freezes well before peak holiday periods in order to avoid introducing changes into the production environment.

1000s  
of events



## Turning Down the Noise

Production systems generate a lot of events; only some of these rise to the level of an **alert**, or something that could be wrong.

1. **Event compression** is the process of mapping one or more events to an alert.
2. **Alert grouping techniques** – time-based, content-based, or ML-based – are then used to group related alerts into an actual incident that may wake someone out of bed depending on its urgency level.

The overall combination of event compression and alert grouping is what we refer to as **noise reduction** – the process of reducing a whole flood of alerts into a single incident. Right now, we're seeing 98% noise reduction from event to incident for customers using our platform.

# Operational Health

Operational health refers to an organization's ability as a whole to respond effectively to real-time work and resolve it. Despite the overall increase in incidents as explained previously, one bright spot is that companies are getting better at improving their mean time to acknowledge (MTTA) and mean time to resolve (MTTR) issues, possibly because of the prevalence of tools like ChatOps, work-where-you-are interfaces (particularly mobile apps), better dependency management using business and technical service relationships, and other features in a modern digital operations management platform.

Organizations can master operational excellence regardless of their operating model (ITIL or DevOps), or what their infrastructure looks like (whether

it's deployed in the cloud, in a datacenter, or a combination of both). Operational excellence improves by taking actions like establishing clear lines of communication, a culture of ownership and responsibility, and senior management buy-in based on metrics that show a clear relationship between operational excellence and improved revenue/customer satisfaction.

MTTA/MTTR are only proxies for overall operational excellence – there are many other metrics possible. But these are the most well-understood ones in the industry, so we will continue to report on them.



## MTTA/MTTR Improves Over Time with Continuous Practice and Learning

While we've observed incident volume increase over time, we've also seen MTTA and MTTR drop, which shows that organizations are adapting and maturing their operating models.

Looking at PagerDuty customers over the course of five years, MTTA and MTTR steadily decrease despite the increase in incident volume over time, which suggests that as more responders acclimate to being on-call and using the platform, the faster they get at acknowledging an incident and triggering the rest of the incident response lifecycle.

We saw that larger companies, typically with deeper pockets and the ability to allocate more resources, are able to adjust and steadily manage their MTTA/MTTR. Simply having more people to swarm a problem or an incident can help reduce time to resolve. In contrast, smaller companies have inconsistent MTTA over time, compared to the steady drop in MTTA across all other company size segments. We saw MTTR across all segments steadily improve over tenure of using the platform.

Figure 2. MTTA by Account Age in Months

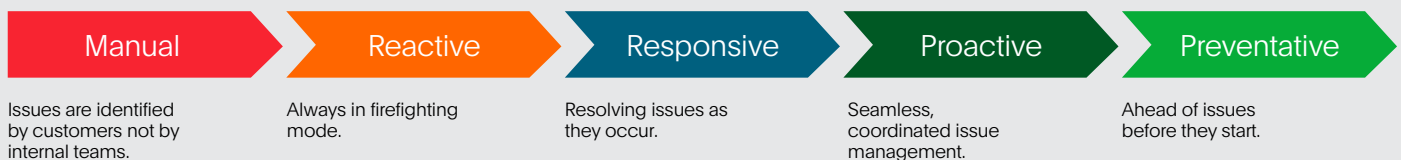


Figure 3. MTTR by Account Age in Months



## Phases of Digital Operations Maturity

To help organizations measure their operational maturity, PagerDuty developed a Digital Operations Maturity Model. The model gives IT organizations a way to define operational maturity, learn how to identify where they fall on the spectrum, and understand where to focus their efforts to improve. PagerDuty developed this model through more than ten years of working with customers that represent all major industries around the world.





## More Ack'd Incidents and Faster to Ack!

We use the percentage of critical incidents acknowledged (Ack%) as a proxy for the level of responsibility and accountability in an organization. High-performing teams take ownership and acknowledge issues quickly, even if it may take some time to investigate and resolve them. Organizations that do not quickly acknowledge issues often have a “tragedy of the commons” approach to incident management – muddled accountability that allows teams to ignore issues and assume that someone else will handle them.

We see that Ack% has increased over the course of using the platform, meaning that responders are acknowledging incidents faster and also acknowledging more of them, versus letting them sit unhandled. When we look at acknowledgment rate, it continues to improve over an account's tenure, showing that investing in digital operational practices has measurable results.

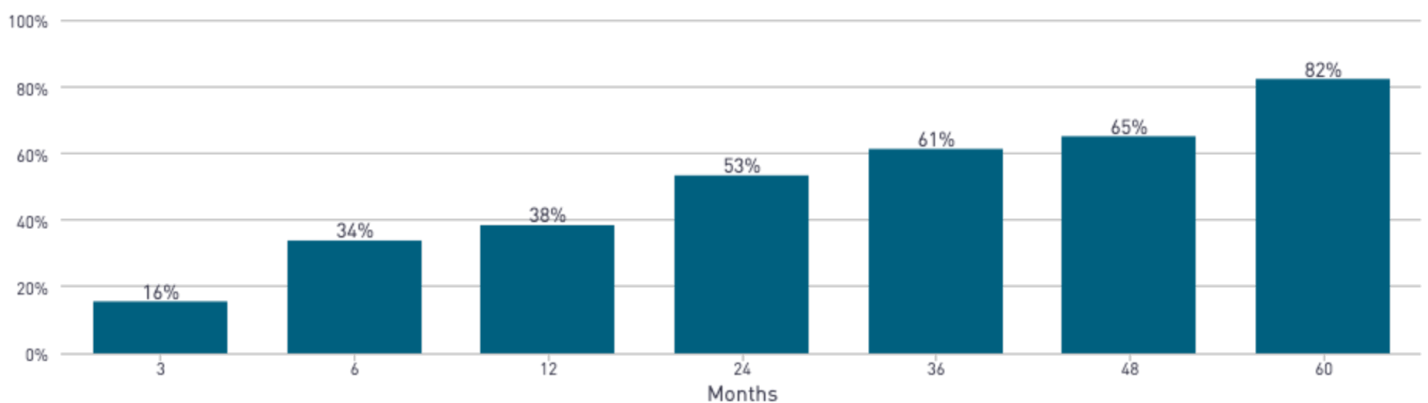
Looking across our customer base, we expect to see varying ranges of Ack%. It's an indicator of operational maturity, the types of use cases PagerDuty is being used for at a customer account, and how robust an organization's digital operations practices may be. For example, at customers where there have been investments in full-service ownership and where there is accountability built into the incident response process, we would expect to see higher Ack%. Compare that to organizations that have no consequences for when alerts are ignored, and it's not surprising to see lower Ack%.



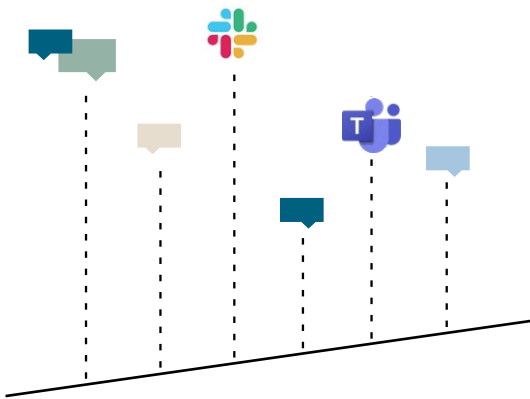
We looked at accounts that have been using PagerDuty over five years, and it's clear that they are getting better at incident response as they continue using the platform. Even with performance cohorts split out, with the 10th percentile being nearly twice as fast at acknowledging incidents compared to the 25th percentile, all accounts are seeing improved MTTA over time.

When we looked at the same data by company size, larger accounts were able to reduce MTTA from six minutes to under four minutes. In contrast, VSB (Very Small Businesses) was an outlier with less change over time, suggesting that prioritizing resourcing is key to alleviating challenges in digital operations management before organizations can unlock improvements and fine-tune operational processes.

Figure 4. Ack Rate Improvement Over an Account's Lifetime



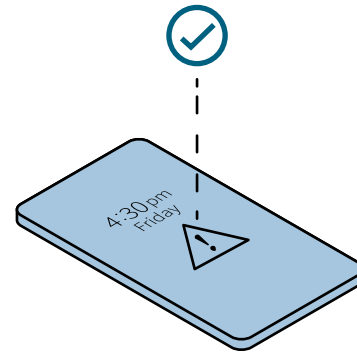




## Steady Growth of ChatOps Adoption

General-purpose enterprise-wide chat tools like Slack and Microsoft Teams have been around for years, but their use as the primary interface to drive the disposition of real-time work is on the rise – a trend known as ChatOps. Rather than forcing engineers to context switch among a chat tool, monitoring tools, and an incident response platform, ChatOps enables them to drive the entire real-time response from the chat interface. This increases collaboration and visibility by all parties during a critical issue, particularly around specific actions that responders are taking.

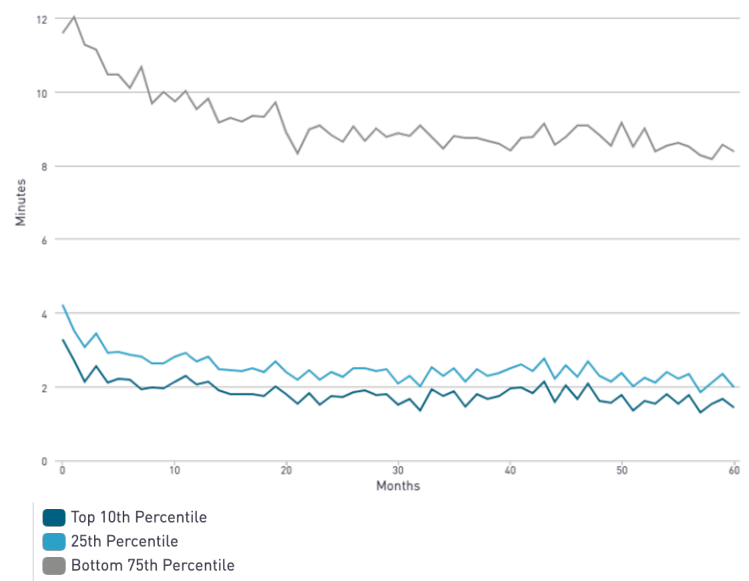
Many companies shifted to a 100% remote work environment during 2020, which prevented “swivel chair” interactions with co-workers and having entire teams in physical “war rooms” to collaborate together. So, we expected the adoption of chat tools and ChatOps processes specifically to increase, and the data reflects this. In the last year we have seen ChatOps adoption increase by 22%.



## Increased Mobile Adoption Helps with MTTA

We looked at adoption penetration of PagerDuty’s mobile application and compared it to MTTA to determine if there was any impact. Regardless of size, we saw that organizations with higher mobile adoption rates had 40-50% faster MTTA than those with lower mobile adoption. These benefits increase as the account size gets larger, and as companies get bigger.

Figure 5. MTTA Efficiency Over Account Age



# Human Factors

Humans ultimately sit at the center of incident response. While noise reduction can alleviate alert fatigue and automation and auto-remediation can help resolve some issues, in many cases, a critical incident results in someone being paged – perhaps in the middle of the night – to fix something.

Accordingly, organizations need to keep a pulse on team health and actively manage resourcing to spread the workload equally. For instance, if an on-call week has been particularly rough on an individual, team managers should strongly consider relieving that person's duties and adjust the schedule to spread the load among the rest of the team.

In this section, we look at human factors data: confronted with the rise in overall critical incident volume, how are responders' lives being impacted? What proportion of those critical incidents fall during normal working hours – when the impact is lower – versus ones that fall during non-working hours, especially in the middle of the night when responders are asleep and need to be pulled out of bed?

Unsurprisingly, there is clear bifurcation into distinct cohorts of teams who have healthy and unhealthy on-call experiences. If not addressed, unhealthy on-call experiences can lead to burnout, or worse, become employee attrition.



## Working Hour Consistency Drops for Certain Cohorts

We analyzed hours worked throughout the day and compared them between the first 12 months of pandemic-related shelter in place (March 2020-Feb 2021) and the preceding 12 months (March 2019-Feb 2020) to see the delta from the shift to working from home.

We found that over a third of users worked a considerably less consistent schedule in 2020 than in 2019, the equivalent to working two extra hours per day. This is significant, totaling an extra 12 week of work over the course of a year!

By industry, we saw that software/technology had the biggest drop in working hour consistency, with the average user working an extra hour a day. In these cases, perhaps it is the hyperconnectivity of remote work options available to those in the sector that trap employees working remotely at home into working longer hours.

A recent Microsoft study<sup>2</sup> on the use of its office tools in the last year quantifies the digital overload for workers. People around the world spent 148% more time in meetings and sent 45% more chats in February 2021 versus February 2020, along with 40.6 billion more emails sent through Microsoft Outlook.

Staying cognizant of potential overwork is critical for business and technical teams alike. Burnout reduces productivity and increases risk of attrition, which is in turn costly and damaging to the organization.





## Off Hours, On Duty: Interruptions Around the Clock

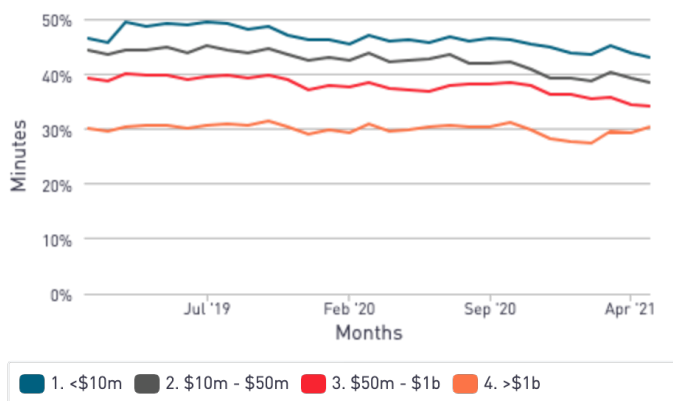
We define an **interruption** as a non-email notification (push notification to mobile phone; SMS; phone call) generated by an incident.

We saw that the absolute volume of interruptions has increased 4% from 2019 to 2020. However, what's surprising is that the percentage of users getting interrupted is flat or trending downward. So overall, companies are doing a good job spreading the load equitably across their employees.

However, this isn't necessarily the case for all organizations. In 2020, teams at smaller companies felt a heavier burden from interruptions than at enterprise companies, with VSB having 46% of its users getting interruptions each month compared to 30% of enterprise users.

While smaller organizations frequently have significant resource constraints and are often in hypergrowth mode, managers should be aware that such growth has to be balanced against the risk of burnout for technical staff, who are interrupted at all hours to deal with unstable software.

Figure 6. Percentage of an accounts' users being interrupted



## Not “If,” but “When”

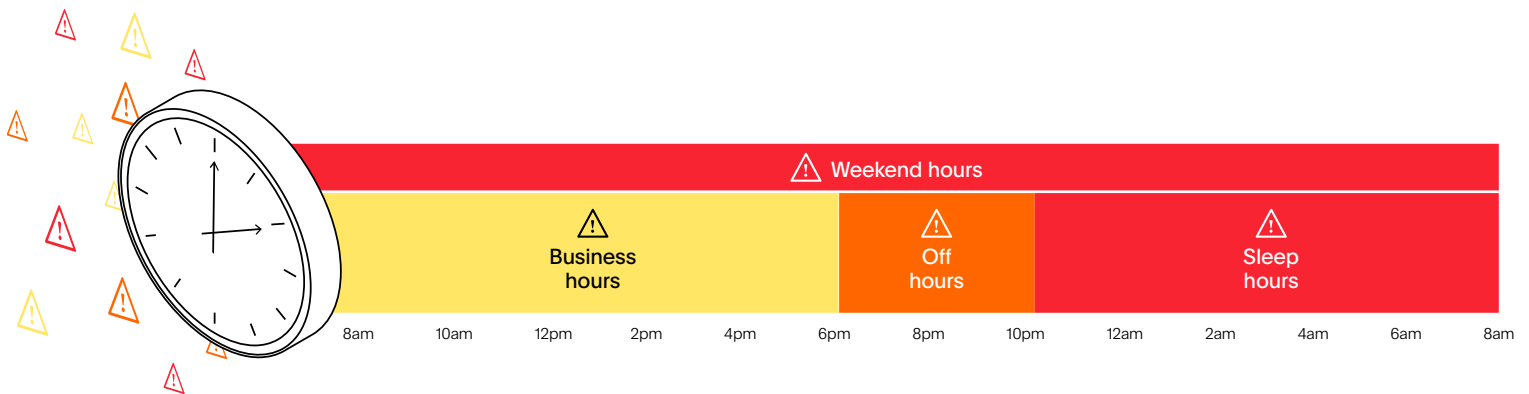
When on call, responders expect that they might get interrupted, but there’s a huge difference in impact depending on when they get interrupted. For example, an on-call issue that occurs after dinner but before bedtime is annoying and inconvenient, but much less impactful than being awakened at 3 a.m. to put out a fire.

We looked at interruptions for responders just in the US, normalized to the user’s timezone, to see when they happen, categorizing them into the same three categories that the PagerDuty Analytics<sup>3</sup> product uses:

- **Business Hours Interruptions:** The count of interrupting notifications sent between 8 a.m. and 6 p.m. Monday to Friday in the user’s local time.
- **Off Hours Interruptions:** The count of interrupting notifications sent between 6 p.m. and 10 p.m. Monday to Friday or during 8 a.m. to 10 p.m. over the weekend in the user’s local time.
- **Sleep Hours Interruptions:** The count of interrupting notifications sent between 10 p.m. and 8 a.m. in the user’s local time.

For the purposes of this report, we also split out “weekend and holiday hours” as a distinct time category to quantify interruptions in that specific slice of a responder’s life.

Compared to 2019, organizations saw 4% more interruptions in 2020. However, when digging into the spread across time categories, there was a 9% increase in off-hour interruptions and a 7% lift in holiday/weekend hour interruptions, compared to 5% increase in business hour interruptions and 3% decrease in sleep hour interruptions.



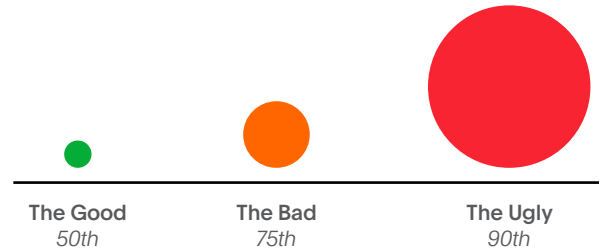


## Preventing Burnout Starts with Measurement: The Good, the Bad, and the Ugly

It's easy to look at overall data about response times, interruptions and other characteristics without considering the impact on the people behind these numbers. So we separated the data into cohorts to see what the lives of the outliers were like – what's "good" versus what's "ugly"?

Looking just at responders in the US in 2020 – for whom we have the most data – we split the analysis of off-hour interruptions into several cohorts to gauge a healthy responder versus an overworked responder, and what we're calling a burned-out responder.

Figure 7. Responder Stress Benchmarking



**2**   
interruptions  
per month

**The Good**  
50th percentile

The benchmark: The median is two non-working hour interruptions a month per user. We define this as a "Good" profile for a responder.

**7**   
interruptions  
per month

**The Bad**  
75th percentile

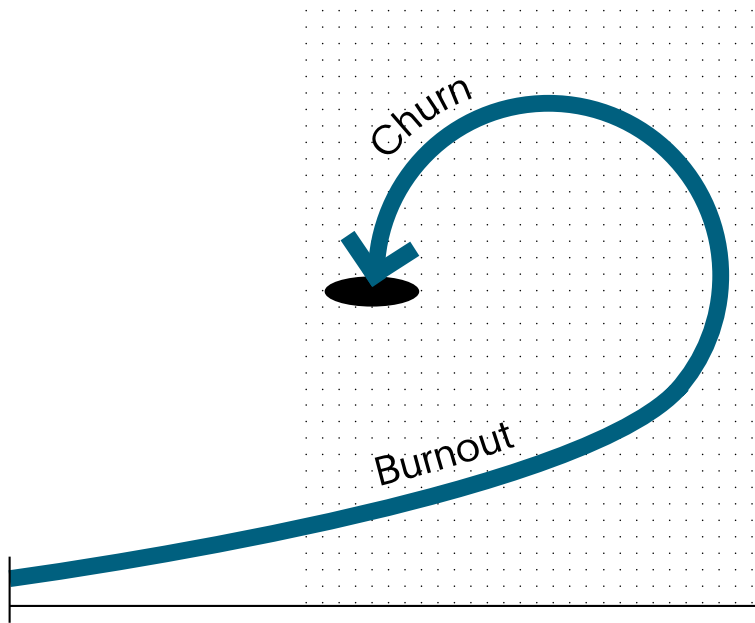
"Overworked" responders have seven non-working hour interruptions a month – over 3x as many interruptions vs. the median responder per month.

Users from smaller companies are feeling more stress, with nine non-working interruptions a month compared to the seven non-working interruptions a month experienced by responders from the same overworked cohort at enterprise companies.

**19**   
interruptions  
per month

**The Ugly**  
90th percentile

"Burned-out" responders have 19 non-working hour interruptions a month on average. That's almost 3x as many non-working hour interruptions per month as the Overworked responder, and 10x that of the Good/Median responder per month, a phenomenon that gets worse for smaller companies.



## Risk Factor: Unmanaged Burnout Can Lead to Employee Churn

We saw that responder profiles leaving the platform experienced a higher than average off-hour incident load. This cohort had to deal with off-hour incidents every 12 days compared to every 15 days for remaining users. Using regression analysis, we looked at material off-hour incident work volume for both deleted users (which we used as a proxy for employee departures) and remaining users and found a statistically significant positive correlation between off-hour volume and a user's odds of deletion.

When thinking about these metrics, companies should consider the tangible cost associated with attrition. Actively managing incident response workloads to promote better team health and avoid overworking employees have direct impacts on productivity and happiness. Team health metrics in the PagerDuty platform surface this sentiment and help visualize load balancing from a responder standpoint.



# Looking Forward

As companies continue to accelerate their digital efforts and business pressures force them to embrace modern tech stacks, there are several trends we've shared from our data:

- 1 Complexity, noise, and incident volume have all increased over time and show no sign of slowing down.
- 2 Critical incidents require real-time work to address and resolve, placing direct stress on responders and work-life balance.
- 3 Operational processes and intelligent platforms can help alleviate the pressure on teams and empower organizations to unlock faster MTTA and MTTR.

Every company needs a sustainable way to allocate resources to manage incident response, not only to keep a strong digital presence and provide a delightful customer experience, but also to retain its employees. In the end, it's humans—the ones who build and manage the digital applications and infrastructure that businesses and customers rely on – who are at the core of managing ever-increasing noise and complexity.

Companies that excel at digital operations management throughout the real-time work lifecycle, the ones that can balance the workload for their people to keep them happy and productive, will be best positioned to deliver the highest quality customer experiences and mitigate risk for their business.





## Credits

This research and the development of this report would not have been possible without the support and collaboration of the following contributors:

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## About PagerDuty

PagerDuty is a digital operations management platform that empowers the right action, when seconds matter.

For the teams that build and run digital systems, PagerDuty is the best way to manage the urgent, mission-critical work that is essential to keeping digital services always on. We make it easy to handle any unplanned task, event, or opportunity right away. Teams use PagerDuty to detect, mobilize, diagnose, and resolve issues in their digital systems – but more importantly, they are empowered to continuously learn from what happened with the aim to prevent repeat incidents in the future.

The PagerDuty platform can be set up in minutes, is intuitive to use, works at cloud scale—and it delivers immediate value. Teams rely on PagerDuty to spend less time dealing with low-level, repetitive tasks—and more time focused on creating new and better digital experiences.

To keep up with trends like these and future State of Digital Operations reporting, visit [pagerduty.com/state-of-digital-ops](https://pagerduty.com/state-of-digital-ops).