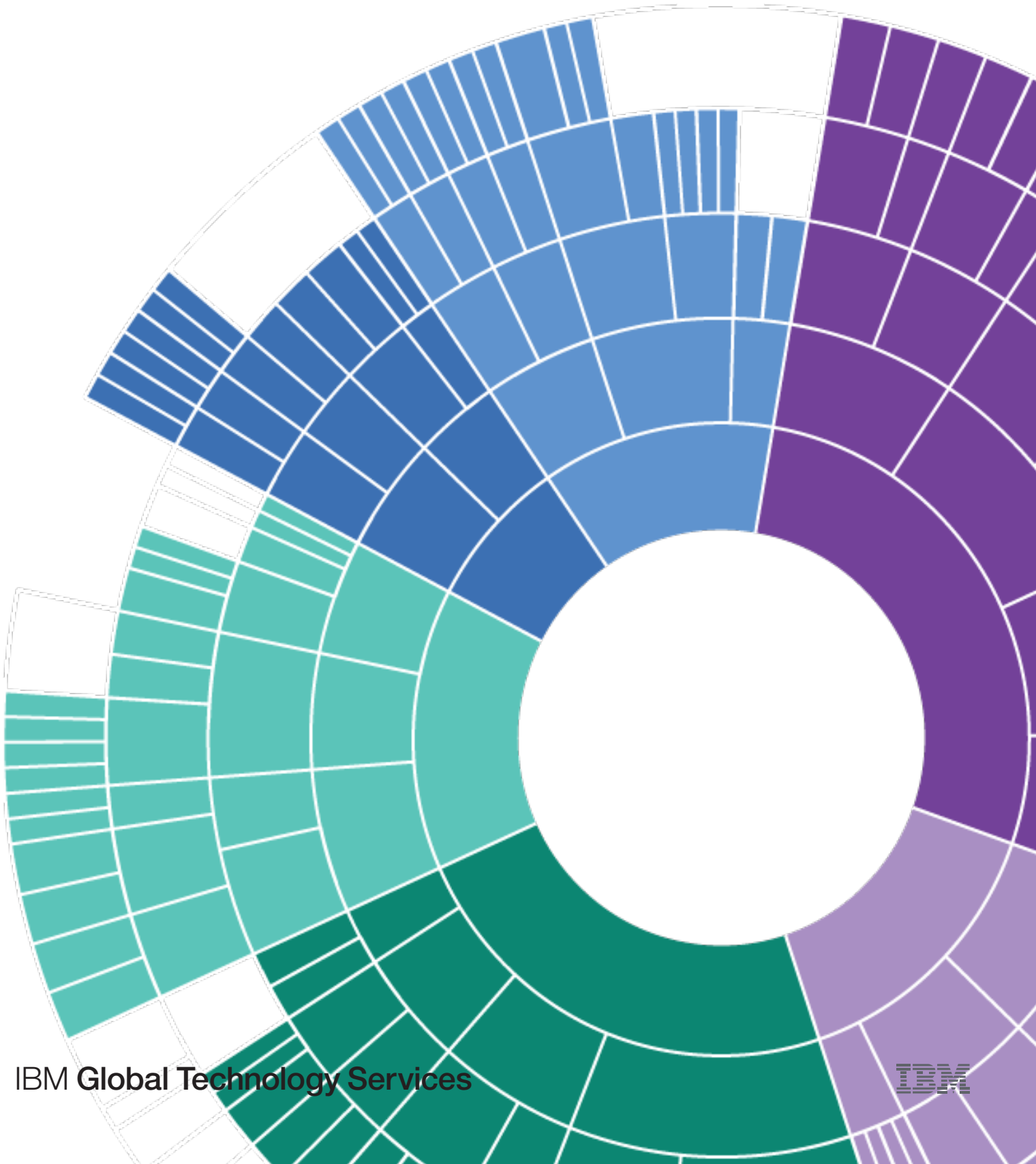
Leveraging the Data:

Using a Cognitive Platform to Transform Business Outcomes



IBM Global Technology Services

Part I
What We Do

photographer: Denyx Nevozhai

Introduction

The cognitive platform has seven domains. This section contains case studies demonstrating how IBM has worked with partners and clients to combine these seven domains for improved business outcomes.

The seven domains

The Cognitive Technology Services Platform has seven domains. Offerings, applications and services are presented across these domains and together address the entire service lifecycle.

The **Data Lake** curates data from IBM's 30+ years of experience transforming and running client environments—past and current—as well as from other providers and data partnerships.

It's a source of truth for managed environment data that can be accessed and use for multiple applications. The volume of data collated from everything that IBM manages creates information that is statistically relevant, enabling insights.

Cognitive Delivery Insights and **Cognitive Services Optimizer** uncover connections among the different kinds of data in IBM's data lake to drive continuous improvement. These domains constantly refine every part of the working environment, and automatically optimize where and how workloads are run.

This 'restless' approach to continuous service improvement reveals insights and recommendations not previously available, which drives increased service quality. The solutions are specifically designed to pre-emptively improve environments, on both small and strategic scales, resulting in higher service quality and reduced costs.

> "Big Data will spell the death of customer segmentation and force the marketer to understand each customer as an individual within eighteen months, or risk being left in the dust."
>
> Ginni Rometty, IBM CEO

The **Cognitive Services Manager** pre-emptively detects, solves issues and directs automation to repair unexpected incidents to ensure environments are always-on and compliant with security guidelines. Its benefit is increased availability and performance at reduced cost.

The **Cognitive Solution Designer** partners with clients and IBM experts to design IT solutions—using standardized services offerings—to meet business objectives.

This results in solutions to clients requests being created faster, creating more time for engagement with the client themselves. The solutions are high quality as they are informed by previous experience.

The **Hybrid Environment** meets the non-functional needs of performance, availability, scale-ability etc, that clients demand today. At the same time that it delivers on demands of the business around IT responsiveness, it also retains agility and control of security, compliance and cost.

The **Role-based Dashboards** provide leaders, architects and administrators full transparency and control of managed services, as well as advice on business and technology decisions.

This simplifies the platform user experience, providing users with access to just the information they need. This avoids the danger of the benefit of the platform services not being fully realized, on account of an overwhelming volume of function exposed in an unstructured way.

Case study: Citigroup

Our journey with Citibank led to the established pattern that we now call our analytics business transformation journey. The foundation lay in trust and transparency, followed by changing contractual deliverables into deliverables for business outcome, and the key was SPSS predictive and advanced analytics.

The Citigroup call center has over 300,000 clients across 93 countries, supports 20 languages, and processes over 100,000 tickets monthly. Yet more than half of these tickets were moved to higher cost service providers, even though the majority were not technology-related problems. This reliance on external partners to delivers answers had a severe impact on their business outcomes. They turned to IBM to assist them in creating solutions for more efficient operations and improved decision support, and in capturing and responding to their customers' needs.

IBM designed and built an underlying analytics platform that could ingest both structured and unstructured data, and deliver on the business objectives. This became one of the first instances of an onPremise Data Analytics Engine.

> "Given that 90% of information comes into our brain through the visual vortex, as humans, we are created to find and recognize patterns. Close your eyes and imagine a million records in a database— there's no understanding in that. But imagine it on a map, and you can instantly recognize that one particular country has 20 tickets open and needs more focus."
>
> Katrina Read, *Delivering Actionable Insights at Citigroup*

With this structured and unstructured data now available, the team turned to forming the data into a narrative, using Cognos, Watson Analytics, and Tableau. With these tools, the abstracted data could be represented and understood via visualization techniques such as geo-spatial representations, word clouds, and correlation and causation charts.

The results were truly transformational. With the call center teams empowered to understand the data, they could analysis and address the root causes. No longer only tracking simple call completion times and categories, the teams began using the unstructured data in the call records to identify patterns and trends, and implement changes.

In parallel, the culture shifted to emphasize self-service over external reliance. Citigroup added new content, conferences, marketing brochures, and campus educational campaigns. As a result, half of all incidents related to educational or navigational assistance are now routed to employee self-service.

According to Laurie Kenski, Senior Vice President and Portfolio Manager at Citigroup, in 2015 alone, Citigroup saved millions of dollars as a result of reductions in duplicate, withdrawn, and escalated tickets. Radically remodeling and re-branding the self-help experience not only produced significant, measurable business outcomes, but also improved client experience.[1]

Case Study: Sysco

Sysco processes huge volumes of data in short periods of time: 8000 trucks must leave, loaded up and on-time, every day. Sysco CTO Wayne Shurts notes, "On-time delivery is very important, because a lot of our customers, what they're serving for lunch or dinner is on our truck to the restaurant that morning."[2]

With more than 270 locations in the US, Canada, Bahamas, and Europe, and 150,000 deliveries per day, there is no margin for error. Even a few minutes' delay causes warehouse overtime, which impacts the company's bottom line, and in turn impacts delivery to their clients.

"We've had a great long-term partnership with IBM, and dynamic automation has taken it to the next level."

Wayne Shurts, CTO, EVP, Sysco

Dynamic automation identifies and fixes problems instantly. Within six months of its introduction in 2015, critical incidents dropped by 89%. In the two years since, server uptime has increased by 50%. Severity 1 issues—critical outages affecting multiple people or locations—have dropped from 19 hours to just 28 minutes.

Dynamic automation keeps Sysco's critical operational systems running every day. The company requires peak performance, always, and dynamic automation delivers.

Case Study: insurance industry

A multi-national insurance company's project suffered from an unfriendly user interface, CIO escalation, skill support concerns, contract non-compliance and cost overruns. Additionally, accumulated tech debt had led to major service disruptions, less than optimal processes, contested resources with limited cycle time, and an overall unhappy client-user community.

Cognitive analytics was a key answer for correcting course. With a new DPE onboard, the first step in this journey was to use IBM Watson to collect and analyze client satisfaction data. As IBM worked with the client to understand what was driving these negative user experiences, we then moved into PASIR (predictive analytics) to weed out the noise in incident tickets, and more importantly, get a strategic sense of the highest priorities. This led to optimizing the IT staff, which freed the client to focus on the most important IT problems and address compliance debt issues.

As the project progressed, the team collaborated on a Tableau dashboard workload management tool for delivery. This put the client in overdrive with this combination of data analysis and improved tooling/software to identify problem areas. With these, the client is able to focus tactically, strategically, and within a budget.

"It's important to put it all together and tell stories about the data, to make people aware of what this means to them. Give them the context in which to make the decision."

Beth Rudden, Distinguished Engineer, IBM

These improvements have also fed into the client's culture and support teams, showing overall improvement beyond the immediate sphere of the project's scope. The results speak for themselves including positive feedback from the CIO and key stakeholders as we embark on a new contract.

In 2017, the next phases of this journey include more client self-help tooling, and improved operational metrics reporting. These will improve accuracy and reduce operational staff cycle time.

The project will next turn its attention to cost optimization, cost take-out, gain-sharing, and reinvestment into new automation. Automation starts with machines, then typically progresses to process (RPA, BPM), which will provide the client with a solid set of structured and unstructured data.

This lays the groundwork for introducing Cognitive automation through the use of NLU and NLP, and thus beginning the next iteration of continuous improvement.

Part II Where We're Going

photographer: Alexander Radelich

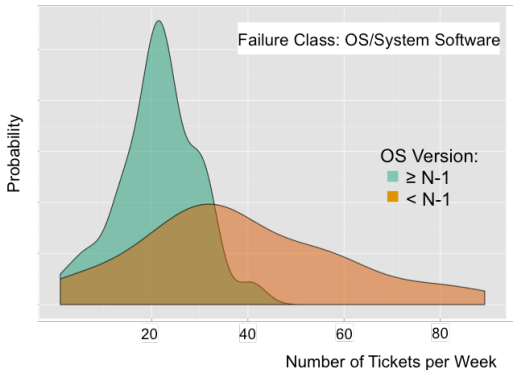
Looking Ahead

The following ongoing projects illuminate some the ways the cognitive platform is creating clear business benefits for growth generation, cost reduction, visualization insights, and predictive analyses.

Infrastructure Data, Analytics, and Insights

The project known as Predictive Analytics for Server Incident Reduction (PASIR) is designed to balance a server's purpose with hardware, resources, and operating system information. The complexity lies—among other things—in the fact that incidents vary each month, depending on the purpose, the operating system, the utilization, server age, and server architecture; tickets also contain a combination of structured and unstructured data, with upwards of a million rows generated each month.[3]

The team began by pulling in years of past server tickets, text-mining each one, and linking the results to servers. They also pulled in a running two month period of of CPU utilization data, and linked these results to the related servers, in turn. They gathered data from hundreds—even thousands—of units across many asset types, each with well-documented and regularly-updated configurations. Lastly, they added hardware information and noted each server's purpose (e.g., application, database, security, web).



Incidents per week, by OS

Levels of utilization, OS versions, and hardware age are significant—if often underestimated—drivers of daily incidents. The goal was to find the right combination of attributes to minimize the incidents that must be handled by IT technicians. This expanse of data would be key for machine learning and statistical models, to answer questions, show trends, predict outcomes, and build strategies for server incident reduction.

The team built a prediction algorithm to address the following: what is the chance this server will fail, given the above variables, and what's the best way to reduce that probability and number of incidents?

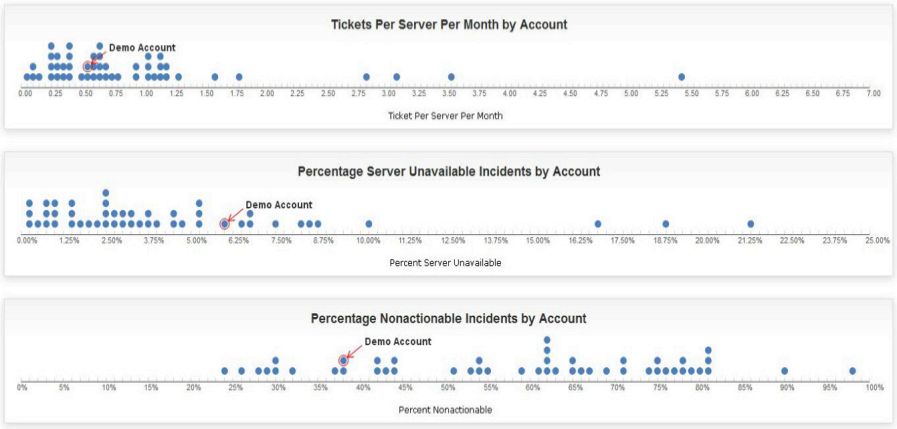
The next step was integrating these variables with the unstructured data from the incidents themselves, with trained modelers using the PASIR infrastructure. A modeler reviews a sample of the incidents, and teaches the classification algorithm to accurately classify the rest. While a time-consuming task, it's crucial for increasing the models' accuracy.

After the servers are classified as problematic or non-problematic based on the parameters, a set of Monte Carlo simulations are run to examine the impact of possible improvement actions. These include refreshing hardware, upgrading the operating system, adding memory, and so on. The possible actions are evaluated, based on a reduction in the probability of a server unavailable incident, and a reduction in total incidents.

> "IT managers are bombarded with daily issues. The good news is they have a huge advantage in addressing these constraints: their data."
>
> George Stark, Distinguished Engineer

With the data processed through the model, the results are output into a clean and user-friendly visualization. An overview tab contains information about the data collected, as well as a summary visualizations of the results. PASIR creates a Problematic Groups tab with servers grouped by similarity, such as age, operating system, purpose, or results. The user can drill into an individual group plan and see evaluated alternatives, their results, and the server group's vitals.

When the user selects an individual server, they can see the linked tickets that drove the recommendations. The Custom Groups tab allows the user to create views of the problematic servers based on their criteria, such as application, location, or business unit. Lastly, the Analyzed Servers tab contains the full list of analyzed and classified servers, where the user can filter based on the data items collected. Together, these tabs allow the user to identify the most troublesome servers, compare the possible trade-offs, and choose among the options for the best method to reduce server downtime.



PASIR Benchmarking dot plots

Recently, a major manufacturing leader asked to apply the PASIR service to the company's systems. The company's CIO was newly-hired, and needed to stabilize the environment before implementing any strategic imperatives. With PASIR laying out the roadmap, the company implemented the recommendations, and began a Cloud migration based on the applications with the most problematic infrastructure components.

This reduced the number of severity 1 incidents by more than 60%, and saved the company more than $32M in the first year. Unexpectedly, this also reduced restoration time. As more technicians were available to resolve incidents rather than fighting severity 1 fires, the overall time-to-resolve dropped dramatically.

Implementing the PASIR recommendations also reduced the number of server unavailable incidents by 2.5%, and increased server available hours by over 40,000 per year. This additional productivity was valued at more than $16M, in the first year alone.

As the part of cognitive platform, this solution is currently readily available for companies world-wide. Its demonstrated power has clear business benefits for both growth generation, and cost reduction.

Systems Management Research

Based on the above success, a new multi-disciplinary, cross-team project is taking a variation on the PASIR concept to a global level. Led by IBM Research, in collaboration with Global Technology Services and the Global Chief Data Office, this project's goal is to predict whether a given server will go down in the coming days or weeks, based on patterns in the server's utilization data.[4]

The team began by asking: what behavior—across CPU, memory, or other metrics—might indicate a server's load?

Normally, unplanned server down time creates chaos, both in disruption to users, and in the need for rapidly allocating resources to deal with it. Operational costs would drop significantly, if the approach could be preventive, allowing users to allocate resources in advance. Preventing outages would also have the benefit of reducing SLA violations and penalties.

The team began by asking: what behavior—across CPU, memory, or other metrics—might indicate a server's load? To figure that out, the team needed fairly detailed monitoring and utilization data, down to fifteen-minute

intervals, across over 600K servers.

One of the first issues the team found was that their source database didn't store the raw data they needed. Instead, storage issues meant the raw data was only stored for a week, then aggregated into averages (day, week, month).

The multi-disciplinary team collaborated to utilize the cognitive enterprise data lake, developed by Global Chief Data Office, to handle these data volumes with minimal time overhead, and in an optimal manner, which resolved the storage issue. And secondly, the existing data collection process meant a tool already existed to fit the team's purposes; the team was able to piggy-back, pulling the data needed, and storing it in the cognitive enterprise data lake.

"We cannot do this without the historic information. For us, the data lake is a great tool to collect something that wouldn't have been collected previously, and then to see things in the data that we wouldn't see otherwise."

Frank Bagehorn, Senior IT Architect

Gradually they built up a much longer history, about six months or more. To get a sense of how much data this is, a new data point arrives every fifteen minutes, from each server; the team is currently inserting about 200+ million new rows every day.

With six months' historical data collected, the team introduced deep learning approaches, searching for patterns. These anomaly detection tools focus on historic data for normal behavior, and having learned those patterns, it can identify deviations, flagging each as normal or an anomaly. By predicting outages with enough precision, a servers' team can establish preventive measures.

Currently, the team is working through the algorithm creation process, trying and testing the right combination to develop a full prediction model. Based on work by another team, doing similar but for network devices, the team is confident they're on the right track. The key element has been the historic information, and the data lake has proven to be a great tool to collect something that couldn't have been collected previously.

Together, the team is able to uncover and mine the data to reveal insights that would otherwise be hidden. Imagine what these solutions could bring to your company or organization.

Data Analytics Center of Excellence

With modern tools and methods for data visualizations, the Data Analytics team is able to introduce different depths to a view, well beyond what's visible when it's only two numbers on a spreadsheet.[5]

"If you see it in the spreadsheet, it's just two numbers, and you miss the significant relationships, compared to sizes, shapes, and colors. What the visualizations do is let you add different depths to one view."

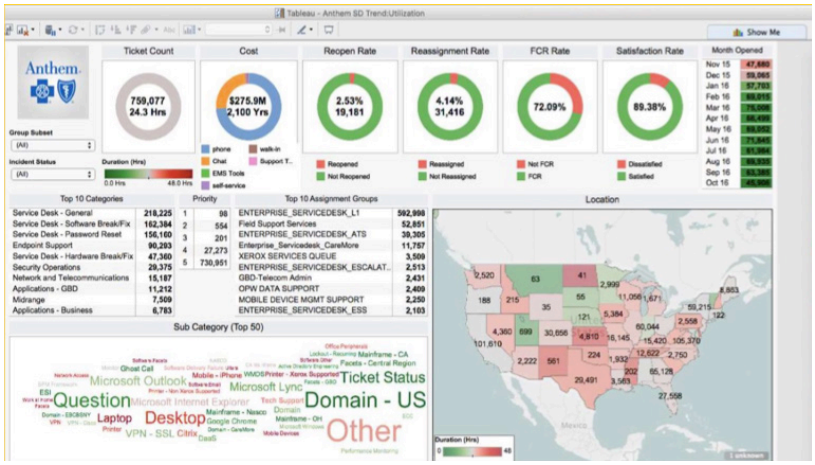
Sarah White Eagle, Data Scientist

The team's focus is analytics, but they're equally knowledgeable about user experience. It's common for clients to not be entirely certain what they're looking for, though sometimes there are hints in what they currently pay attention to. It's not surprising for users to miss the relationships in their existing data, and how one data point may inform a seemingly unrelated data point. Consider a situation where there are a high number of tickets, of a certain type: comparing those tickets to a mean-time-to-repair (MTTR) lets the users can see the once-hidden story within the data relationships.

The team's use of visualization tools enables a lot of flexibility for

interviewing users, testing a potential display, and revising based on the user feedback. The new tools also provide the team with the means to quickly tweak and release iterations, and deploy them for immediate review.

A dashboard can contain the most basic pieces—pie charts, bar charts, other graphs—but the real power of visualization tools lies in filtering functionalities. The user can click in one section, narrow the results, and the rest of the dashboard adjusts to change everything else; that one filter changes the context for the entire dashboard. Linear regression and natural language classification are two more powerful types of filtering, each of which allow for clustering tickets.

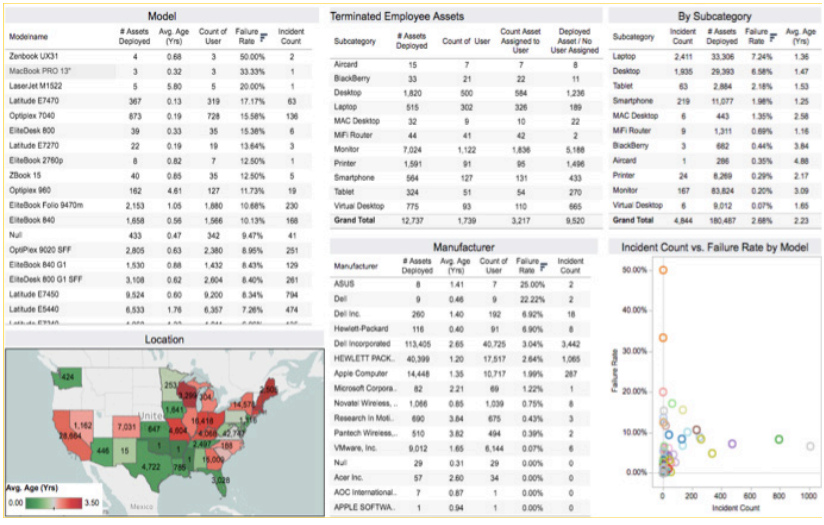


Actionable Insight Dashboard, first screen

Filtering can create some eye-opening moments, illuminating the data relationships in an extract. It creates more insights, on a multi-dimensional level, rather than flat one-dimensional data. Shapes and sizes can also provide additional dimension; a third element of depth can be added with color. Taken altogether, a well-designed dashboard can be an incredibly powerful tool for users to see the stories in their data, in real time.

Dashboard complexity does require tailoring to the users, and user interviews and feedback are crucial for for usable and user-friendly dashboard design. Beyond this, the more experienced users are with dashboards, the greater the amount of data they'll consume.

At the same time, some environments (such as mobile) work better when users begin with a focus on the most important details, and are empowered to explore as needed. The data visualization team understands that a user's first goal is usually to get the gist of the most important details. Understanding where, and how, the user needs to rise up—or drill down—is an important part of defining the user experience.

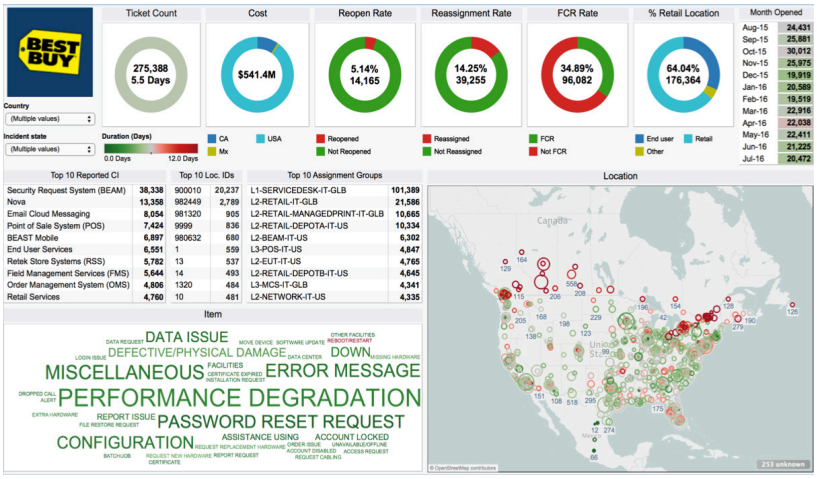


Actionable Insight Dashboard, second screen

The next innovation is one enabled by the relationships revealed in the visualizations. With better data, and better models, the visualizations can be deconstructed to create predictive models. Currently, visualizations use historical data, but a gap remains in terms of predictive potential. By deconstructing the visualization to a model, then applying that model to a different data set, the team can create a predictive model.

For instance, with outage probability, the team has taken historical alert behavior and derived a basic mathematical equation. In a variation of the underling concepts in the Infrastructure Analytics and Systems Management Research projects, studying the data over a time period allowed the team to determine the probability of an outage.

In the case of dynamic automation, the team can take a range of tickets, each one mapped to a known automata (high CPU utilization, high



Actionable Insight Dashboard, main screen

disk utilization, etc, issue types). With a natural language classifier model—based on the text entered for an incident summary—and the corresponding automata, the team is able to extend this mapping and train a corresponding model. When a new data set is submitted to that trained model, it can identify the expected automata for a ticket, process it, produce the results, and also provide an estimated level of confidence in its estimate and outcomes.

This is truly a cognitive way to process data, rather than the old-fashioned method of looking through each ticket, long-hand, to find specific types. This predictive aspect is especially powerful when the user is unfamiliar with the specific topic in a ticket, such as unfamiliar or obsolete technology. By incorporating a model that's been trained on these types of errors, the user is able to rely on the model's automatic identification, without requiring additional expertise.

Lastly, the visualization is only as good as the data entered, and the most common client reaction is a kind of 'aha moment', with the data itself. As mentioned above, a metric such as MTTR may be interesting, but usually it's a more of a generalized value or calculation. It's also highly reliant on how strictly a company enters the relevant data.

This is the other next step, beyond data: not simply the impact on—and by—technical problems, but also the impact on the business' ability to process problems. To measure team performance or issues, a team must be vigilant in their data collection, and that requires solid, tested processes. With that final step in place, users will be able to mine those gems of insight, and learn from what they've done in the past.

"Discovering hidden patterns and delivering them through exciting data stories will empower not only companies and organizations, but their clients, customers, and partners. The possibilities are endless."

Eugene Kolker, VP and Chief Data Officer, GTS

Conclusion

With the winning combination of our user-centric focus and cognitive platform, companies and organizations can monitor multiple data sources, derive rich and comprehensive insights, and make the data truly actionable. As a result, the data can be leveraged for internal consumption, decision making, optimization, and beyond.

Discovering hidden patterns through exciting stories will empower companies and organizations: to focus on actionable outcomes, improve digital strategies and practices, for business transformation and empowering companies' clients, customers, and partners.

About the Author

Kate Hamilton is the UX Strategist for Global Technology Services' Chief Data Office, and is a writer, developer, and UX practitioner with over twenty years' experience in the IT industry.

Acknowledgements

Eugene Kolker is the Vice President and Chief Data Officer (CDO) of Global Technology Services (GTS), the largest business unit of IBM. Eugene's mission is to leverage data and analytics as strategic business assets of GTS and IBM for data-enabled, better-informed decision making and execution.

Beth Rudden is a Distinguished Engineer and visual data storyteller. She leads large, geographically dispersed analytic teams to develop and deliver cognitive analytic solutions that deliver actionable insights for IBM's clients.

George Stark is a Distinguished Engineer of IT Operational Analytics, and specializes in organizational measurement programs and analytic models for decision-making, and has over 40 publications on software reliability, project estimation, and quality management.

Frank Bagehorn is a Senior IT Architect at IBM Research, whose work focuses on developing tools and applications for data analysis and record linkage.

Sarah White Eagle is a data scientist in the Data Analytics Center of Excellence, with a specialization in data visualization.

Footnotes

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2. IBM Services. "Sysco delivers for their customers with IBM Enterprise IT Automation Services" 19 April, 2017, https://www.youtube.com/watch?v=1-XoTiOGU00

3. George Stark. Personal Interview. 15 May 2017.

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Additional Resources

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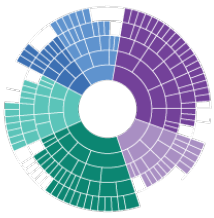

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