Up Your Up-Time with Automation:

Outage Pre-Verify

A Technical Paper prepared for SCTE by

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1. Abstract

The goal of tooling automation in operations centers is to speed the identification of issues and translate them into the swiftest fix agent response. Efficient management of outage events relies on multiple layers of detection tools that provide critical information for operations centers to coordinate event management and resolution. Numerous operation centers rely on Lines of Questioning (LOQs) to walk agents through key troubleshooting points to create consistent outcomes for identifying the root cause of system events.

The opportunity to reduce triage time comes from integrating key event knowledge points and automating LOQs to streamline assessment and dispatch tactics. Outage Pre-Verify (OPV) is a tooling automation strategy that creates technology solutions to automate current operation center processes. Process automation requires in-depth linkage of available system status data, understanding outcomes expected from LOQs, tooling development strategy, process optimization, and the capability to transition people through system changes. OPV takes the technology outage telemetry and enhances operational center processes by reducing triage time, improving event response time, and optimizing fix agent resources.

This paper and presentation will review strategies for identifying automation opportunities in outage triage. It will discuss how to optimize effectively transitioning people and business processes to integrate new tooling automation. Authors Kathy Fox, VP of Product Management, Excellence in Operations Centers (XOC), and Joann Shumard, a VP of Engineering Operations at Comcast, are leaders in Shane Portfolio's organization focusing on operational technology integration. They will detail the tooling transformation process and the impact on the user community. Emphasis will be given to effectively integrating automation change while simplifying the user experience and transforming operational processes.

2. Introduction

For several years now, teams at Comcast have focused on finding best practices and implementing them across all three Comcast divisions. As part of this best practice identification, process sameness opportunities have been discovered and implemented in the design, engineering, construction, and operations. While finding and implementing a best practice across three different divisions often takes a good bit of analysis, debate, and planning, once process sameness is in place, we then look to identify opportunities for simplification and automation. In this paper, we will review the automation of Comcast's OPV work where we focused on implementing process sameness related to both digital and analog node outages, measured the results, and then worked closely with these teams to identify specific improvements we could implement. We will review how we worked through data analysis, use case development, tooling requirements development, and finally tooling development, testing, and implementation to deliver automation that resulted in time savings for operations center technicians and truck roll reduction for our plant maintenance technicians both of which ultimately lead to a better customer experience.

3. Process Alignment

One area we previously gained alignment on across our three division operations centers was OPV. After much analysis and discussion, the teams had agreed upon a single process which included the same LOQs (Lines of Questioning) and timing for node outages to "soak", a term we use to indicate the period during which node components self-clear any alarms. It is important to note that nodes go into soak when a certain percentage of modems served by that node goes through a registration state change (to offline). The cost savings that resulted across our divisions with this process were noteworthy with a significant reduction in No Trouble Found (NTF) or Power Outage-related incidents as well as overtime savings.

However, the additional troubleshooting did create many more tasks (which means more time!) for our access network staff in the operations center. On a few occasions, the LOQs added enough triage time that the operations technicians were not able to keep up with all the triage activities, especially when node outages increased during inclement weather events, resulting in increased plant maintenance truck rolls.

The team began to investigate what efficiencies or automation we might deliver to the business to lighten the load for our operation center teams. There is a great deal of information that can be obtained from our network and the project team began to investigate what information might be available to help us more quickly determine if there was a power outage in the area. Any information that would tell us that nodes were in soak because a lot of customers had lost power would save our operations technicians a good bit of triage time either checking power providers' outage notification tools or calling the appropriate power company.

4. Technical Development

Aligned processes pave the way for automation. When processes and procedures are different across groups, the tooling is maintained in a customized and typically inefficient way. Once there is full cooperation in the way work is completed, the LOQs can be evaluated for automation opportunities. For OPV, building automation is focused on accuracy in identifying dispatchable outage events while reducing triage events for the operations centers. When considering the major steps of event detection—triage (LOQs), and Dispatch of a fix agent—automation provides the opportunity to bypass the manual triage and move the event to an auto dispatch state.

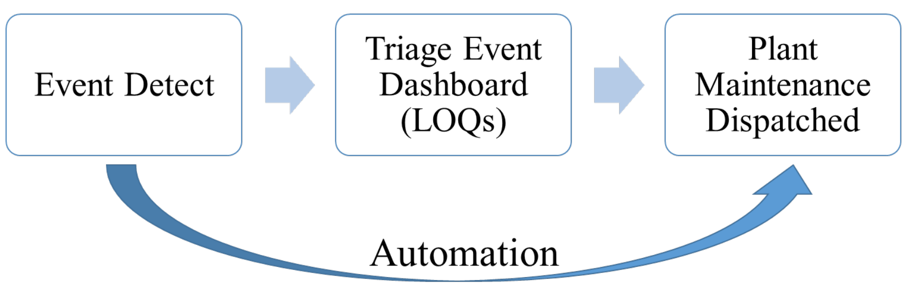

Figure 1: Manual to Automated Transformation

4.1. Design Methodology

In agile development methodology, the needs of the users drive the development requirements [1]. Sprints are used to develop iterations and progress towards initial implementation. For OPV automation, the requirements were captured from the initial manual implementation of standardized LOQs. This required a full review of which aspects of the LOQ could be translated into automated machine language.

Another aspect of agile development is to ensure there is clarity in task prioritization [1]. This is important to reduce the potential of rework and lost development. For OPV, this required full alignment will all key users to collaborate to maintain the standard from manual to automation. This ultimately translated into the initial user story used for the technology development.

During development, continuous user feedback was required to make final adjustments or address issues [1]. This required consistent connections with the teams currently managing outage events using the manual implementation of OPV. It also provided an opportunity to ensure the process was collaboratively reviewed for improvement opportunities.

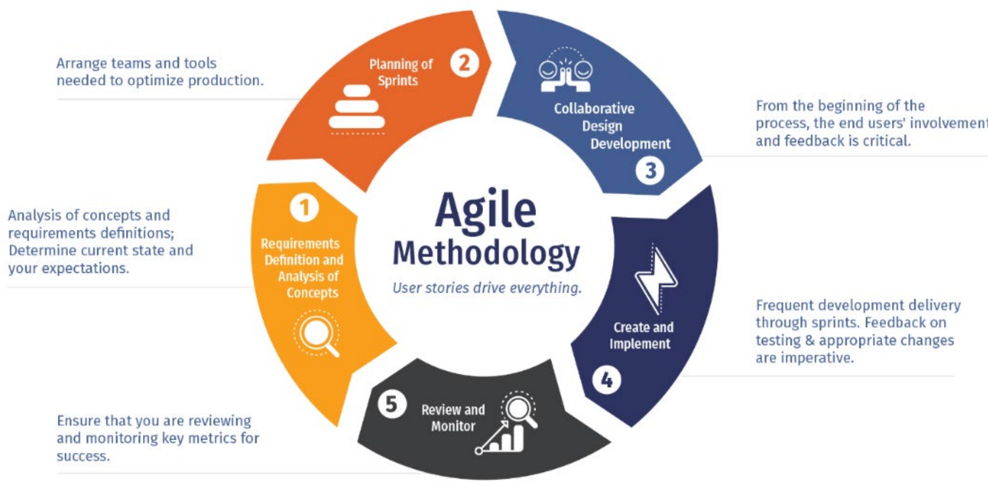

Figure 2: Agile Methodology [1]

4.2. Design Details

The logic of recreating the LOQs and drive automation capability was built to align with reduced field truck roll requirements while also reducing transactions for the operation centers completing the manual review. The summary of the key logic points of the LOQs and automation creation are:

- Upstream (US) Bandwidth Utilization.
  - Identification of a significant drop in US traffic;
- Upstream In Bps.;
  - Identification of a significant drop in US traffic.
- Power Supply Telemetry;
  - Identification of power current changes;
- Node Device Offline %;
  - The entire node was determined as a whole node outage determined by % of devices offline;
- Interactive Voice Response (IVR) Call Threshold; and
- Storm Mode Status.

These logic points are based on leading outage-based plant characteristics and time-boxed to provide assessment considerations for the algorithm. The target was to ensure that the logic was constructed so that it could be configured and adjusted as a part of continuous agile improvement. When considering the build of this type of automation, these characteristics and thresholds may fluctuate based on system architecture variations. The storm status is a specific consideration that considers how the algorithm adjusts as a system transitions from plant outages created by typical event types (degradation, plant damage, etc.). to the more rapid pace of storm creation where dispatching may be held until it is safe for fix agent technicians to engage.

4.3. Challenges

Through the agile process, consistent feedback from the users was key to preparing for the adoption of the technology. One challenge was ensuring consistency in the thresholds across the organization. There was considerable discussion about the variety of plant characteristics and local considerations that had to be integrated into the final algorithm. Overall, this challenge was met through the partnership commitment to consistency and the agility of adjustments throughout the build process.

The integration of power outage information is a continuing challenge that the team continues to evaluate. When the power supply telemetry identifies the absolute loss of commercial power, it combines into the logic cleanly. The issue is that power grid boundaries do not consistently line up with node boundaries which makes the automation more challenging. The logic requires telemetry of every system power supply to be reporting consistently but due to maintenance issues, a number of units may not be fully reporting. This ambiguity in the power status supporting the node can cause the event to transition from an automated event to a manual review triage requirement.

Obtaining a unified buy-in of the working logic of the resource teams required a commitment to integrating continuous feedback while utilizing data modeling to confirm impact assessment. The logic build required that consistency is maintained through collaboration and strategic focus on a common goal. With multiple division teams, opinions on the solution path varied at times but having a change strategy supported the success of the implementation.

4.4. Delivery

This logic sits in a user interface tool that is used to process the logic and translate it into actionable alerts and jobs. When the automation logic triggers a pre-verified outage event through automation, the logic flows to an automated dispatch of a plant maintenance technician to resolve. This ultimately reduces triage time by operations team members. Events that do not meet the logic parameters or are unclear become a dashboard task for triage and validation. The introduction of automation creates an immediate reduction as well as creates a platform for continuous process improvement.

5. Trusting The Technology

Research tells us that people will inherently trust technology to be accurate, but it relies on the simplicity of the data and how well they know the technology [2]. Research shows that people are more suspicious of accuracy when they tend to confirm information validity using their expertise and skills. This algorithm complexity also drives the teams who have historically reviewed the work directly to want to see incremental validation before trusting the value.

The trust-skepticism balance can be overcome through targeted training and providing cross-reference data that illustrates confirmation of event accuracy [2]. Balance can be achieved by implementing system verification and reporting to work in parallel with the new technology algorithm. The skepticism is created from the psychological bias that some may have against trusting the technology to replace the work they are completing. The vetting of information through the agile process development is a key component of the feedback loop.

Since Outage Pre-Verify (OPV) was an embedded manual process being conducted by industry experts, building trust in the information was key to preparing to adopt the new technology. This was accomplished through the trial process where events were confirmed valid when tagged for automated dispatching. Another key aspect was the creation of reports that illustrated that the volumes were not significantly changing while also measuring the value to the business.

Understanding the impact of the change is a key component of preparing the teams to trust the innovative technology. This logic analysis is designed to reduce LOQ manual tasks. The trust in the automation requires the team to build confidence in the accuracy of what is dispatched without manual validation.

6. Change Impact

With any technological change, we must care for the tools, the processes, the documentation, and most importantly, the people. Organizational change management has become part of our standard project practice and has been well-received by the teams we serve. Our teams have been utilizing the Prosci ADKAR Model (Awareness, Desire, Knowledge, Ability, Reinforcement) for a few years now with impressive results. This powerful model is based on the understanding that organizational change can only happen when individuals change. The ADKAR Model focuses on individual change—guiding individuals through a particular change and addressing any roadblocks or barrier points along the way [3]. We have found that investing time upfront to understand the impact on our people and to develop plans that care for those impacts, enables an improved implementation experience and is time well spent.

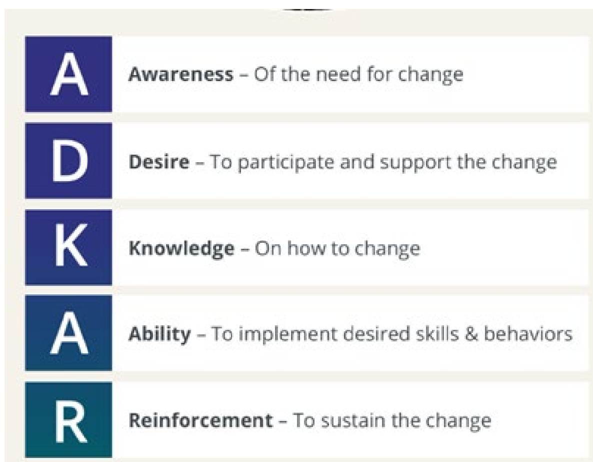

Figure 3: The Prosci ADKAR Model [3]

6.1. Planning the Change

During the initial project planning stages, we perform a change impact assessment. This involves project team members, change agents, and representatives from each of the expected impact areas. During the assessment, we look at each impacted role, discuss the expected impact in detail and determine if the change impact is high (a ‘5”) or low (a “0” or “1”) or somewhere in between. That information is then used in the development of the organizational change management plan.

For OPV , our operations center teams had been investigating node outages for several years, so they knew the time needed to determine if a node is in soak because of a commercial power outage. Our three division operations centers have somewhat different staffing models. Although the three divisions had agreed upon a single set of LOQs for OPV, one of our divisions had difficulty executing all the questions for the node soak triage because of staffing. As a result, they omitted some of the questions in the LOQ, expecting that future development would introduce time savings and negate the need for these questions. One of our other divisions had added the full set of LOQs but had not increased staffing for this effort so the team was feeling the impact on their workload. There was a desire on the part of the divisions to reduce the workload for the operations teams while maintaining the benefit of reduced plant maintenance truck rolls. The solution developed by the technical team was expected to reduce triage time by three minutes which is a significant impact given the thousands of triages performed by the operations centers each week. For the one division that had the abbreviated list of LOQs, the automation aligned them with the other two divisions.

For this technological change, the team quickly understood the resulting work benefit and considerable time savings, but there was also the potential that this advancement could introduce feelings of job insecurity or there could be a lack of trust in the solution being implemented. Insecurity or lack of trust in the solution could lead to resistance by the individuals impacted by this change. We wanted to proactively address the concerns and make certain the operations teams had Awareness of the change and a Desire to adopt it and the Knowledge to trust the solution (the "A" Awareness, "D" Desire, and "K" Knowledge in ADKAR).

6.2. Implementing the Change

When we can introduce an operational change as a trial, allowing the end-users to execute testing, it is a significant benefit. The first benefit is those end-users know the different scenarios they encounter every day, and they usually assign their most skilled users to conduct testing, validate the solution, or find issues that need to be addressed. The second benefit is the testers are part of the solution, they take ownership and often become champions of the change being implemented, helping other team members to adopt and accept the change once we move to full operationalization, supporting the "A" for Ability in the ADKAR Model.

Implementation plans will vary based on the Change Assessment results. For high-impact changes, we are certain to include formalized training, extensive communications, both written and verbal, and often, testimonials from testers or early adopters. We have created a detailed list of tactics that should be used based on the degree of impact. For the automation related to OPV , we considered it a medium-level impact and focused our communication on the efficiencies being provided to the teams while also sharing the new areas of focus for the teams. We were removing busy work to free them up to focus on more complex activities.

6.3. Challenges

Innovative technology implementations typically produce challenges. With OPV, we were fortunate to have the operations teams take part in the trial/testing phase which helped identify several technical improvement opportunities before implementation. We also found a number of process variances related to multi-node outages but were also able to address those, allowing for the solution development to be built one way.

7. Value & Results

The development process first determined what the initial goal was to create business value for the organization. The expected results were used to identify what level of reduction could be accomplished to reduce manual tasks. The reduction is calculated based on the total number of Hybrid Fiber Coax (HFC) outage events created then calculating the number of outages that were captured in the OPV engine and sent directly to the fix agent technicians. The total time per task for the manual process is calculated for this series of events. To calculate an estimate of cost savings, an industry estimated rate of $40 per hour is used for illustration. The launch of the new algorithm was implemented in mid-January 2022. The year-to-date average of reduced manual triage handling is 24% which is now the basis to increase automation in future iterations.

The figure below shows how significant the time savings are. The top line shows OPV performance for the three months before implementation of the OPV Automation. The bottom line shows the improvement for the most recent three months' performance with automation. The number of outages to be triaged is significantly less and the average completion minutes has dropped by more than the expected three minutes. Proper change planning ensured that the teams were part of both the journey and the solution, knowing what other tasks they would be working on once this automation was delivered. This type of reporting is shared with the teams to reinforce the benefits and highlight their contributions; the "R" in ADKAR is for reinforcement.

Table 1: Average savings, in minutes, for triage activities with automation

	#Triaged	Avg Completion Min	Avg Min on Dash	Max Min on Dash
OPV Prior To Automation	220,917	9.8	18.6	797
OPV With Automation	167,958	5.1	12.2	594
Reduction/Improvement	**52,959**	**4.7**	**6.4**	**203**

Susan Bean, Sr. Director, XOC & Excellence in Plant Maintenance (XPM) summed up the OPV benefit this way. "Last year, the division XOCs set out on a journey to showcase processes and collectively solve for areas of opportunity. One area of focus was finding efficiencies for node outage triage with the goal of quicker restoration times for our customers. The collaboration of the operations and development teams was critical to finding a common approach. We were able to identify a successful solution, removed non-complex tasks for our operations teams, and redirected their efforts to more complex work."

When calculating the value of the business implementation there are two considerations. The first is the overall task reduction which can be multiplied by the average manual task time to get working time saved for the quarter view. The secondary improvement is generated in the reduction of task triage time through the streamlining of the LOQs and reducing handle time. This led to an opportunity to save approximately 250k minutes in the quarter that could then be used to support additional events.

Table 2: Quarterly Time Savings Potential

	# Jobs Triaged	Average Completion Minutes	Total Time Minutes
OPV Prior To Automation	220,917	9.8	2,164,987
OPV With Automation	167,958	5.1	856,586
Time Saved	**52,959**	**4.7**	248,907

8. Conclusion

This evolution of automation followed a path from the historical manual triaging process of plant-related events but was transformed into a path of optimizing performance through automation. Aligning processes is foundational to tool development. When processes vary, the implementation of the tool is inconsistent and inefficient thus restricting the ability to automate. The focus of this initiative was to capitalize on the efficiencies gained through the consistent process and LOQs and utilize technology to reduce transactions and time to complete tasks.

Having an agile and inclusive development plant paves the way for the adoption of these new changes. Through collaboration, the continuous feedback loop in the development lifecycle aided in change acceptance and building trust in these new ways of completing work tasks. This first phase of automation has reduced total transactions by 24% while improving LOQ time efficiency by 48%. These strong results illustrate the reinvestment opportunity of these resources completing manual work by providing them the opportunity to focus more on complex tasks.

As the network continues to become more intelligent, there will be more information available, allowing our tools to self-diagnose and self-service for repair. This will free up our people resources to focus on more complex issues that need investigation as well as occasional problem escalations for resolution. To be successful, we must utilize agile development methodologies and exercise proper organizational change management practices to advance the network, systems, tools, and people collectively.

Abbreviations

ADKAR	Awareness, Desire, Knowledge, Ability, Reinforcement
LOQ	Line Of Question
OPV	Outage Pre-Verify
US	Upstream
IVR	Interactive Voice Response
HFC	Hybrid Fiber Coax
XOC	Excellence In Operations Centers
XPM	Excellence In Plant Maintenance
NTF	No Trouble Found
SCTE	Society of Cable Telecommunications Engineers

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