

# **We Have Arrived. Our Light Bulbs Finally Have IP Addresses!**

## **Approaches for Proactively Managing Customer Experience and Reducing OPEX in a Cable Operations Environment**

An Operational Practice prepared for SCTE/ISBE by

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## Introduction

We have arrived. Our light bulbs finally have IP addresses!

Meanwhile, operators must hire buildings full of customer service representatives (CSRs) to answer questions about networks and devices over which they have little control. There's a better way to maintain and grow the Customer eXperience (CX) by leveraging data, technology, and methods that are available today.

Homes that previously hosted a single computer with high speed data service now have numerous Internet of Things (IoT) devices, complex Wi-Fi networks, and subscribers that insist it all work seamlessly. Business subscribers and home-based workers have even higher expectations. Call centers are strained trying to keep up with technology advances and are buried under a growing call volume.

In their *Customers 2020* research, a Walker study finds that CX is overtaking price and product as the key brand differentiator. In fact, over 85% of subscribers would be willing to pay more for a better customer experience [Campbell]. Poor experiences drive consumers to buy less and share their bad experiences more. According to the White House office of consumer affairs, news of a bad customer experience reaches more than twice as many ears as praise for a good service.

For call centers, the days of simple workflow, scripted line-of-questioning tools have passed. Energetic cable operators have attempted to take a next step by aggregating piles of data into one screen, only to find they still are not getting ahead. CSRs are not analysts: there's not enough time on calls and not enough training available for operators to expect them to arrive at a clean situational view of a subscriber's service challenges. While some tech savvy cable operators are performing some form of periodic subscriber churn analysis or leveraging basic data aggregation to guide call center workflows, a more comprehensive approach is needed.

Additionally, with CX impacting all areas of the cable organization, advanced strategies must be up-leveled and made a top priority across the organization, combining resources to establish a systematic and aggressive CX plan. Business survival is at stake, as a growing number of subscribers have alternative service options available and are being marketed to for additional revenue.

This paper discusses CX drivers, reviews metrics, and lessons learned from several CX initiatives. It also provides an approach for addressing CX challenges. A cross-group view is used here as the basis for discussion – in an effort to give the reader a larger vision of the CX opportunity.

## The Changing Service Environment

### 1. Dramatic Changes in the Service Landscape

This section outlines several of the complexities operators must deal with in their pursuit of the happy customer.

### 1.1. Experience Is The Brand

Brands are no longer valued strictly on product experiences. Every interaction with a company becomes part of the aggregated subscriber experience, allowing people to quickly compare companies to their competitors [Forbes].

According to a Walker study, by the year 2020, customer experience will overtake price and product as the key brand differentiator. In a world of information everywhere and immediate gratification, immediate resolution may not be fast enough, the Walker study says. Consumers will demand personalized support experiences and expect companies to resolve their current (and even their future) needs.

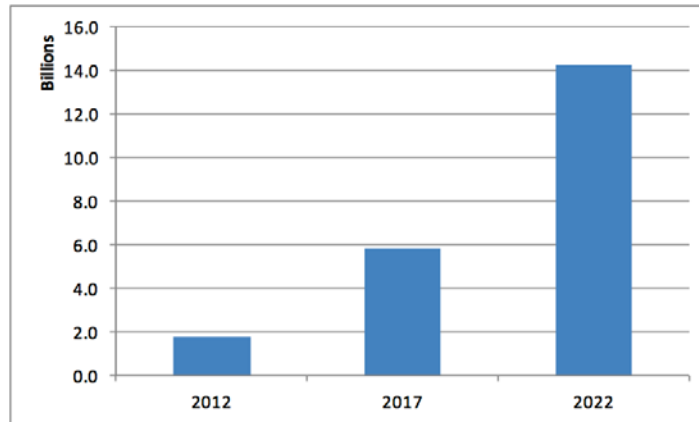
### 1.2. Home Network, Transformed

It's a new era for connected consumer electronics. Today's home network allows us to consume media in new ways, supports home security, helps us stay connected with family, and allows our printer to order its own ink. With this growing digital lifestyle, home network complexity is skyrocketing. An operator's responsibility no longer stops at the Customer premises equipment (CPE). The subscriber's expectation of service health isn't lessened by the device they're using, the room they are in, what's happening outside the home, or how much bandwidth is being used.



**Figure 1 – A New Era in the Connected Home**

Trends in the volume of connected consumer devices show no signs of slowing. By 2020, OECD predicts that an average home could have as many as 50 connected devices.



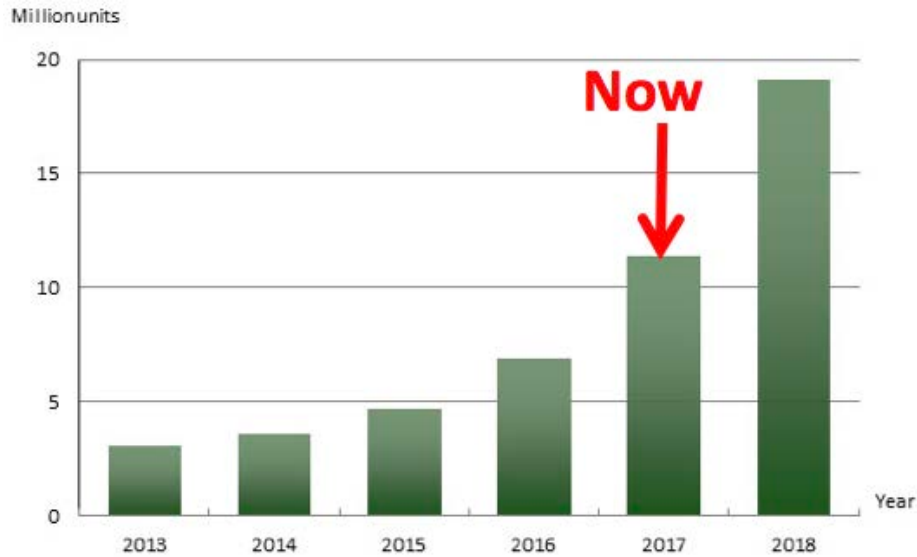
**Figure 2 – Total “Smart” Devices in Households (Estimated)**

**CPE:** To satisfy connectivity needs for these devices, CPE (including modems and home gateways) is playing a more complex role in the home. Devices are often shipped with dual-band Wi-Fi capabilities, while also managing all IP traffic, high speed data functions, voice service, security, parental controls, and acting as a local router. In the role of a residential gateway, subscribers expect it to handle any flavor of consumer device in the home. Subscribers attempt to be their own IT administrators, dealing with the numerous subscriber-facing configuration options – which allow a complex set of combinations.

### 1.3. Medical Home-Care

Broadband service has become mission critical for a growing population of subscribers using network-enabled medical devices from within the home. Berg Insight forecasts that the number of patients using connected home medical monitoring devices will grow at a compound annual growth rate (CAGR) of 44.4% to reach 19.1 million in 2018.

In this scenario, CX expectations could be magnified by potential business partnerships between service providers and health organizations, where premiums are paid by health organizations for a higher service level. Here, it’s possible auditable records would be required along with faster response times during service impairments. Even after subsidizing connectivity, cost savings in health care costs could be recognized [AHA]



**Figure 3 – Connected Home Medical Monitoring Devices, (World 2013-2018)**

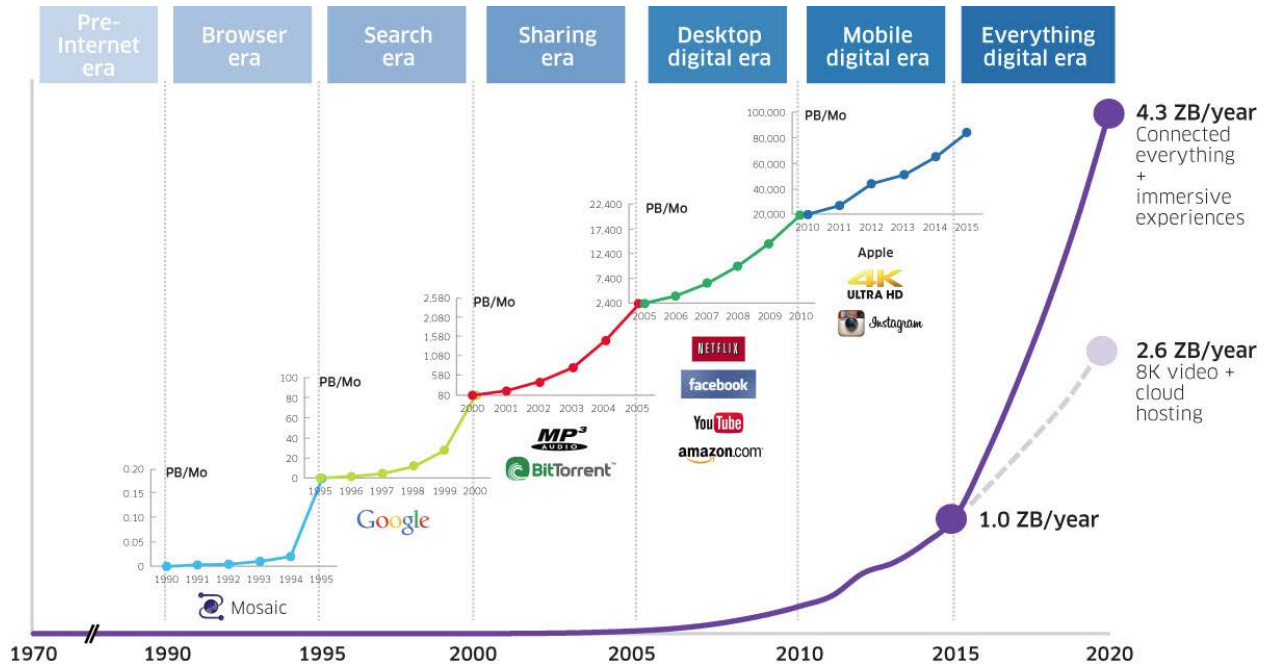
#### 1.4. Capacity and Architecture Challenges

In addition to the expanding home network, operators battle numerous challenges as they expand and improve service.

**Bandwidth:** Consumers’ insatiable appetite for bandwidth is triggering massive shifts in the Hybrid Fiber Coax (HFC) network architecture. Global consumer Internet traffic has seen a 5x increase in the last 5 years and could increase 3-4x by 2020 [Davidson]. Driven by this, complexity is being magnified by new DOCSIS® standards, updated hardware for headend, plant, and home, all with new management interfaces. This creates a balancing act as operators work to align the timing of their network expansion to meet consumer demands.

Consumers are impacted by the legacy HFC plant, neighbors consuming bandwidth on shared channels, network interference resulting in Codeword Error Ratio (CER) and lower throughput, and home network and device issues.





**Figure 4 – Data Transfer Projections to 2020 (source: Bell Labs)**

Deployment of higher-level QAM for increased capacity demands tighter Radio Frequency (RF) performance tolerances, further increasing the demand on operators to proactively manage the plant. Forward Error Correction (FEC) and Adaptive Equalization (EQ) techniques compensate for RF/interference issues to a point, yet can't protect subscribers from inevitable service impairments. Growing trends toward Distributed Access Architectures (DAA) and migration of core functions from the headend to the outside plant could exacerbate challenges in aerial networks as weather and other environmental factors wreak havoc.

### 1.5. A Typical Day: One Operator's Struggle

There are so many things that can interrupt service and whole operator teams are created around manually triaging and resolving service issues.

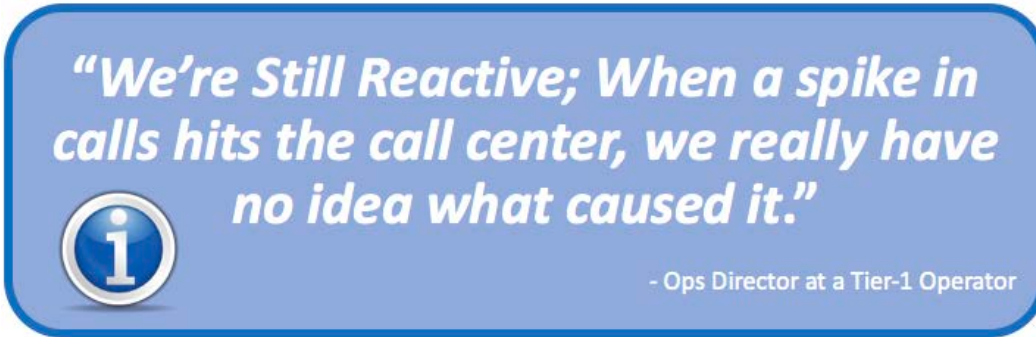
The day-to-day manifestation of these operational challenges was summed up by an operations director of a large cable operator earlier this year:

*"We're still reactive; When a spike in calls hits the call center, we really have no idea what caused it. Another analysis begins."*

This director made it clear that it goes far beyond issues in the plant. He continued,

*"Despite our efforts gathering data and making it visible to engineers and CSRs, most correlations are done manually. We can't tell if this event was caused by a recent CPE firmware update, a model of consumer device that just received an update, upstream noise in the plant affecting subscribers all over the node, or even some intermittent noise from an outside source in the area. Those intermittent ones are the toughest."*





**Figure 5 – Ops Director’s Quote on Struggles Triaging Call Center Spikes**

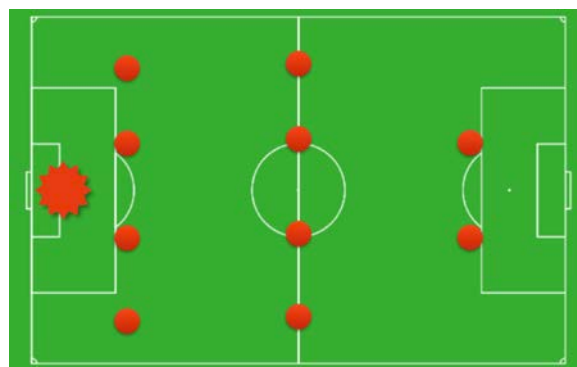
## 2. Taking the Next Step

### 2.1. Who’s Got The Ball?

In the previous section, the director’s statements identify a lack of visibility across realms and a gap in understanding and sharing data. In organizations across the globe, we see endless amounts of data being gathered, maybe post-processing for post-mortem review. However, insights and correlations are not keeping pace with expectations, they are not leading to actionable, impactful results.

While the scenario above begins in the call center, the larger issue really is organization-wide. Managing CX and related OPEX-heavy activities starts with the very first truck-roll.

A simple sports analogy helps explain the group dynamics involved: In soccer, whose job is it to prevent a goal from being scored by the opposing team? It’s not just the goalie/keeper. Every person on the field has a role. Translation: whose job is it to address a service-affecting event that drives calls to the call center? The whole organization. The goalie (call-center) should be treated as a last resort in preventing loss.



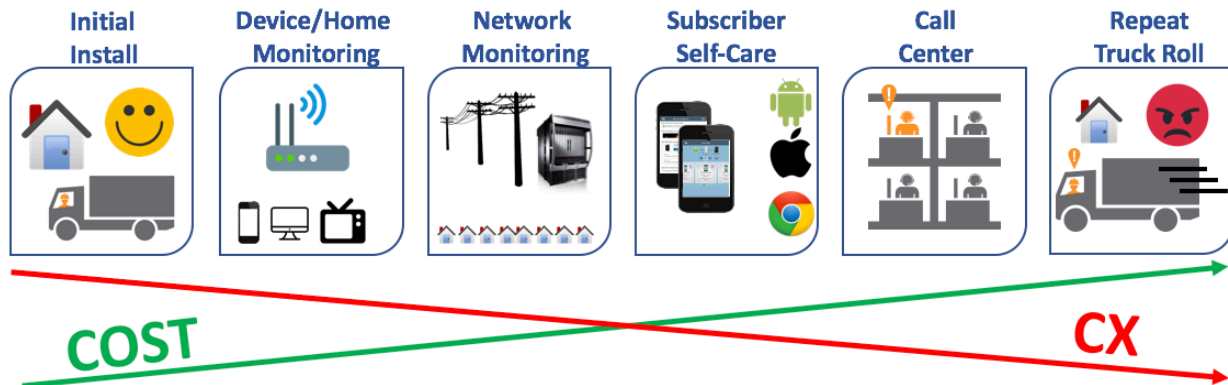
**Figure 6 – Entire Team Must Protect the Goal (a.k.a. Call Center)**

In business terms, the deeper into the organization a service event reaches before resolution, the more expensive it is and the more impacted/upset the subscriber (lower CX). This is why programs aimed at CX and call center success must be a cross-group effort. After reading this, an expected reaction is “Well,

*that's obvious...*” Maybe, but here’s the reality in most organizations, as observed during numerous engagements with operators around the globe over many years:

**Table 1 – Reality of Inter-team Dynamics & CX Efforts**

<b>Examples of Operations Not Targeting Overall Company Targets</b>
Directors protect their own OPEX/P&L hoping for another team to pick up the expense of intelligence projects
Revenue-generating efforts are funded heavily while OPEX-driven programs are constrained, despite the expectation of positive ROI on OPEX-saving investments
Internal teams point to each other as the culprit in service outages
Technicians are lightly armed with tools needed to properly perform Install/Repair (I&R)
Technicians are often pressured/incented to get on to the next job
Network Operations Center (NOC) analysts are not given the time to appropriately study situations, capture metrics, create an audit trail, and root cause; losing a golden opportunity for future pattern recognition. Trouble tickets often go unclosed or not updated with root cause and summary info
CSRs find ways around any Method & Procedure (M&P) to (1) appease subscribers by rolling trucks and (2) improve their metrics by shortening call times and getting on to the next call despite the best intentions of managers
Call centers that continue to allow non-standard experiences – where CSRs have too many views, too much data, and their “favorite” screen/tool, thus reducing impact of M&Ps and training
Lack of cross-group feedback cycles – preventing proper knowledge transfer for top service impacting use-cases that would prevent issues in the future
Lack of sophisticated integration between tools/groups, preventing true interpretation of the customer experience



**Figure 7 – Cost, CX, and the Impairment Management Lifecycle**

What are some ways that this can start to be addressed? Improvement opportunities for these areas are reviewed in sections below. More important than emulating one specific program is establishing and maintaining an organizational mindset of incremental improvement through common goals, automation, technology, and measurement. Projects tagged with saving the world are doomed to fail – instead, small wins justify continued resources and maintain team motivation.

## 2.2. Organizational Strategy

CX efforts relate to groups across the organization and are made stronger when coordinated. To be successful, progressive companies will need to view customer satisfaction as an executive leadership role and that the role of “Chief Customer Champion” will become more commonplace. [Walker]

Here are two recent success stories from the telecommunications industry:

**Rogers Communications:** Through intense focus on the customer, Rogers has reduced customer complaints by 50% between 2014 and 2016 [Forbes, Davis]. Deepak Khandelwal, Rogers Chief Customer Officer, crisscrosses Canada to communicate his frontline perspective directly with call center staff and field techs.

**A large tier-1 telco in North America:** This organization established an executive-level role focused on improving the customer experience. Operations leads and consultants interviewed for this paper stated that an immediate effect was realized as cross-group roadblocks were removed and efforts aligned, resulting in up to 5% reduction in OPEX on key programs.

Why does this work?

- Having a common leader with unified goals helps reduce the urge for individual teams to prioritize protection of their own budget and P&L over the larger company goal
- Resources can be shared and project redundancy reduced, minimizing a dynamic where one team is “taking the hit” for another team’s benefit
- More transparency and measurement drives data-driven identification of trouble spots and stops teams from blaming each other for service issues

- A thoughtful solution architecture can be established and incrementally improved, allowing foundational technology and services to be shared. An example of this might be a common telemetry collection and storage program that feeds analytics and IT efforts on multiple programs

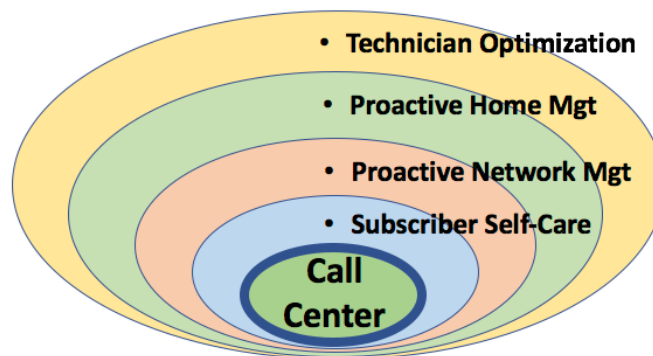
While all this sounds like great news, only 39% of companies have at least 1 senior-level executive leading the CX charge [Forbes]. If not an executive position, operators should consider establishing a strong leader who is empowered to unify CX efforts, establish clear goals, learn from industry lessons, make mistakes, and, more importantly, commit to a cadence of continued incremental improvement over time.

The specific programs and proposals captured in this paper should be viewed through the eyes of a Customer Experience leader. Think bigger than your realm.

## Real Examples: Proactive Issue & Call Prevention

A key goal of this paper is to discuss how a more integrated and auto-interpreted Situation Analysis helps transform operations success. Those topics will be discussed and it is critically important to include strategies for proactively preventing the call in the first place, thus lowering OPEX and increasing CX.

Figure 8 illustrates several layers of operational protection that should be in place; groups driving these areas should be chartered with aggressive and insatiable call/issue prevention. This layered graphic will act as a guide through preventative strategies discussed below.



**Figure 8 – Issue & Call Prevention is the Top Priority**

### 3. Field Technician: The Front Lines

The world of the field technician is a world of competing priorities: They must complete high quality work and provide a focused personalized experience to the subscriber – while at the same time work as fast as possible and get to the next job. Operations managers reading this paper have no doubt seen technicians do whatever they need to do to get out of the subscriber home and on to the next job, even if it means someone will need to fix service issues after the fact. There are certainly technician-based

challenges, but technicians are not to blame. Most of the larger opportunities for improvement are based on repeatable and systematic operations programs created and driven by field ops management.

### 3.1. Case Study: Preventing Wasted Trouble Calls With IVR

Technician productivity can be increased by using automation to maximize the prevention of wasted I&R trouble calls. In one region of a sizeable cable operator, an Interactive Voice Response (IVR) system was used to automatically call ahead to subscribers with a trouble call scheduled for the following day. (Specific numbers are purposely withheld to help maintain the anonymity of the operator). Subscribers answering the call were asked if they still had an issue, and were given the option to cancel or reschedule the work order by pressing numbers on their telephone. Of those that answered, an average of 10% cancelled or rescheduled each day, leading to a daily prevention of truck rolls that would have resulted in *Customer Not Home* or *Reschedule Request* scenarios. This one simple program saved the operator over \$2 million annually.

### 3.2. Case Study: Field Work Certification Program

A business process analysis was performed on three cable markets at a mid-tier cable operator suffering from abnormally high repeat truck roll volume – driven by a large number of customer calls and complaints. One of the early findings was that most of the customer calls occurred within one or two days after completion of a residential trouble call.

It was then determined that technicians, often contractors, were financially incentivized to maximize the number of jobs completed per day. Without proper quality/metrics programs in place and limited management visibility, technicians would rush through I&R work and on to the next job, often leaving the subscriber with impaired service (low SNR, high CER) or resolving one service while negatively affecting another.

To address these challenges, a field work certification program was created whereby technicians were required to use a mobile platform to certify the work they had just completed and archive the results for future reference. The interface was designed to provide raw data for those that could understand it, and it also allowed for a simple Pass/Fail indicator on the most important metrics. This simplified view took the guess work out of completion results and allowed technicians to move quickly.

Records could be viewed later and aggregated into management metrics reports. Additionally, work quality and repeat rates were added as key factors for compensation packages.

Several dramatic results occurred, as outlined in the table below.

**Table 2 – Key Findings of an Install/Repair Certification Program**

#	Key Finding	Impact to Business
1	Techs more effective	Having better tools and recognizing the focus on increased transparency, technicians were better prepared and more thoughtful about on-site work completion / quality. This was also helped by the normalized mobile interface, giving the

#	Key Finding	Impact to Business
		technician a common look and feel no matter what vendor/model of cable modem was involved.
2	Records helped future techs	Future technicians were better prepared for trouble calls at the same location since they could (a) look back at previous work certificates and evaluate the state of service during previous work orders, (b) read technician comments, and (c) see how the environment had changed.
3	84% Fewer Calls to Call Center	<p>A dramatic reduction in repeat trouble calls to the call center was recognized. Since technicians were now able to clearly see lingering issues in the home, they were guided to resolve them before closing the work order.</p> <p>A key part of this success was that field techs were given the extra time required to properly validate &amp; cleanse the home service during the same truck roll.</p>
4	82% fewer repeat truck rolls	<p>A dramatic reduction in repeat truck rolls was recognized. This was primarily driven by first-visit resolution on previous truck rolls.</p> <p>To accomplish this, field managers had to improve handling of work orders in jeopardy (jobs scheduled later are at risk of starting late) when a tech had to stay longer at a job.</p>
5	Better management visibility	With the archived data, managers had better insights into which technicians were closing jobs without properly resolving key home issues, allowing them to better target training and performance programs. Key data was available to allow for correlations between device models, firmware, and RF performance.
6	CSRs viewed certificates in their M&P	Although not optimized for the call center, CSRs and Level 2/3 troubleshooting/support engineers used these historical certificates for improved visibility when handling customer complaints. They could see that the service was certified and working well at the time of work order completion.
7	False negative RMAs reduced	One way CSRs would appease customers was to have the subscriber's CPE replaced with a new device. While this may have helped and end the support call quickly, it did not resolve service issues and unnecessarily increased RMA load. Since there were fewer subscribers calling with issues, there was less opportunity for a CSR to send a replacement CPE.



It's recognized that these reductions in calls and truck rolls were dramatic; this organization had a long way to go. That said, even for well-trained and well-armed field teams, this type of a program can have a strong impact with a positive ROI.

For operators that have a certification program in place – or who don't want to impact the field technician's work load, variations on this program have been implemented across other global operators – with positive results. For example:

- 1) **Auto-Baselining:** One operator has launched a program to automatically create work certificates for CPEs deployed within the past two days. This is accomplished with a small amount of scripting and leveraged real-time web services typically available with most modern enterprise-class DOCSIS surveillance platforms. Through this effort, a service baseline exists for every device – which can be referenced during future troubleshooting events.
- 2) **Pre/Post Trouble Call Certificates:** Another operator also leverages validation/certificate web services by automatically creating them before and after each trouble call. How it worked: The night before a scheduled trouble call, a work certificate was created for any DOCSIS device with a scheduled trouble call the following day. Following closure of the work order, another work certificate is created, providing visibility into the impact of the work.

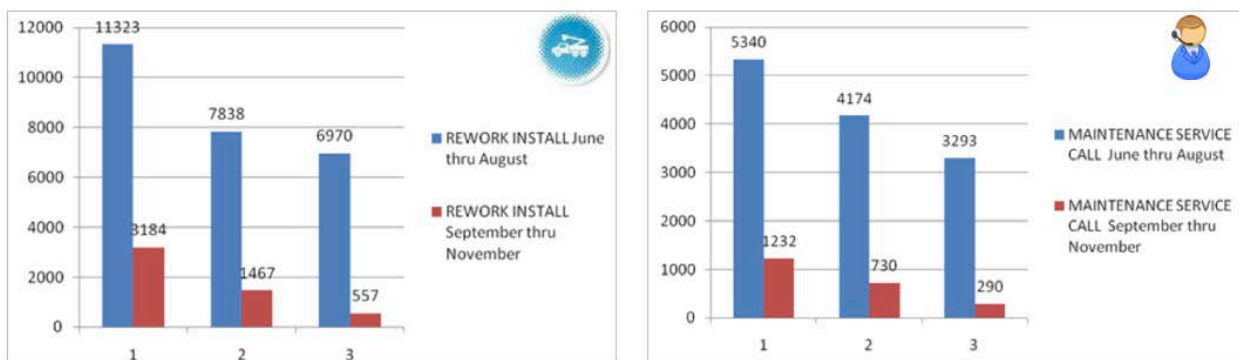
Notice that in the two cases above, the technician did not need to do extra work onsite other than perform their regular field I&R duties well. One way to get started is to focus programs like these on VIP/Business subscribers or those purchasing the premier product/speed package.

\$1.6

million

Savings in One Quarter

- Repeat truck rolls reduced by 82%
- Fault-based Service calls reduced by 84%



**Figure 9 – Case Study: Impact of a Birth Certificate Program**

## 4. Proactive Network Management

Cable operators have historically had some sort of script to look for sudden drops in online modem counts. While basic tools like these are helpful, operations teams are unfortunately alerted reactively –



after customer impact has occurred. Today, enlightened cable operators are working to become more proactive, focusing more programs that attempt to prevent outages. Hard work by CableLabs has really expanded the discussion.

A great deal of investment is being made by leading cable technology vendors to deliver a fully proactive solution, with the goal of transforming the way operators maintain the plant and prioritize work. The new goal is to find and fix network impairments without subscribers ever knowing there was an issue.

#### 4.1. Case Study: Impact of a Proactive Network Management Program

In a project with a large cable operator, a proactive network management program was launched. This particular deployment covered a region with over 2 million DOCSIS modems. While this operator is quite cable & tool savvy, they had the following goals:

- 1) Help them evolve their maintenance program to be more proactive.
- 2) Leverage a system that automated much of the work done by their network analysts.
- 3) Correlate the tsunami of network symptoms & events into the root cause, squelching the volume of data.
- 4) Lessen the need for “eyes on glass”, driving automation and notification into daily processes.
- 5) Assist them in determining the probable location of impairments.
- 6) Detection of granular events, allowing pin-pointed truck rolls. This minimizes service impact since techs now knock fewer people offline – while disconnecting network elements during the maintenance window. (Think: work on a tap, not a node.)

**Table 3 – Key Findings of a PNM Program**

#	Key Finding	Impact to Business
1	Shift from Reactive to Proactive	Organization was able to shift daily processes and workflow from Reactive to Proactive. To find targeted network areas to work, they relied less on surprise call spikes from the call center and more on automated fingerprinting of RF impairments.
2	More automation in NOC meant less time searching in the field	<p>Proactive Network Maintenance (PNM) analytics &amp; tools cut through mountains of data to help determine impairment location, while preparing the majority of the data for the work order. Analysts had advanced tools to fill gaps where necessary.</p> <p>Maintenance work allocation:</p> <ul style="list-style-type: none"> <li>• FROM: 20% in NOC, 80% in Field</li> <li>• TO: 80% in NOC, 20% in Field</li> </ul> <p>While there will always be a need for expert line techs in the field, this shift allowed field teams to focus on execution and smarter maintenance strategy rather than roaming searching for the source of impairments.</p>

#	Key Finding	Impact to Business
3	Planning Cycles	Shifted from weekly maintenance planning schedule to a daily standup. The team was able to prioritize quickly and address service interrupts more readily.
4	Home wiring	Previously, truck rolls were sometimes wasted as CSRs and analysts struggled to separate in-home issues from neighborhood impairments.  Analytics produced a “home score”, which clearly separated in-home wiring issues from neighborhood plant issues. These homes were also seen as a potential source of noise ingress. Operations processes were modified to attach tickets for individual homes to line tickets, so several issues could be resolved with one truck roll.

#### 4.2. Global Trend: Separate Proactive Team

While there is always a need for a quick-reaction team to handle network outages, there is a growing global trend among enlightened cable operators to establish a *separate proactive plant maintenance* team.

This team is tasked with more strategic efforts: finding large-impact maintenance opportunities; identifying performance characteristics among plant hardware vendors/models that impact multiple regions; improving proactive impairment detection strategies and tools; and working on the big challenges that frequently-interrupted outage teams would not have time to focus on.

At a few operator sites, separate proactive NOCs have been built – allowing customized war-room views to be displayed on the wall, different views into RF telemetry to be evaluated, and maintenance truck rolls to be dispatched. The prevention of outage-based distractions allowed this team to look further ahead. The results are clear: Dramatic reduction in trouble calls and truck rolls to the plant.

Not all operators are ready for this step –the important point here is to recognize that focused time and resources are needed to transform cable operations from reactive to proactive. As previously mentioned, steady incremental progress is more important than attempting a Hail Mary project. As a way to get started, a few cable operators have established a tiger-team to brainstorm proactive solutions, evaluate tools, and, to be actionable, rotate line technicians in/out of the tiger team periodically to give them and the team a fresh perspective.

### 5. Monitoring the Home Network

A growing number of operators are choosing to aggressively deploy residential gateways or Wi-Fi-enabled modems. Working with these operators day-to-day, it’s clear the demand to meet time-to-market milestones is intense. With few exceptions, early Wi-Fi launch strategies follow an approach of *get-the-service-out-there-and-manage-it-later*. This has magnified the complexity of operator-customer expectations greatly. As reviewed in earlier sections, subscribers struggle with seemingly simple network management tasks and are flooding call centers.

In mid-2015, one large cable operator with an extremely aggressive Wi-Fi market launch experienced the operational impacts shown in Figure 10. Such support loads are not sustainable and will demand an equally aggressive monitoring strategy.



**Figure 10 – Early Operations Impact of an Aggressive Wi-Fi Program for a Large Operator**

Globally, it’s early days for automated Wi-Fi analytics and proactive management, resulting in a desperate need for structured programs to (a) expand visibility into the home network and (b) leverage automation to help reduce manual surveillance and support efforts. Some ideas on how this can be impactful appear below, and later sections will review how intelligent insights could be used in the call center.

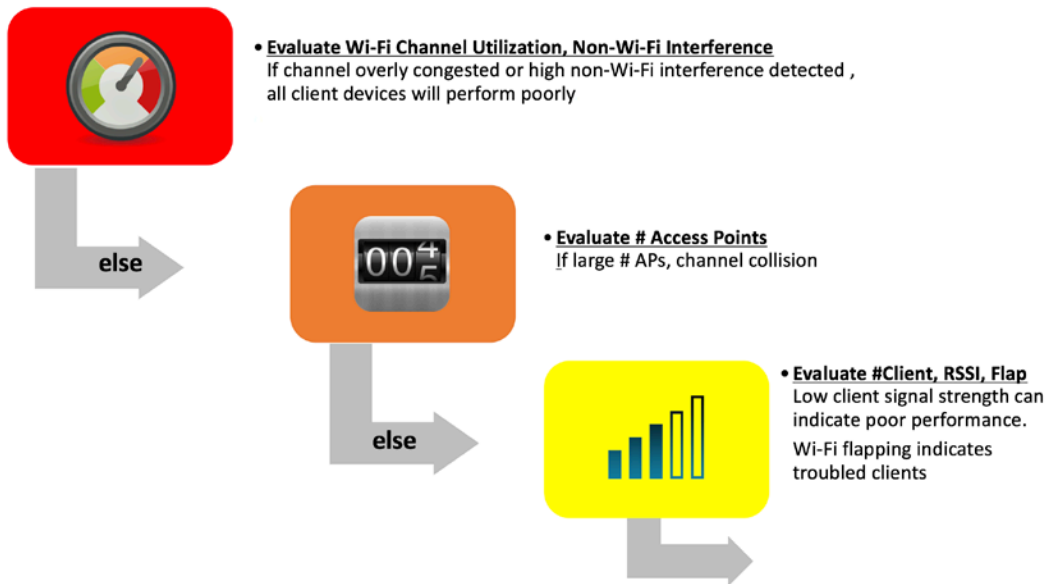
### 5.1. Remote Home Surveillance & Wi-Fi QoE

As was done for cable modems during early DOCSIS days, operators are now expanding telemetry collection, on-demand tools, and data storage strategies to include Wi-Fi and home network data. This is the starting point for IT teams, so that infrastructure and tools can be built.

The volume of surveillance data required to represent today’s home network has grown – leveraging protocols like TR-069, TR-181, and XMPP for visibility to attached consumer devices. Various approaches are being discussed for how to determine problems in the home network and there are lots of places where problems can occur.

Providing algorithms and specific object identifiers is not the goal of this paper – however, the general concepts should be clear. If we start by attempting to characterize a single home, one reasonable approach is to look for issues that affect all devices in the home –and then get more specific from there. The general flow is described here with a more specific example in Figure 1.

- (1) Identify critical issues that impair home Wi-Fi service (all clients likely impacted).
- (2) Identify pocket issues that could impair normal operation for multiple devices (users will likely have a mixed quality experience).
- (3) Examine individual devices to determine impact.



**Figure 11 – Early Thoughts on Home Wi-Fi QoE**

Additional examples of remote automations to be considered for healthy Wi-Fi service:

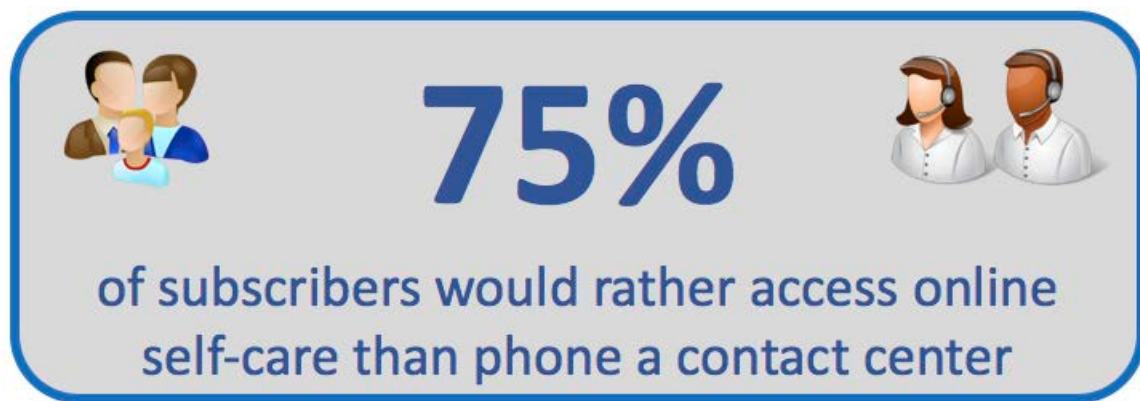
- 1) **Security:** Automated identification of gateway security issues creating service risk, and automated workflows triggered to resolve them.
- 2) **Old Devices:** Identifying older 802.11 devices which, on certain gateway models, slows service down for all attached devices.
- 3) **Low Signal:** Sustained low signal strength (RSSI) for attached devices (careful to make use of “last seen” time to filter out offline devices that some gateways may remember).
- 4) **Flapping Devices:** Flag devices continually connecting/disconnecting from the gateway.
- 5) **Too Many Devices:** Look for very large number of devices attached to the gateway.
- 6) **Interference:** Determine regional interference issues impacting Wi-Fi (correlate to geographic areas).
- 7) **Throughput:** Heavy channel load or link bandwidth may indicate over-use of limited bandwidth resources.
- 8) **Wi-Fi “Birth” Certificates:** Manual or scripted service certificates for connected devices, Signal Strength, AP configurations, and more.
- 9) **Service Package:** Correlating gateway configuration against the billing system to determine if subscriber is getting less/more features than they are paying for.
- 10) **Temporal Issues:** Track patterns over time, find repeated cycles of Good / Bad service.

These are just a few examples of opportunities for automated Wi-Fi surveillance. The output of these types of programs is critical for being able to manage home service profitably.

## 6. Subscriber Self-Care

### 6.1. Subscribers are Ready

Tools allowing subscribers to help themselves are more common today than ever before and provide a huge opportunity to prevent calls to the call center. What used to be as simple as a web page for Frequently Asked Questions (FAQ) is often now an interactive system or mobile app. In a survey published in 2013, 70% of consumers expect companies to offer some sort of self-service application [Van Belleghem].



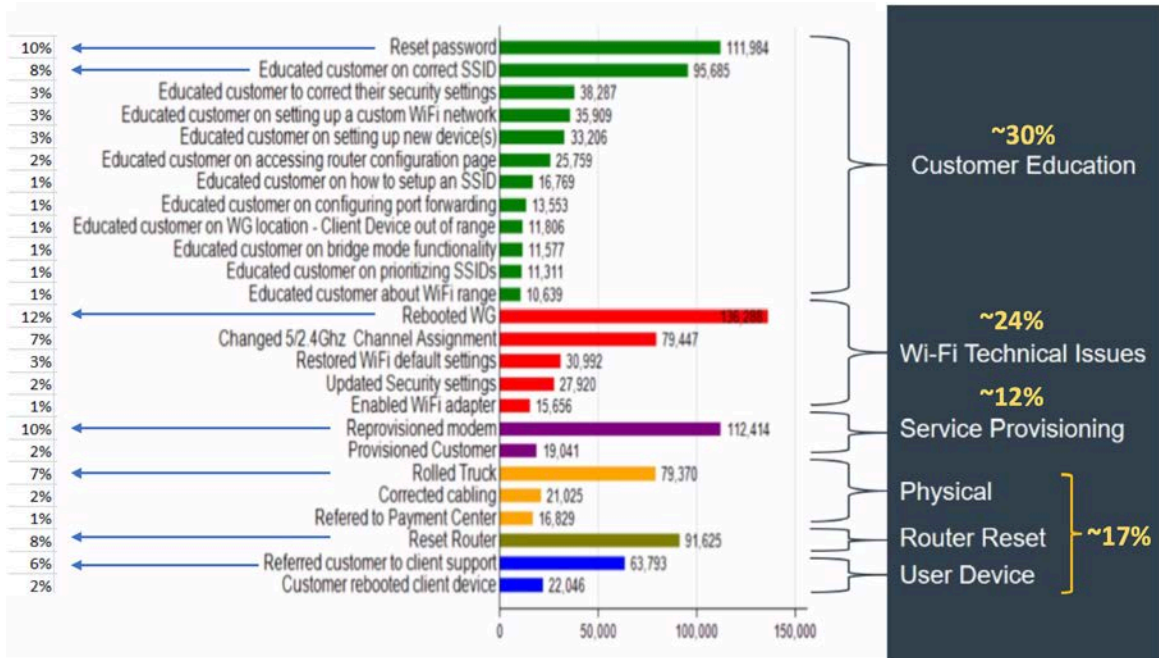
**Figure 12 – Consumers Are Ready for Self Care**

The self-help trend is seen everywhere in society: people use ATMs and mobile apps instead of bank tellers, choose the self-checkout isle when buying groceries, pump their own gas, and order coffee via their phone. Nearly 3 out of 4 consumers prefer to solve customer service issues on their own [Aspect], and Gartner predicts that by 2020, customers will manage 85% of their relationship with the enterprise without interacting with a human. In fact, 65% of consumers surveyed in a 2015 study for Aspect said they felt good about themselves and the company they were doing business with when they could resolve a problem without talking to customer service.

### 6.2. Wi-Fi Calls Dominate the Call Center

The growing self-help trend is very good news for operators. Working with a large cable operator in their call center, it was observed that 30% of technical calls (e.g. non-billing) were Wi-Fi related. Of those, over 30% were resolved through subscriber education, with customer’s often asking “*What is my Wi-Fi Password?*”, and “*What is my Wi-Fi SSID?*” Another 20% were resolved by rebooting a CPE/gateway.





**Figure 13 – Wi-Fi Resolution Codes in the Call Center**

These use cases are perfectly suited for a subscriber self-help application. Part of the value comes from the fact that a self-help app user interface offers a normalized experience. It looks virtually the same no matter what gateway vendor the operator chooses to deploy.

ARRIS is deploying its Wi-Fi self-help portal app with a tier-1 telco in Latin America and expectations for call deflection are big. Rebranded to match the look and feel of the provider, subscribers can easily perform basic home network management functions from their mobile phone – like those discussed above as top call reasons including: check gateway status, view Wi-Fi password, enable guest Wi-Fi, view the home network, review top FAQ articles, and much more. The operator has a mixed deployment of multiple Wi-Fi gateway vendors – yet the subscriber self-care app looks the same.



**Figure 14 – Intuitive Wi-Fi Self-Service Tools**

### 6.3. A World Without Self-Care Apps

Let's take a moment and review what a subscriber must do to configure their Wi-Fi gateway without an integrated app:

- 1) Get on a PC physically wired to their router.
- 2) Use Google to determine the default non-routable IP address of their gateway model (and understand what an IP address is).
- 3) Open a browser on the same network and type in the IP address.
- 4) Subscriber must remember that the gateway admin UI user/password is not the same as their Wi-Fi SSID password, their email password, nor their computer/PC password.
- 5) Use Google again to determine the default admin user/password for their specific gateway vendor.
- 6) If they get this far, they need to then spend an hour with Google deciphering Wi-Fi security settings and why their child's Xbox won't connect to the Internet.

Self-care apps simplify the experience for subscribers managing their home network and will have a significant impact on cable operations and customer satisfaction. Later in the paper, read about how the mobile app provides the perfect platform for operators to deliver proactive service alerts.

## A View from the Call Center

At this point in the paper, we've reviewed various layers/programs involve in minimizing issues that drive subscriber calls, reviewed some new ideas about automating issue detection, and offered a few alternative methods for handling issues when they are not avoidable. When all that is still not enough, impacted subscribers reach out to the operator. How do we handle this? Why are we still struggling to keep pace with call volumes and customer satisfaction? It's now time to talk about the call center.

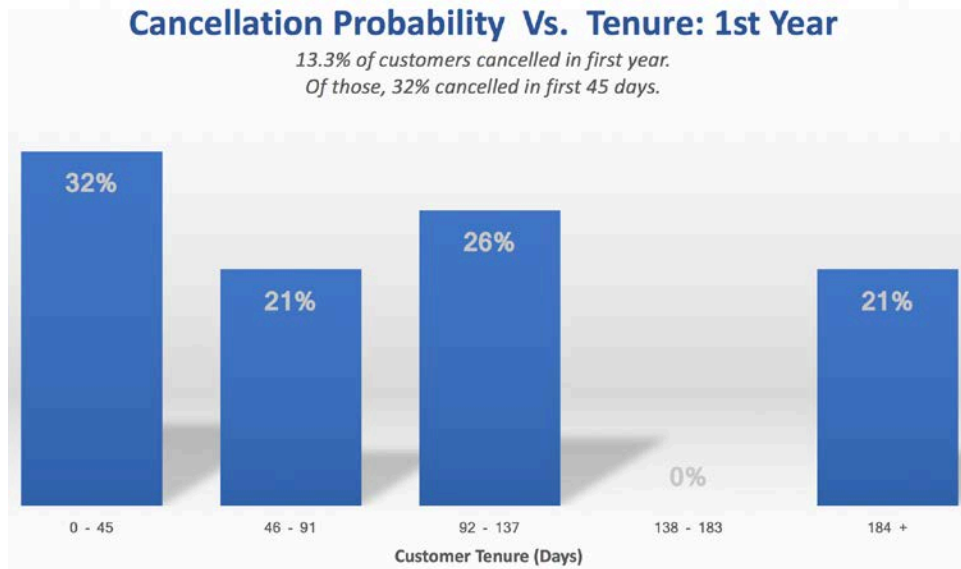
### 7. Context: The Call Center Universe

To help readers understand call center solutions and related challenges, it will help to review a bit about the call center environment.

**Subscribers:** A common theme heard throughout interviews with call center leaders was, by the time a subscriber is calling the call center, they are looking to connect with a human. One top complaint consistently heard from callers is, "I hate that IVR system", after being forced to navigate the IVR menu gauntlet – or repeat to a human information already entered. In fact, 89% of customers get frustrated when they need to repeat information – often to multiple representatives as they get passed around [Accenture].

One example of why it's so critical to properly receive, route, and resolve customer calls is shown in a study at a medium-sized Latin American MSO. It was determined that 13% of their customers cancel within the first year. Of those, 32% cancelled within the first 45 days. Their data showed a clear correlation indicating that customers who cancelled early also called the call center multiple times. This provides a special opportunity to intercept and provide special care since it's cheaper to maintain an existing customer than acquire a new one.





**Figure 15 – Cancellations Happen Early On, Correlate to Calls**

**Call Center Technology:** Call centers typically use a workflow tool to guide CSRs through a call flow. This tool prompts the CSR to ask questions, enter subscriber responses, and be guided on to next steps through the tool’s branching logic. This drives a slow step-by-step verbal exchange, relying on the subscriber for device and performance information. Modern versions of these tools may be integrated into a basic set of network data to show current & historical performance details, which can be useful for basic problems. In an *Omni-Channel* environment, subscriber can connect with support resources via email, chat, social media, knowledge base, etc.

The goal is to architect these channels to leverage a common set of underlying services for a consistent, positive support experience.

**CSR:** CSRs are in a challenging environment. Callers are upset. CSRs are often lightly trained, have a high turnover rate, have little domain expertise, and are expected to quickly move through calls toward a resolution. CSRs may feel pressure to complete the call or appease the subscriber. Multiple call center managers reported that, “If a CSR wants to roll a truck, they know how to make it happen.” It’s not realistic or cost-effective to treat CSRs as an army of service analysts, applying their tribal knowledge on every call.

### 7.1. What’s the Problem?

The core problem with all this is as follows:

1. Automated surveillance and analytics programs are not delivering enough actionable insights on service health, HFC plant, home network, devices, impairments, or the subscribers themselves.
2. Correlation of information cross-realm is not happening, preventing larger insights from emerging.

- Today's information is not presented in a way that can be quickly and clearly understood, pushing much of the work onto the CSR, NOC engineer, or data consumer. The resulting information-overload causes people to stop in their tracks and ask, "Where do I start? What's going on?"

**Scenarios:**

- Is it useful to have the CSR shown a page full of numbers if half of them are within limits – and *none of them is the real issue*?
- Is it better to show the CSR a page full of colorized icons instead of raw data – and let them decide what to do? ...or is that on-the-fly analysis too error prone and tough to make consistent?
- Why would we look at live subscriber SNMP data and claim that "everything's fine" when the data is available to show there is a real intermittent QoE issue every day at 10 am to 12 pm daily?
- Why would we allow trucks to be repeatedly sent to homes when data is available showing us their poor QoE is due to heavy network utilization on their stream channel, or a nearby plant impairment?
- Is that group of modems offline due to an outside plant issue or an IP Scope issue in the back office?
- If we can see that the house Wi-Fi gateway has an active iPad v1 running 802.11b and is slowing down the Wi-Fi for everyone in the house, can that be shown in plain English on the CSR screen?
- For the subscriber complaining of home network issues, should CSR tools automatically show what's happening elsewhere in the house and neighborhood? While we have them on the phone with a high speed data question, should we also take an extra minute and address the other two issues we see on their home network? These insights can be extended to views given to NOC engineers.

This is not an exhaustive list of examples – and probably not even the best ones, yet the point is clear. We're suffering from data overload, and punchline "underload" – and cable operators are paying the price. What is frustrating for operations teams is that many scenarios are not hard to model – but there hasn't been enough focus on modeling them in a systematic and scalable way and presenting them in a straightforward cohesive view.

**Intermittent Issues:** Conversely, there are also issues that are too challenging for quick casual human inspection: intermittent / flapping issues. There's just too much data and too many devices, which is a perfect opportunity for automation. In these scenarios, service for a subscriber may fluctuate between good/bad intermittently and may follow a clear time-based pattern. These are especially frustrating for everyone because they are hard to understand/explain and, with today's lightly integrated CSR views, subscribers often get the CSR response "things look OK right now." After 4 calls in 2 weeks, the subscriber is ready to cancel service. Now imagine that at a larger scale where area interference impacts 25 subscribers, the source of which is neither the home nor physical plant impairment. This story summarizes the challenge:

An operations VP told the story of a ham radio operator with powerful transmission capability, severely impacting certain RF frequencies. His usage pattern was fairly regular. The situation triggered numerous customer calls & truck rolls – but those impacted did not always call the call center, and not all at the same time. It took careful manual evaluation of call records and network data to narrow it down to a target cause/area. During visual inspection of the neighborhood, the large antenna was seen and the situation was addressed.

**Cable Operators are Trying:** Many operators are trying to build their own CSR tool to expedite the call experience. Lots of great work has been done, but in the last 18 months, at least 8 different operators have said they aren't seeing the impact they expected. Often, their efforts were focused on creating a consolidated view, aggregating lots of data into a few screens. Some operators created a peer tool to be used to complement their scripted workflow product, requiring the CSR to swivel-chair between several windows. In most cases, a lot of good data was provided – but still required the CSR to interpret the overall situation. Almost none of the operators had made any attempt to capture a thoughtful profile of the subscriber, showing if they've called for the same issue, showing other issues occurring in the home, special call handling directives, etc.

## 8. An Integrated Approach

A big challenge is that the insights needed by a CSR can't always be prepared just-in-time after a subscriber calls in. Such an approach lengthens calls and puts unrealistic and unnecessarily heavy performance burdens on IT systems. The content below attempts to paint a picture of a more intuitive and integrated system. The point of this is not the individual scenario/logic shown but that the visibility and flow is simplified to give contextual insights and actionable next steps to the CSR.

### 8.1. Imagine a Call Center Where...

- **Before a subscriber calls** in, systems in the background are constantly tracking anomalies, generating insights, tracking stats on calls per account per type, prepping key insights for use by other systems – not just exposing data
- **Caller ID** is used to detect that the subscriber is calling from home and automatically populates the CSR view with Account and Situational data
- **Interpreted Situation Summary**: Rather than see a page of data, the CSR is immediately shown a brief, intuitive situation summary, with the most important data first – including selections from the following sections:
- **Subscriber Experience Profile**: A top element of this situation report is a caller profile – meant to inform the CSR of the subscriber's engagement & experience.
  - **QoE Metrics**: An ongoing home QoE score is maintained - allowing the CSR to see a summary metric of subscriber experience for the past 4 hours, 1 day, 7 days, and last month. If necessary, the CSR can drill down to see individual QoE scores for each service: Internet; Voice; Video; Wi-Fi; and Security.
  - **Call Pattern**: A simple view shows how many times this customer has called in the last 3 weeks and whether those calls were for the same event. The CSR can acknowledge an ongoing issue and quickly get up to speed. The subscriber is happier, because they don't feel they are starting from square one on every call.
  - **Truck Rolls to Home**: Similar to above, the system shows highlights of recent trouble calls with techs visiting the home, including if one is scheduled soon.
  - In one scenario, it's clear the subscriber is a new customer and has called 3 times for Wi-Fi. The CSR is now empowered to stay on the phone as long as necessary to identify and resolve issues. Although more expensive, it's cheaper than fielding multiple calls, negative word of mouth, and potentially a subscriber cancellation.
- **Punchlines Over Data**: The situation summary also identifies likely service problem/causes, with an attempt made to order them by likelihood of impact and prioritized to match the call reason when necessary. (Wi-Fi, Video, Voice, or Internet)

- Rules of engagement: no raw data shown, colored/iconized per-KPI summary available as a drill down if user is authorized.
- The system is designed to show only the most likely scenarios (constantly refined through disciplined & vigilant feedback and modeling by the call center leadership, working with the NOC and Field Ops).
- For slightly better trained CSRs, permissions would allow drill down past summary info into carefully organized information. That said, even the data is curated to meet specific use cases. A design gate-keeper protects this UI real estate. For example, rather than show raw graphs of historical CER and SNR data, drill-down views might show only Green/Yellow/Red indicators for last hour/day/week. They may also be relabeled “Data Quality” and “Signal Quality” to help them be understood. (Of course, a power user’s view would show all data.)
- **Issues Outside the Home:** Often, subscriber service issues are caused by problems outside the home. Here are a few scenarios:
  - *Active neighborhood plant issues* are shown clearly at the top of the page. CSR explains that there is an issue impacting the area, work is in progress, ETA to completion is 2 hours, and offers to auto-alert the subscriber when the event is complete (SMS, email, or IVR call – no humans). Auto-alert setup occurs with one click. In such a scenario, a trouble call truck roll is not allowed.
  - *High Utilization in Neighborhood:* More subtle scenarios are also modeled: CSR is directly informed by the system that there is dramatic and sustained high bandwidth consumption on the same channels – leading to a degraded experience. Truck rolls to the home are not going to help, neither will a modem reset, nor drop-shipping a new device. In a perfect world, engineering has already been alerted and a ticket would already exist to address this capacity issue – with a targeted conservative completion time.
  - Power supply issues impacting the neighborhood would also land here.
  - CSR asks subscriber if they would like to be alerted to future large outages impacting them. SMS/Text is an option, yet preferred mechanism is alerts via the mobile app. This allows the subscriber to control the volume of alerts.
  - Actions are available allowing the CSR to “Refresh Ticket Status” which does not display technical data, just updates.
- **Issues Not Outside the Home:** When the system doesn’t find outside issues causing problems, a prioritized list of home issues would be shown, in simple terms.
  - The system knows which are most impactful and alerts those in red
  - The subscriber’s CPE device configuration and service class are compared to billing information to make sure customer is getting what they pay for
  - System checks that data has actually been flowing upstream and downstream, data is useful when discussing outage or upsell scenarios. Verifies that all bonded channels are working and no “partial service” situation exists
  - Wi-Fi and Home Network risks are identified. The goal is to not present a view of every consumer device and status – but have anomalous findings indicated. Many Wi-Fi QoE scenarios were discussed in earlier sections but here, the CSR sees the concise lists of risks. Priority is given to service impacting items, followed by risk items that may prove problematic in the future – such as security issues, old consumer Wi-Fi devices, not using fastest 802.11 configuration, etc.

- CSR view clearly indicates whether this caller has called recently for home network issues. If so, CSR is encouraged to stay on phone and work through critical issues, education, and security/performance items
- Patterns for time-based and intermittent home issues are identified in graphic form, with colors/icons over a timeline. This may involve tracking peak use times by watching bandwidth consumption for the overall gateway. This helps CSRs know when that one home may experience congestion. Slow or “chatty” devices are flagged since they reduce overall home Wi-Fi speeds
- For basic home network and configuration questions, CSR guides the subscriber to the Self-Service system – which teaches them to find their own answer in future
- Quick action buttons drive CSR action:
  - Send the subscriber their Wi-Fi SSID name and password
  - Enable guest Wi-Fi
  - Reset Wi-Fi password
  - Reboot modem/gateway
  - Re-enable radio
  - Speed test
- **General Actions:** Actions are described above, available for specific scenarios. Others general actions may include:
  - Send service summary to subscriber (email)
  - Escalate to advanced support (full details included automatically)
  - Escalate to SRO/maintenance ticket (full details included automatically)
  - Create Whole Home Birth Certificate (checks all home devices/services, archives results)
  - Whole Home Check (checks all home devices/services again, live)
- Since intermittent problems are tracked, timing information is used to roll a truck to the home when the issue is likely to be happening
- **Upsell:** In some situations, there may be opportunities for upselling the subscriber. In our “what if” scenario, insights have been generated showing that the subscriber is on a low-bandwidth package and consistently consumes near their maximum. Maybe the subscriber calls about “slow surf” occasionally too, setting up a good opportunity for upsell. One call center manager said that their data-driven upsell approach had his team out producing front-line sales & marketing efforts for service expansion
- **Ongoing Metrics:** Metrics tracking is in place to review device & subscriber behaviors, learn more about how subscribers really act, feeding back to office managers
  - Peak use times, distribution of consumer device types as well as which ones cause problems, problematic gateway models, firmware versions

## 8.2. Applying Concepts to the Back Office

The focus of this paper is CX and the call center. That said, these concepts apply to network surveillance systems as well. Imagine that instead of managing a bunch of SNMP traps, looking at lists/graphs of cable modems with high CER, or staring at raw RF plots, a plant maintenance manager was presented with automated situation analysis for a node. With all the raw data available to back it up, such a summary might say something like:



*95% of the modems on this node are currently within tolerance, but 3 hours ago for a duration of 45 minutes, 35% of devices (60 of 200) were impaired and appears focused only on 36.8 MHz on the upstream. Of those 60 devices, 30 were actively in use and showed an average CER of 3% during that time.*

Another regional scenario that might involve full band capture might say:

*Strong interference has been detected at 36.8 MHz across 3 nodes in the same area. Aggregate QoE for those nodes has dropped from 96% positive to 60%. A maintenance ticket was recently opened for this area. Recommend check for sweep transmitter left in use.*

### 8.3. Proactively Notifying the Subscriber

With all of these powerful insights aligned with the critical need to prevent/deflect support phone calls, operators might be tempted to create an aggressive subscriber notification program, sending subscribers SMS/texts and emails when any issues are found. This is a risky idea unless approached carefully.

**Subscriber Frustrations:** In discussing these concepts with call center leaders, the consensus was that subscribers would be frustrated receiving numerous alerts for situations they had no control over. In addition, by proactively alerting subscribers for every service issue, they might be alerted for an impairment even when they may have never noticed a service issue.

**Exceptions:** In some cases, some subscribers may want to receive alerts of service impacting issues or periodic QoS score summaries. Even with these, an “opt in” approach should be used:

- Confirmed, sustained network outages in their area (alert, clear)
- Service interruptions for business-class subscribers
- Service interruptions for high-SLA subscribers (Gold / 1 GB package)
- Managed service customers (e.g. paying for Wi-Fi managed service)
- Subscriber requested a one-off notification from the call center for a specific ticket (e.g. network outage or maintenance ticket)

**A Better Way:** A natural platform for such alerts is via mobile app. This strategy builds on existing support and customer engagement strategies already in motion. In this scenario:

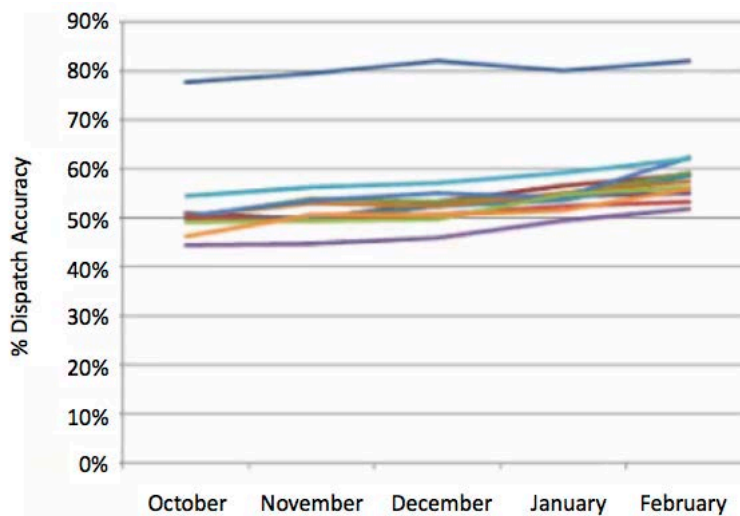
- Subscriber can configure alert frequency and severity
- Subscriber can opt to view alerts on their schedule rather than be interrupted
- Subscriber could subscribe to specific alerts
- Education/FAQ blasts could be offered (mapping to current top call trends)
- Upsell / marketing alerts could be customized and targeted. Top bandwidth users could be offered an expanded package

## 9. Get Started

When asked about how to get started on some of the programs discussed here, one call center leader said, “Just get started. Start small, these small improvements add up.” As stated above when talking about the need for a CX champion, it’s more important that the organization commit to the goal; provide time; resources; make incremental improvements; and measure progress along the way.

### 9.1. Simple Changes go a Long Way

In a comparison of 8 separate domestic and international front-line call centers being used to handle calls for a telecommunications company, one stood out. This call center had an only slightly simpler CSR interface, the key difference being their CSRs saw a green “Thumbs Up” or red “Thumbs Down” icon indicating health of a device/component/service, whereas the other call centers showed more detailed, numerical data. The results were impressive: Comparing dispatch directives against field results (no trouble found, field issue found) most call centers dispatched trucks with +/- 50% success rate – meaning, half the time trucks were sent to the field, no trouble was found. A leader associated with the program said, “This was no more effective than a coin flip.” The call center with the simpler UI was consistently above 80% effective [ARRIS Internal Study].



**Figure 16 – Comparing Technician Dispatch Success Across 8 Call Centers**

At one Latin American operator, call center processes allowed CSRs to create trouble call/dispatch tickets based on verbal quality checks, but without any data-driven validation. At its peak, this call center was measured as having 89% of their dispatched trucks find no issue in the home and a post-mortem analysis that there was no CER/SNR issue. This is an extreme case, however, it clearly shows that by simply integrating a check for service impacting telemetry, the number of wasted truck rolls would drop significantly [ARRIS Internal Study].

## Conclusion

Today’s operational and support programs have a long way to go. Output and interfaces show too much information and don’t create the insights needed to effectively manage a business. Much of the work gets pushed onto people, the rest just gets dropped.

**What do organizations need to realize? The price will be paid somehow.** Either organizations commit to becoming more proactive and savvy about how to manage their customer experience, or they’ll pay by being forced to support an unsustainable load of calls to the call center, a high rate of repeat truck rolls, and high customer churn rates.



It's clear that customer support programs have a dramatic effect on customer satisfaction – and therefore branding, subscriber loyalty, and business survival. Subscriber satisfaction is driven more by customer experience than by marketing and sales efforts.

Subscribers are now expecting high-touch, personalized, immediate support, and are no longer just using the telephone to get it. It's critical that programs be designed to focus very intensely on (1) preventing issues, (2) providing methods for subscriber self-service, and (3) carefully optimizing the customer support experience for analysis and resolution of issues.

Organizational strategy should be considered strongly to prevent individual directors from protecting their P&L at the cost of the overall organization. A true customer champion role can be a unifying force in the battle for organizational alignment.

Programs like those discussed in this paper provide important service insights that are valuable to multiple internal audiences, only one of which is the customer support center. It should be clear that the value of that core investment is magnified by its impact on multiple groups within the organization. When architecting such programs, leaders should be thinking of all the ways resulting artifacts/insights can be leveraged across the organization.

The savviest operators are starting to realize that, when choosing a vendor to work with for architecting and executing their customer experience vision, it has less to do with finding the cheapest outsourced call center or ready-made workflow tool, and much more to do with which company knowing the systems, data, hardware, and cross-organization strategies the best.

## Abbreviations

Term	Definition
Call Deflection	Using various mechanisms to intercept or prevent a support call to a CSR in the call center
CER	Codeword Error Ratio
CPE	Customer Premises Equipment
CSR	Customer Support Representative
CX	Customer Experience
DAA	Distributed Access Architecture
DOCSIS	Data Over Cable System Interface Specification
EQ	Adaptive Equalization
FAQ	Frequently Asked Questions
FEC	Forward Error Correction
HFC	Hybrid Fiber Coax
I&R	Install & Repair
IoT	Internet of Things
IT	Information Technology
IVR	Interactive Voice Response
M&P	Methods and Procedures
NOC	Network Operations Center

Omni-Channel	Implies a contact center supporting various communication paths for subscribers to get support, including online chat, text, phone, email, web, mobile app, social media
OPEX	Operational Expense
P&L	Profit and Loss
PNM	Proactive Network Maintenance
QAM	Quadrature Amplitude Modulation
QoE	Quality of Experience
RF	Radio Frequency
RMA	Return Merchandise Authorization
RSSI	Received Signal Strength Indicator
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
TR-069	A technical specification that defines an application layer protocol for remote management of end-user devices, published by the Broadband Forum
XMPP	Extensible Messaging and Presence Protocol

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