

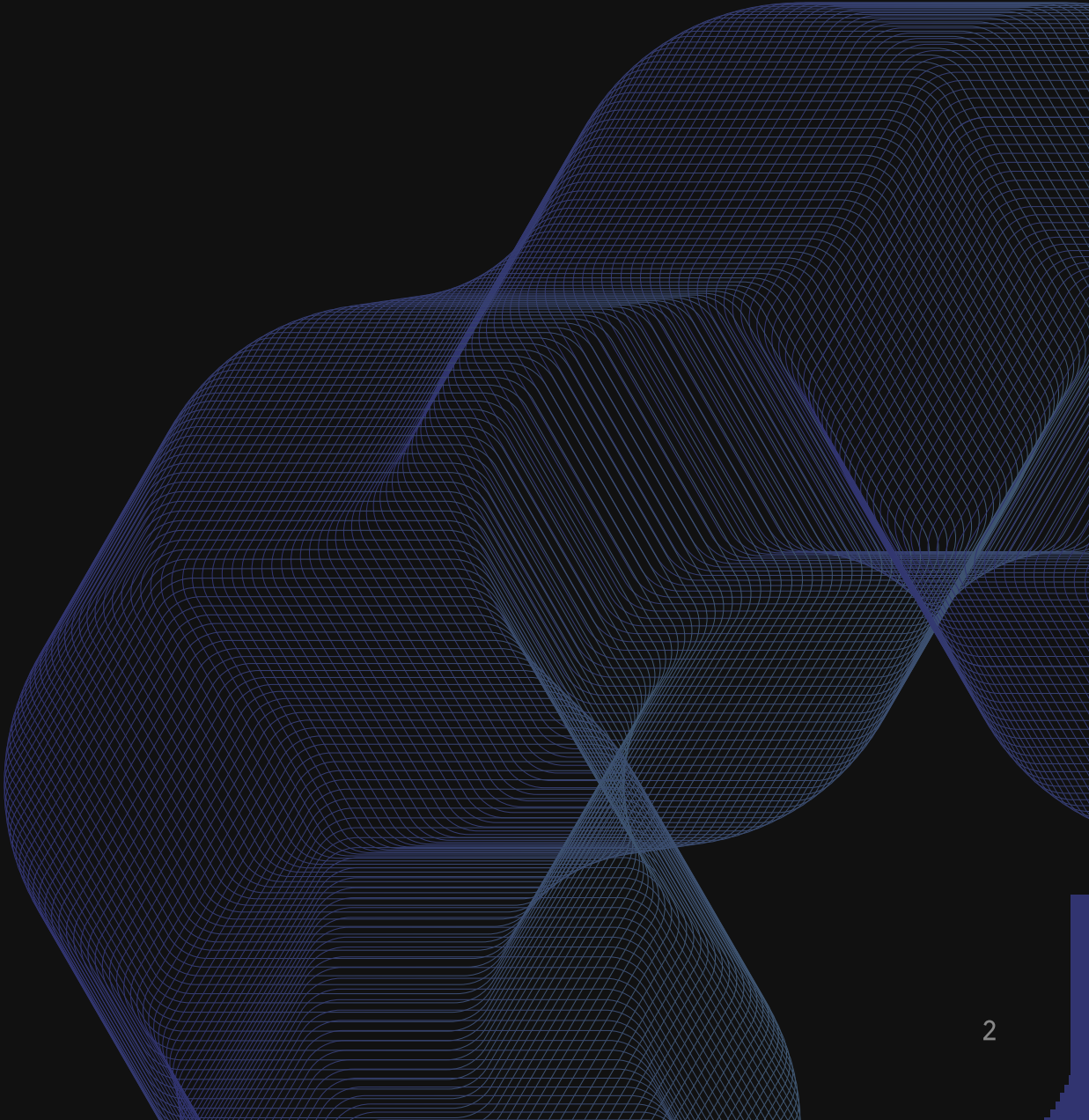
Total Cost of Ownership Study

Plume Consumer Experience Management Platform



Table of contents

3	Executive summary	10	Financial results and key findings
4	Key findings	11	Call and truck roll reduction
5	CSP key challenges with legacy solutions	12	ROI and total lifetime value tabulation
6	Top motivations for CSP adoption of Plume CEM Platform	13	Deployment models
7	Plume CEM Platform implementation	14	Deployment speed and agility
8	Plume CEM services and products	15	Conclusion
9	Plume services delivery model	16	Appendix: by the numbers



Executive summary

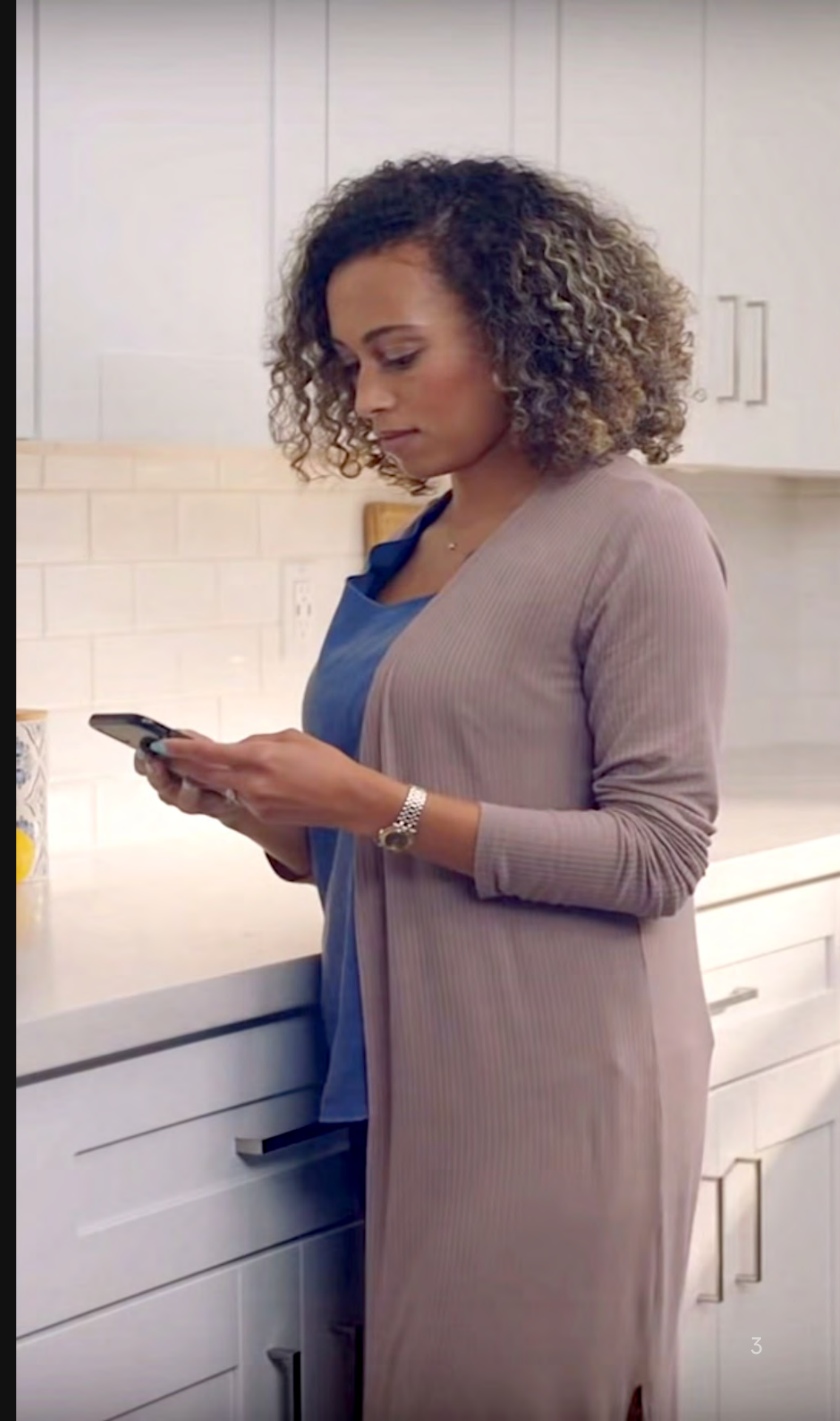
Plume's Consumer Experience Management (CEM) Platform transforms Communications Service Providers (CSPs) from hardware-, firmware- and TR-069-driven, disparate services ecosystems to agile, cloud-based services delivery platforms, ultimately accelerating CSPs' end-to-end services delivery to their customers.

Widescale deployment and adoption of the CEM Platform increases ARPU, lowers OPEX costs, and increases customer longevity through reduction of churn. To better understand the benefits and costs associated with a cloud-based CEM system, a complete total cost of ownership study was completed to measure the benefits and draw conclusions about the preferred model for CSPs to deploy services going forward in their networks.

Results of the study consider the overall benefits of a CEM Platform in the following areas:

- Increase in new monthly revenue as a result of enhanced services offering
- Reduction in call-in rates (CIR) and truck roll rates (TRR) through improved performance, reliability, customer engagement, and customer service
- Improved customer longevity through reduction of churn
- Increased service delivery velocity compared to alternative solutions

Results were compiled based on Tier 1, 2, 3 CSPs deploying Plume's CEM Platform, including analyzing CSP call-in records for over 2 million customers from November 2018 to August 2019.



Key findings



ARPU increased
by up to:

\$10-\$15 ↑



Churn reduced
by up to:

30% ↓



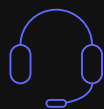
Truck roll rates (TRR)
reduced by up to:

67% ↓



Feature development timelines
accelerated by up to:

67% ↑



Call-in rates (CIR)
reduced by up to:

51% ↓

An increased ARPU of \$10 to \$15/mo for customers with whole-home WiFi offerings, and a 39% increase in broadband only services.

New Smart Home Services delivered through the CEM Platform generate new revenue to the tune of \$1,456 for those customers, an increase of 43% over broadband only customers.

OPEX expenses of call-in rates and truck roll rates reduced by 51% and 67% respectively.

Through a combination of intelligent cloud-based control algorithms, an intuitive mobile app, and engagement features, Plume's CEM drastically reduces customer calls and related truck rolls without the need to upend existing architectures.

Churn is reduced by 30%, representing an increased overall customer lifetime of 2.9 years, and an increase in customer lifetime value of 70%.

Customer churn rates are reduced with each new service introduced into the network. New services delivered through the Platform significantly reduce churn rates with large financial impact.

Service installation and activation of Plume HomePass™ is performed by the customer, eliminating the need for on-site technicians, eliminating 97% operational cost.

App-driven self-install of HomePass has a >95% success rate, and eliminates the need for technician cost and scheduling.

Feature development timelines are accelerated by 67% versus the traditional model, allowing for major feature delivery 6 months faster to market than alternative solutions.

Delivery of major feature releases through the CEM Platform is shortened through the elimination of firmware dependencies, enabling network updates to occur every month. Cloud releases are instant, delivering features across the network overnight.

CSP key challenges with legacy solutions

CSPs have several challenges with deployment of services using legacy firmware and TR-069-based systems. The recurring themes are lack of speed and agility to support business-level initiatives, which hold back the overall cloud-based transformation movement. More specifically, CSPs identify the following challenges:

Significant backlogs of services and products to release for customers.

CSP product deliveries are complex, with many moving parts. Everything from IT ordering systems, activation, marketing, pricing tariffs, and support training are required for a successful launch. Disjointed back-end systems and slow gateway firmware rollout schedules lead to waterfall-type releases and slow product rollouts.

The percentage of single play customers continues to rise, leading to higher churn.

With the fall of voice and video services in CSPs, the number of single-play, broadband-only subscribers is as high as 39%, leading to blended churn rates above 20% per year. New service revenue and accompanying lower churn rate is needed to reverse the alarming trend.

Operational expenses to support customers who call in or need truck rolls are rapidly increasing for WiFi connectivity services.

Over one half of all support issues for CSPs are related to WiFi and internet connectivity in the home. Support options to troubleshoot in-home connectivity issues are limited to only the most basic connection statistics, leading to inaccurate troubleshooting steps and unnecessary equipment replacements and truck rolls.

The systems used for provisioning, service activation, monitoring, and lifecycle management are difficult to update.

TR-069-based systems in place for service initiation and monitoring are infrequently updated, leaving little room for enhancements and improvements without long lead times.



Top motivations for CSP adoption of Plume CEM Platform

CSPs have a large installed base of customers with access to high-speed fiber or DOCSIS services, but the ability to offer advanced services on top of high-speed internet is often constricted due to the difficult upgrade paths presented by legacy vendors. A cloud-based services platform centered around the customer is needed. Plume's CEM Platform enables the following main drivers:

Perfect WiFi connectivity—guaranteeing wall-to-wall coverage in the home—on which to build other services.

Maintaining a good level of service to all devices in the home is critical, and requires the introduction of a new provisioning system, control plane, management tools, performance monitoring, network optimization algorithms, and mobile app. Plume's CEM Platform offers all these instantly.

Capability to upgrade and deploy new services from the same platform to enhance best-in-market internet service.

CSPs' customers expect additional service offerings on a regular basis in order to lessen churn and boost net subscriber gains quarter-over-quarter. Plume's CEM is used to rapidly deploy new HomePass services to differentiate from competing CSPs and GAFA companies.

Reduction in OPEX expenditures to support customers with challenging connectivity environments.

OPEX expenditures are reduced by a combination of coordinated cloud network optimizations and whole-home extender WiFi coverage and connectivity, all managed with advanced tools for real-time troubleshooting and proactive care.

Modernization of the CSP's service platform to include big-data analytics and web-based APIs for provisioning and monitoring.

The CSP's marketing and product teams base decisions for product launches and investment on

customer analytics and speed to market. Customer analytics requires a big-data platform to understand and react to customer behavior driving revenue growth, support costs, and churn.

Services that are self-installed, without assistance from technicians.

The cost for technician-assisted install of any service is high. In the case of new customers with a new service, the cost can be greater than 5 months of total operating profit. For add-on services to existing customers, the cost can skyrocket to 12 months. Customer self-installation is required to curb these costs.

Introduction of a mobile app for their leading internet service offering.

Many CSPs do not have a mobile app option for their main broadband home offering. Customers are forced to log in to their gateway in the home using a PC to monitor or change their setup. A customer- friendly mobile app, with the ability to interact with the service at home or remotely is required for increased customer satisfaction.

Efficient use of internal IT resources.

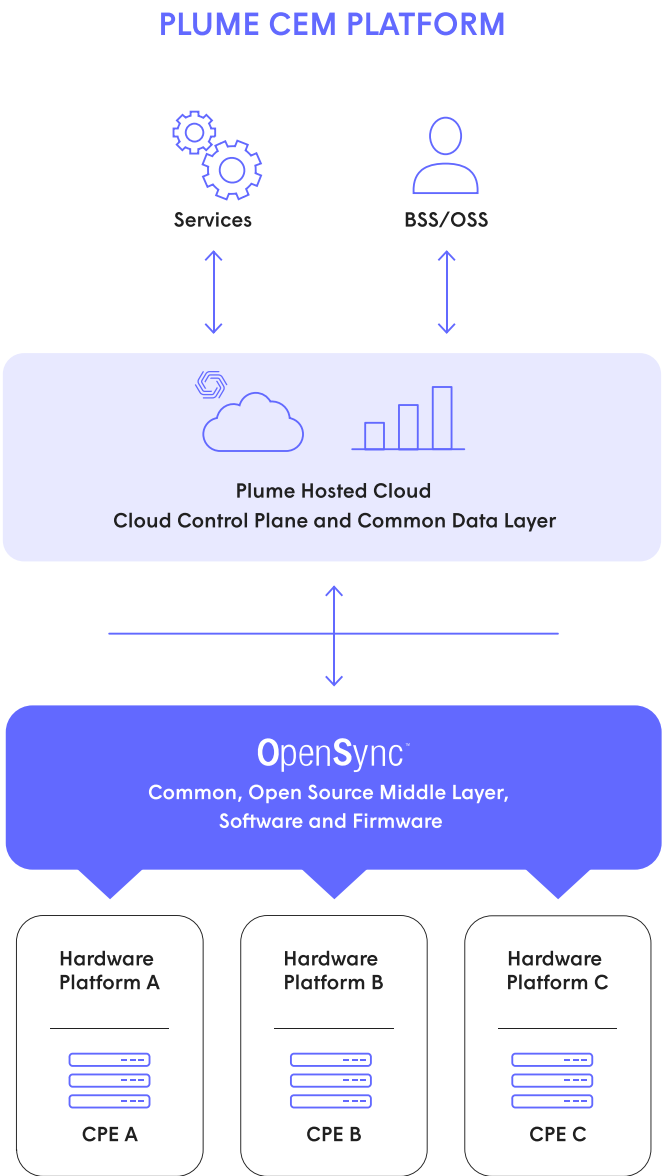
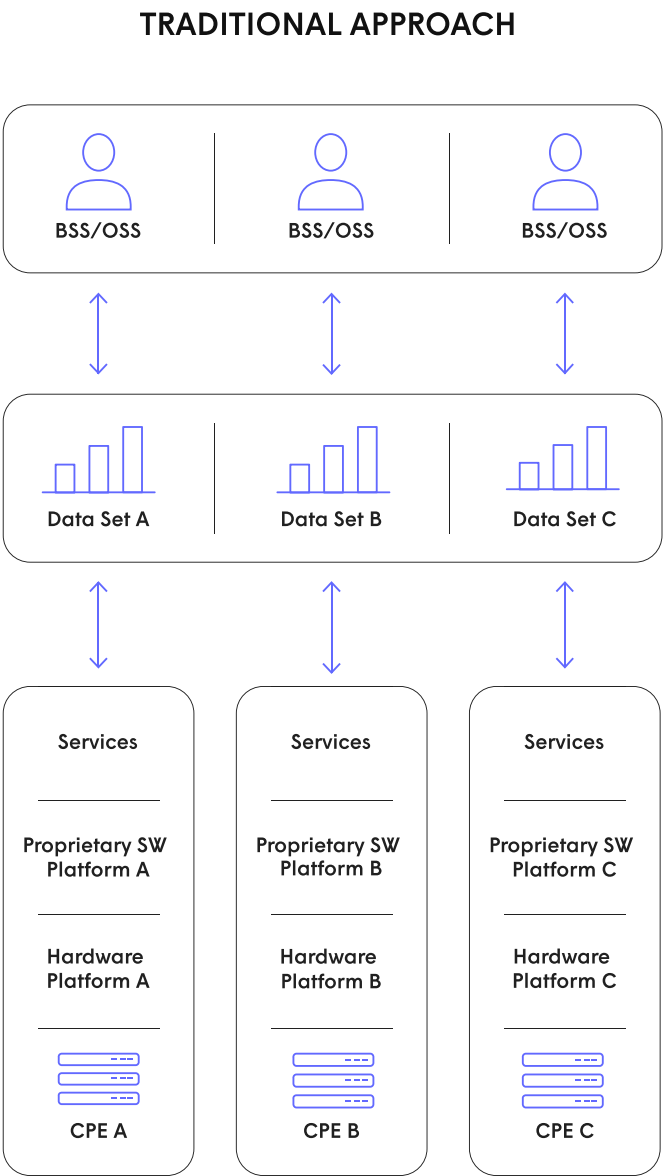
With a move to a cloud-based CEM Platform, CSPs can continue their digital transformation while reducing operational costs. Operators previously working to manage this infrastructure can then be re-tasked to value-add functions. IT should and can be a value-creation partner, rather than merely a cost center.

Plume CEM Platform implementation

Prior to using a cloud-based delivery platform, CSPs relied on the proprietary firmware functionality present in the home gateway to enable and manage services. Some telemetry was provided from the gateway for monitoring, and service activation was made possible via imperfect TR-069 interfaces.

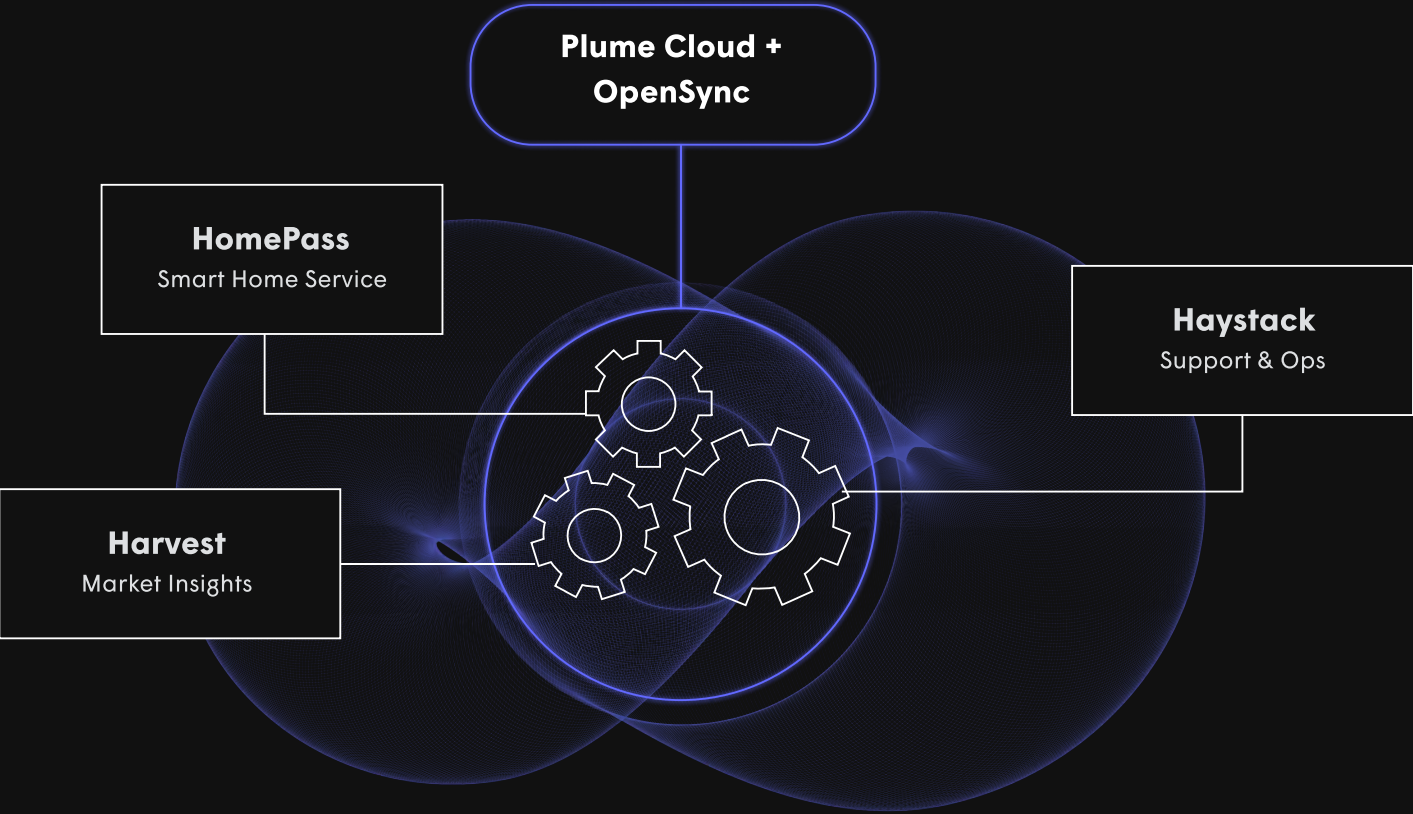
While this architecture has dominated for many years, it is fraught with problems to the detriment of the CSP and its customers. Time frames between firmware releases can be very long, lasting between 6 and 12 months. Scaling was also difficult, as it required specialized firmware to be rolled out on different gateway hardware platforms, from different vendors, each with their own idiosyncrasies. The result is the inability for CSPs to be adaptive to market needs and maintain time-to-market advantages to stay ahead of the competition. As such, web scale companies like Google, Amazon, Facebook, and Apple (GAFA) are making strong inroads into the

customer home with the opportunity to take over the traditional CSP service business. Plume's CEM Platform increases CSP service velocity by way of OpenSync™, a modern Software Defined Network (SDN) framework integrated onto different CPE HW solutions, enabling the delivery of new Smart Home Services rapidly and at massive scale. CEM deployments and upgrades are carried out each month, representing an order-of-magnitude reduction of release timelines when compared to network-wide firmware upgrades, allowing for an agile development process and feature enhancement.



Plume CEM services and products

Plume’s CEM Platform provides a full suite of services including:



HomePass highly personalized front-end consumer services suite for top line growth via incremental ARPU



Haystack back-end support & ops suite for opex reduction via visibility and AI



Harvest insights suite for margin expansion via market personalization

HOMEPASS

The HomePass Smart Home Services Suite, which includes Adapt™, Control™, Guard™, and Sense™ is managed by the Plume Cloud, a data- and AI-driven cloud controller currently running the largest software-defined network in the world. HomePass leverages OpenSync, an open-source framework which comes pre-integrated and supported on the leading silicon and platform SDKs for coordination by the Plume Cloud. All HomePass services are managed via the HomePass app, available for both Android and iOS.

HAYSTACK

A comprehensive back-end monitoring solution catered to support, engineering, and operations teams. The Frontline application provides insights for Tier-1, -2, and -3 support and engineering personnel, coupled with Panorama dashboards to monitor the operational aggregate health of the network. Signal, a predictive analytics system, pinpoints unhappy customers and proactively generates outbound customer self-help contact to reduce calls and increase customer satisfaction, an industry first.

HARVEST

Customer device trends, usage behavior, and application patterns are captured with the ability to create and filter cohorts of your customer base with Harvest. Network analytics help to drive marketing, promotional, and product decisions to take advantage of network trends and customer purchasing decisions.

Plume services delivery model

Plume's CEM Platform is deployed in three main components: the HomePass app, Plume Cloud, and OpenSync framework.

The HomePass app is widely available for both iOS and Android platforms, and communicates directly with the Plume Cloud, supporting customer self-installation, configuration, monitoring, and interaction with all HomePass services.

The Plume Cloud, operating on AWS, is hosted by Plume and scalable from one home to millions of homes with the same infrastructure. Plume is fully responsible for upgrades, maintenance, and scaling of the cloud platform to meet CSPs' growing needs.

OpenSync provides an open-source interface between the Plume Cloud and the customer CPE permitting cloud-based applications to access data and management control of the CPE and WiFi extenders. OpenSync is compatible with all major chipsets and many ODM manufacturers.

CSPs can get up and running in as little as 45 days, and have full access to all Plume marketing assets to help advertise and communicate services to their customers. All components of the system are pre-built and ready for instant activation for deployment.

CSPs can get up and running in as little as 45 days, and have full access to all Plume marketing assets to help advertise and communicate services to their customers.

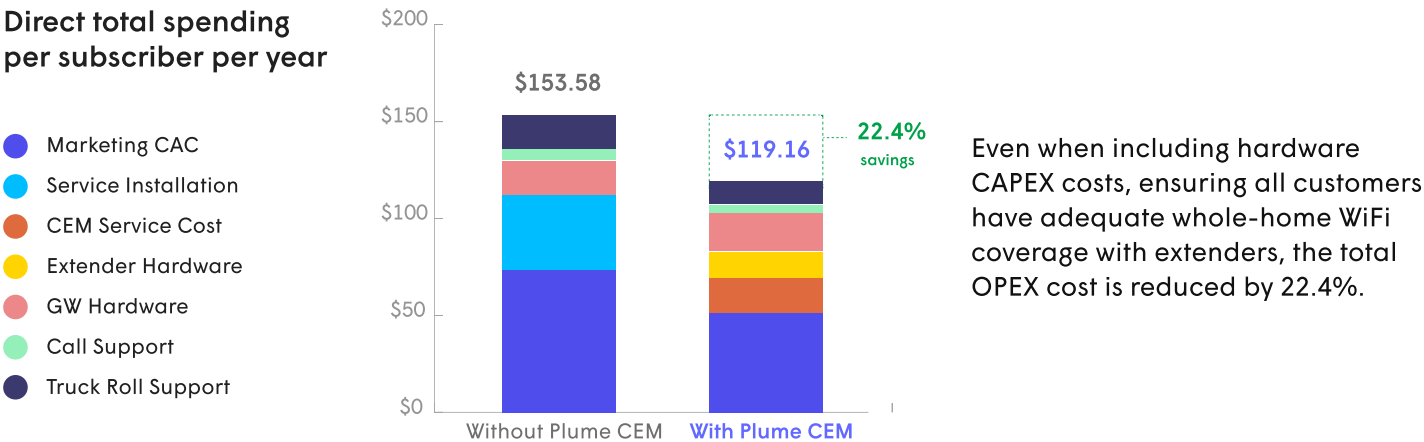
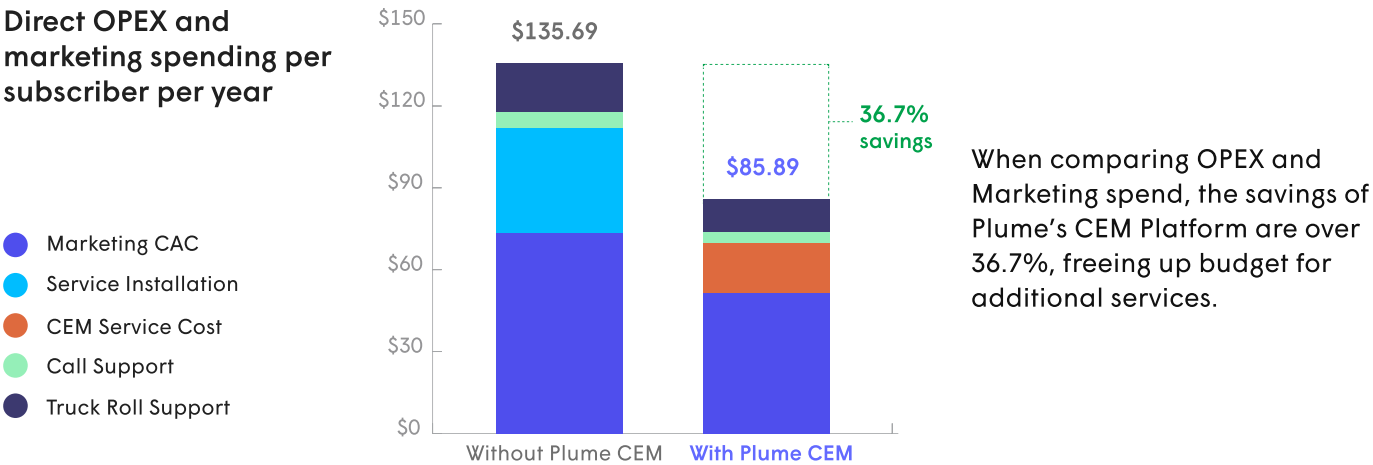
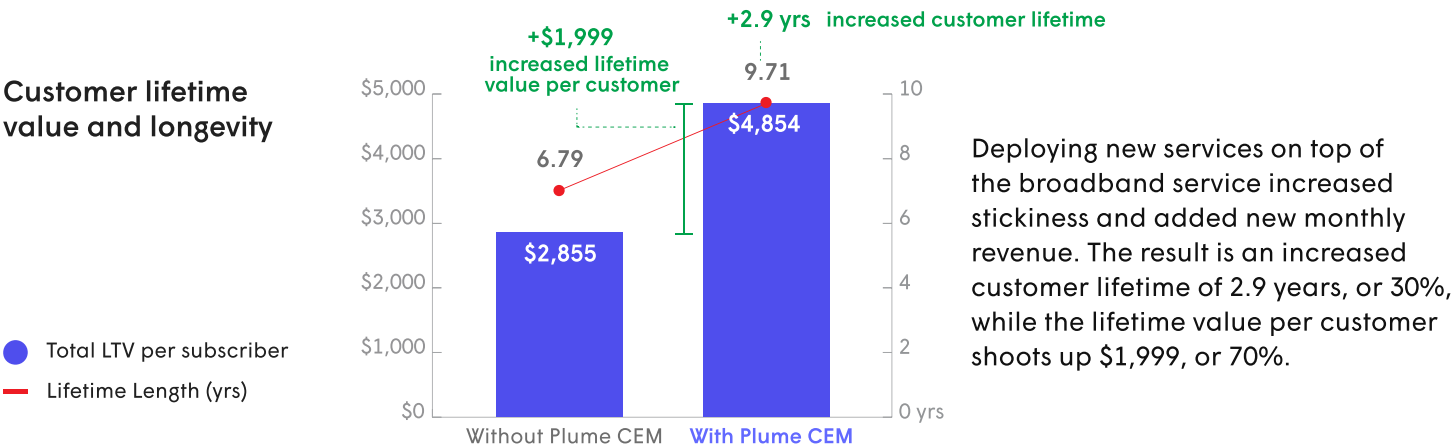


Financial results and key findings

Plume’s CEM is widely deployed by all sizes of CSP, with over twenty million homes globally using the service. This TCO study accounts for additional revenue gained by CSPs for offering new services, streamline of service installation, cost of hosted services, ongoing operational cost reductions, and customer churn impact on overall business.

Long-term phone call and cost records from November 2018 to August 2019 for over 2 million customers were analyzed in the first half of 2019 to measure the operational benefits of the Plume CEM Platform deployment. The study considers a blended deployment model of Tier 1, Tier 2, and Tier 3 CSPs on a per-customer basis, including multiple service types and home types. Each customer is provided one or more of Plume’s HomePass services, including Adapt, Control, Guard, and Sense. Monitoring and management of customers are done via Plume’s backend applications, including Frontline and Panorama.

TOP-LINE AND BOTTOM-LINE BENEFITS ANALYSIS



Call and truck roll reduction

Call-in records were analyzed before and after the CEM Platform deployment to measure the level of success the Platform has in preventing customer dissatisfaction and associated calls and truck rolls.

Monitoring took place for a total of 60 days before and after the activation of Plume's CEM Platform. Customers were provided with the option to purchase Plume's CEM Platform and associated services, with self-installation and activation through the mobile app.

As shown in the figure, we observed drastic increases in call-in rates starting at 25 days before the activation of Plume's CEM Platform. This is typically the moment the customer has reached a very high level of dissatisfaction and the Plume service is activated to resolve the issues.

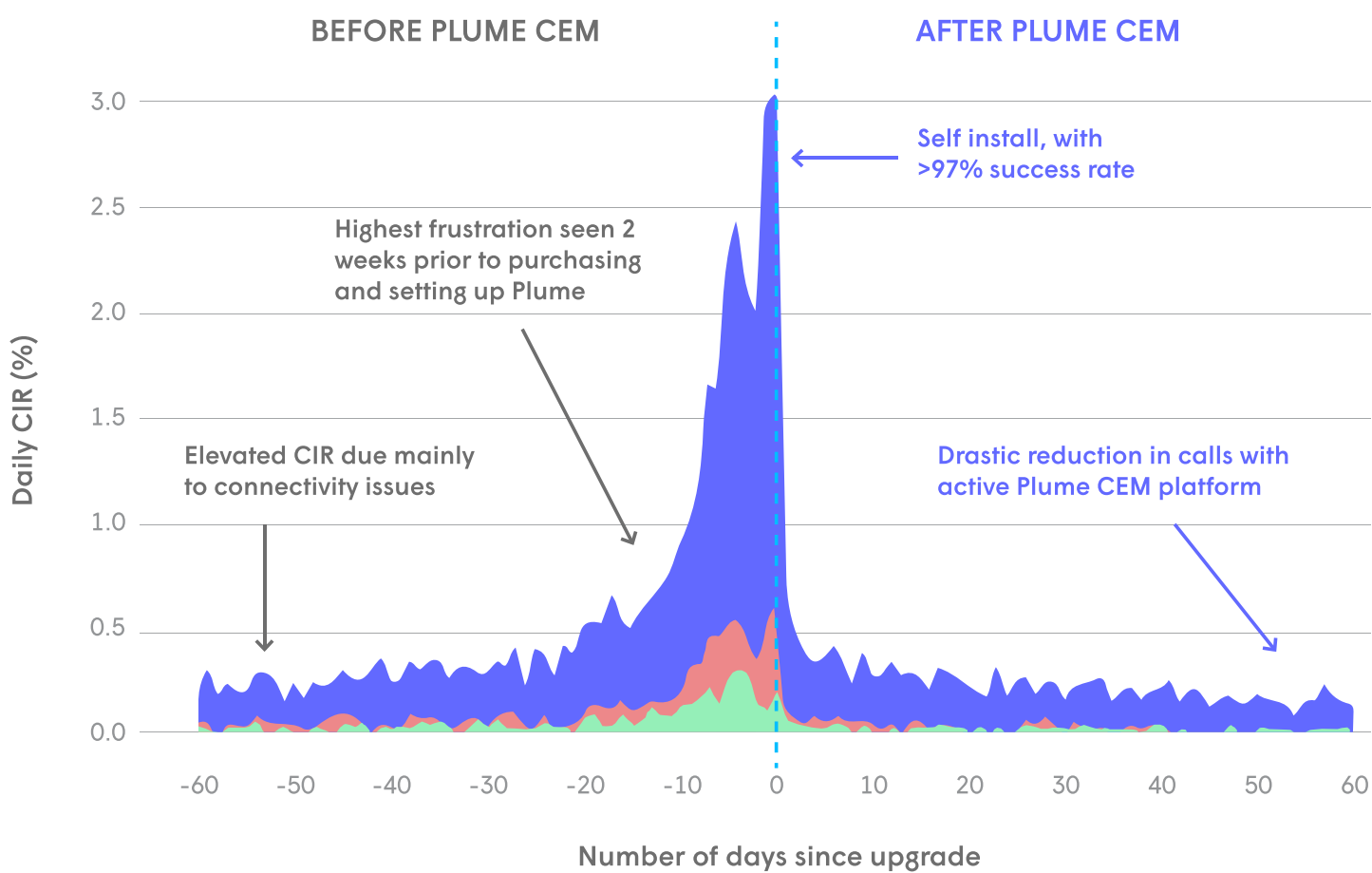
The results show call-in rates (CIR) are reduced by over 51% after activation of the Platform.

Likewise, related truck roll rates (TRR) are reduced by 67% from previous steady state levels for the same customers.

INTERNET CIR OVER TIME BROKEN DOWN BY TROUBLE TYPES

FIGURE: CIR REDUCTION OF >50%

- Connectivity
- Others
- Wireless Setup



ROI and total lifetime value tabulation

A timeline comparison of the solution deployed with and without Plume’s CEM Platform is tabulated below.

With the Plume CEM Platform, breakeven is seen almost within the first year, and the total lifetime value with Plume’s CEM Platform is lengthened due to reduced churn, earning 70% higher overall cumulative profit.

	WITHOUT PLUME CEM			WITH PLUME CEM		
	Cost	Revenue	Cumulative Profit	Cost	Revenue	Cumulative Profit
Initial Install	-\$691.05	\$0.00	-\$691.05	-\$607.65	\$0.00	-\$607.65
Year 1	-\$825.01	\$1,375.01	-\$141.04	-\$877.21	\$1,462.01	-\$22.84
Year 2	-\$825.01	\$1,375.01	\$408.96	-\$877.21	\$1,462.01	\$561.96
Year 3	-\$825.01	\$1,375.01	\$958.96	-\$877.21	\$1,462.01	\$1,146.76
Year 4	-\$825.01	\$1,375.01	\$1,508.97	-\$877.21	\$1,462.01	\$1,731.57
Year 5	-\$1,016.05	\$1,375.01	\$1,867.92	-\$984.85	\$1,462.01	\$2,208.72
Year 6	-\$825.01	\$1,375.01	\$2,417.93	-\$877.21	\$1,462.01	\$2,793.53
Year 7	-\$655.77	\$1,092.96	\$2,855.11	-\$877.21	\$1,462.01	\$3,378.33
Year 8	CUSTOMER CHURNED		\$2,855.11	-\$877.21	\$1,462.01	\$3,963.14
Year 9			\$2,855.11	-\$877.21	\$1,462.01	\$4,547.94
Year 10			\$2,855.11	-\$727.80	\$1,033.58	\$4,853.73

70% Higher overall cumulative cash with the Plume CEM Platform.

Deployment models

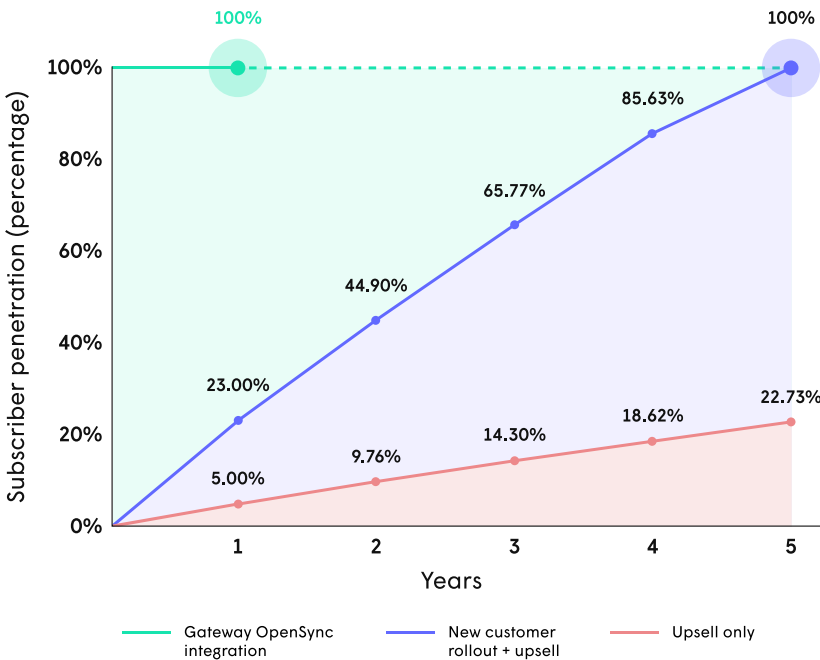
Multiple deployment models exist, providing flexible options and go-to-market strategies. In order to maximize increased profits for each customer, it is critical to deploy the CEM Platform to as many homes, as fast as possible. Three deployment models were analyzed to measure the difference in profit improvements.

Plume offers three flexible go-to-market options to maximize service penetration and shorten time to market. Using a combination of the models ensures both a fast time to market and high growth rate.

DEPLOYMENT MODEL	HOW IT WORKS
Individual upsell	CEM Platform services are provided only to those customers who separately purchase the services.
New customer roll-out	Services are provided as part of the base offering for all new customers, coupled with OpenSync-enabled gateways and extenders.
Gateway OpenSync integration	Services are turned on for all customers after enabling OpenSync across all deployed Gateways.

Offering Plume’s new Smart Home Services as an upsell to existing customers provides a fast time to market, but the subscriber penetration over 5 years is only 23%. To achieve a higher penetration rate, go to market strategies should also include providing Smart Home Services by default to all new customers and also upgrading existing deployed home Gateways with OpenSync to enable 100% of customers with the service and benefit from the resulting churn and OPEX savings.

AVERAGE INCREASE IN SUBSCRIBER PENETRATION WITH CEM DEPLOYMENT



Plume provides OpenSync certification programs along with integration partners to work with your CPE ODMs to support upgrades of eligible Gateways deployed in the field. OpenSync supports all major chipset manufactures and many existing ODMs for DOCSIS, fiber and router configurations. Contact Plume today to review your most efficient go-to-market options.



Deployment speed and agility

Plume's CEM Platform abstracts hardware complexity from the gateway and extenders, which avoids traditional challenges with firmware releases and updates. The benefits of a cloud-based services platform are:

- Uniform service consistency and compatibility across different hardware platforms
- Agile development process with iterative deployments and improvements
- New features or enhancements delivered every four weeks, skipping the traditional firmware deployment and regression cycle

The time improvement in development and deployment for Plume's cloud-based CEM Platform vs. a traditional firmware-based approach is eight months or an 89% reduction. Major features releases typically take three cloud release cycles, or three months, resulting in an overall feature velocity improvement of 67%.

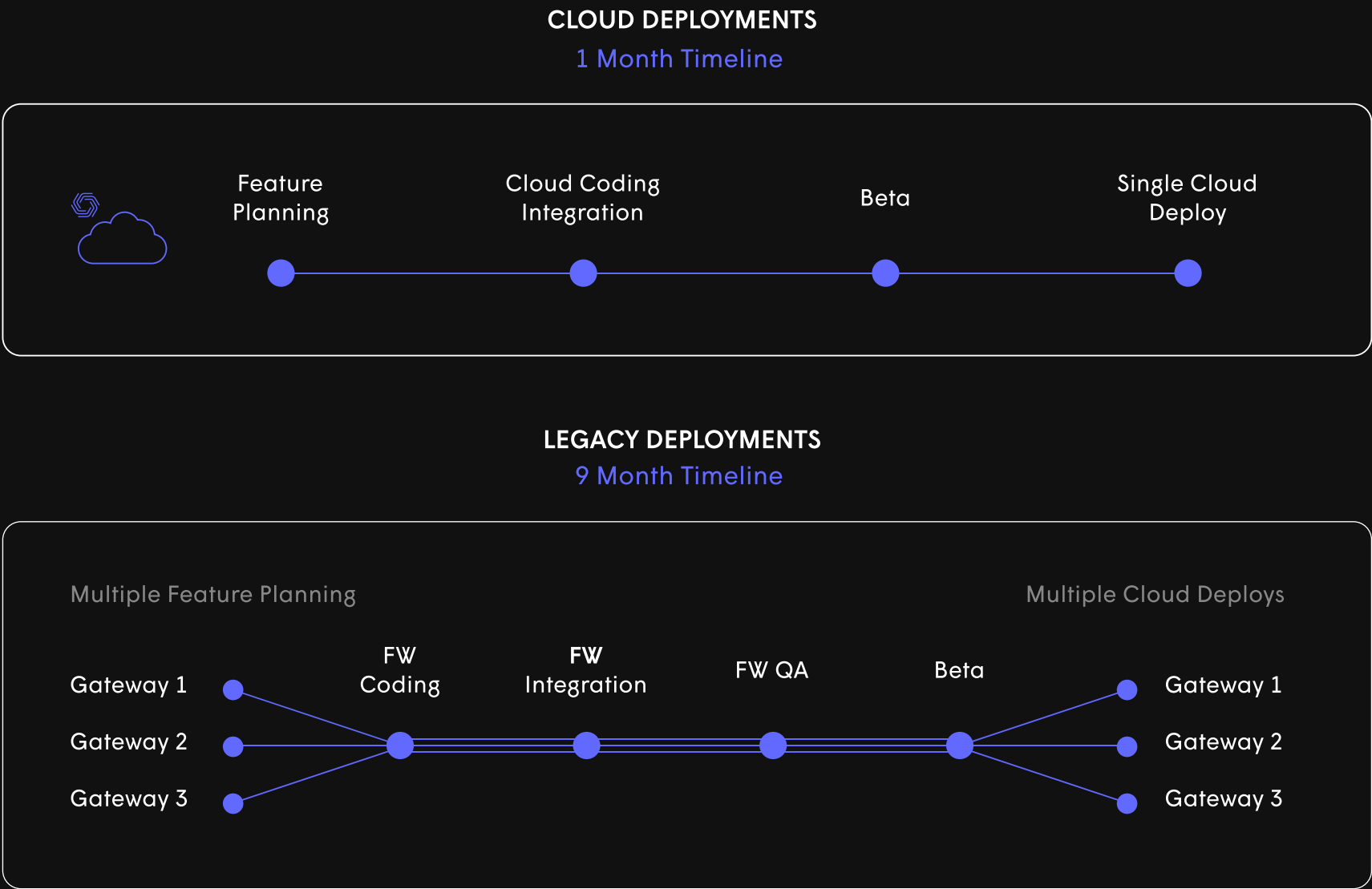


FIGURE: ACCELERATED DEPLOYMENT SCHEDULE WITH PLUME CEM PLATFORM OVER TRADITIONAL FW UPGRADES

Conclusion

There is a clear set of common problems faced by CSPs of all sizes in this ever-evolving smart home world—all of which are measurably addressed by the Plume CEM solution. With Plume, software-defined, cloud-based implementation is simple and infinitely scalable, allowing CSPs to bring an entire—and growing—suite of Smart Home Services to their customer base nearly instantaneously.

© 2021 Plume Design, Inc. All rights reserved. Plume, Powered by Plume, Powered by Plume HomePass, Plume IQ, SuperPod, PowerPod, HomePass, OpenSync, Adapt, Control, Guard, Sense, Thrive, Haystack, Panorama, Signal, Frontline, Harvest, Clarity, Crusade, and Generate are trademarks or registered trademarks of Plume Design, Inc. Other company and product names are used for informational purposes only and may be trademarks of their respective owners.



Appendix: by the numbers

Long-term phone call and cost records for over 2 million customers were analyzed in the first half of 2019 to measure the operational benefits of the Plume CEM Platform deployment. All statistics represent the greatest percentages measured for each category

This TCO study considers a blended deployment model of Tier 1, Tier 2, and Tier 3 CSPs on a per-customer basis, including multiple service types and home types. Each customer is provided one or more of Plume’s HomePass services, including Adapt, Control, Guard, and Sense. Monitoring and management of customers was done via Plume’s backend applications, including Frontline and Panorama.

The analysis methodology is based on actual average CSP service or lease fees to customers, call-in and truck roll rates. Churn reduction was measured by customers cancelling their internet service after being active for 60 days prior, operational expenses as reported in financial reports, and hardware costs from CSPs and ODMs supplying hardware for high speed internet service. This study accounts for additional revenue gained by CSPs for offering new services, streamlining of service installation, cost of hosted services, ongoing operational cost reductions, and customer churn impact on overall business.

THE FOLLOWING METRICS WERE USED IN THE FINANCIAL STUDY, BASED ON CSP RECORDS AND PRICING.

REVENUE (PER MONTH)	
Single-play (internet)	\$60.00
Whole-home WiFi with HomePass	\$12.50
HomePass alone	\$5.00
Double-play (internet + video)	\$90.00
Triple-play (internet + video + voice)	\$120.00
Quad-play (internet + video + voice + cell)	\$150.00

OPERATIONAL EXPENSES (PER TRANSACTION)	
Customer call	\$8.00
Truck roll	\$100.00
Technician installation	\$150.00
Operating cost percentage of revenue	60%

SUPPORT RATES (DAILY)	
Call-in rate (Total)	0.20%
Call-in rate (Internet related)	50%
Truck roll rate as percentage of calls	25%

CHURN RATES (YEARLY)	
Single-play	28%
Double-play	23%
Triple-play	13%
Quad-play	6%
Blended churn rate	18%

HARDWARE COSTS (PER HOME)	
Gateway	\$70.00
Extenders (2x per home, super fast)	\$160.00
Hardware lifecycle	5 years

MARKETING EXPENSES (PER CUSTOMER)	
New customer acquisition	\$500.00
Existing customer acquisition	\$100.00

