



Data Driven Personalized Engagement

Harnessing the power of device telemetry, customer context and big data analytics to keep customers engaged, learning and happy.

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asurion

EXECUTIVE SUMMARY

In the era of proliferating mobile applications and ever-increasing data volumes, personalized customer engagement is the key for attracting new customers and optimizing their satisfaction. Properly managed, personalization leads to significant value, but mismanaged personalization leads to disappointed customers and poor business performance. Asurion's data-driven personalized engagement system offers a state-of-the-art solution for optimizing business value based on big data analytics and mobile device telemetry, while protecting PII and ensuring data security.

The Value in Personal Engagement

An effective engagement strategy engages the customer at each stage of their journey. Content is tailored to specific customer segments and hyper-personalized to individuals. Actively engaging the customer is a key tool to improve their experience and therein increase their lifetime value. The business impact of effective personal engagement can have significant business impact. One such study found that reducing churn by 5% boosted profits by 25 to 85% across several industries.

Data-driven Engagement System

The personalized engagement system utilizes multiple information sources, including device telemetry. The system includes state-of-the-art, big data algorithms and machine learning for addressing the key use cases underlying customer engagement. Customer engagement sub-systems, such as Asurion's Soluto Connect (CRM software and call center tech coaches) or the Soluto Engagement Manager directly engage the customer. The system targets each customer and customer segment with unique, valuable and actionable insights.

Privacy and Data Isolation

Customers expect personalization. For personalization to be successful, the customer must trust that their data is kept private and that sharing their data returns value. Similarly, in protecting their customers, mobile telecommunications carriers require isolation of the their customers' data. Asurion's personalized engagement system keeps personal information private, supports regional isolation of data and ensures data isolation between carrier customers.

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CONTINUALLY IMPROVE
CUSTOMER LOYALTY WITH
DATA-DRIVEN ENGAGEMENT

Personalized Engagement Brings Loyalty

With 11.6 billion or more mobile-connected devices being online in 2020 [1], personalized engagement with customers is a key requirement for business success.

Personalizing Engagement

Personalized engagement is about delivering content tailored to individuals [2, 3]. Engagement is valuable when it is relevant, timely and actionable. An effective engagement strategy must include educating, motivating, rewarding, delighting and inspiring customers so that their subscription continuously returns value.

The leading companies of the world harness the power of big data and advanced analytics to create personalized and engaging content. Similarly, Asurion's Personalized Engagement System employs advanced big data analytics in order to drive personalized engagement and business impact.

Impacting Business KPIs

The value of subscription-based products and services, such as Asurion's Soluto Premium Support, are characterized by well-known business Key Performance Indicators (KPIs) such as Customer Life Time Value (CLV), and Monthly Recurring Revenue (MRR). The drivers of these KPIs are customer satisfaction and

engagement. Actively engaging the customer is a key tool to improve CLV, leading to significant business value [5].

The business impact is significant. For example, a well-known study found that reducing churn by 5%

boosted profits by 25 to 85% across several industries [6]. Asurion found that the difference in churn rate of an engaged customer with a Soluto Premium Support subscription and that of a device protection customer without engagement is up to 33%.

Personalization Throughout the Customer Journey

An effective engagement strategy engages the customer at each stage of their journey.

Every mobile device customer moves among four basic stages where they need personalized engagement:

On-boarding

The customer needs to get up and running. The personalized engagement gives a warm welcome, helps configure the device and peripherals, transfer content, load their applications, and set up accounts.



Support

The customer seeks technical support for using their device or application better. The personalized engagement occurs through click to chat, technology call center or in-app notification.



Periodic, personalized engagement throughout the customer's lifetime increases customer loyalty.

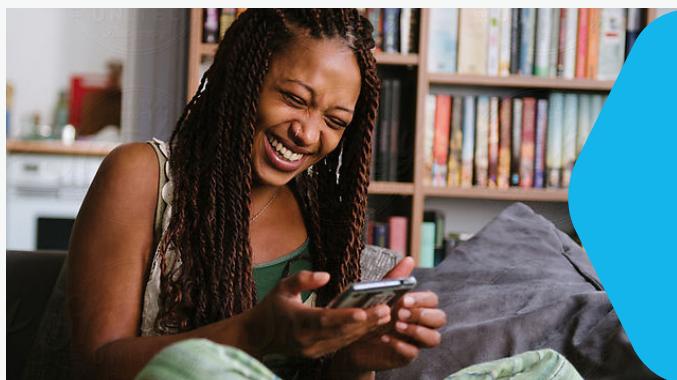
Recovery

The customer needs to resume using the device following a device claim, such as for replacement or repair. The personalized engagement helps restore their applications and accounts.



Growth

The customer is learning how better to use their device and applications and is growing in their connected life. The personalized engagement sends messages about trending applications that correspond to their persona and interests.





BIG DATA ANALYTICS

The Data-Driven Engagement Ecosystem

The Asurion data-driven personalized engagement system includes multiple information sources, a big data analytics platform, and customer engagement sub-systems. The system is massively scalable for processing high volume, high velocity, and high variety data sets in order to present engaging content to the customer.

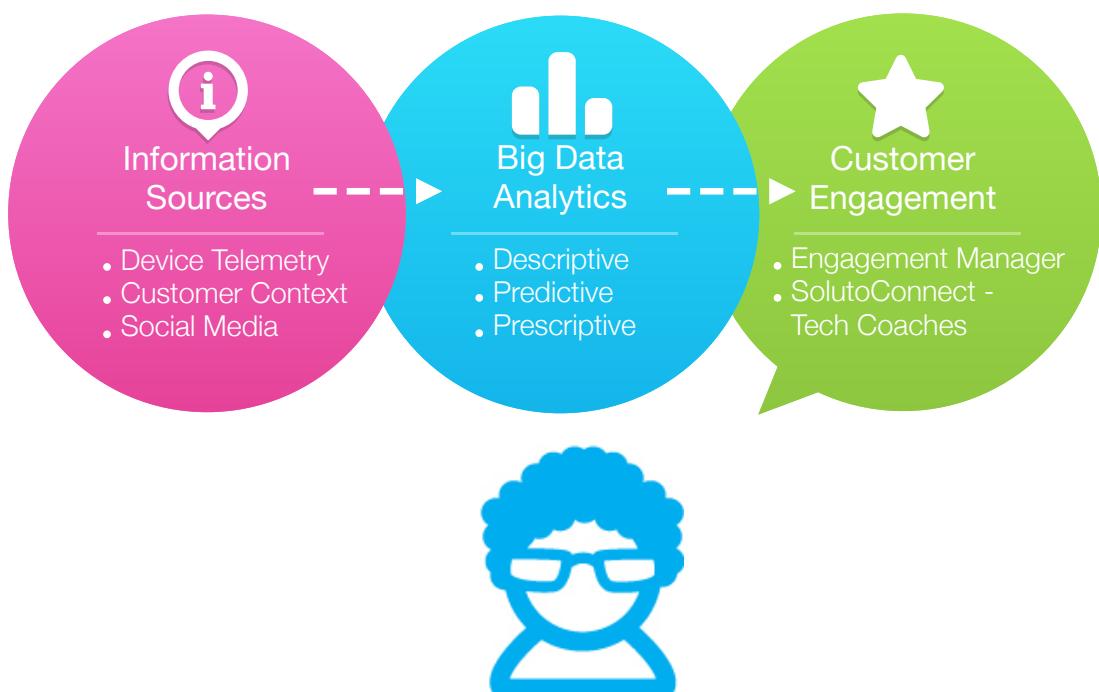
Following recent trends with the world information explosion [4], the Asurion big data analytics platform derives value from the increasing variety, high volume and high velocity of information sources. Key data sources include customer journey context from their enrollment data, call center logs, device claims, device telemetry, and social media trends.

The analytics platform is based on Amazon's Elastic Map-Reduce cloud computing infrastructure. Analytics algorithms are horizontally scalable and include machine learning paradigms required by the personalized content use cases. Analytics are characterized as descriptive in nature, predictive or prescriptive.

Customer engagement sub-systems, such as Soluto Connect or Engagement Manager, engage the customer with "Targeted Insights," corresponding to a specific individual or customer segment.

Soluto is the Asurion-branded premium support solution for support of smartphone and IOT (Internet of Things) customers. A Soluto technical support coach (call center agent) provides one-on-one technical support coaching to customers through click-to-chat or click-to-call tools.

The Engagement Manager enables delivery of Targeted Insights via SMS, email, in-app notification and Soluto Connect Tech Coaches.



Device Telemetry

“ Device telemetry enables real-time measurement of customer experience and context.

Collection of device telemetry is the process of remotely measuring and collecting information on the device and transmitting the data to a system for analysis and monitoring. The Asurion mobile application includes a Telemetry Library, which collects diagnostic information for the purpose of quantifying the customer experience.

The Telemetry Library is an SDK and constitutes a well-defined application programming interface (API) for easy

integration. The SDK is available for Android and iOS. Following collection, the telemetry data is uploaded to the Asurion cloud-based analytics system. Collection and transmission of device telemetry are optimized to balance frequency of collection for obtaining up-to-date information with minimizing battery drain and data volume.

The key tenets of device telemetry collection are:

PII

Personally Identifiable Information (PII) is not collected from the device and device identity is anonymized.

See details about this in the "Privacy and Data Security" section.

Compression

All data is compressed on the device to minimize data transmission costs. Payloads are small as possible: the average data usage is approximately 25 to 40 KB per day.

Minimal Battery Use

Telemetry collection is optimized for minimal battery impact. Analytics computation on the device is minimal.

Restrict when to send data

The device can be configured to send data only when connected to Wi-Fi or only when the device is charging.

Details about collecting data on Android and iOS devices are contained in the *Telemetry Report Datasheet*, available from your Account Manager. For example, some of the information collected for an Android device is listed in the table below.

Android Telemetry Report	Description
Overview	An overview of the device: its make, model, operating system, firmware version, storage, and telephony information.
Settings	Various settings, including screen brightness, auto-brightness, location services, GPS, Wi-Fi, Bluetooth.
Battery Usage	Data about battery power level, temperature, voltage, and current.
Storage	The amount of internal and external storage used by different types of content.
Network Usage	Mobile and Wi-Fi data used by the device overall and categorized by application.
Apps	All applications on the device, when they were installed and last updated.
Bluetooth	Bluetooth settings, along with the external accessories paired with the device.
Wi-Fi	Wi-Fi settings, including routers that the device has connected to.
Age	The last times when key features of the phone were used, such as last photo taken, last SMS sent, last email sent, and so on.
Accelerometer	X, Y, Z directions of acceleration of the device.

Big Data

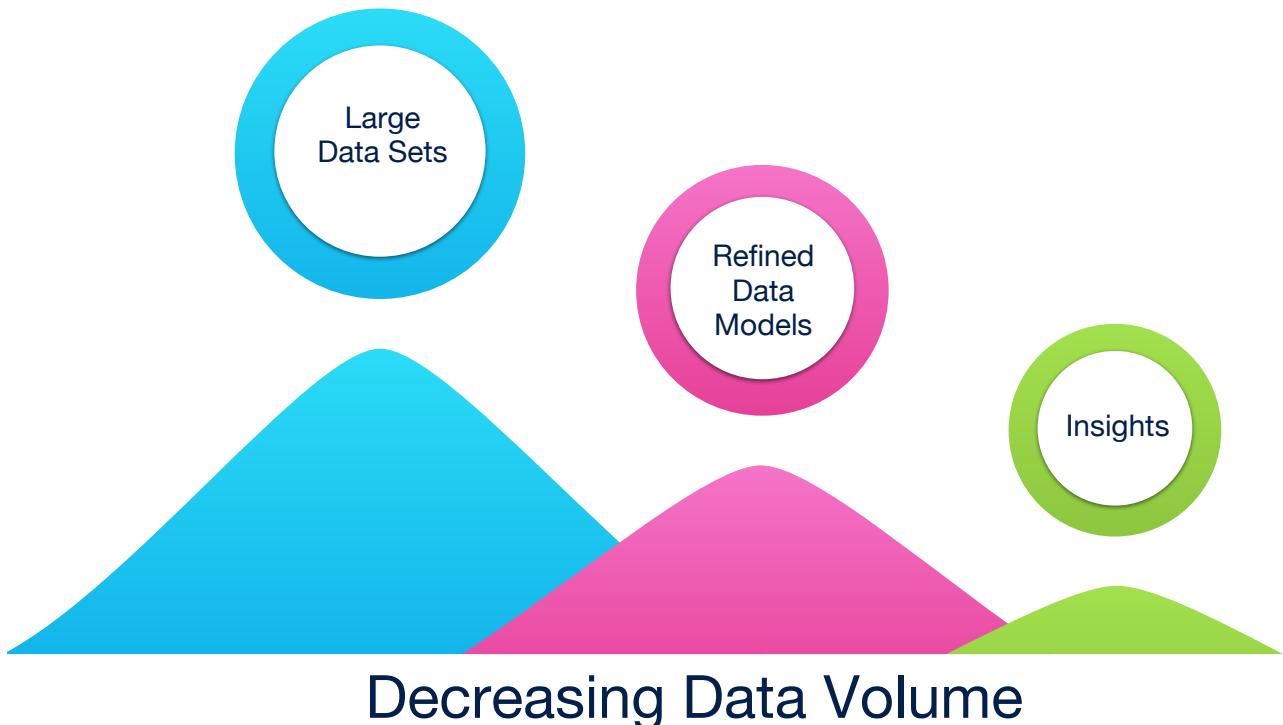
There are numerous definitions for the terms "big data" and "big data analytics" [6,7]. A popular definition of big data analytics is: big data analytics is the process of collecting, organizing and analyzing large sets of data to uncover hidden patterns, market trends, customer preferences and other useful information. At Asurion, we call this information "Insights".

Based on this definition of big data, we describe big data analytics in the context of the Asurion personalized engagement system as having the following features:

- ▶ Processing peta-byte and zetabyte-scale data sets
- ▶ Advanced analytics
- ▶ Targeted Insights

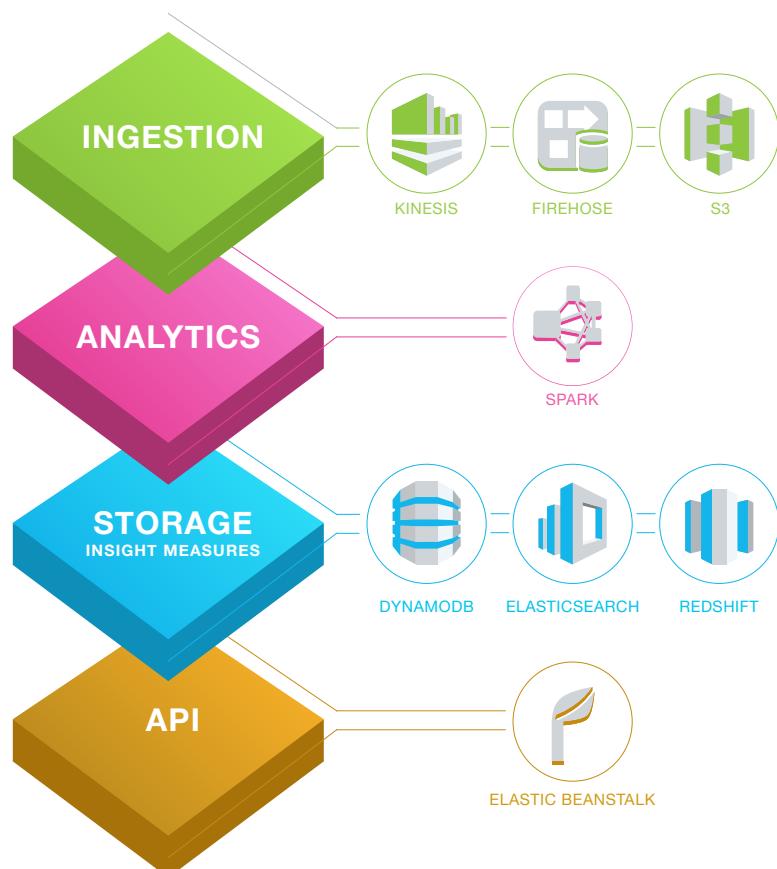
The amount of data required for personalized engagement decreases as data processing progresses through the system.

The system begins by processing raw, unprocessed information sources such as device telemetry (petabytes), call support logs, customer context and social media data (10 zettabytes scale, 2016) [8]. Advanced analytics are then applied and generate refined data models. Finally, Targeted Insights—relevant and personalized content—are derived corresponding to customer segments.



Processing Large Data Sets

Asurion's big data processing platform resides on Amazon Web Services (AWS). Big data processing and analytics algorithms employ distributed computing machinery for achieving virtually unlimited and cost-effective scalability.



Ingestion of device telemetry, customer context, tech support call logs, and social media feeds employs Kinesis, Firehouse and S3 storage.

Advanced analytics are built on the Spark platform. Spark is the world's leading open source platform [11, 12, 13] for implementing iterative algorithms, such as linear regression, supervised learning and unsupervised learning on large data sets. Spark is 100x faster in memory and 10x faster on disk than Hadoop [23, 24]. Asurion's advanced algorithms are implemented utilizing Spark's Machine Learning Library (MLLIB).

Analytics results ("measures") are stored in DynamoDB NoSQL highly scalable and performant storage and the Elasticsearch distributed indexed document search engine. Elasticsearch [13] stores segmentation indexes for the purpose of targeting insights to specific customers or customer segments.

For scalability to an arbitrary number of customers, access to Targeted Insights is implemented as RESTful (REpresentational State Transfer) APIs on Elastic Beanstalk.

“

The Asurion Big Data Engagement Ecosystem derives customer value by ingesting and processing high volume, high velocity, high variety data and delivering relevant, timely, and actionable Insights.

Advanced Analytics

"Advanced analytics" means more than large scale data processing. In addition to descriptive statistics, the Asurion big data platform provides advanced predictive and prescriptive models. These models, implemented as Spark algorithms, describe the past, forecast the future, and suggest actions that enhance the customer experience.

Describe the Past

Descriptive analytics reflect the past, what has happened, such as the average device storage use and the rate of change.

Forecast the Future

Predictive analytics use statistical models that forecast what could happen. Predictive analytics include, for example, linear regression which estimates when the device will be out of storage.

Suggest Actions

Prescriptive analytics techniques are used both to estimate the future and suggest decision options, such as actions to avoid running out of storage. One such recommendation would be to delete unnecessary mobile application files.



INGESTION, MINING, PARSING, CLEANSING

Information
sources



DESCRIPTIVE

Provides insight into the past and what happened



PREDICTIVE

Forecasts the future and what could happen



PRESCRIPTIVE

Estimates the future and suggests decision options

The following table summarizes the advanced analytics algorithms and technical use cases employed by Asurion's big data system:

Analytics Categories	Technical Use Cases	Big Data Algorithms
Descriptive Analytics	<ul style="list-style-type: none"> • Individual performance statistics • Cohort statistics • Time-series descriptive statistics 	<ul style="list-style-type: none"> • Spark Data Frames and MLLIB
Supervised Learning	<ul style="list-style-type: none"> • Prediction and detection of customer experience issues • Customer churn modeling 	<ul style="list-style-type: none"> • Linear Regression, Bayes models, Logistic Regression • Regression Tree, Support Vector Machines and Ensemble models • Time-series analysis, ARIMA • K – Nearest Neighbor (Prediction)
Un-supervised learning	<ul style="list-style-type: none"> • Customer Persona 	<ul style="list-style-type: none"> • K-means • Heuristics-based persona algorithms
Recommendations	<ul style="list-style-type: none"> • Recommended content • Application recommendations 	<ul style="list-style-type: none"> • Apriori algorithm • Propensity score analytics • K-Nearest Neighbor • Collaborative Filtering with Singular Value Decomposition and Alternating Least Squares
Trending Issues	<ul style="list-style-type: none"> • Social media trending issues 	<ul style="list-style-type: none"> • Word frequency and sentiment analysis • Time-series with poison arrivals distribution
Indexed Document Search	<ul style="list-style-type: none"> • Segmentation 	<ul style="list-style-type: none"> • Elasticsearch (Lucene Indexes)

Description and background on these algorithms can be found in references such as [10, 13, 14, 15]. Asurion custom algorithms and heuristic methods complement these standard big data algorithms.

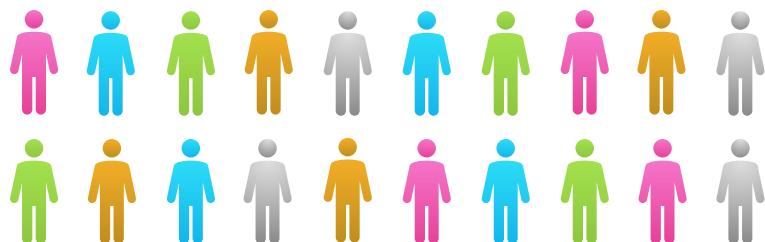
Segmentation

Segmentation is a key enabler for delivering and quantifying effective personalization. Following the analytics processing, segmentation enables differentiation of the customer set according to logical combinations of parameters. Segmentation is built on Elasticsearch, with an indexed document corresponding to each endpoint.

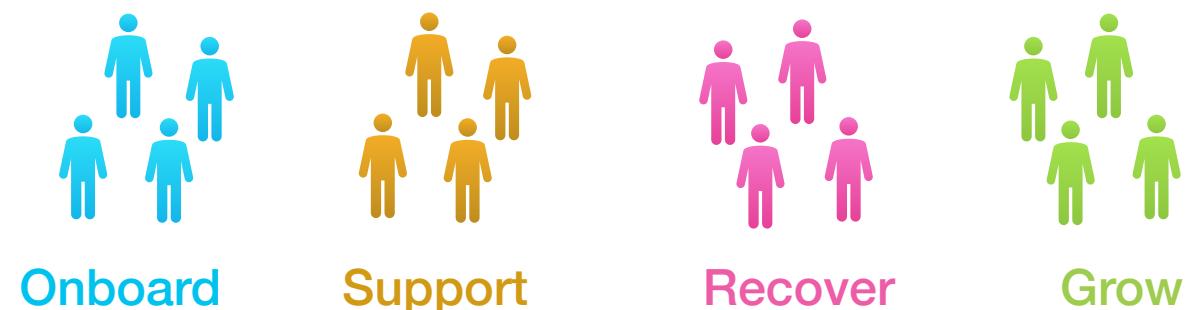
The diagram illustrates segmentation by customer journey, where each journey segment is derived from the customer context. In addition to segmenting by the

customer journey, segmentation also breaks out each customer journey group into sub-segments based on combinations of parameters such as device make and model, device settings, installed applications, and persona. For example, the top data-consuming applications may be sent to the Support segment.

Additionally, segmentation is a key tool for quantifying the effectiveness of personalization through the use of A/B testing and the impact of engagement on business KPIs.



Segmentation Based on Consumer Journey



Targeted Insights

The big data API receives targeting logic, forms logical combinations of measures and returns Targeted Insights.

Targeted Insights are the means to realize personalization and consist of content formulated and directed to specific customers or segments of customers. Targeted Insights result from a combination of Elasticsearch-based indexes and combinations of measures that satisfy the prescribed targeting logic.

For example, one such measure may represent the storage used by a device. A Targeted Insight might consist of the following logical combination of measures: devices of a specified make, model, OS version, battery drain performance relative to other devices of the same make and model (cohort), devices that have Wi-Fi On, and devices that are impacted by social media derived issues or call center trending issues.

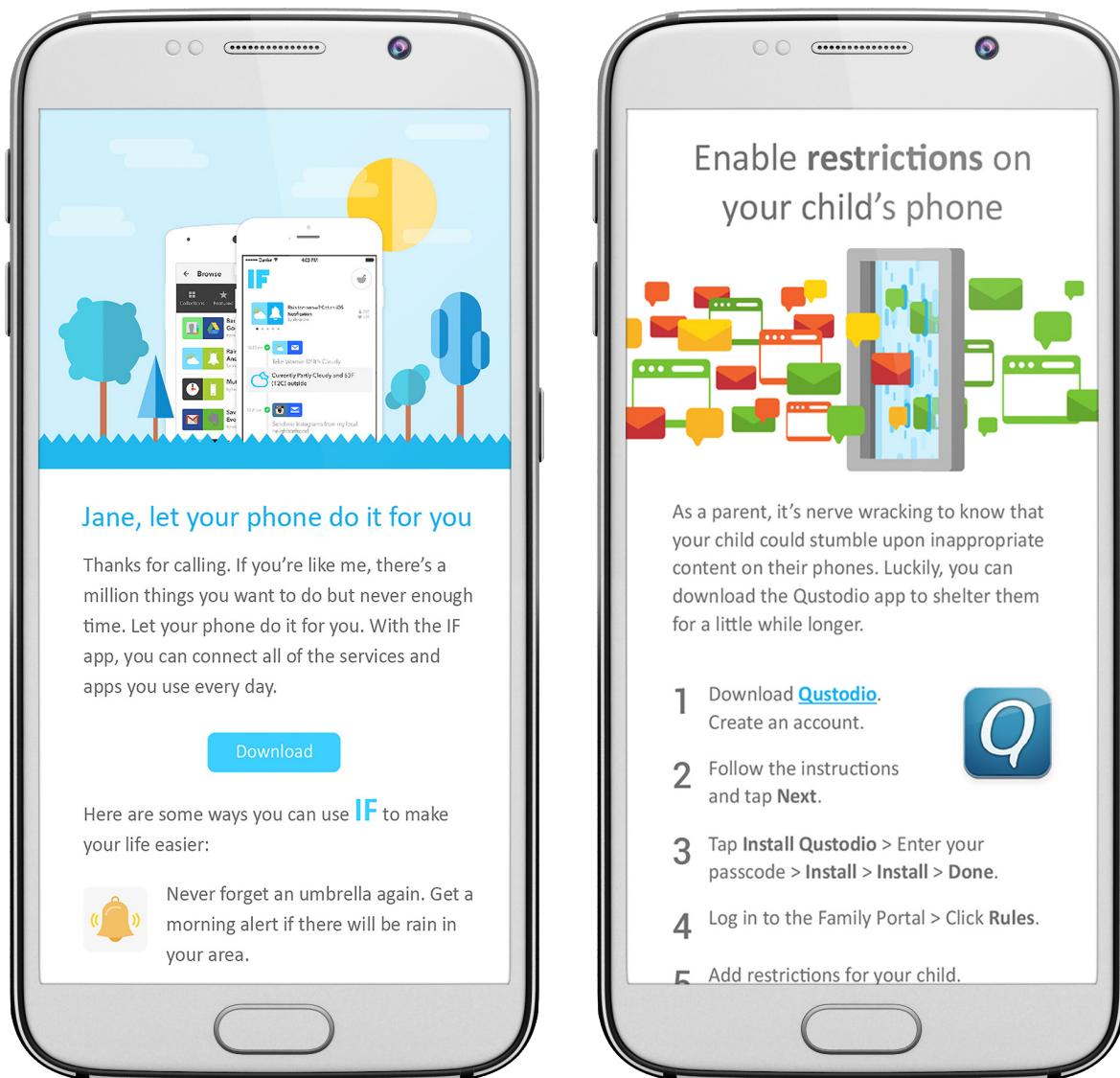


Personalized Content Delivery

The engagement subsystems query the big data API, receive Targeted Insights, render content into visually appealing designs and distribute the content.

The engagement subsystems access big data APIs in order to identify the devices which will receive personalized content. The content may be combined with other content sources and is then delivered to the target customers through in-app notifications, device messaging or email.

Below are two examples of Targeted Insights. On the left is an Insight sent to a customer who has been identified as a "Tech Savvy" device user who is always interested in improving their device use skills. On the right is a Targeted Insight sent to a customer who is identified with the "Family with Kids" persona and offers advice on how to enable restrictions on the children's phones.





**CONFIDENCE IN PRIVACY
INCREASES ENGAGEMENT**

Privacy and Data Isolation

For personalization to be successful, the customer must trust that their data is kept private and that sharing their data returns value.

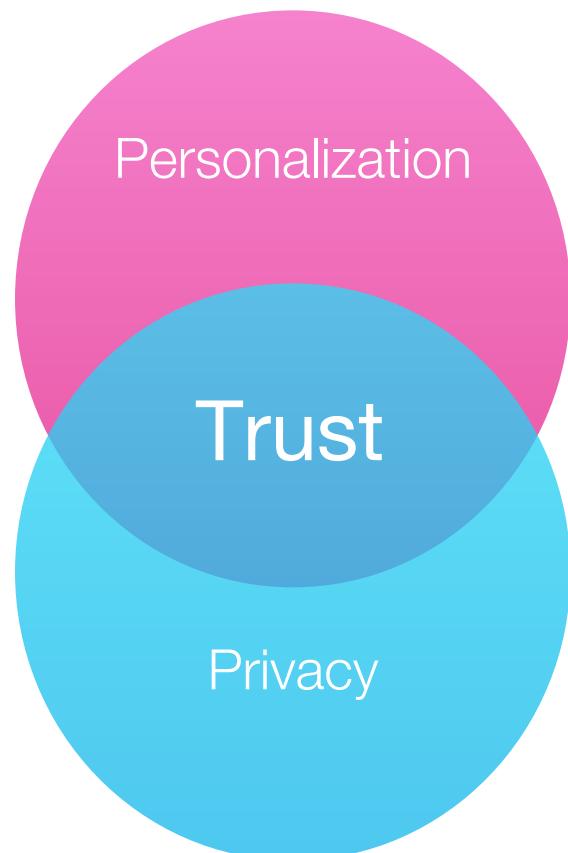
There are two key sets of requirements for handling Personally Identifiable Information (PII): legal requirements [15, 17] and customer trust [16, 19]. PII or SPI (Sensitive Personal Information) is information that can be used on its own or with other information to identify, contact or locate a single person. Additionally, most countries include a requirement that personal information remain inside of the country.

Customers are protective of their data and they expect personalization. Building trust with customers requires transparency with how their data is used to create correspondingly meaningful and valued engagements. Without trust, customers are more likely to "unlike" and unsubscribe from products and services, but they are more willing to share their data when they trust [16, 19] its use.

Asurion secures PII and keeps each carrier's data isolated and secure. Targeted Insights enable creating personalized content for the specific customer segments where it is valued.

Common PII items are [15, 17]:

- ▶ **Name**
- ▶ **SSN**
- ▶ **Address**
- ▶ **Internet Address**
- ▶ **MAC Address**
- ▶ **Photographic Image**
- ▶ **Telephone numbers**
- ▶ **Date of Birth**
- ▶ **Date of Birth**
- ▶ **Place of Birth**
- ▶ **Race**
- ▶ **Religion**
- ▶ **Weight**
- ▶ **Location**
- ▶ **Employment**



Keeping Personal Information Private

Best practices for protecting personal information include anonymization, minimizing collection, following use and retention policies, and enforcing privacy safeguards [15, 17].

Asurion maintains standards and procedures to meet governmental requirements and follow best practices. Customer information is kept private and telecommunications carrier customer data is isolated and secure [18].

Customer context data is anonymized and secured. PII fields are encrypted prior to access by the data-driven engagement system. Prior to applying analytics algorithms, telemetry data is anonymized by de-identifying personally identifiable information. That is, PII is removed or obscured. Following de-identification, the information is aggregated for making comparisons, analyzing trends and identifying patterns. Carrier customers and their consumers can trust that Asurion secures their private data.

How Anonymization Works

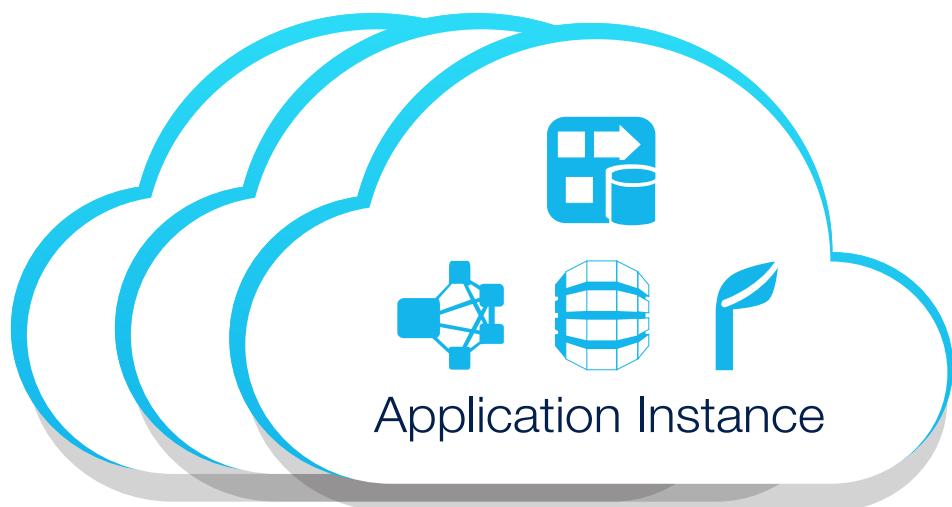
- 1 The smartphone registers with the big data system using its Mobile Directory Number (MDN). The MDN is encrypted and secured and not used in further processing.
- 2 After registration, the smartphone is assigned an End Point identifier (EID). The EID is a Universally Unique Identifier (UUID), Type 4 (Random).
- 3 The smartphone registers its Google Cloud Messaging (GCM) token or Apple Push Notification (APN) token with the system. Following this registration procedure, all communications to or from the smartphone are based on GCM or APN tokens.
- 4 The smartphone uploads its telemetry data to the Asurion's data-driven engagement system using its EID. Device telemetry does not include PII. Following telemetry collection, the big data analytics system generates Insights based on customer context and device telemetry and stores them in anonymized data storage.
- 5 The Engagement Manager then accesses Insights by EID and, according to specific engagement business rules, sends them to the smartphone according to its corresponding GCM/APN token.

Data Isolation

The specifics of any cloud computing architecture is driven by business requirements, security and privacy [20, 21, 22]. Two key requirements are 1) secure isolation of data between carrier customers; 2) regional cloud computing centers to ensure that personal data is not exported out of the country or region.

The Asurion big data system satisfies both of these requirements. Regional or country deployments is a

fundamental feature offered by AWS, enabling the engagement system to be deployed regionally. A Multi-Instance Multi-Tenant system is employed, where each carrier customer is assigned a dedicated virtualized application instance. The system maintains data isolation between carrier data and also provides the benefits of multi-tenant cloud scalability [22].



Conclusions

Personalized Engagement Value

- An effective engagement strategy engages the customer during each stage of their journey.
- Personalization serves relevant, timely, and actionable information to customers by harvesting rich and heterogeneous data sources.
- Personalized engagement increases customer satisfaction, has significant impact on business KPIs and increases Customer Lifetime Value.

Data-Driven Engagement System

- Asurion's leadership in big data and advanced analytics provides a complete, state-of-the-art, data-driven personalized engagement system.
- Rich information sources ensure a robust and endless source of relevant content for personalization.
- Device telemetry enables real-time measurement of customer experience and context.
- The system is designed to process arbitrarily large data sets.
- Advanced analytics, including predictive and prescriptive models and big data algorithms, support all key customer engagement use cases.
- Targeted Insights support personalized content to individuals and segments.
- Engagement subsystems obtain Targeted Insights, render the content into visually appealing designs and deliver the content.

Privacy and Data Isolation

- Asurion follows PII best practices, maintains standards and procedures to meet governmental requirements, and keeps carrier customer and customer information private.
- Device telemetry does not collect PII. Telemetry and Insight storage are anonymized and customer context-related PII data is secured and encrypted.
- Following anonymization, information is aggregated for making comparisons, analyzing trends and identifying patterns.
- A Multi-instance Multi-tenant architecture provides limitless scalability and ensures data isolation for carrier customers.

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Asurion is an award-winning, global, technology company providing device protection, personalized claim and technical support, and warranty protection. Our 17,000 employees are committed to making technology easy for device users; being transparent, personalized, and reassuring when we address customer inquiries. We help each person grow in their connected life and we strive to delight customers with the technology that their lives depend on.

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