

Signaling Data for More Accurate News Push: Postprint

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Abstract

With the evolution of the Internet, users no longer exclusively rely on news applications to obtain news information; emerging information access modalities such as browser-based news feeds and social media reading are increasingly competing for the user resources of news applications. Faced with this competition, how can news clients maintain their competitiveness? Beyond accelerating information dissemination and optimizing content quality, the news information push notification functionality—which directly captures user attention—cannot be overlooked. However, current traditional precision news push methods have not achieved genuine precision. News applications can leverage telecom operators' signaling data to improve news push accuracy, thereby attracting users and enhancing competitiveness.

Full Text

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Leveraging Signaling Data for More Precise News Delivery

Abstract: With the development of the Internet, users no longer rely solely on news applications to obtain news and information. Emerging information channels such as browser-based news and social media reading are competing for user resources from news apps. Faced with this competition, how can news clients maintain their competitiveness? In addition to accelerating information release speed and optimizing content quality, the news push function—which directly competes for user attention—cannot be ignored. However, current personalized news push methods have not achieved true precision. News apps can leverage telecom operators' signaling data to improve the accuracy of news pushes, attract users, and enhance competitiveness.

Keywords: News; Signaling Data; Telecom Operators

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1. Telecom Operators' Signaling Data

In network transmission, various signals are transmitted. Some are directly needed (such as voice calls, internet data packets, etc.), while others are not directly needed but are specifically used to control circuits. This latter type of signal is called signaling. Signaling is a message transmitted between terminals, or between terminals and networks, specifically used to control circuits, establish, manage, and delete connections so that users can communicate normally through these connections. Therefore, signaling is essentially a control signal, and signaling data refers to user information obtained during signaling transmission. This data includes basic user information (name, gender, phone number, etc.), billing information (tariff data, package subscription data, etc.), service information (service usage, internet access behavior, etc.), and location information (base station and cell location, etc.). This information is highly comprehensive and can reflect user behavior in detail, precisely tracking users' every action. As providers of telecommunications services, telecom operators have access to complete real-time signaling data for every mobile user and can output this data as a service capability for various industries.

2. Is Precise News Push Truly Precise?

Mobile news clients are applications that provide continuous, real-time, and comprehensive news updates for mobile phone users, covering domestic and international news, military, social issues, finance, sports, entertainment, and other information. With the popularization of smartphones and the development of mobile internet, mobile news clients have become one of the primary channels for people to access news. However, as browsers evolve from "browsing" to "reading," and social platforms rise as news reading channels, the ways people obtain news from mobile devices are gradually changing. News clients face the challenge of attracting and retaining users. To meet this challenge, besides focusing on news release speed, content quality, and user experience, news pushes that reach users immediately upon opening the app are equally important. News push refers to the proactive delivery of real-time major information by news clients to the notification bars of mobile devices such as smartphones

and tablets, ensuring that information appears before users' eyes at the first moment of device usage.

Current personalized news recommendation mechanisms primarily rely on the following approaches:

User profile data including gender, age group, city, and interest characteristics.

Collaborative filtering, which includes article-based collaborative filtering (e.g., if 70% of users who read article A also read article B, then recommend article B to users who read article A) and user-based collaborative filtering (if user A and user B have similar interest profiles, recommend to user A articles that user B has read but user A has not).

Content similarity modeling by extracting entity words from articles, analyzing and categorizing them, and refining user profiles. For example, if a user's profile is technology-related and an article is also technology-related, the article is recommended to the user.

Positive and negative feedback mechanisms to evaluate recommendation accuracy. Positive feedback includes clicks, reading duration, shares, bookmarks, and comments. Negative feedback is similar to the "×" button in Toutiao, which asks users for reasons for their lack of interest.

Other factors such as article publication time may also carry weight in information-based services. In practice, these algorithms are combined to ensure recommended content matches user interests. The more articles a user reads, the more historical behavior is recorded, and the more accurate the recommendations become.

However, the above mechanisms have significant limitations. First, once users develop certain reading habits, recommended content becomes confined to their existing interests, potentially failing to expose them to new fields or hot topics. To address this, some apps feature fixed top stories or hot topic channels. Second, such pushes cannot dynamically track changes in user behavior to provide dynamic personalized recommendations. For instance, when a user's geographic location changes, news clients should push location-relevant information based on the user's whereabouts. Third, there is the cold start problem. "Cold boot" is a technical term in data mining that refers to the challenge of requiring data accumulation when the product initially has no data or insufficient data volume. In the early stages, news clients lack user behavior records, making personalized pushes for early users impossible to achieve through the above methods.

3. How Signaling Data Enhances News Push Precision

Signaling is a message transmitted between terminals, or between terminals and networks, specifically used to control circuits, establish, manage, and delete connections. Through statistical analysis of signaling data, we can obtain authentication information for internet users, including their online time, data consumption, visited website IP addresses, and content. Combining this signaling-derived information with user attributes enables analysis of different user groups' internet characteristics and preferences, thereby enabling more

precise news pushes.

Signaling data can provide the following types of internet user behavior information:

User network consumption capacity can be determined by analyzing data usage over a specific time period.

Identification of various mobile applications used by users, such as WeChat, Weibo, and UC Browser, along with statistics on data consumption, access frequency, download speed, and success rate for each application throughout the day.

Identification of users' internet content, including websites browsed on mobile devices, keywords searched through search engines, products viewed and keywords searched on e-commerce platforms, videos watched, and regular online activity times.

Identification of user location information, including current location, cell 归属, cell attributes (high-traffic or high-call-volume cells), and administrative region classification. Location information derived from mobile cellular networks offers distinct advantages that GPS cannot replace, helping to formulate differentiated user-specific strategies.

Compared with user behavior information obtained through traditional news pushes, signaling data provides more comprehensive, accurate, and dynamic information. Telecom operators can access rich data including terminal information, location, call behavior, and mobile internet usage trajectories. This data encompasses users' lives and work, communications and internet activities, offering higher information value and broader scope, enabling more precise determination of user consumption behavior, internet behavior, and interest tags. Through data mining techniques (such as classification, clustering, and RFM analysis), operators can perform customer segmentation and build comprehensive 360-degree user profiles, making news pushes more precise.

4. System Architecture

4.1 Network Architecture

Telecom operators obtain real-time communication status data through signaling monitoring systems. Via interface servers, they trigger news push server functions, call internet media push APIs, and deliver news content to users in need at appropriate times. Simultaneously, operation records are synchronized to billing servers. When necessary, SMS gateways can be integrated to send messages to precise users, thereby increasing user activity in news apps. Media companies can use statistical query terminals to view results for business analysis. If issues are identified, they can send operation and maintenance tickets to telecom operators through management terminals to report problems.

4.2 Information Flow

By interfacing with China Mobile, China Unicom, and China Telecom, real-time signaling data is obtained from each operator's inter-network signaling monitoring system or core network optimization system, then converged and delivered to a data filtering and sharing platform. The required data is transmitted to the precise news push system.

5. Value and Implications

5.1 Commercial Value of Signaling Data Innovation

People currently face an information overload environment. Precise news push in news clients enabled by signaling technology can spare users the effort of searching for valuable information like finding a needle in a haystack, delivering potentially needed information directly to them. For example, when a user arrives at a school, signaling data analytics can push school-related information to users interested in the school, or recommend nearby snacks to users who frequently browse food websites. This news client push advertising model is highly targeted with a clear audience, unlike traditional broad-coverage advertising, thus offering higher potential to attract users. Moreover, this advertising approach is accessible not only to large manufacturers but also to small merchants who can advertise when users enter their business range. This approach is cost-effective and more likely to attract users, creating new revenue streams for news clients.

5.2 Transforming Telecom Operators' Business Models

As network-service separation accelerates and OTT providers and virtual telecom operators gradually rise, telecom operators are being reduced to traffic pipelines. Their traditional voice and SMS businesses face unprecedented challenges, and revenue growth has hit bottlenecks. As data becomes increasingly important to economic development and internet penetration deepens, mobile data traffic from telecom users is growing rapidly. Telecom operators can leverage their data resource advantages to provide information services to news clients, transforming from traditional single network service providers to diversified intelligent information service providers. However, operators must protect user privacy when providing information services. They have access to all data transmitted by users and can track every user action—where users go, what they do, whom they contact, and the content of those communications. Therefore, when providing user information to news clients, operators should be selective, providing data tags rather than specific values whenever possible to ensure user privacy is not violated.

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.