A Ten-year Traffic Forecast Study for China

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Abstract

China is facing a dramatic changing in mobile communications. Traditional voice traffic keeps growing, while data traffic bursts in recent years. Current mobile communication networks are thus challenged by this movement. Although some predicts on traffic growth in some countries are made, China has its unique characters that deserves further study. A Ten-year traffic forecast for China is proposed in this paper, which introduces long time forecast.
Key Words: mobile communications; data traffic forecast; ten-year forecast;

1. Introduction

Long term traffic forecast is utilized in various fields [1-4]. For instance, it is usually used as inputs for spectrum requirement calculations [5-6]. Spectrum allocation always takes years to be realized, thus the traffic forecast should cover a relatively long span, such as for several years. Although traffic forecast is considered in mobile communications, they are most concerned as short time forecast. Forecasts for several years are rare in this field, because people were eager to know if the change in traffic volume would have effects on network performance in the past. However, operators start to worry about having limited spectrum for the bursting traffic. In this way, long time forecast becomes hot recently.

China has some special characters that have great impacts on traffic forecast for a long time span. For example, the mix of different education background as well as the vast variety in people's ages, not to mention the emerging various types of terminals [7-11]. A novel analyzing method, namely Long Time Forecast Method (LTFM), is proposed in this paper to handle the long term traffic forecast study for China.

The rest of this paper is as follows. Sector 2 introduces LTFM. Sector 3 analyzes the characters in China, and presents the forecast results. Conclusions are drawn in Sector 4.

2. Long Time Forecast Method

Considering key factors in the traffic forecast and materials collected relationship, the follow chart of LTFM is shown below.

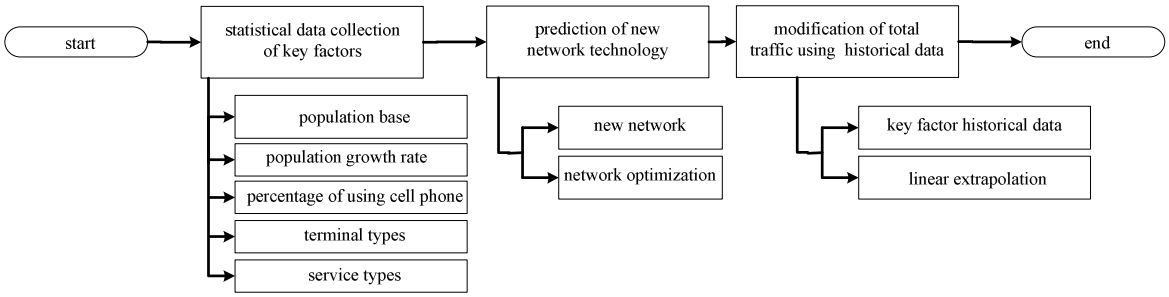

Fig. 1 The flow chart of LTFM

According to Fig. 1, LTFM mainly considers the following aspects in forecast for China.

2.1 New Mobile Application

The new series of content-rich mobile applications is the majority of consumers and business users increasingly being sought after, at the same time, these new business has also led to the explosive growth of data traffic. 3G network traffic statistics developed regions in Europe and the United States, the comprehensive three main terminals (intelligent terminal, laptop, netbook) flow analysis showed that: online video applications generate 30-40% of the traffic, and will become the most important mobile data traffic growth driving factors; ranked in second place is the web browser, 20-

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30% of the traffic. In addition, social networking, audio, email transceivers, software download mobile applications is also a 3G data traffic source.

2.2 Population Growth

The population is the basis of the number of users. The number of users is obtained on the basis of a certain user penetration statistics. The impact on the number of users of the population is reflected in the following aspects:

The natural growth of the population: the natural growth of the number of users will bring more traffic requirement.

The age composition of the population: it will affect the composition of the users of different ages. Obvious difference lies in the proportion of different ages in using the mobile communications business.

The education level of the population and practitioner characteristics: the level of education of the labor force has a strong correlation with its data services business volume and type of business. For example, the marketing strategy will often specified for different levels of education and age user; the use of multiple cell phones is found in higher proportion of foreign workers and frequent staff between the two places.

Population urbanization: with the development of economy, urbanization gradually accelerates across the country. People are pouring into the city, and will also generate more urban mobile users.

Population is the basic consideration. U_p and r_p represent population base and population growth rate. The predicted population is expressed as $(1+r_p)\times U_p$. Only part of the population would use mobile service. α_u is the percentage of people in proper age using cell phone, and γ is predicting time. γ is always valued by year. Yong people would grow up and start to use cell phone, thus $(1-\alpha_u)^\gamma$ of the population will be new added to mobile service subscribers.

Subscribers using different types of terminals have various data service habits. In LTFM, percentage of each terminal type is considered. Let l stands for the terminal type. v_l refers to the percentage of terminal type l in all subscribers. Thus, the number of subscribers using terminal type l can be derived as:

$$U_l = (1+r_p)\times(1+(1-\alpha_u)^\gamma)\times U_p \times v_l \tag{1}$$

Based on above deriving, specific subscriber number of terminal type l is calculated in Equation (1). Different kinds of services need be predicted to obtain detail traffic amount for each kind of terminals. There are many kinds of services, such as voice, short message, downloading, web browsing, social networking, etc. This paper sets m as the service type. Because the capabilities vary among different types of mobile terminals, each mobile terminal type has different traffic amount for the same service. This paper defines t_m^l as the traffic amount of service m generated by mobile terminal type l. The predicted traffic for one network is presented in Equation (2).

$$T = \sum_l \sum_m (1+r_p)\times(1+(1-\alpha_u)^\gamma)\times U_p \times v_l \times t_m^l \tag{2}$$

2.3 The Development of Mobile Terminal

In recent years, the growth and application of the new terminal is an important reason for the growth of the wireless network traffic. Including smart phones, netbooks, tablet PCs, e-readers, networking, game consoles and other terminal equipment connected to the network, greatly enhance the network traffic. Some of these terminals act as a strong complement to traditional mobile phone, while others can completely replace the traditional mobile phone.

New network technology usually increase data transmitting rate. This will bring better subscriber experience and increase data traffic. The adoption of new network technology is considered.

For network i, subscriber using mobile terminal type l is encouraged to generate more traffic weighted by w_l^i. Thus the total traffic can be expressed as Equation (3).

$$T_{total} = \sum_i \sum_l \sum_m U_l \times t_m^l \times (1+w_l^i) \tag{3}$$

2.4 Modification of Total Traffic Using Historical Data

In Equation (1) (2) (3), traffic amount is obtained based on the start point (current data) and the end point(the forecast end). Historical data for population, terminal types, service traffic amount and so on is required to predict the developing trends of each key factor.

Using linear extrapolation based on the intrinsic link between the key factors and the total traffic volume. The Byrds curve method and a linear function of the model combined the data analysis methods, is used to predict the future development of the mobile communications service situation.

3. A Ten-year Traffic Forecast Study for China

China is exploring the rapid development of mobile communications business as well as the explosive growth in data traffic in recent years. Although network operators utilize a number of technical means to increase network capacity, network capacity growth rate is far less than the growth rate of the volume of business. Therefore, it is necessary to draw our future business development forecast as the basis of our estimates of future spectrum requirements. The main concern in traffic forecasting of China is as follows.

3.1 Leading Factors in China

According to the sixth census data in China and the 2010 China Human Resources White Paper, labor force in China for the past 10 years has raised, the scale of human resources continued to expand, the national education levels were significantly increased, and the proportion of high education in the population increased year by year.

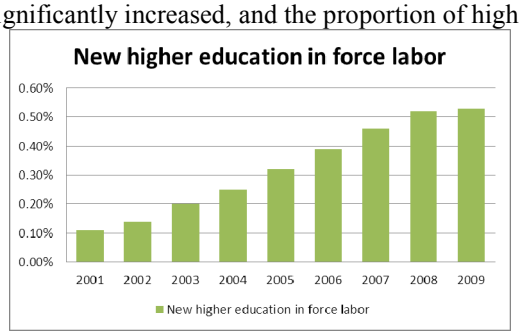

Fig. 2 New higher education in force labor

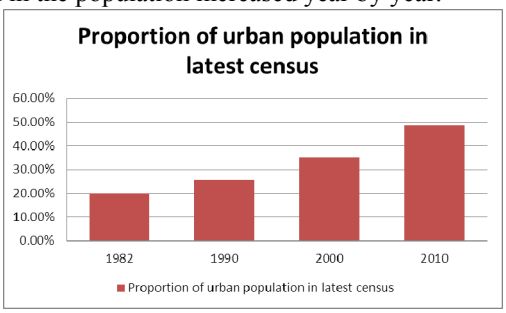

Fig. 3 Proportion of urban population in latest census

According to China's census data, the growth of labor resources could also be derived as follows.

Based on the above data, the preliminary judgment could be as follows. China's population will continue to increase, and labor resources to maintain a linear growth. The population slowly increases, and the level of education in the 21-50 age segments of the mobile phone subscriber will keep a growth rate higher than other age groups. The method can use the linear extrapolation of the above considerations be predicted.

In 2010, despite the growth in basic voice telephone traffic ended at 1570PB/year, the voice traffic in the business proportion dropped to 35%. As shown below, it was a significant upward trend in the volume of business generated by the laptop and smartphone [9].

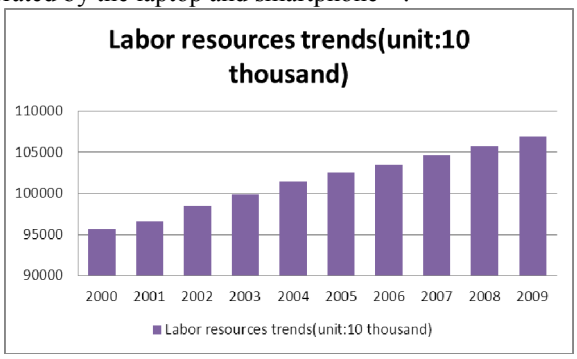

Fig. 4 Labor resources trends

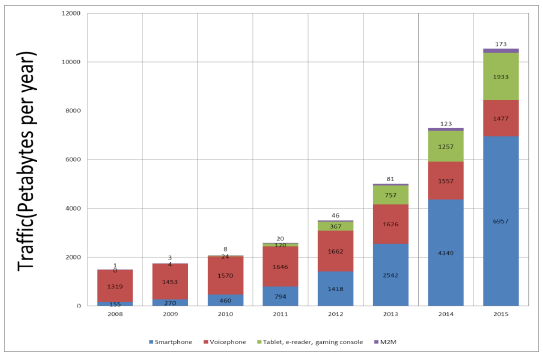

Fig. 5 Mobile traffic generated by the different terminals (PB / year), the existing data and predictive value [9]

3.2 Traffic Forecast for China

Due to a variety of reasons, only historical data in the network of China Mobile is obtained. China's total volume of business data is derived on the basis of the Chinese mobile traffic data translated in accordance with the number of mobile users in China and the proportion of national users.

Voice traffic forecast considering the amount of users and the growth rate of the user MOU and the growth rate, the growth rate of the billing duration. The total billing Duration is the cumulative of length per user billing.

2012-2020 growth rate forecast for data traffic is primarily based on the 2010 and 2011 survey data. Changes in the long-term growth rate is generally expressed as a four morphology that grows linearly concave function, convex function and S-curve key parameter prediction, the empirical method can be used to select the optimal prediction results.

Limit of spectrum resources and other factors on the development of the volume of business is more obvious according to Fig. 14 and Fig. 15. Especially in the late predict midterm the optimistic forecast results with the results of the conservative forecast difference quickly increase, which means further meet conservative forecast traffic based on the amount of spectrum to meet for optimistic business forecast will also rapidly increasing.

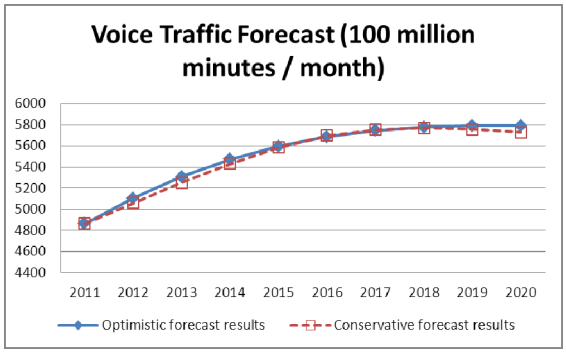

Fig. 6 Voice Traffic Forecast for China

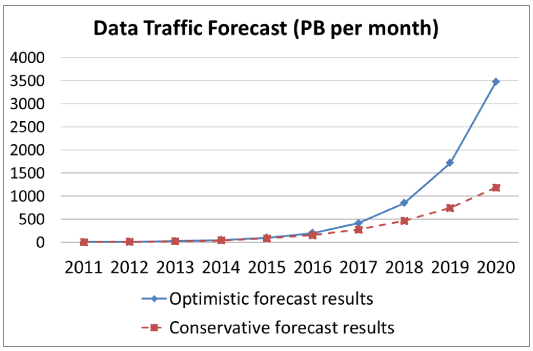

Fig. 7 Data Traffic Forecast for China

4. Conclusions

As data traffic keeps rising with a much higher speed than the network capacity rises in recent years, the allocated spectrum is going to run out soon. Long term traffic forecast is called for deciding new spectrum for telecommunications. Current researches focus on traffic floatation forecast within 24 hours, but few studies mention long term forecast. Long Time Forecast Method (LTFM) is proposed in this paper to give a solution to long term traffic forecast. LTFM begins with an analysis of the key factors to consider in traffic forecast, and also traffic forecast for China from 2012 to 2020.

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