

# Clock synchronization methods of electric meters based on wireless communication

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## I. INTRODUCTION

The development of power system has higher requirements for the clock accuracy of electric meters. The accuracy of clock is closely related to the accuracy of electric meters. At present, most electric meters can only maintain minute-level clock accuracy. To achieve the second-level accuracy of clock synchronization for electric meters, a new clock calibration method is required. This paper presents a clock synchronization method of electric meters based on wireless communication, which can improve the clock synchronization accuracy of electric meters without changing the electric meters.

## II. CLOCK SYNCHRONIZATION METHODS FOR ELECTRIC METERS

In the current metering automation system, the collection terminal is equipped with a 4G wireless communication module, which can obtain the absolute time from communication base station. In this paper, according to the business characteristics, the collection terminal actively uses the wireless communication network base station to synchronize the clock to reduce the load of collection master station. In this way, the collection terminal can rely on the communication module to become a secondary clock source, which improves the accuracy of clock synchronization on the one hand, and also improves the frequency of time service and clock synchronization on the other hand. It can be realized by upgrading the collection terminal software. Compared with GPS and other clock calibration methods, it is not necessary to add or modify existing equipment. On the other hand, to obtain the base station time from 4G wireless communication module, there is no need to consider the signal reception problems of other clock systems.

## III. EXPERIMENTS AND RESULT

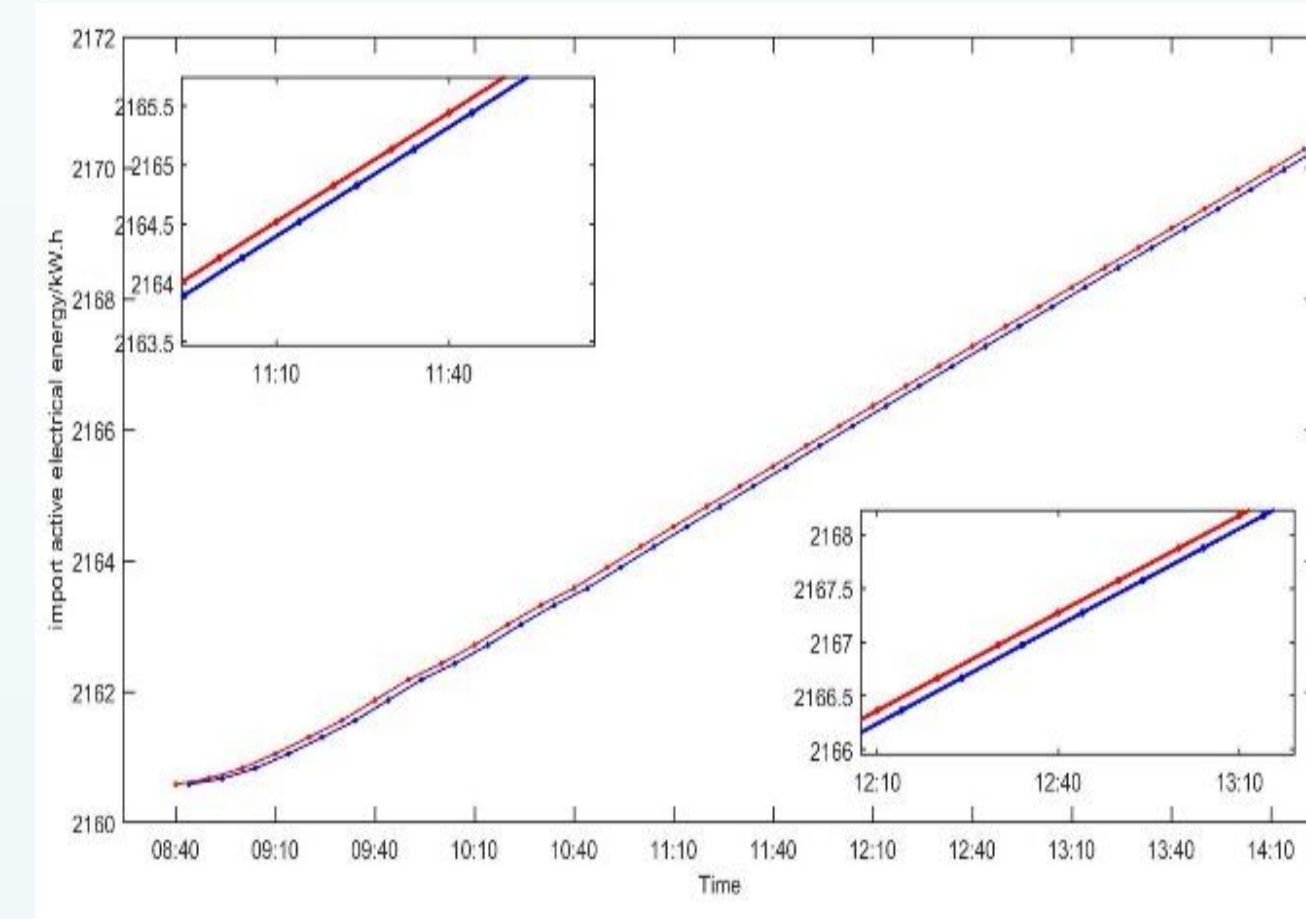


Fig. 2 Clock drift diagram before clock calibration.

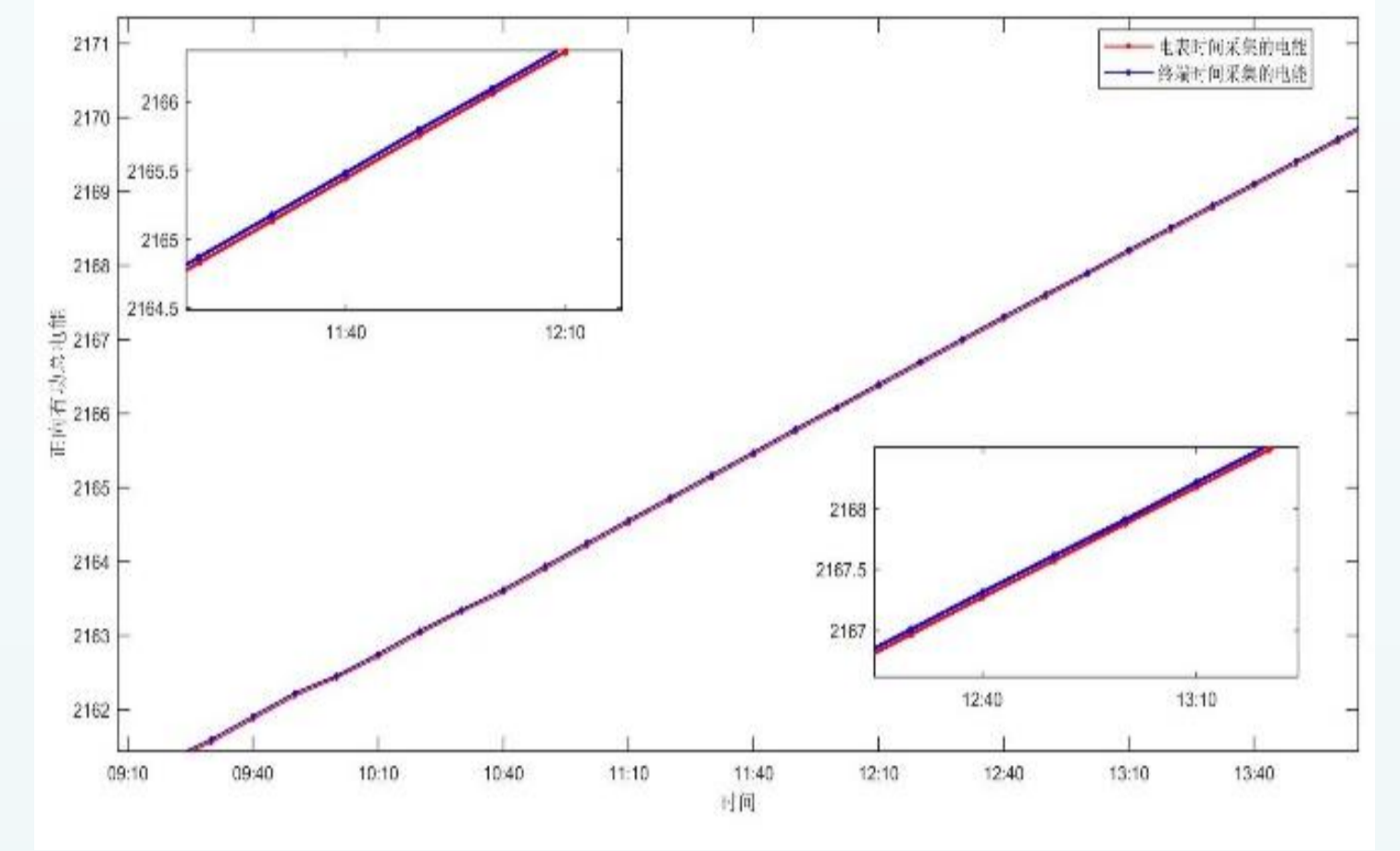


Fig. 3 Clock drift diagram after clock calibration.

The meter time is closer to the absolute time obtained by the terminal. And the time error can reach the second level after calibration according to the obtained data, which meets the real-time requirements of the electricity spot transaction business.

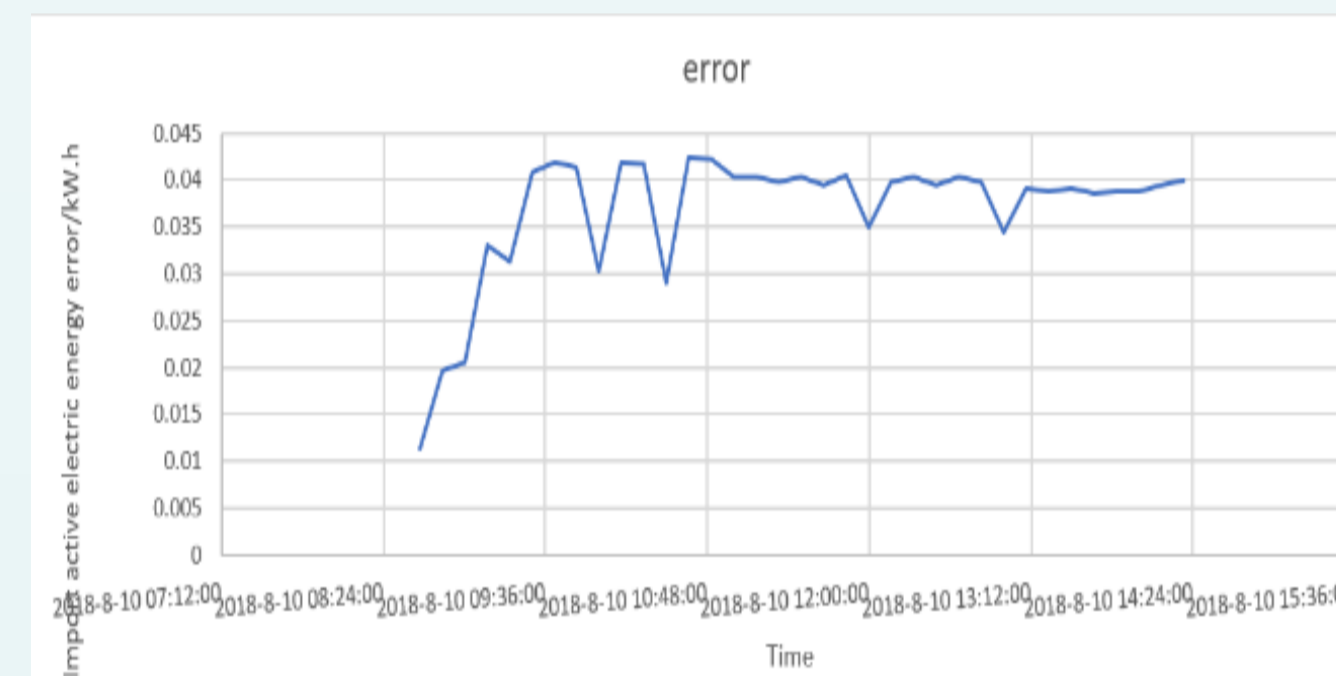


Fig. 4 Import active electrical energy error before clock synchronization.



Fig. 5 Import active electrical energy error after clock synchronization.

The data obtained by clock calibration is more accurate, which provides a more accurate data basis for subsequent electricity spot trading business and electricity bill settlement analysis. And the result will be more reliable.

## V. CONCLUSION

This paper proposed two wireless communication clock synchronization methods to maintain the clock synchronization accuracy of electric meters at levels of seconds, thus guaranteeing the successful real-time metering data collections. The method proposed in this paper does not need to upgrade the existing collection terminals. And it uses external equipment to improve the accuracy of meter clocks. It provides support for businesses that require high meter clock accuracy such as electricity spot trading. Accurate clock calibration can effectively improve the system's clock synchronization efficiency, reducing the burden of master station servers and saving cost of electric meters due to clock failure.

As the clock synchronization equipment is restricted by the DLT645 protocol, the clock calibration can only be used once a day. In the future, we can consider coordinating meter manufacturers to open more free time calibration authority on the second RS485 port, which can achieve high-frequency time calibration. If the cellular base station time synchronization method is approved, the existing collection terminal can be upgraded to support the base station timing, and the collection terminal can use a high-precision time source to calibrate the electric meter. This method only needs to upgrade the software of the existing collection terminal, without modifying or adding new equipment.

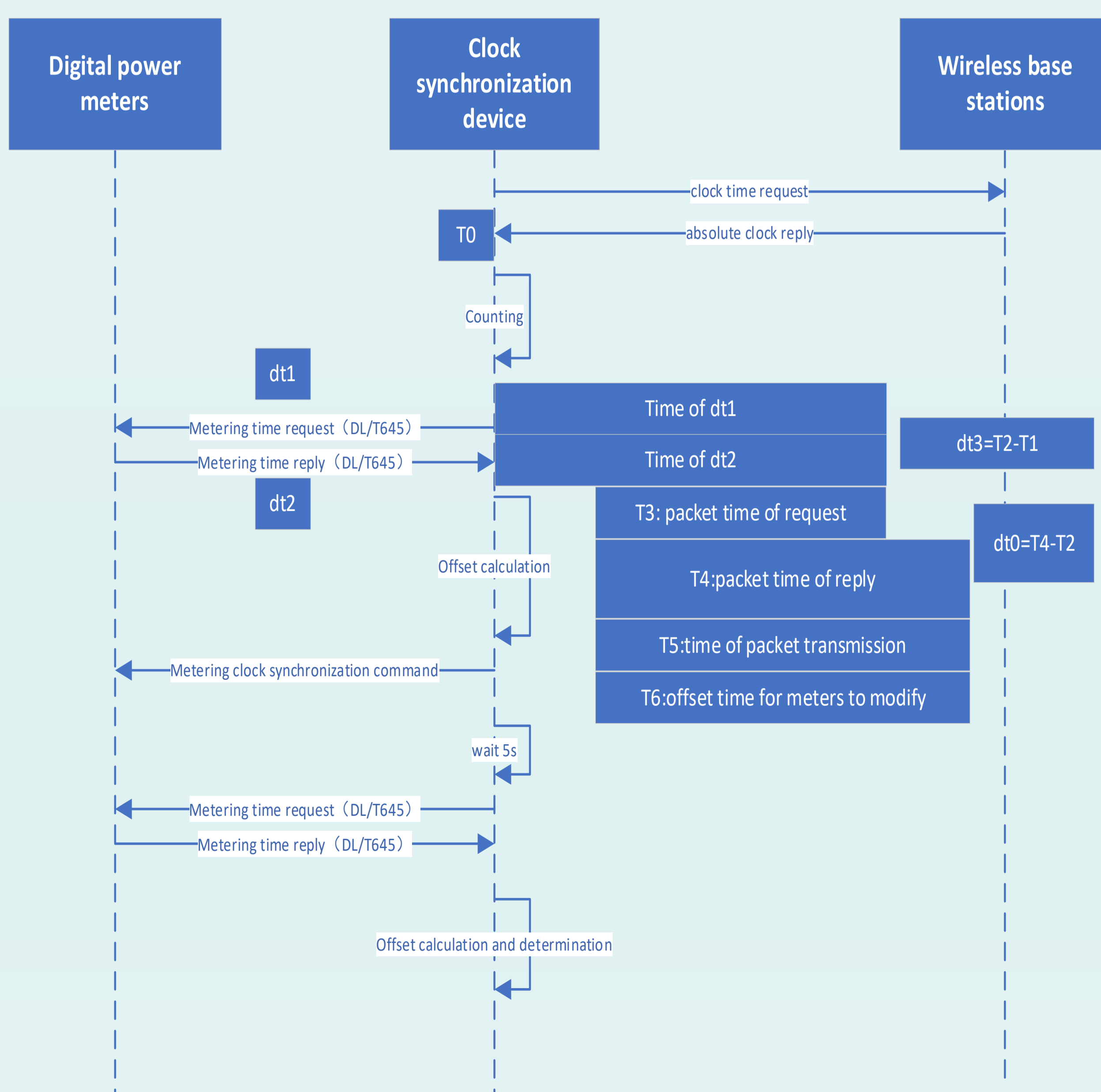


Fig. 1 clock synchronization based on wireless communication.