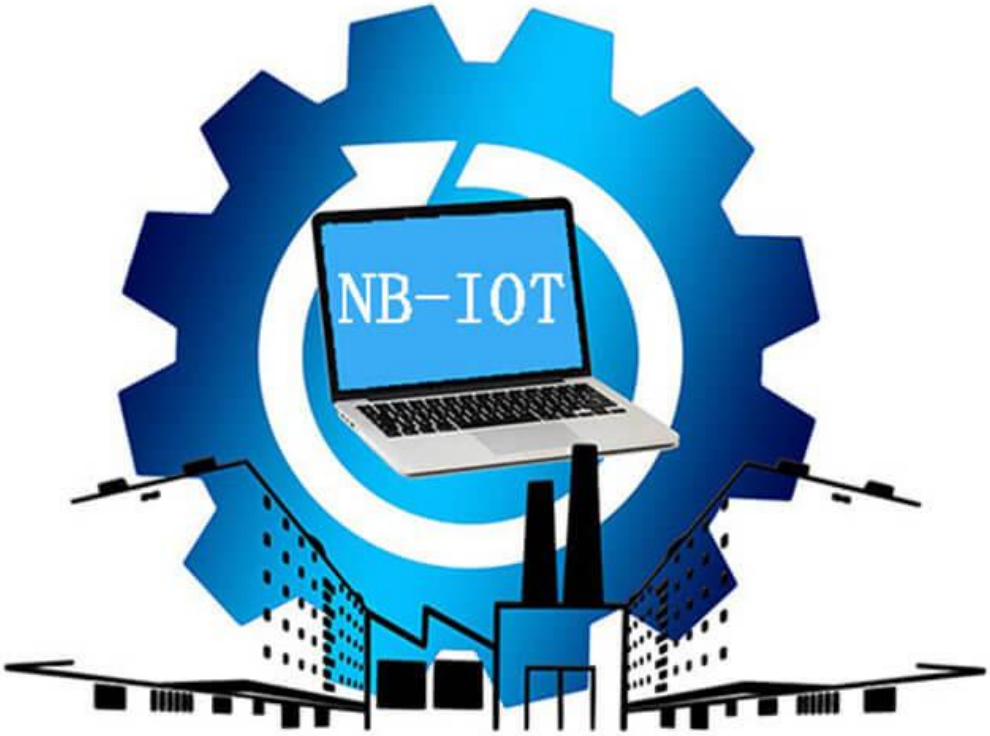
About NB-IoT, You Don't Know



Today, we talk about something about NB-IoT which you may not know.

What is NB-IoT?

NB-IoT refers to Narrow Band - Internet of Things (IoT) technology, which focuses on the Low Power Wide Area (LPWA) Internet of Things (IoT) market and is an emerging technology that can be widely used around the world.

NB-IoT uses the License band and can be deployed in three ways: in-band, protected-band, or an independent carrier, coexisting with existing networks.

NB-IoT is an emerging IoT technology that has attracted much attention because of its low power consumption, stable connection, low cost, and excellent architecture optimization, etc. Huawei, as the domestic leader in developing NB-IoT technology, has also attracted considerable attention from the technology community.

NB-IoT has four major features.

First. Wide coverage, which will provide improved indoor coverage. Under the same frequency band, NB-IoT gains 20dB over the existing network and expands the coverage area by nearly 100 times;

Second. NB-IoT can support tens of thousands of connections in one sector, supporting low latency sensitivity, ultra-low device cost, low device power consumption, and optimized network architecture;

Third. Lower power consumption, the standby time of NB-IoT terminal module can be up to 10

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years;

Fourth. Lower module cost.

NB-IoT Frequently Asked Questions

Q: How are the frequency bands for NB-IoT divided by domestic and international operators?

A: Most operators worldwide use the 900MHz band to deploy NB-IoT, and some operators deploy in the 800MHz band.

China Unicom's NB-IoT is deployed in the 900MHz and 1800MHz bands, and currently, only 900MHz is available for trials.

China Mobile will get an FDD license in order to build NB-IoT Internet of Things and will be allowed to re-farm the existing 900MHz and 1800MHz bands.

China Telecom's NB-IoT is deployed in the 800MHz band, with only a 5MHz frequency.

Q: NB-IoT network deployment schedule?

A: China Unicom launched NB-IoT field scale network trials based on 900MHz and 1800MHz in 7 cities (Beijing, Shanghai, Guangzhou, Shenzhen, Fuzhou, Changsha, and Yinchuan) in 2016, as well as more than 6 business application demonstrations. 2018 will start to fully promote the commercial deployment of NB-IoT nationwide.

China Mobile plans to start the NB-IoT commercialization process in 2017.

China Telecom plans to deploy NB-IoT networks in the first half of 2017.

Huawei joined with six operators (China Unicom, China Mobile, Vodafone, Emirates Telecom, Telefonica, and Telecom Italia) to establish six NB-IoT open labs around the world to focus on NB-IoT business innovation, industry development, interoperability testing, and product compatibility verification.

ZTE, together with China Mobile, completed a technology verification demonstration of the NB-IoT protocol in the lab of China Mobile 5G Joint Innovation Center.

Q: Can non-operators deploy NB-IoT networks?

A: The answer is no.

Q: Does NB-IoT require a real-name system?

A: All of them are required, tracked to the responsible subject.

Q: Does NB-IoT all adopt eSIM?

A: NB-IoT products are characterized by no installation and configuration and can work directly by powering on and connecting to the network, and support functions such as automatic device registration and over-the-air upgrade.

SIM cards and eSIM will co-exist for a long time, and operators reject the model of soft SIM.

Q: What is the operator's plan for 2G/3G network decommissioning?

A: China Unicom is likely to gradually shut down its 2G network in 2018, and in some places, it may be shutting down its 3G network.

Japan's mobile operators have all shut down their 2G networks, and AT&T in the US and Telstra and Optus in Australia has announced plans to shut down their 2G networks.

Telenor plans to shut down its 3G network in Norway this year, followed by its 2G network in 2025.

Some operators will maintain the GSM band for a longer period of time, given the presence of

more than 100 million GPRS IoT terminals, the long term presence of low-end GSM handsets, and the fact that GSM costs less than LTE in the long term due to its lower complexity and lack of royalties.

Q: Do operators support NB-IoT roaming among themselves?

A: The answer is no.

Q: How do operators guarantee the stability of NB-IoT networks?

A: NB-IoT is directly deployed in GSM, UMTS, or LTE networks, which can be multiplexed with existing network base stations to reduce deployment costs and achieve smooth upgrades, but uses a separate 180KHz band that does not occupy the voice and data bandwidth of existing networks, ensuring that traditional services and future IoT services can be stable and reliable at the same time.

The control and bearing of NB-IoT are separated, signaling goes to the control plane, data goes to the bearing plane. If it is a low-rate service, it will go directly to the control plane, no longer establish a dedicated bearer, omit the NAS and the core network to build the chain signaling process, shorten the wake-up recovery time delay.

NB-IoT is an operable telecom network. This is the key that distinguishes NB-IoT from GPRS, LoRa, SigFox, and other technologies.

Q: How can operators profit from NB-IoT networks?

A: Operators' existing QoS quality of service assurance, network security, carrier-grade billing, and big data services continue to maintain industry advantages. NB-IoT network allows operators to reinforce their business service capabilities in the IoT field, including cloud service provision, massive customer management, IoT real-name authentication, system turnkey integration, and high-end customized services for large customers.

Q: What is the price issues related to NB-IoT?

A: Operator tariff: one is billed by traffic, one is billed by message, the trend will be lower than GPRS cost.

Chip price: lower than 2G main chip, reasonable expectation price $1

Module price: lower than GPRS module price, reasonable expectation price $2

Terminal price: based on actual function pricing

Maintenance cost: much lower than existing network maintenance cost

Subsidy policy: operators will provide large operating subsidies in the early stage

Q: Will the NB-IoT standard support TDD LTE?

A: Currently, the FDD LTE system supports NB-IoT technology, and currently, the TDD LTE system does not support NB-IoT technology.

The physical layer design of NB-IoT mostly follows the LTE system technology, such as SC-FDMA for uplink and OFDM for downlink, and the high-level protocol design follows the LTE protocol with functional enhancements for its small packet, low power consumption, and large connection characteristics.

The core network is partially connected based on the S1 interface and supports both standalone and upgrade deployment.

Q: Does NB-IoT support base station positioning?

A: R13 does not support base station positioning, but operator networks can do private solutions, such as cell ID-based positioning, which will not affect terminals and only require networks to add positioning servers and links to base stations.

R14 plans to do positioning enhancement, supporting E-CID, UTDOA, or OTDOA, and the target positioning accuracy operators want is within 50 meters.

If considering from the terminal complexity point of view, UTDOA is better because there is almost no impact on the terminal, and in the case of coverage enhancement (basement 164dB), UTDOA (uplink) consumes less power; if most scenarios do not need coverage enhancement, OTDOA (downlink) will be better from the network capacity point of view.

Q: What are the deployment methods of NB-IoT?

A: NB-IoT supports 3 different deployment methods, namely standalone deployment, protected band deployment, and in-band deployment.

Standalone deployment: It can utilize a separate frequency band, which is suitable for GSM band re-farming.

Protected band deployment: can utilize the edge unused bands in the LTE system.

In-band deployment: any resource block in the middle of the LTE carrier can be utilized.

Q: What modem technology is used for NB-IoT?

A: OFDMA is used for downlink, with 15 kHz subcarrier spacing.

SC-FDMA is used for uplink, Single-tone: 3.75kHz/15kHz, Multi-tone: 15kHz.

Only half-duplex support is required, with a separate synchronization signal.

The terminal supports an indication of Single-tone and Multi-tone capability.

MAC/RLC/PDCP/RRC layer processing is based on existing LTE processes and protocols, with relevant optimization of the physical layer.

Q: What are the number of connected-state users and active users of NB-IoT base stations?

A: NB-IoT has 50~100 times uplink capacity improvement over 2G/3G/4G. With the same base station, NB-IoT can provide 50~100 times more access than existing wireless technologies.

Under 200KHz frequency, according to the simulation test data, a single base station cell can support 50,000 NB-IoT terminal accesses.

Q: What is the coverage range of NB-IoT base stations?

A: NB-IoT improves 20dB gain over LTE and GPRS base stations and expects to cover places where signals are difficult to reach such as underground garages, basements, and underground pipes.

According to the simulation test data, NB-IoT coverage capability can reach 164dB in standalone deployment mode, and in-band deployment and protection band deployment are yet to be simulated and tested.

Q: What is the upstream and downstream transmission rate of NB-IoT?

A: NB-IoT RF bandwidth is 200kHz.

Downlink rate: greater than 160kbps, less than 250kbps.

Uplink rate: greater than 160kbps, less than 250kbps(Multi-tone)/200kbps(Single-tone).

Q: Does NB-IoT support a retransmission mechanism?

A: NB-IoT adopts mechanisms such as retransmission (up to 200 times) and low-order modulation for coverage enhancement.

Q: Does NB-IoT support voice?

A: The voice supported by NB-IoT without coverage enhancement is Push to Talk.

In the scenario of 20dB coverage enhancement, only similar to Voice Mail can be supported.

NB-IoT does not support VoLTE, its latency requirement is too high, and the high-level protocol stack needs a QoS guarantee, which will increase the cost.

Q: Why is the chip of NB-IoT low power consumption?

A: The energy consumed by the device is related to the amount or rate of data, and the size of the packet sent per unit time determines the power consumption.

NB-IoT introduces eDRX power-saving technology and PSM power-saving mode, which further reduces power consumption and extends battery life.

NB-IoT allows devices to be online at all times but achieves power saving by reducing unnecessary signaling and not accepting paging messages when in a PSM state.

In PSM mode, the terminal is still registered on the network, but signaling is not reachable, thus allowing the terminal to reside in deep sleep for a longer period of time to achieve the purpose of power-saving.

The eDRX power-saving technology further extends the sleep cycle of the terminal in idle mode, reduces unnecessary start-up of the receiver unit, and significantly improves the downlink reachability compared to PSM.

Q: Does NB-IoT sleep-wake mode affect battery life?

A: The current operating time given by NB-IoT is based on simulation data and does not take into account the battery itself and environmental factors, such as self-discharge and aging of the battery, high and low-temperature environmental impact. In actual use, the battery power supply time needs to be evaluated comprehensively according to the real situation.

NB-IoT adopts the power saving scheme of hibernation wake-up, and the battery will receive instantaneous strong current when it is woken up during sleep, which will greatly affect the battery life.

Meter reading applications typically use lithium thionyl chloride (Li/SOCl2) batteries with supercapacitors. Consumer electronics and other applications are typically powered by lithium polymer batteries.

Q: Why is the chip of NB-IoT cheap?

A: Low rate, low power, and low bandwidth bring low-cost advantages.

Low rate: means no need for large cache, so you can cache small, low DSP configuration;

Low power consumption: means low RF design requirements, small PA can be achieved;

Low bandwidth: means no need for complex equalization algorithms.

These factors make NB-IoT chips can be made small, so the cost will be lower.

Taking the chip as an example, the NB-IoT chip integrates BB, AP, Flash, and battery management, and reserves sensor integration. Among them, AP contains three ARM-M0 cores, each M0 core is responsible for the application, security, and communication functions respectively, which reduces cost and power consumption while facilitating function management.

Q: What is the range of NB-IoT for device mobility rate?

A: NB-IoT is designed for application scenarios where mobility support is not strong (e.g. smart

meter reading, smart parking, etc.) while simplifying the complexity of terminals and reducing terminal power consumption.

NB-IoT does not support mobility management of the connected state, including related measurements, measurement reports, switching, etc.

Q: What is the network latency of NB-IoT?

A: NB-IoT allows latency of about 10s but can support lower latency, such as about 6s, in a maximum coupling loss environment.

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