

SLIDE 13: In 5G, system info is divided into two parts : minimum system info and other system info. 5G uses MIB and SIBs for sharing the system information to CPE. SIBs consists of SIB1, SIB2 till SIB9. Minimum system information is shared using MIB and SIB1. MIB and SIB1 is sent using BCH and PBCH.

Open another layer and watch the SSB. SSB accounts for 20 RB resources. The broadcast message is sent once in 80ms, which is the definition of L2. It can be considered that the broadcast message is updated every 80ms. However, in the physical layer, the period of transmission alone is not the same 20ms transmission period, and is sent 4 times in 80ms to ensure reliability. At the same time, in order to allow more resources to be used for data services, the protocol definition must be completed in the first 5 ms of 20ms. At present, the realization of our products is to send SSB in the first 2 ms of 5ms, that is, 4 slots. Each slot sends 2 SSBs, and each SSB is sent on different narrow beams, for a total of 8 narrow beams. Therefore, the SSB's resource ratio in the entire time-frequency resource is very small. Under the current implementation, $(20 \times 3 + 12) \times 8 / 273 \times 20 \times 2 \times 14 \approx 0.4\%$, in some special beam scenarios. For example, if there is only one SSB in the peak scenario, then the remaining 7 SSB resource locations can be saved for data services to ensure peak rate.

SLIDE 14: The RMSI message tells the start position of the initial BWP and the offset of the SSB start position.

Upstream BWP agreement has not been fully determined

After the user boots, press raster to scan the entire bandwidth, obtain the SS, get the cell PCI, and determine the 5G cell. (Under the current NSA network, the frequency is obtained through the configuration of 4G, without the terminal to scan), SS and PBCH are together, called SSB, so the MIB message sent in the PBCH is obtained, and the MIB will pass the indication offset. (in units of carriers) notifying the location of pointA, configuring CORESET, defining the frequency domain location of the PDCCH, scheduling the SI, and telling the UE to read the system message in the CORESET (Common CORESET) range. According to the message indicated by CORESET, the scheduling is received, that is, SIB1 is read. These messages are called RMSI (ie, 4G SIB1), and RMSI is in PDSCH. The SIB1 will notify the mobile phone of the initial BWP, which is part of the PDSCH. So the initial BWP should include CORESET

RMSI is called SIB1

First, after obtaining the PCI, the SSB reads the MIB and obtains the pointA, thereby configuring the Coreset to obtain the SI. Then, through the coreset, the SIB1 can be received, thereby reading the initial BWP, that is, the part of the PDSCH. That is, the bandwidth of the initial BWP includes coreset.

SLIDE 15: How to put 14 symbols in each slot, how to divide the PDCCH resources, is the first 1 to 3 symbols of a slot, and is the same as LTE. The PDCCH is responsible for paging, power control, and scheduling information. The REG is a combination of 12 SCs in the frequency domain and 1 symbol in the time domain. The figure is 2 REGs. The current 5G supports spatial division multiplexing of the PDCCH, that is, it can be spatially complex. Use, to reuse the same time-frequency REG to 2 users. The six REGs are put together as a CCE. The CCE is the smallest unit for scheduling users. Several CCEs are used for user scheduling. Depending on the channel conditions, the current definition is 1, 2, 4, 8, and 16, the so-called scheduling level. Up to 16 levels. Improve the transmission reliability of CCE by adding redundant bits. 273 RBs, each RB has 1 REG, then from the time domain, 1 symbol is 273 REGs, 6 REGs form a CCE, so 273 REGs are 45 CCEs, then 1 scheduling period If it is a symbol user

PDCCH, it can schedule up to 45 users. If it is 2 symbols, it can schedule up to 91, and so on. If you can do 2 layers of spatial multiplexing, then double.

This resource is defined by CORESET.

The user does not know how many CCEs he needs to schedule, so it is done by blind inspection. That is, the RNTI, the UE first sends a random number through the temporary ID assigned by the access side. After accessing the network, the network gives it a temporary identifier RNTI (Radio Network Temporary ID), which is unique to the user in the same cell. Use RNTI to go to the blind detection area, only in the BROADCAST's CORESET to blind detection based on different levels, first scan by level, not scan, step by step, level 1, level 2, level 4, level 8, level 16. According to the read scheduling information of the RNTI that is read, the scheduling resource is obtained. According to the need to read the content of the information, with the RNTI ID indicating the different channels, such as the system message, the uplink and downlink data transmission scheduling, power control, to match the potential DCI in the CORESET, for example, there is no system message, Is there any data for me, is there any chance of my uplink sending, and there is no immediate access response. All are controlled by various DCI (downstream control indication) in CORESET.

The PUCCH is used to transmit uplink L1/L2 control information to support uplink and downlink data transmission. Compared with the PDCCH, the PUCCH carries less information content (only need to tell the gNB not to know the information)

Obtaining the downlink scheduling resource is a basic function of the downlink scheduling, and is mainly to obtain resources on the downlink PDSCH.

Features of PDSCH resources:

In the frequency domain, the bandwidth of the PDSCH is the total bandwidth of the downlink system, and the available bandwidth is determined by the system configuration.

In the time domain, the time domain resources in each TTI are time-divisionally shared by the PDSCH and the PDCCH, and the first symbol in each slot is used as the PDCCH resource.

S frame, there are 2 symbols GP, and the last 1-2 symbols are used as SRS or PUCCH resources.

SLIDE 16: DMRS is used for channel estimation during demodulation

Each channel requires a reference signal as a fixed reference. The reference signal can be considered as an accessory to the channel. Any channel has such a reference point, which is distributed among the channels. In 5G, the reference signal distribution of PBCH and PDCCH is exactly the same, and every 4 REs reference signals. The difference is that the RS position of the PBCH will change with the modulo 4 of the PCI, so there is a less rigid principle when planning, that is, the modulo 4 problem. The reference signal of the PDSCH needs to be slightly concerned. This channel has two types of RSs, the side peak selects type2, and the frequency domain is full. The two symbols in the time domain are consecutive, in order to be able to send 8 layers. If it is a single symbol, type 2 can send 6 layers, and double type 2 can send 12 layers. Because we want to send 8 layers, we use the double symbol of type2. Type1 and type2 may not be the same in the multiplexed code points. Different layers need different reference signals to distinguish them. ?? The difference between a single symbol and a double symbol is that RS occupies a few symbols, and it takes two symbols to generate multiple layers. In order to combat the high-speed delay spread, it is necessary to add more reference signals, that is, additional RS, as shown in the figure, generally not.

The time-frequency resources occupied by the PDCCH and the DM-RS can no longer be used for data transmission.

SLIDE 17: If the cell has no users, the whole cell is very quiet compared to LTE, and it is very quiet, only SSB.

For the channel evaluation reference signal, the SSB can also measure the RSRP to do channel estimation, but because the resources are small and the frequency domain is concentrated, the measurement is not accurate.

The CSI-RS time domain period can be configured. For the user, it is a dedicated resource. The base station can let the mobile phone continuously evaluate the downlink channel, and send its own CQI, RI, PMI, or CSI (Channel Status Indicator) continuously. Go up and adjust for the base station.

CSI is also sent through multiple layers. It is perceived that there are 8 channels in transmission, and 8 are clearly heard. It can be at least 8 layers for multi-stream. If the RS does not have 8 ports, the RI will not recognize 8 layers.