Design high-speed PCBs using parallel method

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Higher speed and integration in smaller devices has been the trend in computing, communications and consumer electronics in recent years, thus posing a huge challenge to PCB design. This article describes PCB parallel design through a mobile-phone example.

The PCB design process can be divided into different stages: netlist importing, packaging, master designing (layout design, macro placement), physical and electric constraints analysis, placement, routing, design quality control and design export.

Among these design processes, placement and routing are the most difficult. To address the efficiency requirements of placement and routing, the use of a parallel design method is highly recommended.

Parallel design procedures are similar to placement and routing, with the design object as the only difference.

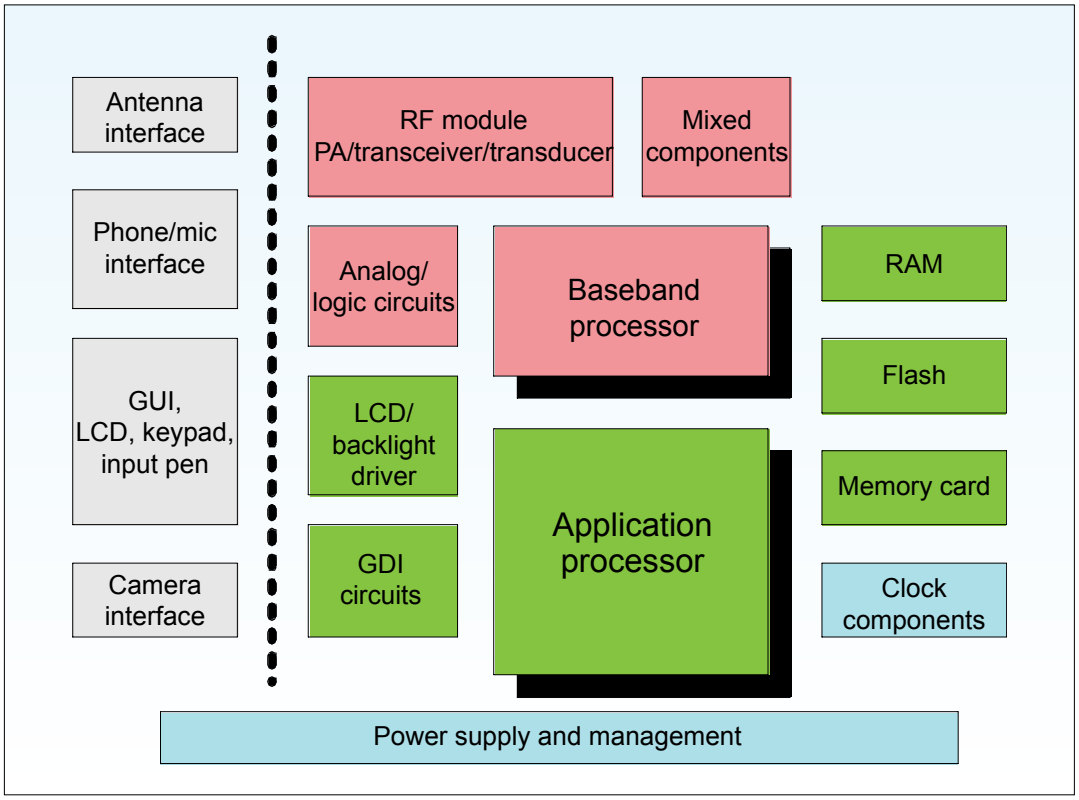

Figure 1: Placement of circuit blocks can be explored based on signal flow.

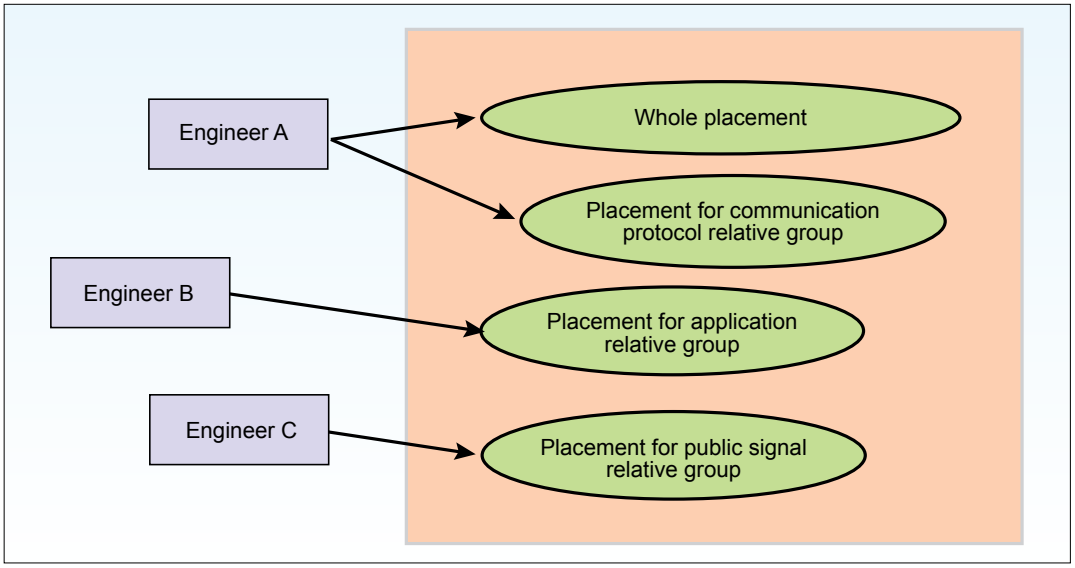

Figure 2: The task can be divided among three engineers dealing with different virtual communication protocol, virtual applications and external virtual signal tasks.

Design constraints

Placement analysis begins with mechanical design constraints and electric topology. Mechanical design constraints include board geometry, dimension requirements, hole and position mounting, height limitations for special components and placement area requirements.

Figure 1 shows a design example of a cellphone's main board. There are clear differences with each circuit block. Placement can be explored based on signal flow. Electric and magnetic shields as well as EMC requirements should be guaranteed. For a reliable and stable product, signal integrity must also be considered.

Based on the sample analysis, we can deduce a parallel design method. It involves exploring by circuit topology as well as assigning suitable placement area and qualified engineers.

Role assignment

The task in **Figure 1** can be broken down among the following groups:

1. Virtual communication protocol group—This includes RF modules (power amplifier, transceiver and transducer), mixed-signal components,

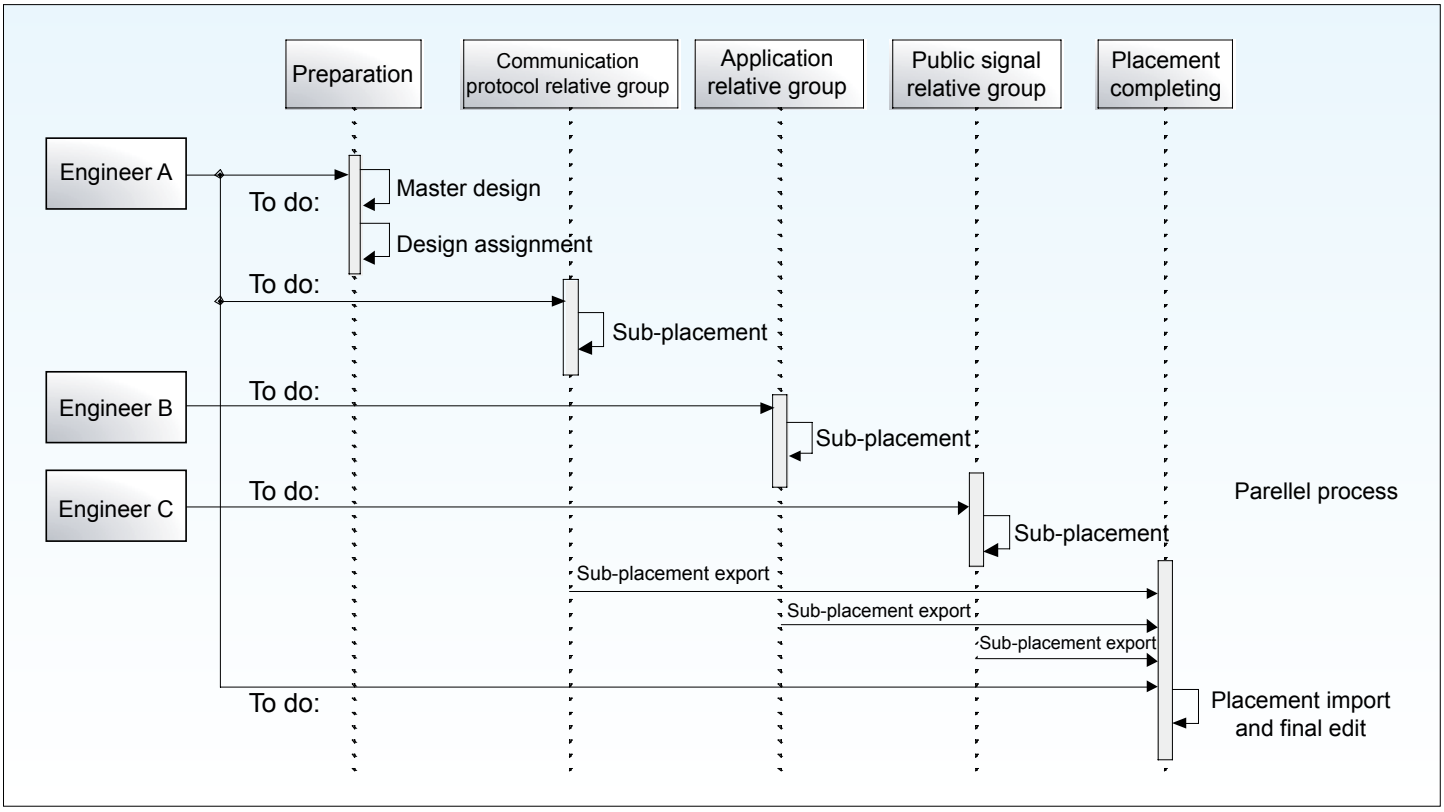

Figure 3: Role assignment takes advantage of each engineer's skill and specialty.

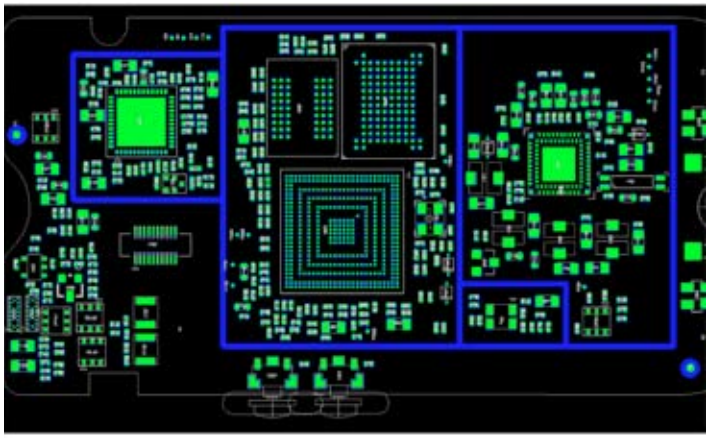

Figure 4: The parallel method explores the different area partitions and signal flow, as well as routing priorities.

regular analog and logic chips, and baseband processor.

2. Virtual applications group—This includes LCD/backlight driver, graphics processor, application processor, RAM, flash and memory card.
3. External virtual signal group—This includes external interface, power supply and management, and clock module.

If each parallel stage requires an engineer to finish it, the role assignment can be represented in **Figure 2**. Engineer A is in charge of the whole placement and placement for the virtual communication protocol group. Engineer B is in charge of the placement of the virtual applications group, while Engineer C is in charge of the external virtual signal group. This role assignment takes advantage of every engineer's special skill.

Figure 3 is a graphical representation of the parallel design flow. Engineer A completes the master design after importing the netlist, doing the mechanical design, hole position mounting, dividing the whole design into blocks with different signal features and documenting the task assignment. Engineer A would then turn over the schematic design, BOM, task assignment documents and PCB master design to Engineer B.

Engineers would complete their assigned design tasks after etching off some components, exporting their sub-placement file and submitting it to Engineer A through PCB editor tools.

Engineer A imports the two sub-placement files to the sub-placement design through PCB editor tools; Engineer A does the final placement editing and optimization.

Figure 4 is part of the parallel mobile-phone design result in silkscreen.

Routing analysis begins with circuit topology and electric-signal analysis. An electric signal can be restricted or non-restricted. The difference between routing and placement is the file type.

With the mobile-phone example, the method explores the different area partitions and signal flow, as well as routing priorities to ensure that project cycle meets design feature requirements. Thus, a parallel design method can achieve the design goal with available resources.