3GPP TSG-RAN WG3 #117bis-e R3-225938

Online, 10th -18th October, 2022

Agenda Item: 13.3

Source: Huawei (moderator)

Title: Summary of CB: # IAB3\_MobEnh

Document for: Approval

# Introduction

This paper is for the following offline discussion:

|  |
| --- |
| **CB: # IAB3\_MobEnh****- Discuss whether mIAB-node configurations should be stored at the mIAB node, e.g.:** * **multiple F1- and BAP-related configurations, corresponding to different target donors, that can be activated upon fulfilment of certain condition(s)**
* **PCI list, IP address, IAB-DU cell configuration and F1 association, BH configuration**

**- Discussion on procedures for group mobility, including** * **signalling of mobility information for group of UEs**
* **whether the benefits are clear**
* **whether the focus should be on enhancements to reduce signalling**
* **Which interface should be impacted?**
* **Is there any dependency with work in RAN2?**

**- Discuss identification of onboard UEs*** **Should Idle/Inactive UEs be also considered?**
* **Is there dependency with progress in RAN2?**
* **Can it be done by implementation?**

**- Discuss whether there is a need to change broadcast information for mIAB-nodes during mIAB node mobility****- Discuss issues concerning user location information and whether to consider the case where it does not match the real user location (e.g. during partial migration)**(HW - moderator)Summary of offline disc [R3-225938](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5Cz00377060%5CReceiveFile%5CInbox%5CR3-225938.zip) |

The following papers will be covered as assigned by the chair:

|  |  |  |
| --- | --- | --- |
| [R3-225346](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225346.zip) | Enhancements for IAB-Node Mobility (Ericsson) | discussion |
| [R3-225360](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225360.zip) | Enhancements for mobility of IAB-node and its served UEs (Qualcomm Inc.) | discussion |
| [R3-225436](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225436.zip) | Discussion on IAB-node mobility together with served UEs (Fujitsu) | discussion |
| [R3-225440](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225440.zip) | Discussion on enhancements to UE migration in mobile IAB scenario (ZTE) | discussion |
| [R3-225441](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225441.zip) | Discussion on mobility enhancement for mobile IAB (ZTE) | discussion |
| [R3-225455](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225455.zip) | Discussion on mobility enhancements (Nokia, Nokia Shanghai Bell) | discussion |
| [R3-225490](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225490.zip) | Mobility enhancements for mobile IAB-node and its served UE (Lenovo) | discussion |
| [R3-225491](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225491.zip) | (TP to TS 38.401) Support for group mobility of mobile IAB-node (Lenovo) | other |
| [R3-225682](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225682.zip) | Group mobility for mobile IAB (Huawei) | discussion |
| [R3-225683](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225683.zip) | Preconfiguration and information sharing for mobile IAB (Huawei) | discussion |
| [R3-225716](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225716.zip) | Discussion on mobility enhancements (Samsung) | discussion |
| [R3-225753](file:///C%3A%5CUsers%5Cz00377060%5CAppData%5CRoaming%5CeSpace_Desktop%5CUserData%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117bis-e%5CDocs%5CR3-225753.zip) | Discussion on mobility enhancement (Xiaomi) | discussion |

Please give your feedback before Wednesday, 12 October, 2022, 11:59 UTC. This is to allow we can discuss the summary for this CB in the mobile IAB online session.

# For the Chairman’s Notes

To capture the following proposal as agreements

# Discussion

## Group signaling

The RAN3#117-e has the following agreement related to UE group signalling:

**For group mobility enhancement, RAN3 to discuss the benefit and whether to support signaling of information related to multiple UE contexts in a single message, during e.g. the handover preparation, path switch, and context release procedures.**

[R3-225346 E///], [R3-225490 Len], [R3-225682 HW] [R3-225753 Xiaomi] indicates that the UE group signaling is beneficial from the signaling reduction (especially for saving the F1AP signaling for BH configuring along the target path), admission control for the group of UEs served by the mobile IAB. And the following procedures are mentioned in the above papers to consider the group signaling:

* XnAP and NGAP group handovers
* Path switch on NGAP
* Context release on XnAP
* Handover execution phase [R3-225753 Xiaomi]

As we discussed in last meeting, the handover execution phase for each UE needs to be performed separately, since the RRCReconfiguration for each UE is delivered separately.

In addition, [R3-225436 Fujitsu] states: In case the handover preparation of UEs is performed before or together with that of the mobile IAB-MT, e.g., in gradual bottom-up or nested procedure, the signal of IAB Transport Migration Management procedure can be saved since the Handover Request messages for UEs have already carried the traffic QoS information. [R3-225682 HW] states: Xn HO preparation procedure for mobile-IAB can indicate some context of its serving UEs (e.g. the identifiers of the connected UEs), it will be helpful for the target CU to determine whether to accept them all.

[R3-225360 QC] suggests that the group signalling can be considered as optimization after the baseline procedures have been defined. [R3-225455 Nok] states that the group signaling is not helpful for signaling load reduction, latency and admission control, so it proposes to not introduce group handover and just reuse the current separate handover procedure for UEs.

Companies are invited to provide your comments on the following questions:

**Q1-1): Do you agree that RAN3 can study group signalling which allow information of multiple UEs served by a mobile IAB-node be included in one message, as optimization for the following procedure:**

* **Handover preparation on XnAP/NGAP.**
* **Path switch on NGAP.**
* **Context release on XnAP.**

**Q1-2): Do you agree that the Handover preparation of UEs can be carried out together with that of mobile IAB-node?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Reasons/Comments** |
| **Huawei** | Q1-1): YesQ1-2): Yes | We believe the mobile IAB and all UEs moving with it should be treated as a “group” when perform admission control at the target side and provide configuration along the target BH links. And we admit that the group signalling is optimization for the mobility procedure. |
| Nokia | Q1-1): No.Q1-2): No | As discussed in R3-225455, there is **no clear benefit for the group signaling**. \* It does not reduce signaling, since it is still the same UE context to be transferred over NG/Xn interface.  \* It does not reduce the latency, since it is still the same number of UEs to be handled in target Donor. It actually delay the HO preparation since the single Group HO message can only be handled by one VM after the completed reception of the super large group HO message, while the current per UE based HO signaling can be distributed over the multiple VMs. \* it does not help the admission control. If target donor has to reject some UEs due to lack of resource, it is still same even with group HO. via current HO signaling, source donor can also know the UEs is rejected during the HO preparation procedure.The group HO actually has some issues, e.g. **cause sudden overload in target donor, less efficient in transport layer since it has to transmit a super large group HO message, cause head-of-line blocking in target donor**, etc. So please clarify the benefit for group signaling. If the purpose is to inform target donor that a HO is for a UE connected with mobile IAB, source donor can simply include IAB’s ID in the HO signaling for UE, but not require a new group signaling.  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**

##  Information sharing between two logical DUs .

[[R3-225455](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224378.zip) Nok] [R3-225436 Fujitsu] [R3-225440 ZTE] [R3-225683 HW] and [R3-225716 SS] have common understanding that for the IAB-DU migration, the co-located source DU and target DU can share some configuration and/or UE context considering they are co-located, such information sharing can reduce signaling for Xn and/or F1 interface, and also for the Uu interface if the UE’s target cell can be determined without UE’s measurement report.

Based on the common understanding from the above papers, Companies are invited to give your view on the following questions:

**Q2-1): Do you agree that the information sharing among two co-located logical DUs in the mobile IAB-node provides beneficial in case of IAB-DU migration?**

**Q2-2): Do you think RAN3 can investigate the following info for information sharing between two logical DUs in case of IAB-DU migration: UE context, cell configuration, low layer configuration?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Reasons/Comments** |
| **Huawei** | Q2-1): YesQ2-2): Yes | Some cell configurations can be shared between the two logical DUs. Based on the sharing of cell configurations, the network can acquire the UE’s target cell without the measurement report. |
| Nokia | Q2-1): YesQ2-2): Yes | DUs serving the same UEs withing the same coverage area (e.g.) inside a vehicle, could utilize the same configurations. Details can be further discussed. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**

##  Pre-storing the F1 and BAP configurations

At last RAN3 meeting, the following was agreed with respect to pre-storing of configurations at mobile IAB-nodes:

**RAN3 to discuss whether a mobile IAB node may be configured with multiple configurations, each corresponding to a different target donor, that can be activated upon fulfillment of certain condition(s). The details of the configurations are FFS.**

[R3-225346 E///] proposes that a mobile IAB node may be configured with multiple F1- and BAP-related configurations, and suggests RAN3 to investigate the following configurations for pre-storing:

* BAP configurations for the mobile IAB-MT.
* BH RLC Channel configurations for the mobile IAB-MT.
* Configurations for setting up the F1 connection.
* Configurations for setting up the SCTP connection and IPsec tunnel(s).
* TNL addresses of the mIAB-node and the new donor.
* Configurations of cells to be served by the mobile IAB-DU.
* gNB-DU system information.

[R3-225683 HW] also suggests that the PCI list, IP address, default BH configuration, IAB-DU cell configuration and F1 association related configuration can be pre-configured to the mobile IAB node.

Companies are invited to provide feedback on the following question:

**Q3-1): Do you agree RAN3 to study the following as optimization: a mobile IAB node may be configured with multiple F1- and BAP-related configurations that can be activated upon fulfilment of certain condition(s)?**

**Q3-2): If your answer to Q3-1 is YES, do you think the following configurations can be pre-configured to a mobile IAB-node?**

* BAP configurations for the mobile IAB-MT.
* BH RLC Channel configurations for the mobile IAB-MT.
* Configurations for setting up the F1 connection.
* Configurations for setting up the SCTP connection and IPsec tunnel(s).
* TNL addresses of the mIAB-node and the new donor.
* Configurations of cells to be served by the mobile IAB-DU.
* gNB-DU system information.
* PCI list.
* Default BAP configuration.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Reasons/Comments** |
| Huawei | Q3-1) YesQ3-2) Yes, but with comments | For Q3-2): The BH configuration is transmitted to the mobile IAB-node, it means the whole transmission path should be ready, and the resource is reserved in each hop of the IAB-node between the mobile IAB-node and the donor. So, for the BH configuration of F1-U, reserving the resource to all F1-U traffic in all possible target paths is resource consuming. In addition, the UP traffic served by the mobile IAB-node may change a lot during the moving of the vehicle, and such traffic change is not predictable, then the reserved resource along the target path may not suitable any more when the mobile IAB node activate the corresponding pre-configurations. Alternatively, we see that the default BH configuration which to be used by the non F1-U traffic, may be pre-configured, since the resource reserved for the default BH configuration is not large, and the QoS info for the non-UP traffic is stable. We are not sure which detail will included in the following two bullets, maybe Ericsson can provide more explanation when providing input in this table:* Configurations for setting up the F1 connection.
* Configurations for setting up the SCTP connection and IPsec tunnel(s).

 Currently, we prefer the pre-configuration can contains the following:* TNL addresses of the mIAB-node and the new donor.
* Configurations of cells to be served by the mobile IAB-DU.
* gNB-DU system information.
* PCI list.
* Default BAP configuration.
 |
| **Nokia** | Q3-1) Not now, see commentQ3-2) See comment | Q3-1): Pre-configurations could be usable only in certain use cases, particularly in cases where the movement of the vehicle in known (e.g. train, bus, ..). However, RAN3 should first specify a generic solution that could be applied in all deployment scenarios. In general, this should be low-priority issue.Q3-2): the pre-configured parameter seems include 2 parts: 1) the IAB-DU related parameter, which is OAM configured. Pre-configuration is an implementation issue. 2) the IAB-MT related parameters, which is in RAN2 scope. * BAP configurations for the mobile IAB-MT. RAN2 scope
* BH RLC Channel configurations for the mobile IAB-MT. RAN2 scope
* Configurations for setting up the F1 connection. OAM scope.
* Configurations for setting up the SCTP connection and IPsec tunnel(s). this is not possible. SCTP/IPSec need to be “refresh”
* TNL addresses of the mIAB-node and the new donor. OAM scope
* Configurations of cells to be served by the mobile IAB-DU. OAM scope.
* gNB-DU system information. OAM scope
* PCI list. OAM scope
* Default BAP configuration. RAN2 scope.

So what is the impact to RAN3? |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**

## Mobile IAB indication

At last RAN3 meeting, the following was agreed with respect tothe mobile IAB indication:

**The donor CU should know that the IAB node is “mobile”.**

**RAN3 to discuss whether the target IAB-donor should know the migrating IAB-node is “mobile IAB-node” from the source IAB-donor.**

[R3-225682 HW] thinks the above agreement is unclear, and expect RAN3 to clarify whether the “mobile” means the node type is mobile IAB or the moving status of the node, considering that an Rel-18 mobile IAB-node may also serve as stationary R16/17 IAB-node if not moves. Based on the agreements, many papers e.g. [R3-225346 E///] [R3-225360 QC] [R3-225441 ZTE] and [R3-225490 Len] propose that the IAB-MT send mobile IAB indication to the donor CU via RRC message. And [R3-225346 E///] also suggest to send LS asking RAN2 to include the “mobile IAB-node” indicating in RRC signalling used during IAB-node integration. Based on the moderator’s understanding, in these papers, the “mobile” indication send to the donor CU is for the device type rather than the moving status. [R3-225753 Xiaomi] states that the IAB-donor can know whether the IAB-node is mobile by the location info of the IAB-MT.

Regarding the second agreements, [R3-225682 HW] [R3-225346 E///] [R3-225360 QC] [R3-225441 ZTE] and [R3-225490 Len] has common understanding that the source donor informs the target donor via XnAP that the migrating node is a mobile IAB-node. [R3-225455 Nok] think the source donor transfer the “mobile IAB” indication to target donor during the handover preparation procedure for the mobile IAB-node, but the indication can be sent to target donor as part of the RRC container and there may be no further changes to XnAP in case it is part of the RRC Context. [R3-225753 Xiaomi] states that the target donor can also know the IAB-node is mobile by the location info of the IAB-MT, and no need to transfer the mobile IAB-node indication from the source IAB-donor to the target IAB-donor.

[R3-225455 Nok] also proposes that RAN3 to discuss whether the source donor should know about mobile-IAB cells under the target donor’s control to avoid, or minimize, Handover Requests for IAB nodes indicating a mobile-IAB cell as target cell.

Companies are invited to provide feedback on the following questions.

**Q4-1): Do you agree the mobile IAB-node indication is device type rather than the moving status?**

**Q4-2): Do you agree that the mobile IAB-node indication is sent by the IAB-MT to the donor CU during integration procedure via RRC?**

**Q4-3): Do you agree the source donor informs the target donor via XnAP that the migrating node is a mobile IAB-node?**

**Q4-4) If your answer to Q4-3) is YES, which way do you prefer?**

* **Option 1: Explicit mobile IAB-node indication in the XnAP HO request message.**
* **Option2: Using RRC container to carry mobile IAB-node indication without impact to XnAP.**

**Q4-5): Do you think the source donor should know about mobile-IAB cells under the target donor’s control to avoid, or minimize, Handover Requests for IAB nodes indicating a mobile-IAB cell as target cell.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Reasons/Comments** |
| Huawei | Q4-1) YesQ4-2) YesQ4-3) YesQ4-4) Option 1Q4-5) not sure | For Q4-4): We prefer explicit indicator, similar as R16/17.For Q4-5): We understand the motivation, but it seems there is not such mechanism to let the source donor know whether the target cell is “iab-support” or not in R16 and R17, so similar as Rel 16/17, maybe such optimization is not necessary in Rel-18.  |
| **Nokia** | Q4-1) YesQ4-2) Yes, but RAN2Q4-3) YesQ4-4) see commentQ4-5) maybe | On Q4-4: this needs to wait for RAN2 discussion. On Q4-5, we think in Rel.16-17 the “IAB supported” typically does, or does not, apply to the whole target gNB. Mobile IAB nodes not supporting child nodes will change this. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**

## Identifying on-board UEs

At last RAN3 meeting, the following was agreed with respect tothe onboard UE identification:

**RAN3 to discuss whether to support means to identify onboard UEs.**

About this issue, [R3-225346 E///] suggests that the support for identifying onboard UEs is up to implementation. [R3-225360 QC] suggests that the mobile IAB-DU to report to the network for each cell if it aims to serve onboard UEs. [R3-225441 ZTE] proposes that the mobile IAB cell only allow the access of UE which is authorized or subscribed to this mobile IAB node, and the CAG mechanism in PNI-NPN may be leveraged for the on-board UE identification. [R3-225753 Xiaomi] states that the IAB-donor should be aware of the on-board UE. The means provided by these papers are diversified and there is no clear common understanding.

In addition, [R3-225682 HW] and [[R3-225455](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224378.zip) Nok] pointed out that how to identify the on-board UE is RAN2 issue, and RAN3 should wait RAN2 progress on this issue.

Companies are invited to provide feedback on the following questions.

**Q5: Do you agree that RAN3 should wait RAN2 on how to identify the on-board UEs?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Reasons/Comments** |
| Huawei | Yes | This issue is discussed in RAN2 now, we can wait their progress.  |
| Nokia | Yes |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**

## TAC/NCGI/RANAC of mobile IAB-DU cell

A lot of papers discuss the location information for mobile IAB cells. But different companies have different views. [R3-225346 E///] proposes to discuss only the static TAC solution in RAN3, dynamic TAC impact RAN2.

[R3-225441 ZTE] and [R3-225684 HW] think the TAC/RANAC should be changeable, and reflect the real UE location. [R3-225441 ZTE] also proposes that the UE may replace the old NCGI with new NCGI of mobile IAB-node-DU’s cell for the cells included in the RNA configuration, if the UE RAN area is configured with a list of NCGIs.

[R3-225360 QC]: After partial migration, the NCGI and TAC broadcast by the mobile IAB-DU’s cell may not represent the UE’s geographical location. During mobile IAB-DU migration, RAN3 to discuss support for TAC following the outside network vs. TAC remaining unchanged.

[R3-225360 QC], [R3-225441 ZTE] and [R3-225684 HW] has common understanding that the NCGI of the mobile IAB-DU cell should be updated when the F1-terminating donor changes, since the NCGI needs to reflect the identifier of the target donor CU.

[R3-225436 Fujitsu]: F1-terminating donor-CU reconfigures the Cell ID/TAC for the serving cell of mobile IAB-DU based on the Cell ID/TAC for the access cell of mobile IAB-MT.

Companies are invited to provide feedback on the following question about the location information.

**Q6-1): Do you think that the NCGI of the mobile IAB-DU cell should be updated when the F1-terminating donor changes?**

**Q6-2): Which option do you prefer for the TAC and RANAC of the mobile IAB?**

* **Option 1: TAC/RANAC for the mobile IAB cell is changeable and should reflect the physical location** **when it moves.**
* **Option 2: Static TAC/RANAC for the mobile IAB cell, not change when it moves.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Answer** | **Reasons/Comments** |
| Huawei | Q6-1): YesQ6-2): option 1 | For the NCGI, it includes the gNB ID, which corresponds to the F1-terminating CU. The TAC/RANAC will be used for CN/RAN paging UE, and should reflect the actual location of the UE. So, we think the RANAC should using same principle as the TAC for mobile IAB-node.For mobile scenarios, so it is straightforward that the TAC/RANAC broadcast by the mobile cell should be updated to match current geographic location. Otherwise, there will be some impact in CN if using static TAC, and we should check with SA2 on the impact. |
| Nokia | Q6-1); yesQ6-2): see comments | For Q6-2), we think this is a deployment/configuration issue, and both should be supported.For RANAC, in case the NCGI need to be changed, RANAC should use RAN area ID, rather NCGI. But this may be an implementation/configuration issue.  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary：**