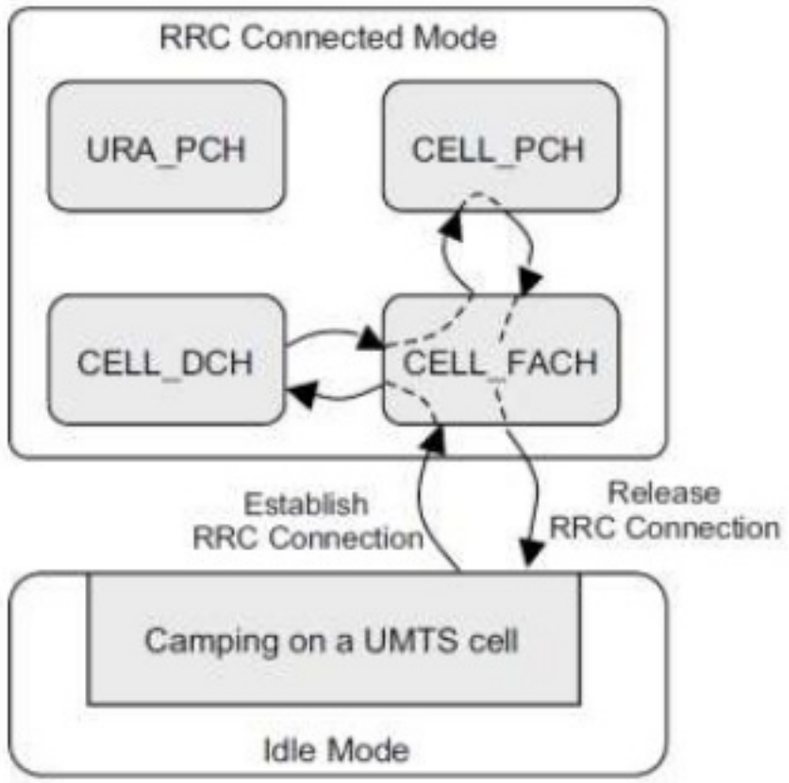
Cell PCH

Some Questions answered

CELL PCH



Q: What is Cell PCH State?

- CELL_PCH allows UE to remain in RRC Connected mode for relatively long periods of time while minimizing the network and UE resource requirements.

- UE can be paged in CELL_PCH, but the response must be sent in CELL_FACH.

- Similar to CELL_FACH, the RNC keeps track of the individual cell upon which the UE is camped

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Features:

- Uplink data transfer is not possible
- Paging Type 1 messages with a DRX cycle are used for paging purposes
- **Paging UE in CELL_PCH is more efficient than paging UE in RRC Idle mode**
- Transitions to CELL_FACH use the Cell Update procedure for more than one reason
- The UE and network resource requirement is less than CELL_FACH
- Inter-system and inter-frequency cell reselections possible
- Radio access network uses **U-RNTI** to identify UE

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Now this must be confusing. You must be wondering about the following:

- What is U-RNTI?
- How is UE paged in CELL_PCH state?
- How is CELL_PCH better than Cell Idle Mode
- How is signaling reduced with Cell_PCH?

Scroll down to find the answers ☺

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Q: What is U-RNTI

- In normal RRC Idle mode, a UE is recognized by its IMSI, TMSI, or P-TMSI
- However in Cell DCH, Cell FACH, CELL PCH and URA PCH, the IMSI, TMSI are replaced by U-RNTI. The U-RNTI provides a unique identifier for the RRC connection within the PLMN.
- The RRC Connection Setup message allocates a U-RNTI. U-RNTI is a concatenation of the SRNC identity with the S-RNTI.
- In terms of PAGING, if the UE is in CELL_PCH or URA_PCH, the TMSI is replaced by the U-RNTI.
- UE in CELL_FACH are assigned a Cell Radio Network Temporary Identifier (C-RNTI) in addition to a U-RNTI. C-RNTI are assigned by the controlling RNC to address the UE within a specific cell.

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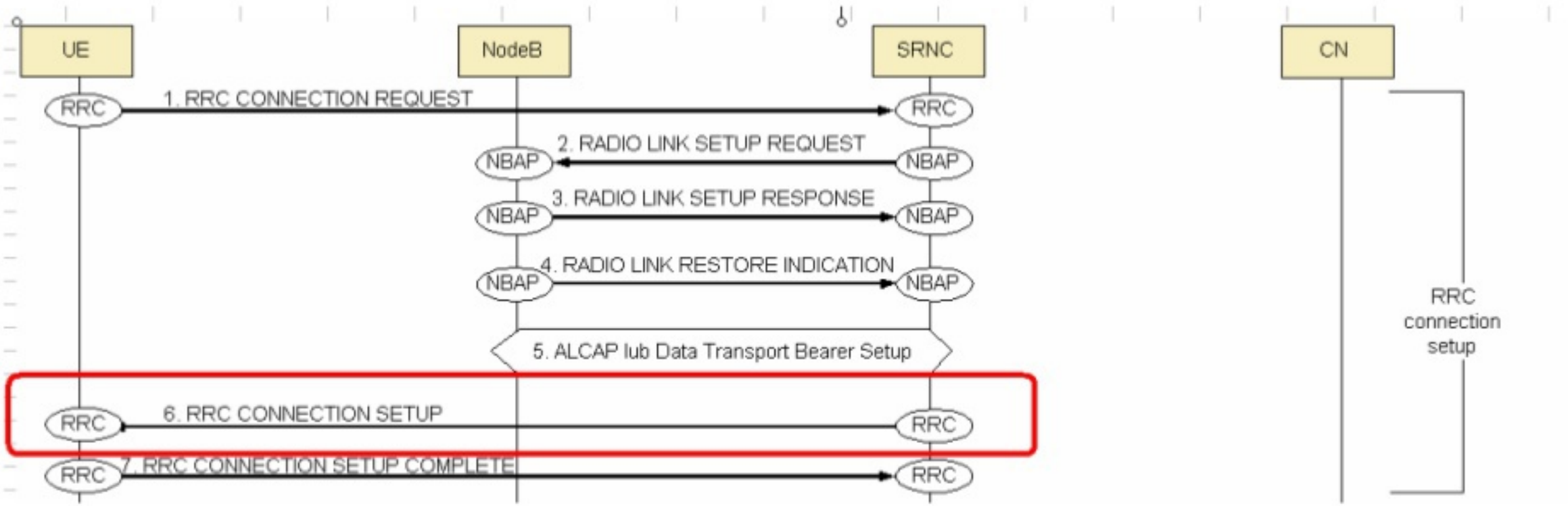
The SRNC sends the TMSI and U-RNTI information to the UE in the downlink RRC Connection Setup Message.



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Q: How is a UE paged in Cell_PCH State?

- A UE in CELL_PCH can be paged using a Paging Type 1 message. Paging Type 1 messages are transferred on the PCCH logical channel and are used to page UE in RRC Idle mode, CELL_PCH and URA_PCH.
- This is in contrast to Paging Type 2 messages which are used to page UE in CELL_DCH and CELL_FACH.
- Paging Type 2 messages do not include any indication of UE identity because they are transferred using the DCCH logical channel.
- If the UE is in CELL_PCH or URA_PCH, the TMSI is replaced by the U-RNTI.

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Q: How long does a UE stay in Cell PCH State?

- Inactive UE are typically maintained in CELL_PCH for 30 minutes before returning them to RRC Idle mode via CELL_FACH.

- If UE are maintained in CELL_PCH for only a short period of time there is an increased probability that the end-user initiates a subsequent connection from RRC Idle mode.

- This would then involve a more complex and time-consuming connection establishment procedure, i.e. connection establishment delay is increased.

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Q: How is Paging Load Optimized when using Cell_PCH state?

- **We know that in Idle Mode Paging, all cells of a particular LAC are paged**
- **In general, Paging Type 1 messages for UE in CELL_PCH are directed towards only a single cell because the RNC has knowledge of which cell each UE is camped upon.**
- This means that the network paging load can be decreased by allowing UE to remain in CELL_PCH rather than RRC Idle mode.

- Scroll down to find more details…..

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Q: How is Paging Load Optimized when using Cell_PCH state?

- This scenario is illustrated in Figure in next slide
- On the Right, the serving RNC (RNC2) receives the paging message from the CS core and directs it towards the appropriate cell.
- However, the second RNC (RNC1) also receives the paging message and does not have any knowledge of where the UE is located. This RNC directs the paging message to all cells belonging to the location area. Consider this RNC behavior with a UE in RRC Idle Mode.
- The UE in Cell PCH state served by RNC2 receives **direct paging message from the cell it is connected to**

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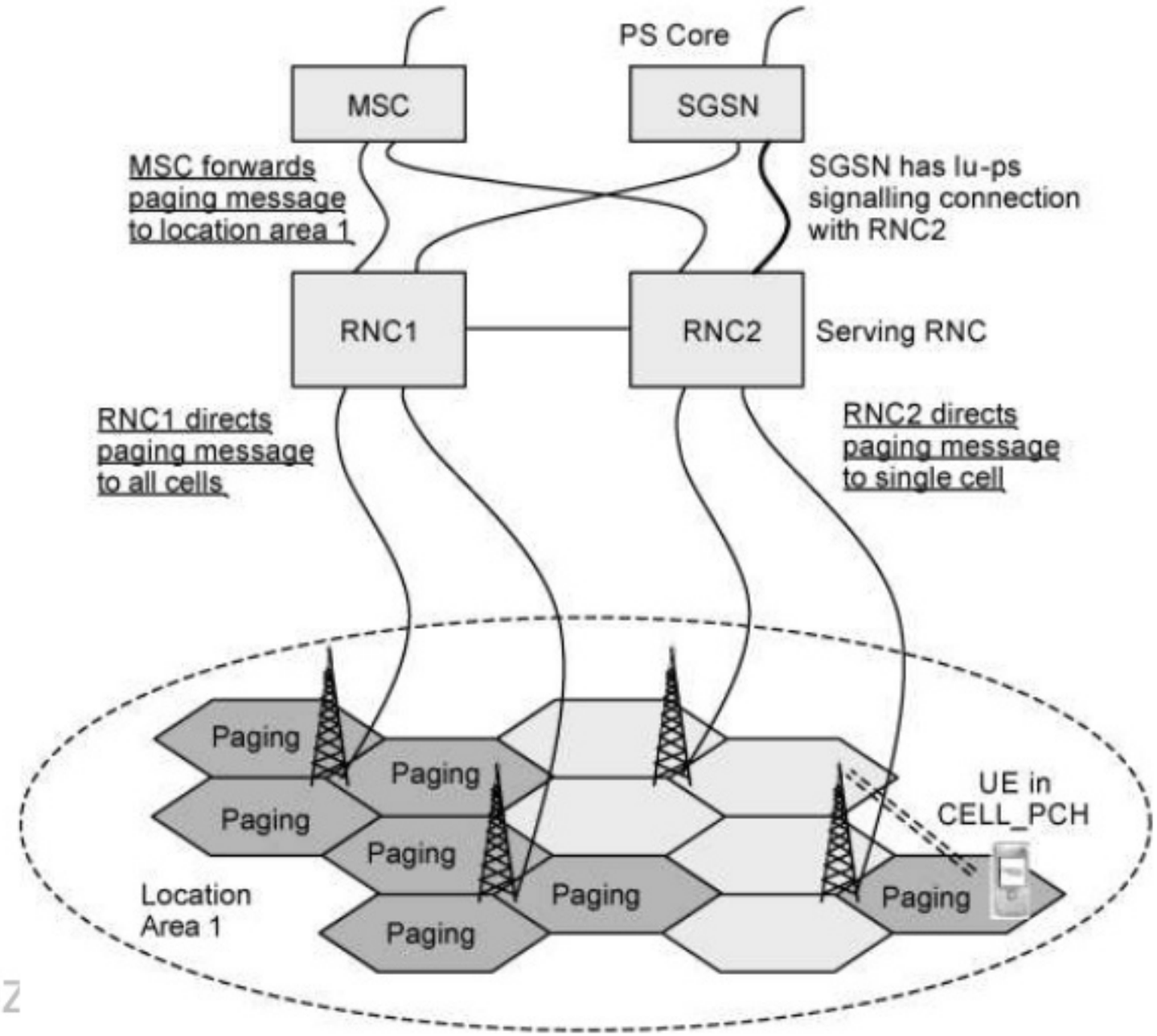
Q: How is Paging Load Optimized when using Cell_PCH state?



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Q: Will the RRC signaling be used when UE is in Cell_PCH state?

- From the network perspective, UE in CELL_PCH require the Iu-ps signaling connection to be maintained and to be allocated logical RNC resources in terms of a U-RNTI.
- There are no dedicated resources on the air-interface, at the Node B nor on the Iub. We expect to see less RRC Attempts, hence, reduced signaling
- If a UE in CELL_PCH moved out of coverage and returned to RRC Idle mode as a result of failing to complete a periodic cell update then the RNC would page the UE on a location area basis rather than on a cell basis.
- The RNC would also address the UE using its TMSI, P-TMSI or IMSI rather than its U-RNTI which the UE would have deleted after returning to Idle mode.

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So how do we do a transition to Cell PCH?

- State transition is, moving between different RRC States, for example:
  - Moving UE from RRC IDLE to Cell DCH is called a State Transition.
  - Similarly, moving UE from Cell DCH to Cell FACH and from Cell FACH to Cell PCH is called STATE TRANSITION

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- How do we move between different UE STATEs?
- Generally, moving between states in CS domain is quite simple. A UE in RRC Idle mode, upon RRC Connection Setup Complete, moves directly to Cell DCH
- However, this story is different when we talk about PS Domain
- In PS domain, the RLC buffer occupancy determines which state a UE should be.
- If we can recall, we used to set the parameters UlBeTraffInitBitrate or DlBeTraffInitBitrate. Here we're actually setting thresholds for RLC Buffer to take certain actions based on Buffer data occupancy.
- The control of RLC buffer and decisions based on PS Traffic volume are governed by Dynamic Channel Configuration Control – DCCC
- However, State Transition is not strictly a DCCC governed function

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- Cell FACH to Cell PCH Transition

- When receiving a report that event 4B occurs and the traffic volume is **Zero**, the RNC starts the timer for transition from Cell FACH to Cell PCH and the counters for 4B Ul/Dl event reports.
- If the RLC buffer is Zero for the length of the Timer, state transition from Cell FACH to cell PCH happens.

Service Type	Cell FACH to PCH Transition Timer	Thd of 4B	Time to Trigger	Pending time After Trigger
BE Service in PS Domain	BeF2PStateTransTimer	D2F2PTvmThd	F2PTvmTimetoTrig	F2PTvmPTAT

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Parameter	Parameter name	Recommended value
BeF2PStateTransTimer	BE FACH to PCH Transition Timer	65535s
D2F2PTvmThd	BE D2F/R Or F/R2P 4B Threshold	64bytes
F2PTvmTimeToTrig	BE F2P 4B Time	5000ms
F2PTvmPTAT	BE F2P 4B Pending Time	16000ms

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- ***BeF2PStateTransTimer***
  - Content: Timer for state transition from FACH to PCH of BE services, used to check whether the UE in the CELL_FACH state is in the stable low activity state. When this parameter is set to 65535, it is regarded that the state transition from FACH to PCH is not performed. If the value of this parameter is too low, whether the UE is in the stable low activity state cannot be determined. If the value of this parameter is too high, the common channel resources are wasted. This parameter should be set on the basis of the BE service model.
  - Set this parameter through SET UUESTATETRANSTIMER.
- ***D2F2PTvmThd***
  - Content: This parameter is used to check whether the UE in the low activity state. If the UE is on DCH channel, the low activity counter increases by 1 every time traffic volume event 4B is reported. If the UE is on FACH channel, the low activity counter increases by 1 if the traffic volume is 0 in the traffic volume event 4B report.
  - Set this parameter through SET UUESTATETRANS.
- ***F2PTvmTimeToTrig***
  - Content: When the traffic volume is below the 4B threshold and remains so for the period specified by this parameter, the event 4B is reported. This parameter prevents unnecessary traffic volume events that are caused by traffic volume instability from being triggered.
  - Set this parameter through SET UUESTATETRANS.
- ***F2PTvmPTAT***
  - Content: Pending time after the traffic volume event 4B is reported. This parameter is used to prevent too many traffic volume events 4B being reported.
  - Set this parameter through SET UUESTATETRANS.

Thank you for reading

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