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ENHANCEMENT OF ATTACH PROCESS FOR ROAMING

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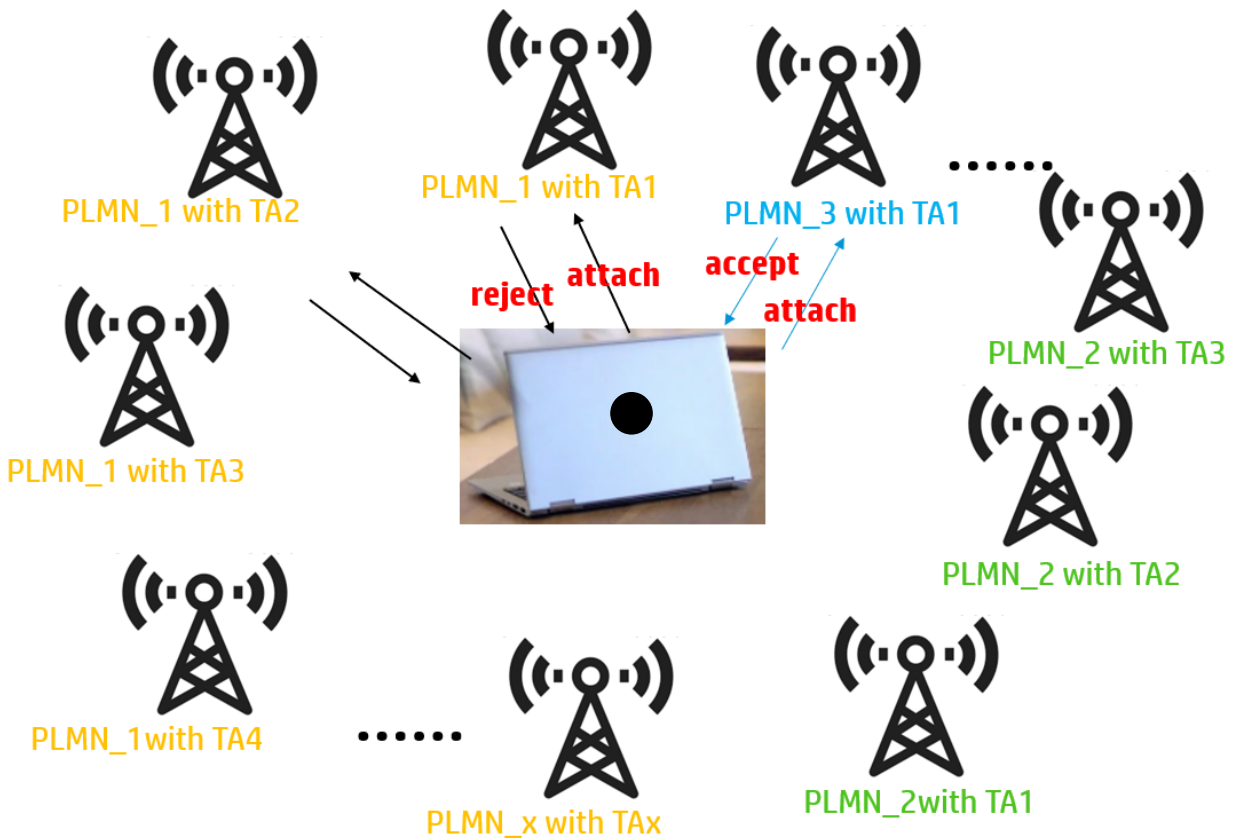
Enhancement of attach process for roaming

Abstract

When the user travels to another country, he/she turns on the device sometimes it may take a long time to get the mobile service. In this disclosure, we provide an algorithm to reduce the service acquisition time and improved user experience.

Background

Below is the environment, PLMN_1 to PLMN_2 is without roaming agreement and PLMN_3 is with roaming agreement with the SIM card. Once the device tries to attach the cell without roaming agreement, it will get attach rejection and the cause is #15-No suitable cells in tracking area.



From the 3GPP spec. 23.301, when the device gets the reject cause #15, device will try another TA (Tracking area) with the same PLMN until latest one, then the device can start to try another PLMN. If the device is in an urban area, the device should try many times (take much time) with the PLMN.

If we can reduce the attempt time, the device can speed up to get service. Then the user can surf internet, receive mail etc.

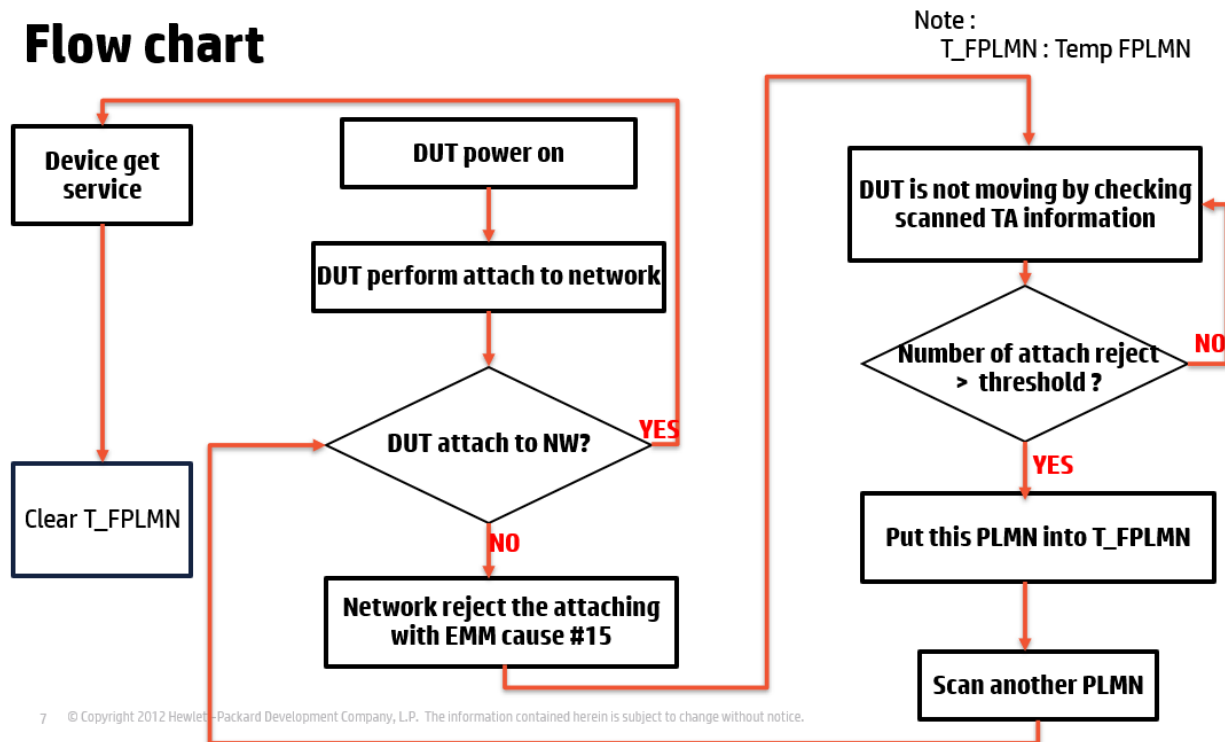
How it works

To reach the goal that reduce the attach attempts, we provide the algorithm below.

1. When power up, the device tries to attach to PLMN_1 and get the reject with cause #15
2. Set threshold N, N is the number of attach reject.
3. If the # of reject > N, put the PLMN_1 to T_FPLMN (temporary Forbidden PLMN) list. Because of the PLMN_1 is in FPLMN, the device does not try to attach to this PLMN.
4. The device will try to attach PLMN_2 and check if it is rejected by network with cause #15.
5. If yes, repeat step2 to step4 until the device is getting service.
6. Once the device is in service, clear the T_FPLMN.

See below flow chart

Flow chart



Benefit

Below log is from the real case, you can see the 1st attach for PLMN_1 is at 5:19:22 and 1st attach for next PLMN_2 is at 05:20:20. It means for PLMN_1, the device takes about 58 seconds.

If we set the threshold N to 3, it means when the device tries 3 times for the PLMN_1, it will try to next PLMN_2. As my experience, the time stamp for 1st of PLMN2 should be 05:19:25~ 05:19:27.

As the result, the reduction of acquisition should be from 58 seconds to 3~5 seconds. If the number of PLMN without roaming agreement is bigger, it can reduce much time when applying this algorithm.

1st attach

2022.03.11 05h:19m:22s:010.981,949ms	ATTACH_REQUEST	NAS_EMM: UL
2022.03.11 05h:19m:22s:026.033,304ms	rrcConnectionRequest	ERRC: UL_CCCH
2022.03.11 05h:19m:22s:057.719,652ms	rrcConnectionSetup	
2022.03.11 05h:19m:22s:057.975,292ms	rrcConnectionSetup	
2022.03.11 05h:19m:22s:057.990,215ms	rrcConnectionSetup	
2022.03.11 05h:19m:22s:063.071,842ms	rrcConnectionSetupComplete	ERRC: UL_DCCH
2022.03.11 05h:19m:22s:303.923,595ms	dlInformationTransfer	
2022.03.11 05h:19m:22s:304.063,837ms	rrcConnectionRelease	
2022.03.11 05h:19m:22s:304.333,723ms	ATTACH_REJECT	

3rd attach

2022.03.11 05h:19m:23s:910.494,062ms	ATTACH_REQUEST	NAS_EMM: UL
2022.03.11 05h:19m:23s:947.784,514ms	rrcConnectionRequest	ERRC: UL_CCCH
2022.03.11 05h:19m:23s:978.737,475ms	rrcConnectionSetup	
2022.03.11 05h:19m:23s:978.806,070ms	rrcConnectionSetup	
2022.03.11 05h:19m:23s:978.852,867ms	rrcConnectionSetup	
2022.03.11 05h:19m:23s:983.866,575ms	rrcConnectionSetupComplete	ERRC: UL_DCCH
2022.03.11 05h:19m:24s:261.722,799ms	SystemInformation(sib5,sib7)	
2022.03.11 05h:19m:24s:285.692,548ms	dlInformationTransfer	
2022.03.11 05h:19m:24s:285.815,154ms	rrcConnectionRelease	
2022.03.11 05h:19m:24s:286.076,563ms	ATTACH_REJECT	

Perform another PLMN attach

2022.03.11 05h:20m:20s:634.725,606ms	ATTACH_REQUEST	NAS_EMM: UL
2022.03.11 05h:20m:20s:669.674,585ms	rrcConnectionRequest	ERRC: UL_CCCH
2022.03.11 05h:20m:20s:696.330,697ms	rrcConnectionSetup	
2022.03.11 05h:20m:20s:696.579,353ms	rrcConnectionSetup	
2022.03.11 05h:20m:20s:696.593,828ms	rrcConnectionSetup	
2022.03.11 05h:20m:20s:701.679,524ms	rrcConnectionSetupComplete	ERRC: UL_DCCH
2022.03.11 05h:20m:20s:885.663,304ms	dlInformationTransfer	
2022.03.11 05h:20m:20s:885.951,455ms	AUTHENTICATION_REQUEST	

Disclosed by Keath Kuo and Fong Hong, HP Inc.