**Input to TDD-synch web-meeting #5 the discussion on ECC PT1 CG report on Practical guidance for TDD networks synchronization**

**Source**: NSN, Bolloré Telecom

**Purpose:** Explanation and Analysis for the feasibility and restrictions of Synchronization approaches in different scenarios

**Introduction:**

As part of the study-item on synchronization for TDD networks, some considerations on the synchronization approaches are raised in section §2.2 in the draft report. This contribution tries to clarify the feasibility and restrictions of Synchronization approaches in different scenarios.

The feasibility and restrictions of Synchronization approaches in different scenarios was discussed in previous web-meetings and some restrictions or considerations regards to different synchronization approaches are discussed e.g. the GPS jamming and the partial on-path support in section §2.2 as well in the draft report. The below table provides the explanation and analysis on the considerations which could be an reference information for operators to select the synchronization schemes according to different deployment scenarios.

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| --- | --- | --- |
| Synchronization scheme  | Considerations and restrictions for selecting this scheme | Analysis considering the considerations and sticking to current 3GPP requirements  |
| Synchronization with GNSS (including GPS).  |  GPS loss due to jamming, receiver failure, etc. v.s. hold-over timeIf the GPS signal is weak and unavailable, the other approaches (instead of the sync with GNSS) need to be selected for sync. | According to the lastest draft report (version 20140103) section 2.2.1 that most jamming events have a duration of about a few seconds or minutes, however longer durations (10 minutes in this example) cannot be excluded even though those events are rare. For Macro BS, there is no severe concern since the Macro BS hold-over time is long enough. For low power BS (including Micro, Pico and Femto), the outdoor deployment which assumes synchronization with GPS should with holdover capability of larger than the duration of GPS jamming. Considering the GPS jamming duration is several minutes, it should not a big problem for the oscillator hold-over design. |
| Synchronization with IEEE 1588v2  |  Considerations: 1) The node in between may not support IEEE 1588v2.  2) It is possible the timing source of the IEEE 1588 Master clock is depending on a GPS receiver on building roof, which is a simple distribution solution for a building. Thus the Master clock source may introduce error due to GPS receiver.  In addition, it is also possible that the switch nodes are not supporting IEEE 1588v2.3) For devices which have not been designed or standardized to support IEEE1588-2008 (mainly those asymmetric transmission like DSL, xPON, MWR), normally in these cases the IEEE 1588v2 approach will not be selected without upgrading. | For consideration 1), with proper PTP-enabled equipment, 3µs is feasible. And normally in the case if IEEE 1588v2 are not available, this approach will not be selected. However the case partial on-path support may also be considered under some condition. It is possible to have up to 2 or 3 hops with 1GE interfaces without BC clock and the synchronization accuracy required at eNB could still fulfill 3us. The case exceeds the hops will not meet the same accuracy/reliability. For consideration 2) that is quite similar question for sync with GNSS and risk 1). And the timing source is for the building distribution system thus the Grandmaster clock worth a good oscillator with good holdover capability and shall be able to compensate the delay caused by the cable.  For consideration 3) in the case IEEE 1588v2 is not supported, this approach will not be selected. |
| Synchronization over the air (with network listening). | Considerations: long distance between the source BS and the synced BS may lead to larger timing deviation.   | For this consideration, it is specified in 3GPP TS36.133 §7.4.2 thatfor >500m case, the requirement for network licensing is 1.33 + Tpropagation s, larger than 3us. And if for the BSs which are not overlapped in coverage i.e. not neighbors, it is assumed the BSs will not interfered between each other thus the timing deviation between these two BSs are not necessary to be restricted.  |

The most concerned challenging scenario for synchronization were assumed low power BSs indoor case where the GPS signal may not be available and the holdover time may not be very long and simultaneously the IEEE 1588v2 is not supported by backhaul. For this case if all the other two approaches are not available, the 3GPP also provides the approach of over the air (network listening) synchronization for HeNBs. The over the air approach already supports synchronization across operators, and it allows indicating stratum/source source information and supporting multiple hops. Technically it is not expected to be a huge change to allow the over the air synchronization approaches for other low power BSs, e.g. Micro and Pico BSs if 3GPP identified the needs for support.