Requirement of automatic error compensation for asymmetry of physical line

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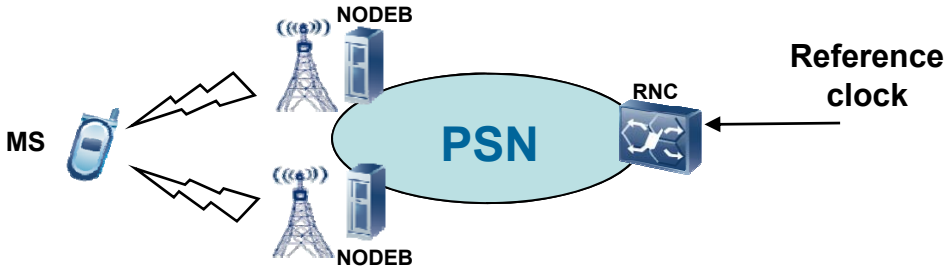
Agenda

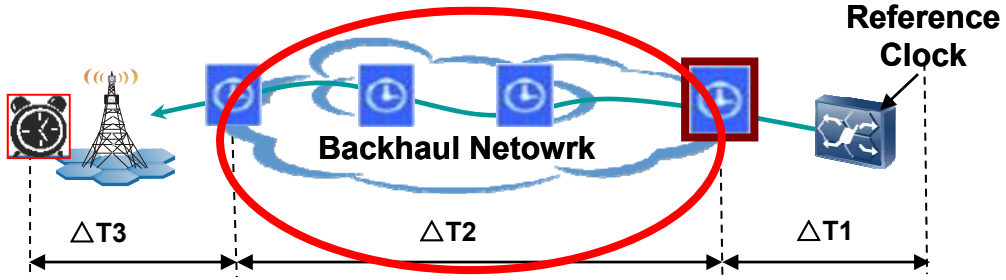
- **Current compensation method**
- **Requirement of automatic compensation**

Synchronization accuracy

- **3G/TD-SCDMA Access Networks**



- **Sync accuracy requirement in 3G/TD-SCDMA**
  - Base stations need frequency sync: +/- 0.05ppm, and phase sync: +/- 3us
  - For base stations, reference clock is distributed via PSN, it is necessary of physical synchronization support (e.g. Sync Ethernet) for frequency sync and packet-based synchronization (e.g. 1588v2) for time/phase sync.
    - Time sync between NodeB and Reference clock: +/- 1.5us
- **Sync accuracy requirement in backhaul network**
  - Considering RNC and NodeB will introduce time offset, PSN need more precise time synchronization: +/- 1us



Suggestion:
|△T1| < 200ns
|△T3| < 300ns
|△T2| < 1000ns

Reason for compensation for asymmetry of physical line

- **PTP(1588v2) can't eliminate delay asymmetry of physical fiber line**
  - Ethernet ports are usually full-duplex, which means upstream and downstream packets go through different physical links, such as fibers
  - The transport delay of optical fiber is 5us per 1km, so 100 meters length difference will introduce 250ns error

- **Some real data from 1588v2 trial in China Mobile backhaul network**
  - Some of physical lines had serious asymmetry, **whose error compensation was even up to 6us.**
  - Most of physical lines didn't have to be carried out error compensation, **however, we had to measure every line to find whether error was zero.**

China Mobile has large backhaul network, compensation for asymmetry of physical line is really a mandatory requirement.

Current compensation method

- **Hop by hop compensation**
  - Through some measurement equipment, measure asymmetric error of every physical line between any two directly connected nodes
  - **Problems**
    - It is hard work to measure asymmetric error hop by hop
    - Accumulated error from measurement of every hop maybe considerable

- **End to End compensation**
  - Use GPS to measure the end-to-end compensation value at the endpoint (e.g. mobile base station)
  - **Problems**
    - It is hard work to measure compensation value at every endpoints
    - It is hard to get GPS signal in some places, e.g. subway

Above methods are manual mode, which will lead to large work in the deployment of 1588v2. When network changes (e.g. repair fiber line break), compensation should be manually measured again.

Agenda

- **Current compensation method**
- **Requirement of automatic compensation**

Requirement of automatic compensation

- **Requirement**
  - Automatically measure the compensation value caused by asymmetry of physical lines
  - Either “hop by hop” or “end-to-end”
  - When network changes, compensation measurement can run again automatically

- **Difficulty**
  - For duplex link, asymmetry of physical line is hard to measure through some software protocol, so it’s hard to do it automatically

New work

- **Could it be possible to add the automatic compensation for asymmetry of physical lines into new work?**

Thank you

Q&A