This document explains the different stratum levels and outlines the minimum performance requirements for digital network synchronization. Clock systems provide a stable frequency source even during circuit impairments, ensuring that connected equipment remains unaffected until the clock's holdover drift leads to a slip. While occasional slips are inevitable, the goal is to minimize their frequency. Through careful network engineering of clock systems, near-perfect timing can be achieved at a reasonable cost, with excellent reliability and maintainability.

A stable clock can transform a network that experiences issues multiple times a day into one that maintains timing even during major trunk outages. As long as the repair time is comparable to the time of the first frame slip, the network can continue operating without disruption until the outage is resolved (see table below).

The table below 1 summarizes the requirements for each stratum level, comparing their drift and slip rates. Higher stratum level clocks can control lower strata levels. If multiple Stratum 1 sources are used, it's recommended to trace them back to another standard to ensure their accuracy.

Stratum	Accuracy	Stability	Pull-In-Range	*Time to frame slip
1	0.01ppb	N/A	N/A	72 Days
2	16ppb	.1ppb/Day	16ppb	7 Days
3	1ppm	10ppb/Day	4.6ppm	3.5 Hours
3E	4.6ppm	370ppb/Day	4.6ppm	6 Minutes

Note: Slip rate calculation assumes a frequency offset equal to the 24-hour drift, accumulating bit slips until 193 bits are reached. Drift rates for atomic and crystal oscillators are not always linear or consistently increasing.

Stratum 1

A Stratum 1 clock is a fully independent timing source with no external input, except perhaps for yearly calibration. Common sources include atomic standards (Cesium Beam or Hydrogen Maser) or reference oscillators (OCXO). A properly calibrated source provides bit-stream timing that won't slip relative to an absolute standard more than once every 4 to 5 months. Atomic standards like Cesium clocks offer even better performance. A Stratum 1 clock is considered a Primary Reference Source. An example is a clock system directly controlled by Coordinated Universal Time (UTC) frequency and time services, such as the Global Positioning System (GPS), which can provide high-accuracy, low-cost Stratum 1 timing.

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Stratum 2

A Stratum 2 clock system tracks an input under normal conditions and maintains the last best estimate of the input reference frequency during impaired conditions. Typical examples include Rubidium Standards and Double Oven OCXOs.

Stratum 3 & 3E

Stratum 3 clocks also track an input, similar to Stratum 2, but over a wider range. Some Stratum 3 clock equipment may not be suitable for timing SONET network elements. Stratum 3E is a newer standard introduced to address SONET equipment requirements.

Need more information?

Check out our website at https://suntsu.com/ or contact us by phone at (949) 783-7300.

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