New Definitions for IEEE 802.1ASbt

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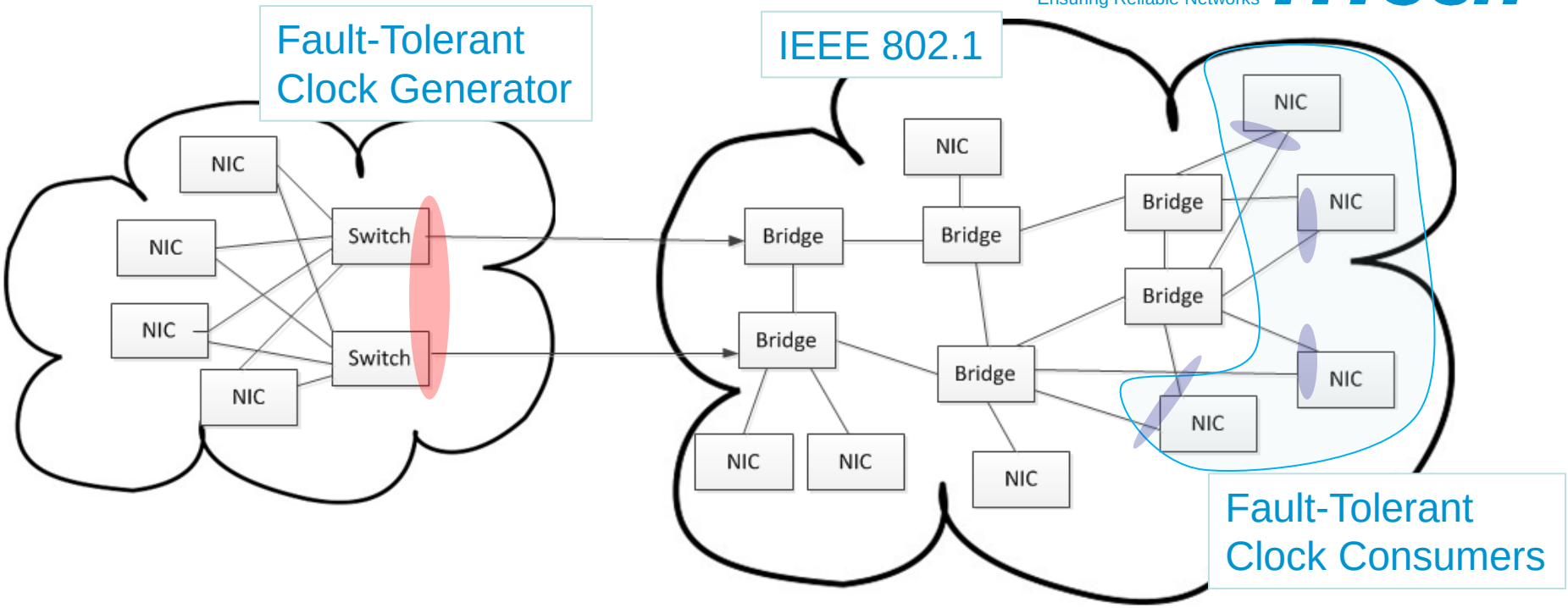
Interface Design

Ensuring Reliable Networks TTTech



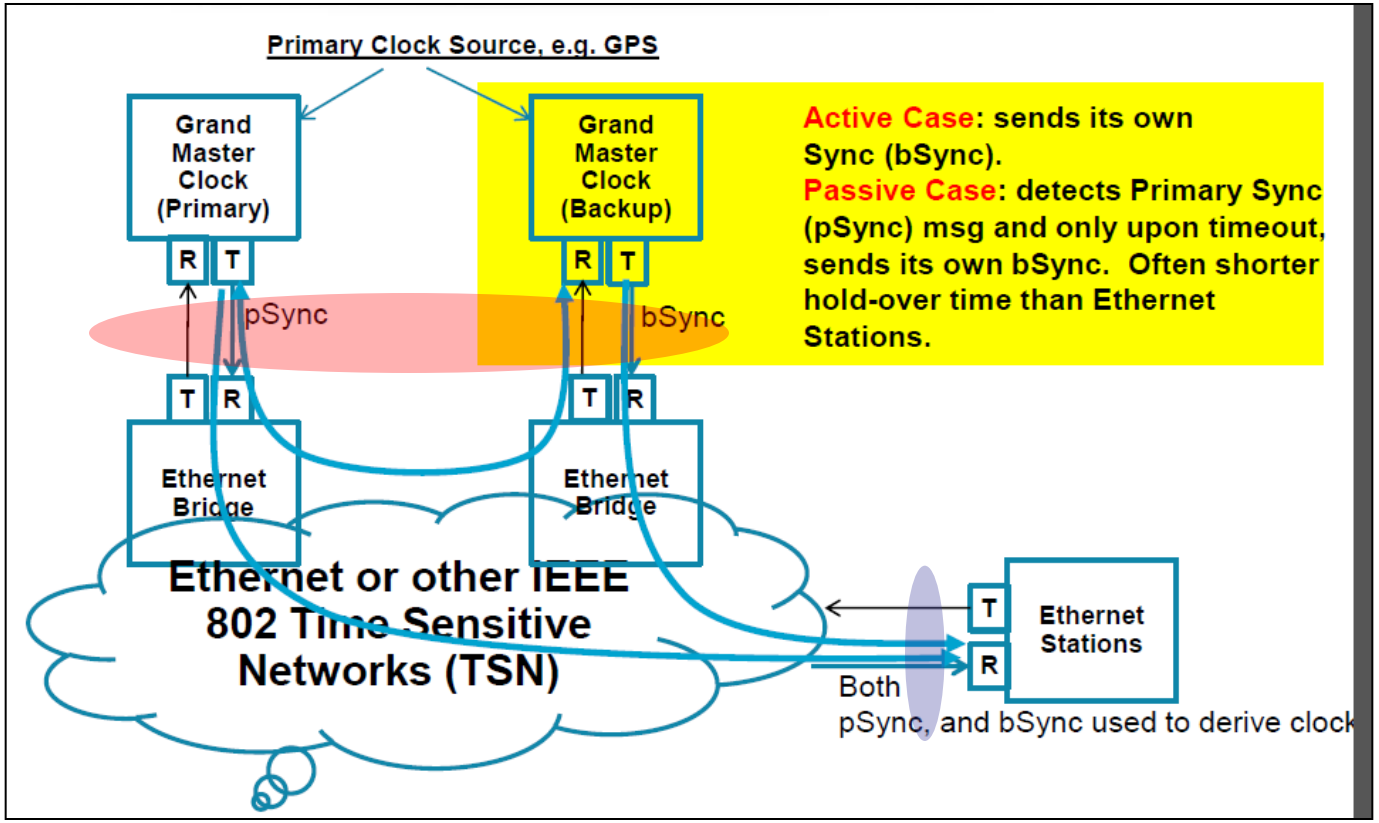
"Architecture Design is Interface Design" [Kopetz]

Red Interface specifies the behavior of the FT Clock Generator *as observed by the connecting bridges of the IEEE 802.1 network*.

Internal behavior of the FT Clock Generator may (and most likely will) *be much more complex* than as observed at the interface.

Blue Interface specifies the behavior of the FT Clock Generator *as observed by the FT Clock Consumers.*

There is also a red interface in the 802.1ASbt Backup Master concept



http://www.ieee802.org/1/files/public/docs2013/ASbt-Spada-Kim-Fault-tolerant-grand-master-proposal-0513-v1.pdf

Mandatory elements of the interface description of a FT Clock Generator

failure model: description of failure mode, number, frequency, etc.

precision: worst-case difference of any two non-faulty clocks in the system

accuracy: worst-case difference of the clocks in the system relative to an external time reference

startup time: worst-case time after startup of the time sources until the system is synchronized (with given precision and/or accuracy)

integration time: worst-case time for a non-synchronized component in the system to become synchronized

changeover time: worst-case time for the components in the system to change from one time source to another one (e.g., in the case that the original time source fails)

recovery time: worst-case time for the synchronized timebase to recover after global synchronization loss

Necessary new Definitions for IEEE 802.1

1588-accuracy:

"*3.1.1 accuracy: The mean of the time or frequency error between the clock under test and a perfect reference clock, over an ensemble of measurements. Stability is a measure of how the mean varies with respect to variables such as time, temperature, and so on.*"

1588-precision:

"The precision is a measure of the deviation of the error from the mean."

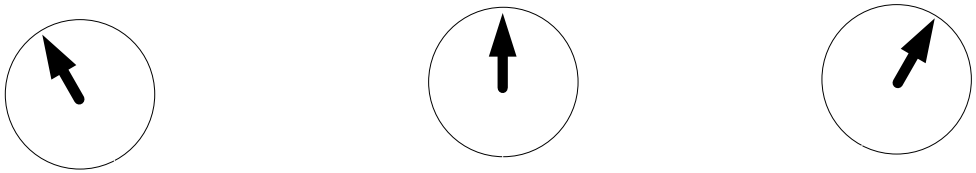
→ For .1Qbv, scheduled traffic, we need worst-case numbers (at least for the time differences).

→ E.g., ITU-Q13 uses a term called the

maximum absolute value time error

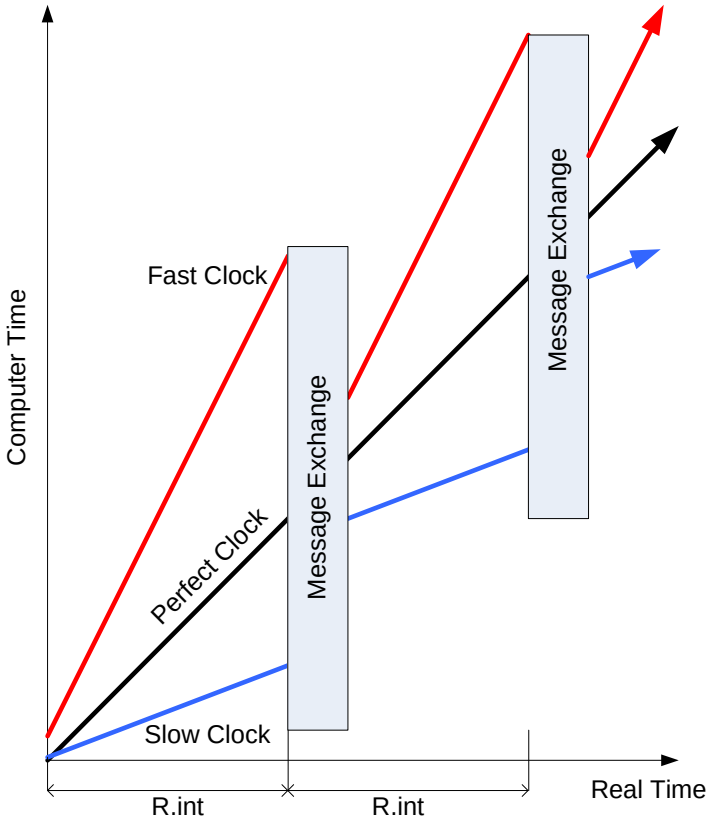
→ We need definitions according these lines, and some fancy names.

In an ensemble of clocks, the [insert fancy name here] is defined as the maximum time difference between any two synchronized non-faulty clocks at any point in real time.



Late Clock Perfect Clock Early Clock

Synchronization Services



[Insert fancy name for Pi here]:

$$\forall t > t_0 : |C_p(t) - C_q(t)| < \Pi$$

Cp,q() … the computer time of the clocks p and q

t … any point in real time

"[Insert fancy name for Pi here] defines the maximum difference in computer time of any two clocks at any point in real time."

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