More type approval testing for NGN

ITSF / Jean-Loup Ferrant / November 16, 2006

Impairments in Packet networks

different applications

Different solutions for transport of timing in packet networks

Testing methods

CES test experience

Proposal

Impairments affecting **Timing Distribution**

Packet Transfer Delay

May cause a lag in response to changes in the master clock

Static delay is not usually a problem for recovery of clock frequency or phase

Packet Delay Variation (PDV)

Appears as change in frequency or phase of the recovered clock

Multiple causes, including queuing delays, routing changes, congestion etc.

Packet Loss

Not usually an issue for clock recovery, due to integration over several seconds of data and sequencing approach

Packet Error

Bit errors in packets cause packet loss due to discard of the packet

Extended Packet Loss (Network Outages)

May cause clock recovery process to go into “holdover” from lack of information

Application requirements: different tests

Mobile: frequency accuracy

- GSM- well known 50 ppb requirement
- CDMA with additional strigent phse requirements

TDM networks: PDH, SDH

- G.823, G.824, G.825 jitter and wander masks

Real time applications

- VOIP wander requirements much easier than for TDM

Video

- DVB , Digital Video Broadcasting
- MPEG2

etc

Different timing transport: different tests

Pseudowire: CES for transport of TDM

- Adaptive Method
- Differential Method (don't forget ref clock noise and desynchronisation)

packet networks: transport of timing

Time Protocols

- Precision Time Protocol (IEEE1588)
- Network Time Protocol (NTP) &Real Time Protocol (RTP)

Synchronous Ethernet

- The aim of this method is to reproduce the behaviour of SDH networks
- The performance is **independant of payload**
- No new testing method is required: Characterisation of an equipment clock should be enough

Testing procedure

The performance of most methods proposed to transport timing are influenced by the payload content (not with Synchronous Ethernet).

Two main methods are used for these tests

- **Network simulator**

It simulates the effect of network by generating a PDV histogram

-**test network**

This process of specification has been used in G.8261

It requires the definition of test payload and the definition of a test network

Network simulator

-Simulators outputs must be independant on the host PC

- 2 years ago, some suppliers used to contest measurement results done with a simulator
- Personal experience showed that rare unexpected spikes occuring on the timing output, being damageable for MTIE measurements.

-Simulators simplify testing

- A PC may simulate a network made of 10 many switches
- It has been recently proposed in ITU to consider the definition of a simulator, in addition to test patterns.

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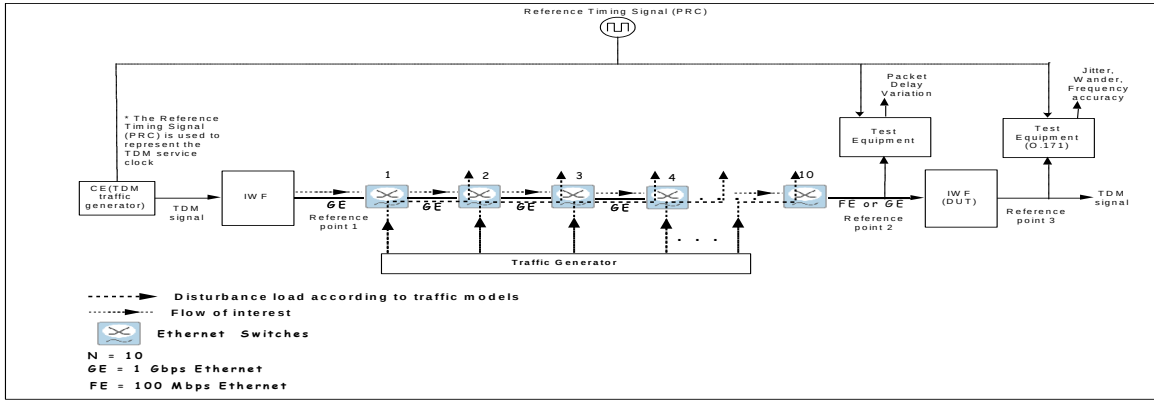
Test network (1)

-definition of a test network



-definition of the traffic model

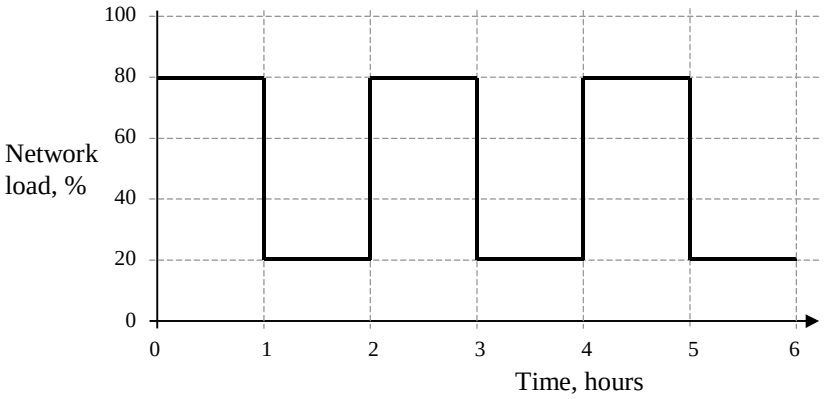
- They define the type of packets and their percentage, e.g.
- 80% of the load must be minimum size packets (64 octets)
- 15% of the load must be maximum size packets (1518 octets)
- 5% of the load must be medium size packets (576 octets)

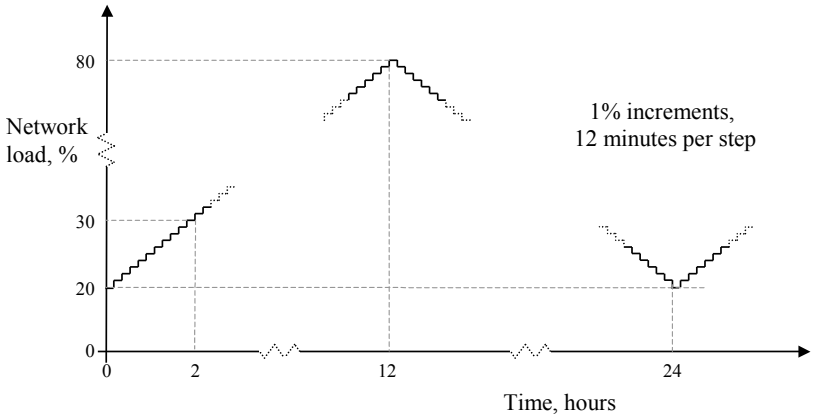
Test network (2)

Definition of 2 main payload test

behaviour in case of payload steps

Behaviour in case of slow payload modulation





Test network are very helpful but are complex to implement

- Need for several switches and results are Switch dependant
- Need for several generators

Some results on CES testing on a test network

Following results have been performed on different CES systems

The objective is not to compare them but highlight some good performance and draw attention on some problems.

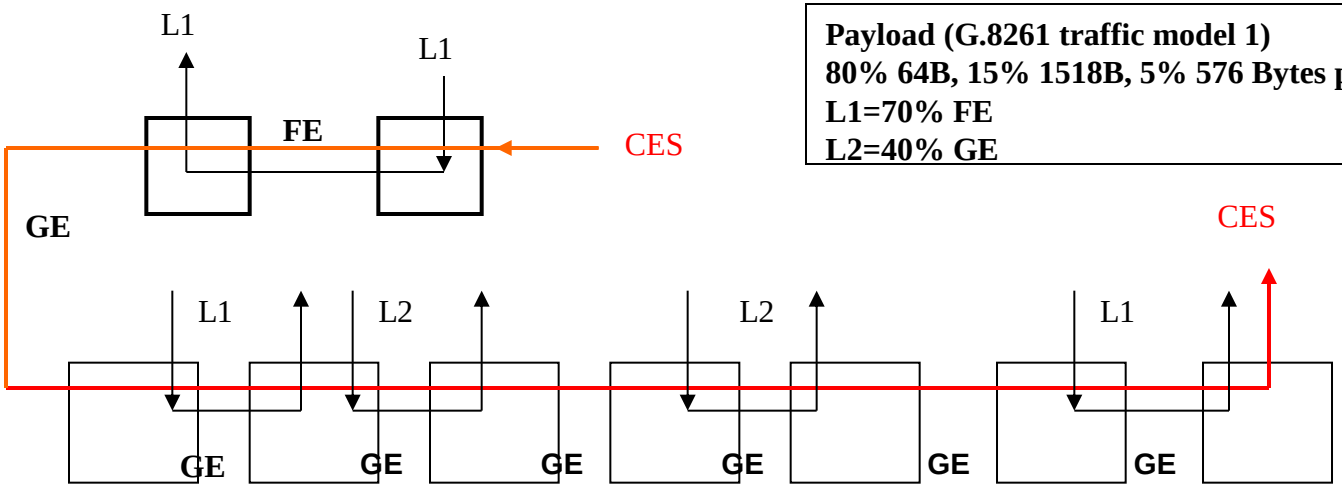
- One test was made on a network with variable payload with QOS
- One test was done in a pure best effort network
- One test compares a design in idle and variable payload condition
- Some problems are reported

CES testing1 : Influence of payload variation

CES packets transports 256 bytes of a 2 Mbit/s signal

Transport network 1 FE , 7GE links

QOS was implemented giving priority to CES traffic



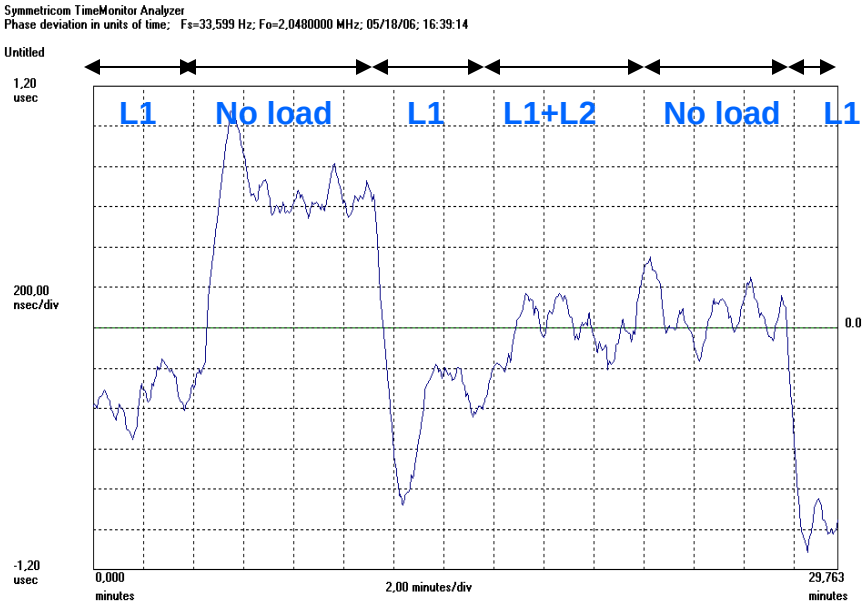
Payload (G.8261 traffic model 1)
80% 64B, 15% 1518B, 5% 576 Bytes packets
L1=70% FE
L2=40% GE

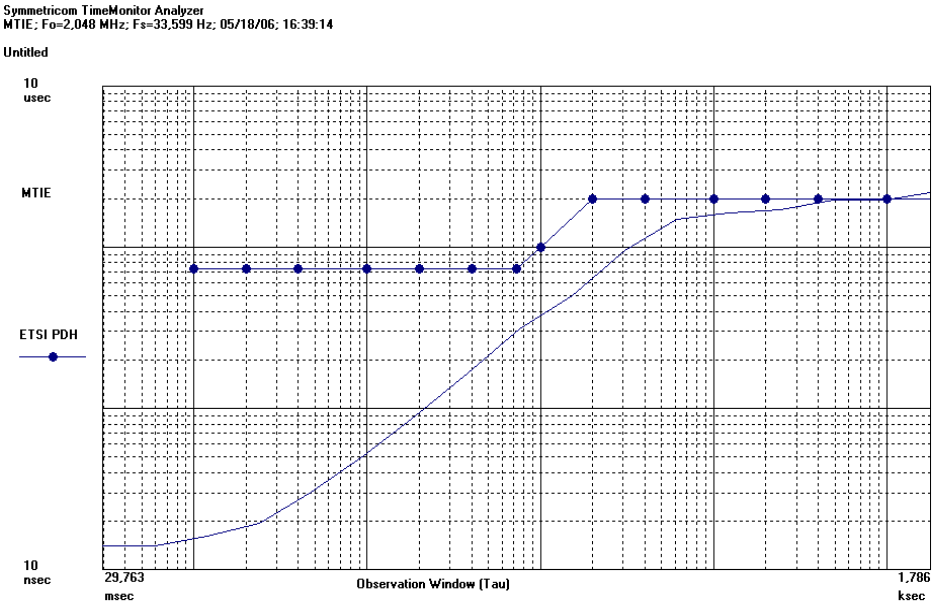
Test network: Eth switches

CES testing1:TIE & MTIE results

Loads L1 and L2 have been applied as shown on the TIE results

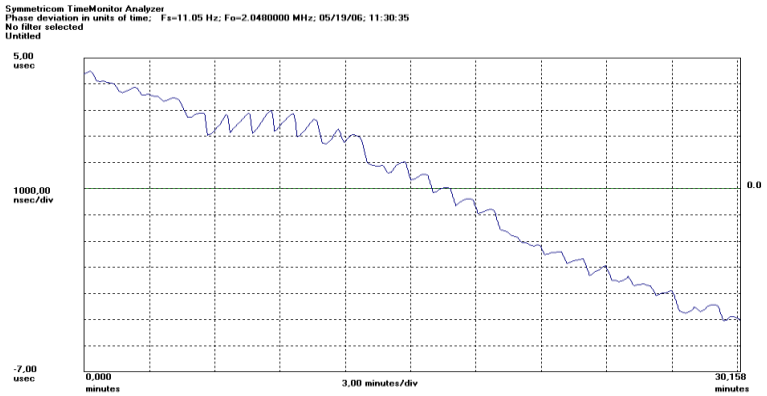
MTIE is almost compliant with the G.823 synchronisation mask

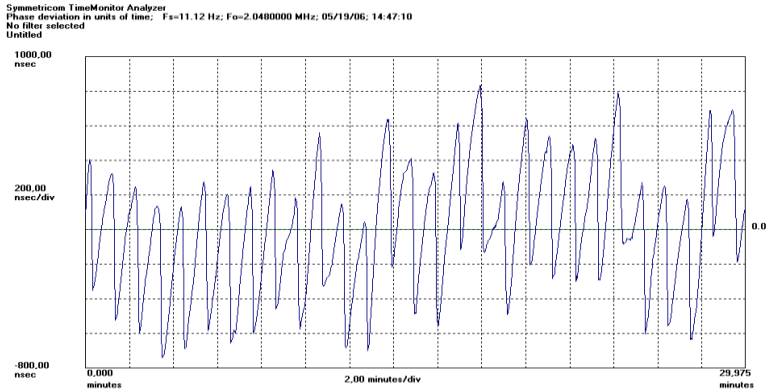




CES testing 2

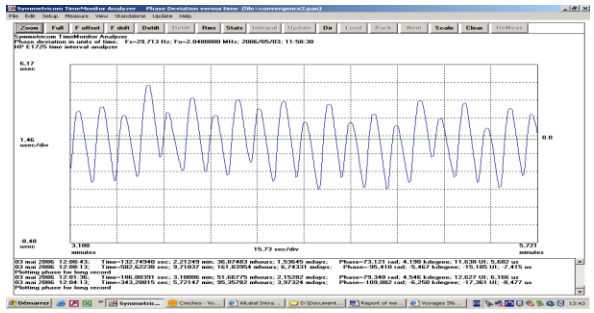
- The test network was changed from 9 switches with QOS to a 3 switch one in best effort
- It has been needed to modify one CES parameter to restore the performance
- This shows how the configuration is critical for testing

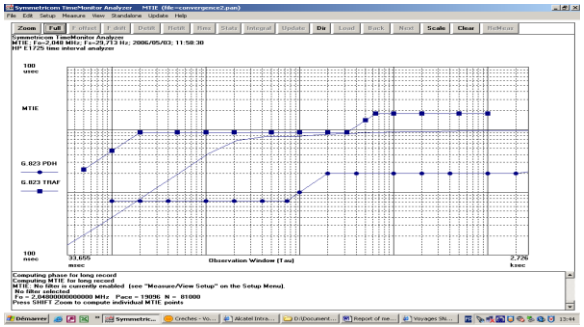




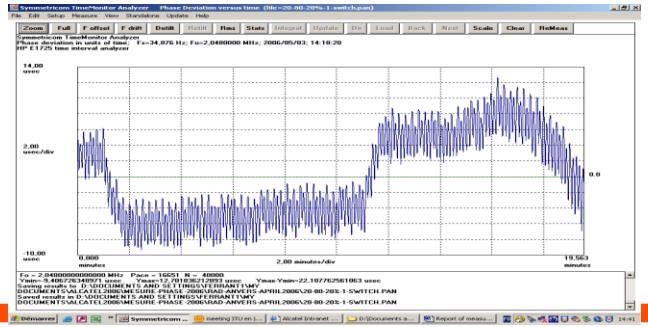
CES testing 3:Idle vs loaded conditions

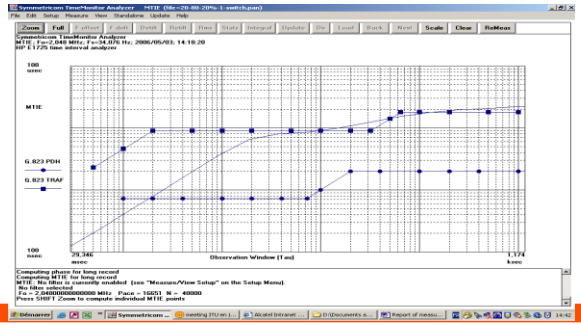
- First test shows a CES system without any intermediate network that just meets the MTIE





- Second test with a large nework and 20-80-20 payloads change almost meets MTIE





CES testing 4: some problems

- **Temperature**
  - Systems transporting timing are making use of oscillators, that are filtering PDV effects.
  - Some test revealed weakness with temperature variations
- **Maintenance signals**
  - Some CES systems do not generate an AIS on the TDM output when the input TDM is missing
  - That makes these systems unable to transport timing

Current status of tests methods for CES

Simulators

- practical issues that sometimes corrupted measurements
- Based on statistics and do not allow to simulate specific network conditions

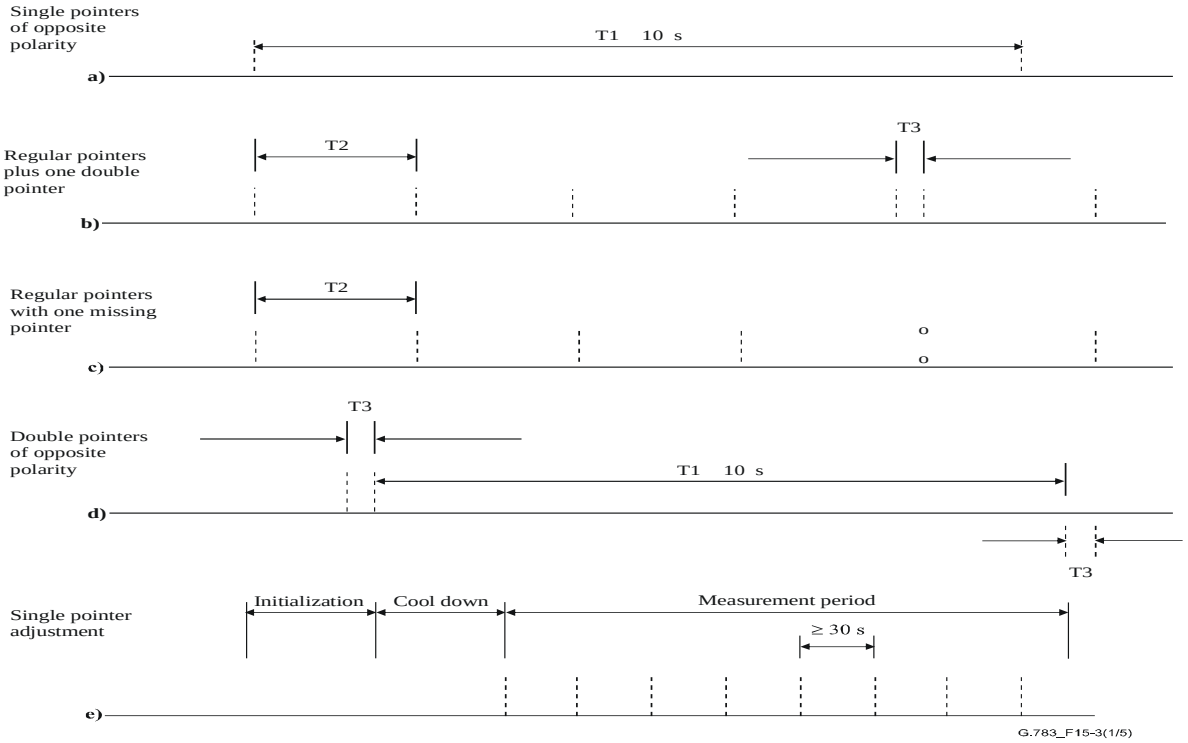
Test networks

- Good characterisation, but depends on the characteristics of the switches used for the test network
- Difficult to realise because of the amount of equipments and test generators needed.

Other Method? Test patterns?

3rd way for testing CES: test patterns?

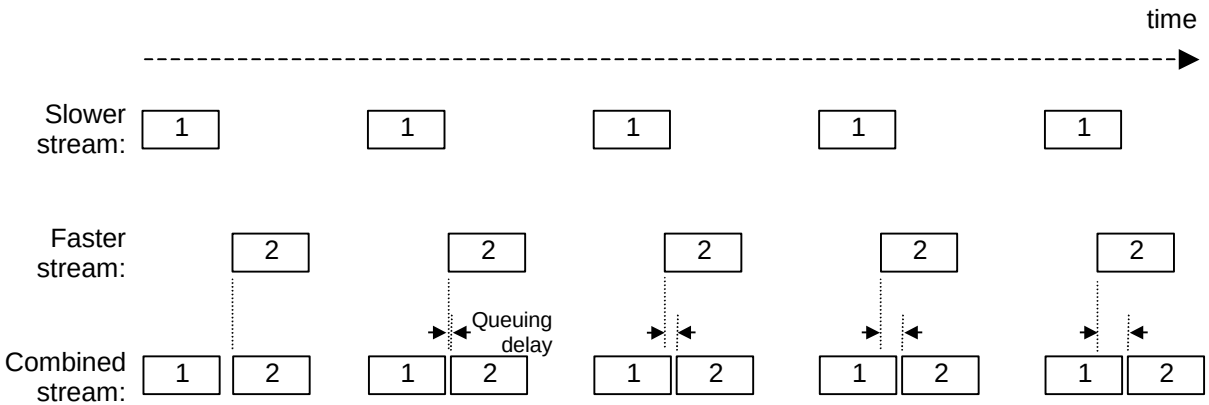
Test patterns have been successfully specified in G.783 and used to characterize SDH equipments in presence of network stress such as a desynchronization.



Test patterns

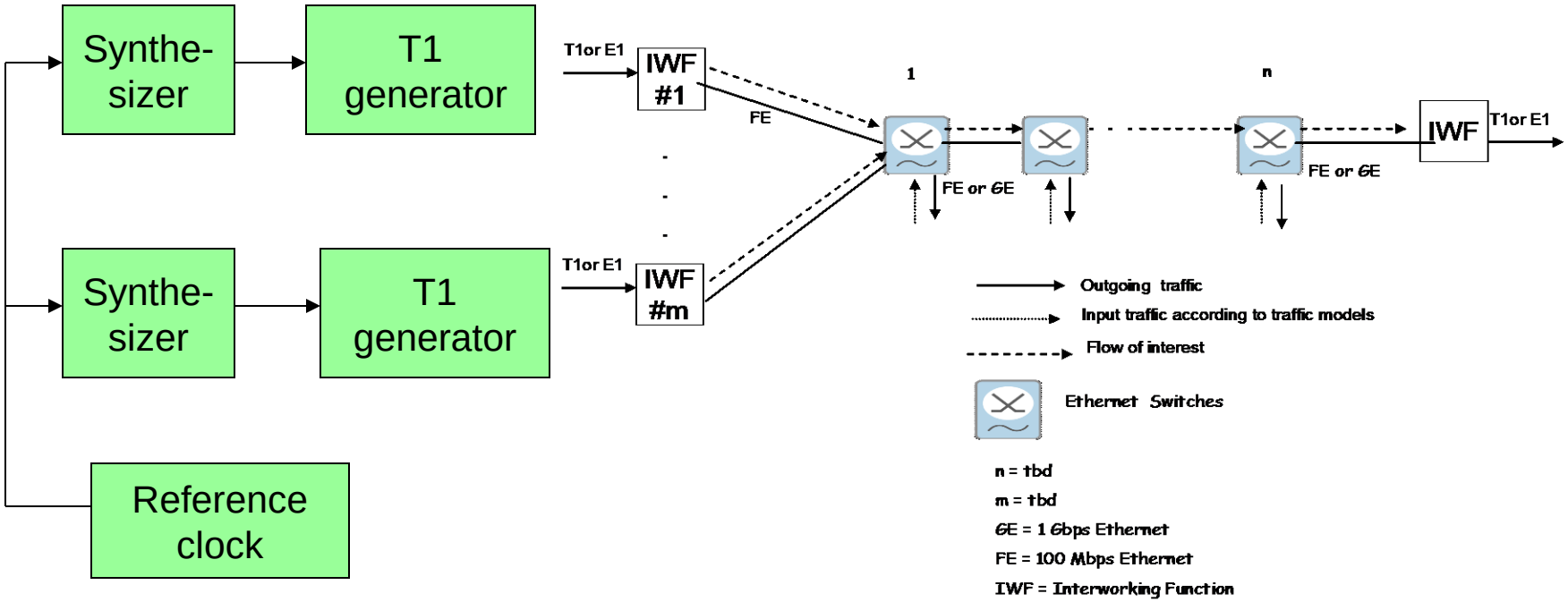
Test patterns could be specified in addition to similators mainly based on statistical estimations to characterize equipments in specific network conditions such as:

- Beating, which is generally tested only with 2 different CES systems but could involve many CES with different clocks and require as many synthesizers
- Any other specific condition
- Such pattern might also include packet loss



Testing beating

A complete characterisation of beating needs one Synthesizer per CES



Conclusion

Test in NGN is not easy and much more complex than test in SDH.

Several testing methods are in use but are either limited to emulate some network behaviours, or they are complex to implement and require a lot of equipments.

Another method has been proposed that could match the advantage of existing methods.

This presentation addressed mainly CES testing, Time Protocol testing may require other techniques.

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