World Class Standards

Transport of 64 kbit/s transparent data service over IP

Martin Brand
TELEKOM AUSTRIA

Name : Martin Brand

Position: Senior IT Specialist at A1 Telekom

Vice Chairman ETSI TC INT

Vice Chairman ITU-T SG11 WG4

tel: + 43 50 664 31916

mob: + 43 664 663 1916

fax: + 43 50 664 9 31916

skype: martin_bd2000

E-mail: martin.brand@a1telekom.at

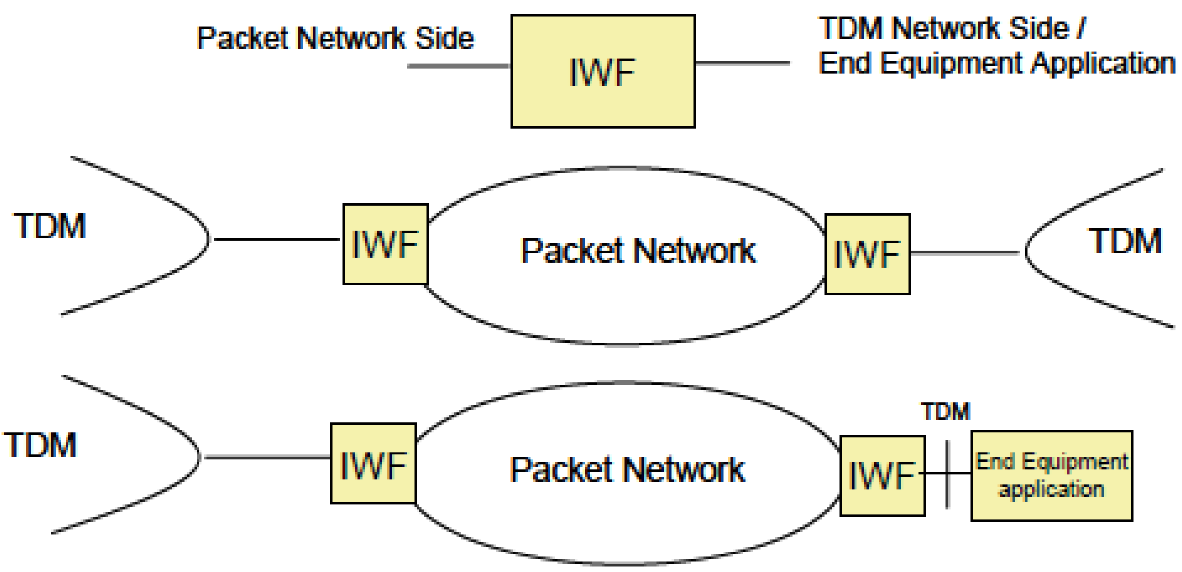
____

Company address: Telekom Austria; Lassallestrasse 9 ;
1020 Vienna; Austria

ISDN 64 kbit/s transparent data applications

- Video conferencing systems (conventional)
- Radio and TV Channels Transmission
- Secure data transfer between banks
- Data transfer between hospitals
- ISDN Fax group 4
- Remote maintenance of PBX
- LEONARDO (Apple)

IWF in Network



Timing requirements at edge and in core networks for 64 kbit/s transparent data

- The jitter and wander network limits currently specified in the relevant ITU-T Recommendations i.e. G.822, G.823, G.824, G.825, G.826

Timing and synchronization requirements in packet networks for 64 kbit/s transparent data

- To ensure the timing requirements the packet network (access and core) must be synchronized according the ITU-T Recommendation G.8261/Y.1361

Timing recovery for constant bit rate services transported over packet networks

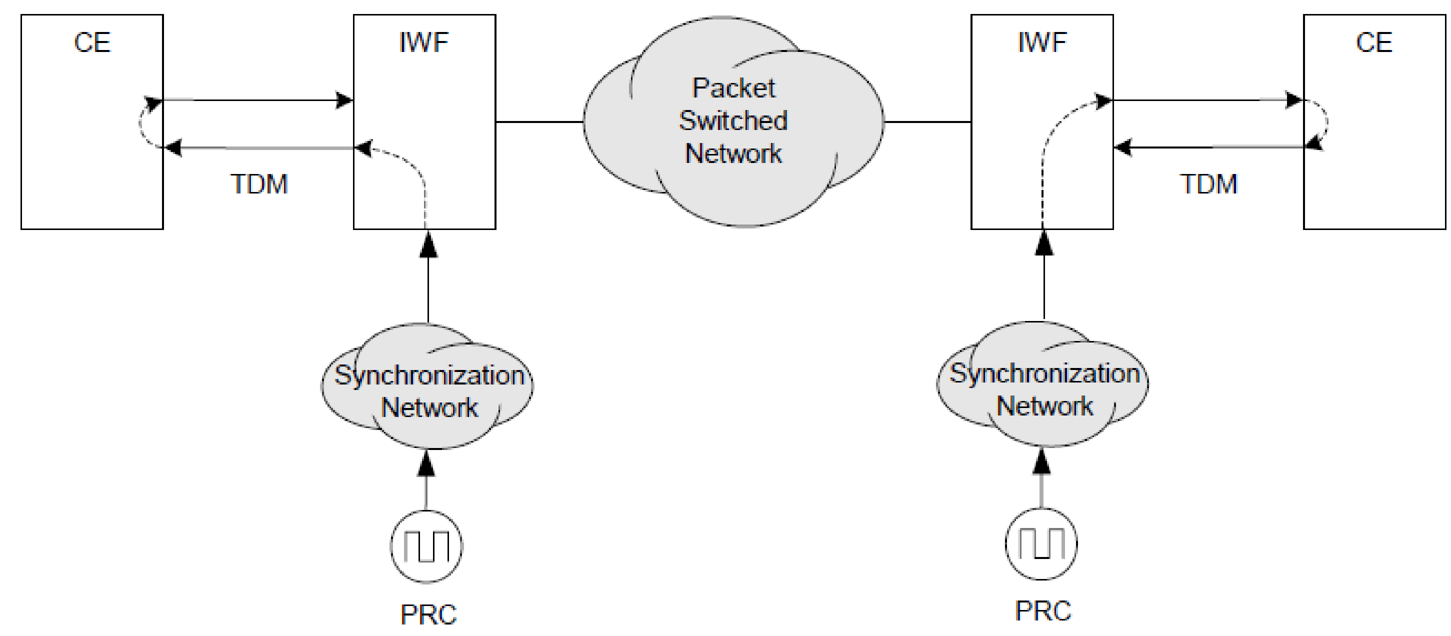
❑ Timing recovery operating methods:

- Network synchronous operation
- Differential methods
- Adaptive methods
- Reference clock available at the TDM end systems

Network synchronous operation (1)

This method refers to the fully network-synchronous operation by using a PRC traceable network derived clock or a local PRC (e.g., GPS) as the service clock. This implies the availability of a PRC reference. It should be highlighted that this method does not preserve the service timing.

Network synchronous operation (2)

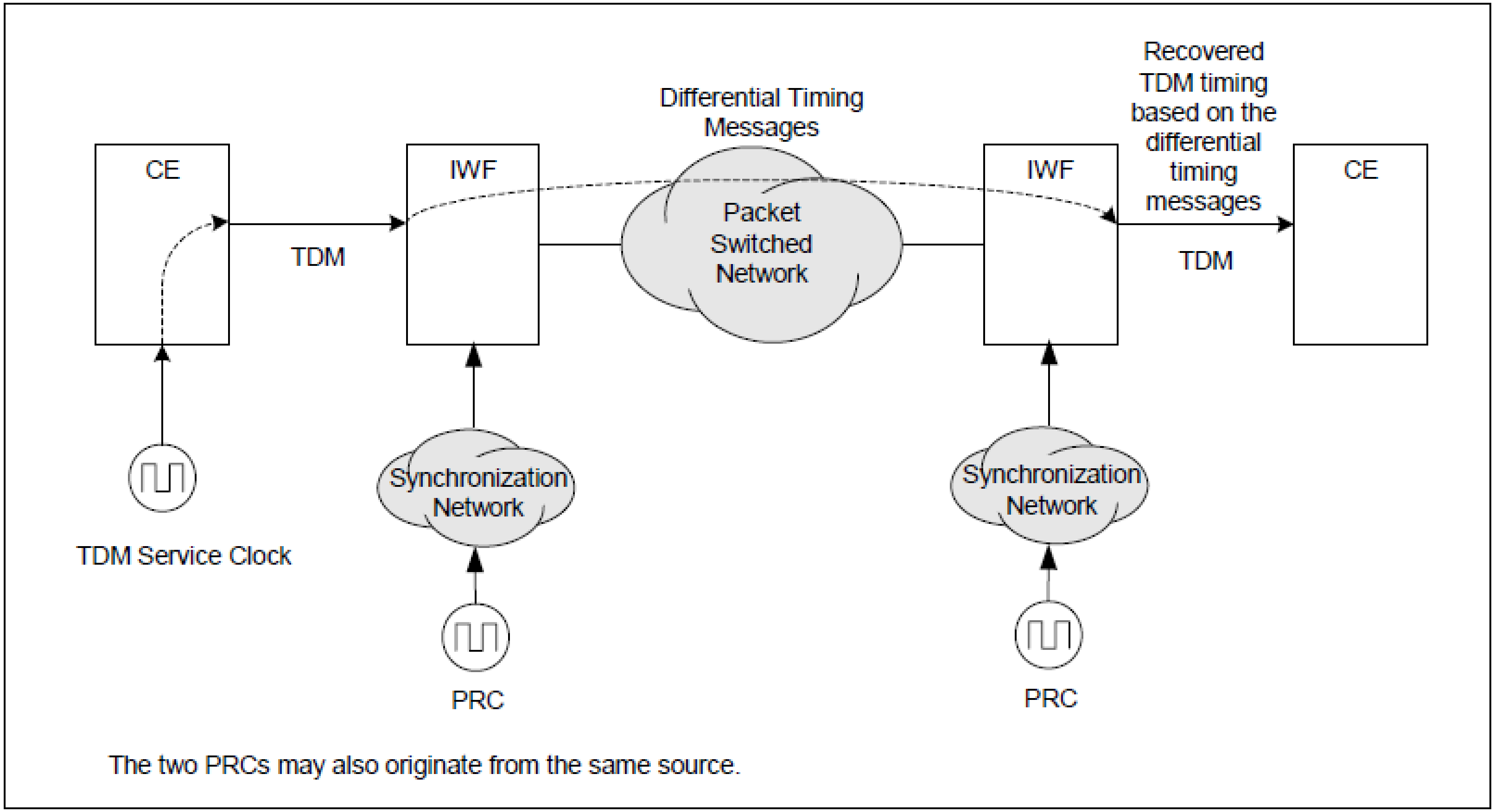


The two PRCs may also originate from the same source.

Differential methods (1)

According to the differential methods, the difference between the service clock and the reference clock is encoded and transmitted across the packet network. The service clock is recovered on the far end of the packet network making use of a common reference clock. The synchronous residual time stamp (SRTS) method [b-ITU-T I.363.1] is an example of this family of methods. It should be highlighted that the method can preserve the service timing.

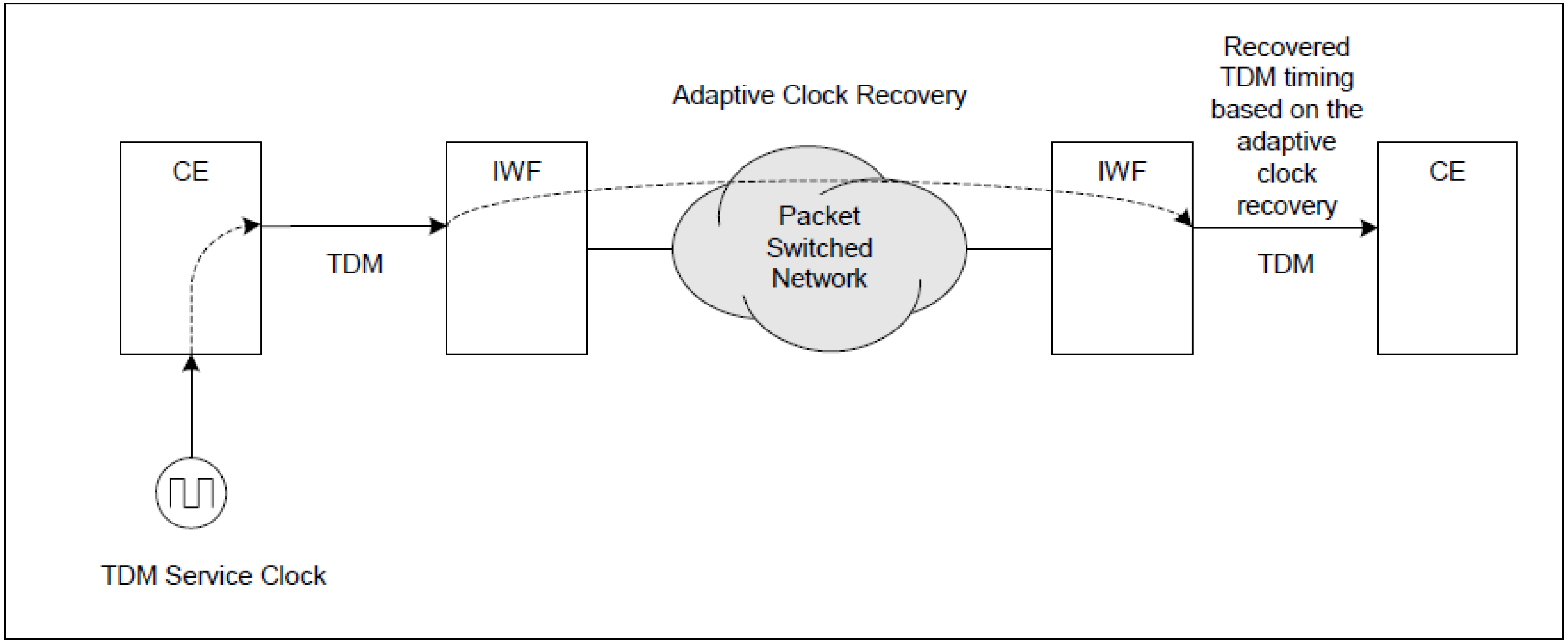
Differential methods (2)



Adaptive methods (1)

In the adaptive method, the timing can be recovered based on the inter-arrival time of the packets or on the fill level of the jitter buffer. It should be highlighted that the method preserves the service timing

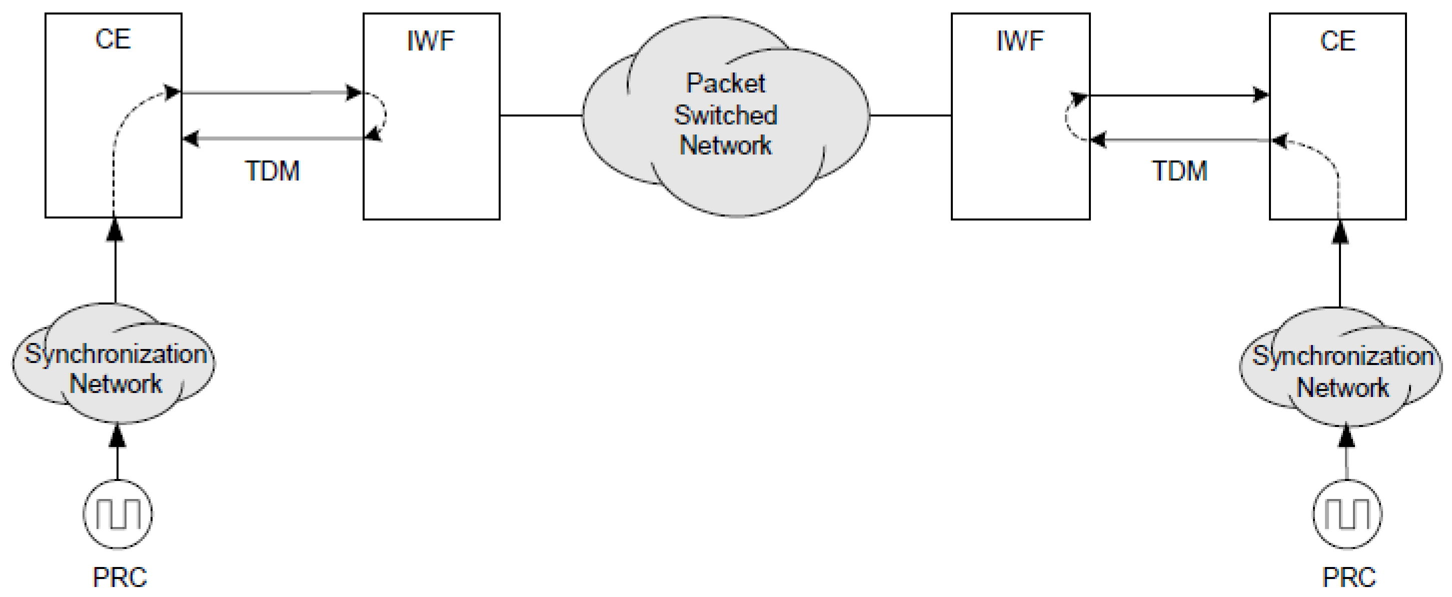
Adaptive methods (2)



Reference clock available at the TDM end systems (1)

When a reference clock is available at each TDM end system, this is a trivial case, since both the end systems have direct access to a timing reference, and will retime the signal leaving the IWF.
Therefore, there is no need to recover the timing.
The use of loop timing in the IWF on the TDM interface is an example of the implementation of this method. An example, of when this scenario might apply, is when two PSTN domains are connected via a packet network. In this case, both the transmitter and receiver are digital switches where there is a need to control slips.

Reference clock available at the TDM end systems (2)



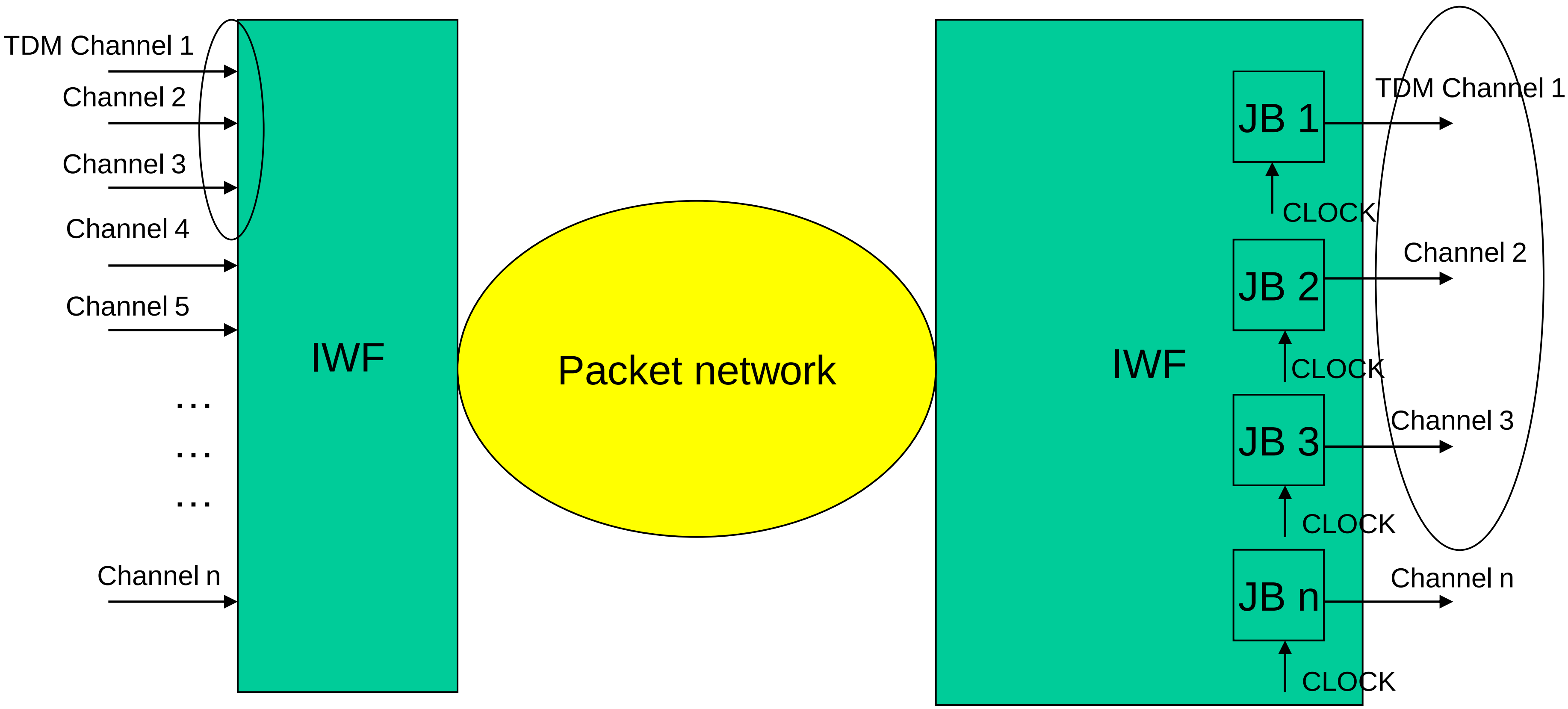
The two PRCs may also originate from the same source.

Outcome of the synchronization requirements in packet networks

- As the DSL access (IAD) is usually not synchronized, 64 kbit/s transparent data can not be offered on DSL access lines
- As the data channels are transmitted over an packet network the end-to-end association of bundled channels must be ensured
- Synchronisation of jitter buffers for the transmission of bundled 64 kbit/s transparent data channels is needed

World Class Standards

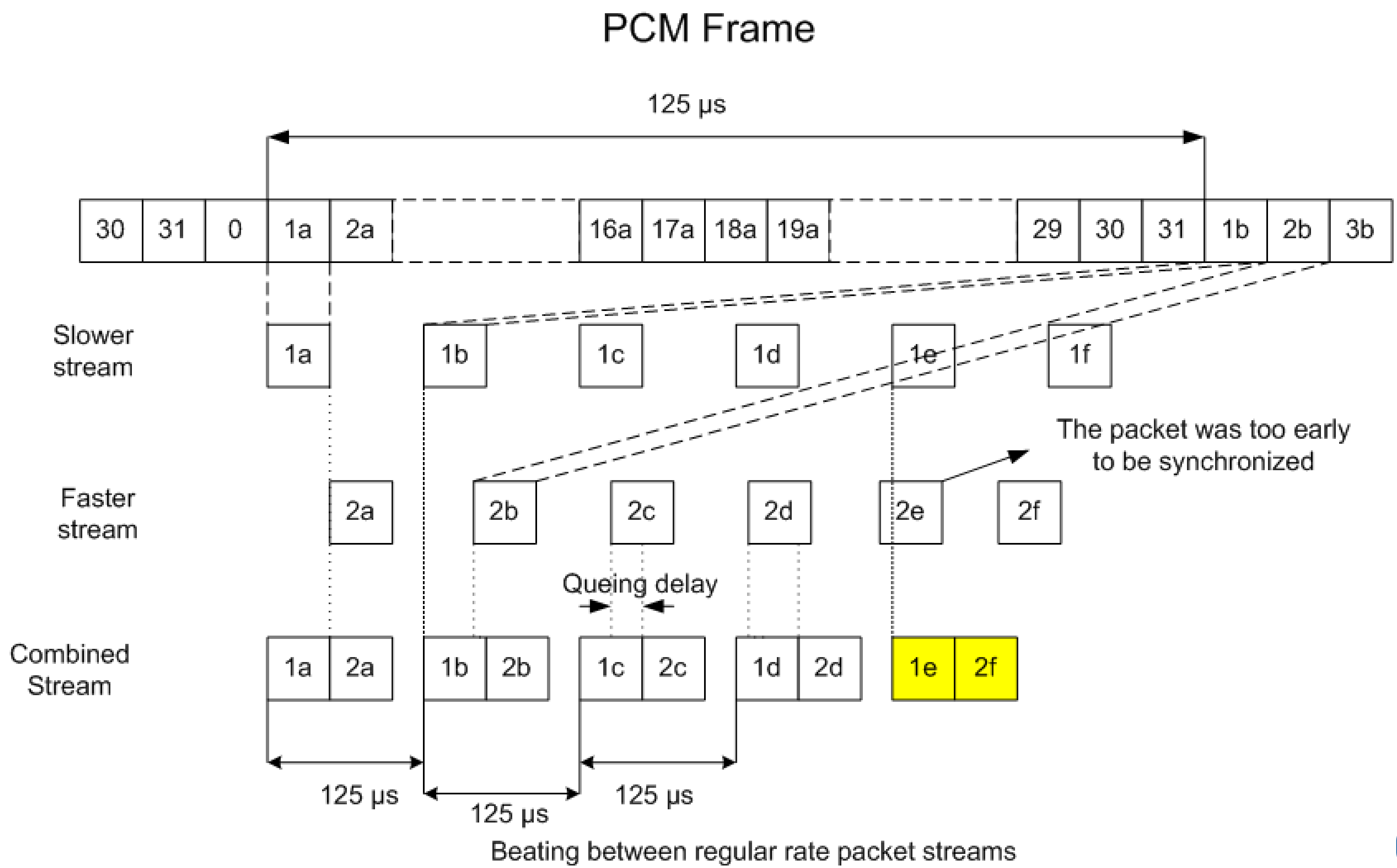
Bundling of n x 64 kbit/s channels (1)



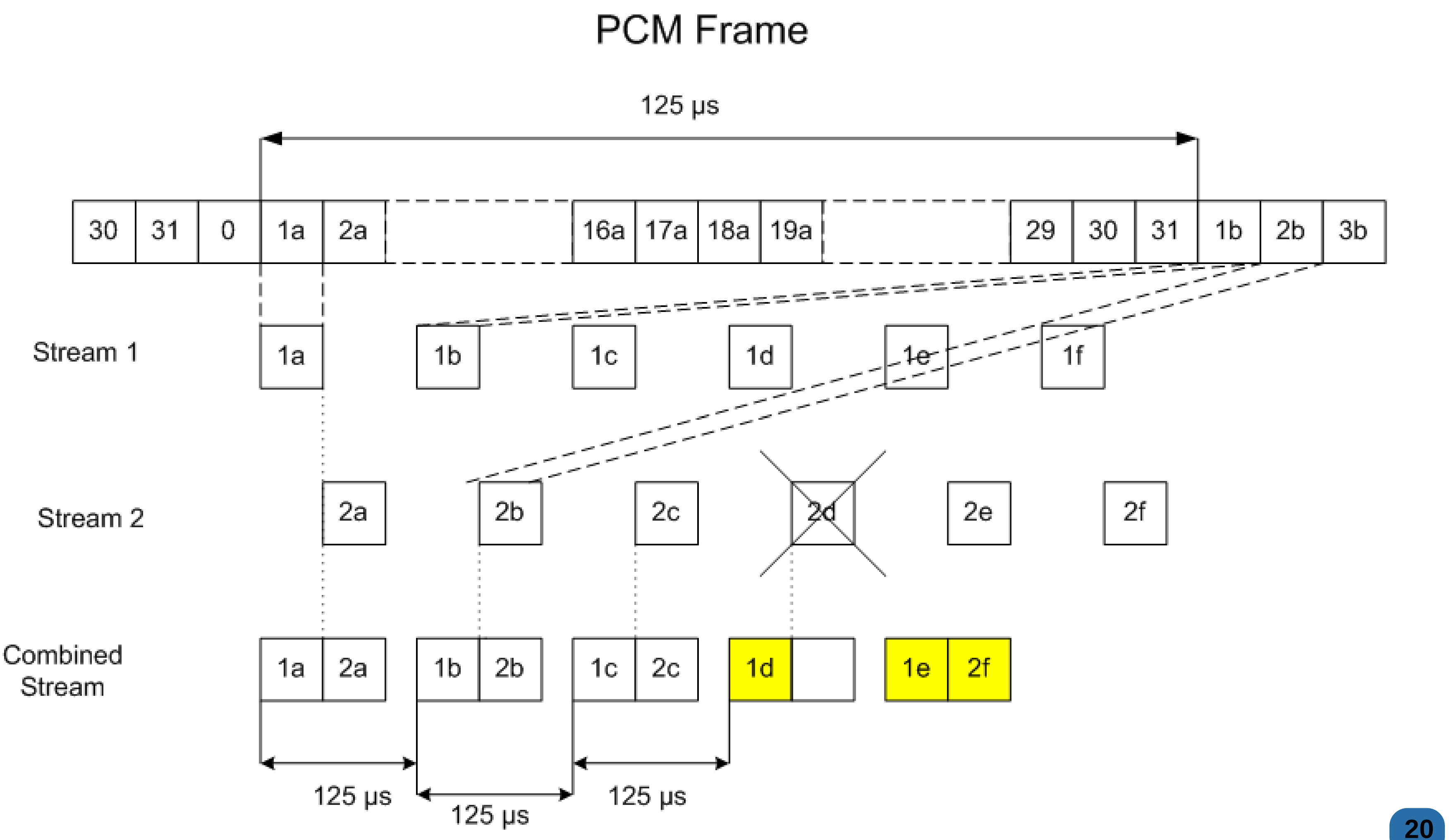
Bundling of n x 64 kbit/s channels (2)

- The network suppliers are synchronizing each RTP channel separately or a complete PCM
- The clock for the synchronization is located after the jitter buffer
- The loss of frame synchronization is caused due two events:
  - Loss of frame synchronization due different queuing delay
  - Loss of frame synchronization due packet loss

Loss of frame synchronization due different queuing delay



Loss of frame synchronization due packet loss



Summary of requirements for transport of 64 kbit/s transparent data service over IP

- Forward error correction
- Synchronisation jitter buffers for the transmission of bundled 64 kbit/s transparent data service channels
- End-to-end association of channels
- Synchronisation of the access points and destination points
- Constant jitter buffer for all synchronized channels

IP Requirements to carry 64 kbit/s transparent data service

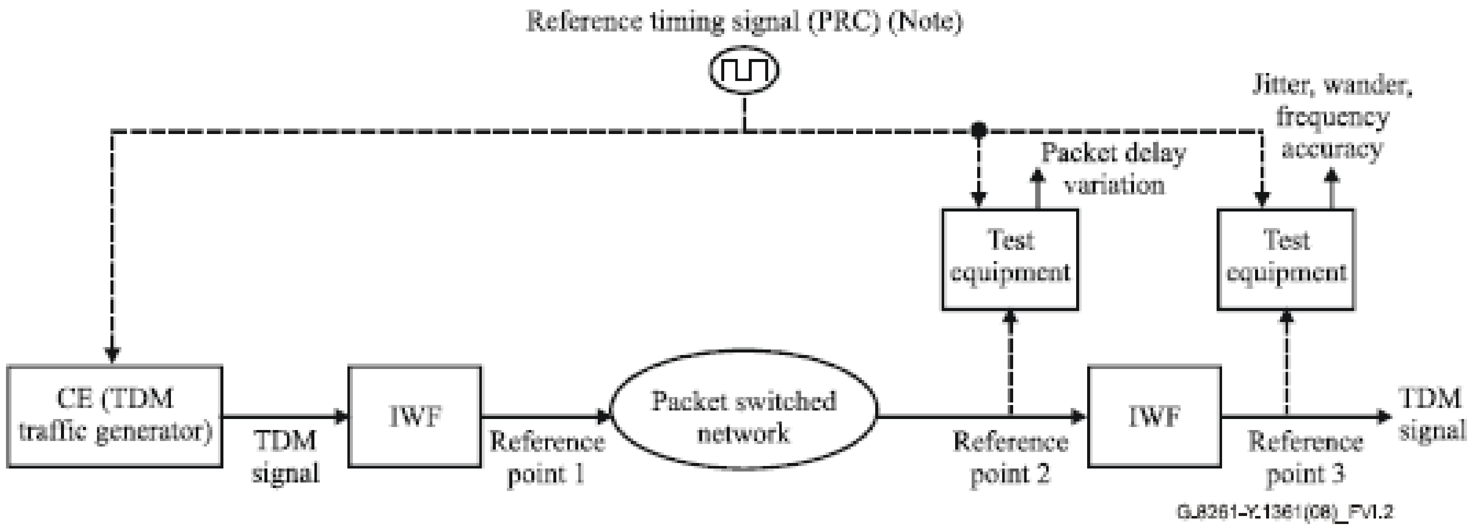
- The basis of the objective is to use as base the ITU-T Recommendation G.826

Parameter	Objective
IP packet loss ratio for national connections	**$2{,}75 \times 10^{-7}$**
IP packet loss ratio for each operator's network	**$9{,}0 \times 10^{-8}$**
end-to-end probability IP packet loss ratio	**$1{,}5 \times 10^{-6}$**
IP packet error ratio for each operator's network	**$1{,}0 \times 10^{-8}$**

Network QoS Classes for Voice Applications

		QoS Classes					
Network Performance Parameter	Nature of Network Performance Objective	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5 Un-specified
IPTD	**Upper bound on the mean IPTD**	**100 ms**	**400 ms**	Not relevant for voice communication!			
IPDV	**Upper bound on the $1-10^{-3}$ quantile of IPTD minus the minimum IPTD**	**50 ms**	**50 ms**				
IPLR	**Upper bound on the packet loss probability**	**1×10^{-3}**	**1×10^{-3}**				
IPER	**Upper bound**	**1×10^{-4}**					

Test Configuration



NOTE – The reference timing signal (PRC) is used to represent the TDM service clock.

Questions ?

Thank you for your attention