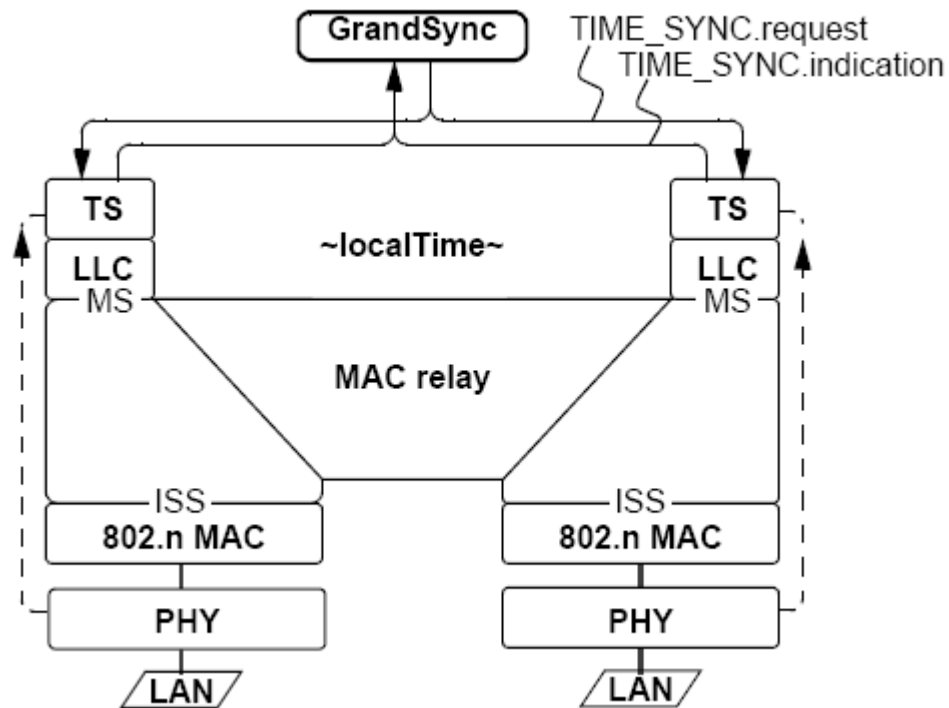


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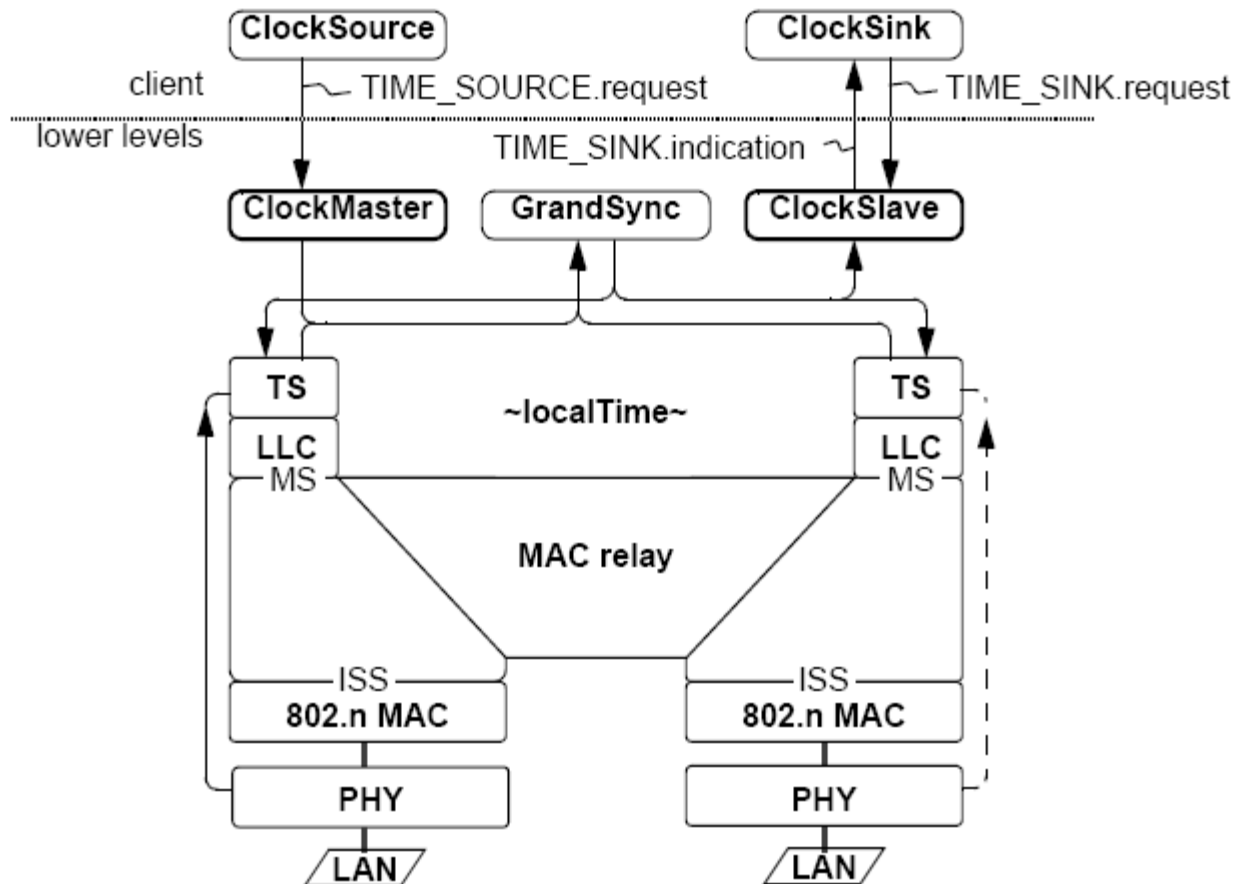
**AV bridging:**  
**Time-synchronization interfaces**

David V James & Chuck Harrison

# Time-sync entity overview



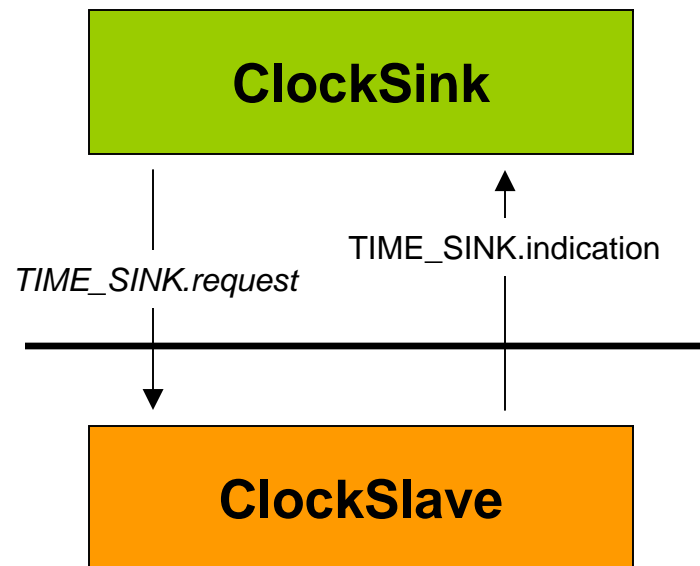
# Time-sync clock interfaces



---

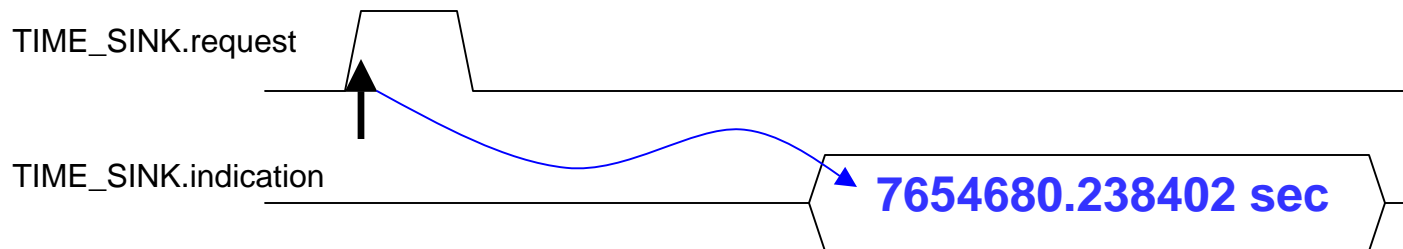
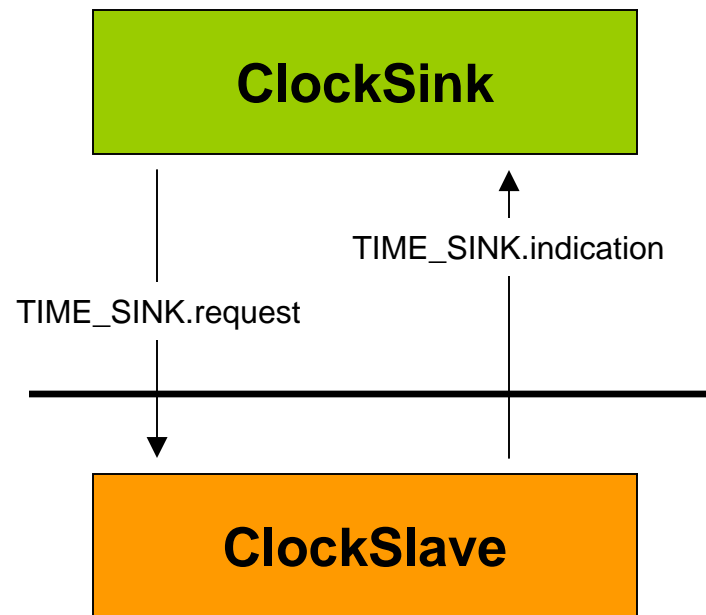
# Clock-sink interfaces

# ClockSink interface options

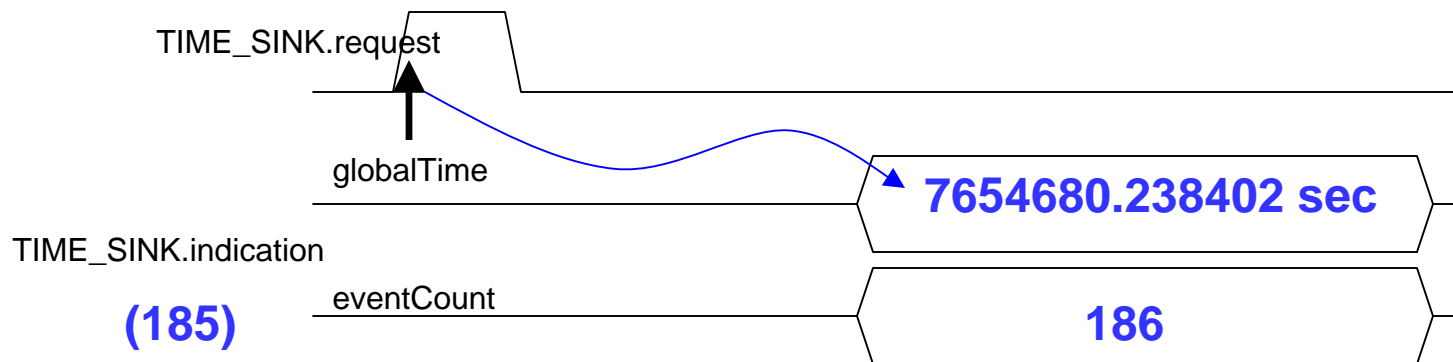
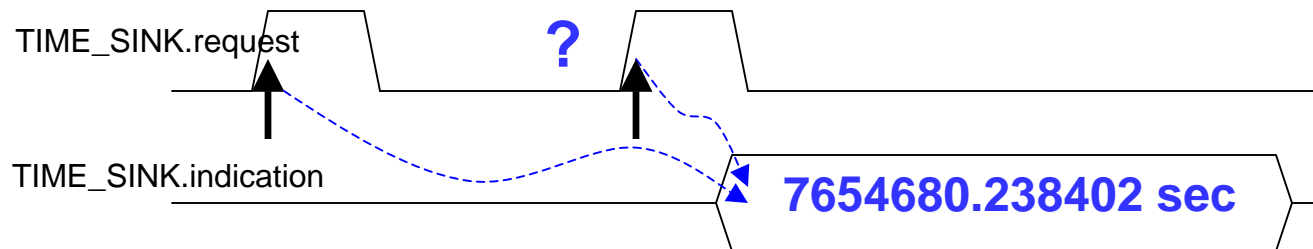


- Option 1: strobe w/o count protection
- Option 2: strobe with count protection
- Option 3: periodic transmissions

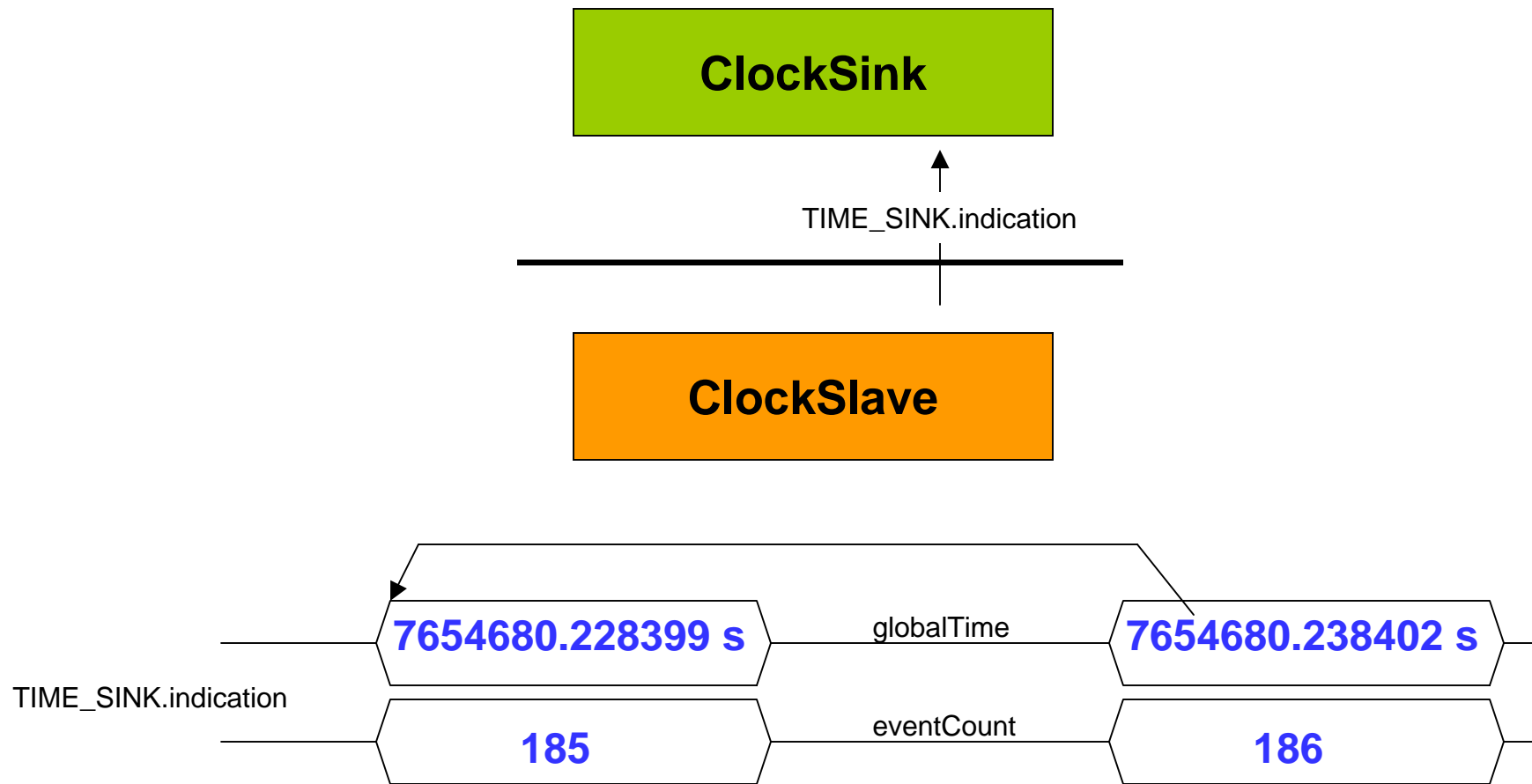
# Option 1: Strobe w/o protection



# Option 2: Strobe with protection



# Option 3: Periodic clocking





# Service primitive parameters

TIME_SYNC.request ( )	no parameters in this primitive
TIME_SYNC.indication (	
event_count,	index of AS_CLK_EVENT.request for this timestamp
global_time,	802.1AS timestamp value
<b>Which one?</b> {	
stabilization_time	time since most recent 802.1AS timescale discontinuity
stabilization_count	incremented on each 802.1AS timescale discontinuity
)	

- Abstract Interface
  - Manufacturers free to implement the functionality by any method
  - Need not be an “exposed” interface
- Mandatory for any 802.1AS device claiming to provide clock service

# Abstract *and* mandatory (!)

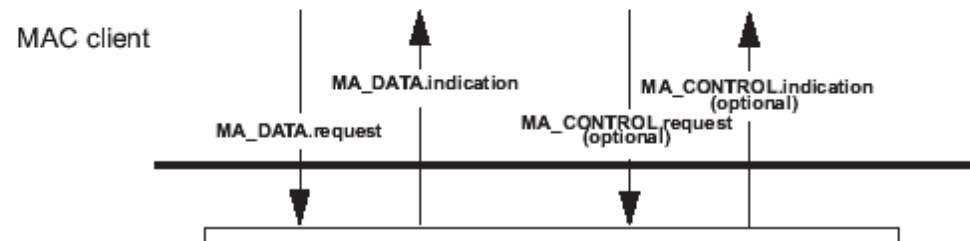
CSMA/CD

IEEE  
Std 802.3-2005

## 2. Media Access Control (MAC) service specification

### 2.1 Scope and field of application

This clause specifies the services provided by the Media Access Control (MAC) sublayer and the optional MAC Control sublayer to the client of the MAC (see Figure 1-1). MAC clients may include the Logical Link Control (LLC) sublayer, Bridge Relay Entity, or other users of ISO/IEC LAN International Standard MAC services (see Figure 2-1). The services are described in an abstract way and do not imply any particular implementation or any exposed interface. There is not necessarily a one-to-one correspondence between the primitives and the formal procedures and interfaces described in Clause 4 and Clause 31.



### 2.2.4 Basic services and options

The MA\_DATA.request and MA\_DATA.indication service primitives described in this subclause are mandatory. The MA\_CONTROL.request and MA\_CONTROL.indication service primitives are mandatory if the optional MAC Control sublayer is implemented.

---

# **Hypothetical compliant implementations of clock slave**

# PICS entries

## A.5 Major Capabilities

Item	Feature	Status	References	Support
SCLK	Is a slave clock service supported?	O	A.6	Yes[ ] No[ ]
MCLK	Is a master clock service supported?	O		Yes[ ] No[ ]

## A.6 Slave Clock Service

Item	Feature	Status	References	Support
SCLK-1	Are AS_CLK_EVENT.request and AS_CLK_TIMESTAMP.indication primitives implemented?	SCLK:M		Yes[ ]
SCLK-2		SCLK:M		Yes[ ]

# PICS entries (continued)

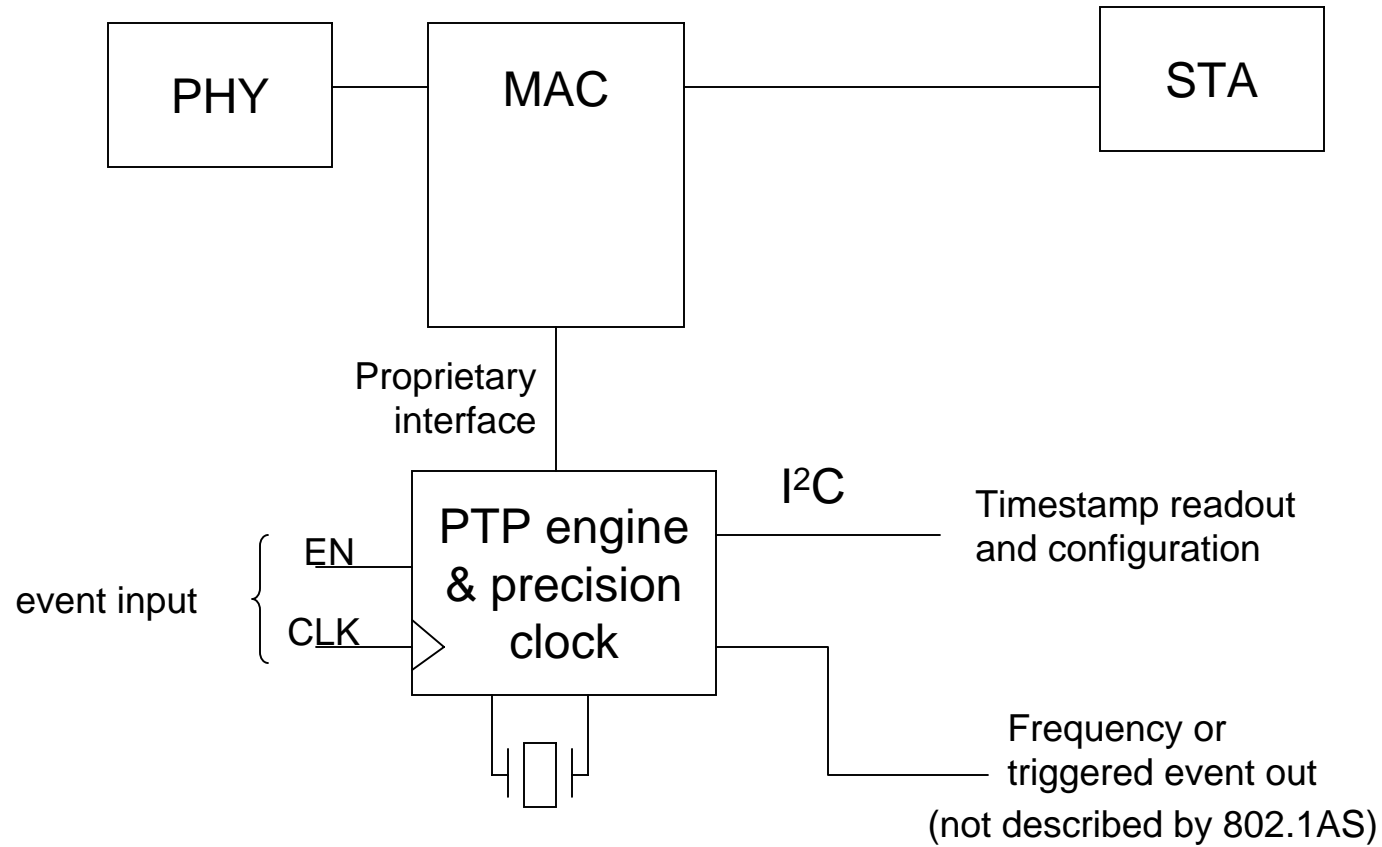
## A.7 Implementation Parameters

Item	Feature	Status	References	Support
IMP-1	State the maximum value for event_count	SCLK:M		_____

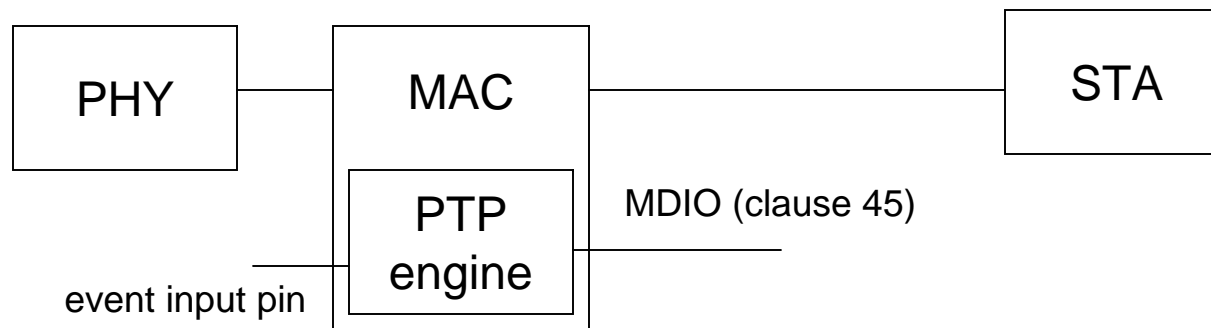
## A.8 Performance

Item	Feature	Status	References	Support
PERF-1	State the maximum delay from presentation of AS_CLK_EVENT.request to availability of corresponding AS_CLK_TIMESTAMP.indication	SCLK:M		_____ microsec

# MAC sidecar

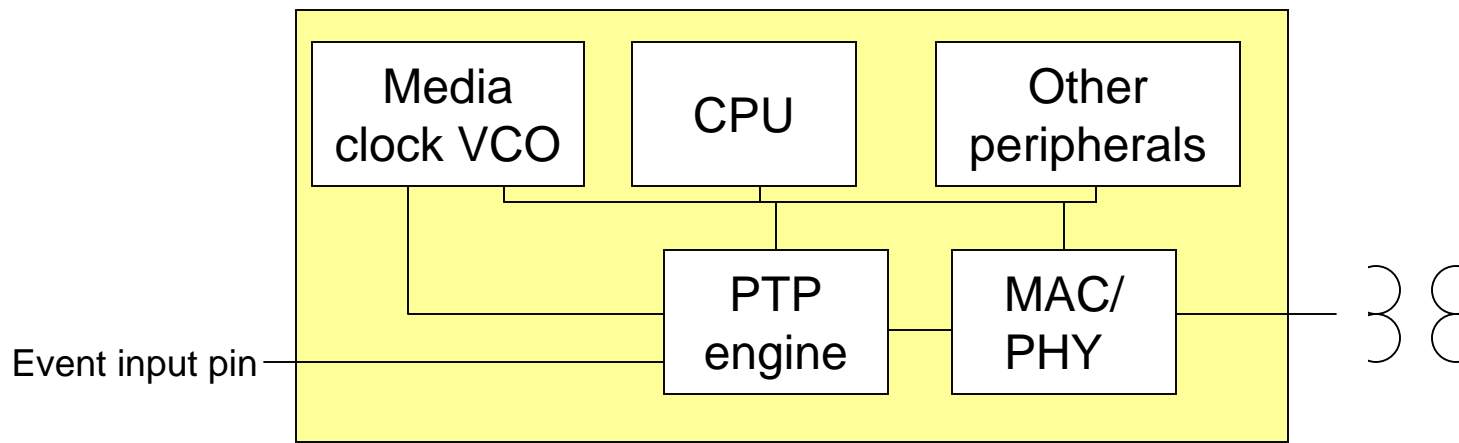


# Enhanced MAC



MMD registers assigned for *event\_count*, *global\_time*, and *stabilization\_time*

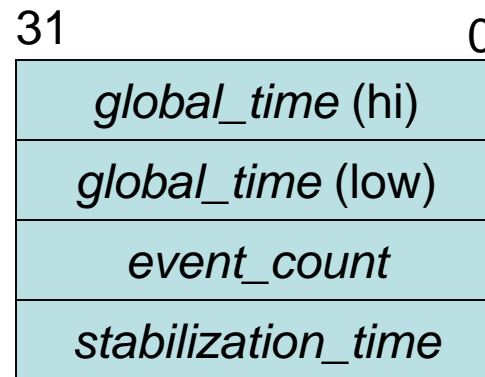
# Integrated MAC/clock in micro-controller



## PERIPHERAL MEMORY MAP:

Reading *global\_time* (hi) memory address causes snapshot of all parameter values to be latched into readout register bank

Writing to a particular reserved address constitutes a CPU-generated event



SvcIntfc<sub>i</sub>

Independent interface instances for media clock, event input, CPU-generated event



# Other slides

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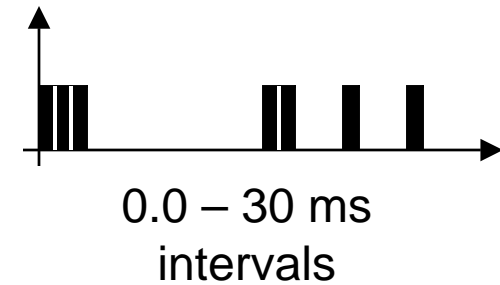
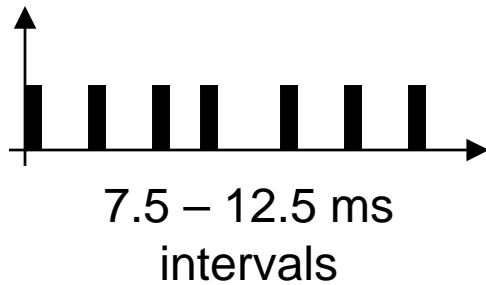
(TBDs)

# 802.1as basic requirements

- Media friendly
  - Link-dependent time-sync intervals
  - Clock-master or clock-slave initiated
- Accurate
  - Errors limited by snapshot accuracies
  - Eliminate: gain peaking
  - Incorporate: per-stage low-pass filtering
- Responsive
  - RX: linkDelay—neighbor local-clock syntonization
  - TX: Minimal grandTime syntonization
- Simple
  - Minimal residence-time constraints

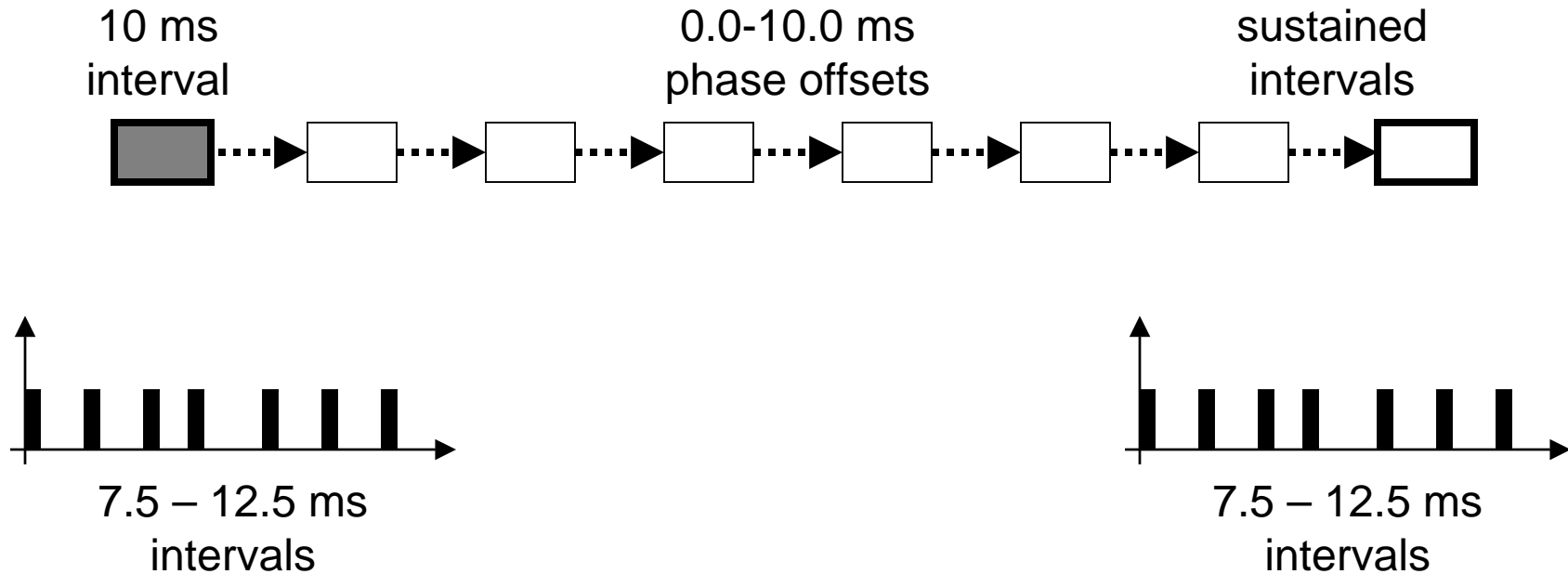
# Cascaded TOD synchronization

(a nonscalable approach)



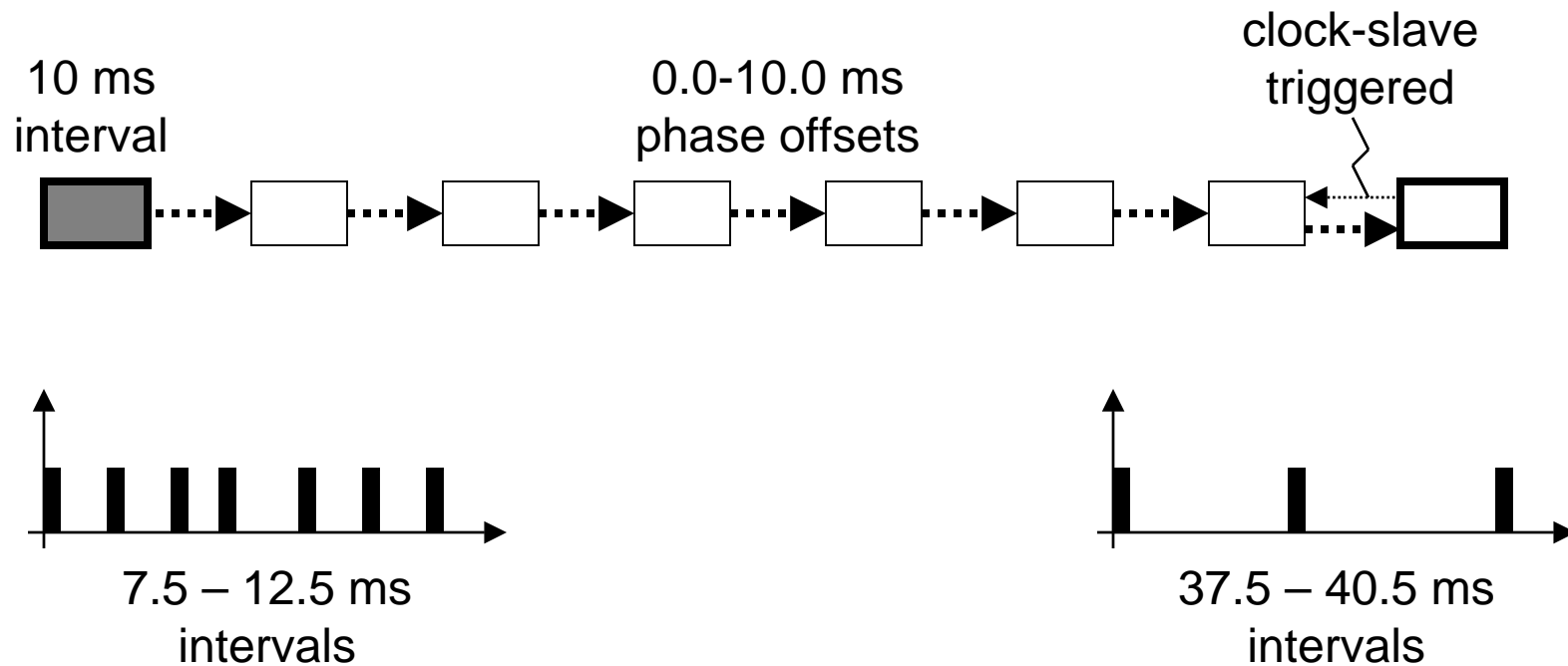
# Reclocked TOD synchronization

(a scalable approach)



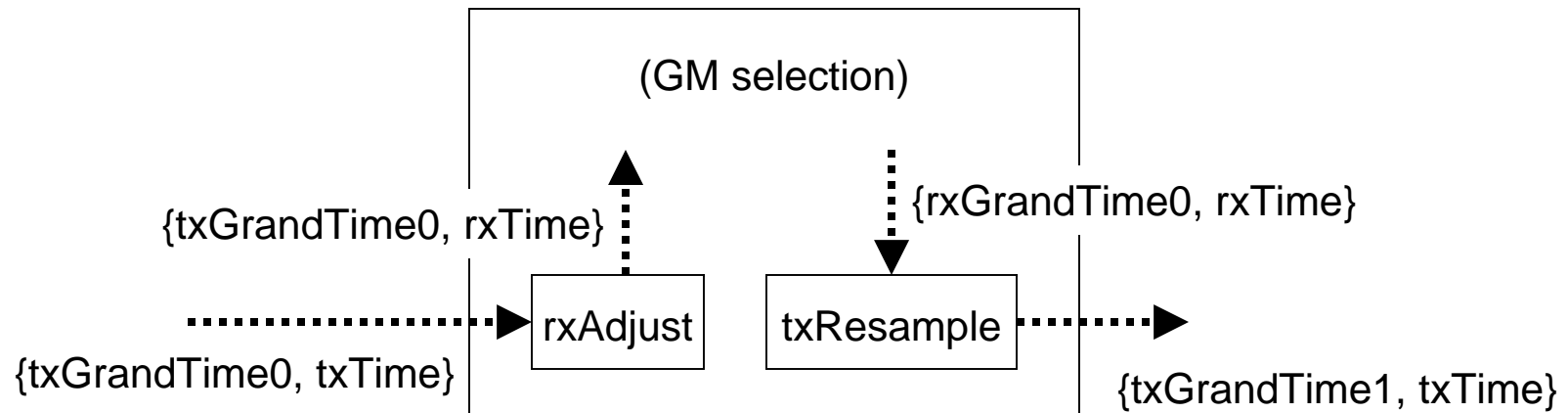
# Slave-triggered synchronization

(a more heterogeneous cascade)



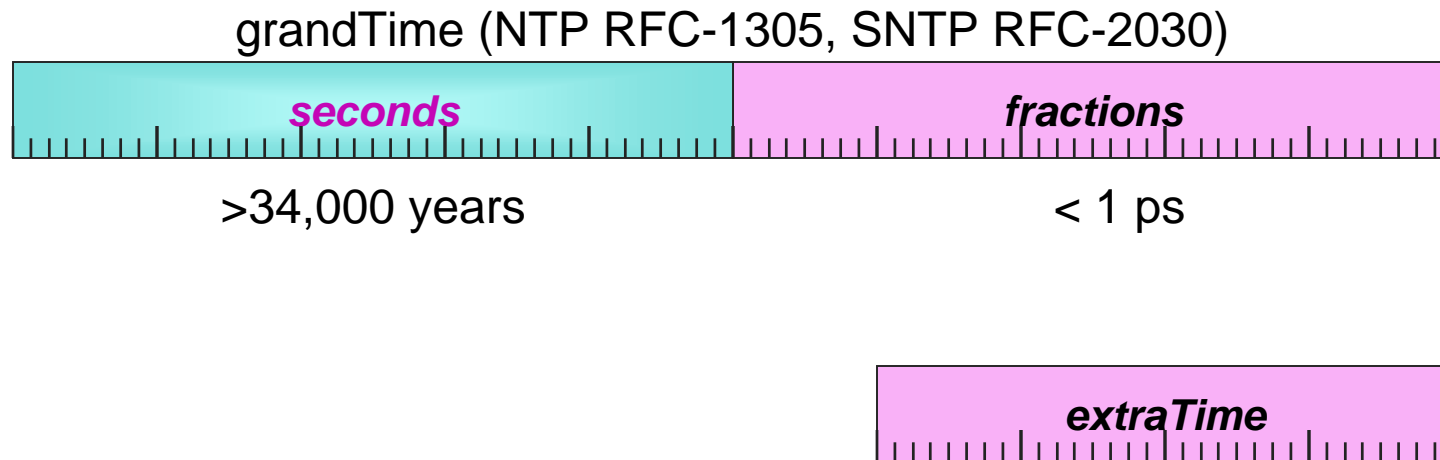
# Rate conversion overview

(decoupled processes)





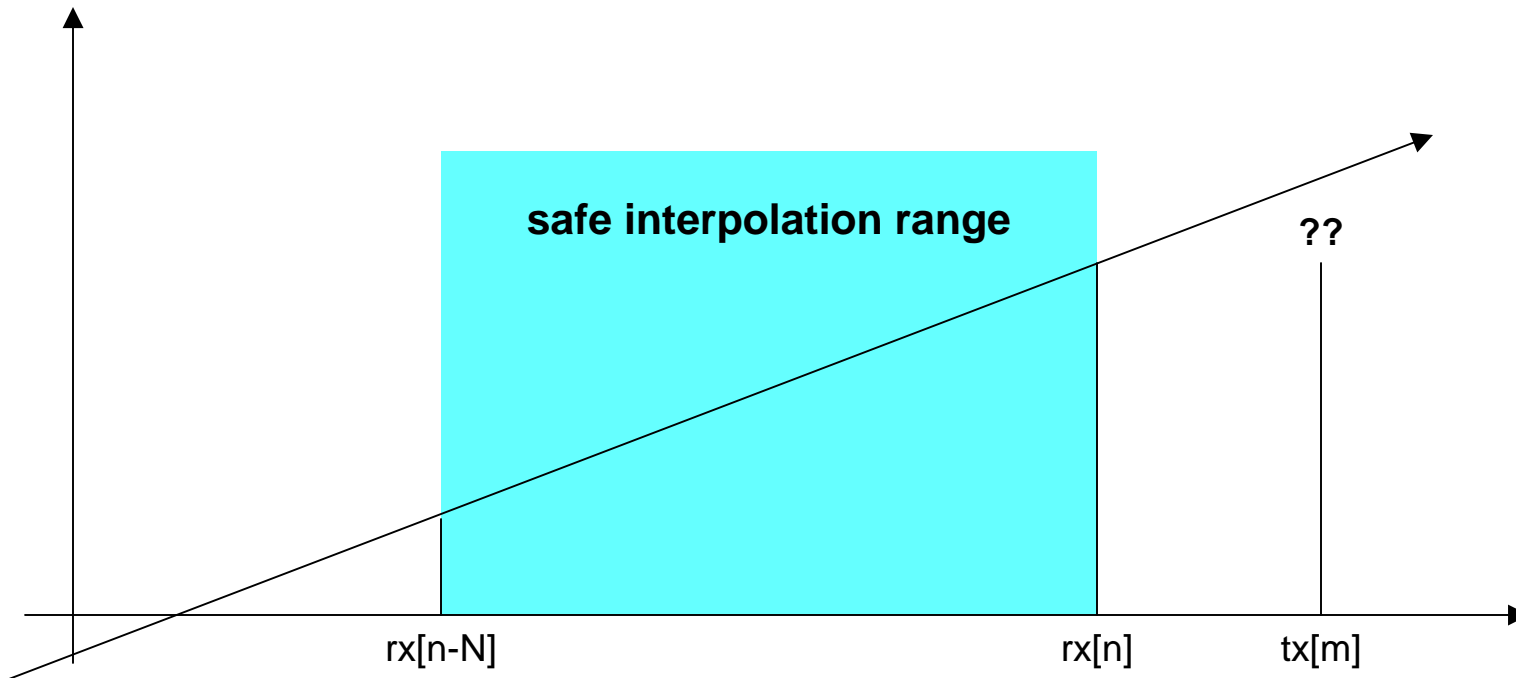
# Time formats



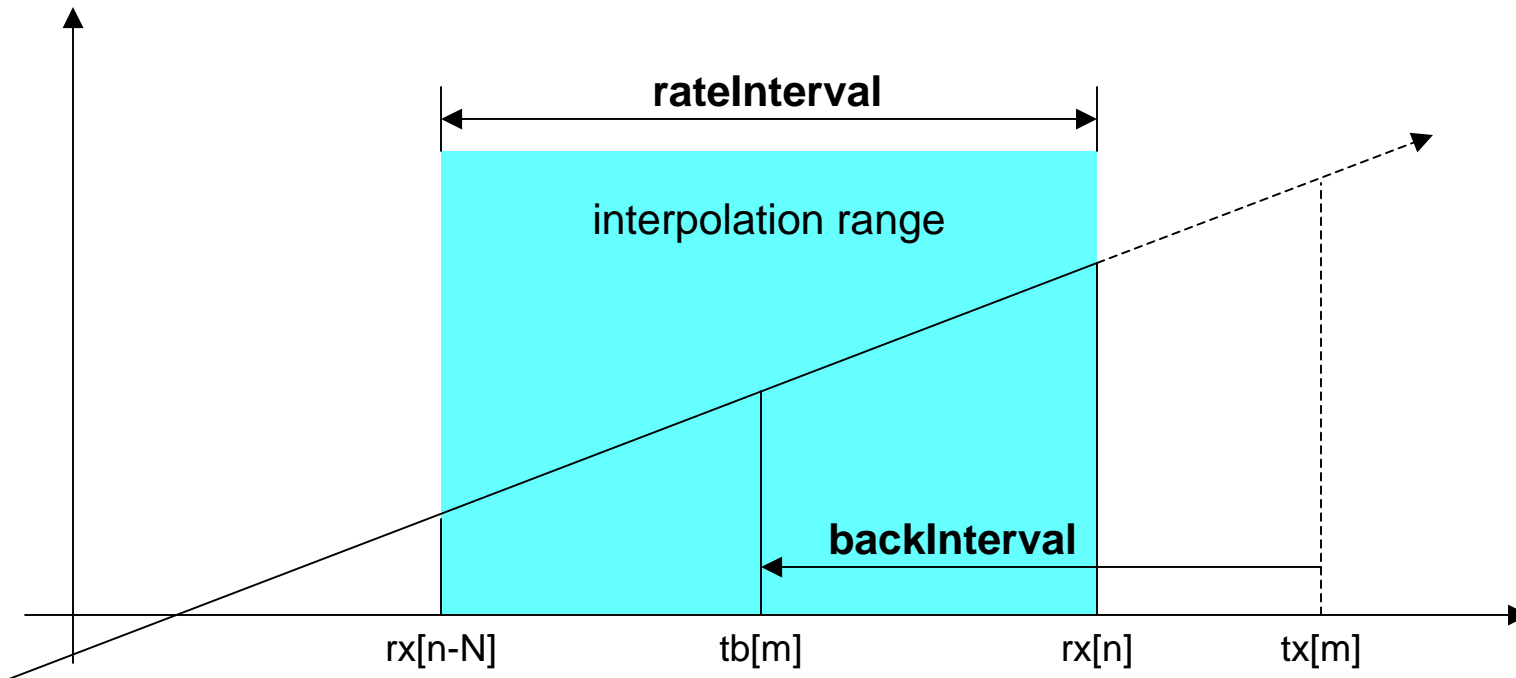


# Interpolation concepts

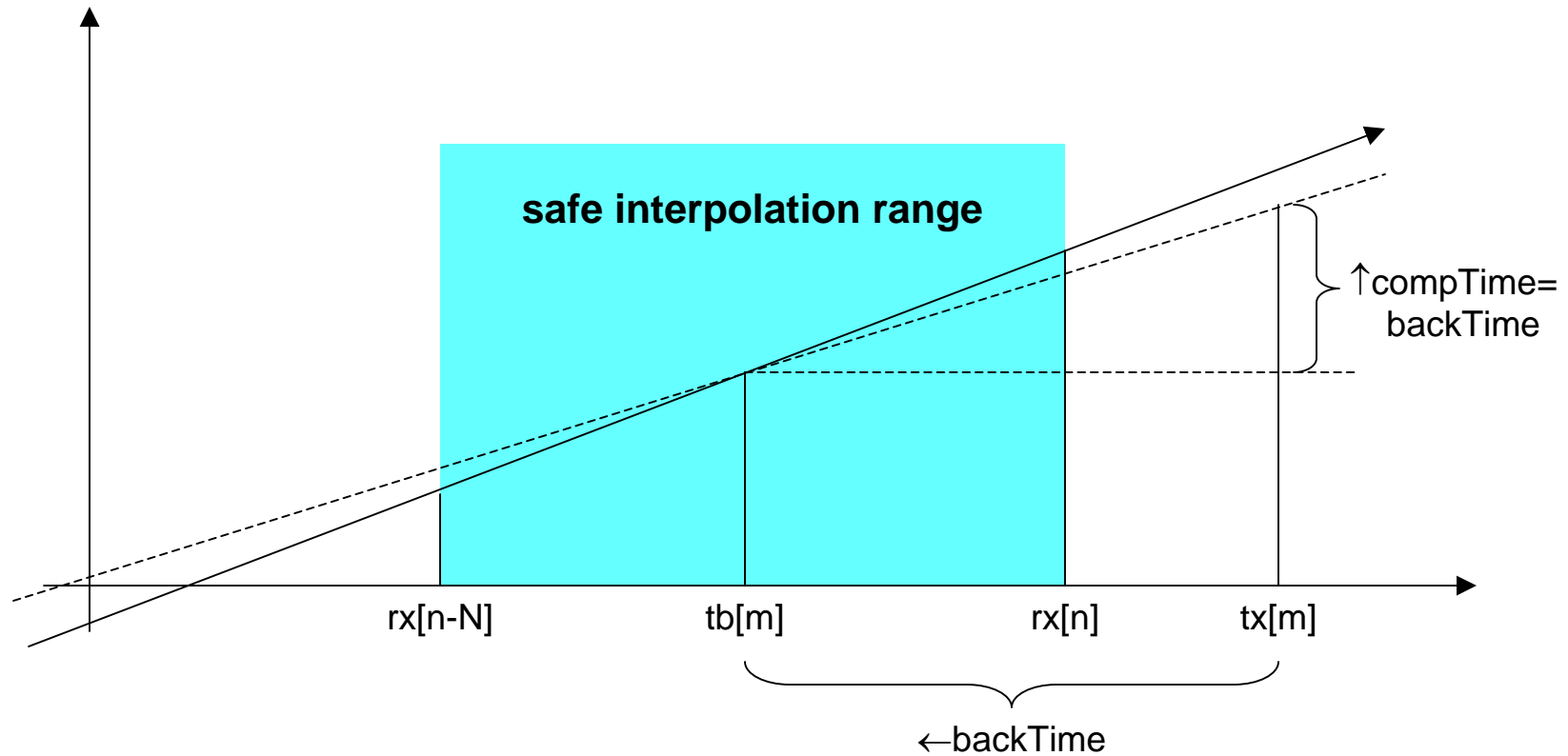
(interpolation range)



# Interpolation intervals



# Interpolation adjustments



# Interpolation errors

(extraTime supplement)

