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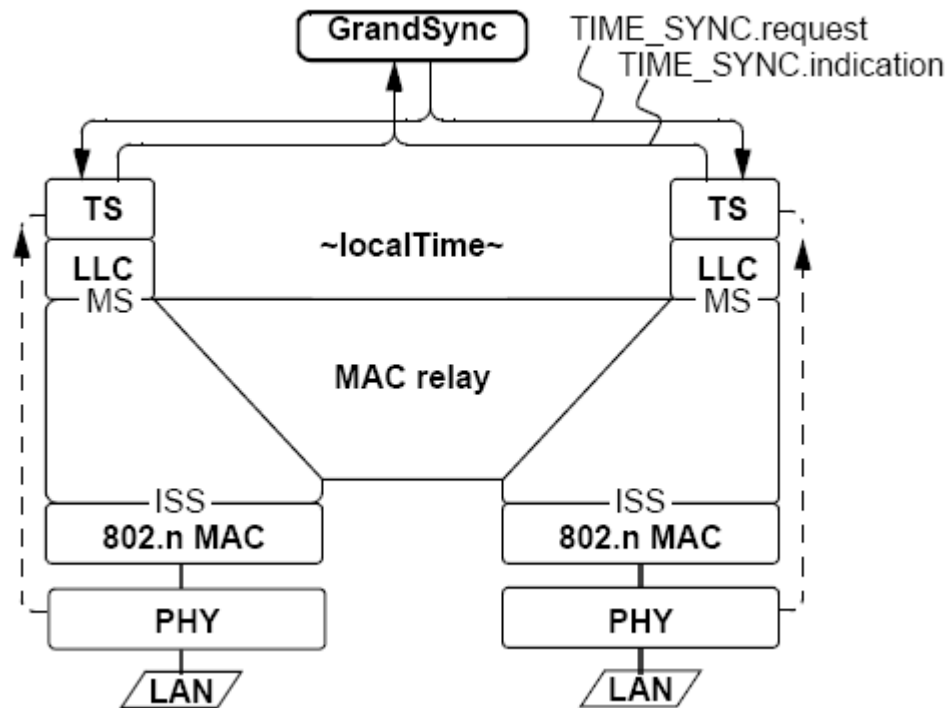
**AV bridging:**  
**Time-synchronization interfaces**

David V James

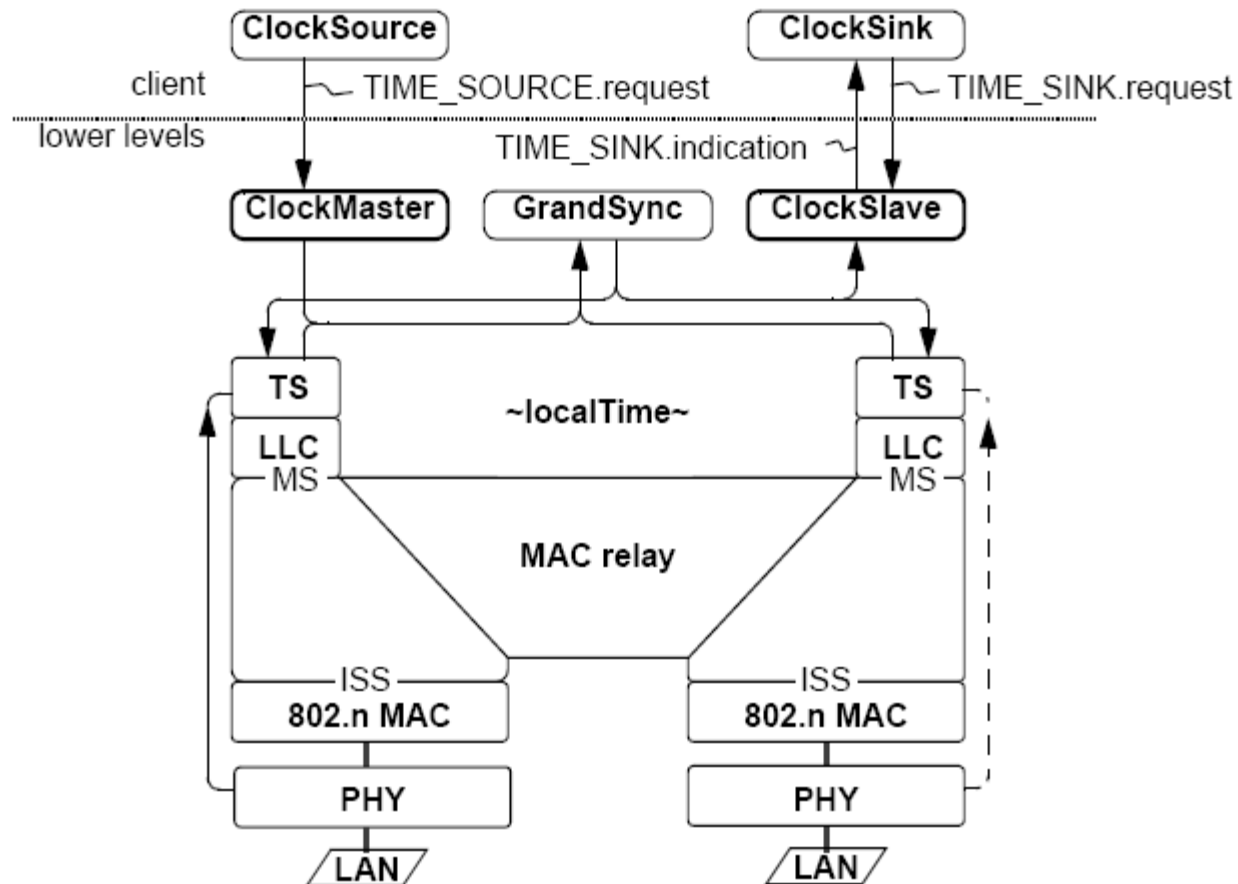
# 802.1as interface suggestions

- Distinct entities:
  - GrandSync, ClockMaster, ClockSlave
  - Divide and conquer (definition of an architect)
  - Optional components vs options features
- Unified messages:
  - One pair of {sync.indication, sync.request} PDUs
  - The announce/sync partitioning is media dependent
  - Should include misc GM state and syncInterval?
- Local timer
  - Don't distribute syntonized timer!
  - Startup time is severely impacted
  - Syntonized timer are “unnatural”=>hard to distribute
  - Local timers are sufficient!

# Time-sync entity overview



# Time-sync clock interfaces



# 802.1as application interfaces

- ClockMaster:
  - CM.request with {grandTime, syncInterval}
  - The interval is used for timeout purposes...
- ClockSlave:
  - CS.request with {phase, period}
  - Provides a periodic indication w/o hazards
  - This is probably necessary and sufficient!
- GrandSync:
  - Time discontinuity indication
  - Recovery timing done at the application
  - Its absence doesn't ensure resynchronization is done...

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# Clock-sink interfaces

# 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

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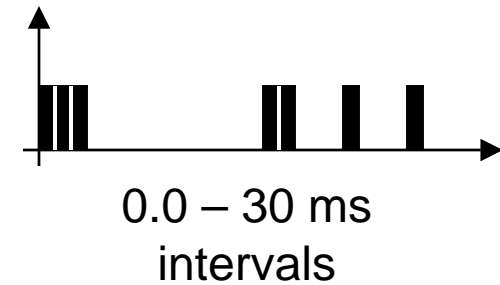
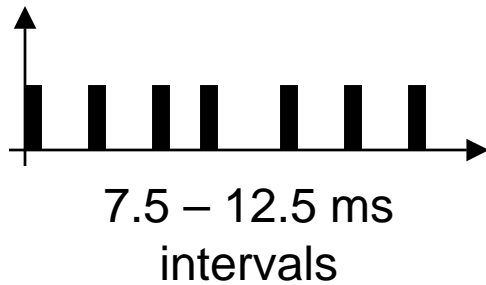
**AV bridging:**  
**Sync interval reclocking**

David V James



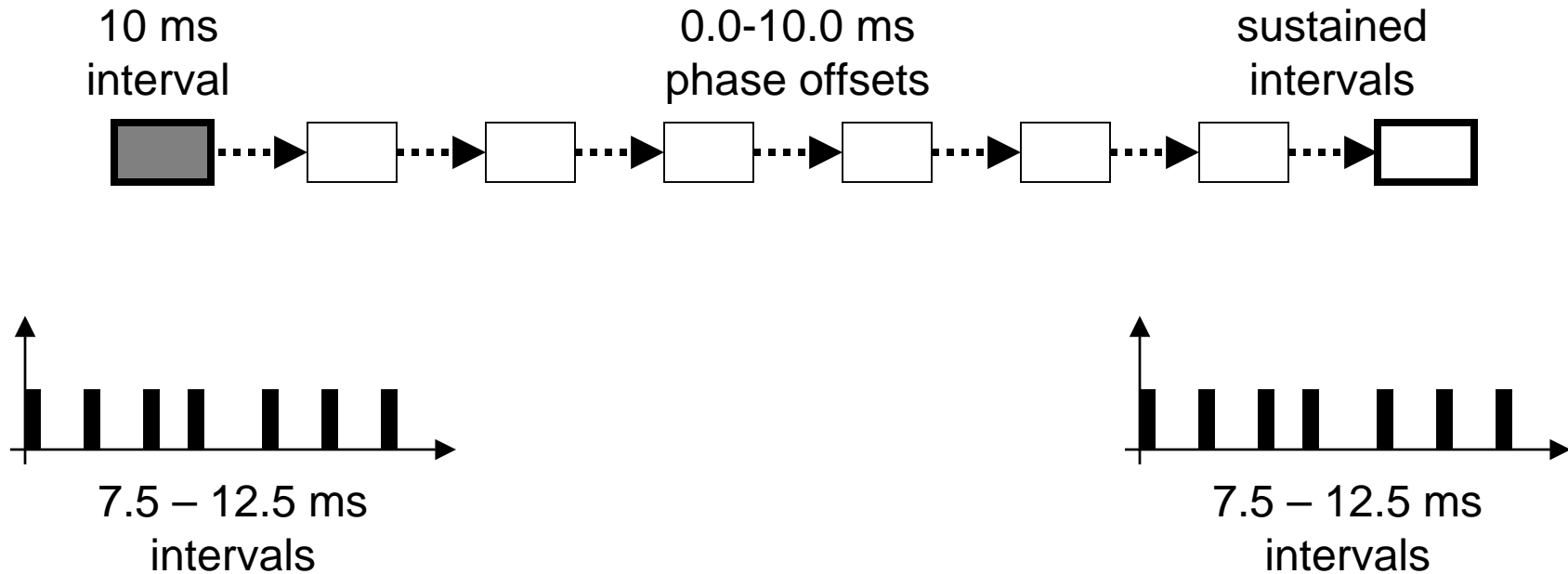
# Cascaded TOD synchronization

(a nonscalable approach)



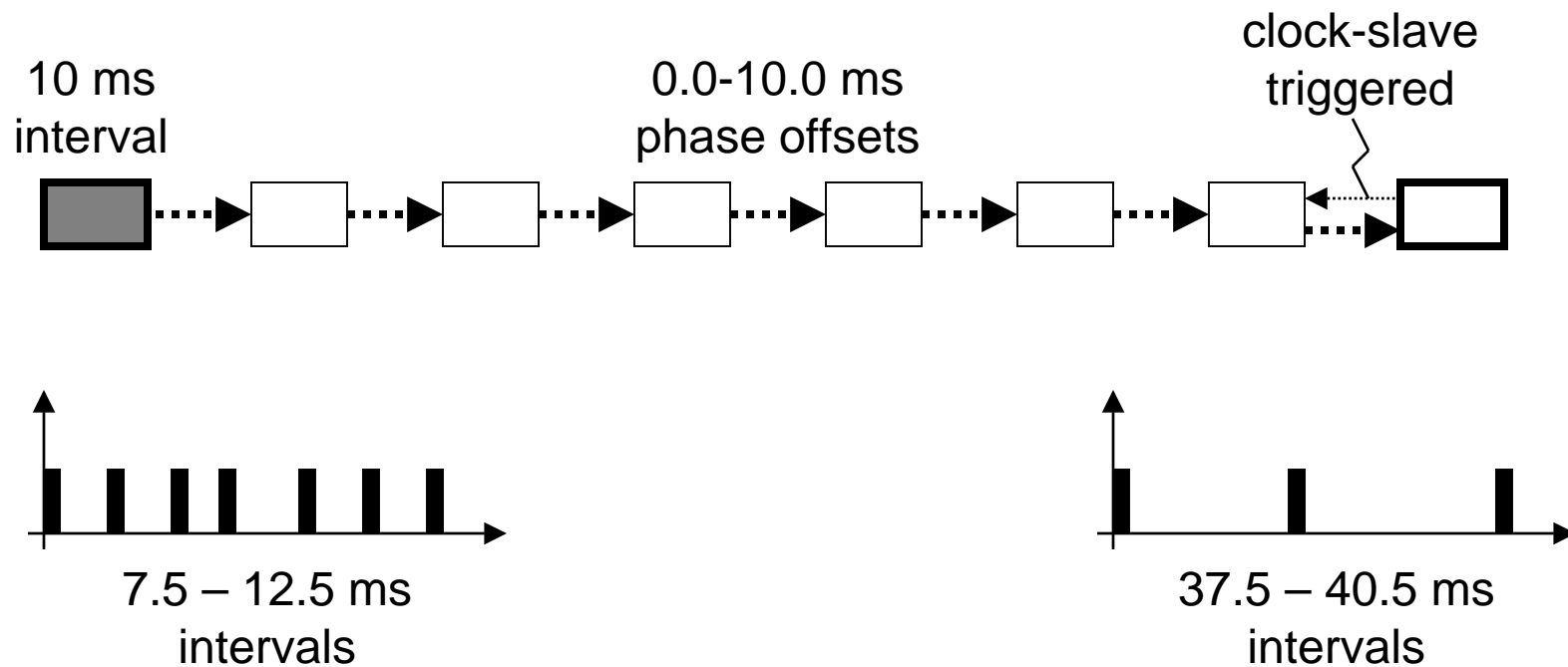
# Reclocked TOD synchronization

(a scalable approach)



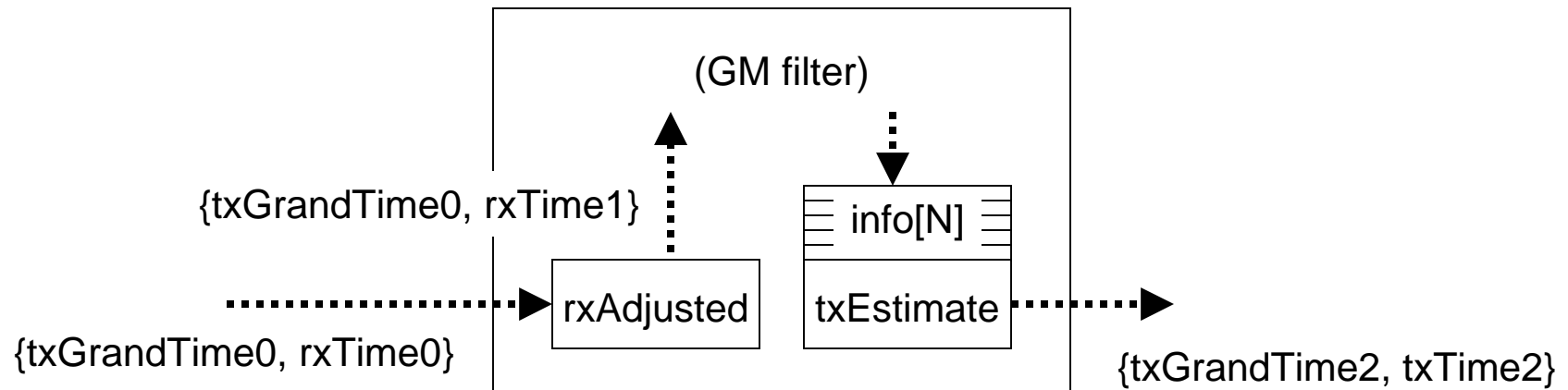
# Slave-triggered synchronization

(a more heterogeneous cascade)



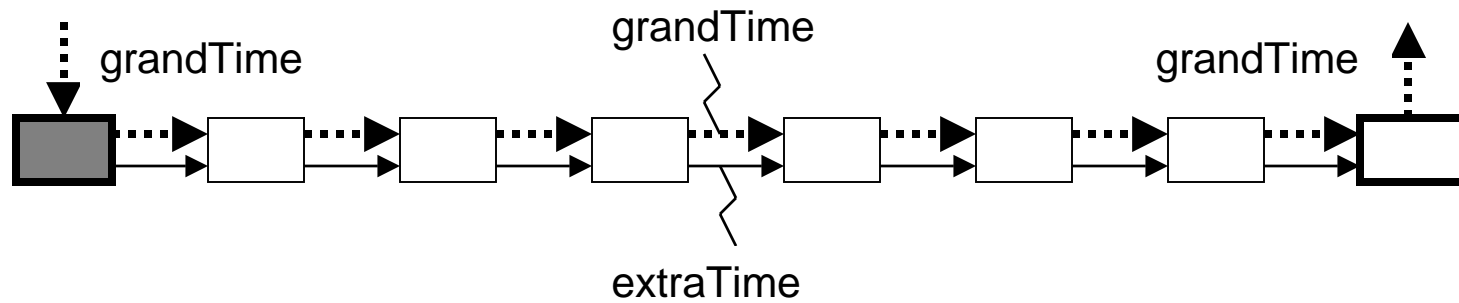
# Rate conversion overview

(decoupled processes)

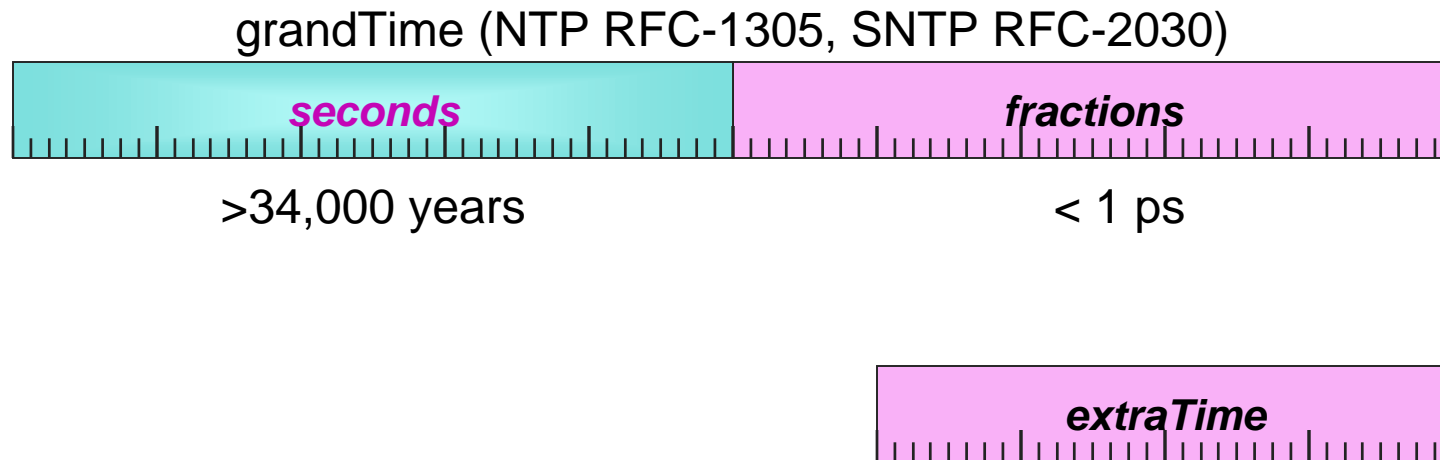


# Gain-peaking suppression

(distinct calibration & deviation indications)

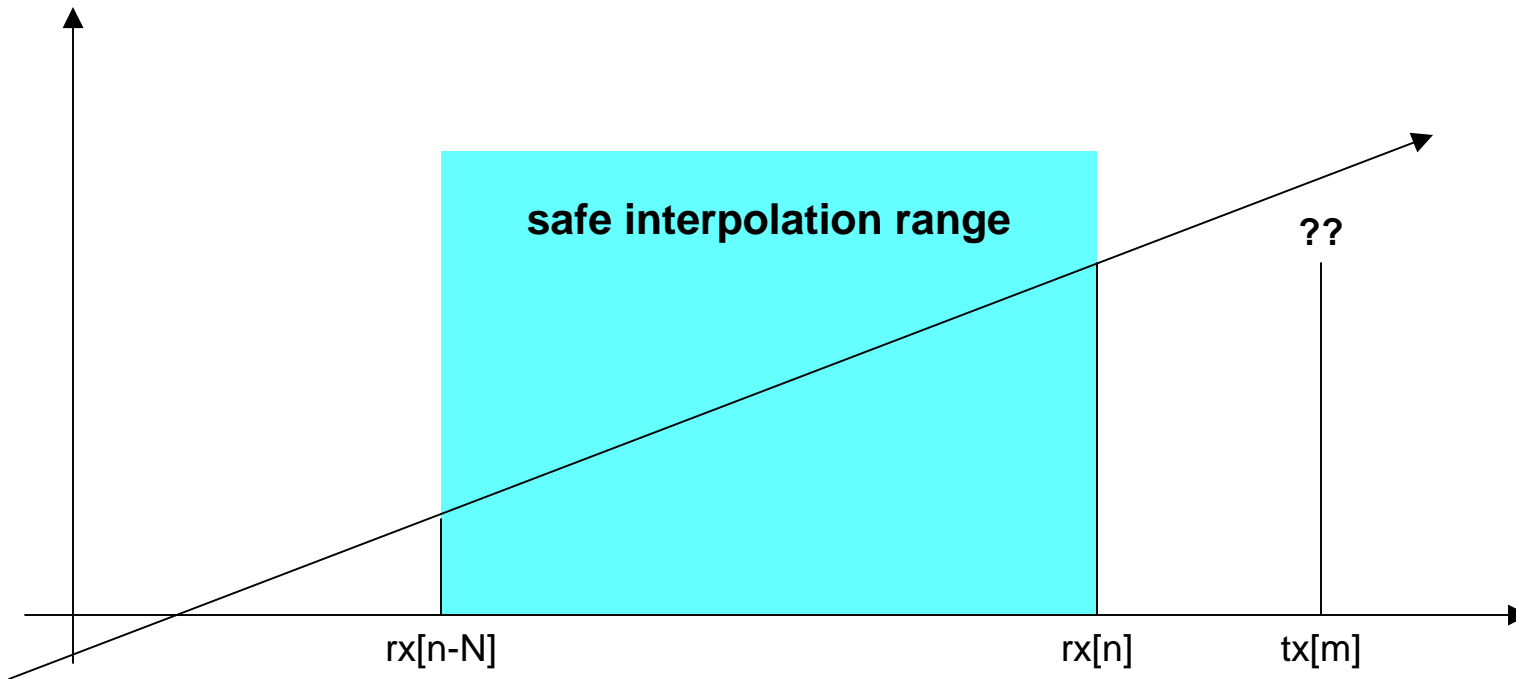


# Time formats

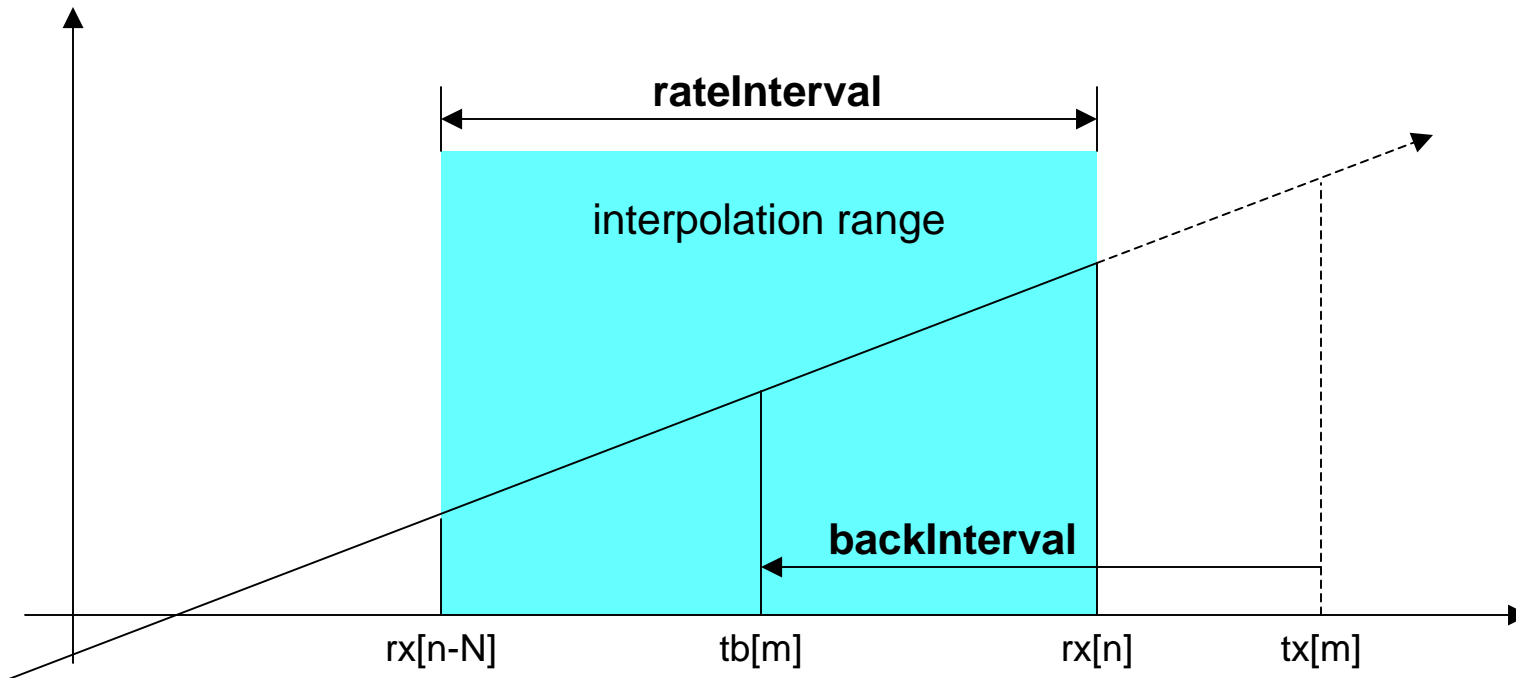


# Interpolation concepts

(interpolation range)

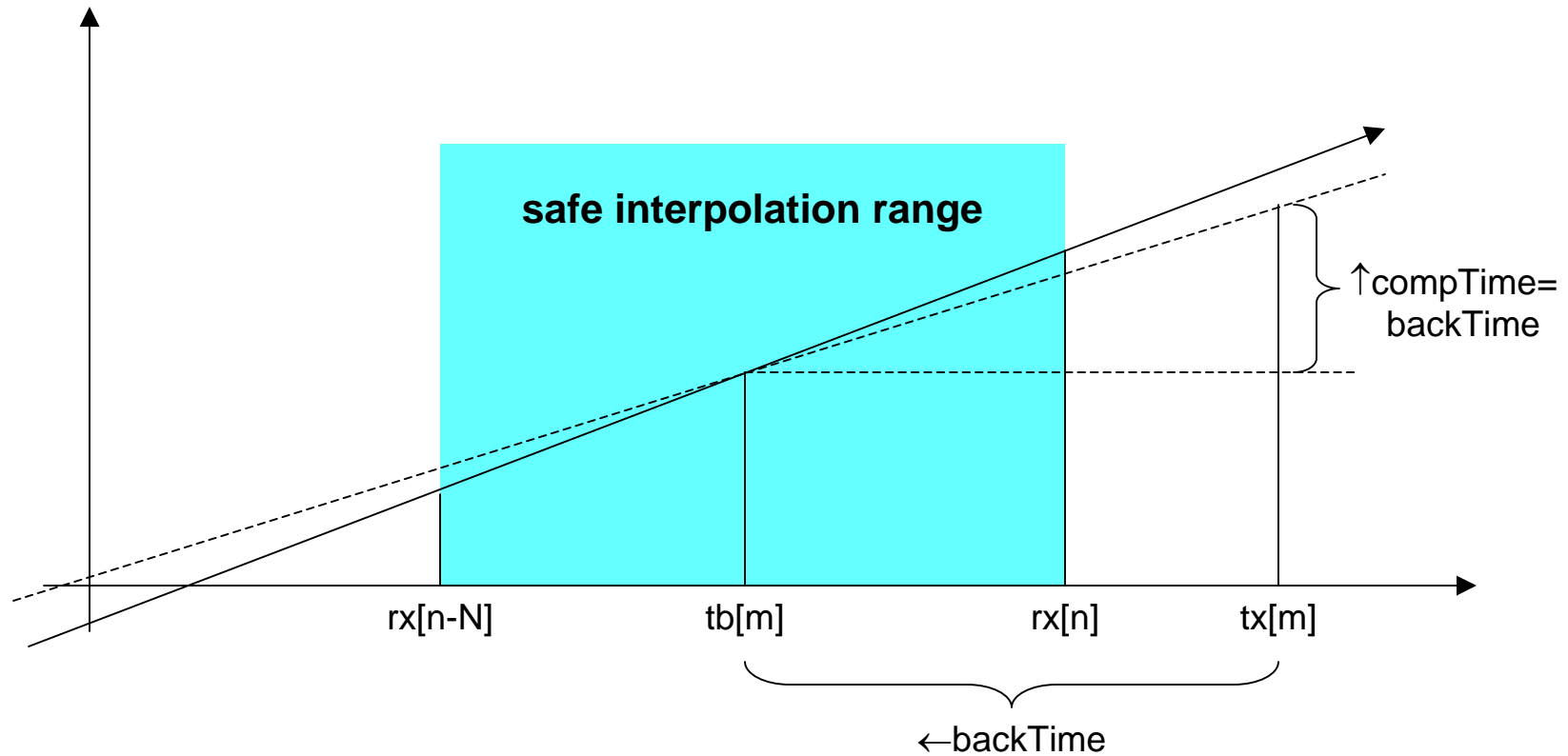


# Interpolation intervals



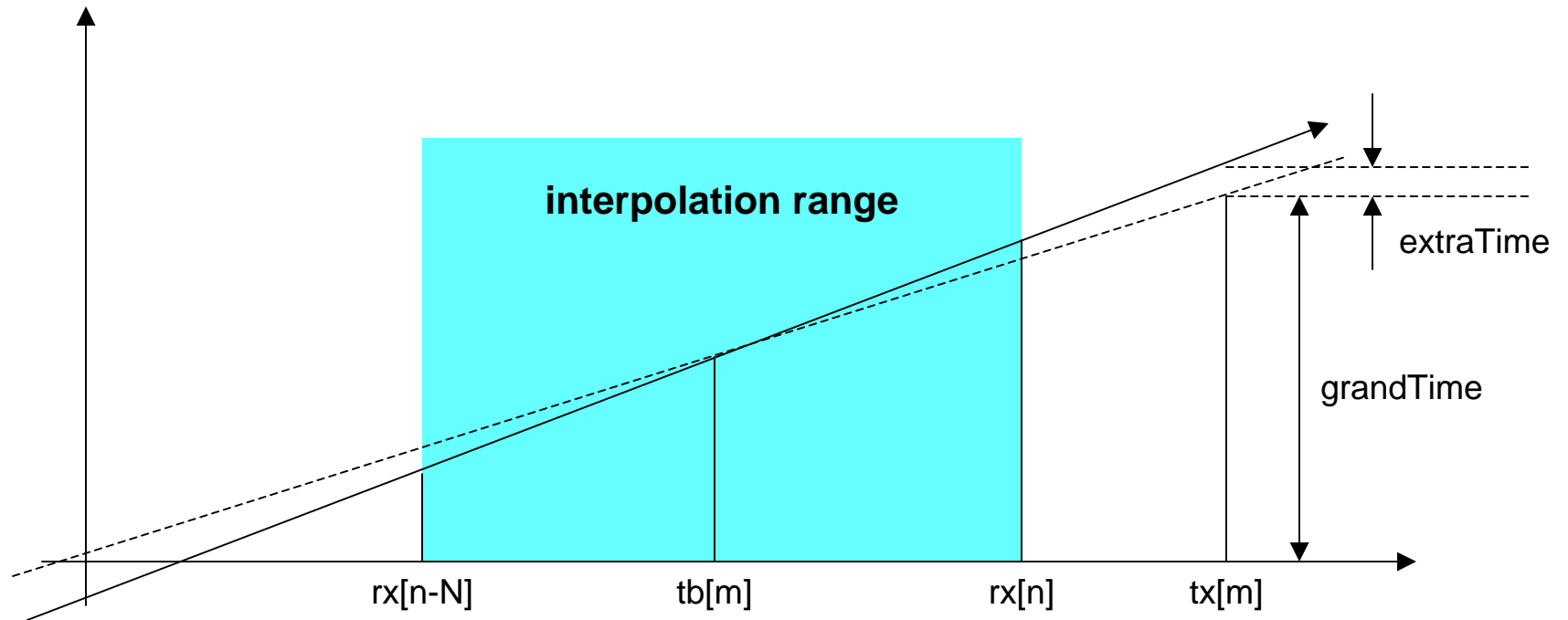


# Interpolation adjustments

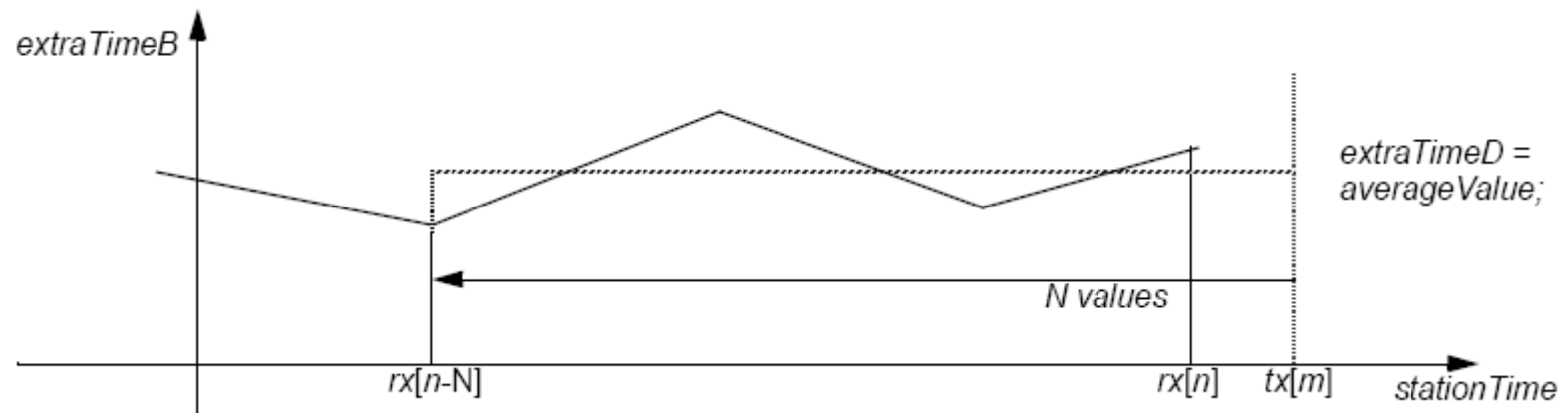


# Interpolation errors

(extraTime supplement)



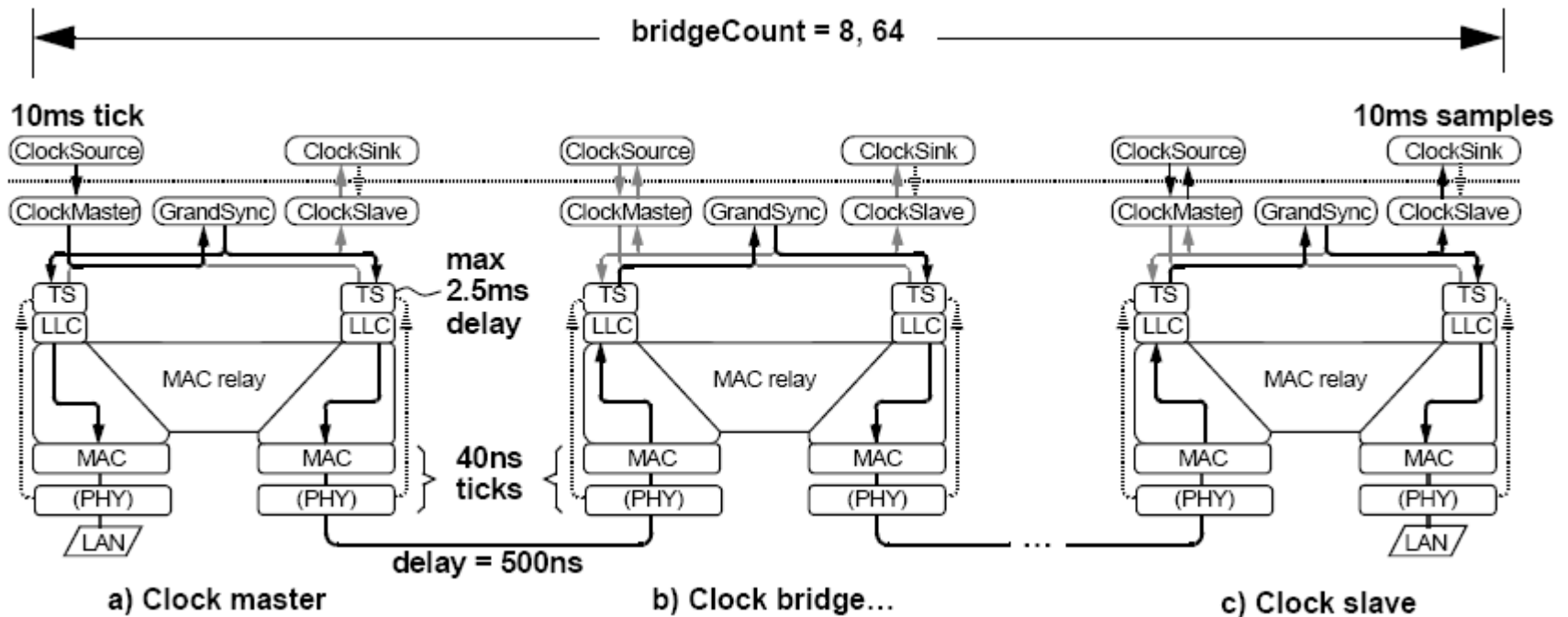
# extraTime averaging



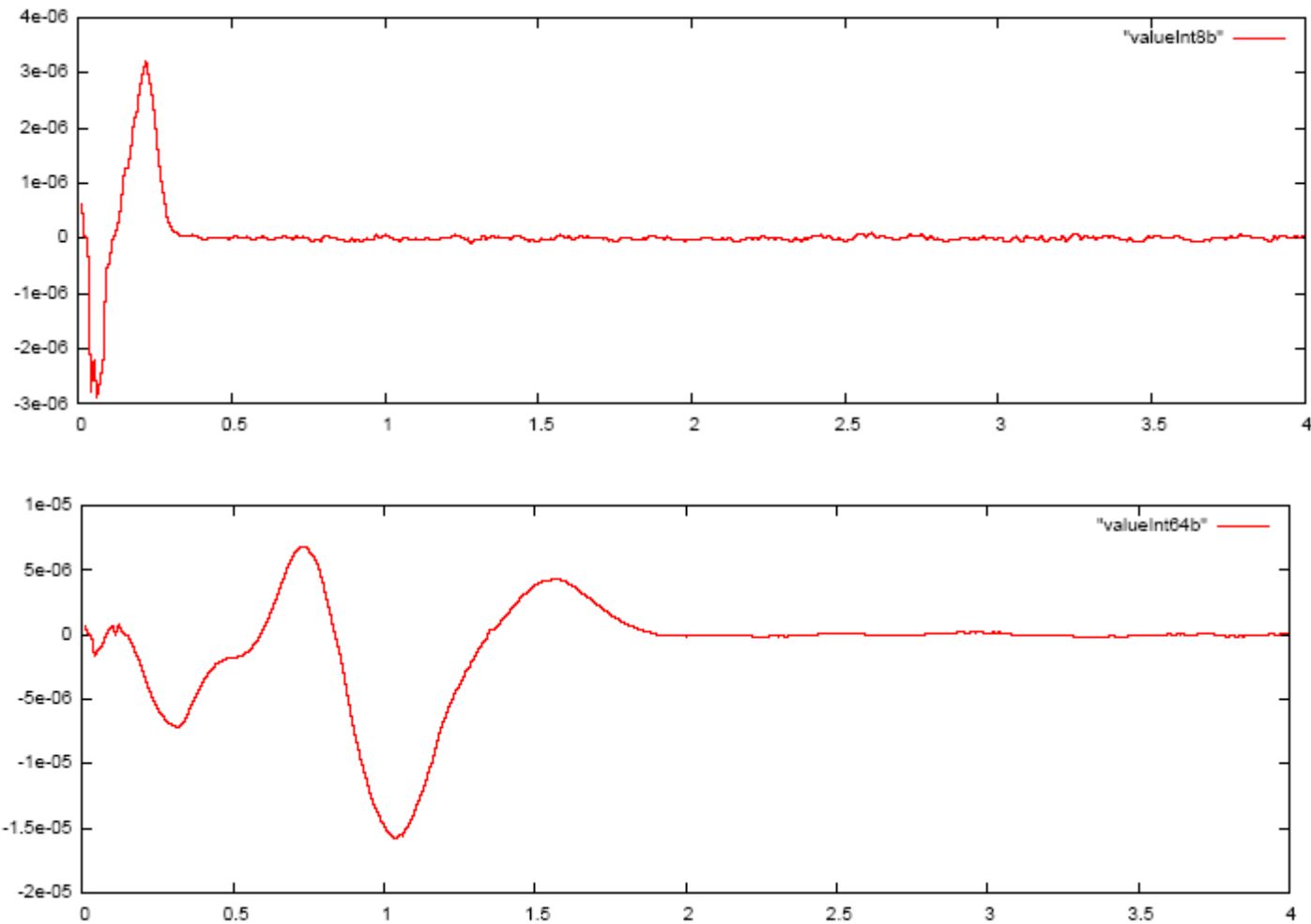
# Simulations: true or false

- Simulation environment:
  - Event driven software
  - Queue-connected entities
  - Entities grouped into stations
- Timing:
  - 128-bit simulation timer
  - Stations with  $\pm 100$ ppm (random) rate differences
  - Station timers quantized to the (free-running) station clocks
- Execution time?
  - 8 stations at approximately 50X real time
  - 64 stations at approximately 2x real time  
(linked-list overheads increase with count)

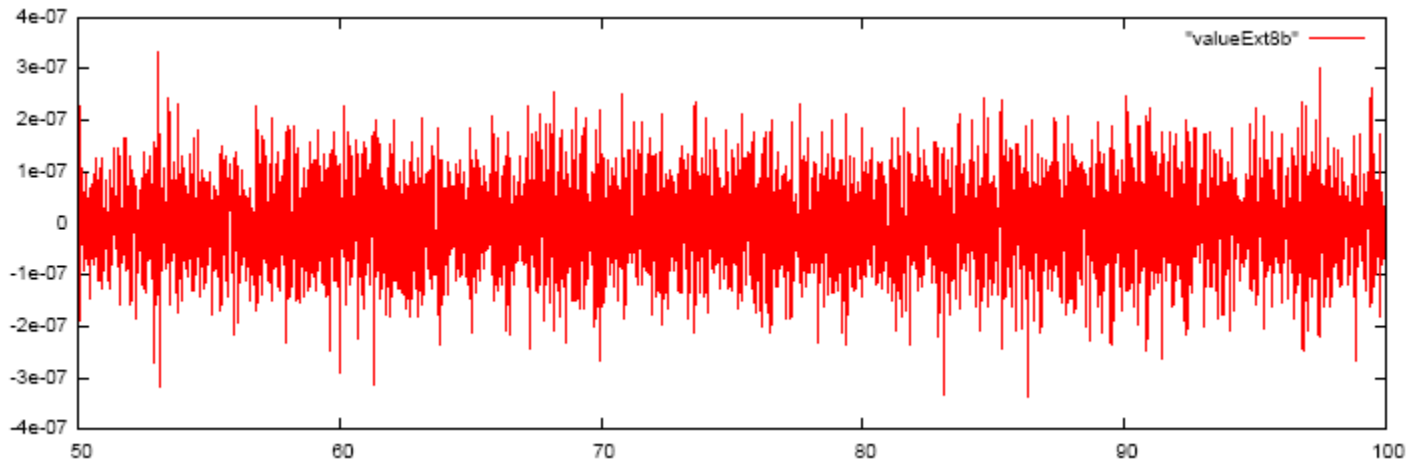
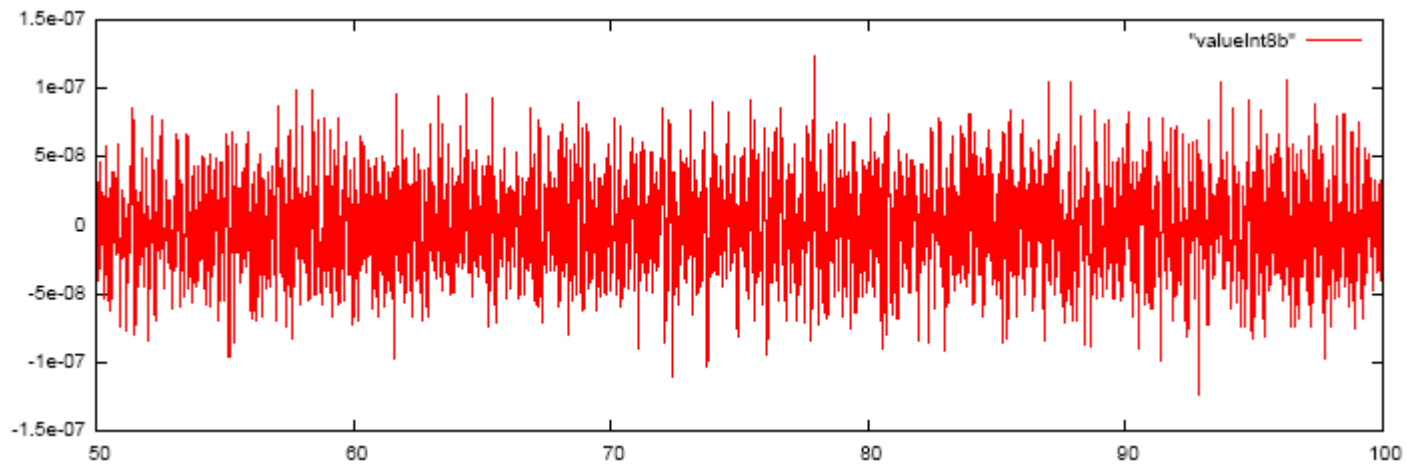
# Simulation environment



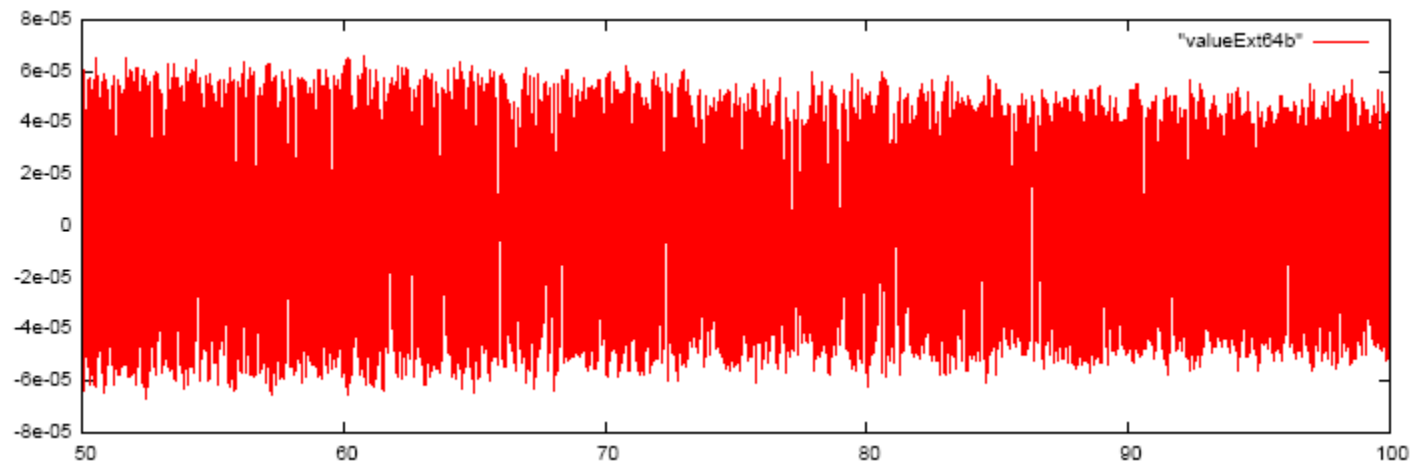
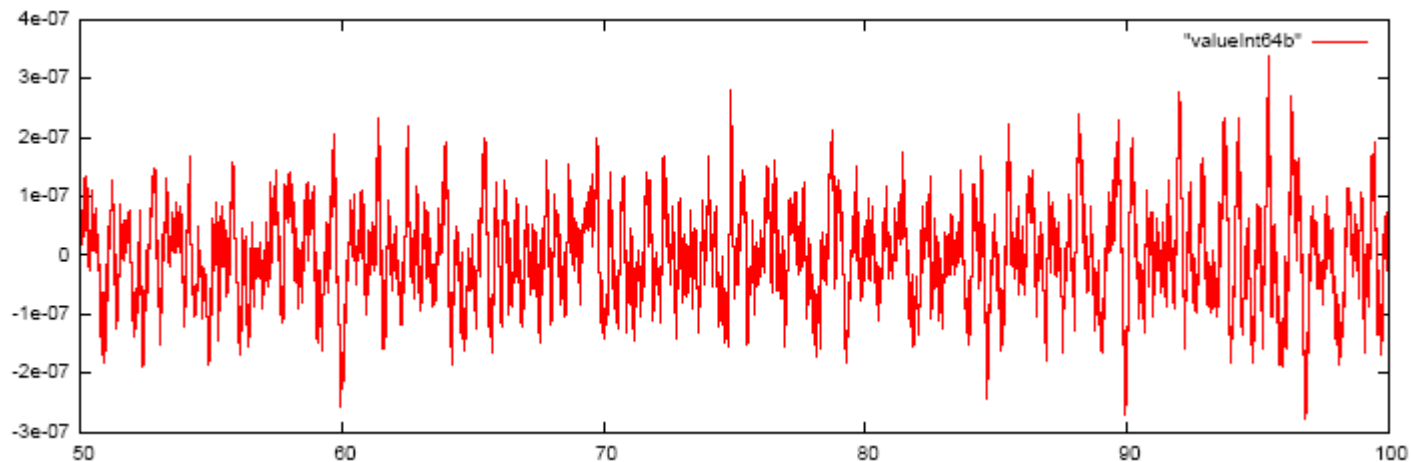
# Transients (w/o syntonization)



# Interpolation vs extrapolation x8



# Interpolation vs extrapolation x64





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**AV bridging:**  
**Homogeneous messages**

David V James

# Rough text

- 3) Title: Homogeneous messages.
- By DVJ.
- 20 minutes
- Abstract:
- From presentation (1), the possibility of multi-rate sync intervals must be considered. With this design model, the
- 4-phase (error sensitive) packet-transmission model of 1588
- is simplified into a single uniform packet transmission.
- Variants for distinct links, wherein portions of the content
- may be sent through media-dependent means, are also illustrated.
- (This can now be compared to the complex 1588-derived
- link/phase interdependent protocols only recently published
- in the draft 802.1as specification.)
  
- Drop-in text is provided, so that fixing these problems
- will advance (not hinder) the standard schedule.
  
- 4) Title: Grand-master selection.
- By DVJ.
- 20 minutes
- Abstract:
- The simple homogeneous messages of (3) will be shown sufficient
- to perform grand-master selection, with minimal corner cases
- due to decoupled 1588-like state machine operations. The classic
- concern of using broadcasts for this function (broadcast storms,
- a problem within large systems) is an additional advantage of
- performing grand-master selection in this way.
  
- Drop-in text is provided, so that fixing these problems
- will advance (not hinder) the standard schedule.