Wide Area Control and Time Synchronization Issues

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imagination at work

AEP PMU circa 1988

Cost of GPS clock: $13,727.50

General Time Sync Requirements

- General Requirement: about 50 μsec accuracy for Sequence of Events
  - 61850 Time Stamp resolves to about 60 nsec
  - Achieved with IRIG-B / 1588
  - Marginal accuracy with SNTP (typical: 1msec)
  - Non-essential for protection
- Synchrophasor Accuracy Requirement
  - Better than 1 μsec
  - Will become essential for Wide Area Protection
  - Hold-over time / Time Inaccuracy becomes important / a requirement

Special Timing Requirements

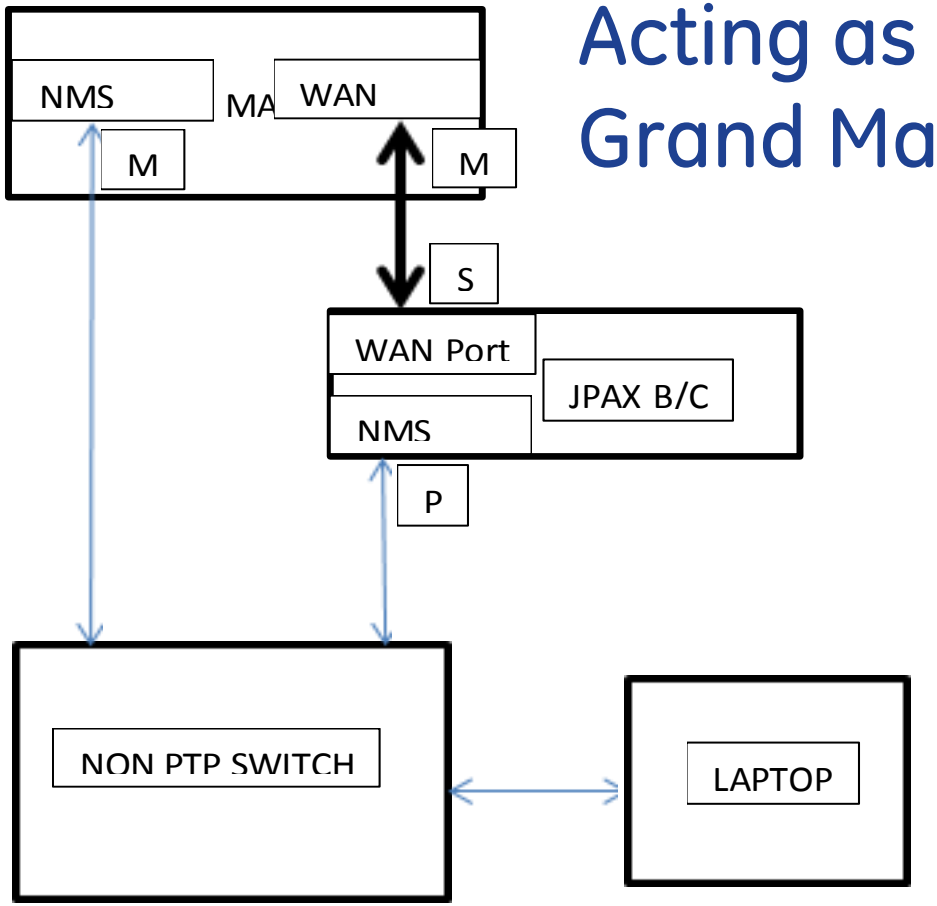
- Traveling Wave Protection
  - Better than 1 μsec desirable
  - Essential for protection
- PD/Traveling Wave Fault Detection
  - 100 nsec accuracy desirable
  - Non-essential for protection

Timing Challenge: Current Differential

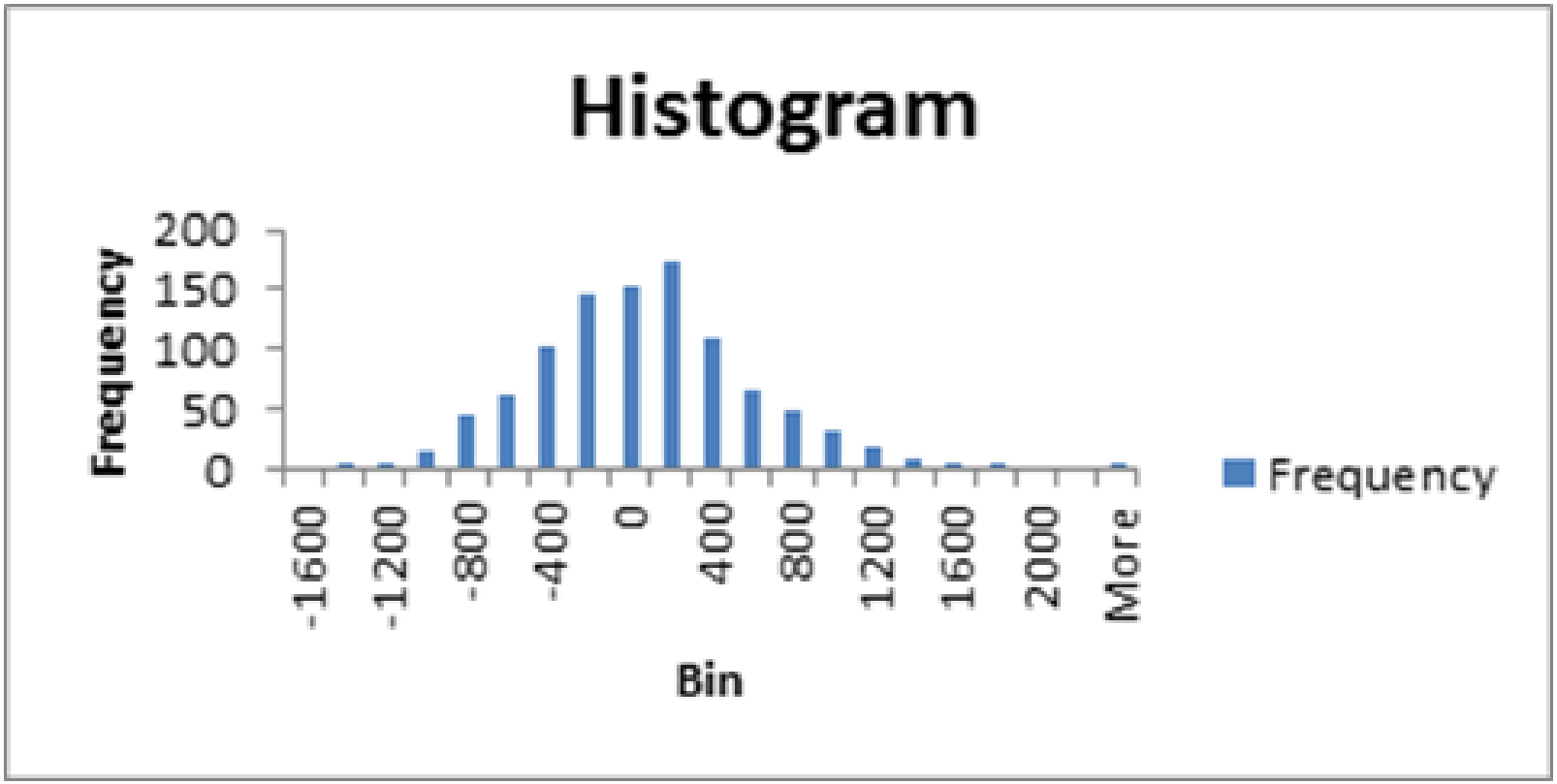
GPS Time Sync NOT needed nor desired….
….unless Communication Paths are Asymmetric
Problematic with Process Bus Data – given loss of Sync on one side

Time Sync over MPLS

MPLS node Acting as a Grand Master



Variance in Time on the two Paths:



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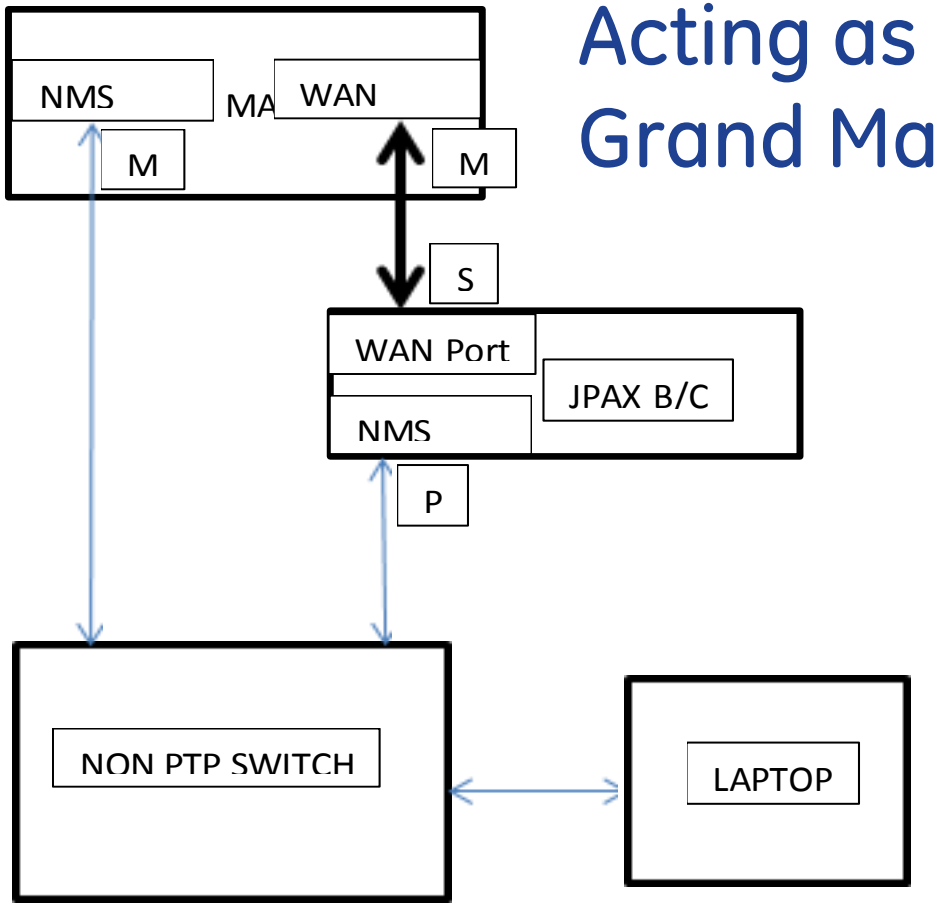

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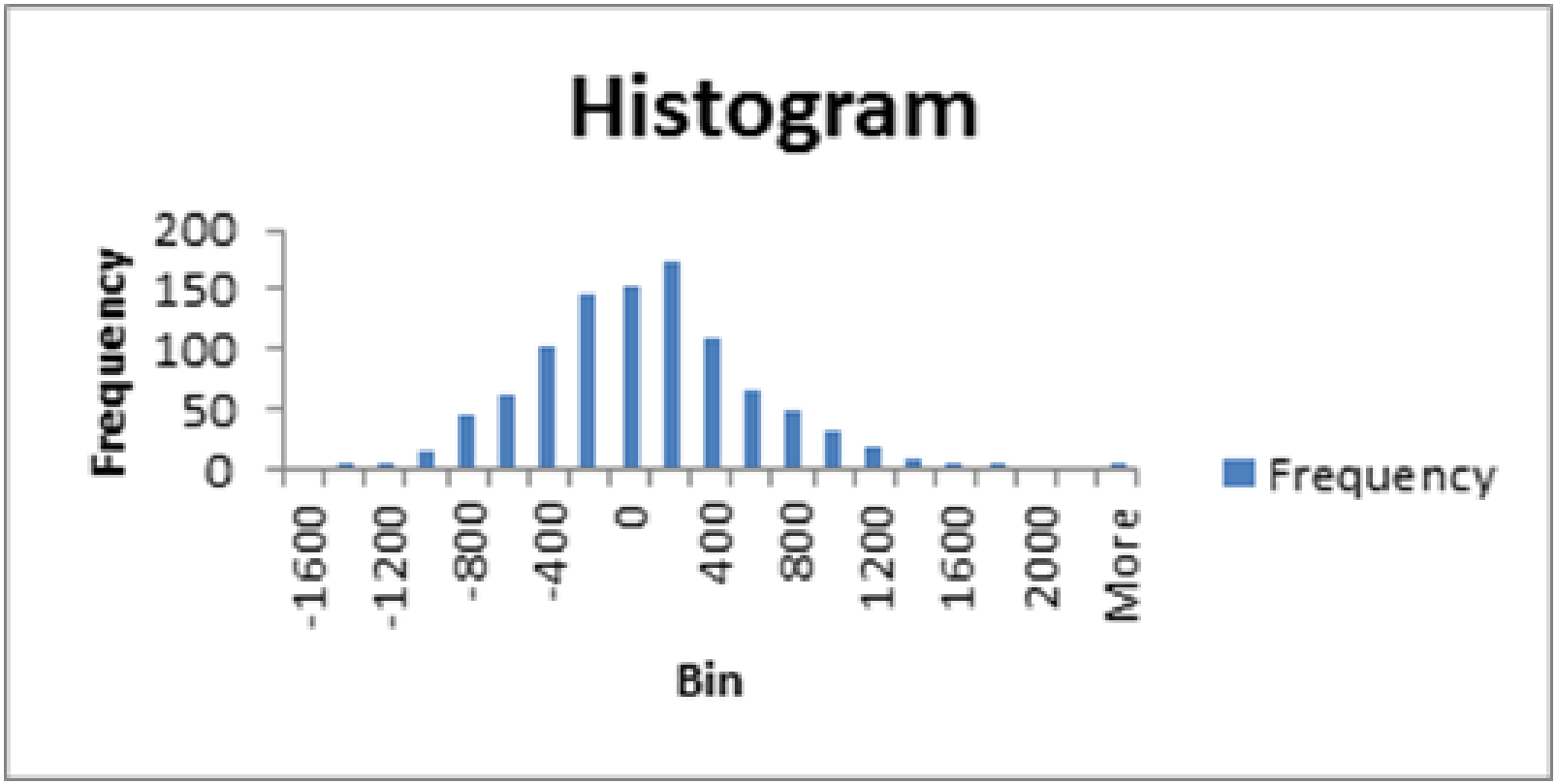
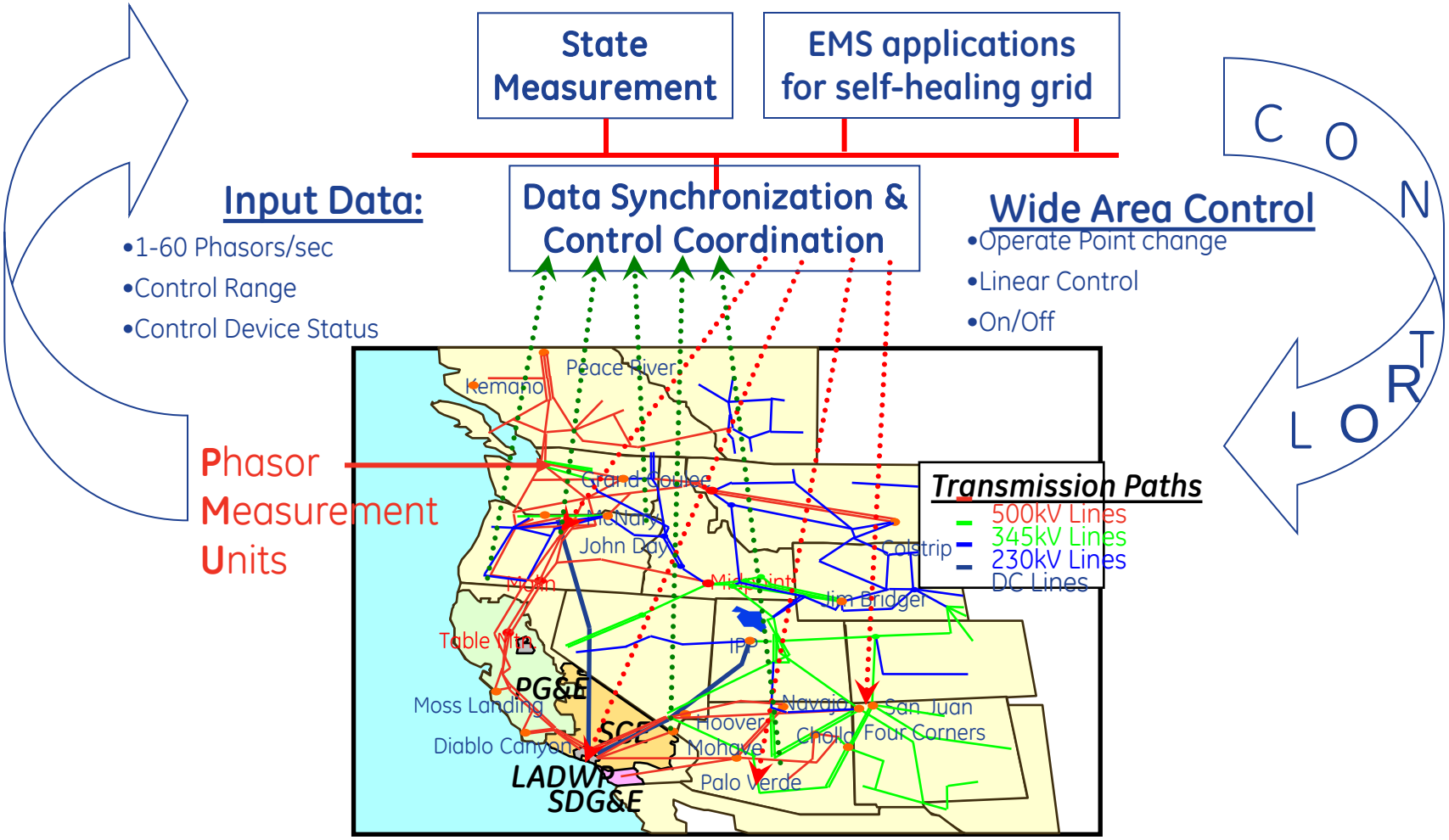
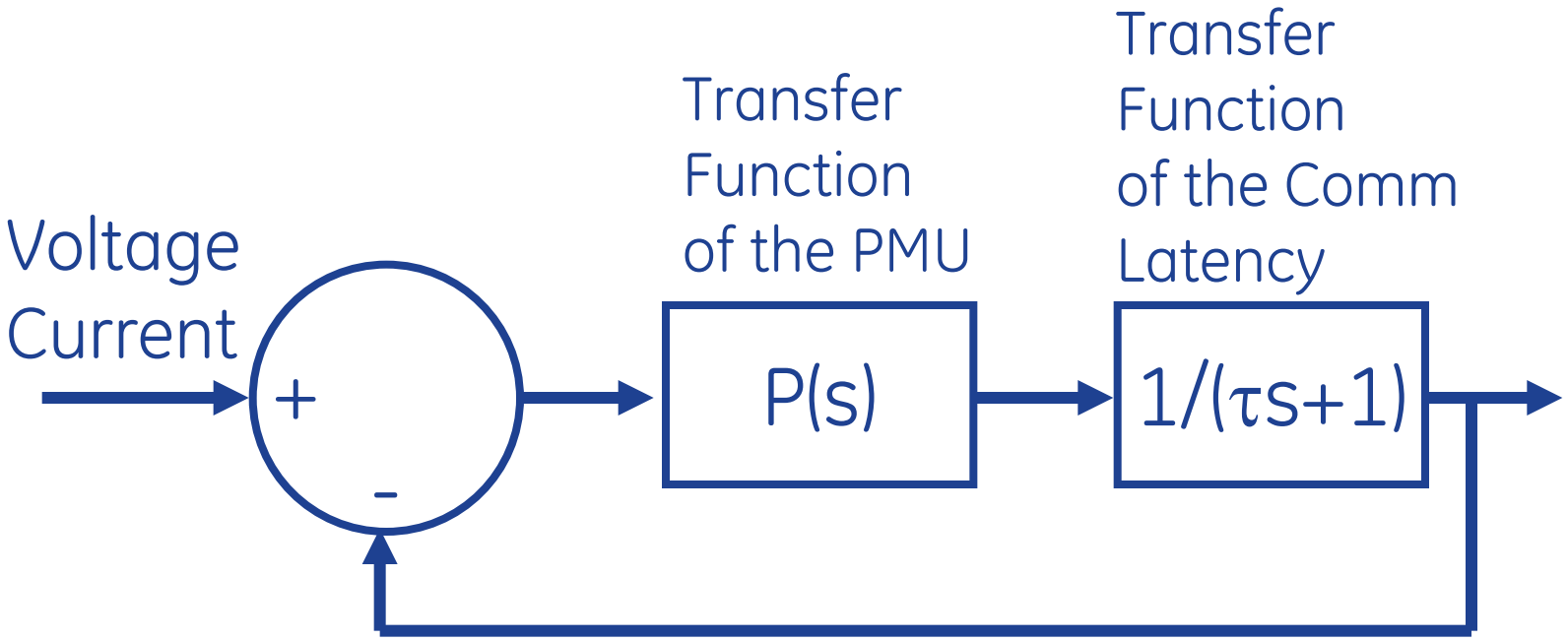


Wide Area Monitoring and Control



Phasor Measurement Function



Communication Latency is part of the Closed Loop Solution

Time Synchronized Control

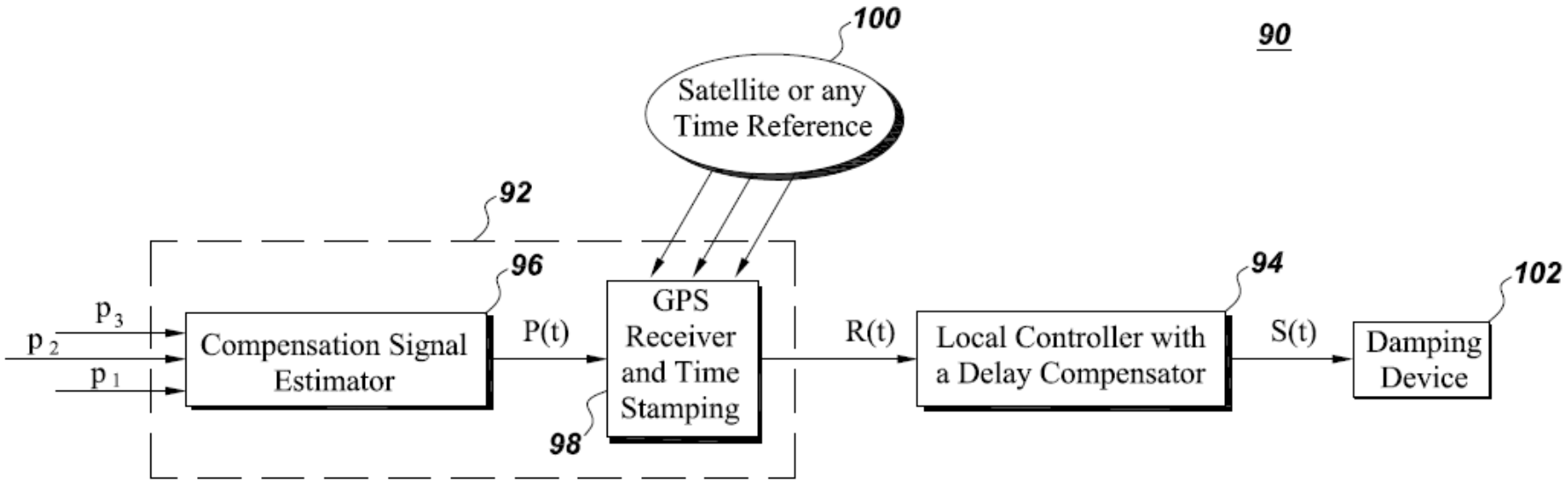


Fig. 4