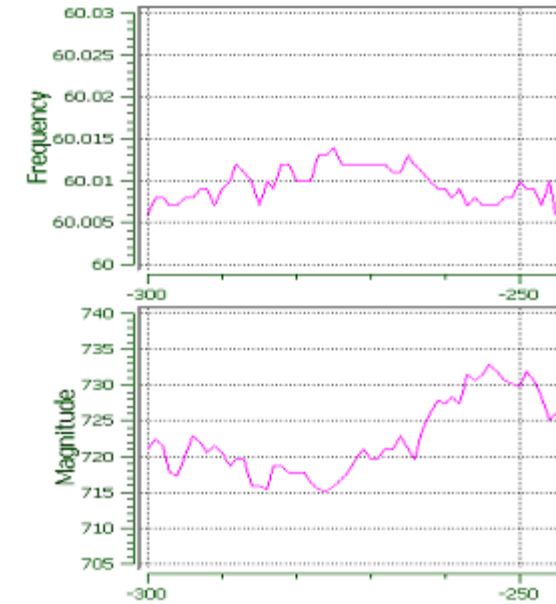


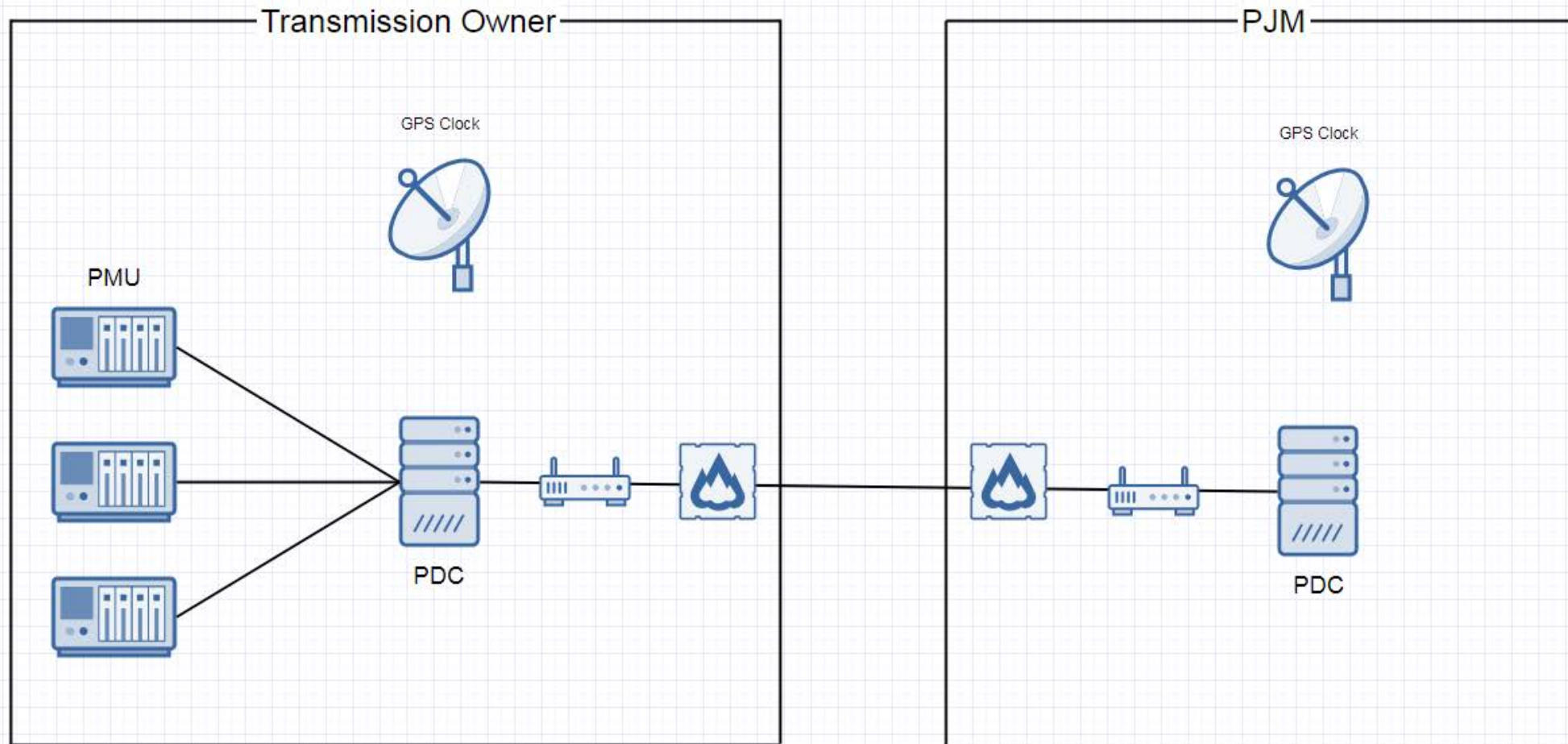
Latency Overview

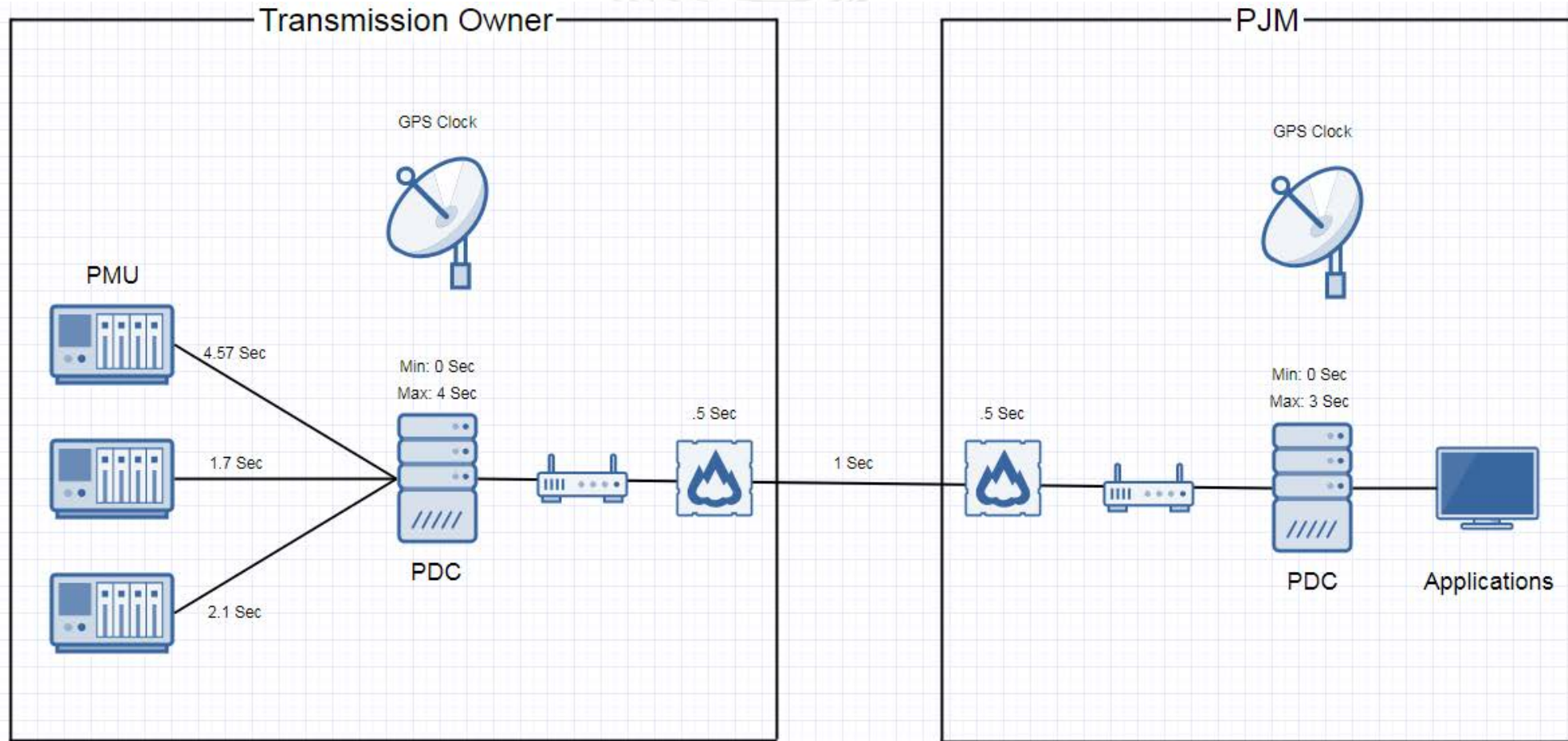
Erkan Tuna
September 19, 2018

- Latency has an impact on all network connected devices
 - Particularly important for Synchrophasors
 - Loss of C37.118 stream
 - Bottlenecking ability for non-latent data
 - Dropouts of signals
 - Impact on downstream applications
 - Negative impact on Phasor Data Quality Reports



- Local PDC latency settings have an impact on signals/streams
- How?
 - Latency range too restricted:
 - Has the potential for signals to be dropped out
 - If a PMU latency has greater latency than the maximum configured latency, the signal will be marked as dropout.
 - Latency range too relaxed:
 - Has the potential to delay the entire stream
 - If the maximum latency setting of the PDC is too high, then less latent signals will be forced wait (or queued) until the maximum latency bounds are met.
 - Can cause the entire stream of PMU signals to be even more latent.





- Things to consider:
 - PMU minimum, maximum, average latencies should be observed
 - The maximum latency configuration should be used to dropout big outliers
 - Latency configurations earlier in the network path should be reviewed
 - Devices earlier in the network path could be a bottleneck
 - A good rule of thumb is to set the maximum PMU latency + 1 sec (or a few hundred milliseconds if your application supports it) as the maximum PDC latency

- PJM and Transmission owners should coordinate latency settings
 - Early in 2017, PJM conducted a latency survey of all Transmission Owners
 - Configured current day latency settings based on Transmission Owner input
 - Assisted in the data quality metrics after implementation of reviewed settings
 - Latency settings should be revisited since new signals/devices have been added
 - New network equipment/configurations could have changed
 - Latency parameters could have changed over time

| Company | Output Wait Time (ms) | Avg Latency (ms) | Recommended Wait time | Drop Out % |
|---------|-----------------------|------------------|-----------------------------|------------|
| DOM | 1000 | 1088 | 2088 | 4.473 |
| RECO | N/A | 67 | Keep existing output config | 0.024 |
| PSEG | 150 | 207 | 357 | 0.07 |
| PPL | 1000 | 773 | 1773 | 0.08 |
| PE | N/A | 36 | Keep existing output config | 0.018 |
| FEAP | N/A | 1474 | 1474 | 1.91 |
| COMED | 200 | 278 | 478 | 0.135 |
| BGE | 350 | 96 | 446 | 0.016 |
| DUQ | N/A | 113 | Keep existing output config | 0.48 |
| DEOK | 300 | 481 | 781 | 1.804 |
| AEP | 1500 | 1452 | 2952 | 4.7936 |
| PHI | N/A | 125 | Keep existing output config | 0.349 |

2017 Latency Stats

Questions?

- For any Phasor inquiries:
 - PJMSynchroPhasorSupport@pjm.com