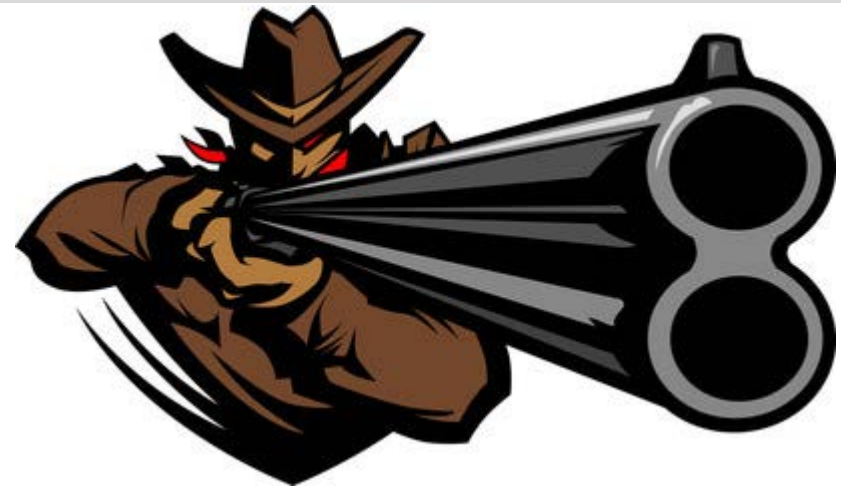


Trouble Shooting

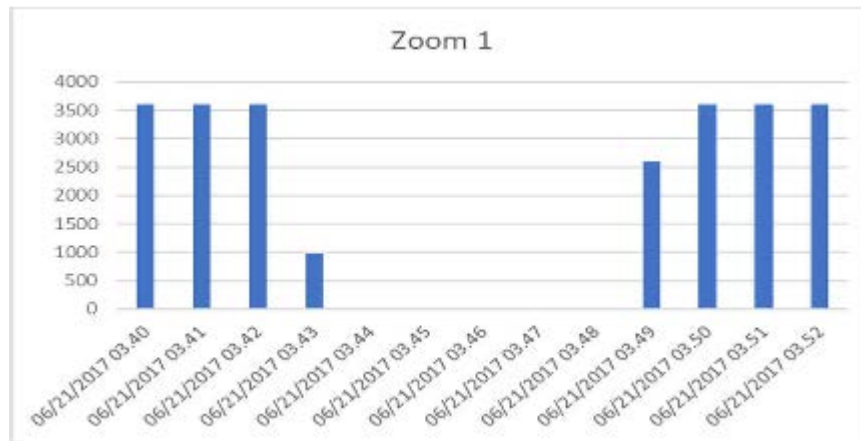
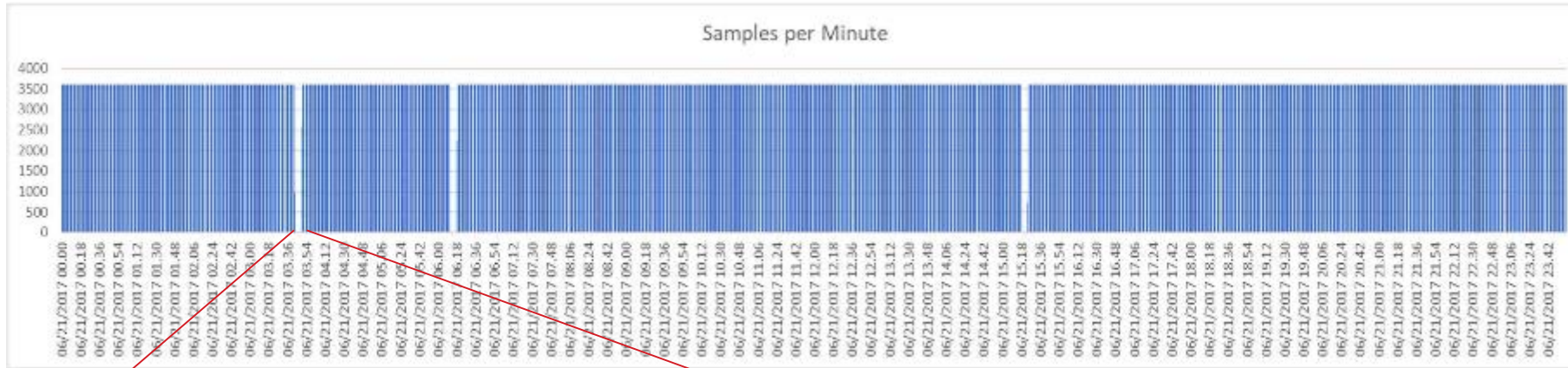
Just because the name is trouble *shooting* doesn't mean you should use the shotgun method



- Understand the terminology
- Take advantage of time stamps
- Build Dashboards



Trouble Shooting



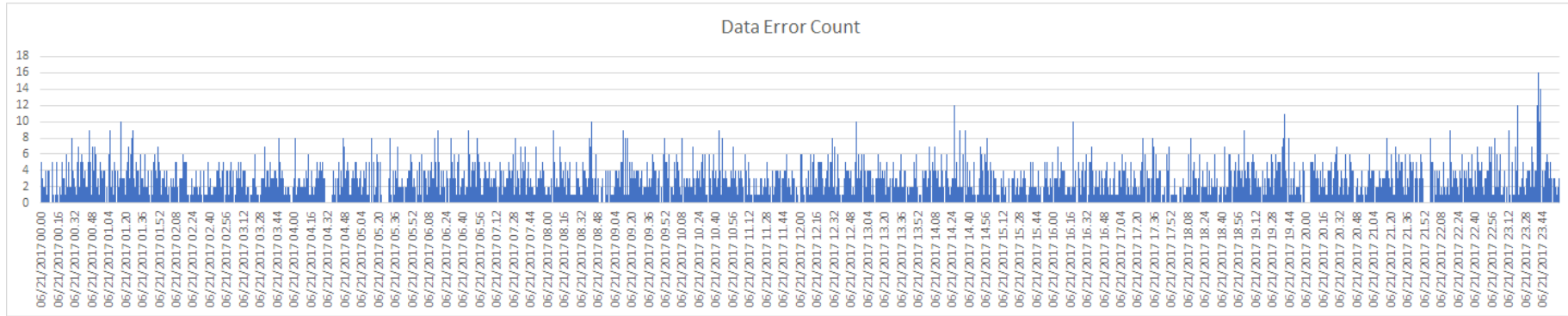
- Counting how many samples arrive every minute can help trouble shooting
- In this case it could indicate router issues or some timed process overloading the network

Data Dropouts Substation PDC to Control Center PDC

Typical of TCP/IP communication issues



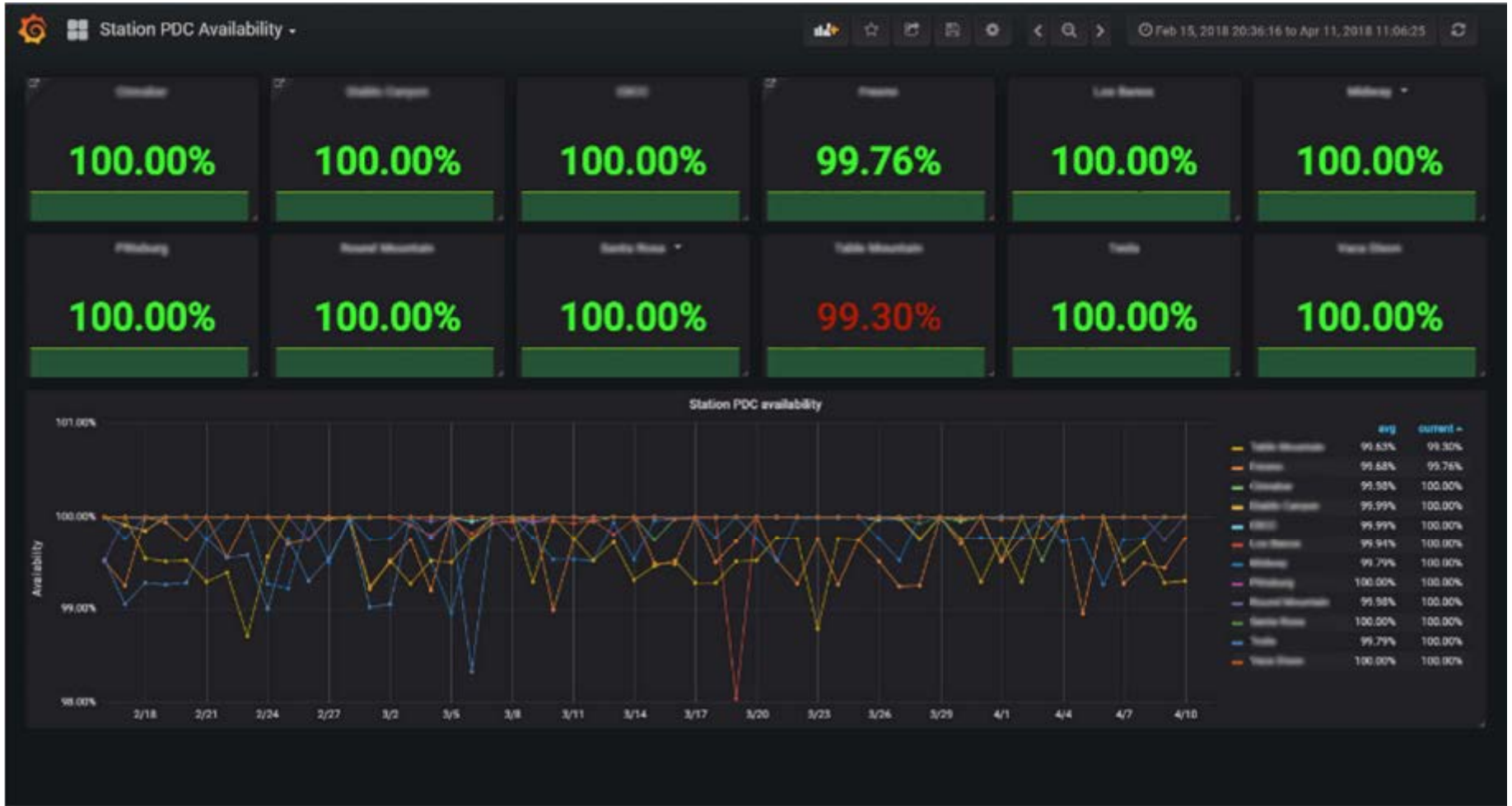
Trouble Shooting



- PMU to PDC communication errors as seen on the output of the PDC
- Spread out over entire day (4407 data errors)
- Typical of UDP communication issues



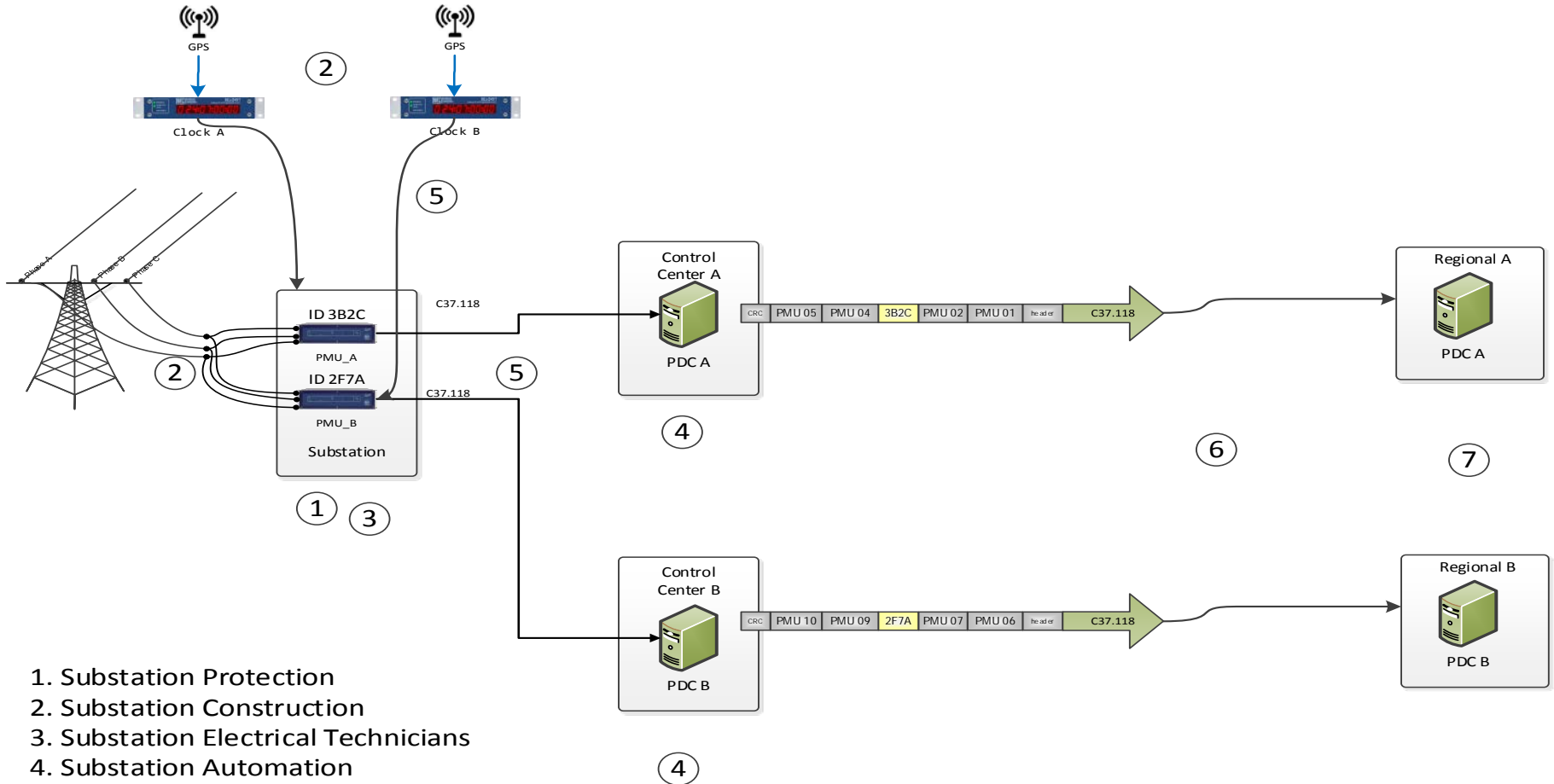
Dashboards



TCP/IP does not guarantee 100% delivery

Trouble Shooting

Many departments are required to make it all work



1. Substation Protection
2. Substation Construction
3. Substation Electrical Technicians
4. Substation Automation
5. Substation Network Technicians
6. WAN Communications Technicians
7. IT (Corporate and Operations)