Experiment 10

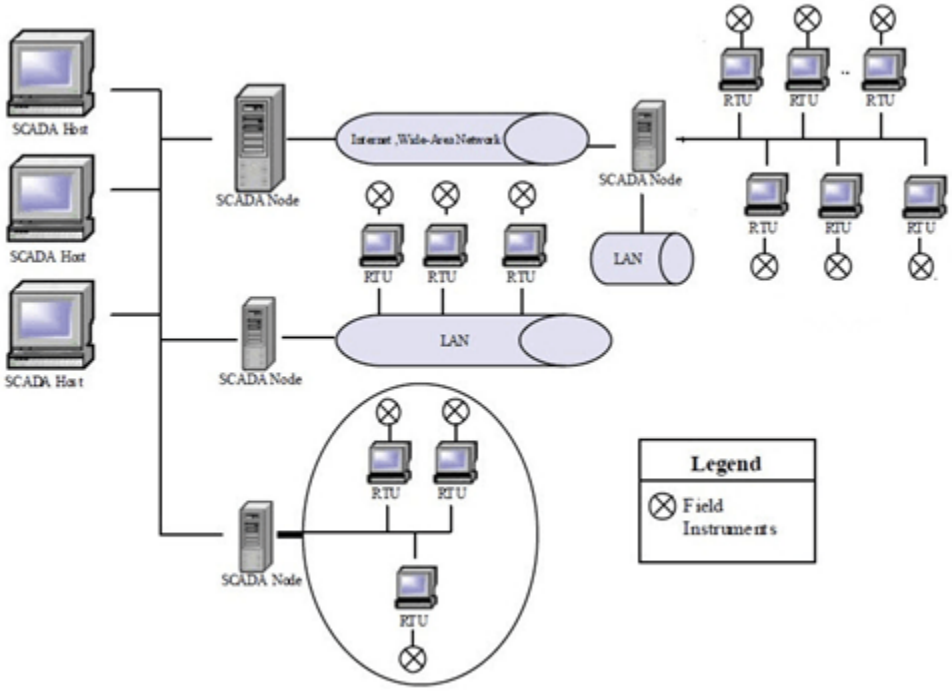
Aim: To study the SCADA architecture and its types

Theory:

SCADA or Supervisory Control and Data Acquisition is a system that is used for monitoring, analyzing and controlling an industrial process. A SCADA system is capable of real time monitoring and management of physical assets dispersed over a very large geographical area.

- A SCADA system performs four functions:
  - Data acquisition
  - Networked data communication
  - Data presentation
  - Control

- Components of SCADA
  - Programmable logic controller(PLCs): connect to sensors in the process and convert sensor signals to digital data. PLCs have more embedded control capabilities than RTUs. PLCs are sometimes used in place of RTUs as field devices because they are more economical, versatile, flexible and configurable.
  - Remote terminal units (RTUs) connect to sensors in the process and convert sensor signals to digital data. They have telemetry hardware capable of sending digital data to the supervisory system, as well as receiving digital commands from the supervisory system.
  - A telemetry system is typically used to connect PLCs and RTUs with control centers, data warehouses, and the enterprise. Examples of wired telemetry media used in SCADA systems include leased telephone lines and WAN circuits. Examples of wireless telemetry media used in SCADA systems include cellular and microwave and other communication mediums.
  - A data acquisition server is a software service which uses industrial protocols to connect software services via telemetry with field devices such as RTUs and PLCS. It allows clients to access data from these field devices using standard protocols.
  - A human-machine interface or HMI is the apparatus or device which presents processed data to a human operator, and through this, the human operator monitors and interacts with the process. The HMI is a client that requests data from a data acquisition on a server.



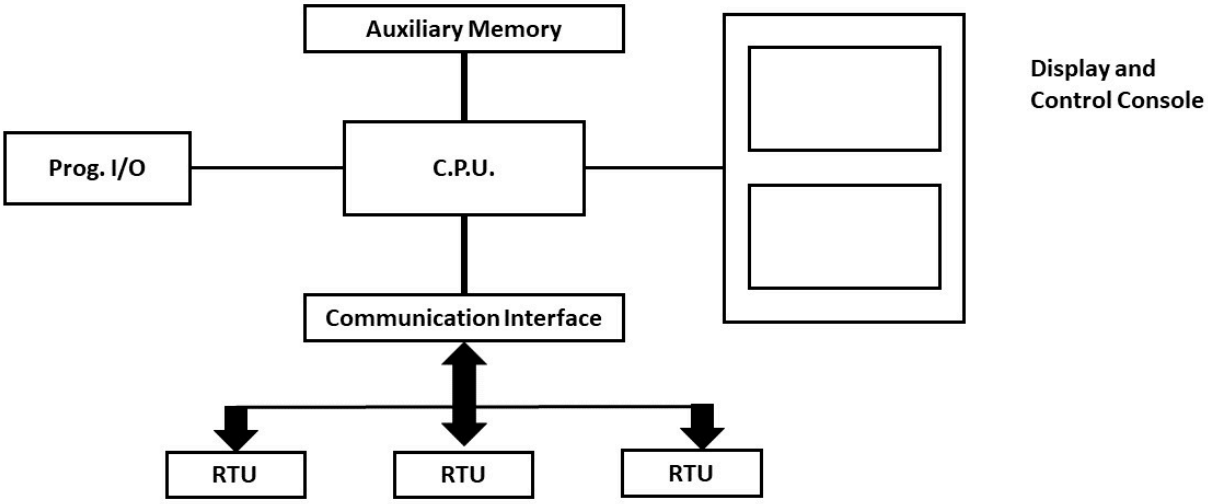


Figure: Simple SCADA System With Single Computer

- SCADA Architecture:
  1. First Generation: Monolithic
  2. Second Generation: Distributed
  3. Third Generation: Networked

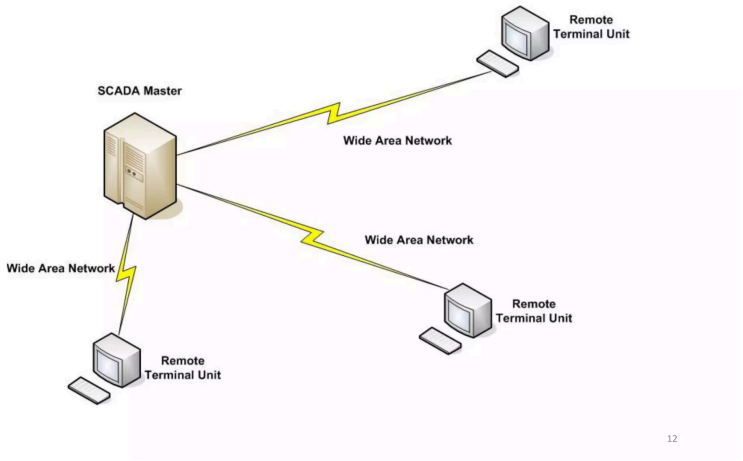
  1. Monolithic SCADA system: Minicomputers are used earlier for computing the SCADA systems. In earlier times, during the time of first generation, monolithic SCADA systems were developed wherein the common network services were not available. Hence, these are independent systems without having any connectivity to other systems.

  2. Distributed SCADA system: The processing was distributed across multiple stations which were connected through a LAN and they shared information in real time. Each station was responsible for a particular task thus making the size and cost of each station less than the one used in First Generation.

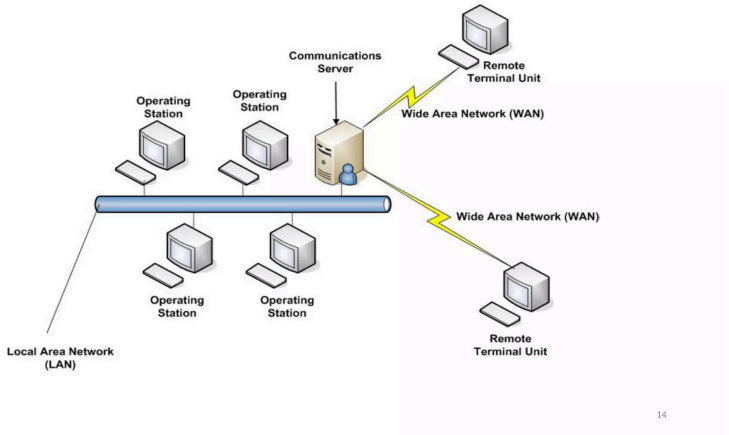
  3. Networked SCADA system:
     >Open system architecture
     >Multiple networked systems, sharing master station functions
     >Utilizing open standards and protocols
     > Distribute SCADA functionality across a WAN
     >Open standards eliminate multiple limitations
     >Easier to connect to third party peripheral devices to the system or the network
     >Disaster survivability

- Applications of SCADA system:
  - Electric power generation, transmission and distribution Water treatment plant
  - Oil and Gas Trans & Distributions
  - Food processing industry
  - Traffic signals

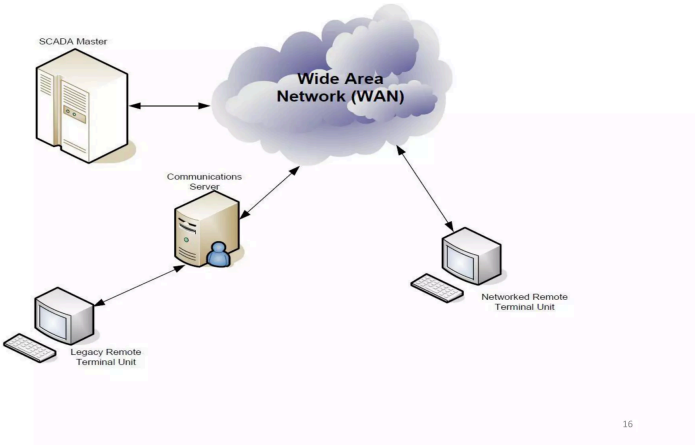
- Benefits of SCADA
  - The benefits one can expect from adopting a SCADA system for the control of experimental physics facilities can be summarized as follows:
  - a rich functionality and extensive development facilities.
  - reliability and robustness.
  - technical support and maintenance by the vendor.



Monolithic SCADA system



Distributed SCADA system



Networked SCADA system