

Computing Units in OT - An Introduction

OT - Operational Technology

OT describes the domain of hardware and software used on production floors, in industrial control systems and the like. The term aims to differentiate the OT domain from the traditional IT (Information Technology) domain since different technologies are needed and used. OT can therefore be called "The IT of the non-carpeted areas". Typical examples of technologies include PLC, RTU, CNC, SCADA systems and industrial bus protocols like Modbus. Domains like IoT, embedded systems and automotive (like VCUs or ECUs) can also be regarded Operational Technology. Technologies and standards used in OT are typically unknown in the traditional IT domain, although they follow the same basic principles.

PLC - Programmable Logic Controller

PLCs are computing units typically used to control and monitor production machines in automated manufacturing. Examples would be production lines, printing machines, packing machines, and the like. Historically, production machines were controlled using time relays and human workers that both continuously made way to PLCs. Today, PLCs are controlling traffic lights, car tunnels, trains, boats and even electrics in private houses (smart building).

Because of their origin, PLCs are typically programmed by electrical engineers and machine builders using graphical programming languages that resemble wiring diagrams (LD) or logic diagrams (FBD). However, with PLC systems becoming more and more complex, code based programming languages like 'Structured Text' are on the rise and more software centered expertise is needed bringing software engineers into the domain. This transformation is still in the process today (2023) and many changes are expected in the years to come (keywords: IIoT, Industry 4.0, Industrial Cyber Security, etc).

RTU - Remote Terminal Unit

RTUs are computing units typically used to read data from sensors and forward them to a centralized control system like SCADA. They can also control things and support various interfaces for I/O or bus protocols. Typical examples where RTUs come to use are Oil rigs, weather stations, power plants, sewage treatment, and the like. They are very durable considering factors like vibration, weather conditions, weak power or internet supply, etc. Typically, they can be programmed using a graphical web interface, or in programming languages like C# or BASIC, but often also support the five IEC 61131-3 defined programming languages.

PLC vs RTU

Although PLCs and RTUs come from completely different backgrounds, they are becoming increasingly similar to the point where the borders blur. Both can be interfaced with a SCADA system, both feature different Bus Protocols, I/O and the like. So let's summarise some of the differences:

- PLC: Is primarily made to control (but can also monitor) in a local environment
- RTU: Is primarily made to monitor (but can also control) in a remote environment
- PLC: Is cheaper than a RTU
- RTU: Is more durable in rough conditions (vibration, heat, moisture, etc)

- PLC: Is typically programmed in one of the 5 IEC 61131-3 programming languages
- RTU: Is typically programmed using a simple graphical web interface, C# or BASIC
- PLC: Is made to be supplied with stable AC power and internet connection
- RTU: Can better handle DC power and weak internet connections

SCADA - Supervisory Control And Data Acquisition

SCADA can be described as a hardware and software architecture for supervision of industrial systems. It consists of control and monitoring units (e.g. PLC, RTUs), industrial HMIs (Human Machine Interfaces), IIoT (Industrial Internet-of-Things) devices (e.g. IIoT sensors), communication technology (e.g. bus systems, ethernet, radio technology), and a highly abstracted graphical supervisory interface. In simpler terms: all OT devices connected to each other becoming bigger than the sum of its parts. The highly abstracted graphical supervisory interface on the top level features live data from several machines and sensors regarding production rate, maintenance, efficiency, throughput, environment and the like. Imagine the main control floor in a nuclear power plant for example. Everything that can be seen on the control panels roots down several layers to sensors and actuators. This architecture could be set up using SCADA.

OT Vendors

Unlike IT, OT is highly proprietary technology, with little to none open source concepts and many vendor specific standards. Although the trend goes into the direction of standardisation, choosing the right vendor or ecosystem can be crucial for the success of the project. Often once a vendor's technology is implemented, it is very hard to migrate to a different ecosystem. Some of the most common vendors include:

- Siemens
- Beckhoff
- B&R
- Honeywell
- Allen Bradley
- Mitsubishi
- ABB
- Bosch
- Wago
- Phoenix Contact
- ABB
- ...