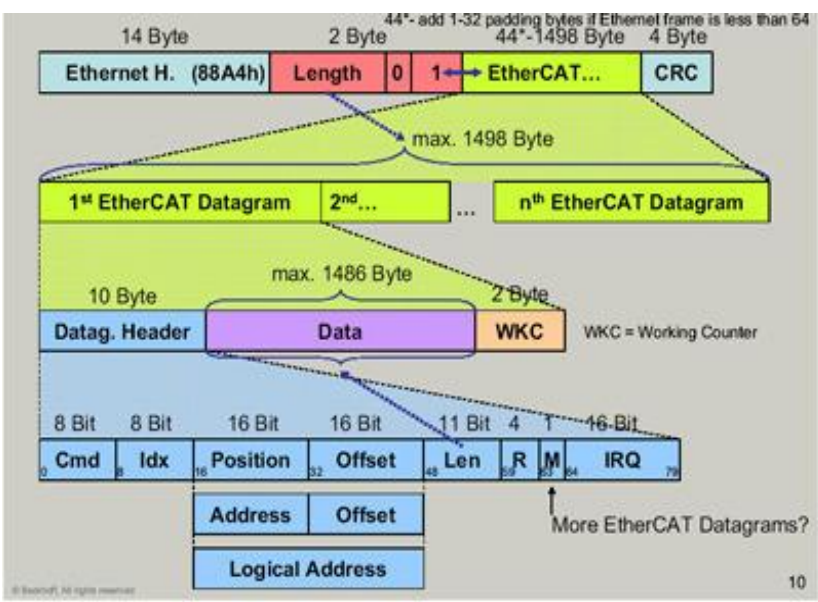
EtherCAT

EtherCAT stands for "Ethernet for Control Automation Technology." It is an open standard and high performance system that aims to use Ethernet protocols (the favored system for Local Area Networks) in an industrial environment, especially for factories and other manufacturing concerns which make use of robots and other assembly-line technologies.
The outstanding and unique functional principle of EtherCAT is processing the Ethernet frame “on the fly” within an EtherCAT network.

Ethernet

Ethernet is the established (and favored) communications standard for local area networks, originally designed to connect different computers to each other for sharing information and data. Ethernet technologies have gone through several phases of development and these have all been for the purposes of simplifying the connections between computers and users as well as increasing the size of the pipeline (through which information will flow) to establish maximum efficiency in resource allocation.
One of the major contributions of Ethernet development are the concepts of information 'packets' – bundles of information or instructions which are then streamed to every computer in the network – and traffic control systems – this mechanism ensures that information packets are sent to the correct recipients. There are also procedures in place to ensure that recipients can still receive the packets even if the computers are 'busy'.



Understanding EtherCAT

EtherCAT is, in a sense, a synergy of several distinct technologies and developmental efforts, starting with the "fieldbus". Handling is straightforward and similar to a “fieldbus”, thanks to flexible topology and simple configuration. Moreover, since EtherCAT can be implemented very cost-effective, the system enables fieldbuses to be used in applications where “fieldbus” networking was not an option in the past.

"Fieldbus" is a broad, non-specific term which describes an updated digital communications system in an industrial setting. An industrial system that makes extensive use of automation – for example, a modern automobile assembly line which uses robots for assembly, welding, painting and other repetitive tasks – requires a highly organized, multi-level structure of controllers to function efficiently.

This usually requires a top-level unit called a Human Machine Interface where a human operator monitors and controls the system; followed by a middle-level comprised by a number of Programmable Logic Controllers (PLCs) which are linked to the upper-level HMIs by a communications system; and finally, the "fieldbus" which links the PLCs to the actual operational components such as motors, actuators, sensors, etc.

In a human organization, one can think of the HMI as the top-level manager (or Chief Operating Officer) who oversees and directs the company's operations; the PLC is the equivalent of the company's 'middle managers' who head up separate divisions dealing with specific areas of company operations; and the 'operators' – or the people working under the middle managers who handle specific, day-to-day operations or activities: field agents, mechanics, drivers, support personnel, etc.

The 'fieldbus' is the communications system which links the field personnel to the middle managers, providing status reports, implementation data, etc. which are processed and forwarded to the COO.

Although the communication linkages between the different levels may appear to be simple, this can become increasingly complex if one considers the multitude of actions and activities that take place at the 'field' level – many of which have to be coordinated with each other, requiring an exchange of information at that level and going upwards to 'middle managers' which, in turn, have to interact and communicate with each other, and so on.

Source: http://www.tech-faq.com/ethercat.html