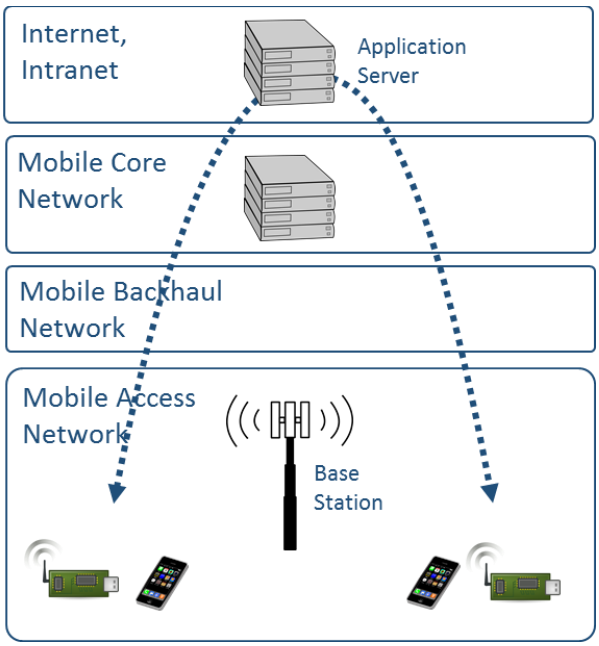
Real-Time Mobile Edge Cloud

The Challenge

Reliable and secure wireless connectivity is an essential requirement for Industry 4.0. In addition to that, many industrial processes require real-time communication performance. This means that data transport **latencies shall be low**, more specifically, **deterministically** low**.**

The obvious technology choice would be to build a private network using Short Range Device (SRD) technologies such as WiFi/WLAN or Bluetooth. However, due to operation in shared frequency bands (unlicensed spectrum), these technologies were designed to cover only small areas. So, building radio coverage for e.g. a large industrial campus may require a high number of Access Points, thus become expensive. Furthermore, these technologies were not developed with strict Quality-of-Service (QoS) in mind.

Another approach to solve the problem above is using mobile network technologies, in particular LTE, which are designed for exclusive frequency bands (licensed spectrum). LTE has a significantly larger radio link budget compared to SRD technologies, thus a much smaller number of radio base stations (eNB) will be needed in order to cover the same area. With LTE, round-trip times (RTT) less than 20ms can be achieved. This will be reduced with 5G even further. However, low latencies are only possible under ideal conditions, namely that the number of transport hops (routers, switches, etc.) in the data path is minimized and the geographical distance between the user devices (machines, sensors and actors in Industry 4.0 scenarios) and the data processing equipment (Application Server) is short. Data travels through fiber cables with a speed of approximately 200,000 km/s, so 1000 km distance between a mobile operator's Base Station and the Core Network adds 10ms to the RTT. In typical core-centric mobile networks today, IP packets travel long distances over many hops, the mobile backhaul network. It is obvious, that deterministic latencies in the range of a few milliseconds cannot be achieved with this architecture.

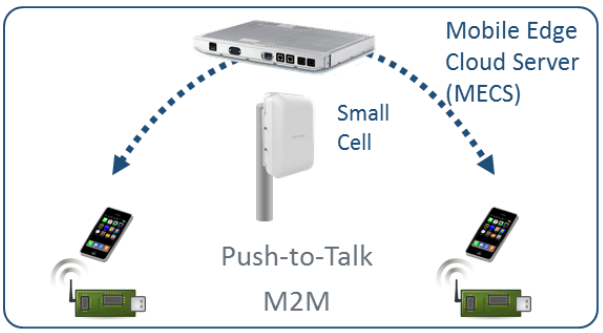


The solution

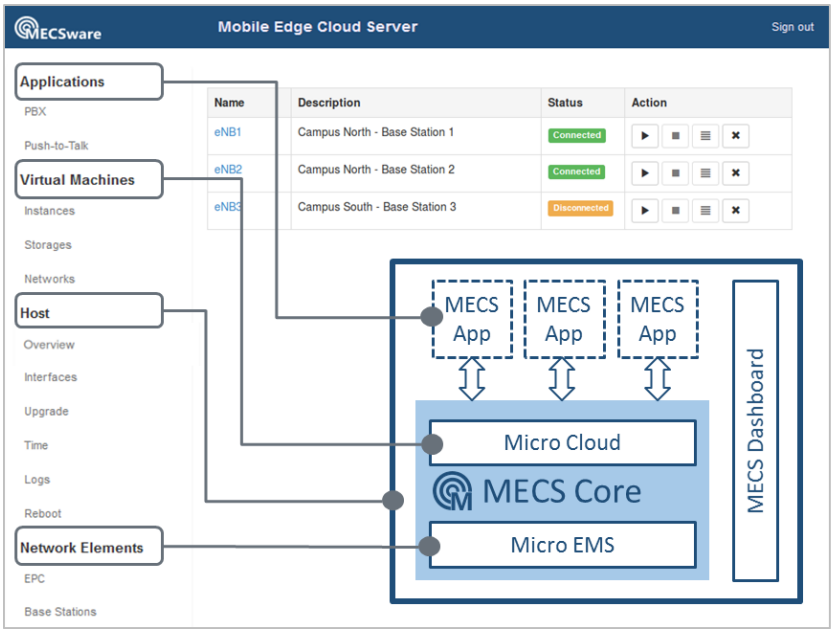
MECSware's solution is based on three main ideas:

Firstly, we are **using LTE radio technology** which has a much higher link budget compared to WLAN, thus supports large coverage areas more efficiently. This approach will also support the adoption of future 3GPP evolutionary steps such as LTE-M, also known as LTE for Machine-Type Communications (LTE-MTC), Narrowband LTE-M (NB-LTE-M) or NB-IoT. Through LTE's sophisticated end-to-end QoS management, latencies can be deterministically controlled.

Secondly, through **relocating LTE Core Network functions** to the enterprise site, our solution supports local routing and application processing, thus end-to-end latency issues due to long data paths will be avoided. Instead of having the data flowing over many hops through a Core Network which may be hundreds or even thousands of kilometers away, all data handling is performed on-site.



Thirdly, through **integrating a Micro Cloud** infrastructure, our Mobile Edge Computing Server (MECS) provides computing resources and storage capacity to user applications and connects them on the shortest possible path through the private LTE network with the user devices. Through adoption of industry-standard cloud computing principles, the integration of customer specific application software will be greatly accelerated. As an example, distributed IoT/M2M platform components could be implemented, but also communication services such as Push-to-Talk, so that employees can communicate with each other using the same infrastructure.



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