Cellular IoT - Past, Present, and Future

oneM2M Industry Day Tokyo | Andreas Neubacher | Dec. 2023

AGENDA

- Cellular IoT Use Cases
- Requirements on IoT connectivity
- Clever use of legacy technologies like 2G/GSM
- State of the art technologies like NB-IoT & LTE Cat-M
- Pitfalls and potential hiccups
- Facilitating a straightforward and scalable path towards IoT connectivity

Cellular IoT Use Cases

Outdoor

Water level measurement and warning network

In places that are not easy to reach

Temperature measurement of high voltage lines

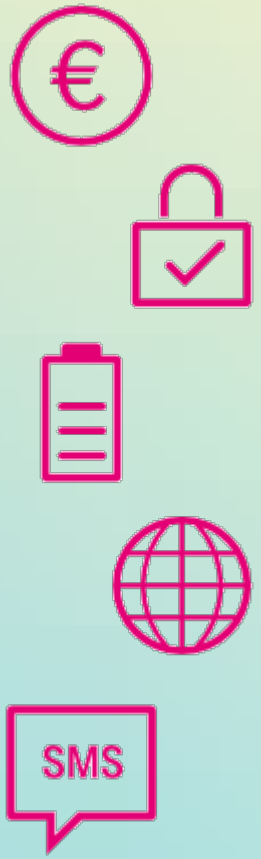
Deep indoor

Water metering for smart city system

pictures by courtesy of Microtronics

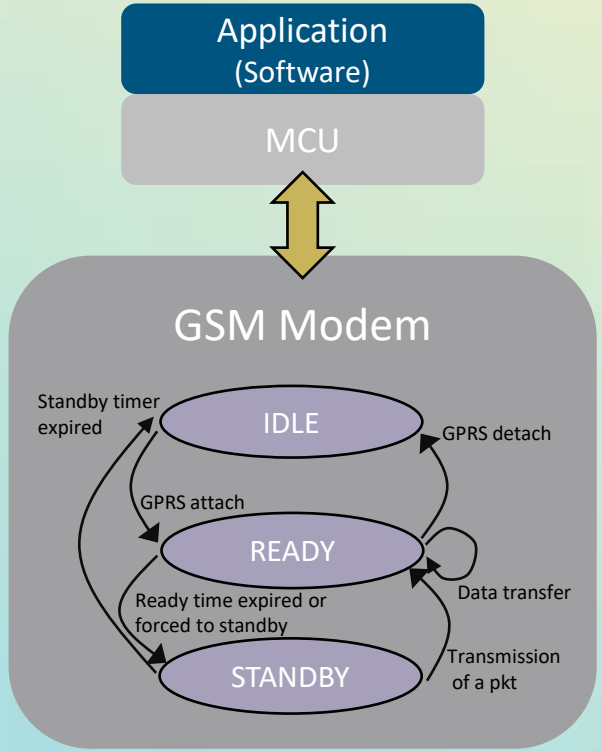
Requirements on IoT connectivity

- Low hardware Costs => to allow mass deployments
- End 2 End Security => to avoid additional overhead
- Low energy consumption => Improved battery life
- Reduced signaling overhead => improved energy consumption
- Support of SMS => to comply with legacy developments
- Global availability, and use => to allow a global deployment
- Improved Max Coupling Loss / Link Budget => to allow deep indoor deployments



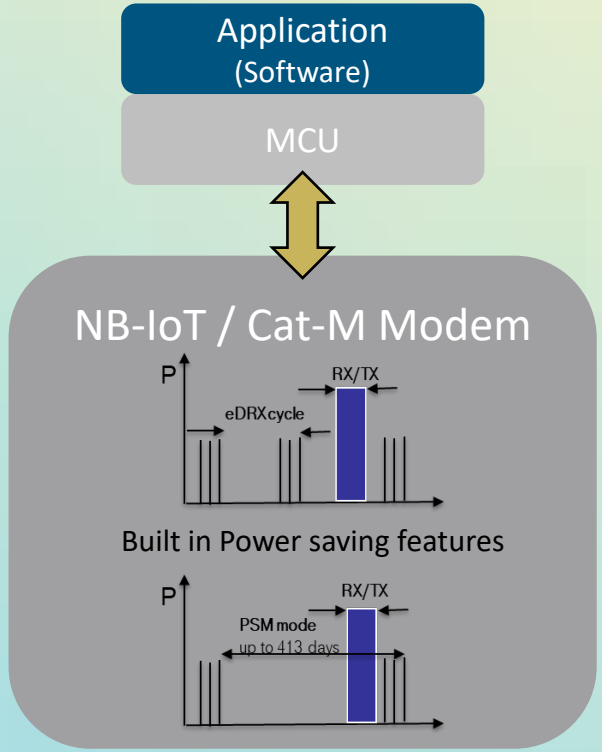
Clever use of legacy technologies like 2G/GSM

- Properties:
  - GSM modem technology is a very “low cost” technology
  - GSM networks widely and dense deployed
  - Fairly low Power consumption in IDLE state
- Usage for IoT:
  - For primarily uplink driven Applications:
    - In case of infrequent uplink data, detach from GSM network, and (re)-attach once date need to be sent, otherwise use IDLE mode as much as possible
- For up-downlink driven Applications:
  - use IDLE mode as much as possible, trigger of GPRS attach can be done by SMS



State of the art technologies like NB-IoT & LTE Cat-M

- Properties:
  - Reduced HW cost compared to mobile broadband LTE modules
  - Signaling overhead reduced compared to mobile broadband LTE modules
  - Improved MCL (Max Coupling Loss) / link budget
  - Power saving Features already part of the design
- Usage for IoT:
  - For primarily uplink driven Applications:
    - 3GPP developed the PSM mode (Power Saving Mode).
      PSM is similar too power-off, but the Device remains registered with the network. No need to re-attach or re-establishment of PDN connections are necessary.
- For up-downlink driven Applications:
  - 3GPP developed the eDRX mode.
    eDRX allows the device to turn parts of its circuitry off during the extended DRX period to save power. During the extended DRX, the device is not listening for paging messages. E.g. for NB-IoT eDRX cycles can be up to 174min.

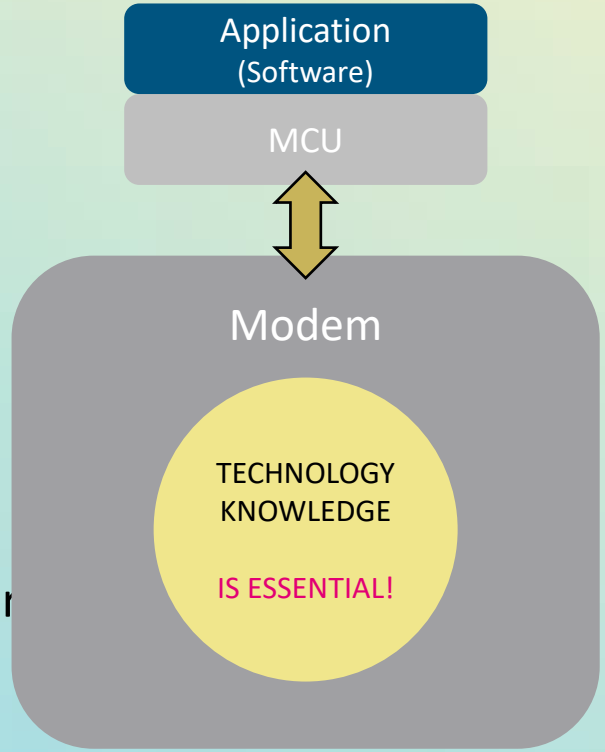


Pitfalls and potential hiccups

- Pay attention:
  - Avoid resetting modems! Think of cumulative effects on the server/backend side!
  - Avoid concurrent data transfer, especially in case many devices are deployed in the same area?
  - Power saving features are most likely depending on operator network configurations! Battery lifetime may vary considerably e.g. in case of roaming!
  - Protocols having built in “keep alive” functionality (e.g. TCP) may have adverse effects on Power saving features!
  - Operators roaming firewalls may terminate the connection in case no data transmitted for some time!

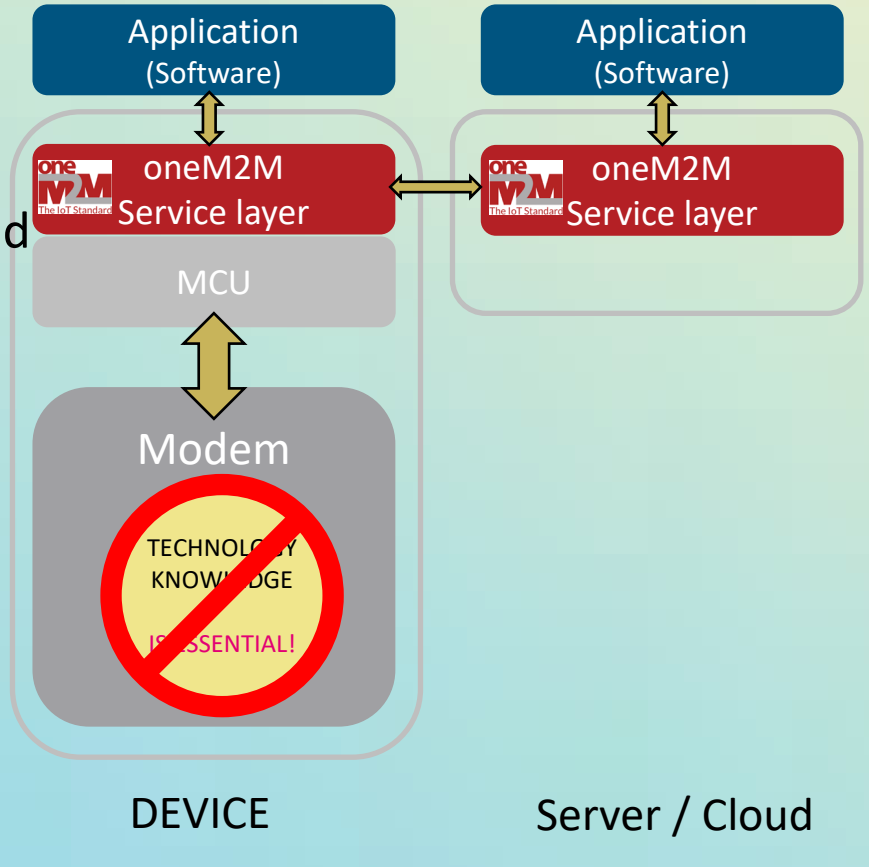
To avoid, Pitfalls and potential hiccups

- Technology independent issues to be considered:
  - Know your Use Case!
    - How often data need to be transmitted?
    - What's the data volume per transmission?
    - What's the direction (Up/Downlink)?
    - Where will the application be deployed, countries, outdoor, (deep)-indoor
- Technology dependent issues to be considered:
  - What are the basic states of the technology?
  - What are the is the average power consumption in this states or between ther transitions?
  - Are there Power saving features coming along with the selected technology?
  - How can those features be applied to the envisaged Use Case?
  - Are there Power saving features efficiently in context of the selected protocols?



Facilitating a straightforward and scalable path towards IoT connectivity

- Circumvent possible mistakes form scratch!
  - Build your Use case upon a standardized service logic, already considering and circumventing any pitfalls!
  - oneM2M service layer provides already built in functionality to avoid most pitfalls!
    - Work Items like “Effective IoT Communication to Protect 3GPP Networks” are dedicated to such problems
  - Application Software may just focus on the IoT Use case, and need not to take care on specific connectivity specifics



Questions?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