



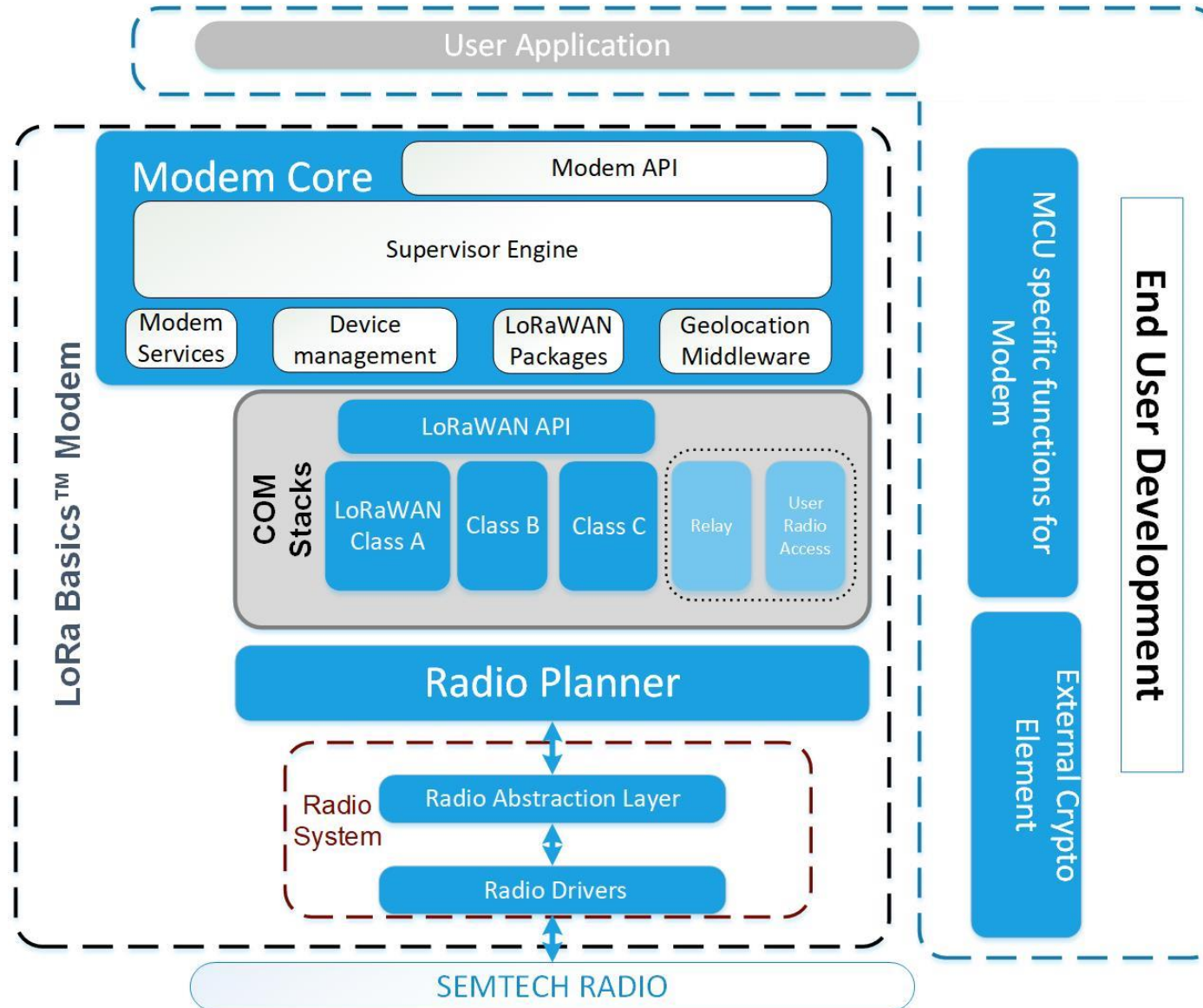
SEMTECH®

# Semtech Stack Evolution

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25 MAY 2023

# OVERVIEW / LoRa Basics™ Modem Architecture



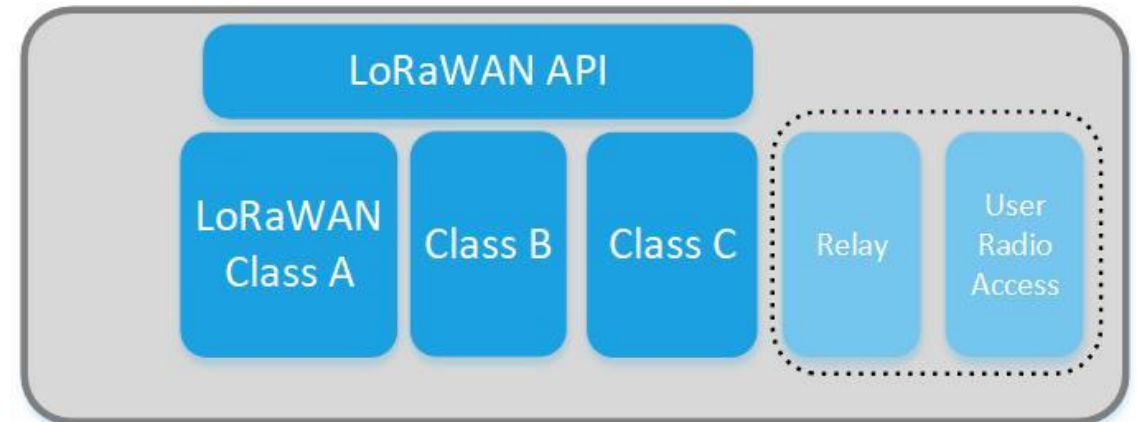
# OVERVIEW / LoRaWAN STACK

- **LoRaWAN® Stack Features:**

- L2 V1.0.4
- Class A, B and C
- Full RP2 –1.0.3
- LRFHSS support
- Management of Multicast (up to 4 sessions)
- LBT
- Duty Cycle ( both for normal transmissions and for join procedure)
- Passing LoRa Alliance® certification for all regions
- **Automatic board delay compensation (for rx1, rx2)**
- **Datarate Profile (Long Range, Low Power, Custom)**

- **LoRaWAN® Code Structure**

- A unique state machine in class A
- Class A, class B and class C implementation fully independent
- LBT and DTC are fully independent (services)
- Region fully separated (with REAL)
- Failsafe and watchdog integrated
- Nothing is done under it except flagging
- RTOS or bare metal
- Generic secure element interface (reuse from LoRaMac-Node™)
- Code size: 35 KB with 14KB for all regions
- Dedicated API



# Overview / Services / Upper layer

## LoRaWAN Packages:

- Clock sync package
- FUOTA (not publicly available)

## LoRa Basics™ Modem Services :

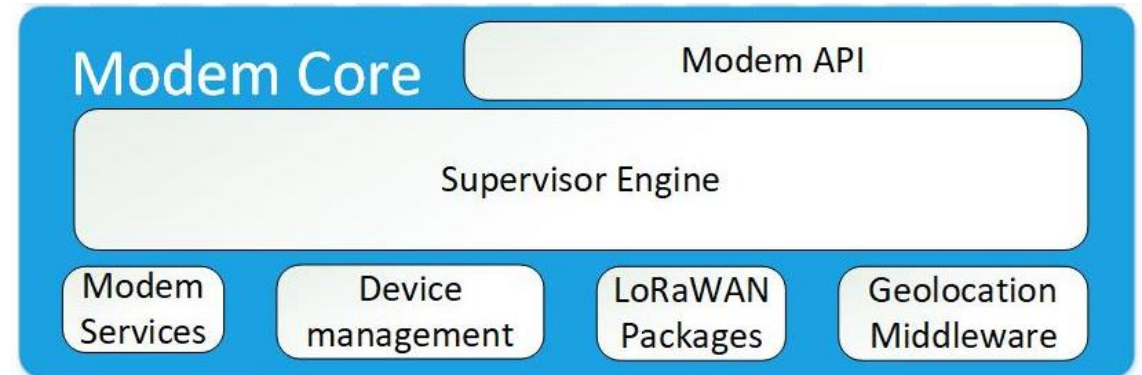
- Device management (cloud services)
- Large file upload (fragmentation + redundancy)
- Stream (fragmentation / aggregation + redundancy)
- Large file download
- Geolocation services (for LoRa Edge™)

## LoRa Basics™ Modem Supervisor:

- Launches and updates high-level tasks
- Arbiter between user request and internal services
- Scheduler, but without real-time constraints.

## LoRa Basics™ Modem API:

- Asynchronous events (Reset, Joined, TxDone, DownData, NewLinkAdr, ...)



# Overview / Simplified production

<b>LoRaWAN Certification</b>	LoRa Basics™ Modem certified by an independent test house
<b>FCC/ETSI ... certification</b>	Test mode embedded
<b>32K crystal accuracy</b>	Crystal error as an input to adapt timing for RX windows / ping slots Digital PLL to track beacon in class B
<b>Power offset, board delay,...</b>	Adaptative RX windows to estimate and compensate board delay (tcxo delay for example)
<b>Battery life estimation</b>	get charge natively implemented, distribution of data rates
<b>Reliability</b>	failsafe, watch dog, non regression test suites (end nodes to multiple network providers)
<b>Switch dynamically between region</b>	No impact on code size, only extra RAM
<b>LoRaWAN downlink for configuration</b>	Ex: Rejoin natively embedded even in 1.0.4
<b>FUOTA</b>	Natively embedded as a service (flag of compilation)
<b>Mcu Porting</b>	toolchain to ease/validate the mcu porting
<b>Check FW download in production</b>	provide firmware version with a short delay

# Key Requirements

- Reduced complexity:
  - Just for Class A : Fine tune RX timing (32k) , back off procedure, max payload size, ack strategy, rejoin, certification, test mode, FOPTS or port 0, multiple regions support
- Release radio access after LoRaWAN transaction
- Reliability
- Code size / Ram size reduction
- State of the art of the TC recommendations
- MCU agnostic
- Bare metal or RTOS
- Ready for production

# What's Behind

- Development started in 2017
- Feedback collected with LoRaMac-node (Miguel LUIS is a key contributor)
- Feedback coming from both end node customers and GW providers
- Extremely involved in the LoRa Alliance (for ex: LBM is ready for relay features)
- 4 fulltime C developers and up to ~10 with contractors
- Reliability:
  - ISO9001 certified
  - A dedicated (independent) validation/verification teams
    - *Non regression end to end tests (nightly, light, full)*
    - *RF validations tests in temperatures (PER, Power, ...)*
    - *Multiple NS are continuously tested (SENET, TTN, ORANGE, HELIUM, CHIRPSTACK,...)*
    - *Use an independent test house (DEKRA) to certify the stack*
    - *Estimated duration ~ 1 month for the overall validation & certification*



# LBM Demo

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## What are the differences between the two stacks?

- Support multiple radio access
- **Data Rate Profile** (long range, low power, custom)
- A unique state machine in class A
- Class A, Class B and Class C implementation fully independent
- LBT and DTC are fully independent (services)
- Failsafe and watchdog integrated

## What would compel developers to use this version of the stack?

- Relay, stack V1.2, interleave LoRaWAN standard with another protocol in parallel, multi-stacks, multiple regions in parallel

## If there are differences in protocol behavior between the two, how to deal with that?

- No

## Is it 100% backwards compatible?

- User API is different

## Licensing terms?

- BSD 3-Clause Clear License

## Pass LCTT and certification?

- Yes, all regions certified both with LCTT and DEKRA test house



For the latest version of  
**LoRa Basics™ Modem**

Visit



<https://github.com/Lora-net/SWL2001>

