LoRaWAN® ENABLES SMART ELECTRICITY METERS IN INDIA

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LoRaWAN® Live!
New Delhi, India
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Energy & Utilities sector is expected to comprise 25 percent of India's IoT market ($3.75 billion by 2020)

Source : moneycontrol.com https://www.moneycontrol.com/news/technology/energy-and-utilities-industrial-manufacturing-to-lead-iot-space-iamai-2761591.html

Utilities and Digital Transformation

India is estimated to install 130 million smart meters by 2021

Source: *asian-power.com*
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=2ahUKEwiO24f46JDlAhXWR30KHa_oB-8QFjADegQIBBAC&url=http%3A%2F%2Fasian-power.com%2Fsites%2Fdefault%2Ffiles%2Fasianpower%2Fprint%2FAPMay_2013_lr_12.pdf&usg=AOvVaw1iLsD3fcoaD4pSZc1VWW5S

Opportunities for LPWAN in Utilities Market

Use cases and benefits:

- Meter-to-cash services
- Remote switch control
- Eliminate electricity theft
- Outage management
- Integration of renewable or distributed energy resource systems
- Storage and demand response programs

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Why LoRaWAN® For Smart Meter?

- Low power operation as compared to other technologies

- Factory commissioning

- Easy maintenance

- True IOT network

- Highly secure network, with help of secure element

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India Smart Meter Requirements

- IS16444 compatible meter

- Large number of tamper requirements

- Large load-survey data

- Large billing data from meter to server

India Smart Meter LoRaWAN® Challenges

- IS16444 packet size is large

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Instantaneous Readings: (108+ bytes)
10/10/2019 12:31:15.997 [TX] - 7E 00 1E 10 00 00 00 00 00 00 00 FF FF FF FE 00 00 24 43 50 47 45 54 10 00 FF FF
FF FF 40 00 BC A6 AF
10/10/2019 12:31:16.108 [RX] - 7E 00 68 10 00 00 00 00 00 00 00 00 00 FF FE 00 00 24 43 50 50 53 48 5A 00 F0 2E
01 00 40 00 E8 63 4A 27 00 00 00 00 00 00 52 09 00 00 00 00 00 00 00 00 F4 01 00 00 00 00 00 00 08 00 0F D3 00
00 01 00 00 00 00 00 00 00 80 63 4A 27 00 00 00 00 00 00 00 00 00 00 57 01 00 00 00 00 00 00 00 00 00 00

Load-survey Example: (86+ bytes)
10/10/2019 12:32:25.827 [TX] - 7E 00 1E 10 00 00 00 00 00 00 00 FF FF FF FE 00 00 24 43 50 47 45 54 10 00 FF FF

Billing Data Example: (232+ bytes)
10/10/2019 12:33:08.860 [TX] - 7E 00 1E 10 00 00 00 00 00 00 00 FF FF FF FE 00 00 24 43 50 47 45 54 10 00 FF FF
FF FF 43 00 BC 56 FC 7E 00 1E 10 00 00 00 00 00 00 00 FF FF FF FE 00 00 24 43 50 41 43 4B 10 00 FF FF FF FF 43
00 CE F1 60
10/10/2019 12:33:10.384 [RX] - 7E 00 E4 10 00 00 00 00 00 00 00 FF FE 00 00 24 43 50 44 41 54 D6 00 F0 2E
01 00 43 00 80 63 4A 27 64 00 57 01 00 00 00 00 00 00 00 00 57 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 52 01 00 00 00 00 00 00 00 00 52 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 28 05 E0 69 22 27 00 00 00 00 00 28 05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 E0 69 22 27 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 14 05 E0 69 22 27 00 00 00 00 14 05
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 E0 69 22 27 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 9F 02 00 00 E7 EA D6
```

- LoRaWAN packet size for India

  - SF 12 : 51 bytes
  - SF 11 : 51bytes
  - SF 10 : 51 bytes
  - SF 9 : 122 bytes
  - SF 8 : 222 bytes
  - SF7 : 222 bytes

Need to have High Capacity Network

Large Number of Gateways

Cost of Network Deployment is High

- Atlist SF8 network required for single packet data transfer

- Fragmentation is another option
  - For accurate fragment reception, confirm packet required
  - Confirm packet will increase overhead on gateway

Possible Solution No. 1

• Processing IS16444 packet at LoRa-Module end

Pros	Cons
• Data payload can be very small • Data can be push to network sever • No latency, if class C implemented • Parodic Data delivery can be with UNCNF packet • Tramper can be treated as events for NS and pushed by node stack	• Complex software implementation over LoRaWAN stack on small microcontroller • One more specification required on top of IS16444 • Data specification required for application server • Memory requirements will be higher at end LoRaWAN end node • Data management and storage need to be implemented on LoRaWAN end node • Multiple data packets need to send, for generating required data for end user • CNF need to use for less data losses

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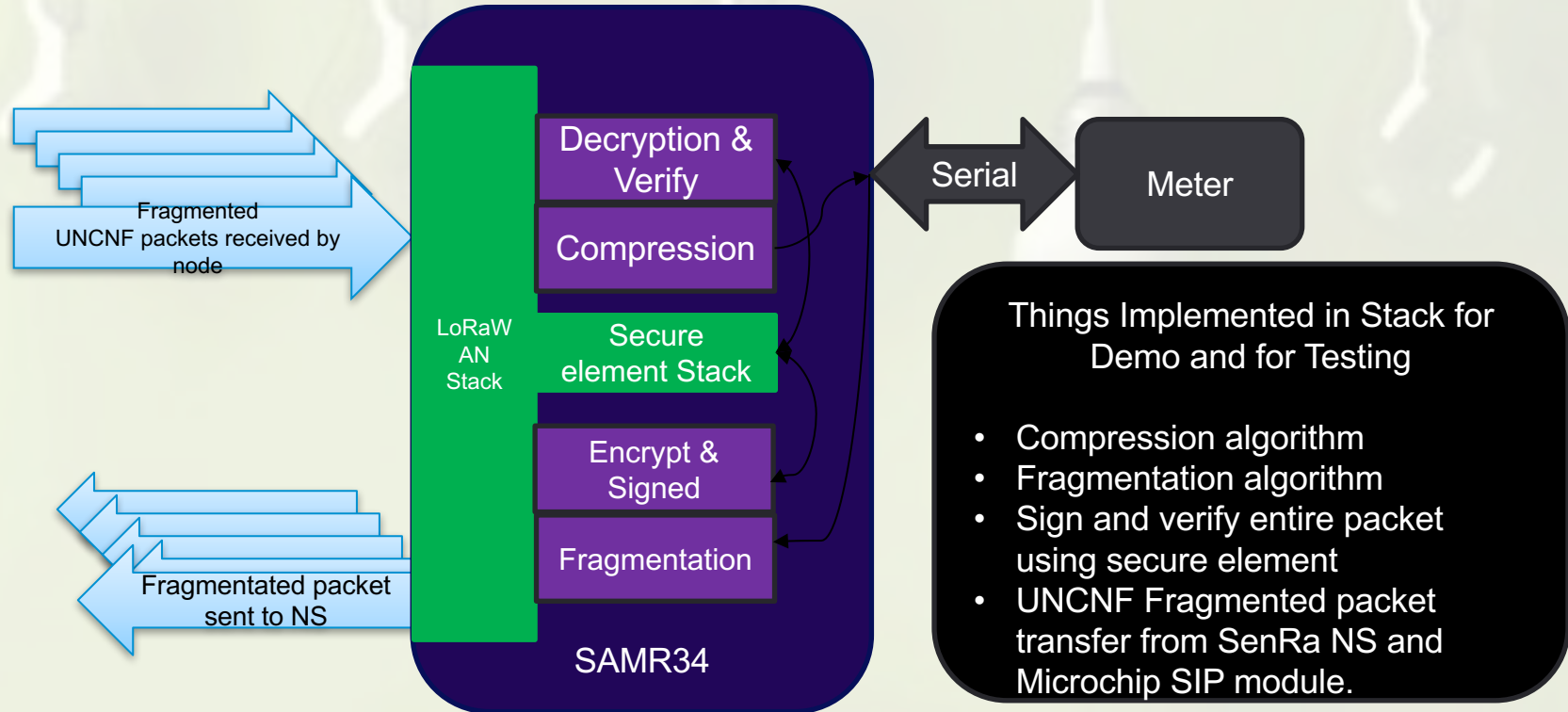
Possible Solution No. 2

- Simple Forward Error Correction (FEC) code can be used for fragmented transport, similar to FUOTA documented by LoRaWAN

- Adding FEC in the data fragmentation process allows an end-device/NS to autonomously recover the full data even in the presence of lost frames without having to systematically request the missing fragments

- With help of ADR and current data length number of redundancy packets and number of fragmentation can be automatically adjust

- FEC data transfer is designed for UNCNF data transfer

- UNCNF data transfer will reduce overhead on gateway

- Standard "IS16444 Compliant Head End System (HES)" reading tools can be used at application server to get data

- Standard protocol from end to end, makes LoRaWAN end node less complex, easier for end user to process data

- Each data packet can be encrypted and signed with secure element for better security

- No need of Specific data rate network, Fragmentation size can be of 51 bytes.

- Result in Simple Secure and connected Network for India energy meter market
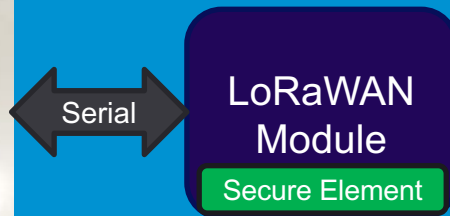
- Cons: more data for simple packet.

Smart Electricity Meters over LoRaWAN®

Smart Electricity Meters over LoRaWAN®
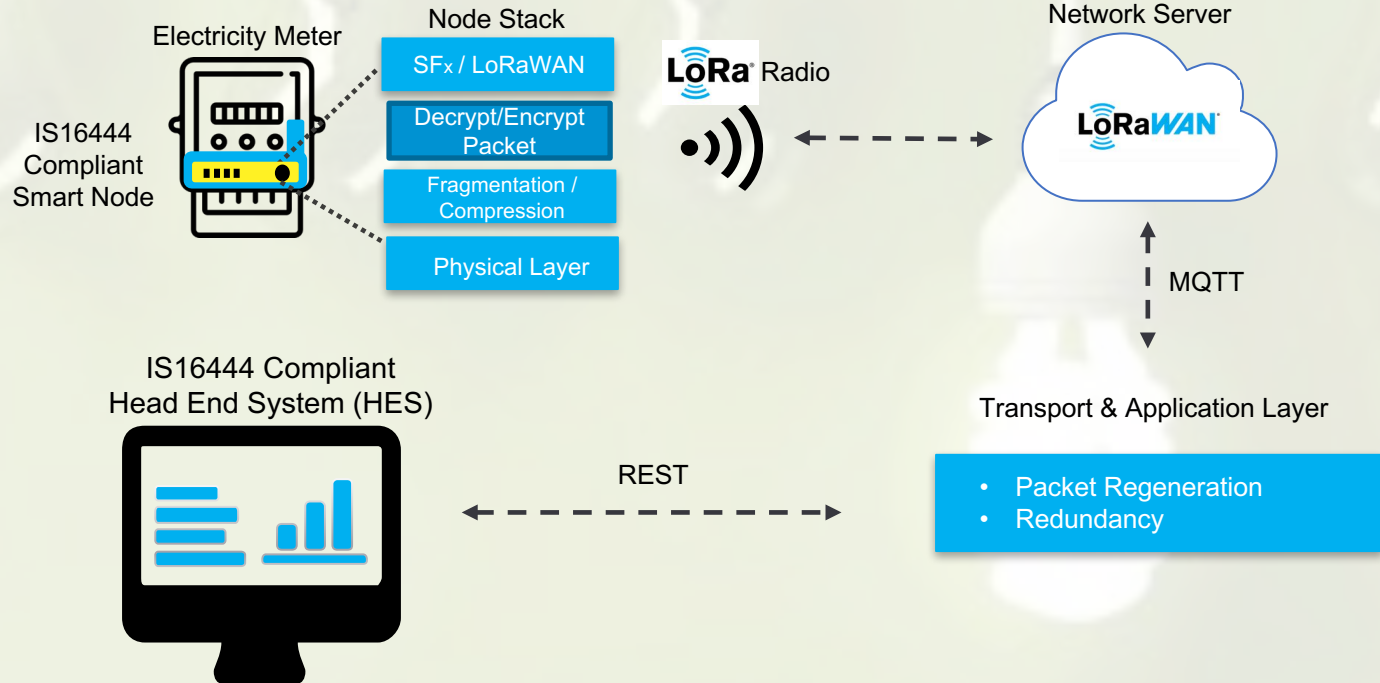
Serial ↔ LoRaWAN Module / Secure Element

Following Devices Used for Testing and Demo
1. ATMSAMR35J18A based Module
2. ATECC608A-SSHDA-B for secure Element.

- **Simple connection**
- **Module connected to meter on serial port**
- **Fragmentation header at port 13**
- **Fragmentation TX port 12**
- **Fragmentation RX port 20**
- **LoRaWAN module will be transparent on rest of port number**
- **Secure singed fragmented data transfer using secure element**

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Smart Electricity Meters over LoRaWAN®

- India smart meter data (larger data) requirements has been "taken into consideration"
- Data fragmentation and compression algorithm help to transfer larger data, like 1024/512/256 over LoRaWAN
- Secure element makes sure data will be secure for end point
- Fragmentation make possibilities to send data over UNCONF packet
- True intelligent fragmentation size with help of ADR, to transfer data faster and more reliably

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DEMO

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