

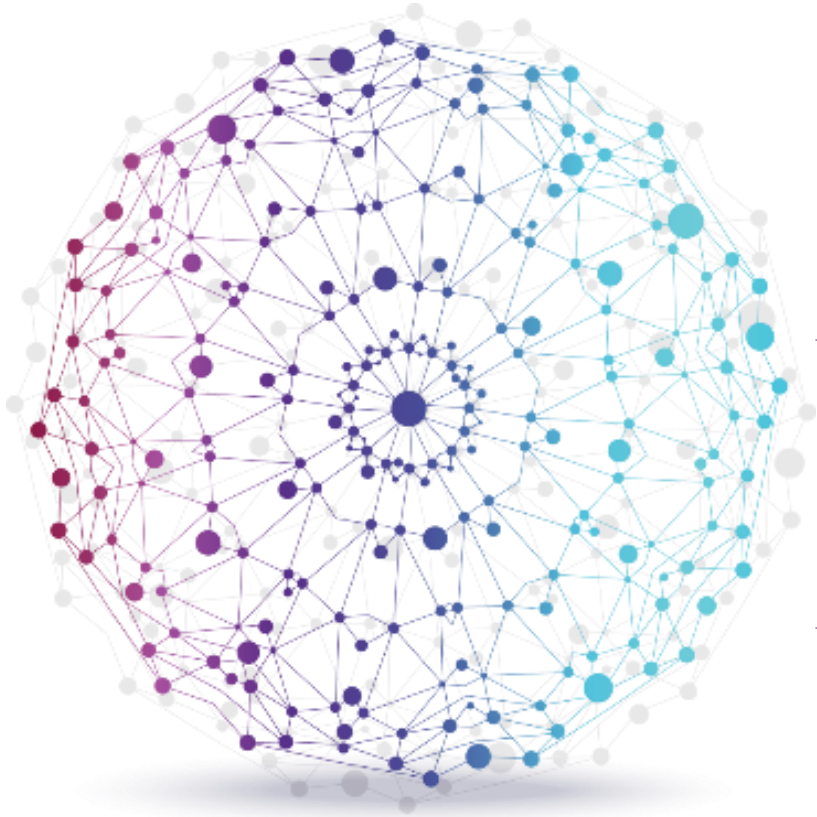


**Ministry of New and Renewable Energy
(MNRE)**

Guidelines for State Level SEDM Platform Development



Topics Covered



1

National & State Level Solar Energy Data Management (SEDM) Platform

- National Level SEDM : Vision
- High Level Software Architecture
- Module Level Software Architecture

2

State Level SEDM Platform – System Related Software Module Details

- Consumer Management
- Project Progress Management
- Asset Management
- Complaint and Ticket Management
- Live Asset Monitoring
- Performance Analysis
- Report Manager

3

State Level SEDM Platform – Device Integration Software Modules

- Device Management
- SCADA Tag Processing
- Events & Notification Processing
- Database Server with Archiving and Historian
- MDAS & MDM

4

State Level SEDM Platform – Other Modules

- User and Role Management
- Site Survey Mobile Application
- Farmer Mobile Application

5

Annexures

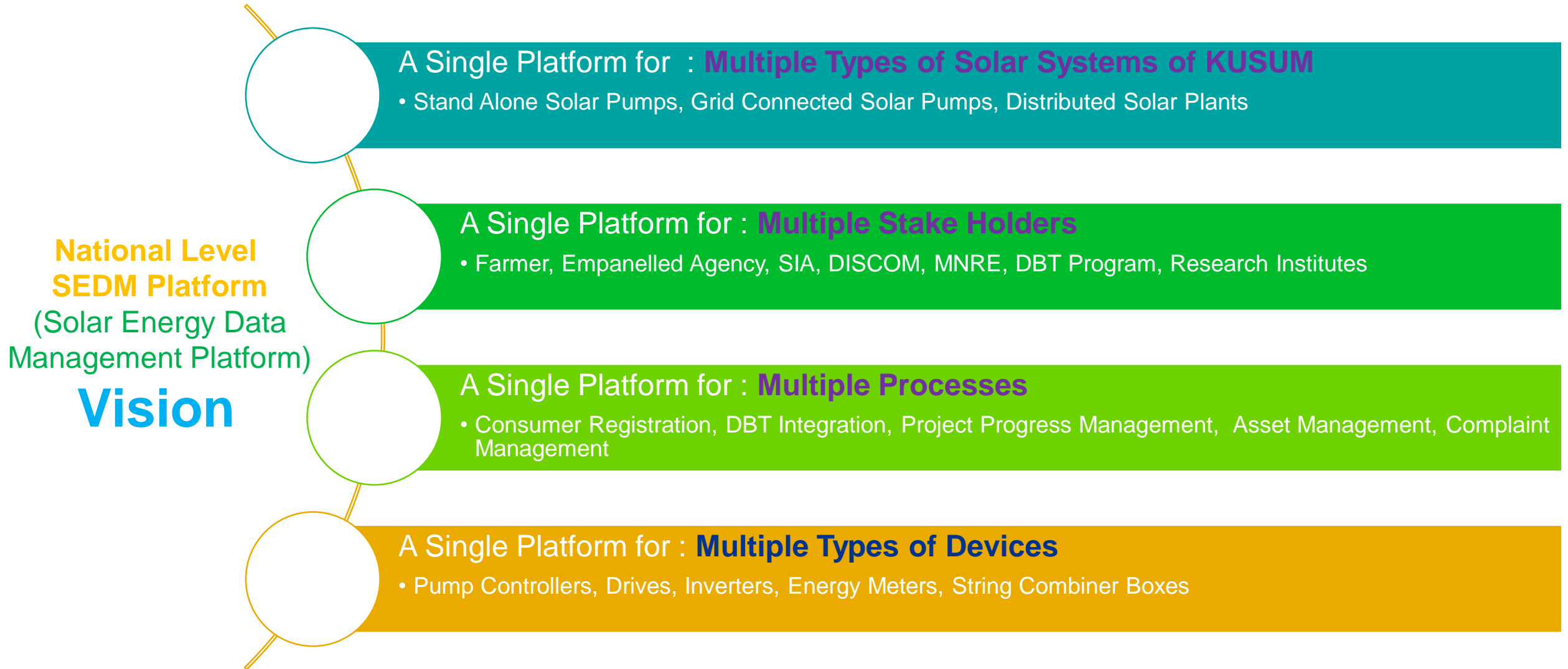
- Annexure -1 : RMS Integration with State Level SEDM Platform
- Annexure -2 : System Component & Architecture for KUSUM Component A, B, C
- Annexure -3 : List of Consumer Information for Beneficiary Tracking
- Annexure -4 : Data Integration between National and State Platform

National and State Level SEDM Platform

Overview & Architecture

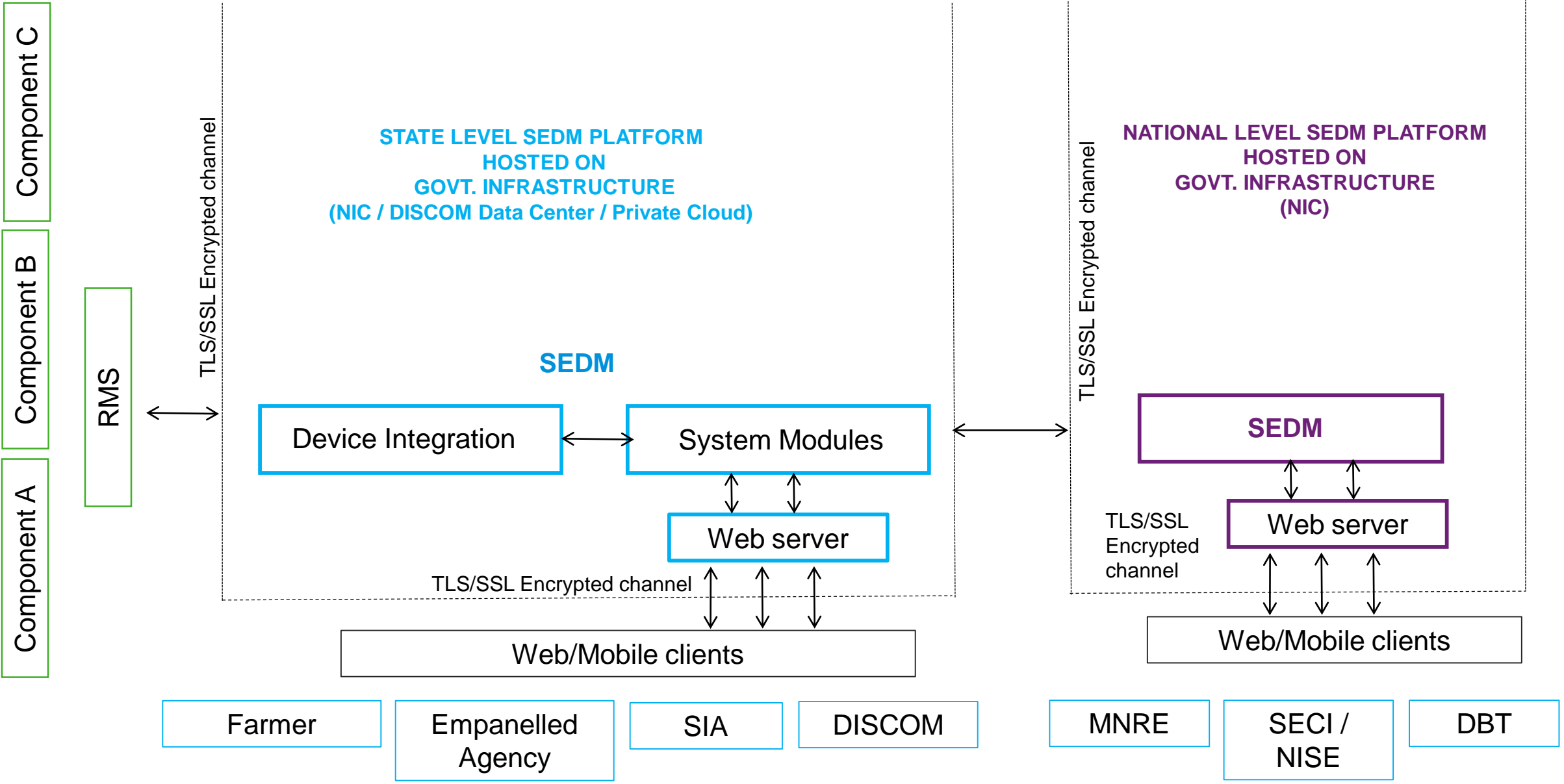


One Nation - One Solar Energy Data Management (SEDM) Platform for PM-KUSUM



High Level System Architecture (with reference to EESL Tender Annexure 8)

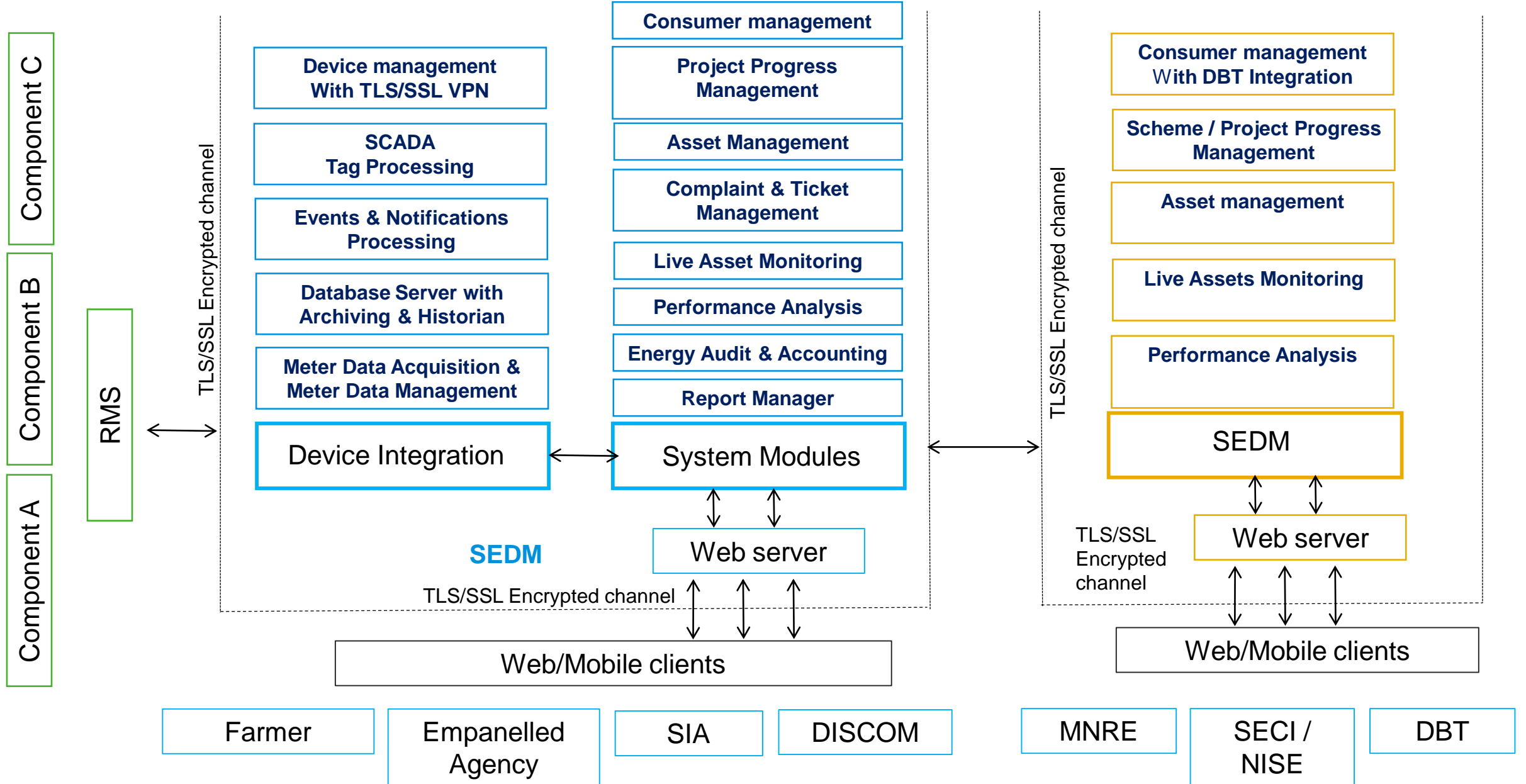
Scalability to Manage Thousands of Systems Security using TLS/SSL VPN Data Integrity by Hosting on Govt. Infrastructure



**RMS
Field Systems**

State Level SEDM Platform

National Level SEDM Platform



System Related Software Modules



Consumer Management

- **Consumer Registration Process**
 - **Add/Edit/Delete Consumer with multiple Details**
 - Application and Consumer Information
 - Contact and Location Details
 - Irrigation Information
 - Agriculture Information
 - Pump Information
 - Solar Plant Details
 - Bank Details
 - Service Center Details
 - Financial / Commercial Details
 - **Multiple Options for Registration**
 - Web User Interface for consumer details
 - .csv bulk upload
 - For Component-C, API based integration with existing Utility CRM
- **Consumer Unique Identification**
 - Primary Identification : Mobile Phone Number
 - Secondary Identification : Adhar Number / Consumer Service Number
- **Consumer Profile on Mobile Application**
 - Credentials : Username, Password with SMS based password update
 - Consumer Profile Update

Beneficiary Tracking Details

Application &
Consumer Details



Agriculture Details



Bank Details



Contact &
Location Details



Pump Details



Agency Details

Irrigation Details



Solar Details



Financial &
Commercial
Details



Consumer
Registration Form



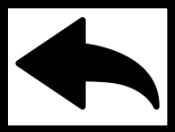
Site Survey Form



Vendor
Registration Form

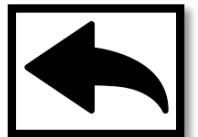


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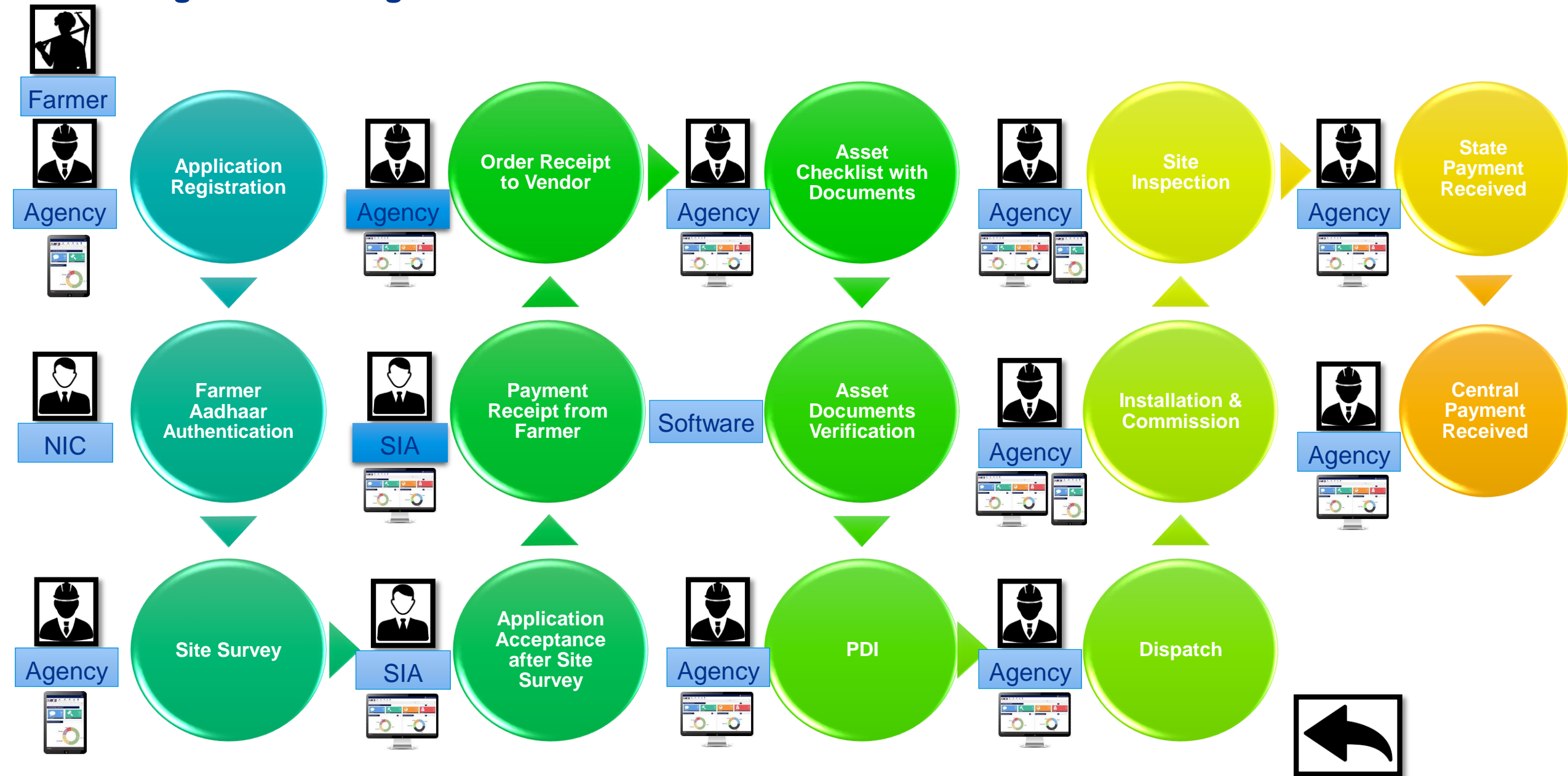


Project Progress Management

- **Provision to Update and Track Multiple Application Status for Work Flow**
 - 14 Primary Application Status for National Platform requirement
 - Based on State requirement they may add sub status
- **Work Flow with User and Role Management**
 - User from State Implementing Agency or Empaneled Agency may update the status of Application with Date
 - Access to User and Work Flow sequence for sub status may be decided by state implementing agency
- **Provision to Update Application Status in Multiple Modes**
 - Individual Application Status Update
 - Bulk Update
 - To select multiple consumer application number and update the status with date and document ref number
 - District wise .csv upload of multiple applications with status dates
 - Web or Mobile User Interface to update Application Status from Various Modules

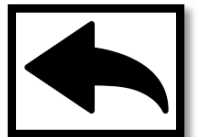


Progress Tracking Work Flow

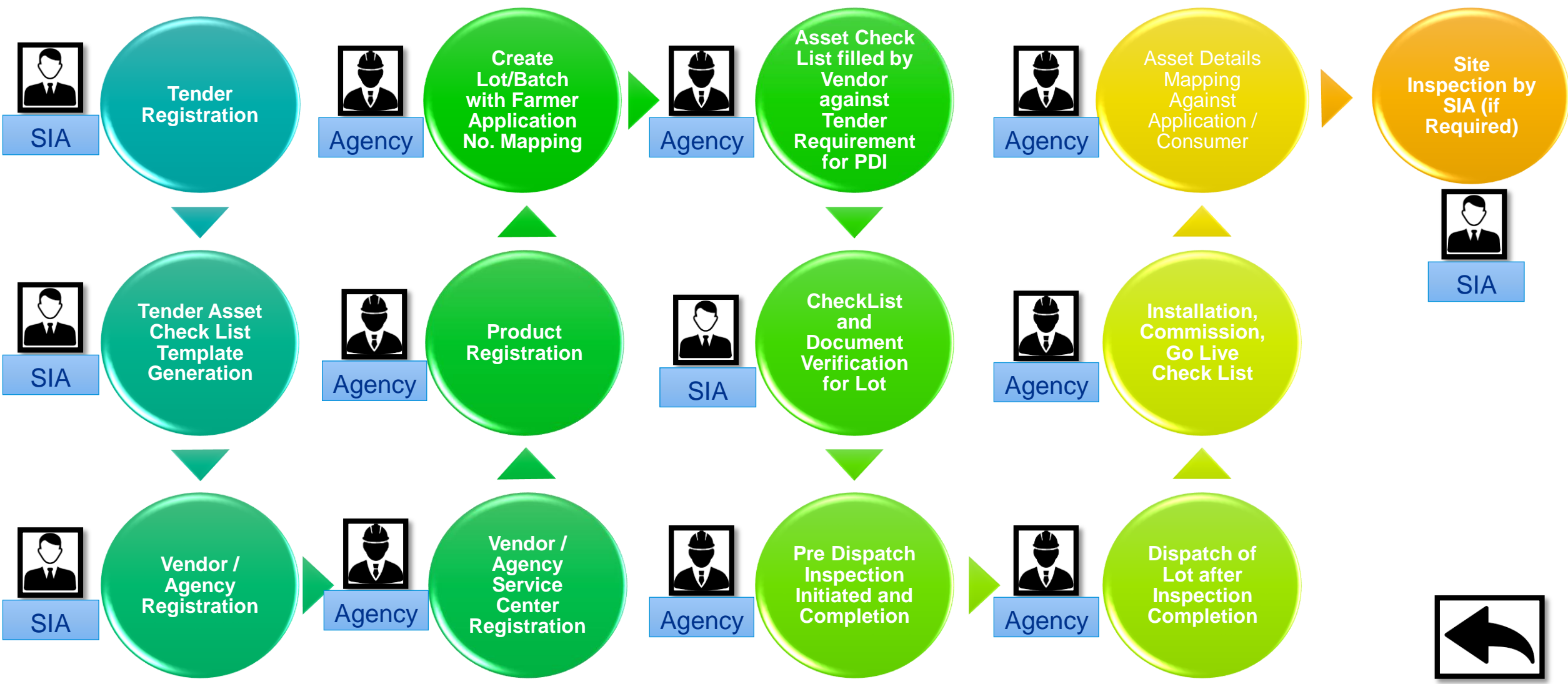


Asset Management

- **Template Generation** : Register a tender and generate specification Check List Template against individual Item
- **Item Registration** : Panel, Pump Sets, Pump Controllers, Inverters, String Combiner Box, Meters, RMS
- **Vendor Registration** : Registration of Manufacturers, Dealers/Distributors, System Integrators
- **Asset Registration** : Vendor can register bulk assets against a lot prepared for PDI (Pre Dispatch Inspections)
 - **Solar Assets** :
 - Solar Panels with Serial Number of Individual Panel
 - String Combiner Box, AC DB, DC DB
 - Inverter
 - **Pump Assets** :
 - AC/DC Pump
 - Pump Controller / Drive
 - **Metering Assets** :
 - Bi Directional Net Meter
 - Generation Meter and Pump Consumption Meter
 - **Remote Monitoring and Data Acquisition System**
 - Remote Communication : GSM / GPRS / 3 G / 4 G / NB- IoT
 - Geo Location Sensing : GPS / GNSS / Manual Configuration
 - Local Communication : Ethernet / Bluetooth / Wi-Fi
 - Field Interfaces : Analog Inputs, Digital Inputs, Digital Outputs
- **Asset Check List** : Vendor can fill up check list against template requirements with required documents to speed up PDI
 - Ratings, Specifications, Type Tests, Certificates
- **Consumer Asset Registration Mapping**
 - Make, Model No, Serial No, Manufacturing Date, Warranty Details
- **Consumer Asset Replacement**
 - Replacement Details with Date
 - Report generation for Asset Replaced



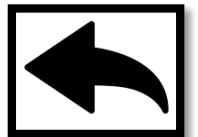
Asset Tracking Work Flow



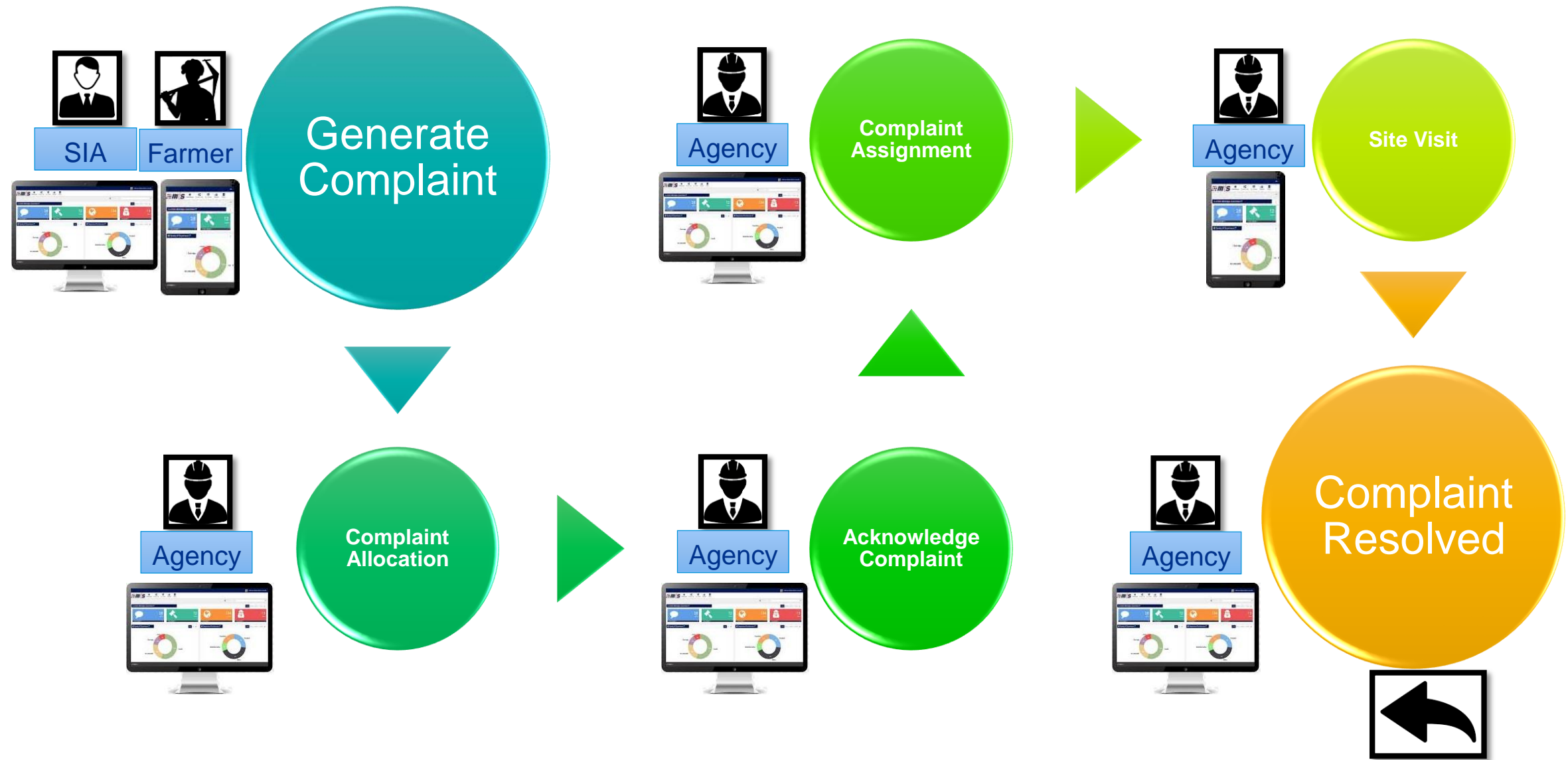
Complaint and Ticket Management

Acknowledge . Allocate . Respond . Resolve . Analyse

- **Complaint Logging :**
 - Farmer Mobile Application
 - Implementing Agency Engineer
- **Ticket Generation and Allocation :**
 - Ticket generation against complaint
 - Ticket Allocation to respective Vendor
- **Ticket Status Tracking :**
 - Acknowledgement
 - Allocation
 - Assignment
 - Site Visit – Status update by Vendor
 - Resolution – Resolved Status update by Vendor
- **Ticket Analysis :**
 - Time Taken to Acknowledge, Respond and Resolve a ticket
 - Reason and Component Failure Analysis



Complaint & Ticket Management Work Flow



Asset Live Monitoring

Monitoring . Configuration . Control . System Diagnostics

- **Monitoring of Live Parameters on Dash Board with Map View**
- **Navigation :**
 - It shall be possible to navigate from State to District to Individual Consumer on a single page in Map View
 - At State and District Level Summary of Parameters to be displayed in Pop Window
- **List of Important Parameters to be displayed in pop Window:**
- Electrical Parameters
 - DC/AC - Voltage, Current, Frequency
- Power Parameters
 - Solar kW, Pump kW, Net kW (Import / Export)
- Status and Running Hours Parameters
 - Geo Location Mismatch Status, Pump Status, Inverter Status – On/Off/Alarm, Grid Status – Not Available, Single Phase, Three Phase
- Communication Status
 - Live / Connected / Disconnected Status
 - Last Time Stamp
 - Last RSSI (Signal Strength)
- **Entire Architecture should be based on Pub Sub Model and integrated with National Level Platform**
- **Configuration of Parameters :**
- Configuration of Protection Limits
- **On Demand Operations and control :**
- Remote Pump Operations
- Remote Appliance control
- **System Diagnostics :**
- Error / Fault / Warnings of drives/controllers/inverters
- Communication failures
- Grid Failures and single phase / three phase switching

Live Operational Status – Instantaneous Parameters with Geo Location

IA Level : On Line Data From Remote Monitoring System – IIoT SCADA, Pub Sub Communication Model

Live Geo Location of all Assets deployed under KUSUM A, B, C

Component -A

- String (200-500 kW) : DC - V, I, kW
- Inverter (500 -1500 kW) : DC & AC – V, I, F, kW, kVAR
- ICR (1500 – 2000 kW) : DC&AC – V, I, kW
- MCR (2000 – 10000 kW) : AC – V, I, kW
- Status : String, Inverter, Breaker, Plant, Connectivity

Component -B

- Pump Controller : DC / AC – V, I, kW
- Pump : Frequency, Water Flow Rate
- Status : Pump Controller, Pump, Connectivity

Component-C

- Grid Parameters : Voltage, Single Phase, Three Phase
- Inverter : DC & AC – V, I, F, PF, kW, kVAR
- Net Meter : V, I, PF, F, kW, kVAR
- Pump : I, kW, Water Flow Rate
- Status : Inverter, Pump, Import / Export , Connectivity
- Status : Inverter, Pump, Import / Export , Connectivity

State Level : BOTs for Analysis and Summary of On Line Data

Consumer Summary from Raw Data

Feeder Level Summary – Sum, Count, %

DISCOM Level Summary – Sum, Count, %

Summary Parameters:

Number of Systems Connected : Total and %

Number of Pumps On : Total and %

Number of Generation On : Total and %

Solar Generation : Total kW and % of Installed Capacity

Pump Load : Total kW

Net (Import/Export) Load : Total kW

Water Flow : Total Water Flow Output

National Dash Board : Subscribe and Filter On Line Data

Subscription of Sum / Count / % Data

National Summary

State / DISCOM / District wise Summary

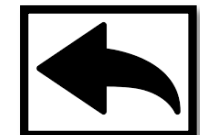
Mapping and Sorting of Data

Chart Representation

- Google Map Indicators for Display of Summary Parameters in Pop Window against each Location

- Top Five States against parameter

- Last Five States against parameter



Key Performance Analysis

System Performance Analysis . Irrigation Analysis . Energy Transaction Analysis

- **Duration Selection Filter**
 - Between Any Dates From Last Two Months
 - Standard Duration Options : Last Week / Current Week / Last Month / Current Month
- **System Performance Analysis**
 - Solar Performance Analysis – Generation, %CUF, %PR
 - Pump Performance Analysis – Pump Consumption vs. Running Hours
 - Grid Performance Analysis – Running Hours in Single Phase/Three Phase/Over Voltage/Under Voltage
 - RMS Performance Analysis - % Data Availability, % Device Connectivity
- **Irrigation Analysis**
 - Pump Running Hours / Usage vs. Season, Area, Crop
 - Water Discharge / Usage vs. Season, Area, Crop
- **Energy Transaction Analysis**
 - Solar Generation, Pump Consumption, Import, Export, Net Energy
- **Navigation :**
 - It shall be possible to navigate from State to District to Individual Consumer on a single page in Map View
 - At State and District Level Summary of Parameters to be displayed in Pop Window
 - On selecting any parameter from pop window, It shall be possible to have display of Day wise Trend for selected duration

Energy transaction – Performance Analysis – Irrigation Analysis

IA Level : Archived Data From Remote Monitoring System – SCADA with IIoT Based Comm., Pub Sub Model

Component -A

- String (200-500 kW) : DC kWh, Running Hours, %CUF
- Inverter (500 -1500 kW) : kWh, kVARh, Running Hours, %CUF
- ICR (1500 – 2000 kW) : kWh, kVARh, %CUF
- MCR (2000 – 10000 kW) : kWh, kVARh, %CUF
- Connectivity : % Connectivity, % Data Availability

Component -B

- Generation : kWh, Running Hours, %CUF
- Pump : Running Hours, Till Date Water Discharge
- Connectivity - % Connectivity, % Data Availability

Component-C

- Grid : % Three Phase Supply, % High Voltage Run Hours
- Generation : kWh, Inverter Running Hours, %CUF
- Net Meter : Import kWh, Export kWh, Net kWh
- Pump : Pump kWh, Pump On-% Low PF Run Hours, Total Water Discharge
- Connectivity - % Connectivity, % Data Availability

State Level : BOTs for Analysis and Summary of Archived Data

Consumer Summary from Raw Data

- Feeder Level Summary – Sum and %
- DISCOM Level Summary – Sum and %

Summary Parameters:

Total Energy Transaction : Import, Export, Net Energy

% Availability : Connectivity, Data, Grid Three Phase

Solar Performance : % CUF

Running Hours : String, Inverter, Pump, Feeder

Power Quality : % High Voltage Run Hours, % High kVAR Run Hours, % Low PF Run Hours

Irrigation : Water Discharge, Pump Run Hours in Day Time

National Dash Board : Subscribe and Filter Archived Data

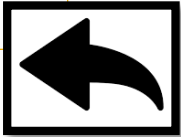
Subscription of Data Archived Data

- National Summary
- State / DISCOM / District wise Summary

Client Side Processing of Data

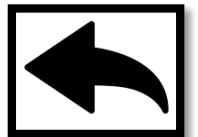
Chart Representation

- Google Map Indicators for Display of Summary Parameters in Pop Window against each Location
- Over All Summary of multiple Performance Indicators
- Top Five States (Against Performance Parameter)
- Last Five States (Against Performance Parameter)



Report Manager

- **Reports generation with multiple duration filters :**
 - Last Week,
 - Last Month,
 - Current Week,
 - Current Month,
 - Current Billing Cycle,
 - Between User Configurable Dates
- **Report Generation for multiple performance indicators :**
 - Running Hours
 - %CUF
 - Pump Consumption
 - Solar Energy Generation
 - Billing : Net, Import, Export of Energy
 - Loss Calculations
 - Abnormal Electrical System Reports : Over Voltage, Voltage Un balance, Over Load, Un Balance Load, High Temp.
 - Instantaneous Parameters : Min., Max., Average values of Voltage, PF, Power etc.
 - % Device Connectivity
 - % Data Availability
 - Comparison & Correlation Reports : Comparison of two duration/season , comparison of two products etc.



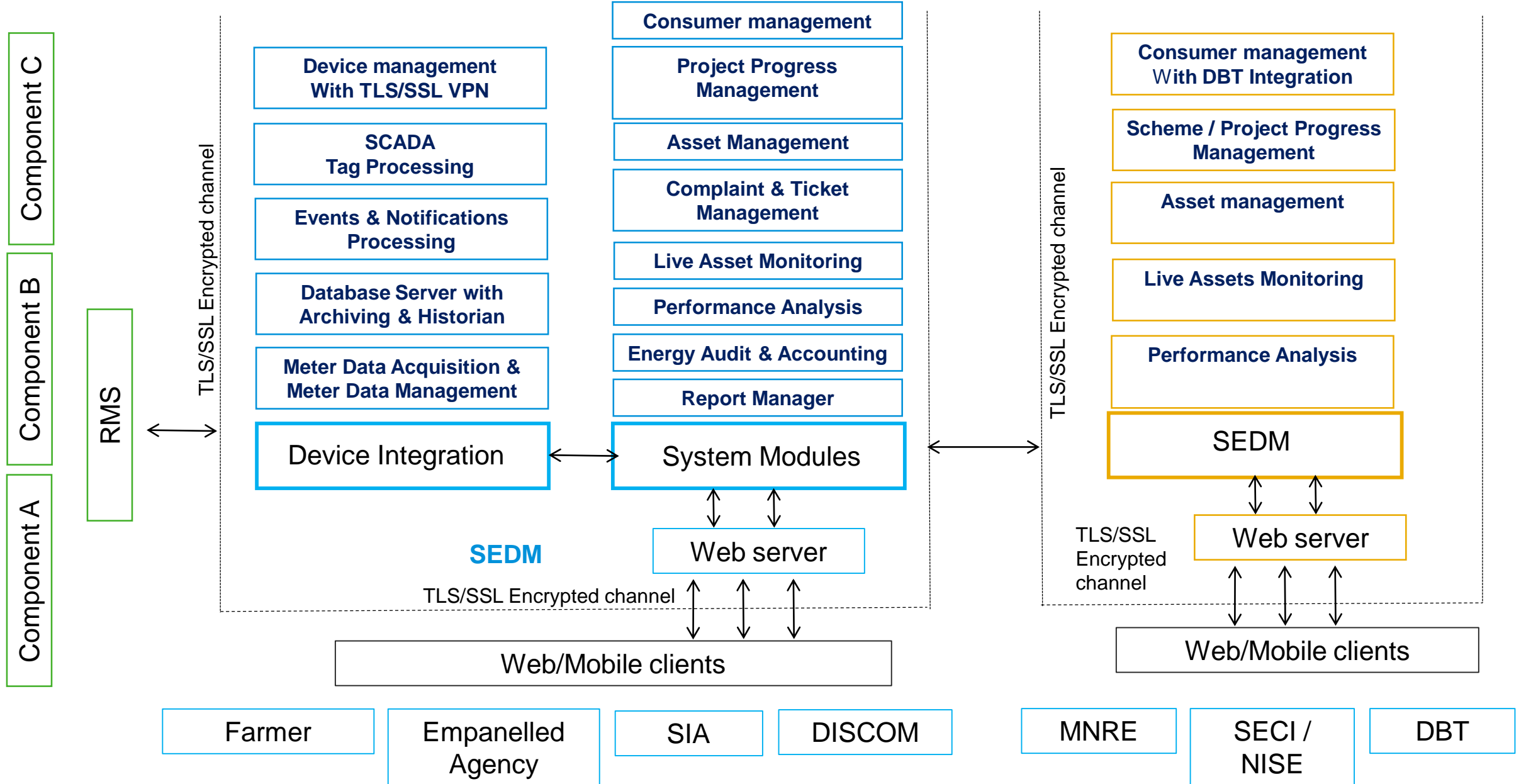
Device Integration Software Modules



**RMS
Field Systems**

State Level SEDM Platform

National Level SEDM Platform



Device Management

Configuration . Security. Connectivity. Communication. Availability

- **Device Registration and Configuration :**
 - Universal Unique ID : IMEI number(Cellular Connectivity) or MAC ID (Ethernet or Wi-Fi Connectivity)
 - Manufacturer Unique ID : Serial Number, Batch, Manufacturing Date, Model Number etc.
 - VPN Security : Upload and configure TLS / SSL certificate for AES 256 Bit Encryption
 - Device SIM Card Details : Mobile Number of Device, Service Provider APN, User Name, Password
 - Server Connection Configuration : IP, URL, Port, MQTT and FTP server details
 - Server Authentication Credentials : Token/Username and Password for MQTT and FTP Server
 - OTP Configuration : Auto Generation and exchange of 32 character random topic for OTP subscription
 - Communication Topics : Auto Generation and Exchange with Topic authorization against Unique Identification
 - Gateway Mobile Number Configuration for SMS connectivity
- **Multiple Device Communication Connectivity**
 - MQTT (IIoT) Server to handle bi directional communication of up to 5000 devices with single instance
 - SMS Gateway Integration
 - FTP Server for updating Device Configuration Files
- **IIoT Communication Modes**
 - 1. Push on Periodic Interval 2. Push on Event 3. On Demand Read Parameter 4. On Demand Command 5. Configuration Read / Write
- **IIoT Communication Analysis**
 - 1. % Device Connectivity 2. % Data Availability of Different Parameters 3. Number of Messages / Data
- **SMS Communication Modes**
 - 1. SMS of Periodic Data 2. SMS to Read and Write a parameter on Demand 3. SMS for Configuration Update
- **SMS Communication Security**
 - Verification of Device Mobile Number, IMEI Number, OTP
- **IIoT Communication Security**
 - 1. Identification 2. Encryption 3. Authentication 4. Authorization 5. OTP

SCADA Tag Processing

Message Processing . Data Processing . History Back Fill Processing . Mapping & Group Processing

- **Message Processing :**
 - MQTT Messages
 - Device Push Messages : Push on Periodic Interval | Push on Event
 - JSON parsing of messages at a speed of **100 messages per second** using multiple threads
 - Virtual Device configuration based message parsing : single device may have **10 virtual devices such as Pump Controller / Drive, Bi Directional Meter, Generation Meter, Pump Meter, Health Parameters etc.**
 - Device On Demand Messages : User / Server Initiated Parameter Read or Write Commands
 - **Send Remote Commands** to Device such as Remote Pump Operation
 - **Update single or multiple configuration parameters** such as alarm limits or schedule of operation
 - **Bulk Update multiple devices on a single command** such as updating pump operation running hours
 - **Auto Update Device Configuration** such as RTC sync with Server Time Stamp
 - **Auto Generated M2M (Device-Device) Commands** such as Pump Off for Demand Side Management
 - SMS Messages : Read and Write an individual parameter using SMS messages
- **Data Processing :**
 - Processing multiple tags or parameters such as V, I, PF, F, kW, kWh for trend and analysis purpose
 - Processing Soft Parameters based on logics and conditions **Voltage Un Balance / Un Balance Load etc.**
- **History Back Fill Processing :**
 - Server side Automatic Processing of mixing data based on missing indexes, periodic interval and time period
 - Priority configuration for virtual device, duration, samples to retrieve important missing data on higher priority
- **Mapping and Group Processing :**
 - Create multiple group of parameters : Instantaneous, Notifications, Mobile Application Groups
 - Map Device against consumer to automatically allow consumers to view groups
 - User and Role Management against group processing to restrict user access

Events & Notification processing

Alarms . Events . Notifications . M2M Event Handling

- **Alarm Configuration & Processing :**
 - Configuration of Limits for Analog Alarms – H, HH, L, LL Limits and Digital Alarms – V, I, kW, PF, F etc.
 - Processing Hard Tags and Soft Tags and generating alarms against it – Pump Status, Inverter Status etc.
- **Soft Alarm Configuration & Processing:**
 - Generating logic and calculation based alarms against Hard Tags and soft tags
- **Alarm against archived parameters:**
 - Configuration and processing of alarms / events / notifications against archived parameters – Daily / Weekly / Monthly %CUF, Average Pump Running Hours etc.
- **Notification:**
 - Configuration and processing of Notifications against Alarm/Event or schedule basis
 - **SMS, Mail and Push Notifications to configured users**
 - **Notifications at different intervals on unavailability of Data to Farmer as well as Vendor**
 - **Component A : 24 Hours (Vendor)**
 - **Component B : 3 Days (Vendor), 10 Days (Farmer)**
 - **Component C : 3 Days (Vendor), 5 Days (Farmer)**
- **Notification Groups & Security:**
 - User and Role Management based subscription of Notifications for User as well as Device

Archiving And Historian

Parameter Trend . Event History . Archiving . Historian . Summary

- **Rule based Archiving :**
 - Archiving with Min., Max., Initial, Last, Count, Sum values of configured parameters and time duration
 - 15 min. slot wise Archiving
 - Daily Archiving
 - Monthly Archiving
- **Archiving configuration :**
 - Configuration of multiple parameters from multiple devices in a single virtual device
- **Summary Parameters:**
 - Deriving Summary of entire district or Feeder or State on Daily and Monthly basis
- **Archiving Notification:**
 - Configuration and processing of Notifications against Alarm/Event of archived parameters
- **Soft Tag :**
 - API based logic and calculation processing of integrated parameters
- **Historian :**
 - Storage and retrieval of history data in multiple tables, formats derived based on archiving

MDAS & MDM

Meter Data Acquisition & Meter Data Management

- **Meter Information :**
 - Meter Make, Model Number, Serial Number, Ratings etc.
- **Meter Instantaneous Data :**
 - RTC Time Stamp
 - Voltage : Line to neutral voltage and Line to Line voltage
 - Current : Phase wise current, Total Current
 - Power : Active Power, Reactive Power, Apparent Power
 - Power off Duration
- **Meter Billing History Data :**
 - Active Energy
 - Reactive Energy
 - MD (kW)
 - MD (kVA)
- **Load Survey Data :** 15 minute load survey data
- **Tamper Data :** Tamper events with snap shot of multiple parameters
- **Rule based Meter Data Verifications and Validation**
- **Meter Replacement Process**
- **Integration with Billing System**

Other Software Modules



User & Role Management

Meter Data Acquisition & Meter Data Management

- **Create Multiple Types of Organizations :**
 - National Implementing Agency
 - State Implementing Agency
 - State PSUs : DISCOMs, Transmission Companies etc.
 - Solar EPC / Project Execution Agency
 - RMS and Software System Integrator
- **Add Multiple Users**
- **Assign District Level or Feeder Level or Plant Level Access to Organization**
 - Component A : Plant Level
 - Component B : District Level
 - Component C : Feeder Level
- **Create Multiple User Roles for Configuration**
 - Admin
 - Users with Add / Edit / Delete Rights
 - View Only Users
- **User Level Access Control :**
 - Assign systems and group of parameters against user
 - View Only Access of Data
 - Write Command and Configuration to System
- **Consumer / Farmer / Owner Mapping :**
 - Add Thousands of consumers in a system
 - Access control to his particular system only

Farmer Mobile Application with Multiple Language Selection

Monitor . Analyze. Complain . Help . Improve Utilization

- **Multiple Language Selection at Log In**
- **User Profile & Details**
- **OTP based Password Reset Mechanism**
- **System Details**
 - Pump Ratings , Plant Ratings , Connection Details
- **Live Status**
 - RMS Connectivity Status Parameter
 - Pump Status : ON / OFF
 - Generation Status : Inverter ON /OFF
 - Grid Status : Not Available Single Phase / Three Phase
 - Power Status : Import / Export (in kW)
 - Today's Running Hours : Pump Running Hours
- **Performance Analysis – Summary**
 - Yesterday and Current Month
 - Summary of Generation, Consumption, %CUF
- **Performance Analysis – Trend**
 - Current Week / Last Week / Current Month / Last Month
 - Day wise Trend of Solar Generation / Pump Consumption / Net Energy
 - Day wise Trend of Water Discharge and Pump Running Hours
- **Complaint Registration**
- **Service Center Contact Details**
 - Address
 - Contact Person
 - Mobile Number
- **Help Documents**
 - Safety Guidelines
 - Guidelines for System Performance Improvement

Site Survey Mobile Application

- **Provision to Search farmer/beneficiary by Application No/Mobile No**
- **Site Survey Mobile app shall capture latitude, longitude of the location where system shall be installed**
- **Provision to upload images such as site photographs etc.**
- **Provision to upload site survey consent/approval document from farmer/beneficiary**
- **Site Survey shall cover Following Fields as per Actual Site Details**
 - Crop Details
 - Source of Water
 - Micro Irrigation System
 - Existing Pump details
 - Source of Power for existing pump
 - Required Pump details
 - Grid Connection application status

Annexure-1

RMS Integration with State Level SEDM Platform

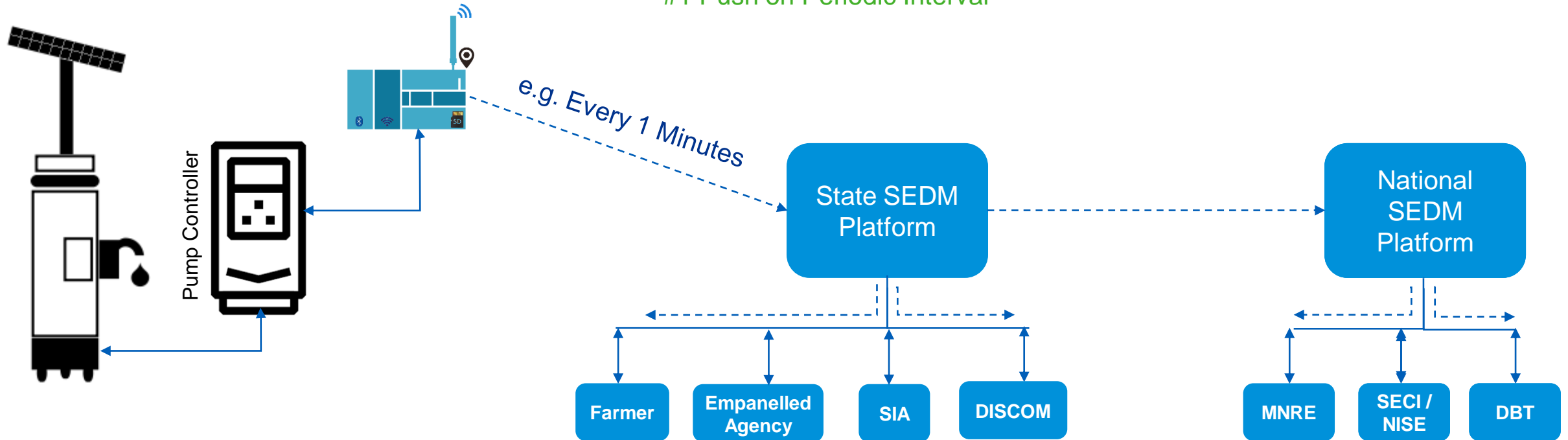


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION MODES (with reference to EESL Tender Annexure 8 – clause 4.b)

Five Different Communication Modes between RMS & SEDM Platform

#1 Push on Periodic Interval

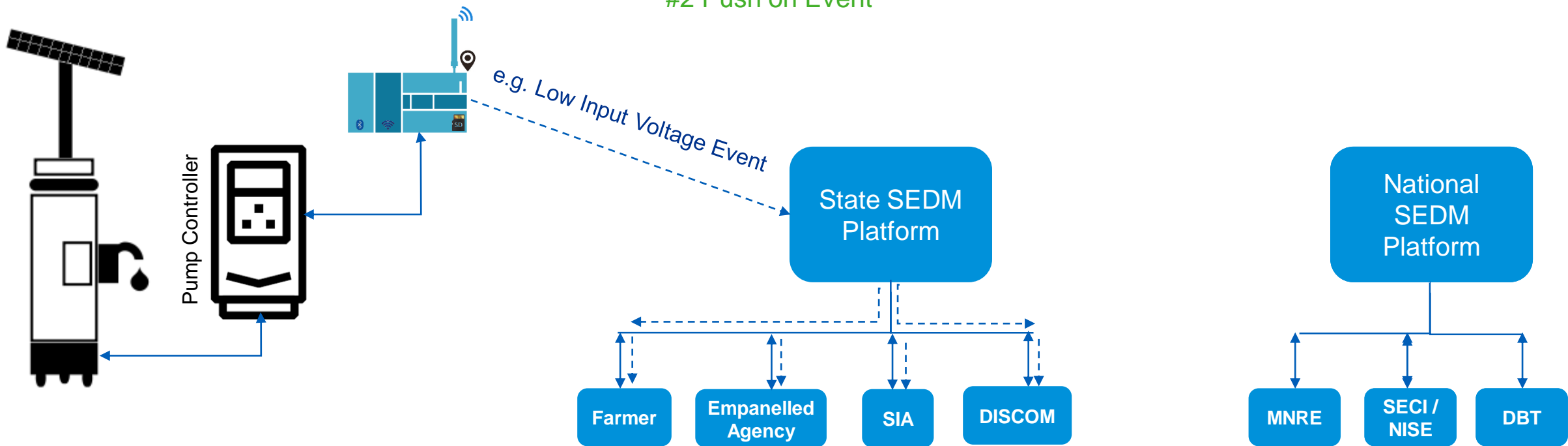


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION MODES

Five Different Communication Modes between RMS & SEDM Platform

#2 Push on Event

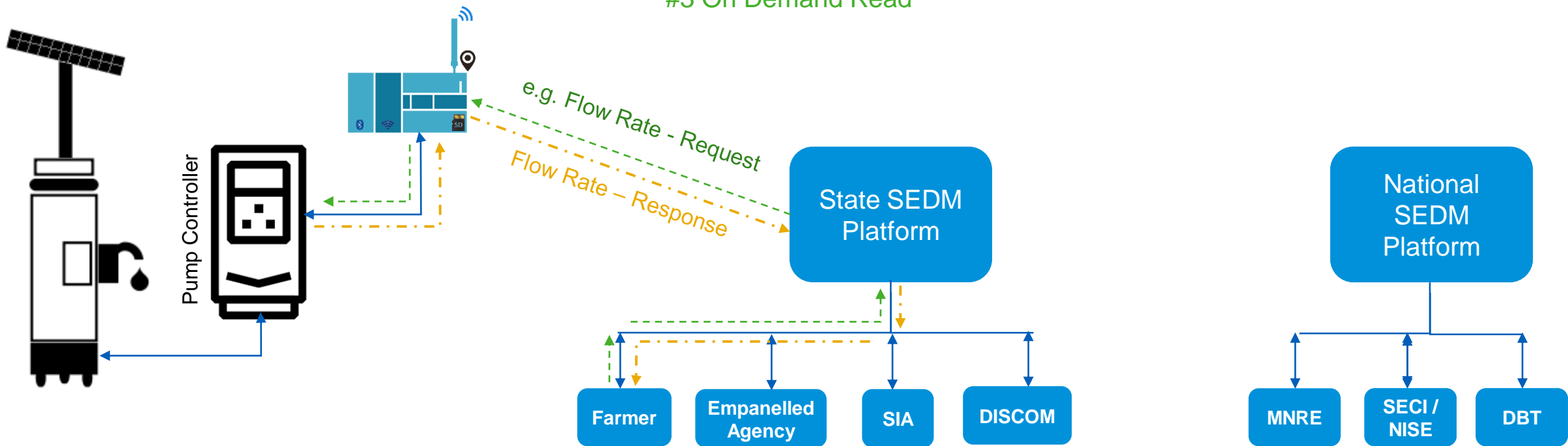


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION MODES

Five Different Communication Modes between RMS & SEDM Platform

#3 On Demand Read

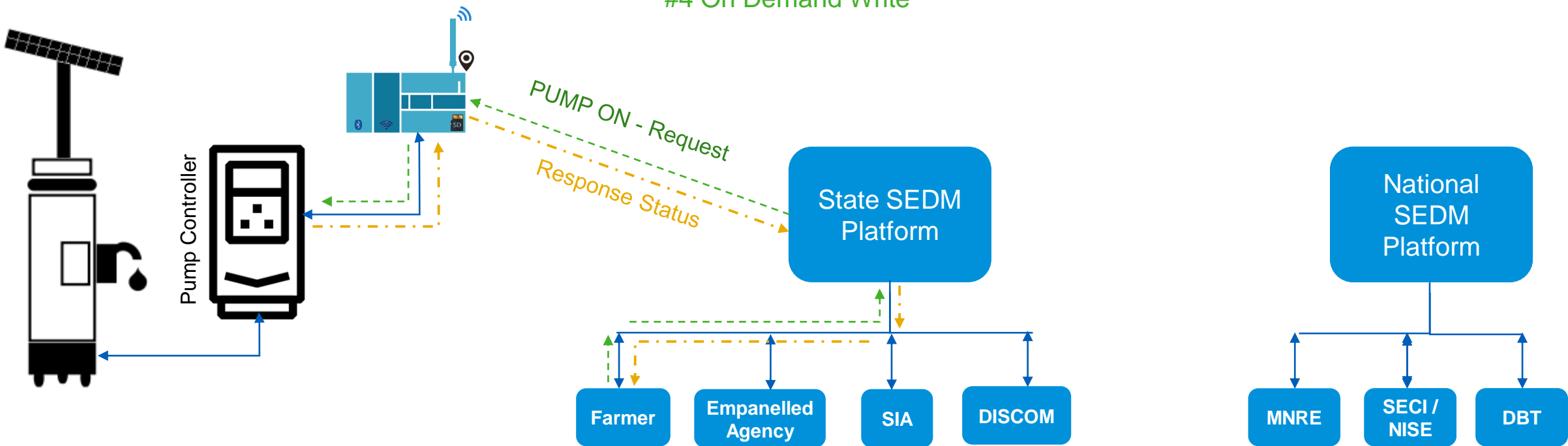


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION MODES

Five Different Communication Modes between RMS & SEDM Platform

#4 On Demand Write

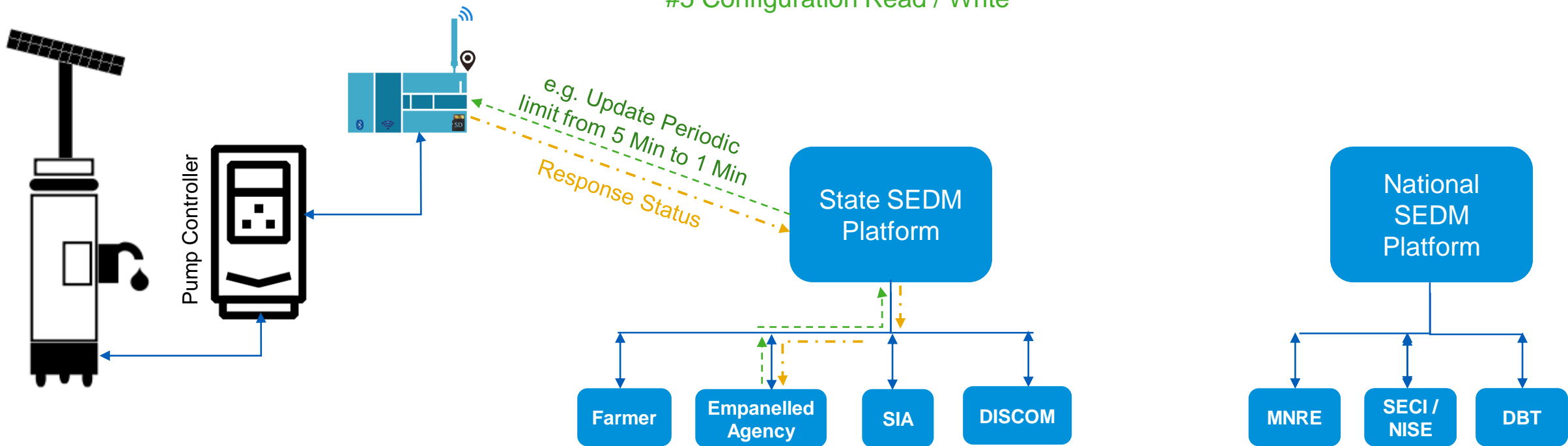


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION MODES

Five Different Communication Modes between RMS & SEDM Platform

#5 Configuration Read / Write



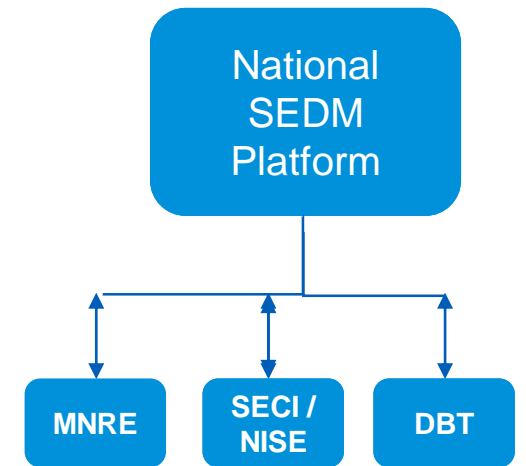
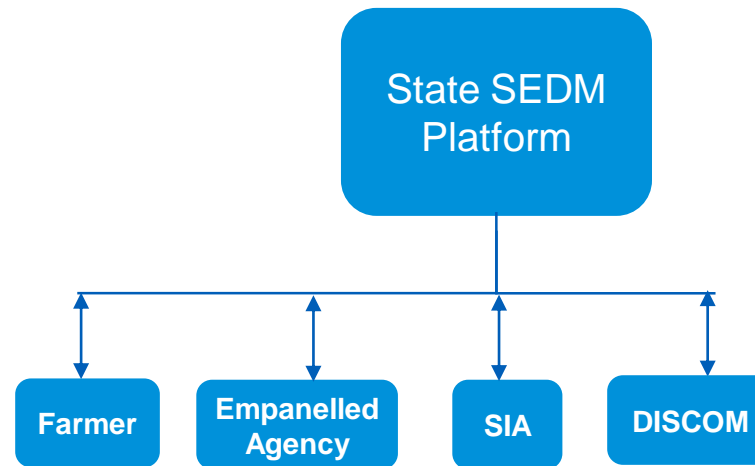
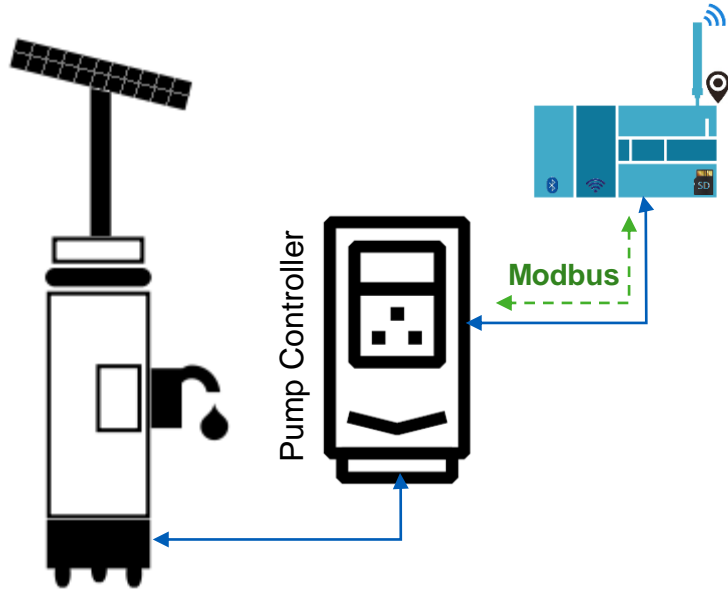
Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION PROTOCOLS (with reference to EESL Tender Annexure 8 – clause 4.a & 4.c)

Open Protocol Architecture Accepted Worldwide by all Manufacturers

#1 Field Device Communication

An Open Device communication Protocol supported by Manufacturers of Pump Controller/ Drive/Inverter/ Energy Meters / String Combiner Box

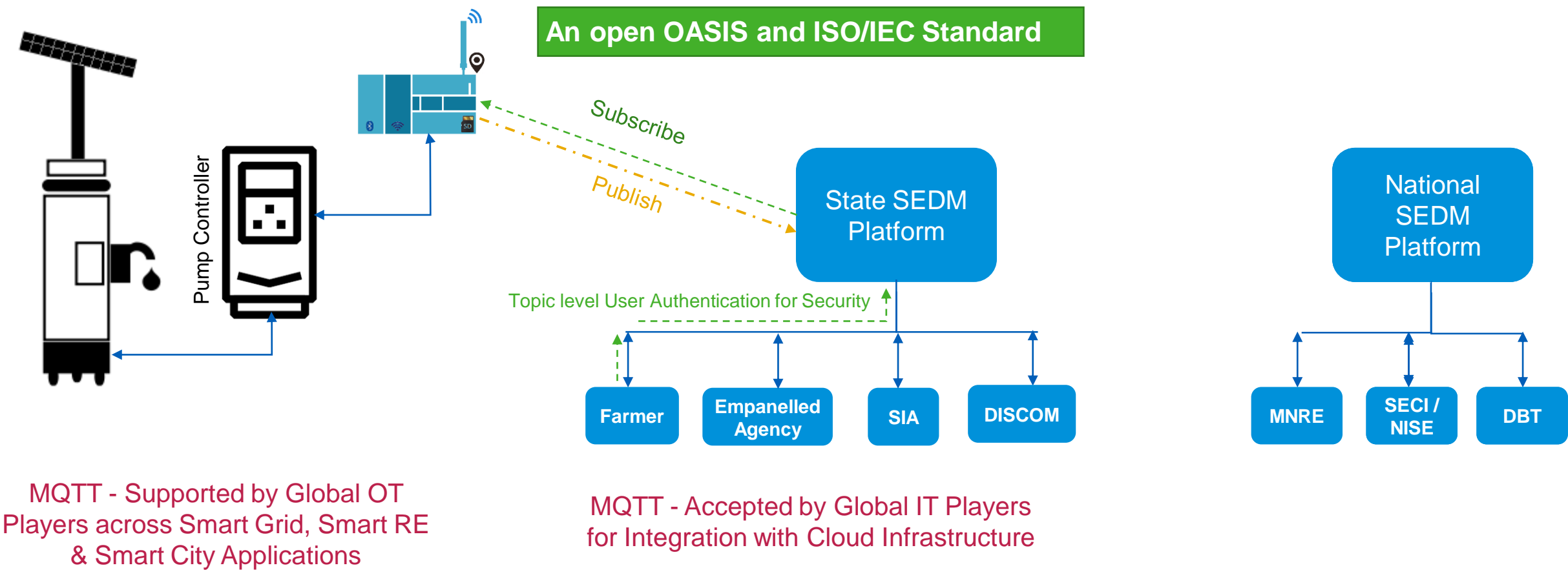


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

COMMUNICATION PROTOCOLS

#2 RMS to Server Communication – **Industrial IoT MQTT Protocol**

Lightweight – Low bandwidth remote applications | Pub-Sub Architecture – Scalable for Millions of Devices | Message Queuing

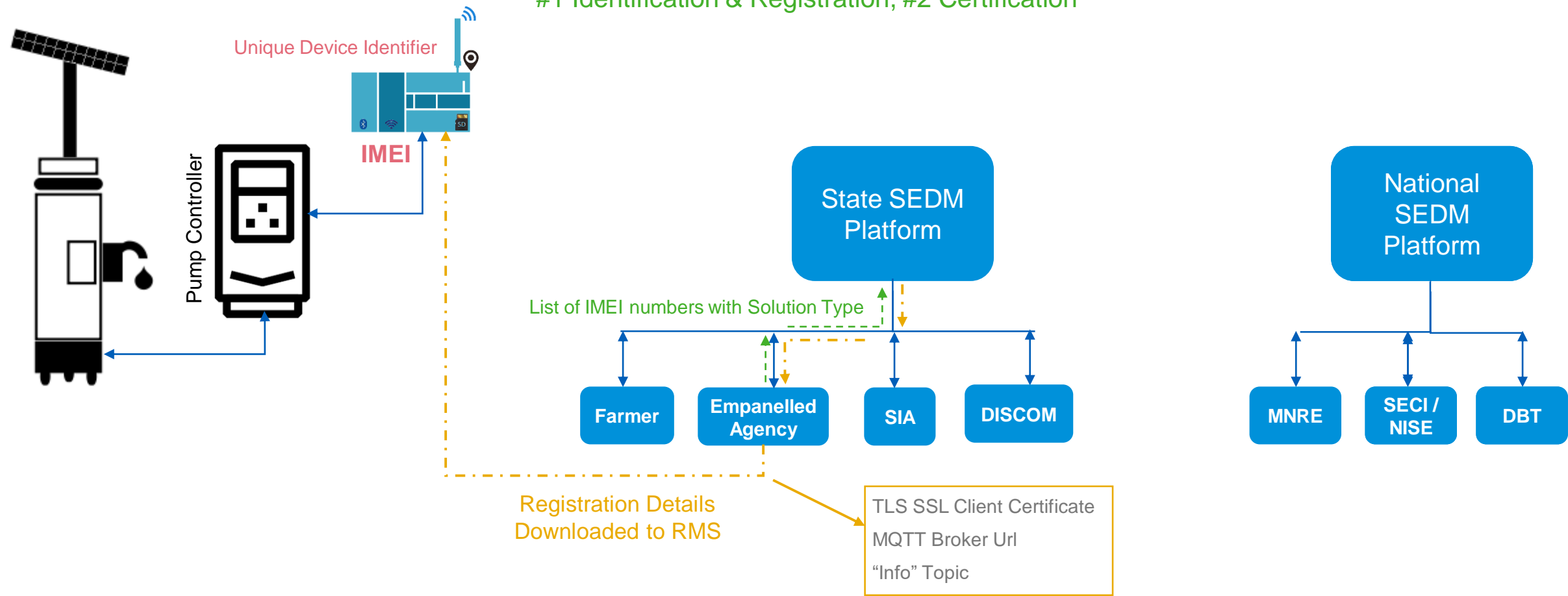


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

SECURITY ARCHITECTURE (with reference to EESL Tender Annexure 8 – clause 4.d)

Identification & Registration | Certification | Authentication | Encryption | Authorization | OTP

#1 Identification & Registration, #2 Certification

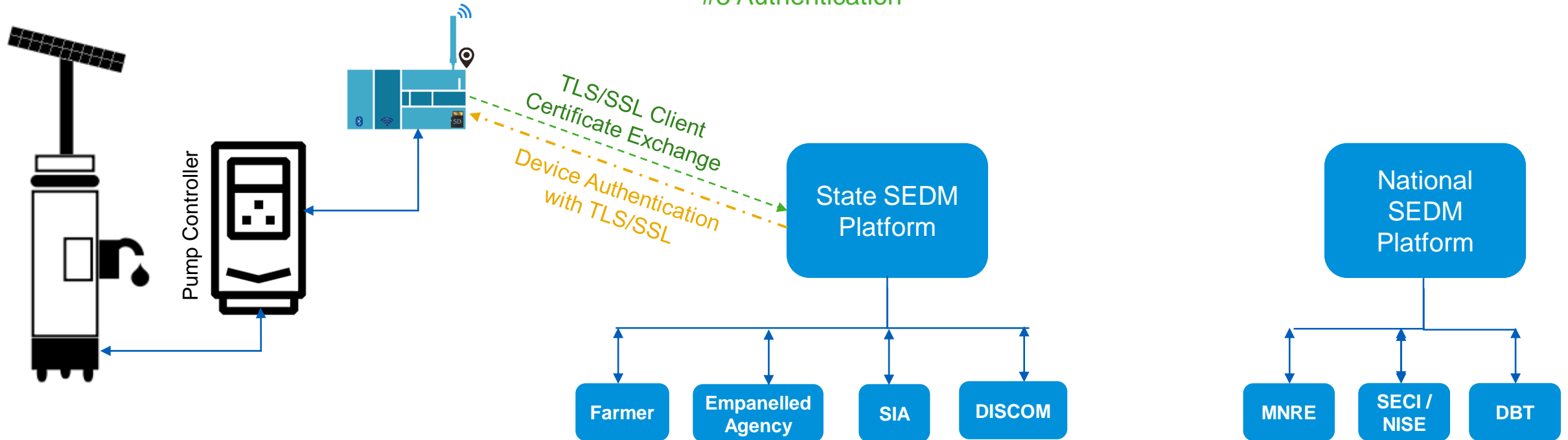


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

SECURITY ARCHITECTURE

Identification & Registration | Certification | Authentication | Encryption | Authorization | OTP

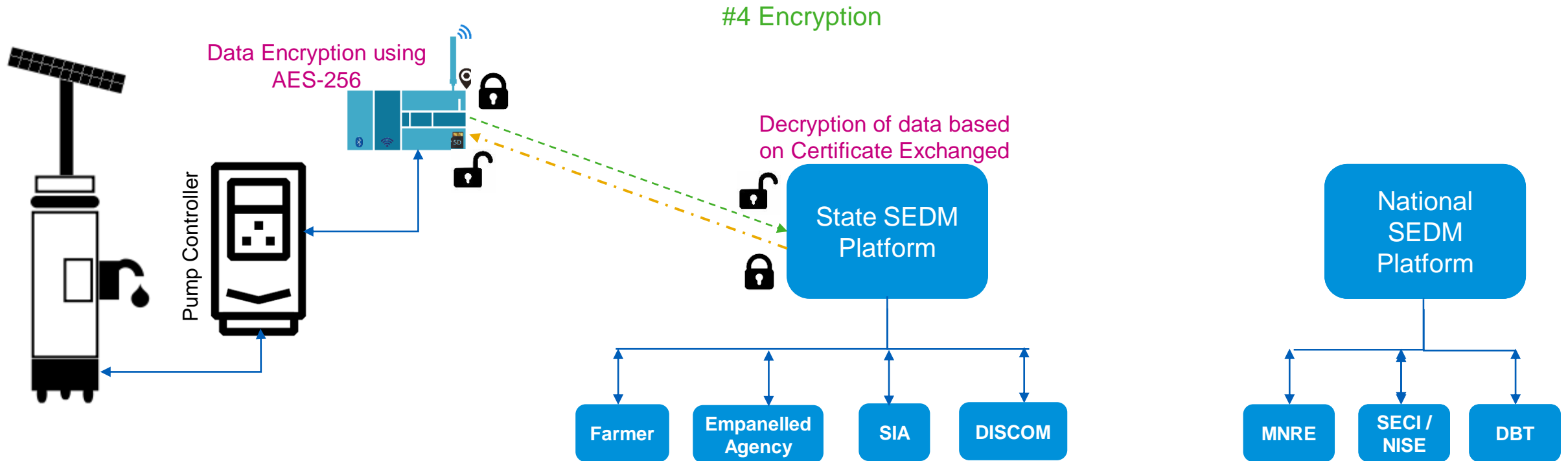
#3 Authentication



Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

SECURITY ARCHITECTURE (with reference to EESL Tender Annexure 8 – clause 4.d)

Identification & Registration | Certification | Authentication | Encryption | Authorization | OTP

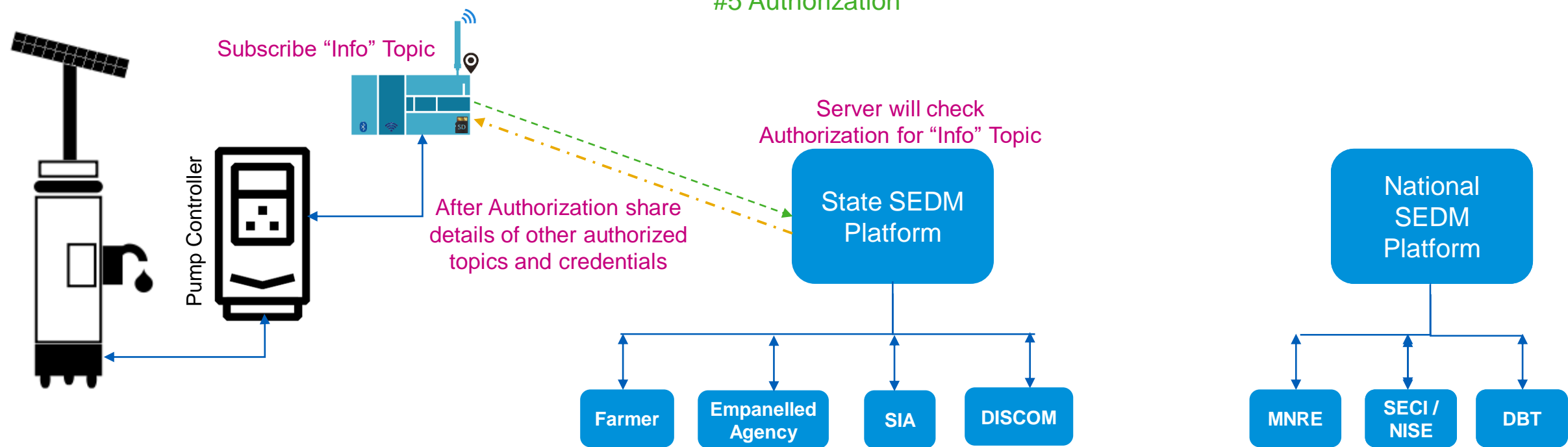


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

SECURITY ARCHITECTURE

Identification & Registration | Certification | Authentication | Encryption | Authorization | OTP

#5 Authorization

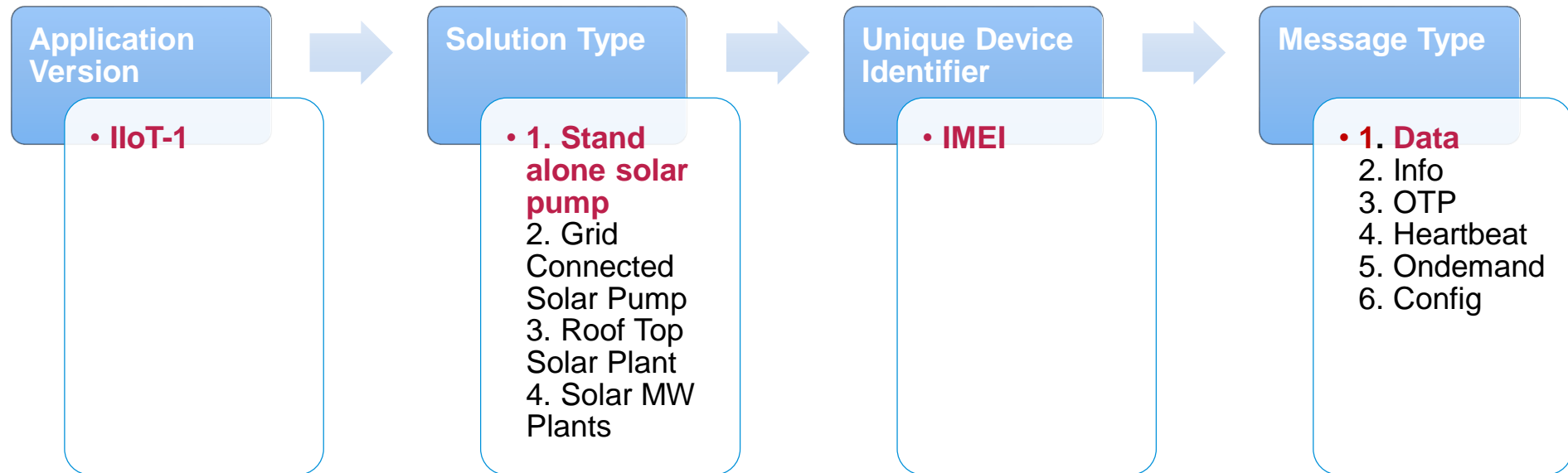


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

MQTT Topic Structure for Authorization

Sample topic Structure for Standalone Solar Pump

IIOT-1 / Standalone Solar pump / IMEI / data

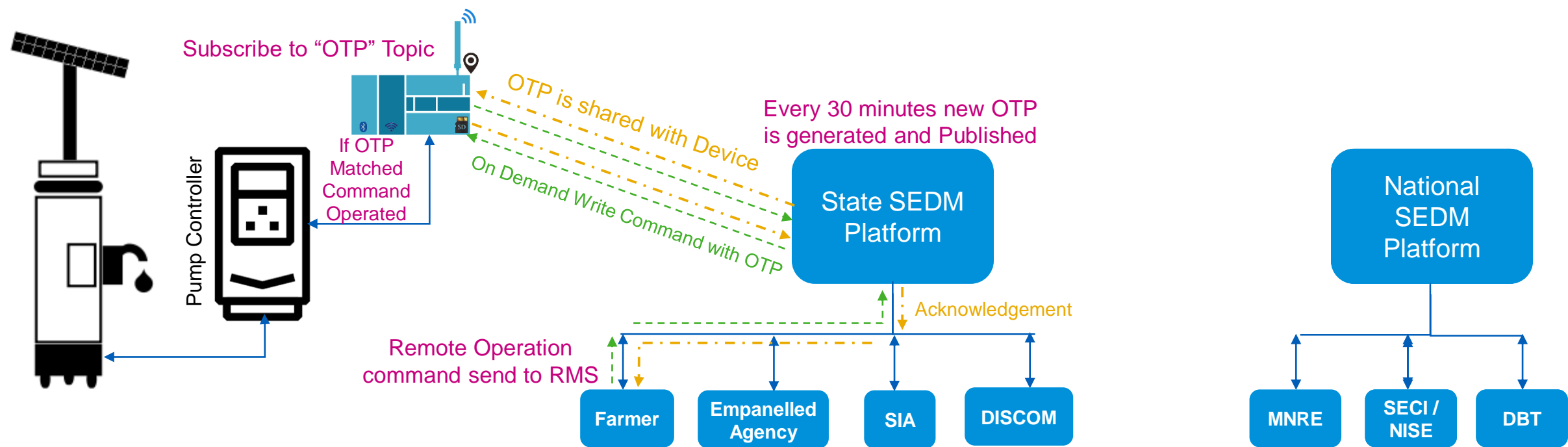


Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

SECURITY ARCHITECTURE

Identification & Registration | Certification | Authentication | Encryption | Authorization | OTP

#6 One Time Password (OTP) Mechanism for command and Configuration Updates



Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

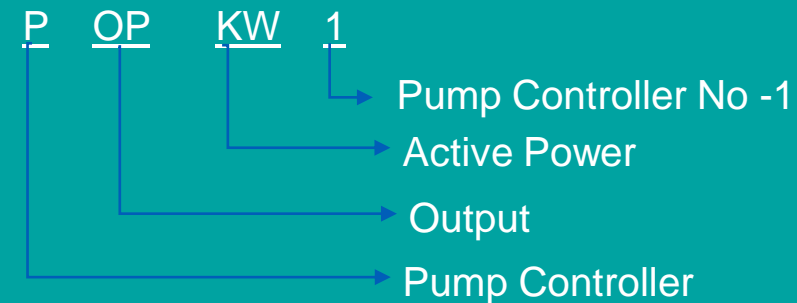
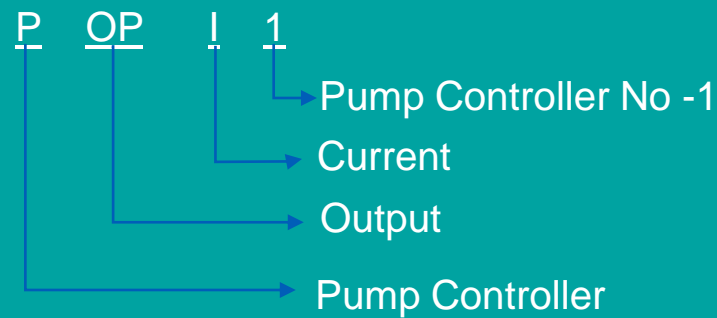
JSON MESSAGE STRUCTURE (with reference to EESL Tender Annexure 8 – clause 4.e)

An open Human readable message format, easy to parse in web /mobile/embedded applications

Message Format

```
{  
  "POPI1": 30,  
  "POPKW1": 3.6  
}
```

Keyword Abbreviation



Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

JSON MESSAGE STRUCTURE (with reference to EESL Tender Annexure 8 – clause 4.e)

keyword	Description	Format	Sample Value
IMEI	Unique Identification of RMS/DCU – required to ensure registered source of data	Numeric – 15 Digit	863287049443888
VD	Virtual device/group – required for grouping parameters based on update interval/subsystems such as inverter/pump controller/meter/string combiner box etc.	Numeric	2
MSGID	Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback	Numeric	123456789
COMMAND	Read/Write - Applicable only in case of “Ondemand”/”Config” message Type	String (Read/Write)	Read
TIMESTAMP	RTC timestamp of RMS/DCU against all parameters of vd/group	(YYYY-MM-DD HH:mm:ss)	2019-08-20 20:15:08
STINTERVAL	Periodic interval at which RMS shall store and transmit data to server. (in minutes)	Numeric	15
DATE	local storage date – required as a reference to fetch data from local storage	(YYYY-MM-DD)	2020-06-15
INDEX	Local storage Index – required as a reference to fetch data from local storage	Numeric	5
MAXINDEX	Local storage maximum index of local storage date – required to calculate missing index	Numeric	96
LOAD	Local storage retrieval command & status	Numeric	0
POTP	Previous One Time Password	Numeric – 6/8 Digit	12345678
COTP	Current One Time Password, State SWPS Broker will update OTP at interval of 30/60 minutes	Numeric – 6/8 Digit	12345678

Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

MQTT JSON MESSAGE STRUCTURE

Message Format : Periodic Push - Pump Controller – Part I

Response Message		
Message	Description	Requirement in JSON Format
{		
"vd":1	Virtual Device Index/Group	Must Have
"timestamp":"2020-05-18 17:58:00",	RTC timestamp of RMS/DCU against all parameters of vd/group	Must Have
"maxindex":96	maximum index of local storage date	Must Have
"index":7,	reference of local storage	Must Have
"load":0,	Local storage retrieval command & status	Must Have
"stinterval":15,	Periodic interval at which RMS shall store and transmit data to server. (in minutes)	Must Have
"msgid":"",	Message Transaction Id - required for "Ondemand"/"Config" message type, request/response/acknowledgement/feedback	Must Have
"date":200518,	local storage date	Must Have
"IMEI":"1234561234561234",	IMEI No. of First Sim to be considered always for unique identity of DCU	Must Have
"ASN_11":"34123450",	Pump Controller Serial No.	Must Have
"POTP":"341234",	Previous One Time Password	Must Have
"COTP":"341234",	Current One Time Password	Must Have

Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

MQTT JSON MESSAGE STRUCTURE

Message Format : Periodic Push - Pump Controller – Part II

"PMAXFREQ1":"50.00",	Maximum Frequency	Good to Have
"PFREQQLSP1":"50.00",	Lower Limit Frequency	Optional
"PFREQHSP1":"50.00",	Upper Limit Frequency	Optional
"PCNTRMODE1":"1",	Solar Pump Controller Control Mode Status	Optional
"PRUNST1":"2",	Solar Pump Controller Run Status	Must Have
"PREFFREQ1":"50.00",	Solar Pump Controller Reference Frequency	Optional
"POPFREQ1":"50.00",	Solar Pump Controller Output Frequency	Good to Have
"POPI1":"20.00",	Output Current	Must Have
"POPV1":"230.00",	Output Voltage	Must Have
"POPKW1":"45.00",	Output Active Power	Must Have
"PDC1V1":"550.00",	DC Input Voltage	Must Have
"PDC1I1":"50.00",	DC Current	Must Have
"PDCVOC1":"650.00",	DC Open Circuit Voltage	Optional
"PDKWH1":"35.00",	Today Generated Energy	Must Have
"PTOTKWH1":"120.00",	Cumulative Generated Energy	Must Have
"POPFLW1":"2.00",	Flow Speed	Good to Have
"POPDWD1":"120.00",	Daily Water Discharge	Must Have
"POPTOTWD1":"220.00",	Total Water Discharge	Must Have
"PMAXDCV1":"750.00",	Max DC Voltage	Good to Have
"PMAXDCI1":"40.00",	Max DC Current	Good to Have
"PMAXKW1":"650.00",	Max Output Active Power	Good to Have
"PMAXFLW1":"650.00",	Max Flow Speed	Good to Have
"PDHR1":"8.00",	Pump Day Run Hours	Must Have
"PTOTHR1":"8.00",	Pump Cumulative Run Hours	Must Have
}		

Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

MQTT JSON MESSAGE STRUCTURE

Message Format : Periodic Push - RMS Device Heartbeat - Part I

Response Message		
Message	Description	Requirement in JSON Format
{		
"vd":0	Virtual Device Index/Group	Must Have
"timestamp":"2020-05-18 17:58:00",	RTC timestamp of RMS/DCU against all parameters of vd/group	Must Have
"maxindex":96	maximum index of local storage date	Must Have
"index":7,	reference of local storage	Must Have
"load":0,	Local storage retrieval command & status	Must Have
"stinterval":15,	Periodic interval at which RMS shall store and transmit data to server. (in minutes)	Must Have
"msgid":"","	Message Transaction Id - required for "Ondemand"/"Config" message type, request/response/acknowledgement/feedback	Must Have
"date":200518,	local storage date	Must Have
"IMEI":"1234561234561234",	IMEI No. of First Sim to be considered always for unique identity of DCU	Must Have
"ASN_11":"34123450",	Pump Controller Serial No.	Must Have
"POTP":"341234",	Previous One Time Password	Must Have
"COTP":"341234",	Current One Time Password	Must Have

Unified Data Integration Architecture for Solar Energy Data Management (SEDM) Platform

MQTT JSON MESSAGE STRUCTURE

Message Format : Periodic Push - RMS Device Heartbeat – Part II

"gsm":1,	Device connected to GSM network	Optional
"sim":1,	SIM detected (1 - detected)	Optional
"net":1,	Device in Network (1 - in network)	Optional
"gprs":"1",	GPRS connected (1 - connected)	Optional
"rssi":22,	Signal Strength	Must Have
"sd":"1",	SD card detected (1 - detected)	Must Have
"online":1,	Device Online (1- Online)	Optional
"gps":1,	GPS Module Status (1-ON,0-OFF)	Must Have
"gpsloc":1,	GPS Location Locked	Must Have
"rf":1,	WiFi/Bluetooth Module Status (1-ON,0-OFF)	Must Have
"rtcdate":180918,	RTC Date	Must Have
"rtctime":175800,	RTC Time	Must Have
"temp":45.5,	Device Temperature	Optional
"lat":19.06,	Latitude from gps	Must Have
"long":72.8777,	Longitude from gps	Must Have
"simslot":1,	Sim Slot (Current Sim Slot: 1 or 2)	Optional
"simchngcnt":10,	Total Sim Slot Change Count	Optional
"flash":1,	Device Flash Status 1: Detected 0: Error	Good to Have
"Battst":0,	Battery Input Status: 1 if on battery power else 0	Good to Have
"vbatt":5.0,	Battery Voltage	Good to Have
"Pst":1	Power Supply (1-Mains, 2-Battery)	Good to Have
}		

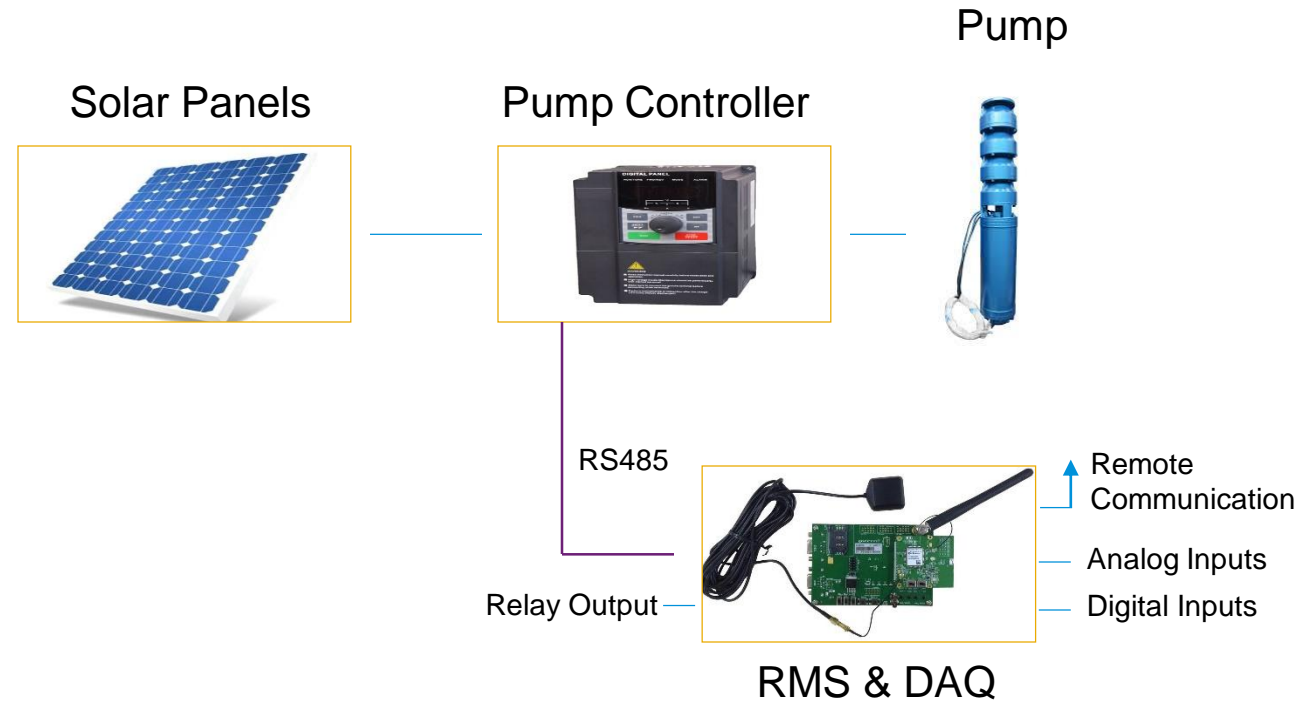
Annexure-2

System Components & Architecture



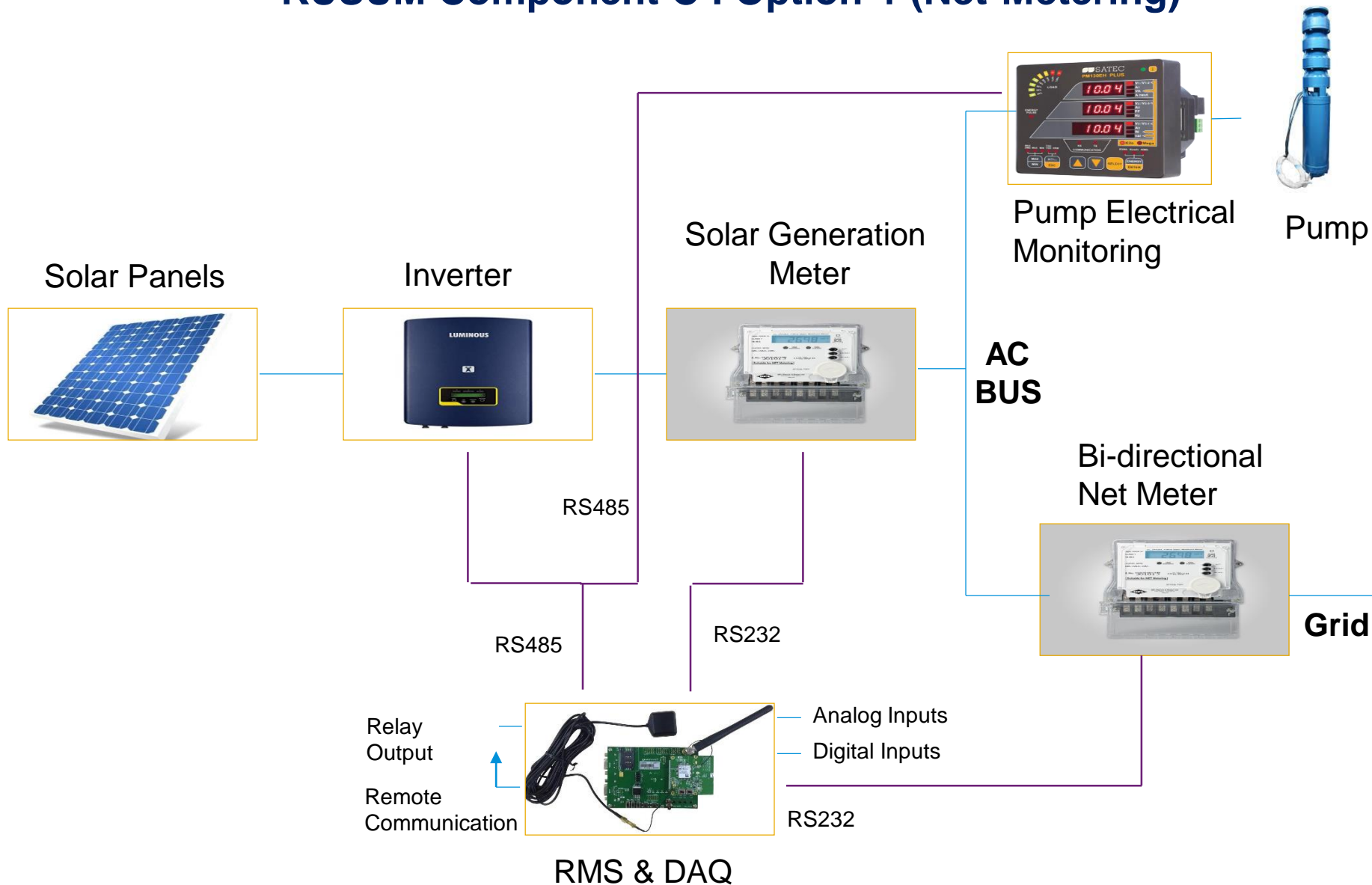
System Components & Architecture

KUSUM Component B



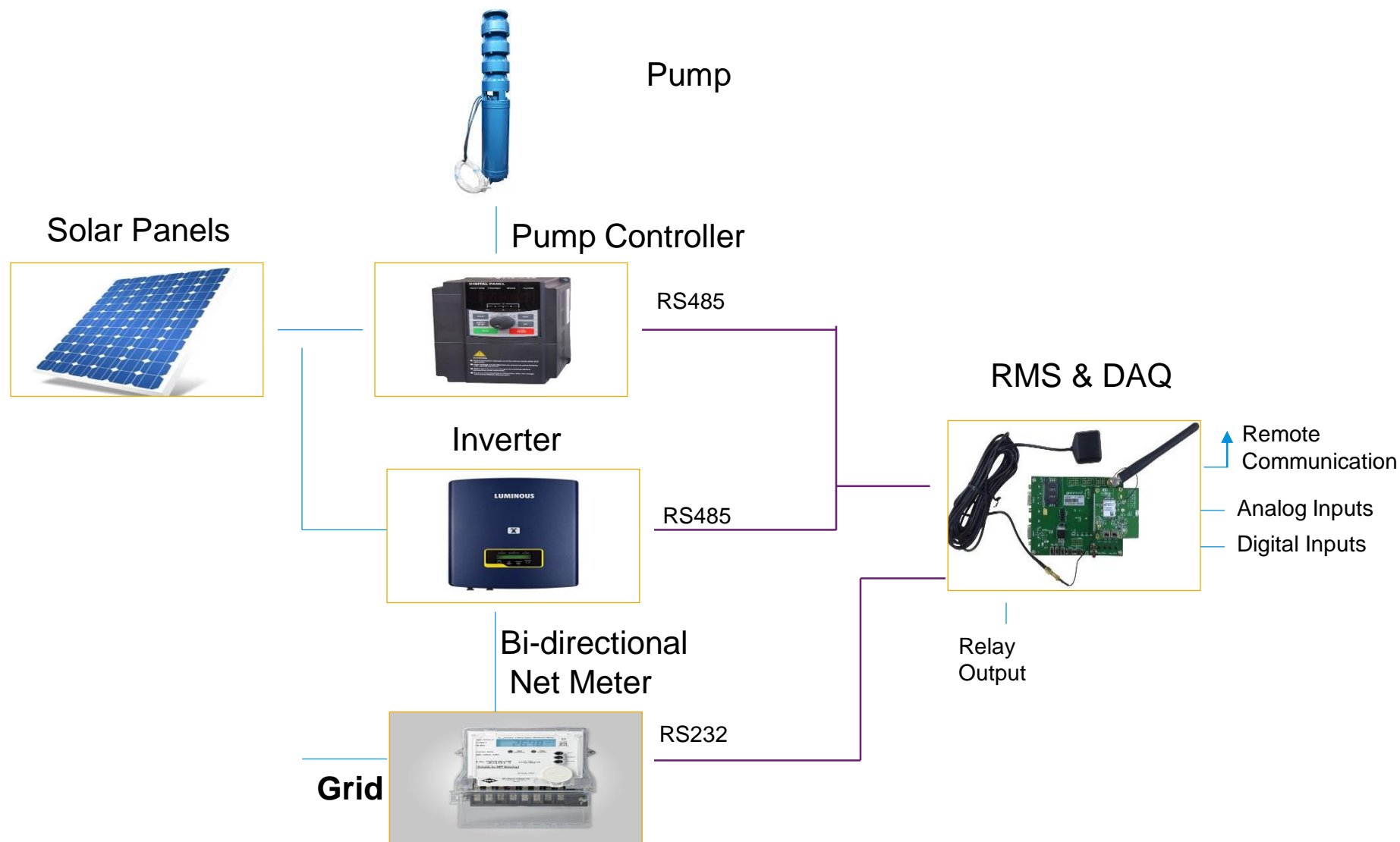
System Components & Architecture

KUSUM Component C : Option-1 (Net-Metering)



System Components & Architecture

KUSUM Component C : Option-2 (Pump to run on Solar Power Only)

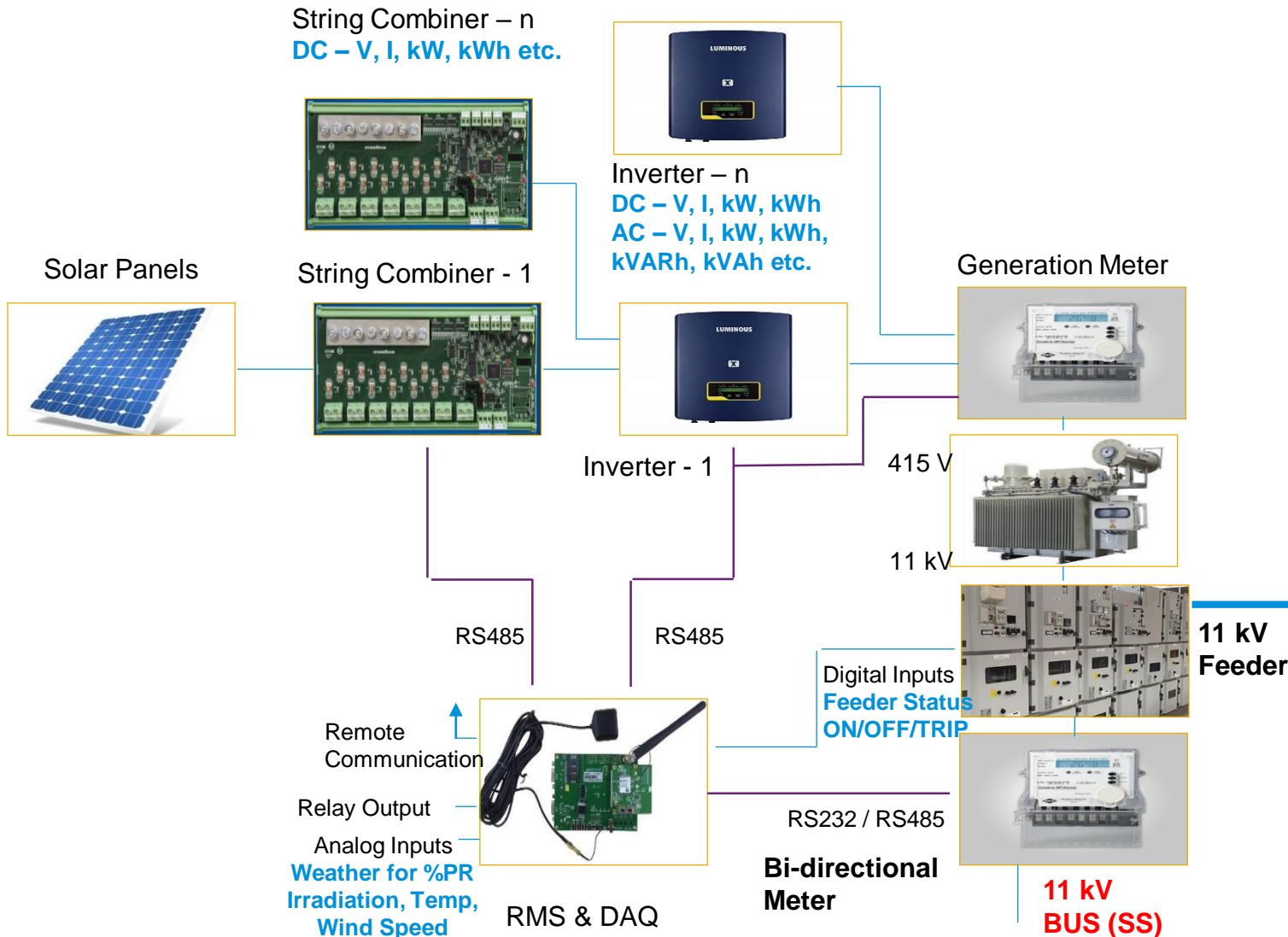


System Components & Architecture

KUSUM Component C or A : Option-3 (Solarisation of Ag Feeder at SS Level)

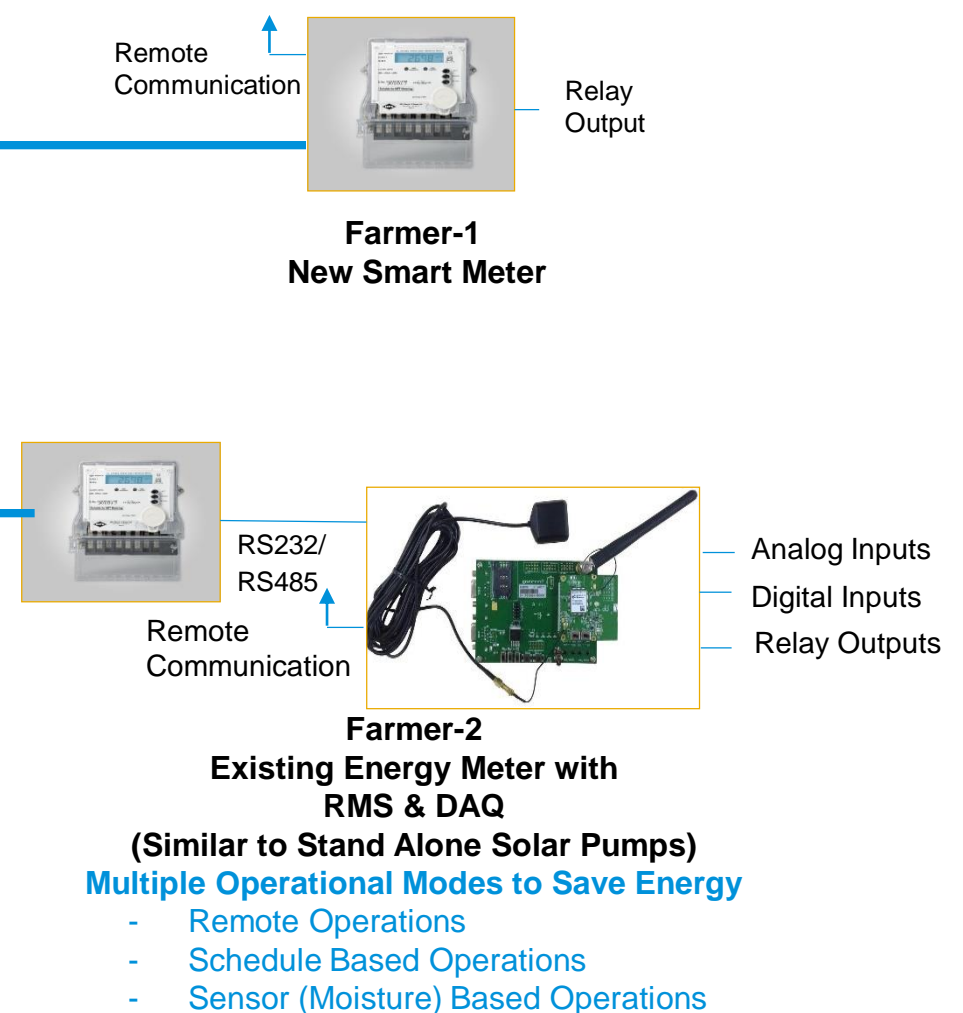
Sub Station End

Solar Plant Performance & Feeder Availability Monitoring



Farmer End

Pump Performance & Energy Monitoring



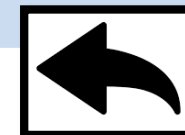
Annexure-3

List of Consumer Information for Beneficiary Tracking



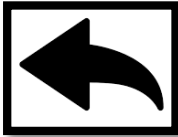
Application & Consumer Details

Field Name	Description	Sample Data
Application No	State Application No. Input value should be unique Application No.	123456789
Application Category	Farmer/Gaushala/Water User Association	Farmer
Aadhaar No	Should be Unique Aadhaar No	12345678902
Farmer Name	Farmer Name should be as per land registration Document.	CHAMPABEN PATEL
Father/Husband Name	Name of Applicants father/Husband	HARIBHAI PATEL
Gender	Male/Female/Transgender	Female
Email	Email Address for Communication	abc@gmail.com
Mobile No.	Should be Unique Mobile No for Aadhaar Authentication.	9876543210
FarmerType	GEN/SC/ST/OBC	SC
Implementation Agency	Name of the Implementing Agency DISCOM/PHED/Agriculture Department	GUVNL
Application Priority	Priority of Application	1,2,3



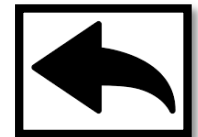
Agriculture Details

Field Name	Description	Sample Data
CropType_Y1	Previous Year Crop Type Rabi/Kharif/Zaid	Rabi
CropType_Y2	Last to Last Year Crop Type	Rabi
CropCount_Y1	No. of Crops in previous Year.	1
CropCount_Y2	No of Crops in last to last year.	1
Land Coverage	Value should be in Sq. Meter.	1250



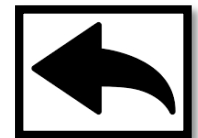
Irrigation Details

Field Name	Description	Sample Data
Water Depth Level	Value should be in Feet for surface - 0.	50
Irrigation Mode	Micro Irrigation/Open Irrigation/Irrigation with Pipe	Micro Irrigation
Micro Irrigation Mode	Drip / Sprinkler	
Existing Farm Pond	Existing Farm Pond Field : Yes/No/Under Construction	Yes
Source of Water	Source of Water : Bore, Well, Pond, River/Canal	Borewell
Quality Of Water	Fit for Irrigation / Not Fit for Irrigation	Fit for Irrigation
Size of Borewell	Size of Borewell in inches	10



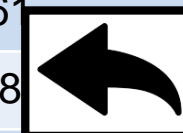
Bank Details

Field Name	Description	Sample Data
Bank Branch	Branch Name of the Bank where Bank Account of the Farmer is held	Sola Road
Bank Name	Name of Bank where Bank Account of the farmer is Held	State Bank of India
Bank Account No	Bank Account No of the Farmer	30222806989
Account Type	Savings / Current	Savings
IFSC Code	Unique Brach Code of the Bank	SBIN0000838
Account Holder Name	Farmer Name as per the records of the Bank	CHAMPABEN HARIBHAI PATEL



Contact & Location Details

Field Name	Description	Sample Data
Address	Should be Landmark/ house no. where farmer resides for communication	L.S NO.266/1
Town	Name of the Town/Village where farmer is residing.	SAMLOD
Taluka	Name of the Taluka of corresponding Town.	BHARUCH
District	Name of the District of corresponding Taluka.	BHARUCH
Assembly Constituency	Name of Assembly Constituency as per Voter Registration	BHARUCH
State	State Code for corresponding District.	GJ
Pincode	Pincode of farmer communication address	38061
Location_SurveyNo	Farm's Survey No. where Solar Pump is to be installed.	455/1
Location_Town	Name of the Town/Village of corresponding Survey No. Where Solar Pump is to be installed	SAMLOD
Location_Taluka	Name of the Taluka of corresponding Town.	BHARUCH
Location_District	Name of the District of corresponding Taluka.	BHARUCH
Location_State	State Code for corresponding District.	GJ
Location_PinCode	Pincode of Farm location	380061
Latitude	Latitude of the location where system is to be installed.	22.258
Longitude	Longitude of the location where system is to be installed.	71.1924



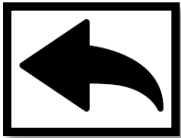
Pump Details

Field Name	Description	Sample Data
Is Existing Pump User	Is Farmer already using water Pump? Yes/No	Yes
Existing Pump Type	If Existing Pump User, then Pump Type : AC/DC	AC
Existing Pump SubType	Submersible/Surface	Surface
Existing Pump Capacity	Value of Existing pump capacity should be in HP.	3
Energy Efficient Pump	For Existing Pump, Yes/No	Yes
Required Pump Type	If Existing Pump User, then Pump Type : AC/DC	AC
Required Pump SubType	Submersible/Surface/BLDC	
Pump Category	Required Pump Category : Oil filled/ Water Filled	Oil Filled
Required Pump Capacity	Value should be in HP.	5
Annual Diesel Requirement	Value Input should be in liters, If existing diesel pump user, Only for Component B	985
Water Throughput required	Value should be in litres/Minute	50
Source of Power Existing Pump	Diesel/Electric	Diesel



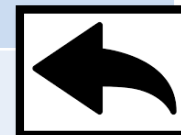
Solar Details

Field Name	Description	Sample Data
SPV Cap as per Norms	SPV Capacity as per Norms in KW-DC	10
SPV Cap Applied	Applied SPV Capacity Installed in KW-DC	10



Financial & Commercial Details

	Description	Sample Data
Installer	Installation Agency Name	XYZ PVT LTD
Solar Pump Cost	Cost of the Total System to be deployed	200000
Is USPC	USPC Purchased by Farmer ? Yes/No	No
USPC Cost	Cost of the USPC System in INR	0
Central Contribution	Value input should be in percentage (%).	20%
State Contribution	Value input should be in percentage (%).	20%
Farmer Contribution	Value input should be in percentage (%).	60%
FarmerLoan_institution	Name of the Institution from where Farmer has availed loan facility	NABARD
FarmerLoan_Amount	Loan amount of the farmer if availed. Number input should be in INR.	100000
LOA Date	LOA. Input date should be DD/MM/YYYY	13/03/2020
PBG_Amount	Performance Bank Guarantee from Installer. Number input should be in INR.	50000
Scheduled Implementation Date	Scheduled Implementation Date. Input date should be DD/MM/YYYY	13/03/2020

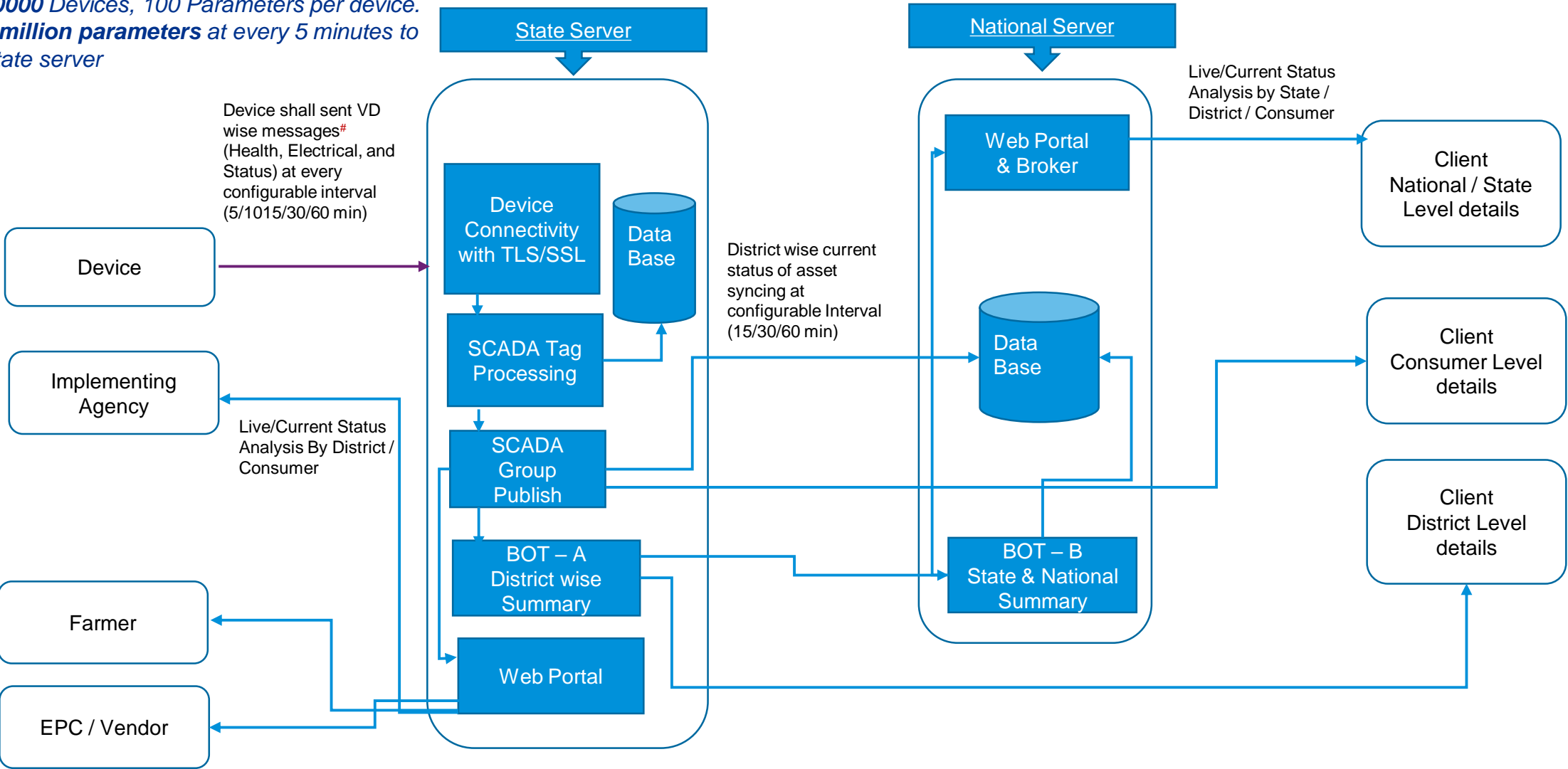


Annexure-4

Data Integration Between National and State Level Portal



50000 Devices, 100 Parameters per device.
5 million parameters at every 5 minutes to State server



Live Monitoring Parameters	Solar Generation kW, Pump Load kW, Net Power kW, String Level DC Current, DC Voltage, Inverter DC /AC Voltage and Current, PF, Frequency etc.
	Grid Status, Pump Status, Inverter Status, Drive Status, Protection Status, Alarm Status, ICR/MCR Breaker Status, ICR/MCR Transformer Status
BOT-A Process (Live Monitoring Parameters)	Consumer wise summary, District wise summary, State summary Dash Board -1 with Google Map View : District / Division / Sub Division / Sub Station / Feeder / Inverter Control Room
BOT-B Process (Live Monitoring Parameters)	State wise summary, Nation summary Dash Board -1 with Google Map View : State/District / Division / Sub Division / Sub Station / Feeder / Inverter Control Room

BOT-A Process (Performance Indicators)	Consumer wise monthly summary, District wise daily summary, District wise monthly summary, state monthly summary. Dash Board : State / DISCOM / District / Division / Sub Division / Sub Station / Feeder / Inverter Control Room / Main Control Room Duration Filters : Current Week / Current Month / Last Week / Last Month / Individual Month / Between Dates Connectivity : % Device Connectivity / % Data Availability Energy : Energy Generated / Energy Import / Energy Export / Net Energy / Energy Consumed Solar Performance : % CUF / Per Day Per kW Generation / Individual Inverter Level Generation / Individual String Level Generation Running Hours : Grid Available / Three Phase Supply Available/Inverter Running Hours / Pump Running Hours / High Voltage Running Hours / Low PF Running Hours / String Level Generation Hours Irrigation Indicators : Total Water Output / % Day Time Pump Operation / Income Earned by Farmers in case of no Irrigation
BOT-B Process (Performance Indicators)	State Level monthly summary, Nation monthly summary Dash Board : National / State / DISCOM / District / Division / Sub Division / Sub Station / Feeder / Inverter Control Room / Main Control Room Duration Filters : Current Week / Current Month / Last Week / Last Month / Individual Month / Between Dates Connectivity : % Device Connectivity / % Data Availability Energy : Energy Generated / Energy Import / Energy Export / Net Energy / Energy Consumed Solar Performance : % CUF / Per Day Per kW Generation / Individual Inverter Level Generation / Individual String Level Generation Running Hours : Grid Available / Three Phase Supply Available/Inverter Running Hours / Pump Running Hours / High Voltage Running Hours / Low PF Running Hours / String Level Generation Hours Irrigation Indicators : Total Water Output / % Day Time Pump Operation / Income Earned by Farmers in case of no Irrigation

