

AUTOMATIC METER READING SYSTEM

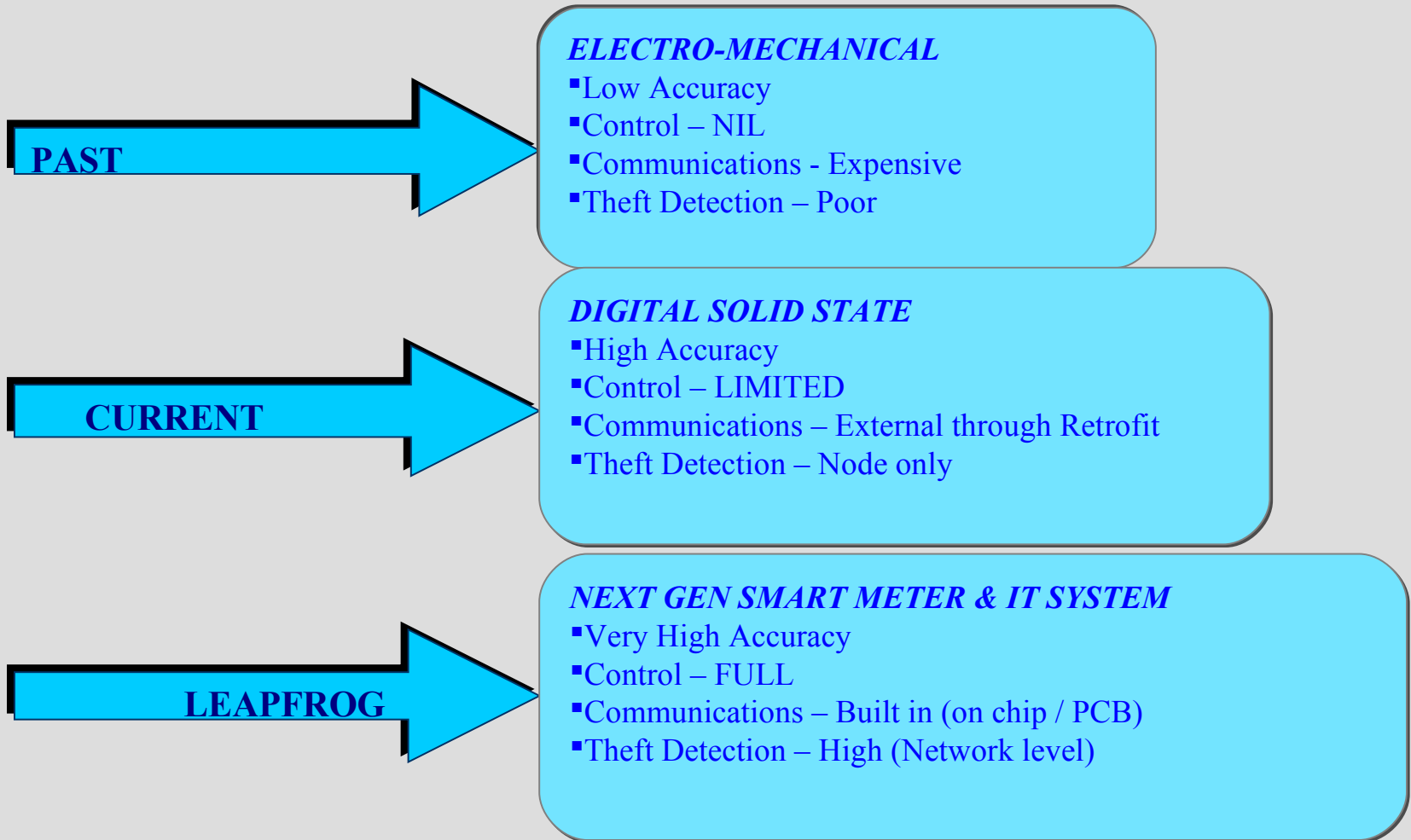
Contents

- Issues with stand alone metering
- Smart Metering and IT: An opportunity to Leapfrog
- Critical Benefits from AMRS
- Definition
- AMR network architecture
 - _ GSM Based Communication
 - _ PLCC based Communication
 - _ Network Architecture/Hybrid Communication
- Primary components
- PLCC / GSM Modem
- Inbound Outbound Dialing
- Advantages

Issues with Stand-alone meter reading

- Highly Person dependant.
- Human errors cannot be avoided.
- Accessibility of meters in rural/ Agricultural zones.
- Energy Audits performed based on bill collection which is highly inaccurate.
- Billing done mainly on estimated/ monthly average basis
- Inability to monitor and control discrete loads
- Billing cycle requires excessive time.
- Meter data used only for billing, cannot help in analysis like demand analysis, energy audit, pinpointing losses, etc.

Smart Metering and IT: An opportunity to Leapfrog



Critical Benefits from AMRS

- Ability to detect tamper events and outage occurrences.
- Remotely Connect/ Dis-connect power supply through meter.
- Calculate transformer loading and sizing from interval data
- 15 minute interval data gives accurate load information for supply scheduling, switching operations, planning etc
- Monitor voltage at each premise to know conditions when to operate capacitor switches or regulators
- Consistent and granular data for improved accuracy

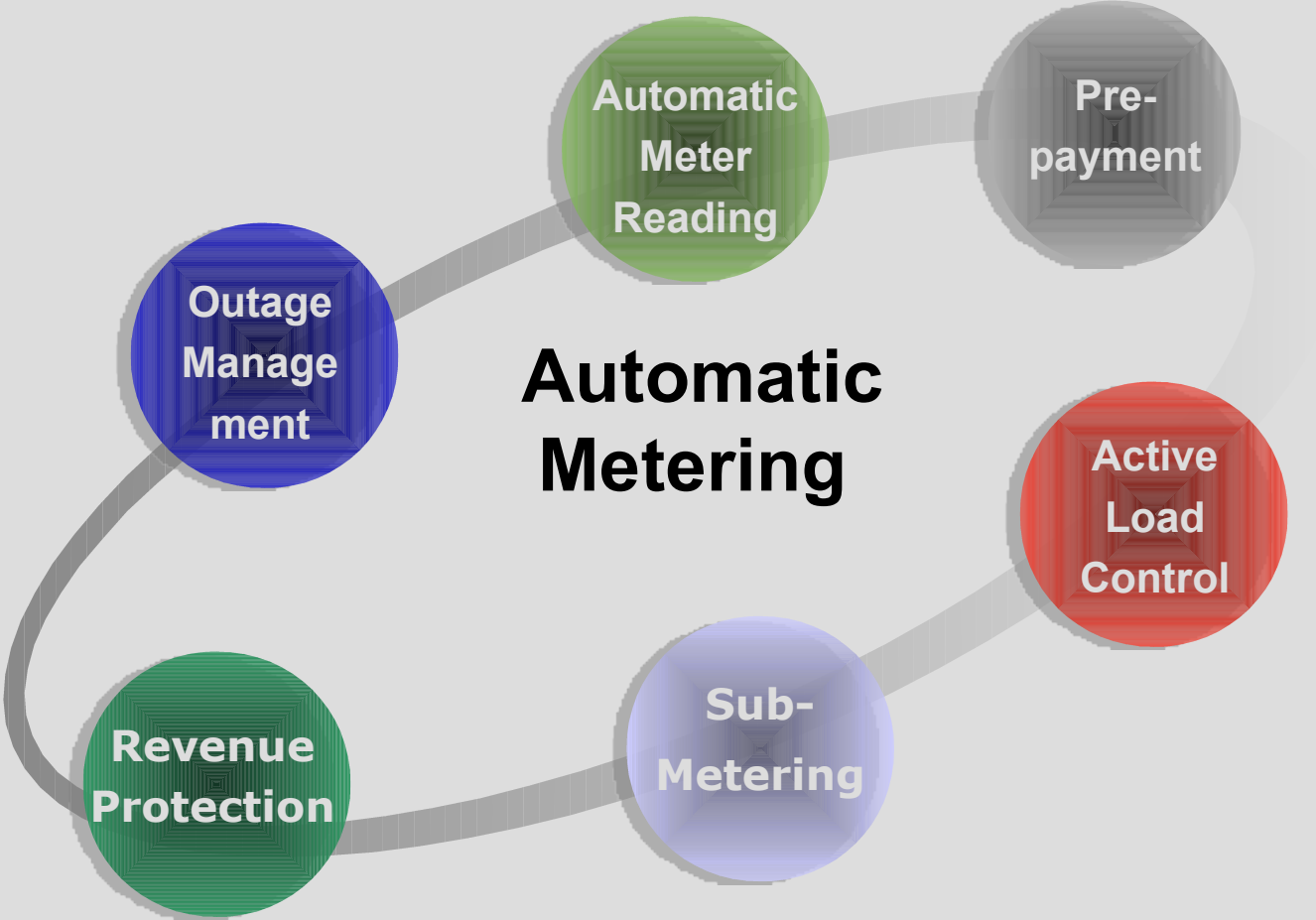
Definition

- **AMR**

- Automatic Remote Meter Reading .
- Automating the process of measurement through digital communication techniques.
- Bring “intelligence” into the revenue cycle and manage it:

Metering  Billing  Operations  Customer  Service

Automatic Metering



**Automatic
Metering**

Automatic
Meter
Reading

Pre-
payment

Active
Load
Control

Sub-
Metering

Revenue
Protection

Outage
Manage
ment

AMR NETWORK ARCHITECTURE

Connectivity in AMR Architecture

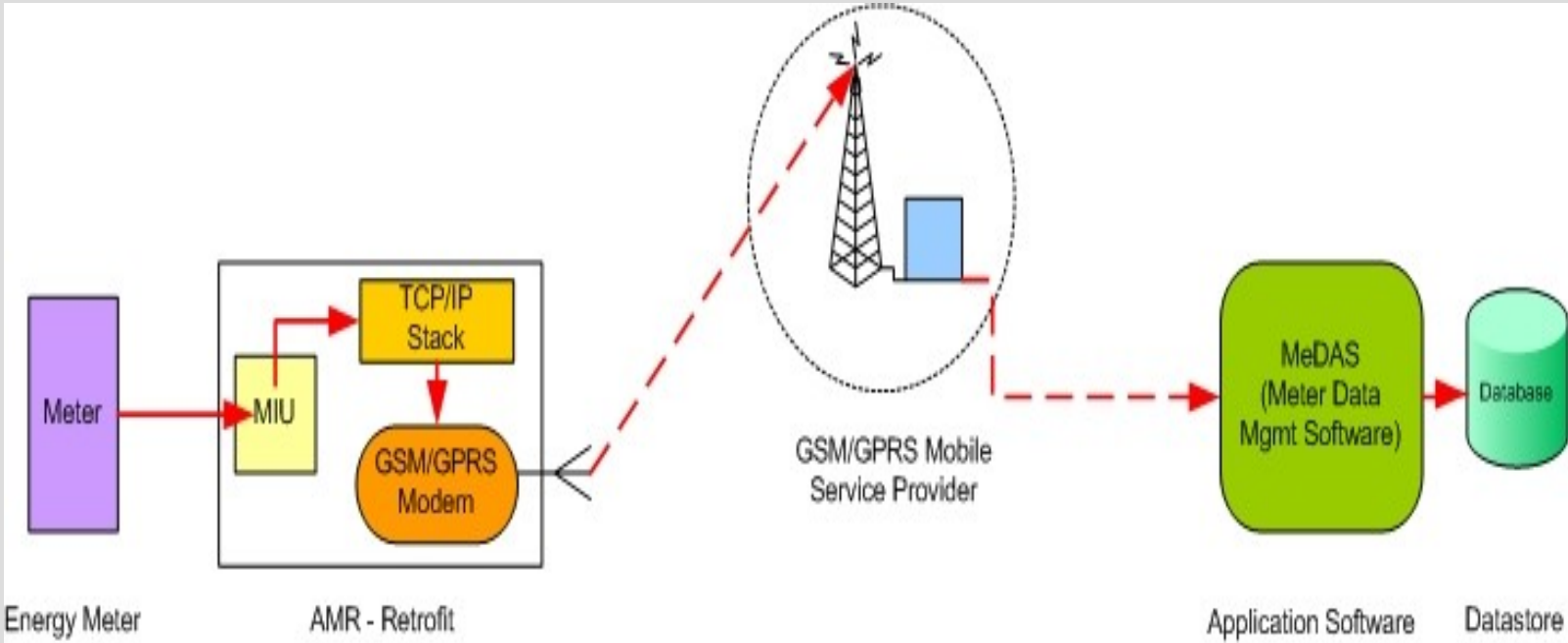
1. GSM Based Communication

Single stage communication between Meter and central station through GSM Modem

2. Hybrid Communication

Two stages of communication in AMR System

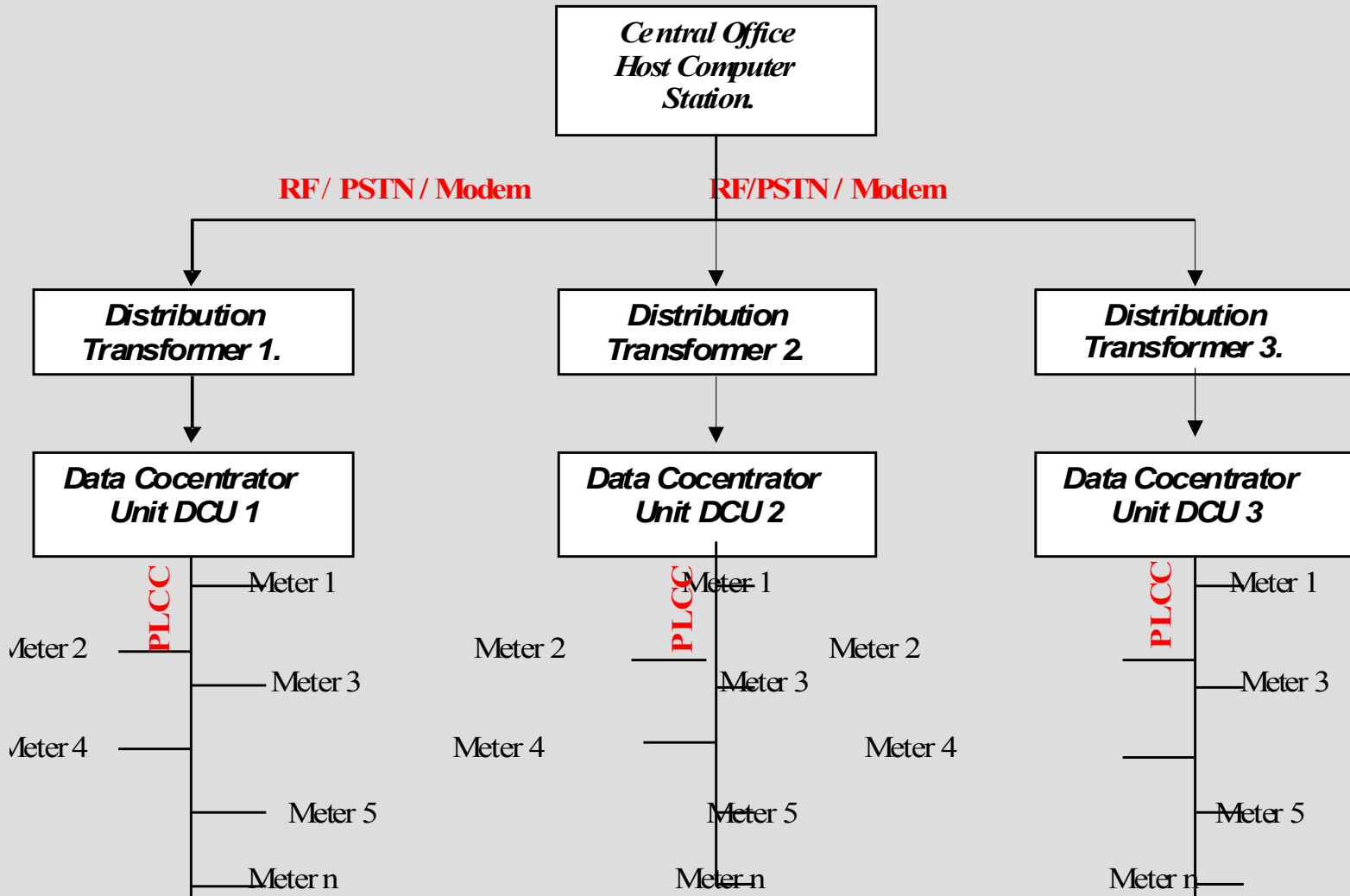
GSM Based Communication



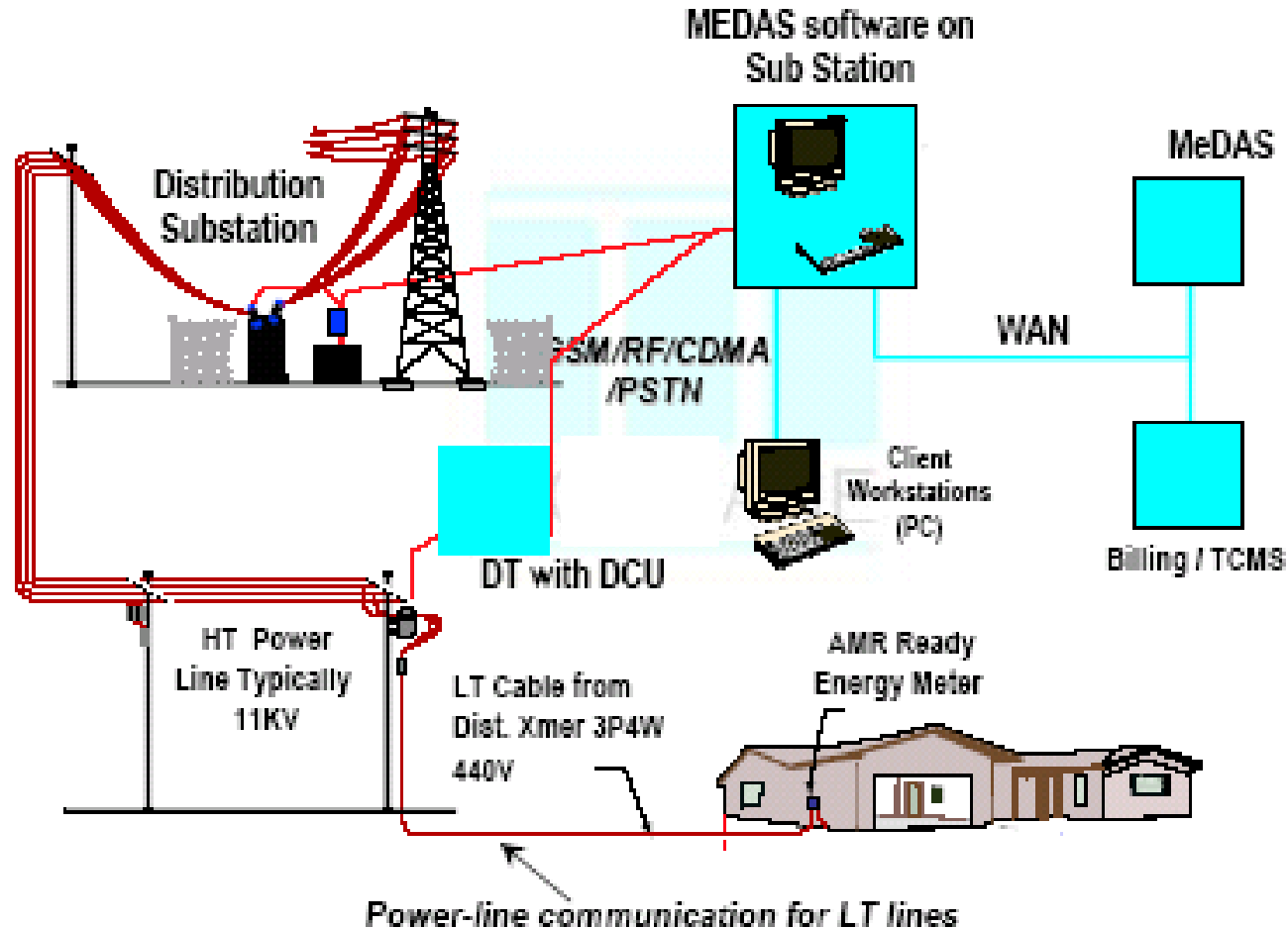
Hybrid Communication

- Two stages of communication in AMR System
 - **Meters and Data Concentrator Unit (DCU):**
Communication channel used between meters and DCU is Power Line.
 - **DCU and Host Central Station (HCS):**
Communication channel used between DCU and HCS is the standard GSM, CDMA, RF or PSTN Network.

AMR ARCHITECTURE



Network Architecture/Hybrid Communication



PRIMARY COMPONENTS:

- Meter Interface Module
- Communication System
- Central Office Equipment

Meter interface module

- The AMR system starts at the meter. Some means of translating readings from rotating meter dials, or cyclometer style meter dials, into digital form is necessary in order to send digital metering data from the customer site to a central point.
- Electro - optical interface
- Signal Processing Electronics
- RAM & Program Memory

A. GSM Based Communication

- GSM modem
- Antenna

GSM Modem



- Dual Band or Triband GSM GPRS modem (EGSM 900/1800MHz) / (EGSM 900/1800 / 1900 MHz)
- Designed for GPRS, data, fax, SMS and voice applications
- Fully compliant with ETSI GSM Phase 2+ specifications (Normal MS)
- **Interfaces**
- RS-232 through D-TYPE 9 pin connector
- Power supply through Molex 4 pin connector
- SMA antenna connector
- Toggle spring SIM holder
- Red LED Power on
- Green LED status of GSM / GPRS module

B. PLCC Communication

Data Concentrator Unit (DCU)

- The Data Concentrator sits on the loop of secondary of the distribution transformer. Collects meter readings from all the meters using Power Line Communication System at predefined intervals.
- The DCU and all the meters connected to it can be considered as a sub-system of the HCS. The sub-system is set up with a DCU monitoring the low voltage power zone downstream of a Distribution Transformer.



Retrofit Card

- Consists of a single PCB, which converts CF pulses of Electronic Energy Meters to Electrical pulses, accumulate them and generate a meter reading with help of Microprocessor.
- Microprocessor converts this data into Power Line Modulation.
- Existing Meter Reading, Meter Constant and Meter ID is stored in NV RAM of Micro controller, before Retrofit is made operational.
- One unit is incremented when Retrofit senses the pulses equal to Meter constant.
- The incremented unit are stored in the NV RAM of the Micro controller.

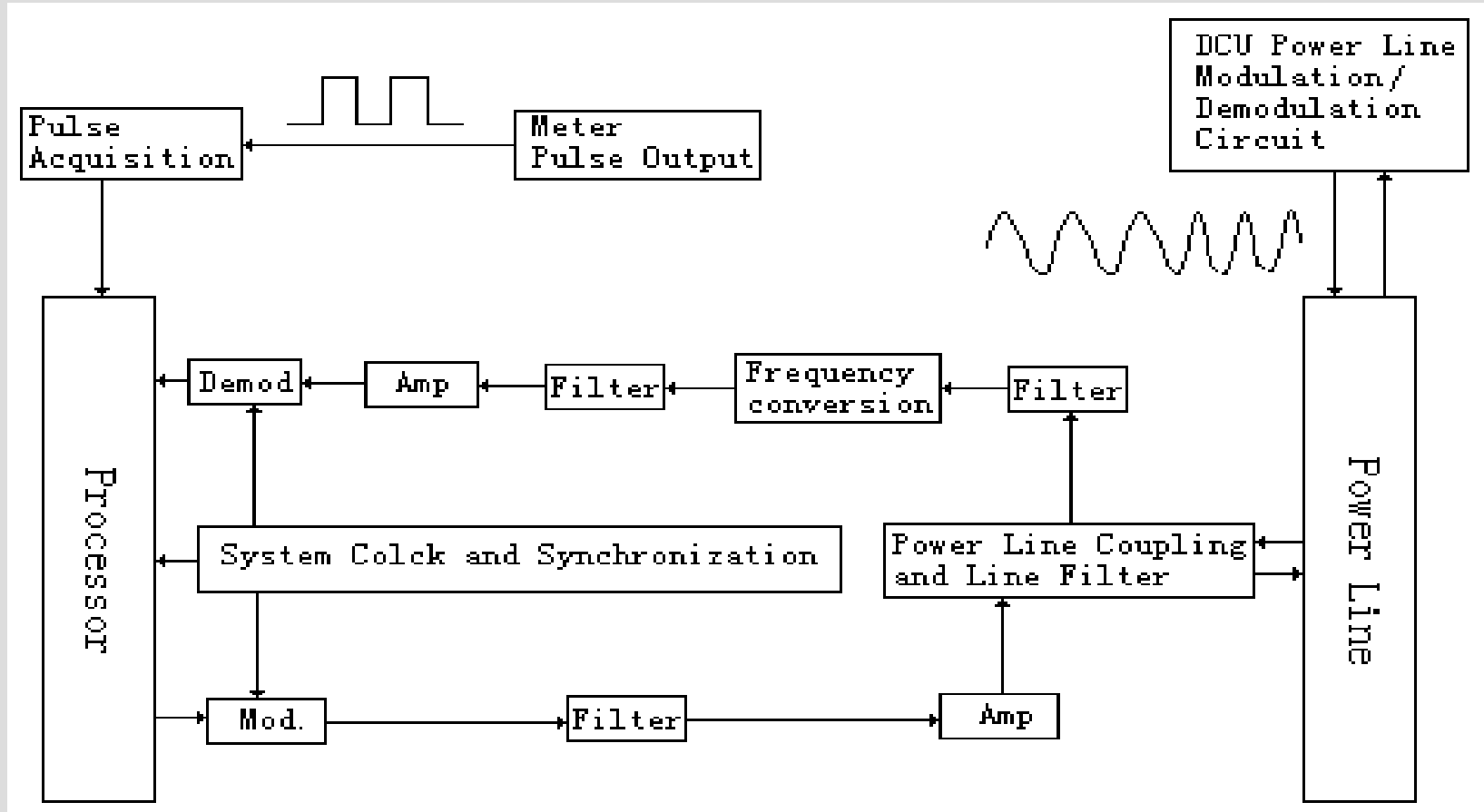


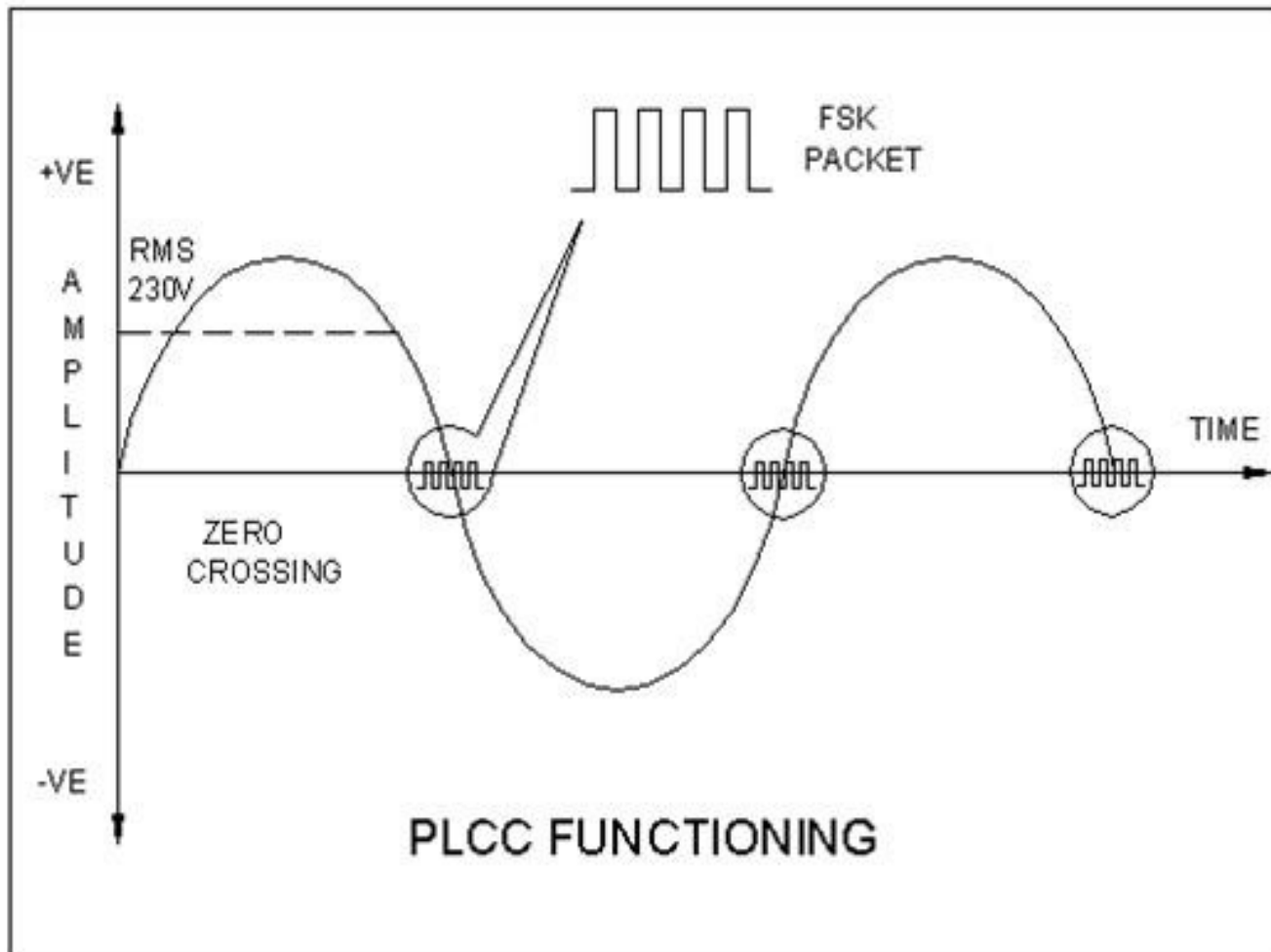
PLCC Communication

Power Line Carrier Communications

- Most economically viable technology for transferring Meter data to DCU.
- Uses the technique of communicating the data over existing Electrical Lines which carry LT power to the site.
- Employs an ASIC, which accepts digital data & converts it into FSK modulation and transmits it over the power line by sensing a zero crossing of 220V sine wave.
- Typical frequency used for frequency modulation is 132KHz.

PLC Schematics





C. AMR Enabled Meters

- Collect, process and record power consumption data and transfer it to DCU over existing Power Lines.
- Monitor electrical load in real time.
- After receiving a set of commands from DCU, meter process energy consumption data according to pre-set time intervals.
- Data received from different meters are stored in corresponding Load Data Records in Flash memory of DCU.
- The MIU is built-in, no separate Interface Unit is required.

Communications systems

- Used for the transmission, or telemetry, of data and control signals between the meter interface units and the central office.
 - GSM Network
 - Power Line

GSM Network In AMR

- Utilizing an existing cellular network for data transportation requires no additional equipment or software, resulting in a significant savings in both time and capital.
- Cellular technology utilizes an encryption technique to prevent an outside source from receiving the transmitted data.
- The cellular network provides full two-way communications, allowing scheduled reads, demand reads, alarm and event reporting, power outage reporting and power restoration reporting.

Why Power Line / Hybrid Communication?

- PLCC Best Suited for LT 440 V network for detecting outages, tamper events and performing remote disconnect
- Uses same power lines as communication media, so ideally suited for rural/ agricultural connections
- Communication on HT side can be implemented via a choice of GSM, CDMA, RF or PSTN

Central office systems

- **Central office systems** equipment includes:
 - Modems
 - Central server
 - Client Software for data acquisition and data analysis

MeDAS

- Software for AMR network management;
Data aggregation, Analysis & Energy Accounting

MeDAS - Meter Data Aggregation System

Network Navigator

Network Topology | Energy Accounting | AMR Communication

Starting With Level: SubStations

Showing Sub Levels for Meters under DCU IPCL DCU SN1/Transformer TR3

Showing All Meters under DCU IPCL DCU SN1/Transformer TR3

Count = 37

MIU Typ	MIU Num	Meter Se	Basic Cur	Basic Cur
1	1643	B300001	1652	Amperes
1	1644	B300002	1653	Amperes
1	1645	B300003	1654	Amperes
1	1647	B300005	1656	Amperes
1	1648	B300006	1657	Amperes
1	1649	B300007	1658	Amperes
1	1650	B300008	1659	Amperes
1	1651	B300009	1660	Amperes
1	1652	B300010	1661	Amperes
1	1653	B300011	1662	Amperes
1	1654	B300012	1663	Amperes
1	1659	B300017	1668	Amperes
1	1662	B300020	1671	Amperes
1	1665	B300023	1674	Amperes
1	1667	B300025	1676	Amperes
1	1668	B300026	1677	Amperes
1	1669	B300027	1678	Amperes
1	1670	B300028	1679	Amperes
1	1671	B300029	1680	Amperes
1	1672	B300030	1681	Amperes

Selected Path: IPCL Zone / IPCL Circle / IPCL Division / IPCL Sub-Division / TEST / TEST12 / TEST / 10 / TEST / TES

UserName : A, Role : Admin | No DCU Connected | Showing All Meters under DCU IPCL DCU SN1/Transformer | Session Start: 11:07:50 PM

Meter Data Analysis & Energy Accounting

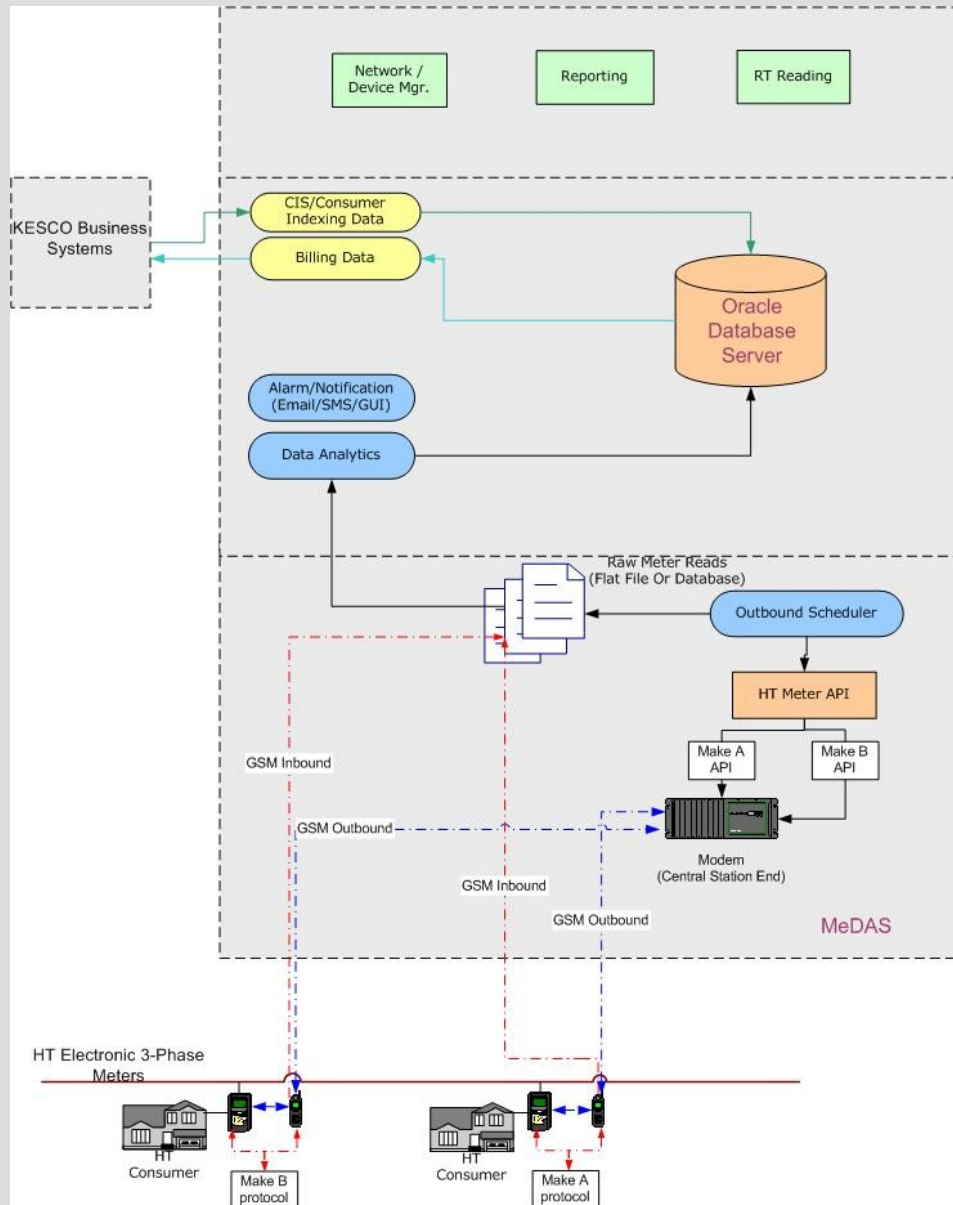
- **Network Schematic Modelling:** Modelling the physical network structure (substation, HT Feeder, Transformer, LT Feeder) & keeping it updated as changes occur.
- **Handle Feeder Switching scenarios for Energy Accounting:**
 - From One LT feeder to another on the same transformer
 - From One distribution Transformer to another distribution transformer, but with the same LT feeder
 - From One HT feeder to another HT feeder but through the same DT and LT feeder

- contd.

- Reports/Analysis
 - Identifying customers with tampered meters or zero readings.
 - Monitoring the **energy consumed /supplied** and **energy accounts /reconciliation** over a particular duration
 - by customer category
 - by network device (LT Feeder, transformer, HT Feeder, Substation)
 - by geographical area (zone, circle, division, subdivision)
 - Monitoring the **maximum demand**, voltage levels, current, power consumption/ load **on each meter**.
- Can calculate Max demand of LT / HT feeder, Transformer & Substation
 - Abnormal consumption report
 - **Ability to build ad-hoc reports** without having to know any programming language or query language.
 - Energy Balance Report
 - Areas of High Loss Report
 - Consumption trends Report

AMR FEATURES/ FUNCTIONS

Inbound and Outbound Dialing



Inbound and Outbound Dialing -contd.

- This supports both outbound and inbound communication modes. In the latter mode, the modem passes the commands sent by the data acquisition server to the meter and directs the meter response as-is back to the server. The meter manufacturer specific APIs running on the server will send the necessary commands to collect the meter data.
- In the inbound mode, the modem will initiate communication to send reading or event data to the data acquisition server. It will again invoke manufacturer specific meter commands to collect data from the meter reading and tamper registers.

Inbound and Outbound Dialing -contd.

- This server comprises the following modules:
 - Data Acquisition: The server holds the APIs for enabling outbound dialing to various makes of HT meters. MeDAS' outbound scheduler schedules automatic dial out to respective meter-end modems.
 - Data analytics:
 - » Raw reading/tamper data retrieved is first stored in flat files. This also applies to the data obtained from inbound dialing or downloaded from MRIs.
 - » The data analytics module then validates the raw data and stores it in the Oracle Database so that it can be used for further analysis.

Inbound and Outbound Dialing -contd.

- Alarms and Notification: Sends notifications to the users via email/SMS/GUI for preprogrammed parameters like demand violation, abnormal power factor, tamper conditions, missing data and other preset conditions that the user might need alarms for.
- Interfaces to existing KESCO systems to exchange consumer indexing information and billing data.

Advantages

ELECTRIC COMPANY BENEFITS

- Smart automated processes instead of manual work
 - Accurate information from the network load to optimise maintenance and investments
 - Customized rates and billing dates.
 - Streamlined high bill investigations.
 - Detection of tampering of Meters.
 - Accurate measurement of transmission losses.
 - Better network performance and cost efficiency.
 - Demand and distribution management.
 - More intelligence to business planning.
- Better company credibility.

CUSTOMER BENEFITS

- Precise consumption information
- Clear and accurate billing
- Automatic outage information and faster recovery
- Better and faster customer service
- Flag potential high consumption before customer gets a high bill.

Thank you