ENGINEERING AND R&D SERVICES

HCL

WHITE PAPER on "HVAC Industry: Challenges, Trends, Market Drivers"

June 2014

2 Engineering experiences

Acceleration | Value | Technology

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Abbreviations:

S No.	Acronyms	Description
1.	HVAC	Heating, Ventilation and Air conditioning
2.	IoTF	Internet of Things Framework
3.	OEM	Original Equipment Manufacturer

- HVAC industry can act as a significant contributor in energy conservation and thereby supporting “Go Green” initiatives
- Smart grids and smart metering can help minimize transmission losses

Objective

HCL team has been regularly tracking the HVAC industry for some time. This white paper lists key findings with respect to trends observed and challenges faced by HVAC industry. This is followed by sections on how HCL’s in-house developed solution IoTF can effectively meet some of these challenges.

HVAC Industry: Trends, Challenges and market drivers:

Some of the key findings / trends observed from the recent analysis are listed below:

a) Increased focus on energy conservation and demand prediction: Since prerequisite for any effective management is measurement, a high emphasis is observed on measuring and reporting of energy consumption at an increasingly granular level. Increased focus on the energy utilization is also due to the fact that the energy consumption level in the HVAC appliances is comparatively higher.

b) **Slow Economic Recovery is resulting in demand moderation of HVAC systems** and leading to a greater emphasis on energy savings: Global economic recovery has been sluggish especially in the US and Europe regions. This coupled with reduced incomes and higher energy bills have impacted the overall demand for HVAC systems.

c) **Greater shift towards smart grids, smart metering and building automation**: Smart grids help in intelligent distribution resulting in minimal losses, whereas measurement and reporting of consumption in real time is achieved by smart meters.

d) **Cost reduction via preventive maintenance and remote diagnostics**: HVAC systems are among the largest consumers of energy, indicating that these systems can be the source of good savings if the overall performance is increased and the faults are detected on time. Cost savings will also be achieved by reduced trips by service persons.

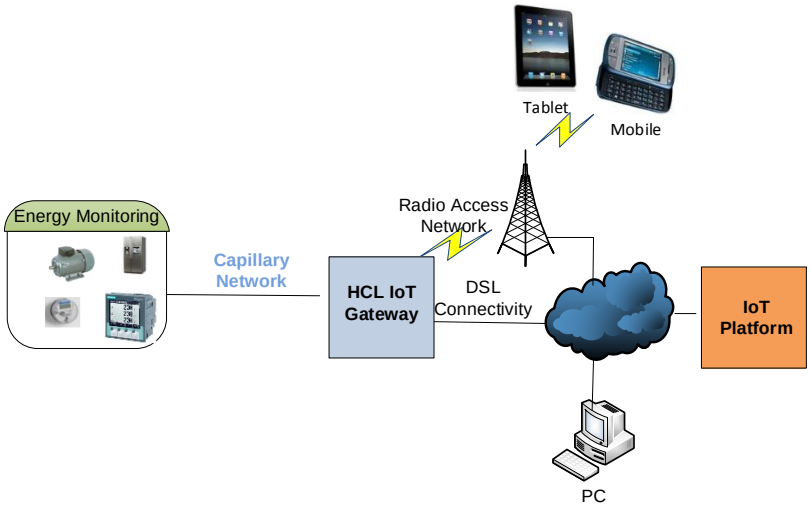
e) Environmental factors like ozone depletion and global warming has resulted in increased awareness about effective energy consumption and also seeded various “Go Green” initiatives.

f) Increased interest in the technologies like Big data, cloud computing and advanced analytics: HVAC OEMS are increasingly turning to technologies like Big

- HCL inhouse developed IoTF can be leveraged for effective energy management
- IoTF can also support use cases like remote diagonostics, preventive maintainance
- Feature analytics can help OEM's in product refinement

data, cloud computing and advanced analytics to create product differentiation and gain market share. These technologies are used for trend analysis, pattern recognition, cause and effect analysis, etc. Big data and advanced analytics are also being leveraged to predict future energy requirements, to comply with statutory and regulatory guidelines by giving detailed proof of efficiency and performance.

Proposed Solution



Some of the challenges/issues mentioned in the previous section can be overcome by deploying the Internet of Things (IoT) framework as shown in the figure above. Detailed scenarios/use cases leveraging IoTF are listed below:

1. **Energy Management**: Energy management is explained in following three cases:
   a. HVAC appliances will be interfaced with Power/Energy meter to measure the energy consumption data at the individual device level or household level. This data will be sent to IoT platform in near real time via IoT Gateway and can be analyzed / recommendations can be given to the user.
   b. Smart Grid integration can also be done and demand response based system can be implemented.
   c. The presence sensor can communicate with the gateway about the absence of any one, gateway can then switch off the HVAC devices in order to optimize energy consumption. The rules can be

configured via the platform and pushed to gateway for implementation.

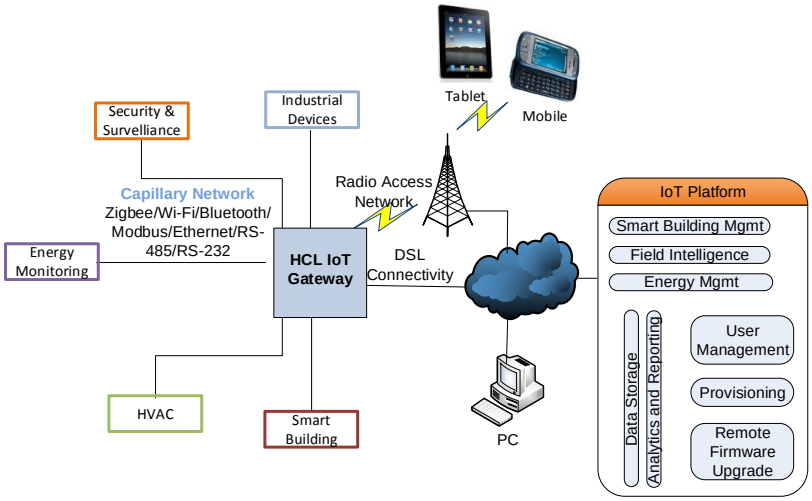
2. **Remote Monitoring and control**: The different setting of the HVAC devices e.g. cooling mode, set temperature etc. can be remotely monitored as well as controlled from the mobile devices. The mobile devices will connect to the HCL IoT Gateway either over the cellular network or LAN network. The IoT gateway receives these commands and sends corresponding commands to ZigBee (or other capillary network) thermostat, enabling the remote control and monitoring of HVAC appliances.
3. **Preventive Maintenance and Remote Diagnostics**: The operational/diagnostics information from the HVAC devices will be sent to the platform via gateway. Based on the configured rules and the available historical data, proactive alerts would be sent to the user about the HVAC part which requires repair or replacement. Additionally, it would be possible to send the diagnostics information which the service person can analyze to suggest corrective actions. This would result in considerable savings as there is no need for the service person to physically travel to perform the repair operation.
4. **Feature Analytics**: The real time data about the usage characteristics of the HVAC devices would be sent to the platform via the gateway. The data at the platform is consolidated and advanced analytics are run so as to analyze the usage patterns of the end users. This would provide a very good insight to the product managers and can help in product definition of the next version of the product.

- IoTF gateway component provides the connectivity to HVAC devices
- IoTF platform enables services like energy management and smart building managment

HCL's Solutions relevant for HVAC industry

HCL has come up with solutions which can be helpful to overcome some of the challenges faced by industry. These solutions are addressing the key requirements of connectivity, cloud enablement, Big data and advanced analytics. Overview of solution is given below:

IoT (Internet of Things) Framework



The two components of the framework are:

- Cloud enabled IoT Platform
- IoT gateway

The Platform can (directly or via gateway) connect to devices from diverse domains and hence support variety of applications. Gateway will provide connectivity to HVAC appliances and convert them into smart devices. The features supported by the framework are listed below:

- Remote access and monitoring
- In Memory analytics
- Real time subscription management
- Configurable events, alerts (e-mail, SMS) and scheduler functionality
- Device provisioning and configuration
- Complex Event Processing
- Remote firmware upgrade
- Video monitoring and camera Control
- Protocols/connectivity interfaces supported by gateway
    - SD card for storing logs/local data

- Zigbee
- Wi-Fi
- RS-232/RS-485
- Ethernet
- Bluetooth
- USB 2.0 (host and OTG)
- Flash

References:

1. How Big Data and Analytics change the Game for HVAC Systems (http://www.traneoregon.com/news/how-big-data-and-anayltyics-chang-the-game-for-hvac-systems/)
2. Better HVAC Systems can deliver the Smart Grid Promise(http://www.demandresponsesmartgrid.org/Resources/Documents/NTM%20Presentations/Eugene%20Smithart%20(Trane)%20-%20NTM%20A-2.pdf)

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