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Real-World Applications of Reliable, Low Power Wireless Sensor Networks

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Product Marketing Manager, Dust Networks Product Group
Linear Technology
Dust Networks Overview

- Acquired by Linear Technology in December, 2011
- Pioneer of reliable, ultra-low power and scalable embedded wireless sensor networks (WSN)
- Dominant WSN supplier to global Industrial OEMs
- “No wires” WSN specialist: defining the way to connect smart device

**Dust** has played a pioneering role in wireless sensor networking.

Harry Forbes, senior analyst at ARC Advisory Group
Overview

- Standards, Markets and their Technical Demands
- SmartMesh Basics and Applications
Standards, Markets and Technical Demands
The Wireless Landscape

WSN = Low Power : Low Data Rate : Lots of Devices
Wireless Sensor Networking (WSN)

- 10x reduction in the cost of installing sensor networks
- Increases sensor deployment
- Provides access to real-time information
- Enables new services

Monitoring Systems
Control Systems
Enterprise Applications

Analog Sensors
Digital Sensors and Actuators
Serial Devices
WSN Enables Business Opportunities

- “Wire replacement”
  - Use wireless instead of wires to grow existing wire-based sensor networks

- “Wirelessly enabled”
  - New products or services enabled by wireless because wired networking costs are prohibitively high or because wires of any sort are impractical

- Technology challenge: the reliability of wires, with the economics of wireless
Sensor Network Evolution

- **Wired Networks**
  - Very high reliability
  - $$$$ Installation
  - Inflexible Network

- **Point-to-Point Wireless**
  - Low reliability
  - $$ Installation
  - Flexible Network

- **Wireless Mesh**
  - Very high reliability
  - $ Installation
  - Very Flexible Network
WSN Markets & Standards

- **INFRASTRUCTURE**
  - Cities
  - Rail
  - Water

- **BUILDING AUTOMATION**
  - Demand Response
  - Net Metering
  - AMI, SCADA

- **CONSUMER ELECTRONICS**
  - Consumer
    - TV
    - VCR
    - DVD/CD
    - Universal Remotes
  - Other consumer
    - Wifi
    - Bluetooth
    - ZigBee
    - Others

- **PERSONAL HEALTH CARE**
  - Chronic disease
  - Elderly care
  - Fitness
  - Wellness

- **INDUSTRIAL CONTROL**
  - Asset Mgt
  - Process Control
  - Environmental Energy Mgmt
  - Retail Store Mgmt

- **HOME CONTROL**
  - Security
  - Safety
  - HVAC
  - Lighting Control
  - Access Control
  - Irrigation

- **Various**
  - For other apps

- **Proprietary/802.15.4G**

- **WirelessHART**
  - For Process

- **dust networks™**
Many Industrial Applications of WSN Products

Seismic sensing: 7%
Other: 8%
Wellhead mtrg: 14%
Steam trap mtrg: 14%
Structural/corrosion mtrg: 15%
Factory automation: 15%
Lighting controls: 19%
Energy/HVAC: 20%
Pipeline mtrg: 20%
Emissions/toxin mtrg: 20%
Process control: 27%
Valve mtrg: 39%
Asset/machine health: 41%
Tank level mtrg: 47%
Process mtrg: 80%

Source: OnWorld, 2012
“Low energy consumption and reliable end-to-end delivery have been the primary design goals of Dust Networks for many years, and this explains their leadership in the industrial WSN market”

SmartMesh Basics and Applications
- Full mesh and channel hopping for wire-like reliability
- Every mote can run on batteries for 5-10 years (or energy harvester)
- Built in security and network management
Wireless Sensor Networking Applications

Industrial
- Equipment health/condition monitoring
- Process monitoring and control

Energy
- Energy Management
- Data Center Monitoring & Control
- Utility Scale Solar Monitoring and Control

Smart Infrastructure
- City infrastructure
- Transportation

And many more...
Customers Using Dust Networks Products

- Emerson
- Phoenix Contact
- Streetline
- IBM
- Siemens
- Pepperl+Fuchs
- Endress+Hauser
- Liebert
- GE
- Vigilent
- ABB
- Dust Networks
Examples of Products that Utilize SmartMesh

Freight Rail

Parking Management

Data Center Energy Management

Industrial Process

Over 20,000 networks in 120 countries
Industrial Process Automation

- Electrical/Mechanical contractor installed per wired practices
- Thousands of sensors
- >100m distances
- >5 year life on C-cell
- Wiring extremely expensive
Vigilent Data Center Energy Management

Vigilent server detects high temperature reading and determines where cooling is needed.

Wireless sensor measures temperatures higher than threshold.

System sends wireless command to turn CRAC unit on to provide necessary cooling.

Increased cooling reduces rack temperature to within configured ranges.

Vigilent is the leader in intelligent energy management systems for data centers, telcos and large, commercial buildings.
Smart Buildings - Vigilent Corporation

- Hundreds of sensors and control points deployed in the data center with no wires
- Example: NTT saves 7.6 million kWh and 10 million lbs of carbon emissions per year = $630,000/yr in two data centers
Networked by Dust: Streetline Networks

Street-based wireless sensors and parking meters collect real-time parking-space occupancy readings and payment activity.
Smart Cities - Streetline Networks

- Street-based wireless sensors and parking meters
- Collect real-time parking-space occupancy readings and payment activity
Railcar Condition Monitoring

- Remote monitoring of freight rail cars
- Multiple sensors per car
- Requires a robust no-wires solution
Smart Buildings

- Low-Power Motes at The Metropolitan Museum of Art
- The wireless environmental sensor network helps preserve the works of art
Emerson Process Management, an Emerson business, is a leader in helping businesses automate their production, processing, and distribution in the chemical, oil and gas, refining, pulp and paper, power, water and wastewater treatment, mining and metals, food and beverage, life sciences, and other industries.
-48 °F with a wind chill of -70 °F Wireless Transmitter on the North Slope of Alaska
In high heat furnace boiler application
FPSO – Floating Platform, Storage and Offloading
Mobile – transmitters on a truck, drive up to a network for temporary mobile monitoring.
“End users are talking

“I got the flow numbers I needed within 24 hours of installing the devices. Wireless is fantastic.”
Gary Borham, Operations Manager

“When Emerson first approached me with their industrial wireless solution, they said ‘We’re plug and play,’ said Tim Gerami, senior design engineer at PPG. I have to admit I laughed; nothing I’d seen so far was that easy. “But I’m a believer now. *Five minutes after installing it, the wireless network came to life.* It’s been there ever since.”

Wheeling Pittsburgh Corporation, a steel products company

PPG

dust networks™
WSN Enables Business Opportunities

Time Synchronized Channel Hopping mesh networks enable new applications with:

- UltraLow Power
- Wirelike Reliability (>99.999%)
- Ease of Installation