Per andare dove dobbiamo andare... per dove dobbiamo andare?

...noio volevum savuar...
Agenda

1. Honeywell Connected Plant
2. Digital Transformation
3. Architecture
4. Analytics
5. Visualization
6. Integration
7. Infrastructure
8. Getting Started
Past Trend

Workflow 1

Workflow 2

Workflow 3

Data

Analytics

Analytics

Analytics

Reactive Insights
Current Trend

People + Process

Data

Technology

Collaboration Enhanced Analytics

Situational Awareness
Future Trend

People + Process

More Data

Situational Awareness

More Analytics
Better Insights

Streaming Insights
Honeywell Connected Plant - Value Proposition

Deliver and sustain improvements in our customers’ profitability by increasing throughput & yield at lower cost via:

- Integrated Safety & Cyber Security
- Increased Production Efficiency
- Improved Process Reliability
- Optimized Supply Chain
- Workforce Competency
Connected Elements

Unequaled Equation For Success

Connected Process
- Domain expertise
- Data in context
- System optimization via analytics

Connected Assets
- External expertise & capabilities
- Aggregate and collaborate on all relevant data w/ analytics

Connected People
- HPS Solutions to execute/ maintain improvements
- Enhanced decisions via data analytics
- Worker safety & compliance

Connected Plant
- Unmatched industry offering
- Unique value prop
- Robust platform to attract “app” development & monetization
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Vediamo chiaramente dove andare e siamo “attrezzati”?

Mi hanno detto che a Milano, quando c’è la nebbia ....non si vede
Distributed Control Systems Are the Earliest Form of IIOT

Millions of Values per Minute

Thousands of Sensors → Analyzed, Processed, and Actioned

Where Can We Go From Here?
Evolve Industrial Internet Landscape

Connectivity Providers

Consultants

CRM/ERP

OEMs

Automation Providers

Disruptors

Success Depends on Connecting Offerings to Customer Outcomes
iIOT Vision

Cloud iIOT

Future

iIOT Sensors

Mobility

Legacy

Control System

Historian

MES Operations Framework

Analytics

OT

IM

Quality, Yields, Safety, Margins

- Connected Assets
- Surveillance
- Notifications
- Performance Contracts

Business

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What does Digital Transformation (IIoT) look like?

**Honeywell IIoT Open & Secure Framework**

- **Advanced Analytics**
- **Smart and Secure Collaboration**
- **Data Management and Onsite Control**
- **Smart & Connected Assets and Devices**

**INspire™ (Joint Innovation Program)**

- Honeywell App Store
- External App Developers
- Knowledge Vendors
  - EPCs
  - OEMs
  - SIs
  - Process Licensors
- Data Scientists

**EDGE**

- Equip. Vendors (ex. Flow Serve, MHI, etc.)
- DCS Process Data
- Ancillary System Data (ex. SAP, ERP, LIMS, etc.)

**Use Case Examples**

- **Production Efficiency**
  - Optimizing process by connecting external equipment
  - Ex. Shell Furnace Flooding

- **Process Reliability**
  - Predictive maintenance via data analytics
  - Ex. Codelco/ SKF Vibration Monitoring

- **Supply Chain Optimization**
  - Improved monitoring, forecasting & utilization
  - Ex. AirGas asset tracking

**Ecosystem Critical to Add Domain Knowledge to Solve Challenging Problems**

**Smart and Connected Assets and Devices**
IIoT by Honeywell – Driving Value

1. Disparate Information Systems across Customer Enterprise
   - Federate siloed information from “data swamps” within individual plants or functions
   - Leverage smart sensors, connected devices to be able to better monitor/control real time

2. Enterprise Intelligence Management
   - Collecting across systems
   - Visualize & Contextualize
   - Alarm Mgmt & Mobile Notification

3. Data Insight
   - Advanced analytics via Machine Learning & Data Science
   - Secure data transfer & aggregation in cloud
   - Single version of truth across enterprise/functions
   - Tools to contextualize/share data & deliver insights to stakeholders

4. Expert Support
   - External support beyond enterprise
   - Facilitating collaboration/secure data exchange with specialized experts (OEMs, Process Licensors, EPCs, etc.)
   - Facilitated by common platform

Cloud Intelligence
- Secure data transfer & aggregation in cloud
- Single version of truth across enterprise/functions
- Tools to contextualize/share data & deliver insights to stakeholders
- Enables enterprise wide fact-based decision support & KPI benchmarking

Insight
- Advanced algorithms & models to uncover insights from real-time & historical data
- Incremental improvements previously unseen thru conventional analysis

Insight Plus
- External support beyond enterprise
- Enabling collaboration/secure data exchange with specialized experts (OEMs, Process Licensors, EPCs, etc.)
- Facilitated by common platform
- Richer insights, improved asset performance, faster service time

Connected Plant
- Federate siloed information from “data swamps” within individual plants or functions

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Honeywell Connected Plant – An Integrated approach

- Asset Management: Sentinel, Fault Models
- Big Data Analytics: Cognitive Learning
- Fundamental Models: UniSIM, 3rd Party models
- Common Asset Model: Eng conversion tools
- Private Cloud
- 3rd Party Cloud
- 3rd Party Vendors: IIoT Partners
- Abstraction
- Firewall
- ERP
- LIMS
- MES
- MMS
- DCS
- IIoT

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Connected Performance Services

Key Customer Challenges

- **Energy and Emissions**
  - Emission standards
  - Energy reduction

- **Human Capital Challenges**
  - Knowledge gaps
  - Operational excellence

- **Underperforming Assets**
  - Sub-optimal operations
  - Performance vs peers

- **Unplanned Downtime**
  - Process issues
  - Equipment failures

CPS Architecture

The Connected Plant Delivered with CPS

- Analyze plant performance to reveal full potential through a cloud-based service
  - Around-the-clock monitoring of plant data and rigorous simulations
  - Provides on-going, operational recommendations to close performance gaps
  - Leveraging UOP Process Models & longstanding experience in operational support and troubleshooting

- Customer value of $0.30-$0.50/bbl in refining & $10-$20/MT in Petrochemicals
Honeywell – iIOT Strategy

Figure 1: The adoption and impact path of the Industrial Internet

1. Operational Efficiency
   - Asset utilization
   - Operational cost reduction
   - Worker productivity

2. New Products & Services
   - Pay-per-use
   - Software-based services
   - Data monetization

3. Outcome Economy
   - Pay-per-outcome
   - New connected ecosystems
   - Platform-enabled marketplace

4. Autonomous, Pull Economy
   - Continuous demand-sensing
   - End-to-end automation
   - Resource optimization & waste reduction

“If you can’t measure it, you can’t manage it.”

World Economic Forum, January 2015, Industrial Internet of Things: Unleashing the Potential of Connected Products and Services
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Digital Intelligence

Advanced Analytics

Smart and Secure Collaboration

Data Management and Onsite Control

Smart & Connected Assets and Devices

Apply powerful analytics to detect and predict issues

Connect process intelligence to business KPIs

Organize and visualize data in asset context

Capture real-time process and event data

Visualization
Across Entire Enterprise

KPIs Mgmt
Alarm Mgmt
Supply Chain
Predictive Mntce.

Driven via instant notifications

Collaboration
Across Entire Ecosystem

System Integrators

Plant Mgr

CEO

OEMs

Operations Ldr

Plant

Maintenance Mgr

Central Engineering

Enterprise

Consultants

Enterprise Ecosystem

Actions
Digital Elements

- Competence, leadership and training
- Organisation
- Collaborative work spaces
- Work Processes
- Visualization & Analytics
- Information access, interfaces, integration layer and security
- Communications infrastructure and standards
- Data capture and standards
- Assets and their Equipment
- Operational
- Organisational & Processes
- Tools
- Technology
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A Pragmatic Definition of Data Analytics

<table>
<thead>
<tr>
<th>Data Infrastructure or Historian</th>
<th>Data Collection (integration, aggregation, and management)</th>
<th>Data Context (contextualization, modeling &amp; access)</th>
<th>Analysis</th>
<th>Human Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive</td>
<td>What happened?</td>
<td>Descriptive</td>
<td>Decision</td>
<td>Action</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>Why did it happen?</td>
<td>Diagnostic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictive</td>
<td>What will happen?</td>
<td>Predictive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescriptive</td>
<td>What should I do?</td>
<td>Prescriptive</td>
<td>Decision Support</td>
<td></td>
</tr>
</tbody>
</table>

The goal of analytics is to provide information for **improved decisions and actions** for economic benefit.

Note that maximizing automation and minimizing human input are *not* always the goals → analytics should be suited to the use case.

Analytics: Asset Health, Process Performance and People

- Make faster decisions with better insights
- Convert tacit knowledge into explicit knowledge
- Link day to day actions to high level business goals

Process Performance
- Improve process efficiency
- Reduce capacity loss
- Reduce energy spend

Asset Health
- Improve Overall Equipment Effectiveness (OEE)
- Increase asset utilization
- Identify underperforming assets

People Productivity

Excellence by Digital Transformation
Uniformance Asset Sentinel Goal & Values

Current Situation
- Known knowledge are documented and trained but unknown knowledge leading to adhoc actions or failures
- No visibility or understanding on where Operations or maintenance against design at all loads

Goal
- Improve the effectiveness of asset, people and process to keep the overall reliability & performance of plant at higher level with optimal cost of running.

Value
- Improved performance by triggering appropriate corrective action early
- Knowledge Repository & Reuse
- Reduced Opex & Capex
- SME collaboration in monitor models

Challenges
1. Silo Operations, data, decisions
2. Experts are few
3. Continuous improvements automation

The Solution
- Visual Analytics – Rule Search
- Train Models
- Trigger Root Cause Analysis
- What If Analysis
- Large pool of data
- Experts & Engineers
- Offline
- Online
- Historian
- Sensor Data
- Continuous Equipment Monitoring
- Alert
- Investigation & Decision
- Data Analytics & Fault Diagnosis
- Data Analytics & prediction
- Take actions
- No Action
- Operation & Technician

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Type of Monitoring & Examples

- **Equipment Performance Monitoring (Reliance)**
  Example: Compressor Performance Monitoring

- **Overall Equipment Monitoring (Aramco)**
  Example: Fired Heater Performance (1st Principle), Fault monitoring: simple rules, time window based rules, predict time to fail based on online real time regression function in Sentinel

- **Equipment Health Monitoring (Shell Bridge)**
  Example: Choke Value Leak detection using dynamic pattern detection (dynamic PCA)

- **Instrument Health Monitoring (Suncor)**
  Example: Smart Temperature control valve (device diagnostics & NAMUR)

- **Process Performance Monitoring (Glatfelter)**
  Example: Generate control limits based on user baseline definition of a golden run in Sentinel and report deviation to operator

- **Energy Monitoring (RepSol)**
  Example: Dynamic target model for CDU, energy aggregation and identify actionable events to improve overall energy efficiency

- **Rigorous Optimization service (CPS-UOP)**
  Example: Platforming model – data preprocessing, Fault detection and leverage Unisim Link for data reconciliation, Parameter estimation, Optimization
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Typical Integration Challenges

- Information integration between data sources
- Collaboration between individuals
- Integration between applications needs intensive consulting & guidance (not shown in diagram)
Honeywell Methodology – Business Process Modeler

Multi-Dimensional Business Process Modeler

Process Decomposition

- Tasks & Activities
- Roles/ Location
- Functions

Manufacturing Decision Framework
- Collaboration
- Workflow/ Visualization
- Roles/ Location
- Information Integration
- Data/ Application Management
- Data Capture/ Quality Assurance
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IIoT by Honeywell Structure

IIoT is driven by devices that are:

- Smarter
- More Connected
- More Controllable
- Easier to service

**Key Structural Elements**

- Plant Gateway
- Unit Gateway
- WiFi or Cellular
- Stranded Asset
- Skid or Unit

Building off elements that you already have to enable IIoT
Enabling Infrastructure Options
HON Solution – Connecting Workers With Workplace

Real-time data:
- Threat readings
- Alarms
- Man-down status
- Compliance status
- Worker location

Safety

Productivity

Workers Field Collaboration

Instant situational awareness – the right information at the right time
CONext safety solution – connectivity options

- WiFi Infrastructure
- MESH Network

<table>
<thead>
<tr>
<th>Alarm Notifications</th>
<th>Map Displays</th>
<th>Decision Aid</th>
<th>Plume Modeling</th>
<th>Data Integration</th>
</tr>
</thead>
</table>

- RAEMesh Reader
- RAEPoint

- 200m (600+ ft.)
- 300m (990+ ft.)
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Getting Started

PWC: Industry 4.0: Building the digital enterprise
E ho detto tutto!!!
Digital Transformation to help improve performance, availability, reliability and safety

www.hwll.co/IloT