

A night-time photograph of an industrial facility, likely a refinery or chemical plant, with numerous tall distillation columns and structures illuminated by warm lights. Overlaid on the scene is a complex network of white lines and glowing nodes, representing a digital or data network. The background is a deep blue sky with some clouds.

INDUSTRIAL TECHNOLOGY VISION

SRINIVAS CHINTHA
CTO, HONEYWELL CONNECTED ENTERPRISE

09-MAY-2024

Honeywell

Honeywell Confidential - © 2024 by Honeywell International Inc. All rights reserved.

AGENDA

- 01** INNOVATION – OUR DNA
- 02** ARAMCO OPERATIONS TRANSFORMATION
- 03** DIGITALIZATION JOURNEY TOWARDS AUTONOMY
- 04** TECHNOLOGY OF THE FUTURE
- 05** HONEYWELL COMMITMENT TO SAUDI ARAMCO

INNOVATION - CORE OF OUR DNA

Most Honeywell offerings incorporate at least one of our three core R&D innovation foundations:
Controls and Autonomy, Digital Transformation and Sustainability

★ **1598 Patents filed by Honeywell Connected Enterprise**



CONTROLS AND AUTONOMY

Higher productivity and efficiency,
improved safety and speed for
more profitable business



DIGITAL TRANSFORMATION

Connecting assets, people and
processes to power business
digital transformation



SUSTAINABILITY

Broad offerings that span
circularity, energy, environment,
health, safety, security and
resiliency/accountability

Our Innovation & Decades of Industry Expertise Keeps the World Working

TOP

8

TECHNOLOGY
BETS

HONEYWELL Next Frontiers In Digital Transformation

Honeywell

Energy Storage
Green Fuels
Plastic Circularity
Blue / Green Hydrogen
Refrigerants / Membranes
Carbon Capture and
Storage
Carbon Emission
Plastic Recycling

5G
Wifi6
GPS / GNSS Denied Nav
LORA
BLE

Trust no one
across all layers

Digital Twin
AR / VR
Wearables
Gamification



CLEAN ENERGY
AND SUSTAINABILITY



FUTURE OF
CONNECTIVITY



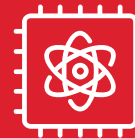
ZERO TRUST
ARCHITECTURE



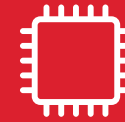
METaverse /
WEB 3.0



DISTRIBUTED
INFRASTRUCTURE



NEXT GEN
COMPUTING



NEXT GEN
SENSORS



APPLIED AI &
AUTONOMY

Hybrid / Multi Cloud
IIOT Enabled
Edge Analytics

Quantum
Custom Chipset

LIDAR
Radar
Smart Edge Devices
Emission Sensing

Robotics
Intelligent Automation
Edge AI
Gen AI
Machine Vision
Speech Recognition
Autonomous Controls

ARAMCO OPERATIONS TRANSFORMATION

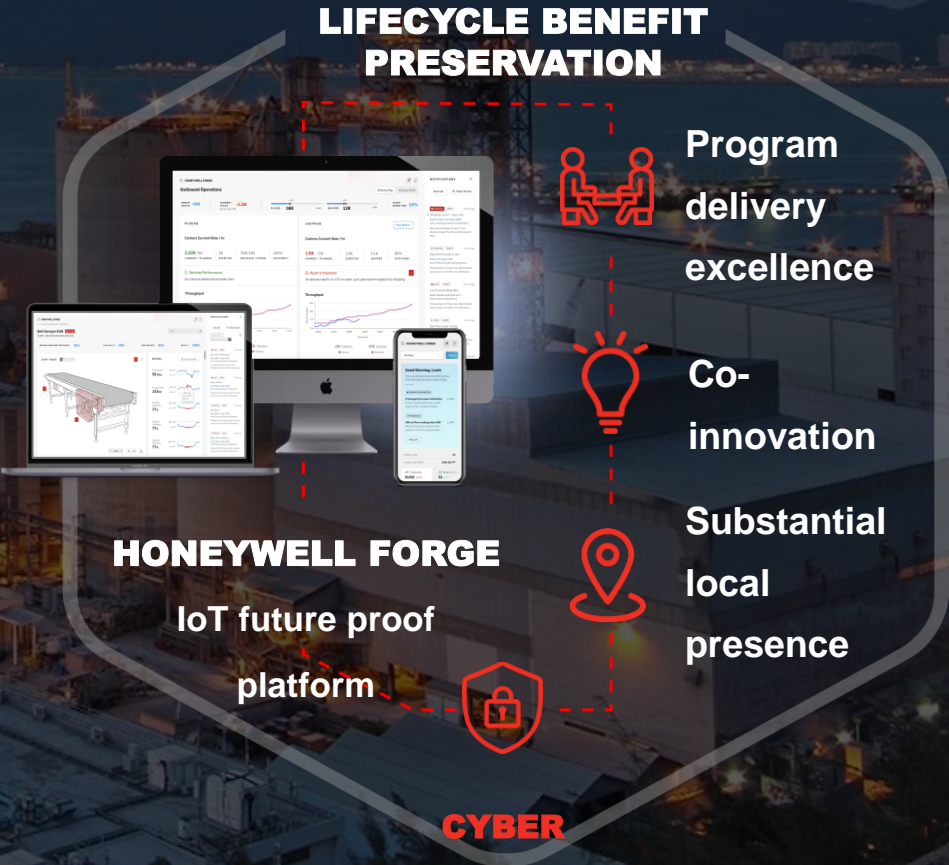
ARAMCO VISION

- Maintain 12m bpd**
While Maximizing Gas production and new assets
- 11m tons Blue Ammonia**
by 2030
Lower carbon products
- Net Zero**
by 2050
De-carbonization

- 1 Business Compliance
- 2 Operational Efficiency
- 3 Asset Availability
- 4 Upskilling Talent
- 5 Net Zero Carbon Emissions

DIGITAL TRANSFORMATION STRATEGY

Honeywell



DIGITALIZATION JOURNEY TOWARDS AUTONOMY

PAST



Experts Collect the Data,
Then Analyze, Then Act

PRESENT



Experts Analyze The
Data & Act

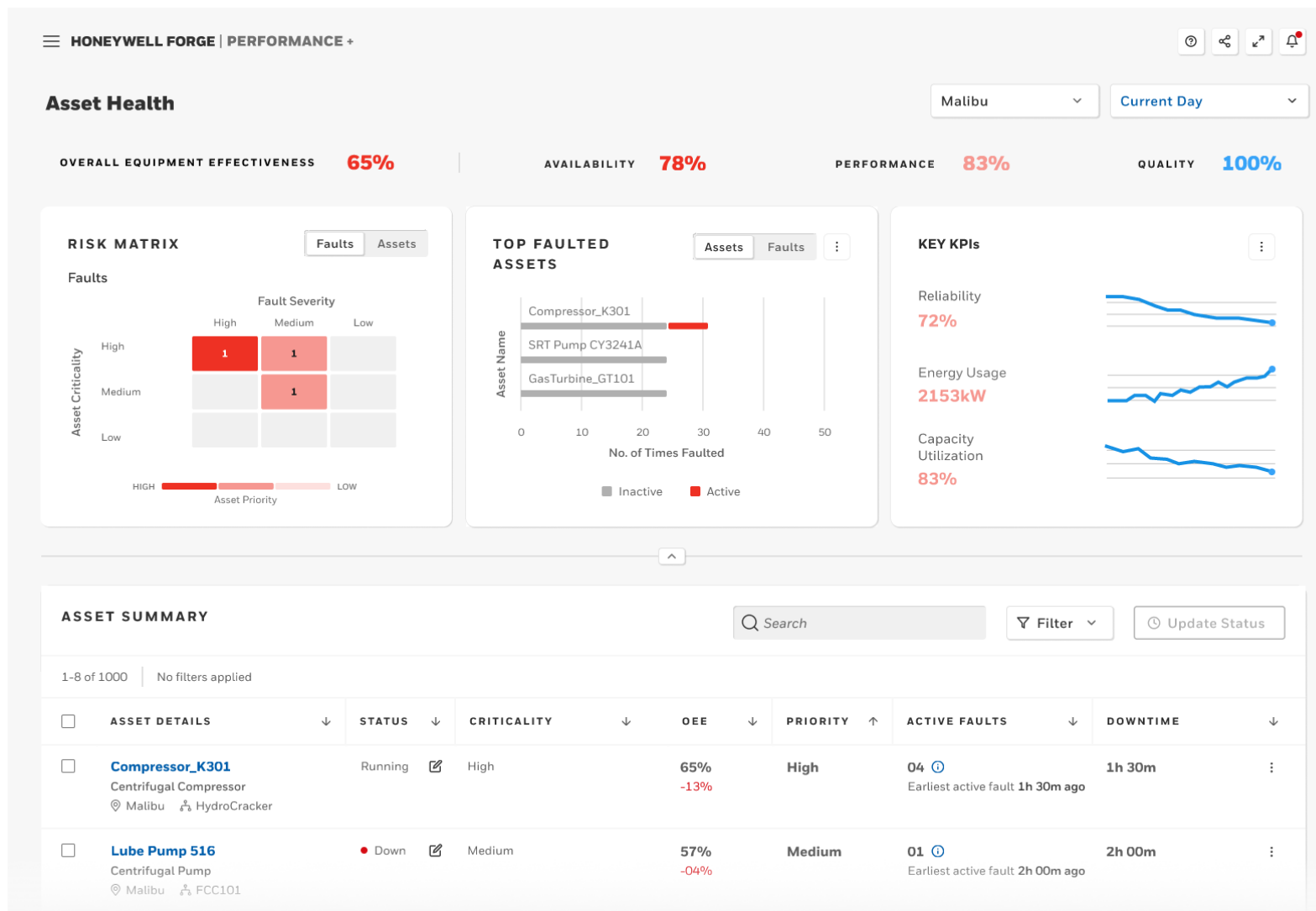
FUTURE



Experts Insights/Actions Provided
To Us

OUR PRESENT

- Deterministic AI but lack of information on action required
- Siloed system hindering decision making



NOTIFICATIONS & EVENTS

Notifications 1 All Events

HIGH FAULT 5 mins ago

Compressor - Rotor DE Vibration High
 Asset Name: Compressor_K301
 Area Name: HydroCracker
 High Vibration observed in Rotor Drive End

MEDIUM FAULT 8 mins ago

Compressor Performance Degradation
 Asset Name: Compressor_K301
 Area Name: HydroCracker
 Abnormal decrease in Polytrophic Efficiency

HIGH FAULT 8 mins ago

Bearing Temperature DE High
 Asset Name: Compressor_K301
 Area Name: HydroCracker
 High Bearing Temperature on Drive End Bearing

MEDIUM FAULT 8 mins ago

Excess Recycle Flow
 Asset Name: Compressor_K301
 Area Name: HydroCracker
 Excessive Recycling detected

OUR FUTURE

Honeywell Industrial Vision – Leveraging Advanced Analytics & AI

Data enabled. Expertly trained. Action oriented.



Reliability Co-pilot

Domain infused
Actionable
Workflows

The screenshot displays the Honeywell Forge Performance dashboard. The main interface shows an 'Events Overview' section with a bar chart for 'EVENT PROBABILITY' and a table for 'EVENT MONITORING'. The AI Assistant overlay on the right shows a workflow progress: Root Cause Analysis, Historical Analysis, Prescriptive Recommendation, and Implementation (4/4 Task Completed). A notification box states 'Work Order has been created'. The dashboard includes various filters and data points such as 'TOTAL EVENTS: 1,234' and 'ACTIVE EVENTS: 135'.

INTELLIGENT OPERATIONS THROUGH AI ASSISTANT

OUR FUTURE



HONEYWELL FORGE

Validate insight

Ethylene Production deviated ↗ Currently deviating

Stacked scale

Historical action

Based on historical action it is suspected that coke formation must have formed on the heater coils.

Recommended action: **Take H-101 into decoking**

What would you like to do next ?

- Assign H-101 decoking Case to Site team
- Prepare report for analysis

Type your message here

pipes @Ram

INTELLIGENT OPERATIONS THROUGH AI ASSISTANT

TECHNOLOGY POWERING OUR FUTURE



Operator Co-pilot



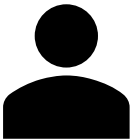
Plant Mgr Co-pilot



Reliability Co-pilot

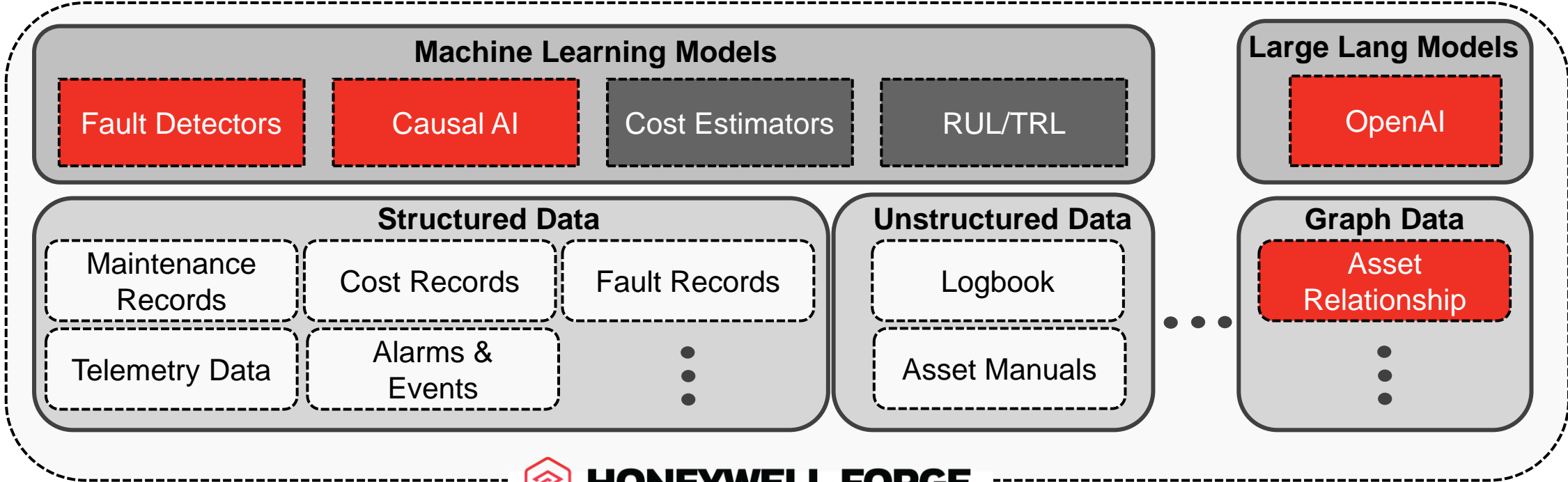


Enterprise Co-pilot



Field Worker Co-pilot

AI Enabled Assistant



HOW DOES HONEYWELL HELP DRIVE INTELLIGENT AUTONOMY

HONEYWELL IS UNIQUE IN DRIVING INDUSTRIAL AUTONOMOUS OPERATIONS

PROCESS LICENSING

UOP Enabled

- Core process licensing and know-how
- Technology proven since decades driving business value

AUTOMATION LEADER

Experion & Beyond

- Leader in automation systems
- Driving automation from sensors. Controls, ESD systems
- Leader on OT cybersecurity
- Centralized/Remote Operations

CORE SOLUTIONS EXPERTISE

Outcome Based Software

- Largest breadth of software portfolio
- Exhaustive list of successful deployments
- Domain expertise
- Services delivered
- Sustaining outcomes through managed services

CONNECTED SOFTWARE

Open loop, Self-learning Systems

- Connecting Process, Automation & Domain to create knowledge graph
- Ability to interface with transactional and real-time data sources
- Leverage data analytics to drive intelligent peak performance operations

INTELLIGENT AUTONOMY

Self-Optimizing Closed-Loop Systems

- Driving closed loop true "Autonomous operations"
- Sustaining business value through technology adoption and business process changes

Increasing levels of Capability to drive Intelligent Autonomous

HONEYWELL IS STRONG IN ALL LAYERS

OUR COMMITMENT TO YOU

Honeywell CEO Level Oversight & Ownership Honeywell – Saudi Aramco | Shared Vision

Delivery of Benefits With Assurance

Industry Leading Technology

- Alignment of **Technology Roadmaps** with Saudi Aramco objectives
- Access to **HON Capabilities**: Controls, Safety, Process Equipment, Gas Detection, Physical Security, Cyber, UAV's, Quantum Computing, APC/RTO, Process Modeling, OTS
- Honeywell **Forge IoT platform** application and data architecture combined with AI/ML
- **Future-proof** technology and data architecture
- Extensive **OT cyber security** capabilities

Accelerated Delivery Model

- Local **Program Execution Office** utilizing state-of-art project management tools
- HON **professional services** comprised of +2,500 domain and functional experts
- **Global Scale** with Agile Capability Deployment
- Global **Partner Strategy**: Technology, System Integrators, Strategy Consulting

Co-Innovation

- Up to **5% of revenue deployed in shared R&D** pool directed by joint steering committee
- Co-innovation with Saudi Aramco and JV's
- Multiple **Joint Ventures** (JV) in-place globally

KSA Investment

- Establish **KSA Digitalization Center**
- Partner with **Saudi Aramco** to supplement current training programs of local Saudi youth in digital technology
- HON commitment / track-record on **localized content and capability**

TRANSFORMATIONAL CHANGE & INDUSTRY LEADERSHIP

HOW WE APPLY TECHNOLOGY OF THE FUTURE

CONTROL & OPTIMIZE



Bridge AI and controls to safely maximize & sustain output and profitability

- Autonomous controls from wellhead to refining products
- 100% constraint adherence avoiding incidents
- Autonomously execute optimization of production between wells and downstream operations

INTELLIGENT ASSETS



AI and controls combine to eliminate unplanned downtime

- Analytics predict remaining useful life, intelligently generating work orders
- Assets optimize for energy or production objectives
- UAV's & camera sensors perform inspections

EXPERT PEOPLE



Zero harm operations with maximized human potential

- Zero people on upstream assets
- Time-to-expertise is 6 months with experiential learning using VR
- Flawless procedure execution – always following the SOP

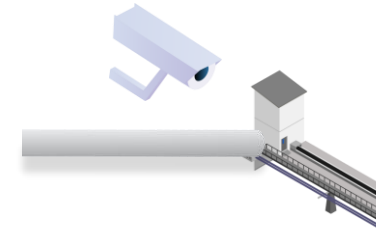
INTEGRATED CENTRAL OPERATION



Digital-first way of working to augment workers and processes with practical AI

- What-if scenarios provided for max production or best sustainability modes
- KPI deviations presented with AI assisted recommended actions
- Digitized morning meetings showing adherence to KPIs

SUSTAINABILITY



Autonomous control of avoidable carbon emissions

- Leaks and vents (fugitive) identified in real time with cameras and sensors
- Elimination of periodic LDAR and manual accounting
- Closed loop decisions to optimize on carbon vs. production

SHIFT FROM EXPERTISE-BASED DECISIONS TO CLOSED-LOOP AUTONOMOUS OPERATIONS COMBINING AI, DIGITAL TWINS, AND AUTOMATION



Honeywell

Honeywell Confidential - © 2024 by Honeywell International Inc. All rights reserved.

WHAT IS HONEYWELL FORGE?

Honeywell Forge is a IoT platform delivering AI-enabled solutions and services for intelligent, sustainable, and secure industrial operations

COMPONENTS

1 Forge IoT Platform

Real-time edge-to-cloud data connectivity and normalization for OT assets with built-in cybersecurity and open architecture

2 Forge Digital Services

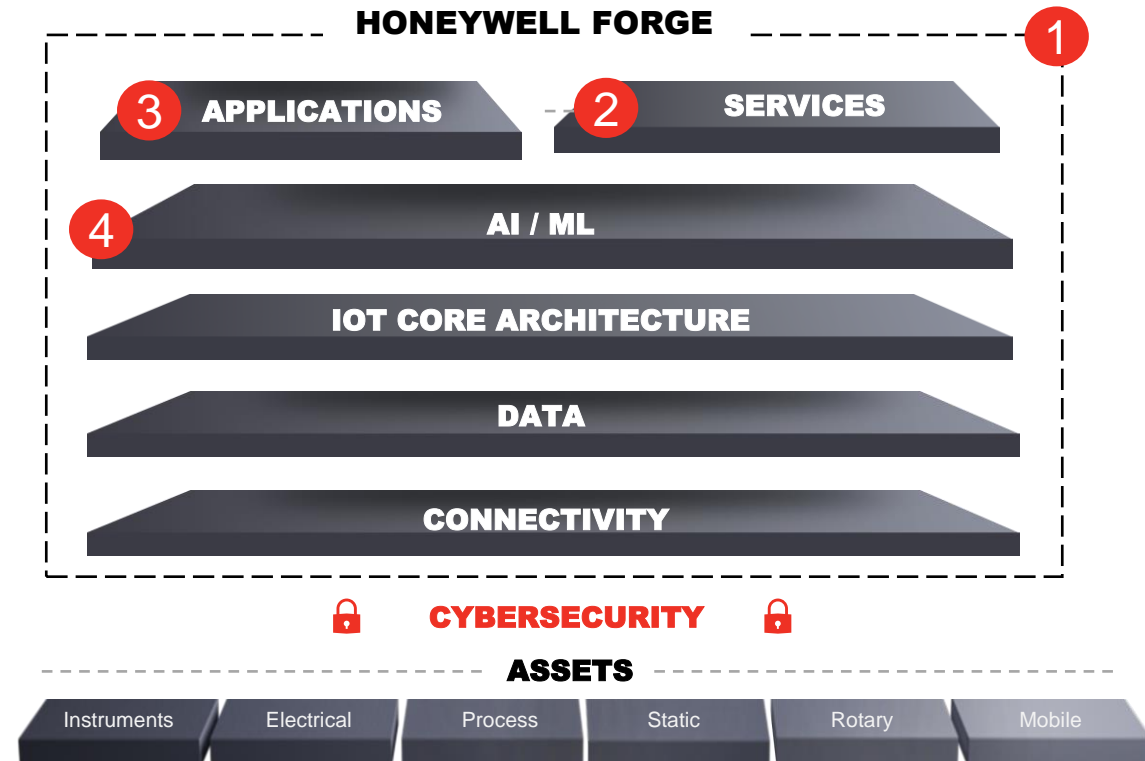
Augments in-house capabilities with Honeywell's domain expertise to unlock value through prescriptive insights, AI-enabled assistance, and performance optimization

3 Forge Applications

Industry leading SaaS applications that automate processes and centralizes operational decision-making to drive better outcomes and higher productivity

4 Forge AI Engine

AI at scale with industrial grade reliability to intelligently automate processes and unlock new insights across the enterprise



HONEYWELL FORGE | FUTURE READY IOT PLATFORM

1 IoT Platform

Readymade Connectivity & Interoperability

- Collect real-time data from any asset incl. legacy, proprietary, remote, mobile, and IoT devices using standard connectors.

Continuous Compliance

- Provide assurance for compliance to regulatory standards for responsible AI, data privacy & security (EU Data, AI Act, SOC2)

Full Lifecycle Operations Support

- Manage full application lifecycle for software-as-a-service from application introduction to operations support

2 Digital Services

Global IT/OT X-Product Data Unification

- Unify data connectivity and onboarding of hardware and software assets leveraging domain centric AI algorithms

Intelligent Edge

- SLM models on Edge, TinyML sensing and inferencing for operations efficiency with Digital services platform

Gen AI Digital Services Portal

- Prescriptive insights and outcomes for Reliability, Optimization and Margin and Compliance outcomes for customers



**HONEYWELL
FORGE**

3 Applications

Low-Code Application Builder

- Deploy applications within weeks with low code UI, drag and drop workflows, calculation engines and 200+ pre-configured services

Pre-integrated Product Portfolio

- Use out-of-the-box pre-built applications in 3 suites: Performance+, Sustainability+, and Cyber+ with a unified customer portal

Domain Model Libraries

- Reduce time to value with codified proprietary domain model libraries for controls, assets, and processes

4 Industrial AI Engine

AI-driven Data Fabric for Industrials

- Utilize pre-trained domain centric AI for data contextualization and curation of IT/OT data streams

Operations as neural-net : Agentic workflows

- Apply Interoperable AI across applications and devices, with agentic using latest LLMs across clouds, open-source

SLM, Mixed Reality AI and TinyML on Edge for Industrials

- Apply Generative AI solutions on Edge (SLM), leverage multimodal interactions using text, audio & video, deploy closed loop edge-inferencing for reliability and closed-loop outcomes