

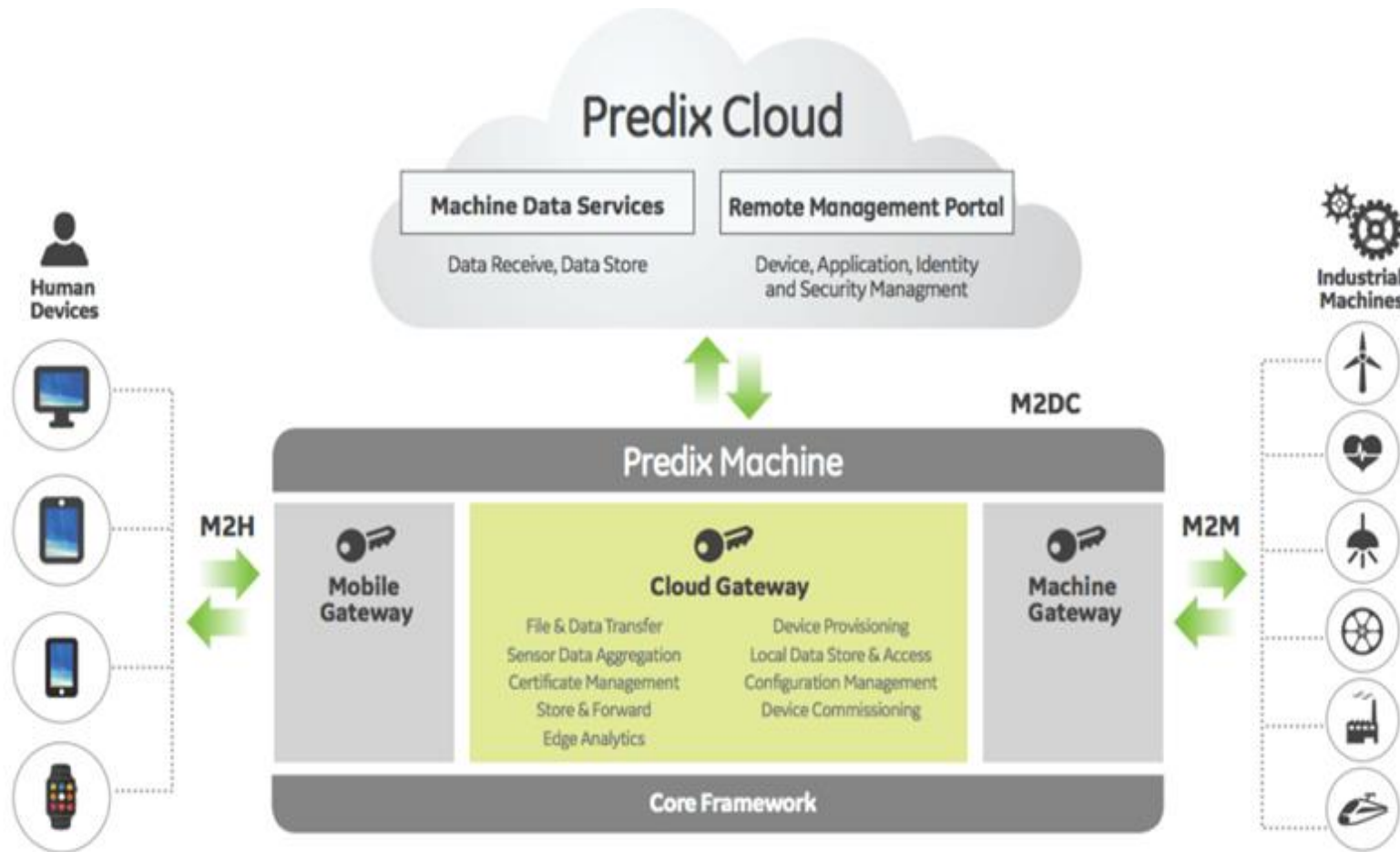
OT and IT Convergence in the Nuclear Fleet

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The IT Vision – IoT for Condition Based Monitoring (CBM)



Source: GE Predix

- Gather data from sensors, store in PI Historian
- Leverage Predix “Digital Twin” analytics for CBM:
 - Reduce unplanned downtime
 - Reduce labor costs
 - Improve safety and reduce worker radiation exposure

The OT Reality – Typical Existing Plant



- Plants built 30-40 years ago, unable to digitize due to stringent and costly regulations and cannot disrupt operations.
- Manual and analog instruments, pneumatic air operated valves and controllers.
- No plant data network, limited power outlets in plant locations
- Technicians conduct manual rounds, but must limit radiation exposure.

The Gap Between the IT Vision and OT Reality

The “Gap” Challenge:

- Huge investment in IoT analytical software (Predix) promises significant operational benefits
- But lack of access to data to feed Predix is limiting full IoT potential
- Traditional methods to “digitize” existing plants too expensive and too disruptive to operations

Exelon’s Solution:

- Use new non-invasive wireless clamp-on technologies
- No downtime/process disruption
- Limits expensive safety and engineering review/analysis
- Limits costly cable runs
- Interface with Predix and existing plant IT systems (e.g. historian)

Example Non-Invasive Digitization: Wireless Gauge Reader

Pneumatic Level Controllers



Wireless Gauge Reader



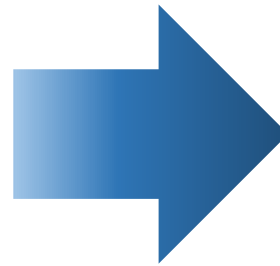
“Digitized” Pneumatic Controller



- “Electronic Eyeball” transmits readings wirelessly
- Non-invasive, clamp-on to existing gauges – less than 15 minutes per gauge to install
- Installed Cost per Gauge \$1,500
- No process downtime, no leak check, no wiring
- Estimated 10,000 potential data points per site which can use this technology to capture data
- Store data in PI Historian – allow access for multiple users: Engineering, Maintenance, Operations, Compliance

Case Study: Pneumatic Valve CBM

Pneumatic Actuated Valve – Water Level Control for Feedwater Heaters (36 units “digitized” in Plant)



NON INVASIVE
DIGITIZATION



- Valve faults can cause feedwater dumps which cause plant level power output reduction and/or reactor power spikes.
- 1MWh (\$55,000) estimated impact per excursion.
- Cost to retrofit with digital positioners > \$100,000 each, not including plant downtime impact.
- Non-invasive Wireless Gauge Readers provide process data for Condition Based Monitoring (four process readings per valve)
- Allows predictive maintenance to avoid excursions.
- Installed cost per unit approx. \$8,000. Time to install under 1 hour – no disruption to operations.

Benefits

- Detect Equipment Faults – Advanced Pattern Recognition, Condition Based Maintenance
- Reduce Operations Labor – Rounds
- Improve Worker Safety – lower radiation exposure
- Optimize process efficiency – manage supervisory setpoints
- Assist in Compliance – record keeping