2019 NZ Water Conference

Using Technology to Enhance Human Performance

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Advanced Solutions Manager
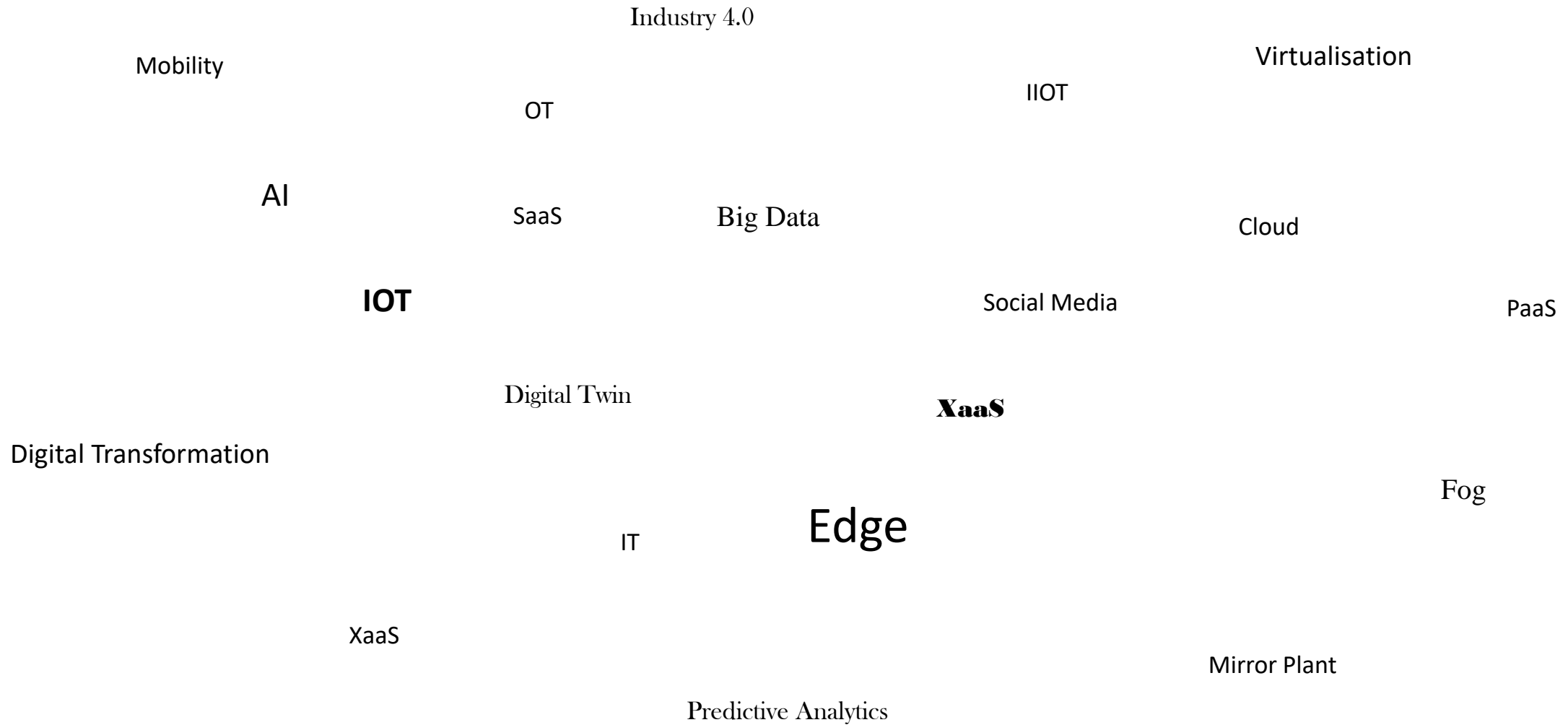
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Technology Jargon

Don't be distracted by the Jargon!

Industry 4.0

Mobility

Virtualisation

IIOT

OT

AI

SaaS   Big Data

Cloud

IOT

Social Media

PaaS

Digital Twin

XaaS

Digital Transformation

Fog

Edge

IT

XaaS

Mirror Plant

Predictive Analytics

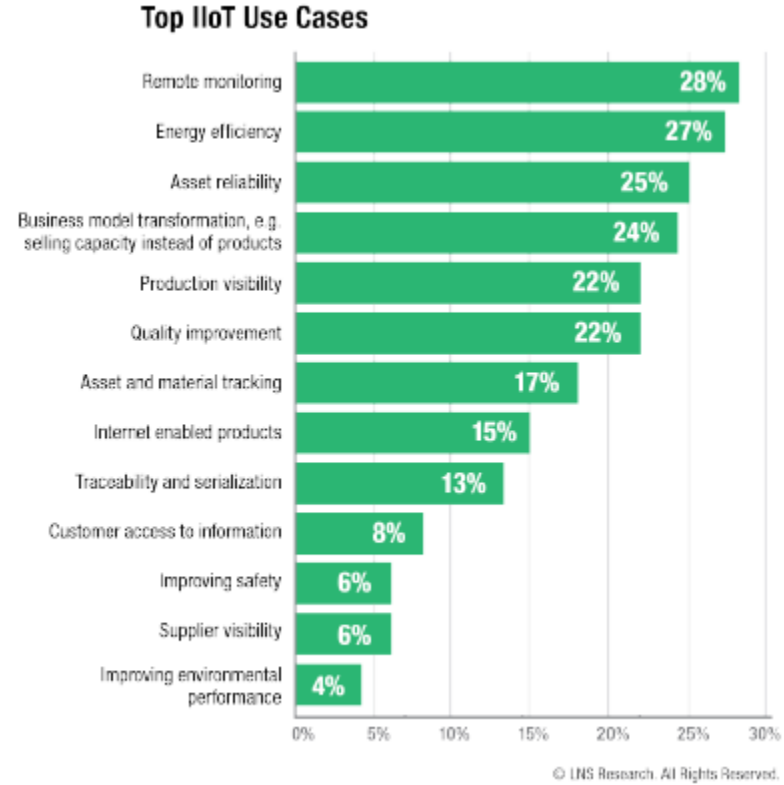**#edge2insight**

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The Market

The main issues

- Ageing infrastructure

- Processes and Procedures

  - Loss of experienced personnel
  - Training of new personnel
  - Paper based processes and procedures
  - Management of multiple third party service providers

- Poor Quality Data

- Geographically dispersed infrastructure

- Unreliable connectivity

- Cyber Security

- Lack of familiarity and trust of the cloud

- How best to Digitalize Operations

Top IIoT Application investments

- Remote monitoring
- Energy efficiency
- Asset reliability
- Business model transformation
- Production visibility
- Quality improvement
- Asset and material tracking
- Internet enabled products
- Traceability and serialization
- Customer access to information
- Improving safety
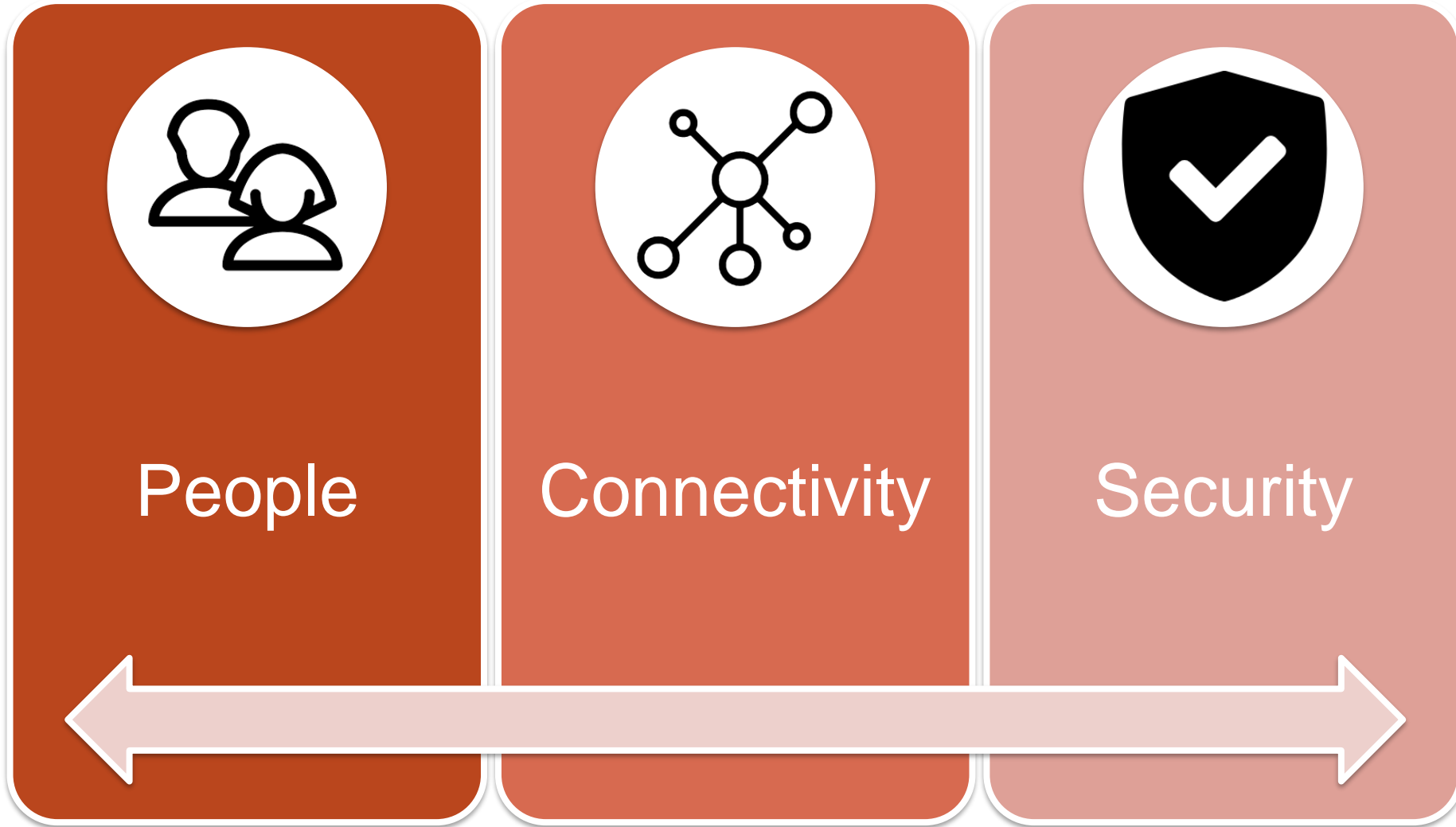- Supplier visibility
- Improving environmental performance

Top IIoT Use Cases

Use Case	Percentage
Remote monitoring	28%
Energy efficiency	27%
Asset reliability	25%
Business model transformation, e.g. selling capacity instead of products	24%
Production visibility	22%
Quality improvement	22%
Asset and material tracking	17%
Internet enabled products	15%
Traceability and serialization	13%
Customer access to information	8%
Improving safety	6%
Supplier visibility	6%
Improving environmental performance	4%

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Challenges

People

Connectivity

Security

The Issues

Ageing infrastructure

- **Requires Closer monitoring than new**

- **More frequent Inspections**

- **Audit trail**

- **Predictive analytics**

- **Require Increased data**
  - smart wireless or cloud connected vibration monitoring devices,
  - pump winding temperature measurement,
  - gear box lube oil test results,
  - corrosion monitoring devices coupled with simulations that predict corrosion potential,
  - ultra high speed pressure measurement devices that can detect cavitation

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Procedures – procedural automation

- Enables the knowledge of the most experienced operators, maintenance and safety personnel to be codified, linked with all relevant information and presented to the operator exactly when it is needed, without having to look for it.

- lead the operator through the procedure step by step, with all the checks required before moving from one step to the next.

- either tightly linked with the control system, on the same HMIs, or via a separate HMI depending upon the control systems and the control room layout.

- a tool to guide the operators and to enable the operators to actively use and set up enabling multiple procedural approaches to be compared, agreed upon, tested and then implemented.

- advisory mode or automated mode. This is useful as it may take time for operations personnel to check that a newly added procedure is correctly implemented before they enable it to run automatically.

- progressively implemented procedures enable continuous operation improvements.

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- Logbooks
- Shift Handovers
- Work Instructions (incl linkage to spare parts management, ordering and invoicing)
- Permits to Work (incl work pack generation)
- Incident management (provides visibility for OHS and ESG)
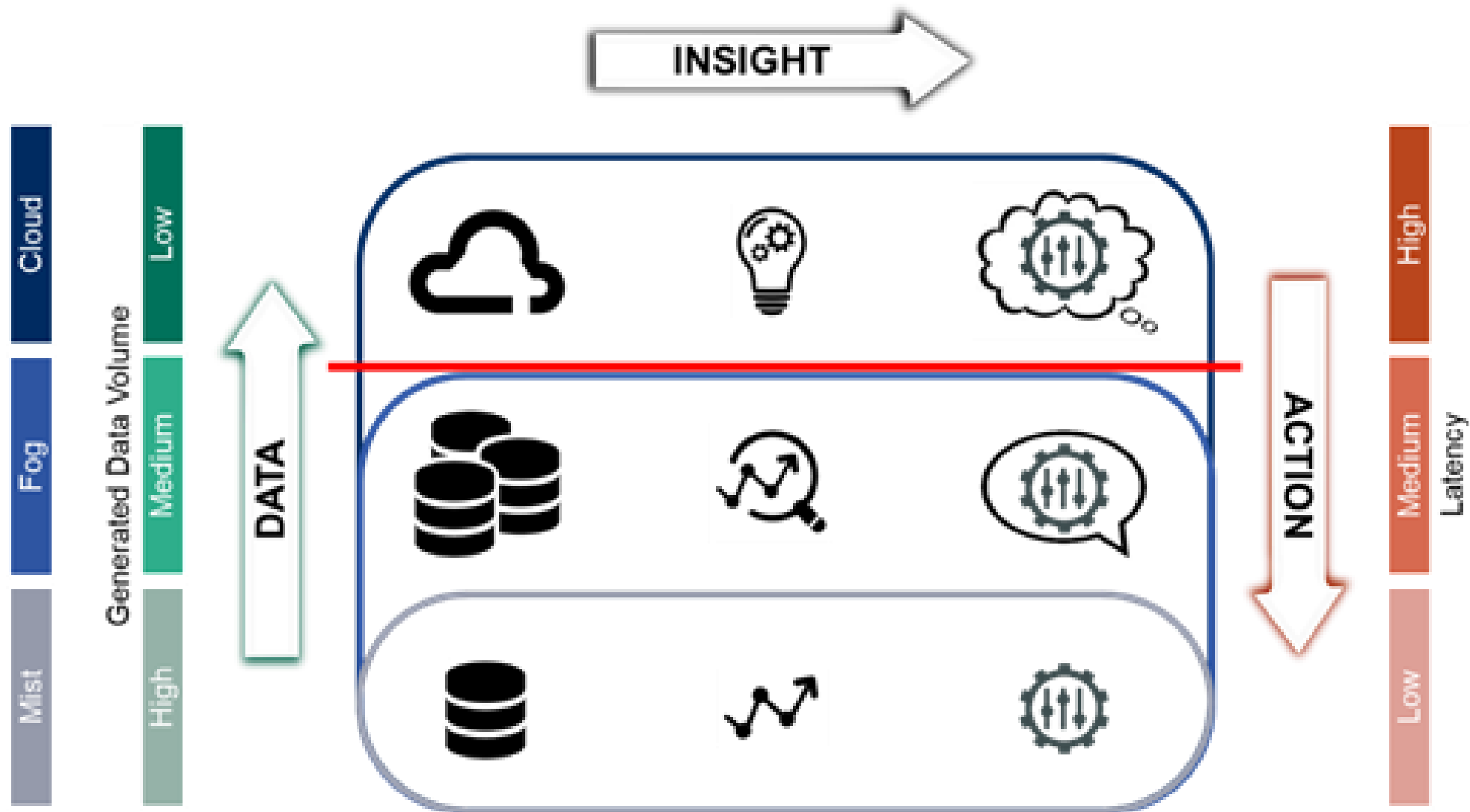- Management of change (incl Maintenance, Modifications, Upgrades)

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Digitalisation & automation of operational processes

Enabling ONE single window for all the necessary operational tasks

OPERATIONS MANAGEMENT

Holistic view to monitor, control and report plant operations

CONTROL ROOM AND FIELD OPERATIONS

Mobility Devices

Start of Shift Handover

Closed Loop Operations

Incoming Operators, Supervisors, Managers

Shift Briefing, Review and Discussion

Operations Management

- Incident Management
- Management of Change
- Permit to Work
- Logbook
- Shift Handover
- Work Instructions

Outgoing Operators, Supervisors, Managers

Shift Handover/ Performance Report

Plant data

- Procedural Automation
- Handheld Inspections
- Asset Management
- Alarm Management
- Lab Info. Management (LIMS)
- Plant Historian

RPO DB

Interface

- Other Enterprise Systems
- Document Mgmt. System
- ERP

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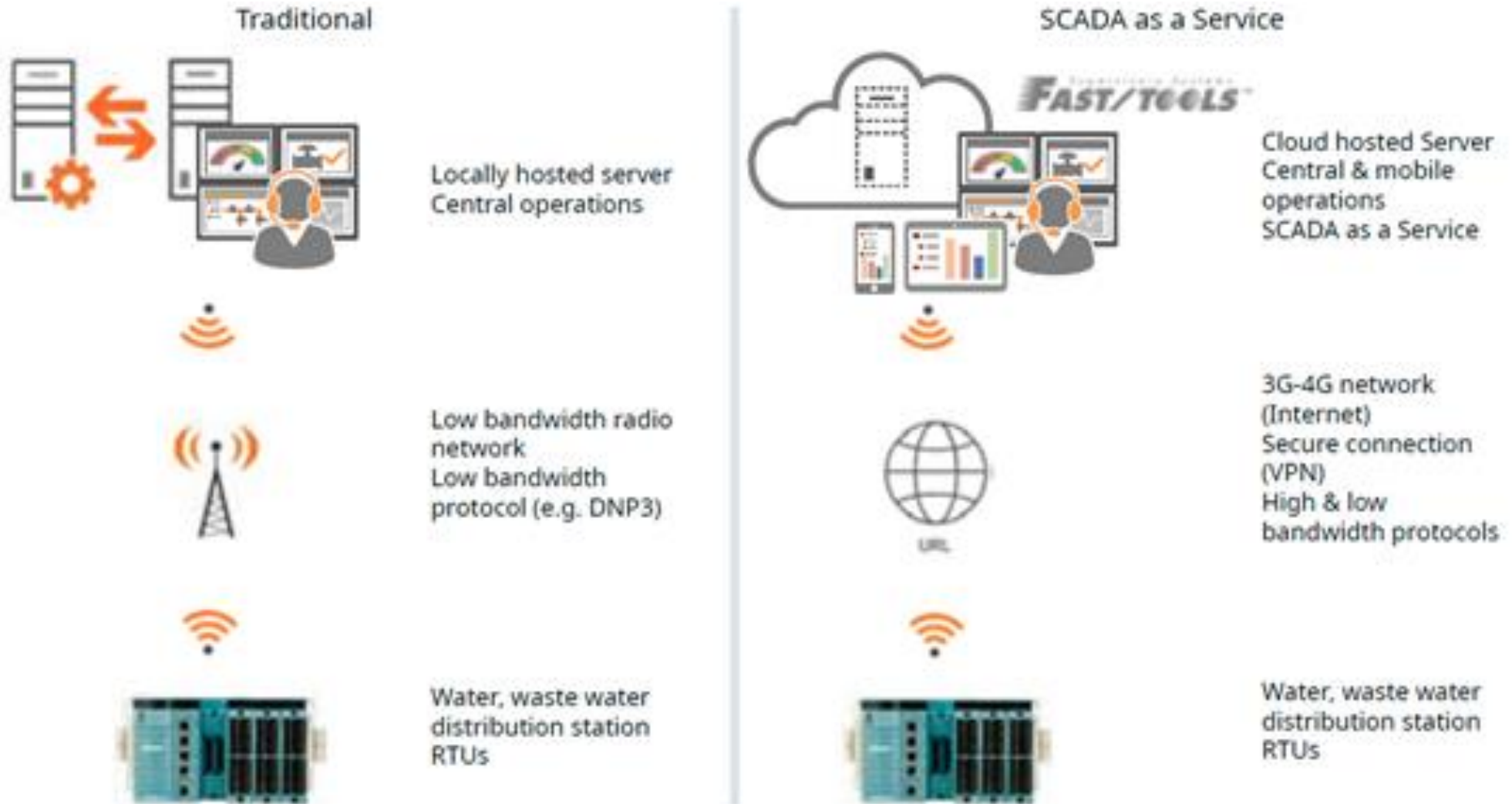# Poor Data Quality - Automated data quality assurance

NAMUR NE-107 categorization and visualization for standardized instrumentation status

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- Automated data quality assurance
- compensate (automatically) for the drifting / poor data quality,
  - ◆ Put that control loop or part of the process into manual, if required or
  - ◆ Adjust operational set points
- plan to fix or replace the instrument or device
  - ◆ by (automatically) generating a work order
  - ◆ inform all relevant parties of the situation
  - ◆ enables a planned maintenance approach based upon the criticality of the data to continued smooth and safe operations.
- Turn unplanned downtime into planned events & maintenance

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Traditional

- Locally hosted server
- Central operations

- Low bandwidth radio network
- Low bandwidth protocol (e.g. DNP3)

- Water, waste water distribution station RTUs

SCADA as a Service

FAST/TOOLS

- Cloud hosted Server
- Central & mobile operations
- SCADA as a Service

- 3G-4G network (Internet)
- Secure connection (VPN)
- High & low bandwidth protocols

- Water, waste water distribution station RTUs

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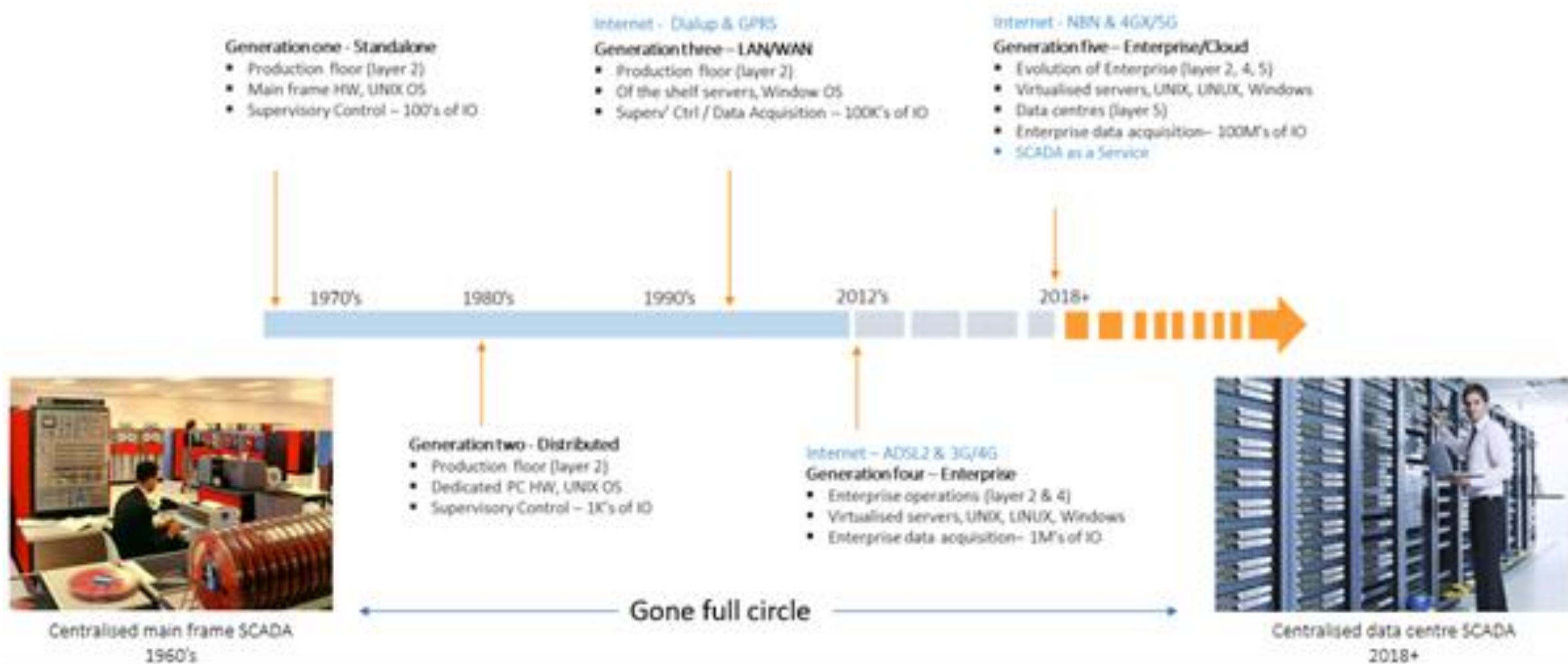
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- SCADA and SCADA as a Service can operate effectively even with unreliable and intermittent connectivity
- sufficient data buffering capacity
- if essentially no communications
  - Regular drive bys
  - Drone flights
- Some data is better than no data

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- growing demand from regulators and insurance companies to prove a reliable 24/7 cyber security regime is a critical aspect of good corporate governance.

- Outsourcing or use a hybrid model?

- Data Centre teams and dedicated cyber security teams with remote access to the facilities and sites have many times more resources dedicated to Cyber Security than most operating companies.

- 24/7 protection, support and disaster recovery.

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Internet – Dialup & GPRS
Generation three – LAN/WAN
- Production floor (layer 2)
- Of the shelf servers, Window OS
- Superv/ Ctrl / Data Acquisition – 100K's of IO

Internet – NBN & 4GX/5G
Generation five – Enterprise/Cloud
- Evolution of Enterprise (layer 2, 4, 5)
- Virtualised servers, UNIX, LINUX, Windows
- Data centres (layer 5)
- Enterprise data acquisition– 100M's of IO
- SCADA as a Service

Generation one - Standalone
- Production floor (layer 2)
- Main frame HW, UNIX OS
- Supervisory Control – 100's of IO

1970's   1980's   1990's   2012's   2018+

Generation two - Distributed
- Production floor (layer 2)
- Dedicated PC HW, UNIX OS
- Supervisory Control – 1K's of IO

Internet – ADSL2 & 3G/4G
Generation four – Enterprise
- Enterprise operations (layer 2 & 4)
- Virtualised servers, UNIX, LINUX, Windows
- Enterprise data acquisition– 1M's of IO

Centralised main frame SCADA
1960's

Gone full circle

Centralised data centre SCADA
2018+

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Digitalization approach

- Identify and gather all stakeholders & collaboration partner(s)
- Obtain consensus on the specific desired outcomes
- Evaluate and document the as-is state across people, processes & technology (base line to measure outcomes)
- Define the future (to-be) state across people, processes & technology
- Document expected benefits and value
- Define the nature of the required insights
- Define likely data requirements
- Choose flexible & scalable system architecture
- Choose appropriate security aligning with operational requirements
- Evaluate and define priorities. Roll out phases.
- Understand the transition stages of the transformation/ implementation
- Create clearly defined roadmap with visible and measurable first step
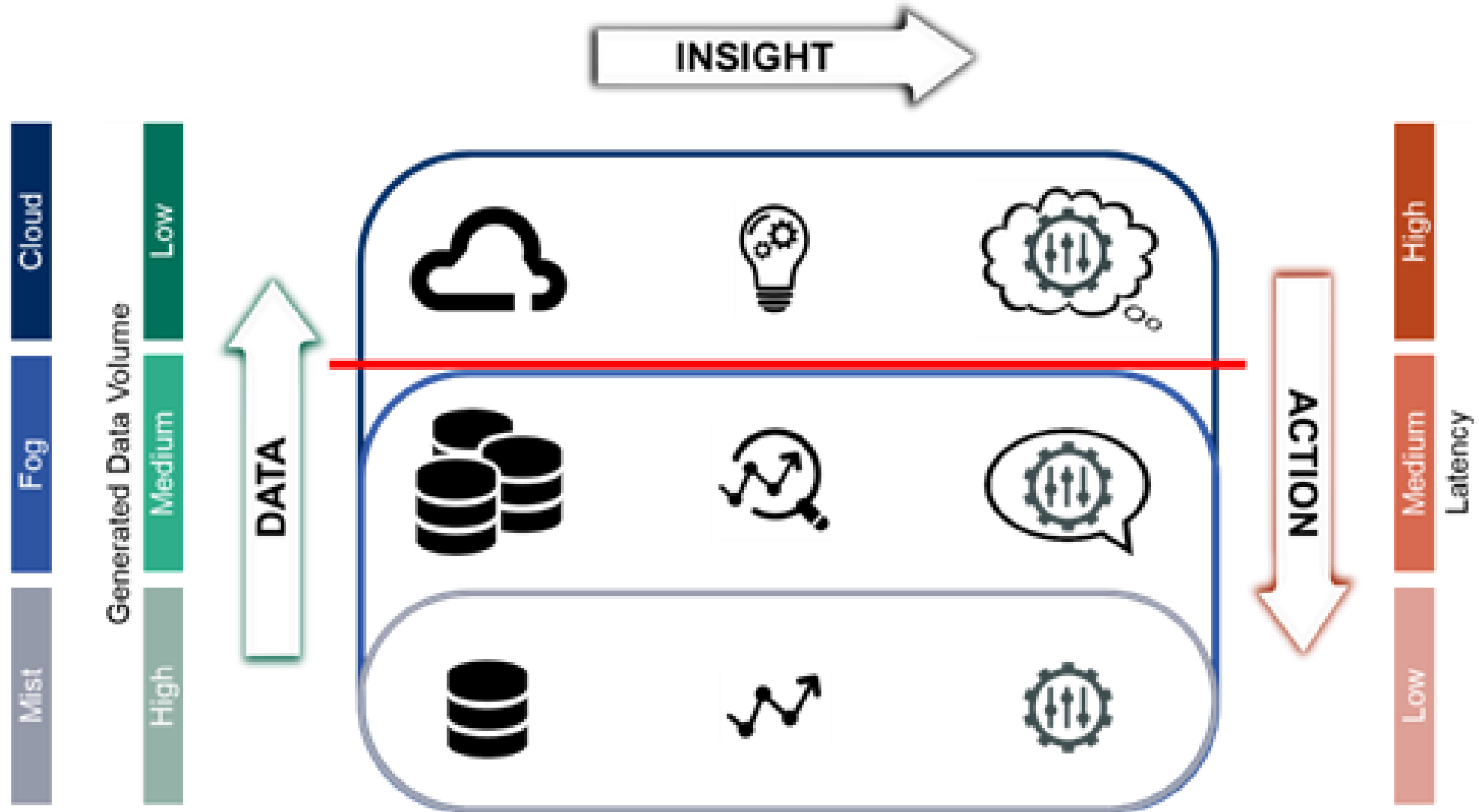
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Yokogawa's Digital Maturity Model

		Vulnerable	Operable	Optimal	Sustainable
	Targeted Outcomes	Risk minimization	Stable & repeatable operations	Industry leading efficiency	Sustainable & Autonomous
	Business strategy & processes	Ad-hoc or absent	Siloed initiatives and visions	Integrated, common vision	Active ecosystem integration
	People & Culture	Disengaged and losing vital knowledge	Active knowledge transfer	Culture of learning & development	Leaders are digital innovators
	IT / OT Collaboration	Adversarial	Tolerant	Collaborating	Engaged & integrated
	State of Data	Islands of Information	Integrated Plant Data	Enterprise Data Lake	Value Chain Integration
	State of Technology	Legacy	Current	Advanced	Innovative
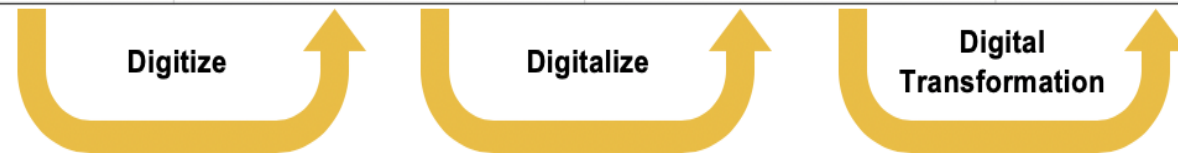
Digitize   **Digitalize**   **Digital Transformation**

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Desired Outcomes

desired outcomes → nature of required insights → data requirements → system architecture → technology

Desired Outcomes

- Improved Decision Making
  - Real-Time Decision Making
  - Increased Visibility
- Improved Safety
  - Risk Reduction
- Increased Productivity
  - Increased Throughput
  - Reducing Downtime
  - Predictive Maintenance
- Optimized Business Processes
  - Cost Reduction
  - Standardized Communications & Controls
  - Easy & Efficient Collaboration

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desired outcomes → nature of required insights → data requirements → system architecture → technology

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Questions?

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