Machinery With Longevity - How Condition-Based Maintenance (CBM) Is Transforming Industries

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24th October 2017

Agenda

- Introduction
- Condition-Based Maintenance (CBM)
- Escalator CBM
- Train CBM
- Conclusion

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NCS Data Scientist Team

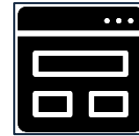**>30 Data Scientists**
Ph.D., Masters, Bachelors

Data Science Skills
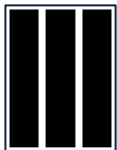Anomaly detection, time series analysis, text analytics, optimisation etc

Cross-Disciplinary Team
Statistics, Machine Learning, Computer Science, Engineering, Business, Psychology

Software Competencies
R (e.g. H2O), Python (e.g. TensorFlow), SAS, SPSS, Watson
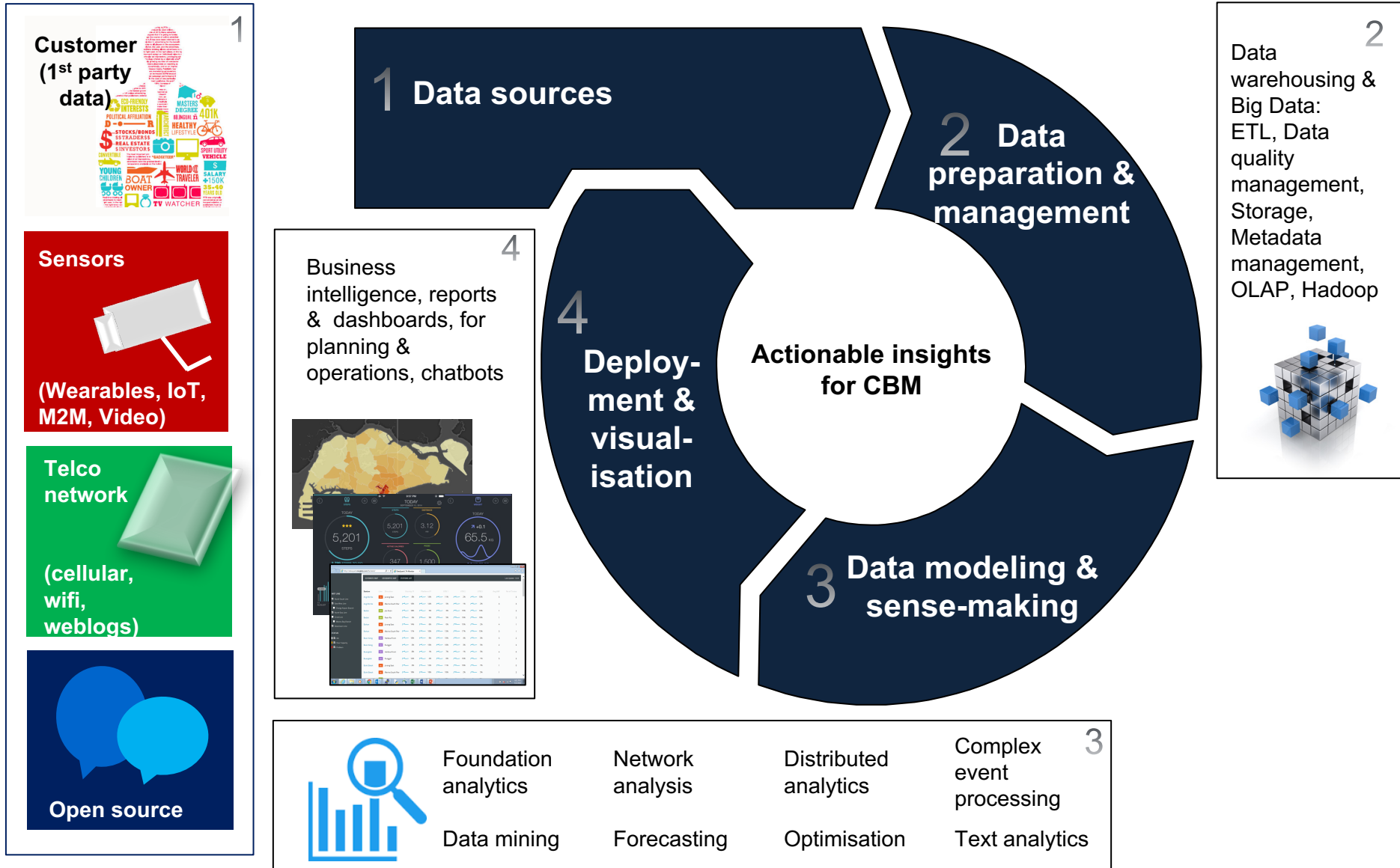
Cross-Industry Projects
Transport, Defence, Public Safety, Education, Healthcare, Commercial, FSI etc

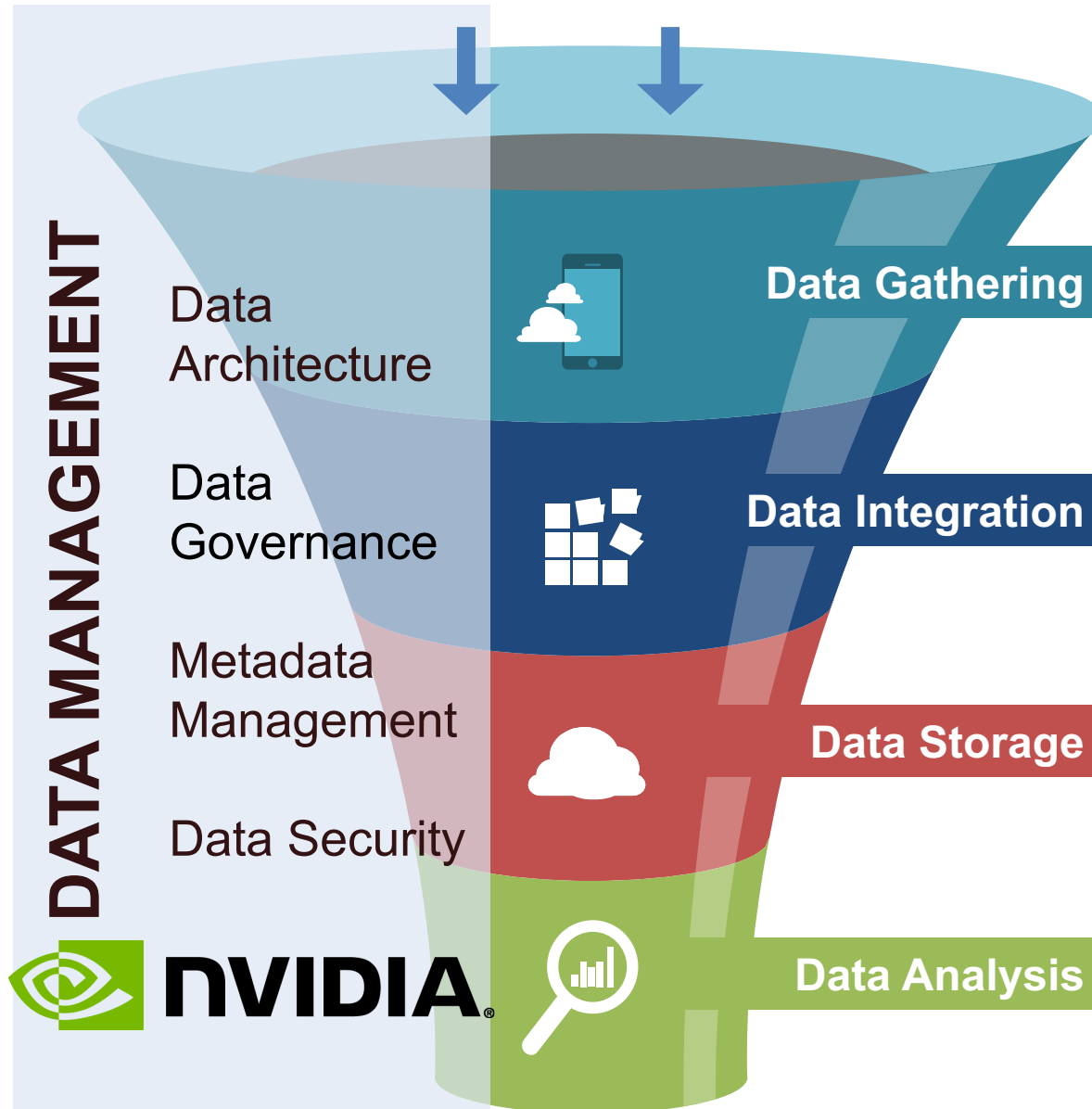**Completed Meaningful / Iconic Projects**
Since January 2015

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NCS End-to-End Data Science Coverage

Customer (1st party data) — 1

Sensors — (Wearables, IoT, M2M, Video)

Telco network — (cellular, wifi, weblogs)

Open source

1 Data sources

2 Data preparation & management

Data warehousing & Big Data: ETL, Data quality management, Storage, Metadata management, OLAP, Hadoop — 2

Actionable insights for CBM

4 Deployment & visualisation

Business intelligence, reports & dashboards, for planning & operations, chatbots — 4

3 Data modeling & sense-making

Foundation analytics	Network analysis	Distributed analytics	Complex event processing
Data mining	Forecasting	Optimisation	Text analytics

3

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Condition-Based Maintenance (CBM)

CBM Platform

Escalator CBM

Escalator Maintenance Challenges

- Frequent escalator incidents
  - Breakdowns or service interruptions
  - Trapped or even injured passengers

- Escalator data availability issues
  - Sensor data collected in near real-time but belongs to third party
  - Escalator fault and bio data are augmented with building-related data

- Escalator design complexity and significant resource constraints
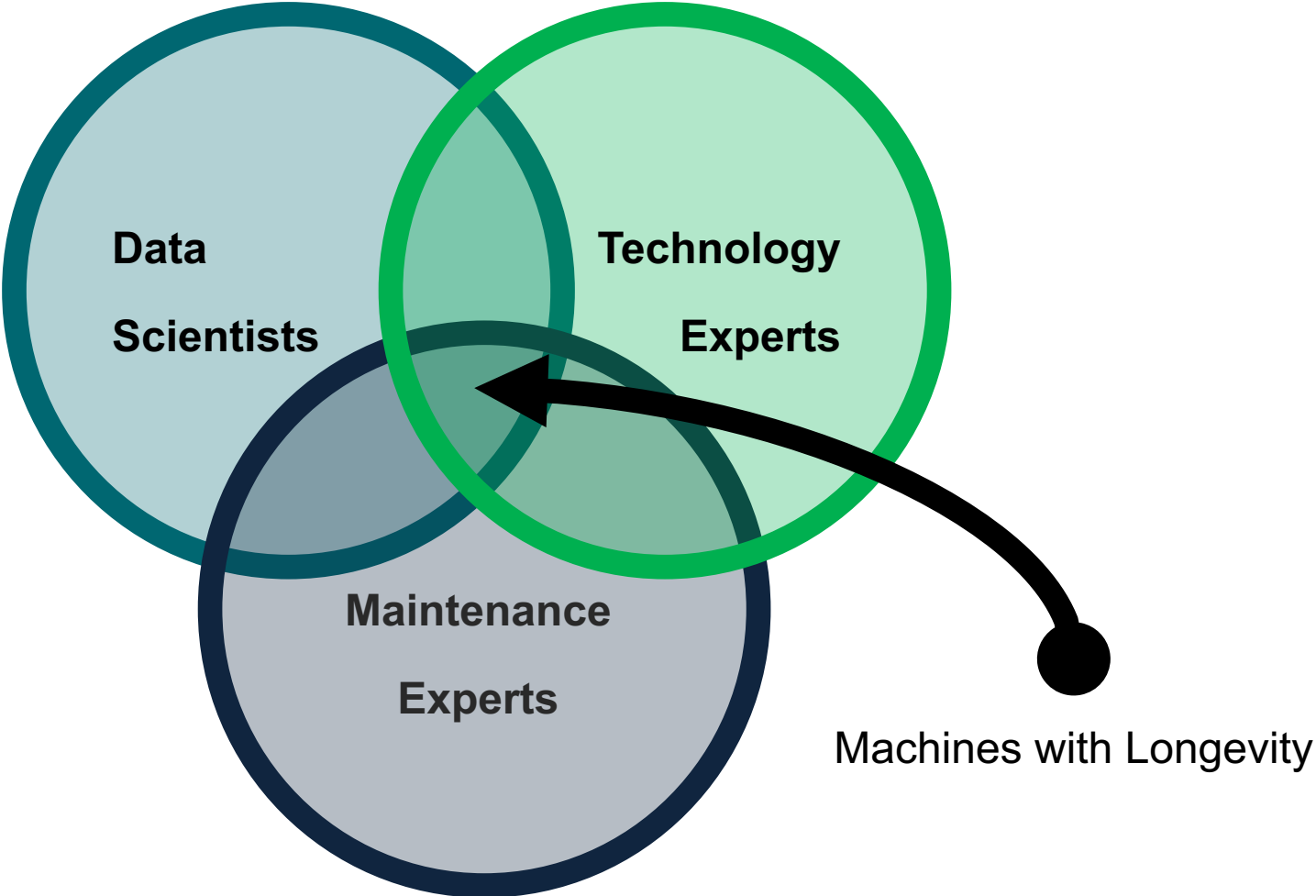
Train CBM

Rolling Stock Maintenance Challenges

- Minimal capabilities for real-time monitoring of rolling stock
  - Currently doing breakdown maintenance (which is reactive) and preventive maintenance (which is limited by maintenance schedule)
  - Sensor data transmission may be an issue
- Difficulty to troubleshoot issues due to rolling stock design complexity
  - Multiple train variants
  - Not sure if diagnostic, fault and workshop data is all available and of good quality
- Significant resource constraints
  - High rolling stock utilization
  - Maintenance crew and depot unavailability
  - Spare part unavailability

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How to be Successful in CBM?

Questions?

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