Operational Intelligence (OI) brings international expertise in Master System Integration (MSI) around workshop methodology to ratify MSI deliverables in context of key outcomes and experiences sought for a development across four primary levels.





To build out on functions already recognized 3

To examine interdependencies and data flows



For seamless alignment with Principal Project Requirements and Digital Engineering strategy as well as workflows.

Master System Integration (MSI)

OI works hand-in-glove with leading developers, contractors, design teams and owners to:

 Design and deploy ESG, Energy Efficiency and Digital Experience aligned to Key Tenant, Visitor, Wellness, FM, Asset Management and Reporting capabilities for State Significant projects, Precincts and Smart Buildings. Integral to the broader Oberix Group, our clients benefit from deep expertise across:

 Services, Strategy, Data, Cyber, ESG, MSI, IoT, Building Automation, Energy Management, Efficiency and User Experience

Backed by 26 years of uninterrupted commercial success and over 300 deep subject experts, headquartered and with leadership in Australia.

Our seamless, outcomes-based approach to the integration of solutions cement our work's reputation for Resilience, Safety and Reliability with an agile culture to drive Innovation across complex, project stakeholder groups.

OI uses Operational System Integration, innovative technologies and Business Process Management to eliminate barriers hereby delivering new benchmarks around smarter, more engaging, responsive, sustainable and lean built environments.



This delivers the ability to interconnect people, processes and systems as the foundation for sustainability, efficiency, collaboration, experience and communication.

Our operational capability enables the monitoring of workplace systems and processes in real time, for increased resilience, effectiveness, productivity, control and greater financial return on assets.

Project and Services experience include single-pane-of-glass, integrated user and building management solutions using BMS data for the carbon-neutral Barangaroo South precinct in Sydney across 200,000 sqm and 3 mixed-use towers, as well as for the award winning Paya Lebar Quarter in Singapore, Quay Quarter in Sydney, the Celcom Tower in Malaysia as well as Melbourne Quarter.



Across its office network in Australia, Singapore, Malaysia, the UK and the USA, OI as part of the Oberix Group provides services that develop, integrate and maintain **integrated Property for connected People and Places.**



Methodology

Oberix Group offers workshop methodology to ratify MSI outcomes for seamless alignment with Principal and Digital Executive Plans for developments and with key outcomes sought, key user journeys, personas and experiences.

This is with focus on four primary levels, for each stakeholder domain, to build out on functions already recognized and to examine interdependencies and data flows:

- Definition of functions;
- Objective per function;
- Any extra functions noted;
- Key data and integrations;
- Direction of integration;
- Primary User Journeys involved.

Level 1: Smart & Inform	This sophistication level focuses on the building's ability to sense and provide data. This covers everything from people counters through to HVAC or Utility performance data.
Level 2: Smart & Direct	This sophistication level focuses on the building's ability to sense and give direction.
Level 3: Smart & Control	This sophistication level focuses on the building's ability to sense, orchestrate and control. Typical examples would be sensor driven lighting, occupancy driven HVAC, Lift / access orchestration etc.
Level 4: Smart & Augment	This sophistication level focuses on how the building technology can augment business operations and integrate to core business systems. Typical example is integration of maintenance with facility availability to minimize disruption or maximize availability by optimization of maintenance scheduling.

To specify and design a comprehensive Open Building System Interface (OBSI) solution, it is necessary to have a view of all major integration points, and the direction, i.e. East-West or North-South.



Subsystem Integration

OI bring deep-experience in the integration of the following subsystems:

a. Integration Platforms

- c. Metering (electrical, water, thermal energy, gas);
- e. Air Quality Monitoring System;
- g. Closed Circuit Television (CCTV);
- i. Emergency Lighting System;
- k. Generator control system / SCADA
- m. Carpark Entry/ Exit and Management;
- o. End of Trip facilities such as Lockers;
- q. Information Boards and Way Finding;
- s. Lift Advertising;
- u. Public Wi-Fi System;
- w. Hydraulic Services;
- y. Solar PV System;
- aa. Waste Management;
- cc. Public domain security;
- ee. Public domain entertainment services.

b. ICN (Integrated Communications Network) d. Building Management System (BMS) & HVAC plant; f. Access Control, Intruder Detection & Intercom (Security); h. Lighting Control System; j. Electrical Switchboards monitoring; I. Emergency Power system (UPS / Generators); n. Logistics management; p. Digital Displays / Digital Artwork (AV Installations); r. Lift, Escalators, and Travelators; t. People Counting / Occupancy Sensors; v. Fire Services (monitoring only); x. Façade / Blind Control system; z. Network Management System / Network Security; bb. Public domain Lighting; dd. Public domain information kiosks: ff. YARDI property management software

Example - Use Case - Technology & Solution Integration

SI No.	Use Case	Purpose	Technologies Integrated	
1	Technician Geolocation	The ability to allot work to a technician based on their geolocation within the Terminal building.	 RTLS QR Codes BIM Maintenance software Resource Management SW Mobile App for technicians 	
2	Augmented Reality	Most equipment and systems in a given location are hidden behind walls and false roofs. An authorised user at a given location can navigate to a relevant location on BIM overlayed with status and operations.	 QR codes RTLS BIM IBMS ELV systems 	
3	SmartBIM	BIM has rich information but is static in nature. BIM can be made operational by making it an interactive canvas upon which information and interactions can be presented. Smart BIM application connects building and business systems to fetch information and present interactions.	 Autodesk Revit Forge BIM 360 Business systems Building systems 	
4	Predictive Maintenance	Switching to predictive maintenance from planned preventive maintenance saves costs. When real-time information related to equipment and systems is made available for analysis, this is achievable. iviva C2O application has a growing list of algorithms for detecting and predicting failures.	 Building systems IBMS Workorder Management C2O 	
5	System/ Equipment Performance Management	Ability to detect degradation of performance will allow managers to take prompt corrective actions to bring the system back to its commissioned state reducing losses.	 Building systems C2O IBMS 	9

Examples Dashboard Design



Technology Options Workflow Editor

Lucy is a development tool which breaks down operational and information technology siloes. Lucy can be used to create tangible data driven insights and deploy any digital workflow, to drive up seamless user experiences and efficiencies and to drive down utilization of resource across energy, management, maintenance and risk.

C2O Analytics

C2O simplifies integration with the building management system (BMS), and enables real-time, data-driven management for AFDD.



C20 is a platform for data integration, intelligent process automation and the creation of a rule-based, model based predictive analytics and AI.

It provides the following capabilities:

Viisual programming interface for defining, creating & modifying rules and models that incorporate advanced analytics and AI. Basic building blocks connect to

and exchange data with other systems and provide a low-code visual environment to compose larger, complex integrations. R R^R

Enabling user journeys and business processes through intelligent process automation with dynamic team formation.

C2O is an out of the box solution for AFDD and failure prediction to enable predictive operations and the maintenance of systems.

The solution provides a next generation operating model with an integrated, systems-driven approach including the following capabilities:

Automated Fault Detection and Diagnosis (AFDD) to proactively determine equipment faults. Integration of AFDD with power distribution and energy consumption information to identify opportunities and strategies for automation of optimization. Integration of AFDD with for example space condition monitoring ensures spaces are maintained at the right comfort level to eliminate complaints handling In relation to overcooling and undercooling. Machine learning based algorithms are used to predict future faults and operational performance deviations. C2O includes the following key application functionality:

1. Integration to HVAC System via building control system.

2. AFDD and Root Cause Analysis (RCA).

3. Predictive analytics and Machine Learning.

Key Benefits



The integration of model based, and rule based FDD strategies provides a significantly higher level of accuracy for detection of faults, to determine root cause and to optimise equipment settings.



Condition based operations and maintenance enable spaces and equipment to be continuously monitored and commissioned for proactive rectification and improvement.



C2O FDD provides a systems-driven approach to determine root cause of performance deviations, location and timing of systems and equipment maintenance, as well as to provide visibility into operational inefficiencies to facilitate step change improvements to drive down cost and drive up performance.

System-Wide Analysis of Faults

C20 FDD Solution can apply AFD tor a single equipment, a system comprising several component equipment or across an entire subsystem.

In the HVAC system network diagram below, C20 AFDD Solution identifies and highlights probable cause in regard to the ACMV network.



Root Cause Analysis

Root Cause Analysis Report									
Root Cause									Root Cause Analys
Execution Time 2020/02/02 13:36 ARB ()	Asset Chiller Plant 3-DDC 1	Test Name Chiller Header Supply Temp Vs Set Point	٩						-
Detected Failures				Asset ID	Parameter Name	Test Value	Lower Limit	Upper Limit	Execution Sequence
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Successful Executio	ns			Chiller Plant 2-DDC 1	CHW Header Supply Temperature	7.4			Chiller Plant 2:DDC 1 : CHW Header Supply Temperature Value (7.4 °C) is not in Design
Execution Time	Asset	Test Name							Value Range
2020/02/02 13:36 ARB ✔	CHWSP-C3-03	SCHWP Circuit DIFF(Pressure) Vs Set Point + DIFF(Temp) Vs Design	٩	₫ ~		୬			

Predictive Operational Analysis

C20 AFDD Solution Predictive Maintenance capabilities drive down maintenance costs and reduce inefficiencies associated with traditional maintenance programs.

Future equipment and system anomalies are identified enabling PPM maintenance plan adjustment.

Predictive maintenance represents high value in high-energy-consuming equipment such as chiller plants, AHU and FCU.



Example models - predictive - equipmen	t and system future performance
Efficiency check	 Ensure optimum operations while detecting and predicting maintenance requirements: 1. Coefficient of Performance (COP) 2. Energy Efficiency Index (EEI) 3. Energy Efficiency Ratio (EER) 4. Seasonal Energy Efficiency Ratio (SEER)





AHU Filter Clog Status Prediction



Chilled Water Valve Leak Detection	Off-coil Vs on-coil temperature check
Chilled Water Demand vs Ambient Enthalpy	Chilled Vs ambient water demand changes
Chilled Water Flow vs Ambient Enthalpy	Chilled Vs ambient water supply changes
Chiller Plant Capacity vs Demand	Chilled water demand and supply balance

Example - End User Reporting





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Example - Operational and Analytical Dashboards (Fault, Predictive, Energy)

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HVAC/Wellness/Comfort Overview

Provides the ability to see the thermal load of each individual floor based on room temperature sensors, on each level, with custom views, across the 3 towers, across one tower or by floor.

People Counting

Provides the ability to view occupancy counts & total net count in floor plan view at each entry/exit point.



Lighting System

Provides ability to see the lighting status of the entire building from one page.

For example, the next graphic demonstrates at least one lighting zone that has an 'On' status, on a particular floor.

View of individual levels enables greater granularity of this 'On' condition for interrogation and forward action.

