ROCC and Role

IMPLEMENTATION OF RAIL OPERATIONAL CONTROL CENTRES FOR RESILIENCE

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Important

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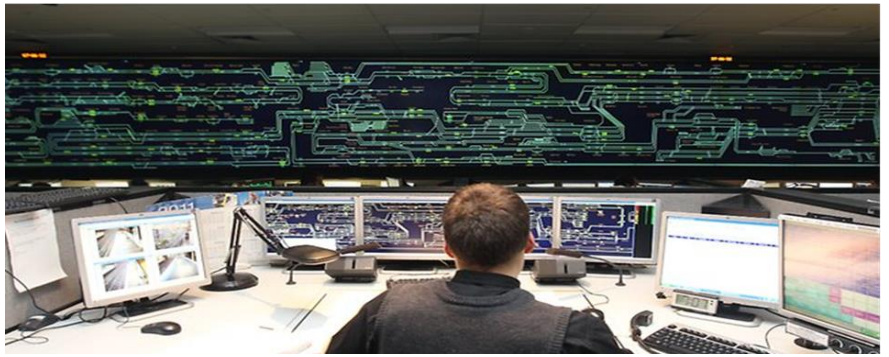
Purpose

- The purpose of this presentation is to:
  - Describe how a Rail Operations Control Centre (ROCC) contributes to operational resilience
  - Provide a framework to define a ROCC that achieves such resilience
- Agenda
  - Defining rail operations and operational resilience
  - Outlining Rail Operations Control Centre
  - Establishing ROCC For Resilience Framework
    - Operational integration criteria
    - System integration criteria
  - Quick look at Back-up ROCC
  - Conclusion

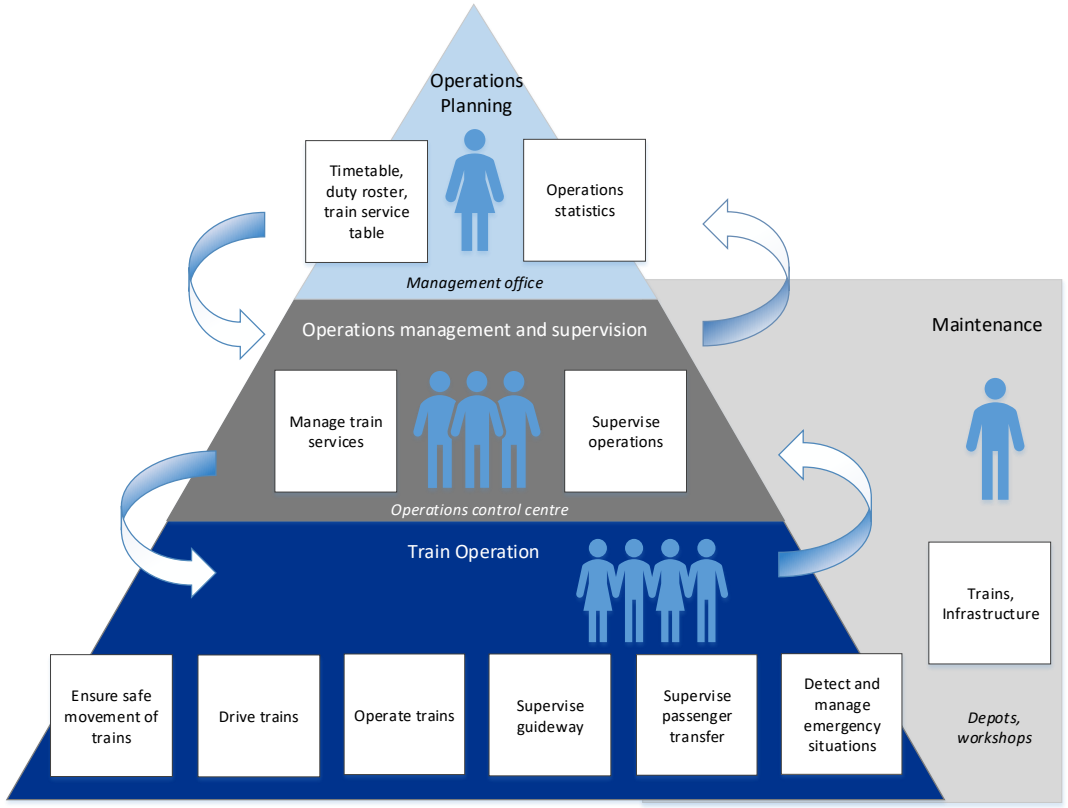


Introduction

- Railways are a complex and complicated business
  - Customers demand improved performance
  - Rail operators strive for business excellence
- Resilience is the ability to cope with situations that don’t go to plan and getting back to plan
- Running trains to schedule day in and day out without incident is a major challenge
- Any number of incidents can cause the railway operations to deviate from the plan
- A Rail Operations Control Centre (ROCC) can contribute to rail operational resilience and achieve customer satisfaction and business success
- This presentation describes a framework to implement a ROCC for resilient railway operations

Rail Organisation and Operational Modes

IEC 62290 depiction of rail operations organisation

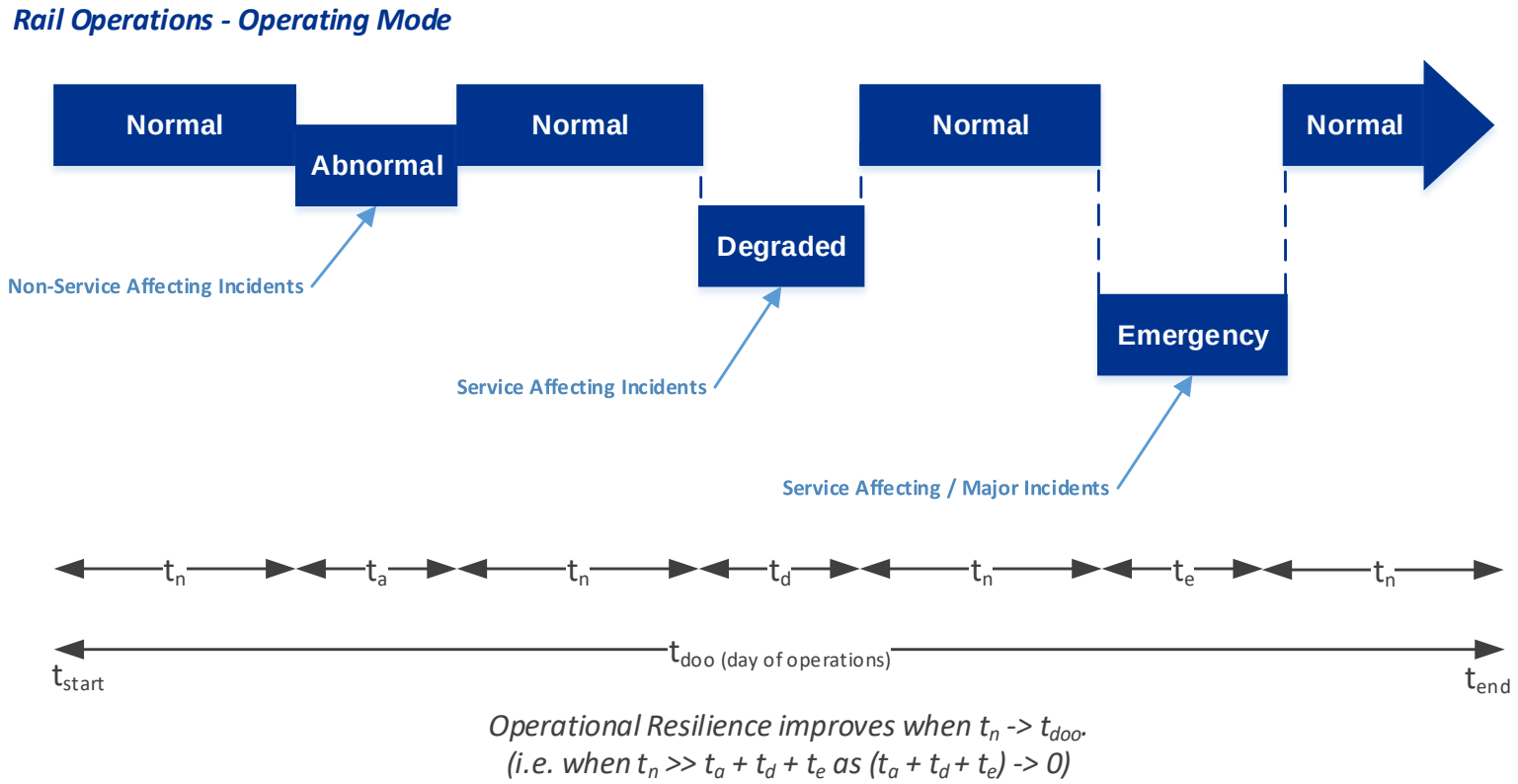


Rail operations provides a transportation service to customers

- Modes of Operation
  - Normal mode – everything going to plan
  - Degraded mode – short term disruption
  - Emergency mode – major issue
- Incidents (uncontrolled events)
  - Technical incidents (e.g. equipment failure)
  - Customer incidents (e.g. emergency stop)
  - Operator incidents (e.g. crew unavailable)
  - External incidents (e.g. fire, flood, bad weather)
- Service affecting nature of incidents
  - Service affecting impact the service delivery resulting in degraded or emergency mode
  - Non-service affecting do not immediately impact the service delivery but can impact later if not responded adequately in time

Rail Operational Resilience

- Normal mode is the desired state of operations
  - Aim to maximise normal mode
- The ability to maintain normal operations despite incidents is being resilient
- The lesser of time required to respond to an incident to restore normal operations, the more resilient the rail operations becomes



Operational Resilience improves when t_n -> t_{doo}.
(i.e. when t_n >> t_a + t_d + t_e as (t_a + t_d + t_e) -> 0)

Rail Operations Control Centre

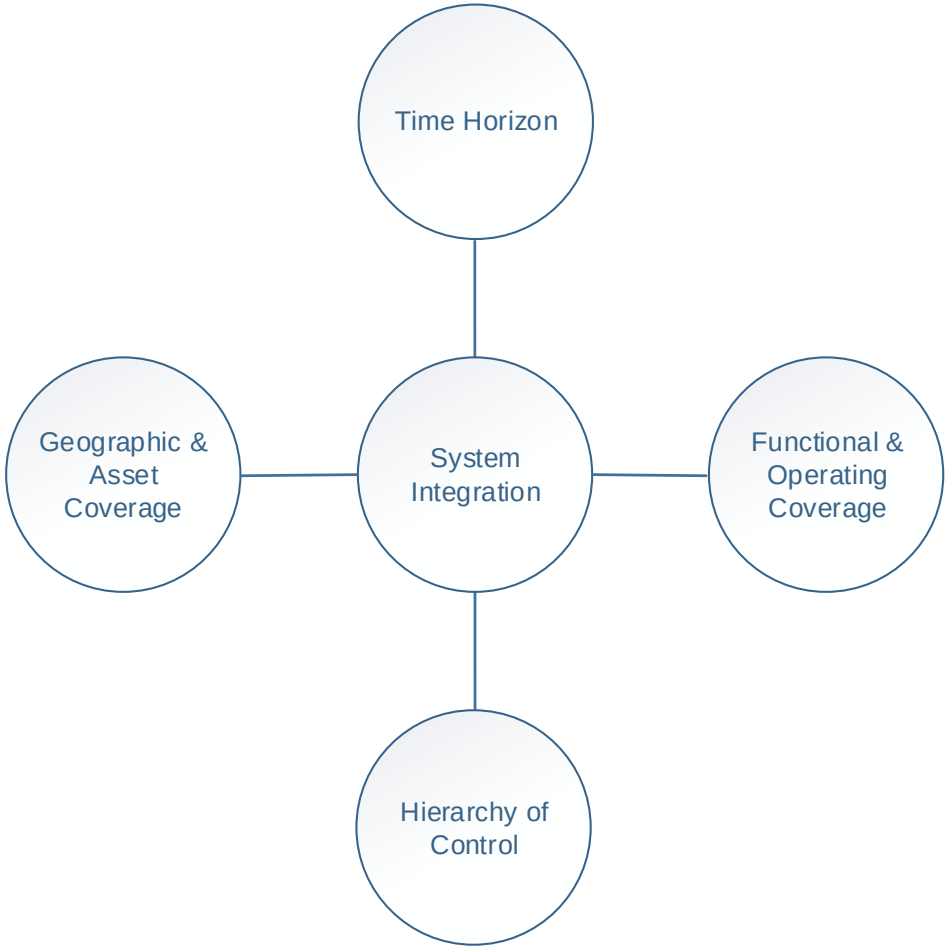
- ROCC is a facility of people, processes and technology to deliver the operations plan
- Generally the primary command and control hub to manage rail operations (can be more than one)
- **ROCC contributes to operational resilience by having the 'situational awareness'**
  - Always knowing the current state of the railway
  - Response to incidents to minimise disruptions

ROCC has the 'situational awareness' and is best placed to manage disruptions

The more that it is aware the better it can contribute to operational resilience

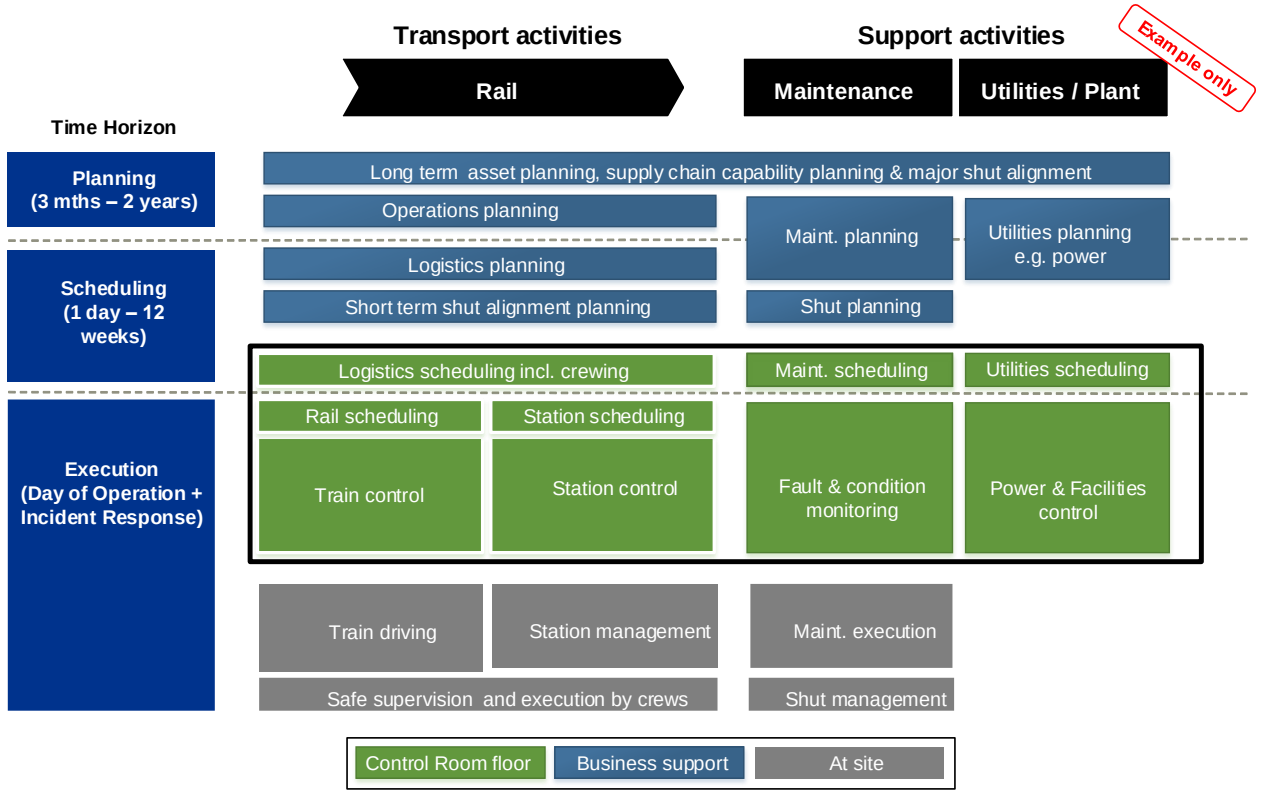
ROCC for Resilience Framework

- A framework to define the ROCC to contribute to resilient rail operations
- Operational Objectives & Key Performance
  - Concept of Operations / Rail Operations Plan
- Operational Integration criteria
  - Time horizon
  - Hierarchy of control
  - Geographic coverage
  - Asset coverage
  - Functional coverage
  - Operating coverage
- System Integration criteria
  - People
  - Process
  - Technology



Operational Integration – Time Horizon

- Time horizon is the length of time coverage for the provision of the railway operational service by the ROCC
  - Planning: 3 months to 2 years out
    - Strategic planning, build-in the resilience
  - Scheduling: 1 day to 3 months before day of operations
    - Resources, timetable, schedule resilience
  - Day of operations: 24/7 less maintenance downtime
    - Handle minor variations
  - Incident management: minutes / hours to respond to incidents
- The ability of the ROCC to manage incidents, especially those that are service affecting is a significant contribution to rail operational resilience



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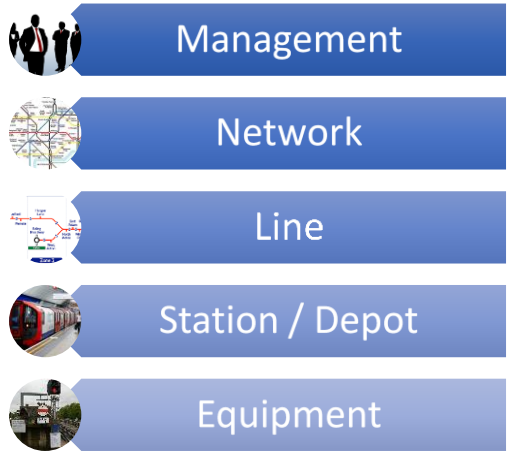
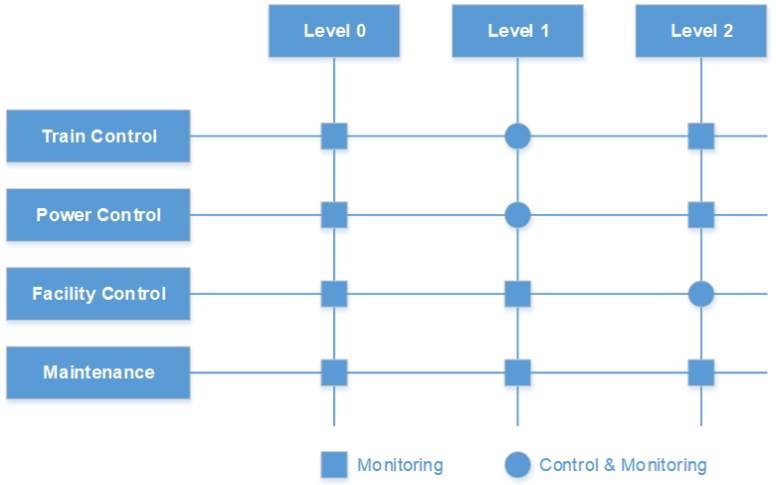
Operational Integration – Hierarchy of Control

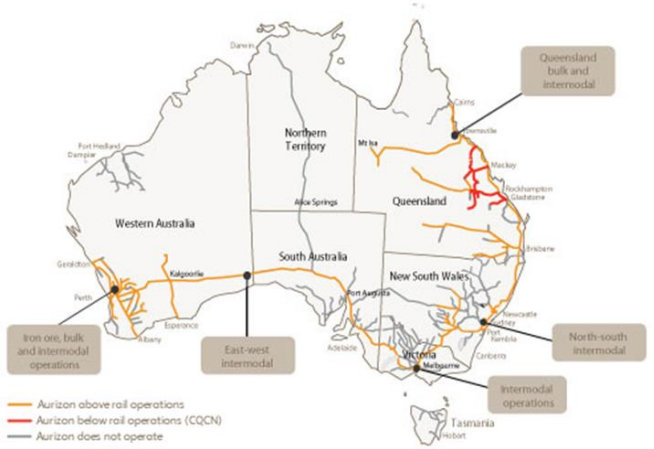
- Hierarchy of control is a coordination strategy to manage the rail operations
  - Based on a top-down ‘chain of command’ approach for the authority of operations
- Primary control
  - control level with the wide-ranging authority, the fastest response times, and is best able to manage the operational dynamics and variables
- Secondary control
  - Control level with specific or assigned authority for localised situations, often as a fall-back for degraded mode operations or for self-contained operations
- Responsibility apportionment
  - Who gets what and who is control at each level?

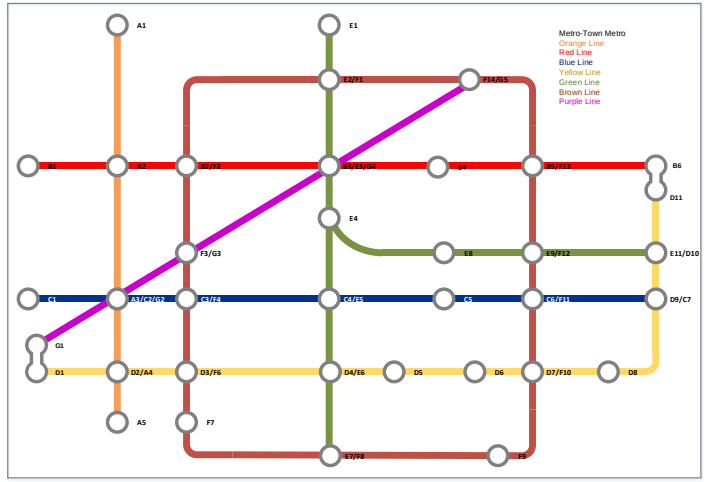




Operational Integration – Geographic Coverage

- Geographic coverage sets the foundation of the ROCC for its operational scope
- ROCC (or multiple ROCCs) must consider
  - Railway lines (alignment) including mainline, depots, stabling and terminals
  - Geographical territory included international / national, state / territory, region and city areas
  - Boundaries, demarcation and interface points
  - Rail corridor coverage (e.g. fence to fence)
- Metro railway may have a ROCC per line
- Conventional railways may have a few ROCCs
- National freight operator may have one ROCC





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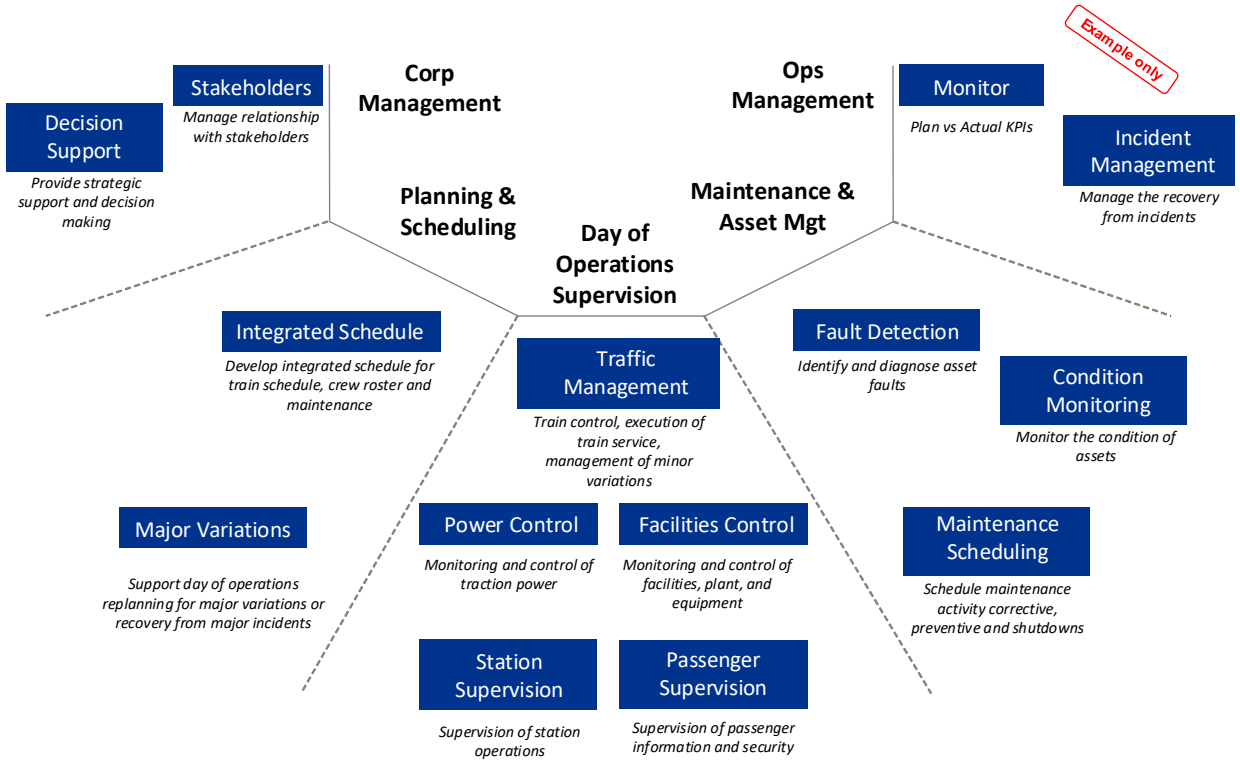
Operational Integration – Asset Coverage

- Asset coverage are the assets that will be supervised, monitored, and controlled by the ROCC
  - Network lines and track
  - Civil infrastructure including tunnels, bridges and elevated sections
  - Rolling stock
  - Signalling and Telecommunications
  - Traction Power and Electrification
  - Buildings, Stations, Depots, Facilities
  - External interfaces (assets not included)
- Assets to be included depends on their relative contribution to the service delivery or impact on incident management
  - Generally, more the better

If the assets are not monitored, then how does operations know what's going on!

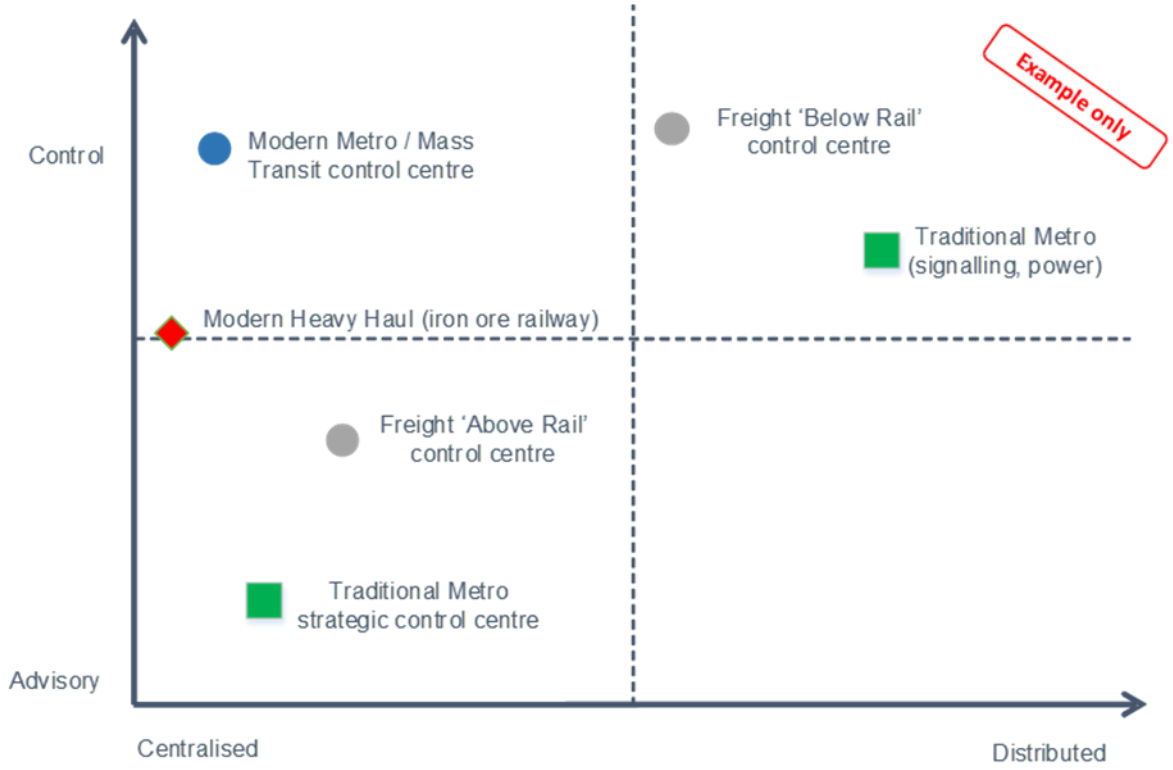
Operational Integration – Functional Coverage

- Functional coverage is the control and monitoring and other functions provided by the assets
  - Planning and schedule management systems
  - Train control and signalling, traffic management
  - Power control and monitoring (PSCADA)
  - Facilities control and monitoring (FSCADA)
  - Telecommunications (radio, tel, PAS/PIS)
  - Security and passenger safety (CCTV, Help)
  - Asset condition monitoring and protection
  - Maintenance and failure detection
  - Training and simulation
  - Reporting
  - Asset and maintenance management
  - External interfaces

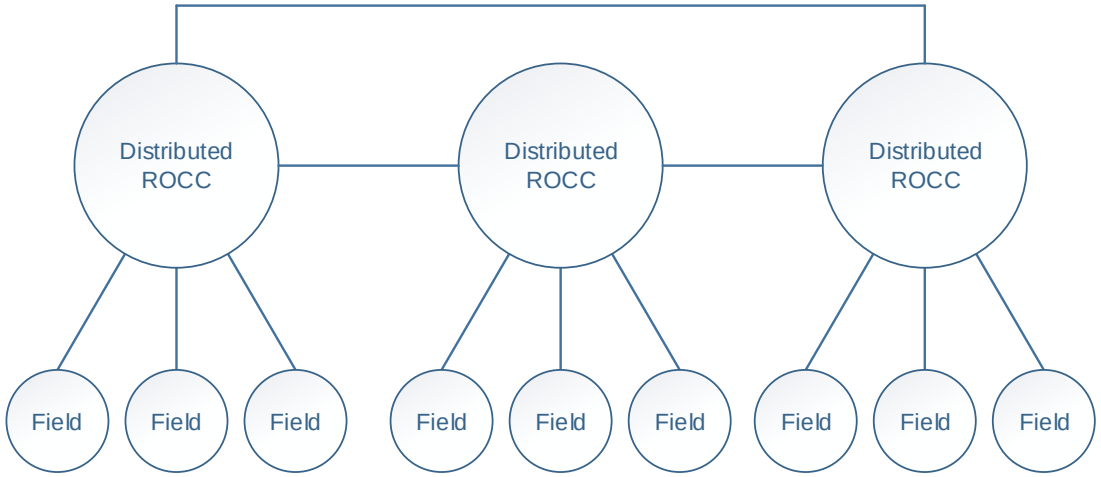


Operational Integration – Operating Coverage

- Operating coverage are the locations where operations are performed and the associated personnel arrangements to staff those locations
- Degree of centralization
  - Is the ROCC the only point of control and supervision for the railway operations or are there other locations that will perform control or support
- Balance between
  - Fully centralised control versus distributed control
  - Operator control (actuation) versus advisory (supervision)

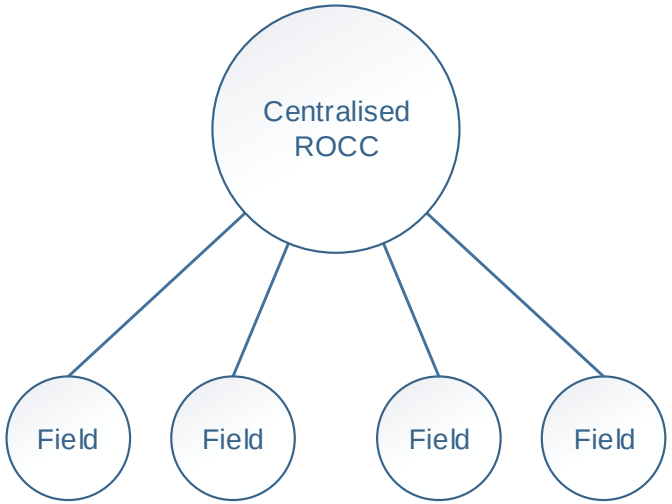


Operation Integration – Operating Coverage Arrangements

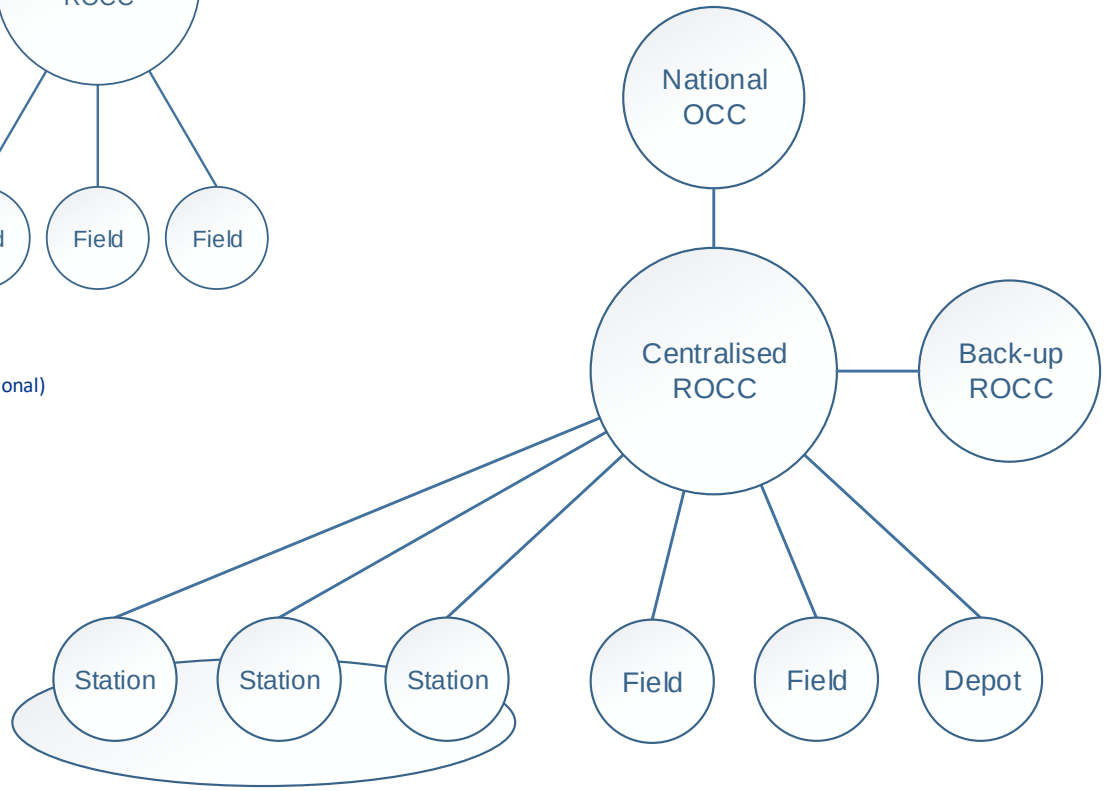


Distributed OCC

(without comms between OCCs - traditional)



Centralised OCC



Combined OCC

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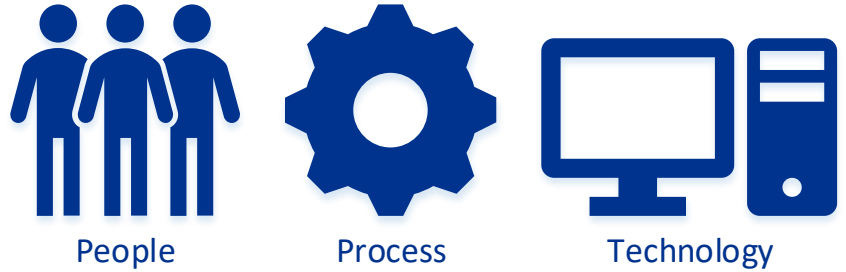
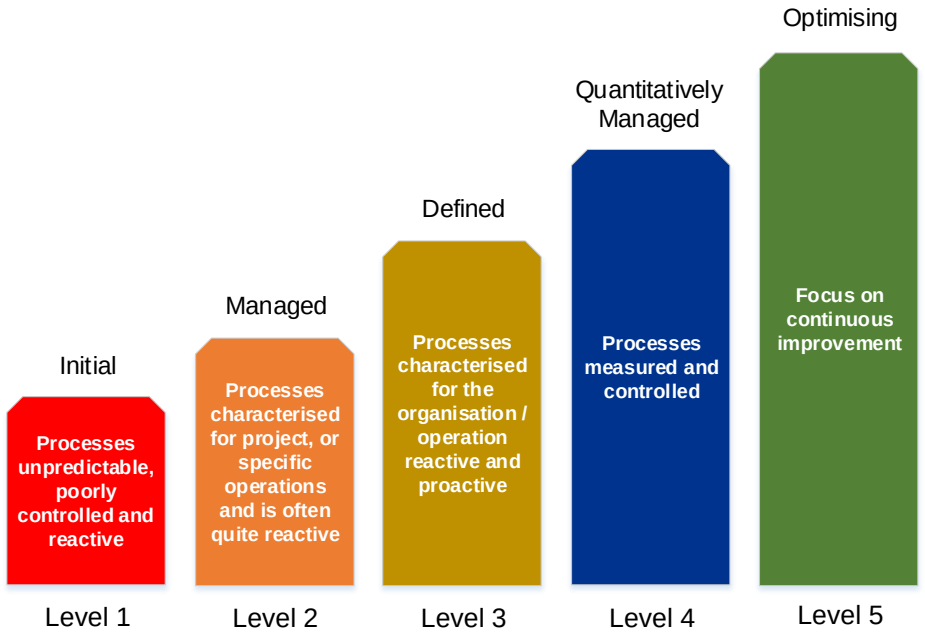
System Integration - Overview

- System integration drives the implementation and risk mitigation of the ROCC
  - Reduced ‘frictional losses’ vs costly aspirations
- People
  - Defines operations and maintenance personnel roles and responsibilities
- Process
  - Policies, plans, and procedures
  - Level of automation
  - Capability Maturity Model Integration (CMMI)
- Technology
  - Selection, utilisation & integration of technology
    - Human Machine Interface (HMI)
    - System Servers
    - Software and data





CMMI

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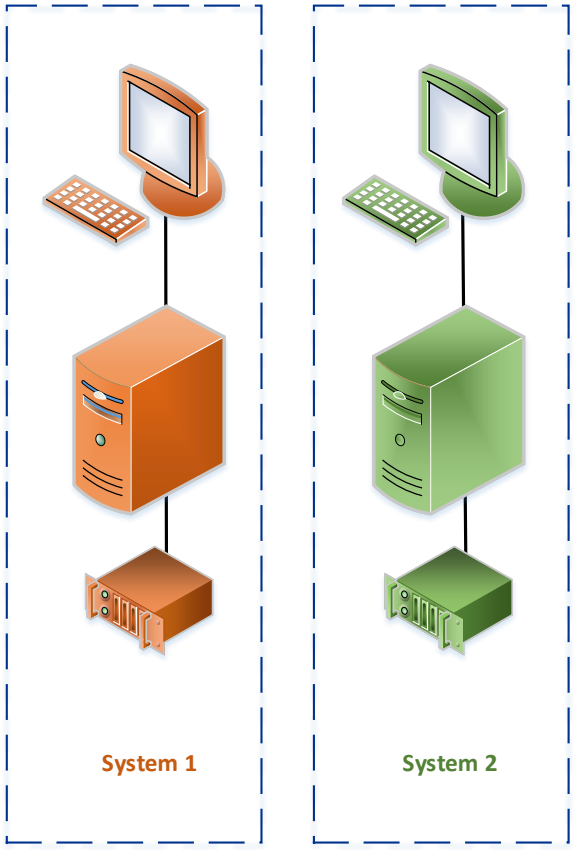
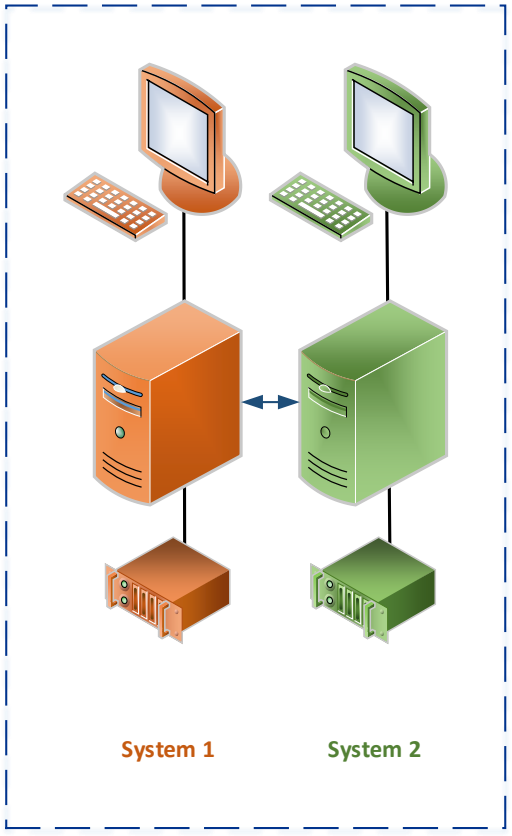
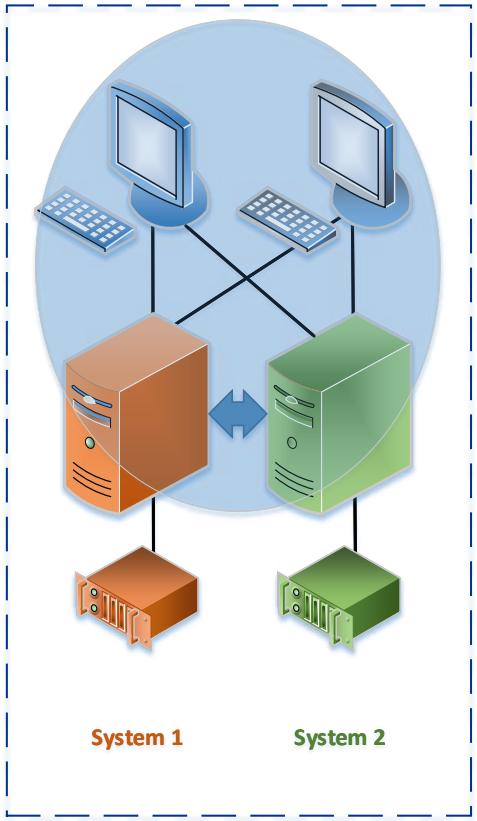
System Integration – Integration Types



Type 1 Silo



Type 2 Physical Integration



Type 3 Data & Visual Integration

improved situational awareness

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System Integration – Integration Types Comparison

Integration Type	Advantages	Disadvantages
Type 1 Silo	• Traditional. • Easier to implement (separate systems. • Well understood.	• Performance can be constrained. • Coordination more difficult. • Situational awareness is limited.
Type 2 Physical Integration	• Reasonably cost effective (systems in same facility). • Improved situational awareness. • Future integration platform.	• Procedural dependent - multiple silos in the one room. • Lack of flexibility. • Some tasks manually onerous.
Type 3 Data and Visual Integration	• Improved situational awareness and coordination. • Automation of key functions. • Flexibility of operator roles. • Availability of common ‘big data’ (e.g. root cause analysis).	• Greater implementation complexity – development and change impact. • Sole-sourced / concentrated suppliers. • Costly to implement. • High availability to avoid any common point of failure.

Back-up ROCC – Is it needed?

Positives

- ✓ Provides disaster recovery if the ROCC is unavailable
  - ✓ The need to evacuate the ROCC control room (e.g. reported gas or water leak) where the operational systems and technology assets remain available but are not impacted
  - ✓ The need to evacuate the ROCC where the operational systems and technology assets are impacted (e.g. complete power failure, fire, flood)
- ✓ Provides operating continuity and enhances resilience

Negatives

- ❖ Expensive to implement and maintain
- ❖ Logistics, personnel and change-over time considerations
- ❖ Requires regular updates and checks to make sure it is available when needed
- ❖ Perhaps not the best utilization of the asset
  - ❖ Can consider other purposes such as a training centre, simulation and test facility
- ❖ Alternative strategies may be more effective
  - ❖ Critical control location for signalling, local controls

Conclusion

- A ROCC is best placed to enhance the situational awareness of the railway to manage incidents
- A well defined ROCC can improve operational resilience
- A resilient operation leads to improved customer experience
- Applying the ROCC for resilience framework allows rail operations to **ROCC and role**!

End

November 2, 2019