ENHANCING RAIL PROJECT SUCCESS THROUGH SYSTEMS ENGINEERING

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TOPIC

Enhancing Rail Project Success through Systems Engineering

Agenda

- Problem Statement
- System Engineering and areas of SE
- System Assurance and areas of SA
- Solutions through SE and SA
- Future Recommendations
- WSP Services

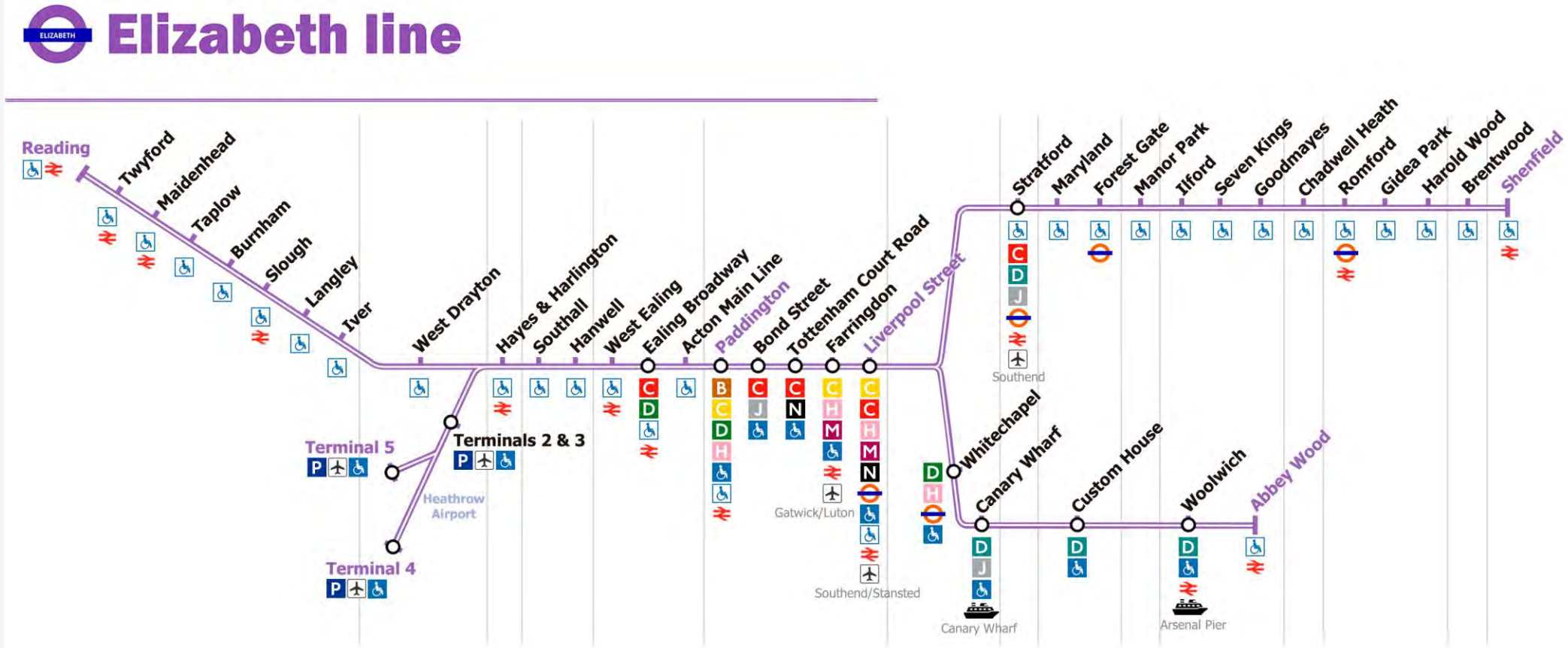
INTRODUCTION TO ELIZABETH LINE


BBC

Cross rail- Overview

- 120 kms, 21 km twins bore tunnels
- 41 stations, (10 new stations/8 UG)
- 70 new trains (200mtrs)
- 24 trains/hr

- 3 signaling systems
- Platform screen Doors (PSD)
- Original Project budget £15bn
- Final spend £19bn



PROBLEM STATEMENT

The Situation – Late 2018

01 Lack of overall programme integration and unrealistic

02 Lack of overall technical integration

03 Discrepancy between reported status and actual status

Key Challenges

01 Program Integration and Reporting

02 Software integration & configuration management

03 Testing and Commissioning

04 Transition between signaling systems

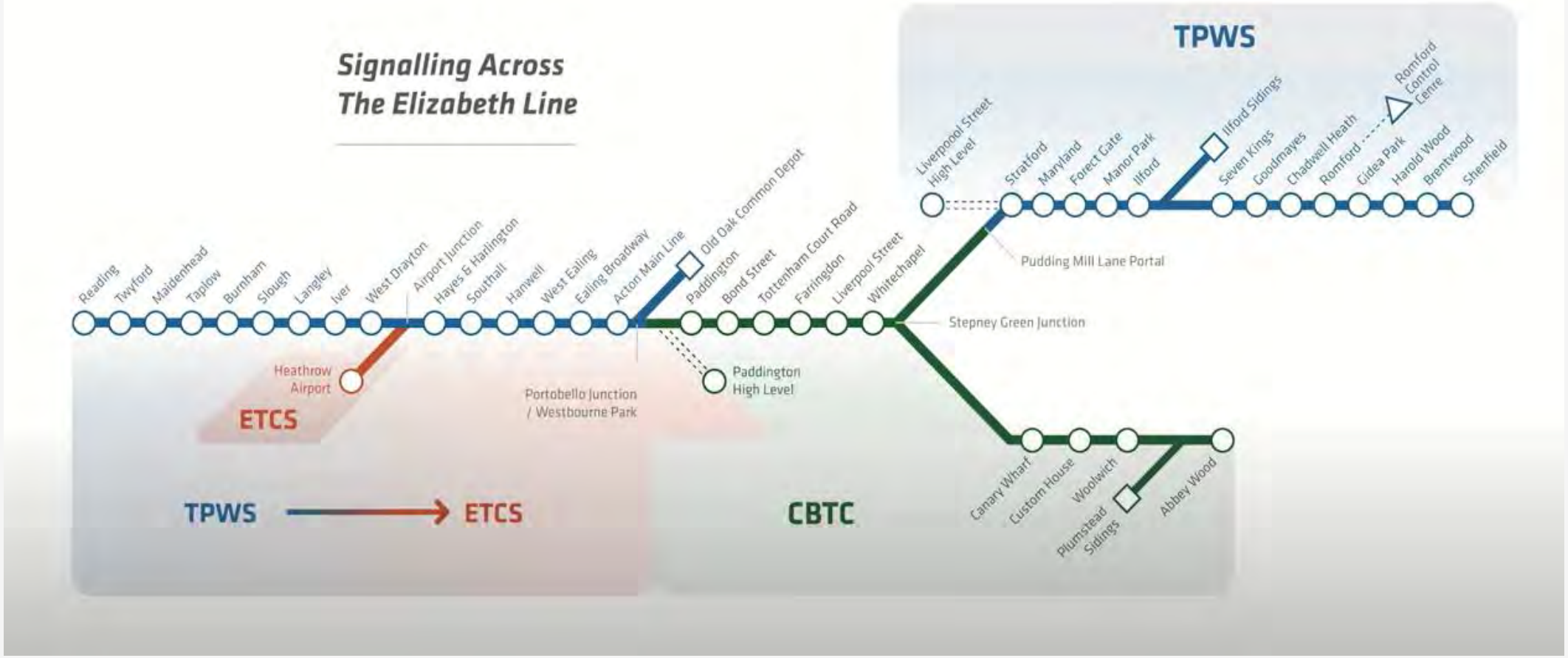
05 Technical and operational Interfaces with PSD/TVS/SCADA

06 Redeployment of System Assurance

- PSD: Platform Screen Door
- TVS: Tunnel Ventilation Systems
- SCADA: Supervisory Control and Data Acquisition

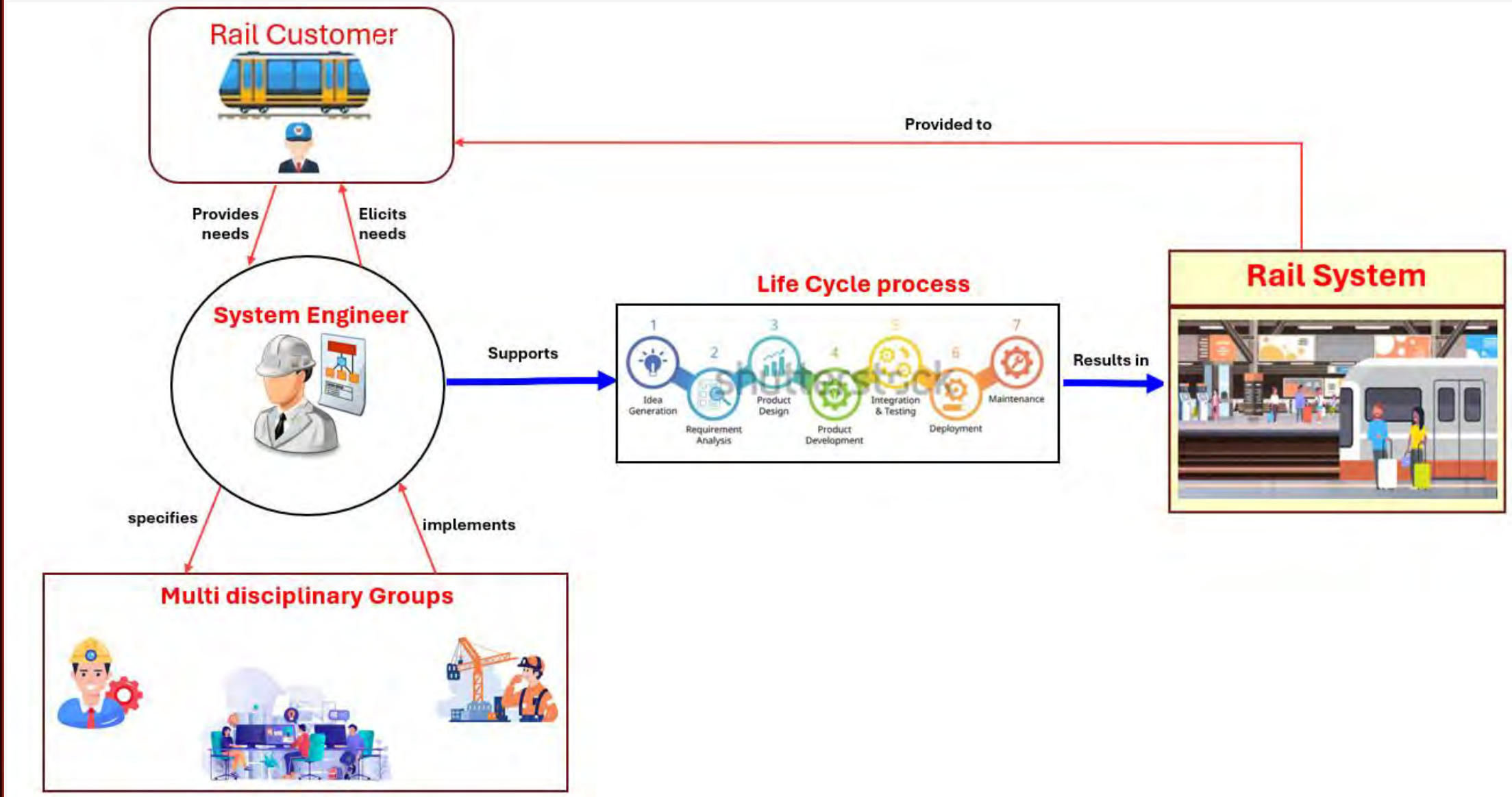
Integrating Complexity-Three Signalling system

* CBTC – Communication Based Train Control
  ETCS – European Train Control System
  TPWS – Train Protection Warning System
  TCMS – Train Control Management System



SYSTEM ENGINEERING

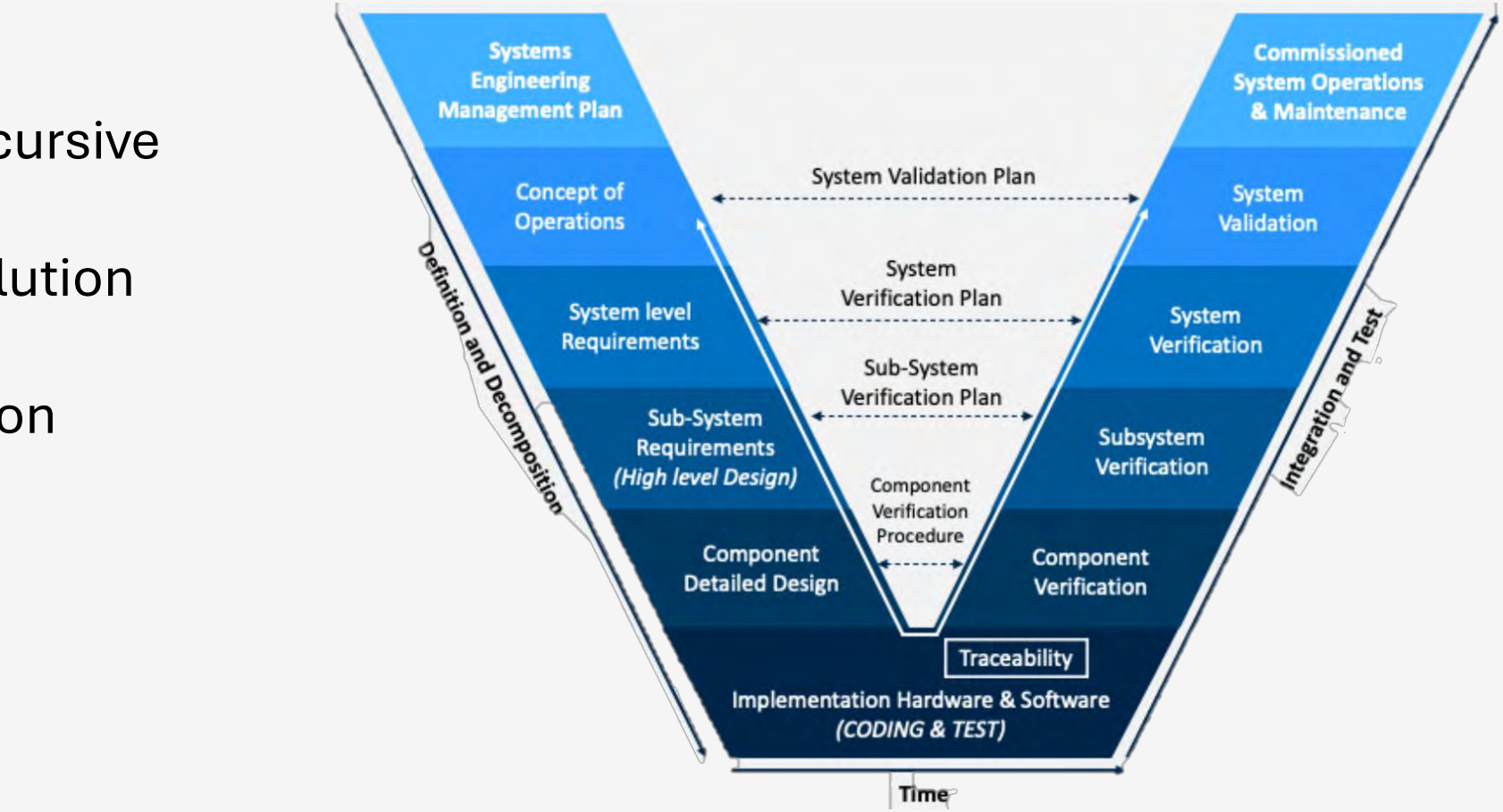
What is System Engineering?



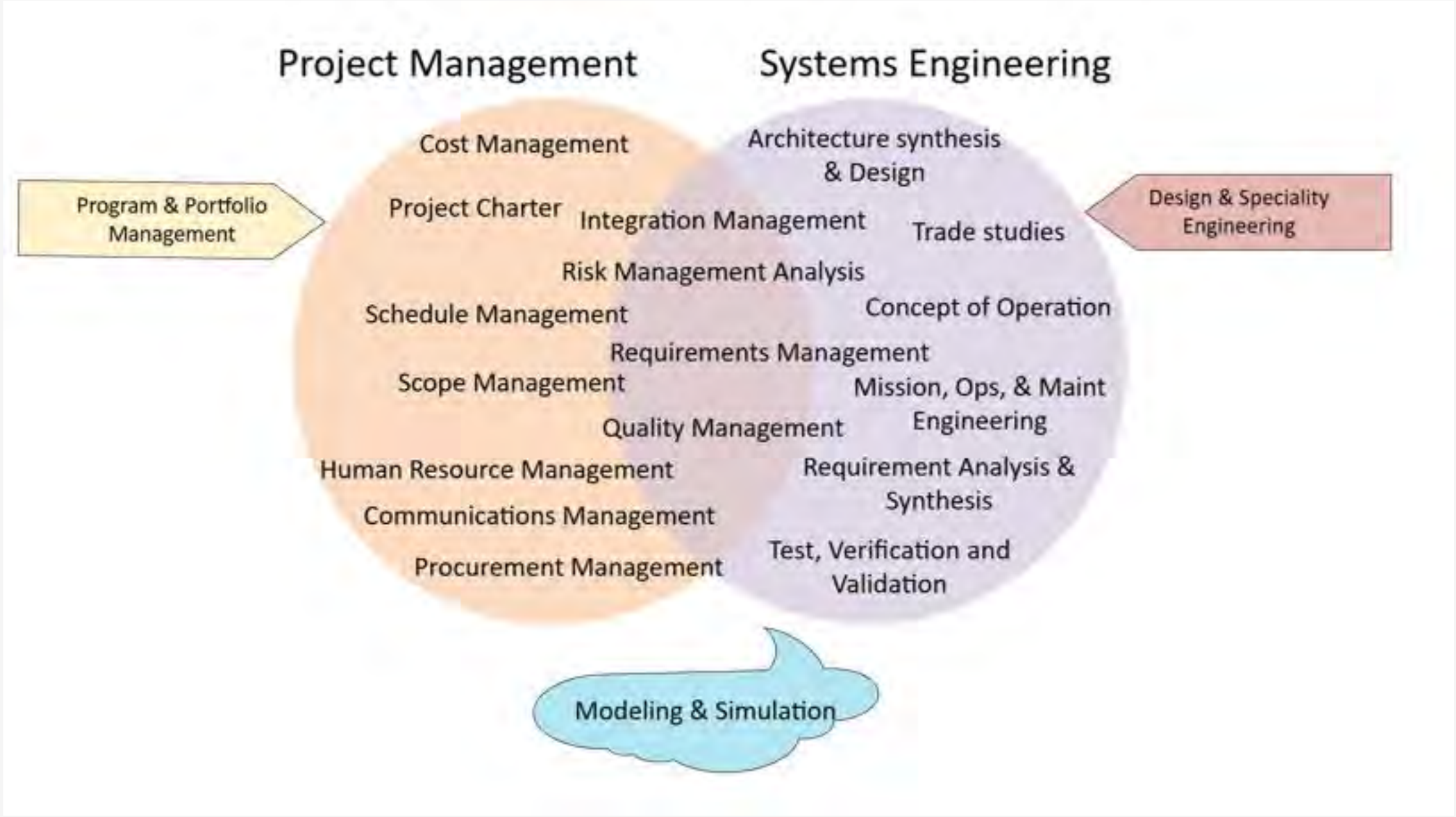
Why System Engineering?

System Engineering manages complexity and risk

- Iterative & recursive
- Conflict resolution
- Decomposition



Project Management vs System Engineering



AREAS OF SYSTEM ENGINEERING

Areas of System Engineering

01 Concept Development

02 Requirements Management

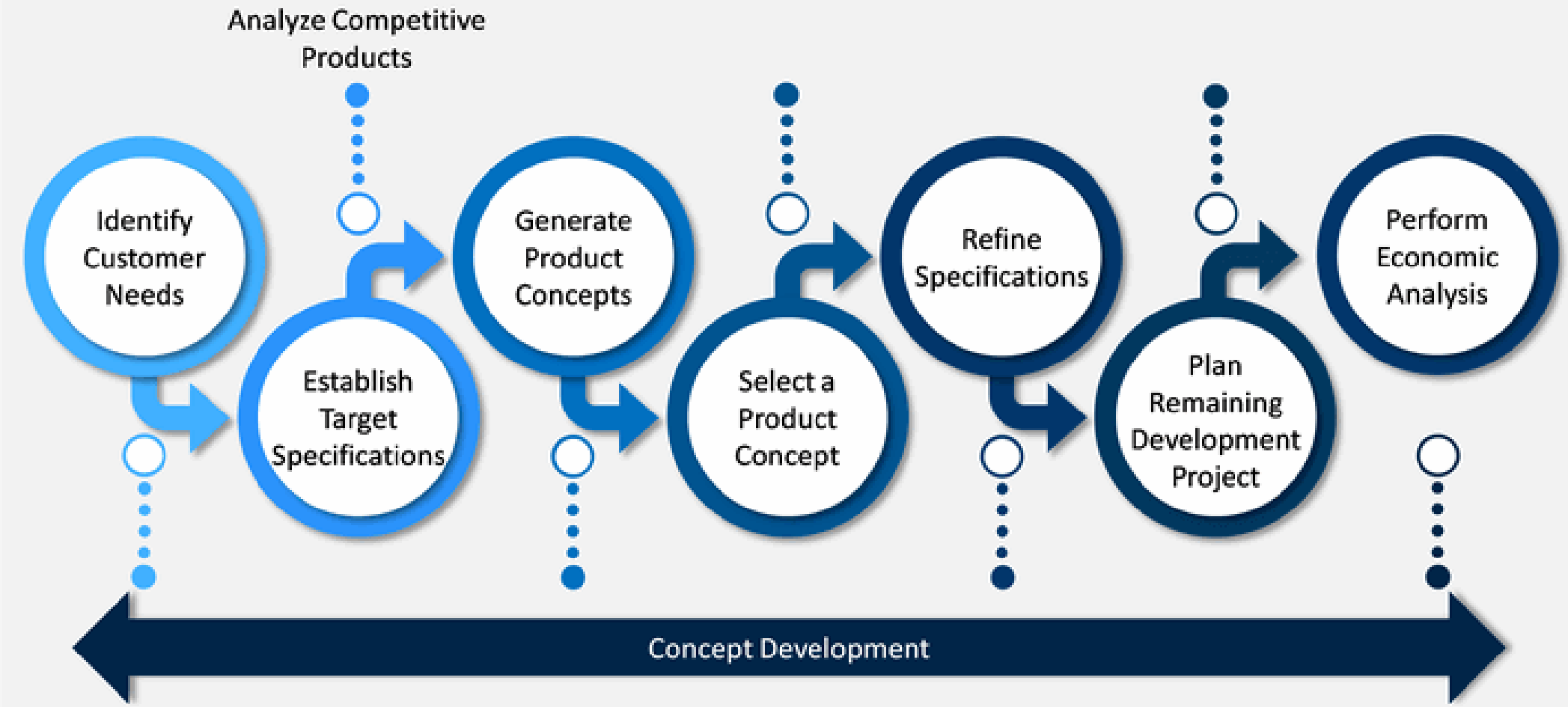
03 Interface Management

04 System Integration

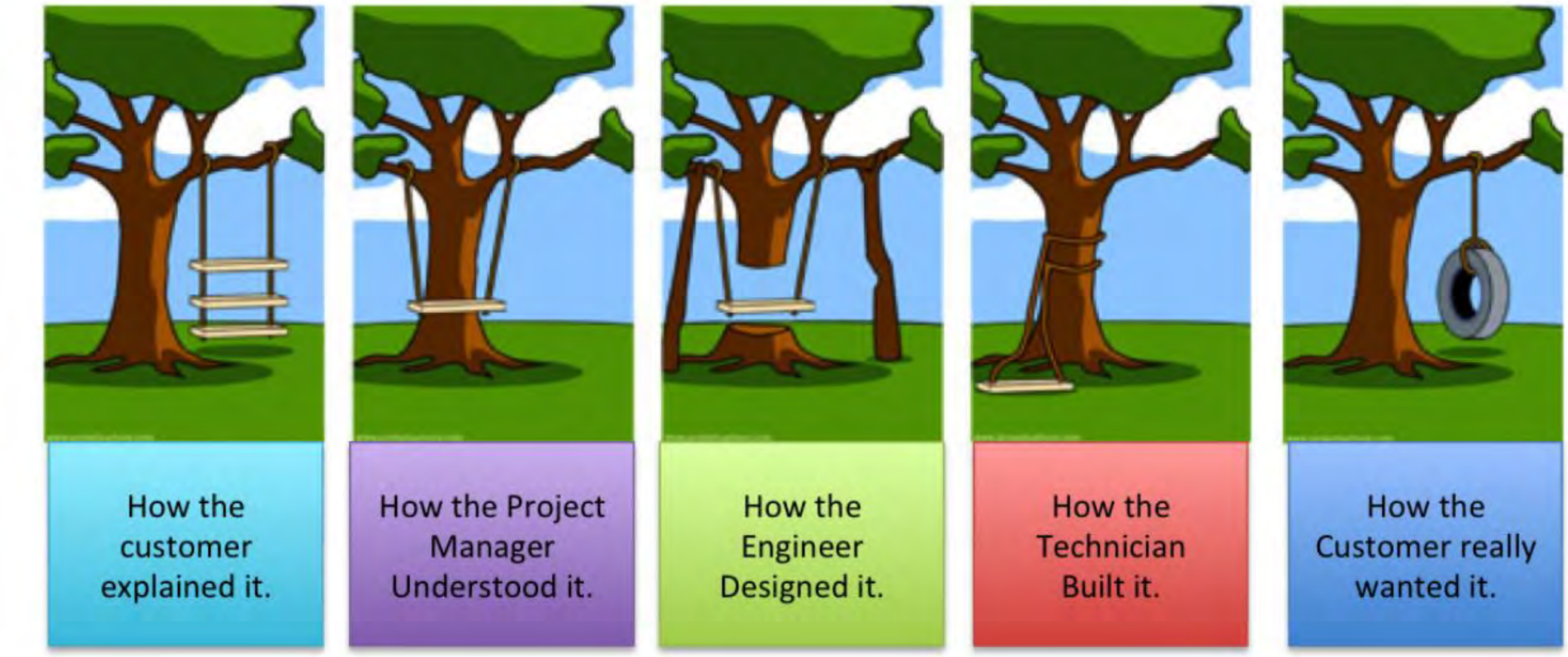
05 Verification and Validation

06 Configuration Management

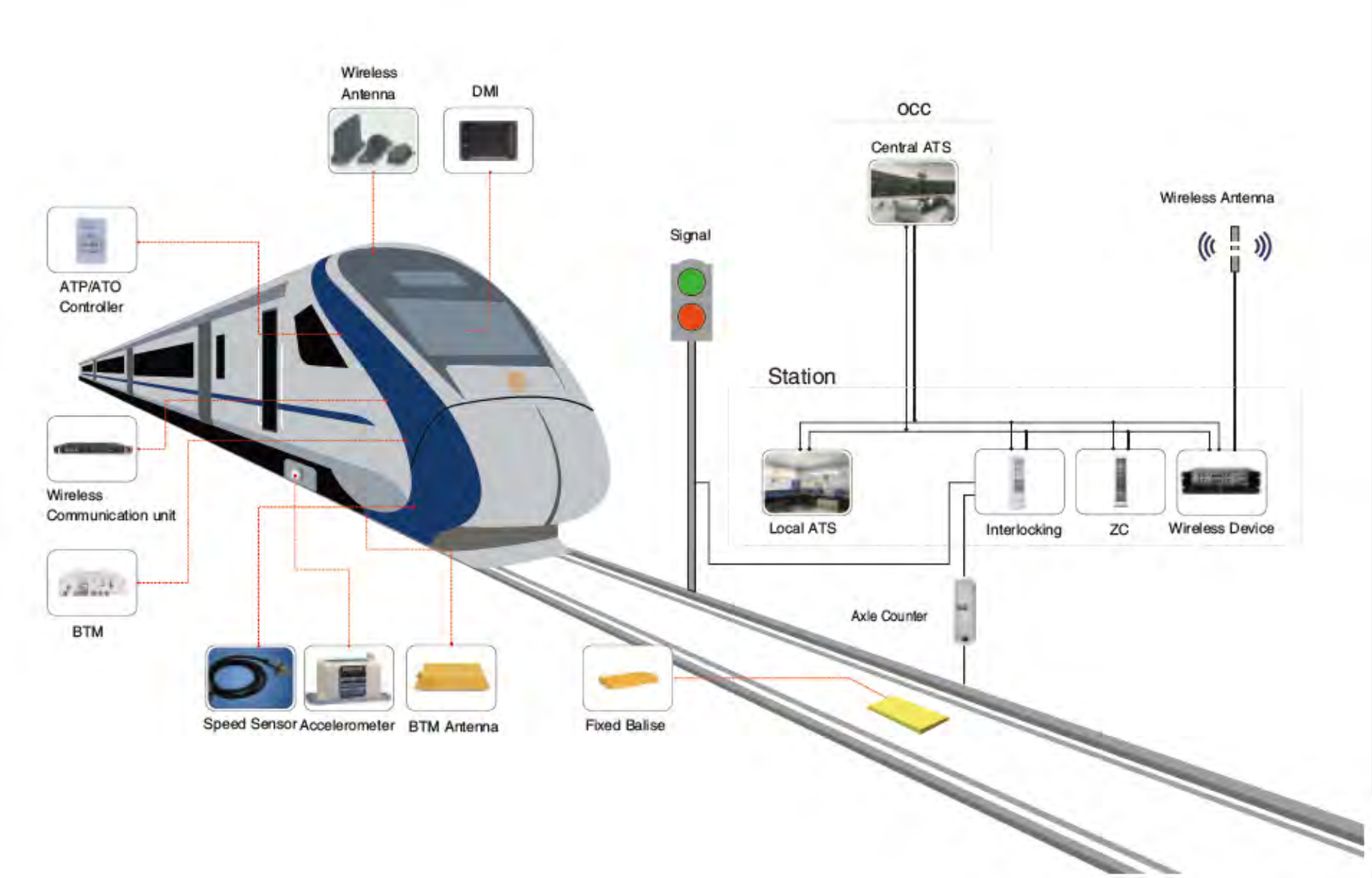
Concept Development



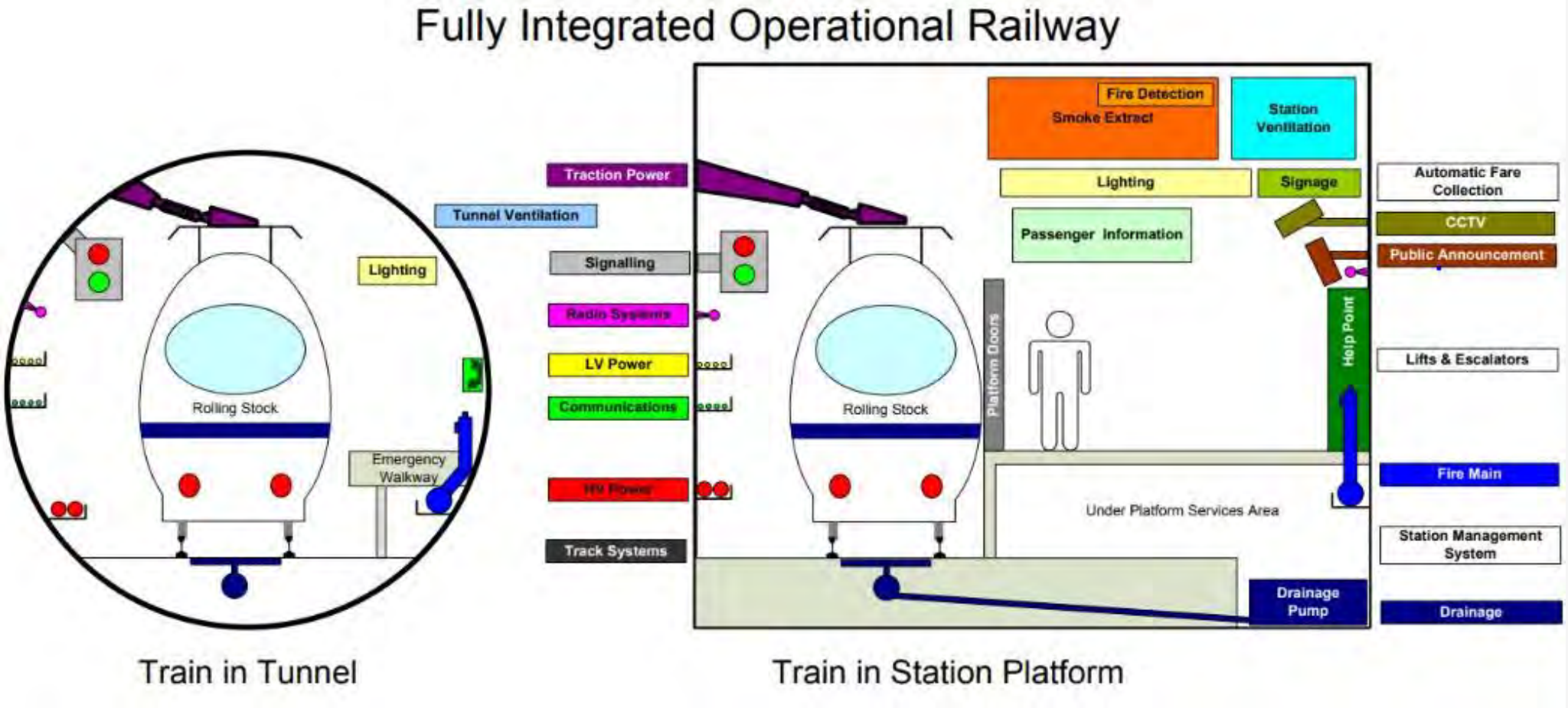
Requirements Management



Interface Management

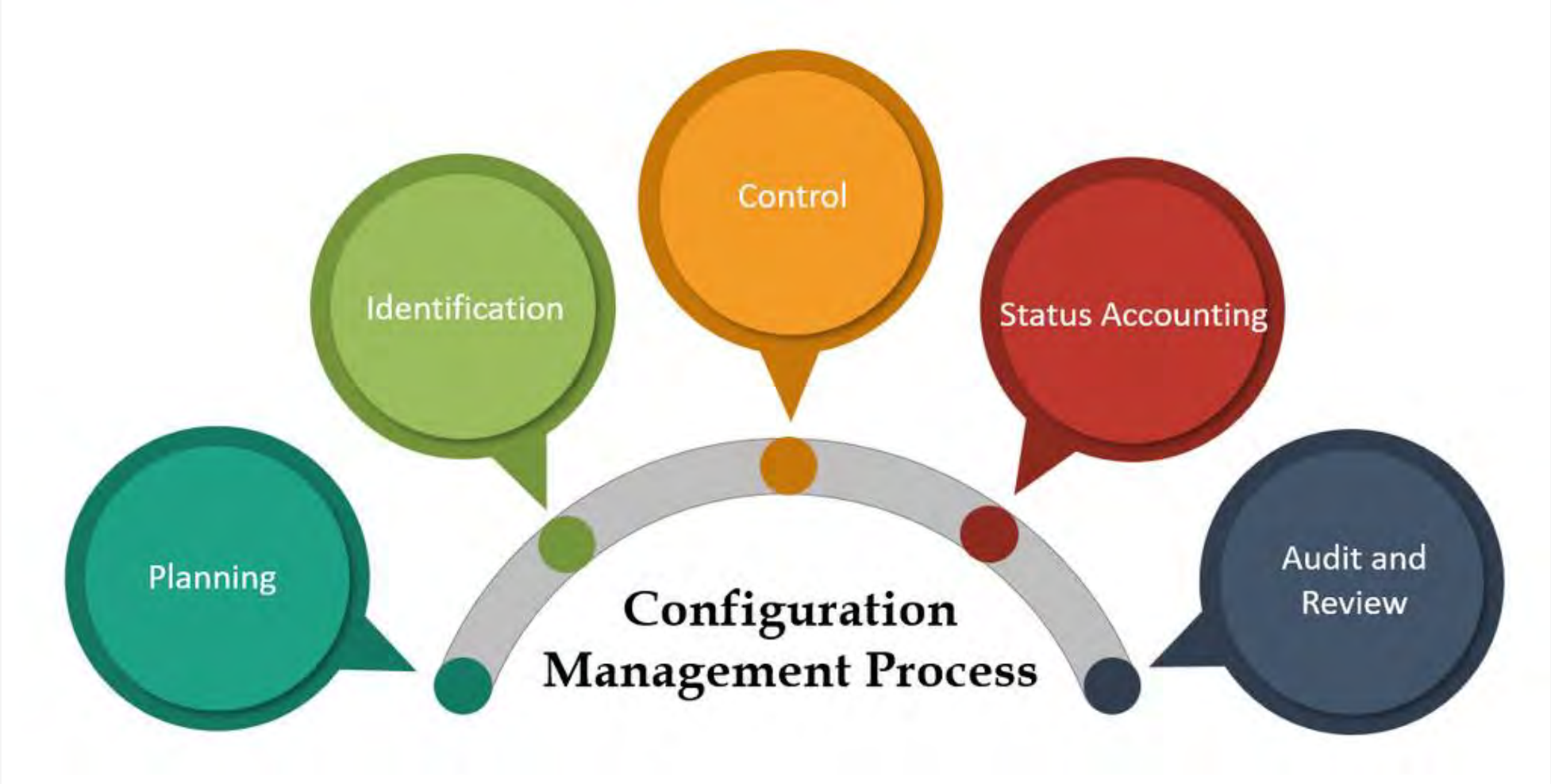


System Integration



Verification and Validation

Configuration Management



Areas of System Engineering

01 Concept Development

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05 Verification and Validation

06 Configuration Management

SYSTEM ASSURANCE

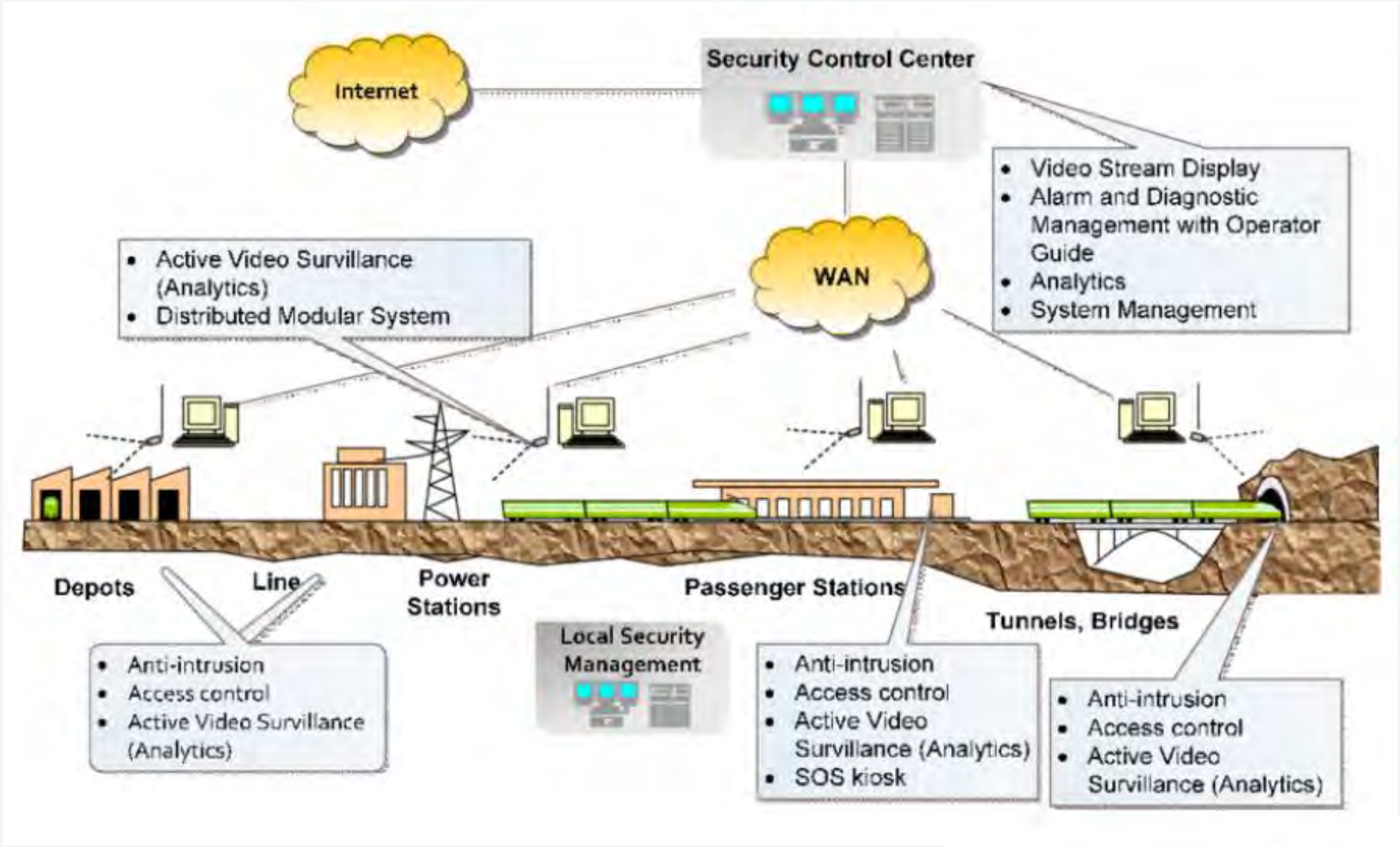
What is System Assurance?

AREAS OF SYSTEM ASSURANCE

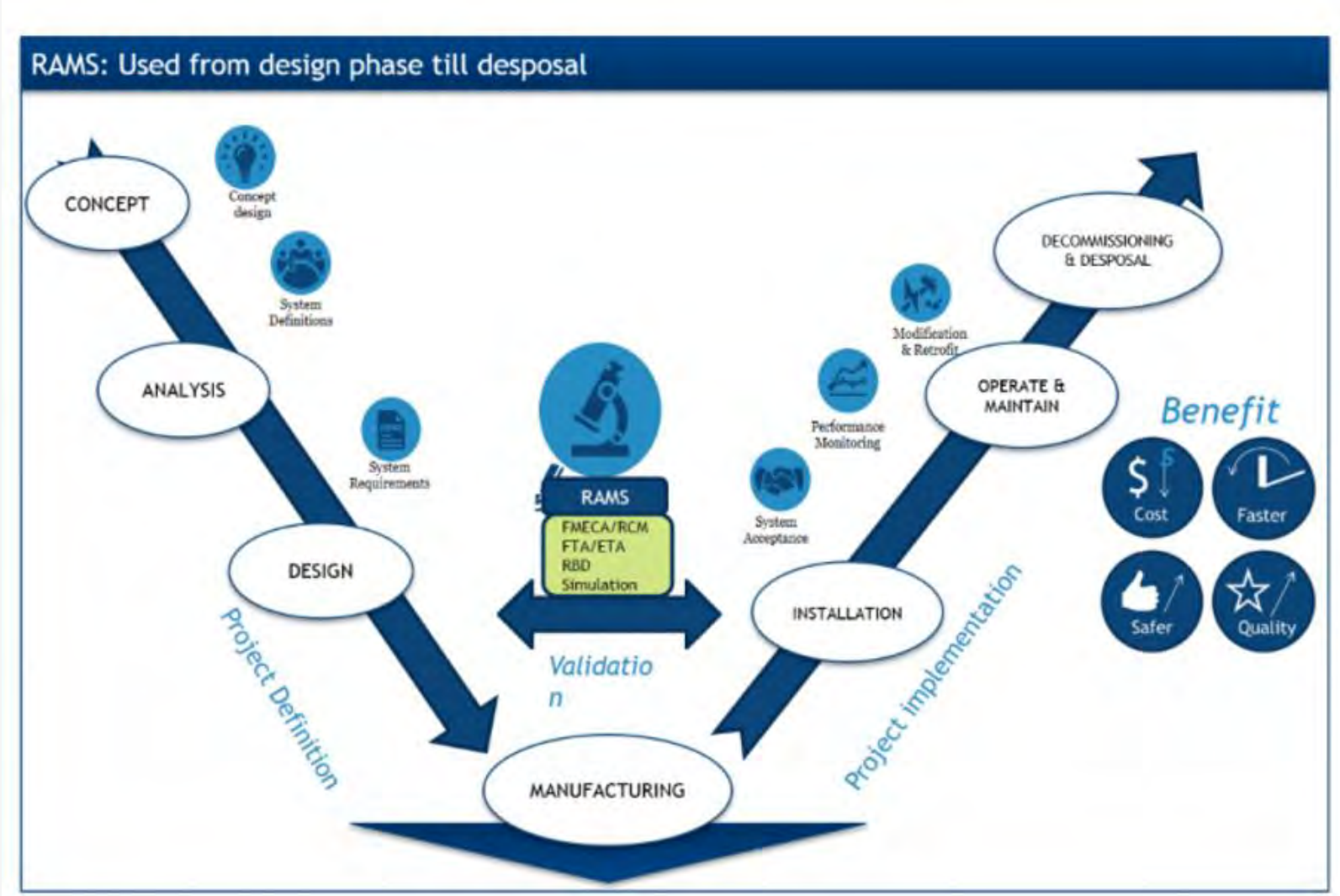
Safety Assurance

Human Factor Analysis

Security


Internet
Security Control Center
Video Stream Display
Alarm and Diagnostic Management with Operator Guide
Analytics
System Management
WAN
Active Video Survillance (Analytics)
Distributed Modular System
Depots
Line
Power Stations
Passenger Stations
Tunnels, Bridges
Local Security Management
Anti-intrusion
Access control
Active Video Survillance (Analytics)
Anti-intrusion
Access control
Active Video Survillance (Analytics)
SOS kiosk
Anti-intrusion
Access control
Active Video Survillance (Analytics)

Reliability, Availability, Maintainability



Areas of System Assurance

01

Safety Assurance

02

Human Factor Analysis

03

Security

04

Reliability Availability & Maintenance

SOLUTION THROUGH SE AND SA STRATEGY

Integrating Complexity- Collaborative 'PLATEAU'

01

7 Cross rail Project Team

02

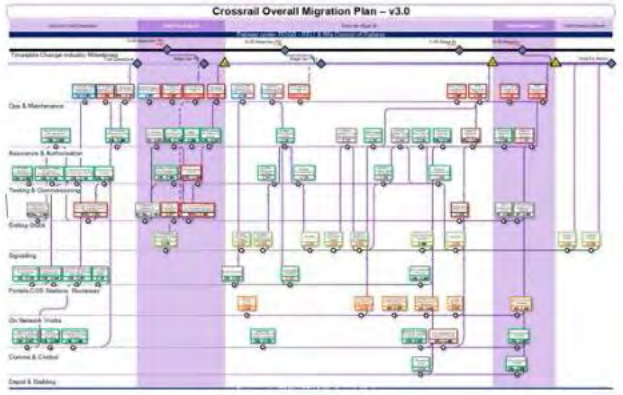
4 Operators

03

2 Major Suppliers

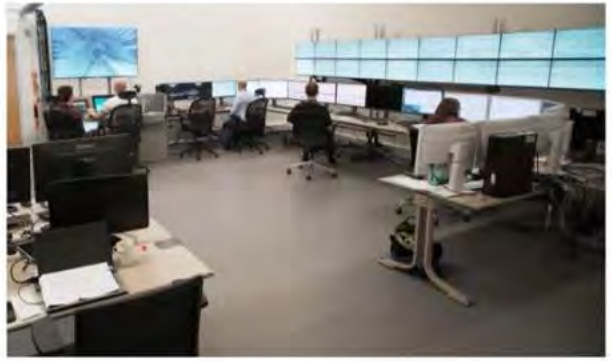
Integrating Complexity- Collaborative 'PLATEAU'

Migration Planning

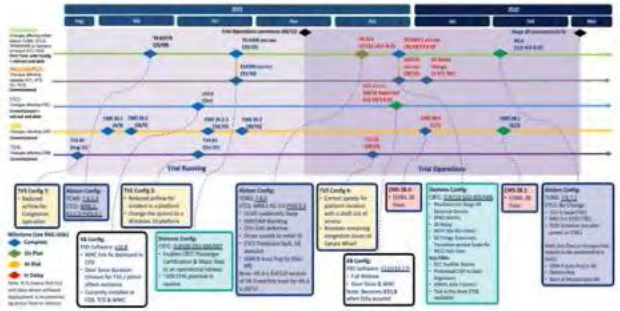


Minimum Functionality

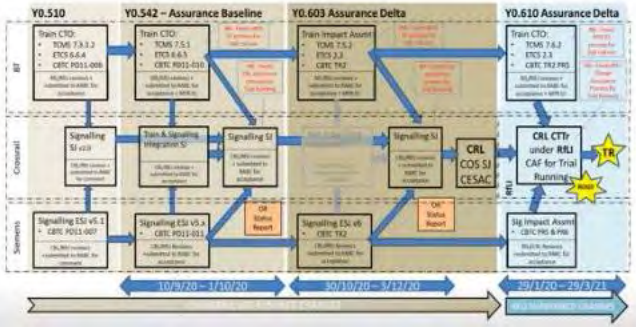
Testing and Commissioning



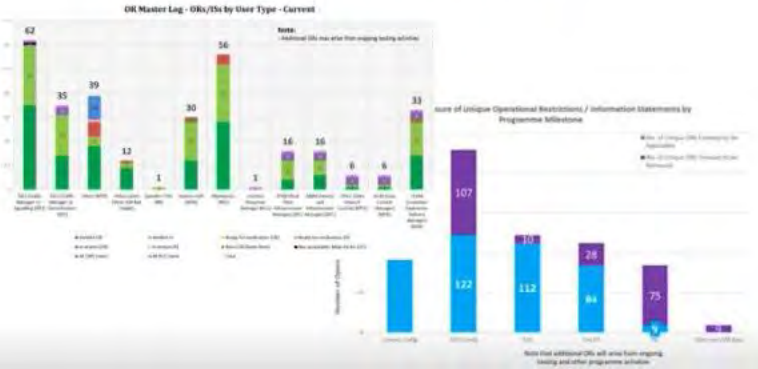
Software Release Strategy



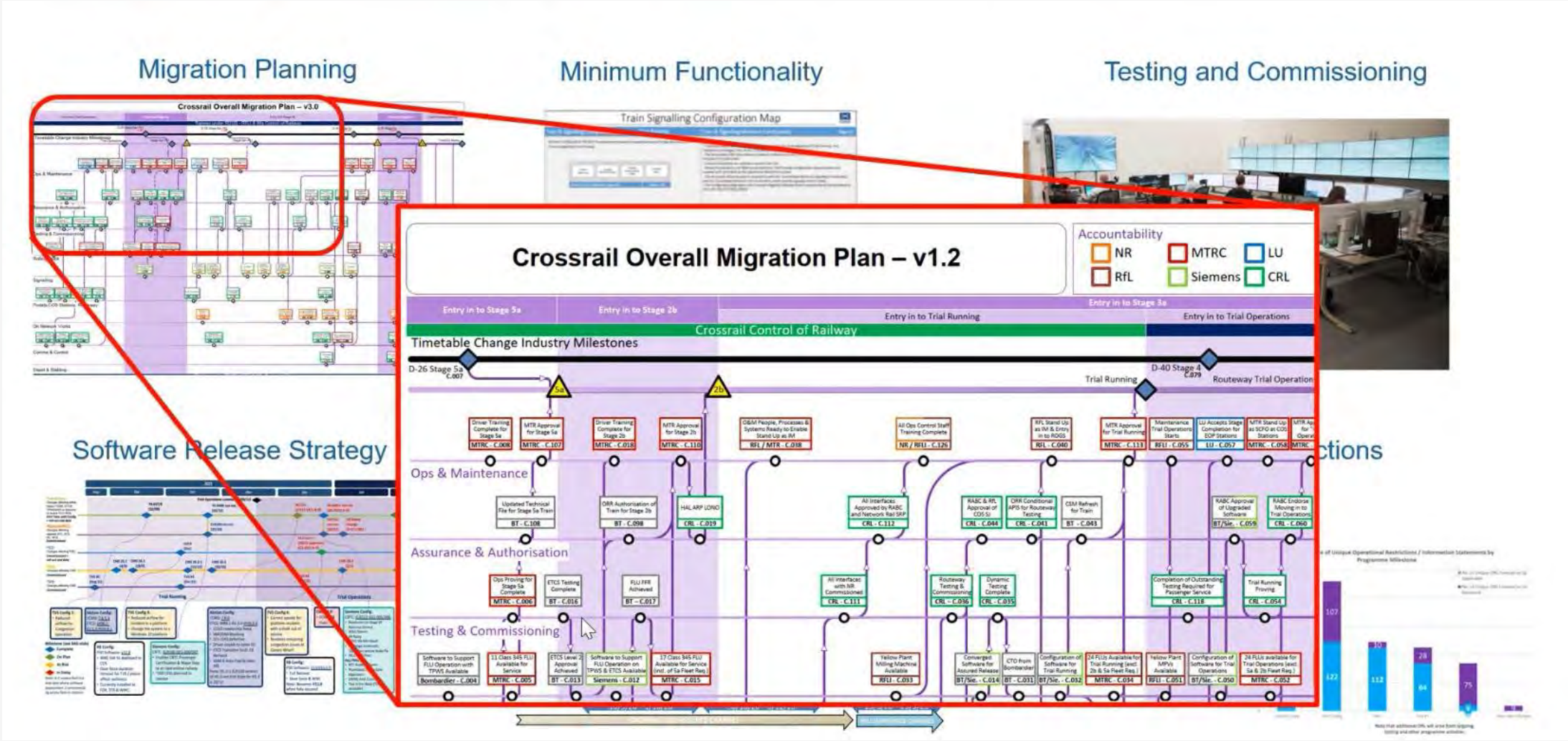
Train and Signalling Assurance Strategy



Operational Restrictions



Integrating Complexity- 'PLATEAU' Workstreams



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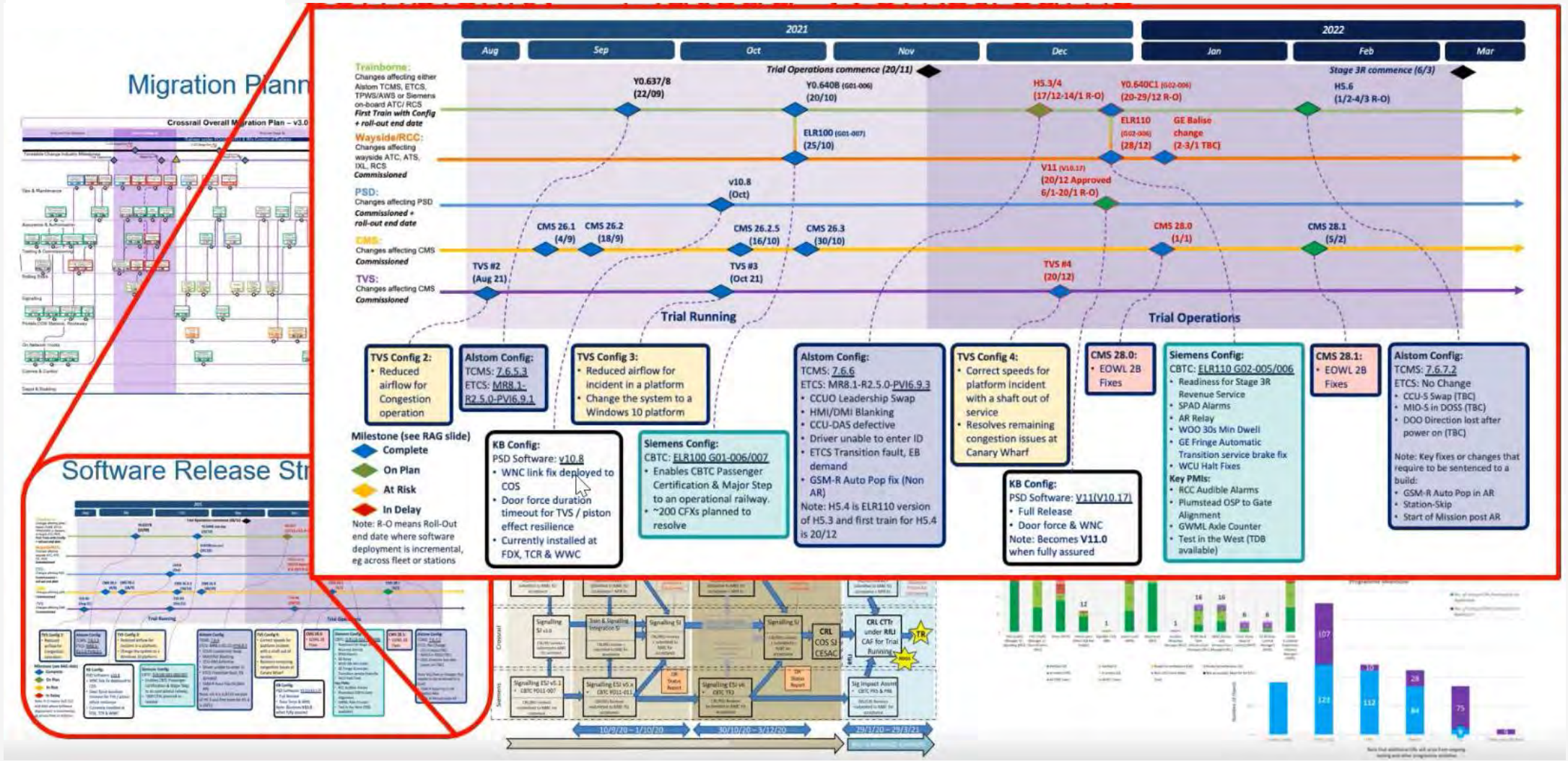
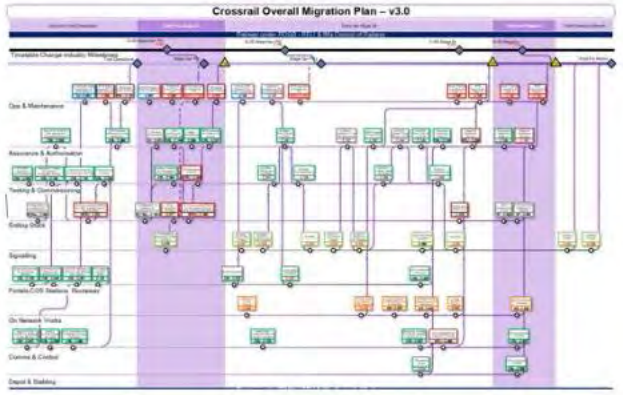


Integrating Complexity- Collaborative 'PLATEAU'

Migration Planning



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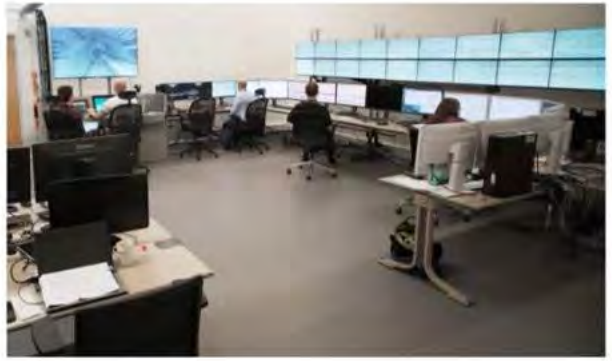

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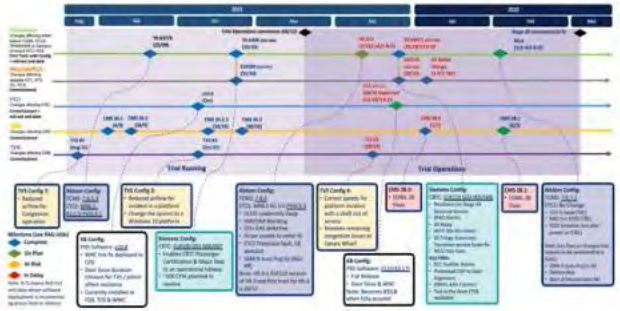

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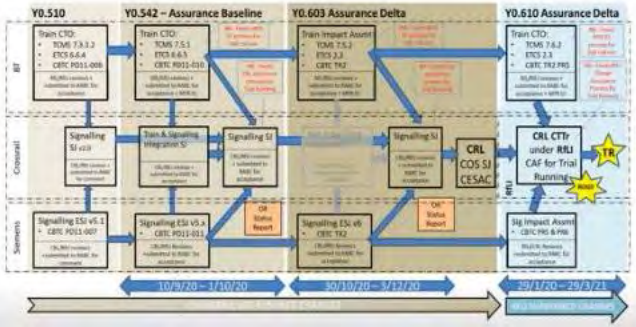

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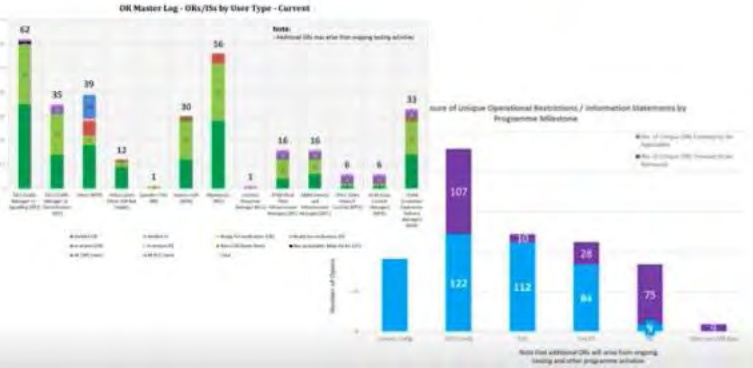

WSP Achievements

01. Successful handover of assets and mobilized Operators

02. Worlds First integration of CBTC/ETCS L2

03. UK’s first Technical Auto reverse on Mainline

04. Successful opening of the railway as planned

05. One of the highest performing and used railways in the UK

06. UK’s first interoperable introduction of ETCS L2

FUTURE RECOMMENDATIONS

Future Recommendations

01 Adopt an Output-Based Approach

02 Coordinate Complexity Effectively

03 Simplify the Management Approach

04 Collaborative Success for All Stakeholders

05 Foster Trust and Transparency

wsp

CANADA SERVICES

WSP CANADA SERVICES

System Engineering

- Concept of operations
- Requirements Management
- Interface Management
- Configuration Management
- Change Management
- Verification & Validation
- Modelling and Simulation
- Modelled based System Engineering

Rail System Design

- Electrification Design
- Overhead Catenary System (OCS)
- Traction Power Substation (TPSS)
- Third-Rail,
- Grounding & Bonding
- Signalling Design, Testing & Engineering
- Train Control Systems & Technology Solutions
- Communications, ICS/SCADA
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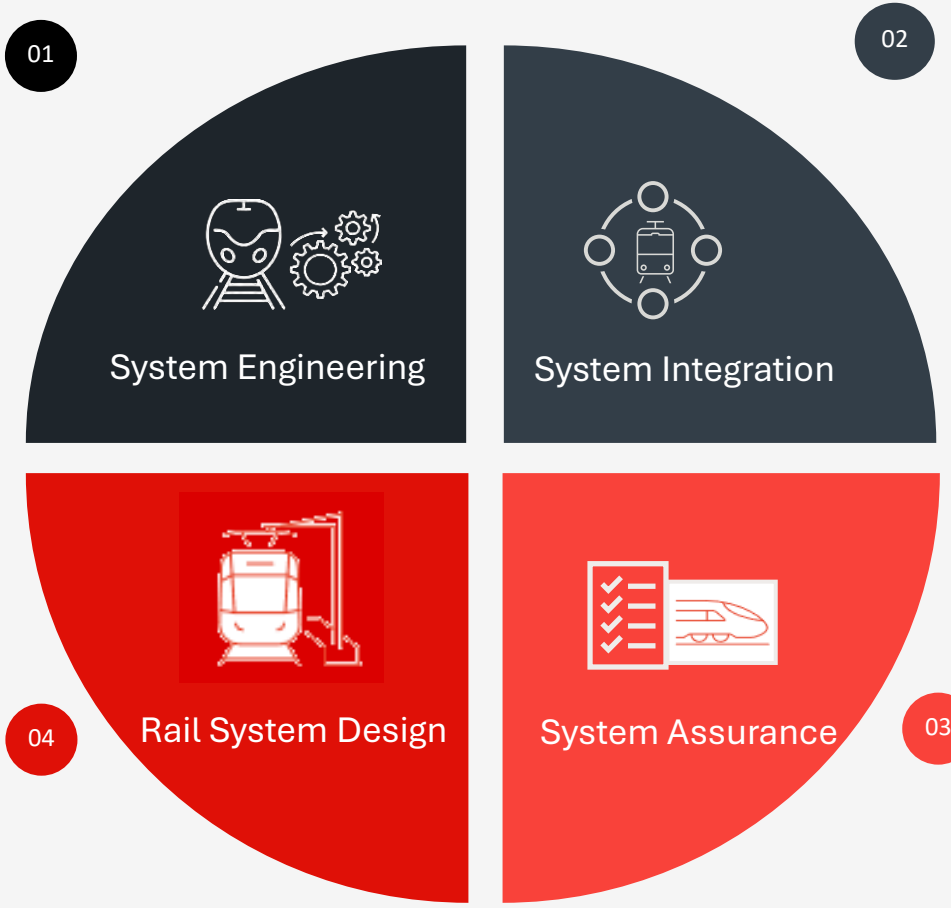
- Station Systems, Vertical Transportation
- Fire & Life Safety
- Fire & Smoke Ventilation Systems



System Integration

- Integration Management
- Design Staging Analysis
- Temporary cutover design coordination
- Testing & Commissioning
- Operations and Maintenance

System Assurance

- Safety Assurance
- Reliability, Availability, & Maintainability (RAM)
- Physical Security
- Cybersecurity
- Human Factor Analysis
- Accident Investigation
- Independent Safety Assessment (ISA)

System Engineering

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WSP CANADA SERVICES

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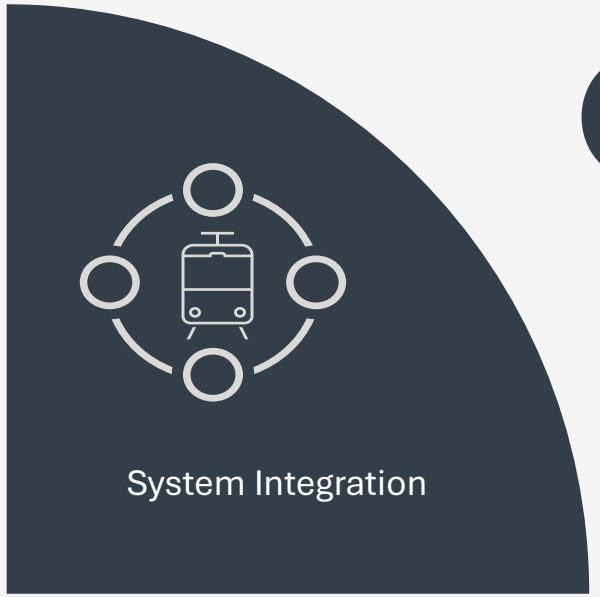

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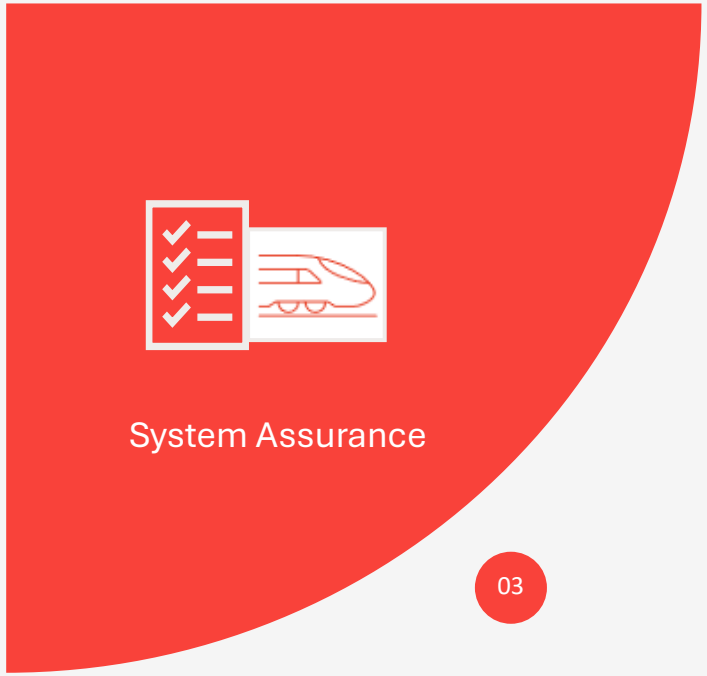

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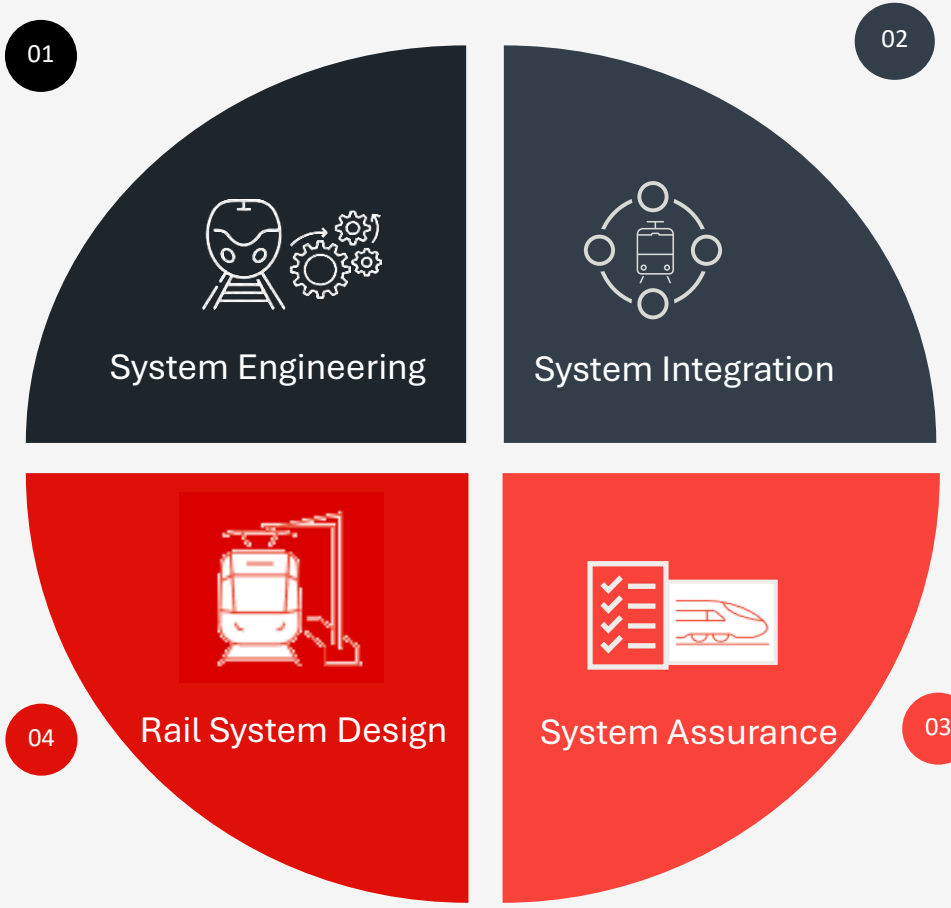

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End of the Presentation

Thank You! For Listening to Our Presentation

Q&A

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