Leveraging Private 5G For Safe, Smart and Connected Mining Operations
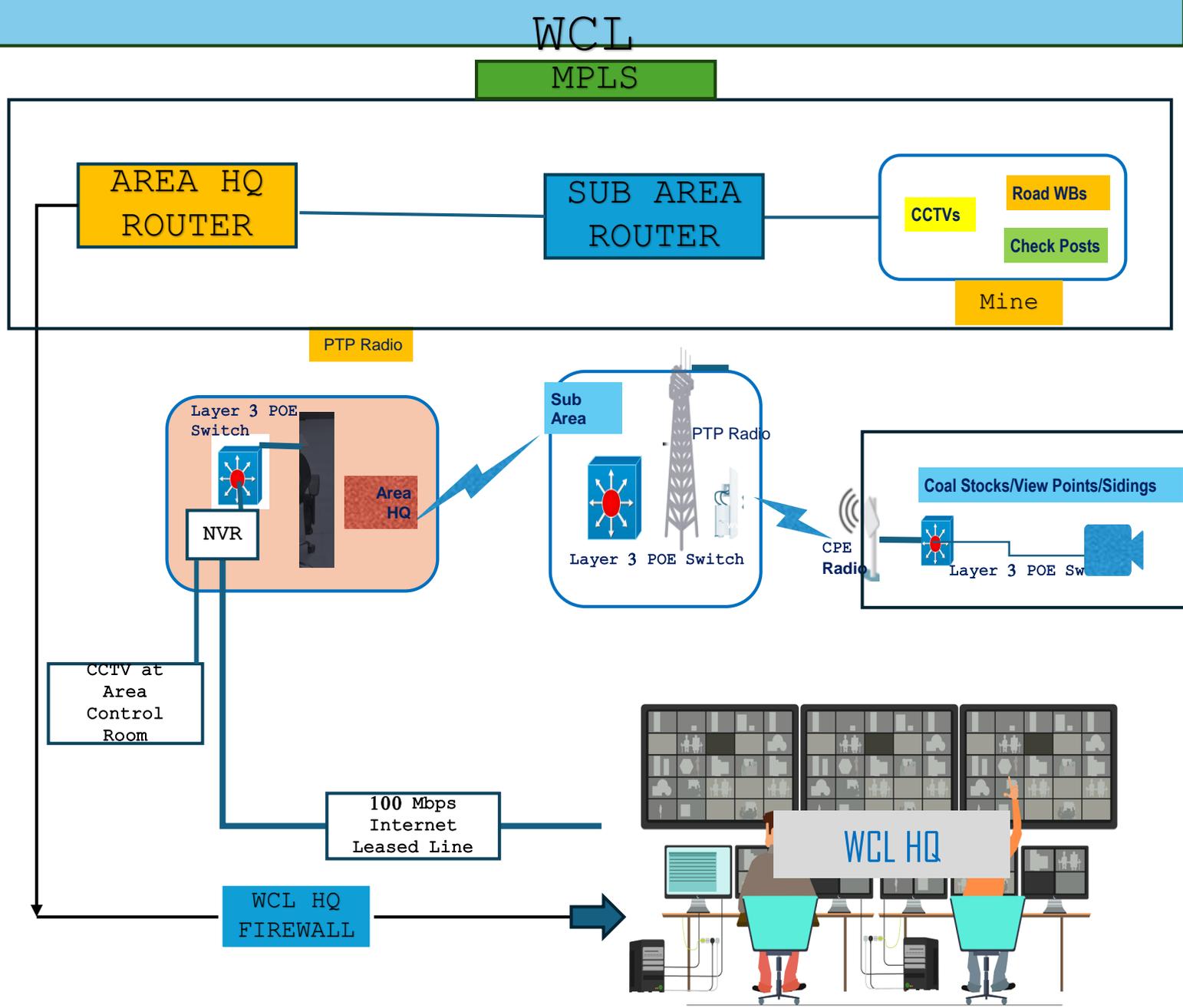
PRESENT NETWORK INFRASTRUCTURE IN WCL
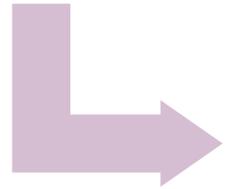
MPLS

AREA HQ ROUTER

SUB AREA ROUTER

CCTVs

Road WBs

Check Posts

Mine

PTP Radio

Layer 3 POE Switch

NVR

Area HQ

Sub Area

PTP Radio

Layer 3 POE Switch

CPE Radio

Coal Stocks/View Points/Sidings

Layer 3 POE Sw

CCTV at Area Control Room

100 Mbps Internet Leased Line

WCL HQ

WCL HQ FIREWALL

LOCATION PLAN OF W.C.L. AREAS

SCALE: 10km, 10km, 20km.

PATHAKHERA AREA

KANHAN AREA

Head OFFICE

PENCH AREA

Head Office

M A D H Y A   P R A D E S H

NAGPUR AREA

NAGPUR

M A H A R A S H T R A A

AMRAVATI

UMRER AREA

MAJRI AREA

CHANDRAPUR AREA

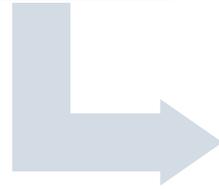WANI NORTH AREA

WANI AREA

CHANDRAPURK

BALLARPUR AREA

A. P.
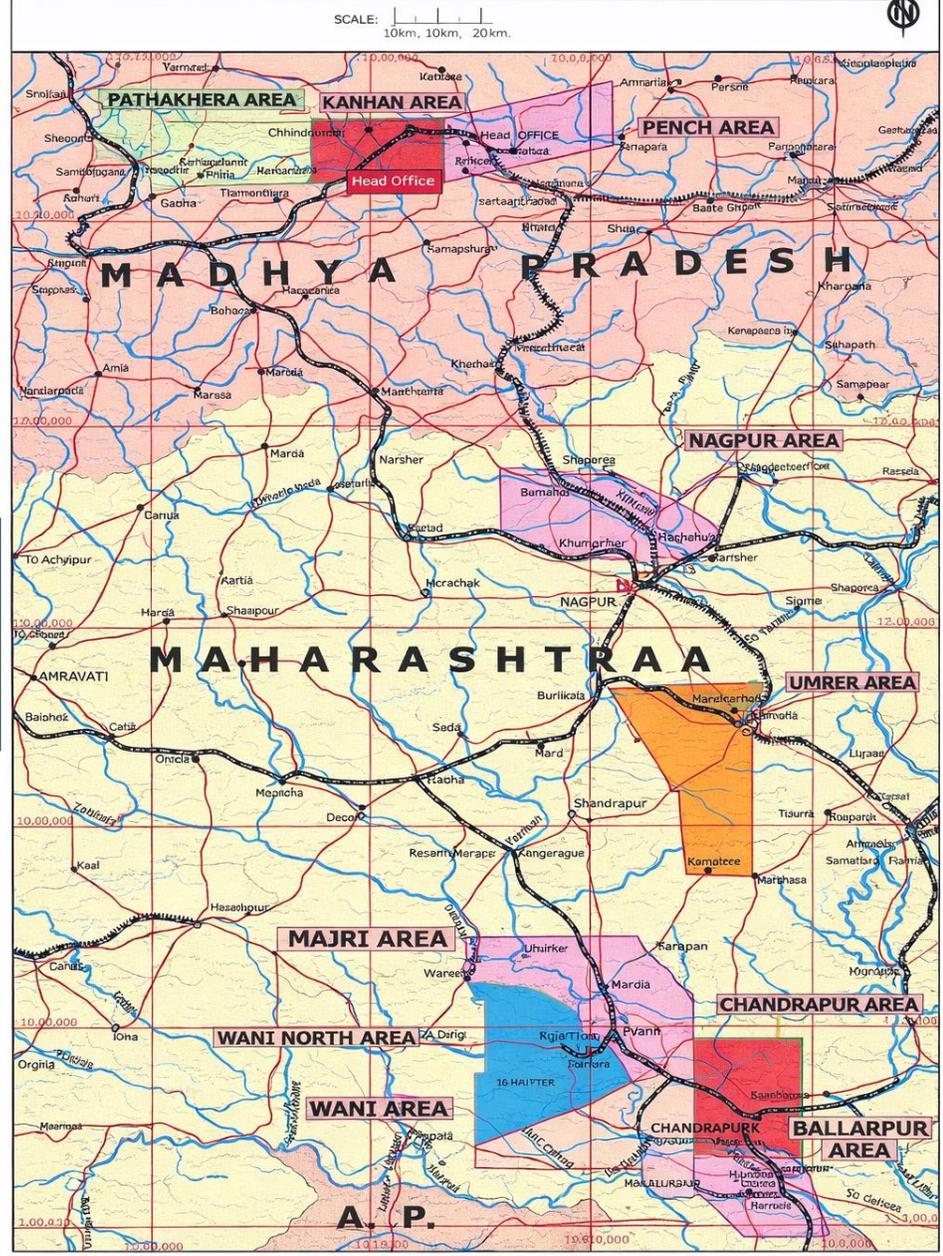
Network integration in WCL

451 Nodes of MPLS

- Used for transfer of RFID Weighbridge/ Checkpost and CCTV data

421 IP Radio Links at Areas

- Used for integration of IP cameras working at different locations with Area HQ control room for live monitoring and recording

100 Mbps Internet Leased Line at AHQs

- Provided at all 10 Area HQs for integration of live feed from 500 different IP cameras with ICCC at WCL HQ

750 Mbps Internet Leased Line at ICCC, WCL HQ

- For continuous monitoring of live feed from areas and recording of 500 cameras at ICCC, WCL HQ

Integrated Command & Control Center(ICCC), WCL

Video Management Software supports AI/ML based Video Analytics

Virtual view of Mines, Sidings, Coal Stocks, Magazines.

Integration of CCTVs for 24X7 Live monitoring

Recording of video footage

IT Hardware installed and integrated at ICCC of WCL

CCTV

500 CCTV cameras installed at various vulnerable locations i.e. Check posts, Weighbridges, View Points, Coal stocks , Siding etc.
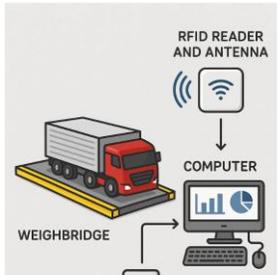
RFID based Boom Barrier

Monitoring of RFID Based Boom Barrier at 119 Check Posts to allow only Authorized Vehicles into the Mine Premises

RFID integrated weighbridge

166 Road Weighbridges integrated with RFID system for auto capturing of vehicle details and Weighment and connected to central server for real time data

GPS based Vehicle Tracking System

3195 GPS devices for live monitoring of internal coal transporting and OB/Coal production vehicles

IOT BASED PUMP MONITORING SYSTEM

MONITORING OF VARIOUS PARAMETERS SUCH AS

DRONE BASED SURVEILLANCE SYSTEM

Aerial surveillance/inspection of the open cast mines

ENVIRONMENTAL TELEMONITORING SYSTEM

Continuously tracks life-critical parameters such as methane, carbon monoxide, oxygen levels, etc at 05 UG mines

KEY WAY FORWARD

Dual authentication of coal transport vehicles by ANPR cameras and RFID.

Enhancing integration of cameras at ICCC from 500 to 1250.

Additional 500 AI/ML analytics in cameras

IIoT-based Remote Pump Monitoring System with ICCC.

Integration of CCTV, GPS, RFID & IIoT projects on common ICCC platform.

Two-Way Communication System connecting the ICCC with strategic field locations

AI and ML based Video Analytics

VA Bunch – I (300 Nos.)

➢ Crowd detection

➢ Facial Recognition

➢ Classification of objects like person, vehicle or animals

➢ Traffic Congestion Detection

➢ Automatic Traffic Counting and Classification

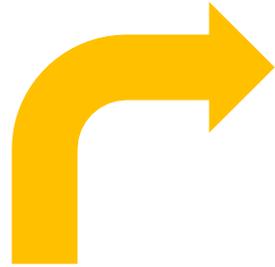➢ Loaded/Unloaded condition of the vehicles

VA Bunch – II (100 Nos.)

➢ Fire & Smoke Detection

➢ Difference in number of people inside vehicle during tare and gross weighment.

➢ Vehicles tail gating

➢ Weighbridge and Boom Barrier tampering

➢ Insufficient illumination.

VA Bunch – III (100 Nos.)

➢ AI based PPE KIT detection

➢ AI based other safety hazards detection: Human presence near speeding vehicles/ HEMM etc., water-logging, saggy electrical wires, any accidents etc.
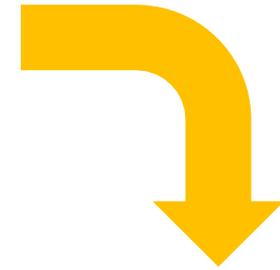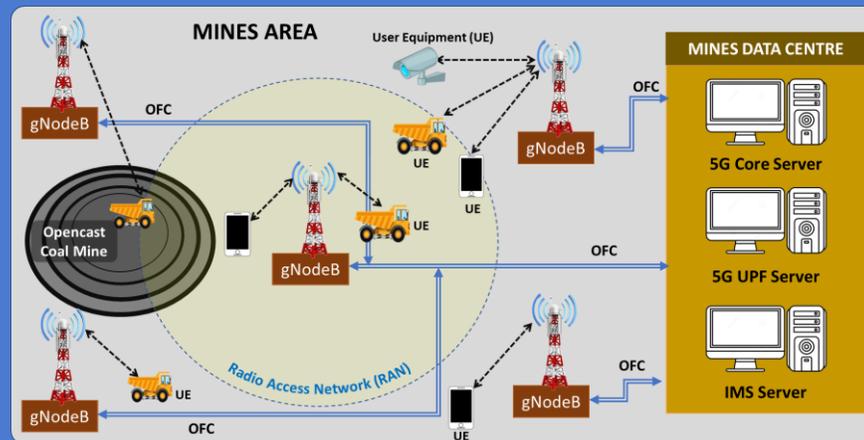
BENEFITS OF 5G CNPN & OUTCOMES IN COAL MINES

Solution
Private 5G Network

- Improved Communication
- Enhanced connectivity
- One network for all applications
- Scalable & Flexible Communication Infrastructure

Challenges

- Low Connectivity
- Lack In Technology
- Multiple isolated networks
- No-Real time monitoring

Outcomes

- Automation
- Improved Safety & Efficiency
- Enhanced Mobility
- Increased Operational Efficiency
- Remote Operation
- Workers Training through AR/VR over 5G

Exploration of application & use cases for 5G Network infrastructure with 5G Captive Non-Public Network (CNPN):

1. 5G Mission Critical Communication (MCX) System for OCMs with a facility to contact Mobiles with Video / Audio calling & SMS

2. 5G Enabled Remote Drone Operations for Digital Mine Mapping

3. 5G Camera with AI enabled Video Analytics

4. 5G IOT Machinery Sensors for knowing Fuel status, Speed & Utilization

5. 5G Enabled Automated Drilling Operations

6. AI enabled Traffic Control System and AI based HEMM Haul Road Crossing System

Exploration of application & use cases for 5G Network infrastructure with 5G Captive Non-Public Network (CNPN):

7. 5G Enabled Slope Stability Radar System (ability to miniaturize design)

8. AR/VR with 5G enabled remote maintenance support.

9. 5G C-V2X based Collision Avoidance System for Dumpers

10. Digital Twin of Load Haul Dumper operations

11. 5G IOT based Environmental Sensors(CAAQMS), Operation of Mist Fogger/ Sprinklers

THANK YOU