

# CHAPTER 5 **Network Monitoring System (NMS)**

## **5.0 Introduction**

Network Monitoring System (NMS) shall be is provided over OFC Network (E1 interface) for centralized monitoring of KAVACH equipped Trains and Stations within the network. It is used for troubleshooting of error events, off line simulation, real time monitoring of loco KAVACH etc. Stationary KAVACH and Loco KAVACH transmit exceptional fault/critical messages to NMS. A Central Server is present in the Division Control Room. All relay information and radio packets exchanged between Station and Loco are logged in Central Server and accessed through NMS.

## **5.1 NMS Hardware requirements**

The hardware requirements of NMS are as follows:

- 2 Nos. Servers for redundancy
- (NMS data shall be logged onto each server) and Shared Firewall on both servers
- Keyboard and Mouse

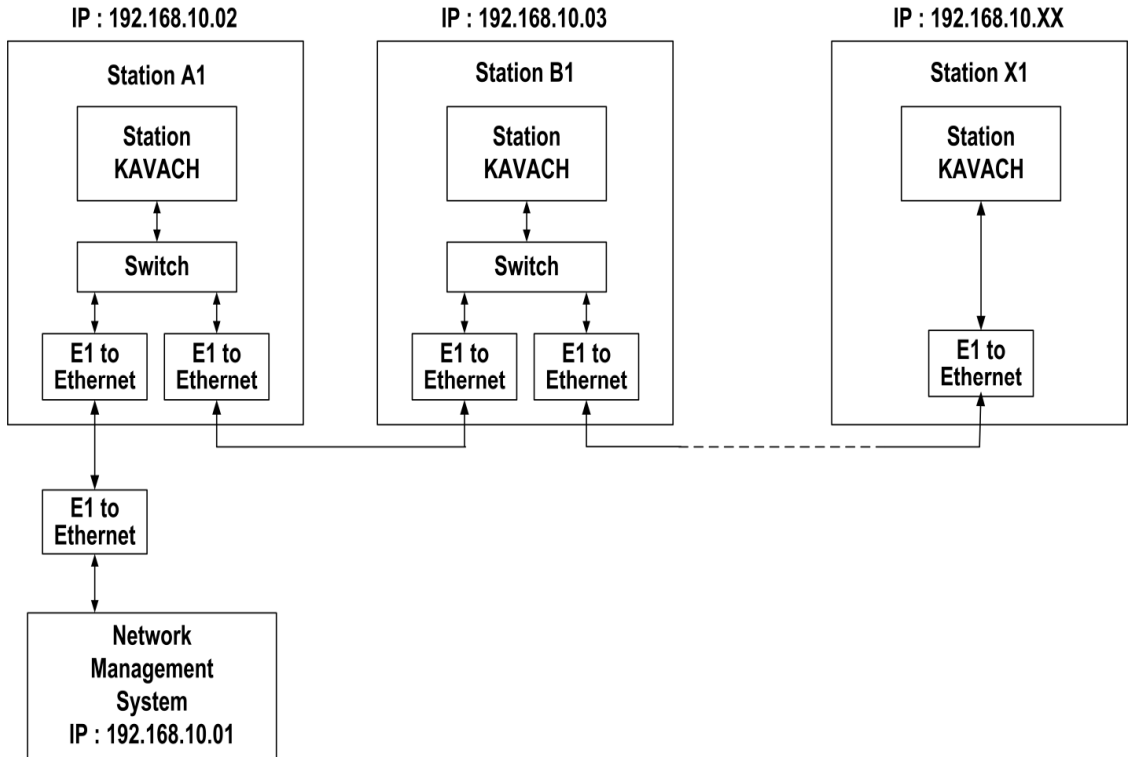
55" 4K/UHD Professional TV. (If one screen is insufficient for display, separate screen shall be provided with seamless integration to enable complete view of KAVACH territory).

## **5.2 Stationary KAVACH to NMS & Stationary KAVACH to Stationary KAVACH Communication on E1 Interface**

- KAVACH NMS Network is built on E1 interface which is provided by the Indian Railways. Centralized monitoring of a group of stations is achieved by collecting signal aspects, track occupancy, loco absolute position etc., from each of the Stationary KAVACH unit within the network. Network monitoring is limited to its own network. Stationary KAVACH units communicate with NMS unit using the predefined packets.

## 2| iATP (Automatic Train Protection System) KAVACH

- Using E1 interface, each Stationary KAVACH unit is connected to adjacent stationary KAVACH unit/Network Monitoring System to form a network, as shown in Figure. 6.1. Using Ethernet protocol over this network, Stationary KAVACH units will exchange Stationary- Stationary communication packets with adjacent Stationary KAVACH units and NMS.
- Number of Stationary KAVACH units in one E1 ring shall be limited to 5-7. The IB huts are connected to the nearest Station in T network.



**Fig. 5.1** Network Monitoring System (NMS) connectivity diagram

Stationary KAVACH shall log fault messages and transmit to Network Monitoring System through Ethernet or GSM interfaces in the following cases:

- In the event of a Radio Communication failure longer than applicable time-out.
- In the event of a failure of only one radio of Loco KAVACH, out of two radios in hot standby.
- If the incremental difference between CPU and GPS time is not matching and the difference between two GPS is greater than the frame interval.
- In the event of failure of both – GPS/GNSS and Real Time Clock.
- In the event of Active Cab/Desktop DMI communication failure.

### 5.3 Loco KAVACH to NMS Communication on GSM Interface

The communication between Loco KAVACH and Network Monitoring System (NMS) shall be through two GSM interfaces provided in Loco KAVACH Vital Computer. The exceptional fault/critical messages logged by Loco KAVACH unit are transmitted to NMS through two GSM interfaces provided in hot standby mode.

Loco KAVACH logs fault messages and transmits to Network Monitoring System through GSM interfaces in the following cases:

- In the event of a RFID reader failure (any one or both readers).
- To indicate the Loco KAVACH mode to NMS through Stationary KAVACH Unit on encountering any tag (excluding LC Gate Tag), when Loco KAVACH unit is in Post Trip (PT) Mode or Isolation (IS) Mode.
- In case of missing RFID Tag information received from Stationary KAVACH. This in turn send an SMS alert to the Maintenance Staff.
- Information to NMS if the turn out tag is over read by Loco KAVACH unit.
- In the event of a Radio Communication failure longer than applicable time-out (30 Seconds).
- In the event of a failure of only one radio out of two radios in hot standby.
- In the event of failure of both GPS/GNSS and Real Time Clock (RTC).
- In the event of Active Cab/Desktop DMI communication failure.

### 5.4 Salient feature of NMS

- Real time display of train movement on NMS monitors.
- Offline display of train movement on NMS monitors at Normal, 2x, 4x, 8x, 16x & 32x speed.
- Display of Data log in Spreadsheet (Excel Format).
- Display of "Permitted Speed+ Current Speed Vs Location" and "Permitted Speed+ Current Speed V/s Time" including information whether brake command is applied by KAVACH or not.
- Ability to watch the NMS at Distant Location through Internet (Password protected)
- Ability to extract offline data log through NMS
- Generation of Exception Reports - Loco KAVACH Unit-wise, Stationary KAVACH Unit-wise, RFID Tag Set wise.
- Prompt for missing one of the two RFID tags of same set.
- Prompt for missing both RFID tags of same set.

#### 4| iATP (Automatic Train Protection System) KAVACH

- Prompt for missing communication packets overall below a set level (say 20%) for moving train in Communication mandatory zone.
- SMS Alert for repeated same RFID tag missing events in Full Supervision Mode.
- SMS Alert for any brake application command by KAVACH Loco forcing train to bring to dead stop in Full Supervision Mode.
- SMS Alert for SPAD.
- SMS Alert for SPAD Prevention by KAVACH.
- Capturing of speed restrictions imposed by TSR Management System from Stationary KAVACH after every update.
- Capturing health status and event log from Loco KAVACH if LTE is available.

### 5.5 Playback NMS

As the name suggests, playback NMS will have a provision for offline NMS, one of the feature of NMS. The salient features of this tool is listed below:-

Application will display list of stations with station name and code from the Database file (Fig 5.2).



Fig. 5.2 Playback NMS home screen

- Either any or all the stations of the network can be selected by using GUI based applications.
- After selection of a particular yard or whole playback option is provided (Fig 5.3).

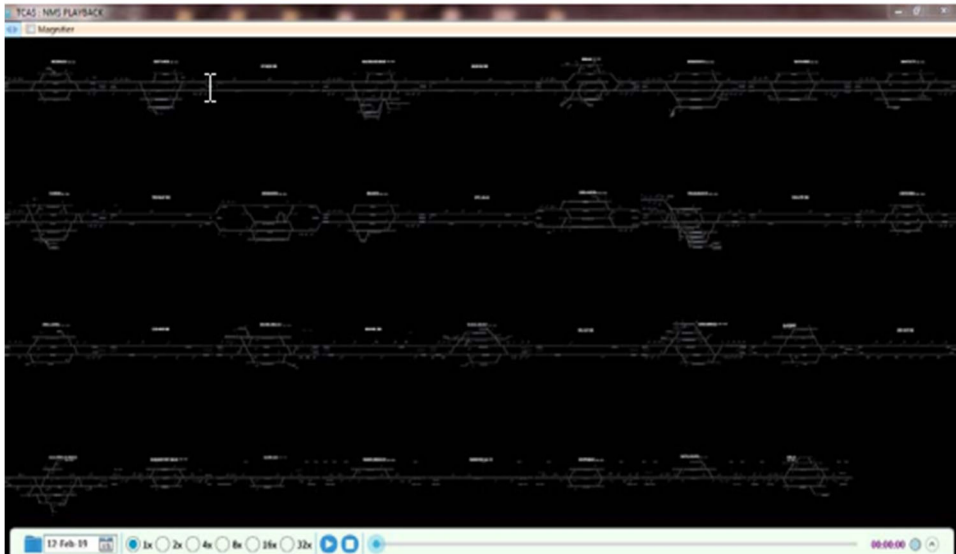


Fig. 5.3 Playback NMS Main screen

- Based upon the selection of the database file (bin file) from the log files which have been saved in the database, the replay NMS tool plays the NMS for the given selection (Fig 5.4).

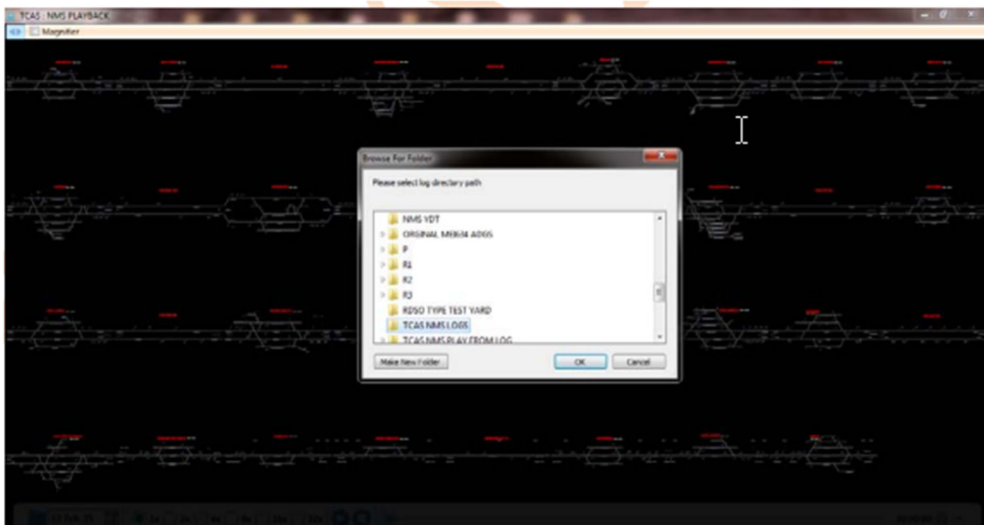


Fig. 5.4 Playback NMS log directory selection screen

## 6| iATP (Automatic Train Protection System) KAVACH

- Even the specific station or specific loco movement can be replayed using the selection, otherwise it will play the whole network events for the selected date (Fig 5.5).



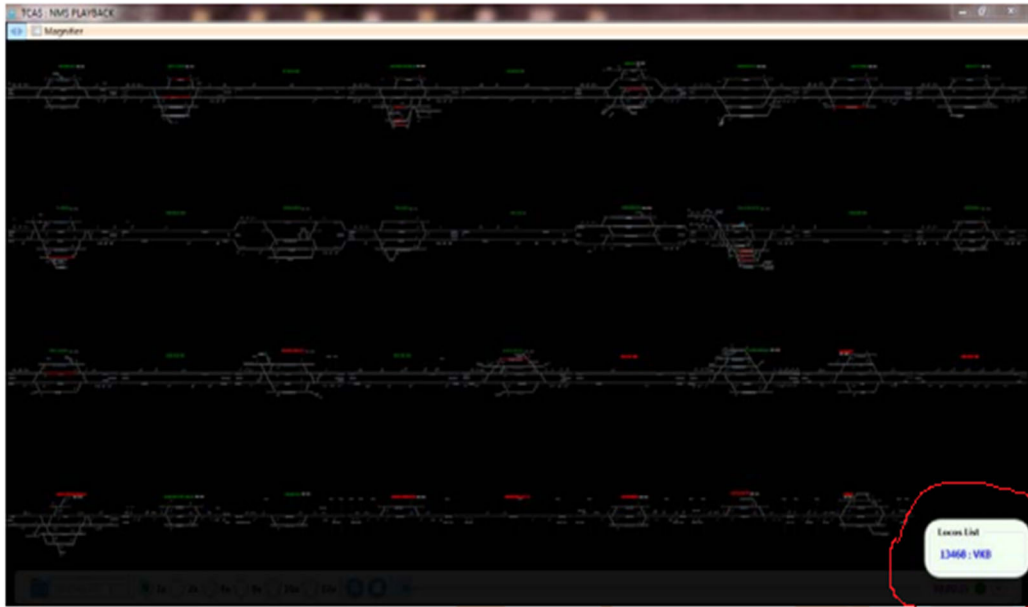
Fig. 5.5 Playback NMS date selection screen

- Replay NMS has provision for player control having pause & stop the content along with time slider (Fig 5.6).



Fig. 5.6 Playback NMS player control screen

- Application will display different speed options for the playback which is selectable from 1x, 2x, 4x, 8x, 16x and 32x.
- Application also has the provision for tracking a particular loco using selection (Fig 5.7) .



**Fig. 5.7** Playback NMS loco list (encircled) screen

- Application has provision for exporting the content which is played on replay NMS.
- Application will display playing time on screen.

## 5.6 Remote NMS

One of the salient features of NMS is remote NMS, using this NMS can be watched at remote places other than server location. The salient features of Remote NMS are listed below:

Application will display a list of stations with station name & code which can be selected as in case of NMS like either or all at a time.

Application will display a list of IPs available in the PC from which user can select one IP at a time for connecting NMS (Fig 5.8).

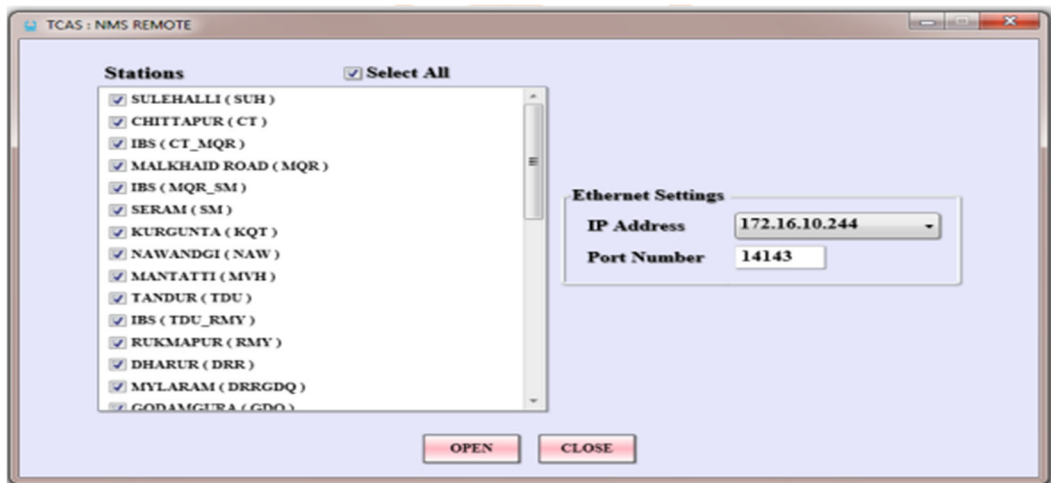


Fig. 5.8 Remote NMS screen

- User has to enter an available Port number for NMS Communication. Port number should be in the range [1-99999].
- After entering the IP & port details using the OPEN button Remote NMS main screen (Fig 5.9) will be opened after validating the input provided by the user.



Fig. 5.9 Remote NMS main screen

- Remote NMS main screen will have a login option .After clicking on login option a pop window will open ,upon entering the credentials provided for remote NMS connect button is used to connect to Remote NMS (Fig 5.10).





**Fig. 5.10** Remote NMS login screen

- After successful validation of credentials Remote NMS connected screen (Fig 5.10) will appear which will work like normal NMS with login remote user name on GUI, else it will show appropriate error messages on the screen.
- Remote NMS allows a minimum 5 nos. of remote users simultaneously. It does not allow