WHITE PAPER

NEXT-GEN ELEVATOR EMERGENCY CALL HANDLING

Abstract

Elevator Emergency Handling has traditionally used Time Division Multiplexing (TDM) technologies for the communications part. Most of the alarm systems used are Dual Tone Multi Frequency (DTMF) based. While this has served well till now, it limits the possibilities of multimedia communication between the Elevators and the Rescue Service Call Centers that can help a lot in more effective emergency handling. Another problem that has assumed increasing significance is DTMF handling/ transcoding by the network elements, since most of the networks are IP based.

This White Paper proposes an IP based [Session Initiation Protocol (SIP), Message Queuing Telemetry Transport (MQTT) specifically] communication architecture that can be realized by third-party Service Providers (e.g. Infosys) for providing next generation Elevator Emergency Handling.

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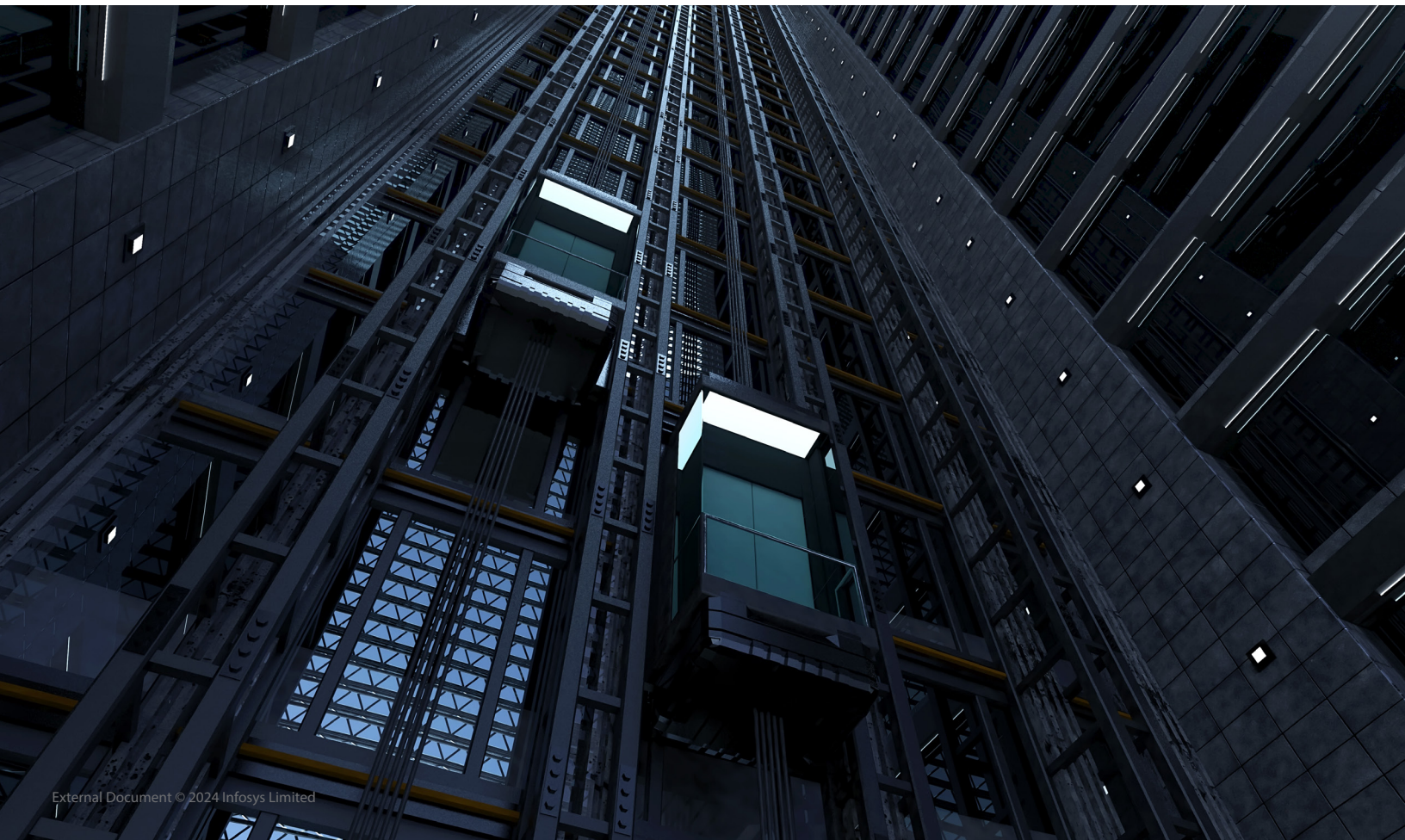
Introduction

Today, offices are becoming increasingly digital, transforming every aspect of work-life to amplify productivity and efficiency. Moreover, workplaces have become purpose-driven hubs that foster in-person innovation, encourage teamwork and strengthen the connection among the workforce. While the technological shift in workplaces is a welcome change, employee safety in the workplace remains a top priority. Moreover, digital transformation can be leveraged to enhance safety as it offers immense potential to enhance emergency response systems, such as Elevator Emergency Handling. However, Elevator Emergency Handling, has traditionally used Time Division Multiplexing (TDM) technologies for the communications part. Most of the alarm systems used are Dual Tone Multi Frequency (DTMF) based. While this has served well till now, it limits the possibilities of multimedia communication between the Elevators and the Rescue Service Call Centers, which can ideally make emergency handling more effective. Another problem that has assumed increasing significance is DTMF handling/transcoding by the network elements, since most of the networks are IP based. This paper proposes an IP based (SIP, MQTT specifically) communication architecture that can be realized by third-party service providers (e.g. Infosys) for providing next generation Elevator Emergency Call Handling. Additionally, this same approach could be enhanced to provide similar services for other connected vehicle classes by adding more endpoints as and when needed.

Architecture Proposed for Next-gen Elevator Emergency Call Handling

The proposed architecture can be used to provide the below services for Elevators:

- Emergency rescue
- Remote assistance where possible
- Analytics using Calls and Telemetry Data from the Elevators
- Preventive maintenance



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Components Required

The proposed architecture comprises of below components:

SIP Device on the elevator to allow its passengers to dial a Voice Emergency Call. Typically, the interface which is provided for the passenger to use this device is an Emergency Button.

IoT Device/Sensors with their respective software endpoints to periodically send elevator parameters like door status, Emergency Button status, number of passengers in the elevator, and temperature, among others

Central Data Repository synced with Customer Enterprise Database / Data Store to provide information like elevator's location, service contract, technician availability, among others

SIP Service for registration and call routing e.g. an IP PBX, along with other VoIP infrastructure like SBCs, SIP trunks

Contact Centre Applications to manage incoming calls from elevators

Microservices to handle/process Telemetry Data (we will call it Telemetry Service)

Technician Assignment Application as a part of the customer infrastructure for the CC Agents to create emergency incidents for technicians

Mobile Application with Technicians for managing emergency incidents while out in field

Workflow

The block diagram (fig. 1) illustrates the proposed Emergency Handling Architecture, followed by workflow details:

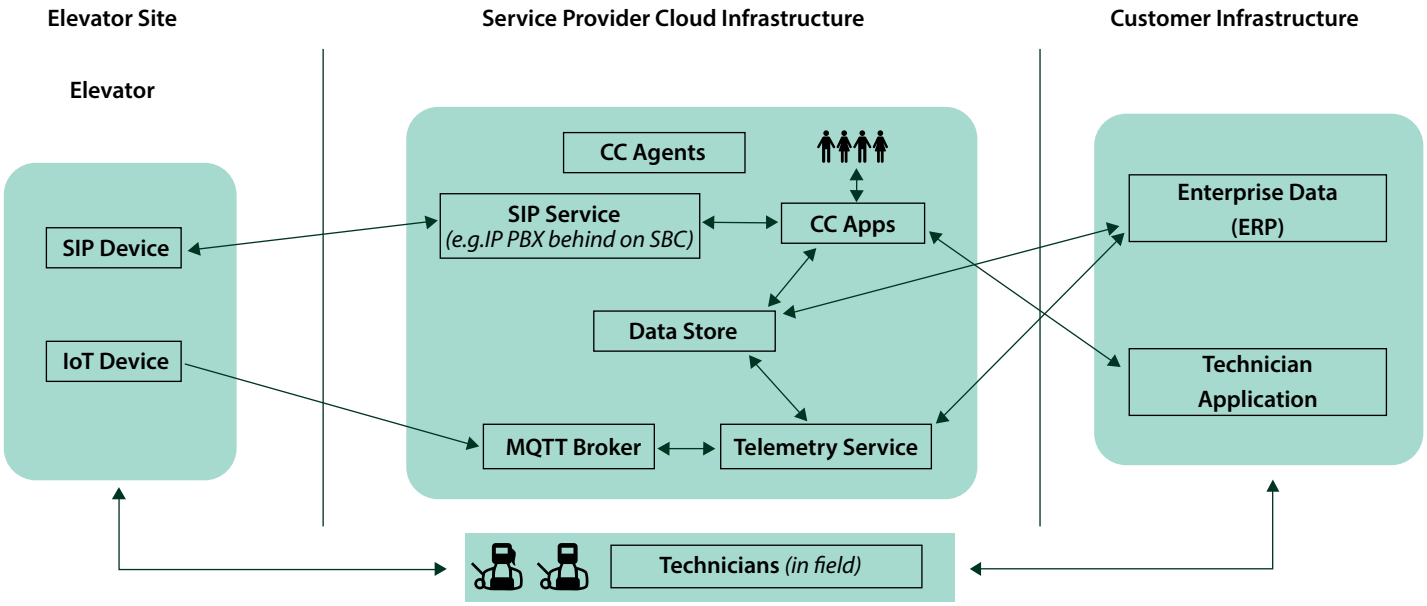

Fig. 1 Block diagram of the proposed Elevator Emergency Handling architecture

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1. Elevator along with its SIP and IoT devices are provisioned in the Customer Enterprise Database and synchronised to the Service Provider Data Store.
2. Elevator SIP and IoT devices register with respective services.
3. When there is an emergency, the passenger presses the Emergency Button, which in turn initiates an Emergency Call using the SIP device.
4. Service specific Custom SIP headers conveying the Elevator Id, Elevator SIP URI *(Uniform Resource Identifier)*, Call Type get included in the SIP Invite sent by the Elevator.
5. SIP service receives the Invite and evaluates the service specific headers.
6. Based on the Call Type Custom SIP Header, the SIP service routes the call either to:
    a. Emergency call queue
    b. Technician call queue
    c. Test call application

The Emergency call queue being the topmost on the priority queue.

7. If Emergency call:
    a. First available agent with the required skills (e.g. language) answers the call and enters DTMF required to mark the Emergency call start at the Elevator Dialler.
    b. CC Application queries the Elevator Data Store with the Elevator Id or Elevator SIP URI received in the incoming Invite, and presents Elevator information (e.g. location, service contract, status, etc.) to the Agent
    c. Agent speaks with the passenger, and using the information provided by the Data Store creates an Emergency Incident, and assigns a Technician in the Technician Application, based on factors like Technician availability in the elevator location and SLA per the Service Contract purchased by the Customer. If need be, the Agent engages Video or Chat channels for effective Emergency Call Handling, if implemented.
    d. Technician Application notifies the Technician via an SMS or Push Notification on a Mobile Technician Application.
    e. Technician resolves the issue, either via Remote Assistance, or by visiting the Elevator site, and closes the Incident.
8. If Call Type is Technician Call, it is routed to Technician queue, which is a lower priority queue. An available Agent with the appropriate skills and knowledge to assist with technical issues will be assigned to handle the call.
9. If Call Type is Routine/Test Call, it is routed to the CC Test Application, with which DTMF exchanges take place to complete the Routine Test.
10. The IoT devices, on the other hand, on an ongoing basis, Notify Elevator parameters like the below as Telemetry data to the Telemetry Service via MQTT publish-subscribe model:
    a. Door status
    b. Number of passengers in the Elevator
    c. Temperature
    d. Emergency Button status
11. Cloud Service processes the Telemetry Data Notifications and:
    a. Create a Trouble Ticket if any notifications suggest so, OR
    b. Create a Preventive Maintenance Ticket if any notifications suggest that preventive maintenance is due.

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Some Points to Note During Implementation of the Proposed Architecture

Benefits of Elevator Emergency Call Handling

The proposed IP based Emergency Handling Service architecture provides the below mentioned new capabilities over existing TDM based systems:

a. Multimedia communication is possible, enabling the Rescue Agents to use Video and Chat media additionally to provide more effective Emergency Handling

b. In legacy systems Elevator parameters are passed over DTMF signals which are limiting and unreliable over increasingly used packet-based networks in the core. In the proposed architecture use of IoT sensors allows a whole new range of Elevator parameters to be able to be made available for more effective Elevator Emergency Handling

c. With increased data possibilities meaningful analytics is possible

d. Preventive maintenance is also possible with the data in the Data Store

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Challenges Expected in Implementing the Elevator Emergency Call Handling

While the proposed solution architecture promises lots of new benefits, there are a few challenges that must be overcome to achieve a successful implementation:

a. Customer ERP schemas and interfaces are varied and interworking with those requires their good understanding and careful design and implementation.

Proposed Mitigation

Such interfaces should be scoped and designed with ERP architect on customers team and if some development is needed on ERP, it should be planned alongside.

b. Customer Elevator Dialers and Sensors could use custom parameters and possibly protocols.

Proposed Mitigation

Adapters will need to be implemented to accommodate such cases.

c. Country specific regulatory requirements in different countries could pose challenges.

Proposed Mitigation

All country specific regulatory requirements must be vetted with legal/compliance teams and planned for before making commitments.

d. DTMF handling for Call Transfer and Forwarding to outside the CC gets challenging as different legacy Callee/Transferee Telephony systems might not handle DTMF as RFC 2833 Out-of-band, which is what is required as DTMF format for VoIP.

Proposed Mitigation

In these cases, the Emergency calls should be configured to be forwarded or transferred only to the personnel trained in Emergency Call Handling protocols.

Conclusion

As more and more aspects of workplaces are getting digitalized now, Elevator Emergency Handling technology is due for an overhaul to an IP, Cloud, VoIP based architecture. The core network for this could also be used for providing Emergency Call Handling services for other connected devices like private, commercial vehicles. It could also be used to provide services to multiple customers as a multi-tenant cloud. Until now, Elevator Emergency Handling has traditionally been mostly implemented by the Elevator manufacturers. Going forward, Software Service Providers can pitch in to implement these core networks and provide these services for multiple customers and device classes using this architecture, ensuring enhanced safety at workplaces, at scale.

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[2] ASME A17.1/CSA B44-2019 - Safety Code For Elevators And Escalators ASME A17.1

[3] RFC 3261 – SIP: Session Initiation Protocol, SIP

[4] OASIS – Message Queueing Telementry Transport, MQTT

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Abbreviations

CC	Call Center
DTMF	Dual Tone Multi Frequency
ERP	Enterprise Resource Planning
MQTT	Message Queuing Telemetry Transport
SIP	Session Initiation Protocol
SP	Service Provider
TDM	Time Division Multiplexing
URI	Uniform Resource Identifier
VoIP	Voice over IP

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Satyajyoti is a Unified Communications Technologies Professional with over 20 years of experience developing solutions for OEMs, Service Providers, Enterprise Customers for their collaboration needs, across Engineering, Product Development and Consulting roles.

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