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Destination Dispatch Elevator Integration

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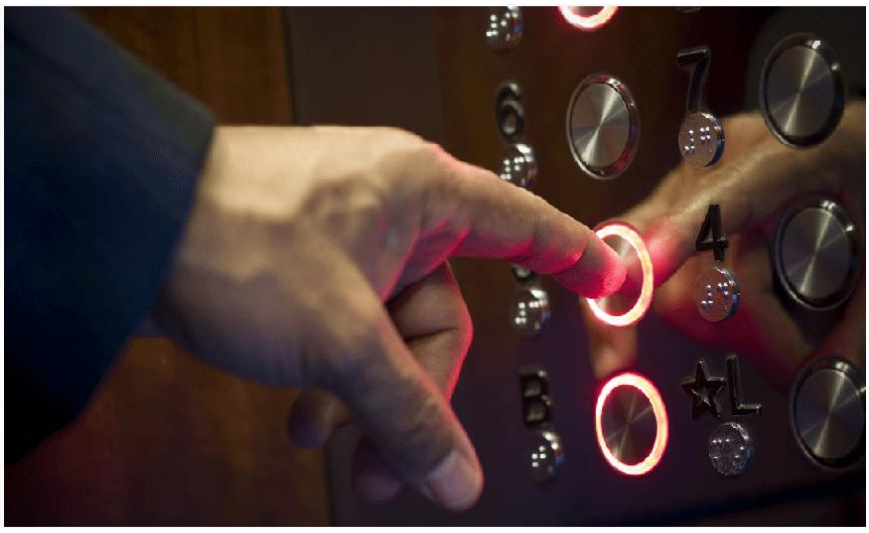
Many systems run simultaneously to make up the office building ecosystem. In addition to the physical security system, there is the HVAC, lighting, and elevator systems. The latest software controlled elevator dispatch systems save money by requiring fewer cabs, using less energy, and reducing traveler wait times. Symmetry keeps pace with the improvements to elevator control systems by integrating to destination dispatch systems from various elevator manufacturers. Thus, Symmetry provides building tenants and managers with the ability to secure access to desired floors without introducing complexity into the operations.

Background

An office building is an ecosystem. Various components must interface and coexist in harmony for the whole system to function efficiently.

Elevator control has moved well beyond the traditional, push a call button and wait for the car to arrive at your floor. Now banks of elevator cars are continuously run through efficiency algorithms to determine the most effective route for each car and to group passengers going to the same place in the same car. Referred to as software-controlled destination dispatch systems, users enter their destination into a control panel before they get into the car and the system tells them which car to get into.

Figure 1: Traditional Floor Selection



The new systems, however, are not compatible with traditional physical security systems. In the traditional model, the call button in the lobby might be secured by a card reader, and only personnel with an access card can call the elevator to their floor. Once in the car, an access card is swiped again which will illuminate the floor access buttons for the floors the individual has access privileges assigned such as depicted in Figure 1.

This traditional access control model uses banks of mechanical relays (see Figure 2) controlled by the security system to enable/disable the floor selection buttons in the elevator car. These solutions can be expensive to install and were not very reliable. Security systems must be updated to support the elevator destination dispatch solution.

Figure 2: Traditional Elevator Interface

Methodology

There are actually two different configurations for how elevator manufacturers have developed destination dispatch. In one model, the elevator control system requests floor access and other information from the access control system (the "real-time integration model"). This is depicted in Figure 3 which shows a block diagram of the destination dispatch system side-by-side with the security system. In the second model, entire card holder database is shared with the elevator system including modifications, deletions and additions (the "data synchronization model"). The elevator system makes all access decisions itself.

AMAG Technology offers software level interfaces between several elevator manufacturers:

- Otis Compass (IDC2 and IDC3) – Real-Time Integration
- Kone Polaris – Real-Time Integration
- Thyssen Krupp Destination Dispatch – Real-Time Integration
- Schindler PORT – Data Synchronization & Real-Time Integration
- Mitsubishi E-Lip – Real-Time Integration

Each of these supports different features as indicated in the Third Party Integration Compatibility Matrix (available from AMAG Technology), however building owners and managers cannot select the interface based on desired features – the interface is specific to the elevator dispatch system installed at the facility. The matrix, therefore, describes features that are supported. The dispatch system may provide features that have not been implemented in the Symmetry interface so it is imperative that the matrix is studied to identify which features are or are not supported.

Destination Dispatch – Real-Time Integration Model

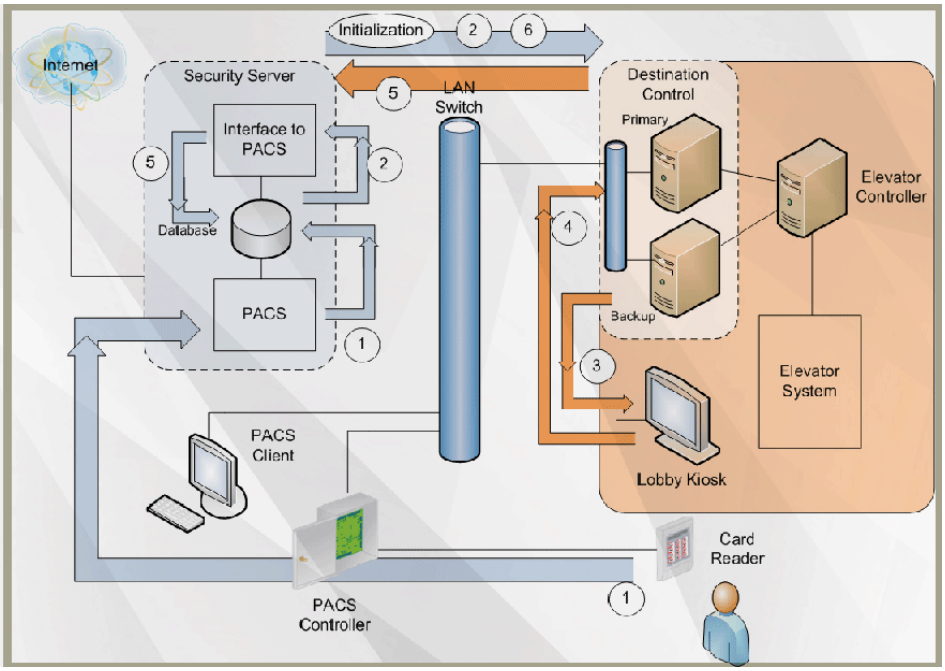
In the Real-Time Integration model, supported by Thyssen Krupp, Otis, Schindler, Mitsubishi and Kone, the elevator control system communicates in real time with the access control system through the local area network. In this model an elevator kiosk or other destination entry panel is located at each floor. When a user swipes their access card, the security system sends a message to indicate to the dispatch system where this person is allowed to go. The user enters their desired location and the elevator optimization algorithm determines which elevator car should be assigned, and the user is directed there.

In Thyssen Krupp, Otis, Mitsubishi and Kone, the security system can also indicate to the dispatch system when the system is in free access, when the system is in secure access or when the system is locked down. The various systems that utilize the real-time integration model all operate basically the same, however there are different features supported by the different manufacturers. Be sure to consult the compatibility matrix on features that are supported by the different systems.

Initialization:

When the elevator interface first starts up, it will gather information from the security system database that describes which floors are free access and which floors are secured access. This initialization begins the heartbeat communication ⑥ that goes on between the two systems.

Figure 3: Security Integration with Destination Dispatch



Operation:

A building occupant swipes their access card at the reader associated with an elevator dispatch control panel.

- This card swipe ① is recognized by the access control panel and the floors to which that user has access are sent ② to the elevator dispatch system (see Figure 3) along with an indication of which control panel was used (where the card holder is physically situated).
- The elevator dispatch control system then displays ③ the floors available to the user.
- The user selects a floor ④ and the destination control system determines the best elevator car, assigns the user to that car and schedules the car to go to the selected floor.
- The destination system relays back to the security system which floor was selected ⑤ by the user.

Logging and Alarms:

- If the card swipe at ① does not match with a known card holder in the system, then an alarm is generated indicating “unknown card”. This can optionally be associated with video.
- The user, the selected floor, and a time/date stamp are recorded as a single transaction in the database.
- The security system is in constant communication ⑥ with the destination control system. A heartbeat message is sent to each of the servers every 5 seconds. A response is expected. If no response is received after a time-out period an error message is logged.

Scheduling and Special Features

- In all cases that support Real-Time Integration, the elevator schedule can be made in the elevator controller. The feature set supported by the elevator controller varies with elevator manufacturer.
- With TKE and Otis, scheduling can optionally be accomplished via the Symmetry user interface. Since Destination Dispatch elevator systems allow for floor by floor security, configuration of access rights can be much more complicated than traditional elevator systems.
- Special features may exist in a real time integration. These vary by manufacturer, but include VIP (will be called a unique cab), Handicap (longer good open times) and others.

- Default Floor features exist in many integrations, which will automatically call a cab to a cardholder's defined home floor. Optionally, the cardholder may override this selection by selecting a floor prior to swiping their badge.
- Schindler and Otis both support readers connected to their elevator controllers rather than Symmetry panels. In this case, special care must be given to ensure that both systems are reading the same card format.

Issues & Concerns:

One of the most important aspects to any elevator integration is the user experience. How long will it take from card presentation until elevator car assignment? There is a lot of communication and database activity when using the real-time integration model. After the card swipe, the interface has to look up a number of different data elements from the database to pass on to the elevator system. The elevator system also has to collect floor selection from the user, process this data for optimization, and pass the floor selection back to Symmetry. There are additional technical issues with this model.

- When the XML Open API is installed (not needed for the elevator interface), a service is created that constantly polls configured hardware for status updates. Since the elevator interface requires the configuration of "virtual" elevator panels, the Microsoft Message Queues (MSMQ) for those virtual chains will build up with undelivered messages. This seems to cause a delay on the response of the card reader at the kiosk – up to three seconds was witnessed in some systems.
- Symmetry Command Center performs a similar process, but only while the window is open. This creates a similar situation to that above.
- Restarting the SMS Services will zero out the MSMQ for disabled (virtual) chains. Also, technical support has a Windows Registry setting that will prevent XML from statusing the hardware..
- Legacy hardware may introduce a delay in the time a card is read to the time that the transaction is sent to the elevator system. For best results, panels that have built in network interface cards, such as the EN-2DBC should be used. Delays of 3-4 seconds are common with legacy panels, and can be longer depending on the length of the chain. In no case will a destination dispatch call be as fast as a traditional relay based system, as all communication must go through multiple servers as opposed to electrical connections.

Destination Dispatch – Data Synchronization Model

In the data synchronization model, Symmetry must initialize the interface and send over the entire card holder database including floor access privileges for each card holder. Any changes to floor access privileges or card holder data are similarly pushed over to the elevator control

system. The Schindler elevator system uses this model. Figure 4 shows the layout of the data synchronization model.

Initialization:

The major difference between the synchronization model and the real-time model is that in the synchronization model, on initialization, the database information is sent to the destination dispatch controller system. The elevator interface to Symmetry also has to monitor for changes to cardholders as these also have to be synchronized with the destination system.

When the elevator interface first starts up, it will gather information from the security system database including: cardholder information such as name and card number, access privileges assigned to cardholders, and which floors are free access and which floors are secured access. This information is sent to the destination dispatch system. This initialization begins the heartbeat communication that goes on between the two systems.

***Operation*:**

A building occupant swipes their access card at the reader associated with an elevator dispatch control panel.

- This card swipe ① is recognized by the access control panel and the cardholder ID number is sent ② to the elevator dispatch system (see Figure 3) along with an indication of which control panel was used (where the card holder is physically situated).
- The elevator dispatch control system then displays ③ the floors available to the user.
- The user selects a floor ④ and the destination control system determines the best elevator car, assigns the user to that car and schedules the car to go to the selected floor.
- The destination system relays back to the security system which floor was selected ⑤ by the user.
- Periodically, the elevator interface checks for updates to the cardholder database and pushes these over to the elevator controller.

Logging and Alarms:

- If the card swipe at ① does not match with a known card holder in the system, then an alarm is generated indicating “unknown card”. This can optionally be associated with video.
- The user, the selected floor, and a time/date stamp are recorded as a single transaction in the database.

- The security system is in constant communication ⑥ with the destination control system. A heartbeat message is sent to each of the servers every 5 seconds. A response is expected. If no response is received after a time-out period an error message is logged.

Issues & Concerns:

The timing concerns discussed in the real-time integration model are not present in the synchronized model; however, because the elevator system performs all functions associated with elevator access control, the access control system and the security officers monitoring the system have little visibility into the real-time activity taking place in the building lobby or elsewhere having elevator functions.

Discussion

Figure 4: The User Interface

SAVE ENERGY COSTS

- The large motors or hydraulic lifts used to move people around consume massive amounts of electricity.
- Making the elevator system more efficient saves on energy costs and provides a better user experience and overall more appealing user environment.

TECHNOLOGY DRIVES EFFICIENCY

- Modern elevator dispatch systems evaluate all the requested trips from personnel on every floor and route the available cars to take people to their destinations in the most efficient manner.
- This reduces the number of trips the elevator must make thereby reducing the energy used to move people through the building.
- The efficiency algorithms limit the number of stops an elevator car will make before transporting personnel to their destination. This reduces the wait time experienced by the user.

ELEVATOR MANUFACTURERS

- All of the top manufacturers of elevator systems now have a software-controlled dispatch solution including ThyssenKrupp, Kone, Schindler and Otis.
- Each has their own mechanism for interacting with the elevator users and collecting their destination request.

CHALLENGES & EXPENSES

- The elevator dispatch system must interact with the access control system, life safety system, and others to provide the most efficient integrated solution.
- Traditional access control systems would temporarily enable an elevator call button when an authorized access card was presented, or would only enable the floor selection buttons for those floors associated with the person's employer. These solutions interacted with one another through "hardwiring" – actually putting an interrupter in the circuit so that the button or indicator was not connected until the security system connected it.
- The personnel that maintain the elevator are often different than the personnel that maintain the security and life safety systems making it more difficult to resolve issues with various parties involved.

- Legacy interfaces are based on mechanical relays and are more prone to failure than software solutions. Since the relays were located in different parts of the building it may not be obvious where one relay has failed or another.
- The biggest challenge of all is that the modern elevator dispatch systems don't support the traditional relay interfaces from access control.

SOLUTIONS AND MORE CHALLENGES

- The solution is to move the security system interfaces to one that utilizes the common building network, however, we run into additional challenges.
- The type of information that is shared between the security system and the elevator system differs from manufacturer to manufacturer.
- A security system manufacturer has to make separate major commitments to each elevator system in order to develop and test the interface – this isn't a "write once, use everywhere" development effort. Standardization would resolve some of these issues, but that is not likely for at least 3 - 5 years.
- The sequence of operations is not the same among elevator manufacturers. Depending on the access control system, they may not be able to operate in both of these modes.

CHOICES

Consolidation in the security industry has caused some manufacturers to focus solely on internal solutions rather than providing open integration. When a single conglomerate owns both elevator manufacturer and security system manufacturer, there is pressure to only support the one interface. This works for the customers that use that interface, but is not a safe proposition for someone that is looking for an open system providing options to the integrator and the end user.

Finally, there are at least four different elevator dispatch systems in wide-spread use today. A security system manufacturer may choose to focus on one or two of these solutions, but that will only apply to a limited fraction of the elevator control market. End users with multiple buildings, security engineers and consultants, and system integrators should focus on security manufacturers that can provide a range of options.

Summary

The market is changing for integrated elevator control and physical access control. Where these systems used to be interfaced through mechanical relays, today economic, architectural, and regulatory pressures have moved elevator control into a software-driven solution providing energy savings and a preferential user experience. While most access control systems require

the old mechanical interface, Symmetry now integrates with software-based elevator dispatch systems sending commands and data over the network. Furthermore, Symmetry supports the top suppliers of destination dispatch elevator systems.

When the elevator dispatch system and the access control system are tightly integrated, the building operator and tenants are the big winners. Such integrated systems provide simpler operations (cutting down on training requirements), reduced energy consumption through efficient routing, and shorter wait times for tenants and visitors.

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Revision History

1 Feb 2014	Initial draft release.
25 Feb 2014	Final release, Issue 1.
28 July 2016	Revision, add specific elevator capabilities and Mitsubishi support.