Cabling The Friendly Skies

Smarter Airport Low Voltage Design

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DATACOM SOLUTIONS

Connecting You To More

When people think of airports, they generally think of lines, planes, passengers and terminals, but rarely think of all of the systems and services that support the passenger experience throughout the airport proper and outlying buildings. Passenger services across the airport grounds include retail, parking, baggage, offices, terminal services, people movers, and the most important application, security. In fact, a recent survey of passengers in the UK showed that 1/5 of all passengers surveyed would travel to a farther airport for better support. One common denominator to all services at the airport is the communications protocols and products that convey all of the required bits of information and, in some cases, power from one point to another.

If one follows the passenger experience, the first encounter is in the parking areas upon entering the airport property. Parking structures, perimeters and outbuildings are not generally seen as IT spaces, however from a security standpoint, they are rich in cameras and surveillance. Outbuildings can be any mix of surveillance, RFID, wired and wireless devices. Cameras for surveillance today are often IP based compared to coaxial CCTV options of the past. Today, cameras are generally connected via either copper or sometimes fiber for extended distances. The cameras may actually be powered via the network switch called Power over Ethernet (PoE/PoE+) or be powered at the camera via traditional AC power. The latter of which is more common when camera heaters are required during winter months to keep them from freezing. PoE and PoE+ are perfectly suited for lower power applications that can operate over a structured copper cabling channel. Newer PoE++, 4PoE or UPoE applications deliver higher power well suited for longer range wireless access points, heated cameras, and other applications that require greater than the 30W delivered by PoE+. In some cases, the cameras are connected over secure wireless networks.

For a copper-based cameras and wired Ethernet deployments, the standards-based channel is 100m. This distance is prohibitive for many environments around the airport such as parking structures, walkways, tunnels, perimeters, jetways and rail areas. This makes deployment particularly challenging to support devices outside the 100m limitation for copper. The dual award winning GameChanger cable was designed to extend supported distances for a variety of Ethernet applications outside of the 100m TIA and ISO limits making it a go to solution for solving distance problems.

To get past 100m without GameChanger, there are a few options. One is to provide a digital to optical transceiver at each end of the channel with fiber spanning the longer distance. The problem with this solution is that it adds two additional points of failure (one at each end of the channel), two additional points to secure, and as such, two additional points of risk. The transceivers require power, adding two power connections to each channel. The act of distributing power generates loss and the power circuits add costs to the communications channel. This is often the most expensive way to extend circuit length.

Another option is to provide repeaters which can be in-line passive (no outside power is required) or in-line powered. Both in-line options add additional points of failure and risk as outlined above. If not clearly documented as to exact location, troubleshooting can also be an issue as these devices sit in a telecommunications area generally in a ceiling or other hard to reach space.

A third option is to utilize fiber optic video cameras. These cameras have the digital to optical transceivers inside and are several times more expensive than their copper-based counterparts. Power to these cameras is provided either by an additional copper cable for PoE/PoE+ or an external power supply meaning that two channels are run to each camera. The power copper can be traditional AC power or PoE/PoE+ provided over a data cable. This in effect, doubles the cost of the cable plant.

With GameChanger, the copper cable and PoE+ all traverse one category style cable. The cable terminates just like a category cable, but the reach and support are 2x a standard 100m channel for Gigabit Ethernet with full support for PoE+ eliminating many IDFs and additional power requirements throughout the surveillance system. For 10M video (H.264, 1080p, 30 Frames Per Second) the distance supported is at least 850' or 2.5x the standard 100m channel. In fact, an independent pricing analysis showed that a GameChanger deployment can be 80% less expensive than the least costly of these options.

In addition to surveillance systems outside airports, emergency services/signaling phones and incidence response systems. One such company is Code Blue which has tested their products with GameChanger cable and were able to achieve 1006' without repeaters, removing another application's needs for 100m IDFs. These phones carry packetized

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Voice over IP conversations extending onsite law enforcement reach via closed loop communications for more rapid response compared to a passenger calling 911 and being re-routed to airport security or police. In some instances, these devices are also fitted with some sort of photographic or video equipment. Many also are illuminated for ease of location identification. The power for the illumination and video can all be supplied via GameChanger.

Inside the Terminal

Inside the terminal, the passenger experience is supported from the ceiling to the counter. In addition to the surveillance and security systems described above, other Ethernet and IoT applications are found throughout the terminal. The ability to add Artificial Intelligence and smart systems will further enhance the passenger experience and increase information technology and communications needs.

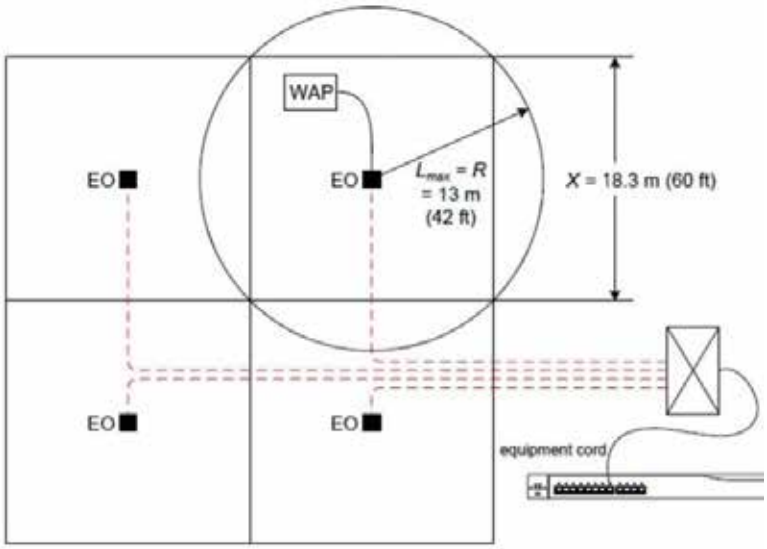
Information displays are growing connection demands as they become more informative and not just used for passenger entertainment. Increasing numbers of displays are being deployed to broadcast flight updates, directions and ways, reminders for check in processes and in some cases are interactive for things like airport maps, listings and directories of flight arrival and departure gates. Some monitors are "push information" viewing stations, but more are totally interactive with this functionality enabled due to IP Video and newer capabilities for interactive systems and screens. Properly positioned, these systems work well to inform passengers and alleviate the need to constantly find a human for answers thereby increasing passenger satisfaction. Of course, not to be overlooked are passenger safety screens that communicate instructions on the fly for evacuation plans, areas of refuge, instructions, safe zones, and other life safety information. By utilizing GameChanger cabling, the number of intermediate IDFs decrease due to the longer reach of the cable. This cable also can be used to cable around construction projects, and other remodels.

Outside of the visually oriented experience, one of the most prevalent passenger systems is wireless networking used throughout the facility. Wireless access points and their location can make WiFi communications great or frustrating. While in theory, access points have a certain area of expected coverage, in practice, they are limited by a few factors. One is multipath which is the signal bouncing off building materials, other signals and even inhabitants. By laying out a grid of 60m square for coverage area zones, TIA issued a technical service bulletin (TSB-162-A) where access points are connected to structured cabling channel(s) within each grid and then long patch cords (up to 13m) can be used to adjust antenna location within each zone.

With the announcement of IEEE 802.11AC higher speed wireless, the newer access points for high speed take 2 each cabling channels either 6A or better or OM3 (min) fiber. With fiber installations, additional power circuits will be required for each access point. This could be an actual AC power drop or additional category copper channels for PoE/PoE+ or a higher power digital powered circuit where all 4 pairs transmit power (4PPoE) for Type 3 – PoE++, 50W, UPoE (60W) or Type 4-4PPoE (90W) as defined in IEEE 802.3bt.

Should an environment not be precabled with two connections to support 10G wireless but higher than Gigabit speeds are required, two newer standards for Ethernet been ratified to address speeds in between 1 Gig and 10Gig. The two new standards address 2.5 G and 5G transmissions over category 5e and 6 respectively. Both have 100m uplink cable distances that can be extended with GameChanger cabling.

Most passengers just expect an easy and seamless way to connect to their internet service providers both in terminals and in restaurant and lounge areas. When saturation occurs, additional access points may provide some relief and allow for more user connections. Although it is important to note that additional access points may require additional



Typical Uniform Coverage Area Grid Pattern

IDF resources. Although WiFi does not provide a guaranteed connection, it is the norm for most phones, tablets and laptops.

Inside and Outside

For more robust or challenging environments like those used for trains, transit, and passenger security applications, products like those from Fluidmesh® lead the market in mission critical wireless communication systems. Fluidmesh's technology has been adopted by customers worldwide in security, transportation and terminal operations markets. Fluidmesh delivers wireless networks to airports that support large-scale CCTV and data backbone networks, connectivity to automate People Movers and airport shuttles for security, automation, controls and passenger WiFi, airside ground vehicle coverage for tele-remote and IoT applications, and wireless voice and video services to emergency vehicles and personnel active on the tarmac.

Fluidmesh provides these services via ultra-low latency networks using Prodigy 2.0 MPLS-based protocol that boasts 30-50% greater range than traditional WiFi with zero-ms handover. The antennas have a 30-50% greater range because of specialized 2x2 MIMO antenna technology which reduce the amount of wireless infrastructure and the resulting costs. The network supports both Multicast and Broadcast transmissions. As a unique feature, the MPLS network, normally reserved solely for backbones, is extended into the WiFi network. All transmissions offer AES and FIPS 140-2 encryption for stringent security. Each radio can support up to 500Mbps and up to 10Gpbs per network. What sets these systems apart from traditional WiFi is the TITAN technology which provides a failover mechanism for mission critical applications resolving any system failure within a 500ms threshold eliminating any single point of vulnerability in even the most challenging installations.

Fluidmesh solutions lend themselves well to perimeter security additions as it is difficult to get easements or stop air traffic for upgrades and extensions. The solution is also well suited for temporary installations or areas where equipment locations may be fluid. The zero millisecond hand off the solution provides also makes the Fluidmesh network perfect for people movers, equipment movers and offloading of data. GameChanger fully supports Fluidmesh equipment making the reach and ease of installation attractive regardless if the deployment is temporary, incremental or for equipment in a fixed location.

Security, Safety and Access Control

Whether the network is set up for just passengers or includes additional wireless security requirements, connectivity is an important part of the passenger experience. But there are other systems that support passenger safety that the passenger may never see.

Access control systems and life safety systems exist throughout the terminals and other airport areas. For fire safety, there is more to wiring fire systems than just connecting a red wire. NFPA 72 2016, National Fire Alarm and Signaling Code, defined the term "survivability" as "the ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information to remain operational during fire conditions." In short, the cables that are used for "Areas of Refuge," Emergency Voice Alarm Communication (EVAC), smoke and fire alarm systems, emergency lighting, fireman's telephone, and any other critical systems as defined in NFPA must be able to transmit for the period of survivability defined. Standard cable will not meet these requirements.

To understand the survivability ratings, Chapter 12 of NFPA 72 2016 now describes survivability in terms of levels. Level 0 indicates no survivability requirements. Level 1 requires all wiring in metal raceways and installed in buildings that have full protection by an automatic sprinkler system installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems. Level 2 requires the installation of two-hour fire-rated CI (Circuit Integrity) cable, or a two-hour fire-rated electrical-circuit-protective system, or of cables in a two-hour fire-rated enclosure or protected area. Or, one can use two-hour performance alternatives approved by the authority having jurisdiction (AHJ). Level 3 has identical requirements to Level 2 and a provision that the wiring and system installation must take place in a building "fully protected by an automatic sprinkler system in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems."

The basis for the circuit survivability requirements depended on the availability of two-hour fire-rated cable, called Type CI, that met the requirements of UL 2196. Cables successfully meeting this requirement survive in a fire test of approximately 1,850°F for two hours and remain operational. Cables with two-hour ratings accomplish this via conduit encasement (CIC=Circuit Integrity in Conduit) or open air (CI) with a special coating on the cable that will become ceramified when the cable is exposed to fire. This allows the cable to transmit required signals for up to two hours and is used when crossing fire zones, to areas of refuge, and other areas as deemed by the local Authority Having Jurisdiction, Insurance requirements, owner preference and location of cables as defined by code. In some instances, airports and other public buildings chose to install this cable everywhere as that offers protection from having to recable should a remodel or addition change the survivability requirements.

Paige's cables in the VITAlink® product line are UL Listed, Type FPLR-CI-LS, two-hour fire-rated alarm cables that can be installed in open air environments saving the cost of additional conduits, but can also be installed in Electrical Metallic Tubing (EMT) or Intermediate Metal Conduit (IMC) per FHIT System 40A (Electrical Circuit Protective Systems) when installed in accordance with Installation instructions. The cable accomplishes this via a thermoset insulation called Fire-Roc (TM) that ceramifies in fire conditions. VITAlink cables can be installed with or without conduit depending on the application and code requirements. Without VITAlink, the cable must be mated and changed to another type of cable or wrapped in a product that provides compliance adding roughly $35 per running foot (at time of this paper). The cable complies to the following:

- NEC type FPLR-CI-LS, CMR-CI-LS, & CL3R-CI-LS for use in Electrical Circuit Integrity System FHIT 40A
- c(UL) Listed CMR-LS
- CEC and CSA Listed FAS 105 to C22.2 No. 208-14
- UL Certified to ANSI/UL 2196 2-Hour fire rating for use in FHIT system 40A. (See UL Fire Resistance Directory R27557)
- CAN/ULC-S139 Certified with Hose Stream Test for use in FHIT7 system 40A
- UL 1424 Listed FPLR-CI-LS for Power-Limited Fire Alarm Cables; 300V / 105°C
- UL 13 Listed CL3R-CI-LS for Power-Limited Circuit Cables; 300V / 105°C
- UL 444 Listed CMR-CI-LS for Communication Cable; 300V / 105°C
- Fire certified for power-limited system use at 72V phase-to-phase utilization voltage
- Sunlight Resistant
- For use in wet locations
- NYC Electrical Advisory Board approval # 54502, April 2017
- California State Fire Marshal Approved

Connecting it All

Fiber backbones both inside and outside the terminals are used to connect everything together from a networking perspective. There is a great debate over the use of all singlemode fiber or a combination of singlemode and multimode fiber. As speeds increase, the complexity for parallel applications over multiple strands of fiber and the associated polarity methods have increased. While the common argument in using multimode over singlemode has always been that the cost of the electronics for multimode are lower, this argument is weakening as the cost for singlemode electronics are decreasing and silicon photonics that move the complexity to a chip promise even lower costs across the various speeds.

In general, the longer the channel and the more centralized the switching equipment, the lower the costs overall. This also means that the airport will have fewer supporting areas required. This makes more area available for passengers and other revenue generating equipment. Costs associated with additional distribution areas include the need to secure them, the difficulty with which they are moved, the cost of the electronics, maintenance fees on the electronics, additional power, and the costs to upgrade/patch the equipment as

needed, amongst others.

One mistake that is commonly made is not looking at the entire communications channel cost from core to endpoint. For instance, one manufacturer may market the energy port for a piece of equipment making it sound attractive, while the edge device at the other end of the port negates any power savings. It is also wise to look at longevity and complexity for any communications. The more complex the environment, the more risk there is over its lifetime. The fewer moving parts, the better. Singlemode has continued to support longer distances without a change in fiber as opposed to now 5 generations of multimode fiber. One consideration is not only the cost of fiber, which remains lower with singlemode, but also the cost of installation which includes install, rip out and replacement x 5 for multimode. It is for this reason that the majority of airports remain singlemode as the costs in a live environment to rip out and replace are simply cost and logistically prohibitive.

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Data Center Considerations

Most airports have data centers to support site-wide services. Paige offers a full line of copper and fiber products for this environment including system interconnects, cabinets by Rittal ® and pathways for use inside and outside of the data center. As more data centers are moving to leaf and spine and end of row deployments, Paige has experts to help make the deployment clean and neat while providing longevity of design. Paige is vendor agnostic when it comes to active systems. As such, our experts are frequently called upon to review designs and provide cost saving input across the data center whitespace including power and cooling, networking, server, SAN, and other data center systems. Whether you would like to learn about new technologies, how to streamline your data center, upgrade for new systems, or learn what products are available for this complex environment, Paige is here to help. Throughout our partner network, we team with quality product manufacturers, companies and resources to kick start new data center deployments, upgrades, retrofits and disaster recovery sites.

For help in the design and specifications of all of airport systems from irrigation to edge, Paige has the resources to assist in getting the right products for your project. Call us when you are planning a renovation to improve the passenger experience, upgrade technology throughout the terminals, or provide critical safety infrastructure. For consultants, architects and engineers, we can provide specifications and Division 27 documents. For more information, contact your Paige sales representative or visit www.paigedatacom.com.

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