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zzz Automating Distribution Frames

4. The History of Copper Automation

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To date, despite strong interest in implementing automated distribution frames, there have been technology limitations that have hampered service providers from actually deploying these types of devices. While cross-connecting technologies have existed for some time, none have been able to meet all of the aforementioned automated distribution frame requirements in a cost-effective and scalable manner.

Historically, service providers first looked at electromechanical solutions that leverage metallic relays as a means of automating distribution frames. This type of solution is known to be extremely reliable for cross-connecting, having been used for many years in conventional telecommunications equipment, such as voice switches. However, it is difficult to build large non-blocking switches with conventional relays, as they would require an enormous amount of space and cost due to the size of individual relays and the amount that would be required to create automated distribution frames of significant size. A CO serving tens of thousands of subscribers, for example, would require millions of relays to establish any-to-any connectivity. As this would take up a significant amount of equipment space and require a vast amount of capital expenditure, this type of solution never got put into practice in an automated distribution frame application.

Service providers then turned their attention toward robotic solutions. In this type of solution, robotic technology is used to physically remove and insert pins when making a cross-connect. While simple in concept, this type of solution never quite matured into a viable technology for automating distribution frames. That is because pure mechanical, robotic solutions have reliability and maintenance issues due to their moving parts. This limits their effectiveness in larger COs or in environments where significant churn is experienced.

Perhaps the biggest "show stopper" for robotics, and all of the other copper automation technologies previously examined for frame applications, has been scalability. As COs vary dramatically in size, automated distribution frames must have the flexibility to grow in size, too. But, functionality cannot be sacrificed in the process. Traditional copper automation technologies typically become blocking at higher port counts or high port utilization. This dramatically limits their performance in medium to large COs. Those that can provide any-to-any connectivity in large deployments typically require tremendous amounts of hardware to do so. Rather than experiencing a linear growth rate, whereby the ratio of frame ports to subscribers remains constant regardless of the size of deployment, these solutions have a tendency to grow exponentially. This means that for any-to-any non-blocking connectivity to be maintained, the ratio of frame ports to subscribers must grow at a geometric rate. Such growth

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requires enormous capital expenditures and dramatically increases the complexity of a network infrastructure.

Figure 3. An automated distribution frame solution that can grow linearly to keep pace with subscriber growth rates is more cost-effective and easier to deploy than one that grows exponentially.
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Figure 3, click for full-size version

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