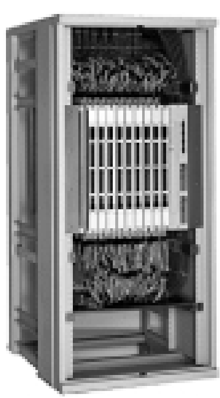
White Paper on MDF Management

ControlPoint™

MDF/IDF Line Management
in an ILEC Central Office or Remote Environment

February 2001



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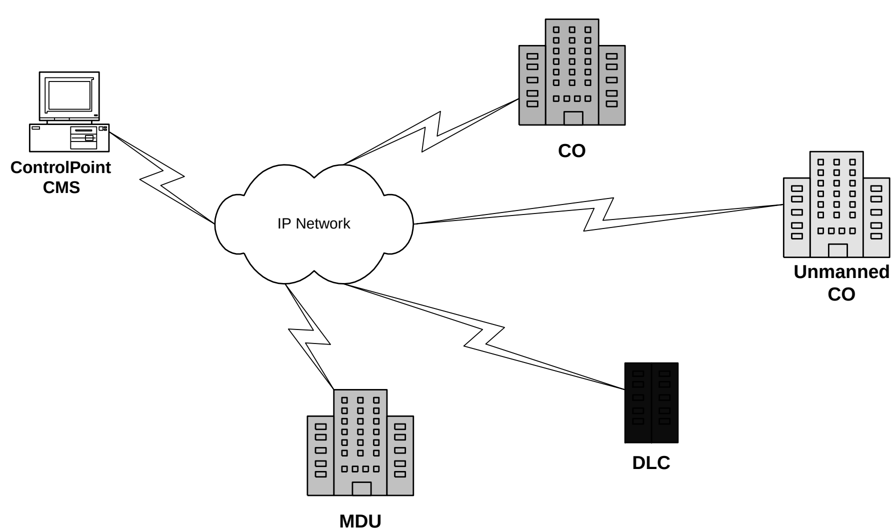
Introduction

The deregulation of telecommunications services and recent FCC rulings has changed the dynamics of the local loop. Collocation is an everyday reality in most central offices and potentially in many remotes. Connection management, as customers migrate between providers, is challenging and presents a "service strain" to the service provider. "Line sharing" rulings are expected to accelerate demand and pose new line-qualification challenges to the ILEC.

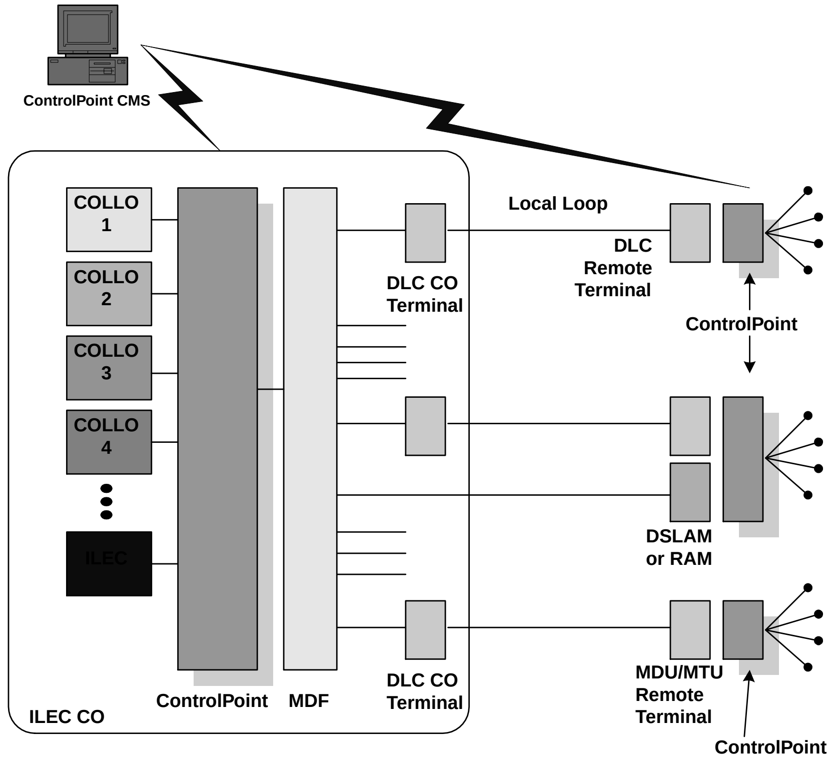
The dramatic increase in competition for the local loop increased the level of activity centering on connection, maintenance, and management of copper wire and wireline services. Given these high levels of activity in the loop, the traditional labor-intensive manual approach to cross-connect management is no longer viable via manual labor and processes. “Truck rolls” are too slow and expensive to be effective in today's competitive industry. The obvious answer: automate the provisioning process and provide intelligent wireline management at the physical layer.

NHC's innovative ControlPoint Cross-Connect System replaces labor intensive wiring, reducing operating costs and maintenance, improving service delivery cycles. ControlPoint dramatically reduces labor, space, and time of service versus conventional MDF/IDF and OSP distribution frames that require on-site wiring by experienced technicians. The NHC solution provides the ILEC with complete control over the entire service deployment cycle, and ensures quality of service (QoS) via fallback switching. ControlPoint works with all copper based services including POTS, ISDN, T1, xDSL and other voice and data protocols. The ControlPoint Cross-Connect Systems is deployable in:

- Manned central offices (CO).
- Small unmanned COs under 5,000 lines.
- Remote Terminal Cabinets housing Digital Loop Carriers (DLC).
- Multi-Dwelling and Multi-Tenant Units (MDU/MTU)
- OSP Feeder/Distribution Cross-Connect Frames



NHC’s ControlPoint solution addresses the problem of automating the basic cross-connect function of provisioning, test access, service migration and fallback switching, in each of these locations. The purpose of this document is to show how NHC’s ControlPoint Cross-Connect System can help the ILEC manage its MDFs more effectively.



The MDF marks the point at which the local loop meets the Telco's access service equipment. The myriad of connections that need to be made and remade due to new deployment and churn, are putting greater manpower pressures on the ILEC. Compounded by the fact that the ILEC must manage not only its own telecom lines but also the lines feeding to multiple co-locations (COLLOs), the ILEC is forced to look for new ways to automate some of the service provisioning and migration task.

The problem with subscriber churn is prompting ILEC's to seriously look at new technologies to control MDF management costs and improve quality of service (QoS). The following quotation from Telecommunications Magazine provides a idea of the scope of the problem.

"…. the average U.S. churn rate now hovers around 40 percent for most providers, with customer acquisition costs at about $400 per subscriber."….

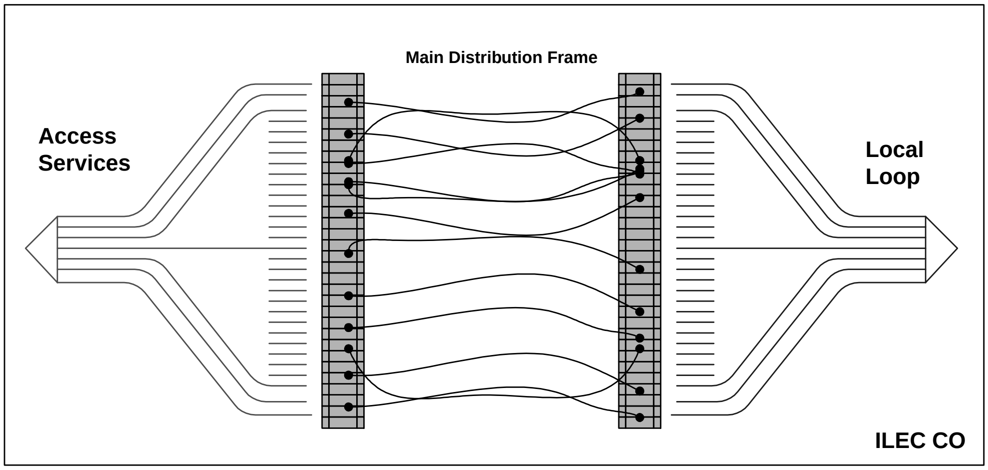
"But Europe also leads its New World counterparts in less positive statistical measurements. Subscriber churn in many markets now exceeds 3 percent a month, rising to near-disastrous rates of 35 percent to 50 percent on an annual basis. The expense of acquiring new European customers, which can cost up to $700 each, makes these high churn rates even more painful."…..

"Churn now costs European and U.S. telcos close to $4 billion each year, and the global cost of customer defection may well approach a staggering $10 billion."

Source: Telecommunications Magazine. February 1999. Jean Schmitt, chief executive officer of SLP InfoWare, a provider of churn-management and customer-retention software applications.

Services To Be Managed at the MDF

The MDF is the point of cross-connection for a wide array of telecom and datacom services. The type of services that require cross-connect management include POTS, ISDN, Centrex, T1, SDSL, ADSL, HDSL, HDSL2, TIE lines and dry copper pairs originating from residential and business users, MTU/MDU, Digital Loop Carrier (DLC) remote terminals and other CPE equipment. These lines terminate on the Main Distribution Frame and are then cross-connected to various equipment such as Class 5 switches, multiplexers, digital access cross-connects (DACs), DLC CO terminals, add/drop multiplexers, routers, POTS splitters and DSLAMs. The MDF provides the facility by which each copper subscriber pair gets connected to the correct carrier and service.



Manual Reconnection Work

Currently each connection requires a frame technician to manually re-terminate a patch cable between the subscriber line and the access equipment. A large taskforce is often reserved only for this task. In some unmanned COs, a technician must be sent on site every time a re-connection is required. As the number of COLLOs grows, the rate of churn increases, putting more pressure on the ILECs to connect and re-connect subscribers to high-speed services. ILECs are being forced to increase their manpower simply to move connections at the MDF. Consequently, they are searching for ways to offset this cost by automating some of the work. The type of connections being performed at the MDF include:

- Connecting the local user to a new access service.
- Migrating a subscriber to a new service.
- Re-connecting a subscriber from a faulty line card to a spare.
- Connecting subscriber lines to COLLO distribution frames.
- Connecting test equipment to the local loop.

Which Lines to Automate First

While the objective is to use ControlPoint to manage the entire MDF, from a logistics point of view it may be necessary to proceed in phases, beginning with the lines that have the highest churn rate.

Therefore the main problem facing the ILEC in deploying an automated MDF is identifying which lines and services to automate first. The main criteria in determining this is the rate of subscriber churn.

T1 or DSL subscriber loops that migrate several times per year present a higher priority to the ILEC in terms of managing them through ControlPoint. POTS lines on the other hand in general have a lower churn rate and therefore may not seem be immediate candidates for ControlPoint. However, the ILEC could elect to terminate large blocks of POTS lines immediately onto to ControlPoint in anticipation that they will migrate to higher speed services.

Therefore, the first task of the ILEC is to rank its local loop segments, services and carriers by "churn rate" and to assess whether any POTS loops should be pre-terminated onto an automated cross-connect for future service migration. Churn is usually measured as the percentage of lines that are moved or disconnected each month. This exercise provides an indication of where to focus efforts in automating the MDF.

As an illustration, the following table shows how this ranking might look for a particular CO. In the example, if the Sector D portion of the local loop is a prime candidate for migration to highspeed service (ie; because of its location, etc), then it could be pre-terminated earlier than other sectors that do not have this expectation for service migration.

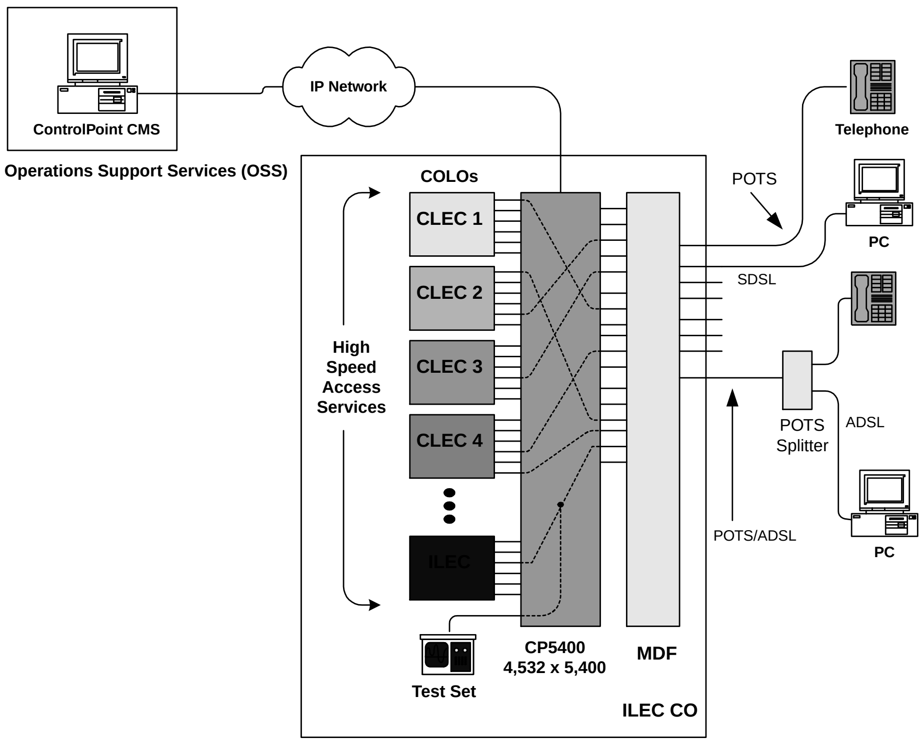
CO A - Monthly Churn Rates					
Carrier	% churn	Service	% churn	Local Loop	% churn
CLEC C	3%	T1	2.5%	Sector B	2.0%
CLEC B	2.5%	ADSL	2.0%	Sector A	1.9%
CLEC D	2%	HDSL	1.5%	Sector C	1.8%
CLEC E	1.3%	Centrex	1.0%	Sector D*	1.3%
ISP A	1.2%	POTS	.6%		
ILEC	1.0%				

*anticipate shift to DSL

From the above table, one approach would be for the ILEC to prioritize lines and services with churn rates of 2% per month or higher. Thus, CLEC C, B, E and services T1, ADSL and local loop sector B would be connected to ControlPoint first.

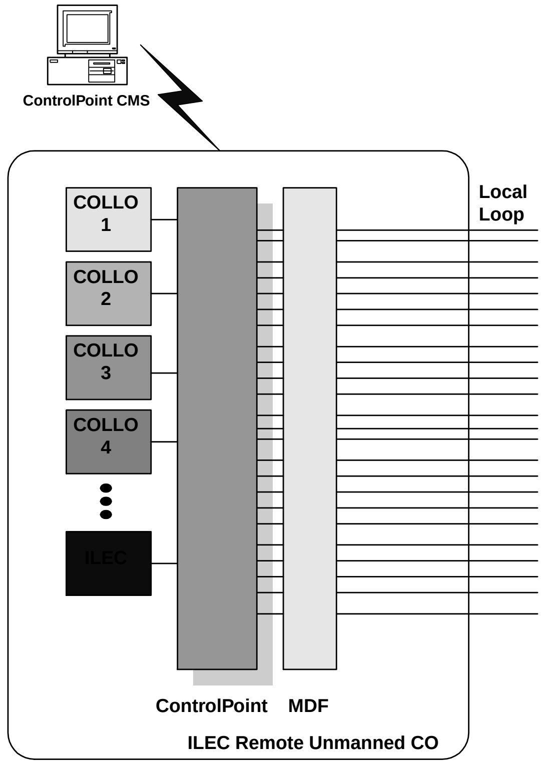
Managing High Speed Data Lines

In determining which part of a CO's MDF operation to automate first, the ILEC may choose to prioritize service connections that exhibit the highest overall churn rate, such as high speed data lines. These services would include T1, SDSL, ADSL, G.Lite, HDSL and HDSL2 among others. These services may be terminated on ILEC equipment or on CLEC distribution frames and may originate from multiple COLLOs or from the ILEC's own equipment. The following diagram shows how NHC's ControlPoint 5400 Crossconnect Switch (CP-5400) could handle the cross-connect function between multiple high-speed services.



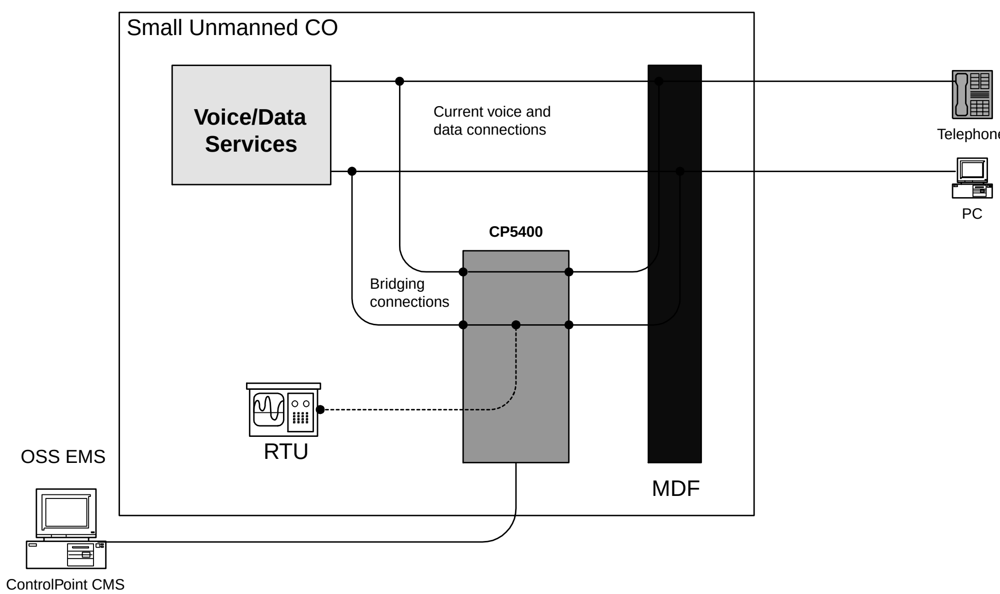
Small Unmanned COs Under 5,000 Lines

One of the ILEC's major problems is how to manage the numerous small unmanned COs in its territory. Large enough to require a facility-based MDF but not large enough to require a full-time on-site frame technician, these unmanned COs are often located far from the main CO and support under 5,000 lines, mainly simple dial tone offices with little or no COLLO. Consequently whenever a re-connection is needed, a technician has to travel significant distances to make a simple re-connection. Using ControlPoint, the ILEC could manage these MDFs remotely without having to send a frame technician on-site.

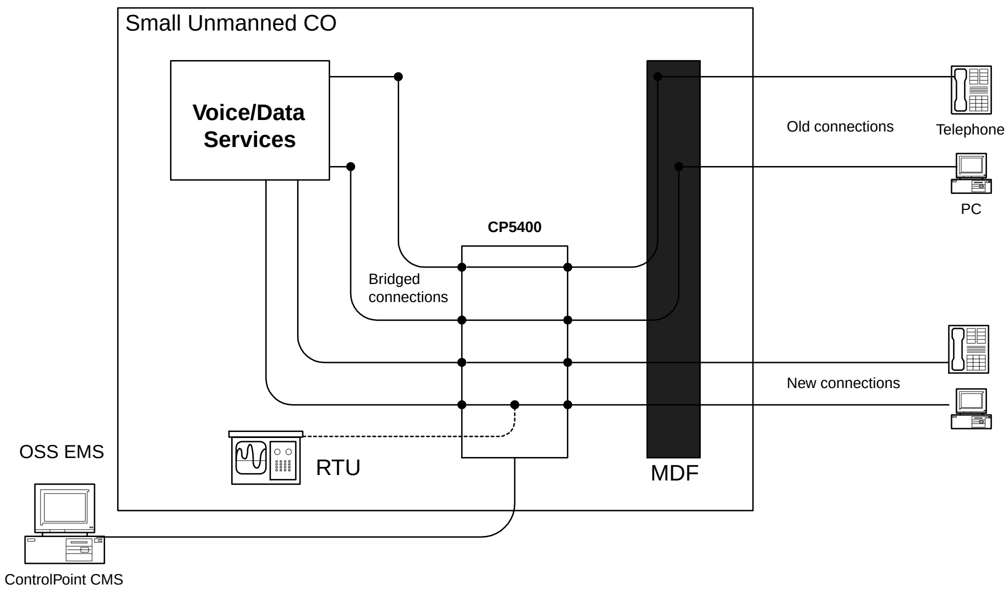


The cut-over would take place by first bridging the ControlPoint 5400 to the existing MDF. Once testing is completed and the CP5400 has been put into service, the MDF would be removed. New lines would be terminated directly onto the CP5400. The following diagrams show the cutover process.

The first stage would be to attach bridging adapters between existing voice/data services and the CP5400. An RTU connected to ControlPoint could be used to verify the lines before final cutover.

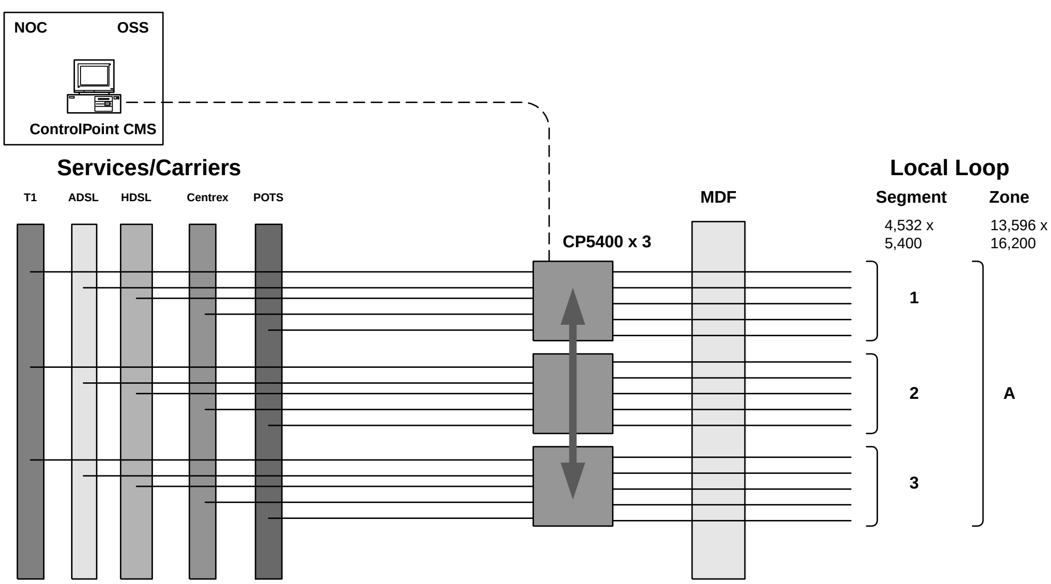


Once testing is complete the connections would be switched over to ControlPoint. The old connections would be removed. Subsequent connections would be managed exclusively via ControlPoint and all new services would be terminated directly onto ControlPoint, bypassing the conventional MDF.

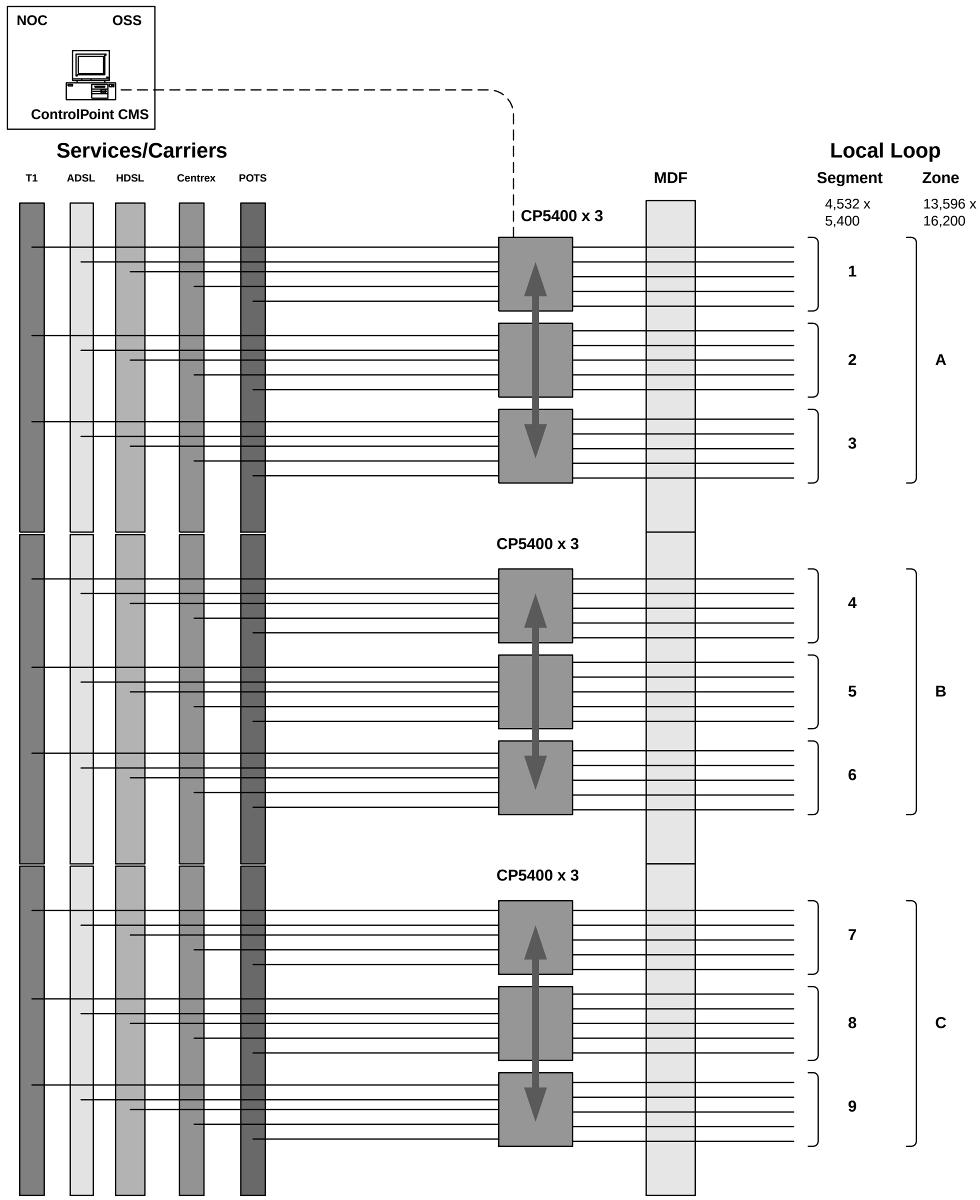


Managing an MDF of 50,000 lines

The management of larger MDFs would follow a process similar to an unmanned CO. The difference would be that in smaller COs, a single CP5400 (4532x5400) would be sufficient to handle all terminated lines and service access ports. On the other hand, in the larger COs where the number of lines exceeds the capacity of the CP5400, it would be necessary to partition the MDF into "zones" so that service access ports are available to any subscriber loop that is terminated onto any ControlPoint switch. Thus subscriber lines could be connected to any service regardless of which cross-connect switch they are connected to. The allocation of access ports to each switch would depend on the local loop subscriber profile of the CO. In the diagram below each ControlPoint is connected to a group of local loop pairs constituting a "segment".



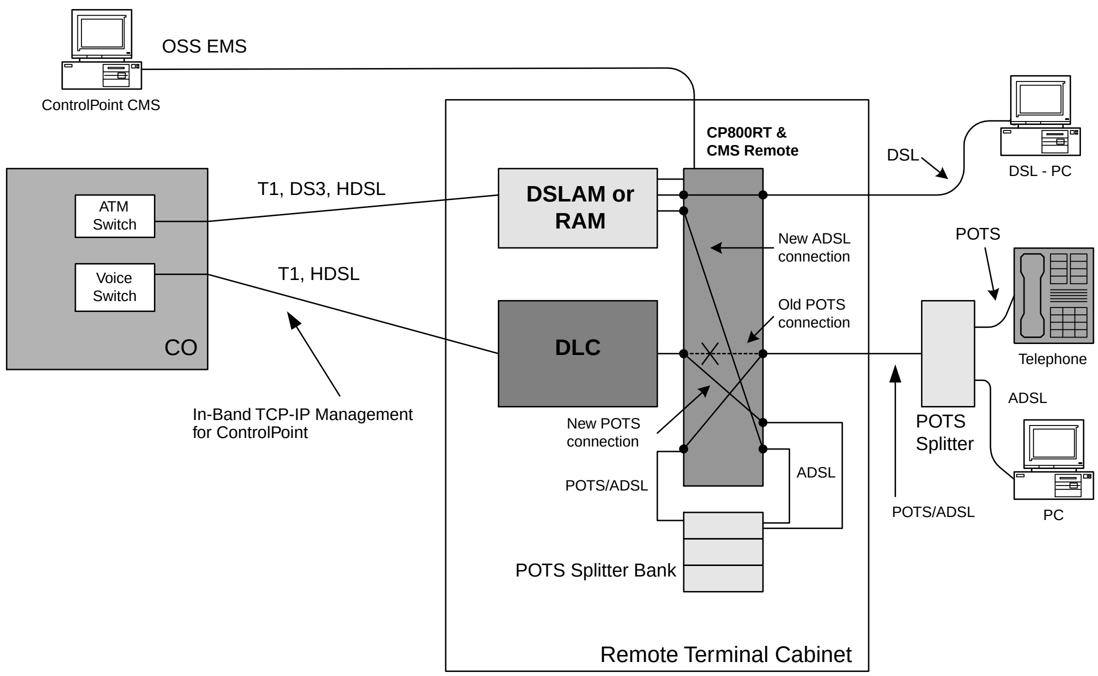
In order to handle matrices larger than 5,000, the CP5400 has the capability of being able to be cascaded to another CP5400 in order to create a larger, "any-to-any" blocking matrix. For example three CP5400s can be cascaded to form a matrix of 13,596 x 16,200, of which 950 lines may be connected anywhere within a zone. These 16,200 lines would constitute an MDF "zone". Once these 950 lines are used up, the matrix is blocked and the cross-connect switch may need to be "reset" to free up some of these 950 cross-connect points. These 950 lines are basically to handle the disproportionate distribution of services versus subscribers. For example, if a subscriber needs access to a T1 line and there are no more allocated to the switch that he is connected to, then it would be possible to connect him to a different switch within the same zone. The following diagram illustrates the zoned approach.



Using a zoned approach, MDFs of even greater size could be managed in a similar way. The main problem is how to allocate subscribers and services to each MDF so that most cross-connections are handled within a given zone. This should be determined by gathering data about what the service profile is for each segment of the MDF. This information helps to determine how many service ports of each service class to allocate to each CP5400.

Remote Outside Plant Application - RT and MDU/MTU

The outside plant is another area in which ControlPoint could be used for local loop management. This includes Remote Terminals and MDU/MTUs. The Outside Plant Serving Area Cross-connects (SAC) contain DLC equipment that is traditionally used only for voice. Today, the RT's are being expanded to support highspeed data service and additional equipment such as DSLAMs, Remote Access Multiplexers (RAMs) RTUs, and POTS splitters are being installed. Tasks such as line qualification, service migration and fallback switching could be handled remotely with ControlPoint, eliminating the need to send a trained field service technician to the RT.



DEDICATED COPPER LINE

The ControlPoint switch would sit between the DLC/DSLAM and the termination frame. All local loops, DSLAM ports, DLC ports and POTS splitter ports would be pre-terminated on the switch. In the case where the CLEC owns the DSLAM, it would issue a request to the ILEC to provision a new copper pair to its DSLAM. The ILEC ControlPoint Operator could connect a remote test unit to the line via ControlPoint to qualify the line for highspeed data. Once the line was qualified, the ILEC could hand off the connection to the collocated DSLAM via ControlPoint. Depending on the number of lines to be managed, the appropriate size ControlPoint switch would be deployed; from the CP800RT (800 lines) up to the CP5400 (5400 lines).

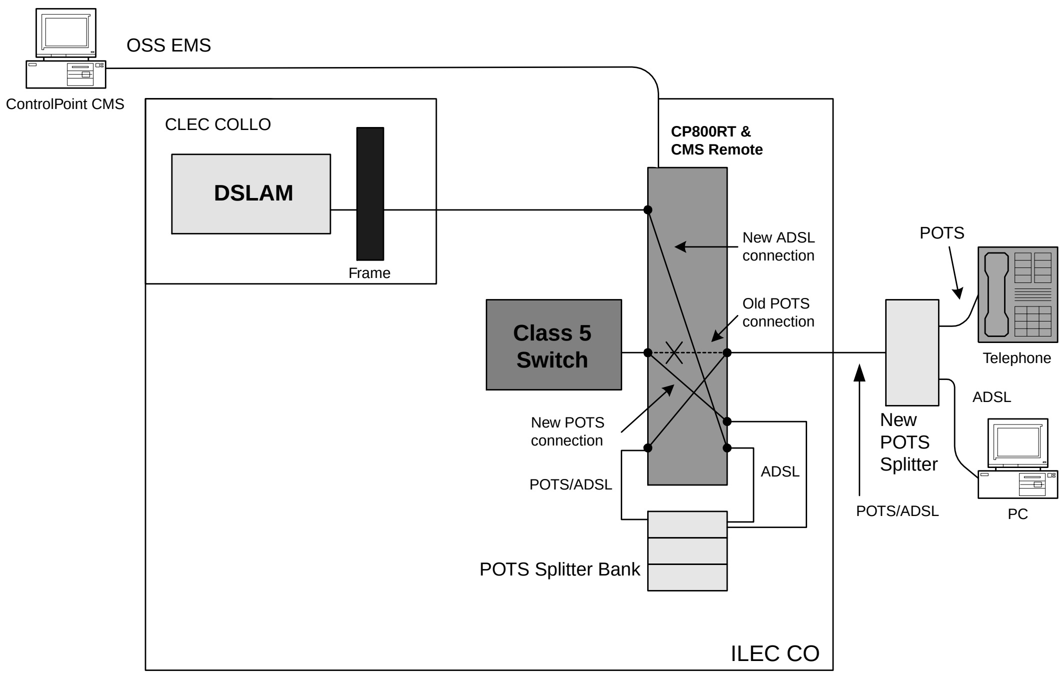
SHARED-LINE

In the case where the line is to be shared, the CLEC would install a POTS/DSL splitter at the CP. The ILEC would switch the CP's POTS service over to a POTS/DSL splitter located in the RT. The CP800RT would remotely make the necessary connection between the splitter, DLC and the local loop. Once the CLEC was ready, the ILEC would cut-over the data portion of the splitter to the CLEC's DSLAM or RAM. Pre-qualification could be handled by the ILEC in the same way as an unshared line, depending on the COLLO agreement.

Shared-Line Environment

In an unshared line environment there are dedicated copper pairs for POTS service and separate dedicated pairs for data. Mass deployment of ADSL has led to further FCC deregulation whereby the ILEC must allow a CLEC to share the ILEC's existing POTS lines in order that the CLEC can provide high-speed data service to the subscriber. This means that the ILEC (or CLEC) must install POTS/ADSL splitters that allow the data portion of the line to be handed off to a CLEC (or to the ILEC's own DSLAM) and the POTS service to be connected to the ILEC's Class 5 voice switch.

If the splitters are installed in the ILEC's wiring area, then connections to and from the splitter would need to be managed by ControlPoint in order to automate the cut-over from POTS-only service to POTS/ADSL service. The following diagram shows how this cut-over would take place.



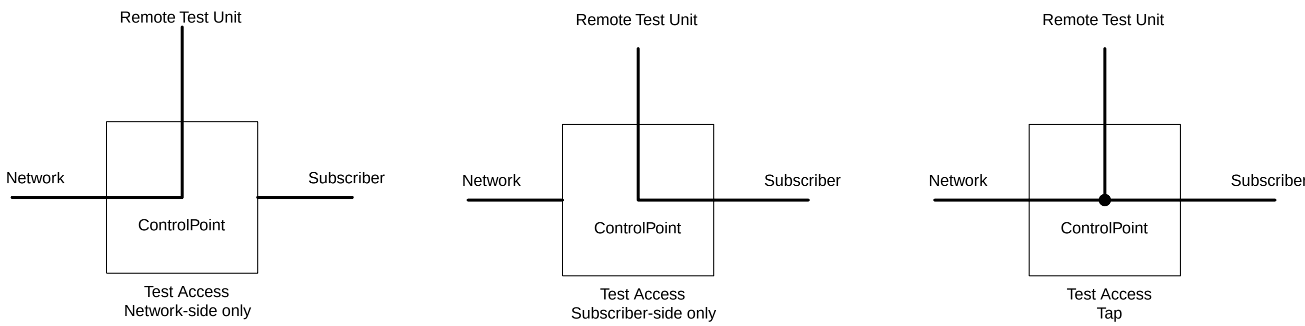
The provisioning process might be handled in the following way:

1. CLEC receives a service request from a subscriber to connect to its ADSL service.
2. CLEC requests ILEC to terminate the data portion of the subscriber's line on the CLEC's frame.
3. ILEC connects the subscriber's copper pair to a spare loop port on ControlPoint.
4. POTS/xDSL splitters pre-terminated on ControlPoint and on the Class 5 switch waiting for cutover.
5. ILEC performs full-spectrum line-testing and reports to CLEC (depending on COLLO agreement).
6. Class 5 Switch re-programmed to allow the subscriber to maintain current POTS service and number.
7. ControlPoint connects the subscriber to the POTS/xDSL port on the splitter.
8. ControlPoint connects the xDSL port on splitter to the CLEC data line terminating on the CLEC frame.
9. CLEC terminates the subscriber line on its DSLAM and commissions service.

Test Access

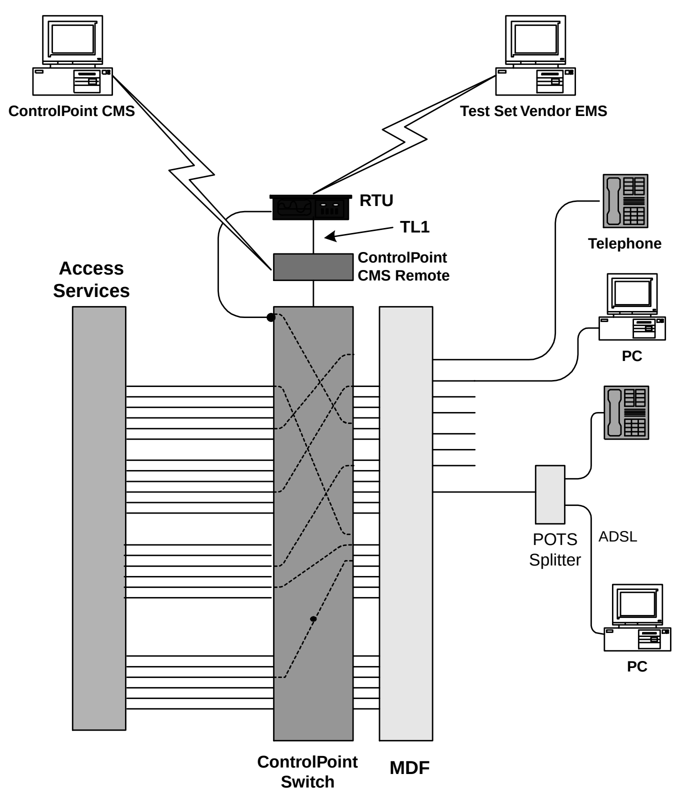
ControlPoint also operates as a metallic test access unit (MTAU) to allow the ILEC to conduct local loop line qualification at the MDF or remote terminal. ControlPoint features subscriber-side loopback and multipoint capability enabling the switch to support a variety of test configurations, including;

a) test access on subscriber-side only
b) test access on network-side only and
c) test access via center tap



ControlPoint will work in conjunction with third part test set vendors such as Hekimian, Tollgrade, Sunrise and Harris to support a variety of single-ended or dual-ended tests, providing a complete test access solution. In the current state, ControlPoint and third party test sets would be controlled via each vendor's respective EMS. Depending on the ILEC's needs custom APIs could be developed to further integrate the ControlPoint with the ILEC's preferred test set vendor.

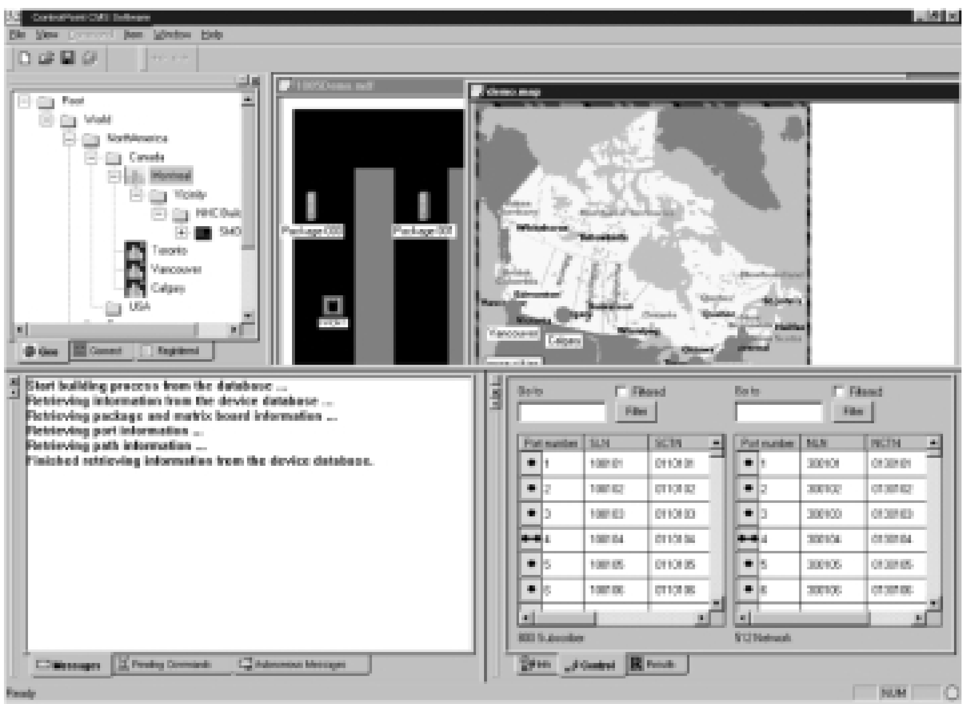
NHC is currently developing a TL1 interface to allow any third party RTU to control the ControlPoint Switch via its own EMS.



Software Capabilities

Initially, ControlPoint would be managed via NHC's ControlPoint Connection Management System (CMS) Software. The CMS Software is a Windows-based GUI interface that communicates with ControlPoint via NHC's ControlPoint CMS Remote SNMP Controller. The OSS would generate a work order that says "Connect subscriber line A to access service point B". A CO-based ControlPoint operator would call up the CMS software and instruct ControlPoint to make the changeover.

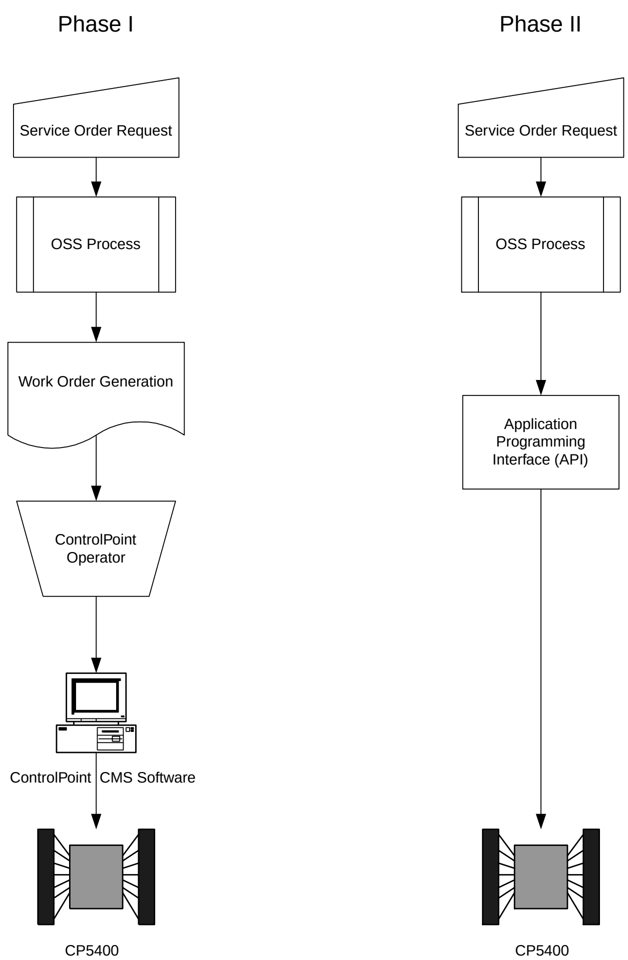
CMS provides real-time cable/connection records and communicates over an Ethernet 10/100 LAN via SNMP. Connecting and disconnecting ports using CMS is a simple drag & drop operation, providing all the controls required to manage the matrix switch. Locating and taking control of any matrix switch in a multi-switch configuration is handled graphically by clicking on switch icons or by clicking on leaves of a tree representing switches. In fact, the CMS software allows an operator to create multi-level geographical views of any installation, detailing countries, cities and buildings and represent them with icons and backdrop bit maps. By clicking on these icons the user can easily drill-down to locate and take control of any matrix switch on the associated network.



During the initial installation phase an operator can totally configure and test the matrix switch before installing the unit in its final location. Connection changes may be pre- programmed and saved for later execution. Once executed, a pre-programmed connectivity file can be left unattended, while the process continues until complete. In addition, the system allows the operator to interrupt this process to accommodate additions, deletions and changes. A backup procedure, allows connectivity and database information to be stored for later recovery should a failure occur.

Flow-Through Provisioning

Initially, ControlPoint would integrate with the ILEC's OSS through its usual service order process. When a service order is received, work orders would be issued and the ControlPoint operator would process the connection order as any other work order. ControlPoint CMS would be treated as a standalone Element Management System (EMS). Once this phase is operational, the second phase would be to streamline the flow-through provisioning process and have the ILEC OSS control the switch directly via a TMN-based Application Program Interface (API). This would allow the paper-based work orders process to be bypassed and connection changes made on-line. This interface may be developed with the ILEC directly or with one of the third party OSS vendors. The following diagrams illustrate the two phases.



Conclusion

With the dramatic increase in competition for the local access market, there is a significant increase in the level of activity focussed on connection, maintenance, and management of the copper wire and the services running over it. Given these high levels of activity in the loop, the traditional management approach is not viable;using manual labor and processes. Rolling trucks with trained technicians, is too slow and expensive to be effective in today's competitive industry. The obvious answer is to automate the provisioning process and provide intelligent wireline management in the physical layer.

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