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SECTION 10
NETWORK INFRASTRUCTURE PRODUCTS

This section provides an overview of current Defense Information Systems Network (DISN) Services, networks, and products used in the network infrastructure. DISN services include transport, data, voice, video, messaging, and other Unified Capabilities (UC) along with ancillary enterprise services, such as directories. The DISN services also provides less apparent but critical support services, such as timing and synchronization (T&S), Source Address (SA) of the network, address assignment services, and domain name services.

Currently, DISN uses a composite of separate networks to provide customers with transport, data, voice, and video services as well as the means to satisfy their classified and Sensitive but Unclassified (SBU) requirements. These networks and their relationship to each other and to the DISN service are shown in Figure 10-1, Current DISN Services and Networks Overview.

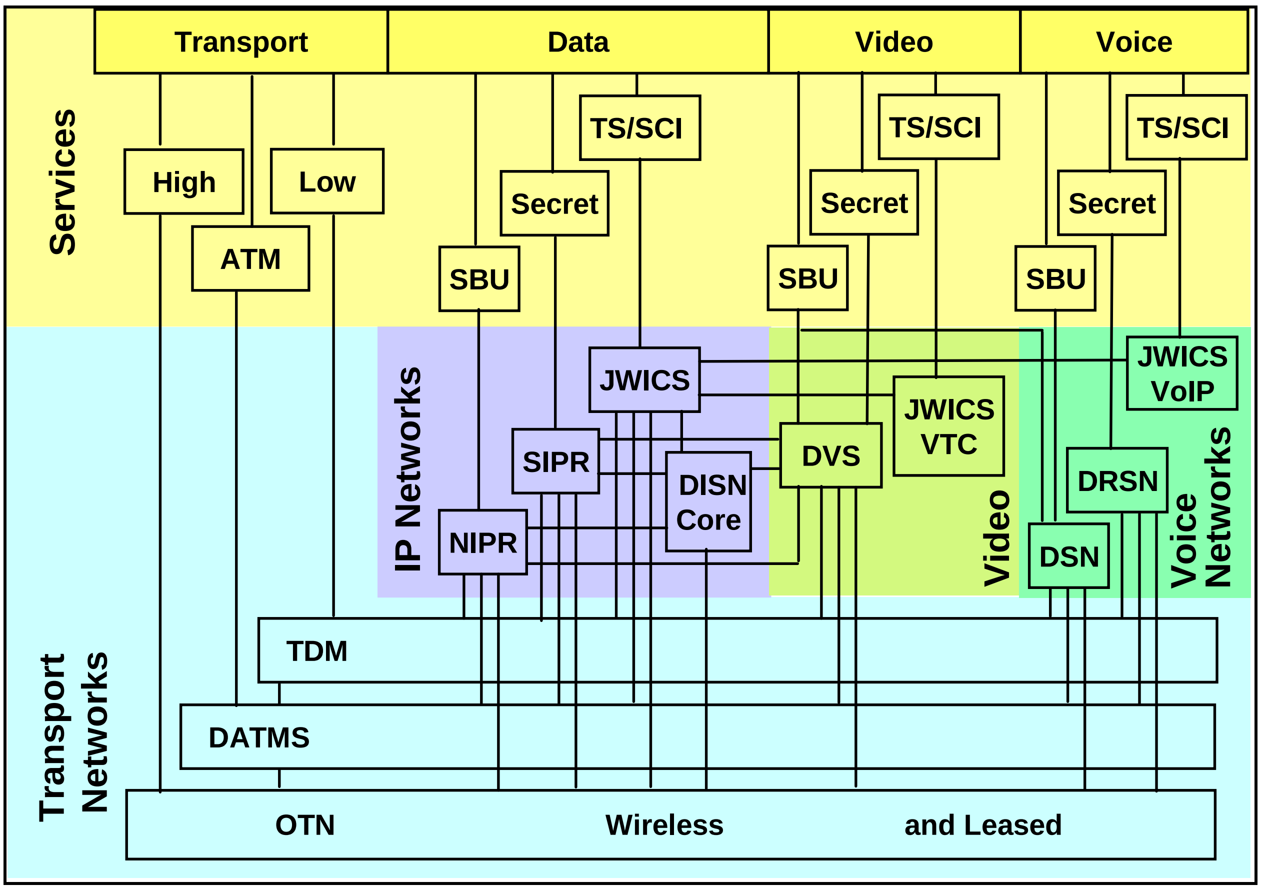

Figure 10-1. Current DISN Services and Networks Overview

Products employed within the network infrastructure include Optical Transport System (OTS), Optical Digital Cross-Connect (ODXC), Multi-Service Provisioning Platform (MSPP), M13 Multiplexer (M13 MUX), Serial Time Division Multiplexing (TDM) Multiplexer (Serial TDM MUX), T&S Product, DISN Router, and Passive Optical Networks (PONs). Products within this section may be certified and Approved Products List (APL) listed for one product category (e.g., OTS) or a combined product category called a Network Infrastructure Product (NISP):

- OTS. Multiplexes optical signals from various sources (e.g., router, transport switch function, Channel Access Grooming) at the optical core layer. The OTS consists of the following components: Terminal, Reconfigurable Optical Add and Drop Multiplexer (ROADM), and an Optical Line Amplifier (OLA). An Optical Supervisory Channel (OSC) runs between these components.
- Transport Switch Function (TSF). Today, the TSF functionality is satisfied by the ODXC equipment within the DISN. The TSF is an Optical cross-connect device that is located primarily at Class 1 sites but it could also be deployed at select Class 2 sites. The lowest level that it will cross-connect is an STS-1.
- Aggregation Grooming Function (AGF). Receives low-speed circuits on multiple ingress ports and multiplexes them together onto higher speed egress interfaces. The AGF multiplexing allows for multiple internal cross-connects between the low-speed ports and the high-speed ports. The AGF product can connect circuits from any port to any other port within the bandwidth limitations of the ports. The AGF product within the DISN is also known as an MSPP.
- Network Infrastructure Product (NISP). UCR 2013, Section 10, defines three products: an OTS product, a TSF product, and an AGF product. The product category of NISP represents the combination of two or more network infrastructure products within the same platform. The System Under Test (SUT) is certified to perform as a NISP product by performing the functions completely of any combination of the following products: OTS, TSF or AGF.
- ODXC. Input optical signals are converted into electronic signals after they are demultiplexed by demultiplexers. The electronic signals are then switched by an electronic switch module. Finally, the switched electronic signals are converted back into optical signals by using them to modulate lasers and then the resulting optical signals are multiplexed by optical multiplexers onto outlet optical fibers.
- MSPP. Close to the customer, must interface with a variety of customer premises equipment and handle a range of physical interfaces. Most vendors support telephony interfaces (DS-1, DS-3, E1, E3), optical interfaces (OC-3, OC-12, OC-48, STM-1, STM-3, STM12), and Ethernet interfaces (10/100Mb). MSPPs enable service providers to offer customers new bundled services at the transport, switching, and routing layers of the network, and they dramatically decrease the time it takes to provision new services while improving the flexibility of adding, migrating or removing customer networks.
- M13 Multiplexer (M13 MUX). Integrates 28 T1 tributary channels into a single 45 Mbps data stream using bit-level multiplexing and M13 bit-interleaving framing format. M13 terminal multiplexers also provide T1 channel grooming and offer direct connection to T3 networks or DS3 equipment over copper or fiber links.

- Serial TDM Multiplexer (Serial TDM MUX). Supports TDM, asynchronous transfer mode (ATM), serial, and cell-based data types, and securely converts them for Internet protocol (IP) transport at gigabyte speeds. Serial TDM Multiplexers are required to ensure Mission critical legacy data can be smoothly transitioned to the GIG. Multiple timing recovery options, based on telecom standards should be enforced to ensure that the data that enters the IP cloud, exits in the proper order and precedence.
- Timing and Synchronization (T&S). The complexities of an analog and digital multi-standard, multi-format data transports require flexibility in customizing the synchronizing needs of the network. Signals from a master sync pulse generator (SPG) are critical in order to synchronize all of the equipment in a system.
- DISN Routers. Routers required for the DISN fall into categories of small, medium, and large. Each of these routers may support a variety of interface types and numbers. The size of the routers is indicative of certain characteristics such as backplane capacity and packet forwarding capability, but the overall functionality of the router does more to place the router than any one attribute, and is determined by the sponsor.
- PON. Point-to-multipoint, fiber to the premises network architecture in which unpowered optical splitters are used to enable a single optical fiber to serve multiple premises, typically 16-128. A PON consists of an optical line terminal (OLT) at the service provider's central office and a number of optical network units (ONUs) near end users. A PON configuration reduces the amount of fiber and central office equipment required compared with point-to-point architectures. A passive optical network is a form of fiber-optic access network. Downstream signals are broadcast to all premises sharing a single fiber (encryption is used to prevent eavesdropping). Upstream signals are combined using a multiple access protocol, usually time division multiple access (TDMA).

The product placement of the equipment described above as members of the Network Infrastructure Design and Products class are depicted in Figure 10-2, Network Infrastructure Product Arrangements.

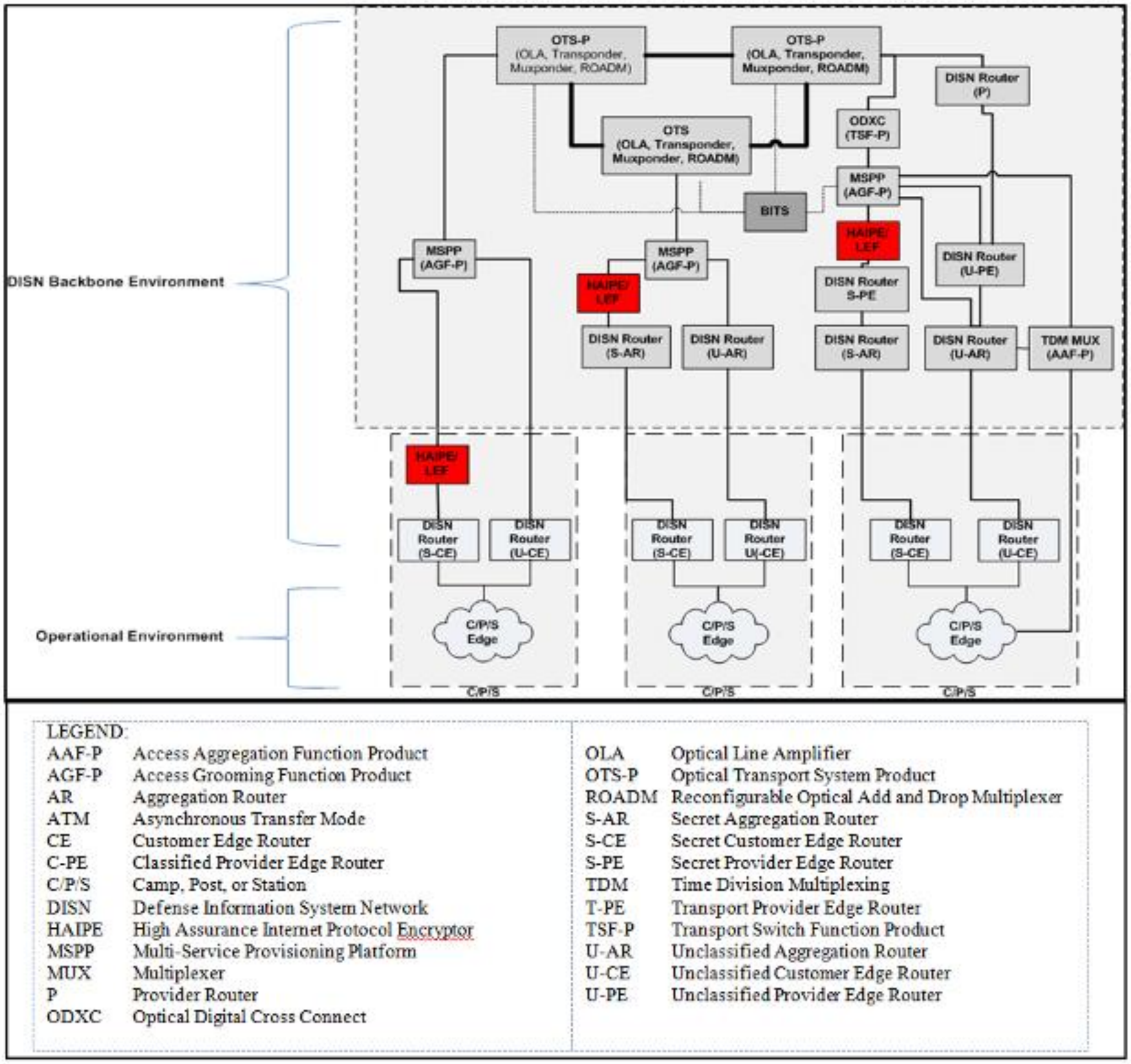

Figure 10-2. Network Infrastructure Product Arrangements

Figure 10-3, Conceptual Depiction of 2 Nodes of the DISN illustrates the DISN router hierarchy from a Transport Boundary perspective. This will allow for a better understanding of NISP product placement relative to the DISN architecture (no circuit cross-connects shown). Predominantly, the products OTS, ODXC, MSPP, m13 MUX, Serial TDM MUX, Building Integrated Timing Supply (BITS), and DISN Routers are currently located above the DISN Distribution Layer Boundary, extending to the DISN IP Core; while PONs predominantly exist at the Base/Camp/Post/Station (B/C/P/S) Layer (Note that the products defined within this section can be deployed within the DISN or B/C/P/S infrastructure).

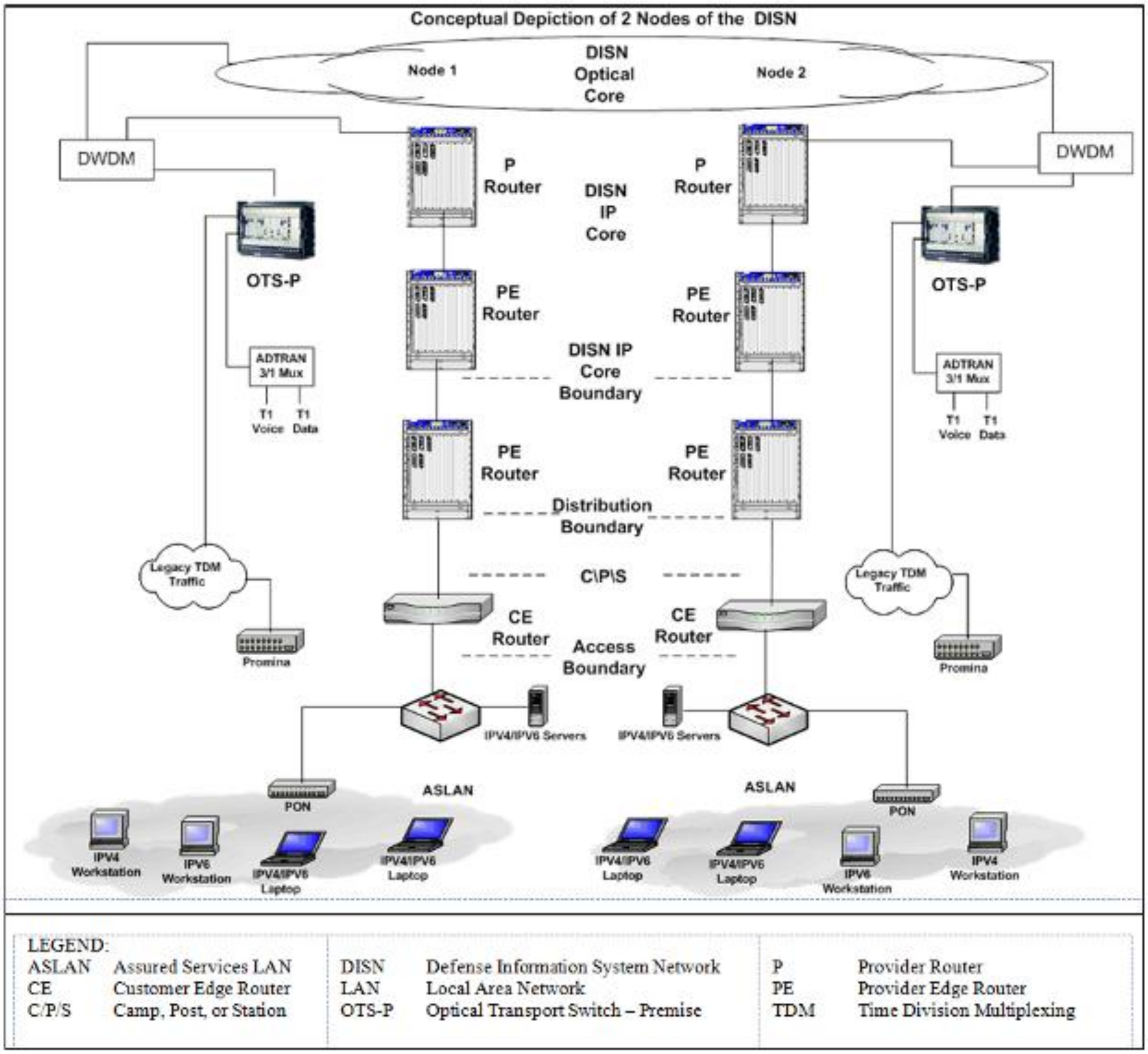

Figure 10-3. Conceptual Depiction of 2 Nodes of the DISN

Figure 10-4, DISN Router Hierarchy, illustrates the current DISN router hierarchy for both the unclassified network and the classified network. At this point, the NIPRNet and SIPRNet Routers have been transformed to be Unclassified Aggregation Routers (ARs) (U-ARs) and classified ARs connected to the unclassified Provider Edge (U-PE) Routers and classified Provider Edge (C-PE) Routers, respectively.

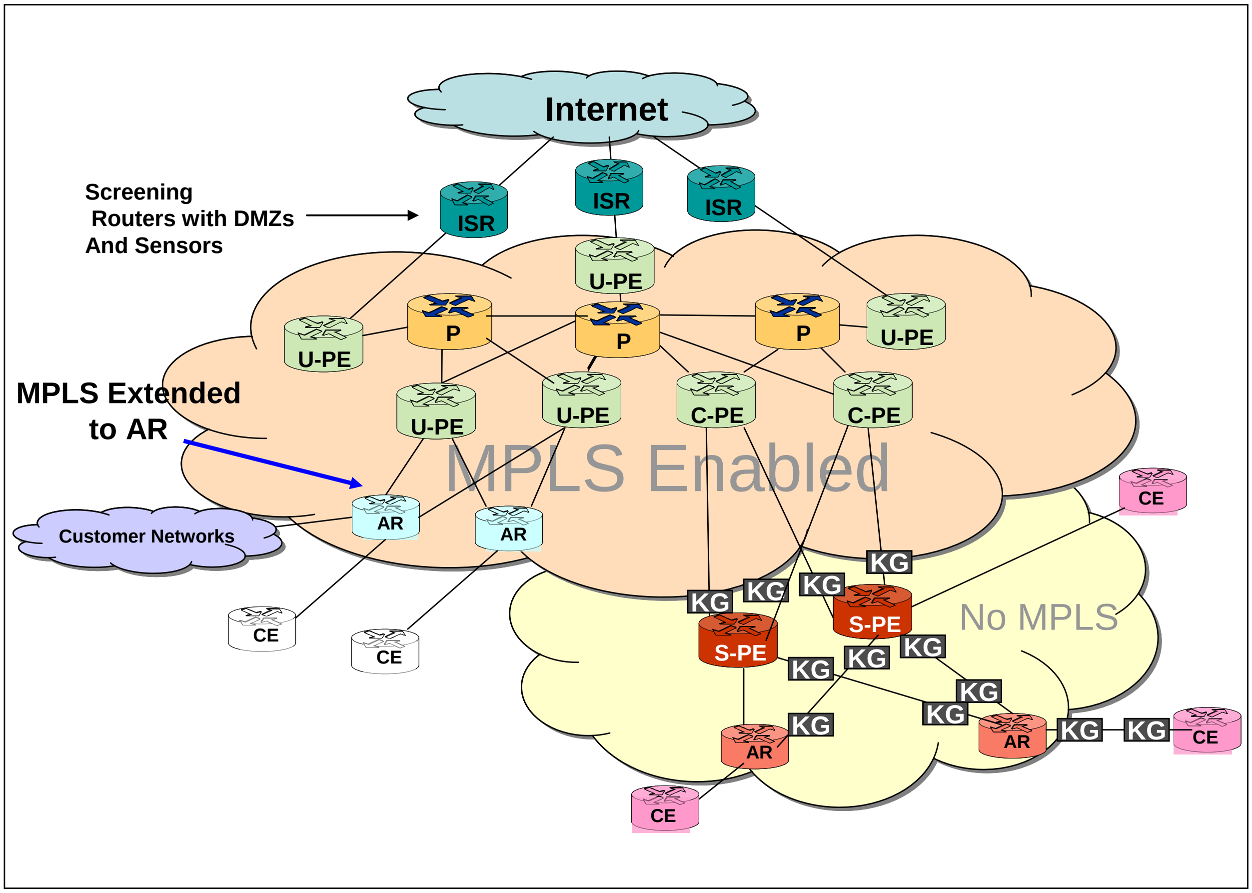

Figure 10-4. DISN Router Hierarchy

Near-Term DISN Architecture. In addition to the DISN Core Transition, the Department of Defense (DOD) satellite communications (SATCOM) networks will migrate from single channel per carrier (SCPC) type modems using serial trunks and dedicated point-to-point satellite circuits to IP modems over Demand Assigned Multiple Access (DAMA)/Bandwidth on Demand (BoD) Time Division Multiple Access (TDMA) connections that allow for the more efficient utilization of scarce satellite resources. The Defense Information Systems Agency (DISA) leads the way in IP modem standards development that leverages commercial off-the-shelf (COTS) implementations in order to achieve interoperability. Through its partnership with the Services, DISA also uses annual Joint User Interoperability Communications Exercise (JUICE) exercises to test various features and capabilities of IP modems. The effort will be in concert with other efforts such as WIN-T, Joint Tactical Radio System (JTRS), and Wideband Gapfiller System (WGS) and is called “incremental capability phase 2.” In addition, the IP modems will also contain embedded Transmission Security (TRANSEC) and centralized management to ease the network management load on deployed warfighters.

2013 – Mid Term DISN Architecture. In 2013, the MSPPs and Multiprotocol Label Switching (MPLS) will provide Layer 1/Layer 2 transport capabilities. Within DISN Class1A Sites, NIPRNet and SIPRNet will have disappeared as distinct entities. Legacy TDM (if any) will be supported on the MSPP. Edge applications (Defense Switched Network [DSN], Defense RED

Switch Network [DRSN], and DISN Video Services [DVS]) will primarily use IP as a transport means. The DISN Converged Access (DCA) architecture with the added use of Serial to IP (STI) devices will permit ATM and Promina/Integrated Digital Network Exchange (IDNX) to be removed from the DISN.

10.1 DISN CONVERGED ACCESS

This new transport access architecture is called the DISN Converged Access (DCA). The DCA architecture uses IP/MPLS with CoS (traffic shaping, policing and prioritization) to provide deterministic transport of customer requirements. RSVP-TE will be used to create label-switched paths (LSPs) and MPLS fast re-route will be used to quickly switch traffic to a back-up path in the event of a network failure. DCA equipment will support a single data stream that contains a variety of cypher text and unencrypted unclassified traffic. The DCA architecture goal is to replace native ATM at the edge, and accept circuit emulation traffic containing TDM and serial traffic. It will support ATM elimination for multiple traffic types, including native ATM cell traffic, IP traffic including NIPRNET, SIPRNet and Private IP traffic and layer 1 circuit traffic. For unencrypted IP traffic, DCA equipment shall support interworking of customer interfaces from ATM, T1/E1, DS3/E3 and Packet over SONET, to Ethernet in support of an Ethernet-based DISN infrastructure.

Transport for layer 2 traffic (ATM and Ethernet) as well as unencrypted IP traffic will be provided by L2 pseudowires (PW). In the case of layer 2 traffic, the layer 2 datagram (Ethernet frame or ATM cell) will be encapsulated in MPLS for transport at the ingress and will be delivered to the customer in the format received. When the destination interface is ATM, DCA will support aggregation of customer traffic using ATM VPI/VCIs. In the case of unencrypted IP traffic, the IP datagram will be encapsulated for transport. When the destination interface is Ethernet, DCA will provide aggregation of customer traffic using 802.1Q VLAN tags. DCA will have port density to support new services required, achieved via IEEE 802.1Q L2 VLAN aggregation of Ethernet interfaces to within the core infrastructure. This will enable use of only one port for multiple VLANs with ATM, Ethernet cards.

DCA equipment will use L1 circuit emulation when the DCA devices cannot detect IP packets in the bit stream, either because the interface is inherently not IP (Low-Speed Time Division Multiplexing [LSTDM], PBX to MFSS legacy voice circuit) or when the bit stream is encrypted.

DCA will be configurable to either recognize the Differentiated Services Code Point (DSCP) and prioritize traffic in accordance with the UCR, or ignore customer DSCPs. Layer 1circuit emulation traffic will be treated as Expedited Forwarding (EF) traffic to minimize delay.

Layer 2 (L2) PWs are an MPLS transport capability (RFC 3985, 5462) that encapsulates ATM, Ethernet (C2, SIPR, and NIPR traffic), but does no L3 routing or VPN. Layer 2 VPN support is needed to support the evolution of DISN access from point-to-point access circuits to multipoint access LANs, potentially improving reliability of IP services and utilization of access infrastructure.

Traffic policing and marking will be used for layer-2 PWs at the customer interface. Traffic that is within the requested bandwidth will be queued differently than traffic that exceeds the requested bandwidth. This excess traffic can either be dropped at ingress (at the customer interface) or marked as 'drop eligible' so that it will be dropped before other traffic that does comply to agreements. The architecture for DCA access networks will be engineered to support "in contract" traffic under certain failure conditions. Edge switches are often dual homed to larger switches at the edge or at the core sites.

Customers may encrypt their traffic before handing to DCA (this is transparent to the DCA, which emulates a L2 switch) using CoS with proper queuing and interface policing, DCA can allow customer IP traffic to burst into otherwise unused bandwidth.

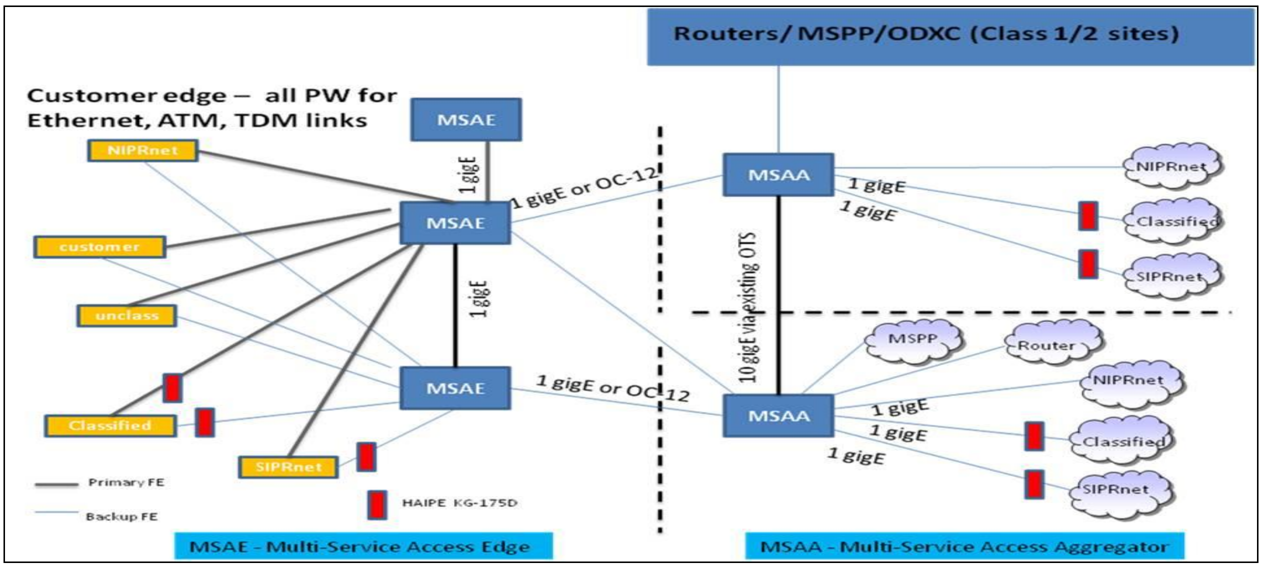

Figure 10-5. DCA Architecture

MSAA devices will be at the CORE Class 1 and 2 locations and they will have a larger node requirement that could support up to 10Gig of bandwidth for aggregation to DISN service nodes and inter DCA connectivity for redundancy purposes. MSAA can also connect to ODXC via SONET. DCA physical interfaces will comply with UCR 2013 section 10.6.1.1 through 10.6.1.3. The equipment redundancy requirements for DCA are compliant with 10.6.14.