Adtran Total Access 5006
AOE (Advanced Operations Environment)
www.adtran.com/aoe
https://supportforums.adtran.com/community/documents

Overview:

Total Access 5006:
Received a Total Access System for testing purposes as a FTTX solution in replacement of the Calix B6 series Active Ethernet solution.

The Total Access 5006 comes with a SCM (Management) Module, 2 x 10G Uplink Modules (A and B) and a 24 port dual-port, slim, Active Ethernet module.

SCM (System Control Module): This module provides the following resources:

-Communication with other Total Access Systems
-Craft serial access
-Monitors system status and controls alarm relays
-Provides SNMP and TL1 NMA (Network Management Application interface for the system
-Maintains alarm history and system event log.
-Auto provisioning/Copy provisioning of modules. (If a card fails it can be swapped without losing provisioning data and will auto download the config to the replacement module).
-Additional information on the SCM card can be found here: https://supportforums.adtran.com/docs/DOC-2478 *login required

==========

SM (Switch Module) 2-10Ge/ 2-1Ge: This module provides the following resources:

-SFP and XFP for copper and optical connectivity
-802.ah for OAM
-802.1p for CoS
-802.1q VLAN Tagging
-802.1 Q-in-Q VLAN Tagging (vlan in vlan or double tagging)
-802.3ad LACP (Link Aggregation Control Protocol)
-Support for 1:1 and N:1 VLAN Topologies
-Supports G.8032 Ethernet Right Protection Switching (ERPS) on 10Gige and 1Gige
-Additional information on the SM can be found here: https://supportforums.adtran.com/docs/DOC-2387 *login required

==========

AE 24 port Access Module - Slim: This module provides the following resources:

-Provides subscriber interfaces using Compact bidirectional SFP's.

-Supports Voice (MGCP/SIP), Video(IGMP) and Data (DHCP/Opt 82).

-Point to Point TLS

-E-LAN (Point to Multipoint TLS)

-Additional information on the AE Access Module can be found here: https://supportforums.adtran.com/docs/DOC-5813 *login required

==========

AOE (Advanced Operations Environment)

AOE is a holistic approach to OLT and ONT management similar to that of Calix Management System (CMS).

AOE is a web based interface for provisioning Data, Video, Voice, and TLS services.

-Service Designer: Allows the administrator to build specific services(data, video, voice, and tls) for end users.

-Service Activator: A simple approach to service activation. Drag and drop methods.

-Service Check: A troubleshooting tool for PM, status, provisioning, hardware information.

-Service Monitor: a performance monitoring tool used to identify circuits with physical or packet degradation issues.

-Capacity Manager: Monitors link and trunks throughout the access network to identify potential bottlenecks

-Inventory Manager: Network wide port usage by equipment type and location.

-OSS Gateway: Provides integration with service provider billing, provisioning, and facilitates OSS to automate common tasks and functions.

- More information on AOE can be found here: https://supportforums.adtran.com/community/network-management-solutions/aoe *login required

Additional information can be found here: /ambiguous network drive

Environment Setup:

In order to successfully test the Adtran Total Access 5006 (TA5K) and the AOE system, a test environment had to be established. This was completed by setting up a field cabinet in the mezzanine with DC power.

Outside plant and Operational Support spliced in additional fibers from the mezzanine down to the Headend. Network Operations ran a fiber from the Fiber Preterm on S3 over to the test ports going to the Network Operations area. This terminated to a test Extreme Network X440 switch on Port 45 and the Gigabit Ethernet 1 on Slot A of the TA5K. Also on the x440, two copper ports were then routed over to the AOE server and a test laptop.

A test vlan was established to bring the AOE server, Laptop, and TA5K on the same network. The subnet of 192.168.1.0 CIDR /24 (Subnet of 255.255.255.0).
AOE: 192.168.1.5
TA5K: 192.168.1.10
Laptop: 192.168.1.15

In order to test SIP service, I had to move the AOE server and subsequently the TA5K onto production management networks. This also allowed for remote access to the equipment from our desktops. This also allowed easier access for Go To Meetings with Adtran.
AOE: 172.30.12.65 (Gateway: 172.30.12.1 CIDR /22)
TA5K: 172.30.6.6 (Gateway: 172.30.6.1 CIDR /24)

AOE Installation

AOE was installed on a desktop server provided by IS. Adtran Sales Engineers assisted with the installation of AOE.

I started using CENToS 6.0. We were informed that AOE was supported on RHEL/CENToS. I had immediate access to CentoS 6.0 and tried to install AOE. I kept getting errors when trying to install. Regardless of the version of CENToS (Lite, Full, etc.), they would install the MySQL Libraries. AOE install files does a process check and found that those libraries were running as part of Postfix. This could not be uninstalled as they were dependencies on other processes (libs > Postfix > Centos kernel).

CentoS 6.0 was used was due to lack of access to documentation of AOE. Once I obtained access to Adtran's support website, I found that AOE was supported on CENToS 5.0 or RHEL 5.0. It was difficult to find CENToS 5.0 in a complete ISO. Once I was able to get CENToS 5.0 installed, AOE installed without difficulty.

By the time I was able to get CENToS 5.0 installed for AOE, Adtran Sales Engineers (SE) were onsite. Adtran SE advised that they've been able to get AOE installed on CENToS 6.0 but it's difficult and not a supported version and they would be able to assist on the installation, should we choose to go with CENToS 6.0.

Adding Total Access 5006 in AOE

To access the AOE application, enter the IP information of the AOE server into your web browser.

Username: ******* (all lowercase)
Password: ******* (all lowercase)

After bringing AOE and the TA5K on the same network, under ViewNetwork, at the bottom was a DISCOVER button. I entered the new management IP of the TA5K and then synchronized the TA5K with AOE.

At this point we were able to validate inband management, web provisioning of both AOE and the TA5K.

Creating EVC - Templates

Next task was then to extend the Data vlans of FD5, occam-video, and occam-management. (A TLS vlan was created later - netops).

These templates were built using real-world scenarios of Internet, Video, Phones (SIP), TLS, and Pseudowire (T1 Emulation) services. S-tags (Service Provider tags) were created after production vlans.

When creating a template a user needs a firm understanding of networking fundamentals. If you're sending Tagged Vlans from the upstream switch, your EVC (explained below), should match. IE; FD5 has an S-Tag of 3850 on the upstream switch, your S-Tag on the TA5K should match 3850 and the data this VLAN carrying.

There are several steps that have to be completed before a residential template, or profile, can be created.

-EVC (Ethernet Virtual Circuit) - this is essentially the vlan creation on the TA5K and assignment to an ethernet port.

-EVC Map - this defines how you handle the EVC. IE: Double tagged, MAC switch, CE-VLAn preservation.

-Ethernet Flow profile - this defines how you manipulate the service. Data or IGMP, Option 82 w/ remote ID, Proxies (ARP or DHCP) etc.

-Service Template - Rate limiting, combining EVCs for service provisioning, ONT Ethernet port assignments etc.

-ONT Profile - how many Ethernet, or Voice ports are enabled.

==========

Testing Parameters:

Residential services:

- -Internet
- -Video
- -Voice

Business services:

- -Internet
- -Video
- -Voice
- -TLS (Transparent LAN Service)
  - -PtP (Point to Point): On Adtran
  - -PtMP (Point to Multi-Point): On Adtran
  - -PtP: Off Adtran to 3rd party
  - -PtMP: Off Adtran to 3rd party

Bandwidth Throughput Performance:

Pseudowire Emulation (TDM service over IP)

SNMP Traps.

Ethernet Resilient Packet Switching (ERPS)

Link Aggregation Control Protocol (LACP)

Troubleshooting - ONT's

==========

Residential Testing - Most provisioning for Residential services are performed through AOE. The exception is dual services off a single interface (Explained below).

Internet

Goal: To have CPE device acquire a DHCP IP address and be able to access internet within their rate limited service.

Steps:

The data vlan of FD5 (S-Tag 3850) was extended on to the test x440 to port 45. I created an EVC of fd5-evc with an S-Tag of 3850 added it to the default ethernet interface. The software on the TA5K will automatically select the interface it thinks is the primary uplink. This can be manipulated in the EVC setup.

After setting up the Data EVC, I built the EVC-Map that outlined how the data would be handled. I blocked IGMP traffic. Enabled Option 82. Enabled DHCP Proxy - Snooping.

Results:
I tested this setup with both a laptop and a residential grade Netgear wireless router. Both tests were successful. They both pulled DHCP IP address, were able to access various websites within their assigned rate limit.

CONCERN!!!: During provisioning we noticed that the bandwidth limiting was finicky. If you don't apply the downstream shaper, that matches the p-bit of the EVC, this will cause the ONT to have a full Gigabit of bandwidth. This was proved when doing speedtests. It's also possible to circumvent AOE rate limiting by going into the ONT and ONT > Bandwidth > change to what you want here. It's also possible to "break" rate limited by making changes to the service template, then save, then modify the ONT, without modifying anything, then putting it out of service and then in service. This has happened a couple of times, but we need to do more testing to see if we can consistently get this to happen.

==========

VIDEO:

Goal:
To have a single and then multiple STB's acquire a multicast IP stream and display authorized content on the Television**.**

Steps:
The steps to setup video were very similar to that of Internet service. Video required the EVC (Ethernet Virtual Circuit), EVC-Map, and service template to be built.

Results:
After building the template and applying it to an ONT, on the 2nd Ethernet port, this service was working.

CONCERN!!! We noticed that when we ran speed tests on the data side of things, we weren't getting the full bandwidth. Video traffic and Data traffic seemed to using the same bandwidth rate limiting. It was determined that this was because the shaper was looking at a incoming p-bit (priority bit) of both VLAN 3850 (Data) and 3865 (Video), which both happened to be set to 0.

Shaper 0 was rate limited to 30Mbps. Thus any bandwidth available left after the multicast traffic was given to data. To fix this, we changed the incoming p-bit of video to be 4, or higher priority than data of 0. This then allowed the shaper to ignore any traffic coming in on 4, but concentrate rate limited to the p-bit of 0. After making this change, we could tune the 3 STB's to 4 (one was DVR and recording) multicast streams, and not have pixelation or reduce the data bandwidth.

==========

Data and Video on the same Ethernet port:

Goal: To provision dual services off one Ethernet port to maximize the MDU application of a 4 port ONT.

Steps:
We setup a profile to allow both Data and Video services off a single Ethernet port on the ONT. In the Service Designer, Under GPON/AE, I changed the Data EVC and Video EVC to be allowed on Port 1 only.

Results:
We were able to get Internet only to work when provisioning only in AOE.

CONCERN!!!
To get both Internet and Video to work off the same port, we have to log into the TA5K via CLI, AFTER THE ONT IS PROVISIONED, and add a MATCH MAC SOURCE 00:02:02:xx:xx:xx 00:02:02:ff:ff:ff command. If the ONT is ever removed, or the profile is deleted or the video service removed and then needs put back on, this command will need to be manually entered again. This command will also need to be applied to every port on the ONT that both Internet and Video is desired.

Additional testing required: During video testing we noticed that when assigning the Video service to multiple ports on the ONT, the 2nd ONT had issues with acquiring new multicast streams. This will be re-tested on 4-25-2014.

==========

Whole Home DVR:
Whole Home DVR was requested to be tested off the ONT. Essentially bridge the ethernet ports on the ONT to act like an unmanaged switch. Currently this is not a supported feature and is in the roadmap for Adtran. Dustin is uncertain if this will be a firmware upgrade or built into the hardware of future ONT's.

==========

Voice:

Goal:
Establish working phone service off a residential ONT.

Steps:
Created the SIP-EVC profiled. Entered the dial-plan information and allowable features (caller-id, call-waiting, etc.) I entered the metaswitch information for sip server info.

I used the test number for Network Operations of 555-867-5309- converted this to a sip line. During the service activation, I added the extension (or phone number), username (set the voiceline in metaswitch to authenticate against the TN as the username AND password).

After the ONT is provisioned it then downloads its SIP configuration from AOE. This means that AOE and the ONT have to be able to reach each other. Adtran is working on moving the SIP provisioning from IP based to OMCI (ONT Management Control Interface)

Results:
After the ONT downloaded is configuration file from AOE, I was able to make and receive calls. Call quality was acceptable. I didn't observe any static, echo, tunneling, or break up.

CONCERN!!!
There was observed instances of the SIP service that appeared to quit working after a while. Cause of this wasn't immediately known, but I believe it's a result of modifying an ONT services without deleting the services and then re-adding them. I've noticed that when I provision an ONT by deleting services first then re-provisioning, I have better luck with service stability and taking affect on the ONT.

==========

Business Services

TLS
This one was a bit trickier to get working correctly. In my mind, I thought that this would be a business template, but later learned that this is not according to Adtran. This service is setup in the Residential Templates.

==========

Point-to-Point Between two Adtran endpoints:

Goal:

To establish a working LAN between two laptops on remote ends of the Adtran Network.

Steps:
I created a new vlan called netops, S-Tag 715. I wanted to keep it simple as a start and just do single tagging from one ONT to another on the same Adtran blade on slot 6. This proved difficult in setting up so I contacted Adtran who advised that this kind of setup would be considered an E-LAN not a TLS. (This opposes the industry term of TLS.) So in order to setup an E-LAN for multiple points, you have to enable MAC Switching, create a custom flow that sets everything to transparent, including ARP Proxy (there was some debate about this between myself, Dustin, Diron, and Adam). Depending on how the customer is sending vlans (if at all), you need to enable CE-VLAN preservation and enable double tagging. IE CEVLAN= 215 => S-Tag 715 [715|215].

After creating the new EVC, EVC MAP, and Ethernet Flow, we were able to finally get pings acrossed the two ONTs. We had Summit 200 switches off the ONT's for testing purposes between sending untagged vlans and tagged vlans.

Results:
After working through the initial steps of getting the E-LAN created, I was able to ping across the two ONT's. Latency was <1 millisecond, which is great.

==========

Point-to-MultiPoint between Adtran ONT Endpoints:

Goal:
To establish a working LAN between three laptops on remote ends of the Adtran Network

Steps:
This was easy to implement after the PtP service profile was established. I just provisioned the 3rd ONT with the same profile and added the necessary vlans to the Summit 200 switch. I set the test laptops up with static IP's in the 192.168.1.0 CIDR /24.

Results:
After adding the 3rd ONT, I was able to ping to all laptops off the Summit switches.

==========

Point-to-Point between Adtran ONT and 3rd Party ONT:

Goal:
To establish a working LAN across Adtran ONT and a 3rd party ONT.

Steps:
I added the VLAN 715 to the port 45 Gige interface on the test x440 as tagged and then added it to port 44 on the same switch as untagged. This allowed me to extend the TLS network from the TA5K to another test laptop.

Results:
I was able to ping across without any issues.

==========

Point-to-MultiPoint between Adtran ONT and 3rd Party ONT:

Goal:
To establish a working LAN across Adtran ONT's and 3rd party ONT's

Steps:

I added the VLAN 715 to the x440 on Ports 24 and 48, then on Port 5:32 and 5:48 on the BD8K to the FD5 Card 13. I provisioned the test ONT there for TLS service.

Results:
This test was successful. I was able to successfully ping across to all laptops.

CONCERN!!!
The biggest problem with this setup, is that Adtran has virtually no documentation on TLS or E-LAN setup. The only setup support available was from those who know how to do this. This information was provided by Adtran.

I will be building specific step by steps for this procedure should we go with this solution.

When needing to deploy a TLS service on an ONT with Internet service, the TLS service will need to added via CLI. AOE only has a single downstream shaper. To provision TLS with a different bandwidth rate, the TLS EVC would need to assigned a different Priority value. A new Queue and Shaper would need to be created and assigned to that TLS EVC.

NOTE!! Any changes made in CLI, AOE is not made aware of them.

1. If you're troubleshooting the ONT, and look in AOE for services, TLS would not be listed.
2. If you make any changes to the ONT profile, such as bandwidth changes, the TLS service will be broken. Example: Oskaloosa School District has E-Rate every year. Every year the bandwidth will be changes for their ONT. Every year when that ONT is changed, the OSD

TLS link would be broken and would need to be manually rebuilt. It is unknown if Adtran has plans to correct this problem.

==========

Multiple Dwelling Unit (MDU)

Goal:
To provision multiple services off a single ethernet port, to maximize the amount of customers per ONT.

Steps:
I created a custom ethernet flow to allow both EVCs on the same interface. I then created a Service Template that allowed both services on the same interface and rate limited to 25 Mbps.

Results:
When I connected a residential switch off of Ethernet port 1, with a laptop and STB, I was only able to be Internet services to work. To resolve this, I had to add a command, via Command Line Interface (CLI), of MATCH MAC SOURCE “MAC ADDRESS”. I then also had to MATCH UNTAGGED Traffic in AOE. When these steps were added Video service began to work.
CONCERN!!!
To enable Internet and video services on the same port, additional provisioning is required via Command line. Additionally, in order to provision different bandwidth profiles on different ports, we would need to create additional EVC’s (VLANS) on the TA5K. We would then need to assign a different Priority Bit (P-Bit) to those individual EVC’s. A new Queue and Shaper would need to be created on the TA5K and assigned to the new EVCS. The Queue/Shaper would match the P-bit of the EVC. When these are created in the TA5K, AOE is not made aware of them. So after you provision the initial port, the remaining ports are unaware.

Any changes to the profile in AOE will break services for the remaining ports, as AOE is not aware of them, and will attempt to overwrite those settings.

Note: After the initial port provisioning in AOE, the remaining provisioning is done via CLI. It is quite possible to make mistakes and inadvertently affect the entire system.

==========

Remaining Items:

There are a few remaining items that are left to be tested: They are as follows:
1. Pseudowire Emulation - TDM services over IP networks.
2. TLS services in conjunction with Data, Video, and Voice off the same ONT. The challenge here is setting up the TLS and Data with separate queues and rate shapers so if the TLS is

30Mbps and the Data is 10Mbps, the TLS won't be affected by the Data rate limiting. I will be working with Adtran on setting up those queues on the TA5K. Once the shapers are set on the TA5K for that specific ONT, there can be no further changes allowed to that customer provisioning without the assistance of Network Operations as this will break the TLS service. AOE won't be made aware of the CLI changes made to the TA5K.
3. Multiple STB's off a single ONT.
4. Multiple services off a single ethernet port - on every ethernet port on the ONT.
5. ERPS - Ethernet Resilient Packet Switching.
6.TA5K service passthrough: Essentially daisy chaining TA5K's off each other, similar to the Calix B6-316 blades on the XG ports. I checked with Adtran and they advised this is possible and that's done by A: setting the EVC to connect to, not only the default ethernet interface, but also specifying the downstream interface. B: Changing the downstream interface to..well..downstream (literally). This is pending an additional TA5K from Adtran. I have a request in with Mike to acquire one.
7. Bandwidth testing - testing the throughput of the Gig-E ports. We've ran into a couple of issues, **1.** Laptops will not generate more than 70-100 Mbps of traffic. (This was tested through the network and laptop to laptop. This was also tested with i7 Quad core laptops and JPERF) **2.** The VEEX MX100+/MLX100 apparently do not have the 1Gig option enabled. Note: It appears we can use Copper SFP's in the optical ports for 1 Gig-E testing.

Summary/Misc:
Overall the TA5K and AOE will work, although a good portion of Business services require provisioning done via CLI.

It is compatible with NISC. We are unsure of how NISC will provision services. We are also not sure if it will provision to AOE or to the TA5K directly.

The plus side to the TA5K over the B6 blades is that the SCM card will allow for failed card replacement without the need to rebuild or reapply the configuration manually. This would be handy for reducing MTTR (Mean Time To Repair).

OPINION:
It appears that AOE and the TA5K are not mature products. AOE lacks the focus for a non-carrier ethernet deployment in the telecommunication field. To me, this means that Adtran has taken a product built for one solution and are trying to capitalize on it, in another area. I think that with time, AOE and the TA5K can be a more solid product with better front end provisioning, but right now with the amount of necessary back end provisioning needed for simple services, it would become a hindrance on company efficiencies.