AAA TRANSFORMATION

Internet Service Providers – Is it Time to Update Your AAA & Policy Infrastructure?

A cornerstone of DSL and other wireline IP data networks, AAA infrastructure serves as an important service and policy control framework, enabling internet service providers to control how their subscribers access and consume IP data services. In this capacity, AAA touches a number of areas within the core network and back office, from security to provisioning to billing and beyond.

While the core functions of AAA have remained, for the most part, unchanged since its inception in dialup and, later in DSL internet networks over a decade ago, today's rapid growth in subscriber numbers and overall data usage has placed new demands on the AAA infrastructure, not only in terms of network capacity and performance, but also in the creation and delivery of innovative, differentiated services that heighten the customer experience. Throughout the years, service providers have commonly introduced workarounds or stopgap solutions in an effort to extend the capabilities of the legacy AAA infrastructure to meet these new demands. Over time, this can create a complex and operationally inefficient AAA environment, one that inevitably limits scalability and hinders performance.

To emerge successful and profitable, service providers must employ an advanced AAA and policy framework, and do so efficiently without impacting existing services or the customer experience.

AAA Transformation is about more than replacing a "box" in your network; it is a holistic approach to evolving the AAA and policy framework in a legacy core network to one that is modern, scalable, and highly extensible, in order to realize sophisticated end-to-end business processes and to achieve greater network optimization. The following sections detail Alepo's approach to AAA Transformation, including design concepts and architectures of Alepo's high-performance AAA and Policy Framework for wireline internet service providers.

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A PERFORMANCE-DRIVEN AAA & POLICY FRAMEWORK

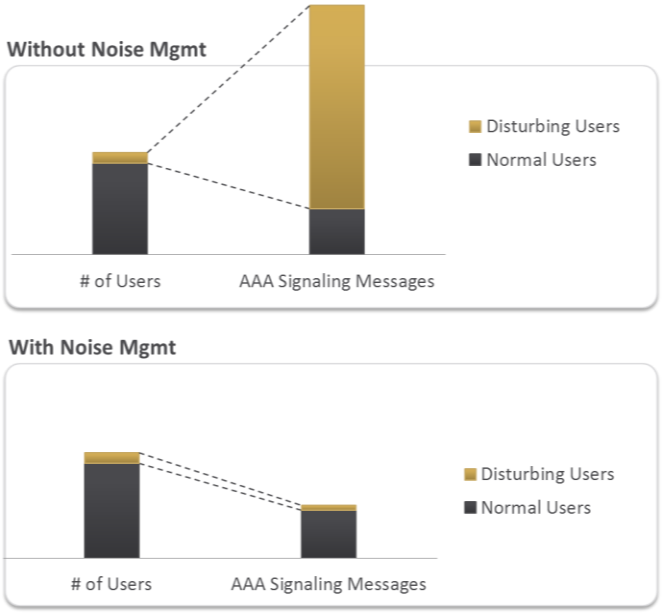
To realize true AAA Transformation, Alepo offers an advanced, carrier-grade AAA and Policy Framework. The performance-driven solution enables service providers to stay ahead of their growing networks and to expand the network alongside subscriber growth.

Alepo's reliable solution does not sacrifice flexibility or feature-richness either. Rather, it allows service providers to readily create new business plans and to bring new innovative products to market sooner, keeping them competitive and profitable. What's more, its open, flexible architecture allows for a rapid and cost-efficient deployment, including robust integration with third-party and legacy systems.

Noise Management

Alepo takes a multi-faceted approach to realizing a high-performance AAA and policy framework by intelligently handling and reducing signaling "noise" on the network. On wireline networks, AAA signaling noise is commonly produced by repeated authentication failures and errors. This is exacerbated by today's advanced CPEs and modems, which are designed to automatically and continually attempt to reconnect to the network upon rejection or disconnect, creating an endless loop of authentication requests that can burden the AAA system unproductively.

One way that Alepo's AAA solution efficiently mitigates noise issues is by using an intelligent combination of network counters, policy rules, and Alepo's Notification Center *(right)* in order to redirect disturbing users, instructing them to take some corrective action. For other types of noise, built-in system intelligence allows service providers to readily identify and block malicious or abusive attempts from disturbing or overwhelming the network.



AAA Signaling Messages with vs. without Noise Management

By efficiently handling authentication errors, Alepo's AAA solution lends itself to achieving greater network performance and capacity, not only of the AAA system, but also of the BRAS or NAS. More so, Alepo's approach to noise management promotes greater customer satisfaction by granting instant, automatic visibility and advice on connection issues that may otherwise impact or inhibit normal usage.

Alepo's Notification Center

Alepo's Notification Center makes it easier than ever for service providers to automatically communicate with customers when service issues arise by pushing pop-up messages through Alepo Web Self Care or by redirecting customers to a captive portal page to display an error message or instructions to contact support. This works to alleviate non-productive load on the AAA caused by repeated authentication rejections. For example, if there is some error that repeatedly rejects a customer's authentication, the end user's browser may be redirected to a captive portal that instructs him to troubleshoot or call customer care.

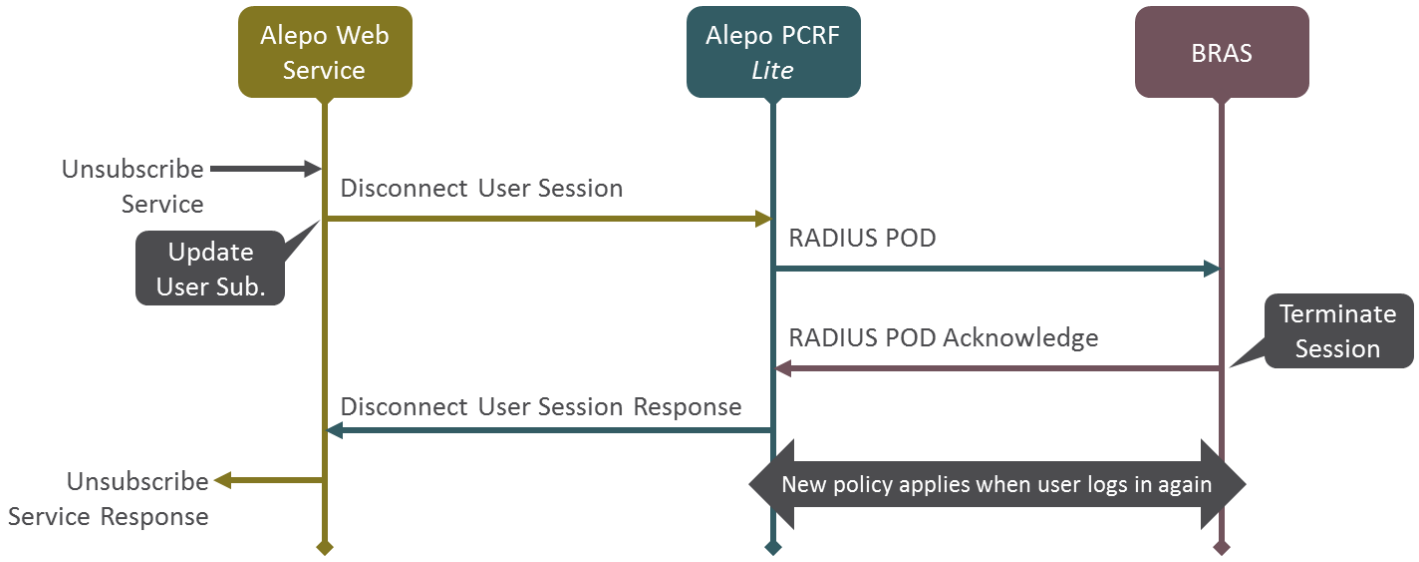
Real-Time Policy Control

As a centralized network policy decision point (PDP), Alepo's AAA and Policy Framework handles both "pull-based" and "push-based" policy control. This makes it possible for internet service providers to realize a myriad of common and advanced policy use cases, from enforcing fair usage policies to downgrading overactive users to installing parental controls and more.

"Pull-based" policy refers to policy decisions that are made upon request by the network access gateway (in the case of a DSL network, the BRAS). When a subscriber connects to the network, the BRAS sends the subscriber's information to the AAA, and the AAA responds with the subscriber's policy information. This could include the subscriber's bandwidth allotment, usage quota, and more.

A real-time or "push-based" policy layer (Alepo's PCRF Lite) extends Alepo's AAA and Policy Framework, enabling service providers to realize mid-session policy changes, such as a turbo button for on-demand bandwidth boosts or mid-session disconnects. "Push-based" policy means that the AAA and Policy Framework can send unsolicited messages to the BRAS for mid-session interaction. For example, if a customer elects to temporarily boost his bandwidth via Alepo's Web Self Care portal, the PCRF Lite instantly notifies the BRAS to install the change in policy.

Alepo's AAA and Policy Framework, including Alepo's PCRF Lite policy layer, functions fully in a true RADIUS network environment, giving service providers the option retain RADIUS protocol while supporting more advanced policy use cases. Alternatively, service providers who work within Diameter-based networks will find full functionality in Alepo's 3GPP-compliant Policy and Charging Rules Function (PCRF) and Diameter-based AAA solution. Alepo's signaling infrastructure is built with a highly scalable, dual RADIUS / Diameter stack to facilitate true network convergence and to ease core network evolution to 4G and beyond.



Business Processes Sophistication

A key driver for service providers to update or replace their legacy AAA infrastructure often stems from the need to realize more advanced business processes and more granular, differentiated service offerings. This is why Alepo's AAA solution is built on an open architecture that promotes flexibility, adaptability, and automation wherever possible. With it, service providers can bring new data services to market faster, and be reassured of their continued ability to do so in the future, even as market trends evolve and new, unforeseen business demands emerge.

Whether Alepo's AAA solution is deployed in a multi-vendor environment with integration towards legacy and third-party billing, charging, and CRM systems, or as part of an end-to-end Alepo solution[‡], service providers can be assured of its proven ability and performance.

Alepo's Scripting Engine

Alepo's software environment features a powerful scripting engine that boasts industry-leading high performance and sub-millisecond latency. It allows for new business rules to readily be written, tested, and implemented in house without having to recompile or "dirty up" the source code, so that service providers can realize new business requirements and customizations in a matter of minutes, without needing to call the AAA vendor to do so.

While similar network solutions on the market today commonly utilize scripts to realize new business rules, Alepo's scripting engine is unique in that it does not sacrifice performance to achieve flexibility. This means that all service providers - including those with tens of millions of subscribers - can enjoy the benefits of complex scripting.

Alepo's scripting engine employs a high-speed interpreter written in assembler, a state-of-the-art Just in Time (JIT) compiler, an innovative trace compiler integrated with advanced, SSA-based optimizations, and a highly tuned code generation backend to further heighten performance and reduce latency.

What's more, the scripting language offers human-readable scripting syntax to make for easier, user friendly scripting. Installing a new script is as easy as creating and saving a new text-based file in system folders; no server restart is required. In addition, use of the scripting engine helps to isolate the testing required for new customizations, allowing for more rapid, cost-effective deployment of new rules and logic.

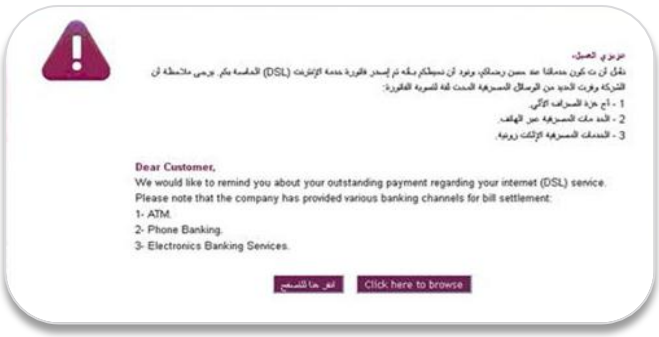
```
--[[
--      Authentication checks
]]--
--[[ WRONG PASSWORD ]]--
accessallow = 0
if (string.find(SpecialStatus,"INVALID_PASSWORD")) then
    if User["SkipPasswordCheck"] == 1 then
    accessallow = 1
    elseif (Group["CustomNumField2"] == 1 and string.len(User["CallerId"]) > 0  and
        RadiusRequestList["Alepo-Unique-Session-Id"] ~= nil) then
        local calling_station_id1
        if (string.match(RadiusRequestList["Alepo-Unique-Session-Id"], "%d+") ~= nil)
          calling_station_id1 = RadiusRequestList["Alepo-Unique-Session-Id"];
          if (User["CallerId"]==calling_station_id1) then
          LogWrite("Success:CLI Base Authentication for User-" .. User["UserName"])
            --RadiusReplyList["2"]["Class"] = ",Auth=CLI"
            CLIBaseAuth=1
            accessallow=1
          else
          LogWrite("Failure:CLI Base Authentication for User-" .. User["UserName"])
          end
        end
    end

   if (accessallow == 1) then
    local SpecialMessages=MM.split(",",SpecialStatus)
    local FinalSpecialMsg=""
    if (table.getn(SpecialMessages) > 0) then
        for k, v in ipairs(SpecialMessages) do
            if (tostring(v)~="INVALID_PASSWORD") then
                FinalSpecialMsg=FinalSpecialMsg .. tostring(v) .. ","
            end
        end
    end
    SpecialStatus=FinalSpecialMsg
   end
```

Sample script of Handling Authentication Errors

Dunning & Aging Processes

Alepo's Notification Center serves a number of customer-related use cases, including the support of dunning and aging processes. Subscribers with outstanding invoices or low account balances can be redirected to a captive portal to view notification messages before they are able to browse. Alepo's Notification Center pages are fully customizable in HTML. This is another example of Alepo's AAA solution readily adapts to fulfill the real-world business needs of service providers today.



An example of Alepo's Notification Center used to deliver a dunning message regarding an outstanding payment.

Intuitive Web 2.0 Enterprise Portal

Alepo's web-based Enterprise Portal brings to life the full functionality of Alepo's AAA and Policy Framework in an intuitive, Web 2.0 administrative GUI. The portal creates a centralized dashboard for service providers to efficiently and easily configure the system, define new services and business rules, handle all daily operations and maintenance, and review system-wide audit trails and logs.

Customizable, role-based portal access means that system administrators can define tiered tasks and responsibilities for different system users in order to increase productivity and reduce human error. Alepo's Java-powered enterprise portal features built-in audit trails, security, and other advanced management tools.

In addition, Alepo can implement its carrier-grade Customer Care solution alongside its AAA and Policy Framework, affording Point of Sale and customer care agents a complete 360° view of all customer-related information, greatly reducing time, costs, and errors associated with multiple customer databases. Alepo's Customer Care solution is feature-rich to make every customer interaction more accurate and efficient. Service providers with existing CRM systems and web portals can leverage Alepo's Integration Framework and high-performance APIs to achieve an integrated solution. Alepo can ensure an end-to-end solution that delivers on service providers' and their customers' needs – whether out-of-the-box or via integration.

Alepo Product & Service Catalogs

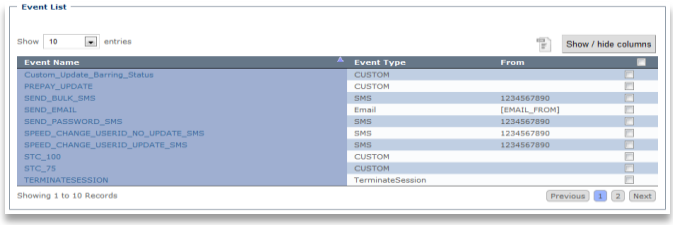
Alepo's centralized product and service catalogs facilitate a rapid time to market for new, innovative services and offers across the entire service provider environment. New product and service offerings can be readily defined and made available instantly to end customers, including all parameters related to Quality of Service, charging and billing, inventory allocation, subscriber segmentation, and more. Alepo's Enterprise Web Portal interface simplifies and streamlines the process with point-and-click configuration and user-friendly navigation.

Provisioning Optimization

By design, AAA infrastructure plays a leading role in the provisioning and fulfillment of IP data services, from the creation of new services and subscriber accounts to quota management and beyond. Multiple touch points to and from different network and IT systems are commonly required to carry out various provisioning processes efficiently. Alepo's AAA infrastructure excels at achieving a fast, reliable provisioning environment, leveraging Alepo's advanced, open architecture and rich library of APIs, as well as Alepo's extensive, proven field experience in systems integration.

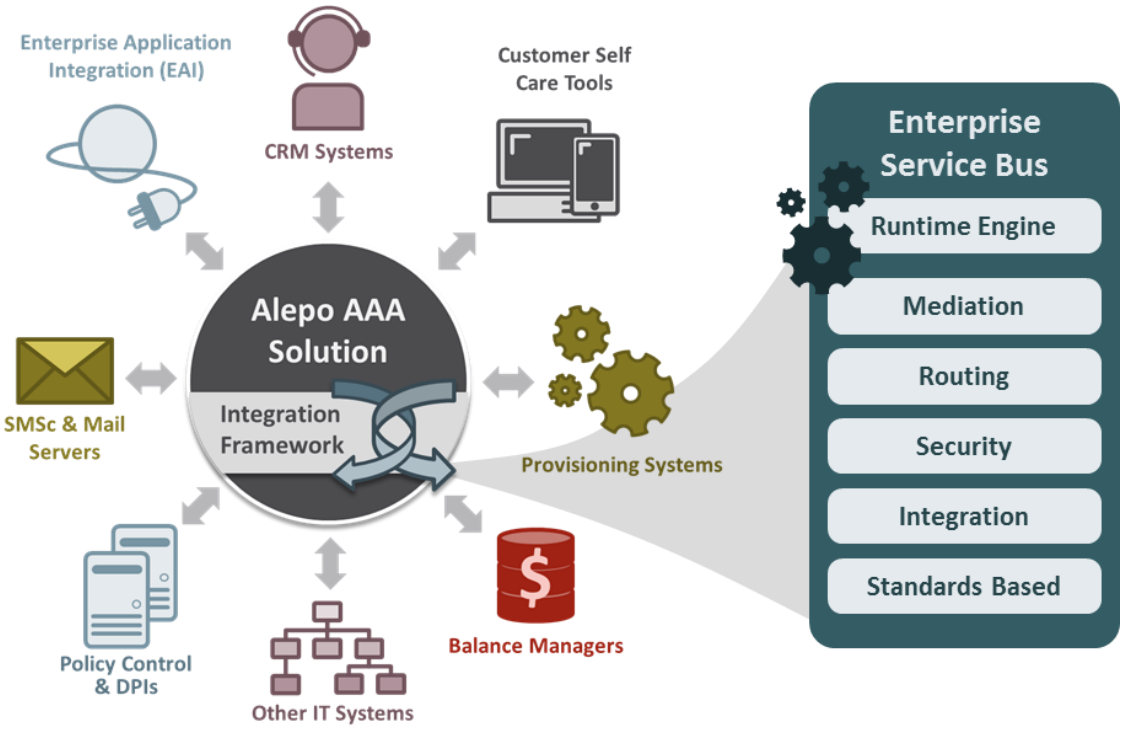
Alepo's Messaging & Event Framework

Alepo's Messaging & Events Framework provides a unified method of processing and asynchronously executing event-based messages to and from external systems, such as an SMSc, e-mail server, provisioning servers, or other IT systems. In doing so, it improves overall reliability and performance of Alepo's solution.



Integration Success

As with all Alepo software solutions, Alepo's AAA infrastructure leverages a proven, scalable integration framework, making it rapidly deployable and fully functional any best-of-breeds network. **Alepo's Integration Framework** is built on high-performance web services, enterprise service bus, a rich library of proven SOAP APIs, an integrated RADIUS client, IPv6 support, open Java portal technologies, and leading industry standards to facilitate smooth and scalable system integration. In doing so, it reduces the time and risks of integration as well as overall total cost of ownership.



Alepo Case Study: Saudi Telecom's AAA Transformation

Project Overview

In 2012, Saudi Telecom (STC) called on Alepo to replace its legacy AAA infrastructure in order to support a rapidly growing DSL subscriber base and evolving business needs. In addition to retaining the full functionality of the legacy system, STC required:

- More efficient APIs and integration
- Faster provisioning and fulfillment operations
- Greater scalability and capacity for growth
- Intelligence to design sophisticated business plans
- Ready adaptability to evolving business needs
- Integration with policy tools (PCRF, DPI)
- Intuitive management tools to ease daily operations
- A complete migration of all subscriber data

Alepo successfully delivered a comprehensive solution that leveraged its high-performance AAA infrastructure as well as expert professional services to integrate seamlessly with the existing network and to realize all of STC's requirements and business needs. Most importantly, Alepo did so ***without any downtime or impact on existing services or the customer experience.***

Proven Results

With Alepo's high-performance AAA solution and expert professional services, STC was able to achieve the following highlighted results:

- Increased AAA performance capacity ***three fold***
- Increased API response time ***100 fold***
- Eliminated provisioning queue lag
- Seamless integration with numerous network elements
- Increased subscriber capacity from 3 to ***10 million***
- Successful data migration and data cleanup with ***no reported errors or disturbances to subscribers' experience***
- Able to immediately test and implement new business logic in-house
- Continual ***low total cost of ownership (TCO)*** and investment protection, even as the network grows
- ***Lower OPEX*** with Alepo's Enterprise Portal (GUI)
- Continually backed by ***24 x 7 x 365 remote support***

Note: The case study above is an abridged version of the full case study. Please visit www.alepo.com or contact an Alepo representative to request the full version.

About Alepo

Alepo is a leading provider of IT and network infrastructure software solutions for communications service providers worldwide. Alepo works closely with market leaders including Vodafone, MTN, France Telecom, and Digicel, empowering them to compete aggressively and realize data opportunities across technologies and generations. Alepo is proud to support innovative market leaders as they evolve in the telecommunications marketplace.

Founded in 1994, Alepo is a major player in revenue and customer management, packet core evolution, carrier Wi-Fi, mobile data offload, fixed mobile convergence, and more. Today, Alepo's solutions reach millions of global subscribers, spanning technologies like LTE, HSPA+, ADSL, and Wi-Fi.

With core values of constant innovation, customer satisfaction, and recognizing and rewarding merit, Alepo strives to stay at the forefront of telecommunications technologies. Maturity, stability, and innovation make Alepo a leading solutions vendor for greenfield and established service providers.

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