Next Generation Networks Control Plane Evolution

Whitepaper by Traffix Systems

1. Introduction

Control plane signaling has been an issue since the early days of telecommunication. Telco carriers have started as wire accesses with human exchange. Later on, humans were replaced by efficient automated electro mechanic exchange[1]. At the 1980's, the central office electro mechanic exchange was replaced by low maintenance solid state digital circuit switches, but still at the cost of few million dollars each. Today, office LAN switch that costs 1,000$ can handle more switching then those exchanges.

Although equipment vendors moved to packet switching in the core, they still deliver the software controlling the switching bundled in monolithic package. Telco carriers needed the equipment vendors for introducing new services or modifying existing ones. To confront this, IN (Intelligent Network) was introduced in the 90s and enabled some of the much needed flexibility. However, IN is still far behind fully computerized and automated industries like enterprise IT and the Internet.

To enable the full flexibility in service creation and maintenance the core of the network should be decomposed into different

[1] http://en.wikipedia.org/wiki/Almon_Strowger

functionalities. This breakdown should allow an average software engineer with an idea for a new service or requirement for different functionality to modify the needed servers without knowledge of the internals of the core of the network. These servers should reside in the control plane connected via IP and replace the core of the Telco carrier network.

With this requirement in mind, NGN was introduced to allow Telco carriers to compete in the world governed by Google and alike. In NGN architecture, generic control plane signaling architecture based on Diameter (IETF RFC 3588) was defined to contest the old and fragmented world Authentication, Authorization and Accounting (AAA). Yet, the new architecture solved old problems but introduced new challenges for the Telco carriers.

We believe that in the control plane, Telco carries will have the biggest pain when introducing distributed concepts of IMS/NGN and service delivery.

2. NGN Control Plane Challenges from Telco View

The control plane pains affecting Telco carriers are:

1. **Management** – Networks have always been hard to manage. In NGN the distributed and fragmented nature of the control plane and the introduction of new functionalities combined with the more real-time and dynamic nature of the services makes this problem more severe than ever before.
2. **Scalability** – The control plane is less scalable in NGN than in the past, not only because of the number of new components, like policy and enforcing servers, but also because many

services are dependent upon other services (e.g. location, presence, etc…).

3. **Convergence** – There are three dimensions of convergence that are causing pain:
   - Connecting the Legacy to NGN because of different protocols (for example RADIUS on the legacy side and Diameter on the NGN side).
   - Connecting the various technologies (wireline, Mobile, WiMax, etc…) for Fixed Mobile Convergence, the standard bodies have created different variants and interfaces of Diameter.
   - Interoperability and vendor "lock-in", where each vendor has its own variants of specific Diameter interfaces.
4. **Multi Layer** – NGN is a great concept, but the introduction of a well defined horizontal architecture has also created a barrier between existing horizontal layers, thus affecting the ability of operators to synchronize their business layer with the network and the control plane.

3. Lessons from the past

The identified challenges have many similarities with past problems solved by introduction of Routers[2] and SOA.

1. Routers may provide connectivity inside enterprises, between enterprises and the Internet, and inside Internet Service Providers (ISP). The largest routers (like Cisco CRS-1 or Juniper T1600) interconnect between ISPs, used inside ISPs and very large enterprise networks. The smallest routers

[2] Router - http://en.wikipedia.org/wiki/Router

provide connectivity for small and home offices. Routers connect two or more logical subnets, which do not necessarily map one-to-one to the physical interfaces of the router. The term **layer 3 switch** is often used interchangeably with the term **Router**, but switch is really a general term without a rigorous technical definition. A router is a computer whose software and hardware are usually tailored to the tasks of routing and forwarding information. Traditional routers are built proprietary hardware and software (like Cisco's IOS or Juniper Networks JUNOS). High-end routers contain multiple modules where each module hosts multiple processors. With appropriate software (such as Untangle, XORP or Quagga), a standard PC can act as a router.

2. Services-Oriented Architecture (SOA)[3] is a software architecture where functionality is grouped around business processes and packaged as interoperable services. SOA also describes IT infrastructure which allows different applications to exchange data with one another as they participate in business processes. The aim is a loose coupling of services with operating systems, programming languages and other technologies which underlie applications. SOA separates functions into distinct units, or services, which are made accessible over a network in order that they can be combined and reused in the production of business applications. These services communicate with each other by passing data from one service to another, or by coordinating an activity between two or more services. SOA concepts are often seen as built upon, and evolving from older concepts of distributed computing and modular programming.

[3]SOA - http://en.wikipedia.org/wiki/Service-oriented_architecture

One can argue that **SOA** is a definition for **routing** business processes.

Thorough examination of Telco challenges, many similarities with data routing and SOA concept led Traffix to introduce the control plane signaling routing concept.
The innovation that control plane routing offers is in the fusion of two concepts that arise from different areas (networking and IT) together and with Traffix's control plane and Diameter expertise.

It is important to note that the concept of a centralized Diameter routing is not new and was introduced in the IETF Diameter standards as a Proxy Agent. In legacy networks centralized control management solutions (like STP), were used for fast introduction and configuration of services, however in the NGN and LTE network standard bodies have chosen to omit it.

Evidence from the Market

Today, Operators are starting to discover that the wheel turns around and that the past problems reappear. This is evident from the introduction of the first (again not standard) Diameter and control "in between" components like Diameter gateways, Diameter load balancers and proxies, it is becoming obvious as more services will be introduced the problem will be more severe and the need for Routers will arise.

About Traffix Systems

Traffix Systems is the Diameter control plane expert. Traffix supports telecom operators on their way to Next Generation Network (NGN, IMS or LTE) technology by providing cost saving Diameter solutions such as Diameter gateways and load-balancing solutions for the Diameter control plane achieving network connectivity and scalability and thus enabling the opportunities to generate new service revenues based on the Diameter control plane innovation.

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