

# NAC: An Architecture for Multimedia Content Adaptation for Mobile Devices

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In the current web infrastructure, access to content is achieved from a variety of terminals such as desktop PCs, smart phones, set top boxes and personal digital assistants (PDAs). The different capabilities of these terminals led to the development of a variety of parallel webs each one accommodating a particular device feature. This situation poses a serious problem to web designers and maintainers since every piece of information needs to be authored for every type of terminal with the associated protocols. Our research work in the WAM project at INRIA is an attempt to unify web access to information with a more flexible and negotiated approach.

Providing a tailored content and presentation for different clients in heterogeneous environments is becoming increasingly important today. Devices such as small palm computers, smart phones, pocket PCs are already common components of the computing infrastructure. Providing adapted content that takes into account all the range of devices and user agents is challenging since the capabilities of these terminals are evolving at rapid pace. On the other hand, web content is mostly designed for desktop PCs and to a lesser extent for terminals with poor capabilities such as first generation WAP based systems (screen resolution, bandwidth). Designing an infrastructure flexible enough to cope with this situation requires the modification of several components of the current web. At the lower layers, one of the basic requirements is the provision of a minimal knowledge about the different entities that compose the content delivery chain i.e. client, server, document and media resources, etc. Starting from such knowledge, adaptation mechanisms and content negotiation strategies could be applied to deliver to the target client a content that takes advantage of its capabilities and satisfies its constraints.

The negotiation and adaptation core, called NAC, is an architecture developed in order to provide a solution for the delivery of multimedia content in heterogeneous environments. For content generation, NAC uses dynamic and static adaptation techniques. The adaptation is controlled using an adaptation and negotiation module (called ANM), and an optional module, called UCM (user context module), that runs on embedded devices. UCM allows enriching the ANM knowledge about the client description in terms of profiles. NAC default organization is proxy-based (Figure 1), but the proxy entity can be omitted by using (installing) ANM at the server side.

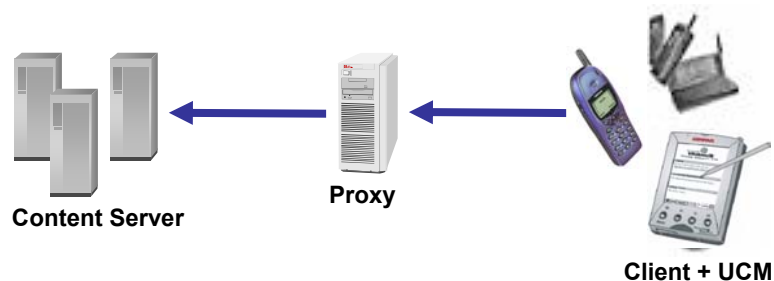


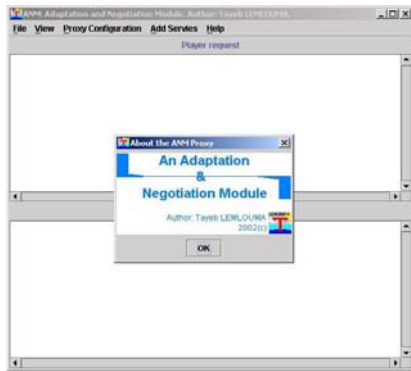
Figure 1: The NAC architecture

The proxy is a third entity that stands between servers and clients. This allows a better handling of the heterogeneity of clients and the variety of content representations on servers. Indeed, proxies allow content adaptation without affecting the existing components in the system. For the content generation by adaptation, the proxy (Figure 2.a) is the entity responsible of retrieving client requests and profiles and performing possible adaptation on the content received from the original server. The adapted content is then sent to the target client with respect to its characteristics. The proxy can transform existing multimedia content and thus the content has not to be authored in multiple versions. In such situations and in order to avoid the adaptation cost, a negotiation strategy is used to select the best variant to be delivered. All the proxy tasks are designed to behave transparently to clients and servers.

In NAC, the description of the environment (device capabilities and preferences, network limitation, content characteristics, etc.) is described as a set of constraints that the content provider should satisfy. In our approach, the constraints resolution strategy is achieved by adding progressively the constraints to the original content.

The universal profiling schemata (UPS) was defined in the NAC framework to have a central role in the generation of adapted content by modelling the different profiles of the environments. UPS extends CC/PP to describe not only the client capabilities and preferences but also the capabilities of servers and proxies, the characteristics of the content and the adaptation methods that may exist at the server or the proxy level. UPS identifies three main categories of contexts: the client category, the server category and the network category.

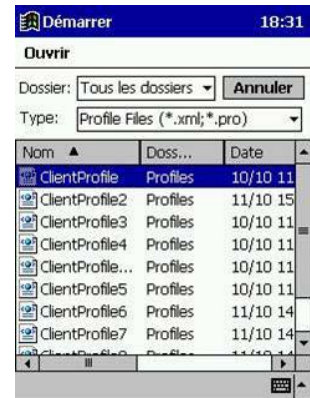
Profiles in the first category contain the description of the client characteristics (software, hardware and user agent) and the constraints related to the use of different media resources (supported media formats, size, resolution, etc.). The server category includes the *document instance profile* that describes the document characteristics and functionalities. It includes also the *resource profile* that describes media resources used in documents and the *adaptation method profile* that describes available adaptation methods that exist in the server or the proxy side. Finally, the *network profile* describes the network characteristics. ANM includes a set of adaptations techniques that ranges from real-time (re)encoding of media items such as video to structural transformations such as XHTML to WML.



(a) The proxy



(b) Pocket SMIL: an embedded multimedia player



(c) The User Context Module

Figure 2: NAC entities: the ANM proxy, Pocket SMIL and the UCM module

**Links:**

- <http://wam.inrialpes.fr>
- <http://opera.inrialpes.fr/people/Tayeb.Lemlouma/NAC.htm>
- <http://www.w3.org/Mobile/CCPP/>
- <http://www.w3.org/2001/di/>

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