

An Open Service Infrastructure for Enriching Networked Interactive Multimedia Experiences in a Converged World

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Abstract: The project iNEM4U (Interactive Networked Experiences in Multimedia for You) is developing a service infrastructure that enables users to share integrated multimedia experiences in networked environments. In iNEM4U, these experiences involve seamless combinations of multimedia content and value-added services from different domains of technology, such as the Web, in-home consumer electronics, mobile telecommunication networks, and interactive digital TV. This results in much richer multimedia experiences than are possible today, for instance in terms of level of interactivity, ease of use, and availability of community aspects. From a business perspective, the iNEM4U infrastructure allows different providers to establish cross-domain business collaborations so that they can collaboratively provide iNEM4U experiences. In this paper, we outline the project's vision and objectives and provide a brief overview of its first results (scenarios and overall system architecture).

Keywords: cross-technology interoperability, service and content integration, communities, service platform

1 INTRODUCTION

Today's multimedia services are predominantly IP-based, yet many of them fail to interoperate because they rely on different technologies at the service level (e.g., different protocols, user identities, or metadata formats). Examples are managed IPTV services (based on RTSP and IGMPv2), mobile telecommunications services (based on

IMS), in-home multimedia services for consumer electronics (e.g., based on DLNA/UPnP), and "Web 2.0" multimedia services (e.g., based on HTTP or peer-to-peer technologies).

The result of this lack of interoperability is that multimedia services are organized in a vertical way and are part of separate "technology domains". The result is a fragmented media landscape that limits the multimedia experience of end-users in several ways. For example,

- Users cannot engage with multimedia whenever and wherever they want because content and services are often bound to specific devices or networks. One of the consequences is that TV viewers cannot watch an IPTV stream on a mobile device using just their IPTV subscription;
- Services and content from different technology domains cannot be synchronized. For example, it is not possible to watch a show on television (interactive TV domain) and at the same time receive additional information about the show via the Web in a synchronized manner;
- Rich forms of personal interaction are restricted to services and communities in the PC domain; and
- Communities are bound to specific technology domains (usually the Web or the mobile domain), but are not integrated.

The goal of iNEM4U is to overcome these problems by means of an open service infrastructure that enables applications to seamlessly combine multimedia content and value-added services from providers in different

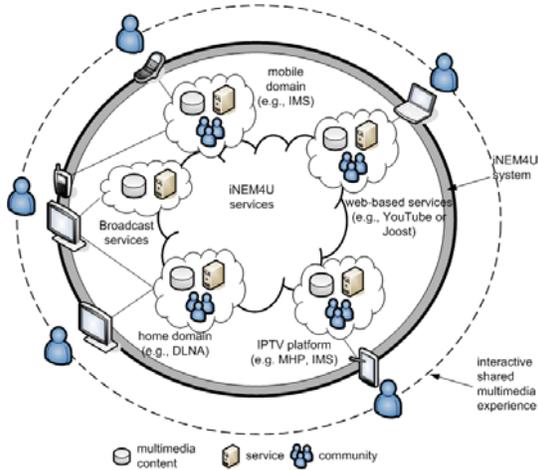


Figure 1. A cross-domain media experience.

technology domains into one service offering. This allows these applications to facilitate a richer user experience, for instance by combining high quality content from the world of interactive TV with community and interactivity services from the Web (“best of both worlds”). The other main advantage is that an open service infrastructure creates new business possibilities, for instance because it makes it easier for players in one technology domain to make their content and services available to consumers in another technology domain. iNEM4U focuses on media experiences for communities, which may be of a synchronous or asynchronous nature.

There exist various prior works on integrating different technology domains. For example, Mansutti et al. [3] developed a service infrastructure to integrate IMS with services on the Web. The difference with our work is that they focus on applications for instant group communications (e.g., integrating presence services, instant messaging, and voice/video capabilities), whereas we concentrate on sharing media experiences (which may include group communication services to enhance the experience). In addition, the services they are integrating are part of the IMS domain (i.e., within one technology domain).

Schatz et al. integrate broadcast services (DVB-H), IMS, and a Jabber-based chat service [7], which is what they call Mobile Social Interactive TV. They specifically focus on extending broadcast services with interactivity and community elements, whereas we focus on a more generic service infrastructure that supports a larger class of applications (e.g., applications in which users also actively share content).

Other related work deals with integrating the Web with broadcasting services [5] and on combining broadcast services and mobile telecom services [6]. These projects did however not consider media experiences for groups. There is also ongoing work on integrating social services on the Web with consumer electronics services [4].

In the rest of the paper, we discuss the vision of iNEM4U (Section 2), the project’s objectives (Section 3), and its results so far: scenarios (Section 4) and a first version of

the overall architecture (Section 5). We conclude with a summary and a short description of future work.

2 VISION

The vision of iNEM4U is an interoperable world in which multimedia content and value-added services from different technology domains can be seamlessly combined into rich interactive multimedia experiences for individuals and communities. By combining the unique features of domain-specific content and services, these experiences will provide a rich and intuitive way for people to people consume, share, and interact with multimedia content and also communicate about the content with each other. In addition, users will be able to obtain content from various domains, thus extending their range of available media. iNEM4U focuses on combining content and services from the worlds of interactive TV, the Web, mobile communications, and consumer electronics. Figure 1 shows an example of what an iNEM4U experience could look like.

The second cornerstone of our vision is that we believe that the content and services in an iNEM4U experience should be offered by different providers. This is in line with larger economic trends in which multiple providers team up in a network and together offer a service to end-users (value networks rather than chains). One of the advantages of such a collaborative approach is that it allows existing service providers such as broadcasters, long-tail content providers, and mobile operators to seamlessly include their domain-specific services in an iNEM4U experience, which increases the usage of these services, which in turn benefits the stakeholder providing the service. For example, a telecom operator could make its IMS-based billing services available to third party service providers on the Web so that they can bill their customers through their phone bill. Another advantage is that it will provide opportunities for new participants to

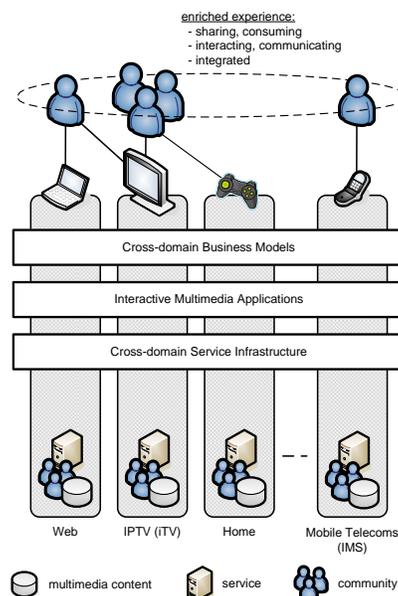


Figure 2. iNEM4U approach.

Service Enabler	Responsibility
Identity Management (G)	Relates different domain-specific identities of the same user
Synchronised Media Consumption (G)	Enables users to send, receive, and interact with multimedia content across multiple domains and devices in a synchronised manner
Metadata integration (G)	Integrates domain-specific metadata formats
Community Service (IC)	Supports the creation and modification of such cross-domain communities
Recommendation Service (IC)	Community-centric service that interacts with domain-specific recommendation services.
Shared Experience Service (IC)	Enables users and service/content providers to flexibly combine different services and content types into one session
Context Management Service (IC)	Enables applications to obtain context information from different domains through a unified interface and data format

Table 1. iNEM4U service enablers.

enter the market with relatively low investments, thus generating new business and new jobs. A new entrant could for instance combine an IMS presence service, professional content from an IPTV operator, and user-generated content from the Web into a single new service. Besides new multimedia services, iNEM4U value networks may also result in also revenue streams across or shared between domains, which in turn may enable domain-specific stakeholders to extend their reach into new markets (technology domains).

3 OBJECTIVES

To realize our vision, we aim for an open service infrastructure that operates across different technology domains and enables applications to facilitate rich integrated multimedia experiences. The objectives of iNEM4U are to (1) research and develop this service infrastructure, (2) investigate suitable business models for iNEM4U experiences, and (3) explore the impact of cross-domain aspects on end-user experiences.

3.1 Service Enablers

The technical work in iNEM4U focuses on R&D on the key functions needed to facilitate rich multimedia experiences. These functions take the form of “service enablers”, which are software components that can be used by developers to easily build cross-domain multimedia applications and by service providers to offer services that support these applications. Figure 2 illustrates this.

The iNEM4U service enablers allow applications to set up “sharing sessions” between people, for instance making it possible to:

- Mix professional content, user-generated content, and value-added services in one session, possibly in a synchronized manner (e.g., when a service needs to be activated when a certain content item appears).
- Allow people to interact with value-added services (e.g., a web shop) and the other people in the session. These interactions are part of the same session and may take place in various ways (e.g., verbally through a VoIP call, visually, or through other modalities such as gestures or vibrations).
- Use different types of rendering and interaction devices (using different types of networks) to participate in a session and seamlessly switch between them when necessary. Different parts of the same content item may be rendered on multiple time-synchronized devices.
- Allow people to participate in the session using their personal preferences, for instance to filter the information provided by the services in the session (e.g., based on someone’s interests).

An important characteristic of the iNEM4U service enablers is that they make use of existing domain-specific services and leverage existing standards and technologies in these domains. Because of their cross-domain nature, they help create an open ecosystem in which multimedia elements and value-added services from different technology domains can be easily mixed and matched into a rich multimedia experience.

iNEM4U distinguishes two types of enablers: generic cross-domain services and interactive community services. The first provide basic interoperability functions, whereas the latter support enhanced interactive multimedia experiences. The interactive community services build on the basic cross-domain services, but may also work directly with domain-specific services and content. Table 1 provides an overview of the enablers and whether they are generic (G) or interactive community services (IC).

We will design and develop an attractive (interactive TV) application that makes use of the iNEM4U service enablers.

3.2 Business Models

The iNEM4U service enablers will make it possible to build new value networks and offer new types of

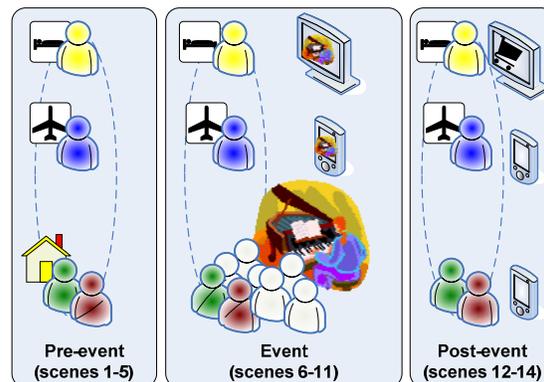


Figure 3. Scenario “Our Event”.

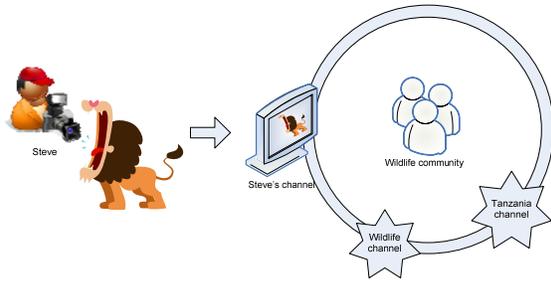


Figure 4. Steve adds his channel to the wildlife community.

multimedia services that facilitate rich multimedia experiences. Our work on business models will result in a few “blueprints” of iNEM4U value networks. This work will take existing domain-specific and cross-domain business models into account.

3.3 User Experiences

While experiences are very personal, we believe the richness of iNEM4U experiences may ultimately lead to people at remote locations actually sharing a similar experience. This will for instance increase the feeling of “connectedness” with other people or the perception of “involvement” in a particular shared experience, which are crucial factors in many application areas (e.g., in entertainment). One of our goals in the project is carry out a small scale experiments to validate these ideas. We will use our prototype system (application and underlying enablers) for this purpose.

4 SCENARIOS

As a first activity, we developed a number of scenarios. The purpose of these scenarios is to illustrate possible usages of the iNEM4U service infrastructure, to guide the business work, and to illustrate the project’s objectives in general. We ended up with three scenarios, which we call “Our Event”, “Community Channel”, and “Family and Friends”.

To construct the scenarios, we used a user centric approach. We started with collecting a large set of functionalities based on technical input and a number of usage stories describing possible usages of the system from a non-technical point of view. Next, we ranked the list of features based on criteria such as end-user perceived value, business value, and technical innovation and used the features to develop the actual scenarios. The detailed scenarios, the procedure we used to develop them, and an analysis of the scenarios from a technical and a business perspective can be found in [1]. In is paper, we only provide a summary of the three final scenarios.

4.1 OurEvent

The OurEvent scenario focuses on sharing a live event experience with a group of people that have gathered in an ad-hoc way around that live event. As such, issues like user generated content (UGC), the synchronisation of UGC and professional content and the real-time interaction between event participants are important. Further, the ad-hoc grouping is obviously important as well as services related to real-time events. Also, the

scenario places emphasis on location and event specific content recommendation.

From a community of individuals perspective, this scenario assumes the individuals gather around the event in an ad-hoc manner, while the other two scenarios focus on communities that form around real-life family and friends (Family & Friend scenario) and communities that form around a common topic of interest (Community Channel scenario). From a content perspective, this scenario focuses on content that is live, real-time, interactive and synchronised between different sources, whereas the other two scenarios focus more on messaging and keeping in touch in an asynchronous way (Family & Friends scenario) and content and services that revolve around one common interest (Community Channel scenario). A distinction has been made in the activities that are typical for the different phases around an event (see Figure 3).

4.2 Community Channel

The Community Channel scenario focuses on communities that form around a common topic of interest. As such, content is the grouping criterion for the community. The scenario has a strong focus on community created content, the mixing of professional content and user generated content as well as personalization of media ‘channels’. Such channels can be used to create individual media presence. Further, it addresses communities that interact with each other as well as integration of other community initiatives such as Facebook.

From a community of individuals perspective this scenario focuses on long term communities forming around content, while the other scenarios focus on ad-hoc communities gathered around a life event (OurEvent scenario) and existing communities of real life relatives (Family & Friends scenario). From a content perspective this scenario focuses on a longer term topic of interest and the services that could gather around such a topic, while the other two scenarios focus on real-time event content and services (OurEvent scenario) and content aimed at sharing messages and staying in touch in an asynchronous way (Family & Friends scenario). A typical situation of the Community Channel is given in Figure 4.

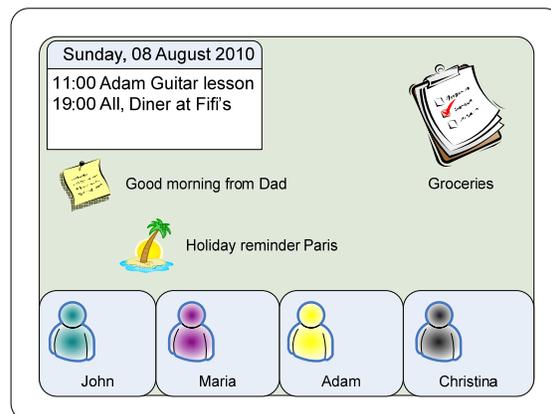


Figure 5. Example of tablet-PC Whiteboard UI.

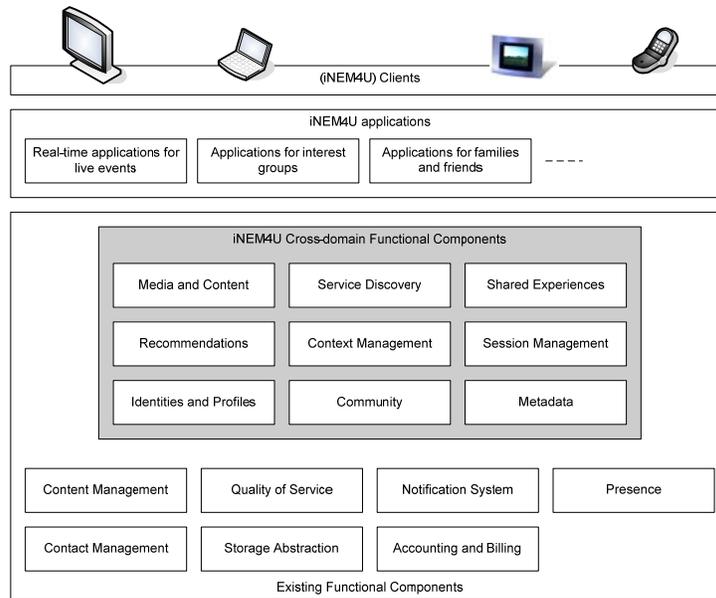


Figure 6. iNEM4U overall architecture.

4.3 Family & Friends

The Family & Friends scenario focuses on the support of existing networks of real-life relatives. As such, issues like multimedia messaging between relatives at different locations and time as well as shared multi-user home entertainment and information sharing are important. For example, family members can stay in touch with traveling relatives through a family whiteboard (see Figure 5). The scenario also emphasizes the sharing of different information networks and media centered around the home setting. One could think of kids having immediate access to their school network as well as travelling family members that have access to their home content in the hotel where they are staying and therefore can share the same media experience as those at home.

From a community of individuals perspective this scenario focuses mostly on already existing networks while the other two scenarios focus on ad-hoc communities around live events (OurEvent scenario) and communities gathered around a common topic of interest (Community Channel scenario). From a content and services perspective this scenario focuses on content aimed at staying in touch while the other two scenarios focus on content that is live, real-time, interactive and synchronized between different sources (OurEvent scenario) and content and services that revolve around a common interest (Community Channel scenario).

5 ARCHITECTURE

Figure 6 shows an overview of the iNEM4U overall architecture, which we are currently developing based on the iNEM4U scenarios [1] and the iNEM4U system requirements [2]. The core of the architecture consists of iNEM4U components and so-called “assumed components”. The iNEM4U enablers are new service enablers that will be developed within the project. They

act as bridges between external third party services and/or specific iNEM4U services. The assumed enablers are already existing enablers that the project will build upon. Table 2 provides an overview of the iNEM4U components.

Both types of enablers are available to iNEM4U applications through the public Internet and through managed environments (e.g., an IMS-based telecom operator network). iNEM4U applications make use of the enablers, enabling end-user and third party service access to the iNEM4U infrastructure via the Open Internet or

Component	Responsibility
Session Management	Setup cross-domain sharing sessions (content + services)
Shared Experiences	Allows users to participate in cross-domain sharing sessions
Media and Content	Cross-domain content acquisition, transformation, composition and delivery
Identities and Profiles	Cross-domain authentication, secure and privacy-aware sharing of user information, anonymous service usage.
Service Discovery	Discover and query metadata across domains
Community	Interoperate communities over different domains
Metadata	Create, obtain, use, and translate metadata for different domains
Recommendations	Recommendations about (content) items and services
Context Management	Collects, orders, stores, and distributes context information across domains

Table 2. iNEM4U components.

Managed Networks via Web Services and/or IMS interface to consume and offer services as well as consume and upload content.

Corresponding service flows identifying necessary communication between these components represent the interaction between the architectural components and corresponding scenarios.

6 SUMMARY AND FUTURE WORK

Today's landscape of networked multimedia is organized in a vertical manner, which limits the multimedia experience of end-users. iNEM4U is developing an open service infrastructure that enables applications to combine multimedia content and services from providers that are part of different domains of technology (managed IPTV, mobile telecommunications, the Web, and in-home consumer electronics) into one service, thus facilitating much richer experiencing and opening up new business opportunities.

We are currently developing our overall architecture and have begun to work on the architecture of the enablers themselves. We are also in the process of analyzing and developing typical value networks that are viable in an iNEM4U ecosystem.

Acknowledgments

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