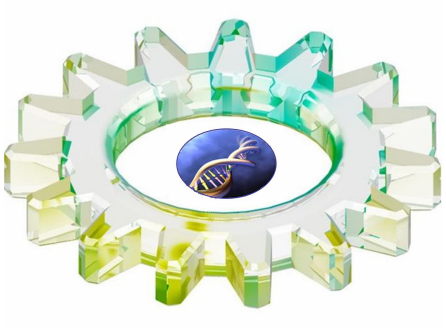

BIONETS

WP 3.3 – BUSINESS MODELS

NOKIA

D3.3.3 Enhanced BIONETS business concepts

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Executive Summary

The objectives of this document are to describe the current understanding of BIONETS architecture and ecosystem as a basis for viable business models and propose how successful business could be built on top of it.

In this document we present SWOT analysis of the BIONETS architecture as a platform for a viable business. Key conclusions from that work are that architecture has a great business potential, but the introduction of the architecture to the market is somewhat challenging. The online evolution is also problematic from the business model point of view.

We propose some approaches that should be taken in the introduction of the architecture to the market. We also propose that services should take inspiration from games to incentivize users to use BIONETS services.

Document History

Version History

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Summary of Changes

Version	*Section(s)*	*Synopsis of Change*
0.1	*All*	*Whole content improved*
0.11	*All*	*Comments from PD and DM included*
1.0	*Document info*	*Approved version*

Contents

1. Executive summary

This document describes the current understanding of BIONETS architecture and ecosystem as a basis for viable business models.

The original purpose was to document also experiences from "BIONETS-like" field trials i.e. Undersound, but as that activity was discontinued at the end of 2006 from the project, we did not get real world experiences from the social aspects of BIONETS-like trials.

In D3.3.1 [BIODelivD331] we proposed that a BIONETS internal value transfer system should be developed to enable some kind of means to transfer value between various actors within the system. That has not happened, unless we consider proposals made and simulated to use "data barter" between U-nodes to enhance the efficiency of data dissemination among U-nodes [BIODelivD43]. Thus it is necessary to build our business model proposal without built-in value transfer mechanisms.

From the SWOT analysis performed it is possible to conclude that the BIONETS architecture has great potential from the business point of view, but especially online evolution is a challenge. There is also need to look carefully at the introduction of BIONETS services/habitat to enable high enough penetration of services in a specific geographic area already from an early phase.

The key issue for the development of healthy BIONETS business ecosystem is the introduction of BIONETS architectural components to the market. The first problem – the availability of BIONETS compatible T-nodes – should be solved by developing BIONETS-based packages of T-node(s) plus relevant service set that should be marketed to existing local user communities. In the second phase, when some T-nodes are already in use the BIONETS habitat can be introduced to a larger set of U-nodes either by U-node manufacturers or as a free download to enhance the utility of the nodes.

When the BIONETS habitat is "mature" i.e. there are enough T-nodes and U-nodes in use, new types of T-nodes can also be introduced. Assuming a large number of operational U-nodes, it is possible to introduce wide range of various T-nodes distributing relevant information to the U-nodes. One foreseen category of these nodes is T-nodes distributing advertisements and offers in shops.

It is proposed that BIONETS services should be game-like to incentivise people to use BIONETS and thus enhance its operation.

As the development of the BIONETS concept is progressing it is important to implement as widely operating demonstrator(s) of BIONETS as possible and test them in real-life conditions. It is important to involve real user communities in these trials to gain knowledge about the impact of community into the operation and economics of the BIONETS concept.

2. Objective of this document

The objectives of this document are to describe the current understanding of BIONETS architecture and ecosystem as a basis for successful business models and propose how successful business could be built on top of it.

The original purpose was to document also experiences from “BIONETS-like” field trials i.e. Undersound, but as that activity was discontinued at the end of 2006 from the project we did not get real world experiences from the social aspects of BIONETS-like trials.

Section 3 contains a brief introduction to this document.

Section 4 presents a SWOT analysis of BIONETS architecture from business model point of view.

Section 5 proposes a business model approaches that to our current understanding would be the most suitable for building BIONETS based business.

Section 6 presents main conclusions of this work.

3. Introduction

In the first deliverable for BIONETS WP3.3 we proposed potentially applicable business models for BIONETS-based business [BIODelivD331]. At that stage the more elaborate information about BIONETS services, protocols and approaches was not yet available.

During the early planning of this deliverable we assumed that in addition to the technical and scientific developments within the BIONETS project we could also utilize experiences on social aspects from Undersound trial as a "BIONETS-like" architecture. That activity however was discontinued from the project and thus we do not have any new insight on possible social behaviour around BIONETS-like systems.

In D3.3.1 we proposed that a BIONETS internal value transfer system should be developed to enable some kind of means to transfer value between various actors within the system. That has not happened, unless we consider proposals made and simulated to use "data barter" between U-nodes to enhance the efficiency of data dissemination among U-nodes [BIODelivD43]. Thus it is necessary to build our business model proposal without built-in value transfer mechanisms.

This document describes our current understanding of the BIONETS architecture as a business platform.

In the D3.3.2 [BIODelivD332] we discussed economic theories and developments potentaially relevant for BIONETS architecture. In this document we have not based our proposals on those theories as there have been no BIONETS trials relevant for economic models yet. We do assume that BIONETS will allow new economic approaches when implemented more or less fully, but the introduction of the architecture need to be based on more "standard" economic approaches.

4. BIONETS architecture as a business platform

BIONETS architecture and services present certain advantages and disadvantages for business model building. This section highlights several such issues utilizing a traditional SWOT framework.

4.1 Strengths

Location specificity

The first and foremost strength of the BIONETS architecture is its location specificity. The new information the BIONETS habitat receives is always implicitly relevant to the location a U-node is located in. This makes it possible to build various services based on this information on the device itself with or without additional external information.

Adaptability

The second strength of BIONETS is its adaptability. Assuming full-blown BIONETS architecture with on-line evolution of services or other bio-inspired adaptation mechanisms the service set within a U-node can adapt even to unexpected environments.

Scalability

As BIONETS is not a centralized architecture it can scale up to enormous amounts of U-nodes and T-nodes. As services will primarily utilize only nodes they meet more or less physically (within a range of the proximity radio), the architecture can scale to very large numbers of nodes. The automatic data filtering and discarding of obsolete data will also enable scaling to long periods of time and large quantities of collected data.

User specificity

The BIONETS architecture requires a certain set of preferences from the service user to be able to work properly. Thus it also defines a playground in which services and data can be introduced to the user in relevant locations and according to user's preferences. This feature can be used for example for location-based advertising.

Energy efficiency

As the BIONETS architecture does not collect data centrally, the majority of the energy consumption related to data collection and transmission is avoided. In a centralized solution, if measurement information is collected from a large number of sensors in near real time, the connection from each sensor to the servers need to be kept on all the time and will consume quite lot of energy.

Low deployment cost

As BIONETS does not require fixed infrastructure to be put in place, its deployment costs are extremely reduced, providing a very low entry barrier to the market.

4.2 Weaknesses

Opportunistic communication

The first weakness comes from the fact that BIONETS nodes communicate only opportunistically. That naturally means that real-time applications are limited to only between those nodes that are within the connectivity range. Further, the best-effort nature of communications in the BIONETS world limits the range of services that could be offered (I. e. services requiring a given assured level of quality does not fit well with BIONETS):

Service evolution

Evolving services will also pose problems from a business model point of view. First of all according to our current understanding online evolution is a very resource-hungry process and thus does not suit very well for mobile devices.
Another problem related to online evolution is the fact that evolution creates new functionalities which according to current IPR laws do not have any "owner" and thus nobody could be kept as responsible for the functionality if it causes some issues during its operation. This may also cause other types of IPR problems as it is difficult to claim IPR ownership of a specific functionality in this type of environment.
Further, service evolution may pose some issues in terms of security (albeit some solutions have been envisioned in WP4 to minimize such risk) and related accountability (who can be blamed in case a failure in a software component harms devices and/or users?).

4.3 Opportunities

Scalability and energy efficiency

The greatest opportunities come from the key features of the BIONETS architecture which are the scalability of the system to very large number of nodes and relatively high energy efficiency.

Personalized preferences

Also the fact that personal U-nodes can contain highly personalised "preference lists" of the users makes it possible to build highly user-relevant information services for example in the form of "customized" advertising.

Location specificity

The third opportunity comes from the implicit location specificity of the information received from T-nodes, which guarantees that information within the BIONETS system is highly relevant to the user of a U-node.
This feature is also an enabler for potential social interactions utilizing BIONETS as a platform for "*zones of proximal development*" [Ha06].

Distributed Security/Trust management

BIONETS WP4 has progressed in several areas in defining security mechanisms for the BIONETS architecture. These are potential enablers for trust creation, evaluation

and maintenance in situations where centralized security infrastructure in not available.

4.4 Threats

Online Evolution

One threat for BIONETS is the fact that evolving services may not be accepted by the general public. It may be impossible to avoid maliciously behaving services if they are freely allowed to evolve.
Online evolution also creates issues related to IPR and trust in general. Due to online evolution it may not be possible to point any actor as responsible for a specific functionality as it may have evolved autonomously

Density of U-nodes

Another problem for BIONETS business is the fact that BIONETS services do not work very well if the density of T-nodes and especially the density of U-nodes is low. This means that the BIONETS habitat needs to be installed into a fairly large number of U-nodes in a specific geographic area relatively simultaneously during the service introduction.

Bootstrapping

This problem relates to the previous one. In order to ensure a purposeful BIONETS habitat, we need to enable BIONETS on the devices of a non-negligible share of the population active in a given area. While BIONETS services tend to become more and more attractive as more users join (as the available resources on the U-Nodes plane grows consequently), in order to successfully bootstrap BIONETS services an important marketing effort may be necessary, encompassing initiatives such as, e.g., online distributed games or social networking applications (“localized facebook”).

4.5 Conclusions on SWOT analysis

From this brief analysis it is possible to conclude that the BIONETS architecture has great potential from the business point of view, but especially online evolution is a challenge. There is also need to look carefully at the introduction of BIONETS services/habitat to enable sufficiently high penetration of services in a specific geographic area already from an early phase.

5. Business model proposal for BIONETS

Until now it has not been possible to form a stable picture about the technical capabilities of the BIONETS ecosystem. In the internal deliverable ID3.3.4 [BIODelivID334] we made an approach to describe BIONETS concept in a holistic way. This description is the basis for these proposals.

Unfortunately as there are no full demonstrations of BIONETS available yet, it has not been possible to gain any noticeable user experience about such systems. Thus this proposal is mainly based on the technical capabilities of BIONETS and generic information about features of mobile applications.

5.1 Recommended features for BIONETS business models

5.1.1 Actors in the BIONETS business ecosystem

According to D3.3.1 there are various actors in the BIONETS ecosystem. In practical systems however the number of actors should be minimized especially in the introduction phase. In the following we identify the most important actors, whose role is necessary for the market deployment of BIONETS services

Habitat/Service creator

Although BIONETS services may evolve over time autonomously, the platform itself needs to be created “manually” and the initial services as well. Depending on the viability of online code evolution all BIONETS services may need to be “pre-planned” to a certain extent. This actor should work using current open source SW model as evolution will create new derivatives of the system and other SW business models would not fit for this purpose.

Service/habitat introducer

To be able to run BIONETS services some actor needs to introduce the BIONETS habitat and initial services to a group of U-nodes. Later on additional services may be introduced by other actors. This act could be performed by some existing local community that is interested in running some BIONETS-based services.

(Remark: in a 'closed' environment the first two actors may coincide.)

Users

The number of users for BIONETS services has to be reasonable soon after the introduction of the concept, as BIONETS value is increased by the number of U-nodes interacting with each other roughly according to network law. The users could be the members of previously mentioned local community.

Data disseminators (T-nodes)

These are core parts of BIONETS architecture. As one of the main use cases for the BIONETS habitat is to use it as a collection and dissemination platform for sensor and other data, there is a need for actors who provide this data for the BIONETS users.

5.1.2 Service lifecycle issues

The introduction of the BIONETS habitat into U-nodes can be implemented by several means. One possibility is that the basic BIONETS habitat is built into U-nodes when they are sold to users as part of the operating system of the device. This would possibly enable high penetration of basic functionality over a relatively short period of time, assuming a reasonable market share for the device manufacturer at least regionally.

Another option is open source or shareware-type download into U-nodes having otherwise suitable capabilities. This would enable more existing community-driven introduction and assuming that BIONETS habitat does not pose too high requirements for the U-node platform it could possibly be installed into a wide variety of existing U-nodes (mobile phones). For getting high penetration in a short period of time in one physical area this would be the preferred solution.

As mentioned in the SWOT analysis, the data dissemination within the BIONETS system does not work very well if the density of U-nodes is low. Thus the introduction of BIONETS services can not happen only for example as a download from the web, but requires also a localized “campaign” component. This could happen for example in a mall by giving some discounts in exchange of installation of BIONETS service(s).

When planning for the services to be run on top of the BIONETS habitat they should be based on information that has a high local relevance for the users of the service.

The introduction of T-nodes for the architecture is a somewhat complicated issue as there is no good way to “sell” the data to U-nodes from T-nodes in the current architecture. The T-nodes could be installed for example by an existing community. For example the parents of schoolchildren could purchase an air-quality measuring T-node for their schoolyard. Another possibility could be that commercial actors would install T-nodes disseminating relevant information at their location similarly to today’s public thermometers. This could be motivated by just getting consumers to pass by to get the information. Other motivation for the commercial actors would be the possible customized advertising via the T-node.

5.1.3 Service features and operation

As one of the key features of the BIONETS systems is the data collection and dissemination function of the system, the BIONETS business model should be built in such a way that it incentivizes users to collect as much information as conveniently possible and also facilitates the efficient dissemination of such information. Naturally this means that information to be collected should be of high interest among the users of BIONETS services.

One way to do the incentivizing is to build the application into a game format. The inspiration could be sought from things like geo-caching or MMORPGs.
The BIONETS system could also be used as a “connector” between the real world i.e. measurements and other information about the real world could be used as an input or “fuel” for a game in the virtual world.

As BIONETS is not really a real-time system the BIONETS services should be as delay-tolerant as possible.

The current BIONETS scenario descriptions do not describe the user interface properties of BIONETS services except the Interactive maps scenario in which the collected data is shown on a map. User interfaces for the services should be built according to best practices for mobile device user interfaces.

5.1.4 End-of life issues

So far the project has not dealt too much with the end-of-life issues for the services. In evolution research “death” of services is common, but in real systems this phenomenon is still to be seen. Based on the current work we can however conclude that the BIONETS ecosystem should be resilient to disappearance of any U-node i.e. collected data should reside in multiple locations. It would also be a useful feature if the data collected in single U-node could be backed up and restored into a new environment when that underlying HW or SW platform is upgraded.

The T-nodes that are not used any more for one reason or another should also be removed from the environment. This should be the responsibility of the original introducer of the T-node. T-nodes should be made so that their disposal will not introduce any hazardous waste. They should also be returned to the manufacturer for recycling like consumer electronic devices in many countries already are.

5.2 Proposal for BIONETS business

In this section we propose a concrete way to introduce the BIONETS habitat as a platform for various services.

The key stumbling block for BIONETS architecture-based business is the introduction of all the needed architectural components. The easiest solution foreseen for this problem is to start by selling specific T-nodes for measuring parameters of general interest. In addition to BIONETS compatible T-nodes the node manufacturer disseminates a BIONETS habitat and an initial service set for using these sensors. This habitat should be installable into existing mobile devices users already have.

In an ideal case the sensors should be marketed to existing groups of users so that the community aspect of BIONETS could be utilized from the start.
In this approach there should be a wide selection of T-nodes and service sets available targeted for various specific user groups, but they should all be based on a compatible BIONETS habitat to enable a healthy BIONETS ecosystem growth over time.

The other practical option for introducing the BIONETS habitat to U-nodes is either directly as part of mobile device firmware or as a free download to it. This would be motivated by the fact that having the BIONETS habitat running in a mobile device would increase the utility of the device for the user and thus make it more

competitive. In this approach there is the problem that making the habitat generally available will not guarantee the availability of relevant T-nodes. There will also be no direct link to existing local communities, unless specific marketing actions are implemented towards that direction.

When BIONETS-compatible T-nodes are available and in use, it will be possible to introduce services based on information from those nodes independently of node sales. These service packages should also be of open source nature as evolution of services practically makes other SW business models impractical since in general in open source model the monetizing of the service introduction should happen via consultation and education of the users and/or via advertising.

When the BIONETS habitat is “mature” i.e. there are enough T-nodes and U-nodes in use, new types of T-nodes can also be introduced. Assuming a large number of operational U-nodes, it is possible to introduce wide range of various T-nodes distributing relevant information for the U-node users. One foreseen category of these nodes is T-nodes distributing advertisements and offers in shops.

6. Conclusions and further work

From the SWOT analysis it is possible to conclude that the BIONETS architecture has great potential from the business point of view. However it is not yet clear if online evolution is a feature that can be profitably implemented. There is also need to look carefully at the introduction of the BIONETS services/habitat to enable high enough penetration of services in a specific geographic area already from an early phase.

As majority of BIONETS functionality is relatively lightweight to implement it is possible to install the BIONETS habitat potentially into an order of one billion existing mobile devices (Smartphones). How widely this architecture will be ultimately applied, is up to the usability and ultimate value to the end users of the services provided.

The key issue for the development of a healthy BIONETS business ecosystem is the introduction of BIONETS architectural components to the market. The first problem – the availability of BIONETS-compatible T-nodes – should be solved by developing BIONETS-based packages of T-node(s) plus a relevant service set that should be marketed to existing local user communities. In the second phase, when some T-nodes are already in use the BIONETS habitat can be introduced to a larger set of U-nodes either by U-node manufacturers or as a free download to enhance the utility of the nodes.

It is proposed that BIONETS services should be game-like to incentivise people to use BIONETS and thus enhance its operation.

As the development of the BIONETS concept is progressing it is important to implement as widely operating demonstrator(s) of BIONETS as possible and test them in real-life conditions. It is important to involve real user communities into these trials to gain knowledge about the impact of community into the operation of the BIONETS concept and vice versa.

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