Libre Texting: A Reshaping of the Medium
An NSF SBIR Proposal

Neda Communications, Inc.

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About this Document

This document is the transcript of a Small Business Innovation Program (SBIR) proposal, submitted to the National Science Foundation (NSF) by Neda Communications, Inc. on December 3, 2009.

SBIR proposals are rarely web published. This is because SBIR proposals are usually about the development of a proprietary technology, and so must be kept confidential to maintain proprietary ownership of the technology. Furthermore the quality of the proposal, and the nature of the statements and claims made within the proposal, may prove embarrassing if made public. The proposal is also kept private to avoid any adverse effect on the corporate image of the originating company. For these reasons there are very few examples of NSF SBIRs available for public examination.

In contrast to the usual practice, we have web published our SBIR proposal for free examination by anyone. We have done so for several reasons:

- Because we can. Our proposal is entirely non-proprietary, requiring none of the usual ownership protection mechanisms such as patents, copyright, or trade secrecy. The proposed technology is patent-free, copyleft, and based entirely on free software. There are thus no confidentiality requirements.
- Because we believe in the societal benefits of openness and transparency. Specifically, we believe that the technologies and assets resulting from research are vastly more beneficial to society when they are freely available for use as a public asset.
- Because we take pride in our work, and we are pleased to make it public.

The present document is materially identical to the original SBIR submission. It has been edited to correct some minor solecisms, and also reformatted for easier online reading. The following documents provide a more detailed description and further information about the Libre Texting project:

- Libre Texting: A Collaborative Initiative and Reference Implementation
  http://www.neda.com/PLPC/110015
- ByStar Libre Texting Business Plan
  http://www.neda.com/PLPC/110019

If you wish to know more or wish to participate in this open initiative, please contact us.

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1 Project Summary

1.1 Intellectual Merit

This Small Business Innovation Research Phase I project proposes Libre Texting: a new incarnation of the Mobile Email/Wireless Texting (henceforth "Texting") medium, based on the Free Software ideology. Today the Texting industry is dominated by the proprietary, walled garden model. Libre Texting aims to provide equivalent functionality to existing proprietary Texting solutions such as BlackBerry, but (a) based entirely on patent-free protocols and free software, (b) using any mobile Internet device, (c) wherever any type of wireless Internet connectivity is available. The proposed approach comprises five elements: (1) the inherent propagative power of the Free Software and end-to-end models, (2) an overlay network architecture, (3) a new set of messaging protocols, (4) a novel software architecture for Message Transfer Agent integration, and (5) a new software architecture for multiform device integration, based on Device-Resident End-MTA middleware. The proposed technology is highly synergistic with current industry dynamics, including: burgeoning recognition of the power of FOSS, ready availability of Linux-based mobile devices, and widespread Wi-Fi availability. Existing email protocols lack push-mode delivery, and bandwidth and power efficiency; the proposed new protocol profile corrects these shortcomings. The proposed research is to determine feasibility of all critical elements of this approach at large scale.

1.2 Broader Impacts

The proposed Libre Texting technology is transformative, allowing the current walled-garden hegemony to be broken, and creating a new point of convergence as the standard. This has major engineering, business and societal consequences, with tangible benefits to the end-user. For example, greatly expanded range of choice—the user can now make independent selection of each component of her Texting setup, including the user interface, the Mail User Agent, the device, and other desired components (forwarders, synchronizers, filters). The Libre Texting technology unbundles the Texting application, opening every point of the Texting technology chain to competition and best-in-class component selection. Furthermore, the Libre model opens the Texting industry to the powerful free software generative dynamics. Businesswise, this Libre Texting initiative represents a radical shift of the Texting industry to the non-proprietary, for-profit quadrant, causing a major industry reconfiguration, with significant winners and losers. The losers are the existing vested proprietary interests, whose economic hegemony vanishes. But the winners are the many more companies who can now enter the Texting market—and the end-user who benefits from the resulting competition. Regarding broader societal consequences, the Libre model provides assurances of transparency, privacy and freedom of speech—assurances absent under the proprietary model.

2 Identification and Significance of the Innovation

We are proposing a new incarnation of the Mobile Email/Wireless Texting medium (henceforth just "Texting"), based on the ideological principles of Free Software. We refer to this new incarnation as the **Libre Texting** model. Texting is already well established as a communications medium. But today the Texting industry exists in the form of a proprietary, walled-garden model, controlled by a small number of powerful proprietary commercial interests. The goal of the Libre Texting initiative is to provide equivalent functionality to existing proprietary Texting solutions such as BlackBerry, but:

- In a completely non-proprietary form
- Using *any* mobile Internet device
- Wherever *any* type of wireless Internet connectivity is available
- At very large (planet-wide) scale

The strategy to accomplish this has two distinct parts: the "model" part, and the technology part.

2.1 The Model

The model part refers to the technocratic context within which the Texting functionality exists and is delivered. The proposed model is completely non-proprietary, or **Libre**. This means that the Texting service is based exclusively on patent-free protocols [**?**], implemented exclusively in free software, and conforms fully to the Internet end-to-end principle.

The upshot of all this is that the Libre Texting technology does not carry any restrictive limitations on its dissemination, implementation, or usage by anyone.

2.2 The Technology

The technology part consists of the technological innovations required for practical, large-scale implementation of Libre Texting. The critical enabling technology consists of the following four components, acting together in close integration:

- An Overlay Network architecture for end-to-end communication, permitting NAT traversal, and push.
- A new set of messaging protocols, providing push-mode delivery, wide-area narrowband efficiency, and scalability.
- A novel software architecture for smooth integration into existing Message Transfer Agents (MTAs). This is necessary for ready industry adoption and integration into multiple MTAs.
- A novel software architecture for uniform integration with multiple existing open-platform devices and Mail User Agents. The proposed architecture is based on the concept of a Device-Resident End-MTA middleware module, as intermediary between the protocol software and the MUA.

Note that the Libre Texting initiative is not about new or enhanced messaging functionality. In terms of capability, Libre Texting provides essentially equivalent functionality to existing Mobile Messaging/Texting solutions such as the proprietary BlackBerry system. Rather, it is about a radically new model for ownership and delivery of this functionality.

Though the model is the critical basis for Libre Texting, it is not the subject of this project. As a starting-point assumption, we take the viability of the Libre model for granted. This research proposal is focused entirely on the above technology components. Specifically, the key focus of the research is to determine feasibility of these technology solutions at large scale.

To sum all this up, the proposal is *to determine feasibility of the critical technological components required for practical implementation of a complete Texting service, based on the Libre model, on a multiplicity of devices, and at very large (planet-wide) scale*.

This, of course, has enormous business consequences. Should this proposal prove feasible, we plan to develop the business dimension to profit from our unique leadership role.

3 Background and Phase I Technical Objectives

3.1 About this resubmission

This is a resubmission of an SBIR proposal previously submitted to the NSF. The proposal was first submitted on June 9, 2009, as proposal number 0946146. That proposal was declined by the NSF. We received notification of this decision, along with the review comments, on November 02, 2009.

We subjected the review comments to our own internal review, and concluded that they are almost entirely incorrect, representing a near-total lack of understanding by the reviewers of the substance of the proposal.

The following materials relating to our initial submission, our subsequent analysis, and this resubmission are available for review online:

- The proposal as originally submitted: http://www.neda.com/Records/200906091
- The NSF review comments, as provided to us via FastLane: http://www.neda.com/Records/200911031
- A Live Case Study, presenting our own analysis of NSF review comments and process: http://www.neda.com/PLPC/110016

3.2 Background

The mobile messaging industry of today is a closed, proprietary construct. The wireless phone companies and/or their business partners own and control every component of the messaging service, including the device, the protocols, the software and the network.

In addition to their proprietary nature, existing wireless texting/messaging implementations (telephony SMS, and mobile email solutions such as BlackBerry) violate the Internet end-to-end principle by implementing centrally controlled, service provider store-and-forward components as a function "within" the network. This is in contrast to the Internet email architecture, which is end-to-end.

3.2.1 Requisite industry assets

Until quite recently, implementation of a Texting solution outside these walled-garden environments has been blocked by absence of the necessary non-proprietary components, such as open devices and public wireless spectrum. But now a completely non-proprietary, end-to-end Libre Texting solution is technically possible. This is enabled by a number of industry developments:

- Public spectrum Wi-Fi is now ubiquitous and has become the standard technology for final-leg device connectivity. In many locations Wi-Fi is available for direct, single-leg connectivity between the mobile device and the open Internet. This coverage can be expected to spread, eventually resulting in near-universal Wi-Fi Internet access.
- In situations or locations where direct Wi-Fi Internet connectivity is not available, a number of wide-area networks now exist to provide second-to-last-leg, wide-area wireless connectivity.
- Mature and sophisticated Linux-based PDAs are readily available as generic open mobile devices.
- Open, patent-free protocols exist for efficient wireless messaging. Also, device and server implementations of the protocols exist in the form of free software.
- The eventual transition to IPv6 will allow restoration of the true mobile Internet end-to-end model, delivering mobile messaging capability without any form of built-in dependence on the service provider.

Thus all the necessary industry assets are now in place to implement a completely Libre Texting service. Every component of the service can be implemented in an open form, without any closed or proprietary or dependencies. This includes the device, the protocols, the software, and access to the wireless network.

3.2.2 The opportunity

The opportunity is now also in place.

The existing Texting/Mobile-Email industry is dysfunctional and unstable in a number of respects. First, the industry is severely fragmented. In 2009 there are five major mobile messaging players: BlackBerry, AT&T + Apple iPhone, Sprint + Palm Pre, T-Mobile + Google Android, and Microsoft PocketPC. These all provide essentially the same functionality. Yet these are isolated islands of functionality, based on different devices, different protocols, and different Mail User Agents, none of which are cross-compatible. A systems integrator or user cannot mix and match among these components. As additional industry players attempt to muscle their way into the lucrative Texting market, all indications are that this fragmentation will increase.

In the long term, this situation is untenable. As a global communications medium, there are strong forces of convergence towards a single dominant solution. Sooner or later the industry must and will coalesce around a unified Texting solution, providing across-the-board, industry-wide standardization.

In addition, there are strong strategic forces at work for change within the industry. Today the industry is a proprietary hegemony, from which small business players are excluded. Also excluded are some very large players, exceedingly covetous of the gigantic Texting market. Thus there is great pressure to break the walled-garden regime, by powerful forces outside the walled garden.

Given all this, a major industry shift of some sort is inevitable. Whether acting individually or in concert, there is strong motivation among the industry players to preemptively fabricate, and lay claim to, the elusive point of convergence. The preemptive fabrications may take many forms, but are likely to be quasi-Libre constructs, superficially resembling the true Libre solution we propose.

We believe that the Libre Texting model is ideally constituted to emerge as the decisive point of stability and convergence. In contrast to the existing proprietary incumbents, and any quasi-Libre upstart, Libre Texting is not constrained by any form of proprietary ownership mechanism such as patents or restrictive copyright. This is the fundamental generative power of the free/Libre model. It is this power that can cause Libre Texting to displace the existing proprietary regime, in the face of ferocious attempts by very powerful vested interests to defeat it in favor of the status quo.

Our goal is to establish Libre Texting as the convergence point and common standard for operation of all devices, and all message transfer services, worldwide. We believe Libre Texting is the right solution at the right time. The inherent generative power of the Libre model, together with the current industry instabilities, together with the four enabling technological innovations we describe, together with sophisticated engineering and business execution—all this can destroy the existing proprietary regime completely, preemptively stifle any quasi-Libre hijack attempt, and establish Libre Texting as the new industry standard.

The long-term forces towards convergence dictate an ultimate, winner-takes-all scenario. That winner can be us.

3.2.3 Definitions

A consistent terminology for wireless texting/messaging has not yet been established, and terms such as "texting," "wireless messaging," and "mobile email" are often used interchangeably, and with different meanings. "Texting" is often used in the context of telephony SMS, and "messaging" is often used in the context of mobile email, but this usage is by no means universal. The best we can do is define our own terms clearly.

We use the term **Texting** to mean a mobile messaging service that:

- Supports the unconscious carry, always on, model for device usage
- Supports immediate (push-mode) delivery and alert for right-now messaging
- Is a functional extension of Internet email, oriented to short text messages

Thus we are here talking about an email-type service, with a richer functionality than today's telephony SMS.

In terms of model, we now formally define **Libre Texting** as a Texting service that:

- Is based exclusively on patent-free protocols
- Is based exclusively on 100% free software
- Is delivered as a Libre Service
- Conforms fully to the Internet end-to-end model

We also define a **Libre Texting Device** as a device that:

- Has an unconscious-carry form factor (shirt or pants pocket)
- Has text format input and output capability
- Has Wi-Fi for last-leg connectivity, or other form of wireless Internet connectivity
- Is an open platform—i.e. permits unrestricted software addition and configuration

Note that there is no implication that the device is necessarily a traditional data-enabled mobile phone. To the contrary, our baseline assumption throughout this proposal is that the device takes the form of a typical Wi-Fi-based Mobile Internet Device (MID).

Wi-Fi capability is now near-universal in mobile devices, so that this is by far the most common form of last-leg device connectivity. But Wi-Fi specifically is in no way a requirement, and any form of Internet connectivity will suffice.

In 2009 a large number of Libre Texting Devices are available in the marketplace, including Nokia 800/810/n900, unlocked Android, unlocked iPhone, PocketPC, and others.

3.2.4 The user experience

We assume the following initial conditions as a starting point: (1) the user already has or will independently acquire a Libre Texting Device as defined above, and (2) the user has final-leg Wi-Fi (or other wireless) connectivity to the Internet.

Setting up Libre Texting service starts with provisioning the user with the necessary accounts and access credentials. She starts by accessing the generic Libre Texting website, and creating a new account for herself. At the time of account creation, the following items are created for her:

- A Libre Texting account, and account credentials (username and password)
- Overlay Network access credentials (username and password)
- A unique Overlay Network static IP address

Next, we set up her mobile device with the necessary software, and configure the device with her account credentials. Using the mobile device, she accesses her Libre Texting website account and invokes the device setup procedure. The setup queries her for the device make and model number, then following proper confirmation the setup automatically downloads the free Libre Texting software to her device, and configures it with her credentials for access to the Overlay Network, and for access to her Libre Texting account.

Figure 1 shows how Libre Texting delivers functionality to the user. The EMSD-specific components (EMSD User Agent and EMSD Server) are shown in green in the figure. The Overlay Network at the bottom of the stack (shown in yellow) is used whenever EMSD connectivity is needed.

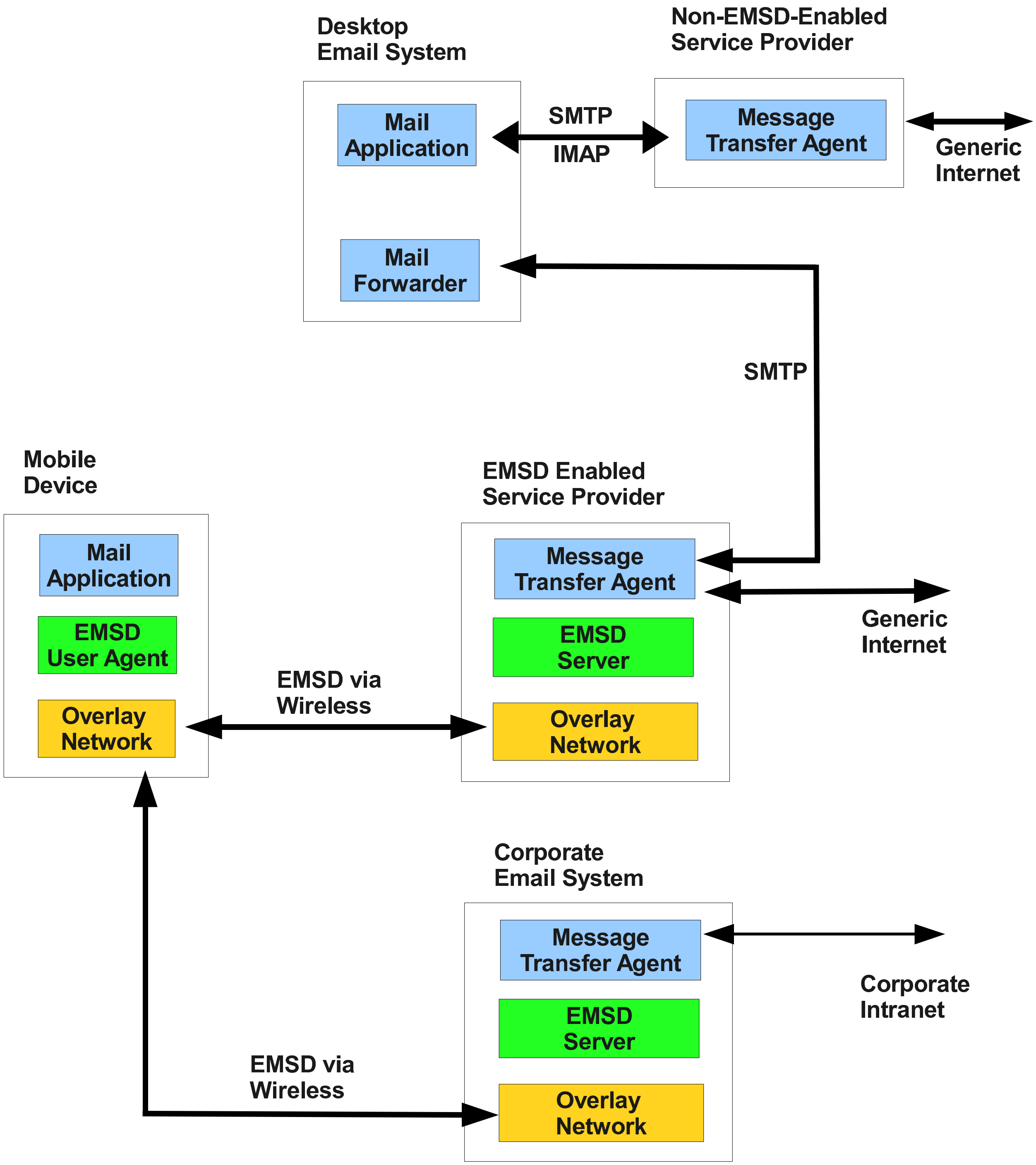

Figure 1: Libre Texting: Functional Operation

3.3 Technology

3.3.1 Overlay Network Wireless Access

By definition, the Libre Texting Device has some form of wireless Internet connectivity. The most common situation is where the device has Wi-Fi connectivity behind Network Address Translation (NAT), with a leased dynamic private IP address.

Regardless of the wireless modality, it must be extended to achieve NAT traversal, for mobility and presence detection (needed for push-mode operation), and for security enhancement. We propose use of an Overlay Network architecture for this. The Overlay Network resides on top of the existing network structure, and provides the following requirements:

- A static IP address (independent of the user's physical location and point of attachment within the local Wi-Fi network)
- Unfiltered bidirectional data flow for Libre Texting traffic (NAT traversal)
- Layer 3 authentication and data confidentiality

The device first establishes initial Internet connectivity, typically behind a NAT. Based on that initial connectivity the device then signs on to the Overlay Network based on its unique static IP address, and is now end-to-end, two-way connected. Thus the device is always reachable by the server. Reachability while mobile is in effect accomplished by the static IP address.

The Overlay Network architecture also gives us immediate presence detection, allowing prompt message push delivery. In other words, the moment the device is reachable, the MTA becomes aware of the device. By means of the Overlay Network we become in effect a network operator, without owning a physical network.

We are using the term Overlay Network in a broad generic sense. The actual overlay capability can be provided by any of the following technologies:

- Virtual Private Network (based on OpenVPN)
- Public Mobile IPv6
- Private Mobile IPv6

All these are viable candidates, and possible future evolutionary directions for Libre Texting. A key consideration for selecting one or more of these for support is ready availability of free software for implementation of these technologies on Libre Texting Devices.

Note that we exclude public and private mobile IPv4 from the list of candidate technologies. We exclude public IPv4 because of exhaustion of the address space. We exclude private mobile IPv4 because it is essentially equivalent to Virtual Private Network, and because software for Mobile-IPv4 is not widely available for mobile device platforms.

3.3.2 Libre Texting Protocols

The key component of our implementation is a set of mobile messaging protocols called the EMSD protocols. The EMSD protocols fully satisfy the necessary technical requirements for mobile messaging. They provide the efficiency required for wireless applications, and support push-mode message delivery, an essential requirement for the expected immediacy of Texting.

The EMSD protocol, titled:

Neda's Efficient Mail Submission and Delivery (EMSD) Protocol Specification Version 1.3

was published as Internet RFC-2524 [**?**] in 1999.

The EMSD protocol provides reliable connectionless mail submission and delivery services on top of ESRO. The ESRO protocol, titled:

was published as RFC-2188 [?] in 1997.

The Principal Investigator for this proposal (M. Banan) is the primary designer of the protocols, and the primary author of both RFCs.

EMSD narrowly focuses on submission and delivery of short mail messages with a clear emphasis on efficiency. It is designed specifically with wireless network usage in mind. EMSD is designed to be a natural enhancement to the mainstream Internet mail protocols, when efficiency in mail submission and mail delivery are important.

Efficiency

The submission of a short message using SMTP requires 15 transmissions. The submission of a short message with SMTP and PIPELINING requires 9 transmissions. The submission of a short message with EMSD (EMSD-P and ESRO) typically requires only 3 transmissions.

Various efficiency studies comparing EMSD with SMTP, POP and IMAP are available. A detailed theoretical and empirical comparison of SMTP and EMSD is available in *Efficiency of EMSD* [?].

Relationship of EMSD to other mail protocols

EMSD is designed to be a companion to existing Internet mail protocols. It is designed to fit within the many protocols already in use for messaging.

The various Internet mail protocols provide different sets of capabilities for mail processing. For example, a user interested in highly mobile messaging functionality can use EMSD for the submission and delivery of time-critical, and use IMAP for comprehensive access to his/her mailbox.

3.3.3 Libre Texting Message Transfer Agent Software

An important consideration is that Libre Texting must fit naturally into the existing structure of the Internet email service. Libre Texting may be disruptive in terms of model, but it must not be disruptive in terms of technological implementation. To facilitate ready industry adoption, the Libre Texting protocols must fit in a straightforward way into existing Message Transfer Agents.

The great majority of Internet email traffic is currently handled by the following MTAs: qmail, Sendmail, Microsoft Exchange, Postfix, Exim.

Figure 2 shows the proposed software architecture for integration of EMSD-SA into the qmail Mail Transfer Agent. This particular proposed architecture is specific to Linux and qmail, but we expect that integration with the other major MTAs can be accomplished based on a similar scheme.

The configuration proposed in Figure 2 consists of the usual qmail architecture (shown in blue), with emsd-sa-submitd (shown at the top in green) added as a module to process incoming EMSD traffic. The architecture of emsd-sa-submitd will be similar to that of mailfront, which is a modern modular replacement for qmail-smtpd. This architecture permits sharing of the Credential Validation Module (cvm), and the Credentials, between emsd-sa-submitd and mailfront.

Based on the presence detection information acquired from the Overlay Network, EMSD deliveries will be initiated immediately the device becomes reachable.

The novel and experimental (unproven) part of this proposed architecture is the linkage between the Presence Detection module (shown in red) and qmail-queue. Apart from its main input, output and timers, qmail-queue is not event driven. An important technological objective is to investigate the feasibility of reusing or modifying the queuing and spooling system of qmail, in conjunction with lower-layer presence detection for immediate EMSD delivery.

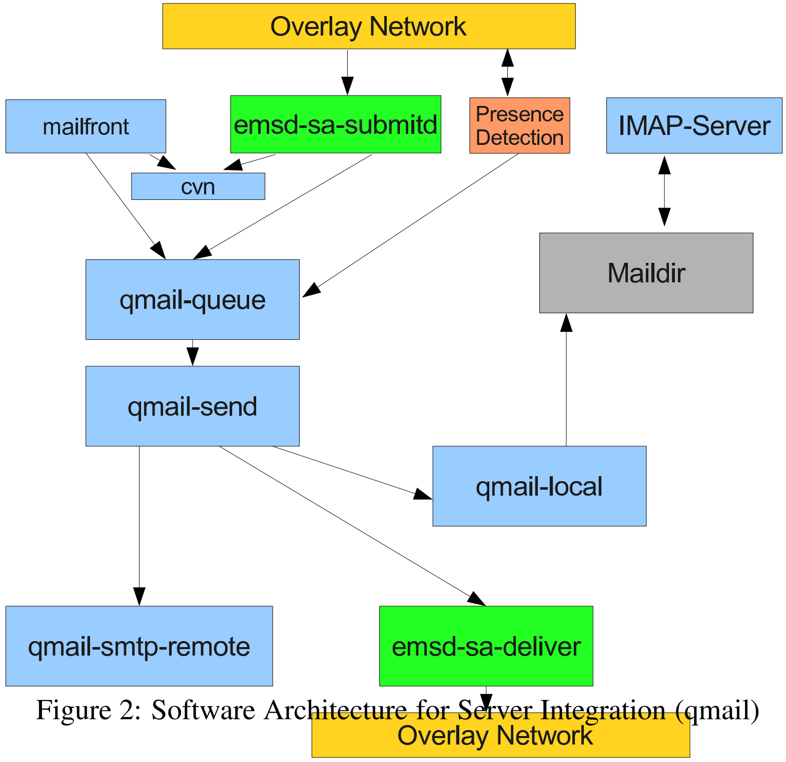

Figure 2: Software Architecture for Server Integration (qmail)

Since the entire software proposed in Figure 2 is free/Libre Software, EMSD-enabled MTAs can be deployed by anyone wishing to implement Libre Texting.

3.3.4 Libre Texting Mobile Software

Towards our goal of widespread industry adoption, the Libre Texting protocols must fit in a straightforward way into many end user devices, running a variety of Mail User Agents (MUA). To facilitate this there must be minimal disruption of the existing MUA architecture.

We propose an architecture based on the concept of a **Device-Resident End-MTA** middleware module, acting as intermediary between the protocol software and the MUA.

In Figure 3 we show a software architecture for integration of EMSD-UA with qmail to create a Device-Resident End-MTA. On its external interface (shown in grey and yellow at the bottom of the figure), the Device-Resident End-MTA interacts with the Internet at large using EMSD, SMTP, and IMAP. On its internal interface (local loop-back interface; address 127.0.0.1) the Device-Resident End-MTA interacts with the MUA based on SMTP and IMAP. Thus the MUA need have no awareness of EMSD at all. This architecture is quite general, and can be used on almost all platforms. In this model, the MUA is always configured for the 127.0.0.1 interface for the SMTP gateway, and the IMAP server. The Device-Resident End-MTA is then configured with the real external server information.

offlineimap will be used to optionally synchronize the device's mailstore/Maildir (shown in grey) so that the user's inbox is locally available, even when there is no network connectivity.

Note that because the entire software proposed in Figure 3 is free/Libre software, the Device-Resident End-MTA can be made available on any Linux-based device without any restrictions.

A technological objective of Phase I is to validate correct operation of the Device-Resident End-MTA against a number of existing clients such as modest, Claws Mail, and Emacs GNUS.

4 Phase I Research Plan

The objective of the Phase I program is to determine feasibility and validity of all four components of our technological approach: (1) the proposed Overlay Network, (2) the EMSD protocols, (3) the proposed MTA software integration and propagation, and (4) the proposed Device-Resident End-MTA software architecture.

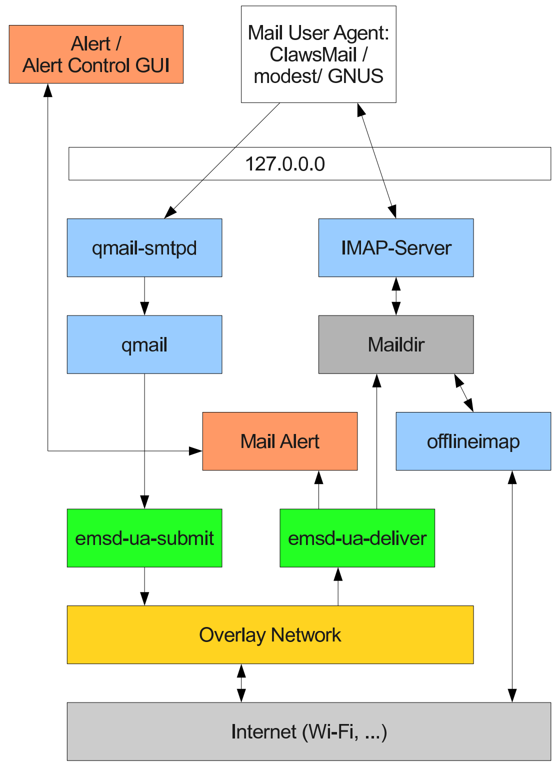

Figure 3: Software Architecture for Device Integration

4.1 Research platforms

To carry out the feasibility study, proof of concept, and other tasks described in this proposal we need both server side and device platforms. The server side platform will be Debian GNU/Linux based. The device hardware platform will be Nokia n810 Internet Tablet and the Nokia n900 phone. The device software platform will be Maemo 4 and Maemo 5.

Multi-Use Radio Service (MURS) public narrowband spectrum will be used for validation of Libre Texting over slow, high-latency networks. Verizon/Novatel's MiFi 2200 will be used for validation of Libre Texting over existing 3G networks.

We will publicly release the entire software for the Device-Resident End-MTA and the EMSD-MTA in source code form, subject to GPL, LGPL and AGPL licensing.

4.2 Research Task Areas

For timeline purposes, "Day 0" is when the project is funded, at which time work begins.

4.2.1 Overlay Network Research Tasks

The Phase I research program in this area is designed to validate our assumptions and increase our current understanding of the following aspects of use of the Overlay Network approach.

Scalability: Questions to be answered are: How many Mobile Texting Devices can a single server handle simultaneously? What are the bottlenecks? How reliable is OpenVPN under load? Should OpenVPN prove inadequate for large scale usage, what are other alternatives for building the overlay network? Are Mobile-IPv6 implementations viable?

Presence Detection: Questions to be answered are: How soon after establishment of a tunnel, can presence be determined outside of OpenVNP? What mechanisms for notification can be used? How best can presence information be communicated to the MTA or EMSD-SA?

We will use the server side research platforms to generate load on OpenVPN and conduct studies to answer the above questions. These research tasks will be conducted by Dr. Hammoude. The work will start at Day 0 and be completed within 3 months.

4.2.2 MUA-EMSD Software Integration Research Tasks

The following aspects of integration of EMSD with Mail User Agent software on the Device will be investigated.

Questions to be answered are: Is the Device-Resident End-MTA Software Architecture shown in 3 practical for widespread deployment on Linux devices? What are practical software and protocol choices for on-demand mailbox synchronization?

We will use the device research platform to build a prototype Device-Resident End-MTA software package. By modelling and empirical verification we will establish the optimum software module configuration for the device. We will then verify correct operation against at least three Maemo-based email clients: (1) modest, Maemo's native Mail User Agent; (2) Claws Mail, a popular alternative; and (3) Emacs GNUS, a sophisticated mail client. Correct functioning of all features against all these MUAs will provide a significant measure of validation for our assumptions. These research tasks will be conducted by the Principal Investigator (Mohsen Banan). This will be completed no later than 4 months after Day 0.

4.2.3 MTA-EMSD Software Integration Research Tasks

The following aspects of incorporation of EMSD into the existing MTA architectures will be investigated.

Optimum Software Integration Model: We hypothesize that it will be feasible to exclude message queuing and spooling functionality from the software implementation of EMSD, and instead provide this functionality via qmail. By modelling, prototyping and empirical verification we will establish feasibility of this integration approach. We will also identify and eliminate/minimize the causes of end-to-end EMSD + qmail submission and delivery delays.

Delivery Trigger Based on Presence Detection: We will investigate the feasibility of reusing the queuing and spooling system of qmail, in conjunction with lower-layer presence detection (Section 2), for immediate EMSD delivery.

This task will be conducted by the PI (M. Banan). The research will be completed at the end of Phase I.

4.2.4 EMSD and ESRO Protocols Research Tasks

Some aspects of EMSD and ESRO may require enhancements. EMSD uses ASN.1 for encoding, and currently does not support language tags. We will investigate methods for providing generalized ways of incorporating recent Internet email localization enhancements to EMSD. ESRO retransmission timer algorithms to minimize adverse link effects are not specified in the base protocol. We will investigate ESRO Congestion Control and related issues. This task will be conducted by the PI (Mohsen Banan). This research task will be completed at the end of Phase I.

4.2.5 Libre Texting Security

Libre Texting is a seamless and consistent extension of the existing Internet email structure. Likewise, in order to provide true end-to-end security over both the wired and wireless Internet, the security mechanisms for Libre Texting must be an integral part of the overall Internet email structure.

The Phase I research program in the area of security is designed to identify protocol and network threats and validate the proposed security mechanisms. The Libre Texting paradigm fully supports the implementation of existing Internet email security mechanisms such as PGP or S/MIME. True end-to-end security can readily be implemented in the context of Libre Texting by means of these technologies. We will investigate mechanisms that can facilitate practical widespread usage of PGP and S/MIME with Libre Texting.

We will use the device side platform to validate the practicality of securing end-to-end email exchange.

These research tasks will be conducted by the PI (Mohsen Banan). It will be completed in 6 months.

5 Making Libre Texting Widespread

The Libre Texting model can be thought of as comprising two distinct elements: the adoption component, and the commercialization component. The adoption component is about making Libre Texting widespread. The commercialization component is about profiting from this. In this section we discuss the adoption dynamics; in the next section we discuss the commercialization mechanisms.

An essential component of the Libre Texting model is the logic and dynamics of how it will become widespread.

Today's mobile messaging landscape consists of ferocious competition among a multiplicity of solutions, all residing wholly within the confines of the proprietary ideological context.

Our proposal stands separate and distinct from all that. In terms of functionality, Libre Texting provides nothing new. It does not fall in the address-a-functional-need category. It provides the same functionality, but under a model that is vastly more potent than the proprietary model. This potency rests ultimately on the tremendous propagatory power of the non-proprietary model, which *removes all barriers and frictions from development, deployment, and usage at every point within the messaging framework.*

Every element of the Libre Texting model—the protocol design, the proposed software architecture, and the service delivery model—has been designed with a critical goal in mind: to enable its widespread propagation. Libre Texting has been endowed with all the necessary characteristics for it to emerge as the global Mobile Messaging industry standard, in use planet-wide, to the exclusion of all proprietary messaging solutions. The key dynamics to achieve this are:

- Eliminate all restrictions to deployment, participation and usage of Libre Texting at each point within the mobile messaging technology chain. The Libre Texting solution must spin within a frictionless bearing.
- Make the Libre Texting solution fully compatible with the existing messaging infrastructure.

Libre Texting includes the following components to achieve this:

- Completely open and patent-free protocols
- Free software for devices
- Free software for MTAs (Message Transfer Agents)
- A network architecture compatible with the existing messaging infrastructure
- An initial, in-place, easy-to-enroll Libre Texting service

5.1 Open and patent-free protocols

The Libre Texting protocols are patent-free, so there are no restrictions on their deployment and usage by anyone. Any company, organization or individual can implement the protocols without incurring licensing fees or other financial obligation.

As well as being patent-free, the Libre Texting protocols are also totally unrestricted. They have been published as Internet RFCs, thus ensuring that they remain freely and permanently available within the public domain.

5.2 Free software for devices

Implementation of Libre Texting at the device end is based on a Device-Resident End-MTA architecture. This is an important component of our design-for-propagation principle. This architecture allows Libre Texting capability to be implemented as a straightforward add-on to existing Mail User Agents (MUAs). There is no disruption to the existing MUA landscape at all, so that best-of-breed MUAs can be used for Libre Texting without no modification.

The Device-Resident End-MTA package resulting from this proposal is quite general, and can be installed in all Linux PDA platforms, and very likely other platforms as well.

5.3 Free software for MTAs (Message Transfer Agents)

The same design-for-propagation principle applies at the message center end. The software architecture for integration of Libre Texting into existing Message Transfer Agents (MTAs) involves inclusion of minimal new software, allowing straightforward integration of Libre Texting into the existing messaging infrastructure.

The Libre Texting MTA package resulting from this proposal is also quite general, and immediately applicable to many existing mail servers.

5.4 Starting point Libre Texting service: part of ByStar services

The final piece required for widespread usage is an initial service to deliver Libre Texting functionality to the end user. We have our own service in place to address this requirement: the ByStar family of services [**?**], providing Libre Texting as a standard feature. As part of our strategy to promote unrestricted and widespread usage of the service, the ByStar services will initially be deployed under a no-cost model.

The ByStar services are in fact much broader in scope than mobile messaging, providing a comprehensive set of services for individuals and businesses. In particular they provide Libre Texting as part of an integrated suite of messaging capabilities, providing various messaging forms and access methods, both wired and mobile. Hereafter we will call the messaging component of ByStar the **ByStar Libre Texting service**.

6 Commercial Potential

Libre Texting represents a radical shift of the Texting industry to the *non-proprietary, for-profit quadrant*, causing a major industry reconfiguration, with significant winners and losers. The losers are the existing vested proprietary interests, whose economic hegemony vanishes. But the winners are the many more companies who can now enter the Texting market—and the end-user who benefits from the resulting competition.

Clearly, the commercial potential of this is immense, and certainly not limited to Neda. This can impact, positively, thousands of jobs throughout the industry.

We have already formulated a coherent business plan for our own participation. Deployment of our broad-based Libre Texting services will take place within the context of our existing ByStar Libre Services [**?**], as part of the existing ByStar Business Plan [**?**]. This is an Open Business Plan that specifically addresses the dynamics and mechanisms of business operation within the *non-proprietary, for-profit quadrant*.

As an established communications modality, the magnitude of the Texting market is already well characterized. For example see the article titled *thx 4 the revnu* by Steven Cherry in the October 2008 issue of IEEE Spectrum, available at: http://www.spectrum.ieee.org/oct08/6817. This article provides relevant analysis and statistics on Texting usage and market size.

In 2008 the Texting/Mobile Email market was over $150 billion dollars. Putting this in the context of our $150k Phase I SBIR funding application, we see that the market size is about one million times greater than our funding request. Furthermore, the texting market is a recurring revenue market.

6.1 Revenue sources

Our major revenue streams are described in the following sections. The first two are transient and tactical in nature. The third is the truly enormous business opportunity, and our ultimate strategic goal.

6.1.1 Software licensing (transient, tactical)

We will develop a complete set of Libre Texting software based on two sets of licenses: (1) Free Software Licenses, and (2) Neda Professional Software Licenses.

This dual licensing strategy is well established in the open-source arena. From a business perspective, the Gnu General Public License (GPL) is very restrictive. The GPL generally bars usage under the proprietary model, thus creating a demand for Neda Professional Software Licenses.

6.1.2 Professional and consulting services (transient, tactical)

We anticipate that our Software Licensing revenues will be accompanied by Systems Integration consulting revenues. Neda has a long track record in the Consulting and Systems Integration arena.

6.1.3 Broad-based Libre Texting services (ultimate, strategic)

The ultimate long-term revenue source is of course the Libre Texting services business itself. Our unique leadership role gives us a number of advantages in this arena including: (a) first-mover position in the Libre Texting industry, (b) name recognition as the leader of this initiative, and (c) a highly favorable marketing opportunity in the form of Libre vs Proprietary ideological conflict.

The assets we have built over the past several years, in particular our Data Center and our existing Internet Application Services, leaves us well positioned to realistically target becoming a large-scale Libre Texting service provider.

6.2 Path to commercialization

The proportions of revenues deriving from the three major sources above will shift radically over time. Initially, the majority of Neda's revenues will derive from software licensing and professional services. Though we will provide support for Libre Texting services from the beginning, we do not expect this to be a significant revenue source at the outset.

However, as the industry matures, support for the Libre Texting service (and beyond that, the broader ByStar services) will emerge as the dominant revenue stream, and will eventually eclipse all others. The Libre Texting and ByStar segment of the industry represents the ultimate, major, profit-making opportunity for Neda. The path to commercialization consists of the following steps:

Making Libre Texting widespread (Linux PDAs): We have previously described the general principles of our strategy for making Libre Texting widespread. The execution steps for specific device platforms and operating systems include:

- Include device-side Libre Texting software as available with the following distributions: Maemo 5, Maemo 4, Ubuntu, Debian (and perhaps Android). Note that Maemo 5, Maemo 4, Ubuntu and Debian all use the .deb packaging, and that standard entry into the Debian distribution propagates to other distributions.

- Include MTA Libre Texting software as available with the following distributions: Debian, Ubuntu, Redhat, Centos.
- Promote and support usage among the following MID/phone/netbook communities: Nokia n900, Nokia n810, Android, Asus, and other Debian/Ubuntu based netbooks.
- Support ByStar Libre Texting for the above. Note that standard entry into the distribution of device-side Libre Texting software directs usage towards our ByStar Libre Texting service by default.

This stage of execution generates minimal revenues. However the incremental cost of building and maintaining these software products and services is minimal for Neda—we have much of this in place already.

Note that because of our non-proprietary model, we do not need to partner with any existing players to initiate and promote Libre Texting usage.

Support for ISP/ASP deployment (professional services, plus hosting revenues): Once usage of Linux Mobile Internet Devices for Libre Texting is well established, we will promote inclusion of Libre Texting into existing services of ISPs and ASPs. Details of our business development strategy in this arena is presented in a separate document [**?**].

Our revenue sources at this stage will consist of consulting services involved in deploying Libre Texting services within the ISP and ASP operating environment. In certain cases we may host the service for ISPs/ASPs in our data center, providing hosting as a further revenue source for us.

Software for proprietary devices (licensing, plus professional services): Once usage of GNU/Linux Mobile Internet Devices for Libre Texting is well established and multiple Libre Texting service providers are in place, we will next focus on enabling Libre Texting implementation on devices with proprietary operating systems.

Devices based on proprietary operating systems such as Windows CE, iPhone, Palm OS, Epoc, etc. provide a licensing revenue source for Neda since they cannot use the General Public License. For these devices we offer commercial Neda Professional Software Licenses. This Software Licensing revenue source will typically be accompanied by revenues from systems integration and other professional services.

Subscription-based, ByStar Libre Texting services: As usage of our ByStar Libre Texting services grows, more of our revenues will be based on recurring subscription service usage model. In terms of revenue characteristics, this is similar to RIM's Blackberry model. This is an ultimate, strategic revenue source.

Advertizing-based ByStar Libre Texting services: As our Libre device software becomes increasingly widespread and reaches larger scale, it then becomes cost-effective to point users by default to the advertizing supported branch of ByStar Libre Texting Services. In terms of revenue characteristics, this is similar to Microsoft's hotmail service.

6.3 Competition: protocols, software, & services

The nature of competition within the Libre context is very different from the proprietary context.

Within the Libre context, it is not possible to maintain sustainable advantage on the basis of proprietary ownership, nor is it possible to create advantage on the basis of functional service differentiation from any other Libre Texting service provider. Any technical enhancement becomes instantly available to all providers throughout the entire Libre environment.

Instead, competition within the Libre environment becomes a matter of which protocols, software implementations and services are used to implement and deliver the service.

With regard to protocols/profiles, we recognize Lemonade (RFC-4550) [?] [?] [?] and Push-IMAP ([?] plus its internet-draft) as potential alternatives to EMSD. However, we believe that the efficiency characteristics of EMSD [?], which are not matched by these IETF-proposed protocols, will prove decisive. The efficiency of EMSD is better suited to Libre Texting, particularly in the case of narrowband wide-area networks.

With regard to free software protocol implementations, alternative and/or overlapping software capabilities are inherently non-competitive, and freely available for integration in our own Neda Libre Texting implementation. Furthermore, our own implementations are accompanied by a coherent business model, which is not the case for most other FOSS projects.

With regard to Application Service Providers (ASPs), we expect that large proprietary services such as Google, MSN and Yahoo will be reluctant and slow to adopt the Libre Texting model, because of their existing business relationships and investment in proprietary solutions.

6.4 Company information and facilities

Neda Communications, Inc. is an Internet Application Services company. We provide consulting and Internet services to small-to-medium businesses (SMBs) and to individuals. We are a one-stop full-service shop—we maintain our own Data Center, and we provide a full suite of services for clients requiring any sort of Internet presence. Our revenues derive from the customary sources: consulting, website development, hosting, and subscriber service fees.

Neda has a core team of engineering and management personnel with extensive experience in the technical Internet and data communications fields. Among the team there are relationships going back many years, reflecting a long history of productive cooperation.

Of immediate relevance to this project is Neda's Data Center. In all respects (space, power, connectivity, etc.) the Neda Data Center will adequately meet the initial demands of our Libre Texting initiative.

7 Equivalent or Overlapping Proposals to Other Federal Agencies

NONE. This SBIR is a resubmission of a previous submission. This and its predecessor represent the first and only proposal of its kind to the US government.