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**Links Between Research and
Experimentation:**

Use Case for FIRE Testbed

Version 1.3

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ABSTRACT

The Delay Tolerant Research Group (DTNRG), and N4C are looking at methods for interfacing between experimental remote networks and the traditional IPv4 networks as well as the emergent IPv6 networks. In order to do this a new URI addressing scheme is being developed (draft-irtf-dtnrg-dtn-uri-scheme). In order to provide service locations capabilities, the N4C project has suggested that this address scheme be extended to enable finding networks that have capabilities required by remote networks. This extension is defined in (draft-davies-dtnrg-uri-find). The scenario use case described involves creating the required discovery and service agent to sit at the edge of the FIRE facilities and offer the ability to test among the real life remote community residents of the DTN networks whether they be in formal test laboratories or are individual remote community residents of the technology.

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Dissemination level	
	Level
PU = Public	X
PP = Restricted to other programme participants (including the Commission Services).	
RE = Restricted to a group specified by the consortium (including the Commission Services).	
CO = Confidential, only for members of the consortium (including the Commission Services).	

EXECUTIVE SUMMARY

The Delay/Disruption Tolerant Network Research Group (DTNRG) in general, and the N4C project in specific are investigating methods for interfacing between experimental remote networks and the traditional IPv4 networks, as well as the emergent IPv6 networks where available. The motivation for this research is that the value of a remote network to the resident of a communications challenged community is completely dependent on its ability to connect to the wider network and its services. To just have a remote network, without gaining access to the power of the Internet would have no immediate societal impact.

One of the solutions being investigated in the DTN architecture is the use of separate name spaces. DTN research is currently looking at the use of specifically defined Uniform Resource Indicators (URI) to establish the addressing architecture¹. In order to provide service location capabilities, the N4C project has proposed² that this address scheme be extended to enable finding networks that have capabilities required by remote networks. The scenario use case described involves creating the required service agent to sit at the edge of a FIRE test bed to offer an otherwise unavailable capability to the living laboratory residents of the remote networks using DTN access.

Using URIs as addresses allows services to be requested without needing to know where those services are located. The bundle³ is sent to a URI that specifies the service requested. Architecturally, this is a form of anycast usage. This anycast technique is a variant on traditional service location techniques which use a multi-phase process, first the client asks the location server for the IP address of a previously advertised service and then, once it has the IP addresses, it requests the service. In this case, by using the URI, the client can directly address a service whose address is already known within some part of the routing system.

In this test case a simple example of one service, FAX service, is setup and tested. Though a service from another age, many government offices and financial institutions still use and require faxed documents, especially when a signature, or the facsimile of a signature, is required on a formal document. The use case here is for a remote community resident to scan a FAX, using a personal computer, for that FAX to be bundled and delivered to a fax server that sends the fax and returns a confirmation to the original sender. The service could be extended to provide a bi-directional service allowing for a FAX reception service by people in a remote area. The client is located in a remote area, while the Fax server is located in an established test bed with a connection to the larger Internet.

¹ <http://tools.ietf.org/id/draft-irtf-dtnrg-dtn-uri-scheme>

² <http://tools.ietf.org/id/draft-davies-dtnrg-uri-find>

³ The Bundle protocol is defined in RFC5050 and is the core protocol of the DTN architecture.

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DESCRIPTION⁴

INTERFACING WITH THE USER⁵

Goal – The goal is to enable a first instance of a service that could be used both to provide a communications means for the remote population and a service offering for a provider. A Fax service would be enabled through the use of DTN protocols and Service Locations architecture methods. While the immediate goal is a unidirectional service from the remote location to a FAX server that exists within a FIRE test bed, a secondary goal would be producing a bidirectional service.⁶

Actors – Individuals wanting to send a fax from a remote region and the service providers who wish to provide such service. This would also be a model for other services that could be created using similar techniques.

PLATFORM SET UP

Pre-conditions or assumptions

- Remote community resident has FAX capability
- Remote community resident's FAX capability is interfaced to Bundle protocol
- Remote community resident's computer is set up for bundle processing using DTN technology
- FAX Server exists and has access to the incumbent network that provides FAX capability and has access, either direct or via the Internet, a gateway reachable from the DTN accessed segment used by the client.
- URI for FAX bundle service is known within DTN routing system.

Trigger

- Remote community resident sends FAX
- Bundle is addressed to URI that represents a FAX server

Steps

- Remote community resident scans document she wants to FAX
- Remote community resident inputs telephone number of FAX recipient
- Remote community residents instructs FAX to be sent

Non-functional requirements –

⁴ For ease of reference, I have included the explanations that were contained in the FIRE provided template as comments. These can only be seen in the Word version of the file and not in the PDF.

⁵ Reviewers of this paper have commented on the social impropriety of referring to those who use the feature being proposed as 'users'. In all instance after this review, the term was changed to some other more specific, more respectful of personal identity term. As this particular usage was in the template provided by FIRE, it was not changed.

⁶ The bidirectional service is more complicated in that it requires the prior registration of a remote user at a server so that a telephone number could be provided to those who wish to send a fax to a remote user. This level of prior registration would not necessarily be required for the sending of a fax by a remote user, though some form of billing mechanism would need to be arranged.

RESULTS ACQUISITION

Please provide information at least on the following:

Post-conditions.

Success end condition

A document scanned in by a remote community resident is transferred over the DTN bundle network to a Fax server and delivered via Fax to its destination.

Remote community resident receives notification of sending

Failure end condition

FAX can fail to reach server. In this case the remote community resident should be notified of a timeout

FAX can reach server but fail to reach destination. In this case the remote community resident should receive failure receipt from FAX server

Minimal Guarantee

The remote community resident is informed of the success or failure of the FAX delivery within a specified time period, possibly sent by the sender.

CHARGING

At the very least a way of doing a charge back for the actual cost of sending the FAX over the incumbent network. This can be done either by having a pre-established account for the client with the server or by including information in the meta-information of the FAX bundle. If account information is included in the Bundle, it will require sufficient security.

EXPECTED IMPACT

1) The research necessary to make this Fax service using DTN access work involves:

- Adding URI processing to the DTN2 research code
- Adding the capability of routing on URIs
- Creates a way of traversing multiple address spaces using DTNs bundle architecture.

2) To achieve the level of security needed for secure delivery of documents and correct attribution of charging related to this service would involve providing a pseudo-transaction service that did not require a real time connection between client and server. Research work would require development of a system related to the work done by the OASIS consortium on 'cohesions' which resulted in the Business Transactions Management standards^{7,8}.

RESEARCH ON THE FUTURE INTERNET

A research possibility that has been discussed in a few technical conferences has to do with mainstreaming the bundle protocol used by DTN (defined in the experimental RFC 5050) into the Internet and using it as a method by which diverse addresses spaces, such as IPv4 and IPv6, can be spanned. This test case, if successful, would lend credence to this nascent capability.

THE MARKET

Service locations and the methods by which they can be located is still ongoing work with many different technologies being used, e.g. Bonjour, Jini, WS-Discovery, and ZeroConf. Whether using DTN access or on the Internet, service discovery is still a new field but is one of the keys of a future Internet.

EVOLUTION OF AN INDEPENDENT ENTITY

If the techniques for providing service to remote remote community residents are successful, there are many services that could be set up and could be used to sustain the systems that provide the services. Remote community residents in one location that had access to a special service of some sort, would be able to provide those services to buyers wherever in the world they might be.

⁷ http://www.oasis-open.org/committees/download.php/12415/business_transaction-btp-1.1-cd-01.zip

⁸ http://www.oasis-open.org/committees/download.php/2077/BTP_Primer_v1.0.20020605.pdf