Telehealth Infrastructure Services

July 7, 2011
Final

Report by NICTA for
Northern Territory Department of Health
Disclaimer

While every effort has been made to ensure the accuracy of this document and any attachments, the uncertain nature of research means that National ICT Australia Limited are unable to make any warranties in relation to the information contained herein. The Commonwealth, National ICT Australia Limited, their employees and agents disclaim liability for any loss or damage which may arise as a consequence of any person relying on the information contained in this document and any attachments.

The analysis and results of this document are based partly on support and input from key experts in telemedicine. The analysis and results of this document do not necessarily represent the opinions of these experts directly or indirectly.

National ICT Australia Limited
ABN: 62 102 206 173
www.nicta.com.au

Corporate Head Office
Australian Technology Park
Level 5, 13 Garden Street
Eveleigh   NSW   2015

T: +61 2 9376 2000
F: +61 2 9376 2300

Report prepared by
Leif Hanlen
Michelle Carden

ISSN Title: National ICT Australia Technical Reports
ISSN Number: ISSN 1833-9646

Acknowledgement
Substantial contributions to the workshop planning and presentation, including the structure of the governance model and initial vision statements for the telehealth service were provided by Ms. Cathie Steel, General Manager, Australian Centre for Health Innovation. We gratefully acknowledge the work provided by the Australian Centre for Health Innovation.

NICTA is funded by the Australian Government as represented by the Department of Broadband, Communications and the Digital Economy and the Australian Research Council through the ICT Centre of Excellence program
# Contents

1. Executive Summary ........................................................................................................ 6
   1.1 Purpose, approach and context ................................................................................. 6
   1.2 Summary of major recommendations .................................................................... 7
   1.3 Comment on the recommendations of this study .................................................... 7

2. Vision statement: the future National Telehealth Infrastructure Service (NTIS) ............ 8

3. Introduction ..................................................................................................................... 9
   3.1 Purpose of this study .............................................................................................. 9
   3.2 Scope of this study ............................................................................................... 10
   3.3 Process of this study ............................................................................................ 10
   3.4 Structure of this document .................................................................................... 11

4. Define the clinical use cases ....................................................................................... 11

5. Define the value chain ............................................................................................... 12

6. Support common minimum standards for interconnection .......................................... 12
   6.1 Technical requirements ......................................................................................... 13
      6.1.1 Network Service ......................................................................................... 14
      6.1.2 Devices ....................................................................................................... 14
      6.1.3 Applications ............................................................................................... 15
   6.2 Policy .................................................................................................................... 15
      6.3 Sustainable business models (Contract Management) ........................................ 15
         6.3.1 Single point of contact for support (maybe interfacing to many suppliers) .... 16
         6.3.2 Clear payment model for each of the components in the ecosystem ............. 17
         6.3.3 Demand aggregation ................................................................................. 17

7. Governance .................................................................................................................. 17
   7.1 Project Development Governance .......................................................................... 18
   7.2 National Telehealth Infrastructure Service Governance ........................................ 18

8. Phases and Milestones ............................................................................................... 19
   8.1 Technical connectivity: H.323 and SIP (initial step, specification) ......................... 21
      8.1.1 Standard protocol ....................................................................................... 21
      8.1.2 Videoconference firewall traversal per island .............................................. 22
   8.2 Management tools (initial step, momentum) ......................................................... 22
      8.3 Scale (initial step, sustainability) ........................................................................ 22
         8.3.1 Call for participation .................................................................................. 22
   8.4 Value add, innovation and continual improvement (next step) ............................... 22
      8.4.1 Additional services: value add ..................................................................... 23

9. Success Criteria: translating the pilot into a sustainable system .................................. 23
   9.1 Proof of efficacy in current environment ............................................................... 24
   9.2 System user satisfaction ....................................................................................... 24
   9.3 Improved health outcomes .................................................................................... 24
   9.4 Increased access within jurisdictions and across jurisdictions ................................ 25
9.5. Evidence of business model sustainability ................................................................. 25
9.6. Auditing information related to quantity of system use ............................................. 25

10. Major Recommendations .......................................................................................... 26
10.1. Review current state of telehealth service (connectivity, videoconference) and relevant use-cases across all jurisdictions ......................................................... 26
10.2. Define and quantify the complete value chain for telehealth delivery .............. 26
10.3. Define clear technical and business requirements .................................................. 26
10.4. Develop staged project milestones that capture continual improvement and innovation ................................................................................................................. 26
10.5. Define success criteria with emphasis on cross-jurisdictional scenarios ....... 26

11. Recommendations ..................................................................................................... 27

12. Appendix: Workshop participants ............................................................................. 28

13. Appendix: current network status for participating jurisdictions ................. 29
13.1.1. Grampians Rural Health Alliance (GRHA); Victoria ..................................................... 29
13.1.2. Hunter New England Area Health Service (HNEAHS); New South Wales .... 29
13.1.3. Queensland Health (QLD-H); Queensland .................................................................. 29
13.1.4. Northern Territory Department of Health; Northern Territory ...................... 30
13.2. Current limits to connectivity (videoconference and network) .................. 31
13.2.1. Hardware/physical limits .......................................................................................... 31
13.2.2. Geographic separation of organisations ................................................................. 31
13.2.3. Logical separation of (health) organisations ............................................................. 31
13.2.4. Inter-ISP .................................................................................................................. 31

Table of Figures

Figure 1 Key words from the Telehealth Infrastructure Service workshop ................. 5
Figure 2 Outline of possible network architecture. Image courtesy of Clinicians on-line project ................................................................. 8
Figure 3 Value chain for telehealth with example actors ............................................ 12
Figure 4 Technical standards and applications for Telehealth service, courtesy Clinicians Online Project Proposal ................................................................. 13
Figure 5 Step-wise improvement in service options, capturing innovation and leading to self-sustaining service delivery options and improved health outcomes .......... 20
Figure 6 Survey response: clinicians in your health service have a videoconference with connectivity to [see entry] ................................................................. 30
Figure 7 Network set up with connectivity to [see entry] ............................................. 31
In Figure 1 we have attempted to graphically convey the key information expressed by the two-day workshop. Larger fonts indicate a greater emphasis – either by repeated use of the word by participants and/or by high voting frequency in various voting exercises. The image was developed using Wordle.com
1. Executive Summary

1.1. Purpose, approach and context

The purpose of this study was to facilitate and scope an initial project and a call for proposals to deliver a common service that allows clinicians to securely and easily connect using online videoconferencing and desktop sharing.

Initially Phase 1 (proof of concept) was set to be the common service delivered between:

- NT Department of Health,
- WA Country Health, and
- Aboriginal Services Alliance of the NT (AMSANT) Members

However this has now changed to be a large project for development of a “National Telehealth Infrastructure Service” which has four Phases. Phase 1 will be provided to early adopters – NT Department of Health, WA Country Health and AMSANT members. Phases 2, 3 and 4 comprise extending this service to include:

- Phase 2: cross jurisdictional connection;
- Phase 3: inclusion of non-standards based technologies
- Phase 4: addition of in home and community based monitoring service

Phase 1 will allow eventual scaling of the common service above to a National Telehealth Service and will provide advice for the requirements definition of the project.

NICTA performed this study through a combination of:

- A short response written survey
- A two-day workshop, with experts for identifying key issues relating to telehealth requirements in several health jurisdictions. The workshop used various brainstorming techniques – including facilitation and independent voting. The emphasis of the workshop is captured in Figure 1.

This work carries on from the previous workshop held on behalf of the Department of Broadband, Communications and the Digital Economy held April 2010.

Four key motivators for urgently developing a telehealth service were given in the workshop

- The implementation of Medicare Benefits Schedule (MBS) items for Telehealth from 1 July 2011.
- The National Broadband Network deployment is providing significant impetus for the development of telehealth infrastructure and
- There is a need for rapid development of applicable Telehealth Standards, within the Standards Australia, IT-014-012 task group.
- Providing access to health care, of equal standard as that expected in metropolitan areas.

A number of barriers were considered for telehealth:

- **Regulatory:** including cross-jurisdictional, business models and geographic separation
• **Innovation capture:** ensuring that innovation and continual improvement is core to the service delivery
• **Interoperability:** technical constraints and (lack of) standardization
• Pervasive access: ensuring common minimum standards for bandwidth and quality-of-service
• **Useability:** ensuring systems are intuitive, easy-to-use and have minimal impact on clinical work-flows.

Several key underlying principles informed our approach to this study. These were captured during the workshop. Where possible we have associated the specific participant quote that formed the basis of the principle:

• Ensuring the patient and clinical best practice are central in any approach for telehealth service delivery: “patient centric”
• A need for common minimum standards for access: “interoperability, fit-for-purpose”
• A need to leverage existing processes, approaches, capabilities and technologies where possible: “convergent approaches”
• A need for appropriate business approaches, to accommodate multiple stakeholders: “sustainable and flexible business models”
• Adopting inclusive approaches, such that both public and private access is allowed: “access and equity is key”.
• Scaling: projects and proof-of-concept must be developed so as to facilitate national systems.

There is a natural tension between each of these principles. Also a key observation that the service will be national and hence eventually include all health participants emphasizes the need to involve people from all parts of the health care system in stakeholder interactions.

1.2. **Summary of major recommendations**

We make a number of recommendations; details are provided in later sections. A summary of the recommendation is given below:

1. Review current state of telehealth service (connectivity, videoconference) and relevant use-cases across all jurisdictions
2. Define and quantify the complete value chain for telehealth delivery
3. Define clear technical and business requirements
4. Develop staged project milestones that capture continual improvement and innovation
5. Define success criteria with emphasis on cross-jurisdictional scenarios.

1.3. **Comment on the recommendations of this study**

This study was undertaken with support and input from many experts in telemedicine, as acknowledged in the Introduction. We very much appreciate these contributions. We have attempted to capture consensus views where they existed. Where substantial variation existed between expert opinions we have attempted to capture the range of views.

The analysis and results of this document are based partly on support and input from these contributors. The analysis and results of this document do not necessarily represent the opinions of all these experts directly or indirectly.
2. Vision statement: the future National Telehealth Infrastructure Service (NTIS)

The National Telehealth Infrastructure Service is an inclusive standards-based interoperable service that provides a platform for clinical grade videoconferencing and telehealth by providing agreed service levels, including usability; guaranteed common quality standards; secure network interconnections; from anyone-to-anyone and anyone-to-everyone across multiple health networks, including public and private health provider networks and with providers and patients both on- and off-net. The service will be intuitive (easy to use), scalable and connect urban, outer metropolitan, rural, regional and remote health providers and patients.

The service will leverage and align appropriate existing and emerging national services including governance models, existing secure dependable services, national privacy standards, clinical protocols and current jurisdictional capabilities. Robust governance and operational models that support innovation, continual improvement and flexibility will underpin the service and position the service to be sustainable into the future.

The service will support patient centric approaches and best-practice clinical care, allowing increased access and equity and improved health outcomes.

An overview of the interconnected service is provided in Figure 2, below.

Figure 2 Outline of possible network architecture. Image courtesy of Clinicians Online Project, and CISCO.
3. Introduction

The European Union E-health Task Force recently observed: network connectivity is only one step toward substantial adoption of e-Health and telehealth.\(^1\)

More than 90% of European hospitals are connected to broadband, 80% have electronic patient record systems, but only 4% of hospitals grant patients online access to their electronic records, according to the results of a survey conducted for the European Commission. European hospitals are more advanced than US hospitals in terms of external medical exchange, but they lag behind in using eHealth to view laboratory reports or radiology images.

The survey shows that in general public, private and university hospitals in Europe are taking advantage of eHealth technologies to a greater or lesser extent: 92% are connected to broadband, 71% use online eBooking systems for patients’ appointments with medical staff and 39% use videoconferencing (mainly for consultations between internal medical staff and external specialists).

In December 2010 the federal government released the “Connecting Health Services with the Future: Modernising Medicare by providing rebates for online consultations”. This policy initiative intends to introduce MBS charging for Telehealth consultations from 1 July 2011. This initiative also addresses one of the key barriers to the acceptance of telehealth as a valid service delivery mechanism.

Within Australia, the National Broadband Network deployment is providing significant impetus for the development of telehealth infrastructure and there is a growing national awareness that geographic location should not be an indicator of the access and quality of health care.

There is a need for rapid development of applicable Telehealth Standards within the Standards Australia IT-014-012 task group to accommodate the development of national telehealth services, to a common service level.

3.1. Purpose of this study

The Northern Territory Government, Department of Health, commissioned this study to facilitate and scope an initial project and a call for proposals to deliver a common service that allows clinicians to securely and easily connect using online videoconferencing and desktop sharing.

The context of this is a large project for development of a “National Telehealth Infrastructure Service” which has four Phases. The project outline is provided for explanation below:

**Phase 1: Development of the Telehealth Cloud Service ‘Proof of concept’**

*The primary output of this stage will be the Request for Proposal. This proposal will captures all of the information required for the blueprinting of the detailed specification of the products outlined by the broader cross jurisdictional telehealth reference group.*

---

This will deliver an Infrastructure based Cloud Service to connect the following entities, using H.323 and SIP protocols:

- NT Department of Health,
- WA Country Health, and
- Aboriginal Services Alliance of the NT (AMSANT) Members

**Phase 2:** Cross Jurisdictional Connection to the Telehealth Cloud

**Phase 3:** Inclusion of Non Standards based technologies into the Telehealth Cloud

**Phase 4:** Addition of in home and community based monitoring service

### 3.2. Scope of this study

This study considers only the development of a National Telehealth Infrastructure Service and requirements definition as part of Phase 1. We do not consider a more general e-health service. The report is written in the context of developing a national service that provides common access to videoconference resources and may scale to support other telehealth resources.

Where possible we have provided quotations from workshop participants – either from verbal or written communication – which capture the essence of the reported notes. These quotations are highlighted by sidebar call outs.

### 3.3. Process of this study

Interim results have been made available during the study, in the form of summaries, identified case studies and reports and workshop notes and presentations.

Representatives from:
- the Grampians Rural Health Alliance (GRHA),
- Loddon Mallee Rural Health Alliance (LMHA),
- Hunter New England Area Health Service (HNEAHS),
- Queensland Health,
- Victoria Health,
- Western Australia Health,
- Northern Territory Department of Health and
- the National E-Health Transition Authority (NEHTA)

were involved in the workshop.

**Preparation**

- Review prior proposals from regarding cloud services for telehealth from participating organisations
- Collate short response surveys

**Workshop [2 days]**

- Identify and scope major areas of opportunity
- Determine issues and provide guidance for analysis and synthesis
- Elicit insights into key issues for further investigation.

This workshop focused on input from key experts (clinical, CIO and technical) including representatives from NEHTA.
4. Define the clinical use cases

Seven clinical use cases were defined from the workshop. Clinical use cases are needed to evaluate the efficacy of the telehealth pilot and the validation of the requirements analysis. The clinical use cases illustrate some of the requirements around the delivery of service and the network connectivity.

Representatives from GRHA and NHEAHS noted that they have detailed clinical use cases that might be used as a basis for this specification.

Each use case should provide a level of detail, such that the technical and business requirements needed to support that use case may be quantified.

1. Case conferencing: patient-to-clinician(s)
   Case conferencing includes one-to-one (point-to-point) one-to-many (multipoint) videoconferencing and network access.

2. Clinical consultation online
   a. Planned – patient monitoring
   b. Unplanned (emergency) - eg. trauma/stroke

3. Mentoring: clinician-to-clinician(s), including peer support; education – one-one, one-many, clinician to clinician

4. Administration

5. Diagnostics and data: clinician(s)-to-data-source
   Clinicians interacting with data: either directly or remotely to support diagnostic
decisions.

6. Home monitoring

7. Patient to community (ie. families, friends)

As part of the definition of the use cases, the following points must be addressed:

- Does the list of cases below cover the spectrum of uses for the telehealth service?
- The use cases must be defined in sufficient detail to provide examples of care using telehealth and without using telehealth in order to evaluate the delivery of the service.

1. Define comprehensive detailed clinical use cases with quantified details of core requirements. The clinical use cases must explicitly detail any optional components and how these components are needed.

5. Define the value chain

A complete value chain for the provision of telehealth services is needed. This will provide two essential components to the implementation of the program:

1. Ensuring that all stakeholders are included in the requirements analysis
2. Ensuring that the business model is sustainable.

A clear definition of the motivators for each participant in the value chain is essential. This will define what is required for buy-in of each player in the value chain. Answering this question is fundamental to a sustainable business model.

![Value chain for telehealth with example actors.](image)

2. Define a comprehensive value chain including the motivators for each participant in order to include all stakeholder requirements and deliver a sustainable business model.

6. Support common minimum standards for interconnection

There was discussion around the core requirements and the need to define these for any delivered system. The core requirements will be defined in the context of the clinical use cases.
6.1. Technical requirements

We recommend considering the technical requirements in terms of:

- Network Service (the service providing data transport),
- Devices, and
- Applications.

The separation of Devices and Applications from the Network allows consideration of user requirements and interoperability of devices independently of the requirements of the network interconnectivity. In some jurisdictions, “off-net” participants have full network connectivity, but do not have standards-compliant equipment. In this case, “interconnectivity issues” will be caused by the choice of device – and will not be improved by standards based networks.

The scope of this report is with the Network Service. The service should provide a common minimum standard that guarantees interoperability for all compliant equipment. The service may accommodate additional value-add components. All components must be standards-based and standards compliant. The demand for standards implies that some forms of communication (eg. Skype) may not be considered a clinically supported interaction. This does not prevent health care participants from communicating with Skype, but it does preclude assuming support for such communication via the telehealth service.

An overview of the technical standards that are required is provided.

Figure 4: Technical standards and applications for Telehealth service. Image courtesy of the Clinicians Online Project, and CISCO.
6.1.1. Network Service

Technical standards relating to the Network Service are to ensure that the transport layer supports videoconference and network interconnect over common standards. For each of the points below, the appropriate technical standard (see Figure 4) must be applied and the quality, bandwidth security requirements must be quantified.

- **Quality of Service**
  - Data Type eg, voice, image, text
  - Date Rate, eg. bandwidth
  - Data Integrity eg. is the data transfer loss less? Could image resolution be reduced?
  - Quality of service will be common across multiple carriers/vendors

- **Bandwidth**
  - Several participants note a 384kbps network was a sufficient initial minimum requirement.

- **Security**
  - privacy, authentication,
  - need a standard applied for talking to other jurisdictions including firewalls.

- **Encryption** – need a standard applied for talking to other jurisdictions.

- **Application and data sharing**
  - Firewall traversal

- **Orchestration of standards – bringing in standards**

- **Multi-point videoconferencing**

- **H323 and SIP compliant**

- **Recording**
  - what is recorded, how?
  - Do we need standards for this?

- **Storage**
  - how do you store,
  - where do you store,
  - for how long do you store,
  - how much do you store?
  - Data mining: it should not be possible to make inferences based on access pattern.

- **Seamless connectivity whether on-net or off net**

- **Re-use/access**
  - Legal
  - Ownership

- **ISDN gateway**

- **A National dialing plan**

3. Define and quantify the technical network requirements including reference to required Australian standards.

6.1.2. Devices

- Leverage appropriate standards
- Ensure usability: fit for purpose
- Device and space availability
- Interoperability with existing equipment
6.1.3. Applications

- User interface – easy to use, simple, eg. minimum number of clicks
- Federated booking systems – ensure each jurisdiction maintains control over its own resources
  - Authentication services, online, scheduled, adhoc
  - Allocation of resources
  - Naming conventions, dynamic plans
  - Global Address Booking Systems
- Home monitoring aged care – ability to bring in a range of devices
- Billing/subscription
- Evidence of episode

4. Separate network requirements from requirements for devices and applications.

6.2. Policy

Policy settings define the quantities and listed standards above. In this case, the network service policy requirements must be made explicit. Several participants, including Queensland Health and HNEAHS noted that they already had extensive policy documents that might be used as examples in this project.

- Storage
- Security/Privacy
- Data sharing
- Dial plan – naming conventions

5. Produce explicit policies detailing the network response for storage, security and resource sharing.

6.3. Sustainable business models (Contract Management)

The business model needs to be flexible in order to allow a variety of payment and billing approaches, depending on the user requirements. Common, standards-based service, with options

The “flexible” approach suggested comprised a common service agreement. This would provide common (minimum) services levels to all consumers of the telehealth service. In addition, the business model must support “value-add” components that allow specific users to experience additional service, based upon local requirements.

This may mean that specific examples of clinical use cases (Section 0) will require higher service. We illustrate this with an example drawn from the workshop:

Make it clear: who benefits and who pays. The business should be self-sustaining.
A planned clinical consultation (Section 2.a) might be achieved using H.323 / H.460/ H.320 using video over Internet Protocol and videoconferencing with a minimum bandwidth\(^2\) of 256Kbps.

One clinical expert noted that evaluation of epilepsy required a minimum link bandwidth of 2Mbps videoconference in order to achieve reliable clinical outcomes. We note that, “evaluation of epilepsy” whilst being a planned clinical consultation represents a particular clinical use case that might not be supported at the minimum service level.

This example emphasizes

- The “optional” supported services represent variation on the types use (clinical or otherwise) of the telehealth service, whilst still being standards-based.
- The definition of the use cases must be sufficiently detailed to consider "optional" components.

6.3.1. Single point of contact for support (maybe interfacing to many suppliers)

One participant noted that the jurisdiction “did not wish to negotiate with multiple suppliers for multiple options.” A contract manager would ensure that each jurisdiction could exploit multiple service types and payment options – whilst avoiding excessive overhead of managing multiple vendors or accounts.

A single contract manager may be necessary to avoid excess overhead caused by negotiating over multiple vendors and service options.

Using a model of wholesale and retail: one can consider the national service “single point of contact” as the wholesale delivery of software and infrastructure services. This contact would provide access to a series of supply service options.

It is anticipated that suppliers may provide several service options – a “menu” of services. From the collective choices of suppliers and service options, jurisdictions and private health providers would select an appropriate portfolio. Suppliers are not necessarily limited to large corporate vendors. Some of the suppliers may be government agencies. Some suppliers are likely to be corporate vendors (eg. CISCO) and yet others may be small for-profit or not-for-profit organizations. The “small” organizations could be business arms of current jurisdictions\(^3\).

Collectively, the single contract manager could manage the portfolio of suppliers and services. It was not established that each jurisdiction would wish to have the same single contract manager.

A substantial impact on the requirements and the business model of such a manager is whether the single-point-of-contact was optional (used only if desired by the consumer) or mandatory (all jurisdictions including private providers must interact with the manager). A single-point of contact will have less ability aggregate demand under an optional model, however the mandatory approach necessarily limits independence of health providers.

---


\(^3\) A particular jurisdiction might deliver services within its current network, and offer services at an appropriate cost recovery “outside” the jurisdiction. In this sense, the same jurisdiction might act as both consumer and supplier of services, depending upon where the service is delivered.
6. Define the policy choice between optional and mandatory use of a single contract manager by all jurisdictions is needed.

6.3.2. Clear payment model for each of the components in the ecosystem

Several business models were proposed – any and all of which may be expected by a given consumer.

- Membership fees
- Subscription service
- Pre-paid
- Post-paid (eg. invoiced after use)
- Pay-as-you-use, network service support
- Ad-hoc payment for specific resources.
- Subscription to Wide Area Network only, video services, bridging
- Value-add services
- Direct integration into Medicare Benefits Schedule (MBS) items and billing structures.

7. Develop a clear (and comparable) list of flexible business payment/cost models.

6.3.3. Demand aggregation

It is expected that a contract manager would provide demand aggregation, by allowing multiple (consumer) jurisdictions to collectively achieve improved service-vs-cost. Examples include requiring vendors to supply standardized services (improved service) and collectively bargaining lower cost.

Moreover, there is scope for the contract manager to also provide market exposure (the reverse of demand aggregation) by allowing multiple (consumer) jurisdictions to appear as a single national market to a small supplier. This benefit to the vendor is also likely to lead to competition that reinforces the effect of demand aggregation.

An appropriate national demand aggregation may lead to improved service-vs-cost, create new markets and scale existing markets thereby increasing innovation and improving service delivery.

7. Governance

The governance model of the transition project and the governance model of the final national service were jointly considered. It was agreed that the transition project might have a different governance model to the final approach.

A key concern for this component is the need to avoid duplication of existing efforts within e-Health. Consensus was not reached on the exact governance model however several options were tabled, moreover, a convergent approach was widely agreed upon.
7.1. Project Development Governance

The majority of participants agreed on a convergence approach: that where possible an existing governance structure should be adopted in preference to developing or out-sourcing to a new one.

The National E-Health Transition Authority (NEHTA) and the National Health Call Centre Network (NHCCN) were proposed as possible governance approaches of both the transition and the final program. The discussion concluded that a governance model that was similar to NEHTA’s current model would be preferable, conditional upon the need for telehealth to be a strong focus. In particular, there is a need to leverage the clinical reference groups and Council of Australian Governments (COAG) stakeholder capabilities.

Telehealth is part of NEHTA’s “potential future capability” as given pp. 22-3, NEHTA Blueprint Draft4

“[F]uture capabilities ... may include enhanced support for care planning and coordination, personally controlled electronic health records, secondary uses of information and registries, decision support, tele-health, etc.”

[page 145-6:]

“The National E-Health Strategy views telehealth as a significant opportunity to enable improved rural, remote and disadvantaged community access to healthcare services.5

The NEHTA work program does not currently include work on tele-health. Opportunities for addressing the issues within the NEHTA work program may be explored in the future, subject to NEHTA board approval.”

NEHTA does not currently undertake work on tele-health, however, much of the required mechanisms for adoption of the telehealth program proposed for this study are built NEHTA. In other work areas, NEHTA has programs for, development of Australian standards, governance of programs in “design, build and operate” stages and management of the tender process.

7.2. National Telehealth Infrastructure Service Governance

We outline in Table 1, the various governance models proposed within the workshop. These included completely outsourcing the design and the project management to a commercial vendor, stakeholder owned entities and government owned entities.

Against the type of governance, various requirements for each model were listed – including ability to aggregate demand, alignment with the strategic vision of the program. Funding implications allowed participants to estimate the likely impact on a funding proposal, were it to adopt the given governance model. The risk of failure (high risk = poor option, low risk = better option) was discussed across the workshop participants and a consensus view provided.

4 NEHTA Blueprint, National E-Health Transition Authority, V1.0 Draft, August 2010
The commercial option was collectively agreed to be high risk against most criteria, whilst the government owned NFP (which includes NEHTA) was considered low risk. Some concerns were raised regarding the ability of the stakeholders to maintain control of the project if it was designed and operated by a government owned entity.

There was no clear preference within the stakeholder own entities and for each, a concern relating to conflict of interest: the same group was potentially specifying requirements of, delivering and being paid by the service.

Table 1: Governance models and risk of failure for each key requirement

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Outsource to existing commercial partner</th>
<th>Stakeholder owned commercial entity</th>
<th>Stakeholder owned not for profit</th>
<th>Stakeholder owned Joint Venture Agreement</th>
<th>Government owned NFP</th>
<th>Government agency (eg. state)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic mission alignment</td>
<td>high</td>
<td>conflict of interest</td>
<td>conflict of interest</td>
<td>conflict of interest</td>
<td>Low</td>
<td>Med</td>
</tr>
<tr>
<td>Stakeholder engagement and control</td>
<td>contract control: risk of capture</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>concerns over control and implementation</td>
<td>Med</td>
</tr>
<tr>
<td>Ensure technical compliance</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Demand aggregate</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainable business model</td>
<td>Hig-med risk, company may fail</td>
<td></td>
<td></td>
<td></td>
<td>several entities exist, but all have current finite lifespans</td>
<td>Med</td>
</tr>
<tr>
<td>Funding implications</td>
<td>high risk</td>
<td>Unclear benefits of stakeholder owned ventures, duplication of existing efforts</td>
<td>strong support</td>
<td>change of focus, duplicated effort</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was significant discussion around the type of not for profit entity that might provide the optimal governance model. Whilst participants did not agree on the specifics of the model, agreement was achieved on the philosophy that existing entities, models and resources ought to be leveraged as much as possible.

8. Phases and Milestones

The intention of the project is to apply a “learning curve” or “incremental improvement” approach to deployment. Simultaneously as each component and phase is deployed, change management will occur. There will be a period of time for settling in (on the order of 12-24 months) after which the sustainable business model will ensure that the service remains operational.
beyond the support of the initial investment required to start it.

We outline this concept in Figure 5, where we have shown three abstract service delivery improvements, capturing the innovation of the health system and providing ongoing improved health outcomes.

For the telehealth service, the suggested steps⁶ might be:

1. Technical connectivity (H.323 and SIP support)
2. Management tools
3. Scale
4. Value add, innovation and continual improvement

As part of the discussion regarding minimum common standards, suggestion was made that the technical standards should support “both H.323 and SIP”. We have noted that H.323 is a defined videoconference standard, which supports many of the features (e.g. Firewall traversal) that were also noted in the core requirements. SIP does not appear to offer the same functionality and also appears to suffer from multiple standardization options – meaning that two “standard” SIP devices might not be interoperable.

A number of websites, notably www.packetizer.com have observed potential interoperability issues with SIP, due to the vendor-specific extensibility of the protocol.

---

⁶ Where each “step” implies national deployment
An incremental improvement approach, where new standards based services are built upon the successful deployment of previous standards based services is necessary. Each “success” is characterized by a self-sustained infrastructure-as-a-service business service.

Whilst we have shown individual blocks, in reality each process – specification, innovation, “lessons learned” and change management will be ongoing and part of an ongoing improvement cycle.

The continual improvement process for each “new” service offering is likely to follow a similar trajectory:

- Specify requirements
- Apply innovation and new technologies, manage change, measure efficacy and build momentum
- Validate business model
- Deliver ongoing service

We describe this in detail for the initial service, as this defines Phase 1 of the project.

8.1. Technical connectivity: H.323 and SIP (initial step, specification)

Initially the national network will consist of individual “islands” with varying capabilities.

Each “island” in the network is brought up to a common level, such that all can support a minimum level of videoconference and network connectivity. This will require some procurement of equipment for some jurisdictions. Wherever possible, existing services and equipment will be leveraged, with an emphasis on incremental improvement rather than delivery of a complete final offering in the first stage.

The connectivity will be measured through deployment, to ensure proof of efficacy, clinical benefit are captured. The information capture will also be aimed at facilitating future milestone decisions – e.g. as equipment is procured, the availability and use of the equipment is recorded in order to provide “lessons learned” for future deployment.

8. H.323 and SIP standards based bridging equipment should be provided to all jurisdictions (that require them) to bring all jurisdictions up to a common minimum level.

This step includes developing interoperability between jurisdictions and allowing sharing of phone books (internal videoconference and interconnects only).

8.1.1. Standard protocol

A minimum protocol and network support criteria will be agreed and delivered across the national islands. Nominally, this is H.323 and SIP, however other components such as auditing, security and authentication requirements must be addressed.

Incremental improvement should not be confused with lower quality: some components (eg. ease of use, clinical benefit) are non-negotiable, however other components (eg. manual bookings) can be accommodated initially.
8.1.2. Videoconference firewall traversal per island

As above, minimum requirements to connect between border controllers in the network will be established.

9. Provide common minimum levels for auditing, security, videoconference-firewall-traversal to all jurisdictions

8.2. Management tools (initial step, momentum)

Leverage existing capabilities, technologies and initiate demand aggregation. This process may include development of

- a common service desk,
- software development
- manual booking
- procurement systems
- billing and
- manual sharing of videoconference address books.

At this point, it may be necessary to appoint a central organization to provide centralized management tools for the national service

8.3. Scale (initial step, sustainability)

This step represents the point at which the pilot moves toward a national stage: it is expected that through the call for participation, processes will scale. Manual processes will become automated, so that the end goal: any health provider with compliant technology is willing to subscribe to the business model can access the service.

This step should include expansion of the service to include access for GP’s and specialists to jurisdictions via the national organisation

8.3.1. Call for participation

Literally: an open call for health providers and participants to join the network. The implication of this is that the service will scale to support demand and all new entrants, with appropriate requirements, can be accepted by the service. The scaling of services will drive automation of previously manual processes:

- Automate manual processes
- Human Service Directory (HSD)
- Electronic sharing of address
- Online billing

At the conclusion of this stage, it is expected that on- and off-net, as well as jurisdictional boundaries will be invisible to the videoconference participants.

8.4. Value add, innovation and continual improvement (next step)

New services will be developed and required over time. The current telehealth service must support continual improvement and innovation. The innovation captured by the incremental improvement process may come from within the current health system, from
the vendor(s), stakeholders, or through external collaboration with ICT research organizations.

This ongoing collaborative innovation should be part of the structure of the service and a particular example of the service’s continual improvement approach.

This step will include the expansion of the service to provide access to patients in their home.

8.4.1. Additional services: value add

Value add would include guarantees on (minimum) Quality of Service and the use of effectively “dedicated” networks8 – such as might be available over the National Broadband Network. The context of this section assumes availability of the National Broadband Network – which would be leveraged by the improvement in service quality of the existing telehealth network infrastructure. Some discussion was provided regarding the potential to augment such a network using private networks and/or Aarnet. It is expected that the provisioning of “private” networks purely for health connectivity would be prohibitive.

As shown in Figure 5, the additional services are built upon existing standards based service. Innovation is captured within the steps. Each step will build out in a similar manner to the process described above.

| 10. Develop funding for innovation, change management and continual improvement of service |

9. Success Criteria: translating the pilot into a sustainable system

The value of telehealth is well established. The purpose of the pilot is to prove efficacy of the National Telehealth Infrastructure Service, measure the increased use of cross-jurisdictional resources and demonstrate improved health outcomes.

A part of the success criteria will be demonstrating the effective application of telehealth that emphasizes cross-jurisdictional clinical use. The efficacy of telehealth is well established: there is no real value in simple “re-proving” that telehealth provides a benefit in Northern Territory and Western Australia.

It is possible part of this work will align with the randomized control trials that are being proposed to evaluate telehealth in the context of the NBN deployment. It may

---

8 A dedicated network has the appearance of a private network, with the associated guarantees of access, quality of service, bandwidth etc. By leveraging the (very high bandwidth) National Broadband Network, it is possible that the characteristics of a dedicated network may be emulated by the public NBN, without the associated investment of providing a private network.
be sufficient to measure outcomes on all clinical procedures and demonstrate the correlation between improvements and the use of the service.

The key differentiator of the pilot is the cross-jurisdictional aspects and the ability to scale to a national scheme. These differentiators are the focus of the success criteria.

11. Define key success criteria that emphasize cross-jurisdictional resource use.

In the success criteria below we have attempted to suggest quantifiable and objective measures of outcome.

9.1. Proof of efficacy in current environment

Each of the clinical use cases define the example scenarios and may be treated as “before” and “after” use cases for telehealth. As noted above, the particular use cases must incorporate a cross-border component.

**Success criteria:** Number of clinical use cases support per jurisdiction via telehealth

One suggestion was to develop a “living lab” environment, to allow rapid progression from concept, through pilot, to live system. A key motivation for this was the difficulty to allow “live testing” of new service models on existing telehealth systems.

**Success criteria:** Number of clinical use cases demonstrated per jurisdiction via environment

9.2. System user satisfaction

One participant noted “it should be as intuitive as the telephone”. Whilst this may not be possible with arbitrary video conferencing technology, it is a key indicator of uptake that the technology will be available at point of care and in use by clinicians. Another participant noted “Our clinicians are demanding it”. The real success of the NTIS would be the fact that the service is seamless and that the end users (clinicians) do not even know that the service has been implemented other than they can now see their counterparts within their service directory.

**Success criteria:** Number of telehealth participants providing positive feedback

9.3. Improved health outcomes

Clearly defined health outcomes, resulting from the use of the piloted telehealth technology. The key aspects of this would be greater access, faster delivery, ease of use and better quality (and greater number) of health services.

**Success criteria:** Relative reduction in waiting time for service

**Success criteria:** Increase in number of accesses to service

**Success criteria:** Improvement in clinical outcomes
9.4. Increased access within jurisdictions and across jurisdictions

Use of resources from one jurisdiction used by clinicians in another jurisdiction. Similar metrics may be applied to “on” and “off” net clinical use – to evaluate the “cross border” component of the national service.

Use of resources within a jurisdiction by participants not previously serviced (to the same level) within the jurisdiction – “services to the bush”

**Success criteria:** Increased resource use across jurisdictions.

**Success criteria:** Increased access by participants within jurisdiction.

9.5. Evidence of business model sustainability

It is expected that during the pilot stage, evidence will accrue that validates the business model. Part of this evidence is evaluating the “tipping point” – the point at which there are sufficient service users that the payment and billing models can support the business.

A critical component of these success criteria is demonstration of effective demand aggregation.

**Success criteria:** Business revenue and turn-over.

9.6. Auditing information related to quantity of system use

Increased availability and recording of system use is essential. Participants observed the need to ensure that information relating to the use (successful or otherwise) of the service was captured. We have denoted this “auditing information related to quantity of system use.” This information will provide evidence of sustainability and also inform next-steps in the iterative process.

**Success criteria:** Auditing data available, with demonstrated outcomes on service delivery decisions.
10. Major Recommendations

10.1. Review current state of telehealth service (connectivity, videoconference) and relevant use-cases across all jurisdictions

An objective evaluation of current status of jurisdictions relative to the vision statement is required. This must be representative of all potential participants including public, private and allied health. This activity has already been commissioned by Department of Health and Ageing (DoHA).

Comprehensive detailed clinical use cases with quantified details of core requirements are required. The clinical use cases must explicitly detail any optional components and how these components are needed. Representatives from Grampians Rural Health Alliance and Hunter New England Area Health Service noted that they have detailed clinical use cases that might be used as a basis for this specification.

10.2. Define and quantify the complete value chain for telehealth delivery

The value chain must include the motivators for each participant, in order to include all stakeholder requirements and deliver a sustainable business model.

10.3. Define clear technical and business requirements

The technical requirements and business requirements, including need for a single contract manager were developed through the workshop and external material. These requirements must be prioritized and quantified in order to evaluate deployment of the service.

Appropriate national demand aggregation may lead to improved service-vs-cost, create new markets and scale existing markets thereby increasing innovation and improving service delivery.

10.4. Develop staged project milestones that capture continual improvement and innovation

The project will take the form of incremental valued-add service deliveries. Each successful deployment of standards-based services will build upon the sustained business model of previous deployments. It is expected that “self-sustaining” business models will ensure that improved service levels are maintained beyond initial investments.

Innovation, change management and proof of efficacy must be considered in conjunction with the program delivery.

10.5. Define success criteria with emphasis on cross-jurisdictional scenarios

A number of success criteria for the pilot and the intermediate deployments were provided. These include, proof of efficacy in current environment, system user satisfaction, improved health outcomes, increased cross-jurisdictional access, evidence of business model sustainability.
Auditing information related to quantity of system use whilst not being a direct “success criteria” is an essential aspect of validating the business model and also informing next stages in the incremental process.

11. Recommendations

We provide a series of recommendations that were drawn from the workshop. Numbers relate to the numbered recommendation in the text.

1. Define comprehensive detailed clinical use cases with quantified details of core requirements. The clinical use cases must explicitly detail any optional components and how these components are needed.

2. Define a comprehensive value chain including the motivators for each participant in order to include all stakeholder requirements and deliver a sustainable business model.

3. Define and quantify the technical network requirements including reference to required Australian standards.

4. Separate network requirements from requirements for devices and applications.

5. Produce explicit policies detailing the network response for storage, security and resource sharing.

6. Define the policy choice between optional and mandatory use of a single contract manager by all jurisdictions is needed.

7. Develop a clear (and comparable) list of flexible business payment/cost models.

8. H.323 and SIP standards based bridging equipment should be provided to all jurisdictions (that require them) to bring all jurisdictions up to a common minimum level.

9. Provide common minimum levels for auditing, security, videoconference-firewall-traversal to all jurisdictions

10. Develop funding for innovation, change management and continual improvement of service

11. Define key success criteria that emphasize cross-jurisdictional resource use.
12. **Appendix: Workshop participants**

We would like to thank the following experts who provided their time and discussions during the workshop as input into this report:

- Alan Hamilton, WA Country Health
- Angela Ryan, NSW Health
- Cathy Steele, Centre for Health Innovation
- David Bunker, National E-Health Transition Authority
- David Ryan, Grampians Rural Health Alliance
- Doug Cooke, NT Department of Business and Employment
- Doug Hemming, Queensland Health
- Gayle Boschert, Grampians Rural Health Alliance
- Greg Connors, NT Department of Business and Employment
- Jackie Plunkett, NT Department of Health
- Jennifer Jones, Loddon Mallee Rural Health Alliance
- John Ierace, WA Country Health
- Julie Barnes, NT Department of Health
- Leonie Katekar, NT Department of Health
- Matt Skiba, Queensland Health
- Matthew Pickering, NT Department of Health
- Paul Kamler, NT Department of Health
- Robyn Cahill, NT Department of Health
- Tony Green, Hunter New England Area Health Service
- Will Fintein, NT Department of Business and Employment
13. **Appendix: current network status for participating jurisdictions**

13.1. **Current status, based on short-response survey**

Each of the jurisdictions present had different levels of connectivity – both within their own network(s) and with “off-net” or out-of-network participants. It is expected that once a complete survey of all jurisdictions – including private health providers – is undertaken, this variation will increase. In the following sections we give a brief overview of status in each jurisdiction. This material is summarized in Figure 6 and Figure 7.

Connectivity was found to have different meanings depending upon the context. Pure connectivity – and even sufficient bandwidth – was not a determinant for ability to videoconference. The key factor for ensuring videoconferencing was quality of service and interoperable standards-based systems.

The purpose of the following case studies is to emphasize the degree to which each jurisdiction is at a different point of development.

13.1.1. **Grampians Rural Health Alliance (GRHA); Victoria**

Grampians Rural Health Alliance, part of Victoria Health, provides a managed service, with direct personnel support. Point-to-point and multipoint videoconferences are provided. Videoconference and network connectivity is essentially limited to those on the same public network.

13.1.2. **Hunter New England Area Health Service (HNEAHS); New South Wales**

Hunter New England Area Health Service, part of NSW Health, provides video conferencing across an internal network. The network supports point-to-point and multipoint video conferencing[^9]. There is scope for both adhoc and online booking of resources. Support is provided via a central telehealth support desk. Videoconference and network connectivity is limited to those on the same public network and some private health providers.

13.1.3. **Queensland Health (QLD-H); Queensland**

Queensland Health has a single public network, with central support and control. There is extensive connectivity outside the central network via ISDN, H.323 and SIP. Clinicians can self-book point-to-point videoconferences and support is provided by a central telehealth support service and a single-number contact. Videoconference connectivity is to all public health providers on the Queensland network and could be all public health providers on other networks. The network connectivity is universal, although firewall traversal is an issue due to end-point interoperability. End users are not charged, as the entire service is supported through central funds, however, non-Queensland Health

[^9]: Multipoint videoconferences take place within virtual meeting rooms.
Customers may be subject to usage charges for use of Queensland Health facilities and capacity.

13.1.4. Northern Territory Department of Health; Northern Territory

Northern Territory Health has a limited public health network that provides videoconferencing capability to some of the people within the NT network, other public networks and private networks. Videoconferencing is not available to community health providers, GP’s or patients in their home. Network connectivity is available to all members of the current health network, but not to anyone “off net”.

Ease of use is a key issue: whilst the technology may be available, clinicians still may not use it, due to limits of knowledge of the use of the system.

<table>
<thead>
<tr>
<th></th>
<th>All of these people</th>
<th>Almost all these people</th>
<th>Most of these people</th>
<th>Some of these people</th>
<th>None of these people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public health providers on our network</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public health providers on other networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private health providers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community health providers in their offices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community health providers in patients homes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPs in their clinics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients in their homes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- [Queensland Health](#)
- [Hunter New England Area Health Service](#)
- [Grampians Rural Health Alliance](#)
- [Northern Territory](#)

Figure 6 Survey response: clinicians in your health service have a videoconference with connectivity to [see entry]
13.2. Current limits to connectivity (videoconference and network)

Limits to connectivity were discussed by the group and fell into four main categories, relating to specific hardware-based issues, (cross-jurisdictional) issues – both physical and logical separation and multi-step connections, that required inter-ISP activity.

13.2.1. Hardware/physical limits

- Bandwidth limits (different nets ADSL, ISDN)
- (lack of) std. equipment (H.323, H.320 compliant)

13.2.2. Geographic separation of organisations

- limited connect points + gateways

13.2.3. Logical separation of (health) organisations

- Firewall traversal
- “permission” for various types of data, in various nets
- (lack of) direct technical support

13.2.4. Inter-ISP

- QoS between multiple ISPs

An objective evaluation of current status of jurisdictions relative to the vision statement is required. This must be representative of all potential participants including public, private and allied health.