National Information and Communications Technology Authority

UAS Strategic Planning Report, 2018-2022

March 2018

Contents

1 INTRODUCTION

This report represents the Universal and Access Service Fund Strategic Plan, for the five-year period from 2018 to 2022, as approved and adopted by the UAS Board, in consultation with NICTA.

2 UAS MISSION AND VISION

The following represent the Mission Statement and Vision of the UAS Board and NICTA for the utilization of the UAS Fund in support of development of the telecommunications/ICT sector in Papua New Guinea. To fulfill this mission and achieve the overall vision, the UAS Board has adopted this Strategic Plan for the period 2018-2022.

2.1 UAS Fund Mission Statement

The UAS Board and NICTA will utilize the UAS Fund to support investments in the telecommunications and ICT sector in Papua New Guinea, to promote universal access to and utilization of modern, beneficial services throughout the country. UAS Fund resources may be employed to subsidize the costs of infrastructure, networks, facilities, services, equipment, applications, content, and human resource development. The Fund will be utilized to underwrite investments and costs for market segments that would not otherwise be commercially viable. NICTA will strive to manage the Fund in an equitable, cost-effective, transparent, and competitively neutral manner.

2.2 Vision for PNG Telecommunications Development

The UAS Board's and NICTA's vision for the medium-term development of the telecommunications sector in Papua New Guinea encompasses the following goals:

- Universal access to coverage of broadband mobile telecommunications networks and services for all PNG citizens and communities;
- Wide access to advanced, high quality, broadband telecommunications networks and services, and increasing utilization of these services throughout society;
- Expansion of access to free over-the-air radio and television broadcast signals;
- Development and adoption of a broad array of useful and valuable ICT applications and content for all segments of the population;
- Increasing awareness, capacity, and contribution by all citizens in ICT-based activities, business and employment, and public services;

- Growing contribution of advanced and innovative ICTs to support inclusive socio-economic development and opportunity.

This vision is closely aligned with both the Papua New Guinea Development Strategic Plan (DSP) 2010-2030, and the Papua New Guinea Vision 2050. The DSP 2010-2030 defined one of its priority goals as: "A modern and affordable information and communications technology that reaches all parts of the country." It also identified several specific targets for ICT growth, including 800 mobile subscribers per 1000 population, 70% using the Internet, and 100% access to radio and television. The targets for this UAS Strategy would meet or exceed those objectives. Also, the Vision 2050 includes a range of Strategic Focus Areas for PNG development, which will be enabled and reinforced by expansion of access to high quality ICT services. These include, among others, Human Capital Development, Gender, Youth and People Empowerment, Institutional Development and Service Delivery, and Spiritual, Cultural and Community Development.

3 MARKET AND ACCESS GAP ANALYSIS

3.1 Overview

NICTA and its consultants have conducted an extensive statistical analysis and modelling exercise of the PNG telecommunications market, which seeks to present a reasonable estimation of the dynamics of market development. The primary focus is on the market for mobile communications, with emphasis on mobile broadband (3G+) services, while also examining prospective conditions for other segments. The purpose of the analysis is to provide NICTA and the UAS Fund with a baseline understanding of the scope of infrastructure and services, the costs of expansion, and the likely levels of subsidy required to increase access on a province-by-province, and district-by-district, basis. This exercise is not meant to be precise, nor to substitute for the necessary due diligence required for specific UAS Fund project design. But it offers a valuable starting point for identifying options and priorities for resource allocation as part of the strategic planning process.

Further detail is provided in the Annex to this Strategic Plan, and the accompanying spreadsheet file.

3.2 Approach and Assumptions

The statistical model that supports the market analysis involves an extensive set of formulas, calculations, data inputs, and assumptions, which in combination produce a variety of useful estimations of telecommunications market conditions in PNG. While the

model itself is proprietary, its main parameters and key assumptions can be summarized as follows:

- Market Data Inputs: Data from NICTA and operators regarding locations of existing network facilities, degree of geographic coverage of signals. Also data on provincial and district geographic size and populations, and numbers of LLGs.

- Network Buildout Requirements: Assumptions regarding the architecture and configuration of mobile network infrastructure and facilities required to provide service within typical geographic areas: backhaul distance and technology, tower distribution, signal coverage, etc.

- CapEx and OpEx: Estimated average unit capital investment costs for various network components, such as microwave, fiber, cell towers, BTS, etc. Also estimated operating expenses associated with operating and maintaining the network, and providing each type of service, including interconnection and customer service as a percentage of gross customer revenues.

- Revenue Forecasts: Estimated average revenues to be generated by new service customers, based on overall average incomes and spending levels on telecom services by existing customers, adjusted conservatively to account for lower incomes and less favourable market conditions.

- Net Revenues and Subsidy Requirements: The total net revenue/cost results for each location, indicating the level of estimated profit or loss arising from all relevant investment and operating costs and the associated revenues that the services would generate. Areas with positive net revenue results (profits) are considered to be commercially viable, while those with negative net revenues (i.e., net costs/loss) are not viable. The amount of subsidy required is given as the total net economic cost for such non-viable locations.

All estimates and assumptions are based on data obtained from NICTA and industry sources, combined with experience from other, comparable markets. The model relies on very generalized, high-level, and average estimates for most economic assumptions, which can be adjusted for sensitivity analysis and to reflect changing data. This analysis is valid as a strategic planning tool, to guide general budget planning and allocation discussions.

In addition to the primary focus on mobile broadband markets, the model also includes additional inputs and estimates for TV and FM broadcasting, to assess the approximate

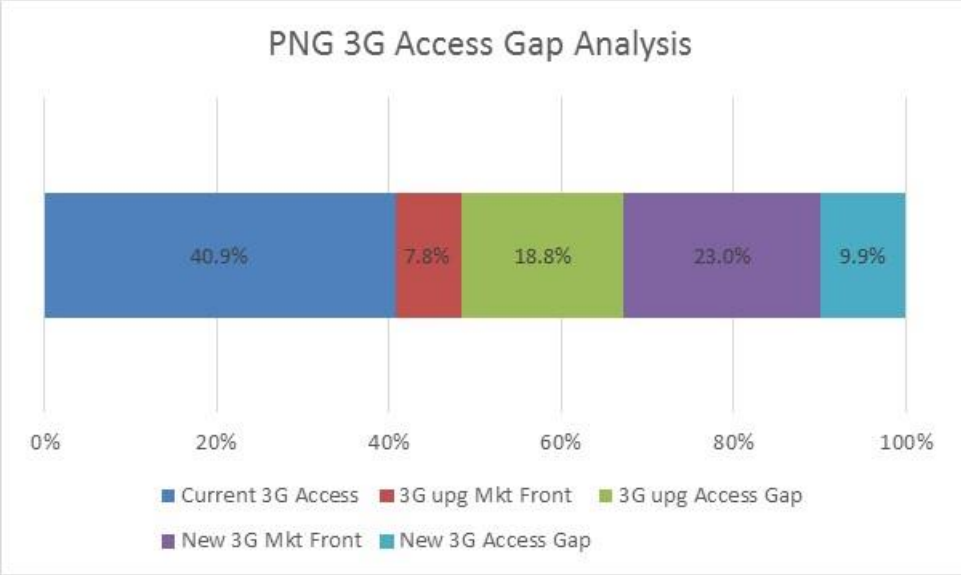
range of capital costs for installing antennae (on existing available towers) to expand broadcast signals into unserved areas.

3.3 Findings for Mobile Broadband

Following from the above assumptions and data, the analysis has calculated the approximate market conditions for mobile broadband network and service expansion in each province and district of PNG. The calculations yield the following parameters for each geographic area:

- Current 3G Access: The % of the total PNG population that is currently within 3G network coverage areas.
- 3G Upgrade Market Frontier: The % of total population that currently receives only 2G service, but is expected to be upgraded by the market, without need for any subsidy.
- 3G Upgrade Access Gap: The % of total population that currently receives only 2G service, and would not be upgraded by the market without some amount of subsidy.
- New 3G Network Market Frontier: The % of total population that currently is not covered by any mobile service, but where market conditions should lead to establishment of new 3G network service, without need for any subsidy.
- New 3G Network Access Gap: The % of total population that currently is not covered by any mobile service, and would not be likely to receive 3G mobile service without some amount of subsidy.

Together, these components add up to 100% of any given market. For the country as a whole, the estimated findings are represented in the following graph:



These results indicate that some 40.9% of the PNG population already has access to 3G mobile broadband services, while an additional 26.6% have 2G-only access, for a total level of current access to one or the other service of about 67.5%. Within the 2G-only areas, only about 7.8% of the national market is likely to be upgraded by operators on their own business initiative, and the other 18.8% is expected to need at least some subsidy to support 3G+ upgrades. For the remaining 32.5% of the population that does not currently have access to any mobile service, about 23.0% of those are within districts that appear to be commercially viable, and these should ultimately receive 3G+ service without a need for subsidy. The remaining 9.9% of the market will potentially require UAS subsidy to construct and operate 3G network services.

See the Annex and attached spreadsheet file for further detail on the specific Gap result findings for each province and district.

Again, note that these are high-level estimates which may deviate from true market conditions in any given location to some degree. But they demonstrate a reasonable set of results as to the current and anticipated state of the market for planning purposes.

The net estimated costs and related subsidy requirements associated with these gaps are also approximations, and are likely to vary significantly over time and geography, as conditions and technology continue to change.

4 UAS OBJECTIVES AND TARGETS

Consistent with the above guiding principles, NICTA and the UAS Board have identified the following priority Objectives for the use and operation of the UAS Fund during this period, and the associated targets and priorities. The identified near to medium term targets and priorities are estimates, based on the range of projected net costs associated with each type of activity. NICTA and the UAS Board may adjust these targets and priorities over time, as changing conditions and new information warrant.

4.1 Universal Access to Broadband Mobile Service

1. Facilitate the expansion of broadband mobile telephone network coverage throughout all unserved areas of PNG, toward the goal of Universal Service in broadband mobile telephony.

The UAS Fund will provide support for expansion of high speed mobile voice and data telephone network coverage (3G/HSPA+, 4G/LTE, or other advanced systems) into geographic areas that are currently not within range of wireless signals, or where only low-speed (2G, voice-text) service access is available, and where signals are poor and inadequate. True Universal Service in modern mobile telecommunications will be achieved only when all PNG households and businesses are fully covered by advanced networks, and when these communication services are available and affordable for all citizens.

Achieving this objective will involve two sets of related programs, as described in section 5.1 below: (i) to upgrade any BTS locations where only 2G service is currently available, and (ii) to establish new infrastructure and facilities in areas with no network, which will be capable of offering advanced services. The targets and priorities for this objective are defined accordingly:

- Targets: 100% of PNG's population covered by reliable advanced wireless mobile telecommunications network signals (at least 3G+ quality).

- Priorities: Establishing advanced mobile network coverage in all unserved local population centers (LLGs) with at least 20,000 inhabitants.

4.2 Public Community Broadband

2. Support the introduction and expansion of public high-speed Broadband Internet connections and in local PNG communities, including connectivity for public institutions and public access facilities, to help increase broadband Internet access and utilization.

The UAS Fund will support the expansion of access to (fixed) high-speed broadband Internet connectivity[1] for selected communities, to bring connections to priority local institutions as well as public access for local citizens. Target public institutions include universities and schools, hospitals and health clinics, agricultural centers, local government offices, and other key public locations. These locations may be in LLGs with no existing fixed telecommunications service, or in areas where current service is poor and inadequate to allow for useful broadband connectivity. In addition, this objective envisions providing public access via Community Information Centers and/or public WiFi signals, allowing citizens to obtain affordable broadband services as well as training and technical support. The initial goal will be to establish Community Broadband network access and facilities in a limited number of pilot locations in larger population centers, with longer term plans to continue expansion of such services nationwide.

NICTA will collaborate with local officials and national Ministries to coordinate planning, implementation, and operation of institutional broadband connections and facilities, to ensure that broadband network development projects deliver needed capacity, services, and other ICT resources to all qualified locations.

- Targets: Approximately 40 sites over 5 years.
- Priorities: Provincial and District Capitals.

4.3 Support for ICT Utilization and Demand

3. Support for ICT utilization and demand initiatives, including content and applications, digital literacy, and affordable devices, to ensure that all PNG citizen can take advantage of and benefit from modern communications technologies and services.

Section 90(1) of the Act states that the objective of the Fund is to "is to promote the long-term economic and social development of Papua New Guinea by funding approved UAS Projects that will encourage the development of ICT infrastructure and improve the availability of ICT services." NICTA is confident that PNG will only achieve these objectives when all citizens and segments of society have the opportunity, capacity, and awareness to take advantage of the limitless possibilities of these technologies. A portion of UAS Fund resources will therefore be devoted toward supporting the needs of users, from individuals to households to small businesses and community groups, to be able to afford, utilize, and understand the options for embracing ICTs in their daily lives. The Fund will accomplish this

[1] As broadband is defined by the National Broadband Plan and/or other Government policy objectives.

through support for development of valuable applications and content, by helping to make devices such as computers, tablets, and smart phones more affordable, by working with government agencies to deliver helpful e-government services, and by assisting with public ICT education, capacity building, and awareness campaigns.

- Targets: National penetration of broadband Internet subscribers and users (mobile and/or fixed) will increase to at least 25% of total population by 2022.

- Priorities: Initial projects will concentrate on increasing ICT awareness, capacity, and demand in selected rural and underserved areas where new network access connections or upgrades are provided.

4.4 Expansion of Broadcasting Network Coverage

4. Facilitate efforts to increase the coverage of broadcasting signals to all populated areas of PNG, allowing all citizens to receive radio and television broadcasts.

Traditional free over-the-air radio and television broadcasting remains an important component of the ICT sector, and of citizens' access to information sources. NICTA will work with national broadcasting operators to identify gaps in access to radio and TV broadcast transmissions, and to develop projects that will provide financial support from the UAS Fund to eliminate these gaps where commercially necessary. The Fund will also seek to help offset the costs of digital broadcast reception for lower income users by subsidizing discounts for set-top boxes.

- Targets: 100% coverage of population centers by broadcast signals, and 100% accessibility in PNG households.

- Priorities: Expand TV and radio signal coverage in parallel with mobile network rollout, starting with all unserved local population centers (LLGs) with at least 20,000 inhabitants.

5 UAS PROGRAMS

This section describes in more detail the Strategic Programs that the UAS Board and NICTA will implement under the UAS Fund during the five-year planning period. In general, the Programs will be implemented through a series of Projects, which NICTA will design in consultation with relevant stakeholders and officials, subject to approval of the UAS Board and the Minister. Where appropriate, UAS Projects may combine elements of multiple Programs within certain geographic areas. The range of specific UAS Projects to be

implemented under each Program will be set forth in each fiscal year's UAS Operating Plan, and the detailed specifications of each such Project will be defined on a case-by-case basis, according to the parameters of the Operating Plan. All UAS Projects, and overall UAS Fund Operating Plans, will take account of available Fund financial, technical, and human resources.

The descriptions that follow provide the main features and parameters of each UAS Program and of the UAS Projects to be implemented.

5.1 Mobile Broadband Network Upgrade and Expansion

The purpose of this program is to extend the coverage of advanced broadband wireless mobile communications services (at least 3G/HSPA+, 4G/LTE, or other advanced systems) as far as possible into all areas of the country. The goal is to deliver reliable, high quality access to Internet and "smart" mobile applications and capabilities to as many PNG citizens as possible, where access to such services is not adequately available, and where existing licensed operators are unwilling or unable to expand their networks, due to commercial or other constraints. The ultimate objective of this program is to achieve virtually 100% mobile broadband service coverage throughout PNG.

These goals will be accomplished under the Fund through support for UAS Projects that invest in advanced mobile network infrastructure and service expansion by licensed mobile operators. UAS Projects under this program will provide financial support for build-out of local broadband mobile network coverage into unserved and underserved areas, to fill identified gaps and ensure signal access for all target communities.

There will be two types of Projects undertaken through this Program: (1) new BTS sites in areas currently with no mobile service, and (2) upgrades to existing 2G BTS sites. Implementing contractors/operators will be responsible for installing and operating wireless voice and broadband data/Internet telecommunications networks and services within specified locations where such service is not currently available. Priority locations for each separate Project will be selected by NICTA, based on market analysis and stakeholder consultations. In general, new sites or 2G BTS upgrades must be located at least 15 km from existing 3G base stations.

The Projects will also support establishment of adequate electrical power supply as needed for the required base stations, with emphasis on utilizing the most economically efficient as well as environmentally friendly solutions. The network and service technology configurations should also take advantage to the greatest extent of lower cost, rural-focused innovations to ensure affordable service for low income customers. Project implementation

may also seek to address other possible constraints to network development, such as rights of way and access fees, among other matters.

On the basis of a one-time UAS Fund subsidy, the selected contractors will be required to operate the required broadband mobile services on a commercial basis, in accordance with the terms of their licenses. Also, Project contracts may require operators to promote and stimulate demand for broadband wireless data/Internet services, and to achieve a minimum level of customer take-up, to ensure adequate utilization of the services.

The general parameters of UAS Projects to be supported under both components of this program include the following:

- Scope of services: (1) Voice telephony services that allow for local subscribers to place and receive voice and SMS text calls both within the network and, through interconnection arrangements, to all other telephone networks in Papua New Guinea. (2) Mobile data/Internet service that meets defined minimum specifications for transmission speed, local and backhaul capacity, and that interconnects with national and international data networks.

- Service availability and quality specifications: The facilities and services must meet all NICTA quality and availability requirements, as for all other licensed public mobile telecommunications services.

- Geographic coverage: The network signals must cover the full geographic area designated in the project scope, with adequate quality and reliability. Specific locations and coverage areas may be subject to negotiation, but subsidies will only apply to providing coverage that is outside of areas already covered by 3G+ network service. NICTA will determine the balance of new mobile broadband BTS sites versus 2G upgrades to be included within each project, based on information provided by operators and other sources.

- Minimum customer take-up requirement: At its discretion, NICTA may require that a subsidized operator must achieve a minimum level of active subscribership and utilization ("customer take-up") of the mobile broadband services within the defined service coverage area, over a specified period of time.

- Infrastructure access, sharing, and roaming: All UAS Fund supported mobile networks and services must be made available for access by all other licensed telecommunications operators in Papua New Guinea. Operators must be able to connect their equipment and facilities to UAS network towers, base stations, and backhaul networks. UAS funded

operators must also provide domestic roaming connections to other PNG licensees, which will permit subscribers of those operators to obtain service and place and receive calls while within the UAS Fund supported service area.

As indicated, the two sub-components of the program are as follows:

5.1.1 Upgrade of Existing 2G Sites

NICTA will identify locations where 2G mobile (voice/text) service is operational, but where the consensus among operators and NICTA's analysis indicate that the net cost of upgrading those sites to 3G+ mobile broadband would not be commercially viable in the foreseeable near future. NICTA will design UAS Projects to provide necessary subsidies for licensed operators to upgrade service in such locations. NICTA will develop Requests for Proposals that will define the scope and requirements for each Project, including the above mandatory components, and specific details such as:

- Upgrade and enhance tower and BTS transmission facilities and related equipment as necessary to provide 3G+ signal and capacity;
- Expand and increase capacity of backhaul links, potentially upgrading from microwave to fiber or other high capacity transmission, where necessary to ensure high quality service;
- Introduce and support high-speed mobile data services, features, and applications for all local customers;
- Provide customer support and marketing required to stimulate and sustain demand among advanced mobile broadband service customers.

5.1.2 New Mobile Broadband Infrastructure and Service

In locations where no mobile network or service is currently available, UAS Fund supported operators will be required to construct and operate all necessary new network infrastructure and facilities to deliver 3G+ signal coverage and services to the designated population centres. Elements of each project design will typically include:

- Construct transmission towers and all related support infrastructure needed to establish a network presence within designated unserved population centers;
- Construct and install a base station and all related facilities to enable provision of 3G+ mobile service to all customers within the designated population centers;
- Install adequate power, backup, supporting structures, and other necessary equipment;

- Install backhaul transmission network links to all sites, with sufficient capacity to support the full level of anticipated usage demand with high quality connectivity;
- Launch and operate the 3G+ mobile service for the designated districts, with all standard features, functions, and capabilities of such services elsewhere in the country, and with tariff pricing options that are no more costly than for customers in other parts of the country.
- Provide customer support and marketing required to stimulate and sustain demand among advanced mobile broadband service customers.

5.2 Community and Institutional Broadband Networks

The purpose of this program is to help deliver high-speed, full-service fixed broadband Internet connections to selected communities, with services and capacity widely available to public institutions as well as local businesses and households, on an affordable basis throughout each designated local service area. To achieve these outcomes, the Community Broadband Program will support comprehensive implementation projects in a limited number of designated locations, which will consist of three integrated components:

- Broadband Network Access and Service: Extending network links into areas unserved by sufficient high capacity signals, to allow for community-wide broadband access.[2] Establishing publicly available retail broadband communication services within each community, both fixed and mobile, for purchase and use by local citizens, enterprises, and other customers.

- Institutional Connectivity: Providing broadband connections directly to identified local public institutions, including schools, health facilities, local government offices, and community centers. In addition to these public institutions, where demand exists, broadband connections may also be provided to other community resource centres that can help facilitate ICT access by all members of the community.

- Community ICT Centres (CICs): Establishment of public access CICs within each designated community, connected to the broadband network, making Internet access, computers, ICT services, and training available to local citizens.

This combination of infrastructure development and service delivery will ensure that communities selected for this program will receive the benefits of full broadband ICT access,

[2] As broadband is defined by the National Broadband Plan or other Government policy.

comparable to that which is available in urban and higher income areas. The program will aim to establish these services on a commercially sustainable basis, by encouraging investment cost-sharing and revenue and demand stimulation. Public-private partnership arrangements will be important for developing the envisaged services and infrastructures, and for the sustained commercial management of the services.

To achieve the multiple, inter-related goals of this program, UAS Projects will be designed to require implementing partners and contractors/operators to provide the full range of specified outputs simultaneously within each defined service area. The scope of these program outputs may differ in details for each project and location as appropriate, but in general they should consist of the key elements summarized below.

5.2.1 Broadband Network Infrastructure and Service

There are three sub-elements to this program component:

- Expansion of national backbone network infrastructure:

This element involves support for extending fiber optic backbone network capacity to the districts included in the Program, where such capacity is not available or insufficient. If other projects or initiatives are already actively developing backbone network infrastructure that will link to a given district, the UAS Fund may collaborate with such projects, to ensure the needed capacity is available in a timely manner to the designated locations. The backbone network should deliver two-way data transport capacity sufficient to allow district-wide retail broadband services in each location, commensurate with near-term and expected future demand.

The network contractor will operate and maintain all network links and ensure continuous service to all locations, with adequate provisions for redundancy, service quality, fault repair, and security.

- Establishment of local broadband access network connections:

This element involves extension of fixed broadband network access directly into the designated communities, establishing a broadband point of presence or network node within each identified local area, linking to the national backbone network infrastructure. Each local access point should deliver sufficient two-way data transmission capacity to allow widespread connection of broadband quality services throughout the community.

In particular, the Broadband Network Access connections must be capable of direct connectivity and adequate service delivery to all community and institutional access

locations designated within the project scope. The local broadband access connection requirement will be technology-neutral, and maybe implemented via any authorized architecture, wireline or wireless, through a single integrated network or via multiple networks to different designated locations within a project, so long as the resulting capacity and access are verifiably achieved. The local access network must also incorporate an electricity power source of sufficient energy to support continuous operation, as well as adequate backup energy supply.

- Provision of public broadband communication services:

This element will require the implementing contractor, either directly or through an affiliated or subcontracted operator, to provide public commercial fixed broadband communication services to each target community covered under this program. Such services should be available throughout the community, to allow connection of households, businesses, and other locations to broadband quality Internet access as well as voice telephone service. Implementation of these public broadband services may be accomplished over time, according to an agreed rollout plan and appropriate sustainable business parameters, but there should be milestones for significant and steady progress in retail consumer broadband access in all target communities.

The required broadband Internet services may be delivered over any technology platform or architecture, as long as they offer the minimum service quality and capacity specified for each project location. All mandatory regulatory standards and service features must be available to all end users, including all functions necessary to ensure full utilization of Internet services and applications. Services to the general public may be provided over the same local network as that delivering service to mandatory public institutions, or may be differentiated from those required dedicated connections.

The public broadband services will be provided on a commercial basis, at prices to be determined by the market. However, project TORs may specify mandatory minimum subscription targets for each location, which the implementing contractor must achieve over given time periods. The UAS Fund subsidy for the project will take account of any below-cost discounts, incentives, or other valid expenses required to achieve the minimum subscriptions and maintain a viable business environment, while yielding long-term sustainable market growth.

5.2.2 Institutional Connectivity

Under this component of the Program, the implementing contractor will be required to install broadband access connections at specified institutional locations within each target

community, linking to each local broadband access network node. The required locations will be identified during each Project's planning phase, and will typically include all qualified local government and other public offices, as indicated below.

Connections to each institution must provide adequate bandwidth to allow for the minimum level of projected network usage in each location. The implementing contractor will be responsible for determining the most appropriate access technology and configurations. The contractor may also be required to install specified internal facilities and equipment at each location (e.g., local area network, server, firewall, etc.), depending on the scope of project terms. The contractor or its affiliate will then also be responsible for providing ongoing data/Internet service delivery to all connected institutions, according to agreed pricing, terms, and conditions (to be negotiated as part of project planning and implementation).

The priority public institutions that will be connected through UAS Projects under this program component are identified below. Other public community buildings or facilities, such as libraries and post offices, may also be required in specific Project terms, as agreed by NICTA and local and national authorities. Ongoing payments for the services provided through these connections will generally be the responsibility of the subscribing institutions, although these may be subject to mandatory discounts or other subsidies, as part of project negotiations and funding decisions.

Priority public institution connections include:

- Educational: Local public schools, university campuses, teacher's colleges, as well as administrative offices. Specific requirements for internal networks, facilities, and equipment should be determined in collaboration with the Ministry of Education.

- Health facilities: Local hospitals and health clinics within the community. Technical equipment and facilities to enable these organizations to utilize their broadband connections should be provided in collaboration with the Ministry of Health.

- Local government offices: Local government office buildings and annexes, including security agencies such as police, fire, and emergency. Locations may also include premises of local community organizations, as well as shared facilities that may house relevant public administration activities. NICTA will work with local officials in the designated districts to identify the required locations.

- Agricultural centes: Facilities to support local farmers and community agricultural development.

5.2.3 Community Information and Communications Technology Centres (CICs)

This program component involves establishment of public access Community ICT Centres (CICs) within the designated community broadband project areas, to provide community-wide access to full-service ICTs at publicly available locations.

A Community ICT Centre is a public location that provides a combination of facilities and services, which may include access to Internet-enabled computers, software based on local information needs (including local content), other technical equipment such as fax and photocopying, and training in basic computer skills, entrepreneurship and business services for small and medium enterprises.

In addition, CICs can provide public Internet access through external WiFi signals from transmitters based in the CIC and/or linked to other locations, allowing users with WiFi-enabled devices to access broadband signals in public places.

Under the Community Broadband program, the selected contractor (and/or affiliates) for a given Project will be responsible for both construction and operation of a CIC in each designated community. The key features of each of these elements are as follows.

- CIC construction, equipment, installation:

Physical creation of the CIC, including procurement and installation of necessary equipment, configuration and other technical setup, connection to the local broadband access network, and any other start-up requirements. This stage may be undertaken by a technical supply firm, which may also be subcontracted to construct and install the institutional connections under a master Community Broadband contract.

Each CIC should have a minimum required configuration of available technology, including computers, broadband network connections, servers and routers, software platforms and applications, and related equipment and capabilities, specified in detail for each mandatory service location within each Project's TORs. The size and scope of CIC installations may vary by the locations in which they are established, according to population, demographics, geography, or other factors. In each case, the facility must be adequate to allow robust access to broadband ICTs for local community users.

The location and housing for the CIC will be decided by NICTA and local officials, ensuring a publicly accessible and secure facility, and ensuring stable ownership and operation. Project financing may cover the costs of building and/or renovating the appropriate space, as needed.

The broadband connections to the CIC will be linked to the network access point established within each community, and may be co-located with this access point/network node. The capacity of the connection within the CIC must be sufficient to allow for simultaneous peak use of all its stations, while retaining adequate extra capacity for outside connections as well.

- CIC operation and management:

This element involves support for ongoing operation and management of CICs in Community Broadband Project locations, following their construction and start-up stage. The purpose of this operations-oriented stage of the Program is to ensure that the public services to be provided through CICs are delivered in the most effective and appropriate manner, by organizations that are most capable of managing such services. Management of the CICs, which will be established with principles of public private partnerships, should be concentrated among local community personnel, with an emphasis on outreach, customer service, training, entrepreneurship, and sustainable business practices. The UAS Projects under this Program will thus aim to establish effective business models for operation and maintenance of the CICs within target communities, following the construction and installation phase.

The CIC operations and management requirements in a UAS Fund contract will typically include the following, to be specified in UAS Project Terms of Reference. Project bidders will be encouraged to design and propose the scope, configuration, and delivery of CIC services and features in their proposals:

- Management, operation, and maintenance of the CIC, by designated staff engaged or arranged by the contractor under its UAS contract. These staff will be responsible for assisting customers, managing finances and accounts, maintaining hardware and software, and overseeing all other CIC operations.

- Availability of a required set of basic CIC services, including public Internet access (internal and external WiFi), computer use, telephone calling, e-mail, access to e-Government services and other applications and information sites, and more as specified in Project TORs.

- Comprehensive ICT training classes and resources, available to various categories of users, offering appropriate knowledge sharing and capacity building, on an affordable basis.

- Full ISP services for local users, customized to local demand; these should typically include Internet account subscription and management, web site and e-mail server hosting, web design assistance, e-commerce, applications and content development support, weblog and social media services, and other specialized Internet capabilities, expanding as demand merits.

- Technical assistance and support for users, both within the CIC and in the local community (for cost-based fees), assisting with system use, equipment support, maintenance and repair, anti-virus and anti-spam software, trouble-shooting, and other basic ICT technical needs.

- Other related and demanded services that can help make the CIC self-sustaining, while providing value to the community: printing, copying, mobile phonecards, even coffee and snacks, etc., as the CIC operator finds worthwhile for customers.

- Marketing and customer/community awareness initiatives, to spread knowledge of the CIC's activities and benefits, reinforce the brand name, and encourage demand for ICTs in general within the community.

5.3 ICT Platform for Future Growth

This program focuses on the demand side of ICT development objectives, to ensure that citizens and communities are able to gain the most benefits from the installation and availability of advanced broadband ICT networks and services. Different groups of users will find value in different types of ICT applications, functions, devices, and services, but there will in all cases be a wide scope of potential uses for individuals, families, small businesses, and others to improve their livelihood through the use of advanced ICTs.

The purpose of this program is therefore to help develop a platform for the future, long-term development of ICT utilization and opportunities across Papua New Guinea society. Projects in this area will support the development of creative, innovative, and high value ICT activities within communities across PNG, which will tap into the resources and knowledge of the local populations. In turn, NICTA is confident that such Projects will encourage further investment in and development of innovative ICT networks and services throughout the country.

There are two main components to this program, which can be implemented through independent UAS Projects or in combination with other Fund Programs. These are (1) ICT Applications and Content, and (2) Digital Literacy projects. Specific individual Projects will

be designed by NICTA and the UAS Board, in consultation with appropriate public officials and other stakeholders. Key features of each program component are summarized below.

5.3.1 ICT Applications and Content

This component focuses on support for the development of relevant electronic information content and applications of value to PNG citizens, as a key input to the national ICT ecosystem. The main goal is to create and reinforce a robust enabling environment for software programmers, applications developers, information services, media organizations, and any public and private entities interested in sharing knowledge via electronic means.

UAS Projects under this component will typically be jointly developed together with partner organizations and agencies. There should ideally be a diversity of projects, in terms of size and scope, type of products, target users, and institutional partners. NICTA's goal is to help launch new applications and content services, which should become self-sustaining over time. The subject matter of content initiatives should ultimately be of interest and relevance to the primary target user populations in PNG.

Examples of the type of ICT content Projects and outputs that this program will support include:

- Original and translated web sites and other materials presented in local, indigenous languages, highlighting information of greatest interest to populations who speak these languages.

- Information content made specifically for local community users, sharing local knowledge, history, and culture, as well as business and government information, ideally developed by local users themselves.

- Projects focused on graphic interface, audio-video, and other non-written content aimed at engaging and assisting non-literate users; similar applications and content for disabled or uneducated users.

- Entrepreneurial ventures focusing on creating innovative applications for mobile and smart phones, tablets, and other new devices.

5.3.2 Digital Literacy

The goal of this component is to promote increased utilization of ICTs by all PNG citizens, as well as small enterprises and public offices, to achieve a broader contribution of ICTs to

social and economic development, consistent with the Government's national development objectives. UAS Projects under this component will be designed to help enhance public awareness, capacity, understanding, and experience in relation to ICT services and applications, and the opportunities that these technologies can present in people's daily lives.

Under this program, NICTA and the UAS Board will define a set of goals, targets, and mechanisms to support widespread digital literacy, especially among disadvantaged, rural, low income, and excluded population groups. Projects will be developed in collaboration with public, private, and civil service organizations. Representative Projects may include the following features:

- Training classes and workshops
- Public relations and awareness building
- Entrepreneurial assistance and incubation initiatives
- Community-based technical support resources
- Public administration training and application development

It is anticipated that Projects will be implemented through different partner organizations, such as technical training organizations and consultants, University programs, local community institutions, and government agencies. NICTA will identify and solicit partners and proposals during Project design. For each Project, key implementation steps will generally include:

- Planning, procurement, and start-up
- Initial trials, tests
- Broader roll-out
- Monitoring and evaluation

5.4 Expansion of Broadcasting Network Coverage

This program addresses the objective of extending coverage of radio and television broadcasting to all citizens and communities in PNG. The UAS Board and NICTA aim to support growth of the broadcasting sector through targeted use of UAS Fund resources to close gaps and assist low income consumers where the broadcasting market may not reach. This activity will focus on support for infrastructure expansion, primarily through enhancement or installation of broadcast antennae on existing or new towers, in close coordination with the rollout of mobile telecommunications infrastructure under Program 1, as well as potential assistance for low-income households with the costs of the digital broadcasting transition, via discounts on set-top boxes.

5.4.1 Broadcasting Infrastructure Expansion

This component focuses on providing financial support through the UAS Fund for enhancement of transmission towers and installation of antennae and related equipment required to extend the reach of radio and television broadcast signals into unserved and underserved areas. NICTA will work with broadcasting entities to identify gaps in signal coverage, and develop investment plans to expand broadcast networks into populated areas. Projects will generally be designed to coordinate with mobile network infrastructure rollout, so that tower construction and equipment installation can be aligned in the most cost-effective manner.

5.4.2 Affordable Digital Transition: Set-Top Boxes

This component will address the requirement that broadcast television viewers must have access to digital reception under the new digital broadcasting standards. For those without access to digital-ready television sets, this requires obtaining TV converter devices (set-top boxes) to allow their sets to receive the new digital signals. The consequence of this policy, which is beneficial to the entire broadcasting industry, could pose financial hardships upon low income households.

The UAS Board and NICTA will therefore investigate developing subsidy Projects to support the cost of digital TV set-top boxes for lower income users. Such Projects will aim to ensure that all households in the country which require digital converters will obtain them in a timely manner, at low, affordable prices, with a minimum of delay or confusion. NICTA will conduct an analysis of the levels of need and costs, and will prepare a plan that provides the most affordable solutions possible.

6 BUDGET PLANNING

This section identifies the estimated UAS Fund budget for the period 2018 to 2022, and the preliminary proposed allocation of Fund resources among Programs as defined above. These estimates are for initial planning purposes, and will be subject to ongoing review and updating by the UAS Board and NICTA on an annual basis. The specific Projects to be undertaken will be defined and elaborated as part of the development of the Fund's annual Operational Plans.

6.1 Budget Forecast

Based on initial estimates of expected mandatory UAS Fund contributions, NICTA forecasts the following approximate levels of Fund income over the planning period from 2018 to 2022. This forecast assumes that licensed operators will contribute 2% of their revenues, as advised by the UAS Board and determined by NICTA. The resulting contribution amounts are conservative estimates, and don't take account of possible other sources of Fund contributions, or higher industry revenue growth. These figures are the basis for the program budget allocations in the next section.

Year	2018	2019	2020	2021	2022	Total
Estimated Fund income (PGK)	25.0 M	27.0 M	30.0 M	33.0 M	35.0 M	150.0 M

6.2 Summary Annual Budget and Project Plans

The following table provides the estimated annual budget allocation for each Program in each year, following from the above total budget forecast. Specific budget allocations for UAS Projects under each Program will be determined in the development of annual Operational Plans, following these guidelines.

Program	2018	2019	2020	2021	2022	Totals
1) Mobile Broadband Network Upgrade and Expansion	20.0 M	20.0 M	21.0 M	22.0 M	22.0 M	105.0 M
2) Public Community Broadband	2.5 M	3.0 M	5.0 M	6.5 M	8.0 M	25.0 M
3) ICT Platform for Future Growth	0.5 M	2.0 M	2.0 M	2.5 M	3.0 M	10.0 M
4) Expansion of Broadcasting Network Coverage	2.0 M	2.0 M	2.0 M	2.0 M	2.0 M	10.0 M
Totals	25.0 M	27.0 M	30.0 M	33.0 M	35.0 M	150.0 M

ANNEX: DETAILED ACCESS GAP MODEL RESULTS AND ASSUMPTIONS

Accompanying this document, NICTA has made available a summary spreadsheet, containing the Inputs and summary Results of the Access Gap simulation model.

The information in the Input tables was provided to NICTA from operators and other sources, and shows the population, size, and # of LLGs per district, with the estimated population coverage of 2G, 3G, and broadcast networks (as of early 2017).

The Results show the approximate area and population within each district needing to be upgraded to 3G, and needing new 3G network coverage, as well as the estimated UAS Fund subsidy that would be required to render 3G service in each such district commercially viable. Where no subsidy amount is given, that district was found to be "within the Market Frontier" -- i.e., that 3G service could be provided commercially without need for a subsidy.

The findings are based on a variety of assumptions and calculations, and are high-level in nature, for planning purposes. It is likely that actual conditions in many districts will differ from these results due to various factors, but the general trends and relationships are likely to be within a reasonable range of these results.

For further clarity, some of the baseline assumptions used to produce these calculations, provided by various industry sources, include the following:

- 3G towers and base stations would be constructed or upgraded where needed, typically with one tower/BTS per unserved LLG, covering a range of approximately 50 square km.
- CapEx for new 3G towers and BTS cost in the range of US$300K to $400K. Upgrade of a BTS site from 2G to 3G incurs a CapEx cost of about $100K.
- 3G BTS will be linked via fiber optic backhaul, with a CapEx cost of about US$25K per kilometre.
- OpEx costs are in the range of US$60K per site per year.
- In consultation discussions with some suppliers, it was suggested that some of these cost figures may be on the low side for PNG, which could have resulted in lower net cost findings than might be the case in the field. However, other stakeholders have suggested that these assumptions are actually higher than in other comparable markets, and in some PNG conditions as well. Variations based on terrain, remoteness, and other factors can significantly affect actual costs in many locations.

- For revenue forecasts, new customers are expected to spend about 3% of income (GDP/cap) on mobile service on average. (Recent experience indicates that existing PNG customers currently spend about 4% of income on such services.)