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Internet Access and Openness: Myanmar 2012

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Report Note

This report is information compiled from the visit of a technology delegation to Yangon and Naypyidaw, Myanmar in early December 2012. The qualitative, quantitative, and anecdotal information synthesized here was derived from a variety of sources, methods, and observations. While it is expected that the most interested audience is technical, the report aims to provide relevant information for policy makers, civil society, and international investors. The effort to collect, distill, and develop this report was supported by the Open Technology Fund and collaborating technologists.

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Introduction

Myanmar, a country with rapidly rising citizen demand for technological freedom, is poised at a crucial juncture: will government reforms improve communication and media freedoms, or will a lack of institutional capacity and political will maintain the status quo and stymie progress? Currently, proposed government regulation is set to improve communication infrastructure and increase freedom of information, both of which underlie many of the free speech challenges existing within the country today. The debate has shifted from whether these changes will occur, to how soon they will be made.

In spite of this fundamental shift in the political climate, many questions remain as to whether Myanmar's current government will relinquish operational control of the communications industry and harness the type of private sector investment necessary to modernize its infrastructure. In 2012, the government released a draft law intended to expand the telecommunications sector by attracting outside investment. Historically, the government has relied on controlling this asset to monitor the population, resisting policy that would promote citizens' liberties and personal autonomy. Moreover, the law proposes to maintain the government's broad powers limiting citizens' freedom of speech. Despite these points of concern, recent investigations into corruption within the state-operated telecommunications entity support the government's commitment to change.[1] It remains to be seen whether the government can improve citizens' freedom of speech and security, and increase levels of private investment.

[1] See Reuters "Myanmar launches major graft probe at telecoms ministry" Jan-24-2013 http://www.reuters.com/article/2013/01/24/us-myanmar-telecoms-idUSBRE90N0CK20130124

This complex and contradictory atmosphere is vividly illustrated on the streets of Yangon. The government does not provide the public with direct access to draft bills before parliament and thus a thriving bootleg market has emerged: street vendors sell bound photocopies at busy intersections throughout the former capital city. In the same spirit of those street vendors, this report hopes to provide important, often inaccessible information openly to Myanmar's citizens and the international community concerned with the country's future. This emerging debate stands to define the future of civil liberties in Myanmar, among which lies the country's access to the world's dominant communication medium, the Internet. Further, the direction Myanmar elects to take will have repercussions throughout the region.

Key Facts

- 6.7 percent of the Myanmar's populations have wire line and wireless Internet capable subscriptions.[2] Some residents are likely to have multiple devices; [3]

- Only 5.1 percent of the country's 60 million inhabitants, or 3.06 million, have mobile service lines. Some subscriptions are shared; [4]

- Internet penetration is less than 1 percent [5] and mobile subscription is approximately 2 percent, or 1.24 million subscriptions; [6]

- The majority of Internet access in Myanmar is obtained through Internet enabled mobile devices;[7]

- The United Nations International Telecommunications Union shows 0.9% of the population subscribing to land-line service; [8]

- The government's focus is on mobile Internet, with intentions to build-out on existing mobile and wireless networks with less emphasis on deploying fiber; [9]

- The average Myanmar income is $60-70 per month; [10] and

- The cost of acquiring and activating an average smartphone is $563.[11]

[2] Conversation with in-country telecommunication experts (Myanmar Computer Federation).
[3] See e.g. http://www.telecomasia.net/blog/content/myanmar-asias-wireless-final-frontier
[4] See e.g. http://www.zdnet.com/regulation-infrastructure-hinder-myanmars-telecom-ambitions-7000006962/
[5] See http://www.itu.int/ITU-D/ict/statistics/.
[6] See http://www.itu.int/ITU-D/ict/statistics/. The Asian Development Bank puts this figure at 3 percent. See Myanmar in Transition, Opportunities and Challenges, August 2012, available at http://www.adb.org/sites/default/files/pub/2012/myanmar-in-transition.pdf.
[7] Translation of local Myanmar newspaper
[8] Note that the use of land-lines may be significantly larger than the number of subscribers. In Yangon the team noted impromptu "phone booths." Individuals with land-line subscriptions or 'access' to an MPT street box would place phones connected to a jack in an adjacent building on the street. Passers-by could pay to place a call. A link to a photo is here.
[9] Source, Myanmar Computer Federation
[10] Conversation with in-country telecommunication experts. United Nations data suggests gross national income per capita as $380. See Myanmar, United Nations Statistics Division at http://data.un.org/CountryProfile.aspx?crName=MYANMAR. Data from the U.S. State Department suggests income levels slighly over $100 per month for the typical resident. See Myanmar report at http://www.state.gov/j/drl/rls/hrrpt/humanrightsreport/index.htm#wrapper. For government employees, annual income appears to have risen since this data was collected. See Myo Thant, "Myanmar gov't personnel given pay raises," *Mizzima*, March 14, 2012, http://www.mizzima.com/news/inside-Myanmar/6765-Myanmar-govt-personnel-given-pay-raises.html.
[11] According to our research detailed in this document. This does not include the recurring cost of data and voice service.

Regulatory Climate

The current Information and Communication Technology (ICT) regulatory situation in Myanmar is uncertain. Policy makers are striving to find a balance between the desires of internal reformers and external business interests. With its geographic neighbors of India and China, Myanmar's recent efforts to increase civil liberties and promote economic reform are a unique hybrid in the region. While today's telecommunication regulator and sole operator in Myanmar are both state-run, the government has expressed its intent to fully privatize the existing operator and offer new operator licenses to both domestic and international telecommunication companies.[12]

In a decision applauded by supporters of democracy and seen as a buck from the influence of its neighbors, Myanmar recently began dismantling the Press Scrutiny and Registration Division commonly known as its censorship office.[13] At the same time, leading journalists within the country continue to be targets of alleged state-sponsored hacking,[14] and Myanmar's leading provider for telecommunication equipment is Huawei,[15] a Chinese company widely considered to be a national security threat by western leaders.[16] The cognitive dissonance visible in Myanmar's attempts to increase and protect citizen rights while simultaneously encouraging broad foreign investment leaves observers uncertain whether the government is capable and willing to develop a balanced legal and regulatory framework.

[12] See Mizzima News "Telecom growth in Burma poised to take off" Oct-9-2012 http://www.mizzima.com/business/8193-telecom-growth-in-burma-poised-to-take.html
[13] See New York Times "Chief Censor in Myanmar Caps His Red Pen" Sept-12-2-12 http://www.nytimes.com/2012/09/22/world/asia/myanmars-chief-censor-is-closing-his-office.html
[14] See New York Times "E-mails of Reporters in Myanmar Are Hacked" Feb-13-2013 http://www.nytimes.com/2013/02/11/world/asia/journalists-e-mail-accounts-targeted-in-myanmar.html
[15] See Mizzima News "Telecom growth in Burma poised to take off" Oct-9-2012 http://www.mizzima.com/business/8193-telecom-growth-in-burma-poised-to-take.html
[16] See New York Times "U.S. Panel Cites Risks in Chinese Equipment" Oct-8-2012 http://www.nytimes.com/2012/10/09/us/us-panel-calls-huawei-and-zte-national-security-threat.html

Relevant Myanmar Legislation

- Myanmar Draft Telecommunications Law (2012) (English): https://docs.google.com/open?id=0BwuAcsJ-0e8YbHdiVldaR19aOEk
- Myanmar Telegraph Act (1885) (English): http://www.mcpt.gov.mm/mcpt/myanmar-telegraph-act.htm
- Myanmar Wireless Telegraph Act (1934) (English Translation): http://www.mcpt.gov.mm/mcpt/myanmar-wireless-telegraphy-act.htm http://www.mcpt.gov.mm/mcpt/amendment.htm
- Electronics act of 2005 (Myanmar copy): http://www.acmv.org/books/Myanmar_Electronics_laws.pdf

Regulation Key Facts

- The primary consultant for draft ICT regulation is the United Nations International Telecommunications Union; [17]
- By the end of 2013, Myanmar regulators and operators hope to connect 10 percent of Myanmar's population, approximately 6 million people, to become wire line or wireless Internet subscribers.[18] There are currently 800,000; [19]
- Regulators are pushing for "technology neutral" 3G mobile infrastructure; [20]
- News related websites from domestic and foreign media outlets became most viewed online media after decreasing online censorship; [21]
- Domain names are controlled and allocated by the Myanmar Post and Telecommunication Authority (MPT) requiring a paper application to be submitted in-person at the telecom office; [22]

[17] Source, Myanmar Computer Federation
[18] Source, The Ministry of Communications, Posts and Telegraphs
[19] Source, Myanmar Computer Federation
[20] Source, The Ministry of Communications, Posts and Telegraphs
[21] Source, The Ministry of Communications, Posts and Telegraphs
[22] See Appendix IV and http://www.nic.mm/.

- Website censorship requests are administered by the Ministry of Communication; [23]

- News censorship requests are administered by The Ministry of Information; [24]

- Spectrum leasing laws are incredibly unclear arbitrary regulated by the Ministry's, and as such reportedly a significant problem; and

- The two operators, MPT and Yatanarpon Teleport, have two 10Gbps connections.[25]

[23] Source, Myanmar Computer Federation
[24] Source, Myanmar Computer Federation
[25] Consultant, Yatanarpon Teleport.

Tools the team used to identify filtering and performance data:

- *OONIprobe* - Used to identify network interference between two points online; [26]
- *TCP Traceroute* - Able to determine the way data travels through the Internet; [27]
- *Netalizer* - Provides analysis on various properties of a user's Internet connection including blocking of important services; [28]
- *Speedtest.net* - Capable of measuring the capacity of an Internet link; [29]
- *GSM Map Project* - Passively determine the security and safety of GSM networks; [30] and
- Manual browsing of standard expected-to-be-blocked sites

Overview of Test Results

Network Openness

Netalyzer tests at the Royal Kumudra Hotel, Naypyidaw, showed blocked services common on the censorship. This could have been because of restrictive settings maintained by the hotel or the hotel's Internet Service Provider. Interestingly, the same tests at the Ministry of Information, Communication, and Technology (ICT) did not show any signs of blocked services.

Censorship tests on mobile networks revealed distinct and unique censored web pages, primarily focused on pornography. Pornography website censorship was confirmed by the Ministry of Telecommunications.

[26] See https://ooni.torproject.org

[27] See http://michael.toren.net/code/tcptraceroute

[28] See http://netalyzr.icsi.berkeley.edu

[29] See http://speedtest.net Note, while measurementlab.net tools are preferred, the lack of local servers made them impossible to use in this region. Note also that, as above, local reports question the provisioning of the test server, which means the results could be off by unknown margins. As a comarative metric, however, these are helpful.

[30] See http://gsmmap.org/

Websites reported previously, and sometimes sporadically, blocked such as popular social networks, email providers, foreign news websites and certain search terms are now consistently available.[31] The Ministry of Telecommunications reported foreign news websites as the most newly uncensored destinations.

Internet Performance

- ICT Ministry, Naypyidaw
    - Provider: UU-Net
    - Download speed: 11.2Mbps
    - Upload speed: 9.8Mbps
    - Ping: 6ms
- Royal Kumadra Hotel, Naypyidaw
    - Download speed: 0.29Mbps
    - Upload speed: 0.3Mbps
    - Ping: 935ms
- Public Access Center (as reported above), Naypyidaw
    - Download speed: 0.1Mbps
    - Upload speed: 0.05Mbps
    - Ping: 490ms
- Hotel in Bagan (1/16/13)
    - Download speed: 0.28Mbps
    - Upload speed: 0.05Mbps
- Green Hills Hotel, Yangon (1/20/13)
    - Download speed: 0.55Mbps
    - Upload speed: 0.16 Mbps
    - Ping: 55ms
- Yangon Residence
    - Provider: Redlink Wimax
    - Peak Hours
        - 1.5Mbps
        - 0.5Mbps
    - Off-Peak Hours
        - 3Mbps
        - 1Mbps

[31] *See e.g.* FreedomHouse, "Freedom On The Net," Myanmar Country Report, 2011.

Mobile GSM Security

A cursory security analysis of Myanmar's only GSM network, MPT - Myanmar Post and Telecommunication, was conducted using the tools provided by the GSM Map. The analysis is based on data samples submitted to the GSM Map project by the visiting technical delegation. GSM Map's analysis is able to determine the percentage of voice calls and text messages that are safely encrypted and the actual level of protection the network employs to protect users from interception, impersonation, and tracking. The level of protection for each of the three categories is represented by a percentage where a higher percentage represents a networks implementation of mitigation measures. As such, a higher percentage in each of these three categories represents a safer mobile phone network.

As determined by the passive data captured, 95% of the voice calls and text messages in Myanmar are completely unencrypted, the remaining 5% are encrypted using the least secure standard, which is A5/2. This leads to generally weak overall scores in GSM Map's three rated categories: Intercept: 6%, Impersonation: 1%, Tracking: 55% (possibly 1%, see "HLR lookup prevention" in Appendix I). A more details from the analysis can be found in Appendix I.

Infrastructure and Access Observations and Statistics

The below presents observations and measurements on Myanmar's infrastructure and connectivity. This in no way claims to present a complete picture. However, as a collection of facts and findings taken on the ground, it can be used as a starting place for those looking to continue work in this area, and those looking for a timely, if not canonical, source of information on a rapidly changing environment.

Note that the content addresses a technical audience, with explication where it makes sense. This said, anyone with an Internet connection and a search engine should be able to piece together the import of unknown terms and descriptions without much trouble. Unless specified otherwise, all amounts have been approximated to the United States Dollar ($USD).

Infrastructure

- 13.5 Gbps is available in country, obtained via the South-East-Asia/Middle East/Western Europe Optical Submarine Cable (SEA-ME-WE 3). Currently everything, wireline and wireless, runs through via this single connection.[32] All traffic runs through the "international gateway" that is on Prome road or PY1. This picture may change soon, however, as the government looks at expanding to SEA-ME-WE 4 as a means to bring tech business to Myanmar and boosting speeds.[33] There is also a crossborder fibre (India, China, Thailand, Laos) that was explained as a "backup link".[34]

- While the government relies on the same backhaul for its own access, the rest of its infrastructure is completely independant from the rest of the population.[35] The difference in performance results between the Ministry and other locations, shown above, points to the impact of this separation.

- 2 ISPs: MPT (100% government) and Yatanarpon Teleport (51% government held, 49% privately held)[36]

- IPv4 addresses are almost non-existent, presenting another significant limitation to further growth. Static IPs are allocated only for elite organizations, for example, banks.[37]

- Local reports say that upkeep and professional maintenance of equipment at the international gateway hasn't happened since 2008, and thus there are rampant vulnerabilities (many DNS attacks), configurations are out of date, and the equipment is not performing well.[38]

[32] International Telecommunication Union, Wireless broadband masterplan for the Union of Myanmar http://www.itu.int/ITU-D/tech/broadband_networks/WirelessBDMasterPlans_ASP/WBB_MasterPlan_Myanmar.pdf

[33] The Myanmar Times, "Faster Internet on trial: deputy minister" August 12, 2012. http://www.mmtimes.com/index.php/business/technology/466-faster-Internet-on-trial-deputy-minister.html; The Myanmar Times, "MPT considers new cable to boost telecoms" September 10, 2012. http://www.mmtimes.com/index.php/business/technology/1365-mpt-considers-new-cable-to-boost-telecoms.html and International Telecommunication Union, Wireless broadband masterplan for the Union of Myanmar http://www.itu.int/ITU-D/tech/broadband_networks/WirelessBDMasterPlans_ASP/WBB_MasterPlan_Myanmar.pdf

[34] Source, Myanmar Computer Federation. *See also* Xinhua Net, "Myanmar builds more cross-border fiber optic links to improve communications services," December 3, 2012, available at http://news.xinhuanet.com/english2010/sci/2010-12/03/c_13633549.htm.

[35] Observed during testing performed within government buildings.

[36] Source, Myanmar Computer Federation.

[37] Conversation with local IT professional

[38] Conversation with Consultant, Yatanarpon Teleport.

- Bluecoat equipment is pervasive, and used in part for deep packet inspection (DPI).[39] Cisco and Huawei are also present.

Access Options

- More than 10,000 Fiber To The Home (FTTH) users are active in the country, relying to two companies, ELight and Fortune. There are reportedly fewer than 300 FTTH users in Yangon. However, Fortune is reportedly engaged in more aggressive deployment. The cost for FTTH installation is $1000 US, with a approximately $50 US per month charge for access. Due to backhaul limitations, FTTh speeds average between 40-100 Kbps.[40]

- While Satellite connections are used, they are of course very bandwidth constrained. Satellites used include Tycom and Viet Sat. Approximately 700-800 Viet Sat units exist within the country using 11GHz. It is no surprise that the lack of non-bandwidth constrained secure connectivity options has reportedly limited investment from oil and gas companies.[41]

- WiMAX exists in selective locations with fairly ubiquitous coverage in Yangon, all reportedly using 315Mhz. Some fixed point wimax also exists, reportedly beginning in 2002. The network relies on MAC address authentication.[42]

- MPT offer metro ethernet for approximately $200 per month and $4,000 installation[43]

- ADSL speeds are extremely slow (reportedly 3 Kbps) due to lack of copper maintenance and rampant congestion. An uncapped plan is advertized at approximately $40 for 128 Kbps. [44]

- There is no Blackberry service in country.

[39] Citizen Lab, University of Toronto, "Behind Blue Coat: An Update From Myanmar," November 29, 2011.
[40] Conversation with Consultant, Yatanarpon Teleport.
[41] Conversation with Consultant, Yatanarpon Teleport.
[42] Conversation with Consultant, Yatanarpon Teleport.
[43] IT Specialist, Radio Free Asia Myanmar Service.
[44] Consultant, Yatanarpon Teleport.

Miscellaneous

- In the early 2000's, someone wanting a mobile phone needed to apply for a mobile phone lottery, where only a small number of users were selected. The cost was approximately $2,000, and there was only one type of mobile phone available.[45]

[45] Source, Myanmar Computer federation

The conditions for access to Myanmar's mobile network are changing rapidly. In early 2012 the Myanmar Ministry of Communications, Posts and Telegraph (MPT) reduced the price of SIMs from approximately $500 to approximately $250.[46] This new price tracks to the government's growing focus on access as an engine for economic growth, but fails to bridge the wide digital divide a Myanmar national earning the average salary must cross to reach the vast amounts of information available on the Internet,[47]

With the rapidly occurring changes, we advise that the findings recounted here be only tentatively projected as the norm throughout the country. Further, foreigners in the capital city of Naypyidaw did this exercise, which is the new and lavish center of Myanmar government power. While we confirmed with many locals that it matches what Myanmar nationals would experience, these limitations should be kept in mind. Intuitively, the following report of this delegation's experience could present differences from those in other parts of the country. Finally, many of the numbers quoted here aren't corroborated by external sources. These are the facts as experienced on the ground, in a rapidly changing country.

The account below narrates this experience and describes the steps required and observations in detail. Unless specified otherwise, all amounts have been approximated to the United States Dollar ($USD).

[46] http://www2.irrawaddy.org/article.php?art_id=23158

[47] 2008 State Department Human Rights Report on Myanmar listed between $0.19 and $0.75/day as average wages for daily workers. This window was tentatively corroborated by those on the ground.
Source: http://www.state.gov/j/drl/rls/hrrpt/2008/eap/119035.htm
The CIA World Factbook estimates that 32% of the Myanmar population live in Poverty.
Source: https://www.cia.gov/library/publications/the-world-factbook/geos/bm.html

Summary of Required Steps

1. Purchase Smartphone; cost ranges between a high of $1,120 to a low of around $130

2. Choose voice/text service plan required to activate the phone

   a. To activate a customer must; complete application forms, submit passport (foreigners) or official national ID (Myanmar) for copies, provide two passport photos

3. Purchase Data-capable SIM; Option to purchase either a national SIM or an International SIM, both costing $250

4. Activate SIM (Immediate); For voice/txt service, there are no ongoing service plans available, only prepaid. Top-up cost is approximately between $10-25 depending on number of minutes/messages and in-country or international access

5. Activate Data Service; after above required steps, cost is approximately $17 and rate is approximately $1 for 280 minutes of usage

6. Wait for Government Approval for Data Service Activation; It takes between 2 and 3 days; the telephone company reports the purchase and customer to MPT

Purchase Smartphone

To obtain the phones and data access, delegation visited multiple stores, comparing phones and plans, and asking questions.[48] Prices for smart phones in these stores ranged from a high of $1,120 for an Apple iPhone with iOS to a low of around $115 for a Samsung Galaxy Y with Android. Being thrifty, the team purchased the Galaxy Mini for $130.

[48] See Appendix I, Photo 1

Service Plans

Voice and Text

Following the selection and purchase of a phone, a buyer is presented to review service plans. “Plans” as understood in the US do not exist. The buyer has three known options: a single-use pre-paid voice and non-international text only service with SIM for a one-time fee of $25 that is not able to be refilled[49], a “top-up” pre-paid voice and non-international text only service with SIM[50], or a pre-paid voice and international text service with SIM. However, it is not clear that the international text message service actually functions, as this setup was unable to receive any texts with foreign origination. The first option is the only one that can be purchased within the airport on arrival or at a retail store. Rates for voice were around $18 for 3 hours of non-international voice service.

Data

Access to data service is obtained separately by completing a number of application forms at a retail store. The forms associate the buyer's identity with a new data-capable SIM and their mobile device. The service is only activated after the Ministry of Communications, Posts and Telegraph (MPT) approves the forms. The estimated time for MPT to approve and activate data was quoted at 2 days. Often this stretches to 3 days while payment is confirmed. The delegation’s data access was activated on day 3. When asked why it takes so long to activate data service, and what the process for approval is, the store employee said that the telephone operator has to send the application to MPT. Beyond this explanation, they did not seem to know and/or want to elaborate about how or why approval is determined.

[49] See Appendix I, Photo 2 & 3
[50] See Appendix I, Photo 4

SIM Activation

During the negotiation for a data service plan, the store employee requires the buyer's passport for a photocopy to accompany the application form submitted to MPT. In addition, the buyer is required to obtain and submit two passport photos to be included with the form. The photos cost a little over $1.00. Compared to the average Myanmar salary (~$2/day) this is a notable sum. After photocopying the passport, the salesperson completed the remaining paperwork. One full copy, including one of the two original passport photos, is given back to the customer for their records. A redacted scan of the completed form is included in Appendix 1 Photo 5. In total, the application to obtain data service requires (1) an official ID (a passport for foreigners), (2) passport photos, and (3) a completed form.

SIM Purchase

Following completion of all required forms and applications, the buyer is offered to purchase a data-capable SIM card, which costs $250. All offered SIMs were for GSM networks. None of the visited stores offered a CDMA data network option.

When purchasing a data SIM, the buyer chooses whether it is an international or national SIM from national operator. With an international SIM, all received calls and texts are free, and international outgoing rates were quoted as costing $1 per minute. With a local SIM, all local and international received calls and texts are free as well; but calls and text can only be sent in country. International or not, a data SIM offered by a Myanmar operator is not capable of international roaming data service. It is capable of receiving additional credit, reloaded or topped-up, for international voice minutes, national voice minutes, and national text messages. Also worth noting, the data SIM offered did not have an authentic appearance, looking almost hand-made, and used.[51]

[51] See Appendix I, Photo 6

Before activating data service, voice and text service must be activated. Two pre-paid activation options for the international service were available for purchase with USD (and formerly with Foreign Exchange Certificates, a form of surrogate currency pegged to the USD at approximately 1:1, for either 10 or 20 FEC). The delegation paid to activate an international data SIM at the cost of $10.[52]

After the phone, pre-paid calling plan, data SIM, and voice/text service were purchased, data activation could be purchased. Activating the data service cost about $17. This fee acts as credit that can be refilled, topped off or reloaded, when credit expires.[53]

Data is charged by the minute with rates that vary between 2 to 3 kyat per min. The variance in rates is represented by two different quotes, which appear fairly standard.[54]. As a point of reference, after converting Myanmar kyat to USD, $1 buys approximately 280 minutes of data usage.

In another example of Myanmar's rapidly changing ICT environment in Myanmar, the per-minute charge for data is scheduled to soon change by the government according to the store employees. In 2013 the government will begin charging per Kilobit; from 2 kyat per minute to 2 kyat per 100 Kilobits of data.

Pirated Apps

After all application forms and fees were signed and paid, the store employee asked if the delegation wanted mobile applications, or apps, installed onto the Android smartphone. This is a service they claim to offer anyone purchasing a smartphone. After the delegation agreed, they gained administrative access to the phone utilizing one of the more than 10 Gigabytes of Android root exploits.[55]

[52] See Appendix I, Photo 7
[53] Note, because we did not try, the delegation was not able to confirm this.
[54] http://www.mmtimes.com/index.php/business/technology/466-faster-Internet-on-trial-deputy-minister.html
[55] See Appendix I, Photo 9

The store had an existing cache of ready-to-load apps saved on a desktop computer and offered to transfer these via the desktop computer to the delegation's new smartphone.[56] The delegation reviewed the app titles, which were all found to be generic and unfamiliar. A short random list of titles included: Battery Indicator; Virus removal; Download possibilities; Camcard; Blacklist; GOthemes; GOlauncher; GOstore.

Other Notes

During the process it was apparent that the stores visited were at high-end of the mobile market, and were targeting affluent Myanmar. Working there itself seemed to represent status, as communicated through dress, English skills, and the iPhones and other expensive devices owned by various employees.

Phones were not available localized to the Myanmar language. The smartphone purchased by the delegation came by default with English language settings, while other locals owned smartphones with German language settings.

In Naypyitaw and Yangon the team encountered countless other small shops, some similar to the one where the phone was purchased, and some more rugged, offering more diverse electronics and services.

[56] See Appendix I, Photo 10

Smartphone Observations: Cost and Availability

All of these observations were made in Naypyitaw, Pyinmana, and Yangon. The limitations noted above apply. Unless specified otherwise, all amounts have been approximated to the United States Dollar ($USD).

- Huawei is the most popular brand, in stores and among those we talked to locally;
- Second most popular is Samsung;
- Next is Apple and imitations, often very expensive;
- Overall, Android dominates in smartphone operating system penetration; and
- In addition, many brands unfamiliar to US natives were available. Photos included below.

Mobile Cost Comparison

$563 - The average calculated cost of a ready-to-use smart phone with International service, computed using the numbers below.

Device costs

Note that some of the lower-range models have limited “smart phone” capabilities and do not appear to be widely available.

- $39: Karbonn K280
- $53: Nokia G365S
- $80: Samsung S III (probably bootleg)
- $109: Lenovo A366t
- $109: Sunlight P900 Mini
- $115: Samsung Galaxy Y
- $130: Samsung galaxy mini
- $189: GMG A9000 (average cost among various offers)
- $243: Venera AKTIV (average cost among various offers)
- $317: Samsung galaxy S
- $524: Samsung galaxy S3
- $624: Huawei C830E
- $1,120: iPhone

Data-capable SIM Cost

- $250: Local SIM (average observed)

Voice Cost

- $12-18: 3.5hrs outgoing voice time

International Service Fee

- $10-20: Activation fee for International service on an existing SIM

Data Cost

- $17: Data activation fee. After the pre-paid allocation is used, the cost is 2-4 Kyat/min (less than $0.01 US/min) for each minute of connectivity to data service.

Public Internet Access Center Snapshot

The Public Access Center (PAC) in Naypyitaw[57] was created by the regional government. It can be seen to represent a desire on the part of government to provide access to citizens, if in a controlled and limited environment. As noted, Naypyitaw is a capital city, and thus can't be seen as representative across the country. Current estimate puts about 2500 PACs in the whole of Myanmar.[58]

- The Center provides citizen access to three PCs, running Windows XP, below. Cost of use was approximately $0.50 US/hour.[59]

- The machines were connected with an ADSL connection with an Alcatel ADSL Home Plusplus 500 router.[60]

- A test run on speedtest.net to a test server in Yangon reported the following[61]:

    - Ping time of 490ms

    - Download speed of .1Mbps and .05Mbps

    - Note that locals on the ground knew the person running the speedtest.net test server. They reported that it was not properly provisioned, and thus the results weren't accurate. Irrespective, the observed DSL performance was excruciatingly slow. By way of example: a 23MB download was slated to take 17 hours to complete. The time to complete on an average US connection would be 2-4 minutes.

- A quick virus and malware scan using a dated version of Kaspersky Anti-Virus detected approximately 100 pieces of malware on one machine.[62]

[57] See Appendix II, Photo 1
[58] Source, Myanmar Computer Federation
[59] See Appendix II, Photo 2
[60] See Appendix II, Photo 3
[61] See Appendix II, Photo 4
[62] See Appendix II, Photo 5

Information About PAC's

A Public Access Center (PAC) license costs $60/ month, and while not all cybercafés are licensed PACs, this is the operational route required by the government to be licensed. Both PAC management and individual customer use come with extensive requirements. For example, each computer is required to have key loggers and a screenshot taken and stored every 5 minutes, and every other week all screenshots and accompanying data are required to be put onto a cd and sent to Myanmar Info-Tech. Anecdotally, many PAC owners use spyware to watch what their users are doing, often for their own interests.[63]

Myanmar PAC Regulations

1. All cybercafé users must supply their name, Identity card or (Passport Number), address, and phone number to the cybercafé. Cyber cafe owners must record their identities. [64]

2. Internet Usage must be recorded in Date/Time/Screen Shot/URLs format and send it to Myanmar Info-Tech via CD-Rom every 2 weeks.

3. Owners and operators of cybercafés should keep backup logs of Internet usage.

4. Screenshots must be taken every 5 minutes.

5. Monitors must be faced to side where they can be easily viewed publicly.

6. Cybercafés must post a sign stating, "Only subscribers of MPT's official email and Mail4U can use email. Other email use is not allowed."

7. Cybercafés must post a sign stating that "Tunneling Website/Software are prohibited"

8. Cybercafés must post a sign stating that "Cyber Crimes (Hacking, Virus Distribution, Port scanning and etc.) and acts against Myanmar culture are prohibited"

9. No access of political web sites is allowed.

[63] Multiple conversations with local IT professionals

[64] See Appendix II, Photo 6 for original version in Myanmar Ref: http://opennet.net/blog/2008/07/Myanmar-regulations-cybercafes-stringent-expected

10. It is prohibited to host or engage in gambling activities in PACs

11. Sale of alcohol and drugs is prohibited.

12. Use of speakers is not allowed. Must use headphones.

13. Use of disk drives, CD drives or USB Ports is not allowed in PACs

14. If a user wants to download or copy files from the Internet, he/she must register in logbook.

15. PACs may not remain open after 11pm.

16. PACs must make fire prevention arrangements.

17. If someone disobeys PAC regulations, owners must promptly inform Myanmar Info-Tech.

18. Owners and operators must obey the Wide Area Network law and related policies for ICT use (3/2003).

19. Owners and operators must obey Myanmar Info-Tech's rules and regulations that are announced as needed.

Conclusion

The purpose of the technical delegation's visit to Myanmar was to gather quantitative, qualitative and anecdotal data from within the country. The analysis here is intended to identify a baseline of media and communication indicators during this period of transition, which will help future efforts to benchmark Myanmar's progress in communication infrastructure and freedom of expression. We position this report as the opening of an ongoing research process in which others will update, expand, and build on the findings here. While this report does not seek to provide an action plan for advocacy, it does seek to highlight the challenges and opportunities currently facing Myanmar as the country strives to evolve.

Key Findings

Some key findings include:

- Little to no separation between government regulators and communication operators;
- Lack of regional and local technology education and access programs;
- Limited number of independent local media outlets;
- Lack of existing safeguards for intermediaries such as Internet Service Providers;
- Lack of legal protections for freedom of speech and journalists;
- Unsafe communication environment for transfer of confidential information;
- Low citizen access to the government's internal decision-making process;
- Insufficient short- and medium-term goals to increase end-user Internet access and communication infrastructure;
- Imbalance of network capacity along with priority for public institutions over small businesses and individuals;

- Unclear legal protections for citizen privacy and protection from surveillance;

- Unclear policies on censorship;

- Current process and cost for Internet access is prohibitive;

- Lack of open and formal process for private industry or civil society to engage with government; and

- No Freedom of Information law.

Recommendations

Despite these resounding challenges, there exist openings and opportunities for policy makers, private investors and civil society to effectuate positive change. The opportunity to expand affordable Internet access in Myanmar from single digit penetration to double or triple current rates in a few years would have a significant impact on politics, economics, and society. It would also demonstrate the government's effectiveness in improving quality of life. We offer these general suggestions as means to act on these opportunities for "technology as post-transition stabilization":

- Domestic and international technologists should seek careful partnerships with Myanmar civil society groups to help disseminate knowledge and help create home-grown ICT solutions;

- The Myanmar government should capitalize on ICT as an area ripe for investment while ensuring that this effort promotes civil liberties and creates economic opportunities for its citizens;

- Diplomatic initiatives in Myanmar should target ICT infrastructure development (e.g. building Internet Exchange Points, establishing efficient routing with neighboring countries, building basic cyber-security systems, and rationalizing prices through fair market regulations). Creating the conditions for a growing ICT marketplace will have many positive externalities with respect to political and economic liberalization.

- International economic development programs should be tied to concrete and measurable ICT progress that advances freedom of expression in Myanmar; and

- Private ICT investors should proceed with caution under the current regulatory climate and pursue investments that foster both capital *and* social gains.

The challenges currently facing Myanmar's ICT industry are substantial and it remains unclear whether the government of Myanmar is willing or able to address the country's telecommunication and media needs. The snapshot contained in this report exposes a country undecided, in which a precarious ICT framework holds both the legacy of autocratic conditions and yet also clear efforts to modernize and democratize. The international attention generated by Myanmar's recent political opening makes this an opportune moment for Myanmar to differentiate itself in the region and embrace its own positive, lasting change.

Appendix I: Detail Analysis of MTP Network Security

SRLabs, the maintainers of the GSM Map Project, details below on all the missing protection measures. For reaching reference network security (100% on each protection measure) the following features are *missing*:

A5/1 + Randomization

The A5/1 cipher can be broken with moderate effort and investment. Even so, it is better than no encryption in the first place.
As A5/1 decryption attacks rely on a known plaintext, knowledge about the full content of any encrypted message provides attack surface, so the following additional measures need to be implemented when using A5/1:

Fill bit randomization

As the information transmitted in most GSM control messages does not fill the whole SDCCH frame, message length is indicated at the beginning of the frame, with following unused bytes traditionally being padded with static bytes. By randomizing these so-called "fill bits", plaintext prediction and cryptographic attacks can be mitigated.

SI/5 randomization

System information type 5 (SI5) messages cannot be scrambled using padding randomization since they are of full length and hence contain no padding. Additionally, their content is predictable, as they are also sent in plaintext before encryption starts. There are several approaches for randomizing or omitting these messages, some of which are standardized through 3GPP and some of which are individual ideas by equipment manufacturers.

A5/3 encryption

The A5/3 encryption derives from a standard introduced by 3GPP for third generation mobile networks, but can also be backported to GSM. As of today, no practical attacks on A5/3 encrypted GSM traffic have been demonstrated. Usually, not all cells in a network are capable of A5/3, which is why the additional measures for A5/1 are necessary.

Hopping entropy

During call setup, the BTS defines a frequency hopping sequence to the handset. For the time of the call, the transmission frequency is constantly switched following the specified pattern. The function to generate the frequency hopping sequence is relying on 4 variables that are either known to the attacker or highly predictable. Introducing entropy into this function will make it much harder for an attacker to record encrypted traffic for later decryption.

> Note: In Myanmar, the hopping entropy score is relatively high because they are using all available frequencies. However, since they are not encrypting at all, this doesn't really help against intercept.

Key reallocation
Changing the encryption key for every transaction prevents impersonation and significantly raises intercept effort. Makes sense, once encryption is implemented.

TMSI reallocation
The temporary mobile subscriber identity (TMSI) is an identification number used in particular during call setup. Once an attacker is able to intercept the TMSI, they can impersonate their victim, if the network does not renegotiate a new TMSI on every transaction. Furthermore, user location tracking is facilitated if TMSIs are not rotated frequently.

Include IMEI in cipher command
During encryption handshake, the mobile's first response is predictable. SALTing it with the IMEI increases entropy and mitigates known-plaintext attacks.

HLR lookup prevention
We were unable to track a mobile number from the Internet using the HLR query "send routing info for short message."
This is good, but can have multiple causes:
1. MPT blocks such queries in general (best practice)
2. MPT blocks such queries from certain providers / countries (okay, but not sufficient)
3. We used inactive phone numbers for the test (error possibility)
So, let's assume that the tracking protection is actually at 55%.

Appendix II: Photos Related to Section Technical Analysis

Photo 1: Mobile Phone Retail Shop

Photo 2: One-time Pre-paid Voice/Text Only SIM Card, External

Photo 3: One-time Pre-paid Voice/Text Only SIM Card, Internal

Photo 4: International Voice/Text Only SIM Card

Photo 5: Redacted SIM Card Application Form

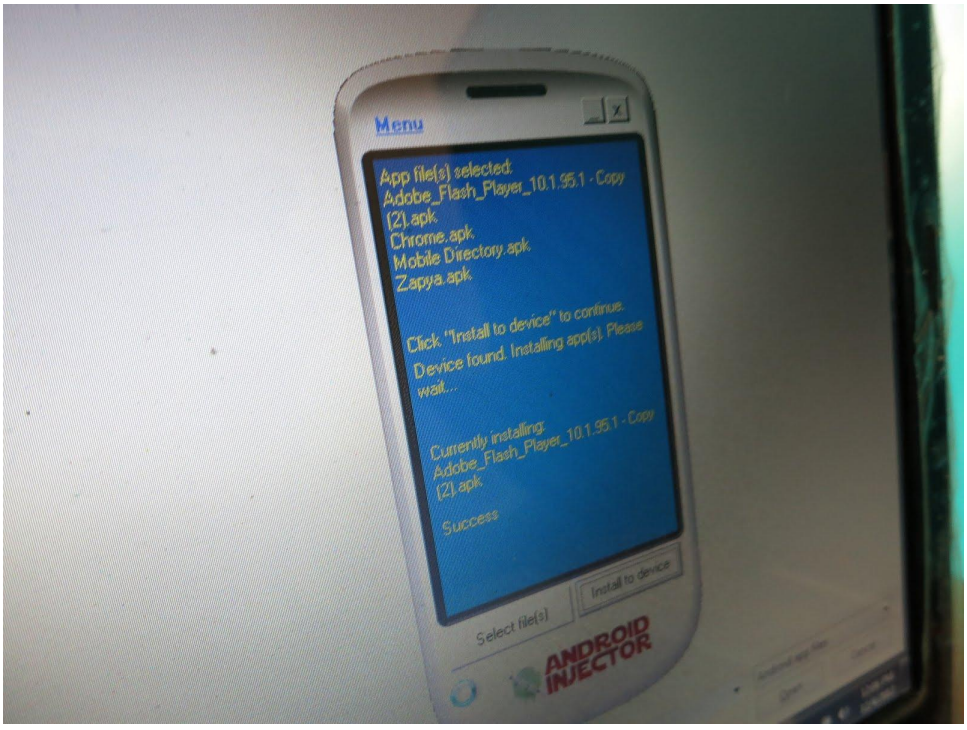
Photo 6: Voice, Text, and Data Capable SIM Card

Photo 7: 10 FEC Prepaid Top Up SIM Card

Photo 8: International SIM Card

Photo 9: Loading Pirated Apps

Photo 10: Loading Pirated Apps, Con't



Appendix III: Photos Related to Public Access Centers

Photo 1: A Public Access Center in Naypyitaw

Photo 2: Inside a Public Access Center in Naypyitaw

Photo 3: Alcatel ADSL Home Plusplus 500 Router Providing Internet

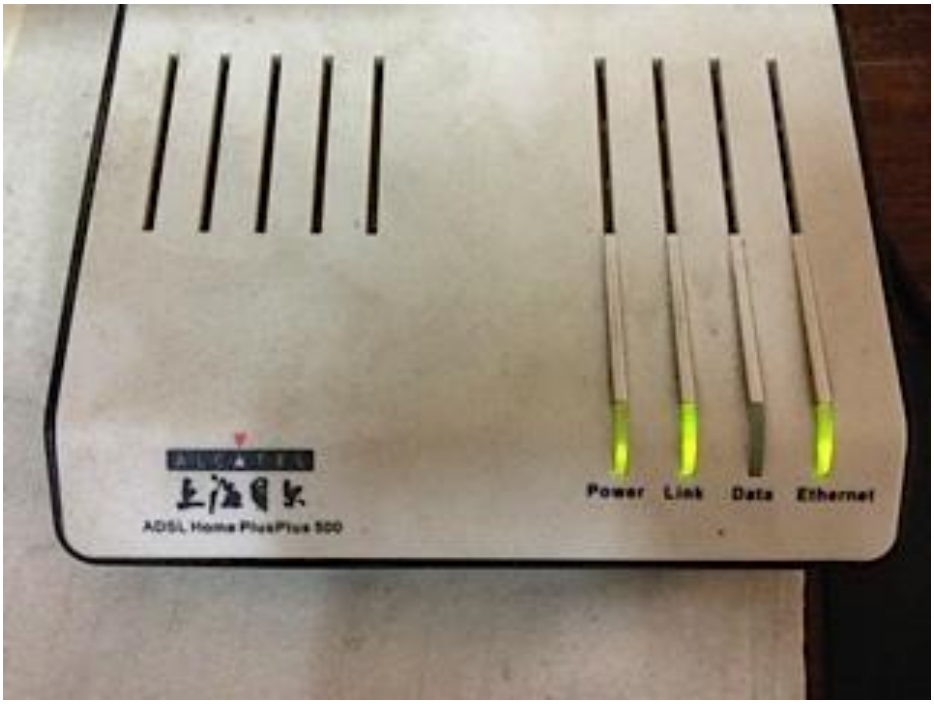


Photo 4: Speedtest.net Results Inside Public Access Center

Photo 5: Kaspersky Anti-Virus, Approximately 100 Pieces of Malware Detected on One Machine

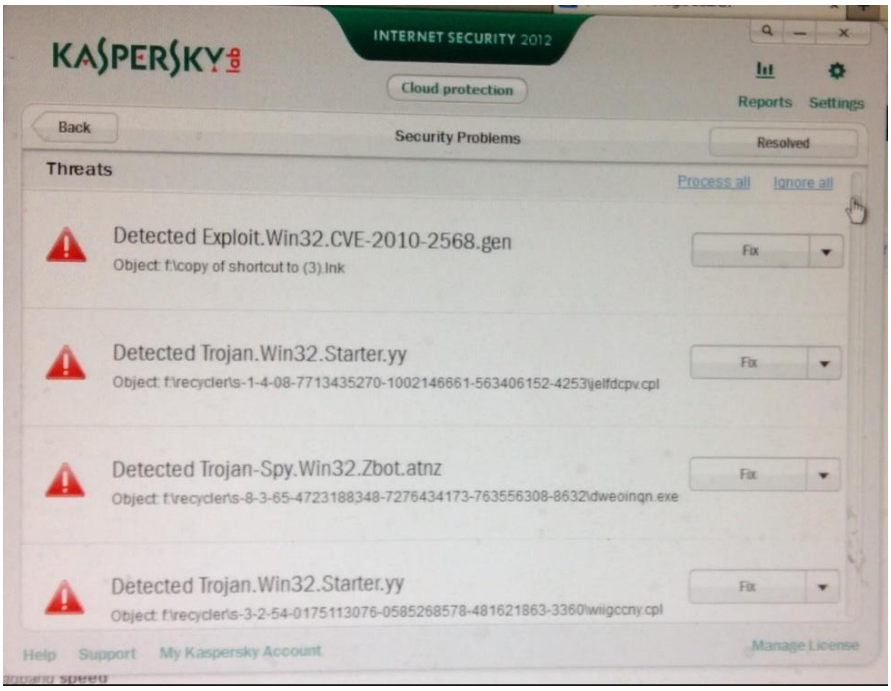


Photo 6: PAC Regulations (Myanmar original document)

Public Access Centerဖွင့်လှစ်သူများ လိုက်နာဆောင်ရွက်ရမည့် စည်းကမ်းချက်များ

၁။ လာရောက် အသုံးပြုသူများ၏ သက်သေခံကဒ်ပြား တစ်ခုခုအား ကြည့်ရှုစစ်ဆေး၍အမည် ၊ မှတ်ပုံတင်အမှတ်၊ (Passport Number)၊ ဆက်သွယ်ရန်လိပ်စာ၊ ဖုန်းနံပါတ် စသည်တို့ကို မှတ်ပုံတင်ထားရှိရမည်။

၂။ လာရောက်သုံးစွဲသူများ၏ သုံးစွဲမှုမှတ်တမ်း(Date/ Time/ Screen Shot/ URLs) အား (၂)ပတ်တစ်ကြိမ် Myanmar Info-Tech သို့ CD ဖြင့်ရေးသားပေးပို့ရမည်။

၃။ အလားတူ မိမိတို့ထံတွင်လည်း Back-up အားသိမ်းဆည်းထားရှိရမည်။

၄။ Screen Shot များကို (၅)မိနစ်တစ်ကြိမ် ရယူထားရမည်။

၅။ မော်နီတာများအား အများမြင်သာသည့်ဘက်သို့ မျက်နှာမူထားရှိရမည်။

၆။ မြန်မာနိုင်ငံအတွင်း တရားဝင်အသုံးပြုလျက်ရှိသော မြန်မာ့ဆက်သွယ်ရေးလုပ်ငန်းမှဆောင်ရွက်ပေးထားသော e-mail များနှင့် Mail4U များကိုသာသုံးစွဲခွင့်ရှိသည်ဟု ဖေါ်ပြထားရမည်။

၇။ Tunnelling Website/Software များအား သုံးစွဲခွင့်မရှိကြောင်း ဖေါ်ပြထားရမည်။

၈။ Cyber Crimes (Hacking, Virus Distribution, Port Scanning and etc.)၊ မြန်မာ့ယဉ်ကျေးမှုနှင့်မဆီလျော်သောကိစ္စများဆောင်ရွက်ခြင်းတို့အား တားမြစ်ကြောင်းရေးသားဖေါ်ပြထားရမည်။

၉။ နိုင်ငံရေးနှင့် ပတ်သတ်သောWeb site များအားကြည့်ရှုခွင့် မပြုရ။

၁၀။ PAC အတွင်း (Online/ Offline)လောင်းကစား အမျိုးမျိုးအား ပြုလုပ်ခွင့်မပြုရ။

၁၁။ PAC အတွင်း အရက်သေစာနှင့် မူးယစ်စေသော ဆေးဝါးနှင့်ပစ္စည်းများ သုံးစွဲရောင်းချခွင့်မပြု။

၁၂။ PAC အတွင်း Speaker သုံးစွဲခွင့်မပြု /Headphone များကိုသာ အသုံးပြုရမည်။

၁၃။ PAC အတွင်းရှိ Computer များ၏ Floopy Drive,CD Drive,USB Port များအားသုံးစွဲခွင့်မပြုရ။

၁၄။ Internet မှDownload ပြုလုပ်ရရှိလိုပါက ဆိုင်တွင် မှတ်ပုံတင်၍ ရေးကူးပေးရမည်။

၁၅။ PAC အား ည(၁၁)နာရီထက် ကျော်လွန်၍ ဖွင့်လှစ်ခွင့်မပြု။

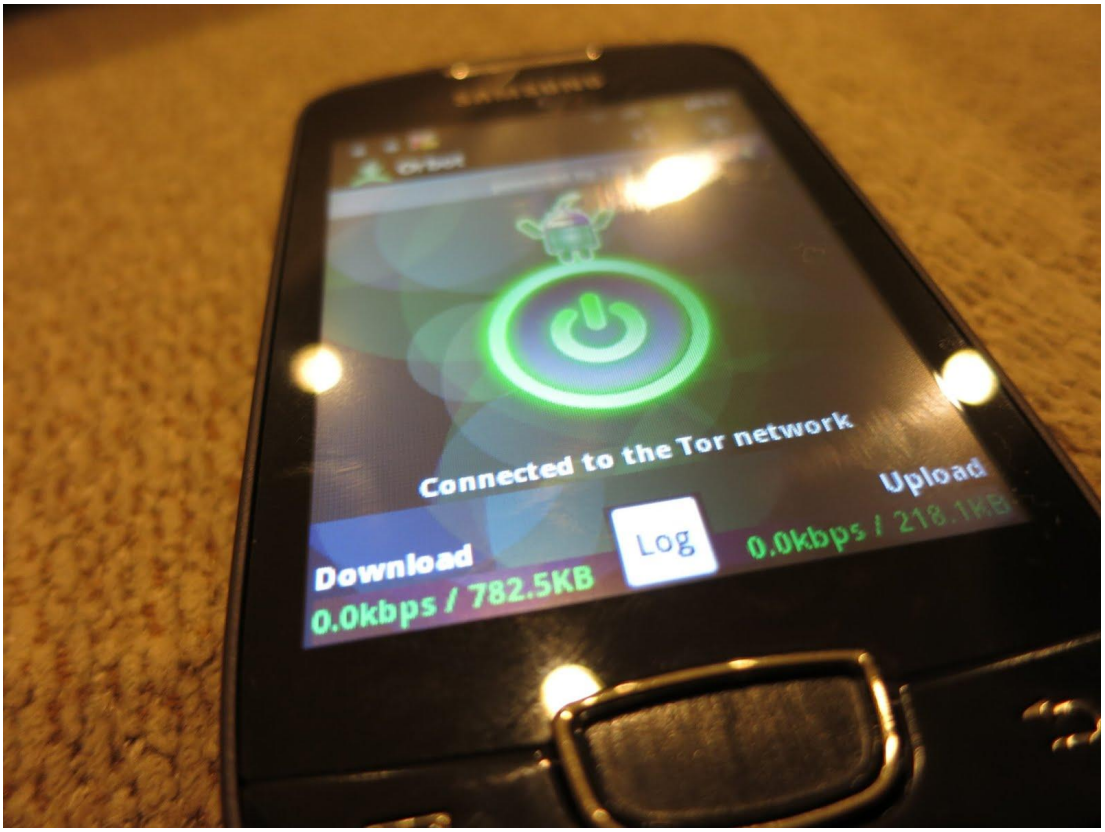
၁၆။ မီးဘေး ကာကွယ်မှုအတွက် ကြိုတင် စီစဉ်ထားရမည်။

၁၇။ PACများတွင် ချမှတ်ထားသောစည်းကမ်းများကို ချိုးဖောက်သည့် User များတွေ့ရှိခဲ့လျှင် Myanmar Info-Tech သို့ချက်ချင်းကြောင်းကြားရမည်။

၁၈။ ဆက်သွယ်ရေး၊ စာတိုက်နှင့် ကြေးနန်းဝန်ကြီးဌာနမှ ၁၀-၇-၂၀၀၂ ခုနှစ် ရက်စွဲဖြင့် ထုတ်ပြန်ထားသောWide Area Network အသုံးပြုကွန်ပျူတာကွန်ရက်ထူထောင်ခြင်း၊ ဝန်ဆောင်မှုပေးခြင်းနှင့်သတင်းဆိုင်ရာနည်းပညာအသုံးပြုခြင်းတို့နှင့်စပ်လျဉ်းသည့် အမိန့်ကြော်ငြာစာအမှတ်(၃/၂၀၀၃) အား လိုက်နာဆောင်ရွက်ရမည်။

၁၉။ အခါအားလျော်စွာ Myanmar Info-Techမှထုတ်ပြန်သောအမိန့်နှင့်ညွှန်ကြားချက်ကျများအားလိုက်နာဆောင်ရွက်ရမည်။

Appendix III: Observed Mobile Phones




ZXET
CE210
Elite
Tech


NOKIA
GMG
Elite
Tech


NOKIA
NOKIA
NOKIA
NOKIA
Sony Ericsson
NOKIA
NOKIA
NOKIA
NOKIA
NOKIA


SAMSUNG
GALAXY S III
HD SUPER AMOLED
Quad Core CPU
Bluetooth
NFC
GALAXY S II


NOKIA
XpressMusic
movistar
NOKIA
เริ่มใช้งาน Chat และ
Push Email บนมือถือ
ของคุณได้แล้ว!
เลือกโดคอน
Email หรือChat
ลงชื่อเพื่อเข้าใช้บริการ
สนุกได้ทันที กับ Chat หรือ
Email ได้ทุกที่
NOKIA
Elite
Elite
Elite

Appendix V: Domain Name Registration Application

(Domain လျှောက်ထားသူမှ ငွေပေးသွင်းပြီးနောက် ဖြည့်ရမည့် AN ပုံစံနမူနာ၊ အဆိုပါ AN ကို MPT commercial ဌာနမှ ထုတ်ပေးပါသည်။)

Myanma Posts And Telecommunications

Information Technology Department

ADVICE NOTE

(DOMAIN SERVICE PERMANENT OR TEMPORARY)

Customer Name .....

Customer Address .....

Customer Phone No .....

E mail Address.....

Domain Name .....

Sub Domain Name .....

Signed by Customer .....

Date .....

Commercial Section

AN No ..... AN Date .....

Payment Date.....

Activate Date .....

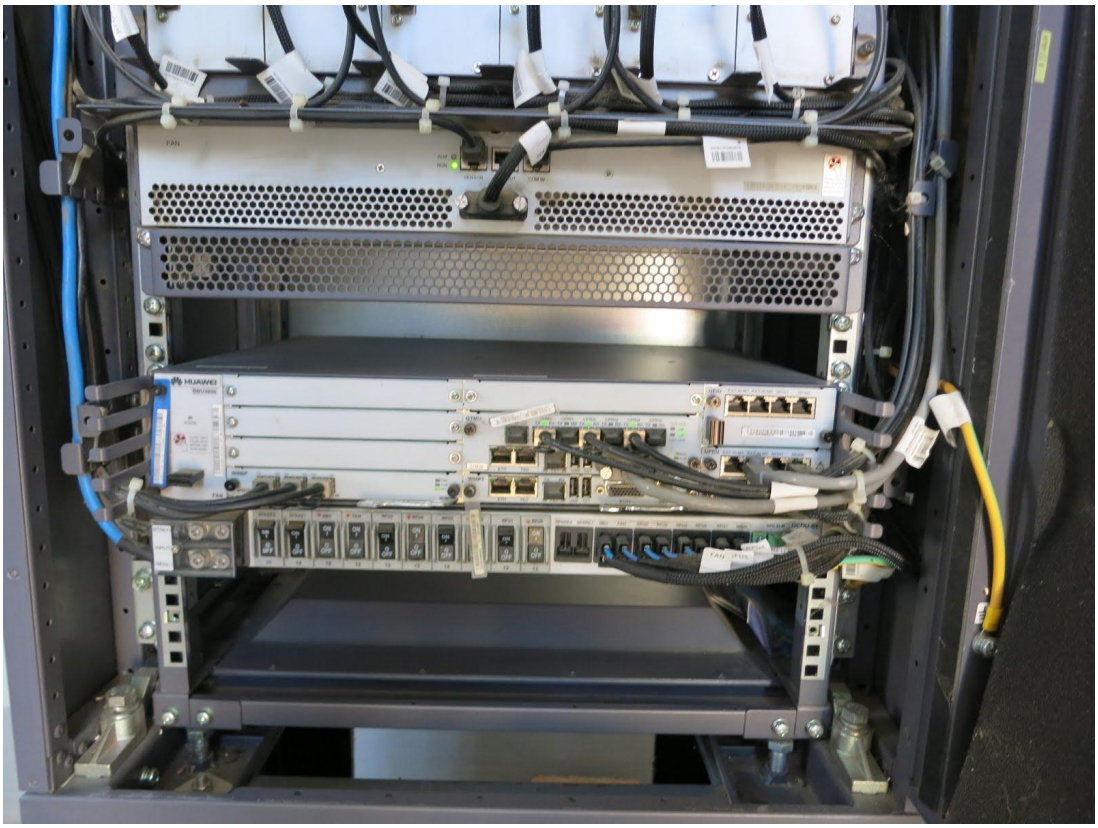
Expire Date .....

Signed by Name.....

Appendix VI: Observed Mobile Infrastructure


HUAWEI


HUAWEI
RX_INB
RX_OUTA
ANT_RXB
ANT_TX/RXA
MON
CPRI1
PWR




BTS3900
CE 0168
N14036
HUAWEI TECHNOLOGIES CO., LTD
MADE IN CHINA
合格证/QUALIFICATION CARD
机型 /MODEL BTS3900
订单 /ORDER 9124899720005
编号 /NO 98GUS0008034-001
质检员 /QC 81001056
日期 /DATE 2010-11-30
HUAWEI
HUAWEI TECHNOLOGIES CO., LTD
MADE IN CHINA