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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 policymakers, 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 Aung Hla Tun, "Myanmar launches major graft probe at telecoms ministry," *Reuters*, 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.

From this report's inception, we expected to confront unresolvable challenges. A delegation of foreigners visited the cities of Naypyidaw and Yangon to conduct the research. This limited geographic coverage could present a different experience from those in other parts of the country. Due to the rapid changes occurring in Myanmar, it will be difficult to adequately corroborate all of the information presented with external sources. The delegation sought to identify what the Myanmar people experience with confirmation from local residents and sources. As such, this report is presented with limitations that should be taken into account. Accordingly, we advise that the presented findings and recounts be tentatively projected as the norm throughout Myanmar.

Key Facts

- 6.7 percent of Myanmar's population has landline 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 percent of the population subscribing to landline service.[8]

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

- The average income in Myanmar is $60-70 per month.[10]

- 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.* Marc Einstein, "Myanmar: Asia's wireless final frontier," *Telecomasia.net*, June 15, 2011, http://www.telecomasia.net/blog/content/myanmar-asias-wireless-final-frontier.
[4] *See e.g.* Kevin Kwang, "Regulation, infrastructure hinder Myanmar's telecom ambitions," *ZDNet*, Nov. 6, 2012, 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* Asian Development Bank, "Myanmar in Transition, Opportunities and Challenges," August 2012, 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 landlines may be significantly larger than the number of subscribers. In Yangon the team noted impromptu "phone booths." Individuals with landline 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, http://data.un.org/CountryProfile.aspx?crName=MYANMAR. Data from the U.S. State Department suggests income levels slightly over $100 per month for the typical resident. *See* Myanmar report, 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 News*, 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. Policymakers are striving to find a balance between the desires of internal reformers and external business interests. Situated between 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 to buck 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 when these factors are accounted for, alongside Myanmar's attempts to increase and protect citizen rights and encourage broad foreign investment, leaves observers uncertain as to whether the government has the capabilities or the willingness to develop a balanced legal and regulatory framework.

[12] *See* "Telecom growth in Burma poised to take off," *Mizzima News*, Oct. 9, 2012, http://www.mizzima.com/business/8193-telecom-growth-in-burma-poised-to-take.html
[13] *See* Thomas Fuller, "Chief Censor in Myanmar Caps His Red Pen," *New York Times*, Sept. 21, 2012, http://www.nytimes.com/2012/09/22/world/asia/myanmars-chief-censor-is-closing-his-office.html
[14] *See* Thomas Fuller, "E-mails of Reporters in Myanmar Are Hacked," *New York Times*, Feb. 13, 2013, http://www.nytimes.com/2013/02/11/world/asia/journalists-e-mail-accounts-targeted-in-myanmar.html
[15] *See supra* Telecom growth, *Mizzima News*
[16] *See* Michael S. Schmidt, Keith Bradsher and Christine Hauser, "U.S. Panel Cites Risks in Chinese Equipment," *New York Times*, 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, bringing them online via landline or wireless Internet subscriptions. This 10 percent would total approximately 6 million people.[18] There are currently 800,000 subscribers.[19]

- Regulators are pushing for "technology neutral" 3G mobile infrastructure.[20]

- News related websites from domestic and foreign media outlets became the most viewed online media after online censorship was decreased.[21]

- Domain names are controlled and allocated by the Myanmar Post and Telecommunication Authority (MPT). Obtaining a domain name requires a paper application submitted in-person at the telecom office.[22]

[17] *Source*, Myanmar Computer Federation. Note, the proposed regulation does not follow the ITU Telecom Regulation Handbook very closely. It is unknown how closely the ITU is consulting with Myanmar regulators and policy makers.
[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 Communications and Information Technology.[23]

- News censorship requests are administered by the Ministry of Information.[24]

- Spectrum leasing laws are incredibly unclear and arbitrary. As such, they are reportedly a significant problem.

- 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]
- *Netalyzr* - 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 determines the security and safety of GSM networks,[30] and
- Manual browsing of standard expected-to-be-blocked sites.

Overview of Test Results

Network Openness

Netalyzr tests run from the Royal Kumudra Hotel, Naypyidaw, showed blocked services that have commonly been reported censored.[31] 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 Communications and Information Technology 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 and Information Technology.

[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 http://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 comparative metric, however, these are helpful.
[30] *See* http://gsmmap.org/
[31] *See* Netalyzr results, http://n3.netalyzr.icsi.berkeley.edu/summary/id=ae81b058-31576-4cb1593c-8b2b-44da-90fe

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.[32] The Ministry of Telecommunications reports that foreign news websites are those for which censorship was most recently lifted.

Internet Performance

All tests were run via Speedtest.net to their server in Yangon hosted by TTT. Detailed network test results are available upon request.

- ICT Ministry, Naypyidaw
    - Provider: MPT > SingTel Internet Exchange
    - Download speed: 11.2Mbps
    - Upload speed: 9.8Mbps
    - Ping: 6ms
- Royal Kumudra Hotel, Naypyidaw
    - Download speed: 0.29Mbps
    - Upload speed: 0.3Mbps
    - Ping: 935ms
- Public Access Center, Naypyidaw area
    - 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 (1/20/13)
    - Provider: Redlink WiMAX
    - Peak Hours
        - Download speed: 1.5Mbps
        - Upload speed: 0.5Mbps
    - Off-Peak Hours
        - Download speed: 3Mbps
        - Upload speed: 1Mbps

[32] *See e.g.* Freedom House, "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 network's 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 percent of the voice calls and text messages in Myanmar are completely unencrypted, the remaining 5 percent 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 percent, Impersonation: 1 percent, Tracking: 55 percent (possibly 1 percent, see "HLR lookup prevention" in Appendix I). A more detailed analysis can be found in Appendix I.

Infrastructure and Access Observations and Statistics

Further measurements on Myanmar's infrastructure and connectivity are presented below. 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 some explication. Unless specified otherwise, all amounts have been approximated to the United States Dollar ($USD).

Infrastructure

- At least 10 Gbps is available in country, obtained via the South-East-Asia/Middle East/Western Europe Optical Submarine Cable (SEA-ME-WE 3). Currently everything, landline and wireless, runs through this single connection.[33] 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 to boost speeds.[34] Allegedly dark cross border fiber cables exist (India, China, Thailand, Laos) explained as "backup links".[35]

- While the government relies on the same backhaul for its own access, the rest of its infrastructure is completely independent from the rest of the population.[36] The difference in performance results between the Ministry and other locations, shown above, points to the impact of this separation.

- Myanmar has 3 ISPs: MPT (100 percent government) and Yatanarpon Teleport (51 percent government held, 49 percent privately held),[37] and Red-link Group, owned by family members of government leaders.[38]

- IPv4 addresses are almost nonexistent, presenting another significant limitation to further growth. Static IPs are allocated only for elite organizations, for example, banks.[39]

[33] *See* 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] Htoo Aung, "Faster Internet on trial: deputy minister," *The Myanmar Times*, August 27, 2012, http://www.mmtimes.com/index.php/business/technology/466-faster-Internet-on-trial-deputy-minister.html; Htoo Aung, "MPT considers new cable to boost telecoms," *The Myanmar Times*, September 10, 2012, http://www.mmtimes.com/index.php/business/technology/1365-mpt-considers-new-cable-to-boost-telecoms.html; 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
[35] *Source*, Myanmar Computer Federation. *See also* "Myanmar builds more cross-border fiber optic links to improve communications services," *Xinhua Net*, December 3, 2012, http://news.xinhuanet.com/english2010/sci/2010-12/03/c 13633549.htm.
[36] Observed during testing performed within government buildings.
[37] *Source*, Myanmar Computer Federation.
[38] *See* "The Internet in Burma (1998-2009)," *Mizzama*, Dec. 24, 2009, http://www.mizzima.com/research/3202-the-internet-in-burma-1998-2009-.html; Wai Moe and David Paquette, "The Coming Cyber War," *The Irrawaddy*, Vol. 18, No. 3, March 2010, http://www2.irrawaddy.org/print article.php?art id=17923.
[39] Conversation with local IT professional

- 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.[40]

Access Options

- More than 10,000 Fiber To The Home (FTTH) users are active in the country, relying on two international companies, ELight and Fortune, who build on top of Myanmar's domestic providers. 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 $1,000, with an approximately $50 per month charge for access. Due to backhaul limitations, FTTH speeds average between 40-100 kbps.[41]

- While Satellite connections are used, they are of course very bandwidth constrained. They also require a special license that most users cannot get. 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.[42]

- WiMAX exists in selective locations with fairly ubiquitous coverage in Yangon, all reportedly using 315Mhz. The network relies on MAC address authentication.[43]

- MPT offer metro Ethernet for approximately $200 per month and $4,000 installation.[44]

- ADSL speeds are extremely slow (reportedly 3 kbps), due to congestion, oversubscription and a lack of copper maintenance. An uncapped plan is advertised at approximately $40 for 128 kbps.[45]

[40] Consultant, Yatanarpon Teleport.
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] IT Specialist, Radio Free Asia Myanmar Service.
[45] Consultant, Yatanarpon Teleport.

- There is no Blackberry service in country.

- 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.[46]

Miscellaneous

- Blue Coat equipment is pervasive, and used in part for deep packet inspection (DPI).[47] Cisco and Huawei are also present.

[46] *Source*, Myanmar Computer Federation
[47] "Behind Blue Coat: An Update From Myanmar," Citizen Lab, University of Toronto, November 29, 2011.

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 SIM cards from approximately $500 to approximately $250.[48] 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.[49]

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).

[48] Hpyo Wai Tha, "Burmese SIM Card Price Slashed by Half," *The Irrawaddy*, March 6, 2012, http://www2.irrawaddy.org/article.php?art_id=23158.
[49] 2008 State Department Human Rights Report on Myanmar listed between $0.19 and $0.75/day as average wages for daily workers. *See* http://www.state.gov/j/drl/rls/hrrpt/2008/eap/119035.htm. This window was tentatively corroborated by those on the ground. The CIA World Factbook estimates that 32 percent of the Myanmar population live in Poverty. *See* https://www.cia.gov/library/publications/the-world-factbook/geos/bm.html.

Summary of Required Steps

1. Purchase a smartphone: The cost ranges between $130 and $1,120.

2. Purchase a data-capable SIM: Customers have the option to purchase either a national SIM or an International SIM, both costing $250.

3. Choose a voice and text service plan: There are only pre-paid service plan options for voice and text. No ongoing or post-paid service plans are available.

4. Activate the SIM's voice and text service: The top-up cost is between $10-25 depending on the desired number of voice minutes and text messages and on the in-country or international SIM type.

5. Activate the SIM's Data Service: Customers who want to use data services must complete additional application forms, submit copies of a passport or official national ID, and provide two passport photos. Activation costs approximately $17. The telephone company reports the purchase and submits the customer application to MPT. The rate is approximately $1 for every 280 minutes of usage.

6. Wait for the government to approve the data service activation request: This wait can take between 2 and 3 days.

Purchasing a Smartphone

The delegation visited multiple stores, comparing phones and plans, and asking questions to obtain a smartphone and data access.[50] Prices for smartphones in these stores ranged from a high of $1,120 for an Apple iPhone with iOS to a low of $115 for a Samsung Galaxy Y with Android. Being thrifty, the team purchased a Galaxy Mini for $130.

[50] *See* Appendix I, Photo 1

Service Plan Detail

Voice and Text

After selection and purchase of a smartphone, a buyer must choose one of three available service plans each with its own distinct SIM.

1. Single-use prepaid voice and non-international text service for a one-time fee of $25.[51] This option can be purchased within the airport on arrival or at a retail store.
2. “Top-up” capable prepaid voice and non-international text only service.[52] This option can only be purchased at a retail store.
3. “Top-up” capable prepaid voice and international text service. This option can only be purchased at a retail store.

Rates for voice were around $18 for 3 hours of non-international voice service. It is not clear that the international text message service actually functions. The delegation was unable to receive any texts with foreign origination using this 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 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. It is reported that often due to payment confirmation, this stretches to 3. 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, a store employee stated the telephone operator has to send the application to MPT. The delegation was not able to identify more detail on approval criteria.

[51] *See* Appendix I, Photo 2 & 3
[52] *See* Appendix I, Photo 4

Activating a SIM

To aquire a data service plan, the store will make a photocopy of the buyer's passport 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 store employee completes 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.

Purchasing a Data SIM

Following completion of all required forms and applications, the buyer is able to purchase a data-capable SIM card, which costs $250.

When purchasing a data SIM, the buyer chooses whether it is an international or national SIM from the 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 texts 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.[53]

Before activating data service, voice and text service must be activated. International data SIM's and service can be purchased for either $10 or $20. Until recently, these SIM's could only be purchased with Foreign Exchange Certificates, a form of surrogate currency pegged to the USD at approximately 1:1.The delegation paid to activate an international data SIM at the cost of $10.[54]

[53] *See* Appendix I, Photo 6
[54] *See* Appendix I, Photo 7

Following the purchase of a phone, prepaid calling plan, data SIM, and voice/text service, data activation could be purchased. Activating the data service cost about $17. This fee acts as credit that can be topped off, when credit expires.[55]

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.[56] 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, store employees reported that the government plans to change the per-minute data charge in the near future. 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 would like additional mobile applications on top of those preinstalled on the Android smartphone. They offer to side-load any of the thousands, more than 10 Gigabytes, of pirated Android apps to customers. The store's ready-to-load apps were kept on a desktop computer and transferred from the desktop computer to the delegation's new smartphone.[57] The delegation reviewed the app titles, which were all found to be generic and unfamiliar.[58]

After the delegation agreed, the employee gained administrative access to the Android device installing the chosen apps. The store employees also maintained an extensive collection of Android exploits to bypass the software and hardware restrictions common to Android smartphones.[59]

[55] Note, because we did not try, the delegation was not able to confirm this.
[56] *See* Htoo Aung, "Faster internet on trial: deputy minister," *The Myanmar Times*, Aug. 27, 2012, http://www.mmtimes.com/index.php/business/technology/466-faster-Internet-on-trial-deputy-minister.html.
[57] *See* Appendix I, Photo 10
[58] A short random list of titles included: Battery Indicator, Virus removal, Download possibilities, Camcard, Blacklist, GOthemes, GOlauncher, and GOstore.
[59] *See* Appendix I, Photo 9

Other Notes

During the process it was apparent that the stores visited were at the 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 Naypyidaw 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.

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.

- 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 U.S. natives were available. Photos included below.

Mobile Cost Comparison

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

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

Device costs

- $39: Karbonn K280,
- $53: Nokia G365S,
- $80: Samsung S III (likely a bootleg or copy),
- $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, and
- $1,120: iPhone.

Data-capable SIM Cost

- $250: Local SIM (average observed)

Voice Cost

- $12-18: 3.5 hrs 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 prepaid allocation is used, the cost is 2-4 Kyat/min (less than $0.01 per min) for each minute of connectivity to data service.

Public Internet Access Center Snapshot

The Public Access Center (PAC),[60] near Naypyidaw, 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 only in a controlled and limited environment. As noted, Naypyidaw 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.[61]

- The Center provides citizen access to three desktop computers, running Windows XP. Photos are included in the Appendix III. Cost of use was approximately $0.50 per hour.[62]

- The machines were connected with an ADSL connection with an Alcatel ADSL Home Plusplus 500 router.[63]

- A test run on speedtest.net to a test server in Yangon reported the following:[64]

    - 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. Nevertheless, 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 U.S. 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.[65]

[60] *See* Appendix II, Photo 1
[61] *Source*, Myanmar Computer Federation
[62] *See* Appendix II, Photo 2
[63] *See* Appendix II, Photo 3
[64] *See* Appendix II, Photo 4
[65] *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.[66]

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.[67]

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

3. Owners and operators of cybercafés must 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, "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.

[66] Multiple conversations with local IT professionals
[67] *See* Appendix II, Photo 6 for original version in Myanmar. *See* "Burmese regulations for cybercafés stringent as expected," OpenNet Initiative, July 2, 2008, 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 the downloaded or copied files in logbook.

15. PACs may not remain open after 11 p.m.

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 policymakers, 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 a 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 (building Internet Exchange Points, establishing efficient routing with neighboring countries, building basic cybersecurity 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.

- 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

In this section, SRLabs, who maintain the GSM Map Project, detail the missing data protection measures evident in Myanmar and uncovered by their analysis of the delegations GSM measurement data. The following information is for a more technical reader familiar with GSM communication protocols. The following reference *missing* network security protection features observed from MPT's GSM network:

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. This 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), and
3. We used inactive phone numbers for the test (error possibility).

So, let's assume that the tracking protection is actually at 55 percent.

Appendix II: Photos Related to Section Technical Analysis

Photo 1: Mobile Phone Retail Shop

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

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

Photo 4: International Voice/Text Only SIM Card

Photo 5: Redacted SIM Card Application Form

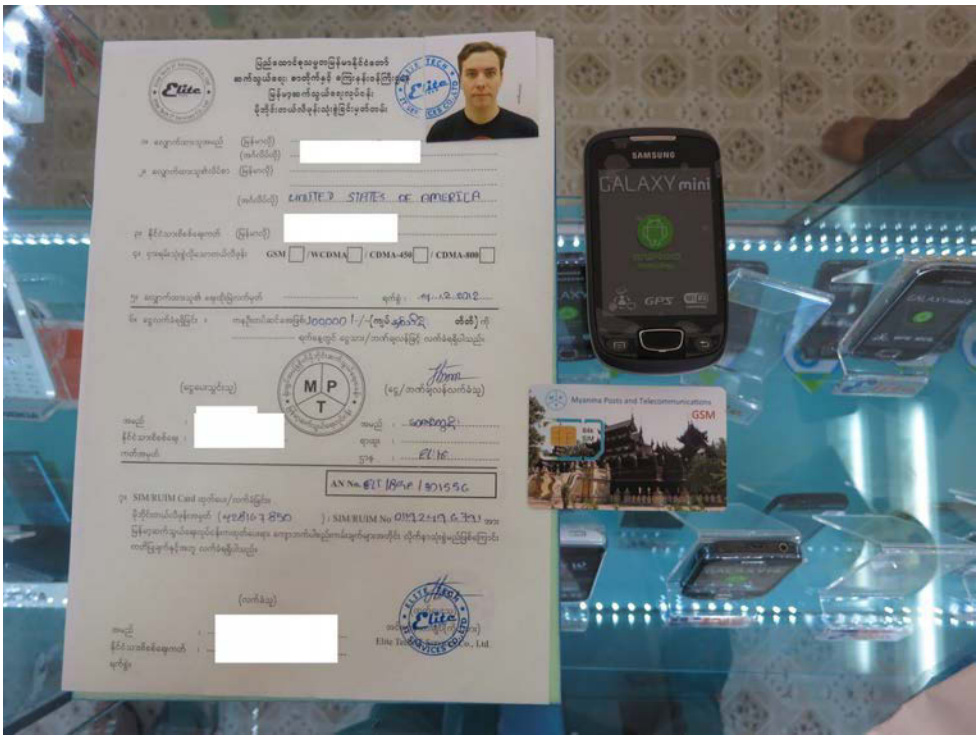


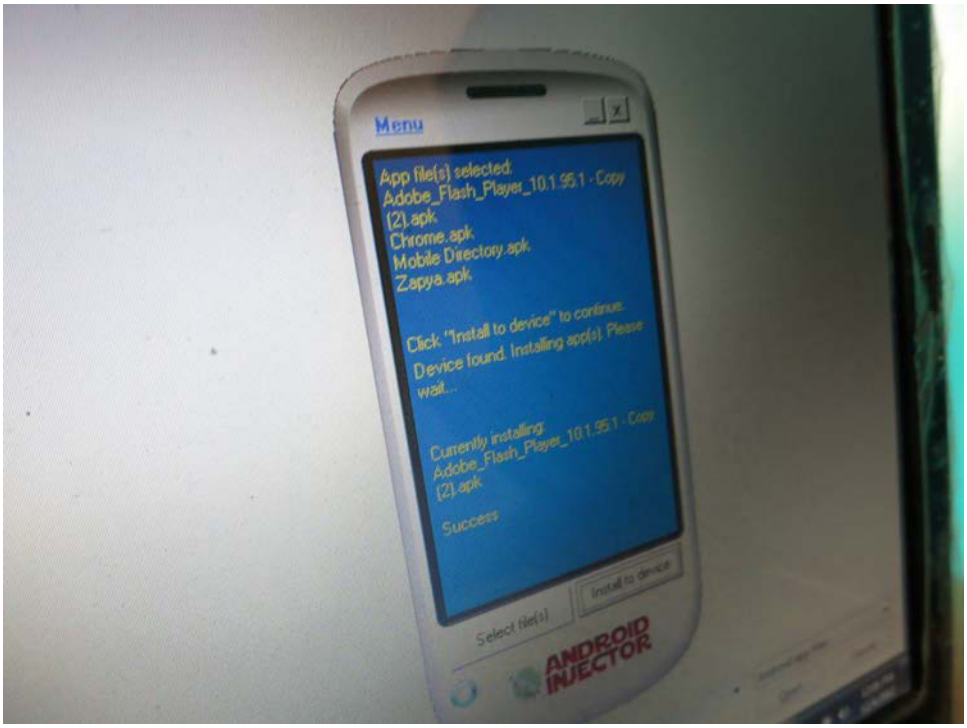
Photo 6: Voice, Text, and Data Capable SIM Card

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 the Naypyidaw area

Photo 2: Inside a Public Access Center in the Naypyidaw area

Photo 3: Alcatel ADSL Home PlusPlus 500 Router Providing Internet

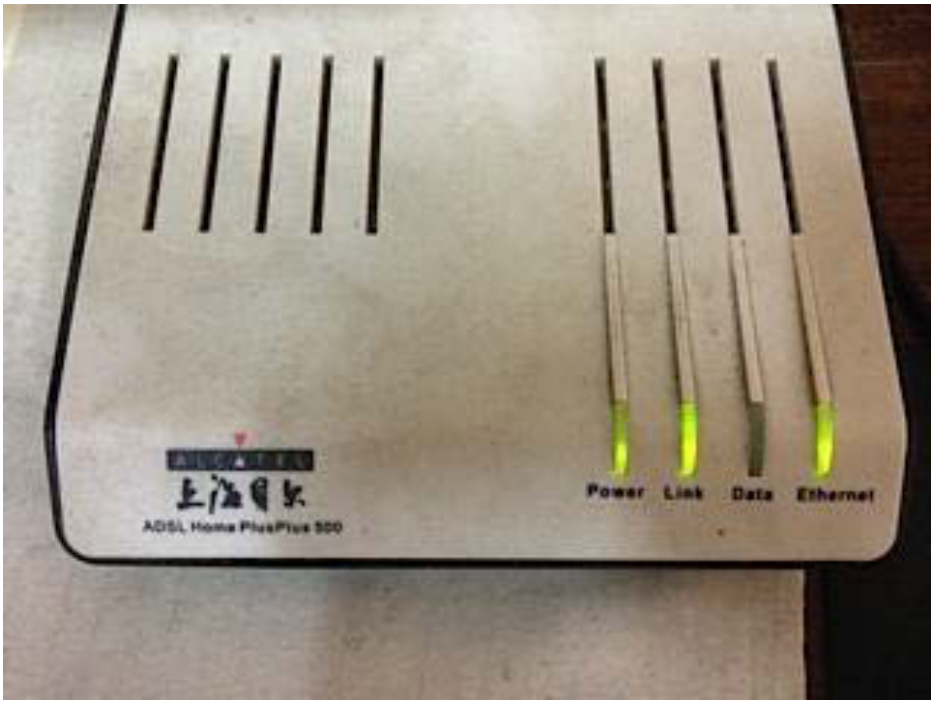


Photo 4: Speedtest.net Results Inside Public Access Center

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

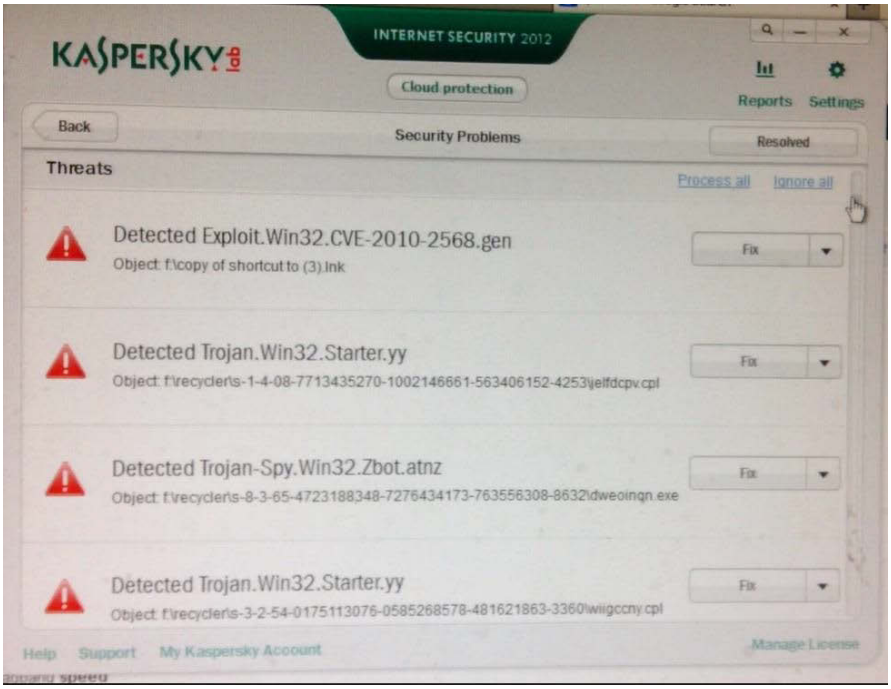


Photo 6: PAC Regulations (Myanmar original document)

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။

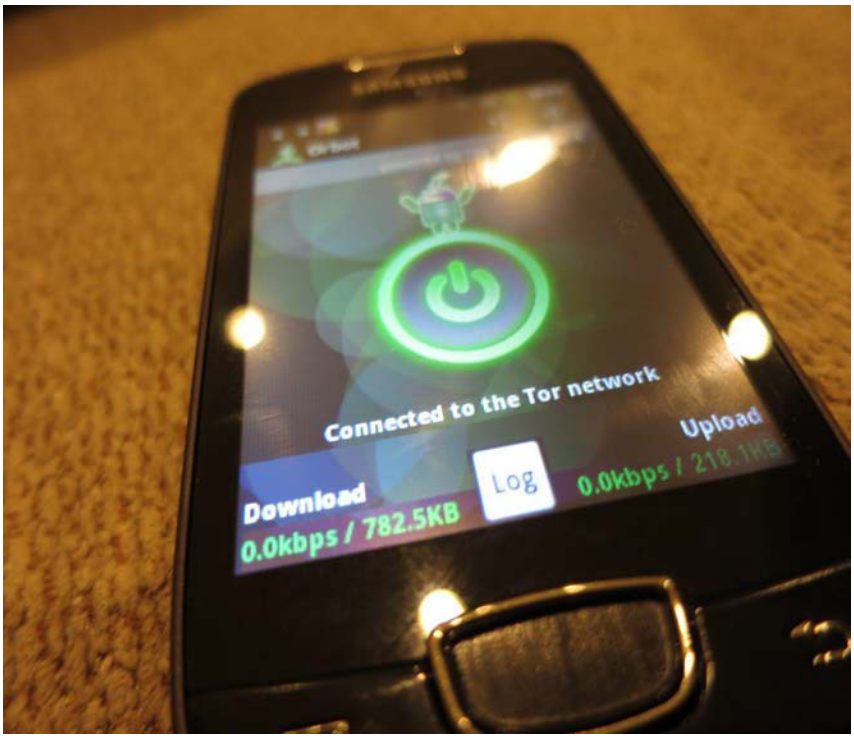
၁၆။ မီးဘေး ကာကွယ်မှုအတွက် ကြိုတင် စီစဉ်ထားရမည်။

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

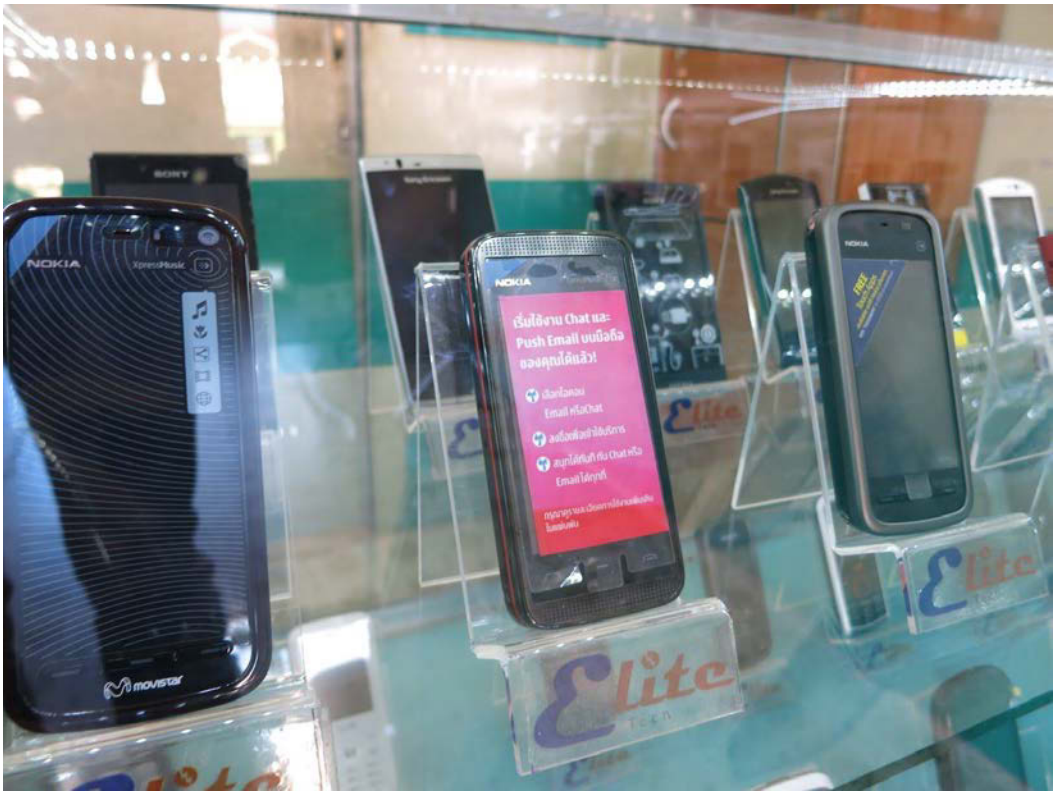



ZXET
CE210
Elite


NOKIA
Elite


NOKIA
NOKIA
NOKIA
NOKIA
NOKIA


GALAXY S III
Quad Core CPU
NFC


NOKIA
XpressMusic
movistar
NOKIA
เริ่มใช้งาน Chat และ
Push Email บนมือถือ
ของคุณได้แล้ว!
Elite
NOKIA
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.....

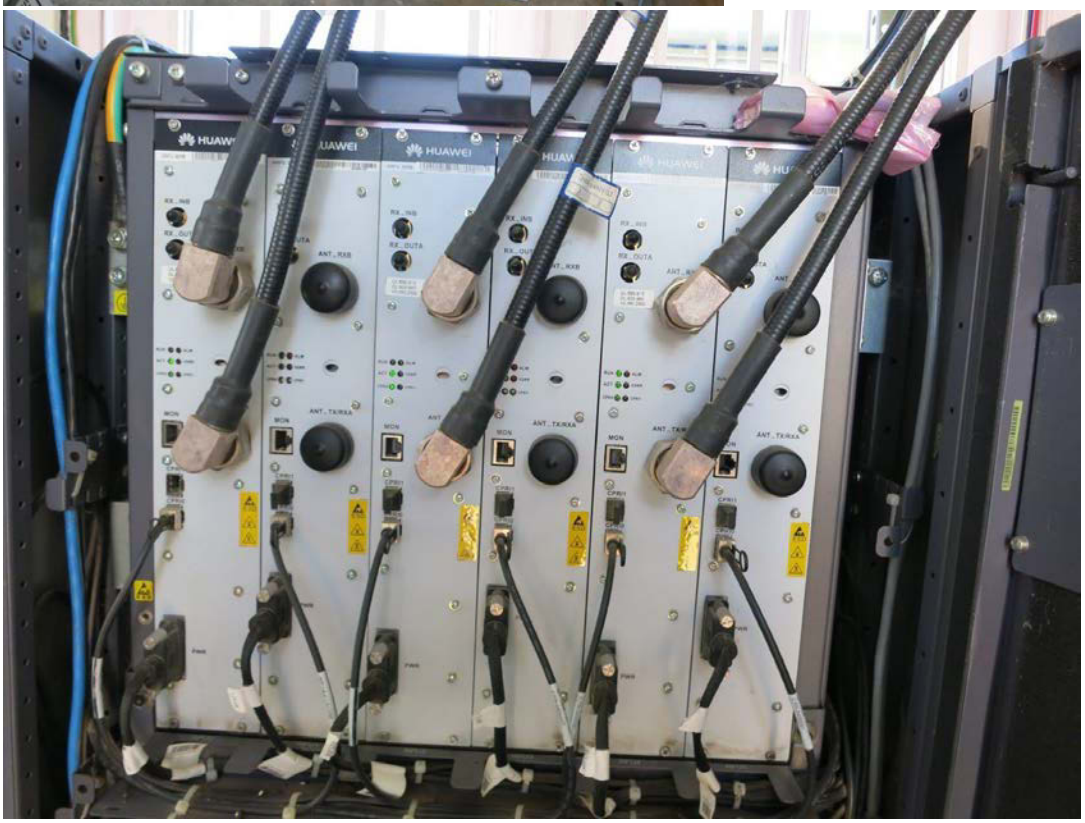
Activate Date .....

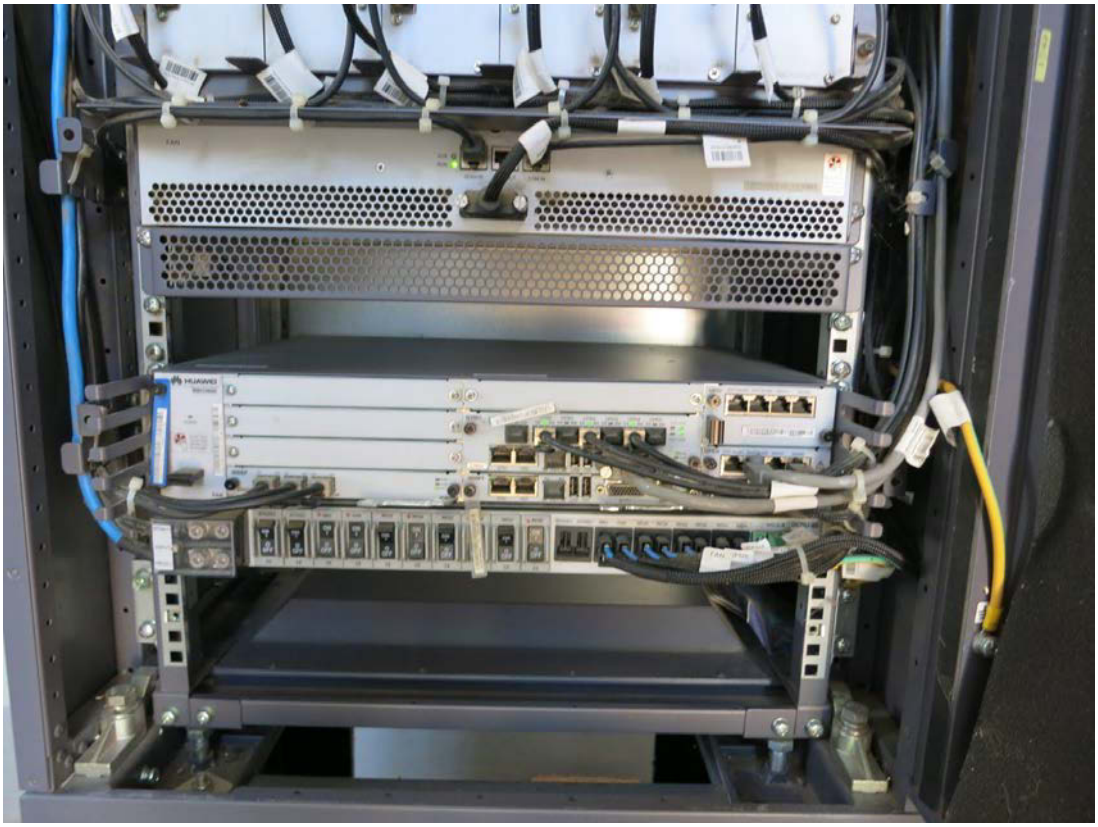
Expire Date .....

Signed by Name.....

Appendix VI: Observed Mobile Infrastructure


HUAWEI


HUAWEI




BTS3900
CE 0168
N14036
MADE IN CHINA
合格证/QUALIFICATION CARD
/MODEL BTS3900
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/NO 98GUS0008034-001
/QC 81001056
/DATE 2010-11-30
HUAWEI
MADE IN CHINA