



Consistel Pte Ltd

Submission to IDA's Second Consultation on
"Proposed Framework for the Allocation of
Spectrum for IMT and IMT Advanced
Services and for the Enhancement of
Competition in the Mobile Market"



Redefining Mobility

26th Aug 2015

*“... clearly we believe that there **is space for a fourth telco** but we just do not want another telco. We want **a telco that can bring innovation to the market**, and therefore, cause the existing incumbents to also innovate. We want to spur competition. Certainly, we will bear all these factors in mind to ensure that it will **spur growth to benefit the consumers**¹”*

Assoc Prof Dr Yaacob Ibrahim

Minister for Communications and Information and Minister-in-charge of Muslim Affairs

¹ Parliament No : 12 Session No : 2 Date of Session : 11th May 2015

EXECUTIVE SUMMARY

In 2014, the IDA initiated a broad based consultation to introduce competition and innovation in the mobile market. This was further refined in the 2nd public consultation released on 7th Jul 2015 (“**Second Consultation**”²).

Current Framework – A Foundation For Success

The current framework proposed by the IDA shows a two pronged approach, focusing both on encouraging the entry of a new MNO and addressing its medium term needs. Both of these factors are important in insuring its long term success. This holistic approach is a step in the right direction.

The framework as proposed is clearly grounded on the objective of bringing about greater competition in the Singapore mobile market. In seeking to level the playing field for a new competitor, the IDA should take comfort in the fact that there is no such thing as over facilitation.

The details in the Second Consultation are a reflection of why the IDA is a world class regulator.

Quantum Change Expected

We believe the Singapore mobile market has been lacking in native innovation and has fallen behind global trends for most of the last 15 years.

Where companies have large market shares, they tend to be unwilling to “experiment”. While steady may be good for the established, the future is built on change.

A new MNO will be a catalyst for change, resulting in a quantum leap in services and packages. This will lead to a transformation in the infocommunications industry as a whole in Singapore.

MNO With SME DNA

We believe that in order to achieve such changes and advancements, the new MNO must have entrepreneurship in its DNA. Entrepreneurship is a trait that can be best found in SMEs who survive on partnership and innovation.

With a suitably qualified SME as the new MNO, the telecommunications industry will experience a “tow” effect. The partners of the SME MNO will grow and expand their areas of expertise as they support the transformation of the new MNO. This will in turn elevate these partners to new heights.

The SME transcending into an MNO will act as a torch bearer for other SMEs making similar leaps in other industries. This has the potential to change the blueprint of SMEs

² IDA's 2nd Public Consultation on “Proposed Framework for the Allocation of Spectrum for IMT and IMT Advanced Services and for the Enhancement of Competition in the Mobile Market” dated 7th July 2015

in the economy as a whole. The approach taken by the IDA towards the new MNO therefore has repercussions beyond the telecommunications industry.

Putting Consumers First

Understandably, the IDA may face resistance from some who may claim that the framework is intrusive and overly biased towards the new MNO. There may also be challenges to IDA's position of encouraging further competition in the mobile market.

The overwhelming success and transformative impact of the NGNBN proved the IDA was right then, as it is now, in its efforts to introduce competition and change. In fact, when introducing the NGNBN, the IDA may be seen to have been more "hands on" when it gave a grant of \$1 billion to the new operators.

NGNBN has been a catalyst for competition in the fixed line market with new plans and services being launched on a near quarterly basis. The pace of such new services has not abated in the 5 years since the launch of commercial services. Consumers and businesses continue to reap the benefits of such competition.

The IDA should therefore remain steadfast in its effort to deliver its ultimate goal of bringing greater value to consumers and business in the mobile market.

SUMMARY OF MAJOR POINTS

The major points of our submission are set out below. Full details of the points raised can be found in the "Comment" section and "Response to Questions" sections :-

1. OVERVIEW (*See "Comments" Section for Details*)

i. Introduction

The IDA has taken the comments of the industry seriously and its Second Consultation is clearly a step in the right direction to facilitate the entry of the new mobile operator here in Singapore.

ii. Active Facilitation In Other Segments

The IDA took a strong facilitation approach in the launch of the Next Generation Nationwide Broadband Network (NGNBN). The outcome has been increased competition with consumers and businesses enjoying unprecedented value.

iii. Previous Attempts To Introduce a New MNO

In 2001, the IDA catered for a 4th Operator by making available 4 spectrum lots despite there being only 3 operators in the market. At that time, the IDA further mandated that the new MNO be able to roam on existing networks. Despite this, since 2001 no new MNO has entered the market.

iv. More Facilitation Not Less

In a market with strong incumbents, the IDA should actively facilitate to level the playing field for a new competitor. In terms of encouraging competition and innovation, there is no such thing as over facilitation.

v. A Chance To Regenerate the Industry

A new MNO at this time will regenerate the Infocommunications industry. MVNOs have been knocking at the door and a new MNO will be more willing to open it. This will rapidly bring opportunities and services to market segments which may have been neglected. If Singapore misses this chance, it may be another 15 years before such an opportunity presents itself again. Similar appreciation for change can be seen in South Korea and Australia who have both been active in introducing new MNOs into their markets.

vi. New MNO's DNA

An SME has entrepreneurship in its DNA. Unlike an MNC, which will simply adopt its existing business practices and apply them to a new market, an SME will adopt a different organisational and business structure. SMEs gravitate towards outsourced and partnership based models.

Outsourcing and partnerships will create distributed centres of innovation and act as a catalyst to the entire infocommunications industry. The “tow” effect will extend to other SMEs as they partner the new MNO. This has the opportunity to change the blueprint for SMEs in the economy as a whole.

2. THE NEW MNO (See response to Question 7)

i. Clear Recognition From The Government

“there is space for a fourth telco”, Minister for Communications and Information Assoc Prof Dr Yaacob Ibrahim, Parliamentary questions, 11 May 2015.

ii. Framework Has Room For Improvement

While this framework is the most comprehensive by far, we humbly believe there is still room for improvement.

iii. New MNO Spectrum

The IDA was correct to bundle 700 MHz, the 900 MHz and the 2.3 GHz spectrum for the new MNO. This spectrum bundle is necessary to ensure current coverage and capacity requirements and assist in future network planning for the new MNO.

iv. Allocating More 900 MHz To The New MNO

The new MNO should be given 2x20 MHz in the 900MHz band. This will enable optimisation of the carrier. The incumbents already enjoy such optimisation in other spectrum bands including the widely adopted LTE 1800MHz band.

Existing MNOs have nationwide coverage with their other bands including the 1800 MHz and/or 2.5 GHz bands. They therefore have a less pressing need for the 900MHz band. Incumbents may argue that they have deployed 3G networks over the 900MHz band, however, they have been aware that these rights were expiring. Even if 900MHz is reallocated to incumbents, it should be on condition that this band be used only for 4G services. This will prevent inefficient use of the spectrum.

v. Spectrum Price For The New MNO

Pricing the bundled spectrum at \$40M will encourage participation in the auction.

vi. New MNO's Spectrum Must Be Contiguous

The spectrum allocated to the new MNO must be contiguous. Contiguity should not come at any addition cost.

vii. Choosing The New MNO

The commitment required to be a new MNO is both serious and considered. We propose that whatever selection process the IDA chooses to adopt, a detailed review of each candidate's ability to deliver innovation and a quality network should be undertaken.

viii. New MNO Must Have Ability To Deliver

Any new entrant that is unable to deliver a quality network will effectively be squandering the spectrum allocated by the IDA.

ix. Tender Method of Selection

With a central objective of encouraging innovation, the IDA should consider the spectrum allocation through a tender process. This would allow the IDA to use competence and capability as benchmarks for determining the new MNO rather than merely the spectrum bid prices.

x. Prequalification For Auction

If an auction approach is adopted, the IDA should use the same set of criteria for a tender process to pre-qualify potential participants in the auction.

xi. Auction Method

Both the ascending round auction approach and the single-round second price approach have their own advantages. We have no preference in the selection of either approach.

xii. Encouraging SME Participation

SMEs by their nature have to be flexible and nimble. To ensure that potential financial barriers do not deter innovative participants, the financial requirements for the bidding process and corresponding Banker's Guarantee should be reduced and payment terms extended.

xiii. Regulating The New MNO

To ensure the new MNO does not deploy sub-par networks which will hamper subsequent competition, the IDA may wish to consider imposing various regulatory obligations on the new MNO.

3. MAIN AUCTION FRAMEWORK (See Response to Questions 3 and 6)

i. EGSM Band

Even though it is for short term use, there is commercial value in the EGSM band. EGSM should therefore be made available during the auction instead of being offered on a FROR basis to the existing spectrum rights holder.

ii. 1800 MHz Band

1800MHz is the "Golden Band of LTE" with the most matured ecosystems. This band will not be available for the next 15 years. The IDA should monitor existing awardees of this band to ensure that they are actively and effectively deploying their full spectrum allocations. Where evidence of spectrum hogging is found, the IDA should reallocate that spectrum to the new MNO.

iii. Use of Spectrum

Only the new MNO should be allowed to downgrade the use of the newly awarded spectrum to offer 3G services. This is necessary to allow a level playing field in the 3G market. The incumbents already have other bands on which they can adequately provide 3G services.

iv. Spectrum Duration

15 year spectrum duration is consistent and reasonable.

v. Main Auction format and Spectrum Caps

In terms of auction format, the use of quantitative and qualitative stages is simple in its design. Spectrum caps should be looked at holistically and on a per operator basis. A new MNO with no spectrum legacy should not be capped.

vi. Spectrum Allocation

Spectrum should be allocated to ensure that spectrum bands are contiguous. Contiguous spectrum is critical for any MNO and more critical for the new MNO.

vii. Regulatory Obligations for Participation in Spectrum Auction

The IDA has the opportunity to secure new obligations from all MNOs as a condition for participating in the upcoming spectrum auction. This opportunity should not be given up lightly.

4. ENCOURAGING MVNOs (See response to Question 8)

i. A New MNO Will Be More Open To MVNOs

Only genuine commercial desires will encourage new MVNOs. Incumbents may be resistant to MVNOs on the basis that they may potentially cannibalise their existing customer base. A new MNO will not be held back by legacy practices.

ii. MVNO Guidelines

To bring innovation and services, an MVNO should have as much liberty as possible to execute its own business plan and not the business plan of its partner MNO. There should be no limit to the scope of services the MVNO can offer. The partner MNO should not discriminate the MVNO's traffic or restrict its potential market segments. The IDA should monitor MNOs to ensure that they do not implement anti-competitive measures with their MVNOs to protect their existing market segments and thus stifle competition.

5. COMPETITION (See response to Question 7)

i. Achieving Competition And Innovation Post Auction

Post auction facilitation should also be considered if the objective is to achieve long term competition and innovation in the infocommunications market.

ii. Use Of New MNO Spectrum Fee

The IDA can champion the goal of introducing innovation and competition by channelling part or the new MNO's license fee into developing centres of innovation both internally, within the MNO, or distributed across the MNO's extended network of partners and suppliers.

iii. Access To CAS

The IDA should go beyond just requiring incumbent operators to "negotiate in good faith with the new MNO, to imposing guidelines and KPIs to cover such negotiations. The IDA should consider establishing pricing principles to prevent joining fees from becoming a barrier to entry. All new CAS deployment must include the new MNO to ensure a level playing field.

iv. Interconnect Committee

An Interconnection Committee should be established to review current policies and ensure that interconnectivity cannot be used to exclude the new MNO.

v. Anti-competitive Behaviour

The IDA should monitor any attempts to prevent access to suppliers; disrupt the MNO's rollout plans; or coordinate pricing. The IDA should have the right of observer status at any meeting involving 2 or more MNOs.

vi. Regulatory Obligations for Participation in Spectrum Auction

The IDA may wish to make all participants agree to competition guidelines as a prerequisite to participating in the upcoming spectrum allocation exercise.

STATEMENT OF INTEREST

Consistel's main business is that of a systems integrator focusing on in-building wireless coverage solutions. Consistel was in fact responsible for building many of the first in-building solutions in Singapore.

The team's experience extends back to the mid-90s and collectively the team has been responsible for the delivering solutions to commercial buildings, tunnels and MRT stations. In 2014, Consistel moved up the value chain and started offering neutral hosting operations in Singapore with the Sports Hub.

Consistel was originally known as MSI (Singapore) and was part of the MSI group. As part of the MSI group, Consistel was involved in the initial rollout of 14 mobile networks in India, Hong Kong and Africa. The MSI group, through Consistel's sister company Celtel, held shares in these 14 mobile operators.

Consistel has directly been responsible for the implementation of more than 3,000 in-building and outdoor solutions throughout the region. Consistel is confident it can meet and exceed the IDA's objectives and build a technologically superior network leveraging on its rollout and neutral hosting experiences.

Consistel was in the front row for the launch of 14 operators and through this has a wealth of experience which makes Consistel confident that it can be the catalyst for change and innovation in the Singapore market and bring benefits to consumers and businesses alike.

With the experiences and knowledge that Consistel has garnered over the years and with entrepreneurship in its DNA, Consistel is ready to take on the challenge of becoming the next MNO.

COMMENTS

1. Introduction

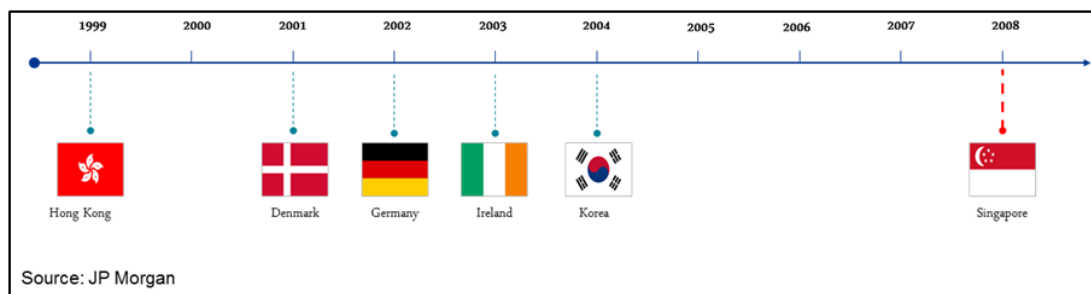
We are pleased to note that the IDA has taken the comments of the industry seriously as reflected in its Second Consultation. The overall framework is definitely a step in the right direction and it signals the IDA's commitment to facilitate the entry of the new mobile operator here in Singapore.

We are highly encouraged by the provisions that the IDA has made but we believe that more can be done to place the new MNO in a position to better compete with the dominant incumbents and to level the playing field^{3 4}.

Following Not Leading

In the last 15 years, Singapore's mobile market has lacked any major native innovation. While there were some changes and developments in the mobile market, these changes were simply following global trends. For many of these changes, the Singapore market was lagging behind other markets.

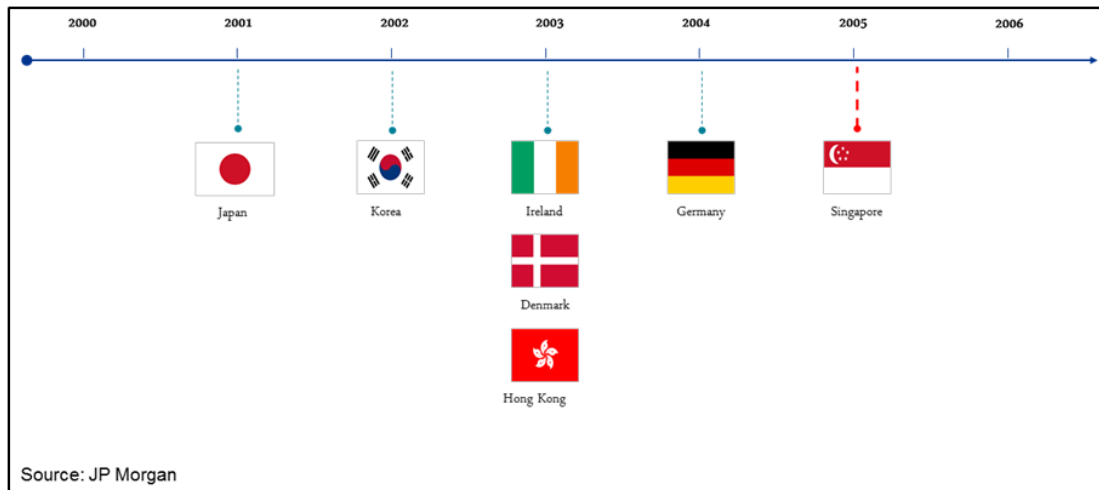
Introduction of Number Portability



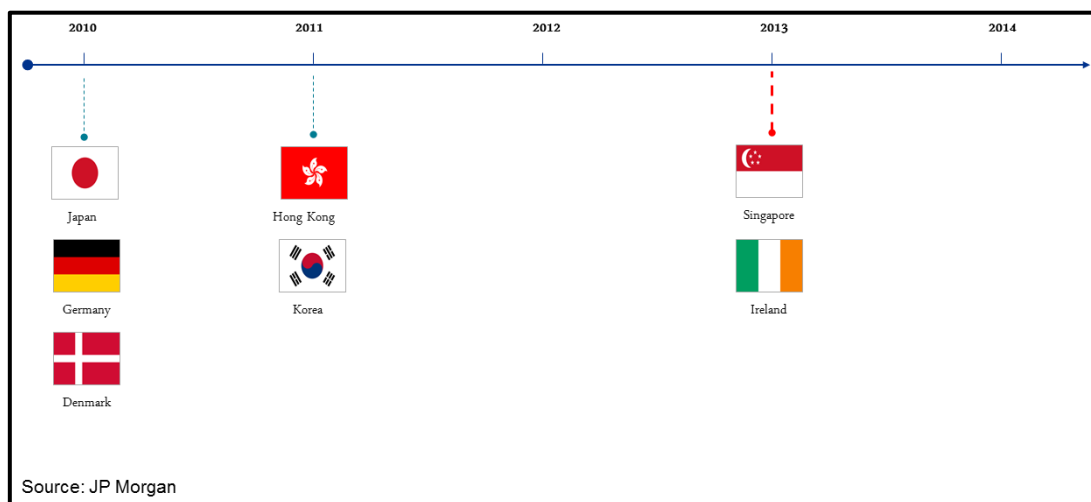
³ "We have thrived and will **continue to thrive where a level playing field for competition is created**," Mr O'Sullivan said. The Singtel Group's results for the fourth quarter and year ended 31st March 2007. <http://info.singtel.com/node/2946>

⁴ The role Optus plays in the Australian communications landscape is a significant one. Optus has long advocated **for a regulatory framework that delivers a level playing field** and improves competition in the fixed-line market. In Dialogue With GCEO Singtel <http://info.singtel.com/annualreport/2012/pdf/in-dialogue-with-gceo.pdf>

Introduction of 3G



Introduction of 4G



With the introduction of the new MNO and with a focus on innovation and change, the IDA has an opportunity to catalyse the market from being a follower to a leader. This is what the IDA did with NGNBN in the broadband market.

2. Active Facilitation In Other Segments

In 2006, the IDA sought to bring about major changes in the fixed line market when it issued a notice for the building of a nationwide broadband network. This was done to spur greater competition in a market that was largely served by 2 ISPs.

Despite arguments from some industry players, the IDA took a pro-active role in its facilitation by injecting \$1 billion into the project to fund 2 new operator companies to operate as the NetCo and the OpCo.

The Next Generation Nationwide Broadband Network (NGNBN) was launched for commercial operations in the middle of 2010 with nationwide coverage achieved in middle of 2013.

The facilitation by the IDA went beyond just funding the new operators. The IDA revised the COPIF to ensure that new developments were ready for fibre installations. The IDA also set up a centre in Esplanade Mall to educate the public about the possibilities that fibre could bring to them and it injected a further \$200 million under the Fibre Ready Scheme⁵ to ensure that SMEs in existing buildings had access to the fibre network.

The IDA set the stage for competition and the entry of new players in the fixed line business and the results speak for themselves with consumers and businesses benefiting from unprecedented increases in services and value.

3. Previous Attempts To Introduce a New MNO

In 2001, 3G was emerging as a leading technology. The IDA recognised this and prepared 4 spectrum lots despite there being only 3 incumbent mobile operators in the market.

To further encourage a new entrant, the IDA:-

- a. Required existing PCMTS networks operators to accept amendments to their FBO obligations and allow a new 3G operator to roam into their networks⁶.
- b. Established and published the conditions for roaming into the PCMTS network⁷.

Despite the efforts of the IDA to level the playing field, no new entrant was forthcoming. Since 2001 there have been a number of spectrum allocation exercises, none of which resulted in a new MNO entering the market.

Now with one of the largest amounts of spectrum being available at a single auction, the IDA has a critical and rare opportunity to set the stage for a new MNO.

4. More Facilitation Not Less

With this unique opportunity, we are of the view that the IDA should provide more encouragement to the entrance of a new MNO and more facilitation thereafter.

The more tools and assistance the IDA provides to the new MNO the more it will be able to innovate and provide the services that are currently lacking.

⁵ <https://www.ida.gov.sg/Tech-Scene-News/Infrastructure/Wired/Fibre-Ready-Scheme>

⁶ Para 4 of the 2001 Information Memorandum of the 3G Auction of Spectrum Rights
http://www.ida.gov.sg/~media/Files/Archive/Policies%20and%20Regulation/Policies_and_Regulation_Level3/Final%20Version%20of%20Information%20Memorandum/Information_Memorandum.pdf

⁷ Appendix 8 to the 2001 Information Memorandum of the 3G Auction of Spectrum Rights
http://www.ida.gov.sg/~media/Files/Archive/Policies%20and%20Regulation/Policies_and_Regulation_Level3/Final%20Version%20of%20Information%20Memorandum/Appendix_8_-_Roaming_onto_PCMTS.pdf

In our view, there is no such thing as over facilitation in seeking to level the playing field for a new competitor in a market of strong incumbents.

Consumers will be the ultimate beneficiaries of the IDA's efforts as the entry of a new MNO will translate into additional services, greater value and more competitive pricing.

5. A Chance To Regenerate the Industry

A new MNO will likely adopt a different organisational and business structure, moving towards an outsourced and partnership based model.

The benefit of this will go beyond the MNO itself and will generate new growth in activities on the supply side of the new MNO. The end result will be distributed centres of innovation supporting the MNO. With new companies and services being developed and supported by the MNO.

MVNOs have been knocking at a door of the infocommunications market in Singapore and a new MNO will be more willing to open up access to them.

A new MNO without legacy business practices will be more welcoming of MVNOs (both thick and thin) to leverage off its network. This will further extend the centres of innovation and encourage growth outside the MNO and across the whole infocommunications industry.

In turn, this will bring services to consumer and business segments which may have been neglected. Alternatively, it may create entirely new market segments which have previously not existed.

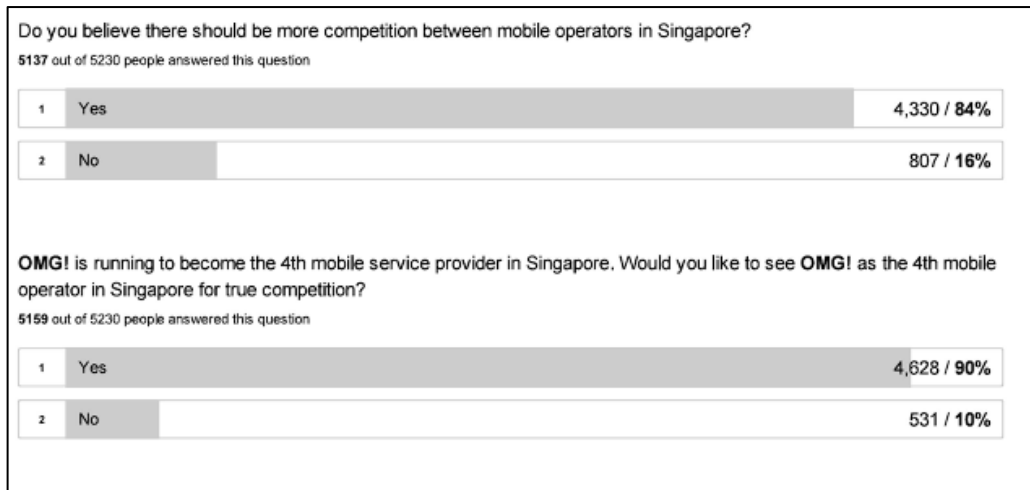
The end result of all this would be greater offerings and adoption of industry leading OTT services which will in turn provide a platform for the realization of a Smart Nation and the Internet-of-Things.

This is the time for change. If Singapore misses this opportunity, it may be another 15 years before any significant activity will happen again in the mobile industry. This has been the case since the introduction of 3G.

Support for encouraging change in domestic mobile markets can be found regionally, where South Korea and Australia have both been active in introducing new MNOs into their markets.

Local Demand For Change

In an online survey conducted at the SportsHub, 84% of consumers wanted to see greater competition between the mobile operators in Singapore. 90% went on to indicate that they would like to see OMG being the 4th mobile operator.



6. New MNO's DNA

Based on the scarcity of spectrum available in the market and the decision of the IDA to wisely bundle selected spectrum together for the new MNO, the IDA has only one shot at introducing a new MNO.

We believe to have the greatest impact on the market, the new MNO must have entrepreneurship in its DNA. If the new entrant is “just another” telco MNC, it will simply adopt existing business practices and apply them to the market.

An SME by its very DNA will adopt different organisational and business models. SMEs survive on their abilities to outsource and find partners. An SME MNO will in turn create a “tow” effect on other SMEs as it reaches out to partners in an effort to compete and grow within the industry.

The new MNO will have the potential to become a role model to other SMEs in other industries. The approach taken by the IDA towards the new MNO therefore has repercussions beyond the telecommunications industry and has the potential to change the blueprint of SMEs in the economy as a whole.

In this context, we believe that the IDA's efforts are in the right direction. However, it will require additional effort and will to see the process through to success.

The ultimate beneficiaries from the entry of a new MNO will always be consumers and businesses.

RESPONSES TO QUESTIONS

Question 1

The proposed allocation of the 700 MHz band together with other suitable bands for mobile services in the next spectrum allocation exercise; and the mechanism to allow the delay of the commencement date of the 700 MHz spectrum right, and correspondingly, the expiry date as well as the spectrum right payment due date, in the event of a delay in the ASO.

1. Allocation of APT 700 provides certainty

The importance of APT 700 is well articulated by the IDA in the Second Consultation. The proposal to bundle the APT 700 band together with other suitable bands in the next spectrum allocation exercise is an excellent move by the IDA. It shows the clear forward sightedness of the IDA and sets it apart as a regulator.

The establishing of the IDA's intention in the APT 700 band through this allocation exercise is well thought out. It creates certainty in the industry and allows all MNOs to plan for future enhancements of their networks in the medium term. This will ultimately translate into cost savings for MNOs and thereby consumers.

The plan to allocate of 2 x 10 MHz of the ATP 700 band to the new entrant is a strategic move by the IDA. This will facilitate the new MNO and enable it to compete through levelling the playing field.

2. Availability of APT 700

We appreciate the constraint faced by the IDA in establishing a final timeline for the release of APT 700 band. This is the result of Singapore having to coordinate the release of new spectrum bands with its neighbours.

The IDA should be applauded for allocating the ATP700 band at this stage, even though its earliest possible adoption date is 2018. The certainty it provides will assist MNOs in designing for future networks upgrades.

However, we believe there is a potential to reap the benefits of the ATP 700 band earlier if the IDA considers allowing restricted use of this spectrum in specific applications. The IDA should consider the limited use of ATP 700 band in confined spaces such as tunnels, MRT Stations and In-building etc.

While we agree that the start date of fees for the ATP 700 band should coincide with its availability, the IDA should consider establishing the license window period (suggested to be 15 years) so that MNOs can take the necessary steps to plan for future network upgrades and achieve appropriate returns on their investment.

Question 2

- a. The proposed 800 MHz band plan based on the 3GPP band 26, or a combination of 3GPP band 27 and band 5 (excluding the EGSM band), including views on the possible phased approach and timeline to migrate existing users of the band; and
- b. The impact to existing users (i.e., Trunked radio and SRD) of the 800 MHz band plan based on the 3GPP band 26, or a combination of 3GPP band 27 and band 5 (excluding the EGSM band).

1. Re-Farming the 800 MHz Band

The proposal to re-farm the 800 MHz band is another timely move by the IDA.

Narrow band trunked radio systems are in the process of being phased out. More efficient systems and technologies are already available to offer public trunking over LTE based solutions. The Tetra standards body is also looking at adopting LTE as its technology of choice for its next development.

We would encourage the IDA to engage with users of trunking solutions, with the objective of encouraging migration out of inefficient narrow band technologies. A move to broadband technologies would also expand the types of services which can be offered, such as video based trunked solutions.

In terms of timing, we recognise that this is a long term plan and understand that it will not be made available in the coming spectrum auction exercise.

Question 3

The allocation of the short-term spectrum rights for the EGSM band, including the approach to extend the short-term spectrum right.

1. Short term access to the EGSM band

We appreciate the IDA's policy position not to impact existing users.

Users of mobile devices normally do not choose the frequency which they will connect to. It is the mobile device itself which generally decides on the best frequency band or base station to connect to. This is done based on the QoS parameters received on the mobile device.

As such, it is our understanding that there are no EGSM "only" users. Even if there are EGSM "only" users, the operator is fully aware that their spectrum rights expires on 31 March 2017 and they should not have any expectation that they should be entitled to continue to have rights over this band.

We believe there is intrinsic value in the EGSM band. If this band is coupled together with the deployment of a spectrum lot in the 900 MHz band, it will allow the operator to deliver greater capacity to its users. While this may only be for a short duration of 3-5 years, we believe it is still of commercial value and should be made available during the auction instead of being offered on a FROR basis to the existing spectrum rights holder

Question 4

- a. The proposed re-allocation of the L-band for wireless broadband in Singapore in the longer term; and
- b. The allocation of the L-band for trial, temporary use, and/or commercial services in the interim period.

1. L-Band Discussions

Given that L-band discussions will be undertaken at WRC-15, we agree that any use of the spectrum should be for short term usage and that an industry consult should be undertaken after it is clear from the decisions taken at WRC-15.

Question 5

- a. The proposed approach for local operators to coordinate with neighbouring countries' operators to address potential co-channel interference in the use of the 2.5 GHz band;
- b. The use of the proposed 5 MHz guard band in the 2.5 GHz band to prevent interference between TDD and FDD systems operating in adjacent bands, versus the imposition of suitable mitigation measures to prevent interference; and
- c. The possible adoption and/or suitable restriction levels for Block Edge Mask, synchronisation of TDD networks and any other suitable mitigation measures to prevent co-channel or adjacent channel interference between different TDD systems or between TDD and FDD systems.

Question 5a

We propose that the IDA take the lead and form a working group with the authorities and operators from neighbouring countries. Such a working group will be a good channel for regulators/operators to address potential interference issues.

Question 5b

A guard band of 5MHz is a fundamental requirement to prevent interference between TDD and FDD systems.

Question 5c

There are several techniques which allow for the co-existence between TDD networks. These include Synchronisation, Sub-Band Filtering, use of Restricted Blocks and Site Coordination.

Sub-Band Filtering and the use of Restricted Blocks is a non-optimised use of spectrum due to wastage arising from allocation. Site Coordination complicates site planning and deployment.

It is therefore advisable to use network synchronization among TDD systems within same band in order to avoid interference. By synchronising neighbouring Base Stations, they will be able to transmit and receive at the same time without interference.

Synchronization is needed for cells operating in the same frequency or in the same band if there is insufficient guard band reserved.

According to the GTI TDD Spectrum White Paper⁸, the latest statistics reveal that over 90 percent of commercial TDD networks adopt the same Downlink/Uplink ratio (3:1), which is best suited for user behaviour in the mobile broadband era. The White Paper goes on to predict that in future TDD commercial networks, the same frame structures will be widely adopted.

The IDA should therefore consider requiring all operators to adopt a 3:1 Downlink/Uplink ratio where they are operating in the same TDD band in order to maximise spectrum usage.

Question 6

The proposed allocation of the spectrum bands in the next allocation exercise, including on the proposed uses and spectrum right durations of the spectrum bands, the proposed 'Clock Plus' auction format, as well as the appropriate spectrum caps and regulatory obligations to ensure the optimal use of the spectrum.

1. Available Spectrum Bands

We recognise that the range of spectrum being contemplated by the IDA in the Second Consultation represent a large, if not the largest amount of spectrum ever made available in Singapore in a single auction exercise. In fact the IDA appears to have made available the maximum amount of spectrum for each band, having taking into consideration reasonable constraints.

A new MNO will have to achieve both coverage and capacity. In order to do this effectively the new MNO will require spectrum in both the sub-1GHz band and in the higher bands. Due to lack of availability, this combination was not present during the 2013 spectrum allocation exercise and this may have had an impact on participation.

2. 1800 MHz Band

Noticeably absent from the auction is the 1800 MHz spectrum. 1800MHz is considered as the "Golden Band of LTE" having the most number of networks deployed and therefore having the most matured ecosystems⁹.

The 1800 MHz spectrum was auctioned off earlier in the 2013 Spectrum Auction exercise and the spectrum rights started with effect from 2015. This has regrettably resulted in the closure of the 1800 MHz band for the next 15 years.

⁸ <http://www.gtigroup.org/Resources/rep/2013-11-11/1407.html>

⁹ *1800 MHz is the main band for LTE Deployments : LTE1800 is used in over 44% of networks.*

Fast Facts 21 July 2015. <http://www.gsacom.com/news/statistics>

From the results of the 2013 Spectrum Auction, it appears that some operators were allocated more than 20MHz of spectrum, resulting in them falling outside of optimal spectrum deployment.

The IDA should monitor these operators to ensure that they are actively and effectively deploying their full spectrum allocations. If operators are not deploying their full spectrum allocations, this might amount to spectrum hogging. Where there is evidence of spectrum hogging, the IDA should re-allocate the spectrum rights and make them available to the new MNO.

Re-allocated spectrum might be better utilized by a new MNO who is currently excluded from the 1800MHz band.

3. Use of Spectrum

The IDA's requirement that allocated spectrum is to be primarily used for 4G services, is reasonable.

While the IDA retains the discretion to allow newly allocated spectrum to be used for 3G services, subject to their discretion, we believe that such discretion should only be exercised cautiously.

The IDA has already recognised the potential of 4G and by its directive on 12 December 2014, has allowed MNOs to deploy 4G systems and services in the allocated 3G bands (namely the 2.1GHz).

The IDA should only exercise this discretion to allow a new MNO to offer 3G services on newly allocated spectrum so as to facilitate the new MNO in levelling the playing field.

To allow operators with existing 3G networks to use newly allocated spectrum for 3G services would be a step backwards and promote non-optimised usage of spectrum.

As with EGSM, the fact that existing 3G service may already have been offered in the respective spectrums should not be grounds for an MNO to be entitled to continue to do so.

4. Spectrum Duration

In terms of spectrum right durations, a 15 year period is reasonable.

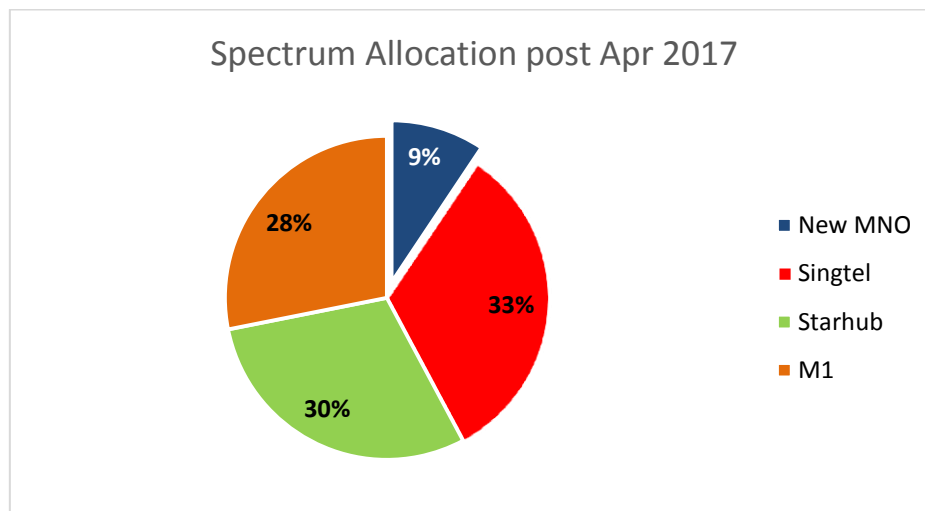
5. Main Auction format and Spectrum Caps

In terms of auction format, the use of quantitative and qualitative stages is simple in its design.

The IDA is correct in its adoption of imposing caps on spectrum bidders to achieve its policy outcome of preventing disruption and ensuring fair distribution of bandwidth to operators.

However, we believe that in terms of a new MNO, in order to achieve a fair distribution, the IDA should take into cognisance the existing bandwidth that incumbent operators already possess in totality (See Annex A for comparison). It is worthy to note that the 2 most widely deployed spectrum bands for 4G networks, namely the 1800 MHz (Band 3) and the 2.5G (also known as 2.6G Band7) have been allocated to the incumbents in the 2013 spectrum allocation exercise.¹⁰

Assuming that at this spectrum allocation exercise the new entrant MNO does not secure additional spectrum and that each incumbent is allocated the remaining available spectrum equally, then post Apr 2017 the spectrum allocation amongst the mobile operators will be reflected as per the figure below.



Based on the above, we believe that spectrum caps should be looked at as a holistic exercise, rather than within specific spectrum bands, with no caps being placed on the new MNO which will, post auction, still have the smallest share of spectrum.

In the current auction, we propose that for a new MNO, the spectrum cap should be increased to 2x20MHz in the 900MHz band. Specific arguments for the allocation of 2x20MHz as part of the spectrum package reserved for a new MNO are set out in our response to Question 7 below.

6. Spectrum Allocation

In the Allocation Stage (qualitative bid stage), we would like to request that the IDA take measures to ensure that each operator should secure contiguous spectrum. Contiguous spectrum ensures that operators will be able to optimise their networks design and deployment.

¹⁰ *"The most widely used spectrum for LTE network deployments continues to be 1800 MHz (3GPP band 3). LTE1800 is now used in 187 commercially launched networks in 89 countries representing over 44% of LTE network deployments. The next most popular contiguous band for LTE systems is 2.6 GHz (band 7) being deployed in 100 networks."* **GSA confirms 422 LTE networks launched, Cat 6 LTE-Advanced deployments setting the pace** http://www.gsacom.com/news/gsa_430.php

In this respect, it is even more critical that for a new MNO the spectrum bands are contiguous. The MNO's allocated spectrum runs the risk of being "disrupted" or "segmented" based on the bidding patterns for spectrum lots.

7. Regulatory Obligations for Participation in Spectrum Auction

As with the modifications to FBO licenses introduced by the IDA in the 2001 3G auction, the IDA has the opportunity to secure new obligations from all participating MNOs. As this will be the largest spectrum auction to date, and possibly for some time, this opportunity should not be given up lightly.

The IDA may wish to consider making obligatory some of the suggestions which we have raised throughout this submission.

Question 7

The proposed facilitation framework for the new MNO, including on the set aside spectrum, the reserve price for the set-aside spectrum, the auction format, and the regulatory obligations on the new MNO.

1. Introduction

"... we believe that there is space for a fourth telco" is the view expressed by the Minister for Communications and Information, Assoc Prof Dr Yaacob Ibrahim during parliamentary questions on 11 May 2015.

The framework for the new MNO is clearly consistent with the view expressed by the Minister. It appears to be the most comprehensive framework for spectrum allocation ever launched by the IDA. It shows the IDA's commitment to creating a healthier and more competitive mobile environment. Humbly, we believe there is still room for improvement.

2. New MNO Spectrum

Spectrum bands allocated for new MNO

We appreciate that the IDA has considered carefully and made available 3 bands namely the 700 MHz, 900 MHz and 2.3 GHz bands for the new MNO.

The 900 MHz band will be crucial for the new MNO to provide nationwide coverage. Given that the new MNO does not have any fall back networks, this is especially important not just to meet the IDA's coverage requirements but also to ensure that customers enjoy connectivity nationwide.

The 2.3 GHz band as identified by the IDA is for capacity.

The 900 MHz and 2.3GHz bands in combination will allow basic wireless broadband to be rolled out in a classical coverage layer coupled with capacity layer.

The allocation of the 700 MHz band is highly appreciated. It shows that the IDA is committed not just to encourage the entry of a new MNO but to ensure that in the medium term, the new MNO can remain competitive.

While the 700 MHz will only be available at its earliest in 2-3 years, this is likely to coincide with the ramp up of the network capacity as the new MNO grows its customer base.

The early allocation of this 700MHz band will allow the new MNO to optimise costs in terms of its network rollout to cater for the future upgrade deployment of the 700 MHz band.

This decision by the IDA will no doubt be studied by regulators around the region who are also in the process of attracting new MNOs into their markets.

Allocating More 900 MHz To The New MNO

The IDA has allocated 2x10 MHz in the 900 MHz for the new entrant. We are proposing that an additional spectrum of 2x10 also be allocated to the new entrant operator in the 900 Mhz band.

With a contiguous 2x20 MHz carrier network, the new MNO will be able to deploy a fully optimised network. While this proposal may appear unfair to existing incumbents we believe that allowing the new MNO to deploy an optimised network is necessary to help level the playing field.

Existing MNOs do not need the 900 MHz for nationwide 4G coverage as they are already obligated to do so using the 1800 MHz and/or 2.5 GHz¹¹ bands.

Further the incumbents have all been allocated at least 2x20 MHz in the "LTE golden" 1800 MHz band¹², something the new MNO will not have access to for at least 15 years. Without a contiguous 2x20MHz spectrum in the 900 MHz band, the new MNO will be hampered compared to the incumbents who are able to fully optimise their 1800 MHz network rollout leveraging on a fully loaded carrier capacity of 20 MHz.

Further, the optimisation available to the incumbents in the 1800 MHz band allows them to push the peak speed of this band to its fullest potential, whether deployed in a singular band or aggregated with other bands.

¹¹ Information Memorandum Auction Of 1800 Mhz Spectrum Rights (2013) and 2.5 Ghz Spectrum Rights (2013) dated 26 April 2013

Para 4.2 "Any operator granted an 1800 MHz Spectrum Right (2013) will also be required to comply with the following timelines for deployment of **nationwide 4G** telecommunication systems and services ..."

¹² Singtel having 6 lots, Starhub having 5 lots and M1 having 4 lots of the 1800 MHz Spectrum.

<http://www.ida.gov.sg/Policies-and-Regulations/Industry-and-Licensees/Spectrum-Management/Spectrum-Rights-Auctions-and-Assignment/1800-MHz-Spectrum-Right-and-2-5-GHz-Spectrum-Right-2013-Auction>

Incumbents who seek to argue that they have deployed 3G networks over the 900 MHz band should also be prevented from crying foul should this band no longer be available to them. They have had exclusive use of the 900 MHz band for at least 8 years since the last auction and were fully aware that their spectrum rights were to expire on 31st March 2017.

The mere fact that they have invested in the 900MHz band in the past should not be grounds for a sense of entitlement moving forward. This would effectively be holding the regulator hostage based on the operators' own commercial decisions.

While the incumbents may further argue that 3G users will be impacted should the 900MHz band be re-farmed, this argument is also without merit.

Currently the incumbents deploy their 3G networks across their existing bands. Given the maturity of the 3G ecosystem, devices support multiple bands. As with EGSM, user mobile devices are able to decide using QoS parameters which is the best frequency band or base station to connect to.

If the 2x20MHz in the 900MHz band is made available to the new MNO, existing operators would still be able to bid for the remaining 5 MHz and EGSM band should they desire to do so. As stated in answer to Question 6 above, even if they were to bid for such spectrum, the IDA should be cautious in allowing its use for the less optimal 3G standard.

Spectrum Price for the new MNO

We appreciate that spectrum package for the new MNO has been priced at a discount. We are in favour of the pricing set at \$40M.

We believe this will encourage participation.

New MNO Spectrum Must Be Contiguous

We note that the spectrum quantity allocated to the new MNO will only be assigned during the Assignment Stage of the Main Auction.

In order to ensure that the spectrum bands allocated or acquired by the new MNO are in contiguous blocks, the IDA should develop a framework such that the new MNO should not be required to spend additional capital to secure a contiguous block.

We do not have preference for any spectrum block within the spectrum band save that all allocated spectrum should be contiguous in nature.

3. Choosing the New MNO

Based on the scarcity of spectrum available in the market and the decision of the IDA to wisely bundle selected spectrum together for the new MNO, the IDA has only one shot at introducing a new MNO.

The commitment to be the new MNO is both serious and considered. To ensure that the new MNO is fully capable of delivering competition and innovation to benefit consumers, the ultimate decision should not rest on guesswork or purely a bid price.

We would therefore propose that whatever selection process the IDA chooses to adopt a detailed and careful review of each candidate should be undertaken.

New MNO Must Have Ability To Deliver

It is critical when reviewing any potential new MNO that the IDA be presented with very detailed deployment plans. Any new entrant that is unable to deliver a quality network will effectively be squandering the spectrum allocated by the IDA.

In the fixed line market the arduous task of building the nationwide network was achieved by the OpenNet consortium. In the mobile market, the new MNO will be responsible for its nationwide network and will require similar expertise and experience in when building it.

The new MNO will need to show the necessary sophistication in its deployment plans to achieve this. Only with the necessary network in place will a new MNO be able to properly introduce competitive pricing without compromising quality of service. A leading factor to the competitive environment that we see today in the fixed line market is the underlying quality of service.

Tender Method of Selection

To ensure that the new MNO has the necessary capabilities, the IDA may wish to consider a tender approach for the selection of the new MNO. In doing so the IDA should go beyond pre-qualification evaluation criteria listed in the Second Consultation¹³.

We believe that tender evaluation criteria should cover key areas such as:-

1. The technologies to be adopted;
2. The ability to build a high quality network, and in particular in-building systems. (This is important as studies have shown that 75% of mobile data consumption is expected to take place indoors);
3. A background in technology and innovation (including industry specific IP);
4. Having an ecosystem development programme to not only bring benefits to consumers but also to re-generate new growth activities in the info-communication sector; and
5. Having Corporate Social Responsibility programme to bring greater benefits to the society.

Prequalification for Auction

Even if a tender approach is not adopted we believe the IDA should use the same set of criteria for a tender process to pre-qualify potential participants in the auction.

¹³ Subnote 43 of IDA's 2nd Public Consultation paper where new entrant is supposed to show "amongst others capital structure, financial proposal, technical capabilities and proposed deployment plans"

Auction Methods

We see benefits and drawbacks in both auction methods proposed by the IDA. We do not have any particular preference for which method to adopt.

Encouraging SME Participation

We believe that the IDA should consider making this framework SME friendly.

The benefits of an SME based MNO is that such an entity will bring new and different business practices from those usually adopted by large corporations and MNCs. SMEs by their nature are flexible and nimble.

This is consistent with the views expressed by the Minister for Communications and Information, Assoc Prof Dr Yaacob Ibrahim during parliamentary questions on 11 May 2015 where he stated: *"... we just do not want another telco. We want a telco that can bring innovation to the market, and therefore, cause the existing incumbents to also innovate."*

One method to encourage SME participation would be to reduce the Banker's Guarantee during the auction stage. We propose that the Banker's Guarantee be set at 10% of the reserve or spectrum price and be maintained at the same level up to the commencement of the spectrum rights.

During the 2013 Spectrum Auction, the IDA provided for the concept of Deferred Payment¹⁴. We would like to propose that the Deferred Payment date be brought as close to the date for the commencement of the spectrum rights as possible and, minimally, no earlier than three (3) months before that date.

4. Regulating the new MNO

To ensure that the potential new operator does not deploy sub-par networks which will hamper subsequent competition, the IDA may wish to consider introducing safeguards through various regulatory obligations on the new MNO. These include requiring the new MNO to provide:-

- a. full nationwide outdoor coverage within 3 months of the commencement of spectrum rights;
- b. coverage to MRT Stations and Tunnels within 18 months of the commencement of spectrum rights;
- c. indoor coverage to 1000 buildings and 2,000 lift shafts within 1 year of the commencement of spectrum rights; and
- d. indoor coverage of up to 4,000 buildings and 8,000 lift shafts within the 4 years of the commencement of spectrum rights.

¹⁴ Page 20 para 2.7 of the Information Memorandum Auction Of 1800 MHz Spectrum Rights (2013) And 2.5 GHz Spectrum Rights (2013) dated 26 April 2013 (Updated On 4 June 2013)

5. Achieving competition and innovation post auction

We appreciate the efforts made by the IDA in allocating bundled spectrum to the new operator and facilitating the new MNO under the framework, however, post auction facilitation should also be considered if the objectives of achieving competition and innovation are to be met.

Use of new MNO spectrum fee

A further mechanism through which the IDA can champion the goal of introducing innovation and competition with the entrance of a new MNO would be to channel part of the new MNO's license fee into developing centres of innovation.

These centres of innovation could be internal to the new MNO or distributed across its network of partners and suppliers.

A further potential application of the new MNO's license fee could be towards ensuring fair and healthy competitive practices are developed and introduced to the industry. This would help fulfil the desired effect of bringing a new MNO to the market.

Access to RAN

We note that the IDA has decided not to impose site sharing or RAN sharing obligations on incumbent operators.

While we note that this is a step back from IDA's position during the 2001 3G Spectrum exercise, we believe this is a reasonable decision for the IDA to take. Even if the IDA has sought to impose such obligations on incumbent operators, we believe it would have been an extremely difficult exercise in practice.

What may be perceived as a gain in rollout speed from leveraging on existing RANs may in turn undermine the objective of innovation and change. Wholesale adoption of existing RANs would result in a replication of the existing incumbent infrastructure, providing some benefits, but also perpetuating any existing problems.

Access to CAS

The IDA's imposition on incumbent operators to "negotiate in good faith with the new MNO to provide access to common antenna systems" is a welcomed move on the part of the regulator.

We believe that the IDA should also set out a process so that any negotiations and subsequent access can be achieved within a timely manner. This would prevent any accusations that incumbent operators are trying to stall the roll out plans of a new MNO.

Further we suggest the IDA may wish to consider the following principles when imposing guidelines on any planned negotiations:-

- a. That for each existing CAS, where there is in place a "caretaker" operator, the new MNO will only need to deal that operator as a single point of contact. In the

- same vein, to provide the new MNO with contact information of each respective "caretaker" within 1 month of the conclusion of the auction;
- b. That the IDA establish a series of KPIs to ensure that information about existing CAS and subsequent access to such CAS is provided within a timely manner;
 - c. The joining fees to be paid to the incumbent for joining an existing CAS should be determined based on the original deployment costs of the relevant CAS. Many CAS have already been depreciated by the incumbents and the joining fees already represent bonus revenue to them.
 - d. While it reasonable for the new MNO to pay for any necessary upgrade costs to join a CAS, the MNO should be able to offset part of these costs from the relevant joining fees to prevent it being overly onerous;
 - e. A liquidated damages policy should be considered to limit potential damages during any upgrades and to simplify any disputes process;
 - f. That all new CAS deployments must include the new MNO to ensure a level playing field, and
 - g. That the IDA be copied in all correspondence relating to above, whether between the new MNO and existing operators or between the operators themselves.

Interconnect Committee

The IDA should consider setting up a dedicated committee to oversee all interconnection issues (Interconnection Committee).

The Interconnection Committee should review current policies and ensure that costs interconnectivity cannot be used to exclude any new MNO or lead to an unbalanced playing field.

Some areas which the Interconnection Committee should review as they may inhibit competition would include:-

- a. termination rates for mobile numbers and fixed line numbers; and
- b. pricing policies which may overly favour some MNOs.

Anti-competitive behaviour

In any industry dominated by a small group of incumbents, there is a risk that anti-competitive behaviour may rear its ugly head in an effort to maintain the status quo.

With the mandate to oversee competition¹⁵ in telecommunications industry, the IDA may wish to pre-empt such potential activities by setting up a competition

¹⁵ Advisory Guidelines Governing Abuse Of Dominant Position, Unfair Methods Of Competition And Agreements Involving Licensees That Unreasonably Restrict Competition Under Sections 8 And 9 Of The Code Of Practice For Competition In The Provision Of Telecommunication Services 2012 Date Of Issue: 25 April 2014
http://www.ida.gov.sg/~media/Files/PCDG/Practice%20Guidelines/Guidelines/IDA_Telecom_Competition_Guidelines.pdf

committee with specific focus and strong deterrents being applied to the following areas:-

- a. Any attempt to prevent access to suppliers;
- b. Any attempt to disrupt the new MNO's rollout plans by causing undue delay;
and
- c. Any attempt to coordinate pricing.

To monitor compliance, the IDA may wish to impose an obligation on all MNOs to inform the IDA of any meeting which involves 2 or more MNOs. Further, the IDA should have the right to have observer status at any such meeting.

Such a mandate should be issued to existing MNOs as soon as possible and should also apply to the new MNO when it comes into being.

Eventually when the new MNO is fully operational, the IDA will be able to scale back its active involvement. This would be consistent with IDA's stated position that "As competition develops, IDA anticipates that it will be able to reduce the level of ex ante regulation, and place greater reliance on ex post enforcement." ¹⁶. A further step would be for the IDA to revise the Code of Practice For Competition in the Provision of Telecommunication Services. While this was recently revised on 25 Apr 2014, further revision may be necessary after taking into consideration the entry of a new MNO.

Regulatory Obligations for Participation in Spectrum Auction

To enshrine these guidelines, the IDA may wish to make all participants agree to the above set of principles as a prerequisite to participating in the upcoming spectrum allocation exercise.

Question 8

The proposed negotiation principles to facilitate wholesale access negotiations between "thick" MVNOs and MNOs.

1. Encouraging MVNOs

The IDA has clearly recognised the potential benefit from the introduction of MVNOs into the market. These benefits are consistent with the objective of increasing competition and further creating new market segments or addressing market segments which may have been previously neglected.

¹⁶ Para 2.1 of IDA's Advisory Guidelines issued on 25 Apr 2014.

The concept of defining negotiation principles to facilitate wholesale access negotiations between “thick” MVNOs and MNOs is a noble attempt and effort by the IDA.

New MNO will be more open to MVNOs

Respectfully, we believe that defining negotiations principles may not achieve the desired outcome if the negotiating parties are not driven by genuine commercial desires. We believe that encouraging MVNOs can best be achieved by the entry of a new MNO.

A new MNO will be driven to partner with MVNOs in order to achieve faster growth and market penetration. Incumbents may be more cautious about partnering an MVNO as they may feel that the MVNO may potentially cannibalise their existing customer base.

We would welcome a “thick” MVNO running their own core platform and application environment. This would allow the “thick” MVNO to differentiate its products and services while leveraging on our network.

MVNO Guidelines

For an MVNO to be truly successful we believe that after securing their required QoS from the MNO, the MVNO should have as much liberty as possible to execute their business plan, in this regard we believe the guidelines for MVNOs should include the following:-

- a. No limits as to the scope of services that can be offered by the MVNO, with traffic bypassing, where possible, the MNO's core platform. This would allow the MVNO to deliver its services directly to its customers;
- b. Within the MVNO's agreed QoS with the MNO, there should be no discrimination of the MVNO's IP traffic;
- c. The MVNO after building its platform and products should not be restricted from offering services to specific customer segments. This would lead to an inherently non-competitive outcome; and
- d. The IDA should monitor MNOs to ensure that they do not implement any anti-competitive measures with their MVNOs in an attempt to protect market segments or restrict the MVNO from delivering it services.

We are of the view that any MNO that seriously wants to partner with an MVNO would be agreeable to such a framework.

CONCLUSION

The time is perfect for the introduction of the new MNO, not just to spur competition in the mobile market but through the MNO, to create a catalyst for the rejuvenation of the infocommunications industry as a whole.

The IDA appears committed to the encouraging the entry of a new MNO, but the role of the IDA should not stop there.

It is key that the IDA plays an active role in facilitating the new MNO to level the playing field with the incumbents. It is only through this facilitation that the long term benefit of increased competition can be achieved in the market by the entry of the new MNO.

The benefit from the introduction of a new MNO goes beyond the consumer market and has the potential to change the industry as a whole. With the scale of the current auction, there is a chance that similar circumstances will not present themselves for another 15 to 20 years, and the most must be made by the IDA of this unique opportunity.

When looking at qualities of the new MNO, the IDA should recognise the inherent benefit of championing an SME. Such a move would have the greatest potential of introducing true innovation that can only be expected from a nimble and flexible new entrant. This would avoid the scenario of producing "just another telco".

There is likelihood that some industry players will comment negatively on the framework proposed and on the need for a new MNO in general. We would urge the IDA to look beyond any possible vested interests behind such comments to the consumers that will benefit from such an entrant.

We have every confidence that the IDA will continue with its excellent track record of being a pro-active regulator seeking to deliver to consumers and businesses as a whole.

ANNEXES

Annex A

Spectrum available post March 2017 ¹⁷
 (excluding spectrum allocated under current proposed framework)

Operator	Spectrum	Bandwidth
Singtel	2.1G	2X20+5
	2.5G	2X20
	1800M	2X20 2X10
	Subtotal	145 MHZ
Starhub	2.1G	2X20+5
	2.5G	2X20
	1800M	2X20 2X5
	Subtotal	135 MHZ
M1	2.1G	2X20+5
	2.5G	2X20
	1800M	2X20
	Subtotal	125 MHZ
NEW ENTRANT MNO	NA	NA
	Subtotal	0 MHZ

¹⁷ <http://www.ida.gov.sg/Policies-and-Regulations/Industry-and-Licensees/Spectrum-Management/Spectrum-Rights-Issued>; and
<http://www.ida.gov.sg/Policies-and-Regulations/Industry-and-Licensees/Spectrum-Management/Spectrum-Rights-Auctions-and-Assignment/1800-MHz-Spectrum-Right-and-2-5-GHz-Spectrum-Right-2013-Auction>