DIRECTION OF THE INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE: PROVISION OF TAIL LOCAL LEASED CIRCUITS AT G.703 INTERFACE STANDARDS

19 OCTOBER 2005

EXPLANATORY MEMORANDUM

Background

1. As a Dominant Licensee, Singapore Telecommunications Ltd ("**SingTel**") is required to offer local leased circuits ("**LLC**") as a mandated wholesale service ("**MWS**"). This obligation is embodied in Section 8 of the Schedule to the Code of Practice for Competition in the Provision of Telecommunication Services (RIO Requirements) Notification 2005 (G.N. No. 414/2005) ("**IRS/MWS Schedule**").

2. Schedule 7A and 7B of SingTel's Reference Interconnection Offer ("**RIO**") sets out the terms pursuant to which SingTel offers to provide LLC to any Facilities-based Requesting Licensee ("**RL**"). In particular, Schedule 7B provides that in the case of tail LLCs ("**TLLC**") of bandwidths from 64 kbps to 1984 kbps ("**n x 64 kbps circuits**"), SingTel will hand over traffic from its network to a RL's network using a default interface standard of V.35[1] (please see Annex 7B-4 of SingTel's RIO).

3. Arising from the implementation of Schedule 7B of the RIO, IDA has received industry feedback highlighting difficulties with respect to accessing n x 64 kbps circuits obtained under the RIO. In particular, the V.35 interface standard implemented by SingTel for n x 64 kbps circuits is not suitable for carrier-to-carrier connection as it results in an ineffective and inefficient hand over of TLLCs.

4. IDA has conducted a careful and thorough review of the difficulties raised by the industry and IDA's assessment is set out below.

IDA's Assessment of Inherent Difficulties with Existing Hand Over Configuration

5. Currently, for n x 64 kbps circuits, SingTel hands over such circuits to the RL using the V.35 interface standard. However, for TLLCs with bandwidths above 1984 kbps, SingTel hands over the circuit using G.703[2] interface standard. The

[1] The V.35 interface standard was an International Telecommunication Union ("ITU") standard for high-speed synchronous data exchange. In 1989, the ITU recommended that the interface was obsolete and replaced it with the V.10/V.11 standard. The V.35 interface is typically found on Data Terminal Equipment and Data Communication Equipment interfacing to high speed digital carrier services.

[2] The G.703 interface standard is an ITU standard which defines the characteristics of transmission facilities over digital circuits running at speeds such as 2 Mbps and 64 kbps.

hand over of TLLCs using V.35 and G.703 interface standards are illustrated by Figure 1 below:

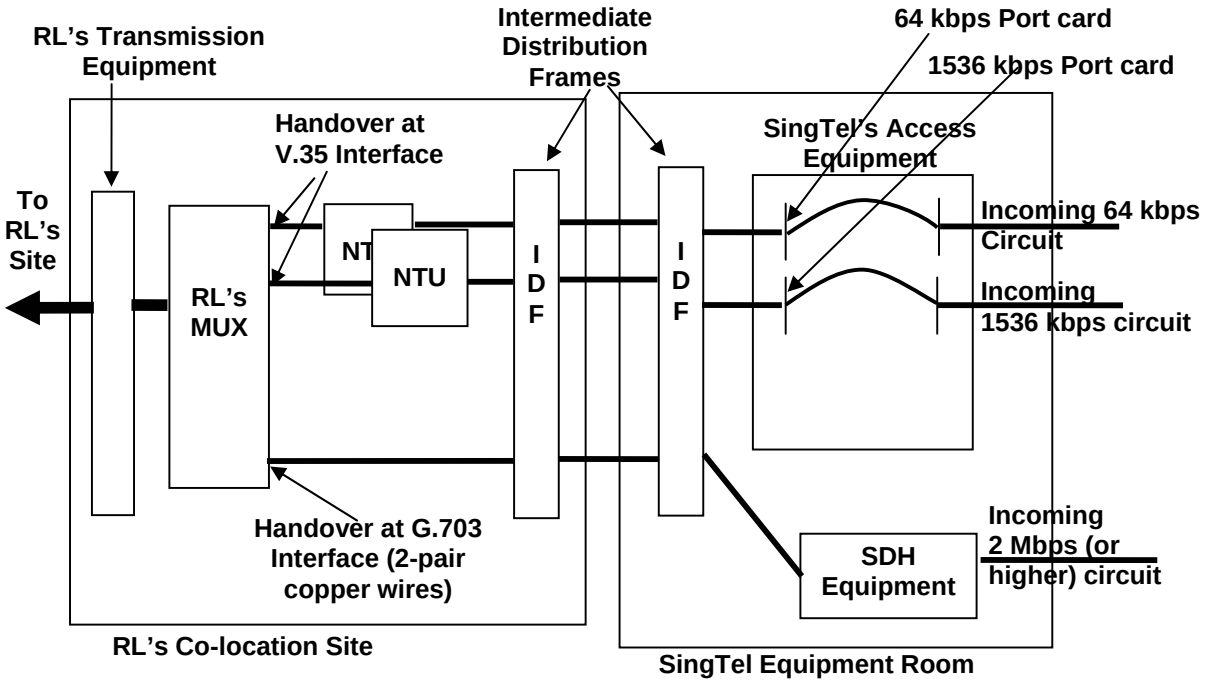

Figure 1: Existing Hand Over Configuration

6. The key difference between the V.35 interface standard and the G.703 interface standard lies in that the V.35 interface standard requires the use of an additional network termination unit[3] ("**NTU**") before the TLLC may be handed over to the RL. Further, if the RL needs to groom the TLLCs, it will also require a multiplexer ("**MUX**"). In contrast, the G.703 interface standard does not require any intermediary equipment, and may be handed over directly to the RL using 2-pair copper wires.

7. In addition, IDA notes that in some cases, SingTel may have groomed its n x 64 kbps circuits into larger capacity circuits (e.g. 2 Mbps, 155 Mbps etc) before routing them to the exchange for termination. In order to hand over the circuits to the RLs at V.35 interface standard, SingTel has to "ungroom" or de-multiplex such larger capacity circuits into individual n x 64 kbps circuits, using its MARTIS equipment. The grooming and subsequent "ungrooming" of the n x 64 kbps circuits is illustrated by Figure 2 below.

[3] The NTU or V.35 Winchester interface equipment, is placed at the final interconnect point between the service provider's network and the customer owned equipment. The NTU used by SingTel in the provision of LLCs is approximately the size of a Singapore phonebook.

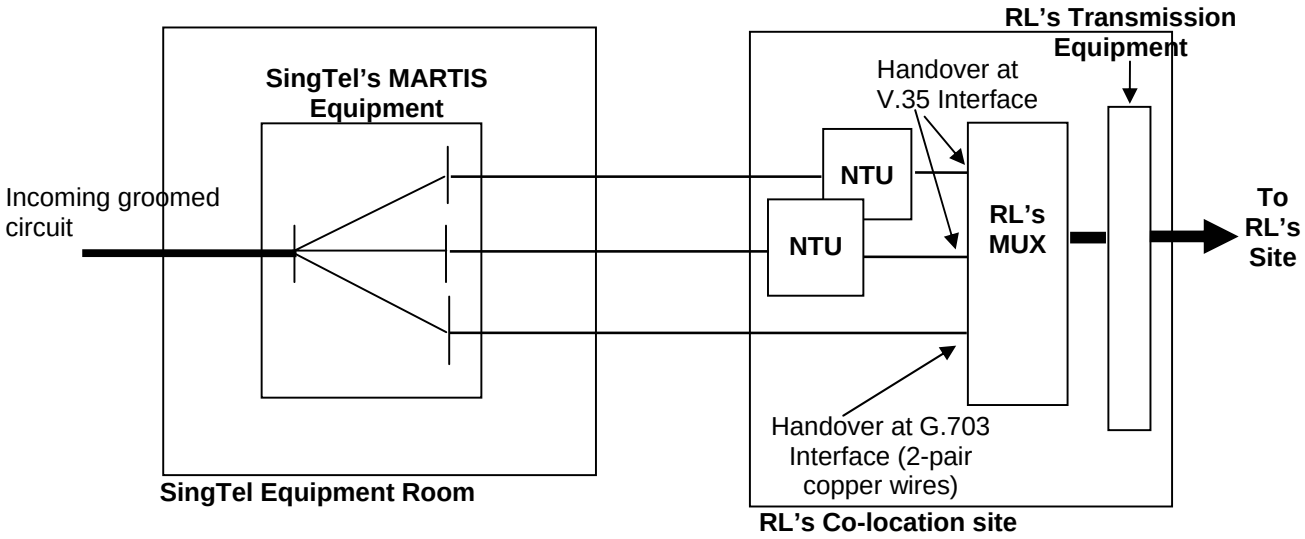

Figure 2: "Grooming" and "Ungrooming" of n x 64 kbps Circuits

8. IDA's assessment is that the current hand over configuration using V.35 interface standard, as provided for in the RIO, for n x 64 kbps circuits is economically and technically inefficient for the following reasons:

8.1 Imposition of unnecessary and unjustified costs on the RL

8.1.1 With the need for intermediary equipment, the RL will incur significantly higher costs to access TLLCs. The RL's underlying costs of provisioning LLCs is directly affected by the number of NTUs required. For each n x 64 kbps circuit that the RL obtains, the RL will have to incur the cost of an NTU, thereby escalating its cost structure incrementally. In addition, other than direct equipment costs for NTUs and MUXs, the RL will also incur additional auxiliary costs for equipment racks, co-location space and power requirements.

8.1.2 Further, in cases where SingTel has already groomed the n x 64 kbps circuits into larger capacity circuits, the need to "ungroom" such larger capacity circuits to n x 64 kbps circuits results in additional costs, which are also borne by the RL.

8.1.3 Accordingly, IDA's position is that the current hand over configuration is clearly economically inefficient as it imposes unnecessary costs on the RL.

8.2 Inefficient use of co-location space at SingTel's exchange buildings

8.2.1 The RL must co-locate each NTU and MUX at the RL's co-location space in a SingTel's exchange building. However, under the RIO, SingTel is only required to lease up to 10 square metres of equipment footprint space in each exchange building for the RL to access not just TLLCs but also other interconnection related services. In any event, co-location space at an exchange building is a limited resource that must be allocated and used efficiently by licensees.

8.3 Technical deficiency of the V.35 interface standard for carrier-to-carrier connection

8.3.1 The V.35 interface standard requires the use of an NTU for each TLLC. By introducing an additional network element between SingTel's and the RL's networks, additional equipment compatibility testing will have to be carried out prior to the hand over and activation of circuits. Furthermore, each additional network element will result in more potential points for network failure and in turn require more complex fault identification and restoration work in the event of circuit failures. In this respect, IDA notes that the V.35 interface standard is more commonly used for carrier-to-end-user connection and is not technically efficient for carrier-to-carrier connection. And RL in this case is not an end-user.

9. For the reasons provided in paragraph 8 above, IDA's position is that an RL which intends to acquire n x 64 kbps circuits in order to roll-out its LLC trunk network may be artificially constrained from doing so. This will be contrary to the underlying policy behind IDA's decision to designate SingTel's LLC as an MWS, which is to encourage facilities-based competition by facilitating competing operators to roll-out LLC trunk networks (please see IDA's decision titled "Designation of SingTel's Local Leased Circuits as Mandated Wholesale Service" dated 16 December 2003 ("**LLC Decision**")).

Alternative Hand Over Configuration

10. IDA had also considered whether there were other more feasible alternatives to hand over the n x 64 kbps circuits. In this respect, IDA issued a public consultation paper on 4 July 2005 to seek the industry's views on the requirement that SingTel provide RLs with an option for direct hand over of the n x 64 kbps circuits to the RL's co-located equipment via 2-pair copper wires, without the need for a separate intermediary NTU ("**Direct Hand Over Configuration**"). Five responses were received from SingTel, StarHub Pte Ltd, the Asia Pacific Carriers Coalition ("**APCC**"), MCI Worldcom Asia Pte Ltd ("**MCI**") and Office of the United States Trade Representative ("**USTR**").

11. StarHub, APCC, MCI and USTR voiced concerns that the Direct Hand Over Configuration would require the use of proprietary equipment from one vendor (i.e., Tellabs). They felt that there was no reason to use proprietary interface when open standards such as G.703/704 are available. They further took the position that, as RLs have little and/or no experience in using Tellabs equipment, the use of such proprietary interfaces and equipment could also result in compatibility issues. In addition, they argued that the costs of proprietary equipment are generally higher than standard similar equipment, so RLs would likely incur higher implementation costs. The parties therefore took the view that SingTel should hand over the n x 64 kbps circuits using G.703 interface standard as the G.703 standard is an open standard used for carrier-to-carrier network interconnection, i.e., the RLs will be able to use the same standard equipment for

all TLLCs[4], not just the n x 64 kbps circuits. In addition, SingTel should also groom the n x 64 kbps circuits before handing it over to the RLs because groomed circuits would be the most efficient mechanism for the provision of multiple n x 64 kbps circuits.

12. SingTel took the view that the Direct Hand Over Configuration may be technically possible. However, it cautioned that the proposed configuration has not been implemented before, and may require extensive trials before it can be implemented.

13. From the responses to IDA's public consultation, IDA is of the view that the Direct Hand Over Configuration is not satisfactory for the purposes of improving the existing hand over configuration of n x 64 kbps circuits and fulfilling our policy objectives for mandating LLC as an MWS.

IDA's Decision to require SingTel to provide G.703 interface standard and grooming

14. Accordingly, having considered the economic and technical inefficiencies of the existing hand over configuration and the shortfalls associated with the Direct Hand Over Configuration, IDA requires SingTel to offer to provide the G.703 interface standard as an alternative to the V.35 interface standard for handing over of n x 64 kbps circuits.

15. However, IDA recognises that requiring SingTel to offer the G.703 interface standard by itself will not be sufficient to effectively address IDA's policy concern and the problems highlighted by the industry. Under such a configuration, SingTel will still be required to install 2 Mbps port cards for each n x 64 kbps circuit requested by the RL. This is inefficient. In addition, the RL will still require a MUX to groom the circuits for routing back to its network sites. (Please see Figure 3 below.) The effect being a configuration that is still not reasonably efficient.

[4] For tail LLCs above 1984 kbps, SingTel hands over the tail LLC using the G.703 interface standard.

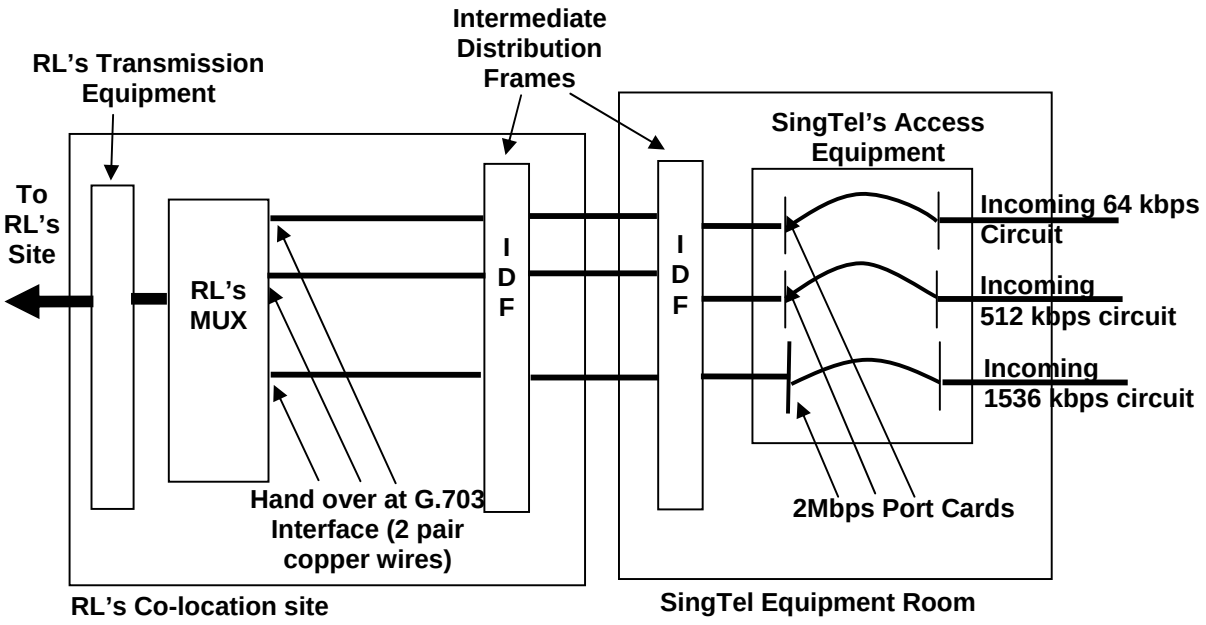

Figure 3: Hand Over Configuration using the G.703 Interface Standard

16. Therefore, in addition to offering G.703 interface standard as an alternative to V.35 interface standard, IDA will also require SingTel to utilise the capacity in each 2 Mbps port card in a more efficient manner, by offering to aggregate and groom the RL's n x 64 kbps circuits into individual circuits of up to 2 Mbps each, and to hand over the groomed circuit to the RL at the latter's transmission equipment. The underlying configuration that IDA adopts is illustrated by Figure 4 below:

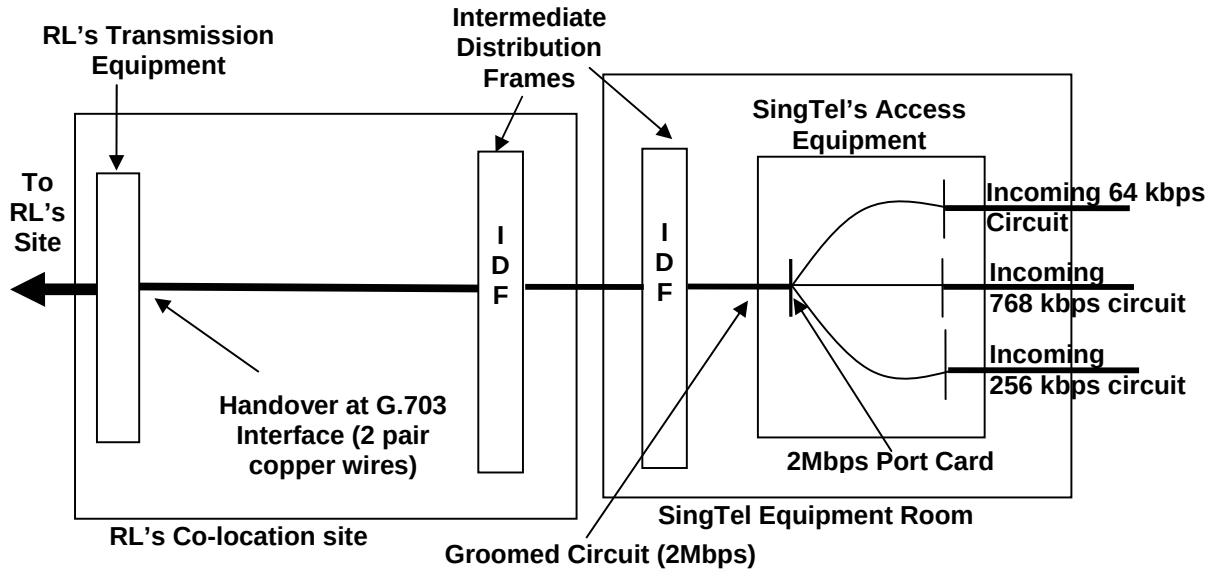

Figure 4: Hand Over Configuration with Grooming

17. IDA is of the view that the above configuration is consistent with IDA's policy objective and addresses the problems highlighted by the industry. It has the advantage of reducing the costs incurred in purchasing unnecessary 2 Mbps port cards for each n x 64 kbps circuit, as well as ensuring that the capacity of each 2

Mbps port card is efficiently utilised. Further, IDA takes the view that this configuration is reasonable given that SingTel already offers the G.703 interface standard for TLLCs for speeds above 1536 kbps and for full LLCs under Schedule 7A of the RIO. IDA sees no economic or technical justification as to why the interface standard should differ in the case of n x 64 kbps circuits.

18. To ensure that SingTel is not prejudiced by IDA's decision, IDA permits SingTel to recover the reasonable costs incurred in grooming the n x 64 kbps circuits for hand over at G.703 interface standard.

19. Prior to IDA designating SingTel's TLLC as an IRS[5], IDA permits SingTel to impose a monthly charge equivalent to its retail rate for grooming circuits under its retail LLC scheme (which is currently at S$100 per circuit). This is consistent with IDA's LLC Decision, which requires SingTel to offer specified discounts on the LLC monthly leasing charges only during the period that LLCs are designated and offered as an MWS under the RIO. In other words, SingTel is not required to offer non-leasing charges (including the grooming charges) at a discount under the RIO. For the avoidance of doubt, where the Requesting Licensee requests for handing over of the n x 64 kbps circuits at the V.35 interface standard, there will be no applicable grooming charge.

20. However, upon designation of SingTel's TLLCs as an IRS with effect from 15 April 2006, the provision of grooming service shall be at cost-based rates. This is consistent with IDA's LLC Decision, which states that TLLCs will be provided at cost-based rates upon designation as IRS. In this respect:

    (a) Where the Requesting Licensee requests for grooming and handing over of the n x 64 kbps circuits using the G.703 interface standard, SingTel may recover its reasonable costs incurred in performing grooming, as well as the costs of the underlying physical copper loop and any associated network management system necessary to ensure service quality of the TLLC circuits; and

    (b) Where the Requesting Licensee requests for handing over of the n x 64 kbps circuits at the V.35 interface standard, SingTel may only recover the costs of the underlying physical copper loop and any associated network management system necessary to ensure service quality of the TLLC circuits. SingTel will not be allowed to recover the cost of "ungrooming" the circuits. The basis for IDA's decision is that the cost of the "ungrooming" process" is wholly redundant and unnecessarily incurred (see paragraph 7 above).

[5] Please see paragraph 19 of the IDA's LLC Decision, as varied by paragraphs 2(b), (c) and (d) of the Minister's Decision dated 2 July 2004 in response to SingTel's appeal against IDA's LLC Decision.