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第6-2/1号课题

最后报告

ITU-D　　第1研究组　　第4研究期(2006-2010)

第6-2/1号课题:

下一代网络对互连互通的监管影响

ITU-D 研究组

2006 年世界电信发展大会（WTDC-06）根据第 2 号决议（2006 年，多哈），保留了两个研究组，并为它们确定了研究课题。WTDC-06 通过的第 1 号决议（2006 年，多哈）规定了研究组应遵循的工作程序。在 2006-2010 年期间，第 1 研究组受托开展电信发展战略和政策领域九个课题的研究工作。第 2 研究组受托开展电信业务及网络和信息通信技术应用的研发与管理领域十个课题的研究工作。

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请联系:

Makhtar FALL先生
国际电联
电信发展局 (BDT)
Place des Nations
CH-1211 GENEVA 20
Switzerland
电话： +41 22 730 6256
传真： +41 22 730 5484
电子邮件： makhtar.fall@itu.int

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摘要

本文件包含第6-2/1号课题的报告草案。该报告是对有关NGN互连互通的主要问题和潜在挑战的简要论述。请所有与会者尽早提交宝贵意见。

目录

第6-1/2号课题

引言

在国际电联电信发展部门（ITU-D）第1研究组于2006年9月在日内瓦召开的首次会议上，报告人组同意就下一代网络互连引发的问题进行探讨。会议还同意在研究期结束前完成一份至少明确指出下一代网络中互连互通问题的报告，与会者将通过电子邮件共同开展工作。该报告将确定下一代网络互连互通工作方面的问题和潜在挑战。2007年9月召开的第二次会议进一步做出决定，向成员国和部门成员征求文稿，以便收集有关该研究课题涉及的相关议题信息。尤其侧重向国际电联成员国主管部门和ITU-D部门成员征求文稿，不幸的是，征稿函发出后并未得到很多响应。2008年4月23-24日召开的报告人组会议注意到，文稿寥寥无几。这意味着，有关NGN互连互通的课题提出过早，而且这种情况还可能持续一段时间，因为NGN尚未得到广泛部署，NGN的问题是国际电联的新问题。从技术角度而言，发展速度快于监管。今天的NGN将传统运营商分为三类：1) 服务提供商；2) 包传输运营商和3) NGN负责服务质量和结算问题的系统管理运营商。NGN将随时随处以最佳价格提供各类信息通信技术（ICT）和电信服务。目前，英国是唯一开始大规模实施NGN网络的国家。NGN包含有线和无线通信，但使用宽带和软交换机。ITU-T第3研究组终于推出了首份有关NGN结算价的建议书。根据文稿及各次会议讨论情况，本报告指出了NGN互连互通的主要问题和潜在挑战。报告人组上次会议的情况表明，对于NGN网络的广泛部署而言，这一课题提出过早。会议决定对该课题进行修订并保留。NGN的部署仍处于初期阶段，在所提出的监管挑战中仍有许多问题有待解决。本报告强调了监管机构和政策制定机构在安排NGN时应着手处理的主要问题。

1. 互连架构

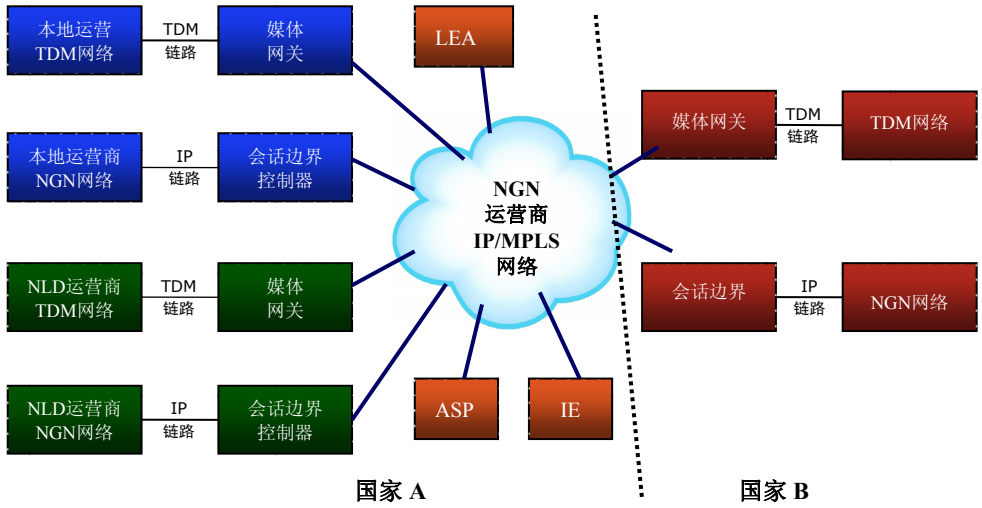
在过去几年中所建设的许多网络具备了NGN的大部分元素。即使技术已十分成熟或近乎成熟，互连互通发展仍很缓慢。由于IP技术的效率和灵活性，正在新建的大多数网络都是基于IP的。ITU-D/2/190号文件（第19-1/2课题的报告）已涵盖了网络架构的一些基本要素。最近部署网络的新兴移动通信运营商已开始实施全IP网络。

如：孟加拉新兴移动通信运营商Warid电信国际有限公司已部署了全IP网络，以实现更快的网络部署、减少CAPEX（资本支出）和OPEX（运营支出）。Warid电信国际有限公司在新德里举办的南亚电信监管机构委员会（SATRC）NGN（包括互连互通）监管问题讲习班（2008年10月16-17日）上的演示稿作为附录2附于本文件。

NGN环境中运营商之间的情况见图1。

按照ISDN用户协议（ISUP），与传统PSTN和移动网络的对等可通过用于IP至TDM或TDM至IP转换的媒体网关和用于IP之上7号信令传送的信令网关互连互通。

图 1：NGN 情况中运营商之间的互连互通架构



LEA：执法机构
ASP：应用服务提供商
IE ： 互连交换机

如图1所示，NGN网络是通过会话边界控制器（SBC）连接的。这些SBC位于网络的行政边界，用来执行有关多媒体会话的政策。会话政策的制定是为管理安全、服务水平协议、网络设备资源、网络带宽、网络之间的互通及协议可互操作性。

SBC可完成多项功能，例如：

- 网络安全
- 拒绝服务攻击和超载控制
- 网络地址翻译和防火墙穿越
- 合法拦截
- 服务质量（QoS）管理
- 协议转译
- 呼叫结算

图1所示MGW（媒体网关）是由NGN中PSTN/移动运营商部署的软交换机控制的。SGW（信令网关）可与MGW整合或作为独立设备。为协助传统网络向至少是话音的NGN过渡，NGN提供了两种能力。ITU-D/2/190号文件（第19-1/2课题的报告）讨论了这些能力。

2. 接口

2.1 物理接口

会话边界控制器SBC提供与其它NGN网络的IP接口。这些物理接口包括：

- 千兆比以太网接口
- 10/100 Base-T快速以太网接口。

SBC提供冗余信令和媒体控制子系统，这些子系统各配备冗余网络接口。SBC子系统通过可用IP接口相互通信。

2.2 信令接口

信令接口针对的网络模式为全IP下一代网络（NGN），网络控制点可为：

- 软交换机，或
- IMS（IP多媒体服务）核心

信令标准化主要是ITU-T的职责，因此，不属于本课题研究范围。但是，因采用某类接口而引发的监管问题事关重大。ITU-T负责协议和信令的标准化工作，而本课题应解决的问题是，监管机构是否应该为确保可互操作性强制实施一个给定标准，还是冒丧失互操作性的风险，对运营商听之任之。

针对本课题的联络声明，ITU-T第13研究组已转呈建议书草案。ITU-T Y.2701和Y.2201建议书为下一代网络提出了接口安全要求和较高的服务及能力要求。除这些建议书外，还有NGN焦点组发布的与定义、协议和架构相关的NGN系列文件。

ITU-T还批准了监管机构可能要使用的Q.3401信令建议书－NGN信令概要文件。

3. 互连点

在过渡阶段，主导运营商可能不得不维持传统的公用电话交换网（PSTN）的互连能力。假设竞争者可通过传统互连服务于主导运营商基于NGN的最终用户客户，那就无需承担提供新的NGN互连能力的监管义务。在过渡阶段，主导运营商将在一定程度上提供IP互连。在过渡阶段结束之际，可能将停止提供传统互连服务。只要它们仍拥有市场支配力，就应该承担以基于成本的价格提供NGN互连的监管义务。在互联网中，互连多采取对等或转接的形式，对于NGN，市场参与者可能会选择对等、转接或其它某种互连模式。事实上，对等仅在骨干网客户及其对等网络客户间提供流量交换，而不提供第三方接入。但在传统的转接关系中，转接客户可使用转接提供商的网络达到互联网的任何角落。主导服务提供商可能不情愿向弱小的竞争运营商提供对等安排。可能仅向几家最大的国内竞争者提供对等安排。因此，较小的国内竞争者的选择是有限的，或继续提供PSTN互连，或购买某个主导运营商的转接服务。对于基于IP的NGN，存在的过多问题阻碍了稳健的互连框架的实施和成功运行。要与另一家公司确立并维持互连协议需要开展一系列的工作。根据情况，技术性工作有时是必不可少的。确立IP互连安排的行政和合同费用往往被忽视。如未签订对等协议，则一种可能的方法是使用可转接所有默认运营商的所有IP 流量的IP互连交换机。

3.1 互连交换机（IE）

互连交换机的基本概念是使不同运营商连接至一个共同点，以便高效交换多重流量。互联网交换机可能是监管机构希望考虑的一种适用于NGN互连的交换机模型。

互连交换机的作用

- 网络运营商间记账

  目前，网络运营商间记账是各服务提供商间存在争议的主要问题。若不采取纠正措施，该问题还将进一步升级。将互连交换机同时作为网络运营商间记账清算机构可能为此重大挑战提供解决方案。运营商间计费可在流量传送至互连交换机的过程中根据 a) 服务等级、b) 内容和 c) 网元而不同。

- 智能网服务

  多运营商多服务情况中的智能网服务可通过综合利用互连交换机网络/运营商间记账清算机构予以提供。

- 号码携带性

  多运营商多服务情况中的号码携带性问题也可以通过互连交换机/网络运营商间记账清算机构可用的集中数据库加以解决。

- 简化

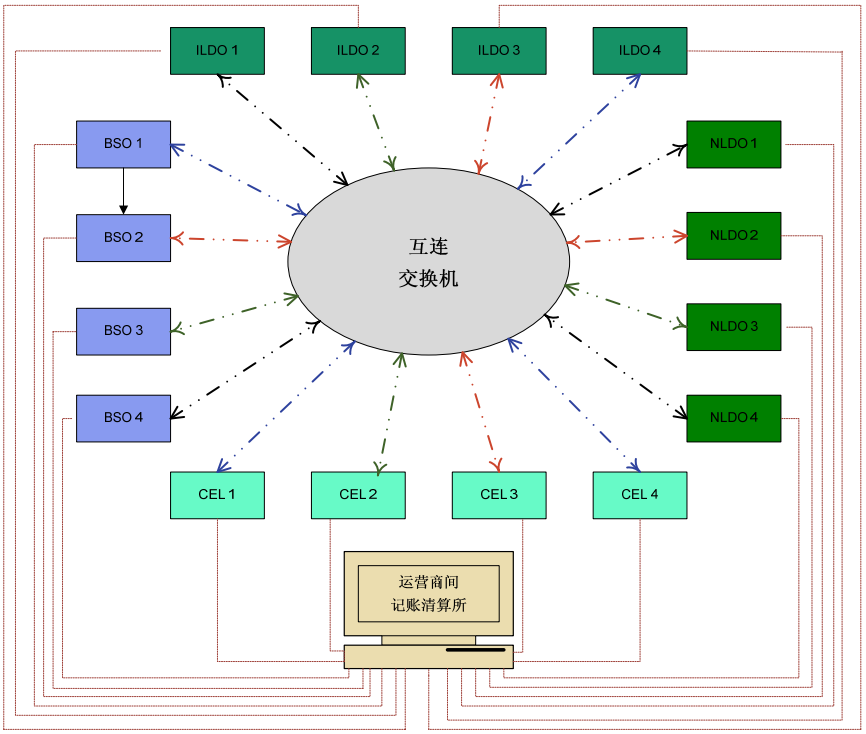
  使用互连交换机/网络运营商间记账清算机构还可以简化网络架构，减少互连点（POI）数量、简化互连使用费结算并缩短等待互连的时间。

当前互连体制的挑战

目前多运营商多服务环境中的双边互联安排可导致：

- 高互连成本和端口收费
- 非对称互连协议及因措辞含混和不平等条件引发的诉讼
- 因容量限制导致拖延提供互连
- 资源不能得到最佳利用
- 呼叫处理无效
- 管理运营商间结算成本费用高昂
- 运营商之间记账
- 互连使用费结算复杂
- 智能网平台的共用
- 号码携带性的实施
- 基础建设投入和运行成本增加，运行难以持久

图 2：互连交换机



注： BSO指基本服务提供商/固网服务提供商
CEL指移动网络

3.2 互连点的位置

目前运营商在共同协商确定的POI相互结合。在运营商无法相互结合的地方使用其它运营商的网络进行经转。

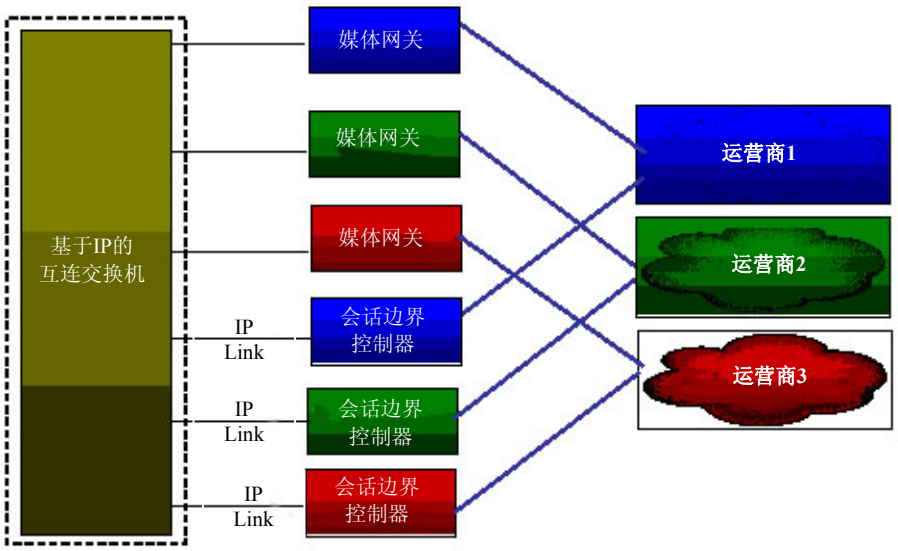
现在，两家对等伙伴必须在POI处设置基于TDM的交换机。随着MPLS网络的实施，与距离相关的传送成本概念将失去意义。NGN控制与媒体功能的分离及分布式架构消除了这种限制。建议在NGN环境中采用以下方法。

i) 可允许运营商选择在其控制分布式媒体网关的网络中设立一个集中控制点或在服务区域内部署SBC。

ii) 应允许运营商在本国任何希望放置POI的地方放置媒体网关和/或SBC。

iiii) 建议在NGN环境中采用互连交换机实现不同运营商之间的互连互通，如图3所示。

图 3：互连交换模式



根据流量要求，在服务区层面上，在多数运营商开展业务的地点可以设立一个或多个互连交换机。

这种模式的优势在于网络规划效率更高。每个运营商均了解其必须提供POI的物理地点，使传输网络的扩展更加井井有条。

NGN的互连架构应与现在的PSTN/ISDN/移动网服务架构相当或更加耐用，因为NGN将随着时间的推移取代上述网络。因此，该架构的一个主要目标是能够在出现互连故障时在最短时间内恢复服务。除使用IP协议和专为满足此项严格要求而配置的网络技术外，必须使用一个富有弹性的多节点架构。

NGN环境中的互连互通应在两个逻辑层上运行 – 信令层和媒体层。为尽可能降低互连成本和复杂性，最好用逻辑VLAN/VPN（虚拟局域网/虚拟专用网）采用L2连接，而不是L3连接。

NGN的互连互通将提供一个安全、低延迟的环境，由此确保所有运营商之间批发连接的质量。

4. 互连收费

目前PSTN/移动网中的互连收费概念以距离和呼叫时间/时长为基础。在基于IP的NGN中，网络提供商在大多数情况下仍是服务提供商，但并不一定是唯一的服务提供商。如Vonage、Skype和SIPgate就是提供服务但未运营自己网络的竞争性公司。在可预见的未来，集成和独立的服务提供者有可能并存，为相同的最终用户客户展开竞争。这种功能的分离对网络提供商和服务提供商均产生深刻的影响。理论上，在基于IP的环境中，网络提供商无从得知或并不关心其承载的应用流量的性质 – 而语音仅仅是另一种应用。

在NGN中，互连收费可采用多种模式，其中包括互免结算模式。在收费情况下，以带宽和用量、所提供的服务质量，使用的网元数量、会话中交流的数据量、和不同时间段等为基础。

NGN网络在计费方面可能需要以下更多特性：

- 按呼叫时长、承载能力、时段和不同时期计费，
- 按QoS、带宽和应用计费，
- 可收费各方（主叫方、被叫方或第三方），
- 附加和增值服务计费。

CDR（呼叫数据记录）的生成、用户记账、干线记账及自动备份和格式转化功能应必不可少。

将相关信息发往记账中心需要标准接口和协议。

在NGN的环境中，建立一个使运营商之间放心结算并方便达成互连协议的互连收费体制至关重要。例如，在印度，目前已采用了基于成本的互连用量收费（IUC），其中涵盖发话、传送和终接收费。然而，NGN网络至少有四种可行的互连收费模式，包括：1. 主叫方网络付费、2. 互免结算、3. 按服务质量收费和 4. 批量记账。互连收费可通过对NGN呼叫建立中不同网元各项成本项目的评定，或采用物物交换形式、或通过测量发送流量（业务量、QoS水平等）做出决定。即使在使用互免结算模式时，一些国家继续使用由始发运营商向接入提供商付费的运营商付费模式。在根据网元决定互连收费时，必须努力按照各运营商提供的输入准确评定相关网元费用。重要的问题是要确定完成一个在多运营商环境中从始发传送至目的地的长途呼叫所涉及的不同网元。

向NGN的过渡将严重影响网络费用以及流量传送成本与流量传送距离之间的关系。NGN与互联网的相同之处引发了走向NGN是否将导致互连收费中“距离死亡”的问题。由于互联网收费通常与数据传送的距离无关，在NGN中，与距离相关的网络费用将大幅度减少。因此，采用基于成本的互连收费将有助于建立适当的监管框架，从而方便NGN在市场中的快速部署。

NGN环境中四个主要互连收费基础：

互联网中，在应用或服务层获取的信息与网络层了解的信息截然不同，对于VoIP，执行一项协议（如SIP）的服务器了解会话发起的时间，还可能知道结束的时间，但对期间所消耗的网络资源几乎一无所知。起始和终止端点的拓扑位置（网络中的逻辑位置）是可知的，但不一定是地理位置。此外，除传统语音应用外，IP网络还将涉及更广泛的应用。呼叫发起方应视为费用制造方的概念在一般情况下是不成立的。在一般情况下，对如何在最终用户间进行费用分配没有显然“正确的答案”。承载网络得到截然不同的信息。在基于IP的环境中，每个IP数据报都是独立处理的，原则上都可以进行独立路由（虽然实际中路由较此更稳定）。相对简单的应用可产生大量的IP数据报。出于会计目的，有必要对这些数据进行总结 – 否则，计费系统将被泛滥的数据淹没。同样，在某一点到点数据传输链路上进行流量测量轻而易举，但在端到端流量接收端的基础上建立整体的流量矩阵将是非常昂贵且繁琐的。

4.1 主叫方网络付费（CPNP）

CPNP指发出呼叫的网络通常按照呼叫时长为呼叫付费，而收到（终接）呼叫的一方分文不付。在IP网络中，收费基于所传送的包的数量，而不是呼叫时长。收费既可以采用按网元收费（EBC）也可以采用按容量收费（CBC）。这两种体系构成了基于成本的体系。

局限性：

- EBC按网元数量决定互连费。在IP网络中实施EBC（或CBC）将产生交易费用（如，为决定IP互连点）。
- 终接垄断。

4.2 互免结算

在该体制中，终接不收费。一般来说，互免结算是一种物物交换，网络运营商*A*将来自网络*B*的话务终接于自己的网络上，相反亦然。由于双向话务量可能相互抵消，因此没有付费流动，*A*网络终接于*B*网络的流量价格等同于*A*网络为终接来自*B*网络流量所提供的网络容量。在此意义上，互连服务不是免费服务。

采用互免结算，交易费用降低，而且没有终接垄断问题。不为终接服务而付费还避免了套利问题。

局限性：

- 采用互免结算，服务提供商愿意将流量切换到另一个网络以便尽早终接，由此导致“热土豆”现象。为解决这一问题，合理的做法是为每个网络运营商适当规定最少的互免结算互连点及位置。

4.3 按服务质量收费

如两家提供商希望为以更好地服务质量传送对方时限要求严格的流量而做出相互补偿，各方均希望证实对方已履行了承诺。

对于QoS，这意味着需要衡量 (1) 提供商之间在各方向交换的各类服务等级的流量及 (2) 实际提供的服务质量的衡量标准。衡量QoS不论在技术层面还是在业务层面都更加复杂。

局限性：

- 提供商之间的承诺通常按延迟的平均值和变量表示。首先，不容忽视的是，这种衡量活动意味着在直接竞争相同最终客户的网络运营商之间需要一定程度的合作。各运营商在向其竞争对手披露网络内部性能特性时都很敏感。各家都不愿对手将其网络局限性暴露给未来客户。
- 第二，人们担心，为了竞争对手，运行在各自网络上的测量服务器可能会为运行带来重大灾难，或安全隐患。

4.4 批量记账（亦称为“互连中心”）

传统按分钟的互连收费体制会使顺畅的结算复杂化，原因是，NGN产品以容量、服务质量和服务等级为基础。由于流量汇集于通用节点，因此有必要批量确定NGN的适用互连收费，而不是采用目前普遍使用的按分钟收费。在NGN中，总体网络和承载费用相对于流量要低得多，因此，每流量单位相关的平均网络费用随之减少。批量计费互联网收费将在运营商之间提供一个平等的条件，由此避免不必要的诉讼和争端，节省合法费用和时间。

在此方面，还应确定需管制的方面以及可通过双方谈判解决的问题。

5. 印度的NGN举措

印度电信业从1994年前的政府垄断到目前每个许可的服务区有10-11家接入服务提供商，经历了漫长的发展进程。全国划分为22个提供统一接入服务的服务区。统一的接入服务提供商可在服务区提供有线和无线服务。无线服务包括完全移动、有限移动和固定无线服务。持照公司还可提供增值服务。同样，目前长途部分有23家国内长途电话服务提供商和18家国际长途电话服务提供商。截至2008年3月31日，所有接入服务持证商的情况如下：

持证提供商概览	
基本业务持证提供商	2
CMTS（蜂窝移动电话服务）持证提供商	39
UAS（统一接入服务）持证提供商	240
持证提供商总计	**281**

随着印度新应用、内容和融合技术的发展，有必要在技术和应用方面对未来电信类型进行研究。虽然目前提供固定通信、移动通信和互联网服务的网络在实质上是分离的；但每用户平均收入（ARPU）的减少和对增值服务和融合需求的增加都要求发展下一代网络的理念。

印度电信运营商正在实施基于IP的核心网络，开始迈向NGN。向NGN的过渡可能是阶段性的，可能需要电信运营商进行大量的投资。除巨额投资外，可能还有需要优先解决的监管和技术问题。为确定并解决与下一代网络有关的各种问题，如过渡到NGN的相关性和时间，印度电信管理局（TRAI）于2005年7月实施了旨在提高认识的举措，并发布了一份研究报告。还向各大运营商发出问卷调查表，征求它们对NGN相关问题的初步意见。2006年1月公布了“有关下一代网络（NGN）问题”的咨询文件。2006年3月TRAI向政府提交了“有关下一代网络（NGN）问题”的建议。TRAI建议的显着特点是：

- 政府应通过各种机构，如电信工程中心（TEC）、远程信息处理研发中心（C-DOT）和高级电信培训中心（ALTTC）等，安排组织一些有关NGN各方面互动的讲习班/研讨会，以提高各利益攸关方的认识。
- 再次强调，应尽快审议TRAI 2005年1月13日有关颁发统一许可证制度的建议，以便各运营商可充分利用NGN平台，使用一种许可证提供各类语音、数据、视频和广播服务。
- 委托TEC对国际NGN的发展动态开展有时限性的研究分析，以便结合印度国情，制定接口要求。
- 成立由TEC、服务提供商、技术机构和供应商等组成的跨行业联合协商小组，分析NGN标准并根据国家要求进行定制。
- 成立由来自DOT、TEC、C-DOT、服务供应商、供应商和学术界的专家组成的专家委员会，研究与NGN相关的各种问题。
- 2006年6月20日成立了名为“NGN eCO”的专家委员会，由来自各利益攸关方部门的30名代表组成。“NGN- eCO”的主要任务是：
- 提高对NGN认识的计划。

- 该国向NGN过渡的时间表。
- TRAI进行互连和QOS问题磋商使用的背景文件。

NGN-eCO还成立了三个由各利益攸关方代表组成的核心分组，详细研究有关颁发许可证、互连互通和服务质量（QoS）的问题。根据这些核心组的报告，NGN eCO于2007年8月24日向TRAI提交了最后报告。

为进一步提高利益攸关方对NGN的认识， TRAI于2007年12月4日在新德里组织了“提高对NGN认识”的全国性研讨会，为期一天。服务提供商、设备供应商、行业组织、政府部门，电力企业（PSU）、学术机构等派代表参加了此次研讨会。

TRAI注意到相当多的电信运营商已开始部署NGN。在向NGN过渡的阶段，根据技术和市场结构的变化，有必要对现有的许可证颁发政策和监管框架进行评估。许多电信运营商已开始部署NGN。根据技术和市场结构的变化，有必要对现有的许可证颁发政策和监管框架进行评估。“一网多服务”的NGN概念强调了这一必要性，并通过服务无关性许可明确了技术中立的做法。

TRAI还注意到，向NGN的过渡可能改变现有服务提供商的业务模式。一方面，传统服务提供商实施NGN后将提高效率，降低成本，并可能向用户提供新服务，从而提高收入和盈利能力。另一方面，服务独立性可催生出新型的服务提供商，即应用和内容服务提供商，鼓励推出创新型服务和具体部门的具体解决办法。这一发展可使传统的网络服务提供商尽可能减少投资，还将促进许多新服务的发展。这些新发展可能导致服务提供模式的改变。传统网络服务提供商可能会成为纯粹的接入服务提供商，许多应用服务（语音、视频、宽带和数据等）可能将由应用和内容服务提供商提供。这可能会在一定程度上改变现有运营商的业务模式，可能需要实施监管措施。

另外还注意到，许多发展中国家的监管部门在实际过渡开始前很早就尝试制定宽泛的NGN过渡原则。这与业务模式、网络和竞争在实施监管之前业已确立的原有网络不同。全世界的运营商和监管机构正在研究如何克服互操作性和互连的技术挑战，以及如何在开放的NGN环境中鼓励进行最小风险的基础设施投资。

考虑到各个方面再加上印度网络和基础设施处于快速发展阶段，TRAI指出，现在是与利益攸关方磋商，解决与NGN相关的监管和颁发许可证问题的时候了。TRAI指出，这不仅有助于加强对许可和监管框架的审查，还将有助于减少运营商的投资风险。因此，TRAI发出“有关下一代网络颁发许可证问题”的咨询文件，就各种问题征求利益攸关方的意见。已收到服务提供商的意见。TRAI正在与利益攸关方协商制定有关下一代网络颁发许可证问题的建议。

TRAI还在考虑在适当时候发布有关“NGN互连互通问题”和“NGN服务质量问题”的咨询文件，确保向NGN的顺利过渡。

6. 韩国的NGN环境

韩国下一代网络（NGN）环境下的互联互通政策附于附录2。

7. 结论

本报告明确了NGN面临的问题和潜在的挑战。报告人组上次会议的情况表明，对于NGN网络的广泛部署而言，这一课题提出过早，这种情况可能还会持续一段时间，直到NGN得到更广泛的部署。一种可能的解决办法是，更多的国际电联部门成员在各自国家实施NGN、运营商进行NGN网络互连时确定关键性问题。会议决定将该课题进行修订并保留至下一研究期。从PSTN向NGN的过渡是一个自然的“分水岭”大事。期间有必要对互连安排进行不断的反思。向NGN过渡的过程亦是重新审议整个互连制度的适当时机。

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[3] J Scott Marcus，《NGN环境中的互连》（Interconnection in an NGN Environment），受托为2006年3月23-24日在国际电联总部举办的有关“基于IP的下一代网络应遵循什么规则？”（What rules for enabled Next Generation Network?）的国际电联新举措项目讲习班所做的背景文件，日内瓦。

[4] OFCOM会议记录：下一代网络 – 接入和互连的未来安排（首轮磋商），2004年10月24日；下一代网络：进一步磋商，2005年6月30日。

[5] TRAI“有关下一代网络颁发许可证问题（Licensing Issues relating to Next Generation）”的咨询文件，2009年6月27日，见 www.trai.gov.in/WriteReadData/trai/upload/ConsultationPapers/163/cpaper27jan09no3.pdf

[6] ITU–T Y.2201建议书，2007年4月。

缩略语清单

NGN	下一代网络
ITU	国际电信联盟
PSTN	公用电话交换网
ISDN	综合业务数字网
TDM	时分复用
IP	互联网协议
SBC	会话边界控制器
IMS	IP多媒体服务
QoS	服务质量
SGW	信令网关
MGW	媒体网关
IMS	IP多媒体服务
IE	互连交换机
POI	互连点
VLANs	虚拟局域网
VPNs	虚拟专用网
CAPEX	资本支出
OPEX	运营支出
MPLS	多协议水平交换
DNS	域名系统
SIP	会话启动协议
URI	用户资源标识符
VoIP	在IP网络上传送话音
CDR	呼叫数据记录
CPNP	主叫方网络付费
EBC	按网元收费
CBC	按容量收费
TRAI	印度电信管理局

附件 1

Presentation on "Next Generation Network (NGN) in Competitive Market Environment" by Warid Telecom International Ltd. (SATRC Workshop on Regulatory Aspects of NGN including Interconnection)

Next Generation Network (NGN) in Competitive Market Environment

Prepared & Presented by Md. Shahriar Rashid, Head of NSS

Warid Telecom International Ltd.
Bangladesh Operations

1

What is NGN?

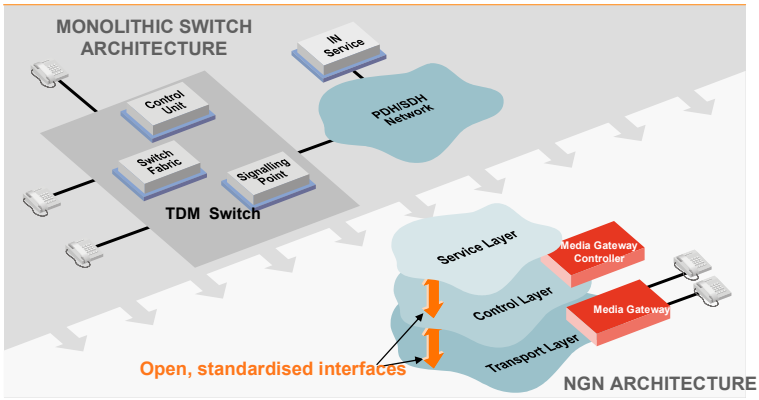
Next Generation Network (NGN)

- Packet-based network.
- Able to provide telecommunication & broadband services.
- Able to support general mobility service.
- Able to support QoS-enabled transport technologies.
- Last but not least , it is a network where service-related functions are independent from underlying transport- related technologies.

2

What NGN Does?

- NGN separates transport layers from control layers.
- Introduce layer architecture.



NGN Next Generation Network

1

Why operator moving towards NGN?

Because of :

Market Situation:

- Continuous volume growth.
- Falling unit prices.
- New service opportunities.

Network Requirements:

- Efficient CAPEX expansion.
- Continuous OPEX reduction.
- IMS preparation.

Cost Optimization & Migration to Common IP Technology.

NGN Next Generation Network

4

NGN Benefits

- "Triple-play" – Voice, Video & Data.
- Simplify service creation environments. -> Easy operation.
- Single network management layer. -> Simplify the operation.
- Services are independent to transport layer. -> Easy deployment.
- Maximize the data network capacity. -> CAPEX savings.
- Open standards creates vendor competition. -> Reduce price.
- Future proof solution for introducing IMS and FMC. -> Ensure TCO.
- Reduce the OPEX and CAPEX.

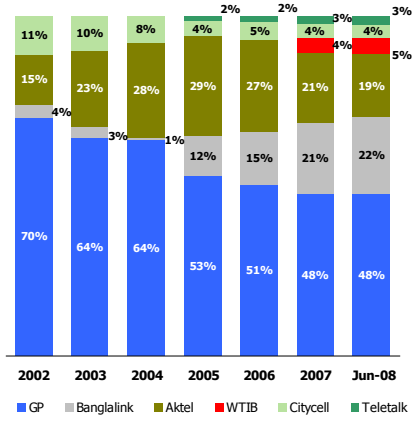
5

Next Generation Network (NGN) deployment in WARID Network

6

WARID is the first operator in Bangladesh deployed NGN Core

Long Term Operator Market Shares (%)



Source: BTRC and WCIS

Operator	Comments
grameenphone	• License: 1996 • Operations: 1997 • Technology: GSM 900 / 1800 • Shareholders: Telenor (62%),Grameen Telecom (38%)
banglalink	• License: 1996 • Operations: 1997 • Technology: GSM 900 / 1800 • Shareholders: Orascom Telecom
AKTEL	• License: 1996 • Operations: 1997 • Technology: GSM 900 / 1800 • Shareholders: Telekom Malaysia International (70%), NTT DoCoMo (30%)
WARID TELECOM BANGLADESH	• License: 2005 • Operations: 2007 • Technology: DCS / GSM 1800 • Shareholders: Dhabi Group
CITYCELL	• License: 1989 • Operations: 1993 • Technology: CDMA 800 • Shareholders: SingTel (45%), Pacific Motors (31%), Fareast Telecom (24%)
TeleTalk	• License: 1996 • Operations: 2005 • Technology: GSM 900 / 1800 • Shareholders: Government

Next Generation Network

7

WARID consideration on NGN selection

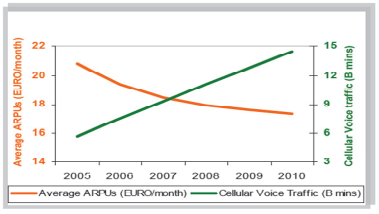
Market Consideration

- ARPU is low.
- 2-3 big players.
- Continuous price cut.
- Continuous new services.
- Fast penetration.
- And fast growth.

Network consideration

- Easy deployment to catch the opportunities.
- Easy operation and maintenance.
- Advanced technology independent on CN and AN.
- Future-oriented network.
- Open system.
- Low cost. TCO.

Global Mobile Traffic vs. Global Mobile Voice ARPU Trends



Source: Alcatel-Lucent Analysis

Mobile Traffic vs. ARPU Trend Characterizes is indicative of Market Dynamics across the industry and strategically impacts all customer segments (fixed,mobile, enterprise, xVNO, etc) and ecosystems.

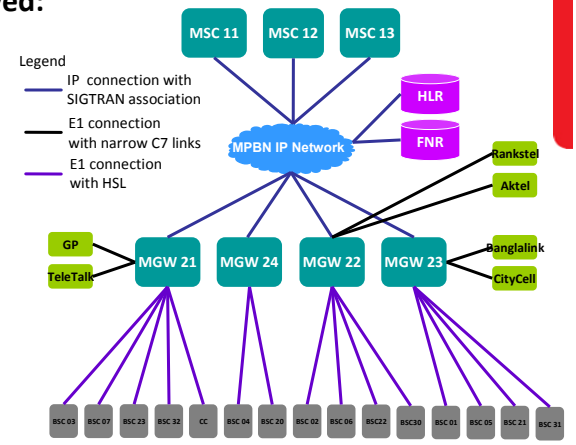
Next Generation Network

8

WARID Core Network

At launch Warid has deployed:

MSC Server	: 09
Media Gateway	: 13
HLR	: 02
FNR	: 02
SGSN	: 01
GGSN	: 01
Core Router:	: 12
Core Switch:	: 12

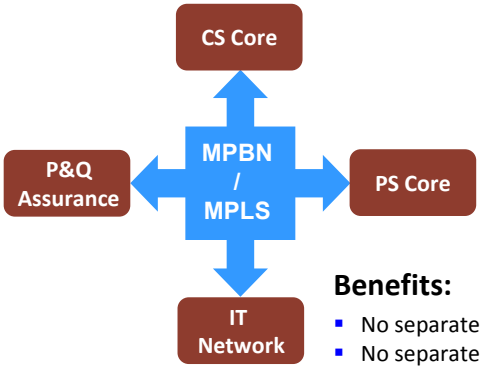


This is happened within 6 to 7 months because of simplified layered (NGN) architecture.

9

WARID IP Backbone

Same transport layer for different services



Same IP backbone used for:

- Circuit switch voice traffic.
- Circuit switch signaling traffic.
- GPRS network/service.
- IT network.
- Performance & quality network.
- IP phone (for Warid office only).

Benefits:

- No separate investment for IT and GPRS network.
- No separate investment for transmission of Warid office internal calls.
- Optimize bandwidth utilization for Warid to Warid calls by payload traffic (Nb Traffic).
- CAPEX and OPEX savings.

10

Transmission Efficieny in Traditional Network

Example: Legacy/Traditional Local Switching

- Call under same BSC has to carry over to MSC by costly TDM based transmission. 2 long distance circuit is required for per intra BSC calls.
- Call under same area PSTN/PLMN has to carry over to MSC by costly TDM based transmission.

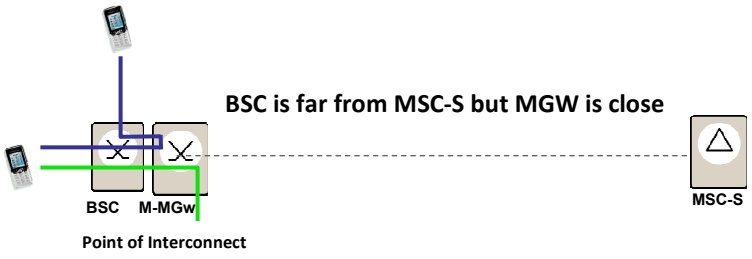
Result: High CAPEX Involvement, Lower optimize usages.

NGN Next Generation Network

11

Transmission Efficieny in NGN Network

Example: NGN Local Switching



- Call under same BSC does not need to carry over to MSC. Saving 2 long distance circuit for per intra BSC calls.
- Call under same area PSTN/PLMN does not need to carry over to MSC.

Benefits: CAPEX saving, CAPEX maximization

NGN Next Generation Network

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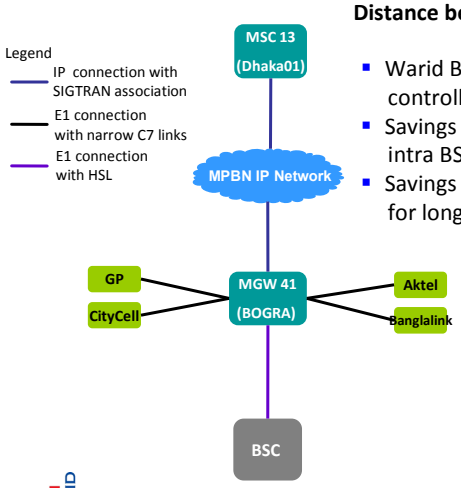
Transmission Efficieny in Warid Network



Distance between Dhaka and Bogra is 300KM.

- Warid Bogra BSC connected with Bogra MGW controlling from Dhaka MSC-S.
- Savings transmission bandwidth and cost for intra BSC/MGW calls.
- Savings 66% transmission bandwidth and cost for long distance calls.

Benefits:

- CAPEX saving.
- CAPEX maximization.
- Bandwidth utilization.

NGN Next Generation Network

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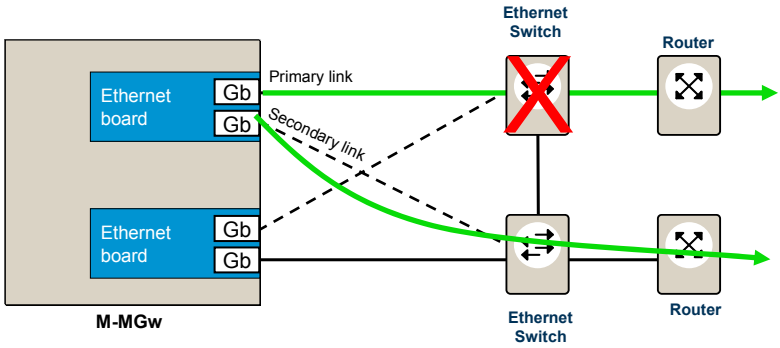
IP Backbone Redundancy in NGN Network

As all service are providing through same IP backbone,

Backbone Redundancy is High Priority.



Benefits: High availability & increased robustness.

NGN Next Generation Network

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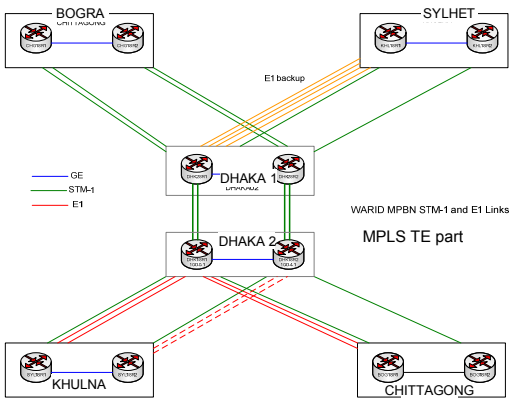
IP Backbone Redundancy in Warid Network



Warid has deployed:

- 1+1 Redundant MPBN.
- Signaling redundancy by E1 Sylhet, Bogra and Khulna incase of fiber cut for MPBN.
- Router to Router is GE.
- Board level Ethernet card redundancy at MGW level.

Benefits:

- Service availability high.
- Day time maintenance.
- No single point of failure.
- Reduce O&M cost.

Next Generation Network

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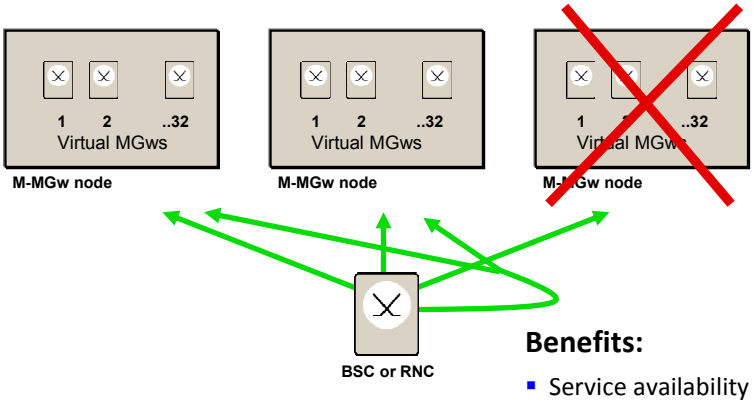
BSC Load Sharing in Warid Network

Advantage of Soft Switch with virtual MGw



Benefits:

- Service availability high.
- Day time maintenance.
- No single point of failure.
- Reduce O&M cost.

Next Generation Network

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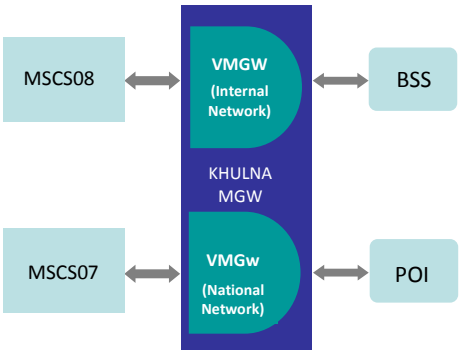
Core Capacity Optimization in Warid Network

Advantage of separate control and connectivity layer

Distance between Dhaka and Khulna is 300KM.



- Khulna MGW is controlling by 2 MSC-S from Dhaka.
- BSC is controlling by one MSC-S.
- POI is controlling by another MSC-S.

Benefits:

- Utilization of MSC-S's extra capacity.
- Resource utilization.
- Service/capacity ensure during festivals like EID.
- CAPEX maximization.

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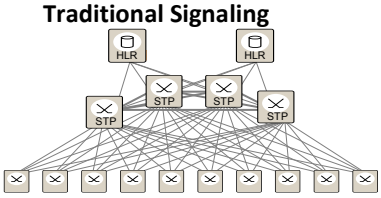
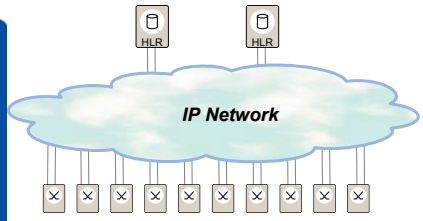
Signaling Architecture in Warid Network

Traditional Signaling



Signaling over IP



- Traditional signaling has complex physical & logical configuration.
- Signaling over IP (Sigtran) has simple configuration (IP address only).
- Warid HLR and FNR are based on Sigtran.
- Warid MSC-S to MSC-S is through Sigtran.
- Warid IN SCP and SDP are based on Sigtran.
- Like other operator Warid does not require separate STP or Signaling Gateway (SG).

Benefits:

- CAPEX saving, no investment for STP & SG.
- Better utilization for transmission capacity.
- Packet switch and O&M traffic can be shared from signaling transmission.
- Less analysis require for signaling.
- Easy O&M means reduce OPEX.

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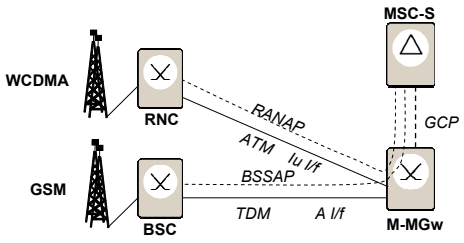
Warid way forward:- 3G network deployment

NGN allows simultaneous access for WCDMA & GSM



- Warid has no traditional MSC.
- Warid has soft switch MSC.
- Warid has IP backbone.
- No investment require in the core network.

Warid core network is ready for 3G deployment. No architectural change is required.

Benefits:

- Flexible use of investment.
- Ensure TCO.

Requirements:

- 3G license from regulator.
- RNC, Iu over IP.
- NodeB, Iub over ATM.

NGN Next Generation Network

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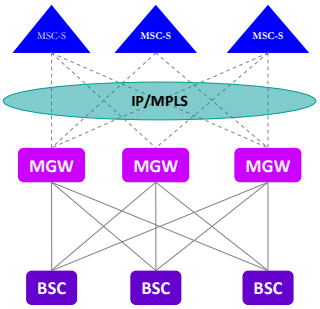
Warid way forward:- MSC in Pool deployment

Defined in 3GPP R4



Advantage of MSC in pool:

- No inter MSC handover is required within the pool area.
- No call drop due to inter MSC handover.
- No LU is required within pool area.
- Traffic balancing, specially during special event like EID, HSC, SSC result, 31st nights.
- Service availability.

Benefits:

- Service availability high.
- Day time maintenance.
- No single point of failure.
- Reduce O&M cost.
- Utilization of MSC-S's extra capacity.

NGN Next Generation Network

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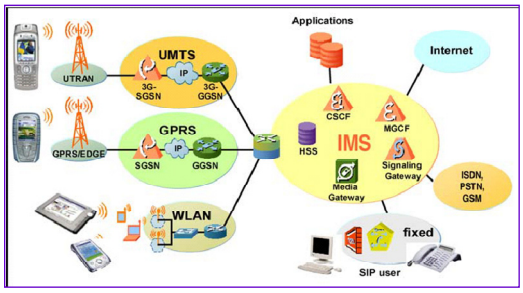
Warid way forward:- IMS deployment

Defined in 3GPP R5

- One of the requirement for IMS is service independent transport layer.
- Warid existing MPBN transport (IP) layer is service independent.



Benefits:

- Time-to-market will be reduced.
- Commercialized services growth will be Cost-effective.
- Ensure TCO.

WARID NGN Next Generation Network

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Nutshell

NGN helps WARID (a green field operator)

- Faster network deployment.
- Maximize utilization the CAPEX.
- Reduce the OPEX.
- Higher availability.
- Participate in the Air time price cut environment.
- Ensure TCO.
- Ready for 3G and IMS.

WARID NGN Next Generation Network

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附件 2

Interconnection Policy under the Next Generation Networks(NGN) Environment in South Korea

Next Generation Network (NGN) environment

A Next Generation Networks (NGN) is a packet-based network able to provide telecommunication services to users and able to make use of multiple broadband, Quality of Services (QoS)-enabled transport technologies and in which service-related functions are independent of the underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users. [ITU-T Recommendation Y.2001 (12/2004) - General overview of NGN]

As network environment moves from circuit-based to packet-based, telecom regulators in most countries need to review whether current policy fit the packet-based environment and promote network development. Among several telecom policy issues, interconnection policy has a major position among issues of telecom policy.

Interconnection policy

Through the interconnected networks, individuals are able to communicate with others who are not in connection directly on their network. That is, if an individual subscriber is connected to a particular network through interconnection, the subscriber can communicate with anyone who is connected to many other networks that are connected with the particular one. Given this, effects which the subscriber can gain through network will increase, as the number of subscribers connected through the interconnection grows. Adding up all of these effects will increase exponentially and this is called network effects.

As the telecommunications market turns over into competitive environments by multi-carriers, government's policy regarding network connection between carriers plays an important role in its competitive policies. While interconnection policy provides incentives for new entrants to do business, it provides investment incentives for the current vendors that own and operate networks. ITU's recommendation for interconnection policy is that the connections between networks should be provided in a timely manner, and the charges should be based on cost-oriented rates. The organization also recommends that the price needs to be set in a transparent, reasonable, and unbundled way (ITU Reference Paper, Para. 2.2(b)).

The key issues regarding interconnection policy include the process of connection request and offer, the assessment procedure of charge, the conditions of level, technology and operation of charge.

Roles of regulator in terms of interconnection

Regarding the government's role of regulating interconnection, there is a need to identify the existing as well as new regulations for the entrants to the interconnection market. Government needs to prepare an interconnection guideline in order to let new entrants know about technical and operational issues on interconnection with other carriers. Generally, in the guideline, definitions of types of interconnection, descriptions on carrier-to-carrier relationship, declaration of carrier-to-carrier charging principles, and accounting principles among carriers are included.

When assessing charges through negotiation between carriers, it can cause conflicts. Right then, it is a high time the government should intervene in the negotiation between carriers. Basically, charges refer to the fees paid for the rent to use other carriers' networks. To some of new entrants, the charges take up to 40~50% of the total cost, making a direct and significant effect on the carriers' outcome.

Interconnection issues under the NGN environment

There are three different types of interconnection models: The interconnection in Public Switched Telephone Network (PSTN) which is the base of telecommunication services; the interconnection in Voice over Internet Protocol (VoIP) which is spreading out recently; and the interconnection in All-IP which is expected to work as the based for the future telecom networks.

In VoIP which is based on the Internet packet system, vendor using access is hard to prescribe the network component of vendor which is providing. In other words, theoretically, delivery path depends on packets, so it is hard to figure out the network components of each vendor properly. As such, it is tough to apply the estimation system to the existing PSTN. Suggested model until now is a charge system which is applied to the data communication systems including the Internet. It is "Uniform Access Charges" which pay charges regardless of the distance and type.

Table 1. Comparison of Telecommunications and Internet Cost Recovery

Telecommunications	Internet
• Cost recovery subject to significant regulation and government oversight. • Settlements are transparency. • Settlements based on traffic flow and charged on minutes of use. • "Half-circuit" approach to sharing the costs of the international link. • Settlements operate on a destination specific basis. • Under the accounting rate settlement model, the same system applies for all network operators.	• Little or no regulatory oversight. • ISP contracts are subject to non-disclosure agreements. • ISPs combine transmission and content. • Cost recovery based on link capacity. • Charged on bandwidth and derived throughput of the link. • ISP network access provides onward transit to many other networks and destinations. • ISPs use different charging models, depending on the characteristics of the ISPs involved.

Regarding models of internet interconnection, there are two agreement schemes which are peering agreements and transit agreements. Peering agreements, which is so called "Sender Keep All" or "Bill and Keep," is a zero compensation arrangements by which two internet service providers (ISPs) agree to exchange traffic at no charge. The process, terms, and conditions remain private. Transit is an agreement in which larger ISPs sell access to their networks, their customers, and other ISP networks with which they had negotiated access agreements. The sender pays the full cost of interconnection. Transit charges are set by commercial negotiation, and are generally not disclosed. One Internet transit payment arrangement with one major Tier-1 ISP can provide a small, remote session initiation protocol (SIP) with access to the rest of the world.

The opportunities VoIP creates for arbitrage create pressures to move toward cost-based pricing for interconnection and adopt uniform charges for access, regardless of the type of call, type of service providers, or other call characteristics. New approach to interconnection pricing should encourage efficient competition and the efficient use of, and investment in, telecommunications networks, preserve the financial viability of universal service mechanisms, treat technologies and competitors neutrally, allow innovation, and minimize regulatory intervention and enforcement.

In the meantime, we forecast that the environment of information communication network will be turned into All-IP type in the future. In this case, relationship between service and cost driver will be ambiguous to prescribe as interconnection is developing to convergence service. Accordingly, new charge estimation system will be requested. As the network environment is developed, the converged IP network based network will be emerged as a popular alternative, providing diverse services through a single backbone network. Here, it should be kept in mind a new charge scheme will become one of the challenges.

Transition on Interconnection policy in South Korea

A monopoly telecom operator, Korea Telecom (KT), was founded in 1982 when there was no interconnection issue due to monopoly. In 1984, Korea Data Telecommunication launched data communication services and there was no interconnection charge for dial-up calls. Spun off from KT, Korea Mobile Telecommunications (KMT) provided analog mobile service in 1988. Interconnection charges and conditions were left to operators' negotiations.

Since Dacom launched international call service in 1991, Interconnection Order was released. The Order declared reciprocal compensation that calling party pays interconnection charge to called party, focused on non-discriminatory interconnection, and did not require accounting separation. Accounting Separation Order was published in 1994. In the Order, it is requested that cost separation of NTS and TS from 1996. In the mid-1990s, several telecom service providers entered the telecom market in Korea. Regarding interconnection, mother network system is applied. For both fixed-to-mobile and mobile-to-fixed calls, mobile operators collect tariffs and paid fixed network's interconnection charges to fixed operator. When interconnecting with local network, the other party paid for the interconnection line. It is required that KT's local switched provides for interconnection to any telecom service providers.

After WTO agreements settled in 1997, which agrees to open telecom market to operators without network, interconnection scheme was back to reciprocal compensation and set interconnection charges at dominant carriers' cost, and abolished NTS deficit contribution and introduced NTS interconnection charges. As Hanaro telecom (now SK Broadband) started local telephony and broadband services in 1999, interconnection between local networks was imposed. It was also determined that cost-based mobile networks' interconnection charges, interconnection line cost borne by user network, and universal service fund introduced.

In 2001 KT's local tariffs was rebalanced. A plan for abolishing NTS interconnection charge for five years was announced in 2001 when long-distance carriers were exempted. Individual interconnection charges for mobile networks for 2002-2003 were determined. Mobile internet facility was opened to mobile ISPs and portals.

Research on Long-run incremental cost (LRIC) started in 2003 and applied from 2004. As data communication services were flourishing, interconnection between data networks was applied. In 2007 through a review process of interconnection charges for 2008 and 2009, different mobile termination charges between dominant and non-dominant carriers was applied.

Interconnection charge scheme of VoIP in South Korea

Even though a dial-pad service based on soft-phone was launched by Saerom in 2000 in South Korea, in substance commercial services started on May 2004 when a guideline of internet telephony was announced. Since October 2004 internet telephony has been common telecom services under regulation and "070" service identification number was assigned to internet telephony services. After expansion of number portability to VoIP services, number of subscribers of VoIP will be expected to increase dramatically.

In terms of interconnection, unbalanced approach is applied. For VoIP calls to fixed or mobile network, VoIP service providers pay the same amount of interconnection charge as circuit-based network to fixed or mobile carriers. Among VoIP service providers, there is no settlement of interconnection charges. In case of calls from fixed or mobile to VoIP users, fixed or mobile operators also pay interconnection charge to VoIP service provider. The fee takes network component of VoIP service providers toward an access to the network into account.

Table 2. Interconnection charge for VoIP in South Korea

Interconnection type	Interconnection charge
VoIP to fixed	VoIP service provider pays the same amount of interconnection fee to fixed operator.
VoIP to mobile	VoIP service provider pays the same amount of interconnection fee to mobile operator.
VoIP to VoIP	No settlement
Fixed or mobile to VoIP	Fixed or mobile operator pays interconnection fee to VoIP service provider. The fee accounts for network component which required to access network.

Current solution for VoIP interconnection charges in South Korea is still a tentative one. As VoIP service diffuses, unbalanced approach for interconnection charge could be a debatable issue. In the long-run, interconnection under the All IP network should be considered. Transition path or scheme also should be come up with. In this process, traditional principles on the objectives of telecom policy – users' benefit, fair competition, network advancement, and technology development – should be taken into account.

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