Pricing mechanisms for GPRS roaming
Jarkko Kuisma
HUT
jikuisma@cc.hut.fi
http://www.hut.fi/~jikuisma

Abstract

The introduction of general packet radio service GPRS shifts cellular communications from the world of circuit-switched communications to packet based data service. The network capacity needs no longer be tied up for the duration of a mobile connection, and the operators do not have to feel restricted to per-minute charging. GPRS introduces volume-based charges and presents a new challenge of defining new pricing structures and levels. Now we are especially considering roaming within GPRS pricing.

1 Introduction

The operators have mainly opted for volume-based pricing, since this reflects the structure of their costs and requires relatively minor upgrades to legacy billing systems.

Some have experimented with other forms of charging, such as by WAP page.

Several operators offer a suite of tariffs with levels of bundled usage designed for different market segments. Recognizing that many users will not yet know their own usage patters, most have also offered usage-only packages. Current price levels are significantly higher for GPRS than for GSM for file transfer services that involve only a little idle time over circuit-switched connections. GPRS offers however some cost savings, particularly for business users for bursty traffic.

GPRS networks bring high-speed mobile data services. These services will be crucial in ensuring the continued growth of mobile service revenue, and in facilitating the transition to 3G.

With a customer base dominated by corporate customers and business travellers, the ability to offer GPRS services in many different locations will be vital, and establishing roaming agreements is therefore a high priority. However, roaming for GPRS demands new models, fundamentally different from those employed for GSM.

2 Roaming

The way in which roaming is implemented will have significant implications for the strategic options and revenue potential for all players with an interest in GPRS services.
key questions:
What are the relative merits of the GRX and ISP models for roaming in terms of quality of service, security, billing and service access?
How much revenue can be expected from GPRS roaming? What roaming arrangements are being adopted by operators? To what extent will the GRX model dominate over the ISP model, and why? Which players are becoming GRX providers, and what are their strengths and weaknesses? What will be the scope of the role of the GRX provider?

One of the keys to the success of GSM voice services has been the exponential growth of international roaming. Consumers will expect no less from wireless data services. Most users are uninterested in the name of the network on which they are roaming and the technology delivery mechanism. Service access, terminal, QoS and price are all that matter. For networks 'visited' by a roaming subscriber, however, it is critical to be able to bill efficiently the customer's 'home' network for an increasingly sophisticated range of services. This means generating both a call data record and an inter-operator tariff.

3   Technical and economical details

a. The technical and economical details for a GRX-system.

GRX provider offers to a network operator

The GRX provider assists operators in their GPRS roaming business. GRX providers are facilitators offering the following features:

Transmission of data packages between operators and their roaming partners.

Different connection types between operator and GRX: Leased Line (LL) based on Frame Relay, ATM or IP/PPP; Tunnelling or VPN connection via public IP; Virtual Private Data Network (VPN) based on leased line.

Guaranteed compliance with IP addressing guidelines on the Inter-PMN backbone.

DNS root service for customer operators.

BGP-4 routing capability.

Routing of traffic between GPRS networks and/or GRX nodes.

Interconnectivity to other GRXs, governed by Service Level Agreements between GRXs

Data Security: IPSec (if applicable), anti-spoofing, non-visibility to public Internet, etc.

GPRS roaming needs

GPRS roaming agreement with one or more operators, or with a Roaming Broker.

MAP V/3 is mandatory.

TAP3 must be implemented to bill GPRS services.

Strategy on ISP or PMN roaming, i.e. access to the Internet in the visited or the home network.

Operator needs to connect to a GRX

Compliance with IP addressing guidelines for Intra-PMN backbone.

DNS service Intra-PMN.

Border Gateway (BG) and preferably a firewall.

AS (Autonomous System) number.

Control which routes to accept from GRX.

Service Level Agreements (SLA) with a GRX provider.

GRX charging principles

At first, charging will be based on volumes, the primary billing unit will be bytes of data transmitted and received on the access lines to the GRX. An other criterion could be geographical length of path. Fixed charges based on access type might apply.

In the future, IPDR (IP detail records) might be used for charging.

Clearing between operators

GPRS operators with roaming relations will use standard GSM clearing procedures between themselves, based on their Roaming Agreements and TAP (Transferred Account Procedure).

The type of encryption used for connections to GRXs and the handling of the encryption keys?

Encryption is not necessary since the connection uses a private IP backbone.

Should operators wish so, they may agree on encryption. The GRX is transparent to encryption. In this case the encryption keys are exchanged directly between the operators.

Connections

There is no automatic roaming connection. Operators need a Service Level Agreement with the GRX provider, a connection to the GRX provider and a Roaming Agreement between themselves.

Each operators pays for the connection to the GRX. Each operator pays for the use of the GRX services (e.g. transferred volume).

The estimated time needed for establishment of a connection

Connection from the operator to the GRX Provider via Leased Lines based on Frame Relay, ATM or IP/PPP: takes approx. 6 weeks

Connection to other operators connected to the same GRX: depends on establishment of the bilateral agreement between the operators

DNS routing in GRX. Who pays (HPMN, VPMN)?

All GRX providers will offer DNS routing.

DNS Routing is included in the GRX service fee. Every operator pays for DNS routing by using/paying the GRX services.

The time taken to connect to different GRXs

Generally in the GPRS Roaming Network every GRX node will be connected to the other GRX nodes (either directly or via third GRXs).

At an early stage, if such a connection is not established yet, the duration to set it up depends on the time to finalise a Service Level Agreement between the two GRXs and to implement the technical connection between the GRXs.

The security between GRXs

The GRXs take the necessary measures to prevent any intruders from accessing the GRX infrastructure. No unauthorised access to GPRS nodes will be possible even though public IP addresses are used.

The service charges in the case of two operators that are customers of two different GRXs. Who pays what (HPMN, VPMN)?

Each operator pays the service charge of his GRX provider.

Charges between GRXs are included in the GRX service charges. The GRX provider has the option to charge differently if the data traffic was routed directly to an operator or via another GRX.

The GRXs charge and pay the service used between them selves as defined in the SLA between the GRXs.

Figure 1. The GPRS Roaming Network

b. The technical details for TAP3

TAP (Transferred Account Procedure) is the file format that operators of GSM networks use to exchange billing information between them selves. The information must include both the charges that each subscriber has to pay for the service usage as well as customer care information in case the subscriber requests details of his telephone bill. TAP3 provides more customer care information than previous TAP versions. Each single call is reflected in a CED (Call Event Detail) comparable to a CDR in older formats.

The new TAP3 includes all features supported by earlier versions of TAP, plus the following additions:

High speed data services (HSCSD and GPRS)

Intelligent network functions (CAMEL) like e.g. virtual home environment

Separation of business and private billing profile, Multiple Subscriber Profile (MSP)

Support of Private Numbering Plans (SPNP)

SIM Application Toolkit

Enhanced Full Rate (EFR) for enhanced voice quality

Fraud Information Gathering System (FIGS)

TAP3 is able to handle all features of the Inter-Operator Tariff (IOT):

HPLMN reprising

Call level discounts

And it allows for the specific requirements of satellite networks or of large countries where one operator does not cover the entire nation (such as USA and India):

Additional charging parameters, e.g. separation of airtime and toll charges

More time zones

TAP3 a global standard.

Reject and Return (RAP files)

Errors in TAP files do occasionally occur.

In the past, an error concerning one single call in a TAP file blocked the entire file and delayed the data of all the other calls. A new procedure, named Rejects & Returns (R&R), was implemented which made possible more efficient handling of erroneous TAP files.

The HPMN (the receiving end of the TAP transfer) validates incoming TAP transfers and rejects call event details that do not conform to the TAP standard or to the terms of the agreement.

Any incorrect call event details is returned to the VPMN so that valid call event details can be processed in the billing system of the HPMN and be billed to the subscriber in a timely manner. This speeds up the process for all correct call data.

R&R supports non-standard validation checks, which may have been agreed bilaterally between roaming partners.

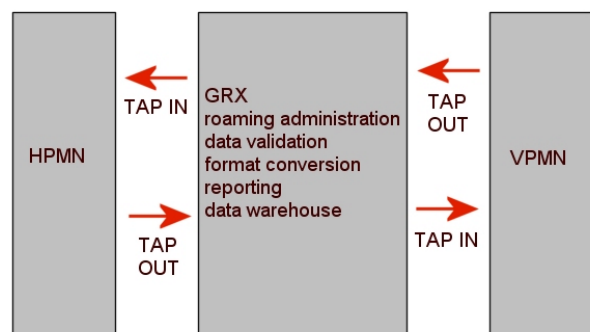The implementation of the Rejects & Returns process requires TAP3.2 or later.

Figure 2. TAP Processes.

HPMN – Home Public Mobile Network
VPMN – Visiting Public Mobile Network
RAP – Returned Account Procedure
TAP – Transferred Account Procedure

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[3] GSM ASSOCIATION – TAP FILES http://www.gsmworld.com/technology/tap3_specs.html