The importance of spectrum and orbit efficient use for large area and developing countries

Marcos G. Castello Branco
CPqD / Brazil
(Vice-Chairman ITU-R Study Group 4)

ITU / BR Workshop on the efficient use of the spectrum/orbit resource
Geneva, 6 May 2009

Summary

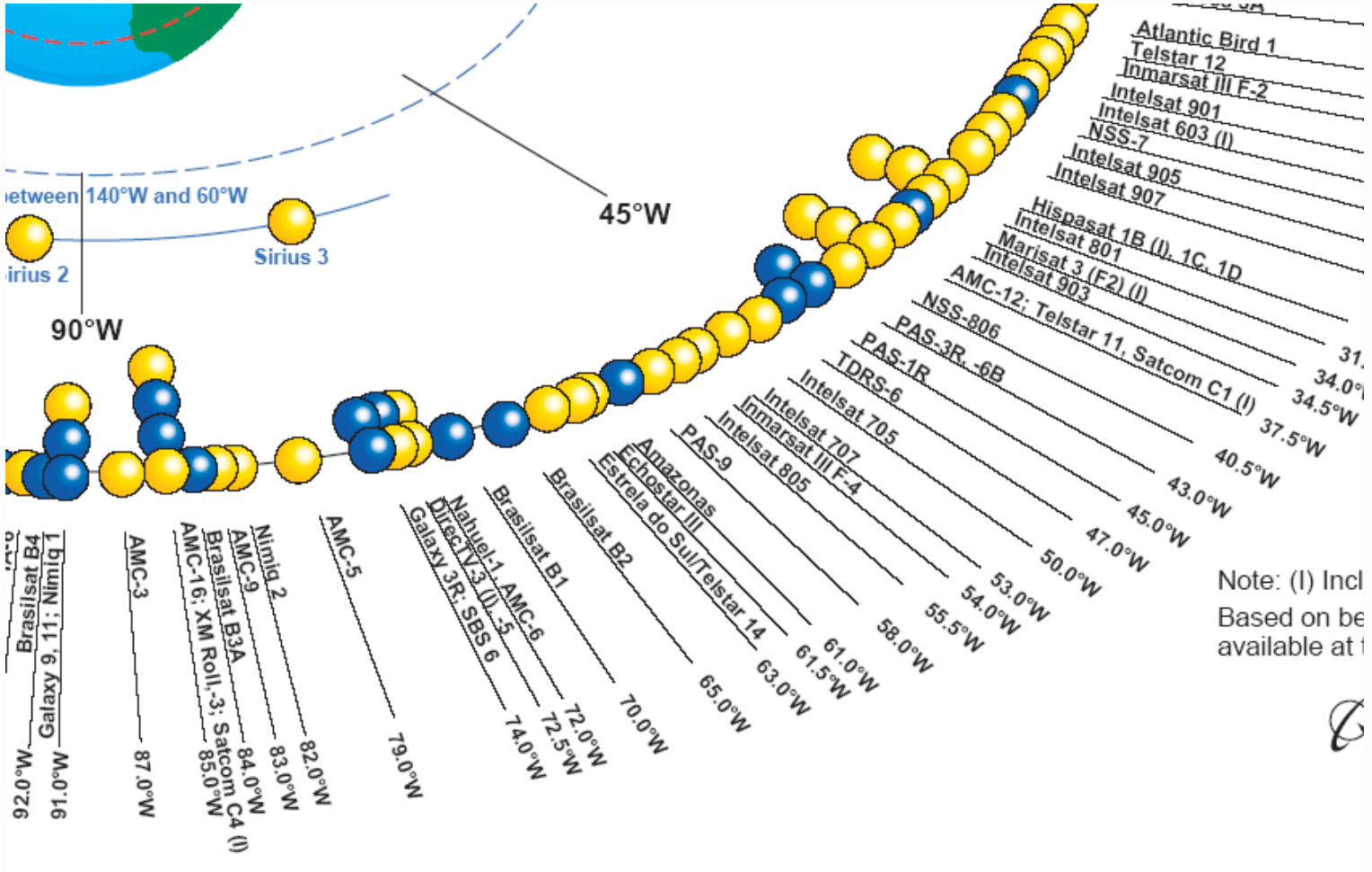
- Satellite strategic roll;
- The importance of satellite service spectrum and orbit management and regulation;
- Geographical, economical and social aspects in Brazil;
- Climate diversity and quality of service impacts;
- Views on possible improvements through ITU.

What satellites can do differently?

Radio tower view

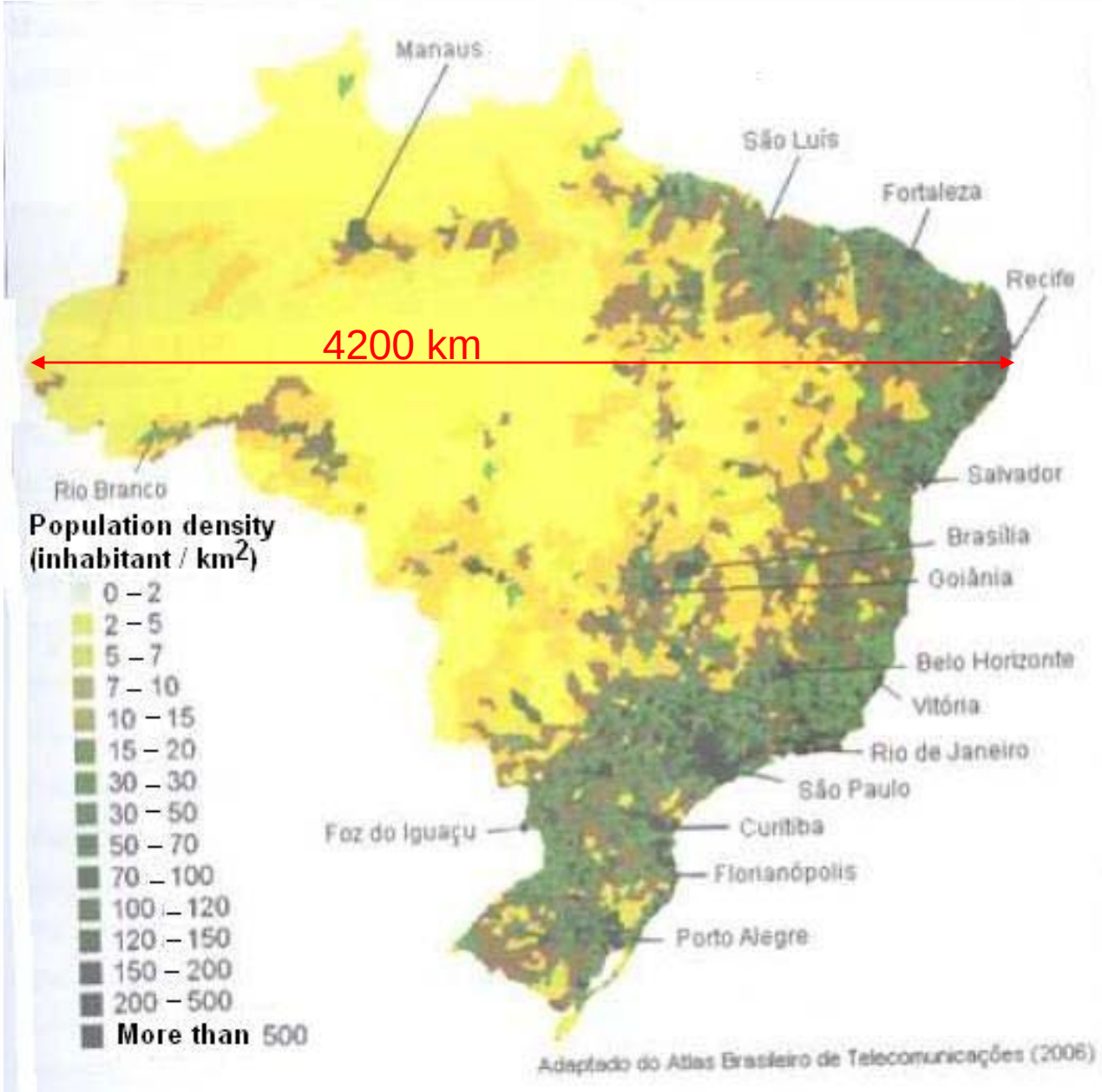
GSO satellite view

Geostationary Satellite Orbit congestion

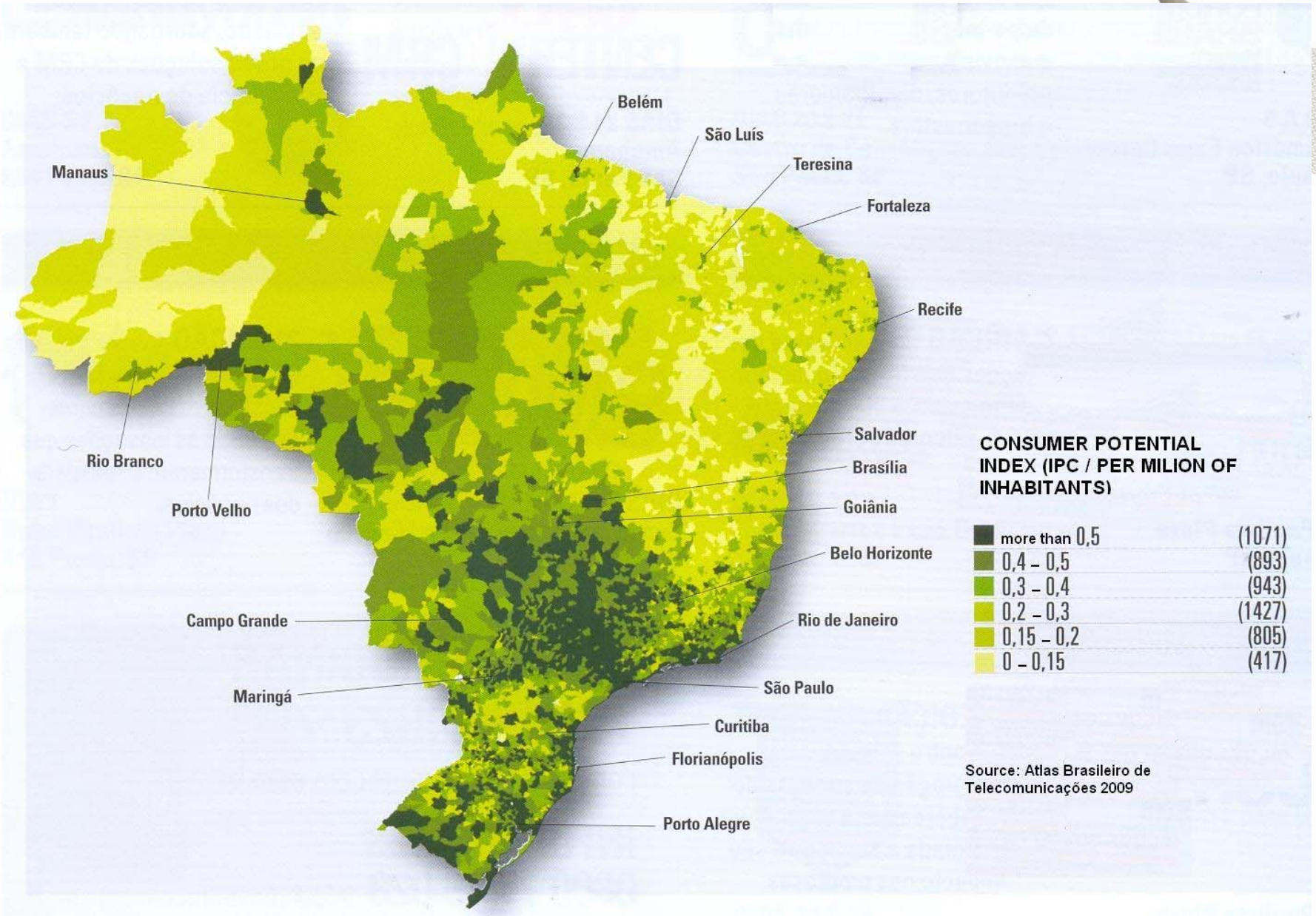


- **Almost the entire GSO arc is already occupied by international and commercial satellite operators**.

Large area and population distribution – Satellite solution constraint 1

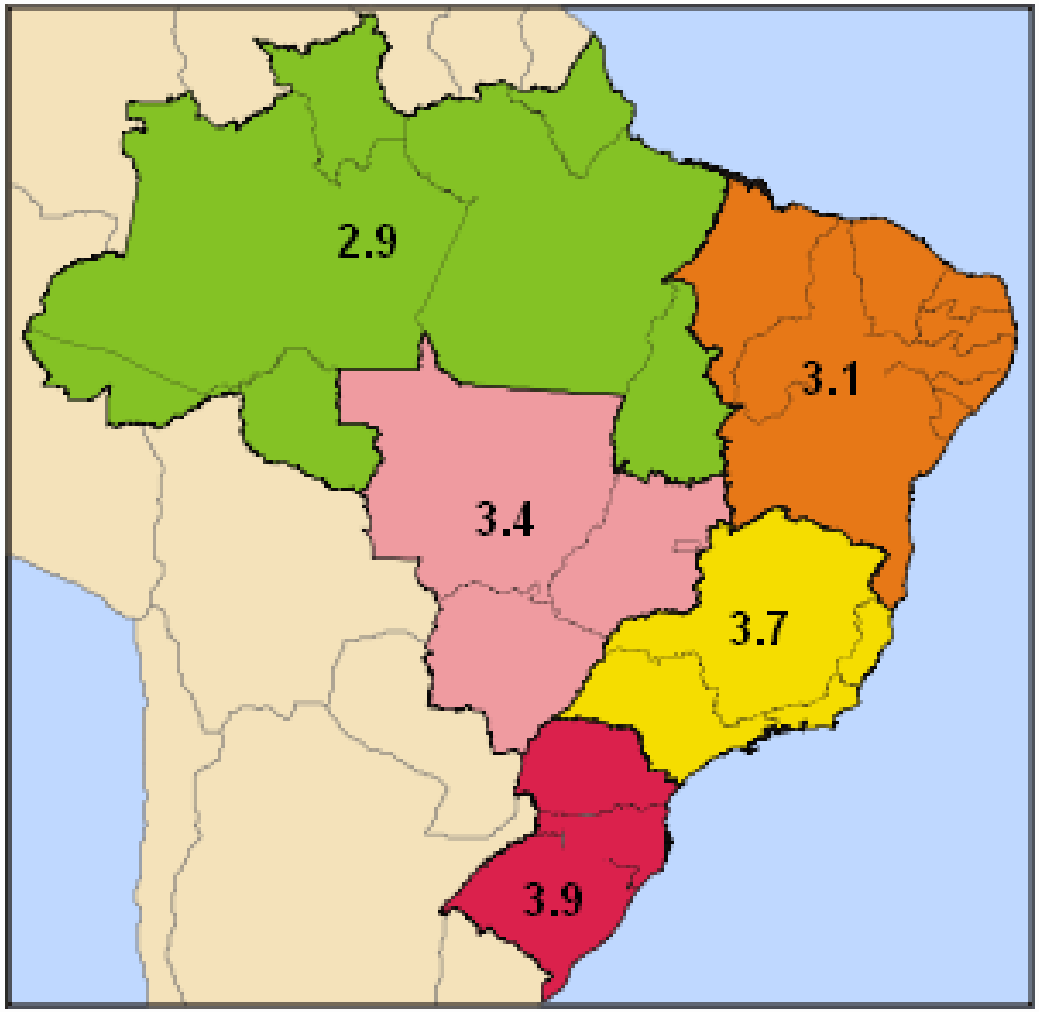


Consumers distribution – Satellite solution constraint 2



Basic telephony subscriber line distribution – Satellite solution constraint 3

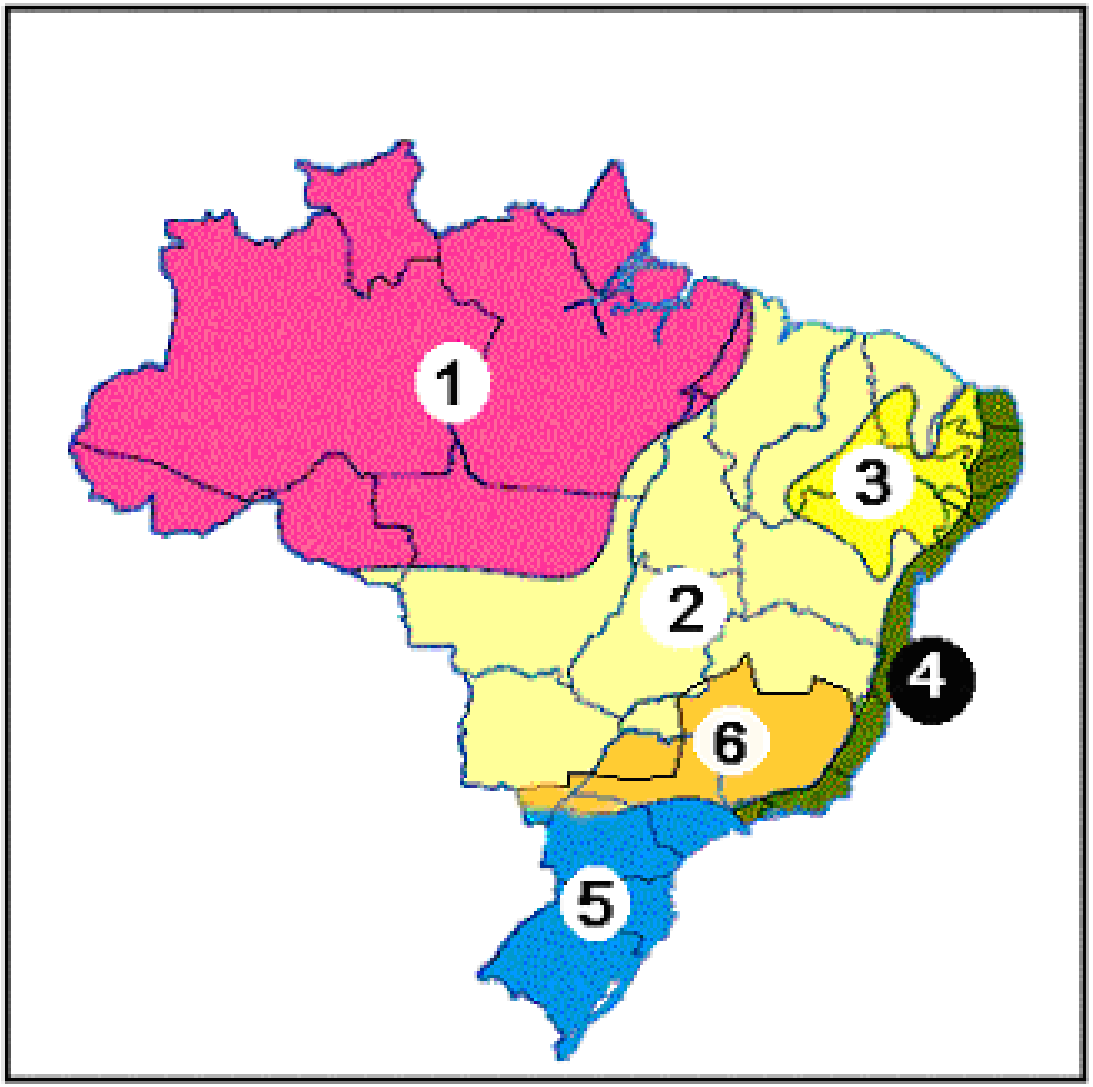
Basic education and social diversity – Satellite solution constraint 4



IDEB 2007 – Basic Education Development Index

Source: Ministério da Educação

Climate diversity – Satellite solution constraint 5



1. Equatorial
2. Tropical
3. Tropical Semiarid
4. Coastal
5. Subtropical
6. Tropical climate of altitude

Available spectrum x climate effects

- 4 / 6 GHz band
  - Best option for Brazilian climate;
  - Some sharing problems with FS, including those using WiMAX technology;
  - Bigger antenna sizes;
  - Difficult space coordination due to wider beams;
- 11 / 14 GHz band
  - Higher number of satellites;
  - Lower link availability due to rain;
  - Smaller antenna sizes x availability;
- 20 / 30 GHz band
  - Strong rain effect;
  - Higher equipment cost.

Latitude diversity – Satellite solution constraint 6

- GSO arc almost vertical for earth stations at lower latitudes;
- GSO arc almost horizontal for earth stations at higher latitudes (South Hem).

Major observations in Brazilian case

- Climate and social distributions produce heterogeneous effects over the satellite coverage and capacity planning in Brazil;
- Economical differences and large remote areas with less network infrastructure make satellites very important to provide basic telecommunication services and uniform national development;
- Satellite frequency spectrum options are rare and hardly shared with terrestrial services as well as subject to propagation conditions due to climate diversity;
- GSO arc has almost no more options for satellite orbital locations specially due to coordination difficulties in 4/6 and 11/14 GHz bands;

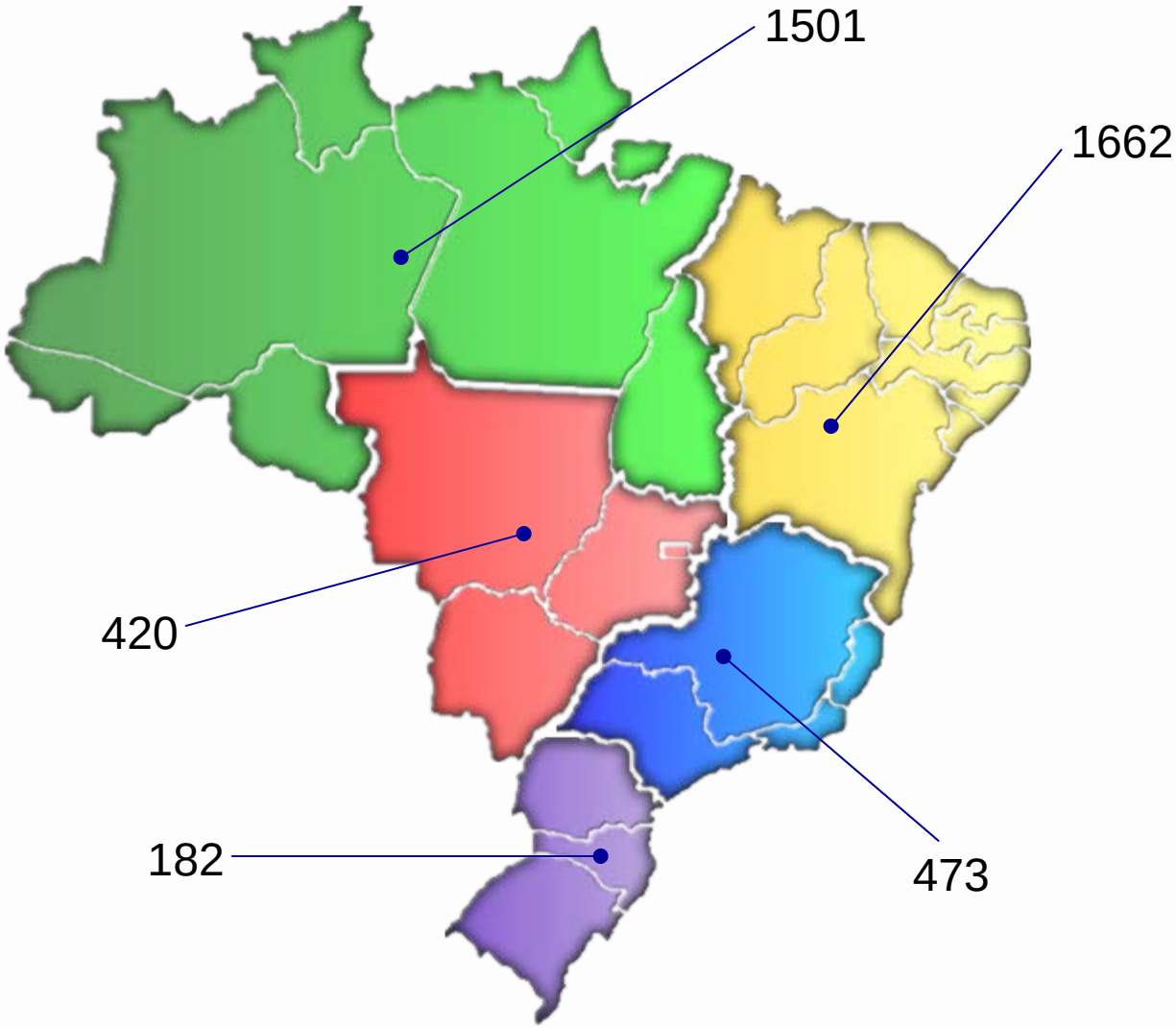
Major observations in Brazilian case

- Satellite antenna beam has to be broad in order to cover the big territory and distribute satellite capacity with adequate cost. Hardest coordination in the beam roll-off region with neighbor Administrations;
- Basic and social services (e.g. - e-Learning Educational and Medical support) are not commercially interesting for international satellite service providers thus requiring public financing;
- Climate and latitude diversity produce heterogeneous types and sizes of earth station antennas and pointing structures as well as hard QoS and link margin.

Brazil – Satellite social importance

- Satellite has been used to fostering the governmental policy:
  - to guarantee the universal telephone access;
  - to provide broadband access to public schools, districts and indigenous villages (almost 5.130 points of presence) (GESAC project);
  - as part of a backhaul to give support to broadband access.

Public Telephones (TUPs) supported by Satellite Earth Stations in Brazil per Region



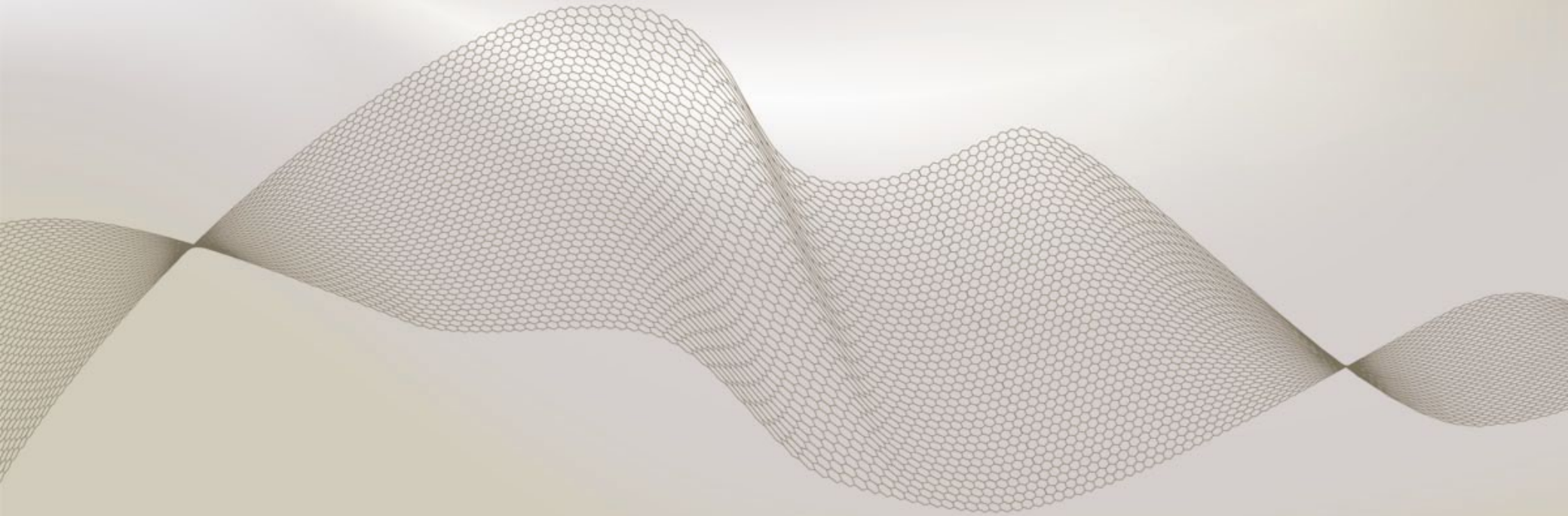
Views on possible improvements through ITU

- Spectrum and Orbit regulations are very much important for large and developing countries (like Brazil) with heterogeneous geographical, climatic, economical and social distributions;
- Satellite network filings and coordination procedures could be simplified to make it easier for countries which strongly depend on satellite resources;
- More stringent side-lobe reference patterns are necessary for earth station antennas, but some relaxation outside the GSO arc is required specially due to latitude diversity (e.g. Rec ITU-R S. [CSREF-PATT]);
- Off-axis e.i.r.p densities limits (e.g. Rec. ITU-R S.524) should be balanced by high rain rate attenuation effects. Otherwise, power control solutions would not be practical and cost effective.

References / Source

- ANATEL – Agência Nacional de Telecomunicações / Comissão Brasileira de Comunicações 2 – Radiocomunicações / Grupo Relator de Radiocomunicações 3 (GRR3) - Serviços por Satélite;
- Ministério das Comunicações – “ As cidades digitais no mapa do Brasil – Uma rota para a inclusão social” – Organizado por: A.A.Souto, J.C.Dall´Antonia e G.M. de Holanda (CPqD) / 2006;
- Ministério da Educação – IDEB 2007;
- Atlas Brasileiro de Telecomunicações 2009.

Marcos G. Castello Branco
castello@cpqd.com.br
+55 19 3705-6543



www.cpqd.com.br