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IP-based networks:

Pricing of telecommunication services –
Impact of VoIP on the price of national and international telephone services

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Pricing & VoIP (1)

- The attractiveness of IP networks compared with circuit switched networks, is that they provide:
  - greater flexibility in network bandwidth requirements, and
  - greater utilisation efficiency of available capacity
- The attractiveness of VoIP is driven by
  1) Artificially inflated international PSTN call prices
  2) ISP Membership but no usage fees
- Why this pricing structure?
  - Because of the structure of prices small ISPs pay to large ones for transit
  - More fundamentally, it is because billing and metering systems on the internet are limited in what they can do – especially regarding end-users

Pricing & VoIP (2)

- Transit contracts are confidential
- There appear to be three basic dimensions around which transit price offers are structured:
  - A fixed rate for a certain number of bits per month;
  - A variable rate for bits in excess of this amount, and
  - A rate based on peak throughput, which may include:
    - pipe size, representing the *option* for peak throughput, and
    - some measure of *actual* peak throughput ('burstiness').
- Lack of more sophisticated pricing e.g. congestion pricing, results in congestion delays that make VoIP a poor quality and unreliable service.

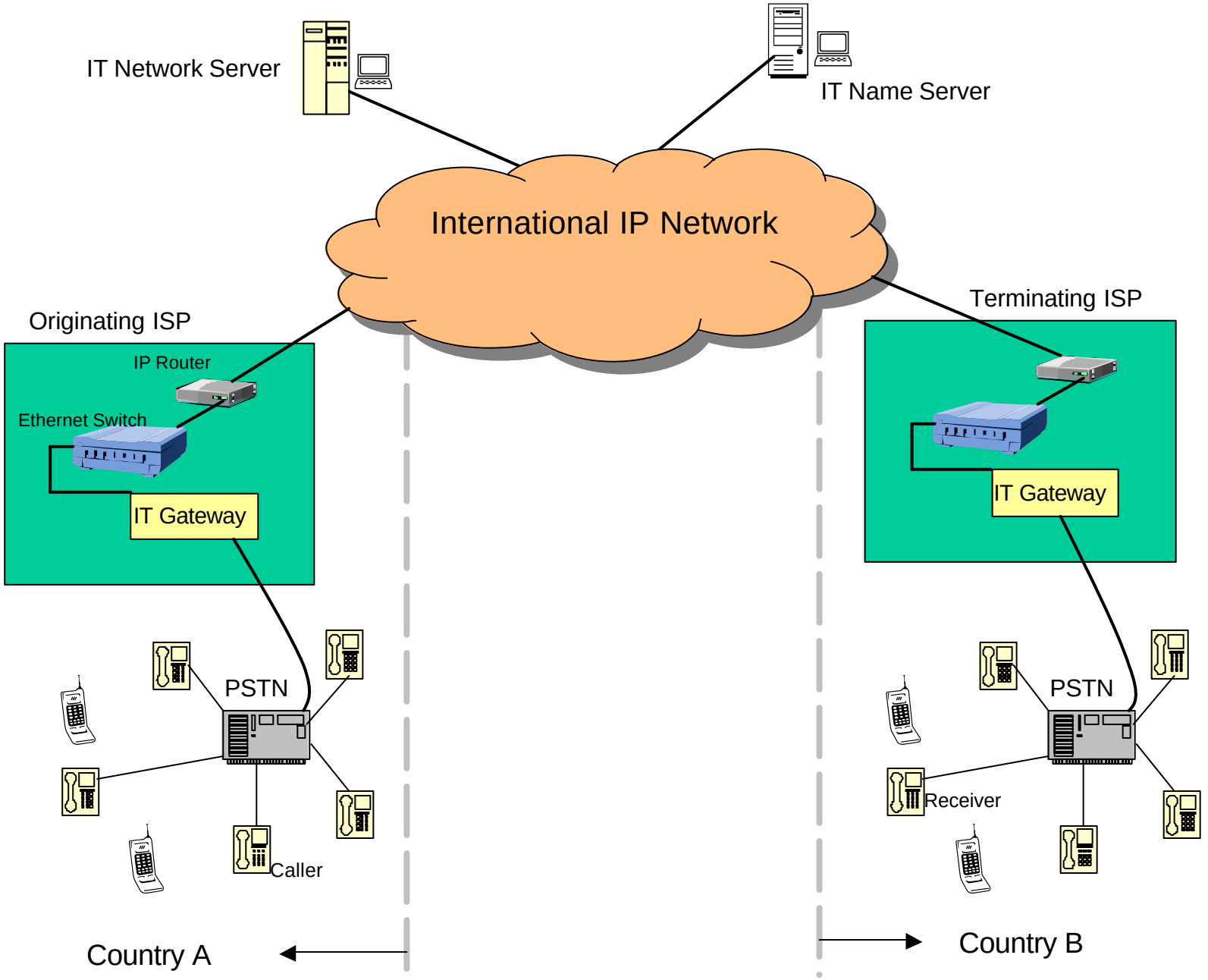
Pricing & VoIP (3)

- The attractiveness of flat rate pricing is also the Internet's weakness, i.e. poor QoS for real-time services
  - All packets treated with equal priority

- Setting up and operating IP networks and especially VoIP, requires technical skills –
  - perhaps one reason why most VoIP occurs in South East Asia where international PSTN calling rates are high and there is a highly educated population.

VoIP: practicals (1)

- It seems likely that VoIP providers are using some combination of the following:
  - interoperability with the PSTN through SIP and H.323 terminals and protocol groups, and the use of compression technologies;
  - technical methods which keep datagrams on-net;
  - dynamic assessment of the QoS on different parts of an ISP transit network, such that calls are router where QoS is best at that moment, and
  - for computer to phone VoIP, computers connected via the PSTN to UDP ports, which imply some QoS differences compared to TCP
- ISP networks are not based on a traditional PSTN configuration where national operators in a country connect with the outside World in international “no man’s land”
  - ISPs that help provide VoIP are not defined by country boarders

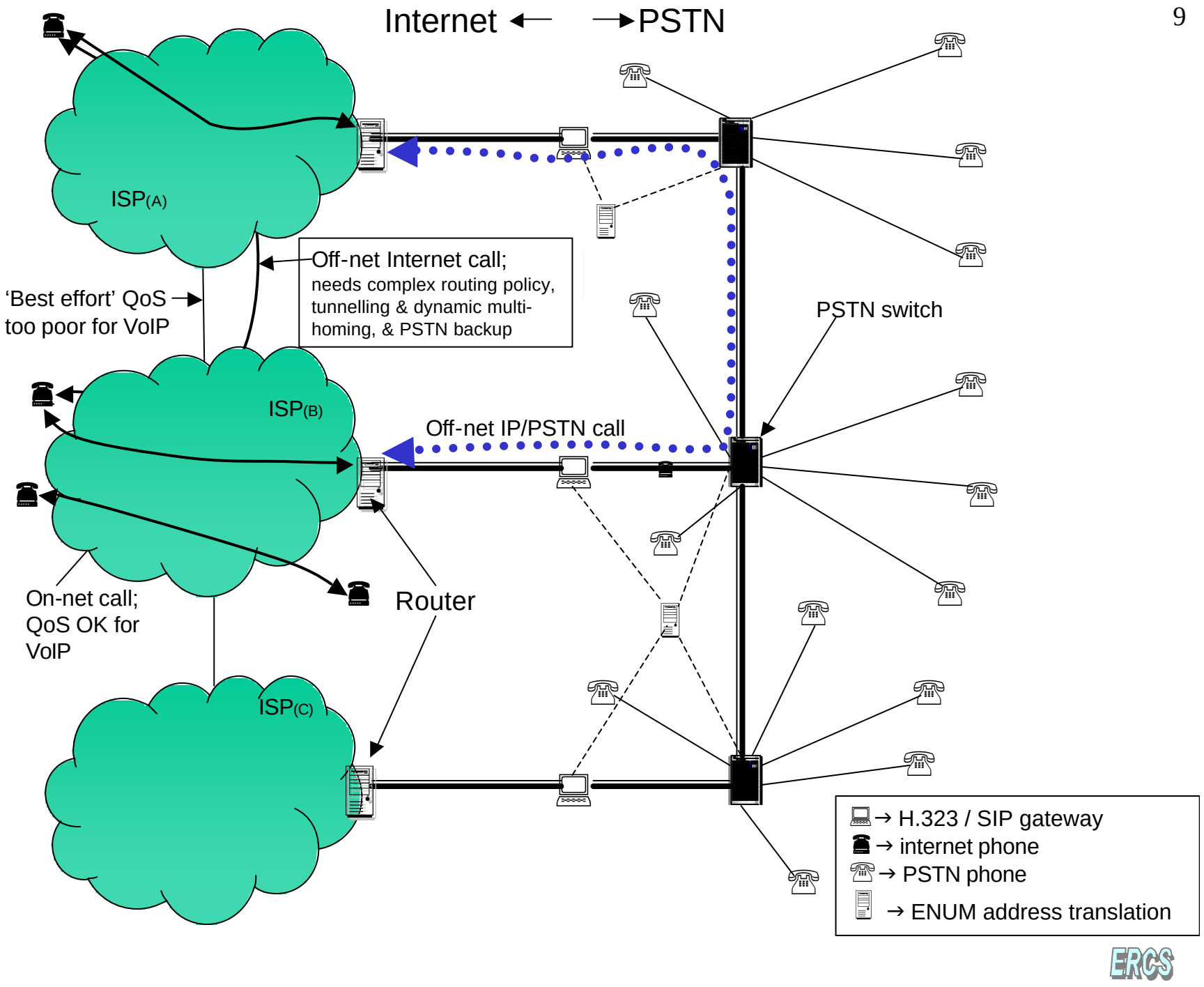

IT Network Server
IT Name Server
International IP Network
Originating ISP
IP Router
Ethernet Switch
IT Gateway
Terminating ISP
IT Gateway
PSTN
PSTN
Caller
Receiver
Country A
Country B

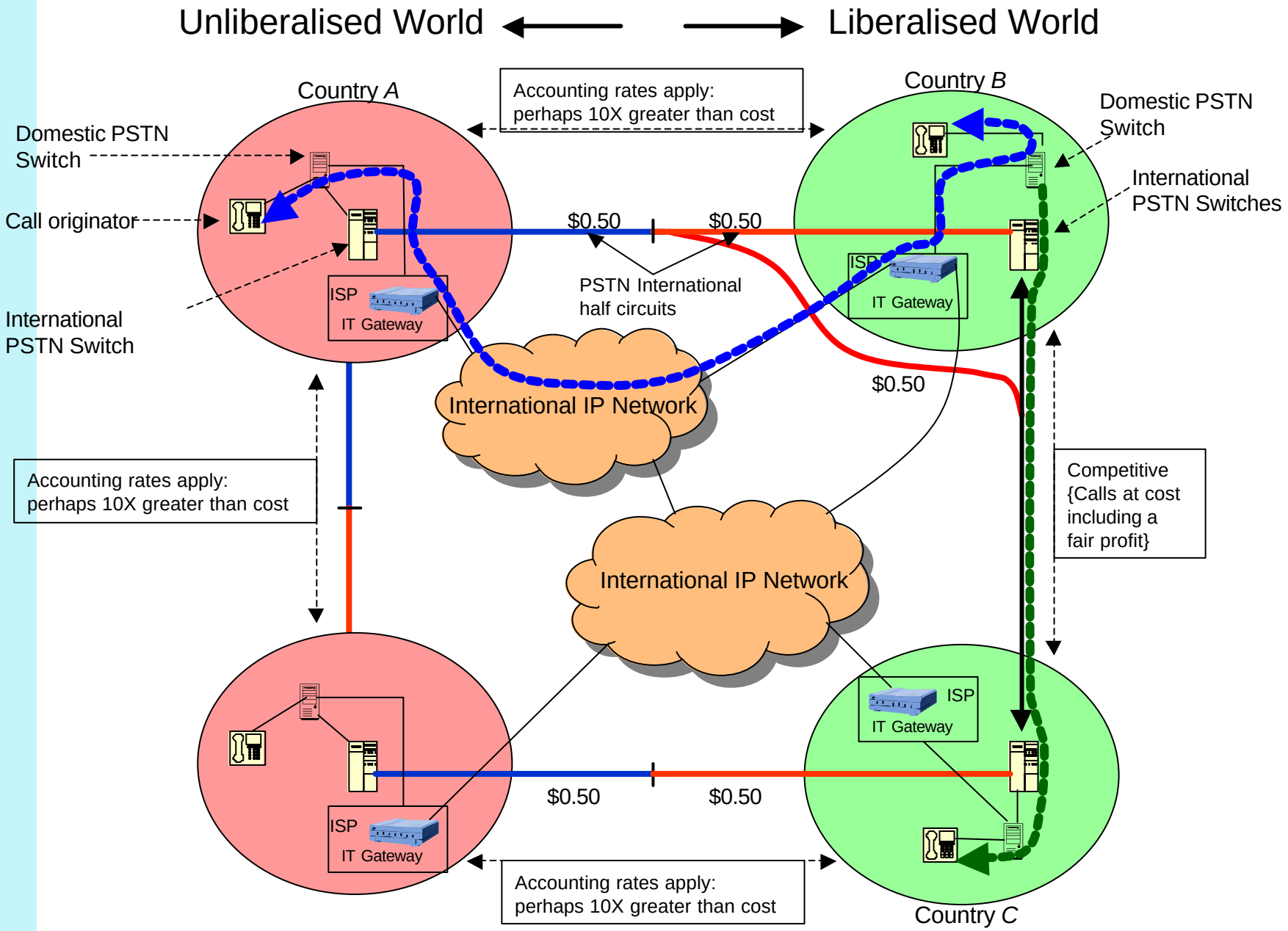
VoIP: practicals(2)

- This enables an ISP in Country *A*, to connect through a gateway directly with the PSTN in Country *B*. In this way an ISP can operate a WAN or WAE between two countries.
- Involves the placement of interface devices and software in countries *A* and *B* which transform messages originated over the PSTN into IP, and for incoming messages visa versa.
- Keeping the IP packets ***on-net*** enables a VoIP service of acceptable QoS given price differentials with PSTN

VoIP: practicals(3)

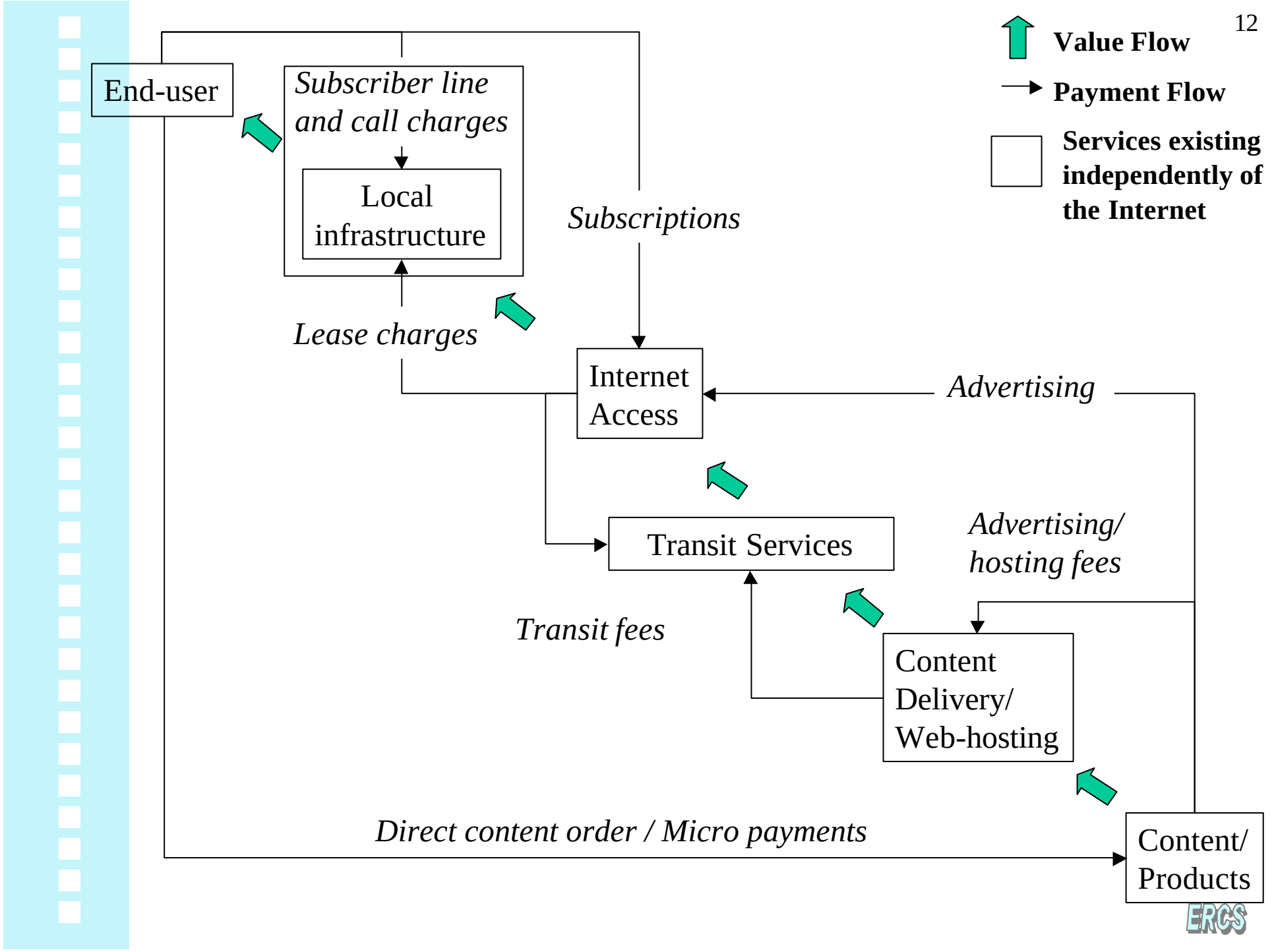
- Where this IP model operates we should expect it to involve large mainly urbanised populations as they can access the ISP's gateway without having to make an expensive long distance call.
- It may be enough for VoIP to get the calling into a developed and liberalised regulatory regime, as from here PSTN termination into other liberalised countries is cheap.
- Computer to computer VoIP is simpler but is limited by the distribution of computers and computer literacy (developing countries!), and is likely to be of lower QoS.


Internet
PSTN
ISP(A)
ISP(B)
ISP(C)
'Best effort' QoS too poor for VoIP
Off-net Internet call;
needs complex routing policy, tunnelling & dynamic multi-homing, & PSTN backup
PSTN switch
Off-net IP/PSTN call
On-net call; QoS OK for VoIP
Router
→ H.323 / SIP gateway
→ internet phone
→ PSTN phone
→ ENUM address translation


Unliberalised World
Liberalised World
Country A
Country B
Country C
Domestic PSTN Switch
Call originator
International PSTN Switch
Accounting rates apply: perhaps 10X greater than cost
$0.50
$0.50
PSTN International half circuits
ISP
IT Gateway
International IP Network
Domestic PSTN Switch
International PSTN Switches
Competitive {Calls at cost including a fair profit}
Accounting rates apply: perhaps 10X greater than cost
Accounting rates apply: perhaps 10X greater than cost

VoIP: practicals (4)

- Is VoIP going to have an important role in providing service to developing countries?
- I will put my neck out and say ***not when looked at in isolation***. Why?
  - VoIP is an accounting rate bypass service
  - The telecoms problems of developing countries are not addressed by whether international calls are VoIP or PSTN
- Many developing economies have underdeveloped networks, even considering their low GDP per capita.
- Most user costs are in the access network and there are thought to be only modest cost savings converting this to IP.


Value Flow
Payment Flow
Services existing independently of the Internet
End-user
Subscriber line and call charges
Local infrastructure
Subscriptions
Lease charges
Internet Access
Advertising
Transit Services
Advertising/ hosting fees
Transit fees
Content Delivery/ Web-hosting
Direct content order / Micro payments
Content/ Products

VoIP: practicals (5)

- There may be cost savings / economies of scope, for network operators in developing countries to provide VoIP along with Internet service.
- This has more to do with NGNs than VoIP per se
- People in developing countries need Internet access
  - They need the information and communication it provides
  - Many need to be taught what can be done with the Internet
  - Programs to provide internet access to schools may be an effective way of addressing this problem
  - Donor money should be available as the information and education provided is a driver of democratisation.

Conclusions

- QoS on the Internet is generally too poor for VoIP
- By keeping traffic on an international WAN or WAE, VoIP quality appears to be acceptable in some cases, given the price of the PSTN equivalent.
- The continued medium-term growth of VoIP appears dependent on international accounting rates being maintained at levels greatly above the relevant resource costs.
  - i.e. VoIP is a regulatory by-pass service
- VoIP does not address the main telecoms problems in developing countries; → network under-development.