Performance of VSAT Networks in the Context of Aeronautical Communications

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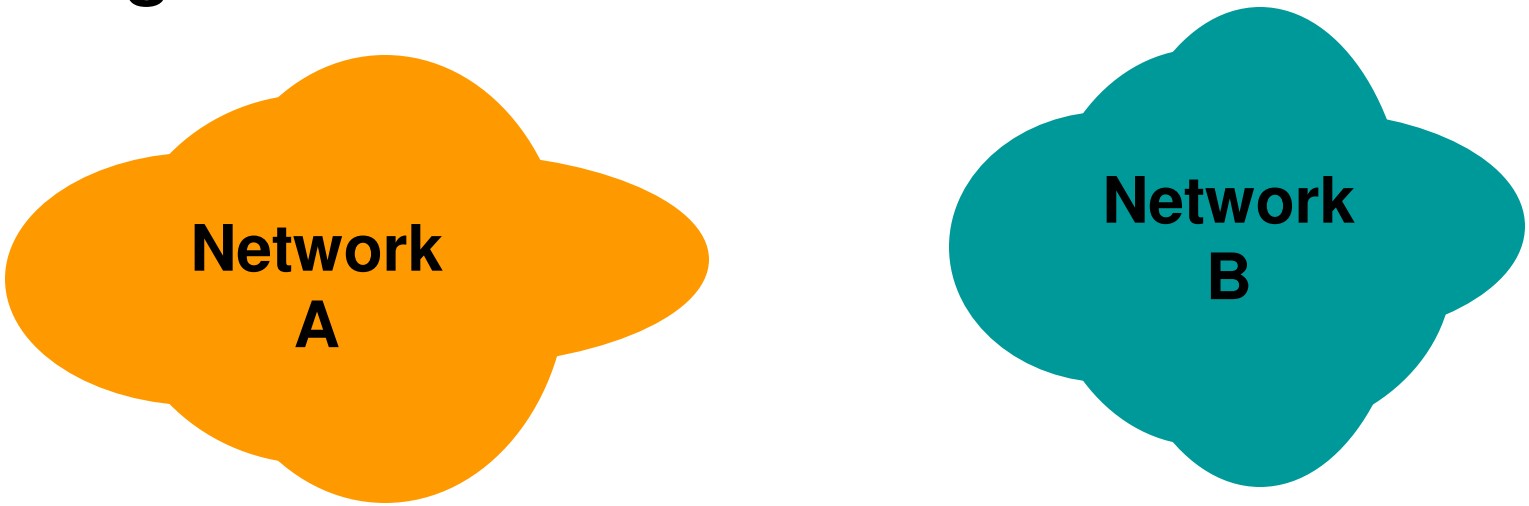
Use of correct terminology

Interconnection? ✓

Interoperability? ✗

integration? ✓



Integration means that the two networks effectively become one! (the preferred option if feasible)

ALLPIRG/5 Conclusions on VSAT (Approved by ICAO Council on 13 June 2006):

5/16 – Implementation of VSATs

That PIRGs

a) discourage the proliferation of VSAT networks where one/some of the existing ones can be expanded to serve the new areas of interest;

b) work towards integrated regional/interregional digital communication networks with a single (centralized) operational control and preferably based on the Internet Protocol (IP); and

c) give due consideration to managed network services (e.g. a virtual private network (VPN)), subject to availability and cost effectiveness.

ALLPIRG/5 Conclusions (cont'd)

Conclusion 5/17 – Provisions for digital communication networks

That ICAO:

a) expedite the development of provisions relating to the use of the Internet Protocol Suite (IPS) in the aeronautical telecommunications infrastructure; and

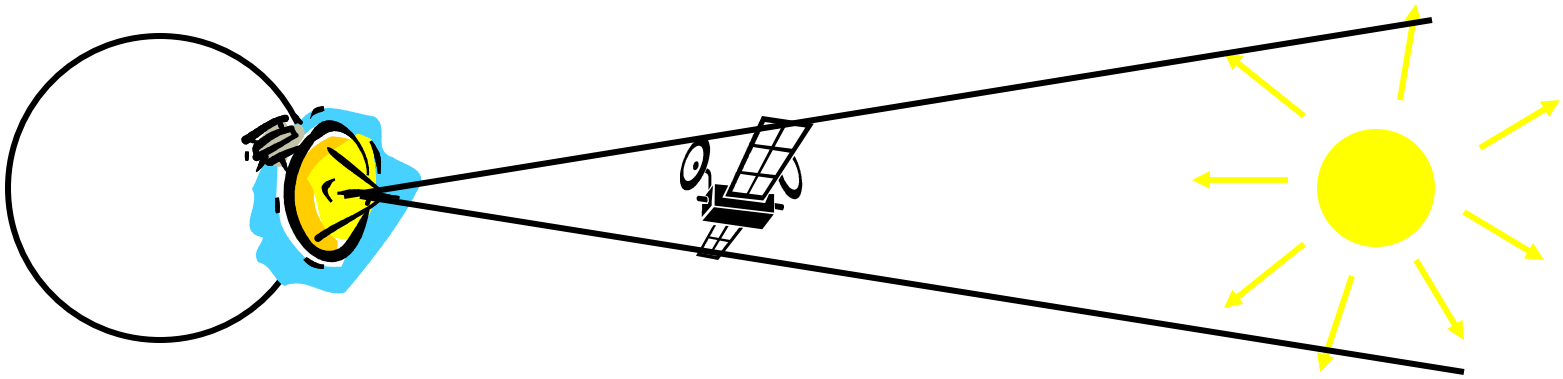
b) initiate the development of provisions governing the end-to-end performance of digital communication networks, irrespective of the technologies and protocols used therein.

PERFORMANCE PARAMETERS

AVAILABILITY

99%? - 99.999%? LET'S BE REASONABLE

Assuming no equipment failure, a single 2.4 m C-band VSAT in Dakar (using IS-903 @325.5 Deg), will experience sun outages about 2 hours per year.



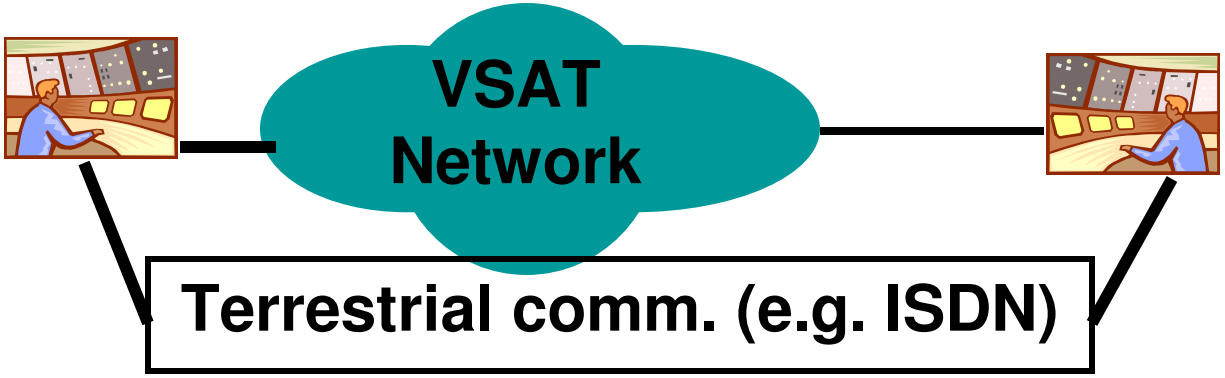
Maximum availability is therefore 99.97%

Allowing for other expected problems, 99.8% (about 18 hrs of outage per year) is a reasonable figure.

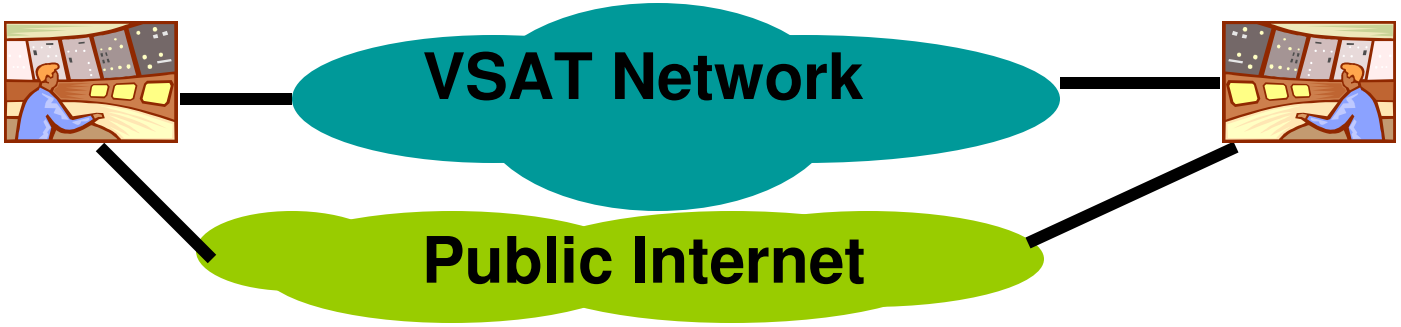
Options for enhancing availability

A

B



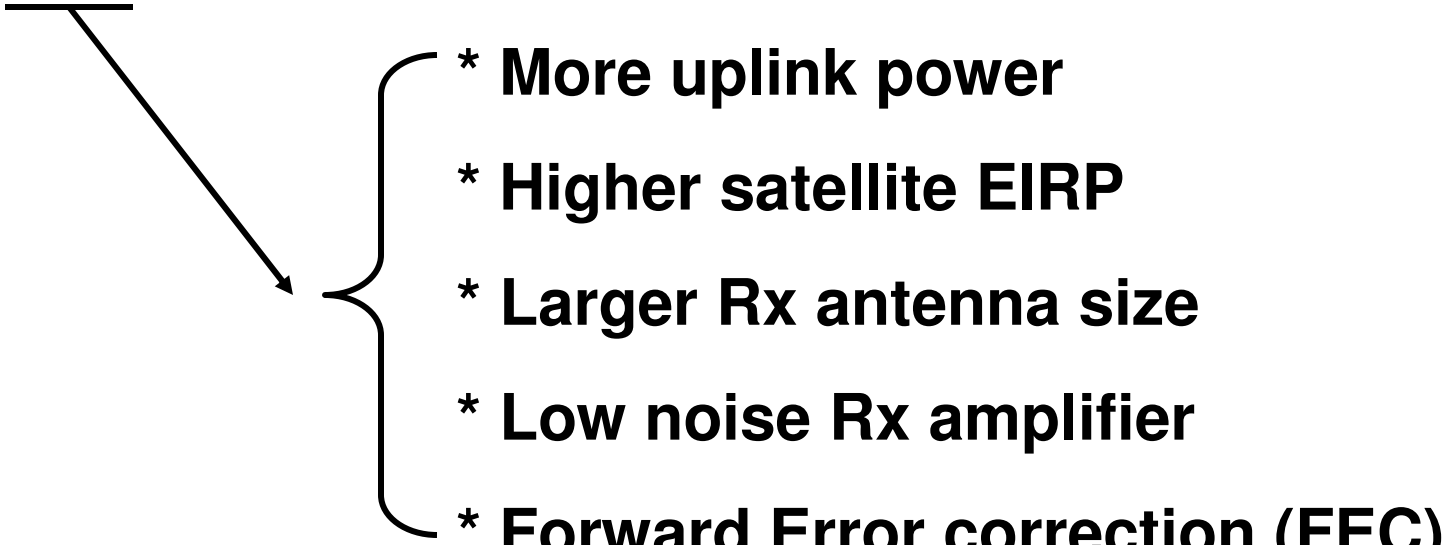
C



Option C is easiest and most cost effective

PERFORMANCE PARAMETERS
Bit Error Rate (BER)

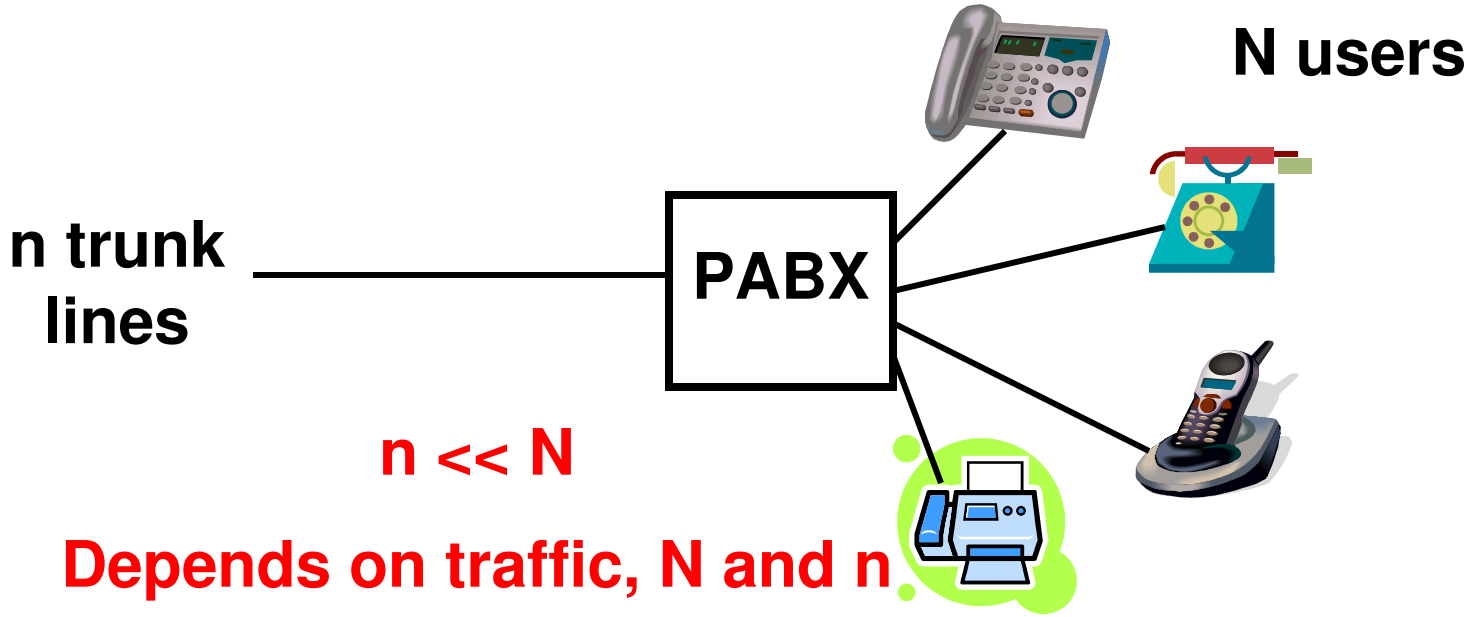
Errors are caused by noise. Higher Signal to Noise Ratio (SNR) reduces BER.



A reasonable figure for VSAT BER is 10^{-7}

PERFORMANCE PARAMETERS

Voice Blocking Probability



Similarly, if there are N VSAT terminals, it is too costly (& outdated) to have N voice channels available at all times for ATS-DS circuits (for total non-blocking performance).

In a modern VSAT network, a blocking probability of 0.25% is quite reasonable (i.e. one in 400 attempts will be unsuccessful).

PERFORMANCE PARAMETERS

Voice Delay (latency)

According to ITU-T Rec. G.114, one-way voice latency limits are:

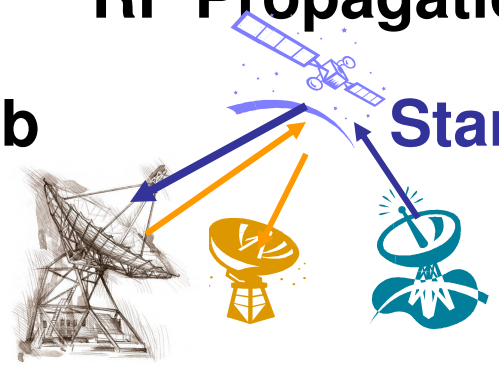
*** less than 150 ms for most users**

*** 150- 400 ms, acceptable if can be tolerated by users**

*** above 400 ms, unacceptable for general network planning purposes (though may be unavoidable in some cases)**

RF Propagation delay (one hop) >= 240 ms

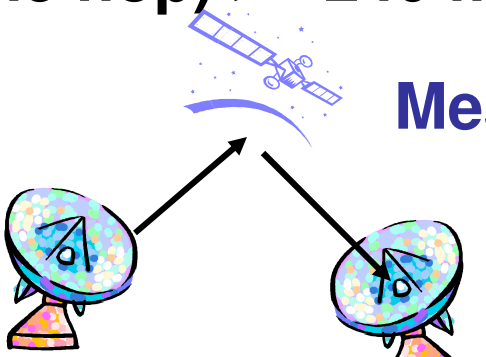
Hub **Star**



delay>=480 ms

(unacceptable!!)

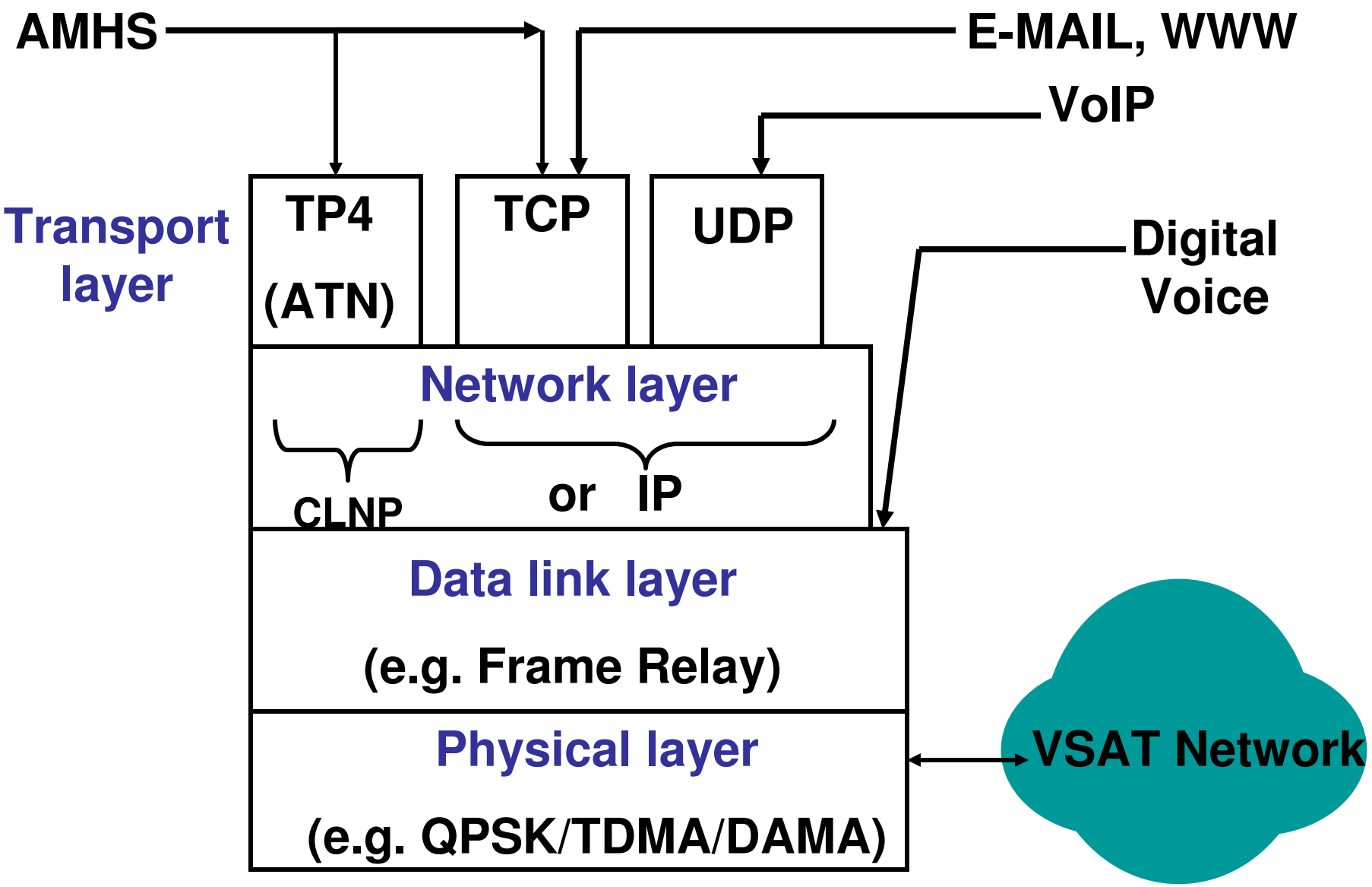
Mesh



delay>=240 ms

Call set-up delay <= 2 Seconds

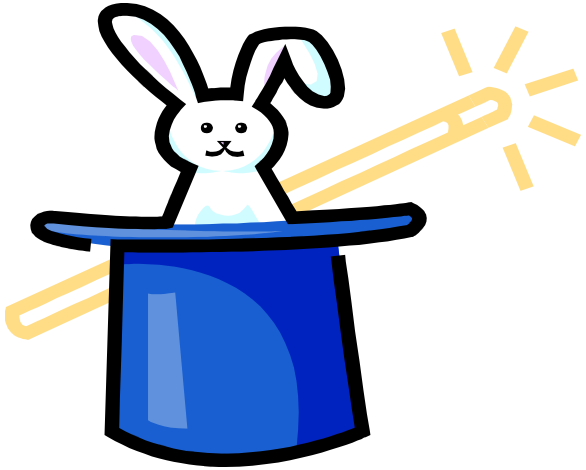
OVERVIEW OF COMMUNICATION LAYERS



Summary

* Proliferation of VSAT networks should be avoided
* Any upgrade opportunity should be used to integrate (i.e. under a single NCC) existing VSAT networks
* No more dedicated circuits! The trend is an IP-based VSAT network for all voice and data applications

Thank you for your attention



Any Questions?