
Technical and Political Issues With Alternatives to Undersea Cables

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Problems with using Undersea Cables for Internet Service

- ◆ installation cost
- ◆ construction duration
- ◆ limited reach
- ◆ relatively low capacity
- ◆ inflexible after installation
- ◆ history of telco management

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Telco Background

- ◆ pre-buy cable slots
 - normally through telco consortium
- ◆ big \$\$ to play in the game
- ◆ price based on assumption of use for voice
- ◆ generally blind to data needs

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Alternatives to Undersea Cables

- ◆ point to point radio
 - need mid-sea platforms
 - or sky hooks
- ◆ worm hole routing
 - next generation
- ◆ satellites
 - = sky hooks

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Types of Satellite-Based Systems

- ◆ geosynchronous (GEO)

36,000 Km



- ◆ Middle Earth Orbit (MEO)

16,000 - 25,000 Km



- ◆ Low Earth Orbit (LEO)

<~ 16,000 Km



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Technical Issues

- ◆ latency

geo - >500 msec rtt

meo & geo - variable, 20-160 msec rtt

tracking satellite as it passes overhead

deep space ...

- ◆ large bandwidth-delay product

lots of data "in flight"

- ◆ transport reliability

high(er) non-congestion related packet loss

- ◆ asymmetric use

e.g. telephone for return path

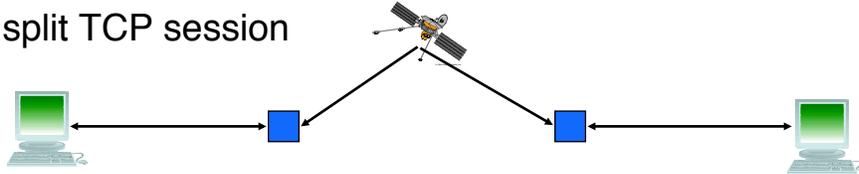
- ◆ intermittent connectivity

when switching between satellites

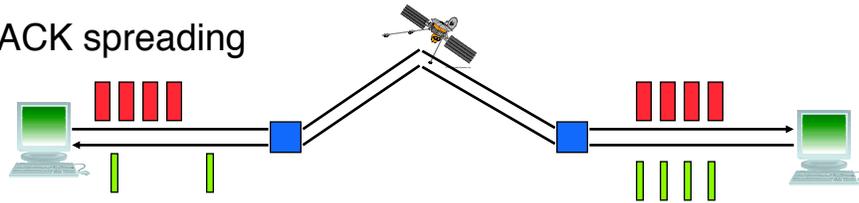
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Technical Issues - Ideas

- ◆ split TCP session



- ◆ ACK spreading



- ◆ forward error correction



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Technical Issues - Ideas, contd.

- ◆ larger initial window
 - 2 or 4 packets vs. 1
- ◆ turn off delayed ACKs during slow-start
 - always ack received data rather than every other
- ◆ use T/TCP
 - bypass 3-way handshake
- ◆ congestion experienced notification
- ◆ TCP pacing
- ◆ TCP spoofing
- ◆ . . .

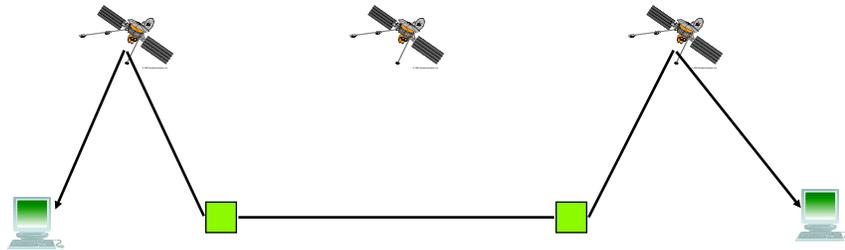
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Political Issues

- ◆ two operational models
 - ground <-> satellite only
 - with intersatellite

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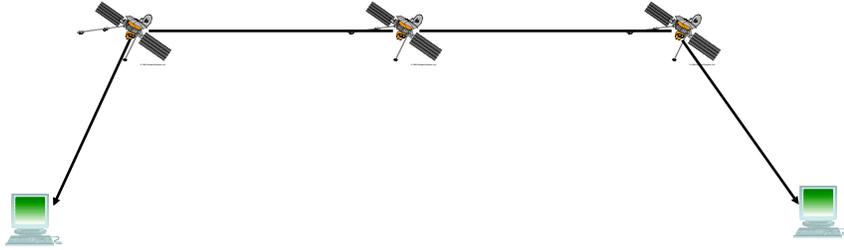
W/O Intersatellite



- ◆ communications through "normal" ground stations
- ◆ local government gets control point
- ◆ local government gets taxing point

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With Intersatellite



- ◆ communications bypass in-country ground station
- ◆ local government loses taxing and control point
humm, LEO is not that far up...