Internet and satellites

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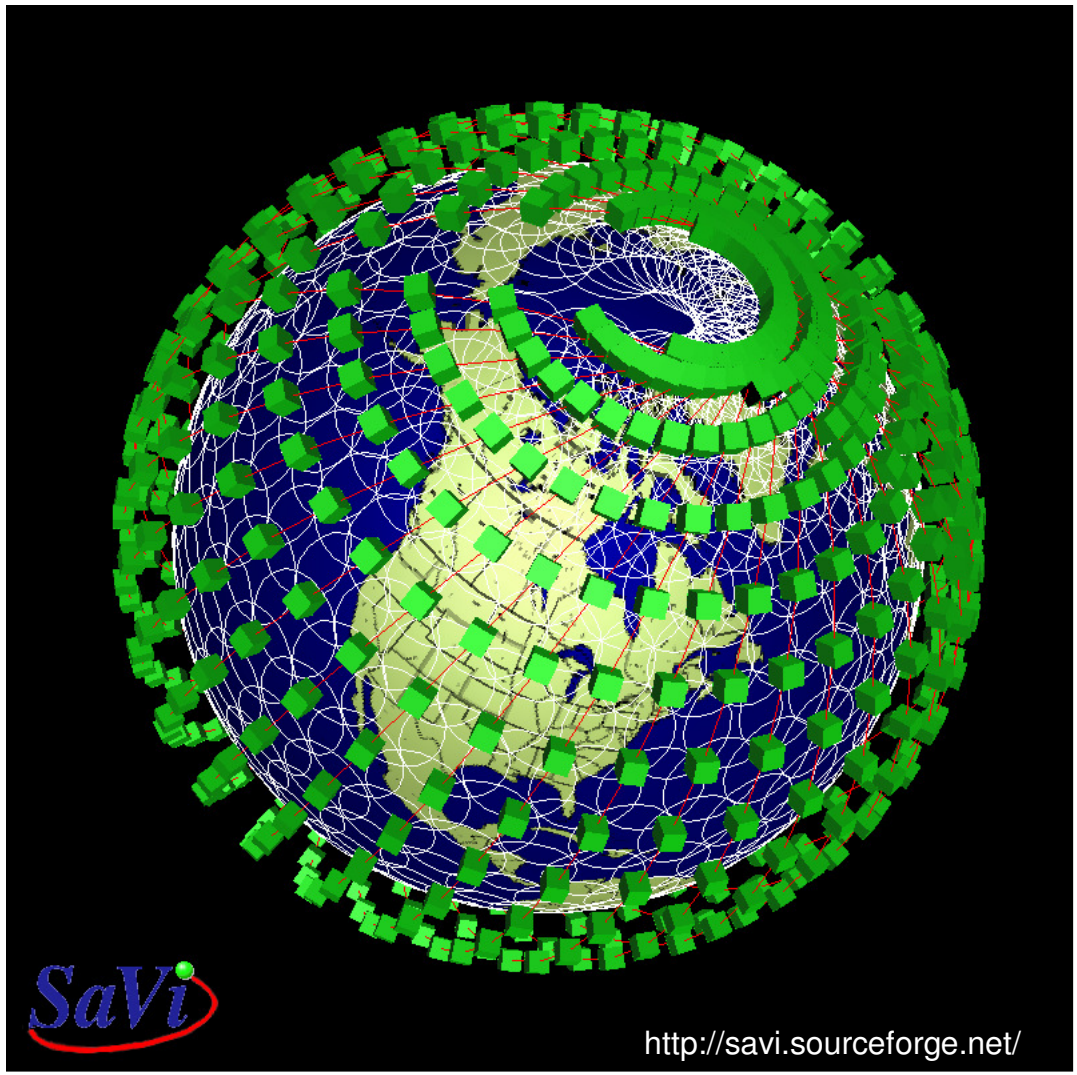
Broadband constellations.

Homogenous. One design. 90's: been there, tried that, failed.

No demand for capacity? No business case? 'Build it and they will come'.

Mass manufacture of identical custom satellites not much cost saving – launch costs still high, (re)design costs will *cripple* you.

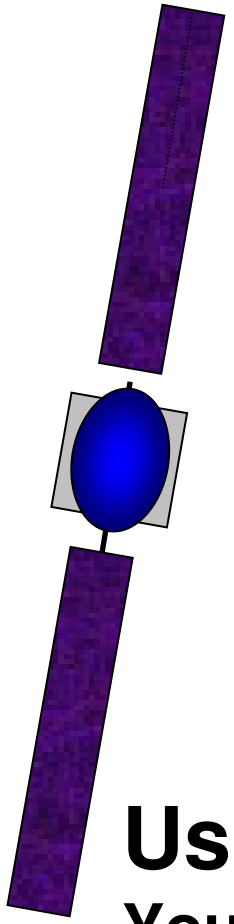
One risky great big leap towards networking. No incremental steps.



Time for a different approach?

Interoperability matters.

(No man is an island.)



A quick comparison

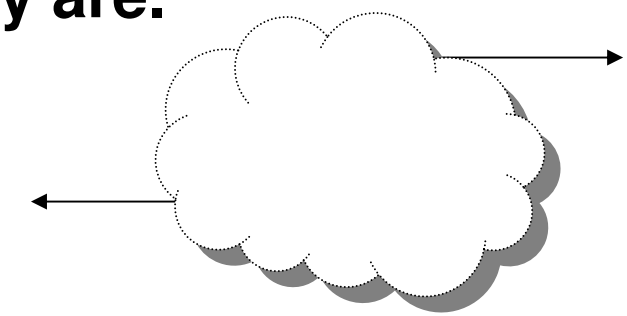
Using transponder in orbital slot

What's the frequency? coding scheme (3/4 etc.)?
modulation? polarisation, even?
Where does coverage reach to?

vs

Using the Internet

You're connected to a networking cloud of functionality.
Everyone else is connected to that same cloud –
somehow. You just presume that they are.
Don't sweat the connectivity details.



Which model is better? More useful?

Some satellite trends

Spotbeams really require switching to be useful.
More spotbeams, more need for onboard switching.

DSP is a form of OBP – onboard processing. See the P!
DSP has benefits. You'll get some OBP that way.

Shared launches have been common for a long while.
Now seeing more complex payloads on a shared satellite bus, e.g.:

***EchoStar 9/Telstar 13* – Ku/Ka- and C-band transponders**
***Galaxy 13/Horizons 1* – C-band and Ku-band transponders**

And do these talk to each other?
Is there interoperability? Is there a cloud?

Two ways to get payloads talking

1. Intersatellite links (ISLs).

These things *work*. Free space. No atmospheric limits. Iridium's not cutting-edge. Seems nobody can agree on an ISL standard or take the deployment risk.

2. Inside on the satellite bus.

Get payloads owned and operated by different people talking to each other across common bus and common standards at ever-higher levels of abstraction.

Break the uplink/downlink dependency. Copy signals around – why should a TV channel ever need to go up from Earth more than once? Why isn't there a TV cloud?

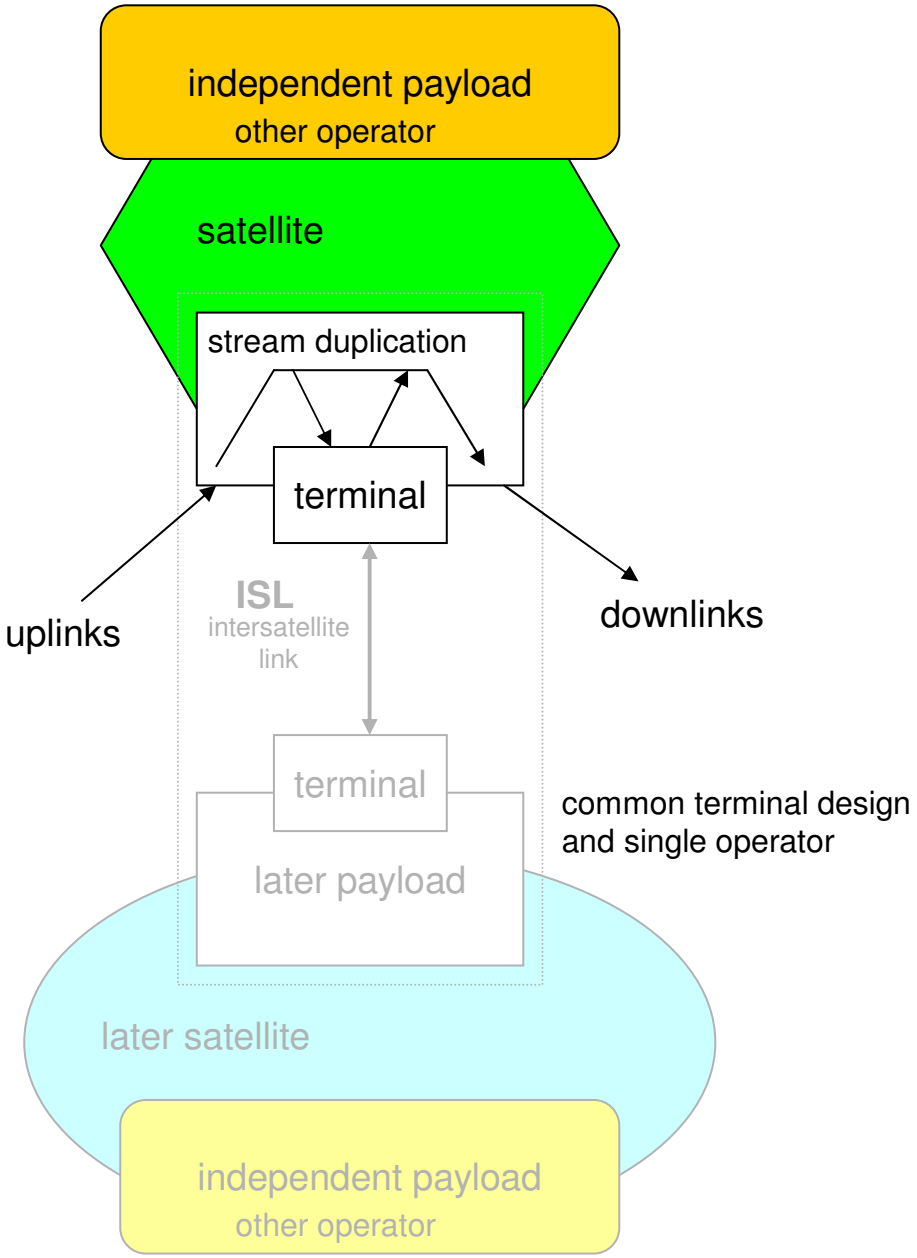
A low-risk method

Launch a payload that:
Decodes received signals to baseband streams (making them easier to switch).

Can copy streams as signals out of an ISL terminal – if you tell it to.

That's all.

(Wait...)



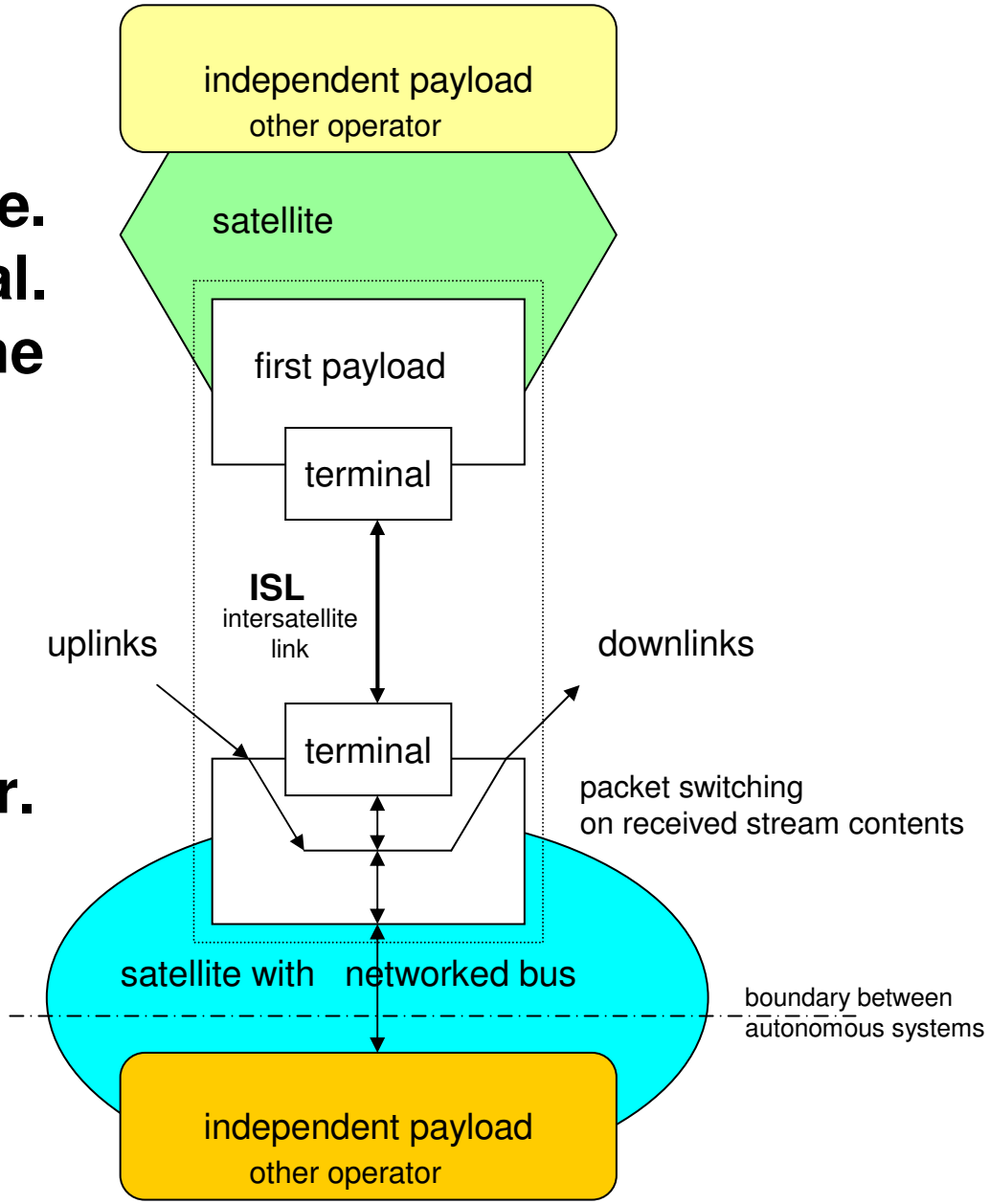
Later steps...

Your second payload gets launched on another satellite. That also has an ISL terminal. May even be smarter than the first payload.

You've just built your own little in-space cloud. Using your own ISL that suits you. In one payload, out the other.

Could also communicate across the satellite bus to a common standard.

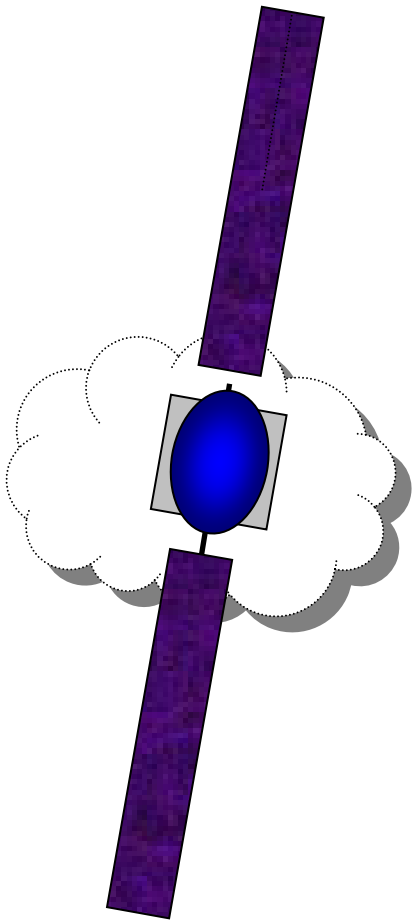
Grows your network cloud.



Last millennium/this millennium

In that world, satellites were part of big elegant-concept single-operator networks.

In this world, satellites can *themselves* be networks – of payloads. Boundaries between network autonomous systems lie *inside* the satellites. ISLs can link similar payloads on different satellites. It's messier.



The satellite becomes a useful cloud; a cloud of television switching functionality, of network functionality...

IP increasingly common everywhere.

Earth is one big IP networking cloud; interoperability with Earth at a high level is attractive. It's an n^2 *network effect*.

IP designed as an overlay network originally. IP overlays can be in individual clouds – IP in television MPEG streams, for example. Could parse streams and switch on each packet...

Satellite clouds become Internet clouds in their own way; for every satellite application, the evolution is different, the details of the incremental steps and technologies differ.

Extending the Internet into space

- NASA JPL gives DERA's STRV-1b IP address (1996)
- NASA Goddard flies IP on SSTL's UoSAT-12 (2000)
- Cabletron router on ISS. Shuttle experiments using IP, culminating in CANDOS (2003)
- NASA gets SpaceDev to launch CHIPSat (2003)
- SSTL adopts IP with DMC satellites (AISAT-1 launched 2002), UK-DMC and others (2003)

Cisco mobile access router onboard UK-DMC satellite alongside imaging payloads.