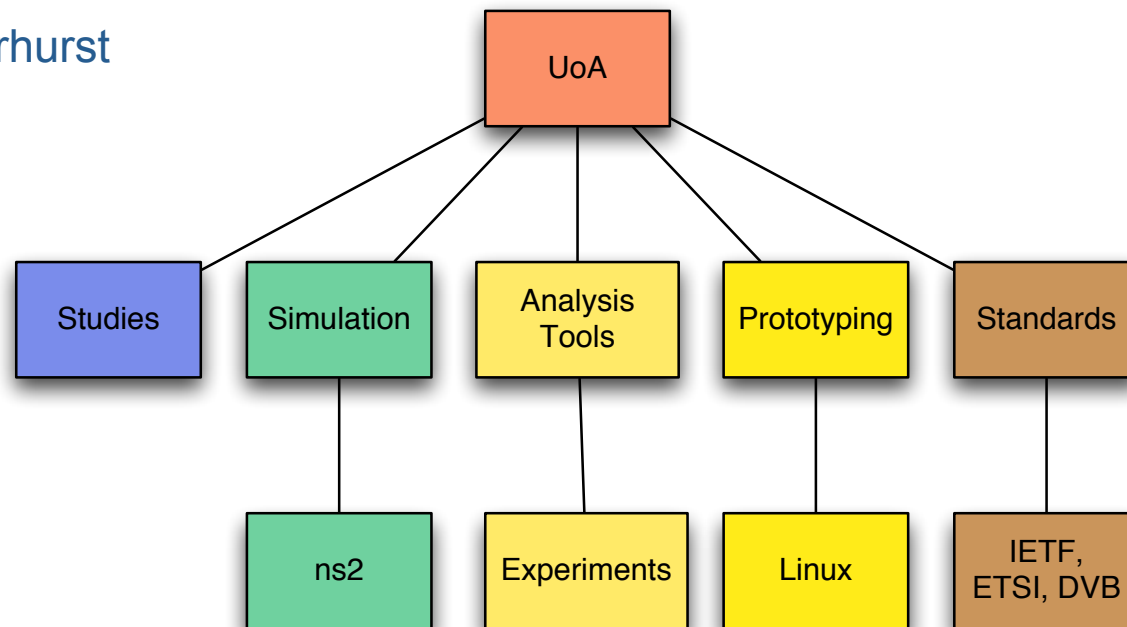# Internet-Related Activities

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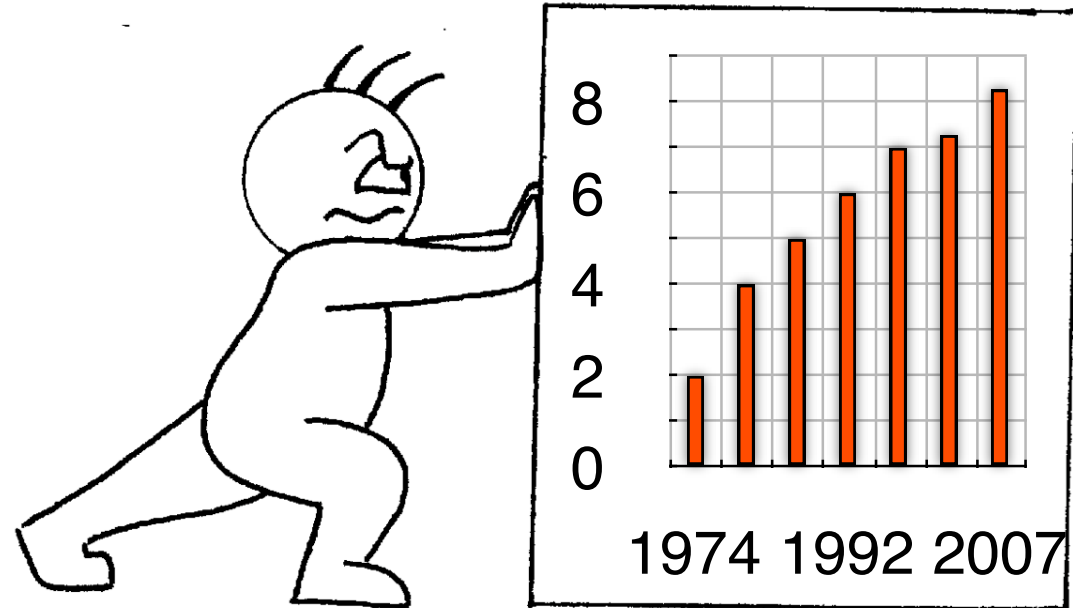
Presented by Gorry Fairhurst

eng174@abdn.ac.uk

gorry@erg.abdn.ac.uk

The Internet has a few problems...

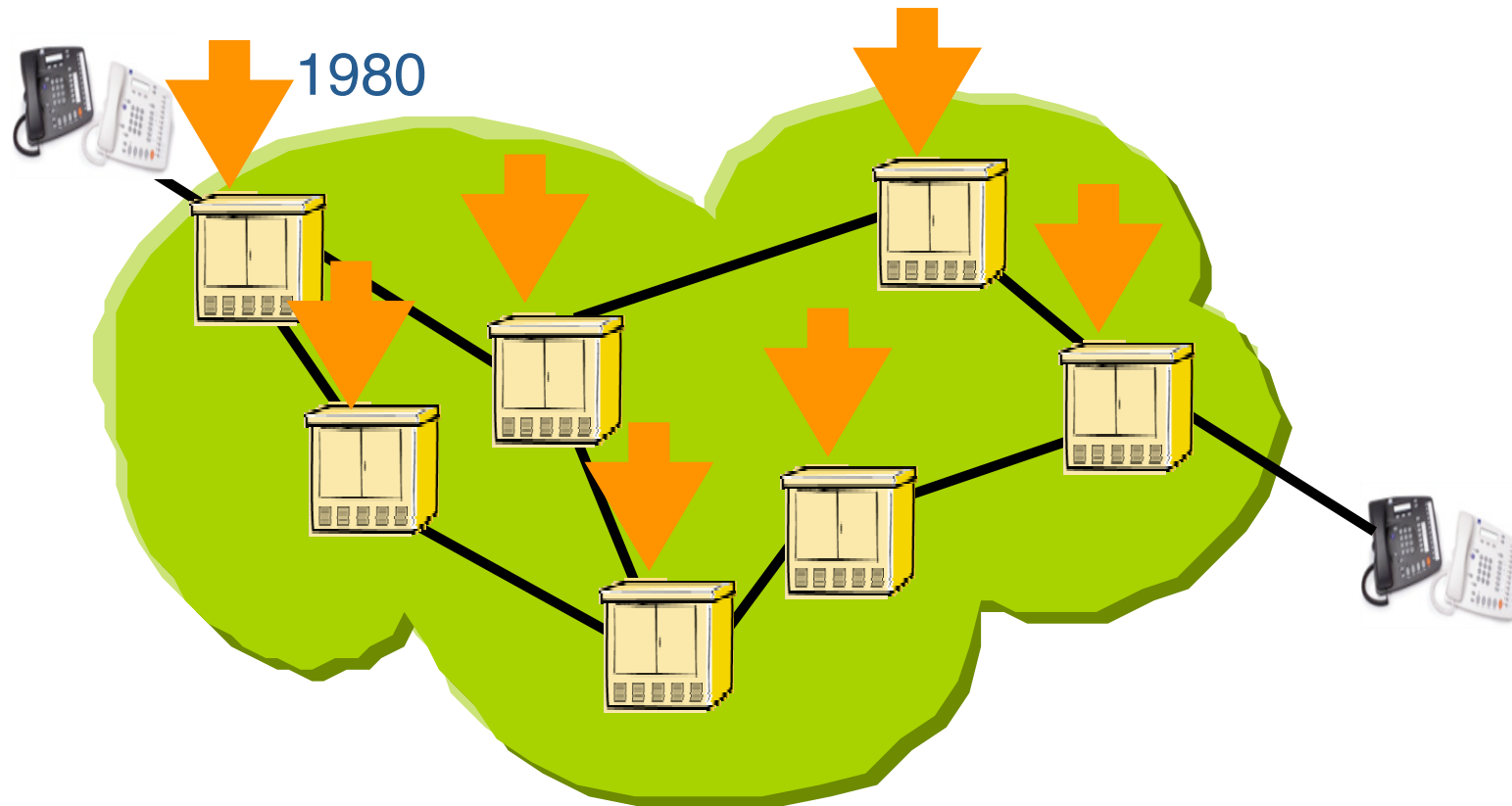IPv4 addresses are getting scarce (time to use IPv6?)

Router scaling is out of control (many proposals)

DNS has not kept up!

Security has not kept up!
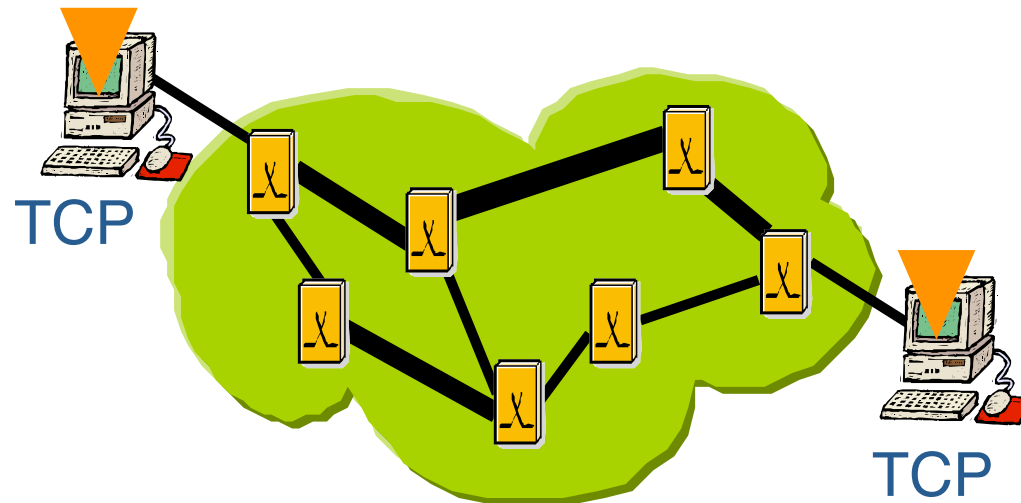
Management was an after-thought! ... etc

Reliable Transport

1980

Data was precious...

Networks needed to be careful not to loose/damage it.

End-to-End Reliable Transport

TCP

TCP

API & **Multiplexing**

Reliable delivery to the application (retransmission, if needed)
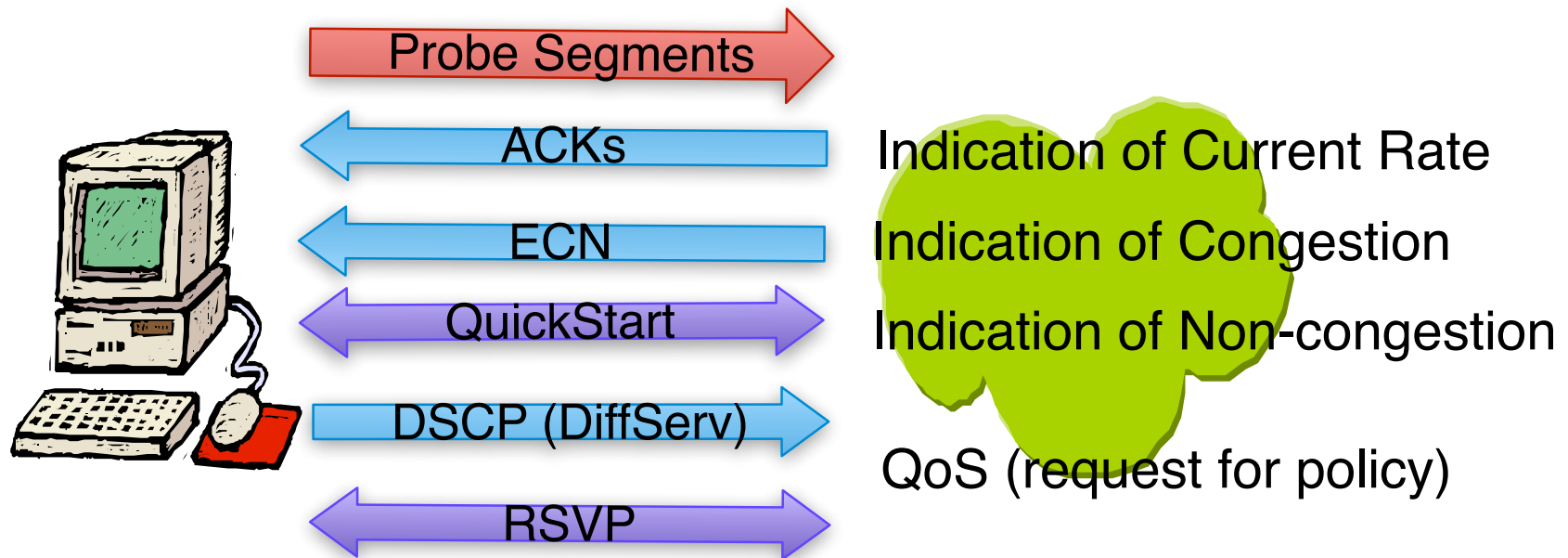
Flow control (prevent overwhelming the receiver)

Dealing with **obstacles** (Midboxes, QoS, Mobility, etc)

Choosing a **safe rate** (prevent overwhelming network)

UNIVERSITY
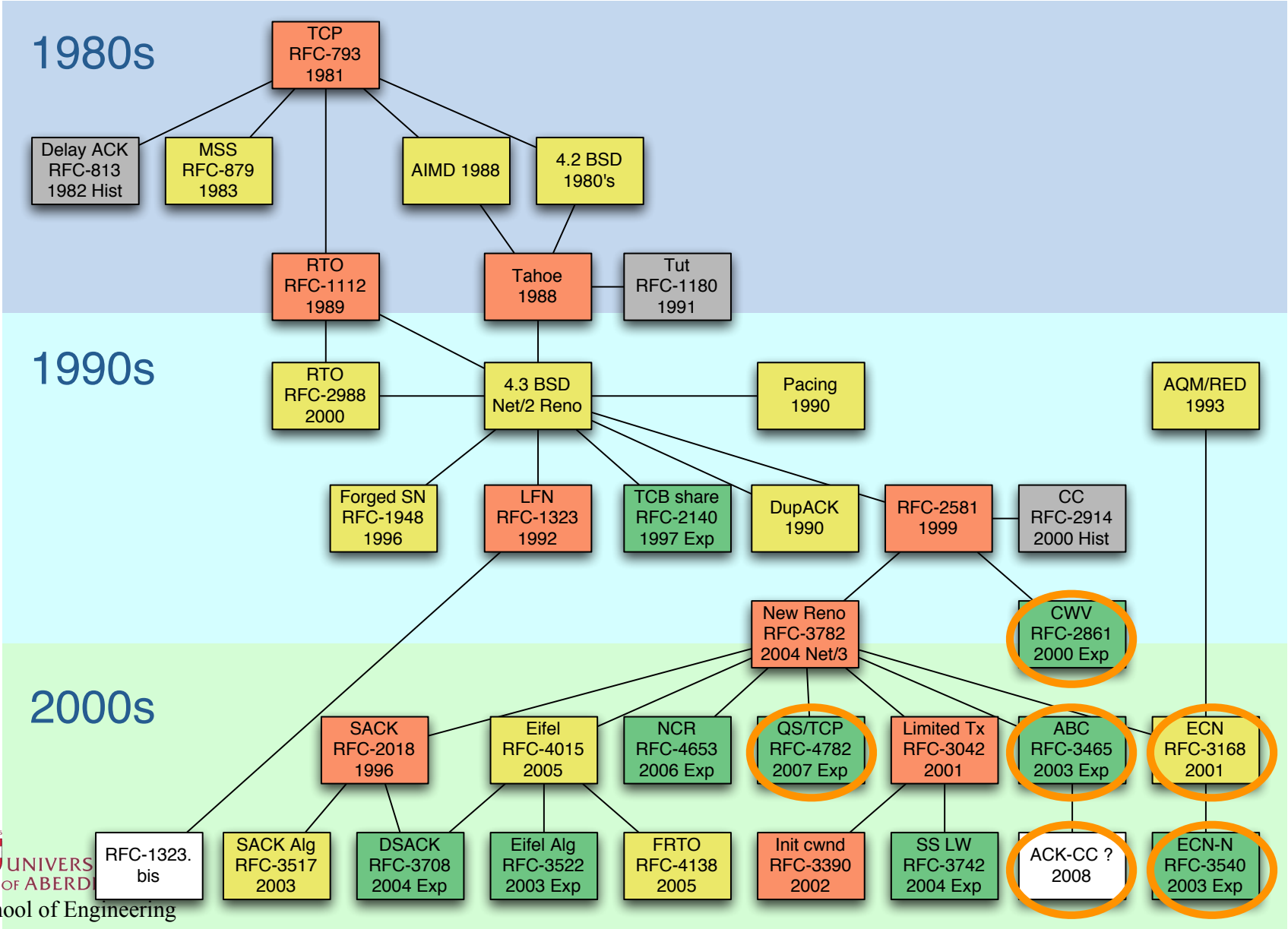OF ABERDEEN
School of Engineering

Choosing a safe *sending* rate

Internet meltdown - Late 1980's

V. Jacobson, "Congestion Avoidance and Control",
in Proc. ACM SIGCOMM '88, Stanford, USA, August 1988.

Probe Segments

ACKs — Indication of Current Rate

ECN — Indication of Congestion

QuickStart — Indication of Non-congestion

DSCP (DiffServ)

RSVP — QoS (request for policy)

Challenge - can we find the right "signals"?

A TCP roadmap

Transport Design for the Internet at UoA

Transport Challenges

Increasing heterogeneity (10 kbps -> 10 Gbps+)

    TCP designed for 10-1000 kbps...

Increasing variety of traffic (multimedia, chat, games...)

    TCP designed for telnet, ftp, ...

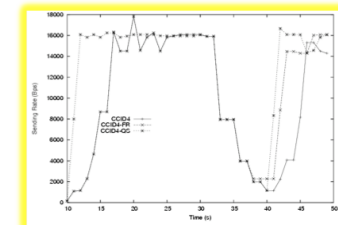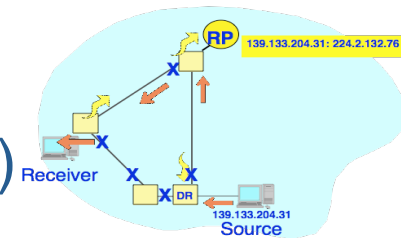Increasing variety of path (mobility, multi-homing, ...)

Different Transport Requirements

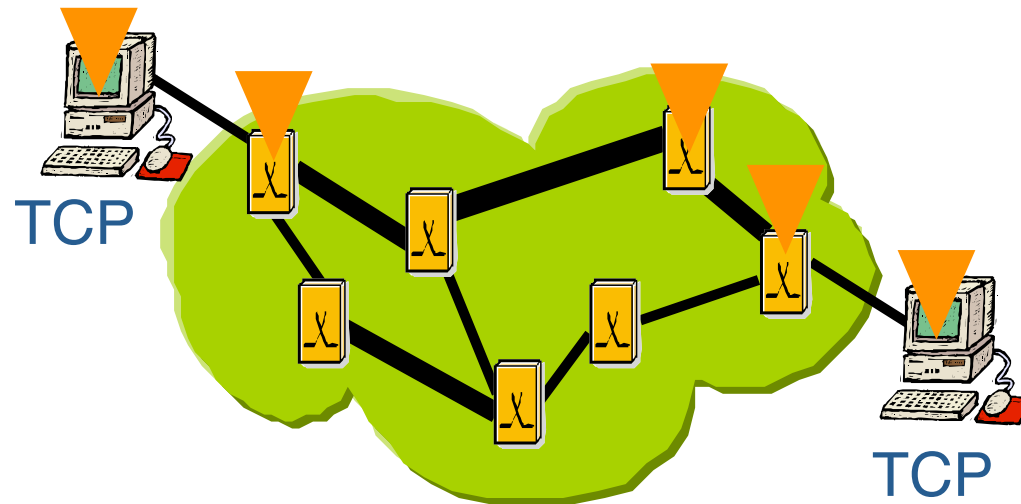Multicast Multimedia (UDP-Lite, and DCCP)

Reliable Multicast Transport (UDP, UDP-Lite)

Delay-Tolerating Transport (DTN, et al)

Multicast Routing Deployment (not transport)

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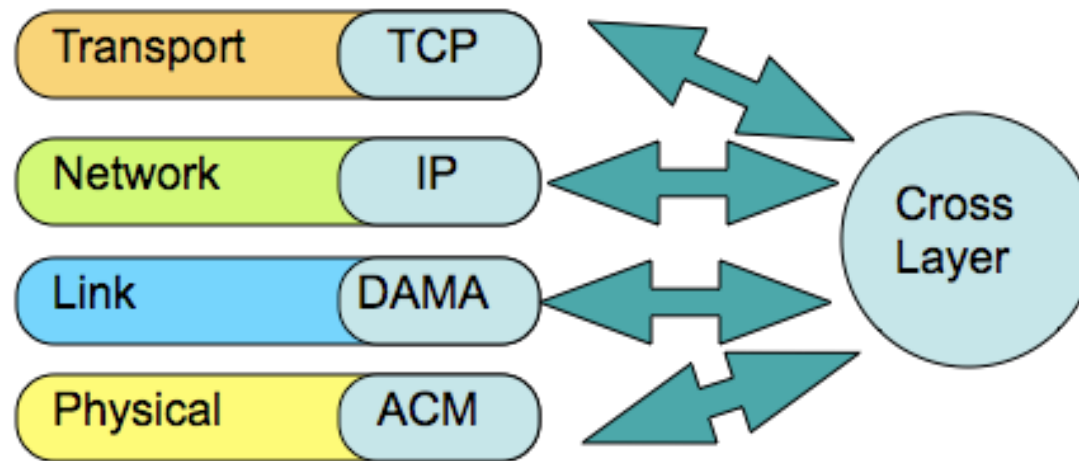# A Clean-Slate Design or Evolution?

TCP

TCP

Two schools of thought:

• Smarter multi-service networks (clean-slate)

• A quiet revolution of network and host stacks

The most important thing is that the solution is deployed
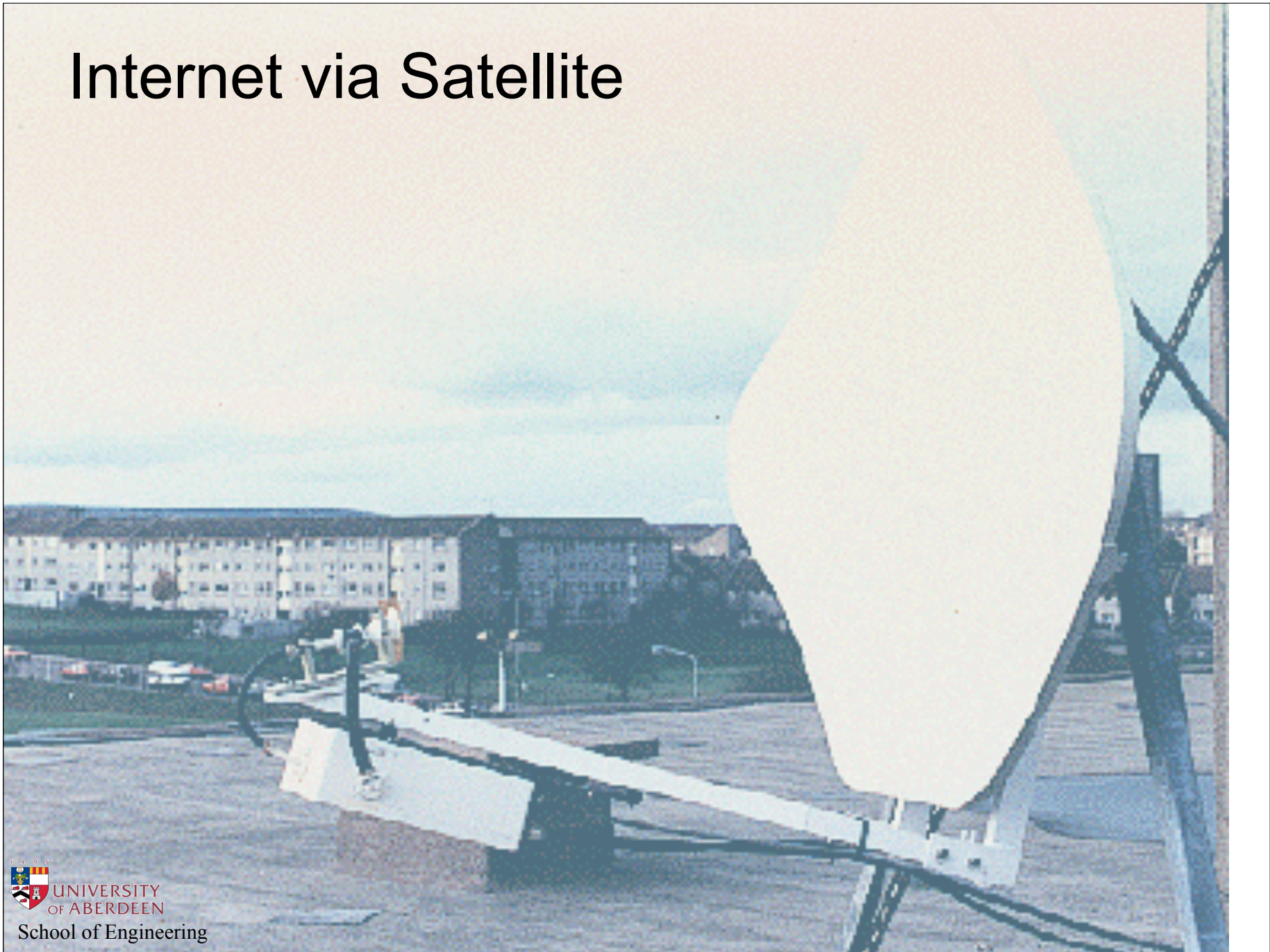
That in itself is hard!

Cross-Layer Design

Cross-layer interactions between protocol layers

Evaluating impact on L4 of decisions at L1, L2, L3

Optimizing use of **radio** resource

Improving ability to operate across **variable** paths

A non-trivial **architecture** and API issue

Internet via Satellite

Communications Satellites

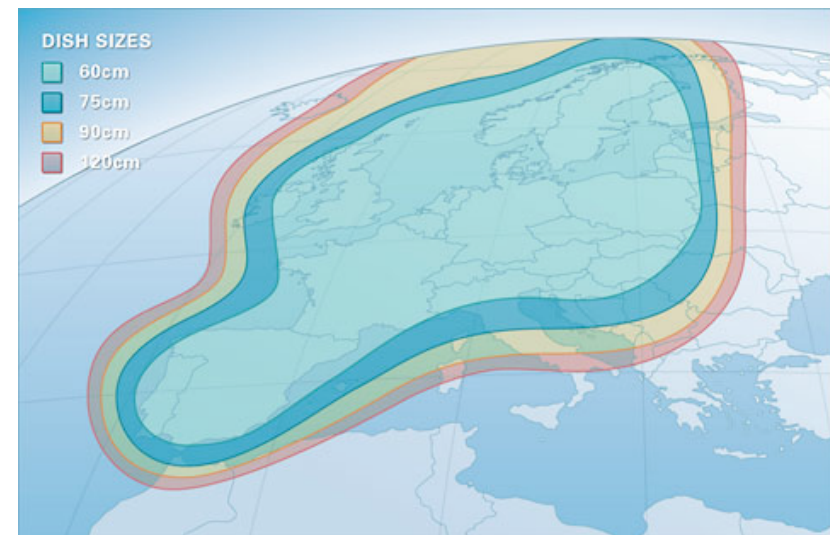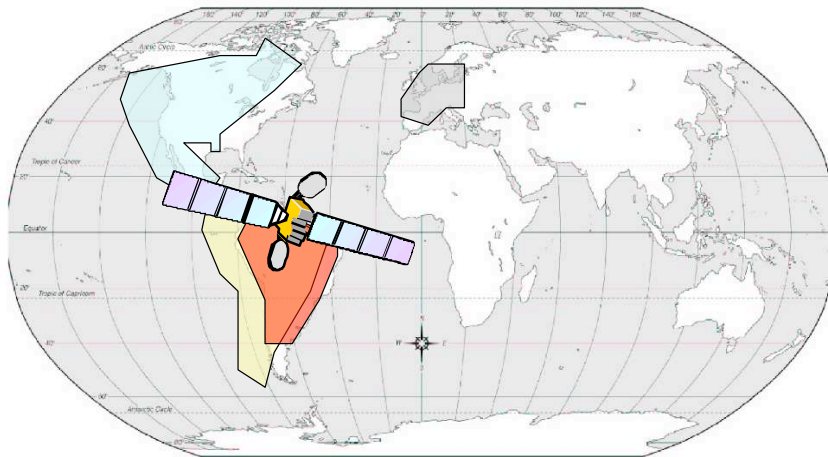Primary platform for **wide-area multicast and broadcast**

Satellites offer a **reliable and dependable** service

Corporate networking

Rapid deployment

Efficient overlay network for terrestrial wireless

Mobile user

Digital Divide Bandwidth Challenges

Not everyone is equal...

Increasing network heterogeneity

- 10 kbps -> 10 Gbps+

- Large diversity of applications

Big danger that people get left behind
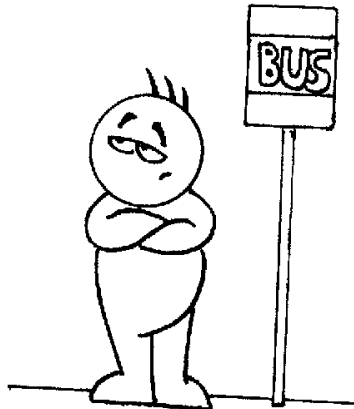
- "traditional" uses by SMEs

- "rural" communities lag in capacity

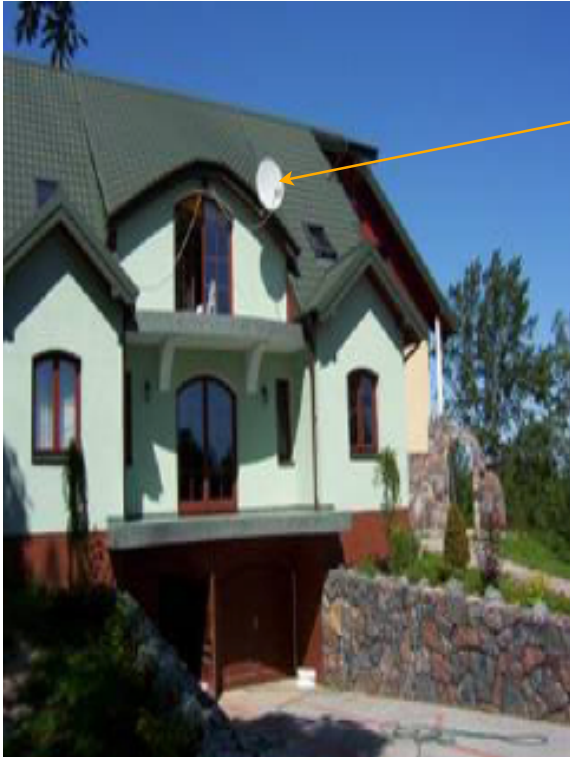**Challenges to deliver bandwidth**

- Rapid deployment scenarios

- Beyond reach of fibre

- Mobile solutions

Rural-Urban divide

Broadband were there is none
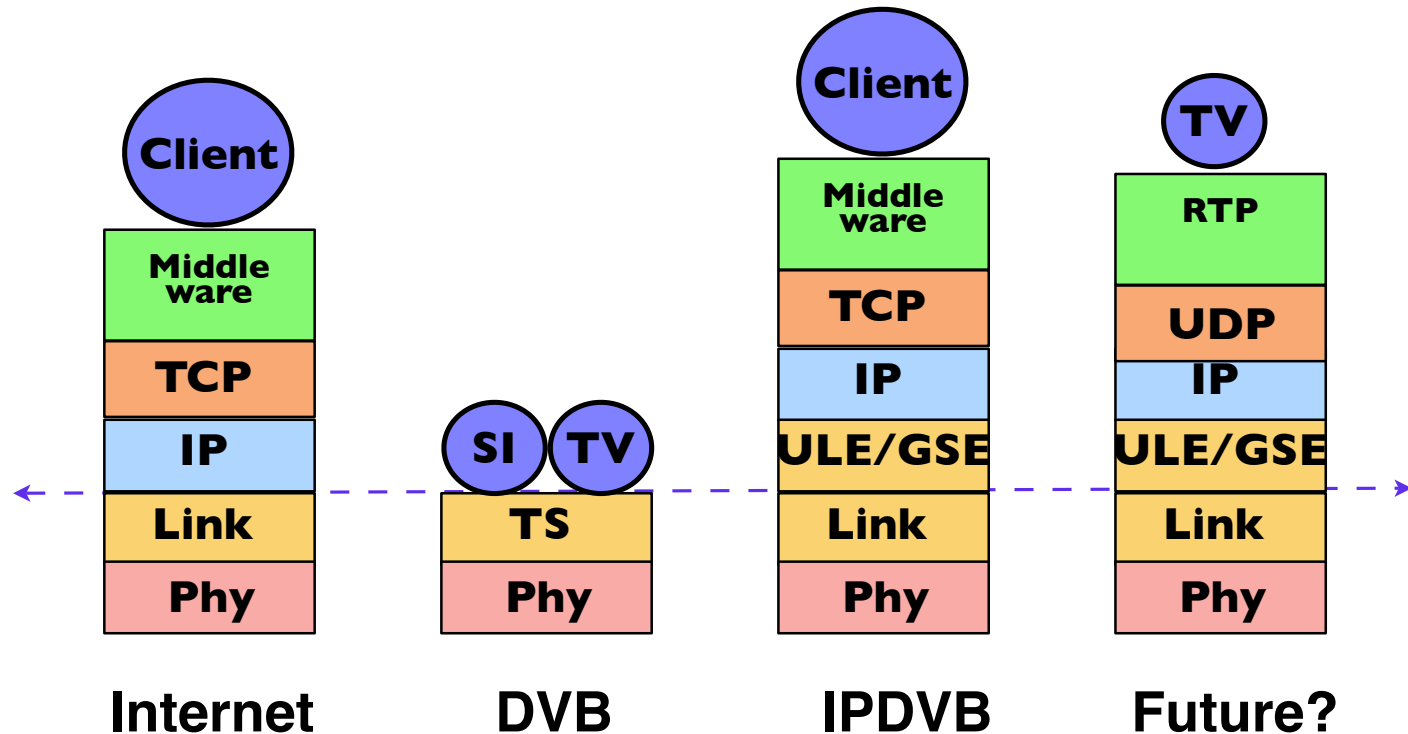

Satellite
Internet

WiFi AP

DVB-RCS Standard
Two-Way Satellite IP connectivity
Anywhere in Europe
e.g. SatSix, Domino, Codis

Shared access 10-50
subscribers per terminal

IP over DVB Evolution

Internet **DVB** **IPDVB** **Future?**

TV & Internet Convergence

Paving the way to all-IP systems

Control plane (SI) and compression still to be done!

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IP over DVB at Aberdeen

Some Aberdeen "firsts"

First IP VSAT network (ESA CODE)

Pioneered IP/DVB

First IPv6/DVB demonstration to EC

Design of GSE for DVB-x2

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Satellite Payload Trends
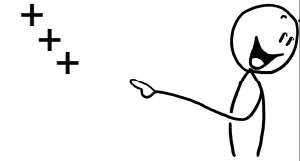
Higher frequency bands

Large antennas:

      Multi-spotbeam & beam-forming

      Reconfigurable payloads

New satellites: more or less powerful (nano satellites)

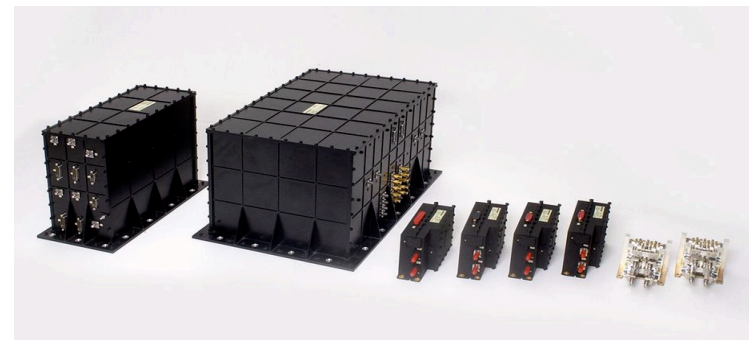   Long-life satellites (able to re-use for new services)
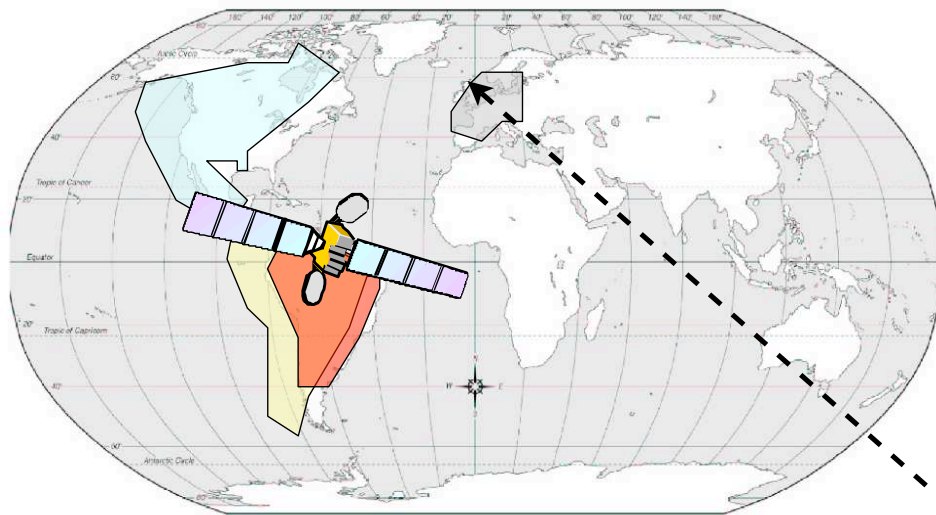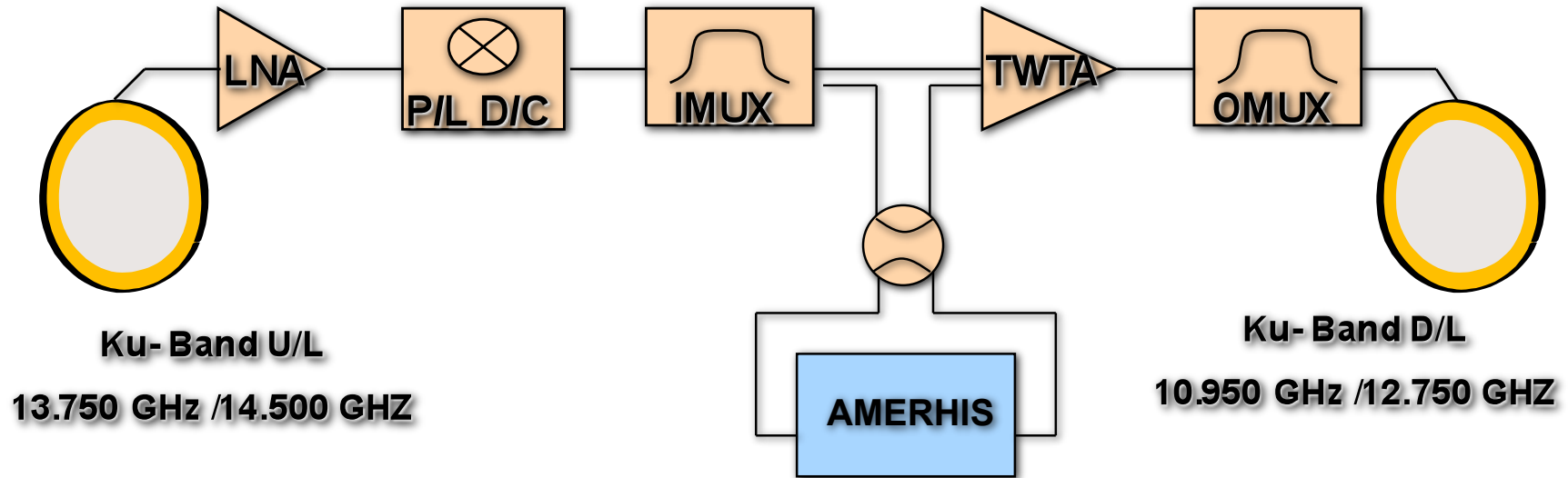
      High-rate inter-satellite links

      On-board Software-defined radio

      On-board (IP or IP-oriented) routing

Amheris - A satellite-router/switch
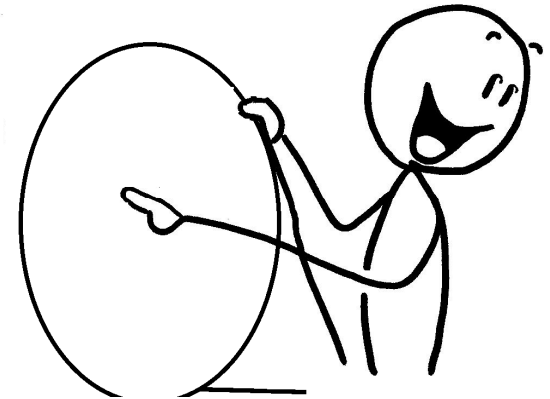
Aberdeen Amheris Receiver
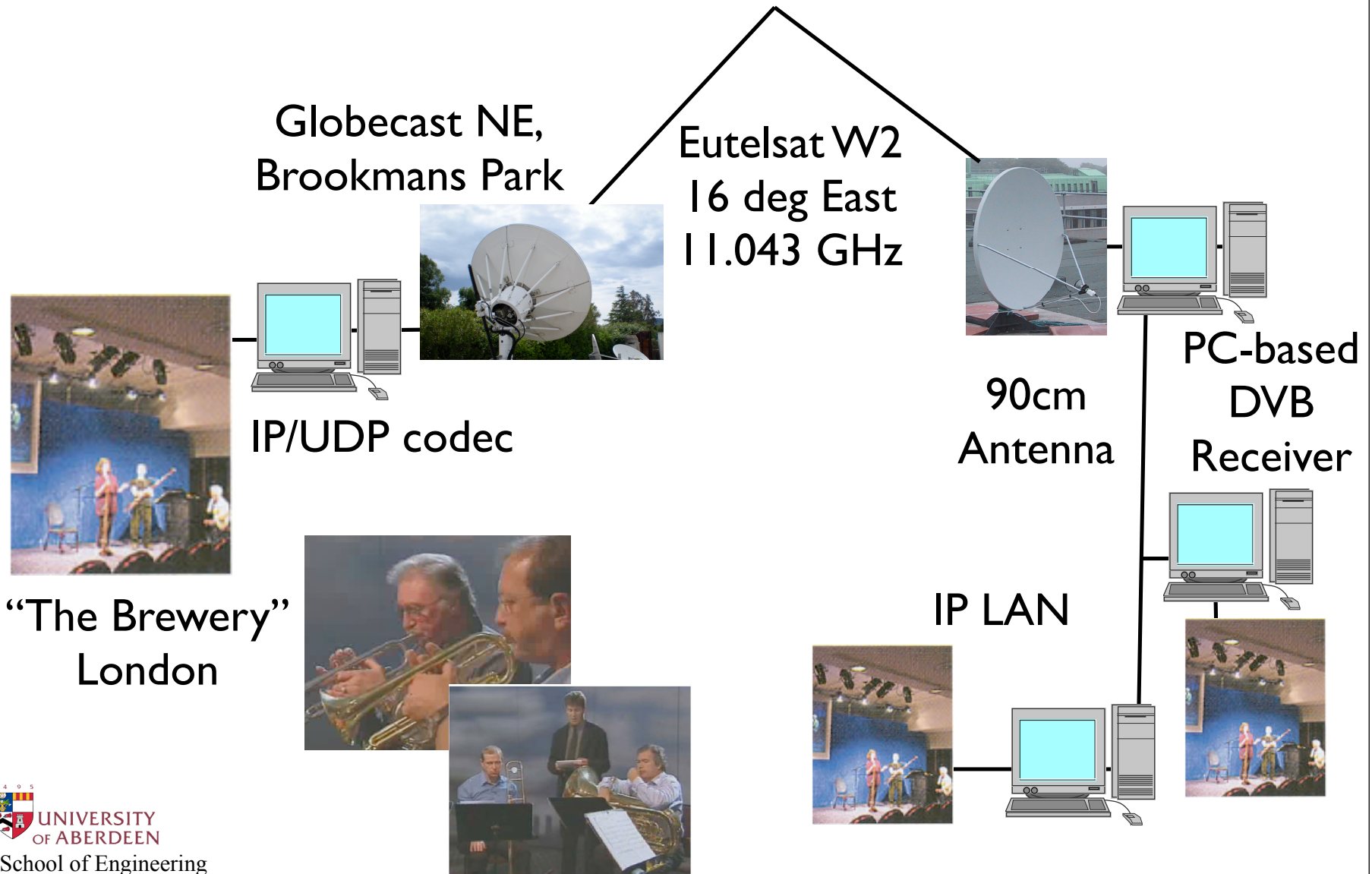
Satellite Terminal Trends

Key techniques:

Adaptive Coding and Modulation (ACM)

Intelligent resource management

Small, low-cost (tracking) terminals

Higher frequencies (Ka-Band), more capacity

Methods to significantly reduce interference

All IP-layer designs

Reduce transmission costs

Increase efficiency, flexibility and dependability

Trials and Testbeds

Globecast NE, Brookmans Park

Eutelsat W2
16 deg East
11.043 GHz

IP/UDP codec

"The Brewery" London

90cm Antenna

PC-based DVB Receiver

IP LAN

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SatNEx

Advancing European knowledge in satellite comms

Coordinated European SatCom research

Durable integration:

  24 European research centres

  10 countries

  Common comms platform

Sixth Framework Programme

SatNEx Platform

Star architecture, 24 sites across Europe

TV, conferencing, remote seminars, and lectures

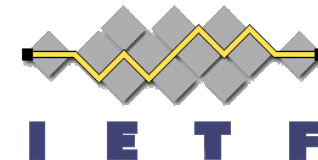3.4m uplink operated by FhI FOKUSDVB-S)

IPv4 MPE multicast gateway

Codian MCU

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Information Society
Technologies

SatNEx

Standards Development

European Telecoms Standards Institute

Contribute to ETSI/BSM, and DVB

IETF Standards developed at UoA

Unidirectional Lightweight Encapsulation (ULE/GSE)
(RFC4326, RFC5153, RFC4259, RFC4947)

Internet Transport
(RFC3366, RFC3819,RFC3449,RFC3828,RFC5097, RFC5405)

Questions and Answers