Internet Daemons

Network Optimization & Communication Rights

Who am I?

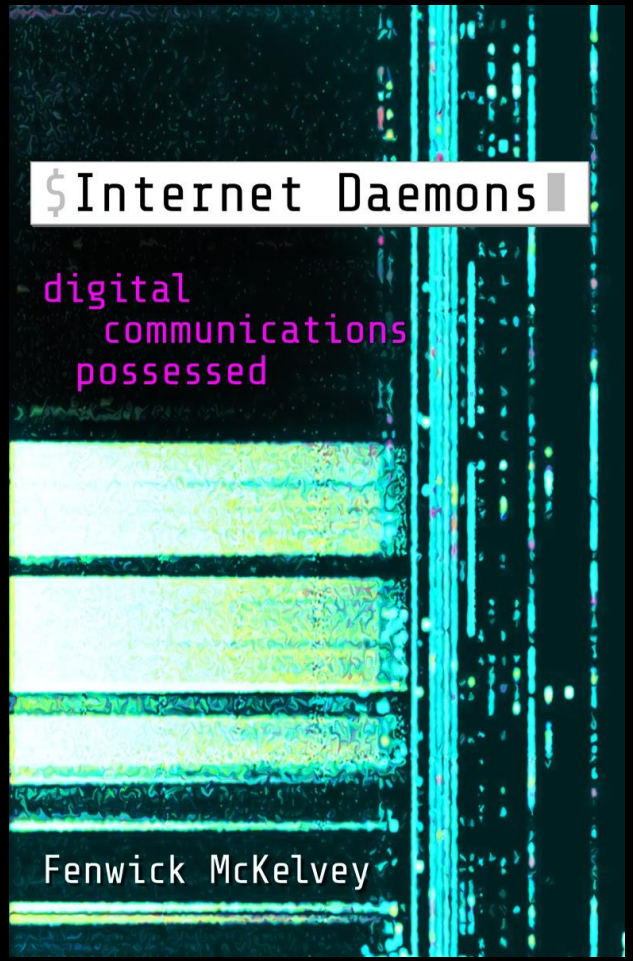
Associate professor in Information and Communication Technology Studies at Concordia University in Montreal, Canada

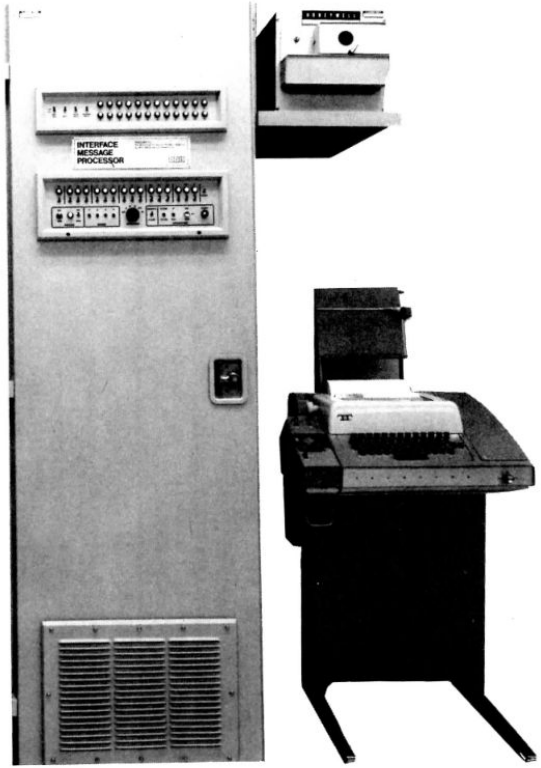
Research focuses on the politics and policy involving algorithms and software as infrastructure

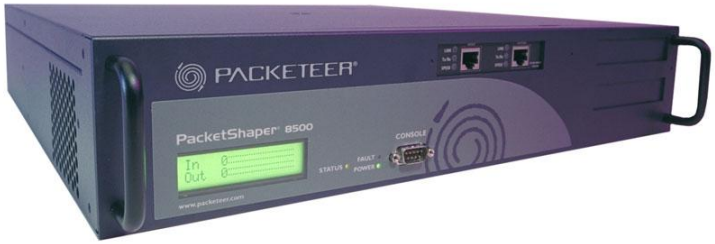
Active policy engagement focused on telecommunications, privacy, artificial intelligence, and disinformation

Open Access

The book is open access thanks to the support of Concordia University




INTERFACE
MESSAGE
PROCESSOR


PACKETEER
PacketShaper 8500
In
Out
CONSOLE
STATUS
FAULT
POWER

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YouTube, Netflix Begin Slowing Services to Handle Coronavirus Strain

The internet should generally hold up under the load of a pandemic. But content providers say they're taking extra precautions just to make sure.

By Karl Bode

Mar 25 2020, 3:04pm

IMAGE: THOMAS TRUTSCHEL/PHOTOTHEK VIA GETTY IMAGES

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Experts Say the Internet Will Mostly Stay Online During Coronavirus Pandemic

Home users may see problems due to neglected U.S. infrastructure, but the internet overall should be able to weather the storm, experts suggest.

By Karl Bode

Mar 19 2020, 8:00am Share Tweet Snap

ISPs use a number of modern network technologies to handle congestion in real time, often letting them intelligently and automatically “deprioritize” the traffic of heavy users in overloaded areas.

Bandwidth management is a problem without a good solution

Two Moments in Internet History

1. Donald Davies and British contributions to packet switching

2. ComCast and the origins of contemporary congestion management

Case One: Donald Davies

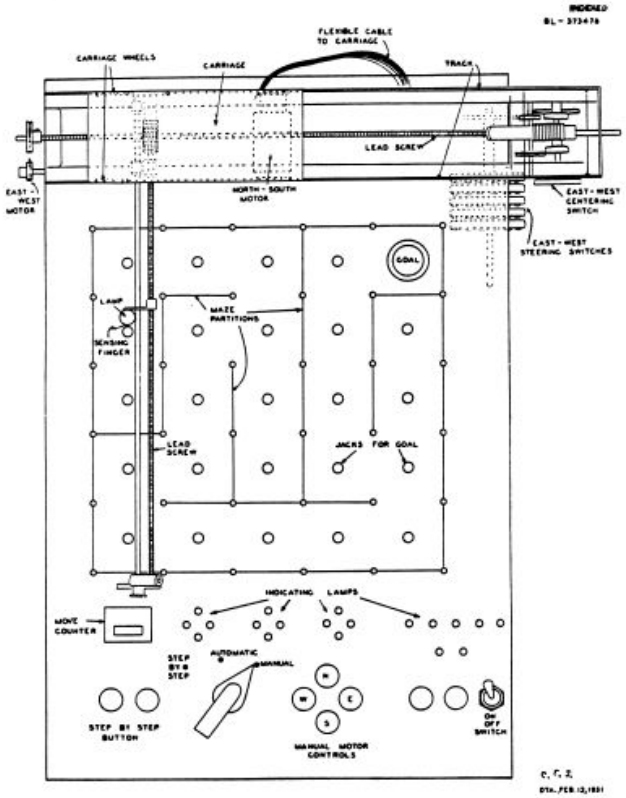
A common network has to be a shared network

Donald Davies and packet-switching in 1966

Table I

BIBLIOGRAPHY OF SEVERAL DISTRIBUTED NETWORK ROUTING DOCTRINES

	Date	Designation	Principal Investigator	Published Reference
1	1952	Mouse in a Maze	C. Shannon	C. Shannon in Cybernetics, H. von Foerster, Editor, Transactions of Eighth Conference, Josiah Macy, Jr., Foundation, New York, 1952, p. 173.
2	1958	Barnstable	D. A. Huffman C. E. Shannon E. N. Gilbert H. P. Galliher E. Reilly	Final Report, Barnstable Summer Study, "A Study of Communications Theory Applied to Military Communications Systems (U)," Confidential, MIT Research Laboratory for Electronics, Cambridge, Massachusetts, October 30, 1958, p. 117.
3	1955	Voice Relay	F. R. Collbohm	F. R. Eldridge, J. B. Carne, H. A. Shapiro, B. Holfer, "Vulnerability of Landline Communications for SAC and ADC (U)," The RAND Corporation, RM-1774, October 1, 1956, p. 67.
4	1957	Time-of-Arrival	F. Yates	Paul Baran and Frank Yates, "A Non-Synchronous Digital Data Link Transmission System Using Randomly Surviving Relay Points," The RAND Corporation, May 25, 1960.
5	1958	Random Repeated Relay	J. Carne	None
6	1959	Directional Relay	T. G. Williams	William G. Todd, "A National Survival Communications System," Rome Air Development Center, Technical Memorandum RCU-TM-59-1, February 1959.
7	1959	Synchronous Flooding	P. Baran	Paul Baran and Robert Hammerly, "A Verified Point of Origin Synchronous Digital Data Link Transmission System Using Randomly Surviving Relay Points," The RAND Corporation, May 25, 1960.
8	1959	Saturation Signaling	G. Svala	Gunnar Svala, "Saturation Signalling and Switching System," North Electric Company, Galion, Ohio, 1959.
9	1960	Two-Phase	J. Bower	Patent disclosure.
10	1960	Hot-Potato Routing	P. Baran	Current series.
11	1961	Tessellated Network	L. J. Craig	L. J. Craig and I. S. Reed, "Overlapping Tessellated Communications Networks," The RAND Corporation, P-2359, June 13, 1961.



The Routing Problem of Packet Switching

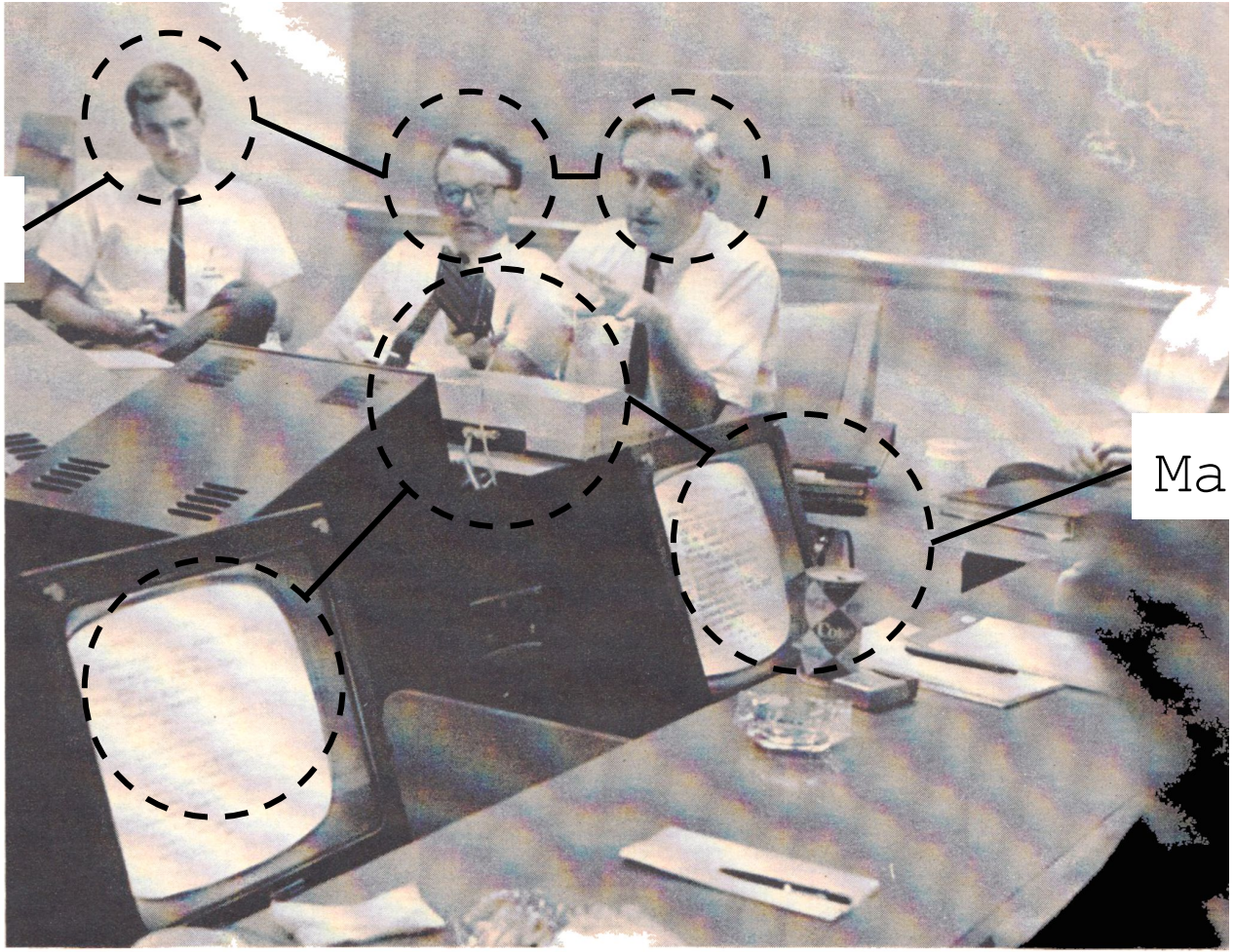
Time sharing

Digital communication at Project MAC (CTSS) circa 1965

Time-sharing computer systems were both experiments in computing and communication

October 1967—A project meeting held through a computer at Stanford Research Institute

Users



Machines

October 1967—A project meeting held through a computer at Stanford Research Institute

Multi-user as common carrier

Davies notes that time sharing systems, specifically the Dartmouth Time Sharing System, have “different kinds of users, for example computers offering real-time services and keyboard / printers for human use, in a way which allows them all to intercommunicate usefully.”

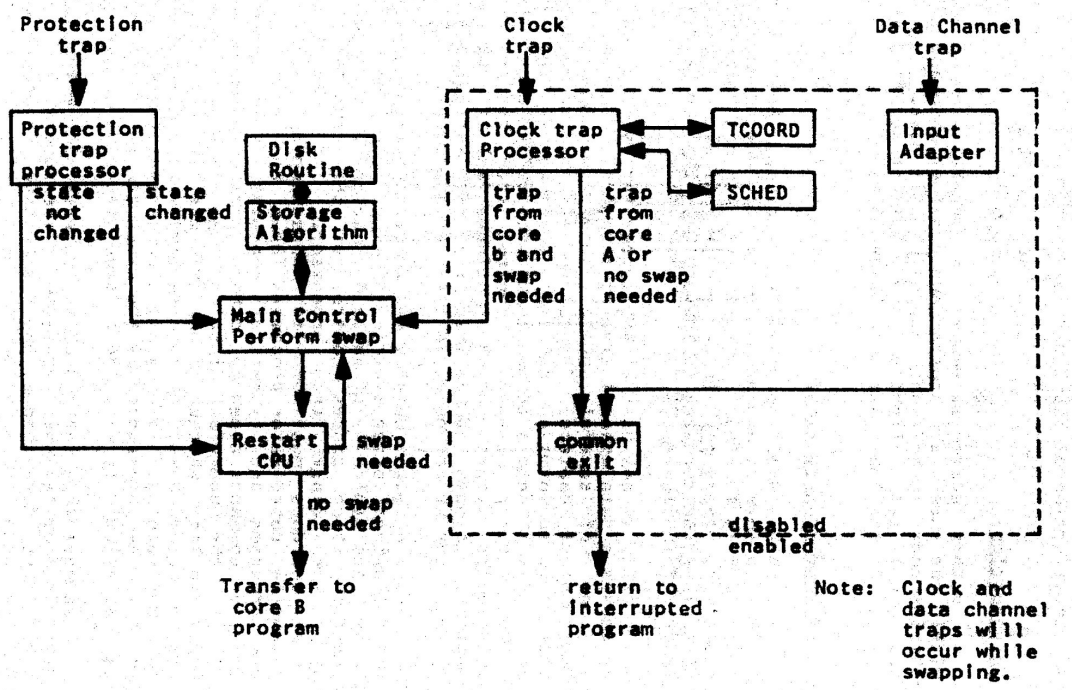


Figure 2.1 -- CTSS supervisor, overall flow.

An early optimizer: the CTSS supervisor

Packets

Translates time-sharing from a model of computer resource sharing to a design for a new digital communication infrastructure

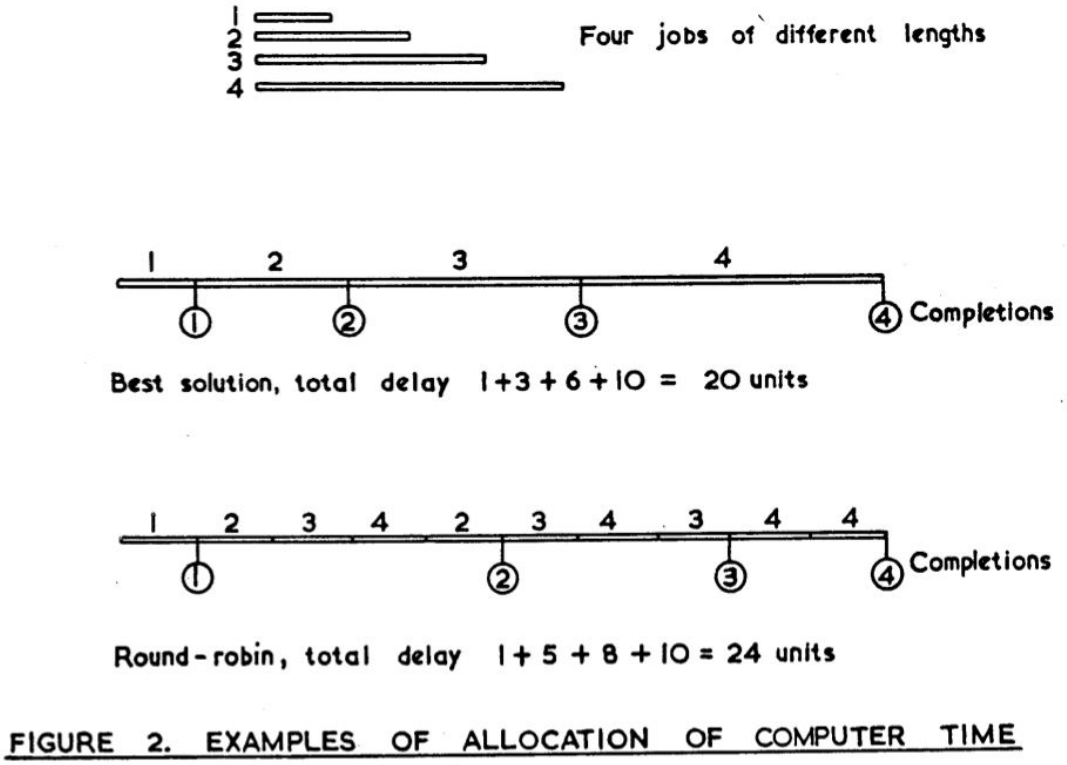


FIGURE 2. EXAMPLES OF ALLOCATION OF COMPUTER TIME

First ACM Symposium on Operating Systems Principles

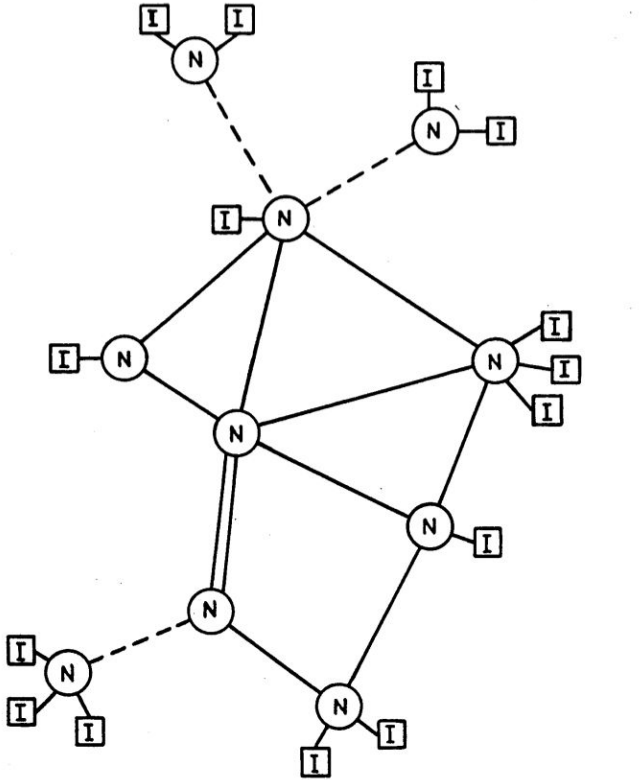


FIGURE 3. A HYPOTHETICAL COMMUNICATION NETWORK

Optimally allocating network resources like time-sharing

The Optimization Problem

According to Leonard Kleinrock, it involved “the problem of allocating network resources to the demands placed upon those resources by the user population.” It was a **technical problem** distinct “from the ‘softer’ social, political, legal and ecological problems”.

An Isarithmic network?

“Since data carrying packets must be created and destroyed, the balance is kept by using empty packets... When data are ready to enter the network, an empty packet must be found and replaced by a data carrying packet.”

-Donald Davies, 1972

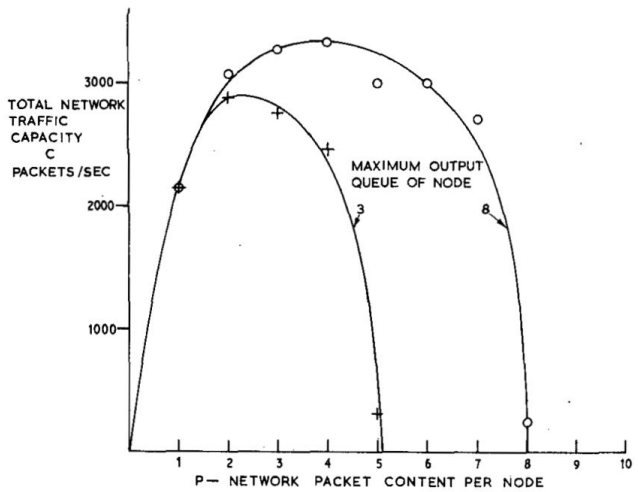


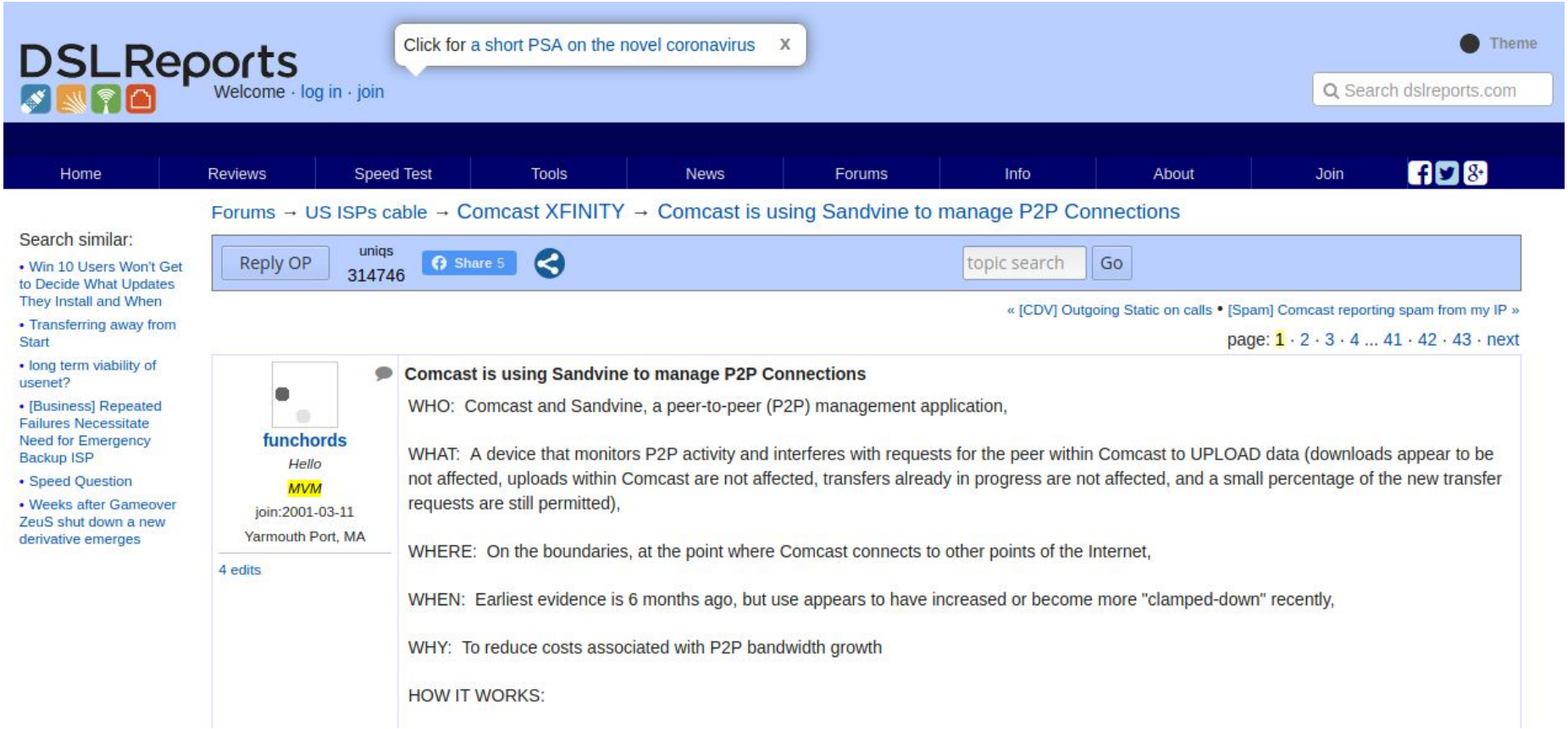
Fig. 1. Characteristic of an isarithmic network (with 18 nodes).

Those plotted here were based on an intermediate stage of development. We did not investigate the precise mechanism of congestion or in particular what caused the complete stoppage of flow at a certain value of P. By better design the saturation can be pushed to higher values of P and the optimum to higher values of C.

A common network does not have a common purpose

Case Two: Comcast

Network neutrality did not solve the network management



Robb Topolski uncovers Comcast slowing down P2P in 2007

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued January 8, 2010 Decided April 6, 2010

No. 08-1291

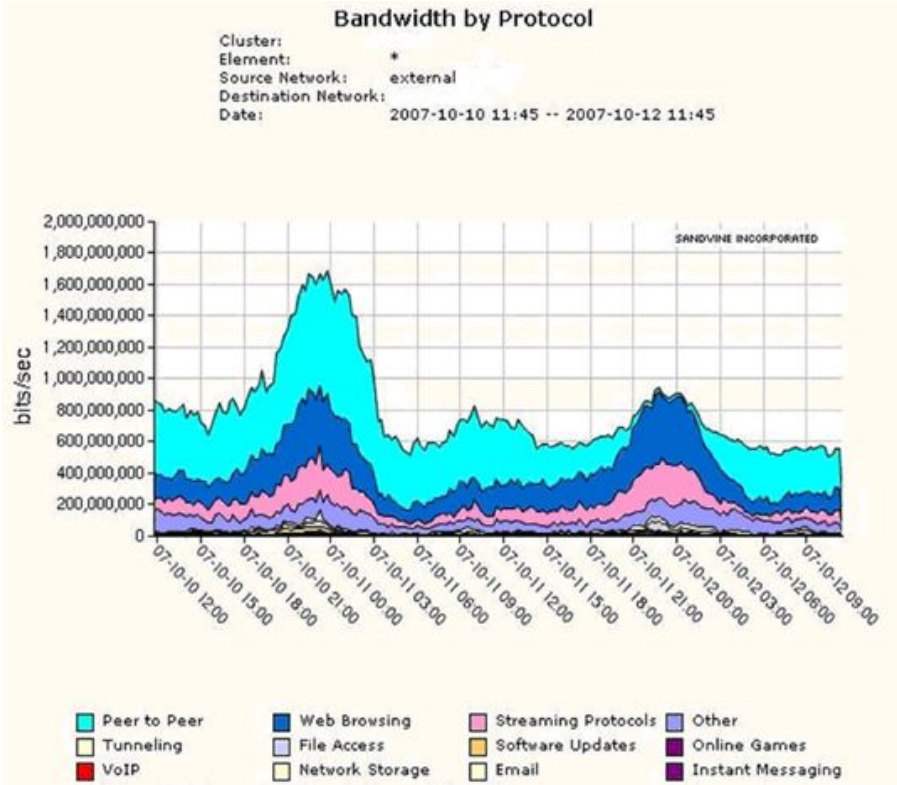
COMCAST CORPORATION,
PETITIONER

v.

FEDERAL COMMUNICATIONS COMMISSION AND UNITED STATES OF AMERICA,
RESPONDENTS

NBC UNIVERSAL, ET AL.,
INTERVENORS

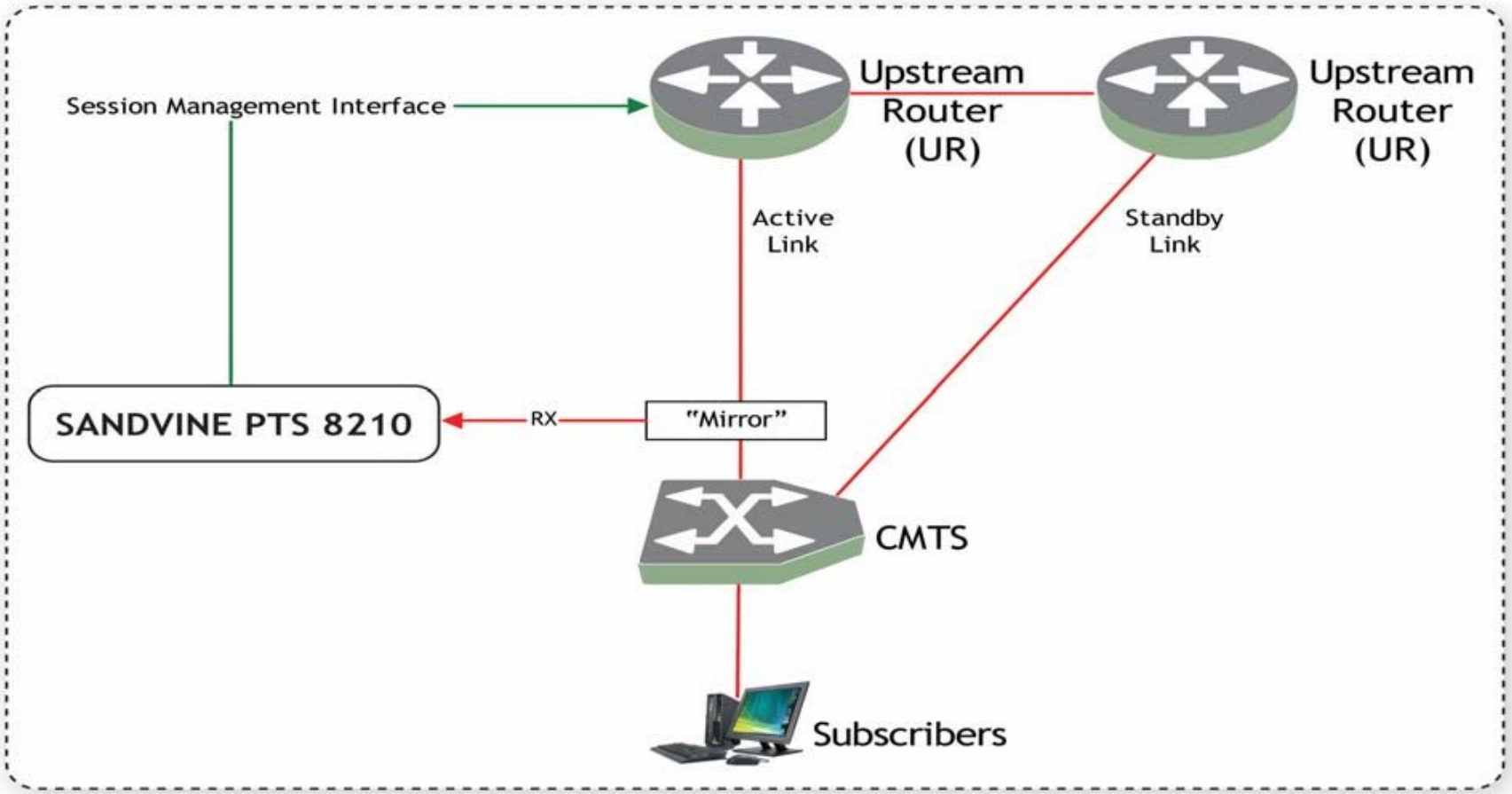
On Petition for Review of an Order
of the Federal Communications Commission

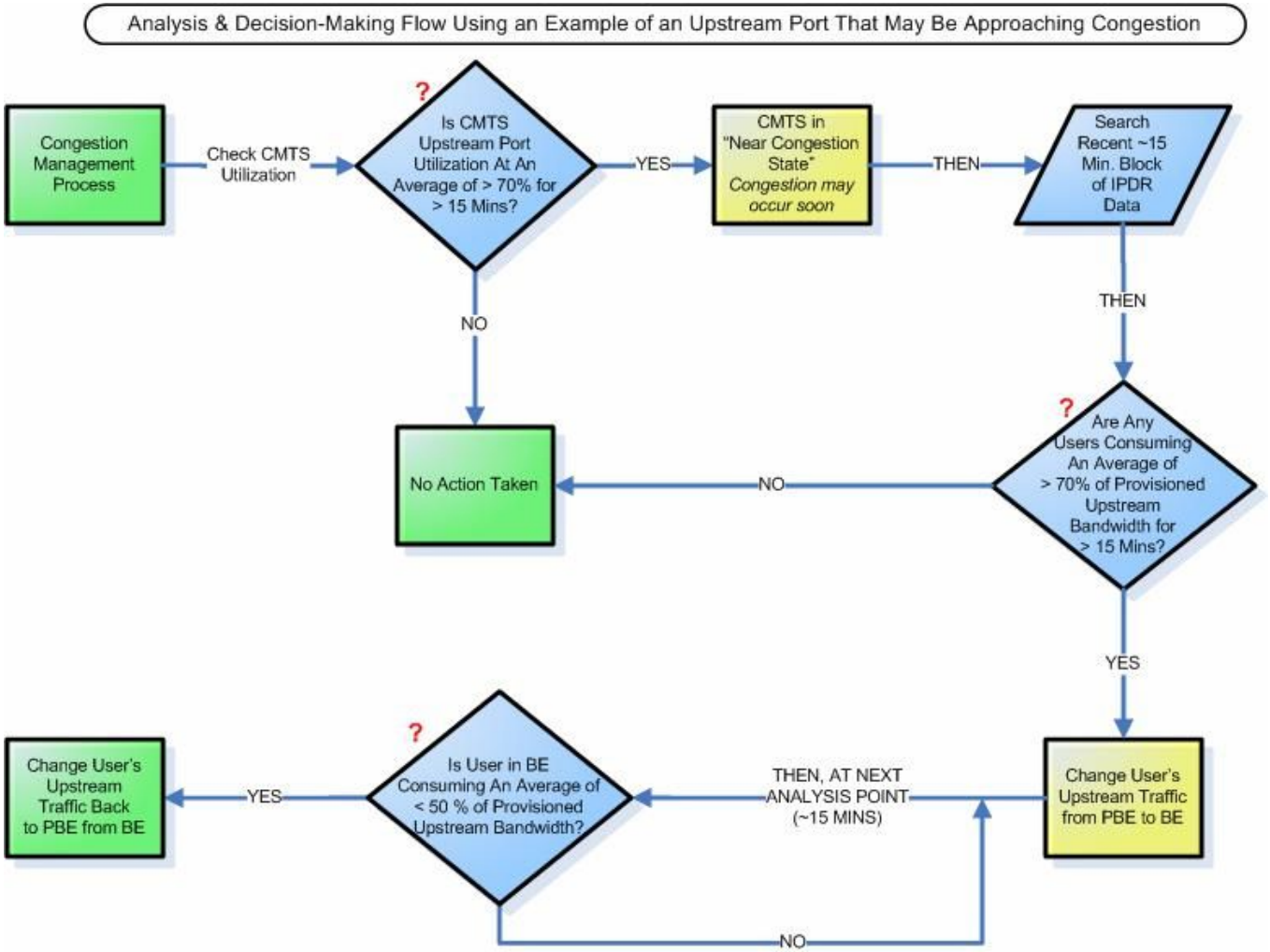


Managing rise in peer-to-peer file sharing


PTS 14000
sandvine
Slot 1
Slot 2
Console 2

Comcast Optical Transport Node (OTN)




Analysis & Decision-Making Flow Using an Example of an Upstream Port That May Be Approaching Congestion
Congestion Management Process
Check CMTS Utilization
Is CMTS Upstream Port Utilization At An Average of > 70% for > 15 Mins?
YES
CMTS in "Near Congestion State" Congestion may occur soon
THEN
Search Recent ~15 Min. Block of IPDR Data
THEN
NO
No Action Taken
Are Any Users Consuming An Average of > 70% of Provisioned Upstream Bandwidth for > 15 Mins?
NO
YES
Change User's Upstream Traffic from PBE to BE
THEN, AT NEXT ANALYSIS POINT (~15 MINS)
Is User in BE Consuming An Average of < 50 % of Provisioned Upstream Bandwidth?
YES
Change User's Upstream Traffic Back to PBE from BE
NO

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Managing bandwidth management is a governance issue

Implications

These problems may get worse as...

Automation reduces explainability and oversight of network management

Policy forums become captured or politicized

New technologies require more complex network management

Bandwidth management is a problem without a good solution

How could human rights be that solution?

Thank You

Algorithmic Media Observatory

Machine Agencies
Milieux Institute

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AMO-OMA.CA
Concordia University

Select Publications

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