

*Living in an Imperfect World –
Disasters and Service Interruptions
Large and Small*

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5:00 pm – 5:50 pm
Room 309**

**Fall 1995 US DECUS Symposium
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San Francisco, California**

"Sooner or later, it was bound to happen. On June 30, 1908, Moscow escaped destruction by 3 hours and 4,000 km – a margin invisibly small by the standards of the universe. On February 12, 1947, another Russian city had a still narrower escape, when the second great meteorite of the 20th century detonated less than 400 kilometers from Vladivostok, with an explosion rivaling that of the newly invented uranium bomb.

In those days, there was nothing that men could do to protect themselves against the last random shots in the cosmic bombardment that had once scarred the face of the Moon. The meteorites of 1908 and 1947 had struck uninhabited wilderness; but by the end of the twenty-first century, there was no region left on Earth that could be safely used for celestial target practice. The human race had spread from pole to pole. And so, inevitably ...

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At 0946 GMT on the morning of September 11 in the exceptionally beautiful summer of the year 2077, most of the inhabitants of Europe saw a dazzling fireball appear in the eastern sky. Within seconds it was brighter than the Sun, and as it moved across the heavens - at first in utter silence - it left behind it a churning column of dust and smoke.

Somewhere above Austria, it began to disintegrate, producing a series of concussions so violent that more than a million people had their hearing permanently damaged. They were the lucky ones.

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NOTES

Moving at 50 kilometers a second, a thousand tons of rock and metal impacted on the plains of northern Italy, destroying in a few flaming moments the labor of centuries. The cities of Padua and Verona were wiped from the face of the Earth; and the last glories of Venice sank forever beneath the sea as the waters of the Adriatic came thundering landward after the hammer blow from space."

— *Rendezvous with Rama*
Arthur Clarke
copyright 1973

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Or,
if you prefer the real world –
World Trade Center,
New York, New York
12:18 EST, 2/28/93

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***Chicago "Loop" District
Spring 1992***

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50 years ago:

***Power – 1 week outage not
unusual***

Telephone – rarely present

Computers – non-existent

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NOTES

40 years ago:

***Power – 1 week outage not
unusual***

***Telephone – 1 week outage
not fatal***

Computers – non-existent

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30 years ago:

Power – 1 day outage unusual

***Telephone – outage
inconvenient***

Computers – rare

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NOTES

20 years ago:

***Power – 1 day outage unusual
Telephone – important, outage
impairs normal business
Computers – common, but not
mission critical in most
businesses***

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10 years ago:

***Power – 1 hour outage unusual
Telephone – mission critical
Computers – any interruption
impairs business;
Arrival of PC***

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Today

***Power – "Normal" outage less
than 5 minutes***

***Telephone – absolutely vital
for most businesses***

***Computers – mission critical,
any unavailability has
severe impact***

***Networks – absolutely vital
to all business operations***

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Today:

PCs/Workstations

Servers/Superminicomputers

PBX/Phones

LANs/WANs

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Today:

No phones

No E-mail

No Voicemail

No Customer Information

No Inventory

No Charge Cards

No Databases

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***Service interruptions,
like Death & Taxes,
are a Fact of Life***

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The Issue:

Computers inspire visions of omnipotence. The reality is quite different.

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When designing any type of network your control over the network infrastructure is limited

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Common Hazards

***Custodial personnel
Trades personnel
Common carriers***

Acts of Clod

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Common Hazards (Cont'd)

Weather

Earthquakes

Floods

Auto, Rail, Plane Incidents

Structural failure

Acts of God

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NOTES

*Any hazard, in an instant,
can turn your perfectly
functioning high-speed
network into a useless
collection of inert copper
wire and glass fiber*

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*Hardware and
Human Factors:*

**Live Wire Cut – AT&T 1/4/91
Power outage at NYC**

**Switching Center
– AT&T 9/17/91**

Hinsdale Fire

– Illinois Bell 5/9/88

Second Avenue Fire

– NY Bell, 2/27/75

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Software Failure

***Arpanet Naturally Occuring Virus
– 10/27/80***

***Switch Failures in
three major cities
– DSC 6/91***

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Conclusion:

There are tigers in the woods!

***The world is a nasty place, you
can get hurt!***

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NOTES

***Amateurs study tactics,
Professionals study logistics.***

– Red Storm Rising
Tom Clancy
copyright 1986

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Lesson from World History

***Supply lines are your umbilical
cord. England, Japan, Hawaii,
North Africa. Long Supply lines
are fatal***

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*The longer your umbilical cord
– the greater the danger*

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**99% uptime =
 $n * .01$ probability of failure**

**where there are n links
in the chain**

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Your PC is:

***connected to the LAN
3 servers
bridged to 4 other offices
each servers has its own
connections***

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*Very quickly, in realtime
terms, your data becomes
unreachable*

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Possible Solutions:

***Backup Connectivity (partial)
Realtime independence***

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Backup Connectivity

***"Last Mile" problem
The Data still exists,
yet is unreachable.***

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*Backup of Data
on other systems
Avoids loss of data.
No answer to "Last Mile"*

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Last Mile Problem

Most connections generally go through a single routing for the last mile (or kilometer). A single accident has a high probability of disrupting all paths.

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Solution to Last Mile Problem

***Data required in realtime
must be in the local facility,
within the campus, building,
floor, or workgroup***

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Example Applications: Electronic Mail

***OpenVMS Mail normally
requires the local node
and remote node online,
and a connection path
between them to send a
message.***

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Drawback

If any link in the chain is down, you cannot send Electronic mail. In a large network, some link or node is always out of service.

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Alternate:

***Store and Forward Systems
e.g. Internet Mail***

Mail program spools message into system spool directory (mailbags) for transmission (possible later) to next link in chain.

Mail Exchangers

Process continues until destination

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Conclusion:

Store and Forward permits even severe outages to disappear from outside view. Front office requirements for long distance online connections MUST be viewed in context.

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Principles:

Constant Online Access

– Local Data

Occasional, non-realtime Access

– Remote via deferred

Store and Forward facilities

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Network component failures are inevitable. Planning must take these failures into account when configuring the network.

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It is possible to provide extremely high levels of availability IF proper precautions are taken.

*However,
100%, 7 day a week,
24 hour a day availability
for every network
component is unrealistic
and not cost effective*

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Questions?

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