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

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"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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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-existant

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40 years ago:

> **Power – 1 week outage not unusual**
> **Telephone – 1 week outage not fatal**
> **Computers – non-existant**

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30 years ago:

> **Power – 1 day outage unusual**
> **Telephone – outage inconvenient**
> **Computers – rare**

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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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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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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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