TOW2013
e-Transfer Operations

MIT Haystack Observatory

May 6th – 9th 2013

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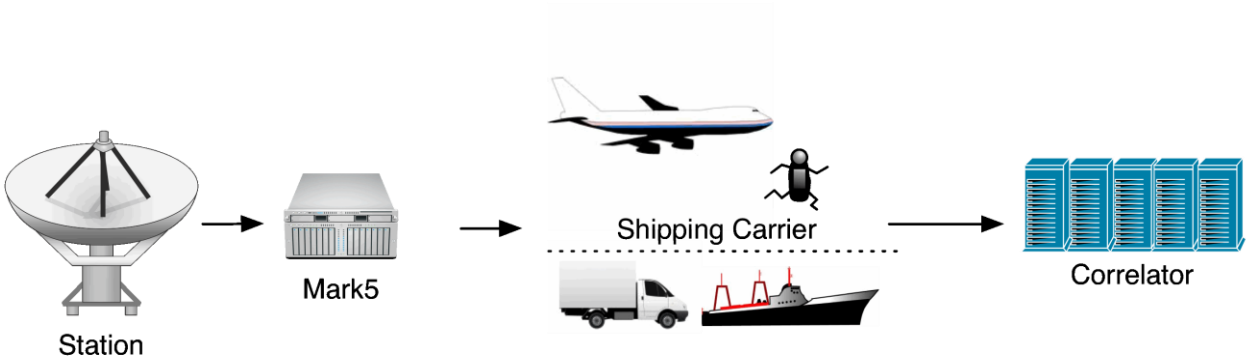
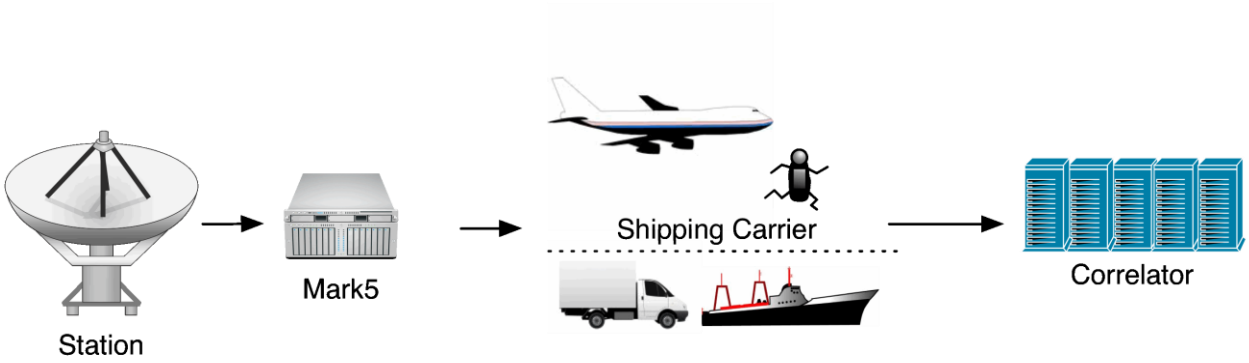
Outline

- e-Transfer Overview
- Networking
- Hardware
- Software
- Operations
- Correlators
- Troubleshooting
- Demonstration
- Q&A

e-Transfer Overview

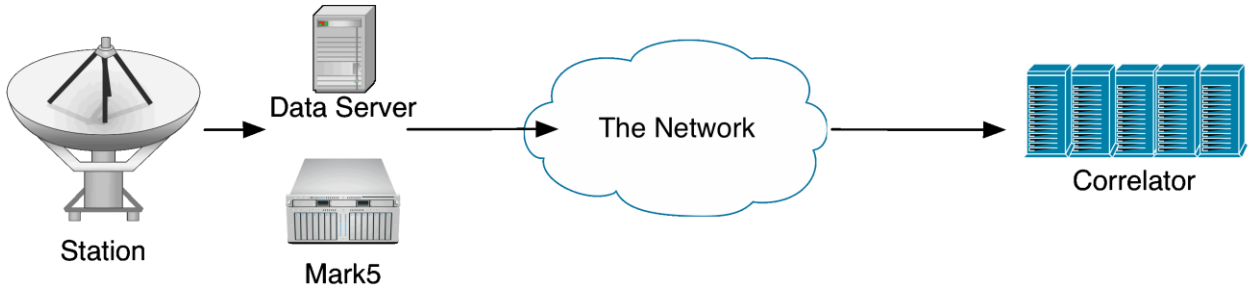


e-Transfer Overview

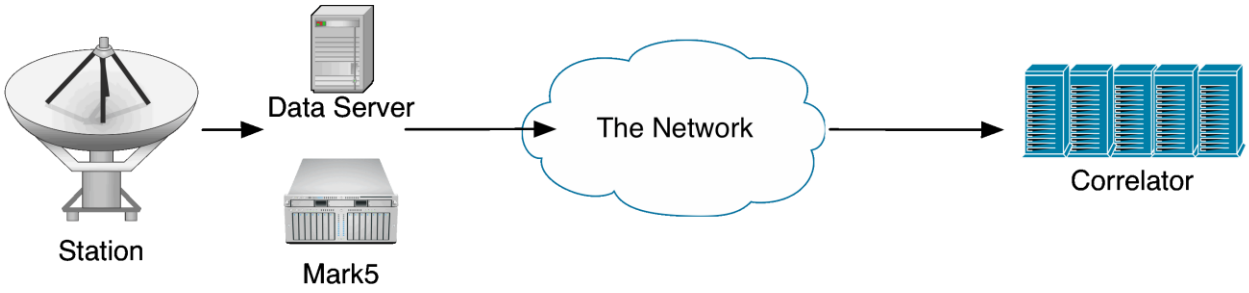


- Data recorded to Mark5 unit
- Modules are brought to shipping
- Shipments can take days/weeks to arrive
- Correlators process the modules

e-Transfer Overview

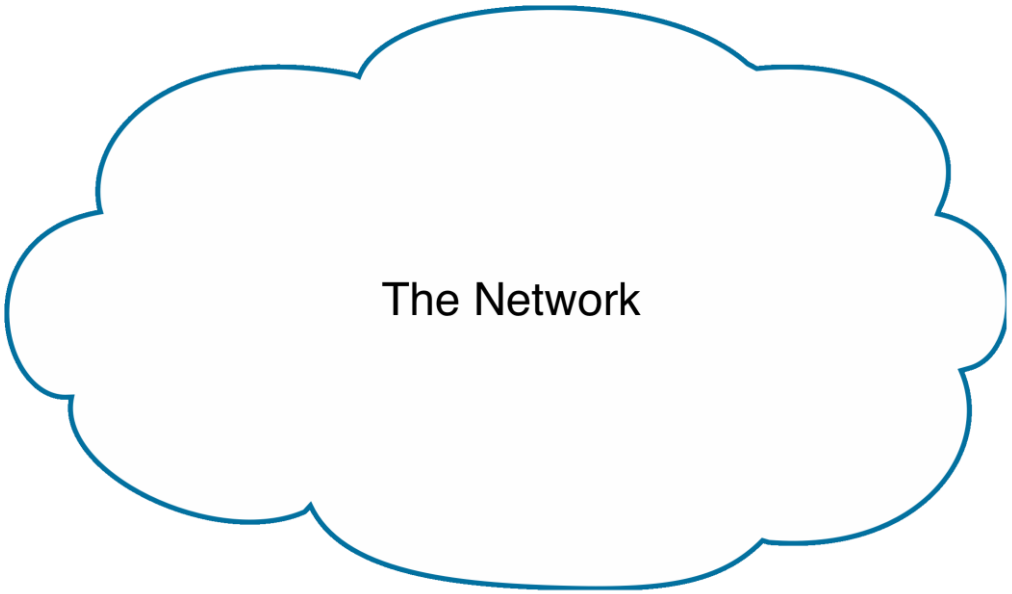


e-Transfer Overview



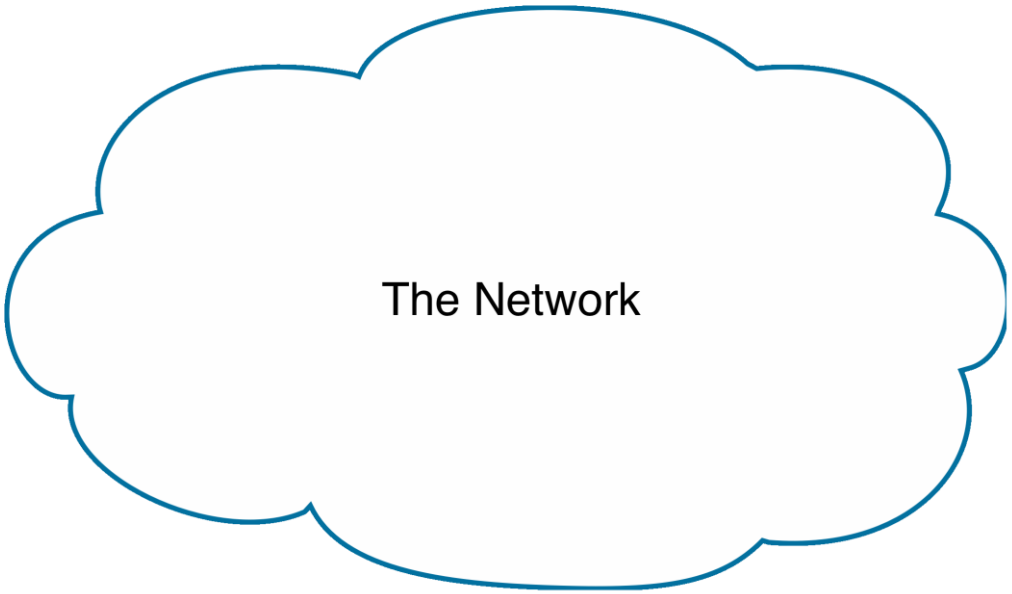
- Data recorded to Mark5 unit
- The Mark5 or Data server is prepared for transfers
- Transfer of data is initiated and sent to Correlator data servers
- Correlators process the files

Networking



Networking

TCP vs UDP



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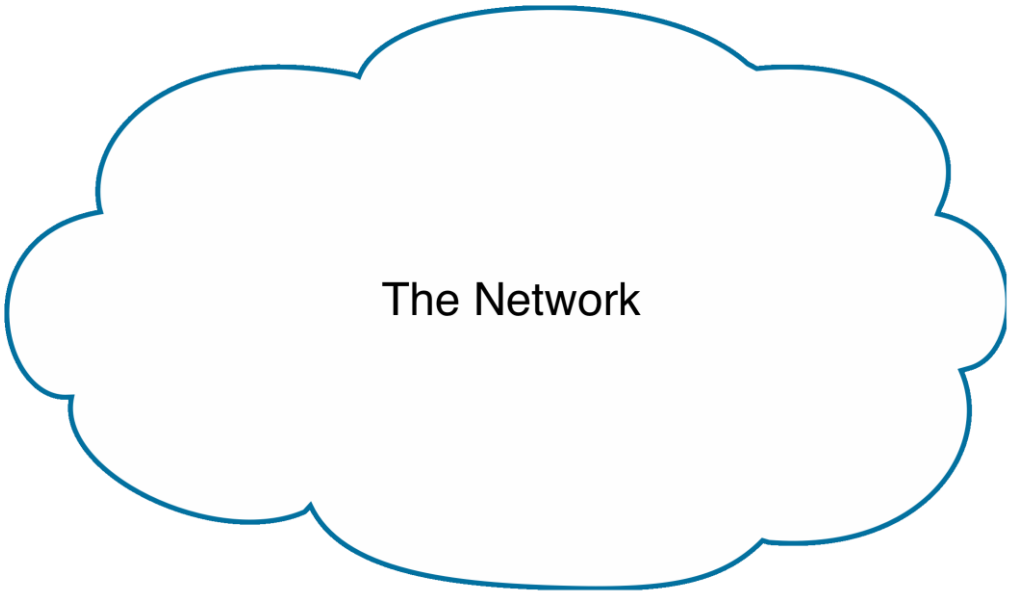
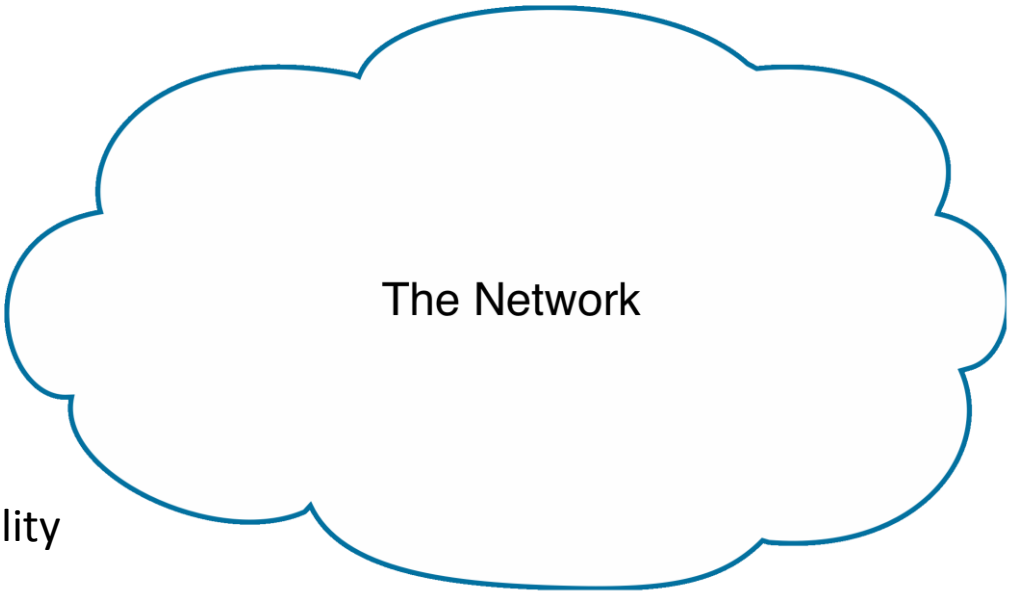


Network Layout

Networking

TCP vs UDP



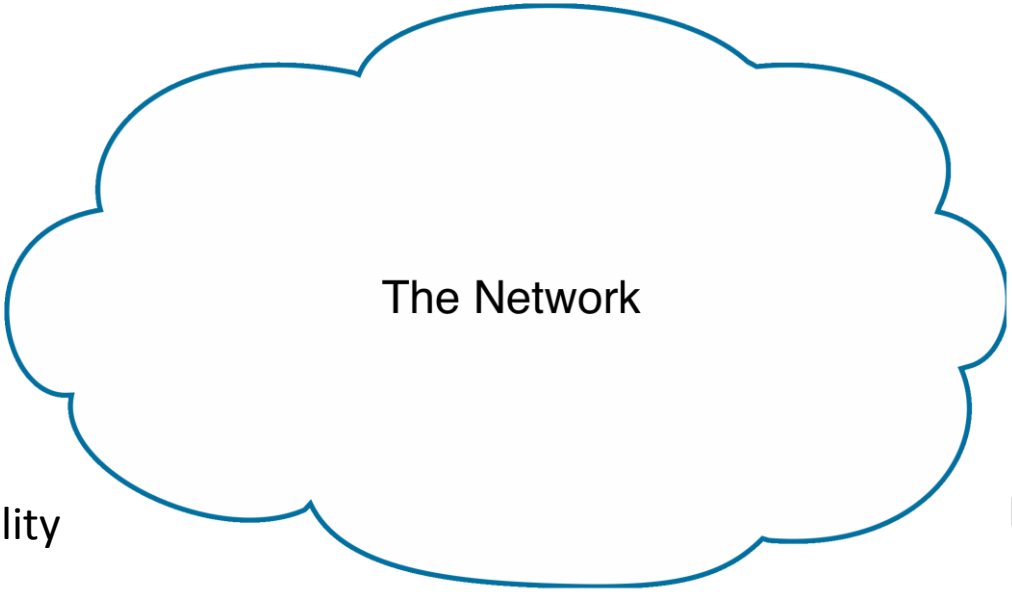
Network Layout

Bandwidth Availability

Networking

TCP vs UDP

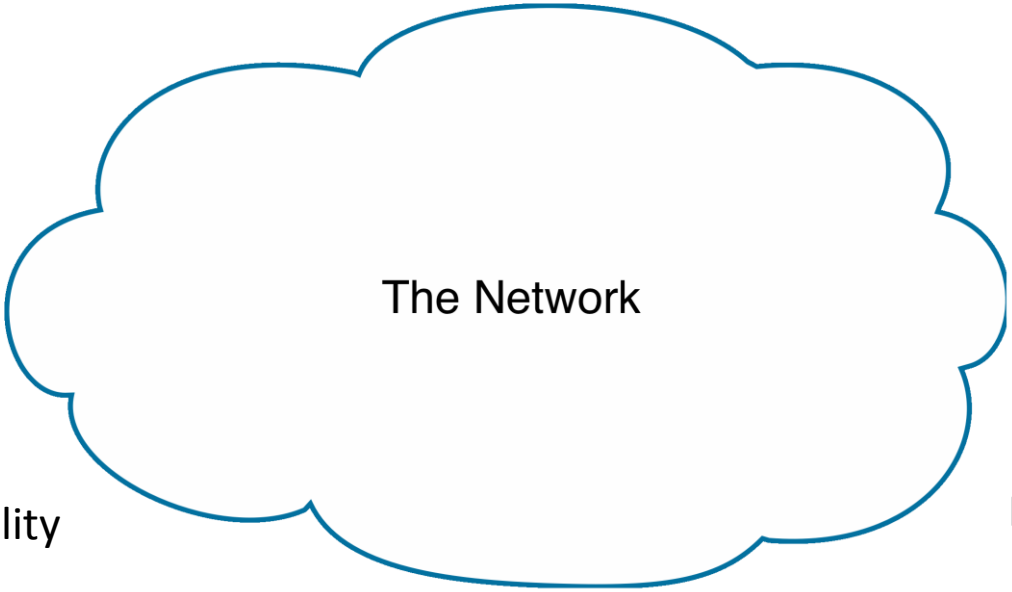
Network Layout



Bandwidth Availability

Firewall and Security

Networking



TCP vs UDP

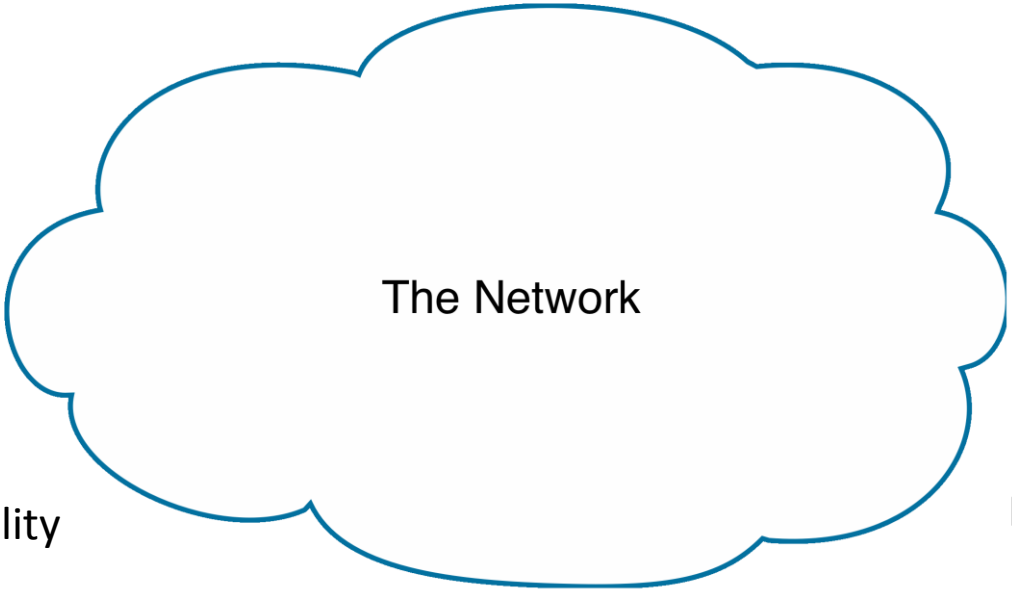
Network Layout

Bandwidth Availability

Firewall and Security

Friendly User

Networking



TCP vs UDP

Network Layout

Bandwidth Availability

Firewall and Security

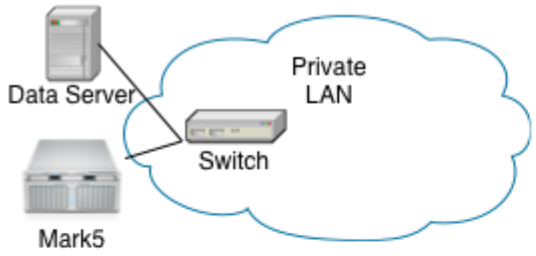
Friendly User

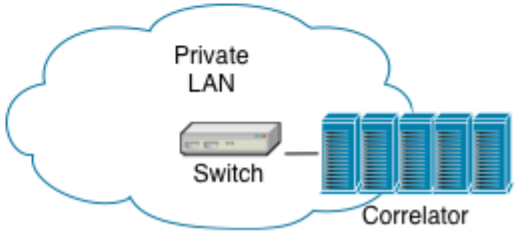
Network Requirements

Networking

TCP	UDP
Reliable transfer method	Fast transfer method
Connection-oriented	Connectionless
Packet order, sequencing	No ordering
Acknowledge	No acknowledgment
Error checking w/ recovery	Error checking w/o recovery
FTP, SSH, WWW	VoIP, SNMP, DNS

Networking


Data Server
Private
LAN
Switch
Mark5


Private
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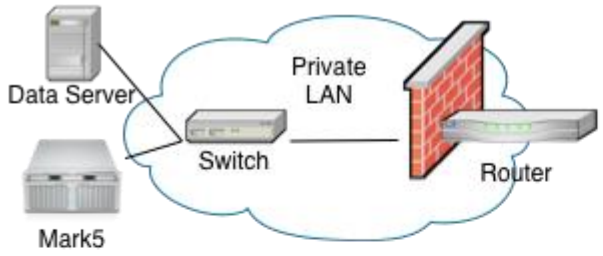
Correlator

Networking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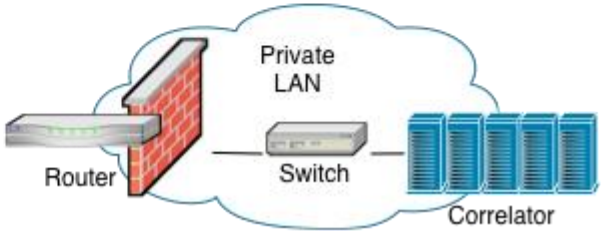
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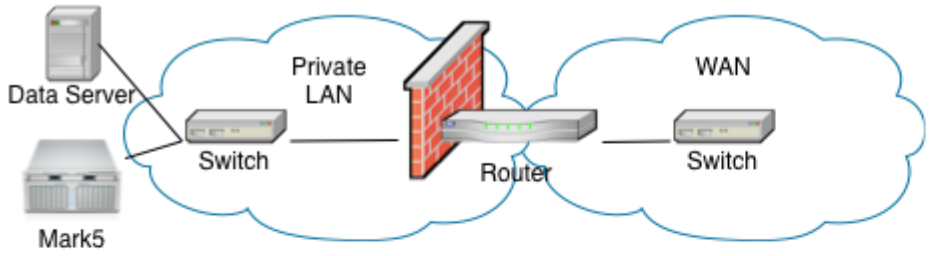
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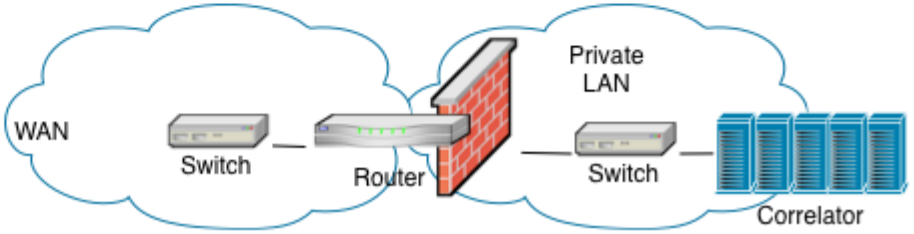
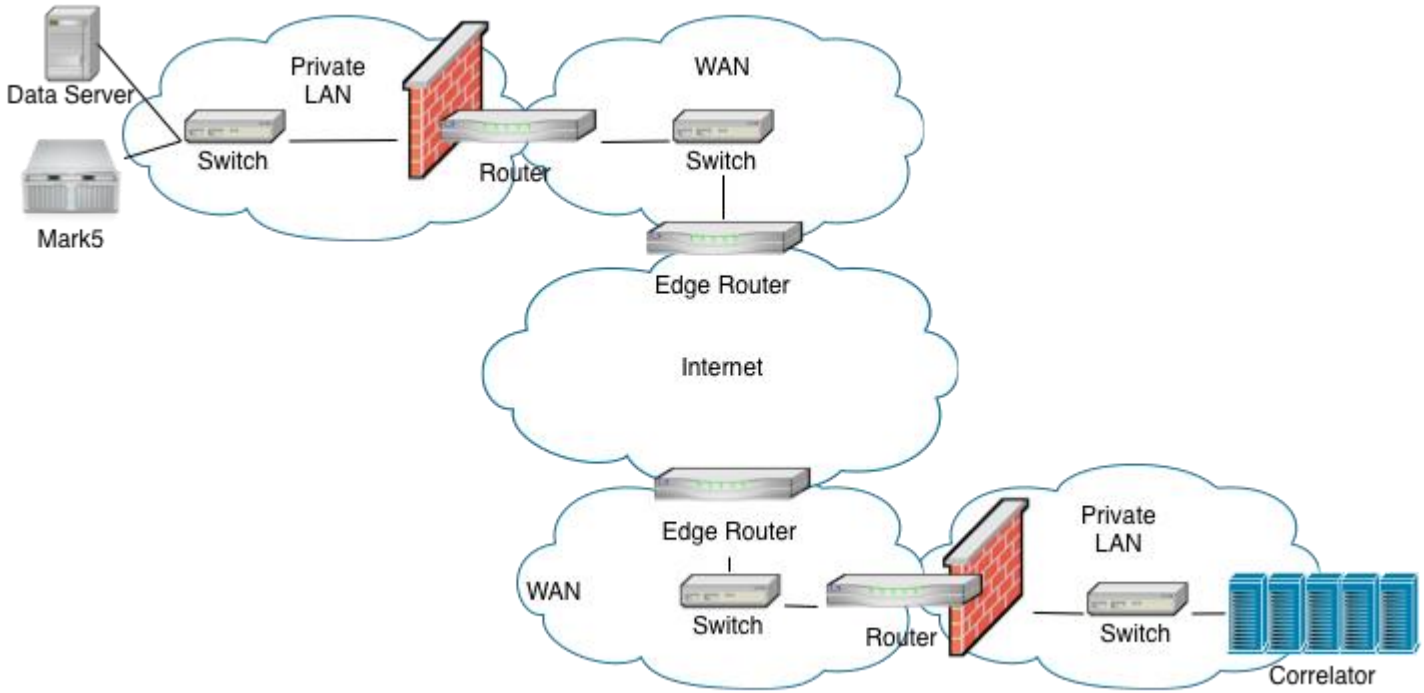

WAN
Switch
Router
Private
LAN
Switch
Correlator

Networking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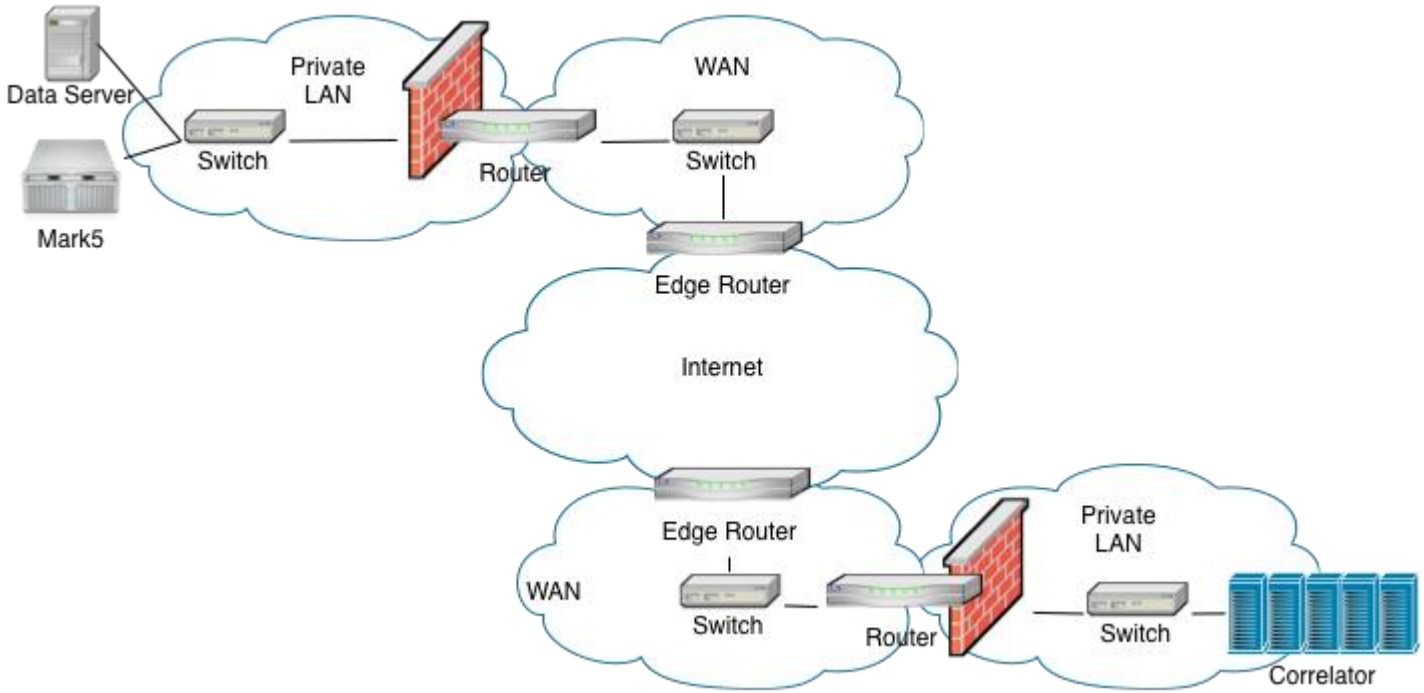
Switch
Router
WAN
Switch
Edge Router
Internet
Edge Router
WAN
Switch
Router
Private
LAN
Switch
Correlator

Networking

- Bandwidth Availability
  - A few factors:
    - Users
    - Bottlenecks
    - Throttling

Networking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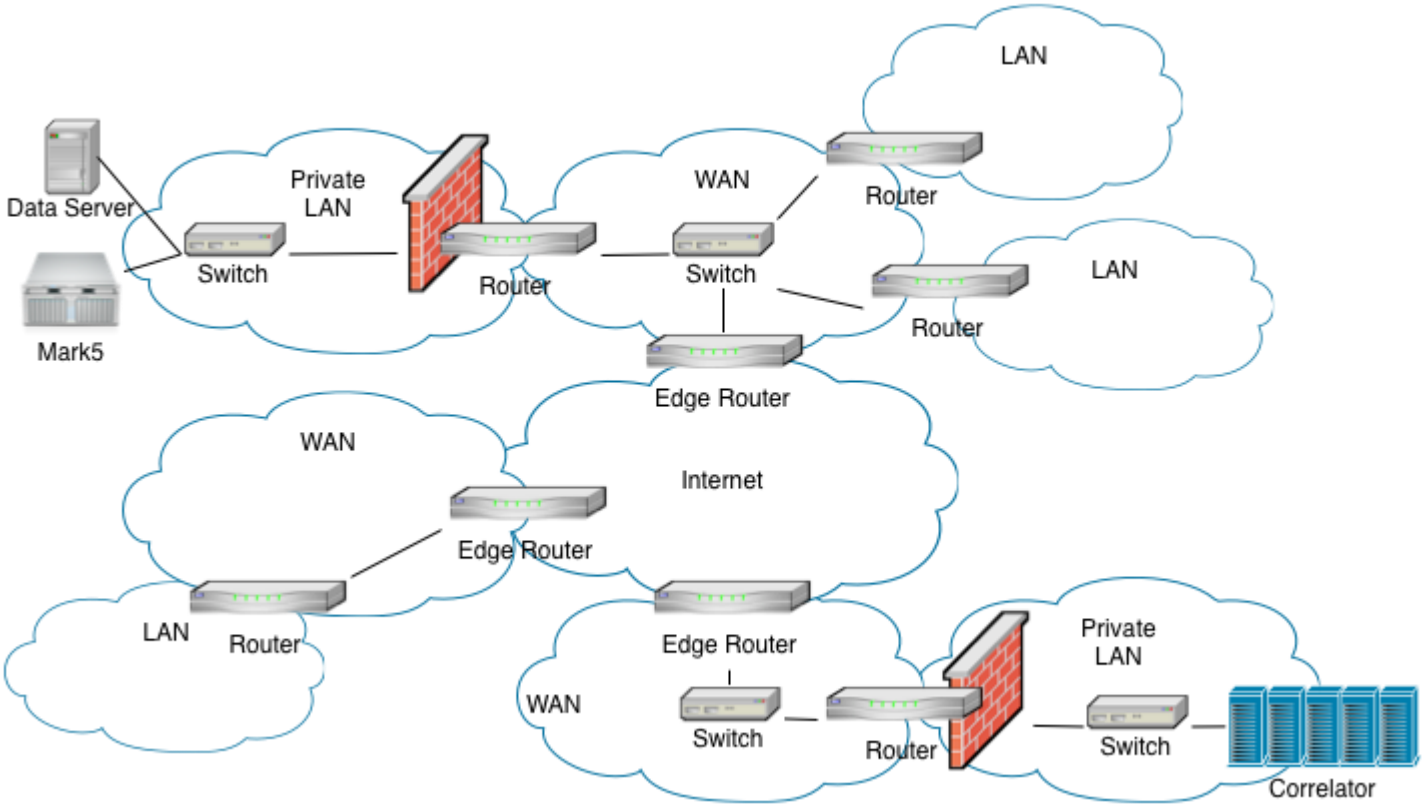
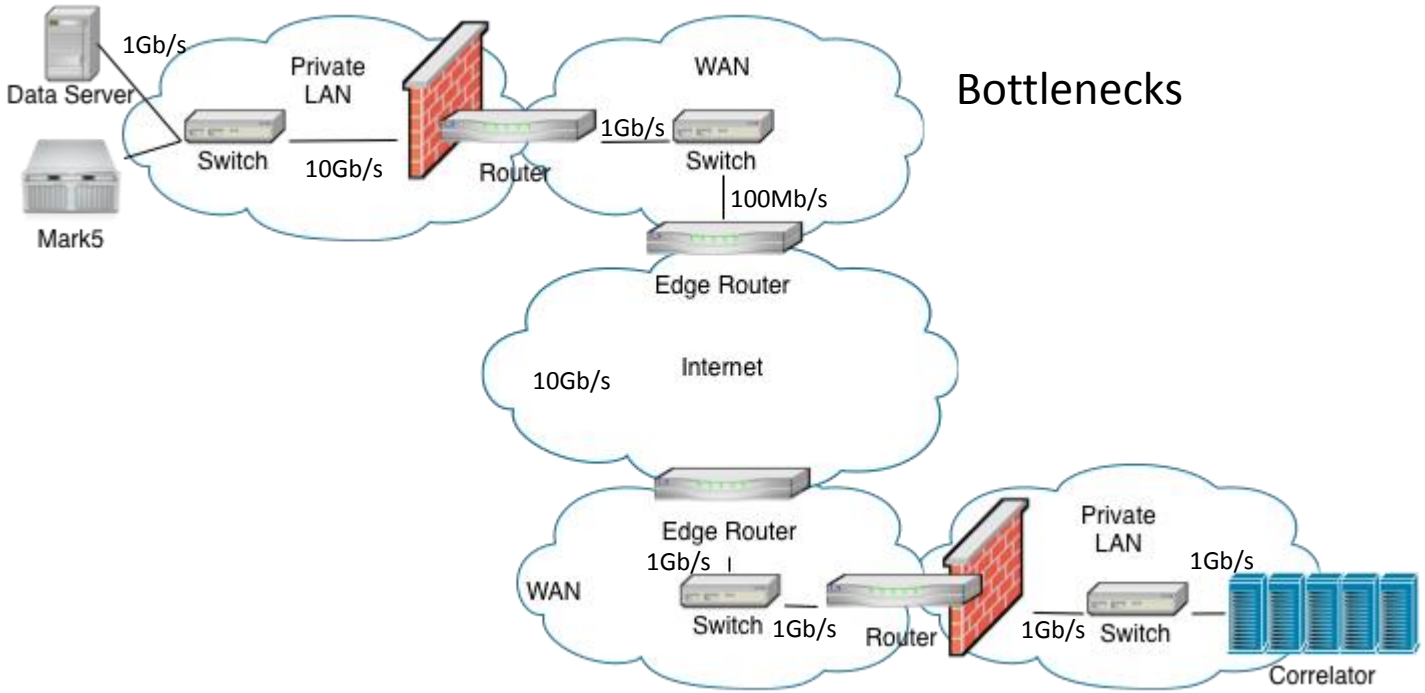


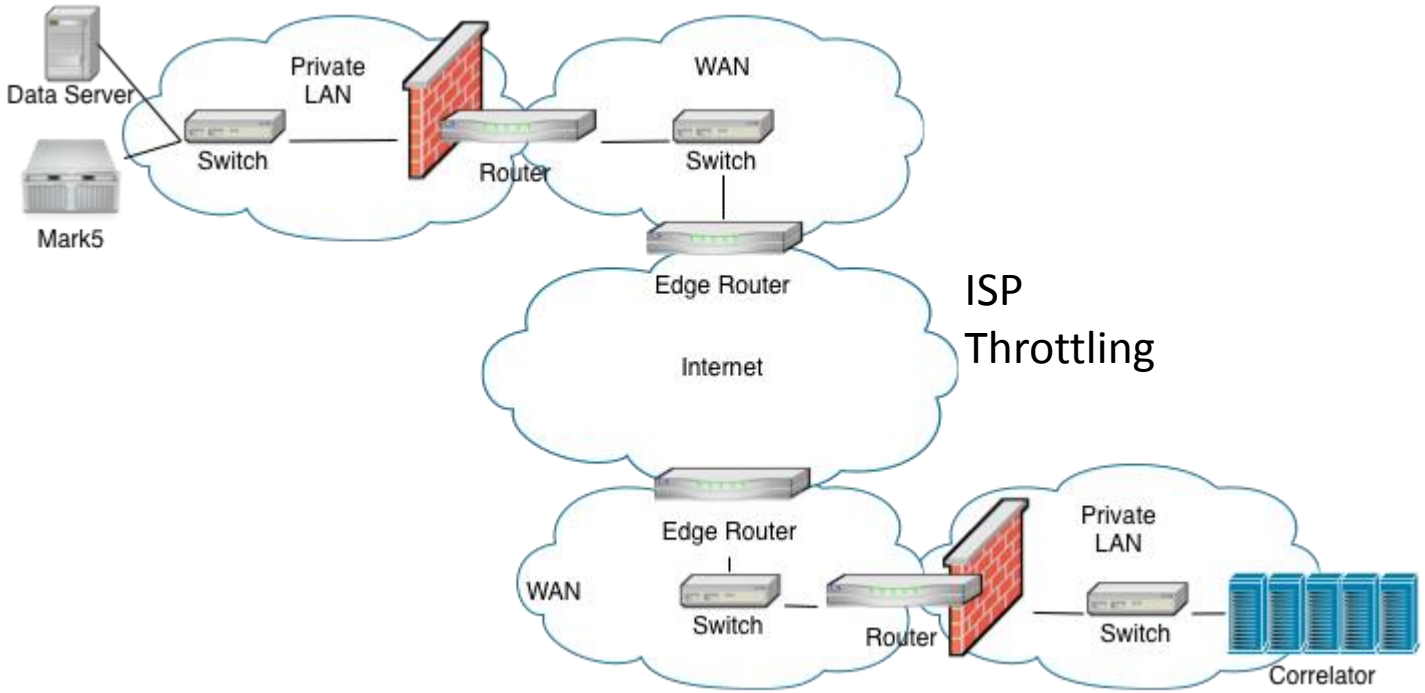
A lot of people use the internet

Networking



Bottlenecks

Networking


Data Server
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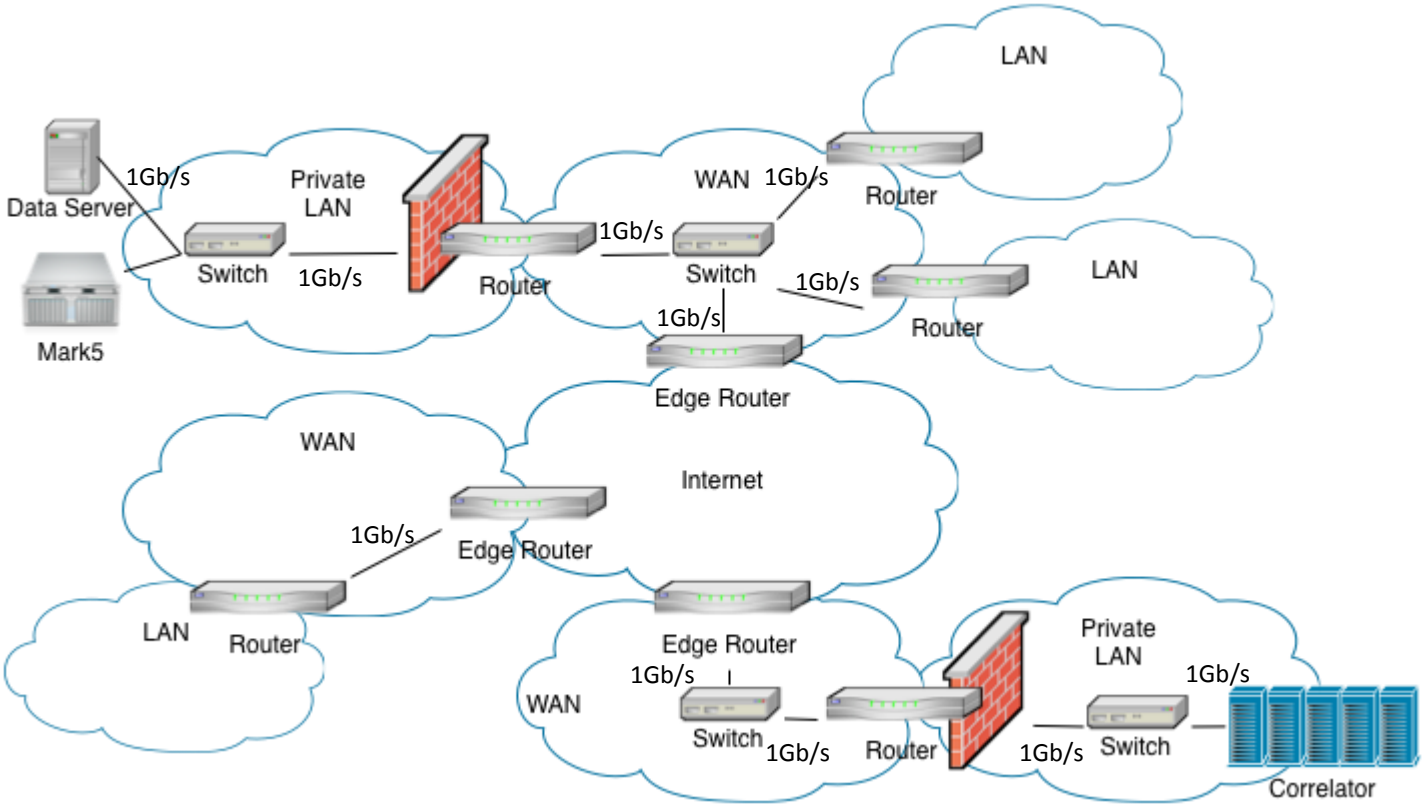
Private
LAN
Switch
Router
WAN
Switch
Edge Router
Internet
ISP
Throttling
Edge Router
WAN
Switch
Router
Private
LAN
Switch
Correlator

Networking

- Firewalls and Security
  - Firewalls block and restrict network traffic in and out of different networks
  - Maintaining a specific access lists tightens security
- Friendly User
  - Networks are a resource
  - Other users may have needs of network and have to be considered

Networking


LAN
Data Server
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1Gb/s
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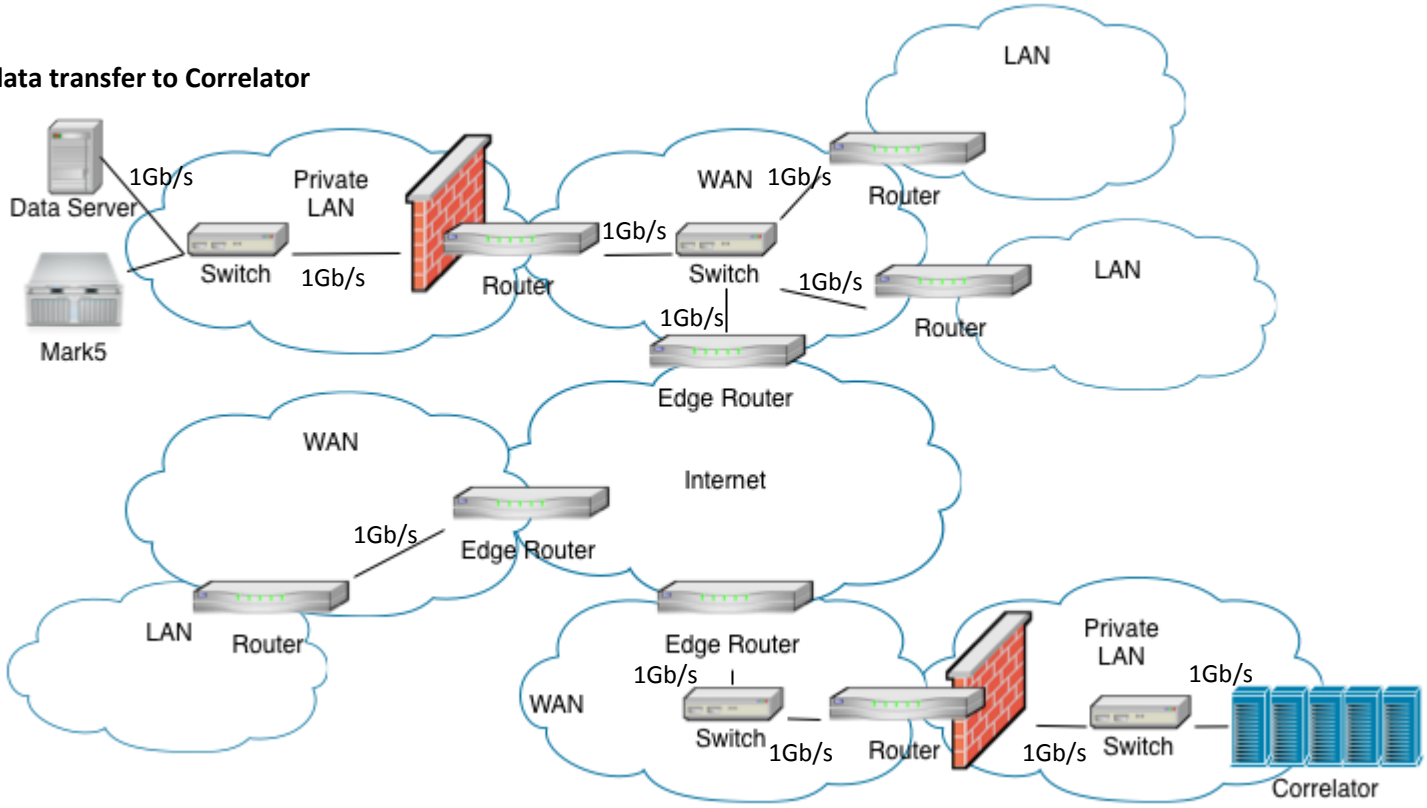
Correlator

Networking

980Mb/s data transfer to Correlator



98% utilization by transfer leaving only 2% available bandwidth for others :(

Network Requirements

- Reliable network connection

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- Reliable network connection
- Recommend 100Mb/s or greater

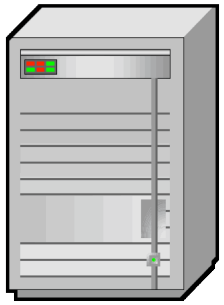
Network Requirements

- Reliable network connection
- Recommend 100Mb/s or greater

Network Speed	T2/OHIG Session ~700 GBytes	R1/R4/CRF Session ~1200GBytes	RDV/R&D Session ~1500GBytes
10Mb/s	560,000 secs ~155hrs	960,00 secs ~266hrs	1,200,000 secs ~333hrs
100Mb/s	~15.5hrs	~26.6hrs	~33hrs
1000Mb/s	~1.5hrs	~2.6hrs	~3.3hrs

Hardware

Mark5



Data Server

Hardware Requirements

- Mark5 unit w/ fusemk5
- File server w/ disk storage

- Considerations
  - Turn around time
  - Disk space/modules
  - Network availability

Software

- Tsunami transfer software
  - TCP control layer
  - UDP data transfer
  - Developed at University of Indiana
  - Contributions and development now by Metsähovi Radio Observatory
  - http://tsunami-udp.sourceforge.net/

Software

- Fusemk5
  - Read-only file system for Mark5 unit
  - Allows access to data from disk module via streamstor as userspace.
  - http://fusemk5a.sourceforge.net/

Software Tools

- Iperf
  - http://sourceforge.net/projects/iperf/
- Nuttcp
  - http://www.lcp.nrl.navy.mil/nuttcp/
  - http://www.wcisd.hpc.mil/nuttcp/Nuttcp-HOWTO.html
- Traceroute
  - Linux distribution
- MRTG/SNMP
  - http://oss.oetiker.ch/mrtg/

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination
- Verify bandwidth availability

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination
- Verify bandwidth availability
- Start tsunami server

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination
- Verify bandwidth availability
- Start tsunami server
- Set up tsunami client

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination
- Verify bandwidth availability
- Start tsunami server
- Set up tsunami client
- Update e-Transfer active transfers site
  - http://www3.mpifr-bonn.mpg.de/cgi-bin/showtransfers.cgi

e-transfer Operations

- Prepare data for transfer
  - fusemk5 or data server
- Verify enough disk space on Correlator destination
- Verify bandwidth availability
- Start tsunami server
- Set up tsunami client
- Update e-Transfer active transfers site
  - http://www3.mpifr-bonn.mpg.de/cgi-bin/showtransfers.cgi
- Initiate transfers

Correlator Hardware

- Bonn
  - 1Gb/s Network
  - 5 file servers, ~125TB disk space
- Haystack
  - 10Gb/s Haystack shared network
  - 2 file servers, ~48TB disk space
- USNO
  - 1Gb/s Network
  - 1 file server, ~54TB disk space

Troubleshooting

- Network performance issues
  - Packet loss
  - Connectivity loss
- Fusemk5
  - Packet errors/loss
  - Read performance
- Data servers
  - RAID disk failure
  - Writing performance

Demonstration

- Software tools
  - Basic network performance tests
  - Determining routes
- e-Transfer Operations
  - Mark5/fusemk5 transfer, Mark5 -> Haystack
  - Data server transfer, Bonn -> Haystack

Thank you

Demonstration & Questions