

# Internet-2 in Israel

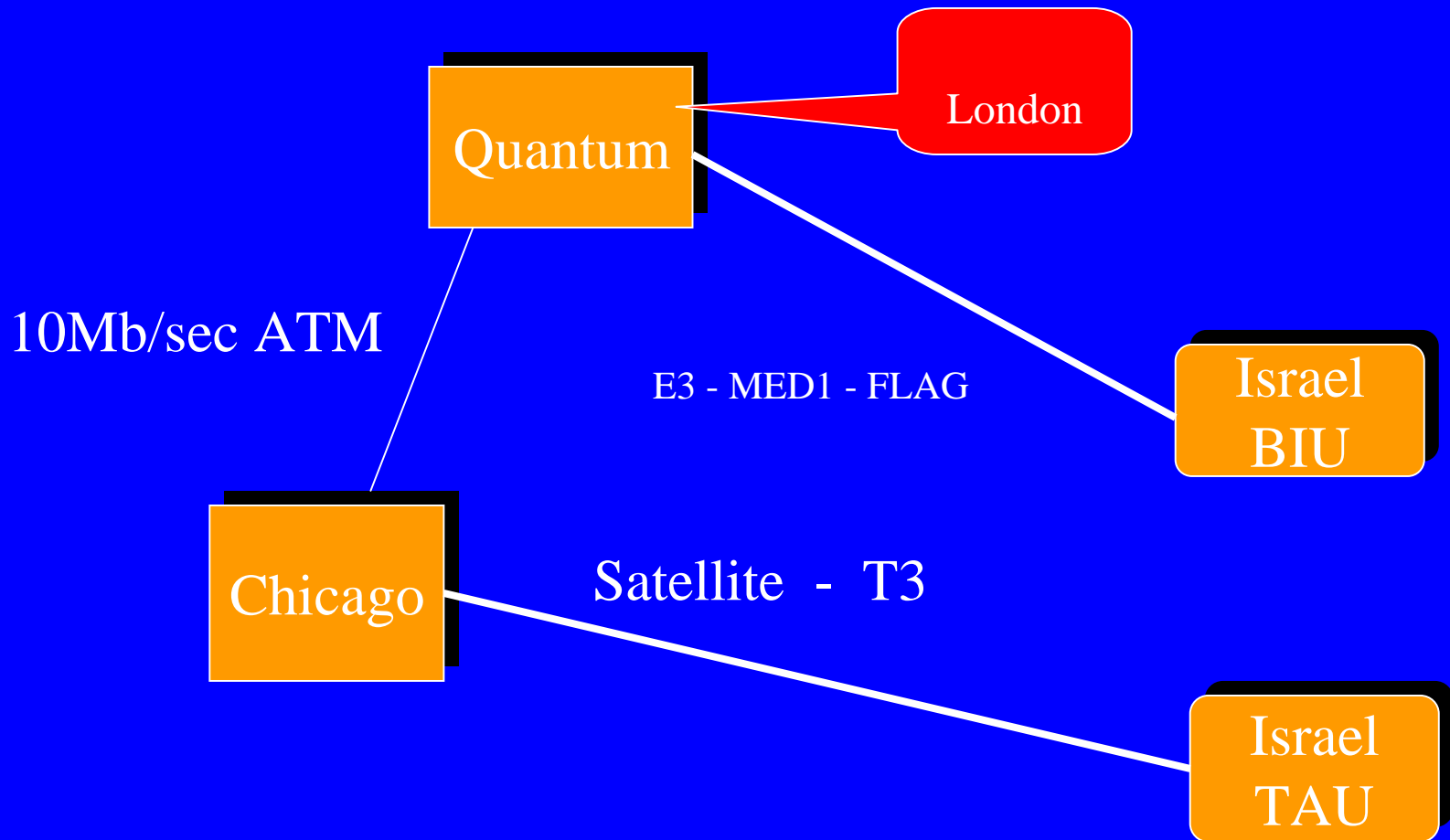
## Satellite aspects

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**Internet-2 Fall Workshop**

**October 1999**

# Internet-2 Design Summary



# Satellite connectivity to USA

- **Israsat/Gilat won tender**
- **IUCC purchased a full transponder**
  - **Mhz and not Mb**
- **Able to reach OC-3 speeds via transponder**
  - **First tried Radyne modems - suffered from Doppler Shift - switched to Efddata - has Doppler buffer**
  - **[http://www.radyne.org/products/dd\\_dm160.htm](http://www.radyne.org/products/dd_dm160.htm)**
  - **<http://www.adaptivebroadband.com/datasheets/sdm-9000.pdf>**

# Satellite issues and QoS

- **TCP streams are limited to 936kb/sec**
  - **RFC2488 - Enhancing TCP Over Satellite Channels using Standard Mechanisms**
    - Path MTU - RFC1191
    - Large windows - RFC1323 (default is 64KB)
    - Large socket buffers -  $\text{bandwidth} * \text{delay} = 45\text{Mb} * 600\text{ms} = 3.3\text{Mbytes}$
    - TCP Selective Ack (SACK) - RFC2018
- **UDP unaffected**

# Satellite issues and QoS

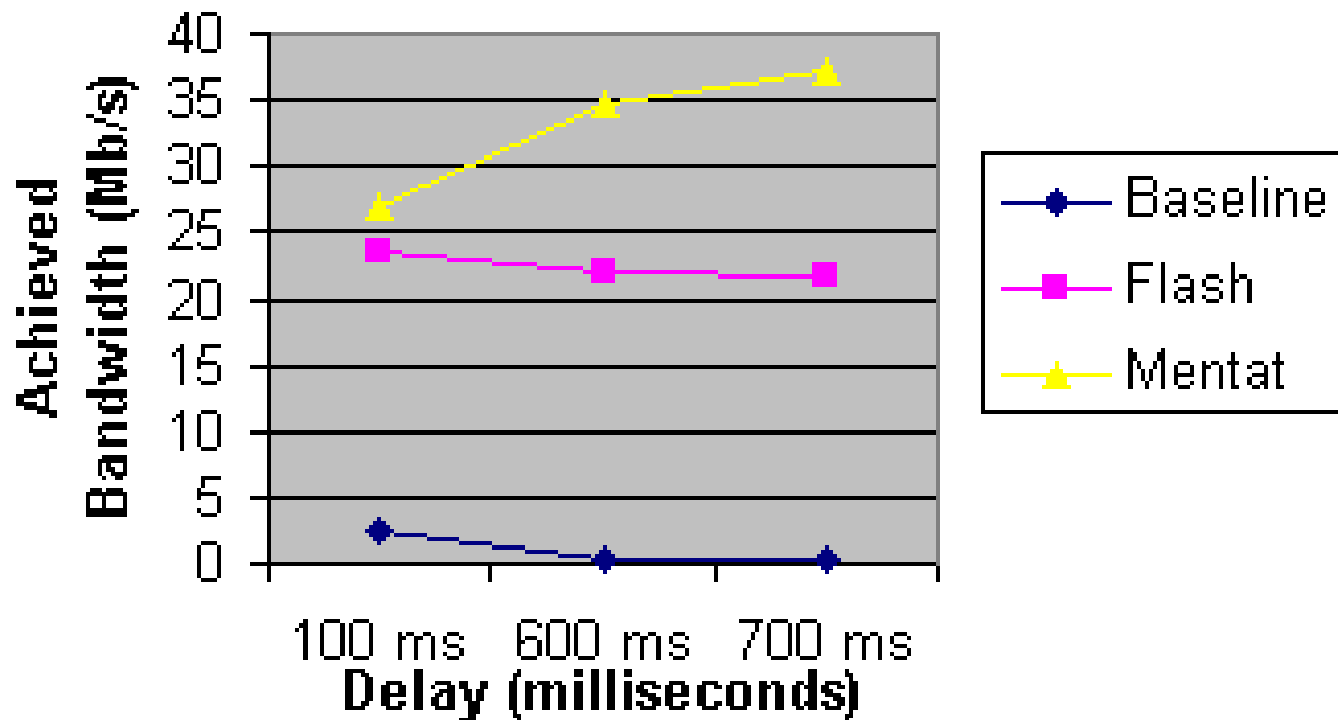
- **Thruput = window size \* RTT**
  - **64K \* 560ms = 117,027 bytes/sec (936kb/sec)**
    - 64K is maximum default - W98 is 8K
  - **1M \* 30ms = 33Mb/sec (Abeline limit?)**
- **Enabling High Performance Data Transfers**
  - [http://www.psc.edu/networking/perf\\_tune.html](http://www.psc.edu/networking/perf_tune.html)

# Satellite black box testing

- **Testing performed in April at Intelsat lab**
  - **Flash Networks and Mentat**
  - results located at: [www.internet-2.org.il/satellite-testing.html](http://www.internet-2.org.il/satellite-testing.html)

# Satellite results

Performance with 100 sessions

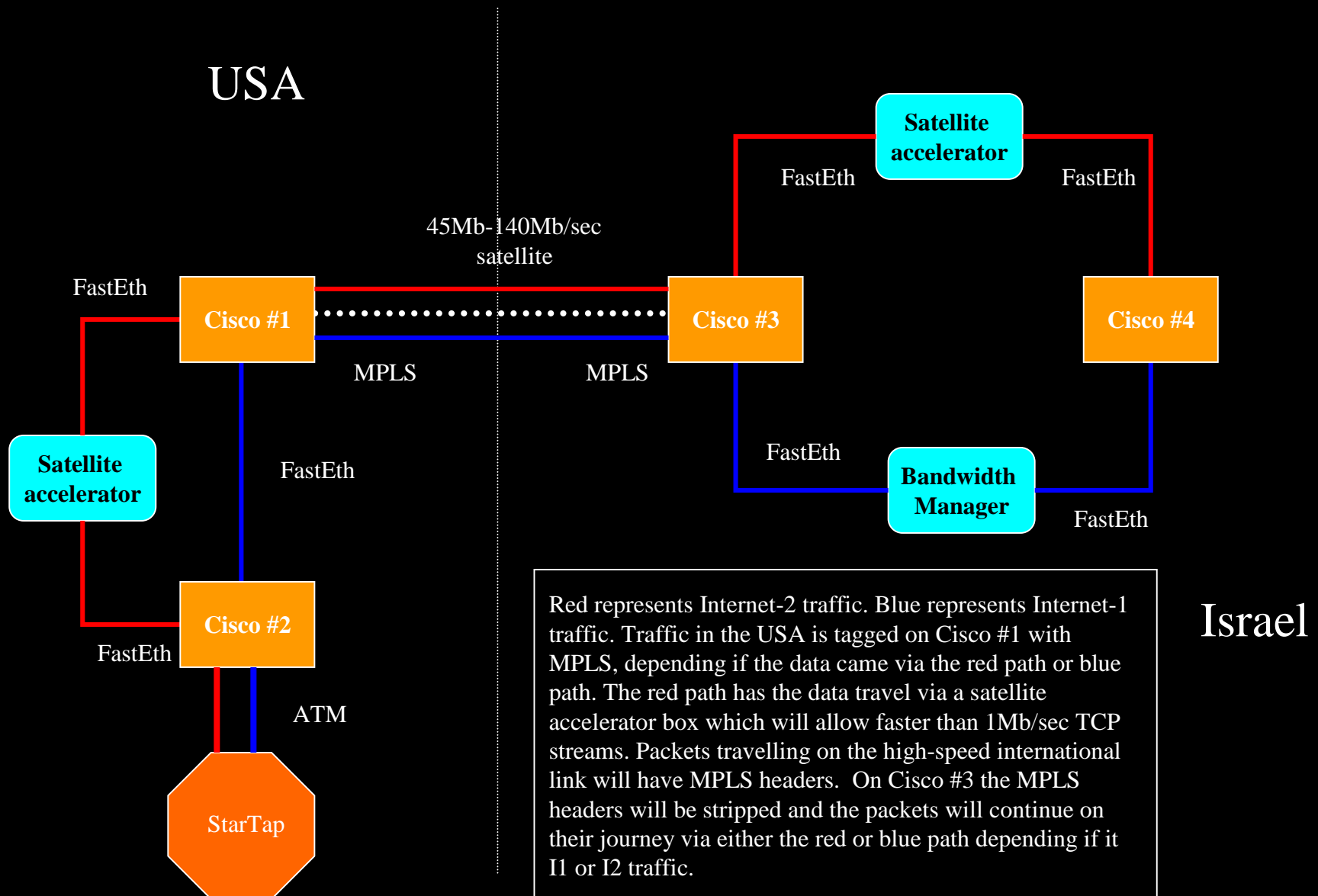


# WAN QoS at high speeds

- **All existing QoS boxes top out at 45Mb/sec**
  - **Packeteer, Allot, IP Highway, Elron Software, NReality**
- **Typical 45Mb/sec contains 10,000-20,000 concurrent TCP streams**
- **Typical router with 2 OC-3's has 60,000 concurrent streams**



# GigaPOP Design for Differentiated Services



# QoS to USA

- **IP based**
- **Cisco features**
  - **CAR - Committed Access Rate**
    - bandwidth management
  - **WRED - Weighted Random Early Detect**
    - Preferential packet discard algorithm
    - congestion avoidance
  - **WFQ - Weighted Fair Queuing**
    - class based queuing
  - **MPLS - Multi Protocol Label Switching**
    - traffic engineering
  - **Multiple BGP routing tables**

# Interim Cisco setup (till MPLS)

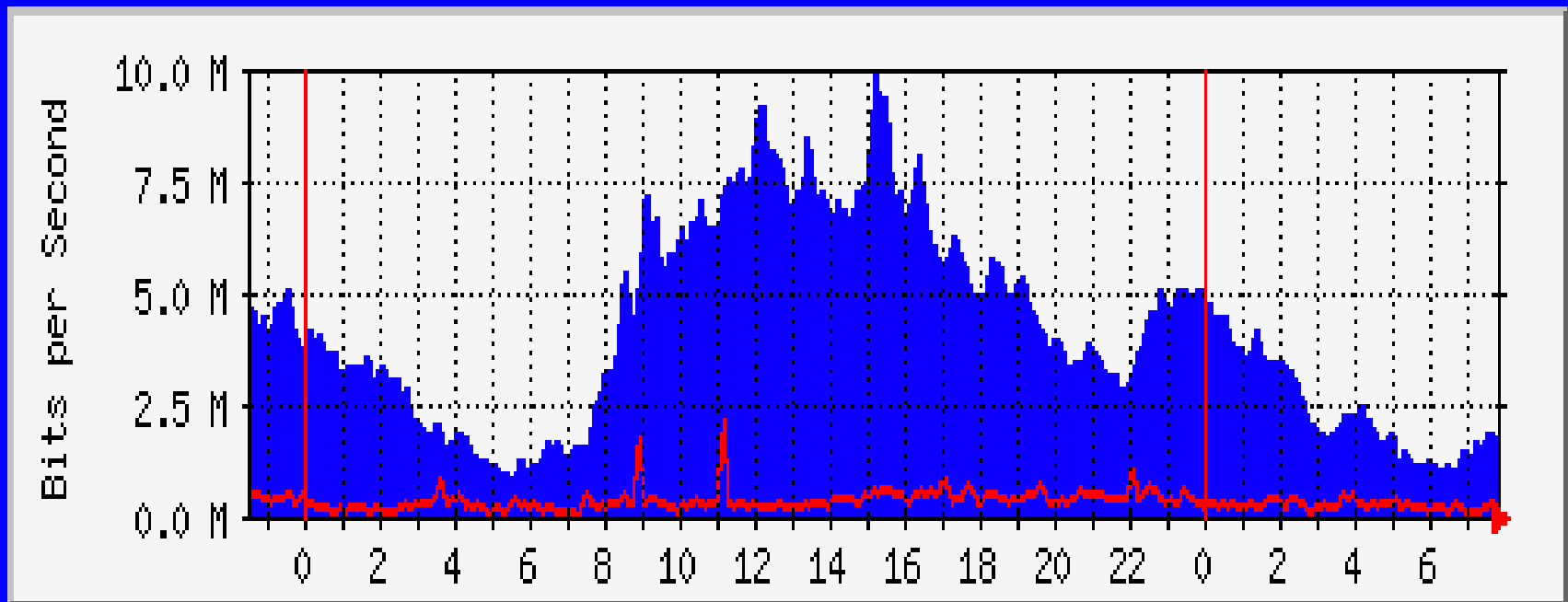
- **Tunnel and policy based routing supports up to 45Kpps**
- **Using dCEF, flow switching, policy switching**
  - `ip cef, ip route-cache flow, ip flow-cache feature-accelerate`
- **VIP2-40s used on Ethernets, VIP2-50s used on the T3 (all 7505 or 7507 with RSP4s)**

# Cisco load

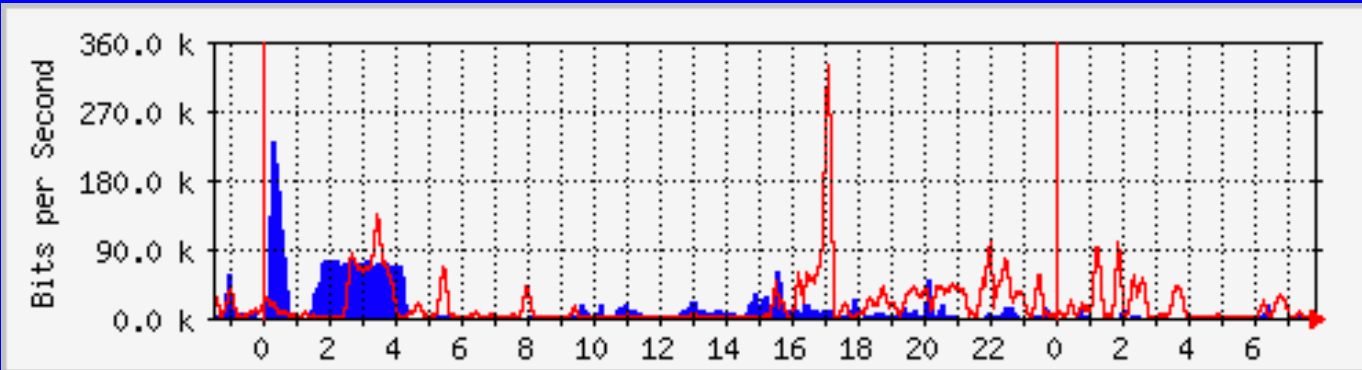
Packet size	1498	528	68
CPU load	7-12%	28-35%	77-88%
PPS	3.7K	10K	45K
Thruput	43Mb/sec	42Mb/sec	30Mb/sec

# Results

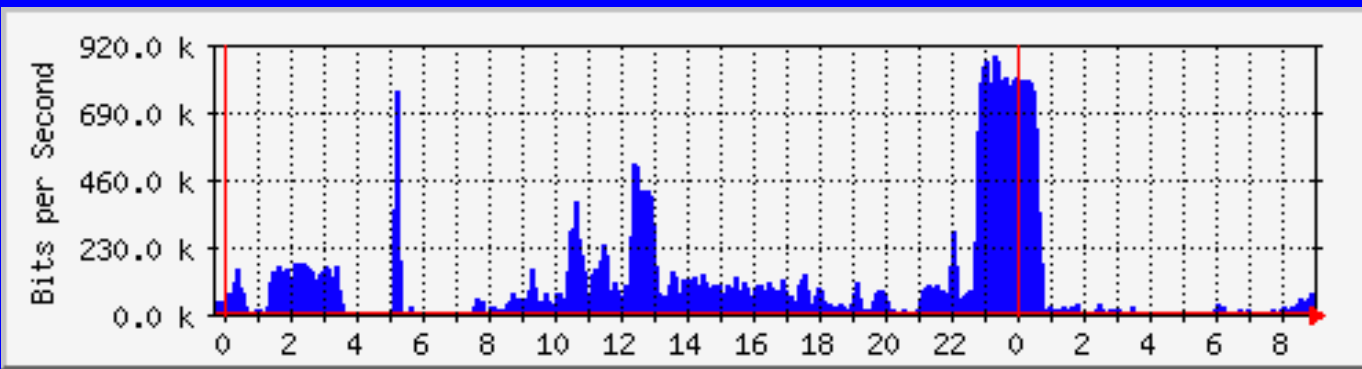
- **Europe RTT: 76ms**
- **Chicago RTT: 560ms**



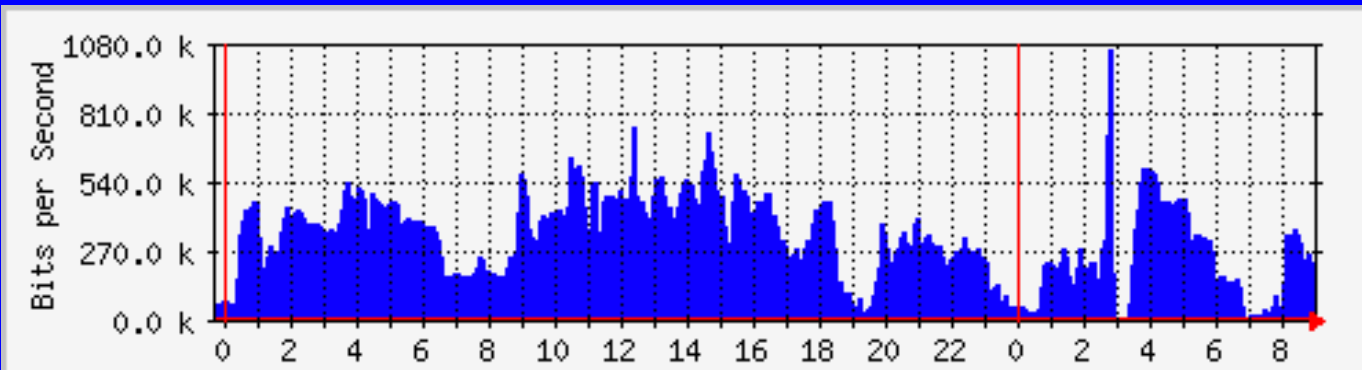
# Internet-2 peers



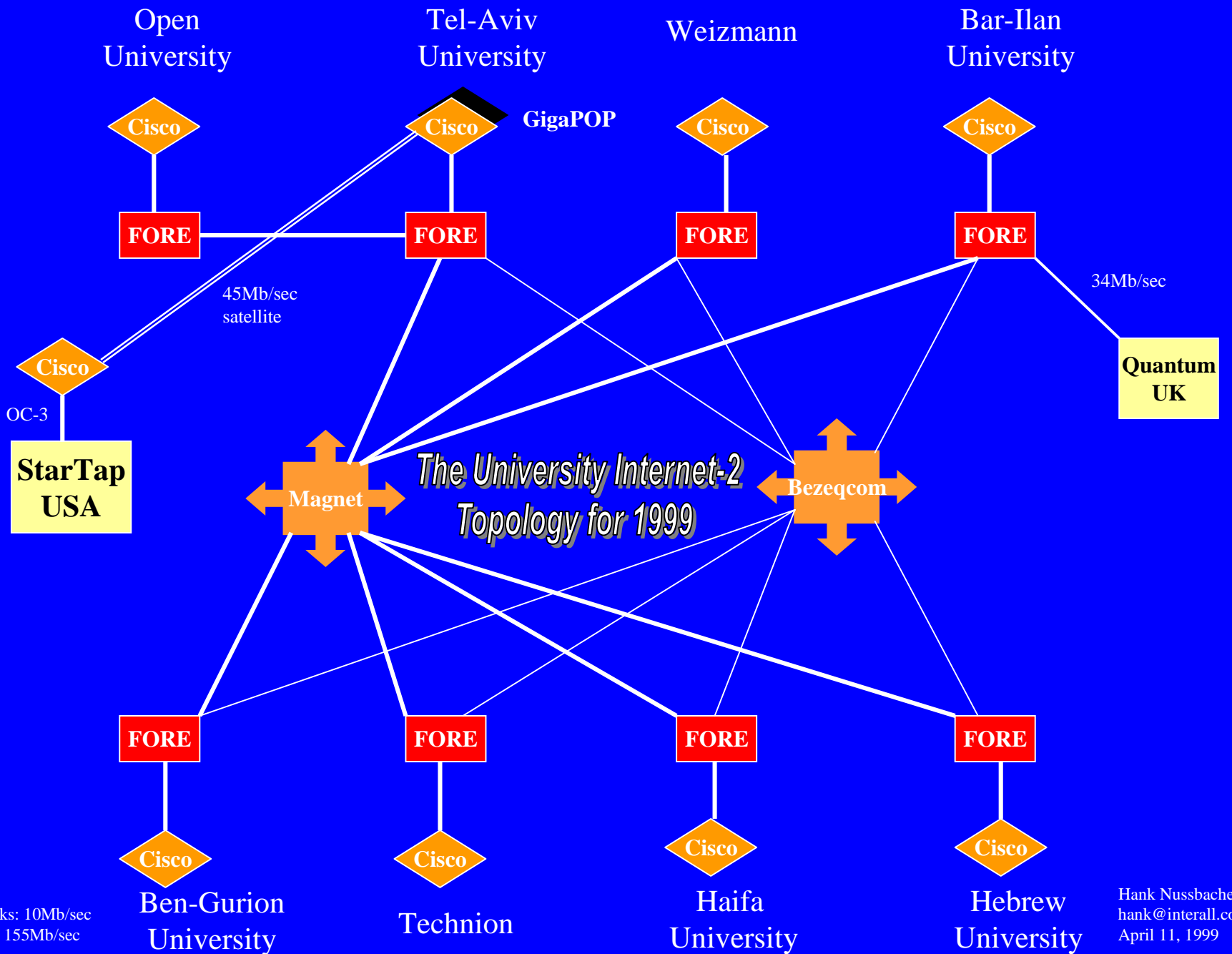
Canarie



Abeline



vBNS



*The University Internet-2  
Topology for 1999*

Legend:  
Bezeqcom links: 10Mb/sec  
Magnet links: 155Mb/sec

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