Internet-2 in Israel

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ICTAF - EUMEDIS

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What we will discuss

- **Philosophy**
- **National infrastructure**
- **International infrastructure**
- **Industry and Internet-2**
- **Applications**

Purpose

- **To provide Israeli researchers with Quality of Service (Qos) and Class of Service (CoS) via the Internet, in order to conduct their R&D activities with colleagues in Europe and the USA**

- **Not intended to speed up standard Internet access**

NGI vs Internet-2

- **NGI - Next Generation Internet**
  - **Go faster**
    - optical switching
    - OC-3072 - 160Gb/sec links
- **Internet-2**
  - **Go smarter**
    - Quality of Service
    - Class of Service - DiffServ

Internet-1 vs Internet-2

- **Internet-1**
  - **socialist philosophy**
  - **everyone gets an equal share of the bandwidth**
- **Internet-2**
  - **capitalist philosophy**
 - **those who pay extra get a better level of service**

National overview

- **Internet-2 uses the Bezeq Magnet network (ATM)**

  - **OC-3 (155Mb/sec) connections to all 8 universities**

- **Internet-2 uses as backup the Bezeqcom network (ATM)**

  - **OC-3 connections to all universities with 10Mb/sec UBR connections**

National overview

- **Connection of both Bezeq ATM networks to each university via donated ATM switches (FORE)**
  - **unique solution - not known as available elsewhere**
- **Each ATM switch interconnects to the current campus Cisco router, thereby providing IP services**

Typical University connection

Cisco router

Campus ATM switch

FORE ATM switch

10Mb

155Mb/sec

Bezeqcom

Magnet
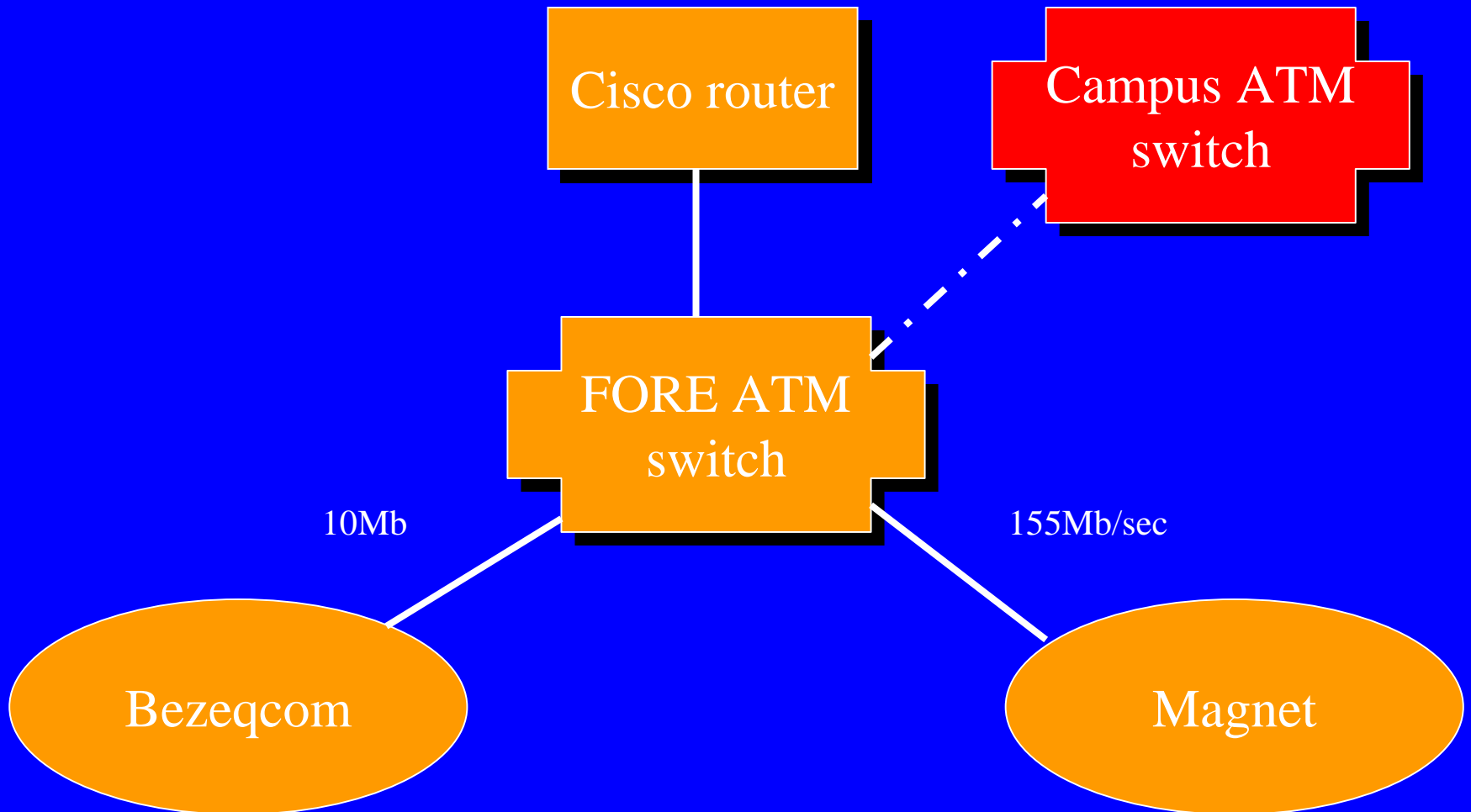
National Overview

- **To provide native ATM services, campuses will be able to connect their existing ATM infrastructure directly to the new ATM edge switch**

- **Machba (IUCC) charged by government decision to be the implementor and operator**

Industry

- **Industry (R&D units only) will be able to connect via either E1 (2Mb/sec) or E3 (34Mb/sec) to the TAU GigaPOP**
  - **technology of connection dependent on what Bezeq can supply - Sifranet, Frame Relay or ATM**
  - **minimum access speed - 2Mb/sec**
- **Connectivity only via the TAU GigaPOP**

Industry connection

Cisco router

Campus ATM switch

FORE ATM switch
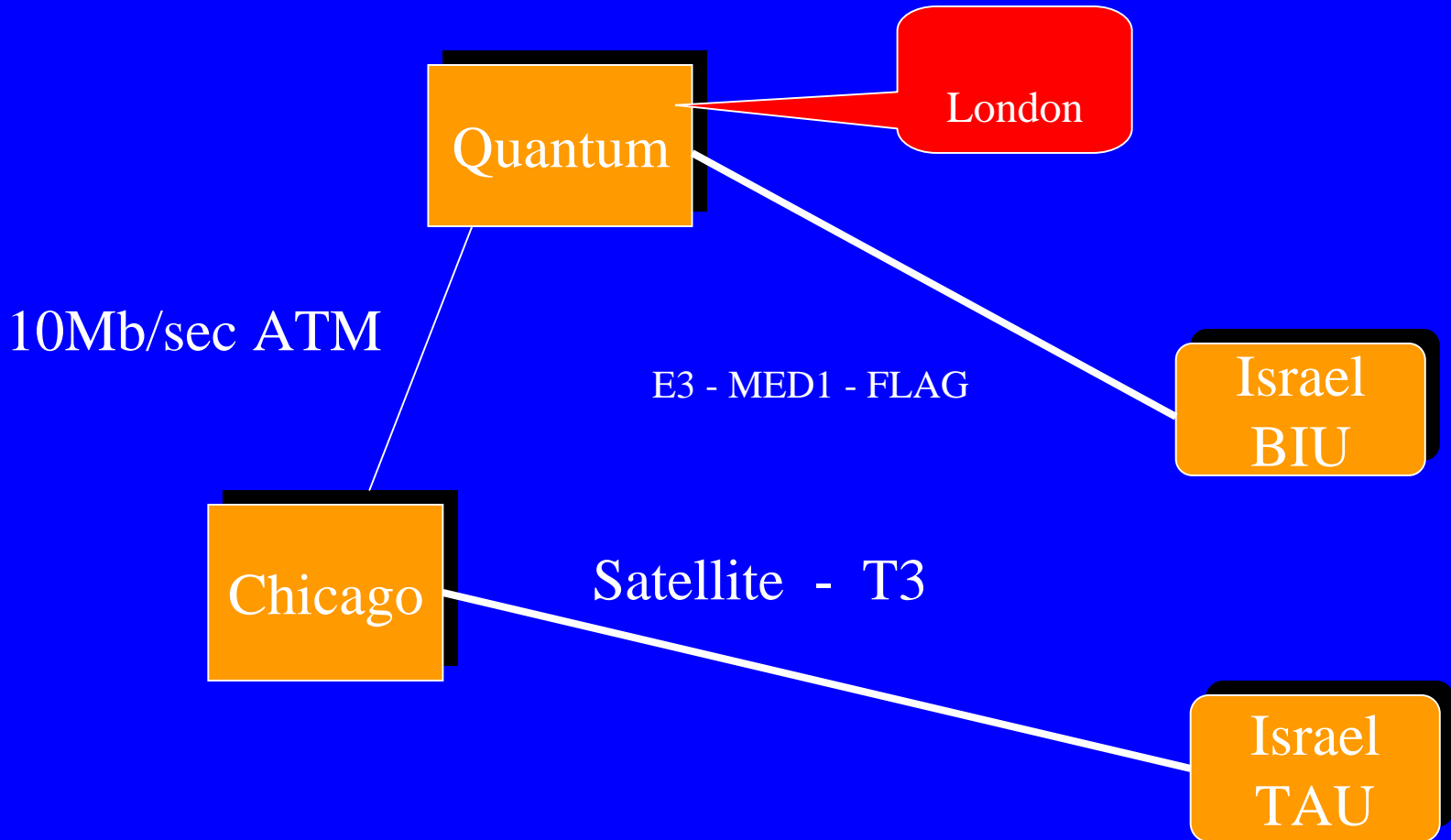
Industry R&D Unit

Bezeqcom
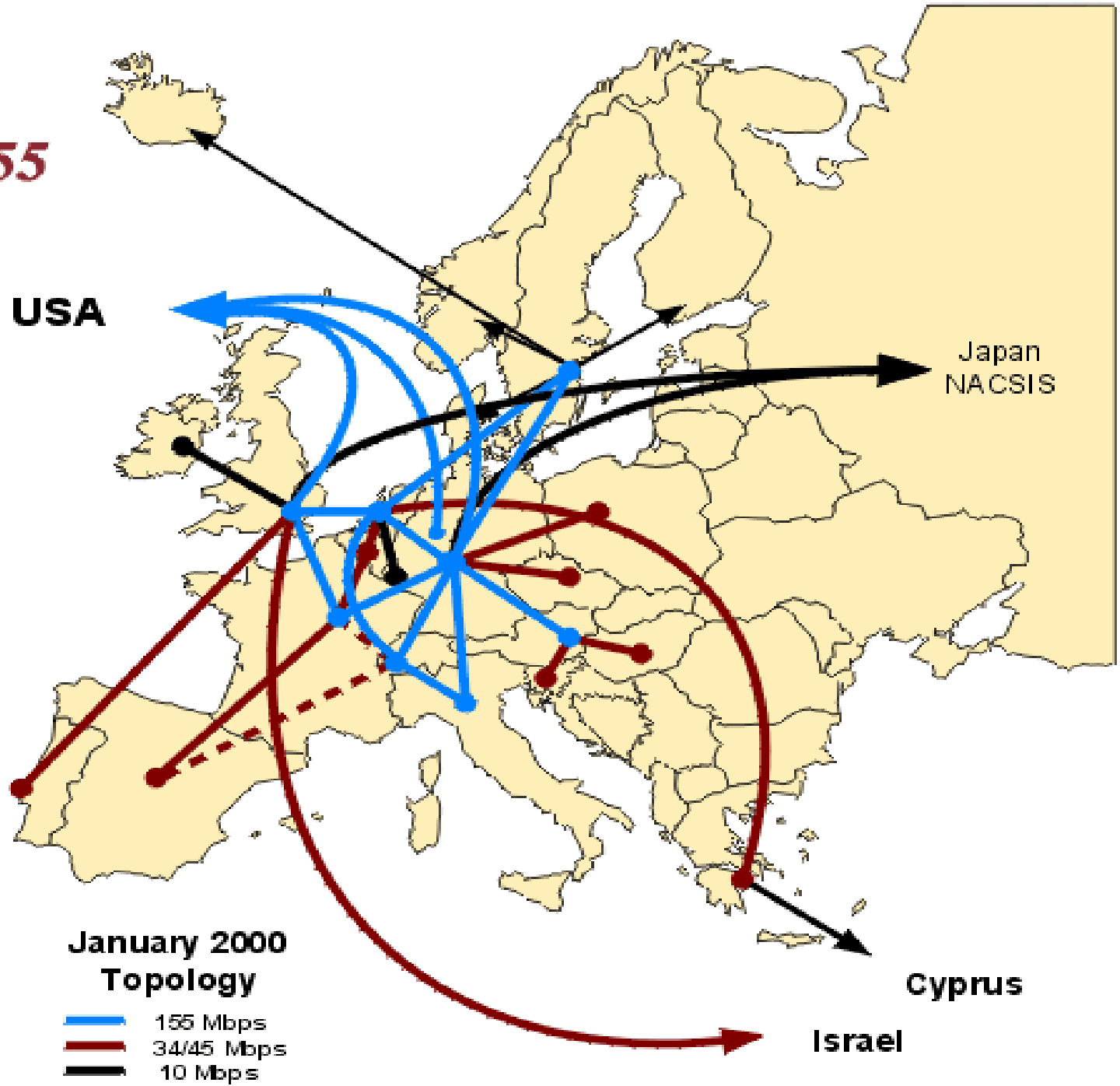
Magnet
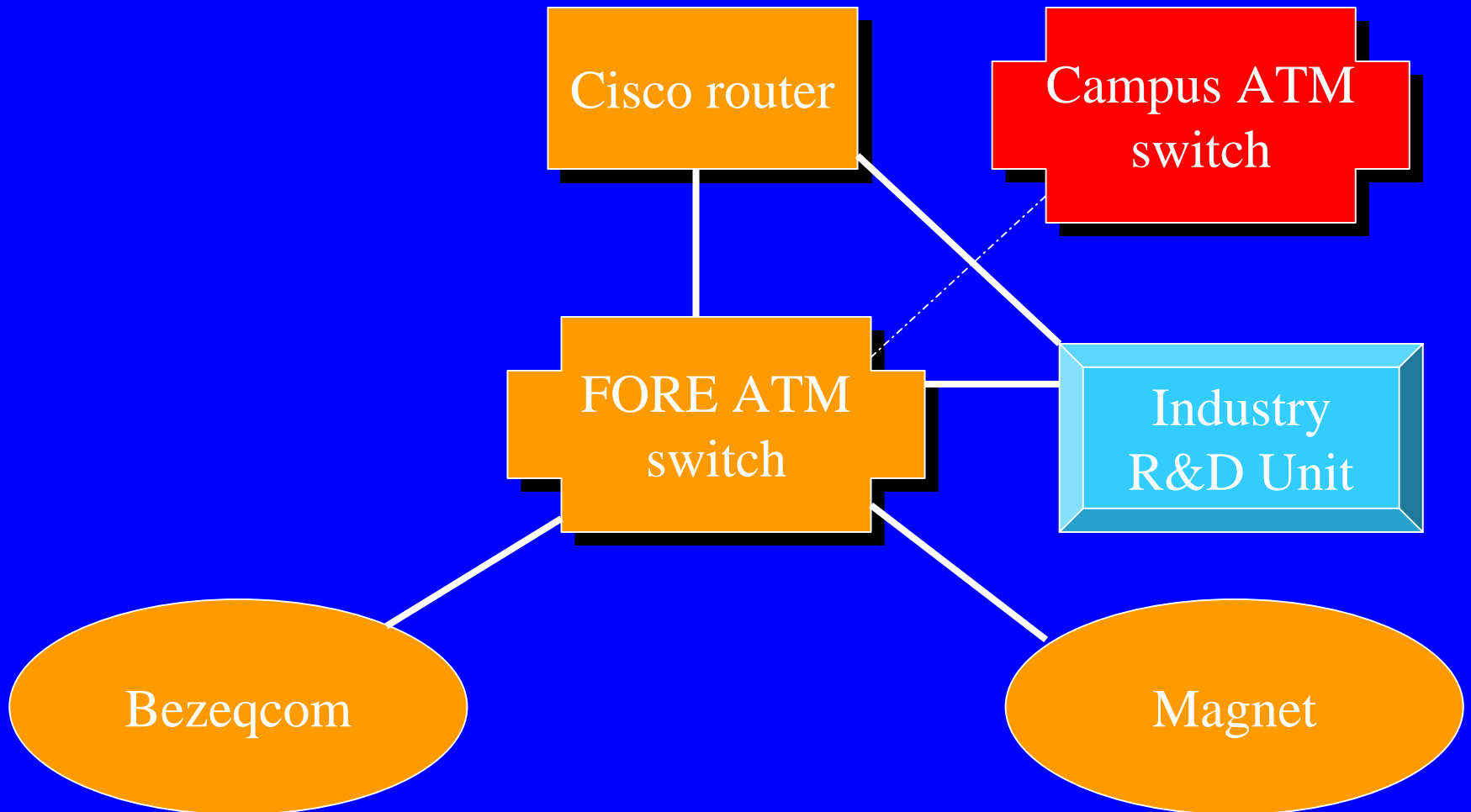
International connectivity

- **International tender closed Nov 16, 1998**
- **Carriers: Bezeq, Barak, GoldenLines, Israsat, Israsrv, Teleglobe**
- **Looking for T3 (45+Mb/sec) to USA via satellite**
  - **Chicago - StarTap - interconnection point for all foreign countries to Internet-2**
  - **Canada, Singapore, Taiwan, Russia, France, Korea, Netherlands, Japan**
- **Looking for E3 (34Mb/sec) to Europe**

International connectivity to Europe

- **Connection in Europe is to QUANTUM network**
  - **QUANTUM - 16 NRNs (National Research Network) in Europe**
  - **Q-Med - Mediterranean consortium of Israel, Cyprus, Greece, Italy and Dante**
  - **Partially funded by EC (40%)**
  - **Israel connects to London via Golden Lines - 34Mb/sec - due to price**

Solution

Quantum

London

Israel BIU

10Mb/sec ATM

E3 - MED1 - FLAG

Chicago

Satellite - T3

Israel TAU

TEN-155

USA

Japan
NACSIS

January 2000
Topology

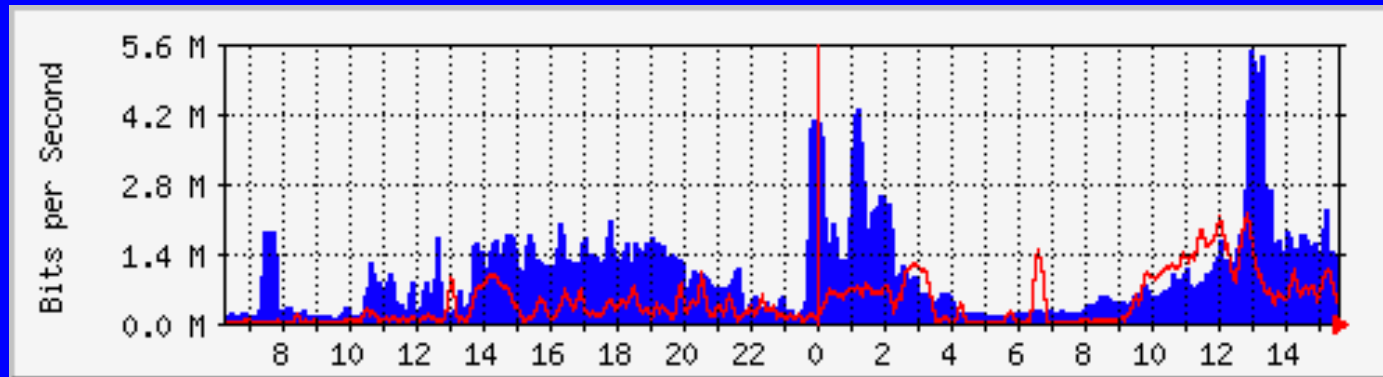155 Mbps
34/45 Mbps
10 Mbps

Cyprus
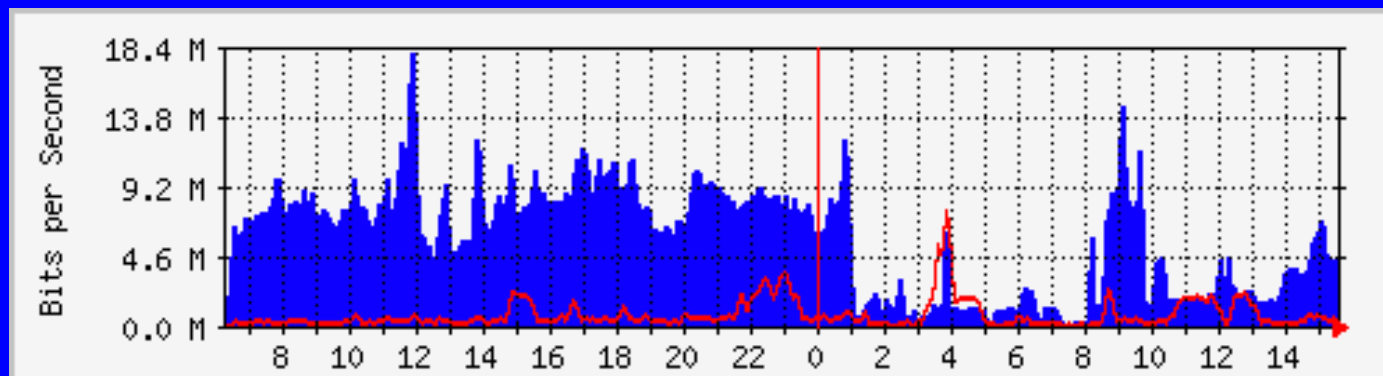
Israel

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**

Results

- ## Europe RTT: 76ms

- ## Chicago RTT: 560ms

Industry and international access

- **Global Internet contains 78,000 networks**
- **QUANTUM contains about 2,100 networks of the NRN's**
  - **http://www.dante.net/ten-155/**
- **Unlimited access to QUANTUM sites at 34Mb/sec**
- **Internet-2 is more complex**
- **StarTap has many US government high speed networks interconnected**

Industry and international access

- **Examples of StarTap peers**
  - **vBNS, ESNET, Abilene (Internet-2), MREN, DREN, NASAnet**
- **Total StarTap peers (out of 78,000) is also about 2000**
  - **http://www.startap.net/**
  - **http://www.internet2.edu/**

How much of the Internet?

- **2100 from Europe**
- **2000 from USA**
- **4100/78000 = 5.7% of the Internet is accessible via Internet-2**

Industry and international access

- **Not meant to replace Internet-1 (commodity) access**
  - **R&D units will still be required to maintain their Internet-1 access lines**
  - **Machba will be using a small 8Mb/sec pipe to run Internet-1 traffic for itself**
- **Will give up to 45Mb/sec throughput for high-speed R&D projects**
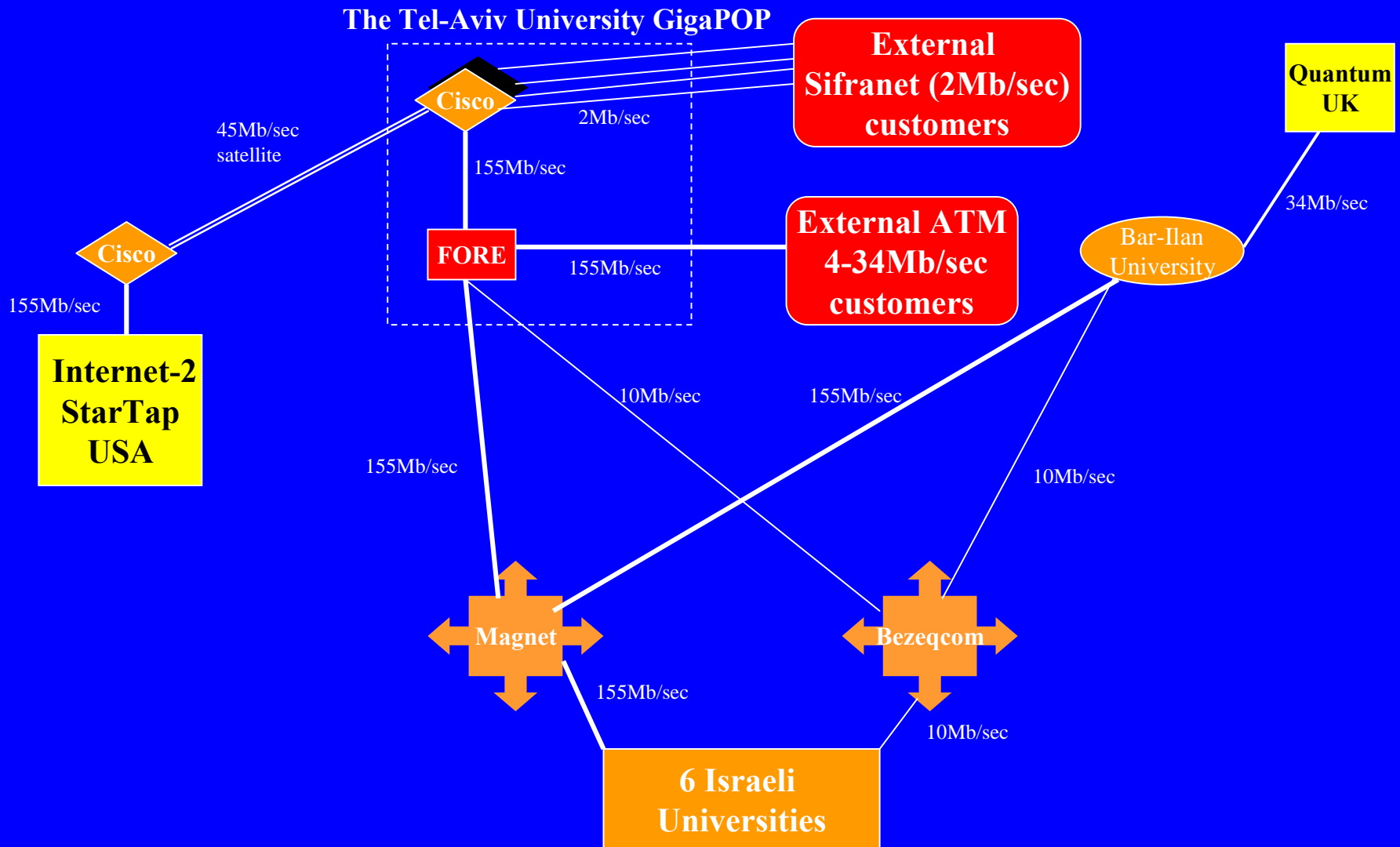
Four things needed to connect (that cost money)

1) **Connection from Bezeq - via ATM**

   4-34Mb/sec

2) **Cisco router to handle multi-homed connection**

   – **BGP-4 & NAT**

3) **Possible: system integrator**

4) **Connection to Machba - free till July 2000+**

Open University

Tel-Aviv University

Weizmann

Bar-Ilan University

Cisco

Cisco   **GigaPOP**

Cisco

Cisco

OC-3

OC-3

OC-3

OC-3

FORE

FORE

FORE

FORE

34Mb/sec

45Mb/sec satellite

Cisco

Quantum UK

OC-3

StarTap USA

Magnet

The University Internet-2 Topology for 1999

Bezeqcom

FORE

FORE

FORE

FORE

OC-3

OC-3

OC-3

OC-3

Cisco

Cisco

Cisco

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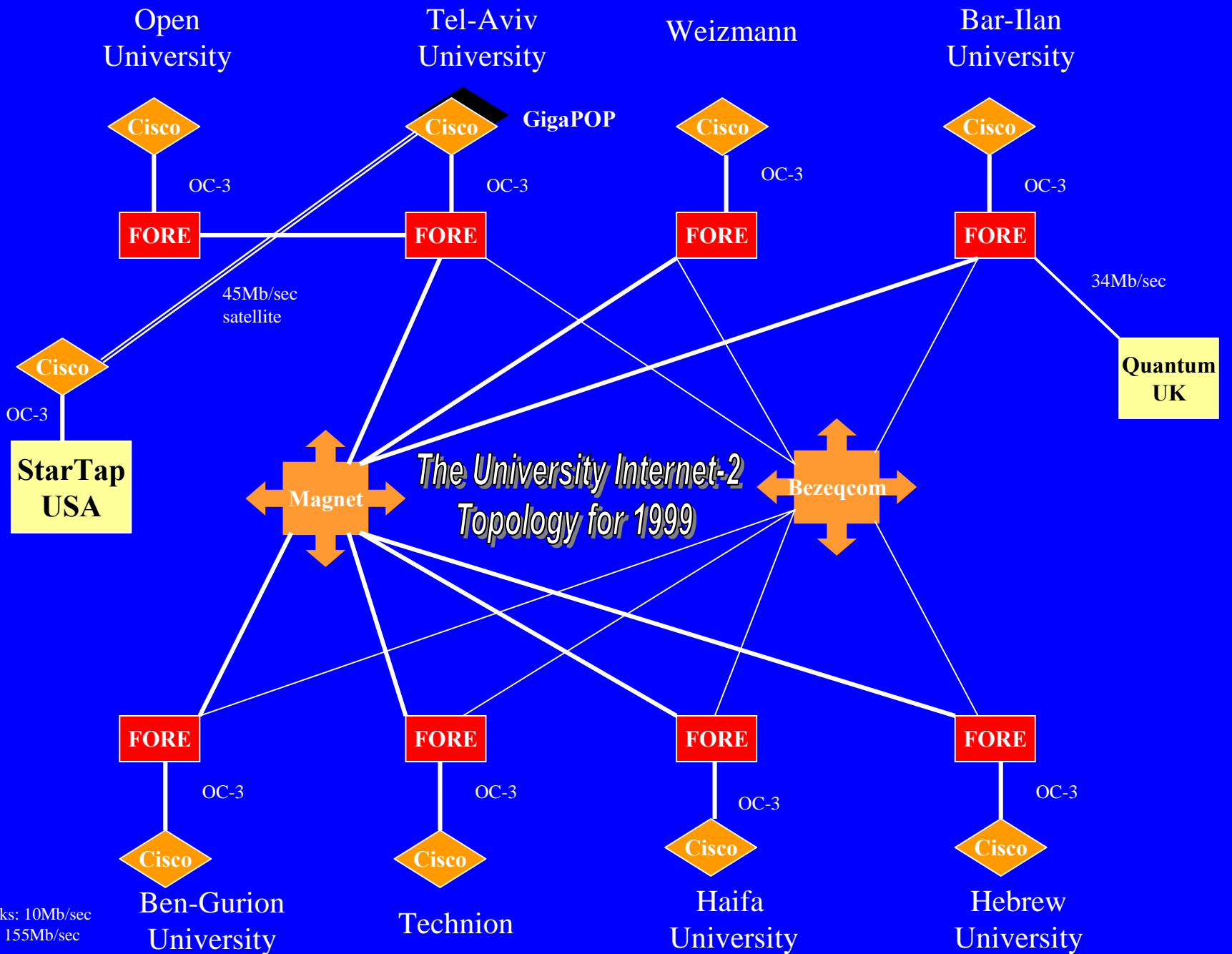
Legend:
Bezeqcom links: 10Mb/sec
Magnet links: 155Mb/sec

Ben-Gurion University

Technion

Haifa University

Hebrew University

The Israeli Internet-2 Topology for 1999

The Tel-Aviv University GigaPOP

Cisco

External Sifranet (2Mb/sec) customers

Quantum UK

45Mb/sec satellite

2Mb/sec

155Mb/sec

34Mb/sec

Cisco

FORE

155Mb/sec

External ATM 4-34Mb/sec customers

Bar-Ilan University

155Mb/sec

Internet-2 StarTap USA

10Mb/sec

155Mb/sec

10Mb/sec

155Mb/sec

Magnet

Bezeqcom

155Mb/sec

10Mb/sec

6 Israeli Universities

Applications

- **The toughest part of the entire network**
- **Tele-immersion**
- **Tele-medicine**
- **Tele-learning**
- **Digital libraries**
- **Terabyte database replication**

More applications

- **Remote instrumentation**
  - **telescopes, microscopes, robots, CAT, MRI**
- **Video conferencing**
  - **Example: CERN's Virtual Room Videoconferencing System**
  - **http://vrvs.cern.ch**

Timing

- **National ATM upgrade completed by end of May 1999**
  - **Magnet upgrade by end of June 1999**
- **QUANTUM line installed May 12, 1999**
  - **operational May 21, 1999**
- **StarTap line installed July 23, 1999**
- **Industry connections - 1st half of 2000**

Management structure

- **Government decision from June 9, 1998 to set up Internet-2**

- **ועת היגוי**

  - co-chairs of **מנכ"ל ות"ת** and **מנכ"ל משרד המדע**

  - members include: **מנכ"ל הילה, יו"ר איגוד תעשיות האלקטרוניקה, מנכ"ל משרד התקשורת, סגן ראש אגף תקציבים במשרד האוצר**

Management - continued

- *מנהלת*
  - *מנכ"ל מחב"א, נציג התעשיינים, נציג ממשלה*
  - Many observers from: Ministry of Science, Ministry of Communications
  - handles all tenders and all day to day policy
- *מחב"א*
  - is mandated to handle all operational issues of setting up and running the network

Financials

- **$10M/yr for a period of 4 years**
  - 90% on telecommunications services
  - 10% equipment and manpower
  - reduced to about $8M/yr
- **Financial split:**
  - 42% - Universities
  - 35% - Ministry of Science
  - 13% - Chief Scientist
  - 10% - Ministry of Finance

Policy

- **Policy as to who/what qualifies as R&D industry**
  - **will be based on a per project basis**
  - **requests will have to be sent to the מנהלת**
- **Policy has not been set how much connection costs will be for industry**
  - **the מנהלת will set price levels**
  - **initially free till July 2000 (perhaps even longer)**

More?

- **http://www.internet-2.org.il**
  - **FAQ, news, maps, Authorized Use Policy, etc.**