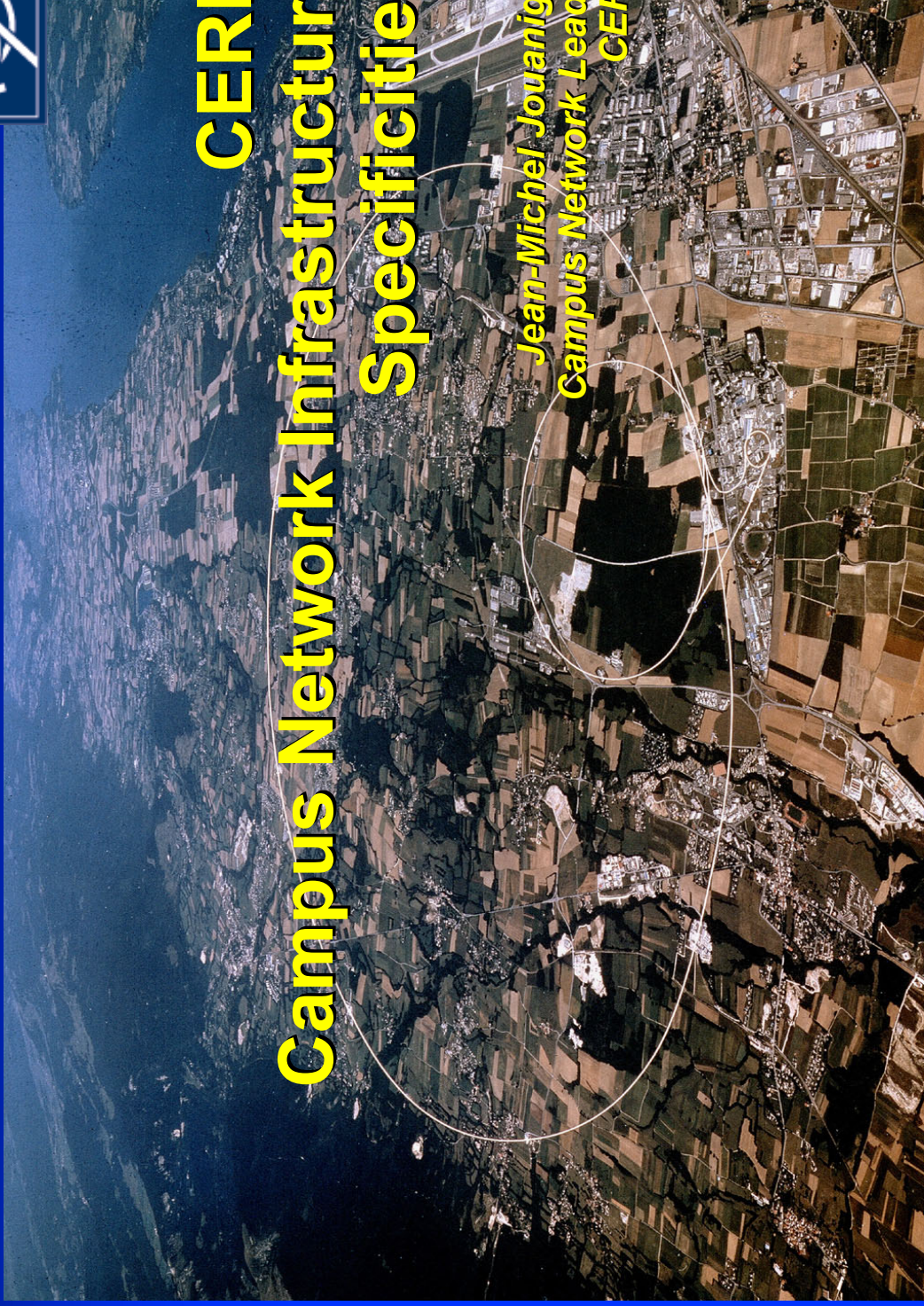EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
EUROPEAN LABORATORY FOR PARTICLE PHYSICS

CERN

Campus Network Infrastructure Specificities

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Networks at CERN

Why are they important?

- Carry all organization "business"

What for?

- Support wide range of equipment (supercomputers to PDAs)
  - Must accommodate <u>any</u> equipment
  - Date, Voice, Video
  - We are operating very much like an ISP
- For complex population (from safety guard to computer expert)
- Low performance (i.e. wireless) to very high performance (i.e. computer center & experiments)

The users expect

- 100% availability
- Global connectivity
- The network to be part of the internet
- Security

A large infrastructure

~150 meters

~10 Tons

- Two distinct multi-gigabit backbones
- About 85 very high performance gigabit routers
- 1'200 subnets
- 800 switches, ~40'000 ports
- 600 Ethernet hubs , ~15'000 ports
- 20'000 active user devices
- 40'000 sockets – 2'000 km of UTP cable
- 200+ starpoints (from 20 to 1'000 outlets)
- 2'500 km of fibers
- **Extremely Dynamic**
  - 1'500+ requests for Moves-Adds-Changes per month
- **Multi vendor** site using <u>only</u> standards
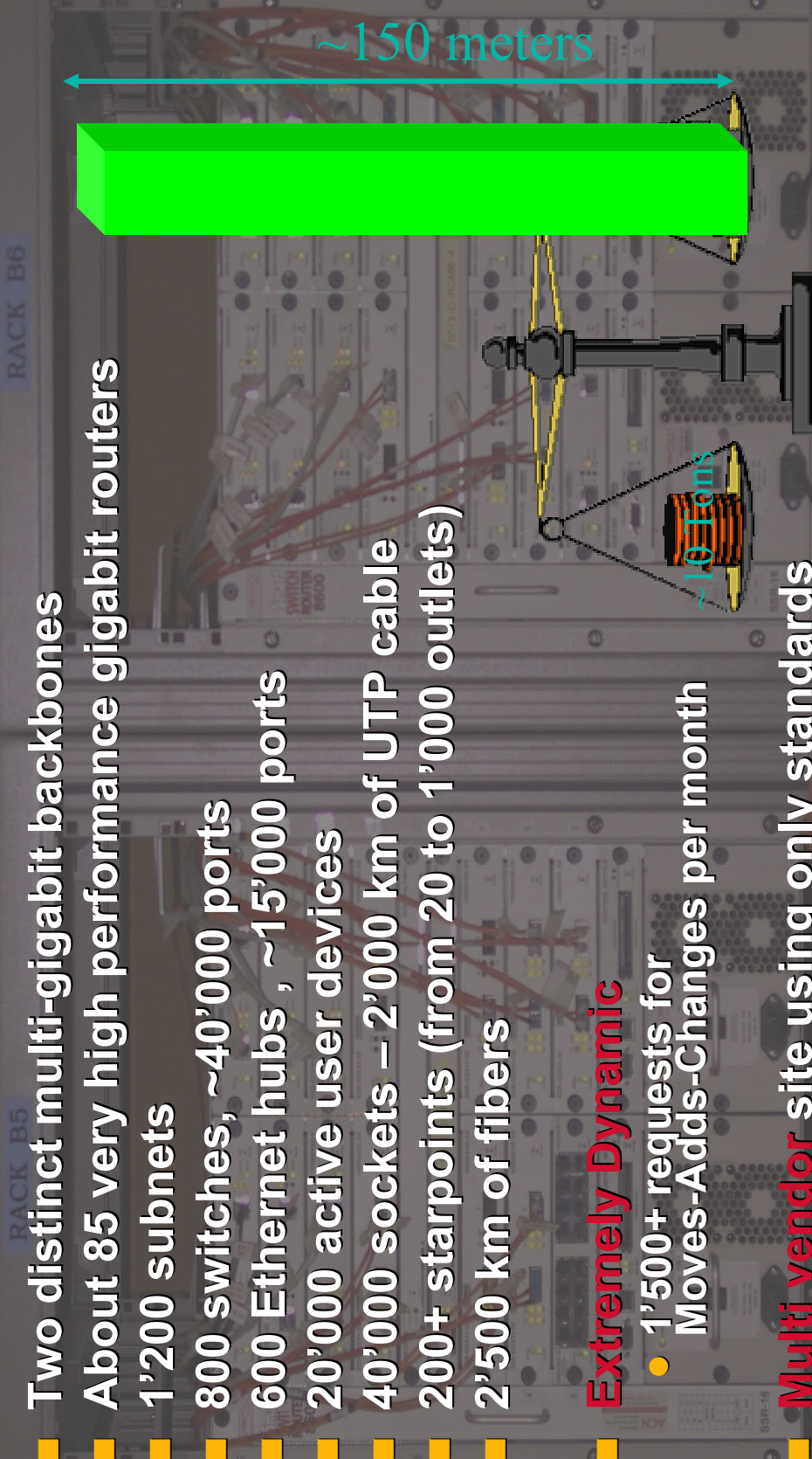
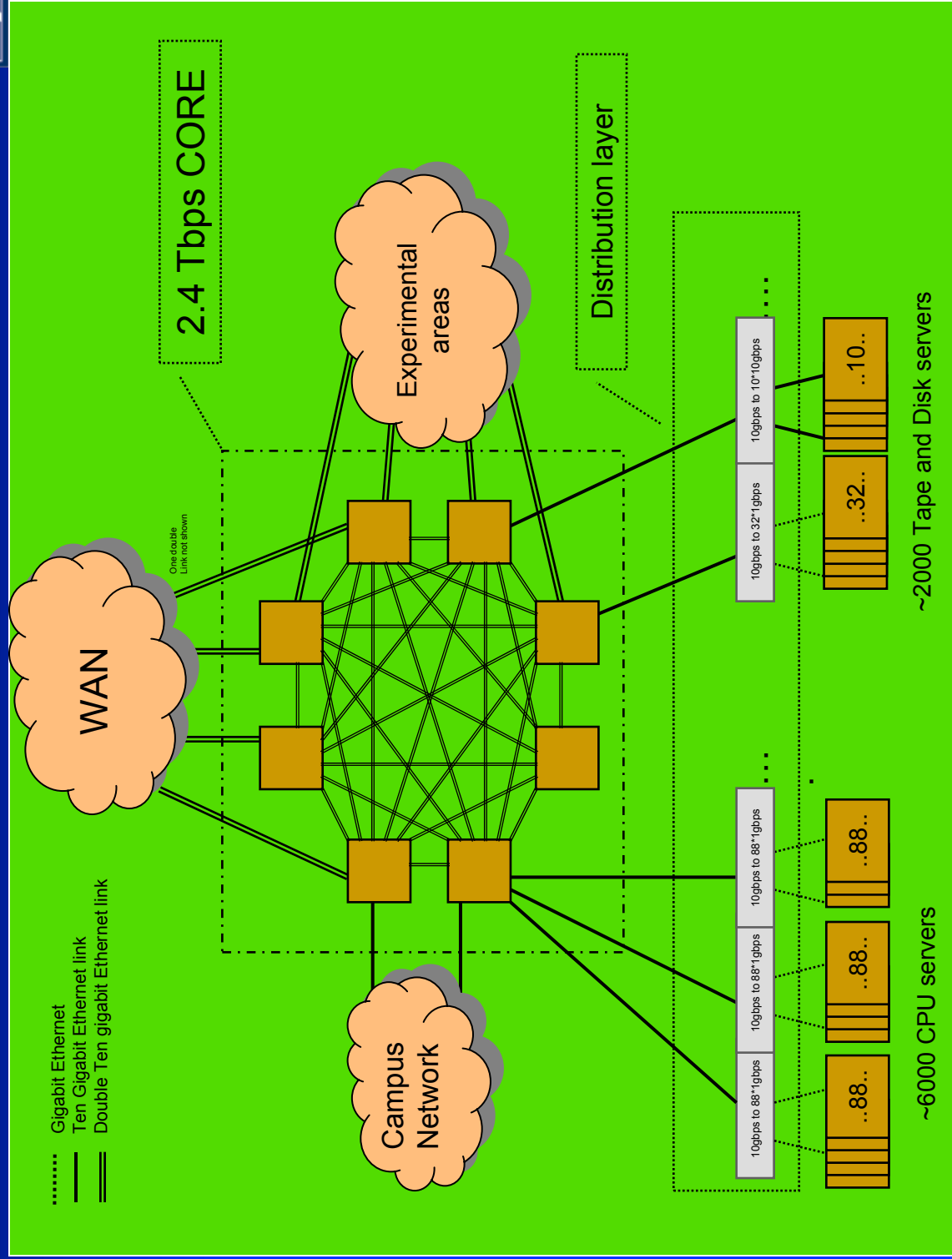# CERN Network infrastructure

Specificities

Product selection and validation

- **International open call for tenders**
  - Understanding market evolution
  - Product evaluation and certification
    - Network "lab" with traffic generators, etc
    - Large computer center testbeds: real life tests

- **Leading Edge products**
  - Constant evaluation of new technologies and early adopters
    - Gigabit Ethernet in 1998
    - Ten Gigabit Ethernet in 2002
  - Strong, direct interaction with manufacturers
    - Technology and product feedback (i.e. Openlab)

- **We have broken almost all the products tested so far**
  - Some manufacturers were not able to reproduce
 - Interest of many manufacturers to validate their equipment at CERN

Example: LCG cluster network

2.4 Tbps CORE

Experimental areas

Distribution layer

WAN

Campus Network

One double Link not shown

.... Gigabit Ethernet
———— Ten Gigabit Ethernet link
═══════ Double Ten gigabit Ethernet link

10gbps to 10*10gbps
...10...
10gbps to 32*1gbps
...32...
~2000 Tape and Disk servers

10gbps to 88*1gbps
...88...
10gbps to 88*1gbps
...88...
10gbps to 88*1gbps
...88...
~6000 CPU servers

The role of automation

- **The Network is heterogeneous, high bandwidth and large**
  - Enterasys, 3COM, BATM, Cisco, HP, etc
- **The network is operated by**
  - First line: 5 FTE (SLA)
  - Second line: 1 FTE
- **Infrastructure**
  - new installations: 7 FTE
  - Software and tools: 6 FTE
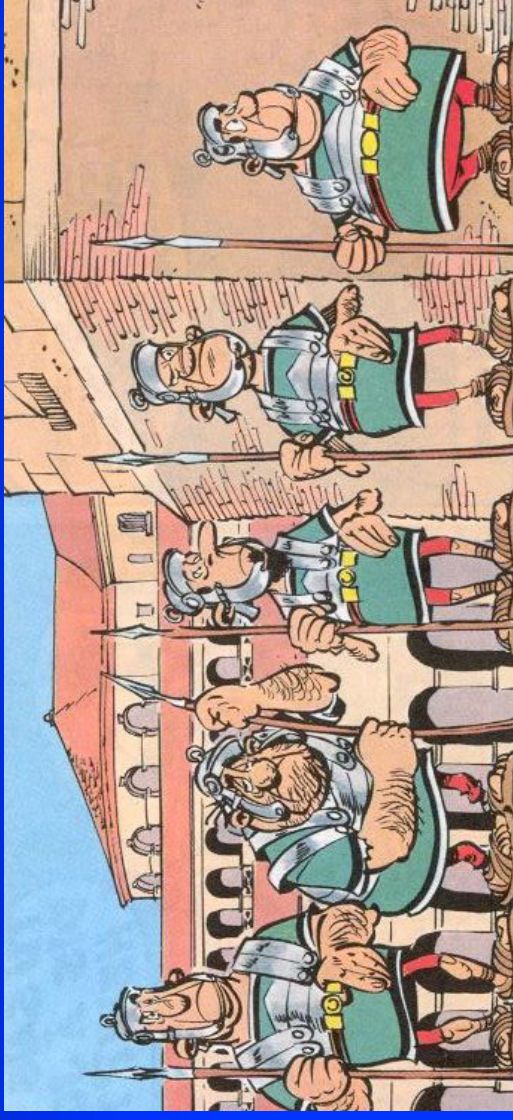
- **Investment in <u>Automation</u> to save manpower**
  - Very large investment in definition & implementation of a global multi-manufacturer management framework
    - Well defined service definition (WEB interfaces, etc)
    - Well defined models and procedures
    - The right tools prevent mistakes and improve reliability

Summary

- **Strong in house knowledge in**
  - Network technologies
  - Product evaluation and validation
  - Design & Operation of very large high performance network infrastructures
  - Network Management Automation

- **Established partnership with some key manufacturers**

- **Early adopters of new technologies**

Thank you!