NLC Controls Network Overview

Control System Overview

Node Counts

Network (POP + Segment + Core)

TRIO Architecture

Mark Crane

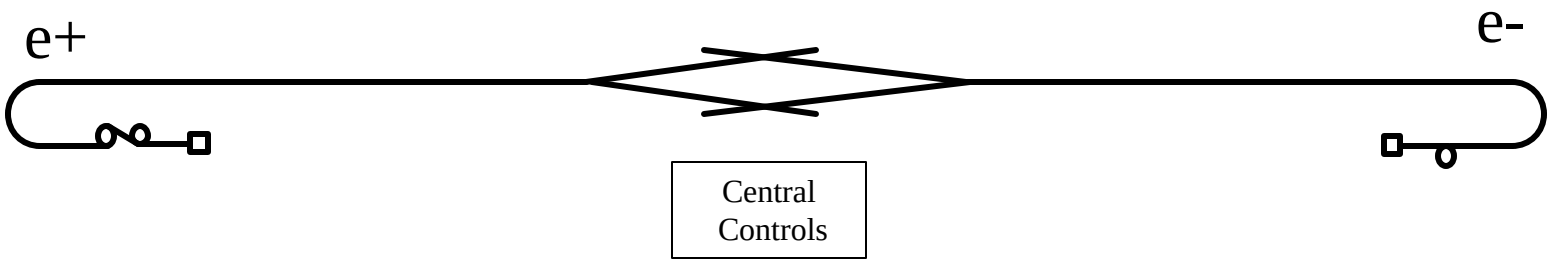
8/5/99

Overview of Control System

- Distributed control system based on EPICS
- Many TCP/IP based network applications
- 120Hz machine cycle requires control system to be “pulsed”
- Realtime data sharing between CPUs over km distances
- Reliable, general purpose network to provide conventional data connectivity (TCP/IP)
- Reliable, low latency, high bandwidth network to provide realtime data connectivity
- Multiple fieldbus types matched to application needs

NLC Control System Size

- How big is it?
  - 10 Km of Linac + 5 Km of Beam Delivery *2
  - 18 Km of fiber optic cable from Central Controls to furthest node
    - ≅ 200uS maximum round trip propagation delay!
  - 192 major clusters of control system devices
  - Pulse train of 95 bunches every 8 ms (120Hz)
  - 3 to 5 million Process Variables
  - Some users are requesting “all the data all the time”

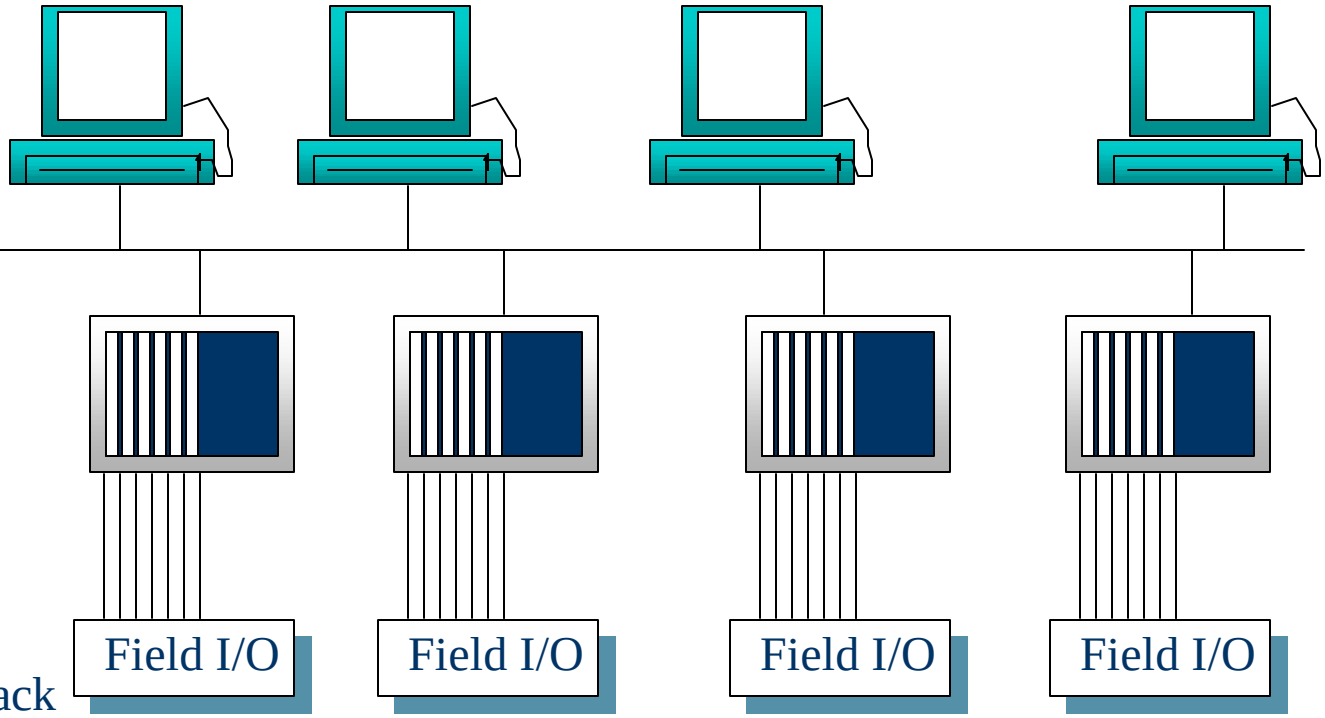


EPICS Hardware Distribution

Workstations:
- Sun
- Hp
- PC

I/O Controllers (IOC)
- VME/VXI/PCI

Remote I/O and Signal Conditioning
- **CAN-Bus**, Industry Pack
- VME, VXI, PCI, ISA
- CAMAC, GPIB
- Profibus, Bitbus, Serial,
- Allen-Bradley, Modbus,
- **IEEE 1394 (Firewire)**



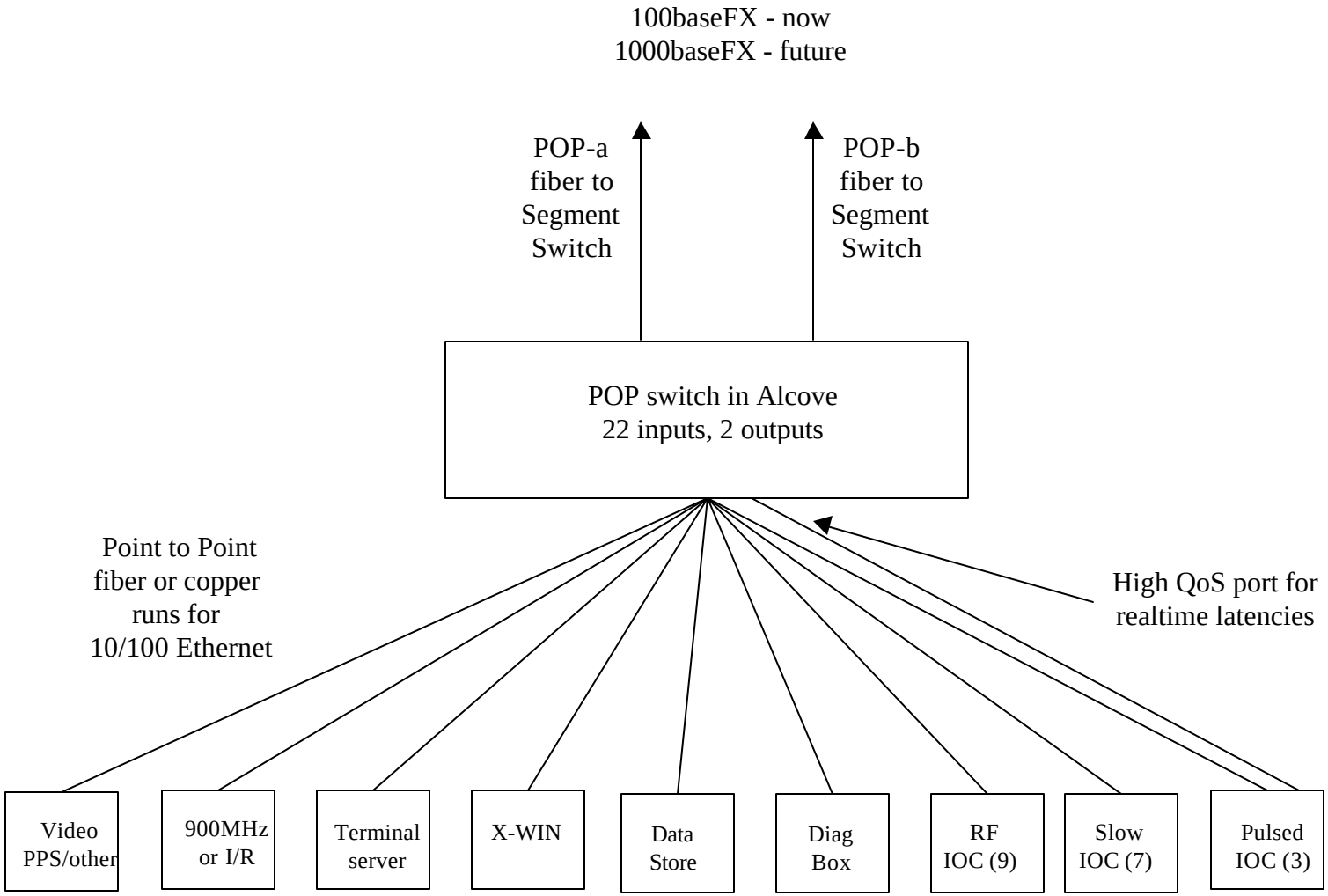
NLC Network Node Counts

- 380 Pulsed Control System IOCs (282 linac + 98 other)
- 600 Slow Control System IOCs (could be 192)
  - Actual IOC count depends on exact local I/O counts
- 414 Linac RF IOCs (pulsed)
- 60 Special purpose IOCs (some pulsed)
  - Damping rings, diagnostic sections, Master Pattern Generator, Feedback, Machine Protection System
- Total ≅ 1500 IOCs (could be 1200)
- 1000 support nodes in the alcoves
- 300 servers and workstations in the Central Controls area
- Grand total ≅ 2800 total nodes in this network (for now)

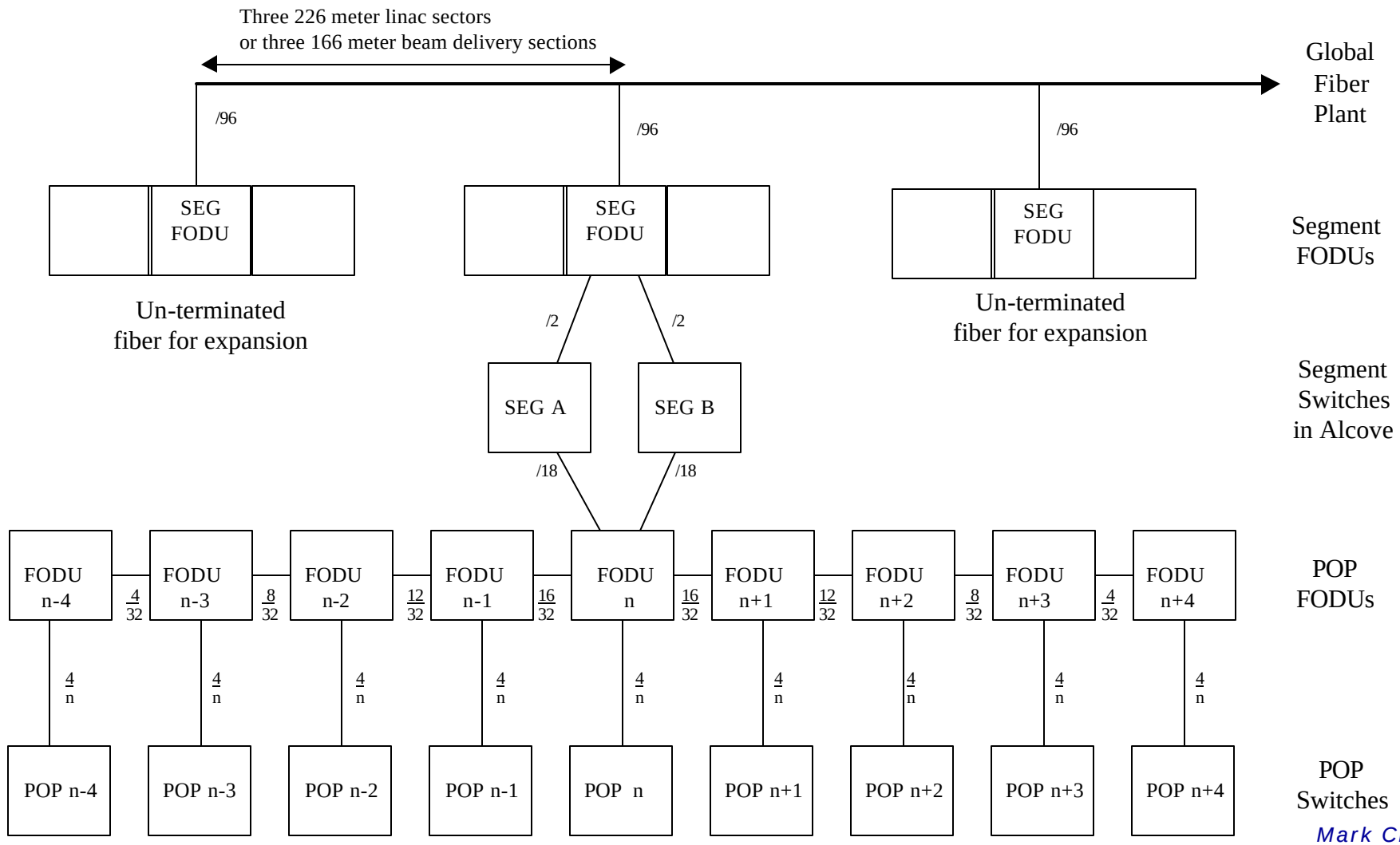
Global Network

- Global network to provide alcove connectivity
  - Model uses Gigabit Ethernet as the physical layer protocol
  - Scaleable, fault tolerant, commercial network
  - TCP/IP based protocols to allow network segmentation
  - Backbone is 100% optical fiber, node access is mixed fiber/copper
  - Redundant systems are used for reliability where cost effective
  - Long fiber runs from central campus area to every third sector in main linac for expansion capabilities = 32 fiber to each sector.
  - Integrated network monitoring and management tools
- Network Point of Presence (POP) provided in every alcove
- POPs are aggregated into Segments using redundant fibers
- Segments are brought together into Core switches

Point of Presence

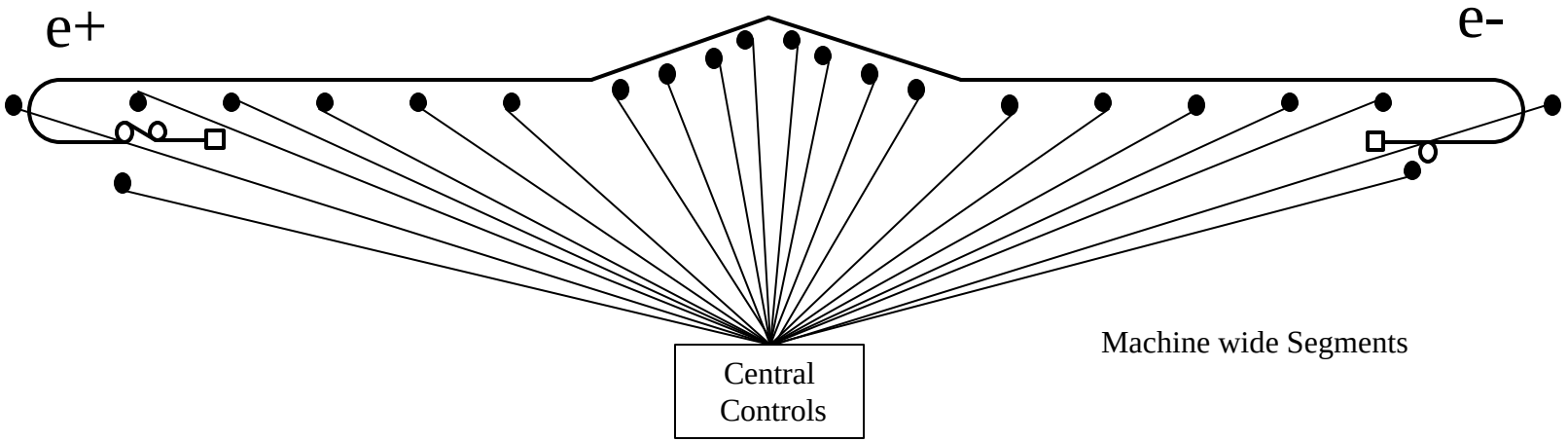


Fiber Distribution to POPs



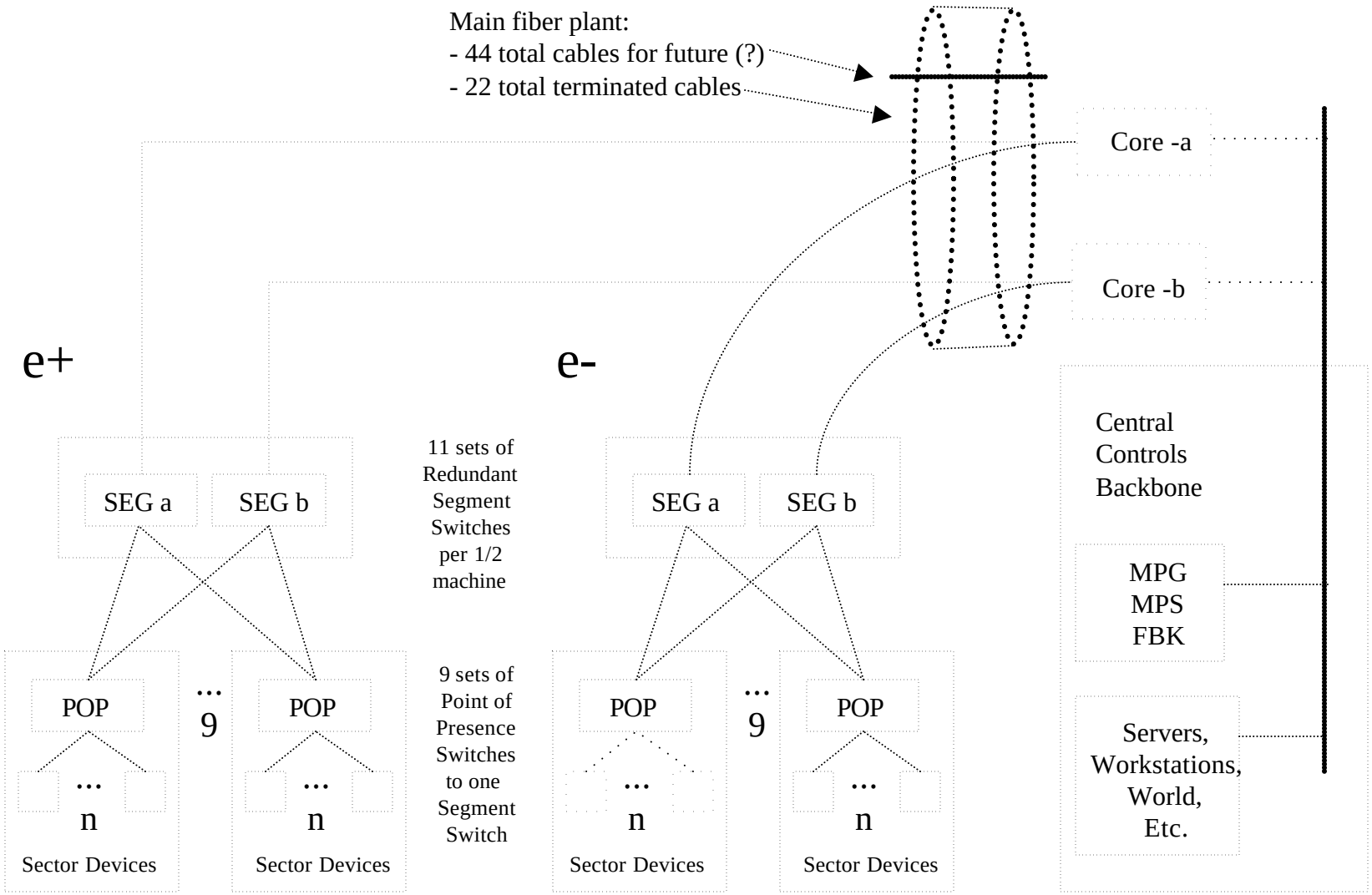
Numbers are required fiber count (no spares)

Segments

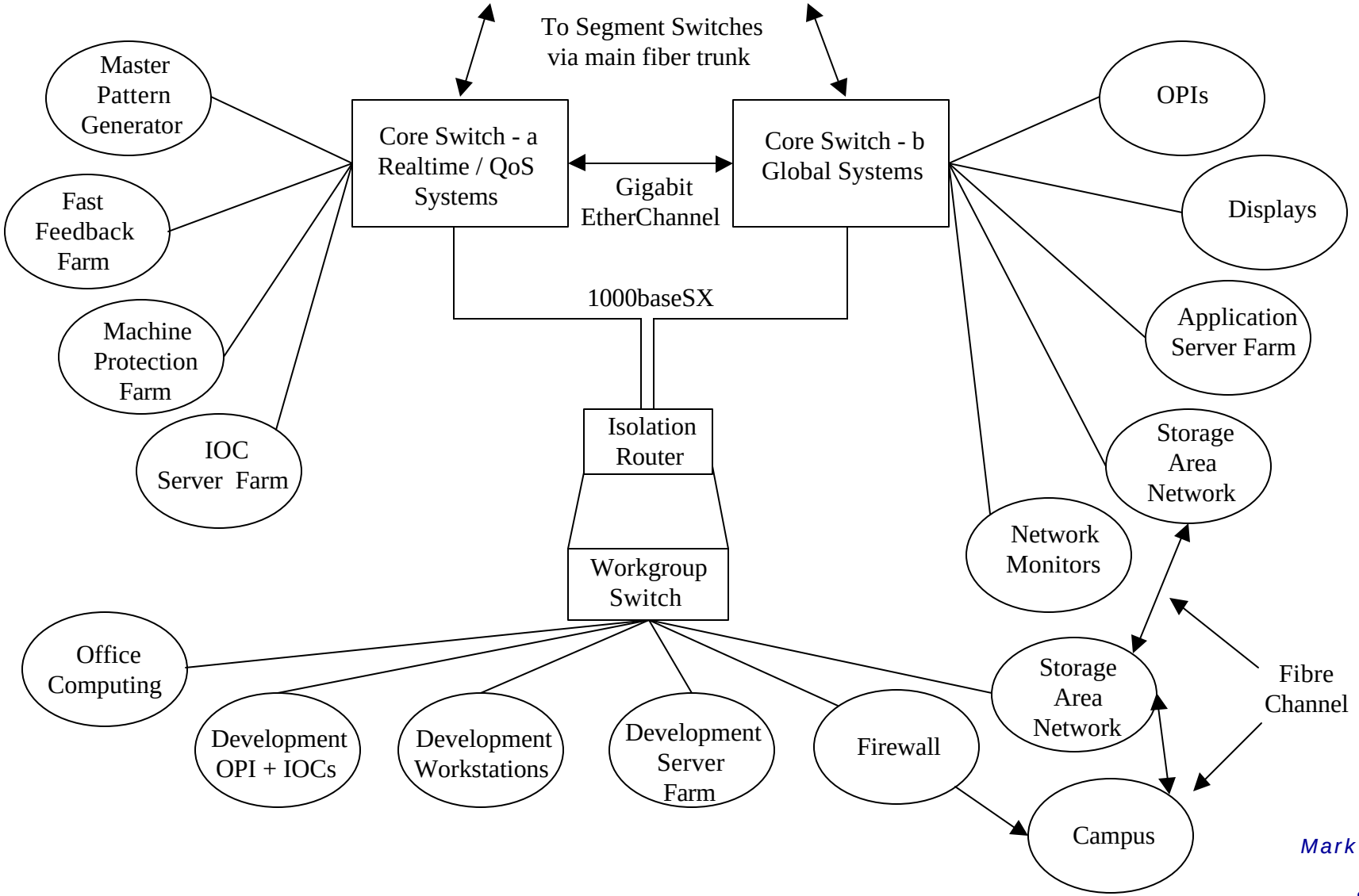


Machine wide Segments

POP + Segment + Core



Central Controls Area



Trio Architecture

- Potential Architecture which needs fiber support
- IOCs in “glass house” in the central controls area
- Rugged CPU platform in the alcove connected to custom network with reliability and low latency designed in
- Fieldbusses connected using custom hardware