

Climbing from the Bottom Up

1976: The 17-meter spark that started a backward industry.

1976 Wuhan: 17 meters pulled by Zhao Zisen.

Loss: ~ 300 dB/km
(vs. 0.2 dB/km today).

Optoelectronic Chips
(The current uphill battle)

Optical Modules
(Mastered Third - Current dominance)

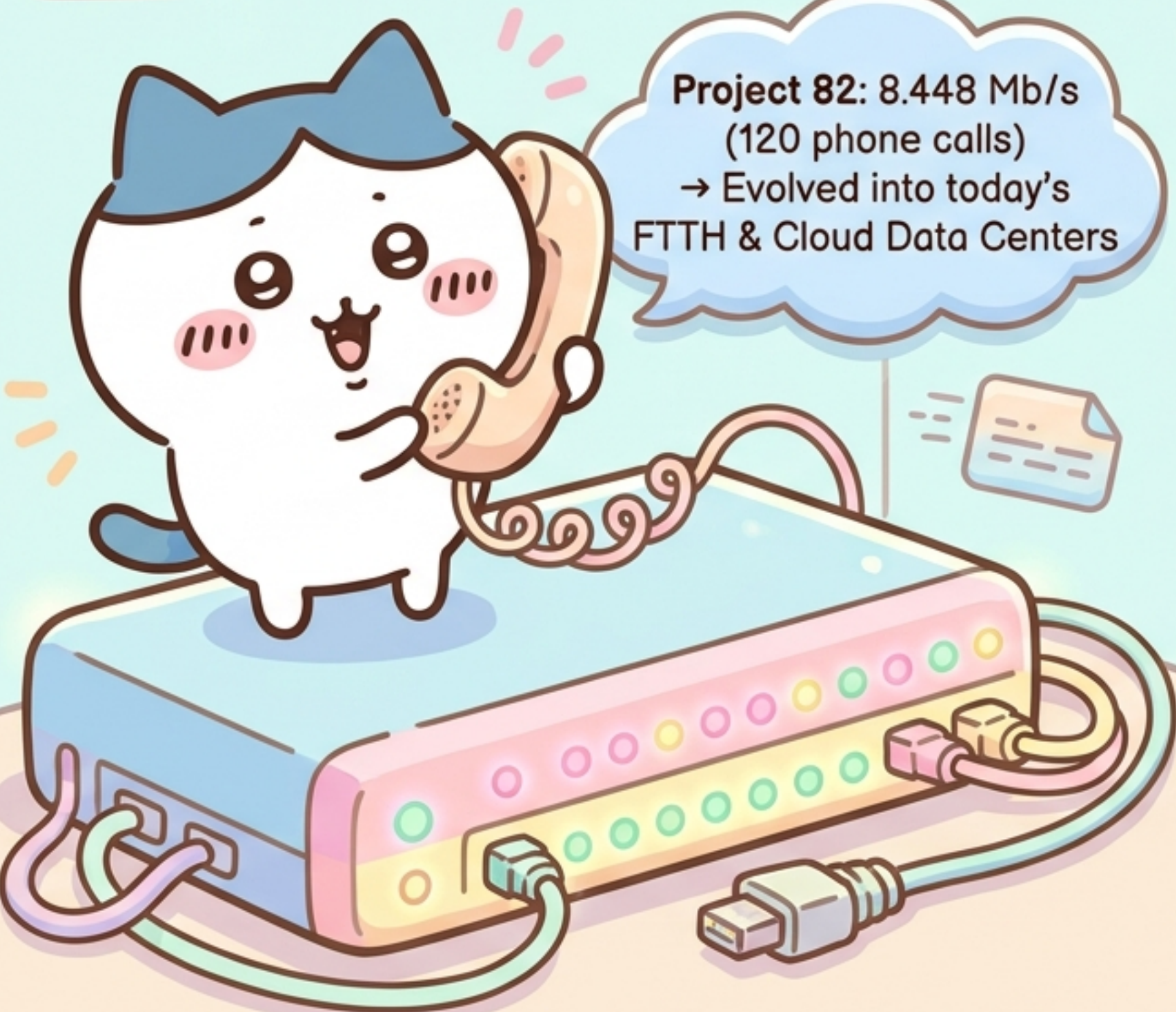
Systems Equipment
(Mastered Second)

Cable & Fiber
(Mastered First)



Mastering System Integration

From 1982's first 13km link to global datacom dominance



Project 82: 8.448 Mb/s
(120 phone calls)
→ Evolved into today's
FTTH & Cloud Data Centers

The Module Playbook

Market Reality: 7 of the Top 10 Global Module Vendors are Chinese (Innolight, Eoptolink, Accelink)

The Strategy: Treating optical modules like PC integration (the Dell/Lenovo model) rather than pure core invention.

The Moat: Fast engineering iteration + Precision packaging + Extreme cost discipline

The Result: First to climb from sample to 1-million-unit ramps for hyperscalers

The Value Trap inside an 800G Module

China won the packaging layer, but the critical nodes remain overseas.

Wa!

Housing / PCB / Packaging:
Low margin, high volume.
Dominated by Chinese vendors.

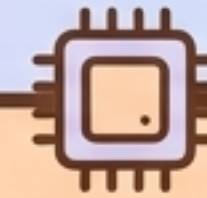
Optical Components + Lasers (EML):
~50% of cost.
Top tier dominated by Lumentum,
Broadcom, Mitsubishi.

ODSP (Digital Signal Processor):
20-40% of cost.
Dominated by Marvell & Broadcom
holding 60-80% share.

The 112G Gap: A modern ODSP pushes the absolute frontier of analog/digital circuit design at under 1 watt per lane.
Domestic share of high-speed ODSPs remains <10%.

Silicon Photonics: A Different Physics

Escaping the advanced-node chokepoint through precision packaging



Compute Chips (CPU/GPU)

Rule: Density matters. Requires advanced nodes (3nm/5nm).

Packaging: Purely electrical.



Photonic Chips

Rule: Alignment matters. Mature nodes (90nm to 45nm) are perfectly fine.

Packaging: Mixed optical-electrical.

Like an optics bench in a physics lab shrunk into a housing. A laser tilted by a hair throws off the whole path. Packaging matters as much as the design.



Feeding the GPU: What Wins Next?

Optical kits now consume 5-8% of total AI data center investment.



CPO (Co-Packaged Optics): Moves optical conversion directly into the switch chip's package.



LPO (Linear-Drive Pluggable): Drops the heavy ODSP for a linear driver, radically reducing power.



Hollow-Core Fiber: Light travels through air, not glass (Azure measured 0.091 dB/km).
Challenge: The Blu-ray problem — amazing performance, massive cost jump.

The Winner-Take-All Rule: High tape-out costs + locked ecosystems = Market consolidation. China has the module capacity; the race to build a domestic Broadcom/Marvell equivalent is officially on.