


Proceedings
Teaching Entrepreneurship to Engineering
Students

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Year 2003

PairGain: The CopperOptics Company

Howard Flagg
PairGain



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PairGain co-founder

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PairGain's Market Idea:

- **Employ Digital Subscriber Line (DSL) technology to deliver multiple phone lines on a single pair of telephone wire**
- **Help telephone companies relieve held orders caused by rapid growth in second residential lines during late 1980s and early 1990s due to the shortage of copper pairs**
- **Gain back pairs of wire: “pair gain”**

PairGain Mission

- **Establish PairGain as a niche supplier to of "pair gain" equipment to telephone to relieve held service orders**
- **Product Idea: Digital Added Main Line (DAML)**
- **Relevant Experience: Digital Signal Processing (DSP) and telephone systems know-how**
- ***Do something new and exciting***

Founders - 1988

- **Combined experience: satellite modems, PBX systems, DSP, telco network transmission, small business operation**
- **Ben Itri - Engineering**
 - ◆ TRW ; Advanced Telecommunications, Inc
- **Howard Flagg - Product Management**
 - ◆ TRW ; Advanced Telecommunications, Inc
- **Mark Tratner - Marketing & Sales**
 - ◆ Lexar ; Micom ; Erlang Corporation
- **Henry Samueli - Systems Engineering**
 - ◆ TRW ; UCLA Professor of EE

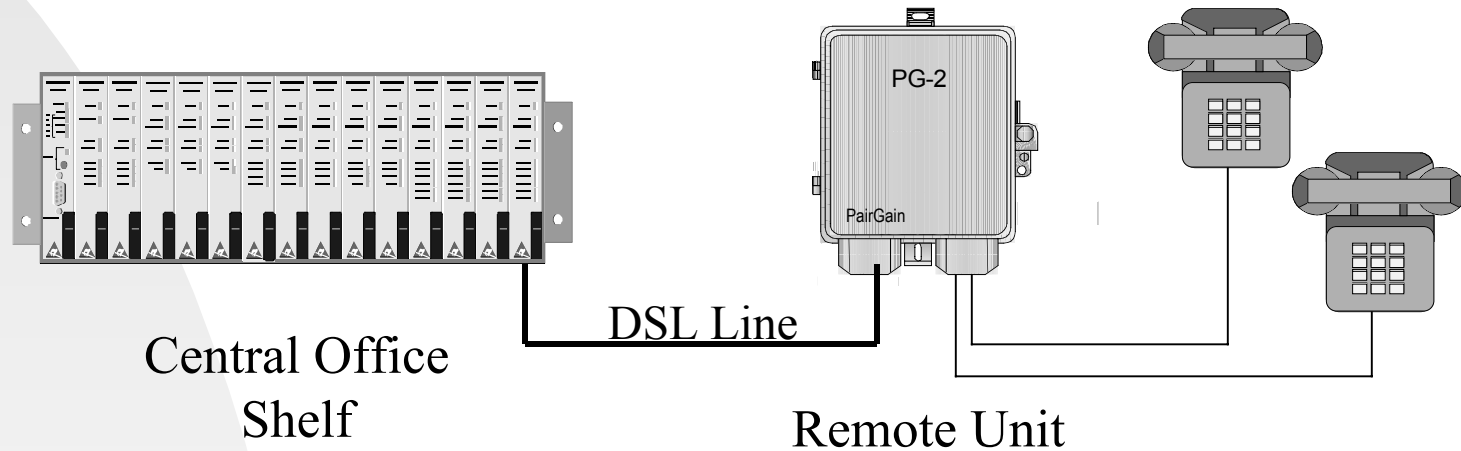
PairGain's Challenges at Startup

- **Customers:** Telcos were notoriously difficult targets for small companies
- **Raising Money:** Founders were unknown to the investment (VC) community
- **Market:** Customers were interested, but not overly enthusiastic; not a “top 5” priority
- **Completing the management & technical team**

History

- **Jan-1988 - First funding attempt and technology prototype development**
 - ◆ Unsuccessful at raising venture funding
 - ◆ Marketed and funded through \$400k raised by contracting & corporate partnership with General Signal TTI division for DAML study
 - ◆ Built a working DSL transceiver prototype
- **Jan-1989 - Raised \$1.7M in venture funding based on customer endorsement and a working DSL prototype**
 - ◆ Typical formula: new CEO & control passed to new board of directors (VCs)

First Product: PG-2 (DAML)



- PG-2: 2 separate phone lines on 3 miles of single pair
- Market: Fast second residential line additions without installing new copper cables
- Core Technology: Digital Subscriber Line (DSL)
- Why PairGain would succeed: know how; niche market (uninteresting to larger, well known, suppliers).

History - cont'd

- **1990 - Transition Year: New Business Plan, New CEO & more money**
 - ◆ Faced the realities of the “RBOC” customer
 - ✦ First product is too costly (compared with residential phone revenue)
 - ✦ No customer urgency - already waited 20 years
 - ✦ Emerging Competition
 - ◆ New CEO (3rd) & more funding from VC's
 - ◆ New Plan: Develop the new *HiGain* product line
 - HDSL (High-bit-rate DSL): DSL lines for quick T1 (1.544 Mb/s digital line) installation

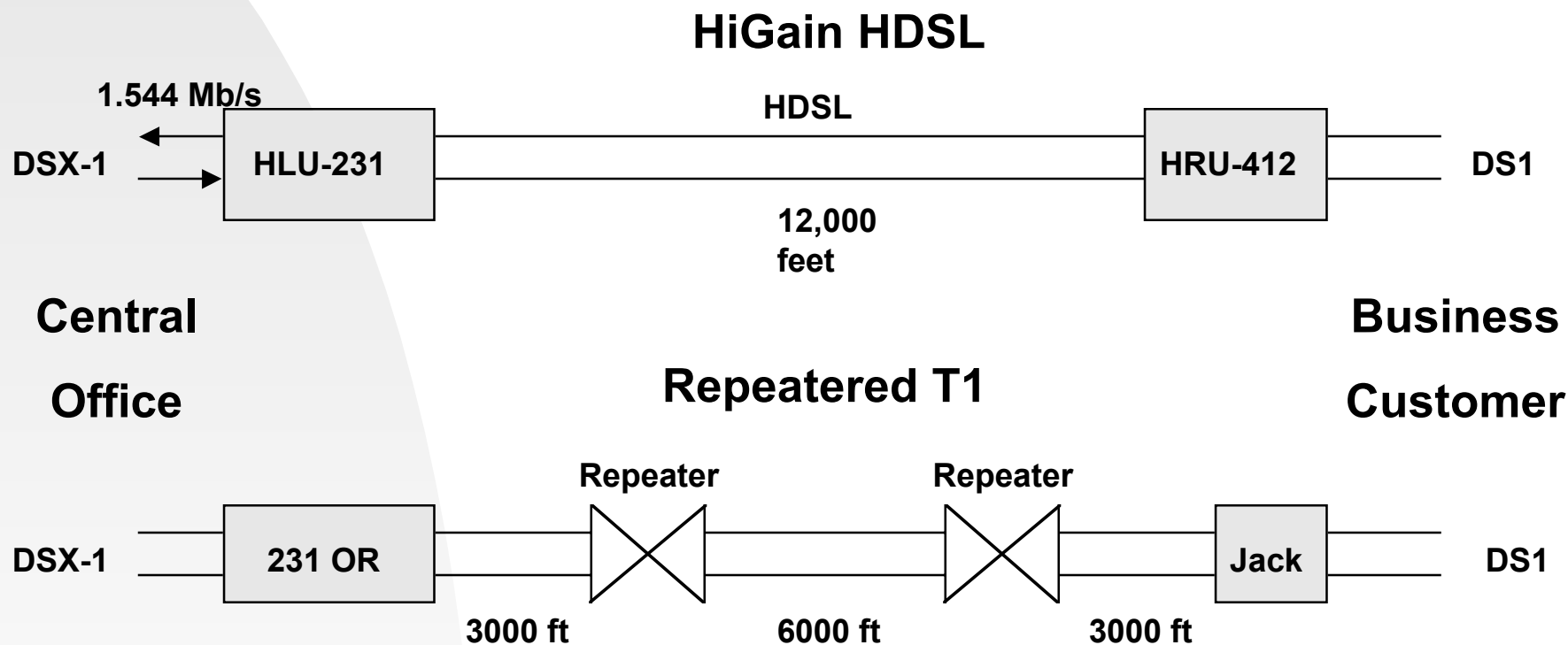
The HiGain HDSL System

- **Allows T1 line installation without repeaters**
 - ◆ repeaters normally needed every 5,000 feet
- **Saves labor - trucks, people, time**
 - ◆ Hours instead of Days, Weeks
- **Requires no wire conditioning or selection**
 - ◆ Pairs often have “bridged taps” and wire gauge changes
- **Fiber quality over copper wire**
 - ◆ Very low bit error rates in operation

HiGain's Winning Strategy (1991)

- Recruited a Microelectronics Team to make 'core' VLSI chip
- Introduced the "ultimate product"
- "Plug & Play" in old repeater equipment bays
- Enlisted "champion" customers - BellSouth and Southwestern Bell for first applications
 - ◆ Bi-weekly design reviews with customers
 - ◆ Married the customer to the product
- Kept a low profile in a "fiber-head" environment
 - ◆ "Grass roots" acceptance by operations staff - bypassed normal approval cycle

HiGain vs. Repeatered T1



HiGain HDSL Units

Line Unit



Doubler



Remote Unit



Problems - 1991

- **Modest funding and schedule slippage created cash problems**
- **Internal Management Conflicts**
 - ◆ CEO vs. founders
 - ◆ Big company guys in a small start-up
 - ◆ Diversification vs. focus
- **CEO #4 - Turnaround**
 - ◆ Re-establish focus and values
 - ◆ Restore investor confidence

But also.... Good Luck

- **Small companies couldn't make DSL products**
- **Large companies wanted telcos to rebuild the network with optic fiber & coax and snubbed DSL**
- **Bell Companies thought the need was only short-term**
 - ◆ RBOCs didn't fund Bellcore's standards work
 - ◆ No long formal procurements; left product selection to the discretion to the field operations managers
- **Competitors were stuck in the lab**
 - ◆ Level One Communications, Inc. convinced 10 companies to use their part - and delivered 2 years late

PairGain's IPO - Sept 1993

- **Excellent “story” - simple concept**
 - ◆ Revenue Growth CY1992-93: \$9M-\$36M
 - ◆ 3 pre-IPO quarters of profitability
 - ◆ Good gross margins: \$50-55%
 - ◆ Market leader in HDSL (>65% share in 1995)
 - ◆ Excellent visibility for the next year
 - ✦ 1994: \$59M; 1995: \$107M
 - ◆ Upside from new broadband data services
- **But: Warnings of unit price reductions from \$1,800 to \$1,200 spooked investors**
 - ◆ Stock spent most of 1994 at \$7-8/share

Coping with Growth

- **New skills and systems needed**
- **Management means personnel issues as much as technical challenges**
- **Not so easy to hand-pick each new employee**
- **Stock market distraction**

Market Leadership 1994-1997

- **Product cost improvements buoyed investors**
 - ◆ Lagging competition
 - ◆ Decent gross margins
 - ◆ Lower prices (27%/year) grew the market
- **Frustrated Competition**
- **Stock price soared to \$165 on solid results (10-14% Q-Q revenue increases)**
- **Couldn't hire fast enough - operating margin reached 30%**

Revenue
- Costs
- Sales
- R&D
- <u>G&A</u>
= 30%!

PairGain Technologies - End of 1996

- **Financial**
 - ◆ 1996 revenue: \$205 M
 - ◆ Pre-tax income: \$55M (27%)
 - ◆ Annual growth rate: > 90%
 - ◆ \$190M cash on hand; no debt
- **People: 560**
 - ◆ Corporate Office in Tustin, CA
 - ◆ R & D center in Raleigh, NC
 - ◆ 50 Nationwide Sales and Support Centers
- **Stock price = \$40 (after two 2:1 splits)**
 - ◆ P/E = 54 ; Price/Revenue = 15

Marketplace Since 1997

- **DSL became a household word**
 - ◆ Every major equipment manufacturer involved with DSL
- **Price wars began in the HDSL market**
 - ◆ 50-70% annual price reductions
- **Hardware market fragmented into 'applications'**
- **Consolidation of the Regional Bell Operating Companies (RBOC):**
 - ◆ Bell Atlantic + Nynex = New Bell Atlantic
 - ◆ Southwestern Bell + Pacific Bell = SBC

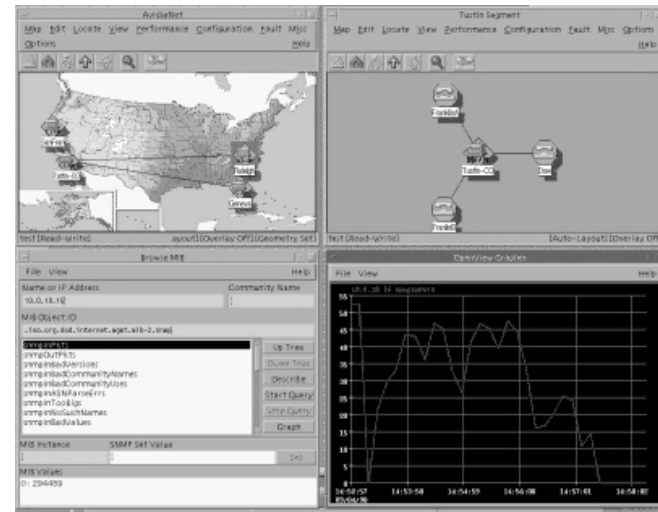
1998-99 Transition: Re-Inventing the Company

- **Growing beyond “commodities” to complex systems**
- **HiGain, Subscriber Carrier & Avidia Businesses**
- **Changing Mission**
 - ◆ New customers
 - ◆ New management
 - ◆ New core technologies
 - ◆ New sales and marketing talent
- **Product Evolution - The Innovator’s Dilemma**
 - ◆ acquire new product lines & their inventors

Avidia DSL Access System



**Avidia Model 8000
Multiservice Access Platform**



Avidia IQ Network Management



Megabit DSL Modems

Chaos in DSL Access

- Alcatel bought the RBOC market at prices below cost
- Copper Mountain captures major share of CLEC applications with a non-standard system
- DSL Modem business attacked by focused startups
- Service introductions are continually delayed
- Lucent & Nortel enter with generous financing packages and acquisitions

Sale of PairGain's VLSI team to Globespan, Inc.

- **DSL components had commoditized; vertical integration was no longer practical 37 engineers**
- **Development of complex components exclusively for internal consumption was no longer economical**
- **DSL component, IP portfolio in exchange for \$90M cash + 3.2M shares of GSPN = \$180M total**
- **Perpetual license to utilize transferred DSL IP in system products was retained by PairGain**
- **\$10M in operating costs saved by divestiture**
- **PairGain given special status as a GSPN customer**

Sale of the Company

- **Critical mass needed to compete with Lucent, Nortel, Cisco in Telecom Carrier marketplace - Sales, breadth of product line, field support**
- **Sale to ADC Telecommunications, Inc. announced in February & closed June, 2000**
- **PairGain shareholders received 0.43 shares of ADCT for each share of PAIR (0.86 equivalent today due to ADCT's August stock split)**

Final Thoughts

- **Before being an entrepreneur, join a mature, market leading company and “learn the machinery”**
 - ◆ Develop your technical expertise
 - ◆ Engage mentor(s)
- **Assess your risk profile**
 - ◆ Join startups later in the game - the number\$ favor it
- **Team is more important than the business plan - one is easily fixed; the other isn't**
- **Have fun**