

# **NEMI Roadmap Gap Analysis**

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# What Does NEMI Do?

## ***Leverage the combined Power of Member Companies to Provide Industry Leadership***

- **NEMI Conducts Industry Forums on Emerging Topics**
- **NEMI Roadmaps the Needs of the North American Electronics Industry (TWG)**
- **NEMI Identifies Gaps (both business & technical) in the North American Infrastructure**
- **NEMI Stimulates R&D Projects to fill these Gaps (TIG)**
- **NEMI Establishes Implementation Projects to Eliminate these Gaps**
- **NEMI Stimulates Standards to speed the Introduction of New Technology & Business Practices**
- **Projects are run by committed volunteers!**

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# Turning Gaps into Actions

- **Roadmap identifies gaps**
- **Gaps verified and project concepts proposed (at meetings like this)**
- **TIG Project teams proposed**
- **SOW agreed**
- **Project initiated**
- **Results published (to members first)**
- **Output**
  - Standards recommendations
  - Know-how



# The 2002 Roadmap

- **Very active optoelectronics team**
  - John Stafford, overall chair
  - Co-chair Laura Turbini
  - Teams for
    - » Level 0,1,2,3
    - » Standards
  - Industry-wide representation
- **160 pages out of 1019**





# Typical Timeline (part of Level 1 analysis)

Technology	2002	2004	2006	2010
Integration	Most devices discrete with little beyond drive electronics and some bulk optics in the package. Little hybrid integration or monolithic integration.	Growing use of hybrid integration; multiple optoelectronic chips in the same package replacing Level 2 integration. Some monolithic chips especially EMLs.	Extensive use of hybrid integration incorporating optoelectronics and electronics in the same package. Monolithic integration widely used in Mux/Demux situations.	Very high level of functionality in packages incorporating monolithic integration in a variety of different materials coupled together using hybrid integration.
Package Type	Hermetically sealed Kovar style packages; mainly butterfly, DIL, mini-DIL and coax.	Growing use of leadframe technology and encapsulation techniques.	Widespread use of leadframes and encapsulation but Kovar style remains for cooled packages. Some BGA style packages.	BGAs and surface mount packages prevalent. Mini-TECs and new chip designs eliminating the need for Kovar style packages.
Automation	Automation focused mostly on low-end, low-cost applications. Lack of volume at higher end limits application of automation particularly with slowdown in telecom industry.  Hermetic device design unsuited to automation.	Design for manufacturing and automation drives higher end manufacturing into mechanization and automation.  Extensive use of pick-and-place for optics assembly.	Fully automated lines incorporating pick-and-place and automated pigtailling. Hybrid integration being designed for automation.	Hybrid integration fully automated allowing multiple OEICs to be integrated on a single platform using combination of passive and active alignment.

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# First The Good News?

- **No major technology showstoppers were found!**
- **Why?**
  - The pace of new technology rollout is dramatically reduced compared with 2000
  - Many concerns are being actively addressed
    - » **NEMI TIGs**
    - » **IPC-STD-040**
    - » **MSAs**



## Now the Bad News.....

- **There's still a LOT of work to do on projects identified in 2000**
- **Progress was good but wasn't as fast as we'd have liked**
  - Business conditions
  - OEM involvement
  - IP Protection
- **Some projects haven't been tackled yet**
- **Because of market & technology changes, some projects are transforming**
- **We need to broaden the roadmap scope to cover non-communications optoelectronics**

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# How the ground shifted 2000-2002

- **In our rapid telecom/datacom growth period we saw**
  - Huge investment in technology
  - Invention, often by major corporations
  - Rapid deployment
  - Speed and market share more important than cost
    - » “if you talk about ROI you just don’t get it”
  - Divergence – many technologies & companies
  - “Brute force manufacturing”
- **In the consolidation period we see**
  - Cost pressure (“technology is only important if it helps our customers develop billable services” – Gary Kunis, Cisco)
  - Delayed technology implementation
  - Shakeout at all business levels – customer, OEM, EMS, component, materials and equipment
  - Increased outsourcing



# Is it all over for the communications business? Are NEMI's current projects still relevant?

- **“Nothing in this world is as good as you hope or as bad as you fear”**
- **Infrastructure spend is down but not out**
- **Internet usage is still rising**
  - Enterprise usage & communications
  - Communications (IM, enhanced cellular)
  - Entertainment (web-based, gaming, media, peer to peer e.g. Napster/KaZaA/Morpheus)
- **There are still market and technology opportunities**
- **The projects started by NEMI are still relevant to these opportunities!**

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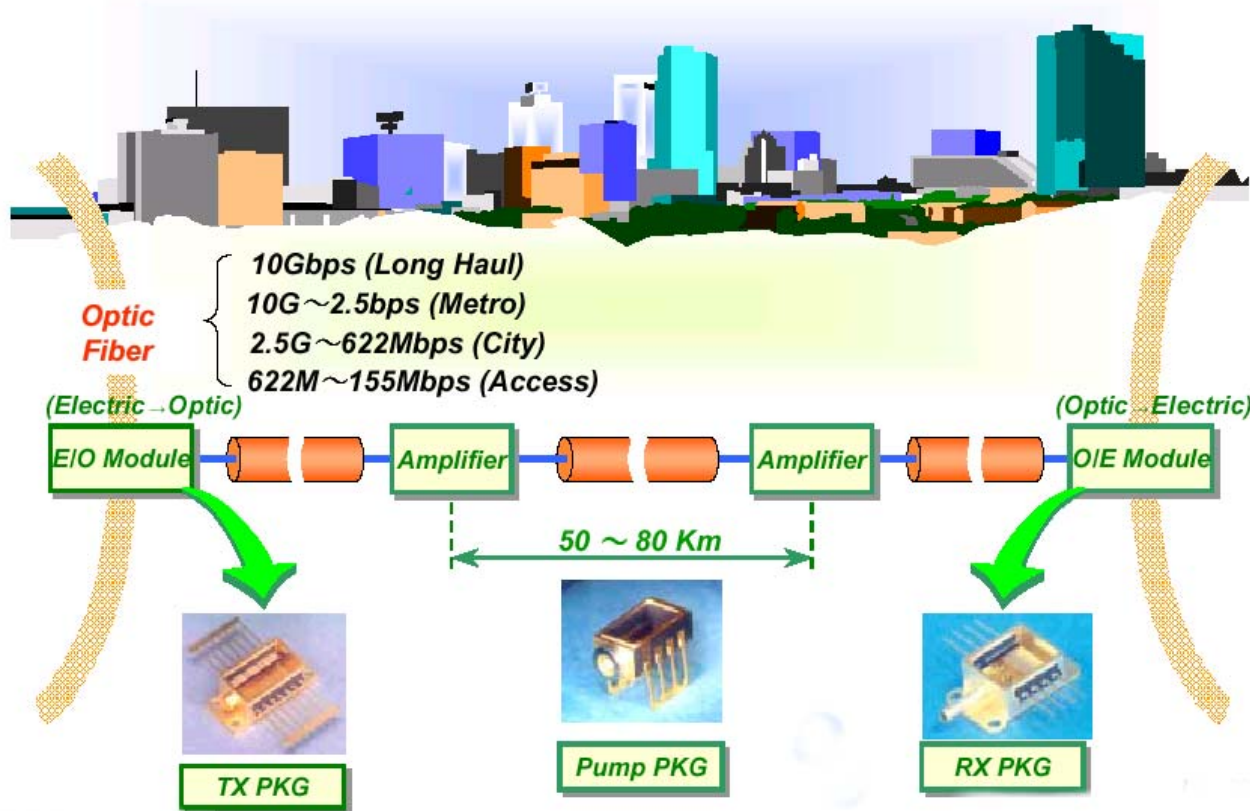


# What's Hot?

- **Local & Metro, especially Optical Ethernet**
  - Low cost
- **DWDM**
  - More signals down the same fiber
- **Storage networking**
  - Reduced storage costs, enhanced security through remote sites
- **Non-networking applications**
  - LED lighting, imaging, displays ~50% of the market growing strongly
  - Intra-board communication still embryonic



# Backbone ↔ Metro ↔ Local



T1 or cable modem 1Mbps

IPC-STD-040

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# Fiber (closer) to the home?

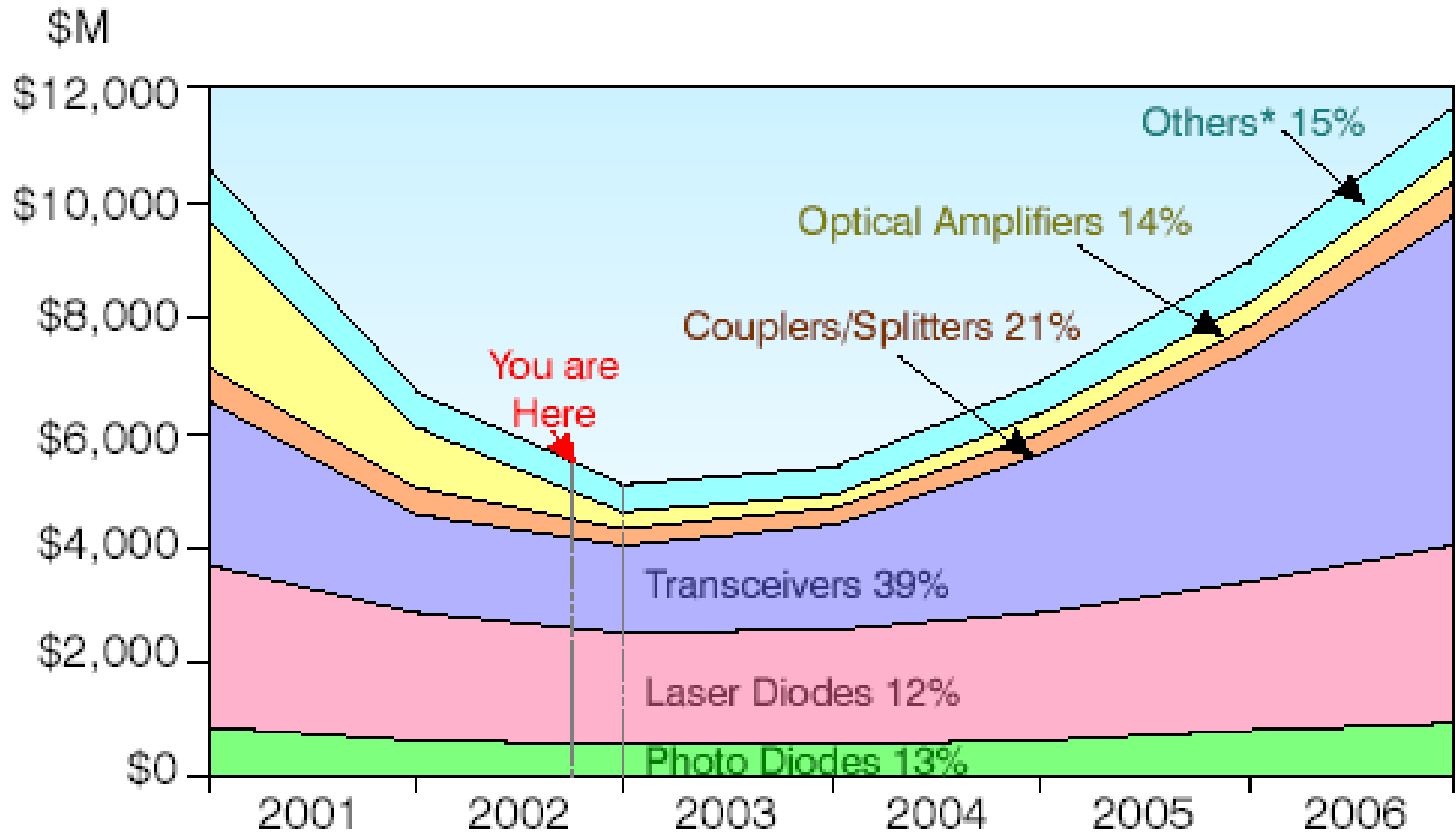
- Backbone 100% optical 10 Gbps
  - Long distance transmission
  - Existing technology (hermetic / pigtail...)
- LAN 5% optical 1 Gbps
  - Business / campus
  - Lower cost
  - DWDM
- Local 1% optical 2Mbps
  - Lowest cost
  - DWDM
  - Stiff competition from wireless (802.16 WiMax), cable, satellite, DSL)
- The key question how much bandwidth do customers really need? And how much will they pay for?
  - Similar to the PC problem...who needs >1GHz processors unless they run complex software?
  - “We need to switch our emphasis from what our engineers want to build to what our customers want to pay for” (Semiconductor manufacturer at PDMA)

Prismark, Others

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# Opto Module & Components Growth (Prismark)



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# What's Not? (for now.....)

- **Backbone infrastructure (except outside US, Europe)**
  - No return on investment
  - Bankruptcies in US – large and small companies
  - Crippling 3G licenses in Europe (~\$400 per man, woman and child paid were a hidden tax on the industry)
- **New technologies**
  - Unless they result in billable services



# Copper is *Really* Fighting Back against Opto!!!

- **Infrastructure and ease of assembly**
- **Economic performance especially at short distances**
- **Low cost (especially after the industry shakeout), reducing faster than opto can catch up**
- **Established design rules ⇔ comfort factor**
- **Many opportunities for improvement in materials and design**
  - **10Gbps through microvia, backdrilled via, advanced dielectrics, embedded passives, Si compensation, broad smooth conductors...**

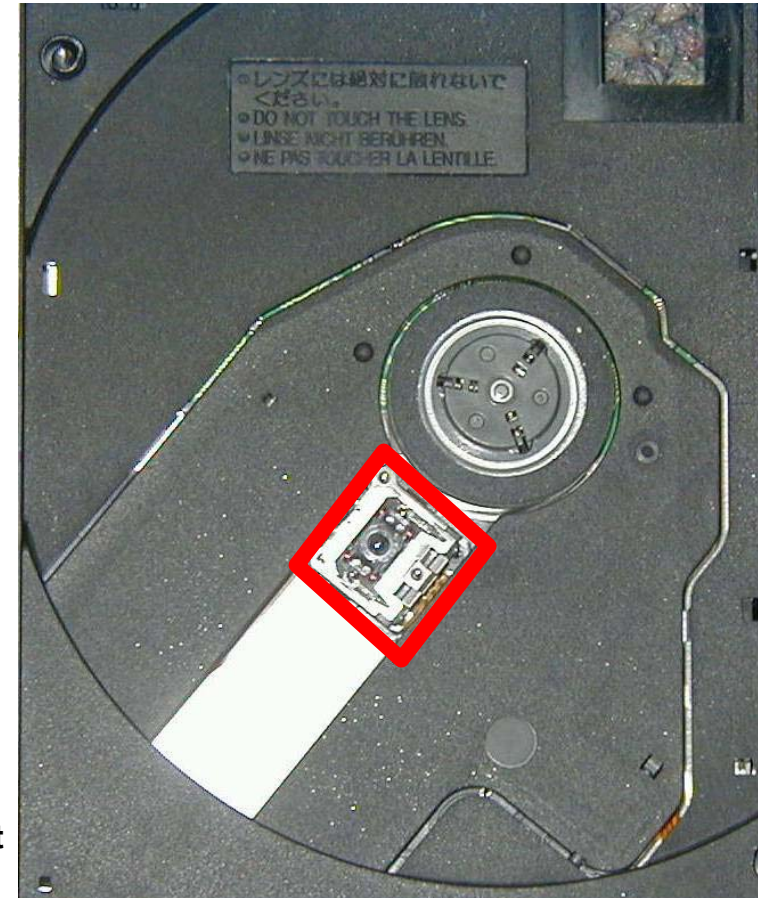
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# The components challenge



- **A telecom transceiver cost \$2000+ in 2000**
  - Hand assembled
  - Hermetic
  - Complex optical components
  - Built to Telcordia standards
  - Prices dropping faster than costs
- **A CD transceiver cost \$1**
  - Automated
  - Non-hermetic
  - Complex optical components
  - Built to consumer standards
  - CD audio ~ 64Kbps
  - DVD ~ 400 KBps in the same size package
- **The communications industry is only ~50% of the optoelectronics industry**
  - Cameras, scanners, laser printers, LED displays, DVD, CD-R.....
  - This other part of the industry actually grew over the past 2 years



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# Roadmap Scope Proposal

- **Communications was the overwhelming business driver in 2000....but not in 2003**

## **Action**

- **We need to cover the other growing and embryonic uses in the roadmaps and our project areas e.g.**
  - **Imaging**
  - **LED lighting**
  - **Displays**
  - **Biosensors**
  - **.....**