

Optical switch port density for major Metropolitan areas

SWITCHING THE Lightwave

**OXC's - The Centerpiece
of all Optical Network**

UPDATE - 2001

MARKETED BY:

PREPARED BY:



INFORMATION GATEKEEPERS INC.

214 Harvard Ave. Boston, MA 02134, USA
Toll-Free: 800-323-1088, Tel: 617-232-3111
Fax: 617-734-8362, E-Mail: info@iggroup.com
Visit Our Web Page: <http://www.iggroup.com>

B&C Consulting Services

c.holliday@ieee.org

www.igigroup.com

Copyright © 2001

0001

FNC 1045

Table of Contents

TABLE OF CONTENTS	2
TABLE OF FIGURES	7
SUMMARY OF CONCEPTS	9
UPDATE INTRODUCTION	12
INTRODUCTION	12
WE HAD A BOTTLENECK; NOW WE HAVE GRIDLOCK	12
WHAT ARE OXCS?	14
UPDATE STATEMENT	14
WHEN IS A SWITCH REALLY A SWITCH?	14
<i>"Switch" Types</i>	14
Routers	14
TDM Switches	15
ATM	15
IP Switches	16
DACS	16
<i>OXC's - The Centerpiece of the All-Optical Network</i>	16
Drivers to DACS Deployment	16
The Parallel Universe of OXC's	17
General Features of an OXC	18
TECHNOLOGIES	19
UPDATE STATEMENT	19
UNDERLYING TECHNOLOGIES	19
REVIEW OF BASIC TECHNOLOGIES	19
OEO	19
OEO Vendors	20
MEMS	20
<i>Two Approaches to MEMS</i>	20
Digital Approach	20
Analog Approach	21
<i>MEMS Developers and Vendors</i>	22
ADC	22
Agere Systems	22
Astarte Fiber Networks	23
C Speed Corp.	23
Calient Networks	23

Corning	24
CoreTek (Nortel)	24
Cronos (JDS Uniphase)	25
IntelliSense Corp. (Corning)	25
Lucent	26
Nanovation	26
Onix Microsystems, Inc.	27
Optical Micro Machines (OMM)	28
Texas Instruments	28
Xros (Nortel)	29
LCD	29
<i>LCD Developers and Vendors</i>	30
Corning	30
Chorum	30
SpectraSwitch	31
Bubbles (Inkjet) – Planer Lightwave Circuits	31
<i>PLC Developers and Vendors</i>	32
Agilent	32
Lightwave Microsystems	33
Kymata, Ltd.(Alcatel)	33
<i>OMO</i>	34
<i>1 D Technology</i>	35
SUMMARY OF CHARACTERISTICS OF EACH TECHNOLOGY	35
BASIC NEEDS OF TECHNOLOGY FOR OXCS	36
<i>Comparison of Transparent and Opaque Switches</i>	36
<i>Examples of Applications of Transparent and Opaque OXCs</i>	37
INSERTION LOSS PROBLEMS OF TRANSPARENT SWITCHES	38
STRUCTURE OF OXCS	40
<i>Importance of Clos Networks</i>	40
CLASSES OF OXCS	41
<i>FXC</i>	42
<i>WSXC</i>	42
<i>WIXC</i>	43
<i>Summary of Features by Class</i>	44
<i>Importance of Tunable Lasers</i>	45
Developers and Vendors of Tunable Lasers	46
Tunable Lasers Vendors List	47
ADC	47
Altitun AB	47
Alcatel	48

Bandwidth9	48
Corning	48
Hewlett-Packard	49
JDS Uniphase	49
Marconi	49
New Focus, Inc.	50
Nortel	50
Novalux	50
APPLICATIONS	51
UPGRADE STATEMENT	51
OPTICAL SWITCHES AS CROSS-CONNECTS	51
<i>Implementing Cross Connects with Different Class Transparent Switches</i>	<i>52</i>
FXC	52
WSXC	53
WICX	54
<i>Implementing Cross-Connects with Opaque OXC's</i>	<i>54</i>
GROOMING	55
CIRCUIT ROUTING	55
<i>The OXC as an Offensive Device</i>	<i>56</i>
<i>Example of Using OXC's to Expand Business Horizons</i>	<i>56</i>
CIRCUIT RESTORAL	57
<i>Substituting for Expensive Router Ports</i>	<i>58</i>
JOINING RINGS	59
<i>How Are the Rings Interconnected?</i>	<i>59</i>
Bridges	61
Baseband	61
Traffic Engineered	61
Electronic Cross-Connect Systems	61
Terabit Routers as Ring Connectors	61
OXCs as Ring Connectors	63
MARKET DRIVERS	64
INTERNET GROWTH	64
<i>Other Internet Traffic Sources</i>	<i>66</i>
VoIP – Voice over IP	66
B2B – Business-to-Business Traffic	67
Offshore IP Growth	68
<i>Summary of Other Internet Traffic Sources</i>	<i>68</i>
OTHER DRIVERS	68
GROWTH IN 'JUNCTION POINTS'	70
MARKET PROJECTIONS	72

Table of Contents

TABLE OF CONTENTS	2
TABLE OF FIGURES	7
SUMMARY OF CONCEPTS	9
UPDATE INTRODUCTION	12
INTRODUCTION	12
WE HAD A BOTTLENECK; NOW WE HAVE GRIDLOCK	12
WHAT ARE OXCS?	14
UPDATE STATEMENT	14
WHEN IS A SWITCH REALLY A SWITCH?	14
<i>"Switch" Types</i>	14
Routers	14
TDM Switches	15
ATM	15
IP Switches	16
DACS	16
<i>OXCs – The Centerpiece of the All-Optical Network</i>	16
Drivers to DACS Deployment	16
The Parallel Universe of OXCs	17
General Features of an OXC	18
TECHNOLOGIES	19
UPDATE STATEMENT	19
UNDERLYING TECHNOLOGIES	19
REVIEW OF BASIC TECHNOLOGIES	19
OEO	19
OEO Vendors	20
MEMS	20
<i>Two Approaches to MEMS</i>	20
Digital Approach	20
Analog Approach	21
<i>MEMS Developers and Vendors</i>	22
ADC	22
Agere Systems	22
Astarte Fiber Networks	23
C Speed Corp.	23
Calient Networks	23

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.