



# HP NonStop Systems Fundamentals



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**Hewlett-Packard**

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# Course Objectives



- Describe NonStop Server positioning in the HP product line
- Describe in a general way the capabilities of HP NonStop servers and the synergy between them and other HP products
- Provide an understanding of
  - NonStop server hardware and software architecture
  - Unique capabilities
  - Role in Adaptive Enterprise





# HP NonStop Fundamentals



## Basic Principles

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# HP NonStop Division



NonStop Enterprise Division

**COMPAQ**  
NonStop Division 2002

**COMPAQ**  
Tandem Business Unit 2001

**TANDEM.**  
*a Compaq company* 1998

**TANDEM** 1997

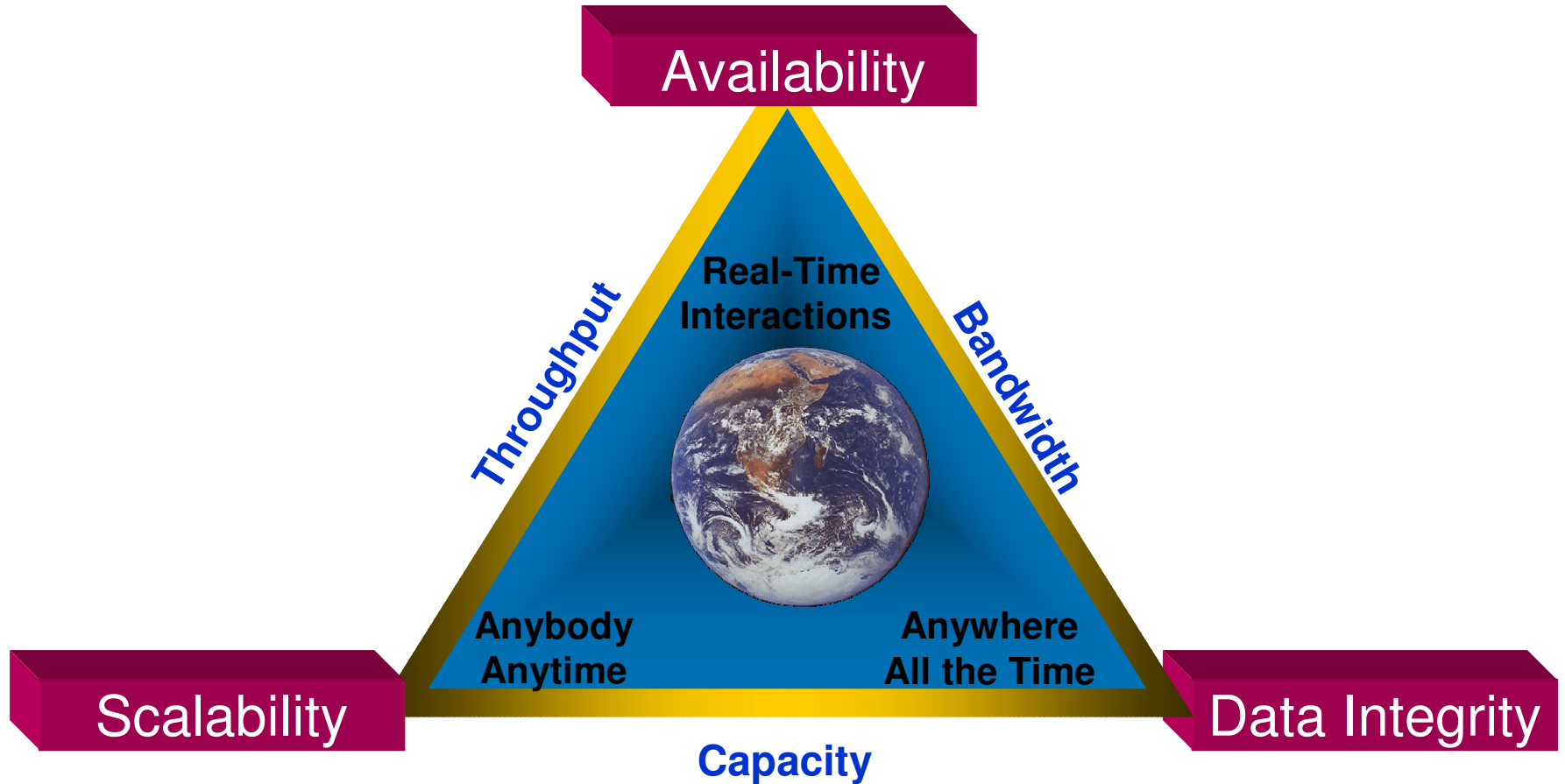
**TANDEM.** 1996

**TANDEM.** 1992

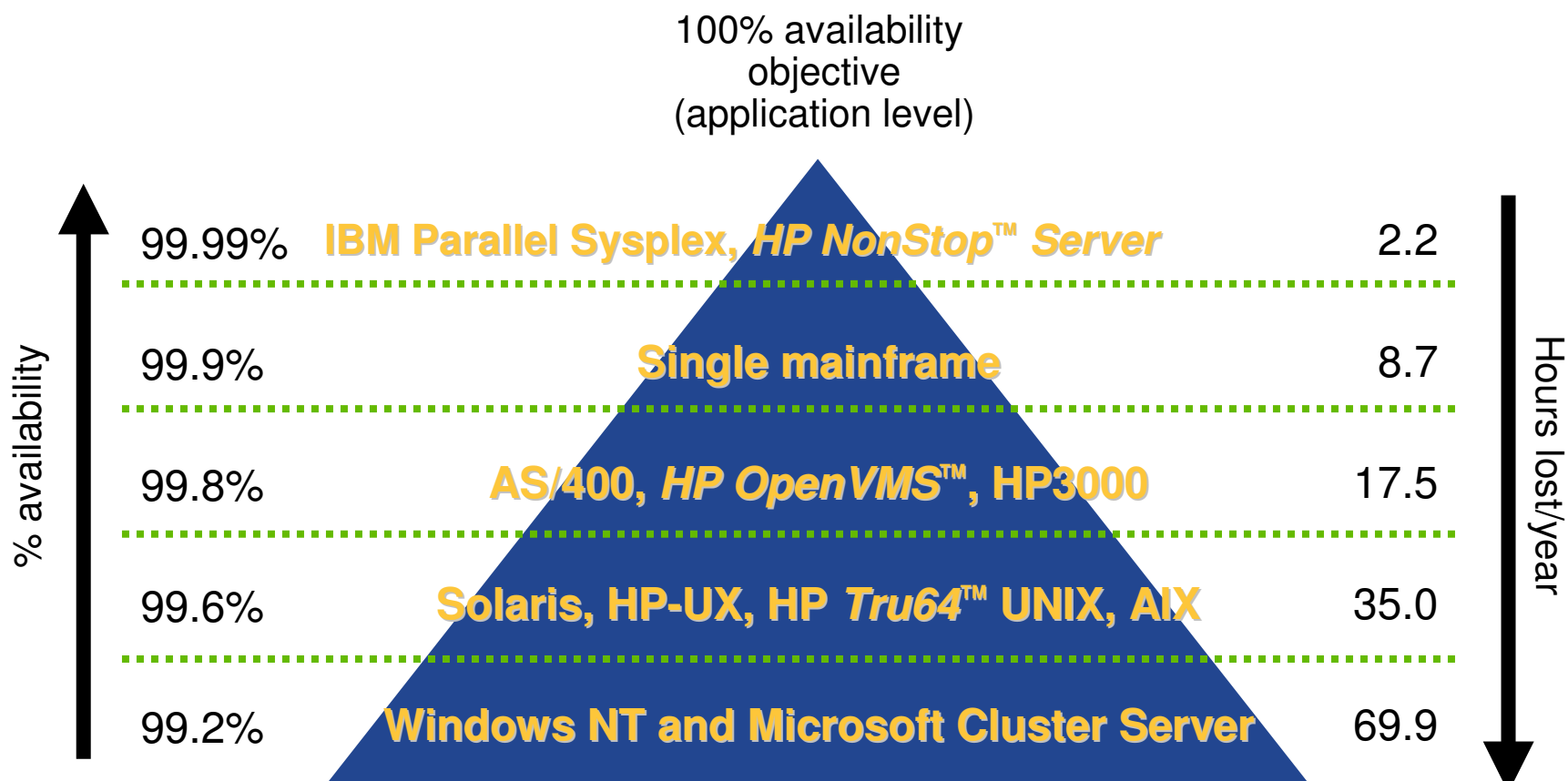
1974



# HP NonStop Computing Design Goals



# Availability Continuum





# Downtime is Expensive

- Lost productivity
- Customer dissatisfaction
- Lost revenue opportunities

*The Standish Group ranks the HP NonStop server the leading system for application availability: "The HP NonStop [server] has the highest peak-time availability both on the system and the application level of all the systems we've researched."*

## Cost of Downtime

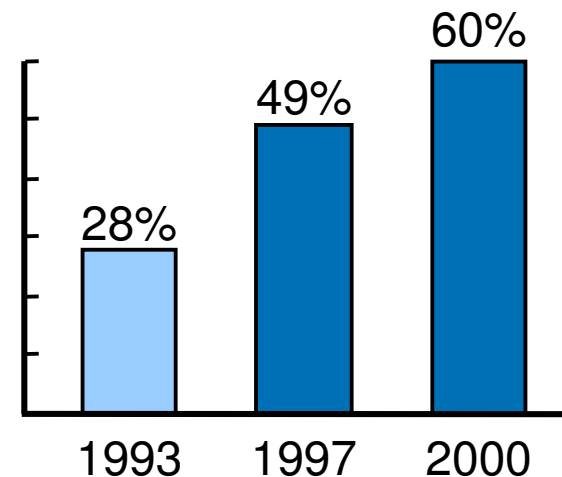
Industry	Business Operation	Average Cost per Hour of Downtime
Financial	Brokerage operations	\$7.84 million
Financial	Credit card authorization	\$3.16 million
Media	Pay-per-view	\$183,000
Retail	Home shopping (TV)	\$137,000
Retail	Home catalog sales	\$109,000
Transportation	Airline reservations	\$108,000
Media	Teleticket sales	\$83,000
Transportation	Package shipping	\$34,000
Finance	ATM fees	\$18,000

# The Demand for 7 x 24 Is Stronger Than Ever



- The Internet is driving electronic commerce and a structural change in business
- Globalization of competition and companies
- Integration of customer and suppliers supply chains
- Networking of dispersed information systems
- 7 x 24 applications growing faster than total server market

## 7 x 24 applications as percent of total





# Scalability

- The ability to expand system resources to meet performance requirements:
  - Processors
  - Storage / Database
  - Peripheral devices
  - Applications
- The challenge is to do this while Online/Internet transaction processing continues!

# Himalaya Massive Scalability

- **I/O Expansion Cabinet**

- 240 GB disk
- 8 GB - 240 GB Disk
- 2-4 I/O controllers



- Any combination of cabinets
- 4080 CPUs
- 16 million GigaBytes Disk
- 65,000 I/O slots

- **CPU CABINET**

- 2-4 CPUs
- 512 KB - 8 GB RAM
- 8 GB - 240 GB Disk
- 2-4 I/O controllers

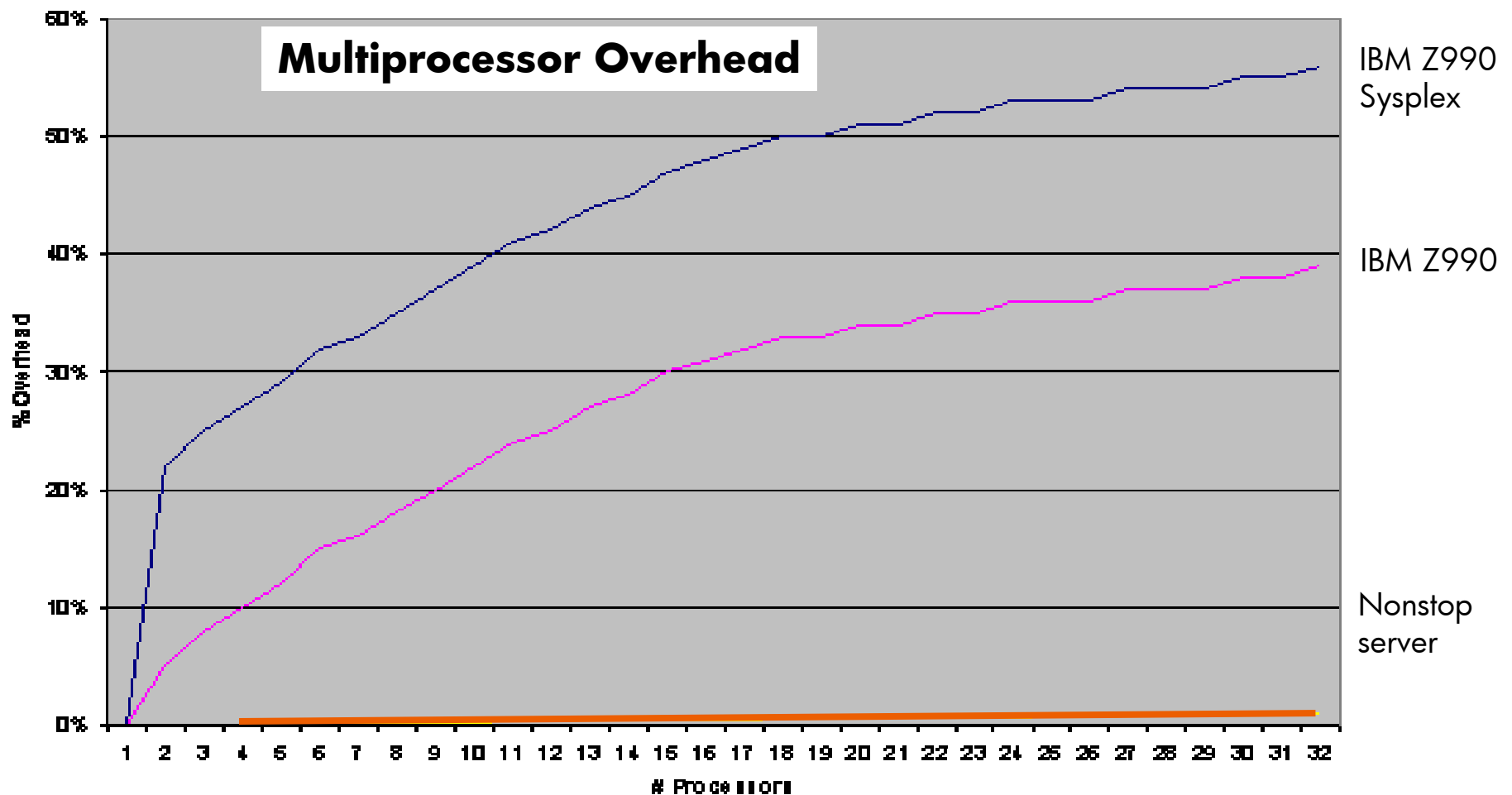
- Any component or cabinet can be
  - added
  - removed
  - replaced
- **While all applications continue running**

- ***The NonStop server at AOL grew from 600 CPUs to 1000 CPUs in 90 days***
  - ***without taking down the application***

# Scalability is Becoming the Big Issue!



- While “Continuous Availability” is still the NonStop domain, Scalability is becoming as important
- Customers are now demanding online scalability to infinite limits!





# HP NonStop™ servers — Business-Critical Enterprise solutions

## 500 Financial Services Companies

- 80% of ATM transactions
- 66% of credit card transactions
- 75% of the world's 100 largest electronic funds transfer networks

## 106 Securities / Commodities Exchanges

- 95+% of securities transactions
- 106 of the world's 120 exchanges

## 135 Telecommunications Providers

- 100% of the 35 largest
- Wireless and land lines

## 40 Police, Fire, Emergency Dispatch Systems

- Many large & small cities worldwide
- Majority of all U.S. 911 calls

## 450 Manufacturers

Most European car manufacturers:  
Mercedes, Peugeot, Renault, Porsche

## 400 Retailers and Wholesalers Worldwide

Including Hertz, Target,  
Victoria's Secret

## 200 Hospitals and Healthcare Providers Worldwide

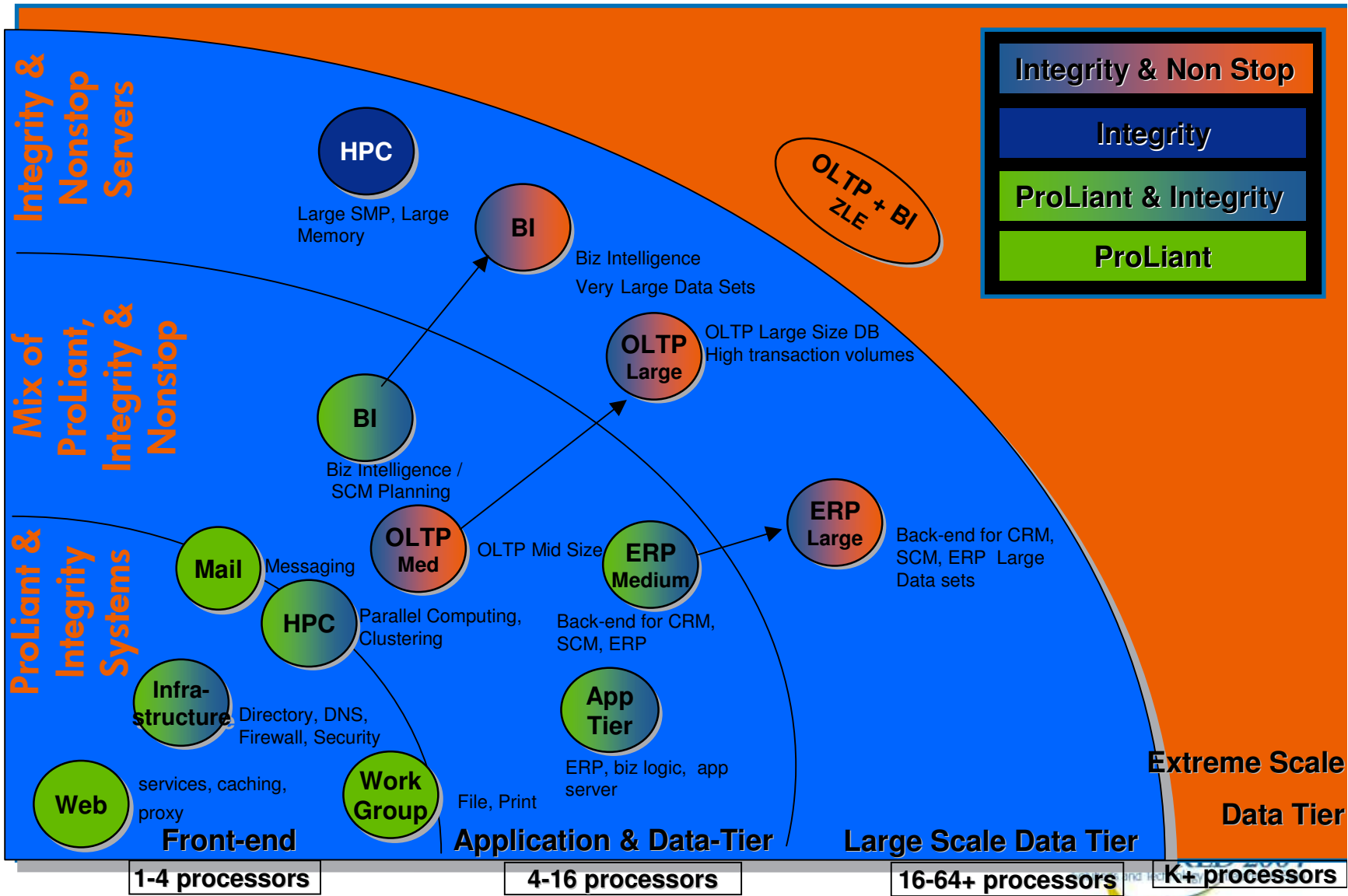
World's Largest HMO: Kaiser

## 100 Very Large Databases for Business Intelligence

- Deutsche Telecom
- AOL
- Target



# NonStop servers Complete HP's high-end availability, scale and data integrity continuum



# Winning against IBM Mainframes



## Account

- One of the largest banks in Latin America
- Consortium of all railroads in the UK
- One of the largest regional EFT networks in the U.S.)
- One of the largest banks in Mexico

## Application

CIF Database

Train Reservations

EFT

Integrated retail  
delivery

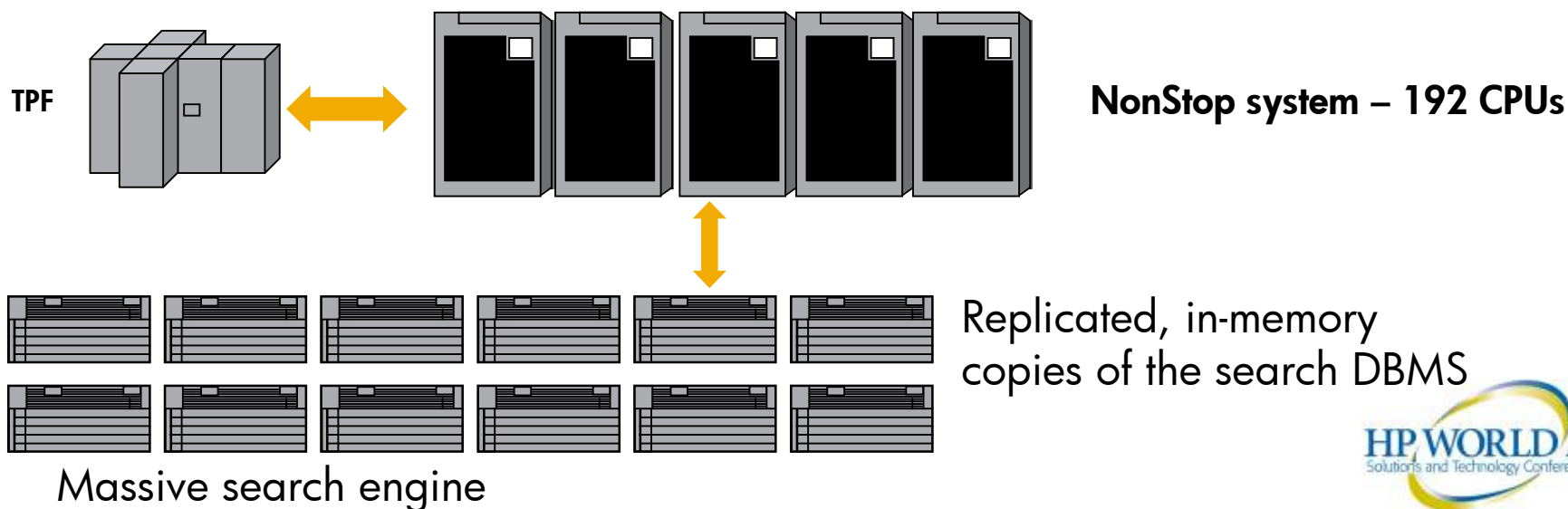


# Sabre – fare search solution

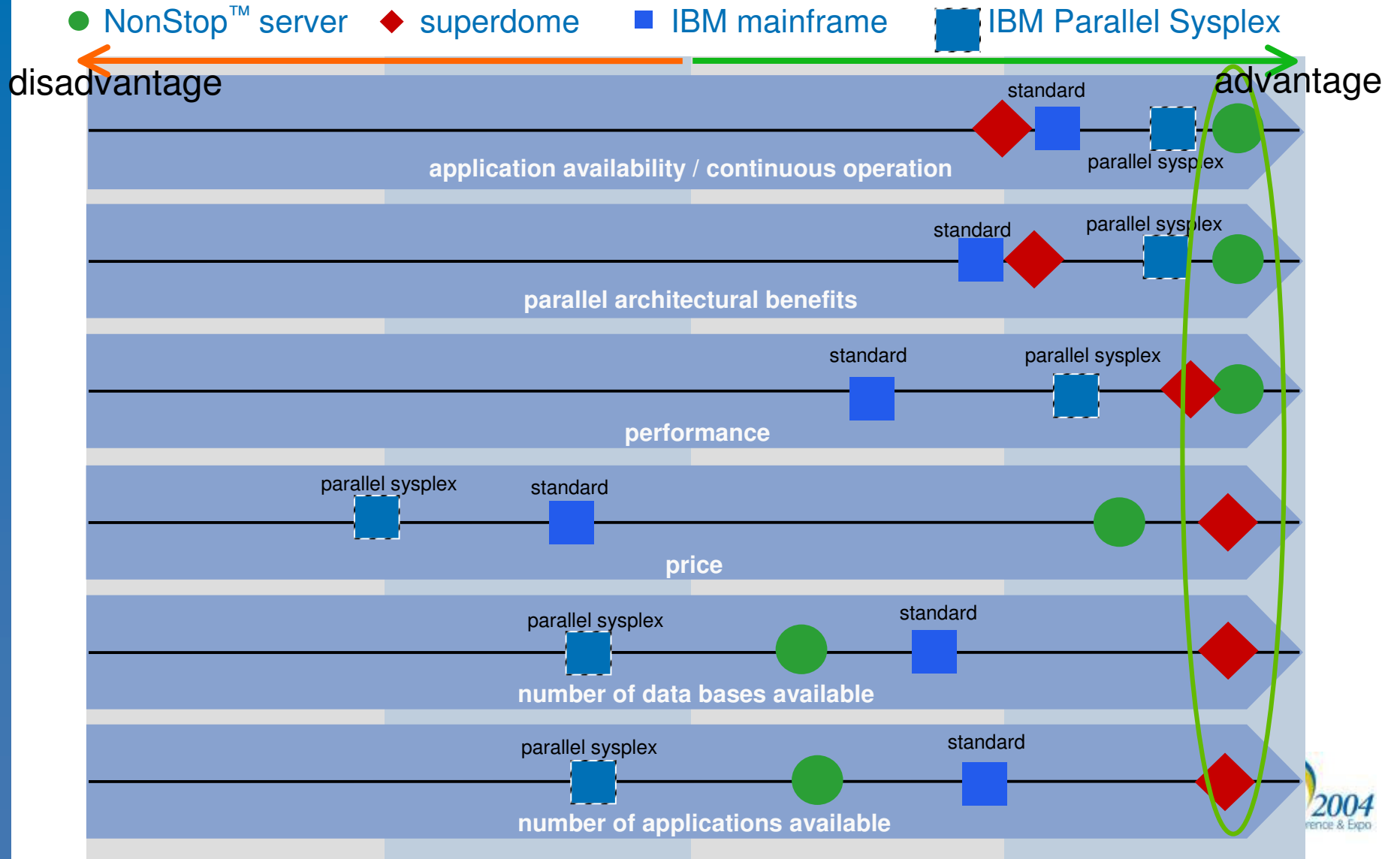
- Central NonStop system with up-to-the-second data
  - Fares, rules, flight seating availability
  - 14,000 TPS, 409,000 I/Os per second
- HP-UX
  - 28 HP rp5405 servers running HP-UX 11i
- Linux
  - 15 HP Integrity rx5670 servers running Red Hat Linux Advanced Server 2.1

Sabre DBOR  
(Database of record)

Sabre ATSE  
(Air Travel Search Engine)



# HP vs. IBM: the high-end ESG server advantages







# Hybrid Common Software Base

- Open languages
  - C, C++, Java, Cobol, Perl, JavaScript
- Open distributed component architectures
  - J2EE, Corba, SOAP, XML, WSDL
- Open DBMS
  - ANSI 92
  - ODBC, JDBC, JSQL, Java stored procedures
- Open middleware
  - Tibco, BEA WLS, WebMethods, SeeBeyond, JMS, MQSeries
  - Tuxedo, Corba OTS, JTS
- Open development
  - Microsoft Visual Studio.net, JDeveloper, VisualCafé. BEA Workbench, eclipse etc.
- Open systems management –
  - OpenView, BMC Command/Post, Tivoli, CA





# HP NonStop Fundamentals



## Hardware Overview

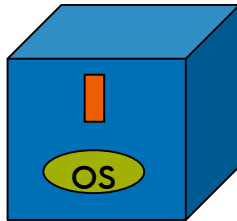
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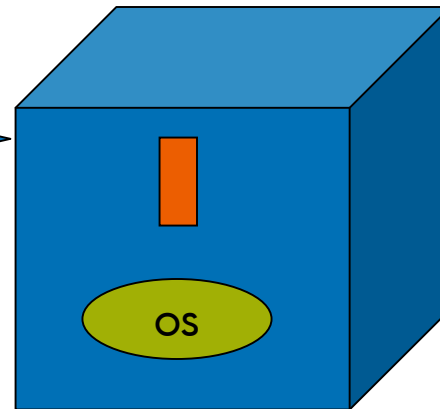
# Computer architectures



Single CPU



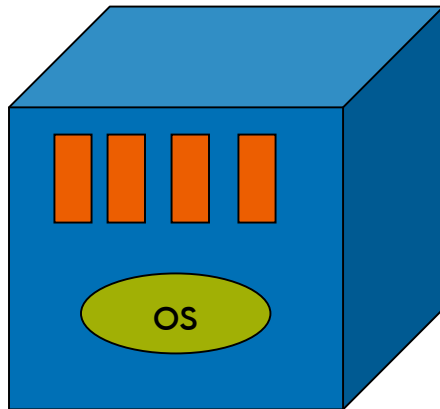
Forklift replacement



SMP

+ scale in the box, cost effective

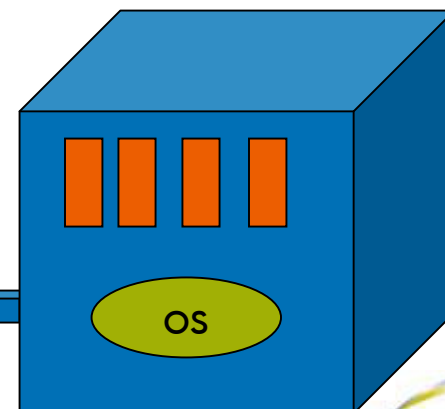
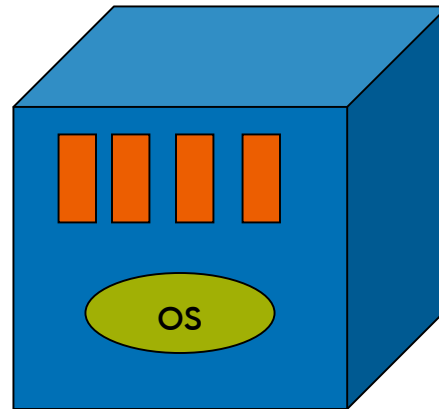
- diminishing returns
- multiple points of failure



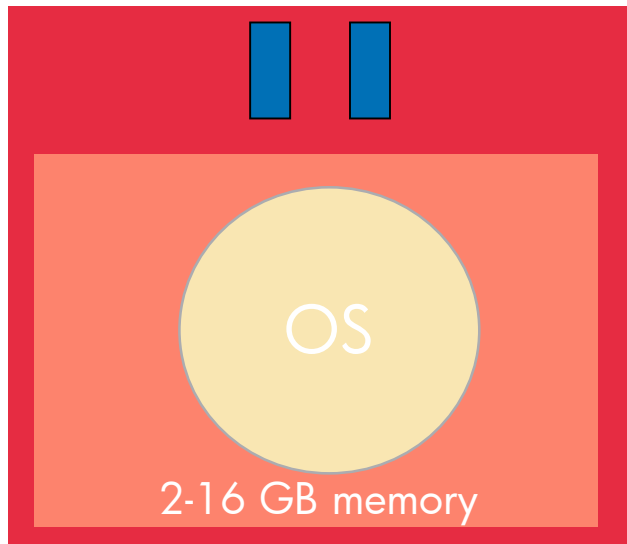
CLUSTER

+ scale, availability

- complexity

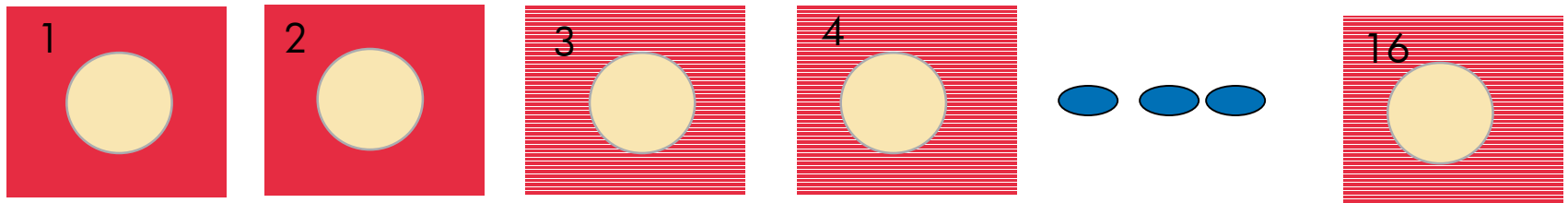


# NonStop™ Server parallel architecture



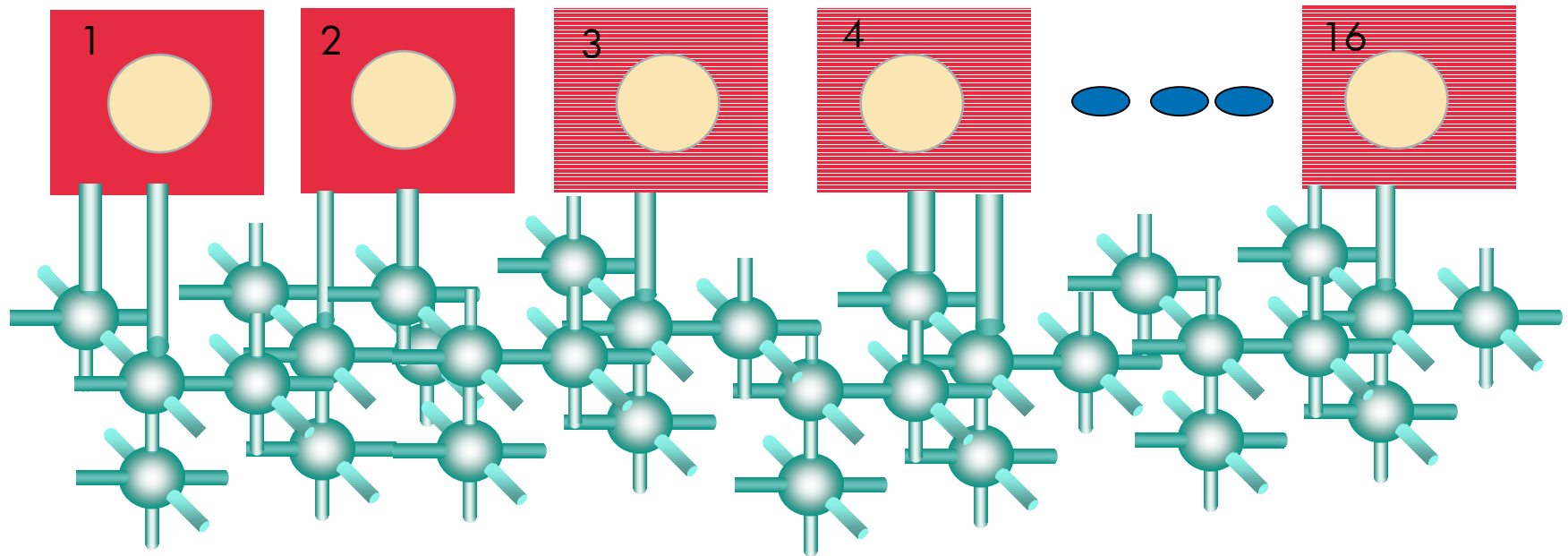
Cell  
2 lock-stepped CPUs  
2-16 GBytes memory  
2 ServerNet controllers

# NonStop™ Server parallel architecture



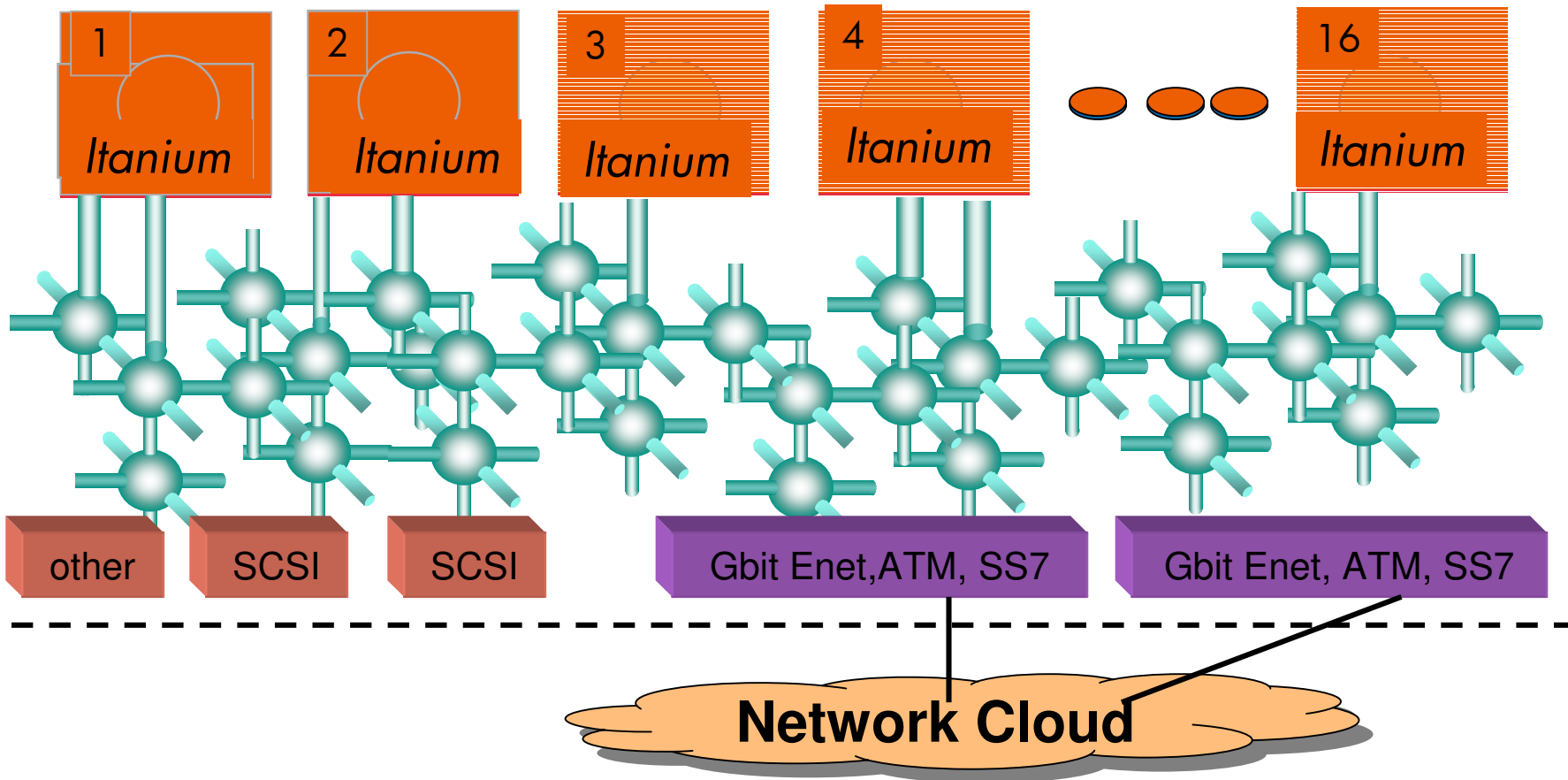
- All CPU/memory cells are similar to hard partitions in SuperDome terminology
- Each has its own copy of the OS
- Each can be added, deleted, upgraded without affecting any other cells
- All applications continue running when a cell fails, is deleted, added or upgraded

# NonStop™ Server parallel architecture



- ServerNet fabric for system internal interconnect
- not for memory access by CPUs
- composed of 12-way non-blocking switches (12 Gbit/sec throughput per switch)
- add switches to a maximum cross-sectional bandwidth of 13 terabytes/sec

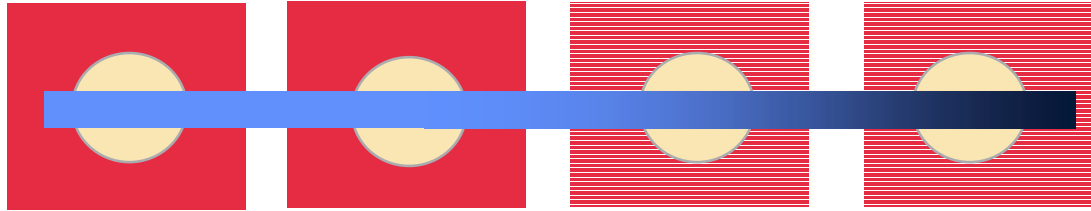
# NonStop™ Server parallel architecture



**System is physically a cluster in a box**



# NonStop™ Server single system image



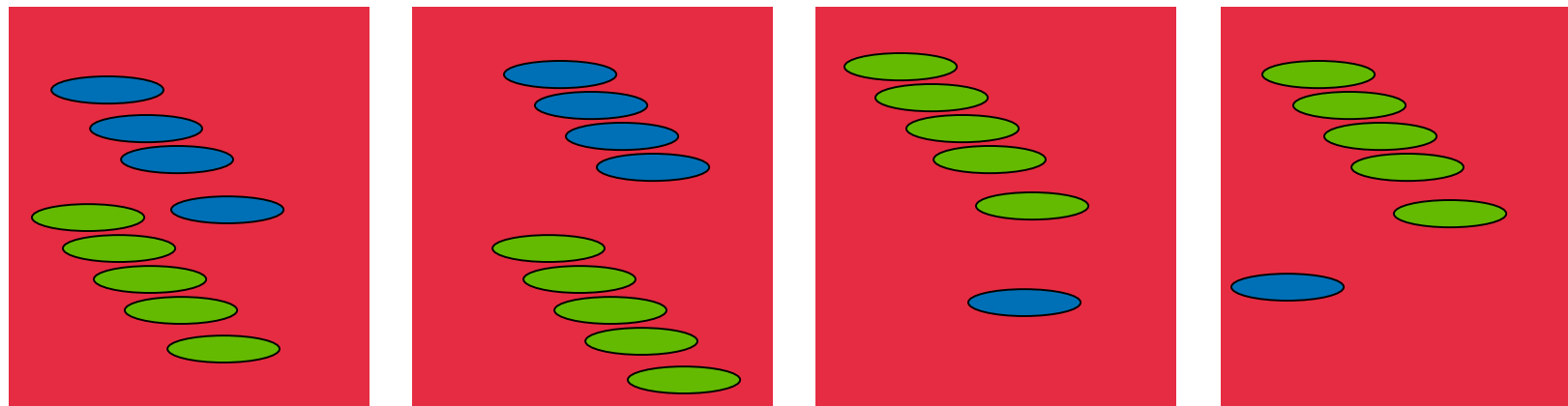
- All copies of the OS on different nodes work together to achieve:
  - Single Virtualized file system
  - Awareness of health of all hardware, applications and middleware
  - Recovery mechanisms
  - Load balancing
  - Single System management
  - Single instance of the DBMS
  - Single application domain



# NonStop™ Virtual Server application architecture



Java Server Pages, Java servlets, Java Beans, EJBs, Tuxedo servers, CORBA objects



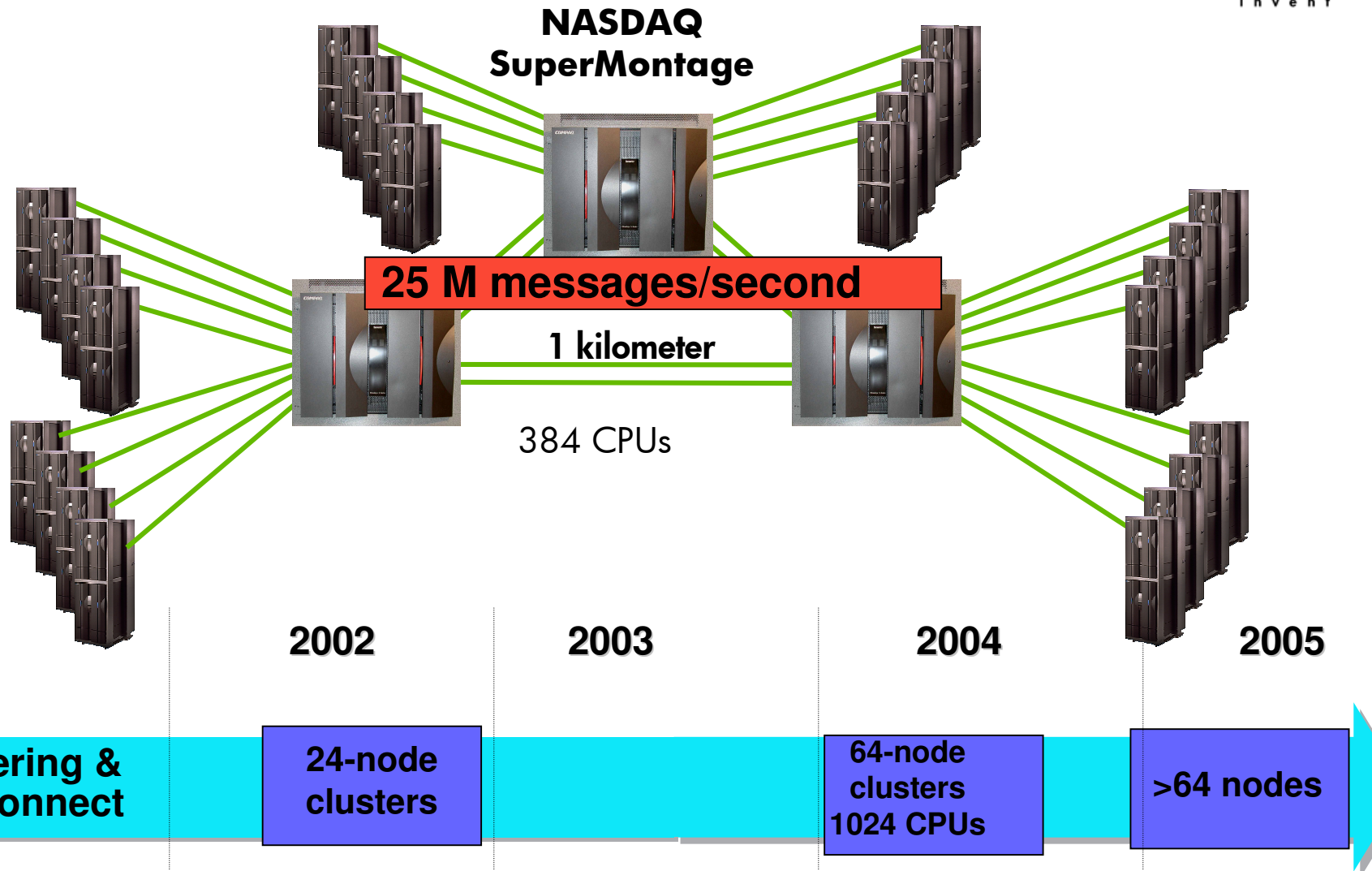
Distributed Services in OS

- Transaction management
- Load balancing
- Logging
- Recovery
- DBMS
- File system

Dynamically change distribution and number of replicated server objects instead of re-partitioning hardware



# NonStop™ ServerNet Cluster



**2005 ServerNet Cluster Scalability > 1024 Itanium CPUs**



# AOL – large system/low management requirements



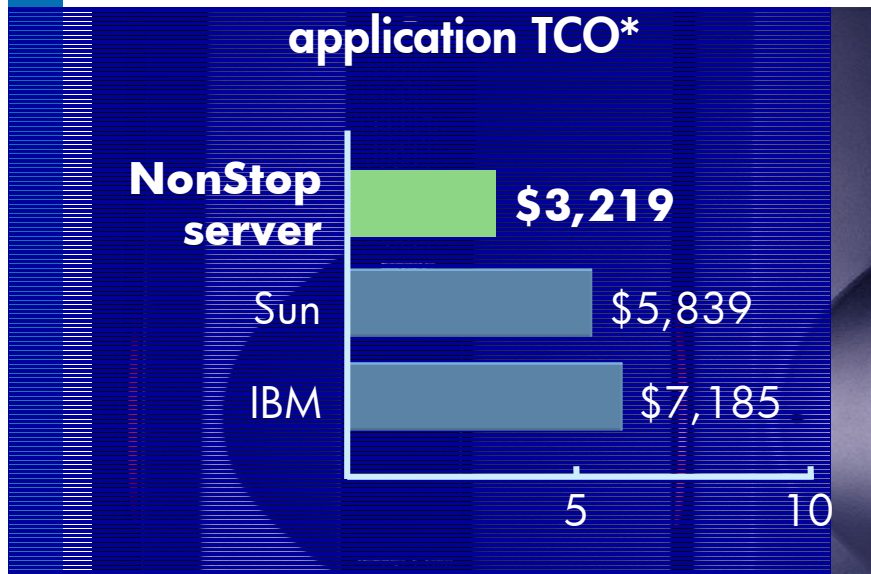
- Over 398 million emails and 500 million recipients per day
  - Peak hour delivery in excess of 21 million emails
  - Greater than 40,000 TPS at peak
- More than 2.5 billion application transactions (user requests) per day
  - More than 2 million user requests per minute at peak
- 28 programs comprise the application accounting for over 49,000 processes running in a typical 24 hour period across the complex

## AOL - Managing 24X7Xforever: Staff

- 4 Developers
- 3 QA Analysts
- 7 Operations Support people
  - 3 DBA's
  - 4 Operations Administrators
- This group manages nearly 1500 NonStop processors



# complex highly available applications



Most comprehensive TCO study  
in our industry

Covered every aspect of IT costs

Measured real applications

Worldwide study of approximately  
2000 customers

- Total cost of ownership must take into account, hardware, software, staff, maintenance etc.
- the NonStop server is
  - 40% lower Total Cost of Ownership than Sun
  - less than one-half the TCO of IBM Parallel Sysplex



# Standards-based server strategy

HP NonStop  
MIPS

HP Integrity  
Itanium

HP 9000 /  
e3000  
PA RISC

HP  
AlphaServer  
Alpha

HP ProLiant  
x86

Investing in  
value-added  
innovation

## Industry standard

HP NonStop  
(Itanium based)

HP Integrity  
(Itanium based)

HP ProLiant  
(x86 based)

Focused  
innovations

- Management
- Virtualization
- High availability
- Storage
- Clustering

# key hardware feature comparison



•feature	NonStop™ S74000	NonStop S86000	NonStop S88000	Itanium
•microprocessor	R12K	R14K	R16K	Itanium II
•s-cache size	4 MB SDR	8 MB DDR	8 MB DDR	6 MB on CPU chip
•main memory	0.5 GB, 2 GB, 4 GB	1, 2, 4, 16 GB	1, 2, 4, 16 GB	4, 8, 16, 32 GB

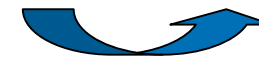
**Speed improvement**



**1.9x**



**1.3x**



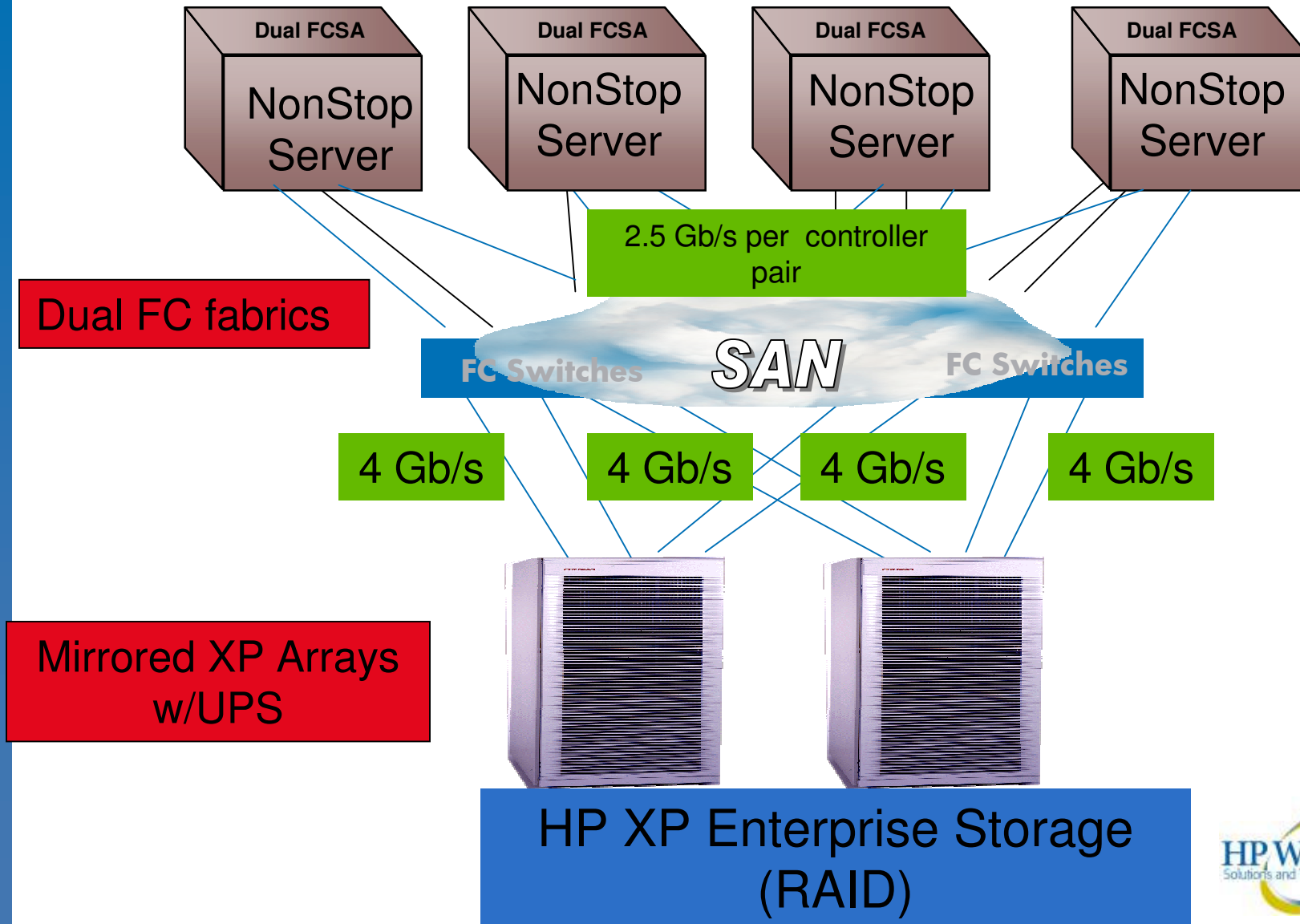
**2.0x**



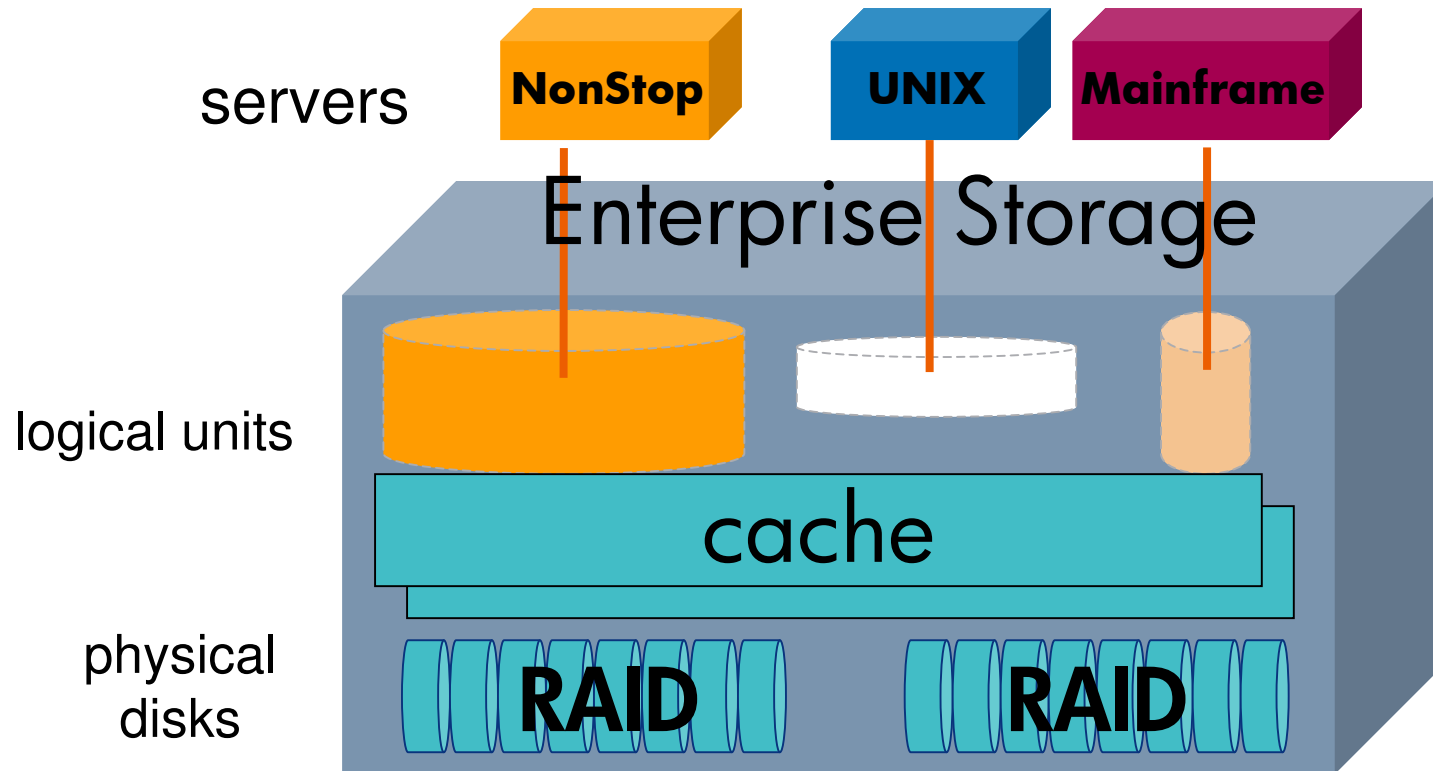
**500%**



# Recommended NonStop SAN Architecture



# Enterprise Storage Virtualization



- Servers access logical units
- Logical units can be enlarged or relocated within the storage
- Enterprise Storage manages physical disks

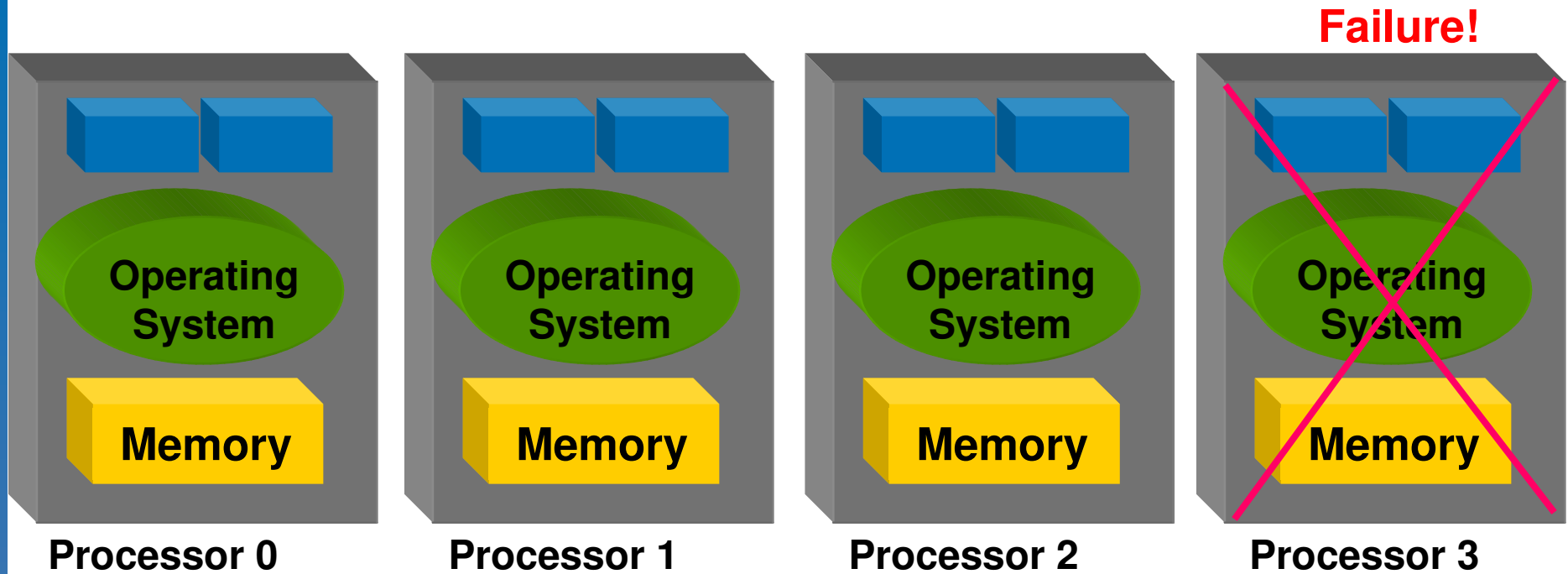




# The NonStop Kernel Operating System

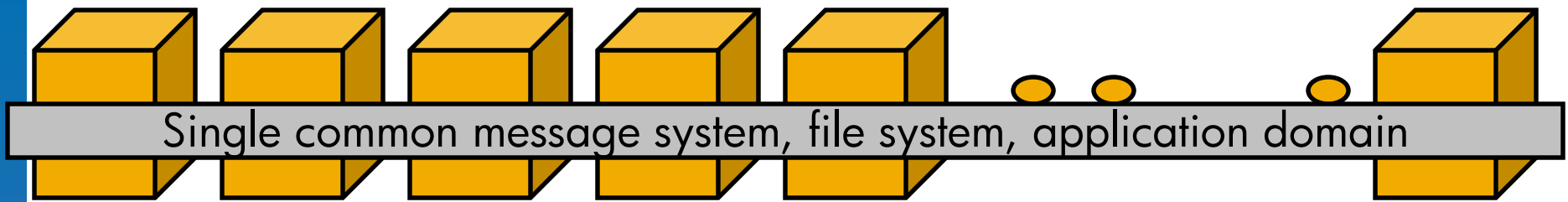


Basic design goal —  
Invisible cluster with no single point of failure



**Remaining processors assume workload  
and continue to run without restart!**

# NonStop Server - Highest level of Fault Tolerance



- Every hardware component can be replaced while all applications continue to run
- Every important system process has a backup process running in a different node
  - 100% synchronized with primary

- Message system
- DBMS engine
- File system
- Transaction manager
- CORBA orb
- Communications stacks
- Web server

Continuous processing

No failover --- Immediate takeover

**If 3,000 TPS**

**&**

**5 minute failover**

**=**

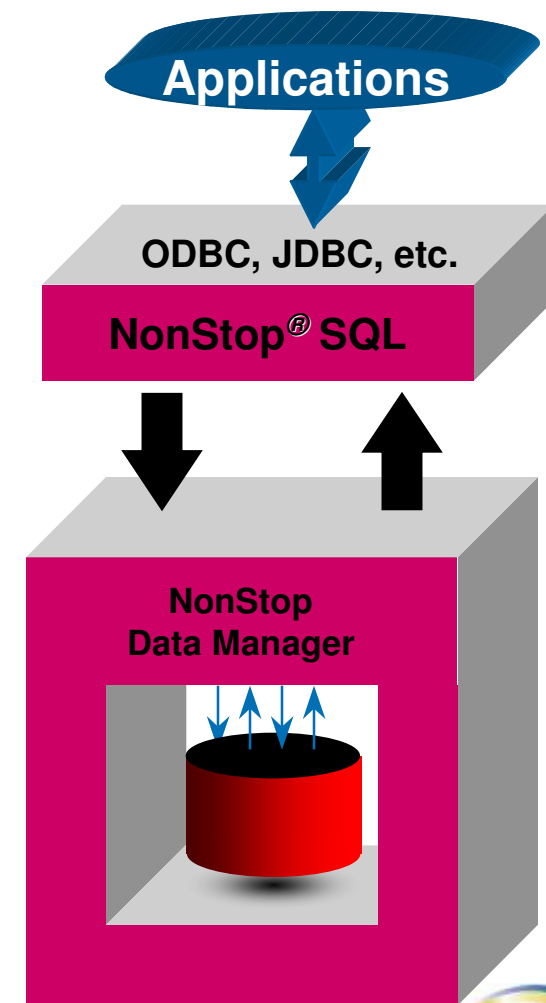
**Over 1 million transactions queued up during failover**



# Integrated Data Access and Transaction Support in the OS

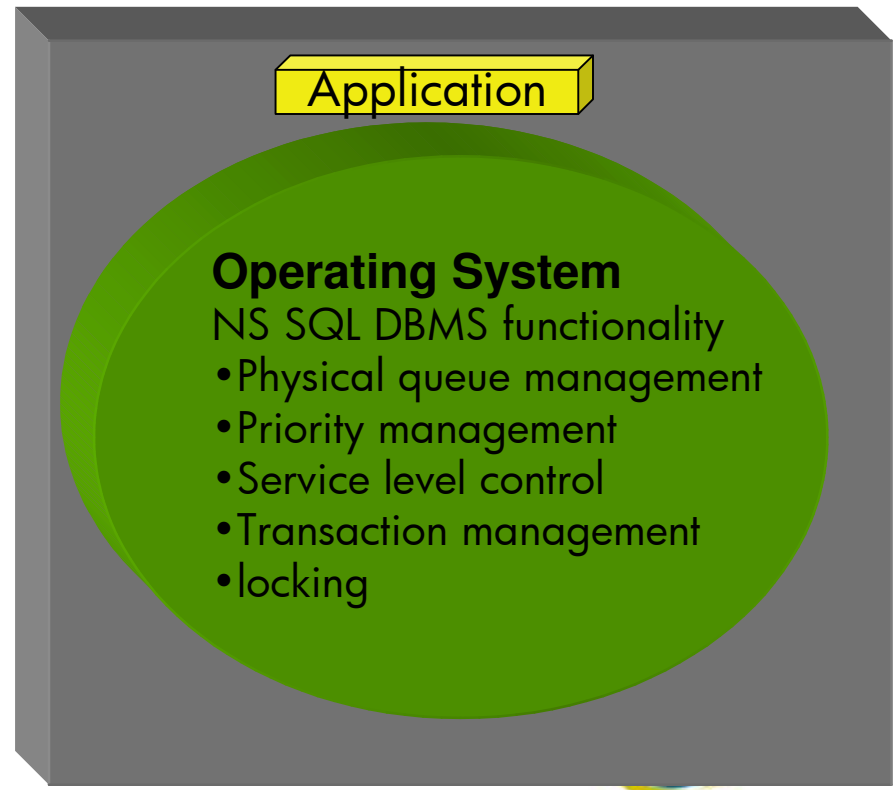
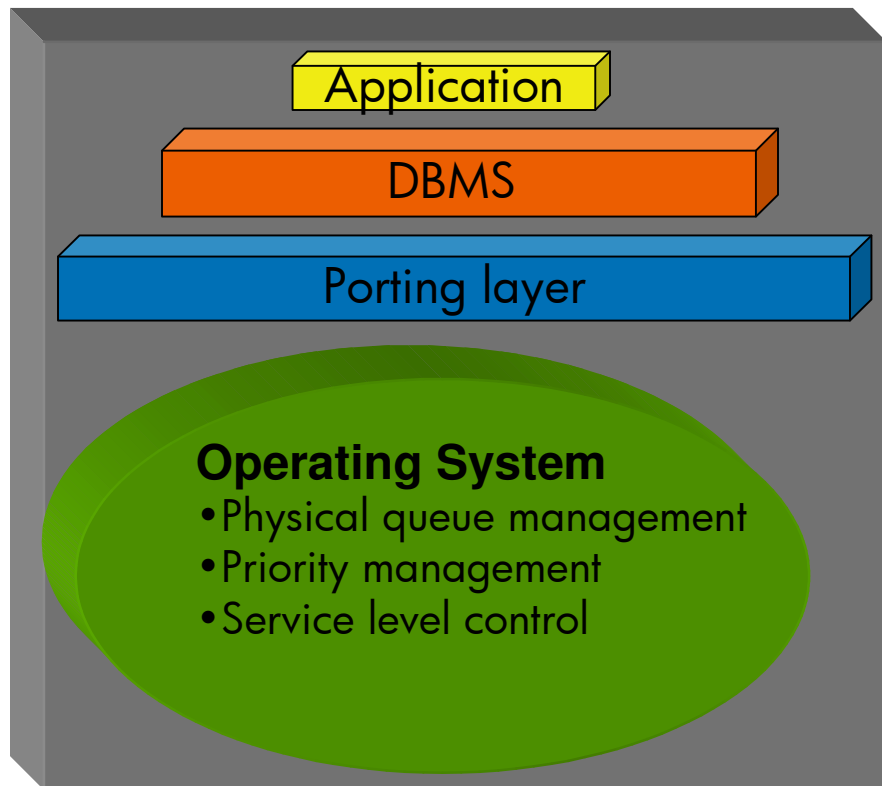


- One Data Access Manager / disk
  - Process pair with helper processes
- SQL access methods
- Data aggregations
- Data functions
- Mixed workload management
- Locking, concurrency control
  - No distributed lock manager
- Transaction support
- Audit log management



# Mixed mode DBMS

- Traditional Portable DBMS is ported outside of the OS and access OS functionality through a porting layer
- Mixed mode processing generates long I/O queues in the OS
- Portable DBMS cannot control the priority of each I/O request inside of the OS



# Unique DBMS for critical applications



## Always available

RDBMS fully available for Inserts, deletes, updates and selects

while:

- Tables are
  - created
  - dropped
  - renamed
  - indexed view, constraint (R/W)
- Database partition are
  - split
  - moved
  - dropped
  - have partition boundaries moved
- Audit trail disk
  - Added
  - Moved
  - Multi-disk version created

## Capable of mixed-mode

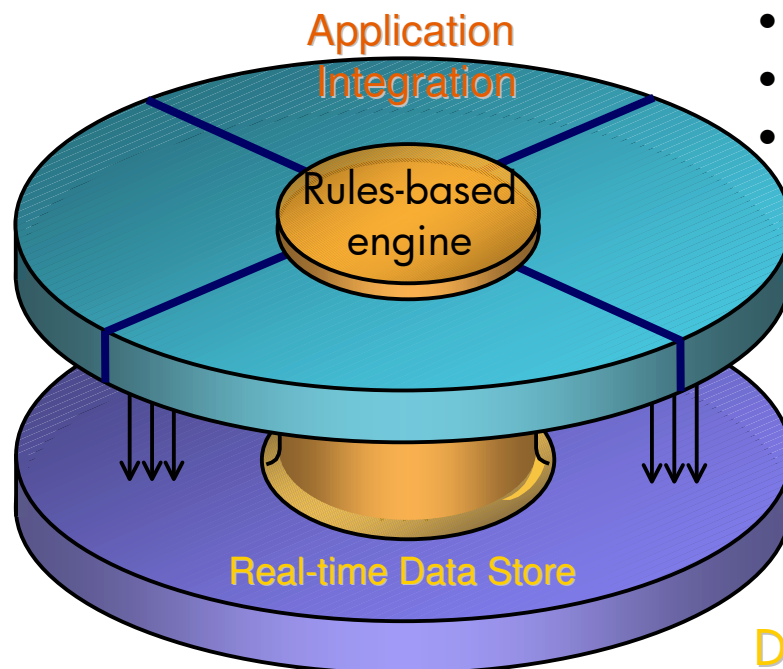
- Provides sub-second response time to transactions concurrent with:
  - Massive queries
  - Full table scans
  - Thousands of simultaneous transactions per second
  - Over any number of nodes

## Open interfaces

- JDBC
- ODBC
- JSQL
- OLE/DB
- ANSI SQL



# AE Integration hub - *Application and data integration as an extension to existing applications*



## Application integration

- Process flow
- Message router
- Transformations

## Rules-based engine

- Business rules applied to events
- access to current transactions
- access to historical transactions
- ability to launch response to events

## Data integration

- 24 x 7 data cache
- Enterprise state engine
- Real-time data warehouse
- Enterprise message log

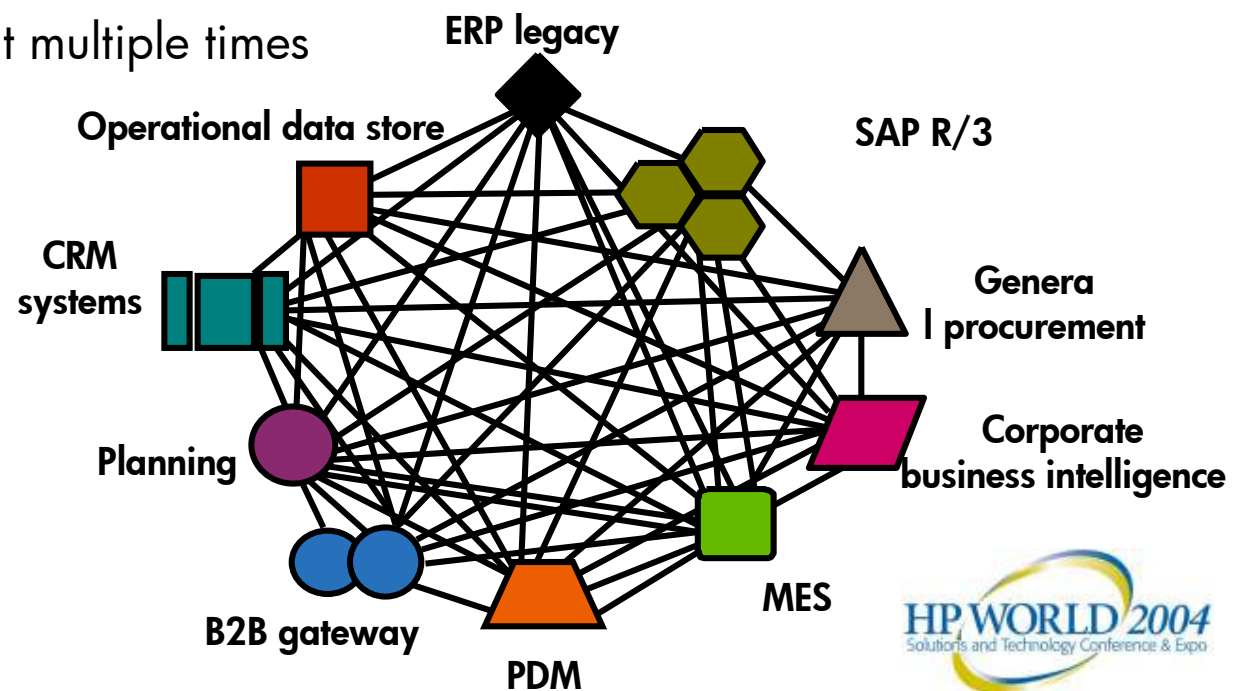


# Real time enterprise – Manufacturing Hewlett Packard



## Challenge

- Lack of real-time, consolidated view of supply chain information
  - higher inventory costs and inaccurate, costly decision making
- Many supply chain management (SCM) applications
- Multiple HP products, technologies, services and partner applications provided from both sides of the merger
- Too much data to push out multiple times

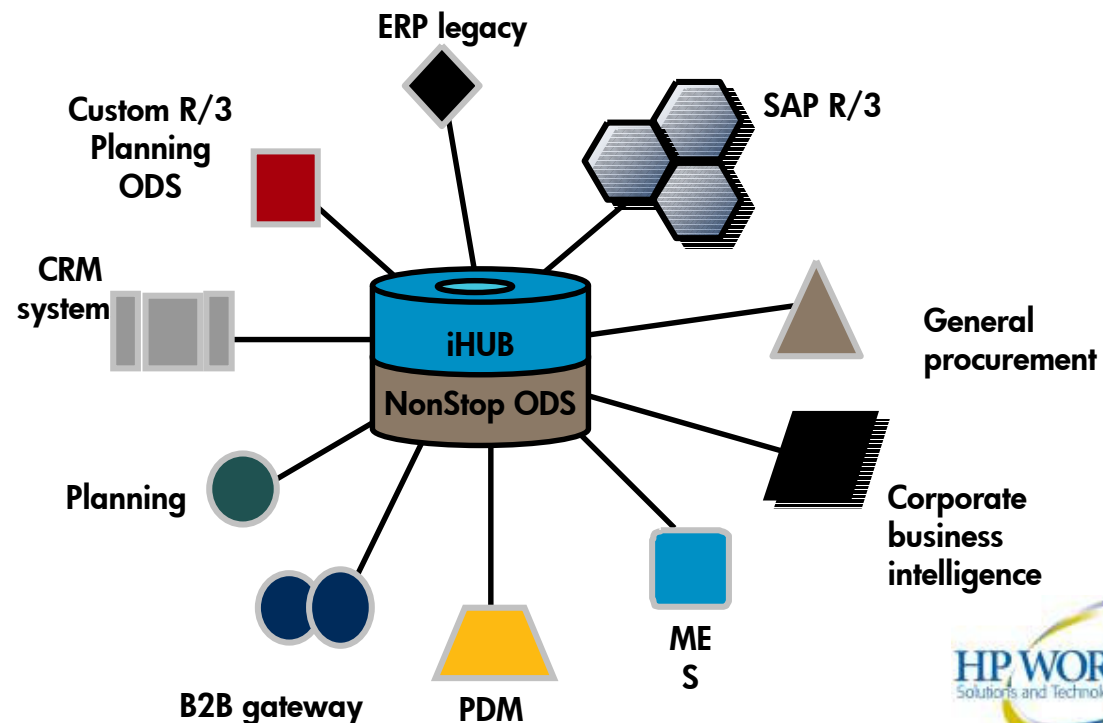




# Adaptive supply chain solution internal project—Integration Hub



- Enhances existing applications portfolio
- Enables integration and consolidation programs
- Centralizes key data from across the supply chain systems
- Enables immediate response to real-time changes in the supply chain



# NonStop in Real Time Supply Chain



- RTSC provides a single, real-time enterprisewide view of the supply chain to enable
  - Real-time decision making
  - Up-to-the-second view of your business
  - New functionality
  - Competitive advantage
- RTSC is designed to easily integrate the largest SAP installations
  - Multiple instances
  - Multiple versions

Total IT benefits	More than US\$6 million per year
Total operational benefits	More than US\$1 million per year
Total strategic benefits	More than US\$2 million per year
Order cycle time	Improved by 15%
Net present value	US\$37 million over a 5-year period

# Real Time Solutions



- Real Time Supply Chain (RTSC)
  - Complete visibility of entire supply chain
  - Ability to recognize and react to events in real-time
- Real Time Financial Services (RTFS)
  - 360° view of every customer
  - Value added to current transactions
    - CRM
    - Fraud
- Real Time Healthcare (RTHC)
- Real Time Homeland Security (RTHS)





# HP NonStop Servers

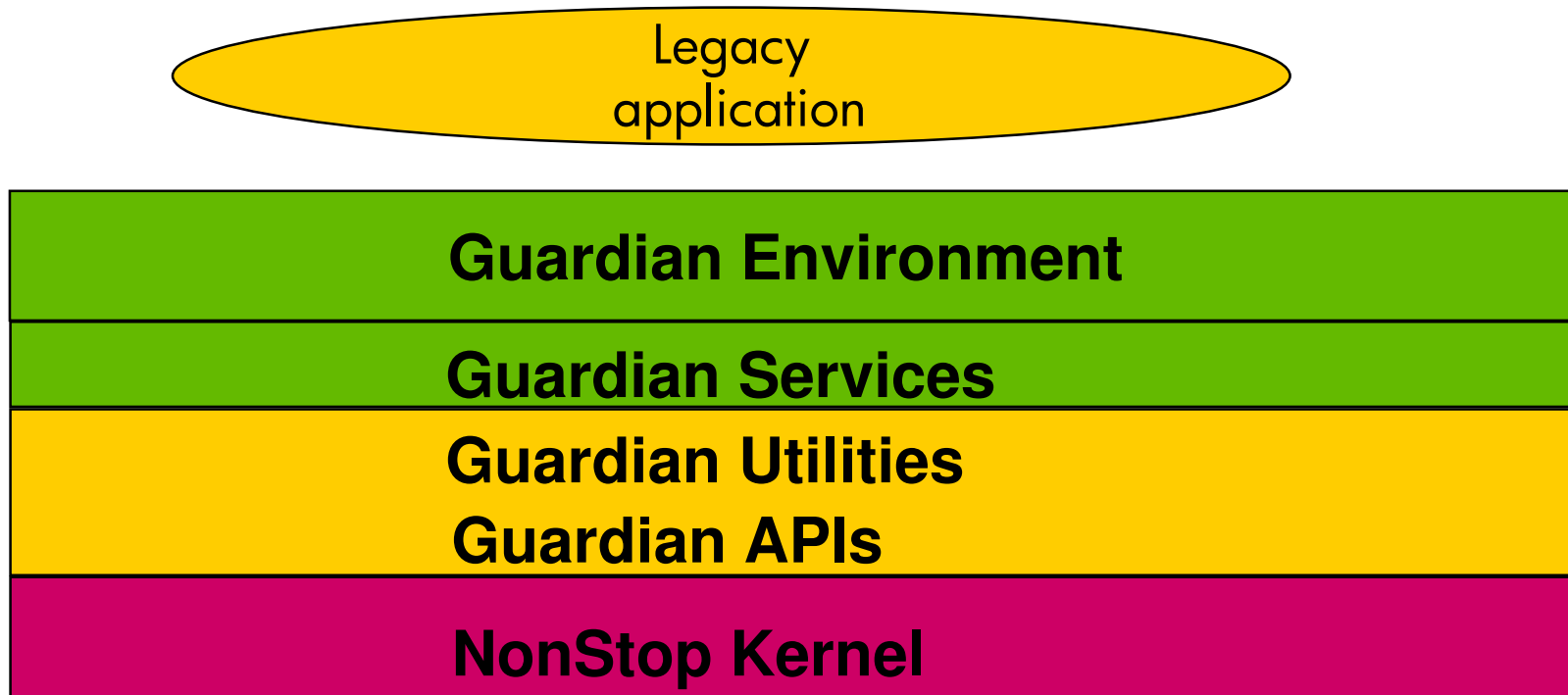


## Software Environment

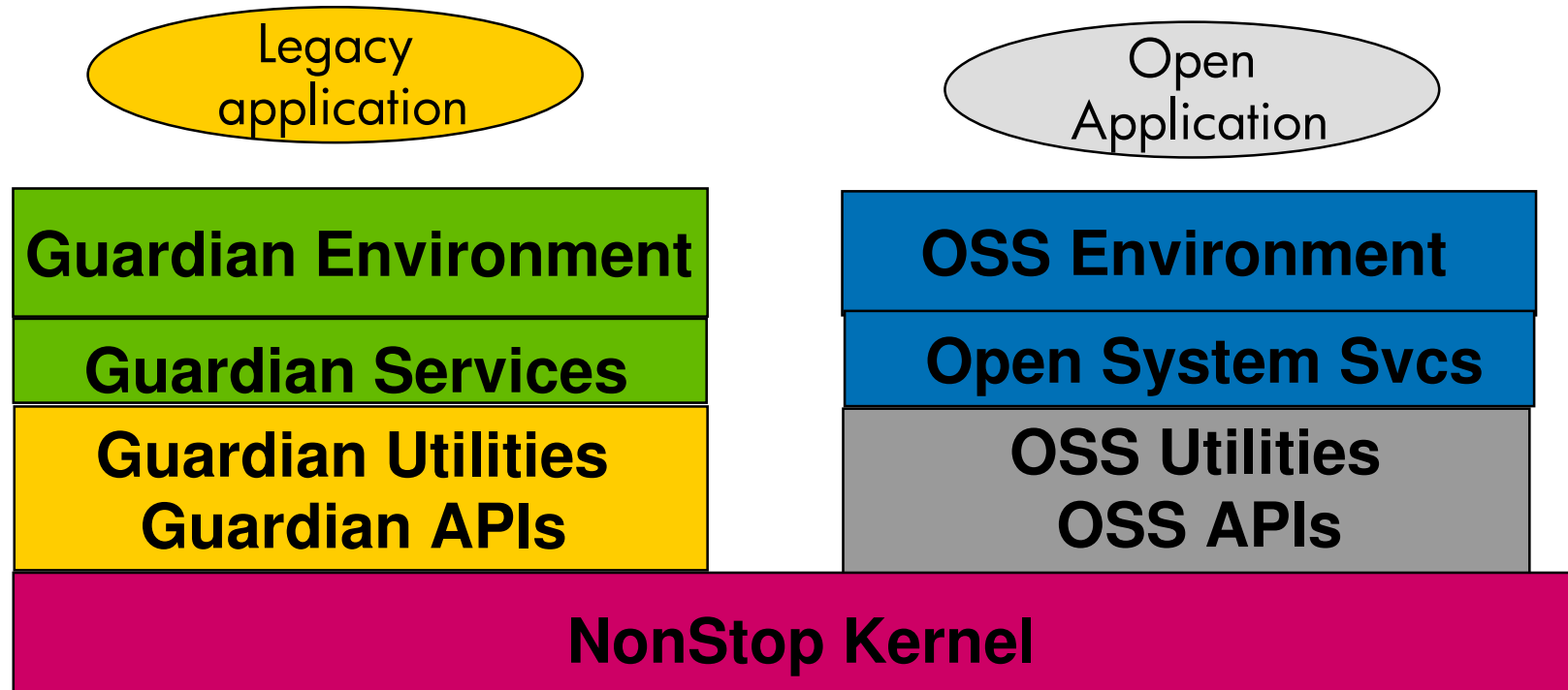
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# NonStop Kernel legacy environment



# NonStop Kernel - Open System Services - (OSS)



# Objectives of Open System Services (OSS)



- Provide a UNIX-based environment with transparent access to NonStop Kernel fundamentals for open applications
- Enable customers to reap the benefits offered by open, standards-based environments:
  - development and management skill set
  - large software base
  - portability



# OSS Product Features



Open Applications

**Open System Services**

**POSIX.2/XPG4 Tools and Utilities**

**POSIX.1/XPG4 API**

**Utilities**

**Libraries**

**150+ C Functions**

**NonStop Kernel**

**Processes**

**File system**

**I/O**

**Pipes/FIFOs**

**Signals**

**I18N (L10N)**

Implemented at the kernel level

Same speed and efficiency as original guardian services







# Products that Use OSS

- TUXEDO – NonStop Tuxedo
- WebServer – itp Webserver
- SQL DBMS –SQL/MX
- CORBA – NonStop Corba
- Java – JVM, SDK
- BEA WLS 8.1, BEA WLI 8.1
- Web services software
  - SOAP, XML, WSDL
- Open Source Software
  - Apache, Tomcat, Perl, TCL, CVS, SAMBA, etc.



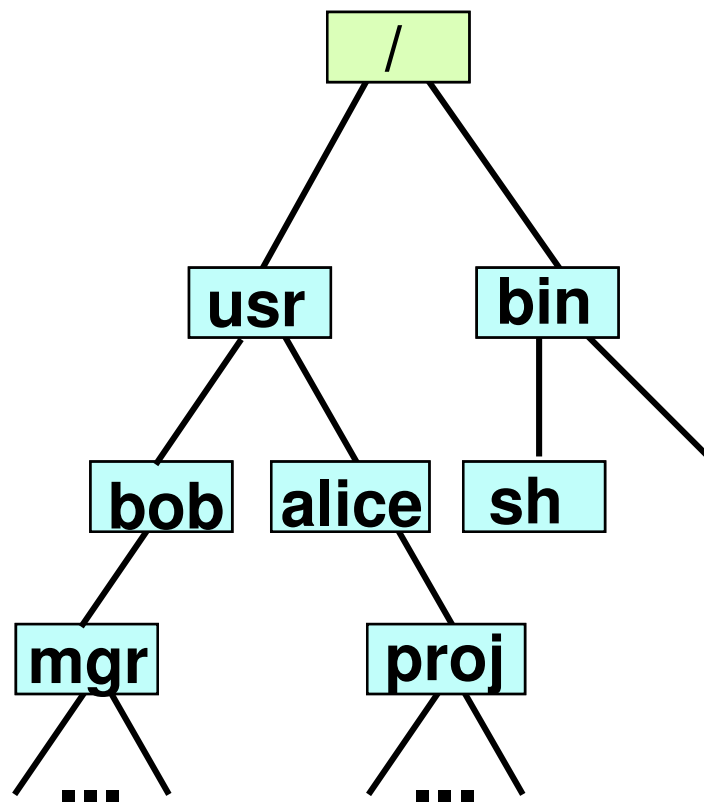
# Commands and Utilities



alias	cpio	fold	lp	ps	tr
ar	csplit	gencat	lpstat	pwd	true
awk	cut	genxlt	ls	read	tty
basename	date	getconf	make	rm	type
bc	dc	getopts	man	rmdir	umask
bg	diff	grep	mkcatdefs	sed	unalias
c89	dirname	head	mkdir	sh	uname
cancel	echo	iconv	mkfifo	sleep	uncompress
cat	ed	id	more	sort	unexpand
cd	egrep	ipcrm	mv	split	uniq
chgrp	env	ipcs	nm	strings	uudecode
chmod	expand	jobs	nohup	strip	uuencode
chown	expr	join	od	stty	vi
cksum	false	kill	passwd	tail	wait
cmp	fc	lex	paste	tar	wc
comm	fg	ln	pathck	tee	who
command	fgrep	locale	pax	test	xargs
compress	file	logger	pr	time	yacc
cp	find	logname	printf	touch	zcat



# OSS file system



# OSS security example

drwx r-x	r-x	and	-rwx	- - -	- - -
drwx r-x	r-x	and	-rwx	r- -	r- -
drwx rwx	r-x	and	-rwx	r- x	r- -
drwx rwx	r-x	and	-rwx	rwx	- - -



# Development Languages & tools

- Languages
  - ISO/ANSI C
  - ANSI C++
  - ANSI COBOL
  - Java
  - Ptal
    - not industry standard but familiar to HP 3000 SPL wizards
- Tools
  - CVS
  - Make
  - VI, EMACS
- C & C++ libraries
  - library routines libl.a, lex
  - libyacc.a, yacc library routines
  - libtermcap.a, termcap routines
  - libinet.a, socket routines
  - ANSI C++ libraries



# ETK – Enterprise Tool Kit



- a Visual Studio .NET based application development environment for NonStop™ servers
  - fully integrated into Visual Studio .NET
  - same look and feel as that of Visual Studio .NET
    - leverages Microsoft technologies and usability research
- supports
  - C, C++, COBOL, pTAL.
  - NonStop SQL
  - Corba
- complementary tools
  - Visual Inspect
    - Symbolic debugger for distributed applications
- Integrated help system.

Featuring

---



# Linux - Open Source Tools



- command shells: bash, osh
- version control systems: cvs, rcs, sccs
- utility sets: diffutils, fileutils, findutils, git, mtools, sh-utils, sharutils, textutils
- utilities: less, rsync, uucp, which
- editors: ed, emacs, vim
- file server: samba
- security tools: openssh, openssl
- scripting languages: perl, python, tcl
- file compression tools: bzip2, gzip, zlib
- windowing systems: X11, vnc

Makes OSS environment look more like a Linux environment to developers and system managers



# open source @ ITUGLIB

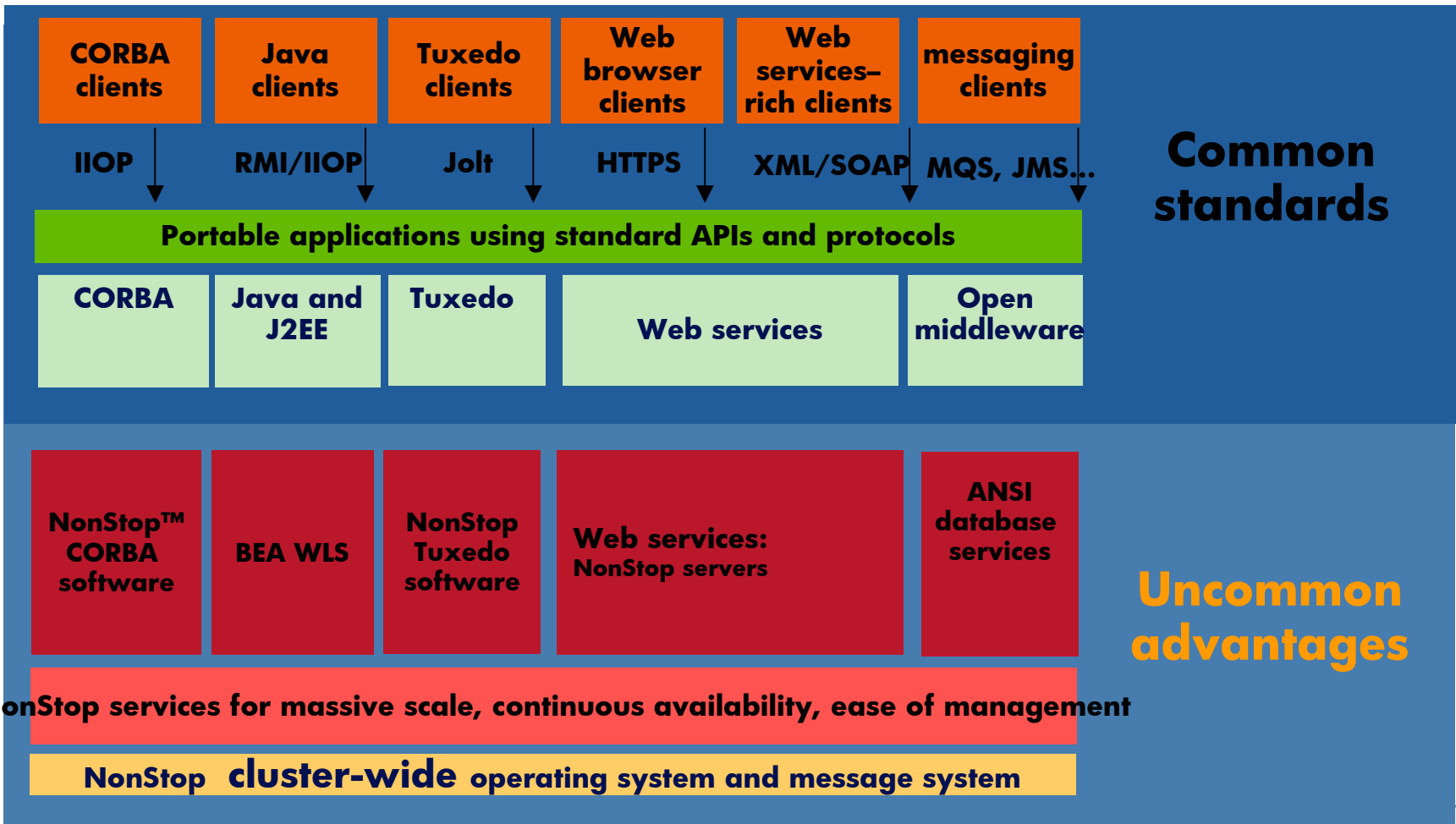


•A2ps	Diction	Glib	Help2man	Nano	Shtool	Which
•Amanda	Diffutils	Global	Httpunnel	Ncftp	Stow	Xaos
•Apache	Doschk	GLPK	Indent	Ncurses	Tar	Zlib
•Autoconf	Ed	Gmp	Jabber	Oleo	Tcl	<b>Db</b>
•Automake	Emacs	Gnats	Jpeg	Patch	Termcap	<b>Dbmanua</b>
e	Enscript	Gnubg	Less	Perl	Termutils	
•Barcode	Fileutils	Gnuchess	Libiconv	Plotutils	Texi2html	
•Bash	Findutils	Gnugo	Libxmi	Pth	TeXinfo	
•Bc	Flex	GnuPG	Libxml2	Python	Textutils	
•Bison	Floss	Gperf	Lynx	RCS	Tiff	
•Bool	Gawk	Grep	M4	Readline	Time	
•Bzip2	Gcal	Groff	Make	Rsync	Trueprint	
•Cpio	Gdbm	Gsl	Man-db	Rx	Units	
•Cscope	Gengetopt	Gtypist	Marst	Samba	Uucp	
•CVS	Gettext	Guile	Mc	Sed	Vim	
•DAP	Ghostscript	Gzip	Miscfiles	Sh-utils	Wdiff	
	Git	Hello	Motti	Sharutils	Wget	





# Open application development and execution



# HP NonStop S-Series Servers

- HP NonStop S7x0
- HP NonStop S7x00
- HP NonStop S7x000 and S86000
- MIPs processor-based
- Intel processors beginning in 2005
  - Seamless migration
  - Full application compatibility
  - Complete protection of customer investment
- All designed for:
  - Availability
  - Data integrity
  - Performance
  - Compatibility





# Where To Go for More Information

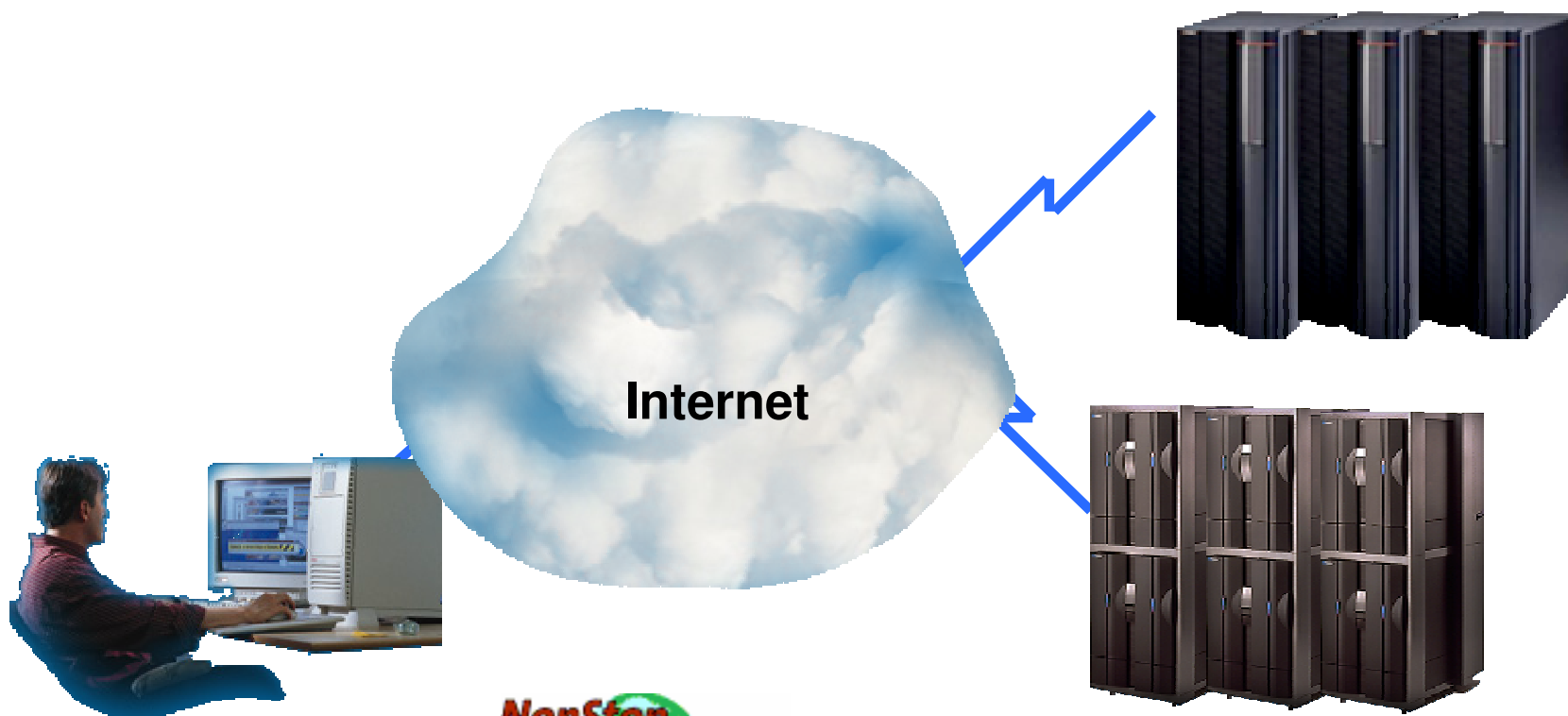


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# World Wide Web

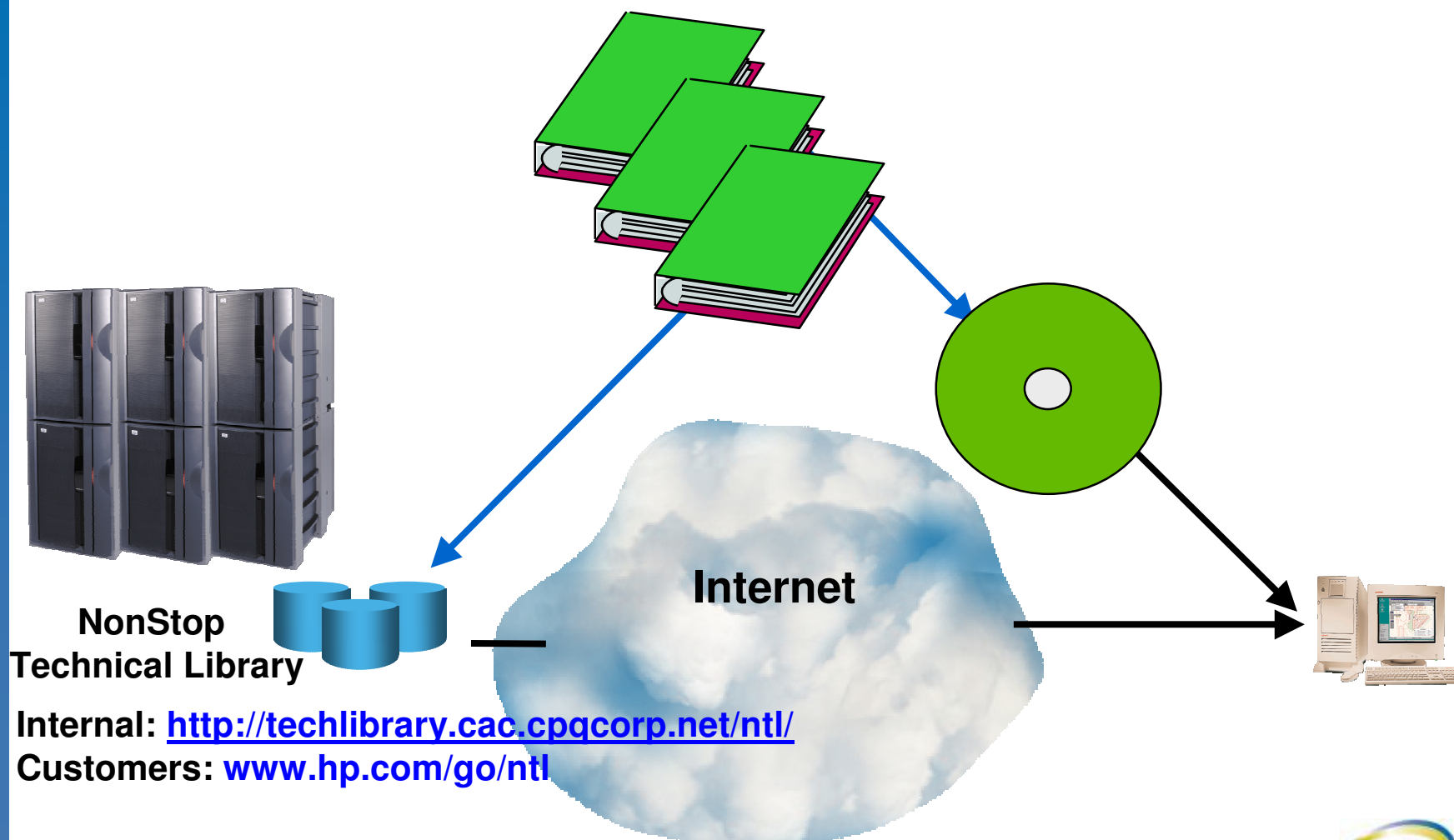
NonStop Enterprise Division Home Page:

<http://nonstop.corp.hp.com/>

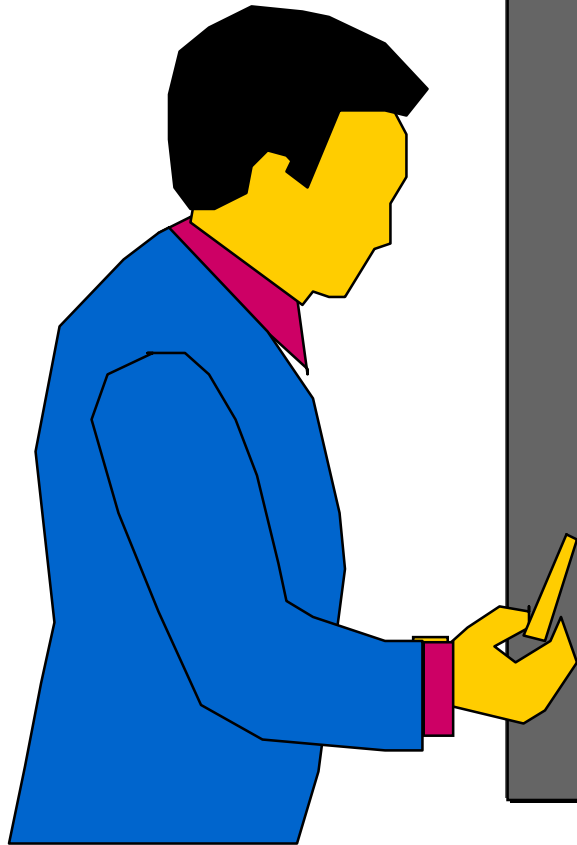


<http://etc.qweb.cpqcorp.net/>

# Technical Reference Materials



# Education

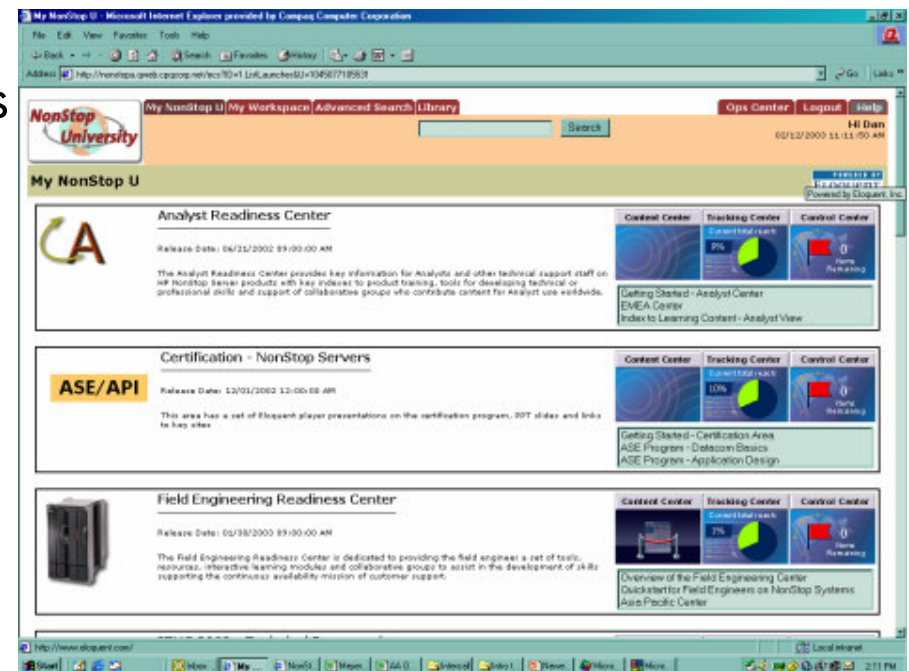


- Instructor-led Training
- CBTs
- Self-study Training
- Web-based training
- Weekly conference calls
- Distribution Lists
- Technical Update Training
- Seminar CDs
- NonStop University
- This presentation for your peers or customers!

# Online Education – NonStop University



- <http://nonstopu.qweb.cpqcorp.net/ecs>
  - Use your corporate login
    - Analyst Readiness Center
    - Certification – NonStop Servers
    - Field Engineering Readiness
    - ITUG Technical Presentations
    - NED Initiatives
    - NonStop Conference Calls
    - Quickstart – NonStop Servers
    - Sales Readiness Center
    - Transfers of Information
    - LOTs more!







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