Life Sciences at Genentech

(and IT infrastructure)

(and Databases)

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Genentech, Inc.

Introductions

Who are you?

- IT Professional?
- Scientist?
- Business?
- Wrong place?

Outline

Part 1
- The Company

Part 2
- IT Infrastructure

Part 3
- Architecture Project
- Unified Database Tier

The Company

Genentech – Mission

"Genentech is a leading biotechnology company that discovers, develops, manufactures and commercializes biotherapeutics for significant unmet medical needs."

Significant unmet medical needs

- **At the end of the day – it's about helping people…**

Genentech – 5x5

Genentech's corporate strategy

Become the world's (leading) biotechnology company by 2005.

<u>In order of priority:</u>

By 2005, we intend to have at least:

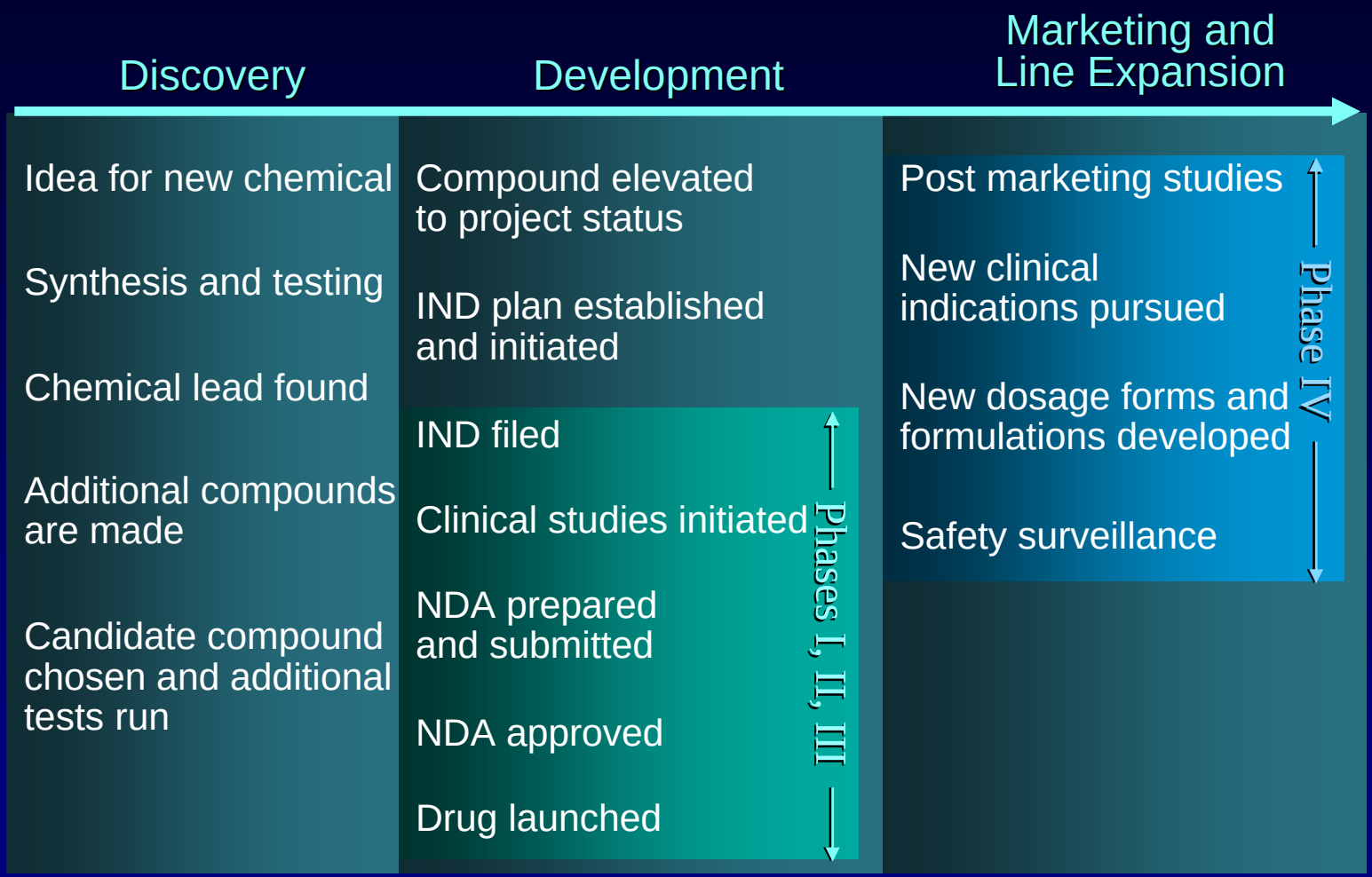
- **25% average annual increase in EPS**
- **25% net income as % of revenues**
- **5 new products/indications approved**
- **5 significant products in late stage clinical trials**
- **$500 million in new revenues from strategic alliances or acquisitions**

Genentech – Vital Statistics

- ~5,000 Employees

- $2.2B in Revenue (2001)
  - $1.9B for first 3 quarters of 2002
- 11 products
  - Protropin®, Nutropin®, NutropinAQ®, NutropinAQ Pen™, NutropinDepot®, Cathflo™ Activase®, Activase®, TNKase™, Pulmozyme®, Herceptin®, Rituxan®
- 1 product awaiting FDA approval
  - Xolair™
- Three major sites
  - South San Francisco, California
  - Vacaville, California
  - Porriño, Spain

Genentech – Process



Genentech – Product Pipeline

Phase I

2C4 Antibody
solid tumors

Anti-Tissue Factor
acute coronary syndrome

Phase II

MLN-02 Antibody
inflammatory bowel disease

rhuFab
age-related macular degeneration

Efalizumab (anti-CD11a)
rheumatoid arthritis

Phase III

Raptiva™
psoriasis

Rituxan®
int/high-grade NHL

Rituxan®
ITP

Herceptin®
adjuvant breast cancer

Avastin™
colon cancer

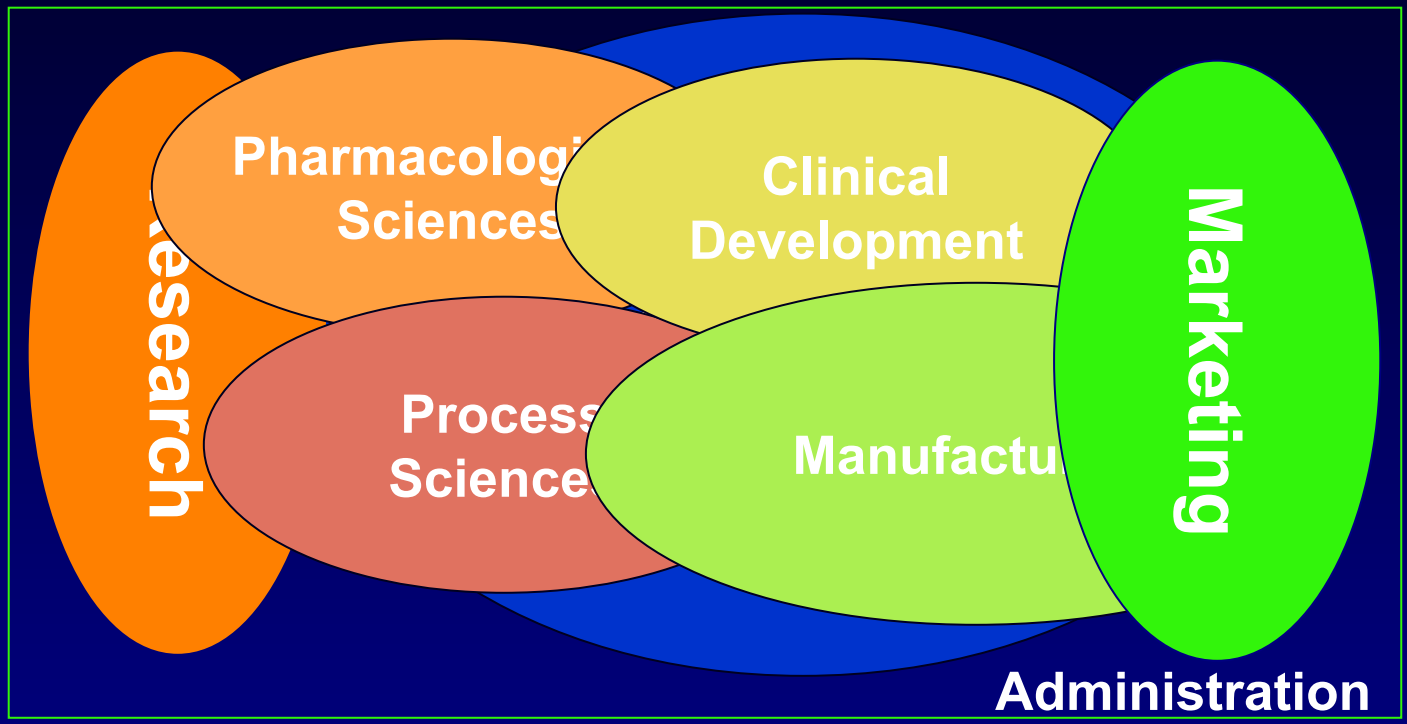
Nutropin Depot®
adult GH deficiency

Tarceva™
lung cancer

BLA Filed

Xolair™
allergic asthma

Genentech – Life Sciences

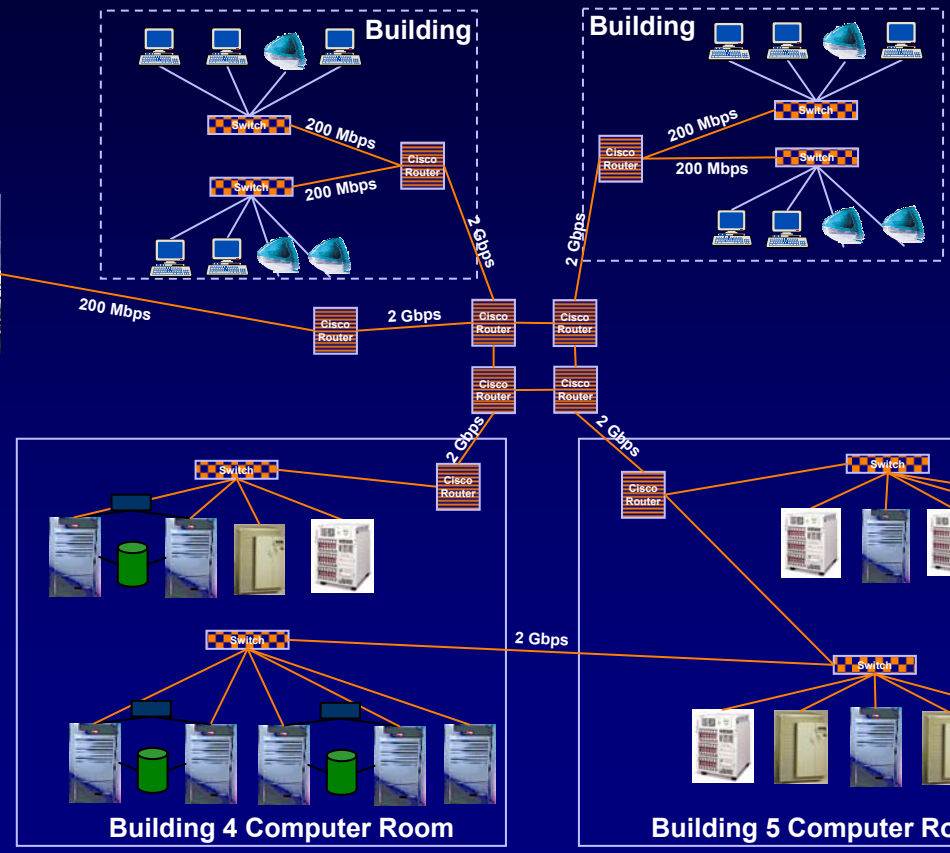


…from idea to product

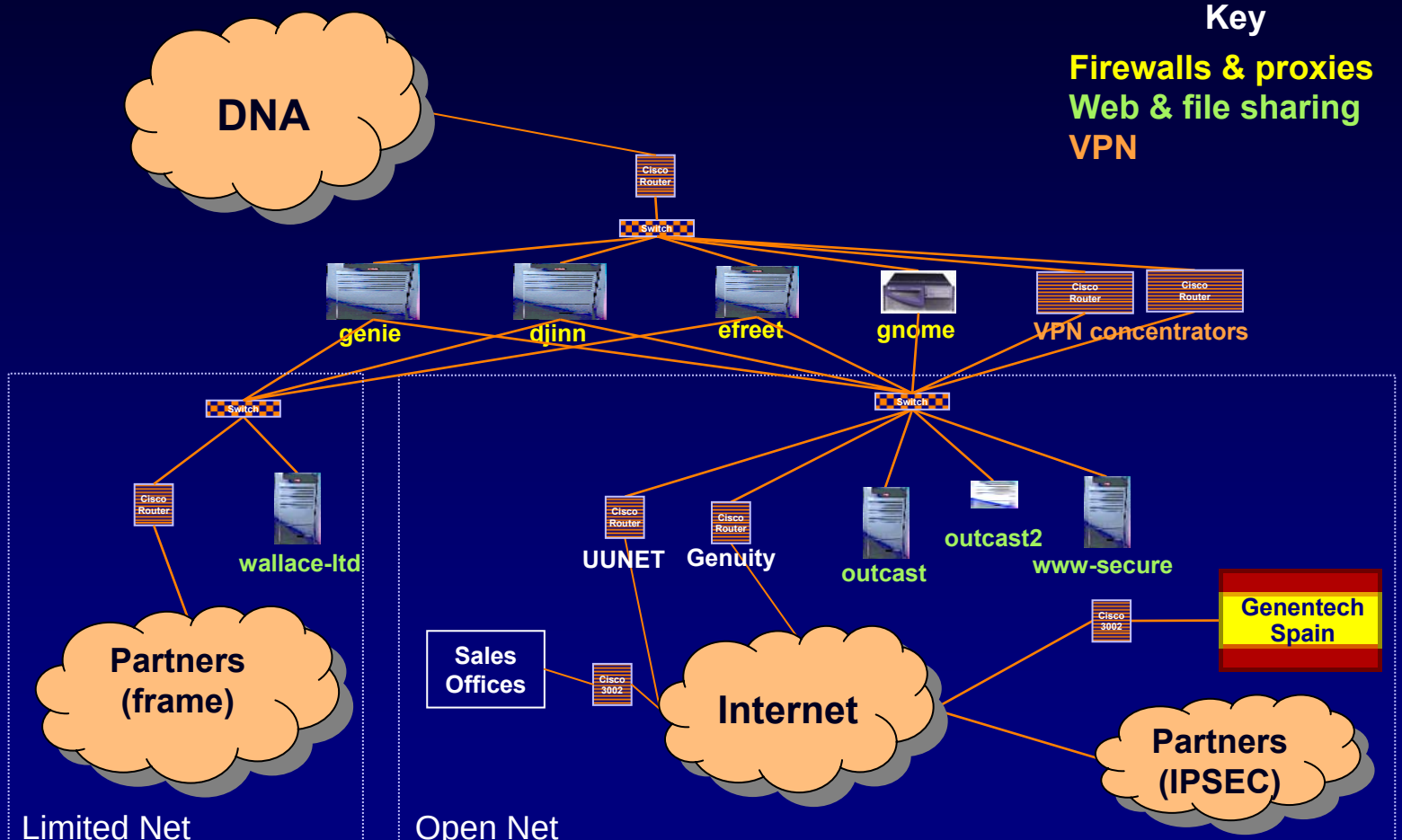
IT Infrastructure

IT Infrastructure

Vacaville



IT Infrastructure



Supported Platforms

Desktop

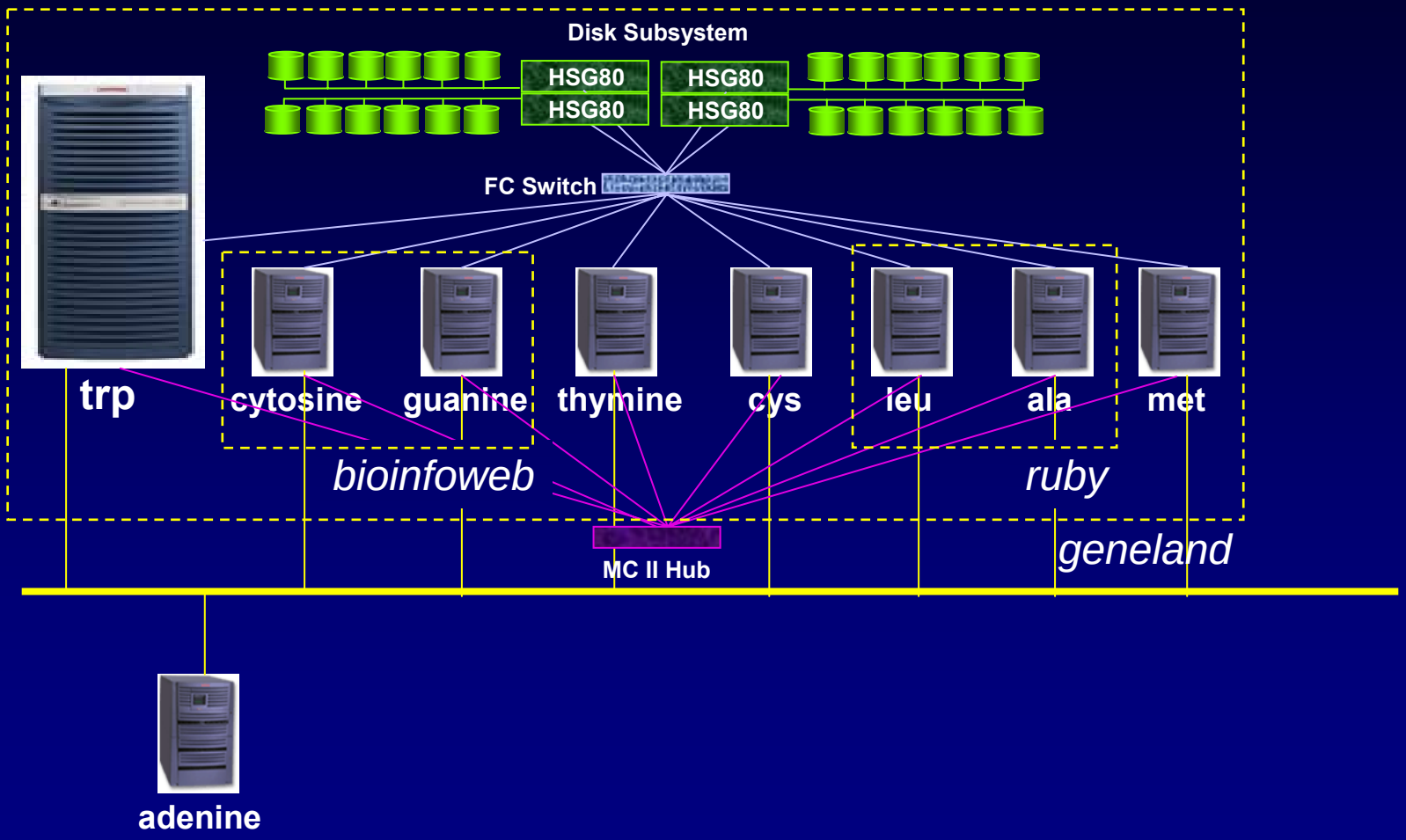
- MacOS 9,X [~2000]
  - Migrating away from MacOS 9
- Windows (NT, 2000) [~6000]
  - Migrating towards Windows 2000
  - Windows XP coming in December
  - NT still in heavy use in validated areas
- SGI Irix [~40]
  - Used primarily in Research
  - Molecular modeling
  - Imaging
  - Structural chemistry
- Sun Solaris [~20]
  - Used primarily in Research
  - Instrument controllers

Supported Platforms

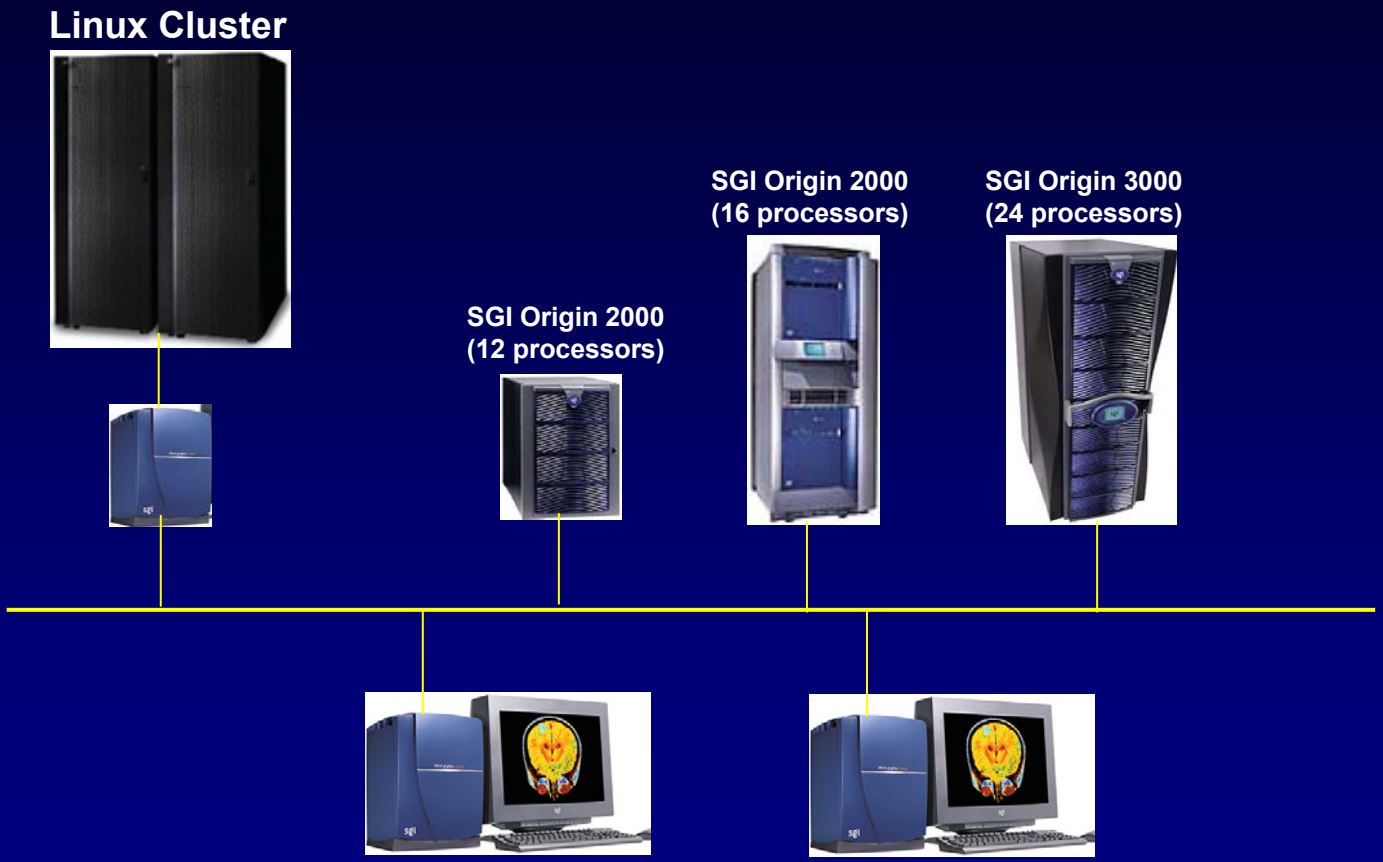
Servers

- HP Tru64 UNIX (Alpha) [64]
  - Infrastructure, Research, Development Sciences, Manufacturing
- HP HP/UX (PA-RISC) [40]
  - Finance (Lawson)
  - HR (Peoplesoft)
  - Manufacturing (NovaManage, BPCS, Beckman LIMS)
  - Imaging (FileNET)
- Linux (IA-32) [34]
  - Research
- SGI Irix (MIPS) [4]
  - Research
- Sun Solaris (SPARC) [76]
  - SAS
  - Oracle Clinical
  - Rational
  - Others
- Windows NT/2000 (IA-32) [300?]
  - Lots…

Bioinformatics Platform



Protein Engineering / Bioorganic Platforms



Supported Databases

Oracle
- Corporate standard
- Used for R&D, Sales and Marketing, Financials, HR, Payroll, IT Services, Facilities, Manufacturing

Informix
- Used for limited legacy applications

SQLServer
- As part of certain applications (black box)

FileMaker
- End-user databases

Access
- Limited use

Custom Databases
- Sequence databases
- Limited applications (BerkeleyDB, MySQL)

Infrastructure Summary

Diversity is the nature of the environment

- Research requires flexibility
- Validation requires more control

Seeing more Linux

- Currently only in Research environments
- Will probably be used in the infrastructure

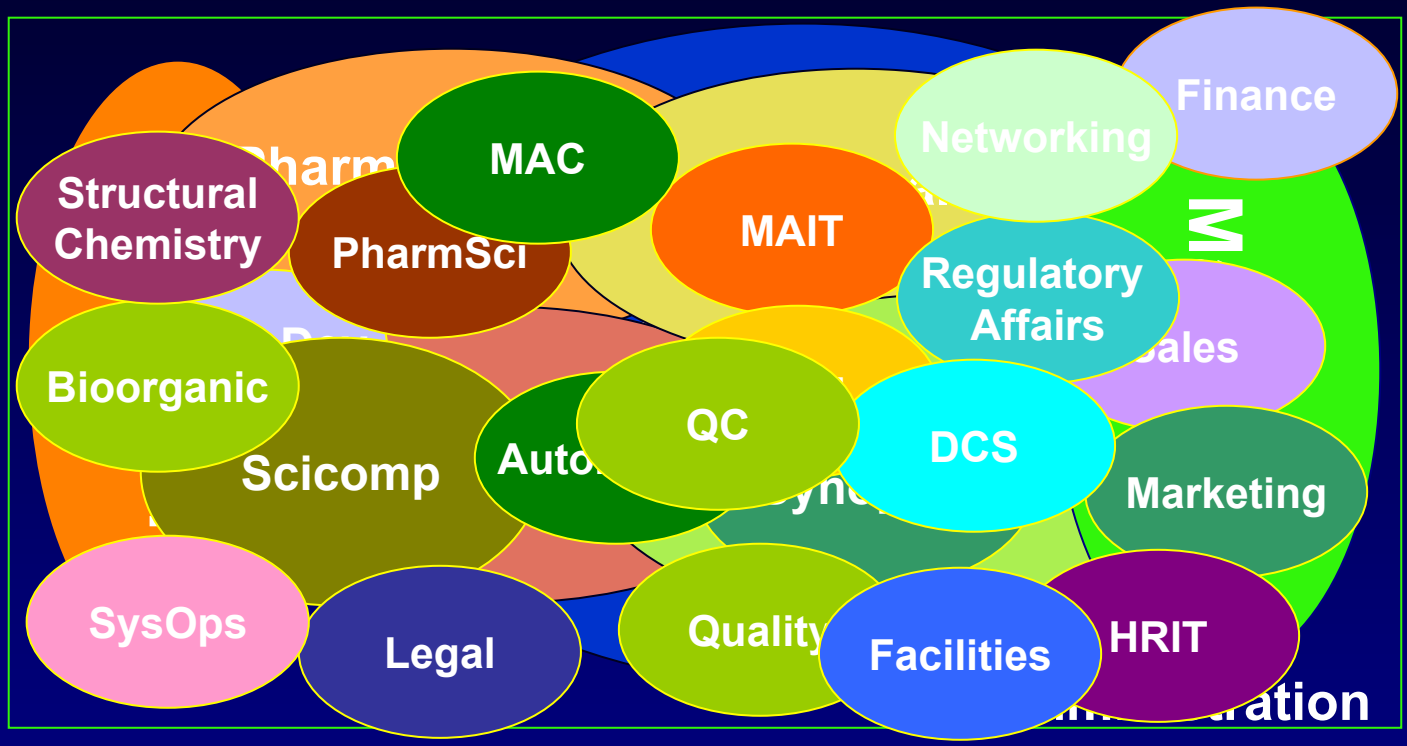
Significant investment in Tru64 and HP/UX

- Closely watching developments from HP

Oracle is a key component in our infrastructure

Architecture Project

Genentech – IT Architecture[1998]



…independent efforts

Genentech IT Architecture

Every group had their own needs/ideas

Few points of "control"

- E-mail
- Network
- Firewall
- Central web servers

Lots of technology/vendor favoritism

No process for business unit input into direction

No process for technical consensus

Architecture Project – 1998

Goal:

- Future architecture (3-5 years out)
- Inform future development

Membership:

- Technical staff from around the company

Process:

- 1-day offsite to decide topic areas
- Working groups to propose architectures in each area
- Groups were asked to avoid technology decisions
- 1-day offsite to review results and choose top areas
  - Top areas selected by “vote”

Architecture Project

13 sub-teams:

- Application Architecture
- Automation Architecture
- Database Architecture
- Desktop Architecture
- Disaster Recovery Architecture
- Document Management and Repositories Architecture
- Internet Architecture
- Intranet Architecture
- Network Architecture
- Security Architecture
- Server Architecture
- Software Development Architecture
- Web Architecture

Key Points (Results)

Identified by participants

- Three votes per participant

Top "vote-getters"

- Open systems and standards [11]
- Three-Tier [10]
- Centralized Security, Single-sign on [10]
- Network bandwidth [8]
- Configuration management [8]
- Reusable services and code [6]
- Corporate high availability strategy [5]
- Distributed objects strategy [5]

Key Points (Results)

Top three "vote getters" all result in reduced costs or increased efficiencies:

- **Open systems and standards**
  - Reduction in vendor dependencies
  - Easier integration
  - Quicker new staff integration
- **Centralized Security, Single-sign on**
  - Reduced user time spent dealing with passwords
  - Better security
  - Decreased staffing dedicated to account maintenance in each group
- **Three-Tier**
  - Increased database consolidation
  - Reduced maintenance costs
  - Increased utilization
  - Better uptime & performance

Three-Tier Architecture →Unified Database Tier

Database (3rd) Tier Project

Decided on 2 supported platforms: Tru64 & HP/UX

Started with Tru64 Cluster

Approach

- Single cluster with multiple instances
  - Instances will failover if a node fails
- Instances balanced manually across nodes
- Validated and non-validated databases in separate instances
- Start small, demonstrate stability, performance and value

Implementation

- Built an Oracle-only development/test environment
  - *yukon:* 2-node DS20 Tru64 UNIX Cluster
- Built an Oracle-only production environment
  - *merced:* 2-node ES40 Tru64 UNIX Cluster

“If you build it, they will come”

Offered *merced* as a “third-tier”

- Web applications migrated immediately
  - Were on a single-node Alpha
- Other customers slowly migrated
- Easier than configuring their own, separate third tier

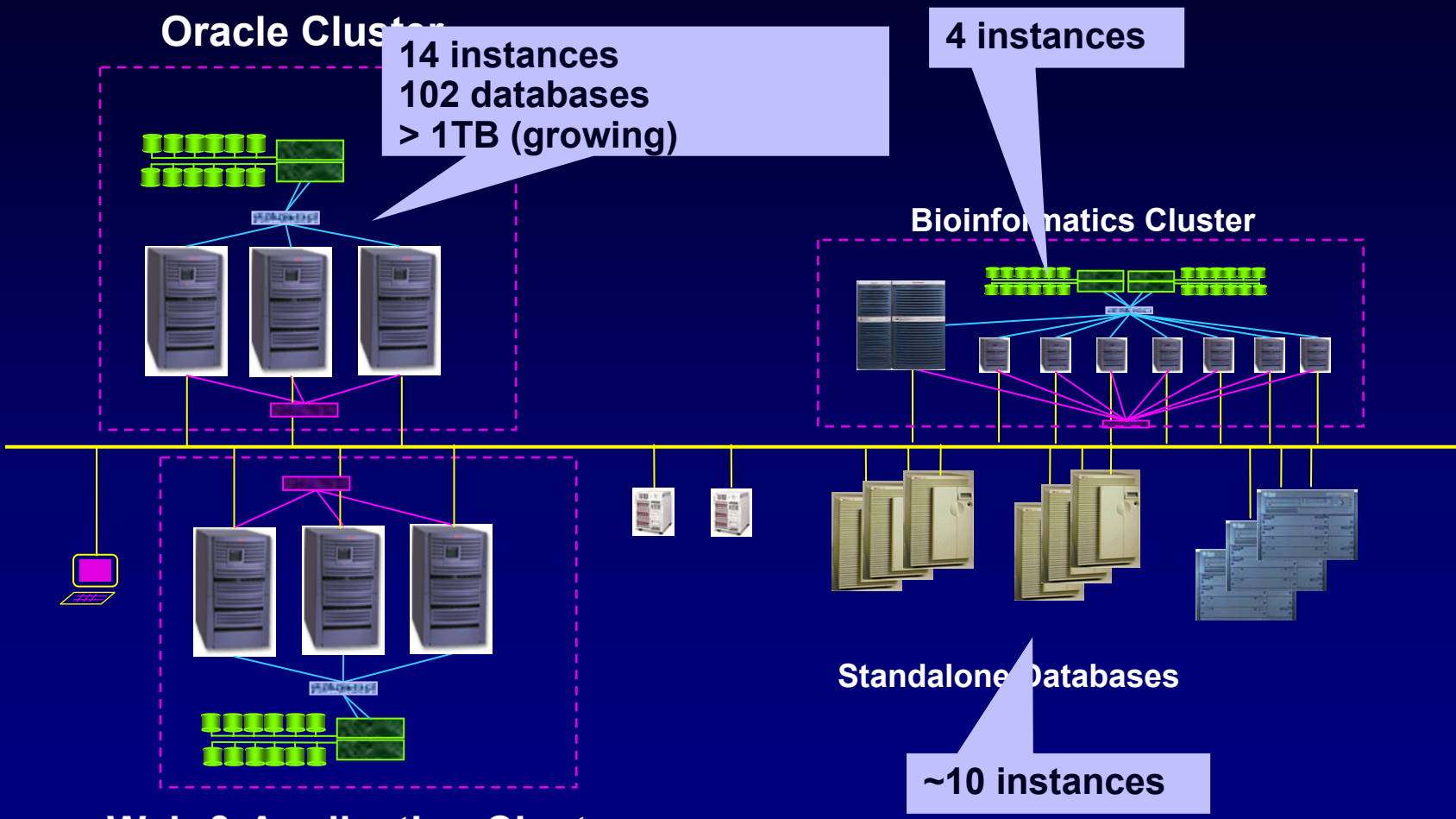
Eventually, became *the* database tier

- Wound up with close to a unified database layer

Architecture allowed for other database servers

- Little interest in additional, separate database servers
  - One group implemented a separate server due to vendor requirements

Current Database Architecture



Unified Database Tier

Advantages

- Single infrastructure to manage
- Can invest in higher availability
- Separate DB infrastructure can provide more focused tuning
- Significant consolidation

Disadvantages

- Single infrastructure to break
  - All “eggs in one basket”
- Entire platform must be qualified
  - Not bad business practice, anyways
- Upgrades require substantial investment in planning
  - Now on a fixed 6-month upgrade cycle

Challenges

- Customer acceptance
- Version sync
  - different vendors certifying against different Oracle versions

Status

Current databases on unified database tier

- 14 instances across 3 nodes
- 102 databases
  - Finance, Research, Sales, Legal, HR, Product Development, Manufacturing, Marketing, Fermentation, Development Sciences, etc.
- 2 additional databases scheduled to migrate

Databases not on unified database tier

- Medical Affairs (Clinical)
  - Local support group
  - Significant vendor tie-in (Oracle Clinical)
- 5 Research databases
  - Local infrastructure, local support
- 6+ Manufacturing databases
  - Production databases
  - Significant application tie-in
- FileNet, Rational
  - require local databases

Status

Performance

- Completely acceptable
  - I/O Wait times ~0.13 – 0.50 on largest instances

Availability

- Excellent uptime (99.99%)

Most customers are happy

- Still some who want complete control
  - Validation
  - Significant scheduling contraints
  - Comfort

Futures

Integration with Kerberos

- Centralized authentication

Additional databases migrated

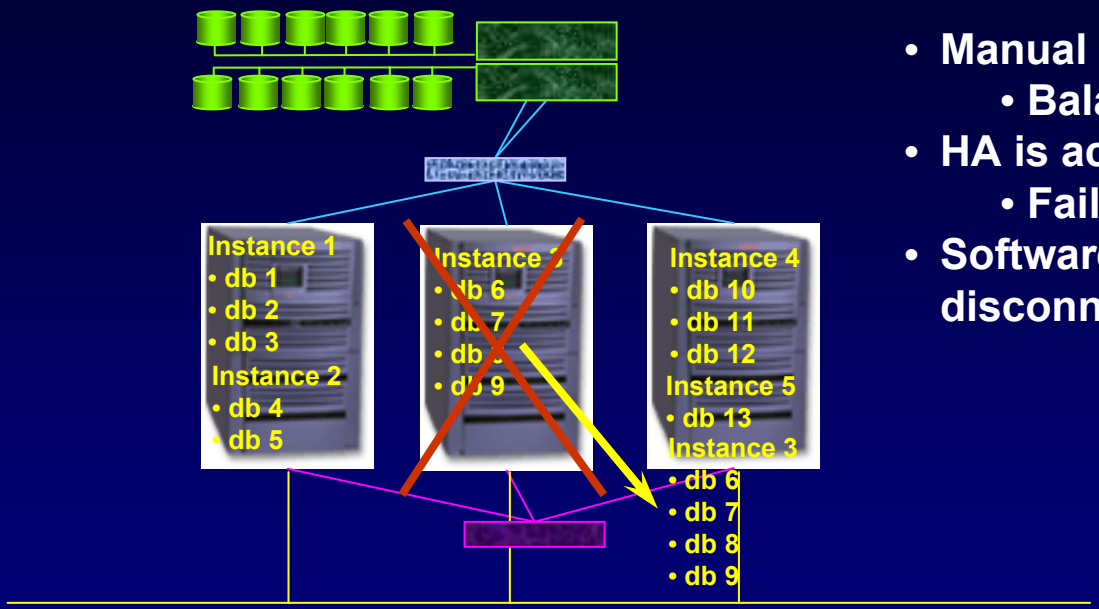
Upgrades

- More nodes
  - If needed
- More disk
  - Will be needed
- Oracle 9i

Oracle 9i RAC

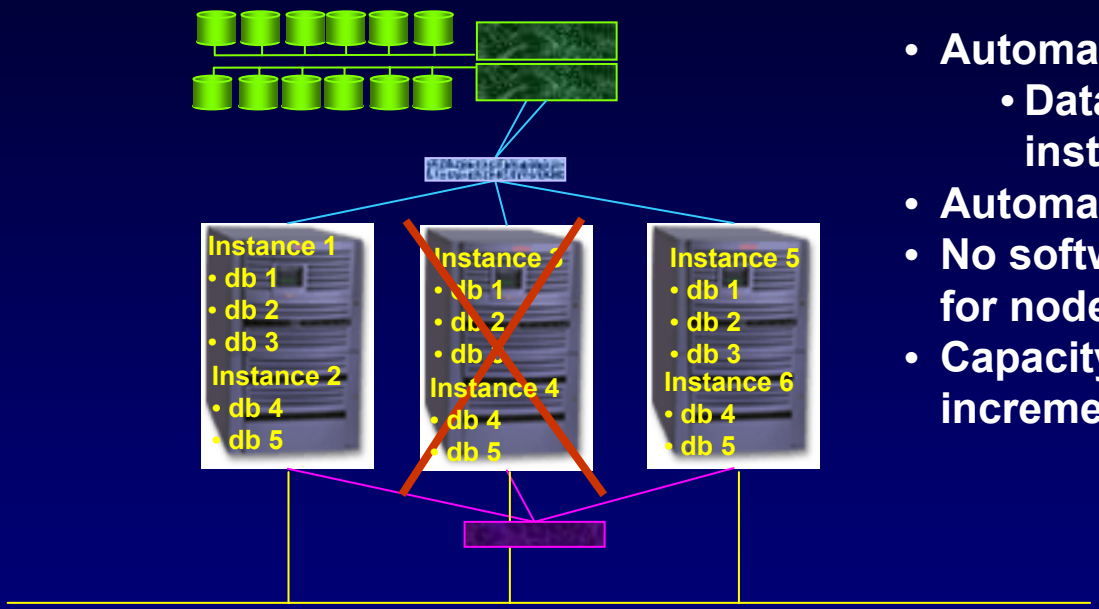
- Oracle 9i RAC Pilot

Oracle 9i



- Manual load balancing
  - Balance by instance
- HA is achieved by failover
  - Failover times 10-30 seconds
- Software must account for disconnects during failover

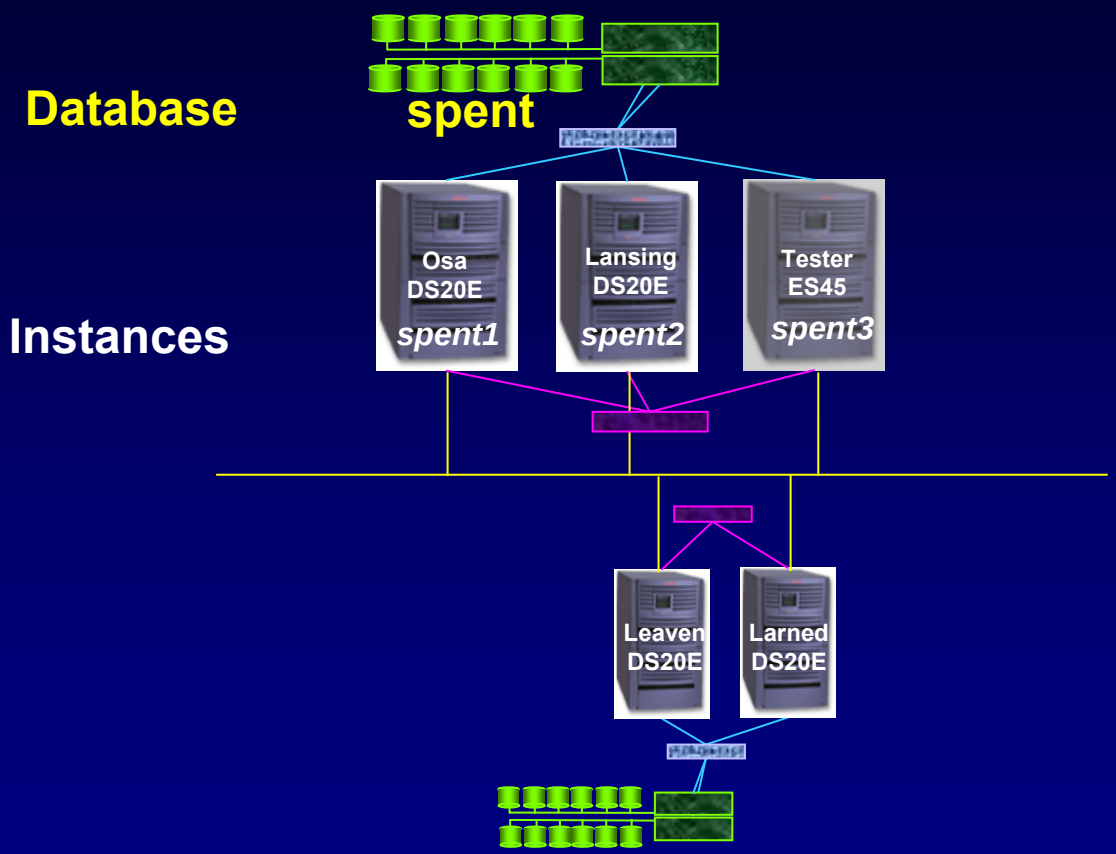
Oracle 9i RAC



- Automatic load balancing
  - Databases served by multiple instances
- Automatic failover
- No software changes to account for node failure[1]
- Capacity can be added incrementally

[1]Actually, not so sure how invisible this is

Oracle 9i RAC – pilot



Oracle 9i RAC – results

RAC is configured and running on cluster

- 1 database
- 2 instances
- No special tuning (OS *or* Database)

Load balancing is configured and working

- Least loaded instance gets connected
- Connection-oriented load balancing at this point

Lessons learned:

- It works, but it takes some work
- Start with a demo database
- Getting installation right takes a couple of times

Next steps:

- Ask HP for demo database
- Do detailed performance benchmarking

Oracle 9i – timeline

Too late for current upgrade cycle

Plan to move into production in August

9iRAC

- **Technology looks *very* interesting**
- **Very enthusiastic about using in the future**
- **Current infrastructure is too good…**
  - **No business driver to upgrade**
  - **Current uptime acceptable**
  - **Current performance acceptable**
- **Will migrate as business needs dictate**

Conclusions

Genentech is all about "*life* sciences"!

IT supports overall corporate mission

IT architectures have evolved

- Decentralized
- More centralized

Unified database tier an important part of our evolution

Questions?

Thank you!

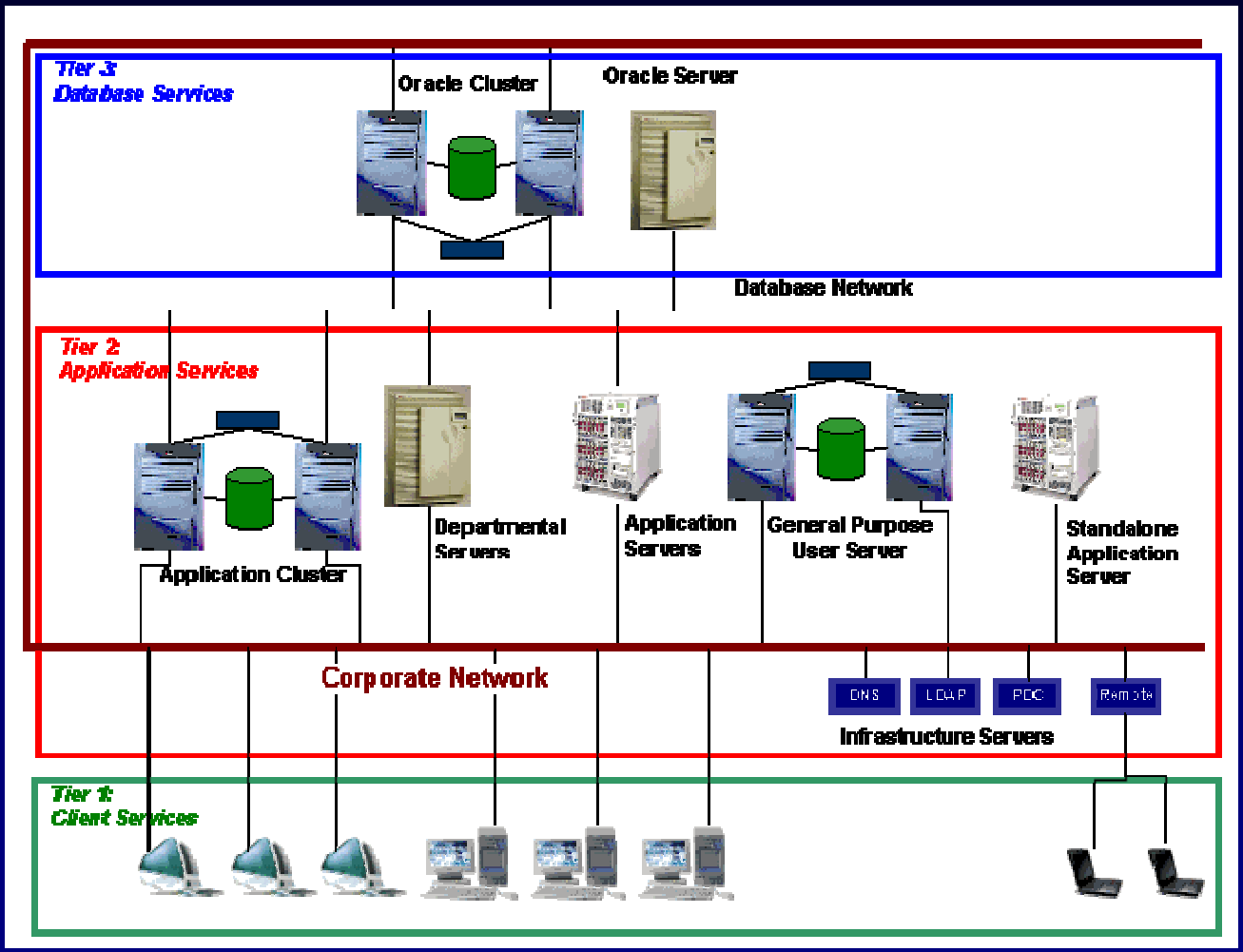
Acknowledgements:
Sonja Bock
Jim Lola
Paul Meadow

Architecture Project

User's View

- Anywhere, anytime computing
- Choice of platform
- Single sign-on
- Integrated corporate applications
  - Only need to enter information once
  - Only need to look one place
- Integrated desktop applications
  - Messaging
  - Conferencing
  - Scheduling
  - Data sharing

Architecture (Systems View)



Architecture

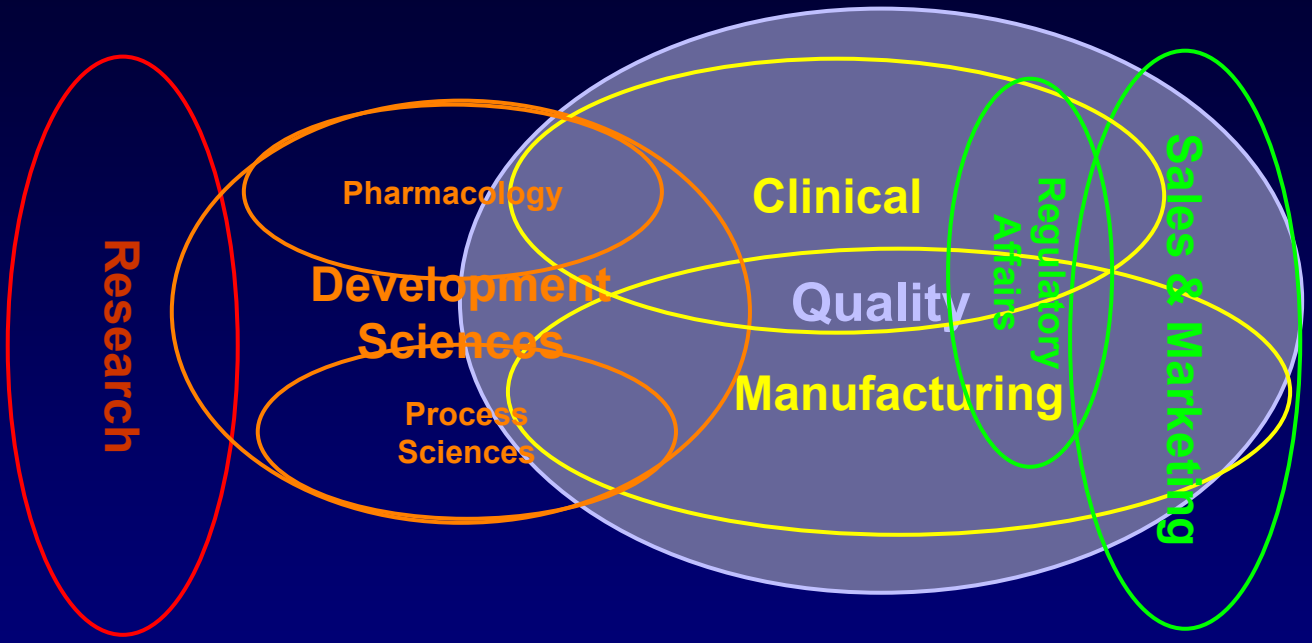
Support View

- Open standards-based
- Centralized where it makes sense
- Decentralized where it makes sense
- Easier deployment and tuning (three-tier)

Developer's View

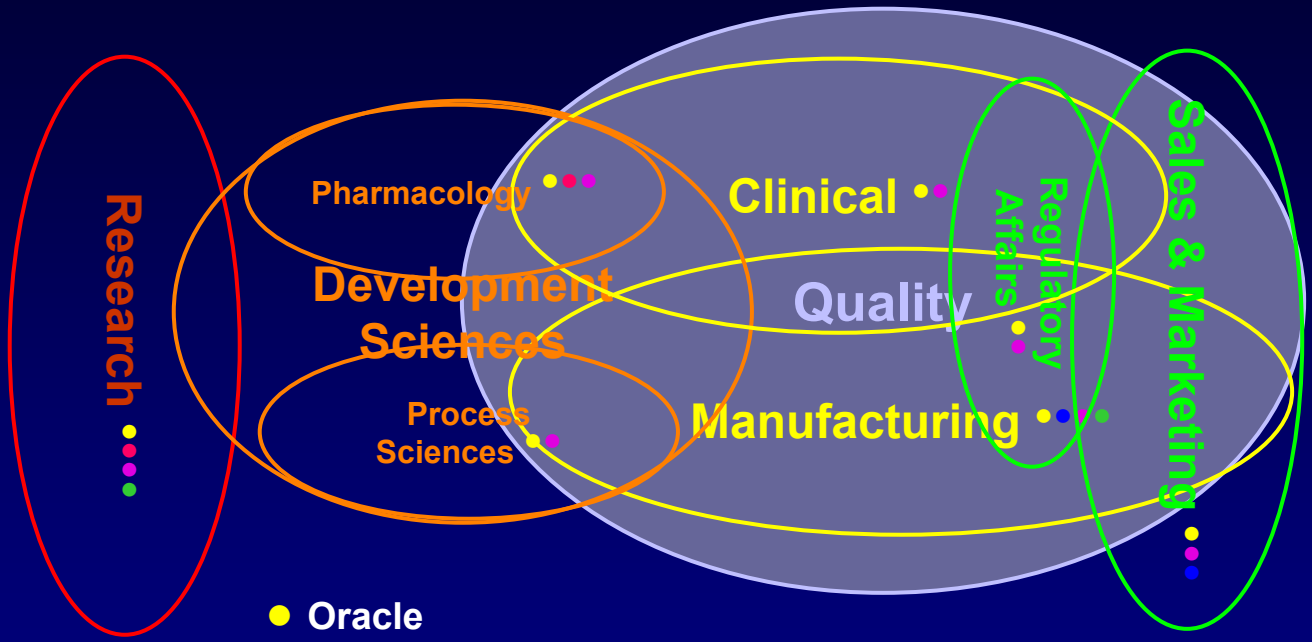
- More code sharing
- Easier integration (distributed objects)
- Better management (configuration management)

Genentech – Pathway



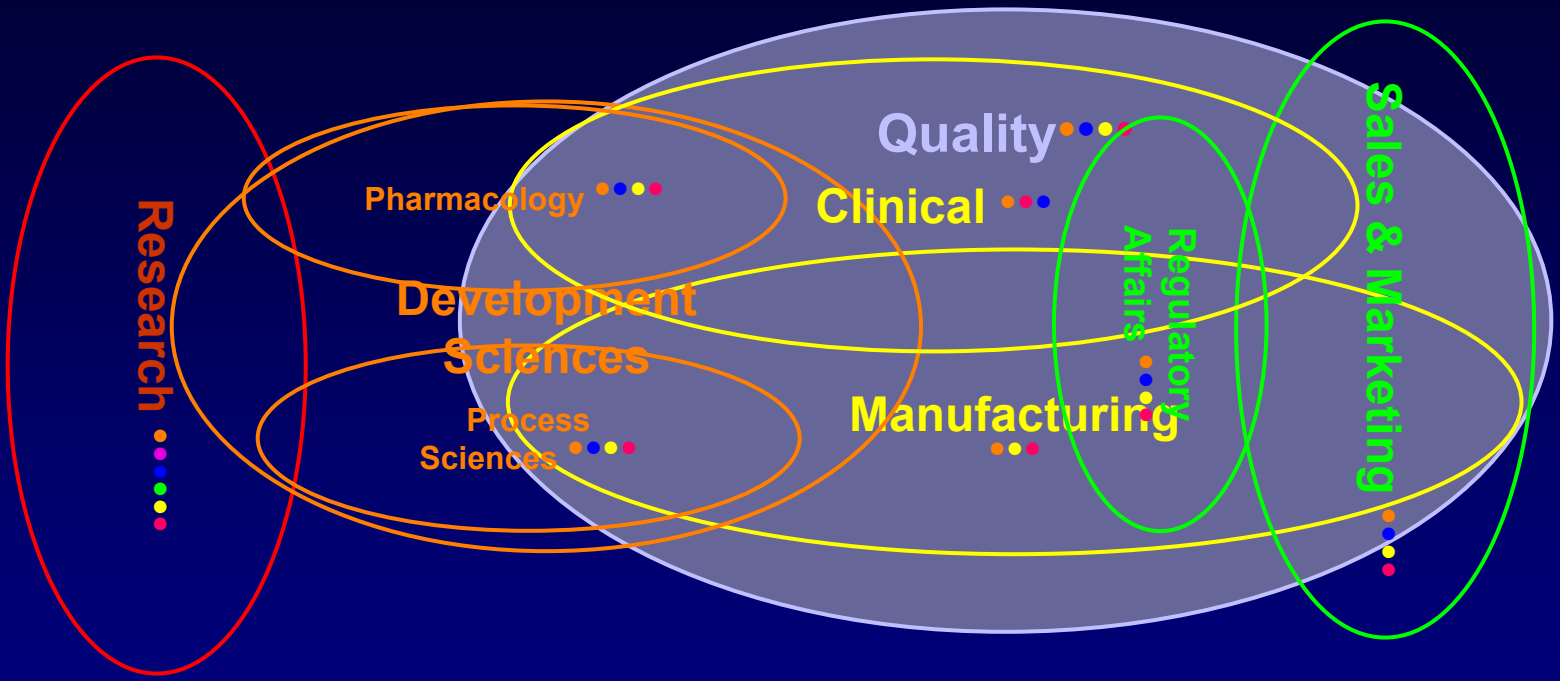
…from idea to product…

Genentech – Databases



- Oracle
- Informix
- SQLServer
- FileMaker
- Custom Databases

Genentech – Platforms



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