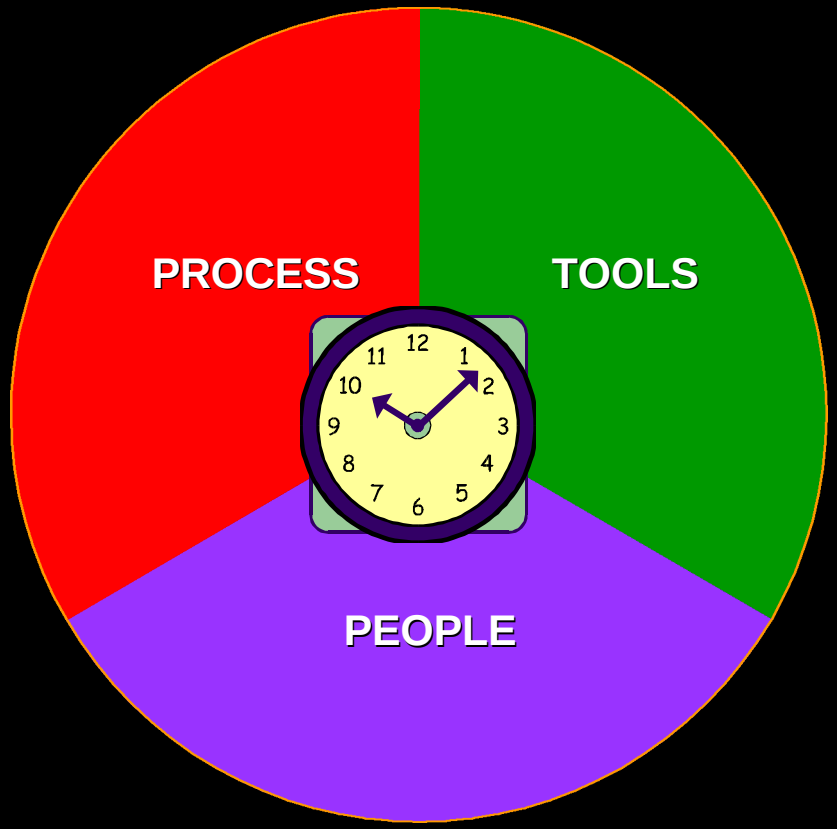
Year 2000 Testing

Year 2000 Testing Strategy



Coastal Technologies
Upper Montclair, NJ, 07043 USA
www.CoastalTech.com

What's All the Fuss About?

The Problem:

– Without costly and time-consuming renovation, many computer systems are destined to fail at the end of the millennium.

– There are no easy shortcuts around this problem.

What's All the Fuss About?

- **The Context of the Problem:**
  - Computers and software are pervasive throughout society.
  - Technology and information are critical areas of business competency today.
  - Everyday business operations are highly dependent on reliable computer systems.
  - Computing power has become a household commodity.
  - Connectivity and the ability to move information has increased dramatically.

What's All the Fuss About?

Conclusion:

We are highly dependent on multiple systems which may fail, and may fail in catastrophic ways, and all in the same time frame.

What will the Y2K conversion cost?

- **$300,000,000,000 to $600,000,000,000 worldwide conversion cost.** Gartner Group
- **$35,000,000,000 U.S. Federal government.** Gartner Group
- **1,000,000 programmers.** Howard Rubin
- **$10,000,000 to $15,000,000 per Fortune 1000 company.** Steven Whitman, Viasoft

What's All the Fuss About?

Why the Year 2000 is Different:

- Some people say: "I've maintained systems for years. I know how to test systems. There's nothing new I need to know (or do) for year 2000 projects."

- However, the year 2000 is different, and in these ways:

What's All the Fuss About?

Why the Year 2000 is Different:

- **Magnitude**: a huge amount of work needs to be done with tight time and resource constraints. Comparing a typical system modification to a year 2000 renovation is like comparing a ripple on a pond to a Tsunami wave.

- **Project management and coordination**: many interdependent renovation and replacement projects need to occur concurrently, while providing ongoing business continuity.

What's All the Fuss About?

Why the Year 2000 is Different:

- **High risk**: many of the systems requiring work are old, technically obsolete (so the skills to work on them are in short supply), poorly documented and understood, and not flexible and robust enough to easily support multiple changes.

- **Liability**: the potential financial liabilities are very high if systems fail or customers leave for companies already Y2K compliant.

We Need a Plan

The old test plan -

If the customer tells us it's broken, we fix it.

- doesn't work anymore.

Agenda

- Preparation
- Programming
- Testing modifications
- System & Acceptance testing
- Installing modified code
- Software tools for conversion

Advice

- Don’t celebrate New Year’s Eve in an elevator after next year
- Get your money out of banks that are not Y2K compliant
- Lobby to make January 2000 a national holiday
- Practice resetting your VCR

Year 2000 Testing Strategy

Objective of this session:

Discuss Year 2000 Conversion and Testing

“Global financial meltdown”

Description of Year 2000 consequences, Business Week cover story

“Chaos of Trivia”

Capers Jones, Software Productivity Research

State of Readiness

Most Year 2000 preparation efforts follow a series of phases:

- **Awareness**
- **Assessment**
- **Renovation (or Replacement)**
- **Validation**
- **Implementation**

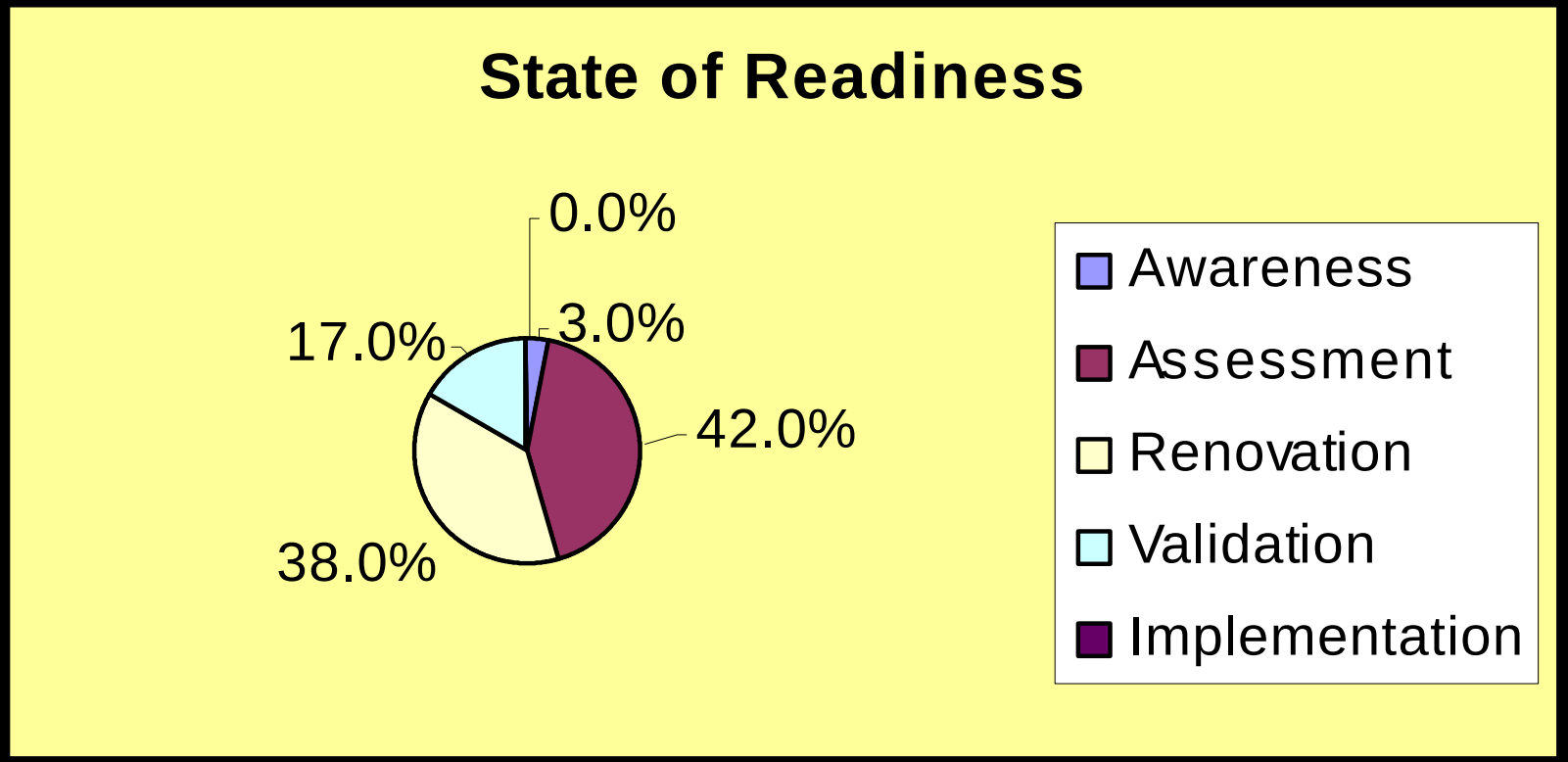
Which of these 5 phases best describes your organisation's current status?

State of Readiness

Attendees at this seminar Aug-Oct 97:

- **Awareness** **3%**
- **Assessment** **42%**
- **Renovation (or Replacement)** **38%**
- **Validation** **17%**
- **Implementation** **0%**

State of Readiness



Deadlines

January 1, 2000

is a pretty firm deadline

What are the deadlines?

January 2000	Systems complete
June 1998	6 month safety margin
September 1998	Vendor requested deadline
December 1998	Leaves a year for testing and fine tuning

State of Readiness

- Denial
- Frustration
- Anger
- Terror
- Panic
- Lunacy
- Search for others to blame

Year 2000 Technical Problems

- The Year 2000 contains consecutive zeros as the last two digits, so that some systems will interpret the last two digits (00) to mean the Year 1900.
- The Year 2000 is a leap year which contains the date February 29 (unlike the Years 1700, 1800 and 1900).
- Most hardware clocks calculate dates as a count of elapsed days from a “day zero” which was chosen at some time in the past. When the date counter reaches its maximum value, there will be a problem the next day when the system attempts to re-set the counter back to zero.
- YY can be used to store non-date information, i.e., “end of file”, “no expiration”.
- Some systems have hard-coded the value “19” for the 20th century.

The Leap Year Calculation

A leap year is any year evenly divisible by 4,
But not evenly divisible by 100,
Unless it is also evenly divisible by 400.

Who cares?

Year 2000 Solutions

- Sliding Century (windowed)
- Data Packing or Compression
- Pivot Year
- Full Conversion
- Re-engineering
- System Replacement
- Manual Work-Arounds
- Encapsulation or Masking

Year 2000 Management Problems

- Resources
- Procrastination
- Validation
- Outsourcing
- Contingency Planning
- Reverse Triage

The Multi-Firm Domino Effect

- Orders, invoices, payments etc.
  - The heart of business activity
- EDI (electronic data interchange)
- JIT (just-in-time inventory)
- MRP (manufacturing resource planning)
- VMI (vendor managed inventory)

The Multi-Firm Domino Effect

- Who do we do business with?
- How do we interact with them?
- How critical is our level of dependency - system or transaction?
- How ready are they?
- How can we validate that they are ready?

Estimating the Year 2000 Effort

Continued….

- The re-testing of existing functionality will be considerably larger then the conversion programming itself, probably by a factor of three.
- Automation might improve this productivity by 10% to 25%.
- Automation provides many other benefits and is the key to quality.

Handling Resource Limitations

- The Demand
- The Supply
- The Automation Alternative
- The Consequences
- Computer Resources

Year 2000 Conversion Issues

- Date Formats
- Aging Computations
- Short Intervals
- Extended Intervals
- Date-Dependent Systems
- Poor Architecture
- Quality of System and Process Documentation
- Day-of-Week and Holiday Computations

Year 2000 Conversion Issues

Continued….

- Special Flags and Indicators
- Merging of Modifications
- Synchronization of Mutiple Projects
- Warranties or Guarantees
- Scope of the Modification Efforts
- Missing Source Code
- Date Use
- Regression and Volume Testing

Year 2000 Testing Issues

- Test Data Generation
- Date Simulation
- Software Licenses
- Multiple Test Periods
- Test Data Management
- External Software Packages
- Faster-than-Real-Time Process
- Moratoriums

Year 2000 Testing Issues

Continued….

- **Ancillary Testing Activities**
- **Re-Work After Testing**
- **Hidden Existing Defects**
- **Testing Before Conversion**

Year 2000 Suggestions

1. Prioritize the Year 2000 changes based on their perceived risk and impact on the organisation, rather than on the relative ease of making the changes.
2. Plan to have all date-sensitive systems and data files converted by December 31, 1998, if possible.
3. Don’t change anything else. The likelihood of inadvertently introducing new errors is high, and the effort slows the conversion.
4. Improve the documentation and test libraries. Document a usable record of the changes made for Year 2000, together with their test data.
5. Develop a test plan and approach before programming any changes.

Year 2000 Testing Approach

- Initial “smoke test” for compliance
- Focussed testing based on risk
  - 15% of test cases uncover 75% of defects
- Before/after comparisons of parallel volume tests
- Automated regression testing
  - Business cycles e.g end of month, end of year
  - Special dates, e.g leap year 2000, holidays
  - Special requirements, e.g international time zones, daylight savings

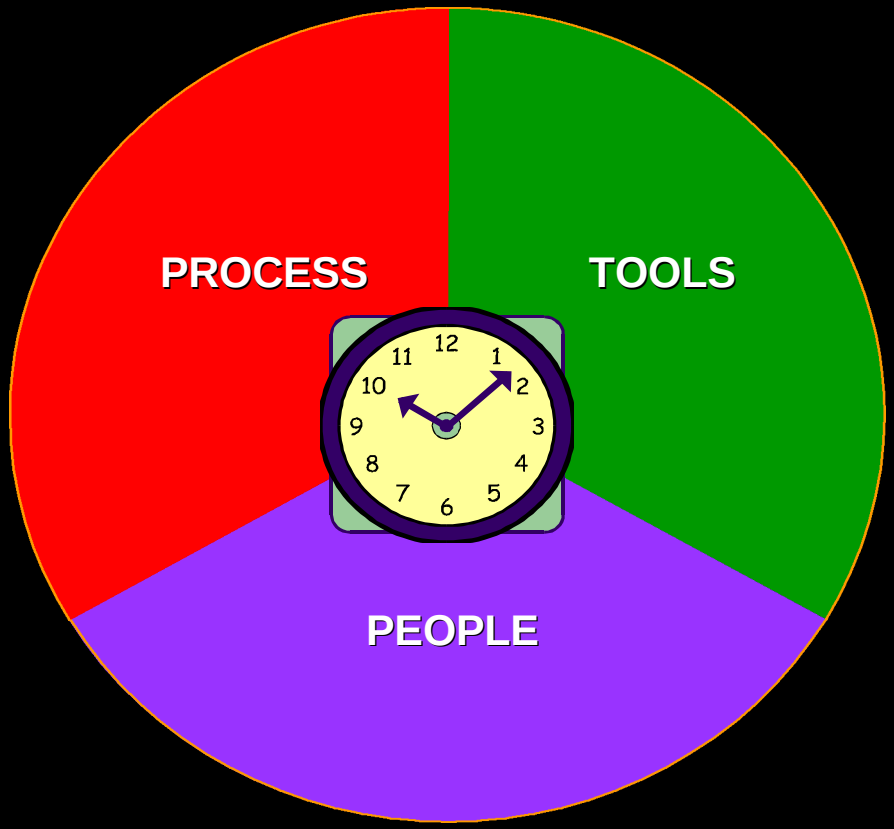
Why Automated Testing?

- Improves systems quality
- Reduces time for testing
- Improves the productivity of the human testers
- Encourages more testing
- Improves the coverage of testing

Why Automated Testing?

- Improves morale
- Reduces false confidence of manual testing
- Improves the repeatability and re-usability of tests
- Provides an organised, detailed test log
- Increases the count of defects found during testing

The Fast Path to Year 2000 Conversion



Estimating the Year 2000 Effort

Based on the work done to date at several organisations, we have some rules of thumb to help estimate the scope of work:

- Approximately 80% of existing systems will be affected by the Year 2000 problem.
- Of these, only 10% to 20% are already date compliant, leaving the remaining 60% to 70% which will require conversion and re-testing.
- Typically, 3% to 5% of the source lines of code (LOC) needs to be modified.
- Maintenance programmers can modify existing source code (in COBOL), at the rate of 10 to 20 LOC per day.

Estimating the Work Effort

Just give me a number, and I won't hold you to it.

Actually, we have been preparing for a long time.

- Financial forecasting frequently goes at least five years into the future.
- Inventory applications will schedule orders and delivery for multiyear projects.
- Bond maturity dates already extend well into the next century.

Management Problems

- Attitude
- Participation
- Resources
- Procrastination
- Budgeting
- Validation
- Contingencies
- Outsourcing

Assessing Readiness

- A complete inventory of applications
- Sufficient information to make informed decisions
- Availability of people resources
- Availability of equipment and facilities
- Information about reliance on vendor and vendor maintained systems
- A map of system dependencies
- Funding information
- Knowledge of funding and support

Date Usage

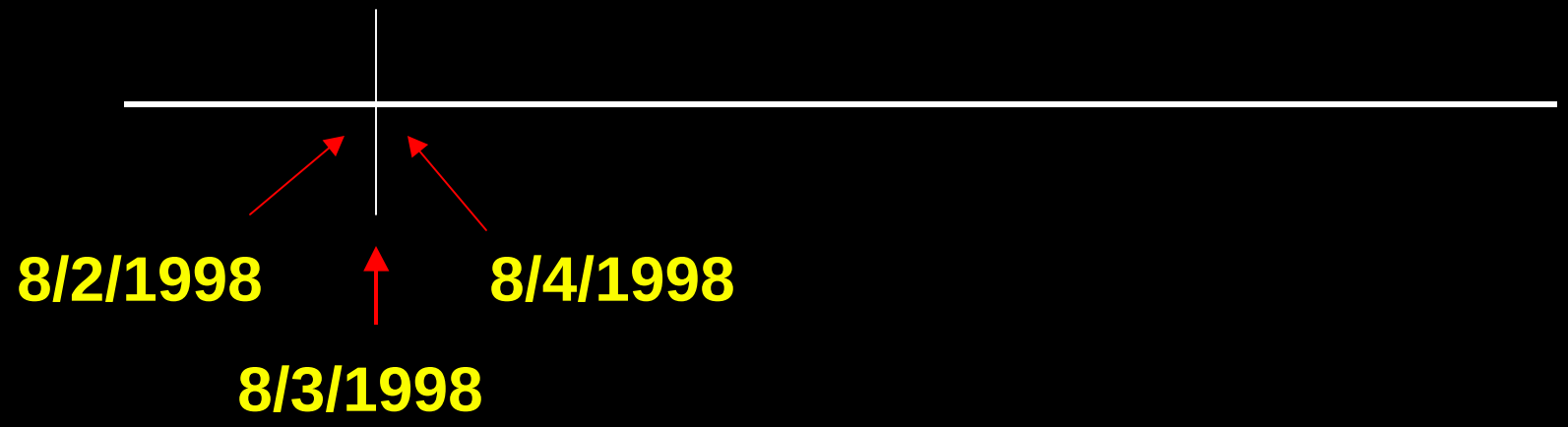
- Computations (12/15/1999 + 20)
- Comparison (5/22/99 > 3/3/1999)
- Sorting (Ascend/descend)
- Indexing
- Internal date moves

Specification

The special fare offer is only valid for travel between August 3, 1998 and September 10, 1998 inclusive.

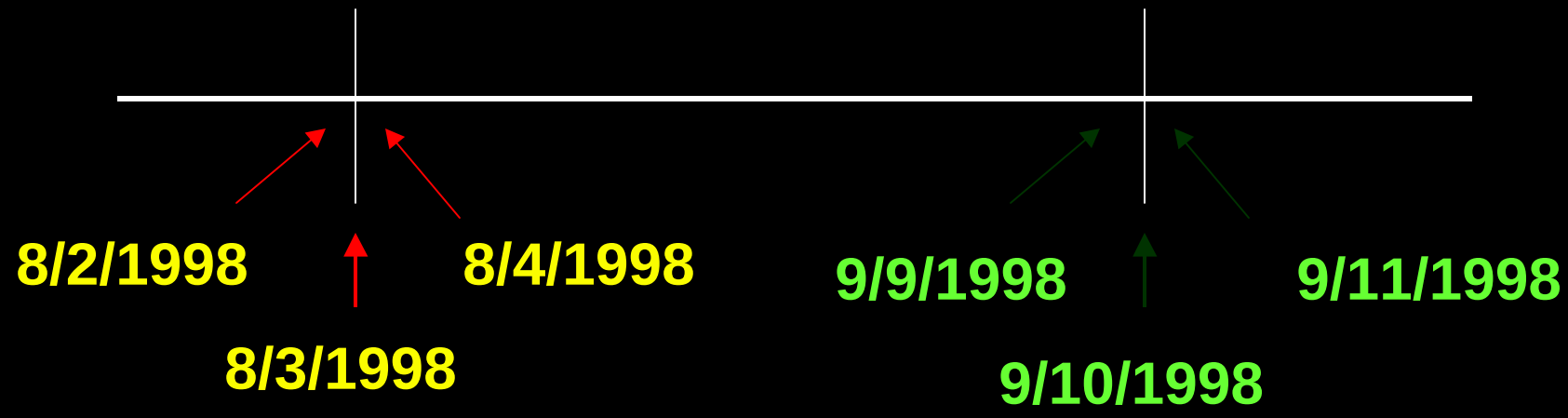
1. Verify that the departure date is valid.
2. Verify that the return date is valid.
3. Verify that the return date is after the departure date.

Boundary Value Analysis
Step 1



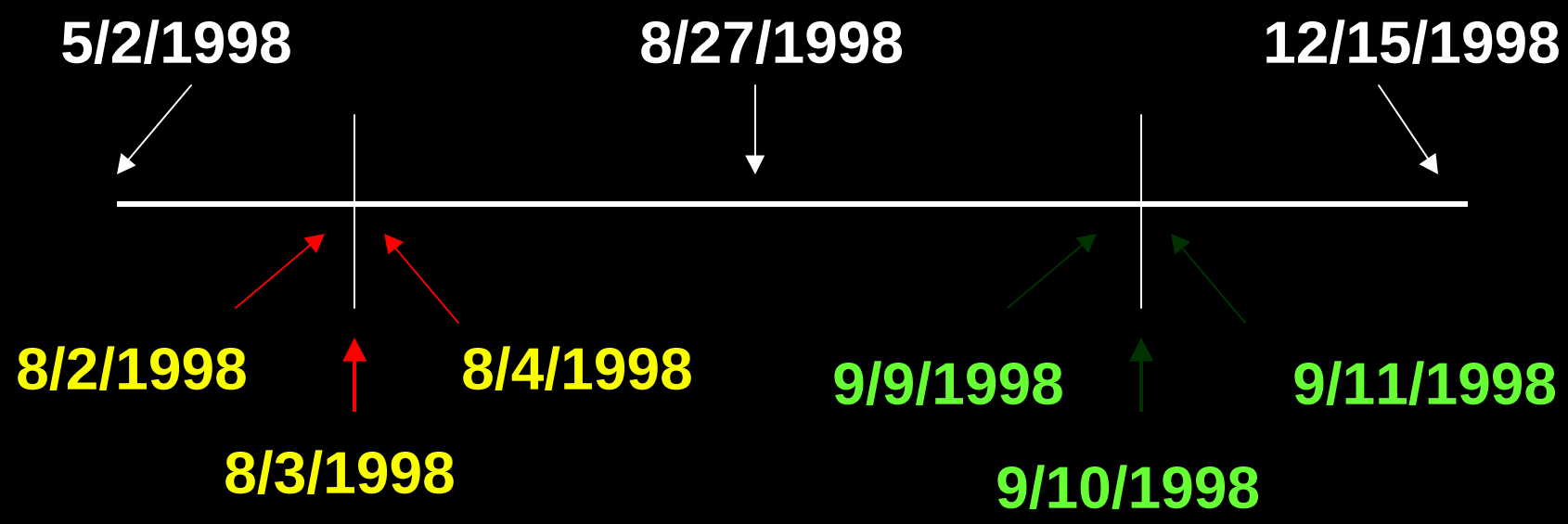
Test the lower boundary and one day on either side of the boundary.

Boundary Value Analysis
Step 2



Test the upper boundary and one day on either side of the boundary.

Boundary Value Analysis
Step 3



Perform 3 range tests. A random mid value, random high value, and a random low value.

Boundary Value Analysis

- 9 tests / field = 99%
- 2 tests / field = 90-95%
  - (1 positive test / 1 negative test)
- 2 tests / record = 50-65%
  - (1 positive test / 1 negative test)

Source: DoD

Unit Vs. System Testing

Unit test:

- Component level
- Performed by the programmer

System test:

- Functional test (start-to-finish)
- Performed by QA

Unit Vs. System Testing

Unit test script example:

Verify that the subscription-date field only accepts valid dates.

System test script example:

Verify that the subscription-date appears on the customer confirmation form below the name field.

Date Boundary Tests

12/31/1999	New year -1
01/01/2000	New year boundary
01/02/2000	New year + 1
02/28/2000	Leap year - 1
02/29/2000	Leap year boundary
03/01/2000	Leap year +1
02/29/2001	Negative test

Test with the system clock set to 1999 and again with 2000. Consider testing right at the 1/1/2000 boundary.

Date Tests

- 12/31/1999 Last day of century
- 1/1/2000 First holiday of century
- 1/3/2000 Monday, first business day
- 1/7/2000 Friday, end of first week
- 1/31/2000 First month end
- 3/31/2000 End of first quarter
- +28 years Day of week testing

Date Tests

- Read
- Write
- Print
- Display
- Get
- Put
- Input
- Output

- Date construction
- Numeric to character conversion
- String functions
- External date functions
- Date features built-in to language

Format Compatibility

Enter the date

Store the date

Retrieve the date

Financial Calendars

- **Actual / Actual**
  - » Actual days in month and year
- **Actual / 360**
  - » Actual days in month / 360 day year
- **30 / 360**
  - » 30 days per month / 360 days per year

Holiday Calendars

- **Fixed national holidays**
- **Fixed state and local holidays**
- **Variable national holidays**
- **Variable state and local holidays**
- **International holiday schedules**
- **Easter, Christmas, Chanukah, Ramadan, Columbus Day, Presidents Day, Thanksgiving, etc.**
- Every day is a holiday somewhere!

The Year 2000 Conversion Project is an opportunity to demonstrate the contribution of the Quality Assurance Organization.

Keep records and document the QA contribution.

?

Did every IT manager in the world change jobs a few years ago, so that the year 2000 problems could be blamed on someone else?

Reasons to Not Test

It compiled, it has to to work.

I only changed one thing.

How bad could it be?

I know what I’m doing.

Why We are Having Problems

We forgot to tell you that you are a beta site.

You can't expect us to find all the problems.

No reasonable customer uses that feature.