**The Ohio State University**
*Department of Computer and Information Science*

# Improving Software ROI through Requirements Validation

## A Web Based Wireless Order Management System

October 31, 2002

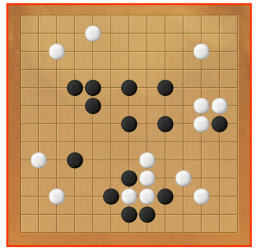
**David Cohen, Ph.D.,**
**President**

**sente** 先手
Corporation 株式会社

***www.sente.com***

**david@sente.com**

# sente means competitive initiative in the game “Go”



## Our focus is on productivity enhancements through Faster:

- delivery of customer solutions
- delivery of information to users
- implementation of organizational changes

# Overview

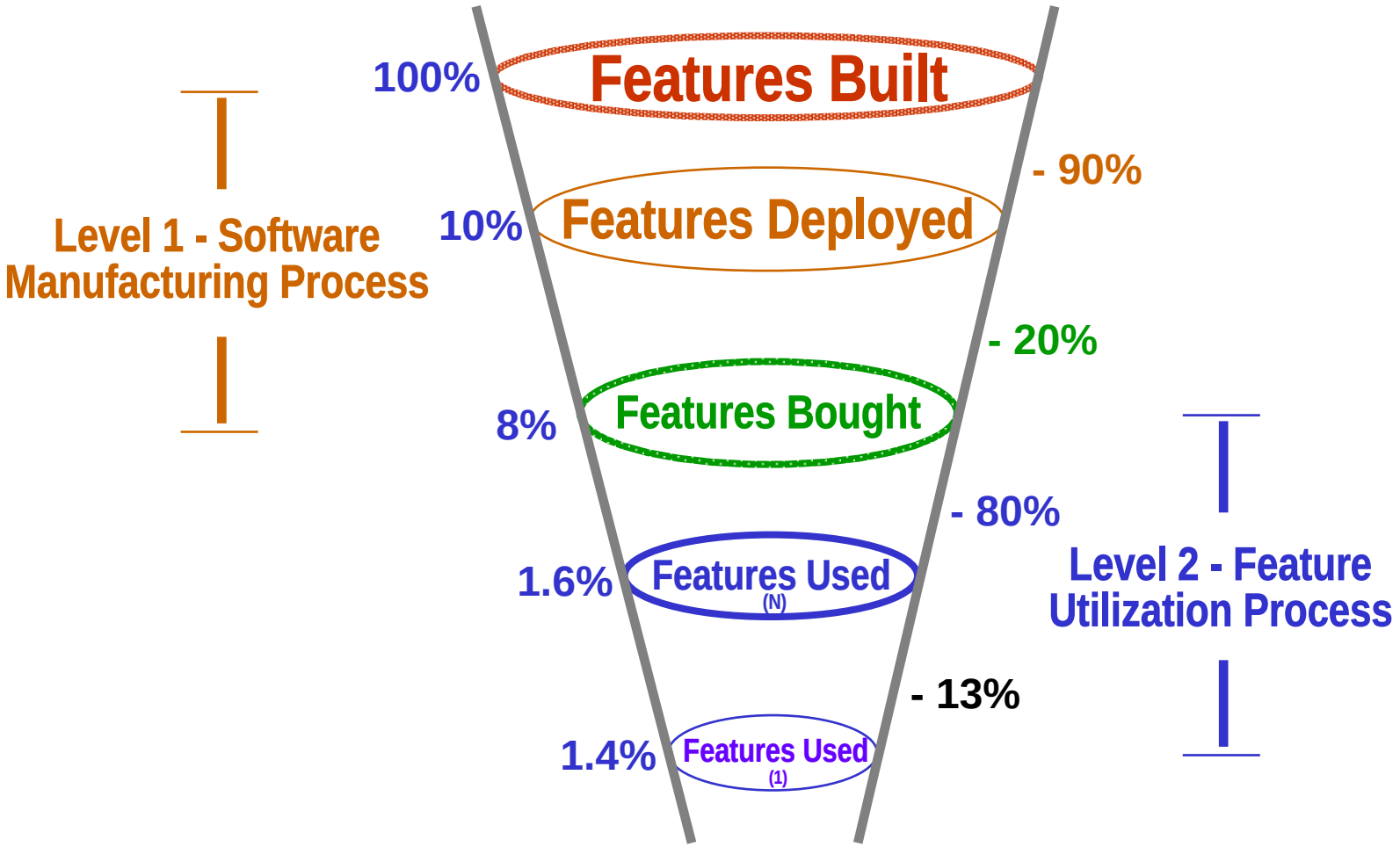
sente Corporation

1. **Software Investment Insights**
   - Existing Requirements-Driven Development-Paradigm **Rarely Delivers** a Good Return on Investment (ROI)
   - **The Challenge is to Deliver Solutions vs. Software**
     - **Software Pollution™**
     - **The Ever Increasing Development Backlog**
     - **Requirements Validation**
       - **deploy order of magnitude better investments**
     - **E-Type vs. S-Type Software Systems**
2. **The *eccm* toolkit capabilities for Requirements Validation**
   - **Architecture, User Interface, Business Rules**
   - **Configuration Management, Operational Processes**
   - **Center Productivity Management**
3. **Summary**

# Software Pollution™ (1/2)

## Feature Manufacturing and Utilization Analysis

sente Corporation

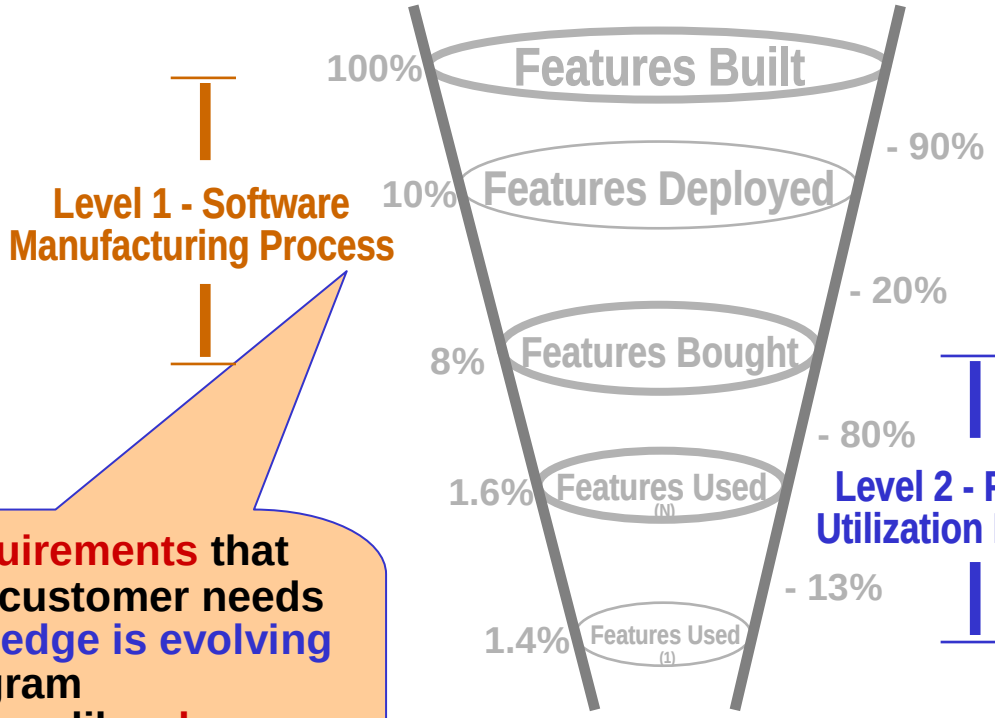



**Ability to Remove Features**
**Guide Re-engineering Programs**

# Software Pollution™ (2/2)

## Feature Manufacturing and Utilization Analysis

sente Corporation




**Level 1 - Software Manufacturing Process**

- **Incomplete Requirements** that do not capture customer needs
- **Customer knowledge is evolving** during the program
- Development Team likes **long delivery programs**
- Development Team uses **"bleeding edge"** technology

**Level 2 - Feature Utilization Process**

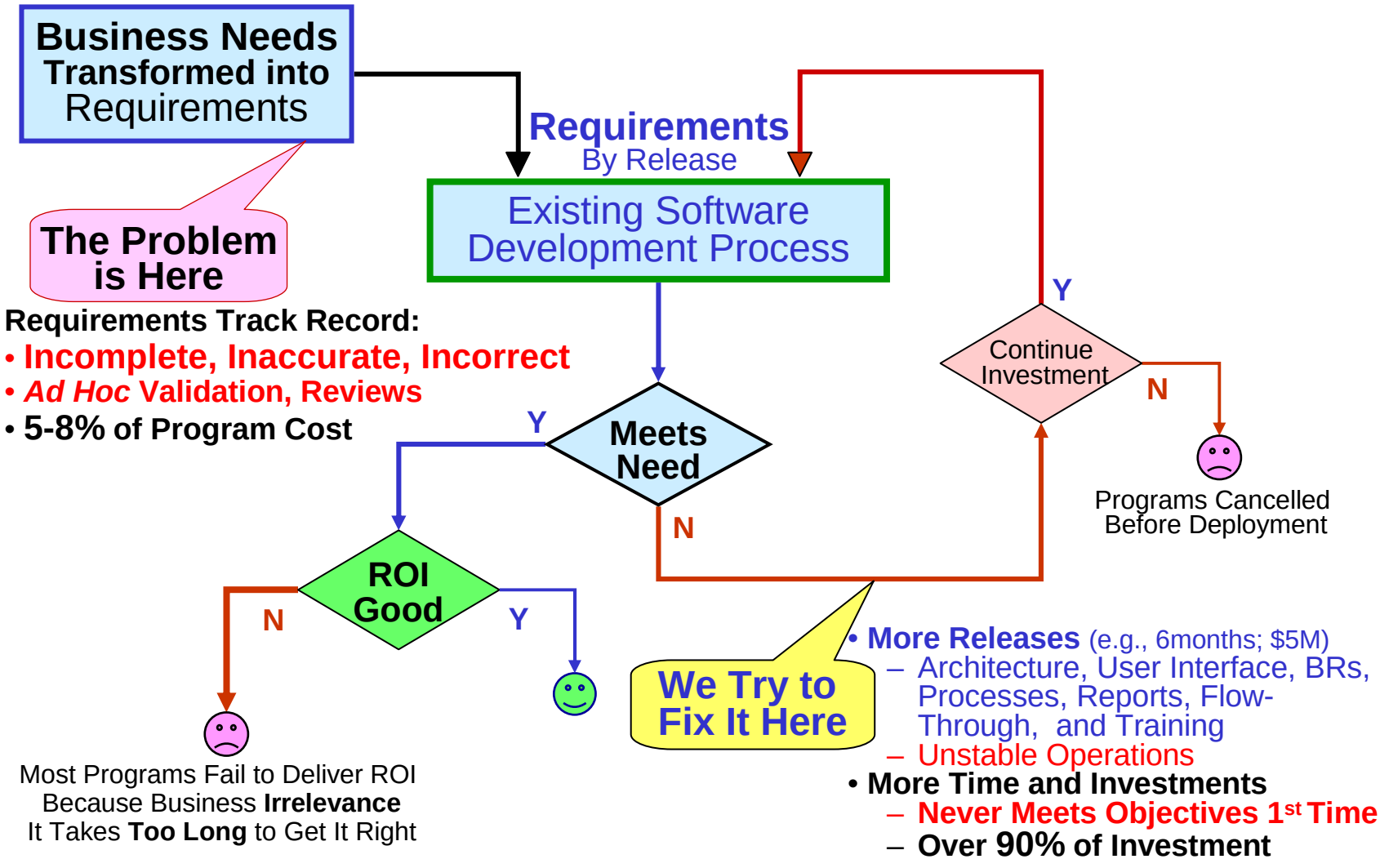
- Users' ability to **absorb new features** is limited
- Features do not fit into **any** useful process
- Late delivered features **no longer relevant**

**Requirements Pollution Levels – Mill spec.**
**A Spec 100:1 B Spec 60:1 B1 Spec 25:1**

# Software Investment (1/5)

## The Requirement Driven Paradigm Fails to Deliver ROI

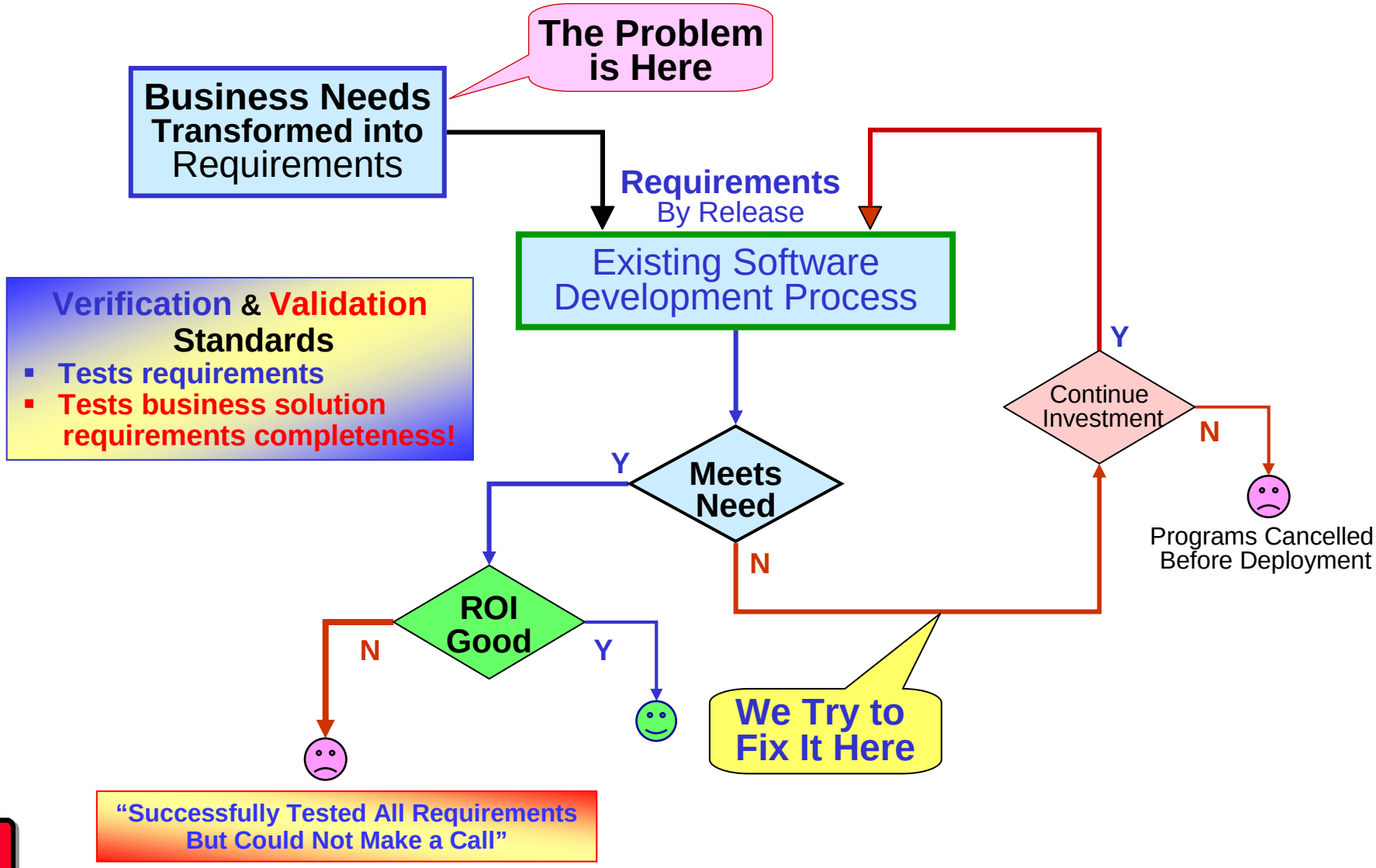
sente Corporation



# Software Investment (2/5)

## Requirements Verification and Validation Standards

sente Corporation



# The DEAL That Worked Well for Over Half a Century (Investment Paradigm)

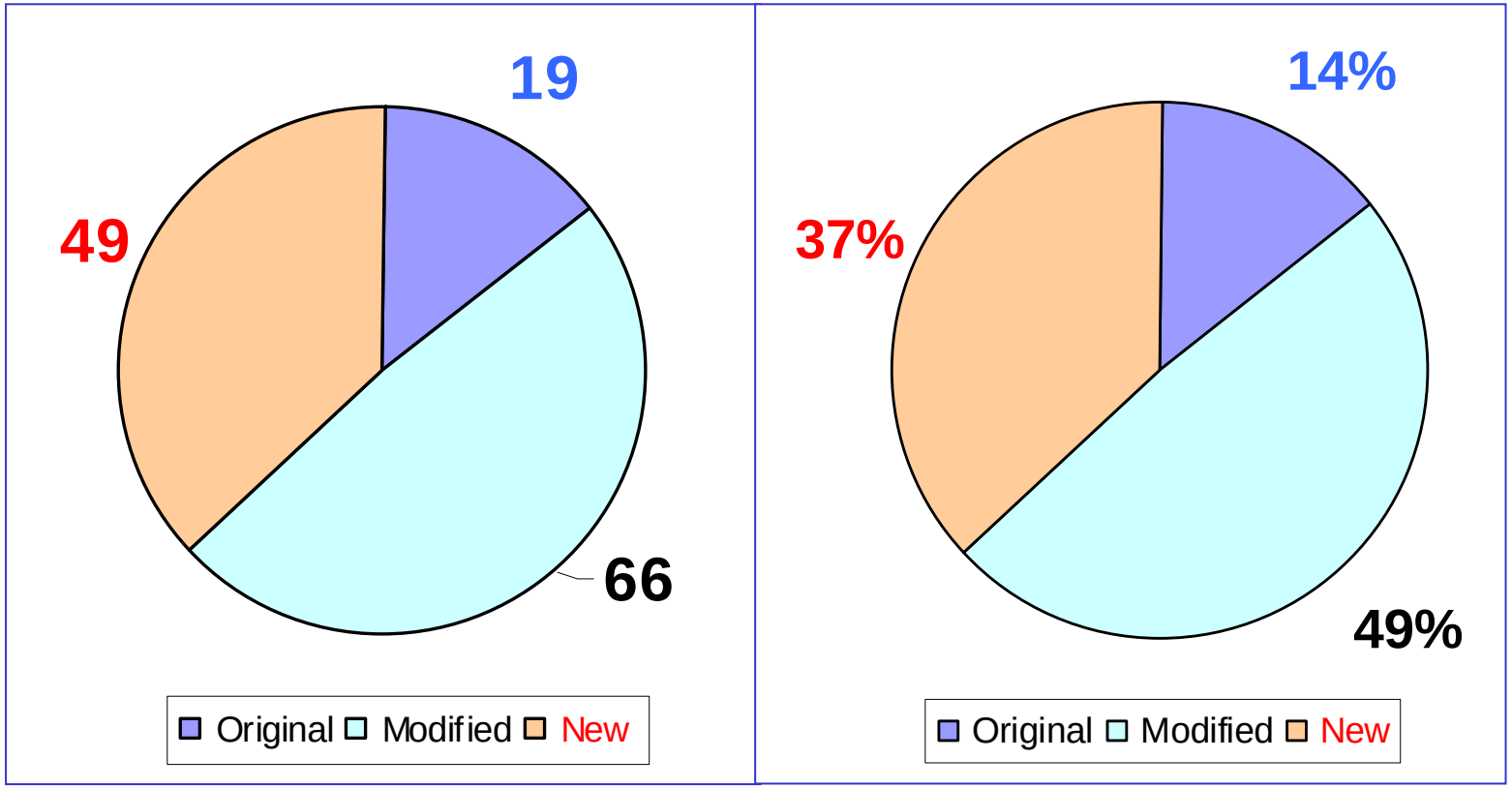
sente Corporation

- **The Business Invests in Software Solutions Based on Incomplete and Inaccurate Requirements**
  - the business unit produces the requirements; therefore, **it is its own fault** when the solution is unsatisfactory
  - the development team sticks to "feature coding assignments"
- **The Business Is Required to Continue Funding Enhancements to an Unsatisfactory Solution**
  - the solution is not able to keep up with the evolving business needs (new or newly learned); revenues/customers lost
  - the users are continuously living with incomplete (irrelevant) solutions; manual workarounds are the norm
- **The Development Team Is Rewarded With Ongoing Funding While It Delivers Barely Relevant Solutions**
  - **not accountable for ROI** and shows no interest expanding scope beyond "feature development"
  - System Integrators (SIs) are doing *barely better*
    - they cleverly shift accountability back to business unit
  - Recently acknowledged failures of supply chain management vendors

Prem to Prem MEGALINK Order

# Business Rule - Validation Results

sente Corporation



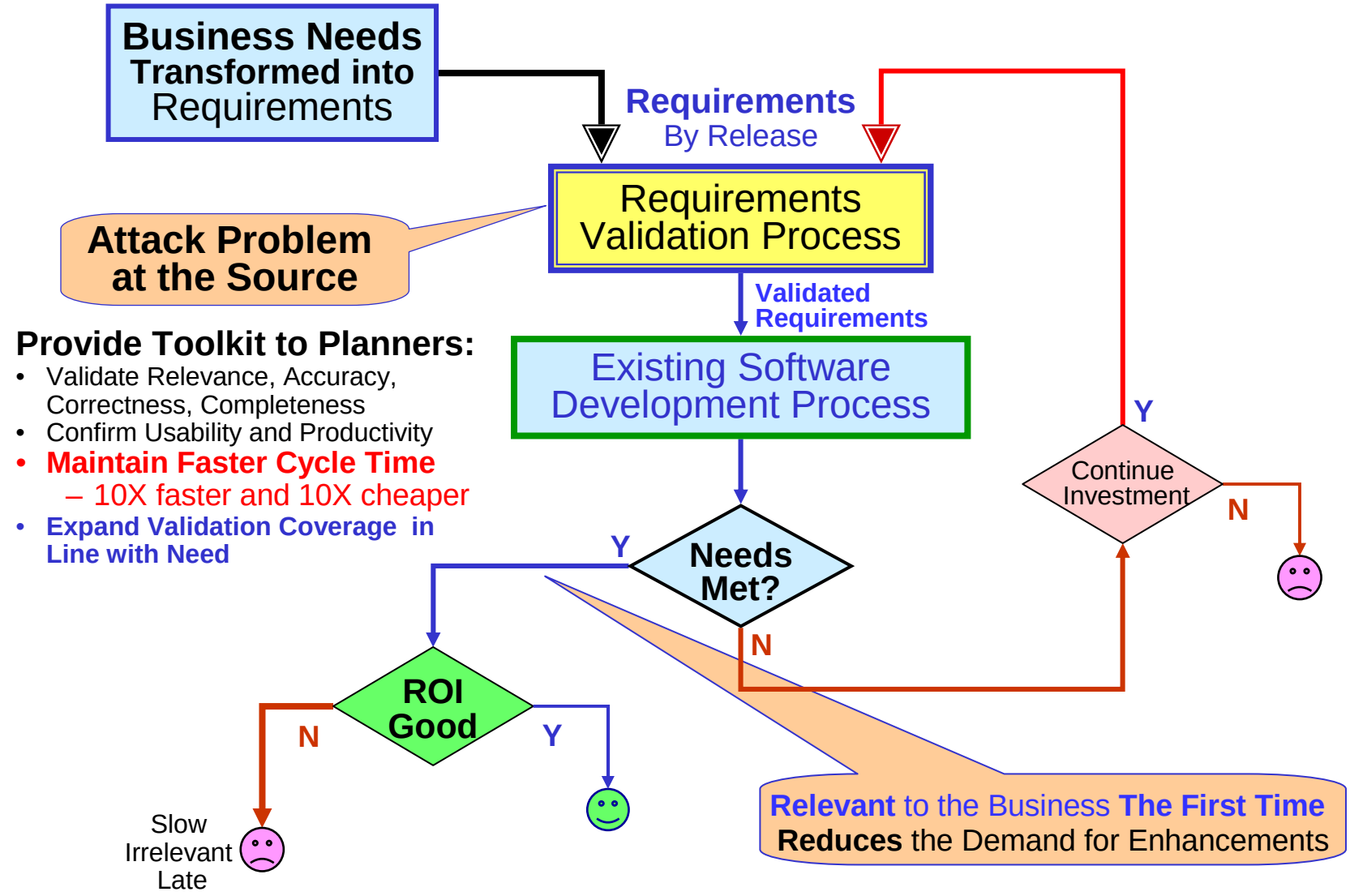

**The Business Rules Were Professionally Maintained**

***Two Orders of Magnitude More Complex Than "Boolean Expressions"***

# Software Investment (3/5)

## Improve Requirements Completeness through Validation

sente Corporation




**Provide Toolkit to Planners:**

- Validate Relevance, Accuracy, Correctness, Completeness
- Confirm Usability and Productivity
- **Maintain Faster Cycle Time**
  - 10X faster and 10X cheaper
- **Expand Validation Coverage in Line with Need**

# Definition of S-Type vs. E-Type Systems

***The Vendors' Economic Incentives Drive the Results*** ***[Lehman 85]***

sente Corporation

## S-Type System **(M. Lehman, "Program Evolution: Processes of Software Change," Acad. Press,1985)**:

- **Specification based software** treats each release as reflected by the requirements; no capabilities are added to reflect life cycle expectations beyond software maintenance (e.g., operating system, DBMS, platforms)
- **Software is always getting bigger, more complex with an incrementally reduced capability to fix bugs or adding features cost effectively**
  - **There is a clear dependency between the demand for new features and increased software complexity** (cause and effect)
  - **The ROI is getting incrementally worse – we never hit the wall because the business unit is forced to reduce feature-demand by relevance and cost considerations**
  - The IT Organization **has only ONE alternative**, that is to **start a new replicated development program** to fight the "software development bottleneck" *(developers rarely able to reuse previous platforms because of code ownership, obsolescence and reuse considerations)*
  - Software pollution becomes an ROI measure (increased pollution reduces solution's life cycle)

## E-Type System:

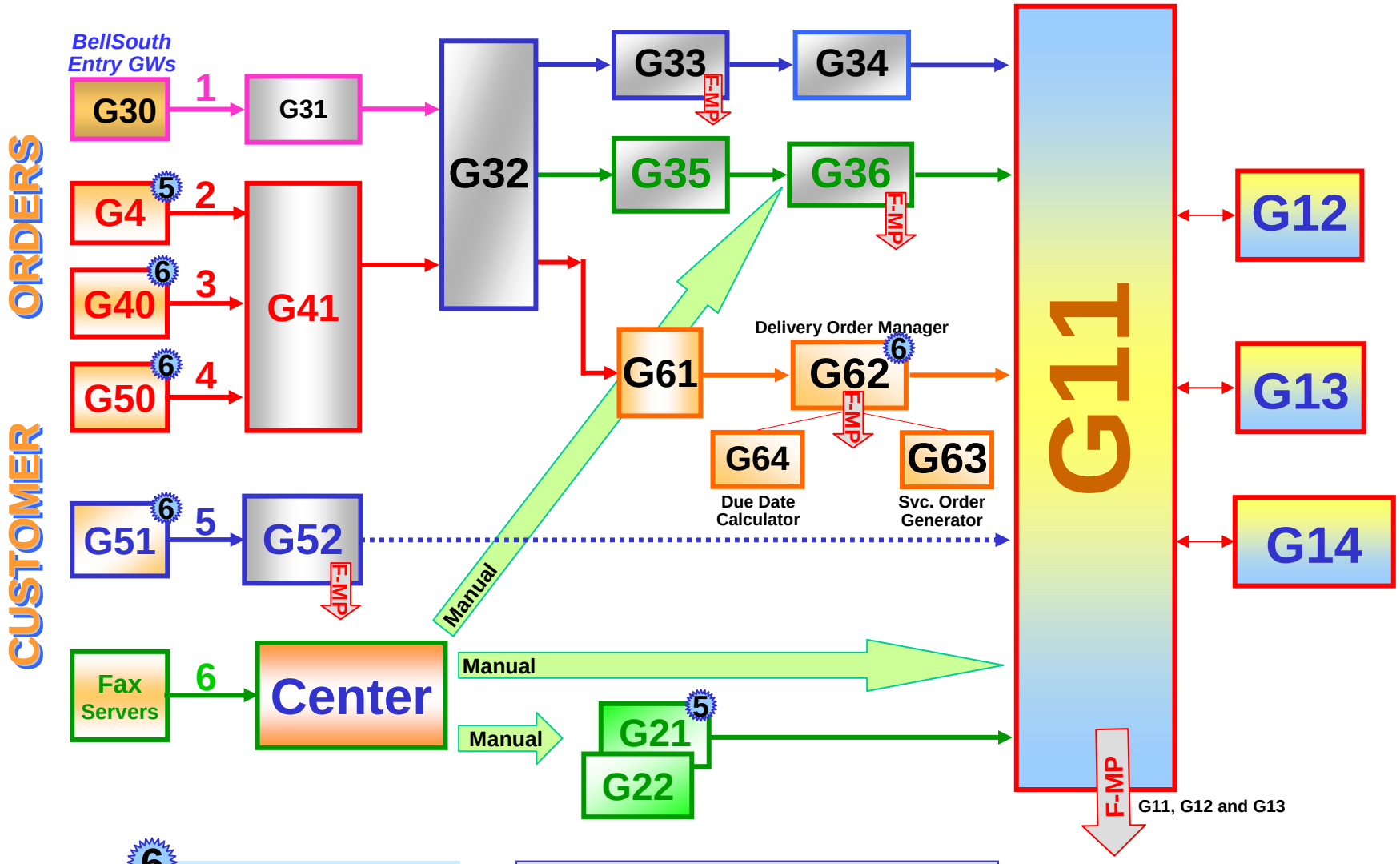
- **Evolution based software** is designed to handle tasks and to evolve with *expected* changing needs through configuration management (CM) capabilities
  - **Requirements are viewed as representative of possible needs** into the future
  - Success criteria includes **the ability to expand capabilities without software development** (e.g., new business rules, process changes, report changes)
  - Software complexity of E-Type systems is increasing at a **slower rate**
  - **Software complexity is proactively reduced** through
    - reimplementation of functionality with increased e-capabilities
    - removal of features that are no longer needed/used but add complexity and maintenance cost
- A **validation platform** can be used to validate requirements reducing the software churning in search of the "true" business-need definition (requirements)

# System Architecture Evolution

## The Objective: Effective Order Processing – Real Flow Through

(**RFLT Definition**: Electronic Processing of a Customer Order Delivered to G11)

sente Corporation




6 **FE Data Validation**
(S1, S2, S3, S4, G11, G12)

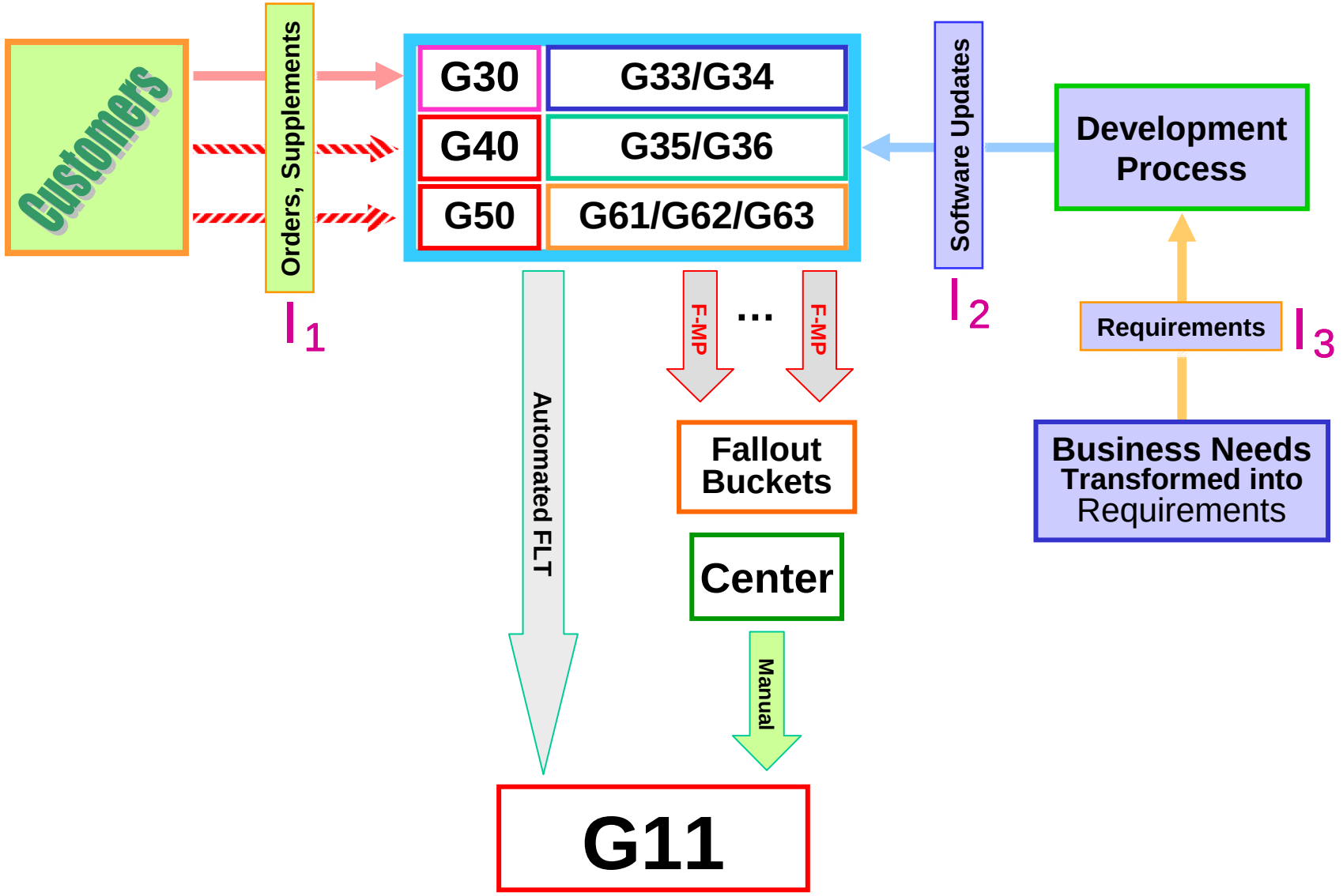
**Software Bottleneck Solutions**
- **Concurrent Development Teams**
- **Replicated System Functionality**
  - Developers are possessive of their code
  - The churning in functionality is killing the software

F-MP Fallout - Manual Processing

# Software Investment Model (4/5)

**Automatic Flow Through Processing**

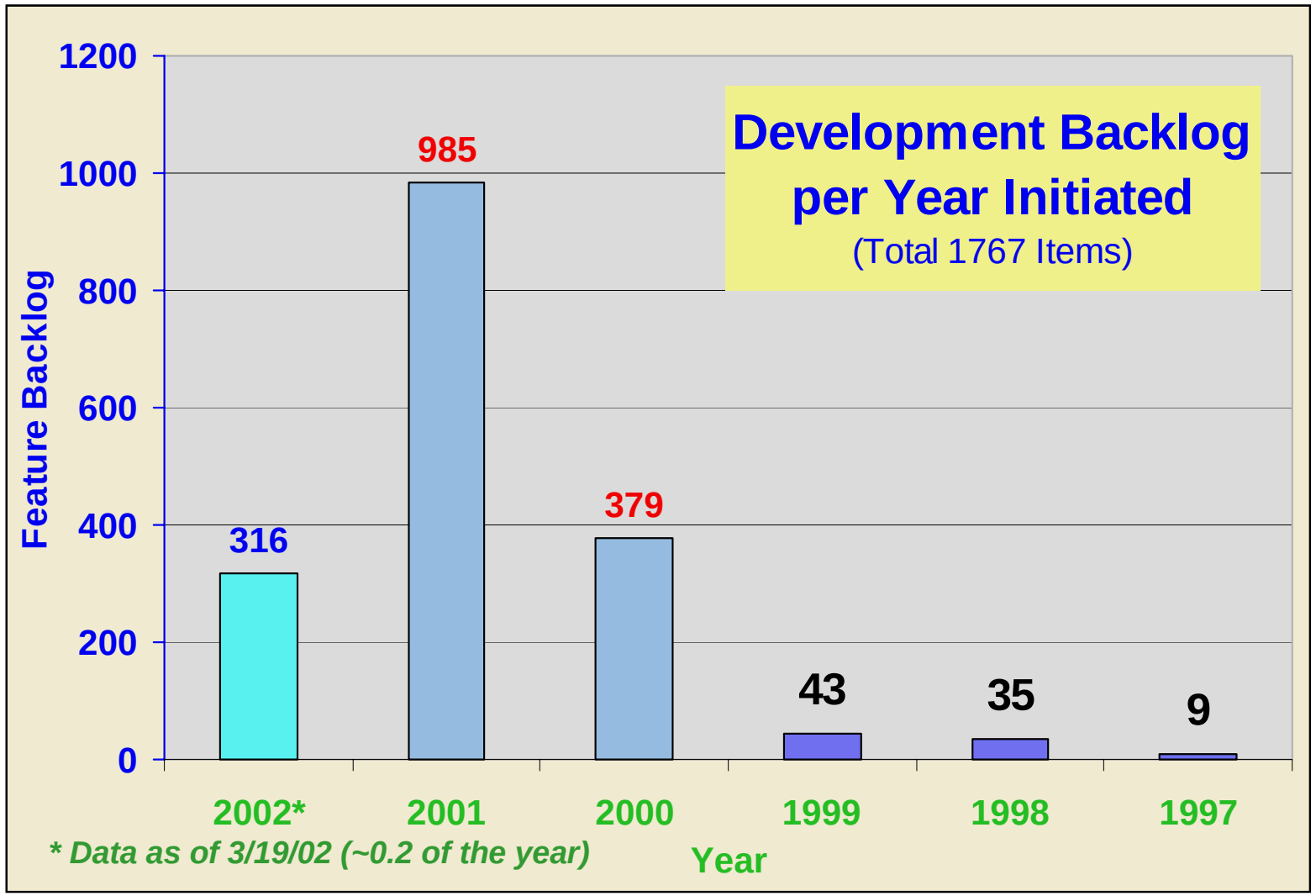
sente Corporation



# Feature Development Backlog per Year

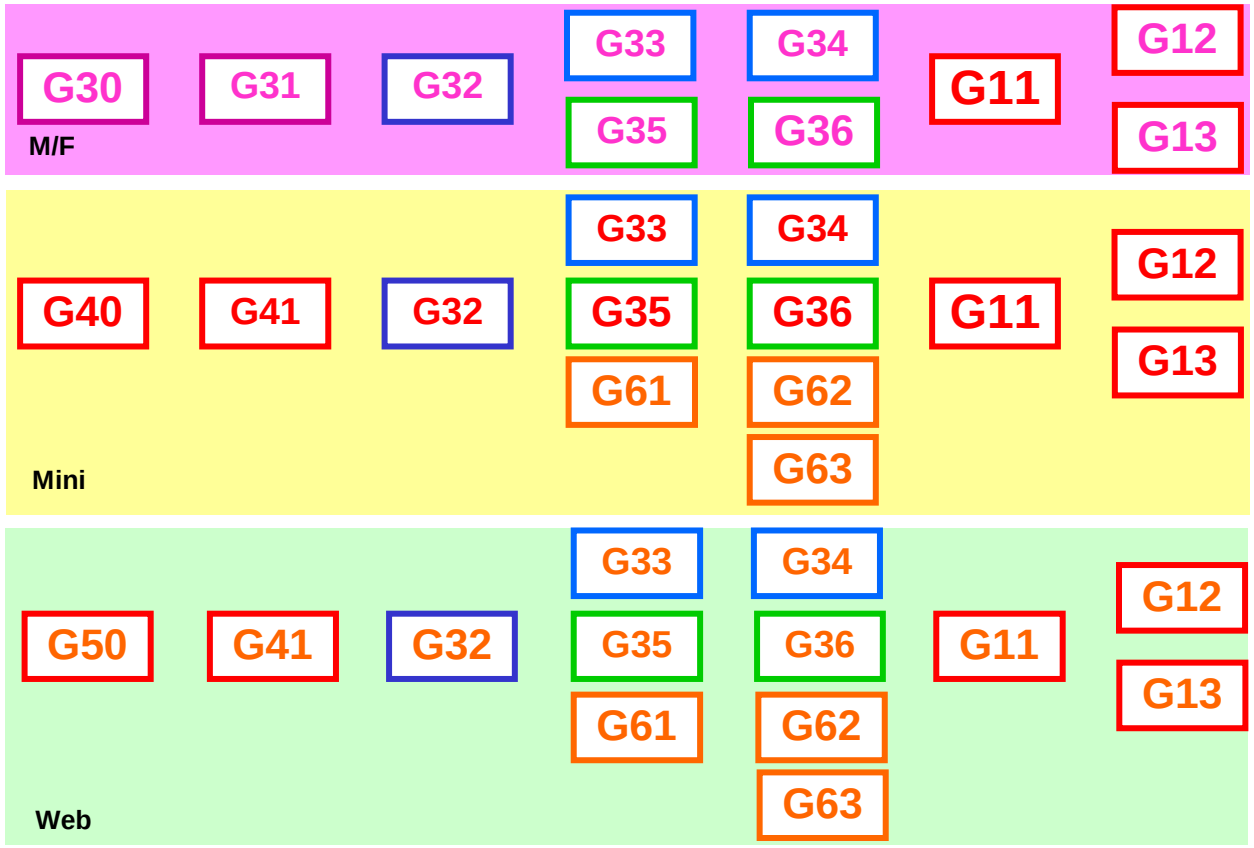
**Historical Summary** (e.g., 9 features still open since 1997)

sente Corporation



# Evolution of a Legacy Solution

sente Corporation




## A Solution's Life Cycle

1. *New needs cannot be satisfied by existing solutions because of a large feature backlog, limited development-team throughput and high cost*
2. *A new solution is approved that is promised to be faster and cheaper (there is no alternative)*
3. *The new solution is late to meet initial commitments*
4. *A feature backlog develops for the new solution*

**Software Bottlenecks Are Generic and Predictable**

# Wireless Center - Business Need

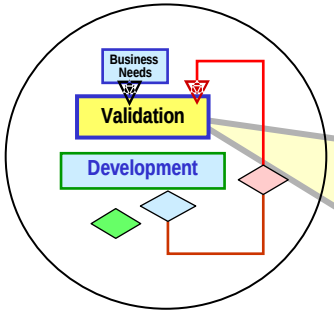
sente Corporation

- **Responsible for provisioning data circuits for the wireless industry**
  - connectivity between switches, antennas, etc.
- **Over 500 customers (revenue $2B/year)**
  - 50 Reps, 40 System Designers
- **Over 80,000 orders per year**
  - orders are received in the center through faxes and emails
  - it takes an average **~1.5 hours** to process an order per Rep *including related clarifies and escalations*
  - each new order must be processed within 12-24 hours
- **Center staffing growing ~30% per year in line with customer orders**
  - recruiting is major challenge
    - it takes **~6 months** to get a new Rep trained/productive
- Success Criteria: **Improve Rep Productivity to Eliminate Staff Growth**

# Software Investment (5/5)

**Supports Validation of Capabilities in Six Key Areas**

sente Corporation




**Architecture Configuration Management**

**Web Based UI**

***electronic customer contact management***

***eccm Toolkit***

**Release V.28**

**Business Rules**

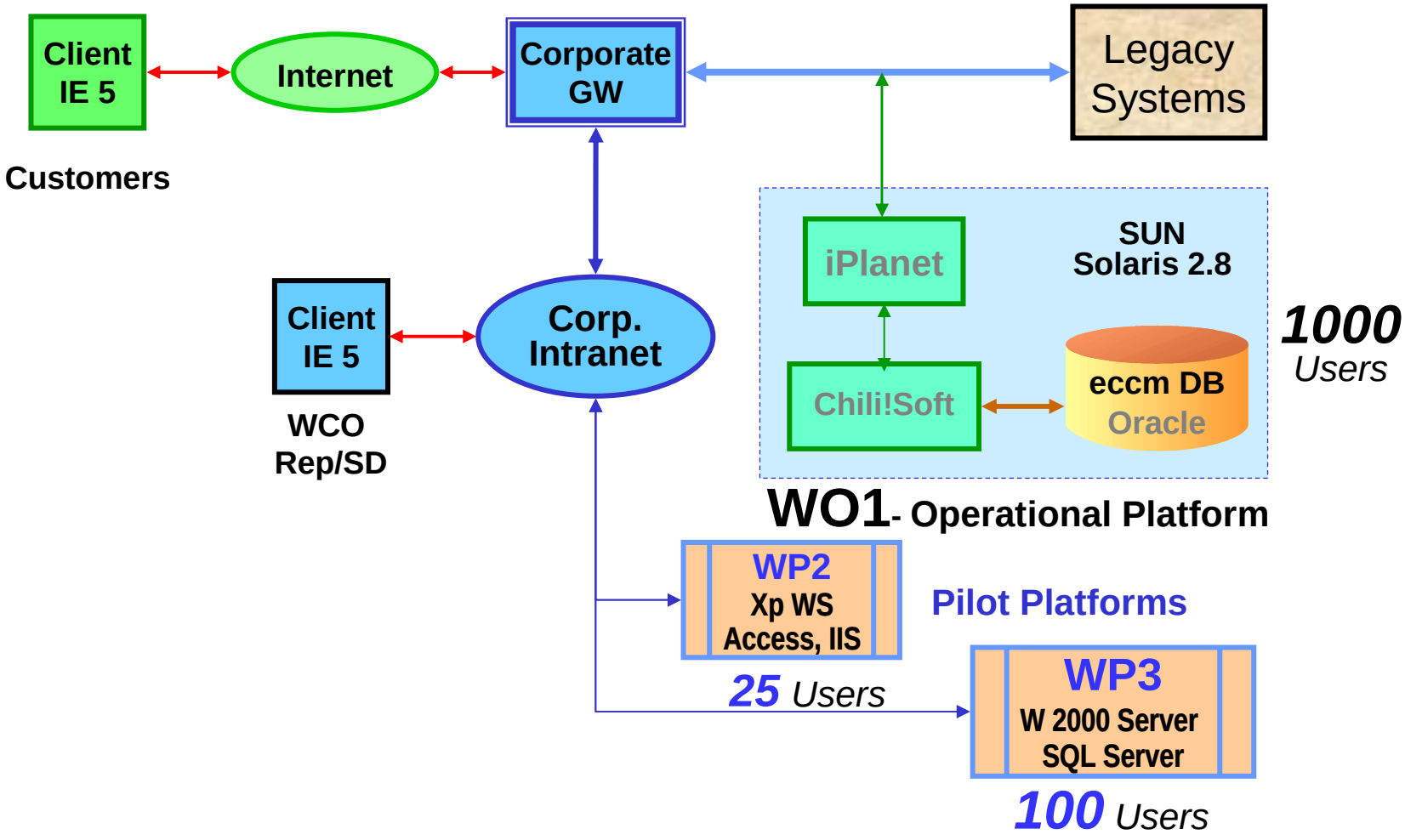
**Operational Processes Center Productivity Management**

- 10 Times Faster Cycle Time (Robust)
- Validation Coverage Expanded with Need

# Deployment Strategy and Architecture

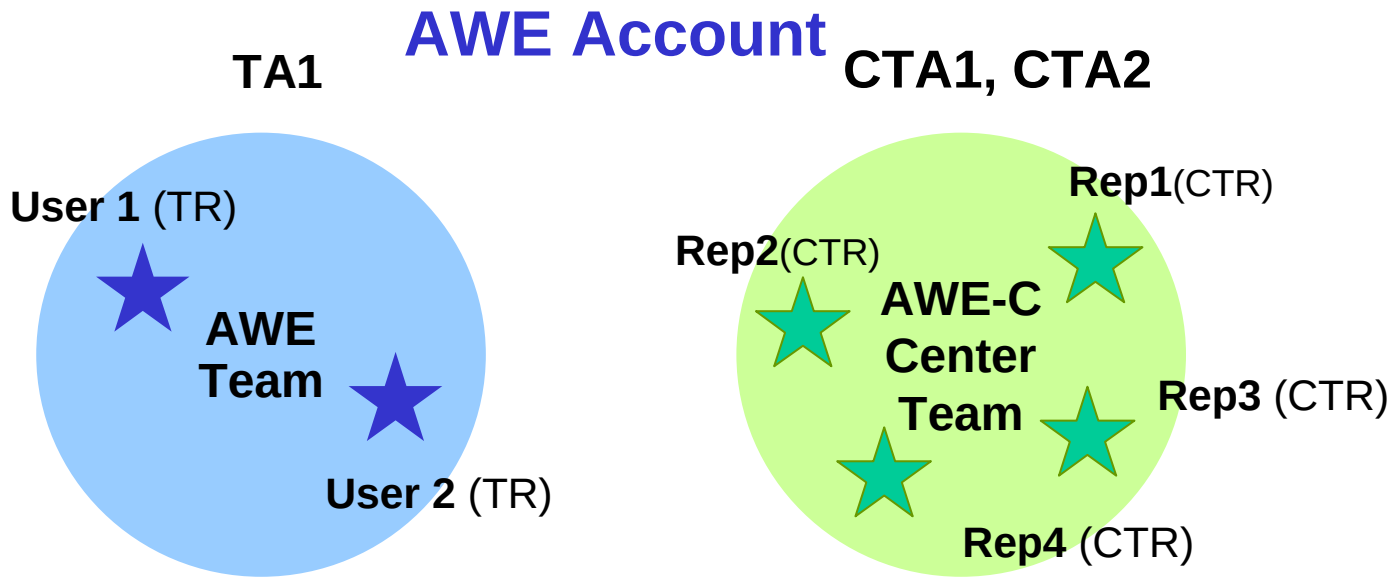
## Managing Change Management

sente Corporation



# Account Management - CM Capabilities

sente Corporation




**SA** - SA1, SA2, SA3

**TA** - team administrator
**TR** - team Rep

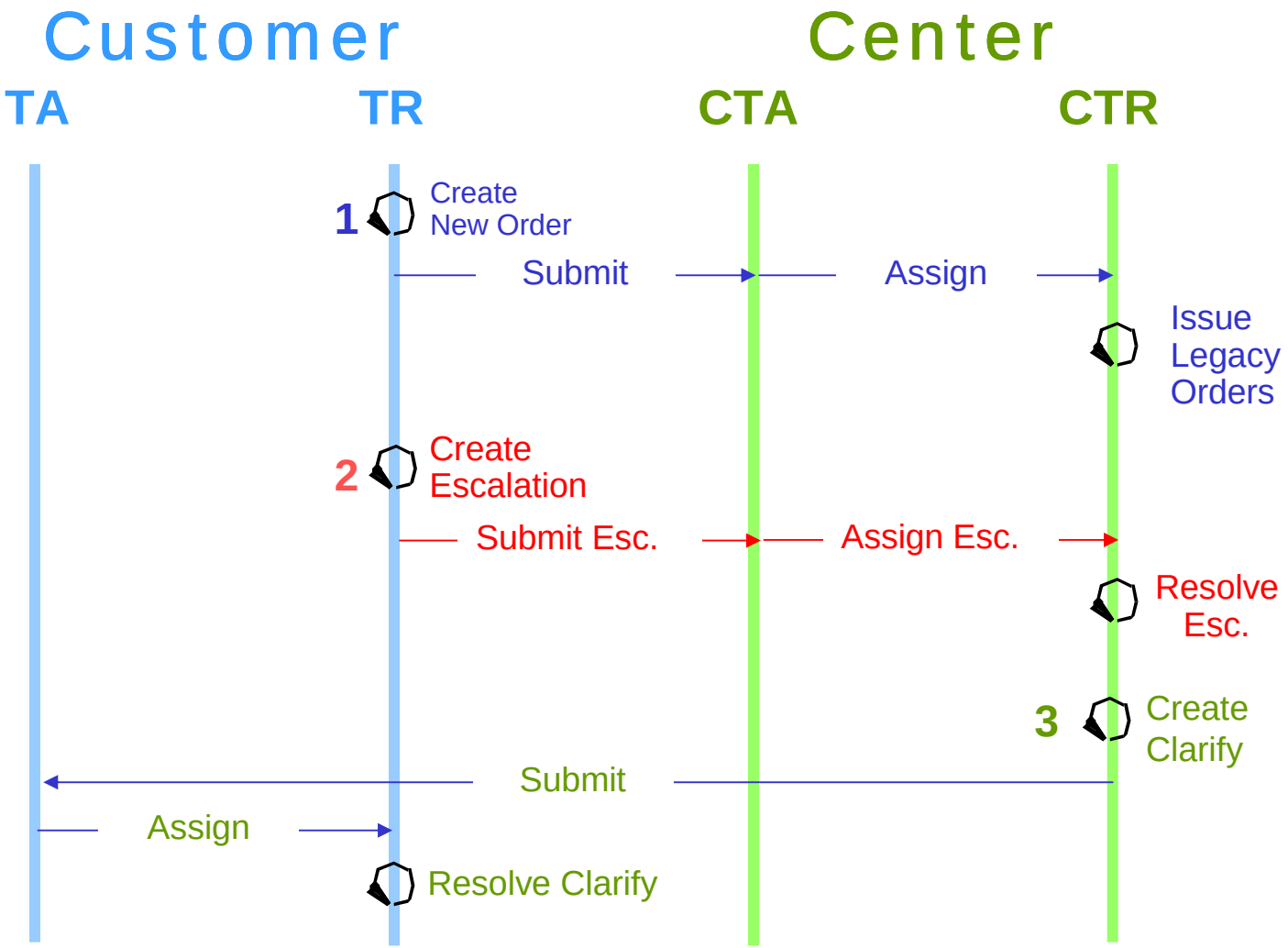
**CTA** - center team administrator
**CTR** - center team Rep

**SA** - system administrator

# Operational Processes Validation

## Create New Order, Escalation and Clarify Processing

sente Corporation



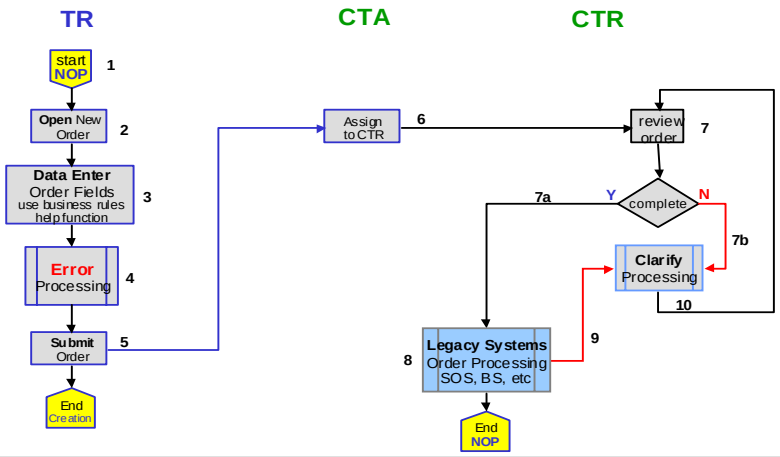
# Process Definitions in (1+4)D

sente Corporation

## Description
### New Order Processing

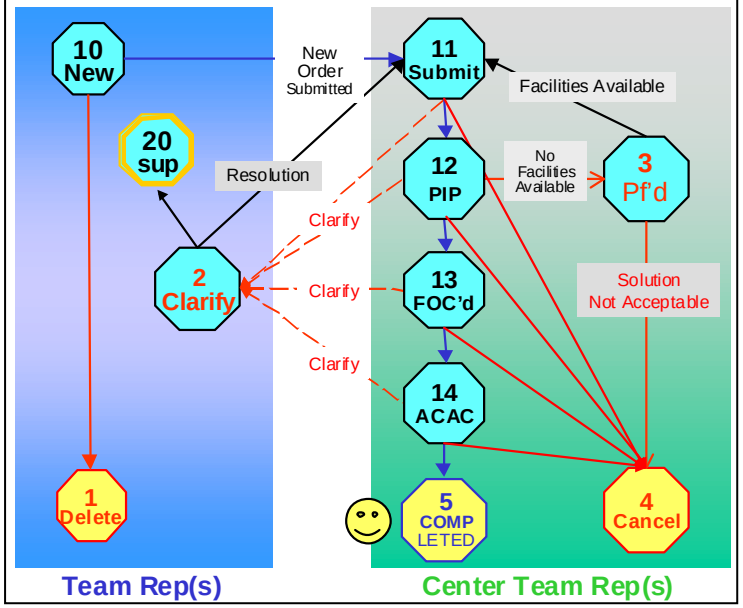
1. Initial Conditions: The Customer Wants to Purchase a Link (e.g., Prem to Prem) to Meet their Wireless Network Needs.
   A TR is assigned by the TA to Create a New Order in Line with the business needs.
2. The TR Logs-in to the ***eccm*** application:
   - selects Prem to Prem MEGALINK/Light/Plus
   - selects Create New Order
3. The TR Data Enters the details of the new order - one field at a time
   - periodically the TR saves the content of the order
   - periodically the TR may verify completeness of the order
     - error messages will be presented in a separate window
     - errors can be fixed incrementally or once the data entry was completed
   - if necessary the session can be terminated and the data entry operation can be renewed at a later time
4. The TR makes all the error corrections
   - clicking on each error message will position the cursor at the right field for correction
   - required and conditionally required business rules are enforced
   - data integrity business rules (telephone number, date, email) are enforced
   - any attempt to submit an incomplete order results in automatic verification with all defects presented in the error window
5. The TR Submits the verified (completed) order to the CTA
   - the order status is changed from New to Submitted
   - the TR no longer can make changes to the order unless a Sup Order is created
6. The CTA Assigns the New Order to appropriate CTR
7. The CTR Reviews Order for completeness
   - If the order is not complete issues a Clarify to the TR
8. Initiate Legacy System Processing

## Data Flow Diagram
### New Order Processing



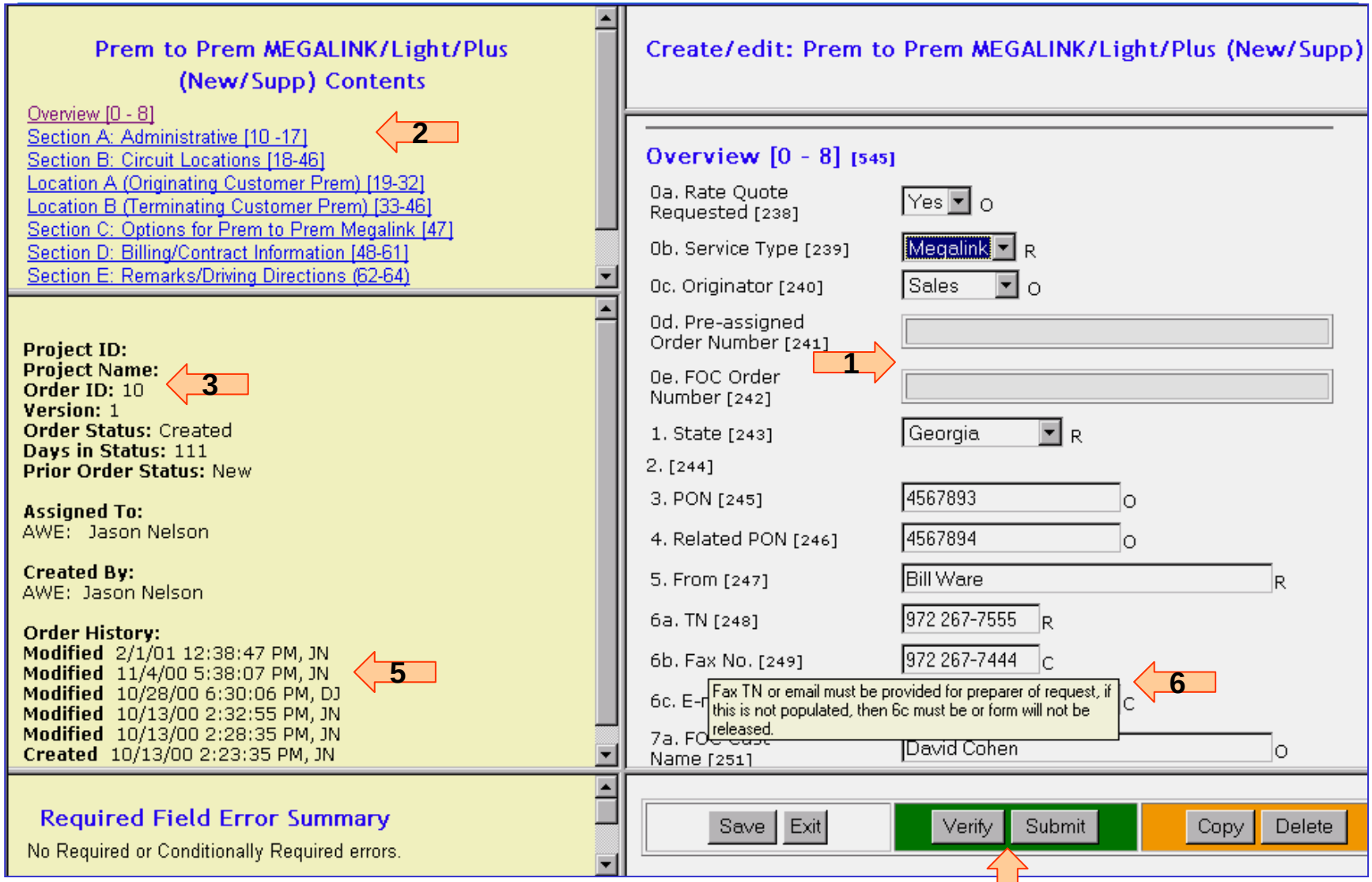

## Screen Layouts
### New Order Processing (1/23)


## New Order Processing
### State Machine



# Data Entry User Interface

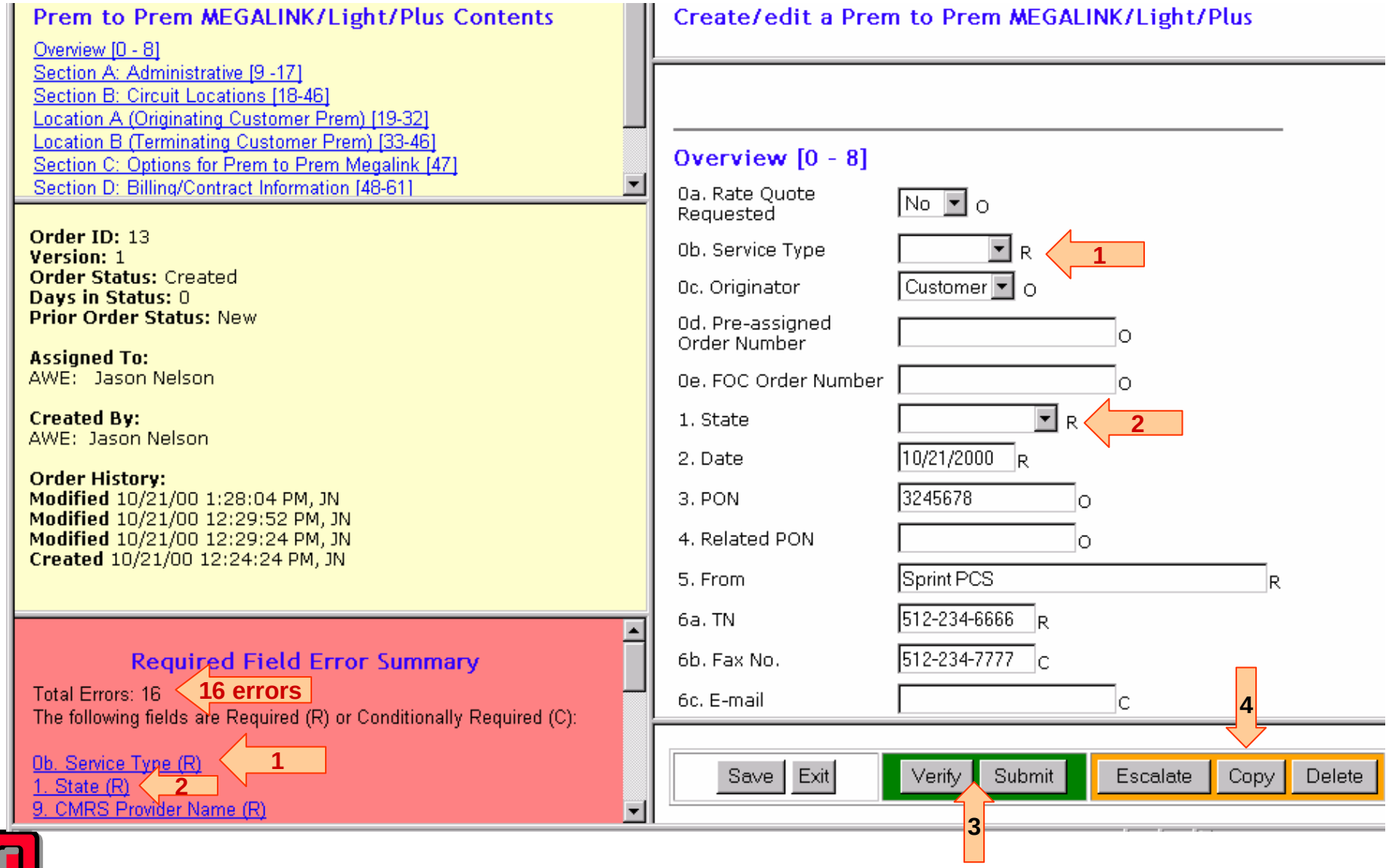
sente Corporation




**Training Objective: ONE DAY vs. SIX MONTHS**

# User Interface
# Business Rules Validation

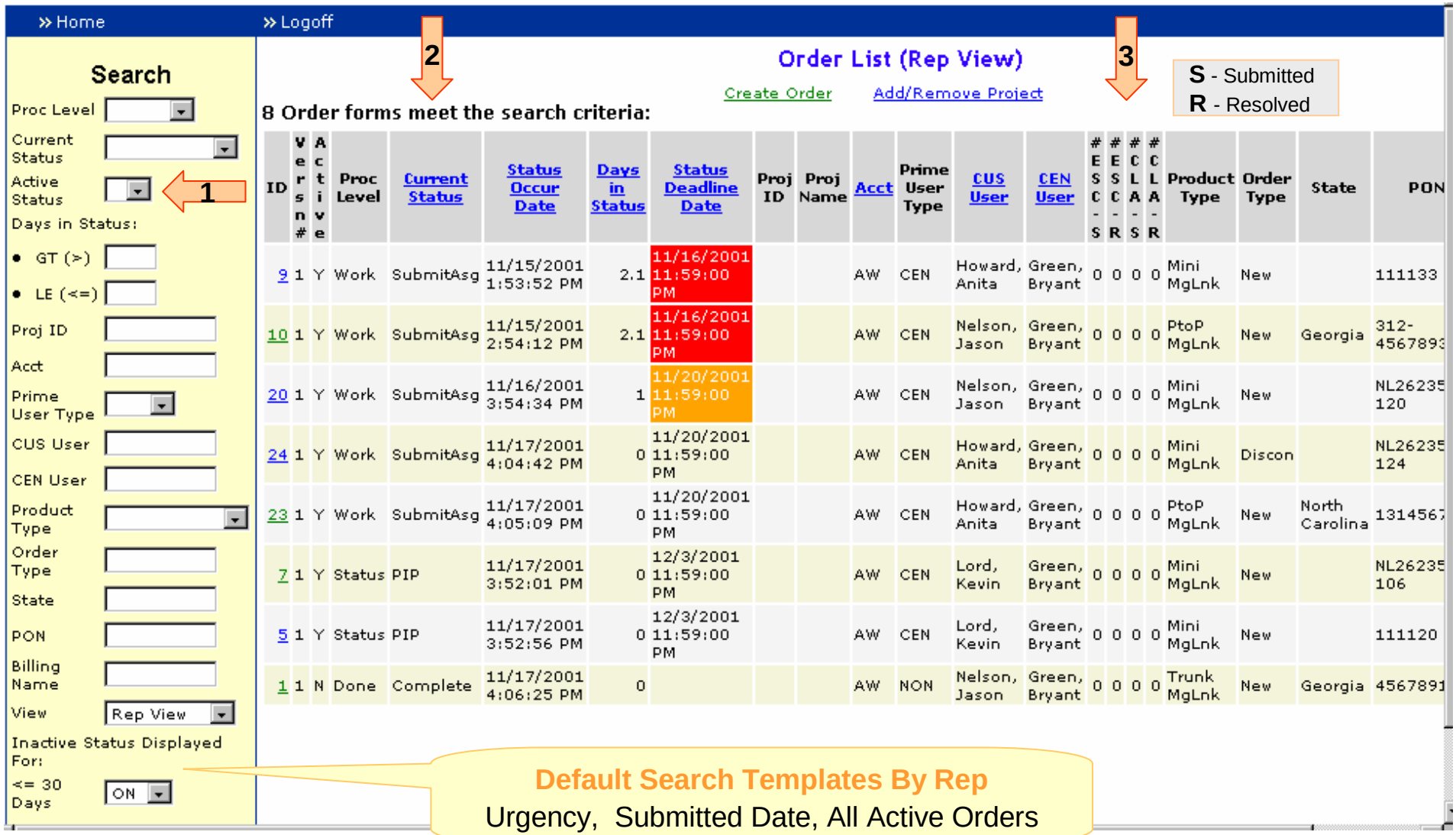
sente Corporation



# List of Orders - User Interface

## Driving Rep and Team Priorities – Rule Driven

sente Corporation



# Summary CM Capabilities V.28

Fields, Forms, System Parameters, Transition Rules and Access Rules

sente Corporation

## Administration

1. Administer Passwords
2. Administer Users
3. Administer Active User Sessions
4. Administer Backup
5. Administer Accounts
6. Administer Organizations
7. Administer Fields
8. Administer Forms
9. Administer Parameters

## Management Reports

1. Status of Projects
2. Order Tracking
3. Escalation Tracking
4. Clarify Tracking
5. User Session Tracking
6. Field Business Rules
7. Status Transition Rules
8. Status & Field Access Rules

2

1

3

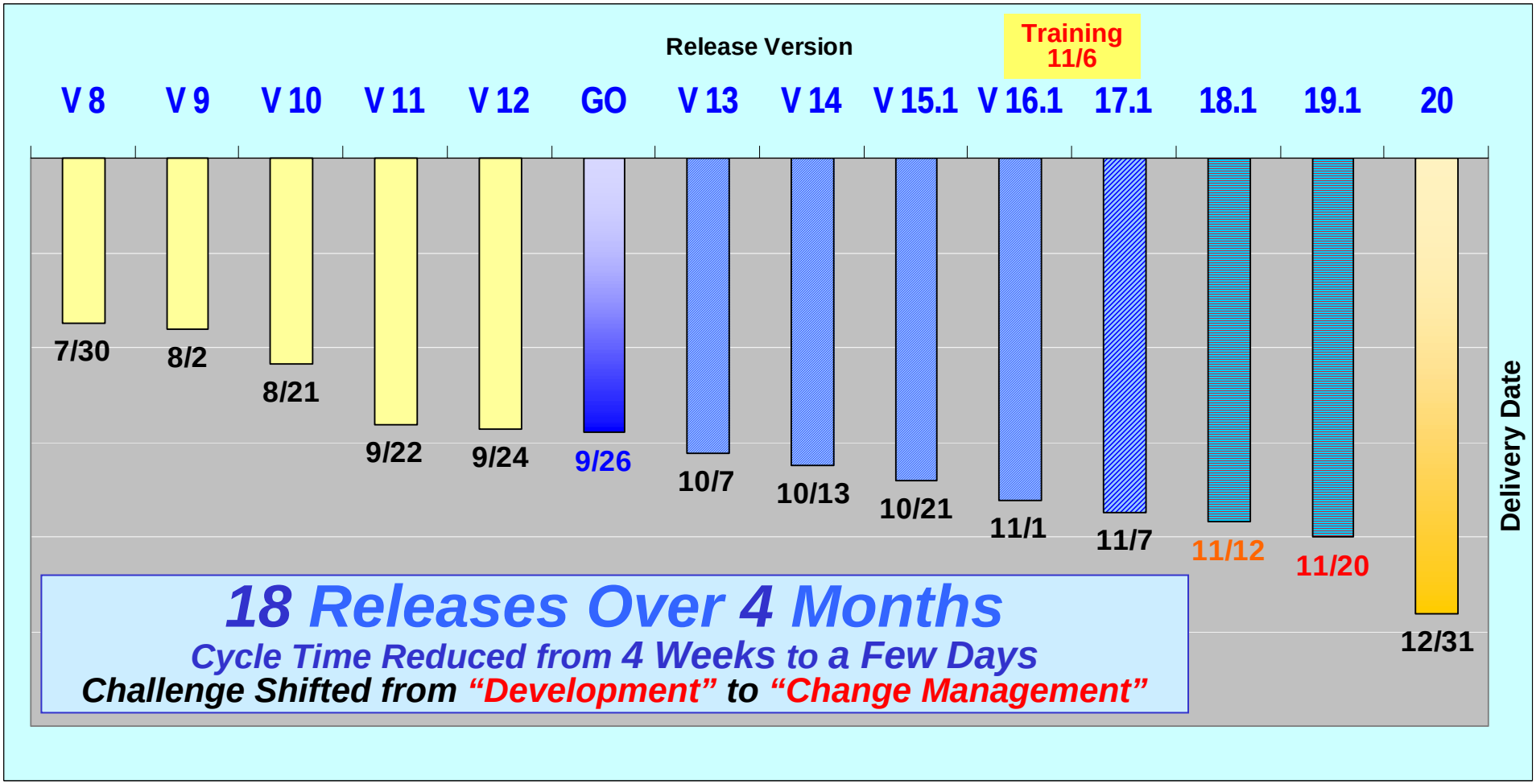
4

***How the Steak is Cooked***

***FASTER***

# *eccm* Software Releases

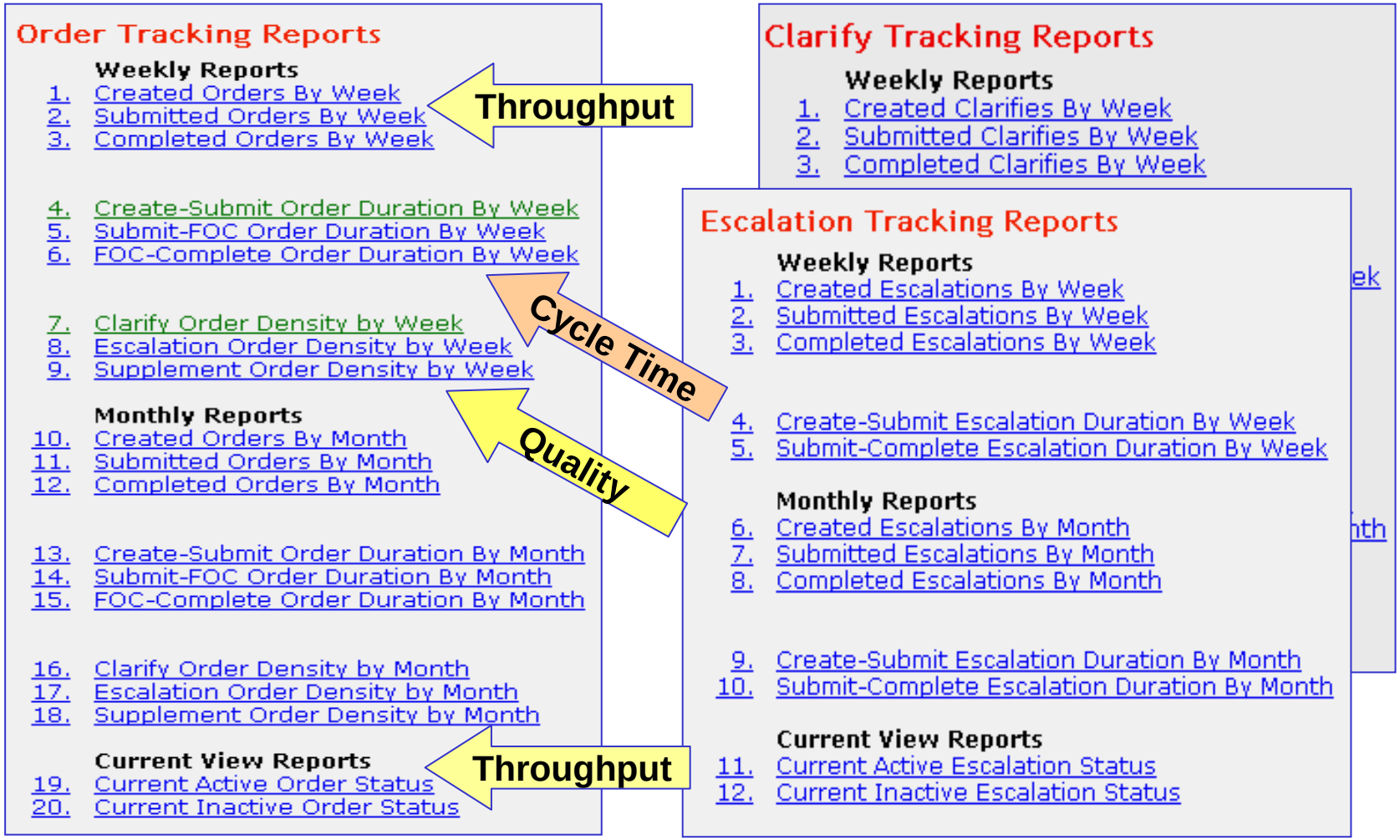
sente Corporation



# Center Management Processes

## Interval Analysis: Orders, Escalations and Clarifies

sente Corporation

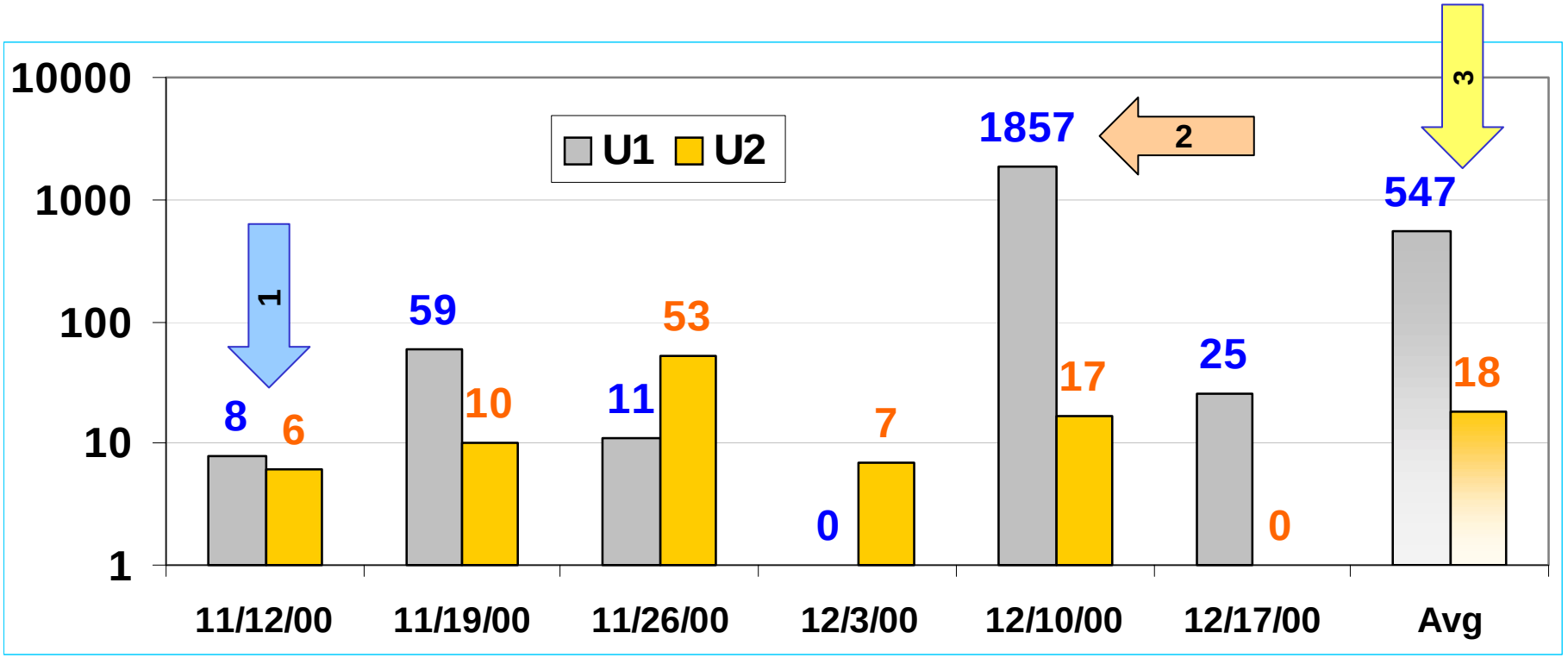



***Cycle Time, Throughput and Quality***

# Order Tracking (1/3)

## Average [**Create - Submit**] Interval (minutes)

sente Corporation




***Invention of the Copy Command***

# Integrated Historical Analysis (3/3)

*Session ID, Action, Form Type and State Change Information*

sente Corporation

**User Session Details**
**(1/30/2001 11:48:47 AM)**
**Customer: Sprint**

| Ref # | Team | Team Rep | Sess Cnt | Sess ID | Action | Time | Form ID | Form Vsn | Form |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Sprint | Bowers | 1 | 16 | Logon | 11/16/2000 10:42:53 AM | | | |
| 2 | Sprint | Bowers | 1 | 16 | Logoff | 11/16/2000 11:26:25 AM | | | |
| 3 | Sprint | Bowers | 2 | 20 | Logon | 11/16/2000 3:11:59 PM | | | |
| 4 | Sprint | Bowers | 2 | 20 | Logoff | 11/16/2000 3:21:38 PM | | | |
| 5 | Sprint | Bowers | 3 | 29 | Logon | 11/17/2000 2:04:27 PM | | | |
| 6 | Sprint | Bowers | 3 | 29 | Logoff | 11/17/2000 2:07:01 PM | | | |
| 7 | Sprint | Bowers | 4 | 39 | Logon | 11/20/2000 11:06:07 AM | | | |
| 9 | Sprint | Bowers | | | Modified | 11/20/2000 11:21:18 AM | 3 | 1 | Clarify |
| 10 | Sprint | Bowers | | | Modified | 11/20/2000 11:30:42 AM | 3 | 1 | Clarify |
| 11 | Sprint | Bowers | | | AssignedBy | 11/20/2000 11:31:00 AM | 3 | 1 | Clarify |
| 12 | Sprint | Bowers | | | AssignedTo | 11/20/2000 11:31:00 AM | 3 | 1 | Clarify |
| 13 | Sprint | Bowers | | | Completed | 11/20/2000 11:31:32 AM | 3 | 1 | Clarify |
| 13 | Sprint | Bowers | 4 | 39 | Logoff | 11/20/2000 11:32:08 AM | | | |
| 14 | Sprint | Bowers | 5 | 42 | Logon | 11/20/2000 1:29:47 PM | | | |
| 15 | Sprint | Bowers | 5 | 42 | Logoff | 11/20/2000 2:07:31 PM | | | |
| 16 | Sprint | Bowers | 6 | 49 | Logon | 11/21/2000 12:36:46 PM | | | |
| 18 | Sprint | Bowers | | | Created | 11/21/2000 12:43:30 PM | 5 | 1 | Prem to Prem MEGALINK/Light/Plus (New/Supp) |
| 19 | Sprint | Bowers | | | Submitted | 11/21/2000 1:00:19 PM | 5 | 1 | Prem to Prem MEGALINK/Light/Plus (New/Supp) |
| 19 | Sprint | Bowers | 6 | 49 | Timeout | 11/21/2000 1:00:41 PM | | | |
| 20 | Sprint | Bowers | 7 | 52 | Logon | 11/21/2000 1:30:14 PM | | | |
| 21 | Sprint | Bowers | 7 | 52 | Timeout | 11/21/2000 1:59:10 PM | | | |
| 22 | Sprint | Bowers | 8 | 55 | Logon | 11/21/2000 2:47:18 PM | | | |
| 23 | Sprint | Bowers | 8 | 55 | Drop | 11/21/2000 2:47:22 PM | | | |

1

2

3

# Summary Results

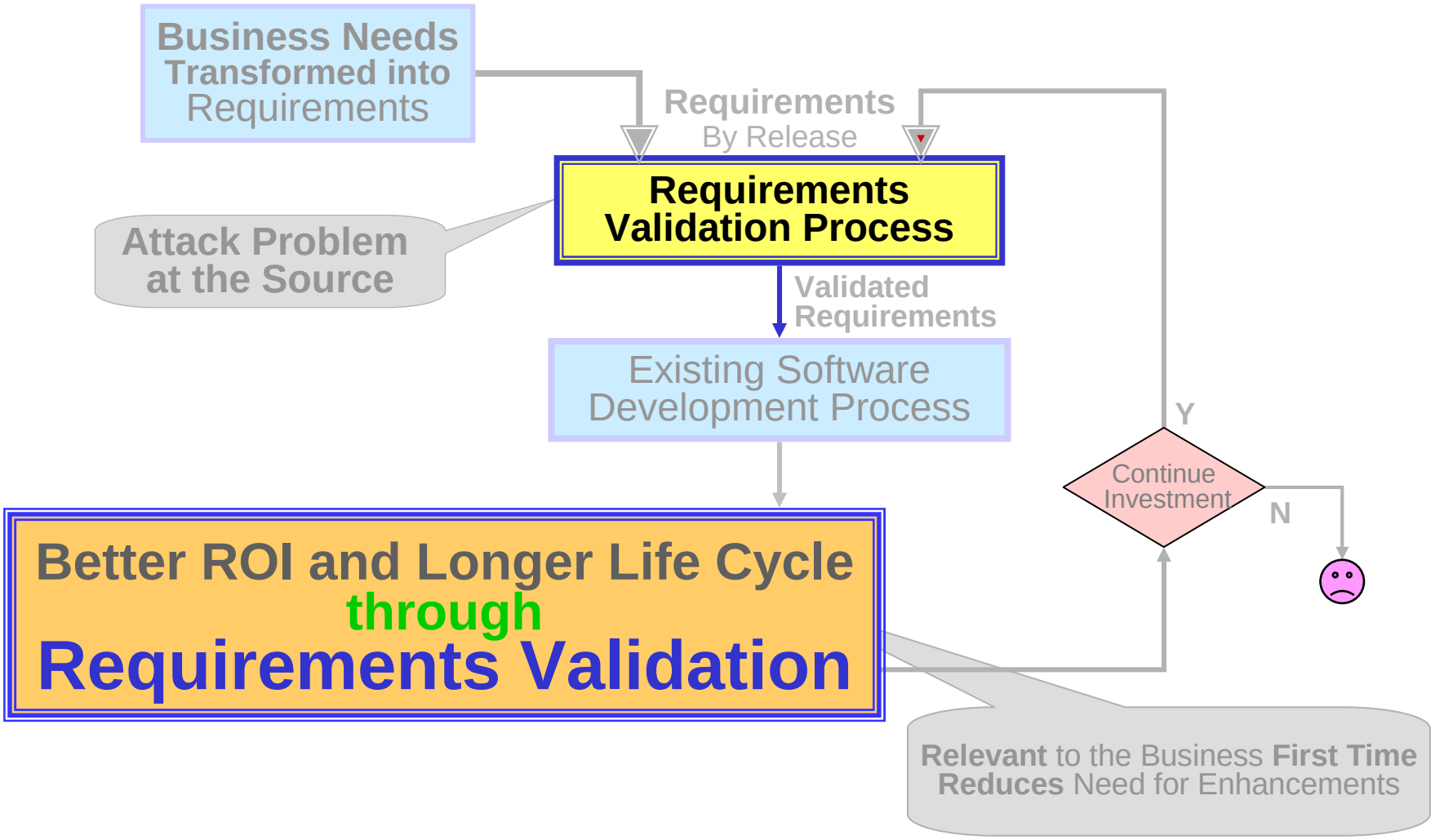
sente Corporation

- **Eliminated software bottlenecks** in the delivery of business solutions*, shifting the challenge from software development to change management.* Software releases are developed weekly and deployed monthly because of our limited ability to distribute changes effectively to over 1000 physically distributed users.
- **Improved delivery of *relevant* and *complete* solutions to center users** (in comparison to similar past projects):
  - **Software release cycle-times** increased by a factor of ***fifteen*** facilitating effective deployment of newly acquired operations-insight (e.g., weekly/daily releases).
  - **Software release cost** has been reduced by at least ***two orders of magnitude*** with a less than *18 month* ROI.
  - **Software release quality** has improved by a factor of ***fifty*** using field reported Severity 1 and 2 defects.
  - **Software release training interval** was reduced by ***at least two orders of magnitude*** *(e.g., to 4-8 hours)*
- **Enhanced center productivity at both the individual and team levels using throughput, cycle time and quality measurements:**
  - **Average Rep productivity** has increased by ***a factor of four***.
  - **Variance in Rep performance** within the same team was reduced by ***a factor of ten***.
  - **Create-Submit interval** for new customer orders was reduced by ***a factor of fifty****.*
- **Reduced significantly development feature churning** caused by incomplete requirements. In the past, without the validation process, development used business rules that were correct only one in seven (e.g., Megalink order).
- **Validated *real time and report based measurements*** to professionally manage center resources and to improve the team's process-maturity level.
- **Utilized change-management capabilities** that *preserve* the center's productivity during release deployments.

# Summary – Requirements Validation

## Improves Solution's Quality, Life Cycle and ROI

sente Corporation

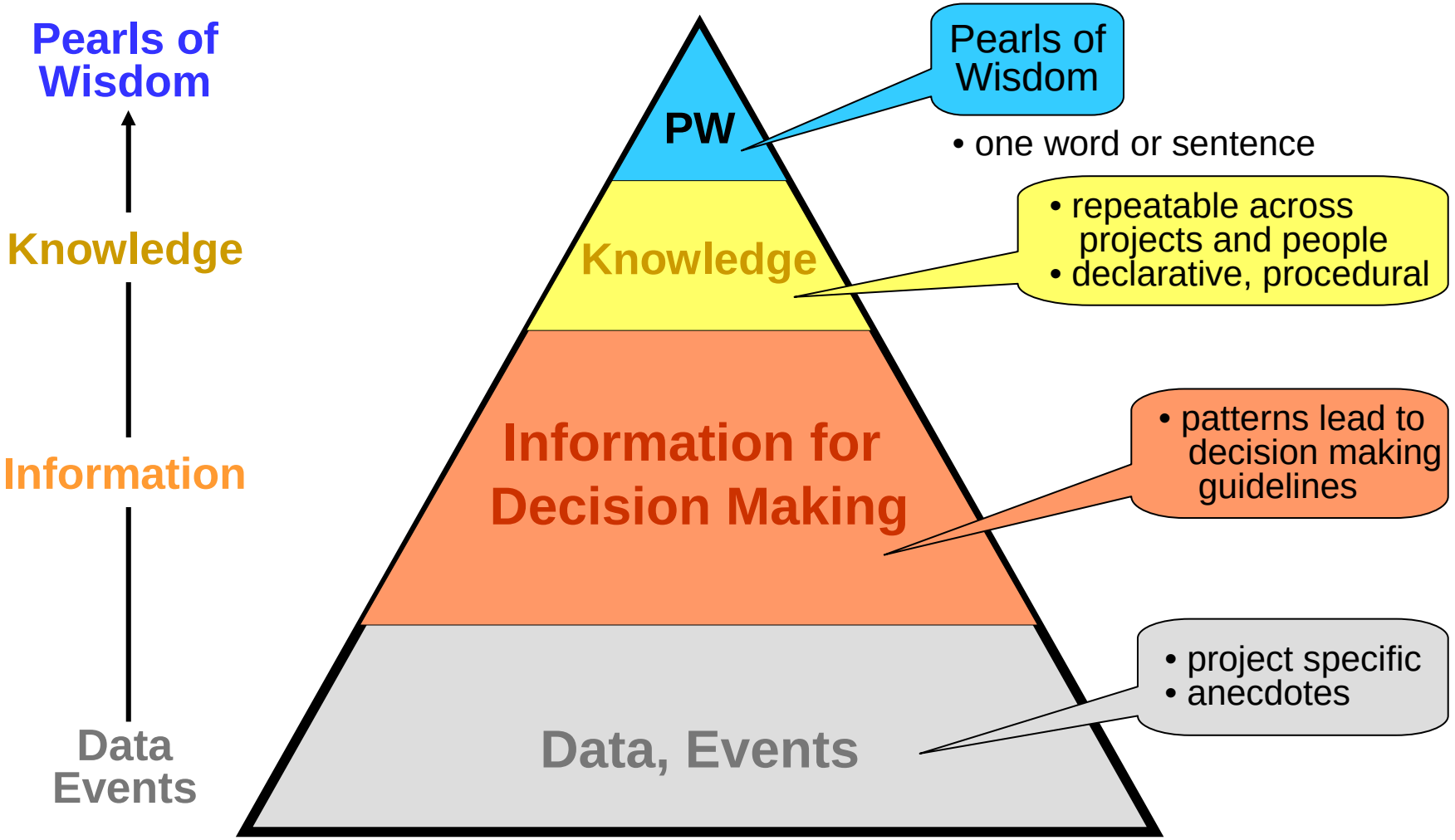


sente Corporation

# Backup Slides

# Insight Categories
## by Knowledge Density

sente Corporation



# Pearls of Wisdom

## Summary

sente Corporation

- Do it **Predictably, Incrementally, and Faster**
  - Must Have Success Criteria - Get an "A"
    - Invest Incrementally in Line with Demand (#customers, users)
    - Operate in 3D (service, distribution channel, operations features)
  - Increase Influence of the Individual
  - Validate Requirements
- Do **Less**
  - Do not confuse motion with progress
- Do **Less with Software**
  - Give a Child a Hammer and *"everything will looks like a nail"* - give an IT organization an opportunity to contribute and "the solution will require software development"; everybody shifts solutions into their domain of expertise.
  - *There are always **effective** alternatives*
    - ***Think e-capabilities***
- All Re-engineering and Large Complex Projects are **"sold on fear"** and will **FAIL to Deliver ROI** (limited/**no** ROI on the investment)
- **Each Release that is Y months long will be late by X months**
  (e.g., **Y=12, X=6**; **(Y=6, X=2) (Y=3, X=0.5)**)